Webster ISB O&M Documents



Note: Not all divisions required O&Ms per spec.

Division	
03	Concrete
04	Masonry
05	Metals
06	Carpentry
07	Waterproofing
08	Openings
09	Finishes
10	Specialties
11	Equipment
12	Furnishings
13	Cold room
14	Elevators
21	Fire Suppression
22	Plumbing
23	HVAC
26	Electrical
27	Communications
31	Earthwork
32	Exterior Improvements

DATE:	July 6, 2017
PROJECT:	Interdisciplinary Science Building 8274 Big Bend Blvd. Webster Groves, MO 63119
OWNER:	Webster University 470 E. Lockwood Ave. Webster Groves, MO 63119
ROOFING CONTRACTOR:	Kirberg Company 1400 South Third Street St. Louis, MO 63104
SPECIFICATION SECTION:	075323 EPDM Membrane Roofing 077100 Roof Specialties 077200 Roof Accessories
SUBMITTAL ITEMS:	Operation and Maintenance Data

Preventative Maintenance Guidelines

Ongoing and proper maintenance of the roofing system is part of a building owner's responsibility under the terms of the guarantee agreement. Only allow approved JM Peak Advantage® Contractors to maintain or perform repairs on a guaranteed roofing system.



Do's and Don't's of Roof Maintenance

Do...

- Perform inspections at least twice a year or as required by the guarantee. The ideal times to perform inspections are at the end of winter and the end of summer, when roofs have gone through the greatest amount of thermal stress (inspecting your roof for any trouble spots and to unclog drains in the spring and fall is also a good idea).
- Conduct additional inspections immediately after unusual occurrences such as heavy rains, high winds, hail, nearby fires, explosions, etc.
- Keep a file of all records and inspection reports relating to your roof.
- Advise equipment service personnel to be careful handling tools and heavy equipment on the roof. Log all such trips to the roof.
- Keep your roof clean and free of debris and contaminants.
- Establish a rooftop control policy. Keep access doors or hatches locked. Advise equipment service personnel to be careful.
- Keep roof drains free of debris.

Don't...

- Allow unqualified personnel to maintain your roof.
- Allow equipment service personnel to make penetrations into your roof; these are to be made only by an approved roofing contractor.
- Power-wash your roof. You may cause unintended damage!
- Puncture the membrane.
- Move heavy equipment across the roof.

Cause and Effect



Split in water line leaking



Evidence of water ponding



Weeds growing in drain due to excess water

Maintenance Checklist

To ensure the integrity of the roofing system, it is important to contact JM before any alterations are made. We encourage all alterations and repairs to be completed by a JM Peak Advantage Contractor to ensure they meet the high standards of JM and the requirements outlined in the guarantee.

Below is a checklist of things to look for while on your roof. Good roofing practice recommends these areas be inspected twice annually to ensure the roofing system integrity.

Building Exterior	
General Condition	Inspect all areas for signs of leaks and/or deterioration.
Walls	Inspect for deterioration, missing mortar and stains in walls indicating possible leaks.
Roof Edge – Coping Caps or Gravel Stop/Gutter	A coping is a covering for the top of a wall that is exposed to weather. It is usually sloped to shed water to the roof. Check for cracking, splits and mortar integrity. Replace any damaged, loose or cracked areas. Caulk joints if necessary.
Fascia	Inspect all surfaces for signs of leaks and/or deterioration.
Building Interior	
General Condition	Inspect all areas for signs of leaks and/or deterioration.
Walls	Inspect all surfaces for signs of leaks and/or deterioration.
Underside of Deck	Inspect for stains, discoloration, spalled or rusted surfaces.
Ceilings	Inspect for evidence of staining.
Field of Roof	
General Condition	Remove any debris such as leaves, small branches, dirt, rocks, etc. that have accumulated.
Surfacing	Minimize the amount of foot traffic on the roof whenever possible. Place walkway pads at roof entry areas and at rooftop equipment access panels.
Laps	Inspect the condition of membrane laps, if applicable.
Drainage System	
General Condition	Water should flow freely, unobstructed from the roof.
Gutters/Scuppers/Down Spouts/Drains	Remove any debris from inside and the surrounding areas. Make sure strainers and clamping rings are secure.
Perimeter/Flashings	
General Condition	Inspect attachment to make sure it remains watertight. All metal work must be caulked and watertight. Only JM metal is covered by the JM Peak Advantage Guarantee.
Base Flashing	Inspect for adequate fastening at top of the flashing. Check attachment to the substrate. Inspect vertical flashing end laps and horizontal laps at membrane.
Counterflashing	Ensure that the counterflashing is well secured. Periodically remove and replace caulking to ensure watertight conditions. Only use commercial grade caulk suitable for rooftop application.
Roof Top Units	
General Condition	All roof penetrations are prone to leaks. All units should be installed using compatible roof materials and should be properly flashed. Be sure to have a JM Peak Advantage contractor assist in the installation and flashing of new rooftop equipment.
HVAC	Check condensation lines for positive drainage. Ensure they are flowing freely to roof drains. Condensation lines should rest on wood blocks or rubber supports and never directly on the roof surface. Ensure equipment is in good condition and working properly. Install protection/walkpads around perimeter of equipment that requires periodic maintenance.
Equipment Supports: Satellite Dishes, Signs, Antennas, etc.	Properly support all heavy equipment on vertical curbs. All vertical curbs should be properly flashed and covered with a metal cap. Use protection/walkpads below all lightweight horizontal wood equipment supports.
Lightning Protection	Should not penetrate the roof surface. Ensure there are no overly loose or dangling cables.
Equipment Flashing	Ensure equipment base flashings are secure, watertight and counterflashed.
Penetrations	
General Condition	Do not allow exhaust fats, petroleum or other chemicals or contaminants directly onto the roof. Contact JM if any chemicals or service fluids come into contact with the roofing system.
Pipes and Vents Penetration Pan/ Pitch Pocket	Inspect the lap at membrane and vertical lap. Ensure that the top to the flashing is secured and caulked properly. An enclosure made of sheet metal, rubber or other material used to flash penetrations through a roof system. Often a source of leaks. Must be topped-off annually with compatible sealer.
Expansion Joints	A structural separation between two building elements that allows free movement between the elements without damage to the building or roofing system. Check for excessive movement or deterioration. Check all end laps and repair or replace lap splice as necessary. JM Expand-O-Flash expansion joints are covered under the terms of the JM Peak Advantage Guarantee.

RS-7395 6-08 (New)



Firestop Submittal Package

TITLE

Project: PROJECTNAME
PROJECTADDRESS1
PROJECTADDRESS2
PROJECTCITY_PROJECTSTATE_PROJECTZIP

Date: SUBMITTALDATE

Submitted by: SUBMITTERNAME
SUBMITTERADDRESS1
SUBMITTERADDRESS2
SUBMITTERCITY_SUBMITTERSTATE_SUBMITTEI

This submittal is auto-generated based on user-selected inputs.
Therefore, Hilti makes no representation as to the suitability of these systems for their intended use.

Hilti. Outperform. Outlast.

Hilti Firestop
Saving lives
through innovation
and education

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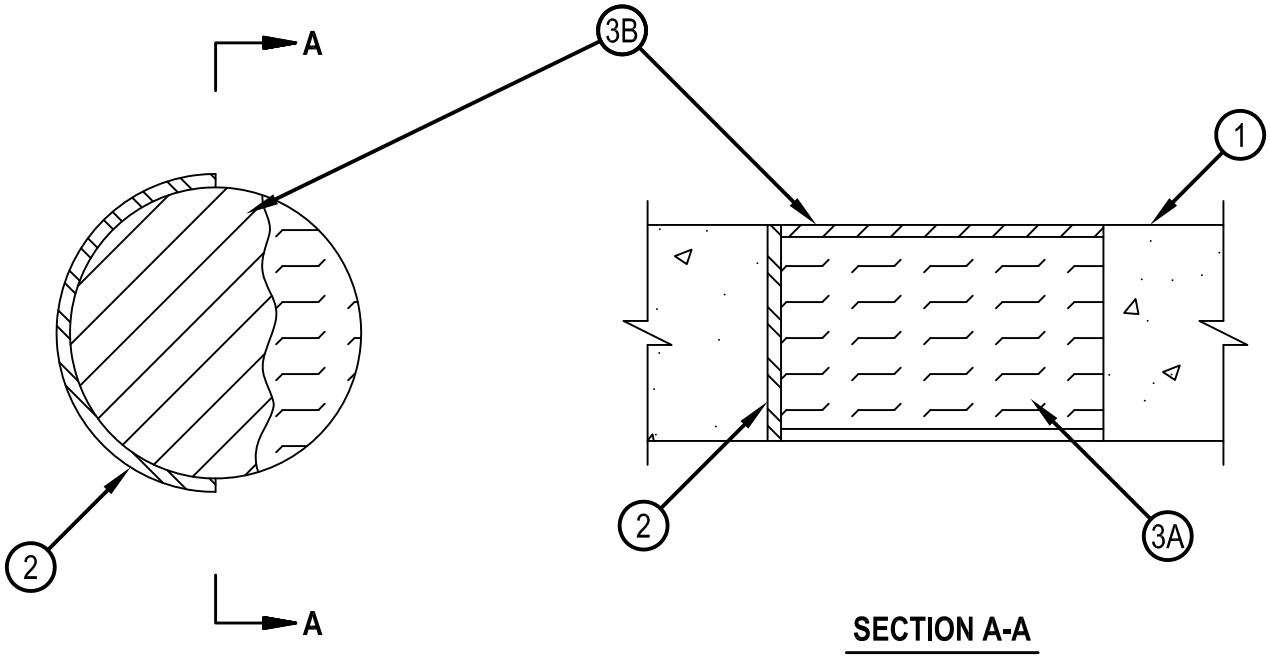
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Classified by
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to UL 1479 and CAN/ULC-S115

System No. C-AJ-0090

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating - 2 Hr	F Rating - 2 Hr
T Rating - 1-1/2 Hr	FT Rating - 1-1/2Hr
	FH Rating - 2 Hr
	FTH Rating - 1-1/2 Hr



SECTION A-A

1. Floor or Wall Assembly — Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m3) concrete. Wall may also be constructed of any UL Classified Concrete Blocks*. Max diameter of opening is 6 in. (152 mm).
   See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.
2. Steel Sleeve — (Optional)-Nom 6 in. (152 mm) diameter (or smaller) Schedule 40 (or heavier) steel pipe cast or grouted into the floor or wall assembly, flush with floor or wall surfaces.
3. Firestop System — The firestop system shall consist of the following:
   A. Packing Material — Min 4 in. (102 mm) thickness of 4 pcf (64 kg/m3) mineral wool batt insulation tightly packed into the opening as a permanent form. Packing material to be recessed from top surface of floor and both surfaces of wall to accommodate the required thickness of fill material.
   B. Fill, Void or Cavity Materials* — Sealant — Min 1/4 in. (6 mm) thickness of fill material applied within the annulus, flush with top surface of floor.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant or FS-ONE MAX Intumescent Sealant

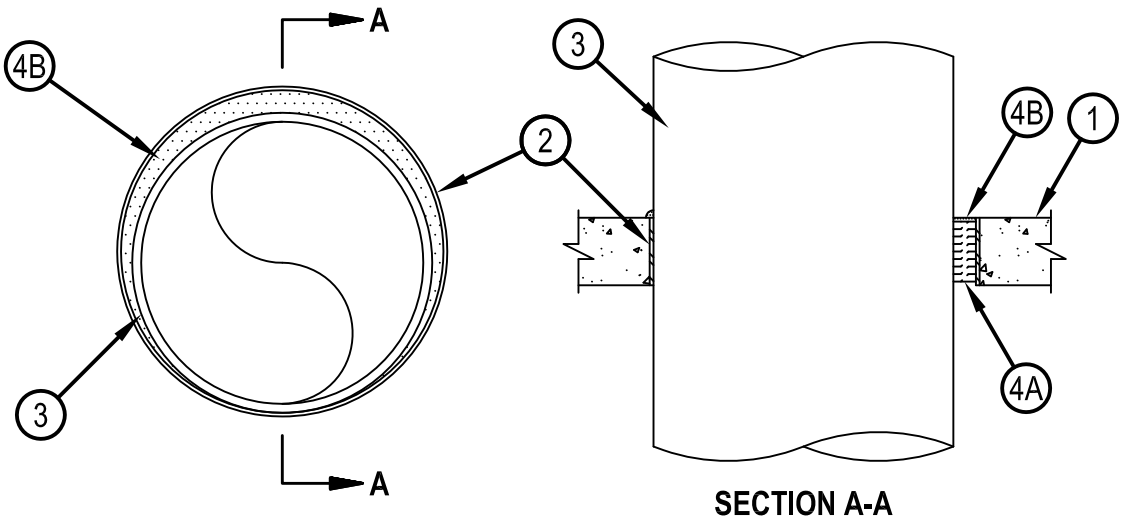
* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

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Classified by
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System No. C-AJ-1226

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 3 Hr	F Rating — 3 Hr
T Rating — 0 Hr	FT Rating — 0 Hr
L Rating At Ambient — Less Than 1 CFM/sq ft	FH Rating — 3 Hr
L Rating At 400 F — 4 CFM/sq ft	FTH Rating — 0 Hr
	L Rating At Ambient — Less Than 1 CFM/sq ft
	L Rating At 400 F — 4 CFM/sq ft



SECTION A-A

1. Floor or Wall Assembly — Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) concrete. Wall may also be constructed of any UL Classified Concrete Blocks*. Max diam of opening is 32 in. (813 mm).
2. Metallic Sleeve — (Optional) Nom 32 in. (813 mm) diam (or smaller) Schedule 40 (or heavier) steel sleeve cast or grouted into floor or wall assembly, flush with floor or wall surfaces or extending a max of 3 in. (76 mm) above floor or beyond both surfaces of wall.

2A. Sheet Metal Sleeve — (Optional) Max 6 in. (152 mm) diam, min 26 ga. galv steel provided with a 26 ga galv steel square flange spot welded to the sleeve at approx mid-height, or flush with bottom of sleeve in floors, and sized to be a min of 2 in. (51 mm) larger than the sleeve diam. The sleeve is to be cast in place and may extend a max of 4 in. (102 mm) below the bottom of the deck and a max of 1 in. (25 mm) above the top surface of the concrete floor.

2B. Sheet Metal Sleeve — (Optional) - Max 12 in. (305 mm) diam, min 24 ga galv steel provided with a 24 ga galv steel square flange spot welded to the sleeve at approx mid-height, or flush with bottom of sleeve in floors, and sized to be a min of 2 in. (51 mm) larger than the sleeve diam. The sleeve is to be cast in place and may extend a max of 4 in. (102 mm) below the bottom of the deck and a max of 1 in. (25 mm) above the top surface of the concrete floor.

3. Through-Penetrant — One metallic pipe, tube or conduit to be installed either concentrically or eccentrically within the firestop system. The annular space between penetrant and periphery of opening shall be min 0 in. (point contact) to max 1-7/8 in. (48 mm). Penetrant may be installed with continuous point contact. Penetrant to be rigidly supported on both sides of floor or wall assembly. The following types and sizes of metallic penetrants may be used:
   A. Steel Pipe — Nom 30 in. (762 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
   B. Iron Pipe — Nom 30 in. (762 mm) diam (or smaller) cast or ductile iron pipe.
   C. Copper Pipe — Nom 6 in. (152 mm) diam (or smaller) Regular (or heavier) copper pipe.
   D. Copper Tubing — Nom 6 in. (152 mm) diam (or smaller) Type L (or heavier) copper tubing.
   E. Conduit — Nom 6 in. (152 mm) diam (or smaller) steel conduit.
   F. Conduit — Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing (EMT).

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System No. C-AJ-1226

4. Firestop System — The firestop system shall consist of the following:

A. Packing Material — Min 4 in. (102 mm) thickness of min 4 pcf (64 kg/m³) mineral wool batt insulation firmly packed into opening as a permanent form. Packing material to be recessed from top surface of floor or sleeve or from both surfaces of wall or sleeve as required to accommodate the required thickness of fill material.

B. Fill, Void or Cavity Material* — Sealant — Min 1/4 in. (6 mm) thickness of fill material applied within the annulus, flush with top surface of floor or sleeve or with both surfaces of wall or sleeve. At the point or continuous contact locations between penetrant and concrete or sleeve, a min 1/4 in. (6 mm) diam bead of fill material shall be applied at the concrete or sleeve/ pipe penetrant interface on the top surface of floor and on both surfaces of wall.

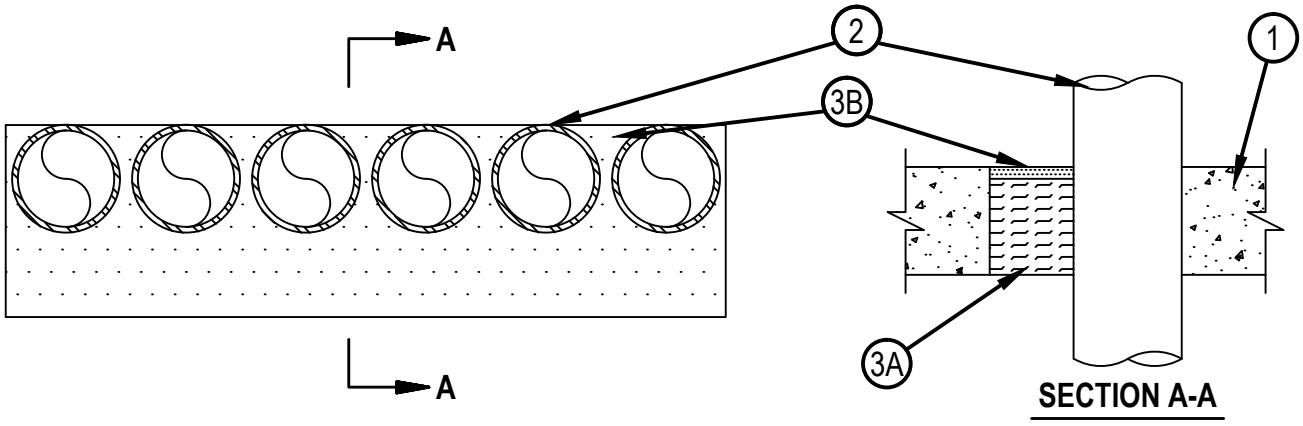
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-One Sealant or FS-ONE MAX Intumescent Sealant

* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

Classified by
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System No. C-AJ-1513

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating - 2 Hr	F Rating - 2 Hr
T Rating - 0 Hr	FT Rating - 0 Hr
	FH Rating - 2 Hr
	FTH Rating - 0 Hr



SECTION A-A

1. Floor or Wall Assembly — Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m3) concrete floor. Min 5 in. (127 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m3) concrete wall. Wall may also be constructed of any UL Classified Concrete Blocks*. Max size of opening is 8 in. (203 mm) by 30 in. (763 mm).
   See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.
2. Through Penetrants — One or more metallic penetrants to be installed either concentrically or eccentrically within the firestop system. The total number of penetrants is dependent on the size of the opening and sizes of penetrants. The annular space between the penetrants and periphery of opening shall be min 0 in. (point contact). The annular space between nom 2 in. (51 mm) diam (and smaller) penetrants shall be a min 0 in. (point contact). The annular space between penetrants greater than nom 2 in. (51 mm) diam shall be a min. 1/2 in. (13 mm). A max annular space in the system shall be 12 in. (305 mm). Penetrants to be rigidly supported on both sides of floor or wall assembly. The following types and sizes of penetrants may be used:
   A. Conduit — Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing or rigid steel conduit
   B. Through Penetrating Product* — Flexible Metal Piping — The following types of steel flexible metal gas piping may be used:
      1.) Nom 2 in. (51 mm) diam (or smaller) steel flexible metal gas piping. Plastic covering on piping may or may not be removed on both sides of floor or wall assembly.
      OMEGA FLEX INC
      2.) Nom 1 in. (25 mm) diam (or smaller) steel flexible metal gas piping. Plastic covering on piping may or may not be removed on both sides of floor or wall assembly.
      GASTITE, DIV OF TITEFLEX
      3.) Nom 2 in. (51 mm) diam (or smaller) steel flexible metal gas piping. Plastic covering on piping may or may not be removed on both sides of floor or wall assembly.
      WARD MFG L L C
3. Firestop System — The firestop system shall consist of the following:
   A. Packing Material — Min 4 in. (102 mm) thickness of 4 pcf (64 kg/m3) mineral wool batt insulation tightly packed into the opening as a permanent form. Packing material to be recessed from top surface of floor or both surfaces of wall to accommodate the required thickness of fill material.
   B. Fill, Void or Cavity Material - Sealant* — Min 1/2 in. (13 mm) thickness of fill material applied within the annulus flush with the top surface of the floor or both surfaces of the wall.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant or FS-ONE MAX Intumescent Sealant.

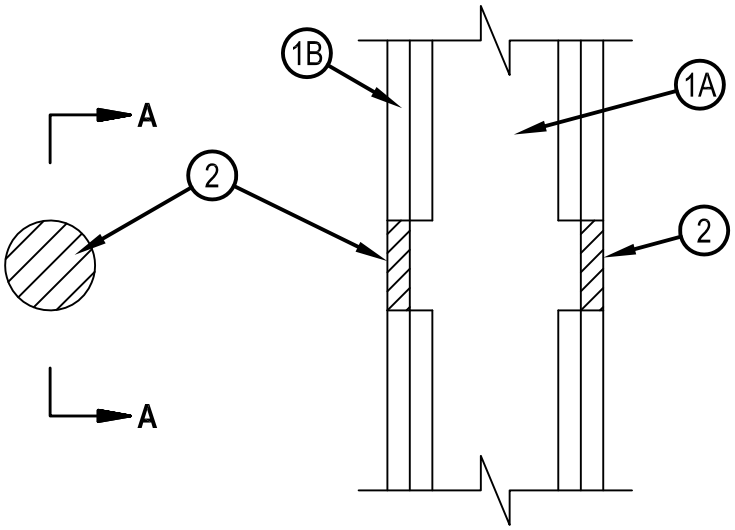
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System No. W-L-0040

Classified by
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ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings - 1 and 2 Hr (See Item 1)	F Ratings - 1 and 2 Hr (See Item 1)
T Ratings - 0 and 1-3/4 Hr (See Item 1)	FT Ratings - 0 and 1-3/4 Hr (See Item 1)
	FH Ratings - 1 and 2 Hr (See Item 1)
	FTH Ratings - 0 and 1-3/4 Hr (See Item 1)



SECTION A-A

1. Wall Assembly — The 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

   A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC.

   B. Gypsum Board* — Thickness, type, number of layers and orientation shall be as specified in the individual Wall and Partition Design. Max diam of opening is 2-1/2 in. (64 mm) or a max area of 4 in. (25.8 cm2) with a max dimension of 2 in. (51 mm).

   The hourly F and FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed. The hourly T, FT and FTH Ratings of the firestop system are 0 and 1-3/4 hr for 1 and 2 hr rated assemblies, respectively.

2. Fill, Void or Cavity Material* — Sealant — Min 5/8 in. (16 mm) thickness of sealant applied within annulus, flush with both surfaces of wall.
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant or FS-ONE MAX Intumescent Sealant

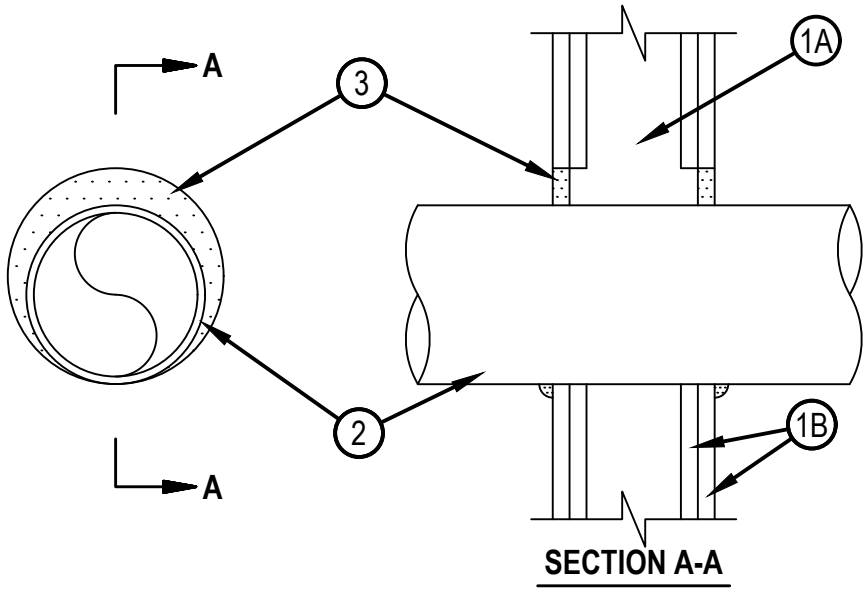
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January 23, 2015

System No. W-L-1054

Classified by
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to UL 1479 and CAN/ULC-S115

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings —1 and 2 Hr (See Items 1 and 3)	F Ratings — 1 and 2 Hr (See Items 1 and 3)
T Rating — 0 Hr	FT Rating — 0 Hr
L Rating at Ambient — Less Than 1 CFM/sq ft	FH Ratings —1 and 2 Hr (See Items 1 and 3)
L Rating at 400 F — Less Than 1 CFM/sq ft	FTH Rating — 0 Hr
	L Rating at Ambient — Less Than 1 CFM/sq ft
	L Rating at 400 F — Less Than 1 CFM/sq ft



SECTION A-A

1. Wall Assembly — The 1 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300 or U400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC. When steel studs are used and the diam of opening exceeds the width of stud cavity, the opening shall be framed on all sides using lengths of steel stud installed between the vertical studs and screw-attached to the steel studs at each end. The framed opening in the wall shall be 4 to 6 in. (102 to 152 mm) wider and 4 to 6 in. (102 to 152 mm) higher than the diam of the penetrating item such that, when the penetrating item is installed in the opening, a 2 to 3 in. (51 to 76 mm) clearance is present between the penetrating item and the framing on all four sides.
   B. Gypsum Board* — 5/8 in. (16 mm) thick, 4 ft (122 cm) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U300 or U400 Series Design in the UL Fire Resistance Directory. Max diam of opening is 32-1/4 in. (819 mm) for steel stud walls. Max diam of opening is 14-1/2 in. (368 mm) for wood stud walls.

The F and FH Ratings of the firestop system are equal to the fire rating of the wall assembly.

System No. W-L-1054

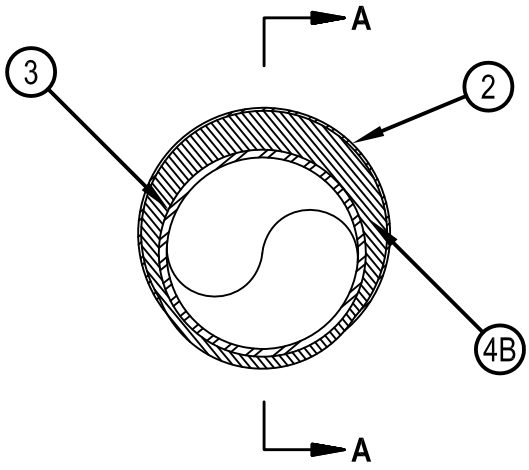
2. Through-Penetrants — One metallic pipe, conduit or tubing to be installed either concentrically or eccentrically within the firestop system. The annular space shall be min 0 in. to max 2-1/4 in. (57 mm). Pipe may be installed with continuous point contact. Pipe, conduit or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes, conduits or tubing may be used:
   A. Steel Pipe — Nom 30 in. (762 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
   B. Iron Pipe — Nom 30 in. (762 mm) diam (or smaller) cast or ductile iron pipe.
   C. Conduit — Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing or 6 in. (152 mm) . diam steel conduit.
   D. Copper Tubing — Nom 6 in. (152 mm) diam (or smaller) Type L (or heavier) copper tubing.
   E. Copper Pipe — Nom 6 in. (152 mm) diam (or smaller) regular (or heavier) copper pipe.
3. Fill, Void or Cavity Material* — Sealant — Min 5/8 in. (16 mm) thickness of fill material applied within the annulus, flush with both surfaces of wall. At the point or continuous contact locations between pipe and wall, a min 1/2 in. (13 mm) diam bead of fill material shall be applied at the pipe wall interface on both surfaces of wall.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-One Sealant or FS-ONE MAX Intumescent Sealant

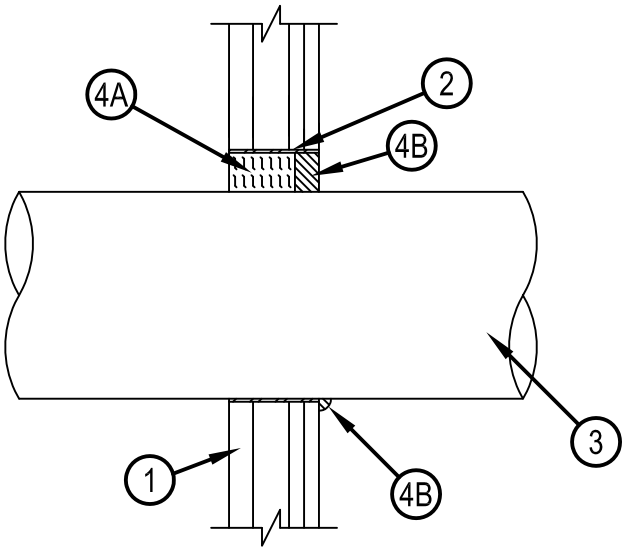
* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

System No. W-L-1206

Classified by Underwriters Laboratories, Inc. to UL 1479 and CAN/ULC-S115

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 1 and 2 Hr (See Items 1 and 4)	F Rating — 1 and 2 Hr (See Items 1 and 4)
T Rating — 0 Hr	FT Rating — 0 Hr
	FH Rating — 1 and 2 Hr (See Items 1 and 4)
	FTH Rating — 0 Hr





SECTION A-A

1. Wall Assembly — The fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400, V400 or W400 Series Wall and Partition Design in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — "C-T" shaped studs 1-5/8 in. (41 mm) wide by 2-1/2 in. (64 mm) deep, fabricated from 25 MSG galv steel, spaced max 24 in. (610 mm) OC.
   B. Gypsum Board* — One layer of nom 1 in. (25 mm) thick, 24 in. (610 mm) wide gypsum liner and one or two layers of nom 5/8 in. (16 mm) thick, 4 ft. (1.27 m) wide gypsum board with square or tapered edges. The gypsum board types, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design. Max diam of opening is 10-1/2 in. (267 mm).

1A. Wall Assembly — As an alternate to the above wall assembly, the 1 or 2 Hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400 or V400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing may consist of either wood studs or steel channel studs. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC.
   B. Gypsum Board* — Thickness, type, number of layers and fasteners as required in the individual Wall and Partition Design. Max diam of opening is 10-1/2 in. (267 mm).

   The hourly F, FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed.

2. Metallic Sleeve — Max 10-1/2 in. (267 mm) diam cylindrical sleeve fabricated from min 0.016 in. (0.41 mm) thick (28 gauge) galv sheet steel and having a min 1 in. (25 mm) lap along the longitudinal seam. Length of steel sleeve to be equal to thickness of wall. Sleeve installed by coiling the sheet steel to a diam smaller than the through opening, inserting the coil through the opening and releasing the coil to let it uncoil against the circular cutouts in the gypsum board layers. Sleeve may also be formed of No. 8 steel wire mesh having a min 1 in. (25 mm) lap along the longitudinal seam.

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January 22, 2015

System No. W-L-1206

3. Through-Penetrants — One metallic pipe, conduit or tubing to be installed either concentrically or eccentrically within the firestop system. An annular space of min 0 in. (0 mm, point contact) to max 1-7/8 in. (48 mm) is required within firestop system. Pipe, conduit or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes, conduits or tubing may be used:
   A. Steel Pipe — Nom 8 in. (203 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
   B. Iron Pipe — Nom 8 in. (203 mm) diam (or smaller) cast or ductile iron pipe.
   C. Conduit — Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing or 4 in. (102 mm) diam steel conduit.
   D. Copper Tubing — Nom 4 in. (102 mm) diam (or smaller) Type L (or heavier) copper tubing.
   E. Copper Pipe — Nom 4 in. (102 mm) diam (or smaller) Regular (or heavier) copper pipe.
   F. Flexible Steel Conduit+ — Nom 2 in. (51 mm) diam (or smaller) flexible steel conduit.
      See Flexible Metal Conduit (DXUZ) category in the Electrical Construction Equipment Directory for names of manufacturers.
4. Firestop System — The firestop system shall consist of the following:
   A. Packing Material — Min 1-5/8 or 2-1/4 in. (41 or 57 mm) thickness of min 4 pcf (64 kg/m^3) mineral wool batt insulation firmly packed into sleeve on one side of the wall as permanent form for 1 and 2 Hr walls, respectively. Packing material to be recessed from the room side of wall to accommodate the required thickness of fill material. In alternate wall assembly, packing material to be flush with either side of the wall and recessed from the other side of the wall to accommodate the required thickness of fill material.
   B. Fill, Void or Cavity Material — Sealant* — Min 1-1/2 in. (38 mm) thickness applied within sleeve, flush with the surface of wall. At the point contact location between pipe and wall, a min 1/2 in. (13 mm) diam bead of fill material shall be applied at the pipe/wall interface.
      HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant or FS-ONE MAX Intumescent Sealant

* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

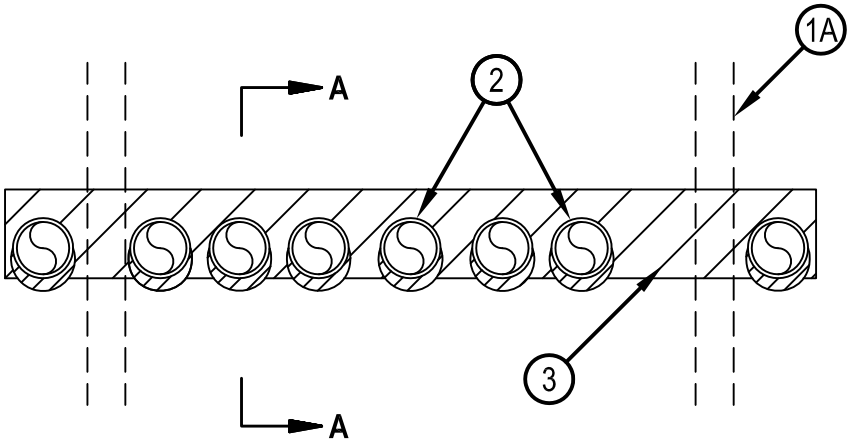
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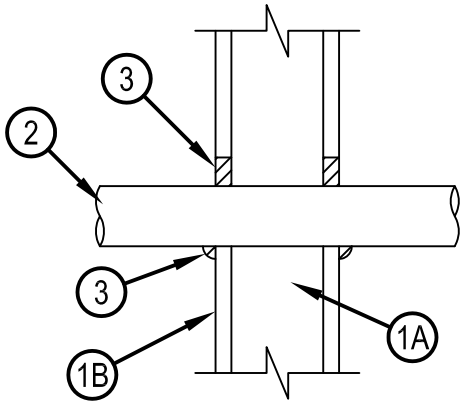
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System No. W-L-1389

Classified by Underwriters Laboratories, Inc. to UL 1479 and CAN/ULC-S115

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings — 1 and 2 Hr (See Item 1and 3)	F Ratings — 1 and 2 Hr (See Items 1 and 3)
T Rating — 0 Hr	FT Rating — 0 Hr
	FH Ratings — 1 and 2 Hr (See Items 1 and 3)
	FTH Rating — 0 Hr





SECTION A-A

1. Wall Assembly — The 1 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing shall consist of min 3-5/8 in. (92 mm) wide steel studs spaced max 24 in. (610 mm) OC.
   B. Gypsum Board* — Thickness, type, number of layers and fasteners, as specified in the individual Wall and Partition Design. Max height of opening is 3-1/2 in. (89 mm). Max width of opening is 32 in. (813 mm).

   The hourly F, FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed.
2. Through Penetrants — Multiple pipes or conduits installed in single layer array within the firestop system. The annular space between the pipes and conduits and the edges of the opening shall be min 0 in. (0 mm, point contact) to max 1-3/8 in. (35 mm). The separation between pipes and conduits to be a min 0 in. (0 mm, point contact) to a max 1-1/4 in. (32 mm). Pipes and conduits to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes or conduits may be used:
   A. Steel Pipe — Nom 2 in. (51 mm) diam (or smaller) Schedule 5 (or heavier) steel pipe.
   B. Conduit — Nom 2 in. (51 mm) diam (or smaller) rigid steel conduit or steel electrical metallic tubing (EMT).
3. Fill Void or Cavity Materials* - Sealant — Min 5/8 in. (16 mm) thickness of fill material installed to completely fill annular space between pipes, conduits and gypsum flush with each surface of wall. Min 1/2 in. (13 mm) diam bead of fill material applied to the through penetrant/wall interface at the point contact locations on both sides of the wall. The 2 hour F, FH Ratings apply only when FS-ONE Sealant is used.

   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — Hilti CP 606 Flexible Firestop Sealant or FS-ONE Sealant, FS-ONE MAX Intumescent Sealant

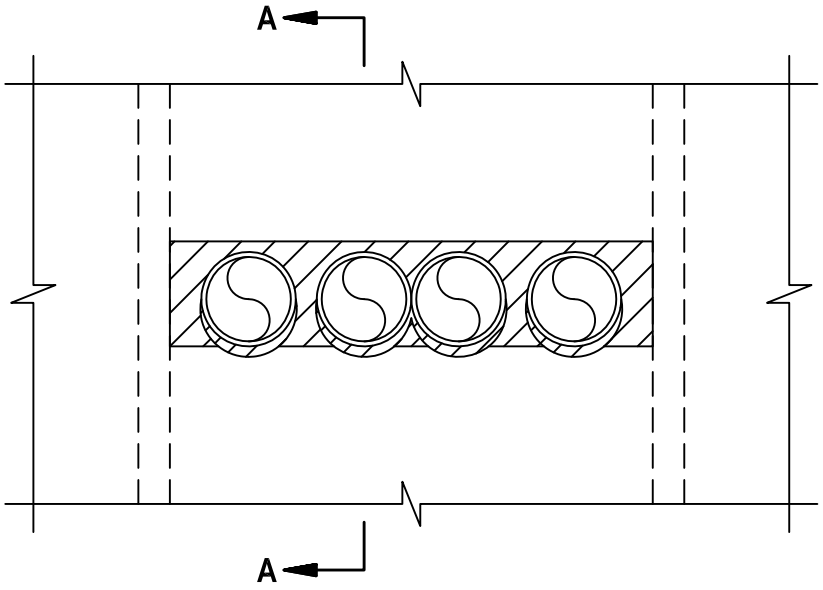
* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

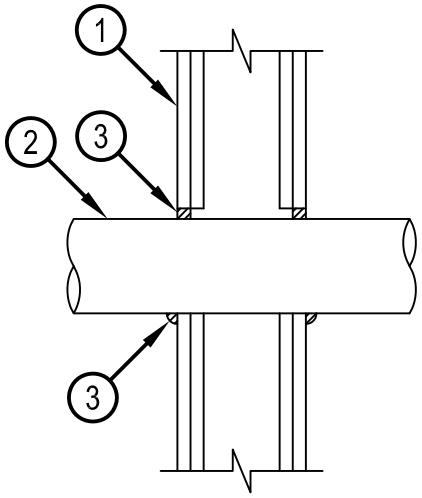
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System No. W-L-1408

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ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings — 1 and 2 Hr (See Item 1)	F Ratings — 1 and 2 Hr (See Item 1)
T Ratings — 0 and 1/4 Hr (See Item 1)	FT Ratings —0 and 1/4 Hr (See Item 1)
	FH Ratings — 1 and 2 Hr (See Item 1)
	FTH Ratings — 0 and 1/4 Hr (See Item 1)





SECTION A-A

1. Wall Assembly — The 1 and 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing shall consist of min 3-5/8 in. (92 mm) wide steel studs spaced max 24 in. (610 mm) OC.
   B. Gypsum Board* — Thickness, type, number of layers and fasteners, as specified in the individual Wall and Partition Design. Max area or opening is 114 in.2 (735 cm²) with max height of 5 in. (127 mm) and max width of 23 in. (584 mm).
   The hourly F, FH Ratings of the firestop system are equal to the hourly rating of the wall. The hourly T, FT, FTH Ratings of the firestop system is 0 hr and 1/4 hr when installed in 1 hr and 2 hr fire rated wall assemblies, respectively.
2. Through Penetrants — Multiple pipes or conduits installed in single layer array within the firestop system. The annular space between the pipes and conduits and the edges of the opening shall be min 0 in. (0 mm, point contact) to max 1 in. (25 mm). The separation between pipes and conduits to be a min 0 in. (0 mm, point contact) to a max 1-1/2 in. (38 mm). Pipes and conduits to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes or conduits may be used:
   A. Steel Pipe — Nom 4 in. (102 mm) diam (or smaller) Schedule 5 (or heavier) steel pipe.
   B. Conduit — Nom 4 in. (102 mm) diam (or smaller) rigid steel conduit or steel electrical metallic tubing (EMT).
3. Fill Void or Cavity Materials* - Sealant — Min 5/8 in. (16 mm) thickness of fill material installed to completely fill annular space between pipes, conduits and gypsum flush with each surface of wall. Min 1/2 in. (13 mm) diam bead of fill material applied to the through penetrant/wall interface at the point contact locations on both sides of the wall.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant, or FS-ONE MAX Intumescent Sealant

* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

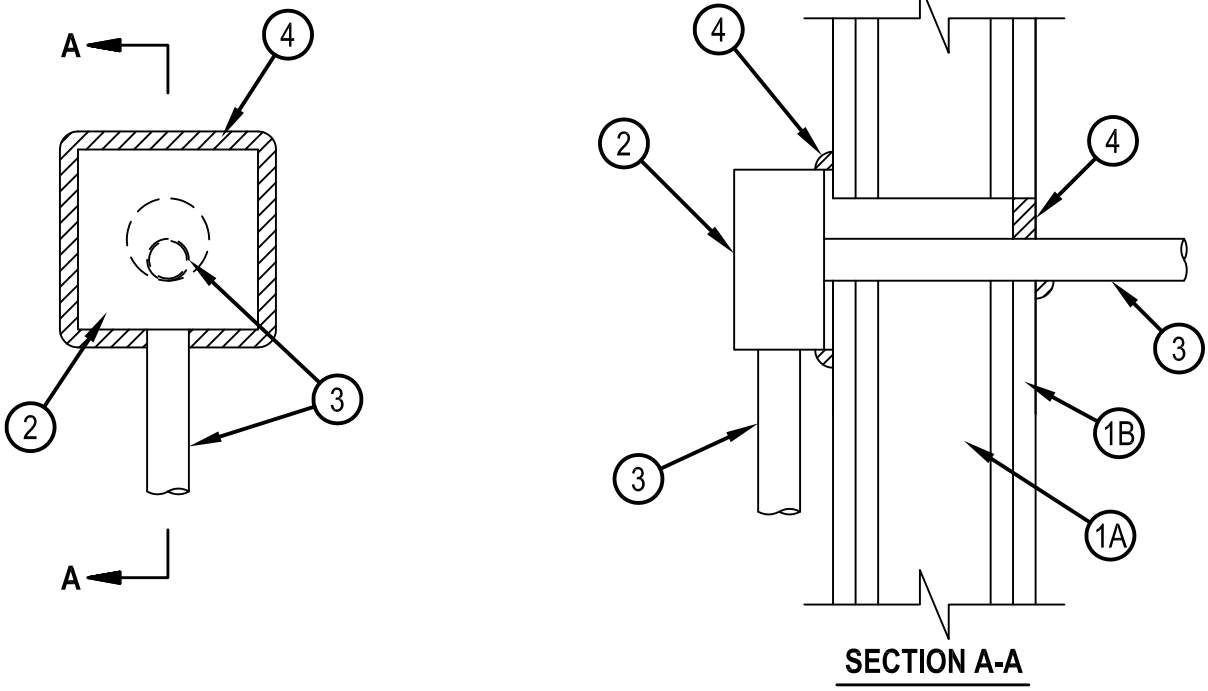
Hilti Firestop Systems

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System No. W-L-1440

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings — 1 and 2 Hr (See Item 1)	F Ratings — 1 and 2 Hr (See Item 1)
T Rating — 0 Hr	FT Rating — 0 Hr
	FH Ratings — 1 and 2 Hr (See Item 1)
	FTH Rating — 0 Hr



SECTION A-A

1. Wall Assembly — The 1 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC.
   B. Gypsum Board* — 5/8 in. (16 mm) thick, 4 ft (1.2 m) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and PartitionDesign. Diam of opening to be min 1/2 in. (13 mm) larger than outside diam of through penetrant. Max diam of opening is 2-1/4 in. (57 mm).

   The F, FH Ratings of the firestop system are equal to the fire rating of the wall assembly.
2. Pull or Junction Box+ — Min 16 ga steel pull or junction box mounted flush with or max 1/4 in. (6 mm) from surface of wall. See Junction and Pull Boxes (BGUZ) category in the Electrical Construction Material Directory for names of manufacturers.
3. Conduit — One nom 1 in. (25 mm) diam (or smaller) steel conduit or steel electrical metallic tubing to be installed either concentrically or eccentrically within the firestop system. The annular space shall be min 0 in. (point contact) to max 1-1/8 in. (29 mm). Conduit or EMT to be secured to back surface of pull or junction box with steel connector and rigidly supported on both sides of wall assembly.
4. Fill, Void or Cavity Material* — Sealant — Min 5/8 in. (16 mm) thickness of fill material applied within the annulus, flush with surface of wall opposite the pull or junction box. A min 1/2 in. (13 mm) diam bead of fill material shall be applied t the point contact location between the conduit and wall. A min 1/2 in. (13 mm) diam bead of fill material shall be applied around the entire perimeter of the pull or junction box at its interface with the wall surface. The fill material shall lap min 1/2 in. (13 mm) onto both the wall and sides of the pull or junction box.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-One Sealant or FS-ONE MAX Intumescent Sealant

+Bearing the UL Listing Mark

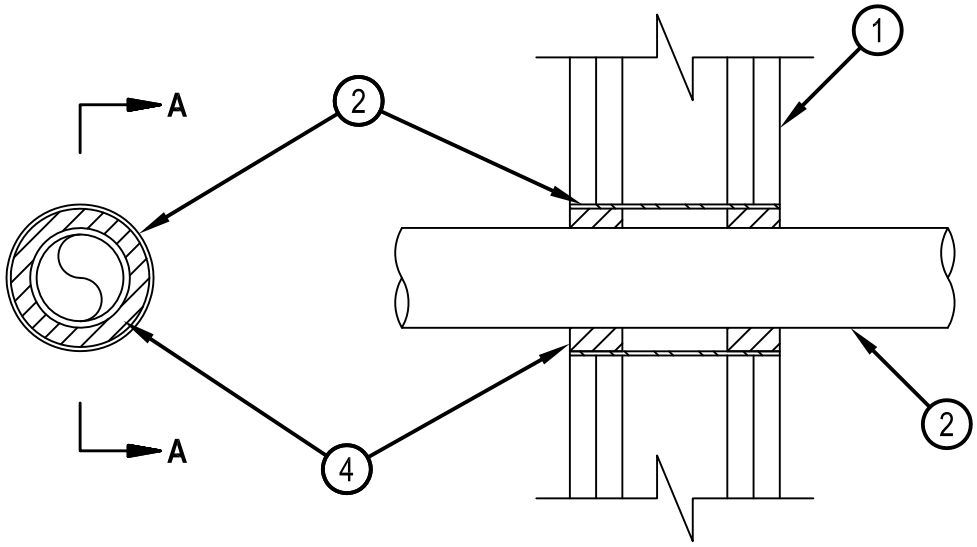
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Classified by
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to UL 1479

System No. W-L-2128

F Rating — 1 and 2 Hr (See Item 1)
T Rating — 0 Hr



SECTION A-A

1. Wall Assembly — The 1 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC.
   B. Gypsum Board* — 5/8 in. (16 mm) thick, 4 ft (122 cm) wide with square or tapered edges. The gypsum wallboard type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design. Max diam of opening is 3-1/2 in. (89 mm).
2. Metallic Sleeve Optional — Nom 3-1/2 in. (89 mm) (or smaller) cylindrical sleeve fabricated from min 0.016 in. thick (28 gauge) galv sheet steel and having a min 1-1/4 in. (32 mm) lap salong longitudinal seam. Length of sleeve to be installed flush with wall surfaces.
3. Through Penetrants — One nonmetallic pipe installed within the firestop system.. Pipe may be installed at an angle not greater than 45 degrees from perpendicular. Pipe to be rigidly supported on both sides of wall assembly. The space between pipe and periphery of opening shall be min 1/4 in. (6 mm) to max 11/16 in. (17.5 mm). The following types and sizes of nonmetallic pipes may be used:
   A. Polyvinyl Chloride (PVC) Pipe — Nom 2 in. (51 mm) diam (or smaller) Schedule 40 PVC pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.
   B. Chlorinated Polyvinyl Chloride (CPVC) Pipe — Nom 2 in. (51 mm) diam (or smaller) SDR13.5 CPVC pipe for use in closed (process or supply) piping systems.
4. Fill, Void or Cavity Materials* — Sealant — For 1 hr F Rating, min 5/8 in. (16 mm) thickness of fill material applied within the annulus, flush with both surfaces of wall. For 2 hr F Rating, min 1-1/4 in. (32 mm) thickness of fill material applied within annulus, flush with both surfaces of wall. HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant or FS-ONE MAX Intumescent Sealant

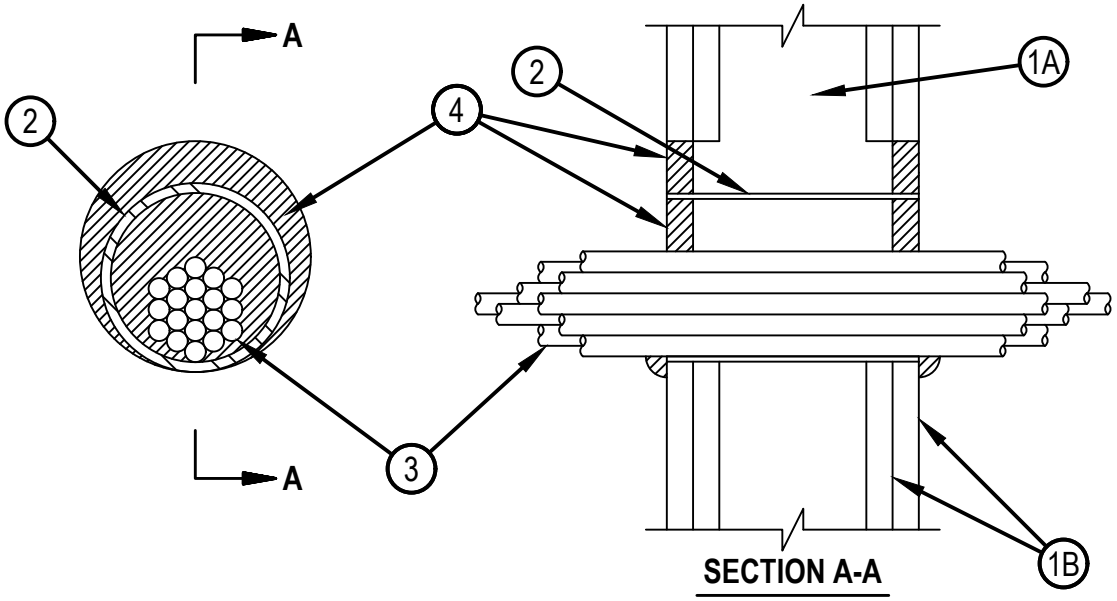
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System No. W-L-3065

Classified by
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ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 1 and 2 Hr (See Item 1)	F Rating — 1 and 2 Hr (See Item 1)
T Rating — 0 and 3/4 Hr (See item 3)	FT Rating — 0 and 3/4 Hr (See item 3)
L Rating At Ambient — 15 CFM/sq ft	FH Rating — 1 and 2 Hr (See Item 1)
L Rating At 400 F — 8 CFM/sq ft	FTH Rating — 0 and 3/4 Hr (See item 3)
	L Rating At Ambient — 15 CFM/sq ft
	L Rating At 400 F — 8 CFM/sq ft



SECTION A-A

1. Wall Assembly — The 1 or 2 fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC.
   B. Gypsum Board* — Nom 5/8 in. (16 mm) thick gypsum board, with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design in the UL Fire Resistance Directory. Max diam of opening is 5-1/2 in. (138 mm) when sleeve (Item 2) is employed. Max diam of opening is 4 in. (102 mm) when sleeve (Item 2) is not employed.

   The F, FH Ratings of the firestop system are equal to the fire rating of the wall assembly.
2. Metallic Sleeve — (Optional) - Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing (EMT) or Schedule 5 (or heavier) steel pipe or min 0.016 in. thick (0.41 mm, No. 28 ga) galv steel sleeve installed flush with wall surfaces. The annular space between steel sleeve and periphery of opening shall be min 0 in. (0 mm, point contact) to max 1 in. (25mm). When Schedule 5 steel pipe or EMT is used, sleeve may extend up to 18 in. (457 mm) beyond the wall surfaces. As an option when Schedule 5 steel pipe or EMT is used, sleeve may extend continuously beyond one wall surface. When cable bundle penetrates wall assembly at an angle of 45 degrees, no metallic sleeve is used.

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System No. W-L-3065

3. Cables — Aggregate cross-sectional area of cable in opening to be max 45 percent of the cross-sectional area of the opening. The annular space between the cable bundle and the periphery of the opening to be min 0 in. (point contact) to max 1 in. (25 mm). When sleeve is continuous on one side of wall (see Item 2), the cable fill may be 0 to 45% and the max annular space is not limited. Cables to be rigidly supported on both sides of the wall assembly. Any combination of the following types and sizes of copper conductor cables may be used:
   A. Max 7/C No. 12 AWG with polyvinyl chloride (PVC) insulation and jacket.
   B. Max 25 pair No. 24 AWG telephone cable with PVC insulation and jacket.
   B1. Max 4 pr No. 22 AWG Cat 5 or Cat 6 computer cables.
   C. Type RG/U coaxial cable with polyethylene (PE) insulation and PVC jacket having a max outside diameter of ½ in. (13 mm).
   C1. Max RG 6/U coaxial cable with fluorinated ethylene insulation and jacketing.
   D. Multiple fiber optical communication cable jacketed with PVC and having a max OD of 5/8 in. (16 mm).
   E. Through Penetrating Products*— Max three copper conductor No. 8 AWG .Metal-Clad Cable+.
   AFC CABLE SYSTEMS INC
   F. Max 3/C (with ground)(or smaller) No. 8 AWG copper conductor cable with PVC insulation and jacketing.
   G. Max 3/4 in. (19 mm) diam copper ground cable with or without a PVC jacket.
   H. Fire Resistive Cables* - Max 1-1/4 in. (32 mm) diam single conductor or multi conductor Type MI cable. A min 1/8 in. (3 mm) separation shall be maintained between MI cables and any other types of cable.
   I. Max 4/C with ground 300 kcmil (or smaller) aluminum SER cable with PVC insulation and jacket.
   J. Through Penetrating Product* - Any cables, Metal-Clad Cable+ or Armored Cable+ currently Classified under the Through Penetrating Products category.
   K. Maximum 3/C No. 8 AWG metal-clad cable.
   L. Maximum 5/8 diam fiber-optic cable with PVC jacket.
   For cable bundle penetrating the wall assembly at an angle of 45 degrees, the T, FT, FTH Ratings are 0 hr and 3/4 hr for 1 and 2 hr wall assemblies, respectively.
   See Through Penetrating Product (XHLY) category in the Fire Resistance Directory for names of manufacturers.
4. Fill, Void or Cavity Material*— Sealant or Putty — Fill material applied within the annulus, flush with each end of the steel sleeve or wall surface. Fill material installed symmetrically on both sides of the wall. A min 5/8 in. (16 mm) thickness of sealant is required for the 1 or 2 hr F Rating . An additional 1/2 in. (13 mm) diam bead of fill material shall be applied at the interface of sleeve with gypsum board.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CP601S, CP606, FS-One Sealants or FS-ONE MAX Intumescent Sealantor or CP618 Putty

5. Packing Material — (Optional, Not Shown) — Mineral wool forming material may be used as a backer for the fill material (Item 4). When used, it shall be firmly packed into annular space within the sleeve as a permanent form and recessed from end of sleeve to accommodate the required thickness of fill material.

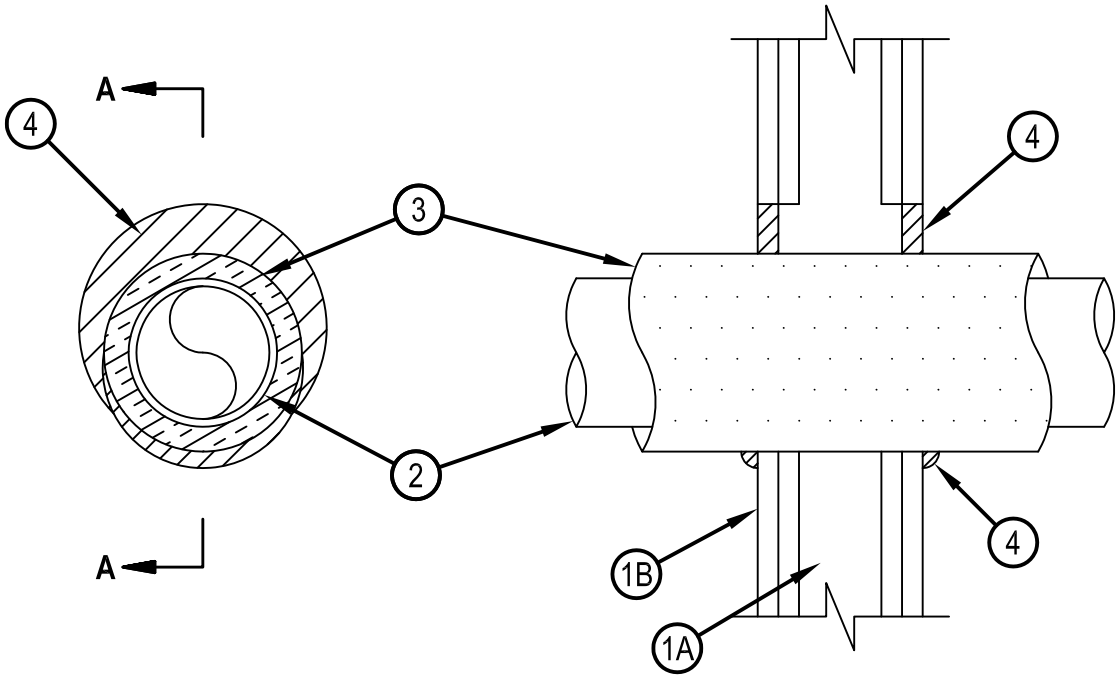
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October 14, 2015

System No. W-L-5028

Classified by Underwriters Laboratories, Inc. to UL 1479 and CAN/ULC-S115

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings — 1 and 2 Hr (See Item 1)	F Ratings — 1 and 2 Hr (See Item 1)
T Ratings — 0, 3/4 and 1 Hr (See Item 3)	FT Ratings — 0, ¾ and 1 Hr (See Item 3)
L Rating At Ambient — Less Than 1 CFM/sq ft	FH Ratings — 1 and 2 Hr (See Item 1)
L Rating At 400 F — Less Than 1 CFM/sq ft	FTH Ratings — 0, 3/4 and 1 Hr (See Item 3)
	L Rating At Ambient — Less Than 1 CFM/sq ft
	L Rating At 400 F — Less Than 1 CFM/sq ft



SECTION A-A

1. Wall Assembly — The 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC.
   B. Gypsum Board* — 5/8 in. (16 mm) thick, 4 ft (1.22 m) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design. Max diam of opening is 7-1/2 in. (191 mm).

   The hourly F and FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed.
2. Through Penetrants — One metallic pipe or tubing to be centered within the firestop system. Pipe or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes or tubing may be used:
   A. Steel Pipe — Nom 4 in. (102 mm) diam (or smaller) Schedule 40 (or heavier) steel pipe.
   B. Copper Tubing — Nom 2 in. (51 mm) diam (or smaller) Type L (or heavier) copper tubing.
   C. Copper Pipe — Nom 2 in. (51 mm) diam (or smaller) Regular (or heavier) copper pipe.

System No. W-L-5028

3. Tube Insulation — Plastics+ — Min 1/2 in. (13 mm) to max 1 in. (25 mm) thick acrylonitrile butadiene/polyvinyl chloride (AB/PVC) flexible foam furnished in the form of tubing. An annular space of min 0 in. (point contact) to max 1-1/2 in. (38 mm) is required within the firestop system. The T, FT and FTH Ratings are 1 hr when the 1 in. (25 mm) thick tube insulation is used and 3/4 hr when the 3/4 in. (19 mm) thick tube insulation is used. When tube insulation thickness is less than 3/4 in. (19 mm), the T, FT and FTH Ratings are 0 Hr.
   See Plastics+ (QMFZ2) category in the Recognized Component Directory for names of manufacturers. Any Recognized Component tube insulation material meeting the above specifications and having a UL 94 Flammability Classification of 94-5VA may be used.
4. Fill, Void or Cavity Material* — Sealant — Min 5/8 in. (16 mm) thickness of fill material applied within the annulus, flush with both surfaces of wall. At the point contact location between pipe covering and gypsum board, a min 1/2 in. (13 mm) diam bead of fill material shall be applied at the pipe covering/gypsum board interface on both surfaces of wall.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant or FS-ONE MAX Intumescent Sealant

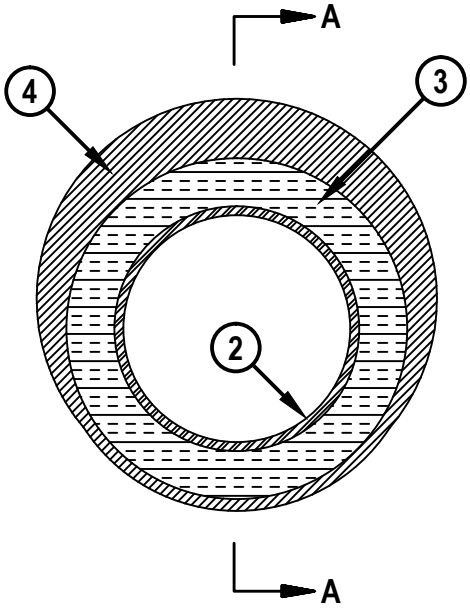
* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

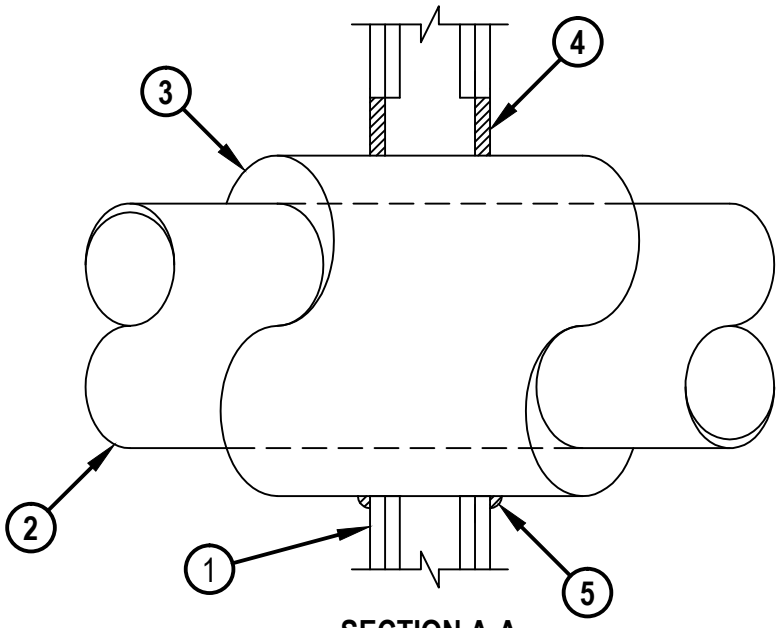
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System No. W-L-5029

Classified by
Underwriters Laboratories, Inc.
to UL 1479 and CAN/ULC-S115

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings — 1, 2 and 3 Hr (See Items 1, 3 and 4)	F Ratings — 1, 2 and 3 Hr (See Items 1, 3 and 4)
T Ratings — 0, 1/2, 1 and 1-1/4 Hr (See Item 3)	FT Ratings — 0, 1/2, 1 and 1-1/4 Hr (See Item 3)
L Rating At Ambient — 4 CFM/Sq Ft	FH Ratings — 1, 2 and 3 Hr (See Items 1, 2 and 4)
L Rating At 400 F — Less Than 1 CFM/Sq Ft	FTH Ratings — 0, 1/2, 1 and 1-1/4 Hr (See Item 3)
	L Rating At Ambient — 4 CFM/Sq Ft
	L Rating At 400 F — Less Than 1 CFM/Sq Ft





SECTION A-A

1. Wall Assembly — The 1, 2 or 3 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide for 1 and 2 hr F and FH rating and 3-1/2 in. (89 mm) wide for 3 hr F and FH rating and spaced max 24 in. (610 mm) OC.
   B. Gypsum Board* — Min 5/8 in. (16 mm) thick with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design. Max diam of opening is 18-5/8 in. (473 mm). The hourly F and FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed.
2. Through Penetrants — One metallic pipe or tubing to be installed within the firestop system. Pipe or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes or tubing may be used:
   A. Steel Pipe — Nom 12 in. (305 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
   B. Iron Pipe — Nom 12 in. (305 mm) diam (or smaller) cast or ductile iron pipe.
   C. Copper Tubing — Nom 6 in. (152 mm) diam (or smaller) Type L (or heavier) copper tubing. When the hourly F or FH Rating of the firestop system is 3 hr, the nom diam of copper tube shall not exceed 4 in. (102 mm).
   D. Copper Pipe — Nom 6 in. (152 mm) diam (or smaller) Regular (or heavier) copper pipe. When the hourly F or FH Rating of the firestop system is 3 hr, the nom diam of copper pipe shall not exceed 4 in. (102 mm).

System No. W-L-5029

3. Pipe Covering* — Nom 1, 1-1/2 or 2 in. (25, 38 or 51 mm) thick hollow cylindrical heavy density (min 3.5 pcf or 56 kg/m³) glass fiber units jacketed on the outside with an all service jacket. Longitudinal joints sealed with metal fasteners or factory-applied self-sealing lap tape. Transverse joints secured with metal fasteners or with butt tape supplied with the product. For 1 and 2 hr F and FH Ratings, the annular space between insulated penetrant and periphery of opening shall be min 0 in. (point contact) to max 1-7/8 in. (48 mm). For 3 hr F and FH Ratings, the annular space shall be min 0 in. (point contact) to max 1-1/4 in. (32 mm).
   See Pipe and Equipment Covering — Materials (BRGU) category in the Building Material Directory for the names of manufacturers. Any pipe covering material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.
   The hourly T, FT, FTH Ratings of the firestop system are 1/2 hr for 1 hr rated walls and 1 hr for 2 hr rated walls. For 3 hr rated walls, the hourly T, FT and FTH Ratings when steel and iron pipes are used are 1 hr. For 3 hr rated walls, the hourly T, FT and FTH Ratings when copper penetrants are used are 1-1/4 hr for 2 in. (51 mm) thick pipe covering and 0 hr for pipe covering thickness less than 2 in. (51 mm).

3A. Pipe Covering* — (Not Shown) — As an alternate to Item 3, max 2 in. (51 mm) thick cylindrical calcium silicate (min 14 pcf) units sized to the outside diam of the pipe or tube may be used. Pipe insulation secured with stainless steel bands or min 18 AWG stainless steel wire spaced max 12 in. (305 mm) OC. When the alternate pipe covering is used, the T and FT Rating shall be as specified in item 3 above.
   See Pipe and Equipment Covering — Materials (BRGU) category in the Building Materials Directory for names of manufacturers. Any pipe covering material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.

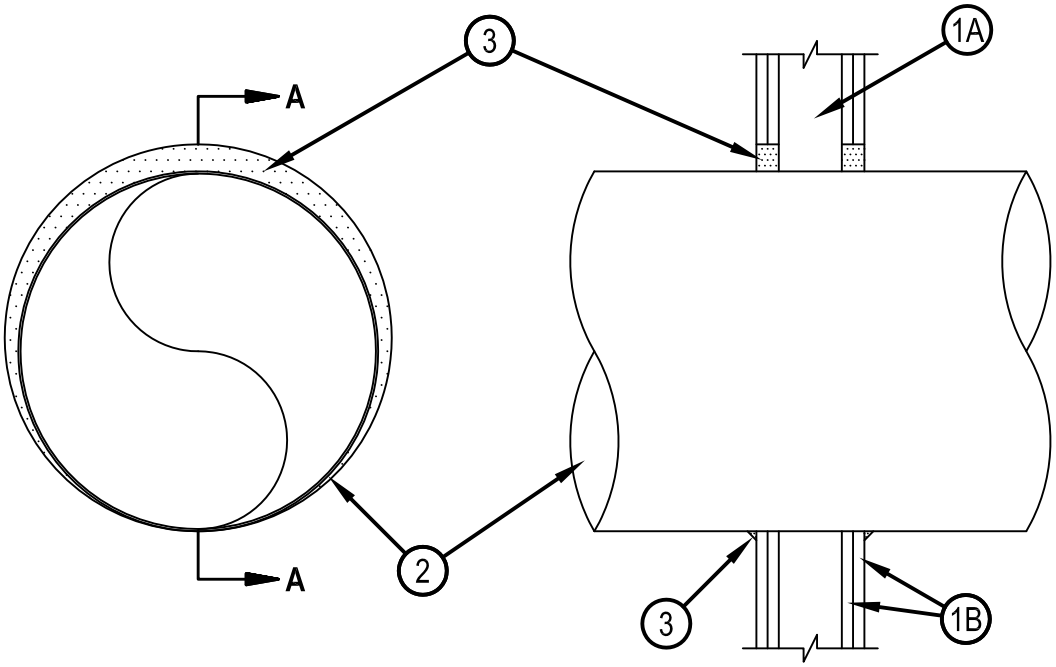
4. Fill, Void or Cavity Material* — Sealant — For 1 and 2 hr F and FH Rating, min 5/8 in. (16 mm) thickness of fill material applied within the annulus, flush with both surfaces of wall. For 3 hr F and FH Rating, min 1 in. (25 mm) thickness of fill material applied within the annulus, flush with both surfaces of wall. At the point contact location between pipe covering and gypsum board, a min 1/2 in. (13 mm) diam bead of fill material shall be applied at the pipe covering/gypsum board interface on both surfaces of wall.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-One Sealant or FS-ONE MAX Intumescent Sealant

* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

Classified by
Underwriters Laboratories, Inc.
to UL 1479 and CAN/ULC-S115

System No. W-L-7042

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings - 1 and 2 Hr (See Items 1 and 3)	F Ratings - 1 and 2 Hr (See Items 1 and 3)
T Rating - 0 Hr	FT Rating - 0 Hr
	FH Ratings - 1 and 2 Hr (See Items 1 and 3)
	FTH Rating - 0 Hr



SECTION A-A

1. Wall Assembly — The 1 or 2 hr fire rated wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features.
   A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced 24 in. (610 mm) OC.
   B. Gypsum Board* — For 1 hr assembly, one layer of min 5/8 in. (16 mm) thick wallboard as required in the individual Wall and Partition Design. For 2 hr assembly, two layers of min 5/8 in. (16 mm) thick wallboard as required in the individual Wall and Partition Design. Max diam of opening is 14-1/2 in. (368 mm) for wood stud walls and 21-3/4 in. (552 mm) for steel stud walls.

   The hourly F and FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed.
2. Through Penetrant — Galv steel duct to be installed concentrically or eccentrically within the firestop system. The annular space between the duct and periphery of opening shall be 0 in. (0 mm, point contact) and max 1-1/2 in. (64 mm) Duct to be rigidly supported on both sides of wall assembly.
   A. Spiral Wound HVAC Duct — Nom 20 in. (502 mm) diam (or smaller) No. 24 MSG (or heavier) galv steel spriral wound duct.
   B. Sheet Metal Duct — Nom 12 in. (305 mm) diam (or smaller) No. 28 MSG (or heavier) galv sheet steel duct.
3. Fill, Void or Cavity Material*—Sealant — Min 5/8 in. (16 mm) and 1-1/4 in. (32 mm) thickness of fill material applied within annulus, flush with both surfaces of wall assembly for 1 or 2 hr rated walls, respectively. At the point contact location between duct and wallboard, a min 1/2 in. (13 mm) diam bead of sealant shall be applied at the wallboard/duct interface on both surfaces of wall assembly.

   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CP601S Elastomeric Firestop Sealant, FS-ONE Sealant, FS-ONE MAX Intumescent Sealant or CP606 Flexible Firestop Sealant

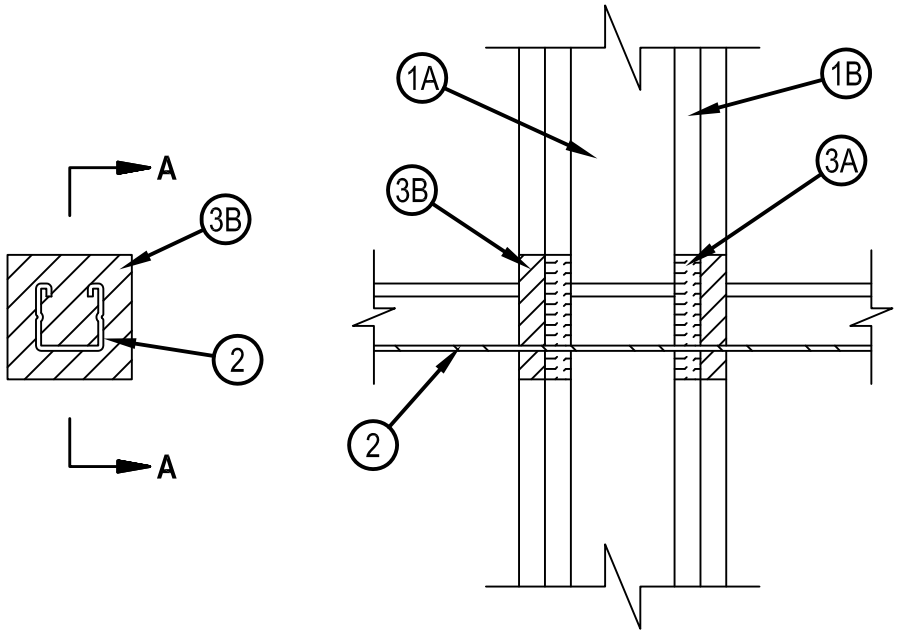
* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

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January 27, 2015

System No. W-L-7130

Classified by Underwriters Laboratories, Inc. to UL 1479 and CAN/ULC-S115

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings - 1 and 2 Hr (See Item 1)	F Ratings - 1 and 2 Hr (See Item 1)
T Rating - 0 Hr	FT Rating - 0 Hr
	FH Ratings - 1 and 2 Hr (See Item 1)
	FTH Rating - 0 Hr



SECTION A-A

1. Wall Assembly — The 1 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced max 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC.
   B. Gypsum Board* — One or two layers of gypsum board, as specified in the individual Wall and Partition Design. Max area of rectangular opening is 15 sq in. (96 cm2) with max dimension of 5 in. (127 mm). In lieu of rectangular opening max diam of circular opening is 3 in. (76 mm).

   The F and FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly.
2. Through Penetrants — One metallic strut, cable, rod or angle service support to be installed within the firestop system. An annular space of min 1/8 in. (3 mm) to max 7/8 in. (22 mm) is required within the firestop system. Strut, cable, rod or angle service support to be rigidly supported on both sides of floor or wall assembly. The strut, cable, rod or angle service support may be installed at an angle not greater than 45 degrees from the perpendicular. The following types and sizes of metallic strut, cable, rod or angle service support may be used:
   A. Steel Strut — Max 1-5/8 by 1-5/8 in. (41 by 41 mm) channel strut formed from min 0.105 in. (2.7 mm) thick galv or painted steel.
   B. Steel Strut — Max 3-1/4 by 1-5/8 in. (83 by 41 mm) H strut formed from min 0.105 in. (2.7 mm) thick galv or painted steel.
   C. Cable — Max 3/8 in. (9.5 mm) diam unjacketed galv steel cable.
   D. Threaded Rod — Max 1 in. (25 mm) diam galv steel threaded rod.
   E. Steel Angle — 2 by 2 by 1/8 in. (51 by 51 by 3 mm) thick steel angle.

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January 27, 2015

System No. W-L-7130

3. Firestop System — The firestop system shall consist of the following:

A. Packing Material — Min 1/2 in. (13 mm) thickness of min 4 pcf (64 kg/m3) mineral wool batt insulation firmly packed into opening as a permanent form. Packing material to be located between penetrant and periphery of opening, and within channels of struts. Packing material to be recessed from both surfaces of wall to accommodate the required thickness of fill material. When through penetrant is oriented perpendicular to wall or when Type FS-ONE Sealant (Item 3B) is used, packing material is optional.

B. Fill, Void or Cavity Material* - Sealant — Min 5/8 in. (16 mm) thickness of fill material applied within the annulus and within the channel struts, flush with both surfaces of wall.

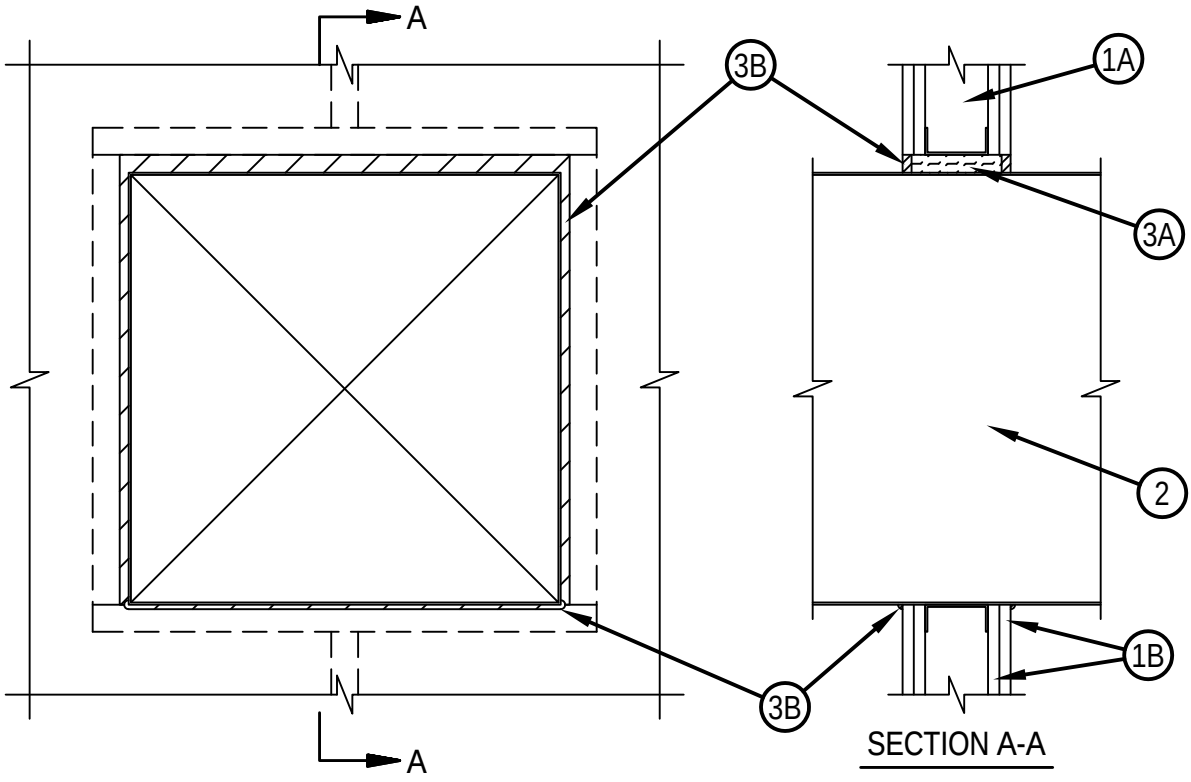
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant, CP 606 Sealant or FS-ONE MAX Intumescent Sealant

* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

Classified by
Underwriters Laboratories, Inc.
to UL 1479 and CAN/ULC-S115

System No. W-L-7143

F Ratings -- 1 and 2 Hr (See Items 1 and 2)
T Ratings -- 0 and 1/2 Hr (See Item 1)



SECTION A-A

1. Wall Assembly -- The 1 and 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs -- Wall framing shall consist of min. 3-1/2 in. (89 mm) wide steel channel studs and spaced max 24 in. (610 mm) OC. Additional 3-1/2 in. (89 mm) wide steel studs shall be used to completely frame opening.
   B. Gypsum Board -- One or two layers of 5/8 in. (16 mm) thick gypsum board as specified in the individual Wall and Partition Design. Max size of opening is 625 sq in. (4032 cm2) with a max dimension of 25 in. (635 mm).
   The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed. The hourly T Rating of the firestop system is 1/2 hr for 2 hr fire rated walls and 0 hr for 1 hr fire rated walls.
2. Steel Duct -- Nom. 24 in. by 24 in. (610 by 610 mm) (or smaller) No. 24 gauge (or heavier) galv. steel duct to be installed within the firestop system. An annular space of min 1/2 in. (13 mm) to max 1 in. (25 mm) is required within the firestop system. As an option, for systems with a 2 hr F Rating only, the min annular space at the bottom of the duct may be 0 in. (point contact) for 2 hr rated assemblies only. Steel duct to be rigidly supported on both sides of wall assembly
3. Firestop System -- The firestop system shall consist of the following:
   A. Packing Material -- Min 3-3/4 in. (95 mm) or 5 in. (127 mm) thickness of min 4 pcf (64 kg/m3) mineral wool batt insulation firmly packed into opening as a permanent form for 1 and 2 hr rated assemblies, respectively. Packing material to be recessed from both surfaces of wall to accommodate the required thickness of fill material.
   B. Fill Void or Cavity Materials* - Sealant -- Min 1/2 in. (13 mm) thickness of sealant applied within annulus, flush with both surfaces of wall assembly. Min 1/4 in. (6 mm) diam bead of sealant shall be applied at the duct/gypsum board interface at any point contact location, on both surfaces of wall assembly.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC -- CP 606 Sealant

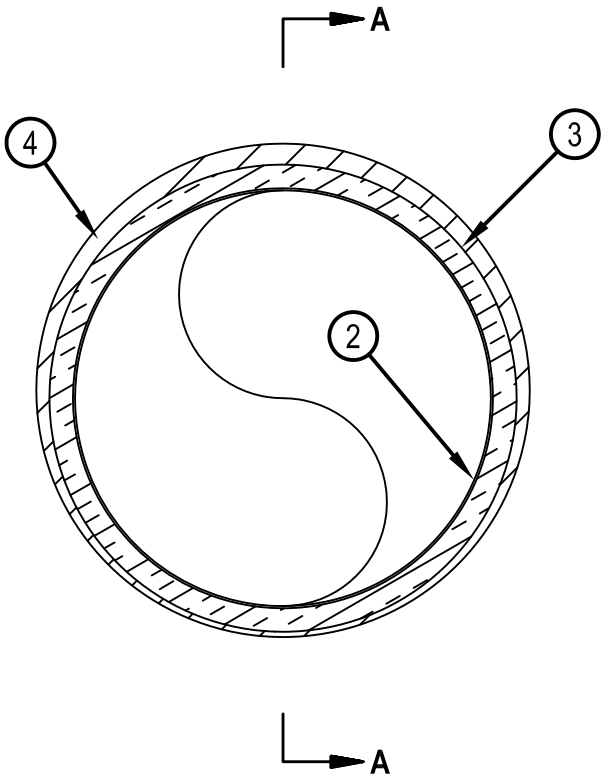
*Bearing the UL Classification Mark

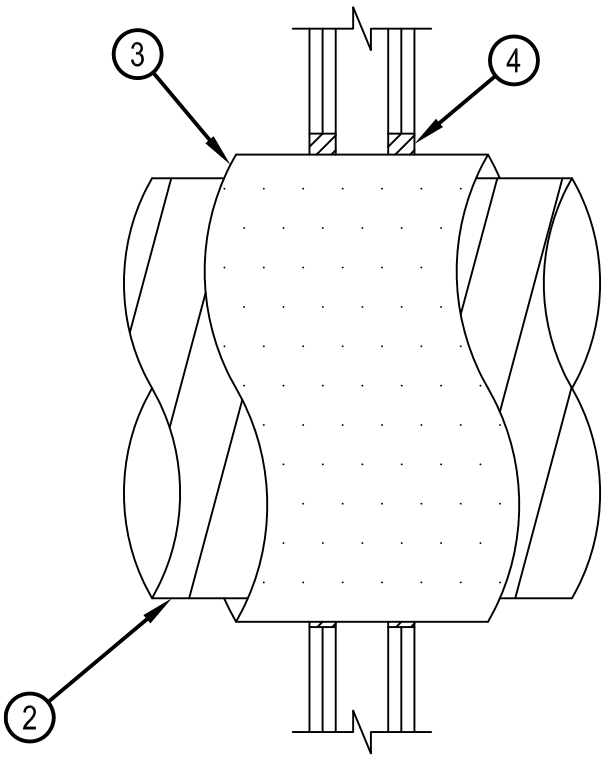
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November 29, 2005

System No. W-L-7153

Classified by Underwriters Laboratories, Inc. to UL 1479 and CAN/ULC-S115

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings - 1 and 2 Hr (See Item 1)	F Ratings - 1 and 2 Hr (See Item 1)
T Rating - 1/2 Hr	FT Rating - 1/2 Hr
	FH Ratings - 1 and 2 Hr (See Item 1)
	FTH Rating - 1/2 Hr





SECTION A-A

1. Wall Assembly — The 1 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400, V400 or W400 Series Wall or Partition Design in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing shall consist of channel studs. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC.
   B. Wallboard, Gypsum* — 5/8 in. (16 mm) thick, 4 ft (122 cm) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design in the UL Fire Resistance Directory. Max diam of opening is 23-1/2 in. (597 mm).
   The hourly F and FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed.

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January 27, 2015

System No. W-L-7153

2. Steel Duct — Galv steel duct to be installed concentrically or eccentrically within the firestop system. Duct to be rigidly supported on both sides of wall assembly.
   A. Spiral Wound HVAC Duct — Nom 20 in. (508 mm) diam (or smaller) No. 24 MSG (or heavier) galv steel spriral wound duct.
   B. Sheet Metal Duct — Nom 12 in. (305 mm) diam (or smaller) No. 28 MSG (or heavier) galv sheet steel duct.
3. Duct Insulation* — Nom 1-1/2 in. (38 mm) thick glass fiber batt or blanket (min 3/4 pcf or 56 kg/m3) jacketed on the outside with a foil-scrim-kraft facing. Longitudinal and transverse joints sealed with aluminum foil tape. During the installation of the fill material, the batt or blanket shall be compressed 50% such that the annular space within the firestop system shall be min 1/4 in. (6 mm) to max 1 in. (25 mm). See Batts and Blankets - (BKNV) category in the Building Materials Directory for names of manufacturers. Any batt or blanket meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index 50 or less may be used.
4. Fill, Void or Cavity Material* — Sealant — Min 5/8 in. (16 mm) or 1-1/4 in. (32 mm) thickness of fill material applied within annulus, flush with both surfaces of wall for 1 or 2 hr walls, respectively. If voids develop after the fill materials cures, the voids shall be sealed with additional fill material.
   HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant or FS-ONE MAX Intumescent Sealant

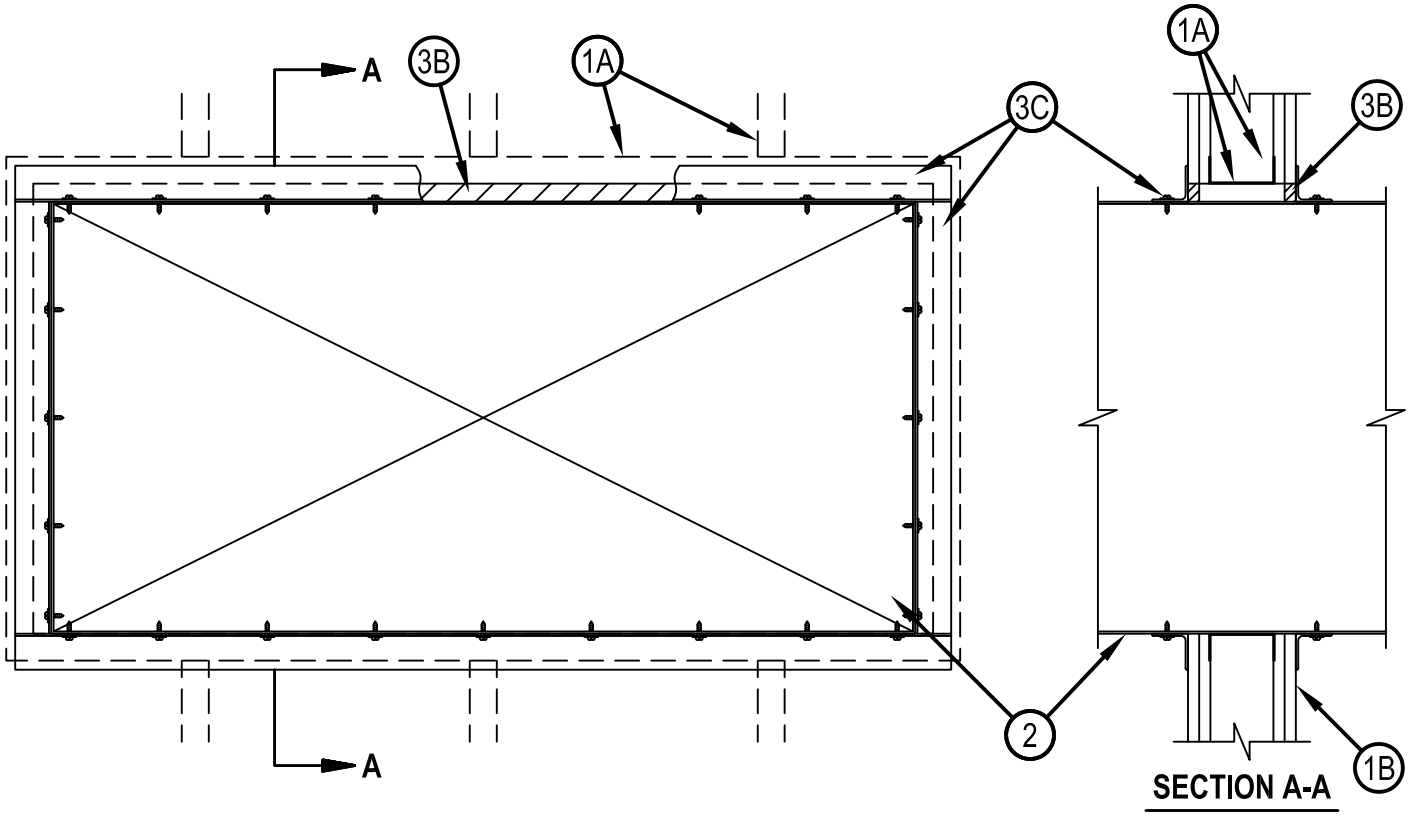
* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

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Classified by
Underwriters Laboratories, Inc.
to UL 1479 and CAN/ULC-S115

System No. W-L-7155

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings — 1 and 2 Hr (See Item 1)	F Ratings — 1 and 2 Hr (See Item 1)
T Ratings — 0 Hr	FT Ratings — 0 Hr
L Rating at Ambient — Less Than 1 CFM/sq ft	FH Ratings — 1 and 2 Hr (See Item 1)
L Rating at 400 F — Less Than 1 CFM/sq ft	FTH Ratings — 0 Hr
	L Rating at Ambient — Less Than 1 CFM/sq ft
	L Rating at 400 F — Less Than 1 CFM/sq ft



SECTION A-A

1. Wall Assembly — The 1 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400, V400 or W400 Series Wall or Partition Design in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing shall consist of min 3-1/2 in. (89 mm) wide steel channel studs spaced max 24 in. (610 mm) OC. Additional steel studs shall be used to completely frame the opening.
   B. Gypsum Board* — 5/8 in. (16 mm) thick, 4 ft (1.22 m) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design in the UL Fire Resistance Directory. Max area of opening is 73.7 sq ft (6.85 m2) with a max dimension of 104 in. (2.64 m).

   The hourly F and FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed.
2. Steel Duct — Max 100 in. by 100 in. (2.5 by 2.5 m) galv steel duct to be installed either concentrically or eccentrically within the firestop system. The duct shall be constructed and reinforced in accordance with SMACNA construction standards. The space between the steel duct and periphery of opening shall be min 0 in. (point contact) to max 2 in. (51 mm). Steel duct to be rigidly supported on both sides of the wall assembly.

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January 27, 2015

System No. W-L-7155

2A1. Through-Pentrating Product* — As an alterate to Item 2. Fiber cement with galvanized steel facing, 3/8 in.(10 mm) thick composite metallic duct, with a max cross-sectional area of 43.0 sq ft, (4 m2) and a max individual dimension of 78 3/4 in. (2 m). Duct to be installed either concentrically or eccentrically within the firestop system such that the annular space is min 0 in. (point contact) to max 2 in. (51 mm). Duct to be rigidly supported on both sides of wall assembly. Refer to Ventilation Duct Assemblies in Vol. 2 of the Fire Resistance Directory.
DURASYSTEMS BARRIERS INC — Type DuraDuct HP.

2A2. Through-Pentrating Product* — As an alternate to Item 2. Fiber cement with galvanized steel facing, 1/4 in. (6 mm) thick, with a max cross-sectional area of 1764 sq in. (1.14 m2), and a max individual dimension of 42 in. (1067 mm). Duct to be installed either concentrically or eccentrically within the firestop system such that the annular space is min 0 in. (point contact) to max 2 in. (51 mm). Duct to be rigidly supported on both sides of wall assembly and installed in accordance. Refer to Ventilation Duct Assemblies in Vol. 2 of the Fire Resistance Directory.
DURASYSTEMS BARRIERS INC — Type DuraDuct SD.

2A3. Through-Pentrating Product* — As an alternate to Item 2. Galvanized steel faced duct panel, with a max cross-sectional area of 2450 sq in. (1.58 m2), and a max individual dimension of 49-1/2 in. (1258 mm) Duct to be installed either concentrically or eccentrically within the firestop system such that the annular space is min 0 in. (point contact) to max 2 in. (51 mm). Duct to be rigidly supported on both sides wall assembly. Refer to Ventilation Duct Assemblies in Vol. 2 of the Fire Resistance Directory.
DURASYSTEMS BARRIERS INC — Type DuraDuct GNX.

3 Firestop System — The firestop system shall consist of the following:

A. Packing Material — (Optional, Not Shown) — Polyethylene backer rod, mineral wool batt insulation or fiberglass batt insulation friction fitted into annular space. Packing material to be recessed from both surfaces of wall to accommodate the required thickness of fill material.

A1. Packing Material — Required as specified in Table below. Min 3-3/4 in. (95 mm) or 5 in. (127 mm) thickness of min 4 pcf (64 kg/m3) mineral wool batt insulation firmly packed into opening as a permanent form for 1 and 2 hr rated assemblies, respectively. Packing material to be recessed from both surfaces of wall to accommodate the required thickness of fill material.

B. Fill, Void or Cavity Material* — Sealant — Min 5/8 in. (16 mm) thickness of fill material applied within the annulus, flush with both surfaces of wall. Min 1/4 in. (6 mm) diam bead of fill material shall be applied at the point contact location between the steel duct and the gypsum board.
HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CFS-S SIL GG Sealant, FS-ONE Sealant, FS-ONE MAX Intumescent Sealant or CP606 Flexible Firestop Sealant

C. Steel Retaining Angles — Min No. 16 gauge galv steel angles sized to lap steel duct a min of 2 in. (51 mm) and to lap wall surfaces a min of 1 in. (25 mm). When max duct dimension does not exceed 48 in. (122 cm) and duct area does not exceed 1300 in2 (8387 cm2), angles may be min No. 18 gauge galv steel. Angles attached to steel duct on both sides of wall with min No. 10 by 1/2 in. (13 mm) long steel sheet metal screws located a max of 1 in. (25 mm) from each end of steel duct and spaced a max of 6 in. (152 mm) OC. Steel angles are optional for those sides of duct that do not exceed the dimension specified in Table below, dependent on packing material, sealant and annular space as specified.

Max Duct Dimension	Duct Thickness	Annular Space	Packing Material	Angle (Item 3C) Required
24 in. (610 mm)	24 ga or heavier	1/2 in. min to 1 in. max (13 to 25 mm)	Item 3A1	No

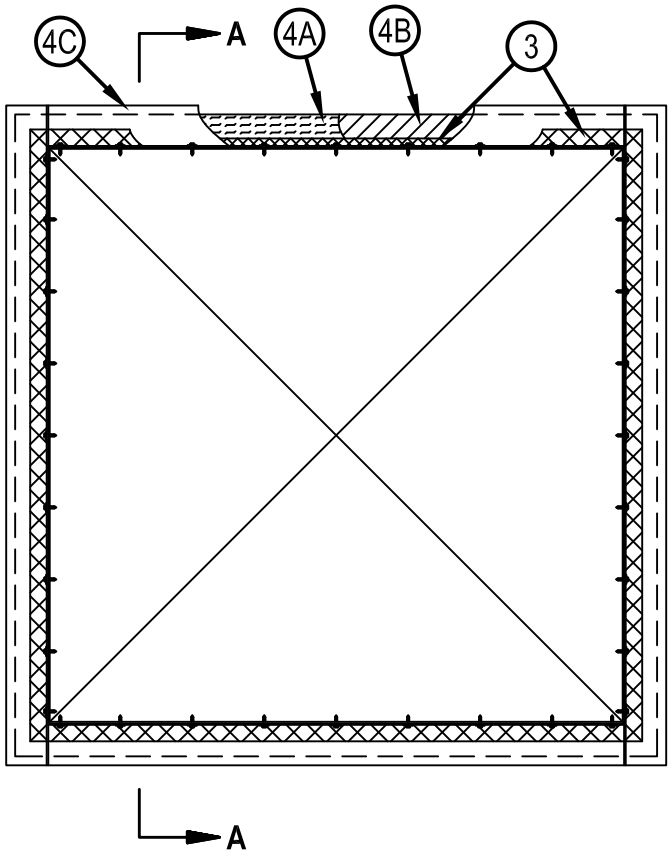
* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

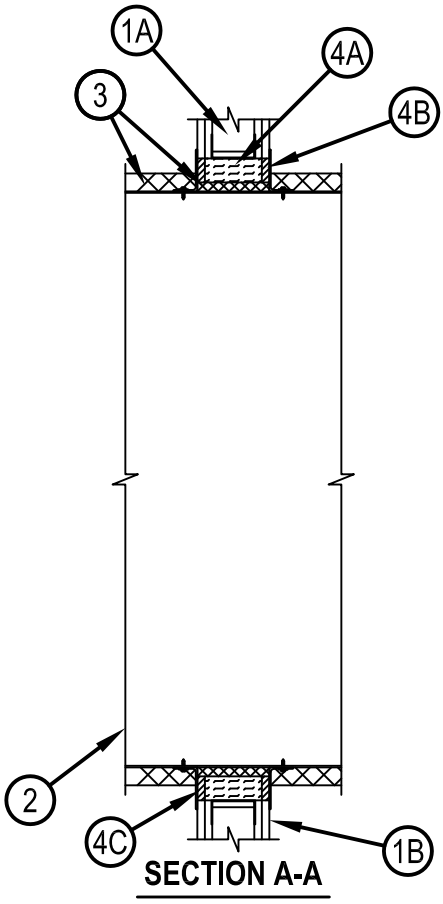
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System No. W-L-7156

Classified by Underwriters Laboratories, Inc. to UL 1479 and CAN/ULC-S115

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings — 1 and 2 Hr (See Item 1)	F Ratings — 1 and 2 Hr (See Item 1)
T Rating — 0 Hr	FT Rating — 0 Hr
	FH Ratings — 1 and 2 Hr (See Item 1)
	FTH Rating — 0 Hr





1. Wall Assembly — The 1 or 2 hr fire-rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing shall consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced max 16 in. (406 mm) OC. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC. Additional framing members shall be used to completely frame around opening.
   B. Gypsum Board* — Min 5/8 in. (16 mm) thick, 4 ft (1.2 m) wide with square or tapered edges. The gypsum board type, thickness, number of layers and orientation shall be as specified in the individual Wall and Partition Design. Max size of opening is 210 sq in. (1355 cm2) with a max width of 14-1/2 in. (368 mm) for wood studs. Max size of opening is 76.2 sq ft. (7 m2) with a max width of 105-1/2 in. (2.7 m) for steel studs.

   The hourly F and FH Ratings of the firestop system are equal to the hourly fire rating of the wall in which it is installed.
2. Steel Duct — Max 100 by 100 in. (2.5 by 2.5 m) steel duct to be installed within the framed opening. The duct shall be constructed and reinforced in accordance with SMACNA construction standards. Steel duct to be rigidly supported on both sides of wall assembly.

System No. W-L-7156

3. Batts and Blankets* — Nom 1-1/2 or 2 in. (38 or 51 mm) thick glass fiber batt or blanket (min 3/4 pcf or 12 kg/m3) jacketed on the outside with a foil-scrim-kraft facing. Longitudinal and transverse joints sealed with aluminum foil tape. During the installation of the fill material, the batt or blanket shall be compressed minimum 50% such that the annular space within the firestop system shall be min 1/2 in. (13 mm) to max 2 in. (51 mm).

   See Batts and Blankets (BKNV) category in the Building Materials Directory for names of manufacturers. Any batt or blanket meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index 50 or less may be used.

4. Firestop System — The firestop system shall consist of the following:

   A. Packing Material — Min 3-5/8 (92 mm) or 4-7/8 in. (124 mm) thickness of min 4 pcf (64 kg/m3) mineral wool batt insulation firmly packed into opening as a permanent form for 1 or 2 hr fire-rated walls, respectively. Packing material to be recessed from both surfaces of wall to accommodate the required thickness of fill material.

   B. Fill, Void or Cavity Material* — Sealant — Min 5/8 in. (16 mm) thickness of fill material applied within annulus, flush with both surfaces of wall. HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant or FS-ONE MAX Intumescent Sealant

   C. Steel Retaining Angles — Min No. 16 gauge (0.059 in. or 1.5 mm) galv steel angles sized to lap steel duct a min of 2 in. 51 mm) and lap wall surfaces a min of 1 in. (25 mm). Angles attached to steel duct on both sides of wall with min No. 10 steel sheet metal screws spaced a max of 1 in. (25 mm) from each end of steel duct and spaced a max of 6 in. (152 mm) OC. When max duct dimension does not exceed 48 in. (122 cm) and duct area does not exceed 1300 in2 (8387 cm2), angles may be min No. 18 gauge galv steel. Angles attached to steel duct on both sides of wall with min No. 10 by 1/2 in. (13 mm) long steel sheet metal screws located a max of 1 in. (25 mm) from each end of steel duct and spaced a max of 6 in. (152 mm) OC. When max 1-1/2 in. (38 mm) thick insulation is used, steel angles are optional for those sides of duct that do not exceed the dimension specified in Table below, dependent on packing material and annular space as specified.

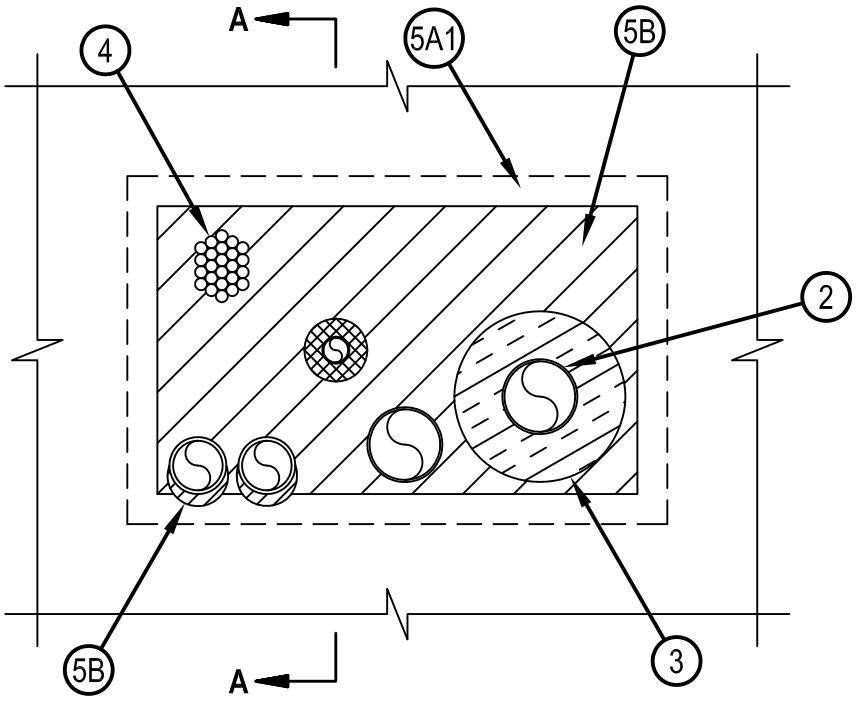
Max Duct Dimension	Duct Thickness	Annular Space	Packing Material	Angle (Item 3C) Required
24 in. (610 mm)	24 ga or heavier	1/2 in. min to 1 in. max (13 to 25 mm)	Item 3A1	No

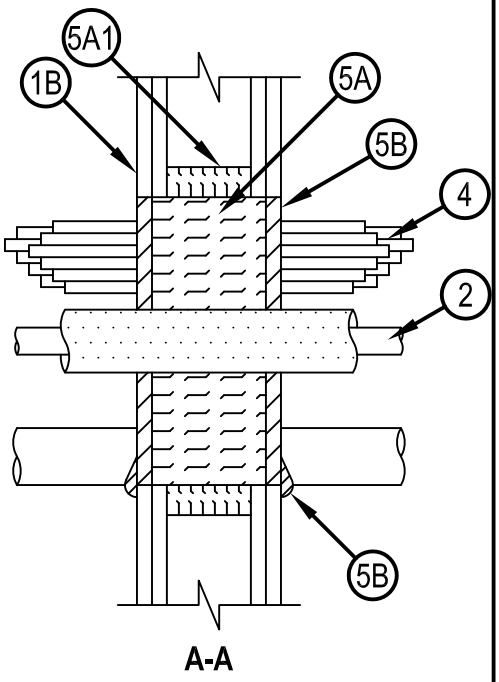
* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

System No. W-L-8079

Classified by Underwriters Laboratories, Inc. to UL 1479 and CAN/ULC-S115

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Ratings — 1 and 2 Hr (See Item 1)	F Ratings — 1 and 2 Hr (See Item 1)
T Ratings — 0, 1/2, 3/4, 1-1/2 and 2 Hr (See Items 2, 3 and 4)	FT Ratings — 0, 1/2, 3/4, 1-1/2 and 2 Hr (See Items 2, 3 and 4)
	FH Ratings — 1 and 2 Hr (See Item 1)
	FTH Ratings — 0, 1/2, 3/4, 1-1/2 and 2 Hr (See Items 2, 3 and 4)





A-A

System tested with a pressure differential of 2.5 Pa between the exposed and the unexposed surfaces with the higher pressure on the exposed side.

1. Wall Assembly — The 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
   A. Studs — Wall framing may consist of either wood studs or channel shaped steel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced max 16 in. (406 mm) OC. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 mm) OC.
   B. Gypsum Board* — 5/8 in. (16 mm) thick with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U300, U400 or V400 Wall and Partition Design. If the through penetrants are installed in a wood stud/gypsum board assembly, the max area of square, rectangular, or circular opening is 210 sq in. (1355 cm2). with max dimension of 14-1/2 in. (368 mm). If the through penetrants are installed in a steel stud/gypsum board assembly, max area of square, rectangular, or circular opening is 240 sq in. (1548 cm2) with max dimension of 20 in. (508 mm) wide.
   The hourly F and FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed.

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System No. W-L-8079

2. Through-Penetrant — One or more pipes, conduit or tubes to be installed within the opening. The total number of through-penetrants is dependent on the size of the opening and the types and sizes of the penetrants. Any combination of the penetrants described below may be used provided that the following parameters relative to the annular spaces and the spacing between the through penetrants are maintained. The separation between the penetrants shall be min 1 in. (25 mm) to max 22 in. (560mm). The annular space between penetrants and the periphery of opening shall be min 0 in. (0 mm, point contact) to max 22 in. (560 mm). Pipes, conduit or tubes to be rigidly supported on both sides of wall assembly. The following types and sizes of pipes, conduit or tubes may be used.
   A. Copper Tubing — Nom 3 in. (76 mm) diam (or smaller) Type L (or heavier) copper tube.
   B. Copper Pipe — Nom 3 in. (76 mm) diam (or smaller) Regular (or heavier) copper pipe.
   C. Steel Pipe — Nom 4 in. (102 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.
   D. Iron Pipe — Nom 4 in. (102 mm) diam (or smaller) cast or ductile iron pipe.
   E. Conduit — Nom 3 in. (76 mm) diam (or smaller) electric metallic tubing (EMT) or rigid steel conduit.
   F. Polyvinyl Chloride (PVC) Pipe — Nom 2 in. (51 mm) diam (or smaller) Schedule 40 cellular or solid core PVC pipe for use in closed (process or supply) or vented (drain, waste, or vent) piping systems.
   G. Chlorinated Polyvinyl Chloride (CPVC) Pipe — Nom 2 in. (51 mm) diam (or smaller) SDR 13.5 CPVC pipe for use in closed (process or supply) piping systems.
   The T, FT and FTH Ratings are 0 Hr if bare pipe and tubing is used.
3. Pipe Insulation — One or more metallic penetrants (pipe or tubing) may be insulated with the following types of pipe coverings:
   A. Pipe Covering* — Min 1 in. (25 mm) to max 2 in. (51 mm) thick hollow cylindrical heavy density min 3.5 pcf (56 kg/m3) glass fiber units jacketed on the outside with an all service jacket. Longitudinal joints sealed with metal fasteners or factory-applied self-sealing lap tape. Transverse joints secured with metal fasteners or with butt tape supplied with the product.
   See Pipe and Equipment Covering - Materials (BRGU) category in the Building Materials Directory for names of manufacturers. Any pipe covering material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.
   B. Tube Insulation-Plastics+ — Min 1/2 in. (13 mm) to max 3/4 in. (19 mm) thick acrylonitrile butadiene/polyvinyl chloride (AB/PVC) flexible foam furnished in the form of tubing.
   See Plastics+ (QMFZ2) category in the Plastics Recognized Component Directory for names of manufacturers. Any Recognized Component tube insulation material meeting the above specifications and having a UL 94 Flammability Classification of 94-5VA may be used.
   The annular space between the insulated penetrants and the periphery of the opening shall be min 0 in. (0 mm, point contact) The separation between the insulated penetrants and the other penetrants shall be a min 1 in. (25 mm).
   The T, FT and FTH Ratings are 1-1/2 hour if Item 3B is used. The T, FT and FTH Ratings are 2 hr if Item 3A is used.

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4. Cables — One max 3 in. (76 mm) diam bundle of cables installed within the opening and rigidly supported on both surfaces of wall. The annular space between the tightly-bundled cables and the periphery of the opening shall be min 0 in. (0 mm, point contact) to max 22 in. (560 mm). The separation between the cable bundle and the other penetrants shall be min 1 in. (25 mm) to max 22 in. (560 mm). Any combination of the following types and sizes of cables may be used:

A. Max 25 pair No. 24 AWG telephone cable with polyvinyl chloride (PVC) insulation and jacket.

B. Max 7/C No. 12 AWG copper conductor power and control cable with PVC or cross-linked polyethylene (XLPE) insulation and PVC jacket.

C. Multiple fiber optical communication cable jacketed with PVC and having a max outside diam of 1/2 in. (13 mm).

D. Max 3/C No. 8 AWG with bare aluminum ground, PVC insulated steel Metal-Clad+ Cable currently Classified under the Through Penetrating Product* (XHLY) category.

E. Max 3/C (with ground) No. 8 AWG (or smaller) nonmetallic sheathed (Romex) cable with PVC insulation and jacket materials.

F RG/U coaxial cable with polyethylene (PE) insulation and polyvinyl chloride (PVC) jacket having a max outside diam of 1/2 in. (13 mm).

G Max 3/4 in. (19 mm) diam copper ground cable with or without PVC jacket.

H Max 1-1/4in. (32 mm) Diam single or multi conductor mineral-insulated copper-clad cable.

The T, FT and FTH Ratings are 1/4 hr if cables D, G and H are used. The T, FT and FTH Ratings are 3/4 Hr for any other combination.

4A. Through Penetrants — (Not shown) - Max six nom 1 in. (25 mm) diam (or smaller) flexible steel conduits to be installed either concentrically or eccentrically within the firestop system. The annular space between the conduits and the periphery of the opening shall be min 0 in. (point contact) to a max 3 in. (76 mm). Conduits to be rigidly supported on both sides of wall.

4B. Through Penetrants — (Not Shown) - Max twelve nom 3/8 in. (10 mm) diam (or smaller) polyvinyl chloride (PVC) pneumatic tubing for use in closed (process or supply) piping systems. Tubing to be installed either concentrically or eccentrically within the firestop system. The annular space between the tubing and the periphery of the opening shall be min 0 in. (point contact) to a max 1 in. (25 mm). Tubing to be rigidly supported on both sides of wall.

5 Firestop System — The firestop system shall consist of the following:

A. Packing Material — In 2 hr fire rated wall assemblies, min 4-3/4 in. (121 mm) thickness of min 4 pcf (64 kg/m3) mineral wool batt insulation firmly packed into opening as a permanent form. In 1 hr fire rated wall assemblies, min 3-1/2 in. (89 mm) thickness of min 4 pcf (64 kg/m3) mineral wool batt insulation firmly packed into opening as a permanent form. Packing material recessed from both surfaces of the wall to accommodate the required thickness of fill material.

A1. Packing Material — Min 1-1/4 in. (32 mm) thickness of min 4 pcf (64 kg/m3) mineral wool batt insulation firmly packed as a backer around the perimeter of opening as a permanent form.

B. Fill, Void or Cavity Material* — Sealant — Min 5/8 in. (16 mm) thickness of fill material applied within annulus, flush with both surfaces of wall. At the point contact location between through penetrants and gypsum board, a min 1/2 in. (13 mm) diam bead of fill material shall be applied at the gypsum board/through penetrant interface on both surfaces of wall.

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* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

+ Bearing the UL Listing Mark

Bearing the UL Recognized Component Mark

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January 28, 2015

Certificate of Compliance

as a

DESIGNATED RESPONSIBLE INDIVIDUAL

Is hereby granted on this day October 16, 2015 to:

Tom Riley
Firestoppers LLC

for successfully meeting all test criteria.

FM Approvals hereby certifies that the individual shown above met all test criteria contained in Approval Standard 4991, Approval of Firestop Contractors, to qualify as a Designated Responsible Individual (DRI).

Said recognition is subject to satisfactory field performance, accumulation of Continuing Education Units and periodic written re-examinations.

Cynthia Frank, Assistant Vice President
Group Manager
FM Approvals
1151 Boston-Providence Turnpike
Norwood, MA 02062

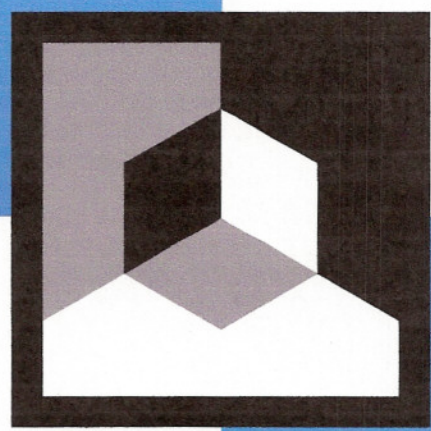
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AAMA 609 & 610-02

Cleaning and Maintenance Guide for Architecturally Finished Aluminum



MANUFACTURERS ASSOCIATION

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1. SCOPE

1.1 This guide outlines methods, equipment and materials applicable for cleaning architecturally finished aluminum after construction and for subsequent periodic maintenance.

1.2 The methods outlined herein are intended for use on anodized or painted architectural products whether rolled or extruded shapes, including window and door frames, store fronts and entrances, curtain walls, mullions, columns, panels, hand rails, flag poles and hardware.

1.3 Types of architectural finishes are: anodic coatings, thermoplastic and thermosetting organic coatings.

2. PURPOSE

This information is intended as a guide for architects, owners, building managers, contractors and others in the building industry who are interested in the proper care and maintenance of finished architectural aluminum. Herein are described safe, practical methods for cleaning, maintenance and protection of finished architectural aluminum.

3. GENERAL

3.1 Anodized Aluminum: As with any finished building material, anodized aluminum requires reasonable care prior to and during installation and periodic cleaning and maintenance after installation. Although anodized aluminum possesses exceptional resistance to corrosion, discoloration and wear, its natural beauty can be marred by harsh chemicals, rough conditions or neglect. Such conditions usually affect only the surface finish and do not reduce the service life of the aluminum. However, the marks resulting from such mistreatment may be permanent. For example, mortar, cement and other alkaline materials will quickly corrode anodic coatings if allowed to dry on the metal surface.

3.2 Painted Aluminum: Organic coatings on aluminum do not normally show an appreciable amount of dirt collection. In many atmospheres dirt or soil would not indicate a detrimental risk to the coating, but cleaning and surface care may be desirable for the sake of appearance. Cleaning may become desirable in areas where heavy industrial deposits have dulled the surface, where materials from construction processes have soiled the surface or where cleaner run-down from other surfaces should be removed.

3.3 Both painted and anodized surfaces, exposed to the atmosphere, collect soil and dirt, the amount of which may vary depending on geographic area, environmental conditions, finish and location on the building. Local atmospheric conditions as well as building location within a geographical area quite naturally have an effect on cleanliness.

More frequent cleaning will be required in heavy industrialized areas compared to rural areas. Seasonal rainfall can affect washing frequency by removing water soluble deposits and less adherent soil. In foggy coastal regions, frequent cycles of condensation and drying can create a heavy build-up of atmospheric salts and dirt which may adhere tenaciously. In climates where rainfall is low, the opportunity for atmospheric washing of the surface is minimal. Los Angeles, for example, has a unique combination of limited rainfall, temperature fluctuation, smog and condensation. This situation requires that cleaning be done more frequently than in other metropolitan areas where rainfall is more frequent.

In both wet and dry climates, recessed and sheltered areas usually become more heavily soiled because of the lack of rain washing. Frequent and longer periods of condensation also occur in protected areas increasing the adhesion of the soil. This is particularly true of soffit areas on some overhangs, bottom areas of fascia panels, sheltered column covers and the like. Periodic maintenance inhibits long-term accumulation of soil which, under certain conditions, can accelerate weathering of the finish. The more frequently aluminum is cleaned, the easier and less costly succeeding maintenance is. It is recommended the finish supplier be consulted for proper cleaning schedule.

3.4 In any case, the aluminum cleaning schedule be integrated with other cleaning schedules for efficiency and economy. For example, both the glass and the aluminum curtain wall on the same building can be cleaned at the same time. If automatic wall cleaning equipment is to be used on a building, a test should be made early in equipment design to insure that the cleaning solutions, brushes, as well as the frequency of cleaning have no detrimental effect on the coating.

4. CLEANING PROCEDURES AND CARE AFTER INSTALLATION

Construction soils, including concrete or mortar, etc., should be removed as soon as possible. The exact procedure for cleaning will vary depending on the nature and degree of soil. When selecting a method of cleaning and type of cleaner, consideration should be given to all other materials that may be adversely affected by the wash of the cleaning process. Try to restrict cleaning to mild weather. Cleaning should be done on the shaded side of the building or ideally on a mild, cloudy day.

4.1 REMOVAL OF LIGHT SURFACE SOIL ON ORGANIC AND ANODIC COATINGS

Removal of light surface soil may be accomplished by alternative methods as described in 4.1.1, 4.1.2, 4.1.3 and 4.1.4. Only trial and error testing employing progressively stronger cleaning procedures can determine which will be most effective. Begin the cleaning process at the top of the building by rinsing an area the width of the stage or scaffolding to the ground level in continuous drop with forceful water spray. This should be done at the beginning and the end of each drop regardless of the final cleaning materials employed.

4.1.1 The simplest procedure is to flush the surface with water using moderate pressure to dislodge the soil. If soil is still adhering after drying, then a mild detergent will be necessary.

4.1.2 When mild detergent or mild soap is necessary for removal of soil, it should be used with brushing or sponging. The washing should be done with uniform pressure, cleaning first with a horizontal motion and then with a vertical motion. Apply cleaners only to an area that can be conveniently cleaned without changing position. The surface must be thoroughly rinsed with clean water. It may be necessary to sponge the surface while rinsing, particularly if cleaner is permitted to dry on the surface. The rinsed surface is permitted to air dry or is wiped dry with a chamois, squeegee or lint-free cloth.

4.1.3 Run-down of cleaner (from any operation) to the lower portions of the building should be minimized and these areas should be rinsed as soon as and as long as necessary to lessen streaking, etc., from unavoidable run-down, lower areas should be kept wet or flooded with water. Do not allow cleaning chemicals to collect on surfaces or to "puddle" on horizontal surfaces, crevices, etc. These should be flushed with water and dried. Always clean coated surfaces down from top to bottom and follow with a thorough rinsing with clean water. (With one-story or low elevation buildings, it is recommended to clean from bottom up and rinse from top down.)

4.1.4 Mild soaps or detergents ruled safe for bare hands should be safe for coated aluminum. Stronger detergents should be carefully spot tested and may necessitate rubber gloves, long handled brushes, etc. With any soap or detergent the finish should be thoroughly rinsed with clean water and dried. Some mild cleaning solutions, comprised of selected wetting agents in water solution, are available for automatic-building-washing machines. These machines would have built-in brush agitation, squeegee, filtration and re-circulation; in some, a fresh water connection may be provided.

4.2 REMOVAL OF MEDIUM TO HEAVY SURFACE SOIL ON ANODIC COATINGS

4.2.1 If surface soil still adheres after using procedures under 4.1, cleaning with the assistance of a cleaning pad can be employed. Hand scrub the metal surface using a palm-sized nylon cleaning pad. Thoroughly wet pad with clean water or a mild detergent cleaner or pumice powder. Start across the top and work down, rubbing the metal surface in the direction of the metal grain with uniform pressure. After scrubbing, the metal surface should be rinsed thoroughly with clean water to remove all residues. It may be necessary to sponge the surface while rinsing, particularly if the cleaner is permitted to dry on the surface. Solvents may be used to remove non-water soluble deposits. Extreme care must be exercised when solvents are used since they may damage organic sealants, gaskets and painted finishes. If solvents are used, rinse the surface completely with clean water and allow the surface to air dry or wipe dry with a chamois, squeegee or lint-free cloth.

CAUTION: These procedures must not be used on surfaces with a factory applied clear organic protective coating unless the clear coating has deteriorated and should be removed. Many organic solvents are flammable and/or toxic refer to MSDS for proper handling.

4.2.2 Use of power cleaning tools may be necessary for removal of unusually heavy soils from large areas including panels and column covers. In such cases an air-driven reciprocating machine fitted with abrasive pads can be employed. During this operation, the surface being cleaned must be continually wetted with clean water or mild detergent cleaning solution to provide lubrication and a medium for carrying away the dirt. The cleaning solution may be applied to the panels by sponging or brushing. Water may be applied in the same manner by spraying from a hose or by utilizing the water connection on the cleaning machine. The machine is moved over the metal by the operator with a sufficient number of overlapped passes to effect maximum cleaning. The direction of travel with the cleaning machine is dependent largely upon the geometric configuration of the surface being cleaned. However, when possible, the machine strokes should be made first in one direction and then in a direction perpendicular to the first; (e.g., horizontal passes followed by vertical passes). Areas which are not accessible with the machine must be manually cleaned as in paragraph 4.2.1.

After an area has been machined scrubbed, it must be rinsed with clean water and thoroughly scrubbed with a fairly stiff bristle brush. While still wet, a final water rinse without brushing completes this cleaning operation. The rinsed surface should be either permitted to air dry or wiped dry with a squeegee, chamois or lint-free cloth. It is important to promptly remove any cleaner rundown

from the uncleaned lower portions of the building to avoid staining.

4.3 REMOVAL OF MEDIUM TO HEAVY SURFACE SOIL ON ORGANIC COATINGS

4.3.1 A mild solvent such as mineral spirits may be used to remove grease, sealant or caulking compounds. Stronger solvent or solvent containing cleaners may have a deleterious or softening effect on paints. To prevent harm to the finish, these types of solvent or emulsion cleaners should be spot tested and preferably the coating manufacturer should be consulted. Care should be taken to assure that no marring of the surface is taking place in this manner since this could give an undesirable appearance at certain viewing angles. Cleaners of this type are usually applied with a clean cloth and removed with a cloth. Remaining residue should be washed with mild soap and rinsed with water. Use solvent cleaners sparingly.

4.3.1.1 It may be possible for solvents to extract materials from sealants which could stain the painted surface or could prove harmful to sealants; therefore, these possible effects must be considered. Test a small area first.

4.3.2 If cleaning of heavy surface soil has been postponed or in the cases of an especially tenacious soil, stubborn stains, etc., a more aggressive cleaner and technique may be required. Cleaner and technique should be matched to the soil and the painted finish. Some local manual cleaning may be needed at this point. Always follow the recommendations of the cleaner manufacturer as to proper cleaner and concentration. Test clean a small area first. Cleaners should not be used indiscriminately. Do not use excessive, abrasive rubbing as such may alter surface texture or may impart a "shine" to the surface.

4.3.2.1 Concrete spillage that has dried on the painted surface may become quite stubborn to remove. Special cleaners and/or vigorous rubbing with non-abrasive brushes or plastic scrapers may be necessary. Diluted solutions of Muriatic Acid (under 10%) may be effective in removing dried concrete stains, however, a test area should be tried first. Proper handling precautions must be exercised for safety reasons. Also, effective proprietary cleaners for concrete and mortar staining are available.

4.3.3 Never mix cleaners together. The mixing of cleaners may not only be ineffective, but also very dangerous. For example, mixing of chlorine containing materials such as bleaches, with other cleaning compounds containing ammonia, can result in poison gas emission.

4.3.4 Always rinse after removal of any surface soil.

4.4 INSPECTION

It is suggested that the building owner provide an engineer or representative to inspect the cleaning work to ensure satisfactory clean appearance of the building.

4.4.1 Metal seams, crevices, sills and any other area that may trap water, cleaner or dirt must be cleaned and thoroughly dried. These "trap" areas must be hand-wiped with absorbent towels or cloths to prevent rundown streaks or "puddling" which will later cause discoloration.

4.4.2 Inspect metal surfaces for any discoloration or stains not removed during cleaning operations. Soil or discoloration's still remaining should be manually cleaned in accordance with sections 4.1, 4.2 and 4.3 until a satisfactory appearance is achieved. Stubborn surface soils should be scrubbed in a uniform direction using a nylon cleaning pad and cleaner solution.

5. CLEANING PRECAUTIONS

Here's a common sense summary of cleaning recommendations for architectural aluminum finishes.

5.1 Correctly identify the aluminum finish to be cleaned when selecting an appropriate cleaning method. Check specifications and/or "as-built" drawings if in doubt as to the finish.

5.2 Never use aggressive alkaline or acid cleaners on aluminum finishes. Do not use cleaners containing trisodium phosphate, phosphoric acid, hydrochloric acid, hydrofluoric acid, fluorides, or similar compounds on anodized aluminum surfaces. Strong solvents or abrasive cleaners can cause damage to painted surfaces. Always follow the cleaner manufacturer's recommendations as to the proper cleaner and concentration. Test-clean a small area first. Different cleaners should not be mixed.

5.3 It is preferable to clean the metal when shaded. Do not attempt to clean hot, sun-heated surfaces since possible chemical reactions on hot metal surfaces will be highly accelerated and non-uniform. Also, avoid cleaning in freezing temperatures or when metal temperatures are sufficiently cold to cause condensation. Surfaces cleaned under these adverse conditions can become so streaked or tainted that they cannot be restored to their original appearance.

5.4 Apply the cleaning solution only to an area that can be conveniently cleaned without changing position. Thoroughly rinse the surface with clean water before applying cleaner. Minimize cleaner rundown over the lower portions of the building and rinse such areas as soon as practical.

5.5 Strong cleaners should not be used on windows and

other building accessories where it is possible for the cleaner to come in contact with the aluminum. Solutions of water and mild detergents should be tried first. If an aggressive cleaner is required for some other component of the building, care must be taken to prevent the cleaner from contacting the aluminum finish.

Note: *Care should be taken to avoid over spray or run off of cleaner onto other buildings components such as glazing materials, weatherstripping sealants, etc.*

5.6 Do not use excessive abrasive rubbing to remove stubborn stains. Such procedures can produce an undesirable appearance or adversely affect the finish.

5.7 The type and frequency of cleaning and coating will vary with the amount of atmospheric soil and dirt accumulated on the surfaces and the owners desires regarding appearance. Periodic re-application and wipe-on surface protectants will assist in maintaining the appearance and reduce the cleaning required.



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DOW CORNING

April 23, 2015

ATTN: Dow Corning Customers

RE: **Cleaning and maintenance of Dow Corning® Construction Sealants**

In response to your request regarding sealant maintenance and cleaning procedures for silicones, Dow Corning offers the following comments.

Silicones have been used in your quality building project because of their stable properties regardless of environmental conditions. Therefore, cured silicone sealants in weatherproofing joints or remedial repair joints do not require cleaning in order to functionally perform as a weatherseal. However, the joints may become dirty and it is desired by a building owner to clean them for aesthetic reasons. This can be accomplished during regular building washing that may occur annually; or it could be a scheduled maintenance event specific to cleaning the sealant. How often this is required is a decision for the building owner, and will be influenced by building location and the environment around the building. In general, Dow Corning would recommend an annual cleaning procedure if desired to maintain peak aesthetic appearance.

A mild detergent and water solution will remove any dirt and most rundown materials from the sealant or 123 strip. Examples of detergents could include, but not be limited to: Simple Green and TSP, which are commonly available at hardware stores. A solution using a mild detergent and water could be sprayed on the joint if the building were being pressure washed anyway, and then the dirt from the surface can either be sprayed away or brushed away with a soft bristle brush. Testing or a mock-up would assist in determining if a brush is necessary. Soft bristle brushes with yellow bristles, available at hardware stores, have been found to work well. Sometimes the label on the brush reads "acid brush." You could also choose to clean the joints individually; in which case the excess dirt and debris should be brushed away; then a detergent solution could be rubbed on; and then this solution should be wiped away with a clean rag. Again, the soft bristle brush could be used to loosen dirt which did not easily release.

In order to lessen the amount of materials required, it has also been found that the cleaning sponges that are pre-soaked with a detergent work well in cleaning stains from silicone surfaces. Examples are the "Mr. Clean" pre soaked sponges. It would still be recommended to remove any excess dirt or debris from the sealant surface first; then if there are spots remaining, the pre-soaked sponges can be used at those areas to further clean the surface.

If the sealant is cleaned using pressure washing during a full building cleaning, Dow Corning recommends that a mock – up area be tested in order to determine the psi required that will clean the sealant or Dow Corning® 123 Silicone Seal without damaging it. Dow Corning warranties do not cover damage caused by water spray. Sealant joints and designs are unique to each building project, so the best way to proceed with pressure washing is to test small areas prior to cleaning the entire building. A starting point would be 1500 psi, fan blade, and a distance of 6-8" from the joint. Wheels from swing stages are not recommended to ride on the Dow Corning® 123 Silicone Seal. Please use caution when wheels need to run over a strip of Dow Corning® 123 Silicone Seal, which will occur, but attempts should be made to move the wheels away from the building at those points.

Please feel free to contact us should you have any concerns regarding weatherseal maintenance.

Dow Corning Corporation
Midland, Michigan 48686-0994

Phone: (989) 496-4000
www.dowcorning.com

DOW CORNING

Sincerely,

DOW CORNING CORPORATION



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DOW CORNING

April 23, 2015

ATTN: Dow Corning Customers

RE: **Cleaning and maintenance of Dow Corning® Construction Sealants**

In response to your request regarding sealant maintenance and cleaning procedures for silicones, Dow Corning offers the following comments.

Silicones have been used in your quality building project because of their stable properties regardless of environmental conditions. Therefore, cured silicone sealants in weatherproofing joints or remedial repair joints do not require cleaning in order to functionally perform as a weatherseal. However, the joints may become dirty and it is desired by a building owner to clean them for aesthetic reasons. This can be accomplished during regular building washing that may occur annually; or it could be a scheduled maintenance event specific to cleaning the sealant. How often this is required is a decision for the building owner, and will be influenced by building location and the environment around the building. In general, Dow Corning would recommend an annual cleaning procedure if desired to maintain peak aesthetic appearance.

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Arnold MO 63010
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Handling and Care Instruction for your Mirror

Read Carefully
Important

- The best and safest cleaner for a mirror is clean, warm water used with a soft, clean cloth. Be careful not to allow the edges of the mirror to get or remain wet over a period of time.
- Do not use any acid or alkali cleaners for mirror cleanup after installation. They can attack the surface and edges as well as the backing of the mirror. And never use an abrasive cleaner on any mirror surface.
- You may also use a standard brand of glass or mirror cleaner that does not contain ammonia or vinegar.
- Remove surface marks or stubborn dirt with 0000 oil-free steel wool, not solvents. These could attack and damage the edges and backing.
- Never spray any cleaner directly onto a mirror. Instead, apply the cleaner to a soft cloth and then wipe the mirror.
- Always use a soft, clean, grit free cloth when cleaning a mirror to reduce scratching the surface.
- Be sure to dry all joint and edges to be certain no commercial cleaner comes in contact with the edge or backing.

Note: Good ventilation will keep mirror from "sweating" and creating condensing liquids which could be corrosive and damaging to mirrors.

Thank You for Your Business!

Special Conditions
Stains on Pre-Fixx protected vinyl wallcoverings can be cleaned by the following methods (Staining agents have been grouped to allow quick reference for cleaning instructions):

Cleaning Agents to Use:

1. Full Strength household cleaners (non-abrasive type) to be used with water and scrub brush
   409 All Purpose Cleaner
   Fantastic
   Butchers Sun Bath Cleaners
   Service Master's Wallglide Plus
   Other type household cleaners and bleaches
2. Solvent type cleaner to be used with scrub brush and cloth. For most effective cleaning, use 100% full strength with brush. Dry area with cloth.
   Rubbing Alcohol (IPA type)
   Service Master's Disaster Clean
   Mineral Spirits
   Kerosene
   Naptha (lighter fluid)
   Turpentine (paint thinner)
3. Strong active solvent cleaners such as nail polish remover (acetone/water) with scrub brush and cloth.

Co-Polymer
To clean co-polymer, dust it with a soft, damp cloth or chamois and wipe the surface gently. Use soap and lukewarm water to remove light dirt. After washing and rinsing, be sure to dry the surface by blotting with a damp cloth or chamois. If a cleaner must be used to remove heavier dirt, please try one of the following recommended cleaners:

- Top Job with Ammonia
- Fantastik
- Swish Detergent
- Spic & Span
- Mr. Clean
- Clagonite
- Johnson's Pledge
- Janitor in a Drum
- Cascade
- Joy Detergent
- Handy Andy
- All Detergent (Powder)
- Isopropanol (45%) – higher concentrations will dull the firm surface

Be careful to avoid getting cleaning solution on the fiberglass core. It is best to apply all cleaners to the cloth or chamois and not directly on the perforated co-polymer surface.

Painted Panels
G&S Acoustics' Painted Panels should be cleaned using the following methods:

- Use compressed air to lightly blow off any debris
- Use a dry cloth or soft bristle brush, such as a feather duster, to wipe away debris

Small Paint Repair Instructions
For small areas where paint is chipped, use a small brush and lightly touch-up the spot with paint supplied by G&S Acoustics.

Large Paint Repair Instructions
For large areas requiring new paint, spray the face of the panel only with new paint. Do not roll or brush on paint.

type cleaning preparations such as nail polish remover, tar and bug removers, etc., can be used with Pre-Fixx protected wallcoverings to remove residual stains that remain after cleaning with standard cleaning agents.

WARRANTY - HIGH PERFORMANCEPC

PRODUCT WARRANTY FOR CARPET WITH HIGH PERFORMANCEPC

Bentley Mills, Inc. broadloom carpet products with High PerformancePC backing are warranted by the manufacturer in accordance with the following terms and conditions:

10 YEARS – SURFACE WEAR, EDGE RAVEL, DELAMINATION, AND TUFT BIND

The manufacturer warrants for a period of 10 years from the date of invoice that the carpet products will not suffer excessive surface wear, edge ravel, delamination from primary backing, or tuft pull problems under ordinary indoor commercial use in direct-glue applications. Excessive surface wear means loss of more than 10 percent by weight of face fiber as a result of abrasion.

MATERIALS AND WORKMANSHIP

The manufacturer warrants for a period of two years from the date of invoice that the performance of the carpet products will not be adversely affected by defects in the materials or workmanship used in manufacture.

STATIC DISCHARGE

The manufacturer warrants for a period of 10 years from the date of invoice that the carpet products will not generate static discharges exceeding 3.5 kV at 70 degrees Fahrenheit and 20 percent relative humidity, using test method AATCC 134, Electrostatic Propensity of Carpets, step.

RADIANT PANEL

The manufacturer warrants that the carpet products as sold have a Critical Radiant Flux of 0.45 W/cm2 (Class I) or better using test method ASTM E 648, Critical Radiant Flux of Floor Covering.

SMOKE DENSITY

The manufacturer warrants that the carpet products as sold have a measure of 450 or less using test method ASTM E 662, Specific Optical Density of Smoke, flaming.

REMEDY, LIMITATIONS, AND EXCLUSIONS

If a carpet product fails to meet this warranty, the manufacturer will correct the affected areas either by repair or (at its option) replacement with comparable product(s) at no charge. If the manufacturer determines that repair or replacement is not reasonably feasible, the manufacturer will refund that portion of the product purchase price allocable to the affected areas; provided that any refund on a claim made more than two years after the date of invoice will be prorated to reflect beneficial use prior to the claim. This is the exclusive remedy for claims related to the carpet products. The manufacturer's liability is limited to repair, replacement or refund as stated herein and, for example, does not include costs associated with moving furniture, partitions, fixtures, or equipment as necessary to allow repair or replacement.

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WARRANTY - HIGH PERFORMANCEPC

This warranty does not cover tears, burns, cuts, pulls or other damage, deterioration, problems or loss caused by abuse, misuse, neglect, improper maintenance, improper installation (including without limitation failure to use direct-glue), flood/excessive moisture, stairs and associated landings, or use of footgear with cleats, spikes, skates, blades or similar projections. Failure to comply strictly with Bentley's installation and maintenance instructions and recommendations shall void warranty coverage for all affected carpet products. Pooling, shading, watermarking, pile reversal, pile crush, dye lot differences and soiling are not manufacturing defects and are not covered by this warranty. Problems arising from use of non-approved adhesives will void warranty coverage. Coverage under this warranty is conditioned upon buyer promptly notifying Bentley of the warranty claim in writing within the applicable warranty period at the following address: Bentley Quality Claims Department, 14641 E. Don Julian Road, City of Industry, CA 91746.

THE WARRANTY, REMEDY, AND LIMITS OF LIABILITY CONTAINED HEREIN ARE EXPRESSLY IN LIEU OF AND EXCLUDE ALL OTHER WARRANTIES, REMEDIES, AND LIABILITIES, WHETHER EXPRESS OR IMPLIED. THE MANUFACTURER MAKES NO OTHER REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED, AND HEREBY DISCLAIMS ANY AND ALL OTHER WARRANTIES THAT MAY ARISE BY OPERATION OF LAW, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS OF ITS PRODUCTS FOR ANY PARTICULAR PURPOSES. THE MANUFACTURER WILL NOT BE LIABLE FOR ANY INCIDENTAL, INDIRECT, SPECIAL, OR CONSEQUENTIAL DAMAGES IN ANY CASE.

MORE INFORMATION

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January 2014

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WARRANTY - AFIRMA™ HARDBACK TILE

PRODUCT WARRANTY FOR CARPET WITH AFIRMA HARDBACK TILE

Bentley Mills, Inc. carpet products made with AFIRMA Hard-Back Tile are warranted by the manufacturer in accordance with the following terms and conditions:

15 YEARS – SURFACE WEAR, EDGE RAVEL, DELAMINATION, TUFT BIND, AND MOISTURE RESISTANCE

The manufacturer warrants for a period of 15 years from the date of invoice that the carpet products will resist moisture penetration through the backing material and will not suffer excessive surface wear, edge ravel, delamination from primary backing, or tuft pull problems under ordinary indoor commercial use. Excessive surface wear means loss of more than 10 percent by weight of face fiber as a result of abrasion.

MATERIALS AND WORKMANSHIP

The manufacturer warrants for a period of two years from the date of invoice that the performance of the carpet products will not be adversely affected by defects in the materials or workmanship used in manufacture.

STATIC DISCHARGE

The manufacturer warrants for a period of 15 years from the date of invoice that the carpet products will not generate static discharges exceeding 3.5 kV at 70 degrees Fahrenheit and 20 percent relative humidity, using test method AATCC 134, Electrostatic Propensity of Carpets, step.

RADIANT PANEL

The manufacturer warrants that the carpet products as sold have a Critical Radiant Flux of 0.45 W/cm2 (Class I) or better using test method ASTM E 648, Critical Radiant Flux of Floor Covering.

SMOKE DENSITY

The manufacturer warrants that the carpet products as sold have a measure of 450 or less using test method ASTM E 662, Specific Optical Density of Smoke, flaming.

REMEDY, LIMITATIONS, AND EXCLUSIONS

If a carpet product fails to meet this warranty, the manufacturer will correct the affected areas either by repair or (at its option) replacement with comparable product(s) at no charge. If the manufacturer determines that repair or replacement is not reasonably feasible, the manufacturer will refund that portion of the product purchase price allocable to the affected areas; provided that any refund on a claim made more than two years after the date of invoice will be prorated to reflect beneficial use prior to the claim. This is the exclusive remedy for claims related to the carpet products. The manufacturer's liability is limited to repair, replacement, or refund as stated herein and, for example, does not include costs associated with moving furniture, partitions, fixtures, or equipment as necessary to allow repair or replacement.

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WARRANTY - AFIRMA™ HARDBACK TILE

This warranty does not cover tears, burns, cuts, pulls or other damage, deterioration, problems or loss caused by abuse, misuse, neglect, improper maintenance, improper installation (including without limitation failure to use Bentley-recommended adhesive), flood/excessive moisture, or use of footgear with cleats, spikes, skates, blades or similar projections. Failure to comply strictly with Bentley's installation and maintenance instructions and recommendations shall void warranty coverage for all affected carpet products. Pooling, shading, watermarking, pile reversal, pile crush, dye lot differences, and soiling are not manufacturing defects and are not covered by this warranty. Problems arising from use of non-approved adhesives will void warranty coverage. Coverage under this warranty is conditioned upon buyer promptly notifying Bentley of the warranty claim in writing within the applicable warranty period at the following address: Bentley Quality Claims Department, 14641 E. Don Julian Road, City of Industry, CA 91746.

THE WARRANTY, REMEDY, AND LIMITS OF LIABILITY CONTAINED HEREIN ARE EXPRESSLY IN LIEU OF AND EXCLUDE ALL OTHER WARRANTIES, REMEDIES, AND LIABILITIES, WHETHER EXPRESS OR IMPLIED. THE MANUFACTURER MAKES NO OTHER REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED, AND HEREBY DISCLAIMS ANY AND ALL OTHER WARRANTIES THAT MAY ARISE BY OPERATION OF LAW, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS OF ITS PRODUCTS FOR ANY PARTICULAR PURPOSES. THE MANUFACTURER WILL NOT BE LIABLE FOR ANY INCIDENTAL, INDIRECT, SPECIAL, OR CONSEQUENTIAL DAMAGES IN ANY CASE.

MORE INFORMATION

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MAINTENANCE **GUIDE**

EXCLUSIVE TO ALL BENTLEY PRODUCTS

Important note: This Maintenance Guide is written to include carpet made from both nylon and wool fiber. However, it is important to note that wool carpet is discussed in a separate section included within this guide. Please understand wool will be specifically included in instructions intended for wool. Otherwise, the instructions are for nylon carpet only. Some of the more aggressive techniques recommended as beneficial and necessary for nylon fiber, such as vacuuming with a beater bar and brush or pile lifting, can be damaging to wool.

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THE RAMIFICATION OF SPECIFICATIONS

The best maintenance program cannot overcome inappropriate choices in colors, patterns, carpet density, backing system, yarn style (cut pile or loop), staple, or BCF fibers and yarn type will all have a significant impact on the performance of the carpet.

The carpet choice should not be made purely on aesthetics but rather on a wide range of criteria like foot traffic, wheel traffic, density of occupancy, type of soil exposure, traffic frequency, and the overall intended use of the area. One of the most important considerations is how you intend to maintain the carpet once it is installed.

For instance, light-to-medium blue carpet will show soiling more than other colors. Solid-color carpet will show traffic lanes and spots more than pattern carpets. Cut-pile carpet in traffic lanes will crush and matte faster than loop carpets. Bulk continuous filament yarn will out perform staple yarn.

Planning should include providing appropriate protection of the new carpet immediately following installation, especially when carpet installation is part of a larger construction or renovation project where other construction trades may be working on top of the new carpet.

The most critical decision of the carpet maintenance program will be WHO will maintain the carpet. 99% of the life of the carpet comes after it is installed. Choosing an in-house person or a company with certified commercial carpet cleaning technicians is crucial. The best products and best installation will not perform as intended if maintained inappropriately.

The goals for any good floor-maintenance program should include the following.

1. Keep the floors looking as close to new as possible.
2. Design a cleaning program that is safe and the least disruptive to the occupancy.
3. Increase indoor air quality.
4. Extent the useful life of the carpet.
5. Be as "GREEN" as possible in the overall maintenance program (energy, water, noise and if possible chemical)

WHY IS REGULAR, PLANNED CARPET MAINTENANCE IMPORTANT?

People spend about 90% of their time indoors. According to the EPA, the air inside facilities are two to five times more polluted than the air outside the buildings. Companies want to provide a healthy and pleasant work environment for their employees. Healthful work environments have been shown to improve employee attitudes and a reduction in sick days, which increase productivity by approximately 10%.

Carpet acts like a filter and can actually reduce air born pollutants including volatile organic compounds compared to hard-surface floors, provided that they are maintained properly. On the other hand, poorly maintained carpet can harbor bacteria and mold, which can cause an increase in indoor air pollution, allergies, breathing issues, foul odors, and productivity reduction.

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A COMPREHENSIVE MAINTENANCE PLAN

A regular routine of carpet maintenance helps prevent soil buildup that can damage carpet fiber, which, in turn, can cause color loss and loss of resiliency. A well-planned maintenance routine can maximize a carpet installation's useful life and forestall the need for replacement because of premature wear or because the carpet "uglies out."

Routine maintenance involves a planned approach of methodical daily care such as vacuuming and spot cleaning, in addition to periodic interim and restorative cleaning performed as soiling becomes apparent.

Excessive soiling, stubborn spots or spills may require different methods or combination of methods. Please keep in mind that when maintenance is neglected or performed at irregular intervals, carpet can deteriorate to a level that will be difficult or impossible to restore to its original luster and beauty—no matter what cleaning methods are used.

Persistent, thorough maintenance and daily-care routines will keep carpet looking its best, as well as enable carpet fiber to perform as intended. This planned approach to maintenance needs to begin immediately following installation.

For instance, when installation is performed in conjunction with other construction projects, the carpet must be protected with a covering such as re-enforced craft paper that allows the carpet to breathe as adhesives continue to cure. Plastic sheeting should be avoided as a means of carpet protection. Trapping adhesive off-gassing underneath plastic sheeting can cause permanent discoloration of new carpeting.

Properly trained technicians armed with the proper tools are essential to correctly performing the five key elements of any successful maintenance program.

Those five elements involve:

OUTSIDE YOUR FACILITY

- **Preventative Maintenance:**

Capturing or containing the soil before it reaches the building by regularly sweeping the parking lot, parking garage, and sidewalks and at the building entryways by using an adequate system of barrier mats at entrances. An adequate barrier system includes mats installed both inside and outside the building, as well as strategically placing mats at funnel areas where traffic loads become more concentrated or at specific highly trafficked interior areas.

A system of appropriate "scrape, scrub, and wipe" mats will remove up to 10 times more soil than carpet mats alone.

With an appropriate walk-off system the first five feet will remove approximately 37% of the soil, 10 feet 52%, 15 feet 71%, 20 feet 86% and 30 feet almost 100% of the exterior soil.

Another consideration:

Areas of the country where ice melts are used. There are different types of ice melts some are more difficult to remove than others, and the volume and frequency of use will have a big impact.

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Asphalts parking lots and driveways coated with inexpensive sealers may "walk off" and discolor all flooring including the carpet. Once the damage is done, it is permanent.

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INSIDE YOUR FACILITY

• **Vacuuming/Pile Lifting:**
Regular vacuuming is the single most important part of a maintenance program. It can cost between $500.00 and $700.00 a pound to remove soil from carpet, once inside the facility. If the soil is removed before it becomes attached to the carpet fiber through proper vacuuming, then the cost to remove it per pound is greatly reduced. A proper vacuuming program can remove about 80% of this soil making it the most cost-effective soil removal process.

Vacuuming is designed to remove dry soil before it becomes attached to the fiber. Pile lifting will enhance routine vacuuming as well as cleaning effectiveness. It should be added as part of the overall maintenance program. The more aggressive pile lifter will help remove more stubborn, embedded soil, as well as working more effectively to lift and separate fiber so that routine vacuuming is more effective.

• **Spot and Spill Removal:**
Promptly addressing spills is the key to prevent the spill from getting into the carpet backing and causing stubborn spots that are far more difficult to clean. Quickly addressing spills helps minimize the chance of that spill becoming a stubborn stain.

• **Interim Cleaning:**
Several different methods can be utilized. If used regularly, interim cleaning can prolong the need for restorative cleaning.

• **Restorative Cleaning:**
Deep cleaning is designed to remove trapped soils. Hot water extraction is the most effective method and the only restorative method recommended by Bentley.

IDENTIFYING SPECIFIC MAINTENANCE NEEDS

Just as various areas of an office or building are subject to different uses, each type of area demands a different level of maintenance and care. Heavy-traffic areas and areas where traffic is more concentrated, such as entrances and corridors, require more frequent vacuuming and cleaning. Areas around vending machines or kitchen areas and desks need daily attention to spills and stains. Some areas may require different types of equipment for effective maintenance or cleaning.

A comprehensive maintenance program should have a color-coded diagram of the building's floor space and furniture layout plan indicating appropriate cleaning frequency rates for vacuuming, spot cleaning, pile lifting, and interim and restorative cleaning, based on the nature and concentration of traffic flow.

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MAINTENANCE TECHNIQUES

The ideal maintenance program is designed to help prevent soil from reaching the carpet and to remove soil before it causes damage. Once soil becomes compacted, vacuuming becomes less effective and more aggressive pile lifting becomes necessary.

When soiling is allowed to build-up and become compacted deep within the fiber, the abrasive combination of heavy foot traffic and compacted soil can scratch and damage the best, most durable fiber, causing color and fiber loss. Deeply compacted soil will affect cut-pile fiber twist levels and cause fiber ends to splay outward, losing resiliency and causing matting.

Once neglect results in color or fiber twist loss, full restoration becomes impossible.

To keep carpet clean and looking as nearly new as possible, this ideal maintenance program should use a combination of methods and frequencies tailored to a facility's specific needs. Those needs should be evaluated by a trained maintenance professional and based on the specific nature of soiling, traffic load, and traffic concentrations.

For instance, the first floor of a building will have maintenance needs that vary significantly from those on the fifth floor. A restaurant or a busy retail outlet will have an even greater variation of maintenance needs.

Remember, poor maintenance can cut short carpet life and adversely affect its long term performance. Failing to adhere to these guidelines in a regular routine that includes interim maintenance as well as restorative cleaning can cause irreparable damage that falls outside warranty coverage.

PREVENTATIVE MAINTENANCE

Maintaining carpet appearance means more than choosing the right cleaning method. Selecting a suitable carpet color, style and construction for the application with careful consideration of traffic load and performance expectations is the best possible start for an effective maintenance program that emphasizes prevention.

Concrete sidewalks, parking lots, and hard-surface floors do very little to remove soil from the bottoms of shoes or from the wheels of rolling traffic.

Barrier mats are essential in keeping as much soil and moisture as possible from ever entering the building.

Outside mats are designed to scrape dirt and debris off shoes while interior mats are designed to remove smaller soil particles as well as help absorb moisture.

Interior barrier mats should extend a minimum of six feet inside the entrance. A planned system of barrier mats, which also requires regular maintenance, is an essential part of any sound maintenance program.

Mats can also be effective in other interior areas including elevators, food station areas, and at stair thresholds. Barrier matting should be maintained the same way as interior carpet with severe traffic as illustrated by the frequency chart in this document. Rubber-backed mats should never be placed on carpet or other rubber floors.

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VACUUM ESSENTIALS

There is no substitute for slow, methodical vacuuming performed at the appropriate frequency with an approved vacuum cleaner, at the appropriate speed of 1.8 feet per second, four passes total for high traffic areas, two north and south, and two east and west. For moderate traffic, two passes at the same speed. This step is not a race to see how fast the area can be vacuumed. When writing a vacuum spec it's not enough to give frequencies of certain areas you must specify the type of vacuum cleaner to use and the rate of production.

Effective daily vacuuming can help reduce the need for more rigorous methods to keep the carpet's clean appearance. Vacuuming removes soil while lifting carpet fiber. In addition to removing soil, the vacuum's lifting action enhances resiliency and helps the vacuum work more effectively on subsequent vacuuming.

THE RIGHT EQUIPMENT

Vacuums with horizontal cylindrical brushes should be used and set so that brushes are always in full contact with the carpet surface. Twin-motor vacuums with independent motors for dedicated to suction and brushing are preferred.

Vacuums with top-loading soil bags and HEPA filters to further contain dust are highly recommended.

Canister and backpack vacuums without motorized rotating brushes should be avoided, as well as riding sweepers with rotary brushes.

The Carpet and Rug Institute's Seal of Approval program grades a variety of maintenance equipment, including vacuum cleaners.

For a list of certified vacuums units, please visit:

http://www.carpet-rug.org/commercial-customers/cleaning-and-maintenance/seal-of-approval-products/index.cfm

Vacuum frequency should be determined by visual inspection and performed at least once daily.

Heavy-traffic areas such as lobbies, entryways, funnel areas, barrier mats, and areas in the direct path of weather influences may require more frequent vacuuming. Furthermore, such high use areas may require vacuuming more frequently than once a day. Keen attention to weather vulnerable areas will help prevent wet soil from being tracked throughout the building.

The proper technique for thorough vacuuming depends upon using slow, overlapping strokes and making sure that the entire carpet surface is covered. Strokes should be no longer than two to three feet in length to avoid unnecessary back strain for the operator.

PILE LIFTING

Pile lifting is an effective method for lifting crushed pile and loosening dry soil. Heavily trafficked cut-pile products need more frequent pile lifting than looped products. Pile lifting should always be used to precondition carpets for general cleaning. Pile lifting improves cleaning effectiveness. For best results, apply the pile-lifter machine against the lay of the pile.

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SPOT CLEANING

Daily removal of spots and spills helps maintain the carpet's appearance between scheduled cleaning. Immediate action against spots and spills also reduce the probability of a permanent stain. Spotting solutions should be selected as appropriate for the specific type of spot or spill.

Different chemistry should be selected for water-based and oil-based spills or spots. A different chemical will be necessary for solids, including gum. Always use spotting solutions sparingly. If the spill is wet, remove as much moisture as possible with dry, white towel or a hand-held extractor before applying any spotter. Try to remove the spot with water on a white towel or by using a hand-held extractor before using a spotting agent.

TREATING WATER-BASED SPOTS

Liquid spills should be blotted with a clean, white cloth to remove as much of the liquid as possible. If the spill is semi-solid or has hardened, gently scrape away with a spoon or spatula and then blot the spot with a damp white cloth. Always work from the edge of the spot towards the center. Never rub across a wet spill in a manner that causes the stain or contamination to be spread outward from the original area. If the spot remains, try **Grab Carpet Spotter** or go to the Carpet and Rug Institutes "Spot Solver" (http://www.carpet-rug.org/commercial-customers/cleaning-and-maintenance/spot-solver.cfm) for an excellent reference that should have an approach to help safely remove the spot.

Apply a minimal amount of the recommended solution. Use a soft-bristle brush and gently agitate the solution by hand. Rinse the affected area with water and allow the area to dry for about one hour and then vacuum. Prevent traffic on the freshly cleaned area until the carpet is completely dry.

Please remember to blot the spot. Do not brush the spot aggressively.

TREATING OIL-BASED SPOTS

When removing oily stains such as grease, tar, or asphalt, try **Grab Grease and Oil Remover**, always check for color fastness by testing in an inconspicuous area of the carpet. Apply **Grab Grease and Oil Remover** directly onto the spot. Again, do not rub across the spill, but wipe gently from the outer edge toward the center of the spot. Repeat the procedure until the spot has been removed. Rinse with water and allow the area to dry about one hour and then vacuum. Protect the freshly cleaned area until the carpet is completely dry.

Please note: A small, portable hand-held extractor can simplify the task of flushing residual solution from spots and spills.

SPOT REMOVAL GUIDE

Please refer to the Carpet and Rug Institutes "Spot Solver" to remedy a wide range of the most typical causes of carpet spotting. The Spot Solver can be found at http://www.carpet-rug.org/residential-customers/cleaning-and-maintenance/spot-solver.cfm.

If you have further questions, please call Bentley at 800.423.4709.

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INTERIM CLEANING

DRY EXTRACTION

Dry compound extraction, such as **Grab Dry** from **XL North**, is a safe, easy, and effective method for performing maintenance on a regular basis. The procedure uses a moist, powder-like compound that does not leave the carpet excessively wet, thus allowing immediate access and traffic once the procedure is complete. This cleaning method typically has the lowest production rate and is the most expensive method of carpet cleaning. Dry compound cleaning eliminates wicking and does well with oily spots and soils. It is considered the safest cleaning method.

The technique for dry compound extraction is as follows:

1. Thoroughly vacuum the carpet two passes at 1.8 feet per second at 2 to 3 feet in length.
2. If carpet is not heavily soiled proceed to step 4.
3. If needed, use a pre-spray like **Grab Carpet Spotter** and allow 10 minutes dwell time, spray evenly and heavy enough to stay damp for 20 minutes using a pump-up or electric sprayer. Do not over spray onto other surfaces, walls, or furniture.
4. Agitate carpet with counter rotating brush machine with the appropriate brush stiffness at 1.5 feet per-second in a V or W pattern. The soil load will determine the number of passes. Continue this step until you can visually see the soil separation from the fiber.
5. Spread the dry compound evenly on carpet making sure not to clump the product use one pound of product for every 150 square feet. Apply in a small area not to exceed 30' x 30' the dry compound must stay moist until it can be agitated into the carpet
6. Agitate the compound into the carpet at 1.5 feet per-second at 2 to 3 feet in length in a V or W pattern.
7. Allow compound to completely dry approximately 30 minutes to one hour.
8. Vacuum up the dry compound with two to three very slow passes, 1 foot per second make sure all visible compound is removed

Please note: This process can be even more effective when the carpet is first pile lifted and vacuumed prior to spreading low-moisture cleaning compound.

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LOW-MOISTURE CLEANING

ENCAPSULATION APPLICATION

The Encapsulation (or crystallizing) method of maintenance uses a liquid (like **Liquid Grab Green**) that breaks down and encapsulates sticky soils, then then dries to a crystal-like powder that is easily vacuumed away. Encapsulation cleaners should be applied and used as follows:

1. Thoroughly vacuum the carpet two passes at 1.8 feet per-second at 2 to 3 feet in length.
2. Spray evenly and heavy enough to stay wet for roughly 20 minutes using a pump-up or electric sprayer. Carpet must stay wet until the agitation process can be completed. Do not over-spray onto other surfaces, walls or furniture.
3. Agitate carpet with counter rotating brush machine with the appropriate brush stiffness at 1.5 feet per-second in a V or W pattern. The soil load will determine the number of passes. Continue this step until you can visually see the soil separation from the fiber.
4. Thoroughly vacuum the carpet two passes at 1.8 feet per-second at 2 to 3 feet in length.

FILMER APPLICATION

Filming encapsulates, like **ResisTech 5,** are technically cleaners but should be viewed also as a fiber treatment. Filmers do encapsulate soils but are not designed to completely release during the vacuuming process. Filmers release or "shed" over time from foot traffic and multiple vacuuming. The soils attach to the treatment on the fiber not the fiber itself, so when the coating separates through vacuuming or foot traffic it only removes a small amount of the treatment, leaving behind more material to which soil can cling, thus repeating the process. For the best results, this method should only be applied to clean carpet preferably after a hot water extraction method was used.

This method will keep the carpet the cleaner than any other cleaning method over a set period of time. And when used in conjunction with Hot water extraction and low moisture encapsulation cleaning, this method will be the most cost effective of all maintenance cleaning programs.

The application process is the same as encapsulation application.

Please note: Both applications can be performed using sprayers or can be applied as a foam.

BONNET CLEANING

Avoid bonnet cleaning. Using a bonnet or any other type machine that rotates in a motion parallel to the flooring surface to clean or dry carpet is not recommended and may void warranty coverage. Low-speed rotary cleaning methods must be approved by Bentley.

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HOT WATER EXTRACTION TRUCK-MOUNT/BOX EXTRACTORS

This method of cleaning has the ability to remove the most amount of soil (up to 95%), depending on the type of equipment and process used. This method can be slow and labor intensive, with more challenges compared to other methods.

1. Before starting this method of cleaning make sure the HVAC system stays on until the carpet is totally dry.
2. Check for any occupancies that may have a chemical sensitivity before using any carpet pre-spray.
3. Always vacuum and pile lift thoroughly before beginning any carpet cleaning method. This is especially important with hot water extraction in order to remove as much dry, loose soil as possible prior to adding water to the carpet.
4. Place wet floor signs at all transition points, from carpet to hard surface.
5. Pre-spray with a traffic lane cleaner such as **Grab Nylon Pre-Spray** or **ResisTech HWE** (a pH between 9.9 and 4.5). Spray heavy enough to keep carpet wet until the carpet can be extracted. Use a pump-up type or electric sprayer with no more than 60 psi (so pre-spray will not aerosolize). Do not over spray on any furniture, walls, or other floor surfaces.
6. Allow to penetrate for 10 minutes.
7. Agitate using a counter-rotating brush machine with the appropriate brushes at a 1.5 feet per second rate, use 2 to 3 foot long strokes in a V or W pattern continue this process until you can visually see the soil separate from the fiber.

All portable extractors should be plugged into a ground fault circuit interrupter. Extract using a carpet wand with straight forward and backward passes (NO V or W pattern) at a rate of 1.8 feet per second, overlap each stroke by 1 inch (use **Grab Crystallizing Acid Rinse** in fresh water tank when using high (9.0-9.9) pH cleaners). On restorative cleaning use multiple passes and finish with 1 dry pass. Continue to pull the wand toward you another 3 inches after releasing the spray trigger to insure all water removal.

Use air movers to help dry the carpet especially at transition points.

Self-contained water extraction equipment (walk behind, pull back, ride on)

This water extraction cleaning method has average-to-good soil removal somewhere between low moisture and hot water truck mount/box extractors. However, it has a much higher production rate compared to truck-mount or box extractors and about the same as low moisture encapsulate cleaning.

Steps for self-contained extraction equipment:

1. Before starting this method of cleaning, make sure the HVAC system stays on until the carpet is totally dry.
2. Check for any occupancies that may have a chemical sensitivity before using any carpet pre-spray

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3. Always vacuum and pile lift thoroughly before beginning any carpet-cleaning method. This is especially important with water extraction in order to remove as much dry, loose soil as possible prior to adding water to the carpet.

4. Place wet floor signs at all transition points from carpet to hard surface.

5. Pre-spray with a traffic lane cleaner Such as **Grab Nylon Pre-Spray** or **ResisTech HWE** with a pH between 9.9 and 4.5 (Spray heavy enough to keep carpet wet until the carpet can be extracted). Do not over spray on any furniture, walls or other floor surfaces.

6. Allow to penetrate for 10 minutes.

Extract
All portable extractors should be plugged into a ground fault circuit interrupter. Overlap each pass at least 3 to ½ inches depending on how soiled the carpet is.

Use a **Grab Crystallizing Acid Rinse** in fresh water tank when using high (9.0-9.9) pH pre-sprays. For best results do not add cleaning solution to fresh water tank.

Use air movers to help dry carpets especially at transition points from carpet to hard surfaces.

THE RIGHT CLEANING SOLUTIONS

Bentley recommends the **Grab** carpet-care system by **XL North** and also the **Resistech** Carpet Maintenance Treatment by **Antron**.

However, if you choose to use others here are some things to consider:

Some commercial carpet cleaning solutions are very harsh and can damage carpet fiber. Only use cleaning chemicals that meet the basic standards outlined here.

It's also important to evaluate each product prior to widespread use by applying in a small inconspicuous area prior to widespread to prevent the possibility of damage. Bentley carpet can be maintained using a number of widely recognized carpet cleaning agents that are readily available. However, cleaning solutions that have earned the Carpet & Rug Institute's Seal of Approval are preferred.

The Carpet and Rug Institute uses an independent testing laboratory to evaluate cleaning chemistry based on the following criteria:

- Overall cleaning effectiveness; this ensures that the product removes soil and spots better than plain water.
- Rate of re-soiling; this ensures that the product does not attract dirt to the cleaned areas faster than the rest of the carpet.
- Chemical pH; a more neutral pH ensures that carpet dyes and fibers are not adversely affected.
- Surface texture change; the product must leave the carpet pile minimally changed after repeated cleanings.
- Optical brighteners; none are allowed, as they can leave some patches of carpet lighter than the rest.
- Colorfastness; products must not be so aggressive that they cause a color change in the carpet.

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For a list of these certified cleaning solutions see the Carpet & Rug Institute's website at: http://www.carpet-rug.org/commercial-customers/cleaning-and-maintenance/seal-of-approval-products/cleaning-solutions-list.cfm?product_type=0&manuf_id=0

Avoid products with pH levels over 9.9 for nylon and a maximum of 8.5 for wool. Also, make sure that cleaning solutions for either nylon or wool are free of toxic or flammable solvents. Detergents designed for use in hot water extraction equipment should not contain an oil-based de-foamer and caution should be used with the amount of detergent added. Oil-based de-foamers have the potential to leave oily residues and adding too much detergent could leave excess detergent on the carpet. Both scenarios will lead to rapid re-soiling and create a need for more frequent cleanings. In addition, cleaning solutions containing optical brighteners should not be used. Optical brighteners can adversely affect the coloration of carpet and lead to premature aging or yellowing of the carpet. Cleaning solutions used for interim and/or restorative cleaning should be tested for sticky residues that may cause re-soiling. To test a solution, pour a small amount in a clean glass dish. Allow the solution to air dry completely (24 hours minimum). Break up any hard residue on the surface of the glass dish and examine it. If the residue can be characterized as dry powder, dry flakes, or dry crystals, the solution is acceptable. If the residue appears oily, greasy, sticky, or in waxy flakes, the solution is not acceptable since it would likely contribute to rapid re-soiling. Spotting solutions should be used as needed and should be flushed out with clean water once the spot has been treated.

MAINTENANCE EQUIPMENT

Using the right equipment is as important as using the right cleaning solution and the best techniques. These guidelines are intended to provide a proper framework for minimum basic maintenance designed to maximize a carpet investment. Equipment should be selected from those units tested and certified by the Carpet and Rug Institute's Seal of Approval program.

- Vacuums: Select a dual-motor, commercial-grade vacuum cleaner bearing the Carpet and Rug Institute's Seal of Approval/Green Label Certification program. Top-loading dust bag machines with HEPA filters are strongly recommended. Battery-powered vacuum cleaners are not recommended.

- Low-moisture applicator: Use only those units with counter-rotating brushes bearing the Carpet and Rug Institute's Seal of Approval.

- Hot water extractor: Truck-mounted extraction units generally provide optimal performance, but self-contained units are more mobile and can be highly effective in most commercial applications. Use only those units bearing the Carpet and Rug Institute's Seal of Approval.

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CARING FOR WOOL CARPET

Wool is a natural protein fiber obtained from sheep. It is sensitive to color change, yellowing, and degradation when exposed to direct sunlight and it has a narrow pH range for cleaning. Wool cleans best between a pH of 5 and 8.5. The cleaning chemistry must not contain bleaching agents or optical brighteners. Temperature in cleaning wool should never exceed 140 to 150 degrees and excessive agitation when used with high temperatures should be avoided. Wool can absorb up to 33% of its weight in moisture, so it is important not to over wet the carpet and to allow ample time for drying. Below are some guidelines that should be followed.

1. Use a cleaning solution with low alkalinity (pH of 8.5 or less). Alkaline cleaning solutions pH above 8.5 may contribute to browning of fibers.

2. Select a solution that leaves no sticky residue following drying.

3. Do not use cleaning products with added bleaches or dyes. Full-strength application of bleach or cleaners containing bleach will dissolve wool fibers. Weakened solution of bleach or cleaners containing bleach can release fiber dyes and discolor the wool carpet completely.

4. Regular vacuuming is crucial to prevent soil from penetrating to the base of the fibers. Wool has an inherent property that suspends soil near the top of the pile on the surface of the carpet face. Regular vacuuming will remove this surface soil and dirt, preventing it from working into the face and abrading/wearing the fibers.

5. Care should be used when vacuuming shag carpeting. A vacuum without a beater bar or rotary brush should be used for this style of carpet. This will prevent damage to carpet or vacuum. High-end vacuums have separately controlled brushes or beater bars. These should be off when vacuuming. Check vacuum bag frequently as loose fibers are long and tend to clog the vacuum when approaching full.

6. For spot cleaning, act quickly and blot it up with a clean cloth or paper towels. Then use a towel dampened with lukewarm water to remove the substance completely. You can replace water with a solution of three parts of water and one part white vinegar. This solution will not cause any damage to your carpet, but helps to dilute the stain. Blot the area continuously with a dry cloth and never leave any wet spots. Avoid rubbing or scrapping the carpet for stain removal. This can cause breaking down of the fibers.

7. Wool offers excellent encapsulation release properties, which makes it an ideal fiber for dry and low moisture cleaning. These encapsulation products, like **Grab Crystallizing Encap, (ADD) Grab Carpet Spotter, and Liquid Grab Green** from **XL North** can be used (see "Interim Cleaning, Encapsulation Method for details on process)sprayed onto the carpet surface, agitated, and then vacuumed to remove the cleaning product and the attached soil. Use caution with overly aggressive agitation. Damage to wool carpet is generally attributed to over wetting, too much agitation, and improper chemical selection.

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NEED MORE?

For more information about carpet maintenance, visit our website at www.bentleymills.com or www.xlnorth.com, or call 888.530.2259.

Bentley is also a Starnet Worldwide Commercial Flooring Partnership partner. We recommend the Starnet Maintenance Guidelines for further reference or assistance with a specific project. Visit www.starnetflooring.com for details.

Additional sites for reference:

1. Carpet and Rug Institute: www.carpet-rug.org

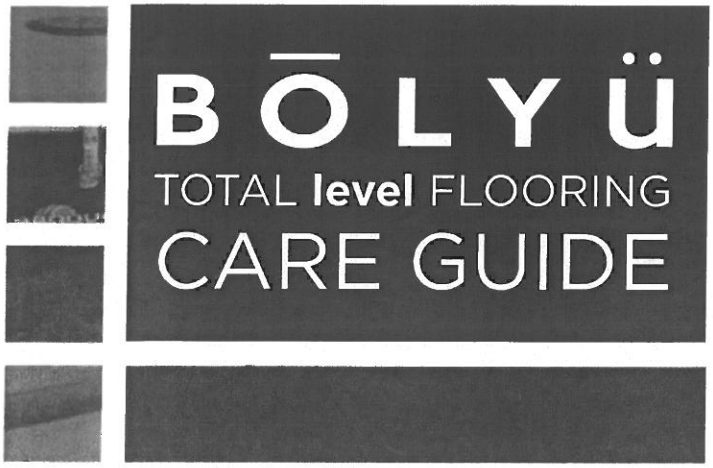
2. The Institute of Inspection, Cleaning, and Restoration Certification: www.iicrc.org

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MAINTENANCE **GUIDE**

Traffic, Soil Rating	Carpet Owner Site Maintenance		Professional Cleaning Restoration Service	
	Vacuuming	Spot Cleaning	Interim Maintenance	Restoration Maintenance
Light ▪ Private offices ▪ Cubicles ▪ 500 traffics or less daily	Twice or more each week	Perform when vacuuming as spots, spills occur	Once per year	Once per year; should include pile lifting
Moderate ▪ Secondary hallways ▪ Share offices ▪ Conference rooms ▪ Classrooms ▪ 500-1000 traffics daily	Once daily	Perform when vacuuming as spots, spills occur	Twice per year; should include pile lifting at least twice or more	Twice per year; should include pile lifting at least twice or more
Heavy ▪ Common entrances ▪ Elevators ▪ Elevators lobbies ▪ Main hallways ▪ Break rooms ▪ Mail rooms ▪ Patient rooms ▪ Waiting areas ▪ 100-2,500 traffics daily	At least once daily; some areas will require more.	Perform when vacuuming as spots, spills occur	Monthly; should include pile lifting	Four times annually; should include pile lifting
Severe ▪ Common entrances when snow and rain are factors ▪ Cafeterias and any food-service areas ▪ Heavy-traffic load funneled into concentrated areas ▪ 2,500 or more traffics daily	At least once daily; some areas will require more.	Perform when vacuuming as spots, spills occur	Weekly Should include weekly pile lifting. More frequent pile lifting may be needed to contain tracked soiling	Monthly Should include pile lifting
This grid is intended as a guideline that should apply as a general minimum in most commercial applications. There will be exceptions where frequencies will need to be adjusted by site needs.				

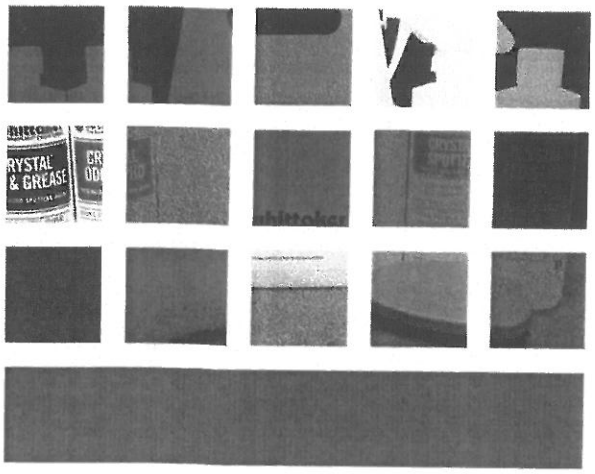
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BŌLYÜ

TOTAL **level** FLOORING

CARE GUIDE



PROACTIVE CLEANING FOR THE HEALTH OF THE **level** FLOORING AND END USER

Without regular removal, dirt and soil accumulates to grind and permanently damage fibers, so **level** flooring can "ugly out" before it's time. **level** by its very nature, will mask soil, stains and abrasion to a certain degree, unlike hard flooring surfaces that readily reveal these symptoms indicating the need for immediate maintenance. It is for this reason **level** must be proactively maintained before soiling becomes noticeable to prolong the appearance and life of your **level** flooring.

> Proactive cleaning is preventive maintenance before the carpet looks dirty, instead of reactive cleaning after the carpet is visibly soiled.

Proactive cleaning is preventive maintenance before **level** looks dirty, instead of reactive cleaning after **level** is visibly soiled. It is the foundation of Beaulieu Commercial Total Solution **level Flooring** Care Guide that proactive daily, interim and scheduled maintenance can reduce or eliminate the cost and time of reactive restoration required for extreme cases of badly soiled or damaged **level** while extending the life and appearance of **level** itself.

Reactive restoration involves water extraction with aggressive agitation followed by thorough rinsing and pile grooming. This procedure may need to be performed several times before any improvement is noticeable. Proactive cleaning provides the best possible **level** appearance day after day, extending replacement due to appearance.

Not only is the proactive nature of cleaning important, so is the overall environmental friendliness of the process. Beaulieu Commercial is committed to the environment. We only recommend cleaning systems that are environmentally friendly which is described as containing minimal to no VOC's, biodegradable, non-toxic, non-flammable, non-hazardous and safe for the environment.

level can act as a filter that traps and keeps dust and dirt out of the air. This can be a significant health benefit since most people spend a great deal of their time indoors. When removing contaminants from **level**, it's important to use equipment that will prevent re-circulation of dust back into the air.

This guide is organized by cleaning frequency (daily, interim, and scheduled). Depending on frequency and traffic, there are different techniques and tools recommended for best results in your particular facility. All chemicals used must have a pH level of less than nine. Do not use chemicals containing optical brighteners or deliminene (orange terpenes).

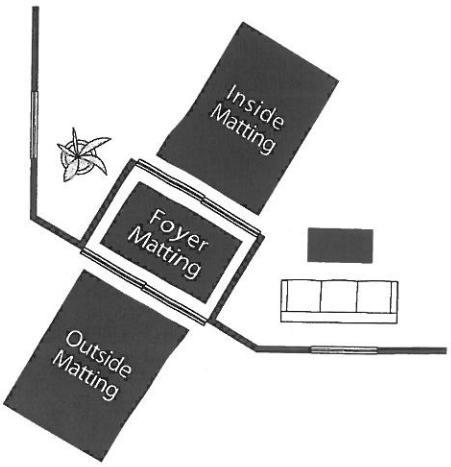
DAILY CLEANING

Daily cleaning is necessary for heavy, medium, and light traffic areas, and includes the following:

- Daily vacuuming of walk-off mats.
- Daily vacuuming of track-off, funnel, and main traffic lanes. In some instances, frequency may be greater.
- Immediate spot removal with emulsification and agitation, extraction, or blotting to guard against permanent staining.
- Recommended Spotters: R.E. Whittaker Co.(Crystal® Spotting Kit & Crystal® Spot Tool) or Windsor Ind. (Pro Spotting Kit)

Cleaning Walk-off Mats As Front Line level Flooring Protection

The first step toward clean **level** is preventing dirt from getting to the **level**. Since 80% of all soil is brought from outside on the bottom of shoes, Beaulieu Commercial strongly recommends walk-off mats at all entry ways and transition areas where soiling is likely. Mats trap or localize dirt, and the longer the mat, the more dirt trapped. Daily vacuuming and frequent cleaning of mats will optimize mat efficiency and provide front line protection to keep **level** flooring cleaner longer.



Recommended Vacuum: ProTeam (ProForce 1500XP) or Windsor Industries (Versamatic Plus)

Vacuuming Efficiently And Effectively

Vacuuming - removes 90% of dry soils that accelerate wear and fiber abrasion.

Vacuuming is a powerful method for preserving **level** life and appearance. The first step in vacuuming is selecting the equipment best suited to your requirements and preferences.

Two-motor Vacuum

In a two-motor vacuum, there is a separate motor for vacuuming and beater brush drive. Each motor is sized and configured to optimize the specific function. Operation is generally quieter and dirt pick-up more effective than single-motor vacuums. We recommend a two-motor vacuum for all traffic levels.

INTERIM CLEANING

Interim cleaning bridges the gap between routine vacuuming and restorative wet extraction. It is the most important component of the total maintenance program relating to **level's** appearance. This is due to two factors - 1) it reduces the oily soils that accumulate on **level** fibers and 2) it lifts and opens the **level** pile, which improves routine vacuuming's ability to remove dry soils. If oily soils are not minimized, then fibers become matted down and stuck together. If this is allowed to occur repeatedly, then even restorative wet extraction becomes incapable of recovering an acceptable appearance, which leads to early **level** replacement. See Fig. 1 below.

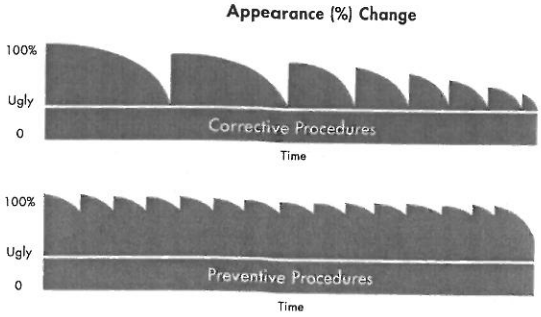


FIG 1

The recommended process for interim cleaning is low moisture encapsulation. It incorporates a cylindrical brush machine (Fig. 2) to agitate an encapsulating pre-spray chemical solution. The chemical solution dries (Fig. 3) and encapsulates the oily soils allowing a dry vacuum to recover these soils that had been stuck to the **level** fibers.

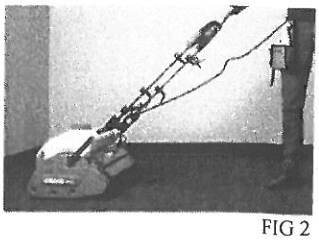


FIG 2

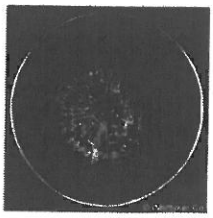


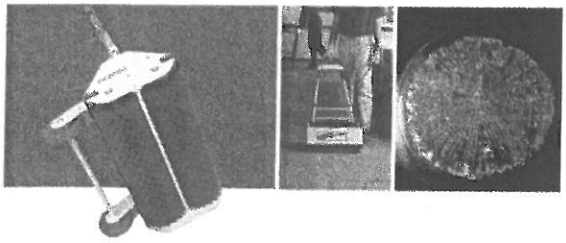
FIG 3

Recommended Low Moisture Encapsulation Method

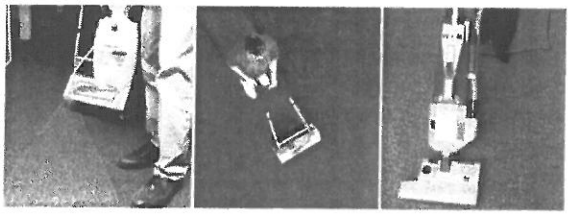
Step 1: Spray a diluted chemical solution onto **level** fibers.

Step 2: Agitate immediately or at same time as spraying, using the soft or medium stiffness brushes. Please avoid using the stiffest brushes.

Step 3: Vacuum, when **level** is completely dry or, at the next scheduled time. **level** is dry in as little as 30 minutes, allowing less disruption in areas during operating hours. Productivity rates for low moisture encapsulation range between 3,000-15,000 square feet per hour depending on equipment being used.



The Crystal Dry chemical action breaks down the sticky and oily residue that attracts soil on contact. The GLS machine works the Crystal Dry deep into the pile and loosens foreign solid materials, lifting the carpet pile at the same time. As the Crystal Dry chemicals dries, it encapsulates the soil in crystals that are then dry extracted by vacuum. The entire interim cleaning process is pictured below



Spraying Scrubbing Vacuuming

Other comments

Beaulieu Commercial recommends chemical pre-sprays, which have received The Seal of Approval of the Carpet & Rug Institute. Additionally, while not required we recommend that the pre-spray be Green Seal certified for reduced environmental impact. By using a cylindrical brush machine during regular interim cleaning there is no need to perform pile lifting as a separate operation with a separate piece of equipment.

Recommended Interim Equipment and Chemistry: R. E. Whittaker Co. (Smart Care® machines and Crystal® brand chemistry).

Recommended Equipment & Chemicals: R.E. Whittaker Company (GLS Crystal Dry, pictured on the left)

Recommended Vacuum: ProTeam (Proforce 1500XP) Windsor Industries (Versamatic Plus) or comparable two-motor vacuum

Beaulieu Commercial does not recommend the use any type of 'bonnet' or rotary shampoo cleaning method for Bolyu or Aqua **level** brands. **Use of the 'bonnet' method may void all warranties.**

SCHEDULED CLEANING

Scheduled periodic overall deep cleaning with hot water extraction cleans to the base of the fiber. It is our recommendation that on new **level** installations hot water extraction be performed only with clean, clear water and when necessary, a pH adjusted rinse (depending on pH of carpet fibers) for best long-term results.

DEEP RESTORATIVE CLEANING

The restorative cleaning process is capable of removing the highest amount of accumulated soil. Beaulieu Commercial and other major fiber producers recommend hot water extraction for the periodic deep cleaning maintenance process. Equipment is used to spray water under high pressure and usually at high temperature to loosen embedded soils and flush them out of **level** fibers with suction. The variety of equipment ranges from truck-mounted high-powered machines to portable machines that use a hose and wand or self-contained extractors.

The restorative cleaning process is performed by spraying a chemical solution onto **level** fibers and immediately removing with suction. Hot water extraction equipment is then used to rinse

level fibers of the soils and chemical solution. **level** fibers should dry in 2-12 hours depending on indoor environment and outdoor climate. It is recommended to operate HVAC system and utilize air movers when possible to speed drying process. Productivity rates range from 500 (hose & wand)-10,000 (large ride-on) square feet per hour depending on equipment used. Beaulieu Commercial recommends hot water extraction equipment, which has received The Seal of Approval of the Carpet & Rug Institute.

Recommended Extraction Equipment & Pre-Sprays: U.S. Products (Cobra Plus Series); Windsor Ind. (Commodore or Dominator series); and R. E. Whittaker Co. (Smart Care® machines for agitation & Crystal® Extract pre-spray).

level Tile Extraction Requirements

level flooring must only be extracted using 100 psi. max and not to exceed 100° at wand. Exceeding these limits may disrupt adhesive bond on perimeter of tiles.

Recommended Hot Water Extraction Methods

Hot water extraction is disruptive and should only be performed after every 3-6 interim cleaning cycles.

Step 1: Spray a diluted chemical solution onto **level** fibers.

Step 2 (optional): Agitate with a cylindrical brush machine to carry chemical solution into the fibers. This step pre-loosens the soils and permits maximum contact between chemical and soils. It also opens and lifts **level** fibers to promote better extraction function.

Step 3: Allow a dwell time of at least 10 minutes to provide time for emulsification of oily soils prior to extraction.

Step 4: Operate hot water extractor to loosen embedded soils and flush them out of **level** fibers. It is our recommendation that on new **level** installations hot water extraction be performed only with clean, clear water and when necessary, a pH adjusted rinse (depending on pH of **level** fibers) for best long-term results. You can cut dry time in half by making extra dry passes with the extractor and directing an air mover onto wet carpet.

Do not over wet **level.** Over wetting **level** causes wick back, which will allow spots to reappear. **level** must also be 100% dry before foot traffic commences to prevent rapid re-soiling.

When To Use Defoamers

If foaming occurs, put a small amount of defoamer into the recovery tank of the extractor. Spraying defoamer onto the inner wall of the recovery tank can give faster contact with foam as it enters the tank.

Warning: Never put defoamer into the solution tank. This can clog the spray jets. Also, defoamer residue on the carpet will cause rapid resoiling.

Recommended Extraction Equipment & Pre-Sprays: U.S. Products (Cobra Plus Series); Windsor Ind. (Commodore or Dominator series); and R. E. Whittaker Co. (Smart Care® machines for agitation & Crystal® Extract pre-spray).



SPOT REMOVAL – 7 RULES FOR BEST RESULTS

Spot removal can be one of the most confusing and frustrating aspects of **level** care. Improperly treated or ignored spots can destroy expensive **level**, The following seven rules can help simplify the challenge.

Recommended Spotting Kits: R.E. Whittaker Co. (Crystal Dry Spotter & Carpet Roamer)

Recommended Spotting Kits: Windsor Industries (Pro Spotting Kit & Presto spotting extractor)

Seven Rules of Spot Removal:

1. The faster you get to a spot the better for removal. At the minimum, spot removal must be a daily routine.
2. Know the fiber make-up of your **level**. Most commercial **level** uses solution-dyed polyester fibers. IICRC certified professional cleaners have simple tests that can determine fiber type for you.
3. Know and recognize the common spots in your facility. Keep a spotting kit on hand with a general purpose spotter and specialty spotters for spots specific to your area of responsibility. Offices, for example, often have coffee or copier toner spots. Hospitals commonly have blood or betadine spots. You can expect coffee, tea, and red food dye spots in retail or hospitality facilities. Nursing homes commonly have urine stains. Gum stains are common in public facilities.
4. Many spots are concentrated areas of general soil tracked into an area. A general purpose water-based spotter will remove these.
5. Greasy spots and tar are best removed by an oil or solvent-based spotter.
6. Protein or fatty soils such as vomit, feces, or blood can be effectively removed with an enzyme-based spotter.
7. When applying a spotter, never rub the spotted area. Always carefully blot the spot with a cloth. To help prevent resoiling, use a spotting water extractor to thoroughly clean the spotted area after blotting.





YOUR MAP TO TOTAL SOLUTION CARPET CARE

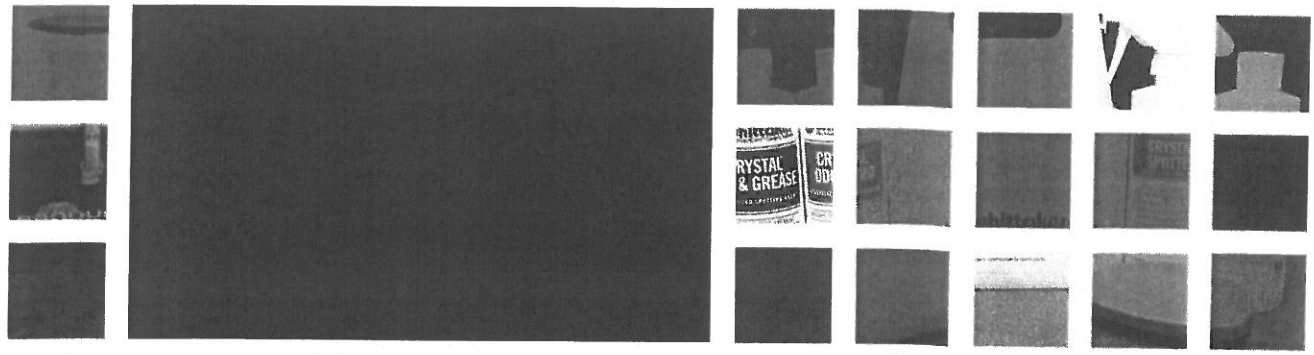
There are many ways to clean commercial **level**. To determine the best for your requirements, you should map out the types of traffic in your facility's areas. Using a copy of your building's floor plan, categorize and label traffic areas as heavy, medium, or light.

AMOUNT OF TRAFFIC	TRAFFIC	VACUUM FREQUENCIES	INTERIM CLEANING FREQUENCIES	DEEP CLEANING FREQUENCIES
Light	Office area with 1 worker	2-3 Times per week	Two to Four times a Year	Every 12-18 months
Moderate	Up to 500	Daily	Quarterly	1-2 times per year
Heavy	500-1000	Daily	Every Other Month	2-4 times per year
Extra Heavy	1000-2000	Daily	Monthly	4-6 times per year
Extremely Heavy	Over 2000	Twice Daily	Weekly to Monthly	6-12 times per year

*The term "traffics" means each time one person walks in the area. The same person walking in the same area 20 times a day equals 20 traffics.

Note: Spotting maintenance should be performed on a daily basis.

You are now on your way to total solution **level** care provided by your partner in business, Beaulieu Commercial, in an effort to increase your return on investment of your floor coverings. For additional technical information pertaining to installation, adhesives, maintenance, specifications and warranties please see our website at bolyu.com or feel free to contact technical services at 800 451 1250.



P.O. Box 1447 • 1996 Highway 225 South • Chatsworth, GA 30705 • 800 451 1250

5/13/2013

Lifetime Commercial Limited Warranty

Modular Carpet

This warranty begins when the carpet product is installed by Masland authorized installation professionals in accordance with Masland Contract's current installation specifications, including the use of Masland Contract adhesives and sealers, if applicable. Providing care recommendations are followed, the warranty continues for the useful life from the date of the original installation. The warranty is further defined as the period the carpet is owned and maintained by the original end-use purchaser. The basis of any warranty related claim is the original Masland Contract invoice or the original Masland Contract dealer invoice. If these specifications and procedures are not followed, a standard two-year warranty against manufacturing defects will be in effect as well as any further protection offered by the fiber producer. *Installation specifications and carpet care recommendations can be obtained from your dealer or Masland Contract Information Center at 1.888.633.4770, or on the Masland Contract web site at www.maslandcontract.com.*

TUFT BIND

Masland Contract warrants that its high performance modular carpet will provide tuft bind strengths consistent with accepted industry standards for these products. Any failure to perform with respect to acceptable tuft bind will be independently evaluated and the product replaced by Masland Contract if a product defect is responsible for substandard performance. Specific product and performance criteria may be noted and registered as part of this specific warranty.

EDGE RAVEL

Masland Contract warrants that under normal use, Masland Contract high performance modular carpets will not edge ravel.

BACKING INTEGRITY DELAMINATION

Masland Contract warrants that, under normal use, the backing will not delaminate. Masland Modular Carpet will not shrink or stretch under normal conditions during the lifetime of the product. This also warrants against cupping, doming, curling or dishing of the Modular Carpet.

SMOKE DENSITY

Masland Contract warrants that its high performance Modular Carpet will generate less than the generally accepted maximum rating of 450 specific optical density for smoke in the flaming mode, when tested in accordance with ASTM Test Method E-662 (NFPA 258). See the specific test report for each high performance product.

STATIC PROPENSITY

Masland Contract warrants that its high performance Modular Carpet prevent static buildup in excess of 3.5 KV when tested using AATCC Test Method 134 at 70 degrees F at 20% R.H.

CARPET CLASS

Masland Contract warrants that its high performance Modular Carpet is appropriately classified under all applicable fire codes for the specified endues as tested under Test Method ASTM E-648. See the specific test report for each high performance product.

NOTICE AND DEFECT CLAIMS AGAINST WARRANTY

All claims under this warranty must be submitted, in writing, to Masland Contract, P. O. Box 11467, Mobile, AL 36671.

OBLIGATIONS OF WARRANTOR

Masland Contract will, within ten working days of receipt of claim, designate a representative to inspect the standard performance and evaluate the warranty claim.

LIMITATIONS

Any portion of the Masland Contract high performance Modular Carpet not performing as stated will be repaired to conform to the warranty. If repair is not commercially practical, Masland Contract may, at its option, replace the affected carpet or refund the proportional purchase price for the affected area. Masland Contract will pay the costs of the carpet, reasonable freight, and labor. Thereafter, Masland Contract will pay only the costs of the carpet and reasonable freight. Costs incurred for the moving of equipment, furnishings, partitions, and the like, that were installed over the Masland Contract standard performance product will be at the consumer's expense. Carpet installed on stairs or in areas subject to abnormal foot-traffic use (i.e., golf spikes, other spiked footwear, ski boots, and the like) is excluded. This warranty does not cover burns, cuts, fading, matting, pills, pulls, odor, soiling, staining, tears or damage due to improper installation or due to improper cleaning agents or methods. Incidental and consequential damages are not the responsibility of Masland Contract, and, to the extent permitted by law, are hereby excluded as to both property damage and personal injury. Replacement carpet will come only from current running line standard performance products comparable to the warranted product.

IMPLIED WARRANTY RIGHTS

This lifetime warranty gives you specific legal rights and is in lieu of all other express or implied warranties. In certain states, you may also have implied warranty rights, including an implied warranty of merchantability or fitness for a particular purpose. In any event of a problem with warranty, service or performance, your rights under both the express and implied warranties may be enforceable in an appropriate court of law. These warranties apply only in the United States and Canada.

Protect and Preserve

Thank you for choosing a Masland Carpet for your fine interior space. Carpet is a textile material and it will receive more abuse and use than any other finish in a building. In order to keep Masland Carpet products performing to their potential, you must design and implement a comprehensive maintenance plan.

Developing A Plan

To develop a proper plan, you should define the type of traffic patterns the carpet will receive.

WALK OFF AREAS- This area is normally at the entrance of the building or at a hard-surface transition where walk-off mats are found. Masland does recommend the use of walk off mats and suggests that they are regularly maintained and changed as needed. You must pay close attention to these areas as soil and other contaminants are easily transferred from the mats onto the carpet. This is likely to be the area that cleaning is required most often.

FUNNEL AREAS- These areas will receive a higher concentration of traffic and soil. Funnel areas occur where two or more traffic lanes merge together to form one concentrated lane. These areas occur in corridor intersections, doorways, and around elevators. These areas, like the WALK-OFF AREAS require more stringent maintenance procedures. Funnel areas can be subjected to significant pivoting traffic that will grind soil deep into the carpet fibers.

MAIN TRAFFIC AREAS- Large spaces that receive heavy foot traffic that is more dispersed than funnel areas.

HIGH SPILL/STAIN AREAS- Immediate attention must be given to spills as they occur. Many spills can result in permanent damage if they are not addressed immediately. These include but are not limited to: Coffee, soft drinks, red wine, mustard, oil, and fruit drinks. These areas require daily maintenance.

LOW TRAFFIC AREAS- These areas are the lowest volume of traffic and soil load such as upper floors and individual offices. These areas would have only 500 traffics per day or less and will not require as much maintenance as the four other areas.

WALK OFF MATS

- The 1st line of defense for your carpet is a walk off mat. Masland suggests a minimum of 5 feet of walk off mats be placed at every building entrance. Studies have shown that 12 feet of mat is optimal if the area will bear it. These mats need to be vacuumed at the very least, once a day. Mats should also be placed at any kitchen area transition. Regularly vacuum and clean the walk off mats as they will receive a high soil load very quickly.

VACUUMING

- The most important maintenance procedure is the removal of dry soil by vacuuming. Appropriate vacuuming is 4 slow passes back and forth in the same area. Use a dual motor upright vacuum where the brushes and suction are driven by separate motors. For best results, change vacuum bags before they become two-thirds full. Masland does not recommend vacuums with beater bars.

- **All vacuums** must be approved under the Carpet and Rug Institute's Indoor Air Quality Vacuum Cleaner Program. A comprehensive list of approved products can be found at www.carpet-rug.org. These vacuums have been performance tested and have met indoor air quality standards to help ensure that your carpet is clean and your indoor environment remains healthy.

SPOT CLEANING

- Spills and spots must be attended to with immediacy. Spills that are allowed to dry are much more difficult to remove. All spot cleaners used on Masland products must be approved by the CRI Seal of Approval Program. These products are listed at www.carpet-rug.org .
- For Synthetic fibers, cleaners should have a pH range of 5.5 to 10.0. Do not use cleaning chemicals outside of this range as damage to the fiber could result. This requirement is for all chemicals (spot cleaners, pre-sprays, and in-tank) used on Masland products. Never rub spots or spills, use a blotting action only.
- For specific Spot cleaning instructions, please refer to the Masland Spot and Spill Removal Guideline at the end of this document.

INTERIM CLEANING

- This type of cleaning is a fast high volume process that is used in between restorative cleanings. Masland suggests methods such as **Low Moisture Extraction**, a cleaning system that uses encapsulants that dry to a crystalline state and can be removed by vacuuming. **Low Moisture Compound Cleaning** is a cleaning technique that applies highly absorbent material onto the carpet face and is then agitated into the carpet and allowed to dry. The cleaning compound and soiling debris are then removed by thorough vacuuming. **Dry Foam** cleaning is conducted by a machine applying a foaming chemical onto the upper surface of the carpet and then removing the chemical and soil contaminants that were captured by the foam. All of these systems dry very quickly and cause less intrusion in an interior space than Restorative cleaning.

RESTORATIVE CLEANING

- Hot Water Extraction is the preferred method of cleaning by Masland. This method is proven to be the most effective means of removing entrapped soil and other residues. This method does require effort and will take some time to dry. Use air movement systems and the HVAC system to aid in drying time. Masland does require that all systems used on Masland Carpet be approved under the Carpet and Rug Institutes Seal of Approval Program. Masland also prefers that all equipment be at least a Silver Level cleaning system. Carpet should only be cleaned by trained technicians. IICRC Certified technicians are preferred.
- Never mix "In-Tank" solutions at greater the recommended concentrations. The most effective cleaning method by hot water extraction employs a pre-spray chemistry coupled with agitation. Always thoroughly rinse any detergents from the carpet with water only as to impede accelerated soiling. If detergent residue or build up exists, clean the carpet with hot water only.
- The use of a pile lifter will help to remove embedded soil and sandy particulate. It will also help to erect the pile fiber and renew the appearance of the carpet. Use of a pile lifter in funnel areas, walk off areas, and around elevators will enhance the appearance of the carpet.

DO NOT USE BONNET/ROTARY SYSTEMS ON MASLAND CARPET. USE OF THIS TYPE SYSTEM WILL VOID ALL MASLAND WARRANTIES.

Follow all guidelines set forth by the Institute of Inspection Cleaning and Restoration (IICRC) S100 *Standard and Reference Guide for Professional Carpet Cleaning*. This is available at www.iicrc.org

FREQUENCY OF MAINTENANCE

The table below is a guideline for the frequency of cleaning established by the IICRC. This is a very good guide for a maintenance schedule. However, each building and traffic patterns are different and modifications to the table may need to be implemented.

	Carpet owner/Maintainer		Professional Carpet Cleaner/Restorer	
Traffic Soil Rating	**Vacuuming**	**Spot Cleaning**	**Interim Maintenance (between restorative cleanings)**	**Restorative Cleanings**
Light <500 Foot Traffics per day	1 to 2 per week	Daily or as soon as noticed	1 to 3 times annually	1 to 2 times annually
Medium 500-1000 foot traffics per day	Daily in traffic areas, overall 3 to 4 X per week	Daily or as soon as noticed	3 to 6 tomes annually	2 to 4 times annually
Heavy 1000-2500 foot traffics per day	Daily in traffic areas, overall 4 to 7 X per week	Daily in traffic areas, overall 4 to 7 X per week	6 to 12 times annually	3 to 6 times annually
Very Heavy >2500 foot traffics per day	1 to 2 X daily in traffic areas. Overall 7 X per week	1 to 2 X daily in traffic areas. Overall 7 X per week	12 to 52 times annually	6 to 12 times annually

HARD SURFACE TRANSITIONS

Areas where carpet meets a hard surface are sometimes more susceptible to accelerated soiling and can become difficult to clean. This area would be similar to a walk off area and will normally require weekly attention. This is even more important in areas of transitions to kitchens or bathrooms. Well placed walk off mats will help to minimize the affect of soiling that comes in these transitional areas.

Maintenance personnel should never use hard surface cleaners on carpet. It should also be noted that buffers or rotary cleaners should never be allowed to spin on or even come in contact with the carpet. High pH cleaners used for hard surface are very likely to harm the carpet.

SPOT CLEANING GUIDE

A. **WATER SOLUBLE STAINS**:
First, blot thoroughly with a white cotton cloth or paper towels. Next, apply a solution of ½ teaspoon (no more) of liquid dishwasher detergent to one quart of water. A spray bottle works well. Repeat until stain is removed.

B. **WATER SOLUBLE STAINS WITH ODOR:**
Same as A, but treat with white vinegar before using detergent.

C. **WATER SOLUBLE STAINS WITH HEAVY COLOR:**
Same as A, but treat with household ammonia before using detergent.

D. **GREASE:** Blot as much as possible with white cloth or paper towels. Apply a volatile solvent such as Perchloroethane (dry cleaning fluid), or lighter fluid (naptha) to a white cotton cloth. CAUTION: Do not apply the solvent directly to the carpet pile as permanent damage WILL result. Use rubber gloves and provide adequate ventilation.

E. **WAXES and GUMS**: Freeze the stain with ice or a commercially available product in an aerosol can. Shatter with a blunt object and vacuum immediately. Repeat until spot is removed.

F. **MEDICAL STAINS:** Commercial preparations are available. A 5% Sodium Thiosulphate solution (from a photography store) may also be used. For stains more than a few hours old, this solution should be heated.

G. **RUST**: Most can be removed with a 10% solution of oxalic acid. More stubborn stains will require professional cleaning as restricted chemicals may be needed. Use of oxalic acid is not recommended for solution dyed products as damage may

result. Certain household cleaners contain oxalic acid and should be used with caution.

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Alcoholic Beverage	A	Grease (auto)	D
Asphalt	D	Grease (food)	A
Beer	A	Ink (ball-point)	D
Betadine	F	Ink (washable)	A
Berries	A	Lipstick	D
Blood (wet)	A	Milk	A
Blood (dry)	C	Mustard	A
Butter	A	Nail PolishNail Polish	Remover
Chewing Gum	E	Paint Latex (wet)	A
Chocolate	C	Paint Latex (dry)	D
Coffee	B	Paint (oil)	D
Cola Drinks	A	Rust	G
Cosmetics	A	Tea	A
Crayon Markers	D	Urine	B
Excrement	A	Vomit	B
Food Dyes	A	Wax	E
Furniture Polish	A,D	Wine	C

Tandus Centiva
A Tarkett Company

MODULAR
LIFETIME LIMITED WARRANTY

Modular styles with nylon face fiber are covered by a non-prorated Lifetime Limited Warranty issued by Tandus Centiva against excessive surface wear, edge ravel, zippering, resiliency loss of backing, and delamination of the secondary backing from the primary backing containing the face fiber. Lifetime is defined as the period of time during which the product is owned and maintained by the original end-use purchaser in the original indoor installation location. Tandus Centiva Modular products must be installed in accordance with the appropriate Modular Installation & Floor Preparation Instructions and must be maintained in accordance with Tandus Centiva care and maintenance guidelines. The use of Tandus Centiva primers and adhesives or approved alternatives is required. Failure to conform to these requirements will result in loss of limited warranty coverage.

Moisture and pH testing requirements and limitations are defined in the Tandus Centiva Modular Installation & Floor Preparation Instructions for each Modular product. Product or installation failure due to moisture or pH levels in excess of the limits set forth in these instructions is specifically excluded from limited warranty coverage.

Chair pads are not required, but are recommended for optimum textural performance. Absent the use of chair pads, more intensive maintenance will be required for areas in direct contact with chair caster traffic, and some degree of appearance change is to be expected.

Soiling visibility is affected by colors and patterns. Information on optimizing your selection can be found at www.tandus-centiva.com. **Appearance retention is not covered by this limited warranty.**

Excessive surface wear means more than fifteen percent (15%) loss of pile fiber weight measured before and after use.

Resiliency loss means more than ten percent (10%) loss of backing resiliency calculated using average thickness measurements of the backing of the carpet before and after use. Since resiliency recovery is not immediate and may be influenced by temperature and other conditions, thickness must be measured only after a 72-hour conditioning period.

Modular products also carry a Lifetime Limited Warranty against excessive static electricity only when installed and maintained in accordance with Tandus Centiva approved procedures. Excessive static electricity means more than 3.0 kilovolts at a relative humidity of 20% and a room temperature of 70 degrees Fahrenheit.

If these products fail to perform as described in this limited warranty, the affected area will be repaired to meet the applicable Tandus Centiva limited warranty provisions. If repair is not commercially practical or possible, Tandus Centiva may, at its sole discretion, replace the affected area or refund the original Tandus Centiva invoice cost for the affected area. If repair or replacement is required, Tandus Centiva reserves the right to utilize an independent qualified labor provider or Tandus Centiva Field Technical personnel. Replacement will be made with a product of comparable cost from the current Tandus Centiva running line of products.

This limited warranty does not cover pile shading, pile crushing, tears, burns, cuts, pilling, matting, damage due to improper installation, improper use, improper maintenance, installation over irregular surfaces, point loads in excess of 150 pounds per square inch or any other damage not expressly covered above and is subject to the applicable Tandus Centiva product tolerances, which are available upon request. **This limited warranty does not cover damage resulting from improper installation or maintenance.** Liability of Tandus Centiva is limited to the actual repair or replacement of the affected area and does not cover incidental or consequential damages. Tandus Centiva is not responsible for any expenses incurred for removal of furniture, partitioning, temporary walls or other fixtures on or around the affected area of the carpet.

All Tandus Centiva Limited Warranty and Maintenance Information can be accessed at www.tandus-centiva.com or by dialing 800-248-2878.

THE BUYER AND/OR END USER IS SOLELY RESPONSIBLE FOR THE SUITABILITY OF THE MERCHANDISE SELECTED FOR A PARTICULAR APPLICATION. TANDUS CENTIVA SHALL NOT BE RESPONSIBLE FOR THE REPAIR OR REPLACEMENT OF ANY PRODUCTS DAMAGED AS A RESULT OF FORCE MAJEURE, INCLUDING BUT NOT LIMITED TO FIRE, FLOOD, OR OTHER CATASTROPHE, ACTS OF GOD, OR ANY CAUSE BEYOND THE CONTROL OF TANDUS CENTIVA.

ALL IMPLIED WARRANTIES WHICH MAY ARISE BY LAW, IMPLICATION OF LAW OR APPLICATION OF COURSE OF DEALING OR USAGE OF TRADE INCLUDING, BUT NOT LIMITED TO, IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY DISCLAIMED AND EXCLUDED. ANY ORAL STATEMENTS ABOUT THE MERCHANDISE DESCRIBED HEREIN ARE NOT WARRANTIES, SHOULD NOT BE RELIED UPON BY THE BUYER, DO NOT FORM ANY PART OF THE BASIS OF THE BARGAIN, AND ARE NOT PART OF THIS OR ANY OTHER LIMITED WARRANTY. NO AGENT, DISTRIBUTOR OR REPRESENTATIVE OF TANDUS CENTIVA, EXCEPT AN OFFICER OF TANDUS CENTIVA, SHALL HAVE AUTHORITY TO AGREE TO ANY TERM, CONDITION OR PROVISION INCONSISTENT HEREWITH OR NOT CONTAINED HEREIN.

Invoice No.	3310846	Company Installed	Flooring Systems, Inc.
Product(s)	Maelstrom - ethos Modular	Color	33201
Project Name	Webster IBS	Total Square Yards	26.67
Project Address	8274 Big Bend Blvd., St. Louis, MO 63119		
Specific Areas Surfaced	Throughout		
Date Installation Began	June 28, 2017	Date Installation Completed	June 28, 2017

Authorized Signature

Sworn to and subscribed before me,
This 5th day of July 2017

SHERRI BENNETT NOTARY PUBLIC WHITFIELD COUNTY GA

Sherri Bennett
SHERRI BENNETT
NOTARY PUBLIC, WHITFIELD COUNTY
MY COMMISSION EXPIRES JUNE 16, 2020

Tandus
TECHNOLOGIES

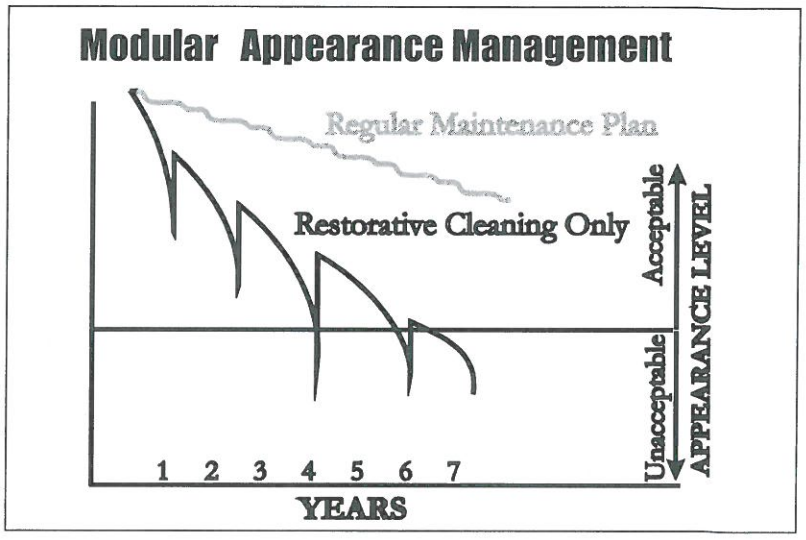
Technical Services Bulletin

MODULAR MAINTENANCE CARE PROCEDURES

The following CARE recommendations should be implemented prior to, or immediately after the installation of Tandus Modular products.

Use and traffic patterns in a facility can vary greatly; therefore, a planned maintenance program must be designed in each facility. In addition to this initial planning, the maintenance program must be reviewed on a regular basis to adjust for changing traffic and use patterns. All modular installations require a properly designed and implemented maintenance system to maximize appearance retention.

Some areas may require a yearly cleaning, while other areas may require cleaning on a weekly basis. The ultimate goal is to maintain a high appearance level in all areas at all times and thus extend the life cycle of the modular carpet. This objective is obtained by eliminating the soiled/cleaned, soiled/cleaned cycle as expressed in the illustration below.



A total maintenance package must be initiated to supplement cleaning in order to assure customer satisfaction of the product. Deep or Restorative Cleaning typically occurs as a result of the failure to maintain any Textile floor covering selection. In essence, the better the maintenance plan, the reduced need for deep cleaning and the longer the lifecycle for modular installations. Following are recommendations for a complete maintenance package. Keep in mind, that frequencies may vary depending upon the diligence of the maintenance program and the inclusion of these essential support tools.

Developing the Plan:

This CARE maintenance program is based on both Low Moisture Primary Maintenance and Hot Water Extraction methods using minimal cleaning agents. Product construction, color selection,

entry mats, daily vacuuming, spot removal, regular cleaning, and product repair are all integral considerations of this CARE program.

Implementing a strategic plan is an essential step in developing and maintaining a successful CARE program. Maintenance is a process of soil removal designed to retain carpet appearance. Soiling is a cumulative process that can easily be controlled by vacuuming and soil localization. A facility diagram assists the plan by identifying areas of soiling before they become excessively soiled.

An effective plan includes color-coding a floor plan identifying areas of extreme, heavy, medium and light traffic areas; spot prone areas, and other areas that may require additional maintenance and cleaning attention. The color-coded diagram of the facility will assist in scheduling where to clean and how often.

The facility diagram also can be useful in selecting the cleaning method and proper equipment to perform the required tasks in each area. For example, entry areas may require daily vacuuming, weekly pile lifting, and monthly cleaning; whereas, break areas may require a hand-held, spot removal extractor for frequent spot removal. Additionally, the plan can be useful in identifying where to place entry mats.

Each maintenance staff member should be provided with a copy of the plan. The floor plan also may be used to identify newly developed tasks that occur during the course of the business day.

Preventive Maintenance:

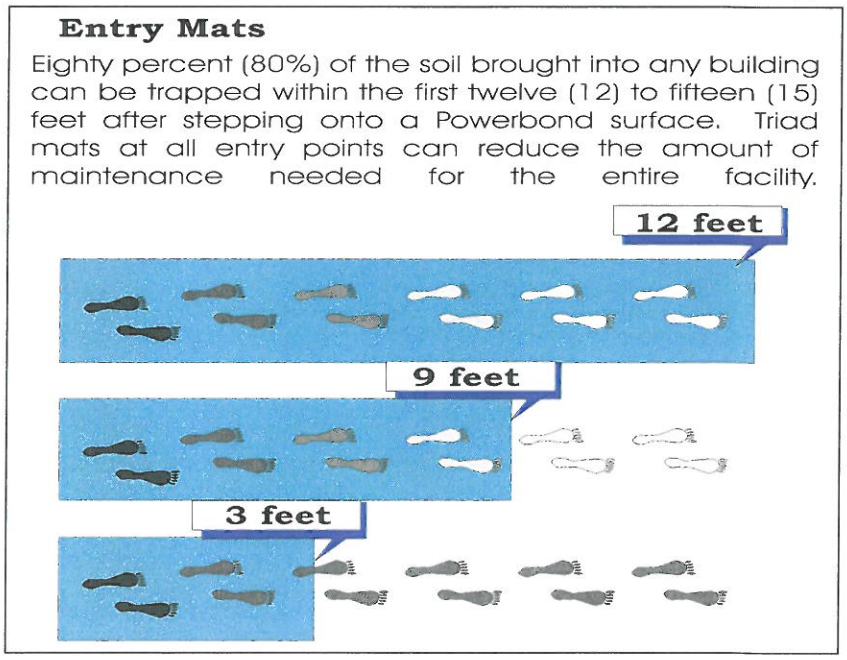
Preventive maintenance is the most cost-effective maintenance activity that takes place. These activities include any active or passive activity designed to eliminate soil before it reaches the modular carpet. It may include careful selection of drinks in soda machines that do not contain dyes, which can permanently stain the nylon face yarns and it may include the strategic placement of additional trash receptacles.

One of the most important, yet most often overlooked, preventive maintenance method is the use of transition/entrance matting systems. Up to 90% of the soil load is caused by soil tracked in from outside areas. Entrance matting is an essential part of the CARE maintenance program. The proper use of matting systems can reduce a significant amount of tracked-in soil. Matting systems should be used at all facility entrances and transition points adjoining hard surface flooring.

All matting must be kept clean to make sure they do not become a source of soil. Ideally, a duplicate set of free lay mats should be provided for all areas. Matting systems should be thoroughly vacuumed or changed weekly to ensure a clean mat is in use at all times. Entrance mats should provide at least eight to twelve footfalls of coverage.
Tandus has developed and recommends the Triad® matting system which utilizes a three-tier soil removal process to reduce soil tracked into a facility.

- Tier ONE Exterior Triad® mats- Placed at outside entrances as the initial protection from tracked-in soil. The scraping action of this mat removes excess soil and moisture from foot traffic
- Tier TWO Foyer Triad® Mats- Placed in the vestibule of an entryway. This mat features a brushing action to remove soil and moisture. Foyer mats also may be used as exterior mats.
- Tier THREE Interior Triad® mats- Placed in interior areas adjacent to entryways and other areas exposed to heavy walk-in traffic. This mat offers unique aesthetic appeal, while completing the three-tier soil removal process.

Cleaning: Triad mats are cleaned using the maintenance procedures detailed in this publication includes daily vacuuming and weekly cleaning. Once these mats become filled with soil they then become an additional source for soil. Make sure the mat is dry prior to use.



Daily Maintenance:

Daily maintenance activities include vacuuming and spot removal. These activities are critical for the success of the maintenance plan. Without an adequate plan for these activities, facility appearance will quickly deteriorate to an unacceptable level and the aesthetic value of the modular carpet will be substantially shortened.

Effective, well-functioning equipment is required for successful daily maintenance. The size and type of equipment will be determined by the requirements of the job. As an example, a wide area vacuum cleaner may be necessary for facilities with large, open areas that must be cleaned on a daily basis. A modular office may require smaller vacuum cleaners in order to clean in tight spaces.

A note on equipment care: Like any tool, keeping cleaning equipment in top working order enhances cleaning results, lowers carpet maintenance costs by extending equipment life and limits staff downtime due to equipment failure. Follow equipment manufacturer recommendations for equipment care. For vacuum cleaners, replace nylon brushes at the first sign of wear. Empty vacuum bags when they become one third to one half full to improve soil removal results. Use only original equipment manufacturer parts for consistent performance results.

Vacuum cleaners should remove adequate soil without introducing substantial particles into the air and without damaging pile yarn. It is impossible to evaluate vacuum cleaner performance based on equipment specifications alone.

Vacuuming :

Vacuuming is the single, most important maintenance activity for modular carpet, so proper vacuuming and vacuum cleaner selection is given a high priority in the CARE maintenance program. Approximately 74%-86% of the soil deposited into carpet is dry particulate soil and may be easily removed with proper vacuuming. Dry soil can abrade and permanently damage pile yarn. Effective dry soil removal can be managed through a continuing planned maintenance program. While vacuuming alone WILL NOT keep textile floor coverings completely clean, vacuuming will remove dry (insoluble) soil that cannot be removed through regular wet extraction cleaning.

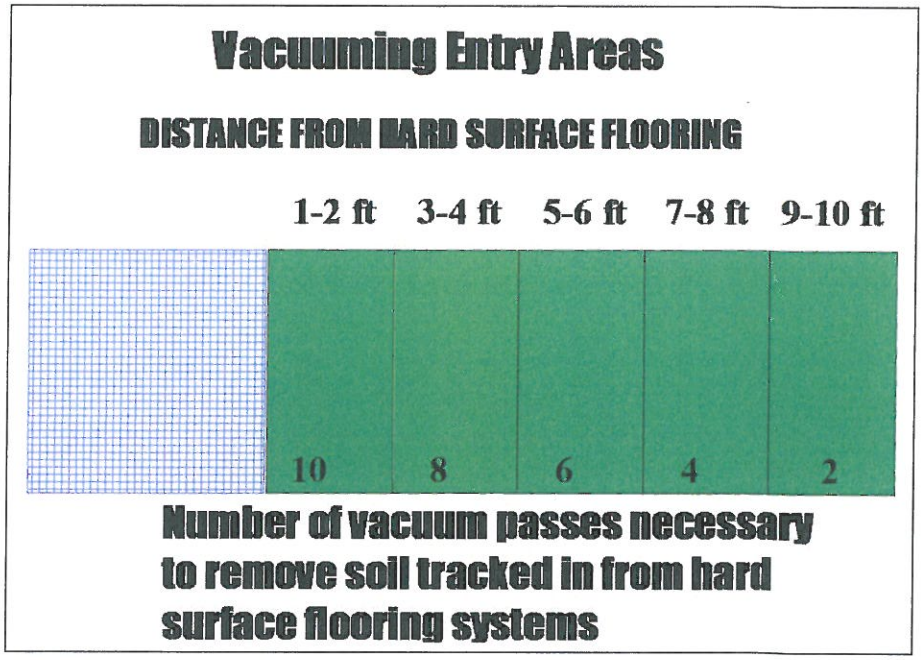
Vacuuming must play a significant part in a planned maintenance program. Cubicle spaces, Track-off areas, heavy traffic areas and entry mats should be maintained at least once ***daily*** using an approved vacuum. For improved indoor air quality, the vacuum should offer high efficiency filtration and should be Carpet & Rug Institute Vacuum – Green Label, Seal Of Approval Certified (www.carpet-rug.org).

A note on backpack vacuums: Backpack vacuums may be used in conjunction with an upright vacuum. These units may be used for daily vacuuming, as they have shown to provide even greater dry soil removal than upright units when used on structured backed product, such as modular tiles.

- Entry areas and areas adjoining hard surface flooring materials should receive a larger share of maintenance emphasis than other heavily trafficked areas within the facility. If an adequate job of entry maintenance is performed, dry soil can be limited to the first 12-15 feet after stepping onto the modular tiles. If dry soil can be restricted to these areas, interior maintenance can be redirected to remove surface litter only, rather than spending an inordinate amount of time in trying to remove embedded dry soil. This translates to vacuuming less square footage on a daily basis, thus reducing labor costs. It will not be necessary to vacuum every square foot each day, if entries can be maintained properly.

Tandus
TECHNOLOGIES

Technical Services Bulletin



Spot Removal:

Spot Removal should take place on a daily basis. Each facility should plan to purchase a spot removal extractor. One of the most effective maintenance tools to be introduced in the past few years is the spot removal extractor. These 1-2 gallon portable extractors are lightweight and are available for quick removal of spot and spills. Spot removal, if performed on a daily basis, can be performed with minimal effort.



As an all-purpose spotter, Tandus recommends SYON-5 for the majority of the spills encountered on a daily basis. SYON-5 should be applied directly to the spill and agitated slightly. Extract the solution after 5-6 minutes of dwell time using fresh hot water only. Spills should be addressed as soon as they occur. The sooner removal can be attempted, the higher the probability of complete spill removal. SYON-5 can be purchased from your local Tandus Account Executive.

The following products will be helpful in removing many spots and spills:

SYON-5	Product patented and distributed by Tandus. May be used as the first solution for all spills. Especially effective on Water Soluble food and beverage spills. Dilution ratio is: Undiluted; up to 1 part: 10 parts of hot tap water.

Hot Water Rinse	Used to rinse detergent residues to limit re-soil potential. Use only cold water on blood spills to prevent setting the stain. Hot water should be utilized in every other situation.
Crystal Clear or iCapsol Encapsulator	Good for water-based spills. May be used instead of SYON-5 is no fragrance is desired and no deodorization is needed.
SAF T SOLV	Bane-Clene product (800.428.9512) Non-Flammable, volatile, dry solvent. Can be used on many oil-based spills, as well as ink, gum and other solvent soluble contaminants.
Acetone	Breaks down adhesives, seam sealer etc. Use 'Caution' and follow label directions for proper use.
Spray n' Go	Chemspec product (800.428.9512) An oxidizing bleach. Works on many permanent stains by removing color from the staining agent. Never use Clorox or any chlorinated bleach that will remove color from the nylon face yarn. Simply dilute Spray n' Go; apply to the area and leave. Solution weakens after a few hours so do not premix more than is needed for immediate use.
Acid Rinse	Use white vinegar or a commercially available extraction rinse solution. This removes some yellowing and neutralizes many high pH detergent residues to limit re-soil propensity.

Common Cleaning Suggestions:

There are no standard frequencies that can be suggested for all facilities. Periodic cleaning is dependent upon soiling levels, traffic levels, and the quality of daily maintenance. Due to this fact, some areas may require cleaning on a weekly basis, while other areas only may require cleaning on a yearly basis.

Proper planning will help identify those areas that require more frequent cleaning. The objective should be to limit soiling to smaller areas, before they spread, rather than cleaning the entire facility. It is less costly to clean a 90 square foot entry area on a weekly basis, rather than clean a 2000 square foot outer office quarterly. This should be accomplished by trial and error, with continuous monitoring. The following are areas that are the first to become heavily soiled. These areas are where the bulk of interior soil originates.

- Entry areas – any outside entry. Asphalt sealer, dry from sidewalks, grass clippings, oily soil. These soils accumulate in entries and slowly spread deeper with the building.
- Areas adjoining hard floors- also called transition areas, these areas occur as a result of the failure to properly maintain hard floors. Even hard floors that are superbly maintained allow

finishes to be tracked to the modular tiles. Restrooms, kitchen and break areas, and tile common areas all contribute to soiling. Cleaning these areas before the traffic pattern begins to spread will lighten the maintenance load.

- Break areas- the majority of spills can be found in these areas. Spills transfer to the soles of shoes and spread throughout the facility. Shoes require about 8 steps to be adequately cleaned. This translates to about 18 linear feet.
- Soda Machines and coffee makers- areas next to refreshment areas should be monitored frequently for spills and should be cleaned semi-monthly (every other week), and before spots/ spills becomes apparent.
- Around the desks of the "neatness challenged"- Cleaning staff usually can identify the offices of those employees who seem to have difficulty in reducing spills in their areas. These areas may require more frequent inspection and more frequent spot cleaning.
- Areas of concentrated traffic- these are areas where traffic funnels to a concentrated area.
- Elevators- modular tile allows for easy removal, cleaning and replacement, as needed, if elevators cannot be maintained frequently
- Stairs- because of increased force exertion, soil from shoes is deposited more quickly and more deeply than in other areas.

Color Fading/Yellowing:

Some cleaning agents may affect dyes causing a gradual loss of color over an extended period. Optical brighteners should NEVER be used on any Tandus product. Optical brighteners can cause permanent yellowing or discoloration, and the use of any cleaning solution containing optical brighteners will adversely affect warranty coverage.

Loss of Color in small areas:

Color loss in limited areas typically may be attributed to bleaching or oxidizing agents used in facility. Some bleaching agents may be latent intruders, such as acne medications, that require several months, with heat and moisture to be activated. Others may affect dyes immediately. Typically, these color changes are permanent and cannot be reversed.

Rotary Shampooing/Bonnet Cleaning:

Is never to be used on Tandus products. As an alternative, PLEASE implement a dual cylindrical brush agitation machine. There are a few Tandus Approved machines: Windsor Industries " iCapsol Mini"; XL North/ Grab Carpet Cleaning System's "XLerator", Carpet Cleaner America's "Dri-Star & Renovator" and North American Cleaning Equipment "Duplex Hydrowasher".

The rotary action does not allow for sufficient cooling from the friction and potential yarn abrasion and permanent pile fiber distortion typically results.

Periodic Cleaning:

Tandus products provide end- users with a high performance, easily maintainable flooring options. An organized, fully implemented maintenance plan will ensure many years of

performance from Tandus products and will reduce product lifecycle costs to make them one of the most affordable flooring options available.
For enhanced performance of your new installation, Tandus has evaluated most methods of periodic cleaning, and has selected the optimum cleaning systems. Based on numerous scientific evaluations involving field and laboratory investigations, Tandus suggests the use of both Low Moisture and Hot Water Extraction systems for the maintenance of all of our products.

While there is no standardized cleaning frequency for all facilities, Tandus recommends regularly scheduled primary maintenance cleaning, before the flooring appears soiled. Some areas will require daily attention, while limited-use areas only may require a yearly extraction. Ultimately, localized use, soiling conditions, the quality of daily maintenance and appearance retention inspections will determine the frequency of primary maintenance cleaning.

The following should be considered when cleaning any Tandus products:

1. Operate heating, ventilation, and air-conditioning (HVAC) system during, and for at least 24 hours following, periodic cleaning with Hot Water Extraction.
2. Utilize air movers, in conjunction with HVAC operation, to expedite drying.
3. Limit traffic on damp modular tiles to limit soil tracking and soil wicking.
4. NEVER use any cleaning product that contains optical brighteners or bleaching agents.
5. Select cleaning products with a pH range of 4 - 9.
6. Select cleaning products that do not leave oily or sticky residues. Evaluate residue by diluting and pouring the solution into a pie plate. Place the pie plate in direct sunlight and allow evaporation. Evaluate residue for oily or sticky consistency.
7. Always keep Material Safety Data Sheets (MSDS) available during cleaning.
8. Always read and comply with label instructions of the detergent formulator.

Following is the recommended periodic cleaning procedure for the maintenance for our products:

- Vacuum the area to be cleaned, taking the required time and effort to remove as much dry particulate (insoluble soil) as possible. Hot Water Extraction (HWE) is performed to remove water-soluble soil, which cannot easily be removed with daily vacuuming. Surfactants, used in the cleaning process, attempt to emulsify these non-water soluble particulates, thus increasing cleaning efficacy.
- Following thorough vacuuming, apply a slightly alkaline prespray surfactant or SYON-5 directly to the pile fiber. Most surfactants require 8-10 minutes of dwell time to enable emulsification and saponification of the contaminants.
- Agitate the area with a pile brush or cylindrical brush agitation, such as the iCapsol Mini/ ProCaps by Windsor/ Prochem OR the XLerator (XL North). NEVER USE A ROTARY BONNET or ROTARY BRUSH for mechanical agitation. Cylindrical agitation will assist the surfactant solution in lifting soil from the pile fiber and pile lifting of the face yarn.

- Extract the surfactant solution and attached soil particles using an extractor with fresh water only. Do not use a detergent solution in the rinse tank. The use of an Extraction Rinse/ Acidic Rinse is suggested.
- After thoroughly rinsing, continue to extract the area using "dry" strokes (no water injection) until suitable moisture removal is attained. Under no circumstance should any textile flooring product be allowed to remain wet for more than 8 hours.

Other considerations:

Soiling that reoccurs more than 24 hours following cleaning often may be attributed to detergent residues that were not adequately rinsed. Evaluate detergency by pouring water onto pile fiber and briskly agitating with a spotting brush. Look for foaming or other signs of detergent residue. If detergent is present, continue to extract these areas until detergent is thoroughly rinsed. In severe situations, an acid rinse may be applied as a pre-spray or added to the extractor rinse tank to neutralize detergent residues. In severe situations, or in areas of Salt and Ice Melt Compound utilization, an acidic, extraction rinse may be applied as a pre-spray and added to the extractor rinse tank to neutralize high pH residues.

Some primary cleaning methods, such as the Windsor iCapsol System; Racine Industries HOST System, the milliCare System and carpet Cleaner America have been proven effective in maintaining desired appearance levels and improving the quality of overall aesthetic value of all Tandus products. These methods may be used to extend the time between wet extractions.

For additional information, please visit: www.tandus.com/maintenance or www.carpet-rug.org.

FLOORING
SYSTEMS
INC.
Commercial Division
4130 Meramec Bottom Rd.
St. Louis, MO 63129
314 329-9300
Fax: 314 329-9399

July 10, 2017

TO: Paric Corporation
77 Westport Plaza, Suite 250
St. Louis, MO. 63146

PROJECT: Webster ISB

COMPLETION DATE: June 30, 2017

We, Flooring Systems INC. guarantee that the flooring which we installed at the above referenced project, has been completed per specifications/drawings.

We, Flooring Systems INC. will repair or replace any flooring item, which may prove to be defective in workmanship within a one (1) year time period from the date of completion.

This guarantee does not cover ordinary wear and tear, abuse or neglect, improper maintenance, or problems caused by excessive alkali or hydrostatic pressure in the sub-floor.

Flooring Systems INC.

Doyle Heaman

LIMITED WARRANTY

TARKETT WARRANTY OVERVIEW

Tarkett is pleased to offer the world's most- integrated, high-performance flooring system, bringing together design, function and safety; leading to enhanced productivity in high-performance environments. All Tarkett products are warranted against manufacturers' defects to ensure high standards of quality, performance and aesthetics.

[illegible]	[illegible]	[illegible]
1	Rubber Sheet Flooring	Arcade; Replay Rolls
2	Compression Molded Rubber Tile	Circulinity™; CorkTones™; Defiant™; Eco-Shell™ with Cork; Folio™; MicroTone™; Mesto Configurations™; Metallurgy™; Minerality™; Prima Olio and Marbleized; Replay Tiles; Safe Sense™ Solid Color Rubber Tile; Tactile Walking Surface Indicators; Terra-Turf; Triumph and Inertia™
3	Rubber or Vinyl Stair Treads	Safe Sense™ Tactile Warning Surface; Safe-T-First
4	Finishing Borders (Wall Base) Finishing Accessories	BaseWorks™; Masquerade™; Millwork; Perceptions™; TightLock; Wall Art™; Traditional Rubber or Vinyl Risers; Rubber or Vinyl Stringers; Safe-T-First; Vent Cove; Vinyl Nosings
5	Vinyl Sheet and Tile Flooring	Acczent; Acczent Flourish; Acczent Wood Acoustiflor; Acczent Wood Safe-T; Aria™ 2.0; iQ™ Granit™/iQ™ Granit™ Micro; iQ™ Granit™ SD; iQ™ Natural; iQ™ Optima; iQ™ Optima Acoustiflor; iQ™ Toro SC; Granit™ Safe-T; Marbled Safe-T; Melodia™ 2.0; Standard Plus; Training
6	Vinyl Composition Tile and Plank	A: Vinyl Composition Tile (VCT): Azrock; Azrock TexTile™ B: Vinyl Enhanced Tile (VET): Azterra™; Color Essence™ Solid Vinyl Tile (SVT): Cortina Grande™; GemStone™
7	Linoleum Sheet Flooring	Harmonium xf²™; Veneto Acoustiflor
8	Luxury Tile and Plank	A: I.D. Freedom™; Transcend™ SureSet™ B: I.D. Inspiration™
9	Luxury Tile and Plank (Light Commercial)	A: Aloft™ Click; Aloft™ Glue Down B: Transcend™ Click
10	Underlayment	SureStart™ Underlayment; Tarkolay Underlayment

LIMITED WARRANTY INFORMATION

SECTION 1: RUBBER SHEET FLOORING

Limited 5-Year Commercial Warranty for Manufacturing Defects: Tarkett warrants from the date of purchase for a period of five (5) years of Commercial use that rubber sheet flooring products conform to written specifications and are free of manufacturing defects, subject to the terms and conditions specified herein.

The customer must notify Tarkett of any obvious visual defects prior to installation; otherwise this warranty will not apply. If the defect is found and Tarkett is notified in writing prior to installation, Tarkett will replace any defective product, at no charge. If the customer believes the product to be defective after installation, the customer must promptly notify Tarkett and permit an inspection of the product. If, upon inspection, Tarkett determines that the product is defective, Tarkett will replace or repair the defective product at its own cost, subject to the limitations in this warranty, and prorated as follows: Material and 100% Reasonable Labor Costs (Year 1); Material and 50% Reasonable Labor Costs (Year 2); and Material Only (Years 3-5).

Tarkett warrants that the products will not wear through for the warranty period of five (5) years of Commercial use. For claims based on wear-through, the customer must notify Tarkett and permit an inspection of the flooring. If Tarkett determines that the original flooring is worn through, Tarkett will replace or repair the worn flooring at its own cost; however, labor costs will be the customer's responsibility except as provided on the prorated basis described in the prior paragraph.

SECTION 2: COMPRESSION MOLDED RUBBER TILE

Limited 5-Year Commercial Warranty for Manufacturing Defects: Tarkett warrants from the date of purchase for a period of five (5) years of Commercial use that molded rubber tile flooring products conform to written specifications and are free of manufacturing defects, subject to the terms and conditions specified herein.

The customer must notify Tarkett of any obvious visual defects prior to installation; otherwise this warranty will not apply. If the defect is found and Tarkett is notified in writing prior to installation, Tarkett will replace any defective product, at no charge. If the customer believes the product to be defective after installation, the customer must promptly notify Tarkett and permit an inspection of the product. If, upon inspection, Tarkett determines that the product is defective, Tarkett will replace or repair the defective product at its own cost, subject to the limitations in this warranty, and prorated as follows: Material and 100% Reasonable Labor Costs (Year 1); Material and 50% Reasonable Labor Costs (Year 2); and Material Only (Years 3-5).

Tarkett warrants that the products will not wear through for the warranty period of five (5) years of Commercial use. For claims based on wear-through, the customer must notify Tarkett and permit an inspection of the flooring. If Tarkett determines that the original flooring is worn through, Tarkett will replace or repair the worn flooring at its own cost; however, labor costs will be the customer's responsibility except as provided on the prorated basis described in the prior paragraph.

SECTION 3: RUBBER OR VINYL STAIR TREADS

Limited 5-Year Commercial Warranty for Manufacturing Defects: Tarkett warrants from the date of purchase for a period of five (5) years of Commercial use that rubber or vinyl stair tread products conform to written specifications and are free of manufacturing defects, subject to the terms and conditions specified herein.

The customer must notify Tarkett of any obvious visual defects prior to installation; otherwise this warranty will not apply. If the defect is found and Tarkett is notified in writing prior to installation, Tarkett will replace any defective product, at no charge. If the customer believes the product to be defective after installation, the customer must promptly notify Tarkett and permit an inspection of the product. If, upon inspection, Tarkett determines that the product is defective, Tarkett will replace or repair the defective product at its own cost, subject to the limitations in this warranty, and prorated as follows: Material and 100% Reasonable Labor Costs (Year 1); Material and 50% Reasonable Labor Costs (Year 2); and Material Only (Years 3-5).

SECTION 4: FINISHING BORDERS (WALL BASE & ACCESSORIES)

Limited 2-Year Commercial Warranty for Manufacturing Defects: Tarkett warrants from the date of purchase for a period of two (2) years of Commercial use that rubber or vinyl wall base and/or accessory products conform to written specifications and are free of manufacturing defects, subject to the terms and conditions specified herein.

The customer must notify Tarkett of any obvious visual defects prior to installation; otherwise this warranty will not apply. If the defect is found and Tarkett is notified in writing prior to installation, Tarkett will replace any defective product, at no charge. If the customer believes the product to be defective after installation, the customer must promptly notify Tarkett and permit an inspection of the product. If, upon inspection, Tarkett determines that the product is defective, Tarkett will replace or repair the defective product at its own cost, subject to the limitations in this warranty, and prorated as follows: Material and 100% Reasonable Labor Costs (Year 1); Material and 50% Reasonable Labor Costs (Year 2).

SECTION 5: VINYL SHEET AND TILE FLOORING

Limited 5-Year Commercial Warranty for Manufacturing Defects: Tarkett warrants from the date of purchase for a period of five (5) years of Commercial use that vinyl sheet and/or tile flooring products conform to written specifications and are free of manufacturing defects, subject to the terms and conditions specified herein.

The customer must notify Tarkett of any obvious visual defects prior to installation; otherwise this warranty will not apply. If the defect is found and Tarkett is notified in writing prior to installation, Tarkett will replace any defective product, at no charge. If the customer believes the product to be defective after installation, the customer must promptly notify Tarkett and permit an inspection of the product. If, upon inspection, Tarkett determines that the product is defective, Tarkett will replace or repair the defective product at its own cost, subject to the limitations in this warranty, and prorated as follows: Material and 100% Reasonable Labor Costs (Year 1); Material and 50% Reasonable Labor Costs (Year 2); and Material Only (Years 3-5).

Tarkett warrants that the products will not wear through for the warranty period of five (5) years of Commercial use. For claims based on wear-through, the customer must notify Tarkett and permit an inspection of the flooring. If Tarkett determines that the original flooring is worn through, Tarkett will replace or repair the worn flooring at its own cost; however, labor costs will be the customer's responsibility except as provided on the prorated basis described in the prior paragraph.

SECTION 6A: VINYL COMPOSITION TILE AND PLANK

Limited 5-Year Commercial Warranty for Manufacturing Defects: Tarkett warrants from the date of purchase for a period of five (5) years of Commercial use that vinyl composition tile and plank flooring products conform to written specifications and are free of manufacturing defects, subject to the terms and conditions specified herein.

The customer must notify Tarkett of any obvious visual defects prior to installation; otherwise this warranty will not apply. If the defect is found and Tarkett is notified in writing prior to installation, Tarkett will replace any defective product, at no charge. If the customer believes

the product to be defective after installation, the customer must promptly notify Tarkett and permit an inspection of the product. If, upon inspection, Tarkett determines that the product is defective, Tarkett will replace or repair the defective product at its own cost, subject to the limitations in this warranty, and prorated as follows: Material and 100% Reasonable Labor Costs (Year 1); Material and 50% Reasonable Labor Costs (Year 2); and Material Only (Years 3-5).

Tarkett warrants that the products will not wear through for the warranty period of five (5) years of Commercial use. For claims based on wear-through, the customer must notify Tarkett and permit an inspection of the flooring. If Tarkett determines that the original flooring is worn through, Tarkett will replace or repair the worn flooring at its own cost; however, labor costs will be the customer's responsibility except as provided on the prorated basis described in the prior paragraph.

SECTION 6B: VINYL TILE FLOORING

Limited 10-Year Commercial Warranty for Manufacturing Defects: Tarkett warrants from the date of purchase for a period of ten (10) years of Commercial use that vinyl tile flooring products conform to written specifications and are free of manufacturing defects, subject to the terms and conditions specified herein.

The customer must notify Tarkett of any obvious visual defects prior to installation; otherwise this warranty will not apply. If the defect is found and Tarkett is notified in writing prior to installation, Tarkett will replace any defective product, at no charge. If the customer believes the product to be defective after installation, the customer must promptly notify Tarkett and permit an inspection of the product. If, upon inspection, Tarkett determines that the product is defective, Tarkett will replace or repair the defective product at its own cost, subject to the limitations in this warranty, and prorated as follows: Material and 100% Reasonable Labor Costs (Year 1); Material and 50% Reasonable Labor Costs (Year 2); and Material Only (Years 3-10).

Tarkett warrants that the products will not wear through for the warranty period of ten (10) years of Commercial use. For claims based on wear-through, the customer must notify Tarkett and permit an inspection of the flooring. If Tarkett determines that the original flooring is worn through, Tarkett will replace or repair the worn flooring at its own cost; however, labor costs will be the customer's responsibility except as provided on the prorated basis described in the prior paragraph.

SECTION 7: LINOLEUM SHEET FLOORING

Limited 5-Year Commercial Warranty for Manufacturing Defects: Tarkett warrants from the date of purchase for a period of five (5) years of Commercial use that linoleum sheet flooring products conform to written specifications and are free of manufacturing defects, subject to the terms and conditions specified herein.

The customer must notify Tarkett of any obvious visual defects prior to installation; otherwise this warranty will not apply. If the defect is found and Tarkett is notified in writing prior to installation, Tarkett will replace any defective product, at no charge. If the customer believes the product to be defective after installation, the customer must promptly notify Tarkett and permit an inspection of the product. If, upon inspection, Tarkett determines that the product is defective, Tarkett will replace or repair the defective product at its own cost, subject to the limitations in this warranty, and prorated as follows: Material and 100% Reasonable Labor Costs (Year 1); Material and 50% Reasonable Labor Costs (Year 2); and Material Only (Years 3-5).

Tarkett warrants that the products will not wear through for the warranty period of five (5) years of Commercial use. For claims based on wear-through, the customer must notify Tarkett and permit an inspection of the flooring. If Tarkett determines that the original flooring is worn through, Tarkett will replace or repair the worn flooring at its own cost; however, labor costs will be the customer's responsibility except as provided on the prorated basis described in the prior paragraph.

SECTION 8A: LUXURY TILE AND PLANK

Limited 10-Year Commercial Warranty for Manufacturing Defects: Tarkett warrants from the date of purchase for a period of ten (10) years of Commercial use that luxury tile and plank flooring products conform to written specifications and are free of manufacturing defects, subject to the terms and conditions specified herein.

The customer must notify Tarkett of any obvious visual defects prior to installation; otherwise this warranty will not apply. If the defect is found and Tarkett is notified in writing prior to installation, Tarkett will replace any defective product, at no charge. If the customer believes the product to be defective after installation, the customer must promptly notify Tarkett and permit an inspection of the product. If, upon inspection, Tarkett determines that the product is defective, Tarkett will replace or repair the defective product at its own cost, subject to the limitations in this warranty, and prorated as follows: Material and 100% Reasonable Labor Costs (Year 1); Material and 50% Reasonable Labor Costs (Year 2); and Material Only (Years 3-10).

Tarkett warrants that the products will not wear through for the warranty period of five (5) years of Commercial use. For claims based on wear-through, the customer must notify Tarkett and permit an inspection of the flooring. If Tarkett determines that the original flooring is worn through, Tarkett will replace or repair the worn flooring at its own cost; however, labor costs will be the customer's responsibility except as provided on the prorated basis described in the prior paragraph.

SECTION 8B: LUXURY TILE AND PLANK

Limited 20-Year Commercial Warranty for Manufacturing Defects: Tarkett warrants from the date of purchase for a period of twenty (20) years of Commercial use that luxury tile and plank flooring products conform to written specifications and are free of manufacturing defects, subject to the terms and conditions specified herein.

The customer must notify Tarkett of any obvious visual defects prior to installation; otherwise this warranty will not apply. If the defect is found and Tarkett is notified in writing prior to installation, Tarkett will replace any defective product, at no charge. If the customer believes the product to be defective after installation, the customer must promptly notify Tarkett and permit an inspection of the product. If, upon inspection, Tarkett determines that the product is defective, Tarkett will replace or repair the defective product at its own cost, subject to the limitations in this warranty, and prorated as follows: Material and 100% Reasonable Labor Costs (Year 1); Material and 50% Reasonable Labor Costs (Year 2); Material Only (Years 3-10); 50% Material Only (Years 11-15); and 25% Material Only (Years 16-20).

Tarkett warrants that the products will not wear through for the warranty period of five (5) years of Commercial use. For claims based on wear-through, the customer must notify Tarkett and permit an inspection of the flooring. If Tarkett determines that the original flooring is worn through, Tarkett will replace or repair the worn flooring at its own cost; however, labor costs will be the customer's responsibility except as provided on the prorated basis described in the prior paragraph.

SECTION 9A: LUXURY TILE AND PLANK (LIGHT COMMERCIAL)

Light Commercial Warranty for Manufacturing Defects: Tarkett warrants from the date of purchase for a period of seven (7) years of Light Commercial use that luxury tile and plank flooring products conform to written specifications and are free of manufacturing defects, subject to the terms and conditions specified herein. Light Commercial applications are defined as foot-traffic only (no rolling loads).

The customer must notify Tarkett of any obvious visual defects prior to installation; otherwise this warranty will not apply. If the defect is found and Tarkett is notified in writing prior to installation, Tarkett will replace any defective product, at no charge. If the customer believes the product to be defective after installation, the customer must promptly notify Tarkett and permit an inspection of the product. If, upon inspection, Tarkett determines that the product is defective, Tarkett will replace or repair the defective product at its own cost, subject to the limitations in this warranty, and prorated as follows: Material and 100% Reasonable Labor Costs (Year 1); Material and 50% Reasonable Labor Costs (Year 2); Material Only (Years 3-5); and 50% Material Only (Years 6-7).

Tarkett warrants that the products will not wear through for the warranty period of seven (7) years of Light Commercial use. For claims based on wear- through, the customer must notify Tarkett and permit an inspection of the flooring. If Tarkett determines that the original flooring is worn through, Tarkett will replace or repair the worn flooring at its own cost; however, labor costs will be the customer's responsibility except as provided on the prorated basis described in the prior paragraph.

SECTION 9B: LUXURY TILE AND PLANK (LIGHT COMMERCIAL)

Light Commercial Warranty for Manufacturing Defects: Tarkett warrants from the date of purchase for a period of ten (10) years of Light Commercial use that luxury tile and plank flooring products conform to written specifications and are free of manufacturing defects, subject to the terms and conditions specified herein. Light Commercial applications are defined as foot-traffic only (no rolling loads).

The customer must notify Tarkett of any obvious visual defects prior to installation; otherwise this warranty will not apply. If the defect is found and Tarkett is notified in writing prior to installation, Tarkett will replace any defective product, at no charge. If the customer believes the product to be defective after installation, the customer must promptly notify Tarkett and permit an inspection of the product. If, upon inspection, Tarkett determines that the product is defective, Tarkett will replace or repair the defective product at its own cost, subject to the limitations in this warranty, and prorated as follows: Material and 100% Reasonable Labor Costs (Year 1); Material and 50% Reasonable Labor Costs (Year 2); Material Only (Years 3-5); and 50% Material Only (Years 6-10).

Tarkett warrants that the products will not wear through for the warranty period of ten (10) years of Light Commercial use. For claims based on wear- through, the customer must notify Tarkett and permit an inspection of the flooring. If Tarkett determines that the original flooring is worn through, Tarkett will replace or repair the worn flooring at its own cost; however, labor costs will be the customer's responsibility except as provided on the prorated basis described in the prior paragraph.

SECTION 10: UNDERLAYMENT

Limited 10-Year Light Commercial Warranty for Manufacturing Defects: Tarkett warrants from the date of purchase for a period of ten (10) years of Light Commercial use of SureStart™ underlayment with approved Tarkett LVT products, subject to subfloors being prepared & meeting Tarkett Installation Instruction guidelines and subject to the terms and conditions specified herein.

The customer must notify Tarkett of any obvious visual defects or concerns prior to install; otherwise this warranty will not apply.

If the defect is found and Tarkett is notified in writing prior to installation, Tarkett will replace any defective product, at no charge. If the customer believes the product to be defective after installation, the customer must promptly notify Tarkett and permit an inspection of the product. If, upon inspection, Tarkett determines that the product is defective, Tarkett will replace or repair the defective product at its own cost, subject to the limitations in this warranty, and prorated as follows: Material and 100% Reasonable Labor Costs (Year 1); Material and 50% Reasonable Labor Costs (Year 2); and Material Only (Years 3-10).

ALL TARKETT COMMERCIAL PRODUCTS:

This Limited Warranty applies only for products installed, used and maintained according to the written recommendations and specifications provided at the time of material purchase.

Warranty Claim Procedure

To be eligible for replacement under this warranty, the customer must file a claim by giving Tarkett written notice of the defect. This notice must be filed immediately, but in no event more than 10 days following discovery of the defect. Notice shall be given to Tarkett at its corporate address of 30000 Aurora Road, Solon, Ohio 44139. Phone: (800) 899-8916; Fax: (440) 543-5774.

If defective product has been discontinued or is otherwise unavailable, Tarkett reserves the right to select and supply the customer with Tarkett replacement flooring, similar in quality and quantity to the material claimed to be defective.

WARRANTY EXCLUSIONS

The Tarkett Limited Warranty does not apply to:

- The exact matching of shade, color or mottling.
- Tears, burns, cuts or damage due to improper installation or use or improper cleaning agents and maintenance methods.
- Labor costs outside of prorated schedule defined in the warranty.
- Sales of non-first quality materials, i.e., "seconds," "off goods" or other irregular flooring. Such non-first quality materials are sold "AS IS."
- Issues associated with the use of adhesives other than those recommended by Tarkett.
- Issues caused by moisture or alkali in the subfloor. Pre-installation moisture and alkali testing is required and must be made available to Tarkett upon request.
- Issues of discoloration or staining associated with subfloor contamination or markings that bleed through the flooring material.
- Problems caused by installation, uses and maintenance that are contrary to Tarkett's specifications, recommendations or instructions.
- Material installed with obvious defects not notified to Tarkett prior to installation.
- Exterior installations – Tarkett products are designed for interior applications only.
- Fading and/or discoloration resulting from heavy sunlight penetration and ultraviolet ray exposure from direct or glass-filtered sunlight.
- Damage to flooring products caused by high or spiked heels, improper protectors/casters or furniture rests. Some rolling-type casters on furniture or appliances may damage resilient flooring. Warranty as to the suitability of the factory-installed casters rests with the furniture or appliance manufacturers. To avoid Tarkett warranty exclusions, casters must be suitable for use on resilient flooring.
- Damage to flooring products from pallet jack and tow-motor traffic.
- Premature wear or deterioration from spikes and skate blade exposure.
- Variations in color or embossing between products, photography or printed color illustrations.

- Installation of Tarkett flooring in work or commercial areas exposed to oil and grease, such as commercial kitchens or butcher shops. Defiant™ Oil and Grease-Resistant Rubber tiles are recommended in such situations.
- Additional expense associated with overtime, replacing or moving appliances or furniture, business interruptions, loss of use or other related costs associated with the replacement of the flooring.
- Shifting, cracking, or movement of the substrate or foundation.
- Hydrostatic pressure, flooding, standing water or moisture on the surface of the substrate.
- Issues related to exposure to heavy rolling loads (Light Commercial Products).

WARRANTY DISCLAIMER

EXCEPT AS STATED HEREIN, TARKETT MAKES NO WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED. ALL IMPLIED WARRANTIES WHICH MAY ARISE BY LAW, IMPLICATION OF LAW OR APPLICATION OF COURSE OF DEALING, PERFORMANCE OR USAGE OF TRADE INCLUDING, BUT NOT LIMITED TO, IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY DISCLAIMED AND EXCLUDED. ANY ORAL STATEMENTS ABOUT THE PRODUCTS DESCRIBED HEREIN ARE NOT WARRANTIES, SHOULD NOT BE RELIED UPON BY BUYER, DO NOT FORM ANY PART OF THE BASIS OF THE BARGAIN, AND ARE NOT PART OF THIS OR ANY OTHER LIMITED WARRANTY. NO AGENT, DISTRIBUTOR OR REPRESENTATIVE OF TARKETT, EXCEPT AN AUTHORIZED OFFICER OF TARKETT, SHALL HAVE AUTHORITY TO AGREE TO ANY TERM, CONDITION OR PROVISION INCONSISTENT HEREWITH OR NOT CONTAINED HEREIN. IN NO EVENT SHALL TARKETT BE LIABLE TO BUYER FOR INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, DAMAGES OR LOSS OF PROFIT ARISING OUT OF OR RELATING TO ANY BREACH OF THIS WARRANY, REGARDLESS OF THE LEGAL OR EQUITABLE THEORY (CONTRACT, TORT, OR OTHERWISE) UPON WHICH THE CLAIM IS BASED.

These warranties provide specific legal rights; these and other rights may vary from state to state. To learn the legal rights in a specific state, consult the local or state Consumer Affairs Office or the State Attorney General.

All of the above is for reference only – for the latest product-specific information regarding warranties, installation and maintenance, please visit tarkettna.com.

Johnsonite®

Rubber & Vinyl Wall Base

Maintenance Instructions

Routine Cleaning

Johnsonite Rubber and Vinyl Wall Base are maintained with regular wiping with a soft, wet cloth. A mild soap may be added to the water. Coarse scrubbing media or harsh cleaning chemicals may damage the surface of the wall base.

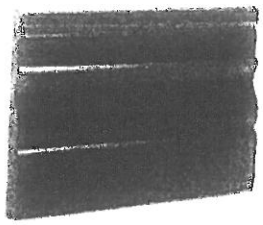
For further questions please contact Johnsonite Customer Service or Technical Services Department at 1-800-899-8916.

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Johnsonite

Millwork® Resilient Wall Base

Installation and Maintenance Instructions



Introduction

Johnsonite Millwork Resilient Wall Base replicates the look of a finely routed wood crown molding, but is manufactured with the most advanced technology and from the highest quality resilient materials to assure dimensional stability, precision fit, and uniform height and gauge. Johnsonites unique finish resists scuffing, gouging, will not fade, discolor, or crack with age and is easy to maintain.

The highest quality of materials and workmanship are employed in the manufacture of Johnsonite Millwork Resilient Wall Base products and careful inspection is made before shipment. However, a quality installation is the responsibility of the installer and we recommend that all materials be checked for satisfactory color match before you begin installation.

Johnsonite cannot accept any responsibility for loss or damage that may result from the use of this information, due to the possibility of variations of processing or working conditions and/or workmanship outside our control. Users are advised to confirm the suitability of this product by performing their own tests.

Handling and Storage

1. Johnsonite Millwork Resilient Wall Base and adhesives must be site conditioned at room temperature for 24 hours prior to, during, and after the installation. **Room temperature must be between 65° and 75° F (18° and 22° C).**

2. Care must be taken not to pull the wall base excessively when removing it from the carton or unrolling the coils. **The wall base will not shrink, but it will relax to its original length, if stretched.**

Surface Preparations

1. Floors and walls must be clean, dry, free of dust, all paints, wallpaper, and all other foreign matter, which may affect adhesive bonding.

2. **Do not install Johnsonite Millwork Resilient Wall Base over vinyl wall coverings or epoxy painted surfaces using acrylic latex water-based adhesives. (Note: Some high solids containing latex paints formulations may impede the adhesive drying process similar to epoxy paint.)**

3. **Never install Johnsonite Millwork Resilient Wall Base on surfaces that will be exposed to drastic temperature changes or moisture.**

4. **Equipment/Materials Requirements:**

   - Standard or Sliding Compound Miter Saw, Radial Arm Saw, or Table Saw equipped with a Carbide or Diamond tip blade with 80 teeth or greater
   - Approved Johnsonite Adhesive 1/8" square-notched trowel for acrylic adhesive
   - Brush or roller for contact bond adhesive
   - Utility knife
   - Straight edge
   - Tape measure
   - Carpenter's square and protractor
   - Hand roller

Millwork Wall Base Installation

1. Cut the Millwork Resilient Wall Base to the required lengths using a Standard or Sliding Compound Miter Saw, Radial Arm Saw, or Table Saw equipped with a Carbide or Diamond tip blade with 80 teeth or greater.

   Note: When butting wall base seams together, it may be necessary to square cut the factory edge if butt ends do not align.

2. For installations on **porous wall surfaces**, spread Apply Johnsonite #960 Resilient Wall Base adhesive to the ribbed surface (back) of the wall base with an 1/8" square-notched trowel. **The adhesive should cover 80% of the back surface.** Leave a 1/4" (6.35mm) uncovered space at the top of the wall base to prevent the adhesive from oozing onto the wall above the base when installed.

3. For installations on **non-porous wall surfaces** (i.e.: metal, epoxy paint, ceramics, etc.) apply Johnsonite #945 Contact Bond adhesive to both the wall surface and the back of the wall base. Allow adhesive to thoroughly dry to the touch. The adhesive will turn from "white to clear" when dry. Carefully position the wall base on the wall surface.

   Note: Once contact is made to the wall surface, the wall base cannot be moved.

4. Position wall base on wall surface and roll with hand roller. **Always roll back to starting point to prevent stretching the wall base.**

5. Clean-up: Remove wet adhesive with a water dampened cloth. If adhesive has dried, use a cloth dampened with mineral spirits.

Optional Quarter Round and Shoe Moulding Installation

1. The 1/2" quarter round (QTR-A) and 1-1/2" shoe moulding (SHU-A) are provided with a pressure sensitive adhesive backing for ease of installation.

2. After the Millwork Wall Base has been installed, wipe down the surface of the wall base using denatured alcohol on a clean white rag to remove any contaminants. Place the quarter round or shoe moulding profile on the floor with the adhesive backing facing the wall base.

3. Remove the release paper from the adhesive backing and press the moulding firmly against the face of the wall base. (Do not adhere the moulding to the floor) Roll with a 2" hand roller to ensure proper adhesion.

Millwork Wall Base Corner Installation

Johnsonite Millwork Resilient Wall Base Inside and Outside Corners are fabricated utilizing the same equipment and techniques required for traditional wood molding or baseboard profiles.

Outside Corners:

1. Position a sufficient length of wall base on the wall so that it tightly abuts the previously installed section and extends past the corner.

2. Using a scribe or pencil, mark the wall corner bend location along the top edge of the wall base.

3. Set the saw blade angle to the required miter angle for the corner using a protractor.

4. Place the wall base section against the saw fence or miter guide so the wall base is laying flat on the machine table with the contoured (show) surface facing up and perpendicular to the saw blade.

5. Align the mark on the top edge of the wall base with the saw blade and cut the wall base to the proper miter angle. Repeat the above procedure for the other side of the corner.

6. Place the two mitered sections of wall base on the corner and check for proper fit. Trim, if necessary, to obtain a tight fit at the corner.

7. Apply the adhesive to the ribbed back of one section of the wall base corner, position the section in place, and roll with a hand roller to ensure proper adhesion to the wall surface.

8. Repeat procedure #7 for the opposite side of the corner. Attention should be given to a tight and even fit to the corner.

   Note: To obtain a tighter and more secure fit between the two mitered sections at the corner, glue the two mitered areas together with contact bond adhesive.

Inside Corners:

1. Set the saw blade angle to the required miter angle for the corner using a protractor.

2. Place the wall base section against the saw fence or miter guide so the wall base is laying flat on the machine table with the contoured (show) surface facing up and perpendicular to the saw blade.

3. Cut the wall base to the proper miter angle. Repeat the above procedure for the other side of the corner.

4. Place the two mitered sections of wall base on the inside corner and check for proper fit. Trim, if necessary, to obtain a tight fit at the corner.

5. Apply the adhesive to the ribbed back of one section of the wall base corner, position the section in place, and roll with a hand roller to ensure proper adhesion to the wall surface.

6. Repeat procedure #5 for the opposite side of the corner. Attention should be given to a tight and even fit to the corner. (Note: To obtain a tighter and more secure fit between the two mitered sections at the corner, glue the two mitered areas together with contact bond adhesive.

Maintenance

Johnsonite Millwork Resilient Wall Base is maintained with regular wiping with a soft, wet cloth. A mild soap may be added to the water. An acrylic wax may be applied to increase the gloss level when desired. Coarse scrubbing media or harsh cleaning chemicals may damage the surface of the wall base.

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HOMOGENEOUS TILE AND SHEET

iQ™ Maintenance Instructions

Johnsonite
A Tarkett Company

iQ Granit™, iQ Natural, and iQ Optima®

Introduction

Johnsonite's iQ flooring solutions are produced with high quality raw materials, unique manufacturing processes, and innovative surface treatments. This innovative technology produces a glass hard surface that requires only dry buffing to restore the original appearance and requires no polish and no finish for life.
The following guidelines are recommended for the proper care and maintenance of the floor.

Post Installation / Initial Cleaning

Job site conditions will cause grit and dirt to accumulate. Initial cleaning must not be performed until 72 hours after installation. However, it is necessary the floor be swept and protected until maintenance begins.

1. Thoroughly sweep or vacuum the flooring to remove all loose dirt and grit.
2. Prepare a cleaning solution using one of the recommended pH neutral cleaners identified on the reference chart below.
3. The dilution ratio depends on light to heavy soil conditions. Follow the manufactures label instructions.
4. Apply the cleaning solution with a nylon or rayon mop.
5. Let the cleaning solution dwell for 5 to 15 minutes (dwell time is based on soil conditions of the floor). **IMPORTANT** – Do not allow the solution to dry.
6. Scrub the flooring using a single disc rotary machine (175 – 350 RPM) equipped with a red pad.
7. Remove the cleaning solution using a wet vacuum or a mop.
8. Rinse the floor thoroughly with clean water.
9. Allow the flooring to dry completely.

NOTE: The cleaning process may need to be repeated on heavily soiled floors.

Preventive Care

1. An effective barrier matting system should be installed at all entrances to reduce cleaning costs and extend the life of the floor.
2. Protect the flooring from damage by using good quality protective feet and casters for chairs, tables, and other furniture using products designed for resilient floors. Caster or wheel damage can be avoided with the use of chair pads.
3. Do not use steel wool, strong solvents (Lestoil, Top Job, etc. and similar products), gasoline, turpentine, and acetone.
4. Sweeping compounds or mops treated with petroleum solvents, silicone compounds or loose abrasives can damage the flooring.
5. Coatings such as shellac, lacquer, varnish, and paste wax or those containing aromatic solvents are not recommended.
6. Some disinfectants and insecticide sprays contain oil or solvents which may settle on the floor in sufficient quantity to discolor, cause slipperiness, and harm the floor covering.

Routine / Daily Cleaning

It is very important to clean the flooring at a frequency consistent with the amount and type of traffic and soil conditions. Daily cleaning is recommended.

1. Thoroughly sweep or vacuum the flooring to remove all loose dirt and grit.
2. Prepare a cleaning solution using one of the recommended pH neutral cleaners identified on the reference chart below.
3. The dilution ratio depends on light to heavy soil conditions. Follow the manufactures label instructions.
4. Damp mop the cleaning solution onto the floor with a nylon or rayon mop. In place of damp mopping, when the space or area will allow, utilizing an auto scrubber equipped with a red pad will ease and expedite the daily routine. Check the manufacturers label instructions for proper use.
5. Allow the flooring to dry completely.
6. Remove minor stains and scuffs in conjunction with the damp mopping. Use a white or red pad if required.

Periodic / Deep Cleaning

When Routine / Daily Cleaning no longer provides adequate results, a more aggressive deep cleaning is required to thoroughly clean the floor.

1. Thoroughly sweep or vacuum the flooring to remove all loose dirt and grit.
2. Prepare a cleaning solution using one of the recommended pH neutral cleaners identified on the reference chart below.
3. The dilution ratio depends on light to heavy soil conditions. Follow the manufactures label instructions.
4. Apply the cleaning solution with a nylon or rayon mop.
5. Let the cleaning solution dwell for 5 to 15 minutes (dwell time is based on soil conditions of the floor). **IMPORTANT** – Do not allow the solution to dry.
6. Scrub the flooring using a single disc rotary machine (175 – 350 RPM) equipped with a red pad.
7. Remove the cleaning solution using a wet vacuum or a mop.
8. Rinse the floor thoroughly with clean water.
9. Allow the flooring to dry completely.

NOTE: The cleaning process may need to be repeated on heavily soiled floors.

Dry Buffing: For customers who prefer to dry buff the flooring.

1. Thoroughly clean the floor prior to beginning the buffing procedure.
2. Buff the floor using a single disc, high speed, rotary machine (maximum 1500 RPM) equipped with a white pad.
3. Frequency of buffing will be determined by the amount and type of traffic.

NOTE: To avoid damage, care must be taken when dry buffing.

Flooring may be maintained by following a conventional floor finish maintenance system if desired. Conventional floor finish maintenance systems require periodic stripping of the floor finish. The use of floor finish and stripper to maintain Johnsonite iQ Vinyl Tile and Sheet flooring is optional and is not required.

Maintenance Product Reference Chart

NOTE: Always follow the manufactures label for proper mixing ratios and use

	Initial Cleaning	Daily Cleaning	Deep Cleaning
Buckeye www.buckeyeinternational.com 1-800-321-2583	Buckeye Blue	Buckeye Blue	Buckeye Blue
	Straight Up	Straight Up	Straight Up
Certified Green Products	Tenacity	True 7	Tenacity
Diversey www.diversey.com 1-800-558-2332	Profi	Profi	Profi
	Prominence	Prominence	Prominence
Certified Green Products	Stride	Stride	Stride
Spartan Chemical www.spartanchemical.com 1-800-537-8990	TriBase	TriBase	TriBase
Certified Green Products	Green Solutions Industrial Cleaner	Green Solutions All Purpose Cleaner	Green Solutions Industrial Cleaner
XL North www.xlnorth.com 1-888-530-2259	XL APC All Purpose Cleaner	XL APC All Purpose Cleaner	XL APC All Purpose Cleaner

Visit www.johnsonite.com for the most current installation and maintenance instructions.
Contact Johnsonite at (800)-899-8916 ext. 9297 with any questions.

Tarkett | THE ULTIMATE FLOORING EXPERIENCE

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limited warranty

product warranty: nora systems, Inc. ("nora"), warrants its nora®, norament®, and noraplan® rubber flooring, norament® rubber stairtreads, (except for the safety grit strip), accessories and adhesives, ("products") to be free of defects in material or workmanship, for one year from the date of purchase from nora. In addition, nora warrants against excessive wear of the listed products as set forth below, and nora warrants the conductivity of its Electro Static Dissipative, ("ESD") flooring system (flooring and adhesive) as set forth below.

EXCEPT FOR THE LIMITED WARRANTIES SET FORTH HEREIN, nora EXTENDS NO OTHER WARRANTIES OR GUARANTEES, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, OR EXACT MATCHING OF SHADE, COLOR OR MOTTLING. nora HEREBY DISCLAIMS ANY OTHER WARRANTY OR GUARANTEE UNLESS EXPRESSLY AUTHORIZED AND ENDORSED IN WRITING AS SET FORTH BELOW.

No agent, employee or representative of nora is authorized to make any warranty or guarantee concerning the products. Any alteration, amendment or waiver of this Limited Warranty must be in writing and signed by an officer of nora.

excessive wear warranty: nora warrants the following products will not wear in excess of the following measurements which shall be prorated from the date of purchase:

norament products	<.0025" wear per year
noraplan products	<.0035" wear per year
norament stairtreads	<.0025" wear per year

conductivity warranty: nora warrants the following ESD flooring system products, installed with nora's conductive adhesive (acrylic or PU), when tested according to the test procedures of ESD S7.1-94 and ASTM-F-150 under >30% relative humidity at room temperature will measure between:

norament® grano ed	10^6 - $<10^9$ OHMS
noraplan® environcare™ ed / mega ed	10^6 - $<10^9$ OHMS

Warranty for other conditions supplied upon request.

notice of claims: To make a claim under any warranty the buyer or end user must provide written notice to nora at 9 Northeastern Blvd., Salem, NH 03079, within thirty (30) days of discovery of any alleged defect of the product. nora must be given the opportunity to inspect and examine the product.

limitation of liability: nora shall not be directly or indirectly liable for any losses, claims or damages regarding any products that have not been installed and maintained according to nora's installation and maintenance guides, that were damaged by a third party, that were installed over an improper subsurface or improperly prepared subfloor, that were improperly repaired, or that were affected by any other mechanical influences including stilettos. Office chairs/furniture wheels shall be type W according to EN 12529. Excluded from this warranty – "fading or discoloration from prolonged, excessive exposure to sunlight or heat". nora shall not be liable for any losses, claims, or damages in excess of the cost of the products invoiced by nora. nora shall not be liable for any incidental, consequential, enhanced or punitive damages. nora reserves the right to replace at no cost that portion of the products that are alleged to be defective but excluding all costs of transportation and installation. nora's maximum liability whether in tort, contract, or otherwise shall be the cost of the products invoiced by nora.

This limited warranty and the installation and maintenance guides are subject to change. Please contact nora for the latest versions. For additional information regarding usage in recommended applications, please refer to www.nora.com/us or call 1-800-332-NORA. Warranty periods commence on the date of purchase of the product by the buyer or end user, whichever is first

governing law; venue: The rights and obligations of the parties hereto and the interpretation, construction and effect of any provision hereof or any contract formed pursuant hereto shall be governed by and construed in accordance with the laws of the state of New Hampshire, without reference to its conflict of law rules.

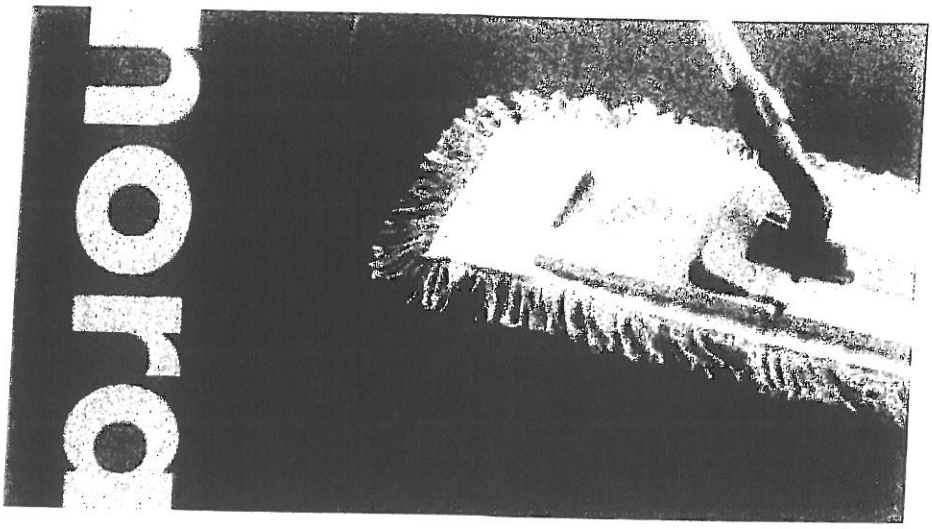
Supersedes all previous information. Effective March 2012.
Printed in U.S.A.

		excessive wear warranty		conductivity warranty
		5 years	10 years	10 years
nora® wall base/sanitary base	commercial traffic	X		
norament® grano/ingresso/serra/strada	extra heavy traffic		X	
norament® grano ed	commercial traffic		X	X
norament® luxor	extra heavy traffic		X	
norament® round & hammered	commercial traffic		X	
norament® stairtread	heavy traffic		X	
norament® 920	special application		X	
norament® 920 stairtread	special application		X	
norament® 992/992 grano	special application	X		
noraplan® degree/ eco/environcare™/ environcare™ acoustic/ sentica/ sentica acoustic/ uni/unita	commercial traffic	X		
noraplan® environcare™ ed/ sentica ed	commercial traffic	X		X

nora systems, Inc.
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Toll free: 800-332-NORA
Phone: (603) 894-1021
Fax: (603) 894-6615
E-mail: info-us@nora.com
www.nora.com/us

nora®
All About Flooring. All About You.

Installation & Maintenance
Service & Support
Installation
Maintenance
nora pro clean system
nora pro clean system FAQs
How-To Videos
Installer Training



Maintenance

Cleaning and maintaining nora rubber flooring.

Your nora rubber flooring requires no finishing, waxing or sealing. All nora floor cove nonporous and dirt-repellant surface—eliminating the need to use unfriendly, harsh c Understanding how to properly clean and maintain your new rubber floor, even by us keep it looking attractive for years to come. Follow the tips below and download the s for your application.

Quick Maintenance Tips

1. Always use "wet floor" signs and/or caution tape when performing any wet clea
2. Refer to MSDS for proper personnel protection requirements before using clea
3. Do not flood the floor.
4. The floor will be slippery when wet or contaminated with foreign materials. Pror foreign materials to maintain the slip-resistant properties of the flooring.
5. Never use grit brushes, black or brown cleaning pads.
6. Use a red cleaning pad for all norament and noraplan surfaces.
7. Make sure to maintain a good walk-off area in the entrance of the facility, in ad mopping.
8. If required, dry buff nora floor coverings with a white cleaning pad or carpet cot
9. Do not allow any metal furniture or trash cans to be in contact with the wet floo

Maintenance Guides

Education (390K PDF)

Vintage
PREFINISHED HARDWOOD FLOORING

Vintage Installation and Maintenance Information

This Installation and Warranty Card is for all Vintage Product lines.

General Installation Instructions for all products

Ensure the site environmental conditions are suitable for installation and take record. This includes: Relative Humidity, Subfloor or Concrete Moisture Reading, condition of product to be layed, sources of water or humidity extremes. Do not continue, if any of the conditions in these directions and warranties are not met and/or according to the NWFA instructions.

Ensure all other trade activities are completed as they may impact the quality of the installed flooring. Wood flooring is one of the last products to be installed at a construction site. Window, door, dry walling and painting and HVAC activation (on for >7 days) must be completed and dry before installation begins. This is to avoid humidity extremes and damages that void the warranty.

Acclimatize the product according to the product directions (many Vintage products are designed to install and perform better without acclimatization). See more information below.

Ensure the subfloor is perfectly level (1/8" per 8'). Level high spots and fill low spots as required. Ensure the subfloor is firmly anchored ensuring no movement, flex or squeaking.

Ensure the subfloor is less than 12% MC and record readings, subfloor must be within 4% of the actual floor being installed.

Thoroughly sweep and vacuum the area the flooring is to be installed.

Prepare installation along longest straightest wall first using long pieces for starting row and across (perpendicular to) floor joist.

Open and select products from multiple boxes to ensure an appropriate mix of lengths, wood character and color.

Inspect each piece before installation. Do not install any defective piece or piece that has a color, character or grain etc. that may not suit the look of the floor and may be displeasing to the consumer. These pieces can be cut and used for starters, installed in a less conspicuous location (E.g. Closet, under Cabinets etc.) or discarded. If you choose not to install these pieces please note they are not covered by Vintage's warranty.

Preparation of Plywood & Concrete Subfloor

Vintage Hardwood Flooring recommends that all Vintage Hardwood Flooring be installed with a minimum of 5/8" (15.8750 mm) A.P.A. approved, C.S.P/D.F.P. stamped plywood, or 3/4" O.S.B. Underlay grade PS2-92 rated, or concrete slab. The use of particleboard as a subfloor will automatically void the warranty. Consult your Authorized Vintage Dealer for recommendations on your specific subfloor application. Any failure of Vintage Hardwood Flooring relating to improper subfloors, or subfloor preparation is not the responsibility of Vintage Hardwood Flooring, and will not be covered under warranty. Sweep and vacuum subfloor. Ensure that old carpets, oils, foreign particles, protruding nails, carpet glues, etc., are removed prior to installation. For wood subfloors, make sure they are level, clean, dry and securely fastened. Repair and/or replace any section that is rotted or damaged. Always follow local building codes.

Do not install Vintage's Pioneered Solid hardwood flooring over concrete unless an acceptable plywood subfloor and vapor barrier is firmly anchored over sleepers and a dehumidifier is in place to continuously remove excess humidity from the room.

Moisture Content
Acceptable subfloors & ground levels installations for Vintage Product

Pioneered Solid	Plywood, OSB	At or above ground level only	Nail
Crafted Engineered	Plywood, OSB or Concrete	At, above or below ground level	Nail, glue or float
Solid Sawn	Plywood, OSB or Concrete	At, above or below ground level	Nail, glue or float
Northern Solid Sawn	Plywood, OSB or Concrete	At, above or below ground level	Nail, glue or float
U-LOC	Plywood, OSB or Concrete	At, above or below ground level	Float

Plywood: The maximum moisture content (MC) for plywood should never exceed 12%
Concrete: The maximum moisture content for concrete should never exceed 12%
The difference between the flooring and the subfloor should never exceed 4%

Tools & Accessories - For all types of Installations

Table saw, miter saw, measuring tape, nail set, hammer, tapping block, nail gun (manual or pneumatic), square, chalk line, putty fill, broom, dustpan and Vintage Cleaning Kits. Always consult the dealer you purchased your flooring from for appropriate installation tools.

Tools & Accessories - Nail Down
15 lb felt or equivalent, nail gun or staple gun (manual or pneumatic), square, chalk line, putty fill, broom, dustpan and Vintage Cleaning Kits. See Chart #4 for nail gun & cleat recommendations.

Tools & Accessories - Glue Down
Trowel, cleaning solvent and moisture cured glue – See Chart #5 for recommendations.

NOTE: It is extremely important that you use the proper trowel to ensure maximum coverage and produce a good bond between subfloor and flooring. You may also require a 100-150 pound roller.

Tool & Accessories - Floating Floors
Vintage T & G glue, Vintage's Premium Underpad, mineral solvents (for cleaning glue), and shims.

** All flooring strips should be installed perpendicular (right angle), to the floor joists. In some applications, installing parallel to floor joist may be required for aesthetic reasons. Consult your dealer, installer, and developer for their recommendations and building code requirements.

Installation - Expansion Gap allowances

Pioneered 3/4"	Leave 3/4" around entire room
Crafted 9/16"	For Nail & glue down leave 1/2". Floating leave 5/8" around entire room
Solid Sawn 3/4"	Leave 3/4" around entire room
Northern Solid Sawn 3/4"	Leave 3/4" around entire room
U-LOC 5/8"	For rooms up to 26'x 52'- Leave 1/2" (13 mm)
	For rooms up to 33'x 66'- Leave 5/8" (16 mm)
	For rooms up to 39'x 79'- Leave 3/4" (19 mm)

For floating floors a 3/4" expansion gap must be left up against all vertical obstructions

(Chart #1)

Material Acclimatization

Pioneered:
Open boxes fully (never just the ends) and allow the wood to acclimate to the ambient temperature of the room. The wood must be given 48-72 hours at approx. 23° C (72°F) and a relative humidity of 40% before installation. Special note: In some instances you may not be able to acclimate flooring.

When the relative humidity is too high or to low (above 50 % and below 40 % RH), acclimating may not be suitable. Always consult your hardwood flooring dealer or installer for their recommendations. Expansion and contraction caused by acclimating is not covered under this warranty.

Crafted, Solid Sawn, Northern Solid Sawn & U-LOC: Do not acclimate. Flooring must be installed immediately upon opening the boxes.

Hardwood flooring should be one of the last items installed when renovating your home. For new construction, the heating system must be operating for at least one week (7 days) at normal residential temperatures (approx. 70°F / 22°C) prior to installation.

Additional Allowance Recommendations

This will cover waste, defects or personal preference of boards. It is the installer's and owner's responsibility that all pieces be inspected, and graded prior to installation. If any piece does not meet installer/owner's personal standard, do no install these pieces. If you choose not to install pieces because of appearance, length of piece, or your personal visual standards, this will not be considered part of the 5% defect allowance. It is also recommended to have additional materials kept in case of future repairs.

2 1/4" - 4 3/8" widths	5% additional
5" - 10" widths	8% additional

(Chart #2)

Important Notes

FOR ALL INSTALLATIONS - ALWAYS WORK FROM 5-6 DIFFERENT BOXES AT ONE TIME

The installer is the final grader. Installer/homeowner will take full responsibility for all flooring that is installed, even if the primary owner of the residence is absent at the time of installation. If you are unsure of any requirements, please consult a Vintage dealer prior to installation. Although Vintage Hardwood Flooring takes every precaution to ensure that Vintage's Hardwood Flooring is graded and shipped to industry standards, we suggest you inspect each piece of Vintage Hardwood Flooring before installation. Boards that you may not like the look of, or contain a mark that you think will affect the look of the floor should be used as cut pieces for your start/end pieces. You may also use these pieces in less conspicuous areas such as in closets or under couches and sofa's etc.

Nailed Down Application

See Chart #4 for nail gun and cleat recommendations

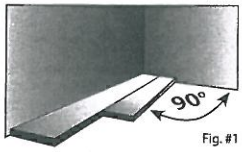


Fig. #1

Step #1 – Mark your starting line using a chalk line, draw a guide line out from the starting wall by measuring out the width of one board plus (see Chart #1). This line is where your first strip of flooring is going, and also allows for the expansion gap. It is very important for the starting line to be straight and square (see Fig. #1).

Step #2 – Install the strips
Face nail or glue using a moisture cured adhesive (best practice) on the first row of strips with the grooved side facing the wall; put the nails as close to the wall as possible. This way, the quarter round will cover the nail heads. You may have to face nail for the first few rows before there is enough room to use the nail/staple gun. It must be nailed/stapled down or glued by hand rather than with the hardwood floor-nailing machine because of the vertical wall obstruction. When clearance allows, start using the hardwood floor nail/staple gun. Nails/staples should be spaced a minimum 2"- 3" (57 – 76 mm) from both ends of the boards, and for all other nails/staples, see Chart #3. Measure and cut the strip to the required length to finish the first row. The remaining section should be used to start the second row, in order to minimize cut waste. The strip selection for completing the first row must be long enough to yield a remaining section of adequate length. Leave the required expansion gap (Chart #1) between the wall and the end of each strip in each row. The subsequent rows must be installed in the same manner. Don't be afraid to waste a few strips in order to adjust and test the nailing machine. See Hardwood Floor Nailing Tips. When you reach the last few rows, you may not be able to complete these rows with the nail/staple gun, due to vertical obstructions. Toe nail, face nail, or glue the last remaining rows.

NOTE : You may have to rip the last strips along the wall in order for them to fit properly. Don't forget to leave the minimum space for expansion (Chart #1).

Step #3 - Finally
Install the transition pieces, baseboards and/or quarter round moldings. Following the initial installation, vacuum thoroughly and clean the floor with your Vintage Hardwood Cleaning Kit. For detailed installation guidelines for your specific installation, contact your Authorized Vintage Hardwood Flooring Dealer.

Installing over a crawl space: You may install over a crawl space providing care has been taken to cover all areas of exposed earth with a 6 mm C.G.S.B polyethylene. You must also ensure that sufficient cross ventilation exists so that no moisture will accumulate and be absorbed in the wood flooring. Follow local building codes.

Wood Displacement (Dimples on Surface)

Hardwood Flooring, dense smooth woods in particular, may show dimpling on the surface from the displacement of wood by the fastener. Vintage Flooring should not dimple providing installation is adhered to. Therefore, dimpling is not covered under Vintage's warranty. It is the responsibility of the installer to monitor and take immediate action if dimpling occurs. (i.e adjusting air pressure, using smaller cleats, adjust/repair nail driver pin, adjust nailer shoe angle etc).

Nailing Pattern/Schedule

	Ends of the boards	Along the board
Pioneered (all widths)	2"-3"	6"-8"
Crafted (all widths)	2"-3"	4"-6"
Solid Sawn (3 1/4"-4")	2"-3"	6"-8"
Solid Sawn (5"-10")	2"-3"	4"-6"
Northern Solid Sawn (3 1/4")	2"-3"	6"-8"
Northern Solid Sawn (4 3/8"-5")	2"-3"	4"-6"

(Chart #3)

Hardwood flooring Nail Gun & Fastener Recommendations

Pioneered Solid	16 gauge or 18 gauge 1 3/4" - 2" cleats
Crafted Engineered	Bostitch EHF1838K staple gun using 18 gauge 1 1/2" staples
Solid Sawn	18 gauge 1 3/4" - 2" cleats
Northern Solid Sawn	16 gauge or 18 gauge 1 3/4" - 2" cleats

Recommendation based on the approved subfloors. Anything outside of this guideline, contact a Vintage dealer.

(Chart #4)

Hardwood Floor Tips

Here are a few tips to make your job easier, should you decide to use a hardwood floor nailer or staple gun.

1. Prevent any scratches and indentations on the surface of the board by keeping the nailer plate (base) clean, free from nicks and scratches at all times. Also by putting down the nailer/stapler on the plywood or on a piece of cardboard, not directly on the prefinished floor.
2. Make sure the nailer/stapler base is squared and sits well on the edge of the strip to ensure the nails /staples are secured into the nailing channel at the proper angle to prevent dimpling and damaging the edges of the strips.
3. Verify regularly the hardwood floor nailer/stapler is in working condition to prevent damages to the strips.
4. Start the second row and subsequent rows with a strip of at least 6" (150 mm) longer or shorter than the strip used in the previous row. This will eliminate unsightly step effects. The remainder of the floor should follow this rule to ensure an aesthetically pleasing floor.

*Pneumatic nailer. Air pressure should be adjusted adequately for each species of hardwood floor being installed and checked regularly (always try it before using) so that the cleats are seated properly in the nailing channel to avoid dimpling. *Great attention to detail during fabrication on the part of the Vintage Hardwood Flooring team ensures exceptional QUALITY in the finished product. Longevity of hardwood floors is directly related to proper installation and lifetime commitment to appropriate care and maintenance.

Glue Down Installation Instructions

Step #1 – Mark your starting line Vintage Flooring recommends that your Vintage Hardwood Flooring be installed parallel to the longest, straightest wall in the room. Start by measuring out from the wall 10 boards wide. Example: for 3.25" Solid Sawn flooring, 10 x 3.25" = 32.50", plus the expansion gap of ¾" which totals 33.25" from the wall. See Chart #1 for expansion gap widths for all products. Using a chalk line draw a guideline parallel to the wall based on the above measurements. This will eliminate any ripping of material at the end of the job for the last row. Using the straightest pieces of 1"x 2"x 8' length of wood and 2-inch concrete nails or screws, fasten the strips to the concrete. Your first row of starter boards will butt against this, so make sure that the strips are in line with the chalk line because this will determine how straight your floor will be.

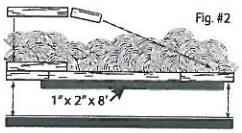


Fig. #2

Note: If you are cutting a piece that has not been set aside for cutting, make sure it is long enough to yield your next row's starting piece. Leave the expansion gap (See Chart #1) between the wall and the end of each strip in each row. See Fig #2.

Step #2 – Spread the adhesive
NOTE: Vintage Hardwood Flooring: only recommends installations when a moisture-cured polymer glue is used. Follow directions of glue manufacturer. Do not use latex/water based glues. Apply the recommended adhesive with a trowel according to the manufacturer's installation instructions (found on adhesive pail) for the specific adhesive that is being used.

SPECIAL NOTE: Open time and installation on adhesives vary from manufacturer to manufacturer so read instructions carefully before starting. Open time can also be affected greatly depending on the temperature and humidity. See Chart #5 for Adhesive recommendations.

Step #3 – Install the strips
You should inspect each piece of Vintage Hardwood Flooring before installation. Boards that you may not like the look of, or with a flaw that you think will affect the look of the floor, should be used as the cut pieces for your start and/or end pieces. You may also choose to put these pieces in less conspicuous areas such as closets or under couches, etc. Start your first piece with the tongue facing the area that will be completed last. Line up the tongue of the boards against the holding strip, and then press the board into the adhesive. Working from left to right, lay the next board and continue working towards the right, until you reach the wall and require a cut piece. Choose one of the pieces set aside for cutting and cut the desired length. NOTE: If you are cutting a piece that has not been set aside for cutting, make sure it is long enough to yield your next row's starting piece. Leave the expansion gap between the wall and the end of each strip in each row. Start the second row with a strip of at least 6" (150 mm) longer or shorter than the strip used in the first row. This will eliminate unsightly step effects. The remainder of the floor should follow this rule to ensure an aesthetically clean looking floor. Minimize adhesive from getting into the tongue or groove; otherwise, the strips of the flooring may not fit tightly. If adhesive gets on the finished side of the strips, clean immediately with appropriate cleaning products - see adhesive manufacturer's recommendations.

Flooring may require slight tapping in order to ensure a tight fit. You may use 3M's blue tape (if required), to hold pieces together until glue bond has developed. If a roller is required to obtain maximum adhesion, wrap a foam sheet around it to minimize any damage to the surface of the floor. When you get to the end of the wall, you may require a pry bar to get the pieces tight. Use shims where required until the glue has dried.

Step #4 – Installation of Accessories & Cleaning
After the floor has dried, you may install the baseboards and quarter rounds. Make sure that the nails penetrate the wall and not the floor. NOTE: Always keep left over pieces for future use. Flooring may become damaged and require replacing several pieces. It's a good idea to have the same production dates put aside. Use a vacuum to pick up any dust and loose fibers. Using your Vintage Cleaning Kit, available at all Authorized Vintage Dealers or visit us at www.vintageflooring.com and follow instructions and clean the whole floor.

Moisture Cured Adhesive Recommendations

For all glue down installations of Crafted, Solid Sawn or Northern Solid Sawn Dural, AF2130 or equivalent Urethane based or polymer adhesives are acceptable. Vintage does not warranty the adhesive, check manufacturers warranty information.

Floating Floor Installation Instructions

Sweep and vacuum the subfloor before laying any material. Make sure that any high points in the subfloor are removed, cleaned and sanded and any low points are filled with leveling compound.

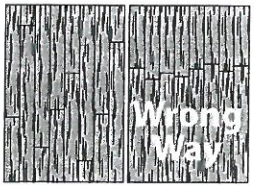
Vintage's Premium Underpad Installation

For installations of Vintage Crafted, Solid Sawn, Northern Solid Sawn or U-LOC

Step #1 - After the subfloor has been cleaned, roll out Vintage's premium acoustic underpad. Unroll the underpad with the film coated (shiny side) facing down against the subfloor. Cut the underlayment about 2" longer than the room length. Butt the edge of the first sheet, (the edge without the over lapping film), along wall and trim to fit adjacent walls. Bring the edge of the adjoining sheet to the first sheet so that the edges of the foam meet and the overlapping film underlies the second sheet. Secure the edges of the foam together with tape strips. Repeat this procedure until the entire room is covered; Vintage recommends running 2" of underlay up the sides of the walls. This excess will be covered by the baseboards. It will prevent excess moisture from the concrete migrating to the floor.

Crafted Solid Sawn & Northern Solid Sawn Products

Step #2 – Laying the wood floor
Using the longest pieces available, lay the first row against the longest and straightest wall. Carefully apply glue into top of groove along the whole length of the piece, using Vintage's T & G glue (available at your Authorized Vintage Dealer) specially designed for Vintage's hardwood flooring. Lay the first piece with the grooved edge against the wall. If the wall is not square, use wedges/shims between the flooring strips and the wall to achieve the desired expansion gap. Start the second row with a strip of at least 6" (150mm) longer or shorter than the strip used in the first row. This will eliminate unsightly step effects. The remainder of the floor should follow this rule to ensure an aesthetically pleasing floor. Clean any glue that gets on the finished side of the flooring before the glue dries. Flooring pieces may require slight tapping in order to ensure a tightfit. You may use 3M's blue tape, if required, to hold pieces together until glue bond has fully developed. Rip the strips for the last row to the required width, not forgetting to allow for expansion. Use a crowbar to ensure tight fitting boards, use shims to hold in place until glue has dried. Remove the shims 24 hours after installation.



U-LOC Installation

Step #2 Laying the wood flooring
Insert the tongue at the side of the board into the groove at 45 (degrees) angle. Use both hands to apply equal pressure to the board. Line up the far left side of the board to be positioned with the end of the previous board installed. Lightly press the board down to lock in place. Never force boards and remove debris that could get in the way of the locking system. For aesthetical reasons, on starting the next row, always make sure to stagger the end joints by at least 6" (15.24 cm). Try to use cut piece from previous row to start new row. Vintage's U-LOC flooring uses a drop loc end joint. Simply drop one end over the adjacent end and they fall into place. Proceed with the subsequent boards in similar manner to complete the row. All joints shall have a tight fit. Leave an appropriate gap between the wall and the flooring for expansion.

To lay the last row, boards must be at least 1 1/2" wide to attach properly, don't forget the expansion gap. Moldings shall be fastened to the adjacent wall by nail or screw, not the floor, overlapping the expansion gap allowance. If the molding is attached to the floor, the floor will be pinched and will not expand and contract as it is made to perform.

General Care & Maintenance for all Vintage Hardwood Floors



Vacuum and sweep your floor as often as required to eliminate dust and debris from your floor. This may have to be done on a daily basis; depending on the amount of traffic in your home. Use Vintage's Maintenance Kit as needed to remove grime.



Never clean your hardwood floor with water or use a cleaner that is mixed with water. Do not use vinegar, bleach, household cleaners or any oil based detergent on your hardwood flooring. These can also leave a greasy and/or cloudy film or damage the finish.



Keep floor mats at all entranceways to keep dirt and moisture from being tracked on your floor. Place walk off mats at all exterior entrances. This will capture much of the harmful dirt before it ever reaches the hardwood floor. Shake out, wash and vacuum mats and rugs frequently.

To avoid water marks, never let spills of any type remain on the surface of the floor. Wipe up spills immediately. Rotate area rugs occasionally to minimize discoloration from sunlight.

Use adequate floor protection (felt pads) under all furniture and chair legs, in order to ease their movements and to prevent scratches and dents. Replace as required or regularly.



When moving heavy furniture or appliances, put a large heavy blanket underneath them to avoid scratches and dents.

Do not wear high heels on your hardwood floor. Spiked shoes exert approximately 1000 pounds per square inch. Old, unprotected tips will dent any hardwood floor.



Try to maintain an average humidity level of 45% in order to minimize the expansion and contraction in your floor. Use a hygrometer to help monitor humidity levels through out the home. Available on Vintage's website or dealer.

Minimize surface scratches by keeping your pets nails trimmed.

Heavy Gauge or Deep Scratch Repair:
Vacuum and clean the floor with Vintage Floor Cleaner and let the floor dry. If you have removed the finish and stain and are seeing the unfinished wood, use color matched pen & fill stick to color the unfinished wood fibers (if the floor is natural no stain is required.) Stay within the line and try not to color on the unaffected area. Vintage has color touch up kits to match all standard colors offered. Let dry.



Care and Maintenance for UV Urethane Oil finish floors

Vintage Flooring recommends the Loba care and maintenance products to be used on any Vintage UV oiled flooring. Loba and Vintage have tested with these products on all Vintage UV Oil hardwood flooring.

Regular dirt and dust removal for residential:
Vacuum and sweep your floors as often as required to eliminate dust and debris from your floor.



Light traffic for residential use: 3-7 days. Use the Vintage Hardwood Cleaning kit that has been specially formulated to eliminate streaking and residue. Never clean your hardwood with a steam mop, wet mop or use vinegar or bleach.

Note: Before using any Oil product, prepare a sample or test area to determine compatibility, appearance and desired results.

UV Oil Maintenance care for residential:
Minor, superficial scratches as well as dull areas on the surface can be sealed and protected and in some cases can be completely removed by applying Loba Aqua Oil.

1. Vacuum and clean the floor with Vintage Hardwood Floor Cleaner and let the floor dry.
2. Apply a thin film of Loba Aqua Oil with a rag or a mop on the affected area or over the entire floor. The product will dry quickly and the floor can be walked on carefully. Resume normal use after 12 hours. Loba Aqua Oil can be used as frequently as desired. The product will form a sacrificial layer which will wear off with regular use. Therefore it is recommended to reapply the product regularly, or as required. If you notice any portion of the floor that is starting to fade and is showing signs of wear, this is an indicator that you should be applying a coat of the Loba Aqua Oil.

For complete recoating of the UV Urethane please contact an authorized Loba dealer for professional care.

Contact a Vintage dealer for Commercial cleaning instructions

Vintage Hardwood Flooring
409 Evans Ave.
Toronto, ON Canada M8Z 1K8
416-521-6100 or 1-877-256-0231
vintageflooring.com

Vintage
PREFINISHED HARDWOOD FLOORING

Vintage Installation and Maintenance Information

This Installation and Warranty Card is for all Vintage Product lines.

General Installation Instructions for all products



3/4" (19 mm) Solid

For all Smooth, Wire Brushed and Etched Pioneered floors

- Product Specifications: 3/4" (19 mm) Solid
- Grades Available: Estate, Select-V & Heritage
- Widths Available: 2 1/4" (57 mm), 3" (76 mm), 3 1/4" (83 mm), 4 1/4" (108 mm)
- Lengths: Random lengths 10" - 84" (254-2134 mm), Averages: 32" - 38" (813-965 mm) depending on grade
- Installation: Nail - At or above ground
- Radiant Heat: No, can use Crafted, Solid Sawn, Northern Solid Sawn or U-LOC



9/16" (13.7 mm) Engineered

For all Smooth, Wire Brushed and Etched Crafted floors

- Product Specifications: 9/16" (13.7 mm) Engineered
- Grades Available: Estate, Select-V
- Widths Available: 3 1/2" (89 mm), 5" (127 mm)
- Lengths: Random lengths 14" - 72" (356-1829 mm), Average: 32" (813 mm)
- Installation: Nail, glue or float - At, above or below ground level
- Radiant Heat: Yes * Check species list



3/4" (19 mm) Solid Sawn

For all Smooth, Hand Scraped, Wire Brushed and Etched Solid Sawn floors

- Product Specifications: 3/4" (19 mm)
- Grades Available: Estate, Select-V, Character
- Width Available: 3 1/4" (83 mm), 4" (100 mm), 5" (127 mm), 7" (180 mm), 10" (250 mm)
- Lengths: Random lengths 16" - 84" (406-2134 mm), Averages: 38" - 48" (965-1219 mm) depending on species and grade
- Installation: Nail, glue or float - At, above or below ground level
- Radiant Heat: Yes * Check species list



3/4" (19 mm)
Northern Solid Sawn

For all Smooth, Wire Brushed and Etched Northern Solid Sawn floors

- Product Specification: 3/4" (19 mm)
- Grades Available: Estate, Select-V, Character
- Widths Available: 3 1/4" (84 mm), 4 3/8" (112 mm), 5" (127 mm)
- Lengths: Random lengths 15" - 84" (381 - 2134 mm), Averages 32" - 42" (813 - 1066 mm) depending on species and grade.
- Installation: Nail, glue or float - At, above or below ground level
- Radiant Heat: Yes * Check species list



7/16" (11 mm) U-LOC

For all Smooth U-LOC floors

- Product Specifications: 7/16" (11 mm) Click
- Grades Available: Estate, Select-V
- Widths Available: 4 1/4" (109 mm)
- Lengths: Fixed lengths 46.14" (1172 mm), 32.36" (822 mm), 28.8" (732 mm), 23.07" (586 mm), 17.32" (440 mm), 13.77" (350 mm)
- Installation: Float - At, above or below ground level
- Radiant Heat: Yes * Check species list

For more details or technical specifications, please contact a Vintage Dealer or our Website.

	Vintage Wear Warranties	
	Pearl & Semi Gloss	UV Urethane Oil
Residential Wear Warranty	25-Year	10-Year
Commercial Wear Warranty	3-Year	1-Year

Congratulations on purchasing one of the highest quality prefinished hardwood floors. Your premium Vintage Hardwood Floor will provide you with a lifetime of memorable moments. Products may be manufactured in one of Vintage's worldwide manufacturing facilities, but all are prefinished in Canada. Contact a Vintage dealer for more information.

Warranty Program takes effect: February 2014 replacing all previous versions.

Warranties

Lifetime Structural Warranty for Residential Installations

Vintage Hardwood Flooring has strict processing controls and every piece is put through a rigorous quality control system. Vintage warranties all the product collections to the original owner of a non-commercial floor in its original manufactured condition to be free from; delamination, milling defects and grading for the lifetime of the floor. This warranty excludes the standard defect allowance of 5% for widths below 4" and 8% for 4 1/4" and over. The relative humidity in the residence must be targeted at 45% and the maximum ranges in the specific product warranty never exceeded. Radiant heat warranty is limited as specified in the radiant heat section. The warranty does not cover the normal movement and reactions of wood to humidity and damages as listed in the exclusion list. To fulfill this warranty, the owner must ensure the pre-installation, installation, maintenance and care guidelines are complied with. Vintage Hardwood Flooring's liability for this warranty is limited solely to the defect amount in excess of the standards above and is for the flooring material only.

Residential Wear Warranty: 25-Year for Pearl & Semi gloss finished floors

This warranty guarantees to the original purchaser that the standard Vintage Semi-gloss and Pearl finishes will not wear through or peel for 25 years from the date of purchase. Oil and Custom gloss finishes are not covered by this warranty. The product must be in its original purchased condition. The wear warranty is applicable to non-structural defects only. Checks, lines or peeling that appear on the surface of knots, checks, cracks, holes, color variation and other related natural character allowed for in the grades are not covered under this warranty. The floor must be installed and maintained in accordance to Vintage's installation and maintenance guidelines. See warranty exclusions for other limitations.

3 Year Finish Wear through Warranty for Commercial Installations
(Special Ordered as "Commercial Finish")

This warranty guarantees to the original commercial purchaser that the standard Vintage Semi-gloss and Pearl finish will not wear through or peel for 3 years from the date of purchase in a commercial environment. Heavy traffic environments, including exterior main access ways are excluded. Oil and Custom gloss finishes are not covered by this warranty. The product must be in its original purchased condition. The wear warranty is applicable to non-structural defects only. Checks, lines or peeling that appear on the surface of knots, checks, cracks, holes, color variation and other related natural character allowed for in the grades are not covered under this warranty. The floor must be installed in accordance to Vintage's installation guidelines.

The floor must be regularly maintained in accordance with Vintage Hardwood Floorings guideline to validate this Warranty. The sole remedy pursuant to this warranty shall be limited to the repair, refinishing or replacement of the floor at the discretion of Vintage Hardwood Flooring to correct the issue. Any attempt to modify, repair or replace products prior to authorization of Vintage Hardwood Flooring will void this warranty. See warranty exclusions for other limitations.

10 Year Limited Residential Wear Warranty – UV Urethane Oil finish (Not an Oxidative Oil)
(1-Year Commercial)

Vintage warranties to the original purchaser that it's UV Urethane Oil will not wear through the finish in normal residential use within 10 years from the purchase date. The thin finish of UV Oil must be carefully maintained, including regular care and maintenance that cleans and protects the floor. Failure to care and maintain the floor for any period, as described in the Vintage care instructions, can lead to failure of the floor and will void the warranty. Wear warranty excludes items listed under exclusions. Vintage recommends refreshing the floor as soon as wear or dulling is observed to provide a protective coat to avoid or correct minor damages. Refreshing may cause variances in the finish if any residue is missed by cleaning or due to varying amounts of refresher applied. Vintage does not warranty gloss variation or contamination resulting from the refresher application. Vintage's thin UV Urethane Oil coat will wear through in heavy traffic areas or where sources of grit or damage are higher. Therefore place mats/rugs in such areas to protect the finish (i.e. Entrance ways, fridges, sink area, etc). In the event the raw wood is exposed due to damage or excessive wear, it is essential to carefully clean and refresh the area to avoid the "wash-out" and discoloration of the underlying stain. Repairs to damage and excessive traffic/wear are not covered by the warranty. Consult a professional when recoating or extensive repairs are required.

Humidity Control (Gapping, Cupping and Splits)

Relative Humidity is the ratio of the actual amount of water vapor contained in the air at a given temperature to the maximum amount of water vapor that the air at a given temperature can hold, expressed as a percent. In other words, relative humidity is the absolute humidity divided by the absolute humidity at saturation of air at the same temperature.

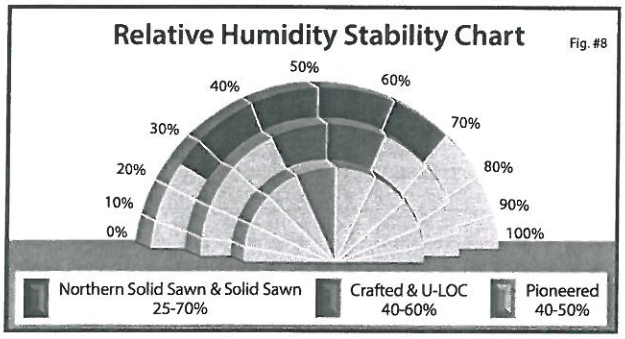
Wood is a hygroscopic material. Always containing water, it constantly exchanges water vapor with the air, picking it up when atmospheric relative humidity is high, and giving it off when relative humidity is low. Since wood swells as it adsorbs water, and shrinks as it releases water, both its moisture content and its dimensions are controlled by the relative humidity of the surrounding air. Wood moisture content is equal to the weight of water contained in the wood divided by the oven dry weight of the wood, expressed as a percent.

Inside homes however, where the relative humidity (RH) of outdoor air drawn inside is drastically altered by heating it and cooling it without humidification or dehumidification. Wide seasonal swings in relative humidity in wood moisture content and dimension changes occur. Since warm air can hold more water vapor than cold air, the relative humidity of air with a certain absolute humidity can be changed by simply changing its temperature. If in winter, for example, outside air at 20°F (-6°C) and 65% RH is drawn inside and warmed to 70°F (20°C) without humidification, its relative humidity drops to about 10%. In summer, outside air at 70°F (20°C) and 60% RH that flows into a basement at 60°F (15°C) will end up at 82% RH. In order to minimize this movement, the relative humidity must be maintained according to product specifications for Pioneered solid anything higher and the flooring will start to cup, anything lower and the floor will start to gap and may check and split in winter months.

Special Note for Crafted, Solid Sawn, Northern Solid Sawn and U-LOC
Although these products are more stable, they can still react to changes in relative humidity according to the season. Minor cupping, crowing, face distortions, etc, is considered normal when near the limits of the stability warranty and is not covered under this warranty. Raising or lowering your humidity level towards the middle of the warranty range will resolve this issue.

Vintage's Crafted, Solid Sawn, Northern Solid Sawn, & U-LOC Hardwood Flooring will perform extremely well with high humidity. However, if the humidity drops below warranted levels the face lamella will start to contract. The construction of these products is such that the core material will minimize the face lamella's contraction. If the humidity drops below warranted levels the core will continue to do its job and minimize the contraction again. However, there comes a point where the face lamella is under so much stress, and the core is not allowing the face to move (minimize cupping) that the face lamella has no other choice but to relieve its pressure by stress cracking. Stress cracking is NOT covered under this warranty.

Vintage manufactures and stores solid wood flooring in a controlled environment. It is important to check and document both the ambient humidity and the moisture of the subfloors in the rooms before installation. Humidity outside the allowed range or subfloors more than 2% difference in moisture on 3 1/4" and wider floors (4% difference on 3" and narrower) will cause the floors to expand/shrink and cup. Wet subfloors and high humidity environments can cause gapping and create splits as the wood dries and returns to a normal humidity levels. Un-insulated heat ducts or radiant heat also cause extreme drying leading to gapping and splitting. Gapping, Cupping and splits resulting from moisture & humidity excesses are not covered under Vintages Warranty. Generally, wood flooring should not be installed over crawl spaces. If necessary, ensure the crawl space has a 6 mil CGSB polyethylene over all exposed earth and that sufficient cross ventilation exists in order that no moisture accumulation occurs. Follow local building codes.



Radiant Heat Instructions & Warranty

New Concrete that is less than 60 days Old – Radiant heat must be turned on and left on for a period of 45 days prior to installation of the Vintage flooring material. Turning the radiant heat on will allow the moisture that is in the concrete to evaporate from the concrete. If the concrete is not dried and the floor is installed, the moisture that is in the concrete will migrate into the wood floor. Perform a calcium chloride or polyfilm test to determine moisture content of the concrete. The Radiant heat must be turned off for at least 48 hours prior to installing any flooring for a conditioning period. Older Concrete – Heating and or cooling concrete must be done slowly. Vintage flooring requires that the radiant heat be turned on for a minimum of 72 hours prior to installing Vintage flooring material. Vintage flooring also requires that the radiant heat system be turned off for at least 48 hours prior to installing any flooring. Turning the heating system off allows for the concrete to properly condition.

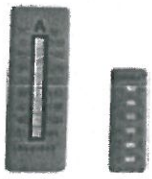
Note: Not conditioning the concrete will void all Vintage Warranties.
Maximum Tube Temperature out of boiler: 129°F (54°C)
Maximum Concrete Temperature: 81°F (27°C) (Below hardwood flooring)

**IMPORTANT ** when using any radiant heat system other than the in slab system referred to above, you must confirm with your heating contractor that the Maximum Temperature of the surface of the subfloor (below the hardwood flooring) CANNOT EXCEED 81°F (27°C).

The humidity level in the home MUST be maintained ABOVE the listed levels in order to validate the warranty *.

Pioneered Hardwood Flooring 40%
*Engineered Crafted Hardwood Flooring 40%
*Solid Sawn Hardwood Flooring 25%
*Northern Solid Sawn Flooring 25%
*U-LOC Hardwood Flooring 40%

A common problem that happens is that the floor will cup and/or crack when the radiant heat is "cranked up" by individuals that are cold. Cranking the heat above the maximum temperate recommended by Vintage will void the warranty. In order to confirm that the floor maximum temperature is not exceeded Vintage will require "thermal sensor stickers" to be applied in strategic areas of the floor and heating system. Thermal sensor stickers are strips of tape with crystals that change to black at a specific temperature. If the heat on the substrate below the hardwood flooring exceeds 81°F (27°C), or the tube temperature out of the boiler exceeds 129°F (54°C) these crystals will turn black. Once they turn black you cannot reverse the color change. Vintage flooring will require 1 thermal tape to be placed on the main tube coming out from the heating unit in the home. Vintage flooring will also require a thermal sensor tape on the subfloor placed within 6" of the wall and the sensor must be placed over the heat tube. Thermal sensors will be mandatory in order for Vintage to warranty radiant installations. If using radiant heat systems other than concrete slab, 3 sensors must be place in various locations on the floor.



If a problem occurs and Vintage is required to inspect a potential claim, Vintage will require that these thermal sensors are removed for verification of temperature. If these sensors are not available to Vintage in accordance with our installation guidelines, the claim will be denied. It is extremely important that the sensors be placed in an area where it can be extracted by Vintage for temperature verification. Vintage requires that the installer draw a diagram on the placement of the sensors in the main heat floor area. This diagram must be submitted to the homeowner and Vintage Flooring for record keeping.

The Radiant Heat Compliance form must be completed and signed to validate radiant heat warranty. A copy must be submitted to Vintage Flooring with the purchase order when ordering a floor. It is the responsibility of the dealer to provide this completed form when ordering material. In signing this compliance form it is agreed that the homeowner will not exceed the maximum temperature as per the above mentioned Vintage guidelines. It is also agreed that the thermal sensor strips will be installed in accordance with these guidelines. The homeowner will also keep a record of the placement of these sensor strips so that they know where the location is, and will make them available for extraction in the unlikely event of a claim.

Installation on radiant heat system

Species	
Hickory	No
Rift & Quarter Sawn Brazilian Cherry	No
Maple	Yes*
Tigerwood	Yes*
Red Oak	Yes
White Oak	Yes*

Vintage products	
Pioneered	No
Crafted	Yes**
Solid Sawn	Yes**
Northern Solid Sawn	Yes**
U-LOC	Yes**
**check Species list	

Effective February, 2014

* Indicates species that are more susceptible to movement and special attention must be taken to adhere to maximum temperatures.

For more detailed information about the Radiant heat warranty, please contact a Vintage dealer.

Warranty Exclusions

The following are excluded from all Vintage warranties

Any damage or failures, but not limited, to the following are not covered by Vintage's warranty.

The finish wear surface must be easily noticeable and cover at least 15% of the total floor area for a claim to be considered.

Damage or structure failure relating to installation and interior conditions that do not comply with Vintage's installation requirements.

Damage due to improper care or failure to comply with Vintage's maintenance and care instructions.

Structural Defects natural in the wood where the finish cracks, contains voids, or color variation that appear on the surface of a knot, check, split, hole or similar naturally occurring wood character in the grade.

Natural expansion, contraction and tensions caused by woods reaction to humidity variations.

Wood displacement due to nailing, stapling or installation (i.e. Dimpling & Nail pops)

Gloss changes due to wear or use, including variation in replacement boards.

Damage due to water, spills, steaming, excessive cleaner, wet mopping, moisture, sink /dishwasher / pet bowl / planter spills that will cause distortion of the wood and blistering and peeling of the finish.

Dents, scratches, high heel marks, pet damage, chemical & adhesive damage. Use of tape except 3M blue tape.

Natural discoloration of the finish, aging, fading or darkening of the wood and excessive exposure to sunlight, including uneven discoloration under rugs & furniture.

Natural color and character marks in the wood as allowed in the grade (Samples do not show all possible character marks allowed in the entire floor).

Environmental extremes of heat, dryness or humidity that exceed the product specified humidity range.

Construction damage, in particular on textured surfaces, can contaminate the naturally occurring or intended undulations in the surfaces (I.e. Drywall dust).

In all cases, any warranty, remedy, or repair must first be approved by Vintage Hardwood Flooring.

Action taken prior to Vintage's approval will void the warranty claim.

The corrective action to remedy any warranty issue is the exclusive right of Vintage Hardwood Flooring.

This Warranty only applies to defects in excess of the 5% on boards under 4" and 8% on boards 4 1/4" or over.

Vintage's liability under this warranty is limited to the replacement or repair, of any portion of the floor, solely at Vintage's discretion, and only up to the total purchase price of the floor (excluding installation). Vintage will not be liable for other costs, including labor, installation, moving, or accommodation costs.

The warranty is only to the original purchaser and cannot be transferred.

Any defect or warranty claim must be submitted in writing to Vintage Hardwood Flooring within 6 months of the occurrence of the issue giving rise to the claim.

Filing a Claim

To file a claim, contact your authorized Vintage Hardwood Flooring Dealer or Builder where you made your purchase. They will assess and complete a claim form if warranted, that will require the details of original purchase, payment confirmation, installation, environment conditions and details of the issue.

Vintage at its discretion reserves the right to: be provided detailed pictures of the floor, access for inspection, and/or removal of samples for analysis.

Warranty Registration Card

(This card must be completed and returned within 30 days of purchase date)

Please Print

Name _____

Address _____

City _____ Postal/Zip _____

Prov/State _____ Date of Purchase _____

Country _____

Name and Address where purchased:

_____

Product purchased:

☐ Estate ☐ Select-V ☐ Character ☐ Heritage

Size _____ Color _____

Reason for purchasing Vintage _____

_____

_____

What room did you install Vintage in:

☐ Bedroom ☐ Den ☐ Family Room ☐ Hallway

☐ Kitchen ☐ Living Room ☐ Bathroom ☐ Basement

Number of residents in your home:

Adults _____ Children _____

Dog _____ Cat _____

Type of Residence:

☐ Single ☐ Condominium ☐ Townhouse ☐ Cottage ☐ Rental

Age of Residence:

☐ 5 years or less ☐ 5-10 years ☐ 10-15 years ☐ 15-20 years ☐ 20 plus

We thank for purchasing Vintage Hardwood Flooring. Take the time and fill in any comments that you may have. The only way to improve is to hear from you, our valued purchaser.

Thank you

Comments _____

_____

_____

Registration can be completed online at www.vintageflooring.com

Internal use only
Vintage Hardwood Flooring
409 Evans Avenue, Toronto, Ontario, Canada, M8Z 1K8
416-252-4182 or 1-877-256-0231

Date received _____ Control # _____

BŌLYÜ

Warranty

NEXTERRA™

Nexterra Warranty

This limited lifetime* warranty applies only to purchasers of BOLYU Contract (BOLYU) products for indoor commercial installations. This limited warranty is valid only if signed below by BOLYU's authorized Representative, the Owner, and by the Flooring Contractor. Provided the carpet has been installed and maintained in the specified commercial location in strict accordance with BOLYU's instructions, procedures and the Owner meets its obligation hereunder, including the use of BOLYU recommended Nexterra pressure sensitive adhesives, BOLYU (subject to the following limitations and remedies) warrants to the designated Owner the following:

I. Items Under Warranty

1. WEAR- BOLYU warrants that Nexterra will not wear more than 10% of its surface pile weight from abrasive wear for the lifetime* of the carpet. By abrasive wear is meant fiber loss from the carpet through normal abrasion, not crushing or flattening of the carpet pile in any area, nor due to abnormal usage of the carpet.

2. STATIC PROCTECTION- BOLYU warrants that Nexterra will not give static discharges in excess on 3.5 KV for the lifetime* of the carpet when tested in accordance with the AATCC Test Method #134-1979.

3. TUFT BIND - BOLYU warrants that Nexterra will not lose tuft bind integrity for the lifetime* of the carpet when tested in accordance with test method ASTM D-1335-67.

4. EDGE RAVEL - BOLYU warrants that Nexterra will not edge ravel along seams for the lifetime* of the carpet.

5. ZIPPERING – BOLYU warrants that Nexterra will not zipper or develop continuous pile runners for the lifetime* of the carpet. This portion of the warranty protects against zippering regardless of the average tuft bind properties, under dry or wet conditions as it might be during cleaning.

6. PILLING AND FUZZING - BOLYU warrants that Nexterra will not exhibit pilling or fuzzing for the lifetime* of the carpet

7. DELAMINATION – BOLYU warrants that Nexterra will not delaminate for the lifetime* of the carpet. Chair pads are not required, but are recommended for optimum textural performance.

8. DIMENSIONAL STABILITY - BOLYU warrants that Nexterra will maintain it's dimensional stability and will not dome or curl for the lifetime* of the carpet when installed per our recomendations.

*Lifetime defined as long as the carpet remains installed in the original location and is owned by the orginal purchaser.

II. Limitations - This warranty does not include:

1. Disfigurement or damage caused by abnormal use or any damage to the carpet not arising out of a defect to the carpet. For example, the warranty does not cover tears, burns, cuts, installation on stairs or damage resulting from improper cleaning methods, or damage in transit.

2. Abuse by any athletic equipment such as roller skates, ski boots, or golf shoes.

3. Differential fading due to light exposure, shading, pile crush, dye lot differences, and soiling.

4. Any condition that would have had a visible defect upon inspection prior to installation.

5. Any condition resulting from other than ordinary wear, or from any use for which the product was not designed.

III. Obligations of Owner

1. The Owner must submit notice of all claims under this limited warranty to BOLYU within the specified warranty period.

2. Claims must be submitted in writing and delivered to:

BOLYU Contract Carpets

Attention: Product Services Group

P.O. Box 1447

Chatsworth, Georgia 30705

3. All areas in which carpet is to be replaced under the terms of this limited warranty must be cleared of all equipment, furnishings, partitions, and the like that have been installed over carpet subsequent to the original carpet installation, at the owners expense.

IV. Warranty Remedies

1. After receipt of proper written notice of claim, BOLYU will designate a representative to inspect that carpet with the Owners representative and BOLYU will meet all warranty obligations.

2. Subject to any monetary adjustment as may be agreed to upon in writing by BOLYU, and subject to the above warranty limitations and Owner obligation. BOLYU shall repair or, in its sole discretion, replace any designated carpet sold by it containing a defect covered by the above Nexterra limited warranty, at no expense to the owner.

3. Any replacement will be made with a comparable product selected by BOLYU from the then-current BOLYU running line. However, BOLYU's obligation shall not include the reimbursing of any indirect costs or consequential damages, however, incurred. By way of example, and not limitation, damages arising from interruption of use of the spaces affected, nor expenses in removing furniture from the affected area be included in our obligation.

4. The remedies provided in connection with the Nexterra warranty are expressly in lieu of any other remedies provided under any other expressed or implied warranty, INCLUDING ANY WARRANTY BY MODEL OR SAMPLE AND ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS, and of any other obligation on the part of BOLYU.

V. Mediation/Arbitration

1. If a dispute arises out of or relates to this limited warranty, or the breech thereof, and if said dispute cannot be settled through direct discussions, the parties agree to first endeavor to settle the dispute in an amicable manner by mediation administered by the American Arbitration Association under its Commercial Mediation Rules, before resorting to arbitration. Thereafter, any unresolved controversy or claim

arising out of or relating to this limited warranty, or breech thereof, shall be settled by arbitration administrated by the American Arbitration Association in accordance with its Commercial Arbitration Rules, and judgment upon the Award rendered by the arbitrator(s) may be entered in any court have jurisdiction thereof.

2. Neither party not the arbitrators may disclose the existence, content, or results of any arbitration hereunder without the prior written consent of both parties.

3. Arbitrators shall be appointed as provided by the American Arbitration Association Commercial Arbitration Rules.

4. In rendering the award, the arbitrator shall determine the rights and obligations of the parties according to the substantive and procedural laws of Georgia.

VI. BOLYU hereby issues its Nexterra warranty to the Owner named below. This limited warranty is only valid when this form is properly executed by the Flooring Contractor, the Owner and BOLYU Contract Carpets.

Owner Name:_____

Address:_____

_____

_____

_____

Place of Installation

Name:_____

Address:_____

_____

_____

_____

Style Name:_____

Style #:_____

Square Yards:_____

BOLYU Invoice Numbers (Attach Invoice Copies)

Invoice # :_____ Date:_____

Invoice # :_____ Date:_____

Invoice # :_____ Date:_____

Invoice # :_____ Date:_____

Invoice # :_____ Date:_____

Invoice # :_____ Date:_____

Dealer Name:_____

Address:_____

_____

_____

_____

Date Installation Completed:_____

The undersigned dealer herby certifies that the above carpet was installed in strict accordance with BOLYU's written installation instructions and procedures. In consideration of BOLYU's extending the foregoing limited warranty knowing that BOLYU and the Owner will rely hereupon, the undersigned hereby agrees to hold BOLYU and the Owner, jointly and severally, harmless from any damage or liability, including reasonable legal fees, arising out of or in connection with the installation of the carpet in the event it was not completed in accordance with this certification.

Dealer

Authorized Signature:_____

Date:_____

Name and Title:

_____

_____

Owner

Authorized Signature:_____

Date:_____

Name and Title:

_____

_____

BOLYU

Authorized Signature:_____

Date:_____

Name and Title:

_____

_____

Date Issued:_____

Warranty #:

_____

BOLYU Contract

PO Box 1447
1996 Highway 225 South
Chatsworth, GA 30705
800.451.1250
www.cambridgecarpets.com

Warranty
AVALAR® SD
AVALAR® RE

The warranties below are only applicable to Beaulieu Commercial products manufactured with 100% AVALAR® SD or AVALAR® RE nylon for indoor use. Installation in a *traffic* environment unsuitable for carpet or failure to sustain a routine carpet maintenance program (as recommended by Beaulieu Commercial) will void these warranties.

AVALAR®SD & AVALAR®SDX Lifetime* Stain Removal Limited Warranty

Beaulieu Commercial warrants for the useful life of the carpet made exclusively with AVALAR® SD & AVALAR®RE solution-dyed nylon, when installed and maintained as recommended by Beaulieu Commercial, will resist permanent stains caused by spills of all substances, subject to the following limitations. This warranty specifically excludes general soiling, discoloration, appearance change due to pile distortion, and exposure to substances or contaminants that degrade or destroy nylon yarn or the color of the carpet. Also, this warranty specifically excludes carpet that has been surface-treated with materials not recommended or approved by Beaulieu Commercial, or which has been subjected to abnormal use or conditions or to cleaning agents or maintenance methods not recommended or approved by Beaulieu Commercial.

THIS IS NOT A CLEANING CONTRACT. In order to make a claim under this warranty, the owner must have attempted to remove the stain within 24 hours after occurrence of the spill, USING ONLY THOSE CLEANING AGENTS AND PROCEDURES RECOMMENDED BY Beaulieu Commercial, and must notify Beaulieu immediately if stain removal is not successful. The original purchaser must also identify the type of stain and the method used to clean it. For approved cleaning agents and removal procedures, maintenance recommendations and other conditions of this warranty, refer to Beaulieu Commercial's "Total Solution Carpet Care Guide". If additional information or assistance is required, or in order to notify Beaulieu Commercial of an unsuccessful attempt to remove a stain, call 1-800-451-1250. Claims under this guarantee must be submitted in writing to Beaulieu Commercial c/o Product Services Group, P.O. Box 1447, Chatsworth, GA 30705.

In addition, the owner must furnish to Beaulieu Commercial the ORIGINAL PROOF OF PURCHASE and non-returnable samples of the carpet for testing, and must permit a Beaulieu Commercial Representative access to the installed carpet in order to attempt to remove the stain. If, in testing and analysis performed by Beaulieu Commercial, and subject to the other limitations set forth herein, the tested carpet or the cleaned area is found to have a rating of less than 4 under the AATCC Gray Scale for Evaluating Change in Color, Beaulieu Commercial will pay for the attempted removal of the stain by the Beaulieu Representative, or replace the original carpet in the affected area, up to 100 times the size of the stain, free of charge, including installation. No charges for floor preparation or for movement or replacement of equipment, furnishings, partitions, etc., will be allowed. At Beaulieu's option, we will refund to the owner the original purchase price of the carpet in the affected area, up to 100 times the size of the stain. If the stain is removed using Beaulieu Commercial's recommended procedures, all stain removal costs will be the responsibility of the owner.

AVALAR®SD & AVALAR®RE Lifetime* Carpet Static Limited Warranty

Beaulieu Commercial warrants, for the useful life of the carpet, products made with Avalar®SD or Avalar®RE nylon, when installed and maintained as recommended by Beaulieu Commercial, will be shock proof to human beings, subject to the following limitations:

If human comfort is affected by shock, the owner must notify the carpet manufacturer and permit Beaulieu Commercial to test the carpet. If, in testing by Beaulieu and subject to the other limitations contained herein, the carpet generates static above 3.5 kv (the threshold of normal human sensitivity is 3.5 kv), when tested in accordance with AATCC test method 134 at 20% relative humidity and 70°F, Beaulieu Commercial will replace the original carpet in the affected room or area, free of charge, including installation, except that no charges for moving or replacing equipment, furnishings, partitions, etc., will be allowed.

AVALAR®SD & AVALAR® RE Colorfast Carpet Limited Warranty

Beaulieu Commercial warrants that products manufactured with 100% AVALAR®SD & AVALAR®RE nylon, when installed and maintained as recommended by Beaulieu Commercial, FOR INDOOR USE ONLY and subject to the other limitations set forth herein, will be colorfast against exposure to light and atmospheric contaminants as specified below:

Colorfastness to Light:

Beaulieu Commercial warrants, for the useful life of the carpet from the date of the original installation, products made with AVALAR®SD & AVALAR®RE will not display or evidence a significant change in color due to exposure to light.

In order to make a claim under this warranty, the owner must notify Beaulieu Commercial and furnish non-returnable samples of the carpet for testing. If, in testing by Beaulieu and subject to the other limitations set forth herein, (1) the carpet is found to have a rating of 3 or less under the Gray Scale for Evaluating Change in Color, AND (2) such rating is determined to be the result of exposure to light for a period of time not to exceed 200 Xenon Fadeometer hours of such exposure, when tested in accordance with the AATCC 16E test method, Beaulieu Commercial will replace the original carpet in the affected room or area, free of charge, including installation, except that no charges for moving or replacing equipment, furnishings, partitions, etc., will be allowed.

Colorfastness to Atmospheric Contaminants:

Beaulieu Commercial warrants, for the useful life of the carpet, products made with AVALAR®SD & AVALAR®RE will not display or evidence a significant change in color due to exposure to atmospheric contaminants (Ozone or Oxides of Nitrogen).

In order to make a claim under this warranty, the owner must notify Beaulieu Commercial and furnish non-returnable samples of the carpet for testing. If, in testing by Beaulieu and subject to the other limitations set forth herein, (1) the carpet is found to have a rating of 3 or less under the Gray Scale for Evaluating Change in Color, AND (2) such a rating is determined to be the result of Ozone exposure for a period of time not to exceed 8 cycles, when tested in accordance

with the AATCC 129 test method, or Oxides of Nitrogen exposure for a period of time not to exceed 8 cycles, when tested in accordance with the AATCC 164 test method, Beaulieu Commercial will replace the original carpet in the affected room or area, free of charge, including installation, except that no charges for moving or replacing equipment, furnishings, partitions, etc., will be allowed.

Colorfastness to Light:

Beaulieu Commercial warrants, for the useful life of the carpet from the date of the original installation, products made with AVALAR®SD & AVALAR®RE will not display or evidence a significant change in color due to exposure to light.

In order to make a claim under this warranty, the owner must notify Beaulieu Commercial and furnish non-returnable samples of the carpet for testing. If, in testing by Beaulieu and subject to the other limitations set forth herein, (1) the carpet is found to have a rating of 3 or less under the Gray Scale for Evaluating Change in Color, AND (2) such rating is determined to be the result of exposure to light for a period of time not to exceed 200 Xenon Fadeometer hours of such exposure, when tested in accordance with the AATCC 16E test method, Beaulieu Commercial will replace the original carpet in the affected room or area, free of charge, including installation, except that no charges for moving or replacing equipment, furnishings, partitions, etc., will be allowed.

Colorfastness to Atmospheric Contaminants:

Beaulieu Commercial warrants, for the useful life of the carpet, products made with AVALAR®SD & AVALAR® RE will not display or evidence a significant change in color due to exposure to atmospheric contaminants (Ozone or Oxides of Nitrogen).

In order to make a claim under this warranty, the owner must notify Beaulieu Commercial and furnish non-returnable samples of the carpet for testing. If, in testing by Beaulieu and subject to the other limitations set forth herein, (1) the carpet is found to have a rating of 3 or less under the Gray Scale for Evaluating Change in Color, AND (2) such a rating is determined to be the result of Ozone exposure for a period of time not to exceed 8 cycles, when tested in accordance with the AATCC 129 test method, or Oxides of Nitrogen exposure for a period of time not to exceed 8 cycles, when tested in accordance with the AATCC 164 test method, Beaulieu Commercial will replace the original carpet in the affected room or area, free of charge, including installation, except that no charges for moving or replacing equipment, furnishings, partitions, etc., will be allowed.

These warranties state the entire liability of Beaulieu Commercial with respect to the product warranted, except for any warranties of merchantability or fitness for a particular use, which are hereby limited to the duration of the applicable express warranty. In particular, these warranties do not cover incidental or consequential damages of any kind, nature or description, which may be claimed as a result of carpet failure or carpet replacement. (Note: Some states prohibit limitations on the duration of implied warranty, as well as the exclusion or limitation of incidental or consequential damages, so the above limitations may not apply to you. These warranties give you specific legal rights, and you may also have other rights, which may vary from state to state.)

*Lifetime defined as long as the carpet remains installed in the original location and is owned by the orginal purchaser.



Manufacturer Warranty

www.clipso.com

Guarantee Terms and Limitations

The Manufacturer, hereinafter known as CLIPSO® Americas, Inc. guarantees, for a period of ten years, that the goods are free from any defect that could affect their resistance to heat and cold or affect their colors in the normal conditions of exposure to light, to the exclusion of any other guarantee of any other type. It is hereby expressly agreed that the products shall be installed by professional installers trained in the installation techniques specific to CLIPSO products. The vendor shall not be liable in any way if the goods are not installed by such personnel.

The Manufacturer shall have no liability in the following cases:

- Defects due to a design made specifically by the customer.
- Defects resulting entirely or partly from normal wear, damage or accidents attributable to the customer or third party.
- Product modification.
- Abnormal or atypical use or use that does not comply with good workmanship or the requirements and recommendations of CLIPSO.
- Installation by personnel with no training in the specific installation techniques of CLIPSO as stated above.
- Installation of the product where exposed directly to weather and/or direct sunlight.
- Defects during and after the installation of the CLIPSO Coverings using other manufacturers' profiles/track rather than the CLIPSO profiles/track.

The customer shall indemnify the Manufacturer against any claim from its insurers or other parties with whom it has contractual relations on the Manufacturer or its insurers beyond the limits and exclusions above. The Manufacturer's guarantee shall always be limited to the replacement of all or part of the goods recognized to be defective, to the exclusion of any liability or compensation for any reason. The third-party liability of the Manufacturer for any cause other than injury or serious misconduct shall be limited to an amount equal to the payment received for the sale of the product.



Clipso Cleaning & Maintenance

www.clipso.com

CLIPSO® Technical Fabric is a polyester fabric coated with polyurethane, which under most circumstances, protects it from absorbing odors. It is hydrophobic and anti-static, thus requiring little or no maintenance.

The CLIPSO Cleaner and Cleaning Glove

If cleaning is required, CLIPSO provides a cleaning spray called "Clipso Cleaner" (Ref# O-CCL10E) (500mL), and a cleaning glove (Ref# O-GN20E), which can be ordered by contacting us at contactusa@clipso.com or 646-422-0919 ext. 704.





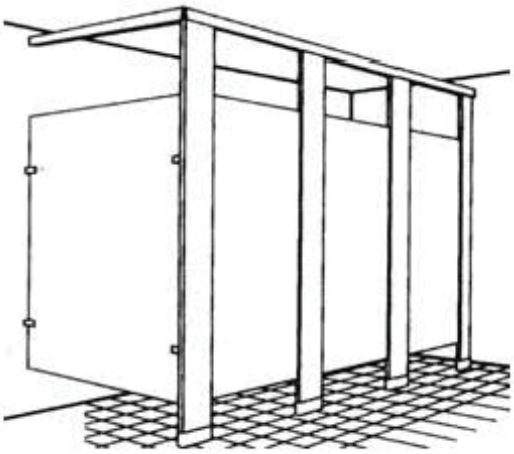
How to Clean CLIPSO Fabric?

Apply the CLIPSO Cleaner to the microfiber glove (or a soft cloth) and rub gently. If the stain persists, you may repeat this process several times.

Under no circumstance should products containing bleach be used.

CLIPSO does not warranty its products if foreign cleaning substances are applied which may cause discoloration or impact the integrity of the fabric.

CARE AND MAINTENANCE



To provide solid plastic toilet partitions with the proper care and maintenance, the following instructions must be followed:

All surfaces should be cleaned with a mild liquid soap only. The finish should then be wiped and dried. In areas containing showers, either self-contained or tiled-in units, the partitions in these rooms must receive ventilation from the outside so that excess humidity can escape.

Under no circumstance should the following agents be used:

- Abrasive powders or scouring pads
- Water closet cleaners
- Ceramic tile cleaners
- Solutions containing more than 1% by volume of ammonia
- Solutions containing acids or lye
- Solutions containing enzymes

If the above instructions are adhered to, our product provides years of dependable service. Global Partitions shall not accept responsibility for product failure if the above instructions are not followed.

Advisory Bulletin

BOBRICK
BUILDING VALUE SINCE 1906

TB-21 Stainless Steel Cleaning and Maintenance

Always: Wipe or polish with the grain direction of satin finishes.

Remove any cleaning or soap residue from stainless surface with water and wipe dry with clean cloth.

Caution: Avoid cleaning products containing bleach, hydrochloric acids and or chlorides . . . these are frequently found in toilet bowl or tile cleaners and in abrasive scrubbing powders.

Avoid use of steel wool which can leave behind fine particles that cause surface rust.

Avoid use of abrasive cleaners on bright polish stainless steel surfaces.

CONDITION	CLEANING AGENT	METHOD OF APPLICATION
Dirt, smudges, and fingerprints	Use mild cleaning solution or stainless steel cleaners.	Apply cleaner. Wipe off soil using a cloth or sponge for smooth surfaces and a soft brush for textured surfaces. Rinse and dry.
Graffiti	Bobrick Graffiti Remover, part #891099 or equivalent.	Apply cleaner, rub spots with soft cloth or sponge. Rinse and dry.
Stubborn spots, atmospheric discoloration	Liquid or spray stainless steel polish.	As recommended by manufacturer. Rinse or dry.
Mineral deposit or scale from hard water	Bathroom cleaners containing phosphoric acid or acetic acids.	Apply liberally, allow to stand for a few minutes; scrub with coarse toweling or soft bristle brush in direction of grain. Rinse and dry.
"Rust" discoloration resulting from exposure to harsh environmental and or chemical conditions	Appropriate cleaner listed above, plus 3M Scotch Brite pad #7447or equivalent.	Clean surface as above, then rub stained area lightly with 3M Scotch Brite pad. Clean with stainless steel polish. Rinse and dry. Rub only with the grain direction of satin finishes. . . do not use on bright polish stainless steel.

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CLEANING INSTRUCTIONS - METAL CABINETS

- Our cabinets by are designed to be maintenance free. However, it is recommended that the outer surface of the cabinet, and the hinge area, be kept clear from debris and dirt, to ensure correct operation of the hinged door.

- If latches, locks or hinges need to be lubricated, use a “3 in 1” type light oil, removing excess with a cloth.

Finish	Description	Cleaning & Maintenance
Painted Steel	Baked-on Powder Coat Paint	Use a soft cloth and mild soap and water.
Aluminum	Aluminum Without Clear Coat	
313/315/Clear	Anodized Aluminum - Dark Bronze, Black , Clear	
US3	Polished Clear Coated Brass	Use a soft cloth and mild soap and water. Never use brass polish or an abrasive cleaner unless you intend to remove all lacquer and totally refinish the product.
US4	Satin Clear Coated Brass	
US9	Polished Clear Coated Bronze	
US10	Satin Clear Coated Bronze	
US10B	Oxidized & Oiled Bronze	Use a soft cloth and a paste furniture wax. Buff lightly so as not to remove the dark oxide coating where it remains.
US32	Polished Stainless Steel	Use a soft cloth and mild soap and water solution. After cleaning, thoroughly rinse with clear water to remove all traces of the solution and wipe dry to prevent water marks from forming. Stains which resist that treatment can usually be removed by polishing in the direction of the grain with a soft cloth and a non-abrasive stainless steel polish. Test in an unobtrusive area.
US32D	Satin Stainless Steel	

CLEANING INSTRUCTIONS - METAL CABINETS

HEADQUARTERS & CUSTOMER SERVICE:4450 WEST 78TH ST CIRCLE, BLOOMINGTON, MN 55435-5416
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ACPG WAREHOUSES: DALLAS TX, LANCASTER PA, ATLANTA GA, CHICAGO, IL, SEATTLE WA 1-5-2011

INTRODUCTION

Anyone who might be expected to use this fire extinguisher should study and understand the information in this manual. Please read it completely and keep it accessible so that it may be reviewed on a periodic basis. OSHA requires training of personnel who might be expected to use an extinguisher in the case of an emergency. Familiarity with this manual and the instruction nameplate on the extinguisher will contribute to successful use of the extinguisher. You should know just what it CAN and CANNOT do, where it is located, how to use it and how to maintain it. Proper and effective use of any fire extinguisher begins with an understanding of the classes of fire. Extinguishers are tested and rated for certain classes and sizes of fires. Some are rated for single classifications, some for multiple classifications and others constitute a hazard if used on certain types of fires.

TYPES AND CLASSES OF FIRES

CLASSES OF FIRES	TYPES OF FIRES	PICTURE SYMBOL
A	Wood, paper, cloth, trash and other ordinary materials	
B	Gasoline, oil, paint and other flammable liquids	
C	May be used on fires involving live electrical equipment without danger to the operator	
D	Combustible metals and combustible metal alloys.	
K	Cooking media (Vegetable or animal oils and fats)	

IMPORTANT THINGS TO REMEMBER!

NEVER DISCHARGE A FIRE EXTINGUISHER INTO ANYONE'S FACE

NEVER THROW AN EXTINGUISHER INTO THE FIRE OR LEAVE IT UNATTENDED IF THE FIRE IS NOT OUT
(Pressure build-up could cause an explosion from even a partially full extinguisher)

KEEP FIRE EXTINGUISHERS AWAY FROM CHILDREN

Water, Water Mist and AFFF and FFFP Foam Extinguishers

The above referred to models are shipped EMPTY – they must be filled and pressurized before being placed into service.

Model 240 – To protect your investment, charge using the Amerex Model 507 Corrosion Inhibitor if your water contains more than 40 P.P.M. of chlorides.

Model 240, 250, 252, 254 – Never use involving live electrical equipment. The nameplate on the extinguishers have the international red slash across the Class C symbol designating the hazard of using them where electricity is involved.

Model B270, B272 – Water Mist Extinguishers must be charged using deionized water to avoid contaminates. These extinguishers are UL Listed for **Class A and Class C fires.**

Never use Water Mist, Water, AFFF or FFFP Foam extinguishers for fires in cooking media. The water in all could flash to steam due to the extremely high temperatures and cause serious burns.

Only the Model 252 FFFP Foam may be used for fires involving water based flammable liquids such as alcohols or ketones.

DO NOT SUBJECT ANY OF THE EXTINGUISHERS IN THIS GROUP TO CONDITIONS WHERE THEY MIGHT FREEZE.

NOTE: Only the Model 240 2½ gallon water extinguisher may be chemically freeze protected to -40º F with the addition of an Amerex Model 506 charge. The 506 is not designed to protect Water Mist, Wet Chemical, AFFF or FFFP Foam extinguishers.

DRY CHEMICAL, DRY POWDER (CLASS D), HALOTRON I, HALON 1211, WET CHEMICAL (CLASS K) AND CARBON DIOXIDE EXTINGUISHERS

These extinguishers are shipped factory charged. **Do not test your extinguisher** since even a small amount of discharge could cause it to lose pressure making it less effective or useless in case of a fire.

Dry chemicals are non-poisonous but either the acidic based (ABC) or alkaline based (Regular or Purple K) chemicals could be an irritant if inhaled. If any physical discomfort is experienced, contact a physician immediately.

Dry chemical is not recommended for fires in delicate electrical equipment or aircraft. Use of this agent may extinguish the fire but may damage the equipment beyond repair.

Neither Halotron I nor Halon 1211 should be used in confined areas smaller than indicated on the extinguisher nameplate, food preparation areas or in the presence of people with cardiac problems. If problems occur, quickly remove the person from the area where the gas is present, apply artificial respiration and transport to a physician.

Never use ABC dry chemical, Halon 1211 or Halotron I fire extinguishers on fires involving chlorine containing oxidizers (example: pool chemicals). A violent explosive reaction could occur with the mixture of chemicals.

Wet Chemical (Class K) Extinguishers are approved for use for fires involving cooking media. Do not subject these extinguishers to conditions where they might freeze

Carbon Dioxide is discharged as a gas (with small particles of snow) at extremely low temperatures and will displace oxygen. Care should be exercised in confined areas. If problems occur, quickly remove the person from the area where the gas is present, apply artificial respiration and transport to a physician. Avoid skin contact which could cause cold burns.

NOTE: As required by OSHA, Material Safety Data Sheets (MSDS) are available for all chemicals contained in these fire extinguishers. Contact your Amerex distributor or Amerex Corporation. In addition, the MSDS information is contained in a special section of all extinguisher labels. All MSDS are available on the Amerex website at www.amerex-fire.com.

MONTHLY

INSPECTION RECORD

FASTEN TO EXTINGUISHER BEFORE INSTALLATION

DO NOT REMOVE

FOLLOW THE INSPECTION INSTRUCTIONS IN OWNER'S MANUAL AND ON THE EXTINGUISHER

Date	Inspected By	Condition

HAVE YOUR EXTINGUISHER PROFESSIONALLY MAINTAINED AND RECHARGED

RECHARGE AFTER ANY USE

IMPORTANT NOTICE TO BOAT OWNERS

If the extinguisher is to be mounted in your boat, make sure that the proper mounting bracket is used. The nameplate (in the area of the UL manifest) says if it is Coast Guard approved and the mounting bracket which MUST be used to complete the approval. You will be cited by the Coast Guard if the correct type of extinguisher and bracket has not been installed.

INSPECTION RECORD
Model No: _____
Serial No: _____
Mfg. Date: _____
Date Installed New: _____

INSPECTION should be performed monthly or more frequently if circumstances dictate. The extinguisher should be checked to see that it is not damaged, the discharge outlet is not blocked, that it is fully charged, the seal is not broken and that the operating instructions are clearly visible.

ANNUAL MAINTENANCE is a more complete inspection of the extinguisher and should be done professionally. It will reveal the need for hydrotesting which must be done on Water Mist, Water, Wet Chemical, Foam and Carbon Dioxide every FIVE YEARS and Dry Chemical, Dry Powder, Halotron I and Halon 1211 extinguishers every TWELVE YEARS. Most local authorities require special tags be attached to the extinguisher to verify this service.

SIX YEAR MAINTENANCE – Every six years extinguishers requiring a 12 year hydrotest shall be emptied and subject to thorough examination of mechanical parts, extinguishing agent and expelling means. When applicable maintenance procedures are done during periodic recharging or hydrotesting, the six year requirement will begin from that date.

RECHARGE should be done professionally immediately after any use by your local Amerex Distributor who has the trained personnel, extinguishing agents and equipment to do it properly. This extinguisher must be recharged with the extinguishing agent specified on the nameplate. Substitutions could cause damage or injury **and will void the warranty.**

DISTRIBUTED BY:

INSTALLATION & DISTRIBUTION

Install, inspect, maintain and test your fire extinguisher in accordance with the National Fire Protection Assoc. Standard 10 "'Portable Fire Extinguishers".

Your fire extinguisher should be mounted in a clean dry area, accessible to possible fire hazards and preferably near an exit. Mount it so that the top is from 3 ½ to 5 feet above the floor and out of the reach of small children.

Use the mounting bracket furnished with the extinguisher or an approved Amerex vehicle bracket if required. Fasten to a solid surface using strong screws or fasteners (not included).

Follow the Mounting Instructions below, particularly in public areas where the extinguisher might be accidentally dislodged from the bracket or have objects placed on it.

MOUNTING INSTRUCTIONS

UL specifies that a hanging device must withstand a vertical force of five times the weight of the charged extinguisher but not less than 100 pounds. The extinguisher bracket should be mounted as follows:

Walls where 2"x4" studs can be found – ALL SIZES: Mount wall hanger bracket securely to stud using two #10 x 1¼" long wood screws through the diagonal smaller holes in the bracket.

Sheetrock – ALL SIZES: Mount a ¾" thick board to the wall using 3/16" toggle bolts – height and width of the board is dependent on extinguisher size. The board should extend a minimum of two inches beyond all sides of the extinguisher profile (excluding hose and horn). Mount wall hanger bracket to board using two #10 x 1" long wood screws as above.

Cinderblock or Cement – ALL SIZES: Mount wall hanger bracket using one ¼" toggle bolt or masonry lead screw expansion anchor through center hole in the bracket. Mount vehicle/marine strap type brackets using two 3/16" toggle bolts or #10 lead screw expansion anchors.

Concrete or Tile Wall – ALL SIZES – Mount wall hanger bracket using one ¼" masonry lead screw expansion anchor through center hole in wall bracket. Mount vehicle/marine strap type brackets using two No. 10 masonry lead screw expansion anchors.

Steel Posts or Beams – ALL SIZES: Special tools and fasteners are required – have extinguisher mounted by a professional fire extinguisher service company.

Tile Walls: Locate in joint.

INSPECTION

Your extinguisher should be inspected monthly, checking for any possible damage, corrosion, leakage or obstructions in the discharge outlet. The tamper seal should be unbroken. The extinguisher should be cleaned so that the instructions on the label are always clearly visible. **Carbon Dioxide** extinguishers should be weighed and the weight verified to be within the tolerances specified on the nameplate (label). **Water Mist, Water, Wet Chemical, Foam, Dry Chemical,** Dry Powder, **Halotron I and Halon 1211** extinguisher pressure gauges should be checked. The indicator will vary slightly due to temperature, but should always be in the GREEN area if it is fully pressurized. Heft or weigh the extinguisher to determine fullness.

IN CASE OF FIRE

1. Have everyone evacuate the area immediately.
2. Call the Fire Department even if the fire appears to be small (small fires quickly become LARGE fires). The Fire Dept. phone number should be posted at every phone.
3. Use your extinguisher properly, according to the instructions on the nameplate and in this manual. A large fire should be fought by professionals. Be prepared to leave the area if the fire cannot be immediately controlled.

HOW TO USE

NOTE: The following instructions are of a general nature, intended to familiarize the user with the basic operating techniques of Amerex hand portable extinguishers. **All operate by removing the ring (safety) pin and squeezing the handles together.** Since extinguishers differ, the extinguisher nameplate must be consulted for specific procedures and starting distances.

1. Hold the extinguisher upright and pull the ring (safety) pin breaking the plastic seal.
2. Stand back from the fire (the minimum distance stated on the nameplate) and aim at the base of the fire nearest you.
3. Keeping the extinguisher upright, squeeze the handles together to discharge and sweep from side to side. Move closer as the fire is extinguished but not so close as to scatter the burning material or liquid.
4. When the fire is out, back away while watching for possible re-ignition.
5. Evacuate and ventilate the area immediately after use. The fumes and smoke from any fire may be hazardous and can be deadly.

NOTE: Whenever possible, protective clothing and breathing equipment should be used while fighting a fire.

1. HOLD EXTINGUISHER UPRIGHT AND PULL THE RING (SAFETY) PIN



2. STAND BACK FROM THE FIRE AND AIM AT THE BASE OF THE FIRE NEAREST YOU



3. SQUEEZE HANDLES TOGETHER & SWEEP THE EXTINGUISHER STREAM SIDE TO SIDE



REMEMBER THIS SIMPLE WORD – P A S S

PULL AIM SQUEEZE SWEEP

OWNER'S MANUAL
for
HAND PORTABLE
Water & Water Mist
Wet Chemical (Class K)
AFFF & FFFP Foam
Dry Chemical
Dry Powder (Class D)
Carbon Dioxide
Halotron I
Halon 1211
FIRE EXTINGUISHERS



AMEREX LIMITED 6 YEAR WARRANTY *

Amerex warrants its fire extinguishers to be free from defects in material and workmanship for a period of six (6) years from the date of purchase. During the warranty period, any such defects will be repaired or the defective extinguisher replaced IF THE ORIGINAL GREY TAMPER SEAL IS INTACT AND/OR IF ONLY FACTORY REPLACEMENT PARTS HAVE BEEN USED TO SERVICE THE EXTINGUISHER. This warranty does not cover defects resulting from modification, alteration, misuse, exposure to corrosive conditions, improper installation or maintenance.

ALL IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO, WARRANTIES OF FITNESS FOR PURPOSE AND MERCHANTABILITY, ARE LIMITED TO THE TIME PERIODS STATED ABOVE. IN NO EVENT SHALL AMEREX CORP. BE LIABLE TO INCIDENTAL OR CONSEQUENTIAL DAMAGES.

Some states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you. Amerex Corp. neither assumes nor authorizes any representative or other person to assume for it, any obligation or liability other than expressly set forth herein. This warranty gives you specific legal right and you may have other rights, which vary from state to state. To obtain performance of the obligation of this warranty, write to Amerex Corp.,P. O. Box 81, Trussville, AL 35173-0081 for instructions.

*One year warranty on HALOTRON I and HALON 1211

AMEREX CORPORATION
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OPERATOR AND SERVICE MANUAL



POWERHEART® AED

G3 PLUS 9390A AND 9390E

70-00914-01 F

CARDIAC science

AT THE HEART OF SAVING LIVES®

Information in this document is subject to change without notice. Names and data used in the examples are fictitious unless otherwise noted.

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Patents

This device is covered by the following U.S. and foreign patents:

5,792,190; 5,999,493; 5,402,884; 5,579,919; 5,749,902; 5,645,571; 6,029,085; 5,984,102; 5,919,212; 5,700,281; 5,891,173; 5,968,080; 6,263,239; 5,797,969; D402,758; D405,754; 6,088,616; 5,897,576; 5,955,956; 6,083,246; 6,038,473; 5,868,794; 6,366,809; 5,474,574; 6,246,907; 6,289,243; 6,411,846; 6,480,734; 6,658,290; 5,850,920; 6,125,298; EP0725751; EP0757912; EP00756878

Other U.S. and foreign patents pending.

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Limited Warranty

Limited Warranty

Cardiac Science Corporation ("Cardiac Science") warrants to the original purchaser that its AEDs and stated battery operating life will be free of any defect in material and workmanship according to the terms and conditions of this Limited Warranty ("Limited Warranty"). For purposes of this Limited Warranty, the original purchaser is deemed to be the original end user of the product purchased. This Limited Warranty is NONTRANSFERABLE and UNASSIGNABLE.

For How Long?

This Limited Warranty covers the following products or parts for the following time periods:

1. Seven (7) years from the date of the original shipment to the original purchaser for Powerheart AED automated external defibrillators. Warranty duration for the pads, batteries and accessories are covered below.
2. Disposable defibrillation pads shall be warranted until the expiration date.
3. Lithium batteries P/N (9146) have a full operational replacement guarantee of four (4) years from the date of installation into a Powerheart AED.
4. One (1) year from the date of original shipment to the original purchaser for Powerheart AED accessories. The terms of the Limited Warranty in effect as of the date of original purchase will apply to any warranty claims.

What You Must Do:

Please complete and submit the Product Registration online at http://www.cardiacscience.com/services-support/product-registration/.

To obtain warranty service for your product:

Inside the US, call us toll free at 800.426.0337 seven days a week, 24 hours a day. Our technical support representative will try to resolve your issue over the phone. If necessary, and at our sole discretion, we will arrange for service or a replacement of our product.

Outside the US, contact your local Cardiac Science representative.

What We Will Do:

If your Cardiac Science product is returned within 30 days of the date it was purchased, at the direction of a technical support representative, we will repair or replace it with a new product of equal value at no charge to you or offer a full refund of the purchase price, provided the warranty applies. Cardiac Science retains the exclusive right to repair or replace the product or offer a full refund of the purchase price at its sole discretion. SUCH REMEDY SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.

If your Cardiac Science product is returned, at the direction of a technical support representative, after 30 days but within the warranty period, Cardiac Science, at its sole discretion, will repair your product or replace it. The repaired or replacement product will be warranted subject to the terms and conditions of this Limited Warranty for either (a) 90 days or (b) the remainder of the original warranty period, whichever is longer, provided the warranty applies and the warranty period has not expired.

Obligations and Warranty Limits:

Limited Warranty Obligation: Exclusive Remedy

THE FOREGOING LIMITED WARRANTY IS IN LIEU OF AND SPECIFICALLY EXCLUDES AND REPLACES ALL OTHER EXPRESSED OR IMPLIED WARRANTIES INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Some states do not allow limitations on how long an implied warranty lasts, so this limitation may not apply to you.

NO PERSON (INCLUDING ANY AGENT, DEALER, OR REPRESENTATIVE OF CARDIAC SCIENCE) IS AUTHORIZED TO MAKE ANY REPRESENTATION OR WARRANTY CONCERNING CARDIAC SCIENCE PRODUCTS, EXCEPT TO REFER PURCHASERS TO THIS LIMITED WARRANTY.

YOUR EXCLUSIVE REMEDY WITH RESPECT TO ANY AND ALL LOSSES OR DAMAGES RESULTING FROM ANY CAUSE WHATSOEVER SHALL BE AS SPECIFIED ABOVE. CARDIAC SCIENCE SHALL IN NO EVENT BE LIABLE FOR ANY SPECIAL, PUNITIVE, INDIRECT, CONSEQUENTIAL OR INCIDENTAL DAMAGES OF ANY KIND, INCLUDING, BUT NOT LIMITED TO, EXEMPLARY DAMAGES, COMMERCIAL LOSS FROM ANY CAUSE, BUSINESS INTERRUPTION OF ANY NATURE, LOSS OF PROFITS OR PERSONAL INJURY OR DEATH, EVEN IF CARDIAC SCIENCE HAS BEEN ADVISED OF THE POSSIBILITIES OF SUCH DAMAGES, HOWEVER OCCASIONED, WHETHER BY NEGLIGENCE OR OTHERWISE.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

What This Warranty Does Not Cover:

This Limited Warranty does not cover defects or damages of any sort resulting from, but not limited to, accidents, damage while in transit to our service location, product tampering, unauthorized product alterations, unauthorized service, unauthorized product case opening, failure to follow instructions, improper use, abuse, neglect, fire, flood, war or acts of God. Cardiac Science makes no warranty claim as to the compatibility of Cardiac Science products with any non-Cardiac Science products, parts or accessories.

This Limited Warranty is Void if:

1. Any Cardiac Science product is serviced or repaired by any person or entity other than Cardiac Science unless specifically authorized by Cardiac Science.
2. Any Cardiac Science product case is opened by unauthorized personnel or if a product is used for an unauthorized purpose.
3. Any Cardiac Science product is used in conjunction with incompatible products, parts or accessories, including but not limited to batteries. Products, parts and accessories are not compatible if they are not Cardiac Science products intended for use with the Powerheart AED.

If The Warranty Period has Expired:

If your Cardiac Science product is not covered by our Limited Warranty:

Inside the US, call us toll free at 1-800-426-0337 for advice as to whether we can repair your Powerheart AED, and for other repair information, including charges. Charges for non-warranty repairs will be assessed and are your responsibility. Upon completion of the repair, the terms and conditions of this Limited Warranty shall apply to such repair or replacement product for a period of 90 days.

Outside the US, contact your local Cardiac Science representative.

This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state.

1 Product Information and Safety

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Before Operating the Powerheart G3 AED:

- Become familiar with the various safety alerts in this section.
- Safety alerts identify potential hazards using symbols and words to explain what could potentially harm you, the patient, or the Powerheart G3 AED.

Contact information

Inside the United States:

To order additional Powerheart G3 AEDs or accessories, contact Cardiac Science Customer Care:

- Toll Free (USA): 1.800.426.0337 (option 2)
- Telephone: +1.262.953.3500 (option 2)
- Fax: +1.262.953.3499
- Email: care@cardiacscience.com

Cardiac Science provides 24-hour telephone technical support. You can also contact Technical Support though fax or email.

There is no charge to the customer for a technical support call. Please have the serial and model numbers available when contacting Technical Support. (The serial and model numbers are located on the underside of the AED.)

- Toll Free (USA): 1.800.426.0337 (option 1)
- Telephone: +1.262.953.3500 (option 1)
- Fax: +1.262.798.5236
- Email: techsupport@cardiacscience.com
- Web site: www.cardiacscience.com

Outside the United States:

Contact your local Cardiac Science representative to order devices or accessories and to receive technical support for your AED products.

Defibrillator tracking

Defibrillator manufacturers and distributors are required, under the Safe Medical Devices Act of 1990, to track the location of defibrillators they sell. Please notify Cardiac Science Technical Support in the event that your defibrillator is sold, donated, lost, stolen, exported, destroyed or if it was not purchased directly from Cardiac Science or an authorized dealer.

Product models

This manual is for Powerheart G3 Plus model 9390E and Powerheart G3 Plus Automatic 9390A AED models. They share a basic set of features and differences are noted throughout the manual.

Product references

For purposes of retaining simple, clear instructions in this manual, note the product references used. Features, specifications, operating instructions and maintenance common to product models will be referred to as:

"Powerheart G3 AED", "AED", or "device" refers to both Powerheart G3 model 9390E and Powerheart G3 Automatic model 9390A AEDs unless otherwise noted.

Warranty information

The Powerheart G3 AED *Operator and Service Manual* and any and all information contained herein (except for the *Limited Warranty* chapter) do not constitute any warranty as to the Powerheart G3, Powerheart G3 Automatic or any related products in any manner whatsoever. The *Limited Warranty* chapter in this manual serves as the sole and exclusive warranty provided by Cardiac Science regarding Powerheart G3 AED products.

Safety terms and definitions

The symbols shown below identify potential hazard categories. The definition of each category is as follows:



DANGER

This alert identifies hazards that will cause serious personal injury or death.



WARNING

This alert identifies hazards that may cause serious personal injury or death.



Caution

This alert identifies hazards that may cause minor personal injury, product damage, or property damage.

Safety alert descriptions

The following is a list of Powerheart G3 AED safety alerts that appear in this section and throughout this manual.

Read and understand these safety alerts before operating the AED.



Caution: Read this Operator and Service Manual carefully.

It contains information about your safety and the safety of others. Become familiar with the controls and how to use the AED properly before operating the product.



DANGER! Fire and Explosion Hazard

To avoid possible fire or explosion hazard, do not operate the AED:

- In the presence of flammable gases
- In the presence of concentrated oxygen
- In a hyperbaric chamber



WARNING! Shock Hazard and Possible Equipment Damage

Defibrillation shock current flowing through unwanted pathways is potentially a serious electrical shock hazard and potential damage to the equipment. To avoid this hazard during defibrillation abide by all of the following:

- Do not use in standing water or rain. Move patient to dry area
- Do not touch the patient, unless performance of CPR is indicated
- Do not touch metal objects in contact with the patient
- Keep defibrillation pads clear of other pads or metal parts in contact with patient
- Disconnect all non-defibrillator proof equipment from the patient before defibrillation



WARNING! Battery is Not Rechargeable.

Do not attempt to recharge the battery. Any attempt to recharge the battery may result in an explosion or fire hazard.



WARNING! Possible Radio Frequency (RF) Susceptibility.

Radio-frequency (RF) interference from devices such as cellular phones and two-way radios can cause improper AED operation. The AED should be used at least 6 feet (2 meters) away from RF devices, as stated in accordance with EN 61000-4-3:2002.



WARNING! Possible Interference with Implanted Pacemaker.

Therapy should not be delayed for patients with implanted pacemakers and a defibrillation attempt should be made if the patient is unconscious and not breathing. The AED has pacemaker detection and rejection, however with some pacemakers the AED may not advise a defibrillation shock. (Cummins, R., ed., Advanced Cardiac Life Support; AHA (1994): Ch. 4)

When placing Pads:

- Do not place the pads directly over an implanted device.
- Place the pad at least one inch from any implanted device.



WARNING! Electromagnetic Compatibility.

Use of accessories or cables other than those specified, with the exception of accessories and cables sold by Cardiac Science Corporation as replacement parts for internal components, may result in increased emissions or decreased immunity of the AED.



WARNING! Improper Equipment Placement.

Position the AED away from other equipment. If it is necessary to use the AED adjacent to or stacked with other equipment, then observe the AED to verify normal operations.



Caution: Restricted Use.

Federal law restricts this device for sale by or on the order of a physician or practitioner licensed by law of the state in which he/she practices.



Caution: Lithium Sulfur Dioxide Battery.

Pressurized contents: never recharge, short circuit, puncture, deform, or expose to temperatures above 65°C (149°F). Remove the battery when discharged.



Caution: Battery Disposal.

Recycle or dispose of the lithium battery in accordance with all federal, state and local laws. To avoid fire and explosion hazard, do not burn or incinerate the battery.



Caution: Use only Cardiac Science Approved Equipment.

Using batteries, pads, cables, or optional equipment other than those approved by Cardiac Science may cause the AED to function improperly during a rescue.



Caution: Possible Improper AED Performance.

Using pads that are damaged or expired may result in improper AED performance.



Caution: Serial Communication Cable.

The AED will not function during a rescue when the serial communication cable is connected to its serial port. When the serial communication cable is connected to the AED during a rescue, the prompt "Remove Cable to Continue Rescue" will be heard until you remove the serial communication cable.



Caution: Moving the Patient During a Rescue.

During a rescue attempt, excessive jostling or moving of the patient may cause AEDs to improperly analyze the patient's cardiac rhythm. Stop all motion or vibration before attempting a rescue.

Caution: Systems Statement.

Equipment connected to the analog and digital interfaces must be certified to the respective IEC standards (i.e. IEC 60950 for data processing equipment and IEC 60601-1 for medical equipment).

Furthermore, all configurations shall comply with the system standard IEC 60601-1-1. Anybody who connects additional equipment to the signal input part or signal output part configures a medical system, and is therefore, responsible that the system complies with the requirements of the system standard IEC 60601-1-1.

Caution: Equipment Malfunction.

Portable and RF communications equipment may affect the AED. Always observe the recommended separation distances as defined in the EMC declaration tables.

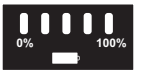
Caution: Equipment Malfunction.

The AED requires special precautions regarding EMC. Use the AED according to the guidelines of the EMC declaration tables.

Symbol descriptions

The following symbols may appear in this manual, on the AED, or on its optional components. Some of the symbols represent standards and compliances associated with the AED and its use.

Symbol	Description	Symbol	Description
	Caution. Consult accompanying documentation.		Additional information is provided in the AED Operation and Service Manual.

Symbol	Description	Symbol	Description
	Dangerous Voltage: The defibrillator output has high voltage and can present a shock hazard. Please read and understand all safety alerts in this manual before attempting to operate the AED.		Defibrillator Proof Type BF Equipment: The AED, when connected to the patient's chest by the pads, can withstand the effects of an externally applied defibrillation shock.
IP24	The AED is protected against the effects of splashing water in accordance with IEC 60529.		Do not recharge battery.
	Classified by CSA International with respect to electric shock, fire and mechanical hazards only in accordance with CAN/CSA C22.2 No.60601-1:08, EN60601-1 and EN60601-2-4. Certified to CAN/CSA Standard C22.2 No. 60601-1:08.		
	Symbol for ON. Open the lid to turn on the AED.		Indicates the AED battery status. The illuminated areas indicate the remaining battery capacity.
	Check pads. The pads are missing, not connected or have compromised functionality.		Indicates AED requires maintenance by authorized service personnel.
	When the SHOCK indicator is lit, press this button to deliver a defibrillation shock.		Serial communication port

Symbol	Description	Symbol	Description
	A red indicator with a BLACK X means the AED requires operator attention or maintenance, and is not Rescue Ready.		A green indicator without a BLACK X means the AED is Rescue Ready.
	Date of manufacture: year and month.		Date of factory recertification (R): year and month.
	Latex free. Not made with natural rubber latex.		Disposable. Single patient use only.
	Tear here to open.		Position of pads on the chest of patient.
	For use by or on the order of a Physician, or persons licensed by state law.		Separate one pad from blue liner by peeling from the tabbed corner.
	Do not incinerate or expose to open flame.		
	Upper and lower operating temperature limits.		Use pads by this date.
SN	Serial Number	REF	Device model number; battery model number

Symbol	Description	Symbol	Description
MODEL	Device model number; battery model number	LOT	Lot number
$LiSO_2$	Lithium sulfur dioxide	EC REP	Authorized representative in the European Community
CE 0086	CE Mark: This equipment conforms to essential requirements of the Medical Device Directive 93/42/EEC.		Manufacturer
	Waste Electronic Electrical Equipment (WEEE). Separate collection for waste electrical and electronic equipment.	Pb	Waste Electronic Electrical Equipment (WEEE) containing lead. Separate collection for waste electrical and electronic equipment.
	Recycle cardboard according to local law.		Dispose of properly in accordance with all state, province, and country regulations.

Electromagnetic emissions standards compliance

Guidance and manufacturer's declaration—electromagnetic emissions

The AED is intended for use in the electromagnetic environment specified below. The customer or the user of the AED should assure that it is used in such an environment.

Emissions test	Compliance	Electromagnetic environment—guidance
RF emissions CISPR 11	Group 1	The AED uses RF energy only for its internal function. Therefore its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.

Emissions test	Compliance	Electromagnetic environment—guidance
RF emissions CISPR 11	Class B	The AED is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Not applicable	
Voltage fluctuations/flicker emissions IEC 61000-3-3	Not applicable	

Guidance and manufacturer's declaration—electromagnetic immunity

The AED is intended for use in the electromagnetic environment specified below. The customer or the user of the AED should assure that it is used in such an environment.

Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment—guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	Not applicable	
Surge IEC 61000-4-5	±1 kV differential mode ±2 kV common mode	Not applicable	

Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment—guidance
Voltage dips, short interruptions and voltage variations on power supply input lines 61000-4-11	<5% U_T (>95% dip in U_T) for 0.5 cycle 40% U_T (60% dip in U_T) for 5 cycles 70% U_T(30% dip in U_T) for 25 cycles <5% U_T(>95% dip in U_T) for 5 sec.	Not applicable	
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	80 A/m	Power frequency magnetic fields should be at levels no higher than those characteristic of a typical location in typical heavy industrial and power plants and the control rooms of H.V. sub-stations.

Note: U_T is the a.c. mains voltage prior to application of the test level.

Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment—guidance
Conducted RF	3 Vrms	Not Applicable	
IEC 61000-4-6	150 kHz to 80 MHz outside ISM bands[a]		
	10 Vrms	Not Applicable	
	150 kHz to 80 MHz in ISM bands[a]		

Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment—guidance
			Portable and mobile RF communications equipment should be used no closer to any part of the AED, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.
			Recommended separation distance
Radiated RF	10 V/m	10 V/m	$d = 1.2 \sqrt{P}$ 80 MHz to 800 MHz
IEC 61000-4-3	80 MHz to 2.5 GHz		$d = 2.3 \sqrt{P}$ 800 MHz to 2.5 GHz
			where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m)[b].

Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment—guidance
			Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,[c] should be less than the compliance level in each frequency range.[d] Interference may occur in the vicinity of equipment marked with the following 

NOTE 1At 80 MHz and 800 MHz, the higher frequency range applies.

NOTE 2These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

a The ISM (industrial, scientific and medical) bands between 150 kHz and 80 MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 to 40.70 MHz.

b The compliance levels in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2.5 GHz are intended to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into patient areas. For this reason, an additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in these frequency ranges.

c Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the AED is used exceeds the applicable RF compliance level above, the AED should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the AED.

d Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 1 V/m.

Recommended separation distances between portable and mobile RF communications equipment and the AED

The AED is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the AED can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the AED as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter W	Separation distance according to frequency of transmitter m			
	150 kHz to 80 MHz outside ISM bands $d = 1.2\sqrt{P}$	150 kHz to 80 MHz in ISM bands $d = 1.2\sqrt{P}$	80 MHz to 800 MHz $d = 1.2\sqrt{P}$	800 MHz to 2.5 GHz $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.12	0.23
0.1	0.38	0.38	0.38	0.73
1	1.2	1.2	1.2	2.3
10	3.8	3.8	3.8	7.3
100	12	12	12	23

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be determined using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

NOTE 2The ISM (industrial, scientific and medical) bands between 150 kHz and 80 MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 to 40.70 MHz.

NOTE 3An additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2.5 GHz to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into patient areas.

NOTE 4These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

2 Introduction

Contents

- AED description 2-1
- Indications for use 2-2
- RHYTHMx AED ECG analysis algorithm 2-3
- Rescue protocol 2-5
- STAR® biphasic waveform 2-5
- STAR biphasic energy protocols for Powerheart G3 AEDs 2-6
- Operator training requirements 2-8

This section presents information about the AED, its use, and the training requirements for operation.

AED description

The AED is a self-testing, battery-operated automated external defibrillator (AED). After applying the AED's defibrillation pads to the patient's bare chest, the AED automatically analyzes the patient's electrocardiogram (ECG) and advises the operator to press the button and deliver a shock if needed. The AED guides the operator through the rescue using a combination of voice prompts, audible alerts, and visible indicators. For the Powerheart AED G3 Automatic, the AED automatically delivers a shock if needed.

Indications for use

Powerheart AED G3 and Powerheart AED G3 Automatic

The Powerheart AED G3 and the Powerheart AED G3 Automatic devices are intended to be used by personnel who have been trained in its operation. The user should be qualified by training in basic life support or other physician-authorized emergency medical response.

The device is indicated for emergency treatment of victims exhibiting symptoms of sudden cardiac arrest who are unresponsive and not breathing. Post-resuscitation, if the victim is breathing, the AED should be left attached to allow for acquisition and detection of the ECG rhythm. If a shockable ventricular tachyarrhythmia recurs, the device will charge automatically and advise the operator to deliver therapy (G3) or automatically deliver the charge (G3 Automatic).

When a patient is a child or infant up to 8 years of age, or up to 55 lbs (25kg), the device should be used with the Model 9730 Pediatric Attenuated Defibrillation Electrodes. The therapy should not be delayed to determine the patient's exact age or weight.

9131 Defibrillation Electrodes

Cardiac Science 9131 Defibrillation Electrodes are single use and intended to be used in conjunction with Cardiac Science automatic external defibrillators (AED) to monitor and deliver defibrillation energy to the patient.

The electrodes are intended for short term use (<8 hours) and must be used before the expiration date listed on the packaging.

The AED electrodes are used for emergency treatment of cardiac arrest patients over 8 years of age or greater than 55 pounds. The user assesses the patient’s condition and confirms that the patient is unconscious, pulseless and is not breathing prior to applying the electrodes to the skin.

RHYTHMx AED ECG analysis algorithm

The RHYTHMx™ AED ECG analysis algorithm provides ECG detection capabilities. The features available with the AED include the following:

- Detection Rate
- Asystole Threshold
- Noise Detection
- Non-Committed Shock
- Synchronized Shock
- Pacemaker Pulse Rejection
- SVT Discriminators
- Supraventricular Tachycardia (SVT) Rate

Detection rate

All ventricular fibrillation (VF) and ventricular tachycardia (VT) rhythms at or above this rate will be classified as shockable. All rhythms below this rate will be classified as non-shockable. This rate is programmable between 120 bpm (beats per minute) and 240 bpm via MDLink Software by the Medical Director. The default Detection Rate is 160 bpm.

Asystole threshold

The asystole baseline-to-peak threshold is set at 0.08 mV. ECG rhythms at or below 0.08 mV will be classified as asystole and will not be shockable.

Noise detection

The AED will detect noise artifacts in the ECG. Noise could be introduced by excessive moving of the patient or electronic noise from external sources like cellular and radiotelephones. When noise is detected, the AED will issue the prompt “ANALYSIS INTERRUPTED. STOP PATIENT MOTION” to warn the operator. The AED will then proceed to reanalyze the rhythm and continue with the rescue.

Non-committed shock

After the AED advises a shock, it continues to monitor the patient ECG rhythm. If the patient's rhythm changes to a non-shockable rhythm before the actual shock is delivered, the AED will advise that the rhythm has changed and issue the prompt "RHYTHM CHANGED. SHOCK CANCELLED." The AED will override the charge.

Synchronized shock

The AED is designed to automatically attempt to synchronize shock delivery on the R-wave if one is present. If delivery cannot be synchronized within one second, a non-synchronized shock will be delivered.

Pacemaker pulse detection

The AED contains pacemaker pulse detection circuitry to detect pulses from an implanted pacemaker.

SVT discriminators

The AED is supplied with the SVT Discriminator enabled and with the default setting "NO THERAPY FOR SVT". With the factory default setting of "NO THERAPY FOR SVT", the AED will not shock an SVT rhythm.

SVT Discriminators are sophisticated filters that analyze the morphology of the ECG waveforms and distinguish VF/VT from SVT and Normal Sinus Rhythms (NSR). The SVT Discriminator will only be applied to rhythms that fall between the Detection Rate and the SVT Rate. The factory default setting for this feature is "NO THERAPY FOR SVT", however the Medical Director can enable this feature using MDLink on the Powerheart AED.

SVT rate

All rhythms with rates between the Detection Rate and SVT Rate will be screened through a number of SVT Discriminators to classify them into VF/VT or SVT. Rhythms classified as SVT between the two set rates are not shockable. All SVT rhythms above the rates will be classified as shockable. The SVT Rate must be greater than the

Detection Rate and is selectable between 160 and 300 bpm or, “NO THERAPY FOR SVT” can be selected via MDLink Software by the Medical Director.

Rescue protocol

The AED rescue protocol is consistent with the guidelines recommended by the AHA/ERC 2010 Guidelines for Resuscitation and Emergency Cardiac Care.

Upon detecting a shockable cardiac rhythm, the AED advises the operator to press the SHOCK button (9390E only) to deliver a defibrillation shock followed by directions to perform 2 minutes of CPR.

For the Powerheart AED G3 Automatic, upon detecting a shockable rhythm, the AED will automatically deliver a defibrillation shock followed by directions to perform 2 minutes of CPR.

STAR® biphasic waveform

The STAR® Biphasic Waveform is designed to measure the patient’s impedance and deliver a customized shock. This allows the delivery of an optimized energy level to each patient. The energy levels for the Powerheart G3 AED are available in three different defibrillation shock levels.

The Ultra-Low Energy (150 VE), Low Energy (200 VE), and High Energy (300 VE) shocks are variable energy. The actual energy is determined by the patient’s impedance. See Table 2-1 on page 2-6, Table 6-2 on page 6-8, Table 6-3 on page 6-8, and Table 6-4 on page 6-9 for additional information.

STAR biphasic energy protocols for Powerheart G3 AEDs

The STAR Biphasic defibrillation waveform will deliver variable escalating energy that is customized to each patient's needs based upon a patient's thoracic impedance. This customization adjusts for the unique physical differences between patients. The Powerheart G3 AED comes equipped with five different biphasic energy protocols.

The operator, with guidance, direction, and implementation from the designated AED program Medical Director, may select from one of these five protocols when placing the Powerheart G3 AED into service. The Powerheart G3 AED's factory default energy protocol is 200-300-300 Joule (J) escalating Variable Energy (VE). The first shock is delivered within the range of 126J-260J. Subsequent shocks are delivered within a range of 170J-351J.

These protocols are selected by using the MDLink software program. The five biphasic energy protocols available are as follows:

Table 2-1: Biphasic Energy Protocols

Energy Protocols	Shock Sequence[1]	Energy Level (VE)	Energy Range[2] (J)
Factory Default	1	200	126-260
	2	300	170-351
	3	300	170-351
Protocol #2	1	200	126-260
	2	200	126-260
	3	300	170-351
Protocol #3	1	150	95-196
	2	200	126-260
	3	200	126-260

Table 2-1: Biphasic Energy Protocols (continued)

Energy Protocols	Shock Sequence[1]	Energy Level (VE)	Energy Range[2] (J)
Protocol #4	1	150	95-196
	2	150	95-196
	3	200	126-260
Protocol #5	1	200	126-260
	2	200	126-260
	3	200	126-260

[1]The Ultra-Low Energy (150 VE), Low Energy(200 VE) and High Energy(300 VE) shocks are variable energy. The actual energy is determined by the patient's impedance.

[2] Allowable energy range.

Operator training requirements

Persons authorized to operate the AED must have all of the following minimum training:

- Defibrillation training and other training as required by state, province, or country regulations
- Training on operation and use of the AED
- Additional training as required by the physician or Medical Director
- A thorough understanding of the procedures in this manual

Note: Keep valid certificates of training and certification as required by state, province, or country regulations.

3 Getting Started

Contents

- AED indicators 3-2
- Setting the AED internal clock 3-6
- RescueCoach™ voice prompts and text display 3-7

AED indicators

The following indicators are located on the AED.

Rescue Ready status indicator

The status indicator is located on the Powerheart G3 AED handle.



When this indicator is green, the AED is Rescue Ready. This means the AED self-tests have verified the following:

- Battery has an adequate charge
- Pads are properly connected to the AED and functioning
- Integrity of the internal circuitry is good



When the status indicator is red, attention is required.

1. Open the lid of the AED to troubleshoot the issue.
2. The AED may become Rescue Ready (the indicator turns green) after it runs further tests.
3. If the indicator remains red, contact Cardiac Science Technical Support (see *Contact information* on page 1-2) or outside the U.S., your local Cardiac Science representative.

Note: When the status indicator shows not Rescue Ready (the indicator is red) you might hear an intermittent beep. See *Audible maintenance indicator* for troubleshooting information.

Audible maintenance indicator

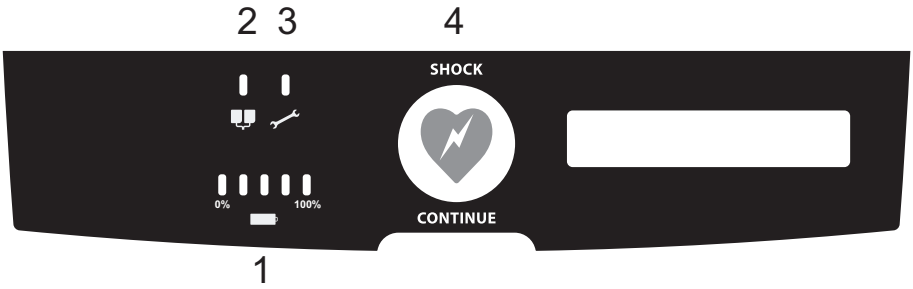
When the daily, weekly, or monthly self-test determines attention is required, a beep sounds every 30 seconds until the lid is opened or the battery power is depleted. Opening and closing the lid may deactivate the beep. If the error is not corrected by the next automatic self-test, the beep will be reactivated.

Because the beep is a general indicator that the AED is not Rescue Ready, always open the lid first and allow the AED to perform its self test. If the AED provides a voice prompt but does not change the Rescue Ready indicator to green, note the prompt and contact Cardiac

Science Technical Support (see *Contact information* on page 1-2) or outside the U.S., your local Cardiac Science representative.

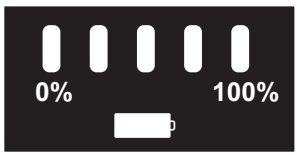
Diagnostic panel

The diagnostic panel has the following indicators:



1 Smartgauge™ battery indicator
2 Pads indicator
3 Service indicator
4 Shock Button (Powerheart G3 model 9390E only)

Smartgauge battery status indicator



The Smartgauge Battery Status Indicator has five LEDs, four green and one red. The right four green LEDs display the remaining capacity of the battery much like a fuel gauge. With use, the green LEDs gradually go out, from right to left, as battery capacity decreases. When the green LEDs go out and the red LED lights up, replace the battery.

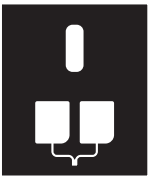
Note: When the red LED initially lights up–upon lid opening or at any time during a rescue–a BATTERY LOW prompt will be issued at once. However, the AED is capable of delivering at least 9 defibrillation shocks after the first BATTERY LOW prompt is issued.

When the AED battery cannot deliver any more shocks, the AED shows BATTERY LOW on the text display, and the red battery LED illuminates. To continue the rescue, leave the lid open, remove the battery, and replace with a fresh battery. If battery replacement takes

longer than 60 seconds, the first rescue will be terminated and a second rescue will begin upon insertion of battery.

Note: When the battery is depleted, neither the LED nor the text display illuminates.

Pads indicator



The Pads LED lights up when the pads are:

- Not properly connected to the AED
- Not within operational specifications (cold, dried, damaged)
- Disconnected from the patient during a rescue

Service indicator



The Service LED lights up when the AED detects an error that cannot be corrected by the self test. Contact Cardiac Science Technical Support (see *Contact information* on page 1-2) or outside the U.S., your local Cardiac Science representative.

Shock button

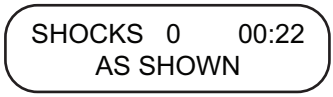


For the Powerheart G3 model 9390E only: The AED has one button called the Shock button. The word Shock and the shock button LED will illuminate red when the AED is ready to deliver a defibrillation shock to the patient.

Text display

The text display has 2 lines of text. The text display provides the operator with information regarding system initialization, text prompts and data during a rescue, and diagnostics.





System initialization occurs when the lid is first opened. The text display shows the operator the identifiers for the internal code, voice prompts and text prompts versions. The text display also shows the current date and time.

During a rescue, the text display shows the number of shocks delivered and the elapsed time from the beginning of the rescue (when the lid was first opened). During CPR, a countdown timer will be displayed. The text version of the voice prompts will also be displayed.

Note: There is a 3 second delay between the time the AED lid is opened and the start of the rescue. This 3 second delay is not included in the elapsed rescue time.

Setting the AED internal clock

For US models, the internal clock is preset to Central Standard Time. You can reset it to your local date and time. To set the clock, you need a Windows XP or newer PC, Rescuelink software installed, and the AED serial cable connected to the PC.

To set the clock:

1. Ensure that the PC is set at the correct local time and date.
2. Open the lid of the AED and run the Rescuelink software on the PC.
3. Connect the cable to the serial port on the AED.
4. Verify that the voice prompt states “Communications Mode”.
5. Click Communications on the main menu. Select AED Date and Time.
6. Click on the Get button to review the current time in the AED.
7. If the time and date is incorrect, click Set to set new time and date. The AED date and time will automatically be updated to the PC’s time and date.

RescueCoach™ voice prompts and text display

The RescueCoach™ voice prompts activate when the AED lid is opened and help guide the operator through the rescue. The AED text display provides a visual display of most of the audible voice prompts.

The following tables list the voice and text prompts and a description of when the prompts are issued.

Table 3-1: Initial instructions

Voice prompt	Text display	Situation
"Stay calm. Follow these voice instructions. Make sure 911 is called now!"	CALL 911!	Plays after lid opening self test, default ON.
"Stay calm. Follow these voice instructions. Make sure Emergency Services are called now!"	CALL EMERGENCY SERVICES NOW!	Medical Director may use MDLink to select this prompt instead of "CALL 911!". MDLink also allows the emergency services and 911prompt to be disabled.

Table 3-2: Preparation

Voice prompt	Text display	Situation
"Begin by exposing patient's bare chest and torso. Remove or cut clothing if needed."	BARE PATIENT'S TORSO REMOVE CLOTHING	Prompts the rescuer to remove patient clothing.

Table 3-2: Preparation (continued)

Voice prompt	Text display	Situation
"When patient's chest and torso are exposed, remove square foil package from lid of AED."	WHEN CHEST IS BARE REMOVE FOIL PACKAGE	Prompts the rescuer to remove the pads from AED lid.
"Tear open foil package across dotted line and remove pads."	TEAR OPEN PACKAGE REMOVE PADS	Prompts the rescuer to open the pad package and remove pads.
"Next, separate one of the white pads completely from blue plastic liner. Begin peeling from the tabbed corner."	PEEL ONE PAD FROM BLUE PLASTIC LINER	Repeats every 3 seconds until the pads are separated. If a pad has been peeled before the prompt starts, this prompt will be skipped. This prompt will be interrupted when pad is peeled.
"Firmly place the pad without the liner on the patient, exactly as illustrated. This pad can be placed on either of the two locations shown."	PRESS PAD FIRMLY TO CHEST AS SHOWN	Prompts the rescuer to place one pad on the patient.
"Next, peel the blue plastic liner off of the second white pad."	PEEL SECOND PAD OFF BLUE PLASTIC LINER	Prompts the rescuer to remove the liner from the second pad.
"Firmly place the second pad on the opposite location, exactly as illustrated."	PRESS PAD FIRMLY AS SHOWN	Repeats until second pad placement is sensed. If the pad is placed before prompt starts then this prompt will be skipped. This prompt will be interrupted when second pad is placed.

Table 3-3: Analysis

Voice prompt	Text display	Situation
"Do not touch patient! Analyzing heart rhythm. Please wait."	DO NOT TOUCH PATIENT ANALYZING RHYTHM	Repeats until analysis of the patient's cardiac rhythm is completed. This prompt will be interrupted when ready to shock.
"Preparing shock. Move away from the patient!"	NO CONTACT WITH THE PATIENT	Repeats while the AED is preparing to deliver a defibrillation shock (charging).

Table 3-4: Delivering shock - Semi-automatic

Voice prompt	Text display	Situation
"Press red flashing button to deliver shock."	PRESS BUTTON TO DELIVER SHOCK	Prompts after the AED is fully charged and ready to deliver the defibrillation shock. The RED SHOCK indicator flashes and the phrase repeats for 30 seconds or until the SHOCK button is pushed.
"Shock delivered"	SHOCK DELIVERED	Prompts when the shock is delivered.

Table 3-5: Delivering shock - Fully automatic

Voice prompt	Text display	Situation
"Shock will be delivered in"	SHOCK IN:	After the AED is fully charged and ready to deliver the defibrillation shock. The SHOCK will automatically be administered approximately three seconds after the end of the voice prompt.
"Three"	THREE	Prompts approximately three seconds prior to delivering shock.
"Two"	TWO	Prompts approximately two seconds prior to delivering shock.
"One"	ONE	Prompts approximately one second prior to delivering shock.
"Shock delivered"	SHOCK DELIVERED	Prompts when the shock is delivered.

Table 3-6: CPR prompts

Voice prompt	Text display	Situation
Note: The AED is shipped from the factory with ENHANCED MODE defaulted ON. The Medical Director may modify the CPR options in MDLink. ENHANCED CPR prompts are listed in this table. Except where noted, prompts apply both to compressions-only CPR and traditional CPR (compressions and breaths).		
"It is now safe to touch the patient."	NOW SAFE TO TOUCH THE PATIENT	Advises the rescuer that it is safe to touch the patient: After the AED delivers a shock After the AED detects a non-shockable cardiac rhythm

Table 3-6: CPR prompts (continued)

Voice prompt	Text display	Situation
"When instructed, give patient 30 rapid compressions then give 2 breaths"	30 COMPRESSIONS 2 BREATHS	This prompt plays at the start of a CPR interval where the AED detects a non-shockable heart rhythm. **Note:** Prompt for traditional CPR only.
"Place heel of one hand on center of chest between nipples."	PLACE ONE HAND ON CENTER OF CHEST	Prompts rescuer to correctly place one hand for giving compressions.
"Place heel of other hand directly on top of first hand. Lean over patient with elbows straight."	PLACE OTHER HAND ON TOP OF FIRST HAND	Prompts rescuer to correctly place other hand and body for giving compressions.
"Press the patient's chest down rapidly one third depth of chest, then release"	PRESS CHEST DOWN FIRMLY	Prompts the rescuer to press down one third depth of patient's chest.
"Start CPR"	START CPR	Prompts to start CPR.
"Press" (30 times at 100/minute) (or) Metronome (30 times at 100/minute) (or) No Prompt (silence) **Note:** Option is selected in MDLink software.	{CPR COUNTER}	CPR counter shows the amount of time remaining for the CPR session.

Table 3-6: CPR prompts (continued)

Voice prompt	Text display	Situation
"Stop compressions"	STOP COMPRESSIONS	Prompts at the end of each CPR round. **Note:** Prompt for traditional CPR only, in enhanced mode.
"Give breath, give breath"	GIVE BREATH	Prompts to give two breaths to patient. **Note:** Prompt for traditional CPR only, in enhanced mode.
"Continue with compressions."	CONTINUE WITH COMPRESSIONS	Prompts in subsequent rounds of the same CPR session. **Note:** This prompt is available only in Enhanced Mode. Prompt for traditional CPR only.
"Stop CPR"	STOP CPR	Prompts to stop CPR.
"Continue CPR"	CONTINUE CPR	Prompts during the CPR interval enabled in the Standard prompt set. Prompts when lid is reopened during CPR cycle.

Table 3-7: Pad issues

Voice prompt	Text display	Situation
"Make sure pad connector is plugged into AED."	CHECK CONNECTOR IS PLUGGED INTO AED	Prompts when defibrillation pads connector is not correctly inserted into pad socket.

Table 3-7: Pad issues

Voice prompt	Text display	Situation
"Press pads firmly to patient's bare skin."	PRESS PADS FIRMLY TO BARE SKIN	Prompts when better pad connectivity to the patient's skin is required because impedance is too high.

Table 3-8: Other prompts

Voice prompt	Text display	Situation
"Battery low"	BATTERY LOW	Occurs once when the battery voltage becomes low, although a rescue can continue for approximately 9 more shocks. When the battery is too low to do a rescue, the following will occur: BATTERY LOW shows on the LCD Smartgauge battery status indicator turns red AED beeps once every 30 seconds while the lid is closed You must replace the battery before continuing with the rescue. If completely depleted, all AED activity will terminate.
"Analysis interrupted. Stop patient motion."	ANALYSIS INTERRUPTED STOP PATIENT MOTION	When the AED detects ECG noise artifact, stop moving or touching the patient. Remove other electronic devices within a 5 meter radius.
"Open lid to continue rescue."	OPEN LID TO CONTINUE RESCUE	When the lid is inadvertently closed during a rescue, this prompt will repeat for 15 seconds.

Table 3-8: Other prompts (continued)

Voice prompt	Text display	Situation
"Rhythm changed. Shock cancelled."	RHYTHM CHANGED SHOCK CANCELLED	When the device is prepared to shock then detects a change in rhythm and therefore cancels the shock.
"Remove cable to continue rescue."	REMOVE CABLE TO CONTINUE RESCUE	When a serial communication cable is connected to the AED during a rescue, the phrase repeats until the cable is disconnected.
"Communications mode"	COMMUNICATIONS MODE	When the lid is open and the serial communication cable is plugged into the AED.
"Service required"	SERVICE REQUIRED	Occurs after the self-tests determine that the AED is not functioning properly. The prompt "SERVICE REQUIRED" will be heard when the lid is opened. The red SERVICE indicator will illuminate. After closing the lid, an alarm beep will be heard until the battery is removed or becomes completely depleted.

4 Data Management

Contents

- Recording rescue data 4-1
- Reviewing rescue data 4-2

The AED is designed for ease of data management and review. The data can be downloaded from the AED and displayed on the PC screen using the Rescuelink software.

Recording rescue data

The AED automatically records Rescuelink data and can store up to 60 minutes of ECG monitoring time in its internal memory. Multiple rescues can be stored in the internal memory, allowing the rescuer to administer additional rescues without downloading the data to a PC. Should the internal memory become full, the AED will purge rescues as needed, beginning with the oldest rescue.

When downloading data, Rescuelink will enable the user to select which rescue to download. See the Rescuelink application HELP files for more information.

Reviewing rescue data

To retrieve data from internal memory:

1. Open the AED lid.
2. Connect the serial cable to the PC and to the AED's serial port under the blue rubber data access cover. The voice prompt will say "Communications Mode."
3. Run the Rescuelink software program.
4. Select Communications, Get Rescue Data.
5. Select Internal Memory of AED then select OK.
6. Select a rescue by clicking on the date and press OK.



WARNING! Electric Shock and Fire Hazard.

Do not connect any telephones or unauthorized connectors to the socket on this equipment.



Caution: Serial Communication Cable.

The serial communication cable is only for use with the AED; it is not to be used with a telephone.

5 Troubleshooting and Maintenance

Contents

- Self-tests 5-1
- Indicator troubleshooting table 5-3
- Scheduled maintenance 5-4
- Authorized repair service 5-6
- Frequently Asked Questions 5-7

This section presents information about the AED diagnostics self-tests, maintenance, and service indications.

Self-tests

The AED has a comprehensive self-test system that automatically tests the electronics, battery, pads, and high voltage circuitry. Self-tests are also activated every time you open and close the AED lid.

When performing the self-tests, the AED completes the following steps automatically:

1. Turns itself on, and the Status Indicator changes to red.
2. Performs the self-test.
3. If successful, the Status Indicator reverts to green.
4. Turns itself off if the lid is closed.

There are three types of automatic self-tests:

- The daily self-test checks the battery, pads, and the electronic components.

- The weekly self-test completes a partial charge of the high voltage electronics in addition to the items tested in the daily self-test.
- During the monthly self-test, the high voltage electronics are charged to full energy in addition to the items tested in the daily self test.

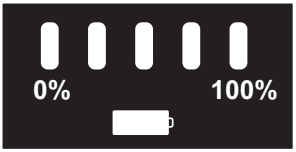
In addition, self-tests will be initiated upon opening the lid and again upon closing the lid.

If the self-test detects an error, the Status Indicator remains red. Upon closing the lid, an audible alert will be issued. The diagnostic panel under the lid indicates the source of the problem according to Table 5-1 on page 5-3.

Indicator troubleshooting table

The following is a troubleshooting table for the AED indicators.

Table 5-1: Indicator Troubleshooting Table

View	Symptom	Solution
	Red Service indicator (LED) is lit.	Maintenance by authorized service personnel is required. Contact Cardiac Science Technical Support or, outside the U. S., your local Cardiac Science representative.
	Red Pads indicator (LED) is lit.	Connect the pads or replace with a new pair.
	The last battery indicator (LED) is red.	The battery is low. Replace with a new battery.
	Rescue Ready Status indicator is red, and no other indicators on the diagnostic panel are lit.	Replace the battery. If the status indicator remains red, contact Cardiac Science Technical Support or, outside the U. S., your local Cardiac Science representative.



Caution: Temperature Extremes.

Exposing the AED to extreme environmental conditions outside of its operating parameters may compromise the ability of the AED to function properly. The Rescue Ready® daily self-test verifies the impact of extreme environmental conditions on the AED. If the daily self-test determines environmental conditions outside of the AED's operating parameters, the Rescue Ready indicator could change to red (not Rescue Ready) and the AED may issue a "SERVICE REQUIRED" alert to prompt the user to move the AED to environmental conditions within the acceptable operating parameters at once. See Chapter 6, *Technical Data*, for acceptable environmental conditions and *Rescue Ready status indicator* on page 3-2 for information about the Rescue Ready indicator.



Caution: Not Rescue Ready.

Issues other than extreme environmental conditions can cause the AED to become not Rescue Ready. For more information, see *Rescue Ready status indicator* on page 3-2.

Scheduled maintenance

Note: Powerheart G3 AEDs perform weekly partial energy and monthly full energy charges of the high voltage circuitry as part of their extensive self testing regimens. Consequently, Cardiac Science does not recommend that users perform any additional energy tests.

Perform the following tests per the schedule indicated:

Daily maintenance

Check the Status Indicator to ensure that it is GREEN. When the indicator is GREEN, the AED is ready for a rescue. If the indicator is RED, refer to the troubleshooting table on page 5-3.

Monthly maintenance

Perform the following procedure each month (28 days):

1. Open the AED lid.
2. Wait for the AED to indicate status: Observe the change of the STATUS INDICATOR to RED. After approximately 5 seconds, verify that the STATUS INDICATOR returns to GREEN.

3. Check the expiration date on the pads.
4. Check that the battery has adequate charge. If the battery indicator is red, replace the battery.
5. Listen for the voice prompts. Additionally, check the display shows text prompts that correspond to the audio.
6. Close the lid and observe the change of the STATUS INDICATOR to RED. After approximately 5 seconds, verify that the STATUS INDICATOR returns to GREEN.

Annual maintenance

Perform the following tests annually to confirm that the diagnostics are functioning properly and to verify the integrity of the case.

Check the integrity of the pads and circuitry:

1. Open the AED lid.
2. Remove the pads.
3. Close the lid.
4. Confirm that the STATUS INDICATOR turns RED.
5. Open the lid and confirm that the Pad indicator is lit.
6. Reconnect the pads and close the lid.
7. Make sure the expiration date is visible through the clear window of the lid.
8. Check to make sure that the STATUS INDICATOR is GREEN. If the pads are not installed properly, the PAD indicator will illuminate. Contact Cardiac Science Technical Support (see *Contact information* on page 1-2) or outside the U.S., your local Cardiac Science representative.
9. Open the lid and confirm that no diagnostic indicators are lit.
10. Check the expiration date of the pads; if expired, replace them.
11. Check the pads packaging integrity.
12. Close the lid

Check the Integrity of the Service Indicator (LED) and Circuitry:

1. Immediately after opening the AED lid, press and hold the Shock button and confirm that the Service LED is lit (for the Powerheart G3 model 9390E only).
2. Release the Shock button (for the Powerheart G3 model 9390E only).
3. Close the lid.
4. Verify that the STATUS INDICATOR remains RED.
5. Open the lid and confirm that no diagnostic panel indicators are lit.
6. Close the lid.
7. Verify that the STATUS INDICATOR turns GREEN.

Check the integrity of the case:

Examine the molded case of the AED for any visible signs of stress. If the case shows signs of stress, contact Cardiac Science Technical Support (see *Contact information* on page 1-2) or outside the U.S., your local Cardiac Science representative.



Caution: Equipment Damage.

When cleaning the device, use one of the following: Isopropyl Alcohol, Ethanol, a mild soapy water solution, or a 3% hydrogen peroxide solution.



Caution: Equipment Damage.

Keep all cleaning solutions and moisture away from the inside of all defibrillation pads and cable connector openings.

Authorized repair service

The AED has no user-serviceable internal components. Try to resolve any maintenance issues with the AED by using the Troubleshooting Table presented in this chapter. If you are unable to resolve the problem, contact Cardiac Science Technical Support (see *Contact information* on page 1-2) or outside the U.S., your local Cardiac Science representative.



WARNING! Shock Hazard.

Do not disassemble the AED. Failure to observe this warning can result in personal injury or death. Refer maintenance issues to Cardiac Science authorized service personnel.

Note: The warranty will be void upon unauthorized disassembly or service of the AED.

Frequently Asked Questions

Q: Can I give CPR while the AED is analyzing?

A: No. As with all AEDs, the operator should stop CPR compressions during the analysis phase.

Q: Can I transport the victim while the AED is analyzing?

A: No. Vehicle motion may cause noise artifacts that could interfere with proper cardiac rhythm analysis. Stop the vehicle when cardiac rhythm analysis is necessary.

Q: Is it safe for the AED to provide a shock to a patient lying on a conductive floor, antistatic floor, or a metal surface?

A: Yes, it is safe. Using a Powerheart AED on a patient lying on a conductive floor, antistatic floor, or a metal surface does not create a safety hazard for either the device user or the patient.

Q: Do I need to prepare the chest prior to pad application?

A: Special preparation is not usually necessary. The chest should be as clean, dry, and as oil free as possible. Follow your Medical Director's instruction.

Q: What happens if the battery is low?

A: There are several Battery Low conditions that the AED will detect:

Battery Low detected - AED not in use: If a low battery condition is detected during a self test, the AED will beep once every 30 seconds. Remove the battery and replace with a fresh battery.

Battery Low detected – AED in use: When the red LED initially lights up—upon lid opening or at any time during a rescue—a BATTERY LOW prompt will be issued at once. However, the AED is capable of delivering at least 9 defibrillation shocks after the first BATTERY LOW prompt is issued.

Battery too low to charge AED during rescue: When the AED is not capable of delivering any more shocks, a BATTERY LOW prompt is displayed until the battery is replaced or AED activity ends.

To continue the rescue attempt, leave the lid open and replace the battery. When the battery replacement takes longer than 60 seconds, the first rescue is terminated and the AED begins to record the events from then on as a separate rescue.

Battery is completely depleted—No AED function: All AED activity stops until the battery is replaced with a fresh battery.

Q: How do I set the AED internal clock?

A: Set the clock by using the Rescuelink Software Program and a PC. See Setting the AED Internal Clock in Chapter 3.

Q: What happens if I close the lid in the middle of a rescue attempt?

A: If you close the lid during a rescue, you must re-open the lid within 15 seconds to continue the rescue. You will hear the prompt, "Open lid to Continue Rescue." If the lid remains closed for more than 15 seconds, a new rescue will initiate when the lid is reopened.

Note: If the lid is closed during a rescue while the pads are connected to the patient, the STATUS INDICATOR remains GREEN. When the lid is reopened, however, the STATUS INDICATOR will turn RED and then back to GREEN. The rescue may be continued.

Q: My AED is sounding an audible alert. Why? How do I stop it?

A: The audible alert indicates that the self-test detected a need for maintenance or corrective action. Open the device lid and view the indicator on the diagnostic panel. Determine the maintenance required by using the troubleshooting table on page 5-3.

Q: The AED did not sound an audible alert when I removed the pads and closed the lid. Why?

Note: Ensure the battery is installed. The AED will never beep while battery is removed.

A: The lid-closed pad self-test only activates the STATUS INDICATOR. The AED allows time for replacement of the pads—as removing pads is a normal procedure after a rescue—or a battery during the post rescue procedure.

Q: What if I have to perform a rescue in an isolated area and at subzero temperatures?

A: When travel to a rescue involves exposing the AED to extremely cold temperatures for an extended period of time, keep the pads and the battery warm.

6 Technical Data

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- STAR biphasic waveform 6-7

This section lists the AED parameters and describes the STAR biphasic waveform.

Parameters

Table 6-1: Parameters

Parameter	Detail
Operation	Semi-Automatic (shock advisory) Automatic
Audible Alerts	Voice Prompt Maintenance Alert
Visible Indicators	Status Indicator Battery Status Indicator Service Indicator Pads Indicator Text Display
Rescue Data Storage	Internal with 60 minutes ECG data with event annotation

Table 6-1: Parameters (continued)

Parameter	Detail
Dimensions	Height: 8 cm (3.3 in) Width: 27 cm (10.6 in) Depth: 31 cm (12.4 in)
Weight (Batteries and Pads)	9390: 3.10 kg (6.6 lb)
Operating Environmental Conditions	Temperature: 0°C to 50°C (32°F to 122°F) Humidity: 5% to 95% (non-condensing) Pressure: 57kPa (+15,000ft) to 103kPa (-500ft)
Shipment, Transport, and Storage Environmental Conditions	Temperature: -30°C to 65°C (-22°F to 149°F) (up to 5 days) 20°C to 30°C (68°F to 86°F) (long term) Humidity: 5% to 95% (non-condensing) Pressure: 57kPa (+15,000ft) to 103kPa (-500ft)
Standby Environmental Conditions	Temperature: 0°C to 50°C (0°F to 122°F) (up to 5 days) 20°C to 30°C (68°F to 86°F) (long term) Humidity: 5% to 95% (non-condensing) Pressure: 57kPa (+15,000ft) to 103kPa (-500ft)
Pads	Self-adhesive, disposable defibrillation pads Minimum combined surface area: 228cm^2 Extended length of lead wire: 1.3m
9146 Lithium Battery Specifications	Output voltage: 12VDC Batteries are non-rechargeable Lithium content: 9.2g Check local regulations for disposal information Full Operational Replacement Guarantee (from date of installation): 4 Years Estimated Shelf Life (from date of manufacture): 5 Years Typical Shocks: 290 shocks **Note:** The battery operating life depends on the type of battery, device settings, actual usage, and environmental factors. Battery was tested with G3 Plus device with Standard prompt set and CPR set to 60 seconds.

Table 6-1: Parameters (continued)

Parameter	Detail
Batteries and Capacitor Charge Times	A new battery, after the AED has delivered 15 300VE shocks, typically takes 10 seconds to charge the AED to maximum energy. A battery with reduced capacity will take longer to charge the AED.
AED Self test Sequence	Daily: Battery, pads, internal electronics, Shock button, and software. Weekly: Battery, pads, internal electronics, Shock button, software, and partial energy charge cycle. Monthly (every 28 days): Battery under load, pads, internal electronics, full-energy charge cycle, Shock button, and software. Open Lid (when lid is opened): Battery, pads, internal electronics, Shock button, and software. Close Lid (when lid is closed): Battery, pads, internal electronics, Shock button, and software.

Table 6-1: Parameters (continued)

Parameter	Detail
Safety and Performance	Model 9390 The AED has been designed and manufactured to conform to the highest standards of safety and performance including electromagnetic compatibility (EMC). The 9390 and pads conform to the applicable requirements of the following:  C US CSA: Classified by CSA International with respect to electric shock, fire and mechanical hazards only in accordance with CAN/CSA C22.2 No.60601-1:08, EN60601-1 and EN60601-2-4. Certified to CAN/CSA Standard C22.2 No. 60601-1:08. Electrical, Construction, Safety and Performance: IEC 60601-1 IEC 60601-2-4 Electromagnetic Compatibility (EMC): IEC 60601-1-2 IEC 60601-2-4
Emissions	EM: EN 55011/CISPR 11, Group 1, Class B RTCA DO-160D Section 21, Category M

Table 6-1: Parameters (continued)

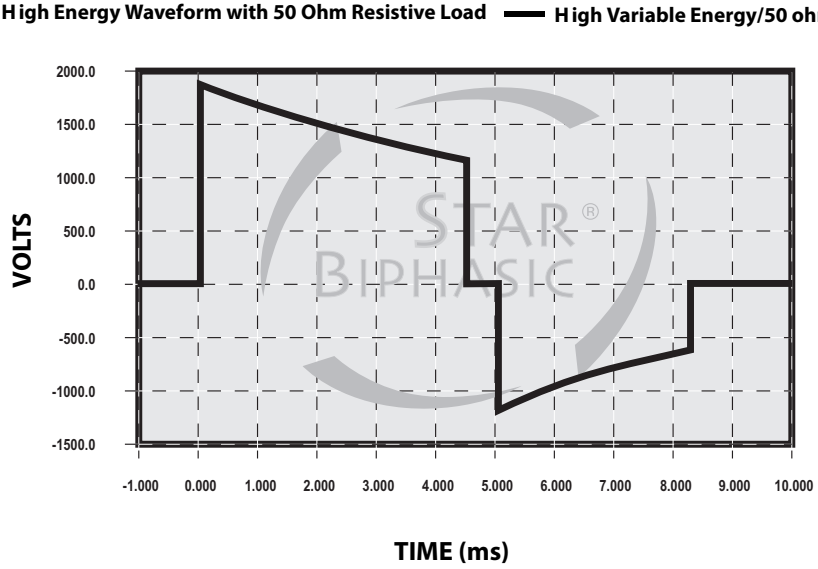
Parameter	Detail
Immunity	EM IEC 61000-4-3, Level X, (20V/m) IEC 60601-2-4 (20V/m) Magnetic IEC 61000-4-8 IEC 60601-2-4 ESD IEC 61000-4-2 IEC 60601-2-4 6kV contact discharge, 8KV air gap discharge
Environmental Conditions	Free Fall Drop: IEC 60068-2-32, 1 meter Bump: IEC 60068-2-29, 40g and 6000 bumps Vibration (Random): IEC 60068-2-64: 10Hz – 2kHz, 0.005 – 0.0012 g^2/Hz Vibration (Sine): IEC 60068-2-6: 10Hz – 60Hz, 0.15 mm and 60Hz – 150Hz, 2g Enclosure Protection: IEC 60529, IP24 Vibration (random): RTCA DO-160D Section 8, category S, curve B Temperature variation: RTCA DO-160D Section 5, category C Temperature/altitude decompression/overpressure: RTCA DO-160D section 4, category A4, operating 0°C to 50°C, ground survival 0°C to 50°C
Shipping and Transportation Conditions	ISTA Procedure 2A
RHYTHMx ECG Analysis Performance	The AED RHYTHMx ECG Analysis system analyzes the patient's ECG and advises you when the AED detects a shockable or non-shockable rhythm. This system makes it possible for a person, with no training in the interpretation of ECG rhythms, to offer defibrillation therapy to victims of sudden cardiac arrest. With a new battery, after the AED has delivered 15 300VE shocks, the maximum time from beginning rhythm analysis until the AED is ready to shock is 17 seconds.

Table 6-1: Parameters (continued)

Parameter	Detail
Cardiac Rhythms Used to Test the Rhythm Recognition Detection System for Powerheart G3 AEDs	Shockable Rhythm – VF: Meets IEC 60601-2-4 requirement and AHA recommendation of Sensitivity of >90% Automatic External Defibrillators for Public Access Defibrillation: Recommendations for Specifying and Reporting Arrhythmia Analysis Algorithm Performance, Incorporating New Waveforms and Enhancing Safety, AHA AED Task Force and approved by the AHA Science Advisory and Coordinating Committee. Circulation, 1997(95), pp 1677-1682 Shockable Rhythm – VT: Meets IEC 60601-2-4 requirement and AHA recommendation of Sensitivity of >75% Non-shockable Rhythm – NSR: Meets IEC 60601-2-4 requirement (>95%) and AHA recommendation (>99%) of Specificity Non-shockable – Asystole: Meets IEC 60601-2-4 requirement and AHA recommendation of Specificity of >95% Non-shockable: Meets IEC 60601-2-4 requirement and AHA recommendation of Specificity – all other rhythms of >95% For detailed information contact Cardiac Science for white papers: P/N 112-2013-005 (Pediatric Defibrillation Instructions for use) P/N 110-0033-001 (RHYTHMx White Paper) P/N MKT-11081-01 (STAR Biphasic White Paper)

STAR biphasic waveform

The waveform generated by the AED is a Biphasic Truncated Exponential waveform. The following is a graph of the waveform voltage as a function of time when the AED is connected to a 50 Ohm resistive load.



The Biphasic Truncated Exponential (BTE) waveform uses variable energy. The actual energy delivered will vary with the patient's impedance and the device will deliver a shock when impedance is between 25-180 Ohms. Energy will be delivered at three different levels referred to as ultra-low variable energy, low variable energy, and high variable energy as shown in the waveform tables on the following pages.

Table 6-2: Ultra-low Variable Energy (150 VE) Powerheart G3 Waveform

	Phase 1		Phase 2		
Patient's Impedance (Ohms)	**Voltage * (Volts)**	**Duration* (MS)**	**Voltage * (Volts)**	**Duration* (MS)**	**Energy** (Joules)**
25	1393	3.3	743	3.2	145-196
50	1420	4.5	909	3.2	128-173
75	1430	5.8	973	3.2	116-156
100	1434	7.0	1007	3.2	108-146
125	1437	8.3	1027	3.2	102-138
150	1439	9.5	1040	3.2	98-132
175	1441	10.8	1049	3.2	95-128

Table 6-3: Low Variable Energy (200 VE) Powerheart G3 Waveform

	Phase 1		Phase 2		
Patient's Impedance (Ohms)	**Voltage * (Volts)**	**Duration* (MS)**	**Voltage * (Volts)**	**Duration* (MS)**	**Energy** (Joules)**
25	1609	3.3	858	3.2	193-260
50	1640	4.5	1050	3.2	170-230
75	1651	5.8	1124	3.2	155-209
100	1656	7.0	1163	3.2	144-194
125	1660	8.3	1186	3.2	136-184
150	1662	9.5	1201	3.2	130-176
175	1663	10.8	1212	3.2	126-170

Table 6-4: High Variable Energy Powerheart G3 Waveform (all values are typical)

	Phase 1		Phase 2		
Patient's Impedance (Ohms)	**Voltage * (Volts)**	**Duration* (MS)**	**Voltage * (Volts)**	**Duration* (MS)**	**Energy** (Joules)**
25	1869	3.3	997	3.2	260-351
50	1906	4.5	1220	3.2	230-311
75	1918	5.8	1306	3.2	209-283
100	1925	7.0	1351	3.2	195-263
125	1928	8.3	1378	3.2	184-248
150	1931	9.5	1396	3.2	176-238
175	1933	10.8	1408	3.2	170-230

* All values are typical.

**Allowable energy range.

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70-00914-01 F



OWNER'S MANUAL



Stationary Elevating Docks

4,5,6,8,10,12,15, & 20,0000 lb. Capacities

Semi-Portable Elevating Docks

4, 5, & 6,000 lb. Capacities

Model Nos. ED, RLD, Lomaster

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IMPORTANT: **Read and understand the contents of this manual before operating the equipment.**

1. Receipt Inspection

This equipment was thoroughly inspected prior to leaving the factory. Before placing the equipment in service, it should be thoroughly checked for damage or loss occurring in transit. If any such damage or loss is evident, a claim must be made against the carrier.

2. Handling & Installation Diagrams

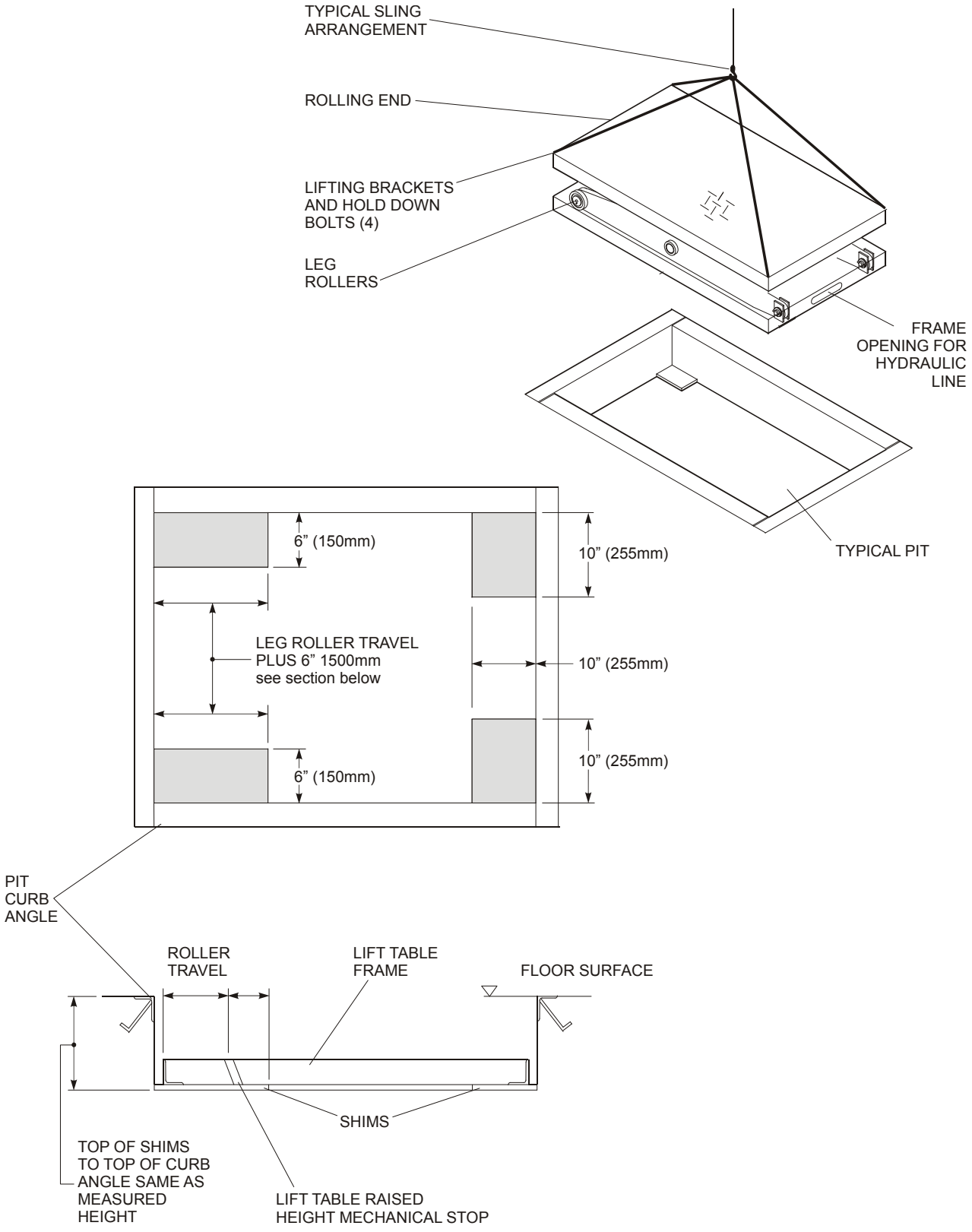


Figure 1 : Elevating Dock Handling and Installation

3. Maintenance Device Detail

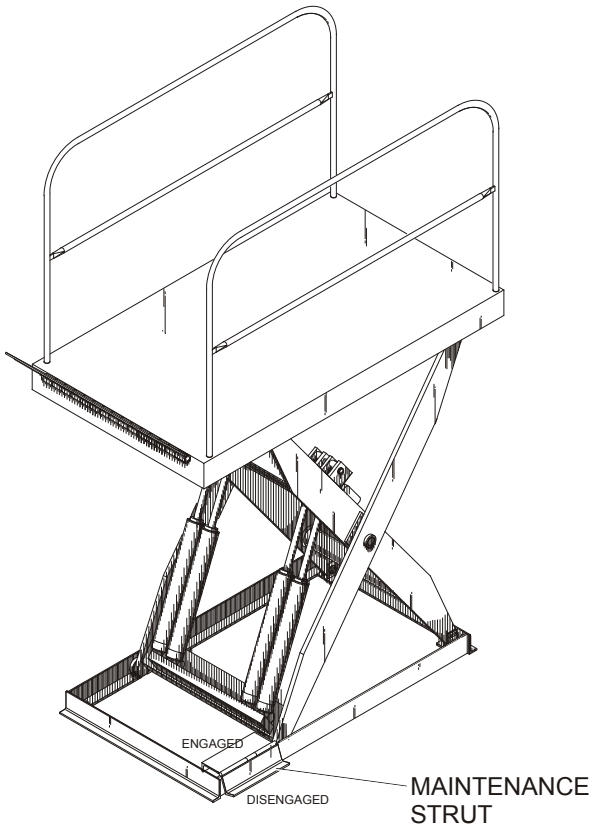


Figure 2 : Maintenance Device Placement

Note: All Stationary Elevating Docks come equipped with a Maintenance Strut as shown in Figure 2. If a Safety Device is not self-contained provided then other means need to make unit safe for maintenance and repairs. An Optional Safety Stand (Part #796-710) is available for use with Semi-Portable Elevating Docks (See Figure 3)

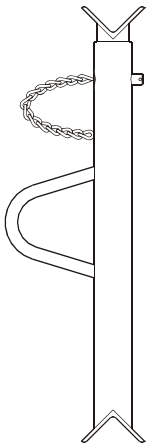


Figure 3 : Maintenance Device - Semi Portables

4. Safety Information

4.1 Owner's Responsibilities

Owner's responsibilities include the following:

1. **Inspection and maintenance**
   The elevating dock shall be inspected and maintained in proper working order in accordance with manufacturer's operating/maintenance manual and safe operating practice.

2. **Removal from service**
   Any elevating dock not in safe operating condition shall be removed from service until it is repaired to original manufacturer's standards.

3. **Repairs**
   All repairs shall be made by authorized personnel in conformance with manufacturer's instructions.

4. **Modifications and alterations**
   Modifications or alterations of industrial scissor lifts shall be made only with written permission of original manufacturer. These changes shall also satisfy all safety recommendations of original equipment manufacturer for particular application of the elevating dock.

4.2 Operator's Responsibilities

Only trained and authorized personnel shall be permitted to operate the elevating dock.

Operator's responsibilities include the following:

1. Read and understand safety/operation information contained herein, or be trained by a qualified person.

2. It is responsibility of operator to be certain that no unsafe conditions exist before using this equipment. Before operating this equipment, inspect it for proper operation and condition. If any unsafe condition exists, remove the elevating dock from service until repairs are made.

3. The elevating dock shall be used in accordance with its intended use and with in manufacturer's limitations and safety rules.

4. Do not exceed rated capacity as indicated on name plates.

5. Ensure that all safety devices are operational and in place.

4.3 Safety Procedures



WARNING!

1. Do NOT operate the elevating dock table or elevating dock unless you have training and authorization.

2. Read, understand and follow these instructions, the hazard warnings on the elevating dock and the warnings/instructions contained in this manual.

3. NEVER go under the elevating dock unless the maintenance device is engaged in accordance with the manufacturers instructions.

4. Prior to using the elevating dock:

   - *Verify that all safety devices supplied with the elevating dock (e.g. guard rails, restraint chains, toe guards and warning bells, if so equipped), are in place and functioning properly.*

   - *Operate the elevating dock through one complete lift/lower cycle and verify its proper operation. At the same time, inspect the unit for any visible or obvious damage. If there is any damage or unusual vibration or noise, remove the unit from service using approved lockout procedures. Notify maintenance personnel immediately.*

5. Do not exceed the units capacity as stated on the nameplate and center loads on the unit. Be aware that the unit may have reduced capacity when loads are rolled over the platform sides or ends. Refer to the nameplate for reduced capacity under these conditions.

6. If load(s) is mobile, secure the load in a fixed position before operating the unit.

7. Prior to operating the unit, ensure that all personnel on or near the unit are aware of its imminent operation, and that no person will be in harms way during its operation.

8. Ensure that objects are clear of the areas beneath or above the platform, and immediately surrounding the perimeter of the unit, while it is in use.

9. Keep area around the unit free of oil, objects and debris that could cause slippage or stumbling into or under the unit.

10. If the unit is equipped with a hinged bridge(s), the bridge must overlap the truck bed a minimum of 4” (100mm) before use. Do NOT use the bridge if it is solely supported by its lifting chain.

11. If maintenance or service is required:
    - *Only authorized service personnel shall provide maintenance/service on the unit.*
    - *Follow approved lock out procedures.*
    - *Do NOT work on or under the unit.*
    - *The unit shall NOT be modified or altered without the written permission of the manufacturer.*

12. When re-locating a Semi-Portable Elevating Dock always use the portable dolly (Part #326-5039) provided *(See Figure 4)*. Center the dolly at the torque bar (opposite the rolling end), lower the deck until it firmly engages with the upper portion of the dolly lift arm.

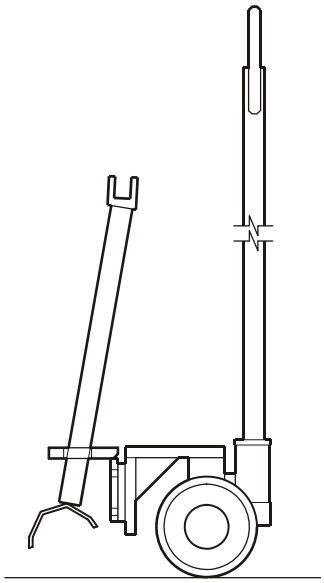


Figure 4 : Portable Dolly

5. Operating Instructions

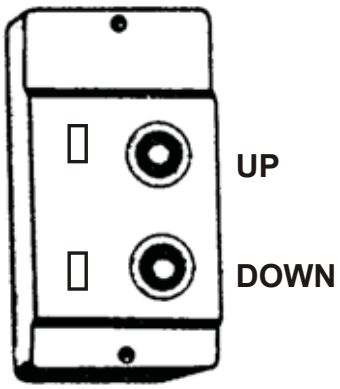


Figure 5 : Typical Push Button Control Station

Note: Manual Reset on Three Phase Only.

1. Read and understand these instructions and safety rules before operating lift.

2. Before using lift, inspect it for proper operation and condition. If any unsafe condition exists, remove unit from service until repairs are made.

3. Before using unit, inspect all safety devices, such as guard rails, snap chains and toe guards to be certain that they are in place and functioning properly.

4. If lift is controlled from a push button station. Station is equipped with constant pressure type buttons labeled with arrows that indicate direction of movement. Pressing and holding "⬆" button will cause unit to rise, pressing and holding "⬇" button will cause unit to lower. Releasing either button will stop movement of lift.

WARNING! : DO NOT EXCEED CAPACITY OF THE UNIT.

5. Prior to placing a load on lift, read and understand unit capacity as labeled on serial number plate. Plate can be found riveted to side of deck assembly. Understand that capacity of lift is expressed as **maximum uniformly distributed load** unit is rated to carry. Unit capacity is down rated for rolling loads or loads concentrated on end(s) or side(s). These down rated capacities can also be found on serial number plate.

WARNING! : TO AVOID BODILY INJURY, STAND CLEAR WHILE THE UNIT IS MOVING.

6. Loading / unloading unit:

   a) If loading/unloading a truck or other mobile vehicle, ensure brakes are set and wheels chocked before proceeding.

   b) Center load on lift platform.

   c) If load is mobile (ie: carts, pallet truck, forklift) set brakes and/or lower load onto platform surface to minimize potential load shift.

   d) Ensure snap chain(s) are securely in position. If unit is equipped with a hinge bridge it must be stored in upright position and secured by safety chain(s).

   e) Using push button station, raise unit so that platform is level or slightly above truck bed.



DANGER! : ENSURE THAT PEOPLE AND OBJECTS ARE CLEAR OF AREAS BENEATH PLATFORM AND IMMEDIATELY SURROUNDING PERIMETER OF UNIT WHILE IT IS IN MOTION.

   f) Lower hinged bridge (if equipped) onto truck bed. Ensure that truck bed and bridge overlap by a minimum of 4" (1 00mm). If overlap is less than 4" (1 00mm) reposition truck to achieve this minimum overlap. (if overlap still cannot be achieved, contact your Blue Giant representative as a longer bridge may be required). Secure bridge in place with safety chain(s).

NOTE: Bridge safety chain must remain slack to Ensure positive contact with vehicle loaded at all times.



WARNING! : DO NOT STAND ON OR APPLY WEIGHT TO HINGED BRIDGE UNLESS IT IS SUPPORTED BY A MINIMUM OF 4" (100MM) OF OVERLAP. NEVER ATTEMPT TO STAND OR APPLY WEIGHT TO HINGED BRIDGE IF SUPPORTED SOLELY BY SNAP CHAINS

   g) Proceed to transfer load.

7. To lower lift, repeat sequence (b) through (e) using "↑" button instead of "↓" button in step (e).

6. Planned Maintenance

WARNING! : DO NOT WORK BENEATH A RAISED DOCK LIFT WITHOUT ENGAGING A MAINTENANCE DEVICE (See Section 3 : Maintenance Device Detail, Figure 2)

WARNING! : ENSURE THAT THE POWER SUPPLY TO CONTROL BOX IS TURNED "OFF" AND LOCKED OUT AS REQUIRED TO ASSURE THAT ELECTRICAL POWER CANNOT BE TURNED "ON" UNEXPECTEDLY.

WARNING! : FAILURE TO FOLLOW THESE WARNINGS COULD RESULT IN SERIOUS INJURY OR DEATH.

Spotting trouble before it happens can prevent costly downtime and extensive repairs and make it possible for service and repairs to be performed when unit is not required for regular operation.

Once a month inspect and lubricate-mechanical, hydraulic and electrical components as outlined below. More frequent inspections are necessary for adverse conditions such as temperature extremes, dirty environment, etc.

Electrical System:

Periodically check for wire and cable damage. Keep water and ice away from power pack.

Mechanical System:

1. Make a safety inspection of complete unit. Check for visible damage or misalignment. Check for excessive wear of all moving parts. Inspect upper limit mechanical stops for damage. Repair if necessary.

2. Lubrication:
   All bearings and bushings are sealed or self-lubricating. However, points shown in *Section 7: Planned Maintenance, Figures 3 & 4* should be oiled once a month with SAE 30 motor oil.

3. Upper limit switches and safety trip bar switches, if so equipped, must be operating.

Hydraulic System:

1. Hydraulic fluid level should be kept to 2" (50mm) above the tank suction fitting with the deck in the fully raised position.

2. Use only approved quality hydraulic fluid. For normal room temperature following oil is recommended: ISO 32 grade oil.

3. Change hydraulic fluid three months after equipment is placed in service and check every twelve months thereafter (more frequently for adverse conditions such as moisture, lower temperature or dusty atmosphere).

4. Leaking or damaged hoses and fittings should be repaired or replaced immediately to prevent loss of fluid and possible damage to hydraulic pump.

5. For safety reasons, the pressure relief valve is factory set. It is set so that unit will lift the rated capacity, but will not lift a load 10% greater. Its function should be checked at least once a year.

6.1 Lubrication Points

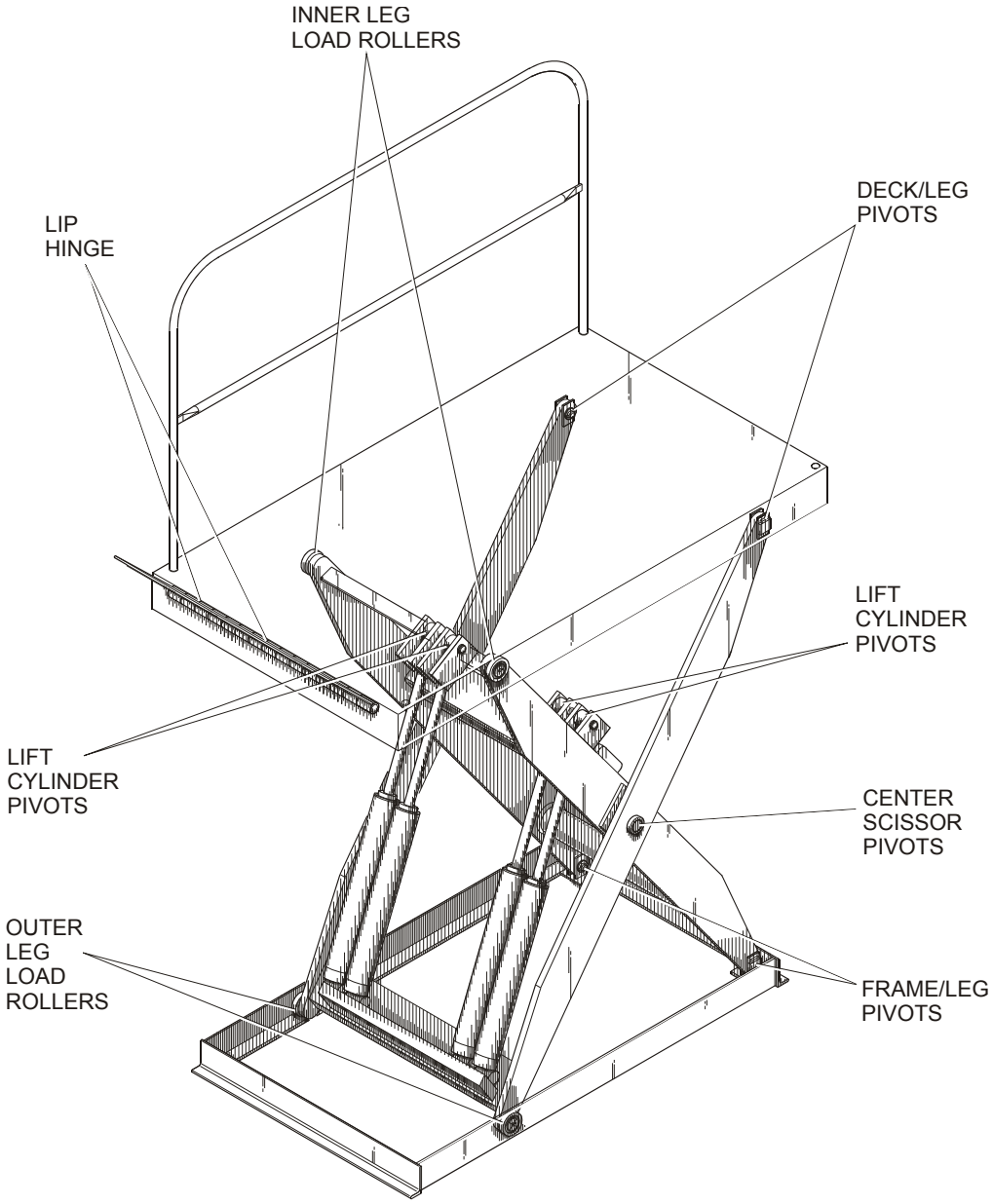


Figure 6 : Lubrication Points - Stationary Elevating Dock

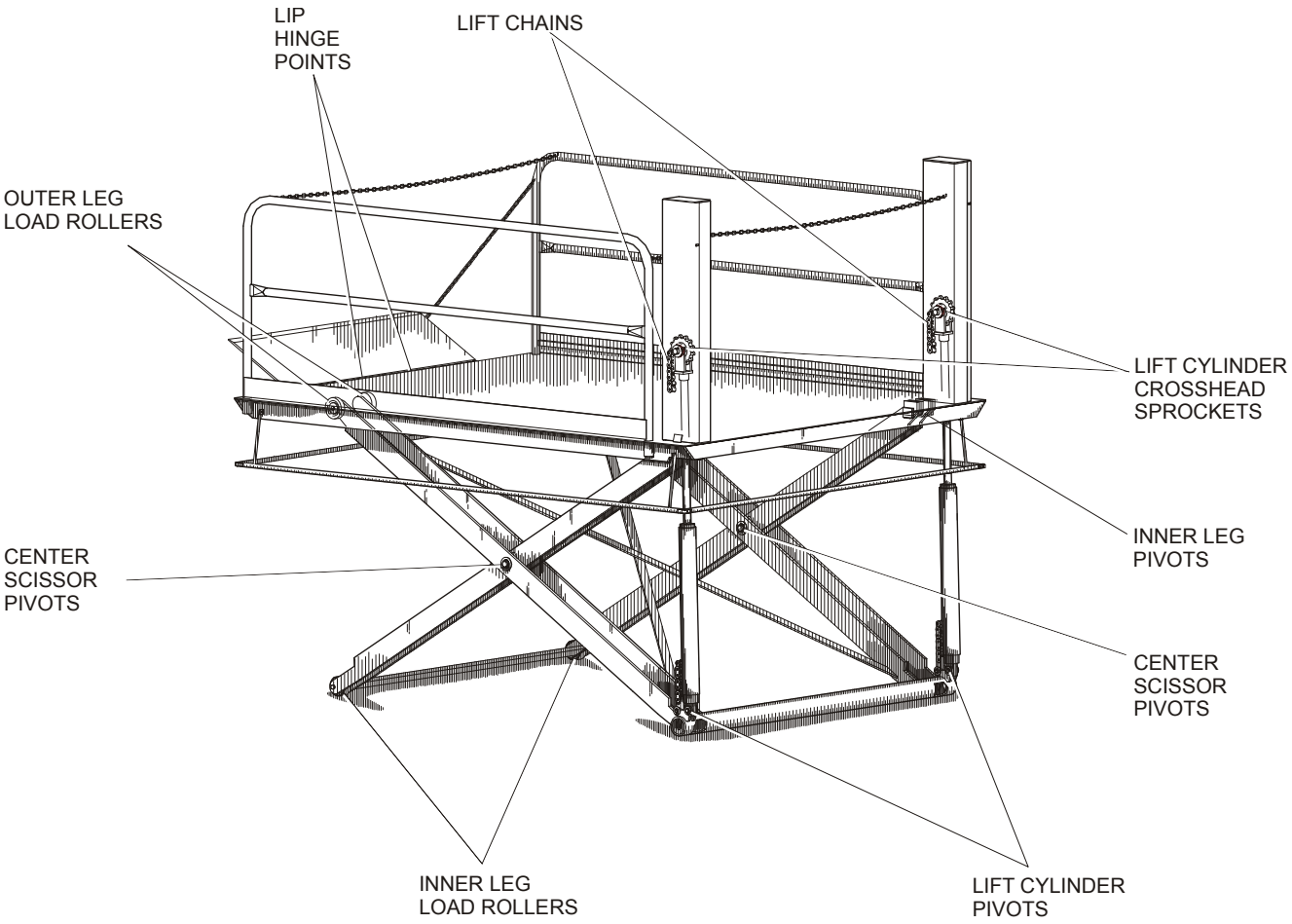


Figure 7 : Lubrication Points - Semi-Portable Elevating Dock

7. Parts Listings - Stationary Elevating Docks - 10" Lowered Height

7.1 General Assembly - 4,5 & 6,000 lb. Cap. - 96" Deck Length

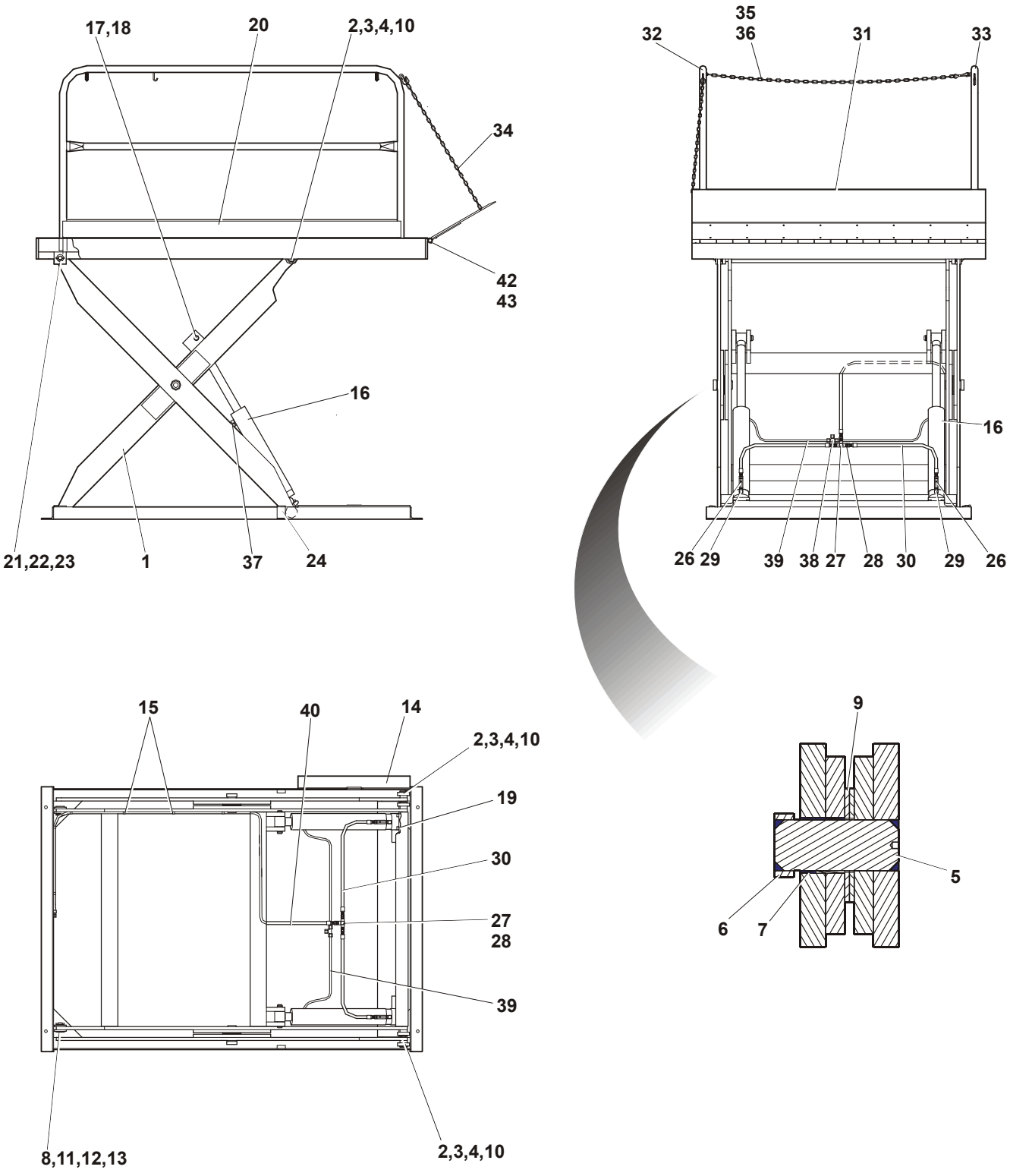


Figure 8 : General Assembly - 4,5,& 6,000 lb. - 96" Deck Length

General Assembly - 4,5 & 6,000 lb. Cap. - 96" Deck Length

Item	Qty	Part No	General Description	Specific Description 310-5423
			General Assembly 4,5,6 - 96" Deck Length	**10" Lowered Height**
1*	**1**	**313-5218-2**	**Frame And Leg Weldment**	**4,000/60X96"**
1*	**1**	**313-5218-3**	**Frame And Leg Weldment**	**4,000/72,84X96"**
1*	**1**	**313-5218-4**	**Frame And Leg Weldment**	**4,000/96X96"**
1*	**1**	**313-5219-2**	**Frame And Leg Weldment**	**5,000/60X96"**
1*	**1**	**313-5219-3**	**Frame And Leg Weldment**	**5,000/72,84X96"**
1*	**1**	**313-5219-4**	**Frame And Leg Weldment**	**5,000/96X96"**
1*	**1**	**313-5220-2**	**Frame And Leg Weldment**	**6,000/60X96"**
1*	**1**	**313-5220-3**	**Frame And Leg Weldment**	**6,000/72.84X96"**
1*	**1**	**313-5220-4**	**Frame And Leg Weldment**	**6,000/96X96"**
2	4	019-022	Bearing, 80x40x18mm	4,&5,000/96"
2	2	019-001	Bearing, 80x40x18mm	6,000/96"
3	4	011-066	Capscrew, Hex Sckt F/H-5/16"-18x3/4"	4,5,&6,000/96"
4	2	013-005	Spring Pin 5/32"x1"Lg	4,&5,000/96"
5	2	313-0024	Leg Centre Pin	4,000/96"
5	2	114-651	Leg Centre Pin 1" Thk Leg (4-7/8" Lg)	5,&6,000/96"
6	2	114-606	Collar - 2" (Centre Pin Mod Ed)	4,5,&6,000/96"
7	2	018-032	Bushing - 2"IDx1-1/2"LG	4,000/96"
7	2	018-033	Bushing - 2" IDx1-3/4"LG	5,&6,000/96"
8	4	018-051	Bushing - 1"IDx3/4"LG	4,000/96"
8	4	018-061	Bushing - 1"IDx1"LG	5,&6,000/96"
9	2	012-219	Washer, Flat 2.13" IDx4.5"ODx0.187" THK	4,5,&6,000/96"
10	4	121-684	Ring-Spacer (1-7/8" O.D)	4,&5,000/96"
11	2	798-048	Pin Ass'y (3/4" Thick Legs)	4,000/96"
11	2	798-043	Pin Ass'y (1" Thick Legs)	5,&6,000/96"
12	2	013-012	Spring Pin - 1/4" X 2	4,&5,000/96"
13	6	105-879	Washer, 3/4"ODx1-3/16"IDx1/16"THK	4,&5,000/96"
14	1	822-440	Strut Weldment, Maintenance	4,&5,000/96"
15	8	035-262	Strap (#6 Hose Clamp)	4,&5,000/96"
16	2	832-157	Cylinder Ass'y (3-1/2"Dia) [19 1/2" Stroke]	4,5,&6,000/96"
17	2	114-993	Pin-Cylinder Pivot	4,5,&6,000/96"
17	2	311-0003	Pin, Cylinder Pivot	4,000/72X96"
17	2	311-0003	Pin, Cylinder Pivot	6,000/84X96"
18	4	013-036	Retaining Ring Ext. 1-1/4"ID	4,5,&6,000/96"
19	4	104-476	Lip Stop (3/4"X5/8")	4,5,&6,000/96"
20	1	312-5260-2	Deck Assembly S2 4,&5,000/60x96	4,&5,000/60X96"
20	1	312-5260-3	Deck Assembly S2 4,&5,000/72x96	4,&5,000/72X96"
20	1	312-5260-4	Deck Assembly S2 4,&5,000/84x96	4,&5,000/84X96"
20	1	312-5260-5	Deck Assembly S2 4,&5,000/96x96	4,&5,000/96X96"
20	1	312-5260-7	Deck Assembly S2 6,000/60x96	6,000/60x96"
20	1	312-5260-8	Deck Assembly S2 6,000/72x96	6,000/72x96"
20	1	312-5260-9	Deck Assembly S2 6,000/84x96	6,000/84x96"
20	1	312-5260-10	Deck Assembly S2 6,000/96x96	6,000/96x96"
20	1	312-5253-2	Deck Assembly S3 (Taprd) 4,&5,000/60X96	4,&5,000/60X96"
20	1	312-5253-3	Deck Assembly S3 (Taprd) 4,&5,000/72X96	4,&5,000/72X96"
20	1	312-5253-4	Deck Assembly S3 (Taprd) 4,&5,000/84X96	4,&5,000/84X96"
20	1	312-5253-5	Deck Assembly S3 (Taprd) 4,&5,000/96X96	4,&5,000/96X96"
20	1	312-5253-7	Deck Assembly S3 (Tapered) 6,000/60X96	6,000/60X96"
20	1	312-5253-8	Deck Assembly S3 (Tapered) 6,000/72X96	6,000/72X96"
20	1	312-5253-9	Deck Assembly S3 (Tapered) 6,000/84X96	6,000/84X96"
20	1	312-5253-10	Deck Assembly S3 (Tapered) 6,000/96X96	6,000/96X96"
21	2	798-048	Pin Ass'y (3/4" Thick Legs)	4,000/96"
21	2	798-043	Pin Ass'y (1" Thick Legs)	5,&6,000/96"
22	6	106-389	Spacer Washer - 1-3/4"ODx1"IDx1/16"thk	4,5,&6,000/96"
23	2	013-012	Spring Pin - 1/4" X 2"	4,5,&6,000/96"

*** - INDENTED SUB-ASSEMBLY – SHOWN ON SAME PAGE**
**** - SUBASSEMBLY - SHOWN ON SEPARATE PAGE**

Continued…

General Assembly - 4,5 & 6,000 lb. Cap. - 96" Deck Length

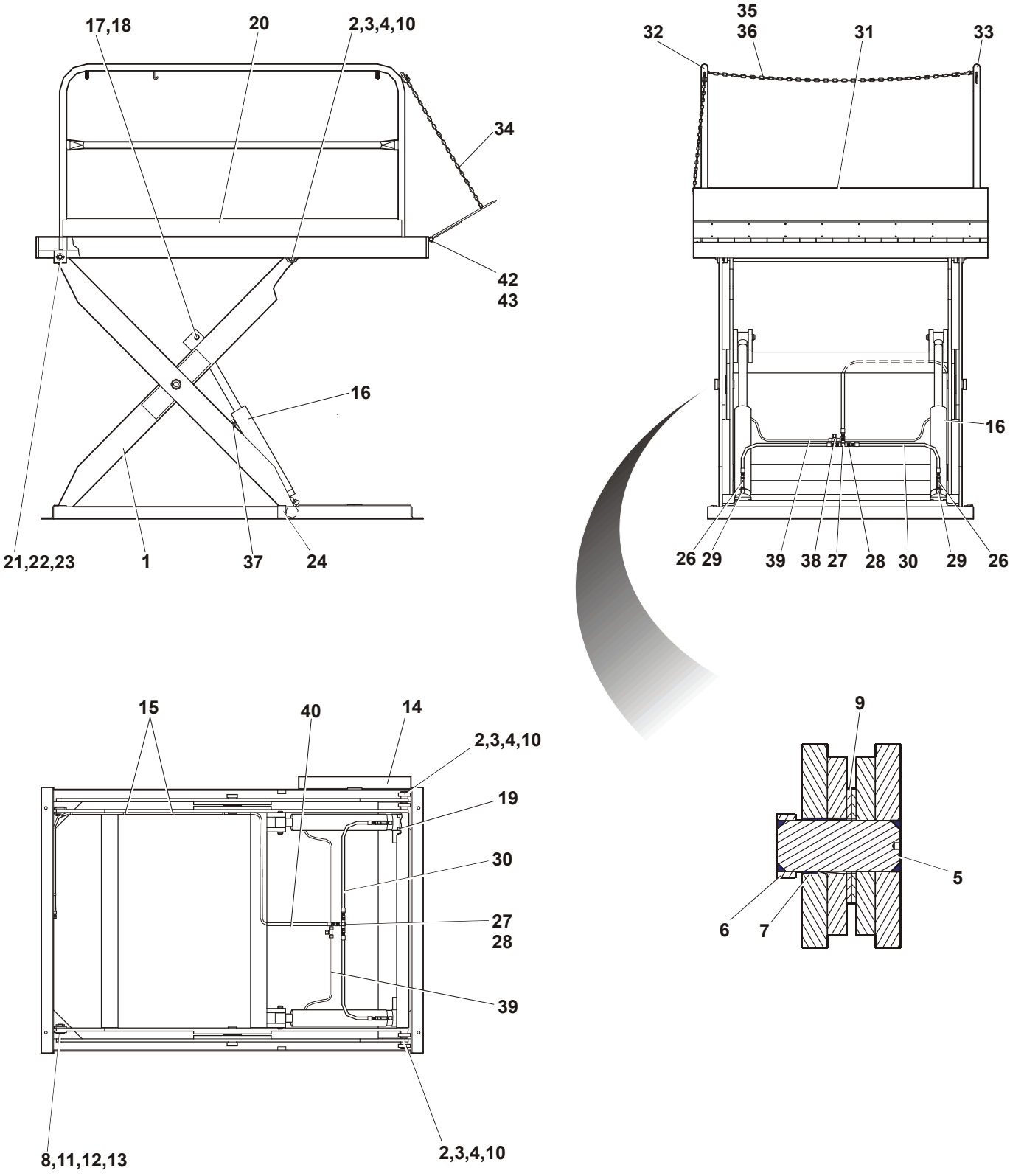


Figure 4: General Assembly - 4,5, & 6,000 - 96" Deck Length

General Assembly - 4,5,6,000 & 8,000 lb. Cap. - 96" Deck Length

Item	Qty	Part No	General Description	Specific Description
24	2	117-005	Roller Stop	4,5,&6,000"
25	1	039-066	Paint, Blue (Fast Dry Enamel)	4,5,&6,000/96"
26	2	033-549	Velocity Fuse 9.0 GPM	4,000/60,72X96"
26	2	033-549	Velocity Fuse 9.0 GPM	5,&6,000/60,84X96"
26	2	033-661	Velocity Fuse 5 GPM	4,000/84X96"
26	2	033-663	Velocity Fuse 7.5 GPM	5,000/72-96X96"
26	2	033-663	Velocity Fuse 7.5 GPM	6,000/60,72,84X96"
26	2	033-661	Velocity Fuse 5 GPM	4,000/60X96"
27	1	034-571	Fitting, Tee 022T-6-6	4,5,&6,000/96"
28	2	034-504	Adapter, Fitting 0103-6-6	4,5,&6,000/96"
29	2	034-599	Fitting Elbow Forged #6MP-4MP-90°	4,5,&6,000/96"
30	2	300-5000-12	Hose, #6 Hp(20"Lg) Str. Swivel(2)	4,5,000/60X96"
30	2	300-5000-14	Hose, #6 Hp(25"Lg) Str. Swivel(2)	4,000/72X96"
30	2	100-5004-1	Hose, #6 Hp(24"Lg)	4,000/84,96X96"
30	2	100-5004-1	Hose, #6 Hp(24"Lg)	5,000/72X96"
30	2	300-5000-14	Hose, #6 Hp(25"Lg) Str. Swivel(2)	5,6,000/84X96"
30	2	100-5004-1	Hose, #6 Hp(24"Lg)	5,000/96X96"
30	2	100-5004-1	Hose, #6 Hp(24"Lg)	6,000/60,96X96"
30	2	100-5004-1	Hose, #6 Hp(24"Lg)	4,000/60X96"
31	1	302-5002	Lip Assy,60"(18"Lg,4&5#)1pc Lp	4,&5,000/96"
31	1	302-5002-7	Lip Assy,60"(18"Lg,4&5#)1pc Lp	6,000/60X96"
32	1	312-5080-4	Guard Rail, Right Side 96"Deck	4,5,&6,000/96"
33	1	312-5081-4	Guard Rail, Left Side 96"Deck	4,5,&6,000/96"
34	1	091-023-0600	Chain (60"Lg) [3/16"Proof Coil Galvanized]	4,5,&6,000/96"
35	2	091-023-0540	Chain (54"Lg) 3/16"Proof Coil Galvanized	4,5,&6,000/60X96"
35	2	091-023-0660	Chain (66"Lg) 3/16"Proof Coil Galvanized	4,5,&6,000/72X96"
35	2	091-023-0780	Chain (78"Lg) 3/16"Proof Coil Galvanized	4,5,&6,000/84X96"
35	2	091-023-0900	Chain (90"Lg) 3/16"Proof Coil Galvanized	4,5,&6,000/96X96"
36	2	R3-19203	Hook Snap 4"Lg - 7/16"-20	4,5,&6,000/96"
37	3	034-674	Fitting - 1/4" M X 3/8" Comp	4,5,&6,000/96"
38	1	034-673	Fitting Nylon Tee - (3/8" Comp)	4,5,&6,000/96"
39	2	091-000-0200	Tubing Black Nylon (3/8"X20"LG)	4,5,&6,000/60X96"
39	2	091-000-0320	Tubing Black Nylon (3/8"X32"LG)	4,6,000/72X96"
39	2	091-000-0440	Tubing Black Nylon (3/8"X44"LG)	4,5,&6,000/84X96"
39	2	091-000-0560	Tubing Black Nylon (3/8"X56"LG)	4,5,&6,000/96X96"
39	2	091-000-0520	Tubing Black Nylon (3/8"X52"LG)	5,000/72X96"
40	1	300-5001-35	Hose, #8 Hp (132"Lg) Str.Swivel(2)	4,5,000/60X96"
40	1	300-5001-38	Hose, #8 Hp (144"Lg) Str.Swivel(2)	4,5,000/72X96"
40	1	100-5008-10	Hose, #8 Hp (144"Lg) Str.Swivel(2)	4,000/84X96"
40	1	100-5008-11	Hose, #8 Hp (192"Lg) Str.Swivel(2)	4,5,&6,000/96X96"
40	1	300-5001-38	Hose, #8 Hp (144"Lg) Str.Swivel(2)	5,6,000/84X96"
40	1	100-5008-8	Hose, #8 MP (120"Lg)	6,000/60X96"
40	1	100-5008-9	Hose, #8 MP (144"Lg)	6,000/72X96"
40	1	100-5008-8	Hose, #8 MP (120"Lg)	4,000/60X96"
41	1	091-000-2400	Tubing Black Nylon (3/8"X240")	4,5,&6,000/60X96"
41	1	091-000-2880	Tubing Black Nylon (3/8"X288")	4,5,&6,000/72X96"
41	1	091-000-3360	Tubing Black Nylon (3/8"X336")	4,5,&6,000/84X96"
41	1	091-000-3840	Tubing Black Nylon (3/8"X384")	4,5,&6,000/96X96"
42	1	121-616-1	Bar, Lip Hinge	4,5,&6,000/96"
43	2	013-005	Pin, Spring	4,5,&6,000/96"

7.2 General Assembly - 4 & 5,000 lb. Cap. - 108" Deck Length

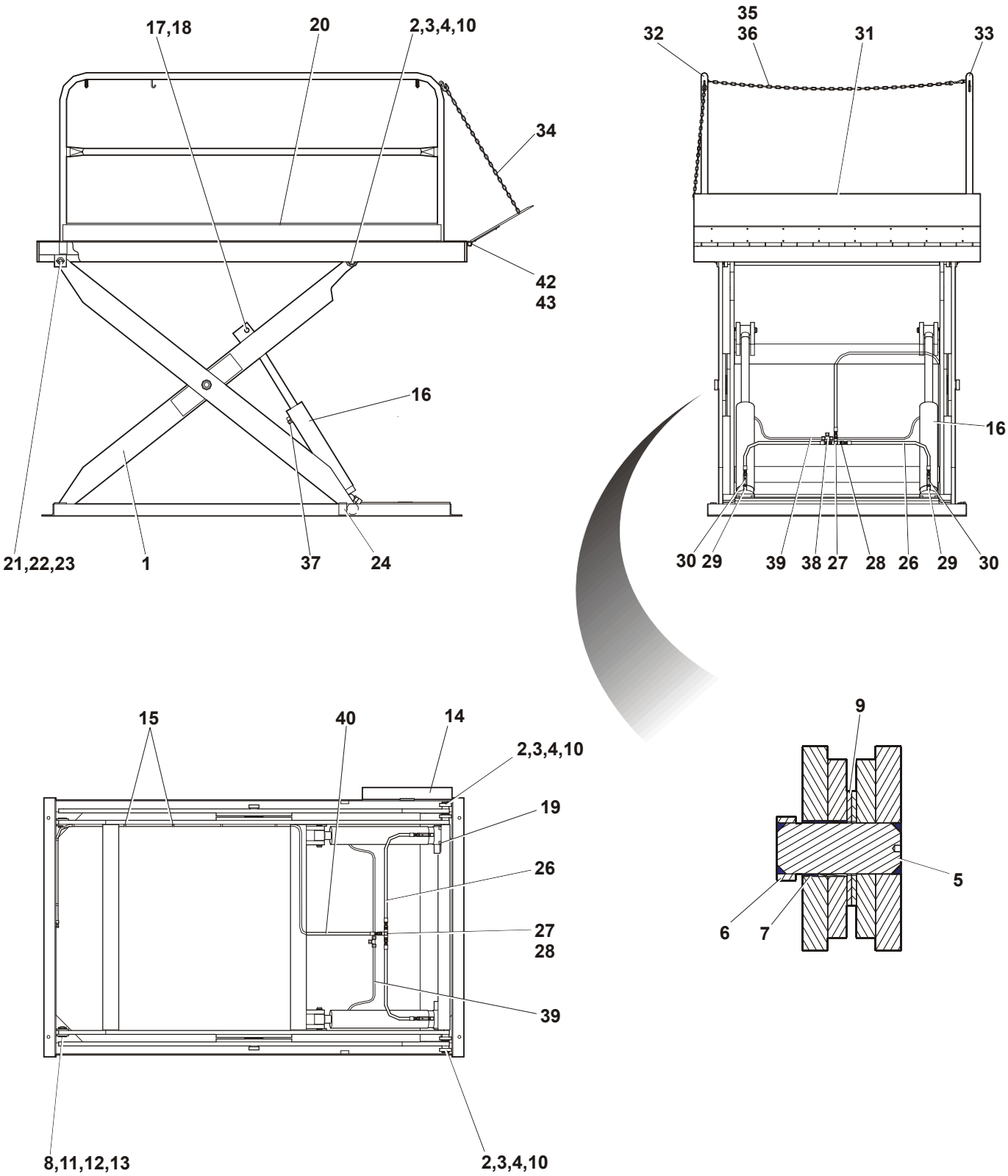


Figure 9 : General Assembly - 4, & 5,000 - 108" Deck Length

General Assembly - 4 & 5,000 lb. Cap. - 108" Deck Length

Item	Qty	Part No	General Description	Specific Description
				10" Lowered Height
			General Assembly 4,5,000 - 108" Deck Length	**REF.DRG.310-5424**
1*	**1**	**313-5221-2**	**Frame And Leg Weldment**	**4,5,000/60x108"**
1*	**1**	**313-5221-3**	**Frame And Leg Weldment**	**4,5/72,84x108"**
1*	**1**	**313-5221-4**	**Frame And Leg Weldment**	**4,5/96x108"**
2	4	019-022	Bearing, 80x40x18mm	4,5,000/108"
3	4	011-066	Capscrew, Hex Skt F/H - 5/16"-18 X 3/4"	4,5,000/108"
4	2	013-005	Spring Pin 5/32"x1"Lg	4,5,000/108"
5	2	114-651	Leg Centre Pin 1" Thk Leg (4-7/8" Lg)	4,5,000/108"
6	2	114-606	Collar - 2" (Centre Pin Mod Ed)	4,5,000/108"
7	2	018-033	Bushing - 2" IDx1-3/4"LG	4,5,000/108"
8	4	018-051	Bushing - 1"IDx3/4"LG	4,5,000/108"
8	4	018-061	Bushing - 1"IDx1"LG	4,5,000/108"
9	2	012-219	Washer,Flt-2.13" IDx4.5"ODx0.187" THK	4,5,000/108"
10	4	121-684	Ring-Spacer (1-7/8" O.D)	4,5,000/108"
11	2	798-043	Pin Ass'y (1" Thick Legs)	4,5,000/108"
12	2	013-012	Spring Pin - 1/4" X 2	4,5,000/108"
13	6	105-879	Washer, 3/4"ODx1-3/16"IDx1/16"THK	4,5,000/108"
14	1	822-440	Strut Weldment, Maintenance	4,5,000/108"
15	8	035-262	Strap (#6 Hose Clamp)	4,5,000/108"
16**	**2**	**780-142-204**	**Cylinder Ass'y (4"Dia) [20-1/2" Stroke]**	**4,5,000/108"**
17	2	114-993	Pin-Cylinder Pivot	4,5,000/108"
18	4	013-036	Retaining Ring Ext. 1-1/4"ID	4,5,000/108"
19	4	104-476	Lip Stop (3/4"X5/8")	4,5,000/108"
20	1	312-5261-2	Deck Assembly S2 4-5,000/60x108	4,5,000/60x108"
20	1	312-5261-3	Deck Assembly S2 4-5,000/72x108	4,5,000/72x108"
20	1	312-5261-4	Deck Assembly S2 4-5,000/84x108	4,5,000/84x108"
20	1	312-5261-5	Deck Assembly S2 4-5,000/108x108	4,5,000/96x108"
20	1	312-5257-2	Deck Assembly S3 (Tapered) 4-5/60x108	4,5,000/60x108"
20	1	312-5257-3	Deck Assembly S3 (Tapered) 4-5/72x108	4,5,000/72x108"
20	1	312-5257-4	Deck Assembly S3 (Tapered) 4-5/84x108	4,5,000/84x108"
20	1	312-5257-5	Deck Assembly S3 (Tapered) 4-5/96x108	4,5,000/96x108"
21	2	798-043	Pin Ass'y (1" Thick Legs)	4,5,000/108"
22	6	106-389	Spacer Washer - 1-3/4"ODx1"IDx1/16"thk	4,5,000/108"
23	2	013-012	Spring Pin - 1/4" X 2"	4,5,000/108"
24	2	117-005	Roller Stop	4,5,000/108"
25	1	039-066	Paint, Blue (Fast Dry Enamel)	4,5,000/108"
26	2	300-5000-12	Hose, #6 Hp(20"Lg) Str. Swivel(2)	4,5/60x108"
26	2	100-5004-1	Hose, #6 Hp(24"Lg) Str. Swivel(2)	4,5,000/72-84x108"
26	2	300-5000-48	Hose, #6 Hp(38"Lg) Str. Swivel(2)	4,5,000/96x108"
27	1	034-571	Fitting, Tee 022T-6-6	4,5,000/108"
28	2	034-504	Adapter, Fitting 0103-6-6	4,5,000/108"
29	2	034-599	Fitting Elbow Forged #6mp-4mp-90	4,5,000/108"
30	2	033-663	Velocity Fuse 7.5 GPM	4,5,000/108"

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General Assembly - 4 & 5,000 lb. Cap. - 108" Deck Length

Item	Qty	Part No	General Description	Specific Description
31	1	302-5002	Lip Assy,60"(18"Lg,4&5#)1pc Lp	4,5,000/108"
32	1	312-5080-5	Guard Rail, Right Side 108"Deck	4,5,000/108"
33	1	312-5077	Guard Rail, Left Side 96-1/2"x45"	4,5,000/108"
33	1	312-5081-5	Guard Rail, Left Side 108"	5,000/72,84X108"
34	1	091-023-0600	Chain (60"Lg) [3/16"Proof Coil Galvanized]	4,5,000/108"
35	2	091-023-0540	Chain (54"Lg) 3/16"Proof Coil Galvanized	4,5,000/60X108"
35	2	091-023-0660	Chain (66"Lg) 3/16"Proof Coil Galvanized	4,5/72X108"
35	2	091-023-0780	Chain (78"Lg) 3/16"Proof Coil Galvanized	4,5,000/84X108"
35	2	091-023-0900	Chain (90"Lg) 3/16"Proof Coil Galvanized	4,5,000/96X108"
36	2	R3-19203	Hook Snap 4"Lg - 7/16"-20	4,5,000/108"
37	3	034-674	Fitting - 1/4" M X 3/8" Comp	4,5,000/108"
38	1	034-673	Fitting Nylon Tee - (3/8" Comp)	4,5,000/108"
39	2	091-000-0516	Tubing Black Nylon (3/8"X51-3/4"LG)	4,5,000/60X108"
40	2	091-000-0576	Tubing Black Nylon (3/8"X57-3/4"LG)	4,5,000/72,84X108"
40	2	091-000-0320	Tubing Black Nylon (3/8"X32"LG)	5,000/72X108"
40	2	091-000-0696	Tubing Black Nylon (3/8"X69-3/4"LG)	4,5,000/96X108"
41	1	300-5001-37	Hose, #8 HP (138"Lg) Str.Swivel(2)	4,5,000/60X108"
41	1	300-5001-40	Hose, #8 HP (156"Lg) Str.Swivel(2)	4,5,000/72X108"
41	1	300-5001-55	Hose Assy #8 HP - (162"Lg.)	4,5,000/84X108"
41	1	300-5001-40	Hose, #8 HP (180"Lg) Str.Swivel(2)	4,5,000/96X108"
42	1	300-5006-3	Vent Line Kit (28"LG)	4,5,000/60X108"
42	1	300-5006-4	Vent Line Kit (29"LG)	4,5,000/72X108"
42	1	300-5006-5	Vent Line Kit (30"LG)	4,5,000/84X108"
42	1	300-5006-7	Vent Line Kit (32"LG)	4,5,000/96X108"
43	1	121-616-1	Bar, Lip Hinge	4,5,000/108"
44	2	013-005	Pin, Spring	4,5,000/108"

7.2.1 Cylinder Assembly- 4 & 5,000 lb. Cap. - 108" Deck Length

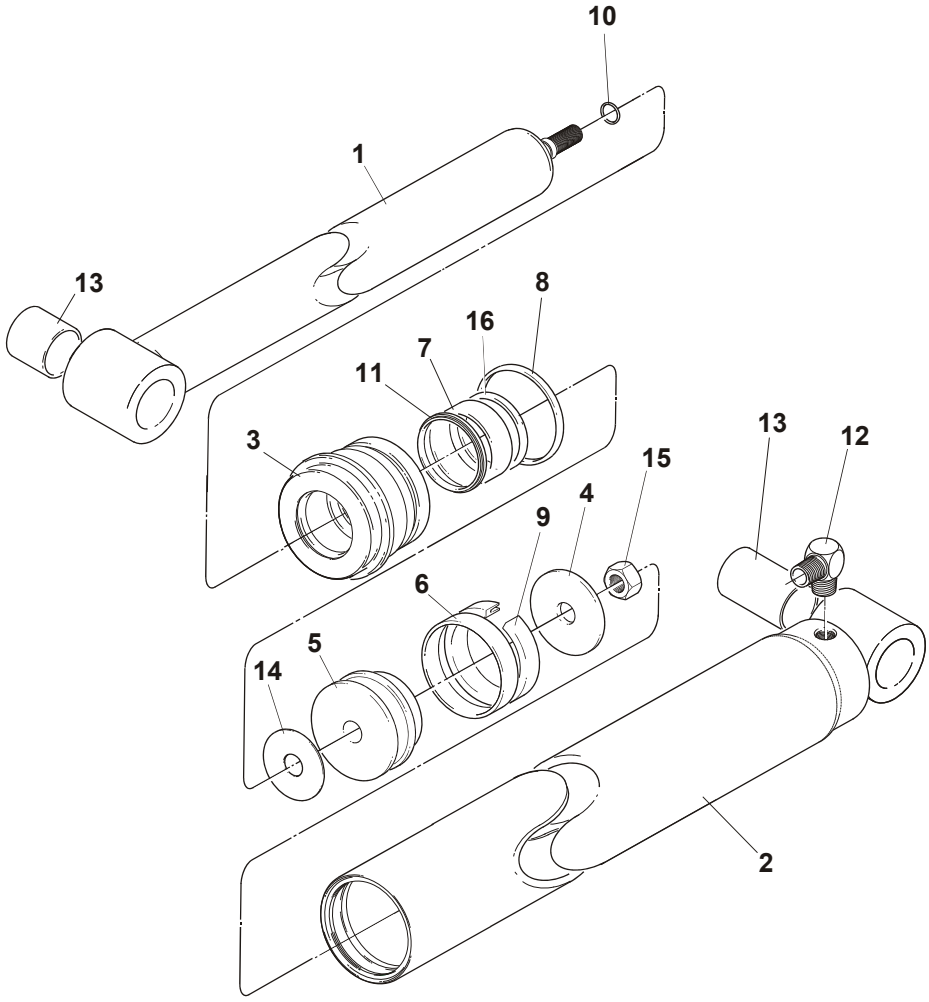


Figure 10 : Cylinder Assembly - Models 4 & 5 - 108" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	**-**	**780-142-204**	**Cylinder Ass'y (4"Dia) [20-1/2"Stroke]**	**4,&5,000/108"**
1	1	786-855	Ram Assy 3", 3-1/2", & 4"	4,&5,000/108"
2	1	780-143	Housing Weldment (4"Dia)	4,&5,000/108"
3	1	117-989	Headnut 4" Dia. Cyl (2" Dia. Rod)	4,&5,000/108"
4	1	114-980	Piston Washer - (4" Dia)	4,&5,000/108"
5	1	114-638	Piston - 4"Dia Cyl	4,&5,000/108"
6●	1	036-156	Wear Ring Pist.Wd.3-1/2x1/2	4,&5,000/108"
7●	1	036-182	Wear Ring - 3" X .125" Thick	4,&5,000/108"
8●	1	036-130	O-Ring - 4"OD X 3-3/4"ID	4,&5,000/108"
9●	1	036-116	U-Cup - 4" X 3-3/8" X 1/2"	4,&5,000/108"
10●	1	036-108	O-Ring - 3/4"OD X 5/8"ID X 1/16"	4,&5,000/108"
11●	1	036-021	Wiping Ring - 2"ID	4,&5,000/108"
12	1	034-500	Fitting, 6-6	4,&5,000/108"
13	2	018-027	Bushing	4,&5,000/108"
14●	1	117-993	Gasket	4,&5,000/108"
15	1	011-530	Nut, Hex Jam - 3/4"-10	4,&5,000/108"
16●	1	036-176	O-Ring (2-1/4" OD X 2" ID)	4,&5,000/108"
-	**-**	**783-572**	**Seal Kit Includes Itme Marked (●)**	4,&5,000/108"

7.3 General Assembly - 6,000 lb. Cap. - 108" Deck Length

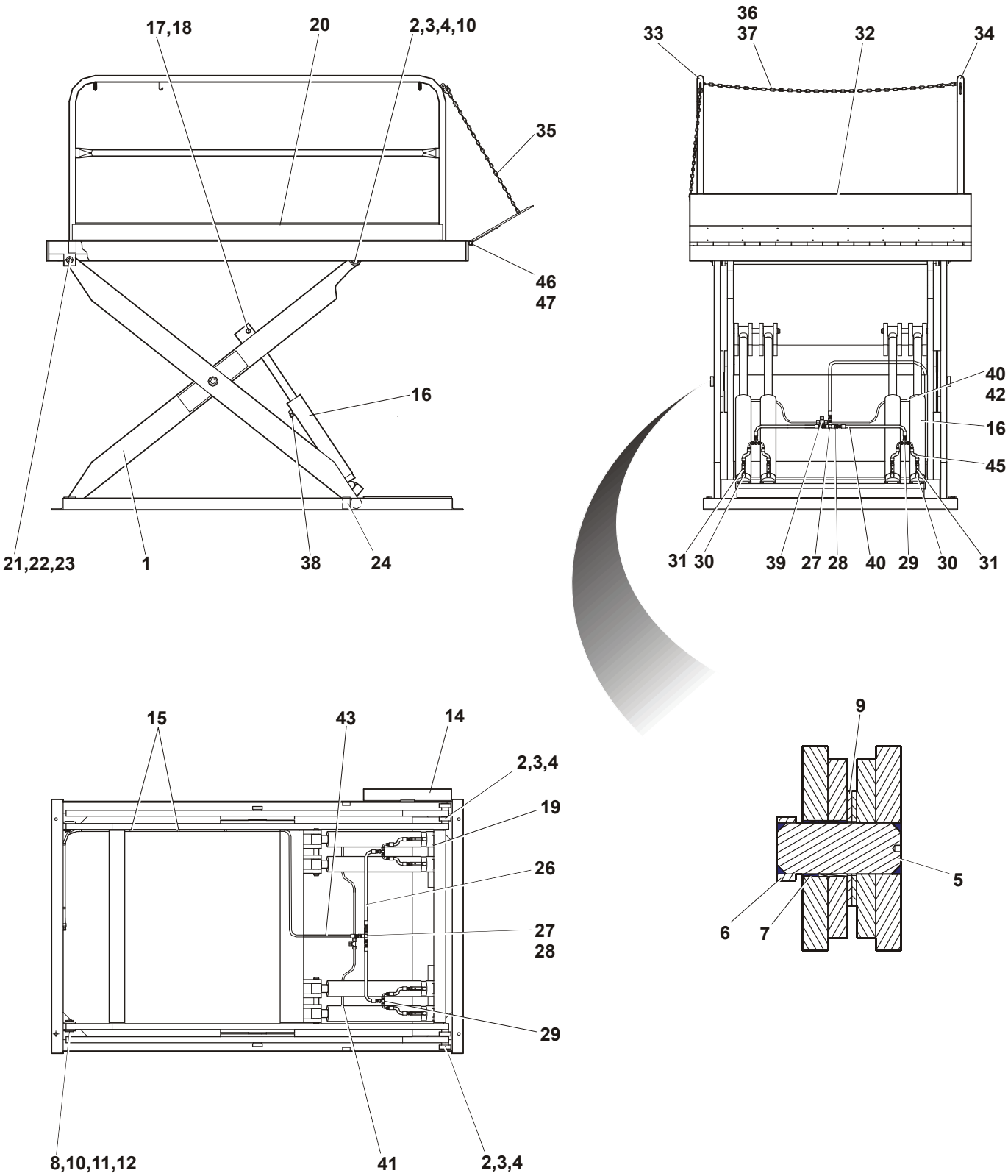


Figure 11 : General Assembly - 6,000 lb. - 108" Deck Length

General Assembly - 6,000 lb. Cap. - 108" Deck Length

Item	Qty	Part No	General Description	Specific Description
				10" Lowered Height
-	**-**	**-**	**General Assy 6,000 - 108" Deck Length**	**REF. Drwg. 310-5425**
1*	**1**	**313-5222-2**	**Frame/Leg Weldment**	**6,000/60X108"**
1*	**1**	**313-5222-3**	**Frame/Leg Weldment**	**6,000/72-84X108"**
1*	**1**	**313-5222-4**	**Frame/Leg Weldment**	**6,000/96X108"**
2	2	019-001	Bearing, 80x40x18mm	6,000/108"
3	4	011-066	Capscrew, Hex Sckt F/H-5/16"-18 X 3/4"	6,000/108"
4	2	013-005	Spring Pin 5/32"x1"Lg	6,000/108"
5	2	114-652	Leg Centre Pin 1-1/2" Thk Leg(4-7/8" Lg)	6,000/108"
6	2	114-606	Collar - 2" (Centre Pin Mod)	6,000/108"
7	2	018-031	Bushing - 2"IDx1"LG	6,000/108"
8	4	018-051	Bushing - 1"IDx3/4"LG	6,000/108"
9	2	012-219	Washer, Flat -2.13" IDx4.5"ODx0.187"TH	6,000/108"
10	4	121-684	Ring-Spacer (1-7/8" O.D)	6,000/108"
11	2	798-048	Pin Ass'y (3/4" Thick Legs)	6,000/108"
11	2	798-043	Pin Ass'y (3/4" Thick Legs)	6,000/108"
12	2	013-012	Spring Pin - 1/4" X 2	6,000/108"
13	6	106-389	Spacr Washer, 1-3/4"ODx1"IDx1/16"THK	6,000/108"
14	1	822-440	Strut Weldment, Maintenance	6,000/108"
15	8	035-262	Strap (#6 Hose Clamp)	6,000/108"
16**	**4**	**780-144-200**	**Cylinder Ass'y (3-1/2"Dia) [20"Stroke]**	**6,000/108"**
17	4	115-043	Pin-Cylinder Pivot	6,000/108"
18	4	013-036	Retaining Ring Ext. - 1-1/4"Id	6,000/108"
19	8	104-476	Lip Stop (3/4"X5/8")	6,000/108"
20	1	312-5261-7	Deck Ass'y S2 6,000/60x108	6,000/60X108"
20	1	312-5261-8	Deck Ass'y S2 6,000/72X108	6,000/72X108"
20	1	312-5261-9	Deck Ass'y S2 6,000/84X108	6,000/84X108"
20	1	312-5261-10	Deck Ass'y S2 6,000/96X108	6,000/96X108"
20	1	312-5257-7	Deck Ass'y S3 (Tapered) 6,000/60x108	6,000/60X108"
20	1	312-5257-8	Deck Ass'y S3 (Tapered) 6,000/72x108	6,000/72X108"
20	1	312-5257-9	Deck Ass'y S3 (Tapered) 6,000/84x108	6,000/84X108"
20	1	312-5257-10	Deck Ass'y S3 (Tapered) 6,000/96x108	6,000/96X108"
21	2	798-049	Pin Ass'y - (1-1/2" Thick Legs)	6,000/108"
22	6	106-389	Spacer Washer - 1-3/4"ODx1"IDx1/16"THK	6,000/108"
23	2	013-012	Spring Pin - 1/4" X 2"	6,000/108"
24	2	117-005	Roller Stop	6,000/108"
25	1.5GA	039-066	Paint, Blue (Fast Dry Enamel)	6,000/108"
26	2	300-5000-12	Hose, #6 HP (20"Lg) Str.Swivel(2)	6,000/60X96"
26	2	300-5000-14	Hose, #6 HP (25"Lg) Str.Swivel(2)	6,000/72-84X96"
26	2	300-5000-48	Hose, #6 Hp (38"Lg) Str.Swivel(2)	6,000/96X96"
27	1	034-571	Fitting, Tee 022T-6-6	6,000/108"
28	2	034-504	Adapter, Fitting 0103-6-6	6,000/108"
29	2	034-551	Fitting, Tee 033T-6-6	6,000/108"
30	2	034-599	Fitting Elbow Forged #6MP-4MP-90°	6,000/108"

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General Assembly - 6,000 lb. Cap. - 108" Deck Length

Item	Qty	Part No	General Description	Specific Description
31	2	033-663	Velocity Fuse, 7.5gpm	6,000/108"
32	1	302-5002-7	Lip Assy,60" (18"LG,6#)	6,000/108"
33	1	312-5080-5	Guard Rail, Right Side 108"Deck	6,000/108"
34	1	312-5081-5	Guard Rail, Left Side 108"Deck	6,000/108"
35	1	091-023-0600	Chain (60"Lg) 3/16"	6,000/108"
36	2	091-023-0540	Chain - 3/16"Galvanized 54"	6,000/60X108"
36	2	091-023-0660	Chain - 3/16"Galvanized 66"	6,000/72X108"
36	2	091-023-0780	Chain - 3/16"Galvanized 78"	6,000/84x108"
36	2	091-023-0900	Chain - 3/16"Galvanized 90"	6,000/96x108"
37	2	R3-19203	Hook Snap 4"Lg	6,000/108"
38	2	034-674	Fitting, 1/4" M X 3/8" COMP	6,000/108"
39	1	034-673	Fitting Nylon Tee - 3/8" Comp,	6,000/108"
40	2	035-085	Fitting, Tee	6,000/108"
41	1	091-000-0340	Tubing, Black Nylon (34"LG")	6,000/60X108"
41	1	091-000-0400	Tubing, Black Nylon (40"LG)	6,000/72-84X108"
41	1	091-000-0520	Tubing, Black Nylon (52"LG)	6,000/96X108"
42	2	091-000-0064	Tubing, Black Nylon (6-1/2" LG.)	6,000/108"
43	1	300-5001-37	Hose, #8 HP (138"Lg) Str.Swivel(2)	6,000/60X108"
43	1	300-5001-40	Hose, #8 HP (156"Lg) Str.Swivel(2)	6,000/72X108"
43	1	300-5001-55	Hose Assy #8 HP - (162"Lg.)	6,000/84X108"
43	1	300-5001-40	Hose, #8 HP (180"Lg) Str.Swivel(2)	6,000/96X108"
44	1	300-5006-3	Vent Line Kit (28'lg)	6,000/60X108"
44	1	300-5006-4	Vent Line Kit (29'lg)	6,000/72X108"
44	1	300-5006-5	Vent Line Kit (30'lg)	6,000/84X108"
44	1	300-5006-6	Vent Line Kit (31'lg)	6,000/96X108"
45	4	300-5000-1	Hose, #6 HP (6"Lg) Str.Swivel(2)	6,000/108"
46	1	106-205	Bar For Lip Hinge (60"Lg)	6,000/108"
47	1	013-010	Spring Pin -1/4" X 1-1/4"	6,000/108"

7.3.1 Cylinder Assembly- 6,000 lb. Cap. - 108" Deck Length

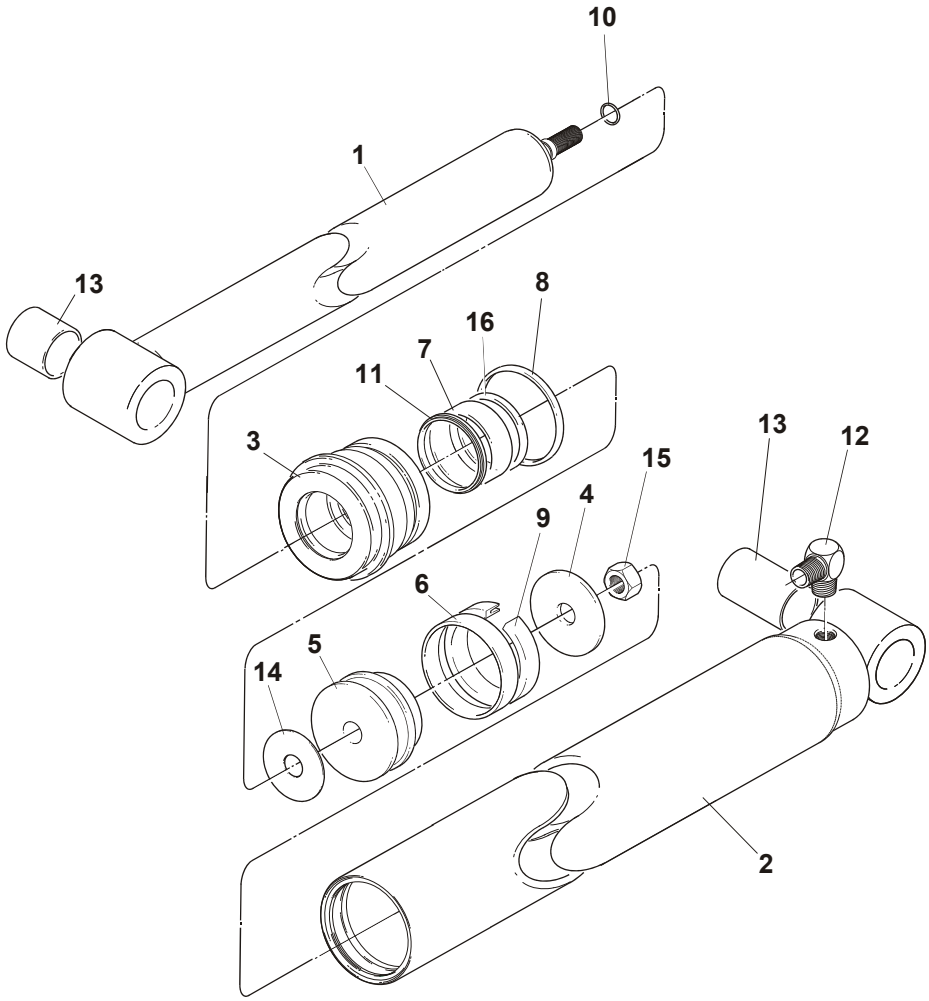


Figure 12 : Cylinder Assembly - 6,000 lb. - 108" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	**-**	**780-144-200**	**Cylinder Ass'y (3-1/2"Dia) [20"Stroke]**	**6,000/108"**
1	1	786-855	Ram Assy 3", 3-1/2", & 4"	6,000/108"
2	1	780-145	Housing Weldment (4"Dia)	6,000/108"
3	1	117-966	Headnut 3-1/2" Dia. Cyl (2" Dia. Rod)	6,000/108"
4	1	114-979	Piston Washer - (3-1/2" Dia)	6,000/108"
5	1	114-639	Piston - 3-1/2"Dia Cyl	6,000/108"
6●	1	036-155	Wear Ring Pist.Wd.3-1/2x1/2	6,000/108"
7●	1	036-182	Wear Ring - 3" X .125" Thick	6,000/108"
8●	1	036-131	O-Ring - 3-1/2"OD X 3-3/4"ID	6,000/108"
9●	1	036-111	U-Cup - 3-1/2" X 2-7/8" X 1/2"	6,000/108"
10●	1	036-108	O-Ring - 3/4"OD X 5/8"ID X 1/16"	6,000/108"
11●	1	036-021	Wiping Ring - 2"ID	6,000/108"
12	1	034-500	Fitting, 6-6	6,000/108"
13	2	018-027	Bushing	6,000/108"
14●	1	117-993	Gasket	6,000/108"
15	1	011-530	Nut, Hex Jam - 3/4"-10	6,000/108"
16●	1	036-176	O-Ring (2-1/4" OD X 2" ID)	6,000/108"
-	**-**	**783-557**	**Seal Kit Includes Itme Marked (●)**	**6,000/108"**

7.4 General Assembly - 4,000 lb. Cap. - 120" Deck Length

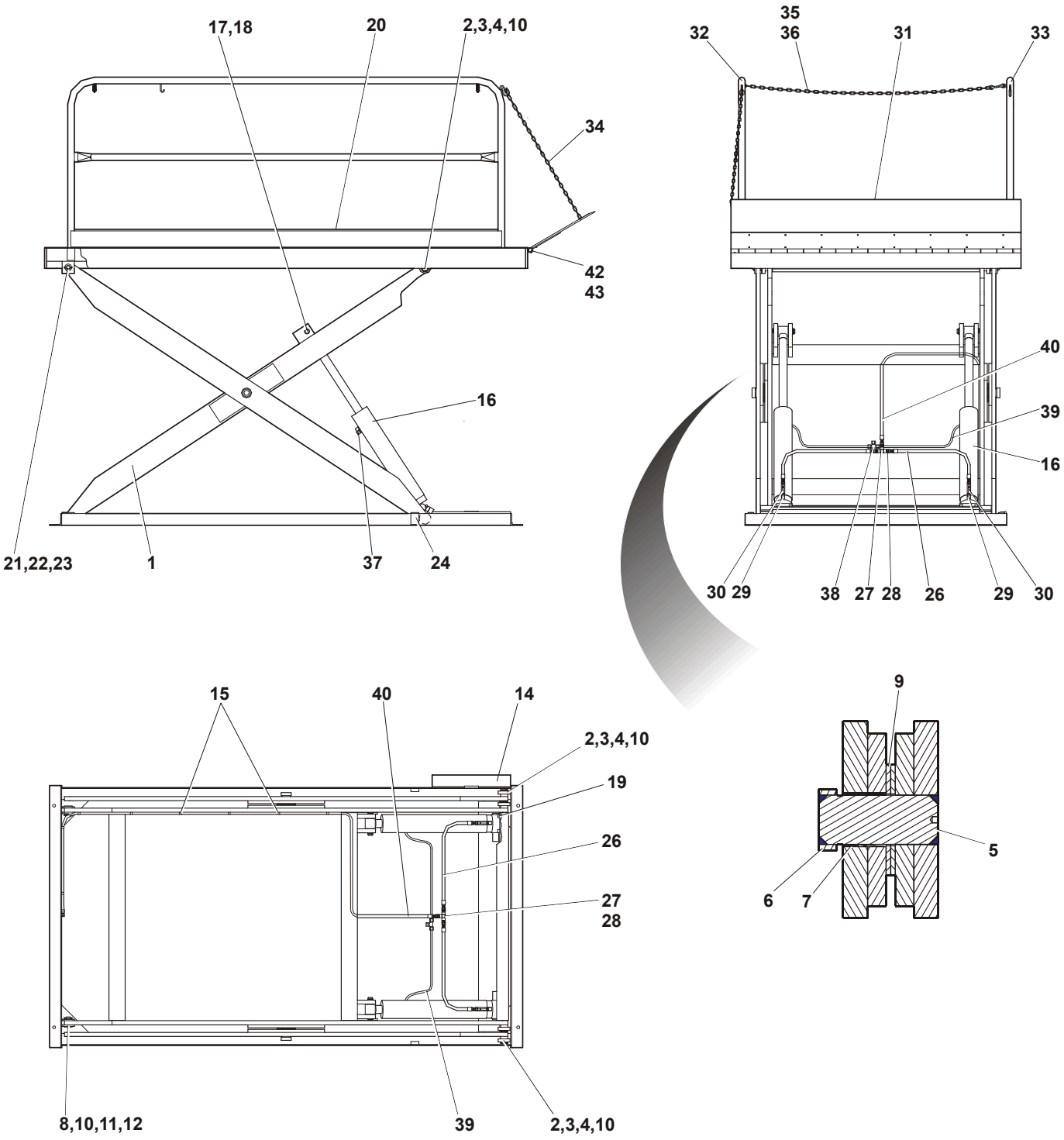


Figure 13 : General; Assembly - 4,000 lb. - 120" Deck Length

General Assembly - 4,000 lb. Cap. - 120" Deck Length

Item	Qty	Part No	General Description	Specific Description
				10" Lowered Height
-	**-**	**-**	**General Assembly ED4 - 120" Deck Length**	**REF. Drwg. 310-5426**
1*	**1**	**313-5223-2**	**Frame/Leg Weldment**	**4,000/60X120**
1*	**1**	**313-5223-3**	**Frame/Leg Weldment**	**ED4/72-84X120**
1*	**1**	**313-5223-4**	**Frame/Leg Weldment**	**ED4/96X120**
2	2	019-022	Bearing, 80x40x18mm	4,000/120"
3	4	011-066	Capscrew, Hex Sckt F/H-5/16"-18 X 3/4"	4,000/120"
4	2	013-005	Spring Pin 5/32"x1"Lg	4,000/120"
5	2	114-651	Leg Centre Pin 1" Thk Leg (4-7/8" Lg)	4,000/120"
6	2	114-606	Collar - 2" (Centre Pin Mod Ed)	4,000/120"
7	2	018-033	Bushing - 2"IDx1-3/4""LG	4,000/120"
8	4	018-061	Bushing - 1"IDx1"LG	4,000/120"
9	2	012-219	Washer,Flat-2.13" IDx4.5"ODx0.187"THK	4,000/120"
10	4	121-684	Ring-Spacer (1-7/8" O.D)	4,000/120"
11	2	798-043	Pin Ass'y (3/4" Thick Legs)	4,000/120"
12	2	013-012	Spring Pin - 1/4" X 2	4,000/120"
13	6	105-879	Spacer Washer, 3/4"ODx1-3/16"IDx1/16"THK	4,000/120"
14	1	822-440	Strut Weldment, Maintenance	4,000/120"
15	8	035-262	Strap (#6 Hose Clamp)	4,000/120"
16**	**4**	**780-142-220**	**Cylinder Ass'y (4"Dia) [22"Stroke]**	**4,000/120"**
17	4	114-993	Pin-Cylinder Pivot	4,000/120"
18	4	013-036	Retaining Ring Ext. - 1-1/4"Id	4,000/120"
19	8	104-476	Lip Stop (3/4"X5/8")	4,000/120"
20	1	312-5262-2	Deck Ass'y S2 4,000/60x120	4,000/60X120"
20	1	312-5262-3	Deck Ass'y S2 4,000/72X120	4,000/72X120"
20	1	312-5262-4	Deck Ass'y S2 4,000/84X120	4,000/84X120"
20	1	312-5262-5	Deck Ass'y S2 4,000/96X120	4,000/96X120"
20	1	312-5258-2	Deck Ass'y S3 (Tapered) 4,000/60X120	4,000/60X120"
20	1	312-5258-3	Deck Ass'y S3 (Tapered) 4,000/72X120	4,000/72X120"
20	1	312-5258-4	Deck Ass'y S3 (Tapered) 4,000/84X120	4,000/84X120"
20	1	312-5258-5	Deck Ass'y S3 (Tapered) 4,000/96X120	4,000/96X120"
21	2	798-043	Pin Ass'y - (1-1/2" Thick Legs)	4,000-120"
22	6	106-389	Spacer Washer - 1-3/4"Odx1"Idx1/16"THK	4,000-120"
23	2	013-012	Spring Pin - 1/4" X 2"	4,000-120"
24	2	117-005	Roller Stop	4,000-120"
25	1.5GA	039-066	Paint, Blue (Fast Dry Enamel)	4,000-120"
26	2	300-5000-12	Hose, #6 HP (20"Lg) Str.Swivel(2)	4,000/60X120"
26	2	300-5000-14	Hose, #6 HP (25"Lg) Str.Swivel(2)	4,000/72-84X120"
26	2	300-5000-48	Hose, #6 Hp (38"Lg) Str.Swivel(2)	4,000/96X120"
27	1	034-571	Fitting, Tee 022T-6-6	4,000/120"
28	2	034-504	Adapter, Fitting 0103-6-6	4,000/120"
29	2	034-599	Fitting Elbow Forged #6mp-4mp-90	4,000/120"
30	2	033-663	Velocity Fuse, 7.5gpm	4,000/120"

*** - INDENTED SUB-ASSEMBLY – SHOWN ON SAME PAGE**
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General Assembly - 4,000 lb. Cap. - 120" Deck Length

Item	Qty	Part No	General Description	Specific Description
31	1	302-5002	Lip Assy,60" (18"LG,6#)	4,000/120"
32	1	312-5080-6	Guard Rail, Right Side 120"Deck	4,000/120"
33	1	312-5081-6	Guard Rail, Left Side 120"Deck	4,000/120"
34	1	091-023-0600	Chain (60"Lg) 3/16"	4,000/120"
35	2	091-023-0540	Chain - 3/16"Galvanized 54"	4,000/60X120"
35	2	091-023-0660	Chain - 3/16"Galvanized 66"	4,000/72X120"
35	2	091-023-0780	Chain - 3/16"Galvanized 78"	4,000/84x120"
35	2	091-023-0900	Chain - 3/16"Galvanized 90"	4,000/96x120"
36	2	R3-19203	Hook Snap 4"Lg	4,000/120"
37	2	034-674	Fitting, 1/4" M X 3/8" Comp	4,000/120"
38	1	034-673	Fitting Nylon Tee - 3/8" Comp,	4,000/120"
39	1	091-000-0532	Tubing, Black Nylon (53-1/4"LG)	4,000/60X120"
39	1	091-000-0592	Tubing, Black Nylon (59-1/4""LG)	4,000/72-84X120"
39	1	091-000-0692	Tubing, Black Nylon (69-1/4"LG)	4,000/96X120"
40	1	300-5001-38	Hose, #8 HP (144"Lg) Str.Swivel(2)	4,000/60X120"
40	1	300-5001-40	Hose, #8 HP (156"Lg) Str.Swivel(2)	4,000/72X120"
40	1	300-5001-41	Hose, #8 HP (168"Lg) Str.Swivel(2)	4,000/84X120"
40	1	300-5001-43	Hose, #8 HP (180"Lg) Str.Swivel(2)	4,000/96X120"
41	1	300-5006-4	Vent Line Kit (29'lg)	4,000/60X120"
41	1	300-5006-5	Vent Line Kit (30'lg)	4,000/72X120"
41	1	300-5006-6	Vent Line Kit (31'lg)	4,000/84X120"
41	1	300-5006-7	Vent Line Kit (32'lg)	4,000/96X120"
42	1	121-616-1	Shaft. Lip Hinge	4,000/120"
43	1	013-005	Spring Pin -1/4" X 1-1/4"	4,000/120"

7.4.1 Cylinder Assembly- 4 & 5,000 lb. Cap. - 108" Deck Length

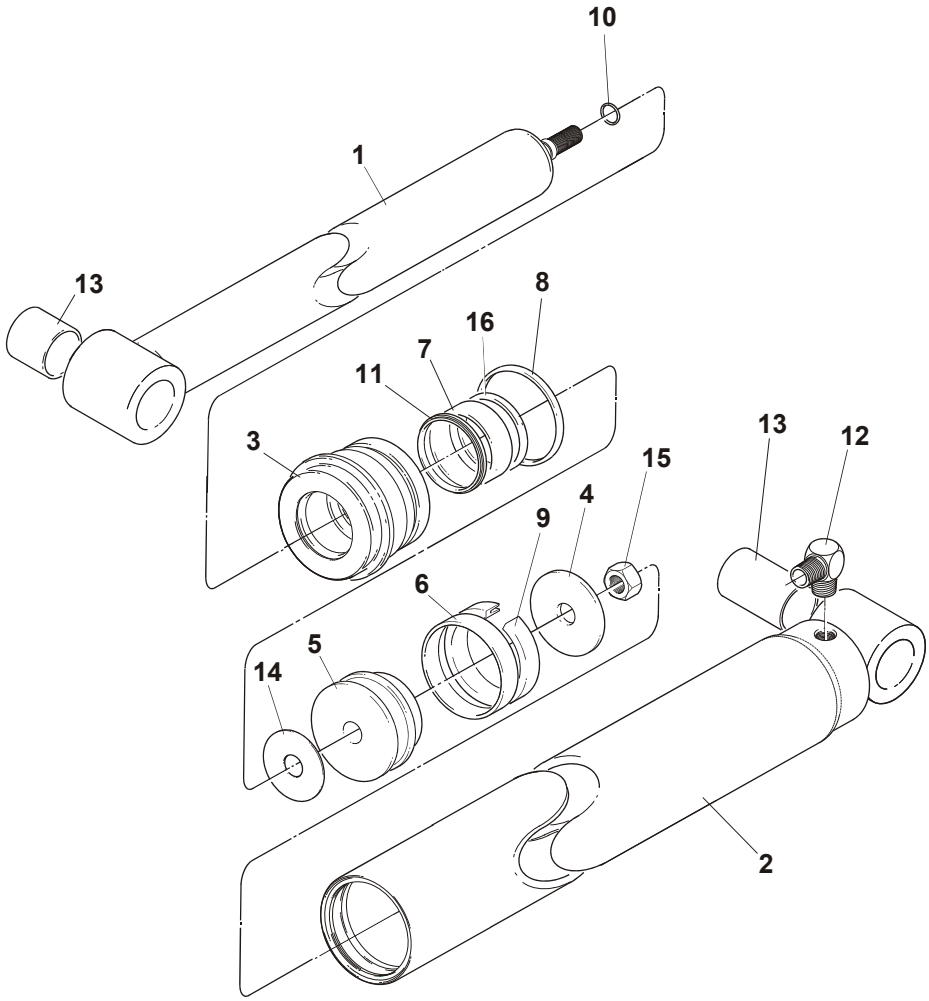


Figure 14 : Cylinder Assembly - 4, & 5,000 - 108" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	**-**	**780-142-220**	**Cylinder Ass'y (4"Dia) [22"Stroke]**	**4,000/120"**
1	1	786-855	Ram Assy 3", 3-1/2", & 4"	4,000/120"
2	1	780-143	Housing Weldment (4"Dia)	4,000/120"
3	1	117-989	Headnut 4" Dia. Cyl (2" Dia. Rod)	4,000/120"
4	1	114-980	Piston Washer - (4" Dia)	4,000/120"
5	1	114-638	Piston - 4"Dia Cyl	4,000/120"
6●	1	036-156	Wear Ring Pist.Wd.3-1/2x1/2	4,000/120"
7●	1	036-182	Wear Ring - 3" X .125" Thick	4,000/120"
8●	1	036-130	O-Ring - 4"OD X 3-3/4"ID	4,000/120"
9●	1	036-116	U-Cup - 4" X 3-3/8" X 1/2"	4,000/120"
10●	1	036-108	O-Ring - 3/4"OD X 5/8"ID X 1/16"	4,000/120"
11●	1	036-021	Wiping Ring - 2"ID	4,000/120"
12	1	034-500	Fitting, 6-6	4,000/120"
13	2	018-027	Bushing	4,000/120"
14●	1	117-993	Gasket	4,000/120"
15	1	011-530	Nut, Hex Jam - 3/4"-10	4,000/120"
16●	1	036-176	O-Ring (2-1/4" OD X 2" ID)	4,000/120"
-	**-**	**783-572**	**Seal Kit Includes Items Marked (●)**	**4,000/120"**

7.5 General Assembly - 5 & 6,000 lb. Cap. - 120" Deck Length

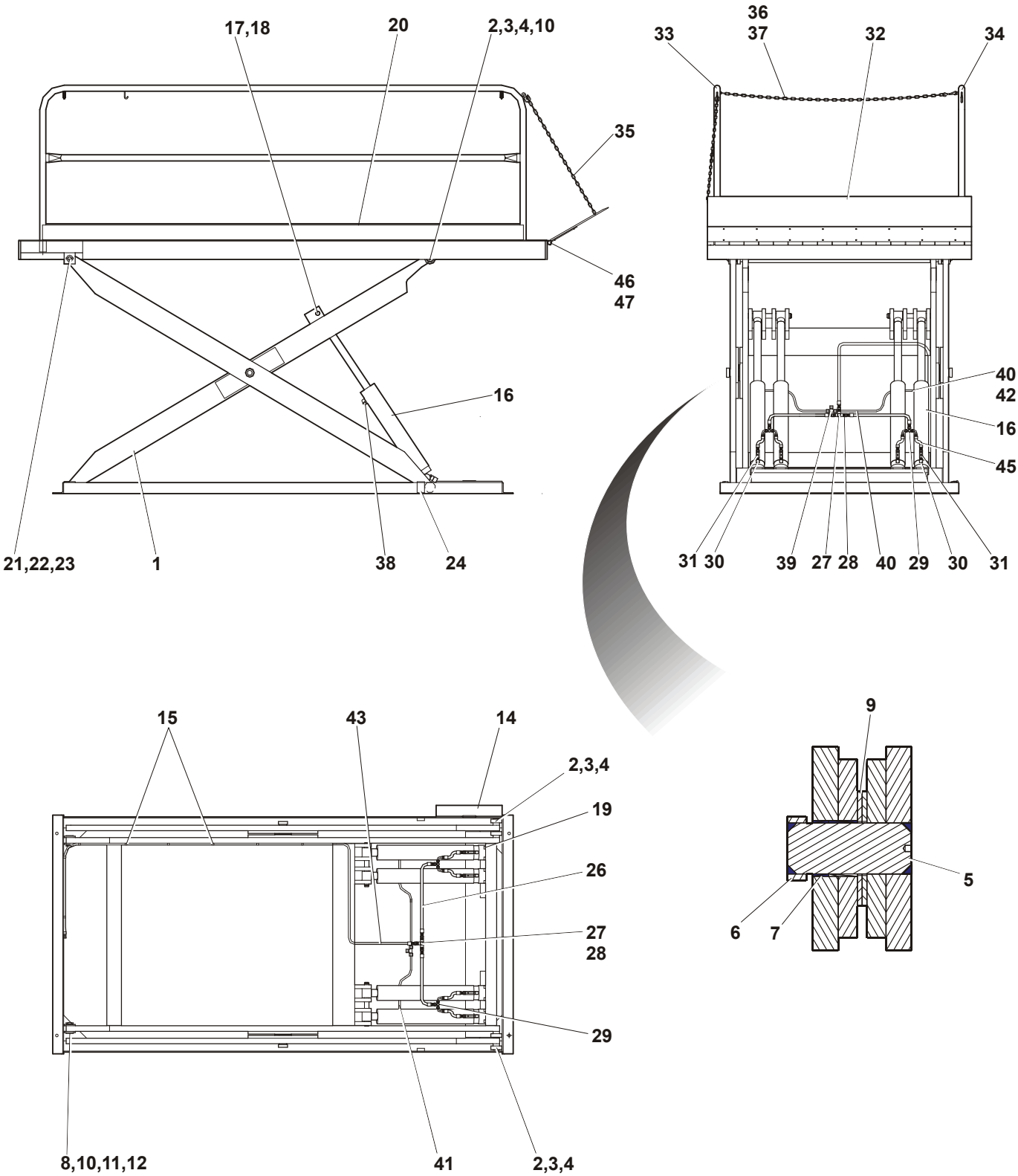


Figure 15 : General Assembly - 5, & 6,000 - 120" Deck Length

General Assembly - 5 & 6,000 lb. Cap. - 120" Deck Length

Item	Qty	Part No	General Description	Specific Description
				10" Lowered Height
			General Assembly ED5,6 - 120" Deck Length	**REF.DRG.310-5427**
1*	**1**	**313-5224-2**	**Frame And Leg Weldment**	**5,000/60X120**
1*	**1**	**313-5224-3**	**Frame And Leg Weldment**	**5,000/72,84X120**
1*	**1**	**313-5224-4**	**Frame And Leg Weldment**	**5,000/96X120**
1*	**1**	**313-5225-2**	**Frame And Leg Weldment**	**6,000/60X120**
1*	**1**	**313-5225-3**	**Frame And Leg Weldment**	**6,000/72,84X120**
1*	**1**	**313-5225-4**	**Frame And Leg Weldment**	**6,000/96X120**
2	4	019-022	Bearing, 80x40x18mm	5,000/120"
2	4	019-001	Bearing Roller - 3"ODx1-5/8"IDx1"W	6,000/120"
3	4	011-066	Capscrew, Hex Sckt F/H-5/16"-18 X 3/4"	5,&6,000/120"
4	2	013-005	Spring Pin 5/32"x1"Lg	5,&6,000/120"
5	2	114-652	Leg Centre Pin 1-1/2" Thk Leg(4-7/8" Lg)	5,&6,000/120"
6	2	114-606	Collar - 2" (Centre Pin Mod Ed)	5,&6,000/120"
7	2	018-031	Bushing - 2" IDx1"LG	5,&6,000/120"
8	4	018-051	Bushing - 1"IDx3/4"LG	5,&6,000/120"
9	2	012-219	Washer,Flat-2.13"IDx4.5"ODx0.187"THK	5,&6,000/120"
10	4	121-684	Ring-Spacer (1-7/8" O.D)	5,&6,000/120"
11	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	5,&6,000/120"
12	2	013-012	Spring Pin - 1/4" X 2	5,&6,000/120"
13	6	105-879	Washer, 3/4"ODx1-3/16"IDx1/16"THK	5,&6,000/120"
14	1	822-440	Strut Weldment, Maintenance	5,&6,000/120"
15	8	035-262	Strap (#6 Hose Clamp)	5,&6,000/120"
16**	**2**	**780-144-214**	**Cylinder Ass'y (3-1/2"Dia) [21-1/2" Stroke]**	5,&6,000/120"
17	2	115-043	Pin-Cylinder Pivot	5,&6,000/120"
18	4	013-036	Retaining Ring Ext. 1-1/4"ID	5,&6,000/120"
19	4	104-476	Lip Stop (3/4"X5/8")	5,&6,000/120"
20	1	312-5262-2	Deck Assembly S2 5,&6,000/60x120	5,&6,000/60X120"
20	1	312-5262-3	Deck Assembly S2 5,&6,000/72x120	5,&6,000/72X120"
20	1	312-5262-4	Deck Assembly S2 5,&6,000/84x120	5,&6,000/84X120"
20	1	312-5262-5	Deck Assembly S2 5,&6,000/96x120	5,&6,000/96X120"
20	1	312-5258-2	Deck Assembly S3 (Taprd) 5,&6,000/60x120	5,&6,000/60X120"
20	1	312-5258-3	Deck Assembly S3 (Taprd) 5,&6,000/72x120	5,000/72X120"
20	1	312-5258-4	Deck Assembly S3 (Taprd) 5,&6,000/84x120	5,000/84X120"
20	1	312-5258-5	Deck Assembly S3 (Taprd) 5,&6,000/96x120	5,000/96X120"
20	1	312-5258-7	Deck Assembly S3 (Tapered) 6,000/60x120	6,000/60X120"
20	1	312-5258-8	Deck Assembly S3 (Tapered) 6,000/72x120	6,000/72X120"
20	1	312-5258-9	Deck Assembly S3 (Tapered) 6,000/84x120	6,000/84X120"
20	1	312-5258-10	Deck Assembly S3 (Tapered) 6,000/96x120	6,000/96X120"
21	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	5,&6,000/120"
22	6	106-389	Spacer Washer - 1-3/4"ODx1"IDx1/16"thk	5,&6,000/120"
23	2	013-012	Spring Pin - 1/4" X 2"	5,&6,000/120"
24	2	117-005	Roller Stop	5,&6,000/120"

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General Assembly - 5 & 6,000 lb. Cap. - 120" Deck Length

Item	Qty	Part No	General Description	Specific Description
25	1	039-066	Paint, Blue (Fast Dry Enamel)	5,&6,000/120"
26	2	300-5000-12	Hose, #6 Hp(20"Lg) Str. Swivel(2)	5,&6,000/60X120"
26	2	300-5000-14	Hose, #6 Hp(24"Lg) Str. Swivel(2)	5,&6,000/72-84X120"
26	2	300-5000-48	Hose, #6 Hp(38"Lg) Str. Swivel(2)	5,&6,000/96X120"
27	1	034-571	Fitting, Tee 022t-6-6	5,&6,000/120"
28	2	034-504	Adapter, Fitting 0103-6-6	5,&6,000/120"
29	2	034-551	Fitting, Tee 033T-6-6	5,&6,000/120"
30	2	034-599	Fitting Elbow Forged #6MP-4MP-90	5,&6,000/120"
31	2	033-663	Velocity Fuse 7.5 GPM	5,&6,000/120"
32	1	302-5002	Lip Assy,60"(18"Lg,4&5#)1pc Lp	5,000/120"
32	1	302-5002-7	Lip Assy,60"(18"Lg,4&5#)1pc Lp	6,000/120"
33	1	312-5080-6	Guard Rail, Right Side 120"Deck	5,&6,000/120"
34	1	312-5081-6	Guard Rail, Left Side 120"Deck	5,&6,000/120"
35	1	091-023-0600	Chain (60"Lg) [3/16"Proof Coil Galvanized]	5,&6,000/120"
36	2	091-023-0540	Chain (54"Lg) 3/16"Proof Coil Galvanized	5,&6,000/60X120"
36	2	091-023-0660	Chain (66"Lg) 3/16"Proof Coil Galvanized	5,&6,000/72X120'
36	2	091-023-0780	Chain (78"Lg) 3/16"Proof Coil Galvanized	5,&6,000/84X120"
36	2	091-023-0900	Chain (90"Lg) 3/16"Proof Coil Galvanized	5,&6,000/96X120"
37	2	R3-19203	Hook Snap 4"Lg - 7/16"-20	5,&6,000/120"
38	3	034-674	Fitting - 1/4" M X 3/8" Comp	5,&6,000/120"
39	1	034-673	Fitting Nylon Tee - (3/8" Comp)	5,&6,000/120"
40	1	035-085	Fitting, Tee	5,&6,000/120"
41	2	091-000-0100	Tubing Black Nylon (3/8"X10"LG)	5,&6,000/60X120"
41	2	091-000-0160	Tubing Black Nylon (3/8"X16"LG)	5,&6,000/72-84X120"
41	2	091-000-0280	Tubing Black Nylon (3/8"X28"LG)	5,&6,000/96X120"
42	2	091-000-0064	Tubing Black Nylon (3/8"X6-1/2"LG)	5,&6,000/120"
43	1	300-5001-38	Hose, #8 HP (144"Lg) Str.Swivel(2)	5,&6,000/60X120"
43	1	300-5001-40	Hose, #8 HP (156"Lg) Str.Swivel(2)	5,&6,000/72X120"
43	1	300-5001-41	Hose, #8 HP (168"Lg) Str.Swivel(2)	5,&6,000/84X120"
43	1	300-5001-43	Hose, #8 HP (180"Lg) Str.Swivel(2)	5,&6,000/96X120"
44	1	300-5006-4	Vent Line Kit (29'lg)	5,&6,000/60X120"
44	1	300-5006-5	Vent Line Kit (30'lg)	5,&6,000/72X120"
44	1	300-5006-6	Vent Line Kit (31'lg)	5,&6,000/84X120"
44	1	300-5006-7	Vent Line Kit (32'lg)	5,&6,000/96X120"
45	4	300-5000-1	Hose, #6 HP 6" LG Str. Swivel(2)	5,&6,000/120"
46	1	121-616-1	Bar, Lip Hinge	5,000/120"
46	1	106-205	Bar, Lip Hinge	6,000/120"
47	2	013-005	Pin, Spring	5,000/120"
47	2	013-010	Pin, Spring	6,000/120"

7.5.1 Cylinder Assembly- 5 & 6,000 lb. Cap. - 120" Deck Length

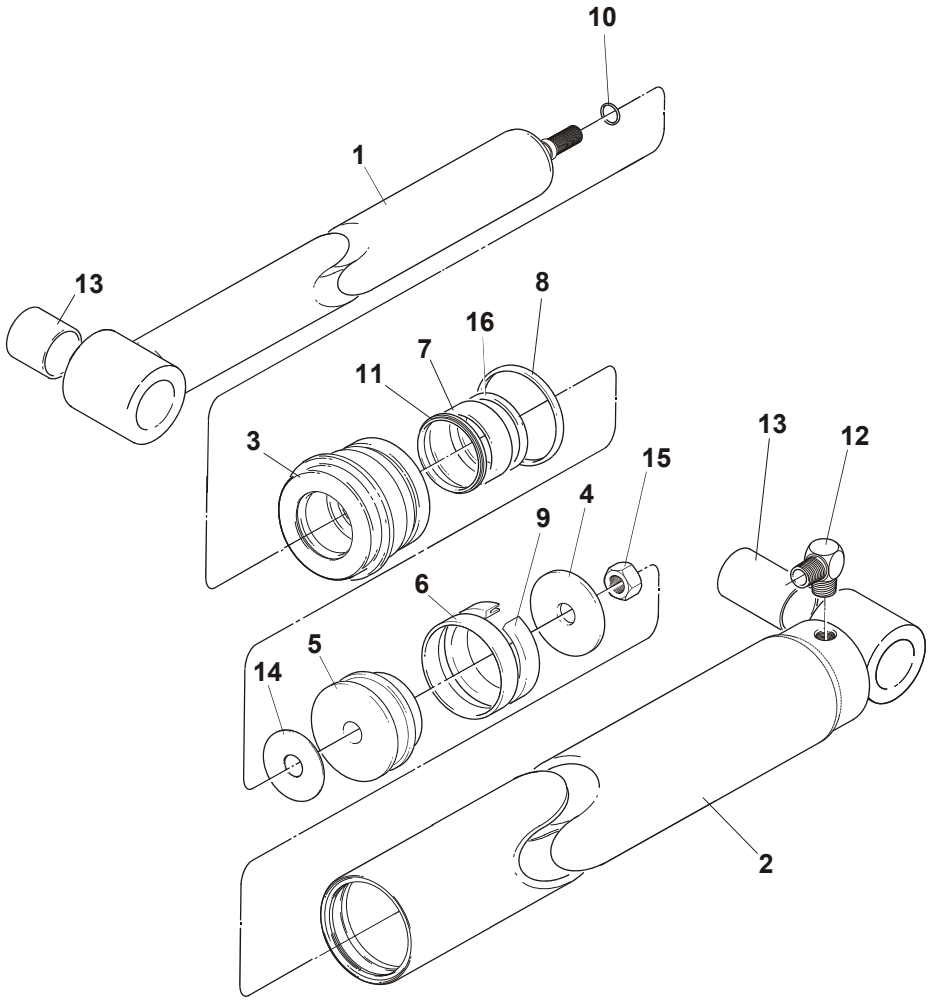


Figure 16 : Cylinder Assembly - 5, & 6,000 - 120" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	**-**	**780-144-214**	**Cylinder Ass'y (3-1/2"Dia) [21-1/2" Stroke]**	**5,&6,000/120"**
1	1	786-855	Ram Assy 3", 3-1/2", & 4"	5,&6,000/120"
2	1	780-145	Housing Weldment (4"Dia)	5,&6,000/120"
3	1	117-966	Headnut 3-1/2" Dia. Cyl (2" Dia. Rod)	5,&6,000/120"
4	1	114-979	Piston Washer - (3-1/2" Dia)	5,&6,000/120"
5	1	114-639	Piston - 3-1/2"Dia Cyl	5,&6,000/120"
6●	1	036-155	Wear Ring Pist.Wd.3-1/2x1/2	5,&6,000/120"
7●	1	036-182	Wear Ring - 3" X .125" Thick	5,&6,000/120"
8●	1	036-131	O-Ring - 3-1/2"OD X 3-3/4"ID	5,&6,000/120"
9●	1	036-111	U-Cup - 3-1/2" X 2-7/8" X 1/2"	5,&6,000/120"
10●	1	036-108	O-Ring - 3/4"OD X 5/8"ID X 1/16"	5,&6,000/120"
11●	1	036-021	Wiping Ring - 2"ID	5,&6,000/120"
12	1	034-500	Fitting, 6-6	5,&6,000/120"
13	2	018-027	Bushing	5,&6,000/120"
14●	1	117-993	Gasket	5,&6,000/120"
15	1	011-530	Nut, Hex Jam - 3/4"-10	5,&6,000/120"
16●	1	036-176	O-Ring (2-1/4" OD X 2" ID)	5,&6,000/120"
-	**-**	**783-557**	**Seal Kit Includes Itme Marked (●)**	**5,&6,000/120"**

7.6 General Assembly - 4,000 lb. Cap. - 144" Deck Length

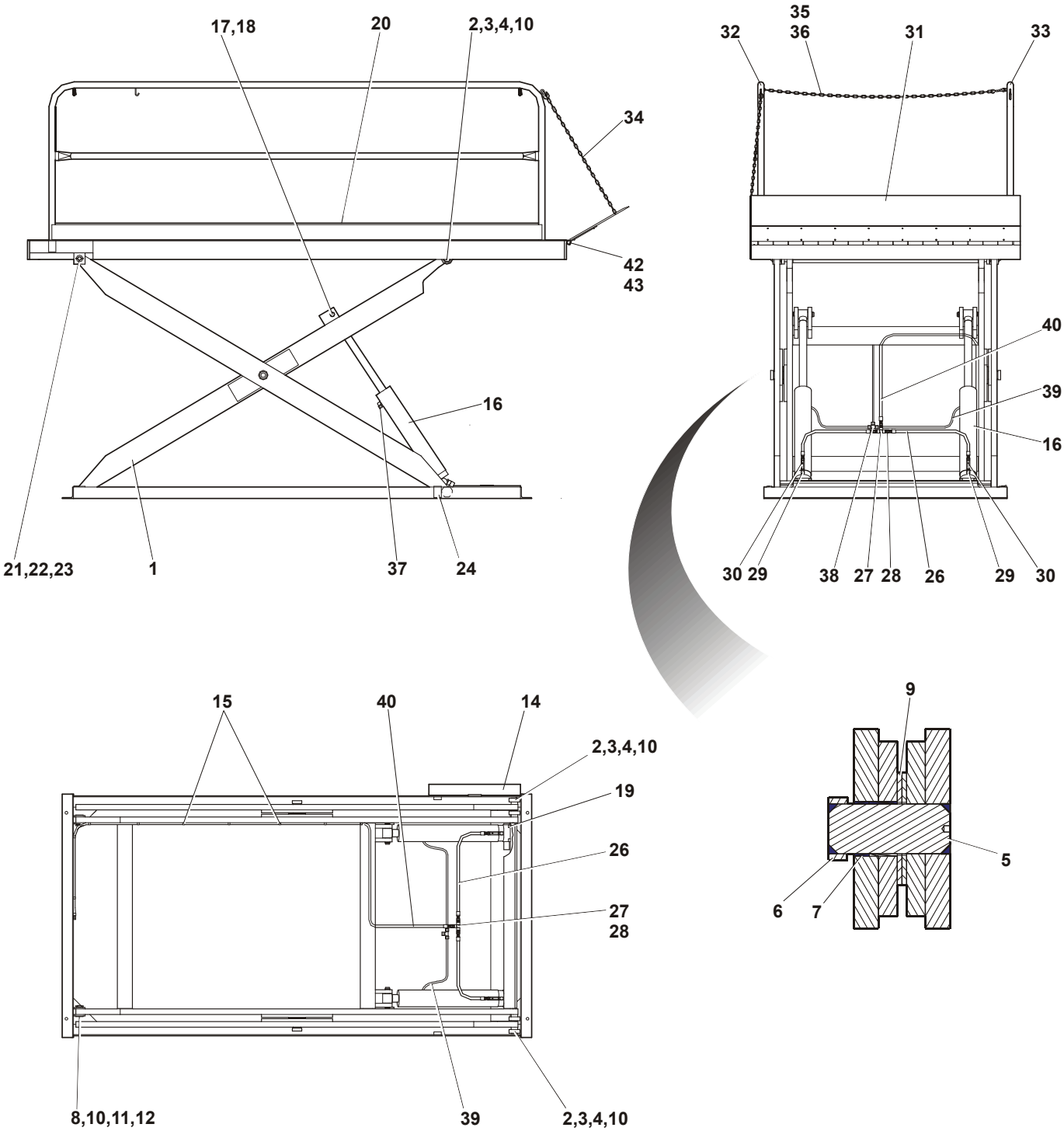


Figure 17 : General Assembly - 4,000 lb. - 144" Deck Length

General Assembly - 4,000 lb. Cap. - 144" Deck Length

Item	Qty	Part No	General Description	Specific Description
				10" Lowered Height
-	**-**	**-**	**General Assy 4,000lb. - 144" Deck Length**	**REF. Drwg. 310-5428**
1*	**1**	**313-5226-2**	**Frame/Leg Weldment**	**4,000/60X144"**
1*	**1**	**313-5226-3**	**Frame/Leg Weldment**	**4,000/72-84X144"**
1*	**1**	**313-5226-4**	**Frame/Leg Weldment**	**4,000/96X144"**
2	2	019-001	Bearing Roller - 3"ODx1-5/8"IDx1"W	4,000/144"
3	2	011-066	Capscrew, Hex Skt F/H - 5/16"-18 x 3/4"	4,000/144"
4	2	013-005	Spring Pin 5/32"x1"Lg	4,000/144"
5	2	114-652	Centre Pin 1-1/2" Thk Leg (5-7/8" Lg)	4,000/144"
6	2	114-606	Collar - 2" (Centre Pin Mod)	4,000/144"
7	2	018-031	Bushing - 2"IDx1"LG	4,000/144"
8	4	018-051	Bushing - 1"IDx3/4"LG	4,000/144"
9	2	012-219	Washer, Fl.P-2.13" IDx4.5"ODx0.187"Th	4,000/144"
10	4	121-684	Ring-Spacer (1-7/8" O.D)	4,000/144"
11	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	4,000/144"
12	2	013-012	Spring Pin - 1/4" X 2	4,000/144"
13	6	105-879	Washer, 3/4"ODx1-3/16"IDx1/16"THK	4,000/144"
14	1	822-440	Strut Weldment, Maintenance	4,000/144"
15	8	035-262	Strap (#6 Hose Clamp)	4,000/144"
16**	**2**	**780-142-226**	**Cylinder Ass'y (4"Dia) [22-3/4"Stroke]**	4,000/144"
17	2	114-993	Pin-Cylinder Pivot	4,000/144"
18	4	013-036	Retaining Ring Ext. - 1-1/4"ID	4,000/144"
19	4	104-476	Lip Stop (3/4"X5/8")	4,000/144"
20	1	312-5263-2	Deck Ass'y S2 4,000/60x144	4,000/60X144"
20	1	312-5263-3	Deck Ass'y S2 4,000/72X144	4,000/72X144"
20	1	312-5263-4	Deck Ass'y S2 4,000/84X144	4,000/84X144"
20	1	312-5263-5	Deck Ass'y S2 4,000/96X144	4,000/96X144"
20	1	312-5259-2	Deck Ass'y S3 (Tapered) 4,000/60x144	4,000/60X144"
20	1	312-5259-3	Deck Ass'y S2 (Tapered) 4,000/72x144	4,000/72X144"
20	1	312-5259-4	Deck Ass'y S2 (Tapered) 4,000/84x144	4,000/84X144"
20	1	312-5259-5	Deck Ass'y S2 (Tapered) 4,000/96x144	4,000/96X144"
21	2	798-049	Pin Ass'y - (1-1/2" Thick Legs)	4,000/144"
22	6	106-389	Spacer Washer - 1-3/4"ODx1"IDx1/16"THK	4,000/144"
23	2	013-012	Spring Pin - 1/4" X 2"	4,000/144"
24	2	117-005	Roller Stop	4,000/144"
25	1.5GA	039-066	Paint, Blue (Fast Dry Enamel)	4,000/144"
26	2	300-5000-12	Hose, #6 HP (20"Lg) Str.Swivel(2)	4,000/60X144"
26	2	300-5000-14	Hose, #6 HP (25"Lg) Str.Swivel(2)	4,000/72-84X144"
26	2	300-5000-48	Hose, #6 HP (38"Lg) Str.Swivel(2)	4,000/96X144"
27	1	034-571	Fitting, Tee 022T-6-6	4,000/144"
28	2	034-504	Adapter, Fitting 0103-6-6	4,000/144"
29	2	034-599	Fitting Elbow Forged #6MP-4MP-90	4,000/144"
30	2	033-661	Velocity Fuse, 5GPM	4,000/144"

*** - INDENTED SUB-ASSEMBLY – SHOWN ON SAME PAGE**
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General Assembly - 4,000 lb. Cap. - 144" Deck Length

Item	Qty	Part No	General Description	Specific Description
31	1	302-5002	Lip Assy,60" (18"LG,6#)	4,000/144"
32	1	312-5080-7	Guard Rail, Right Side 144"Deck	4,000/144"
33	1	312-5081-7	Guard Rail, Left Side 144"Deck	4,000/144"
34	1	091-023-0600	Chain (60"Lg) 3/16"	4,000/144"
35	2	091-023-0540	Chain - 3/16"Galvanized 54"	4,000/60X144"
35	2	091-023-0660	Chain - 3/16"Galvanized 66"	4,000/72X144"
35	2	091-023-0780	Chain - 3/16"Galvanized 78"	4,000/84x144"
35	2	091-023-0900	Chain - 3/16"Galvanized 90"	4,000/96x144"
36	2	R3-19203	Hook Snap 4"Lg	4,000/144"
37	3	034-674	Fitting, 1/4" M X 3/8" Comp.	4,000/144"
38	1	034-673	Fitting Nylon Tee - 3/8" Comp,	4,000/144"
39	1	091-000-0540	Tubing, Black Nylon (54"LG)	4,000/60X144"
39	1	091-000-0600	Tubing, Black Nylon (60"LG)	4,000/72-84X144"
39	1	091-000-0720	Tubing, Black Nylon (72"LG)	4,000/96X144"
40	1	300-5001-40	Hose, #8 HP (156"Lg) Str.Swivel(2)	4,000/72X144"
40	1	300-5001-41	Hose, #8 HP (168"Lg) Str.Swivel(2)	4,000/84X144"
40	1	300-5001-43	Hose, #8 HP (180"Lg) Str.Swivel(2)	4,000/96X144"
40	1	300-5001-45	Hose, #8 HP (192"Lg) Str.Swivel(2)	4,000/60X144"
41	1	300-5006-6	Vent Line Kit (31'lg)	4,000/84X144"
41	1	300-5006-7	Vent Line Kit (32'lg)	4,000/96X144"
41	1	300-5006-8	Vent Line Kit (33'lg)	4,000/60X144"
41	1	300-5006-9	Vent Line Kit (34'lg)	4,000/72X144"
42	1	121-616-1	Shaft. Lip Hinge	4,000/144"
43	1	013-005	Spring Pin -1/4" X 1-1/4"	4,000/144"

7.6.1 Cylinder Assembly- 4,000 lb. Cap. - 144" Deck Length

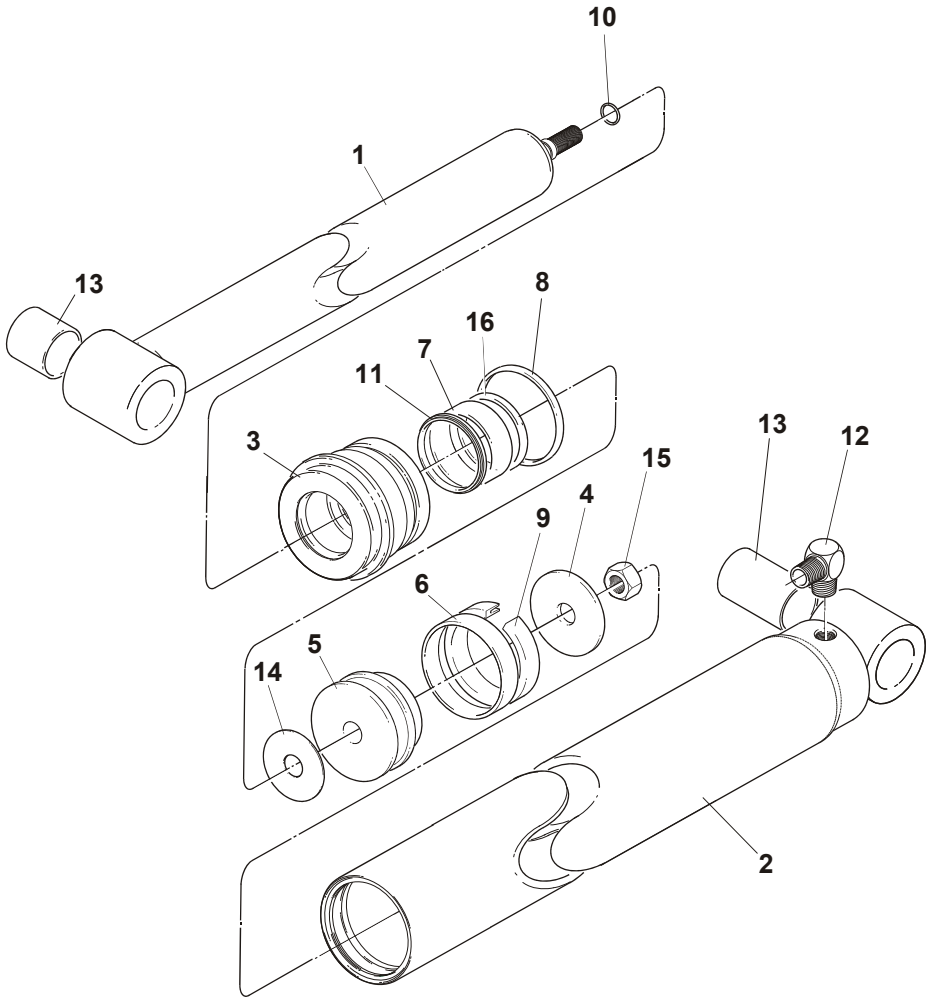


Figure 18 : Cylinder Assembly - 4,000 lb. - 144" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	**-**	**780-142-226**	**Cylinder Ass'y (4"Dia) [22-3/4"Stroke]**	**4,000/144"**
1	1	786-855	Ram Assy 3", 3-1/2", & 4"	4,000/144"
2	1	780-143	Housing Weldment (4"Dia)	4,000/144"
3	1	117-989	Headnut 4" Dia. Cyl (2" Dia. Rod)	4,000/144"
4	1	114-980	Piston Washer - (4" Dia)	4,000/144"
5	1	114-638	Piston - 4"Dia Cyl	4,000/144"
6●	1	036-156	Wear Ring Pist.Wd.3-1/2x1/2	4,000/144"
7●	1	036-182	Wear Ring - 3" X .125" Thick	4,000/144"
8●	1	036-130	O-Ring - 4"OD X 3-3/4"ID	4,000/144"
9●	1	036-116	U-Cup - 4" X 3-3/8" X 1/2"	4,000/144"
10●	1	036-108	O-Ring - 3/4"OD X 5/8"ID X 1/16"	4,000/144"
11●	1	036-021	Wiping Ring - 2"ID	4,000/144"
12	1	034-500	Fitting, 6-6	4,000/144"
13	2	018-027	Bushing	4,000/144"
14●	1	117-993	Gasket	4,000/144"
15	1	011-530	Nut, Hex Jam - 3/4"-10	4,000/144"
16●	1	036-176	O-Ring (2-1/4" OD X 2" ID)	4,000/144"
-	**-**	**783-572**	**Seal Kit Includes Items Marked (●)**	**4,000/144"**

7.7 General Assembly - 5 & 6,000 lb. Cap. - 144" Deck Length

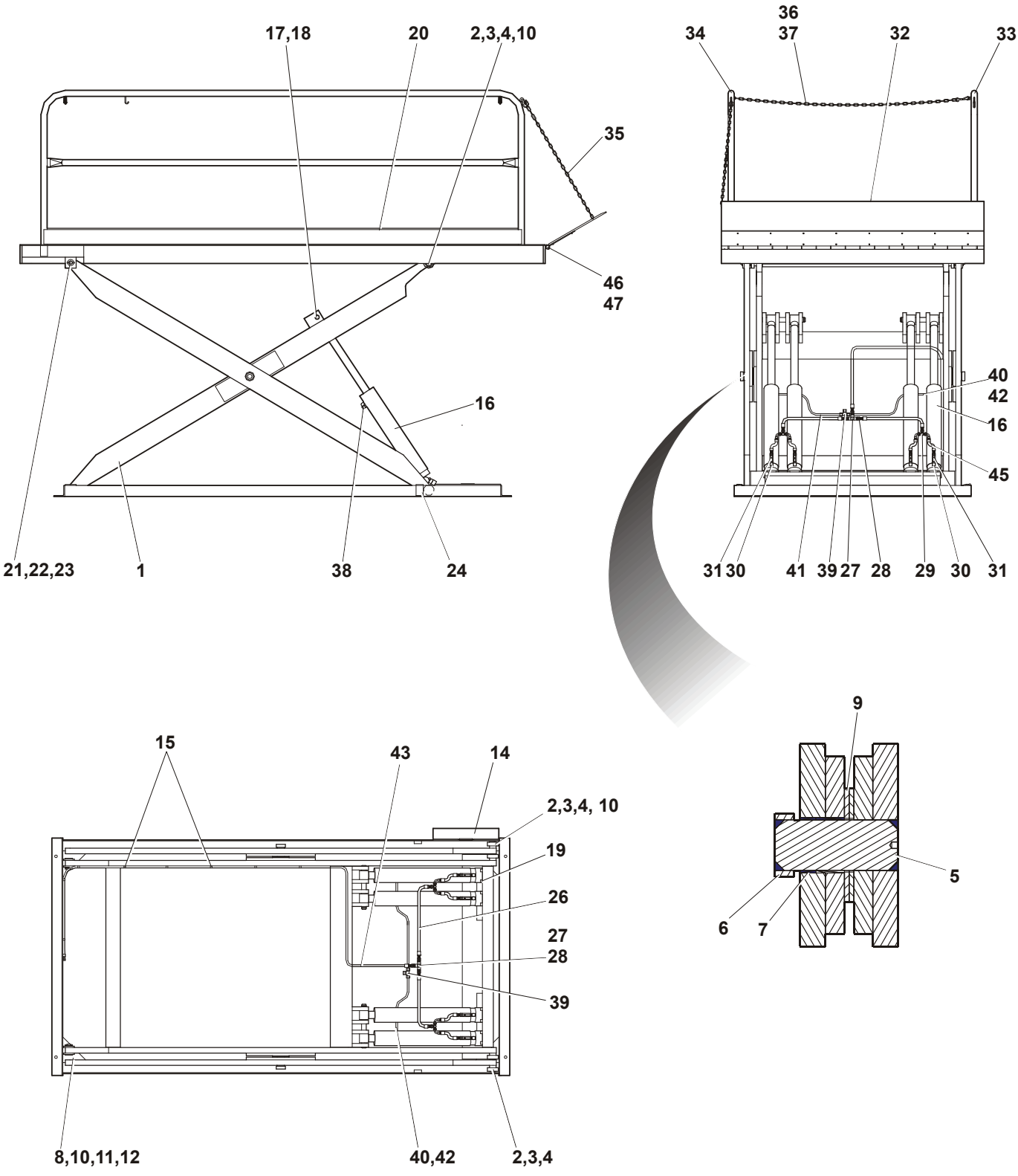


Figure 19 : General Assembly - 5, & 6,000 - 144" Deck Length

General Assembly - 5 & 6,000 lb. Cap. - 144" Deck Length

Item	Qty	Part No	General Description	Specific Description
				10" Lowered Height
			General Assy 5&6,000 - 144" Deck Length	**REF.DRG.310-5429**
1*	**1**	**313-5227-2**	**Frame And Leg Weldment**	**5,000/60X144"**
1*	**1**	**313-5227-3**	**Frame And Leg Weldment**	**5,000/72,84X144"**
1*	**1**	**313-5227-4**	**Frame And Leg Weldment**	**5,000/96X144"**
1*	**1**	**313-5228-2**	**Frame And Leg Weldment**	**6,000/60X144"**
1*	**1**	**313-5228-3**	**Frame And Leg Weldment**	**6,000/72,84X144"**
1*	**1**	**313-5228-4**	**Frame And Leg Weldment**	**6,00096X144"**
2	4	019-022	Bearing, 80x40x18mm	5,000/144"
2	4	019-001	Bearing Roller - 3"ODx1-5/8"IDx1"W	6,000/144"
3	4	011-066	Capscrew, Hex Sckt F/H-5/16"-18 X 3/4"	5,&6,000/144"
4	2	013-005	Spring Pin 5/32"x1"Lg	5,&6,000/144"
5	2	114-652	Leg Centre Pin1-1/2" Thk Leg (4-7/8" Lg)	5,&6,000/144"
6	2	114-606	Collar - 2" (Centre Pin Mod Ed)	5,&6,000/144"
7	2	018-031	Bushing - 2" IDx1"LG	5,&6,000/144"
8	4	018-051	Bushing - 1"IDx3/4"LG	5,&6,000/144"
9	2	012-219	Washer,Flat -2.13"IDx4.5"ODx0.187"THK	5,&6,000/144"
10	4	121-684	Ring-Spacer (1-7/8" O.D)	5,&6,000/144"
11	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	5,&6,000/144"
12	2	013-012	Spring Pin - 1/4" X 2	5,&6,000/144"
13	6	105-879	Washer, 3/4"ODx1-3/16"IDx1/16"THK	5,&6,000/144"
14	1	822-440	Strut Weldment, Maintenance	5,&6,000/144"
15	8	035-262	Strap (#6 Hose Clamp)	5,&6,000/144"
16**	**2**	**780-144-222**	**Cylinder Ass'y (3-1/2"Dia) [22-1/4" Stroke]**	5,&6,000/144"
17	2	115-043	Pin-Cylinder Pivot	5,&6,000/144"
18	4	013-036	Retaining Ring Ext. 1-1/4"ID	5,&6,000/144"
19	4	104-476	Lip Stop (3/4"X5/8")	5,&6,000/144"
20	1	312-5263-2	Deck Assembly S2 5,&6,000/60x144	5,&6,000/60X144"
20	1	312-5263-3	Deck Assembly S2 5,&6,000/72x144	5,&6,000/72X144"
20	1	312-5263-4	Deck Assembly S2 5,&6,000/84x144	5,&6,000/84X144"
20	1	312-5263-5	Deck Assembly S2 5,&6,000/96x144	5,&6,000/96X144"
20	1	312-5259-2	Deck Assembly S3 (Tapered) 5,000/60x144	5,000/60X144"
20	1	312-5259-3	Deck Assembly S3 (Tapered) 5,000/72x144	5,000/72X144"
20	1	312-5259-4	Deck Assembly S3 (Tapered) 5,000/84x144	5,000/84X144"
20	1	312-5259-5	Deck Assembly S3 (Tapered) 5,000-6/96x144	5,&6,000/96X144"
20	1	312-5259-7	Deck Assembly S3 (Tapered) 6,000/60x144	6,000/60X144"
20	1	312-5259-8	Deck Assembly S3 (Tapered) 6,000/72x144	6,000/72X144"
20	1	312-5259-9	Deck Assembly S3 (Tapered) 6,000/84x144	6,000/84X144"
20	1	312-5259-10	Deck Assembly S3 (Tapered) 6,000/96x144	6,000/96X144"
21	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	5,&6,000/144"
22	6	106-389	Spacer Washer - 1-3/4"ODx1"IDx1/16"thk	5,&6,000/144"
23	2	013-012	Spring Pin - 1/4" X 2"	5,&6,000/144"
24	2	117-005	Roller Stop	5,&6,000/144"
25	1	039-066	Paint, Blue (Fast Dry Enamel)	5,&6,000/144"

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General Assembly - 5 & 6,000 lb. Cap. - 144" Deck Length

Item	Qty	Part No	General Description	Specific Description
26	2	300-5000-12	Hose, #6 Hp(20"Lg) Str. Swivel(2)	5,&6,000/60X144"
26	2	300-5000-14	Hose, #6 Hp(24"Lg) Str. Swivel(2)	5,&6,000/72-84X144"
26	2	300-5000-48	Hose, #6 Hp(38"Lg) Str. Swivel(2)	5,&6,000/96X144"
27	1	034-571	Fitting, Tee 022t-6-6	5,&6,000/144"
28	2	034-504	Adapter, Fitting 0103-6-6	5,&6,000/144"
29	2	034-551	Fitting, Tee 033T-6-6	5,&6,000/144"
30	2	034-599	Fitting Elbow Forged #6mp-4mp-90	5,&6,000/144"
31	2	033-663	Velocity Fuse 7.5 GPM	5,&6,000/144"
32	1	302-5002	Lip Assy,60"(18"Lg,4&5#)1pc Lp	5,000/144"
32	1	302-5002-7	Lip Assy,60"(18"Lg,4&5#)1pc Lp	6,000/144"
33	1	312-5080-7	Guard Rail, Right Side 144"Deck	5,&6,000/144"
34	1	312-5081-7	Guard Rail, Left Side 144"Deck	5,&6,000/144"
35	1	091-023-0600	Chain (60"Lg) [3/16"Proof Coil Galvanized]	5,&6,000/144"
36	2	091-023-0540	Chain (54"Lg) 3/16"Proof Coil Galvanized	5,&6,000/60X144"
36	2	091-023-0660	Chain (66"Lg) 3/16"Proof Coil Galvanized	5,&6,000/72X144"
36	2	091-023-0780	Chain (78"Lg) 3/16"Proof Coil Galvanized	5,&6,000/84X144"
36	2	091-023-0900	Chain (90"Lg) 3/16"Proof Coil Galvanized	5,&6,000/96X144"
37	2	R3-19203	Hook Snap 4"Lg - 7/16"-20	5,&6,000/144"
38	3	034-674	Fitting - 1/4" M X 3/8" Comp	5,&6,000/144"
39	1	034-673	Fitting Nylon Tee - (3/8" Comp)	5,&6,000/144"
40	2	035-085	Fitting, Tee	5,&6,000/144"
41	2	091-000-0100	Tubing Black Nylon (3/8"X10"LG)	5,&6,000/60X144"
41	2	091-000-0160	Tubing Black Nylon (3/8"X16"LG)	5,&6,000/72-84X144"
41	2	091-000-0280	Tubing Black Nylon (3/8"X28"LG)	5,&6,000/96X144"
42	2	091-000-0064	Tubing Black Nylon (3/8"X6-1/2"LG)	5,&6,000/144"
43	1	300-5001-40	Hose, #8 HP (156"Lg) Str.Swivel(2)	5,&6,000/60X144"
43	1	300-5001-41	Hose, #8 HP (168"Lg) Str.Swivel(2)	5,&6,000/72X144"
43	1	300-5001-43	Hose, #8 HP (180"Lg) Str.Swivel(2)	5,&6,000/84X144"
43	1	300-5001-45	Hose, #8 HP (192"Lg) Str.Swivel(2)	5,&6,000/96X144"
44	1	300-5006-6	Vent Line Kit (31'lg)	5,&6,000/60X144"
44	1	300-5006-7	Vent Line Kit (32'lg)	5,&6,000/72X144"
44	1	300-5006-8	Vent Line Kit (33'lg)	5,&6,000/84X144"
44	1	300-5006-9	Vent Line Kit (34'lg)	5,000/96X144"
45	4	300-5000-1	Hose, #6 HP 6" LG Str. Swivel(2)	5,&6,000/144"
46	1	121-616-1	Bar, Lip Hinge	5,000/144"
46	1	106-205	Bar, Lip Hinge	6,000/144"
47	2	013-005	Pin, Spring	5,000/144"
47	2	013-010	Pin, Spring	6,000/144"

7.7.1 Cylinder Assembly- 5 & 6,000 lb. Cap. - 144" Deck Length

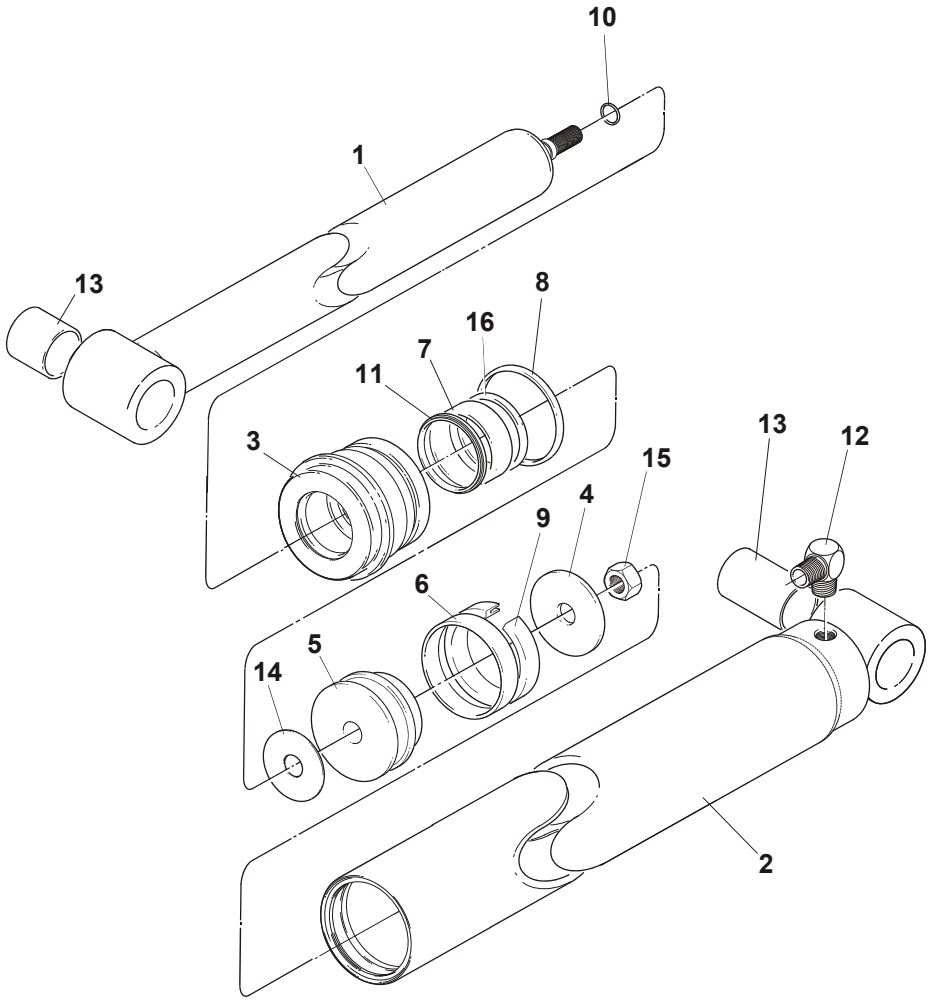


Figure 20 : Cylinder Assembly - 5, & 6,000 lb. - 144" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	**-**	**780-144-222**	**Cylinder Ass'y (3-1/2"Dia) [22-1/4" Stroke]**	**5,&6,000/144"**
1	1	786-855	Ram Assy 3", 3-1/2", & 4"	5,&6,000/144"
2	1	780-145	Housing Weldment (4"Dia)	5,&6,000/144"
3	1	117-966	Headnut 3-1/2" Dia. Cyl (2" Dia. Rod)	5,&6,000/144"
4	1	114-979	Piston Washer - (3-1/2" Dia)	5,&6,000/144"
5	1	114-639	Piston - 3-1/2"Dia Cyl	5,&6,000/144"
6●	1	036-155	Wear Ring Pist.Wd.3-1/2x1/2	5,&6,000/144"
7●	1	036-182	Wear Ring - 3" X .125" Thick	5,&6,000/144"
8●	1	036-131	O-Ring - 3-1/2"OD X 3-3/4"ID	5,&6,000/144"
9●	1	036-111	U-Cup - 3-1/2" X 2-7/8" X 1/2"	5,&6,000/144"
10●	1	036-108	O-Ring - 3/4"OD X 5/8"ID X 1/16"	5,&6,000/144"
11●	1	036-021	Wiping Ring - 2"ID	5,&6,000/144"
12	1	034-500	Fitting, 6-6	5,&6,000/144"
13	2	018-027	Bushing	5,&6,000/144"
14●	1	117-993	Gasket	5,&6,000/144"
15	1	011-530	Nut, Hex Jam - 3/4"-10	5,&6,000/144"
16●	1	036-176	O-Ring (2-1/4" OD X 2" ID)	5,&6,000/144"
-	**-**	**783-557**	**Seal Kit Includes Items Marked (●)**	5,&6,000/144"

8. Parts Listings - Stationary Elevating Docks - 14" Lowered Height

8.1 General Assembly - 4,5,6 & 8,000 lb. Cap. - 96" Deck Length

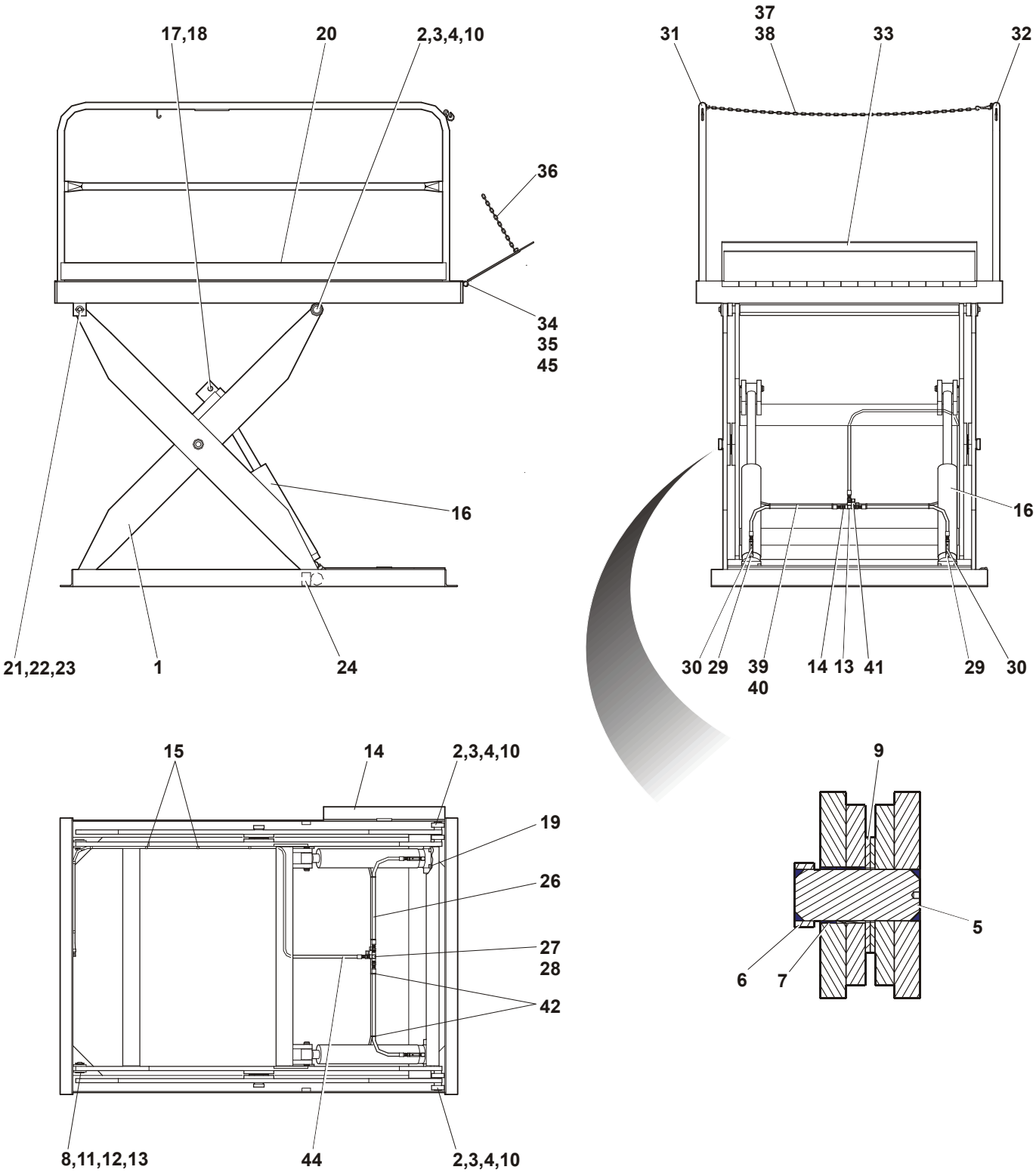


Figure 21 : General Assembly - 4,5,6 & 8,000 lb. - 96" Deck Length

General Assembly - 4,5,6 & 8,000 lb. Cap. - 96" Deck Length

Item	Qty	Part No	General Description	Specific Description
				14" Lowered Height
-	-	-	**General Assy 4,5,6 & 8,000 - 96" Deck Length**	**REF. Drwg. 310-5206**
1*	**1**	**313-5048**	**Frame/Leg Weldment**	**4,&5,000/60X96"**
1*	**1**	**313-5049**	**Frame/Leg Weldment**	**4,&5,000/72X96"**
1*	**1**	**313-5049**	**Frame/Leg Weldment**	**4,&5,000/84X96"**
1*	**1**	**313-5050**	**Frame/Leg Weldment**	**4,&5,000/96X96"**
1*	**1**	**313-5053**	**Frame/Leg Weldment**	**6,000/60X96"**
1*	**1**	**313-5054**	**Frame/Leg Weldment**	**6,000/72-84X96"**
1*	**1**	**313-5055**	**Frame/Leg Weldment**	**6,000/96X96"**
1*	**1**	**313-5058**	**Frame/Leg Weldment**	**8,000/60X96"**
1*	**1**	**313-5059**	**Frame/Leg Weldment**	**8,000/72-84X96"**
1*	**1**	**313-5060**	**Frame/Leg Weldment**	**8,000/96X96"**
2	4	019-022	Bearing, 80x40x18mm	4,&5,000/96"
2	2	019-001	Bearing, 80x40x18mm	6,&8,000/96"
3	4	011-066	Capscrew, Hex Socket F/H - 5/16"-18 X 3/4"	4,5,6,&8,000/96"
4	2	013-005	Spring Pin 5/32"x1"Lg	4,5,6,&8,000/96"
5	2	114-605	Leg Centre Pin - 3/4" Thick Leg (4-3/8" Lg)	4,5,&6,000/96"
5	2	114-651	Leg Centre Pin 1" Thk Leg (4-7/8" Lg)	8,000/96"
6	2	114-606	Collar - 2" (Centre Pin Mod Ed)	4,5,6,&8,000/96"
7	2	018-032	Bushing - 2"Idx1-1/2"LG	4,5,&6,000/96"
7	2	018-033	Bushing - 2" IDx1-3/4"LG	8,000/96"
8	4	018-051	Bushing - 1"Idx3/4"LG	4,5,&6,000/96"
8	4	018-061	Bushing - 1"IDx1"LG	8,000/96"
9	2	012-219	Washer, Flat Pl- 2.13" IDx4.5"ODx0.187" THK	4,5,6,&8,000/96"
10	4	121-684	Ring-Spacer (1-7/8" O.D)	4,&5,000/96"
11	2	798-048	Pin Ass'y (3/4" Thick Legs)	4,5,&6,000/96"
11	2	798-043	Pin Ass'y (3/4" Thick Legs)	8,000/96"
12	2	013-012	Spring Pin - 1/4" X 2	4,&5,000/96"
13	6	106-389	Spacer Washer, 1-3/4"Odx1"Idx1/16"THK	4,&5,000/96"
14	1	822-440	Strut Weldment, Maintenance	4,&5,000/96"
15	8	035-262	Strap (#6 Hose Clamp)	4,&5,000/96"
16**	**2**	**780-140-200**	**Cylinder Ass'y (3"Dia) [20"Stroke]**	**4,&5,000/60X96"**
16**	**2**	**780-140-204**	**Cylinder Ass'y (3"Dia) [20-1/2"Stroke]**	**4,&5,000/72X96, 5/84X96"**
16**	**2**	**780-140-200**	**Cylinder Ass'y (3"Dia) [20"Stroke]**	**4,000/84X96, 5,000/96X96**
16**	**2**	**780-144-200**	**Cylinder Ass'y (3-1/2"Dia) [20"Stroke]**	**6,000/96"**
16**	**2**	**780-142-200**	**Cylinder Ass'y (4"Dia) [20"Stroke]**	**8,000/60,96X96"**
16**	**2**	**780-142-204**	**Cylinder Ass'y (4"Dia) [20-1/2"Stroke]**	**8,000/72-84X96"**
17	2	114-993	Pin-Cylinder Pivot	4,5,6,&8,000/96"
18	4	013-036	Retaining Ring Ext. - 1-1/4"Id	4,5,6,&8,000/96"
19	4	104-476	Lip Stop (3/4"X5/8")	4,5,6,&8,000/96"
20	1	312-5193	Deck Ass'y S2 4,5,&6,000/60x96	4,5,&6,000/60X96"
20	1	312-5194	Deck Ass'y S2 4,5,&6,000/72X96	4,5,&6,000/72X96"
20	1	312-5195	Deck Ass'y S2 4,&5,000/84X96	4,&5,000/84X96"
20	1	312-5196	Deck Ass'y S2 4,5,&6,000/96X96	4,5,&6,000/96X96"
20	1	312-5197-3	Deck Ass'y S2 6,000/84X96	6,000/84X96"
20	1	312-5247-1	Deck Ass'y S2 8,000/60X96	8,000/60X96"
20	1	312-5247-2	Deck Ass'y S2 8,000/72X96	8,000/72X96"
20	1	312-5247-3	Deck Ass'y S2 8,000/84X96	8,000/84X96"
20	1	312-5247-4	Deck Ass'y S2 8,000/96X96	8,000/96X96"
20	1	312-5025	Deck Ass'y S3-(Tapered) 4,5,&6,000/60x96	4,5,&6,000/60X96"
20	1	312-5026	Deck Ass'y S3-(Tapered) 4,5,&6,000/72X96	4,5,&6,000/72X96"
20	1	312-5027	Deck Ass'y S3-(Tapered) 4,5,&6,000/84X96	4,5,&6,000/84X96"
20	1	312-5028	Deck Ass'y S3-(Tapered) 4,5,&6,000/96X96	4,5,&6,000/96X96"
20	1	312-5251-1	Deck Ass'y S3-(Tapered) 8,000/60X96	8,000/60X96"
20	1	312-5251-2	Deck Ass'y S3-(Tapered) 8,000/72X96	8,000/72X96"

*** - INDENTED SUB-ASSEMBLY – SHOWN ON SAME PAGE**
**** - SUBASSEMBLY - SHOWN ON SEPARATE PAGE**

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General Assembly - 4,5,6 & 8,000 lb. Cap. - 96" Deck Length

Item	Qty	Part No	General Description	Specific Description
20	1	312-5251-3	Deck Ass'y S3-(Tapered) 8,000/84X96	8,000/84X96"
20	1	312-5251-4	Deck Ass'y S3-(Tapered) 8,000/96X96	8,000/96X96"
21	2	798-048	Pin Ass'y - (3/4" Thick Legs)	4,5,&6,000/96"
21	2	798-043	Pin Ass'y - (1" Thick Legs)	8,000/96"
22	6	106-389	Spacer Washer - 1-3/4"ODx1"IDx1/16"THK	4,5,6,&8,000/96"LG.
23	2	013-012	Spring Pin - 1/4" X 2"	4,5,6,&8,000/96"LG.
24	2	103-445	Roller Stop	4,5,6,&8,000/96"
25	1.5GA	039-066	Paint, Blue (Fast Dry Enamel)	4,5,6,&8,000/96"
26	2	300-5000-15	Hose, #6 Hp (26"Lg) Str.Swivel(2)	4,5,6,&8,000/60X96"
26	2	300-5000-14	Hose, #6 Hp (25"Lg) Str.Swivel(2)	4,000/72X96"
26	2	300-5000-48	Hose, #6 Hp (38"Lg) Str.Swivel(2)	4,000/84X96"
26	2	300-5000-49	Hose, #6 Hp (54"Lg) Str.Swivel(2)	4,5,6,&8,000/96X96
26	2	300-5000-20	Hose, #6 Hp (34"Lg) Str.Swivel(2)	5,&6,000/72X96"
26	2	300-5000-14	Hose, #6 Hp (25"Lg) Str.Swivel(2)	5,&6,000/84X96"
26	2	300-5000-14	Hose, #6 Hp (25"Lg) Str.Swivel(2)	8,000/72-84X96"
27	1	034-571	Fitting, Tee 022T-6-6	4,5,6,&8,000/96"LG.
28	2	034-504	Adapter, Fitting 0103-6-6	4,5,6,&8,000/96"LG.
29	2	034-599	Fitting Elbow Forged #6MP-4MP-90°	4,5,6,&8,000/96"LG.
30	2	033-563	Velocity Fuse, 4.0GPM	4,&5,000/96"
30	2	033-663	Velocity Fuse, 7.5GPM	6,&8,000/96"
31	1	312-5080-4	Guard Rail, Right Side 96"Deck	4,5,6,&8,000/96"LG.
32	1	312-5076	Guard Rail Weld (84-1/2"X45")	4,5,6,&8,000/96"LG.
33	1	302-5002-2	Lip Assy,60" (12"LG,6#)	4,000/60X96"
33	1	302-5002	Lip Assy ,60"(18"LG,4&5#)	4,000/72X96"
33	1	302-5002-2	Lip Assy,60" (12"LG,6#)	4,000/84-96X96"
33	1	302-5002	Lip Assy ,60"(18"LG,4&5#)	5,000/84X96"
33	1	302-5002-2	Lip Assy,60" (12"LG,6#)	5,000/96X96"
33	1	302-5002-7	Lip Assy,60" (18"LG,6#)	6,000/96"
33	1	302-5007-3	Lip Assy,60" (18"LG,8#)	8,000/96"
33	1	302-5002-7	Lip Assy,60" (18"LG,6#)	8,000/72,84,96X96
34	1	121-616-1	Bar For Lip Hinge (60"Lg)	4,5,6,&8,000/96"LG.
34	1	106-205	Bar For Lip Hinge (60"Lg)	6,000/96"
34	1	809-483	Shaft, Lip (29-1/2"LG)	8,000/60,84,96X96"
34	1	106-205	Bar For Lip Hinge (60"Lg)	8,000/72X96"
35	1	013-005	Spring Pin 5/32"X1"Lg	4,5,6,&8,000/96"
35	1	013-011	Spring Pin -1/4" X 1-3/8"	6,&8,000/96"
36	1	091-023-0600	Chain (60"Lg) 3/16"	4,5,6,&8,000/96"
37	2	091-036-0420	Chain - 1/8"Galvanized) (42"Lg)	4,000/60X96"
37	2	091-023-0660	Chain - 3/16"Galvanized 66"	4,5,&6,000/72X96"
37	2	091-023-0780	Chain - 3/16"Galvanized 78"	4,&5,000/84X96"
37	2	091-023-0900	Chain - 3/16"Galvanized 90"	4,5,6,&8,000/96X96"
37	2	091-023-0540	Chain - 3/16"Galvanized 54"	5,6,&8,000/60X96"
37	2	091-023-0780	Chain - 3/16"Galvanized 78"	6,000/84x96"
37	2	091-023-0660	Chain - 3/16"Galvanized 66"	8,000/72X96"
37	2	091-023-0780	Chain - 3/16"Galvanized 78"	8,000/84x96"
38	2	R3-19203	Hook Snap 4"Lg	4,5,6,&8,000/96"
39	2	034-674	Fitting, 1/4" M X 3/8" COMP	4,5,6,&8,000/96"
40	2	091-000-0460	Tubing, Black Nylon 3/8" X46"	4,5,6,&8,000/60X96"
40	2	091-000-0520	Tubing, Black Nylon 3/8" X52"	4,5,6,&8,000/72-84X96"
40	2	091-000-0640	Tubing, Black Nylon 3/8" X64"	4,5,6,&8,000/96X96"
41	1	034-673	Fitting Nylon Tee - 3/8" Comp,	4,5,6,&8,000/96"
42	4	025-087	Cable Ties	4,5,6,&8,000/96"
43	1	300-5006-2	Vent Line Kit (27'lg) (Not Shown)	4,5,6,&8,000/60X96"
43	1	300-5006-3	Vent Line Kit (28'lg) (Not Shown)	4,5,6,&8,000/72X96"
43	1	300-5006-4	Vent Line Kit (29'lg) (Not Shown)	4,5,6,&8,000/84X96"
43	1	300-5006-5	Vent Line Kit (30'lg) (Not Shown)	4,5,6,&8,000/96X96"
44	1	300-5001-38	Hose, #8 HP (144"Lg) Str. Swivel(2)	4,000/72X96"
44	1	300-5001-38	Hose, #8 HP (144"Lg) Str. Swivel(2)	5,6,000/84X96"
44	1	300-5001-38	Hose, #8 HP (144"Lg) Str. Swivel(2)	8,000/72-84X96"
45	1	120-353	Torsion Spring - Spring Assist Lip	8,000/60,96X96"

8.1.1 Cylinder Assembly- 4,5,6 & 8,000 lb. Cap. - 96" Deck Length

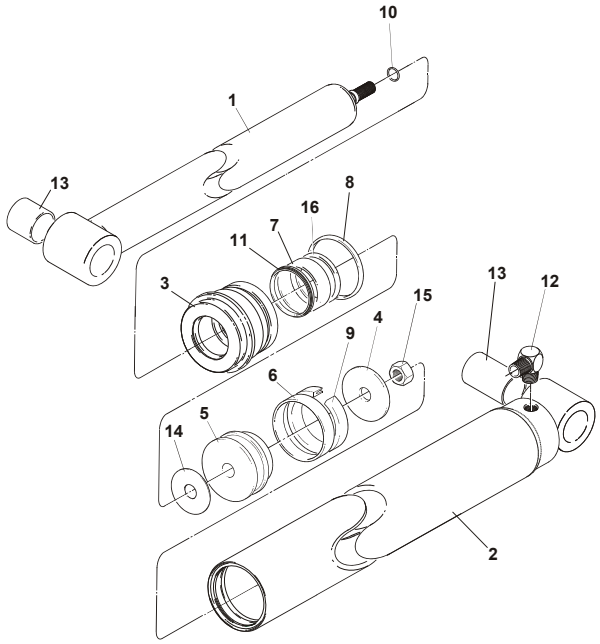


Figure 22 : Cylinder Assembly - 4,5,6 & 8,000 lb. - 96" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	-	**780-140-200**	**Cylinder Ass'y (3"Dia) [20"Stroke]**	**4,&5,000/96"**
-	-	**780-140-204**	**Cylinder Ass'y (3"Dia) [20-1/2"Stroke]**	**5,000/84X96"**
-	-	**780-144-200**	**Cylinder Ass'y (3-1/2"Dia) [20"Stroke]**	**6,000/96"**
-	-	**780-142-200**	**Cylinder Ass'y (4"Dia) [20"Stroke]**	**8,000/60,96X96"**
-	-	**780-142-204**	**Cylinder Ass'y (4"Dia) [20-1/2"Stroke]**	**8,000/72-84X96"**
1	1	786-855	Ram Assy 3", 3-1/2", & 4"	4,&5,000/96"
2	1	783-556	Housing Weldment (3"Dia)	4,&5,000/96"
2	1	780-145	Housing Weldment (3-1/2"Dia)	6,000/96"
2	1	783-573	Housing Weldment (4"Dia)	8,000/96"
3	1	117-991	Headnut 3" Dia. Cyl (2" Dia. Rod)	4,&5,000/96"
3	1	117-966	Headnut 3-1/2" Dia. Cyl (2" Dia. Rod)	6,000/96"
3	1	117-989	Headnut 4" Dia. Cyl (2" Dia. Rod)	8,000/96"
4	1	114-978	Piston Washer - (3" Dia)	4,&5,000/96"
4	1	114-979	Piston Washer - (3-1/2" Dia)	6,000/96"
4	1	114-980	Piston Washer - (4" Dia)	8,000/96"
5	1	114-640	Piston - 3"Dia Cyl	4,&5,000/96"
5	1	114-639	Piston - 3.5"Dia Cyl	6,000/96"
5	1	114-638	Piston - 4"Dia Cyl	8,000/96"
6●	1	036-154	Wear Ring Pist.Wd.3x1/2	4,&5,000/96"
6●	1	036-155	Wear Ring Pist.Wd.3-1/2x1/2	6,000/96"
6●	1	036-156	Wear Ring Pist.Wd.3-1/2x1/2	8,000/96"
7●	1	036-182	Wear Ring - 3" X .125" Thick	4,5,6 & 8,000/96"
8●	1	036-132	O-Ring - 3"OD X 2-3/4"ID	4,&5,000/96"
8●	1	036-131	O-Ring - 3-1/2"OD X 3-3/4"ID	6,000/96"
8●	1	036-130	O-Ring - 4"OD X 3-3/4"ID	8,000/96"
9●	1	036-112	U-Cup - 3" X 2-3/8" X 1/2"	4,&5,000/96"
9●	1	036-111	U-Cup - 3-1/2" X 2-7/8" X 1/2"	6,000/96"
9●	1	036-116	U-Cup - 4" X 3-3/8" X 1/2"	8,000/96"
10●	1	036-108	O-Ring - 3/4"OD X 5/8"ID X 1/16"	4,5,6 & 8,000/96"
11●	1	036-021	Wiping Ring - 2"ID	4,5,6 & 8,000/96"
12	1	034-500	Fitting, 6-6	4,5,6 & 8,000/96"
13	2	018-027	Bushing	4,5,6 & 8,000/96"
14●	1	117-993	Gasket	4,5,6 & 8,000/96"
15	1	011-530	Nut, Hex Jam - 3/4"-10	4,5,6 & 8,000/96"
16●	1	036-176	O-Ring (2-1/4" OD X 2" ID)	4,5,6 & 8,000/96"
-	-	**783-553**	**Seal Kit Includes Items Marked (●)**	**3" Cylinder**
-	-	**783-557**	**Seal Kit Includes Items Marked (●)**	**3-1/2" Cylinder**
-	-	**783-572**	**Seal Kit Includes Items Marked (●)**	**4" Cylinder**

8.2 General Assembly - 4,5,6 & 8,000 lb. Cap. - 108" Deck Length

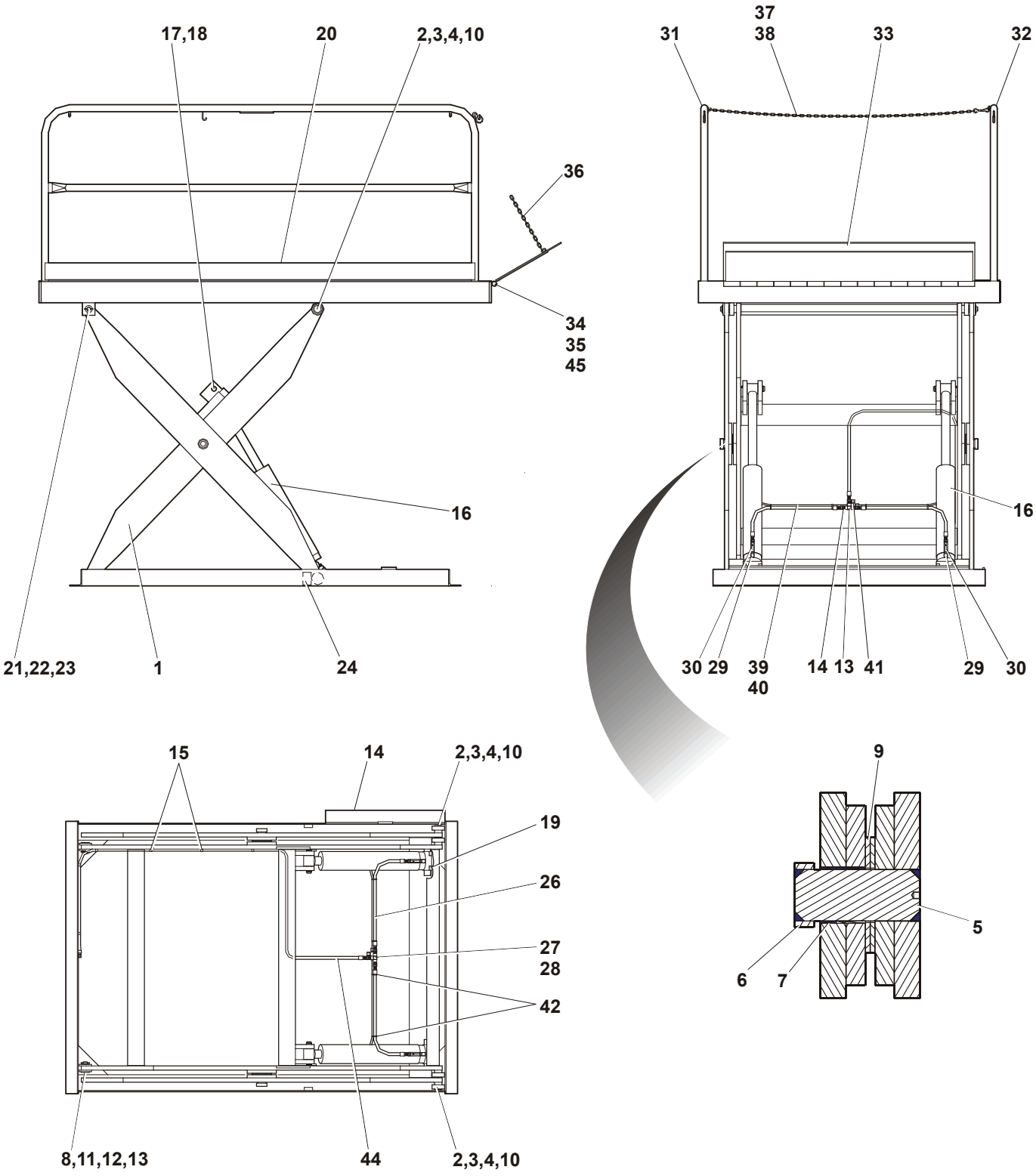


Figure 23 : General Assembly 4,5,6 & 8,000 lb. - 108" Deck Length

General Assembly - 4,5,6 & 8,000 lb. Cap. - 108" Deck Length

Item	Qty	Part No	General Description	Specific Description
			General Assy 4,5,6 & 8,000 - 108" Deck Lg.	**REF Drwg. 310-5227**
-	**-**	**313-5048**	**Frame/Leg Weldment**	**4,&5,000/60X108"**
-	**-**	**313-5049**	**Frame/Leg Weldment**	**4,&5,000/72X108"**
-	**-**	**313-5049**	**Frame/Leg Weldment**	**4,&5,000/84X108"**
-	**-**	**313-5050**	**Frame/Leg Weldment**	**4,&5,000/96X108"**
-	**-**	**313-5053**	**Frame/Leg Weldment**	**6,000/60X108"**
-	**-**	**313-5054**	**Frame/Leg Weldment**	**6,000/72-84X108"**
-	**-**	**313-5055**	**Frame/Leg Weldment**	**6,000/96X108"**
-	**-**	**313-5058**	**Frame/Leg Weldment**	**8,000/60X108"**
-	**-**	**313-5059**	**Frame/Leg Weldment**	**8,000/72-84X108"**
-	**-**	**313-5060**	**Frame/Leg Weldment**	**8,000/96X108"**
2	4	019-022	Bearing, 80x40x18mm	4,&5,000"
2	2	019-001	Bearing, 3"OD X 1-5/8"ID X 1"W	6,&8,000"
3	4	011-066	Capscrew, Hex Sckt F/H-5/16"-18 X 3/4"	4,5,6,&8,000"
4	2	013-005	Spring Pin 5/32"x1"Lg	4,5,6,&8,000"
5	2	114-605	Leg Centre Pin-3/4" Thick Leg (4-3/8" Lg)	4,5,&6,000"
5	2	114-651	Leg Centre Pin 1" Thk Leg (4-7/8" Lg)	8,000"
6	2	114-606	Collar - 2" (Centre Pin Mod Ed)	4,5,6,&8,000"
7	2	018-032	Bushing - 2"Idx1-1/2"LG	4,5,&6,000"
7	2	018-033	Bushing - 2" IDx1-3/4"LG	8,000"
8	4	018-051	Bushing - 1"Idx3/4"LG	4,5,&6,000"
8	4	018-061	Bushing - 1"IDx1"LG	8,000"
9	2	012-219	Washer,Flat-2.13" IDx4.5"ODx0.187" THK	4,5,6,&8,000"
10	4	121-684	Ring-Spacer (1-7/8" O.D)	4,&5,000"
11	2	798-048	Pin Ass'y (3/4" Thick Legs)	4,5,&6,000"
11	2	798-043	Pin Ass'y (3/4" Thick Legs)	8,000"
12	2	013-012	Spring Pin - 1/4" X 2	4,&5,000"
13	6	106-389	Spacer Washer, 1-/4"ODx1"IDx1/16"THK	4,&5,000"
14	1	822-440	Strut Weldment, Maintenance	4,&5,000"
15	8	035-262	Strap (#6 Hose Clamp)	4,&5,000"
16**	**2**	**780-140-200**	**Cylinder Ass'y (3"Dia) [20"Stroke]**	**4,&5,000"**
16**	**2**	**780-144-200**	**Cylinder Ass'y (3-1/2"Dia) [20"Stroke]**	**6,000/60,72,96X108"**
16**	**2**	**780-144-204**	**Cylinder Ass'y (3-1/2"Dia) [20-1/2"Stroke]**	**6,000/84X108"**
16**	**2**	**780-142-200**	**Cylinder Ass'y (4"Dia) [20"Stroke]**	**8,000/108"**
17	2	114-993	Pin-Cylinder Pivot	4,5,6,&8,000/108"
18	4	013-036	Retaining Ring Ext. - 1-1/4"Id	4,5,6,&8,000/108"
19	4	104-476	Lip Stop (3/4"X5/8")	4,5,6,&8,000/108"
20	1	312-5199	Deck Ass'y S2 4,5,&6,000/60x108	4,5,&6,000/60X108"
20	1	312-5200	Deck Ass'y S2 4,5,&6,000/72X108	4,5,&6,000/72X108"
20	1	312-5201	Deck Ass'y S2 4,5,&6,000/84X108	4,5,&6,000/84X108"
20	1	312-5202	Deck Ass'y S2 4,5,&6,000/96X108	4,5,&6,000/96X108"
20	1	312-5248-1	Deck Ass'y S2 8,000/60X108	8,000/60X108"
20	1	312-5248-2	Deck Ass'y S2 8,000/72X108	8,000/72X108"
20	1	312-5248-3	Deck Ass'y S2 8,000/84X108	8,000/84X108"
20	1	312-5248-4	Deck Ass'y S2 8,000/96X108	8,000/96X108"

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**** - SUBASSEMBLY SHOWN OWN SEPARATE PAGE**

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General Assembly - 4,5,6 & 8,000 lb. Cap. - 108" Deck Length

Item	Qty	Part No	General Description	Specific Description
20	1	312-5037	Deck Ass'y S3-(Tapered) 4,5,&6,000/60x96	4,5,&6,000/60X108"
20	1	312-5038	Deck Ass'y S3-(Tapered) 4,5,&6,000/72X96	4,5,&6,000/72X108"
20	1	312-5039	Deck Ass'y S3-(Tapered) 4,5,&6,000/84X96	4,5,&6,000/84X108"
20	1	312-5040	Deck Ass'y S3-(Tapered) 4,5,&6,000/96X96	4,5,&6,000/96X108"
20	1	312-5251-1	Deck Ass'y S3-(Tapered) 8,000/60X96	8,000/60X108"
20	1	312-5243-2	Deck Ass'y S3-(Tapered) 8,000/72X96	8,000/72X108"
20	1	312-5243-3	Deck Ass'y S3-(Tapered) 8,000/84X96	8,000/84X108"
20	1	312-5243-4	Deck Ass'y S3-(Tapered) 8,000/96X96	8,000/96X108"
21	2	798-048	Pin Ass'y - (3/4" Thick Legs)	4,000"
21	2	798-043	Pin Ass'y - (1" Thick Legs)	5,6,&8,000"
22	6	106-389	Spacer Washer - 1-3/4"Odx1"Idx1/16"THK	4,5,6,&8,000/108"
23	2	013-012	Spring Pin - 1/4" X 2"	4,5,6,&8,000/108"
24	2	103-445	Roller Stop	4,5,6,&8,000/108"
25	1.5GA	039-066	Paint, Blue (Fast Dry Enamel)	4,5,6,&8,000/108"
26	2	300-5000-15	Hose, #6 Hp (26"Lg) Str.Swivel(2)	4,5,6,&8,000/108"
26	2	300-5000-20	Hose, #6 Hp (34"Lg) Str.Swivel(2)	4,5,6,&8,000/84-72X108
26	2	300-5000-48	Hose, #6 Hp (38"Lg) Str.Swivel(2)	4,5,6,&8,000/84X108"
26	2	300-5000-49	Hose, #6 Hp (54"Lg) Str.Swivel(2)	4,5,6,&8,000/96X108"
27	1	034-571	Fitting, Tee 022t-6-6	4,5,6,&8,000/108"
28	2	034-504	Adapter, Fitting 0103-6-6	4,5,6,&8,000/108"
29	2	034-599	Fitting Elbow Forged #6mp-4mp-90	4,5,6,&8,000/108"
30	2	033-563	Velocity Fuse, 4.0gpm	4,&5,000"
30	2	033-663	Velocity Fuse, 7.5gpm	6,&8,000"
31	1	312-5080-5	Guard Rail, Right Side 108"Deck	4,5,6,&8,000/108"
32	1	312-5077	Guard Rail Weld (96-1/2"X45")	4,5,6,&8,000/108"
33	1	302-5002	Lip Assy,60" (18"LG)	4,&5,000/108"
33	1	302-5002-7	Lip Assy,60" (18"LG,6#)	6,000/108"
33	1	302-5002-12	Lip Assy,60" (18"LG,8#)	8,000/108"
34	1	121-616-1	Bar For Lip Hinge (60"Lg)	4,&5,000/108"
34	1	106-205	Bar For Lip Hinge (60"Lg)	6,&8,000/108"
35	2	013-005	Spring Pin 5/32"X1"Lg	4,&5,000/108"
35	2	013-011	Spring Pin -1/4" X 1-3/8"	6,&8,000/108"
36	1	091-023-0600	Chain (60"Lg) 3/16"	4,5,6,&8,000/108"
37	2	091-023-0540	Chain - 3/16"Galvanized 54"	4,5,6,&8,000/60X108"
37	2	091-023-0660	Chain - 3/16"Galvanized 66"	4,5,6,&8,000/72X108"
37	2	091-023-0780	Chain - 3/16"Galvanized 78"	4,5,6,&8,000/84X108"
37	2	091-023-0900	Chain - 3/16"Galvanized 90"	4,5,6,&8,000/96X108"
38	2	R3-19203	Hook Snap 4"Lg	4,5,6,&8,000/108"
39	2	034-674	Fitting, 1/4" M X 3/8" COMP	4,5,6,&8,000/108"
40	2	091-000-0460	Tubing, Black Nylon 3/8" X46"	4,5,6,&8,000/60X108"
40	2	091-000-0520	Tubing, Black Nylon 3/8" X52"	4,5,6,&8,000/72-84X108
40	2	091-000-0640	Tubing, Black Nylon 3/8" X64"	4,5,6,&8,000/96X108"
41	1	034-673	Fitting Nylon Tee - 3/8" Comp,	4,5,6,&8,000/108".
42	4	025-087	Cable Ties	4,5,6,&8,000/108"
43	1	300-5006-3	Vent Line Kit (28'lg)	4,5,6,&8,000/60X108"
43	1	300-5006-4	Vent Line Kit (29'lg)	4,5,6,&8,000/72X108"
43	1	300-5006-5	Vent Line Kit (30'lg)	4,5,6,&8,000/84X108"
43	1	300-5006-6	Vent Line Kit (31'lg)	4,5,6,&8,000/96X108"
44	1	300-5001-37	Hose, #8 HP (138"Lg) Str. Swivel(2)	6,000/84X108"
44	1	300-5001-37	Hose, #8 HP (138"Lg) Str. Swivel(2)	8,000/72X108"
45	2	120-353	Torsion Spring - Spring Assist Lip	8,000/60,84,96X108"

8.2.1 Cylinder Assembly- 4,5,6 & 8,000 lb. Cap. - 108" Deck Length

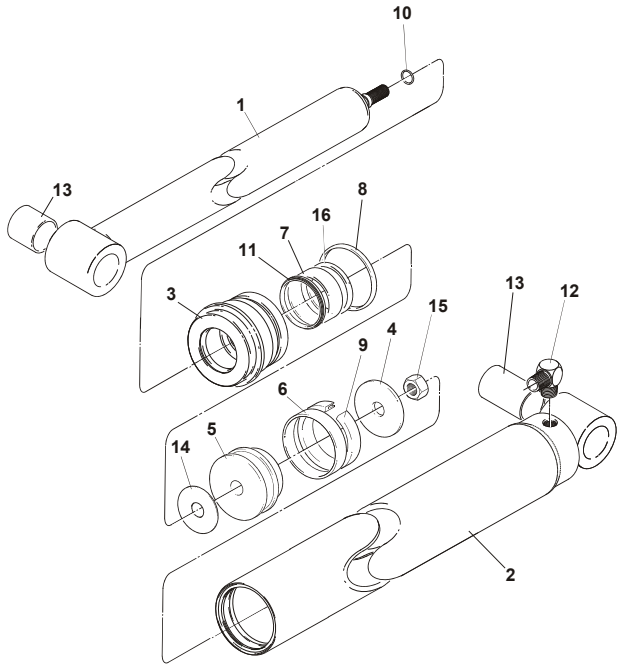


Figure 24 : Cylinder Assembly - 4,5,6 & 8,000 lb. - 108" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	-	**780-140-200**	**Cylinder Ass'y (3"Dia) [20"Stroke]**	**4,&5,000/108"**
-	-	**780-144-200**	**Cylinder Ass'y (3-1/2"Dia) [20"Stroke]**	**6,000/60,72,96X108"**
-	-	**780-144-204**	**Cylinder Ass'y (3-1/2"Dia) [20-1/2"Stroke]**	**6,000/84X108"**
-	-	**780-142-200**	**Cylinder Ass'y (4"Dia) [20"Stroke]**	**8,000/108"**
1	1	786-855	Ram Assy 3", 3-1/2", & 4"	4,&5,000/108"
2	1	783-556	Housing Weldment (3"Dia)	4,&5,000/108"
2	1	780-145	Housing Weldment (3-1/2"Dia)	6,000/108"
2	1	783-573	Housing Weldment (4"Dia)	8,000/108"
3	1	117-991	Headnut 3" Dia. Cyl (2" Dia. Rod)	4,&5,000/108"
3	1	117-966	Headnut 3-1/2" Dia. Cyl (2" Dia. Rod)	6,000/108"
3	1	117-989	Headnut 4" Dia. Cyl (2" Dia. Rod)	8,000/108"
4	1	114-978	Piston Washer - (3" Dia)	4,&5,000/108"
4	1	114-979	Piston Washer - (3-1/2" Dia)	6,000/108"
4	1	114-980	Piston Washer - (4" Dia)	8,000/108"
5	1	114-640	Piston - 3"Dia Cyl	4,&5,000/108"
5	1	114-639	Piston - 3.5"Dia Cyl	6,000/108"
5	1	114-638	Piston - 4"Dia Cyl	8,000/108"
6●	1	036-154	Wear Ring Pist.Wd.3x1/2	4,&5,000/108"
6●	1	036-155	Wear Ring Pist.Wd.3-1/2x1/2	6,000/108"
6●	1	036-156	Wear Ring Pist.Wd.3-1/2x1/2	8,000/108"
7●	1	036-182	Wear Ring - 3" X .125" Thick	4,5,6 & 8,000/108"
8●	1	036-132	O-Ring - 3"OD X 2-3/4"ID	4,&5,000/108"
8●	1	036-131	O-Ring - 3-1/2"OD X 3-3/4"ID	6,000/108"
8●	1	036-130	O-Ring - 4"OD X 3-3/4"ID	8,000/108"
9●	1	036-112	U-Cup - 3" X 2-3/8" X 1/2"	4,&5,000/108"
9●	1	036-111	U-Cup - 3-1/2" X 2-7/8" X 1/2"	6,000/108"
9●	1	036-116	U-Cup - 4" X 3-3/8" X 1/2"	8,000/108"
10●	1	036-108	O-Ring - 3/4"OD X 5/8"ID X 1/16"	4,5,6 & 8,000/108"
11●	1	036-021	Wiping Ring - 2"ID	4,5,6 & 8,000/108"
12	1	034-500	Fitting, 6-6	4,5,6 & 8,000/108"
13	2	018-027	Bushing	4,5,6 & 8,000/108"
14●	1	117-993	Gasket	4,5,6 & 8,000/108"
15	1	011-530	Nut, Hex Jam - 3/4"-10	4,5,6 & 8,000/108"
16●	1	036-176	O-Ring (2-1/4" OD X 2" ID)	4,5,6 & 8,000/108"
-	-	**783-553**	**Seal Kit Includes Items Marked (●)**	**3" Cylinder**
-	-	**783-557**	**Seal Kit Includes Items Marked (●)**	**3-1/2" Cylinder**
-	-	**783-572**	**Seal Kit Includes Items Marked (●)**	**4" Cylinder**

8.3 General Assembly - 4,5,6 & 8,000 lb. Cap. - 120" Deck Length

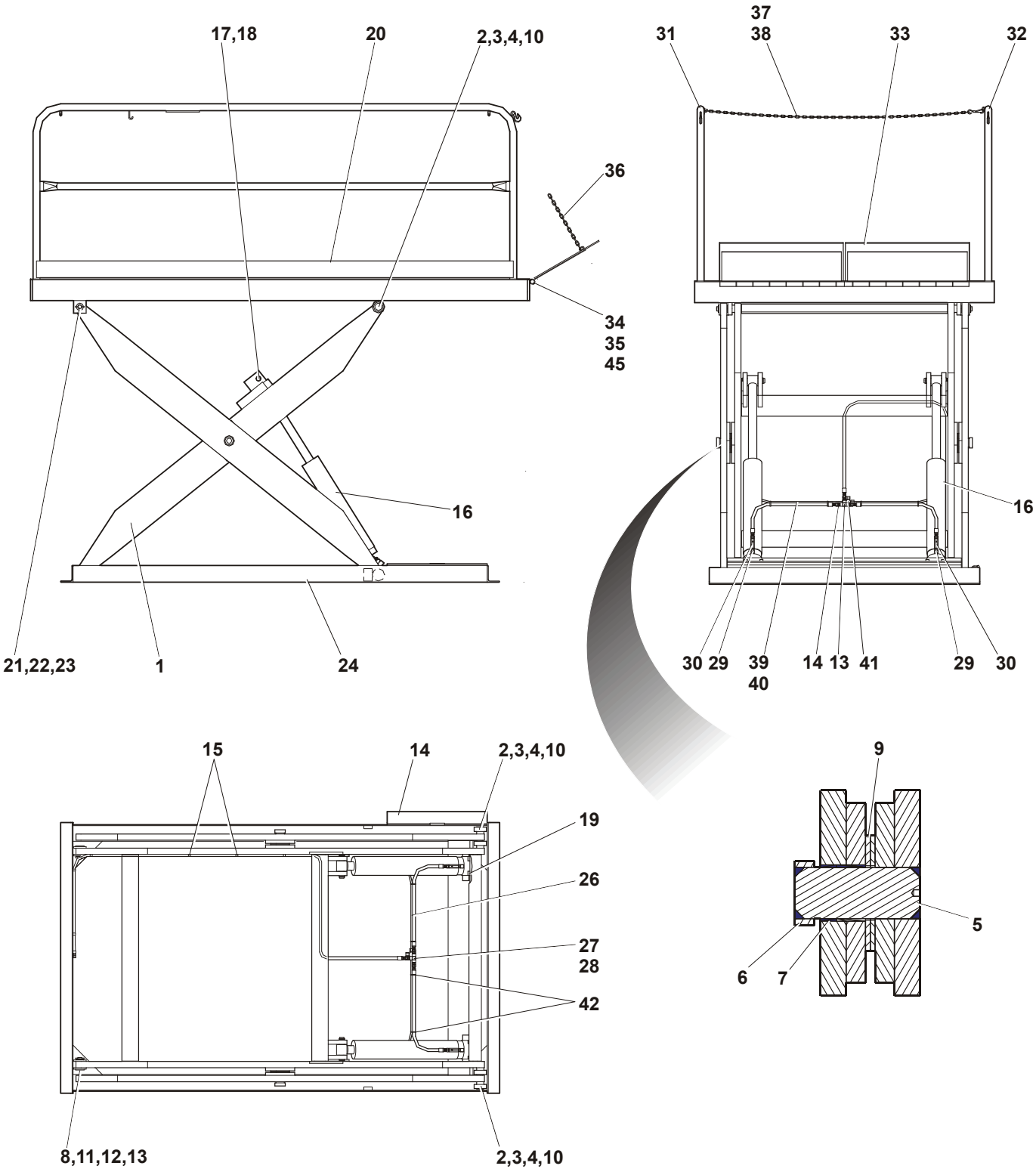


Figure 25 : General Assembly - 4,5,6 & 8,000 lb. - 120" Deck Length

General Assembly - 4,5,6 & 8,000 lb. Cap. - 120" Deck Length

Item	Qty	Part No	General Description	Specific Description
			General Assy 4,5,6 & 8,000-120" Deck Lg	**REF. DRG. 310-5248**
1*	**1**	**313-5063**	**Frame/Leg Weldment**	**4,000/60X120"**
1*	**1**	**313-5064**	**Frame/Leg Weldment**	**4,000/72X120"**
1*	**1**	**313-5064**	**Frame/Leg Weldment**	**4,&5,000/84X120"**
1*	**1**	**313-5065**	**Frame/Leg Weldment**	**4,&5,000/96X120"**
1*	**1**	**313-5068**	**Frame/Leg Weldment**	**5,000/60X120"**
1*	**1**	**313-5069**	**Frame/Leg Weldment**	**5,000/72-84X120"**
1*	**1**	**313-5070**	**Frame/Leg Weldment**	**5,000/96X120"**
1*	**1**	**313-5073**	**Frame/Leg Weldment**	**6,000/60X120"**
1*	**1**	**313-5074**	**Frame/Leg Weldment**	**6,000/72-84X120"**
1*	**1**	**313-5075**	**Frame/Leg Weldment**	**6,000/96X120"**
1*	**1**	**313-5068**	**Frame/Leg Weldment**	**8,000/60X120"**
1*	**1**	**313-5074**	**Frame/Leg Weldment**	**8,000/72-84X120"**
1*	**1**	**313-5080**	**Frame/Leg Weldment**	**8,000/96X120"**
2	4	019-022	Bearing, 80x40x18mm	4,&5,000/120"
2	2	019-001	Bearing, 3"OD X 1-5/8"ID X 1"W	6,&8,000/120"
3	4	011-066	Capscrew, Hex Skt F/H - 5/16"-18 X 3/4"	4,5,6,&8,000/120"
4	2	013-005	Spring Pin 5/32"x1"LG	4,5,6,&8,000/120"
5	2	114-605	Centre Pin - 3/4" Thick Leg (4-3/8" LG)	4,000/120"
5	2	114-651	Centre Pin 1" Thk Leg (4-7/8" LG)	5,&6,000/120"
5	2	114-652	Centre Pin 1-1/2" Thk Leg (5-7/8" LG)	8,000/120"
6	2	114-606	Collar - 2" (Centre Pin Mod)	4,5,6,&8,000/120"
7	2	018-032	Bushing - 2"IDx1-1/2"LG	4,&5,000/120"
7	2	018-033	Bushing - 2" IDx1-3/4"LG	6,&8,000/120"
7	2	018-034	Bushing - 2"IDx2"LG	8,000/96x120"
8	4	018-051	Bushing - 1"IDx3/4"LG	4,000/120"
8	4	018-061	Bushing - 1"IDx1"LG	5,6,&8,000/120"
9	2	012-219	Washer, Flat -2.13"IDx4.5"ODx0.187" TH	4,5,6,&8,000/120"
10	4	121-684	Ring-Spacer (1-7/8" O.D)	4,&5,000/120"
11	2	798-048	Pin Ass'y (3/4" Thick Legs)	4,000/120"
11	2	798-043	Pin Ass'y (1" Thick Legs)	5,6,&8,000/120"
12	2	013-012	Spring Pin - 1/4"x2"	4,5,6,&8,000/120"
13	6	106-389	Washer, 1-3/4"ODx1"IDx1/16"THK	4,5,6,&8,000/120"
14	1	822-440	Strut Weldment, Maintenance	4,5,6,&8,000/120"
15	8	035-262	Strap (#6 Hose Clamp)	4,5,6,&8,000/120"
16**	**2**	**780-140-214**	**Cylinder Ass'y (3"Dia) [21-1/2"Stroke]**	**4,&5,000/120"**
16**	**2**	**780-144-214**	**Cylinder Ass'y (3-1/2"Dia) [21-1/2"Stroke]**	**6,000/120"**
16**	**2**	**780-142-214**	**Cylinder Ass'y (4"Dia) [21-1/2"Stroke]**	**8,000/120"**
17	2	114-993	Pin-Cylinder Pivot	4,5,6,&8,000/120"
18	4	013-036	Retaining Ring Ext. - 1-1/4"ID	4,5,6,&8,000/120"
19	4	104-476	Lip Stop (3/4"X5/8")	4,5,6,&8,000/120"

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General Assembly - 4,5,6 & 8,000 lb. Cap. - 120" Deck Length

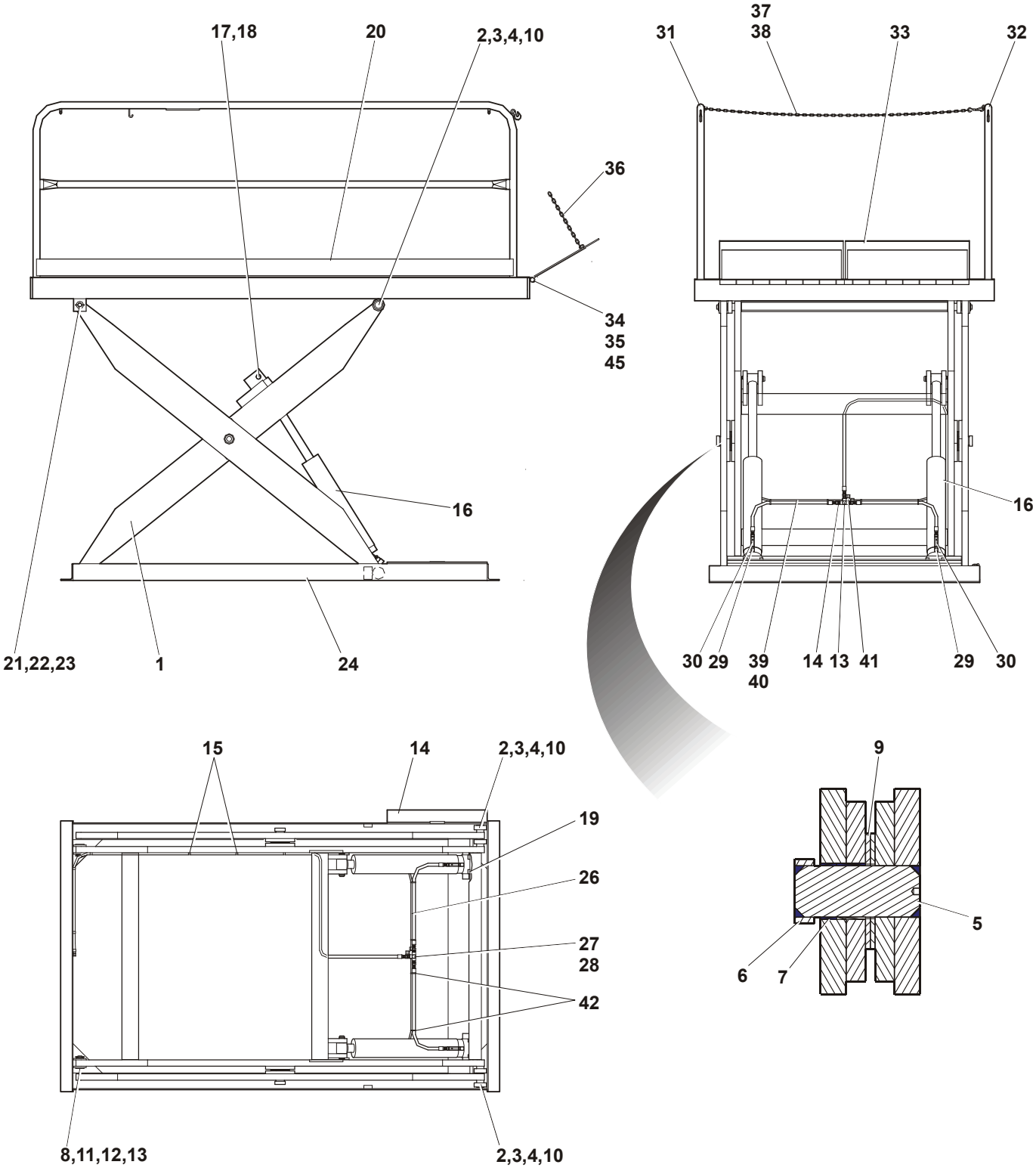


Figure 26 : General Assembly - 4,5,6 & 8,000 lb. - 120" Deck Length

General Assembly - 4,5,6 & 8,000 lb. Cap. - 120" Deck Length

Item	Qty	Part No	General Description	Specific Description
20	1	312-5205	Deck Ass'y S2 4,&5,000/60x120	4,5,&6,000/60X120"
20	1	312-5206	Deck Ass'y S2 4,&5,000/72X120	4,&5,000/72X120"
20	1	312-5207	Deck Ass'y S2 4,&5,000/84X120	4,&5,000/84X120"
20	1	312-5208	Deck Ass'y S2 4,&5,000/96X120	4,&5,000/96X120"
20	1	312-5209-4	Deck Ass'y S2 6,000/72X120	6,000/72X120"
20	1	312-5209-6	Deck Ass'y S2 6,000/84X120	6,000/84X120"
20	1	312-5209-8	Deck Ass'y S2 6,000/96X120	6,000/96X120"
20	1	312-5252-1	Deck Ass'y S2 8,000/60X120	8,000/60X120"
20	1	312-5252-2	Deck Ass'y S2 8,000/72X120	8,000/72X120"
20	1	312-5252-3	Deck Ass'y S2 8,000/84X120	8,000/84X120"
20	1	312-5252-4	Deck Ass'y S2 8,000/96X120	8,000/96X120"
20	1	312-5049	Deck Ass'y S3 (Tapered) 4,&5,000/60x120	4,&5,000/60X120"
20	1	312-5050	Deck Ass'y S3 (Tapered) 4,&5,000/72X120	4,&5,000/72X120"
20	1	312-5051	Deck Ass'y S3 (Tapered) 4,&5,000/84X120	4,&5,000/84X120"
20	1	312-5052	Deck Ass'y S3 (Tapered) 4,&5,000/96X120	4,&5,000/96X120"
20	1	312-5053-2	Deck Ass'y S3 (Tapered) 6,000/60X120	6,000/60X120"
20	1	312-5053-4	Deck Ass'y S3 (Tapered) 6,000/72X120	6,000/72X120"
20	1	312-5053-6	Deck Ass'y S3 (Tapered) 6,000/84X120	6,000/84X120"
20	1	312-5053-8	Deck Ass'y S3 (Tapered) 6,000/96X120	6,000/96X120"
20	1	312-5244-1	Deck Ass'y S3 (Tapered) 8,000/60X120	8,000/60X120"
20	1	312-5244-2	Deck Ass'y S3 (Tapered) 8,000/72X120	8,000/72X120"
20	1	312-5244-3	Deck Ass'y S3 (Tapered) 8,000/84X120	8,000/84X120"
20	1	312-5244-4	Deck Ass'y S3 (Tapered) 8,000/96X120	8,000/96X120"
21	2	798-048	Pin Ass'y - (3/4" Thick Legs)	4,000/120"
21	2	798-043	Pin Ass'y - (1" Thick Legs)	5,&6,000/120"
21	2	798-049	Pin Ass'y - (1-1/2" Thick Legs)	8,000/120"
22	6	106-389	Spacer Washer - 1-3/4"ODx1"IDx1/16"THK	4,5,6,&8,000/120"
23	2	013-012	Spring Pin - 1/4" X 2"	4,5,6,&8,000/120"
24	2	103-445	Roller Stop	4,5,6,&8,000/120"
25	1.5GA	039-066	Paint, Blue (Fast Dry Enamel)	4,5,6,&8,000/120"
26	2	300-5000-15	Hose, #6 HP (26"Lg) Str.Swivel(2)	4,5,6,&8,000/60X120"
26	2	300-5000-20	Hose, #6 HP (34"Lg) Str.Swivel(2)	4,5,6,&8,000/72X120"
26	2	300-5000-48	Hose, #6 HP (38"Lg) Str.Swivel(2)	4,5,6,&8,000/84X120"
26	2	300-5000-49	Hose, #6 HP (54"Lg) Str.Swivel(2)	4,5,6,&8,000/96X120"
27	1	034-571	Fitting, Tee 022t-6-6	4,5,6,&8,000/120"
28	2	034-504	Adapter, Fitting 0103-6-6	4,5,6,&8,000/120"
29	2	034-599	Fitting Elbow Forged #6MP-4MP-90	4,5,6,&8,000/120"
30	2	033-661	Velocity Fuse, 5.0 GPM	4,&5,000/120"
30	2	033-663	Velocity Fuse, 7.5 GPM	6,&8,000"
31	1	312-5080-6	Guard Rail, Right Side 120" Deck	4,5,6,&8/120"
32	1	312-5078	Guard Rail Weld (96-1/2"X45")	4,5,6,&8/120"
33	1	302-5002-2	Lip Assy,60" (12"LG,6#)	4,&5,000/120"
33	1	302-5002-7	Lip Assy,60" (18"LG,6#)	6,000/120"
33	1	302-5007-3	Lip Assy,60" (18"LG,8#)	8,000/120"
34	1	121-616-1	Bar For Lip Hinge (60"Lg)	4,&5,000/120"
34	1	106-205	Bar For Lip Hinge (60"Lg)	6,000/120"
34	2	809-483	Shaft, Lip (29-1/2"LG)	8,000/120"
35	2	013-005	Spring Pin 5/32"X1"Lg	4,&5,000/120"
35	2	013-011	Spring Pin -1/4" X 1-3/8"	6,&8,000/120"
36	1	091-023-0600	Chain (60"LG) 3/16"	4,5,6,&8,000/120"

General Assembly - 4,5,6 & 8,000 lb. Cap. - 120" Deck Length

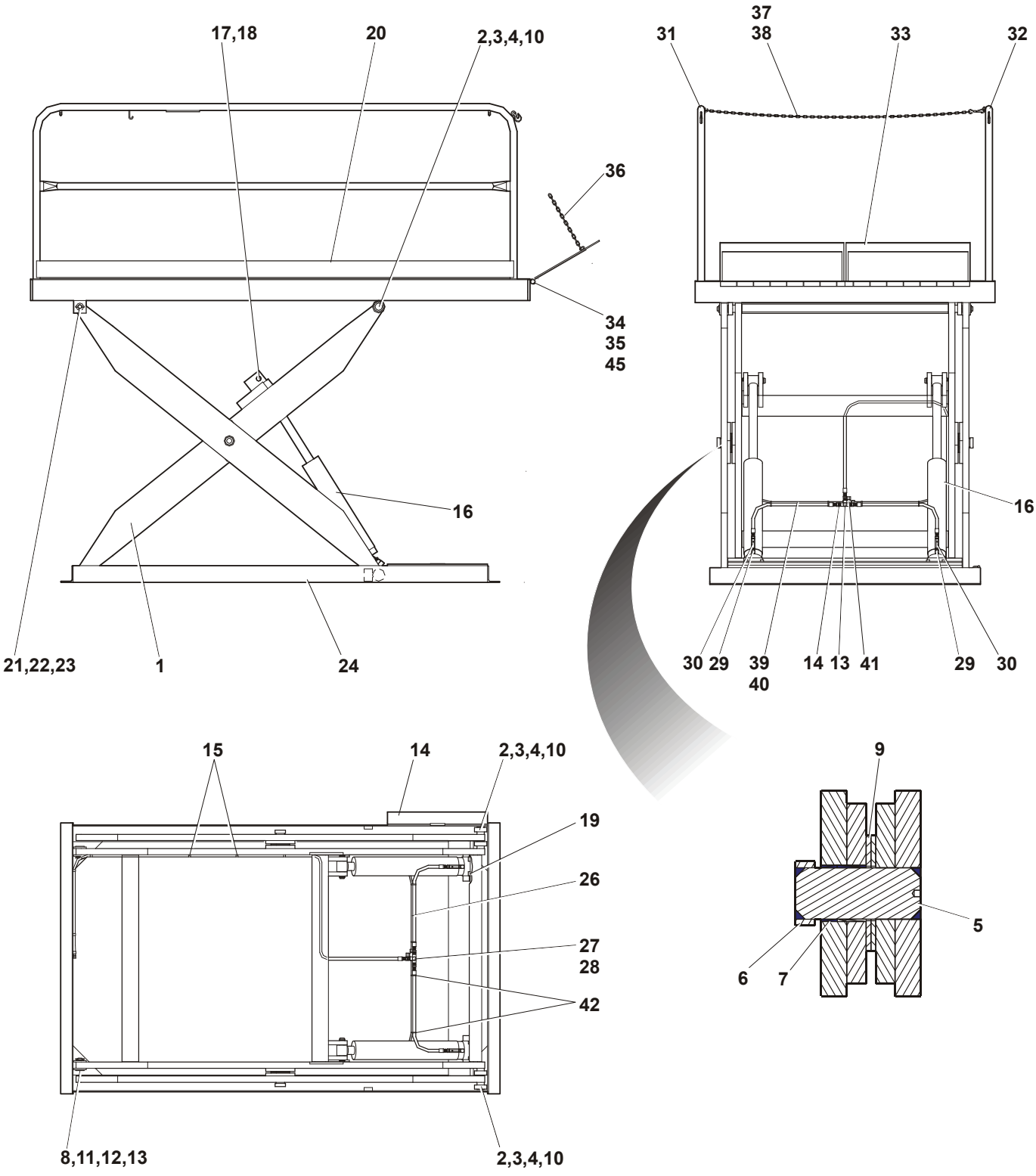


Figure 23 : Models 4,5,6 & 8 - 120" Deck Length

General Assembly - 4,5,6 & 8,000 lb. Cap. - 120" Deck Length

Item	Qty	Part No	General Description	Specific Description
37	2	091-023-0540	Chain - 3/16"Galvanized 54"	4,5,6,&8,000/60X120"
37	2	091-023-0660	Chain - 3/16"Galvanized 66"	4,5,6,&8,000/72X120"
37	2	091-023-0780	Chain - 3/16"Galvanized 78"	4,5,6,&8,000/84X120"
37	2	091-023-0900	Chain - 3/16"Galvanized 90"	4,5,6,&8,000/96X120"
38	2	R3-19203	Hook Snap 4" LG	4,5,6,&8,000/120"
39	2	034-674	Fitting, 1/4" M X 3/8" Comp.	4,5,6,&8,000/120"
40	2	091-000-0460	Tubing, Black Nylon 3/8" X46"	4,5,6,&8,000//60X120"
40	2	091-000-0520	Tubing, Black Nylon 3/8" X52"	4,5,6,&8,000/72-84X120
40	2	091-000-0640	Tubing, Black Nylon 3/8" X64"	4,5,6,&8,000//96X120"
41	1	034-673	Fitting Nylon Tee - 3/8" Comp,	4,5,6,&8,000/120"
42	4	025-087	Cable Ties	4,5,6,&8,000/120"
43	1	300-5006-4	Vent Line Kit (29'LG)	4,5,6,&8,000/60X120"
43	1	300-5006-5	Vent Line Kit (30'LG)	4,5,6,&8,000/72X120"
43	1	300-5006-6	Vent Line Kit (31'LG)	4,5,6,&8,000/84X120"
43	1	300-5006-7	Vent Line Kit (32'LG)	4,5,6,&8,000/96X120"
44	1	300-5001-38	Hose, #8 HP (144"LG) Str. Swivel(2)	5,000/72X120"
44	1	300-5001-38	Hose, #8 HP (144"LG) Str. Swivel(2)	8,000/72X120"
44	1	300-5001-39	Hose, #8 HP (148"Lg) Str. Swivel(2)	8,000/84X120"
44	1	300-5001-37	Hose, #8 HP (138"Lg) Str. Swivel(2)	6,000/84X120"
44	1	300-5001-37	Hose, #8 HP (138"Lg) Str. Swivel(2)	8,000/72X120"
45	2	120-353	Torsion Spring - Spring Assist Lip	8,000/60,84,96X120"

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8.3.1 Cylinder Assembly- 4,5,6 & 8,000 lb. Cap. - 120" Deck Length

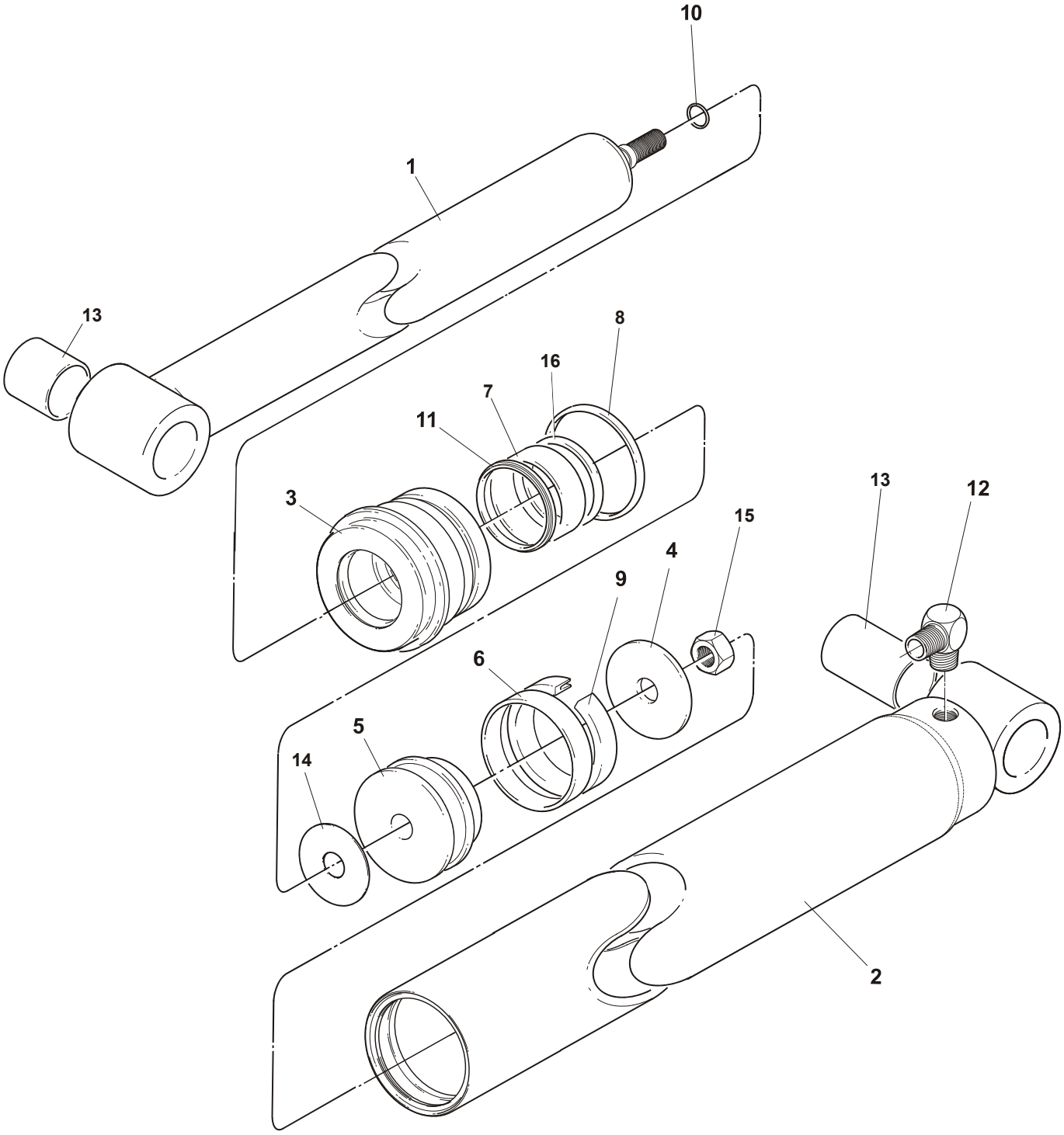


Figure 27 : Cylinder Assembly - 4,5,6 & 8,000 lb. - 120" Deck Length

Cylinder Assembly- 4,5,6 & 8,000 lb. Cap. - 120" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	**-**	**780-140-214**	**Cylinder Ass'y (3"Dia) [21-1/2"Stroke]**	**4,&5,000/120"**
-	**-**	**780-144-214**	**Cylinder Ass'y (3-1/2"Dia) [21-1/2"Stroke]**	**6,000/120"**
-	**-**	**780-142-214**	**Cylinder Ass'y (4"Dia) [21-1/2"Stroke]**	**8,000/120"**
1	1	786-855	Ram Assembly	4,5,6,&8,000/120"
2	1	780-141	Housing Assembly - 3" Cylinder	4,&5,000/120"
2	1	780-145	Housing Assembly - 3-1/2" Cylinder	6,000/120"
2	1	783-143	Housing Assembly - 4" Cylinder	8,000/120"
3	1	117-991	Headnut - 3" Cylinder	4,&5,000/120"
3	1	117-966	Headnut - 3-1/2" Cylinder	6,000/120"
3	1	117-989	Headnut - 4" Cylinder	8,000/120"
4	1	114-978	Washer, Piston - 3" Cylinder	4,&5,000/120"
4	1	114-979	Washer, Piston - 3-1/2" Cylinder	6,000/120"
4	1	114-980	Washer, Piston - 4" Cylinder	8,000/120"
5	1	114-640	Piston - 3" Cylinder	4,&5,000/120"
5	1	114-639	Piston - 3-1/2" Cylinder	6,000/120"
5	1	114-638	Piston - 4" Cylinder	8,000/120"
6●	1	036-154	Ring, Wear - 3" Cylinder.	4,&5,000/120"
6●	1	036-155	Ring, Wear - 3-1/2" Cylinder	6,000/120"
6●	1	036-156	Ring, Wear - 4" Cylinder	8,000/120"
7●	1	036-182	Ring, Wear	4,5,6,&8,000/120"
8●	1	036-132	“O”-Ring - 3" Cylinder	4,&5,000/120"
8●	1	036-131	“O”-Ring - 3-1/2" Cylinder	6,000/120"
8●	1	036-130	“O”-Ring - 4" Cylinder	8,000/120"
9●	1	036-112	“U”-Cup- 3" Cylinder	4,&5,000/120"
9●	1	036-111	“U”-Cup - 3-1/2" Cylinder	6,000/120"
9●	1	036-116	“U”-Cup - 4" Cylinder	8,000/120"
10●	1	036-108	“O”-Ring	4,5,6,&8,000/120"
11●	1	036-021	Wiper, Rod	4,5,6,&8,000/120"
12	1	034-500	Fitting	4,5,6,&8,000/120"
13●	1	117-993	Gasket	4,5,6,&8,000/120"
14	1	011-530	Nut, Huglock – 3/4"	4,5,6,&8,000/120"
15●	1	036-176	“O”-Ring	4,5,6,&8,000/120"
-	**-**	**783-553**	**Kit, Seal - 3" Cyl. - Items Marked (●)**	**4,&5,000/120"**
-	**-**	**783-557**	**Kit, Seal - 3-1/2" Cyl.- Items Marked (●)**	**6,000/120"**
-	**-**	**783-572**	**Kit, Seal - 4" Cyl. - Items Marked (●)**	**8,000/120"**

8.4 General Assembly - 4, 5 & 6,000 lb. Cap. - 144" Deck Length

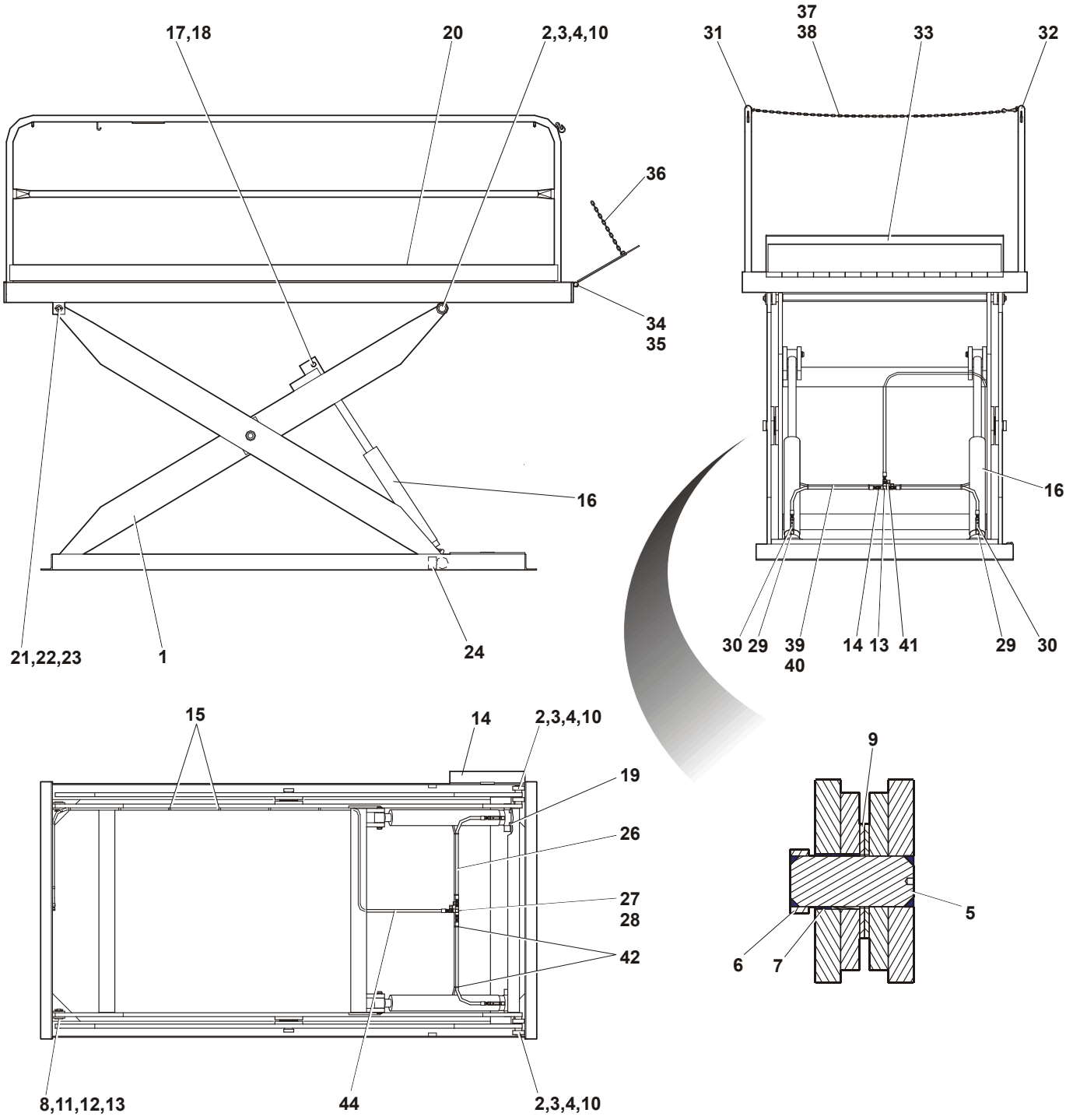


Figure 28 : General Assembly - 4,5,& 6,000 lb. - 144" Deck Length

General Assembly - 4, 5 & 6,000 lb. Cap. - 144" Deck Length

Item	Qty	Part No	General Description	Specific Description
			General Assy 4,5,&6,000 lb-144" Deck Lg	**REF. DRG. 310-5264**
1*	**1**	**313-5083**	**Frame/Leg Weldment**	**4,000/60X144"**
1*	**1**	**313-5084**	**Frame/Leg Weldment**	**4,000/72X144"**
1*	**1**	**313-5084**	**Frame/Leg Weldment**	**4,000/84X144"**
1*	**1**	**313-5085**	**Frame/Leg Weldment**	**4,000/96X144"**
1*	**1**	**313-5088**	**Frame/Leg Weldment**	**5,000/60X144"**
1*	**1**	**313-5089**	**Frame/Leg Weldment**	**5,000/72-84X144"**
1*	**1**	**313-5090**	**Frame/Leg Weldment**	**5,000/96X144"**
1*	**1**	**313-5093**	**Frame/Leg Weldment**	**6,000/60X144"**
1*	**1**	**313-5094**	**Frame/Leg Weldment**	**6,000/72-84X144"**
1*	**1**	**313-5095**	**Frame/Leg Weldment**	**6,000/96X144"**
2	4	019-022	Bearing, 80x40x18mm	4,&5,000/144"
2	2	019-001	Bearing, 3"OD X 1-5/8"ID X 1"W	6,000/144"
3	4	011-066	Capscrew, Hex Skt F/H - 5/16"-18 X 3/4"	4,5,&6,000/144"
4	2	013-005	Spring Pin 5/32"x1"Lg	4,5,&6,000/144"
5	2	114-605	Centre Pin - 3/4" Thick Leg (4-3/8" Lg)	4,000/144"
5	2	114-651	Centre Pin 1" Thk Leg (4-7/8" Lg)	5,&6,000/144"
6	2	114-606	Collar - 2" (Centre Pin Mod Ed)	4,5,&6,000/144"
7	2	018-032	Bushing - 2"Idx1-1/2"LG	4,000/144"
7	2	018-033	Bushing - 2" IDx1-3/4"LG	5,&6,000/144"
8	4	018-051	Bushing - 1"Idx3/4"LG	4,000/144"
8	4	018-061	Bushing - 1"IDx1"LG	5,&6,000/144"
9	2	012-219	Washer, Flat-2.13" IDx4.5"ODx0.187" TH	4,5,&6,000/144"
10	4	121-684	Ring-Spacer (1-7/8" O.D)	4,&5,000/144"
11	2	798-048	Pin Ass'y (3/4" Thick Legs)	4,000/144"
11	2	798-043	Pin Ass'y (1" Thick Legs)	5,&6,000/144"
12	2	013-012	Spring Pin - 1/4" X 2	4,&5,000/144"
13	6	106-389	Washer, 1-3/4"ODx1"IDx1/16"THK	4,&5,000/144"
14	1	822-440	Strut Weldment, Maintenance	4,&5,000/144"
15	8	035-262	Strap (#6 Hose Clamp)	4,&5,000/144"
16**	**2**	**780-140-240**	**Cylinder Ass'y (3"Dia) [24"Stroke]**	**4,&5,000/144"**
16**	**2**	**780-144-240**	**Cylinder Ass'y (3-1/2"Dia) [24"Stroke]**	**6,000/144"**
17	2	114-993	Pin-Cylinder Pivot	4,5,&6,000/144"
18	4	013-036	Retaining Ring Ext. - 1-1/4"Id	4,5,&6,000/144"
19	4	104-476	Lip Stop (3/4"X5/8")	4,5,&6,000/144"
20	1	312-5211	Deck Ass'y S2 4,&5,000/60x144	4,&5,000/60X144"
20	1	312-5212	Deck Ass'y S2 4,&5,000/72x144	4,5,&6,000/72X144"
20	1	312-5213	Deck Ass'y S2 4,&5,000/84X144	4,&5,000/84X144"
20	1	312-5214	Deck Ass'y S2 4,&5,000/96X144	4,&5,000/96X144"
20	1	312-5216-2	Deck Ass'y S2 6,000/60X144	6,000/60X144"
20	1	312-5216-4	Deck Ass'y S2 6,000/72X144	6,000/72X144"
20	1	312-5216-6	Deck Ass'y S2 6,000/84X144	6,000/84X144"
20	1	312-5216-8	Deck Ass'y S2 6,000/96X144	6,000/96X144"

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General Assembly - 4, 5 & 6,000 lb. Cap. - 144" Deck Length

Item	Qty	Part No	General Description	Specific Description
20	1	312-5061	Deck Ass'y S3 (Tapered) 4,&5,000/60x144	4,&5,000/60X144"
20	1	312-5062	Deck Ass'y S3 (Tapered) 4,&5,000/72x144	4,5,&6,000/72X144"
20	1	312-5063	Deck Ass'y S3 (Tapered) 4,&5,000/84X144	4,&5,000/84X144"
20	1	312-5064	Deck Ass'y S3 (Tapered) 4,&5,000/96X144	4,&5,000/96X144"
20	1	312-5065-2	Deck Ass'y S3 (Tapered) 6,000/60X144	6,000/60X144"
20	1	312-5065-4	Deck Ass'y S3 (Tapered) 6,000/72X144	6,000/72X144"
20	1	312-5065-6	Deck Ass'y S3 (Tapered) 6,000/84X144	6,000/84X144"
20	1	312-5065-8	Deck Ass'y S3 (Tapered) 6,000/96X144	6,000/96X144"
21	2	798-048	Pin Ass'y - (3/4" Thick Legs)	4,000/144"
21	2	798-043	Pin Ass'y - (1" Thick Legs)	5,&6,000-144"
22	6	106-389	Spacer Washer - 1-3/4"ODx1"IDx1/16"THK	4,5,&6,000/144"
23	2	013-012	Spring Pin - 1/4" X 2"	4,5,&6,000/144"
24	2	117-005	Roller Stop	4,5,&6,000/144"
25	1.5GA	039-066	Paint, Blue (Fast Dry Enamel)	4,5,&6,000/144"
26	2	300-5000-15	Hose, #6 HP (26"Lg) Str.Swivel(2)	4,5,&6,000/60X144"
26	2	300-5000-20	Hose, #6 HP (34"Lg) Str.Swivel(2)	4,5,&6,000/72X144"
26	2	300-5000-48	Hose, #6 HP (38"Lg) Str.Swivel(2)	4,5,&6,000/84X144"
26	2	300-5000-49	Hose, #6 HP (54"Lg) Str.Swivel(2)	4,5,&6,000/96X144"
27	1	034-571	Fitting, Tee 022T-6-6	4,5,&6,000/144"
28	2	034-504	Adapter, Fitting 0103-6-6	4,5,&6,000/144"
29	2	034-599	Fitting Elbow Forged #6MP-4MP-90°	4,5,&6,000/144"
30	2	033-661	Velocity Fuse, 5.0GPM	4,&5,000-144"
30	2	033-663	Velocity Fuse, 7.5GPM	6,000-144"
31	1	312-5080-7	Guard Rail, Right Side 144"Deck	4,5,&6,000/144"
32	1	312-5079	Guard Rail Weld (132-1/2"X45")	4,5,&6,000/144"
33	1	302-5002-2	Lip Assy,60" (12"LG,6#)	4,&5,000-144"
33	1	302-5002-7	Lip Assy,60" (18"LG,6#)	6,000-144"
34	1	121-616-1	Bar For Lip Hinge (60"Lg)	4,&5,000-144"
34	1	106-205	Bar For Lip Hinge (60"Lg)	6,000-144"
35	2	013-005	Spring Pin 5/32"X1"Lg	4,&5,000-144"
35	2	013-011	Spring Pin -1/4" X 1-3/8"	6,000-144"
36	1	091-023-0600	Chain (60"Lg) 3/16"	4,5,&6,000/144"
37	2	091-023-0540	Chain - 3/16"Galvanized 54"	4,5,&6,000/60X144"
37	2	091-023-0660	Chain - 3/16"Galvanized 66"	4,5,&6,000/72X144"
37	2	091-023-0780	Chain - 3/16"Galvanized 78"	4,5,&6,000/84X144"
37	2	091-023-0900	Chain - 3/16"Galvanized 90"	4,5,&6,000/96X144"
38	2	R3-19203	Hook Snap 4"Lg	4,5,&6,000/144"
39	2	034-674	Fitting, 1/4" M X 3/8" Comp.	4,5,&6,000/144"
40	2	091-000-0460	Tubing, Black Nylon 3/8" X46"	4,5,&6,000/60X144"
40	2	091-000-0520	Tubing, Black Nylon 3/8" X52"	4,5,&6,000/72-84X144"
40		091-000-0640	Tubing, Black Nylon 3/8" X64"	4,5,&6,000/96X144"
41	1	034-673	Fitting Nylon Tee - 3/8" Comp,	4,5,&6,000/144"
42	4	025-087	Cable Ties	4,5,&6,000/144"
43	1	300-5006-6	Vent Line Kit (31'lg)	4,5,&6,000/60X144"
43	1	300-5006-7	Vent Line Kit (32'lg)	4,5,&6,000/72X144"
43	1	300-5006-8	Vent Line Kit (33'lg)	4,5,&6,000/84X144"
43	1	300-5006-9	Vent Line Kit (34'lg)	4,5,&6,000/96X144"
44	1	300-5001-38	Hose, #8 HP (144"Lg) Str. Swivel(2)	5,000/72X144"
44	1	300-5001-37	Hose, #8 HP (138"Lg) Str. Swivel(2)	6,000/84X144"

8.4.1 Cylinder Assembly- 4,5, & 6,000 lb. Cap. - 144" Deck Length

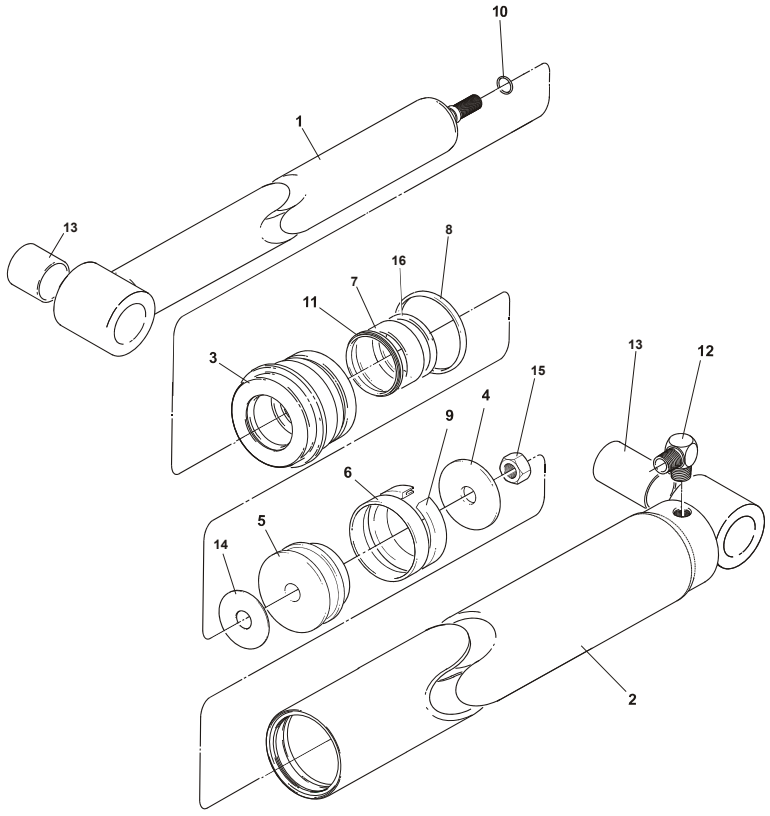


Figure 29 : Cylinder Assembly - 4,5,& 6,000 lb. - 144" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	-	**780-140-240**	**Cylinder Ass'y (3"Dia) [24"Stroke]**	**4,& 5,000/144"**
-	-	**780-144-240**	**Cylinder Ass'y (3-1/2"Dia) [24"Stroke]**	**6,000/144"**
1	1	786-855	Ram Assembly	4,5,&6,000/144"
2	1	780-141	Housing Assembly - 3" Cylinder	4,& 5,000/144"
2	1	780-145	Housing Assembly - 3-1/2" Cylinder	6,000/144"
3	1	117-991	Headnut - 3" Cylinder	4,& 5,000/144"
3	1	117-966	Headnut - 3-1/2" Cylinder	6,000/144"
4	1	114-978	Washer, Piston - 3" Cylinder.	4,& 5,000/144"
4	1	114-979	Washer, Piston - 3-1/2" Cylinder.	6,000/144"
5	1	114-640	Piston - 3" Cylinder	4,& 5,000/144"
5	1	114-639	Piston - 3-1/2" Cylinder	6,000/144"
6●	1	036-154	Ring, Wear - 3" Cylinder	4,& 5,000/144"
6●	1	036-155	Ring, Wear - 3-1/2" Cylinder	6,000/144"
7●	1	036-182	Ring, Wear	4,5,&6,000/144"
8●	1	036-132	“O”-Ring - 3" Cylinder	4,& 5,000/144"
8●	1	036-131	“O”-Ring - 3-1/2" Cylinder.	6,000/144"
9●	1	036-112	“U”-Cup- 3" Cylinder	4,& 5,000/144"
9●	1	036-111	“U”-Cup - 3-1/2" Cylinder	6,000/144".
10●	1	036-108	“O”-Ring	4,5,&6,000/144"
11●	1	036-021	Wiper, Rod	4,5,&6,000/144"
12	1	034-500	Fitting	4,5,&6,000/144"
13	2	018-027	Bushing	4,5,&6,000/144"
14●	1	117-993	Gasket	4,5,&6,000/144"
15	1	011-530	Nut, Huglock – 3/4"	4,5,&6,000/144"
16●	1	036-176	“O”-Ring	4,5,&6,000/144"
-	-	**783-553**	**Kit, Seal - 3" Cylinder - Items Marked (●)**	**4,& 5,000/144"**
-	-	**783-557**	**Kit, Seal - 3-1/2" Cylinder.- Items Marked (●)**	**6,000/144"**

8.5 General Assembly - 8,000 lb. Cap. - 144" Deck Length

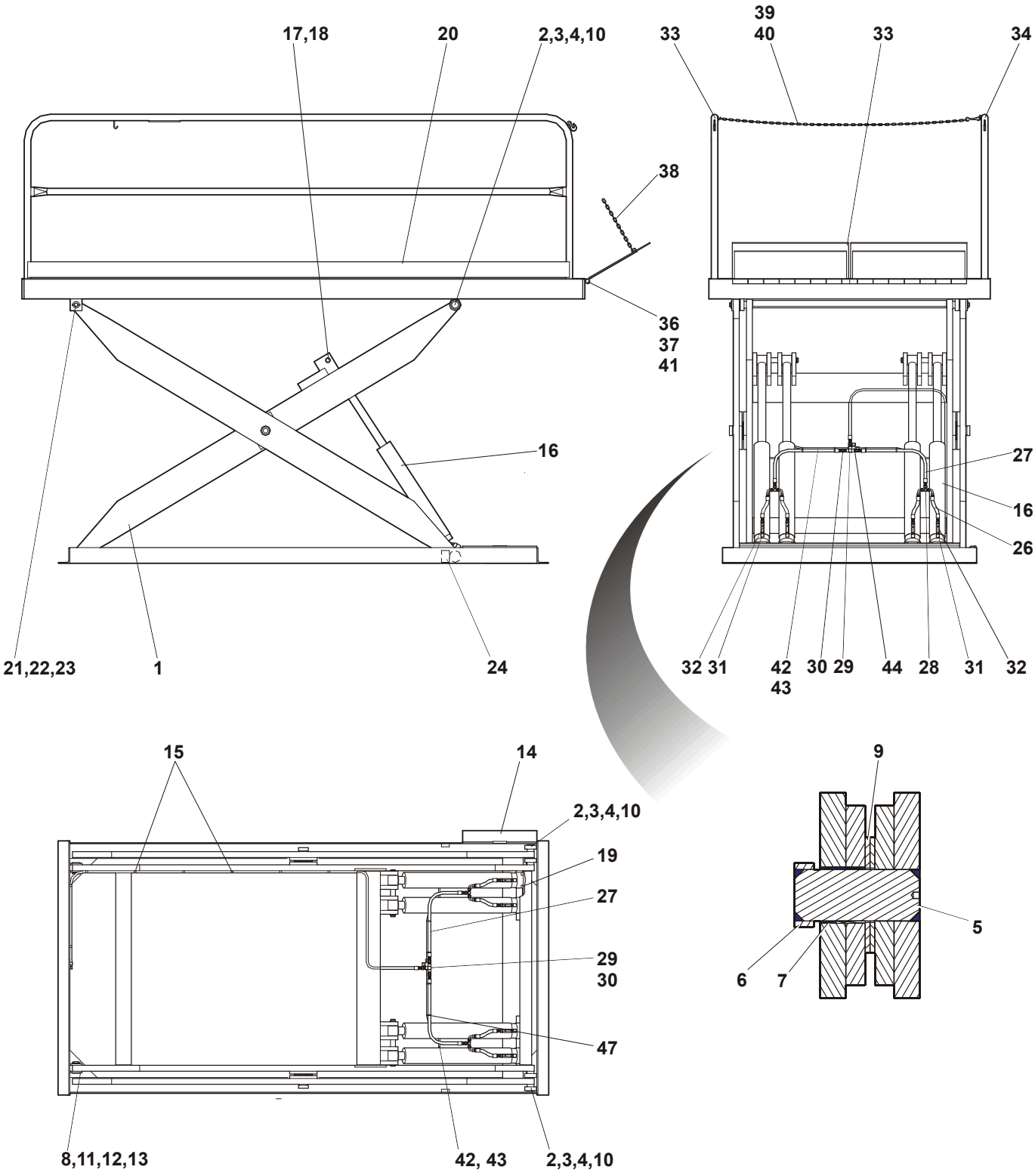


Figure 30 : General Assembly - 8,000 lb. - 144" Deck Length

General Assembly - 8,000 lb. Cap. - 144" Deck Length

Item	Qty	Part No	General Description	Specific Description
			General Assy 8,000 lb. -144" Deck Length	**REF DRG. 310-5270**
1*	**1**	**313-5098**	**Frame/Leg Weldment**	**8,000/60X144"**
1*	**1**	**313-5099**	**Frame/Leg Weldment**	**8,000/72-84X144"**
1*	**1**	**313-5100**	**Frame/Leg Weldment**	**8,000/96X144"**
2	2	019-001	Bearing, 3"OD X 1-5/8"ID X 1"W	8,000/144"
3	4	011-066	Capscrew, Hex Skt F/H - 5/16"-18 X 3/4"	8,000/144"
4	2	013-005	Spring Pin 5/32"x1"Lg	8,000/144"
5	2	114-652	Centre Pin 1-1/2" Thk Leg (5-7/8" Lg)	8,000/144"
6	2	114-606	Collar - 2" (Centre Pin Mod)	8,000/144"
7	2	018-034	Bushing - 2"IDx2"LG	8,000/144"
8	4	018-051	Bushing - 1"IDx3/4"LG	8,000/144"
9	2	012-219	Washer, Flat-2.13" IDx4.5"ODx0.187" TH	8,000/144"
10	4	121-684	Ring-Spacer (1-7/8" O.D)	8,000/144"
11	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	8,000/144"
12	2	013-012	Spring Pin - 1/4" X 2	8,000/144"
13	6	106-389	Spacer Washer, 1-3/4"ODx1"IDx1/16"TH	8,000/144"
14	1	822-440	Strut Weldment, Maintenance	8,000/144"
15	8	035-262	Strap (#6 Hose Clamp)	8,000/144"
16**	**4**	**780-144-240**	**Cylinder Ass'y (3-1/2"Dia) [24"Stroke]**	**8,000/144"**
17	2	115-043	Pin-Cylinder Pivot	8,000/144"
18	4	013-036	Retaining Ring Ext. - 1-1/4"Id	8,000/144"
19	8	104-476	Lip Stop (3/4"X5/8")	8,000/144"
20	1	312-5249-1	Deck Ass'y S2 8,000/60X144	8,000/60X144"
20	1	312-5249-2	Deck Ass'y S2 8,000/72X144	8,000/72X144"
20	1	312-5249-3	Deck Ass'y S2 8,000/84X144	8,000/84X144"
20	1	312-5249-4	Deck Ass'y S2 8,000/96X108	8,000/96X144"
20	1	312-5245-1	Deck Ass'y S3 (Tapered) 8,000/60X144	8,000/60X144"
20	1	312-5245-2	Deck Ass'y S3 (Tapered) 8,000/72X144	8,000/72X144"
20	1	312-5245-3	Deck Ass'y S3 (Tapered) 8,000/84X144	8,000/84X144"
20	1	312-5245-4	Deck Ass'y S3 (Tapered) 8,000/96X108	8,000/96X144"
21	2	798-049	Pin Ass'y - (1-1/2" Thick Legs)	8,000/144"
22	6	106-389	Spacer Washer - 1-3/4"ODx1"IDx1/16"THK	8,000/144"
23	2	013-012	Spring Pin - 1/4" X 2"	8,000/144"
24	2	117-005	Roller Stop	8,000/144"
25	1.5GA	039-066	Paint, Blue (Fast Dry Enamel)	8,000/144"
26	4	300-5005	Hose, #6 HP - 90 Deg. - Str,	8,000/144"
27	2	300-5000-15	Hose, #8 Hp (26"Lg) Str.Swivel(2)	8,000/60X144"
27	2	300-5001-20	Hose, #8 Hp (34"Lg) Str.Swivel(2)	8,000/72X144"
27	2	300-5000-53	Hose, #8 Hp (38"Lg) Str.Swivel(2)	8,000/84X144"
27	2	300-5000-21	Hose, #6 Hp (48"Lg) Str.Swivel(2)	8,000/96X144"
28	2	034-551	Fitting, 033T-6-6	8,000/144"
29	1	034-571	Fitting, Tee 022t-6-6	8,000/144"
30	2	034-535	Fitting, 0103-6-8	8,000/144"
31	2	034-599	Fitting Elbow Forged #6MP-4MP-90	8,000/144"
32	2	033-663	Velocity Fuse, 7.5GPM	8,000/144"

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General Assembly - 8,000 lb. Cap. - 144" Deck Length

Item	Qty	Part No	General Description	Specific Description
33	1	312-5080-7	Guard Rail, Right Side 144"Deck	8,000/144"
34	1	312-5079	Guard Rail Weld (132-1/2"X45")	8,000/144"
35	1	302-5007-3	Lip Assy,60" (18"LG,8#)	8,000/144"
36	2	809-483	Shaft, Lip (29-1/2"LG)	8,000/144"
37	2	013-011	Spring Pin -1/4" X 1-3/8"	8,000/144"
38	1	091-023-0600	Chain (60"Lg) 3/16"	8,000/144"
39	2	091-023-0540	Chain - 3/16"Galvanized 54"	8,000/60X144"
39	2	091-023-0660	Chain - 3/16"Galvanized 66"	8,000/72X144"
39	2	091-023-0780	Chain - 3/16"Galvanized 78"	8,000/84X144"
39	2	091-023-0900	Chain - 3/16"Galvanized 90"	8,000/96X144"
40	2	R3-19203	Hook Snap 4"Lg	8,000/144"
41	2	120-353	Torsion Spring	8,000/144"
42	2	034-674	Fitting, 1/4" M X 3/8" COMP	8,000/144"
43	2	091-000-0063	Tubing, Black Nylon 6-3/8"	8,000/60,72X144"
44	1	035-085	Fitting, Tee	8,000/60X144"
45	2	091-000-0340	Tubing, Black Nylon 3/8" X34"	8,000/60X144"
45	2	091-000-0400	Tubing, Black Nylon 3/8" X40"	8,000/72X144"
45	2	091-000-0460	Tubing, Black Nylon 3/8" X46"	8,000/84X144"
45	2	091-000-0520	Tubing, Black Nylon 3/8" X52"	8,000/96X144"
46	1	034-673	Fitting Nylon Tee - 3/8" Comp,	8,000/144"
47	4	025-087	Cable Ties	8,000/144"
48	1	300-5006-6	Vent Line Kit (31'lg)	8,000/60X144"
48	1	300-5006-7	Vent Line Kit (32'lg)	8,000/72X144"
48	1	300-5006-8	Vent Line Kit (33'lg)	8,000/84X144"
48	1	300-5006-9	Vent Line Kit (34'lg)	8,000/96X144"

8.5.1 Cylinder Assembly - 8,000 lb. Cap. - 144" Deck Length

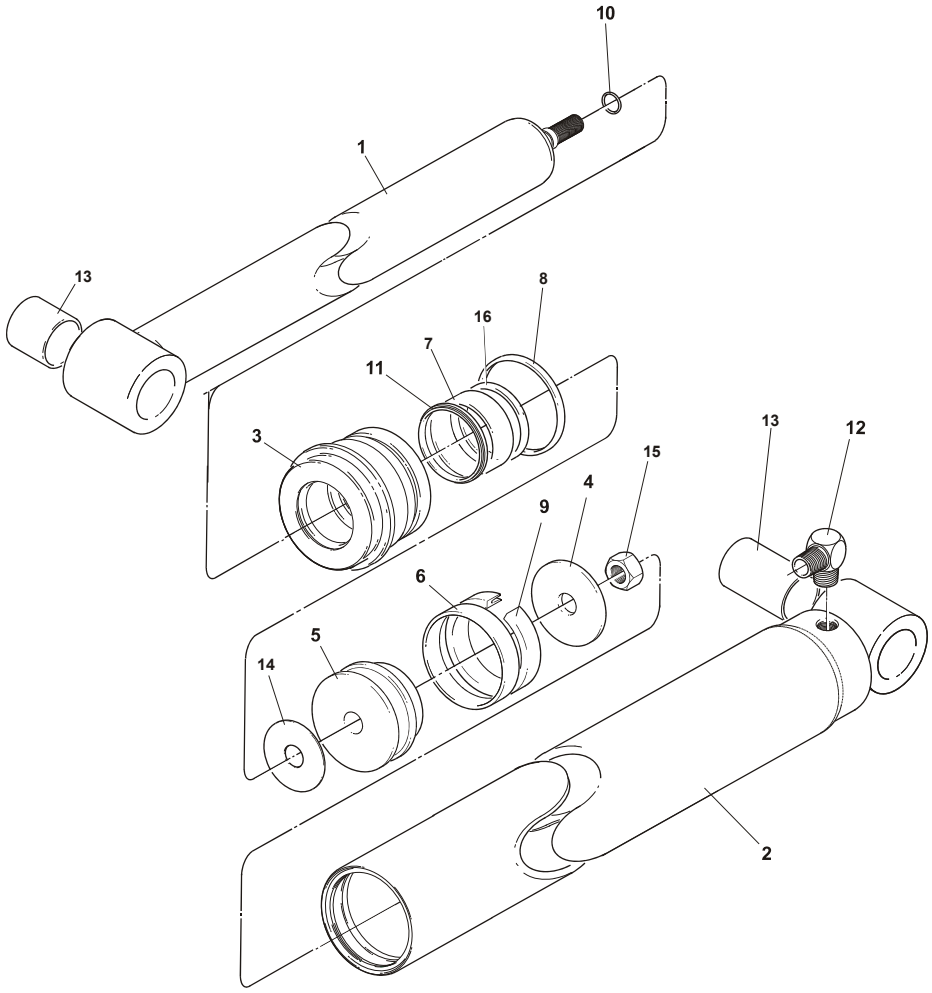


Figure 31 : Cylinder Assembly - 8,000 lb. - 144" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	**-**	**780-144-240**	**Cylinder Ass'y (3-1/2"Dia) [24"Stroke]**	**8,000/144"**
1	1	786-855	Ram Assy 3", 3-1/2", & 4"	8,000/144"
2	1	780-145	Housing Weldment (4"Dia)	8,000/144"
3	1	117-966	Headnut 3-1/2" Dia. Cyl (2" Dia. Rod)	8,000/144"
4	1	114-979	Piston Washer - (3-1/2" Dia)	8,000/144"
5	1	114-639	Piston - 3-1/2"Dia Cyl	8,000/144"
6●	1	036-155	Wear Ring Pist.Wd.3-1/2x1/2	8,000/144"
7●	1	036-182	Wear Ring - 3" X .125" Thick	8,000/144"
8●	1	036-131	O-Ring - 3-1/2"OD X 3-3/4"ID	8,000/144"
9●	1	036-111	U-Cup - 3-1/2" X 2-7/8" X 1/2"	8,000/144"
10●	1	036-108	O-Ring - 3/4"OD X 5/8"ID X 1/16"	8,000/144"
11●	1	036-021	Wiping Ring - 2"ID	8,000/144"
12	1	034-500	Fitting, 6-6	8,000/144"
13	2	018-027	Bushing	8,000/144"
14●	1	117-993	Gasket	8,000/144"
15	1	011-530	Nut, Hex Jam - 3/4"-10	8,000/144"
16●	1	036-176	O-Ring (2-1/4" OD X 2" ID)	8,000/144"
-	**-**	**783-557**	**Seal Kit Includes Items Marked (●)**	**8,000/144"**

8.6 General Assembly - 10,000 lb. Cap. - 96" Deck Length

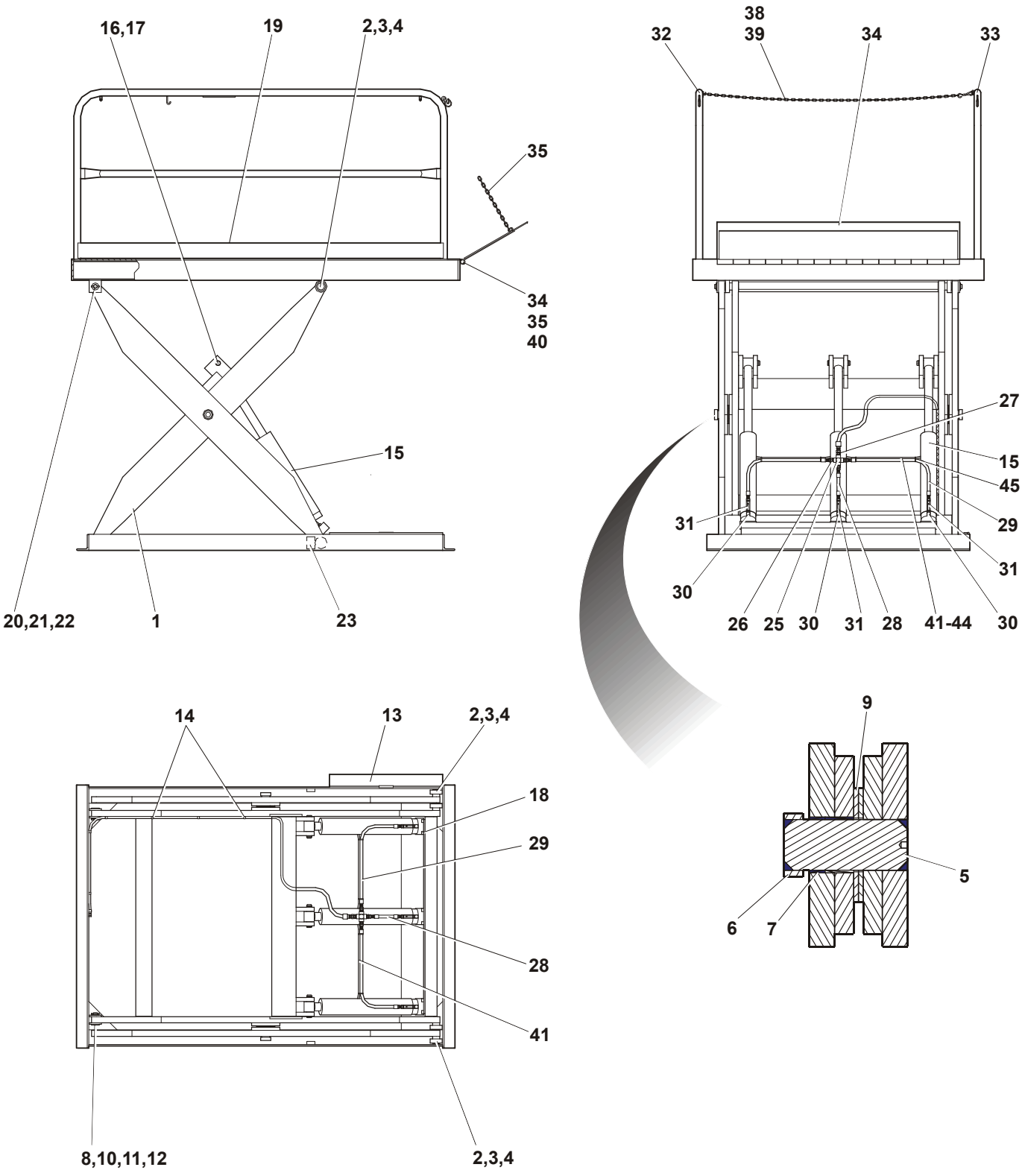


Figure 32 : General Assembly 10,000 lb. - 96" Deck Length

General Assembly - 10,000 lb. Cap. - 96" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	**-**	**-**	**General Assy 10,000- 96" Deck Length**	**REF. DRG. 310-5288**
1*	**1**	**333-5203**	**Frame/Leg Weldm't**	**10,000/60X96"**
1*	**1**	**333-5204**	**Frame/Leg Weldm't**	**10,000/72X96"**
1*	**1**	**333-5205**	**Frame/Leg Weldm't**	**10,000/84X96"**
1*	**1**	**313-5011**	**Frame/Leg Weldm't**	**10,000/96X96"**
2	2	019-001	Bearing, 3"OD X 1-5/8"ID X 1"W	10,000/96"
3	4	011-066	Capscrew, Hex Skt F/H - 5/16"-18 X 3/4"	10,000/96"
4	2	013-005	Spring Pin 5/32"x1"Lg	10,000/96"
5	2	114-652	Centre Pin 1-1/2" Thk Leg (5-7/8" Lg)	10,000/96"
6	2	114-606	Collar - 2" (Centre Pin Mod)	10,000/96"
7	2	018-034	Bushing - 2"IDx2"LG	10,000/96"
8	4	018-051	Bushing - 1"Idx3/4"LG	10,000/96"
9	2	012-219	Washer, Flat Plain - 2.13" IDx4.5"ODx0.187" THK	10,000/96"
10	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	10,000/96"
11	2	013-012	Spring Pin - 1/4" X 2	10,000/96"
12	6	106-389	Washer, 1-3/4"ODx1"IDx1/16"THK	10,000/96"
13	1	822-440	Strut Weldment, Maintenance	10,000/96"
14	8	035-262	Strap (#6 Hose Clamp)	10,000/96"
15**	**3**	**780-144-190**	**Cylinder Ass'y (3-1/2"Dia) [19" Stroke]**	**10,000/96"**
16	3	114-993	Pin-Cylinder Pivot	10,000/96"
17	6	013-036	Retaining Ring Ext. - 1-1/4"ID	10,000/96"
18	6	104-476	Lip Stop (3/4"X5/8")	10,000/96"
19	1	312-5116	Deck Ass'y S2 10,000/60x96	10,000/60X96"
19	1	312-5118	Deck Ass'y S2 10,000/72x96	10,000/72X96"
19	1	312-5120	Deck Ass'y S2 10,000/84x96	10,000/84X96"
19	1	312-5122	Deck Ass'y S2 10,000/96x96	10,000/96X96"
19	1	312-5031	Deck Ass'y S3 (Tapered) 10,000/60x96	10,000/60X96"
19	1	312-5032	Deck Ass'y S3 (Tapered) 10,000/72x96	10,000/72X96"
19	1	312-5033	Deck Ass'y S3 (Tapered) 10,000/84x96	10,000/84X96"
19	1	312-5034	Deck Ass'y S3 (Tapered) 10,000/96x96	10,000/96X96"
20	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	10,000/96"
21	6	106-389	Spacer Washer -1-3/4"OD X 1"ID X 1/16" Th	10,000/96"
22	2	013-012	Spring Pin - 1/4" X 2"	10,000/96"
23	2	117-005	Roller Stop	10,000/96"
24	1.6GA	039-066	Paint, Blue (Fast Dry Enamel)	10,000/96"
25	1	034-671	Fitting Four Way	10,000/96"
26	3	034-536	Adapter, 2021-8-6S	10,000/96"
27	1	034-537	Adapter	10,000/96"
28	1	300-5000	Hose, #6 High Pressure (4"Lg) Str. Swivel(2)	10,000/96"
29	2	300-5000-15	Hose, #6 HP (26"Lg) Str.Swivel(2)	10,000/96"

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General Assembly - 10,000 lb. Cap. - 96" Deck Length

Item	Qty	Part No	General Description	Specific Description
30	3	034-599	Fitting Elbow Forged 6MP-4MP-90°	10,000/96"
31	3	033-661	Velocity Fuse - 5 GPM	10,000/96"
32	1	312-5080-4	Guard Rail, Right Side 96"Deck	10,000/96"
33	1	312-5076	Guard Rail Weld (84-1/2"X45")	10,000/96"
34	1	302-5007-3	Lip Assy 60" Spring Assist 1pc ,18"Lg	10,000/96"
35	2	106-205	Bar For Lip Hinge (60"Lg)	10,000/96"
36	2	013-011	Spring Pin - 1/4" X 1-3/8"	10,000/96"
37	1	091-023-0600	Chain (60"Lg) [3/16"Proof Coil Galvanized]	10,000/96"
38	2	091-023-0540	Chain (54"Lg) 3/16"Proof Coil Galvanized	10,000/60X96"
38	2	091-023-0660	Chain (66"Lg) 3/16"Proof Coil Galvanized	10,000/72X96"
38	2	091-023-0780	Chain (78"Lg) 3/16"Proof Coil Galvanized	10,000/84X96"
38	2	091-023-0900	Chain (90"Lg) 3/16"Proof Coil Galvanized	10,000/96X96"
39	2	R3-19203	Hook Snap 4"Lg - 7/16"-20	10,000/96"
40	2	120-353	Torsion Spring	10,000/96"
41	1	034-674	Fitting, 1/4" Male X 3/8" Comp	10,000/96"
42	2	091-000-0340	Tubing Black Nylon (34"Lg) 3/8"	10,000/60X96"
42	2	091-000-0400	Tubing Black Nylon (40"Lg) 3/8"	10,000/72X96"
42	2	091-000-0460	Tubing Black Nylon (46"Lg) 3/8"	10,000/84X96"
42	2	091-000-0520	Tubing Black Nylon (52"Lg) 3/8"	10,000/96X96"
43	2	035-085	Fitting Tee	10,000/96"
44	1	034-673	Fitting Nylon Tee (3/8" Comp)	10,000/96"
45	4	025-087	Cable Ties	10,000/96"
46	1	300-5006-2	Vent Line Kit (27'lg)	10,000/60X96"
46	1	300-5006-3	Vent Line Kit (28'lg)	10,000/72X96"
46	1	300-5006-4	Vent Line Kit (29'lg)	10,000/84X96"
46	1	300-5006-5	Vent Line Kit (30'lg)	10,000/96X96"
47	1	300-5001-38	Hose, #8 Hp (144"Lg) Str.Swivel(2)	10,000/72X96"

8.6.1 Cylinder Assembly - 10,000 lb. Cap. - 96" Deck Length

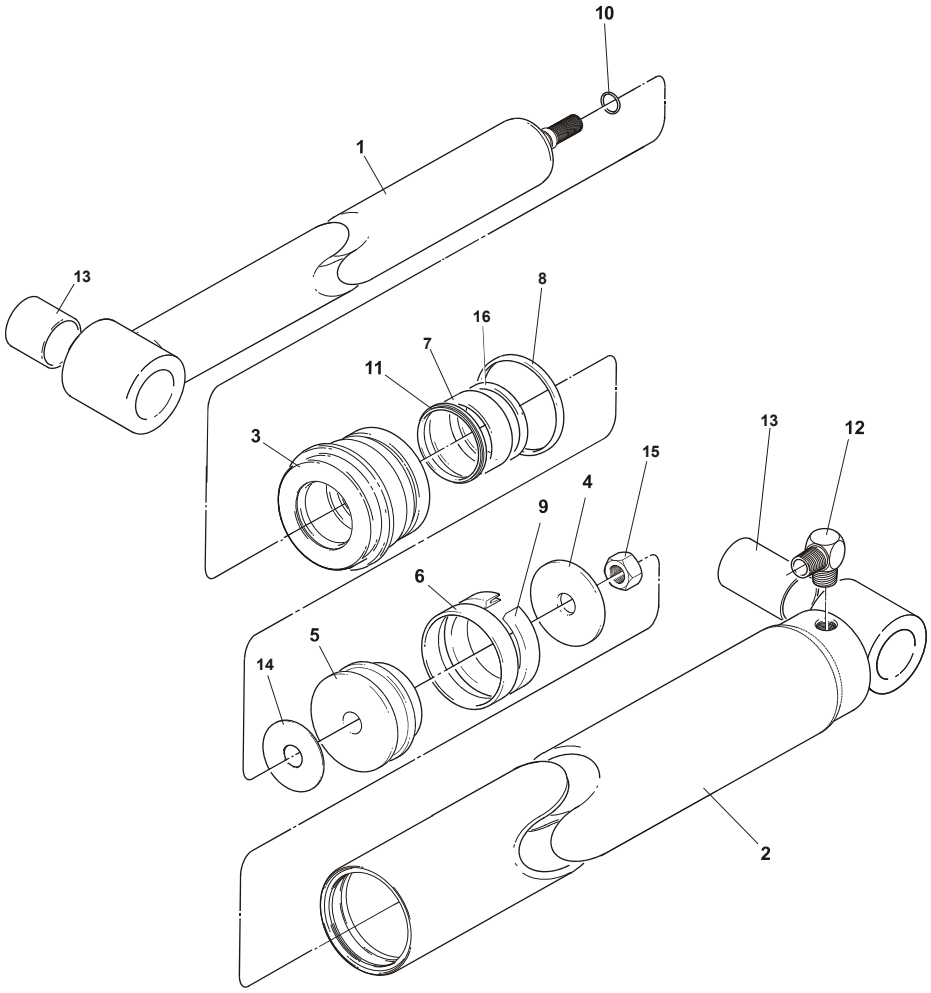


Figure 33 : Cylinder Assembly - 10,000 lb. - 96" Deck Length

Item	Qty	Part No	General Description	Specific Description
15**	**3**	**780-144-190**	**Cylinder Ass'y (3-1/2"Dia) [19" Stroke]**	**10,000/96"**
1	1	786-855	Ram Assy 3", 3-1/2", & 4"	10,000/96"
2	1	780-145	Housing Weldment (4"Dia)	10,000/96"
3	1	117-966	Headnut 3-1/2" Dia. Cyl (2" Dia. Rod)	10,000/96"
4	1	114-979	Piston Washer - (3-1/2" Dia)	10,000/96"
5	1	114-639	Piston - 3-1/2"Dia Cyl	10,000/96"
6●	1	036-155	Wear Ring Pist.Wd.3-1/2x1/2	10,000/96"
7●	1	036-182	Wear Ring - 3" X .125" Thick	10,000/96"
8●	1	036-131	O-Ring - 3-1/2"OD X 3-3/4"ID	10,000/96"
9●	1	036-111	U-Cup - 3-1/2" X 2-7/8" X 1/2"	10,000/96"
10●	1	036-108	O-Ring - 3/4"OD X 5/8"ID X 1/16"	10,000/96"
11●	1	036-021	Wiping Ring - 2"ID	10,000/96"
12	1	034-500	Fitting, 6-6	10,000/96"
13	2	018-027	Bushing	10,000/96"
14●	1	117-993	Gasket	10,000/96"
15	1	011-530	Nut, Hex Jam - 3/4"-10	10,000/96"
16●	1	036-176	O-Ring (2-1/4" OD X 2" ID)	10,000/96"
-	**-**	**783-557**	**Seal Kit Includes Items Marked (●)**	**10,000/96"**

8.7 General Assembly - 12,000 lb. Cap. - 96" Deck Length

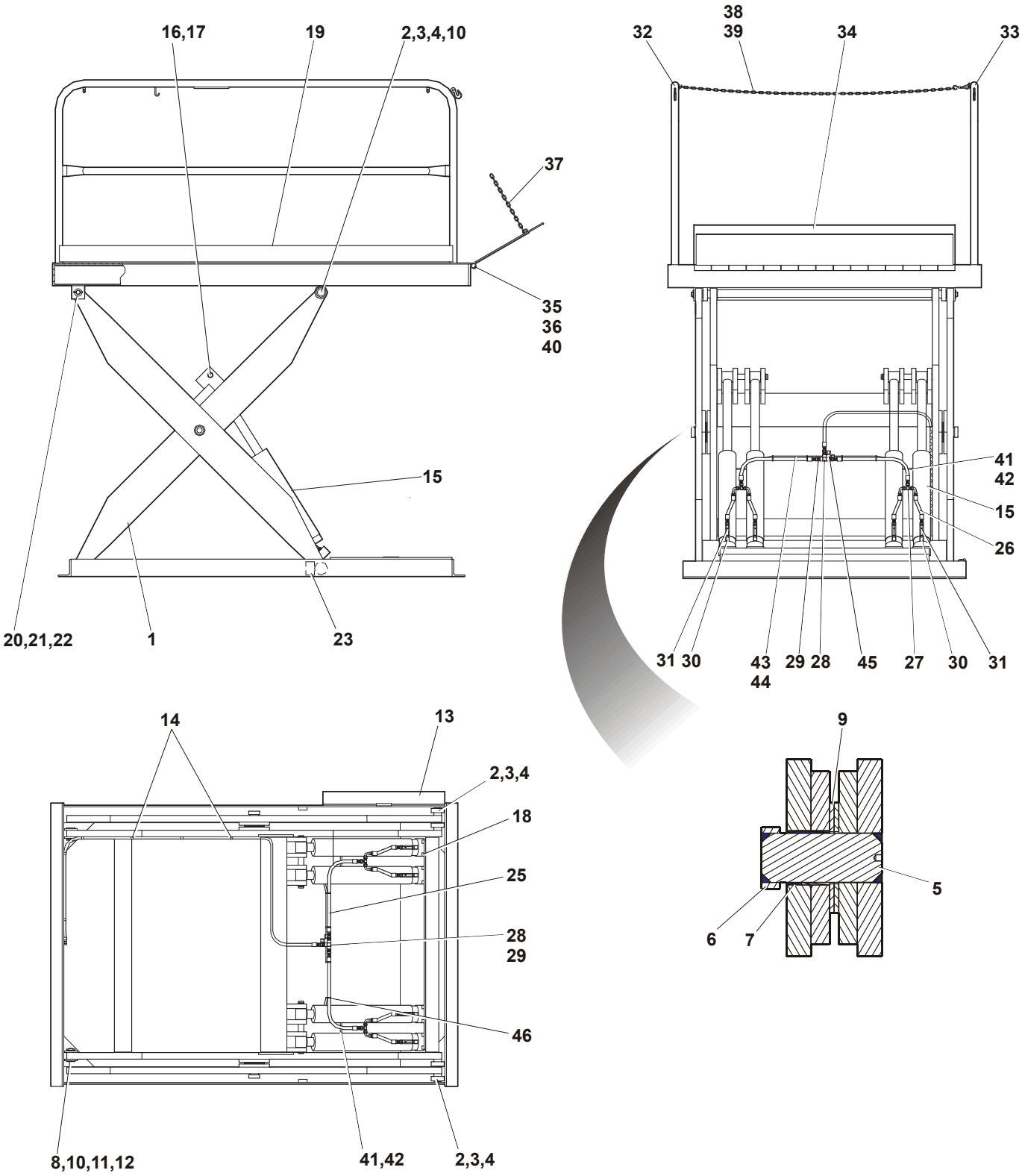


Figure 34 : General Assembly - 12,000 lb. - 96" Deck Length

General Assembly - 12,000 lb. Cap. - 96" Deck Length

Item	Qty	Part No	General Description	Specific Description
			General Assy 12,000 - 96" Deck Length	**REF. DWG. 310-5294**
1*	**1**	**333-5304**	**Frame/Leg Weldm't**	**12,000/60X96"**
1*	**1**	**333-5305**	**Frame/Leg Weldm't**	**12,000/72X96"**
1*	**1**	**333-5306**	**Frame/Leg Weldm't**	**12,000/84X96"**
1*	**1**	**313-5013**	**Frame/Leg Weldm't**	**12,000/96X96"**
2	2	019-001	Roller Bearing, 3"OD X 1-5/8"ID X 1"W	12,000/96"
3	4	011-066	Capscrew, Hex Skt F/H - 5/16"-18 X 3/4"	12,000/96"
4	2	013-005	Spring Pin 5/32"x1"Lg	12,000/96"
5	2	114-652	Centre Pin 1-1/2" Thk Leg (5-7/8" Lg)	12,000/96"
6	2	114-606	Collar - 2" (Centre Pin Mod)	12,000/96"
7	2	018-034	Bushing - 2"IDx2"LG	12,000/96"
8	4	018-051	Bushing - 1"IDx3/4"LG	12,000/96"
9	2	012-219	Washer, Flat-2.13" IDx4.5"ODx0.187" TH	12,000/96"
10	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	12,000/96"
11	2	013-012	Spring Pin - 1/4" X 2	12,000/96"
12	6	106-389	Spacer Washer,1-3/4"ODx1"IDx1/16"TH	12,000/96"
13	1	822-440	Strut Weldment, Maintenance	12,000/96"
14	8	035-262	Strap (#6 Hose Clamp)	12,000/96"
15**	**3**	**780-144-190**	**Cylinder Ass'y (3-1/2"Dia) [19" Stroke]**	**12,000/96"**
16	3	115-043	Pin-Cylinder Pivot	12,000/96"
17	6	013-036	Retaining Ring Ext. - 1-1/4"Id	12,000/96"
18	6	104-476	Lip Stop (3/4"X5/8")	12,000/96"
19	1	312-5117	Deck Ass'y S2 12,000/60x96	12,000/60X96"
19	1	312-5119	Deck Ass'y S2 12,000/72x96	12,000/72X96"
19	1	312-5121	Deck Ass'y S2 12,000/84x96	12,000/84X96"
19	1	312-5123	Deck Ass'y S2 12,000/96x96	12,000/96X96"
19	1	312-5088	Deck Ass'y S3 (Tapered) 12,000/60x96	12,000/60X96"
19	1	312-5089	Deck Ass'y S3 (Tapered) 12,000/72x96	12,000/72X96"
19	1	312-5090	Deck Ass'y S3 (Tapered) 12,000/84x96	12,000/84X96"
19	1	312-5091	Deck Ass'y S3 (Tapered) 12,000/96x96	12,000/96X96"
20	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	12,000/96"
21	6	106-389	Spacer Washer - 1-3/4"OD X 1"ID X 1/16Th	12,000/96"
22	2	013-012	Spring Pin - 1/4" X 2"	12,000/96"
23	2	117-005	Roller Stop	12,000/96"
24	1.6GA	039-066	Paint, Blue (Fast Dry Enamel)	12,000/96"
25	2	300-5000-15	Hose, #8 HP (26"Lg) Str.Swivel(2)	12,000/60X96"
25	2	300-5000-20	Hose, #8 HP (34"Lg) Str.Swivel(2)	12,000/72X96"
25	2	300-5001-53	Hose, #8 HP (38"Lg) Str.Swivel(2)	12,000/84X96"
25	2	300-5001-21	Hose, #8 HP (48"Lg) Str.Swivel(2)	12,000/96X96"
26	4	300-5005	Hose, #6 HP - 90 Deg. - Str. Swivel	12,000/96"
27	1	034-551	Fitting, Tee 033T-6-6	12,000/96"
28	1	034-571	Fitting, Tee 022T-6-6	12,000/96"
29	2	034-504	Adapter, 0103-6-6	12,000/96"

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General Assembly - 12,000 lb. Cap. - 96" Deck Length

Item	Qty	Part No	General Description	Specific Description
30	4	034-599	Fitting Elbow Forged 6MP-4MP-90°	12,000/96"
31	3	033-661	Velocity Fuse - 5 GPM	12,000/96"
32	1	312-5080-4	Guard Rail, Right Side 96"Deck	12,000/96"
33	1	312-5076	Guard Rail Weld (84-1/2"X45")	12,000/96"
34	1	302-5007-3	Lip Assy 60" Spring Assist 1pc ,18"Lg]	12,000/96"
34	1	302-5002-8	Lip Assy 60" Spring Assist 1pc ,12"Lg]	12,000/96x96" Lg.
35	2	106-205	Bar, Lip Hinge	12,000/96"
36	2	013-011	Spring Pin - 1/4" X 1-3/8	12,000/96"
37	1	091-023-0600	Chain (60"Lg) [3/16"Proof Coil Galvanized]	12,000/96"
38	2	091-023-0540	Chain (54"Lg) 3/16"Proof Coil Galvanized	12,000/60X96'
38	2	091-023-0660	Chain (66"Lg) 3/16"Proof Coil Galvanized	12,000/72X96"
38	2	091-023-0780	Chain (78"Lg) 3/16"Proof Coil Galvanized	12,000/84X96"
38	2	091-023-0900	Chain (90"Lg) 3/16"Proof Coil Galvanized	12,000/96X96"
39	2	R3-19203	Hook Snap 4"Lg - 7/16"-20	12,000/96"
40	2	120-353	Torsion Spring	12,000/96"
41	2	034-674	Fitting, 1/4" Male X 3/8" Comp	12,000/96"
42	2	091-000-0063	Tubing Black Nylon (6-3/8"Lg) 3/8"	12,000/96"
43	2	035-085	Fitting Tee	12,000/96"
44	2	091-000-0340	Tubing Black Nylon (34"Lg) 3/8"	12,000/60X96"
44	2	091-000-0400	Tubing Black Nylon (40"Lg) 3/8"	12,000/72X96"
44	2	091-000-0460	Tubing Black Nylon (46"Lg) 3/8"	12,000/84X96"
44	2	091-000-0520	Tubing Black Nylon (52"Lg) 3/8"	12,000/96X96"
45	1	034-673	Fitting Nylon Tee (3/8" Comp)	12,000/96"
46	4	025-087	Cable Ties	12,000/96"
47	1	300-5006-2	Vent Line Kit (27'lg) *(Not Shown)*	12,000/60X96"
47	1	300-5006-3	Vent Line Kit (28'lg) *(Not Shown)*	12,000/72X96"
47	1	300-5006-4	Vent Line Kit (29'lg) *(Not Shown)*	12,000/84X96"
47	1	300-5006-5	Vent Line Kit (31'lg) *(Not Shown)*	12,000/84X96"

8.7.1 Cylinder Assembly - 12,000 lb. Cap. - 96" Deck Length

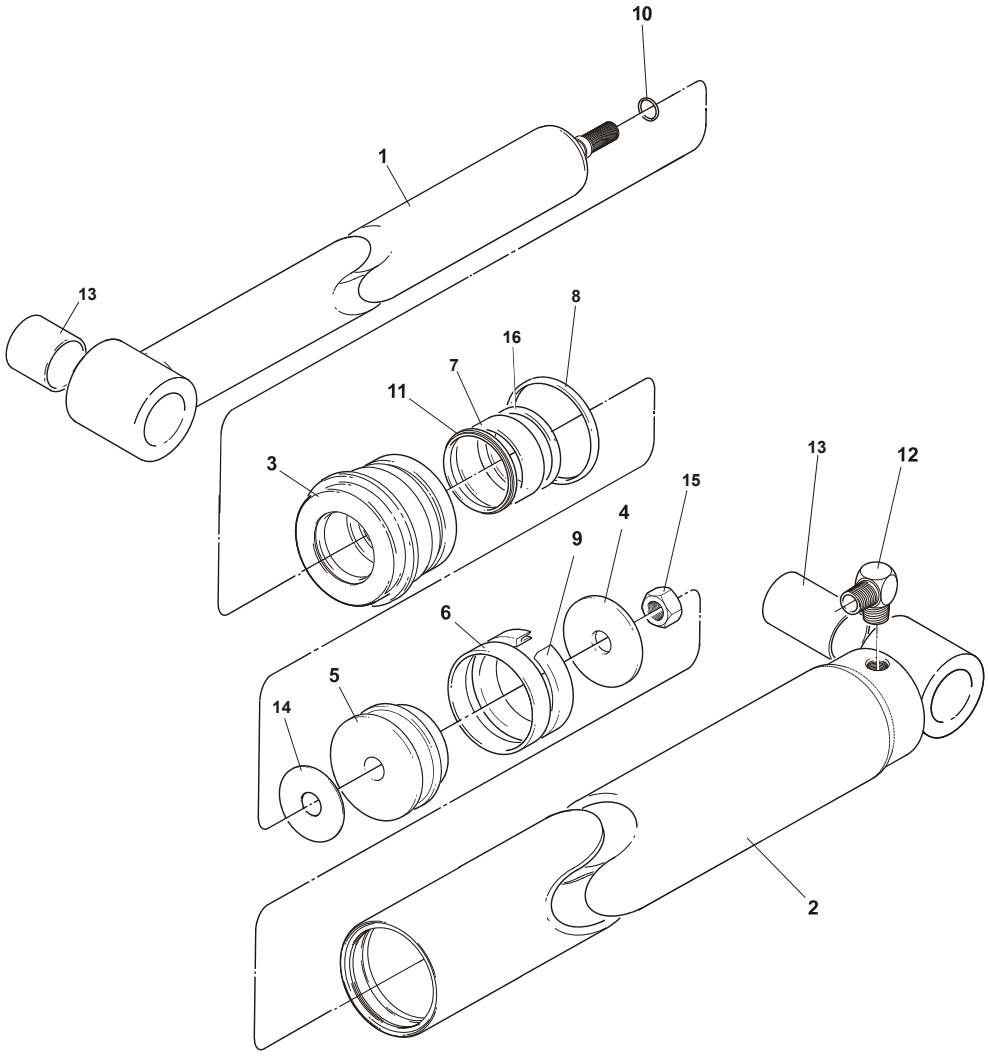


Figure 35 : Cylinder Assembly - 12,000 lb. - 96" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	**-**	**780-144-190**	**Cylinder Ass'y (3-1/2"Dia) [19" Stroke]**	**12,000/96"**
1	1	786-855	Ram Assy 3", 3-1/2", & 4"	12,000/96"
2	1	780-145	Housing Weldment (4"Dia)	12,000/96"
3	1	117-966	Headnut 3-1/2" Dia. Cyl (2" Dia. Rod)	12,000/96"
4	1	114-979	Piston Washer - (3-1/2" Dia)	12,000/96"
5	1	114-639	Piston - 3-1/2"Dia Cyl	12,000/96"
6●	1	036-155	Wear Ring Pist.Wd.3-1/2x1/2	12,000/96"
7●	1	036-182	Wear Ring - 3" X .125" Thick	12,000/96"
8●	1	036-131	O-Ring - 3-1/2"OD X 3-3/4"ID	12,000/96"
9●	1	036-111	U-Cup - 3-1/2" X 2-7/8" X 1/2"	12,000/96"
10●	1	036-108	O-Ring - 3/4"OD X 5/8"ID X 1/16"	12,000/96"
11●	1	036-021	Wiping Ring - 2"ID	12,000/96"
12	1	034-500	Fitting, 6-6	12,000/96"
13	2	018-027	Bushing	12,000/96"
14●	1	117-993	Gasket	12,000/96"
15	1	011-530	Nut, Hex Jam - 3/4"-10	12,000/96"
16●	1	036-176	O-Ring (2-1/4" OD X 2" ID)	12,000/96"
-	**-**	**783-557**	**Seal Kit Includes Items Marked (●)**	**12,000/96"**

8.8 General Assembly - 10 & 12,000 lb. Cap. - 108" Deck Length

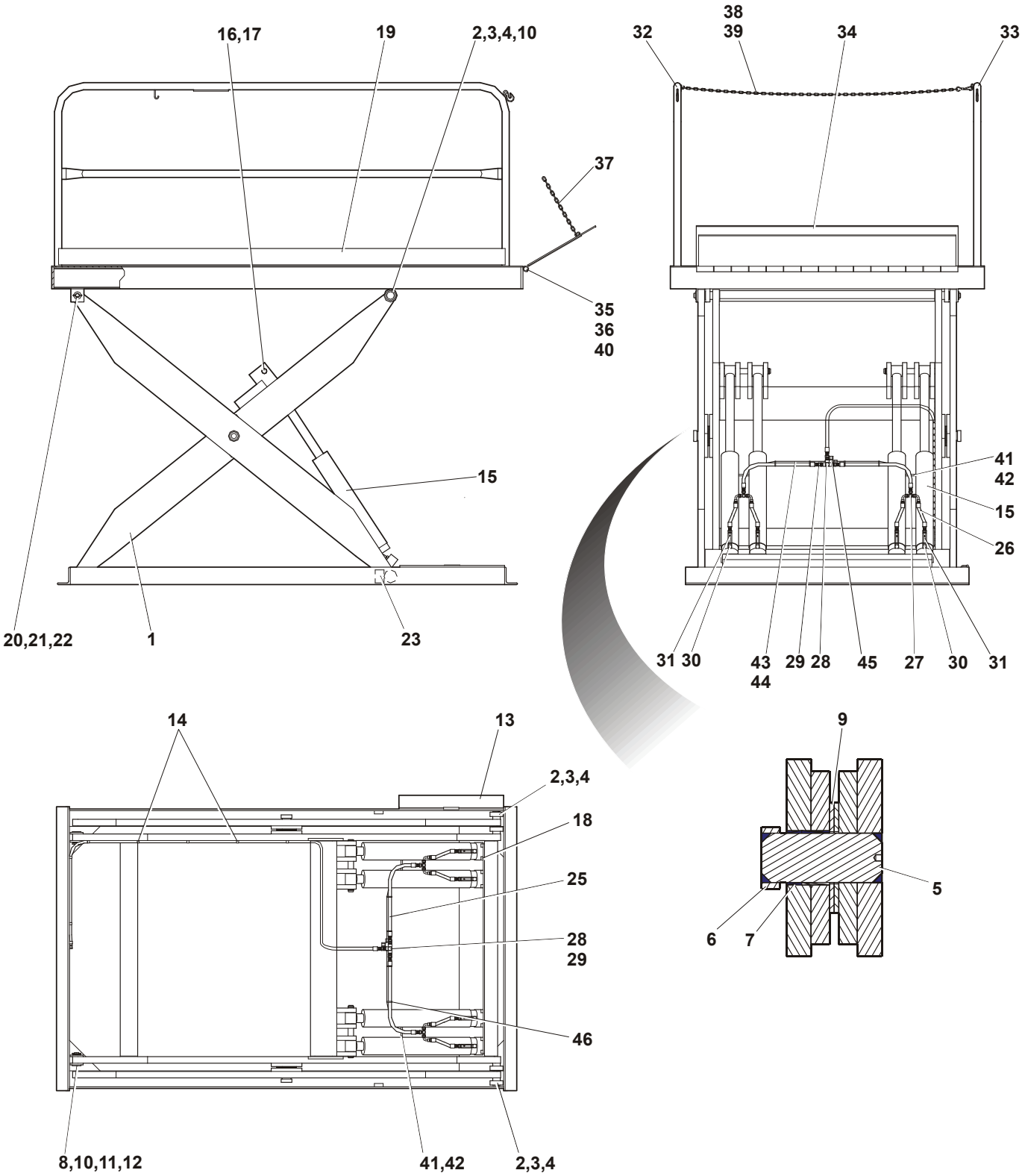


Figure 36 : General Assembly 10 & 12,000 lb. - 108" Deck Length

General Assembly - 10 & 12,000 lb. Cap. - 108" Deck Length

Item	Qty	Part No	General Description	Specific Description
			General Assy 10,&12,000 - 108" Deck Lg	**REF. DWG. 310-5305**
1*	**1**	**333-5308**	**Frame/Leg Weldm't**	**10,&12,000/60X108"**
1*	**1**	**333-5309**	**Frame/Leg Weldm't**	**10,&12,000/72X108'**
1*	**1**	**333-5310**	**Frame/Leg Weldm't**	**10,&12,000/84X108"**
1*	**1**	**313-5015**	**Frame/Leg Weldm't**	**10,&12,000/96X108"**
2	2	019-001	Bearing, Roller 3"OD X 1-5/8"ID X 1"W	10,&12,000/108"
3	4	011-066	Capscrew, Hex Skt F/H - 5/16"-18 X 3/4"	10,&12,000/108"
4	2	013-005	Spring Pin 5/32"x1"Lg	10,&12,000/108"
5	2	114-652	Centre Pin 1-1/2" Thk Leg (5-7/8" Lg)	10,&12,000/108"
6	2	114-606	Collar - 2" (Centre Pin Mod)	10,&12,000/108"
7	2	018-034	Bushing - 2"IDx2"LG	10,&12,000/108"
8	4	018-051	Bushing - 1"IDx3/4"LG	10,&12,000/108"
9	2	012-219	Washer, Flat-2.13" IDx4.5"ODx0.187" TH	10,&12,000/108"
10	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	10,&12,000/108"
11	2	013-012	Spring Pin - 1/4" X 2	10,&12,000/108"
12	6	106-389	Spacer Washer,1-3/4"ODx1"IDx1/16"TH	10,&12,000/108"
13	1	822-440	Strut Weldment, Maintenance	10,&12,000/108"
14	8	035-262	Strap (#6 Hose Clamp)	10,&12,000/108"
15**	**3**	**780-144-210**	**Cylinder Ass'y (3-1/2"Dia) [21" Stroke]**	10,&12,000/108"
16	3	115-043	Pin-Cylinder Pivot	10,&12,000/108"
17	6	013-036	Retaining Ring Ext. - 1-1/4"ID	10,&12,000/108"
18	6	104-476	Lip Stop (3/4"X5/8")	10,&12,000/108"
19	1	312-5132	Deck Ass'y S2 10,&12,000/60x108	10,&12,000/60X108"
19	1	312-5133	Deck Ass'y S2 10,&12,000/72x108	10,&12,000/72X108"
19	1	312-5134	Deck Ass'y S2 10,&12,000/84x108	10,&12,000/84X108"
19	1	312-5135	Deck Ass'y S2 10,&12,000/96x108	10,&12,000/96X108"
19	1	312-5043	Deck Ass'y S3 (Taprd) 10,&12,000/60x108	10,&12,000/60X108"
19	1	312-5044	Deck Ass'y S3 (Taprd) 10,&12,000/72x108	10,&12,000/72X108"
19	1	312-5045	Deck Ass'y S3 (Taprd) 10,&12,000/84x108	10,&12,000/84X108"
19	1	312-5046	Deck Ass'y S3 (Taprd) 10,&12,000/96x108	10,&12,000/96X108"
20	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	10,&12,000/108"
21	6	106-389	Spacer Washer - 1-3/4"OD X 1"ID X 1/16Th	10,&12,000/108"
22	2	013-012	Spring Pin - 1/4" X 2"	10,&12,000/108"
23	2	103-445	Roller Stop	10,&12,000/108"
24	1.6GA	039-066	Paint, Blue (Fast Dry Enamel)	10,&12,000/108"
25	2	300-5000-15	Hose, #8 HP (26"Lg) Str.Swivel(2)	10,&12,000/60X108"
25	2	300-5000-20	Hose, #8 HP (34"Lg) Str.Swivel(2)	10,&12,000/72X108"
25	2	300-5001-53	Hose, #8 HP (38"Lg) Str.Swivel(2)	10,&12,000/84X108"
25	2	300-5001-21	Hose, #8 HP (48"Lg) Str.Swivel(2)	10,&12,000/96X108"
26	1	300-5005	Hose, #6 HP - 90 Deg. - Str. Swivel	10,&12,000/108"
27	1	034-551	Fitting, Tee 033T-6-6	10,&12,000/108"
28	1	034-571	Fitting, Tee 022T-6-6	10,&12,000/108"

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General Assembly - 10 & 12,000 lb. Cap. - 108" Deck Length

Item	Qty	Part No	General Description	Specific Description
29	2	034-504	Adapter, 0103-6-6	10,&12,000/108"
30	4	034-599	Fitting Elbow Forged 6MP-4MP-90	10,&12,000/108"
31	3	033-663	Velocity Fuse - 7.5 GPM	10,&12,000/108"
32	1	312-5080-5	Guard Rail, Right Side 108"Deck	10,&12,000/108"
33	1	312-5077	Guard Rail Weld (96-1/2"X45")	10,&12,000/108"
34	1	302-5007-3	Lip Assy 60" Spring Assist 1pc ,18"Lg]	10,&12,000/108"
35	2	809-483	Shaft, Lip (29-1/2" LG.)	10,&12,000/108"
36	2	013-011	Spring Pin - 1/4" X 1-3/8	10,&12,000/108"
37	1	091-023-0600	Chain (60"Lg) [3/16"Proof Coil Galvanized]	10,&12,000/108"
38	2	091-023-0540	Chain (54"Lg) 3/16"Proof Coil Galvanized	10,&12,000/60X108'
38	2	091-023-0660	Chain (66"Lg) 3/16"Proof Coil Galvanized	10,&12,000/72X108"
38	2	091-023-0780	Chain (78"Lg) 3/16"Proof Coil Galvanized	10,&12,000/84X108"
38	2	091-023-0900	Chain (90"Lg) 3/16"Proof Coil Galvanized	10,&12,000/96X108"
39	2	R3-19203	Hook Snap 4"Lg - 7/16"-20	10,&12,000/108"
40	2	120-353	Torsion Spring	10,&12,000/108"
41	2	034-674	Fitting, 1/4" Male X 3/8" Comp	10,&12,000/108"
42	2	091-000-0063	Tubing Black Nylon (6-3/8"Lg) 3/8"	10,&12,000/108"
43	2	035-085	Fitting Tee	10,&12,000/108"
44	2	091-000-0340	Tubing Black Nylon (34"Lg) 3/8"	10,&12,00060X108"
44	2	091-000-0400	Tubing Black Nylon (40"Lg) 3/8"	10,&12,000/72X108"
44	2	091-000-0460	Tubing Black Nylon (46"Lg) 3/8"	10,&12,000/84X108"
44	2	091-000-0520	Tubing Black Nylon (52"Lg) 3/8"	10,&12,000/96X108"
45	1	034-673	Fitting Nylon Tee (3/8" Comp)	10,&12,000/108"
46	4	025-087	Cable Ties	10,&12,000/108"
47	1	300-5006-3	Vent Line Kit (28'lg)	10,&12,000/60X108"
47	1	300-5006-4	Vent Line Kit (29'lg)	10,&12,000/72X108"
47	1	300-5006-5	Vent Line Kit (30'lg)	10,&12,000/84X108"
47	1	300-5006-6	Vent Line Kit (31'lg)	10,&12,000/84X108"

8.8.1 Cylinder Assembly - 10 & 12,000 lb. Cap. - 108" Deck Length

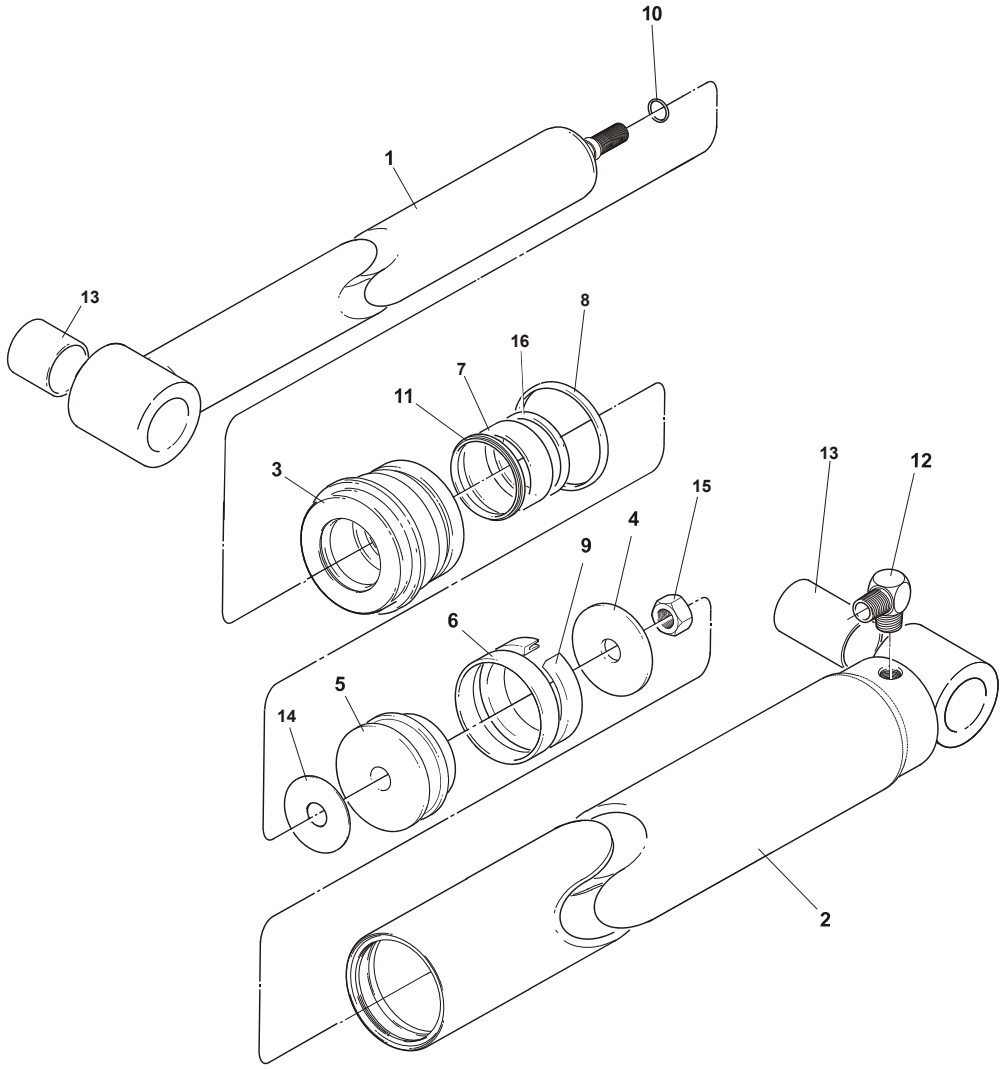


Figure 37 : Cylinder Assembly - 10, & 12,000 lb. - 108" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	**-**	**780-144-210**	**Cylinder Ass'y (3-1/2"Dia) [21" Stroke]**	**10,&12,000/108"**
1	1	786-855	Ram Assy 3", 3-1/2", & 4"	10,&12,000/108"
2	1	780-145	Housing Weldment (4"Dia)	10,&12,000/108"
3	1	117-966	Headnut 3-1/2" Dia. Cyl (2" Dia. Rod)	10,&12,000/108"
4	1	114-979	Piston Washer - (3-1/2" Dia)	10,&12,000/108"
5	1	114-639	Piston - 3-1/2"Dia Cyl	10,&12,000/108"
6●	1	036-155	Wear Ring Pist.Wd.3-1/2x1/2	10,&12,000/108"
7●	1	036-182	Wear Ring - 3" X .125" Thick	10,&12,000/108"
8●	1	036-131	O-Ring - 3-1/2"OD X 3-3/4"ID	10,&12,000/108"
9●	1	036-111	U-Cup - 3-1/2" X 2-7/8" X 1/2"	10,&12,000/108"
10●	1	036-108	O-Ring - 3/4"OD X 5/8"ID X 1/16"	10,&12,000/108"
11●	1	036-021	Wiping Ring - 2"ID	10,&12,000/108"
12	1	034-500	Fitting, 6-6	10,&12,000/108"
13	2	018-027	Bushing	10,&12,000/108"
14●	1	117-993	Gasket	10,&12,000/108"
15	1	011-530	Nut, Hex Jam - 3/4"-10	10,&12,000/108"
16●	1	036-176	O-Ring (2-1/4" OD X 2" ID)	10,&12,000/108"
-	**-**	**783-557**	**Seal Kit Includes Items Marked (●)**	**10,&12,000/108"**

8.9 General Assembly - 10 & 12,000 lb. Cap. - 120" Deck Length

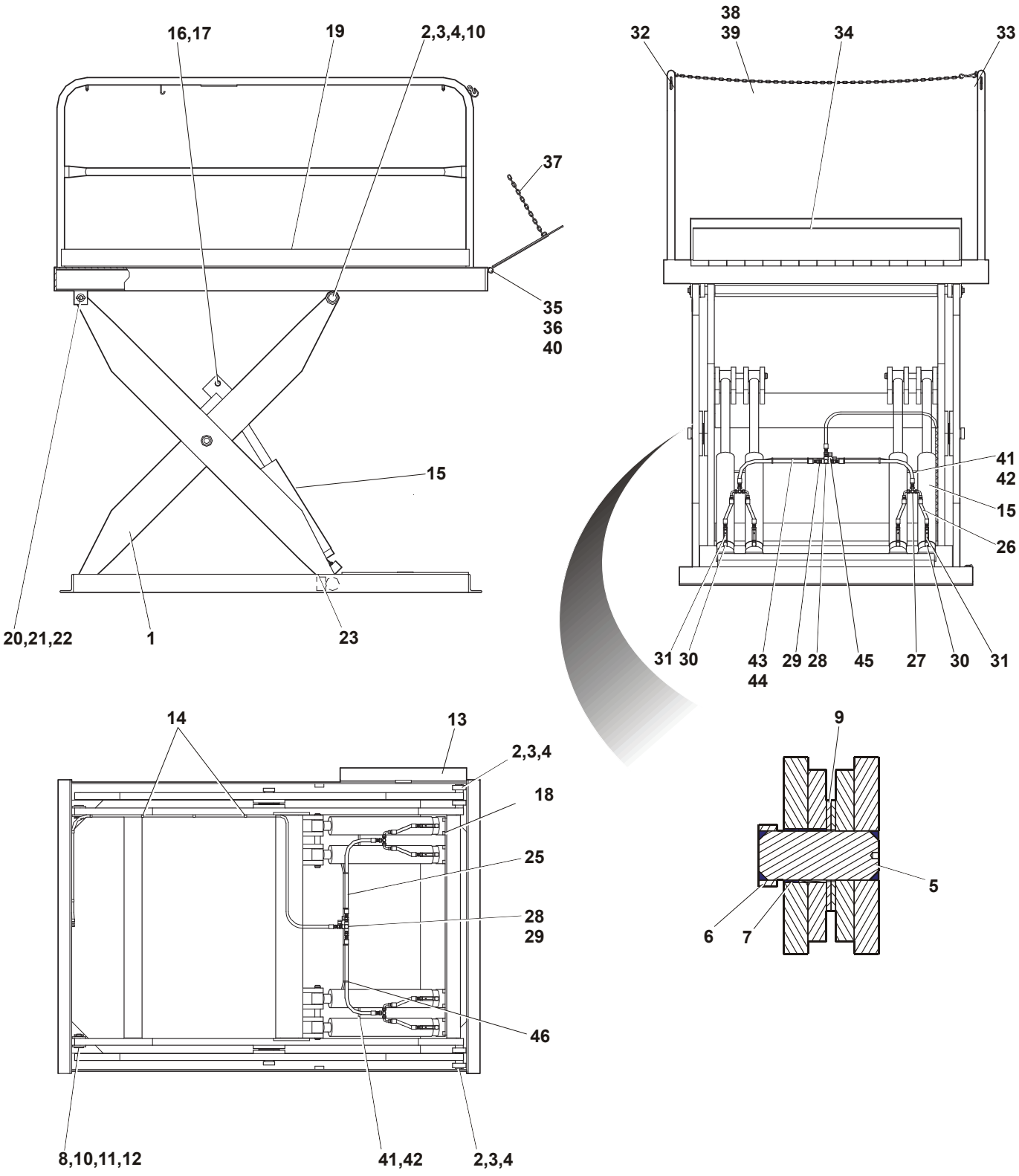


Figure 38 : General Assembly - 10 & 12,000 lb. - 120" Deck Length

General Assembly - 10 & 12,000 lb. Cap. - 120" Deck Length

Item	Qty	Part No	General Description	Specific Description
			General Assy 10,&12,000-120" Deck Lgth	**REF. DWG. 310-5316**
1*	**1**	**333-5308**	**Frame/Leg Weldm't**	**10,&12,000/60X120"**
1*	**1**	**333-5309**	**Frame/Leg Weldm't**	**10,&12,000/72X120"**
1*	**1**	**333-5310**	**Frame/Leg Weldm't**	**10,&12,000/84X120"**
1*	**1**	**313-5015**	**Frame/Leg Weldm't**	**10,&12,000/96X120"**
2	2	019-001	Bearing, 3"OD X 1-5/8"ID X 1"W	10,&12,000/120"
3	4	011-066	Capscrew, Hex Skt F/H - 5/16"-18 X 3/4"	10,&12,000/120"
4	2	013-005	Spring Pin 5/32"x1"Lg	10,&12,000/120"
5	2	114-652	Centre Pin 1-1/2" Thk Leg (5-7/8" Lg)	10,&12,000/120"
6	2	114-606	Collar - 2" (Centre Pin Mod Ed)	10,&12,000/120"
7	2	018-034	Bushing - 2"IDx2"LG	10,&12,000/120"
8	4	018-051	Bushing - 1"Idx3/4"LG	10,&12,000/120"
9	2	012-219	Washer, Flat-2.13" IDx4.5"ODx0.187" TH	10,&12,000/120"
10	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	10,&12,000/120"
11	2	013-012	Spring Pin - 1/4" X 2	10,&12,000/120"
12	6	106-389	Spacer Washer, 1-3/4"ODx1"IDx1/16"TH	10,&12,000/120"
13	1	822-440	Strut Weldment, Maintenance	10,&12,000/120"
14	8	035-262	Strap (#6 Hose Clamp)	10,&12,000/120"
15**	**4**	**780-144-210**	**Cylinder Ass'y (3-1/2"Dia) [21" Stroke]**	10,&12,000/120"
15**	**4**	**780-144-214**	**Cylinder Ass'y (3-1/2"Dia) [21-1/2" Stroke]**	**ED10/96X120"**
16	3	115-043	Pin-Cylinder Pivot	10,&12,000/120"
17	6	013-036	Retaining Ring Ext. - 1-1/4"ID	10,&12,000/120"
18	6	104-476	Lip Stop (3/4"X5/8")	10,&12,000/120"
19	1	312-5144	Deck Ass'y S2 10,&12,000/60x120	10,&12,000/60X120"
19	1	312-5145	Deck Ass'y S2 10,&12,000/72x120	10,&12,000/72X120"
19	1	312-5146	Deck Ass'y S2 10,&12,000/84x120	10,&12,000/84X120"
19	1	312-5147	Deck Ass'y S2 10,&12,000/96x120	10,&12,000/96X120'
19	1	312-5055	Deck Ass'y S3 (Taprd) 10,&12,000/60x120	10,&12,000/60X120"
19	1	312-5056	Deck Ass'y S3 (Taprd) 10,&12,000/72x120	10,&12,000/72X120'
19	1	312-5057	Deck Ass'y S3 (Taprd) 10,&12,000/84x120	10,&12,000/84X120"
19	1	312-5058	Deck Ass'y S3 (Taprd) 10,&12,000/96x120	10,&12,000/96X120"
20	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	10,&12,000/120"
21	6	106-389	Spacer Washer - 1-3/4"OD X 1"ID X 1/16Th	10,&12,000/120"
22	2	013-012	Spring Pin - 1/4" X 2	10,&12,000/120"
23	2	117-005	Roller Stop	10,&12,000/120"
24	1.6GA	039-066	Paint, Blue (Fast Dry Enamel)	10,&12,000/120"

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General Assembly - 10 & 12,000 lb. Cap. - 120" Deck Length

Item	Qty	Part No	General Description	Specific Description
25	2	300-5001-15	Hose, #8 HP (26"Lg) Str.Swivel(2)	10,&12,000/60X120"
25	2	300-5000-20	Hose, #8 HP (34"Lg) Str.Swivel(2)	10,000/72X120"
25	2	300-5001-53	Hose, #8 HP (38"Lg) Str.Swivel(2)	10,&12,000/84X120"
25	2	300-5001-20	Hose, #6 HP (34"Lg) Str.Swivel(2)	10,000/96X120"
25	2	300-5000-11	Hose, #6 HP (18"Lg) Str.Swivel(2)	12,000/72X120"
25	2	300-5000-21	Hose, #8 HP (48"Lg) Str.Swivel(2)	12,000/96X120"
26	4	300-5005	Hose, #6 HP - 90 Deg. - Str. Swivel	10,&12,000/120" Lg.
26	4	300-5000-1	Hose, #6 HP (6"Lg) - Str. Swivel(2)	10,000/96X120" 12,000/72X120"
27	1	034-551	Fitting, Tee 033T-6-6	10,&12,000/120"
28	1	034-571	Fitting, Tee 022T-6-6	10,&12,000/120"
29	2	034-504	Adapter, 0103-6-6	10,&12,000/120"
30	4	034-599	Fitting Elbow Forged 6MP-4MP-90°	10,&12,000/120"
31	3	033-663	Velocity Fuse - 7.5 GPM	10,&12,000/120"
32	1	312-5080-6	Guard Rail, Right Side 120"Deck	10,&12,000/120"
33	1	312-5078	Guard Rail Weld (96-1/2"X45")	10,&12,000/120"
34	1	302-5007-3	Lip Assy 60" Spring Assist 1pc ,18"Lg]	10,&12,000/120"
35	2	809-483	Shaft, Lip (29-1/2" LG.)	10,&12,000/120"
36	2	013-011	Spring Pin - 1/4" X 1-3/8	10,&12,000/120"
37	1	091-023-0600	Chain (60"Lg) [3/16"Proof Coil Galvanized]	10,&12,000/120"
38	2	091-023-0540	Chain (54"Lg) 3/16"Proof Coil Galvanized	10,&12,000/60X120"
38	2	091-023-0660	Chain (66"Lg) 3/16"Proof Coil Galvanized	10,&12,000/72X120"
38	2	091-023-0780	Chain (78"Lg) 3/16"Proof Coil Galvanized	10,&12,000/84X120'
38	2	091-023-0900	Chain (90"Lg) 3/16"Proof Coil Galvanized	10,000/96X120"
39	2	R3-19203	Hook Snap 4"Lg - 7/16"-20	10,&12,000/120"
40	2	120-353	Torsion Spring	10,&12,000/120"
41	2	034-674	Fitting, 1/4" Male X 3/8" Comp	10,&12,000/120"
42	2	091-000-0063	Tubing Black Nylon (6-3/8"Lg) 3/8"	10,&12,000/120"
43	2	035-085	Fitting Tee	10,&12,000/120"
44	2	091-000-0340	Tubing Black Nylon (34"Lg) 3/8"	10,&12,000/60X120"
44	2	091-000-0400	Tubing Black Nylon (40"Lg) 3/8"	10,&12,000/72X120"
44	2	091-000-0460	Tubing Black Nylon (46"Lg) 3/8"	10,000/84X120"
44	2	091-000-0520	Tubing Black Nylon (52"Lg) 3/8"	10,000/96X120"
45	1	034-673	Fitting Nylon Tee (3/8" Comp)	10,&12,000/120"
46	4	025-087	Cable Ties	10,&12,000/120"
47	1	300-5006-4	Vent Line Kit (29'lg)	10,&12,000/60X120"
47	1	300-5006-5	Vent Line Kit (30'lg)	10,&12,000/72X120"
47	1	300-5006-6	Vent Line Kit (31'lg)	10,&12,000/84X120"
47	1	300-5006-7	Vent Line Kit (32'lg)	10,&12,000/96X120"
48	1	300-5001-41	Hose, #8 HP (168"Lg) Str.Swivel(2)	10,000/96X120"
48	1	300-5001-39	Hose, #8 HP (148"Lg) Str.Swivel(2)	12,000/72X120"

8.9.1 Cylinder Assembly - 10 & 12,000 lb. Cap. - 120" Deck Length

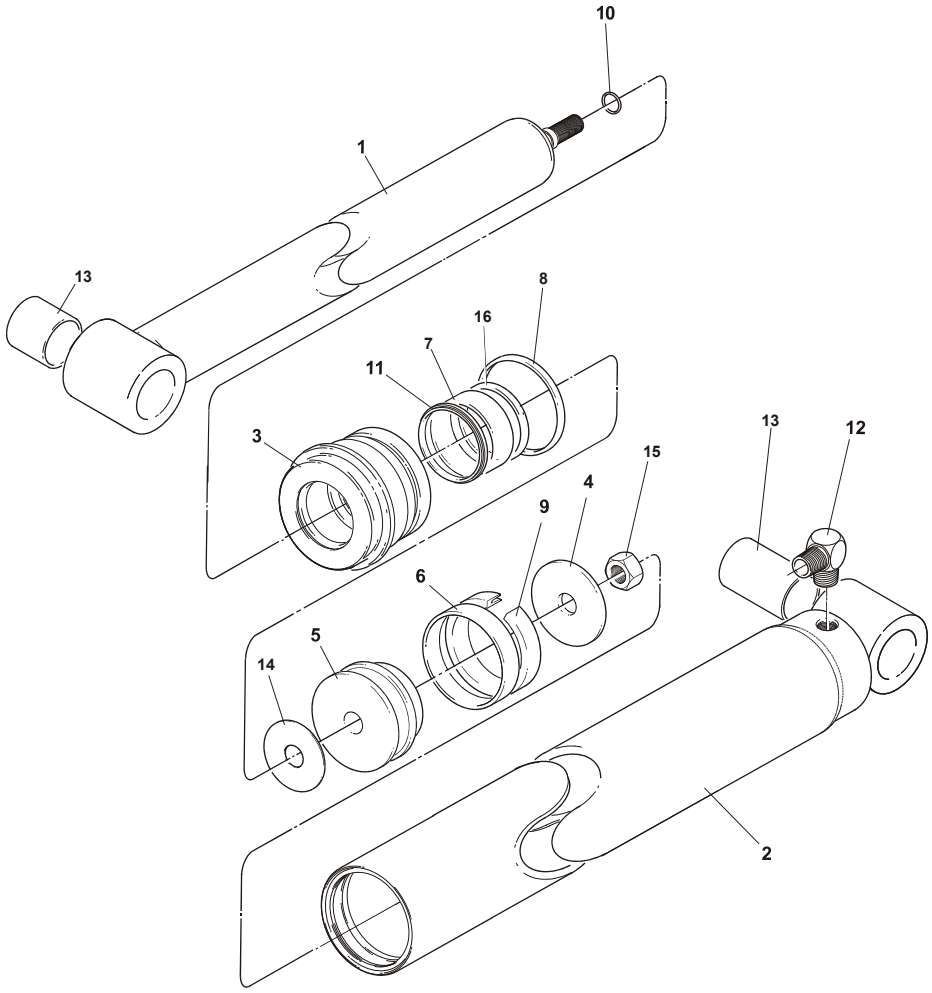


Figure 39 : Cylinder Assembly - 10&12,000 lb. - 120" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	**-**	**780-144-210**	**Cylinder Ass'y (3-1/2"Dia) [21" Stroke]**	**10,&12,000/120"**
-	**-**	**780-144-214**	**Cylinder Ass'y (3-1/2"Dia) [21-1/2" Stroke]**	**10,000/96X120"**
1	1	786-855	Ram Assy 3", 3-1/2", & 4"	10,&12,000/120"
2	1	780-145	Housing Weldment (4"Dia)	10,&12,000/120"
3	1	117-966	Headnut 3-1/2" Dia. Cyl (2" Dia. Rod)	10,&12,000/120"
4	1	114-979	Piston Washer - (3-1/2" Dia)	10,&12,000/120"
5	1	114-639	Piston - 3-1/2"Dia Cyl	10,&12,000/120"
6●	1	036-155	Wear Ring Pist.Wd.3-1/2x1/2	10,&12,000/120"
7●	1	036-182	Wear Ring - 3" X .125" Thick	10,&12,000/120"
8●	1	036-131	O-Ring - 3-1/2"OD X 3-3/4"ID	10,&12,000/120"
9●	1	036-111	U-Cup - 3-1/2" X 2-7/8" X 1/2"	10,&12,000/120"
10●	1	036-108	O-Ring - 3/4"OD X 5/8"ID X 1/16"	10,&12,000/120"
11●	1	036-021	Wiping Ring - 2"ID	10,&12,000/120"
12	1	034-500	Fitting, 6-6	10,&12,000/120"
13	2	018-027	Bushing	10,&12,000/120"
14●	1	117-993	Gasket	10,&12,000/120"
15	1	011-530	Nut, Hex Jam - 3/4"-10	10,&12,000/120"
16●	1	036-176	O-Ring (2-1/4" OD X 2" ID)	10,&12,000/120"
-	**-**	**783-557**	**Seal Kit Includes Items Marked (●)**	**10,&12,000/120"**

8.10 General Assembly - 10 & 12,000 lb. Cap. - 144" Deck Length

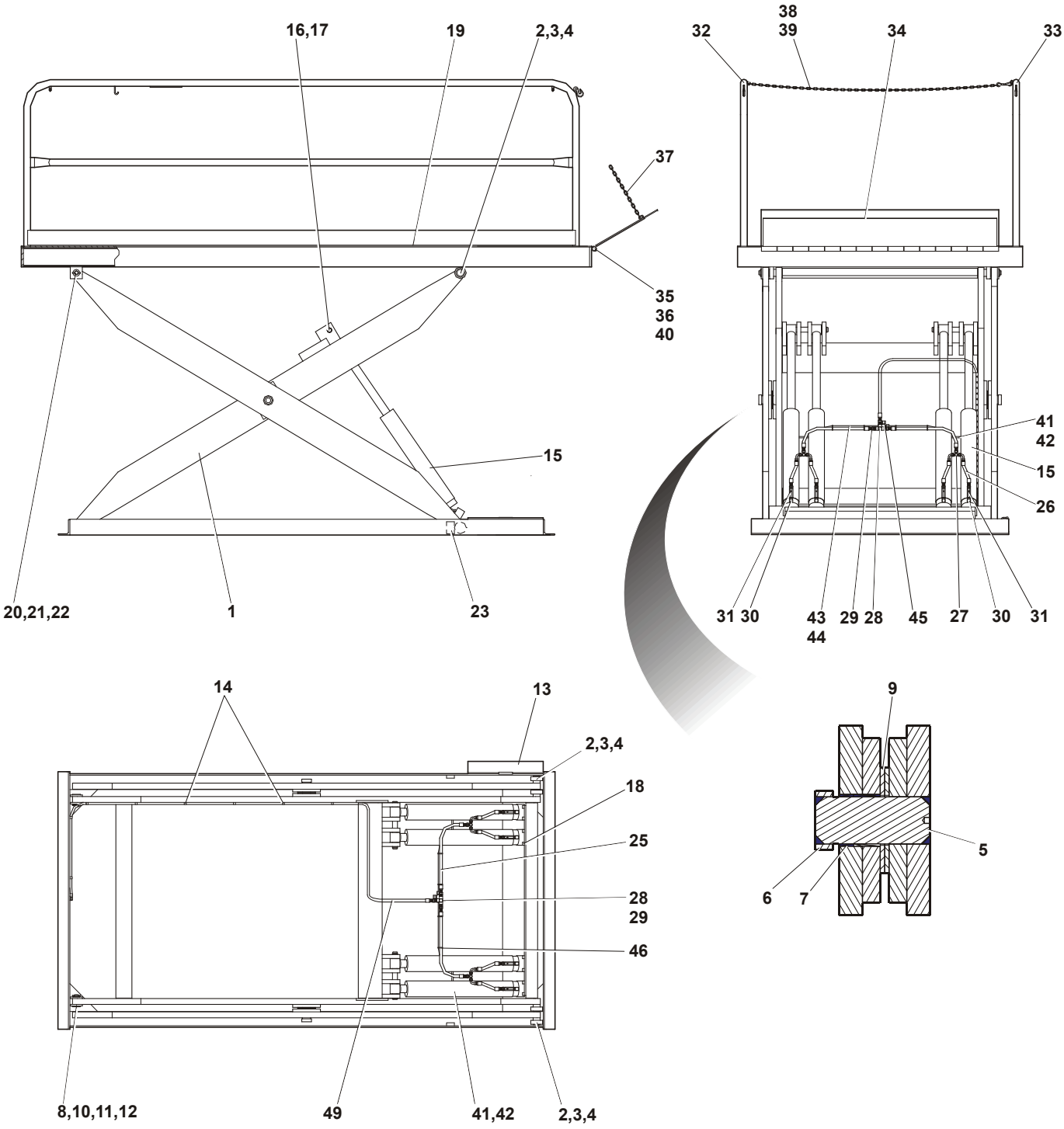


Figure 40 : General Assembly - 10&12,000 lb. - 144" Deck Length

General Assembly - 10 & 12,000 lb. Cap. - 144" Deck Length

Item	Qty	Part No	General Description	Specific Description
			General Assy 10,&12,000-144" Deck Lgth	**REF. DWG. 310-5327**
1*	**1**	**313-5017**	**Frame/Leg Weldm't**	**10,&12,000/60X144"**
1*	**1**	**333-5312**	**Frame/Leg Weldm't**	**10,&12,000/72X144"**
1*	**1**	**333-5313**	**Frame/Leg Weldm't**	**10,&12,000/84X144"**
1*	**1**	**313-5018**	**Frame/Leg Weldm't**	**10,&12,000/96X144"**
2	2	019-001	Bearing, 3"OD X 1-5/8"ID X 1"W	10,&12,000/144"
3	4	011-066	Capscrew, Hex Sockt F/H - 5/16"-18x3/4"	10,&12,000/144"
4	2	013-005	Spring Pin 5/32"x1"Lg	10,&12,000/144"
5	2	114-652	Leg Centre Pin 1-1/2" Thk Leg (5-7/8"Lg)	10,&12,000/144"
6	2	114-606	Collar - 2" (Centre Pin Mod Ed)	10,&12,000/144"
7	2	018-034	Bushing - 2"IDx2"LG	10,&12,000/144"
8	4	018-051	Bushing - 1"IDx3/4"LG	10,&12,000/144"
9	2	012-219	Washer,Flat-2.13" IDx4.5"ODx0.187" TK	10,&12,000/144"
10	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	10,&12,000/144"
11	2	013-012	Spring Pin - 1/4" X 2	10,&12,000/144"
12	6	106-389	Spacer Washer, 1-3/4"ODx1"IDx1/16"TH	10,&12,000/144"
13	1	822-440	Strut Weldment, Maintenance	10,&12,000/144"
14	8	035-262	Strap (#6 Hose Clamp)	10,&12,000/144"
15**	**4**	**780-144-232**	**Cylinder Ass'y (3-1/2"Dia) [23-1/4" Stroke]**	**10,&12,000/144" Lg.**
15**	**4**	**780-144-240**	**Cylinder Ass'y (3-1/2"Dia) [24" Stroke]**	**10,000/84X144"**
16	3	115-043	Pin-Cylinder Pivot	10,&12,000/144"
17	6	013-036	Retaining Ring Ext. - 1-1/4"ID	10,&12,000/144"
18	6	104-476	Lip Stop (3/4"X5/8")	10,&12,000/144"
19	1	312-5157	Deck Ass'y S2 ED10,12/60x144	10,&12,000/60X144"
19	1	312-5158	Deck Ass'y S2 ED10,12/72x144	10,&12,000/72X144"
19	1	312-5159	Deck Ass'y S2 ED10,12/84x144	10,&12,000/84X144"
19	1	312-5160	Deck Ass'y S2 ED10,12/96x144	10,&12,000/96X144"
19	1	312-5067	Deck Ass'y S3 Tapered ED10,12/60x144	10,&12,000/60X144"
19	1	312-5068	Deck Ass'y S3 Tapered ED10,12/72x144	10,&12,000/72X144"
19	1	312-5069	Deck Ass'y S3 Tapered ED10,12/84x144	10,&12,000/84X144"
19	1	312-5070	Deck Ass'y S3 Tapered ED10,12/96x144	10,&12,000/96X144"
20	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	10,&12,000/144"
21	6	106-389	Spacer Washer - 1-3/4"Od X 1"Id X 1/16thk	10,&12,000/144"
22	2	013-012	Spring Pin - 1/4" X 2	10,&12,000/144"
23	2	117-005	Roller Stop	10,&12,000/144"
24	1.6GA	039-066	Paint, Blue (Fast Dry Enamel)	10,&12,000/144"
25	2	300-5001-15	Hose, #8 HP (26"Lg) Str.Swivel(2)	10,&12,000/60X144"
25	2	300-5000-20	Hose, #8 HP (34"Lg) Str.Swivel(2)	10,000/72-84X144"
25	2	300-5001-53	Hose, #8 HP (38"Lg) Str.Swivel(2)	10,&12,000/84X144"
25	2	300-5001-20	Hose, #6 HP (34"Lg) Str.Swivel(2)	10,000/96X144"
25	2	300-5000-21	Hose, #8 HP (48"Lg) Str.Swivel(2)	12,000/96X144"
26	4	300-5000	Hose, #6 HP - 90 Deg. - Str. Swivel	10,&12,000 -144" Lg.
26	4	300-5000-1	Hose, #6 HP (6"Lg) - Str. Swivel(2)	10,000/84X144"

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**** - SUBASSEMBLY SHOWN ON SEPARATE PAGE**

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General Assembly - 10 & 12,000 lb. Cap. - 144" Deck Length

Item	Qty	Part No	General Description	Specific Description
27	1	034-551	Fitting, Tee 033T-6-6	10,&12,000/144"
28	1	034-571	Fitting, Tee 022T-6-6	10,&12,000/144"
29	2	034-504	Adapter, 0103-6-6	10,&12,000/144"
30	4	034-599	Fitting Elbow Forged 6MP-4MP-90	10,&12,000/144"
31	3	033-663	Velocity Fuse - 7.5 GPM	10,&12,000/144"
32	1	312-5080-7	Guard Rail, Right Side 144"Deck	10,&12,000/144"
33	1	312-5079	Guard Rail Weld (96-1/2"X45")	10,&12,000/144"
34	1	302-5007-3	Lip Assy 60" Spring Assist 1pc ,18"Lg]	10,&12,000/144"
35	2	809-483	Shaft, Lip (29-1/2" LG.)	10,&12,000/144"
36	2	013-011	Spring Pin - 1/4" X 1-3/8	10,&12,000/144"
37	1	091-023-0600	Chain (60"Lg) [3/16"Proof Coil Galvanized]	10,&12,000/144"
38	2	091-023-0540	Chain (54"Lg) 3/16"Proof Coil Galvanized	10,&12,000/60X144"
38	2	091-023-0660	Chain (66"Lg) 3/16"Proof Coil Galvanized	10,&12,000/72X144"
38	2	091-023-0780	Chain (78"Lg) 3/16"Proof Coil Galvanized	10,&12,000/84X144"
38	2	091-023-0900	Chain (90"Lg) 3/16"Proof Coil Galvanized	10,000/96X144"
39	2	R3-19203	Hook Snap 4"Lg - 7/16"-20	10,&12,000/144"
40	2	120-353	Torsion Spring	10,&12,000/144"
41	2	034-674	Fitting, 1/4" Male X 3/8" Comp	10,&12,000/144"
42	2	091-000-0063	Tubing Black Nylon (6-3/8"Lg) 3/8"	10,&12,000/144"
43	2	035-085	Fitting Tee	10,&12,000/144"
44	2	091-000-0340	Tubing Black Nylon (34"Lg) 3/8"	10,&12,000/60X144"
44	2	091-000-0400	Tubing Black Nylon (40"Lg) 3/8"	10,&12,000/72X144"
44	2	091-000-0460	Tubing Black Nylon (46"Lg) 3/8"	10,000/84X144"
44	2	091-000-0520	Tubing Black Nylon (52"Lg) 3/8"	10,000/96X144"
45	1	034-673	Fitting Nylon Tee (3/8" Comp)	10,&12,000/144"
46	4	025-087	Cable Ties	10,&12,000/144"
47	1	300-5006-6	Vent Line Kit (31'lg)	10,&12,000/60X144"
48	1	300-5006-7	Vent Line Kit (32'lg)	10,&12,000/72X144"
48	1	300-5006-8	Vent Line Kit (33'lg)	10,&12,000/84X144"
48	1	300-5006-9	Vent Line Kit (34'lg)	10,&12,000/96X144"
49	1	300-5001-47	Hose, #8 HP (240"Lg) Str.Swivel(2)	10,000/84X144"
50		834-298	Pop-Up Safety Stop Assy	10,000/84X144"

8.10.1 Cylinder Assembly - 10 & 12,000 lb. Cap. - 144" Deck Length

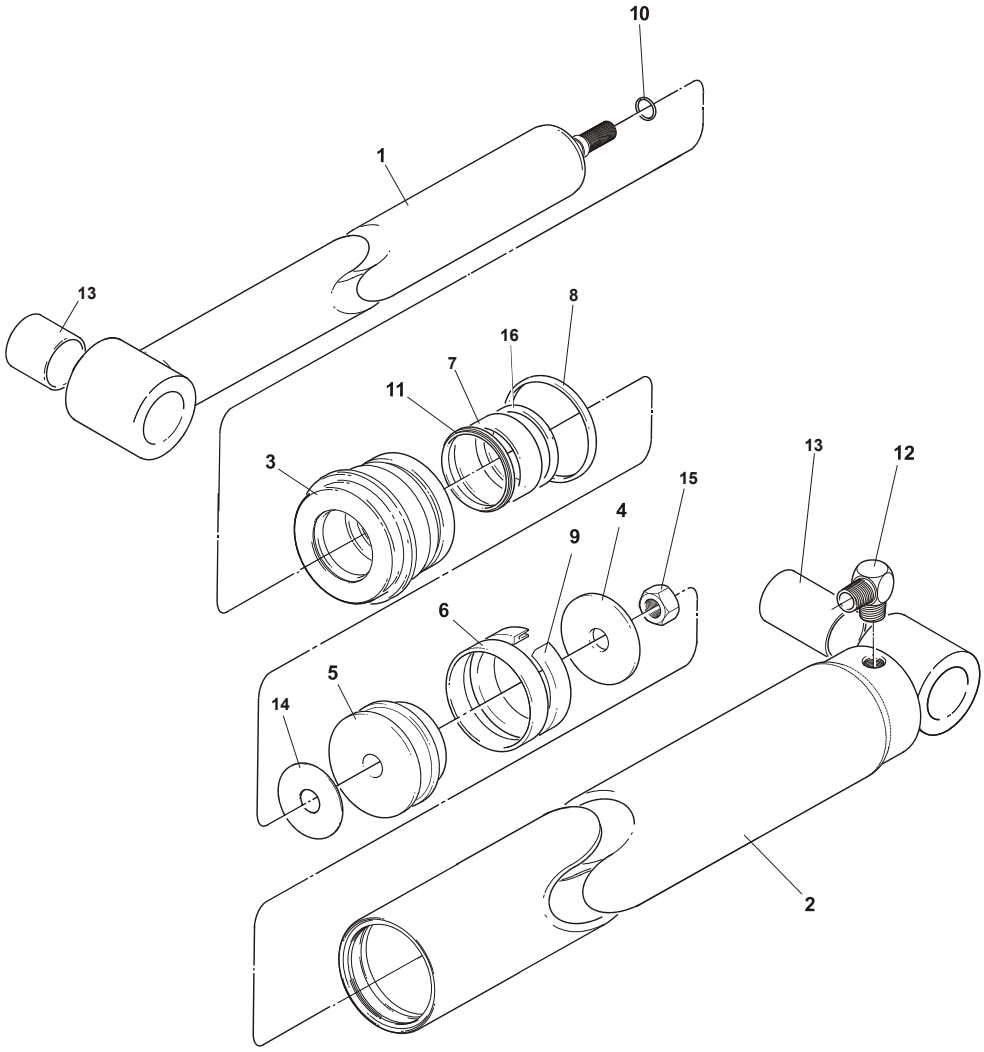


Figure 41 : Cylinder Assembly - Model 10, 12 - 144" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	**-**	**780-144-232**	**Cylinder Ass'y (3-1/2"Dia) [23-1/4" Stroke]**	**10,&12,000/144"**
-	**-**	**780-144-240**	**Cylinder Ass'y (3-1/2"Dia) [24" Stroke]**	**10,000/84X144"**
1	1	786-855	Ram Assy 3", 3-1/2", & 4"	10,&12,000/144"
2	1	780-145	Housing Weldment (3-1/2"Dia)	10,&12,000/144"
3	1	117-966	Headnut 3-1/2" Dia. Cyl (2" Dia. Rod)	10,&12,000/144"
4	1	114-979	Piston Washer - (3-1/2" Dia)	10,&12,000/144"
5	1	114-639	Piston - 3-1/2"Dia Cyl	10,&12,000/144"
6●	1	036-155	Wear Ring Pist.Wd.3-1/2x1/2	10,&12,000/144"
7●	1	036-182	Wear Ring - 3" X .125" Thick	10,&12,000/144"
8●	1	036-131`	O-Ring - 3-1/2"OD X 3-3/4"ID	10,&12,000/144"
9●	1	036-116	U-Cup - 4" X 3-3/8" X 1/2"	10,&12,000/144"
10●	1	036-108	O-Ring - 3/4"OD X 5/8"ID X 1/16"	10,&12,000/144"
11●	1	036-021	Wiping Ring - 2"ID	10,&12,000/144"
12	1	034-500	Fitting, 6-6	10,&12,000/144"
13	2	018-027	Bushing	10,&12,000/144"
14●	1	117-993	Gasket	10,&12,000/144"
15●	1	036-176	O-Ring (2-1/4" OD X 2" ID)	10,&12,000/144"
16	1	011-530	Nut, Hex Jam - 3/4"-10	10,&12,000/144"
		783-557	**Kit, seal - Includes Items marked (●)**	**10,&12,000/144"**

9. Parts Listings - Stationary Elevating Docks - 21" Lowered Height

9.1 General Assembly - 15 & 20,000 lb. Cap. - 96" Deck Length

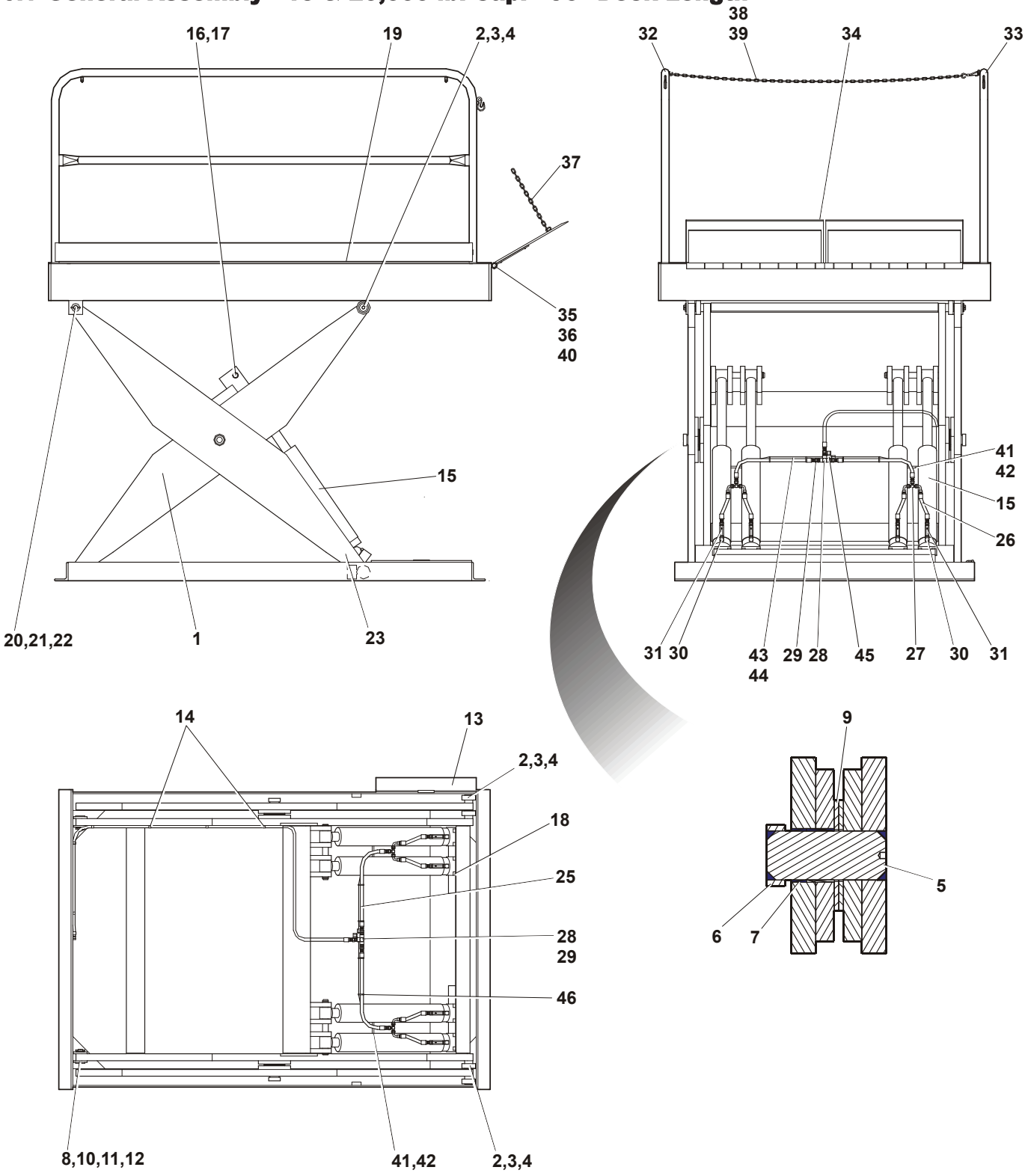


Figure 42 : General Assembly - 15,& 20,000 lb. - 96" Deck Length

General Assembly - 15 & 20,000 lb. Cap. - 96" Deck Length

Item	Qty	Part No	General Description	Specific Description
			General Assy 15,&20,000 - 96" Deck Lgth	**REF. DWG. 310-5382**
1*	**1**	**313-5120**	**Frame/Leg Weldm't**	**15,000/60X96"**
1*	**1**	**313-5121**	**Frame/Leg Weldm't**	**15,000/72X96"**
1*	**1**	**313-5122**	**Frame/Leg Weldm't**	**15,000/84X96'**
1*	**1**	**313-5123**	**Frame/Leg Weldm't**	**15,000/96X96"**
1*	**1**	**313-5126**	**Frame/Leg Weldm't**	**20,000/60X96"**
1*	**1**	**313-5127**	**Frame/Leg Weldm't**	**20,000/72X96"**
1*	**1**	**313-5128**	**Frame/Leg Weldm't**	**20,000/84X96"**
1*	**1**	**313-5129**	**Frame/Leg Weldm't**	**20,000/96X96"**
2	2	019-001	Bearing, 3"OD X 1-5/8"ID X 1"W	15,&20,000/96"
3	4	011-066	Capscrew, Hex Sckt F/H-5/16"-18 X 3/4"	15,&20,000/96"
4	2	013-005	Spring Pin 5/32"x1"Lg	15,&20,000/96"
5	2	114-652	Leg Centre Pin 1-1/2" Thk Leg(5-7/8" Lg)	15,&20,000/96"
6	2	114-606	Collar - 2" (Centre Pin Mod Ed)	15,&20,000/96"
7	2	018-031	Bushing - 2"IDx1"LG	15,&20,000/96"
8	4	018-051	Bushing - 1"IDx3/4"LG	15,&20,000/96"
9	2	012-219	Washer,Flat 2.13"IDx4.5"ODx0.187" THK	15,&20,000/96"
10	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	15,&20,000/96"
11	2	013-012	Spring Pin - 1/4" X 2"	15,&20,000/96"
12	6	106-389	Spacer Washer, 1-3/4"ODx1"IDx1/16"THK	15,&20,000/96"
13	1	822-440	Strut Weldment, Maintenance	15,&20,000/96"
14	8	035-262	Strap (#6 Hose Clamp)	15,&20,000/96"
15**	**4**	**780-144-200**	**Cylinder Ass'y (3-1/2"Dia) [20" Stroke]**	**15,000/96"**
15**	**4**	**780-142-200**	**Cylinder Ass'y (4"Dia) [20" Stroke]**	**20,000/96"**
15**	**4**	**780-142-204**	**Cylinder Ass'y (4"Dia) [20-1/2" Stroke]**	**20,000/72X96"**
16	2	115-043	Pin-Cylinder Pivot	15,&20,000/96"
17	8	013-036	Retaining Ring Ext. - 1-1/4"Id	15,&20,000/96"
18	6	104-476	Lip Stop (3/4"X5/8")	15,&20,000/96"
19	1	312-5218	Deck Ass'y S2 15,&20,000/60x96	15,&20,000/60X96"
19	1	312-5219	Deck Ass'y S2 15,&20,000/72x96	15,&20,000/72X96"
19	1	312-5220	Deck Ass'y S2 15,&20,000/84x96	15,&20,000/84X96"
19	1	312-5221	Deck Ass'y S2 15,&20,000/96x96	15,&20,000/96X96"
19	1	312-5163	Deck Ass'y S3 (Tapered) 15,&20,000/60x96	15,&20,000/60X96"
19	1	312-5164	Deck Ass'y S3 (Tapered) 15,&20,000/72x96	15,&20,000/72X96"
19	1	312-5165	Deck Ass'y S3 (Tapered) 15,&20,000/84x96	15,&20,000/84X96"
19	1	312-5166	Deck Ass'y S3 (Tapered) 15,&20,000/96x96	15,&20,000/96X96"
20	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	15,&20,000/96"
21	6	106-389	Spacer Washer - 1-3/4"Od X 1"Id X 1/16thk	15,&20,000/96"
22	2	013-012	Spring Pin - 1/4" X 2	15,&20,000/96"
23	2	117-005	Roller Stop	15,&20,000/96"
24	1.6GA	039-066	Paint, Blue (Fast Dry Enamel)	15,&20,000/96"

*** - INDENTED SUB-ASSEMBLY – SHOWN ON SAME PAGE**
**** - SUBASSEMBLY SHOWN ON SEPARATE PAGE**

Continued…

General Assembly - 15 & 20,000 lb. Cap. - 96" Deck Length

Item	Qty	Part No	General Description	Specific Description
25	2	300-5000-15	Hose, #8 HP (26"Lg) Str.Swivel(2)	15,000/60X96"
25	2	300-5001-15	Hose, #8 HP (26"Lg) Str.Swivel(2)	20,000/60X96"
25	2	300-5000-20	Hose, #8 HP (34"Lg) Str.Swivel(2)	15,000/72X96"
25	2	300-5001-20	Hose, #8 HP (34"Lg) Str.Swivel(2)	20,000/72X96"
25	2	300-5001-53	Hose, #8 HP (38"Lg) Str.Swivel(2)	15,&20,000/84X96"
25	2	300-5001-21	Hose, #8 HP (48"Lg) Str.Swivel(2)	15,&20,000/96X96"
26	4	300-5000	Hose, #6 HP - 4" Lg - Str. Swivel(2)	15,&20,000/96"
27	1	034-551	Fitting, Tee 033T-6-6	15,&20,000/96"
28	1	034-571	Fitting, Tee 022T-6-6	15,&20,000/96"
29	2	034-504	Adapter, 0103-6-6	15,&20,000/96"
30	4	034-599	Fitting Elbow Forged 6MP-4MP-90	15,&20,000/96"
31	3	033-663	Velocity Fuse - 7.5 GPM	15,000/96"
31	3	033-549	Velocity Fuse - 9 GPM	20,000/96"
32	1	312-5080-4	Guard Rail, Right Side 96"Deck	15,&20,000/96"
33	1	312-5076	Guard Rail Weld (84-1/2"X45")	15,&20,000/96"
34	1	302-5007-3	Lip Assy 60" Spring Assist 1pc ,18"Lg]	15,000/96"
34	1	302-5007-2	Lip Assy 60" Spring Assist 1pc ,18"Lg]	20,000/96"
35	2	809-483	Shaft, Lip Hinge 29-1/2"	15,&20,000/96"
36	2	013-011	Spring Pin - 1/4" X 1-3/8	15,&20,000/96"
37	1	091-023-0600	Chain (60"Lg) [3/16"Proof Coil Galvanized]	15,&20,000/96"
38	2	091-023-0540	Chain (54"Lg) 3/16"Proof Coil Galvanized	15,000/60X96'
38	2	091-036-0540	Chain (54"Lg) 1/8"Proof Coil Galvanized	20,000/60X96"
38	2	091-023-0660	Chain (66"Lg) 3/16"Proof Coil Galvanized	15,000/72X96"
38	2	091-036-0660	Chain (66"Lg) 1/8"Proof Coil Galvanized	20,000/72X96"
38	2	091-023-0780	Chain (78"Lg) 3/16"Proof Coil Galvanized	15,000/84X96"
38	2	091-036-0780	Chain (78"Lg) 1/8"Proof Coil Galvanized	20,000/84X96"
38	2	091-023-0900	Chain (90"Lg) 3/16"Proof Coil Galvanized	15,&20,000/96X96"
39	2	R3-19203	Hook Snap 4"Lg - 7/16"-20nf	15,&20,000/96"
40	2	120-353	Torsion Spring	15,&20,000/96"
41	2	034-674	Fitting, 1/4" Male X 3/8" Comp	15,&20,000/96"
42	2	091-000-0063	Tubing Black Nylon (6-3/8"Lg) 3/8"	15,&20,000/96"
43	2	035-085	Fitting Tee	15,&20,000/96"
44	2	091-000-0340	Tubing Black Nylon (34"Lg) 3/8"	15,&20,000/60X96"
44	2	091-000-0400	Tubing Black Nylon (40"Lg) 3/8"	15,&20,000/72X96"
44	2	091-000-0460	Tubing Black Nylon (46"Lg) 3/8"	15,&20,000/84X96"
44	2	091-000-0520	Tubing Black Nylon (52"Lg) 3/8"	15,&20,000/96X96"
45	1	034-673	Fitting Nylon Tee (3/8" Comp)	15,&20,000/96"
46	4	025-087	Cable Ties	15,&20,000/96"
47	1	300-5006-6	Vent Line Kit (31'lg)	15,&20,000/60X96"
47	1	300-5006-7	Vent Line Kit (32'lg)	15,&20,000/72X96"
47	1	300-5006-8	Vent Line Kit (33'lg)	15,&20,000/84X96"
47	1	300-5006-9	Vent Line Kit (34'lg)	15,&20,000/96X96"

9.1.1 Cylinder Assembly - 15 & 20,000 lb. Cap. - 96" Deck Length

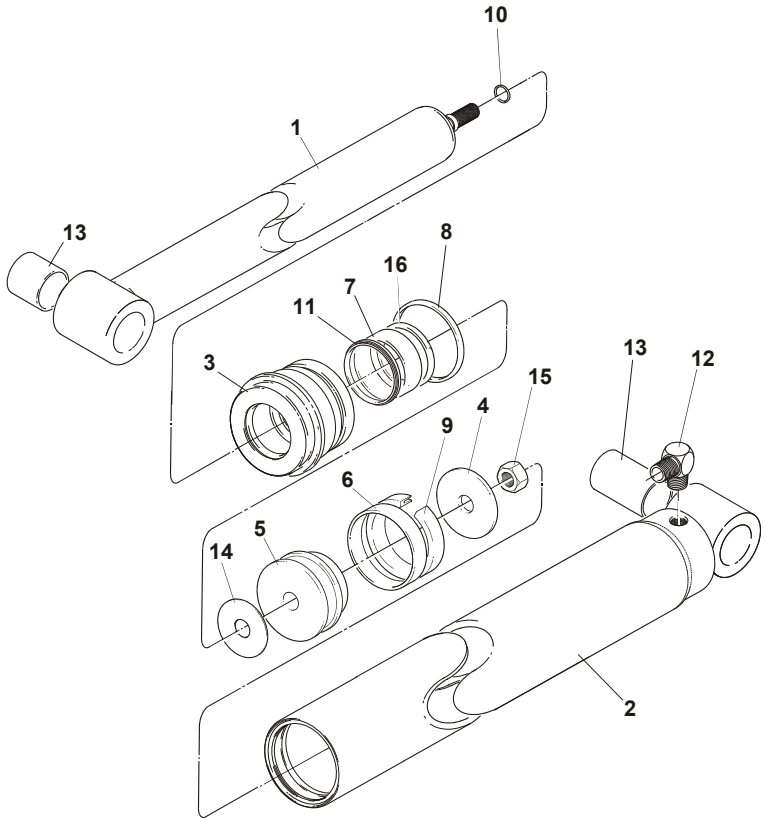


Figure 43 : Cylinder Assembly - 10,&12,000 - 144" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	**-**	**780-144-200**	**Cylinder Ass'y (3-1/2"Dia) [20" Stroke]**	**15,000/96"**
-	**-**	**780-142-200**	**Cylinder Ass'y (4"Dia) [20" Stroke]**	**20,000/96"**
		780-142-204	**Cylinder Ass'y (4"Dia) [20-1/2" Stroke]**	**20,000/72X96"**
1	1	786-855	Ram Assy 3", 3-1/2", & 4"	15,&20,000/96"
2	1	780-145	Housing Weldment (3-1/2"Dia)	15,000/96"
2	1	780-143	Housing Weldment (4"Dia)	20,000/96"
3	1	117-966	Headnut 3-1/2" Dia. Cyl (2" Dia. Rod)	15,000/96"
3	1	117-989	Headnut 4" Dia. Cyl (2" Dia. Rod)	20,000/96"
4	1	114-979	Piston Washer - (3-1/2" Dia)	15,000/96"
4	1	114-980	Piston Washer - (4" Dia)	20,000/96"
5	1	114-639	Piston - 3-1/2"Dia Cyl	15,000/96"
5	1	114-638	Piston - 4"Dia Cyl	20,000/96"
6●	1	036-155	Wear Ring Pist.Wd.3-1/2x1/2	15,000/96"
6●	1	036-156	Wear Ring Piston	20,000/96"
7●	1	036-182	Wear Ring - 3" X .125" Thick	15,&20,000/96"
8●	1	036-131`	O-Ring - 3-1/2"OD X 3-3/4"ID	15,000/96"
8●	1	036-130	O-Ring - 4"OD X 3-3/4"ID	20,000/96"
9●	1	036-116	U-Cup - 4" X 3-3/8" X 1/2"	15,&20,000/96"
10●	1	036-108	O-Ring - 3/4"OD X 5/8"ID X 1/16"	15,&20,000/96"
11●	1	036-021	Wiping Ring - 2"ID	15,&20,000/96"
12	1	034-500	Fitting, 6-6	15,&20,000/96"
13	2	018-027	Bushing	15,&20,000/96"
14●	1	117-993	Gasket	15,&20,000/96"
15	1	011-530	Nut, Hex Jam - 3/4"-10	15,&20,000/96"
16●	1	036-176	O-Ring (2-1/4" OD X 2" ID)	15,&20,000/96"
		783-557	**Kit, Seal - Includes Items marked (●)**	**15,000/96"**
		783-572	**Kit, Seal - Includes Items marked (●)**	**20,000/96"**

9.2 General Assembly - 15 & 20,000 lb. Cap. - 108" Deck Length

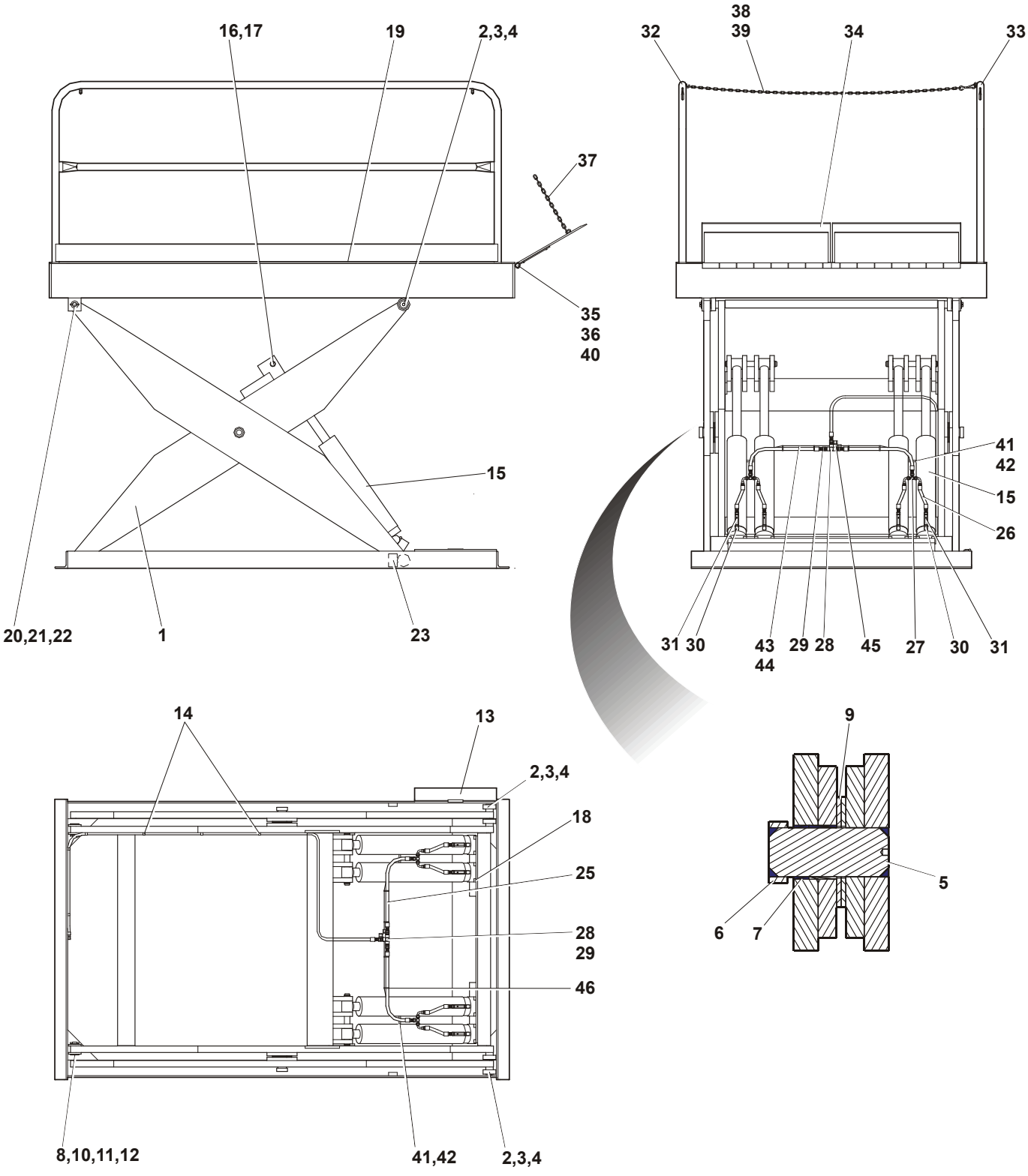


Figure 44 : General Assembly - 15,& 20,000 - 108" Deck Length

General Assembly - 15 & 20,000 lb. Cap. - 108" Deck Length

Item	Qty	Part No	General Description	Specific Description
			General Assy 15,&20,000 - 108" Deck Lgth	**REF. DWG. 310-5393**
1*	**1**	**313-5132**	**Frame/Leg Weldm't**	**15,000/60X108"**
1*	**1**	**313-5133**	**Frame/Leg Weldm't**	**15,000/72X108"**
1*	**1**	**313-5134**	**Frame/Leg Weldm't**	**15,000/84X108"**
1*	**1**	**313-5135**	**Frame/Leg Weldm't**	**15,000/96X108"**
1*	**1**	**313-5138**	**Frame/Leg Weldm't**	**20,000/60X108"**
1*	**1**	**313-5139**	**Frame/Leg Weldm't**	**20,000/72X108"**
1*	**1**	**313-5140**	**Frame/Leg Weldm't**	**20,000/84X108"**
1*	**1**	**313-5141**	**Frame/Leg Weldm't**	**20,000/96X108"**
2	2	019-001	Bearing, 3"OD X 1-5/8"ID X 1"W	15,&20,000/108"
3	4	011-066	Capscrew, Hex Skt F/H - 5/16"-18 X 3/4"	15,&20,000/108"
4	2	013-005	Spring Pin 5/32"x1"Lg	15,&20,000/108"
5	2	114-652	Leg Centre Pin 1-1/2" Thk Leg (5-7/8" Lg)	15,&20,000/108"
6	2	114-606	Collar - 2" (Centre Pin Mod Ed)	15,&20,000/108"
7	2	018-031	Bushing - 2"IDx1"LG	15,&20,000/108"
8	4	018-051	Bushing - 1"IDx3/4"LG	15,&20,000/108"
9	2	012-219	Washer, Flat-2.13" IDx4.5"ODx0.187" TH	15,&20,000/108"
10	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	15,&20,000/108"
11	2	013-012	Spring Pin - 1/4" X 2	15,&20,000/108"
12	6	106-389	Spacer Washer,1-3/4"ODx1"IDx1/16"THK	15,&20,000/108"
13	1	822-440	Strut Weldment, Maintenance	15,&20,000/108"
14	8	035-262	Strap (#6 Hose Clamp)	15,&20,000/108"
15**	**4**	**780-144-214**	**Cylinder Ass'y (3-1/2"Dia) [21-1/2" Stroke]**	**15,000/108"**
15**	**4**	**780-142-214**	**Cylinder Ass'y (4"Dia) [20" Stroke]**	**20,000/108"**
16	2	115-043	Pin-Cylinder Pivot	15,&20,000/108"
17	8	013-036	Retaining Ring Ext. - 1-1/4"ID	15,&20,000/108"
18	6	104-476	Lip Stop (3/4"X5/8")	15,&20,000/108"
19	1	312-5224	Deck Ass'y S2 15,&20,000/60x108	15,&20,000/60X108"
19	1	312-5225	Deck Ass'y S2 15,&20,000/72x108	15,&20,000/72X108"
19	1	312-5226	Deck Ass'y S2 15,&20,000/84x108	15,&20,000/84X108"
19	1	312-5227	Deck Ass'y S2 15,&20,000/96x108	15,&20,000/96X108"
19	1	312-5169	Deck Ass'y S3 (Tapered) 15,&20,000/60x108	15,&20,000/60X108"
19	1	312-5170	Deck Ass'y S3 (Tapered) 15,&20,000/72x108	15,&20,000/72X108"
19	1	312-5171	Deck Ass'y S3 (Tapered) 15,&20,000/84x108	15,&20,000/84X108"
19	1	312-5172	Deck Ass'y S3 (Tapered) 15,&20,000/96x108	15,&20,000/96X108"
20	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	15,&20,000/108"
21	6	106-389	Spacer Washer - 1-3/4"ODX 1"ID X 1/16thk	15,&20,000/108"
22	2	013-012	Spring Pin - 1/4" X 2"	15,&20,000/108"
23	2	117-005	Roller Stop	15,&20,000/108"
24	1.6GA	039-066	Paint, Blue (Fast Dry Enamel)	15,&20,000/108"

*** - INDENTED SUB-ASSEMBLY – SHOWN ON SAME PAGE**
**** - SUBASSEMBLY SHOWN ON SEPARATE PAGE**

Continued…

General Assembly - 15 & 20,000 lb. Cap. - 108" Deck Length

Item	Qty	Part No	General Description	Specific Description
25	2	300-5001-15	Hose, #8 HP (26"Lg) Str.Swivel(2)	15,&20,000/60X108"
25	2	300-5001-20	Hose, #8 HP (34"Lg) Str.Swivel(2)	15,&20,000/72X108"
25	2	300-5001-53	Hose, #8 HP (38"Lg) Str.Swivel(2)	15,&20,000/84X108"
25	2	300-5001-21	Hose, #8 HP (48"Lg) Str.Swivel(2)	15,&20,000/96X108"
26	4	300-5000	Hose, #6 HP - 4" Lg - Str. Swivel(2)	15,&20,000/108"
27	1	034-551	Fitting, Tee 033T-6-6	15,&20,000/108"
28	1	034-571	Fitting, Tee 022T-6-6	15,&20,000/108"
29	2	034-504	Adapter, 0103-6-6	15,&20,000/108"
30	4	034-599	Fitting Elbow Forged 6MP-4MP-90°	15,&20,000/108"
31	3	033-663	Velocity Fuse - 7.5 GPM	15,000/108"
31	3	033-549	Velocity Fuse - 9 GPM	20,000/108"
32	1	312-5080-5	Guard Rail, Right Side 108"Deck	15,&20,000/108"
33	1	312-5077	Guard Rail Weld (84-1/2"X45")	15,&20,000/108"
34	1	302-5007-3	Lip Assy 60" Spring Assist 1pc ,18"Lg]	15,000/108"
34	1	302-5007-2	Lip Assy 60" Spring Assist 1pc ,18"Lg]	20,000/108"
35	2	809-483	Shaft, Lip Hinge 29-1/2"	15,&20,000/108"
36	2	013-011	Spring Pin - 1/4" X 1-3/8	15,&20,000/108"
37	1	091-023-0600	Chain (60"Lg) [3/16"Proof Coil Galvanized]	15,&20,000/108"
38	2	091-023-0540	Chain (54"Lg) 3/16"Proof Coil Galvanized	15,&20,000/60X108"
38	2	091-023-0660	Chain (66"Lg) 3/16"Proof Coil Galvanized	15,&20,000/72X108"
38	2	091-023-0780	Chain (78"Lg) 3/16"Proof Coil Galvanized	15,&20,000/84X108"
38	2	091-023-0900	Chain (90"Lg) 3/16"Proof Coil Galvanized	15,000/96X108"
38	2	091-036-0780	Chain (78"Lg) 1/8"Proof Coil Galvanized	20,000/96X108"
39	2	R3-19203	Hook Snap 4"Lg - 7/16"-20	15,&20,000/108"
40	2	120-353	Torsion Spring	15,&20,000/108"
41	2	034-674	Fitting, 1/4" Male X 3/8" Comp	15,&20,000/108"
42	2	091-000-0063	Tubing Black Nylon (6-3/8"Lg) 3/8"	15,&20,000/108"
43	2	035-085	Fitting Tee	15,&20,000/108"
44	2	091-000-0340	Tubing Black Nylon (34"Lg) 3/8"	15,&20,000/60X108"
44	2	091-000-0400	Tubing Black Nylon (40"Lg) 3/8"	15,&20,000/72X108"
44	2	091-000-0460	Tubing Black Nylon (46"Lg) 3/8"	15,&20,000/84X108"
44	2	091-000-0520	Tubing Black Nylon (52"Lg) 3/8"	15,&20,000/96X108"
45	1	034-673	Fitting Nylon Tee (3/8" Comp)	15,&20,000/108"
46	4	025-087	Cable Ties	15,&20,000/108"
47	1	300-5006-3	Vent Line Kit (28'lg)	15,&20,000/60X108"
47	1	300-5006-4	Vent Line Kit (29'lg)	15,&20,000/72X108"
47	1	300-5006-5	Vent Line Kit (30'lg)	15,&20,000/84X108"
47	1	300-5006-6	Vent Line Kit (31'lg)	15,&20,000/96X108"

9.2.1 Cylinder Assembly - 15 & 20,000 lb. Cap. - 108" Deck Length

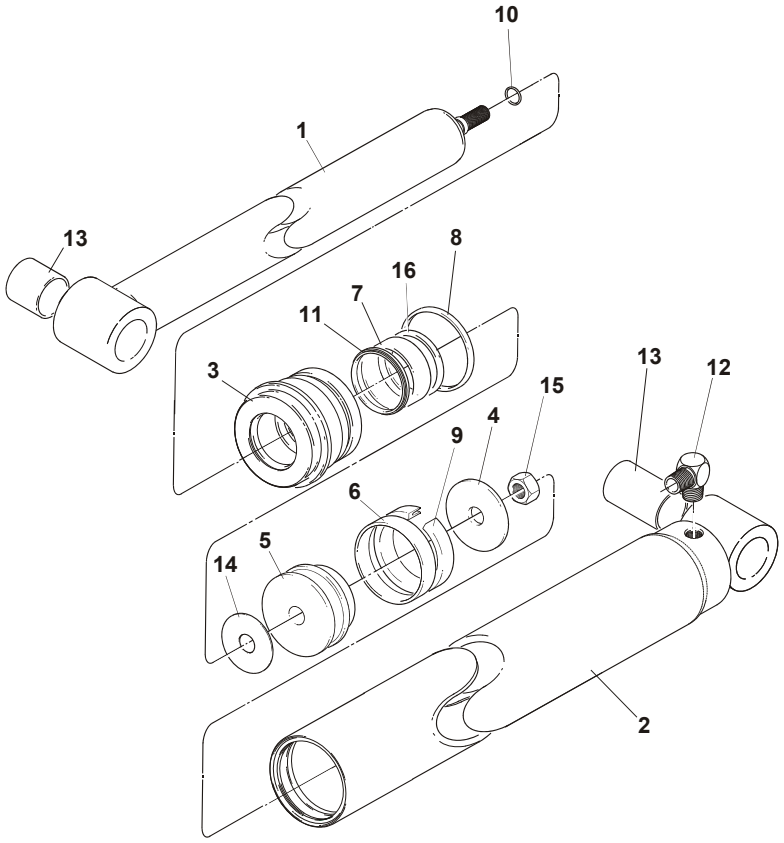


Figure 45 : Cylinder Assembly - 15, & 20,000 - 108" Deck Length

Item	Qty	Part No	General Description	Specific Description
-		**780-144-214**	**Cylinder Ass'y (3-1/2"Dia) [21-1/2" Stroke]**	**15,000/108"**
-	**-**	**780-142-214**	**Cylinder Ass'y (4"Dia) [20" Stroke]**	**20,000/108"**
1	1	786-855	Ram Assy 3", 3-1/2", & 4"	15,&20,000/108"
2	1	780-145	Housing Weldment (3-1/2"Dia)	15,000/108"
2	1	780-143	Housing Weldment (4"Dia)	20,000/108"
3	1	117-966	Headnut 3-1/2" Dia. Cyl (2" Dia. Rod)	15,000/108"
3	1	117-989	Headnut 4" Dia. Cyl (2" Dia. Rod)	20,000/108"
4	1	114-979	Piston Washer - (3-1/2" Dia)	15,000/108"
4	1	114-980	Piston Washer - (4" Dia)	20,000/108".
5	1	114-639	Piston - 3-1/2"Dia Cyl	15,000/108"
5	1	114-638	Piston - 4"Dia Cyl	20,000/108"
6●	1	036-155	Wear Ring Pist.Wd.3-1/2x1/2	15,000/108"
6●	1	036-156	Wear Ring Piston	20,000/108"
7●	1	036-182	Wear Ring - 3" X .125" Thick	15,&20,000/108"
8●	1	036-131`	O-Ring - 3-1/2"OD X 3-3/4"ID	15,000/108"
8●	1	036-130	O-Ring - 4"OD X 3-3/4"ID	20,000/108"
9●	1	036-116	U-Cup - 4" X 3-3/8" X 1/2"	15,&20,000/108"
10●	1	036-108	O-Ring - 3/4"OD X 5/8"ID X 1/16"	15,&20,000/108"
11●	1	036-021	Wiping Ring - 2"ID	15,&20,000/108"
12	1	034-500	Fitting, 6-6	15,&20,000/108"
13	2	018-027	Bushing	15,&20,000/108"
14●	1	117-993	Gasket	15,&20,000/108"
15●	1	036-176	O-Ring (2-1/4" OD X 2" ID)	15,&20,000/108"
16	1	011-530	Nut, Hex Jam - 3/4"-10	15,&20,000/108"
-	**-**	**783-557**	**Kit, seal - Includes Items marked (●)**	**15,000/108"**
-	**-**	**783-572**	**Kit, seal - Includes Items marked (●)**	**20,000/108"**

9.3 General Assembly - 15 & 20,000 lb. Cap. - 120" Deck Length

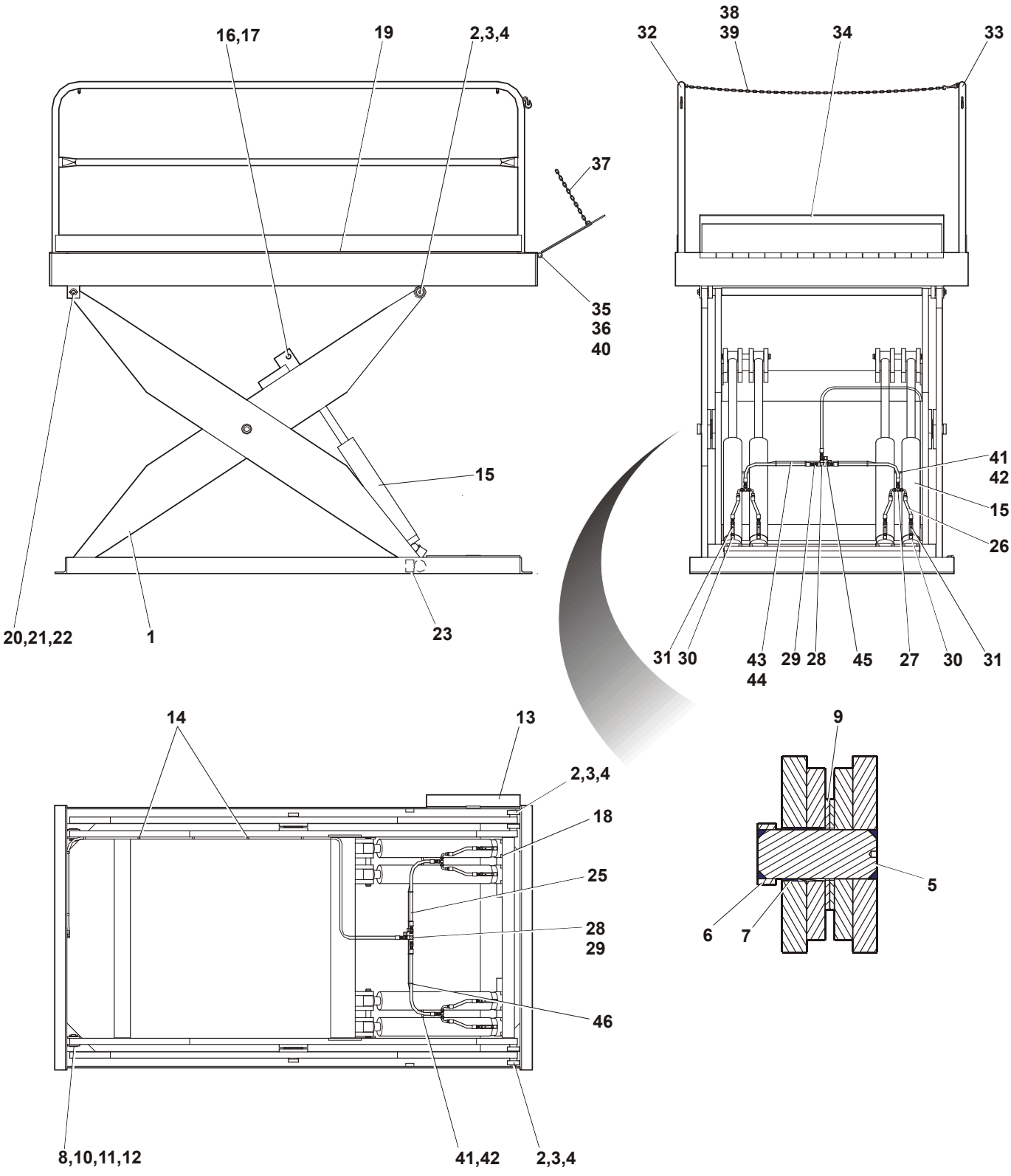


Figure 46 : General Assembly - 15, & 20,000 lb. - 120" Deck Length

Item	Qty	Part No	General Description	Specific Description
			General Assy 15,& 20,000-120" Deck Lgth	**REF. DWG. 310-5404**
1*	**1**	**313-5144**	**Frame/Leg Weldm't**	**15,000/60X120"**
1*	**1**	**313-5145**	**Frame/Leg Weldm't**	**15,000/72X120"**
1*	**1**	**313-5146**	**Frame/Leg Weldm't**	**15,000/84X120"**
1*	**1**	**313-5147**	**Frame/Leg Weldm't**	**15,000/96X120"**
1*	**1**	**313-5150**	**Frame/Leg Weldm't**	**20,000/60X120"**
1*	**1**	**313-5151**	**Frame/Leg Weldm't**	**20,000/72X120"**
1*	**1**	**313-5152**	**Frame/Leg Weldm't**	**20,000/84X120"**
1*	**1**	**313-5153**	**Frame/Leg Weldm't**	**20,000/96X120"**
2	2	019-001	Bearing, 3"OD X 1-5/8"ID X 1"W	15,&20,000/120"
3	4	011-066	Capscrew, Hex Skt F/H - 5/16"-18 X 3/4"	15,&20,000/120"
4	2	013-005	Spring Pin 5/32"x1"Lg	15,&20,000/120"
5	2	114-652	Centre Pin 1-1/2" Thk Leg (5-7/8" Lg)	15,&20,000/120"
6	2	114-606	Collar - 2" (Centre Pin Mod Ed)	15,&20,000/120"
7	2	018-031	Bushing - 2"IDx1"LG	15,&20,000/120"
8	4	018-051	Bushing - 1"Idx3/4"LG	15,&20,000/120"
9	2	012-219	Washer, Flat -2.13"IDx4.5"ODx0.187" TH	15,&20,000/120"
10	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	15,&20,000/120"
11	2	013-012	Spring Pin - 1/4" X 2	15,&20,000/120"
12	6	106-389	Spacer Washer, 1-3/4"ODx1"IDx1/16"TH	15,&20,000/120"
13	1	822-440	Strut Weldment, Maintenance	15,&20,000/120"
14	8	035-262	Strap (#6 Hose Clamp)	15,&20,000/120"
15**	**4**	**780-144-244**	**Cylinder Ass'y (3-1/2"Dia) [24-1/2" Stroke]**	**15,000/120"**
15**	**4**	**780-142-244**	**Cylinder Ass'y (4"Dia) [24-1/2" Stroke]**	**20,000/120"**
16	2	115-043	Pin-Cylinder Pivot	15,&20,000/120"
17	8	013-036	Retaining Ring Ext. - 1-1/4"ID	15,&20,000/120"
18	6	104-476	Lip Stop (3/4"X5/8")	15,&20,000/120"
19	1	312-5230	Deck Ass'y S2 15,&20,000/60x120	15,&20,000/60X120"
19	1	312-5231	Deck Ass'y S2 15,&20,000/72x120	15,&20,000/72X120"
19	1	312-5232	Deck Ass'y S2 15,&20,000/84x120	15,&20,000/84X120"
19	1	312-5233	Deck Ass'y S2 15,&20,000/96x120	15,&20,000/96X120"
19	1	312-5175	Deck Ass'y S3 (Taprd) 15,&20,000/60x120	15,&20,000/60X120"
19	1	312-5176	Deck Ass'y S3 (Taprd) 15,&20,000/72x120	15,&20,000/72X120"
19	1	312-5177	Deck Ass'y S3 (Taprd) 15,&20,000/84x120	15,&20,000/84X120"
19	1	312-5178	Deck Ass'y S3 (Taprd) 15,&20,000/96x120	15,&20,000/96X120"
20	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	15,&20,000/120"
21	6	106-389	Spacer Washer - 1-3/4"ODX 1"ID X 1/16thk	15,&20,000/120"
22	2	013-012	Spring Pin - 1/4" X 2	15,&20,000/120"
23	2	103-445	Roller Stop	15,&20,000/120"
24	1.6GA	039-066	Paint, Blue (Fast Dry Enamel)	15,&20,000/120"

*** - INDENTED SUB-ASSEMBLY – SHOWN ON SAME PAGE**
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Continued…

General Assembly - 15 & 20,000 lb. Cap. - 120" Deck Length

Item	Qty	Part No	General Description	Specific Description
25	2	300-5001-15	Hose, #8 HP (26"Lg) Str.Swivel(2)	15,&20,000/60X120"
25	2	300-5001-20	Hose, #8 HP (34"Lg) Str.Swivel(2)	15,&20,000/72X120"
25	2	300-5001-53	Hose, #8 HP (38"Lg) Str.Swivel(2)	15,&20,000/84X120"
25	2	300-5001-21	Hose, #8 HP (48"Lg) Str.Swivel(2)	15,&20,000/96X120"
26	4	300-5000	Hose, #6 HP - 4" Lg - Str. Swivel(2)	15,&20,000/120"
27	1	034-551	Fitting, Tee 033T-6-6	15,&20,000/120"
28	1	034-571	Fitting, Tee 022T-6-6	15,&20,000/120"
29	2	034-504	Adapter, 0103-6-6	15,&20,000/120"
30	4	034-599	Fitting Elbow Forged 6MP-4MP-90	15,&20,000/120"
31	4	033-663	Velocity Fuse - 7.5 GPM	15,000/120"
31	4	033-549	Velocity Fuse - 9 GPM	20,000/120"
32	1	312-5080-6	Guard Rail, Right Side 120"Deck	15,&20,000/120"
33	1	312-5078	Guard Rail Weld (84-1/2"X45")	15,&20,000/120"
34	1	302-5007-3	Lip Assy 60" Spring Assist 1pc ,18"Lg]	15,000/120"
34	1	302-5007-2	Lip Assy 60" Spring Assist 1pc ,18"Lg]	20,000/120"
35	2	809-483	Shaft, Lip Hinge 29-1/2"	15,&20,000/120"
36	2	013-011	Spring Pin - 1/4" X 1-3/8	15,&20,000/120"
37	1	091-023-0600	Chain (60"Lg) [3/16"Proof Coil Galvanized]	15,&20,000/120"
38	2	091-023-0540	Chain (54"Lg) 3/16"Proof Coil Galvanized	15,&20,000/60X120"
38	2	091-023-0660	Chain (66"Lg) 3/16"Proof Coil Galvanized	15,&20,000/72X120"
38	2	091-023-0780	Chain (78"Lg) 3/16"Proof Coil Galvanized	15,&20,000/84X120"
38	2	091-023-0900	Chain (90"Lg) 3/16"Proof Coil Galvanized	15,000/96X120"
39	2	R3-19203	Hook Snap 4"Lg - 7/16"-20	15,&20,000/120"
40	2	120-353	Torsion Spring	15,&20,000/120"
41	2	034-674	Fitting, 1/4" Male X 3/8" Comp	15,&20,000/120"
42	2	091-000-0063	Tubing Black Nylon (6-3/8"Lg) 3/8"	15,&20,000/120"
43	2	035-085	Fitting Tee	15,&20,000/120"
44	2	091-000-0340	Tubing Black Nylon (34"Lg) 3/8"	15,&20,000/60X120"
44	2	091-000-0400	Tubing Black Nylon (40"Lg) 3/8"	15,&20,000/72X120'
44	2	091-000-0460	Tubing Black Nylon (46"Lg) 3/8"	15,&20,000/84X120"
44	2	091-000-0520	Tubing Black Nylon (52"Lg) 3/8"	15,&20,000/96X120"
45	1	034-673	Fitting Nylon Tee (3/8" Comp)	15,&20,000/120"
46	4	025-087	Cable Ties	15,&20,000/120"
47	1	300-5006-4	Vent Line Kit (29'lg)	15,&20,000/60X120"
47	1	300-5006-5	Vent Line Kit (30'lg)	15,&20,000/72X120"
47	1	300-5006-6	Vent Line Kit (31'lg)	15,&20,000/84X120"
47	1	300-5006-7	Vent Line Kit (32'lg)	15,&20,000/96X120"

9.3.1 Cylinder Assembly - 15 & 20,000 lb. Cap. - 120" Deck Length

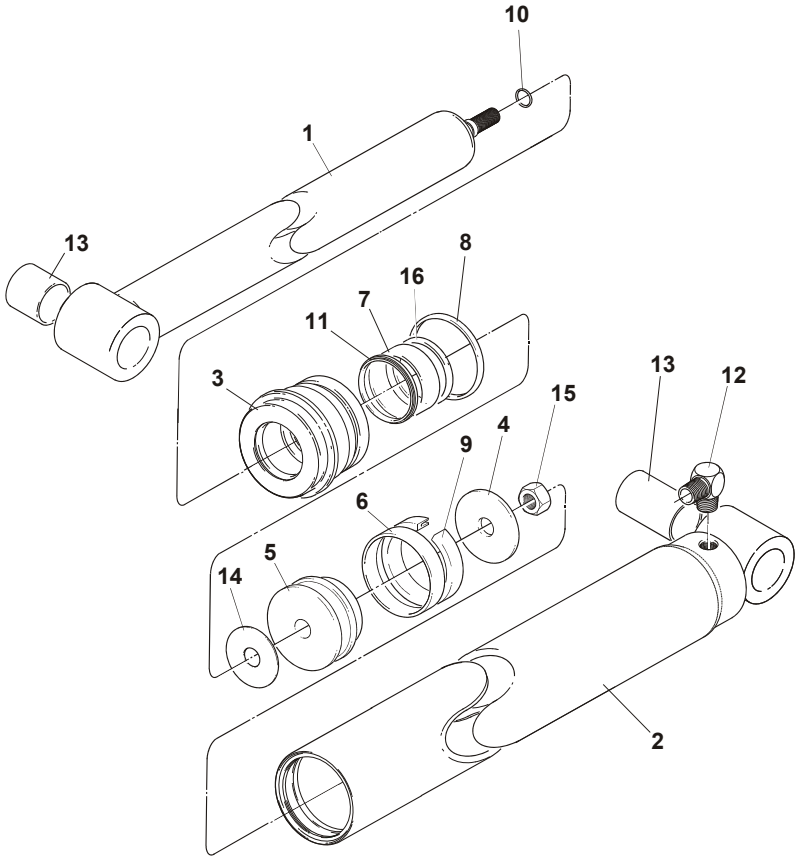


Figure 47 : Cylinder Assembly - 15, & 20,000 lb. - 120" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	**-**	**780-144-244**	**Cylinder Ass'y (3-1/2"Dia) [24-1/2" Stroke]**	**15,000/120"**
-	**-**	**780-142-244**	**Cylinder Ass'y (4"Dia) [24-1/2" Stroke]**	**20,000/120"**
1	1	786-855	Ram Assy 3", 3-1/2", & 4"	15,&20,000/120"
2	1	780-145	Housing Weldment (3-1/2"Dia)	15,000/120"
2	1	780-143	Housing Weldment (4"Dia)	20,000/120"
3	1	117-966	Headnut 3-1/2" Dia. Cyl (2" Dia. Rod)	15,000/120"
3	1	117-989	Headnut 4" Dia. Cyl (2" Dia. Rod)	20,000/120"
4	1	114-979	Piston Washer - (3-1/2" Dia)	15,000/120"
4	1	114-980	Piston Washer - (4" Dia)	20,000/120"
5	1	114-639	Piston - 3-1/2"Dia Cyl	15,000/120"
5	1	114-638	Piston - 4"Dia Cyl	20,000/120"
6●	1	036-155	Wear Ring Pist.Wd.3-1/2x1/2	15,000/120"
6●	1	036-156	Wear Ring Piston	20,000/120"
7●	1	036-182	Wear Ring - 3" X .125" Thick	15,&20,000/120"
8●	1	036-131`	O-Ring - 3-1/2"OD X 3-3/4"ID	15,000/120"
8●	1	036-130	O-Ring - 4"OD X 3-3/4"ID	20,000/120"
9●	1	036-116	U-Cup - 4" X 3-3/8" X 1/2"	15,&20,000/120"
10●	1	036-108	O-Ring - 3/4"OD X 5/8"ID X 1/16"	15,&20,000/120"
11●	1	036-021	Wiping Ring - 2"ID	15,&20,000/120"
12	1	034-500	Fitting, 6-6	15,&20,000/120"
13	2	018-027	Bushing	15,&20,000/120"
14●	1	117-993	Gasket	15,&20,000/120"
15	1	011-530	Nut, Hex Jam - 3/4"-10	15,&20,000/120"
16●	1	036-176	O-Ring (2-1/4" OD X 2" ID)	15,&20,000/120"
-	**-**	**783-557**	**Kit, seal - Includes Items marked (●)**	**15,000/120"**
-	**-**	**783-572**	**Kit, seal - Includes Items marked (●)**	**20,000/120"**

9.4 General Assembly - 15 & 20,000 lb. Cap. - 144" Deck Length

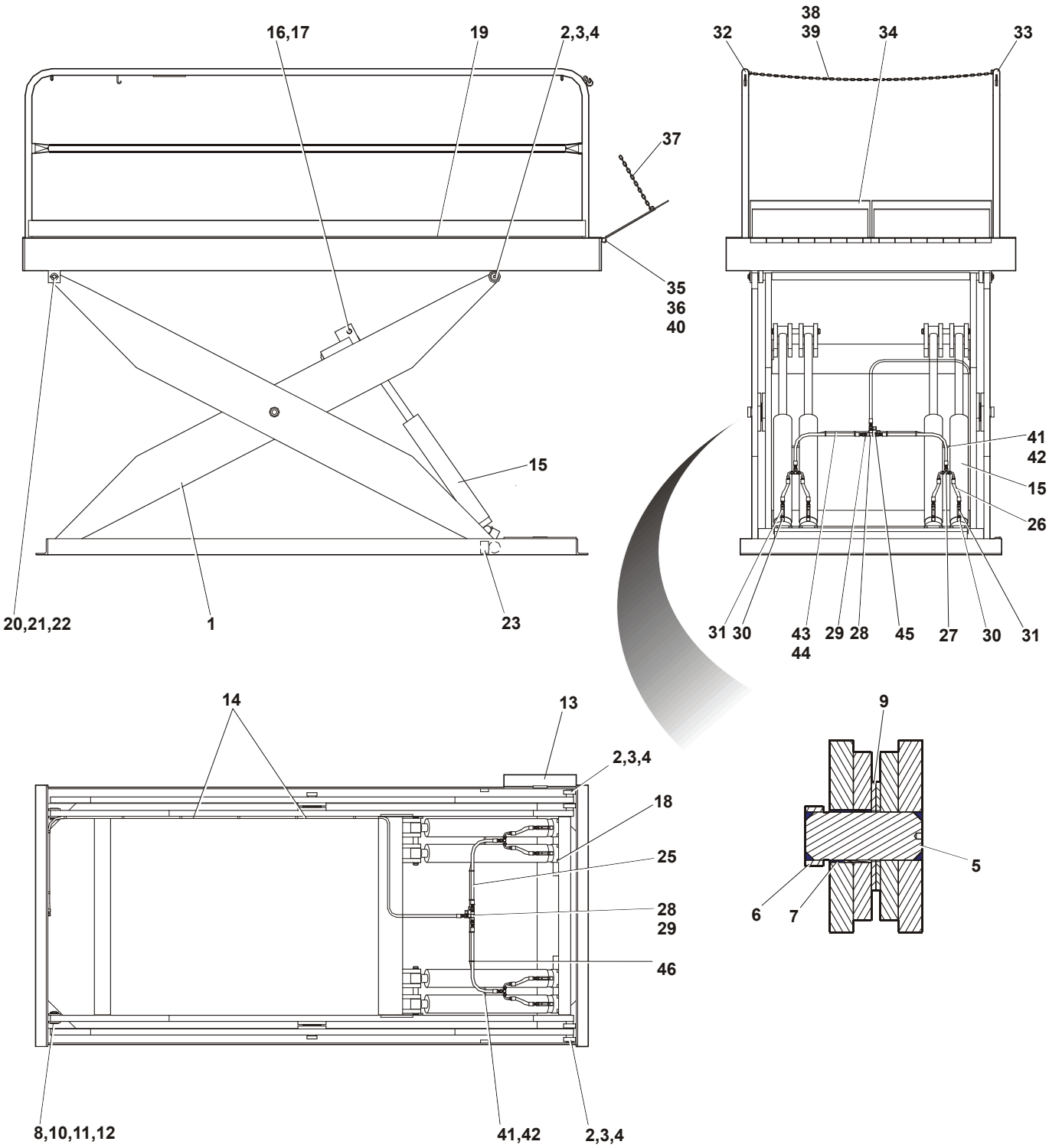


Figure 48 : General Assembly 15, & 20,000 - 144" Deck Length

General Assembly - 15 & 20,000 lb. Cap. - 144" Deck Length

Item	Qty	Part No	General Description	Specific Description
			General Assy 15,&20,000 -144" Deck Lgth	**REF. DWG. 310-5415**
1*	**1**	**313-5156**	**Frame/Leg Weldm't**	ED15,20/60X144"
1*	**1**	**313-5157**	**Frame/Leg Weldm't**	ED15,20/72X144"
1*	**1**	**313-5158**	**Frame/Leg Weldm't**	ED15,20/84X144"
1*	**1**	**313-5159**	**Frame/Leg Weldm't**	ED15,20/96X144"
2	2	019-001	Bearing, 3"OD X 1-5/8"ID X 1"W	15,&20,000/144"
3	4	011-066	Capscrew, Hex Sockt F/H-5/16"-18X3/4"	15,&20,000/144"
4	2	013-005	Spring Pin 5/32"x1"Lg	15,&20,000/144"
5	2	114-652	Centre Pin 1-1/2" Thk Leg (5-7/8" Lg)	15,&20,000/144"
6	2	114-606	Collar - 2" (Centre Pin Mod Ed)	15,&20,000/144"
7	2	018-031	Bushing - 2"IDx1"LG	15,&20,000/144"
8	4	018-051	Bushing - 1"Idx3/4"LG	15,&20,000/144"
9	2	012-219	Washer, Flat Plain - 2.13" IDx4.5"ODx0.187" THK	15,&20,000/144"
10	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	15,&20,000/144"
11	2	013-012	Spring Pin - 1/4" X 2	15,&20,000/144"
12	6	106-389	Washer, 1-3/4"Odx1"Idx1/16"THK	15,&20,000/144"
13	1	822-440	Strut Weldment, Maintenance	15,&20,000/144"
14	8	035-262	Strap (#6 Hose Clamp)	15,&20,000/144"
15**	**4**	**780-142-270**	**Cylinder Ass'y (4"Dia) [27" Stroke]**	**15,&20,000/144"**
16	2	115-043	Pin-Cylinder Pivot	15,&20,000/144"
17	8	013-036	Retaining Ring Ext. - 1-1/4"Id	15,&20,000/144"
18	6	104-476	Lip Stop (3/4"X5/8")	15,&20,000/144"
19	1	312-5236	Deck Ass'y S2 15,&20,000/60x144	15,&20,000/60X144"
19	1	312-5237	Deck Ass'y S2 15,&20,000/72x144	15,&20,000/72X144"
19	1	312-5238	Deck Ass'y S2 15,&20,000/84x144	15,&20,000/84X144"
19	1	312-5239	Deck Ass'y S2 15,&20,000/96x144	15,&20,000/96X144"
19	1	312-5181	Deck Ass'y S3 (Taprd) 15,&20,000/60x144	15,&20,000/60X144"
19	1	312-5182	Deck Ass'y S3 (Taprd) 15,&20,000/72x144	15,&20,000/72X144"
19	1	312-5183	Deck Ass'y S3 (Taprd) 15,&20,000/84x144	15,&20,000/84X144"
19	1	312-5184	Deck Ass'y S3 (Taprd) 15,&20,000/96x144	15,&20,000/96X144"
20	2	798-049	Pin Ass'y (1-1/2" Thick Legs)	15,&20,000/144"
21	6	106-389	Spacer Washer - 1-3/4"OD X 1"ID X 1/16thk	15,&20,000/144"
22	2	013-012	Spring Pin - 1/4" X 2	15,&20,000/144"
23	2	103-445	Roller Stop	15,&20,000/144"
24	1.6GA	039-066	Paint, Blue (Fast Dry Enamel)	15,&20,000/144"
25	2	300-5001-15	Hose, #8 HP (26"Lg) Str.Swivel(2)	15,&20,000/60X144"
25	2	300-5001-20	Hose, #8 HP (34"Lg) Str.Swivel(2)	15,&20,000/72X144"
25	2	300-5001-53	Hose, #8 HP (38"Lg) Str.Swivel(2)	15,&20,000/84X144"
25	2	300-5001-21	Hose, #8 HP (48"Lg) Str.Swivel(2)	15,&20,000/96X144"
26	4	300-5005	Hose, #6 HP - 4" Lg - Str. Swivel(2)	15,&20,000/144"

*** - INDENTED SUB-ASSEMBLY – SHOWN ON SAME PAGE**
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General Assembly - 15 & 20,000 lb. Cap. - 144" Deck Length

Item	Qty	Part No	General Description	Specific Description
27	1	034-551	Fitting, Tee 033T-6-6	15,&20,000/144"
28	1	034-571	Fitting, Tee 022T-6-6	15,&20,000/144"
29	2	034-504	Adapter, 0103-6-6	15,&20,000/144"
30	4	034-599	Fitting Elbow Forged 6MP-4MP-90°	15,&20,000/144"
31	4	033-549	Velocity Fuse - 9 GPM	15,&20,000/144"
32	1	312-5080-7	Guard Rail, Right Side 144"Deck	15,&20,000/144"
33	1	312-5079	Guard Rail Weld (84-1/2"X45")	15,&20,000/144"
34	1	302-5007-3	Lip Assy 60" Spring Assist 1pc ,18"Lg]	15,000/144"
34	1	302-5007-2	Lip Assy 60" Spring Assist 1pc ,18"Lg]	20,000/144"
35	2	809-483	Shaft, Lip Hinge 29-1/2"	15,&20,000/144"
36	2	013-011	Spring Pin - 1/4" X 1-3/8	15,&20,000/144"
37	1	091-023-0600	Chain (60"Lg) [3/16"Proof Coil Galvanized]	15,&20,000/144"
38	2	091-036-0540	Chain (54"Lg) 1/8"Proof Coil Galvanized	15,&20,000/60X144"
38	2	091-036-0660	Chain (66"Lg) 1/8"Proof Coil Galvanized	15,&20,000/72X144"
38	2	091-036-0780	Chain (78"Lg) 1/8"Proof Coil Galvanized	15,&20,000/84X144"
38	2	091-023-0900	Chain (90"Lg) 3/16"Proof Coil Galvanized	15,000/96X144"
39	2	R3-19203	Hook Snap 4"Lg - 7/16"-20	15,&20,000/144"
40	2	120-353	Torsion Spring	15,&20,000/144"
41	2	034-674	Fitting, 1/4" Male X 3/8" Comp	15,&20,000/144"
42	2	091-000-0063	Tubing Black Nylon (6-3/8"Lg) 3/8"	15,&20,000/144"
43	2	035-085	Fitting Tee	15,&20,000/144"
44	2	091-000-0340	Tubing, Black Nylon (34"Lg) 3/8"	15,&20,000/60X144"
44	2	091-000-0400	Tubing, Black Nylon (40"Lg) 3/8"	15,&20,000/72X144"
44	2	091-000-0460	Tubing, Black Nylon (46"Lg) 3/8"	15,&20,000/84X144"
44	2	091-000-0520	Tubing, Black Nylon (52"Lg) 3/8"	15,&20,000/96X144"
45	1	034-673	Fitting Nylon Tee (3/8" Comp)	15,&20,000/144"
46	4	025-087	Cable Ties	15,&20,000/144"
47	1	300-5006-6	Vent Line Kit (31'lg)	15,&20,000/60X144"
47	1	300-5006-7	Vent Line Kit (32'lg)	15,&20,000/72X144"
47	1	300-5006-8	Vent Line Kit (33'lg)	15,&20,000/84X144"
47	1	300-5006-9	Vent Line Kit (34'lg)	15,&20,000/96X144"

9.4.1 Cylinder Assembly - 15 & 20,000 lb. Cap. - 108" Deck Length

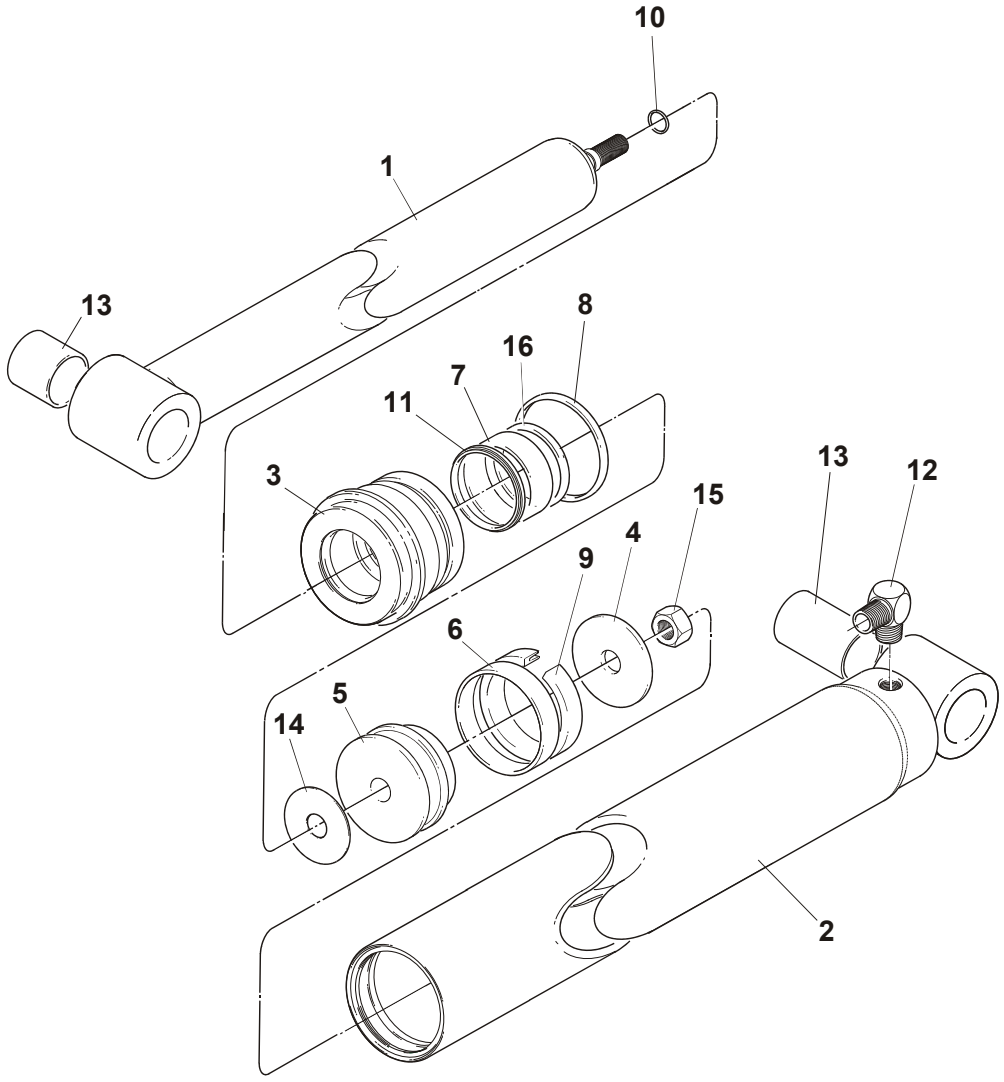


Figure 49 : Cylinder Assembly - 15, & 20,000 lb. - 108" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	**-**	**780-142-270**	**Cylinder Ass'y (4"Dia) [27" Stroke]**	**15,&20,000/144"**
1	1	786-855	Ram Assy 3", 3-1/2", & 4"	15,&20,000/144"
2	1	780-143	Housing Weldment (4"Dia)	15,&20,000/144"
3	1	117-989	Headnut 4" Dia. Cyl (2" Dia. Rod)	15,&20,000/144"
4	1	114-980	Piston Washer - (4" Dia)	15,&20,000/144"
5	1	114-638	Piston - 4"Dia Cyl	15,&20,000/144"
6●	1	036-156	Wear Ring Pist.Wd.3-1/2x1/2	15,&20,000/144"
7●	1	036-182	Wear Ring - 3" X .125" Thick	15,&20,000/144"
8●	1	036-130	O-Ring - 4"OD X 3-3/4"ID	15,&20,000/144"
9●	1	036-116	U-Cup - 4" X 3-3/8" X 1/2"	15,&20,000/144"
10●	1	036-108	O-Ring - 3/4"OD X 5/8"ID X 1/16"	15,&20,000/144"
11●	1	036-021	Wiping Ring - 2"ID	15,&20,000/144"
12	1	034-500	Fitting, 6-6	15,&20,000/144"
13	2	018-027	Bushing	15,&20,000/144"
14●	1	117-993	Gasket	15,&20,000/144"
15	1	011-530	Nut, Hex Jam - 3/4"-10	15,&20,000/144"
16●	1	036-176	O-Ring (2-1/4" OD X 2" ID)	15,&20,000/144"
-	**-**	**783-572**	**Kit, seal - Includes Items marked (●)**	**15,&20,000/144"**

10. Parts Listings - Power Packs

10.1 Power Packs - 3 Horse Power

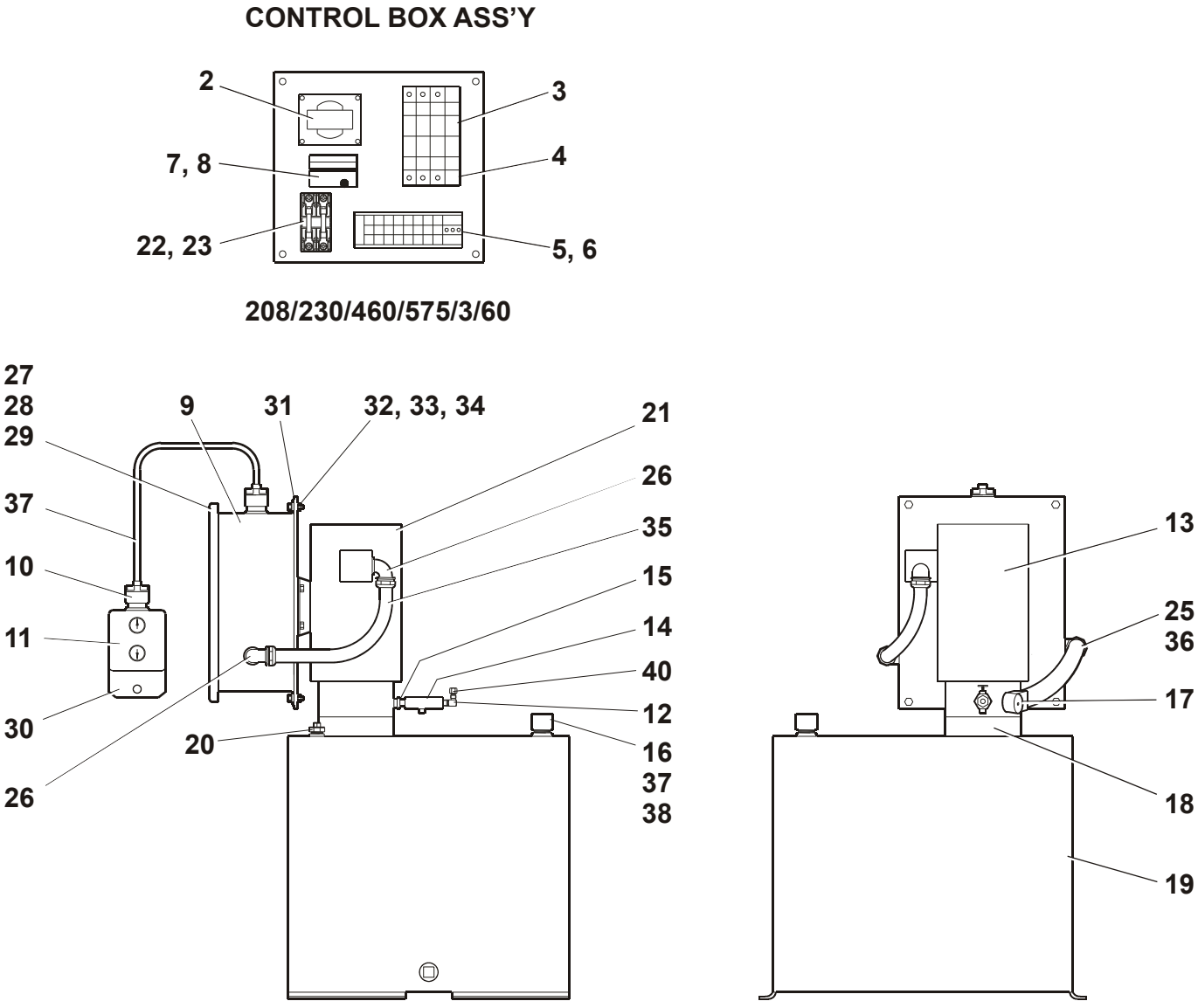


Figure 50 : Power Pack Assembly - 3 Horse Power

Power Packs - 3 Horse Power

Item	Qty	Part No	General Description	Specific Description
			Power Packs - 3 Horse Power	**5 & 10 Gallon Reservoirs**
-	-	**815-P31-230-R**	**Module, Remote Power Pack**	**3HP 230V/1Ø/60-5G**
-	-	**815-P33-208-R**	**Module, Remote Power Pack**	**3HP 208V/3Ø/60-5G**
-	-	**815-P33-230-R**	**Module, Remote Power Pack**	**3HP 230V/3Ø/60-5G**
-	-	**815-P33-460-R**	**Module, Remote Power Pack**	**3HP 460V/3Ø/60-5G**
-	-	**815-P33-575-R**	**Module, Remote Power Pack**	**3HP 575V/3Ø/60-5G**
-	-	**815-P33-208-R11**	**Module, Remote Power Pack**	**3HP 208V/3Ø/60-10G**
-	-	**815-P33-230-R11**	**Module, Remote Power Pack**	**3HP 230V/3Ø/60-10G**
-	-	**815-P33-460-R11**	**Module, Remote Power Pack**	**3HP 460V/3Ø/60-10G**
-	-	**815-P33-575-R11**	**Module, Remote Power Pack**	**3HP 575V/3Ø/60-10G**
-	-	**305-5002**	**Power Pack, Remote Ass'y (5GAL)**	**3HP-230V/1Ø/50/60Hz**
-	-	**305-5002-1**	**Power Pack, Remote Ass'y (5GAL)**	**3HP-208V/3Ø/50/60HZ**
-	-	**305-5002-2**	**Power Pack, Remote Ass'y (5GAL)**	**3HP-230V/3Ø/50/60Hz**
-	-	**305-5002-3**	**Power Pack, Remote Ass'y (5GAL)**	**3HP-460V/3Ø/50/60Hz**
-	-	**305-5002-4**	**Power Pack, Remote Ass'y (5GAL)**	**3HP-575V/3Ø/50/60Hz**
-	-	**305-5002-5**	**Power Pack, Remote Ass'y (10GAL)**	**3HP-208V/3Ø/50/60Hz**
-	-	**305-5002-6**	**Power Pack, Remote Ass'y (10GAL)**	**3HP-230V/3Ø/50/60Hz**
-	-	**305-5002-7**	**Power Pack, Remote Ass'y (10GAL)**	**3HP-460V/3Ø/50/60Hz**
-	-	**305-5002-8**	**Power Pack, Remote Ass'y (10GAL)**	**3HP-575V/3Ø/50/60Hz**
1*	**1**	**630-067**	**Kit, Pick - 3HP 230/1/60 Remote (5GAL)**	**3HP/230/1Ø/60**
1*	**1**	**630-004-1**	**Kit, Pick - 3HP 208/3/60 Remote (5GAL)**	**3HP/208/3Ø/60**
1*	**1**	**630-006-1**	**Kit, Pick - 3HP 230/3/60 Remote (5GAL)**	**3HP/230/3Ø/60**
1*	**1**	**630-007-1**	**Kit, Pick - 3HP 460/3/60 Remote (5GAL)**	**3HP/460/3Ø/60**
1*	**1**	**630-008-1**	**Kit, Pick- 3HP 575/3/60 Remote (5GAL)**	**3HP/575/3Ø/60**
1*	**1**	**630-004-2**	**Kit, Pick- 3HP 208/3/60 Rem. (10GAL)**	**3HP/208/3Ø/60**
1*	**1**	**630-006-2**	**Kit, Pick- 3HP 230/3/60 Rem. (10GAL)**	**3HP/230/3Ø/60**
1*	**1**	**630-007-2**	**Kit, Pick- 3HP 460/3/60 Rem. (10GAL)**	**3HP/460/3Ø/60**
1*	**1**	**630-008-2**	**Kit, Pick- 3HP 575/3/60 Rem. (10GAL)**	**3HP/575/3Ø/60**
2	1	026-302	Transformer 240/480 PR.-120/240Sec.	3HP/230/1Ø/60
2	1	026-306	Transformer 208/416, 120 Sec.	3HP/208/3Ø/60
2	1	026-302	Transformer 240/480 PR.-120/240Sec.	3HP/230/3Ø/60
2	1	026-302	Transformer 240/480 PR.-120/240Sec.	3HP/460/3Ø/60
2	1	026-300	Transformer 600V-120V	3HP/575/3Ø/60
3	1	025-926	Contactor (Ci-25) - 110VAC 50/60Hz	3HP/1Ø/50/60 HZ
3	1	025-924	Contactor, Motor -12A CI-12	3HP/3Ø/50/60 HZ
4	1	026-105	Relay, Overload - 6-9.2A	3HP/208-230V/3Ø Only
4	1	026-103	Relay, Overload - 2.7-4.2A	3HP/460-575V/50/60HZ
5	10	030-842	Terminal Block	3HP/3Ø/50/60 HZ
6	1	030-843	Terminal Block End Section	3HP/3Ø/50/60 HZ
7	1	026-227	Fuseholder, Single 250 Volt	3HP/3Ø/50/60 HZ
8	1	026-147	Fuse, 0.5 Amp .25"x1.25"	3HP/3Ø/50/60 HZ
9	1	110-831	Control Box 10x8x5	3HP/3Ø/50/60 HZ
10	2	025-015	Connector-Cable	3HP/3Ø/50/60 HZ
11	1	025-692	Push Button Station - Nema 4X	3HP/3Ø/50/60 HZ
12	1	034-601	Fitting, 90° Forged - 2103-4-6	<6000lb. Cap
12	1	034-602	Fitting, 90° Forged - 2103-4-8	>6000lb. Cap

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Power Packs - 3 Horse Power

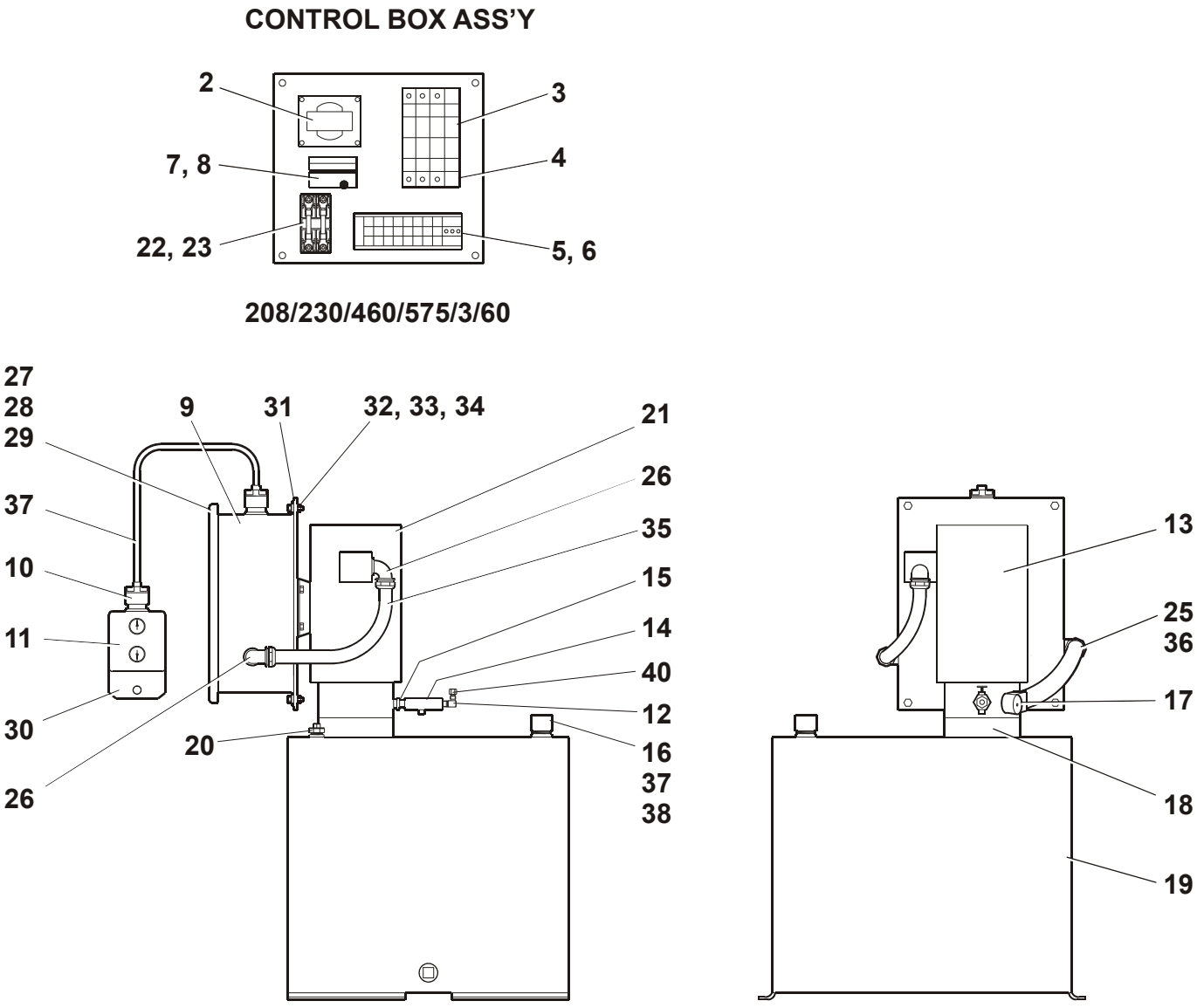


Figure 47 : Power Pack Assembly - 3 Horse Power

Power Packs - 3 Horse Power

Item	Qty	Part No	General Description	Specific Description
13*	**1**	**033-185**	**Powerpack 3HP 240/1/60 5 Gall. Res.**	**3HP/230/1Ø/60**
13*	**1**	**033-780**	**Powerpack 3HP 208/230/460/3/60 - 5G**	**3HP/208,230,460V/3Ø/60**
13*	**1**	**033-788**	**Powerpack 3HP 575/3/60 - 5G**	**3HP/575V/3Ø/60**
13*	**1**	**033-780-1**	**Powerpack 3HP 208/230/460/3/60 -10G**	**3HP/208,230,460V/3Ø/60**
13*	**1**	**033-788-1**	**Powerpack 3HP 575/3/60 -10G**	**3HP/575V/3Ø/60**
14	1	033-785	Valve, Flow Control 2.75 GPM	3HP/208,230,460V/3Ø/60
15	1	034-600	Adapter, 2083-6-4S	3HP/208,230,460V/3Ø/60
16	1	035-278	Breather Cap C/W Dipstick 3/4"	3HP/208,230,460V/3Ø/60
17	1	033-704	Valve 2-Way 2-Position	3HP/208,230,460V/3Ø/60
18	1	033-786	Pump	3HP/208,230,460V/3Ø/60
19	1	033-711	Reservoir - 5 Gallon	3HP/208,230,460V/3Ø/60
19	1	033-424	Reservoir - 10 Gallon	3HP/208,230,460V/3Ø/60
20	1	035-030	Plug, 1/4"NPT. Pipe	3HP/208,230,460V/3Ø/60
21	1	031-100	Motor 3HP, 208-460/3/50/60	3HP/208,230,460V/3Ø/60
21	1	031-101	Motor 3HP, 575/3/60	3HP/575V/3Ø/60
22	1	026-228	Fuseholder,600 V, 30 Amp	3HP/3Ø/50/60 HZ
23	2	026-158	Fuse, Fiber - 13/32"x1-1/2" 1/2 Amp	3HP/208-230V/1&3Ø/60
23	2	026-233	Fuse 2/10 - 600V	3HP/460-575V/3Ø/60HZ
24	1	030-069	Grounding Strip	3HP/3Ø/50/60 HZ
25	1	025-063	Connector	3HP/3Ø/50/60 HZ
26	3	025-010	Connector LT - 3/8-90°	3HP/3Ø/50/60 HZ
27	4	010-072	Capscrew, Hex Hd. - 1/4-20 X 1/2"	3HP/3Ø/50/60 HZ
28	4	012-210	Washer, Flat 1/4" Bolt S	3HP/3Ø/50/60 HZ
29	4	012-202	Washer, Lock - 1/4" Helical	3HP/3Ø/50/60 HZ
30	1	110-287	Bracket, 2 Push Buttons	3HP/3Ø/50/60 HZ
31	1	121-364	Plate, Control Box Mounting Plate	3HP/3Ø/50/60 HZ
32	4	010-036	Capscrew, Hex Hd. 5/16"-18 X 1/2"	3HP/3Ø/50/60 HZ
33	4	012-211	Washer, 5/16" Bolt Size Flat	3HP/3Ø/50/60 HZ
34	4	012-200	Washer, Lock Helical 5/16"	3HP/3Ø/50/60 HZ
35	1	780-214	Conduit Assembly	3HP/3Ø/50/60 HZ
36	1	780-213	Conduit Assembly	3HP/3Ø/50/60 HZ
37	1.0	090-581-1680	Wire Per Metre (168"Lg)	3HP/3Ø/50/60 HZ
38	2	011-005	Screw, Machine R/H Slot 8-32 X 1/2"	3HP/3Ø/50/60 HZ
39	2	012-224	Washer, Lock - #8 Int. Tooth	3HP/3Ø/50/60 HZ
40	1	034-594	Adapter, 2027-8-8S	3HP/3Ø/50/60 HZ

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10.2 Parts Listings - Power Packs - 5 Horse Power

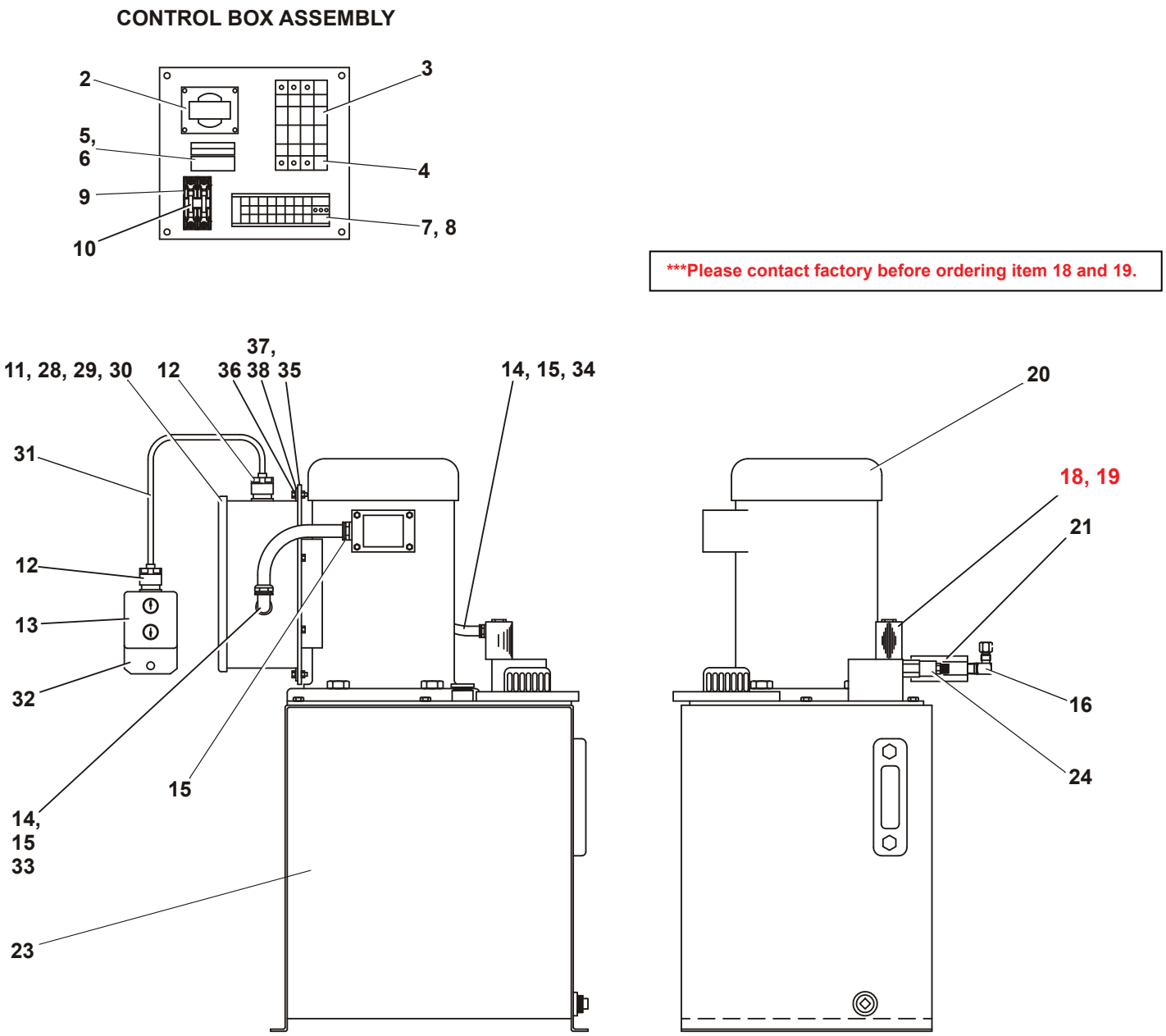


Figure 51 : Power Pack Assembly - 5 Horse Power

Power Packs - 5 Horse Power

Item	Qty	Part No	General Description	Specific Description
			Power Packs - 5 Horse Power	**10 Gallon Reservoir**
-	-	**815-P51-230-R**	**Module, Remote Power Pack**	**5HP 230V/1Ø/60-5G**
-	-	**815-P53-208-R**	**Module, Remote Power Pack**	**5HP 208V/3Ø/60-5G**
-	-	**815-P53-230-R**	**Module, Remote Power Pack**	**5HP 230V/3Ø/60-5G**
		815-P53-415-R	**Module, Remote Power Pack**	**5HP 415V/3Ø/60-5G**
-	-	**815-P53-460-R**	**Module, Remote Power Pack**	**5HP 460V/3Ø/60-5G**
-	-	**815-P53-575-R**	**Module, Remote Power Pack**	**5HP 575V/3Ø/60-5G**
-	-	**305-5003**	**Power Pack, Remote Ass'y**	**5HP-230V/1Ø/50/60Hz**
-	-	**305-5003-1**	**Power Pack, Remote Ass'y**	**5HP-208V/3Ø/50/60HZ**
-	-	**305-5003-2**	**Power Pack, Remote Ass'y**	**5HP-230V/3Ø/50/60Hz**
-	-	**305-5003-3**	**Power Pack, Remote Ass'y**	**5HP-415V/3Ø/50/60Hz**
-	-	**305-5003-4**	**Power Pack, Remote Ass'y**	**5HP-460V/3Ø/50/60Hz**
-	-	**305-5003-5**	**Power Pack, Remote Ass'y**	**5HP-575V/3Ø/50/60Hz**
1*	**1**	**630-003-1**	**Kit, Pick - 5HP 230/1/60 Rem.**	**5HP/230/1Ø/60**
1*	**1**	**630-024-1**	**Kit, Pick - 5HP 208/3/60 Rem.**	**5HP/208/3Ø/60**
1*	**1**	**630-026-1**	**Kit, Pick - 5HP 230/3/60 Rem.**	**5HP/230/3Ø/60**
1*	**1**	**630-040-1**	**Kit, Pick - 5HP 415/3/60 Rem.**	**5HP/415/3Ø/60**
1*	**1**	**630-028-1**	**Kit, Pick - 5HP 460/3/60 Rem.**	**5HP/460/3Ø/60**
1*	**1**	**630-030-1**	**Kit, Pick - 5HP 575/3/60 Rem.**	**5HP/575/3Ø/60**
2	1	026-302	Transformer 240/480 PR.-120/240Sec.	5HP/230/1Ø/60
2	1	026-306	Transformer 208/416, 120 Sec.	5HP/208/3Ø/60
2	1	026-302	Transformer 240/480 PR.-120/240Sec.	5HP/230/3Ø/60
2	1	026-306	Transformer 208/416, 120 Sec.	5HP/415/3Ø/60
2	1	026-302	Transformer 240/480 PR.-120/240Sec.	5HP/460/3Ø/60
2	1	026-300	Transformer 600V-120V	5HP/575/3Ø/60
3	1	025-928	Contactor 32A	5HP/1Ø/50/60 HZ
3	1	025-926	Contactor (CI-25)	5HP/208-230V/3Ø/60
3	1	025-924	Contactor,Motor -12A CI-12	5HP/415-575/3Ø/50/60
4	1	026-118	Relay, Overload - 11-16A	5HP/208-230V/3Ø Only
4	1	026-105	Relay, Overload - 6-9.2A	5HP/415-575V/50/60 HZ
4	1	026-104	Relay, Overload - 4-6.2A	5HP/415-575V/50/60 HZ
5	1	026-147	Fuse, 0.5 Amp .25"x1.25"	5HP/3Ø/50/60 HZ
6	1	026-227	Fuseholder, Single 250 Volt	5HP/3Ø/50/60 HZ
7	10	030-842	Terminal Block	5HP/3Ø/50/60 HZ
8	1	030-843	Terminal Block End Section	5HP/3Ø/50/60 HZ
9	1	026-228	Fuseholder,600 V, 30 Amp	5HP/3Ø/50/60 HZ
10	1	026-158	Fuse, Fiber - 13/32"x1-1/2" 1/2 Amp	5HP/208-230V/1&3Ø/60
10	1	026-238	Fuse, Primary 3/10	5HP/415V/3Ø/60 Hz
10	1	026-233	Fuse, Primary 2/10	5HP/460,575V/3Ø/60 Hz
11	1	025-068	Enclosure	5HP/230/1Ø/60
11	1	110-831	Control Box 10x8x5	5HP/3Ø/50/60 HZ
12	2	025-015	Connector-Cable	5HP/3Ø/50/60 HZ
13	1	025-692	Push Button Station - Nema 4X	5HP/3Ø/50/60 HZ
14	3	025-010	Connector LT - 3/8-90°	5HP/3Ø/50/60 HZ
14	3	025-011	Connector LT - 1/2"-90°	5HP 208V/3Ø/60-5G
15	3	025-009	Connector ST - 3/8"	5HP/3Ø/50/60 HZ
15	3	025-012	Connector LT - 1/2"-Str.	5HP 208V/3Ø/60-5G

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Parts Listings - Power Packs - 5 Horse Power

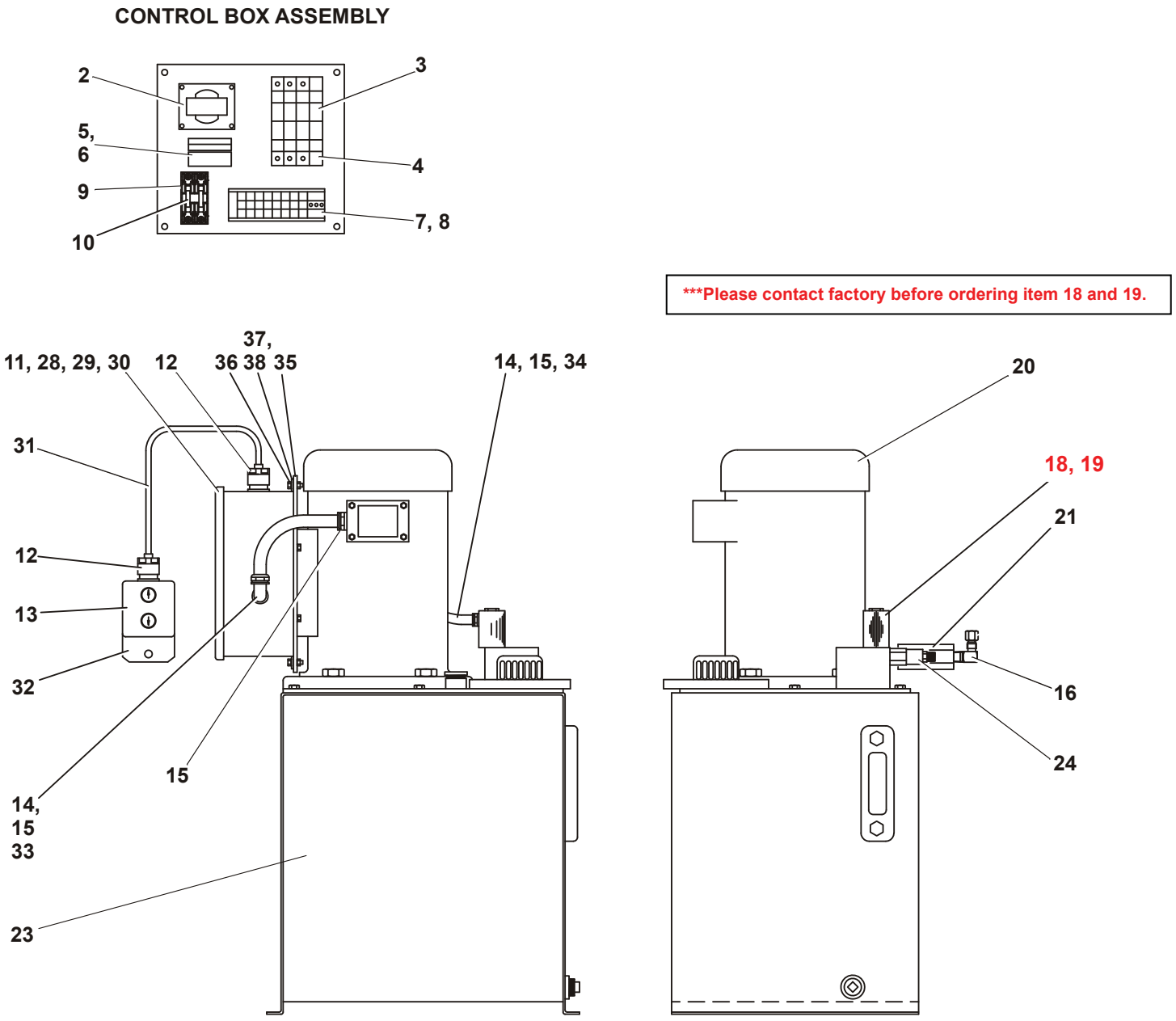


Figure 48 : Power Pack Assembly - 5 Horse Power

Parts Listings - Power Packs - 5 Horse Power

Item	Qty	Part No	General Description	Specific Description
16	1	034-500	Fitting, 90° Forged - 2103-4-6	<6000lb. Cap
16	1	034-540	Fitting, 90° Forged - 2103-4-8	>6000lb. Cap
17*	**1**	**033-796**	**Powerpack 5HP 220/1/60**	**5HP/230/1Ø/60**
17*	**1**	**033-794**	**Powerpack, 5HP, 208-460/3/60**	**5HP/208-460V/3Ø/60 Hz**
17*	**1**	**033-795**	**Powerpack, 5HP, 575/3/60**	**5HP/575V/3Ø/60 Hz**
18	**1**	**033-798**	**Coil, Solenoid Valve**	**5HP/3Ø/50/60 HZ**
19	**1**	**033-800**	**Cartridge, Solenoid Valve**	**5HP/3Ø/50/60 HZ**
NOTE: Please contact factory before ordering items 18 & 19.				
20	1	031-114	Motor, 5HP 230/1/60	5HP 230/1Ø/60
20	1	031-112	Motor, 5HP 230-460/3/60	5HP 230-460/3Ø/60
20	1	031-113	Motor, 5HP 575/3/60	5HP 575/3Ø/60
21	1	033-839	Control, Press. Comp. Flow	5HP/3Ø/50/60 HZ
22	1	033-178	Pump (Not Shown)	5HP/3Ø/50/60 HZ
23	1	035-424	Reservoir, 10 Gallon	5HP/3Ø/50/60 HZ
24	1	033-808	Valve, Relief	5HP/3Ø/50/60 HZ
25	1	030-069	Grounding Strip	5HP/3Ø/50/60 HZ
26	1	025-933	Connector LT - 3/4" 90°	5HP/3Ø/50/60 HZ
27	1	550-129	Gasket, Oil	5HP/3Ø/50/60 HZ
28	4	010-072	Capscrew, Hex Hd. - 1/4-20 X 1/2"	5HP/3Ø/50/60 HZ
29	4	012-210	Washer, Flat 1/4" Bolt S	5HP/3Ø/50/60 HZ
30	4	012-202	Washer, Lock - 1/4" Helical	5HP/3Ø/50/60 HZ
31	4.3	090-581	Wire Per Metre	5HP/3Ø/50/60 HZ
32	1	110-287	Bracket, 2 Push Buttons	5HP/3Ø/50/60 HZ
33	1	090-053-0080	Conduit Assembly	5HP/3Ø/50/60 HZ
34	1	090-053-0110	Conduit Assembly	5HP/3Ø/50/60 HZ
35	1	305-0002	Plate, Control Box Mounting Plate	5HP/1Ø/50/60 HZ
35	1	305-0001	Plate, Control Box Mounting Plate	5HP/3Ø/50/60 HZ
36	4	010-036	Capscrew, Hex Hd. 5/16"-18 X 1/2"	5HP/3Ø/50/60 HZ
37	4	012-211	Washer, 5/16" Bolt Size Flat	5HP/3Ø/50/60 HZ
38	4	012-200	Washer, Lock Helical 5/16"	5HP/3Ø/50/60 HZ
39	AR	090-054-0070	Conduit 1/2 Lt Sealtite	5HP/3Ø/50/60 HZ
40	2	025-136	Washer, Reducing 3/4"-1/2"	5HP/3Ø/50/60 HZ

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10.3 Parts Listings - Power Packs - 7.5 Horse Power

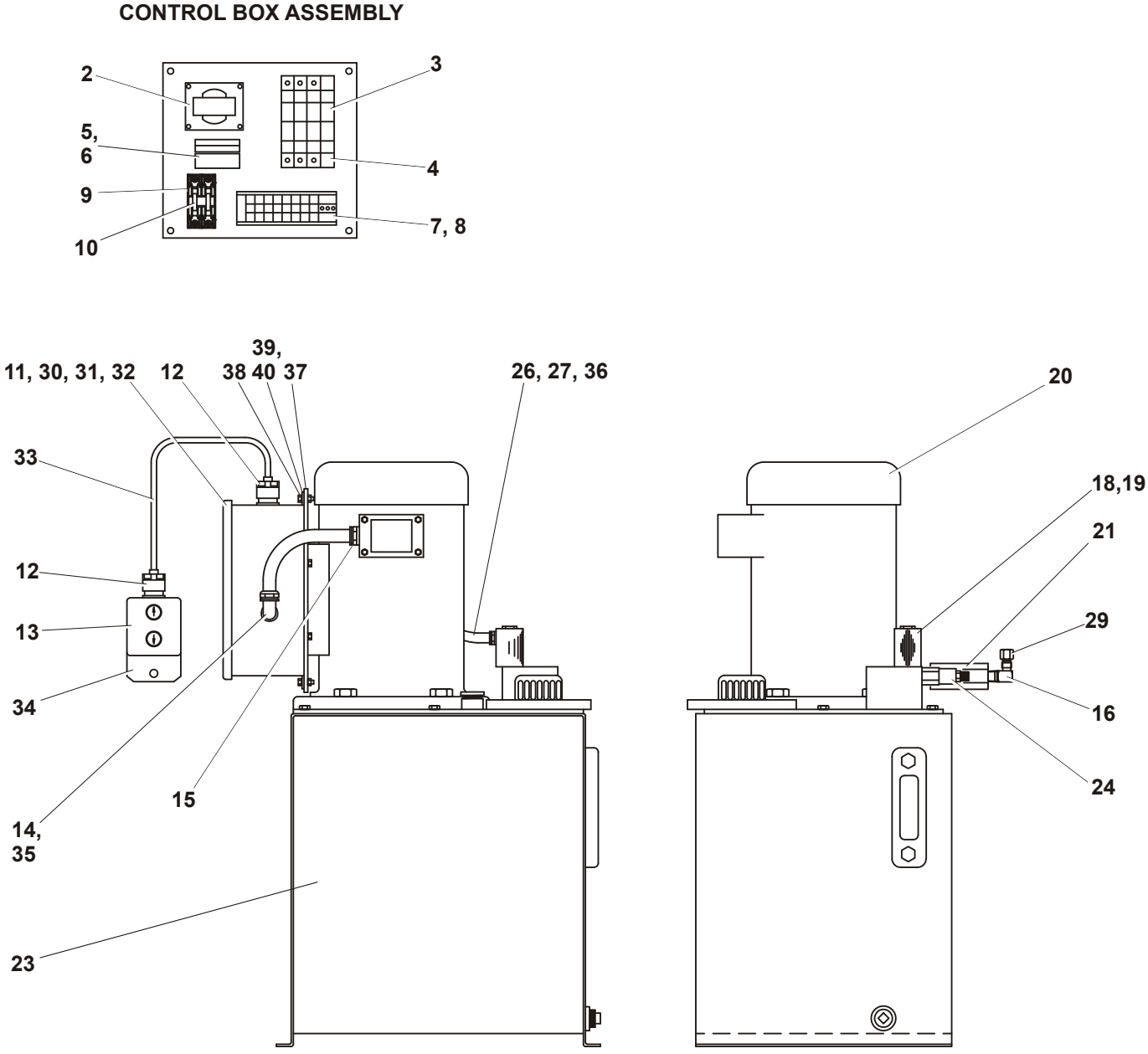


Figure 52 : Power Pack Assembly - 7.5 Horse Power

Parts Listings - Power Packs - 7.5 Horse Power

Item	Qty	Part No	General Description	Specific Description
			Power Packs - 7.5 Horse Power	**10 Gallon Reservoir**
-	**-**	**815-P73-208-R**	**Module, Remote Power Pack**	**7.5HP 208V/3Ø/60-5G**
-	**-**	**815-P73-230-R**	**Module, Remote Power Pack**	**7.5HP 230V/3Ø/60-5G**
-	**-**	**815-P73-415-R**	**Module, Remote Power Pack**	**7.5HP 415V/3Ø/60-5G**
-	**-**	**815-P73-460-R**	**Module, Remote Power Pack**	**7.5HP 460V/3Ø/60-5G**
-	**-**	**815-P73-575-R**	**Module, Remote Power Pack**	**7.5HP 575V/3Ø/60-5G**
-	**-**	**305-5004**	**Power Pack, Remote Ass'y**	**7.5HP-208V/3Ø/50/60HZ**
-	**-**	**305-5004-1**	**Power Pack, Remote Ass'y**	**7.5HP-230V/3Ø/50/60Hz**
-	**-**	**305-5004-2**	**Power Pack, Remote Ass'y**	**7.5HP-415V/3Ø/50/60Hz**
-	**-**	**305-5004-3**	**Power Pack, Remote Ass'y**	**7.5HP-460V/3Ø/50/60Hz**
-	**-**	**305-5004-4**	**Power Pack, Remote Ass'y**	**7.5HP-575V/3Ø/50/60Hz**
1*	**1**	**630-031-1**	**Kit, Pick - 7.5HP 208/3/60 Rem.**	**7.5HP/208/3Ø/60**
1*	**1**	**630-032-1**	**Kit, Pick - 7.5HP 230/3/60 Rem.**	**7.5HP/230/3Ø/60**
1*	**1**	**630-066**	**Kit, Pick - 7.5HP 415/3/60 Rem.**	**7.5HP/415/3Ø/60**
1*	**1**	**630-033-1**	**Kit, Pick - 7.5HP 460/3/60 Rem.**	**7.5HP/460/3Ø/60**
1*	**1**	**630-041-1**	**Kit, Pick- 7.5HP 575/3/60 Rem.**	**7.5HP/575/3Ø/60**
2	1	026-306	Transformer 208/416, 120 Sec.	7.5HP/208/3Ø/60
2	1	026-302	Transformer 240/480PR-120/240Sc.	7.5HP/230/3Ø/60
2	1	026-306	Transformer 208/416, 120 Sec.	7.5HP/415/3Ø/60
2	1	026-302	Transformer 240/480PR-120/240Sc.	7.5HP/460/3Ø/60
2	1	026-300	Transformer 600V-120V	7.5HP/575/3Ø/60
3	1	025-926	Contactor (CI-25)	7.5HP/3Ø/50/60
4	1	026-168	Relay, Overload - 19-25A	7.5HP/208-230V/3Ø Only
4	1	026-117	Relay, Overload - 8-12A	7.5HP/415-575V/50/60 HZ
4	1	026-105	Relay, Overload - 6-9.2A	7.5HP/415-575V/50/60 HZ
5	1	026-147	Fuse, 0.5 Amp .25"x1.25"	7.5HP/3Ø/50/60 HZ
6	1	026-227	Fuseholder, Single 250 Volt	7.5HP/3Ø/50/60 HZ
7	10	030-842	Terminal Block	7.5HP/3Ø/50/60 HZ
8	1	030-843	Terminal Block End Section	7.5HP/3Ø/50/60 HZ
9	1	026-228	Fuseholder,600 V, 30 Amp	7.5HP/3Ø/50/60 HZ
10	1	026-158	Fuse, Fiber - 13/32"x1-1/2" 1/2 Amp	7.5HP/208-230V/3Ø/60 Hz
10	1	026-230	Fuse, Primary 3/10	7.5HP/415V/3Ø/60 Hz
10	1	026-233	Fuse, Primary 2/10	7.5HP/460,575V/3Ø/60 Hz
11	1	110-831	Control Box 10x8x5	7.5HP/3Ø/50/60 HZ
12	2	025-015	Connector-Cable	7.5HP/3Ø/50/60 HZ
13	1	025-692	Push Button Station - Nema 4X	7.5HP/3Ø/50/60 HZ
14	1	025-012	Connector LT - 1/2"-Str.	7.5HP/208V/3Ø/60-5G
15	1	025-011	Connector LT - 1/2"-90°	7.5HP/208V/3Ø/60-5G
16	1	034-540	Fitting, 90° Forged - 2103-4-8	7.5HP/3Ø/50/60 HZ

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Power Packs - 7.5 Horse Power

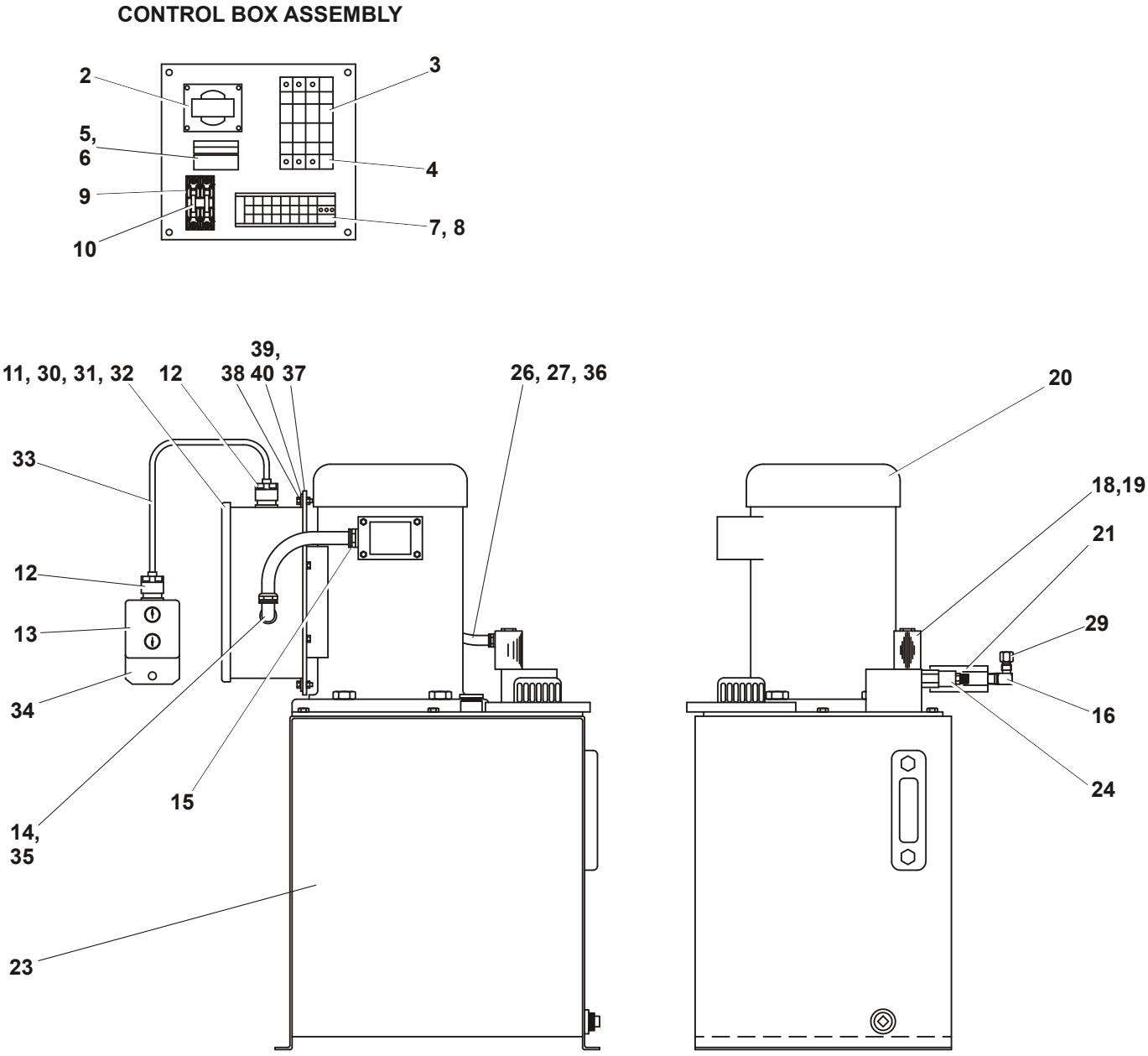


Figure 49 : Power Pack Assembly - 7.5 Horse Power

Power Packs - 7.5 Horse Power

Item	Qty	Part No	General Description	Specific Description
17**	**1**	**033-803**	**Powerpack 7.5HP 208-460/3/60**	**7.5HP/208-430/3Ø/60**
17**	**1**	**033-835**	**Powerpack, 7.5HP, 575/3/60**	**7.5HP/575V/3Ø/60 Hz**
18	1	033-798	Coil, Solenoid Valve	7.5HP/3Ø/50/60 HZ
19	1	033-800	Cartridge, Solenoid Valve	7.5HP/3Ø/50/60 HZ
20	1	031-552	Motor, 7.5HP 230-460/3/60	7.5HP 230/1Ø/60
20	1	031-553	Motor, 7.5HP 575/3/60	7.5HP 575/3Ø/60
21	1	033-839	Control, Press. Comp. Flow	7.5HP/3Ø/50/60 HZ
22	1	033-881	Pump (Not Shown)	7.5HP/3Ø/50/60 HZ
23	1	033-882	Reservoir, 10 Gallon	7.5HP/3Ø/50/60 HZ
24	1	033-808	Valve, Relief	7.5HP/3Ø/50/60 HZ
25	1	030-069	Grounding Strip	7.5HP/3Ø/50/60 HZ
26	1	025-009	Connector ST - 3/8"	7.5HP/3Ø/50/60 HZ
27	1	025-063	Connector LT	7.5HP/3Ø/50/60 HZ
28	1	550-129	Gasket, Oil	7.5HP/3Ø/50/60 HZ
29	1	034-602	Fitting, 2103-4-8	7.5HP/3Ø/50/60 HZ
30	4	010-072	Capscrew, Hex Hd. - 1/4-20 X 1/2"	7.5HP/3Ø/50/60 HZ
31	4	012-210	Washer, Flat 1/4" Bolt S	7.5HP/3Ø/50/60 HZ
32	4	012-202	Washer, Lock - 1/4" Helical	7.5HP/3Ø/50/60 HZ
33	4.3	090-581	Wire Per Metre	7.5HP/3Ø/50/60 HZ
34	1	110-287	Bracket, 2 Push Buttons	7.5HP/3Ø/50/60 HZ
35	1	090-053-0080	Conduit Assembly	7.5HP/3Ø/50/60 HZ
36	1	090-053-0110	Conduit Assembly	7.5HP/3Ø/50/60 HZ
37	1	305-0004	Plate, Control Box Mounting Plate	7.5HP/3Ø/50/60 HZ
38	4	010-036	Capscrew, Hex Hd. 5/16"-18 X 1/2"	7.5HP/3Ø/50/60 HZ
39	4	012-211	Washer, 5/16" Bolt Size Flat	7.5HP/3Ø/50/60 HZ
40	4	012-200	Washer, Lock Helical 5/16"	7.5HP/3Ø/50/60 HZ
41	2	025-136	Washer, Reducing 3/4"-1/2"	7.5HP/3Ø/50/60 HZ

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10.4 Parts Listings - Power Packs - 10 Horse Power

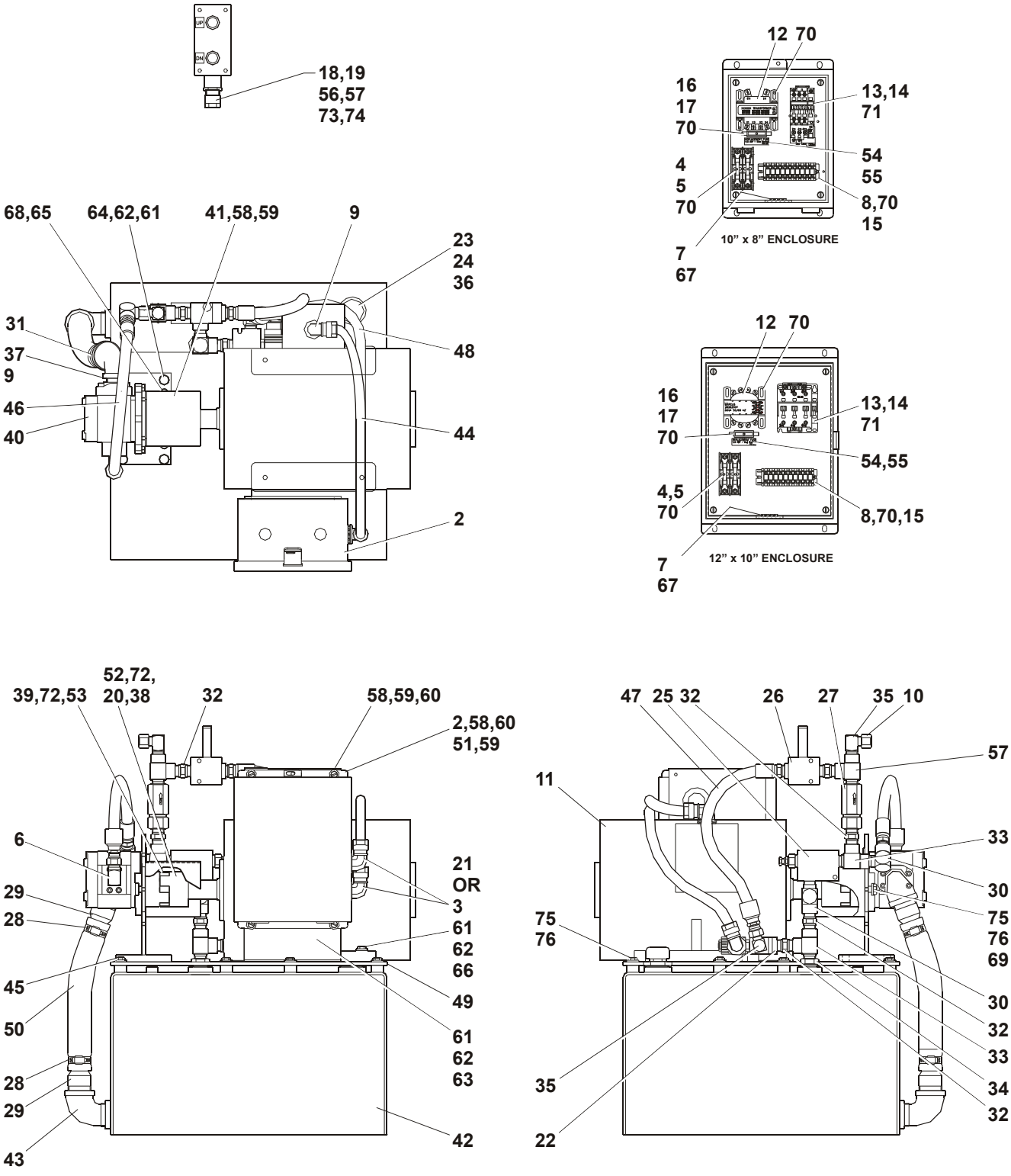


Figure 53 : Power Pack - 10 Horse Power

Power Pack - 10 Horse Power

Item	Qty	Part No	General Description	Specific Description
			Power Packs - 10 Horse Power	**10 Gallon Reservoir**
-	-	**815-P93-208-R**	**Module, Remote Power Pack**	**10HP 208V/3Ø/60-5G**
-	-	**815-P93-230-R**	**Module, Remote Power Pack**	**10HP 230V/3Ø/60-5G**
		815-P93-415-R	**Module, Remote Power Pack**	**10HP 415V/3Ø/60-5G**
-	-	**815-P93-460-R**	**Module, Remote Power Pack**	**10HP 460V/3Ø/60-5G**
-	-	**815-P93-575-R**	**Module, Remote Power Pack**	**10HP 575V/3Ø/60-5G**
-	-	**305-5005**	**Power Pack, Remote Ass'y**	**10HP-208V/3Ø/50/60HZ**
-	-	**305-5005-1**	**Power Pack, Remote Ass'y**	**10HP-230V/3Ø/50/60Hz**
-	-	**305-5005-2**	**Power Pack, Remote Ass'y**	**10HP-415V/3Ø/50/60Hz**
-	-	**305-5005-2**	**Power Pack, Remote Ass'y**	**10HP-460V/3Ø/50/60Hz**
-	-	**305-5005-3**	**Power Pack, Remote Ass'y**	**10HP-575V/3Ø/50/60Hz**
1*	**1**	**630-042-1**	**Kit, Pick - 10HP 208/3/60 Rem.**	**10HP/208/3Ø/60**
1*	**1**	**630-043-1**	**Kit, Pick - 10HP 230/3/60 Rem.**	**10HP/230/3Ø/60**
1*	**1**	**630-090**	**Kit, Pick - 10HP 415/3/60 Rem.**	**10HP/415/3Ø/60**
1*	**1**	**630-035-1**	**Kit, Pick - 10HP 460/3/60 Rem.**	**10HP/460/3Ø/60**
1*	**1**	**630-036-1**	**Kit, Pick - 10HP 575/3/60 Rem.**	**10HP/575/3Ø/60**
2	1	025-068	Enclosure, Control Box	10HP/208,230/3Ø/60
2	1	110-831	Enclosure, Control Box	10HP/415-575/3Ø/60
3	1	025-012	Connector, 1/2"-90°LT Conduit	10HP/230/3Ø/60
4	1	026-228	Fuseholder,600 V, 30 Amp	10HP/415/3Ø/60
5	1	026-158	Fuse, Fiber - 13/32"X1-1/2"-1/2A	10HP/208-230/3Ø/60
5	1	026-233	Fuse 2/10 600V	10HP/415-575/3Ø/60
6	1	034-618	Fitting, 2103-12-8	10HP/575/3Ø/60
7	1	030-069	Grounding Strip	10HP/3Ø/50/60
8	1	030-842	Terminal Block	10HP/208-230V/3Ø Only
9	1	035-090	Reducer. Hex 1" Mx3/4" F	10HP/415-575V/50/60 HZ
10	1	035-251	Cap	10HP/415-575V/50/60 HZ
11	1	031-032	Motor AC 208-460/3Ø 60Hz 10HP	10HP/3Ø/50/60 HZ
11	1	031-028	Motor, 10HP 575/3Ø/60	10HP/575V/3Ø/60 HZ
12	1	026-306	Transformer, PRI 208/416,120S50VA	10HP/208V/3Ø/50/60 HZ
12	1	026-302	Transformer, PRI 240/480,	10HP/230V/3Ø/50/60 HZ
12	1	026-306	Transformer, PRI 208/416,120S50VA	10HP/415V/3Ø/50/60 HZ
12	1	026-302	Transformer, PRI 240/480	10HP/460V/3Ø/50/60 HZ
12	1	026-300	Transformer, 50VA 600V -120V60Hz	10HP/575V/3Ø/60 HZ
13	1	025-928	Contactor 32 Amp	10HP/208-230V/3Ø/60 HZ
13	1	025-926	Contactor (CI-25)	10HP/415V/3Ø/50/60 HZ
13	1	025-928	Contactor 32 Amp	10HP/460V/3Ø/60 HZ
13	1	025-924	Contactor, Motor - 12A (CI12)	10HP/575V/3Ø/60 HZ
14	1	026-169	Relay,Overload 22-32 Amps	10HP/208-230/3Ø/50/60 HZ
14	1	026-118	Relay,Overload 11-16 Amps	10HP/415/3Ø/50/60 HZ
14	1	026-169	Relay,Overload 22-32 Amps	10HP/460/3Ø/50/60 HZ
14	1	026-117	Relay,Overload 8-12 Amps	10HP/575V/3Ø/60 HZ
15	1	030-843	Terminal Block End Section	10HP/3Ø/50/60 HZ

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Parts Listings - Power Packs - 10 Horse Power

Item	Qty	Part No	General Description	Specific Description
16	1	026-227	Fuseholder, Single 250 Volt	10HP/208-230V/3Ø/60 Hz
17	2	026-147	Fuse, Primary-.5 Amp .25"X1.25"	10HP/415V/3Ø/60 Hz
18	2	025-015	Connector-Cable Fitting	10HP/460,575V/3Ø/60 Hz
19	6	025-692	Push Button Station-Nema 4X	10HP/3Ø/50/60 HZ
20	6	023-311	Coupling, Rubber Insert	10HP/3Ø/50/60 HZ
21	4	025-010	Connector Lt, 3/8-90°	10HP/3Ø/50/60 HZ
22	11	033-597	Valve, Solenoid	10HP/208V/3Ø/60-5G
23	11	035-238	Breather Cap (3/4")	10HP/208V/3Ø/60-5G
24	3	035-062	Plug Cored Black 3/4" Pipe	10HP/3Ø/50/60 HZ
25	4	033-587	Valve, Relief	10HP/208-430/3Ø/60
26	4	033-501	Valve, Load Lowering Control	10HP/575V/3Ø/60 Hz
27	4	033-523	Valve, Check	10HP/3Ø/50/60 HZ
28	2	035-207	Clamp, Hose, 1-1/8"-2-1/16"	10HP/3Ø/50/60 HZ
29	4	034-036	Fitting	10HP/3Ø/50/60 HZ
30	4	034-570	Fitting, 2102-8-8	10HP/3Ø/50/60 HZ
31	7	035-054	Fitting, 90° F Elbow 1-1/4"-3/4"	10HP/3Ø/50/60 HZ
32	2	034-561	Fitting, 0101-8-8	10HP/3Ø/50/60 HZ
33	2	034-575	Adapter	10HP/3Ø/50/60 HZ
34	1	034-558	Reducer, 0102-12-8	10HP/3Ø/50/60 HZ
35	1	034-541	Adapter Fitting, 2103-8-8	10HP/3Ø/50/60 HZ
36	9	035-063	Reducer 1-1/4" M-3/4"F Pipe	10HP/3Ø/50/60 HZ
37	9	035-055	Nipple 3/4" Closed	10HP/3Ø/50/60 HZ
38	1	023-309	Coupling HB, 1-3/8" Bore	10HP/3Ø/50/60 HZ
39	1	111-895	Pump Shaft Coupling (023-325)	10HP/3Ø/50/60 HZ
40	1	033-085	Pump , 1"Suction, 3/4"Pressure	10HP/3Ø/50/60 HZ
41	1	796-967	Coupling Shield Assembly	10HP/3Ø/50/60 HZ
42	1	792-473	Reservoir Ass'y (20x20x11-3/4)	10HP/3Ø/50/60 HZ
43	1	797-208	Filter, Suction Ass'y	10HP/3Ø/50/60 HZ
44	1	090-054-0170	Conduit (17"LG) 1/2"LT Sealtite Flex	10HP/3Ø/50/60 HZ
45	1	797-238	Pump Mounting Ass'y 7.5/10 HP	10HP/3Ø/50/60 HZ
46	1	792-654	Hose Ass'y #8 HP-Strght 14"Lg	10HP/3Ø/50/60 HZ
47	1	792-655	Hose Ass'y #8 HP-Strght 16"Lg	10HP/3Ø/50/60 HZ
48	1	090-053-0244	Conduit (24-1/2"LG) - 3/8" Polytuff Gray	10HP/3Ø/50/60 HZ
49	1	106-808	Mounting Plate (20"X15")	10HP/3Ø/50/60 HZ
50	1	104-589	Hose 11.5"LG.	10HP/3Ø/50/60 HZ
51	1	104-997	Mounting Bracket	10HP/208,230V/3Ø/60-5G
51		104-597	Mounting Bracket	10HP/415-575V/3Ø/60Hz
52	1	021-024	Key Input Shaft Ext. - 1/4"X 3/4"	10HP/3Ø/50/60 HZ
53	1	104-355	Key Motor Shaft - 3/16"X 1"	10HP/3Ø/50/60 HZ
54	1	110-282	Self-Adhesive Sticker	10HP/3Ø/50/60 HZ
55	1	110-903	Fuse Sticker	10HP/3Ø/50/60 HZ
56	2	011-005	Screw, Mach. R/H Slot 8-32" X 1/2"	10HP/3Ø/50/60 HZ
57	2	012-224	Washer, Lock - #8 Int. Tooth	10HP/3Ø/50/60 HZ
58	6	012-202	Washer, Lock - 1/4" Helical	10HP/3Ø/50/60 HZ
59	6	010-072	Capscrew, Hex Hd.-1/4"-20 X 1/2"	10HP/3Ø/50/60 HZ
60	4	012-210	Washer, Flat -1/4" Bolt S	10HP/3Ø/50/60 HZ
61	11	012-200	Washer, Lock Helical-5/16"	10HP/3Ø/50/60 HZ
62	11	012-211	Washer, Flat -5/16" Bolt Size	10HP/3Ø/50/60 HZ
63	3	010-036	Capscrew, Hex Hd.-5/16-18 X 1/2"	10HP/3Ø/50/60 HZ
64	4	010-006	Capscrew, Hex Hd.-5/16-18 X 1"	10HP/3Ø/50/60 HZ
65	4	010-008	Capscrew, Hex Hd.-5/16-18 X 1 1/2"	10HP/3Ø/50/60 HZ
66	4	010-037	Capscrew, Hex Hd -5/16-18 X 3/4"	10HP/3Ø/50/60 HZ
67	2	011-098	Screw, Mach. R/H Slot -1/4"-28 X 5/8"	10HP/3Ø/50/60 HZ
68	4	011-502	Nut, Hex -5/16"-18	10HP/3Ø/50/60 HZ

Parts Listings - Power Packs - 10 Horse Power

Item	Qty	Part No	General Description	Specific Description
69	4	012-252	Washer,Flat - 3/8"ID Bs	10HP/3Ø/50/60 HZ
70	7	014-056	Screw, Self Tap -#8x1/2"	10HP/3Ø/50/60 HZ
71	2	014-057	Screw, Self Tap -#8 X 3/4"	10HP/3Ø/50/60 HZ
72	2	014-002	Screw, Set -1/4"X 3/8"	10HP/3Ø/50/60 HZ
73	1	090-581-1680	Wire Per Metre (168"Lg)	10HP/3Ø/50/60 HZ
74	1	110-287	Bracket, 2 Push Buttons 6"Lg	10HP/3Ø/50/60 HZ
75	9	010-012	Capscrew, Hex Hd. 3/8-16 X 3/4"	10HP/3Ø/50/60 HZ
76	9	012-201	Washer, Lock -3/8"Dia.Helical	10HP/3Ø/50/60 HZ

11. Parts Listings - Semi-Portable Elevating Docks

11.1 General Assembly - 4, 5, & 6,000 lb. Cap. - 96" Deck Length

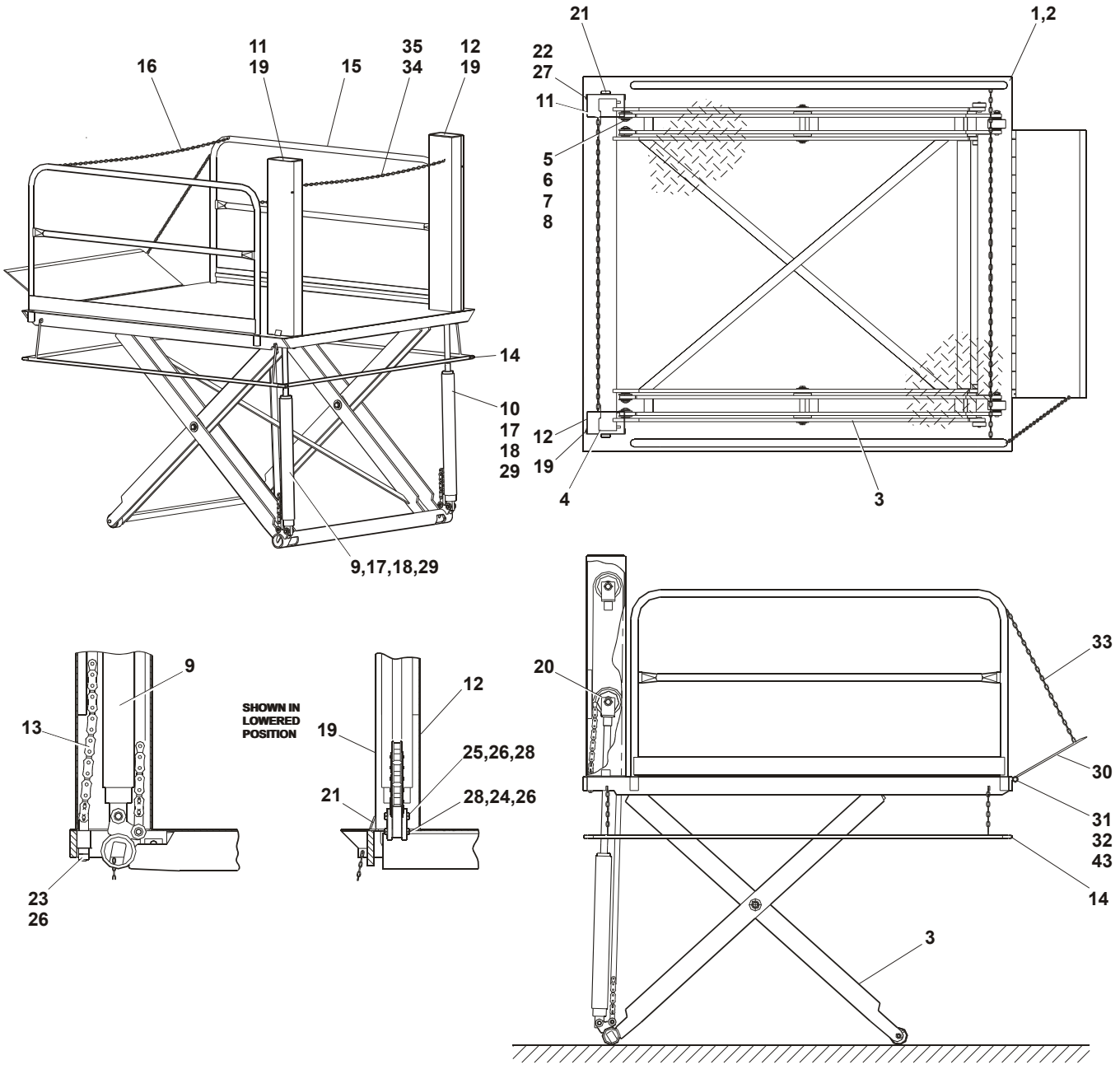


Figure 54 : General Assembly - 4, 5, & 6,000 lb. - 96" Deck Length

General Assembly - 4, 5, & 6,000 lb. Cap. - 96" Deck Length

Item	Qty	Part No	General Description	Specific Description
			Semi-Portable Elevating Dock	**REF DWG. 796-735**
1	**1**	**796-727**	**Deck & Leg Ass'y (72"X96")**	**4,000/72X96"**
1	**1**	**796-746**	**Deck & Leg Ass'y (72"X96")**	**5,000/72X96"**
1*	**1**	**796-746-1**	**Deck & Leg Ass'y (72"X96")**	**6,000/72X96"**
2	1	796-729	Deck Assembly (72"X96")	4,&5,000/72X96"
2	1	796-729-1	Deck Assembly (6s/72"X96")	6,000/72X96"
3**	**2**	**796-292**	**Leg Assembly (85-3/4"X4")**	**4,000/72X96"**
3**	**2**	**796-718**	**Leg Assembly (85-3/4"X4-1/2")**	**5,&6,000/72X96"**
4	1	796-781	Torque Bar Ass'y (62-1/2")	4,5,&6,000/72X96"
5	4	797-445	Pin Weldment (2-1/8"Lg)	4,5,&6,000/72X96"
6	4	013-011	Spring Pin 1/4 X 1-3/8	4,5,&6,000/72X96"
6	4	013-012	Spring Pin 1/4" X 2"	4,5,&6,000/72X96"
7	12	012-214	Washer, Flat Plain - 3/4" BS	4,5,&6,000/72X96"
8	4	018-001	Bushing - 3/4" Lg	4,5,&6,000/72X96"
9**	**1**	**786-720**	**Cylinder Ass'y (Left) [2-1/2"Dia]**	**4,&5,000/72X96**
9**	**1**	**786-657**	**Cylinder Ass'y (Left) [3"Dia]**	**6,000/72X96"**
10**	**1**	**786-721**	**Cylinder Ass'y (Right)[2-1/2"Dia]**	**4,&5,000/72X96**
10*	**1**	**786-658**	**Cylinder Ass'y (Right)[3"Dia]**	**6,000/72X96"**
11	1	797-267	Post, Cylinder Weld (Left)	4,5,&6,000/72X96"
12	1	797-248	Post, Cylinder Weld (Right)	4,5,&6,000/72X96"
13	2	796-946	Chain Assembly (93-3/4"Lg)	4,5,&6,000/72X96"
14	1	302-5000-7296	Bar, Safety Indicator	4,5,&6,000/72X96"
15	1	312-5080-4	Guard Rail, Right Side 96"Deck	4,5,&6,000/72X96"
16	1	312-5081-4	Guard Rail, Left Side 96"Deck	4,5,&6,000/72X96"
17	2	034-599	Fitting Elbow Forged #6MP-4MP-90	4,5,&6,000/72X96"
18	2	033-661	Velocity Fuse - 5 GPM	4,5,&6,000/72X96"
19	2	103-806	Cover, Post (49-1/2"X8-5/8"ID)	4,5,&6,000/72X96"
20**	**2**	**797-459**	**Crosshead Assembly (3"X3")**	**4,5,&6,000/72X96"**
21	2	103-744	Spacer	4,5,&6,000/72X96"
22	4	012-202	Washer, Lock - 1/4" Helical	4,5,&6,000/72X96"
23	2	011-535	Nut, Hex - 3/4"-10 Nylon Insert	4,5,&6,000/72X96"
24	2	103-214	Pin, Chain Link Block	4,5,&6,000/72X96"
25	2	103-215	Pin, Cylinder Pivot	4,5,&6,000/72X96"
26	10	105-879	Washer - 3/4" X 1-3/16" X 1/16"	4,5,&6,000/72X96"
27	4	010-072	Capscrew, Hex Hd. - 1/4-20 X 1/2"	4,5,&6,000/72X96"
28	8	013-024	Cotter Pin-5/32" X 1-1/4"	4,5,&6,000/72X96"
29	2	034-044	Fitting, 6-6	4,5,&6,000/72X96"
30	1	302-5002	Lip Assy,60"(18"Lg,4&5#)1pc Lp	4,&5,000/72X96"
30	1	302-5002-7	Lip Assy,60"(18"Lg,4&5#)1pc Lp	6,000/72X96"
31	1	121-616-1	Bar For Lip Hinge (60"Lg)	4,&5,000/72X96"
31	1	106-205	Bar For Lip Hinge (60"Lg)	6,000/72X96"
32	1	013-005	Spring Pin 5/32"X1"Lg	4,&5,000/72X96"
32	1	013-008	Spring Pin 3/16"X2"Lg	6,000/72X96"
33	1	091-023-0600	Chain (60"Lg) 3/16"	4,&5,000/72X96"
34	1	091-023-0660	Chain (3/16"Galvanized) (66"Lg)	4,000/72X96"
34	2	091-036-0580	Chain (1/8"Galvanized) (58"Lg)	5,&6,000/72X96"
35	2	R3-19203	Hook Snap 4"Lg *(Not Shown)*	4,5,&6,000/72X96"
36	1	797-640	Cradle Plate Assy R.H, *(Not Shown)*	4,5,&6,000/72X96"
37	1	796-926	Cradle Plate Assy L.H. (Ed) *(Not Shown)*	4,5,&6,000/72X96"
38	2	105-487	Wear Plate *(Not Shown)*	4,5,&6,000/72X96"
39	1	797-125	Hose Ass'y #6 Hose (12"Lg) *(Not Shown)*	4,5,&6,000/72X96"
40	1	320-5002	Hose Assy, #6 HP 43"Lg (Str.- 45°) *(Not Shown)*	4,5,&6,000/72X96"
41	1	300-5000-38	Hose, #6 Hp(144"Lg) Str. Swivel(2) *(Not Shown)*	4,5,&6,000/72X96"
42	2GA	039-066	Paint, Blue (Fast Dry Enamel) *(Not Shown)*	4,5,&6,000/72X96"
43	2	120-353	Spring, Torsion	4,5,&6,000/72X96"

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11.1.1 Leg Assembly - 4, 5, & 6,000 lb. Cap. - 72x96" Deck

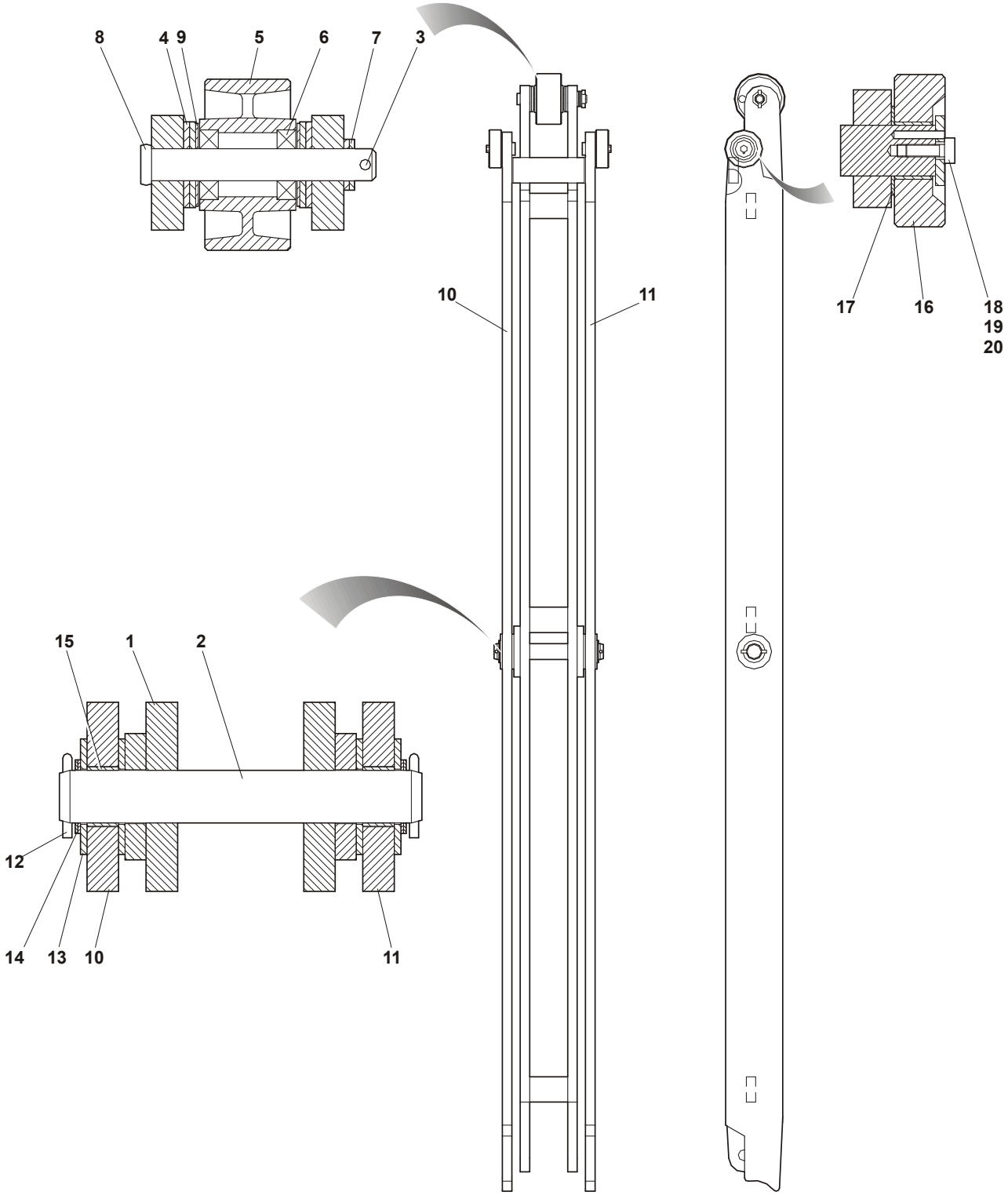


Figure 55 : Leg Assembly - 4, 5, & 6,000 lb. Cap. - 72x96" Deck Length

Leg Assembly - 4, 5, & 6,000 lb. Cap. - 72x96" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	**-**	**796-292**	**Leg Assembly (85-3/4"X4")**	**4,000/72X96"**
-	**-**	**796-718**	**Leg Assembly (85-3/4"X4-1/2")**	**5,&6,000/72X96"**
1*	**1**	**796-291**	**Leg Assy, Inner 85-3/4"X4-1/2"**	**4,000/72X96"**
1*	**1**	**796-719**	**Leg Assy, Inner 85-3/4"X4-1/2"**	**5,&6,000/72X96"**
2	1	103-935	Pin, Centre (8-5/8"X1-1/4"Dia)	4,5,&6,000/72X96"
3	1	013-011	Spring Pin 1/4" X 1-3/8"	4,5,&6,000/72X96"
4	4	012-214	Washer, Flat - 3/4" BS	4,5,&6,000/72X96"
5	1	100-103	Wheel Cast Steel (4"X2")	4,5,&6,000/72X96"
6	2	018-500	Bearing, 3/4"X1-5/8"X7/16"	4,5,&6,000/72X96"
7	2	105-880	Washer Spacer- 3/4"x1-3/16"x1/8"	4,5,&6,000/72X96"
8	1	106-170	Axle, Load Roller (5-1/4"Lg)	4,5,&6,000/72X96"
9	2	105-879	Washer, 3/4" X 1-3/16" X 1/16"	4,5,&6,000/72X96"
10	1	796-290	Leg Assy, Left (82-3/4"X4")	4,000/72X96"
10	1	796-720	Leg Assy, Left (82-3/4"X4-1/2")	5,&6,000/72X96"
11	1	796-289	Leg Ass'y, Right (82-3/4"X4")	4,000/72X96"
11	1	796-721	Leg Ass'y, Right (82-3/4"X4-1/2")	5,&6,000/72X96"
12	2	013-082	Cotter Pin 1/4" X 2"	4,5,&6,000/72X96"
13	4	012-216	Washer, Flat Plain 1-5/16" Bolt Size	4,5,&6,000/72X96"
14	4	105-882	Washer, Spacer (1-3/4" Dia)	4,5,&6,000/72X96"
15	2	018-025	Bushing 1-1/4" X 3/4lg	4,5,&6,000/72X96"
16	2	105-225	Roller C/W Bushing 018-051	4,5,&6,000/72X96"
17	2	106-389	Washer, 1-3/4"ODx1"IDx 1/16"Thk	4,5,&6,000/72X96"
18	2	107-038	Washer	4,5,&6,000/72X96"
19	2	010-037	Capscrew, Hex Hd. 5/16"-18 X 3/4"	4,5,&6,000/72X96"
20	2	013-005	Spring Pin 5/32"X1"Lg	4,5,&6,000/72X96"

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11.1.2 Cylinder Assembly - 4, 5, & 6,000 lb. Cap. - 72x96" Deck Length

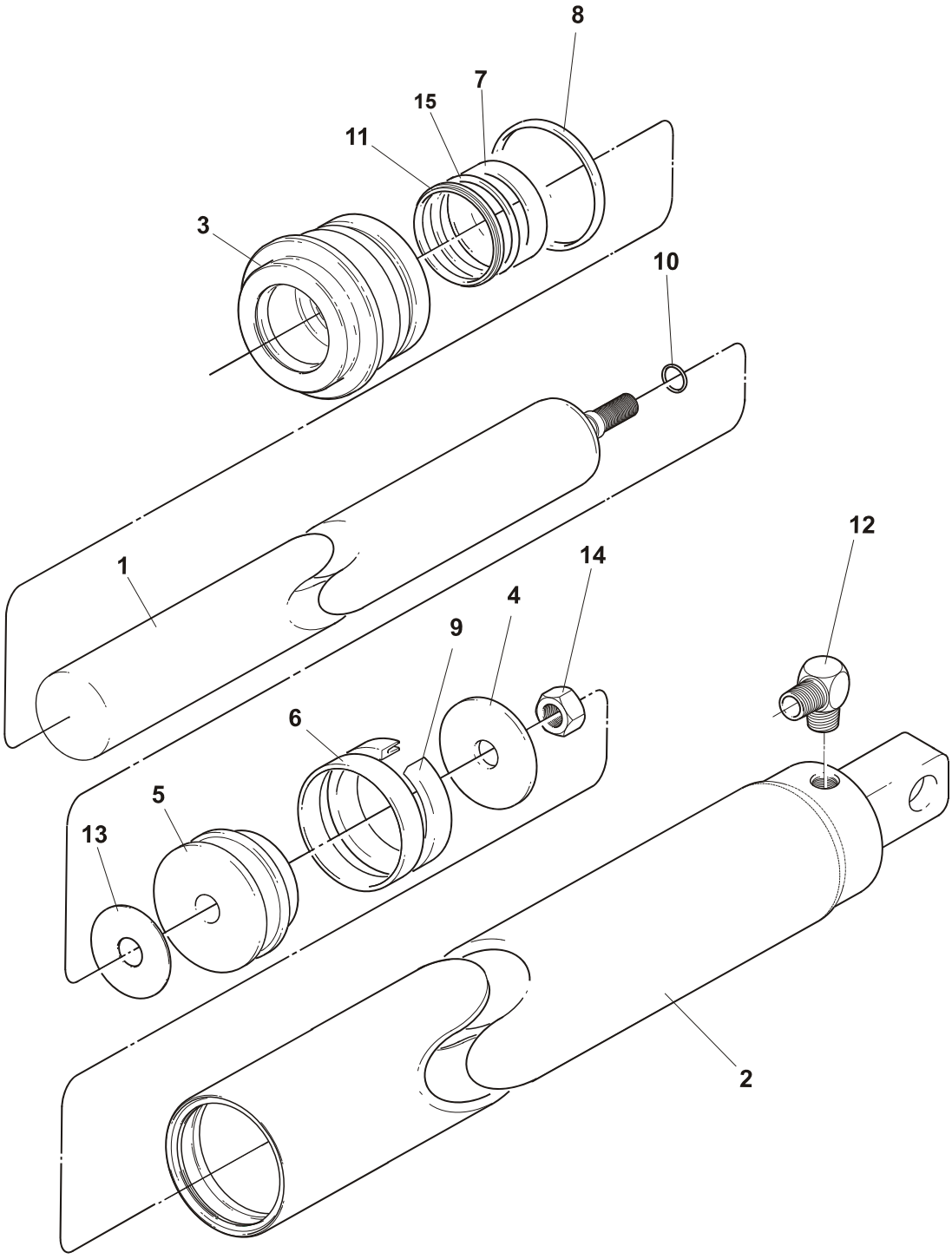


Figure 56 : Cylinder Assembly - 4, 5, & 6,000 lb. Cap. - 96" Deck Length

Cylinder Assembly - 4, 5, & 6,000 lb. Cap. - 72x96" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	**-**	**786-720**	**Cylinder Ass'y (Left) [2-1/2"Dia]**	**4,&5,000/72X96"**
-	**-**	**786-657**	**Cylinder Ass'y (Left) [3"Dia]**	**6,000/72X96"**
-	**-**	**786-721**	**Cylinder Ass'y (Right)[2-1/2"Dia]**	**4,&5,000/72X96"**
-	**-**	**786-658**	**Cylinder Ass'y (Right)[3"Dia]**	**6,000/72X96"**
1	1	118-386	Ram - Semi Portable Table	4,5,&6,000/72X96"
2	1	783-539	Housing Weldment (Left) [2-1/2"Dia]	4,&5,000/72X96"
2	1	783-533	Housing Weldment (Right) [2-1/2"Dia]	4,&5,000/72X96"
2	1	783-537	Housing Weldment (Left) [3"Dia]	6,000/72X96"
2	1	783-532	Housing Weldment (Right) [3"Dia]	6,000/72X96"
3	1	118-387	Headnut, 2-1/2" Dia Cyl (1-1/2" Dia Rd)	4,&5,000/72X96"
3	1	118-389	Headnut, 3" Dia Cyl (1-1/2" Dia Rd)	6,000/72X96"
4	1	114-977	Washer, Piston (2-1/2" Dia)	4,&5,000/72X96"
4	1	114-978	Washer, Piston (3" Dia)	6,000/72X96"
5	1	113-522	Piston Use 113-629 Washer 2-1/2" Dia	4,&5,000/72X96"
5	1	114-640	Piston 3" Dia Cyl.	6,000/72X96"
6●	1	036-153	Wear Ring - 2-1/2" Wide Piston	4,&5,000/72X96"
6●	1	036-154	Wear Ring - 3" Wide Piston	6,000/72X96"
7●	1	036-143	Rod Wear Ring	4,5,&6,000/72X96"
8●	1	036-133	O-Ring, 2-1/2"ODx2-1/4"ID	4,&5,000/72X96"
8●	1	036-132	O-Ring, 3"ODx2-1/4"ID	6,000/72X96"
9●	1	036-119	U-Cup, Seal 1.875" X 2.5" X .5"	4,&5,000/72X96"
9●	1	036-112	U-Cup, Seal - 3" X 2-3/8" X 1/2"	6,000/72X96"
10●	1	036-108	O-Ring, 3/4"OD X 5/8"ID X 1/16"	4,5,&6,000/72X96"
11●	1	036-098	Wiper, 1-3/4ODx1-1/2	4,5,&6,000/72X96"
12	1	034-500	Fitting, 2103-6-6	4,5,&6,000/72X96"
13●	1	118-368	Gasket, 2" Dia Cyl	4,&5,000/72X96"
13●	1	117-993	Gasket	6,000/72X96"
14	1	011-530	Nut, Hex Jam, 3/4"-10	4,5,&6,000/72X96"
15●	1	036-180	O-Ring (Reciprocating)	4,5,&6,000/72X96"
-	**-**	**783-536**	**Kit, Seal - Includes Items marked (●)**	**4,&5,000/72X96"**
-	**-**	**783-538**	**Kit, Seal - Includes Items marked (●)**	**6,000/72X96"**

11.1.3 Crosshead Assembly - 4, 5, & 6,000 lb. Cap. - 72x96" Deck Length

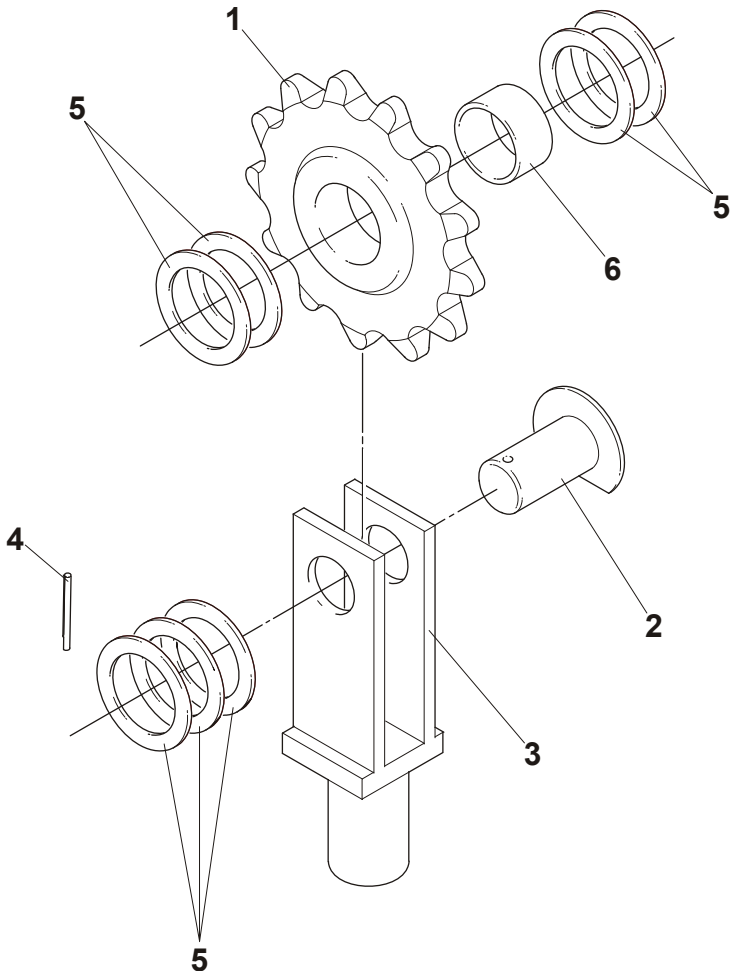


Figure 57 : Crosshead Assembly - 4, & 5,000 lb. Cap. - 72x96" Deck Length

Crosshead Assembly - 4, 5, & 6,000 lb. Cap. - 72x96" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	**-**	**797-459**	**Crosshead Assembly (3"X3")**	**4,5,&6,000/72X96"**
1	1	105-645	Sprocket (Ramtop) Assembly	4,5,&6,000/72X96"
2	1	797-451	Pin Assembly (3"X1-1/4")	4,5,&6,000/72X96"
3	1	797-504	Crosshead Weldment (1-1/2"Ram)	4,5,&6,000/72X96"
4	1	013-012	Spring Pin - 1/4" X 2"	4,5,&6,000/72X96"
5	8	105-882	Washer-Spacer - (1-3/4" Dia)	4,5,&6,000/72X96"
6	1	018-027	Bushing	4,5,&6,000/72X96"

11.2 General Assembly - 4, & 5,000 lb. Cap. - 72x120" Deck Length

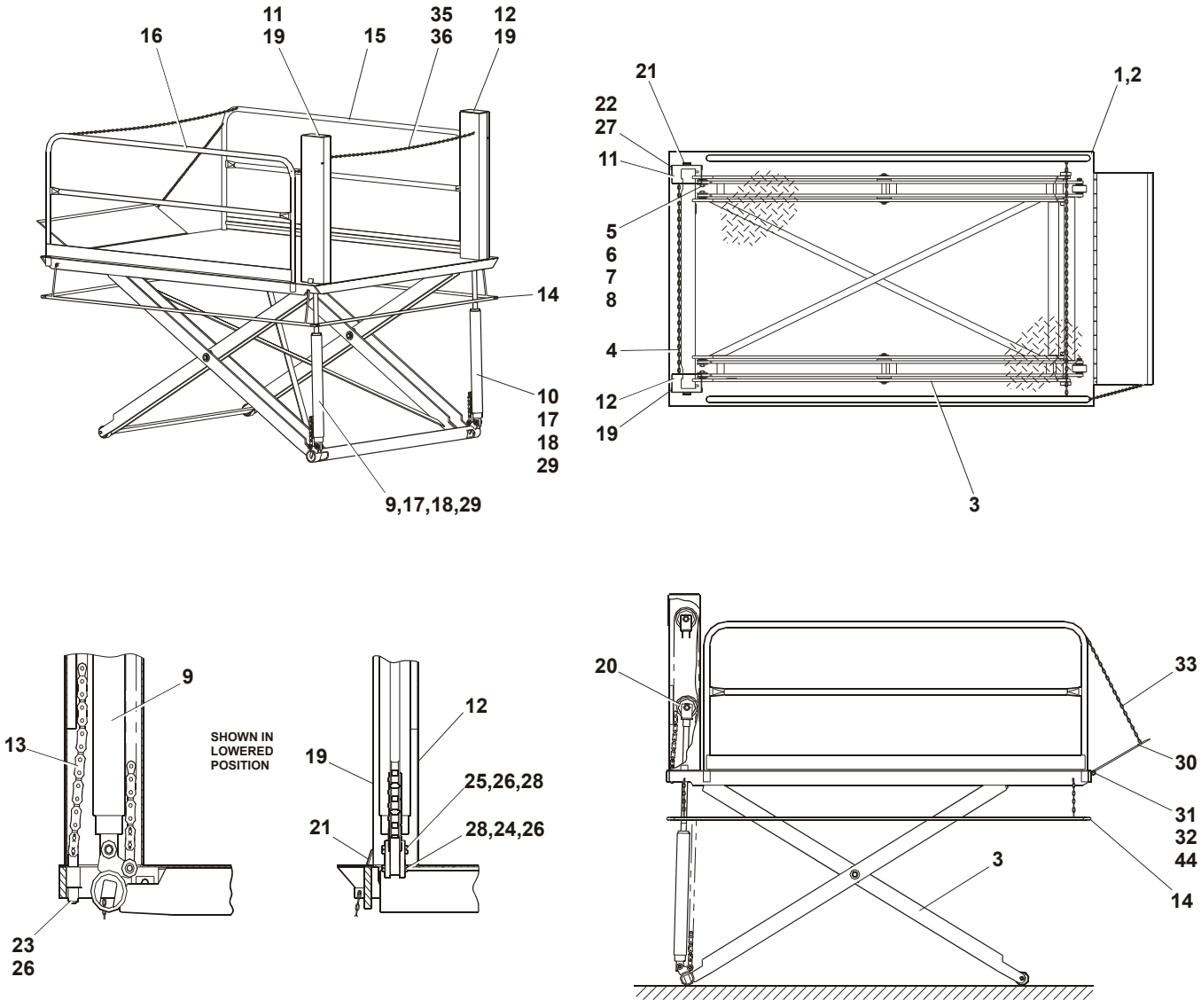


Figure 58 : General Assembly - 4, & 5,000 lb. - 72x120" Deck Length

Item	Qty	Part No	General Description	Specific Description
			Semi-Portable Elevating Dock	**REF. DWG. - 796-086**
1*	**1**	**796-090**	**Deck & Leg Ass'y (72"X120")**	**4,000/72X120"**
1*	**1**	**796-089**	**Deck & Leg Ass'y (72"X120")**	**5,000/72X120"**
2	1	796-091	Deck Assembly (72"X120")	4,& 5,000/72X120"
3**	**2**	**796-114**	**Leg Assembly (109-3/4"X4-1/2")**	**4,000/72X120"**
3**	**2**	**796-111**	**Leg Assembly (109-3/4"X4-1/2")**	**5,000/72X120"**
4	1	796-781	Torque Bar Ass'y (62-1/2")	4,& 5,000/72X120"
5	4	797-445	Pin Weldment (2-1/8"Lg)	4,& 5,000/72X120"
6	4	013-012	Spring Pin 1/4" X 2"	4,& 5,000/72X120"
7	12	012-214	Washer, Flat Plain - 3/4" Bs	4,& 5,000/72X120"
8	4	018-001	Bushing - 3/4" Lg	4,000/72X120"
8	4	018-010	Bushing - 1" Lg	5,000/72X120"
9**	**1**	**786-720**	**Cylinder Ass'y (Left) [2-1/2"Dia]**	4,& 5,000/72X120"
10**	**1**	**786-721**	**Cylinder Ass'y (Right)[2-1/2"Dia]**	4,& 5,000/72X120"
11	1	797-267	Post, Cylinder Weld (Left)	4,& 5,000/72X120"
12	1	797-248	Post, Cylinder Weld (Right)	4,& 5,000/72X120"
13	2	794-833	Chain Assembly (93-3/4"Lg)	4,& 5,000/72X120"
14	1	302-5000-72120	Bar, Safety Indicator	4,& 5,000/72X120"
15	1	312-5080-6	Guard Rail, Right Side 120"Deck	4,& 5,000/72X120"
16	1	312-5081-6	Guard Rail, Left Side 120"Deck	4,& 5,000/72X120"
17	2	034-599	Fitting Elbow Forged #6MP-4MP-90	4,& 5,000/72X120"
18	2	033-661	Velocity Fuse - 5 Gpm	4,& 5,000/72X120"
19	2	103-806	Cover, Post (49-1/2"X8-5/8"Id)	4,& 5,000/72X120"
20**	**2**	**797-459**	**Crosshead Assembly (3"X3")**	4,& 5,000/72X120"
21	2	103-744	Spacer	4,& 5,000/72X120"
22	4	012-202	Washer, Lock - 1/4" Helical	4,& 5,000/72X120"
23	2	011-535	Nut, Hex - 3/4"-10 Nylon Insert	4,& 5,000/72X120"
24	2	103-214	Pin, Chain Link Block	4,& 5,000/72X120"
25	2	103-215	Pin, Cylinder Pivot	4,& 5,000/72X120"
26	10	105-879	Washer - 3/4" X 1-3/16" X 1/16"	4,& 5,000/72X120"
27	4	010-072	Capscrew, Hex Hd. - 1/4-20 X 1/2"	4,& 5,000/72X120"
28	8	013-024	Cotter Pin-5/32" X 1-1/4"	4,& 5,000/72X120"
29	2	034-044	Fitting, 6-6	4,& 5,000/72X120"
30	1	302-5002	Lip Assy,60"(18"Lg,4&5#)1pc Lp	4,& 5,000/72X120"
31	1	121-616-1	Bar For Lip Hinge (60"Lg)	4,& 5,000/72X120"
32	1	013-005	Spring Pin 5/32"X1"Lg	4,& 5,000/72X120"
33	1	013-008	Spring Pin 3/16"X2"Lg	4,& 5,000/72X120"
34	1	091-023-0600	Chain (60"Lg) 3/16"	4,& 5,000/72X120"
35	1	091-023-0660	Chain (3/16"Galvanized) (66"Lg)	4,000/72X120"
35	2	091-036-0580	Chain (1/8"Galvanized) (58"Lg)	5,000/72X120"
36	2	R3-19203	Hook Snap 4"Lg	4,& 5,000/72X120"
37	1	797-640	Cradle Plate Assy R.H,	4,& 5,000/72X120"
38	1	796-926	Cradle Plate Assy L.H. (Ed)	4,& 5,000/72X120"
39	2	105-487	Wear Plate	4,& 5,000/72X120"
40	1	797-125	Hose Ass'y #6 Hose (12"Lg)	4,& 5,000/72X120"
41	1	320-5002	Hose Assy, #6 Hp 43"Lg (Str.- 45°)	4,& 5,000/72X120"
42	1	300-5000-38	Hose, #6 Hp(144"Lg) Str. Swivel(2)	4,& 5,000/72X120"
43	2GA	039-066	Paint, Blue (Fast Dry Enamel)	4,& 5,000/72X120"
44	2	120-353	Spring, Torsion	4,& 5,000/72X120"

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11.2.1 Leg Assembly - 4, & 5,000 lb. Cap. - 72x120" Deck

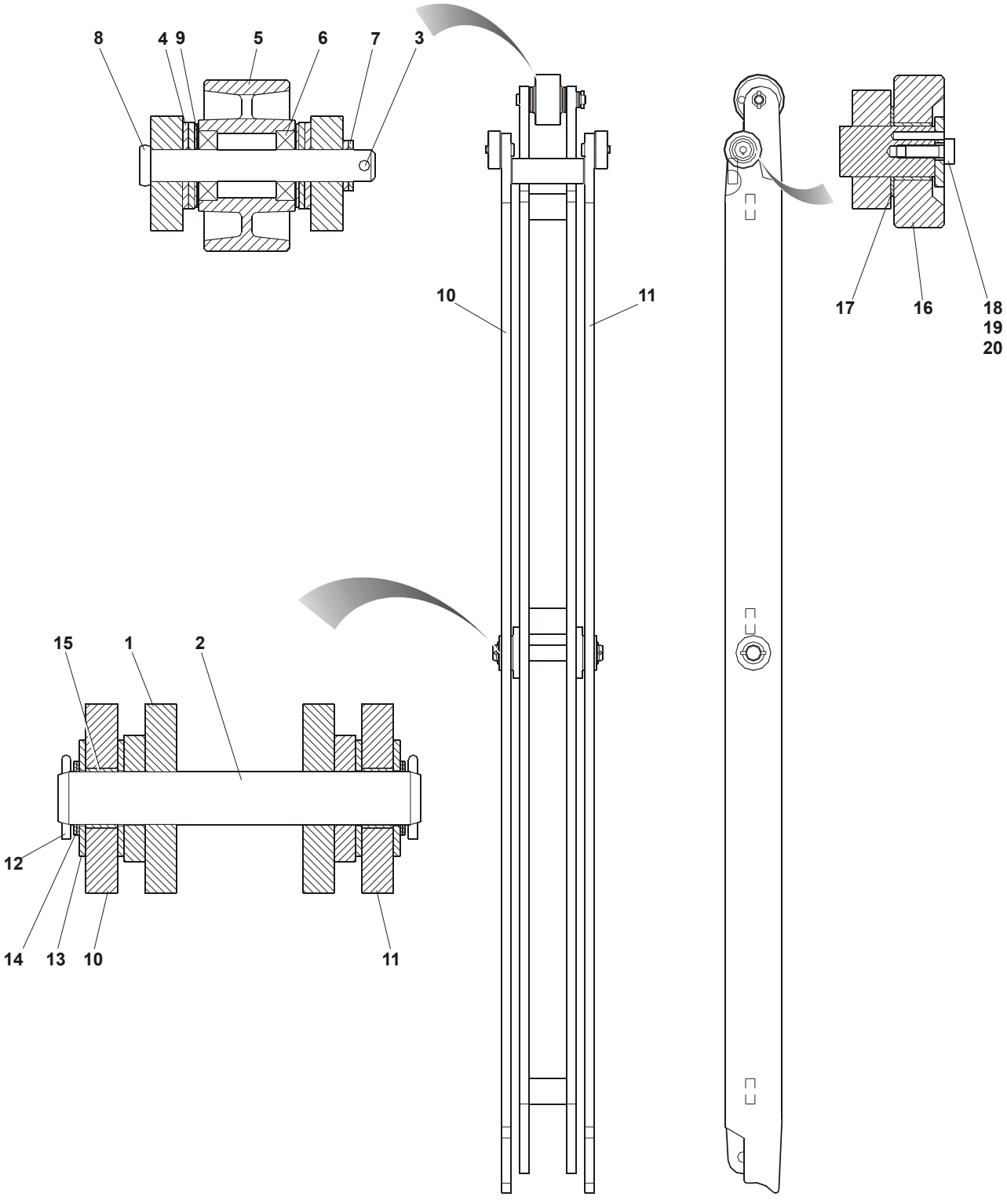


Figure 59 : Leg Assembly - 4, & 5,000 lb. Cap. - 72x120" Deck Length

Item	Qty	Part No	General Description	Specific Description
-	**-**	**796-114**	**Leg Assembly (109-3/4"X4-1/2")**	**4,000/72X120"**
-	**-**	**796-111**	**Leg Assembly (109-3/4"X5")**	**5,000/72X120"**
1*	1	**796-106**	**Leg Assy, Inner 109-3/4"X4-1/2"**	**4,000/72X120"**
1*	1	**796-105**	**Leg Assy, Inner 109-3/4"X5"**	**5,000/72X120"**
2	1	103-935	Pin, Centre (8-5/8"X1-1/4"Dia)	4,000/72X120"
2	1	103-934	Pin, Centre 1" THK. Legs	5,000/72X120"
3	1	013-011	Spring Pin 1/4" X 1-3/8"	4,& 5,000/72X120"
4	4	012-214	Washer, Flat - 3/4" Bs	4,& 5,000/72X120"
5	1	100-103	Wheel Cast Steel (4"X2")	4,& 5,000/72X120"
6	2	018-500	Bearing, 3/4"X1-5/8"X7/16"	4,& 5,000/72X120"
7	2	105-880	Washer Spacer- 3/4"x1-3/16"x1/8"	4,& 5,000/72X120"
8	1	106-170	Axle, Load Roller (5-1/4"Lg)	4,000/72X120"
8	1	313-0015	Axle, Load Roller (5-3/4"x3/4")	5,000/72X120"
9	2	105-879	Washer, 3/4" X 1-3/16" X 1/16"	4,& 5,000/72X120"
10	1	796-107	Leg Assy, Left (106-3/4"X4-1/2")	4,000/72X120"
10	1	796-104	Leg Assy, Left (106-3/4"X4-1/2")	5,000/72X120"
11	1	796-108	Leg Ass'y, Right (106-3/4"X4-1/2")	4,000/72X120"
11	1	796-103	Leg Ass'y, Right (106-3/4"X4-1/2")	5,000/72X120"
12	2	013-082	Cotter Pin 1/4" X 2"	4,& 5,000/72X120"
13	4	012-216	Washer, Flat Plain 1-5/16" Bolt Size	4,& 5,000/72X120"
14	4	105-882	Washer, Spacer (1-3/4" Dia)	4,& 5,000/72X120"
15	2	018-025	Bushing 1-1/4" X 3/4lg	4,& 5,000/72X120"
16	2	105-225	Roller C/W Bushing 018-051	4,& 5,000/72X120"
17	2	106-389	Washer, Spc. 1-3/4"ODx1"IDx1/16"T	4,& 5,000/72X120"
18	2	107-038	Washer	4,& 5,000/72X120"
19	2	010-037	Capscrew, Hex Hd. 5/16"-18 X 3/4"	4,& 5,000/72X120"
20	2	013-005	Spring Pin 5/32"X1"Lg	4,& 5,000/72X120"

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11.2.2 Cylinder Assembly - 4, & 5,000 lb. Cap. - 72x120" Deck

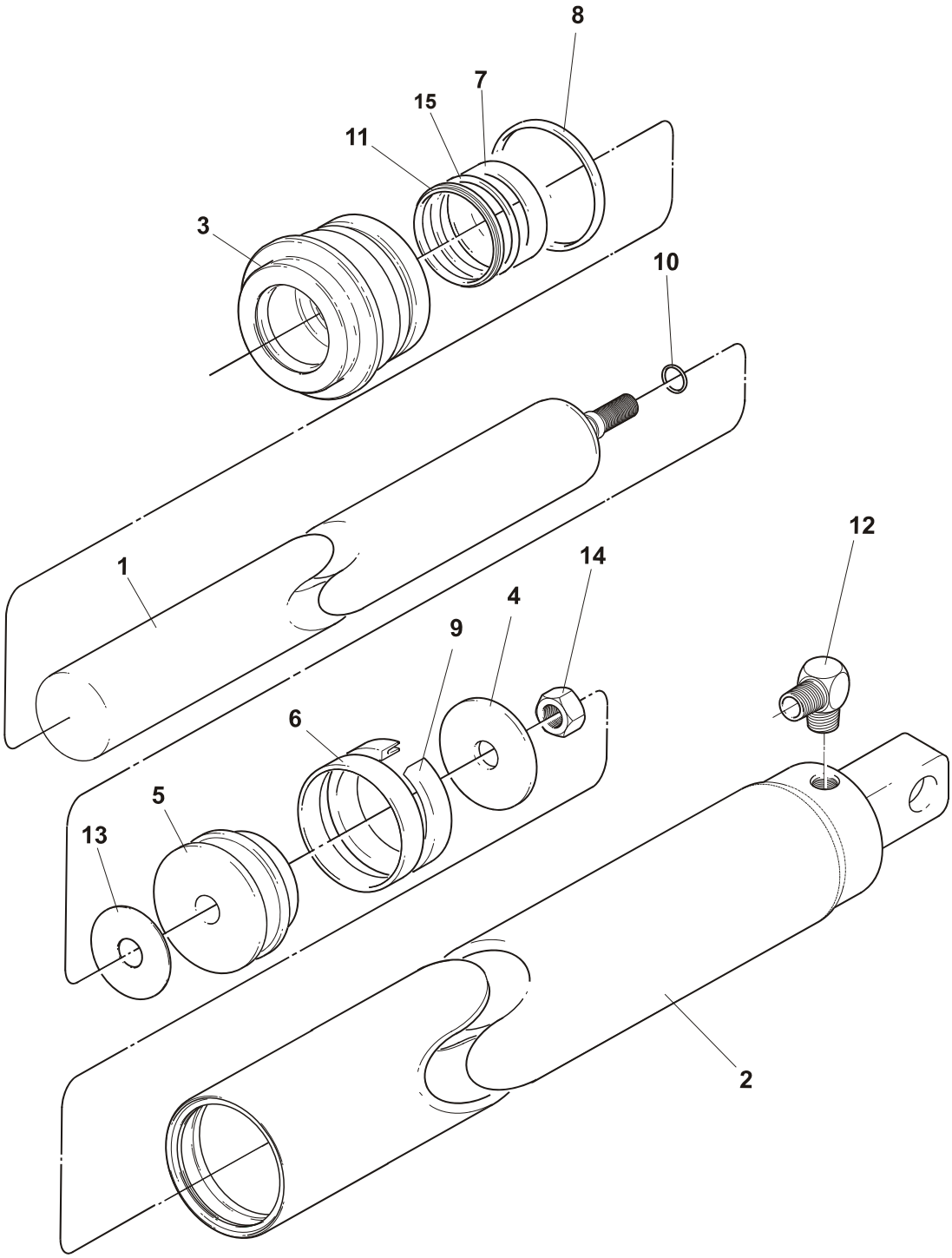


Figure 60 : Cylinder Assembly - 4, & 5,000 lb. Cap. - 72x120" Deck

Cylinder Assembly - 4, & 5,000 lb. Cap. - 72x120" Deck

Item	Qty	Part No	General Description	Specific Description
-	**-**	**786-720**	**Cylinder Ass'y (Left) [2-1/2"Dia]**	**4,5S72X120**
-	**-**	**786-721**	**Cylinder Ass'y (Right)[2-1/2"Dia]**	**4,5S72X120**
1	1	118-386	Ram - Semi Portable Table	4,5S72X120
2	1	783-539	Housing Weldment (Left) [2-1/2"Dia]	4,5S72X120
2	1	783-533	Housing Weldment (Right) [2-1/2"Dia]	4,5S72X120
3	1	118-387	Headnut, 2-1/2" Dia Cyl (1-1/2" Dia Rd)	4,5S72X120
4	1	114-977	Washer, Piston (2-1/2" Dia)	4,5S72X120
5	1	113-522	Piston Use 113-629 Washer 2-1/2" Dia	4,5S72X120
6●	1	036-153	Wear Ring - 2-1/2" Wide Piston	4,5S72X120
7●	1	036-143	Rod Wear Ring	4,5S72X120
8●	1	036-133	O-Ring, 2-1/2"ODx2-1/4"ID	4,5S72X120
9●	1	036-119	U-Cup, Seal 1.875" x 2.5" x .5"	4,5S72X120
10●	1	036-108	O-Ring, 3/4"Od x 5/8"ID x 1/16"	4,5S72X120
11●	1	036-098	Wiper, 1-3/4ODx1-1/2	4,5S72X120
12	1	034-500	Fitting, 2103-6-6	4S72X120
13●	1	118-368	Gasket, 2" Dia Cyl	4,5S72X120
14	1	011-530	Nut, Hex Jam, 3/4"-10	4,5S72X120
15●	1	036-180	O-Ring (Reciprocating)	4,5S72X120
-	**-**	**783-536**	**Kit, Seal - Includes Items marked (●)**	**4,5S72X120**

11.2.3 Crosshead Assembly - 4, & 5,000 lb. Cap. - 72x120" Deck

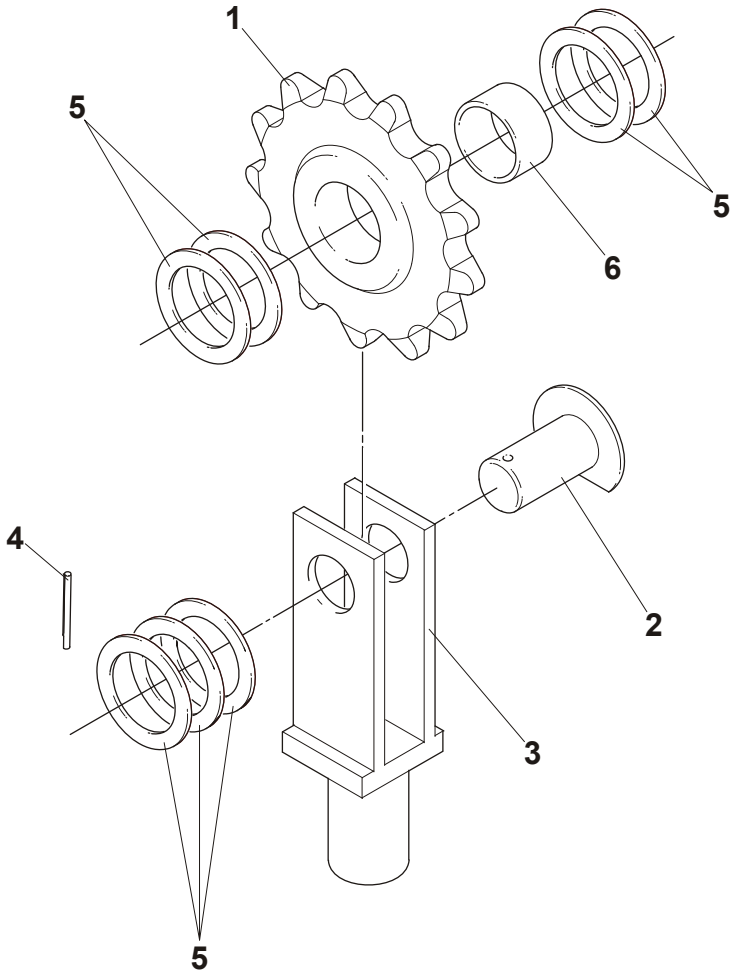


Figure 61 : Crosshead Assembly - 4, & 5,000 lb. Cap. - 72x120" Deck Length

Cylinder Assembly - 4, & 5,000 lb. Cap. - 72x120" Deck

Item	Qty	Part No	General Description	Specific Description
-	**-**	**797-459**	**Crosshead Assembly (3"X3")**	**4,5S72X120**
1	1	105-645	Sprocket (Ramtop) Assembly	4,5S72X120
2	1	797-451	Pin Assembly (3"X1-1/4")	4,5S72X120
3	1	797-504	Crosshead Weldment (1-1/2"Ram)	4,5S72X120
4	1	013-012	Spring Pin - 1/4" X 2"	4,5S72X120
5	8	105-882	Washer-Spacer - (1-3/4" Dia)	4,5S72X120
6	1	018-027	Bushing	4,5S72X120

11.3 General Assembly - 4, & 5,000 lb. Cap. - 84x96" Deck

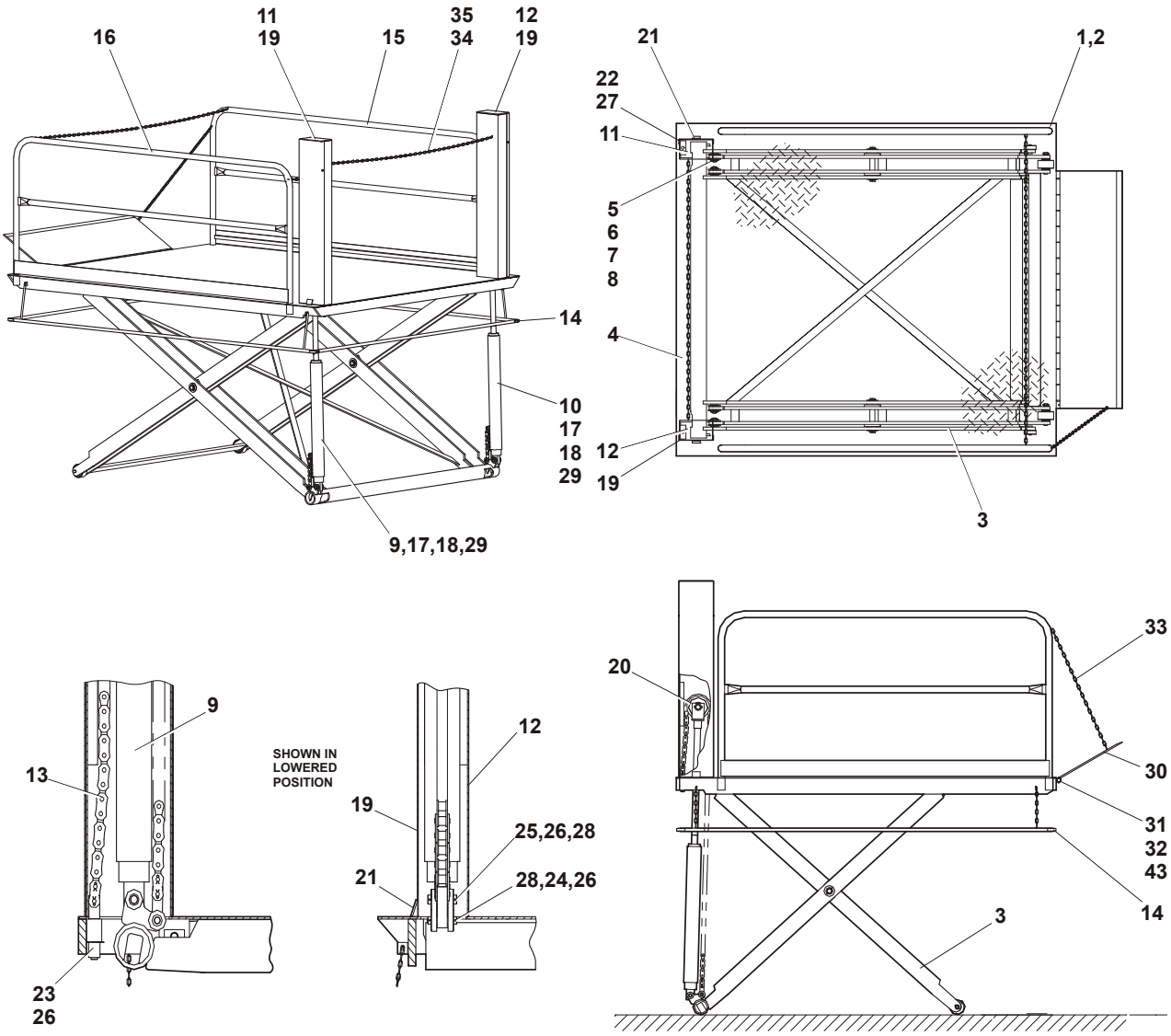


Figure 62 : 4, & 5,000 lb. Cap. - 84x96" Deck Length

General Assembly - 4, & 5,000 lb. Cap. - 84x96" Deck

Item	Qty	Part No	General Description	Specific Description
			Semi-Portable Elevating Dock	**REF. DWG - 796-094**
1*	**1**	**796-098**	**Deck & Leg Ass'y (84"X96")**	**4,000/84X96"**
1*	**1**	**796-096**	**Deck & Leg Ass'y (84"X96")**	**5,000/84X96"**
2	1	796-097	Deck Assembly (84"X96")	4,&5,000/84X96"
3**	**2**	**796-292**	**Leg Assembly (85-3/4"X4")**	**4,000/84X96"**
3**	**2**	**796-718**	**Leg Assembly (109-3/4"X4-1/2")**	**5,000/84X96"**
4	1	796-780	Torque Bar Assy (74-1/2"LG)	4,&5,000/84X96"
5	4	797-445	Pin Weldment (2-1/8"Lg)	4,&5,000/84X96"
6	4	013-012	Spring Pin 1/4" X 2"	4,&5,000/84X96"
7	12	012-214	Washer, Flat Plain - 3/4" BS	4,&5,000/84X96"
8	4	018-001	Bushing - 3/4" Lg	4,&5,000/84X96"
9**	**1**	**786-720**	**Cylinder Ass'y (Left) [2-1/2"Dia]**	**4,&5,000/84X96"**
10**	**1**	**786-721**	**Cylinder Ass'y (Right)[2-1/2"Dia]**	**4,&5,000/84X96"**
11	1	797-267	Post, Cylinder Weld (Left)	4,&5,000/84X96"
12	1	797-248	Post, Cylinder Weld (Right)	4,&5,000/84X96"
13	2	796-946	Chain Assembly (93-3/4"Lg)	4,&5,000/84X96"
14	1	302-5000-8496	Bar, Safety Indicator	4,&5,000/84X96"
15	1	312-5080-4	Guard Rail, Right Side 96"Deck	4,&5,000/84X96"
16	1	312-5081-4	Guard Rail, Left Side 96"Deck	4,&5,000/84X96"
17	2	034-599	Fitting Elbow Forged #6MP-4MP-90°	4,&5,000/84X96"
18	2	033-661	Velocity Fuse - 5 GPM	4,&5,000/84X96"
19	2	103-806	Cover, Post (49-1/2"X8-5/8"ID)	4,&5,000/84X96"
20**	**2**	**797-459**	**Crosshead Assembly (3"X3")**	**4,&5,000/84X96"**
21	2	103-744	Spacer	4,&5,000/84X96"
22	4	012-202	Washer, Lock - 1/4" Helical	4,&5,000/84X96"
23	2	011-535	Nut, Hex - 3/4"-10 Nylon Insert	4,&5,000/84X96"
24	2	103-214	Pin, Chain Link Block	4,&5,000/84X96"
25	2	103-215	Pin, Cylinder Pivot	4,&5,000/84X96"
26	10	105-879	Washer - 3/4" X 1-3/16" X 1/16"	4,&5,000/84X96"
27	4	010-072	Capscrew, Hex Hd. - 1/4-20 X 1/2"	4,&5,000/84X96"
28	8	013-024	Cotter Pin-5/32" X 1-1/4"	4,&5,000/84X96"
29	2	034-044	Fitting, 6-6	4,&5,000/84X96"
30	1	302-5002	Lip Assy,60"(18"Lg,4&5#)1pc Lp	4,&5,000/84X96"
31	1	121-616-1	Bar For Lip Hinge (60"Lg)	4,&5,000/84X96"
32	1	013-005	Spring Pin 5/32"X1"Lg	4,&5,000/84X96"
33	1	091-023-0600	Chain (60"Lg) 3/16"	4,&5,000/84X96"
34	1	091-023-0700	Chain (1/8"Galvanized) (70"Lg)	4,&5,000/84X96"
35	2	R3-19203	Hook Snap 4"Lg	4,&5,000/84X96"
36	1	797-640	Cradle Plate Assy R.H,	4,&5,000/84X96"
37	1	796-926	Cradle Plate Assy L.H.	4,&5,000/84X96"
38	2	105-487	Wear Plate	4,&5,000/84X96"
39	1	797-125	Hose Ass'y #6 Hose (12"Lg)	4,&5,000/84X96"
40	1	320-5003	Hose Assy, #6 HP 43"Lg (Str.- 45°)	4,&5,000/84X96"
41	1	300-5000-38	Hose, #6 HP(144"Lg) Str. Swivel(2)	4,&5,000/84X96"
42	2GA	039-066	Paint, Blue (Fast Dry Enamel)	4,&5,000/84X96"
43	2	120-353	Spring, Torsion	4,&5,000/84X96"

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11.3.1 Leg Assembly - 4, & 5,000 lb. Cap. - 84x96" Deck

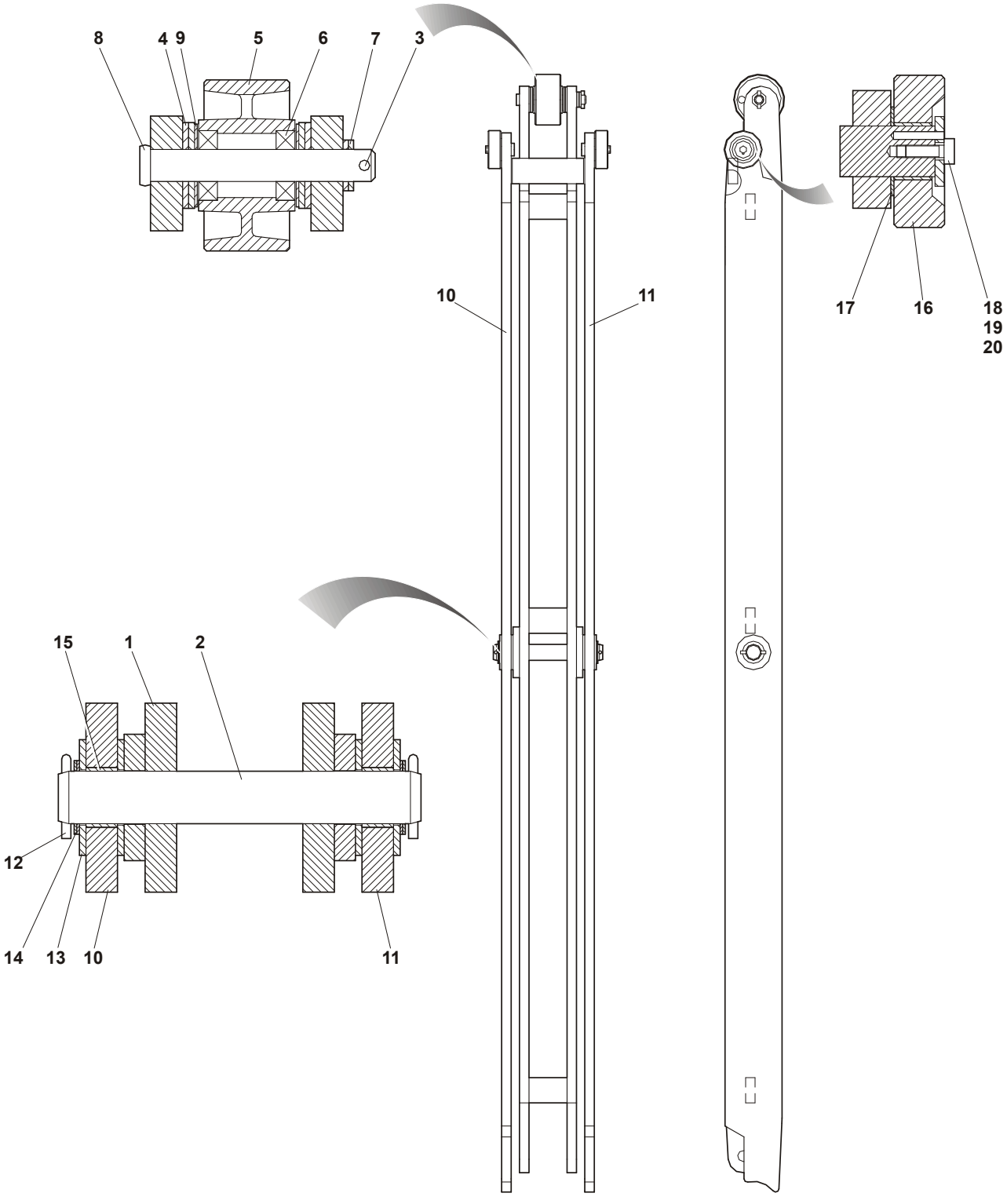


Figure 63 : Leg Assembly - 4, & 5,000 lb. Cap. - 84x96" Deck Length

Leg Assembly - 4, & 5,000 lb. Cap. - 84x96" Deck

Item	Qty	Part No	General Description	Specific Description
-	**-**	**796-292**	**Leg Assembly (85-3/4"x4")**	**4,000/84X96"**
-	**-**	**796-718**	**Leg Assembly (109-3/4"x4-1/2")**	**5,000/84X96"**
1*	**1**	**796-291**	**Leg Assy, Inner 85-3/4"x4-1/2"**	**4,000/84X96"**
1*	**1**	**796-719**	**Leg Assy, Inner 82-3/4"x4-1/2"**	**5,000/84X96"**
2	1	103-935	Pin, Centre (8-5/8"x1-1/4"Dia)	4,&5,000/84X96"
3	1	013-011	Spring Pin 1/4" x 1-3/8"	4,&5,000/84X96"
4	4	012-214	Washer, Flat - 3/4" BS	4,&5,000/84X96"
5	1	100-103	Wheel Cast Steel (4"x2")	4,&5,000/84X96"
6	2	018-500	Bearing, 3/4"x1-5/8"x7/16"	4,&5,000/84X96"
7	2	105-880	Washer Spacer- 3/4"x1-3/16"x1/8"	4,&5,000/84X96"
8	1	106-170	Axle, Load Roller (5-1/4"Lg)	4,&5,000/84X96"
9	2	105-879	Washer, 3/4" x 1-3/16" x 1/16"	4,&5,000/84X96"
10	1	796-290	Leg Assy, Left (82-3/4"x4")	4,000/84X96"
10	1	796-720	Leg Assy, Left (82-3/4"x4")	5,000/84X96"
11	1	796-289	Leg Ass'y, Right (82-3/4"x4-1/2")	4,000/84X96"
11	1	796-721	Leg Ass'y, Right (82-3/4"x4-1/2")	5,000/84X96"
12	2	013-082	Cotter Pin 1/4" x 2"	4,&5,000/84X96"
13	4	012-216	Washer, Flat Plain 1-5/16" Bolt Size	4,&5,000/84X96"
14	4	105-882	Washer, Spacer (1-3/4" Dia)	4,&5,000/84X96"
15	2	018-025	Bushing 1-1/4" X 3/4LG	4,&5,000/84X96"
16	2	105-225	Roller C/W Bushing 018-051	4,&5,000/84X96"
17	2	106-389	Washer,Spr 1-3/4"ODx1"IDx1/16"Thk	4,&5,000/84X96"
18	2	107-038	Washer	4,&5,000/84X96"
19	2	010-037	Capscrew, Hex Hd. 5/16"-18 X 3/4"	4,&5,000/84X96"
20	2	013-005	Spring Pin 5/32"x1"LG	4,&5,000/84X96"

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11.3.2 Cylinder Assembly - 4, & 5,000 lb. Cap. - 84x96" Deck

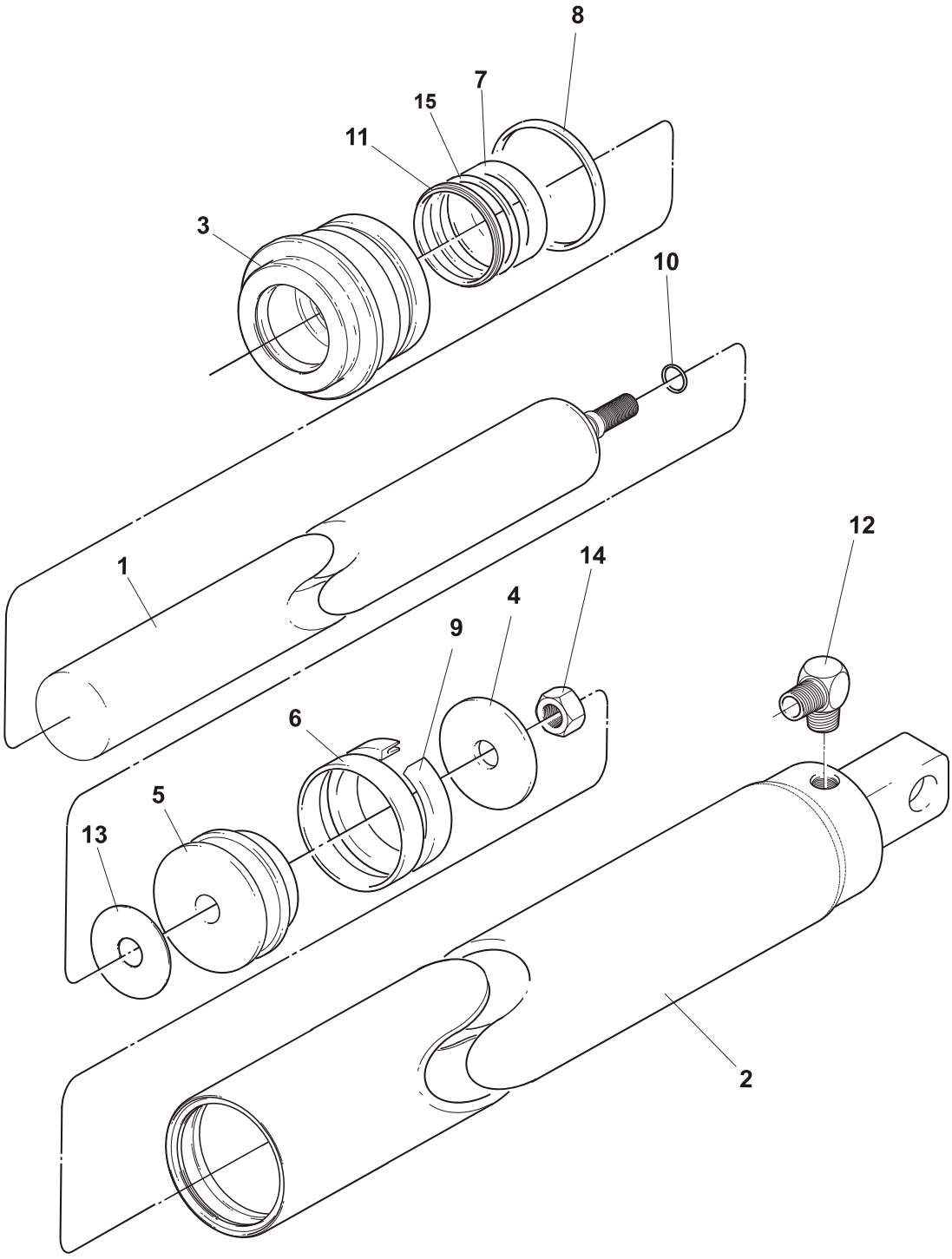


Figure 64 : Cylinder Assembly - 4, & 5,000 lb. Cap. - 84x96" Deck

Cylinder Assembly - 4, & 5,000 lb. Cap. - 84x96" Deck

Item	Qty	Part No	General Description	Specific Description
-	**-**	**786-720**	**Cylinder Ass'y (Left) [2-1/2"Dia]**	**4,&5,000/84X96"**
-	**-**	**786-721**	**Cylinder Ass'y (Right)[2-1/2"Dia]**	**4,&5,000/84X96"**
1	1	118-386	Ram - Semi Portable Table	4,&5,000/84X96"
2	1	783-539	Housing Weldment (Left) [2-1/2"Dia]	4,&5,000/84X96"
2	1	783-533	Housing Weldment (Right) [2-1/2"Dia]	4,&5,000/84X96"
3	1	118-387	Headnut, 2-1/2" Dia Cyl (1-1/2" Dia Rd)	4,&5,000/84X96"
4	1	114-977	Washer, Piston (2-1/2" Dia)	4,&5,000/84X96"
5	1	113-522	Piston Use 113-629 Washer 2-1/2" Dia	4,&5,000/84X96"
6●	1	036-153	Wear Ring - 2-1/2" Wide Piston	4,&5,000/84X96"
7●	1	036-143	Rod Wear Ring	4,&5,000/84X96"
8●	1	036-133	O-Ring, 2-1/2"ODx2-1/4"ID	4,&5,000/84X96"
9●	1	036-119	U-Cup, Seal 1.875" x 2.5" x .5"	4,&5,000/84X96"
10●	1	036-108	O-Ring, 3/4"OD x 5/8"ID x 1/16"	4,&5,000/84X96"
11●	1	036-098	Wiper, 1-3/4"ODx1-1/2"	4,&5,000/84X96"
12	1	034-500	Fitting, 2103-6-6	4,&5,000/84X96"
13●	1	118-368	Gasket, 2" Dia Cyl	4,&5,000/84X96"
14	1	011-530	Nut, Hex Jam, 3/4"-10	4,&5,000/84X96"
15●	1	036-180	O-Ring (Reciprocating)	4,&5,000/84X96"
-	**-**	**783-536**	**Kit, Seal - Includes Items marked (●)**	**4,&5,000/84X96"**

11.3.3 Crosshead Assembly - 4, & 5,000 lb. Cap. - 84x96" Deck

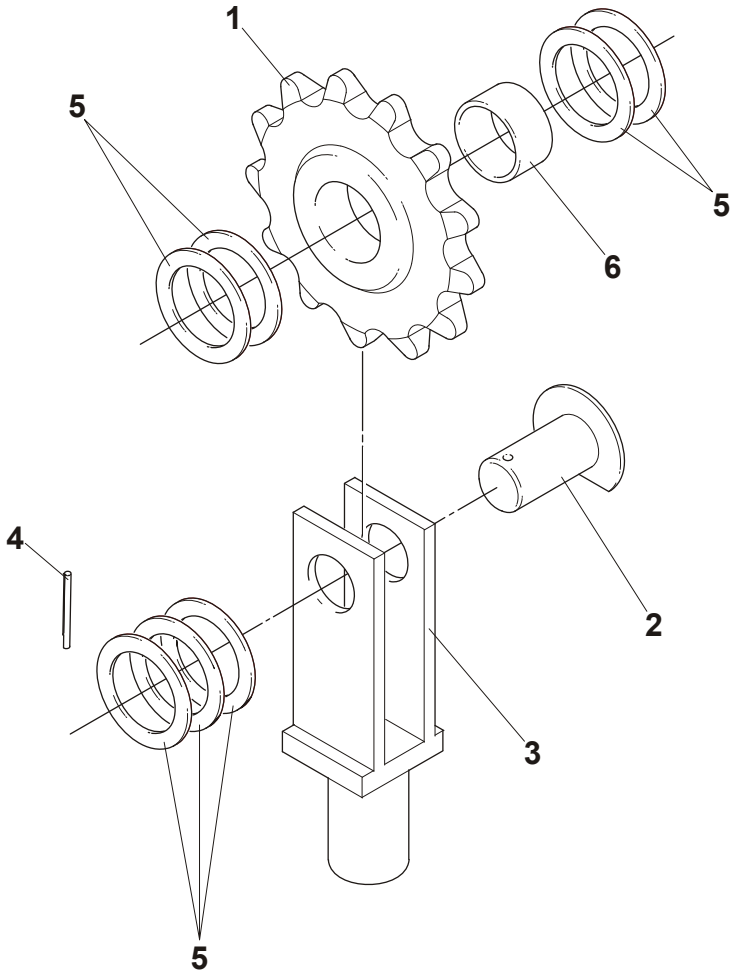


Figure 65 : Crosshead Assembly - 4, & 5,000 lb. Cap. - 84x96" Deck Length

Crosshead Assembly - 4, & 5,000 lb. Cap. - 84x96" Deck

Item	Qty	Part No	General Description	Specific Description
-	**-**	**797-459**	**Crosshead Assembly (3"X3")**	**4,&5,000/84X96"**
1	1	105-645	Sprocket (Ramtop) Assembly	4,&5,000/84X96"
2	1	797-451	Pin Assembly (3"X1-1/4")	4,&5,000/84X96"
3	1	797-504	Crosshead Weldment (1-1/2"Ram)	4,&5,000/84X96"
4	1	013-012	Spring Pin - 1/4" X 2"	4,&5,000/84X96"
5	8	105-882	Washer-Spacer - (1-3/4" Dia)	4,&5,000/84X96"
6	1	018-027	Bushing	4,&5,000/84X96"

11.4 General Assembly - 4, & 5,000 lb. Cap. - 84x120" Deck

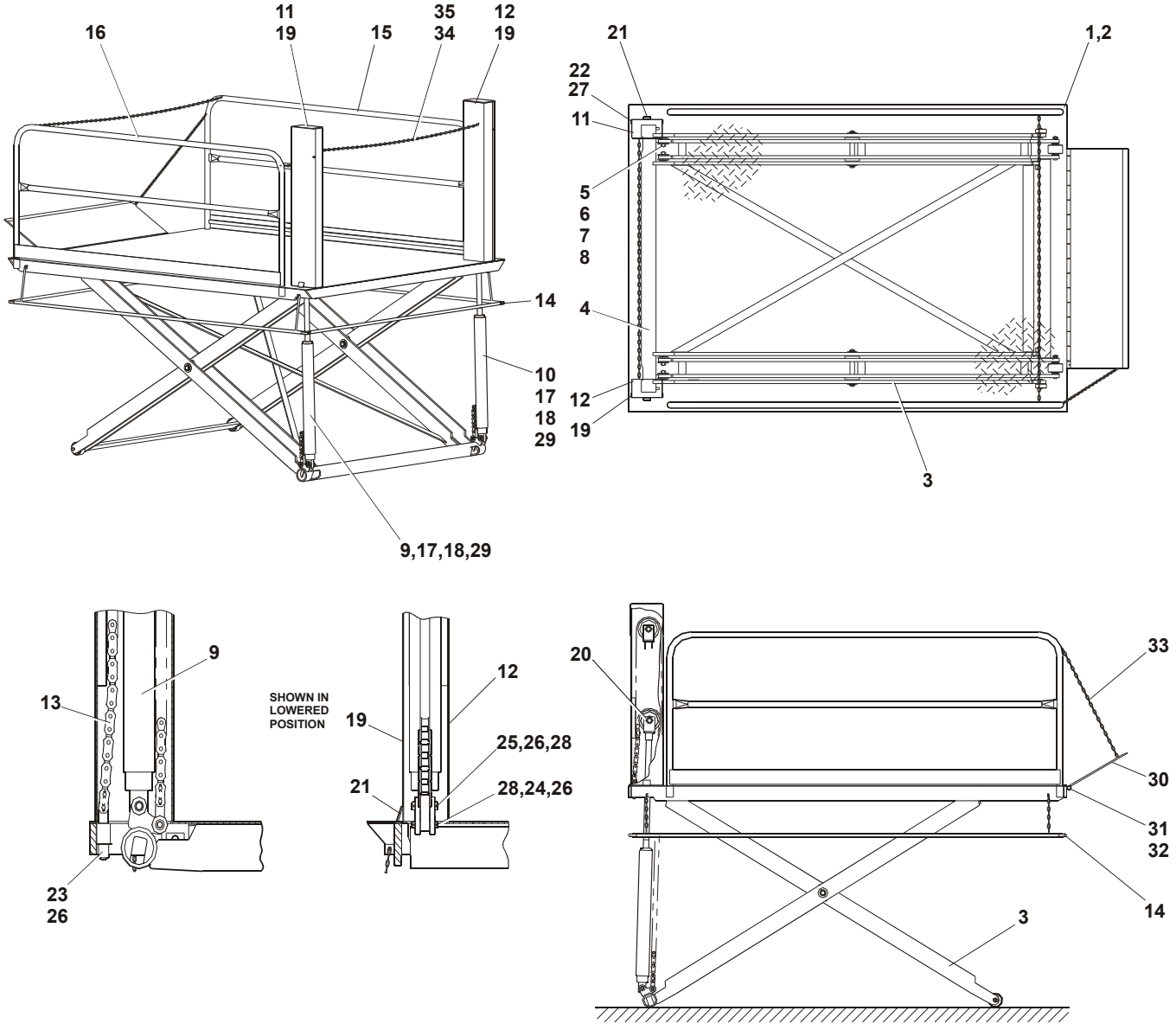


Figure 66 : 4, & 5,000 lb. Cap. - 84x120" Deck Length

General Assembly - 4, & 5,000 lb. Cap. - 84x120" Deck

Item	Qty	Part No	General Description	Specific Description
			Semi-Portable Elevating Dock	**REF. DWG. - 796-100**
1*	**1**	**796-112**	**Deck & Leg Ass'y (84"x120")**	**4,000/84X120"**
1*	**1**	**796-109**	**Deck & Leg Ass'y (84"x120")**	**5,000/84X120"**
2	1	796-113	Deck Assembly (84"x120")	4,& 5,000/84X120"
3*	**2**	**796-114**	**Leg Assembly (109-3/4"x4-1/2")**	**4,000/84X120"**
3*	**2**	**796-111**	**Leg Assembly (109-3/4"x4-1/2")**	**5,000/84X120"**
4	1	796-780	Torque Bar	4,& 5,000/84X120"
5	4	797-445	Pin Weldment (2-1/8"Lg)	4,& 5,000/84X120"
6	4	013-012	Spring Pin 1/4" x 2"	4,& 5,000/84X120"
7	12	012-214	Washer, Flat Plain - 3/4" BS	4,& 5,000/84X120"
8	4	018-001	Bushing - 3/4" Lg	4,000/84X120"
8	4	018-010	Bushing - 1" Lg	5,000/84X120"
9**	**1**	**786-720**	**Cylinder Ass'y (Left) [2-1/2"Dia]**	**4,000/84X120"**
9**	**1**	**786-657**	**Cylinder Ass'y (Left) [3"Dia]**	**5,000/84X120"**
10**	**1**	**786-721**	**Cylinder Ass'y (Right)[2-1/2"Dia]**	**4,000/84X120"**
10**	**1**	**786-658**	**Cylinder Ass'y (Right)[3"Dia]**	**5,000/84X120"**
11	1	797-267	Post, Cylinder Weld (Left)	4,& 5,000/84X120"
12	1	797-248	Post, Cylinder Weld (Right)	4,& 5,000/84X120"
13	2	796-946	Chain Assembly (93-3/4"Lg)	4,& 5,000/84X120"
14	1	302-5000	Bar, Safety Indicator	4,& 5,000/84X120"
15	1	312-5080-6	Guard Rail, Right Side 120"Deck	4,& 5,000/84X120"
16	1	312-5081-6	Guard Rail, Left Side 120"Deck	4,& 5,000/84X120"
17	2	034-599	Fitting Elbow Forged #6MP-4MP-90°	4,& 5,000/84X120"
18	2	033-661	Velocity Fuse - 5 GPM	4,& 5,000/84X120"
19	2	103-806	Cover, Post (49-1/2"x8-5/8"ID)	4,& 5,000/84X120"
20**	**2**	**797-459**	**Crosshead Assembly (3"x3")**	**4,& 5,000/84X120"**
21	2	103-744	Spacer	4,& 5,000/84X120"
22	4	012-202	Washer, Lock - 1/4" Helical	4,& 5,000/84X120"
23	2	011-535	Nut, Hex - 3/4"-10 Nylon Insert	4,& 5,000/84X120"
24	2	103-214	Pin, Chain Link Block	4,& 5,000/84X120"
25	2	103-215	Pin, Cylinder Pivot	4,& 5,000/84X120"
26	10	105-879	Washer - 3/4" x 1-3/16" x 1/16"	4,& 5,000/84X120"
27	4	010-072	Capscrew, Hex Hd. - 1/4-20 x 1/2"	4,& 5,000/84X120"
28	8	013-024	Cotter Pin-5/32"x1-1/4"	4,& 5,000/84X120"
29	2	034-044	Fitting, 6-6	4,& 5,000/84X120"
30	1	302-5002	Lip Assy,60"(18"Lg,4&5#)1pc Lp	4,& 5,000/84X120"
31	1	121-616-1	Bar For Lip Hinge (60"LG)	4,& 5,000/84X120"
32	1	013-005	Spring Pin 5/32"X1"Lg	4,& 5,000/84X120"
33	1	091-023-0600	Chain (60"LG) 3/16"	4,& 5,000/84X120"
34	1	091-023-0700	Chain 1/8"Galvanized) (70"LG)	4,& 5,000/84X120"
35	2	R3-19203	Hook Snap 4"LG	4,& 5,000/84X120"
36	1	797-640	Cradle Plate Assy R.H,	4,& 5,000/84X120"
37	1	796-926	Cradle Plate Assy L.H. (Ed)	4,& 5,000/84X120"
38	2	105-487	Wear Plate	4,& 5,000/84X120"
39	1	797-125	Hose Ass'y #6 Hose (12"LG)	4,& 5,000/84X120"
40	1	320-5003	Hose Assy, #6 HP 43"Lg (Str.- 45°)	4,& 5,000/84X120"
41	1	300-5000-38	Hose, #6 HP(144"LG) Str. Swivel(2)	4,& 5,000/84X120"
42	2GA	039-066	Paint, Blue (Fast Dry Enamel)	4,& 5,000/84X120"

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11.4.1 Leg Assembly - 4, & 5,000 lb. Cap. - 84x120" Deck

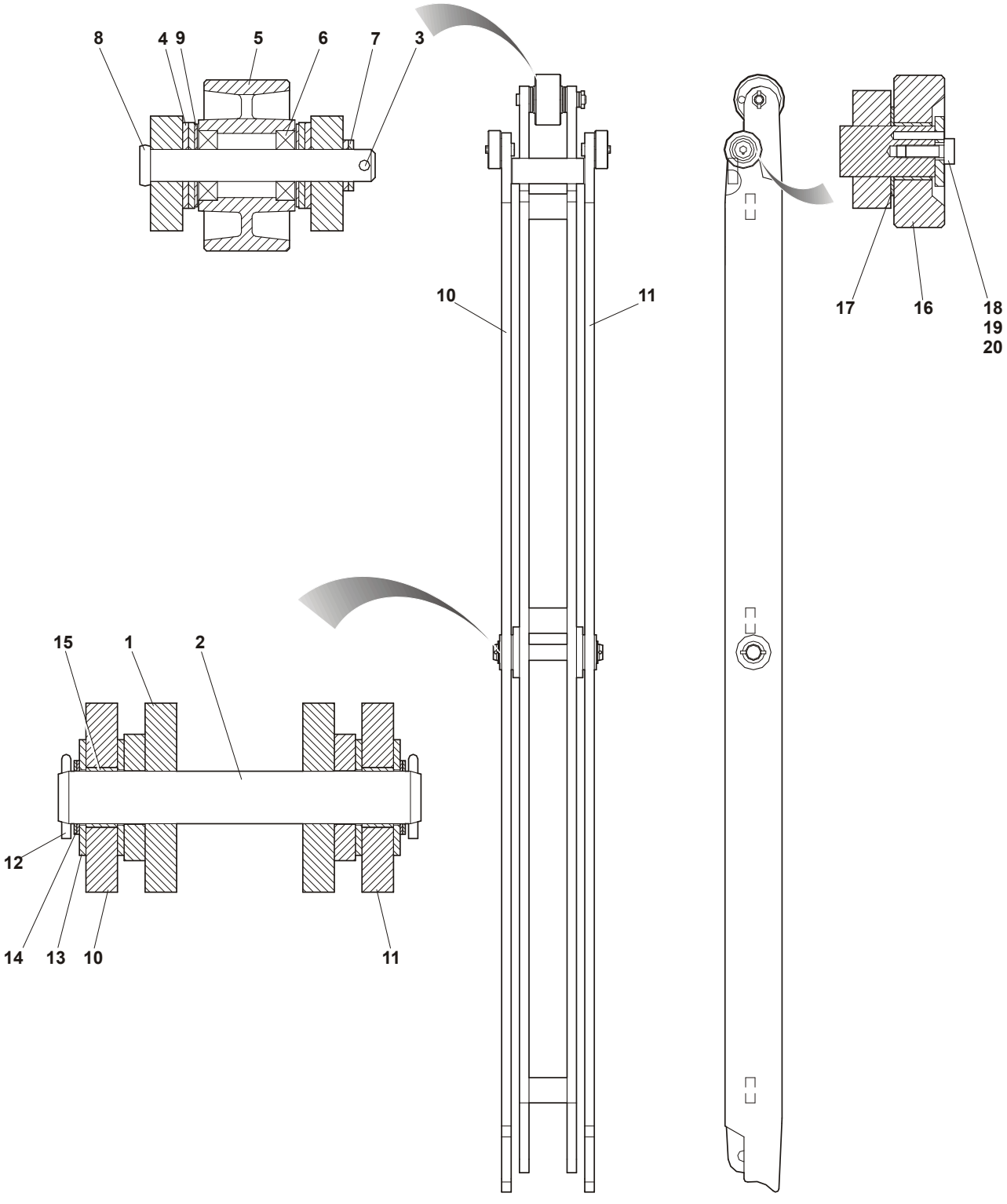


Figure 67 : Leg Assembly - 4, & 5,000 lb. Cap. - 84x120" Deck Length

Leg Assembly - 4, & 5,000 lb. Cap. - 84x120" Deck

Item	Qty	Part No	General Description	Specific Description
-	**-**	**796-114**	**Leg Assembly (109-3/4"x4-1/2")**	**4,000/84X120"**
-	**-**	**796-111**	**Leg Assembly (109-3/4"x4-1/2")**	**5,000/84X120"**
1*	**1**	**796-106**	**Leg Assy, Inner 109-3/4"x4-1/2"**	**4,000/84X120"**
1*	**1**	**796-105**	**Leg Assy, Inner 109-3/4"x5"**	**5,000/84X120"**
2	1	103-935	Pin, Center (8-5/8"x1-1/4"Dia)	4,000/84X120"
2	1	103-934	Pin, Center	5,000/84X120"
3	1	013-011	Spring Pin 1/4"x1-3/8"	4,& 5,000/84X120"
4	4	012-214	Washer, Flat - 3/4" Bs	4,& 5,000/84X120"
5	1	100-103	Wheel Cast Steel (4"x2")	4,& 5,000/84X120"
6	2	018-500	Bearing, 3/4"x1-5/8"x7/16"	4,& 5,000/84X120"
7	2	105-880	Washer Spacer- 3/4"x1-3/16"x1/8"	4,& 5,000/84X120"
8	1	106-170	Axle, Load Roller (5-1/4"Lg)	4,000/84X120"
8	1	313-0015	Axle, Load Roller 5-3/4"x3/4"	5,000/84X120"
9	2	105-879	Washer, 3/4"x1-3/16"x1/16"	4,& 5,000/84X120"
10	1	796-107	Leg Assy, Left (109-3/4"x4-1/2")	4,000/84X120"
10	1	796-104	Leg Assy, Left (106-3/4"x4-1/2")	5,000/84X120"
11	1	796-108	Leg Ass'y, Right (109-3/4"x4-1/2")	4,000/84X120"
11	1	796-103	Leg Ass'y, Right (106-3/4"x4-1/2")	5,000/84X120"
12	2	013-082	Cotter Pin 1/4" x 2"	4,& 5,000/84X120"
13	4	012-216	Washer, Flat Plain 1-5/16" Bolt Size	4,& 5,000/84X120"
14	4	105-882	Washer, Spacer (1-3/4" Dia)	4,& 5,000/84X120"
15	2	018-025	Bushing 1-1/4" x 3/4lg	4,& 5,000/84X120"
16	2	105-225	Roller C/W Bushing 018-051	4,& 5,000/84X120"
17	2	106-389	Washer,Spr 1-1/4"ODx1"IDx1/16"Thk	4,& 5,000/84X120"
18	2	107-038	Washer	4,& 5,000/84X120"
19	2	010-037	Capscrew, Hex Hd. 5/16"-18 x 3/4"	4,& 5,000/84X120"
20	2	013-005	Spring Pin 5/32"x1"Lg	4,& 5,000/84X120"

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11.4.2 Cylinder Assembly - 4, & 5,000 lb. Cap. - 84x120" Deck

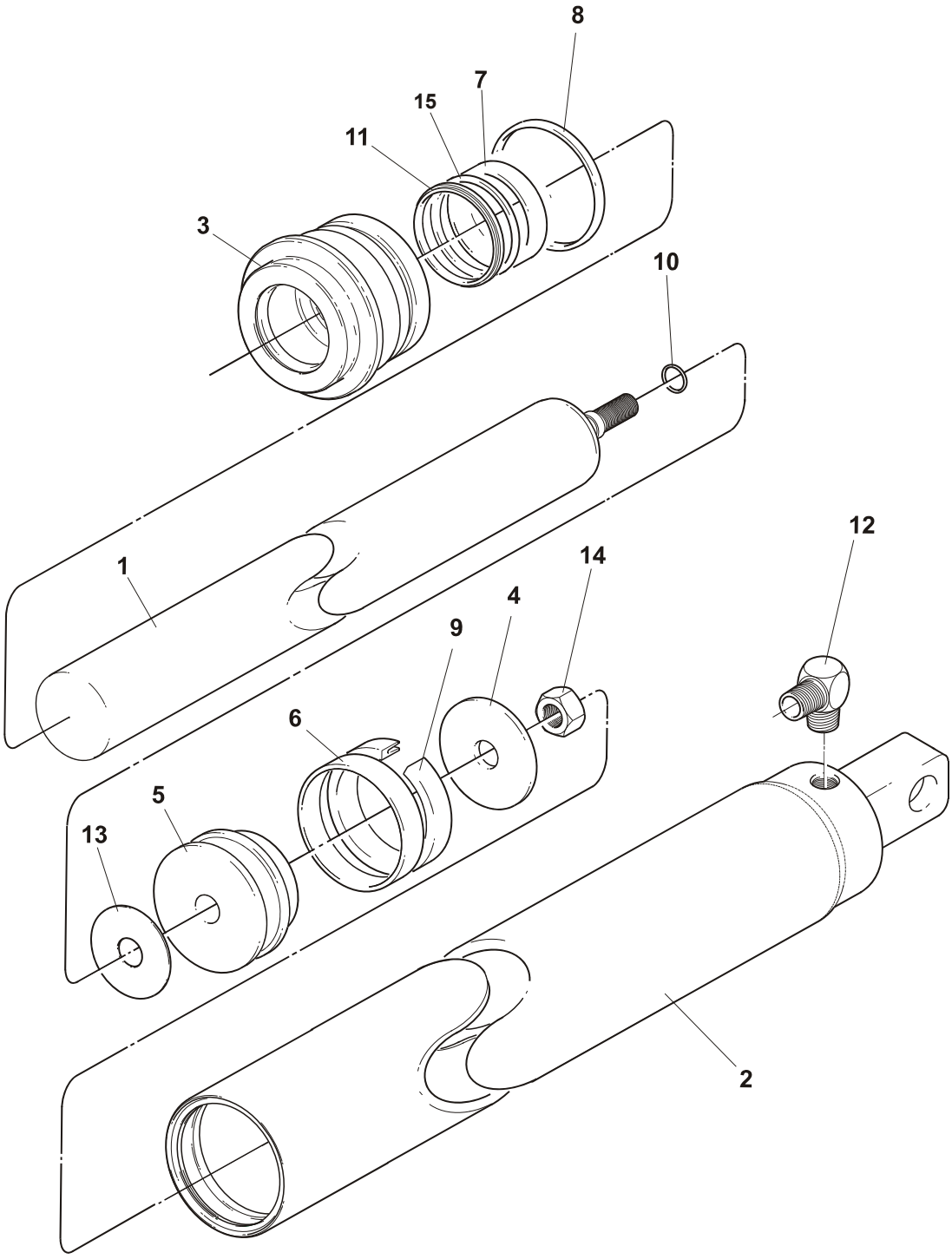


Figure 68 : Cylinder Assembly - 4, & 5,000 lb. Cap. - 84x120" Deck

Cylinder Assembly - 4, & 5,000 lb. Cap. - 84x120" Deck

Item	Qty	Part No	General Description	Specific Description
-	**-**	**786-720**	**Cylinder Ass'y (Left) [2-1/2"Dia]**	**4,000/84X120"**
-	**-**	**786-657**	**Cylinder Ass'y (Left) [3"Dia]**	**5,000/84X120"**
-	**-**	**786-721**	**Cylinder Ass'y (Right)[2-1/2"Dia]**	**4,000/84X120"**
-	**-**	**786-658**	**Cylinder Ass'y (Right)[3"Dia]**	**5,000/84X120"**
1	1	118-386	Ram - Semi Portable Table	4,& 5,000/84X120"
2	1	783-539	Housing Weldment (Left) [2-1/2"Dia]	4,000/84X120"
2	1	783-533	Housing Weldment (Right) [2-1/2"Dia]	4,000/84X120"
2	1	783-537	Housing Weldment (Left) [3"Dia]	5,000/84X120"
2	1	783-532	Housing Weldment (Right) [3"Dia]	5,000/84X120"
3	1	118-387	Headnut, 2-1/2" Dia Cyl (1-1/2" Dia Rd)	4,000/84X120"
3	1	118-389	Headnut, 3" Dia Cyl (1-1/2" Dia Rd)	5,000/84X120"
4	1	114-977	Washer, Piston (2-1/2" Dia)	4,000/84X120"
4	1	114-978	Washer, Piston (3" Dia)	5,000/84X120"
5	1	113-522	Piston Use 113-629 Washer 2-1/2" Dia	4,000/84X120"
5	1	114-640	Piston 3" Dia Cyl.	5,000/84X120"
6●	1	036-153	Wear Ring - 2-1/2" Wide Piston	4,000/84X120"
6●	1	036-154	Wear Ring - 3" Wide Piston	5,000/84X120"
7●	1	036-143	Rod Wear Ring	4,& 5,000/84X120"
8●	1	036-133	O-Ring, 2-1/2"ODx2-1/4"ID	4,000/84X120"
8●	1	036-132	O-Ring, 3"ODx2-1/4"ID	5,000/84X120"
9●	1	036-119	U-Cup, Seal 1.875" x 2.5" x .5"	4,000/84X120"
9●	1	036-112	U-Cup, Seal - 3" x 2-3/8" x 1/2"	5,000/84X120"
10●	1	036-108	O-Ring, 3/4"OD x 5/8"ID x 1/16"	4,& 5,000/84X120"
11●	1	036-098	Wiper, 1-3/4ODx1-1/2	4,& 5,000/84X120"
12	1	034-500	Fitting, 2103-6-6	4,& 5,000/84X120"
13●	1	118-368	Gasket, 2" Dia Cyl	4,000/84X120"
13●	1	117-993	Gasket	5,000/84X120"
14	1	011-530	Nut, Hex Jam, 3/4"-10	4,& 5,000/84X120"
15	1	038-180	O-Ring (Reciprocating)	4,& 5,000/84X120"
-	**-**	**783-536**	**Kit, Seal - Includes Items marked (●)**	**4,000/84X120"**
-	**-**	**783-538**	**Kit, Seal - Includes Items marked (●)**	**5,000/84X120"**

11.4.3 Crosshead Assembly - 4, & 5,000 lb. Cap. - 84x120" Deck

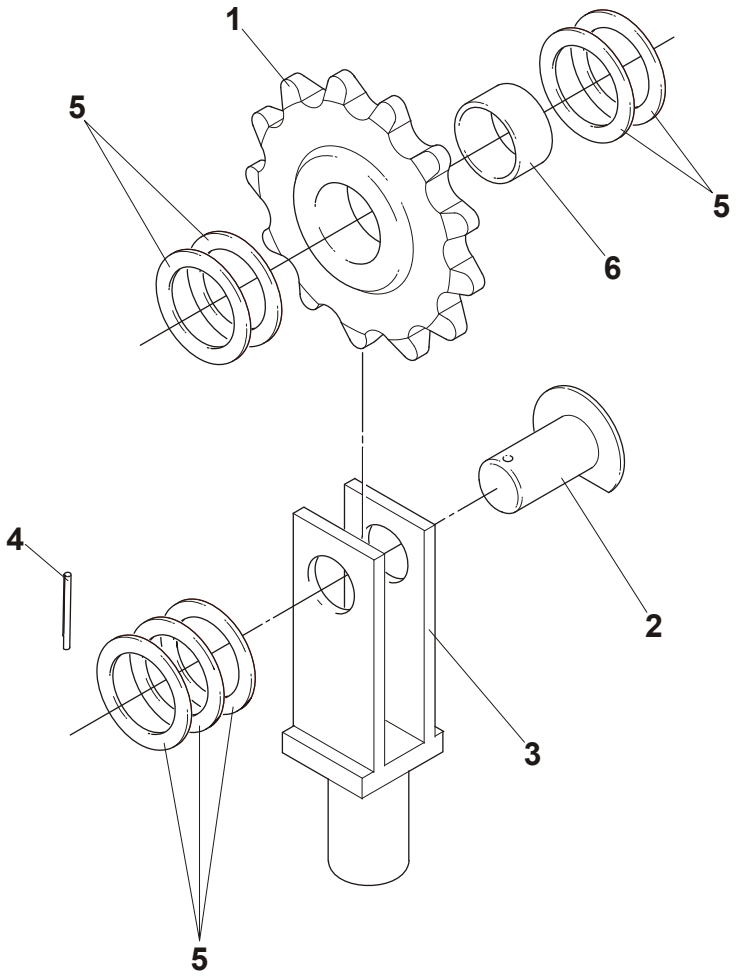


Figure 69 : Crosshead Assembly - 4, & 5,000 lb. Cap. - 84x120" Deck Length

Crosshead Assembly - 4, & 5,000 lb. Cap. - 84x120" Deck

Item	Qty	Part No	General Description	Specific Description
-	**-**	**797-459**	**Crosshead Assembly (3"x3")**	**4,& 5,000/84X120"**
1	1	105-645	Sprocket (Ramtop) Assembly	4,& 5,000/84X120"
2	1	797-451	Pin Assembly (3"x1-1/4")	4,& 5,000/84X120"
3	1	797-504	Crosshead Weldment (1-1/2"Ram)	4,& 5,000/84X120"
4	1	013-012	Spring Pin - 1/4" x 2"	4,& 5,000/84X120"
5	8	105-882	Washer-Spacer - (1-3/4" Dia)	4,& 5,000/84X120"
6	1	018-027	Bushing	4,& 5,000/84X120"

11.5 General Assembly - 4, & 5,000 lb. Cap. - 96x120" Deck

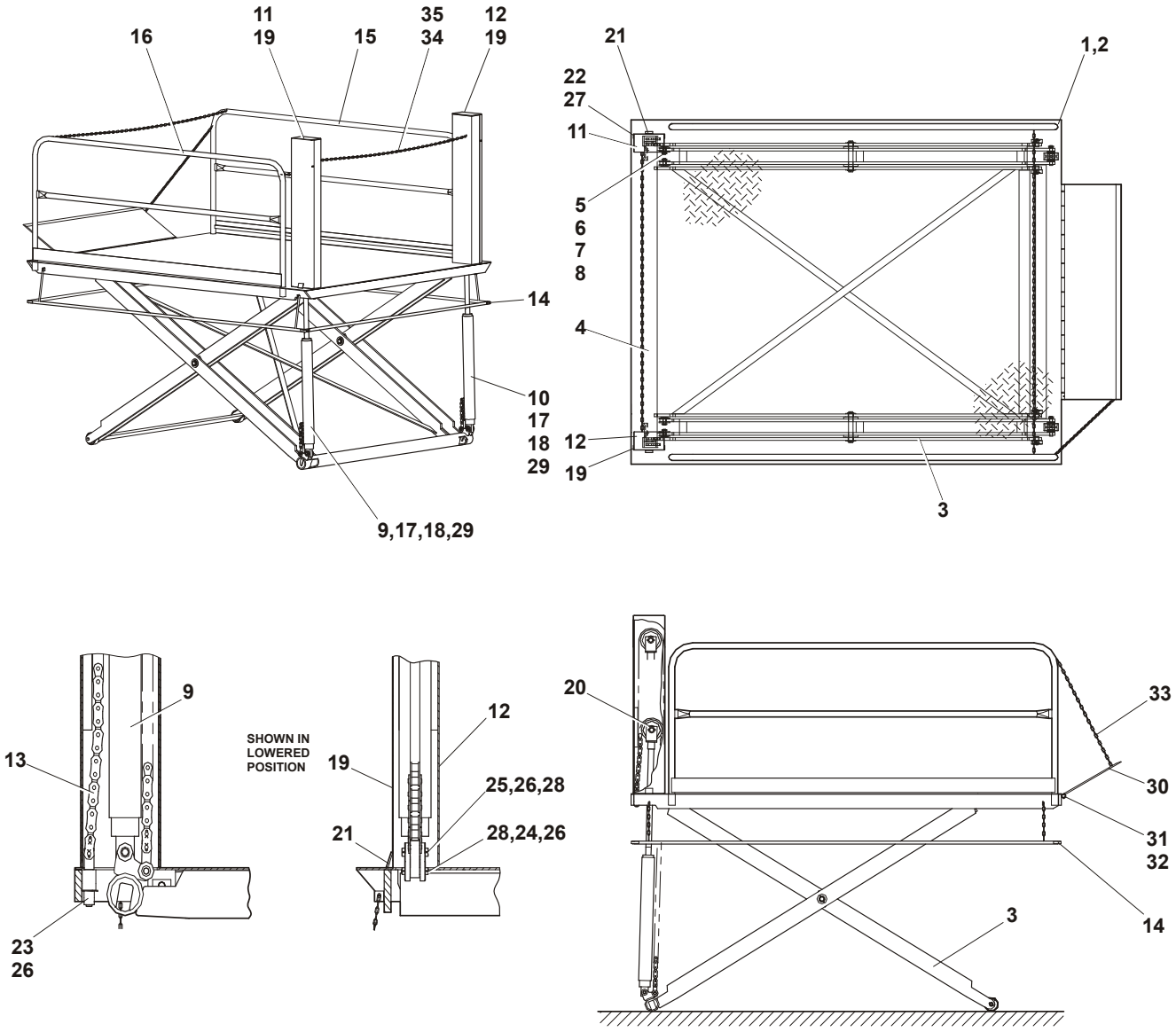


Figure 70 : 4, & 5,000 lb. Cap. - 96x120" Deck Length

Item	Qty	Part No	General Description	Specific Description
			Semi-Portable Elevating Dock	**REF DWG. 310-5373**
1*	**1**	**313-5194**	**Deck & Leg Ass'y (96"x120")**	**4,000/96X120"**
1*	**1**	**313-5195**	**Deck & Leg Ass'y (96"x120")**	**5,000/96X120"**
2	1	312-5242	Deck Assembly (96"x120")	4,& 5,000/96X120"
3*	**2**	**796-114**	**Leg Assembly (109-3/4"x4-1/2")**	**4,000/96X120"**
3*	**2**	**796-111**	**Leg Assembly (109-3/4"x4-1/2")**	**5,000/96X120"**
4	1	313-5193	Torque Bar	4,& 5,000/96X120"
5	4	797-445	Pin Weldment (2-1/8"Lg)	4,& 5,000/96X120"
6	4	013-012	Spring Pin 1/4" x 2"	4,& 5,000/96X120"
7	12	012-214	Washer, Flat Plain - 3/4" BS	4,& 5,000/96X120"
8	4	018-001	Bushing - 3/4" LG	4,000/96X120"
8	4	018-010	Bushing - 1" LG	5,000/96X120"
9**	**1**	**786-720**	**Cylinder Ass'y (Left) [2-1/2"Dia]**	4,000/96X120"
9**	**1**	**786-657**	**Cylinder Ass'y (Left) [3"Dia]**	5,000/96X120"
10**	**1**	**786-721**	**Cylinder Ass'y (Right)[2-1/2"Dia]**	4,000/96X120"
10**	**1**	**786-658**	**Cylinder Ass'y (Right)[3"Dia]**	5,000/96X120"
11	1	797-267	Post, Cylinder Weld (Left)	4,& 5,000/96X120"
12	1	797-248	Post, Cylinder Weld (Right)	4,& 5,000/96X120"
13	2	796-946	Chain Assembly (93-3/4"LG)	4,& 5,000/96X120"
14	1	302-5000-96120	Bar, Safety Indicator	4,& 5,000/96X120"
15	1	312-5080-6	Guard Rail, Right Side 120"Deck	4,& 5,000/96X120"
16	1	312-5081-6	Guard Rail, Left Side 120"Deck	4,& 5,000/96X120"
17	2	034-599	Fitting Elbow Forged #6MP-4MP-90	4,& 5,000/96X120"
18	2	033-661	Velocity Fuse - 5 GPM	4,& 5,000/96X120"
19	2	103-806	Cover, Post (49-1/2"x8-5/8"ID)	4,& 5,000/96X120"
20**	**2**	**797-459**	**Crosshead Assembly (3"X3")**	**4,& 5,000/96X120"**
21	2	103-744	Spacer	4,& 5,000/96X120"
22	4	012-202	Washer, Lock - 1/4" Helical	4,& 5,000/96X120"
23	2	011-535	Nut, Hex - 3/4"-10 Nylon Insert	4,& 5,000/96X120"
24	2	103-214	Pin, Chain Link Block	4,& 5,000/96X120"
25	2	103-215	Pin, Cylinder Pivot	4,& 5,000/96X120"
26	10	105-879	Washer - 3/4" x 1-3/16" x 1/16"	4,& 5,000/96X120"
27	4	010-072	Capscrew, Hex Hd. - 1/4-20 x 1/2"	4,& 5,000/96X120"
28	8	013-024	Cotter Pin-5/32" x 1-1/4"	4,& 5,000/96X120"
29	2	034-044	Fitting, 6-6	4,& 5,000/96X120"
30	1	302-5002	Lip Assy,60"(18"Lg,4&5#)1pc Lp	4,& 5,000/96X120"
31	1	121-616-1	Bar For Lip Hinge (60"Lg)	4,& 5,000/96X120"
32	1	013-005	Spring Pin 5/32"x1"Lg	4,& 5,000/96X120"
33	1	091-023-0600	Chain (60"Lg) 3/16"	4,& 5,000/96X120"
34	1	091-023-0580	Chain 1/8"Galvanized) (58"LG)	4,000/96X120"
34	1	091-023-0820	Chain 1/8"Galvanized) (82"LG)	5,000/96X120"
35	2	R3-19203	Hook Snap 4"LG	4,& 5,000/96X120"
36	1	797-640	Cradle Plate Assy R.H,	4,& 5,000/96X120"
37	1	796-926	Cradle Plate Assy L.H.	4,& 5,000/96X120"
38	2	105-487	Wear Plate	4,& 5,000/96X120"
39	1	797-125	Hose Ass'y #6 Hose (12"LG)	4,& 5,000/96X120"
40	1	795-826	Hose Assy, #6 60"LG	4,000/96X120"
40	1	795-846	Hose Assy, #6 60"LG	5,000/96X120"
41	1	300-5000-38	Hose, #6 HP(144"LG) Str. Swivel(2)	4,& 5,000/96X120"
42	2GA	039-066	Paint, Blue (Fast Dry Enamel)	4,& 5,000/96X120"

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11.5.1 Leg Assembly - 4, & 5,000 lb. Cap. - 96x120" Deck

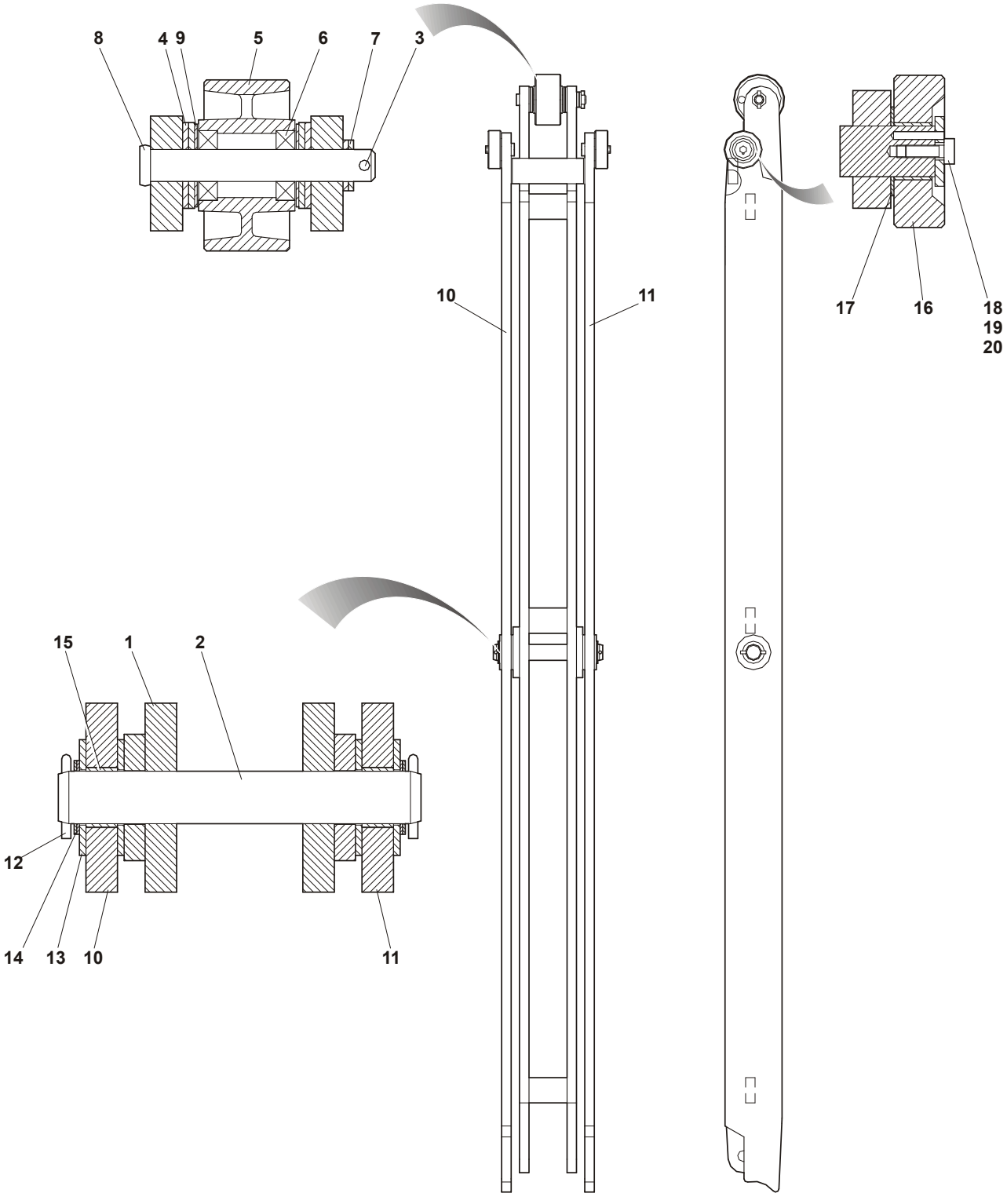


Figure 71 : Leg Assembly - 4, & 5,000 lb. Cap. - 96x120" Deck Length

Leg Assembly - 4, & 5,000 lb. Cap. - 96x120" Deck

Item	Qty	Part No	General Description	Specific Description
-	**-**	**796-114**	**Leg Assembly (109-3/4"x4-1/2")**	**4,000/96X120"**
-	**-**	**796-111**	**Leg Assembly (109-3/4"x4-1/2")**	**5,000/96X120"**
1	1	**796-106**	**Leg Assy, Inner 109-3/4"x4-1/2"**	**4,000/96X120"**
1	1	**796-105**	**Leg Assy, Inner 109-3/4"x5"**	**5,000/96X120"**
2	1	103-935	Pin, Center (8-5/8"x1-1/4"Dia)	4,000/96X120"
2	1	103-934	Pin, Center	5,000/96X120"
3	1	013-011	Spring Pin 1/4"x1-3/8"	4,& 5,000/96X120"
4	4	012-214	Washer, Flat - 3/4" BS	4,& 5,000/96X120"
5	1	100-103	Wheel Cast Steel (4"x2")	4,& 5,000/96X120"
6	2	018-500	Bearing, 3/4"x1-5/8"x7/16"	4,& 5,000/96X120"
7	2	105-880	Washer Spacer- 3/4"x1-3/16"x1/8"	4,& 5,000/96X120"
8	1	106-170	Axle, Load Roller (5-1/4"Lg)	4,000/96X120"
8	1	313-0015	Axle, Load Roller 5-3/4"x3/4"	5,000/96X120"
9	2	105-879	Washer, 3/4"x1-3/16"x1/16"	4,& 5,000/96X120"
10	1	796-107	Leg Assy, Left (109-3/4"x4-1/2")	4,000/96X120"
10	1	796-104	Leg Assy, Left (106-3/4"x4-1/2")	5,000/96X120"
11	1	796-108	Leg Ass'y, Right (109-3/4"x4-1/2")	4,000/96X120"
11	1	796-103	Leg Ass'y, Right (106-3/4"x4-1/2")	5,000/96X120"
12	2	013-082	Cotter Pin 1/4"x2"	4,& 5,000/96X120"
13	4	012-216	Washer, Flat Plain 1-5/16" Bolt Size	4,& 5,000/96X120"
14	4	105-882	Washer, Spacer (1-3/4" Dia)	4,& 5,000/96X120"
15	2	018-025	Bushing 1-1/4"x3/4LG	4,& 5,000/96X120"
16	2	105-225	Roller C/W Bushing 018-051	4,& 5,000/96X120"
17	2	106-389	Washer,Spr 1-3/4"ODx1"IDx1/16"Thk	4,& 5,000/96X120"
18	2	107-038	Washer	4,& 5,000/96X120"
19	2	010-037	Capscrew, Hex Hd. 5/16"-18 X 3/4"	4,& 5,000/96X120"
20	2	013-005	Spring Pin 5/32"X1"Lg	4,& 5,000/96X120"

11.5.2 Cylinder Assembly - 4, & 5,000 lb. Cap. - 96x120" Deck

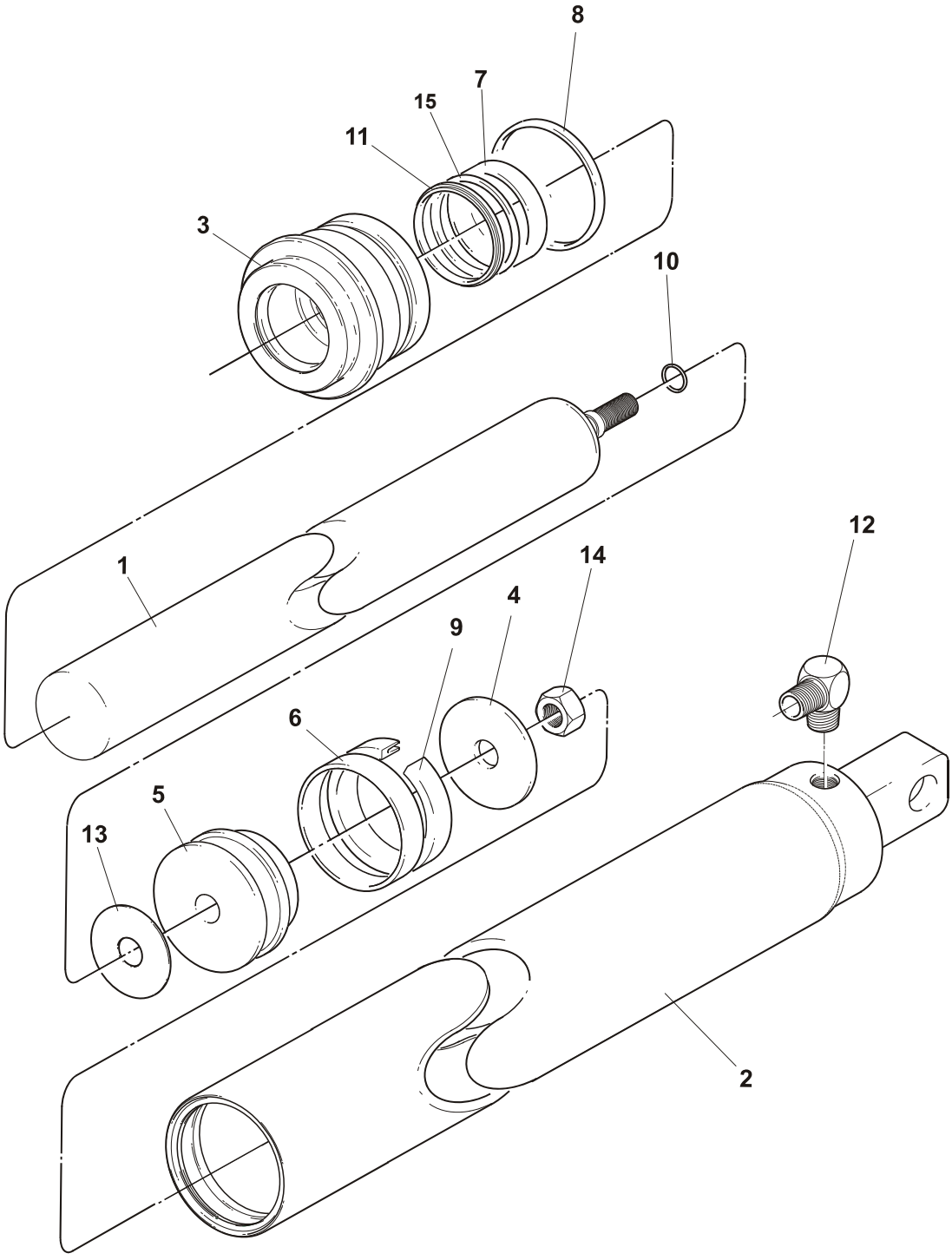


Figure 72 : Cylinder Assembly - 4, & 5,000 lb. Cap. - 84x120" Deck

11.5.3 Cylinder Assembly - 4, & 5,000 lb. Cap. - 96x120" Deck

Item	Qty	Part No	General Description	Specific Description
-	**-**	**786-720**	**Cylinder Ass'y (Left) [2-1/2"Dia]**	**4,000/96X120"**
-	**-**	**786-657**	**Cylinder Ass'y (Left) [3"Dia]**	**5,000/96X120"**
-	**-**	**786-721**	**Cylinder Ass'y (Right)[2-1/2"Dia]**	**4,000/96X120"**
-	**-**	**786-658**	**Cylinder Ass'y (Right)[3"Dia]**	**5,000/96X120"**
1	1	118-386	Ram - Semi Portable Table	4,& 5,000/96X120"
2	1	783-539	Housing Weldment (Left) [2-1/2"Dia]	4,000/96X120"
2	1	783-533	Housing Weldment (Right) [2-1/2"Dia]	4,000/96X120"
2	1	783-537	Housing Weldment (Left) [3"Dia]	5,000/96X120"
2	1	783-532	Housing Weldment (Right) [3"Dia]	5,000/96X120"
3	1	118-387	Headnut, 2-1/2" Dia Cyl (1-1/2" Dia Rd)	4,000/96X120"
3	1	118-389	Headnut, 3" Dia Cyl (1-1/2" Dia Rd)	5,000/96X120"
4	1	114-977	Washer, Piston (2-1/2" Dia)	4,000/96X120"
4	1	114-978	Washer, Piston (3" Dia)	5,000/96X120"
5	1	113-522	Piston Use 113-629 Washer 2-1/2" Dia	4,000/96X120"
5	1	114-640	Piston 3" Dia Cyl.	5,000/96X120"
6●	1	036-153	Wear Ring - 2-1/2" Wide Piston	4,000/96X120"
6●	1	036-154	Wear Ring - 3" Wide Piston	5,000/96X120"
7●	1	036-143	Rod Wear Ring	4,& 5,000/96X120"
8●	1	036-133	O-Ring, 2-1/2"ODx2-1/4"ID	4,000/96X120"
8●	1	036-132	O-Ring, 3"ODx2-1/4"ID	5,000/96X120"
9●	1	036-119	U-Cup, Seal 1.875" X 2.5" X .5"	4,000/96X120"
9●	1	036-112	U-Cup, Seal - 3" X 2-3/8" X 1/2"	5,000/96X120"
10●	1	036-108	O-Ring, 3/4"OD X 5/8"ID X 1/16"	4,& 5,000/96X120"
11●	1	036-098	Wiper, 1-3/4ODx1-1/2	4,& 5,000/96X120"
12	1	034-500	Fitting, 2103-6-6	4,& 5,000/96X120"
13●	1	118-368	Gasket, 2" Dia Cyl	4,000/96X120"
13●	1	117-993	Gasket	5,000/96X120"
14	1	011-530	Nut, Hex Jam, 3/4"-10	4,& 5,000/96X120"
15	1	036-180	O-Ring (Reciprocating)	4,& 5,000/96X120"
-	**-**	**783-536**	**Kit, Seal - Includes Items marked (●)**	**4,000/96X120"**
-	**-**	**783-538**	**Kit, Seal - Includes Items marked (●)**	**5,000/96X120"**

11.5.4 Crosshead Assembly - 4, & 5,000 lb. Cap. - 96x120" Deck

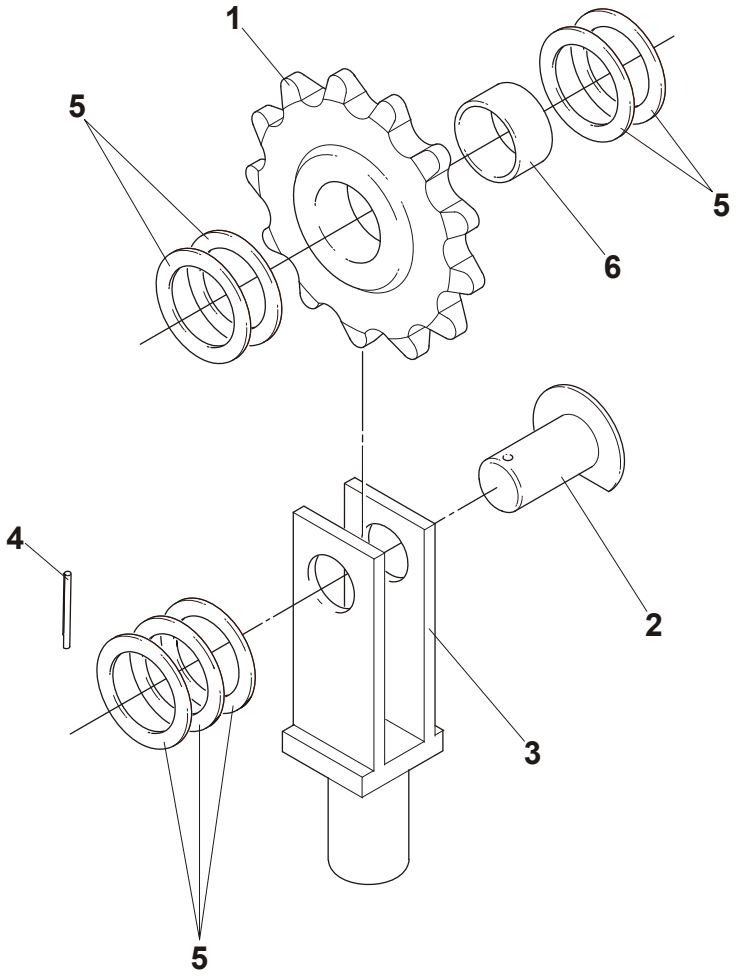


Figure 73 : Crosshead Assembly - 4, & 5,000 lb. Cap. - 96x120" Deck Length

11.5.5 Crosshead Assembly - 4, & 5,000 lb. Cap. - 96x120" Deck

Item	Qty	Part No	General Description	Specific Description
-	**-**	**797-459**	**Crosshead Assembly (3"X3")**	**4,& 5,000/96X120"**
1	1	105-645	Sprocket (Ramtop) Assembly	4,& 5,000/96X120"
2	1	797-451	Pin Assembly (3"X1-1/4")	4,& 5,000/96X120"
3	1	797-504	Crosshead Weldment (1-1/2"Ram)	4,& 5,000/96X120"
4	1	013-012	Spring Pin - 1/4" X 2"	4,& 5,000/96X120"
5	8	105-882	Washer-Spacer - (1-3/4" Dia)	4,& 5,000/96X120"
6	1	018-027	Bushing	4,& 5,000/96X120"

12. Schematics & Wiring Diagrams

12.1 Wiring Diagram-5,7.5,&10 H.P. Power Packs - 230V/1Ø/60Hz

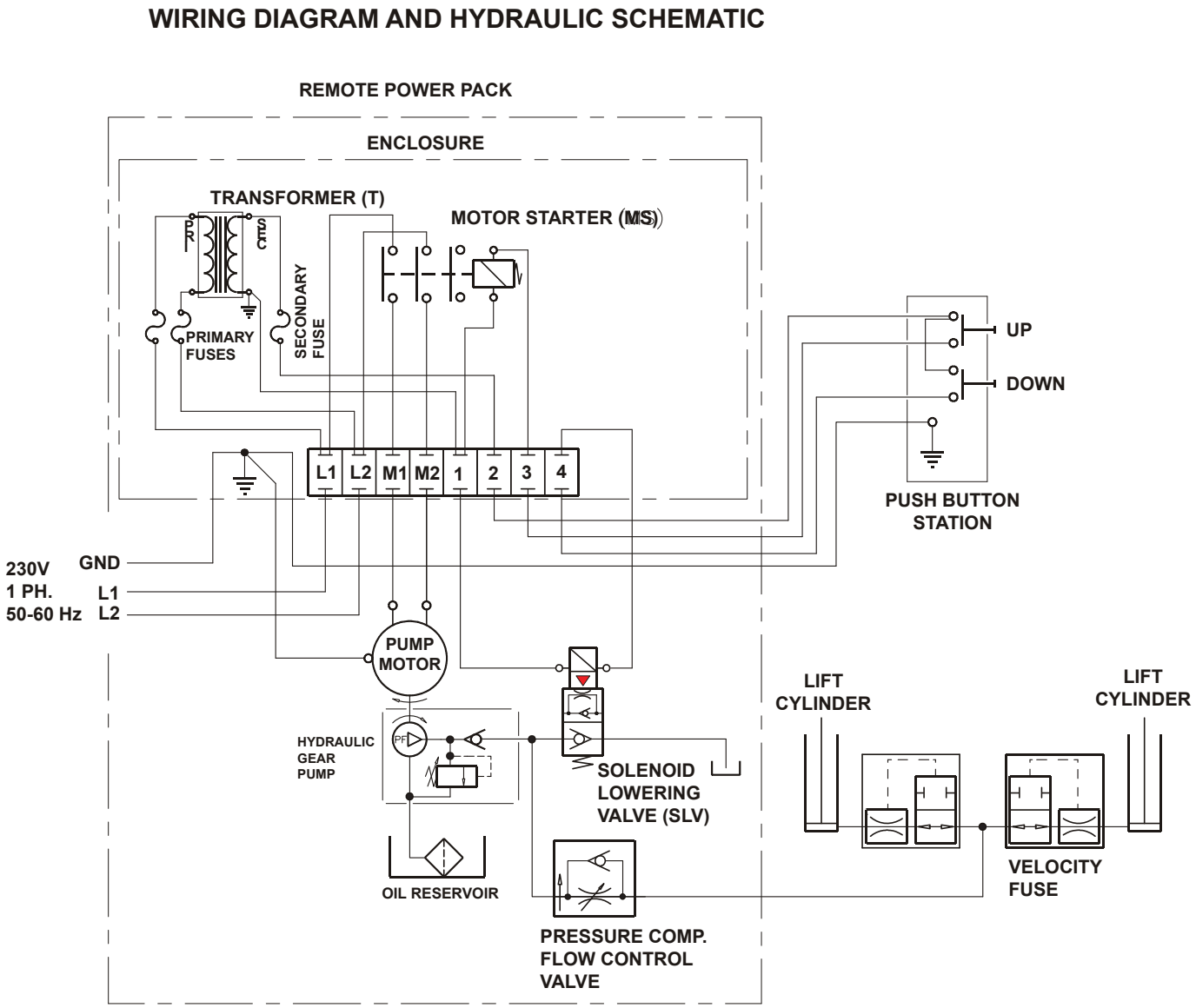


Figure 74 : Wiring Diagram-5,7.5,&10 H.P. Power Packs - 230V/1Ø/60Hz

12.2 Electrical Schematic-5,7.5,&10 H.P. Power Packs - 230V/1Ø/60Hz

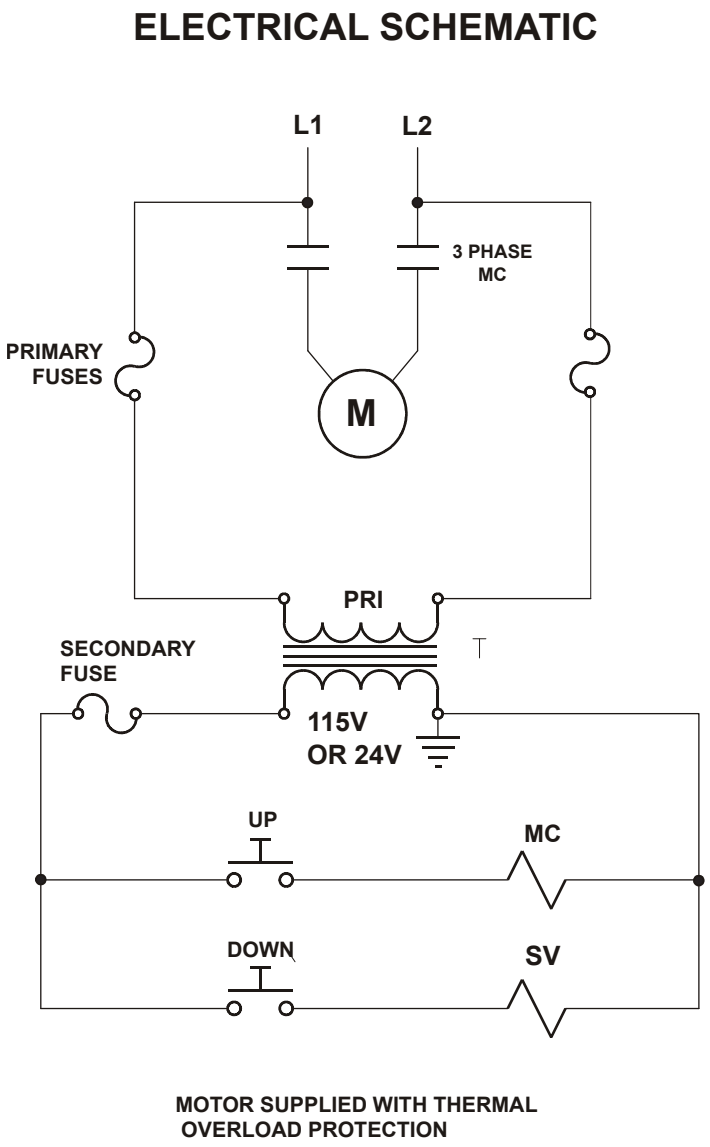


Figure 75 : Electrical Schematic-5,7.5,&10 H.P. Power Packs - 230V/1Ø/60Hz

12.3 Wiring Diagram-5,7.5,&10 H.P. Power Packs - 208-575V/3Ø/60Hz

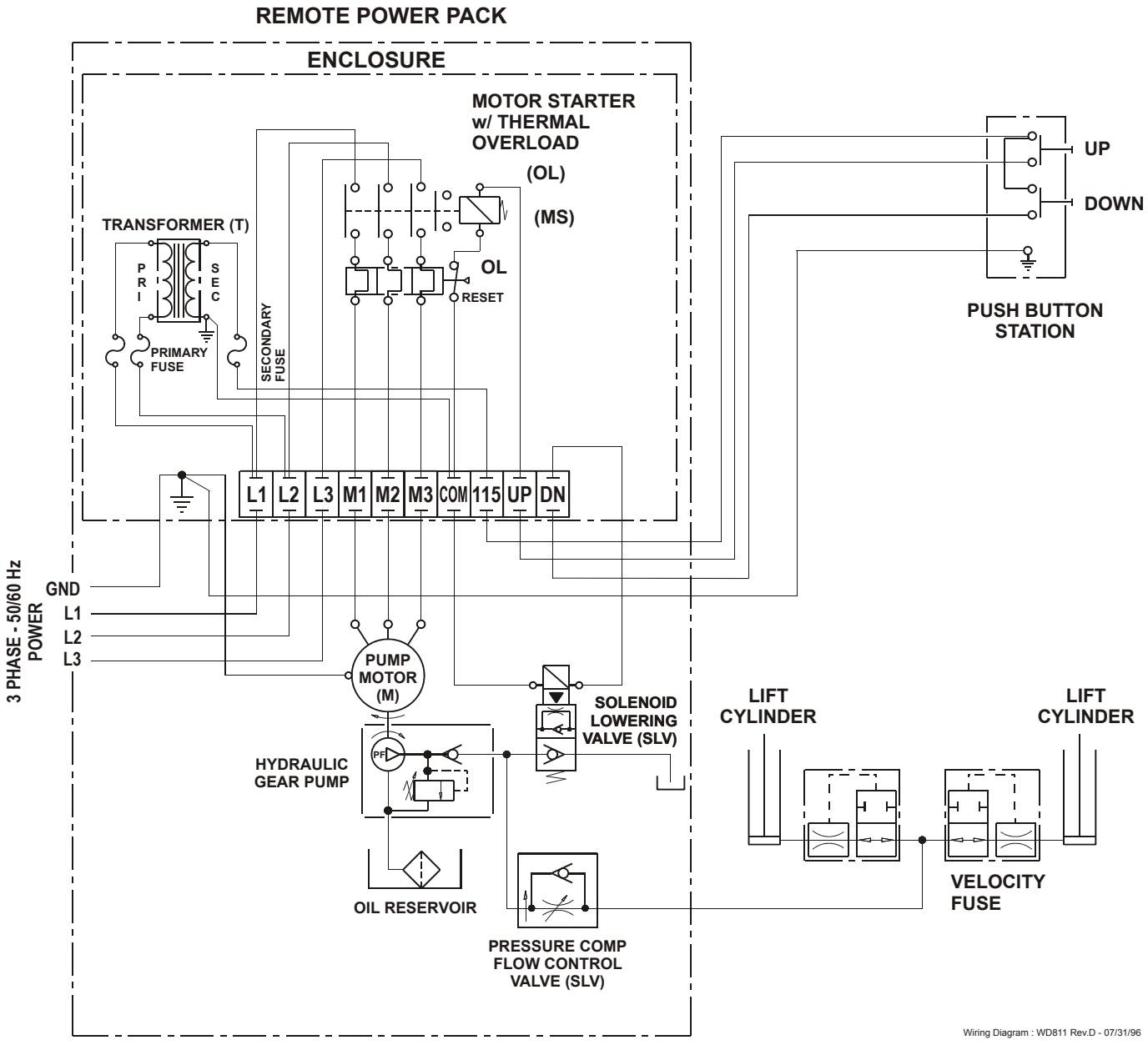


Figure 76 : Wiring Diagram-5,7.5,&10 H.P. Power Packs - 208-575V/3Ø/60Hz

12.4 Electrical Schematic-5,7.5,&10 H.P. Power Packs - 208-575V/3Ø/60Hz

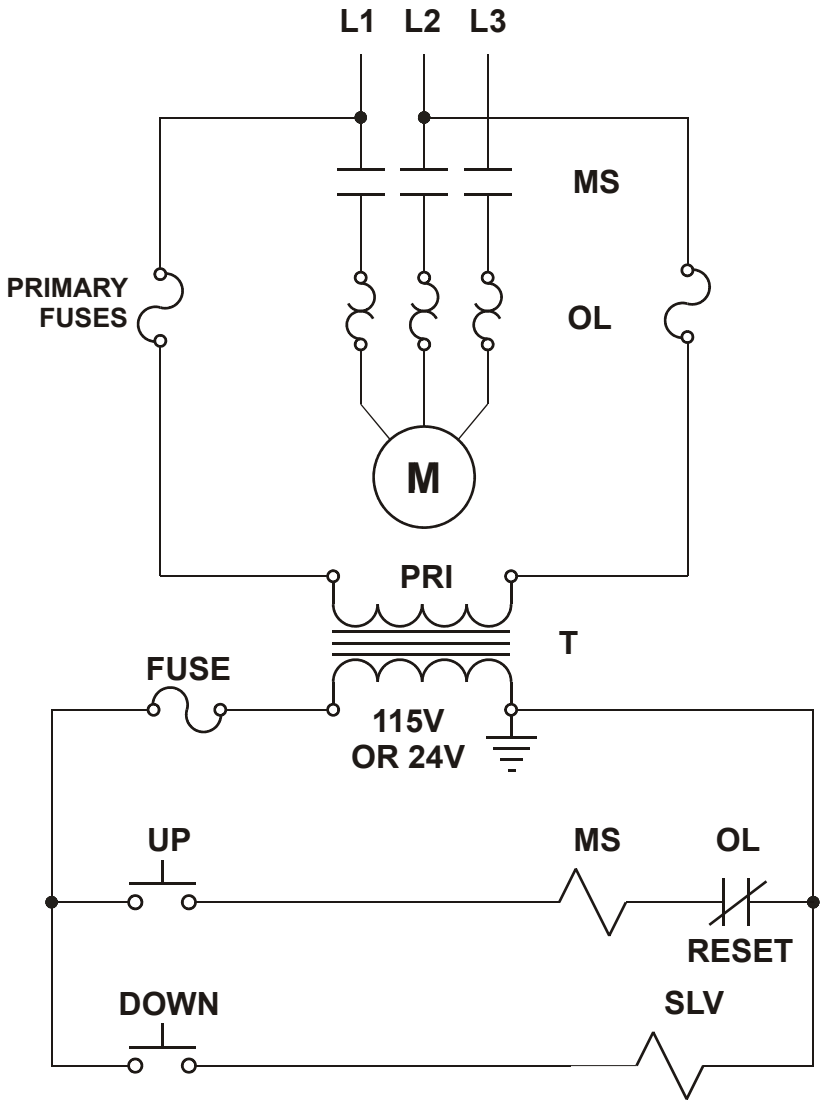


Figure 77 : Electrical Schematic-5,7.5,&10 H.P. Power Packs - 208-575V/3Ø/60Hz

12.5 Wiring Diagram-5-10 H.P. Power Packs - w/Safety Trip Switches

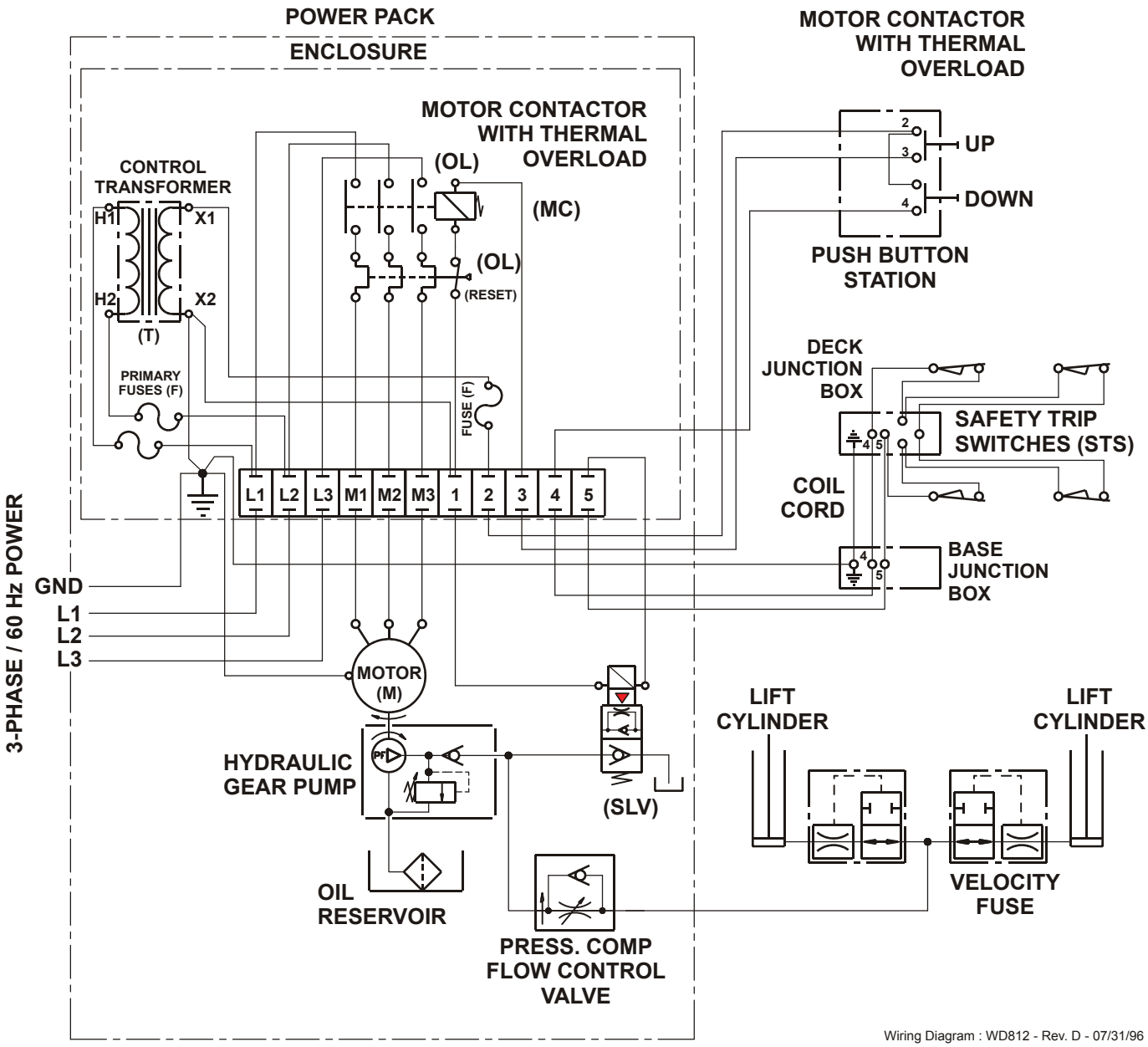


Figure 78 : Wiring Diagram-5-10 H.P. Power Packs - w/Safety Trip Switches

12.6 Electrical Schematic - 5-10 H.P. Power Packs - w/Safety Trip Switches

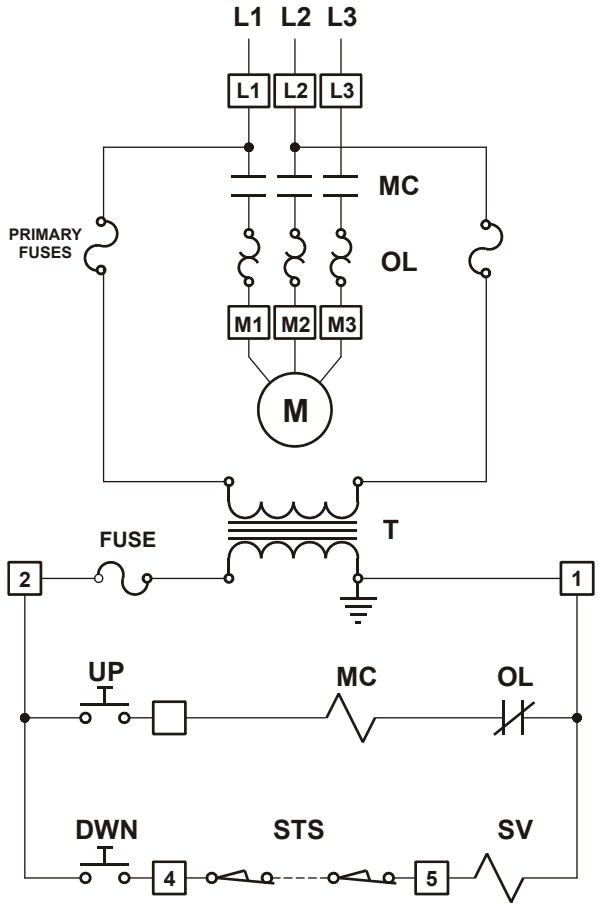


Figure 79 : Electrical Schematic - 5-10 H.P. Power Packs - w/Safety Trip Switches

12.7 Wiring Diagram-5-10 H.P. Power Packs - w/Up-Limit Switch

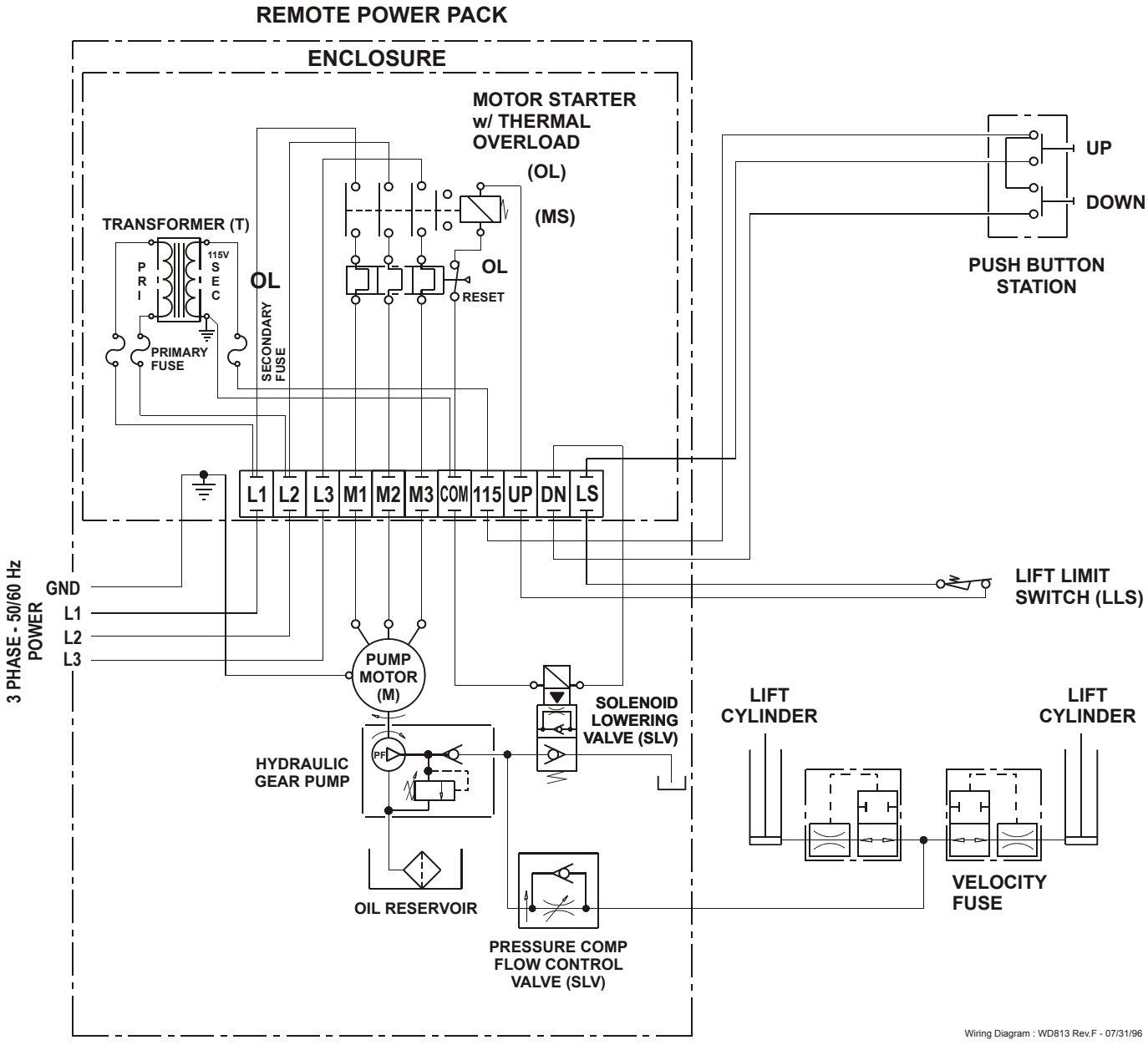


Figure 80 : Wiring Diagram-5-10 H.P. Power Packs - Up Limit Switch

12.8 Electrical Schematic - 5-10 H.P. Power Packs - w/Up-Limit Switch

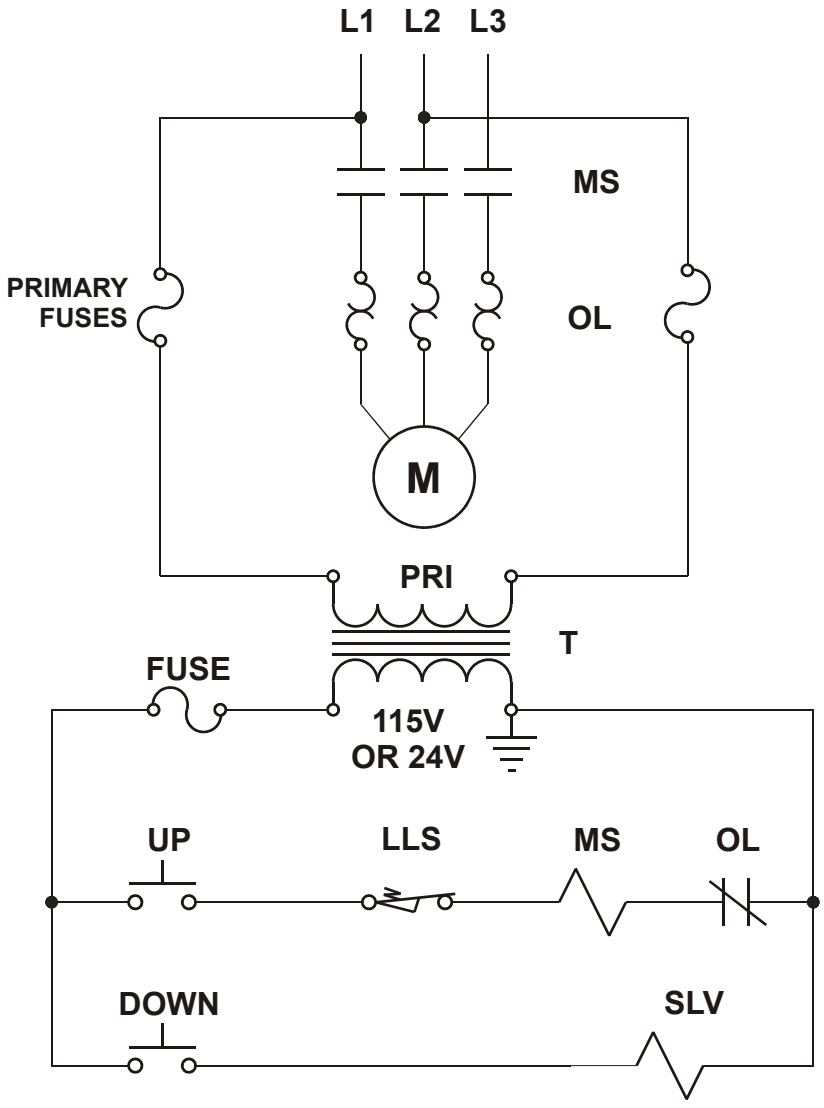


Figure 81 : Electrical Schematic-5-10 H.P. Power Packs - Up Limit Switch

12.9 Electrical Schematic - 5-10 H.P. Power Packs - w/Up-Limit Switch

13. Service / Maintenance History

DATE	WORK PERFORMED	COMMENTS / NOTES

TO ORDER PARTS

For prompt service when ordering parts, please provide the following information to your local distributor.
1. Model and Serial number of the equipment.
2. Part number, description and quantity.
3. Shipping instructions.

When in doubt as to part required, please provide a sketch or the used part as a sample.

RECORD HERE FOR FUTURE REFERENCE

Model Number : _____

Serial Number : _____

Distributor : _____

FOR RECOMMENDED SPARE PARTS CONTACT THE MANUFACTURER

TEL: 800 668 7078 / 905 457 3900
FAX: 800 808 0798 / 905 450 6555

BLUE GIANT®

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Brampton, Ontario, Canada L6W 3K2
Phone : 905-457-3900 Fax : 905-457-2313
www.BlueGiant.com

BLUE GIANT EQUIPMENT CORPORATION

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if calling within North America:
Phone: 1-800-668-7078 Fax: 1-888-378-5781

GEAppliances.com

Convection Built-In Electric Wall Oven

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Using The Oven
Oven Controls 6
Special Features 8
Oven Racks 9
Aluminum Foil and Oven Liners 9
Cookware 9
Cooking Modes 10
Cooking Guide 11

Care and Cleaning
Control Panel 12
Oven Exterior 12
Stainless Steel Surfaces 12
Oven Interior 12
Flat Racks 12
Maintenance 13

Troubleshooting Tips 14

Owner's Manual

JK5000 - 27" Single Wall Oven
JT5000 - 30" Single Wall Oven
JK5500 - 27" Double Wall Oven
JT5500 - 30" Double Wall Oven

For a Spanish version of this manual, visit our Website at GEAppliances.com.

Para consultar una version en español de este manual de instrucciones, visite nuestro sitio de internet GEAppliances.com.

Write the model and serial numbers here:

Model # _____

Serial # _____

You can find them on a label on the side trim or on the front of the (lower) oven behind the oven door.

Printed on Recycled Paper

Printed in the United States

49-80722 03-14 GE

CARROLL
SEATING • SCIENCES • SCHOOLS • SERVICE

CLOSEOUT DOCUMENTS

Project:

Webster University Interdisciplinary Science Building (ISB)

Laboratory Casework Package

(CS404004)

Contractor / Owner Issued To:

Paric Corporation

(15051)

Substantial Completion:

August 7, 2017

ACE ELECTRIC LAB. SYSTEMS

1550 S. Kingshighway, St. Louis, MO 63110
Phone (314) 771-7272 Fax (314) 771-6956

On August 23, 2017 ACE performed an Ashrae 110 Fume Hood Test on a Jamestown Fume Hood. The unit being tested was Serial Number 6-170823-1 located at Webster University Lab 478, Interdisciplinary Science Building.

The test was conducted as described in the Ashrae 110 Standard "Method of Testing Performance of Laboratory Fume Hoods". It is being tested as installed.

Velocity readings were measured as described in the Ashrae 110 Standard with an average velocity of 88.5 fpm with the lab door closed. This was measured with the sash at 18"H and 38" W.

Flow visualization (smoke test) is a test to visualize the hood's ability to contain vapors. The test consists of both a small local challenge and a gross challenge to the hood. The intent of this test is to render an observation of the hood's performance as it is typically used.

On the small local challenge with the sash open to 18"H, the center release has a smooth inflow with some turbulence caused by the air being pulled down the front of the sash. When the release was at the work surface, the smoke showed some reverse flow and turbulence at the lip of the dished work surface. The smoke does not travel past the lip back towards the opening. When tested with the sash closed, a release at the top the smoke travels above the sash through the bypass also a release under the airfoil flowed towards the rear. Tests with no escape.

On the large challenge with the sash open to 18 "H, the smoke flows inward and slightly upward with some turbulence and some smoke getting caught in a rolling action in the top of the hood turning back at the opening. A release at the work surface showed a slight reverse flow and some slight turbulence at the lip of the dished work surface. The smoke does not travel past the lip back towards the opening. Tests with no escape.

The tracer gas test was performed on the unit as described in the Ashrae 110 Standard.

The SF-6 containment test was first performed with the sash at 18"H, with the SF-6 release chamber and mannequin on the left side showing good containment for vertical sash opening. The SF-6 containment test was then performed with the SF-6 release chamber and the mannequin in the center and had good containment for vertical sash opening. The SF6 containment test was performed with the mannequin and the SF6 release chamber on the right side where it showed good containment.



ACE ELECTRIC LAB. SYSTEMS

1550 S. Kingshighway, St. Louis, MO 63110
Phone (314) 771-7272 Fax (314) 771-6956

Description:
The Unit has a single piece sash . Unit does have an airflow monitor on it.
The exhaust goes out through one panel in the rear of the unit.
The panel is 38'W x 33" H.

Dimensions
Exterior:
48"W
57"H
33"D
Work surface is 36" from the floor
From work surface to the nose of the mannequin = 24"H.

Interior:
38"W
49"H
26" from the rear of the air foil to the back of the unit.
23.5" to the rear or the air foil to the front of the panel along the back side of the unit.

Opening size:
18"H x 38"W .
24.5" H x 38" W with sash full open.

Ace Lab Systems
1550 S. Kingshighway
St. Louis, MO 63110
Tel: (314) 771-7272
Fax: (314) 771-6956
WWW.AceLabSystems.Co

Fume Hood Test Report

6-170823-1

Date Tested
8-23-2017

Institution:	Webster University	Certifier:	Brian Dyer
Department:	N/A	Instrument Manufacturer:	Jamestown
Address:	7470 E.Lockwood	Model:	F350-48G5
City, State, ZIP:	St.Louis MO, 63119	Serial #:	6-170823-1
Contact:	Amanda Sutton	Location:	Lab 478
Phone Number:	(314) 227-0088		

Tests Conducted

- [x] Vertical Opening Left Tracer Gas
- [x] Vertical Opening Center Tracer Gas
- [x] Vertical Opening Right Tracer Gas
- [ ] Horizontal Opening Left Tracer Gas
- [ ] Horizontal Opening Center Tracer Ga
- [ ] Horizontal Opening Right Tracer Gas
- [x] Face Velocity
- [x] Smoke Visualization
- [x] Sash Movement Effect
- [x] Walk By Test
- [x] Lab Door Open Test

Final Testing Results

- ○ Test Passed
- ○ Test Failed

Face Velocites

94.2	94.2	92.0	86.6	82.6					
81.2	89.6	89.8	85.4	89.2					

Average Face Velocity (AFV)	88.5
Turbulence Intensity (TI)	0.068
Standard Deviation of Averages (SDA)	4.27

Standard Deviation

2.3	6.2	3.5	5.4	7.8					
13.4	8.3	4.5	4.1	4.9					

Remarks:
Interdisciplanary Science Building



Face Velocites

0	0	0	0	0	0	0	0	0
AFV	TI	SDA	AFV	TI	SDA	AFV	TI	SDA

Standard Deviation

Equipment Used

	Make	Model	Serial #	Cal Date
Detector	Foxboro	Miran-1A CVF	1A3388	8/23/3017
VoltMeter	Radio Shack	22-805	A99023395	8/23/2017
Air Velocity Meter:	TSI	8346	971100212	2/1/2017

B. Dyer
Field Service Engineer

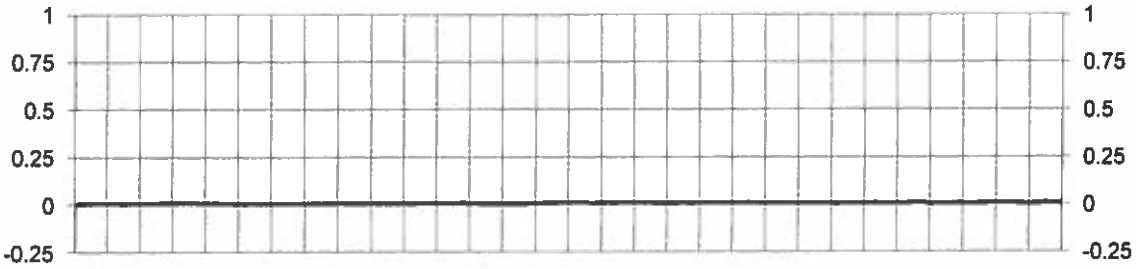
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1550 S. Kingshighway
St. Louis, MO 63110
Tel: (314) 771-7272
Fax: (314) 771-6956
WWW.AceLabSystems.Co

Fume Hood Test Report

6-170823-1

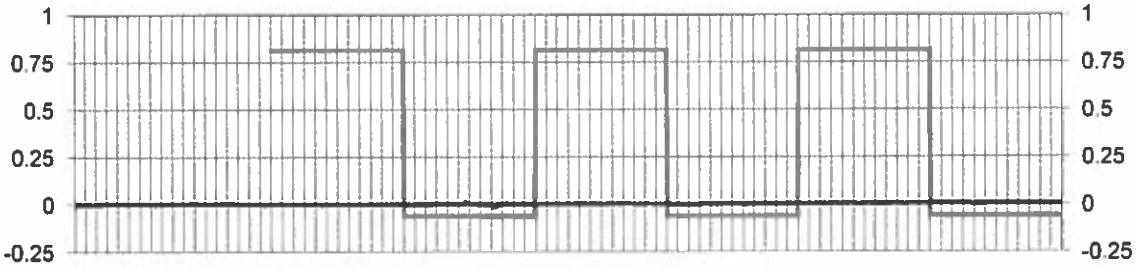
Date Tested
8-23-2017

Vertical Opening Tracer Gas Test Results (Left Side):



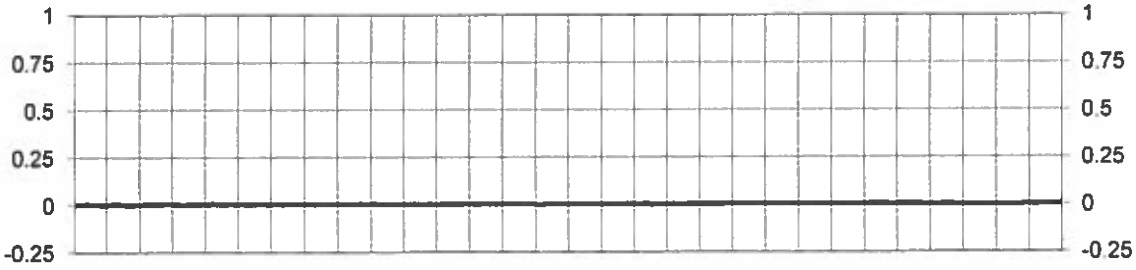
Minimum .000 ppm
Maximum .010 ppm
Average .006 ppm

Vertical Opening Tracer Gas Test Results (Center):



Minimum -.010 ppm
Maximum .010 ppm
Average .001 ppm

Vertical Opening Tracer Gas Test Results (Right Side):



Minimum -.003 ppm
Maximum .006 ppm
Average .001 ppm

Horizontal Opening Tracer Gas Test Results (Left Side):



Minimum .000 ppm
Maximum .000 ppm
Average .000 ppm

* 10 Seconds per Division (X Axis)

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Tel: (314) 771-7272
Fax: (314) 771-6956
WWW.AceLabSystems.Co

Fume Hood Test Report

6-170823-1

Date Tested
8-23-2017

Horizontal Opening Tracer Gas Test Results (Center):



Minimum
.000 ppm
Maximum
.000 ppm
Average
.000 ppm

Horizontal Opening Tracer Gas Test Results (Right Side):



Minimum
.000 ppm
Maximum
.000 ppm
Average
.000 ppm

* 10 Seconds per Division (X Axis)



ACE ELECTRIC LAB. SYSTEMS

1550 S. Kingshighway, St. Louis, MO 63110
Phone (314) 771-7272 Fax (314) 771-6956

On August 23, 2017 ACE performed an Ashrae 110 Fume Hood Test on a Jamestown Fume Hood. The unit being tested was Serial Number 6-170823-3 located at Webster University Lab 491, Interdisciplinary Science Building.

The test was conducted as described in the Ashrae 110 Standard "Method of Testing Performance of Laboratory Fume Hoods". It is being tested as installed.

Velocity readings were measured as described in the Ashrae 110 Standard with an average velocity of 84.8 fpm with the lab door closed. This was measured with the sash at 18"H and 62" W.

Flow visualization (smoke test) is a test to visualize the hood's ability to contain vapors. The test consists of both a small local challenge and a gross challenge to the hood. The intent of this test is to render an observation of the hood's performance as it is typically used.

On the small local challenge with the sash open to 18"H, the center release has a smooth inflow with some turbulence caused by the air being pulled down the front of the sash. When the release was at the work surface, the smoke showed some reverse flow and turbulence at the lip of the dished work surface. The smoke does not travel past the lip back towards the opening. When tested with the sash closed, a release at the top the smoke travels above the sash through the bypass also a release under the airfoil flowed towards the rear. Tests with no escape.

On the large challenge with the sash open to 18 "H, the smoke flows inward and slightly upward with some turbulence and some smoke getting caught in a rolling action in the top of the hood turning back at the opening. A release at the work surface showed a slight reverse flow and some slight turbulence at the lip of the dished work surface. The smoke does not travel past the lip back towards the opening. Tests with no escape.

The tracer gas test was performed on the unit as described in the Ashrae 110 Standard.

The SF-6 containment test was first performed with the sash at 18"H, with the SF-6 release chamber and mannequin on the left side showing good containment for vertical sash opening. The SF-6 containment test was then performed with the SF-6 release chamber and the mannequin in the center and had good containment for vertical sash opening. The SF6 containment test was performed with the mannequin and the SF6 release chamber on the right side where it showed good containment.



ACE ELECTRIC LAB. SYSTEMS

1550 S. Kingshighway, St. Louis, MO 63110
Phone (314) 771-7272 Fax (314) 771-6956

Description:
The Unit has a single piece sash . Unit does have an airflow monitor on it.
The exhaust goes out through one panel in the rear of the unit.
The panel is 62'W x 33" H.

Dimensions
Exterior:
72"W
57"H
33"D
Work surface is 36" from the floor
From work surface to the nose of the mannequin = 24"H.

Interior:
62"W
49"H
26" from the rear of the air foil to the back of the unit.
23.5" to the rear or the air foil to the front of the panel along the back side of the unit.

Opening size:
18"H x 62"W .
24.5" H x 62" W with sash full open.

Ace Lab Systems
1550 S. Kingshighway
St. Louis, MO 63110
Tel: (314) 771-7272
Fax: (314) 771-6956
WWW.AceLabSystems.Co

Fume Hood Test Report

6-170823-3

Date Tested
8/23/2017

Institution:	Webster University	Certifier:	Brian Dyer
Department:	N/A	Instrument Manufacturer:	Jamestown
Address:	470 E.Lockwood	Model:	F350-72G5
City, State, ZIP:	St.Louis MO, 63119	Serial #:	6-170823-3
Contact:	Amanda Sutton	Location:	4th Fl Lab 491
Phone Number:	(314) 227-0088		

Tests Conducted

- [x] Vertical Opening Left Tracer Gas
- [x] Vertical Opening Center Tracer Gas
- [x] Vertical Opening Right Tracer Gas
- [ ] Horizontal Opening Left Tracer Gas
- [ ] Horizontal Opening Center Tracer Ga
- [ ] Horizontal Opening Right Tracer Gas
- [x] Face Velocity
- [x] Smoke Visualization
- [x] Sash Movement Effect
- [x] Walk By Test
- [x] Lab Door Open Test

Final Testing Results
- ○ Test Passed
- ○ Test Failed

Face Velocites

89.4	86.6	83.2	87.0	75.0	84.8	84.4			
86.2	83.4	94.6	86.4	84.2	80.6	80.8			

Average Face Velocity (AFV)	84.8
Turbulence Intensity (TI)	0.081
Standard Deviation of Averages (SDA)	4.35

Standard Deviation

3.4	6.2	10.0	4.1	11.5	4.2	1.9			
8.3	5.0	6.5	9.7	10.5	7.1	7.5			

Remarks:
Interdisciplinary Science Building



Face Velocites

0	0	0	0	0	0	0	0	0
AFV	TI	SDA	AFV	TI	SDA	AFV	TI	SDA

Standard Deviation

Equipment Used

	Make	Model	Serial #	Cal Date
Detector	Foxboro	Miran-1A CVF	1A3388	8/23/2017
VoltMeter	Radio Shack	22-805	A99023395	8/23/2017
Air Velocity Meter:	TSI	8346	97110212	2/1/2017

B Dyer

Field Service Engineer

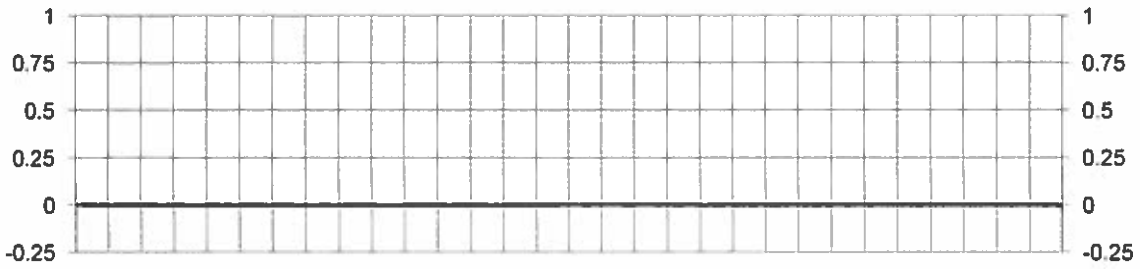
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Fax: (314) 771-6956
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Fume Hood Test Report

6-170823-3

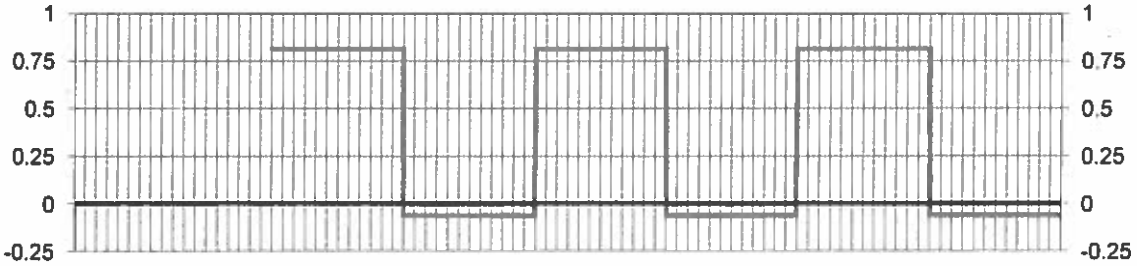
Date Tested
8/23/2017

Vertical Opening Tracer Gas Test Results (Left Side):



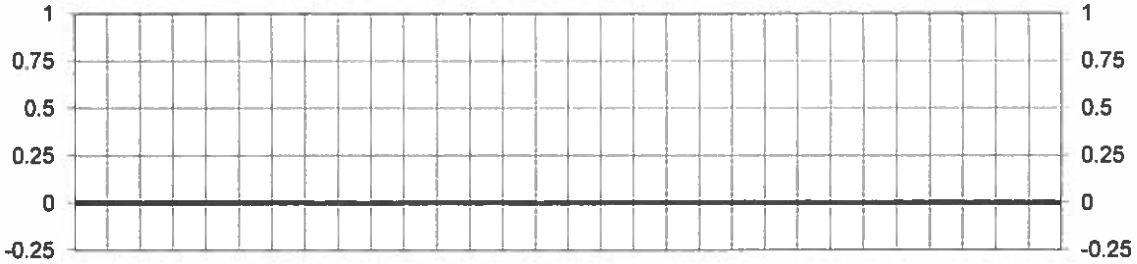
Minimum: -.003 ppm
Maximum: .001 ppm
Average: -.001 ppm

Vertical Opening Tracer Gas Test Results (Center):



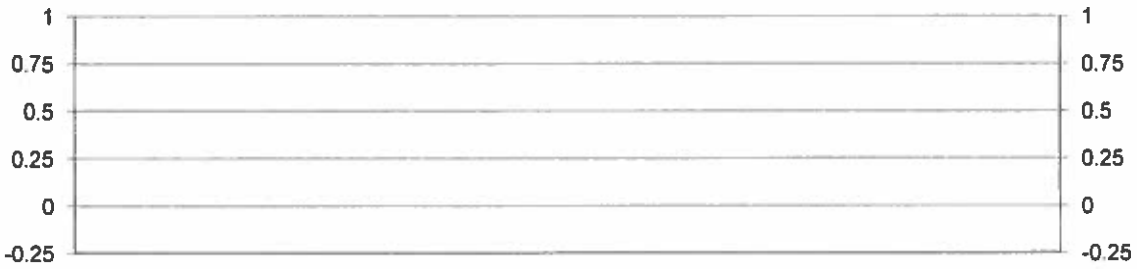
Minimum: -.002 ppm
Maximum: .003 ppm
Average: .000 ppm

Vertical Opening Tracer Gas Test Results (Right Side):



Minimum: -.001 ppm
Maximum: .003 ppm
Average: .001 ppm

Horizontal Opening Tracer Gas Test Results (Left Side):



Minimum: .000 ppm
Maximum: .000 ppm
Average: .000 ppm

* 10 Seconds per Division (X Axis)

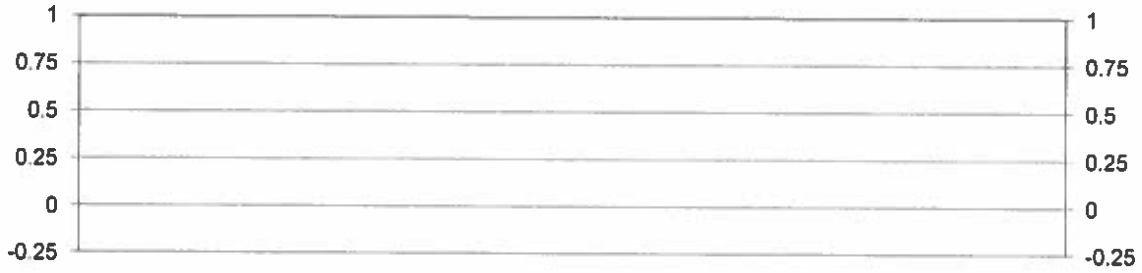
Ace Lab Systems
1550 S. Kingshighway
St. Louis, MO 63110
Tel: (314) 771-7272
Fax: (314) 771-6956
WWW.AceLabSystems.Co

Fume Hood Test Report

6-170823-3

Date Tested
8/23/2017

Horizontal Opening Tracer Gas Test Results (Center):



Minimum
.000 ppm
Maximum
.000 ppm
Average
.000 ppm

Horizontal Opening Tracer Gas Test Results (Right Side):



Minimum
.000 ppm
Maximum
.000 ppm
Average
.000 ppm

* 10 Seconds per Division (X Axis)



Terms and Conditions of Sale

1. ACCEPTANCE

No order shall be binding upon us until accepted in writing by an authorized official at Flex-Strut Inc. Any contract for sale of goods, and these Conditions of Sale, shall be governed by and constructed to the Uniform Commercial Code as adopted in the state of Ohio.

2. ERRORS

Should an error be made filling an order, notify Flex-Strut promptly and we will immediatedly attempt to adjust the matter without any expense to the purchaser.

3. CANCELLATION

Cancellation of orders will be accepted only with the understanding that Flex-Strut will be reimbursed for expenses incurred as a result of the cancellation. Orders for special, non-catalogued items are not subject to cancellation after production is started.

4. RETURNED MATERIAL

Permission to return any standard merchandise must be obtained in writing from Flex-Strut in Warren, Ohio . A Returned Goods Autorization (RGA) form will be provided and must accompany the material upon receipt. Request for RGA must be made within 60 days from the date of shipment and be subject to conditions spelled out in the RGA including, but not limited to the following:

a) Return transportation must be pre-paid.

b) Material not in first-class, saleable condition will be subject to the cost of reconditioning.

c) Merchandise credit will be allowed on the basis of the price charged for the merchandise, less handling and re-stocking charge defined in RGA less any outbound freight allowed or paid by Flex-Strut Inc.

d) Returns will only be considered for standard catalog items. Any special, non-catalogued items are not subject to return for credit under any circumstances.

5. PRICES

PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.

The price list supercedes and cancels all previous quotations on any part listed in this catalog. Orders are accepted with the understanding that material will be billed at the price in affect at the time of shipment, unless otherwise specified in quotation or order.

6. MINIMUM ORDER

$30.00 NET

7. TERMS

1% 10 DAYS DATE OF INVOICE

NET 30 DAYS DATE OF INVOICE

8. TERMS OF PAYMENT

Failure by customer to meet punctual payment shall subject any further deliveries to be suspended or cancelled at the manufacturer's option; without prejudice to the manufacturer's rights to claim for material supplied or work done at the time of cancellation, and for any loss or injury occasioned thereby.

9. TAXES

Prices are exclusive of all Federal, State and Local Taxes.

10. FINANCE CHARGES

Any amount not timely paid by the customer shall bear interest at the maximum rate permitted by law, not to exceed 1-1/2% per month.

11. FREIGHT

All prices are F.O.B. point of shipment, unless otherwise stated.

12. CATALOG WEIGHTS, DIMENSIONS & DESIGN LOADS

Catalog weights and dimensions are careful estimates but not guaranteed. Design loads are based on testing or by calculations based on static load conditions.

13. DAMAGE OR LOSS IN TRANSIT

Delivery of goods to a carrier at our plant or other shipping point shall constitute delivery to purchaser; and regardless of freight payment all risk of loss or damage in transit shall pass to the purchaser at that time. Purchaser shall make claims for loss or damage to goods while in transit against the carrier; Flex-Strut will assist in securing satisfactory adjustment of such claims.

14. CLAIMS

Claims for defective material, shortages, delays, failures in shipment or delivery for any other cause shall be deemed waived and released by purchaser unless made in writing within 30 days after arrival of material. Under no circumstances shall purchaser install damaged or defective material if claims are to be made.

15. LIABILITY FOR MISUSE

Flex-Strut shall not be liable for damages to property or persons due to improper installation of its material or through attempts to utilize the material under conditions which exceed the designed capabilities.

Purchaser agrees to indemnify and hold harmless from any and all claims, liabilities, damages, costs and expenses asserted against Flex-Strut or incurred by Flex-Strut because of injuries to persons or damages to property resulting from the improper installation or misuse of the material.

16. MATERIAL SUPPLIER ONLY

Flex-Strut is a material supplier and fabricator and not a construction sub-contractor. We assume no responsibilty for any terms, conditions, or special provisions contained in any contract between purchaser and any other party, including, but not limited to, provisions regarding warranties, time and method of payment and retainage, cancellation and penalties for delay in completion.

17. PURCHASER'S SPECIFICATIONS

Purchaser agrees to protect, defend, indemnify, and hold Flex-Strut harmless from and against all claims, liabilities, demands, causes of action, losses, damages, costs and expenses, including by way of description but not by way of limitation, attorney's fees, expenses which may be asserted against us or may be incurred by us arising out of manufacture and/or sale of any material furnished to or for purchaser in compliance with purchaser's designs, plans or specifications, including any claim, demand, or liability on account of actual or alleged infringement of any United States or foreign patent or trademark.

18. WARRANTIES

We guarantee to replace, or at our option to repair, any material which we find in our sole discretion to be defective in material or workmanship provided that a claim, and proof thereof, is made in writing to us within thirty (30) days after purchaser's receipt of material. Our obligation with respect to material found by us to be defective shall be limited to replacement or repair. No other warranty or guarantee of any kind is made, expressed or implied, statutory, by operation of law, or otherwise including warranties for merchantability and fitness for a particular purpose.

An extended 5 year warranty is provided for the 6 tall cabinets in Room 272B.

Date: 7/24/17

Job: 04437A thru D
Webster University
Ship Date: 7/10/17

This is to confirm that Institutional Casework, Inc. (ICI), will warrant wood & metal casework, and equipment provided on project 04437A-D/Webster University/St. Louis, MO.

ICI warrants its products to be free from defects in materials and workmanship, under normal use and service, for three years from date of delivery. ICI makes no warranty, expressed or implied, to the merchantability and fitness for a particular purpose, design, sale, installation or use of its products.

This limited warranty is in lieu of all other warranties, expressed or implied, and ICI, shall not be liable for incidental, special, or consequential damages, losses or expenses, resulting from the use of its products. ICI shall not be responsible for damage to its products by other parties or for improper use of its products.

Within the warranty period, ICI, shall, at its option, repair, replace, or refund the purchase price of defective products. ICI shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods prior to return or other disposition. Any returned goods shall be shipped F.O.B. to ICI plant. We do not unilaterally agree to pay charges for finishing or installing replaced casework. ICI will not assume responsibility for field repairs or labor not authorized in writing by ICI.

Products supplied by ICI are subject to tolerances and variations consistent with usages of the trade and regular manufacturing practices with regard to, but not limited to, dimensions, flatness, straightness, composition, physical properties, color, texture and grain.

Fumehoods manufactured by ICI will be covered under standard 3 year warranty; special life time warranty extended on the sash mechanism portion of the warranty referring to #35 case-hardened steel chain, sealed bearings, drive axle and chains attaching points at both sash handle and counterweight.

The warranty with respect to products of another manufacturer sold by ICI is limited to the warranty extended by that manufacturer to ICI.

ICI reserves the right to change design, material, and construction of its products without notice.

Respectfully,

Stephen Burnine

Stephen Burnine

INSTITUTIONAL CASEWORK, INC.
CAMPBELLRHEA, JAMESTOWN METAL PRODUCTS & JAMESTOWN SCIENTIFIC
Corporate Office: **1865 N Market Street, Paris TN 38242**
731.642.4251 FAX: 731.642.4262 www.ici-scientific.com

Date: March 14, 2017

Project: Webster University
Interdisciplinary Science Building
8274 Bidg Bend BLVD
St. Louis, MO 63119

Subject: LEED requirements for MR 6, and MR7

To Whom It May Concern:

The casework for this project is manufactured by Institutional Casework, Incorporated, in Paris, Tennessee. The following is a break-down of the LEED information.

MR 6 Rapidly Renewable Material:

No rapidly renewable material is specified or provided for this project.

MR 7 Certified Materials:

The FSC Chain-of-Custody number for Institutional Casework as indicated on delivery receipt and invoice is RA-COC-001156. A copy of the certificate is attached. The FSC Certified Wood percentage will be 70%. As required by FSC, the invoice will indicate the wood cost and FSC claim, and the delivery receipt will indicate the FSC claim.

Sincerely,

Wayne S. Cathey
Director of Engineering
Institutional Casework INC.
731-642-4251
wcathey@iciscientific.com

CERTIFICATE

for

INSTITUTIONAL CASEWORK, INC./CAMPBELLRHEA

1865 Highway 641 N.

Paris, Tennessee 38242

CERTIFICATE SCOPE

Certificate Type: *Single Chain of Custody and Controlled Wood*
Standard(s): *FSC-STD-40-004 V2-1; FSC-STD-40-005 V2-1*
Product Group(s): *Casework*
Valid from *April 18, 2016* **to** *April 17, 2021*
Certificate Registration Code: *RA-COC-001156, RA-CW-001156*
FSC® License Code: *FSC-CC016935*
Certificate Issue Number: *IN-2016-1*

Additional details regarding the scope, including a full list of products and species are available at info.fsc.org.

Jon Jickling, Director, Certification

Rainforest Alliance
233 Broadway, 28th Floor
New York, NY 10279 USA

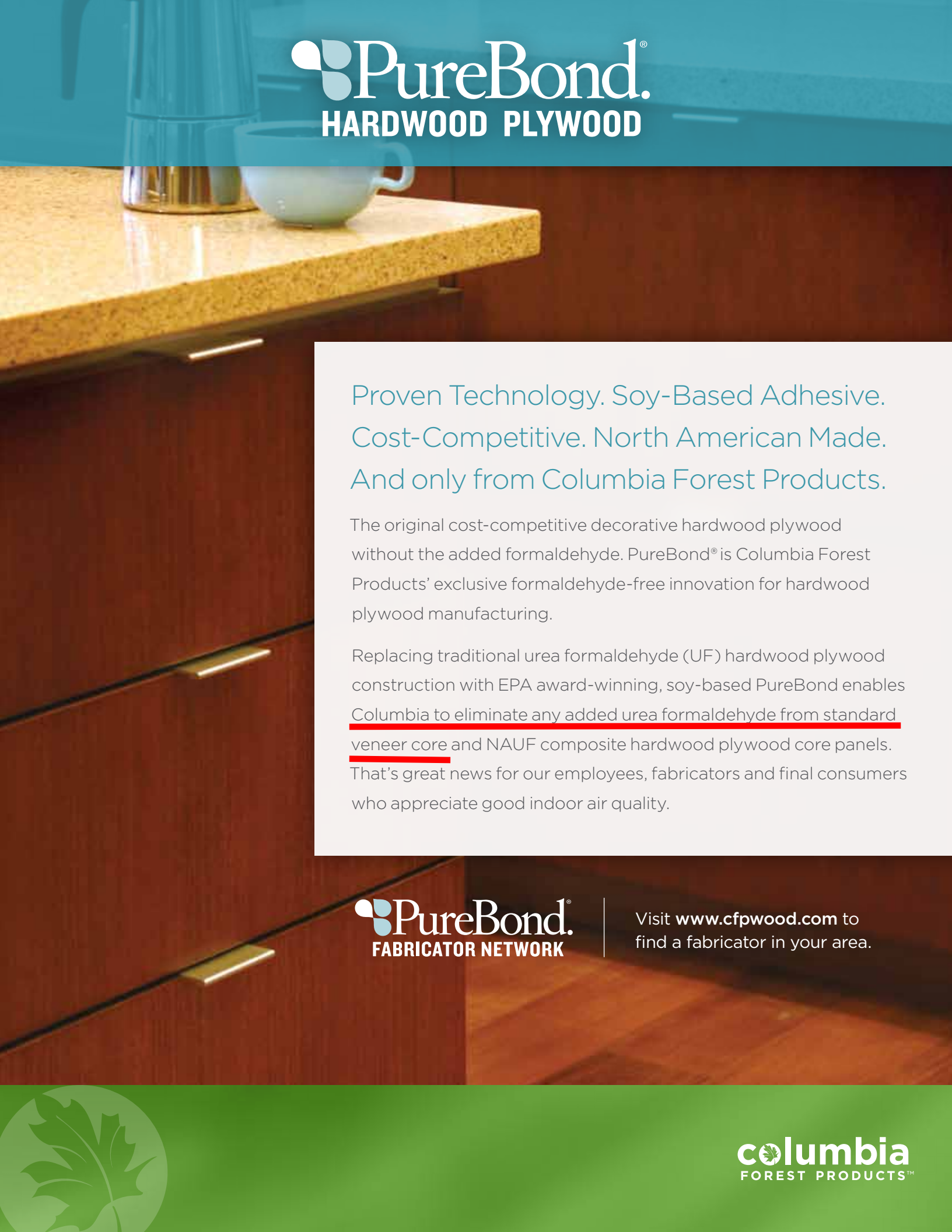
Rainforest Alliance is an FSC accredited certifier FSC® A000520

The validity of this certificate shall be verified on info.fsc.org. This certificate does not constitute evidence that a particular product supplied by the certificate holder is FSC certified and/or FSC Controlled Wood. Products offered, shipped or sold by the certificate holder can only be considered covered by the scope of this certificate when the required FSC claim is clearly stated on invoices and shipping documents.

This certificate is the property of Rainforest Alliance. This certificate and all copies or reproductions of this certificate shall be returned or destroyed if requested by Rainforest Alliance.

FSC
www.fsc.org
FSC® A000520
The mark of responsible forestry

RAINFOREST ALLIANCE CERTIFIED



PureBond®
HARDWOOD PLYWOOD

Proven Technology. Soy-Based Adhesive. Cost-Competitive. North American Made. And only from Columbia Forest Products.

The original cost-competitive decorative hardwood plywood without the added formaldehyde. PureBond® is Columbia Forest Products' exclusive formaldehyde-free innovation for hardwood plywood manufacturing.

Replacing traditional urea formaldehyde (UF) hardwood plywood construction with EPA award-winning, soy-based PureBond enables Columbia to eliminate any added urea formaldehyde from standard veneer core and NAUF composite hardwood plywood core panels. That's great news for our employees, fabricators and final consumers who appreciate good indoor air quality.

PureBond®
FABRICATOR NETWORK

Visit **www.cfpwood.com** to find a fabricator in your area.

columbia
FOREST PRODUCTS™



Library in the U.S. Green Building Council's LEED® Platinum head-quarters; fabricated using PureBond® veneer core hardwood plywood with bamboo veneers.

Formaldehyde-free.

When we say PureBond technology is "formaldehyde-free," we're describing our hardwood plywood panels which are comprised of no added urea formaldehyde components and assembled with zero urea-formaldehyde adhesives.

Less Cost. More Benefit.

What really makes PureBond special is that it's cost-competitive with the standard UF construction of most decorative veneer-core hardwood plywood that's made today. That means PureBond veneer core is substantially less expensive than other no-added-formaldehyde alternatives currently available. Additionally, PureBond has been tested to be even more water resistant than UF panels. PureBond urea formaldehyde-free panels have out-performed UF bonded panels in all moisture degradation tests.

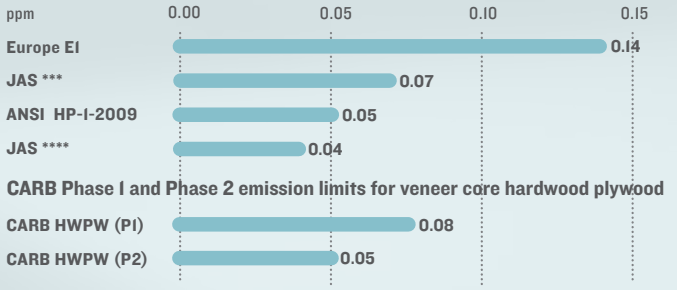
Better Living Through Chemistry.

With indoor air quality of increasing importance in today's architectural community, it's no small benefit that PureBond panels contain no added urea formaldehyde. In fact, PureBond veneer core panels are compliant with the U.S. Green Building Council's Leadership in Energy & Environmental Design (LEED®) standards and satisfy the emissions standards of the California Air Resources Board (CARB) regulations.

PureBond® HARDWOOD PLYWOOD

FORMALDEHYDE EMISSION LINE COMPARISON

Foreign standards normalized to ASTM E-1333 large chamber test method



CARB Phase I and Phase 2 emission limits for veneer core hardwood plywood

PureBond® veneer core hardwood plywood meets CARB Phase 2 today!

PureBond Facts:

- Columbia has manufactured over 50 million panels with PureBond formaldehyde-free hardwood plywood technology.
- PureBond veneer core panels are cost-competitive with traditional panels made using UF construction.
- PureBond panels offer improved moisture resistance compared to composite panels made with UF.
- PureBond panels may contribute points for LEED® IEQ 4.4 Credit for Low Emitting Materials: Composite Wood.
- PureBond panels can be specified as FSC® certified upon request.
- PureBond MDF and Particleboard core hardwood plywood is available upon request.
- PureBond is now the mill standard across our North American manufacturing facilities.
- PureBond is exclusive to Columbia Forest Products.

Want to know more?

For more information on PureBond, or to specify it for your next project, call one of the regional numbers below or visit **www.cfpwood.com.**

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U.S. GREEN BUILDING COUNCIL MEMBER

FSC www.fsc.org FSC® C017600 The mark of responsible forestry

RAINFOREST ALLIANCE CERTIFIED

Eastern US
1 800-237-2428
Central US
1 800-760-3341

Northeastern US & Canada
1 888-664-1964 • 1 888-525-1964
Western US / Canada
1 800-547-1791

columbia FOREST PRODUCTS™
cfpwood.com

PC-3®

Laboratory Table Top Cement

www.smooth-on.com

PRODUCT OVERVIEW

Smooth-On **PC-3®** Laboratory Table Top Cement is a two-component, black epoxy resin compound designed to join, bond and caulk sections of laboratory counters and tables. This epoxy resin cement is heavily filled and will adhere to vertical surfaces without sagging. It cures at room temperature with extremely low shrinkage. **PC-3®** contains no volatile organic compounds (VOC's) or solvents. It is chemically stable and bonds strongly to natural and artificial stones, most metals, glass, wood and to thermosetting resins such as polyester, phenolic and epoxy. **PC-3®** is available in pint units (2.5 lbs.) or quart units (5.0 lbs.) and is sold in case quantities only. A case of pints contains six units and a case of quarts contains 3 units.

TECHNICAL OVERVIEW

Mix Ratio: 1A : 1B by weight or volume	
Mixed Viscosity: Paste	
Specific Gravity/Volume: 1.4 / 20 cu. in./lb.	
Working Life: 20 minutes (100 g at 73°F/23°C)	
Handling time: 2 hours (0.010 in/0.0254 cm film)	
Color: Black	
Barcol 935 Hardness: 75 (after 24 hours)	
Tensile Strength, psi: 3,000	(ASTM D638-84)
Flexural Strength, psi: 5,000	(ASTM D790-87)
Linear Shrinkage: .003 in/in	
Compressive Yield, psi: 5,000	(ASTM D695-84)
Tensile Shear Adhesion to CR Steel, psi: 3,000	(ASTM D1002-72)

* All values measured after 7 days at 73°F/23°C

PROCESSING RECOMMENDATIONS

PREPARATION...*Safety*

- Use in a properly ventilated area ("room size" ventilation). Wear safety glasses, long sleeves and rubber gloves to minimize contamination risk.

Store and use material at room temperature (73°F/23°C). This product has a limited shelf life and should be used as soon as possible.

Any surface to which the PC-3® will be applied should also be at least 73°F/23°C. Sand surface and wipe clean with fast drying solvent (such as acetone) prior to applying PC-3®. Surface must be clean, dry, and free of all contaminants such as oil, grease, water, dust, etc. Mask adjacent areas with masking tape, then strip tape off as soon as installation is completed. Remove excess or unwanted cement with solvent before it sets.

Because no two applications are quite the same, a small test application to determine suitability for your project is recommended if performance of this material is in question.

MEASURING & MIXING...

Measuring & Mixing **-** It is important that Parts A & B be mixed accurately in equal amounts. Excess amounts of either Part A or B will cause improper curing of the material. After dispensing equal amounts of Parts A & B, mix thoroughly for 5 minutes, making absolutely sure that you scrape the sides and bottom of the mixing container several times. If you notice streaks in the mixed material, it is not mixed thoroughly enough. Normal cure time is 24 hours.

Safety First!

The Material Safety Data Sheet (MSDS) for this or any Smooth-On product should be read prior to use and is available upon request from Smooth-On. All Smooth-On products are safe to use if directions are read and followed carefully. **Keep Out of Reach of Children**

BE CAREFUL **-** PC-3® Part A is irritating to the eyes and skin. Avoid prolonged or repeated skin contact to prevent possible sensitization. Use only with adequate ventilation. If contaminated, flush eyes with water for 15 minutes and seek medical attention. Remove from skin with waterless hand cleaner, then soap and water. Read MSDS before using. PC-3® Part B causes burns to the eyes, may burn the skin and cause sensitization. Vapors irritate the respiratory tract. If contaminated, flush eyes with water for 15 minutes and seek medical attention. Remove from skin with soap and water. Use only with adequate ventilation. During the dismantling of a laboratory counter installation, care must be taken to avoid the inhalation of any dust from the epoxy cement or the counter top material itself. The method for removal is to heat up the PC-3® cement to about 130° - 150° F (hot water temperature) using flameless heat gun, then cutting away the joints with a putty knife or scraper blade. The epoxy is very "rubbery" when hot and cuts easily. If any sanding or sawing is performed, proper respiratory protection is mandatory.

IMPORTANT **-** The information contained in this bulletin is considered accurate. However, no warranty is expressed or implied regarding the accuracy of the data, the results to be obtained from the use thereof, or that any such use will not infringe upon a patent. User shall determine the suitability of the product for the intended application and assume all risk and liability whatsoever in connection therewith.

Call Us Anytime With Questions About Your Application.

Toll-free: **(800) 381-1733** Fax: **(610) 252-6200**

The new www.smooth-on.com is loaded with information about mold making, casting and more.

☑ GHS Compliant

Safety Data Sheet

SDS No. 203A

Section 1 - Chemical Product and Company Identification

Product/Chemical Name: PC-3® Series Part A
General Use: Epoxy Adhesive
Manufacturer: Smooth-On, Inc.,
5600 Lower Macungie Rd., Macungie, PA 18062
Phone (610) 252-5800, FAX (610) 252-6200
Emergency Contact: Chem-Tel
Domestic: 800-255-3924 International: 813-248-0585

Section 2 - Hazards Identification

Classification of the substance or mixture

Skin irritation – Category 2
Eye irritation – Category 2A
Skin sensitization – Category 1

GHS Label elements, including precautionary statements

Pictogram: 

Signal word: Warning

Health Hazard:	H313	May be harmful in contact with skin
General Precautions:	P101	If medical advice is needed, have product container or label at hand.
	P102	Keep out of reach of children.
	P103	Read label before use.
Prevention Precautions:	P264	Wash with soap and water thoroughly after handling.
	P270	Do not eat, drink or smoke when using this product.
	P272	Contaminated work clothing should not be allowed out of the workplace.
	P280	Wear protective gloves/protective clothing/eye protection/face protection.
Response Precautions:	P302 + P352	IF ON SKIN: Wash with plenty of soap and water
	P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water [or shower].
	P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P332 + P313	If skin irritation occurs: Get medical advice/attention.
P362 + P364	Take off contaminated clothing and wash it before reuse.

Hazards not otherwise classified (HNOC) or not covered by GHS - none

Section 3 - Composition / Information on Ingredients

The following ingredients are hazardous according to OSHA criteria:

CAS	Component	Concentration
25085-99-8	Propane, 2,2-bis[p-(2,3-epoxypropoxy)phenyl]-polymers	15% - 100%

Section 4 - First Aid Measures

Inhalation: Remove source(s) of contamination and move victim to fresh air. If breathing has stopped, give artificial respiration, then oxygen if needed. Contact physician immediately.
Eye Contact: Flush eyes with plenty of water. If irritation persists, seek medical attention.
Skin Contact: In case of skin contact, wash thoroughly with soap and water.
Ingestion: Do not induce vomiting unless instructed by a physician. Never give anything by mouth to an unconscious person.
After first aid, get appropriate in-plant, paramedic, or community medical support.

Section 5 - Fire-Fighting Measures

Flammable Classification: Non-Flammable
Extinguishing Media: Water Fog, Dry Chemical, and Carbon Dioxide Foam
Unusual Fire or Explosion Hazards: None known.

Fire-Fighting Instructions: Use water spray to cool fire-exposed surfaces and to protect personnel. Shut off "fuel" to fire. If a leak or spill has not ignited, use water spray to disperse the vapors. Either allow fire to burn under controlled conditions or extinguish with foam or dry chemical. Try to cover liquid spills with foam.

Further information: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full face piece operated in pressure demand or positive-pressure mode.

Section 6 - Accidental Release Measures

Spill /Leak procedures:
Only properly protected personnel should remain in the spill area; dike and contain spill; absorb or scrape up excess into suitable container for disposal; wash area with dilute ammonia solution. Stop or reduce discharge if it can be done safely**.**

Environmental precautions:
No special environmental precautions required.

Section 7 - Handling and Storage

Handling Precautions: Use good general housekeeping procedures. Wash hands after use.

Storage Requirements: Keep container(s) tightly closed and properly labeled. Store in cool, dry, well ventilated place away from heat, direct sunlight, strong oxidizers and any incompatibles. Store in approved containers and protect against physical damage. Keep containers securely sealed when not in use. Indoor storage should meet OSHA standards and appropriate fire codes. Containers that have been opened must be carefully resealed to prevent leakage. Empty containers retain residue and may be dangerous. Avoid water contamination.

Section 8 - Exposure Controls / Personal Protection

Respiratory Protection: Respiratory protection is not normally required when using this product with adequate ventilation. Should a respirator be needed, follow OSHA respirator regulations 29 CFR 1910.134 and European Standards EN 141, 143 and 371; wear an MSHA/NIOSH or European Standards EN 141, 143 and 371 approved respirators equipped with organic vapor cartridges.

Hand Protection: Handle with gloves. Wear any liquid-tight gloves such as butyl rubber, neoprene or PVC. Gloves must be inspected prior to use. Use proper glove removal technique to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Eye Protection: Safety glasses with side shields per OSHA eye- and face-protection regulations 29 CFR 1910.133 and European Standard EN166. Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Other Protective Clothing/Equipment: Additional protective clothing or equipment is not normally required. Provide eye bath and safety shower.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics. Wash thoroughly after handling.

Section 9 - Physical and Chemical Properties

Appearance : Black paste
Odor/Threshold: Mild odor
pH: N.A. (non-aqueous)
Melting Point/Freezing Point: N.A.
Low/High Boiling Point: N.A.
Flash Point: >485 °F
Evaporation Rate: Not available
Flammability: f.p. at or above 200 °F
UEL/LEL: Not available

Vapor Pressure: None (Polymeric Resin)
Vapor Density (Air=1): >1
Specific Gravity (H_2O=1, at 4 °C): 1.40
Water Solubility: negligible
Partition coefficient: Not available
Auto-ignition temperature: Not available
Decomposition temperature: Not available
Viscosity: Paste
% Volatile: Nil

Section 10 - Stability and Reactivity

Stability: These products are stable at room temperature in closed containers under normal storage and handling conditions.
Polymerization: Hazardous polymerization cannot occur.
Chemical Incompatibilities: Strong bases, and acids.
Hazardous Decomposition Products: Thermal oxidative decomposition can produce carbon oxides and traces of incompletely burned carbon compounds.

Section 11- Toxicological Information

Skin Corrosion/Irritation: no data
Serious Eye Damage/Irritation: no data
Respiratory/Skin Sensitization: no data
Germ Cell Mutagenicity: no data
Carcinogenicity: no data
Reproductive Toxicity: no data
Specific Target Organ Toxicity – Single Exposure: no data
Specific Target Organ Toxicity – Repeated Exposure: no data
Aspiration Hazard: no data
Acute Toxicity: no data
Chronic Exposure: no data
Potential Health Effects – Miscellaneous: no data

Section 12 - Ecological Information

Toxicity: no data
Persistence and Degradability: no data
Bioaccumulative Potential: no data
Mobility in Soil: no data
Other Adverse Effects: no data

Section 13 - Disposal Considerations

Disposal: Under RCRA it is the responsibility of the user of the product to determine at the time of disposal whether the product meets RCRA criteria for hazardous waste. Waste management should be in full compliance with federal, state and local laws.

Empty containers retain product residue which may exhibit hazards of material, therefore to not pressurize, cut, glaze, weld or use for any other purposes. Return drums to reclamation centers for proper cleaning and reuse.

Section 14 - Transport Information

DOT	IATA	IMDG
Not Regulated	Not Regulated	Not Regulated

Section 15 - Regulatory Information

TSCA Inventory Status (40 CFR710): All components of this formulation are listed in the TSCA Inventory.
SARA 302 Components: No chemicals in this material are subject to reporting requirements of SARA Title III, Section 302

SARA 313 Components: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313

SARA 311/312 Hazards: Acute Health Hazard.

California Proposition 65**:** This product does not intentionally contain any chemicals which have been identified by the state of California to cause cancer, birth defects or other reproductive harm.

16 - Other Information

HMIS	
H	1
F	1
R	1



NFPA

Revision: 10
Date Prepared: April 1, 2015

Glossary: ACGIH-American Conference of Governmental Industrial Hygienists; ANSI-American National Standards Institute; Canadian TDG-Canadian Transportation of Dangerous Goods; CAS-Chemical Abstract Service; Chemtrec-Chemical Transportation Emergency Center (US); CHIP-Chemical Hazard Information and Packaging; DSL-Domestic Substances List; EC-Equivalent Concentration; EH40 (UK)-HSE Guidance Note EH40 Occupational Exposure Limits; EPCRA-Emergency Planning and Community Right-To-Know Act; ESL-Effects screening levels; GHS-Globally Harmonized System of Classification and Labelling of Chemicals; HMIS-Hazardous Material Information Service; IATA-International Air Transport Association; IMDG-International Maritime Dangerous Goods Code; LC-Lethal Concentration; LD-Lethal Dose; LEL-Lower Explosion Level; NFPA-National Fire Protection Association; OEL-Occupational Exposure Limit; OSHA-Occupational Safety and Health Administration, US Dept. of Labor; PEL-Permissible Exposure Limit; SARA (Title III)-Superfund Amendments and Reauthorization Act; SARA 313-Superfund Amendments and Reauthorization Act, Section 313; SCBA-Self-Contained Breathing Apparatus; STEL-Short Term Exposure Limit; TCEQ-Texas Commission on Environmental Quality; TLV-Threshold Limit Value; TSCA-Toxic Substances Control Act Public Law 94-469; TWA-Time Weighted Value; UEL-Upper Explosion Level; US DOT-US Department of Transportation; WHMIS-Workplace Hazardous Materials Information System.

Disclaimer: The information contained in this Safety Data Sheet (SDS) is considered accurate as of the version date. However, no warranty is expressed or implied regarding the accuracy of the data. Since the use of this product is not within the control of Smooth-On Inc., it is the user's obligation to determine the suitability of the product for its intended application and assumes all risk and liability for its safe use.

This SDS is prepared to comply with the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) as prescribed by the United States (US) Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (29 CFR 1910.1200), the Canadian Workplace Hazardous Materials Information System (WHMIS), and European Union Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 (REACH).

Classifications of the chemical in accordance with 29 CFR 1910.1200, signal word, hazard and precautionary statement(s), symbol(s) and other information are based on listed concentration of each hazardous ingredient. Unlisted ingredients are not "hazardous" per the OSHA Hazard Communication Standard (29 CFR 1910.1200), WHMIS and EC No 1907/2006 and are considered trade secrets under US Federal Law (29 CFR and 40 CFR), Canadian Law (Health Canada Legislation), and European Union Directives.

☑ GHS Compliant

Safety Data Sheet

SDS No. 250B

Section 1 - Chemical Product and Company Identification

Product/Chemical Name: PC®-B
General Use: Epoxy Adhesive
Manufacturer: Smooth-On, Inc.,
5600 Lower Macungie Rd., Macungie, PA 18062
Phone (610) 252-5800, FAX (610) 252-6200
Emergency Contact: Chem-Tel
Domestic: 800-255-3924 International: 813-248-0585

Section 2 - Hazards Identification

Classification of the substance or mixture

Skin irritant – Category 3
Eye irritant – Category 2B
Chronic Aquatic Hazard – Category 2

Pictograms: 

Signal word: Warning

GHS Label elements, including precautionary statements

Health Hazards:	H302	Harmful if swallowed
	H320	Causes eye irritation
General Precautions:	P101	If medical advice is needed, have product container or label at hand.
	P102	Keep out of reach of children.
	P103	Read label before use.
Prevention Precautions:	P261	Avoid breathing dust/fume/gas/mist/vapors/spray.
	P264	Wash skin with soap and water thoroughly after handling.
	P270	Do not eat, drink or smoke when using this product.
	P272	Contaminated work clothing should not be allowed out of the workplace.
	P280	Wear protective gloves/protective clothing/eye protection/face protection.
Response Precautions:	P301 + P312	IF SWALLOWED: Call a POISON CENTER/ doctor/physician if you feel unwell.

	P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
	P330	Rinse mouth.
	P337 + P313	If eye irritation persists: Get medical advice/attention.
Disposal Precautions:	P501	Dispose of contents/container according to applicable federal, state and local regulations

Hazards not otherwise classified (HNOC) or not covered by GHS – none

Section 3 - Composition / Information on Ingredients

The following ingredients are hazardous according to OSHA criteria.

CAS	Component	Concentration
112-57-2	Tetraethylene Pentamine	1% - 3%
90-72-2	2,4,6 Tri(dimethyl)phenol	1% - 3%

Section 4 - First Aid Measures

Inhalation: Remove source(s) of contamination and move victim to fresh air. If breathing has stopped, give artificial respiration, then oxygen if needed. Contact physician immediately.
Eye Contact: Flush eyes with plenty of water. If irritation persists, seek medical attention.
Skin Contact: In case of skin contact, wash thoroughly with soap and water.
Ingestion: Do not induce vomiting unless instructed by a physician. Never give anything by mouth to an unconscious person.
After first aid, get appropriate in-plant, paramedic, or community medical support.

Section 5 - Fire-Fighting Measures

Flammable Classification: Non-Flammable
Extinguishing Media: Water Fog, Dry Chemical, and Carbon Dioxide Foam
Unusual Fire or Explosion Hazards: None known.

Fire-Fighting Instructions: Use water spray to cool fire-exposed surfaces and to protect personnel. Shut off "fuel" to fire. If a leak or spill has not ignited, use water spray to disperse the vapors. Either allow fire to burn under controlled conditions or extinguish with foam or dry chemical. Try to cover liquid spills with foam.

Further information: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full face piece operated in pressure demand or positive-pressure mode.

Section 6 - Accidental Release Measures

Spill /Leak procedures:
Only properly protected personnel should remain in the spill area; dike and contain spill; absorb or scrape up excess into suitable container for disposal; wash area with dilute ammonia solution. Stop or reduce discharge if it can be done safely**.**

Environmental precautions:
No special environmental precautions required.

Section 7 - Handling and Storage

Handling Precautions: Use good general housekeeping procedures. Wash hands after use.

Storage Requirements: Keep container(s) tightly closed and properly labeled. Store in cool, dry, well ventilated place away from heat, direct sunlight, strong oxidizers and any incompatibles. Store in approved containers and protect against physical damage. Keep containers securely sealed when not in use. Indoor storage should meet OSHA standards and appropriate fire codes. Containers that have been opened must be carefully resealed to prevent leakage. Empty containers retain residue and may be dangerous. Avoid water contamination.

Section 8 - Exposure Controls / Personal Protection

Respiratory Protection: Respiratory protection is not normally required when using this product with adequate ventilation. Should a respirator be needed, follow OSHA respirator regulations 29 CFR 1910.134 and European Standards EN 141, 143 and 371; wear an MSHA/NIOSH or European Standards EN 141, 143 and 371 approved respirators equipped with organic vapor cartridges.

Hand Protection: Should hand protection be needed, wear any liquid-tight gloves such as butyl rubber, neoprene or PVC.

Eye Protection: Safety glasses with side shields per OSHA eye- and face-protection regulations 29 CFR 1910.133 and European Standard EN166. Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Other Protective Clothing/Equipment: Additional protective clothing or equipment is not normally required. Provide eye bath and safety shower.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics. Wash thoroughly after handling.

Section 9 - Physical and Chemical Properties

Appearance : tan paste
Odor/Threshold: ammonia odor
pH: N.A. (non-aqueous)
Melting Point/Freezing Point: N.A.
Low/High Boiling Point: N.A.
Flash Point: >485 °F
Evaporation Rate: Not available
Flammability: f.p. at or above 200 °F
UEL/LEL: Not available

Vapor Pressure: <1 at 77 °F
Vapor Density (Air=1): Not available
Specific Gravity (H_2O=1, at 4 °C): 1.5
Water Solubility: negligible
Partition coefficient: Not available
Auto-ignition temperature: Not available
Decomposition temperature: Not available
Viscosity: paste
% Volatile: Nil

Section 10 - Stability and Reactivity

Stability: These products are stable at room temperature in closed containers under normal storage and handling conditions.
Polymerization: Hazardous polymerization cannot occur.
Chemical Incompatibilities: Strong bases, and acids.
Hazardous Decomposition Products: Thermal oxidative decomposition can produce carbon oxides and traces of incompletely burned carbon compounds.

Section 11- Toxicological Information

Skin Corrosion/Irritation: no data
Serious Eye Damage/Irritation: no data
Respiratory/Skin Sensitization: no data
Germ Cell Mutagenicity: no data
Carcinogenicity: no data
Reproductive Toxicity: no data
Specific Target Organ Toxicity – Single Exposure: no data
Specific Target Organ Toxicity – Repeated Exposure: no data
Aspiration Hazard: no data
Acute Toxicity: no data
Chronic Exposure: no data
Potential Health Effects – Miscellaneous: no data

Section 12 - Ecological Information

Toxicity: no data
Persistence and Degradability: no data
Bioaccumulative Potential: no data
Mobility in Soil: no data
Other Adverse Effects: no data

Section 13 - Disposal Considerations

Disposal: Under RCRA it is the responsibility of the user of the product to determine at the time of disposal whether the product meets RCRA criteria for hazardous waste. Waste management should be in full compliance with federal, state and local laws.

Empty containers retain product residue which may exhibit hazards of material, therefore to not pressurize, cut, glaze, weld or use for any other purposes. Return drums to reclamation centers for proper cleaning and reuse.

Section 14 - Transport Information

DOT	IATA	IMDG
Not Regulated	Not Regulated	Not Regulated

Section 15 - Regulatory Information

TSCA Inventory Status (40 CFR710): All components of this formulation are listed in the TSCA Inventory.

California Proposition 65**:** This product does not intentionally contain any chemicals which have been identified by the state of California to cause cancer, birth defects or other reproductive harm.

16 - Other Information

HMIS	
H	2
F	1
R	1



NFPA

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Date Prepared: April 1, 2015

Glossary: ACGIH-American Conference of Governmental Industrial Hygienists; ANSI-American National Standards Institute; Canadian TDG-Canadian Transportation of Dangerous Goods; CAS-Chemical Abstract Service; Chemtrec-Chemical Transportation Emergency Center (US); CHIP-Chemical Hazard Information and Packaging; DSL-Domestic Substances List; EC-Equivalent Concentration; EH40 (UK)-HSE Guidance Note EH40 Occupational Exposure Limits; EPCRA-Emergency Planning and Community Right-To-Know Act; ESL-Effects screening levels; GHS-Globally Harmonized System of Classification and Labelling of Chemicals; HMIS-Hazardous Material Information Service; IATA-International Air Transport Association; IMDG-International Maritime Dangerous Goods Code; LC-Lethal Concentration; LD-Lethal Dose; LEL-Lower Explosion Level; NFPA-National Fire Protection Association; OEL-Occupational Exposure Limit; OSHA-Occupational Safety and Health Administration, US Dept. of Labor; PEL-Permissible Exposure Limit; SARA (Title III)-Superfund Amendments and Reauthorization Act; SARA 313-Superfund Amendments and Reauthorization Act, Section 313; SCBA-Self-Contained Breathing Apparatus; STEL-Short Term Exposure Limit; TCEQ-Texas Commission on Environmental Quality; TLV-Threshold Limit Value; TSCA-Toxic Substances Control Act Public Law 94-469; TWA-Time Weighted Value; UEL-Upper Explosion Level; US DOT-US Department of Transportation; WHMIS-Workplace Hazardous Materials Information System.

Disclaimer: The information contained in this Safety Data Sheet (SDS) is considered accurate as of the version date. However, no warranty is expressed or implied regarding the accuracy of the data. Since the use of this product is not within the control of Smooth-On Inc., it is the user's obligation to determine the suitability of the product for its intended application and assumes all risk and liability for its safe use.

This SDS is prepared to comply with the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) as prescribed by the United States (US) Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (29 CFR 1910.1200), the Canadian Workplace Hazardous Materials Information System (WHMIS), and European Union Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 (REACH).

Classifications of the chemical in accordance with 29 CFR 1910.1200, signal word, hazard and precautionary statement(s), symbol(s) and other information are based on listed concentration of each hazardous ingredient. Unlisted ingredients are not "hazardous" per the OSHA Hazard Communication Standard (29 CFR 1910.1200), WHMIS and EC No 1907/2006 and are considered trade secrets under US Federal Law (29 CFR and 40 CFR), Canadian Law (Health Canada Legislation), and European Union Directives.

Care and Maintenance of Epoxy Resin Laboratory Work Surfaces

Epoxy Resin work surfaces are durable, non-porous, man-made stone products that are relatively unaffected by most chemicals, heat, flame and moisture. These super-tough surfaces' physical properties are seldom compromised; however, they do require periodic care and maintenance throughout the life of the lab or school room to keep the surfaces looking like new. Whether you are a facility owner, manager, custodian or lab user, it is helpful to know how to maintain the good appearance of your lab's work surfaces.



Chemical Resistant · Non-Absorbant · Self-Extinguishing

Regular Care Procedures

Durcon recommends instituting a regimen of monthly or quarterly inspections of all surfaces, sinks and joints, plus daily or weekly cleanings to maintain your epoxy resin's original finish and to help ensure a safe, uncontaminated working environment. The following list contains items you may wish to have on-hand for regular cleaning and to handle most problems that may occur.

- Acetone or Paint Thinner
- Crystal Simple Green®
- White Scotch Brite® Pads (always use moist or wet)
- Finish Oil (Mineral Oil)
- Murphy's Oil
- Clean Rags or Sponges
- Chamois Cloth
- Mild Soap or Household Cleaner
- Two-part Smooth-On® epoxy grout

Note: Never use wax or polish containing wax on epoxy resin work surfaces or sinks. Also, never use abrasive pads, powders or liquids (such as Soft Scrub) as dulling of the surface will result.

Work Surface Care

Promptly wipe up all spills. Acetone should be used (where allowed) to thoroughly clean surfaces. Apply and wipe away with a paper towel or a clean rag. As an alternative, Crystal Simple Green® (or comparable household cleaning product) can be used to clean surfaces.

An occasional application of finish oil or Murphy's Oil® can restore the luster to the surface, but remember; too much oil can cloud the surface.

- Apply oil by pouring the minimum amount of oil necessary to cover the surface area onto a clean rag.
- Thoroughly rub in oil using a circular motion.
- Wipe away excess oil with a clean rag.
- A chamois can be used to buff the surface to the desired sheen.

Epoxy Resin Sink Care

Laboratory sink areas usually present the greatest cleaning and maintenance challenges. Sinks are a collection point for dirty and wet lab ware which leaves liquids, residue and chemicals on the surface for extended periods of time. Sink areas will require a more thorough cleaning regimen than dry bench tops as well as more frequent inspections. Sink inspections should include all sink surfaces and joints in sink the area including the outlet joint and the sink rim joint above and below the work surface. Cracked or pitted joints should be filled immediately with two-part Smooth-On® epoxy grout to prevent leaking and damage to the supporting casework.

Marring, Scratches & Stains

If there is a more serious cleaning issue it is important to identify the problem before trying to remedy it.

Marring

Most metals are softer than the work surface and can leave a mar if pulled across the top. Marring is matter left on the surface that appears as a line and remains smooth to the touch. Marring can almost always be removed with acetone or with mild cleaning products and elbow grease.

Always try the softest cloth and the weakest solution (soap and water) first.

If marring persists, progress to a white Light Duty Scotchbrite® Pad moistened with stronger solutions. Never use a dry Scotchbrite pad or a more abrasive pad and always apply the minimum amount of pressure required on the surface to remove the mar.



Scratches

Harder metals, abrasives and heavy or sharp items can dig into the surface resulting in a scratch. Scratches usually appear as a lighter shade of the surface and will be rough to the touch. Scratches in epoxy resin are permanent but will not affect work surface performance.

An aesthetic remedy for scratches is coloring in the void with a permanent marker. This option will never perfectly match the color and gloss of the surrounding surface.

Stained Surfaces

Staining can be caused by chemicals left to dry on the surface. Chemical stains usually lighten or bleach the surface but can also roughen and even crack the top. Like scratches, chemical stains are permanent and, if they have caused too much damage, you may need to replace of the top.

Special Care Issues

Epoxy resin products (especially glued in sinks) are subject to thermal shock and are not warranted against damage from liquid nitrogen or dry ice. Possible effects caused by the improper disposal of these materials include joint failure and/or sink fractures.

Work Surface Care

The performance of Durcon epoxy resin work surfaces will not be compromised by normal laboratory use. Maintaining the appearance depends upon good housekeeping practices. If you wish, copy and post the following "Do's and Don'ts" around the lab as a reminder to users.

Do's

- Do clean up liquid and dry spills immediately
- Do protect the feet of lab apparatus with rubber, felt or a protective pad
- Do place a trivet under all hot containers and components
- Do extinguish all flames on the worksurface
- Do apply a thin coat of finish oil or Murphy's Oil periodically
- Do educate all users in the proper care of epoxy resin work surfaces

Don'ts

- Do not drag items across the surface
- Do not cut, chop or strike items directly on the surface
- Do not drop items onto the surface
- Do not use abrasive sandpaper or metallic scouring pads on work surfaces or sinks
- Do not store chairs on the worksurface without a protective covering such as cardboard
- Do not melt dry ice with hot water directly on the surface or in the sink as the thermal shock may break the joints or cause the sink to fracture
- Do not wax the surface (or use polish containing wax)



By following these simple guidelines your Durcon laboratory work surfaces will look good for the life of the lab. Please take time to share this document with your lab workers and cleaning personnel and institute a maintenance program to help ensure the safety and beauty of your lab. If you have further questions, please contact our customer service department at 512-595-8000 or send an e-mail to sales@durcon.com.

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U.S. WARRANTY

All products sold by Durcon Incorporated™ shall conform to the customer's written specifications for such products and shall be free of defects in material and workmanship for a period of one year from the date of shipment. Product performance with regard to heat resistance, chemical resistance or physical properties will meet or exceed the published test results. Durcon Incorporated expressly disclaims any warranty based on testing of product samples.

If a customer notifies Durcon Incorporated within 30 days after the expiration of the warranty period of a failure of a product under this warranty, Durcon Incorporated shall conduct an inquiry to determine the nature and source of the defect. If the defect is covered by the warranty, Durcon Incorporated shall replace the product or correct the defect, at Durcon Incorporated's option, without cost to the customer. Durcon Incorporated's liability for breach of warranty shall be limited to replacement of materials or repair of the defective product until the defect is corrected. It does not include any repairs, adjustments, alterations, or replacements required as a result of normal wear and tear, installation not in accordance with the installation and layout instructions provided by Durcon Incorporated with the product, use of the product in a manner for which the product was not designed or customer error or omission in specifications provided to Durcon Incorporated. This warranty does not include expenses incurred by the customer to correct defects in Durcon Incorporated product without prior written authorization from Durcon Incorporated. Durcon Incorporated shall not be liable for any incidental or consequential damages of a customer arising from breach of Durcon Incorporated product warranty, including (without limitation) the customer's loss of use or loss of profit.

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The foregoing warranty shall be governed by the laws of the State of Texas.

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General Care & Maintenance

Oak Casework Finish:

Exposed oak cabinet and casework surfaces -

Oak doors and drawer faces -

Exposed shelves and exposed interiors -

Care:

Wipe off spills immediately. Clean the surface with mild soap and warm water. Wipe dry with a soft cloth.

Maintenance:

Waxing of new furniture is not necessary. However, after several years of service, if desired, a good coat of furniture wax may be applied.

Touch ups:

Scuffs and scratches can be treated by applying a thin coat of cleaning wax, *"Liquid Gold"* or a similar product. Follow product's directions for buffing and drying. This will not repair a scuff or scratch, but will make it less noticeable.

Plastic Laminate Door/Drawer Faces:

Care:

Wipe off spills immediately. Clean the surface with mild soap and warm water or with a liquid glass cleaner. Rinse with clean water and wipe dry. Do not use steel wool or abrasive cleaners.

Maintenance:

A thin coat of quality paste wax may be applied for added protection.

Touch ups:

Scuffs and scratches can be treated by applying a thin coat of cleaning wax or a similar product. Follow product's directions for buffing and drying. This will not repair a scuff or scratch, but will make it less noticeable.

Metal Surfaces:

Exposed metal cabinet surfaces -

Faucets, exposed surfaces of gas cocks, turrets, etc.

Note:

Even the most regular, consistent cleaning will not deter the normal corrosive processes of metal surfaces by chemicals. The proper care, handling and storage of such materials is mandatory.

Care:

Fixtures:

Wipe off any spills or splashes immediately. Clean the surface with mild soap and warm water or with a liquid glass cleaner. Rinse with clean water and wipe dry with a soft cloth. Do not use steel wool or abrasive cleaners.

Metal Storage Cabinets, Fume Hoods, Vents, Aquaria covers, etc.

Wipe off any spills or splashes immediately. Clean the surface with mild soap and warm water or with a liquid glass cleaner. Rinse with clean water and wipe dry with a soft cloth. Do not use steel wool or abrasive cleaners.

7.0 Care and Maintenances

7.1 Care and Maintenance of Painted Steel Casework

Clean all exposed casework and hardware surfaces as needed using a high-grade, cream-based furniture polish. We recommend Johnson Wax. The polish forms a protective coating on surfaces that may come in contact with harmful chemicals. If the casework is heavily soiled, wipe it clean with Naptha or Mineral Spirits before you apply polish. Check drawers and cupboards often for chemical spills or leaks. Prompt clean-up will help prevent permanent damage. Any nicks or scratches in the cabinet finish should be refinished with touch-up paint or rust may result. Air dry touch-up paint is supplied for each different color selection.

Introduction

Cleanliness and stainless steel are closely related and, in many applications, each is dependent upon the other. In the handling of food, chemicals, pharmaceuticals and in the use of stainless steel as a construction material (roofs, wall panels, entry ways, signs, etc.), stainless steel provides the degree of corrosion resistance that is necessary to prevent product contamination or surface rusting. However, stainless steel performs best when clean - *cleanliness is essential for maximum resistance to corrosion.*

This handbook describes various practices for cleaning stainless steel during manufacturing and in use. This includes methods for removing free-iron contamination on stainless steel surfaces that may have been picked up from metal working tools, and for removing general accumulation of dirt, grime and surface stains that occur during normal handling and exposure to the elements.

The reader should keep in mind that there are few specific rules for a cleaning procedure. Accordingly, the methods discussed in this handbook are suggestions. Each manufacturer or used, after obtaining competent advice with respect to their individual requirements, should select methods appropriate to those requirements.

What is Stainless steel

Stainless steel is not a single alloy, but rather the name applies to a group of iron-based alloys containing a minimum 10.5% chromium. Other elements are added and the chromium content increased to improve the corrosion resistance and heat resisting properties, enhance mechanical properties, and/or improve fabricating characteristics. There are over 50 stainless steel grades that were originally recognized by the American Iron and Steel Institute (AISI). Three general classifications are used to identify stainless steel. They are:

1) Metallurgical structure
2) The AISI numbering system (200, 300 and 400 series number)
3) The Unified Numbering System, which was developed by the American Society for Testing Materials (ASTM) and the Society of Automotive Engineers (SAE) to apply to all commercial metals and alloys.

The various types of stainless steel are detailed in a designer handbook, “Design Guidelines for the Selection and Use of Stainless Steel,” available from the Specialty Steel Industry of North America (SSINA). Several other publications are also available, including: “Stainless Steel Fabrication,” “Stainless Steel Fasteners,” “Stainless Steel Finishes,” Stainless Steel Specifications,” and “Stainless Steel Architectural Facts,” to mention a few.

Alloy Types

304 is the basic chromium-nickel austenitic stainless steel and has been found suitable for a wide range of applications. It is the most readily available in a variety of product forms. This grade is easy to form and fabricate with excellent resistance to corrosion.

304L is the low carbon version of 304. It is sometimes specified where extensive welding will be done.

316 offers more corrosion-resistance through the addition of molybdenum. This grade is desirable where the possibility of severe corrosion exists, such as heavy industrial atmospheres and marine environments.

316L is the low carbon version of 316

430 is a straight chromium ferritic stainless steel with lower corrosion resistance than the 300 series. It is principally employed for interior use.

Cleaning of Stainless Steel

Stainless steels need to be cleaned for aesthetic considerations and to preserve corrosion resistance. Stainless steel is protected from corrosion by a thin layer of chromium oxide. Oxygen from the atmosphere combines with the chromium in the stainless steel to form this passive chromium oxide film that protects from further corrosion. Any contamination of the surface by dirt, or other material, hinders this passivation process and traps corrosive agents, reducing corrosion protection. Thus, some form of routine cleaning is necessary to preserve the appearance and integrity of the surface. Stainless steels are easily cleaned by many different methods. They actually thrive with frequent cleaning, and, unlike some other materials, it is impossible to "wear out" stainless steel by excessive cleaning. The effect of surface/pattern roughness, grain/pattern orientation, and designs that allow for maximum rain cleaning (exterior applications) should be considered.

Types of Surface contaminants

Dirt - Like any surface that is exposed to the environment, stainless steel can get dirty. Dirt and soil can consist of accumulated dust and a variety of contaminates that come from many sources, ranging from the wind to everyday use. These contaminates will vary greatly in their effect on appearance and coercivity and ease of removal. While some may be easily removed, others may require specific cleaners for effective removal. It may be necessary to identify the contaminate or experiment with various cleaners. Frequently, warm water with or without a gentle detergent is sufficient. Next in order are mild non-scratching abrasive powders such as typical household cleaners. These can be used with warm water, bristle brushes, sponges, or clean cloths.

Ordinary carbon steel brushes or steel wool should be avoided as they may leave particles embedded on the surface which can lead to RUSTING.

For more aggressive cleaning, a small amount of vinegar can be added to the scouring powder.

Cleaning should always be followed by rinsing in clean hot water.

When water contains mineral solids, which leave water spots, it is advisable to wipe the surface completely with dry towels.

Fingerprints and Stains - Fingerprints and mild stains resulting from normal use in consumer and architectural applications are the most common surface contaminates. Fortunately, these usually affect only appearance and seldom have an effect on corrosion resistance. They are easy to remove by a variety of simple cleaning methods. Fingerprints are probably the most troublesome marks to remove from the surface of smooth polished or bright finished stainless steel. Fortunately, they can be removed with a glass cleaner or by gentle rubbing with a paste of soda ash (sodium carbonate) and water applied with a soft rag. Once again, this should be followed by a thorough warm water rinse. There are several special surface finishes where fingerprints present special problems: polished No. 6, etched, some abrasive blasted finishes, and light electrochemical colors applied over satin or brushed finishes. (NOTE: there are several special finishes designed to withstand fingerprints: embossed, swirl patterns, lined patterns, etc.)

Shop oil and Grease - Shop oils, which may carry grease, grit and metal chips, commonly produce surface soiling after many shop operations. Greases and other contaminates may also soil surfaces in food preparation and many other household and commercial situations. These soils may be corrosive in themselves or may not allow the surface to maintain passivity, and so periodic removal is a necessity. Initially, soap or detergent and water may be tried or a combination of detergent and water plus a solvent. The removal of oil and grease from stainless steel parts by immersion in chemical solvents is frequently used with cold-formed or machined parts that are laden with lubricants. This process, in its simplest form, consists of bringing liquid solvent into contact with the surface to be cleaned and allowing dissolution to take pace; for example, washing a surface with trichloroethylene or similar liquid or stirring a batch of small parts in a container of solvent. Non-halgenated solvents, such as acetone, methyl alcohol, ethyl alcohol, methyl ethyl ketone, benzene, isopropyl alcohol, toluene, mineral spirits, and turpentine work well.

Many of these solvents are widely used as individual cleaners, but there are thousands of blended or compound cleaners on the market. Users are advised to contact suppliers of solvents for information on their applications on stainless steel.

Types of cleaners and methods

General Precautions

In selecting cleaning practices, consider the possibility of scratching and the potential for post-cleaning corrosion caused by incompletely removed cleaners. Scratching can occur on a bright mirror finish by cleaners that contain hard abrasives, or even by “grit” in wash water. This is usually not a problem on dull finishes, or those surfaces finished with a coarse polishing grit. The best preventative measure is to avoid using abrasive cleaners unless absolutely necessary. When abrasives are needed, first experiment on a inconspicuous area. A “soft abrasive” such as pumice, should be used. Abrasives can permanently damage some colored and highly polished finishes. Advice should be obtained from the finish supplier when cleaning special finishes. Many cleaners contain corrosive ingredients which require thorough post-clean rinsing with clean water, however, thorough rinsing is recommended for all cleaning procedures.

Clean Water and Wipe - The simplest, safest, and least costly method that will adequately do the job is always the best method. Stainless surfaces thrive with frequent cleaning because there is no surface coating to wear off stainless steels. A soft cloth and clean warm water should always be the first choice for mild stains and loose dirt and soils. A final rinse with clean water and a dry wipe will complete the process and eliminate the possibility of water stains.

Solvent Cleaning - Organic solvents can be used to remove fresh fingerprints and oils and greases that have not had time to oxidize or decompose. The preferred solvent is one that does not contain chlorine, such as acetone, methyl alcohol, and mineral spirits. There are many compounded or blended organic cleaners that are commercially available and attempt to optimize both cleanability and safety attributes. Cleaning can be accomplished by immersing smaller articles directly into the solvent, wiping with solvent-impregnated cloths, or by sophisticated vapor or spray methods. The wiping technique sometimes leaves a streaked surface.

Job	Cleaning Agents*	Comments
Routine Cleaning	Warm Water, Soap, Ammonia, Detergent	Apply with sponge or soft cloth. Can be used on all finishes.
Fingerprints and Smears	3M Stainless Steel Cleaner and Polish, Arcal 20,Lac-O-Nu, Lumin Wash, O'Cedar Cream Polish, Stainless Shine	Provides barrier film to minimize fingerprints. Can be used on all finishes.
Stubborn Stains and Discoloration	3M Stainless Steel Cleaner and Polish, Allchem Concentrated Cleaner, Samae, Twinkle, Cameo Copper Cleaner Grade FFF or Grade F, Italian Pumice, Whiting or talc, Liquid Nu Steel, Copper's or Revere Stainless Steel Cleaner, Household Cleaners, Lumin Cleaner, Zud Restoro, Sta-Clean, Highlite, Allen Polish, Penny-Brite, Copper-Brite	Rub lightly using dry damp cloth in the direction of polish lines on the stainless steel
Grease and Blood Burnt-on or Baked-on Foods.	Scotch-Brite Power Pad 2001, Easy-Off, De-Grease-It, 4% to 6% hot solution of such agents as tri-sodium polyphosphate, 5% to 15% caustic soda solution	Excellent removal on acids, all finishes. Particularly useful where rubbing is not practical
Grease and Oil	Any good commercial detergent or caustic cleanser.	Apply with sponge or soft cloth in direction of polish lines.
*Note: Use of proprietary names is intended only to indicate a type of cleaner and does not constitute an endorsement. Omission of any proprietary cleanser does not imply its inadequacy. All products should be used in strict accordance with instructions on package.		

Commercial Cleaners - Many commercial cleaners compounded from phosphates, synthetic detergents, and alkalis are available for the cleaning of severely soiled or stained stainless surfaces. When used with a variety of cleaning methods, these cleaners can safely provide effective cleaning. Manufacturers should be consulted and their recommendations followed whenever using cleaners of this kind. The general precautions stated above also pertain to these cleaners.

Household Cleaners - Household cleaners fall into two categories: detergent (non-abrasive) and abrasive cleaners. Both are effective for many mild dirt, stain, and soil deposits, as well as light oils such as fingerprints. The abrasive cleaners are more effective but introduce the possibility of scratching the surface. However, the degree of abrasiveness will vary greatly with the particular product, and some brands will produce noticeable scratching on only the most highly polished and some colored surfaces. All of these cleaners vary widely with respect to their acidity and the amount of chloride they contain. A neutral cleaner low in chloride is preferred unless the user is assured that the surface can be thoroughly rinsed after cleaning. The fact that the label states "for stainless steel" is no guarantee that the product is not abrasive, not acidic or low in chloride. The cleaning method generally employed with these cleaners is to apply them to the stainless surface and follow by cloth wiping, or to wipe directly with a cleaner-impregnated soft cloth. In all cases, the cleaned surface should be thoroughly rinsed with clean water and wiper dry with soft cloth if water streaking is a consideration.

8.0 Warranty

Casework Warranty

Jamestown Metal Products guarantees the metal casework for the above referenced building to be free from defects of Jamestown's workmanship or materials and agrees that it will, for a period of three (3) year from the date of acceptance, repair and/or replace, at its own expense, any materials furnished by Jamestown that may develop such defects due to, or arising from, its own workmanship or material. It is understood, however, that the liability of Jamestown Metal Products here under is limited to the making of such repairs or replacements.

Jamestown Metal Products

Fume Hood



Maintenance & Operation Manual

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Fume Hood Applications

If your fume hood is to protect you, it must be designed to be compatible with the type of work that will be performed. For example, working with radioisotopes or carcinogens requires a fume hood with a non-absorbent lining (usually stainless steel) designed to be easily decontaminated.

Today, energy efficiency is a high priority. A HOPEC (Hand Operated Positive Energy Control) fume hood is an energy saving and extremely safe alternative fume hood design.

Only a specially designed laboratory fume hood should be used for perchloric acid procedures. This fume hood type should be clearly labeled and its use restricted to only perchloric acid procedures.

Other specialized applications may require explosion proof fixtures, electrical receptacles, non-combustible liner materials or fire extinguisher systems.

Never use a fume hood that has not been designed for the type of procedure being performed!

To be sure your fume hood is the right one for the work you are doing, you may contact your local jamestown representative or give us a call at 716-665-5313. Our website at *www.jamestown.com* is an excellent source for frequently updated technical information and reference materials about fume hoods and other laboratory equipment. You can also email us for information at *info@jamestown.com*.

Common Fume Hood Types



Bench Fume Hoods:

Most common hood type used for general chemistry procedures. Specialized versions include; ADA Bench Hoods for access by handicapped personnel, OS Height Hoods with larger interior height for work requiring intermediate sized equipment, HOPEC, Radioisotope and Perchloric hoods as described above.



Walk-In Hoods:

A floor-to-ceiling fume hood for chromatography, distillation, pilot plant mock-ups, vat drug preparations and other procedures requiring large equipment inside the containment chamber.

Your Safety is our Top Priority!

Your new Jamestown Fume Hood is the result of extensive research and development to design fume hoods that are economical, efficient and the safest on the market. The design, materials and construction are periodically reviewed to assure an even better and safer product.

But you, the fume hood operator, are the single most important safety feature in the laboratory.

No matter how safe the fume hood system is designed to be, the operator must follow certain procedures for it to work safely and efficiently.

We urge you to become familiar with the recommended fume hood practices outlined in this booklet in addition to those published by your organization but, most important, make a habit of applying them every day. We think you'll agree it's the best way to help ensure a safe, healthy work environment for you and your co-workers.

Our fume hoods, as manufactured, are the safest in the industry but we need your cooperation to keep them that way in your environment.

Maintain an appropriate attitude towards safety.

Every laboratory should have written procedures for handling emergencies such as:

- "Runaway experiments"
- Fire
- Explosion
- Power failure
- Blower failure
- Service fixture failure

These procedures should be posted in a prominent place and all laboratory workers must be familiar with them in order to react appropriately in an emergency situation.

"What if..." drills should be run when a fume hood is first installed, or when staff or procedures change. In surprising numbers of instances, misplaced fire extinguishers, inaccessible fuse boxes and blocked exits are only discovered during such a mock emergency.

Safety drills are not only for the new employee. Long-time employees need reinforcement of safety procedures also.

Aerodynamic Principle & Safety



A Jamestown Fume Hood is designed to contain harmful contaminants and vent them out of the work space. It provides an enclosed area that has a protective air barrier between you and the harmful materials you work with. The directional air flow caries the contaminants towards the rear of the hood and dilutes them with large quantities of air to safely exhaust the hood.

If anything disrupts this air flow, the fume hood's ability to protect you will be seriously reduced**.**

Follow these important safety procedures to ensure proper air flow within the hood:

- **Use the illumination provided and be sure the hood is operational.**

Always turn on the interior light for proper illumination of the work area. Verify the exhaust system is working properly and that air is entering and flowing through the fume hood before starting fume producing activities. Be certain you know how to turn on the hood. In many facilities it is automatically controlled by the HVAC system. In others, control of each hood is local at an on/off switch located on or near the unit.

Verify you have a proper face velocity at or above 100 FPM through the sash opening you select before beginning fume-evolving activities. To confirm that your fume hood's exhaust system is working properly we recommend equipping the fume hood with an air flow monitoring device. Correct face velocity can be assured by periodically checking air flow with a hand-held velometer. Refer to page 10 for more specific information regarding velocity alarms.

- **Verify proper baffle settings.**

Safe and proper fume hood operation requires an understanding of the function of fume hood baffles as well as the HVAC system. Operators should not adjust the baffle settings once they have been balanced by qualified HVAC personnel.

- **Set-ups and apparatus should be as far back from the fume hood face as is possible for safety and optimum performance.**

When you stand in front of the hood with the sash open, the airflow passing your body creates a zone of low pressure directly in front of you extending in about four inches. Since contaminants can enter this area of turbulence from inside the hood, all experiments and equipment should be placed at least six inches behind the plane of the sash, behind the protective air barrier. The further back you can place the source of contaminants, the greater protection a hood can provide. However, don't place items you're using so far back that you need to lean your head or face into the hood during procedures.

- **Allow air flow at the work surface.**

Do not block the lower rear baffle slot of the fume hood. Large, bulky objects should not be placed directly on the fume hood working surface. Block such objects up two or three inches to permit a flow of air underneath and into the lower rear baffle exhaust opening.

- **Avoid rapid movement in front of the fume hood face.**

Avoid rapid movement and excessive personnel passage in front of the fume hood. Air disturbances so created may draw fumes out of the hood.

- **Operate the hood with the sash closed as much as possible.**

While working at the fume hood, open the sash only as far as you need to for access to your work area. The lowered sash increases the distance between your breathing zone and the area where fumes could escape into the lab. It also offers added protection by acting as a solid barrier against splashing chemicals or debris from explosions or runaway experiments.

- **Never store chemicals in the hood.**

Use of laboratory hoods as storage enclosures for corrosive, toxic or flammable materials may jeopardize fume hood performance and create unnecessary hazards. Limit materials within the hood to those required for immediate use.

Today, virtually all packaging is designed to safely contain reagents. Any leaky package should be disposed of immediately and appropriately, not stored in the fume hood. Clean up spills as soon as possible. Always use grounded electrical equipment.

- **Avoid extreme heat.**

Never permit the temperature of the sash surface to reach or exceed 160^{o} F, as laminated safety glass cracks at this temperature. We recommend our standard tempered glass, instead of safety glass, as it is stable up to 400^{o} F.

Black hood liner material, such as epoxy, can also absorb invisible infrared light from heated objects and may crack under heat stress.

- **Maintain lab safety instructional materials.**

Design a videotape outlining your organization's safety procedures, and be sure new employees view this tape. Jamestown can supply a video of this nature, but it lacks specific chemical information and procedures that only you, as the end user, can provide.

In summary, safety in fume hood operation involves three concepts:

- **Following accepted procedures.**
- **Avoiding questionable procedures.**
- **Maintaining the structural integrity of the equipment and the safety awareness of the laboratory staff.**

Clean Fume Hood = Safe Fume Hood

Periodic cleaning of the fume hood interior.

A neat and clean fume hood is not only aesthetically advantageous but also safer and easier to "shut down" in case of an emergency! Clean up any chemical spillage as soon as possible. All worktops recommended by Jamestown are "dished" to help contain spills. Use only cleaning materials recommended for use in conjunction with the procedures being conducted within the hood. By keeping the fume hood clean, the chemical residues of your procedures will have less time to potentially damage the internal components, thereby minimizing the risk of a possibly catastrophic failure of a key hood component.

The following are basic cleaning and maintenance procedures which can be performed by the fume hood operator. Confirm that the cleaning agents being used will not react with the chemicals being used in the hood.

CLEANING

- **Polyglass Liner:**

Can be cleaned with mild soap and water. For persistent stains use our polyglass liner cleaner (part number: SP26), acetone (with a thorough wipe-down afterwards due to flammability), JSS #22 Remove or #400 automotive sandpaper.

- **Sash Glass:**

Can be cleaned with a commercial glass cleaner.

- **Painted Steel Surfaces:**

Can be cleaned with mild soap and water, ethyl alcohol or commercial glass cleaner.

- **Epoxy Liner and Worktops:**

Can be cleaned with mild soap and water, solvent or commercial glass cleaner.

- **Plumbing Fixtures:**

Fixtures are coated with a corrosive resistant coating. Clean with mild soap or detergent only. Do not use an abrasive cleanser.

Basic Maintenance

Schedule frequent maintenance checks of the condition of sash components, exhaust system and load bearing parts.

The very nature of the materials used in a fume hood, harmful or corrosive chemical fumes, can lead to deterioration of the fume hood's components due to the long-term effects of any chemical reactions. Any metallic load-bearing member inside the hood needs to be checked frequently for corrosive deterioration. Be aware of vertical sash counterbalance systems utilizing cables that can release the sash in guillotine fashion of the cable snaps. Horizontal sashes have been known to break loose and cave into the hood when corroded suspension systems give way. Internal back baffle panels have broken free of their deteriorated hanger brackets.

Newer style hoods by most manufacturers combat some of these problems by eliminating or chemically coating the metal parts in question. Jamestown has incorporated a chain driven sash counterweight system that eliminates the possibility of fraying cables or fractured pulleys.

BASIC MAINTENANCE

- **Sash:**

A properly balanced sash, at 50% open, should not move up or down without operator assistance. If the sash is out of balance, do not attempt to adjust it yourself. No portion of the sash mechanism is user adjustable. Contact the appropriate maintenance department for your facility or a Jamestown representative.

- **Velocity Alarm:**

Test the velocity alarm daily by placing your finger over the thermistor reference hole on the front cover plate. Face velocity readout should quickly drop to zero and the audio alarm should sound.

- **Fans and Ductwork:**

Be sure your maintenance staff schedules frequent checks of the fume hood's fans and face velocities. Because the ductwork system is exposed to toxic and corrosive fumes, it is a vulnerable link in your lab's exhaust system and requires vigilant monitoring.

Instructions for Perchloric Fume Hoods

Perchloric acid, $HClO_4$, is unforgiving if not handled correctly. Its acidity is nominal but each molecule essentially carries around four extra oxygen atoms which like to react, burn, or explode; whichever is easiest.

Concentrated perchloric acid should never be heated. Old bottles of acid should be discarded as hazardous waste. It can be expected to react with most types of plastics, except PVC or Teflon.

Perchloric acid may form contact explosives with some shaft bearing lubricants. Only fluorocarbon lubricants should be used on perchloric acid fume hood exhaust fans. We recommend the exhaust streams for these hoods be dedicated and not mixed with other fume hood exhaust streams.

Periodic cleaning of the perchloric acid fume hood interior.

Due to the explosive and reactive nature of perchloric acid salts that accumulate in the hood and ductwork, the washdown system in your fume hood should be used after every use or at minimum, once a day. In continuous use applications washdown the hood at week's end.

Discontinue experiments in the hood and remove devices that could be damaged by water. Switch the exhaust system off, then turn on the washdown bar to flush water through the hood system. The rear baffles should be flushed for at least five minutes. Next, police the hood interior with a sponge, thoroughly rinsing the sponge to remove chemical residue. Be sure the hood interior is completely dry before replacing your equipment.

In most cases, the fume hood ductwork washdown system interfaces with the hood washdown system. Check with the appropriate party in your facility to determine how your system operates. Test the system with an empty hood before attempting a washdown procedure.

Other special considerations for perchloric acid hoods:

Any components used in conjunction with perchloric acid experiments, such as distillation racks, should be fabricated from stainless steel not aluminum.

Instructions for HOPEC Fume Hoods



HOPEC (Hand Operated Positive Energy Control) fume hoods look slightly different than our ISOLATOR hood but they work in much the same fashion. It also addresses concerns such as ADA (Americans with Disabilities Act) and LCV (Low Constant Volume). The main difference being:

- The fume hoods are designed to be operated with at least 50% of the combination sash closed. This condition is achieved by either:

1. Having the vertical portion of the sash completely closed and the horizontal panel(s) open for operation.

2. Having the horizontal panels fully closed and the vertical portion of the sash raised not more than 15".



- The hood is deeper than an ISOLATOR hood due to the design of the front airfoil. The airfoil is bright yellow to remind the operator to keep all experiments and equipment at least six inches behind the plane of the sash.

Velocity Alarms

Air is drawn into the fume hood by its exhaust system which creates a pressure difference between the surrounding room and the hood interior. The speed of the air passing through the sash is called the face velocity. Proper face velocity is required to protect the operator and surrounding area from harmful components inside the hood.

There are two different models of velocity alarms available to choose from.

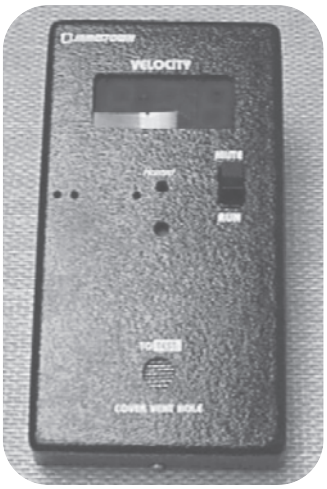


Alnor Velocity Alarm

The Alnor AirGard 335 Velocity Alarm has audible and visual indicators. In dangerous situations a continuous audible alarm will alert the operator. An electronic bar graph moves back and forth through universally recognized zones, red - yellow - green, as the velocity changes. Corresponding large colored LEDs also illuminate. A digital display can be enabled to view velocity quantitatively.

Jamestown Digital Velocity Alarm

This unit will give the fume hood operator a continuous digital readout of fume hood face velocity. If the face velocity drops below a preset alarm set point an audio alarm and flashing red LED display will alert the operator of dangerous situations that may arise.



Always verify you have a proper face velocity before beginning fume hood activities. Remember to test the velocity alarm every day and that everything is running correctly. If it is not, make sure the proper maintenance department for your facility is contacted immediately. Do not use the fume hood until this condition has been corrected.

Velocity Alarm Calibration Instructions

Calibration of Jamestown Digital Velocity Alarm

1. Power up the alarm and set the switch to “Run”, calibrate as follows:

    a. There are three calibration potentiometer holes located on the alarm face plate.
    b. With the fume hood and make-up air off, turn the left most potentiometer (RP2) until the digital counter just moves off zero. Now turn the potentiometer back in the other direction until the reading barely returns to zero.

2. Turn the fume hood and make-up air on. Using the sash or damper adjustment, or both, set the face velocity at the desired sash setting to the desired alarm set point (10 to 100 FPM) using a velometer, not the velocity alarm.

3. Remove the alarm cover and select the one of the ten numbered DIP switches (SW1) that corresponds to your alarm set point. Move the DIP switch to the right (On position). Replace the alarm face plate.

4. Turn the set screw on the center potentiometer (RP1) until the alarm signal activates.

5. Using the sash or damper adjustment, or both, set the fume hood velocity to 100 FPM using a velometer, not the velocity alarm. Adjust the rightmost potentiometer (RP3) until the digital readout is 100 FPM. Alarm is now calibrated and ready for use.

Alarm is now set to digitally read the average face velocity and activate the alarm if the desired minimum value is not held. **Note**: Audio alarm can be muted by activating the Mute switch, but the warning light cannot be turned off.

Calibration of Alnor Velocity Alarm

Please refer to the AirGard 335 owner’s manual for proper calibration of this device or visit their website for manuals and information at www.alnor.com.



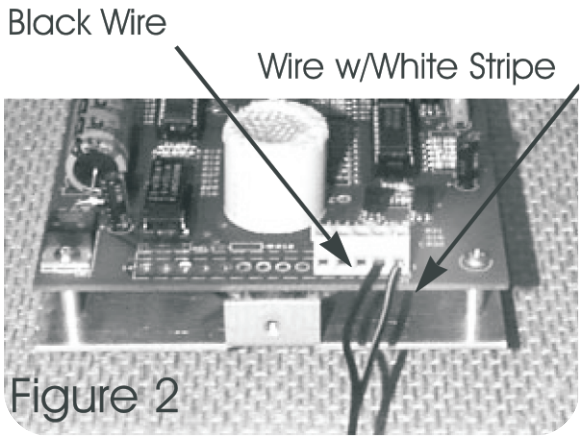


Figure 2

Procedures for Trained Personnel

The following maintenance items should be undertaken only by building maintenance, trained fume hood or HVAC installation personnel.

- **Periodic inspection of the ductwork system.**

At least twice a year the exhaust duct and fan integrity should be inspected. Check for localized corrosion, broken fan parts and debris clogs. If items such as tissue, paper or foil are used in the hood, it is possible for them to be drawn into the baffle/duct system, forming blockages that reduce air flow.

- **Periodic smoke tests.**

At least twice a year we recommend running a smoke test on each hood. Smoke sticks and other testing materials are available for purchase from Jamestown.

- **Periodic testing of the velocity alarm.**

At least once a year test the accuracy of the velocity alarm by using a hand held velometer.

- **If the sash becomes "cocked".**

If the contact between the airfoil and the sash handle is not continuous and flush, loosen both sprockets, on the side that is not making contact with the airfoil, from axle contact by loosening the 3/32" Allen screws (two per sprocket). Close the sash fully making sure it is flush against the airfoil. Verity the chain is properly seated on the sprockets. Re-tighten the Allen Screws on each sprocket.

- **If the sash is out of balance.**

Note: If the sash is a combination sash, first verify all horizontal sliding panels are in place.

Contact your Jamestown representative, who can supply additional small weights to balance the sash. Attachment instructions will accompany the counterweight pieces.

- **If the sash does not operate smoothly or makes noise.**

Contact your Jamestown representative immediately for an inspection. The chain mechanism should not require lubrication. This may be a symptom of a more serious problem.

- **If the sash glass breaks.**

Replacement sash units may be ordered through your Jamestown representative. Do not attempt to replace the glass without first requesting a copy of the instructions for sash replacement.

Fume Hood Safety Labels

If the instructional label on your fume hood is missing or is illegible, we have, for your convenience and safety, reproduced it on this page. Use a copy of this as a temporary safety measure but be sure to contact your local representative or Jamestown Metal Products for an immediate replacement.

FUME HOOD OPERATING INSTRUCTIONS

1. Before using the fume hood, make sure the light is on and the proper face velocity is present. Immediately report any malfunction of the exhaust system!
2. Maintain a protective barrier between yourself and all active procedures.
3. Keep active procedures at least 6" behind the plane of the sash.
4. Operate the fume hood with the sash closed whenever possible.
5. Do not obstruct the baffle openings or place large or bulky items directly on the work surface where they could obstruct the proper airflow through the fume hood.
6. Do not obstruct the airflow at bottom airfoil.
7. Do not place your head inside the fume hood. Keep your hands outside as much as possible.
8. Avoid storing containers of corrosive or volatile liquids in the fume hood.
9. Wipe up any spillage immediately.
10. Wear safety goggles at all times.
11. Do not misuse the hood or use materials which the hood has not been designed for.
12. Ensure that all laboratory workers are following company safety policies and procedures, as well as any additional guidelines supplied by the manufacturer of the hood. Be familiar with suggested maintenance procedures.

PERCHLORIC ACID FUME HOOD OPERATING INSTRUCTIONS

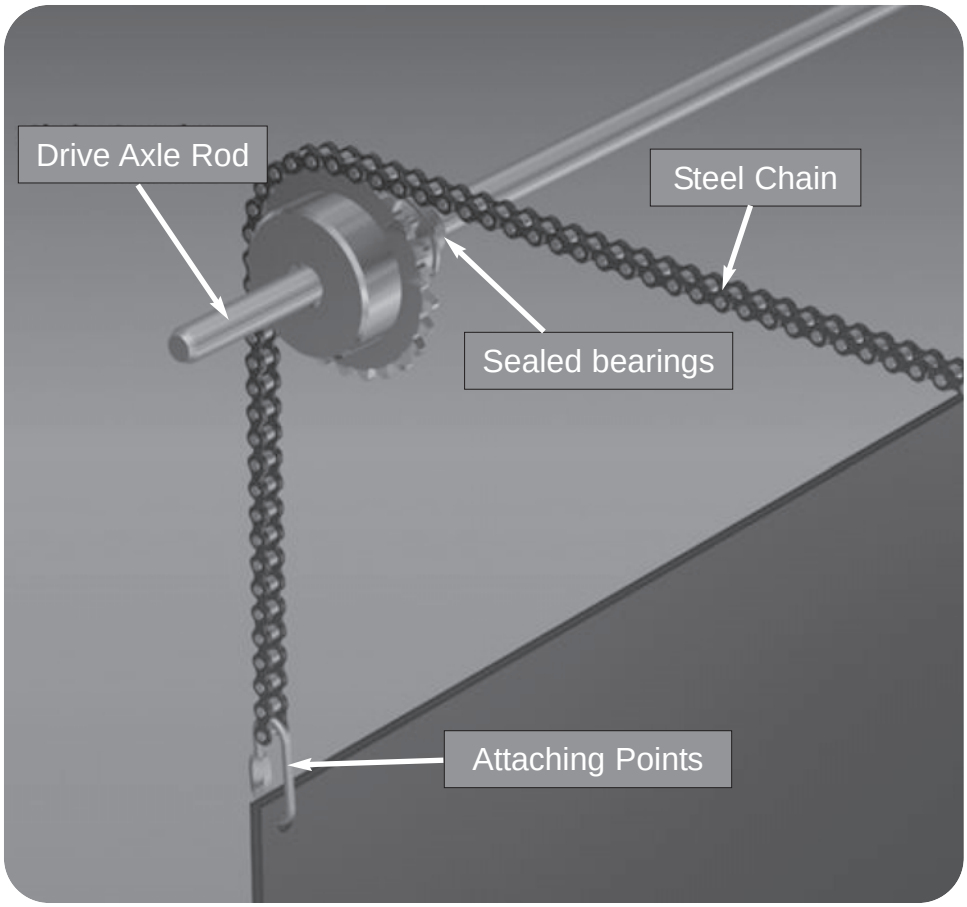
1. Keep all perchloric acid procedures under scrupulous control. Never allow the reagent to come into close proximity with any plastic, except PVC or Teflon.
2. Never use this hood with reagents other than perchloric acid.
3. When your use of this hood is finished, or, at minimum, once a day, run a washdown cycle for at least ten minutes. Switch fan off, then run the cycle, being sure the washdown trench drain is clear at all times.
4. Before using the fume hood, make sure the light is on and the proper face velocity is present. Immediately report any malfunction of the exhaust system!
5. Maintain a protective barrier between yourself and all active procedures.
6. Keep active procedures at least 6" behind the plane of the sash.
7. Operate the fume hood with the sash closed whenever possible.
8. Do not obstruct the baffle openings or place large or bulky items directly on the work surface where they could obstruct the proper airflow through the fume hood.
9. Do not obstruct the airflow at bottom airfoil.
10. Do not place your head inside the fume hood. Keep your hands outside as much as possible.
11. Avoid storing containers of corrosive or volatile liquids in the fume hood.
12. Wipe up any spillage immediately.
13. Wear safety goggles at all times.
14. Do not misuse the hood or use materials which the hood has not been designed for.
15. Ensure that all laboratory workers are following company safety policies and procedures, as well as any additional guidelines supplied by the manufacturer of the hood.

PERCHLORIC ACID IS COMBUSTIBLE, REACTIVE AND EXPLOSIVE. USE EXTREME CAUTION.

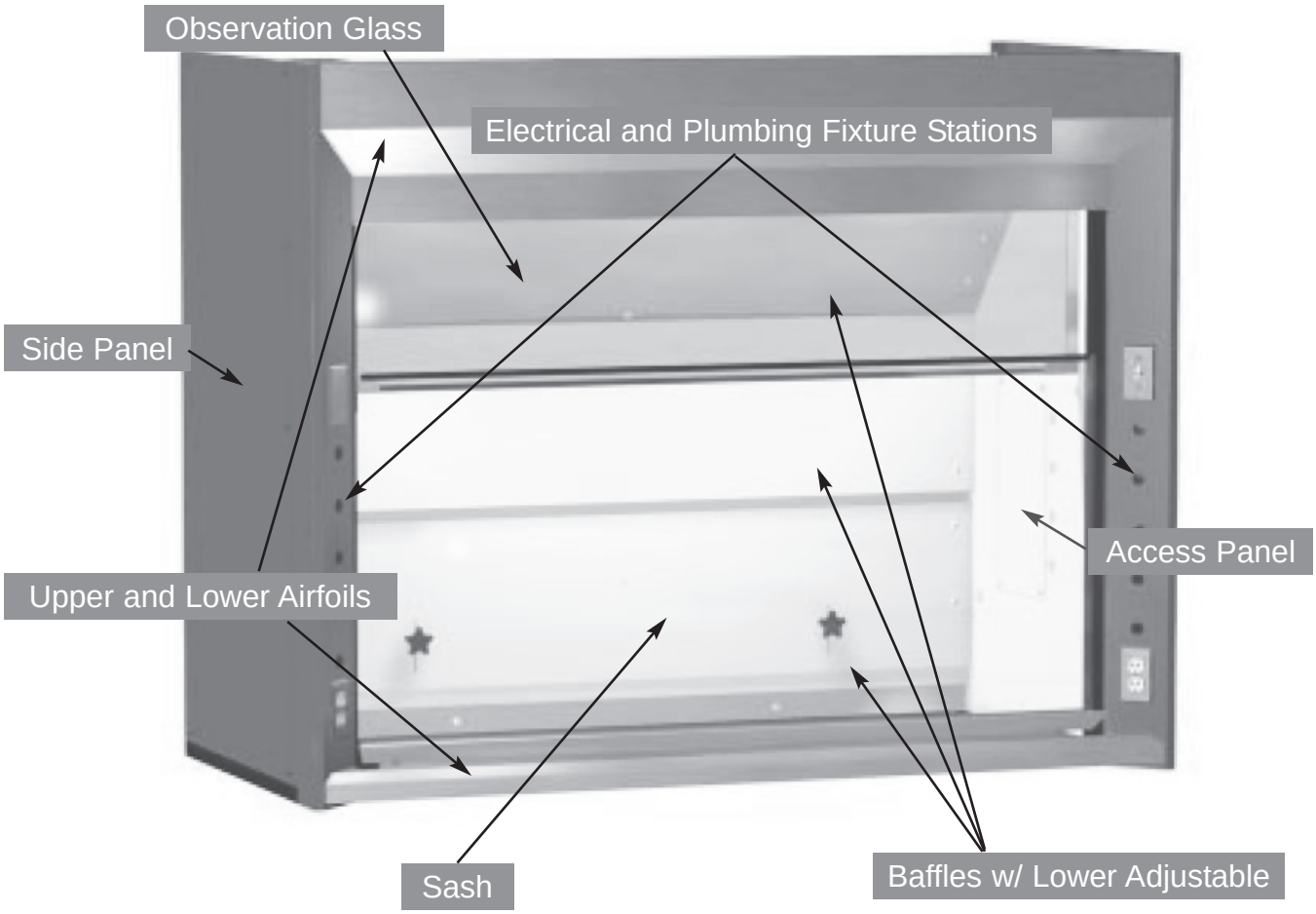
Product Warranty

Jamestown Metal Products for a period of three years, from date of shipment, warrant that furnished products shall be free from defects in material and workmanship. Jamestown Metal Products shall also warrant the products to be as represented and will repair or replace any part, under normal use, if examination discloses it to have been defective within the warranty period.

Jamestown Metal Products for the life of the sash mechanism warrant that furnished products shall be free from defects in material and workmanship. Sash mechanism refers to the #35 case-hardened steel chain, sealed bearings, drive axle rod and chain attaching points at both sash handle and counterweight.



Hood Features & Identification Label



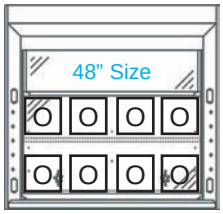
ISOLATOR FUME HOOD
716-665-5313
Manufactured by Jamestown Metal Products
Jamestown, New York 14701

Model:	F-100-72	Serial No:	263 1 01
Phase:	1	Equip No:	12557YS
Cycles:	50/6	Voltage:	120
Max KWS:	2.4	Max Amps:	20

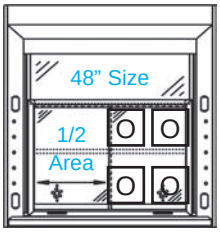
Jamestown Metal Products

Air Flow Chart

Bench Hood
Vertical Sash

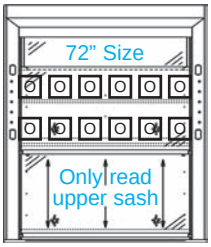


Bench Hood
Horizontal Sash



Horiz. sashes use 50% area of appropriate size hood. Use upper or lower row below to show this.

Walk-In Hood
Vertical Sash



Only use upper vert. sash opening to measure F.P.M.

Name : _____

Organization : _____

Date : _____

Location : _____

Room : _____

Fume Hood Model : _____

Size : _____

Sash : _____

Type : _____

Identification Number : _____

READINGS

F.P.M. Average :

Total F.P.M. - _____ **/** Total Readings - _____ **=** _____

Total C.F.M. :

F.P.M. Average - _____ **x** (*Sq. inches / 144) **=** _____

*Sash opening height x width

1 F.P.M. _____	3 F.P.M. _____	5 F.P.M. _____	7 F.P.M. _____	9 F.P.M. _____	11 F.P.M. _____	13 F.P.M. _____	15 F.P.M. _____
2 F.P.M. _____	4 F.P.M. _____	6 F.P.M. _____	8 F.P.M. _____	10 F.P.M. _____	12 F.P.M. _____	14 F.P.M. _____	16 F.P.M. _____

Each Area Approx. 12" x 12"

36" Hood | 48" Hood | 60" Hood | 72" Hood | 96" Hood

“Knock-Down” Overview / Bench Hood

A bold number system is used to follow the steps for assembly. A subscript system is also in place next to the various components throughout the manual to aid the reader in recognition of those components with a visual reference provided in the rear of this manual.

Care has been taken on the “strategical” presentation of assembly, shying away from the “tactical” assembly, as you can give instructions on how to go from point A to point B but there are many methods and preferences to this goal.

A component and check-off list has been provided, as the heading suggests, to inventory the shipped crate for completeness and to mark off the components as they are used to assure the hood is properly assembled.

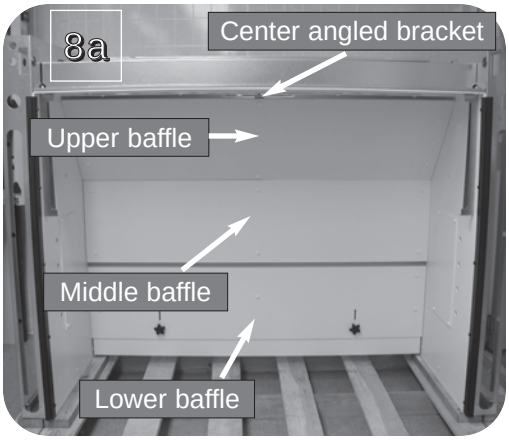
EXAMPLE

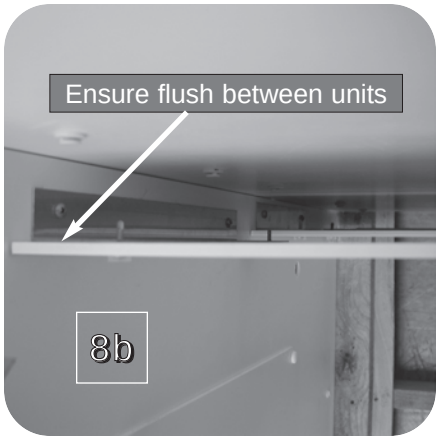
8. Using #10 x 3/4”[13a] screws with base[3] attachments, screw in the bottom, middle and lower baffle units to the center bracket supports and side bracket supports [8a]. Attach the center angled bracket[2]. Check that the baffle units are secure and flush against the bracket supports by visual inspection or physically feeling behind the baffles [8b].

*Paragraph number (**8.**) refers to corresponding picture box(s).

*Subscripts ([13a], [3], [2]) denote the component number on pages 27 & 28 for visual reference.

*Lettered outlined number ([8a], [8b]) signifies specific picture box.





Inventory & Check-off List

Pack List #1

- ☐ Upper baffle
- ☐ Middle baffle
- ☐ Lower baffle
- ☐ Back frame liner
- ☐ Observation glass / smoked
- ☐ Sash
- ☐ Side panels x 2
- ☐ Lower adjustable baffle

Pack List #2

- ☐ Axle rods x 2
- ☐ Lower airfoil
- ☐ Upper airfoil
- ☐ Ceiling Soffit (If included)

Pack List #3

- ☐ Fascia panel x 2
- ☐ End frame assembly x 2

Pack List #4

- ☐ Top frame assembly
- ☐ Back frame panels x 2

Pack List #5

- ☐ Counterweight / J-plate & insert

Pack List #6 # = JMP Part Number

- ☐ #10 x 3/4" screws[13a] x 50 #02300447
- ☐ #10 x 1/2" screws[13b] x 50 #02300443
- ☐ #8 x 1/2" screws[13c] x 20 #02300434
- ☐ U-Tapped clip[1] x 2 #02150414
- ☐ Screw base[3] x 50 (Integral with screw caps)
- ☐ Screw caps[6] x 50 / white #02750410 / black #02750409
- ☐ Viewpass bracket set x 2
- ☐ Center baffle support x 3
- ☐ Side baffle support x 6
- ☐ Nylon bolt and nut[10] x 1 #02750407
- ☐ Baffle knob & bolt[8] x 2 / knob #02450400 / bolt #02100415
- ☐ Center angled bracket[2] #40038408
- ☐ Plug caps, various[11] x 40
- ☐ Chain x 2 #02800493
- ☐ Sprockets[14] x 4 #02800427
- ☐ Spacer collar[7] 1/2" dia. x 4 #02800438
- ☐ Connecting chain link[9] x 4 #02800496
- ☐ Threaded chain connector[16] x 2 #02500496
- ☐ Rubber bumper / black[5] x 2 #02750413
- ☐ PVC pushpin[12] x 50 #02750490
- ☐ Sash stop[15] x 2 #40039200
- ☐ *Assorted electrical components
- ☐ *Assorted plumbing components

*Varies with options ordered.

"Knock-Down" Assembly

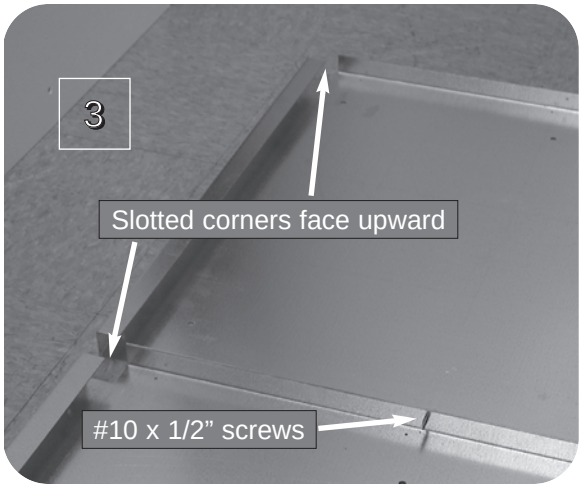
1. Set and level fume hood worktop and base cabinets per manufacturer recommendations.

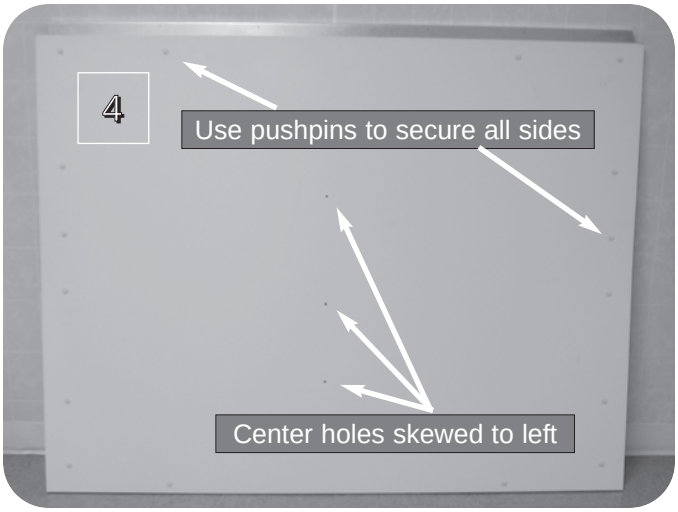
2. Place counterweight at rear of worktop such that the hanging holes are topmost and weight is leaning against the wall with smooth side of J-plate facing to the front.

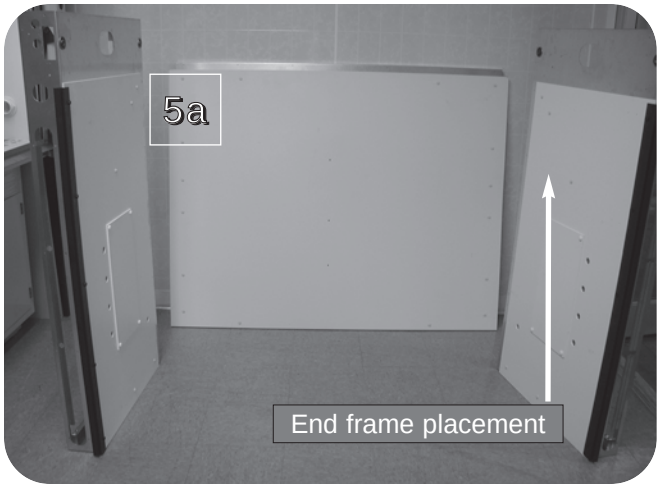
3. Attach the 2 back frame panels. The slotted corners are the top parts of the frame. Use #10 x 1/2"13b screws to attach.

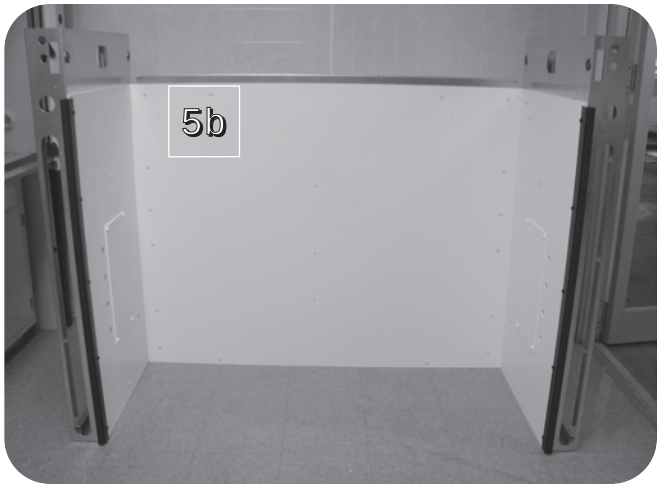
4. Attach the liner to the smooth side of the back frame panel. Line up the hole slots and use the PVC pushpins12 to secure. Top of the back frame is with the center holes skewed to the left. Place the back frame against the wall in front of the counterweight.

5. Take the 2 end frames, liner inward - right side up, attach them to the back frame panel using #10 x 1/2"13b screws [5a]. You can use vice grips to hold the back frame and end frames in place to keep them stable to assemble [5b]. Use #10 x 1/2"13b screws to attach.







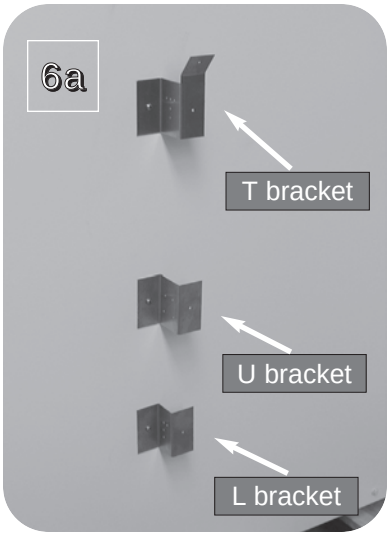


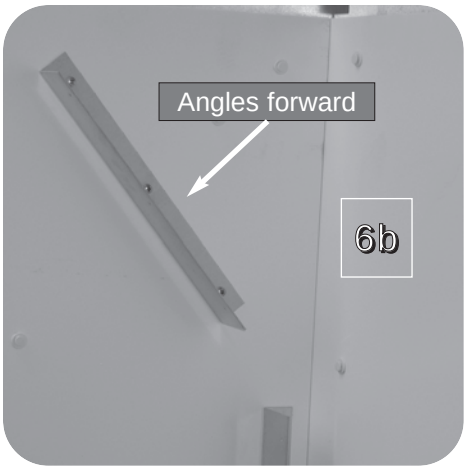
"Knock-Down" Assembly

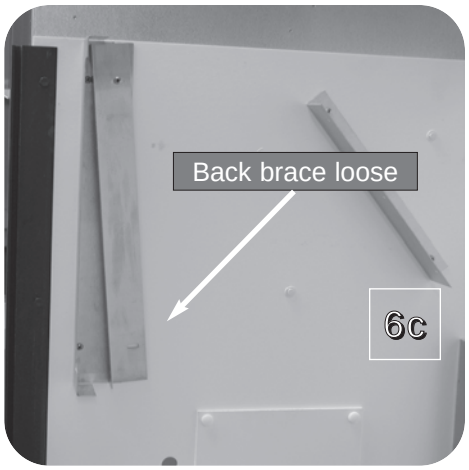
6. Assemble the baffle bracket supports. For side support use short 2 hole for the bottom, long 2 holes for the middle and 3 hole for angled top [6d]. For the center use the code punched center baffle brackets. T-punched bracket for the top portion, U-punched for the middle portion and L-punched for the lower portion [6a]. The reason for the offset holes is for the angled center bracket supports so when attached the holes are centerline with the hood. Then attach the side bracket supports for the viewpass glass [6c]. Only secure the back brace on the top loosely leaving the bottom hole free. This will provide easy insertion later on with the viewpass. #10 x 3/4"[13a] screws are to be used. Be sure to attach side supports with angle facing forward [6b].

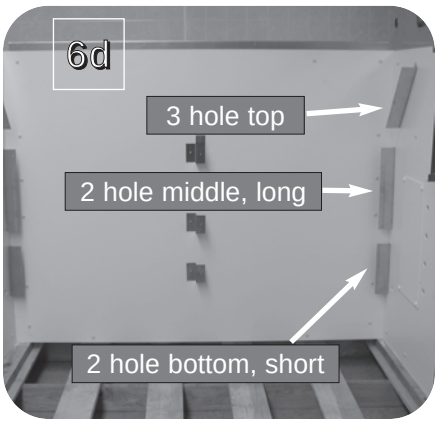
7. Assemble the lower baffle section. Use the lower baffle and lower adjustable baffle. Combine both units correctly using adjustable baffle knob and carriage bolt[8].

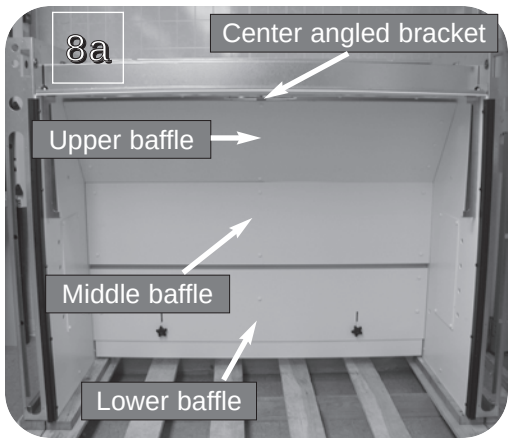
8. Using #10 x 3/4"[13a] screws with base[3] attachments, screw in the bottom, middle and lower baffle units to the center bracket supports and side bracket supports [8a]. Attach the center angled bracket[2]. Check that the baffle units are secure and flush against the bracket supports by visual inspection or physically feeling behind the baffles [8b].

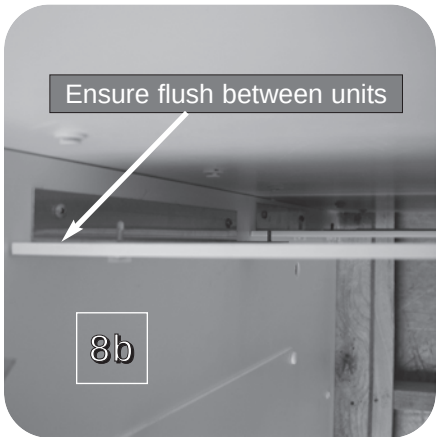








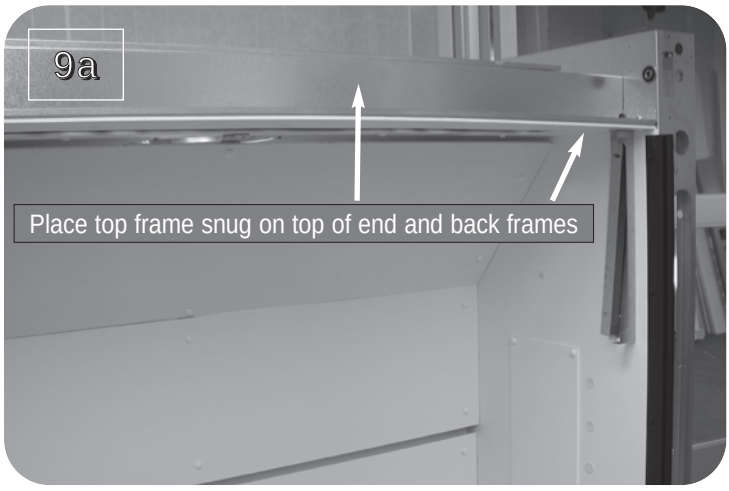


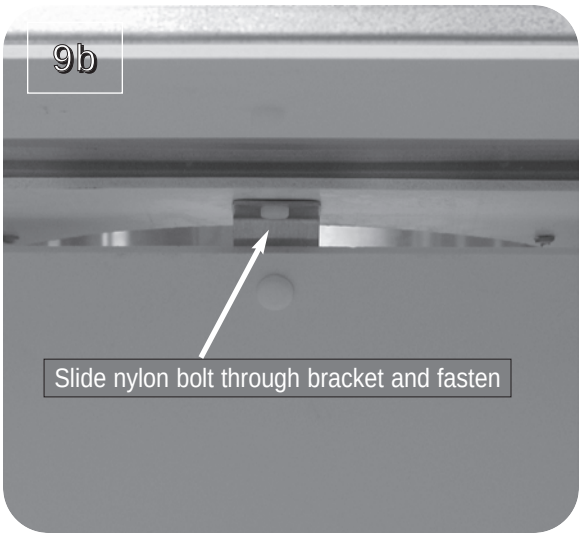


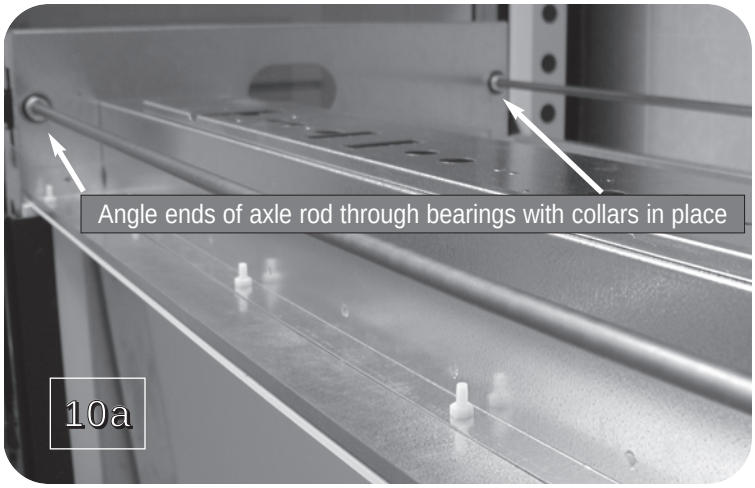
"Knock-Down" Assembly

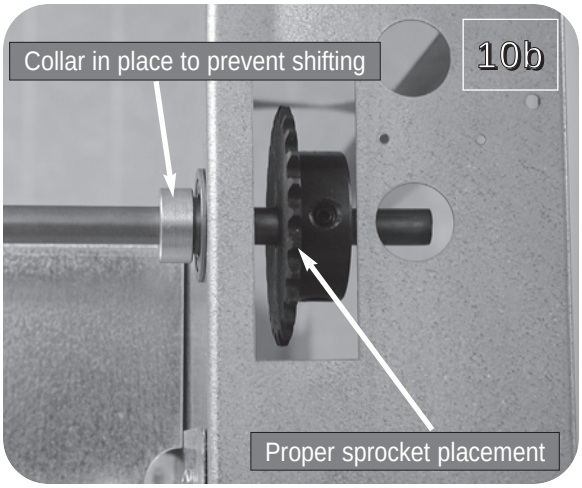
9. Place top hood portion into place with lightbox to front of fume hood [9a]. Around the sides and back of top frame use #10 x 1/2" screws[13b] to attach to back and end frame. After the top is secured use a white nylon bolt and nut[10] to attach the center angled bracket[2] to the fume hood top [9b].

10. Slip one end of the axle rod, angling it, through one of the side bearings[4] [10a]. Slip on 2 collar spacers[7] on the axle rod. Slip the rod through a little further to be able to get in the other end. In the process be sure to attach the sprockets[14] as they have to be in place just after the insertion of the axle rods. Be sure the sprocket teeth side are faced toward the interior of the hood [10b]. Position the axle rods so as to have even spacing from the rod ends to the outside of the end frame. Once everything is in place tighten down the collar spacers to keep the rods from shifting. Repeat the procedure with the back axle rod and components.







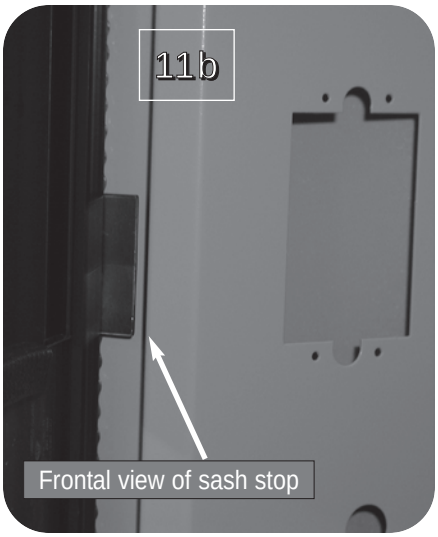


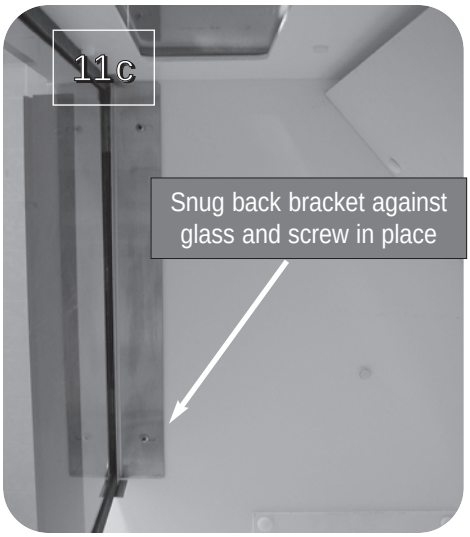
"Knock-Down" Assembly

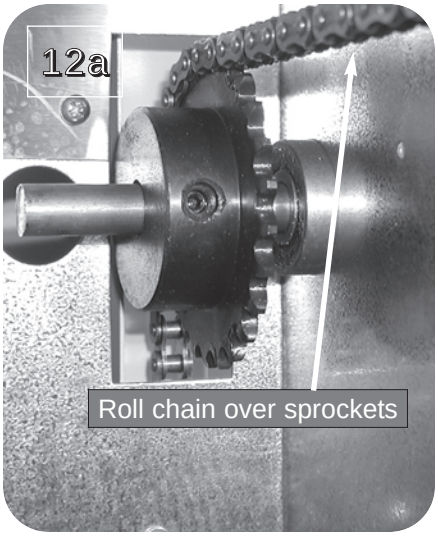
11. At the front of the end frames, insert the sash stop[15] into the vertical slot located approximately in the middle of the end frame assembly [11a]. Use #10 x 1/2"[13b] screws to fasten the sash stops. This prevents the sash glass from dangerously derailing from the sash track via the top [11b]. Place the smoked observation glass into the brackets by sliding in from the bottom. Tighten down the bottom back brace to secure in place [11c] using #10 x 3/4" screw[13a].

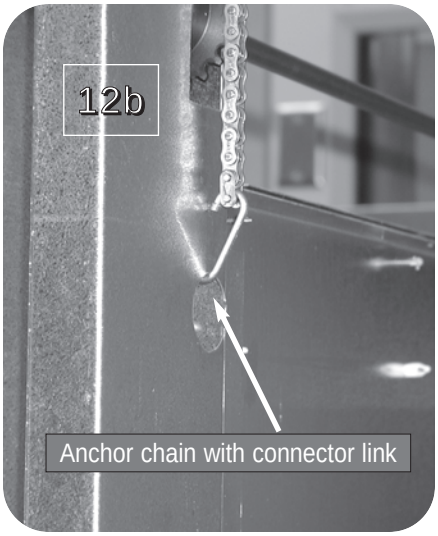
12. Now it is time to lay the chains in place. Roll each chain over the sprockets[14] [12a] and attach the threaded chain link[16] to the back end and secure to an opening, as shown in picture, to keep from rolling off the sprockets [12b]. For extra security for when you attach the sash glass, use the vice grips to anchor the chains as shown in picture [12c].

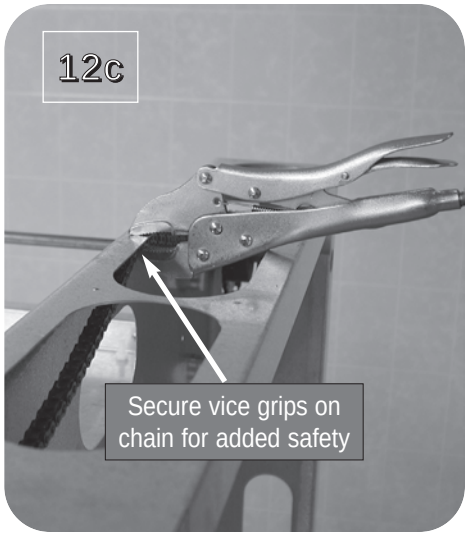








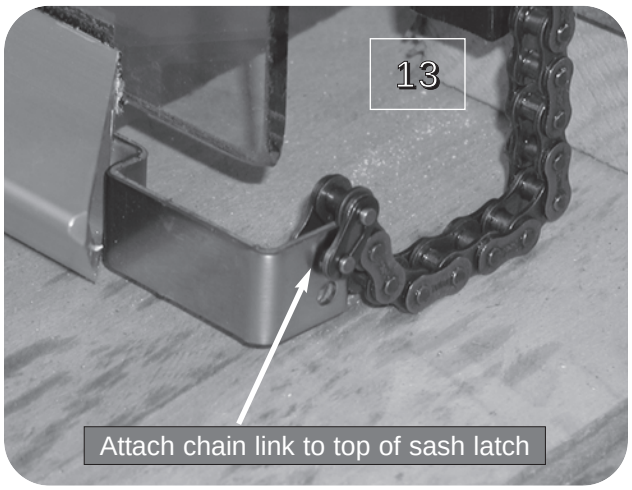




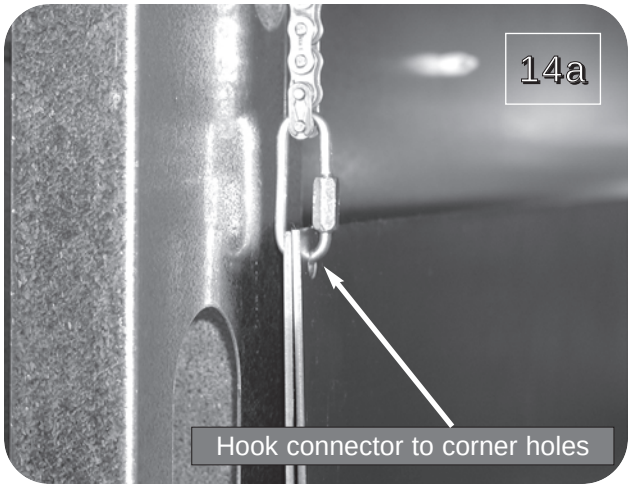
"Knock-Down" Assembly

13. Sash glass installation. Slide the hood forward with enough room to raise the sash glass into the black PVC track slot. Use something to support the sash from the bottom, a reliable and safe support, to give enough space to attach the chain end to the sash chain attachment point using the chain link connector[9] as shown in picture. Once the sash is attached it is time to connect the counterweight to the back end of the chain.

14. Once the sash is attached it is time to connect the counterweight to the back end of the chain. Lift the counterweight ends and attach the threaded chain connector[16] to the hole positions on the corners of the counterweight [14a]. Screw down the threaded chain connector to secure the counterweight to the chain assembly [14b]. You can now release the vice grips holding the chain in place and raise the sash to a clear position to move the hood back into place.





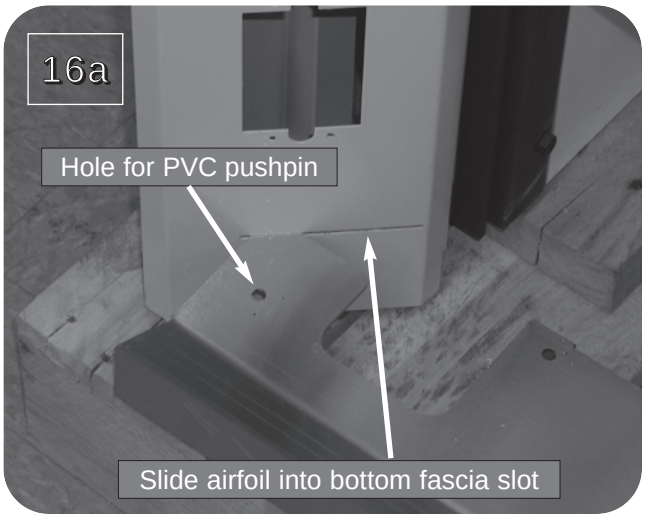


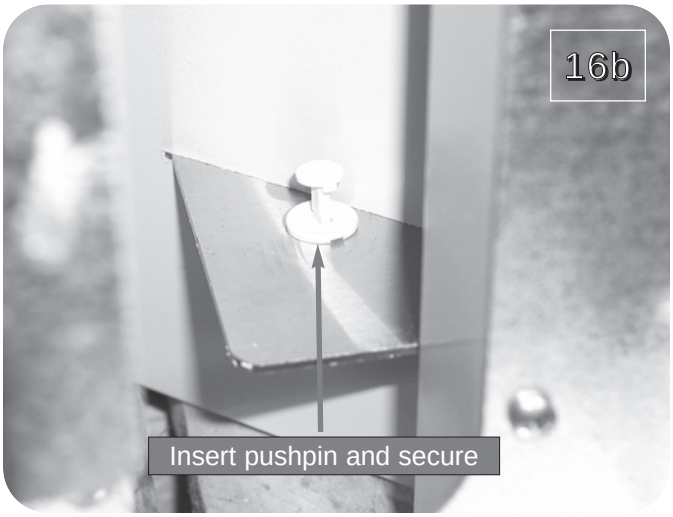
"Knock-Down" Assembly

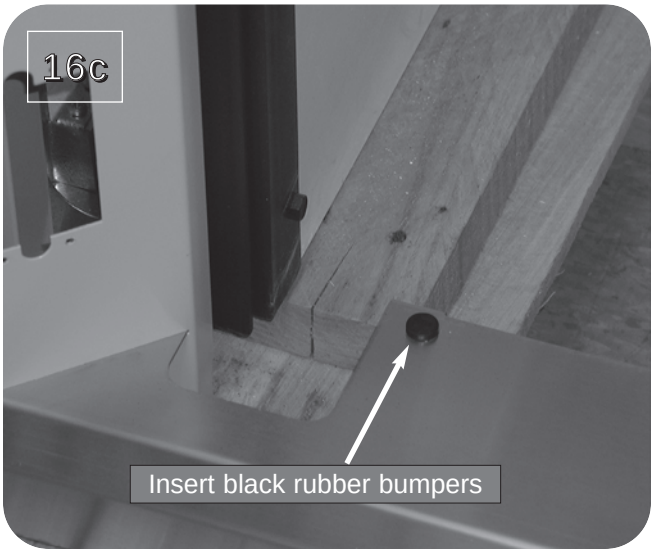
15. Put the fascias on securing the interior row first and then the exterior next with #8 x 1/2" screws[13c].

16. Once the fascias are in place, with the sash raised a few inches, slide the lower airfoil corners into the fascia slots provided until flush with the fascia face [16a]. Then from the interior of the end frames place a PVC pushpin[12] in to the hole provided and secure [16b]. Plug in the 2 black rubber bumpers[5] on the lower airfoil top [16c].



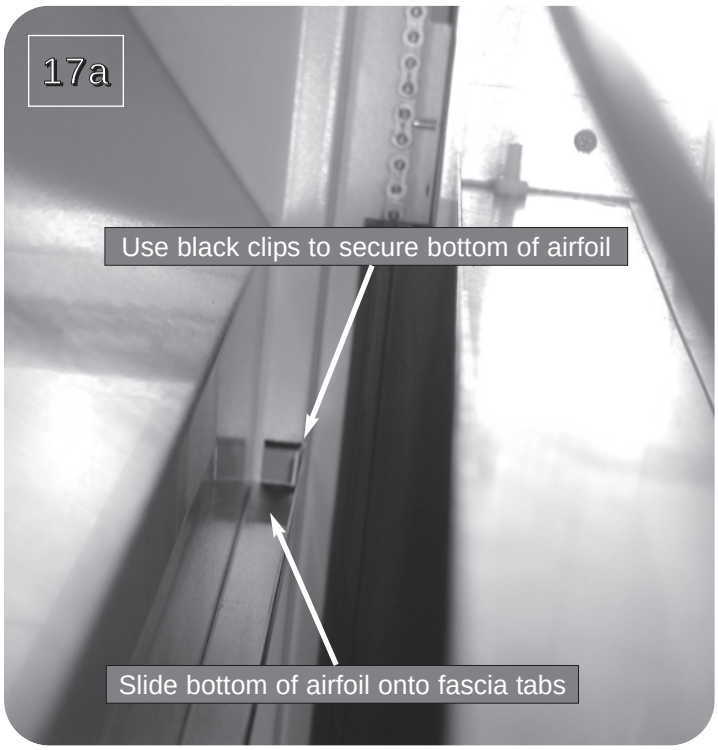


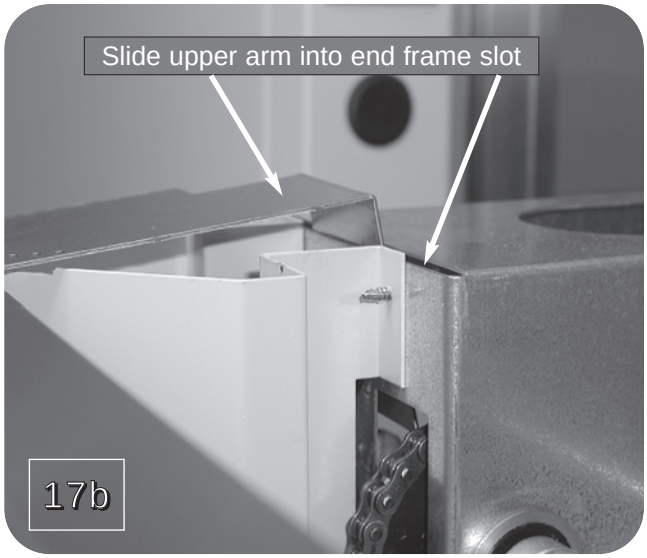


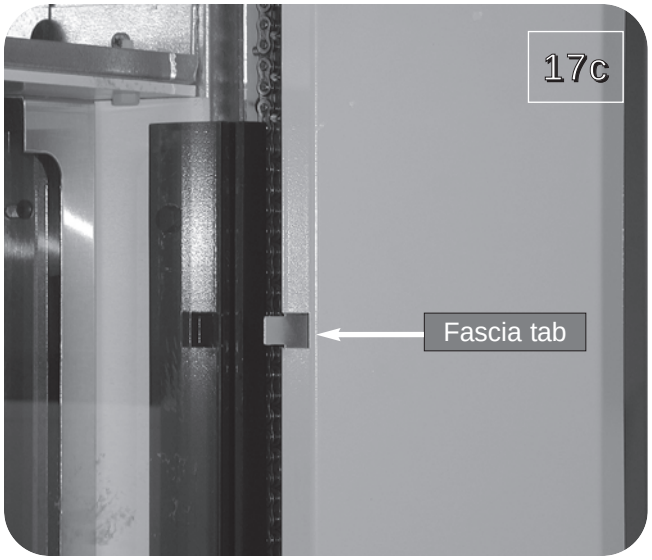


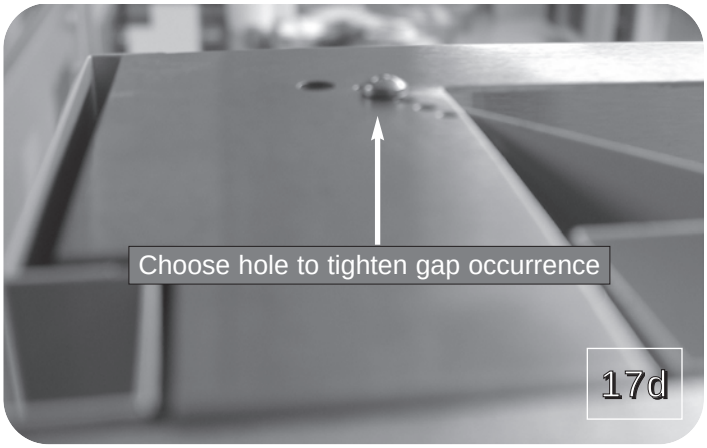
"Knock-Down" Assembly

17. Care should be taken on this next step to prevent fascia scratching. Slide the bottom part of the upper airfoil [17a] onto the tabs on the fascia [17c]. Keeping the bottom in place, bend the upper airfoil arms on the top to slide into the end frame slot as shown in picture [17b]. Secure the arms on the interior of the end frame with #8 x 1/2"[13c] screws. Use black clips[1] to attach fascia tabs to lower part of the airfoil [17a]. Scrutinize the airfoil sides to see if gapping is occurring between the airfoil and fascia. Choose one of the five holes on airfoil arm, using a #10 x 3/4"[13a] screw, to tighten any gap occurrences [17d].





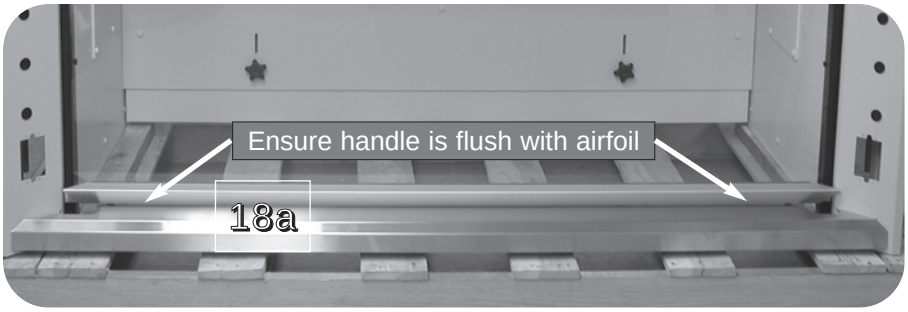


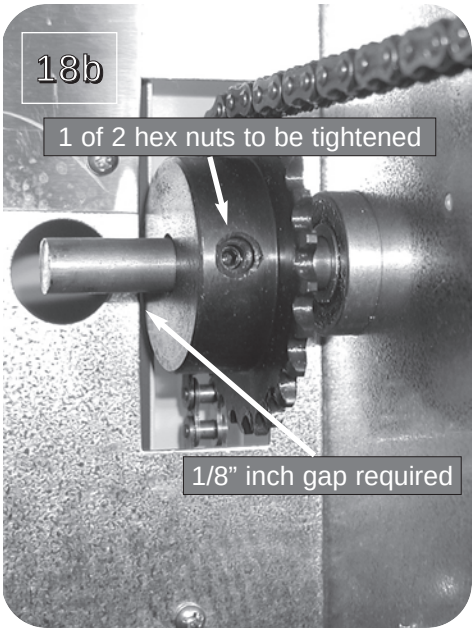


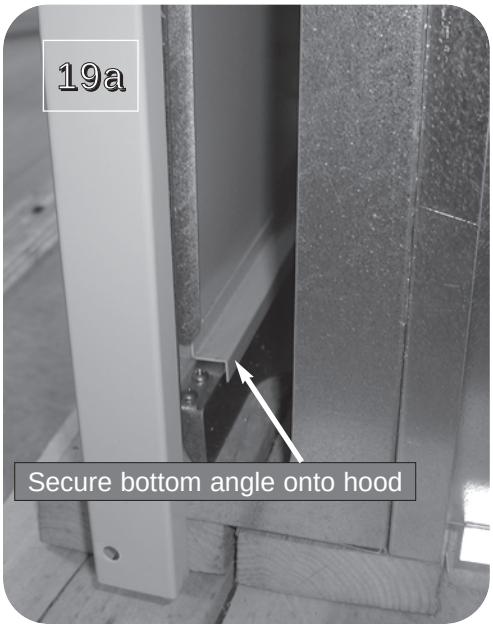
"Knock-Down" Assembly

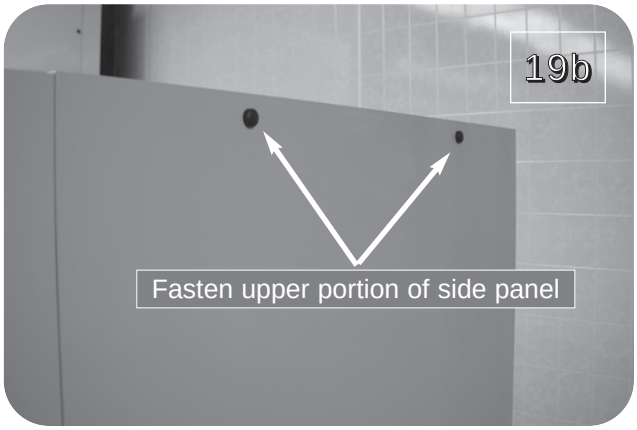
18. Level the sash glass by either raising the sash to sit flush against the sash stops[15] or lowering the sash to sit flush against the bottom airfoil [18a]. Tighten the sprockets[14] with a proper size allen wrench. Be sure to set the sprockets the proper distance prior to leveling the sash [18b]. The ends as shown should be approximately 1/8" of an inch from the side as shown in picture.

19. Using the bottom angle on the side panel cover, overlap to secure lower section onto hood [19a]. Screw in top portion with #10 x 3/4" screw[13a] with base[3] and then cover with cap[6] [19b].

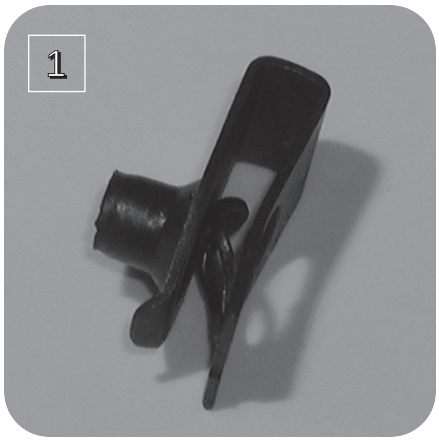




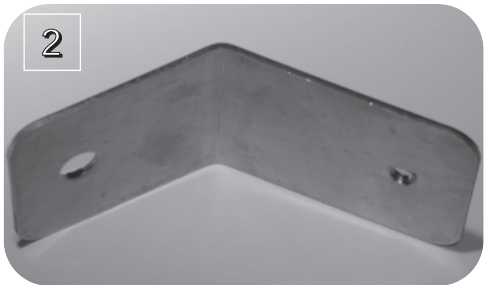




Component Diagram



U-Tapped clip for upper airfoil



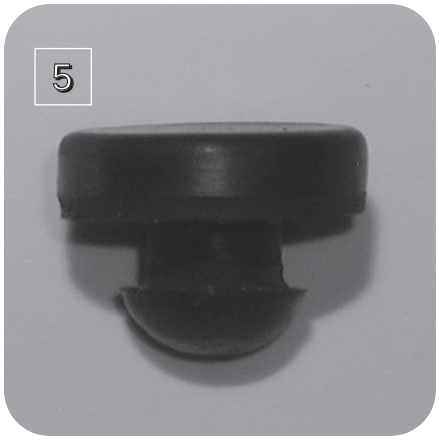
Center angled bracket



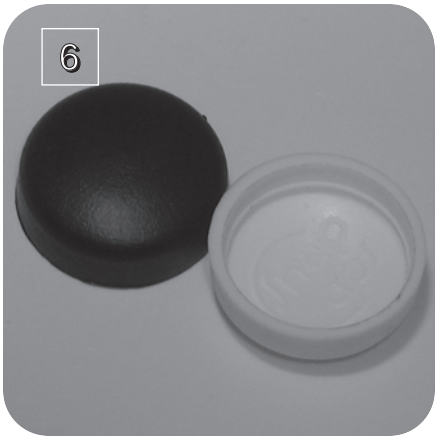
Screw base



1/2” Axle bearing



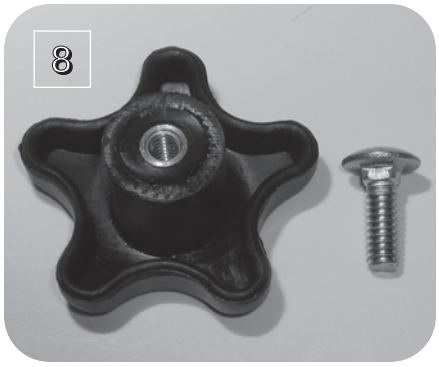
Rubber bumper



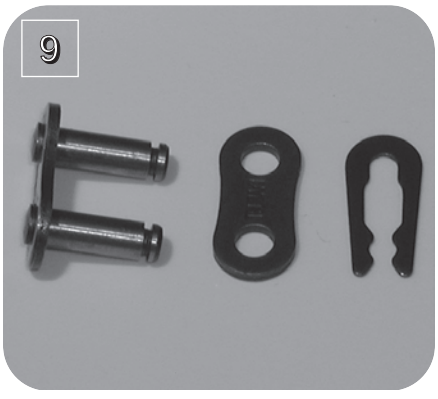
Various screw caps



1/2” Spacer collar

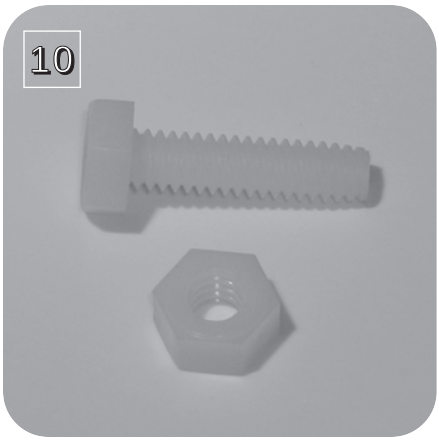


Adjustable baffle knob & bolt

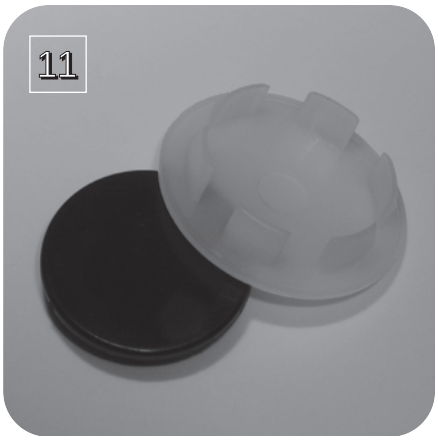


Connecting chain link

Component Diagram



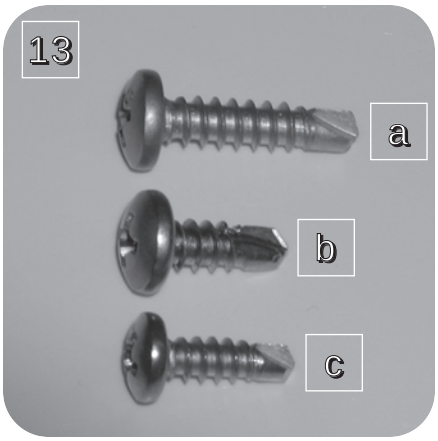
Nylon bolt & nut



Various plug caps



PVC Pushpin



Various screws
a) #10 x 3/4” Self Tapping
b) #10 x 1/2” Self Tapping
c) #8 x 1/2” Self Tapping



1/2” Axle rod sprocket



Sash stop



Threaded chain link

Design and Installation Guidelines

Hole Sizing

WaterSaver fixtures are furnished with standard size inlet shanks to penetrate the deck or wall surface. Minimum hole sizes for thes below:

Inlet Shank	Minimum Hol
3/8" IPS Shank (all fixtures with BI131 series turret, BI158 flange, most mixing faucets, etc.)	3/4" (.750)
1/2" IPS Shank (L2700 series faucets, deck mounted eye washes, but except L600 series faucets)	7/8" (.875)
1/2" IPS Shank (L600 series faucets)	1-1/8" (1.125)
3/4" IPS Shank (electric pedestal boxes, AAP100/101 burette sockets)	1-1/8" (1.125)
1-3/16" dia. Shank (L400 series and L2200 series faucets)	1-3/8" (1.375)

Pipe Sizing and Material

Requirements for the size and material of supply piping are generally covered by local plumbing codes. Reference should be made laying out piping for service fixtures and safety equipment. Pipe sizing is also affected by the number of fixtures or outlets installed typical piping standards for single fixtures and outlets are as follows:

Service	Piping Material	Mi
Gas	Black Iron	3/8
Air/Vacuum	Copper	3/8
Special Gases	Copper or Stainless Steel	3/8
Steam	Black Iron	3/8
Water	Copper	3/8
Distilled, Deionized and Ultra-Pure Water	PVC/Polypropylene/PVDF	1/2
Emergency Showers	Copper	1"
Eye, Eye/Face Wash and Drench Hose Units	Copper	1/2
Safety Stations	Copper	1-1

Installation Procedures

Installation Procedures Installing WaterSaver laboratory faucets, valves and safety equipment requires the use of common plumbin techniques. Observing the following guidelines will help to assure troublefree installation:

1. Thoroughly clean and flush supply lines prior to installing faucets and valves. Pipe shavings, scale, tape and other debris a pipe and into a faucet or valve when the system is activated. This debris can damage valve components and interfere with th the faucet or valve.

2. When placing a faucet or valve on a laboratory countertop or wall, secure the fixture using the lockwasher and locknut. Ti sufficiently to secure the fixture to the counter or wall. Do not overtighten.

3. Generally, WaterSaver fixtures have American National standard taper pipe threads (NPT) on the inlet. Use Teflon tape o seal these threads. Do not apply the sealant in a way that will permit it to enter into the faucet or valve. The faucets which do r (such as our L400 series, L600 series and L2200 series) are furnished with 1/2" OD slip joint connections.

4. Observe the maximum test and working pressures for faucets and valves. Testing or using a valve at pressures for which result in leakage or failure. Refer to the Valve Selection Guide on page 5 for information on maximum test and working pressu

5. Do not use valves for services and applications for which they are not intended. In particular: • Ground key cock valves ar and vacuum service only and at pressures of less than 40 PSI. • Valves for oxygen service and high purity gases must be spe lubricated and packed. Ground key cock valves and needle valves which have not been specially cleaned are not acceptable. be used for gas services only. They are generally not suitable for use with water or steam.

6. To prevent surface damage, use caution when applying a wrench or other tool to the exterior of a faucet or valve.

7. Every WaterSaver faucet is fully assembled at the factory. This includes installing the gooseneck into the faucet body and the gooseneck. Mounting shanks are furnished loose (designated by the suffix "WS") or assembled (designated by the suffix "

8. WaterSaver valve assemblies (such as needle valve or ground key cock valve assemblies) are factory assembled, inspec Mounting shanks are furnished loose (designated by the suffix "WS") or assembled (designated by the suffix "WSA"), as order permits us to test the connections between the valve, the mounting fitting (turret or flange) and the mounting shank. Factory as minimizes the field labor required to install the fixture and minimizes the possibility of damaging the fixture's finish during instal

9. Clean faucets and valves using a soft cloth and soapy water. Do not use abrasives, detergents or other cleaners which ca the fixture. In particular, do not use any solvent in or near a faucet or valve. Solvents can dissolve the lubricants used in the va

home | history | specifications | products | contact | literature

WaterSaver Faucet Co.

Innovative Products for Research

WARRANTY

All products are carefully manufactured, tested, inspected and packed. Water Saver Faucet Company (the "Company") unconditionally warrants all products against manufacturing defects. If any item, within one year after purchase, proves defective due to faulty workmanship or material, the Company will, at its option, repair the defective item or furnish a new item of the same type. No labor, transportation or other consequential damages will be allowed in any such case. Any modification, alteration or repair to an item manufactured by the Company by other than an authorized representative of the Company will nullify this warranty.

As the installation and use of the Company's products is beyond its control, no warranty of any kind is made by the Company as to the effects of such use or the results to be obtained therefrom. It is the Buyer's responsibility to select the appropriate product for the use which is intended and which will satisfy any applicable governmental codes, rules and regulations. The Company is not responsible for any losses which may result from selection and/or installation of products which are unsuitable or improper for a particular application, or which do not satisfy any governmental codes, rules or regulations.

701 W. Erie Street • Chicago, IL 60610 USA
Phone 312 666 5500 Fax 312 666 8597

SciMatCo

Under-the-Counter Cabinet

Installation and Maintenance Instructions

Cabinet Model Numbers:

Model No. 1424	Partially Lined Acid Cabinet
Model No. 1430	Partially Lined Acid Cabinet
Model No. 1436	Partially Lined Acid Cabinet
Model No. 1448	Partially Lined Acid Cabinet
Model No. 1624	Fully Lined Acid Cabinet
Model No. 1630	Fully Lined Acid Cabinet
Model No. 1636	Fully Lined Acid Cabinet
Model No. 1648	Fully Lined Acid Cabinet
Model No. 1824	Flammables Cabinet
Model No. 1830	Flammables Cabinet
Model No. 1836	Flammables Cabinet
Model No. 1848	Flammables Cabinet
Model No. 2036	Partially Lined Combination Cabinet
Model No. 2048	Partially Lined Combination Cabinet
Model No. 2236	Fully Lined Combination Cabinet
Model No. 2248	Fully Lined Combination Cabinet

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SciMatCo

Under-the-Counter Cabinet

Installation and Maintenance Instructions

Please unpack these cabinets carefully. If any damage is evident, immediately notify the delivering freight carrier and the supplier of your SciMatCo Under-the-Counter cabinet.

You have just purchased the finest cabinet designed solely for the safe storage of hazardous chemicals. Please read the manual thoroughly before using this product. Only store chemicals in the compartments which are designed to hold these chemicals. Please keep this manual on hand for future reference.

> ***Caution:*** *Always use eye, face, hand, and body protection when using this cabinet.*

I. Unpacking the Cabinets

The best method of unpacking the cabinets is as follows.

A) Remove staples, tape and banding material from the top and bottom of the carton.

B) Open the top of the box and remove the four (4) packing corners. Gently lift the carton off the product.

C) Move the cabinet to its appropriate location. Make sure the surface on which you would like to set the cabinet can support the weight of the cabinet and its contents.

You must level the cabinet to insure proper door operation. Four leveling feet located at the bottom of the cabinet are to be used for this purpose.

> ***Caution:*** *Do not locate your cabinet near open flame, spark or heat or any source of ignition.*

II. Assembly

Your Under-the-Counter cabinets come fully assembled so no assembly is needed.

> ***Warning:*** *Always close and secure cabinet doors after removing your chemicals.*

III. Maintenance

Acid Storage Compartment

Your SciMatCo Under-the-Counter acid cabinet is constructed of 1" thick, high density plywood, painted with several coats of a lacquer paint and then painted with three (3) coats of clear epoxy. This cabinet was designed to give you years of trouble free service with minimal maintenance.

> ***Caution:*** *Always use eye, face, hand and body protection when cleaning this cabinet.*

The inside of the acid cabinet should occasionally be wiped off using a weak solution of sodium phosphate tribasic. Having a good cleaning program and following it will help you get many years of service out of you cabinet. The ratio is 45 grams of sodium phosphate tribasic to one gallon of water.

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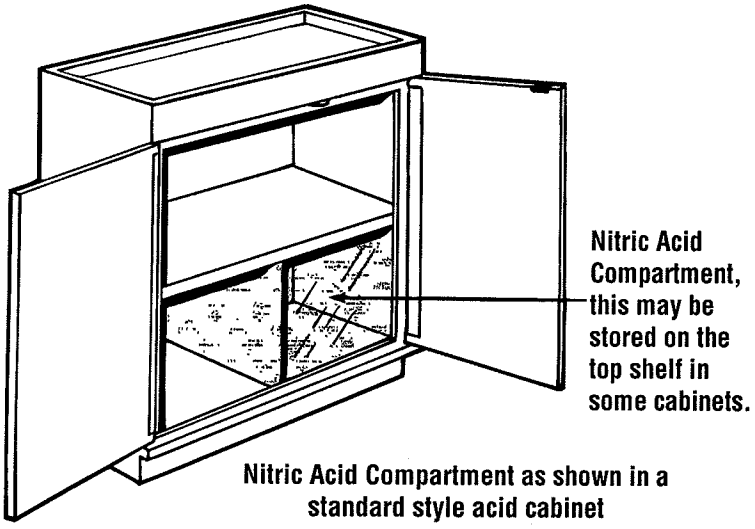
The cabinets should also be completely emptied three (3) times a year and cleaned thoroughly using this solution. Remember, the greatest stress is placed on the cabinet during the hot summer months. Acid bottles are designed to vent and will vent excessively during periods of high temperatures. Keep this in mind when planning your cleaning schedule. Having a good cleaning program and following it will assure you that you will get many years of service out of your cabinet.

Any scratches in the painted surface of the cabinet should be repainted at once. You can order an epoxy touch up paint kit from us. Please refer to the replacement parts list at the end of this manual for the appropriate catalog number.

The wooden hinges, on your acid cabinet, is designed for long life, however, they may occasionally squeak. If this occurs, a lubricant, such as a petroleum spray can be used on the hinges to relieve this problem.

Danger: *Do not store perchloric acid in this cabinet or in the company of any other chemicals. Always store perchloric acid alone. Perchloric acid forms explosive crystals, which can cause an explosion.*

Warning: *Absolutely no flammable materials should ever be stored in the acid section of the cabinet. This provision excludes all acids which may also be flammable.*



Nitric Acid Compartment as shown in a standard style acid cabinet

Flammables Compartment

Your Under-the-Counter flammables cabinet is constructed of 1" thick, high density plywood, painted with several coats of a lacquer paint and then painted with three coats of a clear epoxy. This cabinet was designed to give you years of trouble free service with minimal maintenance.

The flammables compartment should be occasionally wiped off with a wet cloth, using warm water and a common household cleaner. Any scratch in the cabinet should also be repaired immediately by touching them up with the epoxy touch up kit which is available from us.

Your flammables compartment has an all metal hinge. From time to time it may squeak. You may use a petroleum base lubricant on this door hinge to relieve this problem.

Warning: *Absolutely no acid or corrosive materials should ever be stored in the flammables section of the cabinet.*

IV. Nitric Acid Storage
(Acid Compartment only)

There is an urgent need to keep the nitric acid separate from the acetic acid in your acid cabinets. The combination of these two substances has resulted in fires and in small explosions. We offer an accessory for our acid cabinets which has been designed especially for the storage of nitric acid. The use of this welded polypropylene container dramatically reduces the possibility of the mixtures of these two dangerous substances. Please use part number SC8071 when ordering and contact your dealer for pricing.

Warning: *If you do not wish to purchase the optional Nitric Acid Compartment, please do not store the acetic and nitric acid in the same cabinet. A fire or explosion may result.*

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V. Replacement Parts List

Description	Part No.
Paint Touch-up Kits	
Grey	2060-1
Blue	8041-7
Yellow	7021-5
Extra Keys	
Acid	8041-4
Flammables/Poison	7021-1
New Locks	
Acid	8041-5
Flammables/Poison	7021-4
Miscellaneous Parts	
TSP Cabinet Cleaner for Acid Cabinet	8041-8

If you have any questions or need any replacement parts, please contact your supplier.

SciMatCo Product Warranty

Scientific Materials Company warrants its products to be free from defects in materials and workmanship for a period of one (1) year from the date of purchase. This warranty excludes damage caused by abuse, misuse, accidents or the failure to provide proper maintenance.

SciMatCo
Division of Flinn Scientific, Inc.
P.O. Box 305 Batavia, IL 60510
(888) 879-7620 FAX (630) 879-8893

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IMPORTANT SAFETY INFORMATION. READ ALL INSTRUCTIONS BEFORE USING.

⚠ WARNING

Read all safety instructions before using the product. Failure to follow these instructions may result in fire, electrical shock, serious injury or death.

STATE OF CALIFORNIA PROPOSITION 65 WARNING

The California Safe Drinking Water and Toxic Enforcement Act requires the Governor of California to publish a list of substances known to the state to cause cancer, birth defects or other reproductive harm, and requires businesses to warn customers of potential exposure to such substances.

⚠ WARNING This product contains one or more chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

Self-clean ovens can cause low-level exposure to some of these substances, including carbon monoxide, during the cleaning cycle. Exposure can be minimized by venting with an open window or using a ventilation fan or hood.

⚠ WARNING GENERAL SAFETY INSTRUCTIONS

- Use this appliance only for its intended purpose as described in this Owner's Manual.
- Be sure your appliance is properly installed and grounded by a qualified installer in accordance with the provided installation instructions.
- Do not attempt to repair or replace any part of your oven unless it is specifically recommended in this manual. All other servicing should be transferred to a qualified technician.
- Before performing any service, disconnect the power supply at the household distribution panel by removing the fuse or switching off the circuit breaker.
- Do not leave children alone—children should not be left alone or unattended in an area where an appliance is in use. They should never be allowed to climb, sit or stand on any part of the appliance.
- **⚠ CAUTION:** Do not store items of interest to children in cabinets above an oven - children climbing on the oven to reach items could be seriously injured.
- Use only dry pot holders—moist or damp pot holders on hot surfaces may result in burns from steam. Do not let pot holders touch hot heating elements. Do not use a towel or other bulky cloth in place of pot holders.
- Never use your appliance for warming or heating the room.
- Do not touch the heating elements or the interior surface of the oven. These surfaces may be hot enough to burn even though they are dark in color. During and after use, do not touch, or let clothing or other flammable materials contact any interior area of the oven; allow sufficient time for cooling first. Other surfaces of the appliance may become hot enough to cause burns. Potentially hot surfaces include the oven vent opening, surfaces near the opening and crevices around the oven door.
- Do not heat unopened food containers. Pressure could build up and the container could burst, causing an injury.
- Do not use any type of foil or liner to cover the oven bottom or anywhere in the oven, except as described in this manual. Oven liners can trap heat or melt, resulting in damage to the product and risk of shock, smoke or fire.
- Avoid scratching or impacting glass doors or control panels. Doing so may lead to glass breakage. Do not cook on a product with broken glass. Shock, fire or cuts may occur.
- Cook meat and poultry thoroughly—meat to at least an internal temperature of 160°F and poultry to at least an internal temperature of 180°F. Cooking to these temperatures usually protects against foodborne illness.

SAVE THESE INSTRUCTIONS

⚠ WARNING KEEP FLAMMABLE MATERIALS AWAY FROM THE OVEN

Failure to do so may result in fire or personal injury.

- Do not store or use flammable materials in or near an oven, including paper, plastic, pot holders, linens, wall coverings, curtains, drapes and gasoline or other flammable vapors and liquids.
- Never wear loose-fitting or hanging garments while using the appliance. These garments may ignite if they contact hot surfaces, causing severe burns.
- Do not let cooking grease or other flammable materials accumulate in or near the oven. Grease in the oven or near the oven may ignite.

⚠ WARNING IN THE EVENT OF A FIRE, TAKE THE FOLLOWING STEPS TO PREVENT INJURY AND FIRE SPREADING

- Do not use water on grease fires. Never pick up a flaming pan.
- If there is a fire in the oven during baking, smother the fire by closing the oven door and turning the oven off or by using a multi-purpose dry chemical or foam-type fire extinguisher.
- If there is a fire in the oven during self-clean, turn the oven off and wait for the fire to go out. Do not force the door open. Introduction of fresh air at self-clean temperatures may lead to a burst of flame from the oven. Failure to follow this instruction may result in severe burns.

⚠ WARNING OVEN SAFETY INSTRUCTIONS

- Stand away from the oven when opening the oven door. Hot air or steam which escapes can cause burns to hands, face and/or eyes.
- Keep the oven vent unobstructed.
- Keep the oven free from grease buildup. Grease in the oven may ignite.
- Place oven racks in desired location while oven is cool. If rack must be moved while oven is hot, do not let pot holder contact hot heating element in oven.
- When using cooking or roasting bags in the oven, follow the manufacturer's directions.
- Pulling out the standard racks to their stop-locks or the extension rack to its fully open position is a convenience in lifting heavy foods. It is also a precaution against burns from touching hot surfaces of the door or oven walls.
- Do not leave items such as paper, cooking utensils or food in the oven when not in use. Items stored in an oven can ignite.
- Never place cooking utensils, pizza or baking stones, or any type of foil or liner on the oven floor. These items can trap heat or melt, resulting in damage to the product and risk of shock, smoke or fire.

⚠ WARNING SELF-CLEANING OVEN SAFETY INSTRUCTIONS

The self-cleaning feature operates the oven at temperatures high enough to burn away food soils in the oven. Follow these instructions for safe operation.

- Do not touch oven surfaces during self-clean operation. Keep children away from the oven during self-cleaning. Failure to follow these instructions may cause burns.
- Before self-cleaning the oven, remove shiny silver colored oven racks (on some models), the probe, any aluminum foil, and any broiler pan, grid, and other cookware. Only porcelain coated oven racks may be left in the oven.
- Before operating the self-clean cycle, wipe grease and food soils from the oven. Excessive amount of grease may ignite, leading to smoke damage to your home.
- If the self-cleaning mode malfunctions, turn the oven off and disconnect the power supply. Have it serviced by a qualified technician.
- Do not clean the door gasket. The door gasket is essential for a good seal. Care should be taken not to rub, damage or move the gasket.
- Do not use oven cleaners. No commercial oven cleaner or oven liner protective coating of any kind should be used in or around any part of the oven.

SAVE THESE INSTRUCTIONS

Thank You! ... for your purchase of a GE Brand appliance.

Register Your Appliance: Register your new appliance on-line at your convenience!

www.geappliances.com/service_and_support/register/

Timely product registration will allow for enhanced communication and prompt service under the terms of your warranty, should the need arise. You may also mail in the pre-printed registration card included in the packing material.

GE Electric Range Warranty

GEAppliances.com

All warranty service is provided by our Factory Service Centers, or an authorized Customer Care® technician. To schedule service on-line, visit us at www.geappliances.com/service_and_support/, or call 800.GE.CARES (800.432.2737). Please have serial number and model number available when calling for service.

Servicing your appliance may require the use of the onboard data port for diagnostics. This gives a GE factory service technician the ability to quickly diagnose any issues with your appliance and helps GE improve its products by providing GE with information on your appliance. If you do not want your appliance data to be sent to GE, please advise your technician not to submit the data to GE at the time of service.

For the period of one year from the date of the original purchase. GE will provide any part of the range which fails due to a defect in materials or workmanship. During this limited one-year warranty, GE will also provide, free of charge, all labor and in-home service to replace the defective part.

What GE will not cover:

- Service trips to your home to teach you how to use the product.
- Improper installation, delivery or maintenance.
- Failure of the product if it is abused, misused, modified or used for other than the intended purpose or used commercially.
- Replacement of house fuses or resetting of circuit breakers.
- Damage to the product caused by accident, fire, floods or acts of God.
- Incidental or consequential damage caused by possible defects with this appliance.
- Damage caused after delivery.
- Product not accessible to provide required service.
- Service to repair or replace light bulbs, except for LED lamps.

EXCLUSION OF IMPLIED WARRANTIES

Your sole and exclusive remedy is product repair as provided in this Limited Warranty. Any implied warranties, including the implied warranties of merchantability or fitness for a particular purpose, are limited to one year or the shortest period allowed by law.

This warranty is extended to the original purchaser and any succeeding owner for products purchased for home use within the USA. If the product is located in an area where service by a GE Authorized Servicer is not available, you may be responsible for a trip charge or you may be required to bring the product to an Authorized GE Service location for service. In Alaska, the warranty excludes the cost of shipping or service calls to your home.

Some states do not allow the exclusion or limitation of incidental or consequential damages. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state. To know what your legal rights are, consult your local or state consumer affairs office or your state's Attorney General.

Warrantor: General Electric Company. Louisville, KY 40225

Extended Warranties: Purchase a GE extended warranty and learn about special discounts that are available while your warranty is still in effect. You can purchase it on-line anytime

www.geappliances.com/service_and_support/shop-for-extended-service-plans.htm

or call 800.626.2224 during normal business hours. GE Consumer Home Services will still be there after your warranty expires.

Staple your receipt here. Proof of the original purchase date is needed to obtain service under the warranty.

Have a question or need assistance with your appliance?

Try the GE Appliances Website (**www.geappliances.com/service_and_support/**) 24 hours a day, any day of the year! For greater convenience and faster service, you can now download Owner's Manuals, order parts or even schedule service on-line.

Schedule Service: Expert GE repair service is only one step away from your door. Get on-line and schedule your service at www.geappliances.com/service_and_support/ Or call 800.GE.CARES (800.432.2737) during normal business hours.

Parts and Accessories: Individuals qualified to service their own appliances can have parts or accessories sent directly to their homes (VISA, MasterCard and Discover cards are accepted).Order on-line today, 24 hours every day or by phone at 800.626.2002 during normal business hours.

Instructions contained in this manual cover procedures to be performed by any user. Other servicing generally should be referred to qualified service personnel. Caution must be exercised, since improper servicing may cause unsafe operation.

Real Life Design Studio: GE supports the Universal Design concept of products, services and environments that can be used by people of all ages, sizes and capabilities. We recognize the need to design for a wide range of physical and mental abilities and impairments. For details of GE's Universal Design applications, including kitchen design ideas for people with disabilities, check out our Website today. For the hearing impaired, please call 800.TDD.GEAC (800.833.4322).

Contact Us: If you are not satisfied with the service you receive from GE, contact us on our Website with all the details including your phone number, or write to:

General Manager, Customer Relations
GE Appliances, Appliance Park Louisville, KY 40225

Accessories

Looking For Something More?
GE offers a variety of accessories to improve your cooking and maintenance experiences!

To place an order visit us online at:

www.GEApplianceParts.com (U.S.) or **www.GEAppliances.ca** (Canada)

or call **800.626.2002** (U.S.) **800.661.1616** (Canada)

The following products and more are available:

Accessories

Small Broiler Pan (8 ¾ " x 1 ¼" x 13 ½ ")	WB48X10055 (US) 222D2097G001 (Canada)
Large* Broiler Pan (12 ¾ " x 1 ¼" x 16 ½ ")	WB48X10056 (US) 222D2097G002 (Canada)
XL** Broiler Pan (17 " x 1 ¼" x 19 1/4")	WB48X10057 (US) Not available in Canada

Parts

Oven racks	Part numbers vary by model
Oven elements	Part numbers vary by model
Light bulbs	Part numbers vary by model

Cleaning Supplies

CitruShine Stainless Steel Wipes	WX10X10007
CeramaBryte Stainless Steel Appliance Cleaner	PM10X311

*The large broiler pan does not fit in 20"/24" ranges.
**The XL broiler pan does not fit in 24" wall ovens, 27"drop ins or 20"/24" ranges

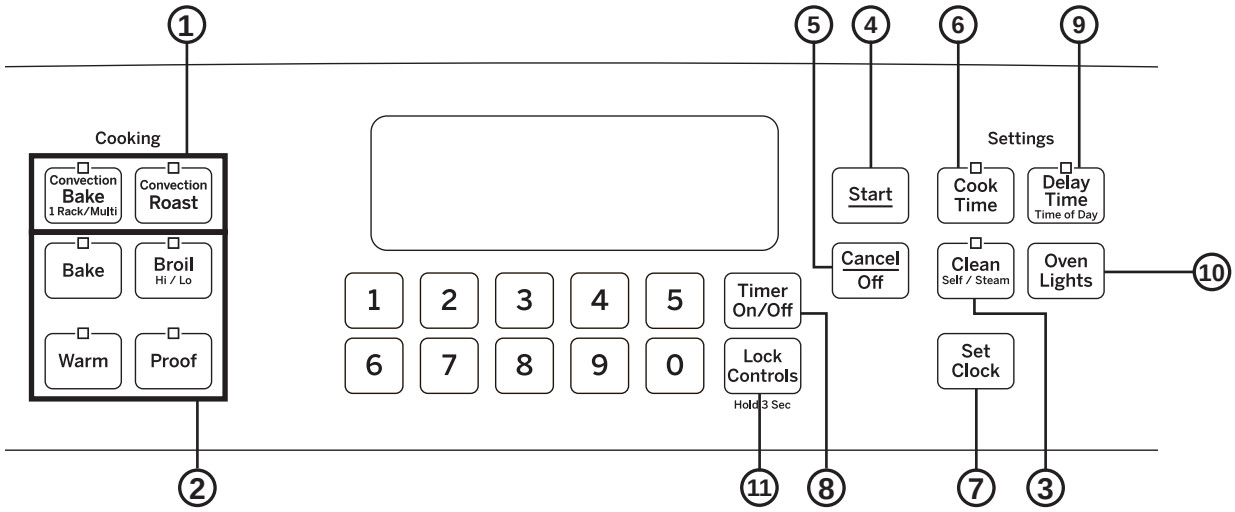
How to Remove Protective Shipping Film and Packaging Tape

Carefully grasp a corner of the protective shipping film with your fingers and slowly peel it from the appliance surface. Do not use any sharp items to remove the film. Remove all of the film before using the appliance for the first time.

To assure no damage is done to the finish of the product, the safest way to remove the adhesive from packaging tape on new appliances is an application of a household liquid dishwashing detergent. Apply with a soft cloth and allow to soak.

NOTE: The adhesive must be removed from all parts. It cannot be removed if it is baked on.

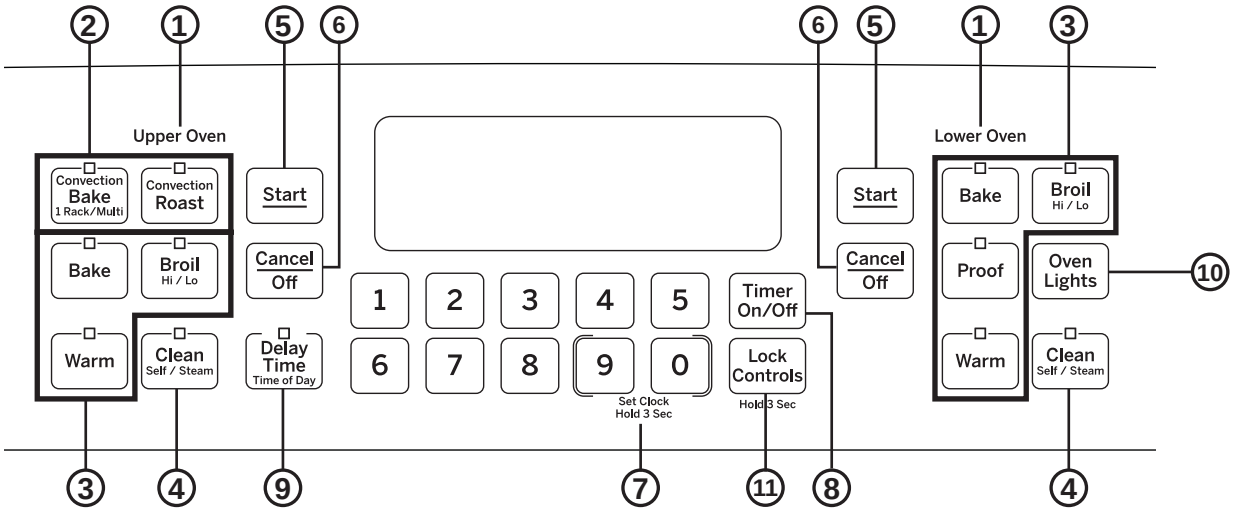
Single Wall Oven



1. **Convection Cooking Modes:** Convection cooking modes use increased air circulation to improve performance. The type of benefit depends on the mode. Your oven has the following convection cooking modes: Convection Bake (1 Rack/Multi) and Convection Roast. See the Cooking Modes section for more information.
2. **Traditional Cooking Modes:** Your oven has the following traditional cooking modes: Bake, Broil Hi/Lo, Proof and Warm. See the Cooking Modes section for more information.
3. **Clean:** Your oven has two cleaning modes: Self Clean and Steam Clean. See the Cleaning the Oven section for important information about using these modes.
4. **Start:** Must be pressed to start any cooking, cleaning, or timed function.
5. **Cancel/Off:** Cancels ALL oven operations except the clock and timer.
6. **Cook Time:** Counts down cooking time and turns off the oven when the cooking time is complete. Press the **Cook Time** pad, use the number pads to program a cooking time in hours and minutes, then press **Start.** This can only be used with Traditional Bake, Convection Bake, Convection Bake Multi, and Convection Roast.
7. **Clock:** Sets the oven clock time. Press the **Set Clock** pad and the number pads to program the clock. Press **Start** to save the time.
8. **Timer:** Works as a countdown timer. Press the **Timer** pad and the number pads to program the time in hours and minutes. Press the **Start** pad. The oven will continue to operate when the timer countdown is complete. To turn the timer off press the **Timer** pad
9. **Delay Time:** Delays when the oven will turn on. Use this to set a time when you want the oven to start. Press the **Delay Time** pad and use the number pads to program the time of day for the oven to turn on then press **Start**. Press the desired cooking mode and temperature then press **Start**. A cook time may also be programmed if desired. Follow the directions under Cook Time for setting this feature. This can only be used with Bake, Convection Bake (1 Rack/Multi), Convection Roast and Self-Clean.

   NOTE: When using the delay time feature, foods that spoil easily—such as milk, eggs, fish, stuffings, poultry and pork—should not be allowed to sit for more than 1 hour before or after cooking. Room temperature promotes the growth of harmful bacteria. Be sure that the oven light is off because heat from the bulb will speed harmful bacteria growth.
10. **Oven Light(s):** Turns the oven light(s) on or off.
11. **Lock Controls:** Locks out the control so that pressing the pads does not activate the controls. Press and hold the **Lock Controls** pad for three seconds to lock or unlock the control. **Cancel/Off** is always active, even when the control is locked.

Double Wall Oven



1. **Upper Oven and Lower Oven:** Designates which oven the controls will operate.
2. **Convection Cooking Modes:** Convection cooking modes use increased air circulation to improve performance. The type of benefit depends on the mode. Your oven has the following convection cooking modes: Convection Bake (1 Rack/Multi) and Convection Roast. See the Cooking Modes section for more information.
3. **Traditional Cooking Modes:** Your oven has the following traditional cooking modes: Bake, Broil Hi/Lo, Warm and Proof (lower oven only). See the Cooking Modes section for more information.
4. **Clean:** Your oven has two cleaning modes: **Self Clean** and **Steam Clean**. See the Cleaning the Oven section for important information about using these modes. Note that proof cannot be run when running a clean mode in the upper oven.
5. **Start:** Must be pressed to start any cooking, cleaning, or timed function.
6. **Cancel/Off:** Cancels ALL oven operations except the clock and timer.
7. **Clock:** Sets the oven clock time. Press the **9** and **0** pads and hold for 3 seconds. Use the number pads to program the clock. Press **Start** to save the time.
8. **Timer:** Works as a countdown timer. Press the **Timer** pad and the number pads to program the time in hours and minutes. Press the **Start** pad. The oven will continue to operate when the timer countdown is complete. To turn the timer off press the **Timer** pad.
9. **Delay Time:** Delays when the oven will turn on. Use this to set a time when you want the oven to start. Press the **Delay Time** pad and use the number pads to program the time of day for the oven to turn on then press **Start**. Press the desired cooking mode and temperature then press **Start**. This can only be used with Bake, Convection Bake (1 Rack/Multi), Convection Roast and Self-Clean.

   NOTE: When using the delay time feature, foods that spoil easily—such as milk, eggs, fish, stuffings, poultry and pork—should not be allowed to sit for more than 1 hour before or after cooking. Room temperature promotes the growth of harmful bacteria. Be sure that the oven light is off because heat from the bulb will speed harmful bacteria growth.
10. **Oven Light(s):** Turns the oven light(s) on or off in both ovens. Note that lights in both ovens will not turn on if the door is opened while the other oven is in a clean mode.
11. **Lock Controls:** Locks out the control so that pressing the pads does not activate the controls. Press and hold the **Lock Controls** pad for three seconds to lock or unlock the control. **Cancel/Off** is always active, even when the control is locked.

Special Features

There are several different special features on your wall oven. To change the settings of these special features, press the **BAKE** and **BROIL** pads at the same time and hold for three seconds. "**SF**" will appear in the display. Select the feature you want to change. When the change has been made, press the **START** key to save the change and return to the time of day.

Adjust the Oven Temperature

This feature allows the oven baking and convection baking temperature to be adjusted up to 35ºF hotter or down to 35ºF cooler. Use this feature if you believe your oven temperature is too hot or too cold and wish to change it. **For double oven models, the upper and lower ovens are adjusted separately.** This adjustment affects Bake, and Convection Bake (1 Rack/Multi) modes. No other cooking modes are affected.

Press the **Bake** pad to select the oven to be adjusted. Press the **Bake** pad again to enter the temperature adjustment mode. A number between 35 and - 35 will display. Use the number pads to set the desired temperature adjustment and use the **Bake** pad to change between negative and positive.

Press the **Start** pad to save the temperature adjustment.

End of Timer Signals

This is the tone that signals the end of a timer. The tone can be continuous (Con bEEP) or one repeating beep (bEEP). A continuous setting will continue to sound a tone until a button on the control is pressed. Press the **Broil** pad to view the current setting and then to change the setting.

Fahrenheit or Celsius Temperature Display

The oven control is set to use Fahrenheit temperatures (F), but you can change it to use Celsius temperatures (C). Press the number **6** and **8** pads at the same time to view the current setting, press again to change the setting.

Clock Display

This feature specifies how the time of day will be displayed or if no time of day will be displayed. You can select a standard 12-hour clock (12 H), 24-hour military time display (24 H), or for no clock displayed (oFF). Press the **Clock** pad to view the current setting, press again to change the setting.

Auto Recipe Conversion

When using Convection Bake 1 Rack or Convection Bake Multi Rack cooking options, Auto Recipe Conversion will automatically convert the regular baking temperatures entered to convection bake cooking temperatures when turned on. Note that this option does not convert convection bake cooking times, it only converts temperatures. Press the **Convection Bake (1 Rack/Multi)** pad to view the conversion setting, press again to toggle between On (Con On) and Off (Con oFF).

Sound Volume

This feature allows the oven tone volume to be adjusted between high (HI bEEP HI), medium (Std bEEP Std), low (Lo bEEP Lo) and off (oFF bEEP oFF). Press the number **1** and **5** pads at the same time to view the current setting or to change the setting. The control will sound the oven tone at the new volume level each time the sound level is changed.

12-hour auto shut-off and Sabbath

Options for this feature are “12 SHdn”, “no SHdn” and “SAbbAtH”.

12-hour auto shut-off turns off the oven after 12 hours of continuous operations.

Sabbath mode disables the oven lights (the oven light will not turn on when the door is opened), all sounds (the control will not beep when a button is pressed), Convection, Broil, Warm, Proof, Cook Time, Timer, Clock, and Delay Time functions. Sabbath mode can only be used with Bake. This feature conforms to the Star-K Jewish Sabbath requirements.

Press and hold the **Bake** and **Broil** pads for 3 seconds to enter special features.

Press the **Delay Time** pad to view the current setting and then to change the setting.

To use Sabbath mode, select “SAbbAtH” and press **Start**. A **]** will appear in the display and the clock will not display.

Note that if you have a double wall oven, when you place the control into Sabbath mode, both ovens are now in Sabbath mode and available for cooking.

Once in Sabbath mode, at any time you can press **Bake**, use the number pads to enter a temperature between 170F and 550F, and press **Start**. No sound will be given when the keys are pressed. At a random time between 30 seconds and 1 minute, **][**, will appear in the display indicating the oven is running.

Note that both ovens of a double wall oven can be used in Sabbath mode. Each oven can be programmed to a different temperature and each oven must be programmed separately.

If you need to adjust the temperature, press **Bake**, use the number pads to enter a new temperature between 170F and 550F, and press **Start**.

To turn the oven off, press **Cancel/Off** at any time. **The oven will immediately turn off** and **][** will change to **]** indicating that the oven has turned off.

Note that each oven of a double wall oven must be turned off separately.

To exit Sabbath mode, make sure that the oven is turned off. Press and hold the **Bake** and **Broil** pads for 3 seconds to enter special features then press **Delay Time** until either “**12 Shdn**” or “**no Shdn**” is in the display and press **Start**.

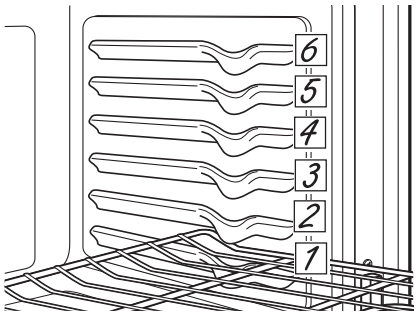
NOTE: If power outage occurs during Sabbath mode the unit will remain in Sabbath mode but off when power is restored.

If you wish to use the Cook Time feature (if available) to bake in the oven and then have the oven automatically turn off, you will need to press the Cook Time button, enter a cooking time duration, and press Start. Then enter special features to start Sabbath mode as detailed above.

Oven Racks

Your oven has six rack positions. Recommended rack positions for various types of foods are provided in the Cooking Guide. Adjusting rack position is one way to impact cooking results. For example, if you would prefer darker tops on cakes, muffins, or cookies, try moving food one rack position higher. If you find foods are too brown on top try moving them down next time.

When baking with multiple pans and on multiple racks, ensure there is sufficient space between pans to allow air to flow.



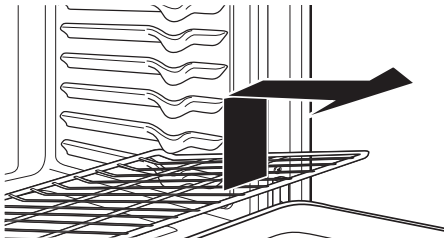
Flat Racks

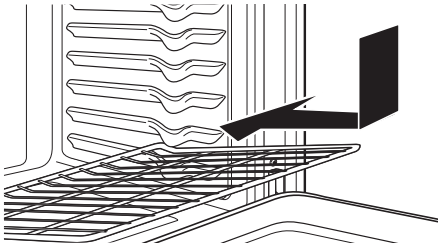
When placing and removing cookware, pull the rack out to the bump (stop position) on the rack support.

To remove a rack, pull it toward you, tilt the front end up and pull it out.

To replace, place the curved end of the rack (stop-locks) onto the oven supports, tilt up the front of the rack and push the rack in.

Racks may become difficult to slide, especially after a self-clean. Put some vegetable oil on a soft cloth or paper towel and rub onto the left and right edges.





Aluminum Foil and Oven Liners

⚠CAUTION: **Do not use any type of foil or oven liner to cover the oven bottom. These items can trap heat or melt, resulting in damage to the product and risk of shock, smoke or fire. Damage from improper use of these items is not covered by the product warranty.**

Foil may be used to catch spills by placing a sheet on a lower rack, several inches below the food. Do not use more foil than necessary and never entirely cover an oven rack with aluminum foil. Keep foil at least 1-1/2” from oven walls to prevent poor heat circulation.

Cookware

Cookware Guidelines

The material, finish, and size of cookware affect baking performance.

Dark, coated and dull pans absorb heat more readily than light, shiny pans. Pans that absorb heat more readily can result in a browner, crisper, and thicker crust. If using dark and coated cookware check food earlier than minimum cook time. If undesirable results are obtained with this type of cookware consider reducing oven temperature by 25º F next time.

Shiny pans can produce more evenly cooked baked goods such as cakes and cookies.

Glass and ceramic pans heat slowly but retain heat well. These types of pans work well for dishes such as pies and custards.

Air insulated pans heat slowly and can reduce bottom browning.

Keep cookware clean to promote even heating.

Cooking Modes

Your new oven has a variety of cooking modes to help you get the best results. These modes are described below. Refer to the Cooking Guide section for recommendations for specific foods. Remember, your new oven may perform differently than the oven it is replacing.

Baking and Roasting Modes

Select a mode for baking and roasting based on the type and quantity of food you are preparing. When preparing baked goods such as cakes, cookies, and pastries always preheat the oven first. Follow recipe recommendations for food placement. If no guidelines are provided, center food in the oven.

Traditional Bake

The traditional bake mode is intended for single rack cooking. This mode uses heat primarily from the lower element but also from the upper element to cook food. To use this mode press the **Bake** pad, enter a temperature, and then press **Start**. Preheating is generally recommended when using this mode.

Convection Bake 1 Rack

The Convection Bake 1 Rack mode is intended for single rack cooking. This mode uses heat from the lower element and also the upper and rear elements, along with air movement from the convection fan to enhance evenness. Your oven is equipped with Auto Recipe Conversion, so it is not necessary to convert the temperature when using this mode. To use this mode press the **Convection Bake (1 Rack/Multi)** once, enter a temperature, and then press **Start**. Preheating is generally recommended when using this mode.

Convection Bake Multi Rack

The Convection Bake Multi Rack mode is intended for baking on multiple racks at the same time. This mode uses heat primarily from the rear element but also heat from the upper and lower elements, along with air movement from the convection fan to enhance cooking evenness. Your oven is equipped with Auto Recipe Conversion, so it is not necessary to convert the temperature when using this mode. Baking time might be slightly longer for multiple racks than what would be expected for a single rack. To use this mode press the **Convection Bake (1 Rack/Multi)** pad **twice**, enter a temperature, and then press **Start**. Always preheat when using this mode.

Convection Roast

The Convection Roast mode is intended for roasting whole cuts of meat on a single rack. This mode uses heat from the lower, upper, and rear elements along with air movement from the convection fan to improve browning and reduce cooking time. It is not necessary to convert temperature. Check food earlier than the recipe suggested time when using this mode or use a meat probe. To use this mode press the **Convection Roast** pad, enter a temperature, and then press **Start**. It is not necessary to preheat when using this mode.

Broiling Modes

Always broil with the door closed. The broil element in this oven is very powerful. Monitor food closely while broiling. Use caution when broiling on upper rack positions as placing food closer to the broil element increases smoking, spattering, and the possibility of fats igniting. For best performance center food below the broil heating element. **Broiling on rack position 6 is not recommended.**

Try broiling foods that you would normally grill. Adjust rack positions to adjust the intensity of the heat to the food. Place foods closer to the broil element when a seared surface and rare interior is desired. Thicker foods and foods that need to be cooked through should be broiled on a rack position farther from the broiler or by using Broil Lo.

Broil Hi

The Broil Hi mode uses intense heat from the upper element to sear foods. Use Broil Hi for thinner cuts of meat and/or foods you prefer less done on the interior. To use this mode press the **Broil** pad once and then press **Start**. It is not necessary to preheat when using this mode.

Broil Lo

The Broil Lo mode uses less intense heat from the upper element to cook food thoroughly while also producing surface browning. Use Broil Lo for thicker cuts of meat and/or foods that you would like cooked all the way through. To use this mode press the **Broil** pad **twice** and then press **Start**. It is not necessary to preheat when using this mode.

Proof

Proof mode is designed for rising (fermenting and proofing) bread doughs. Press the **Proof** pad and then press **Start.** Cover dough well to prevent drying out. Bread will rise more rapidly than at room temperature. Note that for double wall ovens, proof can not be run when running a clean mode in the lower oven.

Warm

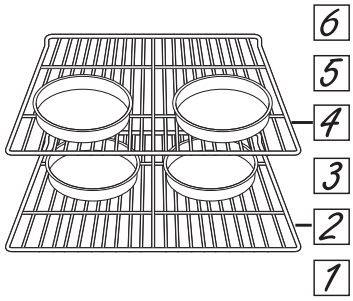
Warm mode is designed to keep hot foods hot for up to 3 hours. To use this mode, press the **Warm** pad then press **Start.** Cover foods that need to remain moist and do not cover foods that should be crisp. Preheating is not required. Do not use warm to heat cold food other than crisping crackers, chips or dry cereal. It is also recommended that food not be kept warm for more than 2 hours.

Cooking Guide

FOOD TYPE	RECOMMENDED MODE(S)	RECOMMENDED RACK POSITION(S)	ADDITIONAL SUGGESTIONS
Baked Goods			
Layer cakes, sheet cakes, bundt cakes, muffins, quick breads on a Single Rack	Traditional Bake	3	Use shiny cookware.
Layer cakes* on Multiple Racks	Traditional Bake	2 and 4	Ensure adequate airflow (see illustration below).
Chiffon cakes (angel food)	Traditional Bake	1	Use shiny cookware.
Cookies, biscuits, scones on a Single Rack	Traditional Bake	3	Use shiny cookware.
Cookies, biscuits, scones on Multiple Racks	Convection Bake Multi Rack	2 and 4 1, 3 and 5	Ensure adequate airflow.
Beef & Pork			
Hamburgers	Broil Hi	5	Use a broil pan; move food down for more doneness/less searing. Watch food closely when broiling. For best performance center food below the broil heating element.
Steaks & Chops	Broil Hi	5	Use a broil pan; move food down for more doneness/less searing. Watch food closely when broiling. For best performance center food below the broil heating element.
Roasts	Convection Roast	2 or 3	Use a low sided pan such as a broil pan. Preheating is not necessary.
Poultry			
Whole chicken	Convection Roast	2 or 3	Use a low sided pan such as a broil pan.
Bone-in chicken breasts, legs, thighs	Broil Hi	1	If breaded or coated in sauce avoid Broil Hi modes. Broil skin side down first. Watch food closely when broiling. For best performance when broiling, center food below the broil heating element.
	Broil Lo Traditional Bake Convection Bake 1 Rack	3	
Boneless chicken breasts	Broil Lo Traditional Bake Convection Bake 1 Rack	3	Move food down for more doneness/less searing and up for greater searing/browning when broiling. For best performance when broiling, center food below the broil heating element.
Whole turkey	Convection Roast	1 or 2	Use a low sided pan such as a broil pan.
Turkey Breast	Convection Roast	2 or 3	Use a low sided pan such as a broil pan.
Fish	Broil Lo	5 (1/2 thick or less) 4 (>1/2 inch)	Watch food closely when broiling. For best performance center food below the broil heating element.
Casseroles	Convection Bake 1 Rack Traditional Bake	3	
Frozen Convenience Foods			
Pizza, french fries, tator tots, chicken nuggets, appetizers on a Single Rack	Convection Bake 1 Rack Traditional Bake	3	Use shiny cookware.
Pizza, french fries, tator tots, chicken nuggets, appetizers on Multiple Racks	Convection Bake Multi Rack	2 and 4	Use shiny cookware.

*When baking four cake layers at a time, use racks 2 and 4. Place the pans as shown so that one pan is not directly above another.

Cook food thoroughly to help protect against food borne illness. Minimum safe food temperature recommendations for food safety can be found at **www.IsItDoneYet.gov**. Make sure to use a food thermometer to take food temperatures.



Cleaning The Oven

Be sure electrical power is off and all surfaces are cool before cleaning any part of the oven.

Control Panel

It's a good idea to wipe the control panel after each use. Clean with mild soap and water or vinegar and water, rinse with clean water and polish dry with a soft cloth.

Do not use abrasive cleansers, strong liquid cleansers, plastic scouring pads or oven cleaners on the control panel—they will damage the finish.

Oven Exterior

Do not use oven cleaners, abrasive cleansers, strong liquid cleansers, steel wool, plastic scouring pads, or cleaning powders on the interior or exterior of the oven. Clean with a mild soap and water or vinegar and water solution. Rinse with clean water and dry with a soft cloth. When cleaning surfaces, make sure that they are at room temperature and not in direct sunlight.

If stain on the door vent trim is persistent, use a mild abrasive cleaner and a sponge-scrubber for best results.

Spillage of marinades, fruit juices, tomato sauces and basting liquids containing acids may cause discoloration and should be wiped up immediately. Let hot surfaces cool, then clean and rinse.

Stainless Steel Surfaces (on some models)

Do not use a steel wool pad; it will scratch the surface.

To clean the stainless steel surface, use warm sudsy water or a stainless steel cleaner or polish. Always wipe the surface in the direction of the grain. Follow the cleaner instructions for cleaning the stainless steel surface.

To inquire about purchasing cleaning products including stainless steel appliance cleaner or polish read the Assistance and Accessories sections at the beginning of this manual.

Oven Interior

The interior of your new oven can be cleaned manually or by using the Steam Clean or Self Clean modes.

Spillage of marinades, fruit juices, tomato sauces and basting liquids containing acids may cause discoloration and should be wiped up immediately. Let hot surfaces cool, then clean and rinse.

Manual Cleaning

Do not use oven cleaners, abrasive cleaners, strong liquid cleansers, steel wool, scouring pads, or cleaning powders on the interior of the oven. Clean with a mild soap and water or vinegar and water solution. Rinse with clean water and dry with a soft cloth. When cleaning surfaces, make sure that they are at room temperature.

Steam Clean Mode

Steam clean is intended to clean small spills using water and a lower cleaning temperature than Self-Clean.

To use the Steam Clean feature, wipe grease and soils from the oven. Pour one cup of water into the bottom of the oven. Close the door. Press the **Clean** pad **twice** and then press **Start**. The oven door will lock. You can not open the door during the 30 minute steam clean as this will decrease the steam clean performance. At the end of the steam clean cycle the door will unlock. Wipe out any excess water and any remaining soil.

Self Clean Mode

Read Self-Cleaning Oven Safety Instructions at the beginning of this manual before using Self Clean Mode. Self clean uses very high temperatures to clean the oven interior. The oven door will lock when using this feature. Before operating the self-clean cycle, wipe up grease and soils from the oven. Remove all items from the oven other than enameled (dark color) racks. Shiny or silver racks and any cookware or other items should all be removed from the oven before initiating a self-clean cycle. Close the door. Press the **Clean** pad once and a default self-clean time is displayed. The clean time can be changed to any time between 3:00 and 5:00 hours by using the number pads to enter a different time and pressing **Start**. For heavily soiled ovens, the maximum 5 hour clean time is recommended. If you wish to use the default time, press the **Start** pad immediately after pressing the **Clean** pad. The oven will turn off automatically when the self-clean cycle is complete. The door will stay locked until the oven has cooled down. After the oven has cooled down wipe any ash out of the oven.

IMPORTANT: The health of some birds is extremely sensitive to the fumes given off during the self-cleaning cycle of any range. Move birds to another well-ventilated room.

Flat Racks

Flat racks can be left in the cavity during self-clean (if enameled racks, not shiny) or can be washed with warm, soapy water.

Racks may be more difficult to slide, especially after a self-clean. Put some vegetable oil on a soft cloth or paper towel and rub onto the left and right edges.

Maintenance

Oven Light Replacement

⚠ WARNING **SHOCK OR BURN HAZARD:** Before replacing oven light bulb, disconnect the electrical power to the oven at the main fuse or circuit breaker panel. Failure to do so may result in electric shock or burn.

⚠ CAUTION **BURN HAZARD:** The glass cover and bulb should be removed when cool. Touching hot glass with bare hands or a damp cloth can cause burns.

1. Disconnect power at the main fuse or circuit breaker panel.
2. Remove oven racks.
3. Slide a flat blade screwdriver between the housing and the glass light cover.
4. Support the glass light cover with two fingers to prevent the cover from falling to the bottom of the oven.
5. Gently twist the screwdriver blade to loosen the glass light cover. Be careful not to chip the oven coating.
6. Remove the glass light cover.
7. Remove the bulb by firmly grasping and sliding the bulb straight out until the two prongs have cleared the ceramic holder.
8. Do not touch the glass of the new replacement bulb with your fingers. It will cause the bulb to fail when it lights. Grasp the replacement bulb with a clean towel or facial tissue with the prongs facing down. Align the two prongs in the ceramic holder, pressing gently until the bulb is securely in the ceramic socket.
9. Slide the protective lens into the holder and push until the clips snap into the housing.
10. Reconnect power.

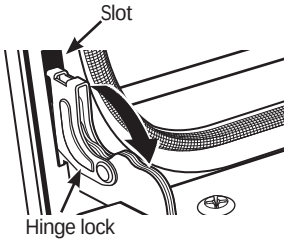
Lift-Off Oven Door

The door is very heavy. Be careful when removing and lifting the door.

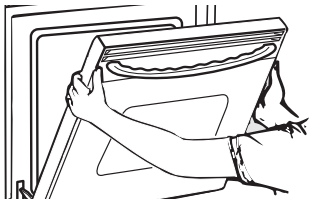
Do not lift the door by the handle.

To remove the door:

1. Fully open the door.
2. Pull the hinge locks down toward the door frame, to the unlocked position. A tool, such as a small flat-blade screwdriver, may be required.
3. Firmly grasp both sides of the door at the top.
4. Close door to the door removal position. The door should be open approximately 3" with no obstruction above the door.
5. Lift door up and out until both hinge arms are clear of the slots.

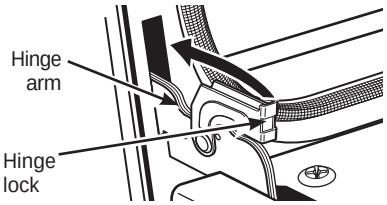


Pull hinge locks down to unlock

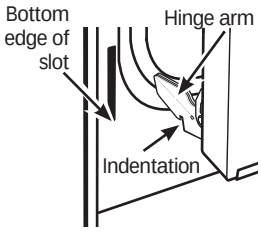

Removal position

To replace the door:

1. Firmly grasp both sides of the door at the top.
2. Starting on the left side, with the door at the same angle as the removal position, seat the indentation of the hinge arm into the bottom edge of the hinge slot. The notch in the hinge arm must be fully seated into the bottom of the slot. Repeat for right side.
3. Fully open the door. If the door will not fully open, the indentation is not seated correctly in the bottom edge of the slot.
4. Push the hinge locks up against the front frame of the oven cavity, to the locked position.
5. Close the oven door.



Push hinge locks up to lock



Troubleshooting tips ... Before you call for service

Save time and money! Review the charts on the following pages first and you may not need to call for service.

Problem	Possible Cause	What To Do
My new oven doesn't cook like my old one. Is something wrong with the temperature settings?	**Your new oven has a different cooking system from your old oven and therefore may cook differently than your old oven.**	For the first few uses, follow your recipe times and temperatures carefully. If you still think your new oven is too hot or too cold, you can adjust the temperature yourself to meet your specific cooking preference. **NOTE:** This adjustment affects Bake, Convection Bake 1 Rack and Convection Bake Multi temperatures; it will not affect Convection Roast, Broil or Clean.
Food does not bake properly	**Oven controls improperly set.**	See the Cooking Modes section.
	Rack position is incorrect or rack is not level.	See the Cooking Modes section and Cooking Guide.
	Incorrect cookware or cookware of improper size being used.	See the Cookware section.
	Oven temperature needs adjustment.	See the Special Features section.
	Ingredient substitution	Substituting ingredients can change the recipe outcome.
Food does not broil properly	**Oven controls improperly set.**	Make sure you select the appropriate broil mode.
	Improper rack position being used.	See Cooking Guide for rack location suggestions.
	Food being cooked in a hot pan.	Make sure cookware is cool.
	Cookware not suited for broiling.	Use a pan specifically designed for broiling.
	Aluminum foil used on the broiling pan and grid has not been fitted properly and slit as recommended.	If using aluminum foil conform to pan slits.
	In some areas the power (voltage) may be low.	Preheat the broil element for 10 minutes.
Oven temperature too hot or too cold	**Oven temperature needs adjustment.**	See the Special Features section.
Oven does not work or appears not to work	**A fuse in your home may be blown or the circuit breaker tripped.**	Replace the fuse or reset the circuit breaker.
	Oven controls improperly set.	See the Using the Oven section.
	Oven is in Sabbath Mode.	Verify, that the oven is not in Sabbath Mode. See the Special Features section.
“Crackling” or “popping” sound	**This is the sound of the metal heating and cooling during both the cooking and cleaning functions.**	This is normal.
Why is my range making a "clicking" noise when using my oven?	**Your range has been designed to maintain a tighter control over your oven's temperature. You may hear your oven's heating elements "click" on and off more frequently than in older ovens to achieve better results during baking, broiling, convection, and self-clean cycles.**	This is normal.
Clock and timer do not work	**A fuse in your home may be blown or the circuit breaker tripped.**	Replace the fuse or reset the circuit breaker.

Troubleshooting tips ... Before you call for service

Problem	Possible Cause	What To Do
Oven light does not work	**Light bulb is loose or defective.**	Tighten or replace bulb.
	Pad operating light is broken.	Call for service.
Oven will not self-clean	**The temperature is too high to set a self-clean operation.**	Allow the oven to cool and reset the controls.
	Oven controls improperly set.	See the Cleaning the Oven section.
Excessive smoking during clean cycle	**Excessive soil or grease.**	Press the **Cancel/Off** pad. Open the windows to rid the room of smoke. Wait until the **LOCKED** light goes off. Wipe up the excess soil and reset the clean cycle.
Excessive smoking during broiling	**Food too close to burner element.**	Lower the rack position of the food.
Oven door will not open after a clean cycle	**Oven too hot.**	Allow the oven to cool below locking temperature.
Oven not clean after a clean cycle	**Oven controls improperly set.**	See the Cleaning the Oven section.
	Oven was heavily soiled.	Clean up heavy spillovers before starting the clean cycle. Heavily soiled ovens may need to self-clean again or for a longer period of time.
"LOCK DOOR" flashes in the display	**The self-clean cycle has been selected but the door is not closed.**	Close the oven door.
LOCKED light is on when you want to cook	**The oven door is locked because the temperature inside the oven has not dropped below the locking temperature.**	Press the **Cancel/Off** pad. Allow the oven to cool.
“F— and a number or letter” flash in the display	**You have a function error code.**	Press the **Cancel/Off** pad. Allow the oven to cool for one hour. Put the oven back into operation.
	If the function code repeats.	Disconnect all power to the oven for at least 30 seconds and then reconnect power. If the function error code repeats, call for service.
Display goes blank	**A fuse in your home may be blown or the circuit breaker tripped.**	Replace the fuse or reset the circuit breaker.
	The clock is turned off.	See the Special features section.
	Oven is in Sabbath Mode.	Verify that the oven is not in Sabbath Mode. See the Special Features section.
Power outage, clock flashes	**Power outage or surge**	Reset the clock. If the oven was in use, you must reset it by pressing the **Cancel/Off** pad, setting the clock and resetting any cooking function.
“Burning” or “oily” odor emitting from the vent	**This is normal in a new oven and will disappear in time.**	To speed the process, set a self-clean cycle for a minimum of 3 hours. See the Cleaning the Oven section.
Strong odor	**An odor from the insulation around the inside of the oven is normal for the first few times the oven is used.**	This is temporary and will go away after several uses or a self-clean cycle.
Fan noise	**A cooling fan may automatically turn on.**	This is normal. The cooling fan will turn on to cool internal parts. It may run for up to 1-1/2 hours after the oven is turned off.
My oven door glass appears to be "tinted" or have a "rainbow" color. Is this defective?	**No. The inner oven glass is coated with a heat barrier to reflect the heat back into the oven to prevent heat loss and keep the outer door cool while baking.**	This is normal. Under certain light or angles, you may see this tint or rainbow color.

Troubleshooting tips ... Before you call for service

Problem	Possible Cause	What To Do
Sometimes the oven takes longer to preheat to the same temperature	**Cookware or food in oven**	The cookware or food in the oven will cause the oven to take longer to preheat. Remove items to reduce preheat time.
	Number of racks in oven	Adding more racks to the oven will cause the oven to take longer to preheat. Remove some racks.
	Different cooking modes	The different cooking modes use different preheat methods to heat the oven for the specific cooking mode. Some modes will take longer than others (i.e. convection bake multi).

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Horno de Pared

Eléctrico con Convección Incorporado

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Manual del Propietario

Horno de Pared Simple JK5000 de 27"
Horno de Pared Simple JT5000 de 30”
Horno de Pared Doble JK5500 de 27"
Horno de Pared Doble JT5500 de 30"

For a Spanish version of this manual, visit our Website at GEAppliances.com.

Para consultar una version en español de este manual de instrucciones, visite nuestro sitio de internet GEAppliances.com.

Escriba los números de modelo y de serie aquí:

Nº de Modelo _____

Nº de Serie _____

Los podrá encontrar en una etiqueta en el borde lateral o en el frente del horno (inferior) detrás de la puerta del horno.

Impreso en Papel Reciclado

Impreso en Estados Unidos

49-80722 03-14 GE

INFORMACIÓN IMPORTANTE DE SEGURIDAD LEA TODAS LAS INSTRUCCIONES ANTES DE USAR

⚠ ADVERTENCIA

Lea todas las instrucciones antes de usar el producto. Si no se siguen estas instrucciones se podrán producir incendios, descargas eléctricas, lesiones graves o la muerte.

ADVERTENCIA DE LA PROPOSICIÓN 65 DEL ESTADO DE CALIFORNIA

La Ley sobre Agua Potable Inocua y Tratamiento de Residuos Tóxicos de California (California Safe Drinking Water and Toxic Enforcement Act) solicita al Gobernador de California que publique una lista de sustancias que el estado reconoce que producen cáncer, defectos de nacimiento u otros daños reproductivos y solicita a los empresarios que adviertan a sus clientes sobre la posible exposición a tales sustancias.

⚠ ADVERTENCIA Este producto contiene uno o más químicos que el Estado de California entiende que producen cáncer, defectos en el nacimiento u otros daños reproductivos.

Los hornos con limpieza automática pueden ocasionar exposiciones de bajo nivel a algunas de estas sustancias, incluyendo monóxido de carbono, durante el ciclo de limpieza. La exposición puede ser minimizada si se ventila con una ventana abierta o si se usa un ventilador o campana.

⚠ ADVERTENCIA INSTRUCCIONES GENERALES DE SEGURIDAD

- Use este electrodoméstico sólo para su propósito original, como se describe en el Manual del Propietario.
- Solicite que un instalador calificado instale su electrodoméstico y que esté adecuadamente conectado a tierra, de acuerdo con las instrucciones de instalación provistas.
- No intente reparar o reemplazar ninguna parte del horno, a menos que se recomiende específicamente en este manual. Cualquier otra reparación deberá ser realizada por un técnico calificado.
- Antes de realizar cualquier servicio técnico, desconecte el suministro de corriente desde el panel de distribución del hogar, retirando el fusible o desconectando el disyuntor.
- No deje a los niños solos – no se deberá dejar a los niños solos o fuera de su radio de atención en el área donde el electrodoméstico se encuentre en uso. Nunca se les deberá permitir trepar, sentarse o pararse sobre ninguna parte del electrodoméstico.
- **⚠ PRECAUCIÓN:** No coloque artículos de interés para los niños sobre los gabinetes que están sobre un horno – si los niños se trepan sobre el horno para llegar a estos artículos podrían sufrir lesiones graves.
- Use sólo mangos de ollas secas – los mangos húmedos sobre superficies calientes pueden producir quemaduras debido al vapor. No deje que los mangos de las ollas toquen los elementos que están calientes. No use una toalla u otra tela voluminosa para reemplazar el mango de las cacerolas.
- Nunca use el electrodoméstico para calentar o calefaccionar la habitación.
- No toque el elemento calentador ni la superficie interior del horno. Es posible que estas superficies estén demasiado calientes como para quemar, aunque su color sea oscuro. Durante y después del uso, no toque ni permita que telas u otros materiales inflamables toquen cualquier área interior del horno; espere a que haya pasado un tiempo suficiente para que se enfríen. Otras superficies del electrodoméstico se podrán calentar lo suficiente como para ocasionar lesiones. Las superficies potencialmente calientes incluyen la abertura de la ventilación del horno, superficies cercanas a la abertura y grietas alrededor de la puerta del horno.
- No caliente envases de comida que no hayan sido abiertos. Se podría acumular presión y el envase podría explotar, ocasionando una lesión.
- No use ningún tipo de aluminio o cobertor para cubrir el fondo del horno o cualquier parte del horno, excepto como se describe en este manual. Los cobertores de horno pueden atrapar el calor o derretirse, ocasionando daños sobre el producto y el riesgo de descargas, humo o incendios.
- Evite las ralladuras o impactos sobre las puertas de vidrio o los paneles de control. Hacer esto podrá producir la rotura de vidrios. No cocine un producto con un vidrio roto. Es posible que se produzcan descargas, incendios o cortes.
- Cocine carnes y carnes de ave en forma completa – la carne por lo menos a una temperatura interna de 160º F y la carne de ave por lo menos a una temperatura interna de 180º F. Normalmente la cocción a estas temperaturas es una protección contra las enfermedades transmitidas por la comida.

GUARDE ESTAS INSTRUCCIONES

⚠ ADVERTENCIA MANTENGA LOS MATERIALES INFLAMABLES ALEJADOS DE LA COCINA

Si esto no se cumple, se podrán sufrir lesiones personales graves o incendios.

- No guarde ni use materiales inflamables en o cerca de un horno, incluyendo papel, plástico, mangos de ollas, trapos, cobertores de pared, cortinas, paños y gasolina u otros vapores y líquidos inflamables.
- Nunca use prendas holgadas o que cuelguen mientras usa el electrodoméstico. Estas prendas se podrán incendiar si entran en contacto con superficies calientes, ocasionando quemaduras graves.
- No permita que la grasa de la cocción u otros materiales inflamables se acumulen en o cerca del horno. La grasa que está en o cerca del horno se podrá incendiar.

⚠ ADVERTENCIA EN CASO DE INCENDIO, SIGA LOS SIGUIENTES PASOS PARA EVITAR LESIONES O LA PROPAGACIÓN DEL FUEGO

- DNo use agua sobre el fuego de la grasa. Nunca tome una olla que se esté incendiando.
- Si hay un incendio en el horno durante el horneado, ahogue el fuego cerrando la puerta del horno y apagando el mismo o usando un químico seco multipropósito o un extintor de incendio con espuma.
- En caso de que haya fuego en el horno durante el ciclo de limpieza automática, apague el horno y espere a que el fuego se extinga. No fuerce la puerta para abrirla. La entrada de aire fresco sobre las temperaturas de la limpieza automática podrá conducir a la producción de llamas en el horno. Si no se siguen estas instrucciones, se podrán producir quemaduras graves.

⚠ ADVERTENCIA INSTRUCCIONES DE SEGURIDAD DEL HORNO

- Manténgase alejado del horno al abrir la puerta del mismo. El aire caliente o el vapor que sale puede causar quemaduras en las manos, rostro y/u ojos.
- Mantenga desobstruida la ventilación del horno.
- Mantenga el horno libre de acumulación de grasa. La grasa del horno se puede incendiar.
- Coloque los estantes del horno en la ubicación deseada mientras éste se encuentra frío. Si es necesario mover el estante mientras el horno está caliente, evite que el mango de la olla tenga contacto con el elemento calentador en el horno.
- Al usar las bolsas para cocinar o dorar en el horno, siga las instrucciones del fabricante.
- Es conveniente empujar hacia afuera los estantes estándares hasta el tope o empujar el estante extensible hasta la posición completamente abierta para levantar comidas pesadas. Esto también es una precaución contra quemaduras por tocar superficies calientes de la puerta o las paredes del horno.
- No deje productos tales como papel, utensilios de cocina ni comida en el horno cuando éste no se encuentre en uso. Los artículos guardados en el horno se pueden incendiar.
- Nunca coloque los utensilios de cocina, piedras para pizza u horneado o cualquier otro tipo de aluminio o cobertor en la base del horno. Estos ítems pueden atrapar el calor o derretirse, ocasionando daños sobre el producto y el riesgo de descargas, humo o incendios.

⚠ ADVERTENCIA INSTRUCCIONES DE SEGURIDAD DEL HORNO CON LIMPIEZA AUTOMÁTICA

La función de limpieza automática usa el horno en temperaturas lo suficientemente altas como para consumir la suciedad de comida que haya dentro del horno. Para un funcionamiento seguro, siga estas instrucciones.

- No toque las superficies del horno durante el ciclo de limpieza automática. Mantenga a los niños alejados del horno durante la limpieza automática. Si no se siguen estas instrucciones, se podrán producir quemaduras.
- Antes de usar el ciclo de limpieza automática del horno, retire los estantes de color gris brillante (en algunos modelos), la sonda, cualquier papel de aluminio, y cualquier bandeja para asar, rejilla, u otros utensilios. Sólo se pueden dejar dentro del horno los estantes para horno cubiertos de porcelana.
- Antes de utilizar el ciclo de limpieza automática, limpie la grasa y restos de comida que haya en el horno. Una cantidad excesiva de grasa se puede incendiar, lo cual puede producir daños con humo en su hogar.
- Si el modo de limpieza automática funciona de forma incorrecta, apague el horno y desconecte el suministro de corriente. Solicite el servicio de un técnico calificado.
- No limpie la junta de la puerta. La junta de la puerta es esencial para un buen sellado. Se debe tener cuidado de no frotar, dañar ni mover la junta.
- No use limpiadores para horno. No se deberá usar limpiadores comerciales para horno ni revestimientos de protección para hornos de ningún tipo en o alrededor de cualquier parte del horno.

GUARDE ESTAS INSTRUCCIONES

¡Gracias! ... por su compra de un electrodoméstico de la Marca GE

Registre su Electrodoméstico: ¡Registre su electrodoméstico nuevo a través de Internet, según su conveniencia!

www.geappliances.com/service_and_support/register/

Un registro puntual de su producto permitirá una mejor comunicación y un servicio más puntual de acuerdo con los términos de su garantía, en caso de surgir la necesidad. También puede enviar una carta en la tarjeta de inscripción pre-impresa que se incluye con el material embalado.

Garantía de la Cocina Eléctrica de GE

GEAppliances.com

Todo el servicio de garantía es provisto por nuestros Centros de Servicio de Fabricación, o un técnico autorizado de Servicio al Cliente (Customer Care®). Para programar una visita del servicio técnico a través de Internet, visítenos en www.geappliances.com/service_and_support/, o llame al 800.GE.CARES (800.432.2737). Cuando llame para solicitar el servicio, tenga los números de serie y de modelo disponibles.

Para realizar el servicio técnico de su electrodoméstico se podrá requerir el uso de datos del puerto de abordaje para su diagnóstico. Esto da al técnico del servicio de fábrica de GE la habilidad de diagnosticar de forma rápida cualquier problema con su electrodoméstico, y de ayudar a GE a mejorar sus productos al brindarle a GE la información sobre su electrodoméstico. Si no desea que los datos de su electrodoméstico sean enviados a GE, solicitamos que le indique a su técnico no entregar los datos a GE en el momento del servicio.

Durante el período de un año desde la fecha original de compra. GE le brindará cualquier parte de la cocina que falle debido a un defecto en los materiales o la fabricación. Durante esta garantía limitada de un año, GE también proveerá, sin costo, todo el trabajo y el servicio en el hogar relacionado con el reemplazo de la parte que presente defectos.

Qué no cubrirá GE:

- Viajes del técnico del servicio a su hogar para enseñarle sobre cómo usar el producto.
- Instalación, entrega o mantenimiento inadecuados.
- Fallas del producto en caso de abuso, mal uso, modificación o uso para propósitos diferentes al original o uso comercial.
- Reemplazo de fusibles de la casa o reinicio de disyuntores.
- Daños ocasionados sobre el producto por accidente, incendio, inundaciones o catástrofes naturales.
- Daños incidentales o consecuentes causados por posibles defectos sobre este producto.
- Daño causado después de la entrega.
- Producto no accesible para brindar el servicio requerido.
- Solicite el servicio técnico para reparar o reemplazar las lámparas, excepto las lámparas LED.

EXCLUSIÓN DE GARANTÍAS IMPLÍCITAS

Su única y exclusiva alternativa es la reparación del producto, como se indica en la Garantía Limitada. Las garantías implícitas, incluyendo garantías implícitas de comerciabilidad o conveniencia sobre un propósito particular, se limitan a un año o al período más corto permitido por la ley.

Esta garantía se extiende al comprador original y a cualquier dueño subsiguiente de productos comprados para uso hogareño dentro de EE.UU. Si el producto está en un área donde no se encuentra disponible un Proveedor Autorizado del Servicio Técnico de GE, usted será responsable por el costo de un viaje o se podrá requerir que traiga el producto a una ubicación del Servicio Técnico de GE Autorizado para recibir el servicio. En Alaska, la garantía excluye el costo de envío o llamadas del servicio a su hogar.

Algunos estados no permiten la exclusión o limitación de daños fortuitos o consecuentes. Esta garantía le da derechos legales específicos y es posible que tenga otros derechos legales que varían entre un estado y otro. Para conocer cuáles son sus derechos legales, consulte a la oficina de asuntos del consumidor local o estatal o al Fiscal de su estado.

Garante: General Electric Company. Louisville, KY 40225

Garantías Extendidas: Adquiera una garantía extendida de GE y aprenda sobre descuentos especiales que están disponibles mientras su garantía aún está vigente. La puede adquirir en cualquier momento a través de Internet en

www.geappliances.com/service_and_support/shop-for-extended-service-plans.htm

o llamando al 800.626.2224 durante el horario comercial habitual. Los Servicios para el Consumidor Hogareño de GE aún estarán allí cuando su garantía caduque.

Abroche su recibo aquí. Para acceder al servicio técnico de acuerdo con la garantía deberá contar con la prueba de la fecha original de compra.

¿Desea realizar una consulta o necesita ayuda con su electrodoméstico?

¡Consulte el Sitio Web de Electrodomésticos de GE (**www.geappliances.com/service_and_support/**) durante las 24 horas, cualquier día del año! Para mayor conveniencia y un servicio más rápido, ahora puede descargar el Manual del Propietario, ordenar piezas o incluso programar el servicio técnico a través de Internet.

Servicio Programado: El servicio de reparación de expertos de GE está a sólo un paso de su puerta. Entre a Internet y programe su servicio en www.geappliances.com/service_and_ support/ o llame al 800.GE.CARES (800.432.2737) durante el horario de atención comercial.

Piezas y Accesorios: Aquellas personas calificadas para realizar el servicio técnico sobre sus propios electrodomésticos podrán solicitar el envío de piezas o accesorios directamente a sus hogares (se aceptan las tarjetas VISA; MasterCard y Discover). Ordene a través de Internet hoy, durante las 24 horas o en forma telefónica al 800.626.2002 durante el horario de atención comercial.

Las instrucciones que figuran en este manual cubren los procedimientos que serán realizados por cualquier usuario. Otros servicios técnicos generalmente deberían ser derivados a personal calificado del servicio. Se deberá tener cuidado, ya que una reparación indebida podrá hacer que el funcionamiento no sea seguro.

Estudio de Diseño de la Vida Real: GE apoya el concepto de Diseño Universal en productos, servicios y ambientes que pueden ser usados por personas de todas las edades, tamaños y capacidades. Reconocemos la necesidad de realizar diseños para una amplia gama de habilidades e incapacidades físicas y mentales. Para más detalles sobre las aplicaciones de Diseño Universal de GE, incluyendo ideas de diseño de cocinas para personas con incapacidades, visite nuestro sitio web hoy. Sobre casos de incapacidad auditiva, comuníquese al 800.TDD.GEAC (800.833.4322).

Contáctenos: Si no se encuentra satisfecho con el servicio que recibió de GE, comuníquese con nosotros a través de nuestro sitio web con todos los detalles, incluyendo su número telefónico, o escriba a:

General Manager, Customer Relations
GE Appliances, Appliance Park Louisville, KY 40225

Accesorios

¿Busca Algo Más?
¡GE ofrece una variedad de accesorios para mejorar sus experiencias de cocción y mantenimiento!

Para realizar una orden, visítenos a través de Internet en:

www.GEApplianceParts.com (EE.UU.) o en **www.GEAppliances.ca** (Canadá)

o llame al **800.626.2002** (EE.UU.) **800.661.1616** (Canadá)

Estos y otros productos están disponibles:

Accesorios

Olla para Asar Pequeña (8 ¾ ” x 1 ¼” x 13 ½ “)	WB48X10055 (EE.UU.) 222D2097G001 (Canadá)
Olla para Asar Grande* (12 ¾ ” x 1 ¼” x 16 ½ “)	WB48X10056 (EE.UU.) 222D2097G002 (Canadá)
Olla para Asar Extra Grande* (17 ¾ ” x 1 ¼” x 19 ½ “)	WB48X10057 (EE.UU.) No disponible en Canadá

Piezas

Estantes del horno	Los números de pieza varían según el modelo
Elementos del horno	Los números de pieza varían según el modelo
Lámparas de luz	Los números de pieza varían según el modelo
Sonda	Los números de pieza varían según el modelo

Suministros de Limpieza

Limpiadores de Acero Inoxidable CitriShine	WX10X10007
Limpiador de Electrodomésticos de Acero Inoxidable CeramaBryte	PM10X311

*La olla para asar grande no entra en cocinas de 20”/24”.
**La olla XL no entra en hornos de pared de 24”, empotrables de 27” o cocinas de 20”/24”.

Cómo Retirar la Película Protectora de Envío y la Cinta de Embalaje

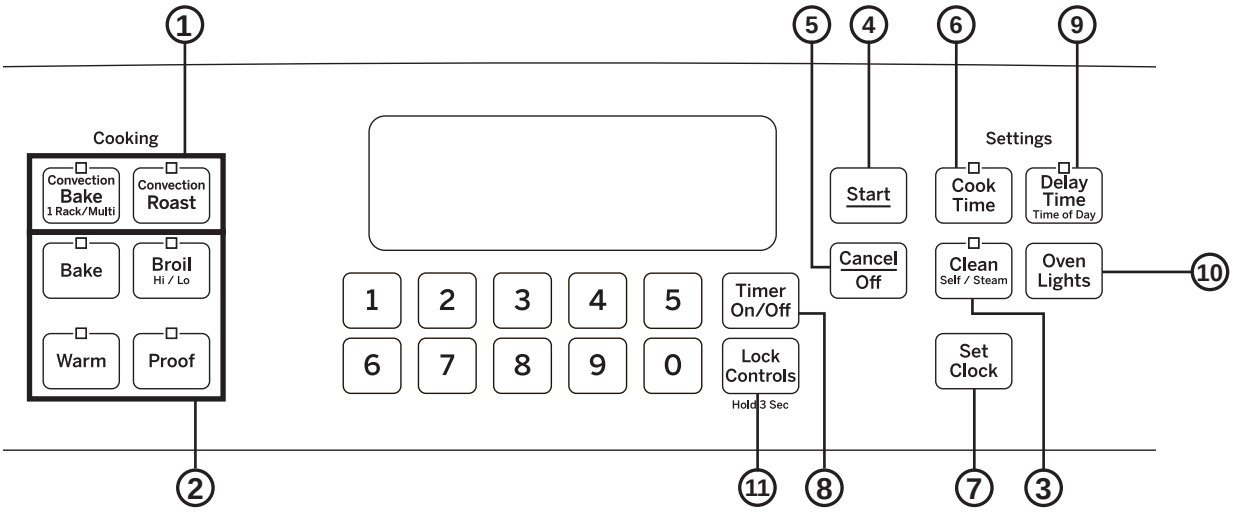
Con cuidado tome un extremo de la película protectora de envío con los dedos y lentamente retire la misma de la superficie del electrodoméstico.

No utilice ningún producto filoso para retirar la película. Retire toda la película antes de usar el electrodoméstico por primera vez.

Para asegurar que no haya daños sobre el acabado del producto, la forma más segura de retirar el adhesivo de la cinta de embalaje en electrodomésticos nuevos es aplicando un detergente líquido hogareño para lavar platos. Aplique con una tela suave y deje que se seque.

NOTA: El adhesivo deberá ser eliminado de todas las partes. No se puede retirar si se hornea con éste dentro.

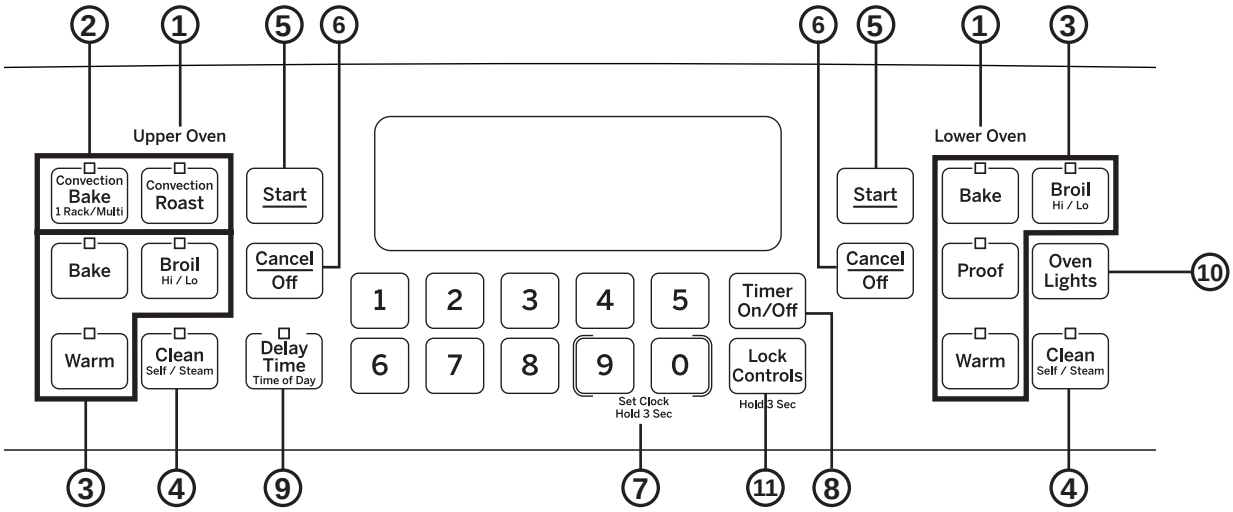
Horno de Pared Simple



1. **Convection Cooking Modes (Modos de Cocción por Convección):** Los modos de cocción por convección utilizan una circulación de aire incrementada para mejorar el rendimiento. El tipo de beneficio depende del modo. Su horno cuenta con los siguientes modos de cocción por convección: Convection Bake (Hornear por Convección) (1 o Múltiples Estantes) y Convection Roast (Asar por Convección). Para más información, consulte la sección de Modos de Cocción.
2. **Traditional Cooking Modes (Modos de Cocción Tradicionales):** Su horno cuenta con los siguientes modos de cocción tradicionales: Bake (Hornear), Broil Hi (Asar Alto), Broil Lo (Asar Bajo), Proof (Leudar) y Warm (Calentar). Para más información, consulte la sección de Modos de Cocción.
3. **Clean (Limpieza):** El horno cuenta con dos modos de limpieza: Self Clean (Limpieza Automática) y Steam Clean (Limpieza con Vapor). Para acceder a información importante sobre el uso de estos modos, consulte la sección de Limpieza del Horno.
4. **Start (Iniciar):** Se deberá presionar para comenzar cualquier función de cocción, limpieza o por tiempo.
5. **Cancel/Off (Cancelar/ Apagar):** Cancelar TODAS las operaciones del horno excepto el reloj y el temporizador.
6. **Cook Time (Tiempo de Cocción):** Cuenta el tiempo de cocción y apaga el horno cuando el tiempo de cocción está completo. Presione la tecla **Cook Time (Tiempo de Cocción)**, use las teclas numéricas para programar un tiempo de cocción en horas y minutos, y luego presione **Start (Iniciar).** Esto sólo puede ser usado con Traditional Bake (Horneado Tradicional), Convection Bake (Hornear por Convección), Convection Bake Multi (Hornear por Multi Convección), y Convection Roast (Dorar por Convección).
7. **Clock (Reloj):** Configure la hora del reloj del horno: Presione la tecla **Set Clock (Configurar Reloj)** y las teclas numéricas para programar el reloj. Presione **Start (Iniciar)** para guardar la configuración de la hora.
8. **Timer (Temporizador):** Funciona como un temporizador con cuenta regresiva: Presione la tecla **Timer (Temporizador)** y las teclas numéricas para programar el tiempo en horas y minutos. Presione la tecla **Start (Iniciar)** El horno continuará funcionando cuando la cuenta regresiva del temporizador se haya completado. Para apagar el temporizador, presione la tecla **Timer (Temporizador)**.
9. **Delay Time (Tiempo de Retraso):** Genera un retraso cuando el horno es encendido. Use esta tecla para configurar el momento en que desea que el horno se inicie. Presione la tecla **Delay Time (Tiempo de Retraso)** y use las teclas numéricas para programar la hora del día en que desea que el horno se encienda y presione **Start (Iniciar)**. Presione el modo de cocción deseado y la temperatura y luego presione **Start (Iniciar)**. Si lo desea, también puede ser programado un tiempo de cocción. Siga las instrucciones de Cook Time (Tiempo de Cocción) para configurar esta función. Esto sólo puede ser usado con Bake (Hornear), Convection Bake (1 Rack/Multi) (Hornear por Convección, 1 o Múltiples Estantes) Convection Roast (Dorar por Convección) y Self-Clean (Limpieza Automática).

   NOTA: Al usar la función de tiempo de retraso, las comidas que se echan a perder rápidamente, tales como leche, huevos, pescado, rellenos, ave y cerdo, no se deberán dejar reposar por más de 1 hora antes y después de la cocción. La temperatura ambiente estimula el desarrollo de bacterias nocivas. Asegúrese de que la luz del horno esté apagada, ya que el calor de la lámpara acelerará el crecimiento de bacterias nocivas.
10. **Oven Light(s) (Luz(es) del Horno):** Enciende o apaga la luz(es) del horno.
11. **Lock Controls (Controles de Bloqueo):** Bloquean el control de modo que al presionar las teclas no se activen los controles. Mantenga presionada la tecla **Lock Controls (Controles de Bloqueo)** durante tres segundos para bloquear o desbloquear el control. La función **Cancel/Off (Cancelar/ Apagar)** siempre está activa, incluso cuando el control está bloqueado.

Horno de Pared Doble



1. **Upper Oven and Lower Oven (Horno Superior y Horno Inferior):** Designa qué horno operarán los controles.
2. **Convection Cooking Modes (Modos de Cocción por Convección):** Los modos de cocción por convección utilizan una circulación de aire incrementada para mejorar el rendimiento. El tipo de beneficio depende del modo. Su horno cuenta con los siguientes modos de cocción por convección: Convection Bake (1 Rack /Multi) (Horneado por Convección, 1 o Múltiples Estantes) y Convection Roast (Asar por Convección). Para más información, consulte la sección de Modos de Cocción.
3. **Traditional Cooking Modes (Modos de Cocción Tradicionales):** Su horno cuenta con los siguientes modos de cocción tradicionales: Bake (Hornear), Broil Hi (Asar Alto), Broil Lo (Asar Bajo), Proof (Leudar) (Horno Inferior) y Warm (Calentar). Para más información, consulte la sección de Modos de Cocción.
4. **Clean (Limpieza):** El horno cuenta con dos modos de limpieza: Self Clean (Limpieza Automática) y Steam Clean (Limpieza con Vapor). Para acceder a información importante sobre el uso de estos modos, consulte la sección de Limpieza del Horno.
5. **Start (Iniciar):** Se deberá presionar para comenzar cualquier función de cocción, limpieza o por tiempo.
6. **Cancel/Off (Cancelar/ Apagar):** Cancelar TODAS las operaciones del horno excepto el reloj y el temporizador.
7. **Clock (Reloj):** Configure el tiempo del reloj del horno. Mantenga presionadas las teclas **9** y **0** durante 3 segundos. Use las teclas numéricas para programar el reloj.. Presione **Start (Iniciar)** para guardar la configuración de la hora.
8. **Timer (Temporizador):** Funciona como un temporizador con cuenta regresiva: Presione la tecla **Timer (Temporizador)** y las teclas numéricas para programar el tiempo en horas y minutos. Presione la tecla **Start (Iniciar)** El horno continuará funcionando cuando la cuenta regresiva del temporizador se haya completado. Para apagar el temporizador, presione la tecla **Timer (Temporizador)**.
9. **Delay Time (Tiempo de Retraso):** Genera un retraso cuando el horno es encendido. Use esta tecla para configurar el momento en que desea que el horno se inicie. Presione la tecla **Delay Time (Tiempo de Retraso)** y use las teclas numéricas para programar la hora del día en que desea que el horno se encienda y luego presione **Start (Iniciar)** Presione el modo de cocción deseado y la temperatura y luego presione **Start (Iniciar)**. Esto sólo puede ser usado con Bake (Hornear), Convection Bake (Hornear por Convección, 1 o Múltiples Estantes) Convection Roast (Dorar por Convección) y Self-Clean (Limpieza Automática).

   NOTA: Al usar la función de tiempo de retraso, las comidas que se echan a perder rápidamente, tales como leche, huevos, pescado, rellenos, ave y cerdo, no se deberán dejar reposar por más de 1 hora antes y después de la cocción. La temperatura ambiente estimula el desarrollo de bacterias nocivas. Asegúrese de que la luz del horno esté apagada, ya que el calor de la lámpara acelerará el crecimiento de bacterias nocivas.
10. **Oven Light(s) (Luz(es) del Horno):** Enciende o apaga la luz(es) en ambos hornos. Se debe observar que las luces de ambos hornos no se encenderán si la puerta es abierta mientras el otro horno se encuentra en el modo de limpieza.
11. **Lock Controls (Controles de Bloqueo):** Bloquean el control de modo que al presionar las teclas no se activen los controles. Mantenga presionada la tecla **Lock Controls (Controles de Bloqueo)** durante tres segundos para bloquear o desbloquear el control. La función **Cancel/Off (Cancelar/ Apagar)** siempre está activa, incluso cuando el control está bloqueado.

Funciones especiales

Existen varias funciones especiales en su horno de pared. Para modificar las configuraciones de estas funciones especiales, mantenga presionadas las teclas **BAKE (Hornear)** y **BROIL (Asar)** al mismo tiempo durante tres segundos. "**SF**" aparecerá en la pantalla. Seleccione la función que desee modificar. Una vez realizado el cambio, presione la tecla **START (Iniciar)** para guardar dicho cambio y regrese a la hora del día.

Ajuste de la Temperatura del Horno

Esta función permite que la temperatura de horneado del horno y de horneado por convección sean ajustadas hasta 35ºF más caliente o 35ºF más fría. Use esta función si piensa que la temperatura de su horno es demasiado caliente o demasiado fría y desea modificarla. **Para los modelos con horno doble, los hornos superior e inferior se ajustan de forma separada**. Este ajuste afecta los modos Bake (Hornear), y Convection Bake (1 Rack/Multi) (Hornear por Convección, 1 o Múltiples Estantes). Ningún otro modo de cocción se ve afectado.

Presione la tecla **Bake (Hornear)** para seleccionar el horno que será ajustado. Presione la tecla **Bake (Hornear)** nuevamente para ingresar el modo de ajuste de temperatura. Se exhibirá un número entre 35 y – 35. Use las teclas numéricas para configurar el ajuste de temperatura deseado y use la tecla **Bake (Hornear)** para realizar cambios en forma descendente y ascendente. Presione la tecla **Start (Iniciar)** para guardar el ajuste de temperatura.

Sonido de Finalización del Temporizador

Se trata de un tono que indica la finalización de un temporizador. El tono puede ser continuo (bEEP Cont) o un pitido repetido (bEEP). Una configuración continua seguirá haciendo que un tono suene hasta que un botón del control sea presionado. Presione la tecla **Broil (Asar)** para visualizar la configuración actual y luego modifique la configuración.

Selección de Temperatura Fahrenheit o Celsius

El control del horno está configurado para su uso con temperaturas Fahrenheit (F), pero lo puede modificar a temperaturas Celsius (C). Presione las teclas numéricas **6** y **8** al mismo tiempo para visualizar la configuración actual; presione nuevamente para modificar la configuración.

Pantalla del Reloj

Esta función especifica cómo la hora del día será exhibida o si no se exhibirá la hora del día. Puede seleccionar el reloj con hora estándar de 12 horas (12 H), la hora militar de 24 horas (24 H), o que no se exhiba ningún reloj (oFF) (Apagado). Presione la tecla **Clock (Reloj)** para visualizar la configuración actual, y vuelva a presionar la misma para modificar la configuración.

Conversión de Auto Recipe

Al usar las opciones de cocción Convection Bake 1 Rack (Hornear por Convección en 1 Estante) o Convection Bake Multi Rack (Hornear por Convección en Múltiples Estantes), Auto Recipe Conversion (Conversión de Auto Receta) convertirá de forma automática las temperaturas de horneado regular ingresadas a temperaturas de cocción de horneado por convección cuando se active. Se debe observar que esta opción no convierte los tiempos de cocción del horneado por convección, sino sólo las temperaturas. Presione la tecla **Convection Bake (1 Rack/Multi) (Hornear por Convección en 1 o Múltiples Estantes)** para visualizar la configuración de conversión; vuelva a presionar para alternar entre On (Con On) (Encendido Continuo) y Off (Con Off) (Apagado Continuo).

Volumen del Sonido

Esta función permite que el volumen del tono del horno sea ajustado entre alto (HI bEEP HI) (Pitido Alto), medio (Std bEEP Std) (Pitido Estándar) y apagado (oFF bEEP oFF) (Pitido Apagado). Presione las teclas numéricas **1** y **5** al mismo tiempo para visualizar la configuración actual o para modificar la configuración. El control hará que el tono del horno suene en el nuevo nivel de volumen cada vez que el nivel de sonido sea modificado.

Apagado automático de 12 horas y Modo Sabático

Las opciones de esta función son “12 SHdn” (Apagar Luego de 12 Horas), “no SHdn” (No Apagar) y “SAbbAtH” (Sabático).

El apagado automático de 12 horas apaga el horno luego de 12 horas de operaciones continuas.

El modo sabático desactiva las luces del horno (la luz del horno no se encenderá cuando la puerta sea abierta), todos los sonidos (el control no emitirá un pitido cuando se presione un botón), los modos de Convección, los modos de Asado, Calentar, Leudar, Tiempo de Cocción, Temporizador, Reloj, y las funciones de Tiempo Retrasado. El modo sabático sólo puede ser usado con la función Bake (Hornear). Esta función se activa conforme con los requisitos Sabáticos Judíos de la Estrella K.

Mantenga presionadas las teclas **Bake (Hornear)** y **Broil (Asar)** durante 3 segundos para ingresar al modo de funciones especiales.

Presione la tecla **Delay Clock (Reloj Retrasado)** para visualizar la configuración actual y luego para modificar la configuración.

Para usar el modo Sabbath (Sabático), seleccione “SAbbAtH” (Sabático) y presione **Start (Iniciar)**. Aparecerá una **]** en la pantalla y el reloj no será exhibido. Observe que si cuenta con un horno de pared doble, al colocar el control en el modo Sabático, ambos hornos están ahora en el modo sabático y están disponibles para la cocción.

Una vez en el modo Sabbath (Sabático), en cualquier momento puede presionar **Bake (Hornear)**; use las teclas numéricas para ingresar una temperatura entre 170ºF y 550ºF, y presione **Start (Iniciar)**. No se emitirá ningún sonido cuando las teclas sean presionadas. En un momento al azar entre los 30 segundos y 1 minuto, **][**, aparecerá en la pantalla indicando que el horno está en funcionamiento.

Observe que ambos hornos de un horno de pared doble pueden ser usados en el modo sabático. Cada horno puede ser programado en una temperatura diferente y cada horno debe ser programado por separado.

Si necesita ajustar la temperatura, presione **Bake (Hornear)**, use las teclas numéricas para ingresar una nueva temperatura entre 170º F y 550º F, y presione **Start (Iniciar)**.

Para apagar el horno, presione **Cancel/Off (Cancelar/ Apagar)** en cualquier momento. **El horno se apagará inmediatamente** y el ícono, **][** cambiará a **]**, indicando que el horno fue apagado.

Observe que cada horno de un horno de pared doble se deberá apagar por separado.

Para salir del modo sabático, asegúrese de que el horno esté apagado. Mantenga presionadas las teclas **Bake (Hornear)** y **Broil (Asar)** durante 3 segundos para ingresar a las funciones especiales, luego presione **Delay Time (Tiempo Retrasado)** hasta que “**12 Shdn**” (Apagar Luego de 12 Horas) o “**no Shdn**” (No Apagar) aparezcan en la pantalla y presione **Start (Iniciar)**.

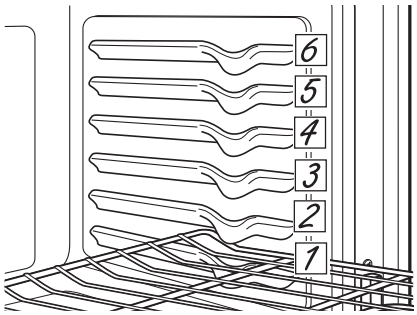
NOTA: Si se produce un corte de corriente durante el modo Sabático, la unidad permanecerá en el modo Sabático pero apagada cuando vuelva la corriente.

Si desea usar la función Cook Time (Tiempo de Cocción) (si está disponible) para hornear en el horno y luego hacer que éste se apague de forma automática, deberá presionar el botón Cook Time (Tiempo de Cocción), ingresar una duración del tiempo de cocción, y presionar Start (Iniciar). Luego ingrese a las funciones especiales para iniciar el modo Sabbath (Sabático), como se detalla más arriba.

Estantes del Horno

El horno cuenta con seis posiciones de estantes. En la Guía de Cocción, se brindan recomendaciones de posiciones de los estantes para diferentes tipos de comidas. Se ajusta un estante en una dirección para afectar los resultados de cocción. Por ejemplo, si se prefieren partes superiores más oscuras en tartas, panecillos o galletas, pruebe moviendo la comida a un estante que se encuentre una posición más arriba. Si encuentra que las comidas están demasiado doradas en la parte superior, pruebe moviendo las mismas más abajo la próxima vez.

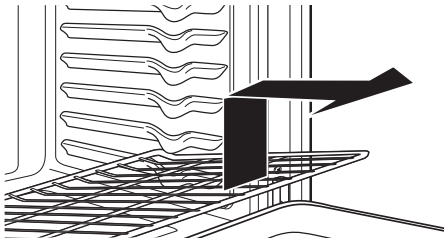
Al hornear con múltiples ollas y en múltiples estantes, asegúrese de que haya suficiente espacio entre las ollas para que fluya el aire.



Flat Racks

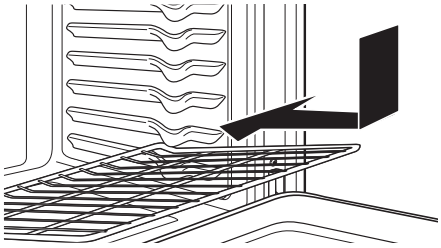
Al colocar y retirar utensilios de cocina, empuje el estante hacia afuera del tope (posición de detención) sobre el soporte del estante.

Para retirar el estante, empuje el mismo hacia usted, incline el extremo frontal hacia arriba y empuje hacia afuera.



Para hacer un reemplazo, coloque el extremo curvo del estante (bloqueadores) en los soportes del horno, incline hacia arriba el frente y empuje el estante hacia adentro.

Es posible que resulte difícil deslizar los estantes, especialmente luego de la limpieza automática. Coloque aceite vegetal en una tela húmeda o toalla de papel y frote sobre los extremos izquierdo y derecho.



Papel de Aluminio y Cobertores del Horno

⚠ PRECAUCIÓN: **No use ningún tipo de aluminio o cobertor de horno para cubrir el fondo del horno. Estos ítems pueden atrapar el calor o derretirse, ocasionando daños sobre el producto y el riesgo de descargas, humo o incendios. Los daños por uso inadecuado de estos ítems no están cubiertos por la garantía del producto.**

Se podrá usar aluminio para evitar derrames, colocando una hoja sobre un estante inferior varias pulgadas debajo de la comida. No use más aluminio que el necesario y nunca cubra totalmente el estante de un horno con papel de aluminio. Mantenga el aluminio a por lo menos 1 1/2” de las paredes del horno, para evitar una circulación deficiente del calor.

Utensilios

Pautas de Uso de Utensilios

El material, el acabado y el tamaño de los utensilios afectan el horneado.

Las ollas oscuras, revestidas y opacas absorben el calor más rápidamente que las ollas claras y brillantes. Al usar ollas que absorben el calor más rápidamente, las comidas podrán resultar más doradas, crocantes y con una capa más gruesa.

Si utiliza utensilios oscuros y revestidos, controle la comida antes del tiempo mínimo de cocción. Si se obtienen resultados no deseados con este tipo de utensilios, considere la posibilidad de reducir la temperatura del horno en 25º F la próxima vez.

Las ollas brillantes pueden producir resultados de horneado más parejos en tortas y galletas.

Las ollas de vidrio y cerámica calientan con lentitud, pero retienen bien el calor.

Estos tipos de ollas funcionan bien con platos tales como tartas y postres con natilla.

Las ollas con aislante de aire calientan lentamente y pueden producir fondos dorados.

Mantenga los utensilios limpios para una cocción más pareja.

Modos de Cocción

Su nuevo horno posee una variedad de modos de cocción para que pueda obtener los mejores resultados. Estos modos se describen a continuación. Para acceder a recomendaciones para comidas específicas, consulte la sección de la Guía de Cocción. Recuerde que es posible que su nuevo horno funcione de manera diferente que aquel que está reemplazando.

Modos de Horneado y Dorado

Seleccione un modo para hornear y dorar basado en el tipo y cantidad de comida que está preparando. Al preparar comidas horneadas tales como tartas, galletas y masas, siempre precaliente el horno primero. Siga las recomendaciones de la receta sobre la colocación de la comida. Si no se brindan pautas, centre la comida en el horno.

Horneado Tradicional

El modo de horneado tradicional está pensado para la cocción en un solo estante. Este modo usa el calor principalmente desde el elemento inferior, pero también desde el elemento superior para cocinar la comida. Para usar este modo, presione la tecla **Bake (Hornear)**, ingrese una temperatura, y luego presione **Start (Iniciar)**. El precalentamiento generalmente se recomienda al usar este modo.

Horneado por Convección en 1 Estante

El modo Convection Bake 1 Rack (Horneado por Convección en 1 Estante) está pensado para la cocción en un solo estante. Este modo utiliza el calor del elemento inferior y también de los elementos superior y trasero, junto con el movimiento del ventilador de la convección, para que la cocción sea más pareja. El horno está equipado con la función Auto Recipe Conversion (Conversión de Receta Automática); de modo que no es necesario convertir la temperatura al usar este modo. Para usar este modo, presione la tecla **Convection Bake (1 Rack/Multi) (Hornear por Convección en 1 o Múltiples Estantes)**, ingrese una temperatura, y luego presione **Start (Iniciar)**. El precalentamiento generalmente se recomienda al usar este modo.

Honeado por Convección en Estantes Múltiples

El modo Convection Bake Multi Rack (Honeado por Convección en Estantes Múltiples) está pensado para honear en múltiples estantes al mismo tiempo. Este modo utiliza el calor principalmente desde el elemento trasero, pero también calienta desde los elementos superior e inferior, junto con el movimiento de aire desde el ventilador por convección para mejorar una cocción pareja. El horno está equipado con la función Auto Recipe Conversion (Conversión de Receta Automática); de modo que no es necesario convertir la temperatura al usar este modo. Es posible que el tiempo de horneado sea un poco más prolongado con estantes múltiples, en comparación con lo que se espera con un solo estante. Para usar este modo, presione la tecla **Convection Bake (1 Rack/Multi) (Hornear por Convección en 1 o Múltiples Estantes) dos veces**, ingrese una temperatura, y luego presione **Start (Iniciar)**. Siempre realice el precalentamiento al usar este modo.

Dorar por Convección

El modo Convection Roast (Dorado por Convección) está pensado para dorar cortes enteros de carne en un solo estante. Este modo utiliza el calor de los elementos inferior, superior y trasero, junto con el movimiento del ventilador por convección, a fin de mejorar el dorado y reducir el tiempo de cocción. No es necesario convertir la temperatura. Cuando use este modo, o si usa la sonda, controle la comida antes que el tiempo sugerido en la receta. Para usar este modo, presione la tecla **Convection Bake (Hornear por Convección)**, ingrese una temperatura, y luego presione **Start (Iniciar)**. No es necesario realizar el precalentamiento al usar este modo.

Modo para Asar

Siempre ase con la puerta cerrada. El elemento para asar en el horno es muy potente. Monitoree la comida de cerca al asar. Tenga cuidado al asar en posiciones de estantes superiores, ya que colocar la comida más cerca del elemento para asar incrementa el humo, salpicaduras y la posibilidad de que se incendien las grasas. **No se recomienda asar en el estante de la posición 6.**

Intente asar las comidas que normalmente haría a la parrilla. Ajuste las posiciones de los estantes para ajustar la intensidad del calor a la comida. Coloque las comidas más cerca del elemento para asar, cuando se desee una superficie más cocinada y un interior poco cocido. Las comidas más gruesas y las comidas cuyo interior debe ser cocinado deberían ser asadas en un estante en una posición alejada del usado para asar, o usando las funciones Broil Lo (Asar Bajo).

Asar Alto

El modo Broil Hi (Asar Alto) usa calor intenso del elemento superior para soasar las comidas. Use la función Broil Hi (Asado Alto) para cortes más delgados de carne y/o comidas que prefiera que queden menos cocinadas en su interior. Para usar este modo, presione la tecla **Broil (Asar)** una vez en **Traditional (Tradicional)** y luego presione **Start (Iniciar)**. No es necesario realizar el precalentamiento al usar este modo.

Asar Bajo

El modo Broil Lo (Asar Bajo) usa menos calor intenso del elemento superior para cocinar la comida completamente mientras también se realiza el dorado superficial. Use la función Broil Lo (Asado Bajo) para cortes de carne más gruesos y/o comidas que desee que queden completamente cocinadas. Para usar este modo, presione la tecla **Broil (Asar) dos veces** y luego presione **Start (Iniciar)**. No es necesario realizar el precalentamiento al usar este modo.

Leudar

El modo Proof (Leudar) está diseñado para elevar (fermentar y leudar) masas de pan. Presione la tecla **Proof (Leudar)** y luego presione **Start (Iniciar).** Cubra bien la masa para evitar que se seque. El pan se elevará más rápidamente que a temperatura ambiente. Se deberá observar que con los hornos de pared doble, la función para leudar no se podrá activar cuando se esté usando un modo de limpieza en el horno inferior.

Calentar

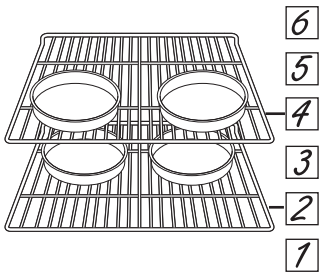
El modo Warm (Calentar) está diseñado para mantener comidas calientes hasta durante 3 horas. Para usar este modo, presione la tecla **Warm (Caliente)** y luego presione **Start (Iniciar).** Cubra las comidas que necesitan mantener la humedad y no cubra aquellas comidas que deberían quedar crocantes. No se requiere precalentar las mismas. No use la función Warm (Calentar) para calentar comida fría, excepto galletas crujientes, papas fritas o cereales secos. También se recomienda que la comida no se mantenga caliente por más de dos horas.

Guía de Cocción

TIPO DE COMIDA	MODO(S) RECOMENDADO(S)	POSICIÓN(ES) DE ESTANTES RECOMEN-DADA	SUGERENCIAS ADICIONALES
Productos Horneados			
Tortas con capas, tortas rectan-gulares, roscas, panecillos, pan rápido en un Solo Estante	Horneado Tradicional	3	Use utensilios brillantes.
Tortas con capas* en Múltiples Estantes	Horneado Tradicional	2 y 4	Asegúrese de que haya un flujo de aire adecuado (Vea la ilustración).
Tortas de grasa (pastel de ángel)	Horneado Tradicional	1	Use utensilios brillantes.
Galletas, galletitas, bizcochitos en un Solo Estante	Horneado Tradicional	3	Use utensilios brillantes.
Galletas, galletitas, bizcochitos en Múltiples Estantes	Horneado por Convección Múltiples Estantes	2 y 4 1, 3 y 5	Asegúrese de que haya un flujo de aire adecuado.
Bife y Cerdo			
Hamburguesas	Asar Alto	5	Use una olla para asa; precaliente 5 minutos si usará el Modo para Asar por Convección. Mueva la comida hacia abajo para que quede más preparada y menos soasada. Preste atención a la comida al asarla. Para un mejor rendimiento, centre la comida debajo del elemento calentador para asar.
Bifes y Chuletas	Asar Alto	5	Use una olla para asar; Mueva la comida hacia abajo para que quede más preparada y menos soasada. Preste atención a la comida al asarla. Para un mejor rendimiento, centre la comida debajo del elemento calentador para asar.
Dorados	Dorado por Convección	2 o 3	Use una olla chata tal como una olla para asar. No se requiere precalentarla.
Ave			
Pollo entero	Dorado por Convección	2 o 3	Use una olla chata tal como una olla para asar.
Pechugas, patas, muslos con huesos	Asar Alto	1	Si se empanó o cubrió con salsa, evite los modos Broil Hi (Asar Alto). Ase del lado de la piel hacia abajo primero. Preste atención a la comida al asarla. Para un mejor rendimiento, centre la comida debajo del elemento calentador para asar.
	Asado Bajo Horneado Tradicional Horneado por Convección en 1 Estante	3	
Pechugas de pollo deshuesadas	Asado Bajo Horneado Tradicional Horneado por Convección en 1 Estante	3	Mueva la comida más abajo para que quede más preparada y menos soasada y más arriba para soasar/ dorar al asar. Para un mejor rendimiento, centre la comida debajo del elemento calentador para asar.
Pavo entero	Dorado por Convección	1 o 2	Usa una olla chata tal como una olla para asar.
Pechuga de Pavo	Dorado por Convección	2 o 3	Use una olla chata tal como una olla para asar.
Pescado	Asado Bajo	5 (mitad del grosor o menos) 4 (>1/2 pulgada)	Precaliente 5 minutos al Asar por Convección. Preste atención a la comida al asarla. Para un mejor rendimiento, centre la comida debajo del elemento calentador para asar.
Cazuelas	Horneado por Convección en 1 Estante Horneado Tradicional	3	
Comidas Congeladas a Conveniencia			
Pizza, papas fritas, tator tots, patitas de pollo fritas, aperitivos en un Solo Estante	Horneado por Convección en 1 Estante Horneado Tradicional	3	Use utensilios brillantes.
Pizza, papas fritas, tator tots, patitas de pollo fritas, aperitivos en Múltiples Estantes	Horneado por Convección Múltiples Estantes	2 y 4	Use utensilios brillantes.

*Al hornear cuatro tortas con capas a la vez, use los estantes 2 y 4. Coloque las ollas como se muestra, de modo que no quede una olla encima de la otra.

Cocine la comida completamente para evitar que se produzcan enfermedades a partir de la comida. Puede encontrar recomendaciones sobre temperatura mínima para cocinar de forma segura en **www.IsItDoneYet.gov**. Asegúrese de usar un termómetro de comidas para medir la temperatura de las mismas.



Limpieza del Horno

Asegúrese de que la corriente eléctrica esté apagada y que todas las superficies estén frías antes de limpiar cualquier parte del horno.

Panel de Control

Una buena idea es limpiar el panel de control luego de cada uso. Limpie con un jabón suave y agua o vinagre y agua, enjuague con agua limpia y pula en seco con una tela suave.

No use limpiadores abrasivos, limpiadores líquidos fuertes, almohadillas para fregar de plástico ni limpiadores de horno en el panel de control; dañarán el acabado.

Exterior del Horno

No use limpiadores de horno, limpiadores abrasivos, limpiadores líquidos fuertes, estropajos de acero, almohadillas para fregar de plástico, ni polvos limpiadores en el interior o el exterior del horno. Limpie el mismo con agua y jabón o una solución de vinagre y agua. Enjuague con agua limpia y seque con una tela seca. Al limpiar supeficies, asegúrese de que estén a temperatura ambiente y fuera del contacto con la luz solar. Si las manchas en el borde de la ventana de la puerta son persistentes, use un limpiador abrasivo suave o una esponja con estropajo para obtener un mejor resultado. El derrame de adobo, jugos de fruta, salsas de tomate y líquidos para humedecer que contengan ácidos pueden ocasionar descoloración y se deberán limpiar de inmediato. Deje que las superficies calientes se enfríen, y luego limpie y enjuague.

Superficies de Acero Inoxidable (en algunos modelos)

No use virutas de acero; éstas dañarán la superficie. Para limpiar la superficie de acero inoxidable, use agua tibia con jabón o un limpiador o pulidor para acero inoxidable. Siempre limpie la superficie en la dirección del veteado. Siga las instrucciones del limpiador para limpiar la superficie de acero inoxidable. Para realizar consultas sobre la adquisición de productos, incluyendo limpiadores o pulidores para electrodomésticos de acero inoxidable, lea las secciones de Asistencia y Accesorios, en el comienzo de este manual.

Interior del Horno

El interior de su nuevo horno puede ser limpiado de forma manual o utilizando los modos Steam Clean (Limpieza con Vapor) o Self Clean (Limpieza Automática).

El derrame de adobo, jugos de fruta, salsas de tomate y líquidos para humedecer que contengan ácidos pueden ocasionar descoloración y se deberán limpiar de inmediato. Espere a que las superficies calientes se enfríen, y luego limpie y enjuague.

Limpieza Manual

No use limpiadores de horno, limpiadores abrasivos, limpiadores líquidos fuertes, estropajos de acero, almohadillas para fregar, ni polvos limpiadores en el interior del horno. Limpie el mismo con agua y jabón o una solución de vinagre y agua. Enjuague con agua limpia y seque con una tela seca. Al limpiar supeficies, asegúrese de que estén a temperatura ambiente y fuera del contacto con la luz solar.

Modo de Limpieza con Vapor

La limpieza con vapor está pensada para limpiar pequeños derrames usando agua y a una temperatura de limpieza más baja que la función Self-Clean (Limpieza Automática).

Para usar la función Steam Clean (Limpieza con Vapor), limpie las grasas y suciedades del horno. Vierta una taza de agua en la parte inferior del horno. Cierre la puerta. Presione la tecla **Clean (Limpiar) dos veces** y luego presione **Start (Iniciar)**. La puerta del horno se trabará. No podrá abrir la puerta durante los 30 minutos de la limpieza con vapor, ya que esto reducirá su rendimiento. Al finalizar el ciclo de limpieza al vapor, la puerta se destrabará. Limpie cualquier exceso de agua y cualquier suciedad que haya quedado.

Modo de Limpieza Automática

Lea las Instrucciones de Seguridad del Horno con Limpieza Automática, en el comienzo de este manual antes de usar el modo Self Clean (Limpieza Automática). Este modo usa temperaturas muy altas para limpiar el interior del horno. Cuando use esta función, la puerta del horno se trabará. Antes de utilizar el ciclo de limpieza automática, limpie la grasa y restos de comida que haya en el horno. Retire todos los artículos del horno, excepto los estantes esmaltados (color oscuro). Los estantes brillantes o de plata y cualquier utensilio u otros artículos deberían ser retirados del horno antes de iniciar un ciclo de limpieza automática. Cierre la puerta. Presione la tecla **Clean (Limpiar)** y se exhibirá un tiempo de limpieza automática por omisión. El tiempo de limpieza puede ser modificado en cualquier momento entre las 3:00 y las 5:00 horas, usando las teclas numéricas para ingresar un tiempo diferente y presionando **Start (Iniciar)**. Si desea usar el tiempo por omisión, presione la tecla **Start (Iniciar)** inmediatamente luego de presionar la tecla **Clean (Limpiar)** El horno se apagará de forma automática cuando el ciclo de limpieza automática sea completado. La puerta permanecerá bloqueada hasta que el horno se haya enfriado. Una vez que el horno se haya enfriado, limpie cualquier ceniza que haya quedado en el horno.

IMPORTANTE: Las emanaciones producidas por el ciclo de autolimpieza de cualquier horno afectan la salud de algunas aves de manera notoria. Procure llevar sus aves a otra habitación bien ventilada.

Estantes Planos

Los estantes planos se podrán dejar en la cavidad durante la limpieza automática (si se trata de estantes esmaltados, no brillantes) o se podrán lavar con agua caliente y jabón.

Es posible que resulte más difícil deslizar los estantes, especialmente luego de la limpieza automática. Coloque aceite vegetal en una tela húmeda o toalla de papel y frote sobre los extremos izquierdo y derecho.

Mantenimiento

Reemplazo de la Lámpara del Horno

⚠ ADVERTENCIA

PELIGRO DE DESCARGA O QUEMADURAS: Antes de reemplazar la lámpara de luz del horno, desconecte la conexión eléctrica del horno del fusible principal o del panel del disyuntor. Si esto no se cumple, se podrá producir una descarga eléctrica o un incendio.

⚠ PRECAUCIÓN

RIESGO DE INCENDIO: La tapa de vidrio y la lámpara de luz se deberán retirar cuando estén frías. Tocar el vidrio caliente sin protección en las manos o con un trapo húmedo puede ocasionar quemaduras.

1. Desconecte la corriente desde el fusible principal o el panel del disyuntor.
2. Retire los estantes del horno.
3. Deslice un destornillador de punta plana entre la caja y la tapa de luz de vidrio.
4. Apoye la tapa de luz de vidrio con dos dedos para evitar que se caiga al fondo del horno. Tenga cuidado de no astillar la cubierta del horno.
5. De forma suave, gire la punta del destornillador para aflojar la tapa de luz de vidrio.
6. Retire la tapa de luz de vidrio.
7. Retire la lámpara sosteniendo firmemente y deslizando la misma hacia afuera, hasta que las dos clavijas hayan dejado el soporte de cerámica.
8. No toque el vidrio de la nueva lámpara con los dedos. Esto hará que la lámpara falle al dar luz. Tome la lámpara de reemplzado con una toalla limpia o un pañuelo de papel con las clavijas hacia abajo. Aliñe las dos clavijas en el soporte de cerámica, presionando suavemente hasta que la lámpara quede asegurada en la ficha de cerámica.
9. Deslice las lentes protectoras del soporte y presione hasta que las pinzas queden enganchadas en la caja.
10. Vuelva a conectar la corriente.

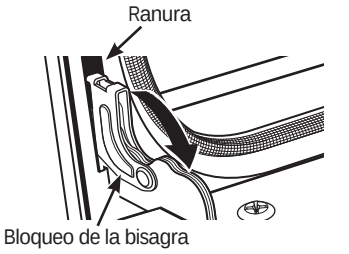
Puerta del Horno Desmontable

La puerta es muy pesada. Tenga cuidado al retirar y levantar la puerta.

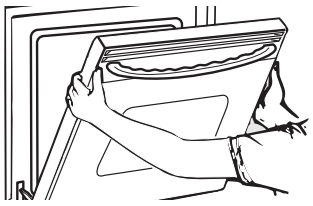
No levante la puerta usando la manija.

Para retirar la puerta:

1. Abra la puerta totalmente.
2. Empuje los bloqueos de la bisagra hacia abajo en dirección a la estructura de la puerta, hasta la posición desbloqueada. Es posible que necesite una herramienta tal como un destornillador pequeño de punta plana.
3. Firmemente tome ambos lados de la puerta por la parte superior.
4. Cierre la puerta hasta la posición de retiro de la misma. La puerta debería ser abierta aproximadamente a 3”, sin obstrucción sobre la misma.
5. Levante la puerta hacia arriba y afuera, hasta que los brazos de las bisagras queden fuera de las ranuras.



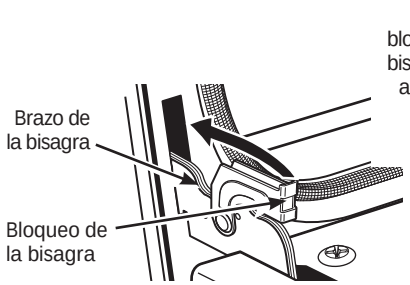
Empuje los bloqueos de la bisagra hacia abajo para desbloquear



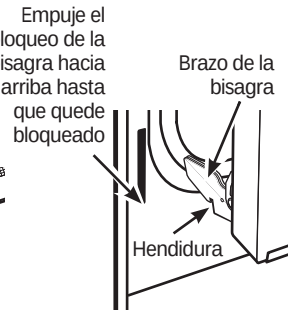
Posición de retiro

Para reemplazar la puerta:

1. Firmemente tome ambos lados de la puerta por la parte superior.
2. Comenzando desde el lado izquierdo, con la puerta en el mismo ángulo de la posición de retiro, apoye la hendidura del brazo de la bisagra en el extremo inferior de la ranura de la bisagra. La abertura en el brazo de la bisagra deberá estar totalmente apoyada en la parte inferior de la ranura. Repita el procedimiento del lado derecho.
3. Abra la puerta totalmente. Si la puerta no se abre totalmente, la hendidura no está correctamente apoyada en el extremo inferior de la ranura.
4. Empuje los bloqueos de la bisagra contra la estructura frontal de la cavidad del horno, hasta la posición de bloqueo.
5. Cierre la puerta del horno.



Extremo inferior de la ranura



Consejos para la Solución de Problemas... Antes de solicitar el servicio técnico

¡Ahorre tiempo y dinero! Primero revise los cuadros que aparecen en las siguientes páginas y es posible que no necesite solicitar reparaciones.

Problema	Causa Posible	Qué Hacer
Mi horno nuevo no cocina como el anterior. ¿Hay algún problema con las configuraciones de temperatura?	**Su horno nuevo cuenta con un sistema de cocción diferente con relación al anterior y, por lo tanto, es posible que cocine de forma diferente.**	En los primeros usos, use los tiempos y temperaturas de su receta con cuidado. Si aún piensa que su horno nuevo cocina con demasiado calor o demasiado frío, podrá ajustar el termostato usted mismo para aplicar su preferencia de cocción específica. **NOTA:** Este ajuste afecta las temperaturas de Bake (Hornear), Convection Bake 1 Rack (Hornear por Convección en 1 Estante) y Convection Bake Multi (Hornear por Convección Múltiple); no afectará las funciones Convection Roast (Dorar por Convección), Broil (Asar), o Clean (Limpiar).
La comida no se hornea de forma apropiada	**Controles del horno configurados de forma incorrecta.**	Consulte la sección Modos de Cocción.
	La posición del estante es incorrecta o el estante no está nivelado.	SeConsulte la sección Modos de Cocción y la Guía de Cocción.
	Uso de una cacerola incorrecta o de una cacerola de tamaño incorrecto.	Consulte la sección Utensilios.
	La temperatura del horno debe ser ajustada.	Consulte la sección Funciones Especiales.
	Sustitución de ingredientes	Sustituir ingredientes puede modificar el resultado de la receta.
La comida no asa de forma apropiada	**Controles del horno configurados de forma incorrecta.**	Asegúrese de seleccionar el modo correcto para asar.
	Se usó una posición incorrecta del estante.	Para acceder a sugerencias de ubicación de estantes, consulte la Guía de Cocción.
	Se cocinó comida en una olla caliente.	Asegúrese de que el utensilio esté frío
	Utensilio de cocina inadecuado para asar.	Use una olla específicamente diseñada para asar
	El papel de aluminio usado para la olla y la rejilla para asar no se ajustó ni cortó de forma apropiada, según lo recomendado.	Si usará papel de aluminio, deberá usarse conforme con las aberturas de la olla.
	En algunas áreas, es posible que el nivel de corriente (voltaje) sea bajo.	Precaliente el elemento para asar durante 10 minutos.
La temperatura del horno es demasiado caliente o demasiado fría	**La temperatura del horno debe ser ajustada.**	Consulte la sección Funciones Especiales.
El horno no funciona o parece no funcionar	**Es posible que un fusible de su hogar se haya quemado o que el disyuntor se haya desconectado.**	Reemplace el fusible o reinicie el disyuntor.
	Controles del horno configurados de forma incorrecta.	Consulte la sección Uso del Horno.
	El horno se encuentra en Sabbath Mode (Modo Sabático)	Verifique que el horno no esté en Sabbath Mode (Modo Sabático). Consulte la sección Funciones Especiales.
Sonido de “chisporroteo” o “traqueo”	**Éste es el sonido de metal calentándose o enfriándose durante las funciones de cocción y limpieza..**	Esto es normal.
¿Por qué la estufa hace un sonido de “clic” cuando uso el horno?	**Su estufa fue diseñada para mantener un control más ajustado sobre la temperatura del horno. Es posible que escuche que los elementos de calentamiento del horno hagan sonidos de “clic” con mayor frecuencia que con hornos más antiguos para lograr mejores resultados durante los ciclos de horneado, asado, convección y limpieza automática.**	Esto es normal.
El reloj y el temporizador no funcionan	**Es posible que un fusible de su hogar se haya quemado o que el disyuntor se haya desconectado.**	Reemplace el fusible o reinicie el disyuntor.

Consejos para la Solución de Problemas... Antes de solicitar el servicio técnico

Problema	Causa Posible	Qué Hacer
La luz del horno no funciona	**La lámpara está floja o presenta defectos.**	Ajuste o reemplace la lámpara.
	La luz de funcionamiento del interruptor está rota.	Llame al servicio técnico.
El modo de limpieza automática del horno no funciona	**La temperatura del horno es demasiado caliente como para configurar la limpieza automática.**	Espere a que el horno se enfríe y reinicie los controles.
	Los controles del horno están configurados de forma incorrecta.	Consulte la sección de Limpieza del Horno.
Exceso de humo durante un ciclo de limpieza	**Suciedad o grasa excesiva.**	Presione la tecla **Cancel/Off (Cancelar/ Apagar)** Abra las ventanas para liberar el humo en la habitación. Espere hasta que la luz de la función **LOCKED (Bloqueado)** desaparezca. Limpie el exceso de suciedad y reinicie el ciclo de limpieza.
Humo excesivo al asar	**La comida está demasiado cerca del quemador.**	Baje la posición del estante con comida.
La puerta del horno no se abrirá luego de un ciclo de limpieza	**El horno está demasiado caliente.**	Espere a que el horno se enfríe por debajo de la temperatura de bloqueo.
El horno no limpia luego de un ciclo de limpieza	**Los controles del horno están configurados de forma incorrecta.**	Consulte la sección de Limpieza del Horno.
	El horno estaba demasiado sucio.	Limpie derrames excesivos antes de iniciar el ciclo de limpieza. Es posible que, en hornos con mucha suciedad, sea necesario usar la limpieza automática nuevamente o usarla durante un período de tiempo más prolongado.
"LOCK DOOR" (Puerta Trabada) titila en la pantalla	**El ciclo de limpieza automática fue seleccionado pero la puerta no está cerrada.**	Cierre la puerta del horno.
La luz de LOCKED (Bloqueado) está encendida cuando desea cocinar	**La puerta del horno está bloqueada debido a que la temperatura interior del horno no descendió por debajo de la temperatura de bloqueo.**	Presione la tecla **Cancel/Off (Cancelar/ Apagar)** Deje que el horno se enfríe.
"F – y un número o letra" titila en la pantalla	**Tiene un código de error de función.**	Presione la tecla **Cancel/Off (Cancelar/ Apagar)** Permita que el horno se enfríe durante una hora. Vuelva a poner el horno en funcionamiento.
	Si el código de función se repite.	Desconecte totalmente la corriente de la cocina durante por lo menos 30 minutos y vuelva a conectar la misma. Si el código de error de función se repite, llame al servicio técnico.
La pantalla queda en blanco	**Es posible que un fusible de su hogar se haya quemado o que el disyuntor se haya desconectado.**	Reemplace el fusible o reinicie el disyuntor.
	El reloj está apagado.	Consulte la sección Funciones Especiales.
	El horno se encuentra en Sabbath Mode (Modo Sabático)..	Verifique que el horno no esté en Sabbath Mode (Modo Sabático). Consulte la sección Funciones Especiales.
Corte de corriente, el reloj titila	**Corte o exceso de corriente**	Reinicie el reloj. Si el horno estuvo en uso, deberá reiniciar el mismo presionando la tecla **Cancel/ Off (Cancelar/ Apagar)** configurando el reloj y reiniciando cualquier función de cocción.
Olor a "quemado" o "aceite" desde la ventilación	**Esto es normal en un horno nuevo y desaparecerá con el tiempo.**	Para acelerar el proceso, configure un ciclo de limpieza automática por un mínimo de 3 horas. Consulte la sección de Limpieza del Horno.
Olor fuerte	**Un olor en la aislación alrededor del interior del horno es normal desde las primeras veces en que el horno es usado.**	Esto es temporario y desaparecerá luego de varios usos o de un ciclo de limpieza automática.
Ruido del ventilador	**Es posible que un ventilador de enfriamiento se active automáticamente.**	Esto es normal. El ventilador de enfriamiento se encenderá para enfriar las partes internas. Es posible que funcione hasta durante una hora y media, una vez que el horno se haya apagado.
La puerta de vidrio del horno parece estar "teñida" o tener un color "arcoíris". ¿Es esto un defecto?	**No. El vidrio del horno interno está cubierto con una barrera de calor que refleja este último nuevamente hacia el horno, a fin de evitar la pérdida de calor y de mantener fría la puerta externa mientras se hornea.**	Esto es normal. Bajo ciertas luces y ángulos, es posible que visualice esta tinta o arcoíris.

Consejos para la Solución de Problemas... Antes de solicitar el servicio técnico

Problema	Causa Posible	Qué Hacer
A veces el horno tarda más en precalentarse a la misma temperatura	**Utensilio o comida en el horno**	El utensilio o la comida en el horno hará que éste tarde más en precalentarse. Retire estos artículos para reducir el tiempo de precalentamiento.
	Número de estantes en el horno	Agregar más estantes al horno hará que éste tarde más en precalentarse. Retire algunos estantes.
	Diferentes modos de cocción	Los diferentes modos de cocción utilizan diferentes métodos de precalentamiento para calentar el horno en un modo de cocción específico. Algunos modos tardarán más que otros (tales como: horneado por convección múltiple).

Hoshizaki America, Inc.

Self-Contained Cubelet

Models
C-101BAH
C-101BAH-DS
C-101BAH-AD
C-101BAH-ADDS

"A Superior Degree of Reliability"

www.hoshizaki.com

INSTRUCTION MANUAL

Issued: 7-25-2013

⚠ WARNING

Only qualified service technicians should install and service the appliance. To obtain the name and phone number of your local Hoshizaki Certified Service Representative, visit www.hoshizaki.com. No installation or service should be undertaken until the technician has thoroughly read this Instruction Manual. Likewise, the owner/manager should not proceed to operate the appliance until the installer has instructed them on its proper operation. Failure to install, operate, and maintain the appliance in accordance with this manual will adversely affect safety, performance, component life, and warranty coverage and may result in costly water damage. Proper installation is the responsibility of the installer. Product failure or property damage due to improper installation is not covered under warranty.

Hoshizaki provides this manual primarily to assist qualified service technicians in the installation, maintenance, and service of the appliance.

Should the reader have any questions or concerns which have not been satisfactorily addressed, please call, send an e-mail message, or write to the Hoshizaki Technical Support Department for assistance.

Phone: 1-800-233-1940; (770) 487-2331
Fax: 1-800-843-1056; (770) 487-3360

E-mail: techsupport@hoshizaki.com

HOSHIZAKI AMERICA, INC.
618 Highway 74 South
Peachtree City, GA 30269
Attn: Hoshizaki Technical Support Department

NOTE: To expedite assistance, all correspondence/communication MUST include the following information:

- Model Number _____
- Serial Number _____
- Complete and detailed explanation of the problem.

IMPORTANT

This manual should be read carefully before the appliance is installed and operated. Read the warnings and guidelines contained in this manual carefully as they provide essential information for the continued safe use and maintenance of the appliance. Retain this manual for any further reference that may be necessary.

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Important Safety Information

Throughout this manual, notices appear to bring your attention to situations which could result in death, serious injury, damage to the appliance, or damage to property.

⚠ WARNING **Indicates a hazardous situation which could result in death or serious injury.**

NOTICE **Indicates a situation which could result in damage to the appliance or property.**

IMPORTANT **Indicates important information about the installation, use, and care of the appliance.**

⚠ WARNING

The appliance should be destined only to the use for which it has been expressly conceived. Any other use should be considered improper and therefore dangerous. The manufacturer cannot be held responsible for injury or damage resulting from improper, incorrect, and unreasonable use. Failure to install, operate, and maintain the appliance in accordance with this manual will adversely affect safety, performance, component life, and warranty coverage and may result in costly water damage.

To reduce the risk of death, electric shock, serious injury, or fire, follow basic precautions including the following:

- Only qualified service technicians should install and service the appliance.
- The appliance must be installed in accordance with applicable national, state, and local codes and regulations.
- The appliance requires an independent power supply of proper capacity. See the nameplate for electrical specifications. Failure to use an independent power supply of proper capacity can result in a tripped breaker, blown fuse, damage to existing wiring, or component failure. This could lead to heat generation or fire.
- **THE APPLIANCE MUST BE GROUNDED:** The appliance is equipped with a NEMA 5-15 three-prong grounding plug to reduce the risk of potential shock hazards. It must be plugged into a properly grounded, independent 3-prong wall outlet. If the outlet is a 2-prong outlet, it is your personal responsibility to have a qualified electrician replace it with a properly grounded, independent 3-prong wall outlet. Do not remove the ground prong from the power cord and do not use an adapter plug. Failure to properly ground the appliance could result in death or serious injury.
- Do not use an extension cord.
- To reduce the risk of electric shock, do not touch the control switch or plug with damp hands. Make sure the control switch is in the "OFF" position before plugging in or unplugging the appliance.
- Do not use an appliance with a damaged power cord. The power cord should not be altered, jerked, bundled, weighed down, pinched, or tangled. Such actions could result in electric shock or fire. To unplug the appliance, be sure to pull the plug, not the cord, and do not jerk the cord.
- Do not make any alterations to the appliance. Alterations could result in electric shock, injury, fire, or damage to the appliance.
- Do not place fingers or any other objects into the ice discharge opening.

⚠ WARNING, continued

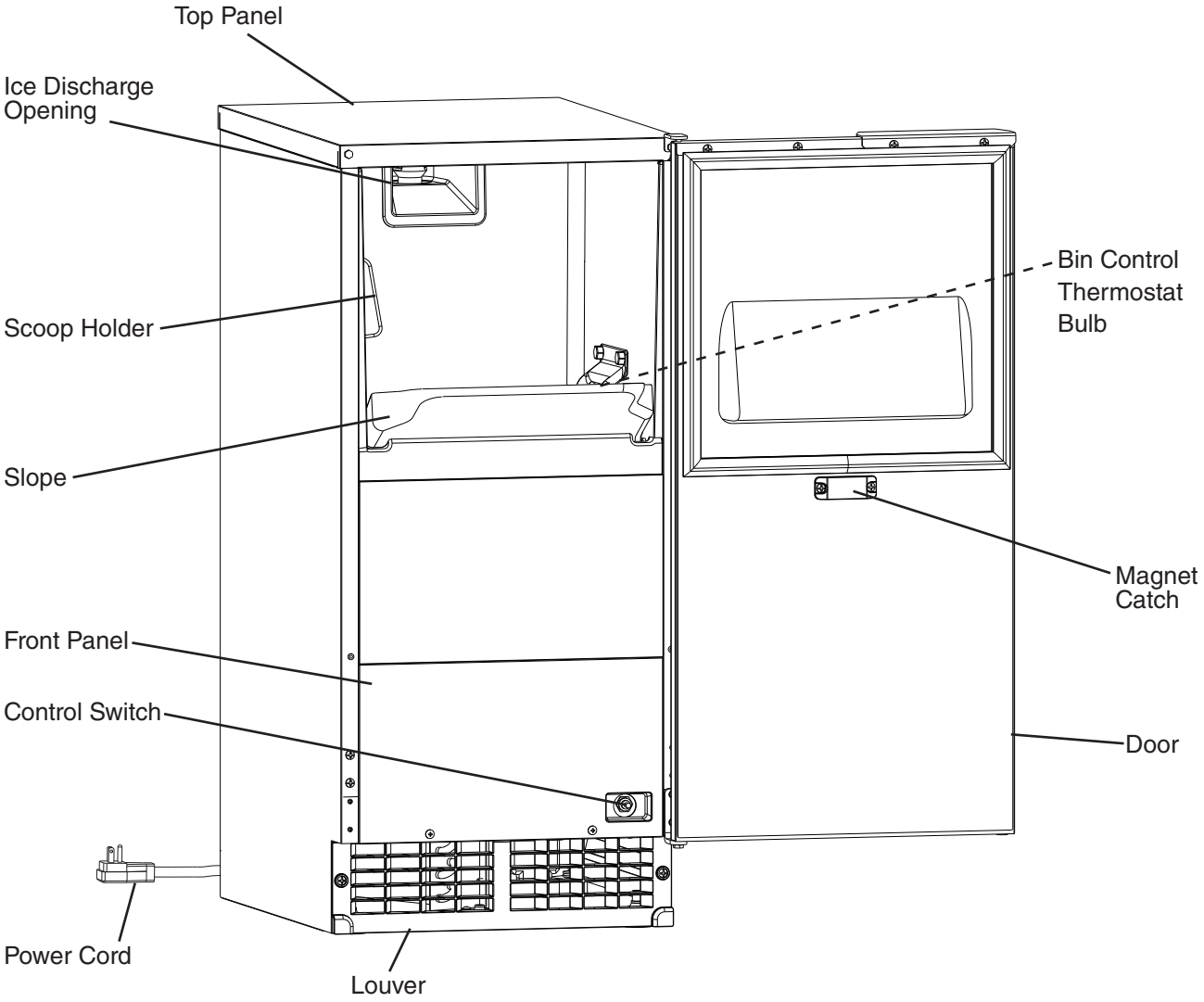
- The appliance is not intended for use by persons (including children) with reduced physical, sensory, or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.
- Young children should be properly supervised around the appliance.
- Do not climb, stand, or hang on the appliance or appliance door or allow children or animals to do so. Serious injury could occur or the appliance could be damaged.
- Be careful not to pinch fingers when opening and closing the door. Be careful when opening and closing the door when children are in the area.
- Do not use combustible spray or place volatile or flammable substances near the appliance. They might catch fire.
- Keep the area around the appliance clean. Dirt, dust, or insects in the appliance could cause harm to individuals or damage to the appliance.

NOTICE

- Protect the floor when moving the appliance to prevent damage to the floor.
- Follow the water supply, drain connection, and maintenance instructions carefully to reduce the risk of costly water damage.
- In areas where water damage is a concern, install in a contained area with a floor drain.
- Install the appliance in a location that stays above freezing. Normal operating ambient temperature must be within 45°F to 100°F (7°C to 38°C).
- If using the optional drain pump (HS-5061), test its operation every time the appliance is cleaned and sanitized. See "IV.E. Optional Drain Pump HS-5061" for details. If the optional drain pump is not operating properly, water could back up and overflow, leading to costly water damage.
- To help ensure the storage bin drain remains clear, follow the instructions in "IV.C. Storage Bin Drain" once every 3 months or as often as necessary for conditions. If the storage bin drain becomes clogged, water could build up in the bin and overflow, leading to costly water damage.
- If water collects in the bin and will not drain, turn off the appliance and close the water supply line shut-off valve. Call for service.
- If water seeps from the base of the appliance, turn off the appliance and close the water supply line shut-off valve. Call for service. Failure to do so could lead to costly water damage.
- Do not leave the appliance on during extended periods of non-use, extended absences, or in sub-freezing temperatures. To properly prepare the appliance for these occasions, follow the instructions in "V. Preparing the Appliance for Periods of Non-Use."
- Keep ventilation openings, in the appliance enclosure or in the built-in structure, clear of obstruction.
- Do not place objects on top of the appliance.
- The storage bin is for ice use only. Do not store anything else in the storage bin.

I. Specifications

A. Construction



B. Electrical and Refrigerant Data

The nameplate provides electrical and refrigerant data. The nameplate is located inside the storage bin. For certification marks, see the nameplate.

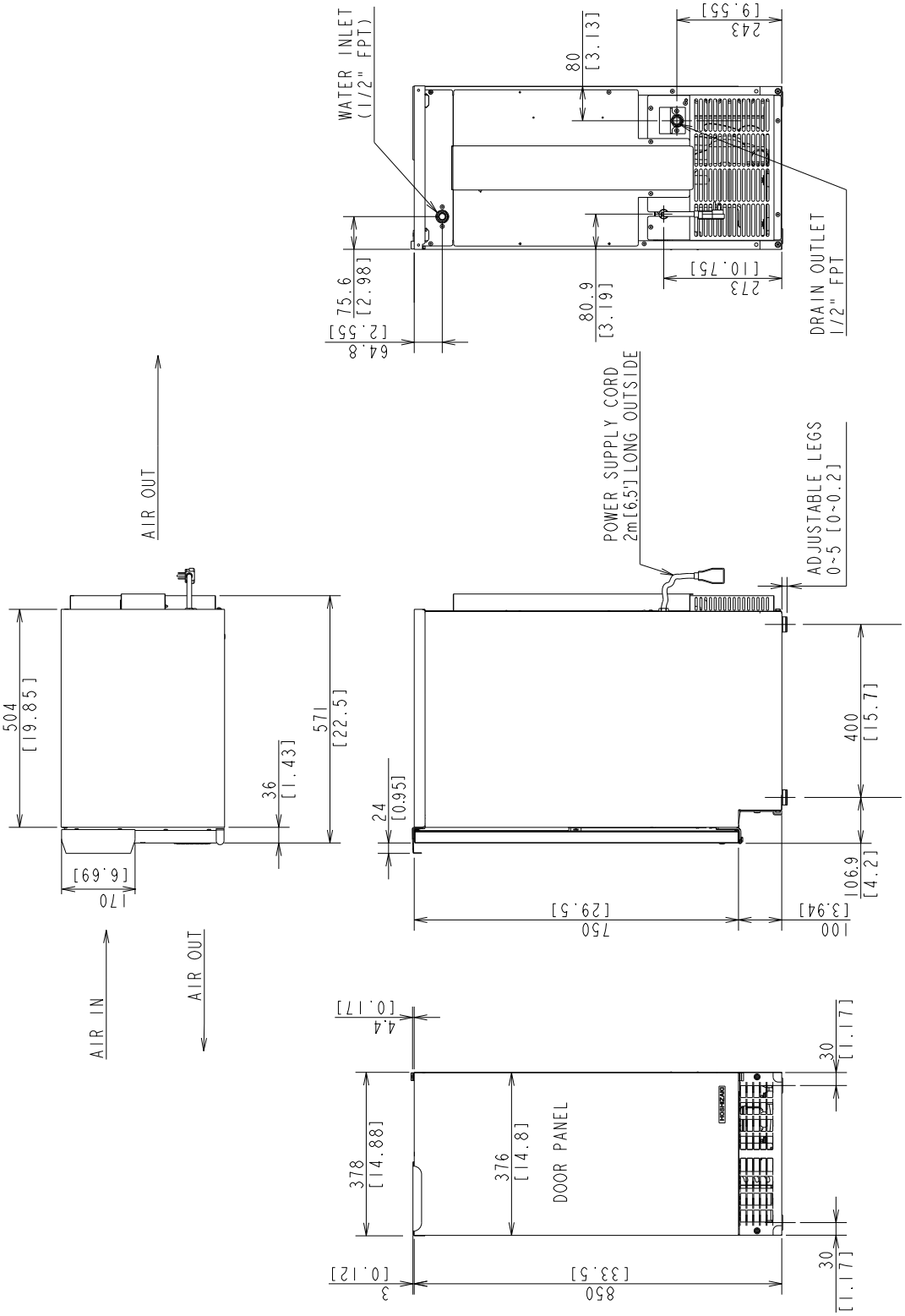
We reserve the right to make changes in specifications and design without prior notice.

Model Number	**C-101BAH** **C-101BAH-DS** **C-101BAH-AD** **C-101BAH-ADDS**
AC Supply Voltage	115-120/60/1
Amperes	4.0 AMPS
Design Pressure	HI-240PSI LO-120PSI
Refrigerant	134a 3.17 OZ.

C. Dimensions/Connections

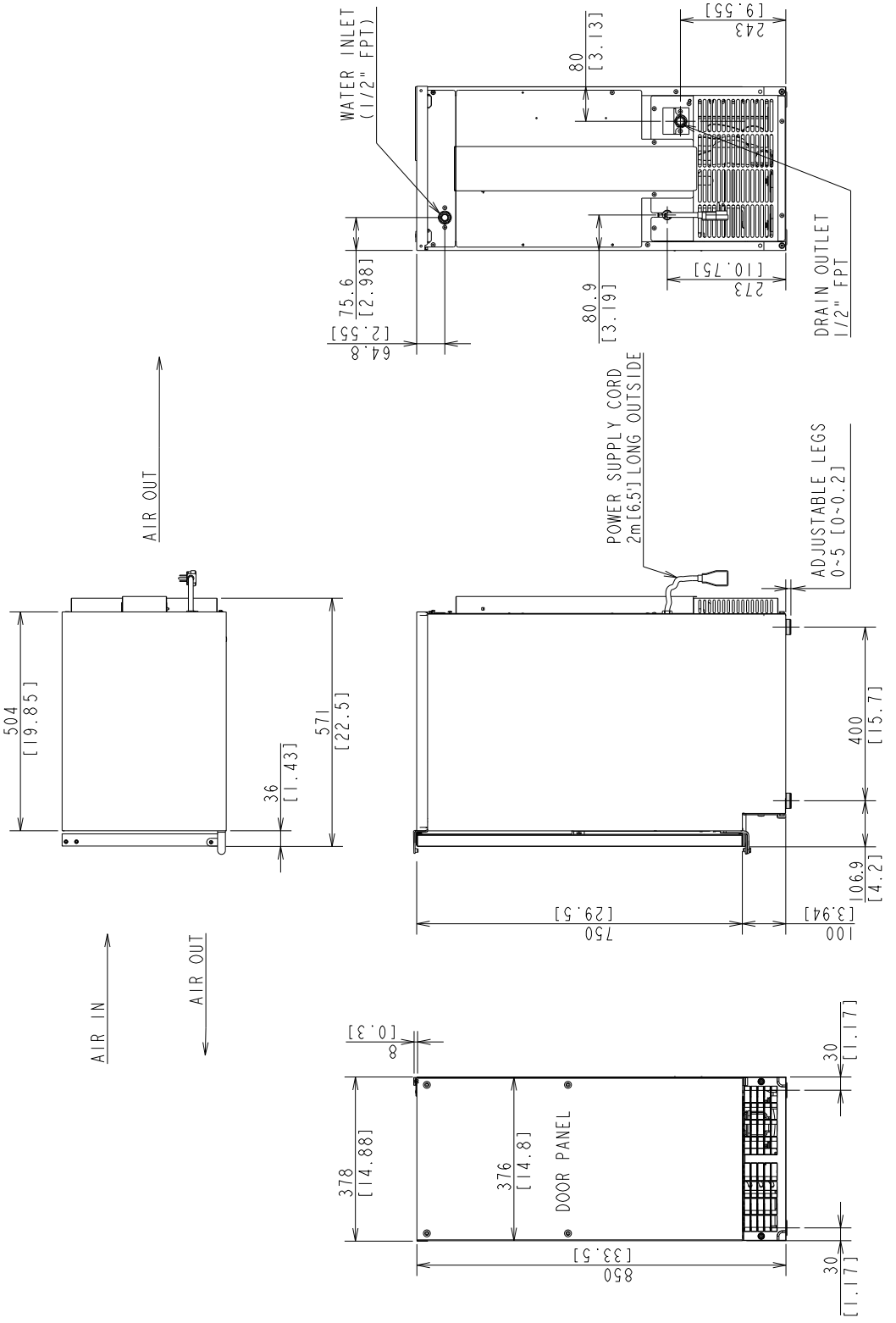
1. C-101BAH

Units: mm [in.]



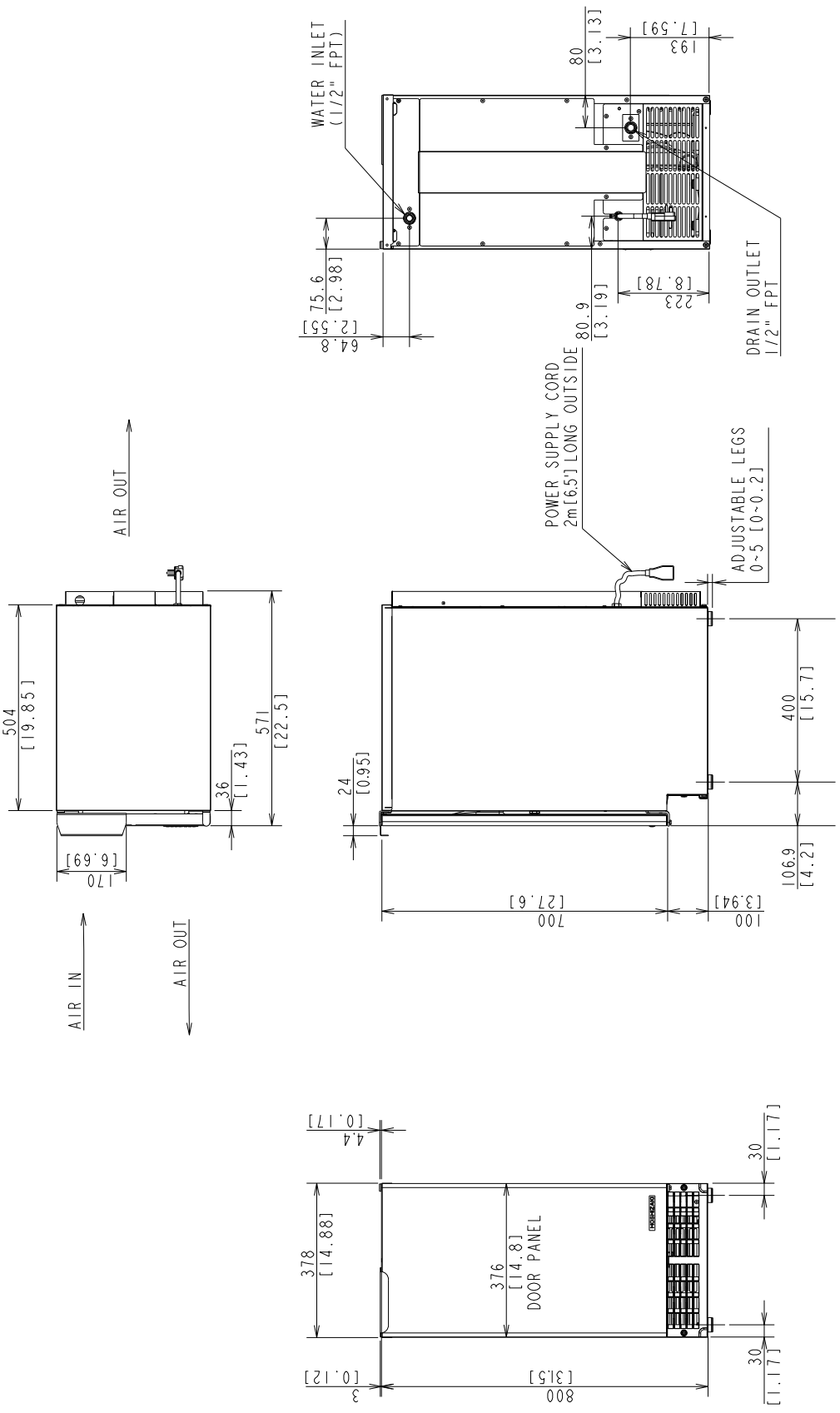
2. C-101BAH-DS

Units: mm [in.]

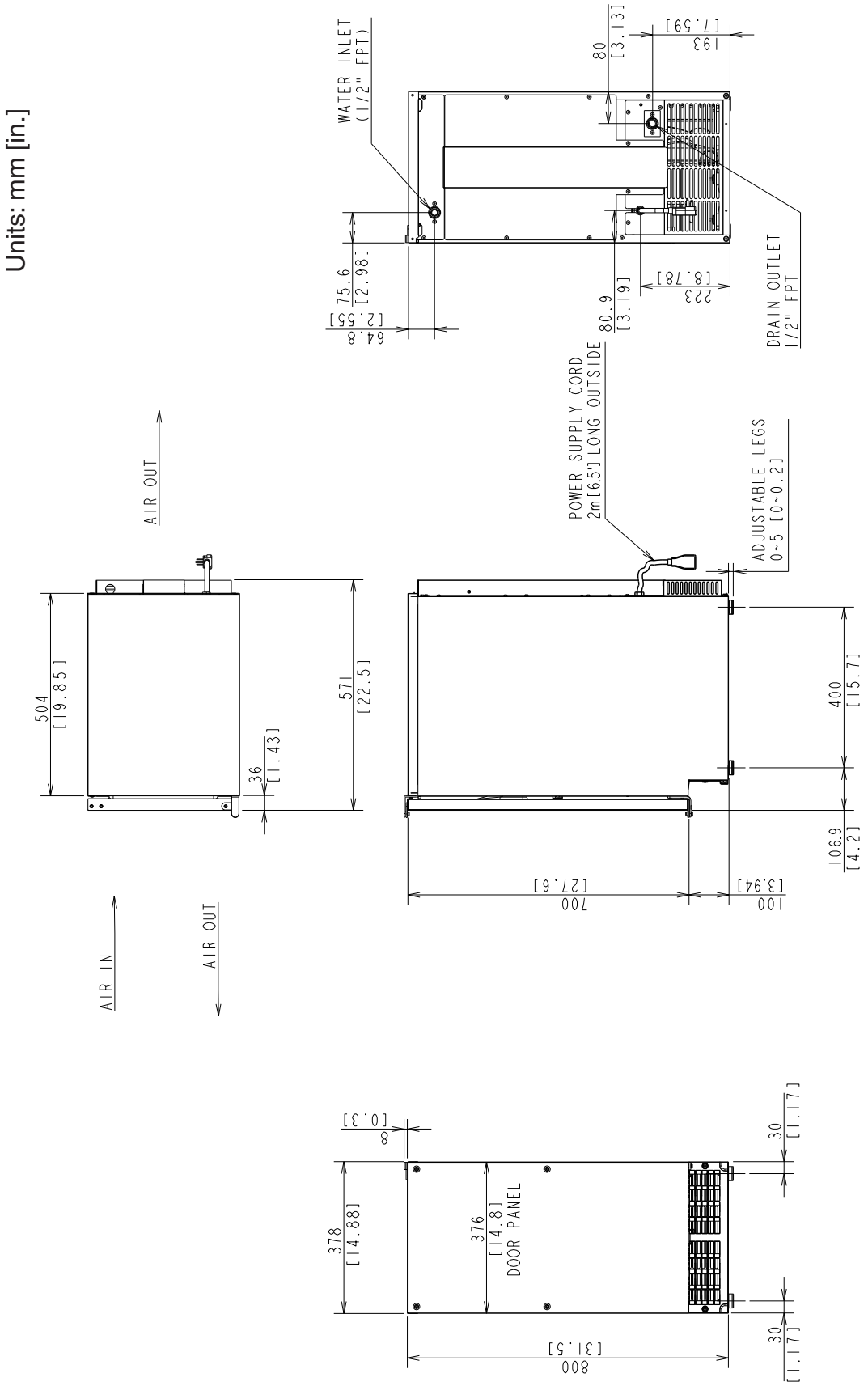


3. C-101BAH-AD

Units: mm [in.]



4. C-101BAH-ADDS



II. Installation Instructions

⚠ WARNING

- The appliance must be installed in accordance with applicable national, state, and local codes and regulations.
- **CHOKING HAZARD:** Ensure all components, fasteners, and thumbscrews are securely in place after installation. Make sure that none have fallen into the storage bin.

A. Checks Before Installation

- Visually inspect the exterior of the shipping container and immediately report any damage to the carrier. Upon opening the container, any concealed damage should also be immediately reported to the carrier.
- Remove the shipping carton, tape, and packing material. If any are left in the appliance, it will not work properly.
- Remove the package containing the accessories.
- Remove the protective plastic film from the panels. If the appliance is exposed to the sun or to heat, remove the film after the appliance cools.
- See the nameplate inside the storage bin, and check that your voltage supplied corresponds with the voltage specified on the nameplate.

B. Location

1. General

The appliance is approved for indoor or outdoor use.

NOTICE

- Normal operating ambient temperature must be within 45°F to 100°F (7°C to 38°C); Normal operating water temperature must be within 45°F to 90°F (7°C to 32°C). Operation of the appliance, for extended periods, outside of these normal temperature ranges may affect appliance performance.
- The appliance will not work at sub-freezing temperatures. To prevent damage to the water supply line, drain the appliance if the air temperature is going to go below 32°F (0°C). See "V. Preparing the Appliance for Periods of Non-Use."

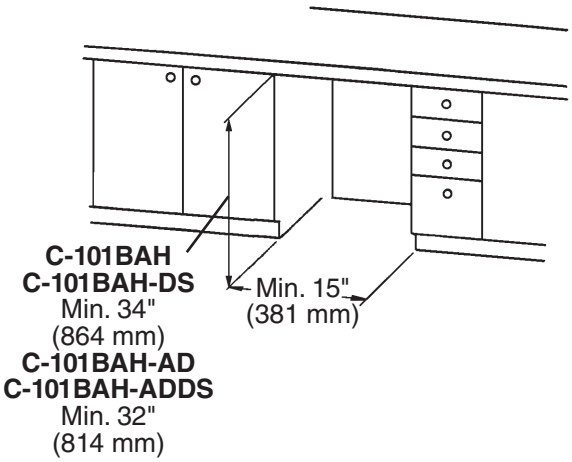
- The appliance should not be located next to ovens, grills, or other high heat producing equipment.
- The location must provide a firm and level foundation for the appliance.
- The appliance requires no side or top clearance. But allow enough space at rear for water supply and drain connections and at least 15" (38 cm) clearance at front.
- The appliance must be at floor level on a finished floor even if under a cabinet. In areas where water damage is a concern, install in a contained area with a floor drain.

2. Built-In Installation Site

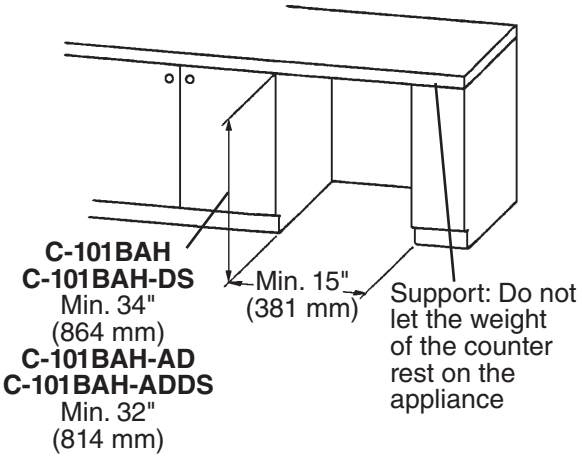
NOTICE
• Do not let the weight of the counter rest on the appliance. • Do not install the appliance in a corner where the door will interfere with other equipment or where the appliance cannot be pulled out for service.

Installation Space			
Model	**Height**	**Width**	**Depth**
C-101BAH C-101BAH-DS	34" (864 mm) minimum	15" (381 mm) minimum	24" (610 mm) minimum
C-101BAH-AD C-101BAH-ADDS	32" (814 mm) minimum		

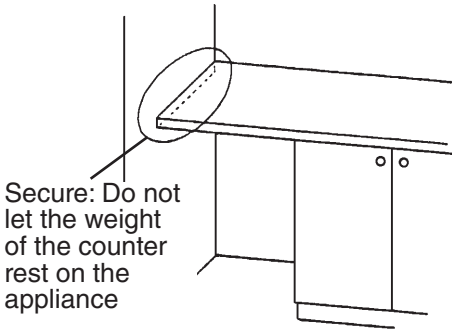
Between Two Cabinets



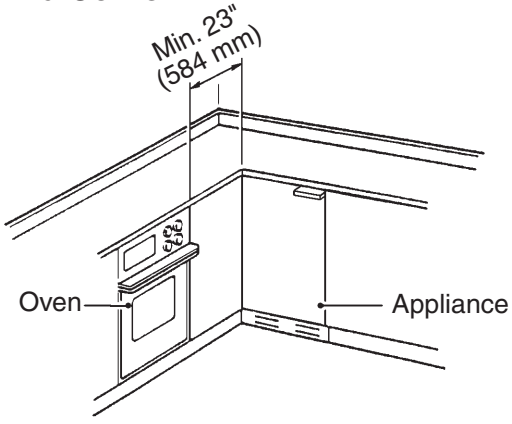
Between a Cabinet and the End of a Counter



Between a Cabinet and a Wall or Tall Cabinet



In a Corner



C. Door

1. C-101BAH, C-101BAH-AD

a) Door Reversal

If you would like to reverse the door swing, follow the steps below. Otherwise, skip to section "II.D. Setup."

1) While maintaining a hold on the door, remove the hinge stop pin from hinge (B). Pull out the bottom of the door slightly and gently remove the door from hinge (A). See Fig. 1.

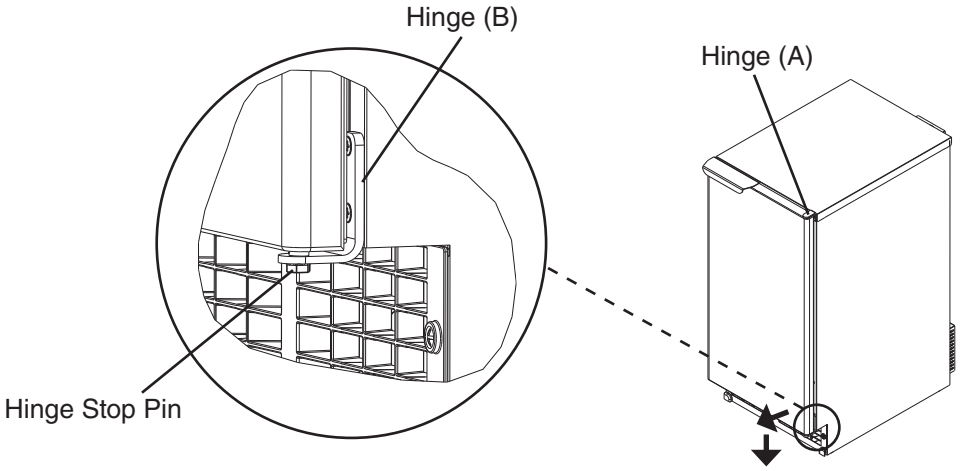


Fig. 1

2) Remove the 2 bolts securing the top panel, then lift it off. See Fig. 2.

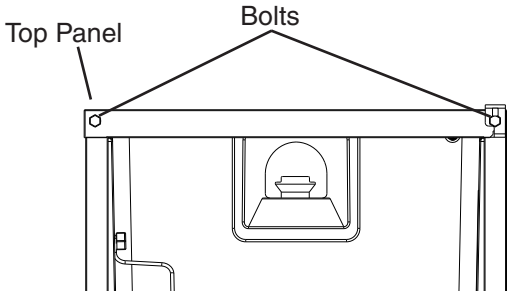


Fig. 2

3) Remove hinge (A) and the bracket from the right side of the appliance and the top brace from the left side. Rotate hinge (A) to position the gasket notch to the inside, then fasten hinge (A) and the bracket to the left side and the top brace to the right side. See Fig. 3.

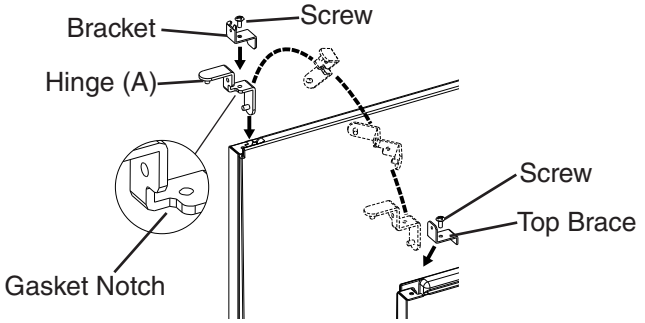


Fig. 3

4) Remove hinge (B) from the right side of the appliance and the 2 filler screws from the left side. Attach the 2 filler screws to the right side and attach hinge (B) to the left side. See Fig. 4.

5) Rotate the top panel 180° from its previous position. This brings the notch that was previously in the right rear to the left front. See Fig. 5. Hook the rear part of the panel on the body, then secure the front with the 2 bolts removed in step 2.

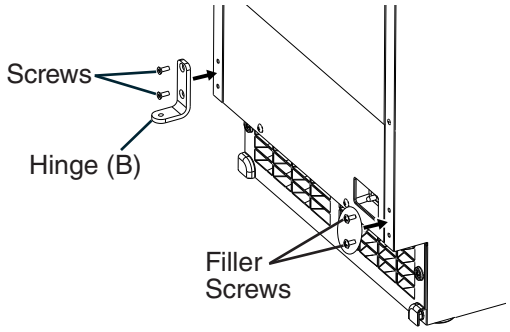


Fig. 4

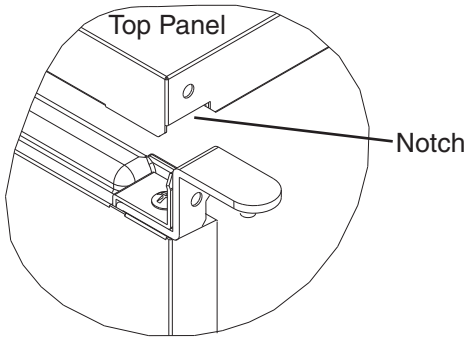


Fig. 5

6) Remove the 2 screws attaching the door handle and also remove the other 2 screws indicated in the illustration. Use 2 of the screws to attach the handle to the other side of the door and attach the other 2 screws in the remaining 2 holes. See Fig. 6.

7) Attach the door to hinge (A), then continue to maintain a hold on the door. Screw the hinge stop pin into hinge (B) until it is tight. See Fig. 7.

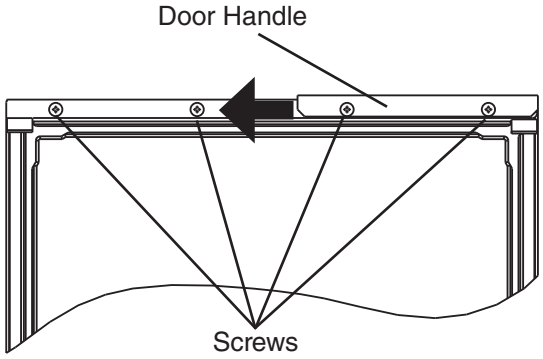


Fig. 6

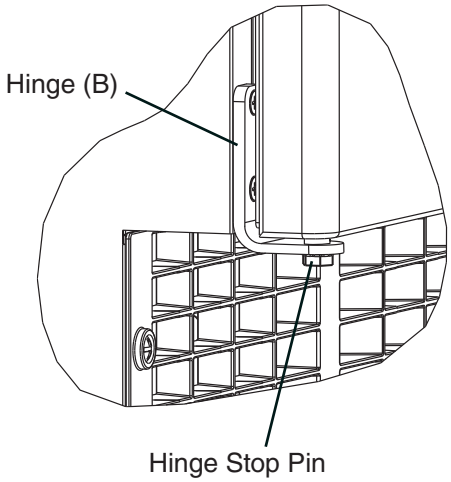


Fig. 7

2. C-101BAH-DS, C-101BAH-ADDS

a) Overlay Panel Fabrication and Attachment

IMPORTANT
The overlay panel must be crafted by a professional cabinet maker to ensure quality results.

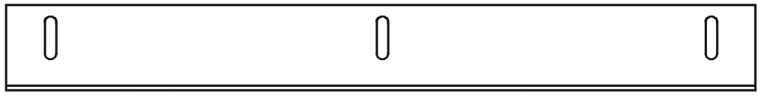
(1) Parts

Ensure that all parts required for the overlay panel assembly are contained in the accessories bag.

Overlay Panel Parts			
No.	**Description**	**Part Number**	**Qty.**
1	Threaded Wood Insert	4A4004-01	6
2	T2 Screw 4×8 SS	7P32-0408	3
3	Pan Head Screw M4×25 SS	7C12-0425	4
4	Truss Head Screw M4×8 SS	7C32-0408	2
5	Canoe Clip	4A0629-02	2
6	Sheet Metal Bracket	4A3998-01	1



1 2 3 4 5

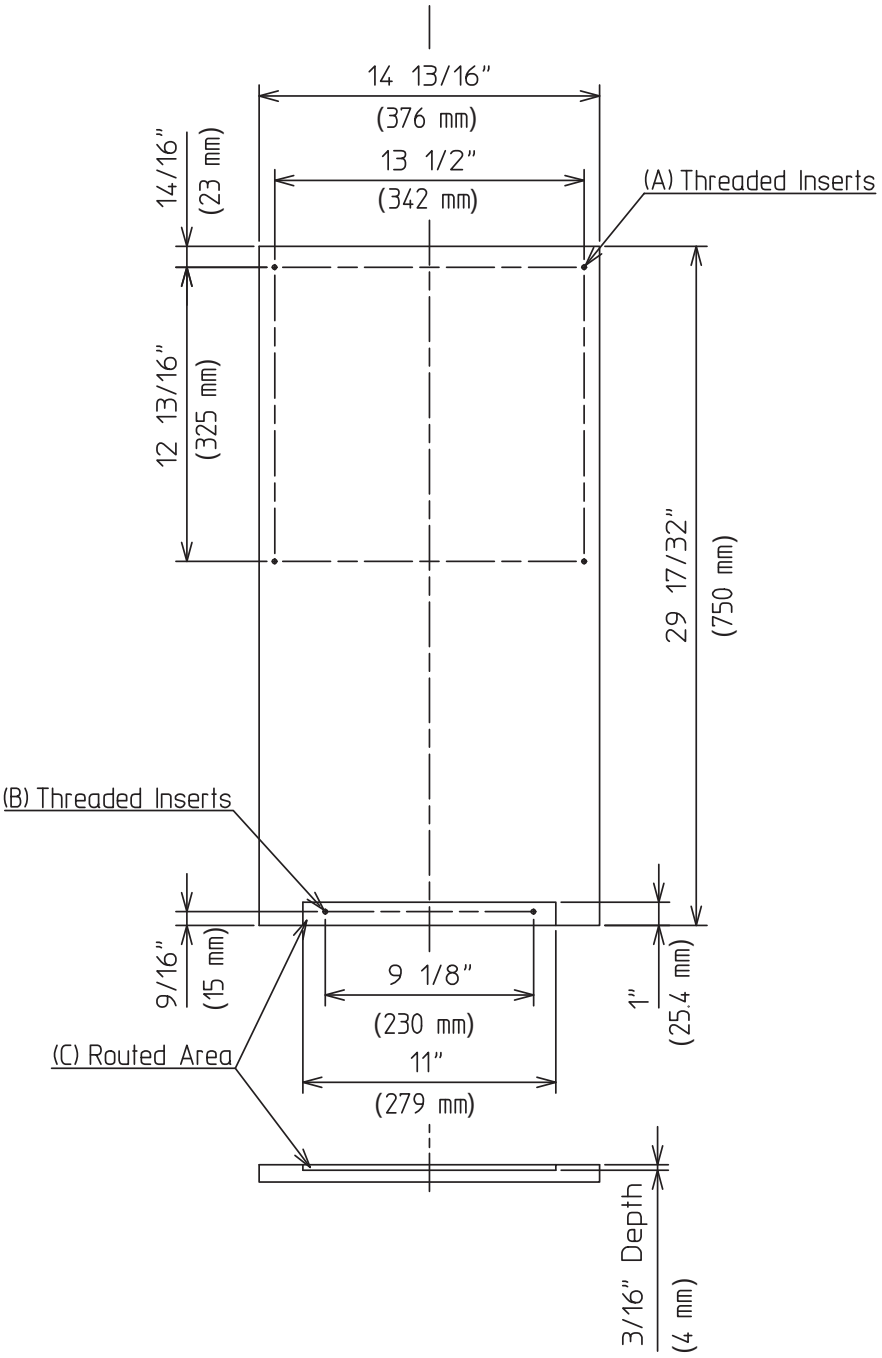


6

(2) Overlay Panel Specification

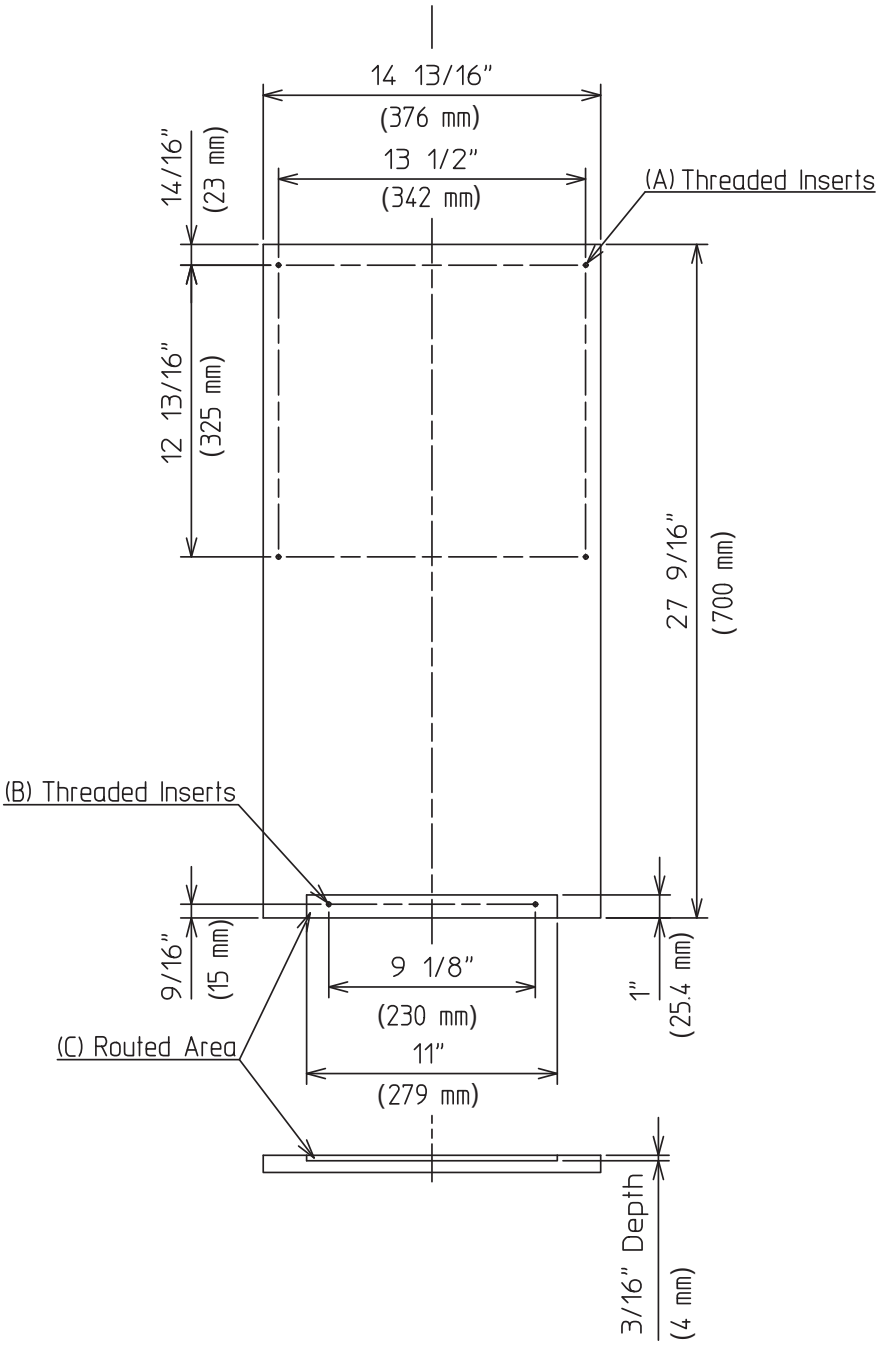
Use the specification that applies to your appliance (C-101BAH-***DS*** or C-101BAH-***ADDS***) and the directions that follow to prepare your overlay panel.

(a) C-101BAH-DS



C-101BAH-DS Overlay Panel Specification	
Overlay Panel Height	29 17/32" (750 mm)
Overlay Panel Width	14 13/16" (376 mm)
Overlay Panel Thickness	5/8" (16 mm) minimum; 3/4" (19 mm) maximum
Overlay Panel and Door Weight (total)	20 lb. (9 kg) maximum

(b) C-101BAH-ADDS



C-101BAH-ADDS Overlay Panel Specification	
Overlay Panel Height	27 9/16" (700 mm)
Overlay Panel Width	14 13/16" (376 mm)
Overlay Panel Thickness	5/8" (16 mm) minimum; 3/4" (19 mm) maximum
Overlay Panel and Door Weight (total)	20 lb. (9 kg) maximum

(3) Fabrication of Overlay Panel

Fabricate the overlay panel as outlined in the specification on the previous page and the instructions below.

1) Rout a channel at the bottom of the overlay panel to the proper dimensions. See "(C) Routed Area" in the specification diagram and Fig. 8.

2) Drill six 1/4" diameter (hardwood may require slightly larger diameter) holes 3/8" (10 mm) deep in the locations designated. ***NOTICE!*** **Use care when drilling holes for mounting hardware. All drilled holes must be straight and drilled to the correct diameter and depth.** See "(A) Threaded Inserts" and "(B) Threaded Inserts" in the specification diagram and Fig. 9.

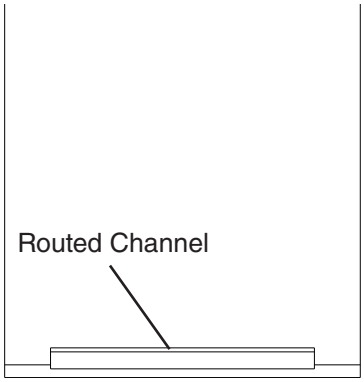


Fig. 8

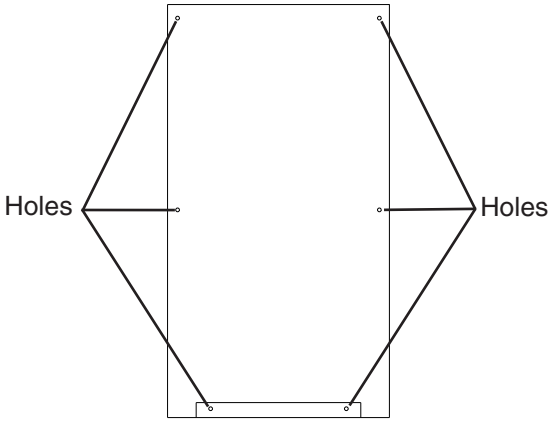


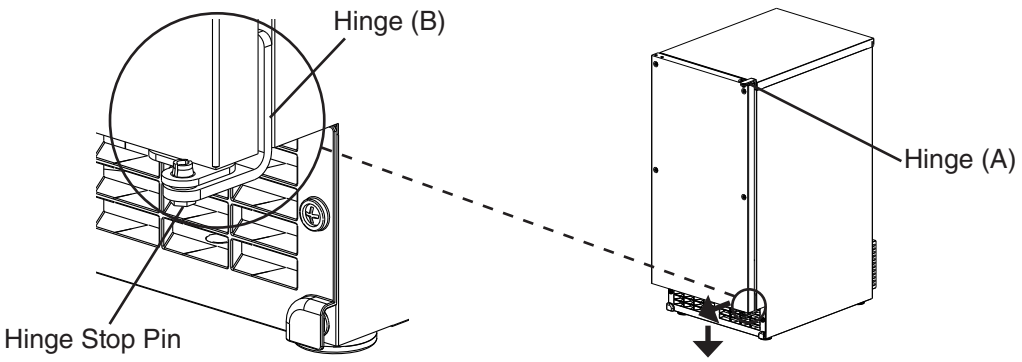
Fig. 9

3) Screw the 6 threaded wood inserts into the 1/4" holes drilled in the previous step. Make sure that the inserts are threaded straight and that the tops of the inserts are flush to the overlay panel surface. Otherwise, the overlay panel cannot be properly fastened to the door.

4) Mount the door handle hardware. Hoshizaki recommends that the door handle hardware be mounted on the edge opposite of the door hinge side (optional hinge reversal is covered in step 6. Countersunk screw heads are required to ensure that the hardware fasteners do not interfere with the overlay panel fitting flush with the door.

5) While maintaining a hold on the door, remove the hinge stop pin from hinge (B). Pull out the bottom of the door slightly and gently remove the door from hinge (A). See Fig. 10. If you are leaving the door right-hinged, skip to step 7. If you would like to reverse the door hinges, proceed to step 6.

Fig. 10



6) If you would like to reverse the door hinges, do the following:

a) Contact your local distributor to purchase Hoshizaki Kit HS-0229. The kit contains "hinge (A)-left."

b) Remove the 2 bolts securing the top panel, then lift it off. See Fig. 11.

c) Remove hinge (A)-right and the bracket from the right side of the appliance. Set aside hinge (A)-right; it is not needed. Remove the top brace from the left side. Fasten hinge (A)-left and the bracket to the left side and the top brace to the right side. See Fig. 12.

Note: When on the proper side, the gasket notch for hinge (A) is to the inside.

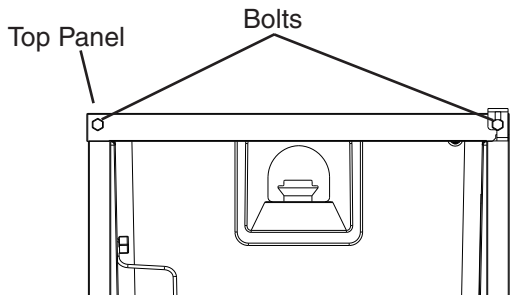


Fig. 11

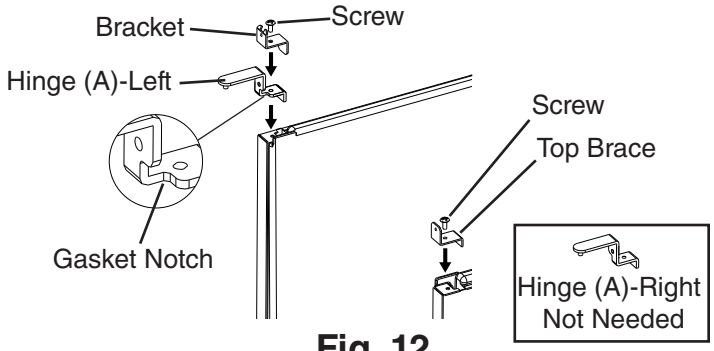


Fig. 12

d) Remove hinge (B) from the right side of the appliance and the 2 filler screws from the left side. Attach the 2 filler screws to the right side and attach hinge (B) to the left side. See Fig. 13.

e) Rotate the top panel 180° from its previous position. This brings the notch that was previously in the right rear to the left front. See Fig. 14. Hook the rear part of the panel on the body, then secure the front with the 2 bolts removed in step 6a.

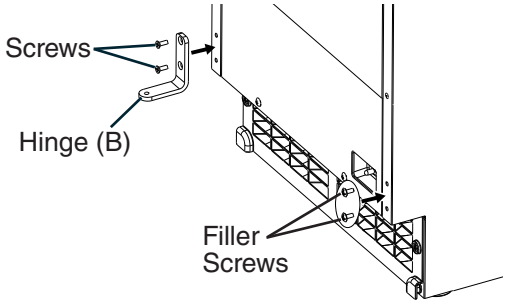


Fig. 13

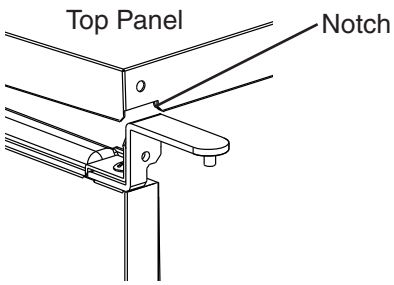


Fig. 14

f) Remove hinge (C1) from the top right part of the door, flip it and reattach to the bottom left. Remove hinge (C2) from the bottom right part of the door, flip it and reattach to the top left. See Fig. 15. Proceed to step 7.

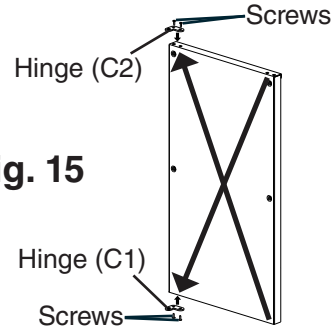


Fig. 15

7) Remove the bushings from hinge (C1) and hinge (C2) (the hinges attached to the door). See Fig. 16.

8) Remove the gasket from the door. See Fig. 17.

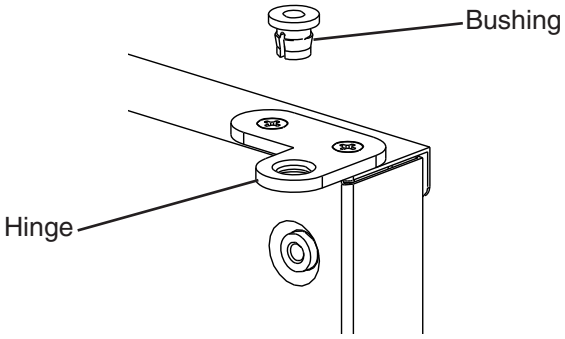


Fig. 16

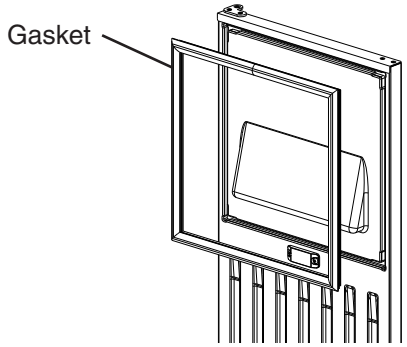


Fig. 17

9) Temporarily fasten the overlay panel to the door using 2 of the M4×25 pan head screws provided. ***NOTICE!*** **Ensure that the back surface of overlay panel is flat before attaching.** See Fig. 18.

10) Mark the centerpoint of the hinge (C1) and hinge (C2) holes that extend over the overlay panel. See Fig. 19.

11) Remove the overlay panel from the door.

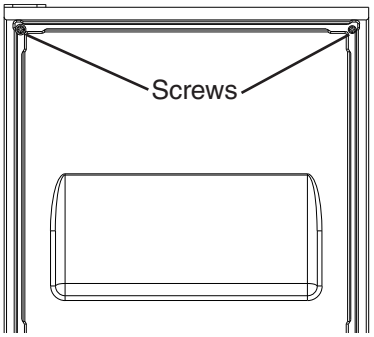


Fig. 18

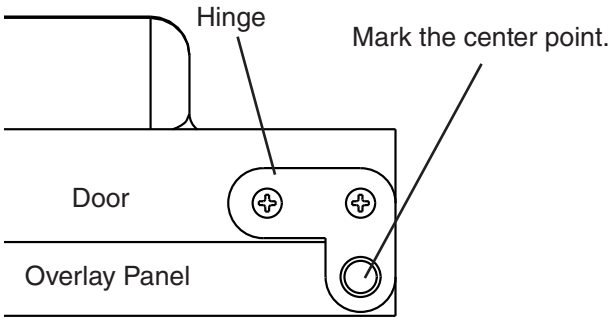


Fig. 19

12) Drill 3/8" diameter holes 1/4" (7 mm) deep where you marked on the overlay panel to accommodate the hinge (C1) and hinge (C2) bushings.

(4) Attachment of Overlay Panel to Door

1) Fasten the sheet metal bracket to the overlay panel using the two M4×8 truss head screws provided. ***Snug the screws, but do not tighten.*** See Fig. 20.

2) Temporarily fasten the overlay panel to the door using 2 of the M4×25 pan head screws provided. See Fig. 21.

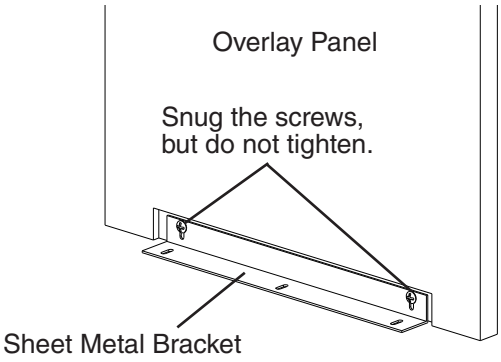


Fig. 20

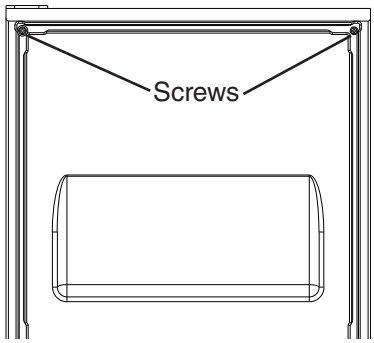


Fig. 21

3) Adjust the sheet metal bracket so that it is flush with the bottom of the door. See Fig. 22.

4) Remove the overlay panel from the door and tighten the two M4×8 truss head screws securing the sheet metal bracket to the overlay panel. See Fig. 23.

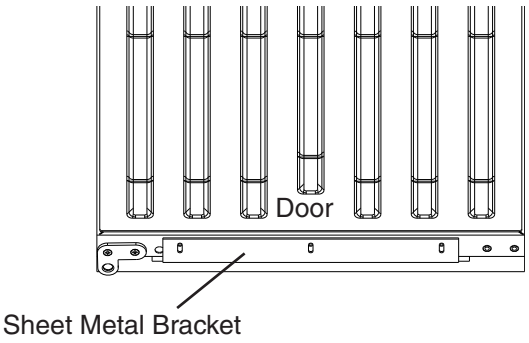


Fig. 22

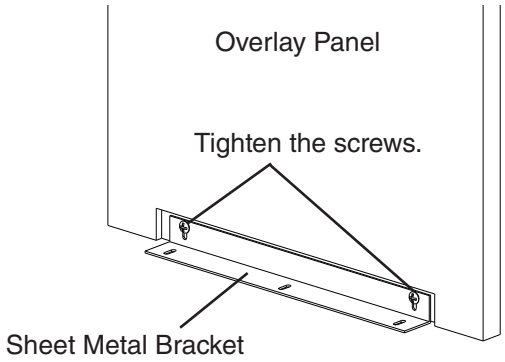


Fig. 23

5) Fasten the overlay panel to the door using the four M4×25 pan head screws provided. ***Snug the screws, but do not tighten.*** See Fig. 24.

6) Fasten the sheet metal bracket to the bottom of the door with the three T2 screws provided. Tighten the screws to the door. See Fig. 25.

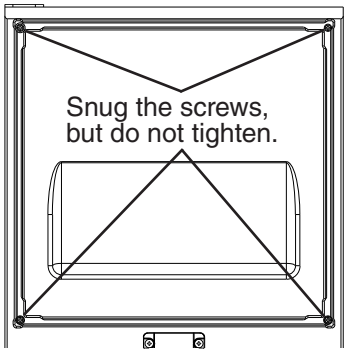


Fig. 24

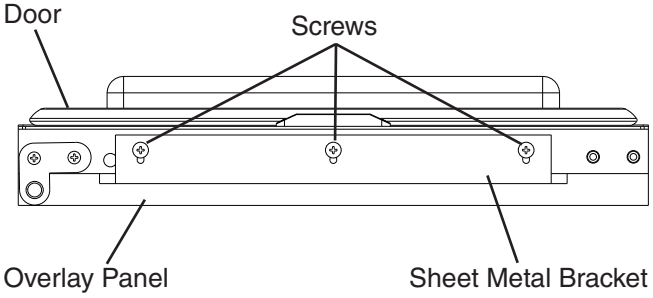


Fig. 25

7) Tighten the four M4×25 pan head screws installed in step 5. See Fig. 26.

8) Replace the door gasket in its proper orientation. Reinsert the bushings into hinge (C1) and hinge (C2) (the hinges attached to the door). See Fig. 27.

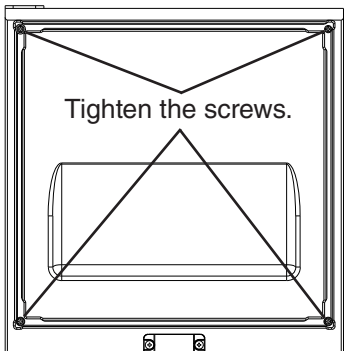


Fig. 26

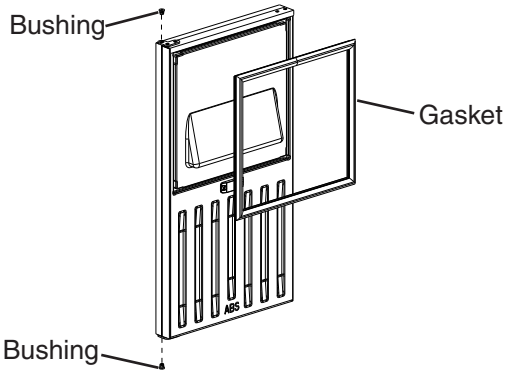


Fig. 27

9) Attach the door to hinge (A), then continue to maintain a hold on the door. Screw the hinge stop pin into hinge (B) until it is tight. See Fig. 28.

10) Insert the 2 canoe clips included in the accessory bag into the holes on top of the door. See Fig. 29.

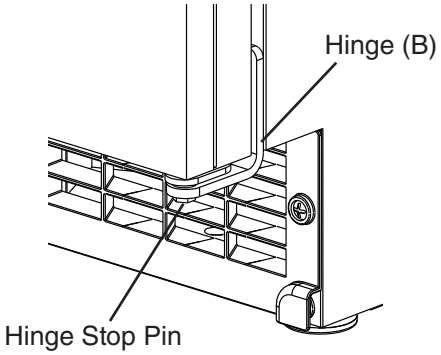


Fig. 28

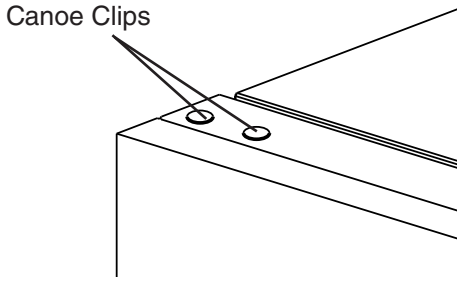


Fig. 29

D. Setup

1) Position the appliance in the selected permanent location.

2) Level the appliance from side-to-side and front-to-rear by adjusting the feet.

E. Electrical Connection

⚠ WARNING

- Electrical connection must meet national, state, and local electrical code requirements. Failure to meet these code requirements could result in death, electric shock, serious injury, fire, or damage.
- The appliance requires an independent power supply of proper capacity. See the nameplate for electrical specifications. Failure to use an independent power supply of proper capacity can result in a tripped breaker, blown fuse, damage to existing wiring, or component failure. This could lead to heat generation or fire.
- **THE APPLIANCE MUST BE GROUNDED:** The appliance is equipped with a NEMA 5-15 three-prong grounding plug to reduce the risk of potential shock hazards. It must be plugged into a properly grounded, independent 3-prong wall outlet. If the outlet is a 2-prong outlet, it is your personal responsibility to have a qualified electrician replace it with a properly grounded, independent 3-prong wall outlet. Do not remove the ground prong from the power cord and do not use an adapter plug. Failure to properly ground the appliance could result in death or serious injury.
- Do not use an extension cord.
- To reduce the risk of electric shock, do not touch the control switch or plug with damp hands. Make sure the control switch is in the "OFF" position before plugging in or unplugging the appliance.
- Do not use an appliance with a damaged power cord. The power cord should not be altered, jerked, bundled, weighed down, pinched, or tangled. Such actions could result in electric shock or fire. To unplug the appliance, be sure to pull the plug, not the cord, and do not jerk the cord.
- The GREEN ground wire in the factory-installed power cord is connected to the appliance. If it becomes necessary to remove or replace the power cord, be sure to connect the power cord's ground wire to this screw upon reattachment.

- Usually an electrical permit and services of a licensed electrician are required.
- The maximum allowable voltage variation is ±10 percent of the nameplate rating.
- For optional drain pump (HS-5061) installation, refer to the instructions included with the pump.

F. Water Supply and Drain Connections

⚠ WARNING

Water supply and drain connections must be installed in accordance with applicable national, state, and local regulations.

NOTICE

- Normal operating water temperature must be within 45°F to 90°F (7°C to 32°C). Operation of the appliance, for extended periods, outside of this normal temperature range may affect appliance performance.
- Water supply pressure must be a minimum of 7 PSIG and a maximum of 113 PSIG. If the pressure exceeds 113 PSIG, the use of a pressure reducing valve is required.
- External filters, strainers, or softeners may be required depending on water quality. Contact your local Hoshizaki Certified Service Representative or local Hoshizaki distributor for recommendations.
- Connect to potable water supply only. Do not connect to a hot-water supply.
- In areas where water damage is a concern, install in a contained area with a floor drain.
- Water line installation to the appliance is not warranted by Hoshizaki.
- Water-hammer issues must be resolved by a qualified plumber before installing the appliance. Water hammer can cause appliance damage that may lead to water leakage or flooding.
- A minimum of 1/2" nominal ID hard pipe or equivalent is required for the drain line. Installing a smaller diameter drain line will reduce water flow and may lead to water leakage or flooding.
- If using the optional drain pump (HS-5061), test its operation every time the appliance is cleaned and sanitized. See "IV.E. Optional Drain Pump HS-5061" for details. If the optional drain pump is not operating properly, water could back up and overflow, leading to costly water damage.

Water Supply Inlet	Minimum Water Supply Line Size	Drain Outlet	Minimum Drain Line Size
1/2" Female Pipe Thread (FPT)	1/4" Nominal ID Copper Water Tubing or Equivalent	1/2" Female Pipe Thread (FPT)	1/2" Nominal ID Hard Pipe or Equivalent

- A plumbing permit and services of a licensed plumber may be required in some areas.
- A water supply line shut-off valve and drain valve must be installed.
- Be sure there is sufficient extra water supply line and drain line for the appliance to be pulled out for service.
- Drain line should not be piped directly to the sewer system. An air gap of a minimum of 2 vertical inches (5 cm) must be between the end of the drain pipe from the appliance and the floor drain.

- For gravity drain installation, drain must have 1/4" fall per foot (2 cm per 1 m) on horizontal runs to get good flow. A vented tee connection is also required for proper flow. Extend the vent at least 12" (30 cm) above the drain outlet.
- For optional drain pump installation, refer to the instructions included with the pump.

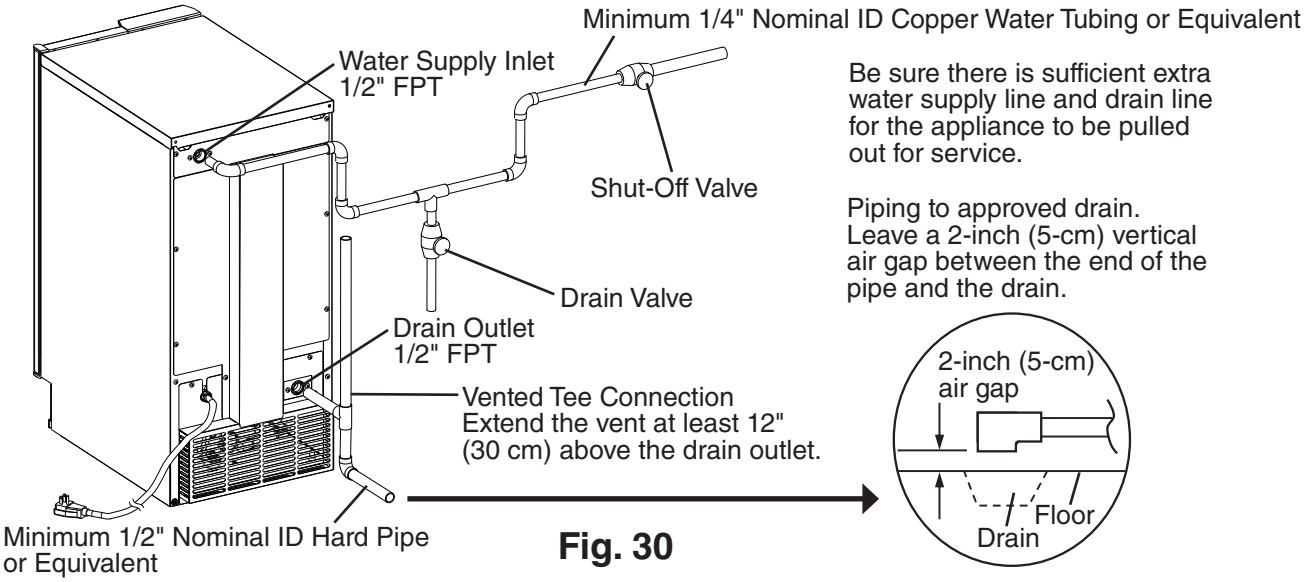


Fig. 30

G. Final Checklist

⚠ WARNING

CHOKING HAZARD: Ensure all components, fasteners, and thumbscrews are securely in place after installation. Make sure that none have fallen into the storage bin.

1) Is the appliance level?
2) Is the appliance in a site where the ambient temperature is within 45°F to 100°F (7°C to 38°C) and the water temperature within 45°F to 90°F (7°C to 32°C) all year around?
3) Have the shipping carton, tape, and packing material been removed from the appliance? Has the protective plastic film been removed from the panels?
4) Have all electrical and water connections been made? Do electrical and water connections meet all national, state, and local code and regulation requirements?
5) Has the power supply voltage been checked or tested against the nameplate rating? Is the power supply a properly grounded, independent 3-prong wall outlet?
6) Are the water supply and drain lines sized as specified? Are the water supply line shut-off valve and drain valve installed? Has the water supply pressure been checked to ensure a minimum of 7 PSIG and a maximum of 113 PSIG?
7) Are all components, fasteners, and thumbscrews securely in place?
8) Has the end user been given this instruction manual, and instructed on how to operate the appliance and the importance of the recommended periodic maintenance?
9) Has the end user been given the name and telephone number of an authorized service agent?
10) Has the warranty tag been filled out and forwarded to the factory for warranty registration?

III. Operating Instructions

A. Important Notes About Usage

⚠ WARNING

- Only qualified service technicians should install and service the appliance.
- Failure to install, operate, and maintain the equipment in accordance with this manual will adversely affect safety, performance, component life, and warranty coverage.
- To reduce the risk of electric shock, do not touch the control switch or plug with damp hands. Make sure the control switch is in the "OFF" position before plugging in or unplugging the appliance.
- The appliance must be maintained in accordance with the instruction manual and labels provided with the appliance. Consult with your local Hoshizaki Certified Service Representative about maintenance service.
- The appliance must be cleaned and sanitized at least twice a year. More frequent cleaning and sanitizing may be required in some water conditions.
- Wash your hands before removing ice. Use the plastic scoop provided.
- Do not place fingers or any other objects into the ice discharge opening.
- The appliance is not intended for use by persons (including children) with reduced physical, sensory, or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.
- Young children should be properly supervised around the appliance.
- Do not climb, stand, or hang on the appliance or appliance door or allow children or animals to do so. Serious injury could occur or the appliance could be damaged.
- Be careful not to pinch fingers when opening and closing the door. Be careful when opening and closing the door when children are in the area.
- Do not use combustible spray or place volatile or flammable substances near the appliance. They might catch fire.
- Keep the area around the appliance clean. Dirt, dust, or insects in the appliance could cause harm to individuals or damage to the appliance.

NOTICE

- Protect the floor when moving the appliance to prevent damage to the floor.
- If using the optional drain pump (HS-5061), test its operation every time the appliance is cleaned and sanitized. See "IV.E. Optional Drain Pump HS-5061" for details. If the optional drain pump is not operating properly, water could back up and overflow, leading to costly water damage.
- To help ensure the storage bin drain remains clear, follow the instructions in "IV.C. Storage Bin Drain" once every 3 months or as often as necessary for conditions. If the storage bin drain becomes clogged, water could build up in the bin and overflow, leading to costly water damage.
- If water collects in the bin and will not drain, turn off the appliance and close the water supply line shut-off valve. Call for service.
- If water seeps from the base of the appliance, turn off the appliance and close the water supply line shut-off valve. Call for service. Failure to do so could lead to costly water damage.
- Do not leave the appliance on during extended periods of non-use, extended absences, or in sub-freezing temperatures. To properly prepare the appliance for these occasions, follow the instructions in "V. Preparing the Appliance for Periods of Non-Use."
- Keep ventilation openings, in the appliance enclosure or in the built-in structure, clear of obstruction.
- Do not place objects on top of the appliance.
- The storage bin is for ice use only. Do not store anything else in the storage bin.

If ice is not used on a regular basis, it may bond together in the storage bin. In this case, discard the bonded ice and allow the appliance to make fresh ice.

B. Startup

⚠ WARNING

All parts are factory-adjusted. Improper adjustments may adversely affect safety, performance, component life, and warranty coverage.

NOTICE

- If the appliance is turned off, wait for at least 3 minutes before restarting the appliance to prevent damage to the compressor.
- At startup, confirm that all internal and external connections are free of leaks.

1) Open the water supply line shut-off valve.
2) Make sure the control switch is in the "OFF" position. Plug the appliance into the electrical outlet. **WARNING! To reduce the risk of electric shock, do not touch the control switch or plug with damp hands. If you have to slide the appliance back for a built-in installation, make sure you do not damage or pinch the water supply line, drain line, or power cord.**
3) If required by sanitation code in your area, seal the perimeter where the appliance touches the floor with approved caulk compound in a smooth and easily cleanable manner.
4) Move the control switch to the "ICE" position to start the automatic icemaking process.
5) Once the appliance starts to produce ice, allow it to run for another 30 minutes.
6) Move the control switch to the "OFF" position.
7) Remove the ice produced, then clean the storage bin liner, door liner, and door gasket using a neutral cleaner. Rinse thoroughly after cleaning.
8) Move the control switch to the "ICE" position to start the automatic icemaking process.
9) To confirm bin control operation, hold ice in contact with the bin control thermostat bulb. If the icemaker does not stop within 10 seconds, the bin control thermostat must be adjusted. Installations at higher altitude locations are more likely to require adjustment.

IV. Maintenance

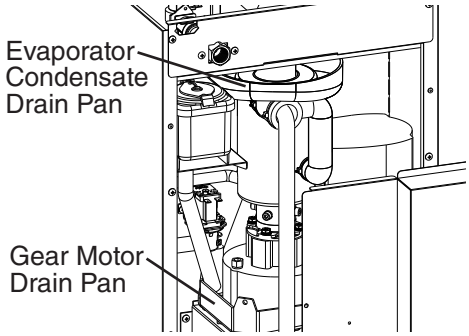
The appliance must be maintained in accordance with the instruction manual and labels provided with the appliance. Consult with your local Hoshizaki Certified Service Representative about maintenance service. To obtain the name and phone number of your local Hoshizaki Certified Service Representative, visit www.hoshizaki.com.

⚠ WARNING

- Only qualified service technicians should service the appliance.
- Failure to install, operate, and maintain the equipment in accordance with this manual will adversely affect safety, performance, component life, and warranty coverage.
- To reduce the risk of electric shock, do not touch the control switch or plug with damp hands. Make sure the control switch is in the "OFF" position before plugging in or unplugging the appliance.
- Move the control switch to the "OFF" position and unplug the appliance from the electrical outlet before servicing.
- **CHOKING HAZARD:** Ensure all components, fasteners, and thumbscrews are securely in place after any maintenance is done to the appliance. Make sure that none have fallen into the storage bin.
- Do not place fingers or any other objects into the ice discharge opening.
- After service, make sure that there are no wires pinched between the panels and appliance. Make sure you do not damage or pinch the water supply line, drain line, or power cord.

A. Maintenance Schedule

The maintenance schedule below is a guideline. More frequent maintenance may be required depending on water quality, the appliance's environment, and local sanitation regulations.

Maintenance Schedule		
Frequency	**Area**	**Task**
Weekly	Scoop	Clean the scoop using a neutral cleaner. Rinse thoroughly after cleaning.
Monthly	Drain the Appliance	Move the control switch to the "DRAIN" position. Allow the water system to drain for 1 minute. Clear ice away from the thermostatic bin control bulb. Move the control switch to the "ICE" position. After the gear motor starts, move the control switch to the "DRAIN" position. Allow the water system to drain for 1 minute. Move the control switch to the "ICE" position to start the automatic icemaking process.
	Appliance Exterior	Wipe down with clean, soft cloth. Use a damp cloth containing a neutral cleaner to wipe off oil or dirt build up. Clean any chlorine staining (rust colored spots) using a non-abrasive cleanser.
Every 3 Months	Storage Bin Drain	Maintain as outlined in "IV.C. Storage Bin Drain."
Every 6 Months	Icemaker and Storage Bin	Clean and sanitize per the cleaning and sanitizing instructions provided in this manual. See "IV.B. Cleaning and Sanitizing Instructions."
	Evaporator Condensate Drain Pan and Gear Motor Drain Pan	Wipe down with clean cloth and warm water. 
	Optional Drain Pump (HS-5061)	Test as outlined in "IV.E. Optional Drain Pump HS-5061."
	External Water Filters	Check for proper pressure and change if necessary.
Yearly	Water Supply Inlet	Close the water supply line shut-off valve and drain the water system. Clean the water supply inlet screen.
	Condenser	Inspect. Clean if necessary. See "IV.D. Condenser."
	Water Hoses	Inspect the water hoses and clean/replace if necessary.
	Upper Bearing (extruding head)	Check for wear using .02" round stock or pin gauge. Replace both upper bearing and lower bearing if wear exceeds factory recommendations. See the Service Manual for details.
After 3 Years, then Yearly	Upper Bearing (extruding head); Lower Bearing and O-Ring (lower housing); Mechanical Seal; Evaporator Cylinder; Auger	Inspect. Replace both upper bearing and lower bearing if wear exceeds factory recommendations. Replace the mechanical seal if the seal's contact surfaces are worn, cracked, or scratched.

B. Cleaning and Sanitizing Instructions

The appliance must be cleaned and sanitized at least twice a year. More frequent cleaning and sanitizing may be required in some conditions.

⚠ WARNING

- To prevent injury to individuals and damage to the appliance, do not use ammonia type cleaners.
- Carefully follow any instructions provided with the cleaning and sanitizing solutions.
- Always wear liquid-proof gloves and goggles to prevent the cleaning and sanitizing solutions from coming into contact with skin or eyes.
- Do not use ice made from the cleaning and sanitizing solutions. After cleaning and sanitizing, be careful not to leave any solution in the appliance.
- Do not place fingers or any other objects into the ice discharge opening (extruding head).

1. Cleaning Solution

Dilute 1.6 fl. oz. (47 ml or 3.2 tbs) of Hoshizaki "Scale Away" or Nu-Calgon "Liquid Ice Machine Cleaner" with 1 qt (1 l) of warm water. This is a minimum amount. Make more solution if necessary. ***IMPORTANT!*** **For safety and maximum effectiveness, use the solution immediately after dilution.**

2. Cleaning Procedure

1) Move the control switch to the "OFF" position.
2) Remove all ice from the storage bin.
3) Move the control switch to the "DRAIN" position.
4) Allow the water system to drain for 1 minute.
5) Move the control switch to the "OFF" position.
6) Using a clean funnel and hose (not included), pour 1 qt (1 l) of cleaning solution over the extruding head. See Fig. 31. Allow the appliance to sit for 10 minutes before operation.

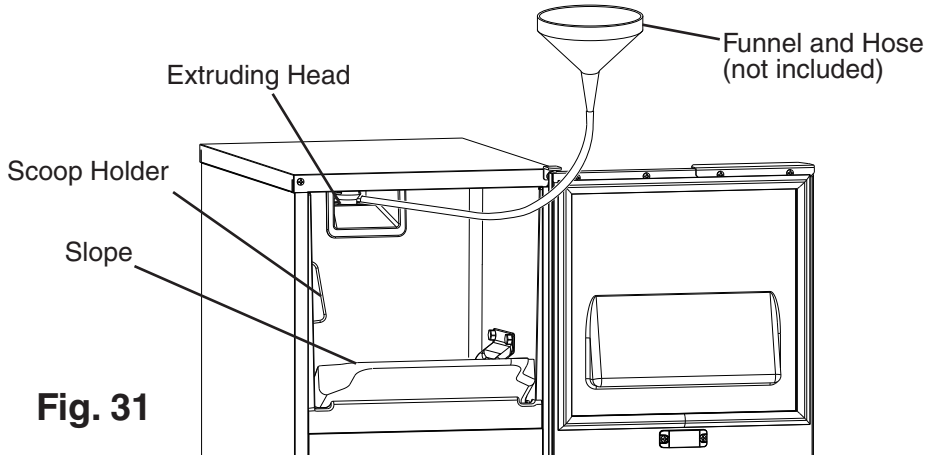


Fig. 31

7) Make sure at least 10 minutes have elapsed since you poured the cleaning solution over the extruding head, then move the control switch to the "ICE" position.

8) Allow the appliance to make ice for 20 minutes, then move the control switch to the "DRAIN" position.

9) Allow the water system to drain for 1 minute.

10) Move the control switch to the "ICE" position.

11) After the gear motor starts, move the control switch to the "DRAIN" position.

12) Allow the water system to drain for 1 minute.

13) Move the control switch to the "OFF" position. In severe water conditions, repeat the cleaning procedure.
Note: If you do not sanitize the appliance, go to step 8 in "IV.B.5. Sanitizing Procedure - Final."

3. Sanitizing Solution

Dilute 1.25 fl. oz. (37 ml or 2.5 tbs) of a 5.25% sodium hypochlorite solution (chlorine bleach) with 2.5 gallons (9.5 l) of warm water. This is a minimum amount. Make more solution if necessary. Using a chlorine test strip or other method, confirm that you have a concentration of about 200 ppm. ***IMPORTANT!*** **For safety and maximum effectiveness, use the solution immediately after dilution.**

4. Sanitizing Procedure - Initial

1) Using a clean funnel and hose, pour 1 qt (1 l) of sanitizing solution over the extruding head. Allow the appliance to sit for 10 minutes before operation.

2) Remove the slope from the storage bin by carefully bending it in the center and releasing it from the 2 slope shafts.

3) Remove the scoop. Remove the 2 thumbscrews securing the scoop holder, then remove it.

4) Pour some of the sanitizing solution into a separate, clean container. Using this sanitizing solution and a clean cloth, wipe down the slope, scoop, scoop holder, inside of the spout, and bin liner.

5) Rinse the parts and areas sanitized in step 4 thoroughly with clean water.

6) Replace all removed parts in their original and correct positions. **WARNING! CHOKING HAZARD: Ensure all components, fasteners, and thumbscrews are securely in place. Make sure that none have fallen into the storage bin.**

7) Make sure at least 10 minutes have elapsed since you poured the sanitizing solution over the extruding head, then move the control switch to the "ICE" position.

8) Allow the appliance to make ice for 20 minutes, then move the control switch to the "DRAIN" position.

9) Allow the water system to drain for 1 minute.

10) Move the control switch to the "ICE" position.

11) After the gear motor starts, move the control switch to the "DRAIN" position.

12) Allow the water system to drain for 1 minute.

13) Move the control switch to the "OFF" position.

5. Sanitizing Procedure - Final

1) Using a clean funnel and hose, pour 1 qt (1 l) of sanitizing solution over the extruding head. Allow the appliance to sit for 10 minutes before operation.
2) Move the control switch to the "ICE" position.
3) Allow the appliance to make ice for 20 minutes, then move the control switch to the "DRAIN" position.
4) Allow the water system to drain for 1 minute.
5) Move the control switch to the "ICE" position.
6) After the gear motor starts, move the control switch to the "DRAIN" position.
7) Allow the water system to drain for 1 minute.
8) Move the control switch to the "ICE" position and allow the appliance to run. Check for leaks.
9) After 30 minutes, move the control switch to the "OFF" position.
10) Pour warm water into the storage bin to melt all of the ice, then clean the storage bin liner, door liner, and door gasket with a neutral cleaner. Rinse thoroughly after cleaning.
11) Move the control switch to the "ICE" position to start the automatic icemaking process.

C. Storage Bin Drain

In some conditions, slime may build up inside the storage bin drain and prevent water from draining properly. To prevent this buildup, perform the following procedure once every 3 months or as often as necessary for conditions.

NOTICE
If the storage bin drain becomes clogged, water could build up in the bin and overflow, leading to costly water damage.

1) Move the control switch to the "OFF" position. **WARNING! To reduce the risk of electric shock, do not touch the control switch with damp hands.**
2) Remove all ice from the storage bin.
3) Mix a batch of sanitizing solution by diluting 1.25 fl. oz. (37 ml or 2.5 tbs) of a 5.25% sodium hypochlorite solution (chlorine bleach) with 2.5 gallons (9.5 l) of warm water. Using a chlorine test strip or other method, confirm that you have a concentration of about 200 ppm. ***IMPORTANT!*** **For safety and maximum effectiveness, use the solution immediately after dilution.**
4) Slowly pour the sanitizing solution into the storage bin.
5) After all of the solution has drained, clean the storage bin liner with a neutral cleaner. Rinse thoroughly with clean water.
6) Move the control switch to the "ICE" position to start the automatic icemaking process.

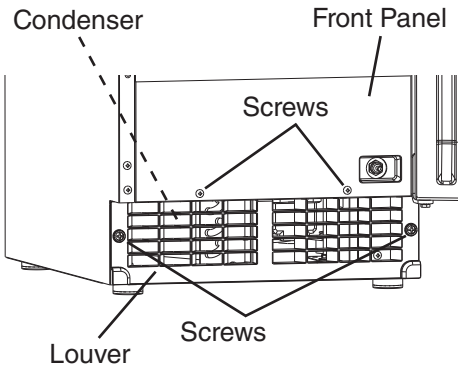
D. Condenser

Check the condenser once a year, and clean if required by following the steps below. More frequent cleaning may be required depending on location.

⚠ WARNING
Condenser fins are sharp. Use care when cleaning.

1) Move the control switch to the "OFF" position, then unplug the appliance from the electrical outlet. **WARNING! To reduce the risk of electric shock, do not touch the control switch or plug with damp hands.**
2) Remove the screws securing the front panel, then remove it. See Fig. 32.
3) Remove the screws securing the louver, then remove it.
4) Use a brush attachment on a vacuum cleaner to gently clean the condenser fins. Do not use too much force, otherwise the fins could be damaged.
5) Replace the louver and front panel in their correct positions. Ensure that the screws are securely in place.
6) Plug the appliance back in. Move the control switch to the "ICE" position to start the automatic icemaking process.

Fig. 32



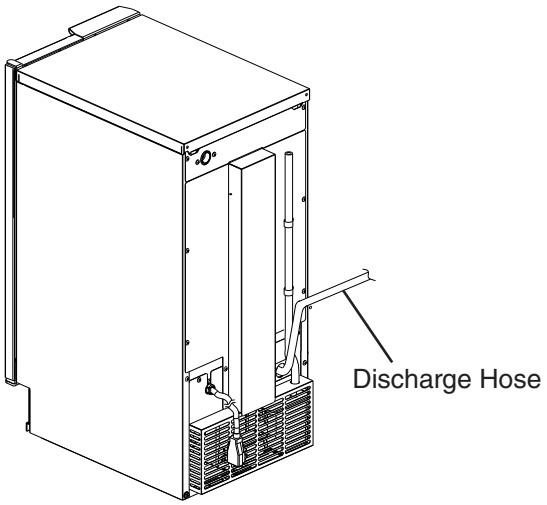
E. Optional Drain Pump HS-5061

If the optional drain pump (HS-5061) is installed, test its operation at least twice a year as outlined below. Note that the pump has power even when the control switch is in the "OFF" position.

NOTICE
If the optional drain pump is not operating properly, it will adversely affect performance, component life, and warranty coverage and may result in costly water damage.

1) Move the control switch to the "OFF" position, then unplug the appliance from the electrical outlet. **WARNING! To reduce the risk of electric shock, do not touch the control switch or plug with damp hands.**
2) Remove all ice from the storage bin.
3) Plug the appliance back in.
4) Slowly pour 24 to 30 oz. (710 to 890 ml) of water over the storage bin drain hole in the storage bin.
5) If water pumps out properly and the drain pump then de-energizes, proceed to step 6. If water does not pump out properly and/or the drain pump does not de-energize, the appliance must be serviced by a qualified service technician before proceeding.
6) Move the control switch to the "ICE" position.
7) Pour another 24 to 30 oz. (710 to 890 ml) of water into the appliance's ice storage bin, then completely restrict the discharge hose while the drain pump is operating. See Fig. 33. Pour more water into the appliance's ice storage bin until the appliance turns off. The drain pump will continue to operate. Check for leaks.
8) Remove the discharge hose restriction and allow the water to be pumped out normally. Power to the appliance will be restored when the water in the drain pump returns to a normal level.
9) If the appliance fails to turn off with the discharge hose restricted or the pump fails to pump out the water, the appliance must be serviced by a qualified service technician.

Fig. 33



V. Preparing the Appliance for Periods of Non-Use

During extended periods of non-use, extended absences, or in sub-freezing temperatures, follow the instructions below. When the appliance is not used for two or three days under normal conditions, it is sufficient to move the control switch to the "OFF" position.

⚠ WARNING

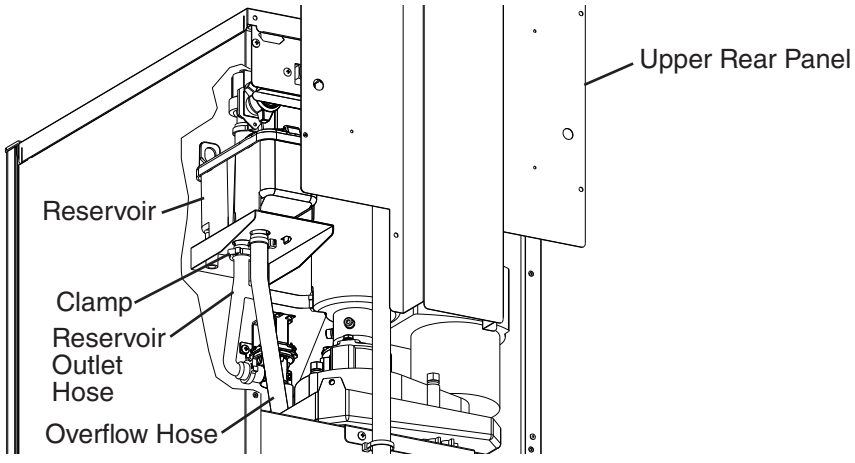
Only qualified service technicians should service the appliance.

NOTICE

During extended periods of non-use, extended absences, or in sub-freezing temperatures, follow the instructions below to reduce the risk of costly water damage.

1) Move the control switch to the "OFF" position. **WARNING! To reduce the risk of electric shock, do not touch the control switch or plug with damp hands.**
2) Close the water supply line shut-off valve, then open the water supply line drain valve.
3) Allow the line to drain by gravity.
4) Move the control switch to the "DRAIN" position.
5) Allow the water system to drain for 1 minute.
6) Attach a compressed air or carbon dioxide supply to the water supply line drain valve.
7) Move the control switch to the "ICE" position.
8) Blow the water supply line out using the compressed air or carbon dioxide supply.
9) Close the water supply line drain valve.
10) Move the control switch to the "OFF" position, then unplug the appliance from the electrical outlet.
11) Remove the screws securing the upper rear panel, then remove it. See Fig. 34.
12) Remove the clamp securing the reservoir outlet hose to the reservoir. Disconnect the reservoir outlet hose from the reservoir.
13) Attach a compressed air or carbon dioxide supply to the reservoir outlet hose.

Fig. 34



14) Plug the appliance back in, then move the control switch to the "DRAIN" position.

15) Blow out the reservoir outlet hose using the compressed air or carbon dioxide supply.

16) Move the control switch to the "OFF" position, then unplug the appliance from the electrical outlet.

17) Reconnect the reservoir outlet hose to the reservoir, then secure with the clamp. Make sure all hoses are connected and secure.

18) Replace the rear panel in its correct position.

19) Clean the storage bin by using a neutral cleaner. Rinse thoroughly after cleaning.

VI. Disposal

The appliance contains refrigerant and must be disposed of in accordance with applicable national, state, and local codes and regulations. Refrigerant must be recovered by properly certified service personnel.

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KitchenAid®

COMMERCIAL-STYLE GAS COOKTOP USE AND CARE GUIDE

TABLE DE CUISSON À GAZ DE STYLE COMMERCIAL

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In Canada, for assistance, installation and service, call: **1-800-807-6777** or visit our website at **www.Kitchenaid.ca**.

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SAFETY INFORMATION

Your safety and the safety of others are very important.

We have provided many important safety messages in this manual and on your appliance. Always read and obey all safety messages.



This is the safety alert symbol.

This symbol alerts you to potential hazards that can kill or hurt you and others.

All safety messages will follow the safety alert symbol and either the word “DANGER” or “WARNING.” These words mean:

⚠ DANGER — **You can be killed or seriously injured if you don't immediately follow instructions.**

⚠ WARNING — **You can be killed or seriously injured if you don't follow instructions.**

All safety messages will tell you what the potential hazard is, tell you how to reduce the chance of injury, and tell you what can happen if the instructions are not followed.

WARNING: If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or death.

– Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

– WHAT TO DO IF YOU SMELL GAS:

- **Do not try to light any appliance.**
- **Do not touch any electrical switch.**
- **Do not use any phone in your building.**
- **Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.**
- **If you cannot reach your gas supplier, call the fire department.**

– Installation and service must be performed by a qualified installer, service agency or the gas supplier.

WARNING: Gas leaks cannot always be detected by smell.

Gas suppliers recommend that you use a gas detector approved by UL or CSA.

For more information, contact your gas supplier.

If a gas leak is detected, follow the “What to do if you smell gas” instructions.

State of California Proposition 65 Warnings:

WARNING: This product contains one or more chemicals known to the State of California to cause cancer.

WARNING: This product contains one or more chemicals known to the State of California to cause birth defects or other reproductive harm.

IMPORTANT SAFETY INSTRUCTIONS

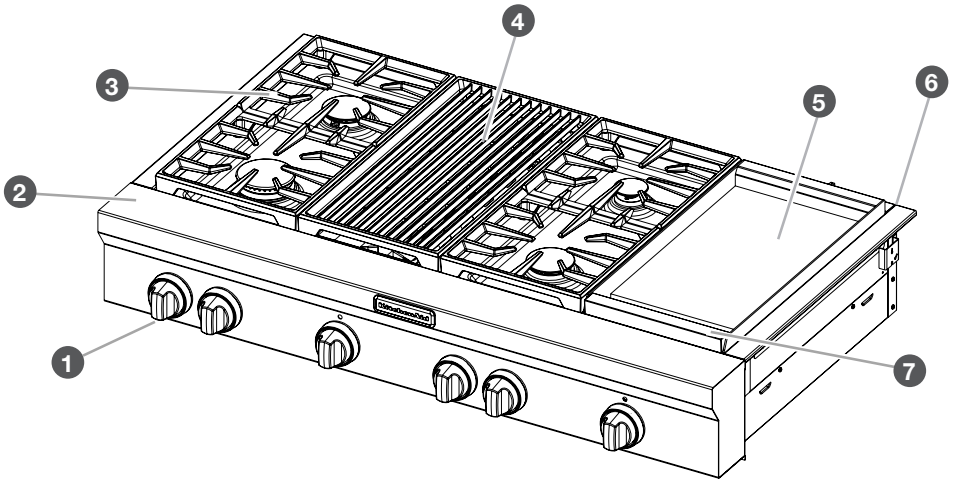
WARNING: To reduce the risk of fire, electrical shock, injury to persons, or damage when using the cooktop, follow basic precautions, including the following:

- **WARNING:** NEVER use this appliance as a space heater to heat or warm the room. Doing so may result in carbon monoxide poisoning and overheating of the cooktop.
- **CAUTION:** Do not store items of interest to children in cabinets above the cooktop – children climbing on the cooktop to reach items could be seriously injured.
- Proper Installation – The cooktop, when installed, must be electrically grounded in accordance with local codes or, in the absence of local codes, with the *National Electrical Code, ANSI/NFPA70 or the Canadian Electrical Code, Part 1*. Be sure the cooktop is properly installed and grounded by a qualified technician.
- This cooktop is equipped with a three-prong grounding plug for your protection against shock hazard and should be plugged directly into a properly grounded receptacle. Do not cut or remove the grounding prong from this plug.
- Disconnect the electrical supply before servicing the cooktop.
- Injuries may result from the misuse of the cooktop such as stepping, leaning, or sitting on the top surface.
- Maintenance – Keep cooktop area clear and free from combustible materials, gasoline, and other flammable vapors and liquids.
- Storage on the cooktop – Flammable materials should not be stored on or near surface units.
- Top burner flame size should be adjusted so it does not extend beyond the edge of the cooking utensil.

SAVE THESE INSTRUCTIONS

PARTS AND FEATURES

This manual covers several different models. The cooktop you have purchased may have some or all of the items listed. The locations and appearances of the features shown here may not match those of your model. Refer to this manual or the Frequently Asked Questions (FAQs) section of our website at **www.kitchenaid.com** for more detailed instructions. In Canada, refer to the Customer Service Section at **www.kitchenaid.ca**.



1. **Commercial-style die cast metal control knobs**
2. **Culinary ledge**
3. **Heavy duty single grate design**
4. **Grill (on some models)**
5. **Electric chrome griddle (on some models)**
6. **Island trim**
7. **Drip tray (on griddle models)**

Not shown:

Optional 9" (22.9 cm), 22" (55.9 cm), and adjustable backguards

Optional griddle cover

Optional grill cover

Optional wok ring

Optional stainless steel knobs

BURNERS

⚠WARNING

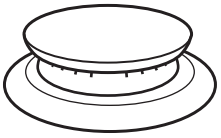
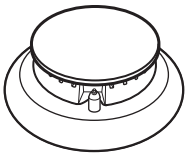
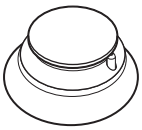


Fire Hazard

Do not let the burner flame extend beyond the edge of the pan.

Turn off all controls when not cooking.

Failure to follow these instructions can result in death or fire.

BTU/Hr	BURNER APPEARANCE	FEATURES
Ultra-Power™ dual-flame burner		This burner has an upper and lower level of flame. The Power HI setting uses both flame levels at full power to provide the highest heat. It is ideal for cooking large quantities of food or liquid and using large pots and pans. The Simmer HI and LO settings use the upper flame only.
Medium burner		This burner is ideal for cooking smaller quantities of food and melting chocolate or butter.
Simmer burner		This burner reaches a low of 500 BTU/Hr. It provides the gentle, low temperatures required for simmering soups, stewing, and melting delicate ingredients like butter, cheese, and chocolate.

Igniting Burners:

- Electric igniters automatically light the surface burners when control knobs are turned to LITE.
- Before setting a control knob, place filled cookware on the grate. Do not operate a burner using empty cookware or without any cookware on the grate.
- Visually check that the burner has lit. If the burner does not ignite, listen for the clicking sound. If you do not hear the igniter click, turn off the burner. Check for a tripped circuit breaker or blown fuse.
- Check that the control knob is pressed completely down on the valve shaft. If the spark igniter still does not operate, call a trained repair specialist.
- When the control knobs for any small or medium burner are turned to the LITE position, all small and medium burners will click. When the control knob for the large burner is turned to the LITE position, these burners will click independently of the other burners. In both cases, only the burner with the control knob turned to LITE will produce a flame.

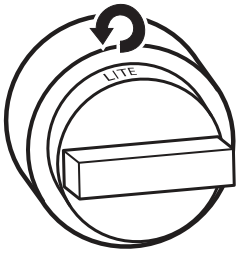
REMEMBER: When cooktop is in use or during the Self-Cleaning cycle, the entire cooktop area may become hot.

Reignition Feature

During cooktop use, if one or more burners are extinguished due to external causes (such as a water spill, wind, or ventilation draft), the ignition system will turn on to reignite the flame. When the flame comes back on, the system will stop sparking. If the draft in the room is not removed, occasional sparking may continue. Sparking may also occasionally occur when using the low setting on a burner.

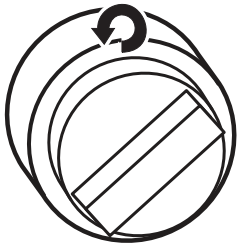
To Set a Burner:

1.



Push in and turn counterclockwise to LITE.

2.

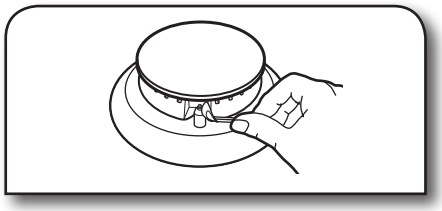


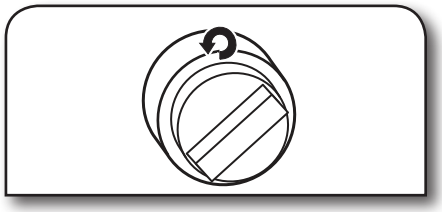
Turn knob counterclockwise between HI and LO.

Push in one more time to get from LO to HI.

In Case of Power Failure

Hold a lit match near a burner and turn knob counterclockwise to HI. After burner lights, turn knob to the desired setting.

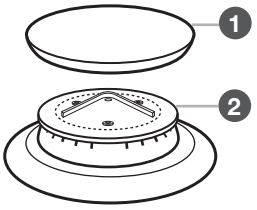




Sealed Surface Burners

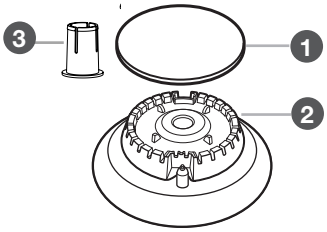
Sealed surface burners are designed to minimize gaps and seams that can allow liquids and spills to get under the cooktop. This design makes cleanup quick and easy.

Stacked Power Burner

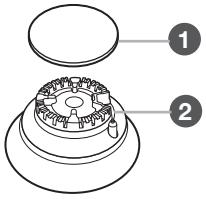


1. **Burner cap**
2. **Burner base**
3. **Choke (for use with medium burner, LP gas only)**

Medium Burner



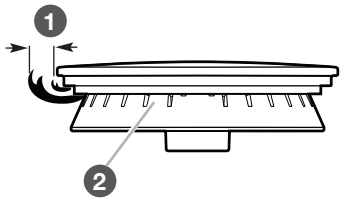
Simmer/Melt Burner



IMPORTANT: Do not obstruct the flow of combustion and ventilation air around the burner grate edges.

Burner cap: Always keep the burner cap in place when using a surface burner. A clean burner cap will help avoid poor ignition and uneven flames. Always clean the burner cap after a spillover and routinely remove and clean the caps according to the "Care and Cleaning" section.

Gas opening: Gas must flow freely throughout the gas opening for the burner to light properly. Keep this area free of soil and do not allow spills, food, cleaning agents, or any other material to enter the gas opening. Keep spillovers out of the gas opening by always using a burner cap.

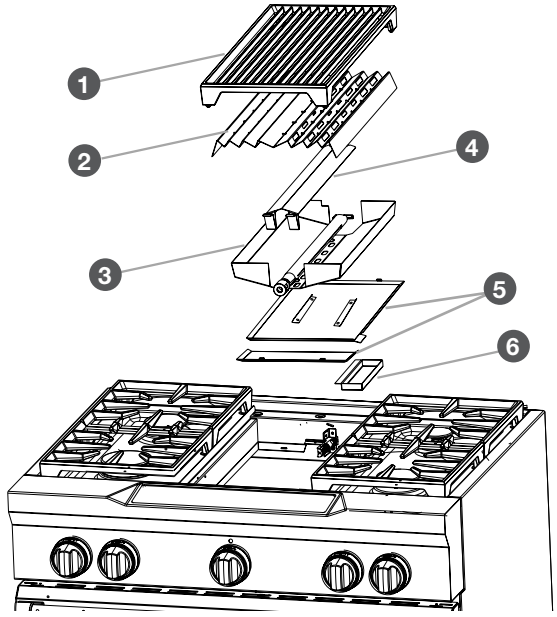


1. **1-1½" (25-38 mm)**
2. **Burner ports**

Burner ports: Check burner flames occasionally for proper size and shape as shown above. A good flame is blue in color, not yellow. Keep this area free of soil and do not allow spills, food, cleaning agents, or any other material to enter the burner ports.

GRILL (ON SOME MODELS)

The grill module consists of a cast-iron grill grate, a wave tray, a flame spreader, a burner assembly, 2 grease trays and a drip tray.



1. **Grill grate**
2. **Wave tray**
3. **Burner assembly**
4. **Flame spreader**
5. **Grease trays**
6. **Drip tray**

When using the grill, follow the guidelines below:

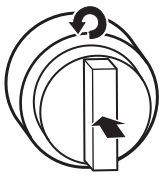
- Trim excess fat to reduce spattering. Slit the remaining fat on the edges to avoid curling.
- Allow space between food on the grill. Crowding food will result in uneven cooking.
- Use a metal spatula or tongs to turn food.
- Steaks, chops, and hamburgers should be turned only once to avoid loss of juices.
- For even cooking, foods such as chicken quarters should be turned several times.
- To check for doneness of meats and poultry, use an instant read thermometer or make a small cut in the center of the food. This will avoid loss of juices.
- Do not leave the grill unattended while cooking.
- To avoid damage to the grill, do not use aluminum foil, charcoal, or wood chips.
- To avoid damage to cookware, do not place cookware on the grill when in use. Food should be cooked directly on the grill grate.

To Use:

1.
Turn on overhead range hood.

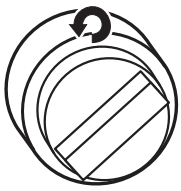
2.
Apply vegetable oil, if desired. Apply a light coating of vegetable oil or nonstick cooking spray to grill grate.

3.



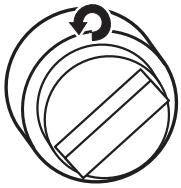
Push in and turn knob to LITE/HI. The flame will ignite in 1-4 seconds.

4.



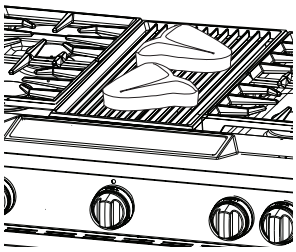
Turn knob to MED and allow grill to preheat for 15 minutes.

5.



Turn knob to desired cook setting.

6.



Place food on grill.

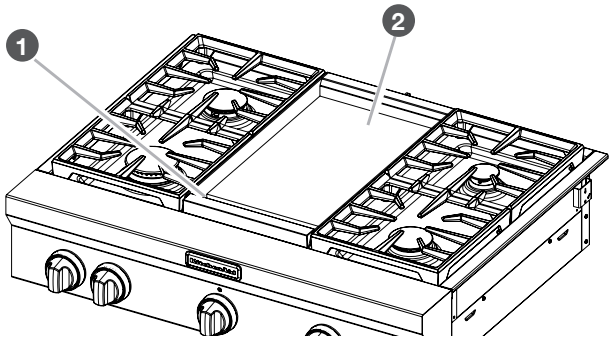
Grill Chart

The settings and times are guidelines only and may need to be adjusted for individual tastes.

FOOD	SETTING	COOK TIME TOTAL MINUTES
Steak		
1" (2.5 cm)		
medium	MED	16-20
well-done	MED	20-30
Ground Meat Patties		
½ - ¾" (1.3-1.9 cm)	MED	20-25
Pork Chops		
1" (2.5 cm)	MED	35-55
Ham Slices		
½" (1.3 cm)	MED	8-12
Frankfurters and Precooked Sausages	MED	8-15
Chicken		
Quarters	MED-LO	50-80
Breasts, boneless	MED	20-40
Fish Steaks		
¾ - 1" (1.9-2.5 cm)	MED	10-15

CHROME ELECTRIC GRIDDLE (ON SOME MODELS)

The chrome electric griddle provides the perfect cooking surface for grilled sandwiches, pancakes, eggs, burgers, sautéed vegetables, and many more family favorites. The attractive low-stick surface is designed to make cleanup easy.



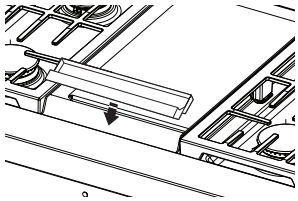
1. **Drip tray**
2. **Griddle**

The chrome electric griddle system provides an evenly heated cooking surface.

- Be sure plastic film has been removed and wash with hot water before first use.
- To avoid scratching the griddle, do not place any pots or pans on the griddle. Use only heat-resistant plastic or wooden utensils.
- The griddle surface is ready to use and does not need to be seasoned.
- Pouring cold water on a hot griddle may warp the griddle, resulting in an uneven cooking surface.

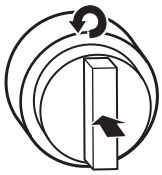
To Use:

1.



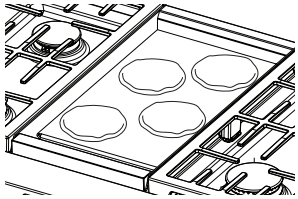
Position drip tray.

2.



Push in and turn knob.

3.



Place food on griddle and cook to desired doneness.

The griddle light will turn off when the griddle has finished preheating. The griddle light will turn on and off during use to indicate that the griddle element is maintaining the selected surface temperature.

Cooking Chart

The settings and times are guidelines only and may need to be adjusted for individual tastes.

FOOD	SETTING	COOK TIME TOTAL MINUTES
Sausage patties and links	325°F (163°C)	12-18
Bacon slices	350°F (177°C)	7-11
Ham steak (fully cooked)	325°F (163°C)	5-7
Frankfurters and precooked Sausages	325°F (163°C)	8-15
Ground meat patties	350°F (177°C)	10-15
Grilled sandwiches	325°F (163°C)	3-5
Fish steaks, fillets	325°F (163°C)	8-15
Eggs	300°F (149°C)	3-5
Hash brown potatoes	400°F to 425°F (204°C to 218°C)	8-12
French toast	350°F (177°C)	5-7
Pancakes	350°F (177°C)	2-4

COOKWARE

IMPORTANT: Do not leave empty cookware on a hot surface cooking area, element, or surface burner.

Ideal cookware should have a flat bottom, straight sides, and a well-fitting lid and the material should be of medium-to-heavy thickness.

Rough finishes may scratch the cooktop or grates. Aluminum and copper may be used as a core or base in cookware. However, when used as a base, they can leave permanent marks on the cooktop or grates.

Cookware material is a factor in how quickly and evenly heat is transferred which affects cooking results. A nonstick finish has the same characteristics as its base material. For example, aluminum cookware with a nonstick finish will take on the properties of aluminum.

Cookware with nonstick surfaces should not be used under the broiler.

Use the following chart as a guide for cookware material characteristics.

COOKWARE	CHARACTERISTICS
Aluminum	■ Heats quickly and evenly. ■ Suitable for all types of cooking ■ Medium or heavy thickness is best for most cooking tasks.
Cast iron	■ Heats slowly and evenly. ■ Good for browning and frying ■ Maintains heat for slow cooking.
Ceramic or ceramic glass	■ Follow manufacturer's instructions. ■ Heats slowly, but unevenly. ■ Ideal results on low-to-medium heat settings
Copper	■ Heats very quickly and evenly.
Earthenware	■ Follow manufacturer's instructions. ■ Use on low heat settings.
Porcelain enamel-on-steel or cast iron	■ See stainless steel or cast iron.
Stainless steel	■ Heats quickly, but unevenly. ■ A core or base of aluminum or copper on stainless steel provides even heating.

HOME CANNING

When canning for long periods, alternate the use of surface burners between batches. This allows time for the most recently used areas to cool.

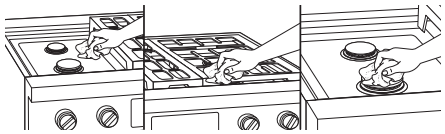
- Center the canner on the grate.
- Do not place canner on 2 surface burners at the same time.
- For more information, contact your local agricultural department. Companies that manufacture home canning products can also offer assistance.

COOKTOP SURFACE

IMPORTANT: Before cleaning, make sure all controls are OFF and the cooktop is cool. Always follow label instructions on cleaning products.

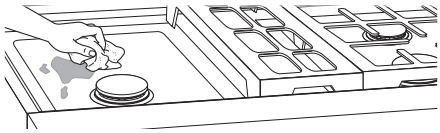
After Each Use:

1.



Wipe off cooktop, grates, and caps.

2.

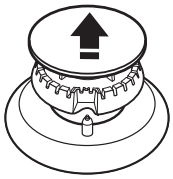


Clean food spills.

To preserve the finish, clean food spills containing acids, such as vinegar and tomato, as soon as the entire appliance is cool.

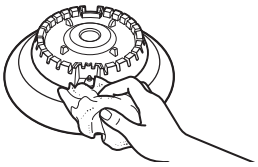
SEALED SURFACE BURNERS

1.



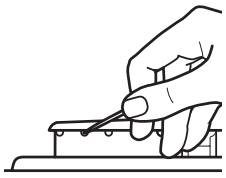
Remove burner cap and base.

2.



Wipe off cooktop, grates, and caps.

3.

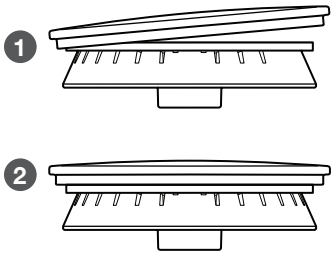


Clean clogged burner ports.

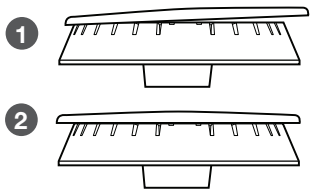
Use a straight pin. Do not enlarge or distort the port. Do not use a wooden toothpick. If the burner needs to be adjusted, contact a trained repair specialist.

4. Replace burner cap.

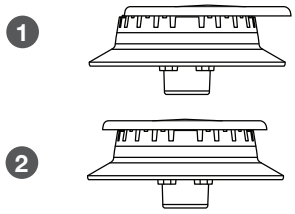
Dual-Flame Burner



Medium Burner



Simmer/Melt Burner



Make sure alignment pins are properly aligned with burner cap.

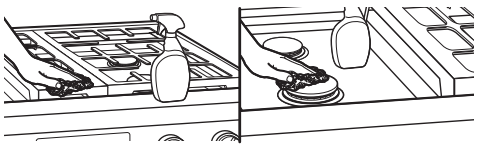
5.



Turn on burner.

If the burner does not light, check cap alignment. If the burner still does not light, do not service the sealed burner yourself. Contact a trained repair specialist.

PORCELAIN-COATED GRATES AND CAPS



Use scrub and cleanser.

Clean with a nonabrasive nylon scrub pad and mildly abrasive cleanser.

Know Your Grates and Caps

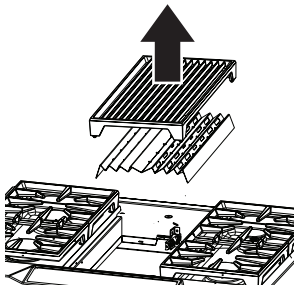
- Food spills containing acids, such as vinegar and tomato, should be cleaned as soon as the cooktop, grates, and caps are cool. These spills may affect the finish.
- To avoid chipping, do not bang grates and caps against each other or hard surfaces such as cast iron cookware.
- Do not reassemble caps on burners while wet.
- Do not clean in the Self-Cleaning cycle.
- Do not clean in dishwasher.

GRILL

To Remove:

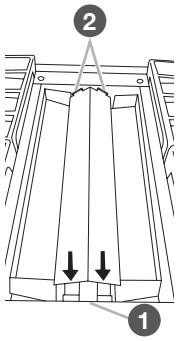
Before removing or replacing grill, make sure the control knobs are turned to OFF. Allow the grill to cool completely before handling.

1.



Remove grill grate and wave tray.

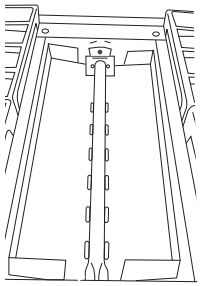
2.



1 Grill front
2 Rear tabs and slots

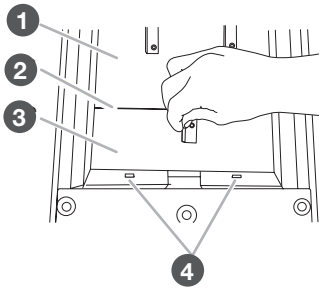
Remove flame spreader. Pull forward slightly on the flame spreader to release the tabs from the rear slots and lift out.

3.



Remove burner assembly. Lift up and out.

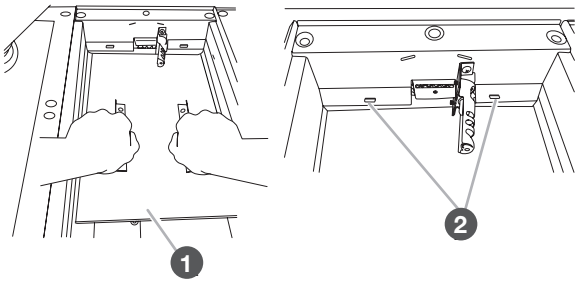
4.



1 Large grease tray
2 Grease tray connection
3 Small grease tray
4 Slots

Remove small grease tray. Unhook tabs from slots and lift slightly to disengage from the large grease tray.

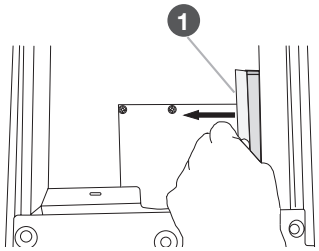
5.



1 Large grease tray
2 Slots

Remove large grease tray. Unhook slots and lift out.

6.



1 Drip tray

Remove and clean drip tray.

CARE AND CLEANING

To Clean:

Do not use oven cleaners, metal brushes, abrasive scouring pads, or other scrubbers made to clean outdoor grills.

Grate:

- Do not clean grill grate in dishwasher.
- Do not clean in a self-cleaning oven.

1.	2.
Scrub with brush while grate is still warm. Use a soft-bristle brush. Oven mitts may be worn while cleaning.	Soak in warm, soapy water for 30 minutes. After soaking, scrub with nonabrasive pad.

Wave Tray and Wave Plate:

1.

Soak in warm, soapy water to loosen soil. After soaking, scrub with non-abrasive pad. Oven cleaner may be used.

Burner Assembly:

- Do not soak in water.

1.

Wipe with warm, soapy water or non-abrasive cleanser. Use damp cloth or non-abrasive pad.

Grease Trays and Drip Tray:

- Allow cooktop to cool before cleaning.

1.

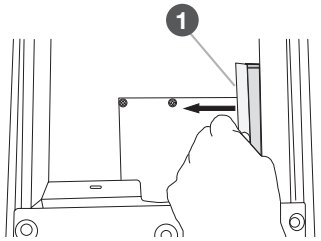
Wipe with warm, soapy water or non-abrasive cleanser. Use damp cloth or non-abrasive pad.

Module Basin:

1.	2.
Wipe with warm, soapy water or non-abrasive cleanser. Use damp cloth or non-abrasive pad.	For heavy soil, soak paper towels in household cleanser and lay them on the soil for at least 30 minutes. After soaking, scrub with a nonabrasive pad.

To Replace

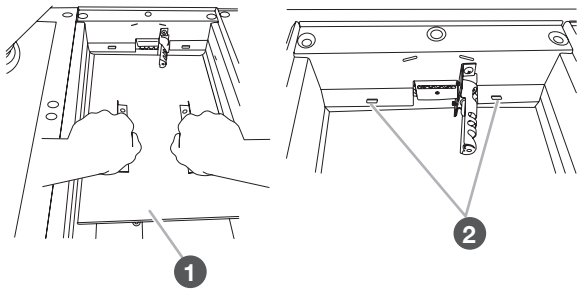
1.



1 **Drip tray**

Replace drip tray. Slide drip tray into opening on the right front side of the grill basin. Follow the guides to ensure correct placement.

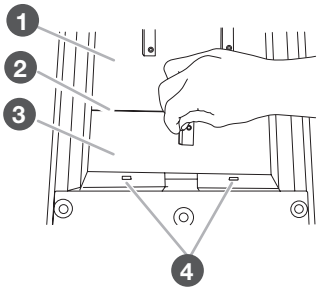
2.



1 **Large grease tray**
2 **Slots**

Replace large grease tray. Insert the large grease tray all the way under the back edge of the grill basin and hook it into the slots.

3.



1 **Large grease tray**
2 **Grease tray connection**
3 **Small grease tray**
4 **Slots**

Replace small grease tray. Insert the small grease tray all the way under the front of the grill basin and hook it into the slots.

When the 2 grease trays are installed properly, the small grease tray will hook over the large grease tray.

GRIDDLE

Tips:

- Prior to cleaning the griddle, make sure that all cooktop burners have been turned off and the oven controls have been locked.
- For best results, clean the griddle shortly after removing the food.

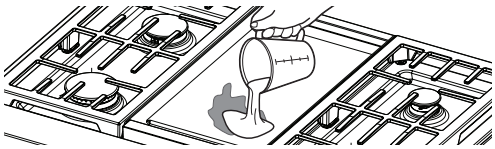
Do Not Use:

- Soap
- Abrasive materials
- Cleaning materials, including stainless steel cleaner

After Each Use:

1. Heat for 10 to 15 minutes at 300°F.

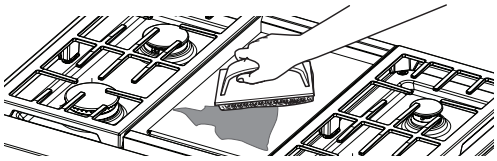
2.



Pour water on soiled area.

Using a measuring cup, pour up to 1 cup tap water over the soiled area, starting at the back, allowing the water to run toward the drip tray in the front. Allow the water to bubble on the griddle for 3–4 seconds.

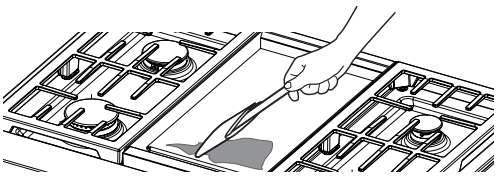
3.



Scrape residue into drip tray.

Use a pad holder or wooden spoon with non-scratch pad. Use pressure on soiled areas. Repeat if needed for heavy soils.

4.

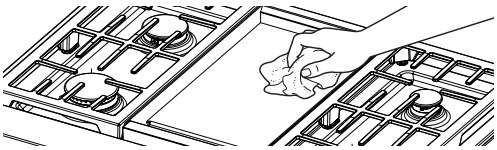


Remove remaining residue.

Fold a damp towel and, with the pad holder or wooden spoon, go over the griddle to remove remaining residue.

5. Turn off griddle and let cool.

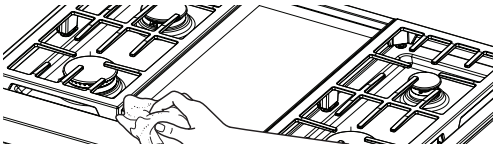
6.



Wipe off griddle.

Once cool, wipe the griddle with a clean, damp terry cloth towel. Then buff with a microfiber cloth. If streaking, rainbowing, or ghosting occurs, use a mixture of 1 part white vinegar to 2 parts water on a towel to wipe the griddle.

7.

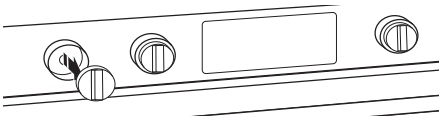


Remove, empty, and clean drip tray.

Clean the drip tray with warm soapy water. Wipe the area under the drip tray clean. Once dry, put the drip tray back in position.

COOKTOP CONTROLS

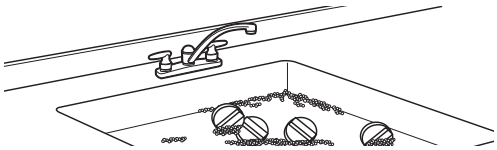
1.



Remove knobs.

Pull the knobs straight away from the control panel to remove.

2.

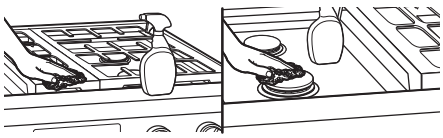


Clean with warm, soapy water.

Know Your Cooktop Controls

- To avoid damage to the cooktop controls, do not use steel wool, abrasive cleansers, or oven cleaner.
- To avoid damage, do not soak knobs.
- When replacing knobs, make sure knobs are in the OFF position.
- Do not remove seals under knobs.
- When replacing knobs after cleaning either the surface burner controls or the griddle module control, make sure the knobs are replaced to the correct location. The power burner knobs have power settings and the griddle knob has temperature settings. All other knobs have Hi, Med, Lo settings only.

STAINLESS STEEL (ON SOME MODELS)



Use cleaner or wipes.

Use affresh® Stainless Steel Cleaner or affresh® Stainless Steel Cleaning Wipes (not included). Rub in direction of grain to avoid possible damage to the steel surface.

Do not use:

- Soap-filled scouring pads
- Abrasive cleaners
- Cooktop polishing creme
- Steel-wool pads
- Gritty washcloths
- Abrasive paper towels

TROUBLESHOOTING



First try the solutions suggested here. If you need further assistance or more recommendations that may help you avoid a service call, refer to the warranty page in this manual and scan the code there with your mobile device, or visit **https://kitchenaid.com**. In Canada, visit **http://www.kitchenaid.ca**.

If you experience	Possible causes	Solution
Nothing will operate	A household fuse has blown or a circuit breaker has tripped.	Replace the fuse or reset the circuit breaker. If the problem continues, call an electrician.
Surface burners will not operate	This is the first time the surface burners have been used.	Turn on any one of the surface burner knobs to release air from the gas lines.
	The control knob is not set correctly.	Push in knob before turning to a setting.
	The burner ports are clogged.	Clean clogged burner ports with a straight pin.
Surface burner flames are uneven, yellow, and/or noisy	The burner ports are clogged.	Clean clogged burner ports with a straight pin.
	On models with caps, the burner caps are not positioned properly.	Make sure alignment pins are properly aligned with the burner cap.
	Propane gas is being used.	The cooktop may have been converted improperly. Contact a trained repair specialist.
Surface burner makes popping noises	The burner is wet.	Let it dry.
Burner sparks but does not light	There is continuous sparking, but the burner does not light.	Discontinue use of the surface burner and contact a service technician.
Excessive heat around cookware on cooktop	The cookware is not the proper size.	Use cookware about the same size as the surface cooking area, element, or surface burner. Cookware should not extend more than ½" (1.3 cm) outside the cooking area.
Cooktop cooking results not what expected	The proper cookware is not being used.	Use medium-to-heavy cookware made of the material that cooks food the way you want. The best cookware should have a flat bottom, straight sides, and a well-fitting lid.
	The control knob is not set to the proper heat level.	Set the Cooktop Control to HI, MED, or LO, depending upon the type of cooking you want to do.
	The cooktop is not level.	The cooktop must be level for the griddle to operate properly. See the Installation Instructions for leveling instructions.

ASSISTANCE OR SERVICE

Before calling for assistance or service, please check the "Troubleshooting" section. It may save you the cost of a service call. If you still need help, follow the instructions below. When calling, please know the purchase date and the complete model and serial number of your appliance. This information will help us to better respond to your request.

If you need replacement parts

If you need to order replacement parts, we recommend that you use only factory specified parts. These factory specified parts will fit right and work right because they are made with the same precision used to build every new KitchenAid® appliance.

To locate factory specified parts in your area, call us or your nearest KitchenAid designated service center.

IN THE U.S.A.

Call the KitchenAid Customer eXperience Center toll free: **1-800-422-1230**.

Our consultants provide assistance with:

- Features and specifications on our full line of appliances.
- Installation information.
- Use and maintenance procedures.
- Accessory and repair parts sales.
- Specialized customer assistance (Spanish speaking, hearing impaired, limited vision, etc.).
- Referrals to local dealers, repair parts distributors and service companies. KitchenAid designated service technicians are trained to fulfill the product warranty and provide after-warranty service anywhere in the United States.

  To locate the KitchenAid designated service company in your area, you can also look in your telephone directory Yellow Pages.

For further assistance

If you need further assistance, you can write to KitchenAid with any questions or concerns at:

KitchenAid Brand Home Appliances
Customer eXperience Center
553 Benson Road
Benton Harbor, MI 49022-2692

Please include a daytime phone number in your correspondence.

IN CANADA

Call the KitchenAid Customer eXperience Centre toll free: **1-800-807-6777**.

Our consultants provide assistance with:

- Features and specifications on our full line of appliances.
- Use and maintenance procedures.
- Accessory and repair parts sales.
- Referrals to local dealers, repair parts distributors and service companies. KitchenAid Canada designated service technicians are trained to fulfill the product warranty and provide after-warranty service anywhere in Canada.

For further assistance

If you need further assistance, you can write to KitchenAid Canada with any questions or concerns at:

Customer eXperience Centre
KitchenAid Canada
200 - 6750 Century Ave.
Mississauga, Ontario L5N 0B7

Please include a daytime phone number in your correspondence.

ACCESSORIES

To order accessories, call the KitchenAid Customer eXperience Center toll free at **1-800-422-1230** and follow the menu prompts. Or visit our website at **www.kitchenaid.com** and click on "Shopping Options." Go to "Replacement Parts & Accessories" and click on "applianceaccessories.com." Portable appliances, bakeware, cookware, gadgets, and textiles are also available.

In Canada, call the KitchenAid Customer eXperience Center toll free at **1-800-807-6777** and follow the menu prompts. Or visit our website at **www.kitchenaid.ca** and click on "Shopping Options." Go to "Replacement Parts & Accessories" and click on "applianceaccessories.ca." Portable appliances, bakeware, cookware, gadgets, and textiles are also available.

Or see the "Accessories" brochure to order.

affresh® Stainless Steel Cleaner and Polish
(stainless steel models)

affresh® Stainless Steel Wipes
(stainless steel models)

affresh® Cooktop Cleaner

Cooktop Protectant

Gas Grate/Drip Pan Cleaner

affresh® Kitchen and Appliance Cleaner

Griddle

Grill and Griddle Cover

Wok Ring

Stainless Steel Knobs - 6 Burner/1 Grill/1 Griddle

Stainless Steel Knobs - 4 Burner/1 Grill/1 Griddle

Stainless Steel Knobs - 4 Burner

19 11/16" (50.0 cm) to 39" (99.0 cm) Adjustable Backguard for 30" (76.2 cm) Ranges

19 11/16" (50.0 cm) to 39" (99.0 cm) Adjustable Backguard for 36" (91.4 cm) Ranges

19 11/16" (50.0 cm) to 39" (99.0 cm) Adjustable Backguard for 48" (121.9 cm) Ranges

9" (22.9 cm) Backguard for 30" (76.2 cm) Ranges

9" (22.9 cm) Backguard for 36" (91.4 cm) Ranges

9" (22.9 cm) Backguard for 48" (121.9 cm) Ranges

22" (55.9 cm) Backguard with Shelf for 30" (76.2 cm) Ranges and Cooktops

22" (55.9 cm) Backguard with Shelf for 36" (91.4 cm) Ranges and Cooktops

22" (55.9 cm) Backguard with Shelf for 48" (121.9 cm) Ranges and Cooktops

KITCHENAID® COOKTOP LIMITED WARRANTY

ATTACH YOUR RECEIPT HERE. PROOF OF PURCHASE IS REQUIRED TO OBTAIN WARRANTY SERVICE.

Please have the following information available when you call the Customer eXperience Center:

- Name, address and telephone number
- Model number and serial number
- A clear, detailed description of the problem
- Proof of purchase including dealer or retailer name and address

IF YOU NEED SERVICE:

1. Before contacting us to arrange service, please determine whether your product requires repair. Some questions can be addressed without service. Please take a few minutes to review the Troubleshooting or Problem Solver section of the Use and Care Guide, scan the QR code on the right to access additional resources, or visit http://kitchenaid.custhelp.com.
2. All warranty service is provided exclusively by our authorized KitchenAid Service Providers. In the U.S. and Canada, direct all requests for warranty service to:

KitchenAid Customer eXperience Center

In the U.S.A., call 1-800-422-1230. In Canada, call 1-800-807-6777.

http://kitchenaid.custhelp.com

If outside the 50 United States or Canada, contact your authorized KitchenAid dealer to determine whether another warranty applies.

FIVE YEAR LIMITED WARRANTY

WHAT IS COVERED

FIRST YEAR LIMITED WARRANTY (PARTS AND LABOR)

For one year from the date of purchase, when this major appliance is installed, operated and maintained according to instructions attached to or furnished with the product, KitchenAid brand of Whirlpool Corporation or Whirlpool Canada, LP (hereafter "KitchenAid") will pay for factory specified replacement parts and repair labor to correct defects in materials or workmanship that existed when this major appliance was purchased or, at its sole discretion replace the product. In the event of product replacement, your appliance will be warranted for the remaining term of the original unit's warranty period.

SECOND THROUGH FIFTH YEAR LIMITED WARRANTY (CERTAIN COMPONENT PARTS ONLY - LABOR NOT INCLUDED)

In the second through fifth years from the date of original purchase, when this major appliance is installed, operated and maintained according to instructions attached to or furnished with the product, KitchenAid will pay for factory specified parts for the following components to correct non-cosmetic defects in materials or workmanship in these parts that prevent function of this major appliance and that existed when this major appliance was purchased. This is a limited 5-year warranty on the below named parts only and does not include repair labor.

- Electric element
- Gas burners
- Solid state touch control system parts
- Any cracking of the rubber seal between the ceramic glass cooktop and porcelain edge
- Any cracking due to thermal shock of the ceramic glass cooktop
- Surface unit elements

YOUR SOLE AND EXCLUSIVE REMEDY UNDER THIS LIMITED WARRANTY SHALL BE PRODUCT REPAIR AS PROVIDED HEREIN. Service must be provided by a KitchenAid designated service company. This limited warranty is valid only in the United States or Canada and applies only when the major appliance is used in the country in which it was purchased. This limited warranty is effective from the date of original consumer purchase. Proof of original purchase date is required to obtain service under this limited warranty.

WHAT IS NOT COVERED

1. Commercial, non-residential or multiple-family use, or use inconsistent with published user, operator or installation instructions.
2. In-home Instruction on how to use your product.
3. Service to correct improper product maintenance or installation, installation not in accordance with electrical or plumbing codes or correction of household electrical or plumbing (i.e. house wiring, fuses or water inlet hoses).
4. Consumable parts (i.e. light bulbs, batteries, air or water filters, etc.).
5. Defects or damage caused by the use of non-genuine KitchenAid parts or accessories.
6. Conversion of your product from natural gas or L.P. gas.
7. Damage from accident, misuse, abuse, fire, floods, acts of God or use with products not approved by KitchenAid.
8. Repairs to parts or systems to correct product damage or defects caused by unauthorized service, alteration or modification of the appliance.
9. Cosmetic damage including scratches, dents, chips, and other damage to appliance finishes unless such damage results from defects in materials and workmanship and is reported to KitchenAid within 30 days.
10. Discoloration, rust or oxidation of surfaces resulting from caustic or corrosive environments including but not limited to high salt concentrations, high moisture or humidity or exposure to chemicals.
11. Food loss due to product failure.
12. Pick-up or delivery. This product is intended for in-home repair.
13. Travel or transportation expenses for service in remote locations where an authorized KitchenAid servicer is not available.
14. Removal or reinstallation of inaccessible appliances or built-in fixtures (i.e. trim, decorative panels, flooring, cabinetry, islands, countertops, drywall, etc.) that interfere with servicing, removal or replacement of the product.
15. Service or parts for appliances with original model/serial numbers removed, altered or not easily determined.

The cost of repair or replacement under these excluded circumstances shall be borne by the customer.

DISCLAIMER OF IMPLIED WARRANTIES

IMPLIED WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO ONE YEAR OR THE SHORTEST PERIOD ALLOWED BY LAW. Some states and provinces do not allow limitations on the duration of implied warranties of merchantability or fitness, so this limitation may not apply to you. This warranty gives you specific legal rights, and you also may have other rights that vary from state to state or province to province.

DISCLAIMER OF REPRESENTATIONS OUTSIDE OF WARRANTY

KitchenAid makes no representations about the quality, durability, or need for service or repair of this major appliance other than the representations contained in this warranty. If you want a longer or more comprehensive warranty than the limited warranty that comes with this major appliance, you should ask KitchenAid or your retailer about buying an extended warranty.

LIMITATION OF REMEDIES; EXCLUSION OF INCIDENTAL AND CONSEQUENTIAL DAMAGES

YOUR SOLE AND EXCLUSIVE REMEDY UNDER THIS LIMITED WARRANTY SHALL BE PRODUCT REPAIR AS PROVIDED HEREIN. KITCHENAID SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. Some states and provinces do not allow the exclusion or limitation of incidental or consequential damages, so these limitations and exclusions may not apply to you. This warranty gives you specific legal rights, and you also may have other rights that vary from state to state or province to province.

11/14

INFORMATIONS DE SÉCURITÉ

Votre sécurité et celle des autres est très importante.

Nous donnons de nombreux messages de sécurité importants dans ce manuel et sur votre appareil ménager. Assurez-vous de toujours lire tous les messages de sécurité et de vous y conformer.



Voici le symbole d'alerte de sécurité.

Ce symbole d'alerte de sécurité vous signale les dangers potentiels de décès et de blessures graves à vous et à d'autres.

Tous les messages de sécurité suivront le symbole d'alerte de sécurité et le mot "DANGER" ou "AVERTISSEMENT". Ces mots signifient :

⚠ DANGER — **Risque possible de décès ou de blessure grave si vous ne suivez pas immédiatement les instructions.**

⚠ AVERTISSEMENT — **Risque possible de décès ou de blessure grave si vous ne suivez pas les instructions.**

Tous les messages de sécurité vous diront quel est le danger potentiel et vous disent comment réduire le risque de blessure et ce qui peut se produire en cas de non-respect des instructions.

AVERTISSEMENT : Si les renseignements dans ce manuel ne sont pas exactement observés, un incendie ou une explosion peut survenir, causant des dommages au produit, des blessures ou un décès.

– Ne pas entreposer ni utiliser de l'essence ou d'autres vapeurs ou liquides inflammables à proximité de cet appareil ou de tout autre appareil électroménager.

– QUE FAIRE DANS LE CAS D'UNE ODEUR DE GAZ :

- **Ne pas tenter d'allumer un appareil.**
- **Ne pas toucher à un commutateur électrique.**
- **Ne pas utiliser le téléphone se trouvant sur les lieux.**
- **Appeler immédiatement le fournisseur de gaz à partir du téléphone d'un voisin. Suivre ses instructions.**
- **À défaut de joindre votre fournisseur de gaz, appeler les pompiers.**

– L'installation et l'entretien doivent être effectués par un installateur qualifié, une agence de service ou le fournisseur de gaz.

AVERTISSEMENT : L'odorat ne permet pas toujours la détection d'une fuite de gaz.

Les distributeurs de gaz recommandent l'emploi d'un détecteur de gaz (homologation UL ou CSA).

Pour d'autre information, contacter le fournisseur de gaz local.

En cas de détection d'une fuite de gaz, exécuter les instructions "Que faire dans le cas d'une odeur de gaz".

Avertissements de la proposition 65 de l'État de Californie :

AVERTISSEMENT : Ce produit contient au moins un produit chimique connu par l'État de Californie pour être à l'origine de cancers.

AVERTISSEMENT : Ce produit contient au moins un produit chimique connu par l'État de Californie pour être à l'origine de malformations et autres déficiences de naissance.

IMPORTANTES INSTRUCTIONS DE SÉCURITÉ

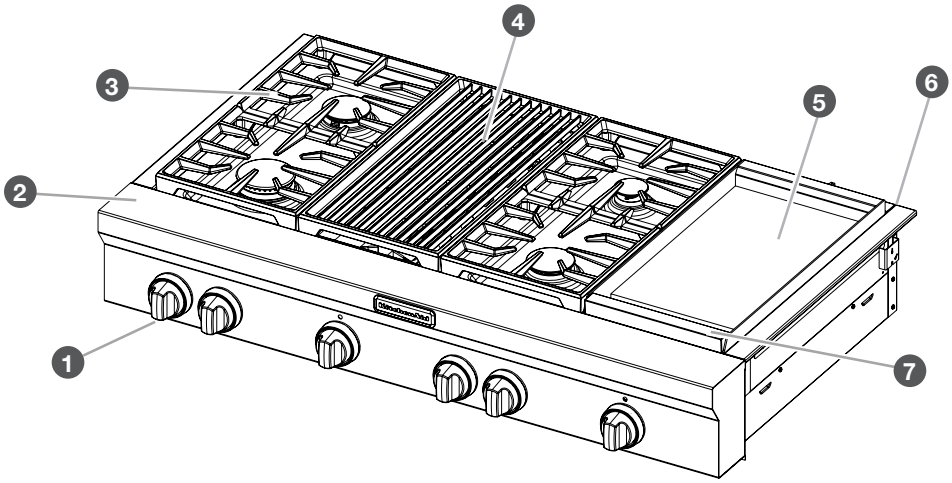
AVERTISSEMENT : Pour réduire le risque d'incendie, de choc électrique, de blessures ou de dommages lors de l'utilisation de la table de cuisson, il convient d'observer certaines précautions élémentaires dont les suivantes :

- **AVERTISSEMENT :** NE JAMAIS utiliser cet appareil comme dispositif de chauffage de la pièce. Le non-respect de cette instruction peut entraîner une intoxication au monoxyde de carbone et une surchauffe de la table de cuisson.
- **MISE EN GARDE –** Ne pas remiser dans des armoires au-dessus de la table de cuisson, des objets que des enfants pourraient vouloir atteindre. Les enfants pourraient se blesser gravement en grimpant sur la table de cuisson.
- Installation appropriée – La table de cuisson lorsqu'elle est correctement installée doit être reliée à la terre conformément aux codes locaux ou, en l'absence de codes locaux, selon le *Code national électrique, ANSI/NFPA70 ou le Code canadien des installations électriques, Partie 1*. S'assurer que la table de cuisson est correctement installée et reliée à la terre par un technicien qualifié.
- La table de cuisson est munie d'une fiche de liaison à la terre à trois broches pour votre protection contre les risques de choc électrique et doit être branchée directement dans une prise de courant bien reliée à la terre. Ne pas couper ni enlever la broche de liaison à la terre de cette fiche.
- Débrancher l'alimentation électrique avant d'exécuter des réparations à la table de cuisson.
- Des blessures peuvent survenir du mauvais usage de la table de cuisson tel que se tenir debout sur la surface, se pencher ou s'asseoir sur le dessus de la surface.
- Entretien – Garder l'espace autour de la table de cuisson dégagé et exempt de matériaux combustibles, d'essence et d'autres vapeurs et liquides inflammables.
- Remisage sur la table de cuisson – Des produits inflammables ne doivent pas être remisés sur ou près des éléments de surface.
- La taille de la flamme des brûleurs de surface devrait être ajustée de sorte qu'elle ne dépasse pas le bord d'un ustensile de cuisson.

CONSERVEZ CES INSTRUCTIONS

PIÈCES ET CARACTÉRISTIQUES

Ce manuel couvre plusieurs modèles différents. La table de cuisson que vous avez achetée peut comporter l'ensemble des articles énumérés ou seulement certains d'entre eux. L'emplacement et l'apparence des caractéristiques illustrées peuvent ne pas correspondre à ceux de votre modèle. Se reporter à ce manuel ou à la section Foire Aux Questions (FAQ) de notre site Web sur **www.kitchenaid.com** pour des instructions plus détaillées. Au Canada, consulter la section Service à la clientèle sur **www.kitchenaid.ca**.



1. **Boutons de commande métalliques coulés sous pression de style commercial**
2. **Rebord de protection**
3. **Conception pour service intense de grille simple**
4. **Gril (sur certains modèles)**
5. **Grille chromée électrique (sur certains modèles)**
6. **Garniture périphérique**
7. **Plateau d'égouttement (sur modèles avec plaque à frire)**

Non illustré :

Dosserets réglables facultatifs de 9" (22,9 cm) et 22" (55,9 cm)

Couvercle de plaque à frire facultatif

Couvercle de gril facultatif

Cerclage de wok facultatif

Boutons en acier inoxydable facultatifs

BRÛLEURS

⚠ AVERTISSEMENT

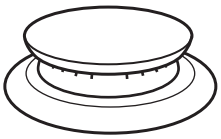
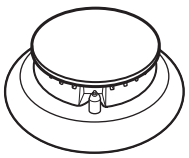
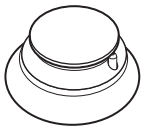


Risque d'incendie

La flamme d'un brûleur ne devrait pas dépasser le bord du récipient de cuisson.

Fermer tous les réglages lorsque la cuisson est terminée.

Le non-respect de ces instructions peut causer un décès ou un incendie.

BTU/H	ILLUSTRATION DU BRÛLEUR	CARACTÉRISTIQUES
Brûleur à double flamme Ultra-Power™		Ce brûleur comporte un débit thermique minimal et un débit thermique maximal. Le réglage Power Hi (puissance élevée) utilise les deux niveaux de flamme à pleine puissance pour fournir le niveau thermique maximal. Il est idéal pour la cuisson de grandes quantités d'aliments liquides ou solides à l'aide de grandes casseroles et poêles. Les réglages Simmer HI et LO (mijotage à grand et petit feu) utilisent uniquement la petite flamme.
Brûleur moyen		Ce brûleur est idéal pour cuire de petites quantités d'aliments et fondre du chocolat ou du beurre.
Brûleur de mijotage		Ce brûleur atteint 500 BTU/h au réglage minimum. Il fournit des températures basses nécessaires pour faire mijoter des soupes, des ragoûts et pour faire fondre des ingrédients délicats comme le beurre, le fromage et le chocolat.

Allumage des brûleurs :

- Des allumeurs électriques allument automatiquement les brûleurs de surface lorsque les boutons de commande sont tournés à LITE (allumage).
- Avant de régler un bouton de commande, placer l'ustensile de cuisson rempli sur la grille. Ne pas faire fonctionner un brûleur avec un ustensile de cuisson vide ou sans ustensile de cuisson sur la grille.
- Vérifier visuellement que le brûleur est allumé. Si le brûleur ne s'allume pas, guetter un déclic. Si l'allumeur n'émet aucun déclic, éteindre le brûleur. Vérifier si le disjoncteur ne s'est pas déclenché ou si un fusible n'est pas grillé.
- Vérifier que le bouton de commande est complètement enfoncé sur la tige de la soupape. Si l'allumeur ne fonctionne toujours pas, appeler un technicien de réparation qualifié.
- Lorsque les boutons de commande d'un brûleur de petite ou moyenne puissance sont tournés à la position LITE (allumage), tous les brûleurs de petite ou moyenne puissance émettent un déclic. Lorsque le bouton de commande commandant le gros brûleur est tourné à la position LITE (allumage), ces brûleurs émettent des déclics indépendamment des autres brûleurs. Dans les deux cas, seul le brûleur dont le bouton de commande est placé sur LITE (allumage) produira une flamme.

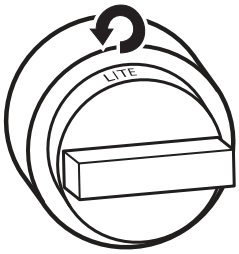
NE PAS OUBLIER : Lors de l'utilisation de la cuisson ou durant le programme d'autonettoyage, toute la surface de cuisson peut devenir chaude.

Caractéristique de rallumage

Durant l'utilisation de la table de cuisson, si un ou plusieurs brûleurs s'éteint/s'éteignent en raison de causes extérieures (tel qu'un renversement de liquide, un courant d'air ou un mouvement d'air lié à l'aspiration), le système d'allumage s'active pour rallumer la flamme. Lorsque la flamme réapparaît, la production d'étincelles cesse. Si l'on n'élimine pas le courant d'air dans la pièce, la production épisodique d'étincelles peut se poursuivre. Une production d'étincelles peut aussi se produire occasionnellement lorsqu'on utilise le débit thermique minimal sur l'un des brûleurs.

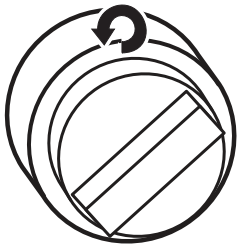
Pour régler un brûleur :

1.



Enfoncer et tourner le bouton dans le sens antihoraire à LITE (allumage).

2.

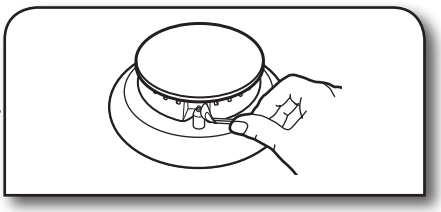


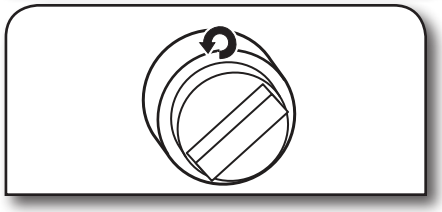
Tourner le bouton dans le sens antihoraire entre HI (élevé) et LO (bas).

Enfoncer une fois de plus pour passer de LO (bas) à HI (élevé).

En cas de panne de courant

Tenir une allumette allumée près d'un brûleur et tourner le bouton dans le sens antihoraire à HI (élevé). Une fois le brûleur allumé, tourner le bouton au réglage souhaité.



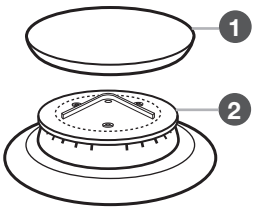


CARACTÉRISTIQUES DE LA TABLE DE CUISSON

Brûleurs de surface scellés

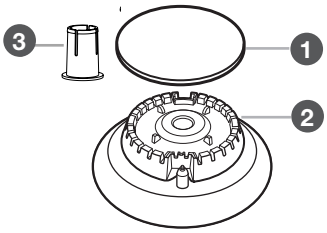
Les brûleurs de surface scellés sont conçus pour minimiser les espaces et joints d'où les liquides et les renversements peuvent pénétrer sous la table de cuisson. Cette conception rend possible un nettoyage rapide et facile.

Brûleur haute puissance superposé

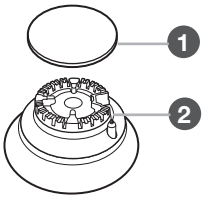


1. **Chapeau de brûleur**
2. **Base du brûleur**
3. **Douille de réduction (pour utilisation avec le brûleur de moyenne puissance, uniquement pour l'alimentation au propane)**

Brûleur moyen



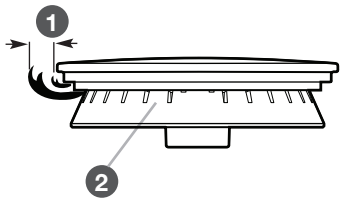
Brûleur de mijotage/pour faire fondre



IMPORTANT : Ne pas entraver l'évacuation de l'air de combustion et de ventilation autour des bords des grilles de brûleur.

Chapeau de brûleur : Toujours garder le chapeau de brûleur en place lorsqu'un brûleur de surface est utilisé. Un chapeau de brûleur propre aide à empêcher le mauvais allumage et les flammes irrégulières. Toujours nettoyer le chapeau du brûleur après un renversement; enlever et nettoyer régulièrement les chapeaux tel qu'indiqué à la section "Entretien et nettoyage".

Ouverture de gaz : Pour que le brûleur s'allume convenablement, le gaz doit pouvoir circuler librement à travers l'orifice de gaz. Garder cette zone propre et ne pas laisser de renversements, d'aliments, d'agents de nettoyage ou tout autre produit pénétrer dans l'ouverture de gaz. Toujours utiliser un chapeau de brûleur pour protéger l'ouverture de gaz contre tout renversement.

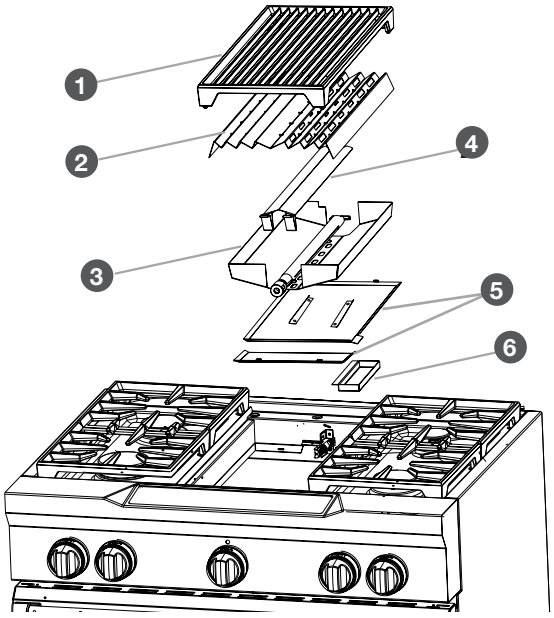


1. **1-1½" (25-38 mm)**
2. **Orifices de brûleur**

Orifices de brûleur : Examiner occasionnellement les flammes des brûleurs pour en vérifier la taille et la forme tel qu'indiqué ci-dessus. Une bonne flamme est bleue plutôt que jaune. Garder cette zone exempte de souillures et ne pas laisser les produits renversés, les aliments, les agents de nettoyage ou autre produit pénétrer dans les orifices de brûleur.

GRIL (SUR CERTAINS MODÈLES)

Le module du gril consiste en une grille en fonte, un plateau ondulé, un répartiteur de flammes, un brûleur, 2 plateaux à graisse et un plateau d'égouttement.



1. **Grille du gril**
2. **Plateau ondulé**
3. **Ensemble de brûleur**
4. **Répartiteur de flammes**
5. **Plateau à graisse**
6. **Plateau d'égouttement**

Lors de l'utilisation du gril, suivre les directives ci-dessous.

- Enlever l'excès de graisse pour réduire les éclaboussures. Entailler le gras résiduel sur les côtés pour éviter que la viande ne se recroqueville.
- Laisser de la place entre les aliments sur le gril. Placer les aliments trop près les uns des autres entraînera une cuisson irrégulière.
- Utiliser une spatule métallique ou des pinces pour retourner les aliments.
- Les steaks, les côtelettes et les hamburgers ne doivent être retournés qu'une fois afin d'éviter la perte des jus de cuisson.
- Pour une cuisson plus uniforme, les aliments tels que les quarts de poulet doivent être retournés plusieurs fois.
- Pour vérifier le degré de cuisson des viandes et de la volaille, utiliser un thermomètre à lecture instantanée ou faire une petite entaille au centre de l'aliment. Ceci préviendra la perte des jus de cuisson.
- Ne pas laisser le gril sans surveillance pendant la cuisson.
- Afin d'éviter d'endommager le gril, ne pas utiliser de papier aluminium, de charbon ou de copeaux de bois.
- Afin d'éviter d'endommager les ustensiles de cuisson, ne pas les placer sur le gril lorsque celui-ci n'est pas utilisé. Les aliments doivent être cuits directement sur la grille du gril.

CARACTÉRISTIQUES DE LA TABLE DE CUISSON

Utilisation :

1.
Mettre la hotte d'évacuation au-dessus de la cuisinière en marche.

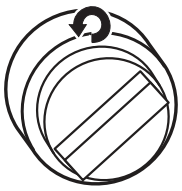
2.
Ajouter de l'huile végétale, au besoin. Appliquer une mince couche d'huile végétale ou d'aérosol de cuisine antiadhésif sur la grille du gril.

3.



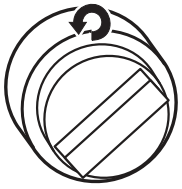
Enfoncer et tourner le bouton à LITE/HI (allumage/élevé). La flamme s'allume en 1 à 4 secondes.

4.



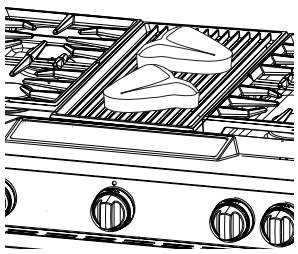
Tourner le bouton à MED (moyen) et laisser la grille se réchauffer pendant 15 minutes.

5.



Tourner le bouton au réglage de cuisson désiré.

6.



Placer les aliments sur le gril.

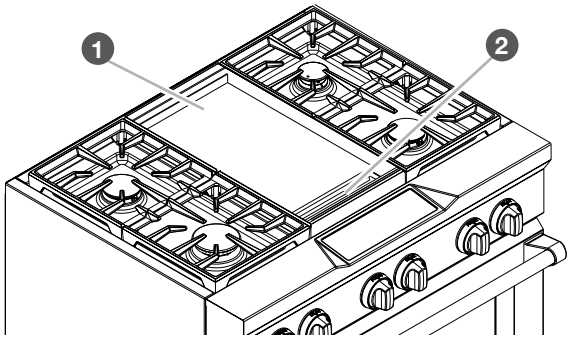
Tableau de cuisson au gril

Les réglages et durées de cuisson sont cités à titre indicatif seulement et peuvent être modifiés en fonction des goûts personnels.

ALIMENT	RÉGLAGE	DURÉE DE CUISSON TOTAL MINUTES
Steak		
1" (2,5 cm)		
à point	MED	16-20
bien cuit	MED	20-30
Galettes de viande hachée		
½ - ¾" (1,3 à 1,9 cm)	MED	20-25
Côtelettes de porc		
1" (2,5 cm)	MED	35-55
Tranches de jambon		
½" (1,3 cm)	MED	8-12
Saucisses de Francfort et Saucisses précuites	MED	8-15
Poulet		
Quarts	MED-LO	50-80
Poitrine, désossée	MED	20-40
Darnes de poisson		
¾ - 1" (1,9 à 2,5 cm) d'épaisseur	MED	10-15

PLAQUE À FRIRE ÉLECTRIQUE CHROMÉE (SUR CERTAINS MODÈLES)

La surface de cuisson de la plaque à frire électrique chromée est idéale pour faire cuire des sandwiches, des crêpes, des œufs, des hamburgers, des légumes sautés et de nombreux autres favoris de la famille. La surface attrayante à faible adhésion est conçue pour rendre le nettoyage facile.



1 Plaque à frire

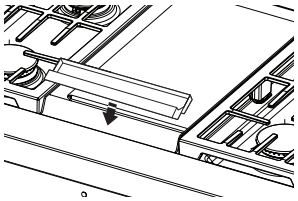
2 Plateau d'égouttement

Le système de plaque à frire électrique chromée fournit une surface de cuisson à répartition de chaleur uniforme.

- S'assurer que la pellicule a été retirée et laver avec de l'eau chaude avant la première utilisation.
- Afin d'éviter d'égratigner la plaque à frire, ne pas placer de casseroles ou de poêles sur la plaque à frire. Utiliser uniquement des ustensiles en plastique ou en bois résistants à la chaleur.
- La surface de la plaque à frire est prête à l'emploi et ne nécessite pas de préparation.
- Le fait de verser de l'eau froide sur une plaque à frire chaude peut déformer la plaque à frire et entraîner une surface de cuisson irrégulière.

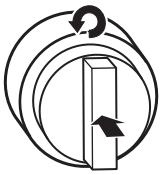
Utilisation :

1.



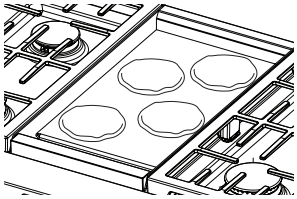
Positionner le plateau d'égouttement.

2.



Pousser et tourner le bouton.

3.



Placer l'aliment sur la plaque et cuire au degré de cuisson désiré.

Le témoin lumineux de la plaque à frire s'éteint lorsque le préchauffage de la plaque à frire est terminé. Le témoin lumineux de la plaque à frire s'allume et s'éteint durant l'utilisation pour indiquer que l'élément de la plaque à frire maintient la température de surface sélectionnée.

Tableau de cuisson

Les réglages et durées de cuisson sont cités à titre indicatif seulement et peuvent être modifiés en fonction des goûts personnels.

ALIMENT	RÉGLAGE	DURÉE DE CUISSON TOTAL MINUTES
Galettes et chapelets de saucisses	325°F (163°C)	12-18
Tranches de bacon	350°F (177°C)	7-11
Tranches de jambon (entièrement cuit)	325°F (163°C)	5-7
Saucisses de Francfort et saucisses précuites	325°F (163°C)	8-15
Galettes de viande hachée	350°F (177°C)	10-15
Sandwiches grillés	325°F (163°C)	3-5
Darnes et filets de poisson	325°F (163°C)	8-15
Œufs	300°F (149°C)	3-5
Pommes de terre rissolées	400°F à 425°F (204°C à 218°C)	8-12
Pain doré	350°F (177°C)	5-7
Crêpes	350°F (177°C)	2-4



USTENSILES DE CUISSON

IMPORTANT : Ne pas laisser un ustensile de cuisson vide sur la surface d'une table de cuisson, d'un élément ou d'un brûleur de surface chauds.

Les ustensiles de cuisson idéals doivent avoir un fond plat, des parois droites, un couvercle qui ferme bien et le matériau doit être d'épaisseur moyenne à forte.

Les surfaces rêches peuvent érafler la table de cuisson ou les grilles. L'aluminium et le cuivre peuvent être employés comme fond ou base dans un ustensile de cuisson. Cependant, utilisés comme base, ils peuvent laisser des marques permanentes sur la table de cuisson ou les grilles.

Le matériau d'un ustensile de cuisson affecte la rapidité et l'uniformité de la transmission de la chaleur, ce qui affecte les résultats de cuisson. Un fini antiadhésif a les mêmes caractéristiques que son matériau de base. Par exemple, un ustensile de cuisson en aluminium avec un fini antiadhésif aura les propriétés de l'aluminium.

Les ustensiles de cuisson avec surface antiadhésive ne doivent pas être utilisés sous l'élément de cuisson au gril.

Utiliser le tableau suivant comme guide pour les caractéristiques du matériau de l'ustensile de cuisson.

USTENSILE	CARACTÉRISTIQUES
Aluminium	■ Chauffe rapidement et uniformément. ■ Convient à tous les genres de cuisson ■ L'épaisseur moyenne ou forte convient le mieux pour la plupart des tâches de cuisson.
Fonte	■ Chauffe lentement et uniformément. ■ Convient pour le brunissage et la friture. ■ Maintient la chaleur pour une cuisson lente.
Céramique ou vitrocéramique	■ Suivre les instructions du fabricant. ■ Chauffe lentement mais inégalement ■ Les meilleurs résultats sont obtenus sur les réglages de chaleur basse à moyenne.
Cuivre	■ Chauffe très rapidement et de façon uniforme
Terre cuite	■ Suivre les instructions du fabricant. ■ Utiliser des réglages de température basse.
Acier émaillé (porcelaine) ou fonte émaillée	■ Voir acier inoxydable ou fonte.
Acier inoxydable	■ Chauffe rapidement, mais inégalement. ■ Un fond ou une base d'aluminium ou de cuivre sur l'acier inoxydable procure un chauffage uniforme.

PRÉPARATION DE CONSERVES À LA MAISON

Lors de la préparation de conserves pendant de longues périodes, alterner l'utilisation des brûleurs de surface entre les quantités préparées. Cette alternance permet aux dernières surfaces utilisées de refroidir.

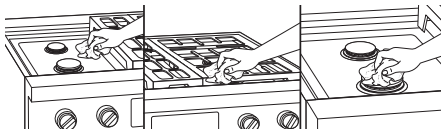
- Centrer l'autoclave sur la grille.
- Ne pas placer l'autoclave sur deux brûleurs de surface à la fois.
- Pour plus de renseignements, communiquez avec votre service local d'agriculture. Les compagnies qui fabriquent des produits pour la préparation de conserves peuvent aussi offrir de l'aide.

SURFACE DE LA TABLE DE CUISSON

IMPORTANT : Avant le nettoyage, s'assurer que toutes les commandes sont éteintes et que la table de cuisson a refroidi. Toujours suivre les instructions figurant sur les étiquettes des produits de nettoyage.

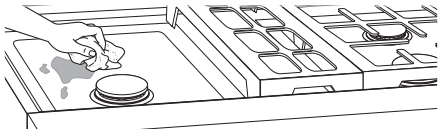
Après chaque utilisation :

1.



Essuyer la table de cuisson, les grilles et les chapeaux.

2.

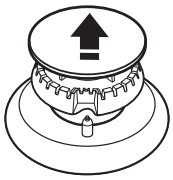


Nettoyer le déversement des aliments.

Afin préserver le revêtement, nettoyer les renversements d'aliments contenant des produits acides, tels que vinaigre et tomates, dès que tout l'appareil est froid.

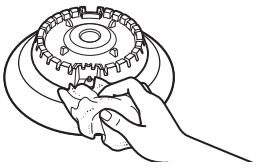
BRÛLEURS DE SURFACE SCELLÉS

1.



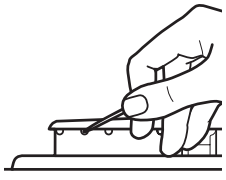
Retirer le chapeau et la base.

2.



Essuyer la table de cuisson, les grilles et les chapeaux.

3.

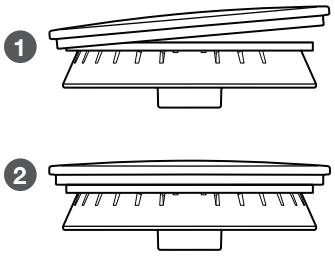


Nettoyer les orifices de brûleur obstrués.

Utiliser une épingle droite. Ne pas agrandir ni déformer l'orifice. Ne pas utiliser un cure-dents en bois. Si le brûleur a besoin d'être ajusté, contacter un technicien de réparation qualifié.

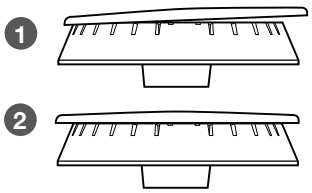
4. Réinstaller le chapeau de brûleur.

Brûleur à double flamme



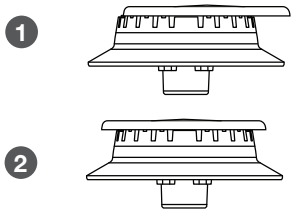
1 **Incorrect**
2 **Correct**

Brûleur moyen



1 **Incorrect**
2 **Correct**

Brûleur de mijotage/pour faire fondre



1 **Incorrect**
2 **Correct**

S'assurer que les broches d'alignement sont bien alignées avec le chapeau du brûleur.

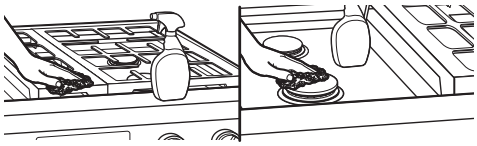
5.



Allumer le brûleur.

Si le brûleur ne s'allume pas, vérifier l'alignement du chapeau. Si le brûleur ne s'allume toujours pas, ne pas réparer vous-même le brûleur scellé. Contacter un technicien de réparation qualifié.

GRILLES ET CHAPEAUX ÉMAILLÉS



Utiliser un tampon à récurer et un détergent.

Nettoyer à l'aide d'outils de récurage en nylon non abrasif et nettoyant légèrement abrasif :

Connaître vos grilles et chapeaux.

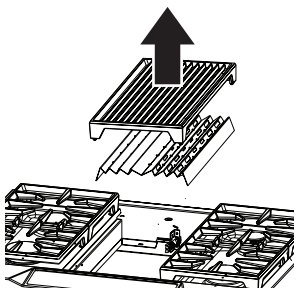
- Les renversements d'aliments contenant des produits acides, tels que vinaigre et tomates, doivent être nettoyés dès que la table de cuisson, les grilles et les chapeaux ont refroidi. Ces salissures peuvent endommager le fini.
- Pour éviter l'écaillement, ne pas entrechoquer les grilles et les chapeaux ni les frapper contre des surfaces dures telles que les ustensiles en fonte.
- Ne pas réinstaller les chapeaux sur les brûleurs lorsqu'ils sont mouillés.
- Ne pas utiliser le programme d'autonettoyage pour les nettoyer.
- Ne pas nettoyer au lave-vaisselle.

GRIL

Démontage :

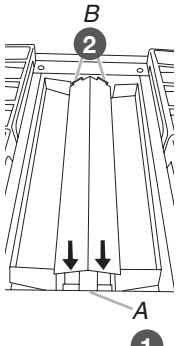
Avant de retirer ou de remettre en place le gril, s'assurer que les boutons de commande sont placés à ARRÊT. Laisser le gril refroidir complètement avant de le manipuler.

1.



Ôter la grille du gril et le plateau ondulé.

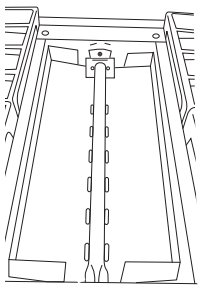
2.



1 **Avant du gril**
2 **Onglets et encoches arrière**

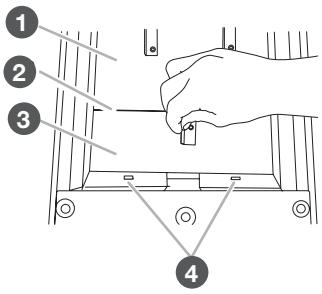
Ôter le répartiteur de flammes. Tirer le répartiteur de flammes légèrement vers l'avant pour libérer les onglets des encoches arrière et le soulever.

3.



Enlever l'ensemble du brûleur. Soulever et sortir.

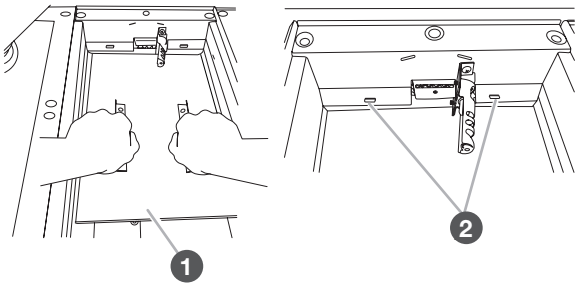
4.



1 **Grand plateau à graisse**
2 **Connexion du plateau à graisse**
3 **Petit plateau à graisse**
4 **Réceptacles d'emboîtement**

Enlever le petit plateau à graisse, en décrochant les onglets des encoches et en soulevant légèrement pour le dégager du grand plateau à graisse.

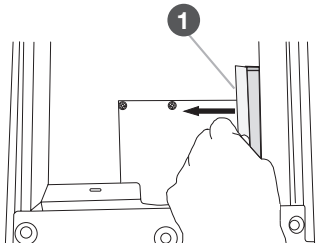
5.



1 **Grand plateau à graisse**
2 **Réceptacles d'emboîtement**

Enlever le grand plateau à graisse. Décrocher les onglets et soulever.

6.



1 **Plateau d'égouttement**

Enlever et nettoyer le plateau d'égouttement.

ENTRETIEN ET NETTOYAGE

Nettoyage :

Ne pas utiliser de nettoyants à four, brosses métalliques, tampons à récurer abrasifs ou autres accessoires de récurage pour nettoyer les grils d'extérieur.

Grille :

- Ne pas laver la grille du gril au lave-vaisselle.
- Ne pas la nettoyer dans un four autonettoyant.

1.	2.
Frotter à l'aide d'une brosse pendant que la grille est encore chaude. Utiliser une brosse à poils doux. On peut porter des mitaines de four pendant le nettoyage.	Laisser tremper dans une eau chaude et savonneuse pendant 30 minutes. Après le trempage, frotter avec un tampon non abrasif.

Plateau et plaque ondulés

1.

Faire tremper dans de l'eau tiède et savonneuse pour désincruster la saleté. Après le trempage, frotter avec un tampon non abrasif. Du nettoyant à four peut être utilisé.

Ensemble de brûleur :

- Ne pas tremper dans l'eau.

1.

Nettoyer à l'aide d'eau chaude savonneuse ou d'un nettoyant non abrasif. Utiliser un chiffon humide ou un tampon non abrasif.

Plateaux à graisse et plateau d'égouttement :

- Laisser la table de cuisson refroidir avant le nettoyage.

1.

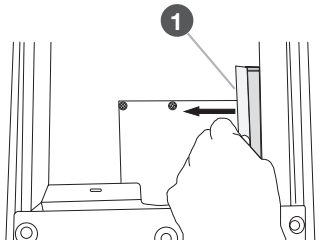
Nettoyer à l'aide d'eau chaude savonneuse ou d'un nettoyant non abrasif. Utiliser un chiffon humide ou un tampon non abrasif.

Bac du module :

1.	2.
Nettoyer à l'aide d'eau chaude savonneuse ou d'un nettoyant non abrasif. Utiliser un chiffon humide ou un tampon non abrasif.	Pour les zones très sales, laisser tremper en utilisant des essuie-tout. Faire tremper des essuie-tout dans du nettoyant ménager et les placer sur les saletés pendant au moins une demi-heure. Après le trempage, frotter avec un tampon non abrasif.

Pour replacer :

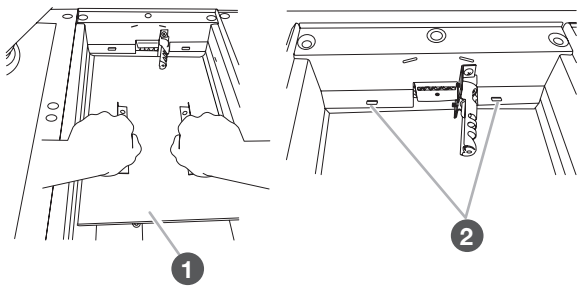
1.



1 **Plateau d'égoutte**

Réinstaller le plateau d'égouttement. Faire glisser le plateau d'égouttement dans l'ouverture du côté droit du bac du gril. Suivre les guides pour assurer un bon positionnement.

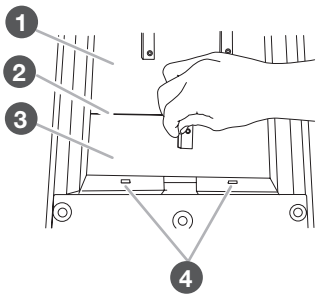
2.



1 **Grand plateau à graisse**
2 **Réceptacles d'emboîtement**

Replacer le grand plateau à graisse. Insérer complètement le grand plateau à graisse sous le rebord arrière du bac du gril et l'engager dans les encoches.

3.



1 **Grand plateau à graisse**
2 **Connexion du plateau à graisse**
3 **Petit plateau à graisse**
4 **Réceptacles d'emboîtement**

Replacer le petit plateau à graisse. Insérer complètement le petit plateau à graisse sous le rebord avant du bac du gril et l'engager dans les encoches.

Lorsque les 2 plateaux à graisse sont correctement installés, le petit plateau à graisse s'emboîte sur le grand plateau à graisse.

PLAQUE À FRIRE

Astuces :

- Avant de nettoyer la plaque à frire, vérifier que les brûleurs de la table de cuisson sont éteints et que les commandes du four ont été verrouillées.
- Pour obtenir de bons résultats, nettoyer la plaque à frire peu de temps après avoir retiré les aliments.

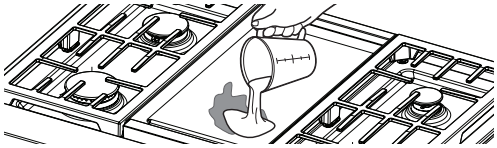
Ne pas utiliser :

- Savon
- Matériaux abrasifs
- Matériaux de nettoyage, incluant les tampons en acier inoxydable

Après chaque utilisation :

1. Faire chauffer pendant 10 à 15 minutes à 300°F.

2.



Mouiller la zone sale.

À l'aide d'une tasse à mesurer, ajouter 1 tasse d'eau du robinet sur la zone souillée. Commercer par l'arrière pour permettre à l'eau de couler vers le plateau d'égouttement situé à l'avant. Permettre à l'eau de faire des bulles sur la plaque pendant 3 à 4 secondes.

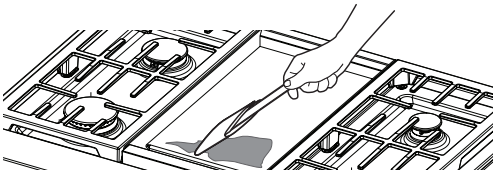
3.



Gratter les résidus dans le plateau d'égouttement.

Utiliser un porte-tampon à récurer ou une cuillère en bois et un tampon à récurer antiégratignures. Appliquer une pression sur les zones souillées. Répéter au besoin pour les zones très sales.

4.

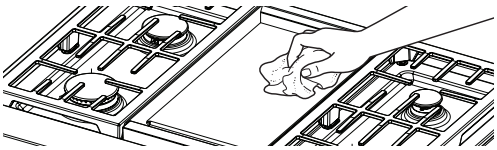


Retirer les résidus restants.

Plier un chiffon humide, et à l'aide du porte-tampon à récurer ou de la cuillère de bois, passer sur la plaque à frire pour enlever les résidus restants.

5. Éteindre la plaque et la laisser refroidir.

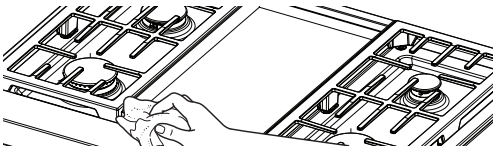
6.



Essuyer la plaque.

Une fois refroidie, essuyer la plaque à frire avec un linge en ratine humide et propre. Polir ensuite avec un tissu en microfibres. Si des rayures, un effet arc-en-ciel ou un effet flou apparaît, utiliser un mélange comportant une part de vinaigre pour 2 parts d'eau et essuyer la plaque à l'aide d'un tissu.

7.

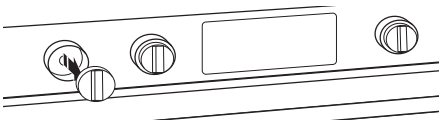


Enlever, vider et nettoyer le plateau d'égouttement.

Nettoyer le plateau d'égouttement avec de l'eau tiède savonneuse. Essuyer la zone sous le plateau d'égouttement. Une fois sèche, replacer le plateau d'égouttement.

COMMANDES DE LA TABLE DE CUISSON

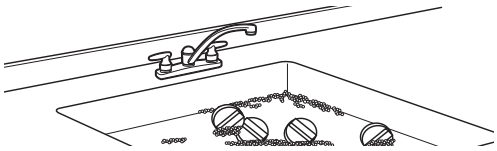
1.



Enlever les boutons.

Tirer les boutons directement hors du tableau de commande pour les enlever.

2.

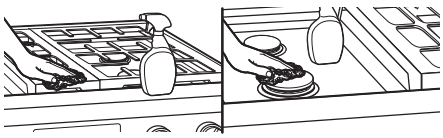


Nettoyer les boutons à l'eau chaude savonneuse.

Se familiariser avec les commandes de la table de cuisson

- Afin d'éviter d'endommager les commandes de la table de cuisson, ne pas utiliser de laine d'acier, de nettoyants abrasifs ou de nettoyant pour four.
- Afin d'éviter toute détérioration, ne pas laisser tremper les boutons de commande.
- Lors de la réinstallation des boutons, s'assurer que chaque bouton est à la position Off (arrêt).
- Ne pas retirer les joints sous les boutons.
- Lors de la réinstallation des boutons après le nettoyage des commandes des brûleurs de surface ou de la commande du module de la plaque à frire, vérifier que les boutons sont réinstallés à leur emplacement correct. Les boutons de brûleur possèdent des réglages de puissance et le bouton de la plaque à frire des réglages de température. Tous les autres boutons possèdent uniquement des réglages Hi (élevé), Med (moyen), Lo (bas).

ACIER INOXYDABLE (SUR CERTAINS MODÈLES)



Utiliser un nettoyant ou des lingettes.

Utiliser le nettoyant affresh® pour acier inoxydable ou les lingettes nettoyantes affresh® pour acier inoxydable (non compris). Frotter dans la direction du grain pour éviter des dommages possibles à la surface en acier inoxydable.

Ne pas utiliser :

- Tampons à récurer savonneux
- Nettoyants abrasifs
- Crème à polir pour table de cuisson
- Tampons en laine d'acier
- Lingettes de texture rugueuse
- Essuie-tout abrasifs

DÉPANNAGE



Essayez d'abord les solutions suggérées ici. Pour obtenir de l'aide ou des conseils qui permettront peut-être d'éviter une intervention de dépannage, consultez la page de garantie de ce manuel et balayez le code QR avec votre appareil mobile, ou visitez le site Internet **https://kitchenaid.com**. Au Canada, visitez le site Internet **https://kitchenaid.ca**.

Si vous rencontrez les problèmes suivants	Causes possibles	Solution
Rien ne fonctionne	Un fusible est grillé ou un disjoncteur s'est déclenché.	Remplacer le fusible ou réenclencher le disjoncteur. Si le problème persiste, appeler un électricien.
Les brûleurs de surface ne fonctionnent pas	C'est la première fois que les brûleurs de surface sont utilisés.	Allumer n'importe quel brûleur de surface pour libérer l'air des canalisations de gaz.
	Le bouton de commande n'est pas réglé correctement.	Enfoncer le bouton avant de le tourner à un réglage.
	Les orifices du brûleur sont obstrués.	Nettoyer les orifices de brûleur obstrués avec une épingle droite.
Les flammes des brûleurs de surface ne sont pas uniformes, sont de teinte jaune et/ou sont bruyantes	Les orifices du brûleur sont obstrués.	Nettoyer les orifices de brûleur obstrués avec une épingle droite.
	Sur les modèles avec chapeaux, les chapeaux de brûleur ne sont pas correctement positionnés	S'assurer que les broches d'alignement sont bien alignées avec le chapeau du brûleur.
	Du gaz propane est utilisé.	La table de cuisson a peut-être été mal convertie. Contacter un technicien de réparation qualifié.
Le brûleur de surface émet des bruits d'éclatement	Le brûleur est humide.	Laisser sécher.
Le brûleur émet des étincelles, mais ne s'allume pas	Il y a une production continue d'étincelles, mais le brûleur ne s'allume pas.	Discontinuer l'utilisation du brûleur de surface et contacter un technicien de service.
Chaleur excessive autour des ustensiles de cuisson sur la table de cuisson	Les ustensiles de cuisson n'ont pas la bonne taille.	Utiliser un ustensile de cuisson à peu près de la même dimension que la surface de cuisson, l'élément ou le brûleur de surface. L'ustensile de cuisson ne doit pas dépasser de plus de ½" (1,3 cm) à l'extérieur de la zone de cuisson.
La cuisson ne produit pas les résultats escomptés	L'ustensile de cuisson approprié n'est pas utilisé.	Utiliser des ustensiles de cuisine d'épaisseur moyenne à forte fabriqués de matière qui cuit les aliments comme l'on souhaite. Les meilleurs ustensiles de cuisson doivent avoir un fond plat, des parois droites et un couvercle qui ferme hermétiquement.
	Le bouton de commande n'est pas réglé au niveau approprié de chaleur.	Régler la commande de la table de cuisson à HI (élevée), MED (moyenne) ou LO (basse) selon le type de cuisson souhaité.
	La table de cuisson n'est pas d'aplomb.	La table de cuisson doit être d'aplomb pour que la plaque à frire puisse fonctionner correctement. Voir les Instructions d'installation pour des instructions de nivellement.

ASSISTANCE OU SERVICE

Avant de faire un appel pour assistance ou service, veuillez consulter la section “Dépannage”. Cette vérification peut vous faire économiser le coût d’une intervention de dépannage. Si vous avez encore besoin d’aide, suivez les instructions ci-dessous. Avant d’appeler, vous devez connaître la date d’achat et les numéros de modèle et de série complets de votre appareil. Ces renseignements nous aideront à mieux répondre à votre demande.

Si vous avez besoin de pièces de rechange

Si vous avez besoin de commander des pièces de rechange, nous vous recommandons d’utiliser seulement des pièces spécifiées par l’usine. Ces pièces spécifiées par l'usine conviendront et fonctionneront bien parce qu’elles sont fabriquées selon les mêmes spécifications précises utilisées pour fabriquer chaque nouvel appareil KitchenAid® .

Pour savoir où trouver des pièces spécifiées par l’usine dans votre région, appelez-nous ou contactez le centre de service désigné par KitchenAid le plus proche.

AUX É.-U.

Appelez sans frais au Centre pour l’eXpérience de la clientèle au : **1-800-422-1230**

Nos consultants peuvent vous aider sur les points suivants :

- Caractéristiques et spécifications de notre gamme complète d’appareils ménagers.
- Renseignements sur l’installation.
- Procédures d’utilisation et d’entretien.
- Vente d’accessoires et de pièces de rechange.
- Assistance spécialisée au client (langue espagnole, malentendants, malvoyants, etc.).
- Orientation vers des concessionnaires, compagnies de service de réparation et distributeurs de pièces de rechange locaux. Les techniciens de service désignés par KitchenAid sont formés pour remplir la garantie des produits et fournir un service après garantie partout aux États-Unis.

  Pour localiser la compagnie de service désignée par Kitchen Aid dans votre région, vous pouvez également consulter les Pages jaunes.

Pour de l’aide supplémentaire

Si vous avez besoin de plus d’assistance, vous pouvez écrire à KitchenAid en soumettant tout question ou problème à :

KitchenAid Brand Home Appliances
Customer eXperience Center
553 Benson Road
Benton Harbor, MI 49022-2692

Veuillez indiquer dans votre correspondance un numéro de téléphone où l'on peut vous joindre dans la journée.

AU CANADA

Appelez sans frais au Centre pour l’eXpérience de la clientèle au : **1-800-807-6777**.

Nos consultants peuvent vous aider sur les points suivants :

- Caractéristiques et spécifications de notre gamme complète d’appareils ménagers.
- Procédures d’utilisation et d’entretien.
- Vente d’accessoires et de pièces de rechange.
- Orientation vers des concessionnaires, compagnies de service de réparation et distributeurs de pièces de rechange locaux. Les techniciens de service désignés par KitchenAid Canada sont formés pour remplir la garantie des produits et fournir un service après la garantie, partout au Canada.

Pour de l’aide supplémentaire

Si vous avez besoin de plus d’assistance, vous pouvez écrire à KitchenAid Canada en soumettant toute question ou tout problème à :

Customer eXperience Centre
KitchenAid Canada
200 - 6750 Century Ave.
Mississauga, Ontario L5N 0B7

Veuillez indiquer dans votre correspondance un numéro de téléphone où l'on peut vous joindre dans la journée.

ACCESSOIRES



Pour commander des accessoires, contactez le service de l'eXpérience à la clientèle KitchenAid en composant le numéro sans frais **1-800-422-1230** et suivez les instructions du menu. Ou visitez notre site Web à **www.kitchenaid.com** et cliquez sur “Shopping Options” (options d'achats). Allez à “Replacement Parts & Accessories” (pièces de rechange et accessoires) et cliquez sur “applianceaccessories.com.” Des appareils portatifs, ustensiles de cuisson et cuisine, gadgets et textiles sont également proposés.

Au Canada, contactez le service de l'eXpérience à la clientèle KitchenAid en composant le numéro sans frais **1-800-807-6777** et suivez les instructions du menu. Ou visitez notre site Web à **www.kitchenaid.ca** et cliquez sur “Shopping Options” (options d'achats). Allez à “Replacement Parts & Accessories” (pièces de rechange et accessoires) et cliquez sur “applianceaccessories.ca.” Des appareils portatifs, ustensiles de cuisson et cuisine, gadgets et textiles sont également proposés.

Ou consultez le dépliant "Accessoires" pour commander.

Nettoyant et poli pour acier inoxydable affresh®
(modèles en acier inoxydable)

Lingettes nettoyantes pour acier inoxydable affresh®
(modèles en acier inoxydable)

Nettoyant pour table de cuisson affresh®

Protecteur de table de cuisson

Nettoyant pour grille et plateau d'égouttement

Nettoyant pour cuisine et appareils ménagers affresh®

Plaque à frire

Couvercle du gril et de la plaque à frire

Cerclage de wok

Boutons en acier inoxydable - brûleur 6 / gril 1 / plaque à frire 1

Boutons en acier inoxydable - brûleur 4 / gril 1 / plaque à frire 1

Boutons en acier inoxydable - brûleur 4

Dosseret réglable de 19 11/16" (50,0 cm) à 39" (99,0 cm) pour cuisinières de 30" (76,2 cm)

Dosseret réglable de 19 11/16" (50 cm) à 39" (99 cm) pour cuisinières de 36" (91,4 cm)

Dosseret réglable de 19 11/16" (50,0 cm) à 39” (99,0 cm) pour cuisinières de 48” (121,9 cm)

Dosseret de 9" (22,9 cm) pour cuisinières de 30" (76,2 cm)

Dosseret de 9" (22,9 cm) pour cuisinières de 36" (91,4 cm)

Dosseret de 9" (22,9 cm) pour cuisinières de 48" (121,9 cm)

Dosseret de 22" (55,9 cm) avec tablette pour cuisinières et tables de cuisson de 30" (76,2 cm)

Dosseret de 22" (55,9 cm) avec tablette pour cuisinières et tables de cuisson de 36" (91,4 cm)

Dosseret de 22” (55,9 cm) avec tablette pour cuisinières et tables de cuisson de 48” (121,9 cm)

GARANTIE LIMITÉE DE TABLE DE CUISSON KITCHENAID®

ATTACHEZ ICI VOTRE REÇU DE VENTE. UNE PREUVE D'ACHAT EST OBLIGATOIRE POUR OBTENIR L'APPLICATION DE LA GARANTIE.

Lorsque vous appelez le centre d'eXpérience de la clientèle, veuillez garder à disposition les renseignements suivants :

- Nom, adresse et numéro de téléphone
- Numéros de modèle et de série
- Une description claire et détaillée du problème rencontré
- Une preuve d'achat incluant le nom et l'adresse du marchand ou du détaillant

SI VOUS AVEZ BESOIN DE SERVICE :

1. Avant de nous contacter pour obtenir un dépannage, veuillez déterminer si des réparations sont nécessaires pour votre produit. Certains problèmes peuvent être résolus sans intervention de dépannage. Prenez quelques minutes pour parcourir la section Dépannage ou Résolution de problèmes du guide d'utilisation et d'entretien, scannez le code QR ci-contre avec votre téléphone intelligent pour accéder à des ressources supplémentaires, ou rendez-vous sur le site http://www.kitchenaid.ca.
2. Tout service sous garantie doit être effectué exclusivement par nos fournisseurs de dépannage autorisés KitchenAid. Aux É.-U. et au Canada, dirigez toutes vos demandes de service sous garantie au

http://www.kitchenaid.ca

Centre d'eXpérience de la clientèle KitchenAid

Aux É.-U., composer le 1-800-422-1230. Au Canada, composer le 1-800-807-6777.

Si vous résidez à l'extérieur du Canada et des 50 États des États-Unis, contactez votre marchand KitchenAid autorisé pour déterminer si une autre garantie s'applique.

GARANTIE LIMITÉE DE CINQ ANS

CE QUI EST COUVERT

GARANTIE LIMITÉE DURANT LA PREMIÈRE ANNÉE (PIÈCES ET MAIN-D'ŒUVRE)

Pendant un an à compter de la date d'achat, lorsque ce gros appareil ménager est installé, utilisé et entretenu conformément aux instructions jointes au produit ou fournies avec, la marque KitchenAid de Whirlpool Corporation ou Whirlpool Canada, LP (ci-après désignées "KitchenAid") paiera pour les pièces de rechange spécifiées par l'usine et pour la main-d'œuvre pour corriger les vices de matériaux ou de fabrication qui existaient déjà lorsque ce gros appareil ménager a été acheté. S'il est remplacé, l'appareil sera couvert pour la période restant à courir de la garantie limitée d'un an du produit d'origine.

GARANTIE LIMITÉE DE LA DEUXIÈME À LA CINQUIÈME ANNÉE (CERTAINS COMPOSANTS UNIQUEMENT - MAIN-D'ŒUVRE NON COMPRISE)

De la deuxième à la cinquième année inclusivement à compter de la date d'achat initiale, lorsque ce gros appareil ménager est installé, utilisé et entretenu conformément aux instructions jointes au produit ou fournies avec, KitchenAid paiera pour les pièces de rechange spécifiées par l'usine concernant les composants suivants pour corriger les défauts non esthétiques de matériau ou de fabrication desdites pièces qui empêchent le gros appareil de fonctionner et qui étaient déjà présentes lorsque ce gros appareil ménager a été acheté. La présente garantie est une garantie limitée de 5 ans sur les pièces énumérées ci-dessous et elle ne comprend pas la main-d'œuvre de réparation.

- Éléments électriques
- Brûleurs à gaz
- Pièces du système de commande à semi-conducteurs
- Toute fissuration du joint d'étanchéité en caoutchouc entre la table de cuisson en vitrocéramique et le bord en porcelaine
- Toute fissuration de la table de cuisson en vitrocéramique due à un choc thermique
- Éléments de l'unité de surface

LE SEUL ET EXCLUSIF RECOURS DU CLIENT DANS LE CADRE DE LA PRÉSENTE GARANTIE LIMITÉE CONSISTE EN LA RÉPARATION PRÉVUE PAR LA PRÉSENTE. Le service doit être fourni par une compagnie de service désignée par KitchenAid. Cette garantie limitée est valide uniquement aux États-Unis ou au Canada et s'applique exclusivement lorsque le gros appareil ménager est utilisé dans le pays où il a été acheté. La présente garantie limitée est valable à compter de la date d'achat initial par le consommateur. Une preuve de la date d'achat initial est exigée pour obtenir un dépannage dans le cadre de la présente garantie limitée.

CE QUI N'EST PAS COUVERT

1. Usage commercial, non résidentiel ou par plusieurs familles, ou non-respect des instructions de l'utilisateur, de l'opérateur ou des instructions d'installation.
2. Visite d'instruction à domicile pour montrer à l'utilisateur comment utiliser l'appareil.
3. Visites de service pour rectifier une installation ou un entretien fautifs du produit, une installation non conforme aux codes d'électricité ou de plomberie, ou la rectification de l'installation électrique ou de la plomberie du domicile (ex : câblage électrique, fusibles ou tuyaux d'arrivée d'eau du domicile).
4. Pièces consomptibles (ex : ampoules, batteries, filtres à air ou à eau, etc.).
5. Défauts ou dommage résultant de l'utilisation de pièces ou accessoires KitchenAid non authentiques.
6. Conversion de votre produit du gaz naturel ou du gaz de pétrole liquéfié.
7. Dommages causés par : accident, mésusage, abus, incendie, inondations, catastrophe naturelle ou l'utilisation de produits non approuvés par KitchenAid.
8. Réparations aux pièces ou systèmes dans le but de rectifier un dommage ou des défauts résultant d'une réparation, altération ou modification non autorisée faite à l'appareil.
9. Défauts d'apparence, notamment les éraflures, traces de choc, fissures ou tout autre dommage subi par le fini de l'appareil ménager, à moins que ces dommages ne résultent de vices de matériaux ou de fabrication et ne soient signalés à KitchenAid dans les 30 jours suivant la date d'achat.
10. Décoloration, rouille ou oxydation des surfaces résultant d'environnements caustiques ou corrosifs incluant des concentrations élevées de sel, un haut degré d'humidité ou une exposition à des produits chimiques (exemples non exhaustifs).
11. Perte d'aliments due à la défaillance du produit.
12. Enlèvement ou livraison. Ce produit est conçu pour être réparé à l'intérieur du domicile.
13. Frais de déplacement et de transport pour le dépannage/la réparation dans une région éloignée où une compagnie de service KitchenAid autorisée n'est pas disponible.
14. Retrait ou réinstallation d'appareils inaccessibles ou de dispositifs préinstallés (ex : garnitures, panneaux décoratifs, plancher, meubles, îlots de cuisine, plans de travail, panneaux de gypse, etc.) qui entravent le dépannage, le retrait ou le remplacement du produit.
15. Service et pièces pour des appareils dont les numéros de série et de modèle originaux ont été enlevés, modifiés ou ne peuvent pas être facilement identifiés.

Le coût d'une réparation ou d'un remplacement dans le cadre de ces circonstances exclues est à la charge du client.

CLAUSE D'EXONÉRATION DE RESPONSABILITÉ AU TITRE DES GARANTIES IMPLICITES

LES GARANTIES IMPLICITES, Y COMPRIS LES GARANTIES APPLICABLES DE QUALITÉ MARCHANDE OU D'APTITUDE À UN USAGE PARTICULIER, SONT LIMITÉES À UN AN OU À LA PLUS COURTE PÉRIODE AUTORISÉE PAR LA LOI. Certains États et provinces ne permettent pas de limitation sur la durée des garanties implicites de qualité marchande ou d'aptitude à un usage particulier, de sorte que la limitation ci-dessus peut ne pas être applicable dans votre cas. Cette garantie vous confère des droits juridiques spécifiques et vous pouvez également jouir d'autres droits qui peuvent varier d'une juridiction à l'autre.

EXONÉRATION DE RESPONSABILITÉ DANS LES DOMAINES NON COUVERTS PAR LA GARANTIE

KitchenAid décline toute responsabilité au titre de la qualité, de la durabilité ou en cas de dépannage ou de réparation nécessaire sur ce gros appareil ménager autre que les responsabilités énoncées dans la présente garantie. Si vous souhaitez une garantie plus étendue ou plus complète que la garantie limitée fournie avec ce gros appareil ménager, adressez-vous à KitchenAid ou à votre détaillant pour obtenir les modalités d'achat d'une garantie étendue.

LIMITATION DES RECOURS; EXCLUSION DES DOMMAGES FORTUITS OU INDIRECTS

LE SEUL ET EXCLUSIF RECOURS DU CLIENT DANS LE CADRE DE LA PRÉSENTE GARANTIE LIMITÉE CONSISTE EN LA RÉPARATION PRÉVUE PAR LA PRÉSENTE. KITCHENAID N'ASSUME AUCUNE RESPONSABILITÉ POUR LES DOMMAGES FORTUITS OU INDIRECTS. Certains États et certaines provinces ne permettent pas l'exclusion ou la limitation des dommages fortuits ou indirects de sorte que ces limitations et exclusions peuvent ne pas être applicables dans votre cas. Cette garantie vous confère des droits juridiques spécifiques et vous pouvez également jouir d'autres droits qui peuvent varier d'une juridiction à l'autre.

11/14

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800-570-3355

OWNER'S MANUAL

FRENCH DOOR REFRIGERATOR

Please read this owner's manual thoroughly before operating and keep it handy for reference at all times.

LFX28968**

P/No. : MFL62184527

www.lg.com

ENGLISH

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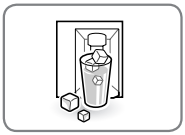
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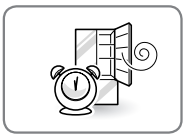
PRODUCT FEATURES

* Depending on the model, some of the following functions may not be available.



FILTERED WATER AND ICE DISPENSER

The water dispenser dispenses fresh, chilled water.
The ice dispenser dispenses cubed and crushed ice.



DOOR ALARM

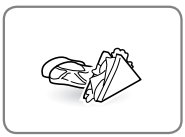
The Door Alarm function is designed to prevent refrigerator malfunctioning that could occur if a refrigerator door or freezer drawer remains open. If a refrigerator door or freezer drawer is left open for more than 60 seconds, a warning alarm sounds in 30 second intervals.



HUMIDITY CONTROLLED CRISPER

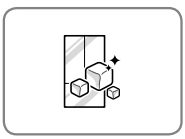
The Humidity Controlled Crisper is designed to help keep your fruits and vegetables fresh and crisp. You can control the amount of humidity in the crisper by adjusting the setting between Low and High.

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GLIDE'N'SERVE

Glide'N'Serve provides storage space that keeps the compartment colder than the refrigerator.
It is a convenient place to store sandwiches or meat to be cooked.



ICE PLUS

Ice production can be increased by approximately 20 percent when the freezer section is maintained at the coldest temperature for a 24-hour period.

IMPORTANT SAFETY INSTRUCTIONS

READ ALL INSTRUCTIONS BEFORE USING THE APPLIANCE.

This guide contains many important safety messages. Always **read and obey** all safety messages.



This is the safety alert symbol. It alerts you to safety messages that inform you of hazards that can kill or hurt you or others, or cause damage to the product.

All safety messages will be preceded by the safety alert symbol and the hazard signal word WARNING or CAUTION. These words mean:



WARNING You can be killed or seriously injured if you do not follow instructions.



CAUTION Indicates an imminently hazardous situation which, if not avoided, may result in minor or moderate injury, or product damage.



WARNING

To reduce the risk of fire, electric shock, or personal injury when using your product, basic safety precautions should be followed, including the following.

Power

- NEVER unplug your refrigerator by pulling on the power cord. Always grip the plug firmly and pull it straight out from the outlet.
- Immediately repair or replace all power cords that have become frayed or otherwise damaged. Do not use a cord that shows cracks or abrasion damage along its length or at either the plug or connector end.
- Do not use an uncertified power outlet.
- Unplug the power plug immediately in the event of a blackout or thunderstorm.
- Plug in the power plug with the power cord facing downward.

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Installation

- Contact an authorized service center when you install or relocate the refrigerator.
- When moving your refrigerator away from the wall, be careful not to roll over or damage the power cord.
- Connect this product to a dedicated grounded electric outlet conforming with the rating prior to use. It is the user's responsibility to replace a standard 2-prong wall outlet with a standard 3-prong wall outlet.
- Do not install the refrigerator where there may be a danger of falling.

Use

- DO NOT allow children to climb, stand, or hang on the refrigerator doors or shelves in the refrigerator. They could damage the refrigerator and seriously injure themselves.
- Do not place heavy objects on the dispenser of the refrigerator or hang onto it.
- Do not place heavy or dangerous objects (bottles with liquid) on the refrigerator.
- Do not put live animals inside of the refrigerator.
- Do not allow children to climb into the product when it is in use.
- In the event of a gas leak (propane/LPG), ventilate sufficiently and contact an authorized service center before use. Do not touch or disassemble the electric outlet of the refrigerator.
- In the event of a refrigerant leak, move flammable objects away from the refrigerator. Ventilate sufficiently and contact an authorized service center.
- Do not use or place flammable substances (chemicals, medicine, cosmetics, etc) near the refrigerator or store them inside the refrigerator. Do not place the refrigerator in the vicinity of flammable gas.

READ ALL INSTRUCTIONS BEFORE USING THE APPLIANCE.

To reduce the risk of fire, electric shock, or personal injury when using your product, basic safety precautions should be followed, including the following.

- Do not use this product for special purposes (storage of medicine or test materials or for ships, etc).
- Unplug the power plug before cleaning or repairing the refrigerator.
- When you replace the light bulb in the refrigerator, unplug the refrigerator or turn off the power.
- Do not modify or extend the power cord.
- Do not use a dryer to dry the interior. Do not light a candle to remove the interior odor.
- For your safety, this appliance must be properly grounded. Have the wall outlet and the circuit checked by a qualified electrician to make sure the outlet is properly grounded.
- Do not use an outlet that can be turned off with a switch. Do not use an extension cord. It is the user's responsibility to replace a standard 2-prong wall outlet with a standard 3-prong wall outlet.
- Do not, under any circumstances, cut or remove the third (ground) prong from the power cord.
- Do not use an adapter plug and plug the power plug into a multi-outlet extension cord.
- Disconnect the power cord immediately if you hear a noise, smell a strange odor or detect smoke.
- Turn the power off if water or dust penetrates into the refrigerator. Call a service agent.
- Do not disassemble or modify the refrigerator.
- Do not put hands, feet, or metal objects below or behind the refrigerator.
- Do not operate the refrigerator or touch the power cord with wet hands.
- In refrigerators with automatic icemakers, avoid contact with the moving parts of the ejector mechanism or with the heating element that releases the cubes. Do not place fingers or hands on the automatic ice-making mechanism while the refrigerator is plugged in.
- When dispensing ice from the dispenser, do not use crystal ceramics.
- Do not touch the cold surfaces in the freezer compartment with wet or damp hands, when your refrigerator is in operation.
- Do not put glass containers, glass bottles or soda in the freezer.
- This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning the use of the appliance by a person responsible for their safety.
- Do not refreeze frozen food that have thawed completely. It may result in a serious health issue.
- If you are throwing away your old refrigerator, make sure the CFC coolant is removed for proper disposal by a qualified servicer. If you release CFC coolant, you may be fined or imprisoned in accordance with the relevant environmental law.
- Junked or abandoned refrigerators are dangerous, even if they are sitting for only a few days. When disposing the refrigerator, remove the packing materials from the door or take off the doors but leave the shelves in place so that children may not easily climb inside.

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READ ALL INSTRUCTIONS BEFORE USING THE APPLIANCE.

To reduce the risk of fire, electric shock, or personal injury when using your product, basic safety precautions should be followed, including the following.

⚠ CAUTION

Installation

- The refrigerator must be properly installed in accordance with the Installer Instructions that were taped to the front of the refrigerator.
- Be careful when you unpack and install the refrigerator. Immediately dispose of packing materials (plastic) out of reach of children.

Use

- Close the door carefully when children are around.
- Keep fingers out of pinch point areas; clearances between the doors and cabinets are necessarily small. Be careful closing doors when children are in the area.
- If you store food properly, beware that it may fall and cause injury.

Maintenance

- Do not use strong detergents like wax or thinners for cleaning. Clean with a soft fabric.
- Wipe foreign objects (dust, water, etc) off the prongs of the power plug and contact areas regularly.

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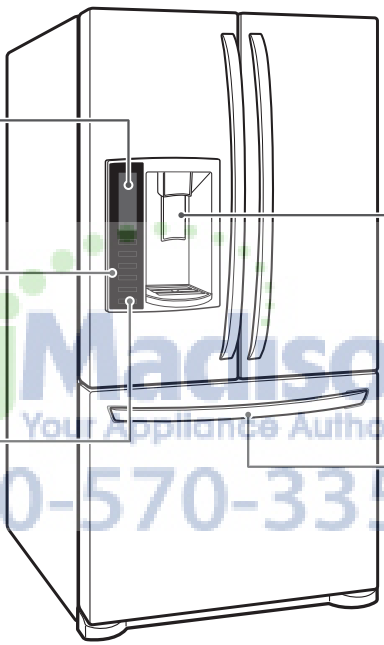
SAVE THESE INSTUCTIONS

COMPONENTS

Use this page to become more familiar with the parts and features of your refrigerator.
Page references are included for your convenience.

*The appearance and specifications of the actual product may differ depending on the model.

Refrigerator Exterior



LED Display
Displays the refrigerator and freezer temperature, the water filter condition and the dispenser status.

Ice Plus
When this feature is activated, the freezer section will run at the coldest temperature for a 24-hour period to increase ice production.

Door Alarm
A warning alarm sounds at 30-second intervals when the refrigerator or freezer door is left open for more than 60 seconds.

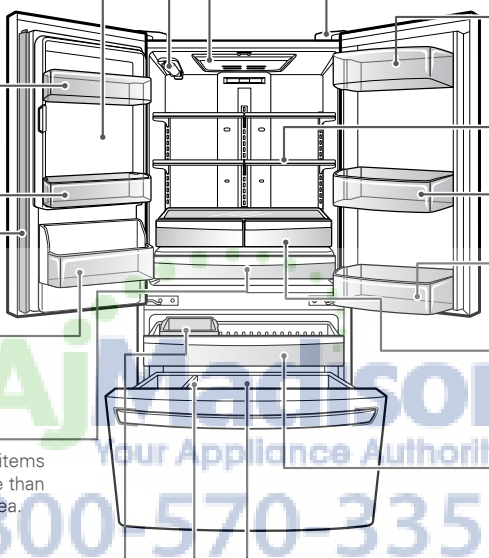
Filtered Water and Ice Dispenser
Dispenses fresh, chilled, filtered water through the door. The ice dispenser offers cubed or crushed ice.

Ez Handle
Easily opens the freezer door.

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Refrigerator Interior



LED Interior Lamps
The interior lamps light up the inside of the refrigerator.

Water Filter

SpacePlus Ice System
Automatically produces 80-130 ice cubes in a 24-hour period.

Fixed Door Bins

Mullion
Folds in when the left door is opened.

Can Storage Bin
Used to preserve chilled food or drinks.

Glide'N'Serve
Allows you to store food items at a different temperature than the regular refrigerator area.

Removable Ice Storage Bin
The ice storage bin can be removed to fill ice buckets, coolers, or pitchers.

Smart Diagnosis Speaker
Hold your phone to this speaker when activating Smart Diagnosis. Refer to the Smart Diagnosis section for more details.

Fixed Door Bin

Refrigerator Shelves
The shelves in your refrigerator are adjustable to meet your individual storage needs.

Modular Door Bin

Fixed Door Bin

Crispers
Controls humidity and helps vegetables and fruit to stay crisp.

Pullout Drawer

Durabase

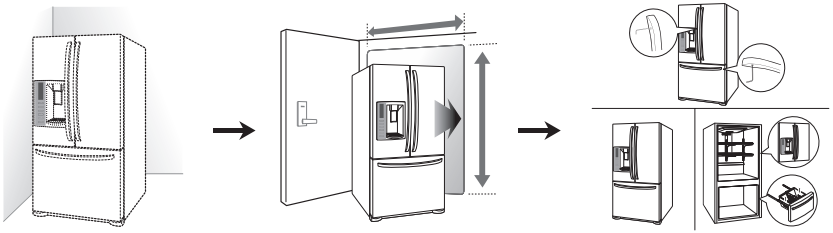
Durabase Divider

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INSTALLATION

Installation Overview

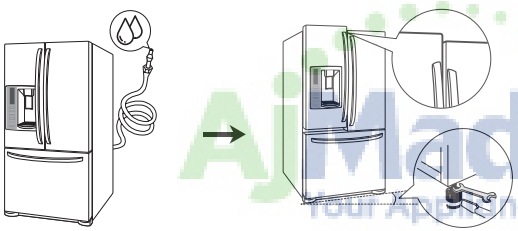
Please read the following installation instructions first after purchasing this product or transporting it to another location.



1 Unpacking your refrigerator

2 Choosing the proper location

3 Disassembling/Assembling



4 Connecting the water supply and water line

5 Leveling and Door Alignment

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Specifications

The appearance and specifications listed in this manual may vary due to constant product improvements.

Bottom-freezer refrigerator model LFX28968**	
Description	French Door Refrigerator
Electrical requirements	115 VAC @ 60 Hz
Min. / Max. Water pressure	20 - 120 psi (1.4 - 8.4 kgf/cm^2)
Dimensions	35 3/4" (W) X 35 3/8" (D) X 69 3/4" (H), 47 5/8" (D w/ door open) 908 mm (W) X 899 mm (D) X 1772 (H), 1210 mm (D w/ door open)
Net weight	342 lb. (155 kg)
Refrigerator storage capacity	18.82 cu. ft.
Freezer storage capacity	8.79 cu. ft.

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Unpacking Your Refrigerator

WARNING

- Use two or more people to move and install the refrigerator. Failure to do so can result in back or other injury.
- Your refrigerator is heavy. When moving the refrigerator for cleaning or service, be sure to protect the floor. Always pull the refrigerator straight out when moving it. Do not wiggle or walk the refrigerator when trying to move it, as floor damage could occur.
- Keep flammable materials and vapors, such as gasoline, away from the refrigerator. Failure to do so can result in fire, explosion, or death.

Remove tape and any temporary labels from your refrigerator before using. Do not remove any warning-type labels, the model and serial number label, or the Tech Sheet that is located under the front of the refrigerator.

To remove any remaining tape or glue, rub the area briskly with your thumb. Tape or glue residue can also be easily removed by rubbing a small amount of liquid dish soap over the adhesive with your fingers. Wipe with warm water and dry.

Do not use sharp instruments, rubbing alcohol, flammable fluids, or abrasive cleaners to remove tape or glue. These products can damage the surface of your refrigerator.

Refrigerator shelves are installed in the shipping position. Please reinstall shelves according to your individual storage needs.

Choosing the Proper Location

- Select a place where a water supply can be easily connected for the automatic icemaker.

NOTE

The water pressure must be between 20 and 120 psi on models without a water filter and between 40 and 120 psi on models with a water filter.

- The refrigerator should always be plugged into its own individual properly grounded electrical outlet rated for 115 Volts, 60 Hz, AC only, and fused at 15 or 20 amperes. This provides the best performance and also prevents overloading house wiring circuits which could cause a fire hazard from overheated wires. It is recommended that a separate circuit serving only this appliance be provided.

WARNING

To reduce the risk of electric shock, do not install the refrigerator in a wet or damp area.

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Flooring

To avoid noise and vibration, the unit must be leveled and installed on a solidly constructed floor. If required, adjust the leveling legs to compensate for unevenness of the floor. The front should be slightly higher than the rear to aid in door closing. Leveling legs can be turned easily by tipping the cabinet slightly. Turn the leveling legs to the left to raise the unit or to the right to lower it. (See Leveling and door Allgnment.)

NOTE

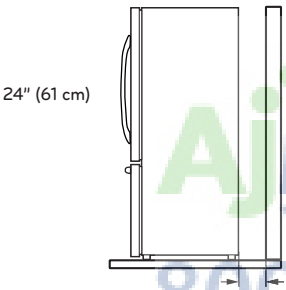
Installing on carpeting, soft tile surfaces, a platform or weakly supported structure is not recommended.

Ambient Temperature

Install this appliance in an area where the temperature is between 55°F (13°C) and 110°F (43°C). If the temperature around the appliance is too low or high, cooling ability may be adversely affected.

Measuring the Clearances

Too small of a distance from adjacent items may result in lowered freezing capability and increased electricity consumption charges. Allow at least 24 inches (61 cm) in front of the refrigerator to open the doors, and at least 2 inches (5 cm) between the back of the refrigerator and the wall.

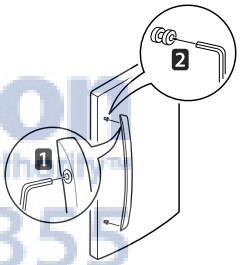


Removing/Assembling the Refrigerator Door Handles

> **NOTE**
>
> Removing the doors is always recommended when it is necessary to move the refrigerator through a narrow opening. If it is necessary to remove the handles, follow the directions below.

Removing the Handles

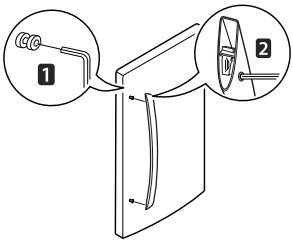
1. Loosen the set screws **1** with a $^{3}/_{32}$ in. Allen wrench and remove the handle.
2. Loosen the mounting fasteners **2** that connect to the refrigerator door and handle using a $^{1}/_{4}$ in. Allen wrench, remove the mounting fasteners.



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Assembling the Handles

1. Assemble the mounting fasteners **1** at both ends of the handle using a $^{1}/_{4}$ in. Allen wrench.
2. Place the handle on the door by fitting the handle footprints over the mounting fasteners and tightening the set screws **2** with a $^{3}/_{32}$ in. Allen wrench.

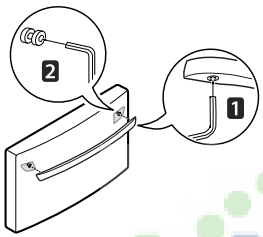


Removing/Assembling the Freezer Drawer Handle

Removing the Handles

1 Loosen the set screws 1 located on the lower side of the handle with a 1/8 in. Allen wrench and remove the handle.

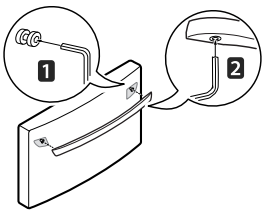
2 Loosen the mounting fasteners 2 that connect to the freezer drawer and handle using a 1/4 in. Allen wrench, and remove the mounting fasteners.



Assembling the Handles

1 Assemble the mounting fasteners 1 at both ends of the handle using a 1/4 in. Allen wrench.

2 Place the handle on the door by fitting the handle footprints over the mounting fasteners and tightening the set screws 2 with a 1/8 in. Allen wrench.



Removing/Assembling the Doors and Drawers

Removing the doors is always recommended when it is necessary to move the refrigerator through a narrow opening.

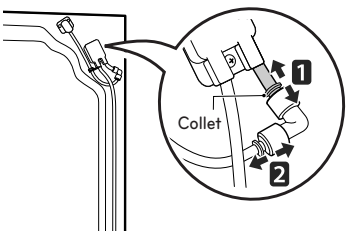
WARNING

- If your entrance door is too narrow for the refrigerator to pass through, remove the refrigerator doors and move the refrigerator sideways through the doorway.
- Use two or more people to remove and install the refrigerator doors. Failure to do so can result in back or other injury.
- Disconnect the electrical supply to the refrigerator before installing. Failure to do so could result in serious injury or death.
- Do not put hands, feet or other objects into the air vents or bottom of the refrigerator. You may be injured or receive an electrical shock.
- Be careful when handling the hinge and stopper. It may result in injury.
- Remove food and bins from the doors and drawers before detaching.

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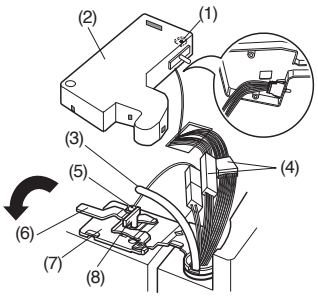
Removing the Left Refrigerator Door

1 The water supply is connected to the upper right part of the rear surface of the refrigerator. Remove the ring in the joint area. Hold the water supply connection and gently push the Collet to detach the water supply line as shown in 1 and 2.



NOTE

Detachment of the water supply line is applicable only when detaching the left refrigerator door.



2 Open the left door. Remove the top hinge cover screw (1). Lift up the cover (2).

3 Remove the cover.

4 Pull out the tube (3).

5 Disconnect all wire harnesses (4).

6 Remove the grounding screw (5).

7 Rotate the hinge lever (6) counterclockwise. Lift the top hinge (7) free of the hinge lever latch (8).

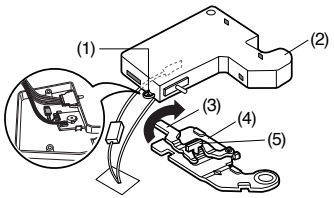
8 Lift the door from the middle hinge pin and remove the door.

9 Place the door, inside facing up, on a non-scratching surface.

CAUTION

When lifting the hinge free of the latch, be careful that the door does not fall forward.

Removing the Right Refrigerator Door



1 Open the door. Remove the top hinge cover screw (1). Lift up the cover (2).

2 Remove the cover.

3 Rotate the hinge lever (3) clockwise. Lift the top hinge (4) free of the hinge lever latch (5).

4 Lift the door from the middle hinge pin and remove the door.

5 Place the door, inside facing up, on a non-scratching surface.

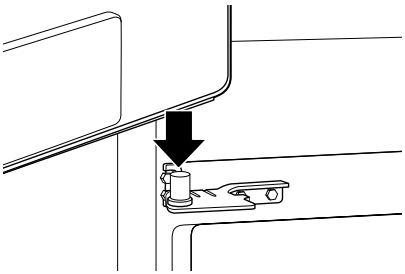
CAUTION

When lifting the hinge free of the latch, be careful that the door does not fall forward.

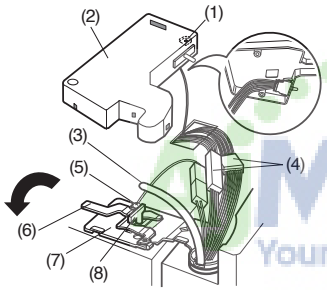
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Assembling the Left Refrigerator Door

Install the left refrigerator door after the right door is installed.



1 Lower the door onto the middle hinge pin.



2 Fit the top hinge (7) over the hinge lever latch (8) and into place.

3 Rotate the lever (6) clockwise to secure the hinge.

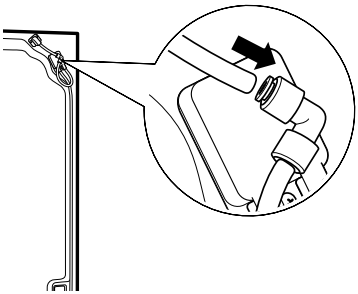
4 Install the grounding screws (5) and connect the two wire harnesses (4).

5 Push the water tube (3) located at the top of the left door into the hole beside the left hinge on the top of the cabinet until it exits through the back.

6 Insert the water supply tube (3) into the connector until you see only one scale mark. Fully insert the tub cover (15 mm).

7 Hook the tabs on the left side of the hinge cover (1) under the edge of the top hinge (7) and position the cover in place.

8 Insert and tighten the cover screw (1).

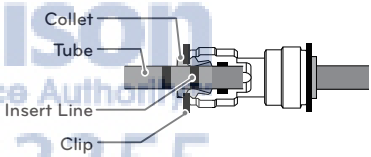


9 Insert the water supply tube at least 5/8 in. (15 mm) into the connector.

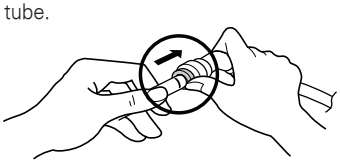
10 Hook the tab on the door switch side of the cover under the edge of the wire opening in the cabinet top.

11 Position the cover into place. Insert and tighten the cover screw.

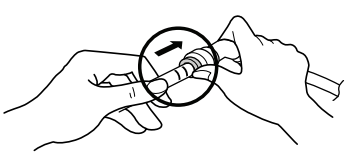
NOTE



1) Gently press the Collet and insert the tube until only one line shows on the tube.



(Correct)



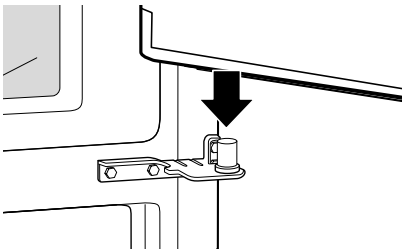
(Incorrect)

2) Pull the tube to make sure that the tube is tightly fastened and then insert the clip.

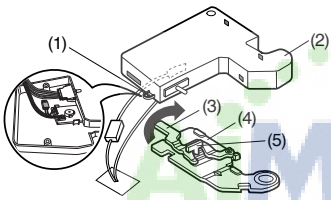
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Assembling the Right Refrigerator Door

Install the right-side door first.



1 Lower the door onto the middle hinge pin. Make sure that the plastic sleeve is inserted into the bottom of the door.



2 Fit the top hinge (4) over the hinge lever latch (5) and into place.

3 Rotate the lever (3) counterclockwise to secure the hinge.

4 Hook the tabs on the right side of the hinge cover (2) under the edge of the top hinge (4) and position the cover in place.

5 Insert and tighten the cover screw (1).

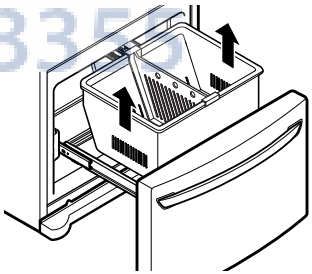
Removing the Freezer Drawers

The top, middle and bottom drawers are all removed in the same way. In the following figures, the Pullout Drawer located above the freezer drawer is not shown for clarity.

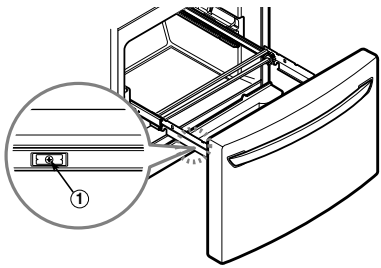
⚠ CAUTION

- Use two or more people to remove and install the freezer drawer. Failure to do so can result in back or other injury.
- Do not hold the handle when removing or replacing the drawer. The handle may come off and it could cause personal injury.
- Be careful of sharp hinges on both sides of the drawer.
- When you lay the drawer down, be careful not to damage the floor.
- Do not sit or stand on the freezer drawer.
- To prevent accidents, keep children and pets away from the drawer. Do not leave the drawer open.

1 Fully extend the freezer drawer. Lifting up and out to remove the Dura Base basket making sure to clear the rail system.

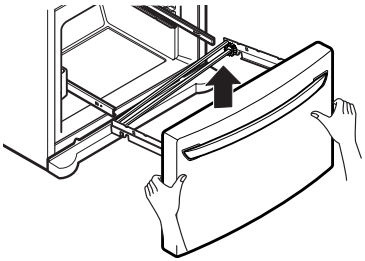


2 Remove one white screw ① on each side of the rails.



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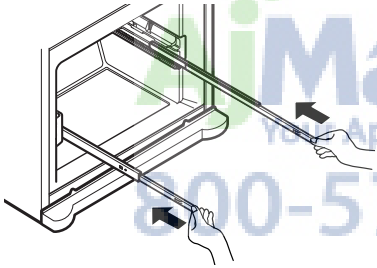
3 Holding both sides of the door pull up to separate the door from the rails.



4 With both hands, hold each rail and push it in to allow both rails to slide in simultaneously.

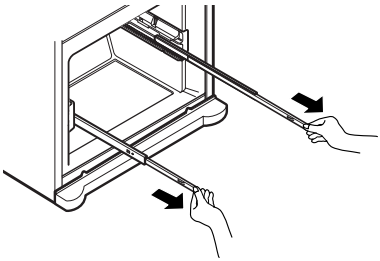
CAUTION

Do not hold the handle when removing or replacing the drawer. The handle may come off and it could cause personal injury.

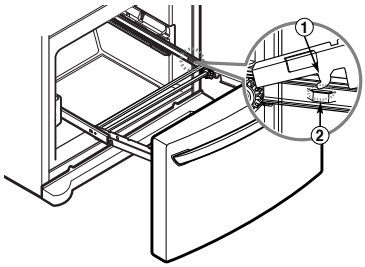


Assembling the Freezer Drawer

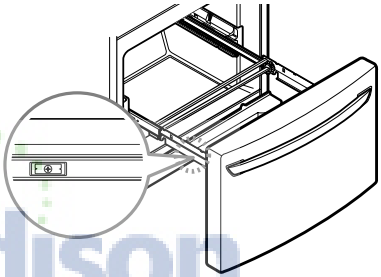
1 With both hands, pull out each rail simultaneously until both rails are fully extended.



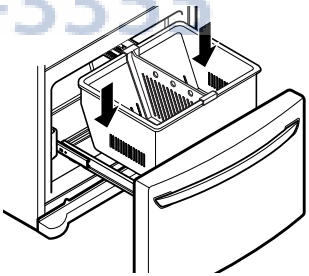
2 Hook door supports ① into rail tabs ②.



3 Lower door into final position and tighten the screws.



4 With the drawer pulled out to full extension, insert the lower basket in the rail assembly.



WARNING

- If the Durabase divider is removed, there is enough open space for children or pets to crawl inside. To prevent accidental child and pet entrapment or suffocation risk, DO NOT allow them to touch or go near the freezer drawer.
- DO NOT step or sit down on freezer drawer.

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Connecting the Water Line

Before You Begin

This water line installation is not covered by the refrigerator warranty. Follow these instructions carefully to minimize the risk of expensive water damage.

Water hammer (water banging in the pipes) in house plumbing can cause damage to refrigerator parts and can lead to water leakage or flooding. Call a qualified plumber to correct water hammer before installing the water supply line to the refrigerator.

⚠ CAUTION

To prevent burns and product damange, only connect the refrigerator water line to a cold water supply.

If you use your refrigerator before connecting the water line, make sure the icemaker power switch is in the OFF (O) position.

⚠ CAUTION

Do not install the icemaker tubing in areas where temperatures fall below freezing.

Water Pressure

A cold water supply. The water pressure must be between 20 and 120 psi on models without a water filter and between 40 and 120 psi on models with a water filter.

If a reverse osmosis water filtration system is connected to your cold water supply, this water line installation is not covered by the refrigerator warranty. Follow the following instructions carefully to minimize the risk of expensive water damage.

If a reverse osmosis water filtration system is connected to your cold water supply, the water pressure to the reverse osmosis system needs to be a minimum of 40 to 60 psi (2.8 kgf/cm^2 ~ 4.2 kgf/cm^2, less than 2.0~3.0 sec. to fill a cup of 7 oz capacity).

⚠ CAUTION

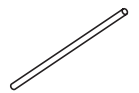
Wear eye protection during installation to prevent injury.

If the water pressure from the reverse osmosis system is less than 21 psi or 1.5 kgf/cm^2 (takes more than 4.0 sec to fill a cup of 7 oz capacity):

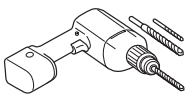
- Check to see if the sediment filter in the reverse osmosis system is blocked. Replace the filter if necessary.
- Allow the storage tank on the reverse usage.
- If the issue concerning water pressure from reverse osmosis remains, call a licensed, qualified plumber.
- All installations must be in accordance with local plumbing code requirements.

What You Will Need

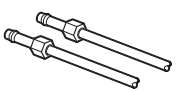
- **Copper Tubing,** ¼ in. outer diameter, to connect the refrigerator to the water supply. Be sure both ends of the tubing are cut square.
- To determine how much tubing you need: measure the distance from the water valve on the back of the refrigerator to the water supply pipe. Then, add 8 feet (2.4 m). Be sure there is sufficient extra tubing (about 8 feet [2.4 m] coiled into 3 turns of about 10 in. [25 cm] diameter) to allow the refrigerator to move out from the wall after installation.



- **Power drill.**
- **½ in. or adjustable wrench.**

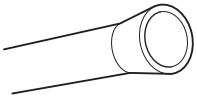


- **Flat blade and Phillips head screwdrivers.**
- **Two ¼ in. outer diameter compression nuts and 2 ferrules (sleeves)** to connect the copper tubing to the shutoff valve and the refrigerator water valve.

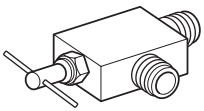


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- If your existing copper water line has a flared fitting at the end, you will need an **adapter** (available at plumbing supply stores) to connect the water line to the refrigerator OR you can cut off the flared fitting with a tube cutter and then use a compression fitting.



- **Shutoff valve to connect to the cold water line.** The shutoff valve should have a water inlet with a minimum inside diameter of 5/32 in. at the point of connection to the COLD WATER LINE. Saddle-type shutoff valves are included in many water supply kits. Before purchasing, make sure a saddle-type valve complies with your local plumbing codes.



NOTE

A self piercing saddle type water valve should not be used.

Water Line Installation Instructions

WARNING

When using any electrical device (such as a power drill) during installation, be sure the device is battery powered, double insulated or grounded in a manner that will prevent the hazard of electric shock.

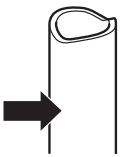
Install the shutoff valve on the nearest frequently used drinking water line.

1 SHUT OFF THE MAIN WATER SUPPLY

Turn on the nearest faucet to relieve the pressure on the line.

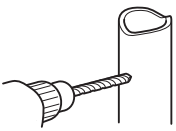
2 CHOOSE THE VALVE LOCATION

Choose a location for the valve that is easily accessible. It is best to connect into the side of a vertical water pipe. When it is necessary to connect into a horizontal water pipe, make the connection to the top or side, rather than at the bottom, to avoid drawing off any sediment from the water pipe.



3 DRILL THE HOLE FOR THE VALVE

Drill a ¼ in. hole in the water pipe using a sharp bit. Remove any burrs resulting from drilling the hole in the pipe. Be careful not to allow water to drain into the drill. Failure to drill a ¼ in. hole may result in reduced ice production or smaller cubes.



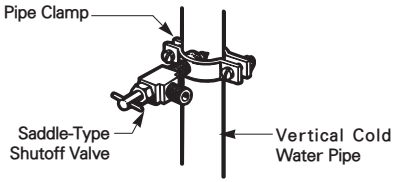
NOTE

The hookup line cannot be white, plastic tubing. Licensed plumbers must use only copper tubing NDA tubing #49595 or 49599 or Cross Link Polyethylene (PEX) tubing.

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4 FASTEN THE SHUTOFF VALVE

Fasten the shutoff valve to the cold water pipe with the pipe clamp.



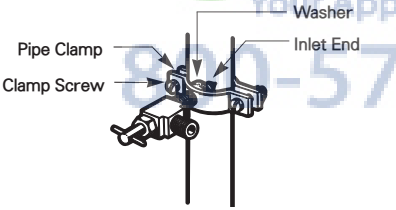
NOTE

Commonwealth of Massachusetts Plumbing Codes 248CMR shall be adhered to. Saddle valves are illegal and use is not permitted in Massachusetts. Consult with your licensed plumber.

5 TIGHTEN THE PIPE CLAMP

Tighten the clamp screws until the sealing washer begins to swell.

NOTE: Do not overtighten clamp or you may crush the tubing.



6 ROUTE THE TUBING

Route the tubing between the cold water line and the refrigerator.

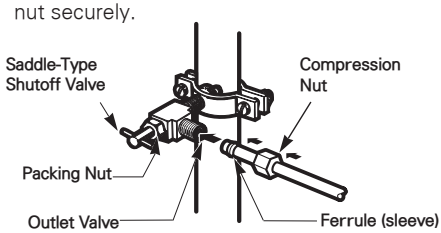
Route the tubing through a hole drilled in the wall or floor (behind the refrigerator or adjacent base cabinet) as close to the wall as possible.

NOTE

Be sure there is sufficient extra tubing (about 8 feet coiled into 3 turns of about 10 in. diameter) to allow the refrigerator to move out from the wall after installation.

7 CONNECT THE TUBING TO THE VALVE

Place the compression nut and ferrule (sleeve) for copper tubing onto the end of the tubing and connect it to the shutoff valve. Make sure the tubing is fully inserted into the valve. Tighten the compression nut securely.



8 FLUSH OUT THE TUBING



Turn the main water supply on and flush out the tubing until the water is clear.

Shut the water off at the water valve after about one quart of water has been flushed through the tubing.

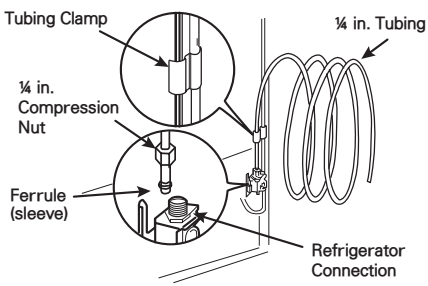
9 CONNECT THE TUBING TO THE REFRIGERATOR

NOTE: Before making the connection to the refrigerator, be sure that the refrigerator power cord is not plugged into the wall outlet.

a. Remove the plastic flexible cap from the water valve.

b. Place the compression nut and ferrule (sleeve) onto the end of the tubing as shown.

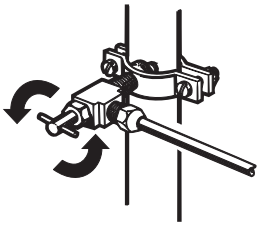
c. Insert the end of the copper tubing into the connection as far as possible. While holding the tubing, tighten the fitting.



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10 TURN THE WATER ON AT THE SHUTOFF VALVE

Tighten any connections that leak.



CAUTION

Check to see if leaks occur at the water line connections.

11 PLUG IN THE REFRIGERATOR

Arrange the coil of tubing so that it does not vibrate against the back of the refrigerator or against the wall. Push the refrigerator back to the wall.

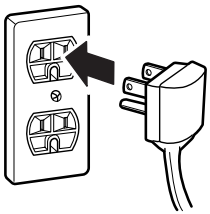
12 START THE ICEMAKER

Set the icemaker power switch to the **ON** position.

The icemaker will not begin to operate until it reaches its operating temperature of 15°F (–9°C) or below. It will then begin operation automatically if the icemaker power switch is in the **ON (I)** position.

Turning On The Power

1 Plug in the refrigerator.



CAUTION

- Connect to a rated power outlet.
- Have a certified electrician check the wall outlet and wiring for proper grounding.
- Do not damage or cut off the ground terminal of the power plug.

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Leveling and Door Alignment

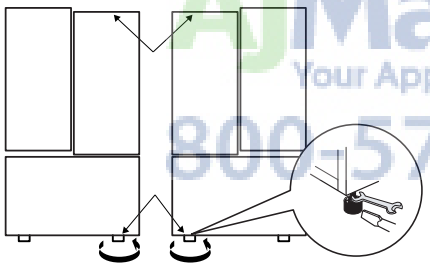
Leveling

After installing, plug the refrigerator's power cord into a 3-prong grounded outlet and push the refrigerator into the final position.

Your refrigerator has two front leveling legs—one on the right and one on the left. Adjust the legs to alter the tilt from front-to-back or side-to-side. If your refrigerator seems unsteady, or you want the doors to close more easily, adjust the refrigerator's tilt using the instructions below:

1 Remove the base grille. Refer to the Base Grille Installation section.

2 Turn the leveling leg to the left to raise that side of the refrigerator or to the right to lower it. It may take several turns of the leveling leg to adjust the tilt of the refrigerator.



NOTE

A flare nut wrench works best, but an open-end wrench will suffice.
Do not over-tighten.

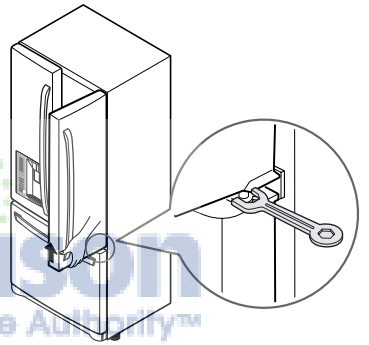
3 Open both doors again and check to make sure that they close easily. If the doors do not close easily, tilt the refrigerator slightly more to the rear by turning both leveling legs to the left. It may take several more turns, and you should turn both leveling legs the same mount.

4 Replace the base grille.

Door Alignment

Both the left and right refrigerator doors have an adjustable nut, located on the bottom hinge, to raise and lower them to align properly.
If the space between your doors is uneven, follow the instructions below to align the doors evenly:

Use the wrench (included with the Owner's Manual) to turn the nut in the door hinge to adjust the height. To the right to raise or to the left to lower the height.



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HOW TO USE

Before use



Clean the refrigerator.

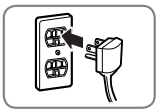
Clean your refrigerator thoroughly and wipe off all dust that accumulated during shipping.

CAUTION

- Do not scratch the refrigerator with a sharp object or use a detergent that contains alcohol, a flammable liquid or an abrasive when removing any tape or adhesive from the refrigerator,.
- Do not peel off the model or serial number label or the technical information on the rear surface of the refrigerator.

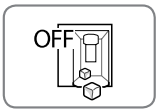
NOTE

Remove adhesive residue by wiping it off with your thumb or dish detergent.



Connect the power supply.

Check if the power supply is connected before use.
Read the "Turning On The Power" section.

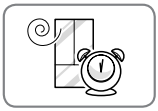


Turn off the icemaker if the refrigerator is not yet connected to the water supply.

Turn off the automatic icemaker and then plug the power plug of the refrigerator into the grounded electric outlet.
* This is applicable only to certain models.

CAUTION

Running the automatic icemaker before connecting it to the water supply may cause the refrigerator to malfunction.

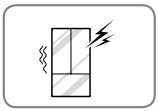


Wait for the refrigerator to cool.

Allow your refrigerator to run for at least two to three hours before putting food in it. Check the flow of cold air in the freezer compartment to ensure proper cooling.

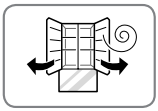
CAUTION

Putting food in the refrigerator before it has cooled could cause the food to spoil, or a bad odor could remain inside the refrigerator.



The refrigerator makes a loud noise after initial operation.

This is normal. The loudness will decrease as the temperature lowers.



Open refrigerator doors and freezer drawers to ventilate the interior.

The inside of the refrigerator may smell like plastic at first. Remove any adhesive tape from inside the refrigerator and open the refrigerator doors and the freezer drawers for ventilation.

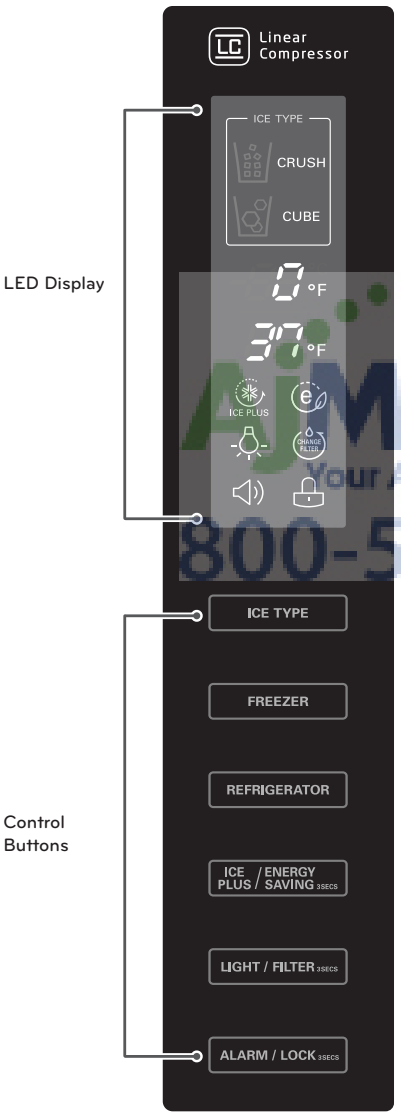
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Control Panel

* Depending on the model, some of the following functions may not be available.

Control Panel Features

The LED Display shows the temperature settings, dispenser options, water filter, door alarm, and locking status messages.



Ice Type

CRUSH CUBE

Press the ICE TYPE button to select either Crushed or Cubed Ice. The selected option will illuminate on the LED display.

Freezer

0 °F

Press the FREEZER button to adjust the temperature in the freezer compartment.

NOTE

To change the display from Fahrenheit to Celsius, press and hold the FREEZER and REFRIGERATOR button for five seconds.

Refrigerator

37 °F

Press the REFRIGERATOR button to adjust the temperature in the freezer compartment.

Ice Plus

ICE PLUS

This function increases both ice making and freezing capabilities.

- When you touch the Ice Plus button, the graphic will illuminate in the display and will continue for 24 hours. The function will automatically shut off after 24 hours.
- You can stop this function manually by touching the button one more time.

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Control Panel Features (continued)

Energy Saving

The Energy Saving function disables the mullion heater located on the refrigerator door in order to conserve electricity. Press and hold the Energy Saving button for three seconds to activate or deactivate this function.

NOTE

Discontinue using the Energy Saving function if excessive moisture begins to collect on the door mullion.

Light

Press the LIGHT button, to turn on the dispenser light. The indicator will appear on the LED display.

Change Filter

When the water filter indicator turns on, you have to change the water filter. After changing the water filter, press and hold the FILTER button for three seconds to turn the indicator light off. You need to change the water filter approximately every six months.

Alarm

- When power is connected to the refrigerator, the door alarm is initially set to ON. When you press the ALARM button, the display will change to OFF and the Alarm function will deactivate.
- When either the refrigerator or the freezer door is left open for more than 60 seconds, the alarm tone will sound to let you know that the door is open.
- When you close the door, the door alarm will stop.

Control Lock

The Control Lock function disables every other button on the display.

- When power is initially connected to the refrigerator, the Lock function is off.
- If you want to activate the Lock function to lock other buttons, press and hold the Lock button for three seconds or more. The Lock icon will display and the Lock function is now enabled.
- To disable the Lock function, press and hold the Lock button for approximately three seconds.

CAUTION

Display Mode (For Store Use Only)

The Display Mode disables all cooling in the refrigerator and freezer sections to conserve energy while on display in a retail store. When activated, OFF will display on the control panel.

To deactivate:

With either refrigerator door opened, press and hold the Refrigerator and Ice Plus buttons at the same time for five seconds. The control panel will beep and the temperature settings will display to confirm that Display Mode is deactivated. Use the same procedure to activate the Display Mode.

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In-Door Ice Bin

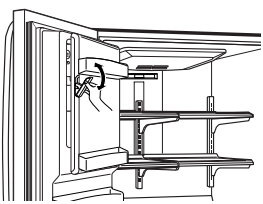
* Depending on the model, some of the following functions may not be available.

CAUTION

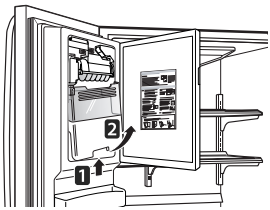
- Keep hands and tools out of the ice compartment door and dispenser chute. Failure to do so may result in damage or personal injury.
- The icemaker will stop producing ice when the in-door ice bin is full. If you need more ice, empty the ice bin into the extra ice bin in the freezer compartment. During use, the ice can become uneven causing the icemaker to misread the amount of ice cubes and stop producing ice. Shaking the ice bin to level the ice within it can reduce this problem.
- Storing cans or other items in the ice bin will damage the icemaker.
- Keep the ice compartment door closed tightly. If the ice compartment door is not closed tightly, the cold air in the ice bin will freeze food in the refrigerator compartment. This could also cause the icemaker to stop producing ice.
- If the ON/OFF switch on the icemaker is set to OFF for an extended period of time, the ice compartment will gradually warm up to the temperature of the refrigerator compartment. To prevent ice cubes from melting and leaking from the dispenser, ALWAYS empty the ice bin when the icemaker is set to OFF for more than a few hours.

Detaching the In-Door Ice Bin

1 Gently pull the handle to open the ice compartment.

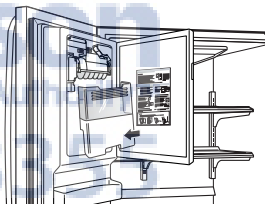


2 To remove the in-door ice bin, grip the front handle, slightly lift the lower part, and slowly pull out the bin as shown.

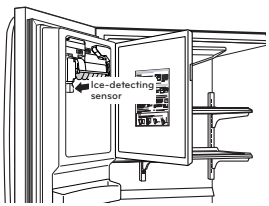


Assembling the In-Door Ice Bin

1 Carefully insert the in-door ice bin while slightly slanting it to avoid contact with the icemaker.



2 Avoid touching the ice-detecting sensor when replacing the ice bin. See the label on the ice compartment door for details.



CAUTION

When handling the ice bin, keep hands away from the icemaker tray area to avoid personal injury.



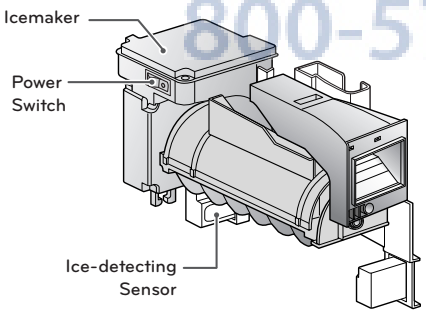
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Automatic Icemaker

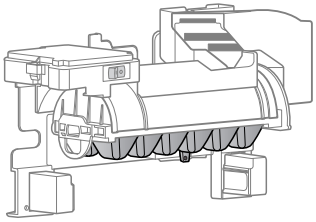
* Depending on the model, some of the following functions may not be available.

Ice is made in the automatic icemaker and sent to the dispenser. The icemaker will produce 12 cubes per cycle—approximately 120 cubes in a 24-hour period, depending on freezer compartment temperature, room temperature, number of door openings and other operating conditions.

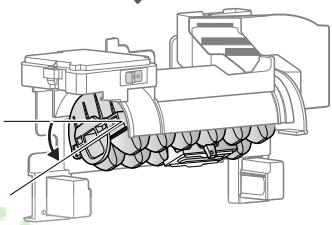
- It takes about 12 to 24 hours for a newly installed refrigerator to begin making ice. Wait 72 hours for full ice production to occur.
- Ice making stops when the in-door ice bin is full. When full, the in-door ice bin holds approximately 6 to 8 (12-16 oz) glasses of ice.
- The water pressure must be between 20 and 120 psi on models without a water filter and between 40 and 120 psi on models with a water filter to produce the normal amount and size of ice cubes.
- Foreign substances or frost on the ice-detecting sensor can interrupt ice production. Make sure the sensor area is clean at all times for proper operation.



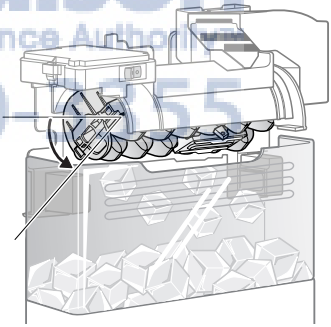
Water fills the ice tray.



1 hour later from supplying water



- 60 minutes after water has been added to the ice tray, the ice tray will sit slightly tilted to help the cold air reach the ice.



- The ice-detecting sensors will sense when the ice is ready to be dumped into the ice bin.

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Turning the Automatic Icekamer On or Off

To turn off the automatic icemaker, set the icemaker switch to **OFF (O)**. To turn on the automatic icemaker, set the switch to **ON (I)**.

Automatic Icemaker (continued)

CAUTION

- The first ice and water dispensed may include particles or odor from the water supply line or the water tank.
- Throw away the first few batches of ice (about 24 cubes). This is also necessary if the refrigerator has not been used for a long time.
- Never store beverage cans or other items in the ice bin for the purpose of rapid cooling. Doing so may damage the icemaker or the containers may burst.
- If discolored ice is dispensed, check the water filter and water supply. If the problem continues, contact a Sears or other qualified service center. Do not use the ice or water until the problem is corrected.
- Keep children away from the dispenser. Children may play with or damage the controls.
- The ice passage may become blocked with frost if only crushed ice is used. Remove the frost that accumulates by removing the ice bin and clearing the passage with a rubber spatula. Dispensing cubed ice can also help prevent frost buildup.
- Never use thin crystal glass or crockery to collect ice. Such containers may chip or break resulting in glass fragments in the ice.
- Dispense ice into a glass before filling it with water or other beverages. Splashing may occur if ice is dispensed into a glass that already contains liquid.
- Never use a glass that is exceptionally narrow or deep. Ice may jam in the ice passage and refrigerator performance may be affected.
- Keep the glass at a proper distance from the ice outlet. A glass held too close to the outlet may prevent ice from dispensing.
- To avoid personal injury, keep hands out of the ice door and passage.
- Never remove the dispenser cover.
- If ice or water dispenses unexpectedly, turn off the water supply and contact a qualified service center.

When You Should Turn the Icemaker Off

- When the water supply will be shut off for several hours.
- When the ice bin is removed for more than one or two minutes.
- When the refrigerator will not be used for several days.

NOTE

The ice bin should be emptied when the icemaker on/off switch is turned to the **OFF** position.

Normal Sounds You May Hear

- The icemaker water valve will buzz as the icemaker fills with water. If the power switch is in the ON (I) position, it will buzz even if it has not yet been hooked up to water. To stop the buzzing, move the power switch to OFF (O).

NOTE

Keeping the power switch in the ON (I) position before the water line is connected can damage the icemaker.

- You will hear the sound of cubes dropping into the bin and water running in the pipes as the icemaker refills.

Preparing for Vacation

Set the icemaker power switch to OFF (O) and shut off the water supply to the refrigerator.

NOTE

The ice bin should be emptied anytime the icemaker on/off switch is turned to the OFF (O) position.

If the ambient temperature will drop below freezing, have a qualified technician drain the water supply system to prevent serious property damage due to flooding caused by ruptured water lines or connections.

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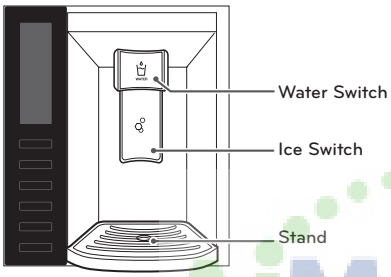
Ice and Water Dispenser

* Depending on the model, some of the following functions may not be available.

CAUTION

Keep children away from the dispenser. Children may play with or damage the controls.

Dispenser



Using the Dispenser

- To dispense **cold water**, push on the water switch with a glass.
- To dispense **ice**, push on the ice switch with a glass.

NOTE

- If discolored ice is dispensed, check the water filter and water supply. If the problem continues, contact a qualified service center. Do not use the ice or water until the problem is corrected.
- The dispenser will not operate when either of the refrigerator doors are open.
- If dispensing water or ice into a container with a small opening, place it as close to the dispenser as possible.
- Some dripping may occur after dispensing. Hold your cup beneath the dispenser for a few seconds after dispensing to catch all of the drops.

	Incorrect Way	Correct Way
Water		
Ice		

CAUTION

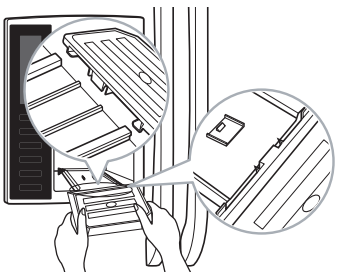
Throw away the first few batches of ice (about 24 cubes). This is also necessary if the refrigerator has not been used for a long time.

Locking the Dispenser

Press and hold the Alarm and Lock button simultainously for 3 seconds to lock the dispenser and all the control panel functions. Follow the same instructions to unlock.

Cleaning the Dispenser Stand

1 Grip the stand with both hands and pull it out.



2 Wipe out dirty areas with a clean cloth.

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Storing Food

Food Preservation Location

Each compartment inside the refrigerator is designed to store different types of food.
Store your food in the optimal space to enjoy the freshest taste.



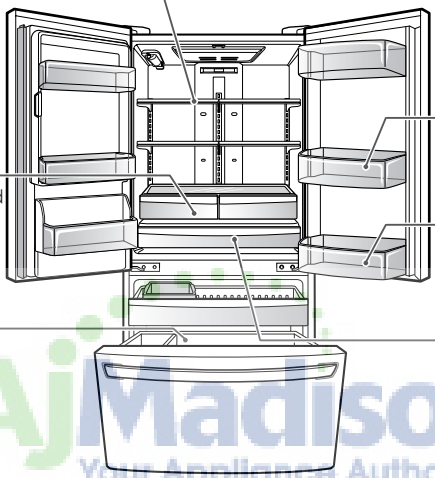
Adjustable refrigerator shelf
Adjustable shelves to meet your individual storage needs.



Vegetable storage (Crisper)
Preserves vegetables and fruit.



Durabase®
Largest storage space in the freezer.





Gallon Storage Bin
Store drinks such as juice and soda, as well as seasonings, salad dressings and other food items.



Glide'N'Serve
Provides storage space that keeps the compartment at a different temperature than the refrigerator. It is a convenient place to store sandwiches or meat to be cooked.

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800-570-3355

CAUTION

- Do not store food with high moisture content towards the top of the refrigerator. The moisture could come in direct contact with the cold air and freeze.
- Wash food before storing it in the refrigerator. Vegetables and fruit should be washed, and food packaging should be wiped down to prevent adjacent foods from being contaminated.
- If the refrigerator is kept in a hot and humid place, frequent opening of the door or storing a lot of vegetables in the refrigerator may cause condensation to form. Wipe off the condensation with a clean cloth or a paper towel.
- If the refrigerator door or freezer drawer is opened or closed too often, warm air may penetrate the refrigerator and raise its temperature. It can also increase the cost of electricity.

NOTE

- If you are leaving home for a short period of time, like a short vacation, the refrigerator should be left on. Refrigerated foods that are able to be frozen will stay preserved longer if stored in the freezer.
- If you are leaving the refrigerator turned off for an extended period of time, remove all food and unplug the power cord. Clean the interior, and leave the door open to prevent fungi from growing in the refrigerator.

Food Storage Tips

* The following tips may not be applicable depending on the model.

Wrap or store food in the refrigerator in airtight and moisture-proof material unless otherwise noted. This prevents food odor and taste transfer throughout the refrigerator. For dated products, check date code to ensure freshness.

Food	How to
Butter or Margarine	Keep opened butter in a covered dish or closed compartment. When storing an extra supply, wrap in freezer packaging and freeze.
Cheese	Store in the original wrapping until you are ready to use it. Once opened, rewrap tightly in plastic wrap or aluminum foil.
Milk	Wipe milk cartons. For best storage, place milk on interior shelf, not on door shelf.
Eggs	Store in original carton on interior shelf, not on door shelf.
Fruit	Do not wash or hull the fruit until it is ready to be used. Sort and keep fruit in its original container, in a crisper, or store in a completely closed paper bag on a refrigerator shelf.
Leafy Vegetables	Remove store wrapping and trim or tear off bruised and discolored areas. Wash in cold water and drain. Place in plastic bag or plastic container and store in crisper.
Vegetables with skins (carrots, peppers)	Place in plastic bags or plastic container and store in crisper.
Fish	Store fresh fish and shellfish in the freezer section if they are not being consumed the same day of purchase. It is recommended to consume fresh fish and shellfish the same day purchased.
Leftovers	Cover leftovers with plastic wrap, aluminum foil, or plastic containers with tight lids.

Storing Frozen Food

NOTE

Check a freezer guide or a reliable cookbook for further information about preparing food for freezing or food storage times.

Freezing

Your freezer will not quick-freeze a large quantity of food. Do not put more unfrozen food into the freezer than will freeze within 24 hours (no more than 2 to 3 lbs. of food per cubic foot of freezer space). Leave enough space in the freezer for air to circulate around packages. Be careful to leave enough room at the front so the door can close tightly.

Storage times will vary according to the quality and type of food, the type of packaging or wrap used (how airtight and moisture-proof) and the storage temperature. Ice crystals inside a sealed package are normal. This simply means that moisture in the food and air inside the package have condensed, creating ice crystals.

NOTE

Allow hot foods to cool at room temperature for 30 minutes, then package and freeze. Cooling hot foods before freezing saves energy.

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Storing Frozen Food (continued)

Packaging

Successful freezing depends on correct packaging. When you close and seal the package, it must not allow air or moisture in or out. If it does, you could have food odor and taste transfer throughout the refrigerator and could also dry out frozen food.

Packaging recommendations:

- Rigid plastic containers with tight-fitting lids
- Straight-sided canning/freezing jars
- Heavy-duty aluminum foil
- Plastic-coated paper
- Non-permeable plastic wraps
- Specified freezer-grade self-sealing plastic bags

Follow package or container instructions for proper freezing methods.

Do not use

- Bread wrappers
- Non-polyethylene plastic containers
- Containers without tight lids
- Wax paper or wax-coated freezer wrap
- Thin, semi-permeable wrap

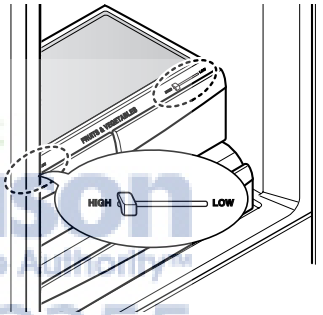
Humidity Controlled Crisper

* Depending on the model, some of the following functions may not be available.

The crispers provide fresher tasting fruit and vegetables by letting you easily control humidity inside the drawer.

You can control the amount of humidity in the moisture-sealed crispers by adjusting the control to any setting between **HIGH** and **LOW.**

- **HIGH** keeps moist air in the crisper for best storage of fresh, leafy vegetables.
- **LOW** lets moist air out of the crisper for best storage of fruit.

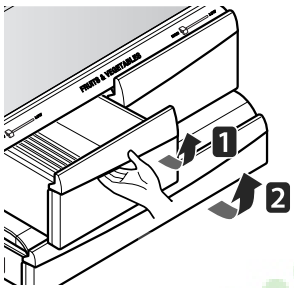


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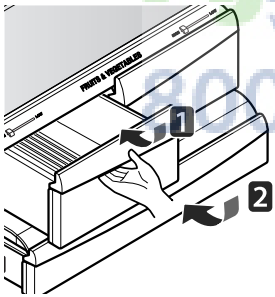
Detaching and Assembling the Storage Bins

Glide'N'Serve and Humidity Controlled Crisper

To remove the Humidity Controlled Crisper and the Glide'N'Server, pull out the Crisper 1 and Glide'N'Server 2 to full extension, lift the front up, and pull straight out.



To install, slightly tilt up the front, insert the drawer into the frame and push it back into place.



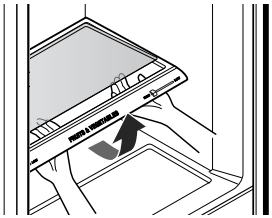
NOTE

Storage Bins may vary in appearance, depending on your model.

To Remove the Glass

(Pantry drawer not shown for clarity)

Lift up the glass under the crisper cover, and pull up and out.

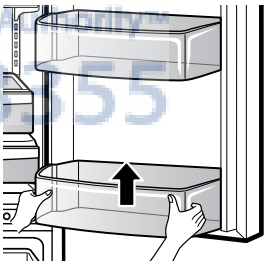


Door Bins

The door bins are removable for easy cleaning and adjustment.

1 To remove the bin, simply lift the bin up and pull straight out.

2 To replace the bin, slide it in above the desired support and push down until it snaps into place.



NOTE

Some bins may vary in appearance and will only fit in one location.

CAUTION

- Do not apply excessive force while detatching or assembling the storage bins.
- Do not use the dishwasher to clean the storage bins and shelves.
- Regularly detach and wash the storage bins and shelves; they can become easily contaminated by the food.

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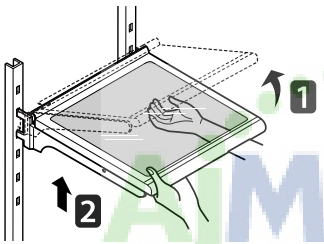
Adjusting the Refrigerator Shelves

The shelves in your refrigerator are adjustable to meet your individual storage needs. Your model may have glass or wire shelves.

Adjusting the shelves to fit different heights of items will make finding the exact item you want easier. Doing so will also reduce the amount of time the refrigerator door is open which will save energy.

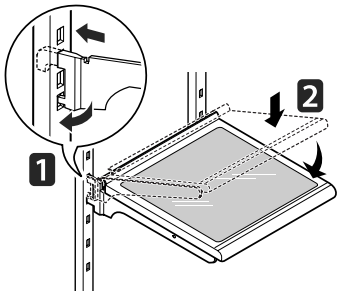
Detaching the Shelf

Tilt up the front of the shelf and lift it straight up. Pull the shelf out.



Assembling the Shelf

Tilt the front of the shelf up and guide the shelf hooks into the slots at a desired height. Then, lower the front of the shelf so that the hooks drop into the slots.



CAUTION

Make sure that shelves are level from one side to the other. Failure to do so may result in the shelf falling or spilling food.

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MAINTENANCE

Cleaning

- Both the refrigerator and freezer sections defrost automatically; however, clean both sections about once a month to prevent odors.
- Wipe up spills immediately.
- Always unplug the refrigeration before cleaning.

General Cleaning Tips

- Unplug refrigerator or disconnect power.
- Remove all removable parts, such as shelves, crispers, etc.
- Use a clean sponge or soft cloth and a mild detergent in warm water. Do not use abrasive or harsh cleaners.
- Hand wash, rinse and dry all surfaces thoroughly.

Exterior

Waxing external painted metal surfaces helps provide rust protection. Do not wax plastic parts. Wax painted metal surfaces at least twice a year using appliance wax (or auto paste wax). Apply wax with a clean, soft cloth.

For products with a stainless steel exterior, use a clean sponge or soft cloth and a mild detergent in warm water. Do not use abrasive or harsh cleaners. Dry thoroughly with a soft cloth.

CAUTION

- Do not use a rough cloth or sponge when cleaning the interior and exterior of the refrigerator.
- Do not place your hand on the bottom surface of the refrigerator when opening and closing.

WARNING

Use non-flammable cleaner. Failure to do so can result in fire, explosion, or death.

Inside Walls (allow freezer to warm up so the cloth will not stick)

To help remove odors, you can wash the inside of the refrigerator with a mixture of baking soda and warm water. Mix 2 tablespoons of baking soda to 1 quart of water (26 g soda to 1 liter water.) Be sure the baking soda is completely dissolved so it does not scratch the surfaces of the refrigerator.

Door Liners and Gaskets

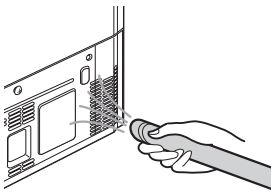
Use a clean sponge or soft cloth and a mild detergent in warm water. Do not use cleaning waxes, concentrated detergents, bleaches, or cleaners containing petroleum on plastic refrigerator parts.

Plastic Parts (covers and panels)

Use a clean sponge or soft cloth and a mild detergent in warm water. Do not use window sprays, abrasive cleansers, or flammable fluids. These can scratch or damage the material.

Condenser Coils

Use a vacuum cleaner with an attachment to clean the condenser cover and vents. Do not remove the panel covering the condenser coil area.



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Light bulb replacement

WARNING

Electrical Shock Hazard

Before replacing a burned-out light bulb, either unplug the refrigerator or turn off power at the circuit breaker or fuse box.

NOTE

The refrigerator compartment has LED interior lighting and service should only be performed by a qualified technician.

Change Freezer Compartment Light Bulb

1 Unplug refrigerator power cord form outlet.

2 Remove the screw using a Phillips screwdriver.

3 Grasp the light cover, pull the cover downward.

CAUTION

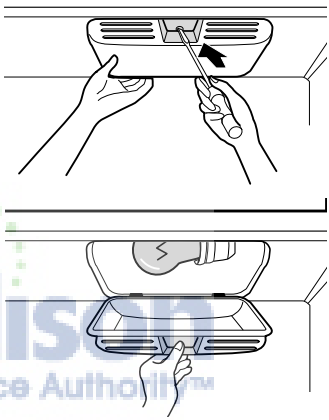
- Make sure the bulb is cool to the touch.

4 Rotate the bulb counterclockwise to remove.

5 Replace with a new 60-watt appliance bulb.

6 Insert tabs on back of cover into slots in freezer ceiling. Push cover up to snap front into place.

7 Tighten the screw using a Phillips screwdriver.



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General Information

Power interruptions

1 If the power will be out for 24 hours or less, keep all refrigerator doors closed to help foods stay cold and frozen.

2 If the power will be out for more than 24 hours, remove all food and store it in a different refrigerator or frozen food locker.

When you go on vacation

If you choose to leave the refrigerator on while you are away, follow these steps to prepare your refrigerator before you leave.

1 Use up any perishables and freeze other items.

2 Turn off the icemaker and empty the ice bin.

If you choose to turn the refrigerator off before you leave, follow these steps.

1 Remove all food from the refrigerator.

2 Clean the refrigerator, wipe it and dry well.

3 Tape rubber or wood blocks to the tops of both doors to prop them open far enough for air to get in. This stops odor and mold from building up.

When you move

When you are moving your refrigerator to a new home, follow these steps to prepare it for the move.

1 Remove all food from the refrigerator and pack all frozen food in dry ice.

2 Unplug the refrigerator.

3 Clean, wipe and dry thoroughly.

4 Take out all removable parts, wrap them well and tape them together so they do not shift and rattle during the move. Refer to the Using your Refrigerator section for removable instructions.

5 Depending on the model, raise the front of the refrigerator so it rolls easier OR screw in the leveling legs all the way so they do not scrape the floor. See the Door Closing section.

6 Tape the doors shut and tape the power cord to the refrigerator cabinet.

When you get to your new home, put everything back and refer to the Refrigerator Installation section for preparation instructions.

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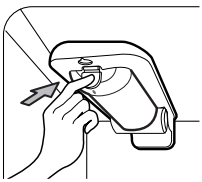
Replacing the Water Filter

It is recommended that you replace the water filter:

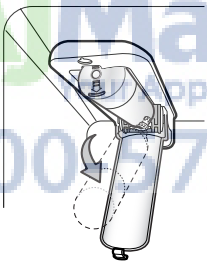
- Approximately every six months.
- When the water filter indicator turns on.
- When the water dispenser output decreases.
- When the ice cubes are smaller than normal.

1 Remove the old water filter.

- Lower or remove the top left shelf to allow the water filter to rotate all the way down.
- Press the push button to open the water filter cover.



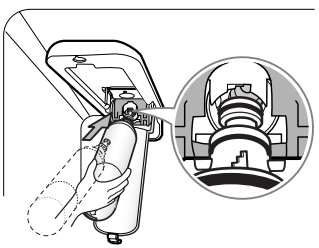
NOTE: Replacing the water filter causes a small amount of water (around 1 oz. or 25 cc) to drain. Place a cup under the front end of the water filter cover to collect any leaking water. Hold the water filter upright, once it is removed, to prevent any remaining water from spilling out of the water filter.



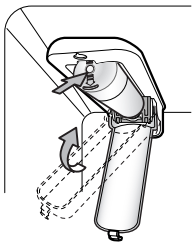
- Pull the water filter downward and pull out. Make sure to rotate the filter down completely before pulling it out of the manifold hole.

2 Replace with a new water filter.

- Take the new water filter out of its packing and remove the protective cover from the o-rings. With water filter tabs in the horizontal position, push the new water filter into the manifold hole until it stops.



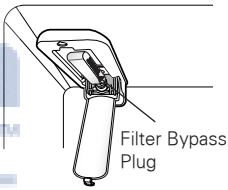
- Rotate the water filter up into position and close the cover. The cover will click when closed correctly.



3 After the water filter is replaced, dispense 2.5 gallons of water (flush for approximately 5 minutes) to remove trapped air and contaminates from the system. Do not dispense the entire 2.5 gallon amount continuously. Depress and release the dispenser pad for cycles of 30 seconds ON and 60 seconds OFF.

4 Water Filter Bypass Plug

Keep the water filter bypass plug. You MUST use the water filter bypass plug when a replacement water filter cartridge is not available.



AjMadison
Your Appliance Superstore™
800-670-3355

CAUTION

DO NOT operate refrigerator without water filter or water filter plug installed.

NOTE

- To purchase a replacement water filter:
  - Visit your local dealer or distributor
  - Web: Find Parts & Accessories from Support section of lg.com
  - Call : 1-800-243-0000 (USA)
    1-888-542-2623 (Canada)
- Part number of the replacement water filter: ADQ36006101

Performance Data Sheet

Model: LG ADQ36006101-S Use Replacement Cartridge: ADQ36006101

The concentration of the indicated substances in water entering the system was reduced to a concentration less than or equal to the permissible limit for water leaving the system as specified in NSF/ANSI Standard 42 and Standard 53.

System tested and certified by NSF International against NSF/ANSI Standard 42 and Standard 53 for the reduction of substances listed below.

Contaminant Reduction	Average Influent	NSF specified Challenge Concentration	Avg % Reduction	Average Product Water Concentration	Max Permissible Product Water Concentration	NSF Reduction Requirements	NSF Test Report
Chlorine Taste and Odor	2.1 mg/L	2.0 mg/L ± 10%	97.2%	0.06 mg/L	N/A	≥ 50%	J-00049247
Nominal Particulate Class I, , ≥0.5 to < 1.0 µm	5,600,000 pts/mL	At least 10,000 particles/mL	98.7%	73,000 pts/ml	N/A	≥ 85%	J-00049282
Asbestos	190 MFL	107 to 108 MFL; fibers greater than 10 µm in length	>99%	< 1MLF	N/A	≥ 99%	J-0004928
Atrazine	0.0094 mg/L	0.009 mg/L ± 10%	94.7%	0.00005 mg/L	0.003 mg/L	N/A	J-00049293
Benzene	0.016 mg/L	0.015 mg/L ± 10%	96.7%	0.005 mg/L	0.005 mg/L	N/A	J-00049300
Carbofuran	0.08 mg/L	0.08 mg/L ± 10%	98.1%	0.002 mg/L	0.04 mg/L	N/A	J-00049294
Lindane	0.002 mg/L	0.002 mg/L ± 10%	98.2%	0.00004 mg/L	0.0002 mg/L	N/A	J-00051975
P-Dichlorobenzene	0.22 mg/L	0.225 mg/L ± 10%	99.8%	0.0005 mg/L	0.075 mg/L	N/A	J-00049298
Toxaphene	0.014 mg/L	0.015 mg/L ± 10%	93%	0.001 mg/L	0.003 mg/L	N/A	J-00049302
2,4-D	0.213 mg/L	0.210 mg/L ± 10%	95.2%	0.009 mg/L	0.07 mg/L	N/A	J-00049284
Lead pH @6.5	0.150 mg/L	0.15 mg/L ± 10%	>99.3%	0.001 mg/L	0.010 mg/L	N/A	J-00051974
Lead pH @8.5	0.150 mg/L	0.15 mg/L ± 10%	>99.3%	0.001 mg/L	0.010 mg/L	N/A	J-00049277
Mercury @ pH 6.5	0.0059 mg/L	0.006 mg/L ± 10%	96.1	0.0002 mg/L	0.002 mg/L	N/A	J-00053886
Mercury @ pH 8.5	0.0058 mg/L	0.006 mg/L ± 10%	90.1	0.0006 mg/L	0.002 mg/L	N/A	J-00051972
Cyst*	120,000 cysts/L	Minimum 50,000 cysts/L	99.99%	<1 cyst/L	N/A	≥ 99.95%	J-00049281

* Based on the use of Cryptosporidium parvum oocysts.

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Application Guidelines/Water Supply Parameters	
Service Flow	0.5 gpm (1.9 lpm)
Water Supply	Potable Water
Water Pressure	20 -120 psi (138 - 827 kPa)
Water Temperature	33°F - 100°F (0.6°C - 38°C)

It is essential that the manufacturer's recommended installation, maintenance and filter replacement requirements be carried out for the product to perform as advertised.

NOTE

- While the testing was performed under standard laboratory conditions, actual performance may vary.

Replacement Cartridge: ADQ36006101
For estimated costs of replacement elements please call USA 1-800-243-0000
CANADA 1-888-LGCANADA (24 hours per day/7 days per week) or visit our website at www.lg.com

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NSF is a trademark of NSF International.
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WARNING

To reduce the risk associated with choking:

- Do not allow children under 3 years of age to have access to small parts during the installation of this product.

To reduce the risk associated with the ingestion of contaminants:

- Do not use with water that is microbiologically unsafe or of unknown quality without adequate disinfection before or after the system. Systems certified for cyst reduction may be used on disinfected water that may contain filterable cysts. EPA Establishment # 070595-MEX-001

CAUTION

To reduce the risk associated with property damage due to water leakage:

- Read and follow. Use Instructions before installation and use of this system.
- Installation and use MUST comply with all state and local plumbing codes.
- Do not install if water pressure exceeds 120 psi (827 kPa). If your water pressure exceeds 80 psi, you must install a pressure limiting valve. Contact a plumbing professional if you are uncertain how to check your water pressure.
- Do not install where water hammer conditions may occur. If water hammer conditions exist you must install a water hammer arrester. Contact a plumbing professional if you uncertain how to check for this condition.
- Do not install on hot water supply lines. The maximum operating water temperature of this filter system is 100°F (37.8°C).
- Protect filter from freezing. Drain filter when temperatures drop below 40°F (4.4°C).
- The disposable filter cartridge MUST be replaced every 6 months, at the rated capacity or if a noticeable reduction in flow rate occurs.
- Protect from freezing, remove filter cartridge when temperatures are expected to drop below 33° F.
- Do not install systems in areas where ambient temperatures may go above 110° F (43.3° C).
- Where a backflow prevention device is installed on a water system, a device for controlling pressure due to thermal expansion must be installed.
- Ensure all tubing and fittings are secure and free of leaks.

Manufactured for LG®Electronics by CUNO Incorporated 400 Research Parkway Meriden, CT 06450 U.S.A Worldwide: 203-237-5541

www.cuno.com

AJMadison Your Appliance Authority™ 800-570-3535

State of California
Department of Public Health

Water Treatment Device
Certificate Number
09 - 2018

Date Issued: December 15, 2009

Trademark/Model Designation	**Replacement Elements**
ADQ36006101-S	ADQ36006101

Manufacturer: Cuno Inc.

The water treatment device(s) listed on this certificate have met the testing requirements pursuant to Section 116830 of the Health and Safety Code for the following health related contaminants:

Microbiological Contaminants and Turbidity

Cysts

Inorganic/Radiological Contaminants

Asbestos
Lead
Mercury

Organic Contaminants

2,4-D Reduction
Atrazine
Benzene
Carbofuran
Lindane
p-Dichlorobenzene
Toxaphene

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Rated Service Capacity: 200 gal

Rated Service Flow: 0.5 gpm

Conditions of Certification:

SMART DIAGNOSIS

Should you experience any problems with your refrigerator, it has the capability of transmitting data via your telephone to the LG service center. This gives you the capability of speaking directly to our trained specialists. The specialist records the data transmitted from your machine and uses it to analyze the issue, providing a fast and effective diagnosis.

If you experience problems with your refrigerator, call 1-800-243-0000. Only use the Smart Diagnosis feature when instructed to do so by the LG call center agent. The transmission sounds that you will hear are normal and sound similar to a fax machine.

Smart Diagnosis cannot be activated unless your refrigerator is connected to power. If your refrigerator is unable to turn on, then troubleshooting must be done without using Smart Diagnosis.

Using Smart Diagnosis

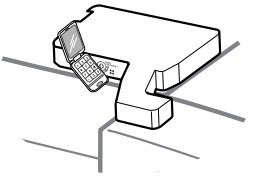
First, call 1-800-243-0000. Only use the Smart Diagnosis feature when instructed to do so by the LG call center agent.

1 Lock the display. To lock the display, press and hold the Lock button for three seconds. (If the display has been locked for over five minutes, you must deactivate the lock and then reactivate it.)

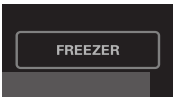


2 Open the right refrigerator door.

3 Hold the mouthpiece of your phone in front of the speaker that is located on the right hinge of the refrigerator door, when instructed to do so by the call center.



4 Press and hold the Freezer Temperature button for three seconds while continuing to hold your phone to the speaker.



5 After you hear three beeps, release the Freezer Temperature button.

6 Keep the phone in place until the tone transmission has finished. This takes about 15 seconds, and the display will count down the time. Once the countdown is over and the tones have stopped, resume your conversation with the specialist, who will then be able to assist you in using the information transmitted for analysis.

NOTE

- For best results, do not move the phone while the tones are being transmitted.
- If the call center agent is not able to get an accurate recording of the data, you may be asked to try again.

NOTE

- Call quality differences by region may affect the function.
- Use the home telephone for better communication performance, resulting in better service.
- Bad call quality may result in poor data transmission from your phone to the machine, which could cause Smart Diagnosis to not work properly.

AjMadison Your Appliance Source 800-570-3365

TROUBLESHOOTING

Review the Troubleshooting section before calling for service; doing so will save you both time and money.

Problem	Possible Causes	Solutions
Refrigerator and Freezer section are not cooling.	The refrigerator control is set to OFF (some models).	Turn the control ON. Refer to the Setting the Controls section for proper temperature settings.
	Refrigerator is in the defrost cycle.	During the defrost cycle, the temperature of each compartment may raise slightly. Wait 30 minutes and confirm the proper temperature has been restored once the defrost cycle has completed.
	Refrigerator was recently installed.	It may take up to 24 hours for each compartment to reach the desired temperature.
	Refrigerator was recently relocated.	If the refrigerator was stored for a long period of time or moved on its side, it is necessary for the refrigerator to stand upright for 24 hours before connecting it to power.
Cooling System runs too much.	Refrigerator is replacing an older model.	Modern refrigerators require more operating time but use less energy due to more efficient technology.
	Refrigerator was recently plugged in or power restored.	The refrigerator will take up to 24 hours to cool completely.
	Door opened often or a large amount of food / hot food was added.	Adding food and opening the door warms the refrigerator, requiring the compressor to run longer in order to cool the refrigerator back down. In order to conserve energy, try to get everything you need out of the refrigerator at once, keep food organized so it is easy to find, and close the door as soon as the food is removed. (Refer to the Food Storage Guide.)
	Doors are not closed completely.	Firmly push the doors shut. If they will not shut all the way, see the Doors will not close completely or pop open section in Parts & Features Troubleshooting.
	Refrigerator is installed in a hot location.	The compressor will run longer under warm conditions. At normal room temperatures (70°F) expect your compressor to run about 40% to 80% of the time. Under warmer conditions, expect it to run even more often. The refrigerator should not be operated above 110°F.
	Condenser / back cover is clogged.	Use a vacuum cleaner with an attachment to clean the condenser cover and vents. Do not remove the panel covering the condenser coil area.

AiMadison Appliance Technician 800-570-3339

Problem	Possible Causes	Solutions
Refrigerator or Freezer section is too warm.	Refrigerator was recently installed.	It may take up to 24 hours for each compartment to reach the desired temperature.
	Air vents are blocked.	Rearrange items to allow air to flow throughout the compartment. Refer to the Airflow diagram in the Using Your Refrigerator section.
	Doors are opened often or for long periods of time.	When the doors are opened often or for long periods of time, warm, humid air enters the compartment. This raises the temperature and moisture level within the compartment. To lessen the effect, reduce the frequency and duration of door openings.
	Unit is installed in a hot location.	The refrigerator should not be operated in temperatures above 110°F.
	A large amount of food or hot food was added to either compartment.	Adding food warms the compartment requiring the cooling system to run. Allowing hot food to cool to room temperature before putting it in the refrigerator will reduce this effect.
	Doors not closed correctly.	See the Doors will not close correctly or pop open section in Parts & Features Troubleshooting.
	Temperature control is not set correctly.	If the temperature is too warm, adjust the control one increment at a time and wait for the temperature to stabilize. Refer to the Setting the Controls section for more information.
	Defrost cycle has recently completed.	During the defrost cycle, the temperature of each compartment may raise slightly and condensation may form on the back wall. Wait 30 minutes and confirm the proper temperature has been restored once the defrost cycle has completed.

AjMadison Your Appliance Superstore 800-570-2255

Problem	Possible Causes	Solutions
Interior moisture buildup.	Doors are opened often or for long periods of time.	When the doors are opened often or for long periods of time, warm, humid air enters the compartment. This raises the temperature and moisture level within the compartment. To lessen the effect, reduce the frequency and duration of door openings.
	Doors not closed correctly.	See the Doors will not close correctly section in the Troubleshooting section.
	Weather is humid.	Humid weather allows additional moisture to enter the compartments when the doors are opened leading to condensation or frost. Maintaining a reasonable level of humidity in the home will help to control the amount of moisture that can enter the compartments.
	Defrost cycle recently completed.	During the defrost cycle, the temperature of each compartment may raise slightly and condensation may form on the back wall. Wait 30 minutes and confirm that the proper temperature has been restored once the defrost cycle has completed.
	Food is not packaged correctly.	Food stored uncovered or unwrapped, and damp containers can lead to moisture accumulation within each compartment. Wipe all containers dry and store food in sealed packaging to prevent condensation and frost.
Food is freezing in the refrigerator compartment.	Food with high water content was placed near an air vent.	Rearrange items with high water content away from air vents.
	Refrigerator temperature control is set incorrectly.	If the temperature is too cold, adjust the control one increment at a time and wait for the temperature to stabilize. Refer to the Setting the Controls section for more information.
	Refrigerator is installed in a cold location.	When the refrigerator is operated in temperature below 41°F (5°C), food can freeze in the refrigerator compartment. The refrigerator should not be operated in temperature below 55°F (13°C).
Frost or ice crystals form on frozen food (outside of package).	Door is opened frequently or for long periods of time.	When the doors are opened often or for long periods of time, warm, humid air enters the compartment. This raises the temperature and moisture level within the compartment. Increased moisture will lead to frost and condensation. To lessen the effect, reduce the frequency and duration of door openings.
	Door is not closing properly.	Refer to the Doors will not close correctly or pop open section in the Troubleshooting section.
Refrigerator or Freezer section is too cold.	Incorrect temperature control settings.	If the temperature is too cold, adjust the control one increment at a time and wait for the temperature to stabilize. Refer to the Setting the Controls section for more information.

AiMadison Your Appliance Authority™ 800-578-5555

Problem	Possible Causes	Solutions
Frost or ice crystals on frozen food (inside of sealed package).	Condensation from food with a high water content has frozen inside of the food package.	This is normal for food items with a high water content.
	Food has been left in the freezer for a long period of time.	Do not store food items with high water content in the freezer for a long period of time.
Icemaker is not making enough ice.	Demand exceeds ice storage capacity.	The icemaker will produce approximately 100 cubes in a 24 hour period.
	House water supply is not connected, valve is not turned on fully, or valve is clogged.	Connect the refrigerator to a cold water supply with adequate pressure and turn the water shutoff valve fully open. If the problem persists, it may be necessary to contact a plumber.
	Water filter has been exhausted.	It is recommended that you replace the water filter: • Approximately every six months. • When the water filter indicator turns on. • When the water dispenser output decreases. • When the ice cubes are smaller than normal.
	Low house water supply pressure.	The water pressure must be between 20 and 120 psi on models without a water filter and between 40 and 120 psi on models with a water filter. If the problem persists, it may be necessary to contact a plumber.
	Reverse Osmosis filtration system is used.	Reverse osmosis filtration systems can reduce the water pressure below the minimum amount and result in icemaker issues. (Refer to Water Pressure section.)
	Tubing connecting refrigerator to house supply valve is kinked.	The tubing can kink when the refrigerator is moved during installation or cleaning resulting in reduced water flow. Straighten or repair the water supply line and arrange it to prevent future kinks.

AJMadison Your Appliance Authority™ 800-570-3333

Problem	Possible Causes	Solutions
Icemaker is not making enough ice (continued).	Doors are opened often or for long periods of time.	If the doors of the unit are opened often, ambient air will warm the refrigerator which will prevent the unit from maintaining the set temperature. Lowering the refrigerator temperature can help, as well as not opening the doors as frequently.
	Doors are not closed completely.	If the doors are not properly closed, ice production will be affected. See the Doors will not close completely or pop open section in Parts & Features Troubleshooting for more information.
	The temperature setting for the freezer is too warm.	The recommended temperature for the freezer compartment for normal ice production is 0°F. If the freezer temperature is warmer, ice production will be affected.
Dispensing water slowly.	Water filter has been exhausted.	It is recommended that you replace the water filter: • Approximately every six months. • When the water filter indicator turns on. • When the water dispenser output decreases. • When the ice cubes are smaller than normal.
	Reverse osmosis filtration system is used.	Reverse osmosis filtration systems can reduce the water pressure below the minimum amount and result in icemaker issues. If the problem persists, it may be necessary to contact a plumber.
	Low house water supply pressure.	The water pressure must be between 20 and 120 psi on models without a water filter and between 40 and 120 psi on models with a water filter. If the problem persists, it may be necessary to contact a plumber.

AjMadison Your Appliance Authority™ 800-570-3355

Problem	Possible Causes	Solutions
Not dispensing ice.	Doors are not closed completely.	Ice will not dispense if any of the refrigerator doors are left open.
	Infrequent use of the dispenser.	Infrequent use of the ice dispenser will cause the cubes to stick together over time, which will prevent them from properly dispensing. Check the ice bin for ice cubes clumping/sticking together. If they are, break up the ice cubes to allow for proper operation.
	The delivery chute is clogged with frost or ice fragments.	Eliminate the frost or ice fragments by removing the ice bin and clearing the chute with a plastic utensil. Dispensing cubed ice can also help prevent frost or ice fragment buildup.
	The dispenser display is locked.	Press and hold the Lock button for three seconds to unlock the control panel and dispenser.
	Ice bin is empty.	It may take up to 24 hours for each compartment to reach the desired temperature and for the icemaker to begin making ice. Make sure that the shutoff (arm/sensor) is not obstructed. Once the ice supply in the bin has been completely exhausted, it my take up to 90 minutes before additional ice is available, and approximately 24 hours to completely refill the bin.
Icemaker is not making ice.	Refrigerator was recently installed or icemaker recently connected.	It may take up to 24 hours for each compartment to reach the desired temperature and for the icemaker to begin making ice.
	Icemaker not turned on.	Locate the icemaker ON/OFF switch and confirm that it is in the ON (I) position.
	The ice detecting sensor is obstructed.	Foreign substances or frost on the ice-detecting sensor can interrupt ice production. Make sure that the sensor area is clean at all times for proper operation.
	The refrigerator is not connected to a water supply or the supply shutoff valve is not turned on.	Connect refrigerator to the water supply and turn the water shutoff valve fully open.
	Icemaker shutoff (arm or sensor) obstructed.	If your icemaker is equipped with an ice shutoff arm, make sure that the arm moves freely. If your icemaker is equipped with the electronic ice shutoff sensor, make sure that there is a clear path between the two sensors.
	Reverse osmosis water filtration system is connected to your cold water supply.	Reverse osmosis filtration systems can reduce the water pressure below the minimum amount and result in icemaker issues. (Refer to the Water Pressure section.)

AjMachine Your Appliance Authority™

Problem	Possible Causes	Solutions
Not dispensing water.	New installation or water line recently connected.	Dispense 2.5 gallons of water (flush for approximately 5 minutes) to remove trapped air and contaminates from the system. Do not dispense the entire 2.5 gallon amount continuously. Depress and release the dispenser pad for cycles of 30 seconds ON and 60 seconds OFF.
	The dispenser panel is locked.	Press and hold the Lock button for three seconds to unlock the control panel and dispenser.
	The dispenser is not set for water dispensing.	The dispenser can be set for ice or water. Make certain that the control panel is set for the proper operation. Press the Water button on the control panel to dispense water.
	Refrigerator or freezer doors are not closed properly.	Water will not dispense if any of the refrigerator doors are left open.
	Water filter has been recently removed or replaced.	After the water filter is replaced, dispense 2.5 gallons of water (flush for approximately 5 minutes) to remove trapped air and contaminates from the system. Do not dispense the entire 2.5 gallon amount continuously. Depress and release the dispenser pad for cycles of 30 seconds ON and 60 seconds OFF.
	Tubing connecting refrigerator to house supply valve is kinked.	The tubing can kink when the refrigerator is moved during installation or cleaning resulting in reduced water flow. Straighten or repair the water supply line and arrange it to prevent future kinks.
	The house water supply is not connected, the valve is not turned on fully, or the valve is clogged.	Connect refrigerator to the water supply and turn the water shutoff valve fully open. If the problem persists, it may be necessary to contact a plumber.

AiMadison
Appliance Solutions
800-570-5555

Problem	Possible Causes	Solutions
Ice has bad taste or odor.	Water supply contains minerals such as sulfur.	A water filter may need to be installed to eliminate taste and odor problems. NOTE: In some cases, a filter may not help. It may not be possible to remove all minerals / odor / taste in all water supplies.
	Icemaker was recently installed.	Discard the first few batches of ice to avoid discolored or bad tasting ice.
	Ice has been stored for too long.	Ice that has been stored for too long will shrink, become cloudy, and may develop a stale taste. Throw away old ice and make a new supply.
	The food has not been stored properly in either compartment.	Rewrap the food. Odors may migrate to the ice if food is not wrapped properly.
	The interior of the refrigerator needs to be cleaned.	See the Care and Cleaning section for more information.
	The ice storage bin needs to be cleaned.	Empty and wash the bin (discard old cubes). Make sure that the bin is completely dry before reinstalling it.
Dispensing warm water.	Refrigerator was recently installed.	Allow 24 hours after installation for the water storage tank to cool completely.
	The water dispenser has been used recently and the storage tank was exhausted.	Depending on your specific model, the water storage capacity will range from approximately 20 to 30 oz.
	Dispenser has not been used for several hours.	If the dispenser has not been used for several hours, the first glass dispensed may be warm. Discard the first 10 oz.
	Refrigerator is connected to the hot water supply.	Make sure that the refrigerator is connected to a cold water pipe. ⚠ WARNING: Connecting the refrigerator to a hot water line may damage the icemaker.
Water has bad taste or odor.	Water supply contains minerals such as sulfur.	A water filter may need to be installed to eliminate taste and odor problems.
	Water filter has been exhausted.	It is recommended that you replace the water filter: • Approximately every 6 months. • When the water filter indicator turns on. • When the water dispenser output decreases. • When the ice cubes are smaller than normal.
	Refrigerator was recently installed.	Dispense 2.5 gallons of water (flush for approximately 5 minutes) to remove trapped air and contaminates from the system. Do not dispense the entire 2.5 gallon amount continuously. Depress and release the dispenser pad for cycles of 30 seconds ON and 60 seconds OFF.

iMadison Your Appliance Authority 800-570-5555

Problem	Possible Causes	Solutions
Icemaker is making too much ice.	Icemaker shutoff (arm/sensor) is obstructed.	Empty the ice bin. If your icemaker is equipped with an ice shutoff arm, make sure that the arm moves freely. If your icemaker is equipped with the electronic ice shutoff sensor, make sure that there is a clear path between the two sensors. Reinstall the ice bin and wait 24 hours to confirm proper operation.
Clicking	The defrost control will click when the automatic defrost cycle begins and ends. The thermostat control (or refrigerator control on some models) will also click when cycling on and off.	Normal Operation
Rattling	Rattling noises may come from the flow of refrigerant, the water line on the back of the unit, or items stored on top of or around the refrigerator.	Normal Operation
	Refrigerator is not resting solidly on the floor.	Floor is weak or uneven or leveling legs need to be adjusted. See the Door Alignment section.
	Refrigerator with linear compressor was jarred while running.	Normal Operation
Whooshing	Evaporator fan motor is circulating air through the refrigerator and freezer compartments.	Normal Operation
	Air is being forced over the condenser by the condenser fan.	Normal Operation
Gurgling	Refrigerant flowing through the cooling system.	Normal Operation
Popping	Contraction and expansion of the inside walls due to changes in temperature.	Normal Operation
Sizzling	Water dripping on the defrost heater during a defrost cycle.	Normal Operation
Vibrating	If the side or back of the refrigerator is touching a cabinet or wall, some of the normal vibrations may make an audible sound.	To eliminate the noise, make sure that the sides and back cannot vibrate against any wall or cabinet.
Dripping	Water running into the drain pan during the defrost cycle.	Normal Operation

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Problem	Possible Causes	Solutions
Pulsating or High-Pitched Sound	Your refrigerator is designed to run more efficiently to keep your food items at the desired temperature. The high efficiency compressor may cause your new refrigerator to run longer than your old one, but it is still more energy efficient than previous models. While the refrigerator is running, it is normal to hear a pulsating or high-pitched sound.	Normal Operation
Doors will not close correctly or pop open.	Food packages are blocking the door open.	Rearrange food containers to clear the door and door shelves.
	Ice bin, crisper cover, pans, shelves, door bins, or baskets are out of position.	Push bins all the way in and put crisper cover, pans, shelves and baskets into their correct positions. See the Using Your Refrigerator section for more information.
	The doors were removed during product installation and not properly replaced.	Remove and replace the doors according to the Removing and Replacing Refrigerator Handles and Doors section.
	Refrigerator is not leveled properly.	See Door Alignment in the Refrigeration Installation section to level refrigerator.
Doors are difficult to open.	The gaskets are dirty or sticky.	Clean the gaskets and the surfaces that they touch. Rub a thin coat of appliance polish or kitchen wax on the gaskets after cleaning.
	Door was recently closed.	When you open the door, warmer air enters the refrigerator. As the warm air cools, it can create a vacuum. If the door is hard to open, wait one minute to allow the air pressure to equalize, then see if it opens more easily.
Refrigerator wobbles or seems unstable.	Leveling legs are not adjusted properly.	Refer to the Leveling and Door Alignment section.
	Floor is not level.	It may be necessary to add shims under the leveling legs or rollers to complete installation.
Lights do not work.	LED interior lighting failure.	The refrigerator compartment lamp is LED interior lighting, and service should be performed by a qualified technician.
Refrigerator has an unusual odor.	The Air Filter may need to be set to the MAX setting or replaced.	Set the Air Filter to the MAX setting. If the odor does not go away within 24 hours, the filter may need to be replaced. See the Replacing the Air Filter section for replacement instructions.
The interior of the refrigerator is covered with dust or soot.	The refrigerator is located near a fire source, such as a fireplace, chimney or candle.	Make sure that the refrigerator is not located near a fire source, such as a fireplace, chimney or candle.

AJ Madison Your Appliance Expert 800-570-3355

WARRANTY (USA)

Should your LG Refrigerator ("Product") fail due to a defect in materials or workmanship under normal home use, during the warranty period set forth below, LG will at its option repair or replace the product. This limited warranty is valid only to the original retail purchaser of the product and applies only when purchased and used within the United States including U.S. Territories. Proof of original retail purchase is required to obtain warranty service under this limited warranty.

WARRANTY PERIOD			
Refrigerator	Sealed System (Condenser, Dryer, Connecting Tube, Refrigerant and Evaporator)		Linear Compressor
One (1) year from the date of original retail purchase	One (1) year from the date of original retail purchase	Seven (7) years from the date of original retail purchase	Ten (10) years from the date of original retail purchase
Parts and Labor (internal/functional parts only)	Parts and Labor	Parts only (Consumer will be charged for labor)	Part only (Consumer will be charged for labor)

Noises associated with normal operation and failure to follow instructions found in the use and care and installation guides or operating the unit in an unsuitable environment will not be covered under this warranty.

- Replacement products and parts are warranted for the remaining portion of the original warranty period or ninety (90) days, whichever is greater.
- Replacement products and parts may be new or remanufactured.

THIS WARRANTY IS IN LIEU OF ANY OTHER WARRANTY, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. TO THE EXTENT ANY IMPLIED WARRANTY IS REQUIRED BY LAW, IT IS LIMITED IN DURATION TO THE EXPRESS WARRANTY PERIOD ABOVE. NEITHER THE MANUFACTURER NOR ITS U.S. DISTRIBUTOR SHALL BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, INDIRECT, SPECIAL, OR PUNITIVE DAMAGES OF ANY NATURE, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR PROFITS, OR ANY OTHER DAMAGE WHETHER BASED IN CONTRACT, TORT, OR OTHERWISE. Some states do not allow the exclusion or limitation of incidental or consequential damages or limitations on how long an implied warranty lasts, so the above exclusion or limitation may not apply to you. This warranty gives you specific legal rights and you may also have other rights that vary from state to state.

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THIS LIMITED WARRANTY DOES NOT COVER:

1. Service trips to deliver, pick up, install, or repair the product; instruct the customer on operation of the product; repair or replace fuses or correct wiring or plumbing, or correction of unauthorized repairs/installation.
2. Failure of product to perform during power failures and interruptions or inadequate electrical service.
3. Damage caused by leaky or broken water pipes, frozen water pipes, restricted drain lines, inadequate or interrupted water supply or inadequate supply of air.
4. Damage resulting from operating the product in a corrosive atmosphere or contrary to the instructions outlined in the product owner's manual.
5. Damage to the product caused by accidents, pests and vermin, lightning, wind, fire, floods, or acts of God.
6. Damage resulting from misuse, abuse, improper installation, repair, or maintenance. Improper repair includes use of parts not approved or specified by LG.
7. Damage or failure caused by unauthorized modification or alteration, or if it is used for other than the intended purpose, or any water leakage where the unit was not properly installed.
8. Damage or failure caused by incorrect electrical current, voltage, or plumbing codes, commercial or industrial use, or use of accessories, components, or consumable cleaning products that are not approved by LG.
9. Damage caused by transportation and handling, including scratches, dents, chips, and/or other damage to the finish of your product, unless such damage results from defects in materials or workmanship and is reported within one (1) week of delivery (Call: 1-800-243-0000).
10. Damage or missing items to any display, open box, discounted, or refurbished product.
11. Products with original serial numbers that have been removed, altered, or can not be readily determined. Model and Serial numbers, along with original retail sales receipt, are required for warranty validation.
12. Increases in utility costs and additional utility expenses.
13. Replacement of light bulbs, filters, or any consumable parts.
14. Repairs when your product is used in other than normal and usual household use (e.g. commercial use, offices, and recreational facilities) or contrary to the instructions outlined in the product owner's manual.
15. Costs associated with removal of your product from your home for repairs.
16. The removal and reinstallation of the product if it is installed in an inaccessible location or is not installed in accordance with published installation instructions, including LG's owner's and installation manuals.
17. Shelves, door bins, drawers, handles, accessories, and other parts besides those that were originally included with this particular model.

The cost of repair or replacement under these excluded circumstances shall be borne by the consumer.

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For complete warranty details and customer assistance, please call or visit our website:

Call 1-800-243-0000 (24 hours a day, 365 days a year) and select the appropriate option from the menu, or visit our website at **http://www.lg.com** Or by mail: LG Customer Information Center: P. O. Box 240007, 201 James Record Road Huntsville, Alabama 35813 ATTN: CIC

Write your warranty information below: _____
Product Registration Information: _____
Model: _____
Serial Number: _____
Date of Purchase: _____

WARRANTY (Canada)

WARRANTY: Should your LG Refrigerator ("Product") fail due to a defect in material or workmanship under normal home use during the warranty period set forth below, LG Canada will at its option repair or replace the Product upon receipt of proof of original retail purchase. This warranty is valid only to the original retail purchaser of the product and applies only to a Product distributed in Canada by LG Canada or an authorized Canadian distributor thereof. The warranty only applies to Products located and used within Canada.

WARRANTY PERIOD: (Note: If the original date of purchase can not be verified, the warranty will begin sixty (60) days from the date of manufacture)			
Refrigerator/ Freezer	**Sealed System (Condenser, Dryer, Connecting Tube, Refrigerant and Evaporator)**		**Linear Compressor**
One (1) year from the date of original retail purchase	**One (1) year from the date of original retail purchase**	**Seven (7) years from the date of original retail purchase**	**Ten (10) years from the date of original retail purchase**
Parts and Labor (internal/functional parts only)	Parts and Labor	Parts only (Consumer will be charged for labor)	Part only (Consumer will be charged for labor)

Noises associated with normal operation and failure to follow instructions found in the use and care and installation guides or operating the unit in an unsuitable environment will not be covered under this warranty.

- Replacement products and parts are warranted for the remaining portion of the original warranty period or ninety (90) days, whichever is greater.
- Replacement products and parts may be new or remanufactured.
- LG Authorized Service Center warranties their repair work for thirty (30) days.

LG CANADA'S SOLE LIABILITY IS LIMITED TO THE WARRANTY SET OUT ABOVE. EXCEPT AS EXPRESSLY PROVIDED ABOVE, LG CANADA MAKES NO AND HEREBY DISCLAIMS ALL OTHER WARRANTIES AND CONDITIONS RESPECTING THE PRODUCT, WHETHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND NO REPRESENTATIONS SHALL BE BINDING ON LG CANADA. LG CANADA DOES NOT AUTHORIZE ANY PERSON TO CREATE OR ASSUME FOR IT ANY OTHER WARRANTY OBLIGATION OR LIABILITY IN CONNECTION WITH THE PRODUCT. TO THE EXTENT THAT ANY WARRANTY OR CONDITION IS IMPLIED BY LAW, IT IS LIMITED TO THE EXPRESS WARRANTY PERIOD ABOVE. LG CANADA, THE MANUFACTURER OR DISTRIBUTOR SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, SPECIAL, DIRECT OR INDIRECT DAMAGES, LOSS OF GOODWILL, LOST PROFITS, PUNITIVE OR EXEMPLARY DAMAGES OR ANY OTHER DAMAGE, WHETHER ARISING DIRECTLY OR INDIRECTLY FROM ANY CONTRACTUAL BREACH, FUNDAMENTAL OR OTHERWISE, OR FROM ANY ACTS OR OMISSIONS, TORT, OR OTHERWISE. This warranty gives you specific legal rights. You may have other rights which may vary from province to province depending on applicable provincial laws. Any term of this warranty that negates or varies any implied condition or warranty under provincial law is severable where it conflicts with provincial law without affecting the remainder of this warranty's terms.

AlMadison Your Appliance Authority™ 800.570.3355

THIS LIMITED WARRANTY DOES NOT COVER:

1. Service trips to deliver, pick up, or install the product; instructing a customer on operation of the product; repair or replacement of fuses or correction of wiring or plumbing, or correction of unauthorized repairs/installation.
2. Failure of the product to perform during power failures and interruptions or inadequate electrical service.
3. Damage caused by leaky or broken water pipes, frozen water pipes, restricted drain lines, inadequate or interrupted water supply or inadequate supply of air.
4. Damage resulting from operating the Product in a corrosive atmosphere or contrary to the instructions outlined in the Product owner's manual.
5. Damage to the Product caused by accidents, pests and vermin, lightning, wind, fire, floods, or acts of God.
6. Damage resulting from the misuse, abuse, improper installation, repair, or maintenance of the Product. Improper repair includes use of parts not approved or specified by LG Canada.
7. Damage or product failure caused by unauthorized modification or alteration, or use for other than its intended purpose, or resulting from any water leakage due to improper installation.
8. Damage or Product failure caused by incorrect electrical current, voltage, or plumbing codes, commercial or industrial use, or use of accessories, components, or cleaning products that are not approved by LG Canada.
9. Damage caused by transportation and handling, including scratches, dents, chips, and/or other damage to the finish of your product, unless such damage results from defects in materials or workmanship and is reported within one (1) week of delivery.
10. Damage or missing items to any display, open box, discounted, or refurbished Product.
11. Products with original serial numbers that have been removed, altered, or cannot be readily determined. Model and Serial numbers, along with original retail sales receipt, are required for warranty validation.
12. Increases in utility costs and additional utility expenses.
13. Replacement of light bulbs, filters, or any consumable parts.
14. Repairs when your Product is used in other than normal and usual household use (including, without limitation, commercial use, in offices or recreational facilities) or contrary to the instructions outlined in the Product owner's manual.
15. Costs associated with removal of the Product from your home for repairs.
16. The removal and reinstallation of the Product if it is installed in an inaccessible location or is not installed in accordance with published installation instructions, including the Product owner's and installation manuals.
17. Shelves, door bins, drawers, handles, and accessories to the Product. Also excluded are parts besides those that were originally included with the Product.

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800-870-3535

All costs associated with the above excluded circumstances shall be borne by the consumer.

For complete warranty details and customer assistance, please call or visit our website:
Call 1-888-542-2623 (24 hours a day, 365 days a year) and select the appropriate option from the menu, or visit our website at **http://www.lg.com**

Write your warranty information below: _____
Product Registration Information: _____
Model: _____
Serial Number: _____
Date of Purchase: _____

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LG Customer Information Center

For inquires or comments,
visit **www.lg.com** or call;

1-800-243-0000 USA, Consumer User
1-888-865-3026 USA, Commercial User
1-888-542-2623 CANADA

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The Life of the Kitchen.®

Microwave In-A-Drawer™

Use and Care Manual



Model MMDV30S

For Use With:

MMDV30S
MMD30
MMD24

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To Our Valued Customer:

Congratulations on your purchase of the very latest in Dacor® products! Our unique combination of features, style and performance make us The Life of the Kitchen™, and a great addition to your home.

In order to familiarize yourself with the controls, functions and full potential of your new Distinctive Appliance, read this use and care manual thoroughly, beginning with the ***Important Safety Instructions*** section.

All Dacor appliances are designed and manufactured with quality and pride, while working within the framework of our company value. Should you ever experience a problem with your product, please first check the ***Before You Call for Service*** section of this manual for guidance. It provides useful suggestions and remedies prior to calling for service.

Valuable customer input helps us to continuously improve our products and services, so please feel free to contact our Customer Service Team for assistance with any of your product support needs.

Dacor Customer Service Team
600 Anton Blvd. Suite 1000
Costa Mesa, CA 92626

Telephone: (800) 793-0093
Fax: (626) 403-3130
Hours of Operation: Monday through Friday
6:00 A.M. to 5:00 P.M. Pacific Time

Web Site: www.Dacor.com

Thank you for choosing Dacor for your home. We are a company built by families for families and we are dedicated to serving yours. We are confident that your new Dacor product will deliver a high level of performance and enjoyment for many years to come.

Sincerely,

The Dacor Customer Service Team

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Important Safety Instructions

Installer: Leave these instructions with the appliance.

Customer: Please read and keep this use and care manual for future reference. This guide provides proper use and maintenance information. **Keep this guide and the sales receipt and/or cancelled check in a safe place for future reference. Proof of original purchase date is needed for warranty service.**

If you have any questions, call:

Dacor® Customer Service
1-800-793-0093 (U.S.A. and Canada)
Monday — Friday 6:00 AM to 5:00 PM Pacific Time
Web site: www.Dacor.com

Have complete model and serial number identification of your appliance ready.

For models MMDV30S and MMD30: The name plate, including model and serial number, is located on the faceplate behind the microwave drawer front.

For model MMD24: The name plate includes the model and serial number. Open the microwave drawer fully. The label is located slightly beyond the back wall of the microwave cavity facing up from the flat surface.

Record these numbers below for easy access.

Model Number _____

Serial Number _____

Date of Purchase_____

For service and warranty information, see page 19.

At Dacor, we continuously improve the quality and performance of all our products. We may need to make changes to this appliance without updating these instructions.

IMPORTANT INFORMATION ABOUT SAFETY INSTRUCTIONS

The Important Safety Instructions and warnings in this manual are not meant to cover all possible conditions and situations that can occur. Use common sense and caution when installing, maintaining or operating this or any other appliance.

Always contact the Dacor Customer Service Team about problems or situations that you do not understand.

SAFETY SYMBOLS AND LABELS

⚠ DANGER

Immediate hazards that **WILL** result in severe personal injury or death.

⚠ WARNING

Hazards or unsafe practices that **COULD** result in severe personal injury or death.

⚠ CAUTION

Hazards or unsafe practices that **COULD** result in minor personal injury or property damage.

⚠ WARNING

PRECAUTIONS TO AVOID POSSIBLE EXPOSURE TO EXCESSIVE MICROWAVE ENERGY

(a) Do not attempt to operate this oven with the door open since open-door operation can result in harmful exposure to microwave energy. It is important not to defeat or tamper with the safety interlocks.

(b) Do not place any object between the oven front face and the door or allow soil or cleaner residue to accumulate on sealing surfaces.

(c) Do not operate the oven if it is damaged. It is particularly important that the oven door close properly and that there is no damage to the: (1) drawer front (bent), (2) glides and latches (broken or loosened), (3) drawer seals and sealing surfaces.

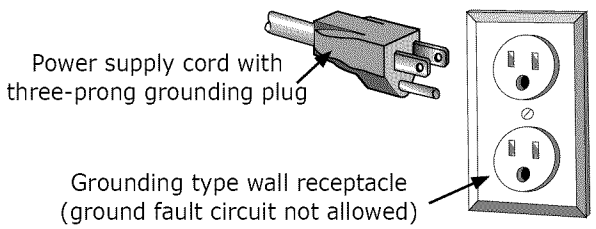
(d) The oven should not be adjusted or repaired by anyone except properly qualified service personnel.

GROUNDING INSTRUCTIONS

⚠ WARNING

Improper use of the grounding plug can result in a risk of electric shock.

This appliance is equipped with a three-prong grounding plug for your protection against possible electric shock hazards. It must be plugged into a grounded wall receptacle. If only a two-prong wall receptacle is available, it is the responsibility of the customer to have it replaced with a properly grounded three-prong wall receptacle. **Do not under any circumstances, cut or remove the third (ground) prong from the power cord.** Do not use an adapter plug. Do not use an extension cord. If the power supply cord is too short, have a qualified electrician or serviceman install an outlet near the appliance. **Do not use a Ground Fault Circuit Interrupter.**



IMPORTANT SAFETY INSTRUCTIONS

⚠ WARNING

When using the appliance, basic safety precautions should be followed, including the following:

⚠ WARNING To reduce the risk of burns, electric shock, fire, injury to persons or exposure to excessive microwave energy:

1. Read all instructions before using the appliance.
2. Read and follow the specific "PRECAUTIONS TO AVOID POSSIBLE EXPOSURE TO EXCESSIVE MICROWAVE ENERGY" on page 1.
3. This appliance must be properly grounded. See page 1 and the separate installation instructions for grounding instructions .
4. Install or locate this appliance only in accordance with the provided installation instructions.
5. Some products such as whole eggs and sealed containers - for example, closed glass jars—can explode and should not be heated in the drawer.
6. Use this appliance only for its intended use as described in this manual. Do not use corrosive chemicals or vapors in this appliance. This microwave is specifically designed to heat and cook food. It is not designed for industrial or laboratory use.
7. As with any appliance, close supervision is necessary when used by children.
8. Do not operate this appliance if it has a damaged cord or plug, if it is not working properly or if it has been damaged or dropped.
9. This appliance should be serviced only by qualified service personnel. Contact nearest Dacor Authorized Servicer for examination, repair or adjustment.
10. Do not cover or block any openings on the appliance.
11. Do not store or use this appliance outdoors. Do not use this product near water—for example, near a kitchen sink, in a wet basement, near a swimming pool or similar locations.
12. Do not immerse the power cord or plug in water.
13. Keep the power cord away from heated surfaces.
14. Do not climb or sit on the drawer.
15. Be sure that fingers or other objects or materials are not around the drawer opening when the appliance is closed.
16. Do not put fingers or clothes around the drawer guides when the appliance is opened or closed. They could be caught in the guides when the drawer is closed.
17. Be sure that the food and it's container can fit inside the drawer completely before closing it.
18. When cleaning drawer sealing surfaces that come together on closing the drawer, use only mild, non-abrasive soaps or detergents applied with a sponge or soft cloth. See cleaning instructions on page 15.
19. To reduce the risk of fire in the appliance cavity:
    a. Do not overcook food. Carefully attend appliance when paper, plastic or other combustible materials are placed inside the drawer to facilitate cooking.
    b. Remove wire twist-ties from paper or plastic bags before placing bag in drawer.
    c. If materials inside the appliance ignite, keep drawer door closed, turn microwave off and shut off power at the fuse or circuit breaker panel.
    d. Do not use the drawer for storage purposes. Do not leave paper products, cooking utensils, or food in the drawer when not in use.
20. Liquids, such as water, coffee or tea are able to be overheated beyond the boiling point without appearing to be boiling due to surface tension of the liquid. Visible bubbling or boiling when the container is removed from the appliance is not always present. THIS COULD RESULT IN VERY HOT LIQUIDS SUDDENLY BOILING OVER WHEN A SPOON OR OTHER UTENSIL IS INSERTED INTO THE LIQUID.

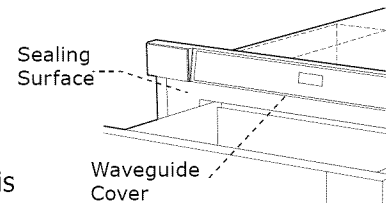
    To reduce the risk of injury to persons:
    a. Do not overheat the liquid.
    b. Stir the liquid both before and halfway through heating.
    c. Do not use straight-sided containers with narrow necks. Use a wide-mouthed container.
    d. After heating, allow the container to stand in the drawer for at least 20 seconds before removing the container.
    e. Use extreme care when inserting a spoon or other utensil into the container.
21. If the appliance light fails, consult a DACOR AUTHORIZED SERVICER.

READ AND SAVE THESE INSTRUCTIONS

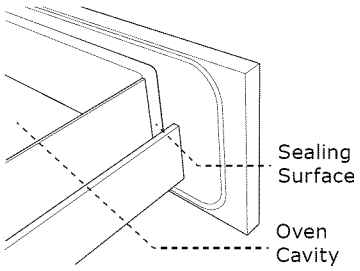
Information You Need To Know

About Unpacking And Examining Your Microwave In-A-Drawer™

1. Remove all packing materials from inside the Microwave In-A-Drawer™. DO NOT REMOVE THE WAVE-GUIDE COVER, which is located inside, on the ceiling of the Microwave In-A-Drawer™.



2. Remove the feature sticker, if there is one. Check the drawer for any damage, such as misaligned or bent drawer, damaged drawer seals and sealing surfaces, broken or loose drawer guides and dents inside the cavity or on the front side of the drawer. If there is any damage, do not operate the Microwave In-A-Drawer™ and contact your dealer or a DACOR AUTHORIZED SERVICER.



RADIO OR TV INTERFERENCE

Should there be any interference caused by the Microwave In-A-Drawer™ to your radio or TV, check to make sure that the appliance is on a different electrical circuit, relocate the radio or TV as far away from the drawer as feasible or check the position and signal of receiving antenna.

About Your Microwave In-A-Drawer™

ALWAYS have food in the drawer when it is on to absorb the microwave energy.

The vent under the Microwave In-A-Drawer™ must not be blocked. During microwaving, steam may come from the right side of the vent.

When using the Microwave In-A-Drawer™ at power levels below 100%, you may hear the magnetron cycling on and off. It is normal for the exterior of the drawer to be warm to the touch when cooking or reheating.

Condensation is a normal part of microwave cooking. Room humidity and the moisture in food will influence the amount of moisture that condenses in the drawer. Generally, covered foods will not cause as much condensation as uncovered ones.

The Microwave In-A-Drawer™ is for food preparation only. It should not be used to dry clothes or newspapers.

Your Microwave In-A-Drawer™ is rated 950 watts by using the IEC Test Procedure. In using recipes or package directions, check food one or two minutes before the minimum time and add time accordingly.

When opening or closing the Microwave In-A-Drawer™ quickly, food in the drawer may be spilled. To clean, please refer to the Cleaning and Care section on page 15.

About Microwave Cooking

- Arrange food carefully. Place thickest areas towards outside of dish.
- Watch the cooking time. Cook for the shortest amount of time indicated and add more as needed. Food severely overcooked can smoke or ignite.
- Cover foods while cooking. Check a recipe or cookbook for suggestions like: paper towels, wax paper, microwave plastic wrap or a lid. Covers prevent spattering and help foods to cook evenly.
- Shield with small flat pieces of aluminum foil any thin areas of meat or poultry to prevent overcooking before dense, thick areas are cooked thoroughly.
- Stir foods from outside to center of dish once or twice during cooking, if possible.
- Turn foods over once during microwaving to speed cooking of such foods as chicken and hamburgers. Large items like roasts must be turned over at least once.
- Rearrange foods such as meatballs halfway through cooking both from top to bottom and from right to left.
- Add standing time. Remove food from drawer and stir, if possible. Cover during standing time, allowing the food to finish cooking without overcooking.
- Check for doneness. Look for signs indicating that cooking temperatures have been reached.

  Signs of doneness include:

  - Food steams throughout, not just at edge.
  - Poultry thigh joints move easily.
  - Meat and poultry show no pinkness.
  - Fish is opaque and flakes easily with a fork.

About Utensils And Coverings

It is not necessary to buy all new cookware. Many pieces already in your kitchen can be used successfully in your new microwave. Make sure the utensil does not touch the interior walls during cooking.

Use these utensils for safe microwave cooking and reheating:

- Glass ceramic (Pyroceram®), such as Corningware®
- Heat-resistant glass (Pyrex®)
- Microwave-safe plastics
- Microwave-safe paper plates
- Microwave-safe pottery, stoneware and porcelain
- Browning dish (Do not exceed recommended preheating time. Follow manufacturer's directions.)

These items can be used for short time reheating of foods that have little fat or sugar in them:

- Wood, Straw, Wicker

DO NOT USE

- Metal pans and Bakeware
- Dishes with metallic trim
- Non-heat-resistant glass
- Non-microwave-safe plastics (margarine tubs)
- Recycled paper products
- Brown paper bags
- Food storage bags
- Metal twist-ties

Should you wish to check if a dish is safe for microwaving, place the empty dish in the microwave on HIGH for 30 seconds. A dish which becomes very hot should not be used.

THE FOLLOWING COVERINGS ARE IDEAL:

- Paper towels are good for covering foods for reheating and absorbing fat while cooking bacon.
- Wax paper can be used for cooking and reheating.
- Plastic wrap that is specially marked for microwave use can be used for cooking and reheating. DO NOT allow plastic wrap to touch food. Vent so steam can escape.
- Lids that are microwave-safe are a good choice because heat is kept near the food to hasten cooking.
- Oven cooking bags are good for large meats or foods that need tenderizing. DO NOT use metal twist ties. Remember to slit the bag so steam can escape.

HOW TO USE ALUMINUM FOIL IN YOUR DRAWER:

- Small flat pieces of aluminum foil placed smoothly on the food can be used to shield areas that are either defrosting or cooking too quickly.
- Foil should not come closer than one inch to any surface of the Microwave In-A-Drawer™.

Should you have questions about utensils or coverings, check a good microwave cookbook or follow recipe suggestions.

ACCESSORIES:

There are many microwave accessories available for purchase. Evaluate carefully before you purchase to make sure that they meet your needs. A microwave-safe thermometer will assist you in determining correct doneness and assure you that foods have been cooked to safe temperatures. Dacor is not responsible for any damage to the appliance when accessories are used.

Open Or Close Drawer

Always press the OPEN or CLOSE key on the control panel to open or close the drawer.

Do not push or pull the drawer by hand, except in case of emergency, such as a power failure. If necessary, push or pull slowly.

About Children And The Microwave

Children below the age of 7 should use the Microwave In-A-Drawer™ with a supervising person very near to them. Between the ages of 7 and 12, the supervising person should be in the same room. The child must be able to reach the drawer comfortably.

At no time should anyone be allowed to lean or sit on the Microwave In-A-Drawer™.

Children should be taught all safety precautions: how to use potholders, remove coverings carefully and pay special attention to packages that crisp food because they may be extra hot.

Do not assume because a child has mastered one cooking skill that he/she can cook everything.

Children need to learn that the Microwave In-A-Drawer™ is not a toy. See page 14 for Control Lock feature.

Information You Need To Know

About Safety

Check foods to see that they are cooked to the United States Department of Agriculture's recommended temperatures.

160°F	- For fresh pork, ground meat, boneless white poultry, fish, seafood, egg dishes and frozen prepared food.
165°F	- For leftovers, ready-to-reheat refrigerated; deli and carry-out "fresh" food.
170°F	- White meat of poultry.
180°F	- Dark meat of poultry.

To test for doneness, insert a meat thermometer in a thick or dense area away from fat or bone. NEVER leave the thermometer in the food during cooking, unless it is approved for microwave use.

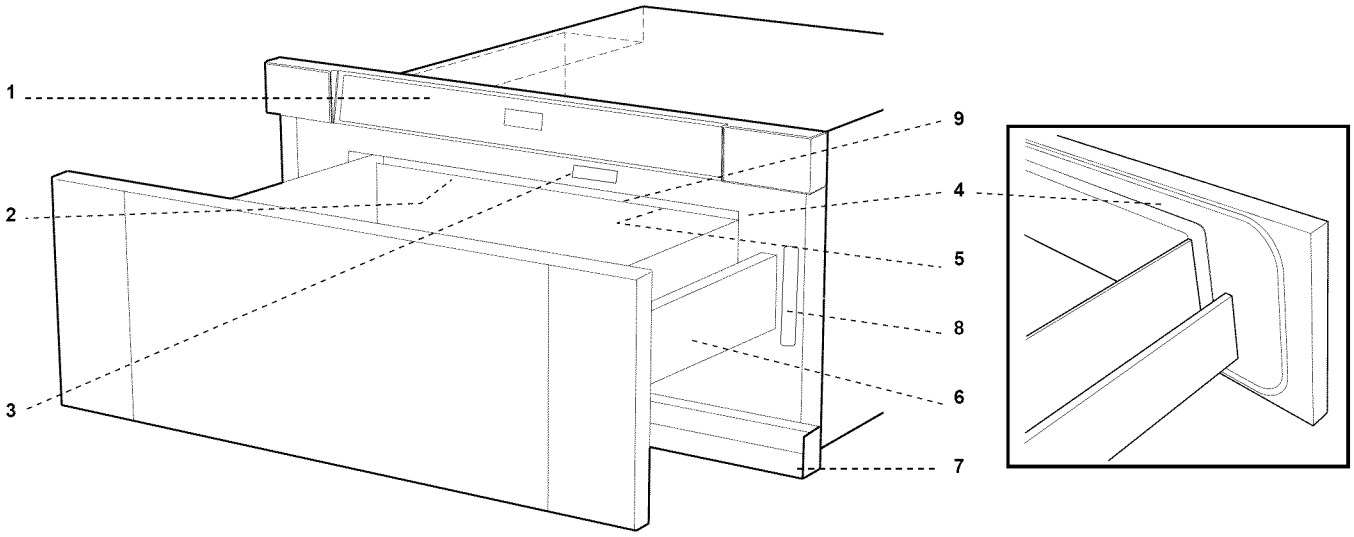
- ALWAYS use potholders to prevent burns when handling utensils that are in contact with hot food. Enough heat from the food can transfer through utensils to cause skin burns.
- Avoid steam burns by directing steam away from the face and hands. Slowly lift the farthest edge of a dish's covering and carefully open popcorn and oven cooking bags away from the face.
- Stay near the Microwave In-A-Drawer™ while it's in use and check cooking progress frequently so that there is no chance of overcooking food.
- NEVER use the Microwave In-A-Drawer™ for storing cookbooks or other items.
- Select, store and handle food carefully to preserve its high quality and minimize the spread of foodborne bacteria.
- Keep waveguide cover clean. Food residue can cause arcing and/or fires. See page 15.

About Foods

FOOD	DO	DON'T
Eggs, sausages, fruits & vegetables	• Puncture egg yolks before cooking to prevent "explosion". • Pierce skins of potatoes, apples, squash, hot dogs and sausages so that steam escapes.	• Cook eggs in shells. • Reheat whole eggs. • Dry nuts or seeds in shells.
Popcorn	• Use specially bagged popcorn for the microwave. • Listen while popping corn for the popping to slow to 1 or 2 seconds or use the special **SENSOR POPCORN** key.	• Pop popcorn in regular brown bags or glass bowls. • Exceed maximum time on popcorn package.
Baby food	• Transfer baby food to small dish and heat carefully, stirring often. Check temperature before serving. • Put nipples on bottles after heating and shake thoroughly. "Wrist" test before feeding.	• Heat disposable bottles. • Heat bottles with nipples on. • Heat baby food in original jars.
General	• Cut baked goods with filling after heating to release steam and avoid burns. • Stir liquids briskly before and after heating to avoid "eruption". • Use deep bowl, when cooking liquids or cereals, to prevent boilovers. • Food should be shorter than the drawer. Please refer to the height of side walls of the drawer.	• Heat or cook in closed glass jars or airtight containers. • Heat cans in the microwave as harmful bacteria may not be destroyed. • Deep fat fry. • Dry wood, gourds, herbs or wet papers.

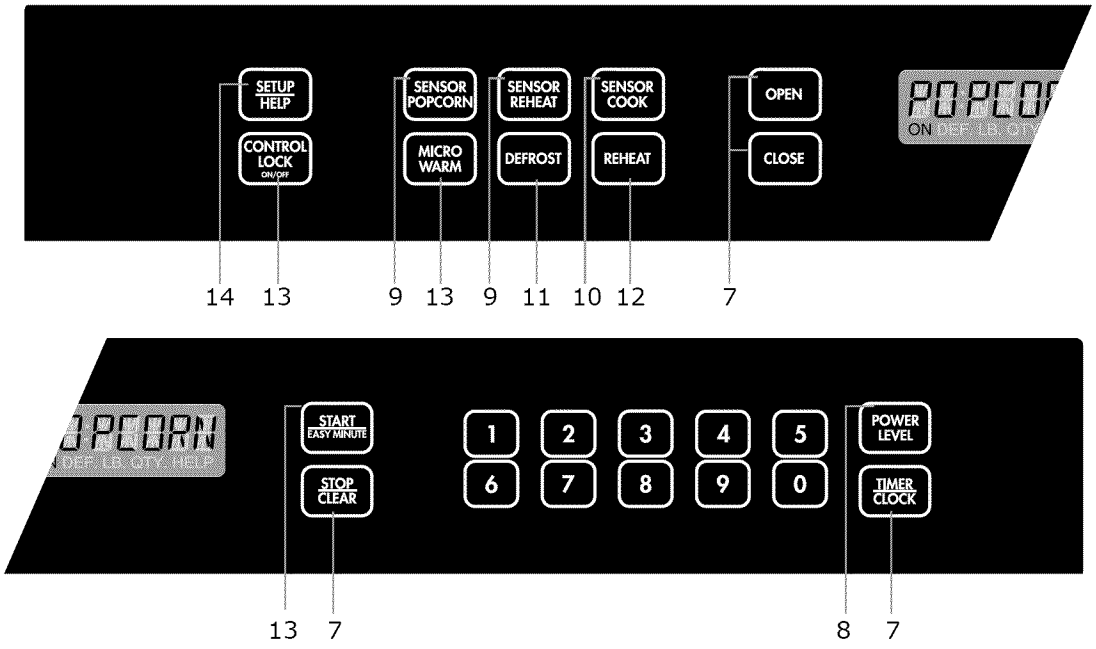
Part Names

Microwave In-A-Drawer™



1. Control Panel
2. Waveguide Cover DO NOT REMOVE
3. Menu Label
4. Drawer Sealing Surfaces
5. Drawer Light
6. Drawer Guides
7. Vent
8. Rating Label for models MMDV30 and MMD30
9. Rating Label for model MMD24: Open the Microwave Drawer fully. The label is slightly beyond the back wall of the microwave cavity, facing up from the flat surface.

KEYSHEET



Numbers next to the keysheet illustration indicate page numbers where feature descriptions and usage information is located.

Before Operating

Before operating your new Microwave In-A-Drawer™ make sure you read and understand this manual completely.

- Before the Microwave In-A-Drawer™ can be used, follow these steps:

1. Plug in the Microwave In-A-Drawer™. ENJOY YOUR MICRO- WAVE TOUCH CLEAR AND TOUCH CLOCK will appear.
2. Touch the **STOP/CLEAR** key. : will appear.
3. Set the clock.

To Set The Clock

1. Touch the **TIMER/CLOCK** key and number 2.
2. Touch the number keys for correct time of day and touch the **TIMER/CLOCK** key again.

This is a 12 hour clock. If you attempt to enter an incorrect clock time, ERROR will appear in the display. Touch the **STOP/CLEAR** key and re-enter the time.

- If the electrical power supply to your Microwave In-A-Drawer™ should be interrupted, the display will intermittently show ENJOY YOUR MICRO- WAVE TOUCH CLEAR AND TOUCH CLOCK after the power is restored. If power is interrupted during cooking, the program will be erased. The time of day will also be erased. Simply touch the **STOP/CLEAR** key and reset the clock for the correct time of day.

NOTE:

- The Microwave In-A-Drawer™ can be programmed with the drawer open except for the **START/EASY MINUTE** feature.

Timer

1. Touch the **TIMER/CLOCK** key and number 1.
2. Enter time.
3. Touch the **TIMER/CLOCK** key again.
4. To cancel timer, touch the **STOP/CLEAR**.

Stop/Clear

Touch the **STOP/CLEAR** key to:

1. Clear a mistake made during programming.
2. Cancel the timer.
3. Stop the Microwave In-A-Drawer™ temporarily during timed cooking.
4. Return the time of day to the display.
5. Cancel a program during cooking, touch twice for timed cooking.

Open Or Close Drawer

Always press the **OPEN** or **CLOSE** key on the control panel to open or close the drawer.

Do not push or pull the drawer by hand, except in case of emergency, such as during a power failure. If necessary, push or pull slowly.

Microwave In-A-Drawer™ Cooking

Time Cooking

Your Microwave In-A-Drawer™ can be programmed for 99 minutes 99 seconds (99.99). Always enter the seconds after the minutes, even if they are both zeros.

- For example: Cook for 5 minutes at 100%.

1. Enter cooking time 5 0 0. 5.00 TOUCH START OR TOUCH POWER LEVEL
2. To cook at 100% power (High), touch the **START/ EASY MINUTE** key.

To Set Power Level

There are eleven preset power levels.

Using lower power levels increases the cooking time, which is recommended for foods such as cheese, milk and long slow cooked meats. Consult a microwave cookbook or recipes for specific recommendations.

- For example: Defrost for 5 minutes at 30%.

1. Enter defrost time 5 0 0. 5.00
2. Touch the **POWER LEVEL** key 8 times.
3. Touch the **START/EASY MINUTE** key.

TOUCH POWER LEVEL PAD NUMBER OF TIMES FOR DESIRED POWER	APPROXIMATE PERCENTAGE OF POWER	COMMON WORDS FOR POWER LEVELS
Power Level x 1	100%	High
Power Level x 2	90%	
Power Level x 3	80%	
Power Level x 4	70%	Medium High
Power Level x 5	60%	
Power Level x 6	50%	Medium
Power Level x 7	40%	
Power Level x 8	30%	Med Low/Defrost
Power Level x 9	20%	
Power Level x 10	10%	Low
Power Level x 11	0%	

Sensor Settings

Dacor's Sensor is a semi-conductor device that detects the vapor (moisture and humidity) emitted from the food as it heats. The sensor adjusts the cooking times and power levels for various foods and quantities.

USING SENSOR SETTINGS:

1. After the Microwave In-A-Drawer™ is plugged in, wait 2 minutes before using any sensor setting.
2. Be sure the exterior of the cooking container and the interior of the Microwave In-A-Drawer™ are dry. Wipe off any moisture with a dry cloth or paper towel.
3. The sensor works with foods at normal storage temperature. For example, popcorn would be at room temperature.
4. Any sensor selection can be programmed with More or Less Time Adjustment. See page 13.
5. More or less food than the quantity listed in the charts should be cooked following the guidelines in any microwave cookbook.
6. During the first part of sensor use, the food name will appear on the display. Do not open the Microwave In-A-Drawer™ or touch **STOP/CLEAR** during this part of the cycle. The measurement of vapor will be interrupted. If this occurs, an error message will appear. To continue cooking, touch the **STOP/CLEAR** key and cook manually.

   When the sensor detects the vapor emitted from the food, the remainder of cooking/reheating time will appear. The Microwave In-A-Drawer™ may be opened when the remaining time appears on the display. At this time, you may stir or season food, as desired.
7. If the sensor does not detect vapor properly when popping popcorn, the Microwave In-A-Drawer™ will turn off, and the time of day will be displayed. If the sensor does not detect vapor properly when cooking other foods, ERROR will be displayed, and the microwave will turn off.
8. Check the food temperature after cooking. If additional time is needed, continue to cook manually.
9. Each food has a cooking hint. Touch the **SET UP/ HELP** key when the HELP indicator is lighted in the display.

COVERING FOODS:

Some foods cook best when covered. Use the cover recommended in the charts for these foods. You may refer to the hints by touching the **SET UP/HELP** key.

1. Casserole lid.
2. Plastic wrap: Use plastic wrap recommended for microwave cooking. Cover dish loosely; allow approximately 1/2 inch to remain uncovered to allow steam to escape. Plastic wrap should not touch food.
3. Wax paper: Cover dish completely; fold excess wrap under dish to secure. If dish is wider than paper, overlap two pieces at least one inch to cover.

Be careful when removing any covering to allow steam to escape away from you.

Sensor Popcorn / Sensor Reheat

You can pop popcorn and reheat many foods without calculating the cooking time or power level.

Touch the **SENSOR REHEAT** or **SENSOR POPCORN** and the **START/EASY MINUTE** key.

When the sensor detects the vapor emitted from the food, the remainder of cooking/reheating time will appear.

NOTE:

- The Sensor Popcorn setting has 2 choices. Follow directions on the display to choose desired option.

SENSOR POPCORN / SENSOR REHEAT CHART

FOOD	AMOUNT	PROCEDURE
Sensor Popcorn	Only 1 package at a time	Use only popcorn packaged for the microwave. Try several brands to decide your favorite. Do not try to pop unpopped kernels.
	2.85 - 3.5 oz. (Regular / Regular light)	Touch the **SENSOR POPCORN** key once.
	1.2 - 1.75 oz. (Mini / Snack)	Touch the **SENSOR POPCORN** key twice.
Sensor Reheat	4 - 36 oz.	Place food to be reheated in a dish or casserole slightly larger than the amount. Flatten, if possible. Cover with a lid, plastic wrap or wax paper. Use covers such as plastic wrap or lids, with larger quantities of more dense foods such as stews. After reheating, stir well if possible. Re-cover and allow to stand 2 to 3 minutes. Foods should be very hot. If not, continue to heat with variable power and time.

Sensor Cooking

1. Touch the **SENSOR COOK** key once.
   SEE | LABEL | SELECT | FOOD | NUMBER
2. See the Menu Label. Select desired food by touching the number key. Ex: Touch 5 for baked potatoes.
3. Touch the **START/EASY MINUTE** key.

NOTE:

- To heat or cook other foods or foods above or below the quantity allowed on the SENSOR COOK CHART, cook manually.

SENSOR COOK CHART

FOOD	AMOUNT	PROCEDURE
1. Fresh vegetables: soft Broccoli Brussel sprouts Cabbage Cauliflower (flowerets) Cauliflower (whole) Spinach Zucchini Baked apples	 .25 - 2.0 lb. .25 - 2.0 lb. .25 - 2.0 lb. .25 - 2.0 lb. 1 med. .25 - 1.0 lb. .25 - 2.0 lb. 2 - 4 med.	Wash and place in casserole. Do not add water if vegetables have just been washed. Cover with lid for tender vegetables. Use plastic wrap for tender-crisp vegetables. After cooking, stir, if possible. Let stand covered for 2 to 5 minutes.
2. Fresh vegetables: hard Carrots, sliced Corn on the cob Green beans Winter squash: diced halves	 .25 - 1.5 lb. 2 - 4 .25 - 1.5 lb. .25 - 1.5 lb. 1 - 2	Place in casserole. Add 1 - 4 tablespoons water. Cover with lid for tender vegetables. Use plastic wrap cover for tender-crisp vegetables. After cooking, stir, if possible. Let stand covered for 2 to 5 minutes.
3. Frozen vegetables	.25 - 1.25 lb.	Do not add water. Cover with lid or plastic wrap. After cooking, stir and let stand covered for 3 minutes.
4. Frozen entrees	6 - 17 oz.	Use this key for frozen convenience foods. It will give satisfactory results for most brands. You may wish to try several and choose your favorite. Remove package from outer wrapping and follow package directions for covering. After cooking, let stand covered for 1-3 minutes.
5. Baked potatoes	1 - 6 med.	Pierce. Place on paper-towel-lined drawer. After cooking, remove from microwave, wrap in aluminum foil and let stand 5 to 10 minutes.
6. Ground meat	.25 - 2.0 lb.	Use this setting to cook ground beef or turkey as patties or in a casserole to be added to other ingredients. Place patties on a microwave-safe rack and cover with wax paper. Place ground meat in a casserole and cover with wax paper or plastic wrap. When microwave stops, turn patties over or stir meat in casserole to break up large pieces. Re-cover and touch **START/ EASY MINUTE**. After cooking, let stand covered for 2 to 3 minutes.
7. Fish/seafood	.25 - 2.0 lb.	Arrange in ring around shallow glass dish (roll fillet with edges underneath). Cover with vented plastic wrap. After cooking, let stand covered for 3 minutes.
8. Rice	.5 - 2.0 cup	Place rice into a deep casserole and add a double quantity of water. Cover with lid or plastic wrap. After cooking, stir, cover and let stand 3 to 5 minutes or until all liquid has been absorbed. **Rice** / **Water** / **Size of casserole** .5 cup / 1 cup / 1.5 quart 1 cup / 2 cups / 2 quart 1.5 cups / 3 cups / 2.5 or 3 quart 2 cups / 4 cups / 3 quart or larger

Defrost

Use this feature to defrost the foods shown in the DEFROST CHART below.

1. Touch the **DEFROST** key. SEE LABEL SELECT FOOD NUMBER
2. See the Menu Label. Select desired food by touching the number key. For example: Touch 2 for steaks/chops. STEAKS CHOPS ENTER WEIGHT
3. Enter the weight by touching 1 0 0. 1.0 Lb
4. Touch the **START/EASY MINUTE** key.
5. The Microwave In-A-Drawer™ will stop so that the food can be checked.
6. After the first stage, open the drawer. Turn steak over and shield any warm portions. Close the drawer. Touch the **START/EASY MINUTE** key.
7. After the second stage, open the drawer. Shield any warm portions. Close the drawer. Touch the **START/EASY MINUTE** key.
8. After defrost cycle ends, cover and let stand as indicated in the chart below.

NOTE:

- Defrost can be programmed with More or Less Time Adjustment. See page 13.
- To defrost other foods or foods above or below the weights allowed on the DEFROST CHART, see MANUAL DEFROST below.
- Do not defrost until all ice crystals are thawed.
- Check foods when the Microwave In-A-Drawer™ signals. After the final stage, small sections may still be icy. Let stand to continue thawing.
- Shielding prevents cooking from occurring before the center of the food is defrosted. Use small smooth strips of aluminum foil to cover edges and thinner sections of the food.

DEFROST CHART

FOOD	AMOUNT	PROCEDURE
1. Ground meat	.5 - 2.0 lb	Remove any thawed pieces after each audible signal. Let stand covered for 5 to 10 minutes.
2. Steaks/chops	.5 - 3.0 lb	After each audible signal, rearrange and if there are warm or thawed portions, shield with small flat pieces of aluminum foil. Remove any meat or fish that is almost defrosted. Let stand covered for 10 to 20 minutes.
3. Boneless poultry	.5 - 2.0 lb	After each audible signal, if there are warm or thawed portions, rearrange or remove. Let stand covered for 10 to 20 minutes.
4. Bone-in poultry	.5 - 3.0 lb	After each audible signal, rearrange pieces or remove portions should they become warm or thawed. Let stand covered for 10 to 20 minutes.
5. Casserole/soup	1 - 6 cups	After each audible signal, break apart and remove any defrosted part. At end, stir well and let stand covered for 5 to 10 minutes.

Manual Defrost

If the food that you wish to defrost is not listed on the DEFROST CHART or is above or below the limits in the AMOUNT column on the DEFROST CHART, you need to defrost manually.

You can defrost any frozen food, either raw or previously cooked, by setting the Power Level to 30%. Follow the exact 3-step procedure found under TO SET POWER LEVEL on page 8. Estimate defrosting time and press POWER LEVEL key eight times for 30% power.

For either raw or previously cooked frozen food, the rule of thumb is approximately 4 minutes per pound. For example, defrost 4 minutes for 1 pound of frozen spaghetti sauce.

Always stop the Microwave In-A-Drawer™ periodically to remove or separate the portions that are defrosted. If food is not defrosted at the end of the estimated defrosting time, program the Microwave In-A-Drawer™ in 1 minute increments at a Power Level of 30% until totally defrosted.

When using plastic containers from the freezer, defrost only long enough to remove from the plastic, then place in a microwave-safe dish.

Reheat

Reheat automatically computes the correct warming time and microwave power level for foods shown in the chart below.

1. Touch the **REHEAT** key once. SEE LABEL SELECT FOOD NUMBER
2. See Menu Label. Select desired food by touching the number key. For example: Touch 2 for frozen rolls or muffins.
3. Touch the number key to select quantity. For example: Touch 2 for 2 rolls or muffins.
4. Touch the **START/EASY MINUTE** key.

NOTE:

- Reheat can be programmed with More or Less Time Adjustment. See page 13.
- To reheat other foods or foods above or below the quantity allowed on the REHEAT CHART, heat manually.

REHEAT CHART

FOOD	AMOUNT	PROCEDURE
1. Fresh rolls/ muffins	1 - 8 pcs	Use this key to warm rolls, muffins, biscuits, bagels etc. Large items should be considered as 2 or 3 regular size. Arrange on plate; cover with paper towel. For refrigerated rolls or muffins, it may be necessary to double the entered amount to ensure the proper serving temperature. For example, enter quantity of 2 for 1 refrigerated muffin.
2. Frozen rolls/ muffins	1 - 8 pcs	Use this key to warm frozen rolls, muffins, biscuits, bagels etc. Large items should be considered as 2 or 3 regular size. Arrange on plate; cover with paper towel.
3. Beverage	.5 - 2.0 cups	This setting is good for restoring cooled beverage to a better drinking temperature. Stir liquid briskly before and after heating to avoid "eruption".

Other Features

Micro Warm

Micro Warm allows you to keep food warm up to 30 minutes.

DIRECT USE

1. Touch the **MICRO WARM** key.
   ENTER | TIME | UP TO | 30 | MINUTES
2. Enter the desired time by touching the number keys. To enter 30 minutes, touch 3 0 0 0.
   30.00 | TOUCH | START
3. Touch the **START/EASY MINUTE** key.

The Microwave In-A-Drawer™ will start. The display will show 30.00 and count down. KEEP | WARM will be displayed intermittently during the count down.

WITH MANUAL COOKING

1. Enter the desired cooking time and power level.
2. Touch the **MICRO WARM** key.
3. Enter the desired warming time, up to 30 minutes.
4. Touch the **START/EASY MINUTE** key.

The operation will start. When the cooking time is complete, a long tone will sound and Micro Warm will start. The display will count down. KEEP | WARM will be displayed intermittently during the count down.

NOTE:

- If you attempt to enter more than 30 minutes for Micro Warm, an error message will appear in the display.
- Micro Warm cannot be programmed with Sensor Popcorn, Sensor Reheat, Sensor Cook, Defrost or Reheat.

Help

Each setting of Sensor Reheat, Sensor Cook, Sensor Popcorn, Micro Warm, Reheat and Defrost has a cooking hint. If you wish to check, touch **SET UP/HELP** whenever HELP is lighted in the interactive display for these and other manual operation hints.

More Or Less Time Adjustment

Should you discover that you like any of the Sensor, Reheat or Defrost settings slightly more done, touch the **POWER LEVEL** key once after touching your selection. The display will show MORE.

For slightly less done, touch the **POWER LEVEL** key twice after touching your selection.
The display will show LESS.

Multiple Sequence Cooking

Your Microwave In-A-Drawer™ can be programmed for up to 4 automatic cooking sequences, switching from one power level setting to another automatically.

Sometimes cooking directions tell you to start on one power level and then change to a different power level. Your Microwave In-A-Drawer™ can do this automatically.

1. First enter the cooking time. Then touch the **POWER LEVEL** key once for 100% cooking or repeat touching the **POWER LEVEL** key for a lower power level.
2. Enter the second cooking time. Touch the **POWER LEVEL** key repeatedly for desired level. You can follow this procedure up to 4 times. TOUCH | START
3. Touch the **START/EASY MINUTE** key.

NOTE:

- If the **POWER LEVEL** key is touched once, HIGH will be displayed.
- If 100% is selected as the final sequence, it is not necessary to touch the **POWER LEVEL** key.
- If you wish to know the power level during cooking, simply touch the **POWER LEVEL** key. As long as your finger is touching the **POWER LEVEL** key, the power level will be displayed.
- Micro Warm can be programmed even if 4 cooking sequences have been set.

Easy Minute

Easy Minute allows you to cook for a minute at 100% by simply touching the **EASY MINUTE** key. You can also extend cooking time in multiples of 1 minute by repeatedly touching the **EASY MINUTE** key during manual cooking.

NOTE:

- To use Easy Minute, touch the key within 3 minutes after cooking, closing the door or touching the **STOP/CLEAR** key.
- Easy Minute cannot be used with Sensor settings, Reheat or Defrost.

Setup/Help

If the electrical power supply to your Microwave In-A-Drawer™ should be interrupted, the display will intermittently show ENJOY | YOUR | MICRO- | WAVE | TOUCH | CLEAR | AND | TOUCH | CLOCK after the power is reinstated. If this situation occurs, the **SETUP/HELP** option you input will be erased. Simply touch the **STOP/CLEAR** key and reset.

Other Features

Audible Signal Elimination

At the end of timed cook, a series of beeps will sound. If you wish to operate the appliance with no audible signals, you can turn them off.

TO TURN SOUND OFF

1. Touch the **SETUP/HELP** key. TOUCH AGAIN
2. Touch the **SETUP/HELP** key again. SOUND OFF ? TOUCH START
3. Touch the **START/EASY MINUTE** key. The display shows SOUND OFF.

TO RESTORE SOUND

1. Touch the **SETUP/HELP** key. TOUCH AGAIN
2. Touch the **SETUP/HELP** key again. SOUND ON ? TOUCH START
3. Touch the **START/EASY MINUTE** key. The display shows SOUND ON.

End Of Cooking Reminder

At end of timed cooking, the microwave will signal every 10 seconds for the first minute; then every 3 minutes until the **STOP/CLEAR** key is touched, up to one hour.

TO TURN REMINDER OFF

1. Touch the **SETUP/HELP** key three times. The display shows REMIND SIGNAL OFF ? TOUCH START.
2. Touch the **START/EASY MINUTE** key. The display shows REMIND SIGNAL OFF.

TO TURN REMINDER SIGNAL BACK ON

1. Touch the **SETUP/HELP** key three times. The display shows REMIND SIGNAL ON ? TOUCH START.
2. Touch the **START/EASY MINUTE** key. The display shows REMIND SIGNAL ON.

Auto Start

If you wish to program the Microwave In-A-Drawer™ to begin cooking automatically at a designated time of day, follow this procedure:

1. Touch the **SETUP/HELP** key 4 times. The display shows AUTO START TOUCH START.
2. Touch the **START/EASY MINUTE** key. ENTER START TIME
3. Enter start time. 4:30 TOUCH CLOCK
4. Touch the **TIMER/CLOCK** key. ENTER COOKING TIME
5. Touch the number keys to enter cooking time. 20.00 TOUCH START OR TOUCH POWER LEVEL
   Touch the **POWER LEVEL** key repeatedly until the desired power level is reached. TOUCH START
6. Touch the **START/EASY MINUTE** key.

Demonstration Mode

TO SELECT DEMO MODE

1. Touch the **SETUP/HELP** key five times. The display shows DEMO ON? HOLD START 3 SEC.
2. Hold the **START/EASY MINUTE** key for 3 seconds. The display shows DEMO ON.

TO CANCEL DEMO MODE

1. Hold the **SETUP/HELP** key five times. The display shows DEMO OFF ? TOUCH START.
2. Touch the **START/EASY MINUTE** key. The display shows DEMO OFF.

NOTE:

- Microwave In-A-Drawer™ doesn't heat in Demo Mode.
- The display counts down quickly.

Control Lock

The Control Lock prevents unwanted Microwave In-A-Drawer™ operation such as by small children. The Microwave In-A-Drawer™ can be set so that the control panel is deactivated or locked.

TO LOCK

Touch the **CONTROL LOCK** key and hold for 3 seconds. The display shows LOCK ON.

TO UNLOCK

Touch the **CONTROL LOCK** key and hold for 3 seconds. The display shows LOCK OFF.

Cleaning and Care

Exterior

The outside surface is precoated metal and plastic. Clean the outside with mild soap and water; rinse and dry with a soft cloth. Do not use any type of household or abrasive cleaner.

Stainless Steel Surface

(Select Models)

The exterior should be wiped often with a soft damp cloth and polished with a soft dry cloth to maintain its beauty. Always wipe in the direction of the grain. There are also a variety of products designed especially for cleaning and shining the stainless exterior of the Microwave In-A-Drawer™. We recommend that the cleaner be applied to a soft cloth and then carefully used on the stainless exterior rather than sprayed directly onto it. Follow package directions carefully.

Front Side Of The Drawer

Wipe the window on both sides with a soft damp cloth to remove any spills or spatters. Metal parts will be easier to maintain if wiped frequently with a soft damp cloth. Avoid the use of spray cleaners and other harsh cleaners as they may stain, streak or dull the door surface.

Touch Control Panel

If desired, the touch keys may be deactivated before cleaning. See the Control Lock information on page 14 of this manual. Wipe the panel with a cloth dampened slightly with water only. Dry with a soft cloth. Do not scrub or use any sort of chemical cleaners. Close the door and follow directions on page 14 for turning Control Lock off. Touch **STOP/CLEAR**.

Interior

Cleaning is easy because little heat is transferred to the interior surfaces; therefore, there is no baking and setting of spills or spattering. To clean the interior surfaces, including drawer sealing surfaces, wipe with a soft damp cloth. DO NOT USE ABRASIVE OR HARSH CLEANERS OR SCOURING PADS. For heavier soil, use mild soap; wipe clean with a soft damp cloth. Do not use any chemical oven cleaners.

Drawer Guides

Remove the food crumbs from the drawer guides. Wipe them with a soft dry cloth in order to keep the drawer opening and closing smoothly.

Waveguide Cover

ATTENTION The waveguide cover, located on the inside top of the Microwave area, is made of mica, so it requires special care. Keep the waveguide cover clean to assure good microwave performance. Carefully wipe with a soft damp cloth any food spatters from the surface of the cover immediately after they occur. Soil build up may overheat and cause smoke or possibly catch fire. Do not remove the waveguide cover.

Odor Removal

Occasionally, cooking odors may remain in the drawer. To remove odors, combine 1 cup water, grated peel and juice of one lemon and several whole cloves in a 2-cup glass measuring cup. Boil for several minutes using 100% power. Allow to set in the drawer until cool. Wipe interior with a soft cloth.

Before You Call For Service

Please check the following before calling for service. It may save you time and expense.

PROBLEM	POSSIBLE CAUSE	SOLUTION
1. Part or all of Microwave In-A-Drawer™ does not operate.	• Power cord of Microwave In-A-Drawer™ is not completely connected to the electrical outlet.	• Make sure the power cord is tightly connected to the outlet.
	• Power outage.	• Check house lights to be sure. Call your local electric company for service.
	• Fuse/circuit breaker at home doesn't work.	• Replace the fuse or reset the circuit breaker.
	• Microwave In-A-Drawer™ is in Demo Mode.	• See page 14 for how to cancel Demo Mode.
2. Food in microwave is not heated.	• No power to the appliance.	• See SOLUTION for PROBLEM 1.
	• Drawer controls improperly set.	• Check if the controls have been properly set.
	• Drawer is in Demo Mode.	• See page 14.
3. Microwave In-A-Drawer™ light does not work.	• Light bulb is loose or burned out.	• Call for service.
4. Touch controls will not operate.	• Control Lock is on.	• See page 14 to unlock.
5. Display flashes.	• Power failure.	• Press the **STOP/CLEAR** key and reset the clock. If the Microwave In-A-Drawer™ was in use, you must reset the cooking function.
6. Steam from the vent.	• Normal operation. During microwaving, steam may come from the right side of the vent.	

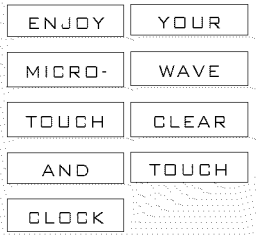
Auto-Touch Guide

Microwave In-A-Drawer™

SET CLOCK

1. Touch the **TIMER/CLOCK** key and number 2.
2. Touch number keys for correct time of day and touch the **TIMER/CLOCK** key again.

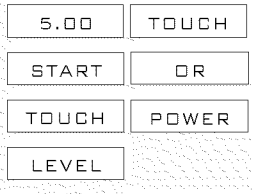
If the electrical power supply to your appliance should be interrupted, the display will intermittently show:



TIME COOKING

High Power Cooking

1. Enter cooking time by touching number keys. To enter 5 minutes, touch 5 0 0.



2. Touch the **START/EASY MINUTE** key.

Variable Power Cooking

1. After step 1 above, touch the **POWER LEVEL** key until desired power level is in the display.
2. Touch the **START/EASY MINUTE** key.

SENSOR COOK

Sensor Cook automatically computes the correct time and power level to cook foods on the Menu Label perfectly.

1. Touch the **SENSOR COOK** key once.



2. See Menu Label. Select desired food by touching the number key. Ex: Touch 5 for baked potatoes.
3. Touch the **START/EASY MINUTE** key.

SENSOR POPCORN/SENSOR REHEAT

Touch **SENSOR REHEAT** or **SENSOR POPCORN** and the **START/EASY MINUTE** key.

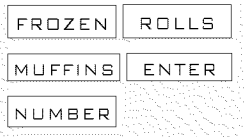
REHEAT

Reheat automatically computes the correct warming time and microwave power level for foods shown on the Menu Label.

1. Touch the **REHEAT** key once.



2. See Menu Label. Select desired food by touching the number key. Ex: Touch 2 for frozen rolls or muffins.



3. Touch the number key to select quantity. Ex: Touch 2 for 2 rolls or muffins.

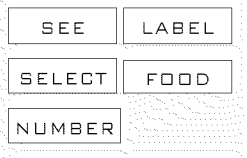


4. Touch the **START/EASY MINUTE** key.

DEFROST

Use this feature to defrost the foods shown on the Menu Label.

1. Touch the **DEFROST** key.



2. See Menu Label. Select desired food by touching the number key. Ex: Touch 2 for steaks/chops.



3. Enter weight by touching number keys. To enter 1 pound, touch 1 0.



4. Touch the **START/EASY MINUTE** key.
5. Microwave will stop to allow food to be turned over, shielded and/or removed. Close the drawer. Touch the **START/EASY MINUTE** key.

Auto-Touch Guide

MICRO WARM

Micro Warm allows you to keep food warm up to 30 minutes.

Direct Use

1. Touch the **MICRO WARM** key.



2. Enter desired time by touching the number keys. To enter 30 minutes, touch 3 0 0 0.



3. Touch the **START/EASY MINUTE** key.

With Manual Cooking

1. Enter desired cooking time and power level.
2. Touch the **MICRO WARM** key.
3. Enter desired warming time up to 30 minutes.
4. Touch the **START/EASY MINUTE** key.

TIMER

1. Touch the **TIMER/CLOCK** key and number 1.
2. Enter time.
3. Touch the **TIMER/CLOCK** key again.

   To cancel timer, touch **STOP/CLEAR**.

EASY MINUTE

Touch **START/EASY MINUTE** for 1 minute at 100% microwave power or to add a minute during manual cooking. Continue to touch for additional minutes.

Other Features

CONTROL LOCK

The Control Lock prevents unwanted drawer operation such as by small children. The Microwave In-A-Drawer™ can be set so that the control panel is deactivated or locked.

To Lock

Touch **CONTROL LOCK** key and hold for 3 seconds.



To Unlock

Touch **CONTROL LOCK** key and hold for 3 seconds.



HELP

Check operation manual for specific details.

Touch the **SETUP/HELP** key.

- 2 times for Sound Off/On.
- 3 times for End of Cooking Reminder.
- 4 times for Auto Start.
- 5 times for Demonstration Mode.

Product Warranty

What Is Covered

CERTIFICATE OF WARRANTIES

DACOR Microwave In-A-Drawer™

WITHIN THE FIFTY STATES OF THE U.S.A., THE DISTRICT OF COLUMBIA AND CANADA*:

FULL ONE YEAR WARRANTY

If your DACOR product fails to function within one year of the original date of purchase, due to a defect in material or workmanship, DACOR will remedy the defect without charge to you or subsequent users. The owner must provide proof of purchase upon request and have the appliance accessible for service.

* Warranty is null and void if non-CSA approved product is transported from the U.S.

OUTSIDE THE FIFTY STATES OF THE U.S.A., THE DISTRICT OF COLUMBIA AND CANADA:

LIMITED FIRST YEAR WARRANTY

If your DACOR product fails to function within one year of the original date of purchase, due to a defect in material or workmanship, DACOR will furnish a new part, F.O.B. factory, to replace the defective part. All delivery, installation and labor costs are the responsibility of the purchaser. The owner must provide proof of purchase upon request and have the appliance accessible for service.

What Is Not Covered

- Failure of the product caused by faulty installation, improper usage, or neglect of required maintenance.
- Service calls to educate the customer in the proper use and care of the product.
- Failure of the product when used for commercial, business, rental or any application other than for residential consumer use.
- Replacement of house fuses or fuse boxes, or resetting of circuit breakers.
- Damage to the product caused by accident, fire, flood or other acts of God.
- Breakage, discoloration or damage to glass, metal surfaces, plastic components, trim, paint, porcelain or other cosmetic finish, caused by improper usage or care, abuse, or neglect.

THE REMEDIES PROVIDED FOR IN THE ABOVE EXPRESS WARRANTIES ARE THE SOLE AND EXCLUSIVE REMEDIES THEREFORE NO OTHER EXPRESS WARRANTIES ARE MADE, AND OUTSIDE THE FIFTY STATES OF THE UNITED STATES AND THE DISTRICT OF COLUMBIA, ALL IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PURCHASE. IN NO EVENT SHALL DACOR BE LIABLE FOR INCIDENTAL EXPENSE OR CONSEQUENTIAL DAMAGES. NO WARRANTIES, EXPRESS OR IMPLIED, ARE MADE TO ANY BUYER FOR RESALE.

Some states do not allow limitations on how long an implied warranty lasts or do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

dacor
The Life of the Kitchen.®

MICROWAVE IN-A-DRAWER™

MODE D'EMPLOI



MMDV30S

Pour l'usage avec:

MMDV30S
MMD30
MMD24

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Importantes Consiges de Sécurité

Installateur : Veuillez laisser ce guide avec cet appareil.

Client: Lire et conserver ces mode d'emploi pour référence ultérieure. Ce livre fournit les informations appropriées d'utilisation et d'entretien. **Gardez ce livre et les ventes acquittent et/ou ont décommandé signent un endroit sûr la future référence. La preuve de la date originale d'achat est nécessaire pour le service de garantie.**

Si vous avez n'importe quelles questions, appelez :

Service à la clientèle de Dacor®

1-800-793-0093 (Etats-Unis et le Canada)

Lundi - Vendredi 6:00 AM au temps Pacifique de 5:00 P.M

Accès par internet : www.Dacor.com

Ayez l'identification complète de modèle et de numéro de série de votre appareil prêt.

Pour modèles MMDV30S et MMD30 : L'étiquette des caractéristiques nominales, y compris les numéros de modèle et de série, est située sur une plaque d'identification derrière la façade du tiroir.

Pour modèle MMD24 : La plaque d'identification comprend les numéros de série et de modèle Ouvrir complètement le tiroir du four à micro-ondes. L'étiquette se trouve légèrement au-delà de la paroi arrière de la cavité du four à micro-ondes sur la surface plate.

Enregistrez ces nombres ci-dessous pour l'accès facile.

Numéro de Modèle _____

Numéro de Série _____

Date D'achat Marchand _____

Pour le service et l'information de garantie, voir la page 19.

Dans notre effort continu d'améliorer la qualité et l'exécution de nos appareils, il peut être nécessaire de faire des changements à l'appareil sans mettre à jour ce livre.

CE QUI VOUS DEVEZ SAVOIR CONSIGES DE SÉCURITÉ

Instructions de sûreté d'avertissement et importantes apparaître en ce livre ne sont pas censés couvrir toutes les conditions possibles et situations qui peuvent se produire. Le bon sens, l'attention et le soin doivent être employés en installant, en maintenant ou en actionnant un appareil.

Entrez en contact avec toujours le fabricant au sujet des problèmes ou des conditions que vous ne comprenez pas.

SYMBOLES DE SÛRETÉ, MOTS, ÉTIQUETTES

⚠ DANGER

Risques immédiats qui auront comme conséquence des blessures ou la mort graves.

⚠ ADVERTISSEMENT

Risques ou pratiques peu sûres qui POURRAIENT avoir comme conséquence des blessures ou la mort graves.

⚠ ATTENTION

Risques ou pratiques peu sûres qui POURRAIENT avoir comme conséquence des blessures ou des dégats matériels mineurs.

⚠ ADVERTISSEMENT

MESURES POUR ÉVITER UNE EXPOSITION POSSIBLE À UNE ÉNERGIE MICRO-ONDE EXCESSIVE

(a) Ne pas essayer de faire fonctionner ce four avec la porte ouverte puisque le fonctionnement avec la porte ouverte peut entraîner une exposition dangereuse à l'énergie micro-onde. Il est important de ne pas enlever ou modifier les verrouillages de sécurité.

(b) Ne pas placer d'objet entre l'avant du four et la porte ou laisser s'accumuler de la saleté ou des résidus de nettoyant sur les surfaces d'étanchéité.

(c) Ne pas faire fonctionner le four s'il est endommagé. Il est particulièrement important que la porte du four ferme bien et qu'il n'y ait pas de dommages: (1) à la tête du tiroir (tordue), (2) aux glissières et verrous (brisés ou avec du jeu), (3) aux joints et aux surfaces d'étanchéité du tiroir.

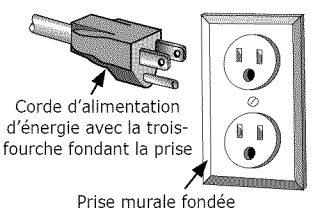
(d) Seul du personnel qualifié en réparations doit ajuster ou réparer ce four.

INSTRUCTIONS POUR LA MISE À LA TERRE

⚠ MISE EN GARDE

Un mauvais usage de la prise de terre peut causer des décharges électriques.

Cet appareil est équipé d'une trois-fourche fondant la prise pour votre protection contre des risques de choc électrique possibles. Il doit être branché à une prise de mise à la terre. Là où une prise murale de deux-fourche standard est produite, il est de la responsabilité personnelle et engagement du client pour le faire remplacer avec une prise murale correctement fondée de trois-fourche. **Pas dans aucune circonstance, coupe ou enlever la troisième fourche (de la terre) du cordon de secteur.** N'utilisez pas une prise d'adapteur. N'employez pas une corde de prolongation. Si le cordon d'alimentation est trop court, demander à un électricien ou un réparateur qualifié de poser une prise près de l'appareil. **N'employez pas un interrupteur moulu de circuit de défaut.**



IMPORTANTES CONSIGES DE SÉCURITÉ

⚠ ADVERTISSEMENT

Lors de l'utilisation l'appareil, il faut prendre des mesures de sécurité élémentaires, y compris les suivantes :

⚠ ADVERTISSEMENT Pour réduire le risque de brûlures, de choc électrique, de blessures personnelles et d'exposition excessive à l'énergie micro-onde :

1. Lire toutes les directives avant d'utiliser l'appareil.
2. Lire et suivre expressément les « MESURES POUR ÉVITER UNE EXPOSITION POSSIBLE À UNE ÉNERGIE MICRO-ONDE EXCESSIVE » à la page 1.
3. Cet appareil doit être correctement mis à la terre. Voir les directives d'installation séparées pour les consignes de mise à la terre.
4. Installer cet appareil uniquement selon les directives d'installation fournies.
5. Certains produits comme les œufs entiers ou des contenants scellés —par exemple, des bocaux fermés— exploseront et ne doivent pas être chauffés au l'appareil.
6. N'utiliser cet appareil que pour l'usage prévu comme décrit dans ce manuel. Ne pas utiliser de produits chimiques ou de vapeurs corrosives dans cet appareil. Cet appareil est spécifiquement conçu pour chauffer, cuire ou sécher de la nourriture. Il n'a pas été conçu pour un usage industriel ou de laboratoire.
7. Comme tout appareil, une surveillance attentive est nécessaire quand des enfants l'utilisent.
8. Ne pas faire fonctionner cet appareil si son cordon ou sa fiche sont endommagés, s'il ne fonctionne pas correctement ou s'il a été endommagé ou est tombé.
9. Seul un personnel qualifié doit réparer cet appareil. Communiquer avec le réparateur Dacor autorisé le plus proche pour une inspection, une réparation ou in réglage.
10. Ne couvrir ou bloquer aucune ouverture de cet appareil.
11. Ne pas ranger ou utiliser cet appareil à l'extérieur. Ne pas utiliser ce produit près de l'eau —par exemple, près d'un évier de cuisine, dans un sous-sol humide, près d'une piscine ou autre endroit semblable.
12. Ne pas immerger le cordon ou la prise dans l'eau.
13. Tenir le cordon loin des surfaces chauffées.
14. Ne pas monter ou s'asseoir sur de l'appareil.
15. Assurez-vous de ne pas tenir vos doigts ou autres objets ou matériaux près de l'ouverture du tiroir quand le l'appareil est fermé.
16. Ne pas placer les doigts ou des vêtements près des glissières du tiroir lors de l'ouverture ou de la fermeture du l'appareil. Il pourrait être pris dans les glissières lors de la fermeture du tiroit.
17. Vérifier que la nourriture ou le contenant sont plus petits que du tiroir avant de le fermer. Vous pouvez vous reporter à la hauteur des parois latérales cet appareil.
18. Lors du nettoyage des surfaces d'étanchéité qui viennent en contact lors de la fermeture l'appareil, utiliser uniquement des savons ou des détergents doux non abrasifs à l'aide d'une éponge ou d'un chiffon doux. Voir les consignes de nettoyage à la page 15.
19. Pour réduire le risque d'incendie dans la cavité du l'appareil:
    a. Ne pas trop faire cuire les aliments. Rester prudemment près du four lorsqu'on utilise du papier, du plastique ou tout autre matériel combustible pour faciliter la cuisson.
    b. Retirer les attaches de métal des sacs de papier ou de plastique avant de mettre les sacs au four.
    c. Si les matériaux à l'intérieur du l'appareil prennent feu, garder la porte du four fermée, arrêter le four et couper l'électricité au fusible ou au panneau d'entrée.
    d. Ne pas utiliser la cavité comme espace de rangement. Ne laisser ni papier, ni ustensiles de cuisson, ni aliments dans l'appareil lorsque l'appareil n'est pas utilisé.
20. Des liquides comme l'eau, le café ou le thé peuvent chauffer au-delà du point d'ébullition sans qu'aucun bouillonnement n'apparaisse à cause de la tension de surface du liquide. Ainsi, quand le contenant est retiré du l'appareil, il peut ne pas y avoir d'ébullition ou de bouillonnement apparents. IL PEUT EN RÉSULTER UN DÉBORDEMENT DES LIQUIDES TRÈS CHAUDS LORSQU'UNE CUILLER OU UN AUTRE USTENSILE EST PLONGÉ DANS LE LIQUIDE.

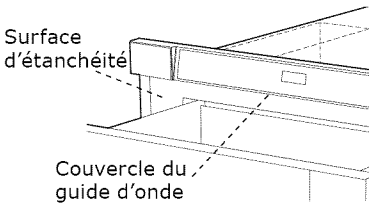
    Pour réduire le risque de blessures personnelles :
    a. Ne pas trop chauffer le liquide.
    b. Remuer le liquide et avant de le chauffer et à mi-cuisson.
    c. Ne pas utiliser de contenants à bords droits et à goulot mince. Utiliser un bocal à large goulot.
    d. Après le chauffage, laisser reposer le contenant dans le four à l'appareil pour au moins 20 secondes avant de le retirer.
    e. Faire très attention lorsque vous mettez une cuiller ou un autre ustensile dans le contenant.
21. Si la lumière l'appareil manque, consulter un RÉPARATEUR DACOR AUTORISÉ.

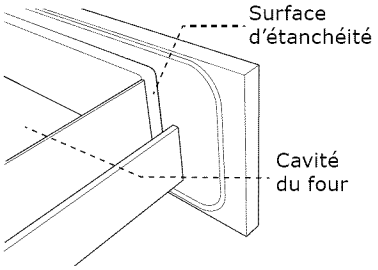
LIRE ET CONSERVER CES DIRECTIVES

Ce Que Vous Devez Savoir

À Propos Du Déballage Et De L'inspection De Votre Microwave In-A-Drawer™

1. Retirer tous les matériaux d'emballage de l'intérieur du Microwave In-A-Drawer™. NE PAS RETIRER LE GUIDE D'ONDES qui est situé au plafond du Microwave In-A-Drawer™.





2. Retirer l'étiquette des caractéristiques, s'il y en à une Vérifier que le four n'a aucun dommage, comme un tiroir mal aligné ou plié, des joints ou des surfaces d'étanchéité de porte endommagés, des glissières cassés ou lâches et des bosses à l'intérieur de la cavité ou sur la façade du tiroir. En cas de dommages, ne pas faire fonctionner le Microwave In-A-Drawer™ et contacter votre détaillant ou un RÉPARATEUR AUTORISE DACOR.

INTERFÉRENCE RADIO OU TÉLÉVISION

Si le Microwave In-A-Drawer™ provoque de l'interférence avec la radio ou la télévision, vérifier qu'il est branché sur un circuit électrique indépendant, en éloigner la radio ou la télévision le plus possible et vérifier la position et le signal de l'antenne de réception.

À Propos De Votre Microwave In-A-Drawer™

Veiller à ce qu'il y ait TOUJOURS des aliments dans le tiroir lorsqu'il est allumé, de sorte qu'ils absorbent l'énergie micro-onde.

L'évent sous le four doit toujours être dégagé.

Pendant la cuisson aux micro-ondes, de la vapeur peut s'échapper par le côté droit de l'évent.

Quand on utilise le Microwave In-A-Drawer™ à des niveaux de puissance inférieurs à 100 %, on peut entendre la mise en marche et l'arrêt du magnétron. Il est normal que l'extérieur du tiroir soit chaud au toucher pendant la cuisson ou le réchauffage.

La condensation est un phénomène normal pendant la cuisson aux micro-ondes. L'humidité ambiante et la teneur en eau des aliments déterminent le degré de condensation à l'intérieur du tiroir. En règle générale, les aliments couverts produisent moins de condensation que ceux cuits à découvert.

Le Microwave In-A-Drawer™ n'est conçu que pour la préparation des aliments. Il ne doit pas servir à faire sécher des vêtements ou des journaux.

La puissance nominale de ce four est égale à 950 watts selon la méthode d'essai IEC. Vérifier la cuisson des aliments une minute ou deux avant l'expiration du temps minimum indiqué sur les recettes et les emballages et, s'il y a lieu, augmenter le temps de cuisson.

Lors d'une ouverture ou d'une fermeture rapide du Microwave In-A-Drawer™, de la nourriture peut être renversée dans le tiroir. Pour nettoyer, veuillez vous reporter au chapitre Nettoyage et entretien à la page 15.

À Propos De La Cuisson Aux Microondes

- Disposer les aliments avec soin. Placer la partie la plus épaisse des aliments vers l'extérieur du plat.
- Surveiller le temps de cuisson. Cuire les aliments pendant la plus courte période indiquée et prolonger la cuisson au besoin. Des aliments trop cuits peuvent dégager de la fumée ou prendre feu.
- Recouvrir les aliments pendant la cuisson. Selon la recette ou le livre de cuisine, utiliser un essuie-tout, du papier ciré, un film plastique allant au micro-onde ou un couvercle. Couvrir les aliments empêche les éclaboussures et leur permet de cuire de manière uniforme.
- Protéger les parties de viande ou de volaille très minces par des petits écrans en papier d'aluminium pour éviter qu'ils ne cuisent trop vite par rapport aux parties plus épaisses.
- Si possible, remuer les aliments de l'extérieur du plat vers le centre une ou deux fois pendant la cuisson.
- Retourner les aliments comme du poulet et des hamburgers une fois au cours de la cuisson afin d'accélérer le processus. Il faut retourner les grosses pièces comme les rôtis au moins une fois.
- Au milieu de la cuisson, déplacer les aliments comme les boulettes de viande du haut vers le bas et de droite à gauche.
- Ajouter du temps de repos. Retirer les aliments du four et, si possible, les remuer. Couvrir les aliments pendant ce temps pour leur permettre Vérifier que les aliments sont bien cuits. Rechercher les signes qui indiquent que les températures de cuisson ont été atteintes.
- Les signes d'une bonne cuisson sont les suivants :
  - La vapeur s'élève de toute la surface des aliments, pas seulement des bords.
  - Le fond du plat est très chaud au toucher.
  - Les cuisses de poulet se détachent facilement.
  - La viande et la volaille ne présentent plus de parties rosées.
  - Le poisson est opaque et se défait facilement à la fourchette.

À Propos Des Ustensiles Et Des Moyens De Couvrir Les Aliments

Il n'est pas nécessaire d'acheter une nouvelle batterie de cuisine. La plupart des ustensiles de votre cuisine peuvent être utilisés dans votre nouveau micro-onde. S'assurer que les ustensiles ne touchent pas les parois intérieures pendant la cuisson.

Se servir de ces ustensiles pour cuire et réchauffer sans danger aux micro-ondes :

- La vitrocéramique (Pyroceram®), comme Corningware®.
- Le verre résistant à la chaleur (Pyrex®)
- Les plastiques pour micro-ondes
- Les assiettes en papier pour micro-ondes
- La céramique, la poterie, la porcelaine pour micro-ondes
- Les plats à brunir (ne pas dépasser pas les temps de préchauffage recommandés. Suivre les directives du fabricant).

Les articles suivants peuvent être utilisés pour le réchauffage très court des aliments qui contiennent peu de sucre ou de graisses :

- Le bois, la paille et l'osier

NE PAS UTILISER

- De casseroles et de plats de cuisson métalliques
- De plats à bordure métallique
- Du verre qui ne résiste pas à la chaleur
- De plastiques ne convenant pas aux micro-ondes (contenants de margarine)
- De produits en papier recyclé
- De sacs en papier brun
- De sacs pour la conservation des aliments
- D'attaches métalliques

Pour vérifier si un plat va au four à micro-ondes, le placer dans le four et mettre le four en marche à la puissance maximale pendant 30 secondes. Si le plat devient très chaud, il ne faut pas l'employer.

LES ARTICLES SUIVANTS SONT IDÉALS POUR COUVRIR :

- Les essuie-tout conviennent bien pour recouvrir les aliments pendant le réchauffage et pour absorber la graisse de cuisson du bacon.
- Le papier ciré peut être employé pour la cuisson et le réchauffage.
- Le film plastique destiné spécialement à l'usage du micro-onde peut être utilisé pour la cuisson et le réchauffage. Le film plastique ne doit JAMAIS entrer en contact avec les aliments. Faire une ouverture pour laisser la vapeur s'échapper.
- Les couvercles pour micro-ondes sont un très bon choix, car ils concentrent la chaleur sur les aliments et accélèrent la cuisson.
- Les sacs de cuisson au four conviennent pour les grosses pièces de viande ou les aliments à attendrir. NE PAS SE SERVIR d'attaches métalliques. Ne pas oublier de percer le sac pour laisser s'échapper la vapeur.

COMMENT SE SERVIR DU PAPIER ALUMINIUM DANS VOTRE TIROIR:

- De petits morceaux non froissés de papier aluminium posés sur les aliments peuvent servir à protéger les parties qui décongèlent ou cuisent trop rapidement.
- Le papier d'aluminium doit être à au moins 2,5 cm des surfaces du Microwave In-A-Drawer™.

Pour toute question concernant les ustensiles ou la manière de couvrir les aliments, consulter un bon livre de cuisine spécialisé en micro-ondes ou suivre les conseils de la recette.

ACCESSORIES:

De nombreux accessoires pour four à micro-ondes sont offerts sur le marché. Évaluer soigneusement vos besoins avant d'en faire l'acquisition. Un thermomètre pour micro-ondes permettra de vérifier la cuisson à point et de s'assurer que les aliments ont été cuits à la bonne température Dacor n'est pas responsable des dommages au tiroir résultant de l'utilisation d'accessoires.

Ouverture Ou Fermeture Du Tiroir

Toujours appuyer sur les touches OPEN ou CLOSE du panneau de commande pour ouvrir ou fermer le tiroir.

Ne pas pousser ou tirer le tiroir à la main, sauf en cas d'urgence, comme une panne de courant. En cas de nécessité, pousser ou tirer doucement.

À Propos Des Enfants Et Du Micro-onde

Les enfants de moins de 7 ans ne devraient utiliser le Microwave In-A-Drawer™ que sous la surveillance étroite d'un adulte. Entre 7 et 12 ans, l'adulte surveillant doit se trouver dans la même pièce qu'eux. L'enfant doit pouvoir accéder facilement au tiroir.

Jamais personne ne doit être autorisé à s'appuyer ou à s'asseoir sur le Microwave In-A-Drawer™.

Il faut enseigner les mesures de sécurité aux enfants : Employer des gants isolants, enlever les couvercles avec précaution, faire très attention aux contenants d'aliments croustillants parce qu'ils peuvent devenir très chauds.

Ne pas présumer qu'un enfant qui connaît bien une fonction de l'appareil peut cuire n'importe quoi.

Les enfants doivent apprendre que le Microwave In-A-Drawer™ n'est pas un jouet. Voir à la page 13 la caractéristique du verrouillage des commandes.

Ce Que Vous Devez Savoir

À Propos De La Sécurité

Inspecter les aliments pour voir s'ils ont été cuits aux températures recommandées par le ministère de l'agriculture des États-Unis.

71 °C (160 °F) -	Pour le porc frais, la viande hachée, le blanc de poulet désossé, le poisson, les fruits de mer, les oeufs frais et les aliments préparés surgelés.
74 °C (165 °F) -	Pour les restes, les aliments réfrigérés prêts-à-réchauffer, et les aliments frais d'un traiteur ou l'équivalent.
77 °C (170 °F) -	Les blancs de volaille.
82 °C (180 °F) -	La viande brune de volaille.

Pour vérifier si les aliments sont cuits à point, insérer un thermomètre à viande dans un endroit épais, à l'écart de la graisse et des os. Ne JAMAIS laisser le thermomètre dans les aliments qui cuisent, sauf s'il est approuvé pour emploi aux micro-ondes.

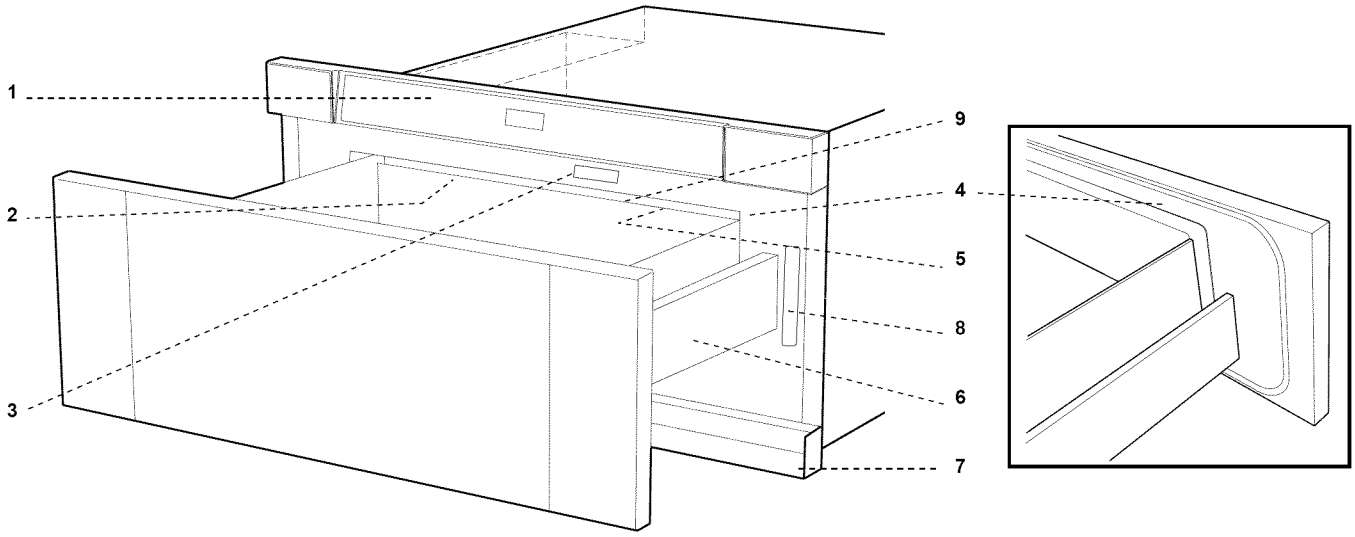
- TOUJOURS utiliser des gants isolants pour éviter des brûlures lorsque l'on se sert d'ustensiles en contact avec des aliments chauds. Assez de chaleur des aliments peut être transféré aux ustensiles pour provoquer des brûlures de la peau.
- Diriger la vapeur loin du visage et des mains afin d'éviter des brûlures. Soulever doucement la partie la plus éloignée des couvercles et des pellicules et ouvrir lentement les sacs de maïs soufflé ou de cuisson en les tenant loin du visage.
- Rester près du four quand il fonctionne et vérifier fréquemment la cuisson afin d'éviter de trop cuire les aliments.
- Ne JAMAIS entreposer des livres de cuisine ou autres objets dans le Microwave In-A-Drawer™.
- Choisir, entreposer et manipuler la nourriture de manière à préserver sa qualité et de minimiser la prolifération de bactéries alimentaires.
- Garder propre le couvercle du guide d'ondes. Les résidus d'aliments peuvent causer des étincelles ou s'enflammer. Voir page 15.

À Propos Des Aliments

ALIMENTS	À FAIRE	À NE PAS FAIRE
Oeufs, saucisses, fruits et légumes	• Percer les jaunes d'œufs avant la cuisson pour empêcher une « explosion ». • Percer la peau des pommes de terre, des pommes, des courges, des hot dogs et des saucisses pour que la vapeur s'échappe.	• Cuire les œufs dans leur coquille • Réchauffer des œufs entiers • Sécher des noix ou des graines dans leur coquille
Maïs soufflé	• Utiliser du maïs soufflé en sac pour micro-onde. • Porter attention à l'éclatement du maïs pour que celui-ci ralentisse à 1 ou 2 secondes ou utiliser la touche **SENSOR POPCORN**.	• Faire éclater du maïs soufflé dans des sacs bruns ordinaires ou des bols de verre • Dépasser le temps maximal inscrit sur le paquet de maïs soufflé.
Aliments pour bébé	• Transférer les aliments pour bébé dans un plat plus petit et chauffer prudemment en remuant souvent. Vérifier la température avant de servir • Mettre les tétines sur les bouteilles après le réchauffage et bien agiter. Essayer sur le poignet avant de nourrir.	• Chauffer les bouteilles jetables. • Chauffer les bouteilles avec les tétines. • Chauffer les aliments pour bébé dans les pots d'origine
Général	• Couper les aliments avec garniture après chauffage pour relâcher la vapeur et éviter les brûlures. • Remuer vivement les liquides avant et après chauffage pour empêcher une « éruption ». • Se servir d'un bol profond, pour cuire des liquides ou des céréales pour empêcher les débordements. • Les aliments doivent être plus petits que le micro-onde tiroir. • Vous pouvez vous reporter à la hauteur des parois latérales du tiroir.	• Chauffer ou cuire dans des pots de verre fermés ou des contenants hermétiques • Mettre en conserve dans le micro-onde car des bactéries dangereuses pourraient ne pas être détruites. • Faire frire de la graisse épaisse • Sécher du bois, des gourdes, des herbes ou des papiers humides

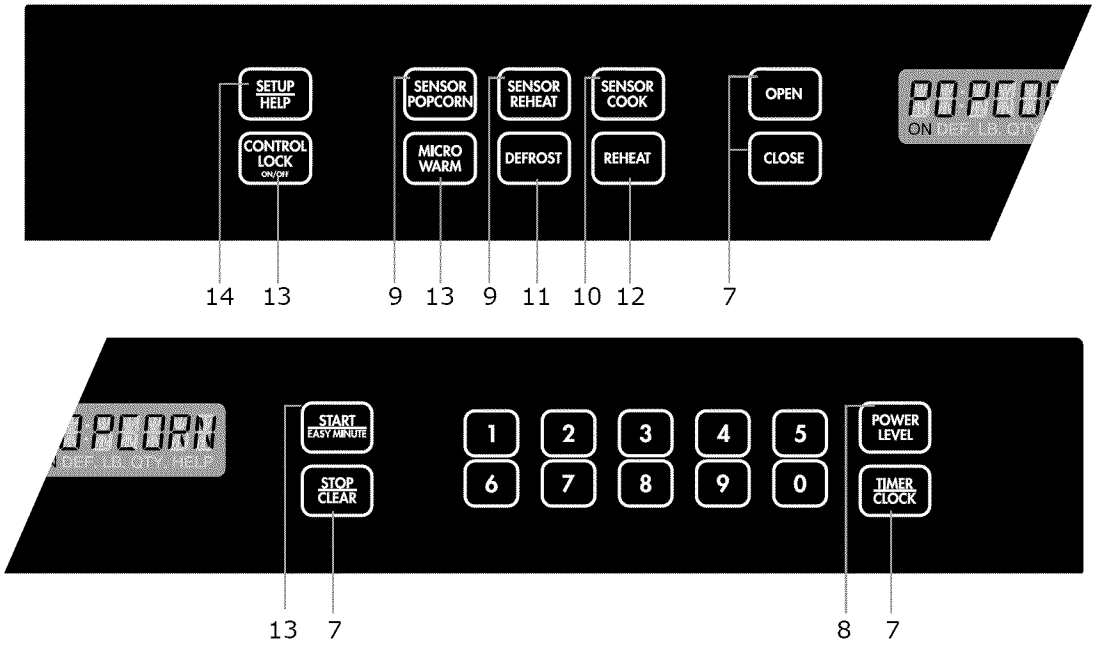
Nom des Pièces

Microwave In-A-Drawer™



1. Panneau de commande
2. Couvercle du guide d'ondes NE PAS ENLEVER
3. Aide-mémoire
4. Surfaces d'étanchéité du tiroir
5. Lumière du tiroir
6. Glissières du tiroir
7. Évent
8. Étiquette des caractéristiques nominales pour les modèles MMDV30 et MMD30
9. Étiquette des caractéristiques nominales pour le modèle MMD24 : Ouvrir le tiroir à micro-ondes complètement. L'étiquette est légèrement au-delà de la paroi arrière de la cavité du four à micro-ondes, face vers le haut, sur la surface plate.

FEUILLE DES TOUCHES



Les chiffres à côté de l'illustration des touches indiquent les pages où on retrouve la description des caractéristiques et les renseignements concernant l'utilisation.

Avant L'utilisation

Avant d'utiliser votre nouveau Microwave In-A-Drawer™, prendre la peine de lire et de comprendre intégralement ce mode d'emploi.

- Avant d'utiliser le Microwave In-A-Drawer™, procéder ainsi :

1. Brancher le Microwave In-A-Drawer™.
   ENJOY YOUR MICRO- WAVE TOUCH CLEAR AND TOUCH CLOCK s'affichera.
2. Appuyer sur la touche **STOP/CLEAR**.
   : s'affiche.
3. Régler l'horloge.

Pour Régler L'horloge

1. Appuyer sur la touche **TIMER/CLOCK** et sur 2.
2. Appuyer sur les chiffres pour corriger l'heure du jour et appuyer de nouveau sur **TIMER/CLOCK**.

Cette horloge a un cycle de 12 heures..En cas d'entrée d'une heure invalide, ERROR s'affichera. Appuyer sur la touche **STOP/CLEAR** et entrer à nouveau l'heure.

- Si l'alimentation électrique du four à micro-ondes est coupée, ENJOY YOUR MICRO- WAVE TOUCH CLEAR AND TOUCH CLOCK s'affichera et clignotera dès que l'alimentation sera rétablie. Si cela se produit durant la cuisson, la programmation sera effacé. L'heure aussi sera effacée. Appuyer simplement sur la touche **STOP/CLEAR** et remettre l'horloge à l'heure.

NOTA:

- Le Microwave In-A-Drawer™ peut être programmé avec le tiroir ouvert sauf pour **START/EASY MINUTE**.

Minuterie

1. Appuyer sur la touche **TIMER/CLOCK** et sur 1.
2. Entrer l'heure.
3. Appuyer à nouveau sur la touche **TIMER/CLOCK**.
4. Pour annuler la minuterie appuyer sur **STOP/CLEAR**.

Stop/Clear (Arrêt/Remise À Zéro)

Appuyer sur la touche **STOP/CLEAR** pour:

1. Effacer une erreur durant la programmation.
2. Annuler la minuterie.
3. Arrêter le micro-onde tiroir temporairement durant la cuisson.
4. Afficher à nouveau l'heure.
5. Annuler un programme durant la cuisson, appuyer deux fois.

Ouverture Ou Fermeture Du Tiroir

Toujours appuyer sur les touches **OPEN** ou **CLOSE** du panneau de commande pour ouvrir ou fermer le tiroir.

Ne pas pousser ou tirer le tiroir à la main, sauf en cas d'urgence, comme une panne de courant. En cas de nécessité, pousser ou tirer doucement.

Temps De Cuisson

Votre Microwave In-A-Drawer™ peut être programmé pour 99 minutes 99 secondes (99.99). Toujours entrer les secondes après les minutes même si les deux sont égales à zéro.

- Supposons que l'on veuille faire cuire pendant 5 minutes à 100 %.

1. Entrer le temps de cuisson 5 0 0. 5.00 TOUCH START OR TOUCH POWER LEVEL
2. Pour cuire à la puissance 100 % (élevée), Appuyer sur la touche **START/EASY MINUTE**.

Pour Régler Le Niveau De Puissance

Onze niveaux de puissance sont prévus.

Plus le niveau de puissance est faible, plus le temps de cuisson est long, ce qui est conseillé pour les aliments tels que le fromage, le lait ou les viandes qui exigent une cuisson lente. Consulter un livre de cuisine ou de recettes pour chaque cas particulier.

- Supposons que l'on veuille décongeler pendant 5 minutes à 30 %.

1. Entrer le temps de décongélation 5 0 0. 5.00
2. Appuyer 8 fois sur la touche **POWER LEVEL**.
3. Appuyer sur **START/EASY MINUTE**.

APPUYER SUR LA TOUCHE POWER LEVEL JUSQU'À CE QUE LE NIVEAU DE PUISSANCE DÉSIRÉ S'AFFICHE	POURCENTAGE APPROXIMATIF DE LA PUISSANCE	NOMS DONNÉS AUX NIVEAUX DE PUISSANCE
Power Level x 1	100%	Fort
Power Level x 2	90%	
Power Level x 3	80%	
Power Level x 4	70%	À demi fort
Power Level x 5	60%	
Power Level x 6	50%	Moyen
Power Level x 7	40%	
Power Level x 8	30%	Moyen faible/ Décongélation
Power Level x 9	20%	
Power Level x 10	10%	Faible
Power Level x 11	0%	

Réglages Des Capteurs

Le capteur de Dacor est un dispositif à semi-conducteur qui décèle la vapeur humidité) émise par les aliments lorsqu'ils sont chauffés. Le capteur permet de régler les durées de cuisson et les niveaux de puissance selon les divers aliments et leur quantité.

UTILISATION DES RÉGLAGES DU CAPTEUR :

1. Après le branchement du Microwave In-A-Drawer™, attendre 2 minutes avant d'utiliser un réglage du capteur.
2. S'assurer que l'extérieur du récipient de cuisson et l'intérieur du Microwave In-A-Drawer™ sont secs. Essuyer toute trace d'humidité avec un chiffon sec ou un essuie-tout.
3. Le capteur fonctionne pour les aliments conservés à la température de rangement normale. Par exemple, le maïs soufflé devrait être à la température de la pièce.
4. Toute sélection du capteur peut être programmée avec réglage de durée en plus ou en moins (More or Less Time Adjustment). Voir page 14.
5. Si la quantité d'aliments est inférieure ou supérieure à celle des tableaux, il faut cuire selon les directives d'un livre de cuisine aux micro-ondes.
6. Au cours de la première période d'utilisation du capteur, le nom de l'aliment s'affichera. Ne pas ouvrir la porte du Microwave In-A-Drawer™, ni appuyer sur la touche **STOP/CLEAR** au cours de cette période, car cela provoquerait l'interruption de la mesure du degré d'humidité. Dans un tel cas, un message d'erreur s'affichera. Pour poursuivre la cuisson, appuyer sur la touche **STOP/CLEAR** et cuire en mode manuel.

   Quand le capteur détectera la vapeur émise par les aliments, le temps de cuisson/réchauffage restant s'affichera. On peut ouvrir le Microwave In-A-Drawer™ lorsque le temps de cuisson restant s'affiche à l'écran. À ce moment-là, on peut aussi remuer les aliments et les assaisonner, au goût.
7. Si pendant le soufflage du maïs, le capteur ne détecte pas correctement la vapeur émise, le four cessera de fonctionner et l'heure sera affichée. Si le capteur ne détecte pas correctement la vapeur émise lors de la cuisson d'autres aliments, l'indication ERROR s'affichera et le micro-onde cessera de fonctionner.
8. Vérifier la température des aliments après cuisson. S'il faut plus de temps, continuer à cuire en mode manuel.
9. Il existe un conseil de cuisson pour chaque aliment. Appuyer sur la touche **SET UP/HELP** quand l'indicateur HELP est allumé sur l'afficheur.

COVERING ALIMENTS:

Certains aliments cuisent mieux lorsqu'ils sont couverts. Se servir su couvercle recommandés dans les tableaux pour ces aliments. Vous pouvez vous reporter aux conseils en appuyant sur la touche **SET UP/HELP**.

1. Couvercle.
2. Film plastique : Utiliser un film plastique recommandé pour la cuisson aux micro-ondes. Couvrir le plat sans serrer et en conservant une ouverture de 1,25 cm (1/2 po) de manière à ce que la vapeur puisse s'échapper. Le film plastique ne doit pas entrer en contact avec les aliments.
3. Papier ciré : Couvrir entièrement le plat et replier le papier sous le plat de manière à ce qu'il soit maintenu. Si le plat est plus large que le papier, utiliser deux morceaux de papier se chevauchant d'au moins 2,5 cm (1 po).

Faire attention en retirant l'élément couvrant les aliments de laisser la vapeur s'échapper loin de vous.

Sensor Popcorn / Sensor Reheat (Mais Soufflé Au Capteur / Réchauffage Au Capteur)

Vous pouvez faire éclater du maïs ou réchauffer de nombreux aliments sans avoir besoin de calculer le temps de cuisson ou le niveau de puissance.

Appuyer sur **SENSOR REHEAT** ou **SENSOR POPCORN** puis sur la touche **START/EASY MINUTE**.

Quand le capteur détectera la vapeur émise par les aliments, le temps restant de cuisson/réchauffage s'affichera.

NOTA:

- Il y a 2 choix pour le réglage du maïs soufflé au capteur. Suivre les instructions sur l'afficheur pour choisir l'option désirée.

TABLEAU DE SENSOR POPCORN / SENSOR REHEAT

ALIMENTS	QUANTITÉ	MARCHE À SUIVRE
Maïs soufflé au capteur	1 paquet à la fois	N'utiliser que du maïs soufflé emballé pour le micro-onde. Essayer plusieurs marques et choisir celle qui vous plait. Ne pas tenter de souffler les grains qui n'ont pas éclaté.
	80 – 98 g (2,85 – 3,5 oz) (Régulier / Régulier léger)	Appuyer une fois sur **SENSOR POPCORN**.
	34 – 50 g (1,2 – 1,75 oz) (Mini / Collation)	Appuyer deux fois sur **SENSOR POPCORN**.
Réchauffage par capteur	112g – 1 kg (4 – 36 oz)	Mettre dans un plat ou une casserole un peu plus grande que la quantité à réchauffer. Aplatir si possible. Couvrir avec un couvercle, film plastique ou un papier ciré. Couvrir avec du film plastique ou des couvercles pour de plus grandes quantités d'aliments plus denses comme les ragoûts Si possible, bien remuer après réchauffage. Couvrir à nouveau et laisser reposer 2 à 3 minutes. Les aliments devraient être très chauds. Dans le cas contraire, continuer à chauffer avec une puissance et une durée variables.

Sensor Cook (Cuisson Au Capteur)

1. Appuyer une fois sur la touche **SENSOR COOK**.
   SEE | LABEL | SELECT | FOOD | NUMBER
2. Voir l'aide-mémoire. Choisir un aliment en appuyant sur un chiffre. Ex : Appuyer 5 fois pour des pommes terre au four.
3. Appuyer sur **START/EASY MINUTE**.

NOTA:

- Pour réchauffer d'autres aliments ou des aliments en quantités inférieure ou supérieure à celles permises sur le TABLEAU DE SENSOR COOK, cuire en mode manuel.

TABLEAU DE SENSOR COOK

ALIMENTS	QUANTITÉ	MARCHE À SUIVRE
1. Légumes frais : tendres Brocoli Choux de Bruxelles Choux Chou-fleur (en bouquet) Chou-fleur (entier) Épinards Courgettes Pommes au four	 0,25 - 2 lb. 0,25 - 2 lb. 0,25 - 2 lb. 0,25 - 2 lb. 1 moyen 0,25 - 1.0 lb. 0,25 - 2 lb. 2 - 4 moyen	Laver et mettre dans une casserole. Ne pas ajouter d'eau si les légumes viennent d'être lavé. Couvrir avec un couvercle pour obtenir des légumes tendres. Utiliser un film plastique pour obtenir des légumes tendres mais croustillants. Après la cuisson, remuer si possible, Laisser reposer, à couvert, 2 à 5 minutes.
2. Légumes frais : croquants Carottes, tranchées Maïs en épi Haricots verts Courge d'hiver : en dés en moitié	 0,25 - 1,5 lb. 2 - 4 0,25 - 1,5 lb. 0,25 - 1,5 lb. 1 - 2	Mettre dans une casserole. Ajouter 1 à 4 c. à soupe d'eau. Couvrir avec un couvercle pour obtenir des légumes tendres. Utiliser un film plastique pour obtenir des légumes tendres mais croustillants. Après la cuisson, remuer si possible, Laisser reposer, à couvert, 2 à 5 minutes.
3. Légumes congelés	0,25 - 1,25 lb.	Ne pas ajouter d'eau. Couvrir avec un couvercle ou un film plastique. Après la cuisson, remuer et laisser reposer, à couvert, 3 minutes.
4. Plats congelés	112g - 1kg (6 - 17 oz)	Utiliser cette touche pour les plats prêt-à-servir congelés. Cela donnera des résultats satisfaisants avec la plupart des marques. Peut-être voudrez-vous en essayer plusieurs et choisir votre préféré. Retirer le plat de l'emballage extérieur et suivre les indications pour le recouvrement du plat. Après la cuisson, laisser reposer, à couvert, 1 à 3 minutes.
5. Pommes terre au four	1 - 6 moyen	Les piquer. Les placer sur un essuie-tout au fond du tiroir. Après la cuisson, les retirer du four, les envelopper dans une feuille d'aluminium et les laisser reposer pendant 5 à 10 minutes.
6. Viande hachée	0,25 - 2 lb.	Utiliser ce réglage pour cuire du bœuf ou de la dinde hachés en fricadelles ou en cocotte avec d'autres ingrédients. Placer les fricadelles sur une grille transparente aux micro-ondes et couvrir de papier ciré. Placer la viande hachée dans une cocotte et couvrir avec du papier ciré ou du film plastique. Quand le four s'arrête, retourner les fricadelles ou mélanger la viande dans la cocotte pour séparer les gros morceaux. Recouvrir et appuyer sur **START/EASY MINUTE**. Après la cuisson, laisser reposer, à couvert, 2 à 3 minutes.
7. Poisson/Fruits de mer	0,25 –2 lb	Disposer en anneau autour d'un plat en verre peu profond (rouler le filet en mettant les bords en dessous). Couvrir avec du film plastique ventilé. Après la cuisson, laisser reposer, à couvert, 3 minutes
8. Riz	0,5 à 2 tasses	Placer le riz dans une cocotte profonde et ajouter le double d'eau. Couvrir avec un couvercle ou un film plastique. Après la cuisson, remuer, couvrir et laisser reposer de 3 à 5 minutes ou jusqu'à ce que tout le liquide ait été absorbé. **Riz** — **Eau** — **Taille de la casserole** 0,5 tasse — 1 tasse — 1,5 pinte 1 tasse — 2 tasses — 2 pinte 1,5 tasse — 3 tasses — 2,5 ou 3 pintes 2 tasses — 4 tasses — 3 pinte ou plus

Defrost (Décongélation)

Utiliser cette caractéristique pour décongeler les aliments indiqués dans le TABLEAU DE DEFROST.

1. Appuyer sur la touche **DEFROST**.
   SEE | LABEL | SELECT | FOOD | NUMBER
2. Voir l'aide-mémoire 2 Choisir l'aliment désirée en appuyant sur un chiffre. Ex : Appuyer sur 2 pour les biftecks ou les côtelettes.
   STEAKS | CHOPS | ENTER | WEIGHT
3. Entrer le poids en appuyant sur les chiffres.
   1 0 0. | 1.0 LB
4. Appuyer sur **START/EASY MINUTE**.
5. Le four d'arrêtera pour que vous puissiez inspecter l'aliment.
6. Après la première étape, ouvrir le Microwave In-A-Drawer™. Retourner le bifteck et masquer les parties chaudes. Fermerle tiroir. Appuyer sur **START/EASY MINUTE**.
7. Après la deuxième étape, ouvrir le Microwave In-A-Drawer™. Masquer tout les parties chaudes. Fermer le micro-onde tiroir. Appuyer sur **START/ EASY MINUTE.**
8. À la fin du cycle de décongélation, masquer et laisser reposer comme indiqué dans le tableau ci-dessous.

NOTA:

- Defrost peut être programmé avec réglage de durée en plus ou en moins. Voir page 14.
- Pour décongeler d'autres aliments dont le poids est supérieur ou inférieur à celui autorisé au TABLEAU DE DEFROST, voir la DÉCONGÉLATION MANUELLE.
- Inspecter les aliments au signal du four. Après l'étape finale, de petites sections peuvent être encore gelées. Laisser reposer pour que le dégel se poursuive. Ne pas décongeler avant que tous les cristaux de glace soient fondus.
- Le masquage empêche que la cuisson ait lieu avant que le centre de l'aliment ne soit dégelé. Utiliser de petites bandes souples de papier d'aluminium pour couvrir les bords et les parties les moins épaisses de l'aliment.

TABLEAU DE DEFROST

ALIMENTS	QUANTITÉ	MARCHE À SUIVRE
1. Viande hachée	0,5 - 2 lb	Retirer les parties dégelées après chaque signal sonore. Laisser reposer, à couvert, 5 à 10 minutes.
2. Biftecks/ Côtelettes	0,5 - 3 lb	Après chaque signal sonore, changer la disposition des aliments et masquer les parties chaudes ou dégelées au moyen de bandes de papier d'aluminium. Retirer la viande ou le poisson presque entièrement dégelés. Laisser reposer, à couvert, 10 à 20 minutes.
3. Poulet désossé	0,5 - 2 lb	Après chaque signal sonore, s'il y a des morceaux chauds ou dégelés, changer la disposition ou retirer. Laisser reposer, à couvert, 10 à 20 minutes.
4. Poulet avec les os	0,5 - 3 lb	Après chaque signal sonore, changer la disposition ou retirer les morceaux. s'il sont chauds ou dégelés Laisser reposer, à couvert, 10 à 20 minutes.
5. Casserole/soupe	1 - 6 tasses	Après chaque signal sonore, briser en morceaux et retirer ce qui est dégelé. À la fin, bien remuer et laisser reposer, couvert, pendant 5 à 10 minutes.

Décongélation Manuelle

Si les aliments que vous voulez décongeler ne sont pas dans le TABLEAU DE DÉCONGÉLATION, ou sont en quantité supérieure ou inférieure à celle de la colonne QUANTITÉ du TABLEAU DE DÉCONGÉLATION, vous devrez décongeler en mode manuel.

Vous pouvez décongeler tout aliment, cru ou déjà cuit, à l'aide du niveau de puissance de 30 %. Suivre exactement la marche suivre en 3 étapes sous LE RÉGLAGE DU NIVEAU DE PUISSANCE à la page 11. Estimer la durée de décongélation et appuyer sur la touche POWER LEVEL huit fois pour une puissance de 30%.

Pour des aliments crus ou déjà cuits, la règle d'or est d'environ 4 minutes par livre. Par exemple, 1 livre de spaghetti dégèlera en 4 minutes.

Toujours arrêter le four périodiquement pour séparer et retirer les portions dégelées. Si les aliments ne sont pas complètement dégelés à a fin du temps de décongélation estimé, programmer le four en incréments d'1 minute, au niveau de puissance de 30 % jusqu'à décongélation complète.

Quand vous utilisez des contenants plastique sortant du congélateur, décongeler seulement assez longtemps pour retirer les aliments du plastique et les mettre dans un plat pour micro-onde.

Reheat (Réchauffage)

Reheat calculera automatiquement le temps de réchauffage approprié et la puissance du four à micro-ondes pour les aliments énumérés dans le tableau suivant.

1. Appuyer une fois sur la touche **REHEAT**. SEE LABEL SELECT FOOD NUMBER
2. Voir l'aide-mémoire Choisir un aliment en appuyant sur un chiffre. Ex : Appuyer sur 2 pour des petits pains ou des muffins congelés.
3. Appuyer sur un chiffre pour choisir la quantité. Ex : Appuyer sur 2 pour 2 pains ou muffins.
4. Appuyer sur **START/EASY MINUTE**.

NOTA:

- Reheat peut être programmé avec réglage de durée en plus ou en moins. Voir page 14.
- Pour réchauffer d'autres aliments ou des aliments en quantités inférieure ou supérieure à celle permise sur le TABLEAU DE REHEAT, réchauffer en mode manuel.

TABLEAU DE REHEAT

ALIMENTS	QUANTITÉ	MARCHE À SUIVRE
1. Petits pains frais/muffins	1 - 8	Utiliser cette touche pour décongeler petits pains, muffins, biscuits, baguels, etc. il faut compter les grosses pièces comme 2 ou 3 de taille régulière. Disposer sur une assiette; couvrir avec un essuie-tout. Pour des petits pains et des muffins réfrigérés, il peut être nécessaire de doubler la quantité pour que la portion soit à la température appropriée. Par exemple, entrer la quantité 2 pour 1 petit pain réfrigéré.
2. Pains ou muffins congelés	1 - 8	Utiliser cette touche pour décongeler petits pains, muffins, biscuits, baguels, etc. il faut compter les grosses pièces comme 2 ou 3 de taille régulière. Disposer sur une assiette; couvrir avec un essuie-tout.
3. Boisson	0,5 – 2 tasses	Ce réglage est bon pour ramener des boissons réfrigérées à une meilleure température de consommation. Remuer vivement les liquides avant et après chauffage pour empêcher une « éruption ».

Autres Caractéristiques

Micro Warm (Micro Réchaud)

Micro Warm vous permet de garder les aliments au chaud pendant 30 minutes.

USAGE DIRECT

1. Appuyer sur la touche **MICRO WARM**.
   ENTER | TIME | UP TO | 30 | MINUTES
2. Entrer la durée désirée en appuyant sur les chiffres. Pour entrer 30 minutes appuyer sur 3 0 0 0.
   30.00 | TOUCH | START
3. Appuyer sur **START/EASY MINUTE**.

Le four se mettra en marche. L'afficheur indiquera 30.00 et le compte à rebours. KEEP WARM sera affiché pendant le compte à rebours.

AVEC CUISSON EN MODE MANUEL

1. Entrer le temps de cuisson et le niveau de puissance.
2. Appuyer sur la touche **MICRO WARM**.
3. Entrer la durée de réchauffage désirée jusqu'à 30 minutes.
4. Appuyer sur **START/EASY MINUTE**.

L'opération démarrera. Quand la durée de cuisson est terminée, une longue tonalité résonnera et Micro Warm démarrera. L'afficheur indiquera le compte à rebours KEEP WARM sera affiché de manière intermittente pendant le compte à rebours.

NOTA:

- Si vous essayez d'entrer plus de 30 minutes pour Micro Warm, un message d'erreur s'affichera.
- Micro Warm ne peut pas être programmé avec Sensor Popcorn, Sensor Reheat, Sensor Cook, Defrost ou Reheat.

Cuisson À Séquences Multiples

Votre micro-onde tiroir peut être programmé pour 4 séquences automatiques de cuisson, passant d'un réglage de puissance à l'autre automatiquement.

Parfois, les conseils de cuisson suggèrent de commencer à un certain niveau de puissance et de poursuivre à un autre niveau. Votre micro-onde tiroir peut le faire automatiquement.

1. Entrer d'abord le temps de cuisson. Puis appuyer sur la touche **POWER LEVEL** pour la cuisson à 100% ou appuyer de nouveau sur **POWER LEVEL** pour un niveau plus faible.
2. Entrer le second temps de cuisson. Appuyer répétitivement sur la touche **POWER LEVEL** jusqu'au niveau de puissance désiré. Vous pouvez faire cette marche à suivre jusqu'à 4 fois. TOUCH START.
3. Appuyer sur **START/EASY MINUTE**.

NOTA:

- HIGH sera affiché si on appuie une fois sur la touche **POWER LEVEL**.
- Si le niveau 100 % doit être utilisé au cours de la dernière séquence, il n'est pas nécessaire d'appuyer sur la touche **POWER LEVEL**.
- Si vous voulez savoir le niveau de puissance, appuyer simplement sur la touche **POWER LEVEL**. Aussi long temps que votre doigt appuie sur la touche **POWER LEVEL**, le niveau de puissance sera affiché.
- Micro Warm peut être programmé même si 4 séquences de cuisson ont été réglées.

Aide

Il y a un conseil de cuisson pour chaque réglage de Sensor Reheat, Sensor Cook, Sensor Popcorn, Micro Warm, Reheat et Defrost Si vous êtes intéressé, appuyer sur **SET UP/HELP** quand HELP est allumé sur l'afficheur interactif, pour lire les conseils de cuisson et ceux de fonctionnement des autres manuels.

Easy Minute

Easy Minute vous permet de cuire pendant une minute à 100 % simplement en appuyant sur la touche **EASY MINUTE**. Vous pouvez aussi prolonger la durée de cuisson de multiples fois 1 minute en appuyant répétitivement sur **EASY MINUTE** en mode manuel de cuisson.

NOTA:

- Pour utiliser **EASY MINUTE**, appuyer sur la touche dans les trois minutes après la cuisson, en fermant la porte ou en appuyant sur la touche **STOP/CLEAR**.
- On ne peut pas utiliser Easy Minute avec Sensor, Reheat ou Defrost.

Control Lock (Verrouillage Des Commandes)

Le verrouillage des commandes vise à empêcher l'utilisation du four comme par de jeunes enfants. Le micro-onde tiroir peut être réglé de telle sorte que le tableau de commande est inopérant ou verrouillé.

POUR VERROUILLER

Appuyer sur **CONTROL LOCK** pendant 3 secondes. LOCK ON s'affichera.

POUR DÉVERROUILLER

Appuyer sur **CONTROL LOCK** pendant 3 secondes. LOCK OFF s'affichera.

Autres Caractéristiques

Réglage De Durée En Plus Ou En Moins

Si vous trouvez que vous préférez les réglages de Sensor, Reheat or Defrost un peu plus forts, appuyer une fois sur la touche **POWER LEVEL** après avoir appuyé sur les touches de votre choix. MORE s'affichera.

Pour des réglages un peu moins forts, appuyer deux fois sur la touche **POWER LEVEL** après avoir appuyé sur les touches de votre choix. LESS s'affichera.

Suppression Du Signal Sonore

À la fin d'une durée de cuisson, un bip résonnera Si vous désirez que votre appareil n'émette pas de signal sonore, vous pouvez le désactiver.

POUR DÉSACTIVER LE SIGNAL SONORE

1. Appuyer sur **SETUP/HELP**. TOUCH AGAIN
2. Appuyer à nouveau sur **SETUP/HELP**. SOUND OFF ? TOUCH START
3. Appuyer sur **START/EASY MINUTE**. SOUND OFF s'affichera.

POUR RÉACTIVER LE SON

1. Appuyer sur **SETUP/HELP**. TOUCH AGAIN
2. Appuyer à nouveau sur **SETUP/HELP**. SOUND ON ? TOUCH START
3. Appuyer sur **START/EASY MINUTE**. SOUND ON s'affichera.

Rappel De Fin De Cuisson

À la fin d'une cuisson, le micro-onde signalera toutes les 10 secondes pendant une minutes et ensuite toutes les 3 minutes pendant une heure, jusqu'à ce qu'on appuie sur **STOP/CLEAR**.

POUR DÉSACTIVER LE RAPPEL

1. Appuyer trois fois sur **SETUP/HELP**. REMIND SIGNAL OFF ? TOUCH START s'affichera.
2. Appuyer sur **START/EASY MINUTE**. REMIND SIGNAL OFF s'affichera.

POUR RÉACTIVER LE RAPPEL

1. Appuyer trois fois sur **SETUP/HELP**. REMIND SIGNAL ON ? TOUCH START s'affichera.
2. Appuyer sur **START/EASY MINUTE**. REMIND SIGNAL ON s'affichera.

Auto Démarrage

Si vous voulez programmer le micro-onde tiroir pour commencer à cuire automatiquement à une heure donnée, prendre cette marche à suivre.

1. Appuyer 4 fois sur **SETUP/HELP**. AUTO START TOUCH START s'affichera.
2. Appuyer sur **START/EASY MINUTE**. ENTER START TIME
3. Entrer l'heure de démarrage. 4:30 TOUCH CLOCK
4. Appuyer sur la touche **TIMER/CLOCK**. ENTER COOKING TIME
5. Appuyer sur les chiffres pour entrer la durée de cuisson. 20.00 TOUCH START OR TOUCH POWER LEVEL. Appuyer sur **POWER LEVEL** répétitivement jusqu'au niveau de puissance désiré. TOUCH START
6. Appuyer sur **START/EASY MINUTE**.

Mode De Démonstration

POUR CHOISIR LE MODE DÉMO

1. Appuyer 5 fois sur **SETUP/HELP**. DEMO ON? HOLD START 3 SEC s'affichera.
2. Appuyer sur **START/EASY MINUTE**. DEMO ON s'affichera.

POUR ANNULER LE MODE DÉMO

1. Appuyer 5 fois sur **SETUP/HELP**. DEMO OFF ? TOUCH START s'affichera.
2. Appuyer sur **START/EASY MINUTE**. DEMO OFF s'affichera.

NOTA:

- Le micro-onde tiroir ne chauffe pas en mode démo.
- Le compte à rebours s'affiche rapidement.

Réglages/Aide

Si l'alimentation électrique de votre micro-onde tiroir est coupée, ENJOY YOUR MICRO- WAVE TOUCH CLEAR AND TOUCH CLOCK s'affichera et clignotera dès que l'alimentation sera rétablie. Dans un tel cas, l'optio **SETUP/HELP** que vous avez entrée sera effacée. Appuyer simplement sur la touche **STOP/CLEAR** et remettre à zéro.

Nettoyage et Entretien

Extérieur

La surface extérieure est en métal peint et en plastique. Nettoyer la surface extérieure à l'eau et au savon doux; rincer et sécher au moyen d'un chiffon doux. Ne pas utiliser de produits de nettoyage ménagers ou abrasifs.

Surface D'acier Inox

(Modèles Choisis)

Il faut essuyer souvent l'extérieur avec un chiffon doux humide et le frotter avec un chiffon doux sec pour lui garder son lustre. Toujours essuyer dans le sens du grain. Il existe aussi de nombreux produits conçus spécialement pour nettoyer et faire briller l'extérieur en inox du four. Nous recommandons d'appliquer le nettoyant sur un chiffon doux et de s'en servir ensuite sur l'inox plutôt que de le vaporiser directement dessus. Suivre à la lettre les instructions de l'emballage.

Avant Du Tiroir

Essuyer les deux surfaces du hublot à l'aide d'un chiffon humide pour enlever les éclaboussures. Il est plus facile de nettoyer les parties métalliques si on les essuie fréquemment avec un chiffon humide. Éviter tout emploi de produits nettoyants vaporisés ou abrasifs car ils peuvent tacher, strier ou ternir la surface de la porte.

Tableau De Commandes

Si désiré, les touches peuvent être désactivées avant le nettoyage. Voir les renseignements sur le verrouillage des commandes à la page 16 de ce manuel. Essuyer le tableau de commande avec un chiffon humecté d'eau. Sécher avec un chiffon doux. N'utiliser ni poudre à récurer ni produits chimiques de nettoyage. Refermer la porte et suivre les instructions de la page 13 pour déverrouiller les commandes. Appuyer sur **STOP/CLEAR**.

Intérieur

Le nettoyage est facile car les parois intérieures n'absorbent pas de chaleur de telle sorte que les éclaboussures ne cuisent pas. Pour nettoyer les parois intérieures, y compris les surfaces d 'étanchéité du tiroir, essuyer avec un chiffon doux humide. NE PAS UTILISER DE PRODUITS ABRASIFS OU DE TAMPONS À RÉCURER. Pour les taches tenaces, utiliser du savon doux et nettoyer avec un chiffon doux humide Ne pas utiliser de nettoyants chimiques pour les fours.

Glissières Du Micro-onde Tiroir

Nettoyer les glissières du tiroir des miettes de nourriture. Les essuyer avec un chiffon doux et sec pour que le tiroir s'ouvre et se ferme en douceur.

Couvercle Du Guide D'ondes

ATTENTION Tenir propre le couvercle du guide d'ondes pour assurer un bon fonctionnement du four. Essuyer immédiatement et délicatement avec un chiffon humide toute éclaboussure d'aliments sur la surface du couvercle. Une accumulation d'éclaboussures peut surchauffer et causer de la fumée ou même s'enflammer. Ne pas retirer le couvercle du guide d'ondes.

Désodorisation

Il peut arriver qu'une odeur de cuisson persiste dans le tiroir. Pour l'éliminer, mettre dans un récipient pouvant contenir 2 tasses, 1 tasse d'eau, le zeste et le jus d'un citron, et plusieurs clous de girofle entiers. Faire bouillir pendant plusieurs minutes à 100 %. Laisser reposer dans le micro-onde tiroir jusqu'à ce qu'il soit froid. Essuyer l'intérieur avec un chiffon doux.

Avant d'appeler pour une Réparation

Vérifier ce qui suit avant de faire appel à un réparateur. Vous pourriez sauver du temps et de l'argent.

PROBLÈME	CAUSE POSSIBLE	SOLUTION
1. Une pièce ou tout le Microwave In-A-Drawer™ ne fonctionne pas.	• Le cordon du Microwave In-A-Drawer™ n'est pas complètement branché à la prise.	• Vérifier que le cordon est bien branché dans la prise.
	• Coupure de courant.	• Vérifier les lumières de la maison pour vous en assurer. Appeler la compagnie d'électricité.
	• Le fusible ou le disjoncteur de la maison ne fonctionne pas.	• Remplacer le fusible ou réenclencher le disjoncteur.
	• Le Microwave In-A-Drawer™ est en mode démo.	• Voir page 14 comment annuler le mode Démo.
2. Le micro-onde ne chauffe pas les aliments.	• Pas de courant à l'appareil.	• Voir la SOLUTION pour le PROBLÈME 1.
	• Les commandes du tiroir sont mal réglées.	• Vérifier les réglages de commandes
	• Le Microwave In-A-Drawer™ est en mode démo.	• Voir page 14.
3. La lumière du Microwave In-A-Drawer™ ne fonctionne pas.	• L'ampoule est desserrée ou brûlée.	• Appeler un réparateur.
4. Les touches de commande ne fonctionne pas.	• Les commades sont verrouillées.	• Voir page 13 pour déverrouiller.
5. L'afficheur clignota.	• Panne de courant.	• Appuyer sur **STOP/CLEAR** et remettre l'horloge à l'heure. Si le Microwave In-A-Drawer™ était en marche, vous devez redémarrer la fonction de cuisson.
6. Vapeur sortant de l'évent	• Pendant la cuisson aux micro-ondes, de la vapeur peut s'échapper par le côté droit de l'évent.	

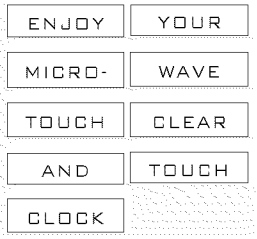
Guide des Touches Automatiques

Microwave In-A-Drawer™

RÉGLER L'HORLOGE

1. Appuyer sur la touche **TIMER/CLOCK** et sur 2.
2. Appuyer sur les chiffres pour corriger l'heure du jour et appuyer de nouveau sur **TIMER/CLOCK**.

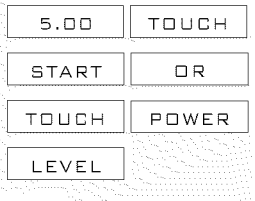
   En cas d'une interruption du courant de votre four, l'écran affichera de façon intermittente:



TEMPS DE CUISSON

Cuisson à haute puissance

1. Entrer la durée de cuisson en appuyant sur les chiffres. (Ex: 5 minutes) 5 0 0.



2. Appuyer sur **START/EASY MINUTE**.

Cuisson à puissance variable

1. Après l'étape 1 ci-dessus, appuyer sur **POWER LEVEL** jusqu'à ce que le niveau de puissance désiré s'affiche.
2. Appuyer sur **START/EASY MINUTE**.

SENSOR COOK

La cuisson au capteur calcule automatiquement la bonne durée et le bon niveau de puissance pour cuire parfaitement les aliments inscrits sur l'aide-mémoire.

1. Appuyer une fois sur la touche **SENSOR COOK**.



2. Voir l'aide-mémoire. Choisir un aliment en appuyant sur un chiffre. Ex : Appuyer 5 fois pour des pommes terre au four.
3. Appuyer sur **START/EASY MINUTE**.

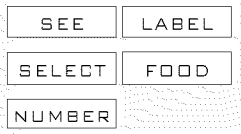
SENSOR POPCORN/SENSOR REHEAT

Appuyer sur **SENSOR REHEAT** ou **SENSOR POPCORN** puis sur la touche **START/EASY MINUTE**.

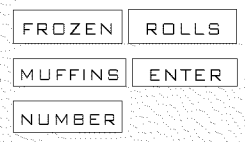
REHEAT

Reheat calculera automatiquement le temps de réchauffage approprié et la puissance du four à micro-ondes pour les aliments inscrits à l'aide-mémoire.

1. Appuyer une fois sur la touche **REHEAT**.



2. Voir l'aide-mémoire. Choisir l'aliment désiré en appuyant sur un chiffre. Ex : Appuyer sur 2 pour des petits pains ou des muffins congelés.



3. Appuyer sur un chiffre pour choisir la quantité. Ex : Appuyer sur 2 pour 2 pains ou muffins.



4. Appuyer sur **START/EASY MINUTE**.

DEFROST

Utiliser cette caractéristique pour décongeler les aliments inscrits à l'aide-mémoire.

1. Appuyer sur la touche **DEFROST**.



2. Voir l'aide-mémoire. Choisir l'aliment désiré en appuyant sur un chiffre. Ex : Appuyer sur 2 pour les biftecks ou les côtelettes.



3. Entrer le poids en appuyant sur les chiffres. 1 0.



4. Appuyer sur **START/EASY MINUTE**.
5. Le micro-onde s'arrêtera pour permettre de tourner, masquer et/ou retirer les aliments. Fermer le tiroir. Appuyer sur. Appuyer sur **START/EASY MINUTE**.

Guide des Touches Automatiques

MICRO WARM

Micro Warm vous permet de garder les aliments au chaud pendant 30 minutes.

Usage direct

1. Appuyer sur la touche **MICRO WARM**.



2. Entrer la durée désirée en appuyant sur les chiffres. Pour entrer 30 minutes appuyer sur 3 0 0 0.



3. Appuyer sur **START/EASY MINUTE**.

Avec cuisson en mode manuel

1. Entrer le temps de cuisson et le niveau de puissance.
2. Appuyer sur la touche **MICRO WARM**.
3. Entrer la durée de réchauffage désirée jusqu'à 30 minutes.
4. Appuyer sur **START/EASY MINUTE**.

TIMER

1. Appuyer sur la touche **TIMER/CLOCK** et sur 1.
2. Entrer l'heure.
3. Appuyer à nouveau sur la touche **TIMER/CLOCK**.

   Pour annuler la minuterie appuyer sur **STOP/CLEAR**.

EASY MINUTE

Appuyer sur **START/EASY MINUTE** pendant une minute à 100% de puissance ou pour ajouter une minute pendant la cuisson en mode manuel. Continuer à appuyer pour des minutes supplémentaires.

Autres Caractéristiques

CONTROL LOCK

Le verrouillage des commandes vise à empêcher l'utilisation non désirée du four comme par de jeunes enfants. Le Microwave In-A-Drawer™ peut être réglé de telle sorte que le tableau de commande est inopérant ou verrouillé.

Pour verrouiller

Appuyer sur **CONTROL LOCK** pendant 3 secondes.



To Unlock

Appuyer sur **CONTROL LOCK** pendant 3 secondes.



AIDE

Reportez-vous au mode d'emploi pour les détails spécifiques.

Appuyer sur **SETUP/HELP**.

2 fois pour Suppression du Signal Sonore.

3 fois pour Rappel de Fin de Cuisson.

4 fois pour Auto Démarrage.

5 fois pour Mode De Démonstration.

Garantie du Produit

Ce Qui Est Couvert

CERTIFICAT DE GARANTIE

Microwave In-A-Drawer™ DACOR

DANS LES CINQUANTE ÉTATS DES É.-U., LE DISTRICT DE COLUMBIA ET AU CANADA* :

GARANTIE COMPLÈTE D'UN AN

Si votre produit DACOR cesse de fonctionner durant l'année qui suit la date initiale d'achat, à cause d'un défaut de matériel ou de main-d'œuvre, DACOR corrigera le défaut sans frais pour vous ou les usages ultérieurs. Le propriétaire devra fournir une preuve d'achat sur demande et l'appareil devra être accessible pour la réparation.

* La garantie est nulle et non avenue si un produit non approuvé CSA est transporté des É.-U.

HORS DES CINQUANTE ÉTATS DES É.-U., LE DISTRICT DE COLUMBIA ET AU CANADA :

GARANTIE LIMITÉE À LA PREMIÈRE ANNÉE

Si votre produit DACOR cesse de fonctionner durant l'année qui suit la date initiale d'achat, à cause d'un défaut de matériel ou de main-d'œuvre, DACOR fournira une nouvelle pièce, FAB en usine, pour remplacer la pièce défectueuse. Tous les frais de livraison, installation et main-d'œuvre sont la responsabilité de l'acheteur. Le propriétaire devra fournir une preuve d'achat sur demande et l'appareil devra être accessible pour la réparation.

Ce Qui N'est Pas Couvert

- Une panne du produit causée par une mauvaise installation,un usage inadéquat, ou un manque de l'entretien requis.
- Les appels de service pour former le client aux bons usage et entretien du produit.
- Une panne du produit s'il est utilisé pour le commerce, les affaires ou la location ou pour tout autre application que pour l'usage résidentiel du client.
- Le remplacement des fusibles ou des boîtes de fusibles de la maison ou le réenclenchement des disjoncteurs.
- Les dommages au produit causés par accident, incendie, inondation ou autres actes de Dieu.
- Le bris, la décoloration ou les dommages au verre, aux surfaces métalliques, aux composantes plastiques, aux garnitures, à la peinture, la porcelaine ou autre fini esthétique, causés par un usage ou un entretien inadéquats, un abus ou par négligence.

LES RECOURS OFFERTS DANS LES GARANTIES EXPRESSES CI-DESSUS SONT LES RECOURS UNIQUES ET EXCLUSIFS; PAR CONSÉQUENT AUCUNE AUTRE GARANTIE EXPRESSE N'EST OFFERTE, ET HORS DES CINQUANTE ÉTATS DES É.-U., LE DISTRICT DE COLUMBIA ET AU CANADA, AUCUNE GARANTIE IMPLICITE, Y COMPRIS MAIS SANS Y ÊTRE LIMITÉE, TOUTE GARANTIE IMPLICITE DE QUALITÉ MARCHANDE ET D'ADAPTATION À UN USAGE PARTICULIER POUR UN ACHAT. EN AUCUN CAS, DACOR NE SERA TENU RESPONSABLE POUR DES FRAIS ACCESSOIRES OU DES DOMMAGES INDIRECTS. AUCUNE GARANTIE N'EST OFFERTE, EXPRESSE OU IMPLICITE À UN ACHETEUR POUR LA REVENTE.

Certains états ou provinces n'autorisent pas de restriction à la durée d'une garantie implicite ni l'exclusion ou la restriction de dommages accessoires ou indirects; les restrictions ou exclusions pourraient donc ne pas s'appliquer à vous. Cette garantie vous donne des droits particuliers et vous pourriez également avoir d'autres droits qui varient selon les états et provinces.

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DACOR
ATTN WARRANTY PROCESSING DEPT
PO BOX 90070
CITY OF INDUSTRY CA 91715-9907

dacor
The Life of the Kitchen.®

Please visit www.Dacor.com to activate your warranty online.

WARRANTY INFORMATION

IMPORTANT:

Your warranty will not be activated until you activate it online or return this form to Dacor. If you have purchased more than one Dacor product, please return all forms in one envelope or activate the warranty for each product online.

Please rest assured that under no conditions will Dacor sell your name or any of the information on this form for mailing list purposes. We are very grateful that you have chosen Dacor products for your home and do not consider the sale of such information to be a proper way of expressing our gratitude!

cut here

Owner's Name: _____
Last (Please Print or Type) First Middle

Street: _____

City: _____ State: _____ Zip: _____

Purchase Date: _____ Email: _____ Telephone: _____

Dealer: _____

City: _____ State: _____ Zip: _____

Your willingness to take a few seconds to fill in the section below will be sincerely appreciated. Thank you.

1. How were you **first** exposed to Dacor products? (Please check one only.)

- ❑ A. T.V. Cooking Show
- ❑ B. Magazine
- ❑ C. Appliance Dealer Showroom
- ❑ D. Kitchen Dealer Showroom
- ❑ E. Home Show
- ❑ F Builder
- ❑ G. Architect/Designer
- ❑ H. Another Dacor Owner
- ❑ I. Model Home
- ❑ J. Other _____

2. Where did you buy your Dacor appliances?

- ❑ A. Appliance Dealer
- ❑ B. Kitchen Dealer
- ❑ C. Builder Supplier
- ❑ D. Builder
- ❑ E. Other _____

3. For what purpose was the product purchased?

- ❑ A. Replacement ***only***
- ❑ B. Part of a Remodel
- ❑ C. New Home
- ❑ D. Other _____

4. What is your household income?

- ❑ A. Under $75,000
- ❑ B. $75,000 – $100,000
- ❑ C. $100,000 – $150,000
- ❑ D. $150,000 – $200,000
- ❑ E. $200,000 – $250,000
- ❑ F. Over $250,000

5. What other brands of appliances do you have in your kitchen?

A. Cooktop _____ C. Dishwasher _____
B. Oven _____ D. Refrigerator _____

6. Would you buy or recommend another Dacor product?

❑ Yes ❑ No

Comments: _____

Thank you very much for your assistance. The information you have provided will be extremely valuable in helping us plan for the future and giving you the support you deserve.

cut here

Web site: www.Dacor.com
Corporate phone: (800) 793-0093

06/20/17	G10062205	TJ9SSIM6	MARCONE 6FT ICEMAKER LINE	1.00	0.00	N
06/20/17	G10062205	HDI11	HOSHIZAKI FILTER *	1.00	250.00	N
06/20/17	G10062205	C101BAHAD	HOSHIZAKI ICE MACHINE - NUGG ICE	1.00	2700.00	N
06/20/17	G10062205	MMDV30S	DACOR 30" MICROWAVE SS *	1.00	1399.00	
06/20/17	G10062205	LFX28968ST	LG SS REFRIGERATOR *	1.00	2350.00	
06/20/17	G10062205	JK5500SFSS	GE SS DOUBLE WALL OVEN	1.00	1975.00	
06/19/17	G10062078	KGCU467VSS	KITCHENAID 36"PROTOP 6.. *	1.00	2300.00	
Report Total:				**7.00**	**10974.00**	**8847.20**

Hoshizaki – } – St. Louis Appliance Repair – 636-349-5588
Dacor – }

LG }
Kitchenaid } – Mid America – 636-928-4131

GE } – 1800-432-2737








Care and Maintenance of Window Treatments

LUTRON®

START HERE

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Care and Cleaning Methods



Hand Dusting

Most routine care of Lutron window treatments will consist of dust removal. Hand dusting is best done using gentle methods which minimize the possibility of damaging or disturbing woven fabrics, lift cords, venetian slats, etc. Soft filament and feather dusters are recommended. Careful wiping with a soft, lint-free cloth may also be effective.



Vacuuming with a Soft Brush Attachment

As stated above, most routine care of Lutron window treatments will consist of dust removal. When hand dusting isn't practical due to the height of a window or other factors, vacuuming is an effective method. Use a soft brush attachment to temper the strength of suction and help lift unwanted dust and fibers from the surface of fabrics, cornices, and lineals.



Low Heat Steaming

Steam cleaning is not recommended as a method of regular care of Lutron® window treatments. However, application of low heat steam as a means of wrinkle removal is acceptable for many of the fabrics in the Lutron collections. Be sure to check the Care and Cleaning Methods by Fabric/Material chart starting on page 13 before applying steam.



Spot Cleaning

In the event that fabric in a Lutron® window treatment becomes soiled or stained, spot cleaning with a mild detergent and water may be appropriate. Use detergent that is intended for fabrics without bleach or fabric softener additives. Apply diluted detergent by blotting with a clean cloth. Do not rub. Then, use a second clean cloth to apply a clear-water rinse. Allow to dry thoroughly.

Be sure to check the Care and Cleaning Methods by Fabric/Material chart starting on page 13 before spot cleaning. Any cleaning product should be tested on a small, inconspicuous area prior to broad application on the shade panel. An 8" x 10" sample of the fabric may also be obtained through Lutron Customer Service for testing purposes.



Professional Cleaning

Reputable drapery and upholstery cleaning services are experts in fabric care and the cleaning methods that work best for specific materials. The methods referenced in this guide are:

Ultrasonic: Usually involves taking down the window treatment and dipping in an ultrasonic bath. This is a very effective cleaning method, and may even include anti-static treatment to help repel dust.

Injection/Extraction: Similar to the popular carpet cleaning method, loose dust and dirt are removed with a vacuum, then, a cleaning solvent is applied, (injection), and immediately suctioned out, (extraction). This heat and agitation-free method can often be performed with shades and drapes left in place.

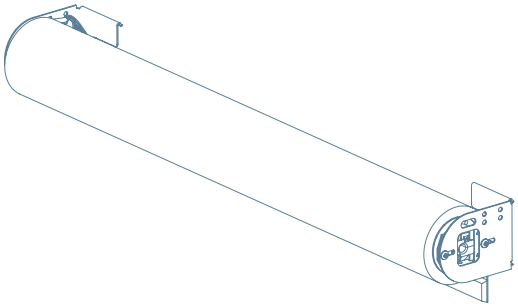
Dry Cleaning: Typically appropriate for drapery fabrics, this method is actually similar to injection/extraction, but is usually done off-site, although service providers who offer on-site dry cleaning do exist.

Be sure to check the Care and Cleaning Methods by Fabric/Material chart starting on page 13 before ordering or allowing any type of professional cleaning.

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Roller Shade Products

- Sivoia® QS single and coupled roller shades
- Sivoia® QS Wireless single and coupled roller shades
- Sivoia® QED single and coupled roller shades
- Lutron® AC roller shades
- Lutron® Stanza roller shades
- Lutron® manual roller shades



Maintenance

Lutron roller shade systems are manufactured to provide maintenance-free performance for the life of the product. All internal and external components are designed to function without user intervention aside from normal operational input. After the shades have been installed correctly by a qualified installer, there is no mechanical upkeep required. In the event adjustments or repairs are needed, the original provider of the systems should be notified. All adjustments and repairs must be made by qualified personnel.

Lutron Roller Shades are backed by Lutron's limited 8-Year Warranty on all components.
http://www.lutron.com/TechnicalDocumentLibrary/Window Systems Warranty.pdf

Fabric Care

Lutron roller shade fabrics are manufactured and process treated for extra strength to prevent wear. Lutron roller shade fabrics are not easily damaged and require only light maintenance to keep them dust and dirt free. Fabrics can be periodically dusted in place using a feather duster or vacuum with a soft brush attachment.



Hand Dust

If staining occurs, most* fabrics may be cleaned with a mild detergent and water applied with a soft cloth. Follow this with a thorough rinsing of clean water and allow the shade to air dry in an unrolled position. There are also numerous restorative vinyl cleaners on the market that can clean and revitalize vinyl and PVC coated sheer weave fabrics, if desired.



Soft Brush Attachment

Any mild cleaning product should be tested on a small, inconspicuous area prior to broad application on the shade panel. An 8" x 10" sample of the fabric may also be obtained through Lutron Customer Service for testing purposes.



Spot Clean

* Refer to the Cleaning Methods by Fabric/Material chart starting on page 13 for Roller Shade fabrics that allow for spot cleaning.

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Care and Cleaning Methods by Fabric / Material

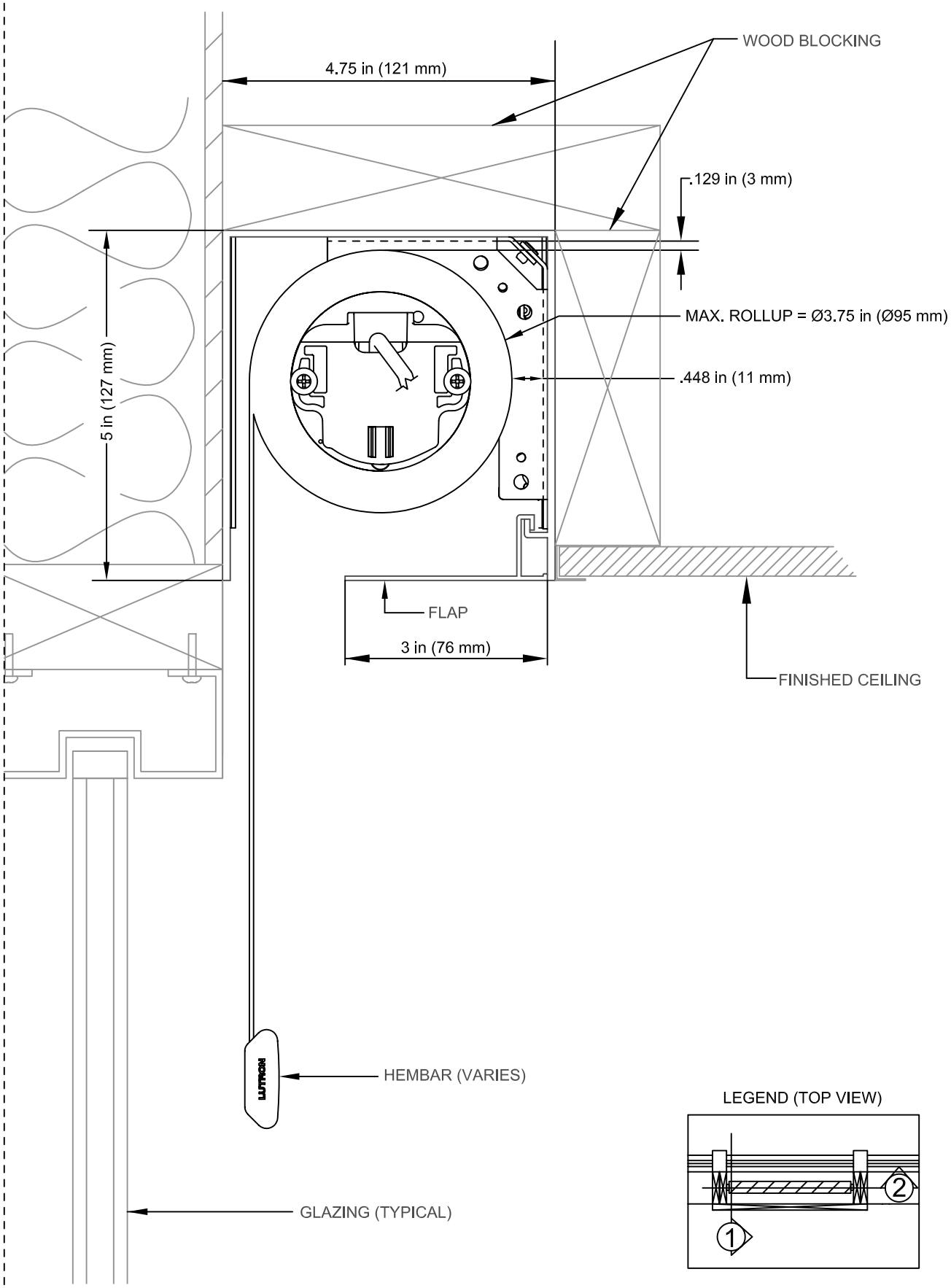
	Product	Composition	Gentle Hand Dusting (soft cloth/feather duster	Gentle Vacuum w/Soft Brush Attachment	Low Heat Steaming	Gentle Spot Cleaning (soft cloth/mild det./rinse)	Professional: Ultrasonic	Professional: Injection/Extraction	Professional: Dry Cleaning
Classico™ Collection Roller Shades									
☐	Greenscreen Revive	Recycled Polyester	○	○		○			
☐	Sheerlite	Polyester/Vinyl	○	○		○			
☐	Value Select 2	Polyester/Vinyl	○	○		○			
☐	Value Select 3 (Discontinued)	Polyester/Vinyl	○	○		○			
☐	Basketweave 90 (SW 2500, 2410, 2360, 2390)	Vinyl/Fiberglass	○	○		○			
☐	Basketweave ES (E-Screen)	Vinyl/Fiberglass	○	○		○			
☐	Basketweave E Screen With Koolblack™ Technology	Vinyl/Fiberglass	○	○		○			
☐	Basketweave MS (M-Screen)	Vinyl/Fiberglass	○	○		○			
☐	Basketweave 4000/Eco (SW 4000, 4100, 4400)	Vinyl/Polyester	○	○		○			
☐	Basketweave 3000	Vinyl/Fiberglass/Polyester	○	○		○			
☐	Basketweave 2000 (SW 2000, 2100)	Vinyl/Fiberglass	○	○		○			
☐	Vela	Polyester	○	○		○			
☐	Basket Weave NT (Natte)	Vinyl/Fiberglass	○	○		○			
☐	Basketweave ST (Satine)	Vinyl/Fiberglass	○	○		○			
☐	Basketweave TS (T-Screen)	Vinyl/Fiberglass	○	○		○			
☐	Basketweave Eco2 (Infinity)	Thermoplastic Olefin	○	○		○			
☐	Jacquard (SW 5000)	Polyester/Vinyl	○	○		○			
☐	Cinq	Trevira® CS (Polyester)	○	○		○			
☐	Opac	Trevira® CS (Polyester)	○	○		○			
☐	Proton	Trevira® CS (Polyester)	○	○		○			
☐	Basketweave 27 (SW 2701, 2703, 2705, 2710)	Vinyl/Fiberglass	○	○		○			
☐	Basketweave Silver (Silverscreen)	Vinyl/Fiberglass/Aluminum Backing	○	○		○			
☐	Value Select 1	Vinyl/Polyester	○	○		○			
☐	Basketweave (Translucent - SW 4800)	Vinyl/Polyester	○	○		○			
☐	Translucent P	Fiberglass	○	○		○			
☐	Obion (Discontinued)	Fiberglass/Acrylic/Cotton	○	○		○			
☐	Standard Blackout (NLFG)	PVC/Fiberglass	○	○		○			
☐	Premiere X (Discontinued)	Polyester	○	○					
☐	Black-Out Premiere (Flocke)	Fiberglass/Acrylic/Cotton	○	○		○			
☐	Black-Out Edessa	Polyester/Acrylic	○	○		○			
☐	Black-Out Avila	Polyester/Acrylic	○	○		○			
☐	Black-Out Value Premiere (SW 7000, 7100)	Polyester/Acrylic	○	○		○			

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ROLLER SHADE DETAIL DRAWING

SCALE: 1/2

0037-R100-PMT-S



1 TYPICAL SECTION

SCALE: 1/2

ROLLER 100 / 200CW - 4.75" POCKET MOUNT

REV: A

DRAWING #

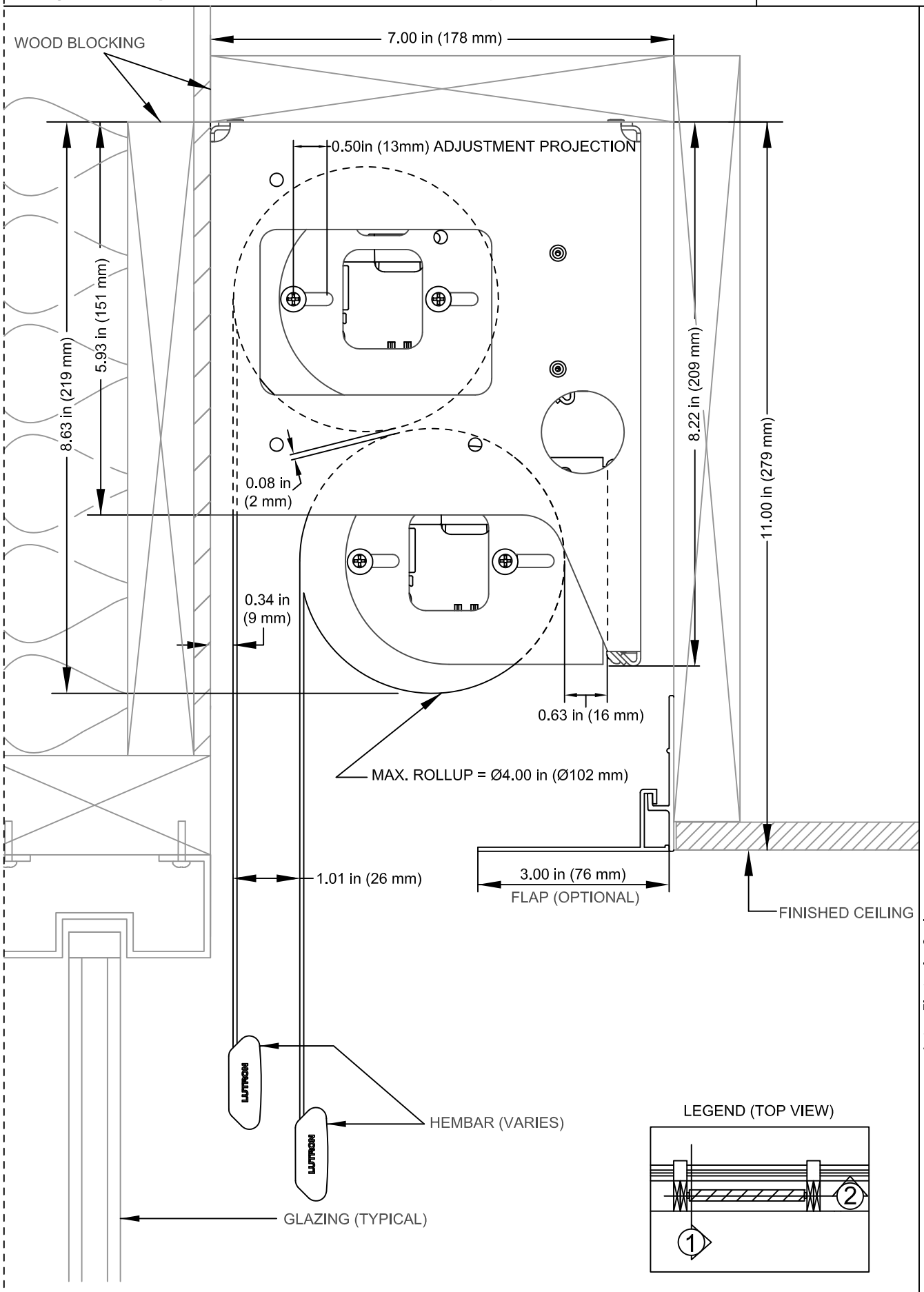
Lutron Electronics Co., Inc.
7200 Suter Road | Coopersburg, PA 18036 | USA
1(800) 446-1503 | fax: (610) 282-7439
shadinginfo@lutron.com

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ROLLER SHADE DETAIL DRAWING

SCALE: 1/2

0051-R100-DMT-S



1 TYPICAL SECTION

SCALE: 1/2

ROLLER 100 / 200CW - DUAL BRACKET MOUNT

REV: A

DRAWING #

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Inline-Coupled Roller Shade Addendum

Shade Mounting & Adjustment Guide for Inline-Coupled Roller 100, 150, 200CW, & 300—Please Read Before Installing

English

CAUTION: RISK OF FALLING OBJECTS. Read and follow all instructions for mounting the shade system. Failure to follow these instructions could result in minor to moderate injury.

Important Notes: Please Read Before Installing

A. Plan the installation to maintain sufficient clearance between the shade and any other object, including window trim, hardware, cranks, lock levers, and drapery.

B. For safety, all shades and coupled panels must be installed by 2 people.

C. The shade system must be mounted to blocking or other suitable structural material. It is the responsibility of the installer to choose and install fasteners that are appropriate for the mounting surface.

D. Lutron systems are intended for use with only Lutron hardware, controls, and power supplies.

NOTE: The pictures and instructions in this document detail the installation of wall-mount sub-brackets. The sequence and methods for installing other types of sub-brackets are the same or similar. Refer to the chassis mounting instructions included with your sub-brackets.

Customer Assistance

USA and Canada: +1.800.523.9466 (24 hrs / 7 days)

UK +44.(0)20.7680.4481 – 08.00 - 18.00 GMT

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Tech Support: +44.(0)20.7680.448 | FREEPHONE: 0800.282.107

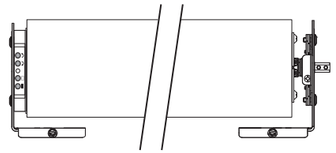
Asian Headquarters | Singapore
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TEL: +65.6220.4666 | FAX: +65.6220.4333 | asiasales@lutron.com

For product warranty information, please see:

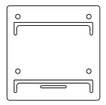
www.lutron.com/TechnicalDocumentLibrary/Window Systems Warranty.pdf

1 Prepare to Install

1.1 Included with inline-coupled shades:

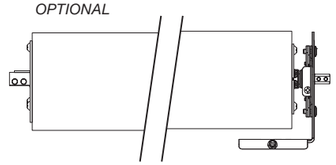


(1) Drive Shade with Shade Brackets and Coupler Pre-Installed



Sub-Brackets
(2 per Drive Shade + 1 per Coupled Panel)

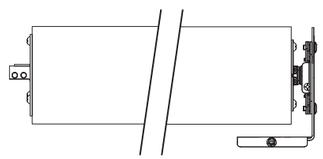
OPTIONAL



Coupled Panel(s)
(up to 4)*

#8 x 1¾ in Mounting Screws
(qty varies with Sub-Bracket type)

#6 x 1 in Coupler Screws
(2 per Coupler + 2 Spares)



(1) Coupled Idler Panel



Coupler Screw Clip
(1 per Coupler)

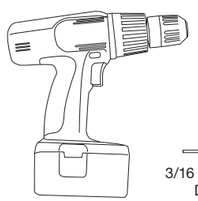


5/64 in Hex Wrench

*A total of 6 panels may be coupled, including the drive shade and coupled idler panel. (Subject to limitations based on drive capacity, panel sizes, and fabric selection; contact Lutron for more information.)

1.2 Additional items you'll need:

FOR MOUNTING SUB-BRACKETS USING SUPPLIED MOUNTING SCREWS



Power Drill

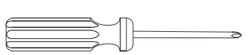
Pencil



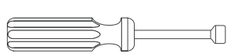
Tape Measure

3/16 in (4.8 mm) Drill Bit

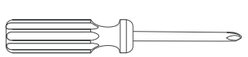
5/16 in (8 mm) Hex Driver Bit
(6 in extension recommended)



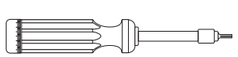
#1 Phillips Screwdriver



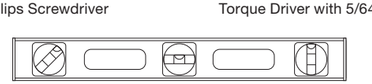
1/4 in Nut driver



#2 Phillips Screwdriver



Torque Driver with 5/64 in hex bit



Level

2 Install the Sub-Brackets

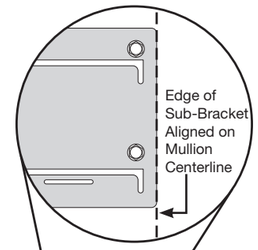
Lay out the sub-brackets at the originally specified bracket-to-bracket distances, as shown below. Verify that all sub-brackets are level and aligned.

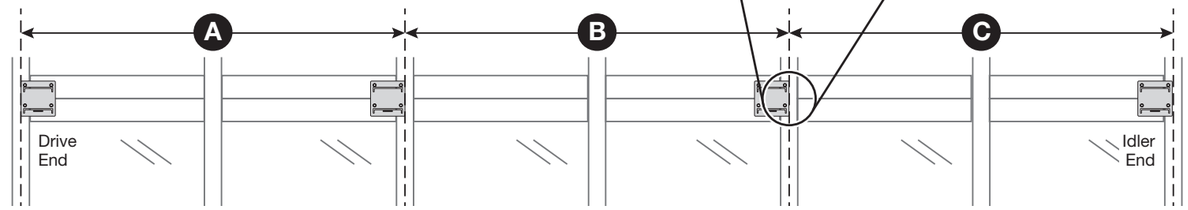
Typical 3-Shade Combination*

A Drive shade bracket-to-bracket width

B Coupled panel bracket-to-bracket width

C Coupled idler panel bracket-to-bracket width



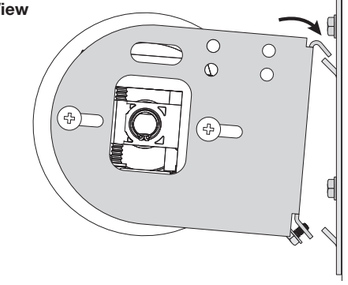


*A total of 6 panels may be coupled, including the drive shade and idler panel.
(Subject to limitations based on drive capacity, panel sizes, and fabric selection; contact Lutron for more information.)

3 Install the Drive Shade (for more information and other bracket types, refer to the chassis installation instructions packaged with the shade)

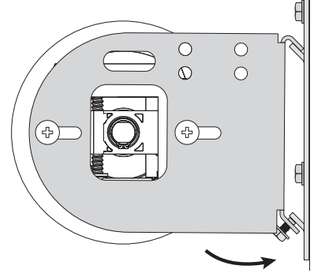
a. Position the drive shade in front of the mounted sub-brackets and hang the top hook of each shade bracket on the upper hook of the sub-bracket as shown.

Profile View



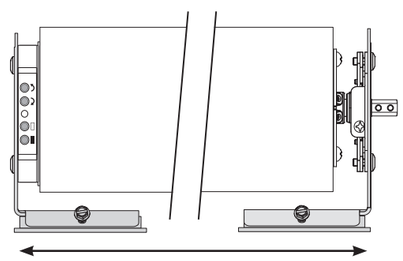
b. Swing the shade down, allowing the lower part of the shade brackets to rest against the sub-brackets.

Profile View



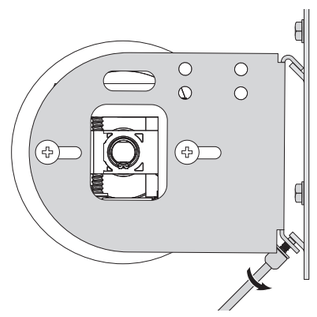
c. Adjust the position of the shade left-right as needed to center the fabric panel on the window opening.

View from Below



d. Use the 1/4 in nut driver to tighten the securing screw of each shade bracket.

Profile View



CAUTION: RISK OF FALLING OBJECTS. The shade bracket securing screw is factory-installed in the shade bracket, and must be tightened firmly into the sub-bracket to ensure safe installation of the shade. If the securing screw is missing, **DO NOT** substitute a different type of screw or omit Step **d.** Check the hardware kit for spare shade bracket securing screws, or contact Lutron for replacement screws. Failure to follow these instructions could result in minor to moderate injury.

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4 Alignment & Adjustment

As coupled panels are added, it is essential for smooth operation that the coupled shade tubes form as straight a line as possible. Depending on the straightness of the sub-bracket mounting surface and the level-alignment of the mounted sub-brackets, it may be necessary to adjust the shade tube projection (distance from the sub-brackets), and/or the level (idler height). Start with the drive shade, then make adjustments as needed to each coupled panel after it is added, before adding the next panel.

4.1 Projection Adjustment:

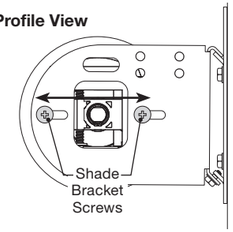
Each shade bracket provides for projection adjustment as shown.

a. Use the #2 phillips screwdriver to loosen both shade bracket screws.

b. Slide the shade toward or away from the sub-bracket.

c. Re-tighten the shade bracket screws.

Profile View

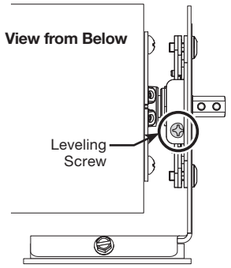


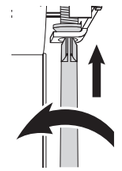
NOTE: When projection adjustment is necessary, it is the responsibility of the installer to maintain adequate clearance around the shade, and to ensure the fabric roll does not come in contact with any surrounding objects; e.g., ceiling, pocket, fascia, brackets, mounting hardware, etc.

4.2 Level Adjustment:

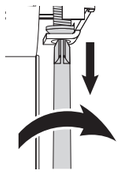
Each idler, coupling and non-coupling, features a leveling screw, accessible from below the shade, which can be used to raise or lower the idler-end of the shade tube. Use the #2 phillips screwdriver.

View from Below





Turn the leveling screw counter-clockwise to raise the idler



Turn the leveling screw clockwise to lower the idler

Complete the Setup of the Drive Shade:

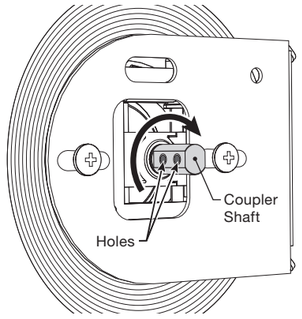
Follow the instructions in the Sivoia QS Basic Wiring & Setup Guide included with the drive shade to connect power and perform operational setup of shade. Ensure that the shade is mounted securely and operating properly, with all wiring dressed and secured, before proceeding to the next Section.

5 Install a Coupled Panel

NOTE: The instructions in Sections **5** and **6** pertain to all coupled panels, including the coupled idler panel. Complete both sections for each coupled panel before another coupled panel is added.

5.1 Position the Coupler Shaft

Use the Arrow buttons (↶↷) on the EDU controls to rotate the drive shade (and any previously-installed coupled panels, if applicable), so that the holes in the coupler shaft are facing downward.



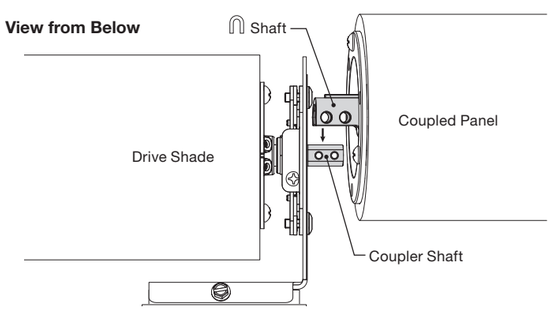
5.2 Attach the Coupled Panel

The coupled panel has one shade bracket, at the idler end, opposite the coupling.

a. Position the coupled panel in-line with the previously-installed shade, hanging its shade bracket on the upper hook of the sub-bracket, then allowing it to rest against the sub-bracket, as shown in Steps **a** and **b** of Section **3**.

b. Rotate and position the coupled panel so that its ⋂ Shaft engages the coupler shaft of the previously-installed shade as shown, with holes aligned.

View from Below

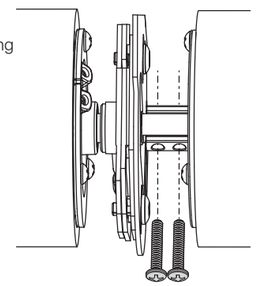


5.3 Secure the Coupled Panel

a. Install both coupler securing screws, threading them through the joined coupler shaft and ⋂ Shaft. Use the #1 phillips screwdriver to tighten until the heads are fully seated.

b. Adjust the position of the coupled panel left-right as needed to center the fabric on the window opening. (The coupler shaft is extendable.)

c. Use the hex-head driver to tighten the securing screw of the coupled panel shade bracket, as shown in Step **d** of Section **3**.

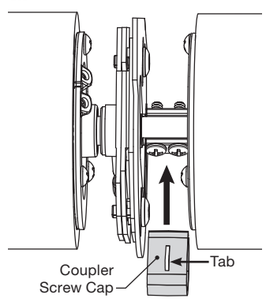


5.4 Install the Coupler Screw Cap

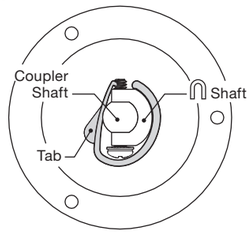
a. Push the Coupler Screw Cap over the joined Coupler Shaft and ⋂ Shaft until it snaps into place.

b. The closed side of the Coupler Screw Cap must cover the screw heads, and the tab must be located on the open side of the ⋂ Shaft as shown.

a.



b.



Profile View of Assembled Coupling

c. Complete all of the steps in Section **6** before adding another coupled panel.

6 Alignment & Adjustment of Coupled Panels

6.1 Adjust Projection

Follow the instructions in Step **4.1** to adjust the projection of the newly-added coupled panel, if necessary.

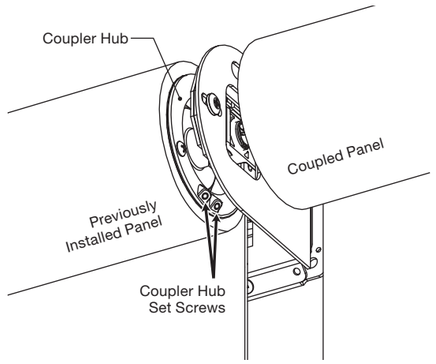
6.2 Adjust Level

Follow the instructions in Step **4.2** to adjust the level of the newly-added coupled panel, if necessary.

NOTE: Before leveling a coupled panel, recheck and verify that the drive shade and any previously installed coupled panels are level, and correct as needed.

6.3 Adjust Hembar Alignment

a. Use the Arrow buttons (↶↷) on the EDU controls to rotate the drive shade so that the set screws in the coupler hub are accessible.



b. While the second person holds the coupled panel fabric roll in place to prevent it from unrolling, loosen the coupler hub set screws.

c. Carefully rotate the coupled panel to align its hembar with the hembar of the previously-installed panel.

d. With the hembars aligned, use the torque driver to re-tighten the coupler hub set screws to a torque of 6.0 in-lbs (0.7 N•m).

⚠ CAUTION: RISK OF FALLING OBJECTS. The coupler hub set screws are tightened at the factory to a torque of 6.0 in-lbs (0.7 N•m). Failure to re-tighten the coupler hub set screws to a torque of 6.0 in-lbs (0.7 N•m) could result in minor to moderate injury.

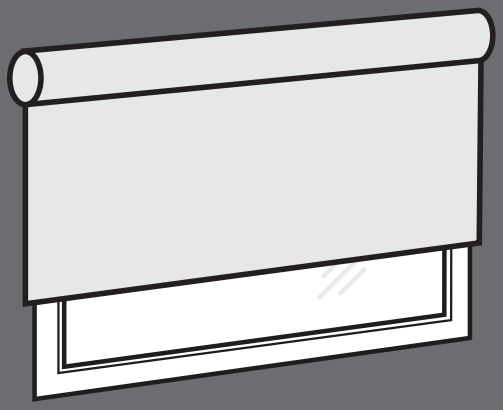
e. Repeat all of the steps in Sections **5** and **6** for each additional coupled panel.

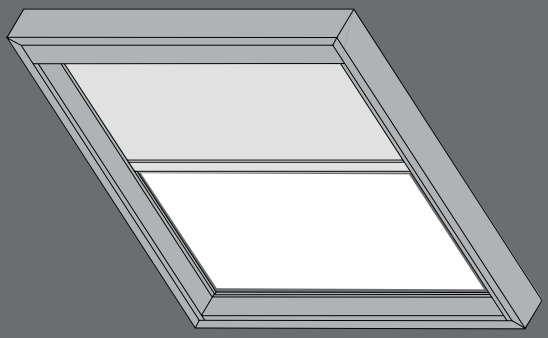
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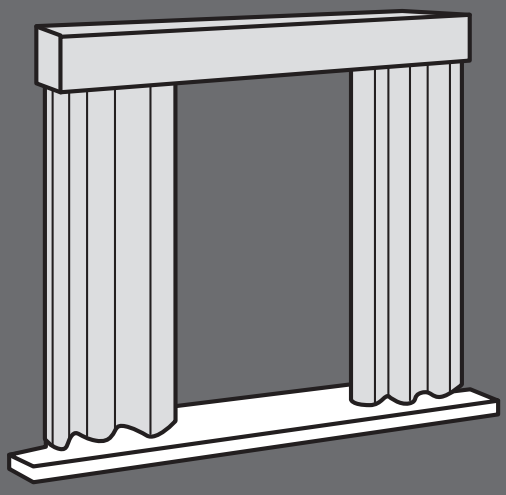
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Coopersburg, PA 18036-1299, U.S.A.

11/2016
P/N 045204 Rev C

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Sivoia® QS

wiring and programming guide

LUTRON®

Sivoia QS Drives are available for control of Draperies, Roller Shades and Tensioned Shades. *Sivoia QS* Shades and Draperies can be controlled as part of a *QS* System, incorporating *GRAFIK Eye QS* lighting controls, or as a *Shades/Draperies only* System, without lighting controls.

Sivoia QS Drives and Keypads are powered from a 24 V⎓ power supply. All drives, power supplies, keypads and other control devices are linked together with the same four wire communication link. This link provides 24 V⎓ to all components.

The Shades/Draperies can also be operated via an infrared Hand-Held Remote Control. These can be used in either a *GRAFIK Eye QS* Integrated System or *Sivoia QS* Standalone System. The IR remotes can move the Shade or Drapery to the open and close limit. They also provide the additional functions of storing and recalling a favorite preset, and setting open and close limits remotely.

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- Individual level adjust 14

Restoring defaults

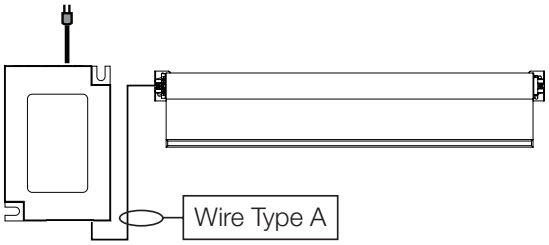
- Drive 15
- Keypad 16

Troubleshooting

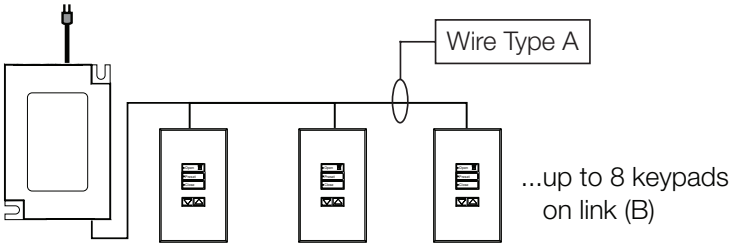
- Troubleshooting Chart 17

1 System Wiring Overview: QS Link Power Supply

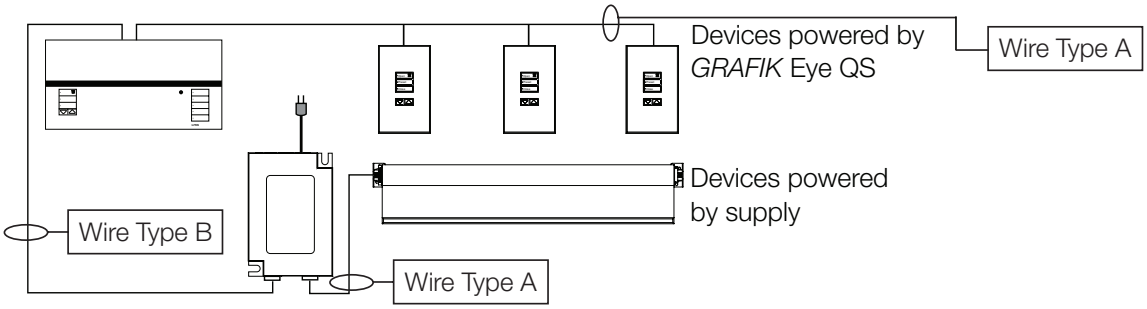
Example: Powering one shade / drapery drive unit
(max of one shade / drapery drive unit per output of a power supply)



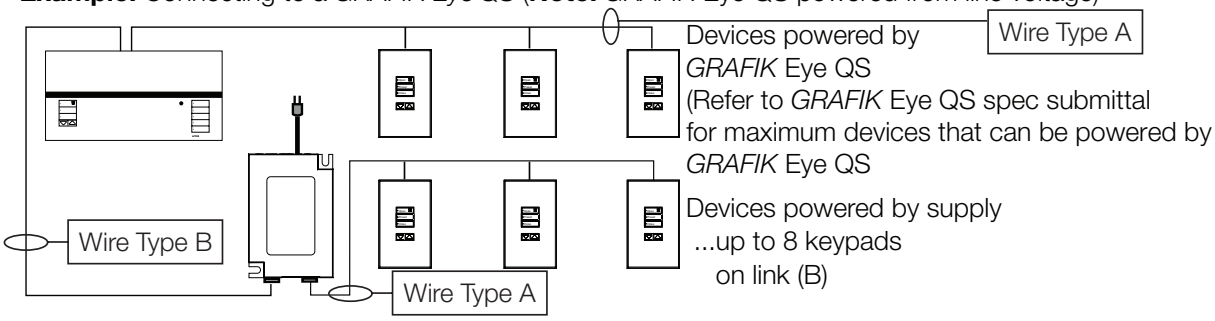
Example: Powering keypads



Example: Connecting to a *GRAFIK* Eye® QS (**Note:** *GRAFIK* Eye QS powered from line voltage)



Example: Connecting to a *GRAFIK Eye* QS (**Note:** *GRAFIK* Eye QS powered from line voltage)



Wiring Type Key

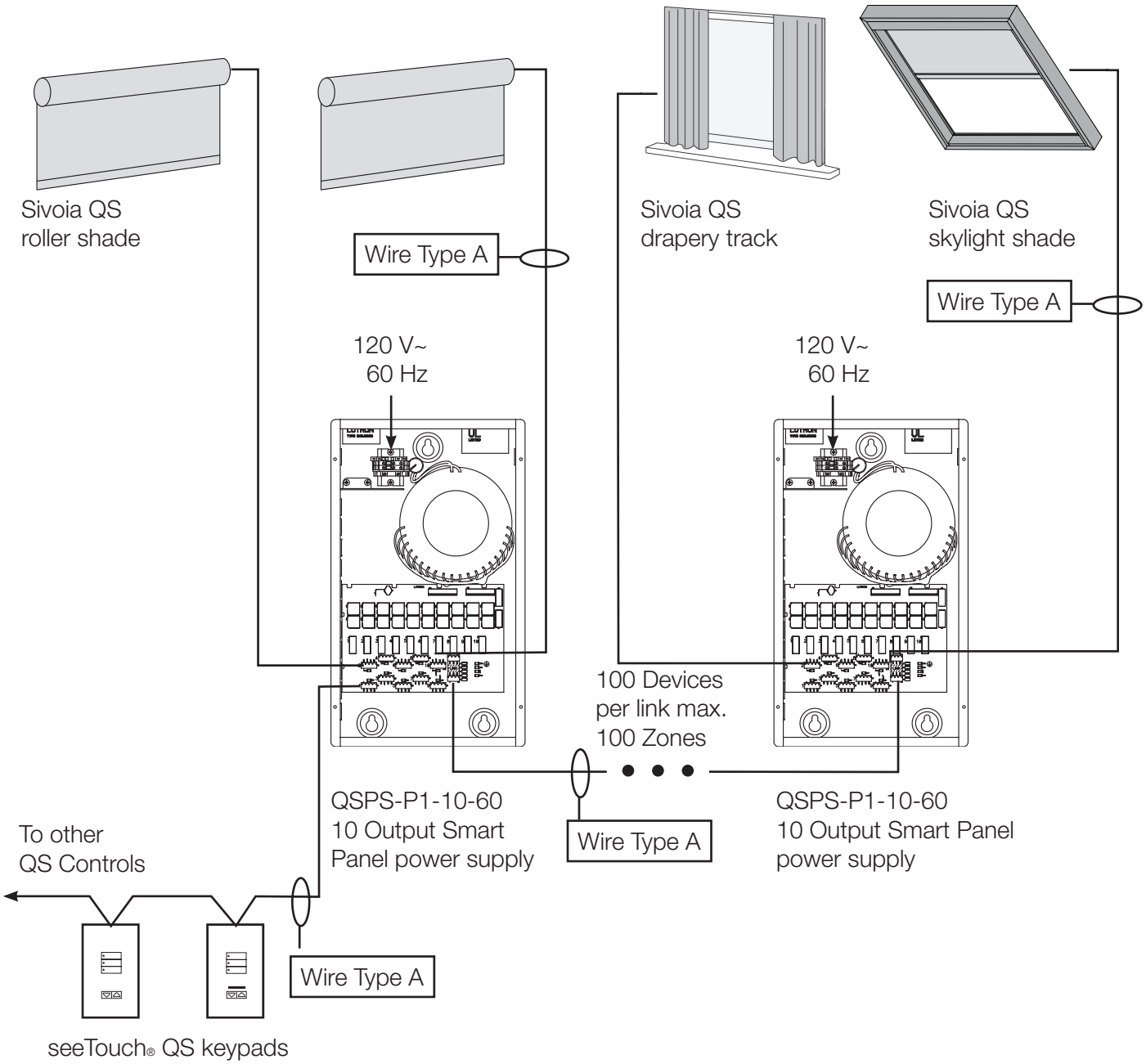
Type A Power and communication link (4 conductor)
Provides power and communication to QS shades or keypads
12-26 AWG (4-0.15 mm²) standard, twisted/shielded

Type B Communication link (3 conductor)
Communications used to connect power supplies to each other or to *GRAFIK* Eye QS
12-26 AWG (4-0.15 mm²) standard, twisted/shielded

Refer to wiring guide on pg 8 for wire gauge based on distance.

Note: Secondary wiring must be of type CL2, CL2P, CL2R, CL2X or other cable with equivalent or better electrical, mechanical, and flammability ratings in accordance with local and national electric code.

2 Sivoia QS System Wiring: Smart Panel power supply, single shade per output



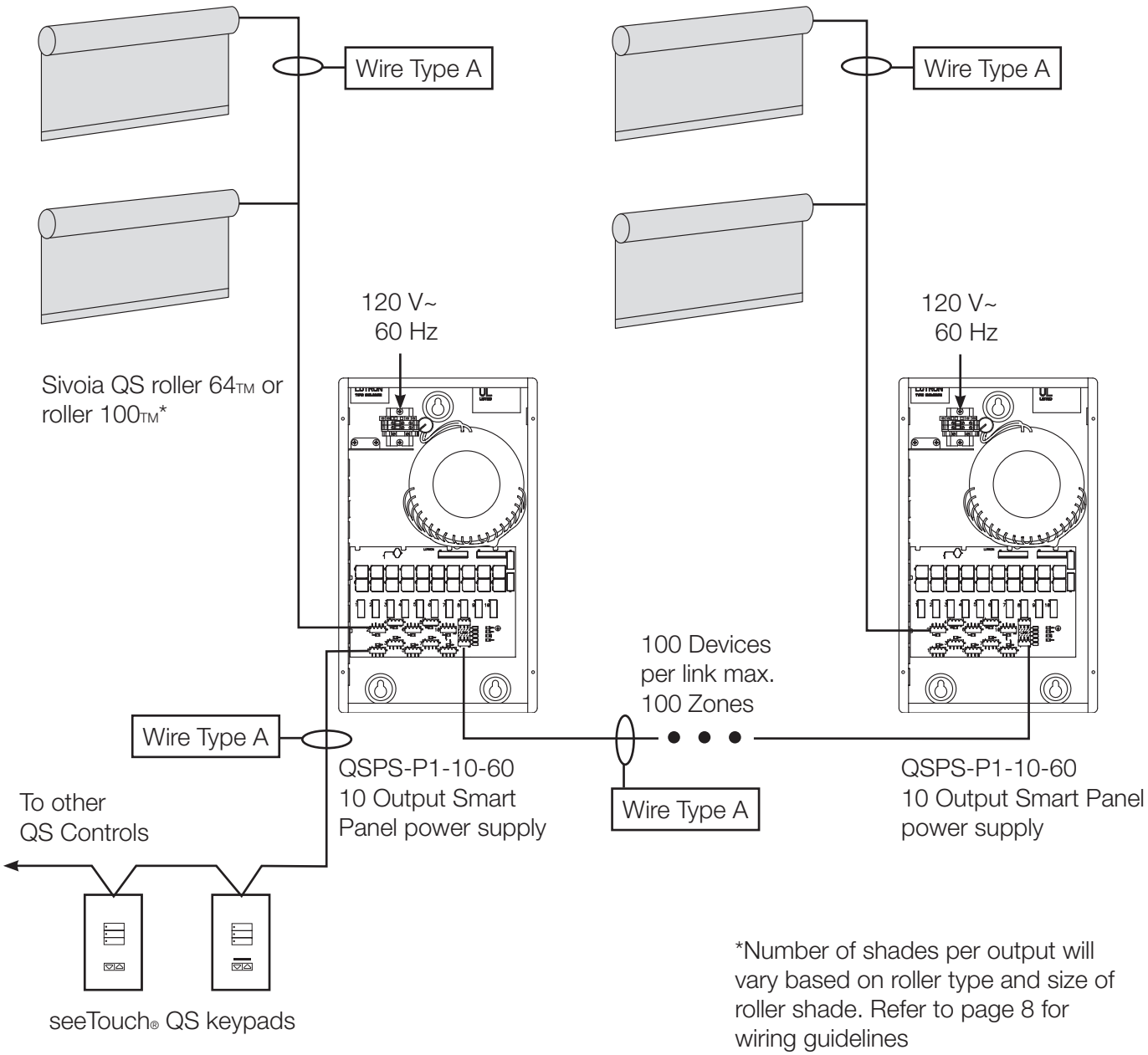
Wiring Type Key

Type A

Communications Link: 4 Conductor (twisted and shielded), listed for application
Refer to wiring guide on pg. 8 for wire gauge based on distance
Maximum comm. link: – Up to 2000 ft (600 m) connecting
all QSPS-P1-10-60 panels

Note: Secondary wiring must be of type CL2, CL2P, CL2R, CL2X or other cable with equivalent or better electrical, mechanical, and flammability ratings in accordance with local and national electric code.

3 Sivoia QS System Wiring: Smart Panel power supply, two shades per output*



*Number of shades per output will vary based on roller type and size of roller shade. Refer to page 8 for wiring guidelines

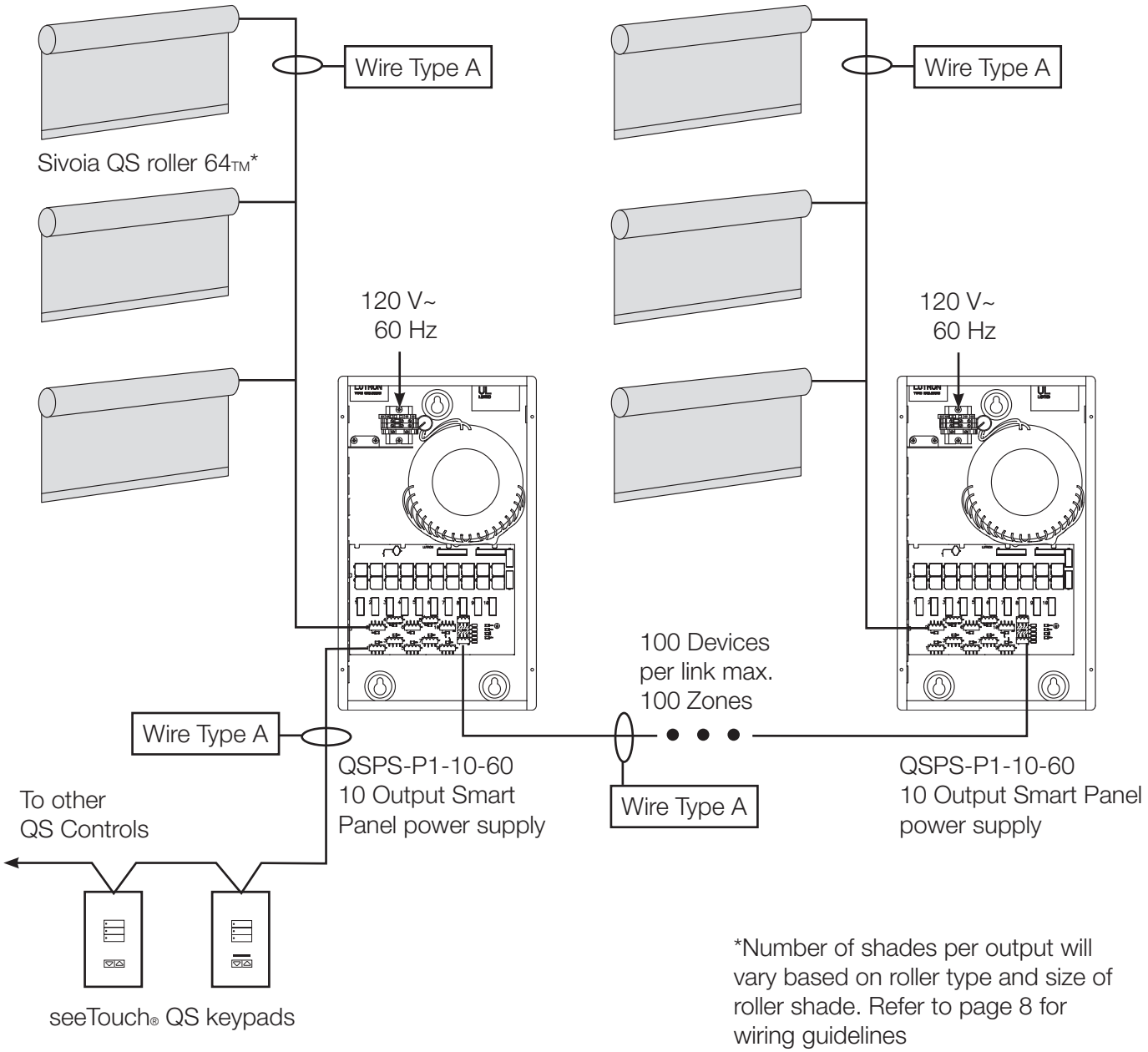
Wiring Type Key

Type A

Communications Link: 4 Conductor (twisted and shielded), listed for application
Refer to wiring guide on pg. 8 for wire gauge based on distance
Maximum comm. link: – Up to 2000 ft (600 m)
connecting all QSPS-P1-10-60 panels

Note: Secondary wiring must be of type CL2, CL2P, CL2R, CL2X or other cable with equivalent or better electrical, mechanical, and flammability ratings in accordance with local and national electric code.

4 Sivoia QS System Wiring: Smart Panel power supply, three shades per output*



*Number of shades per output will vary based on roller type and size of roller shade. Refer to page 8 for wiring guidelines

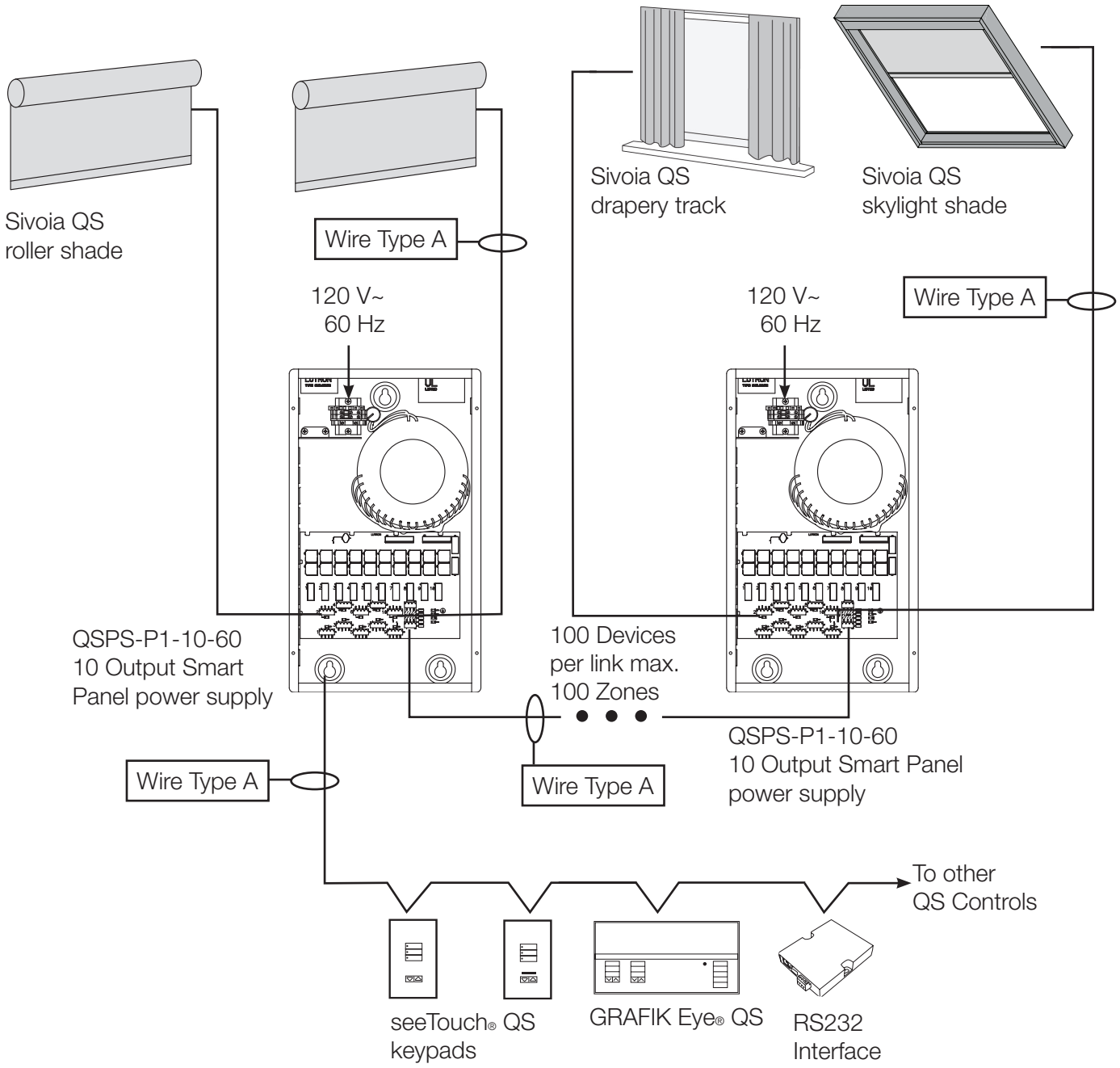
Wiring Type Key

Type A

Communications Link: 4 Conductor (twisted and shielded), listed for application
Refer to wiring guide on pg. 8 for wire gauge based on distance
Maximum comm. link: – Up to 2000 ft (600 m)
connecting all QSPS-P1-10-60 panels

Note: Secondary wiring must be of type CL2, CL2P, CL2R, CL2X or other cable with equivalent or better electrical, mechanical, and flammability ratings in accordance with local and national electric code.

5 Sivoia QS with GRAFIK Eye® QS System Wiring: Smart Panel power supply, single shade per output*



Wiring Type Key

Type A

Communications Link: 4 Conductor (twisted and shielded), listed for application
Refer to wiring guide on pg. 8 for wire gauge based on distance
Maximum comm. link: – Up to 2000 ft (600 m)
connecting all QSPS-P1-10-60 panels

Note: Secondary wiring must be of type CL2, CL2P, CL2R, CL2X or other cable with equivalent or better electrical, mechanical, and flammability ratings in accordance with local and national electric code.

6 Wire Length Chart

QS Smart Panel Power Supply Wiring Guide

Link Rules

- Maximum of 100 devices (such as GRAFIK Eye® QS, seeTouch® QS keypad, smart panel power supply, or Sivoia® QS shade/drapery drive unit)
- Maximum of 100 zones (such as Sivoia QS shade/drapery drive unit, or a lighting zone on a GRAFIK Eye QS)
- Maximum 2000 ft. (600 m) of cable connecting all smart panel power supplies
- Maximum 2000 ft. (600 m) of cable to devices wired from each smart panel power supply
- Only use cable with at least one twisted/shielded pair for communications

Use this chart to determine the number of shades and/or controls that can be run from one output on the Sivoia QS Smart Panel power supply, depending on the size of the shade. Then, verify the maximum cable length for the output configuration, based on the wire gauge that will be used.

Maximum devices per one output		Maximum distance per one output based on wire guage		
Shades + Controls		12 AWG 4 mm² QSH-CBL-L-500 QSH-CBLP-L-500	16 AWG 1.5 mm² QSH-CBL-M-500 QSH-CBLP-M-500	18 AWG 1 mm² GRX-CBL-346S-500
None	Up to 8 seeTouch QS keypads	1200 ft (350 m)	500 ft (150 m)	300 ft (90 m)
1 Sivoia QS shade/drapery drive unit	Up to 1 seeTouch QS keypad	500 ft (150 m)	200 ft (60 m)	125 ft (35 m)
2 Sivoia QS roller 64, ≤ 30 sq ft (2.75 sq m) each	None	200 ft (60 m)	75 ft (20 m)	50 ft (15 m)
3 Sivoia QS roller 64, ≤ 20 sq ft (1.80 sq m) each	None	200 ft (60 m)	75 ft (20 m)	50 ft (15 m)
2 Sivoia QS roller 100, ≤ 50 sq ft (4.6 sq m) each	None	200 ft (60 m)	75 ft (20 m)	50 ft (15 m)

QS Link Power Supply Wiring Guide

Link Rules

- Only use cable with at least one twisted/shielded pair for communications
- Total length of power supply link (A) wire plus device link (B) wire in entire system must be less than 2000 ft. (600 m)

Use this chart to determine the number of shades and/or controls that can be run from one QS Link power supply. Then, verify the maximum cable length for the output configuration, based on the wire gauge that will be used.

Maximum devices from one QS Link power supply		Total wire length based on wire gauge		
Shades + Controls		12 AWG 4 mm² QSH-CBL-L-500 QSH-CBLP-L-500	16 AWG 1.5 mm² QSH-CBL-M-500 QSH-CBLP-M-500	18 AWG 1 mm² GRX-CBL-346S-500
None	Up to 8 seeTouch QS keypads	1200 ft (350 m)	500 ft (150 m)	300 ft (90 m)
1 Sivoia QS shade*/drapery drive unit	Up to 1 seeTouch QS keypad	250 ft (75 m)	100 ft (30 m)	50 ft (15 m)

Note: Secondary wiring must be of type CL2, CL2P, CL2R, CL2X or other cable with equivalent or better electrical, mechanical, and flammability ratings in accordance with local and national electric code.

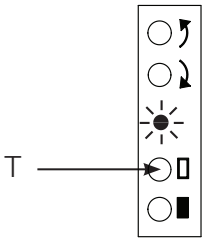
* 2 seeTouch QS keypads may be exchanged for 1 control interface (QSE-CI-NWK-E)

7 Setting Limits From the Drive

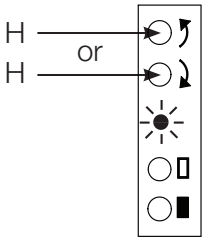
The open and close limits define the travel range of the shade or drapery. Limits can be set at the Drive, or from a keypad or an IR Remote previously assigned to that Drive. It is recommended that limits be set initially at the Drive.

Setting Open Limit

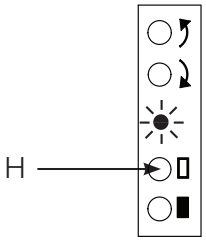
7.1 Tap Open Limit button. Green LED will turn on.



7.2 Move the Shade or Drapery to desired Open Limit by pressing arrow buttons.

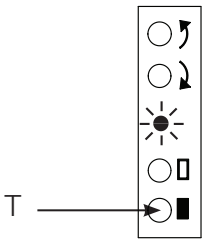


7.3 Press and hold the Open Limit button until the Green LED flashes. Open Limit is stored.

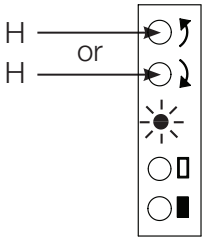


Setting Close Limit

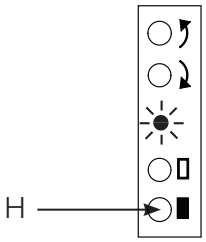
7.4 Tap the Close Limit button. The Green LED will turn on.



7.5 Move the Shade or Drapery to desired Close Limit by pressing arrow buttons.



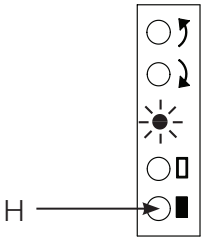
7.6 Press and hold the Close Limit button until the Green LED flashes. Close Limit is stored.



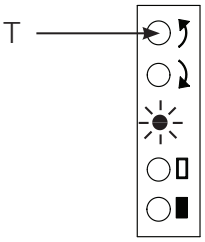
8 Verify Communication

From a Drive:

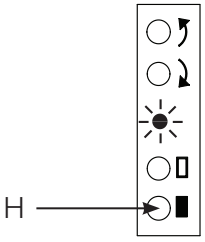
8.1 Press and hold Close (▮) for 5 seconds,



8.2 Tap CCW (↰) to enter Link Diagnostics mode
-All shades/draperies will wiggle*

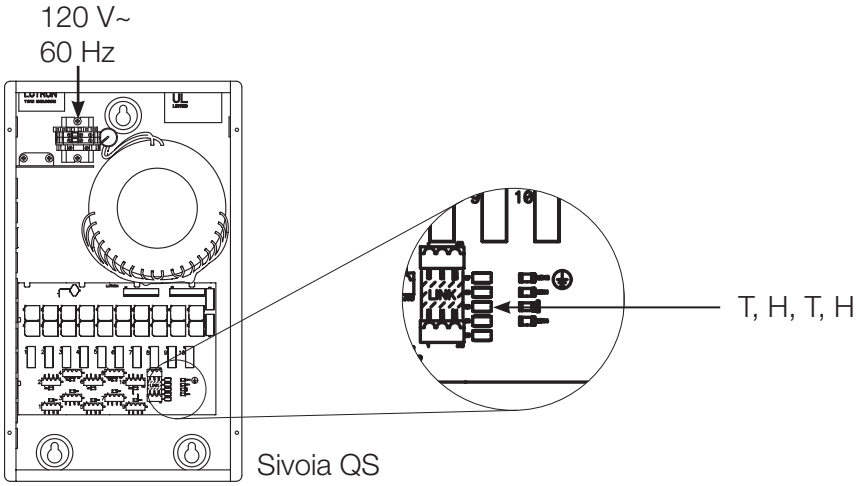


8.3 Press and hold Close (▮) to exit Link Diagnostics Mode.

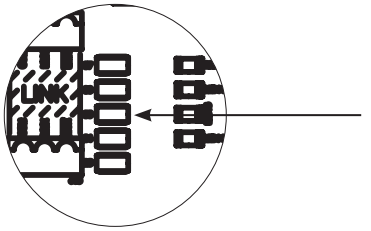


From the Sivoia QS Smart Panel:

8.4 Tap Open, hold Open 5 seconds., tap Open, hold Open 5 seconds.
- All shades/draperies will wiggle*



8.5 Press and hold Open 5 sec. to exit Link Diagnostics mode

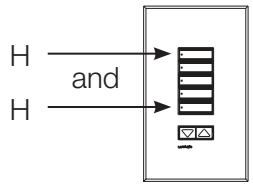


(*) If any shade/drapery is not wiggling, check the wiring

9 Assigning Shades/Draperies to Keypads

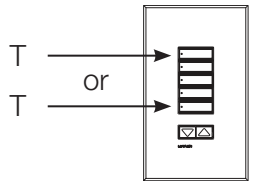
9.1

Press and hold Open and Close simultaneously for 5 seconds
-Shades/draperies that are assigned will move to close (down)
-Shades/draperies that are unassigned will move to open (up)



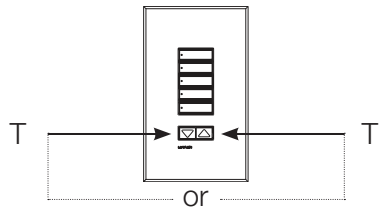
9.2

Tapping Open jogs “forward, Close jogs “backward” through the shades/draperies



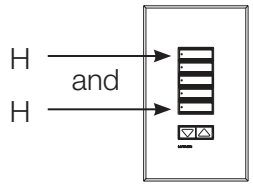
9.3

Tap the Lower (▽) to assign or Raise (△) to unassign a shade/drapery



9.4

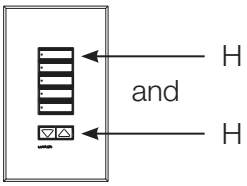
Press and hold Open and Close simultaneously for 5 seconds to exit



10 Setting Limits From a Keypad

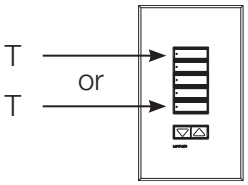
10.1

Press and hold Open and Raise (△) simultaneously for 5 seconds



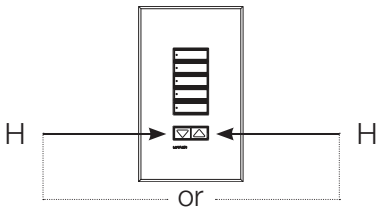
10.2

Tapping Open jogs “forward, Close jogs “backward” through the assigned shades/draperies



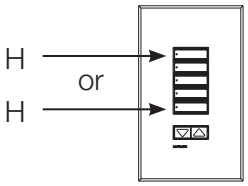
10.3

Use Raise (△) and Lower (▽) to adjust shade/drapery position



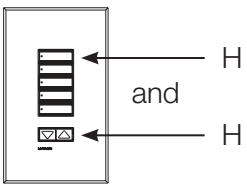
10.4

Press and hold Open for 5 seconds to store the open limit or Close for 5 seconds to store the close limit



10.5

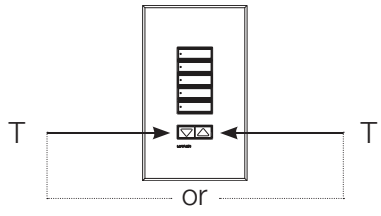
Press and hold Open and Raise (△) simultaneously for 5 seconds to exit



11 Storing Presets from a Keypad

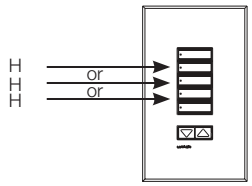
11.1

Adjust the shade/drapery to the desired position using raise or lower buttons.



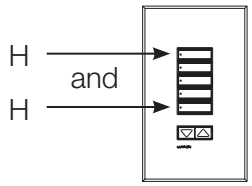
11.2

Store the current position of the shade/drapery by pressing and holding the desired Preset button for 5 seconds

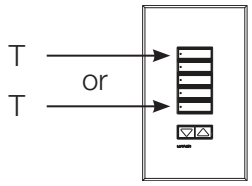


12 Individual Level Adjust

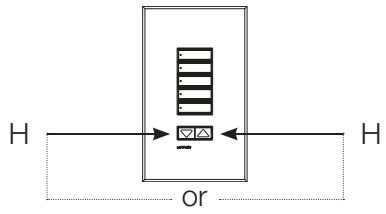
12.1 Press and hold Open and Close simultaneously for 5 seconds
-Shades/draperies that are assigned will move to close (down)
-Shades/draperies that are unassigned will move to open (up)



12.2 Tapping Open jogs “forward, Close jogs “backward” through the assigned shades/draperies

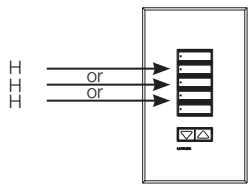


12.3 Use Raise (△) and Lower (▽) to adjust shade/drapery position

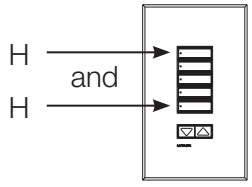


12.4 Repeat steps 12.2 & 12.3 to adjust additional shades/draperies

12.5 Store the current position of the shades/draperies by pressing and holding the desired Preset button for 5 seconds



12.6 Press and hold Open and Close simultaneously for 5 seconds to exit

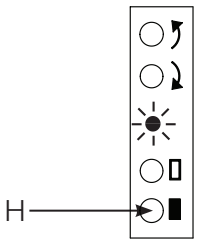


13 Programming | Restoring Drive Default Settings

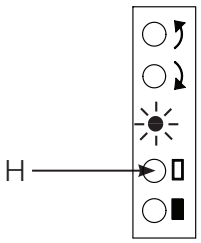
- Restoring a Drive to factory defaults will reset all keypad assignments but will not affect the open and closed limits.

Returning a Drive to its Factory Default Setting

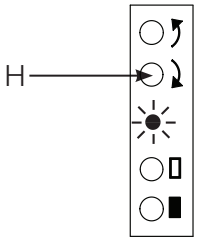
13.1 Press and hold Close Limit button until LED flashes Green then turns on steady.



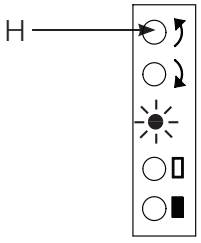
13.2 Press and hold Open Limit button until LED flashes Green then turns on steady.



13.3 Press and hold CW arrow button until LED flashes Green then turns on steady.



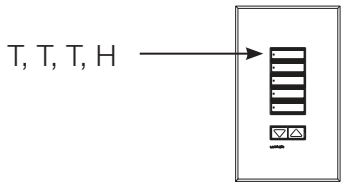
13.4 Press and hold CCW arrow button until LED flashes Green then turns on steady.



14 Programming | Restoring Keypad Default Settings

14.1

Triple tap and hold the top button on the keypad. DO NOT release the button after the third tap.

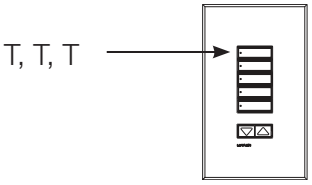


14.2

Keep the button pressed on the third tap until the LED next to the top button turns on solid (approximately 3 seconds).

14.3

Immediately release the button and triple tap it again. The LED next to the top button will flash quickly. When the LED stops flashing, the control has been returned to Factory Settings.



15 Troubleshooting

Symptom	Solution
Drive will not move	Drive is not powered - Check Drive power
	Fabric is obstructed - Free obstruction
	Drive not connected to keypad
Drive does not fully open or fully close	Limits have been set incorrectly - try using raise and lower buttons
	Fabric is obstructed - Free obstruction
Drive opens when pressing close button, and closes when pressing open button	Open and close limits have been reversed - Refer to “setting limits”
	Keypad wired incorrectly - Refer to wiring diagram
Drive does not move smoothly.	Check for binding of fabric
Keypad will not operate drive	Check that keypad is wired properly
IR controls will not operate shade, keypads work properly	IR transmitter does not have line of sight to IR receiver
	Out of range - Move to within 30 ft of IR receiver
Tripping fuse or breaker in power supply	Verify there is no obstruction in the path of the shade, drapery or carriers
	Verify the drapery stackback is not being over compressed
	Verify the Master Carrier is not driving into the idler end or adjacent Master Carrier

Limited Warranty

SCOPE

This limited warranty ("Warranty") covers the Lutron supplied (a) Sivoia Shade Systems ("Sivoia Shade Systems"), (b) manual shade system and (c) alternating current or a/c shade system (each of the foregoing being a "System"). Customer acknowledges and agrees that use of the System constitutes acceptance of all terms and conditions of this Warranty.

LIMITED WARRANTY

Subject to the exclusions and restrictions described below, Lutron warrants that each System will be free from manufacturing defects from the date of shipment by Lutron for a period of (a) one year as to the wall controls, interfaces and system accessories of the Sivoia Shade System ("External Sivoia Components") and (b) eight years as to the other Systems and the electronic drive unit, shade fabric and shade hardware of the Sivoia Shade System. If any manufacturing defect exists in the External Sivoia Components, so long as Customer promptly notifies Lutron of the defect within the one year warranty period and, if requested by Lutron, returns the defective part(s), Lutron will, at its option, either repair the defective part(s) or provide comparable replacement part(s). If any manufacturing defect exists in any of the components of a System other than the External Sivoia Components, so long as Customer promptly notifies Lutron of the defect within the eight year warranty period and, if requested by Lutron, returns the defective part(s), Lutron will, at its option, either repair the defective part(s) or issue a credit to the Customer against the purchase price of comparable replacement part(s) purchased from Lutron as provided below:

Number of Years from Date of Shipment	Percentage of Cost of Replacement Parts Credited by Lutron
Up to 2	100%
More than 2 but not more than 5	50%
More than 5 but not more than 8	25%
More than 8	0%

Replacement parts for the System provided by Lutron or, at its sole discretion, an approved vendor may be new, used, repaired, reconditioned, and/or made by a different manufacturer.

EXCLUSIONS AND RESTRICTIONS

This Warranty will be void, and Lutron and its suppliers will have no responsibility under this Warranty, if Lutron or its representatives cannot access any components of the System to inspect, diagnose problems with or repair the System or any of its components as a result of concealment or inaccessibility of such components within a building structure.

This Warranty does not cover, and Lutron and its suppliers are not responsible for:

1.Damage, malfunction or inoperability diagnosed by Lutron or a Lutron approved third party as caused by normal wear and tear, abuse, misuse, incorrect installation, neglect, accident, interference or environmental factors, such as (a) use of incorrect line voltages fuses or circuit breakers; (b) failure to install, maintain and operate the System pursuant to the operating instructions provided by Lutron and the applicable provisions of the National Electrical Code and of the Safety Standards of Underwriter's Laboratories; (c) use of incompatible devices or accessories; (d) improper or insufficient ventilation; (e) unauthorized repairs or adjustments or alterations; (f) vandalism; (g) an act of God, such as fire, lightning, flooding, tornado, earthquake, hurricane or other problems beyond Lutron's control; or (h) direct exposure to corrosive materials.

2.On-site labor costs to diagnose issues with, and remove, repair, replace, adjust, reinstall and/or reprogram the System or any of its components.

3.Components and equipment external to the System, such as, non-Lutron lighting and automation systems; building wiring audio-visual equipment; and non-Lutron time clocks, photosensors and motion detectors.

4.The cost of repairing or replacing other property that is damaged when any System does not work properly, even if the damage was caused by the System.

THIS WARRANTY IS IN LIEU OF ALL OTHER EXPRESS WARRANTIES. ALL IMPLIED WARRANTIES, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND OF FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO EIGHT YEARS FROM THE DATE OF SHIPMENT, EXCEPT THAT SUCH IMPLIED WARRANTIES ARE LIMITED TO ONE YEAR FROM THE DATE OF SHIPMENT AS TO THE EXTERNAL SIVOIA COMPONENTS.

NO LUTRON AGENT, EMPLOYEE OR REPRESENTATIVE HAS ANY AUTHORITY TO BIND LUTRON TO ANY AFFIRMATION, REPRESENTATION OR WARRANTY CONCERNING THE SYSTEMS. UNLESS AN AFFIRMATION, REPRESENTATION OR WARRANTY MADE BY AN AGENT, EMPLOYEE OR REPRESENTATIVE IS SPECIFICALLY INCLUDED HEREIN, OR IN STANDARD PRINTED MATERIALS PROVIDED BY LUTRON, IT DOES NOT FORM A PART OF THE BASIS OF ANY BARGAIN BETWEEN LUTRON AND CUSTOMER AND WILL NOT IN ANY WAY BE ENFORCEABLE BY CUSTOMER.

IN NO EVENT WILL LUTRON OR ANY OTHER PARTY BE LIABLE FOR EXEMPLARY, CONSEQUENTIAL, INCIDENTAL OR SPECIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO DAMAGES FOR PERSONAL INJURY, FAILURE TO MEET ANY DUTY, INCLUDING OF GOOD FAITH OR REASONABLE CARE, NEGLIGENCE, OR ANY OTHER LOSS WHATSOEVER), NOR FOR ANY REPAIR WORK UNDERTAKEN WITHOUT LUTRON'S PRIOR WRITTEN CONSENT ARISING OUT OF OR IN ANY WAY RELATED TO THE INSTALLATION, DEINSTALLATION, USE OF OR INABILITY TO USE THE SYSTEM OR OTHERWISE UNDER OR IN CONNECTION WITH ANY PROVISION OF THIS WARRANTY, EVEN IN THE EVENT OF THE FAULT, TORT (INCLUDING NEGLIGENCE), STRICT LIABILITY, BREACH OF CONTRACT OR BREACH OF WARRANTY OF LUTRON OR ANY OTHER PARTY, AND EVEN IF LUTRON OR SUCH OTHER PARTY WAS ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

NOTWITHSTANDING ANY DAMAGES THAT CUSTOMER MIGHT INCUR FOR ANY REASON WHATSOEVER (INCLUDING, WITHOUT LIMITATION, ALL DIRECT DAMAGES AND ALL DAMAGES LISTED ABOVE), THE ENTIRE LIABILITY OF LUTRON AND OF ALL OTHER PARTIES UNDER THIS WARRANTY ON ANY CLAIM FOR DAMAGES ARISING OUT OF OR IN CONNECTION WITH THE MANUFACTURE, SALE, INSTALLATION, DELIVERY, USE, REPAIR, OR REPLACEMENT OF THE SYSTEM, AND CUSTOMER'S SOLE REMEDY FOR THE FOREGOING, WILL BE LIMITED TO THE AMOUNT PAID BY CUSTOMER FOR THE SYSTEM. THE FOREGOING LIMITATIONS, EXCLUSIONS AND DISCLAIMERS WILL APPLY TO THE MAXIMUM EXTENT ALLOWED BY APPLICABLE LAW, EVEN IF ANY REMEDY FAILS ITS ESSENTIAL PURPOSE.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS. YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS OR THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU.

WARRANTY CLAIMS, TECHNICAL ASSISTANCE AND WARRANTY INFORMATION

Contact the Lutron Technical Support Center at the numbers provided below or your local Lutron sales representative with questions concerning the installation or operation of the System or this Warranty, or to make a warranty claim. Please provide the exact model number when calling.

USA and Canada (24 hrs/7days)
(800) 523-9466
Other countries (8 a.m. – 8 p.m. ET)
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Toll Free: 1.888.LUTRON
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WEB: www.lutron.com/shadingsolutions

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P/N 045-314 REV. A

Lutron Electronics Co., Inc.
SHADING SOLUTIONS – Eight Year Limited Warranty

English

SCOPE

This limited warranty ("Warranty") covers the Lutron® supplied (a) Serena™ Shades, (b) Sivoia® Shade Systems ("Sivoia Shade Systems"), (c) manual shade system and (d) alternating current or a/c shade system (each of the foregoing being a "System"). Customer acknowledges and agrees that use of the System constitutes acceptance of all terms and conditions of this Warranty.

LIMITED WARRANTY

Subject to the exclusions and restrictions described below, Lutron warrants that each System will be free from manufacturing defects from the date of shipment by Lutron for a period of (a) one year as to the wall controls, interfaces and system accessories of the Shade System ("External Components") and (b) eight years as to the other Systems and the electronic drive unit, shade fabric and shade hardware of the Shade System. If any manufacturing defect exists in the External Components, so long as Customer promptly notifies Lutron of the defect within the one year warranty period and, if requested by Lutron, returns the defective part(s), Lutron will, at its option, either repair the defective part(s) or provide comparable replacement part(s). If any manufacturing defect exists in any of the components of a System other than the External Components, so long as Customer promptly notifies Lutron of the defect within the eight year warranty period and, if requested by Lutron, returns the defective part(s), Lutron will, at its option, either repair the defective part(s) or issue a credit to the Customer against the purchase price of comparable replacement part(s) purchased from Lutron as provided below:

Number of years from date of shipment	Percentage of cost of replacement parts credited by Lutron
Up to 5	100%
More than 5 but not more than 8	50%
More than 8	0%

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the applicable provisions of the National Electrical Code and of the Safety Standards of Underwriter's Laboratories; (c) use of incompatible devices or accessories; (d) improper or insufficient ventilation; (e) unauthorized repairs or adjustments or alterations; (f) vandalism; (g) an act of God, such as fire, lightning, flooding, tornado, earthquake, hurricane or other problems beyond Lutron's control; or (h) direct exposure to corrosive materials.

2. On-site labor costs to diagnose issues with, and remove, repair, replace, adjust, reinstall and/or reprogram the System or any of its components.
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MANUFACTURE, SALE, INSTALLATION, DELIVERY, USE, REPAIR, OR REPLACEMENT OF THE SYSTEM, AND CUSTOMER'S SOLE REMEDY FOR THE FOREGOING, WILL BE LIMITED TO THE AMOUNT PAID BY CUSTOMER FOR THE SYSTEM. THE FOREGOING LIMITATIONS, EXCLUSIONS AND DISCLAIMERS WILL APPLY TO THE MAXIMUM EXTENT ALLOWED BY APPLICABLE LAW, EVEN IF ANY REMEDY FAILS ITS ESSENTIAL PURPOSE.

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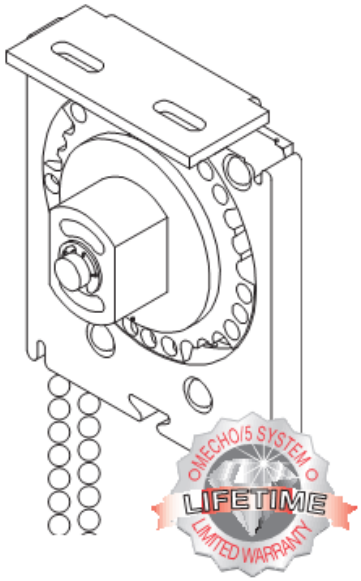
The MechoShade® Manual Drive System

Mecho®/5

Mecho®/5, MechoShade's latest patented design featuring an overrunning clutch, self lubricating components and larger diameter sprocket, providing 67% more lift capacity. As a result, Mecho/5 increases the shade size range that a manual drive system can lift before motorization is required. Plus, the Mecho/5 carries a **Lifetime*** Limited Warranty on the hardware and shadecloth.

Mecho/5 requires no adjustments, resulting in faster, easier installation. Mecho/5 has been field tested and performance proven on hundreds of thousands of shades installed worldwide. Available in Standard, Pocket Extended, Extended and DoubleShade® bracket sizes.

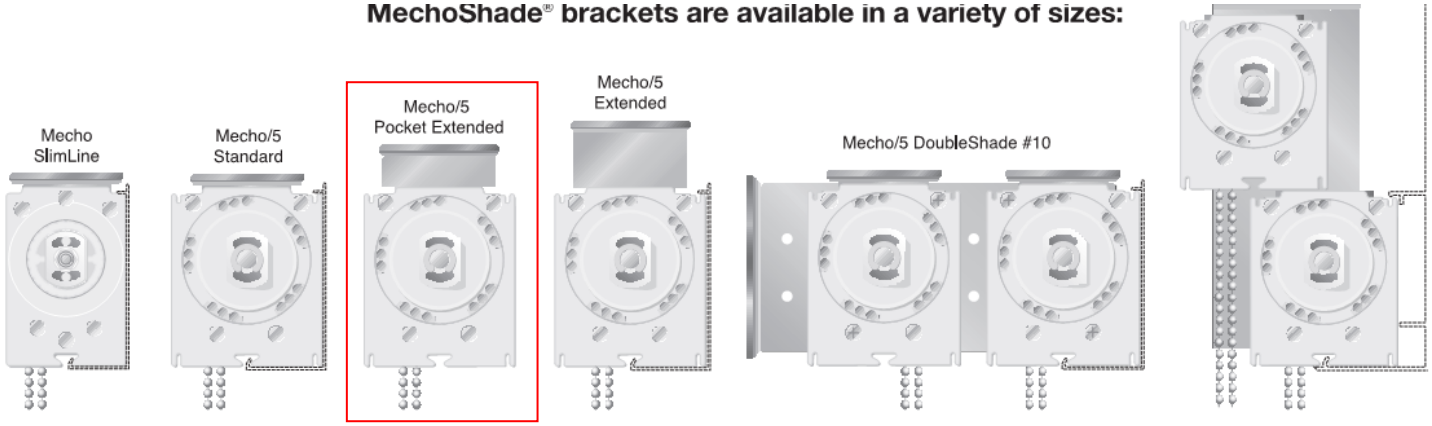
The Mecho/5 can accommodate shades up to 126" (320cm) wide by 180" (457cm) high.



Mecho® SlimLine™:

SlimLine™ is MechoShade's compact heavy-duty bracket system designed for small shades in narrow spaces, uses the Mecho®/3 operating system and carries a 10-Year Limited Warranty† on the hardware and shadecloth.

MechoShade® brackets are available in a variety of sizes:



Bracket Type			Max. Roll Diameter With Fascia	Max. Roll Diameter Without Fascia	Bracket Dimensions Without Optional Fascia, Roll Up Diameter or Wall Mount Bracket
Mecho® SlimLine™			2-1/4" (57mm)	2-3/4" (70mm)	2-3/8" (60mm) W x 3-3/4" (95mm) H
Mecho®/5 Standard			2-3/4" (70mm)	2-3/4" (70mm)	3" (76mm) W x 3-3/4" (95mm) H
Mecho®/5 Pocket Extended			N/A	4" (102mm)	3" (76mm) W x 4-3/8" (111mm) H
Mecho®/5 Extended			3-7/16" (87mm)	5" (127mm)	3" (76mm) W x 4-13/16" (122mm) H
Mecho®/5 DoubleShades®					
#10	Rear shade	Blackout	2-3/4" (70mm)	2-3/4" (70mm)	7-1/2" (191mm) W x 3-3/4" (95mm) H
#10	Front shade	Sunscreen	2-3/4" (70mm)	2-3/4" (70mm)	
#15	Top shade	Blackout	2-3/4" (70mm)	3-3/8" (86mm)	4-5/16" (110mm) W x 7-9/32" (185mm) H
#15	Bottom shade	SunScreen	2-3/4" (70mm)	4-5/16" (110mm)	

*Mecho/5 Lifetime Limited Warranty: for the life of the interior project, not to exceed 25 years. See pages 2.26 – 2.28 for specific details.

† See pages 2.26 – 2.28 for details.

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42-03 35th Street, Long Island City, NY 11101
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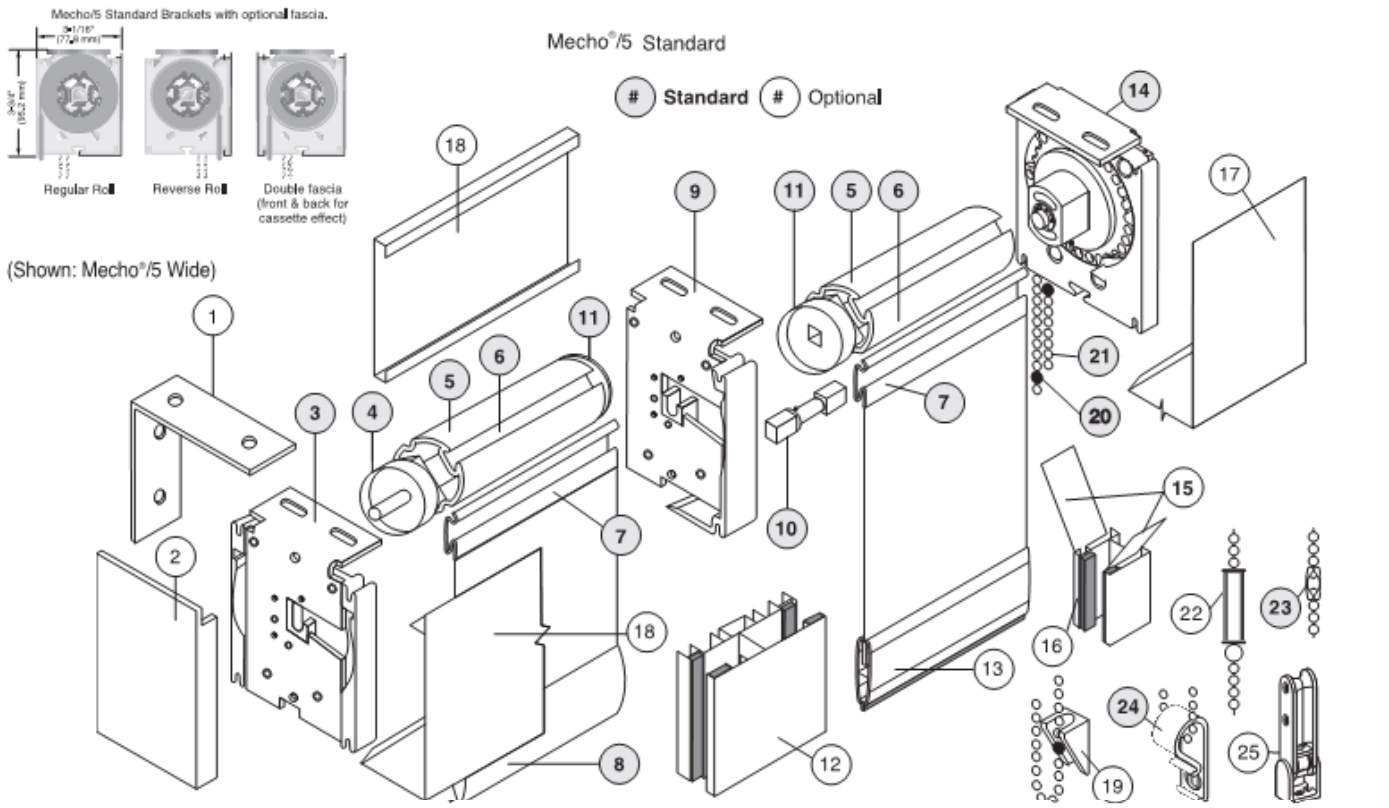
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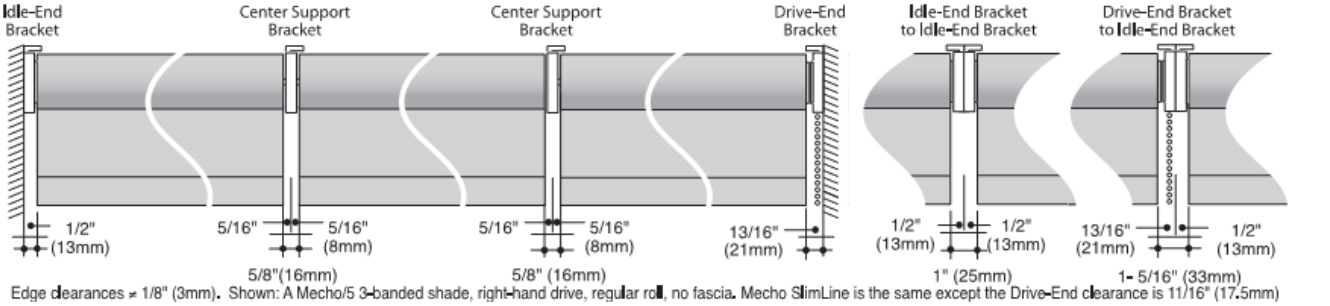
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MechoShade® Parts, Components and Optional Accessories

Multiband MechoShade® exploded view and edge clearances



Edge clearances



Edge clearances = 1/8" (3mm). Shown: A Mecho/5 3-banded shade, right-hand drive, regular roll, no fascia. Mecho SlimLine is the same except the Drive-End clearance is 11/16" (17.5mm)

MechoShades are available in a choice of two drive systems in multiple bracket sizes.

1. Wall-Mount Angle
2. Fascia End Caps
3. Idle-End Bracket
4. Tube Plug (idle-end)
5. SnapLoc® Tube
6. SnapLoc Spline Mounting Channel
7. Snaploc Spline
8. Hembar (standard cloth covered)
9. Center Support Bracket
10. Tube Connector ("dog bone")
11. Tube Plug (Center Support)
12. Room Darkening Center Channel (double) (with Polybond Light Seal)
13. Exposed Hembar with Light Seal (Shown with Optional Welt)
14. Mecho®/5 Drive-End Bracket
15. Room Darkening Shadecloth Guides (pair)
16. Room Darkening Side Channel (single) (with Polybond Insert)
17. SnapLoc Regular-Roll Fascia
18. SnapLoc Reverse-Roll Fascia
19. Bead Chain Keeper
20. Upper and Lower Bead Chain Stops
21. Drive Chain (stainless-steel bead chain)
22. Heavy-Duty Bumper
23. Bead Chain Connector
24. Chain Retainer*
25. Optional Spring Loaded Chain Retainer*

Aluminum Accessory Finishes: Clear Anodized, White, Grey, Black, Quaker Bronze (Duranodic color) and Colonial White (fascia only)

*** Chain Retainers included for all residential and public facilities.**

Optional Regular-Roll Fascia available for: Mecho/5 Standard and Extended brackets and Mecho SlimLine™ brackets.
Optional Reverse-Roll Fascia available for: Mecho/5 Standard brackets. • No Fascia Available: Mecho/5 Pocket brackets.
For Edge Clearances of specific brackets see the last section of this binder.

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Internet Web Site: www.mechoshade.com

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Maintenance Guide for MechoShade® and ElectroShade® Systems

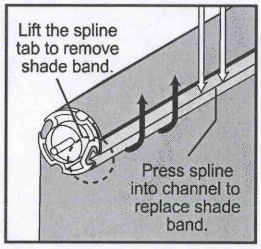
Shadecloth Maintenance

The shadecloth is washable and it is recommended that the shadecloth be cleaned annually. To maintain the shadecloth properly, use a static eliminating chemical on a dry mop to occasionally wipe down the fabric and free it from dust. If the shadecloth should become spotted for any reason, such as from grease, etc., simply use a mild soap to "spot" clean.

MechoShade System

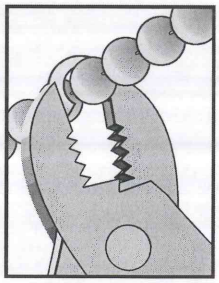
Changing the shadecloth on manually operated shades

Remove the top stop bead and then lower the shade so that the SnapLoc® Spline is visible. The spline, which is welded to the top of the shade cloth, can be removed from the tube by pulling the spline back towards the shade band so that it pops out of the channel a little at a time. A new shade band is easily inserted by centering the shade band left to right on the tube and pressing the spline into the channel. NOTE: Be sure that the winding direction of the shade band, toward or away from the window, is the same as when originally installed. The top stop bead is then reset at its initial position.



MechoShade Brackets and Chain Maintenance

Shade brackets require no maintenance other than the rare repair of a broken chain. If the chain breaks, it can be repaired by splicing with a chain connector or invisibly spliced by utilizing a pair of bead-chain splice pliers. If new chain is required, the length you require is twice the height of the unit less 2 inches. The chain is inserted into the bottom channel of the drive end bracket and led around the sprocket. To guide the chain into the offset-position slot, insert a thin plug into the chain slot to be bypassed. To attach one end of the chain to the other use a clasp which MechoShade Systems supplies. New bead stops should be placed in the same positions on the new chain.



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MechoShade® Lifetime Limited Warranty Announcement

One of the best reasons to specify MechoShade is its LIFETIME*of dependability.



Introducing the MechoShade® and ElectroShade® System Lifetime* Limited Warranty.

We are so confident about the quality and dependability of our Manual and Motorized Shading Systems that we gave them a LIFETIME* Limited Warranty. MechoShade Systems, Inc. warrants to original purchasers that the hardware and shade cloths of dependable service of its Mecho/5™ Manual Shade System and ElectroShade Motorized Shade System (interior use products) are free of manufacturing defects in factory materials or workmanship for a LIFETIME*.

LIFETIME* Limited Warranty is defined to be the life of the project for which it was originally purchased, not to exceed 25 years from the date of shipment. This warranty does not depreciate in value.

See full warranty details on page 2.27 – 2.28.

Continued ☞

MechoShade Systems, Inc.
42-03 35th Street, Long Island City, NY 11101
Telephone: 718-729-2020
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E-mail: info@mechoshade.com
Internet Web Site: http://www.mechoshade.com

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MechoShade® Lifetime Limited Warranty (Non-Depreciating)



LIMITED WARRANTY
(interior product use)

MechoShade Systems, Inc. warrants to original purchasers that its Interior Use Products are free of manufacturing defects in factory materials or workmanship for the specified warranty period.*

- ThermoVeil®, EuroVeil®, Faux Natural™, EuroTwill™, Equinox™ and Soleil® brand **shadecloths** on the associated MechoShade®, ElectroShade®, or Suburban™/2 brand shade systems are warranted to be free of manufacturing defects in factory materials or workmanship for the specified warranty period.
- MechoShade®, ElectroShade®, SlimLine™ and Suburban™/2 brand **hardware** are warranted to be free of manufacturing defects in factory materials or workmanship for the specified warranty period.
- ElectroShade® Motors and Controls are warranted to be free of manu facturing defects in factory materials or workmanship for 5 years from date of shipment.
- Hardware and shadecloths have a Lifetime Warranty not to exceed 25 year from the date of shipment.
- All Limited Warrantees are subject to the general terms and conditions of sale. Copies are available upon request.

All in accordance with MechoShade Systems, Inc. Warranty General Terms and Conditions. The MechoShade Limited Warranties are exclusive and in lieu of all other warranties, whether written, oral or implied (including any implied warranty of merchantability, fitness for a particular purpose, or otherwise).

MechoShade®/5 System*



Lifetime Limited Warranty
to original purchasers on all hardware and shade cloths for the life of the interior project for which it was originally purchased, not to exceed twenty-five years.

MechoShade® SlimLine™ System*



10-Year Limited Warranty
to original purchasers on all hardware and shade cloths.

ElectroShade® System*

Lifetime Limited Warranty
to original purchasers on all hardware and shade cloths for the life of the interior project for which it was originally purchased, not to exceed twenty-five years.



5-Year Limited Warranty
on Motors and Electronics to be free of manufacturing defects in factory materials or workmanship for 5 years from date of shipment.

Suburban™/2 System*



10-Year Limited Warranty
to original purchasers on all hardware and shade cloths.



A 5-Year Limited Warranty
for motors and electronic controls.

Continued ☞

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2.27
MS2200 - 01/01/08

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MechoShade Systems'® Warranty General Terms and Conditions

From the Warranty portion of the MechoShade Systems, Inc. General Terms and Conditions of Sale

(INTERIOR USE PRODUCTS)

VII. WARRANTY

MechoShade Systems, Inc. MSS warrants to the original purchaser that its products are free of manufacturing defects in factory materials or workmanship for the following specified warranty periods:

Hardware and ShadeCloth (interior use):

- Lifetime of the interior project for which it was originally purchased, from date of shipment for the Mecho®/5 and ElectroShade Systems, but not to exceed 25 years.
- 10 years from date of shipment for the Mecho SlimLine System.
- 10 years from date of shipment for the Suburban™/2 System.

Electrical and Electronic Accessories:

- 5 years from date of shipment for ElectroShade products.
- 1 year from date of shipment for Suburban/2 products.

Bead chain in the manual system is a fail safe element and is not warranted.

Monumental Shades:

MechoShade Warrantee for Monumental Shades shall be limited to 10 years for hardware and shadecloth; 5 years for motors and electronics. Monumental Shades are defined to be any shade band over 300 Sq. ft. and shall be wider than 20 ft. and/or higher than 30 ft.

If any part of a MSS product (except for images or artwork on shadecloths) is found in the reasonable judgment of MSS to be defective in factory materials or workmanship during the above-prescribed warranty periods, MSS will repair or replace the defective part at its option. Repair or replacement under this warranty does not include labor or costs for installation, reinstallation, or removal of MechoShade products, parts or components. This warranty extends only to the original purchaser for MSS products installed by an authorized MechoShade dealer representative with a valid written dealer representative agreement with MechoShade® Systems, Inc.

This warranty does not apply if any of the following exclusions exist:

- The product has been subject to misuse, abuse, neglect, negligence, accident, or has been operated in any way contrary to MSS's operating instructions or specifications.
- Damages or conditions that have resulted from improper cleaning, maintenance, care or repair of the product.
- The product has been improperly installed or not installed according to MSS's guidelines or specifications.
- MSS's written instructions for installation and wiring of electrical connections were not followed.
- The product has been used to perform functions or operated in a manner contrary to its design or otherwise is used in a manner contrary to or in excess of MSS's specifications, drawings, or instructions.
- The product is used with electrical accessories or parts, including switches, relays, or other accessory components, that have not been previously approved in writing by the MSS Engineering Department.
- If any electrical accessories and other components have been used in disregard to the basic wiring diagram for which they were designed.
- Failure to comply with all MSS's written instructions and specifications.
- Repairs made necessary from normal wear of the product or by use of parts or accessories which are either incompatible with the product or otherwise adversely affect its operation, performance, or durability.
- Product used for non interior applications or otherwise exposed to outdoor environmental conditions.

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This warranty gives the original purchaser specific legal rights, and the original purchaser may also have other rights which vary from state to state.

For a copy of our General Terms and Conditions of Sale, please see the last section of this binder or contact MechoShade Systems, Inc.

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CARE & MAINTENANCE

Easier to maintain than other stone surface materials, such as granite, Viatera® will provide years of captivating beauty and hygienic reassurance. Please review the following section to ensure you get the most out of your Viatera Quartz countertops.

DESIGNER FAVORITES



HI-MACS

REGULAR CLEANING

Viatera is resistant to most stains including wine, lemon juice, tea, coffee, and fruits and vegetables. Normal cleaning only requires the use of a damp cloth and a mild household detergent. For best results, clean spills as soon as possible.



STAINS & SPILLS

While Viatera is stain-resistant, some stains might be more difficult to remove than others. For tough stains, mild non-abrasive cleansers are a good solution to restoring your surface?s original appearance.

- For dried spills, a non-abrasive scrub pad can be used. Rinse thoroughly and wipe with a damp cloth to remove all residue.

- For tough spots made by substances such as paint, gum, grease or food, carefully use a razor blade to scrape away the residue prior to cleaning. The scraping may leave a grey metal mark on the surface and can easily be cleaned off us a recommended cleanser and non-abrasive pad. Buff with a damp cloth.

- For stubborn spots or stains, apply a pad of soaked paper towels and approved cleanser to the area and allow it to sit for a few minutes. After proceed with necessary cleaning methods and buffing.

DARK COLORS AND HONED FINISHES

Honed finishes require more frequent cleaning to maintain their appearance. Metal marks, fingerprints and other signs of daily wear will be more apparent. The removal of visible marks such as these can be easily performed using a non-abrasive pad and any of the recommended cleaning products listed on this page.

Under ordinary use, dark colors will show dirt, dust, rubs, fingerprints and watermarks more readily than lighter-colored surfaces. Naturally, these colors will require more maintenance and upkeep to maintain their appearance.

VIATERA IS NOT INDESTRUCTIBLE!

Viatera is one of the toughest countertop surfaces available, but there are a few things that can damage it. Avoid contact with harsh chemicals or solvents, especially those containing trichlorethane or methylene chloride, found in car batteries, furniture strippers, oven cleaners, as well as products containing bleach. These substances can cause permanent discoloration and surface damage. In the event any of these agents come in contact with the surface, wipe immediately, rinse with water, and then clean with vinegar-based cleaner. If stain persists, contact the supplier/installer of your Viatera surface.

area.

Excessive/prolonged heat can damage your Viatera surface — always use a trivet between the countertop and any hot pan or heat source. While Viatera is scratch-resistant, materials harder than quartz can scratch it. For example, the bottom of some ceramic dishes may be abrasive enough to inflict minor damage to the surface. Also, be aware that Viatera can be chipped or cracked if it is heavily impacted.

THE FOLLOWING ARE RECOMMENDED BLEACH-FREE, NON-ABRASIVE COMMERCIAL CLEANERS FOR THE ROUTINE CARE AND MAINTENANCE OF YOUR VIATERA QUARTZ SURFACE:

- Simple Green® lime-scale remover
- Vinegar cleaner (diluted)
- Bar Keeper's Friend®
- Formula 409® Glass and Surface Cleaner
- Lysol®
- Greased Lightning®

HI-MACS

SEE THE LG HAUSYS LINE OF SOLID SURFACE PRODUCTS: HI-MACS

HI-MACS

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CARROLL
SEATING • SCIENCES • SCHOOLS • SERVICE

CLOSEOUT DOCUMENTS

Project:

Webster University Interdisciplinary Science Building (ISB)

Fixed Seating Package

(CS404003)

Contractor / Owner Issued To:

Paric Corporation

(15051)

Substantial Completion:

August 7, 2017

ROUTINE CARE AND CLEANING

LAMINATE:

To clean the surface, use a damp cloth or sponge and a mild soap or detergent. Difficult stains such as coffee or tea can be removed using a mild household cleaner and baking soda; mixing to achieve a paste consistency. Use a stiff nylon bristle brush, scrubbing (approx. 15-20 strokes) the affected area. Do not scrub so as to mar (damage, scratch) the surface finish.

Stubborn stains that resist any of the above cleaning methods may require the use of undiluted household bleach or nail polish remover. Use a cotton ball saturated with bleach or nail polish remover (acetone); gently rub the stain for up to two minutes. Rinse thoroughly with warm water and wipe dry using a soft cloth. This step may be repeated if the stain appears to be going away and the color of the laminate has not been affected.

WARNING: Prolonged exposure of the laminate and powder coat surfaces to bleach will cause discoloration. Always rinse laminate and powder coat surfaces after cleaning! Failure to rinse after cleaning can cause damage; even if a small amount of cleaning solution remains on the surface. A dry residue may be invisible; however, moisture from cups or drinks can reactivate it, and result in permanently etched scars or stains over time.

Recommended Household Cleaners:

- Clorox®*
- Formula 409®
- Dawn®
- Glass Plus®
- Dow Bathroom Cleaner with Scrubbing Bubbles™
- Fantastik®
- Favor®
- Windex®
- Lestoi®
- Pledge®
- Grease Relief®
- Lysol® Brand Disinfectant Basin/Tub/Tile Cleaner
- Mr. Clean®
- TOP JOB®

* Prolonged exposure can mar the surface

A Few Notes of Caution:

Acidic or **abrasive** cleaners can damage laminate and powder coat surfaces; do not use them. Drain cleaners containing lye will permanently damage the laminate surface. If you spill a drain cleaner, wipe it up immediately and rinse several times with water.

Hair, textile and food **dyes** can cause permanent stains. If dye should happen to spill, wipe it up immediately with dishwashing detergent or an all-purpose cleaner.

Wipe spills away promptly and rinse several times with water.

Rust removers contain harsh chemicals, which will quickly cause permanent damage. If a spill occurs, wipe off all residues immediately, wash thoroughly with soapy water and rinse several times.

Steel wool and other abrasive pads will damage the laminate and powder coat face. Do not use them for cleaning and don't store steel wool pads on your countertop; the metal can rust and leave stains.

Toilet bowl cleaners contain harsh chemicals that can cause permanent damage. If spills occur, wipe up immediately, wash surface with soapy water and rinse several times.

The cleaners listed below can cause damage to the surface of laminate:

Chemical Ingredient	Synonymous Names
Hydrochloric Acid	Muriatic Acid Hydrogen Chloride
Sulfuric Acid	Oleic Acid Oil of Vitriol Oleum
Hydrofluoric Acid	Rust Remover
Phosphoric Acid	Rust Remover
Sodium Hydroxide	Caustic Soda Caustic Lye Soda Lye
Pumice (abrasive)	

Remember, sharp objects can damage the surface of laminate and powder coat surfaces, marring its beauty and lowering wear and stain resistance. Although the laminate and powder coat surfaces are somewhat resistant to scratch and marring, they can be damaged, even under normal use.

Laminate and powder coat surfaces may need occasional dusting depending on where it's used. To keep the surface beautiful, use a non-oily furniture spray. (Remember to clean the spray off several times a year to prevent build-up.) Furniture polish can also help hide fine scratches in the surface.

UPHOLSTERED FABRIC:

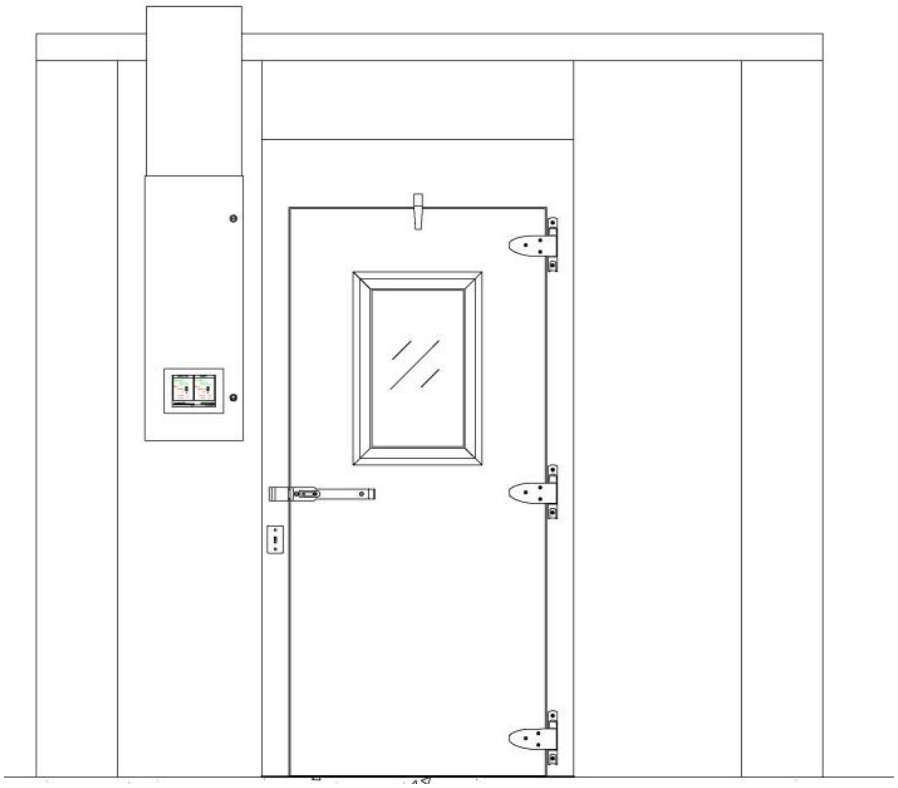
Clean with water-based cleaning agents, foam or pure water-free solvents.

Vacuuming or light brushing is recommended to prevent dust and soil buildup.

For answers to additional questions regarding care or cleaning please contact Sedia Systems.

BIOCOLD
ENVIRONMENTS FOR LIFE

OPERATIONS & MAINTENANCE MANUAL



WEBSTER UNIVERSITY

INTERDISCIPLINARY SCIENCE BUILDING (ISB)

CONTROLLED ENVIRONMENT ROOM (CER)

+4°C WITH NON-CONDENSING HUMIDITY

BioCold Environmental, Inc. | 160 Old State Road | Ellisville, MO 63021 | 636.349.0300 | info@biocold.com

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1. Introduction

BioCold Environmental rooms offer exceptional temperature and humidity control, as specified, for a wide range of applications. This manual is prepared for the walk-in environmental room installed at Webster University for the Interdisciplinary Science Building (ISB) in Webster Groves, Missouri. This manual contains information needed for proper operation of the BioCold environmental room. This chamber uses a BioCold Continuous Refrigeration system with hot gas bypass system with resistive heat, designed to accurately control room temperature at +4°C with ambient / non-condensing.

The control console also complies with the Americans with Disabilities Act (ADA). The BioLogic™ touchscreen allows system monitoring with a secure and dynamic interface at the screen or remotely.

This manual contains information needed for proper operation of the BioCold environmental rooms using the BioLogic™ touchscreen. For any questions or troubleshooting information not addressed in this manual, please contact the BioCold Environmental factory in Ellisville, Missouri (USA) at 636.349.0300 or service@biocold.com.

2. Principles of Operation

The BioCold refrigeration system operates as a "continuous proportional hot gas bypass system." The compressor / condenser unit operates 100% of the time and does not cycle on/off or pump down even during a defrost cycle. BioCold takes the third refrigeration line (5/8" hot gas line) to the evaporator and introduces this through a side port manifold after the liquid expansion valve and before the distributor. The three refrigeration lines are introduced to the room through the ceiling and directly into the side of the air handler with only a few inches of exposed refrigeration lines. The liquid and hot gas solenoid valves are set on top the room, located near the ceiling stub out of the three refrigeration lines.

The BioCold control system includes a 7" color touchscreen user interface as well a programmable logic controller (PLC) with integrated process controls. The PLC is a modular system that includes a temperature process module, as well as dedicated logic modules for controlling chamber components. All operating parameter changes can be made via password-protected access at the color touchscreen interface, which also offers alarm history log and chamber trend data recording.

During normal operation, the 3/8" liquid line (cooling) solenoid valve (Sporlan Model XUP) and the 5/8" hot gas line (heating) solenoid valve (Sporlan Model XRM) cycle in order to control temperature in the evaporator coil. Both valves are normally closed and open when energized.

These valves are controlled by the microprocessor-based temperature controller with a 3/32 VDC output from a solid state relay inside the controller. This signal operates two (2) triac relays with one normally open for the liquid valve and the other normally closed for the hot gas valve. Thus, when one valve is open, the other is closed.

During normal operation, if there is a low temperature alarm event, the control signal is removed from both triac relays, causing both normally closed solenoid valves to close, the unit to pump down, and the compressor to shut off on low suction pressure control. When the remote interlock circuit is wired in series with the compressor contactor, both pump down and contactor coil interlock will occur during a low temperature alarm event. Also during a low limit alarm event in the cold rooms (default alarm temperature of +1°C), the alarm and compressor will cycle on / off, due to the fact that the room will begin to warm as soon as the compressor shuts off. When the room warms above the low limit alarm setpoint, the compressor will come back on, again dropping the temperature below the low alarm setpoint until the malfunction is diagnosed and remedied.

The control console is protected at all times. The unit is wired with a branch circuit using UL489 circuit breakers. Independent temperature safety limit controls are present for high and low temperature monitoring. Remote dry contacts also protect the mechanical equipment. Both an audible and visual alarm, and if applicable, personnel emergency alarm indicators are present as an additional safety feature; the alarm includes an adjustable delay and callback features.

3. Chamber Operations

The BioCold BioLogic™ Console is located on the walk-in exterior wall adjacent to the entry door. The console has a 7" color touchscreen and is connected to the component box mounted on top of each room via low voltage (24VDC) connections. This touchscreen has an "always on" display and high-precision touch accuracy for easy reference and adjustment.

All normal chamber operations are controlled at the BioLogic™ control panel, with temperature setpoint, current temperature reading, alarm setpoints, alarm history, temporary silence switch, and data logging / trend screen incorporated into the control panel. The component box houses the controls that operate the following: interior evaporator fans, lights, heaters, dehumidifier, and alarms.

NOTE: The component box contains equipment that operates on 115/230V, 1-phase or 3-phase power. This component box has a rotary disconnect and should only be opened by a trained professional.

3.1. Overview and Startup

Operation begins by applying power at the circuit breaker panel. After a few seconds of a self-test warm-up, the system will be ready to operate. The desired operating temperature is set or verified on the MAIN screen. The wide range rooms can be set to any temperature between +2°C and +40°C.

The startup procedure requires the user to have administrator privileges to modify the factory parameters like the setpoint. Details of each screen are provided in its corresponding section below.

a) Ensure control console and condensing unit have power and power disconnects are in ON position.

b) Touch LOG ON button on welcome screen (Figure 1, left).

c) Enter the appropriate USER NAME and PASSWORD in the LOG ON popup window.

d) Touch MAIN button on the welcome screen.

e) Set controller setpoint to desired operating temperature.

NOTE: If room is in alarm condition on initial startup, temporarily adjust alarm settings to mitigate an alarm condition. Alarm settings can be readjusted once room reaches normally operating temperatures.

3.2. BioLogic™ Screens and Windows

BioCold designs specialized screens for the control console that monitors and modifies changes in the CER. This section educates the user on the basic functions and / or operations of the screen and its corresponding windows that may pop-up during user options, configuration settings or alarms.

NOTE: The control console screens for your specific CER may vary slightly from those shown in this manual as each console is uniquely tailored for each room. This manual allows the user(s) to gain basic understanding to control the console and its settings.

3.2.1. Log On Window

The LOG ON window (Figure 1) will appear when the LOG ON button is selected. Each parameter has a predetermined security setting in which a user only with that security level or higher may modify that specific parameter. Details are provided in the corresponding Security section below.

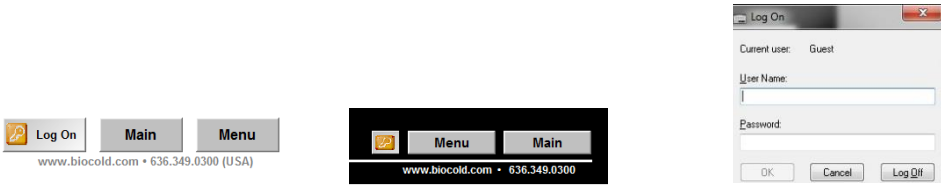


Figure 1. Log On Window

3.2.2. Main Screen

The BioLogic™ MAIN operating screen (Figure 2) navigates to all the information needed for normal system monitoring, including temperature and humidity, as applicable, setpoints, current temperature and / or humidity reading(s), and high / low alarm setpoints. The MAIN button is available on each console screen. The temperature or humidity setpoint is changed directly from the MAIN screen or the TEMPERATURE TUNING screen.

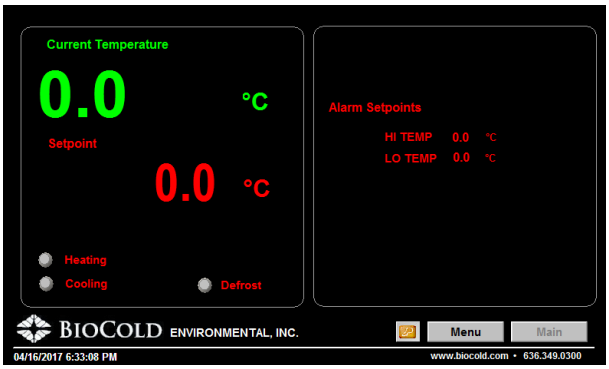


Figure 2. Main Screen

The MAIN screen also displays the status of various parameters, based on the specifications of the room. The status will show a green circle when that parameter is enabled or active. Examples of the various statuses available for display include, but are not limited to, (1) the heat being pumped in via resistive heater(s) or hot gas typically, (2) the cooling of the liquid valve(s), (3) the humidifier(s), (4) dehumidifier(s), (5) defrost, and / or (6) the specific system or zone in a multi-system or multi-zone chamber.

NOTE: When a loss of power to the control panel occurs, an error message may be seen. This is due to the RTD resetting itself; at initial power, the RTD reads a temperature of -270°C, which results in a failure / alarm. This is as-designed and allows the personnel to acknowledge the power incident and assess any other conditions as needed.

To adjust any parameters, users must first log on with the corresponding privileges (See Security, Section 3.3.).

Once logged on, the user may adjust temperature setpoints either by using the + / - buttons, or by using the popup keypad (Figure 3) to input the specific value. To access the popup keypad, first click on the setpoint digits (in Figure 2, this would be "0.0") to view the cursor, and then double-click to activate the popup keypad.

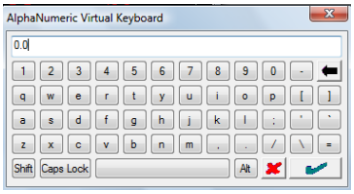


Figure 3. Alphanumeric Keyboard

3.2.3. Menu Screen

The BioLogic™ MENU operating screen (Figure 4) navigates to all the information needed for normal system monitoring, including temperature and humidity, as applicable, setpoints, current temperature and / or humidity reading(s), and high / low alarm setpoints. The MAIN button is available on each console screen. The temperature or humidity setpoint is changed directly from the MAIN screen. The screen contains buttons for each page needed for chamber operation. Based on the logon privileges, unavailable features will be grayed and non-selectable. The MAIN button is available on each console screen.

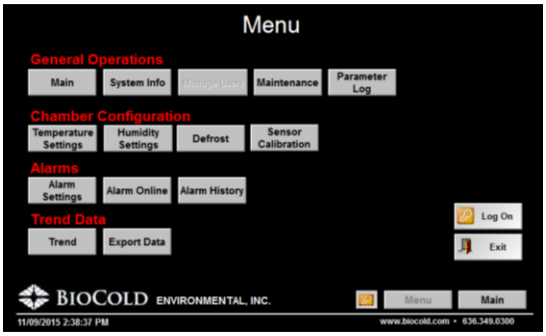


Figure 4. Menu Screen

The MENU screen is divided into four primary options and CER-dependent secondary options of control:

1. General Operations
    a. Main
    b. System Info
    c. Factory (for BioCold or authorized use only)
    d. Log On
    e. Exit (user must be logged on)
2. Chamber Configurations (may include but are not limited to these options)
    a. Temperature Settings
    b. Defrost Settings (not applicable for warm rooms)
    c. Humidity Settings
    d. Redundancy Settings
    e. Grow Lights
    f. Sensor Calibration

   g. Parameter Log
   h. Ventilation
3. Alarms
   a. Alarm Settings
   b. Alarm Online
   c. Alarm History
4. Trend Data
   a. Trend
   b. Export Data.

These screens and any corresponding windows not identified earlier are further detailed in its corresponding sections.

3.2.4. System Information (Startup) Screen

The BioLogic™ SYSTEM INFORMATION screen (Figure 5) is the central screen to navigate to other screens, if needed. The user can LOG ON via this screen or the MENU screen. The information on this startup screen cites factory information such as the version of the software and its corresponding project name.



Figure 5. System Information (Startup) Screen

3.2.5. Parameter Log Screen

The BioLogic™ PARAMETER LOG screen (Figure 6) is a table that is automatically generated to display changes made by a user to the settings of the control console. The timestamp, details of the change, new value, previous value, and user, respectively are captured in this table.

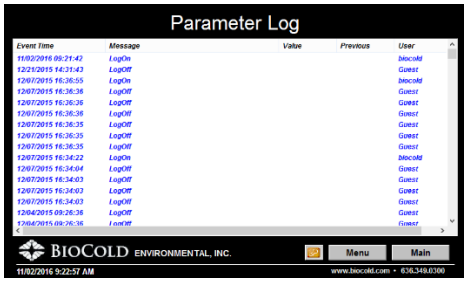


Figure 6. Parameter Log Screen

3.2.6. Maintenance Schedule Checklist Screen

BioCold Environmental highly recommends the upkeep and maintenance of the CER (see Section 3.5). The MAINTENANCE popup window (Figure 7a) provides a reminder for Facilities and/or the responsible team to ensure that the scheduled maintenance is performed. To remove this popup window, hit the Maintenance Reminder acknowledged button.

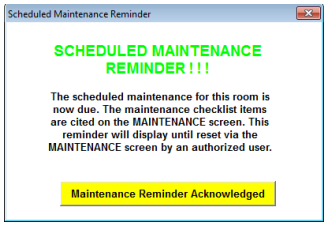


Figure 7a. Maintenance Schedule Checklist Screen

The MAINTENANCE screen (Figure 7b) will appear with maintenance information. The checklist includes:

1. Check the fan motor operations
2. Remove any obstructions from fan intake
3. Clean any dust accumulation from compressor / condensing unit
4. Verify the alarm settings and modify as needed
5. Clean the condenser coil, based on the hours of operation.

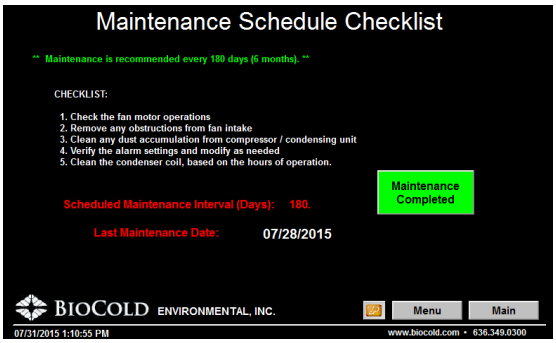


Figure 7b. Maintenance Schedule Checklist Screen

A scheduled interval of 180 days is recommended. This field is editable but a value no greater than 180 days is suggested to ensure that the equipment is checked and operates as specified by the requirements. Once this maintenance is completed, the authorized user will select the MAINTENANCE COMPLETED button and the "Last Maintenance Date" will show as that current day and the interval clock will reset.

3.2.7. Temperature Configuration (Settings) Screen

The BioLogic™ Control Panel incorporates a microprocessor-based Proportional, Integral, and Derivative (PID) controllers for both temperature and humidity (where applicable). These controllers use the PID bands to provide straight-line control.

The TEMPERATURE CONFIGURATION (settings) screen (Figure 8) includes all the parameters needed for temperature operation and adjustment. This single room operates under a single sensor.

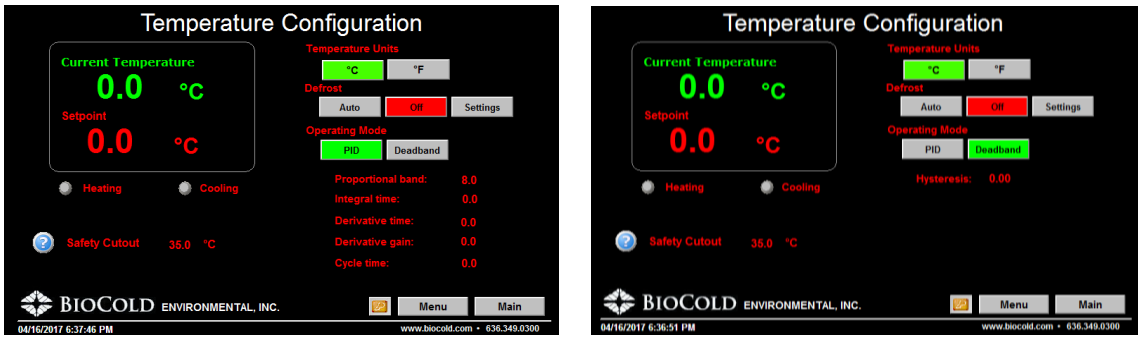


Figure 8. Temperature Configuration Screen with Deadband (left) and PID (right) Mode

The standard operating temperature of the room determines the available parameters on the screen. For example, a cold room or freezer will include the defrost setting. A stability, warm or wide range room may include Chamber Temperature Limits (i.e., cut-outs and cut-ins), which are set values to efficiently use as well as protect the equipment for the CER. More detail is provided in the Additional Information, Warning and Alarm Screen(s) section below.

3.2.7.1. Temperature Setpoint

To adjust the temperature setpoint, click on the temperature setpoint value, and use the popup keypad to adjust chamber temperature. Two operating modes are available: PID or Deadband or hysteresis control.

3.2.7.2. Temperature Units

The user has the option to select the units of temperature. Both the English unit of Fahrenheit and the metric unit of Centigrade (Celsius) are available. The numeric value of the temperature will be converted automatically based on the selected unit.

NOTE: When selecting a different temperature unit, the alarm may be triggered because the range of the alarm setting has not changed. An authorized user will need to adjust this value via the ALARM SETTINGS screen to disengage the alarm based on the selected unit for temperature.

3.2.7.3. Temperature Operation Modes

For normal operation, PID mode provides the tightest control. Each of the PID parameters may be individually adjusted using the Proportional Band, Integral, Derivative and Cycle Time parameters.

3.2.7.3.1. PID Mode

When in PID, five (5) control tuning parameters are calculated: Proportional Band, Integral Time, Derivative Time, Derivative Gain, and Cycle Time.

The default values for the temperature modes are:

1. Proportional Band: 2.0
2. Integral Time = 250.0

3. Derivative Time = 60.0
4. Derivative Gain = 1.0
5. Cycle Time = 15.0

a) **Proportional Band:** This band is a percentage value or amount of change for the input parameter to generate a full change (0 to 100% or vice versa) in the output of the controller. The narrower the band, the smaller the area of the controller's proportioning action. This value is also referenced as the gain, which is the reciprocal of the proportional band. For example, a PB = 25 will have a change of 100% in the output when the parameter has changed by 25° from the setpoint. Trial-and-error settings may need to be tried to achieve the desired PB control.

   a. The desired PB results in a value very close to the setpoint. In the Figure 9 below, the temperature oscillations of the purple line mimics that with close to ideal tuning, with the red line as the setpoint.

   b. If the result seen is more similar to the blue line with large over-and under-shooting values, then adjust the PB to one-half the current value.

   c. The green line correction action would be to multiply the PB by 2x since no oscillations are detected.

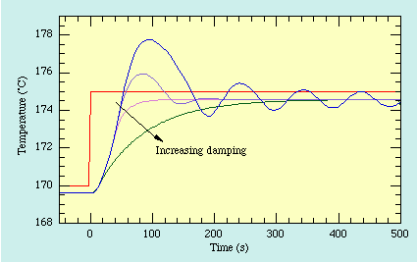


Figure 9. PID Oscillation Adjustments Graph

b) **Integral Time:** This reset adjusts the proportional bandwidth to the setpoint; this function of time compensates for the offset from the setpoint. Excessive overshoot may indicate that this value is set too high; output oscillations indicate that the Integral value may be too low. Note that changes to this value require a corresponding change in the Derivative Time; these values are inversely proportional.

c) **Derivative Time:** This value adjusts for the expected rate of the rise/fall of a system parameter like the temperature, and allows for an automatic modification of the proportional band to reduce the magnitude of the offshoot value. Excessive overshoot may indicate that this value is set too high as with the Integral Time. Note that changes to this value require a corresponding change in the Integral Time; these values are inversely proportional.

d) **Derivative Gain:** The other derivative parameter is the derivative gain. The magnitude of the derivative error to the control action is the derivative gain. If the controller is determining a significant change, the derivative value creates a "slowing" action for the change requested by the controller. The default derivative gain is 1.0.

e) **Cycle Time**: This time is also known as the duty cycle of the controller, which equates to the total length of time for the full on/off cycle. The unit for the cycle time is seconds and governs the frequency with which the controller monitors system conditions. A shorter cycle time will provide closer temperature control, with more frequent indexing of the refrigeration solenoid valves. Longer cycle time results in less frequent valve indexing with a gradual loss of straight line control as the cycle time value increases.

Controls are factory set with a cycle time of five (5) seconds, but this value may be adjusted to any non-zero value.

3.2.7.3.2. Deadband Mode

When in Deadband mode, hysteresis determines the operations. The hysteresis is the value above / below the set point that the operating condition does not change. For example, if the hysteresis is 1.0 and the temperature setpoint is +4.0°C then the heating will turn off at +5.0°C and turn off at +3.0°C. The general idea is to have a more steady heating or cooling when the temperature outside a range of tolerance.

The default hysteresis value is 0.1.

Chamber Temperature Limits (i.e., cutouts and / or cutins) are set values to efficiently use as well as protect the equipment for the CER. More detail is provided in the Additional Information, Warning and Alarm Screen(s) section below.

3.2.8. Defrost Setting Screen

The defrost setting can be accessed via the MENU screen or the TEMPERATURE CONFIGURATION (Figure 10) screen. Defrost cycles are not typically needed on BioCold rooms operating at +4°C or above, and the defrost cycles will default to ON for freezer rooms. Details of this screen are provided in its corresponding section below.

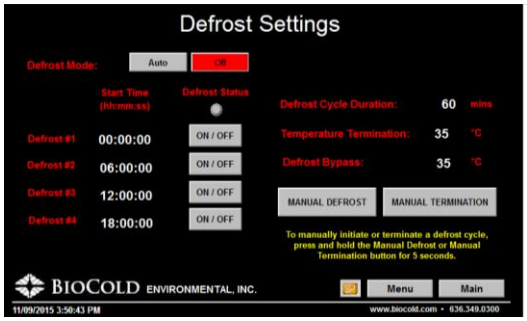


Figure 10. Defrost Setting Screen

In the event that regular defrost cycles do become necessary, the user sets this parameter by selecting the AUTO button for defrost on the Temperature Configuration Screen. The display allow the user to adjust the start times and duration of defrost cycles, up to four (4) cycles per day. The settings on the Defrost Settings screen will control defrost cycles when the Defrost Mode is set to AUTO, currently the button shows as OFF next to the corresponding start times. The defrost time clock is based on the touchscreen internal clock on the lower left corner.

This screen allows the authorized user to adjust the start times and duration of defrost cycles, up to four (4) cycles per day. Enter the start time using the military format for each cycle. For example, 2:15pm would equate to 14:15:00 value for the start time. The defrost cycles are individually enabled by selection the ON/OFF button next to the corresponding defrost start time. When the ON/OFF button is gray, that defrost cycle is disabled; when the button is green, the defrost cycle will trigger at the start time.

To enable the defrost cycles; select the Defrost Mode to AUTO in the DEFROST MODE field. Each individual cycle must be also enabled (i.e., set to ON (green)) to start the defrost cycle. To disable all the defrost cycles for the room; select the OFF button in the upper left for the DEFROST MODE field.

Note: The defrost time clock is based on the touchscreen internal clock on the lower left corner.

The room can be controlled manually for the defrost cycles. The MANUAL DEFROST button allows the room to start manually defrosting at that button request and will last based on the DEFROST CYCLE DURATION value entered. Alternately, if the system is currently in defrost mode, the MANUAL TERMINATION button allows the authorized user to instantly stop the current defrost cycle

3.2.9. Calibration Screens

The chamber is equipped with offset calibration capabilities for the temperature and humidity (as applicable) sensor(s), which can be accessed via the SENSOR CALIBRATION button on the MENU screen. Two calibration options are available to more accurately adjust to the room's present value temperature.

3.2.9.1. Calibration Mode

To calibrate chamber temperature on the CALIBRATION MODE screen (Figure 11), adjust the sensor calibration offset so that the system reading aligns with the standard instrument.

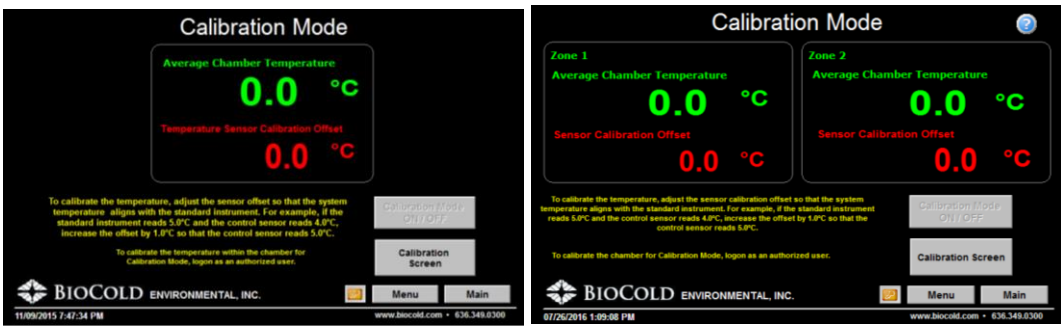


Figure 11. Sensor Calibration Mode Screen

Entering a negative value as the offset will subtract this value from the average sensor reading; a positive value for the sensor calibration offset will raise the sensor reading. This value is added to the current sensor reading prior to initially computing the average value.

The CALIBRATION MODE button allows the room to be calibrated by disabling all outputs from the PLC as well as the corresponding alarms. Only an authorized user can access this mode.

The CALIBRATION SCREEN button displays a new screen to allow adjustment to the average chamber parameters for mapping purposes.

3.2.9.2. Calibration with Uniformity Offset

The dimensions of a larger chamber can result in varying sensor readings. The sensor temperature is the averaged sensor calibration offset plus an initially averaged chamber parameter, given no uniformity temperature calibration offset.

The uniformity calibration offset is the value obtained during the room mapping process. The final averaged chamber temperature is the addition of the uniformity calibration offset with the average of both the sensor reading and the sensor calibration offset.

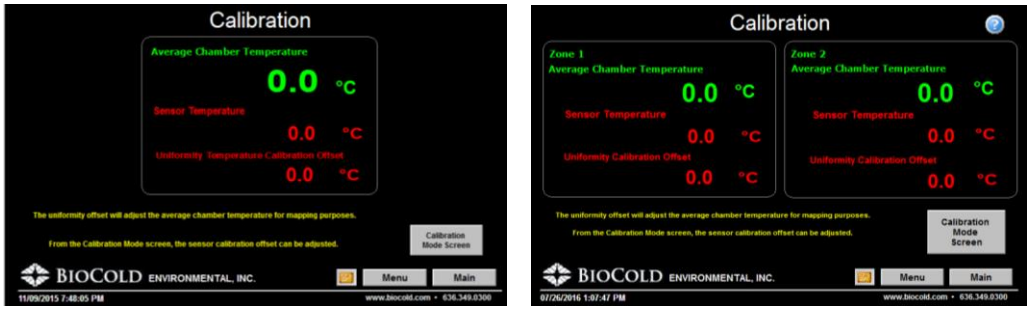


Figure 12. Calibration Screen

On the CALIBRATION SCREEN (Figure 12), entering a negative value as the offset will subtract this value from the average sensor reading; a positive value for the sensor calibration offset will raise the sensor reading. To enter a new value, double-tap on the sensor calibration offset value and use the popup on-screen keyboard to enter new values. This value is added to the current sensor reading prior to initially compute the average value.

3.2.10. Alarm Settings Screen

The BioLogic™ system provides alarm outputs if the room temperature. The high and lows of the parameters for this room are set in this screen (Figure 13) and are also displayed on the MAIN screen. Additional alarm parameters for delays and callbacks are also editable on this screen.

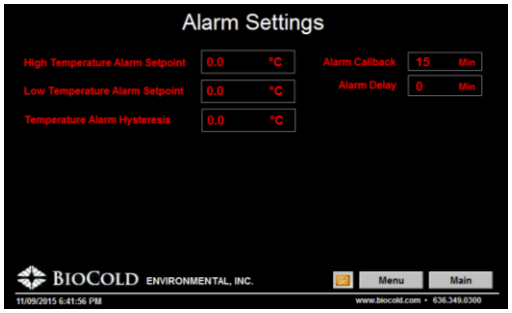


Figure 13. Alarm Settings Screen

3.2.10.1. High and Low Alarms

The high and low setpoints for the high and low alarms, respectively, can be set for the temperature as well as the humidity, if applicable. This value will trigger an alarm when the present value exceeds the high alarm setpoint or falls below the low alarm setpoint.

Upon operation near the desired setpoint the alarms can be set to the desired tolerance around the setpoint. BioCold recommends setting the alarms a minimum of 2.0°C from the setpoint to minimize the possibility of setting the alarms off when the door is left open for short periods of time. Do not change any other menu items

when setting the alarms. The operator with the appropriate security level may set these alarms based on site requirements and specifications.

3.2.10.2. High and Low Alarm Indicator

When an alarm event occurs, the audible alarm will sound and an alarm popup (Figure 14) will appear on the screen. To temporarily silence the audible alarm, press the ALARM SILENCE button. Use the ALARM DETAILS button to obtain the details of alarm and the alarm can also be silenced from this screen. This screen is also available on the MENU screen utilizing the ALARM ONLINE button for the status. See the below section for more details on the ALARM ONLINE screen.

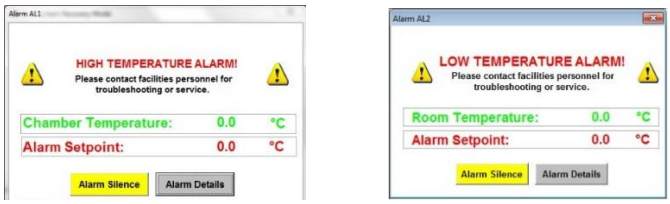


Figure 14. Temperature Alarm Popup Windows

The audible alarm, i.e., buzzer, will continue until the alarm condition is remedied or the alarm is manually silenced by the operator. If the alarm is manually silenced, the alarm will re-sound based upon the Alarm Callback value if the chamber is still in alarm condition.

3.2.10.3. Callback and Delay Timers

There are various timers associated with the alarms. Typically, two types of timers are available: callback timer and delay timer.

The callback timer re-sounds the alarm after the Alarm Callback value has elapsed and the CER is still in the alarm condition. The callback timer will be reset if the alarm condition is remedied. This timer is used to silence the timer in order to contact an authorized user, facilities, and / or BioCold to investigate this alarm as needed.

The delay timer prevents the alarm from triggering and the buzzer from sounding until the Alarm Delay value has elapsed. The delay timer also delays any of the fail-safe triggers until this delay value has completed. This delay is useful when often opening or closing the door for extended periods of time or other circumstances where there are known and frequent external factors that may trigger an alarm otherwise

3.2.11. Alarm Online (Status) Screen

The ALARM ONLINE (Figure 15) screen cites the status of the current or past alarms within this chamber. When an alarm event occurs, the ALARM ONLINE screen provides details concerning the nature of the alarm and user responding to the alarm. The specific details are:

a) the time the alarm occurred;
b) the type of alarm (i.e., high temperature alarm);

c) the time the alarm event cleared/normalized;
d) the user who acknowledged the alarm condition.

Additional fields may be selected by the user using the COLUMN button.

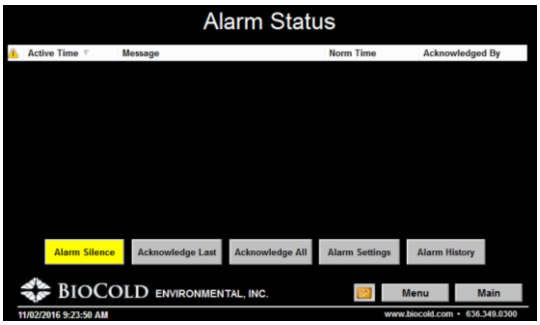


Figure 15. Alarm Online (Status) Screen

The ALARM SILENCE button is highlighted in yellow and appears on the ALARM ONLINE screen. This will silence the audible alarm until the failure can be diagnosed and repaired. If multiple alarms are triggered, then the latest individual or all the current alarms can be acknowledged by selecting the ACKNOWLEDGE LAST or ACKNOWLEDGE ALL button, respectively.

3.2.12. Alarm History Screen

The ALARM HISTORY screen (Figure 16) displays up to the last 100 alarm events with information showing:

a) the time the alarm occurred;
b) the type of alarm (i.e., high temperature alarm);
c) the time the alarm event was acknowledged; and
d) the time the alarm event cleared/normalized.

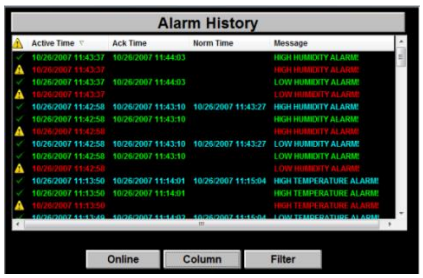


Figure 16. Alarm History Screen

Additional fields may be selected by the user using the COLUMN button on the ALARM HISTORY screen.

3.2.13. Trend Screen

The BioLogic™ HMI hard drive stores temperature and humidity trend data via the TREND screen (Figure 17) securely for a period of 365 days. Data can be accessed using the TREND button from the MENU screen.

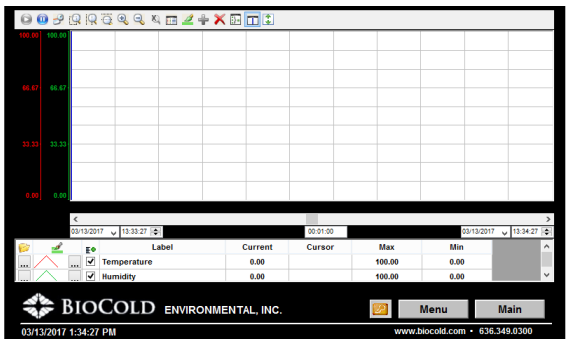


Figure 17. Trend Data Screen

The toolbar across the top of the Trend grid allows a single-button manipulation of the data within the grid. The options are from left to right:

Command/Tool	Description
Run	Sets the trend control to Run Mode (a.k.a. Online Mode). In this mode, the X-axis continues to scroll with the passage of time and the trends are updated with current tag values.
Stop	Sets the trend control to Stop Mode (a.k.a. Historical Mode). In this mode, the X-axis is stopped and the trends display only historical data. If decimation is enabled for one or more trends, the calculation and redrawing is done only in this mode.
Period	Opens a dialog which can be used to modify the X-axis scale main settings.
Window Zoom	Allows the user to click on the trend graph and drag the cursor to select the area that must be visible when the cursor is released. This option is disabled when the Multiple Section option (for the Y scale) is active.
Horizontal Zoom	Allows the user to click on two points in the trend graph, defining the horizontal scale that must be available.
Vertical Zoom	Allows the user to click on two points in the trend graph, defining the vertical scale that must be available. This option is disabled when the Multiple Section option (for the Y scale) is active.
Zoom In	Allows the user to zoom in (display half of the current X and Y scales) each time they click on the trend graph.
Zoom Out	Allows the user to zoom out each time they click on the trend graph.
Cancel Zoom	Cancels the current **Window**, **Horizontal** or **Vertical Zoom** and returns the trend graph to its original scale.
Legend Properties	Opens a dialog which can be used to modify the Legend main settings.
Pen Style	Opens a dialog which can be used to modify the pen style of the selected trend.
Add Pen	Opens a dialog which can be used to add a new trend to the trend control.
Remove Pen	Removes the selected trend from the trend control.
Multiple Sections	Switches the Y scale between Multiple Sections (a section for each trend) and Single Section (all trend share the same Y scale section).

Command/Tool	Description
Cursor	Switches the cursor (ruler) between visible and hidden.
Auto Scale	Changes the Y axis scale to fit all values from the trends that are currently being monitored.

3.2.14. Export Data Screen

From the MAIN menu, the EXPORT DATA button allows users to export the proprietary secure data stored on the HMI into a CSV file which can be easily viewed using spreadsheet software such as Microsoft Excel. This screen is called the EXPORT DATA screen (Figure 18).

Note: A mouse or stylus is recommended to enter information during this exporting of data exercise. To enter a new value without a mouse, double-tap on the desired field value and use the popup on-screen keyboard to enter new value.



Figure 18. Export Data Screen

1. To transfer the file to the USB device:
   - Unlock / unscrew and open the touchscreen enclosure.
   - Insert the memory stick in the USB port underneath the bezel of the touchscreen.
2. From the EXPORT Data screen, enter a start date (mm/dd/yyyy), start time (hh:mm:ss), and duration (in hours) for the period to be downloaded.

   For example, to download data for the week of July 1, 2016, enter a start date of 07/01/2016, start time of 00:00:00 and duration of 168 hours.
3. Select the LOCATION TO SAVE FILE button to enter the desired file name of the document being generated and the path where the file will be saved

   ** The downloaded data has a default location in the folder \\storagecard\biocold\TrendHstCSV\ on the storage card (typically an SD card).

   ** The USB memory device displays as the “HardDisk” icon in the Windows Explorer window.
4. Hit the EXECUTE FILE CONVERSION button to generate the file.

3.2.15. Fuji Limit Controller

The Fuji PXR4 limit temperature controller (Figure 19) provides alarm outputs if the room temperature exceeds the high or low temperature alarm settings as a safety cutout to shut down all or most heat-producing components to protect the control panel. When either alarm occurs, the appropriate HIGH or LOW alarm light will illuminate on the face of this controller and the remote alarm dry contacts will be activated. The range of this controller's alarm setpoints is wider than the range of the CER's alarm setpoints so the audible alarm would sound before the limit alarm would take effect.



Figure 19. Limit Controller

The upper right corner of limit controller indicates its function of °C, or as a temperature limit controller. As needed, a humidity limit controller may also be required and would be annotated with the %RH designation.

3.2.15.1. Display

The limit controller display is as follows:

- Upper right corner of controller indicates function: °C or %RH.
- PV (Process Value) = Indicates actual temperature/humidity level in chamber
- SV (Set Value) = Indicates temperature/humidity setpoint
- AL 1 AND AL2 = Indicate alarm conditions (Unit is in alarm when lit).

The controller automatically returns to the default display screen after about one (1) minute of inactivity.

3.2.15.2. Clock

The clock on the limit controller can be adjusted as needed. On the face of the limit controller, push the ESC button once or twice to show the following:

>Stop
Set Param
Set Clock
Prg Name

a. Push the down button to select "**Set Clock**."

b. Push the OK button once and then the up or down buttons as necessary to select the current day of the week.
c. Push the right arrow key to the first time digit. (Use a 24 hour format.)
d. Set the first digit by pushing the up or down buttons and then push the right button.
e. Similarly, set the subsequent time digits and the date digits.
f. When complete push the OK button

Push the ESC button and the date/time will be displayed.

3.2.15.3. Menu Selection

All control functions are available via the green SEL (select) button.

The three menus for the limit controller are accessed by pressing and holding the SEL button. While holding the SEL button, the menus will scroll automatically. Release the button at the menu desired; the up and down chevron or arrow buttons are to the right of the green SEL button, respectively. The submenus are adjusted using these buttons. Values are changed by tapping the SEL button until the value flashes then moving the value up or down using the arrow keys. Enter new values using the SEL button. After a period of approximately one minute, the control will revert to the default display.

- The first menu begins with the parameter "Stby"
- The second menu begins with the parameter "P"
- The third menu begins with the parameter "P-n1"

To change setpoint values, press the arrow button up or down, based upon the appropriate direction. No other adjustments will need to be made other than changing the alarm setpoints. The controllers can be "locked" by using the "LOC" function to prevent unauthorized tampering and are unlocked at the factory - consult the Fuji Microcontroller Manual for more details.

3.2.15.4. High and Low Alarms

The high and low alarms are factory preset at a safety setpoint temperature above ambient (+35°C for instance) and 1.0°C, respectively.

- **To change High Limit Alarm value:**
  - Press SEL button and hold down until you see "STby".
  - Press down arrow until you see "AL1"
  - Press SEL until lower number flashes.
  - Use arrow keys to create a new value for the high limit alarm
  - Press SEL to enter.
- **To change Low Limit Alarm value:**
  - Press SEL button and hold down until you see "STby".
  - Press down arrow until you see "AL2"
  - Press SEL until lower number flashes.
  - Use arrow keys to create a new value for the low limit alarm

- Press SEL to enter.

3.3. Adjusting the HMI Time and Date

The data collected is based upon the time and date located in the left side of the footer of most screens. If the date and time of the touchscreen need to be adjusted, then follow these instructions below. A USB mouse is recommended to make this adjustment and an admin user for the touchscreen is required.

3.3.1. Via the Factory Screen

1) Login to the touchscreen as a "biocold" user from the MAIN or MENU screen.
2) Select the FACTORY button from the MENU screen
3) Double tap on the parameter to be changed.
    a. Enter the time using the military format of 00:00:00 (hh:mm:ss)
    b. Enter the date using the format of MM/DD/YYYY
4) Hit the corresponding button adjacent to the parameter to set value

3.3.2. Via Windows Desktop

1) Open the control panel door.
2) Plug the USB mouse into the USB port on the bottom side of the HMI unit.
3) Login to the touchscreen as an "admin" user from the MAIN or MENU screen.
4) Go to MENU screen (Figure 20)
5) Select the Logon button (gold key icon)
    a) Enter valid username
    b) Enter valid password
    c) Hit "OK" button



Figure 20. Logging into Project

6) In the MENU screen, select the Exit button (to the right side of the screen) and confirm the command (Figure 21).



Figure 21. Logging Out of Project

7) The screen will now look similar to a Windows screen with a Remote Agent dialog window on the desktop.
8) Use the mouse to cursor to the lower part of the screen to view the Taskbar.
9) Double-click on the time in the Taskbar.
10) In the popup window, check the checkbox to "Automatically adjust clock for Daylight Savings."
11) Make any necessary adjustments to the date, hour and/or minute value(s) (Figure 22).

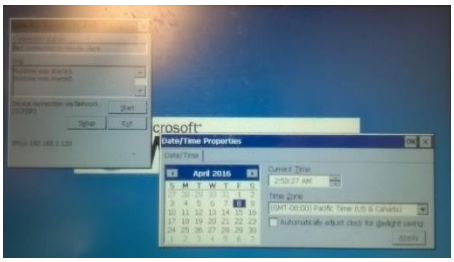


Figure 22. Adjusting Date and Time

12) Hit the "Apply" button.
13) On the Remote Agent window, hit the "Start" button.
    If the program does not start within one (1) minute, cycle the power to the touchscreen.

3.4. Security

The BioCold BioLogic™ HMI interface incorporates logic designed to ensure that only authorized users can modify various parameters to ensure the chamber integrity. The MANAGE USERS screen (Figure 23) allows the administrator to manage the users for the room via the MENU screen. This screen option is unavailable until an admin or user of higher privilege is authenticated and the button will be selectable by the admin. The administrator has up to four (4) user account management options: create user, delete user, reset user password, and unblock a user.

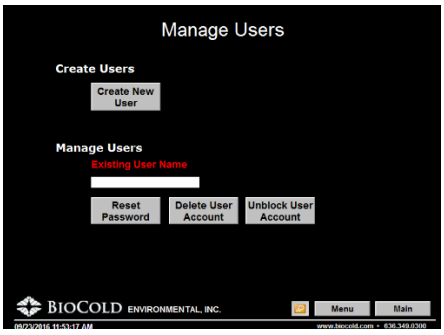


Figure 23. Manage Users Screen

3.4.1. User Accounts

The BioCold BioLogic™ HMI interface has three (3) levels of customer account access security during runtime: guest, user, and administrator. A fourth account is specifically set aside for the factory for development and runtime rights. Only the administrator can create and manage the users once the HMI is fielded.

Screen fonts will be a light grey when the current user logged in is not authorized to make changes to a button selection; conversely, the button font will be black with the appropriate access level. Editable values such as setpoints will show as a grey text field background when not accessible by that user level. A blue text field background on editable values indicates an authorized user is logged in.

A full group account matrix is provided below.

To create a new user account, log on with an administrator level username and password. The MENU screen will now show a MANAGE USER button in the top row. Click on that row to display the MANAGE USERS screen (Figure 24).

3.4.1.1. Guest Access Level

The GUEST account is the default access to the chamber operation and allows basic project control.

Without logging in, a user from the GUEST level can only view most chamber parameters as applicable via the MENU or system information screen:

- (MAIN, TEMPERATURE or HUMIDITY SETTING) temperature and humidity setpoints
- (MAIN, TEMPERATURE or HUMIDITY SETTING) current temperature and humidity readings
- (MAIN or ALARM SETTING) high and low alarms setpoints
- (SENSOR CALIBRATION) calibration values
- (MAIN or REDUNDANT) refrigeration system or controls status
- (ALL) alarm and notification / informational popup windows
- (ALARM HISTORY and ALARM ONLINE) current and past alarm information
- (SYSTEM INFO) startup or project information
- (PARAMETER LOG) changes to parameters by a user or PLC
- (MAINTENANCE) scheduled maintenance information.

Guests cannot modify any chamber settings but can silence an active alarm via its corresponding popup. Guests are able to manipulate the trend data to zoom in, zoom out, etc. because there is no modification to the actual values.

3.4.1.2. User Access Level

The USER level account has all the viewing rights as the GUEST account as well as can access most chamber functions. The user can edit the values or settings for the following parameters:

- (ALARM SETTING and TEMPERATURE / HUMIDITY SETTINGS) high and low setpoints and corresponding hysteresis, alarm delay, alarm callback
- (EXPORT DATA) reports for trend data
- (MAINTENANCE) maintenance duration and last timestamp
- (MENU) exiting or restarting the project server.

The USER has a minimum password size of five (5) characters with a minimum of one (1) alpha character and one (1) numeric character and no requirement for special characters. The password will expire after 180 days. This user will be logged off the project ten (10) minutes after the last user action. For security purposes, the account will be locked up after three (3) invalid attempts and will remain locked until unblocked by the administrator.

3.4.1.3. Administrator Access Level

The ADMINISTRATOR level account has all the viewing and editing rights as the USER account as well as can access most chamber functions.

- (MANAGE USERS) user access control
- (SENSOR CALIBRATION) sensor offsets

The chamber is shipped with one default administrator account:

Default Administrator Login: admin
Default Password: 63011 or 63011a

The ADMINISTRATOR has a minimum password size of six (6) characters with a minimum of one (1) alpha character and one (1) numeric character and no requirement for special characters. The password will expire after 180 days. This user will be logged off the project ten (10) minutes after the last user action. For security purposes, the account will be locked up after three (3) invalid attempts and will remain blocked until unblocked by the factory.

3.4.1.4. User Account Access Matrix

	Group Account			
Permission	Guest	User	Admin	Factory
VIEW	X	X	X	X
Current Temperature and Humidity Values	X	X	X	X
Temperature and Humidity Setpoints	X	X	X	X
Temperature and Humidity Calibration Offsets	X	X	X	X
Heating and Cooling Status	X	X	X	X
Humidification Equipment Status	X	X	X	X
Defrost Status (Cold Rooms and Freezers)	X	X	X	X
High and Low Alarm Setpoints	X	X	X	X
Alarm Hysteresis Values	X	X	X	X
Door Alarm Delay and Inhibit	X	X	X	X
Temperature and Humidity Operating Modes	X	X	X	X
Temperature Units	X	X	X	X
Temperature and Humidity PID and Deadband Parameters	X	X	X	X
Temperature Cutouts and Cutins	X	X	X	X
Alarm and Failure Popup Windows	X	X	X	X
Refrigeration System Status and Failure(s)	X	X	X	X
Alarm Silence	X	X	X	X
Informational Popup Windows	X	X	X	X
Alarm History	X	X	X	X
Current Alarm Online	X	X	X	X
Startup / System Information Screen	X	X	X	X
All Screens Except Manage Users Screen	X	X	X	X

	Group Account			
Permission	Guest	User	Admin	Factory
Manage Users Screen			X	X
Log In or Exit Project			X	X
Parameter Log	X	X	X	X
Scheduled Maintenance Information	X	X	X	X
Trend Data	X	X	X	X
Export Data	X	X	X	X
Controller Status	X	X	X	X
SELECT / EDIT / MODIFY				
Temperature and Humidity Setpoints		X	X	X
Temperature and Humidity Calibration Offsets		X	X	X
High and Low Alarm Setpoints		X	X	X
Alarm Hysteresis Values		X	X	X
Temperature and Humidity Operating Modes		X	X	X
Temperature Units		X	X	X
Temperature and Humidity PID and Deadband Parameters		X	X	X
Temperature Cutouts and Cutins		X	X	X
Humidification Equipment / Heater Mode(s)		X	X	X
Alarm Silence	X	X	X	X
Redundant Refrigeration System Selection		X	X	X
Redundant Refrigeration System Failure Reset		X	X	X
Redundant Refrigeration System Switchover and Overlap		X	X	X
Redundant Recovery Delay		X	X	X
Scheduled Maintenance Information		X	X	X
Current Temperature and Humidity Values		X	X	X
Temperature and Humidity Setpoints		X	X	X
Defrost Settings (Coolers and Freezers)		X	X	X
Add or Delete Users			X	X
Calibration Mode for Testing Purposes			X	X
Change User Passwords			X	X
Door Alarm Delays and Inhibits		X	X	X
Log In or Exit Project			X	X

3.4.2. List User Accounts

A list of users can be displayed for the user with admin privileges and higher. To generate this list, login as an authorized user and then select the SHOW USERS button. The current users will display vertically next to the button.

3.4.3. Create New User Account

Click the CREATE USER button to display the NEW USER ACCOUNT window (Figure 24). On this screen, first enter the user name and password for the new user, then assign that user to a group, either user or admin. Click OK to establish the new login account.

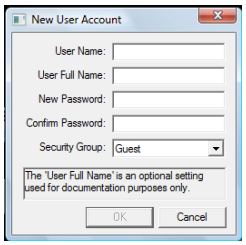


Figure 24. New User Account Window

SECURITY TIPS:

1. To prevent unauthorized access, always log out after making changes to chamber parameters. To log out, press the LOG ON button from the Startup or Menu screens. The popup window will provide an option to LOG OFF.
2. For additional protection, all accounts have an automatic logout function. User level accounts will automatically log off after 5 minutes of inactivity; Administrator level accounts will log off after 15 minutes of inactivity.

3.4.4. Delete User Account

An authorized admin user may remove accounts that are no longer needed. First enter the user name in the Existing User Name field and then click the DELETE USER button. Click OK to remove that login account.

3.4.5. Unblock User Account

The user will be locked out after three (3) consecutive invalid login attempts within five (5) minutes. Any locked out user can be unlocked by an authorized user of a higher security level; e.g., the user-level account must be unlocked by an administrative user account. However, the counter does reset and more attempts are possible by waiting five (5) minutes after the second invalid attempt to reset this counter. In other words, as long as the final attempt is not executed until after waiting the configured amount of time, the user will not be locked out.

To unblock a user, insert the locked out username in the Existing User Name field and then select the Unblock User button. The user will then be unblocked and now has permission to access the data for users.

3.4.6. Reset User Password

An authorized user may also reset another lower-level user's account. First enter the user name in the Existing User Name field. Enter the first verification password and the popup stating the password mismatch will likely appear. Enter the second password verification and the notification window for mismatched passwords will disappear. Click the Reset Password button the new password will take effect for the login account. The password successfully changed window will also appear; hit OK to acknowledge the change.

3.5. Remote Monitoring and Control

BioLogic™ control systems are equipped for remote monitoring and control using a TCP/IP web thin client and/or secure viewing software. The touchscreen is the server for the application (i.e., the thick client). Any thin client machine will need to run the Web Thin Client to remotely view the chamber information. The Ethernet port on the touchscreen must be connected to the local area network (LAN) of the site. To identify the IP address of the server after LAN connection,

14) Open the control panel door.
15) Plug the USB mouse into the USB port on the bottom side of the HMI unit.
16) Login to the touchscreen as an "admin" user from the MAIN or MENU screen.
17) Go to MENU screen at the footer of the screen
18) Select the Logon button (gold key icon)
    a) Enter valid username

b) Enter valid password
c) Hit "OK" button

19) In the MENU screen, select the Exit button (to the right side of the screen) and confirm the command when prompted.
20) The screen will now look similar to a Windows screen with a Remote Agent dialog window on the desktop.
21) Use the mouse to cursor to the lower part of the screen to view the Taskbar.
22) Under the Hidden Icons triangle, locate the Remote Agent startup icon (Figure 25) and click on that icon.



Figure 25. Remote Agent Startup Icon

23) The Remote Agent popup window (Figure 26) will display with the IP address.

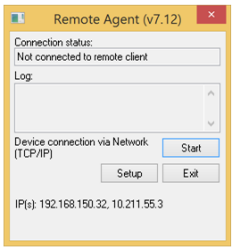


Figure 26. Remote Agent Popup Window

24) Download the Web Thin Client viewer from the following web address:
https://www.dropbox.com/s/u7bxnor436wvo44/ThinClientSetup.exe?dl=0

25) Open an Internet Explorer® browser window on the client machine and connect to the CER IP address using the following URL as an example with the identified IP address from Step 10 in its place. If a problem is encountered, then login to the IE program as an administrator.

http://192.168.1.57/startup.html

26) The login prompt will popup. Login with a valid username and password.

Note that only one web thin client license is available with each CER. Multiple licenses are available as an upgrade. With a single license, when more than one user attempts to access remotely, any secondary client will be denied access until the license is released.

4. Periodic Maintenance

BioCold environmental rooms are designed for long-term operation with minimal maintenance needs. BioCold recommends the following periodic maintenance schedule.

Regular Cleaning:

- ❑ Environmental room finishes may be cleaned on an as-needed basis with standard commercial detergents. Corrosive solvents may damage painted finish.

Monthly Maintenance:

- ❑ Visually inspect compressor/condensing unit to ensure fan intake is not obstructed.
- ❑ Visually inspect evaporator fan coil to ensure it is clear of ice.

Quarterly Maintenance:

- ❑ Clean compressor/condensing unit to remove dust accumulation and potential obstructions.

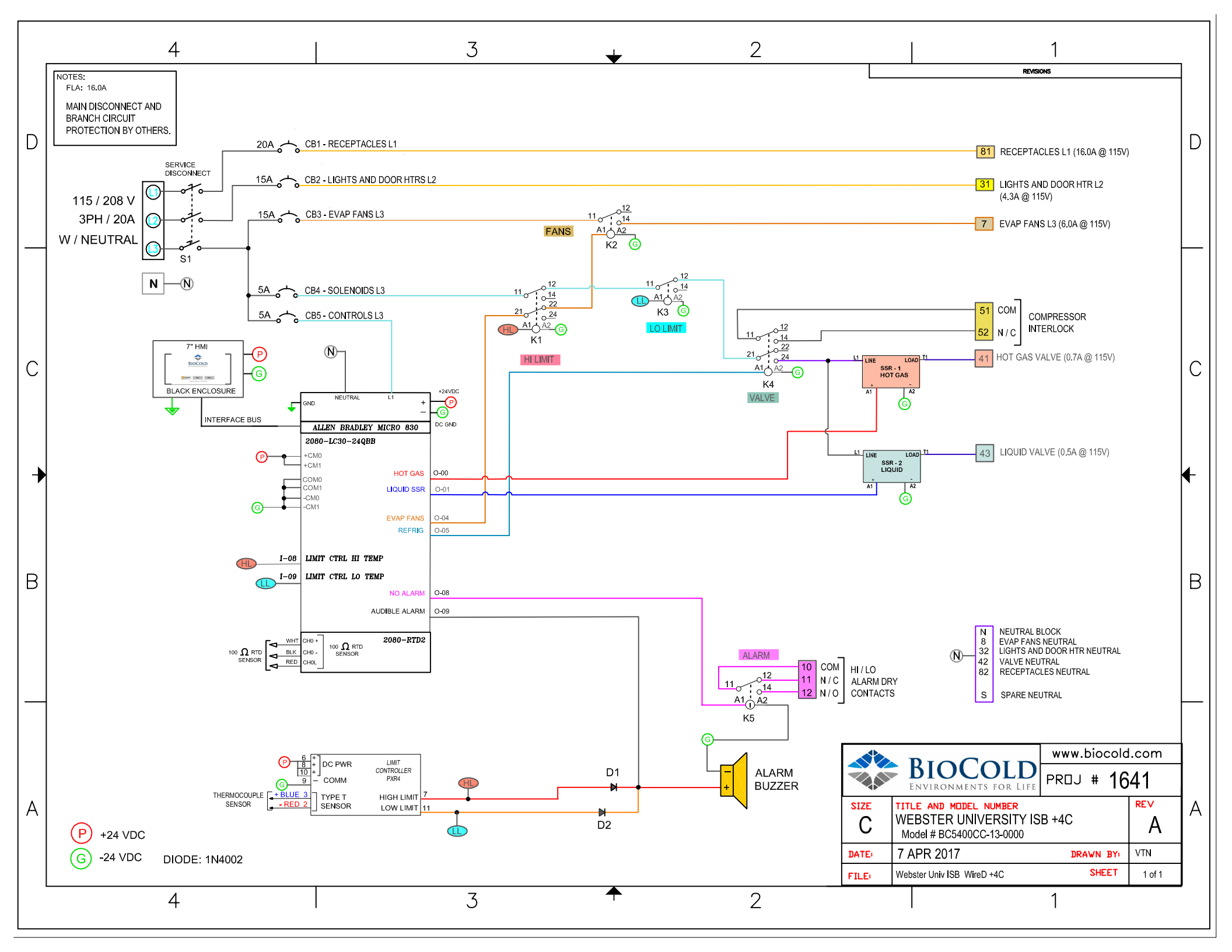
5. Regulatory Data Compliance

5.1. 21 CFR Part 11

Ensuring 21 CFR Part 11 compliance is fundamental to each BioCold project as electronic records are created, archived, and maintained within this control panel. The BioLogic design enables the client to retrieve and transmit the data through multiple media storage devices, via a secure network or externally. The applicable Predicate Control rules take precedence to ensure that the original automated data entries are stored properly.

BioCold understands that our compliance as the supplier or vendor of this project must be in accordance with your established processes. BioCold advises the authorized personnel or compliance department (i.e., the party liable for ownership of these records) to implement and adhere to established Procedural Requirements that includes but is not limited to formal training, accountability guidelines, and documentation control processes to maintain the integrity, confidentiality (as applicable), and authenticity of the automated electronic records generated. Ultimately, the record owner or end user has the responsibility to employ best practices for controls once the control panel is fielded.

The BioLogic offers its products and ongoing services through the life of the control panel.


NOTES:
FLA: 16.0A
MAIN DISCONNECT AND BRANCH CIRCUIT PROTECTION BY OTHERS.
REVISIONS
115 / 208 V
3PH / 20A
W / NEUTRAL
SERVICE DISCONNECT
S1
20A CB1 - RECEPTACLES L1
15A CB2 - LIGHTS AND DOOR HTRS L2
15A CB3 - EVAP FANS L3
5A CB4 - SOLENOIDS L3
5A CB5 - CONTROLS L3
81 RECEPTACLES L1 (16.0A @ 115V)
31 LIGHTS AND DOOR HTR L2 (4.3A @ 115V)
7 EVAP FANS L3 (6.0A @ 115V)
FANS
K2
K1
K3
LO LIMIT
HI LIMIT
K4
VALVE
51 COM
52 N / C
COMPRESSOR INTERLOCK
41 HOT GAS VALVE (0.7A @ 115V)
43 LIQUID VALVE (0.5A @ 115V)
SSR - 1 HOT GAS
SSR - 2 LIQUID
7" HMI
BLACK ENCLOSURE
INTERFACE BUS
ALLEN BRADLEY MICRO 830
2080-LC30-24QBB
HOT GAS O-00
LIQUID SSR O-01
EVAP FANS O-04
REFRIG O-05
I-08 LIMIT CTRL HI TEMP
I-09 LIMIT CTRL LO TEMP
NO ALARM O-08
AUDIBLE ALARM O-09
2080-RTD2
ALARM
K5
10 COM
11 N / C
12 N / O
HI / LO ALARM DRY CONTACTS
N NEUTRAL BLOCK
8 EVAP FANS NEUTRAL
32 LIGHTS AND DOOR HTR NEUTRAL
42 VALVE NEUTRAL
82 RECEPTACLES NEUTRAL
S SPARE NEUTRAL
DC PWR
COMM
LIMIT CONTROLLER PXR4
THERMOCOUPLE SENSOR
TYPE T SENSOR
HIGH LIMIT
LOW LIMIT
D1
D2
ALARM BUZZER
P +24 VDC
G -24 VDC
DIODE: 1N4002
BIOCOLD ENVIRONMENTS FOR LIFE
www.biocold.com
PROJ # 1641
SIZE C
TITLE AND MODEL NUMBER
WEBSTER UNIVERSITY ISB +4C
Model # BC5400CC-13-0000
REV A
DATE: 7 APR 2017
DRAWN BY: VTN
FILE: Webster Univ ISB WireD +4C
SHEET 1 of 1

SERVICE MANUAL
WALK-IN COOLERS AND FREEZER
IM-268S-11

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Safety Walk Strips ____ 2

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Door Closer

- Replacing Door Closer ____ 10

ROUTINE MAINTENANCE

A. Keep all walkway surfaces clean and free of spilled liquids and food particles.

B. Walk-In panels and magnetic door gasketing should be periodically wiped clean with a damp cloth. Use only mild soap to clean the panels: never abrasive pads or powders that could mar the finish. Remove all soap film and thoroughly dry with a clean cloth. Protect Digital and Electronic Alarms from moisture, or warranty is null and void.

C. Never flush the inside of the Walk-In with water. Use a clean damp mop or rag when cleaning spills on the floor.

D. Heater wires should be checked for proper function. Feel for warmth around the door frames on hinged entrance doors and pressure relief port doors, if applicable. Note: Condensation or Ice buildup around doors may indicate leakage or heater failure. Contact a serviceman immediately.

E. Keep door gaskets clean with a solution of water and mild soap.

F. Inspect refrigeration units frequently for proper function of evaporator & condenser fan motors, drain pan heaters, defrost controls, and drain line heaters. Condensate water must never be permitted to drip on the Walk-In floor. Drain pan or drain line heater failure will result in ice buildup and Evaporator damage. Refer to the Refrigeration System Instructions for proper drain pan and condensate drain line instructions.

G. Don't overload the Walk-In with product. Maintain orderly storage to permit good airflow within the unit.

H. Inspect the condition of abrasive anti-skid strips monthly. Replace or add additional strips when necessary.

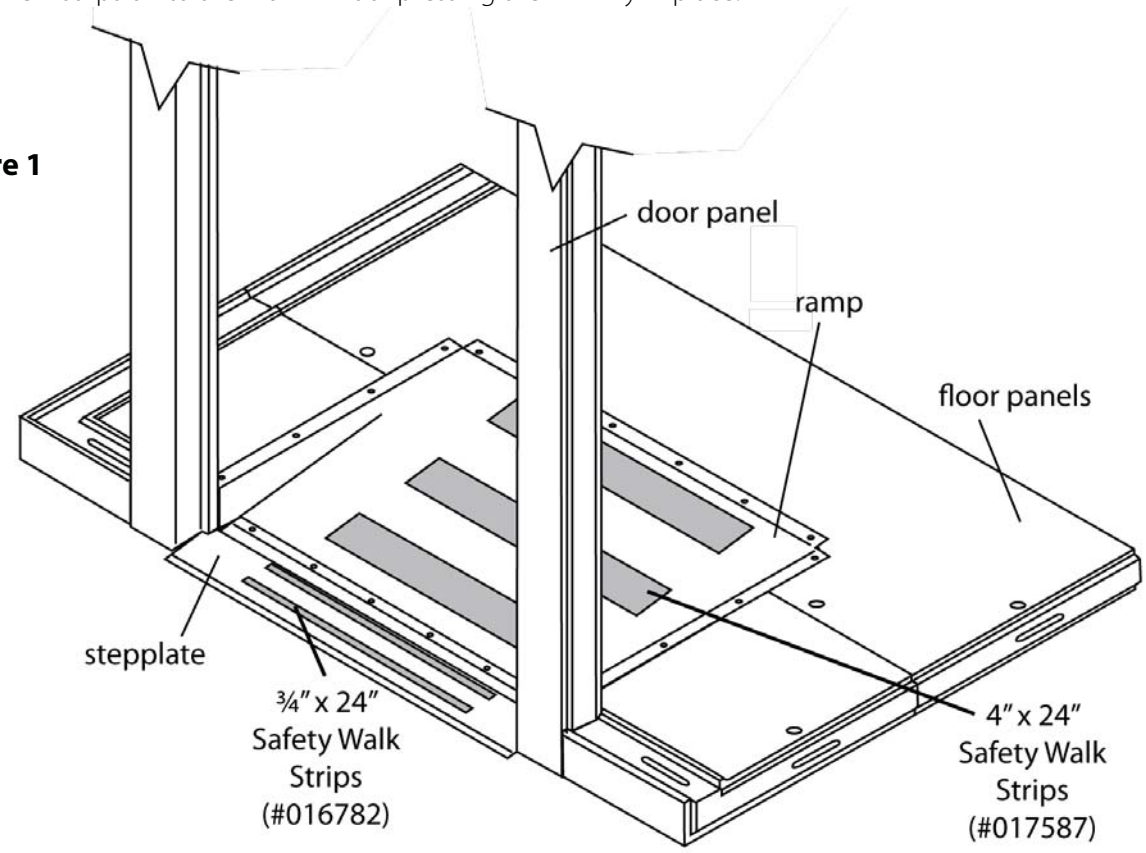
REPLACING SAFETY WALK STRIPS

A. Remove old worn Safety Walk Strips from Walk-In floor, ramps, or a stepplate. *See figure 1*.

B. Clean and completely dry areas where new strips are to be placed.

C. Install new strips on to the Walk-In floor pressing them firmly in place.

Figure 1



IM-268S-11 2013 © Bally Refrigerated Boxes, Inc.

GASKETS

Replacing magnetic door gasket on Hinged Walk-In doors

A. Remove the old gasket and clean the surface where the new gasket will be placed.

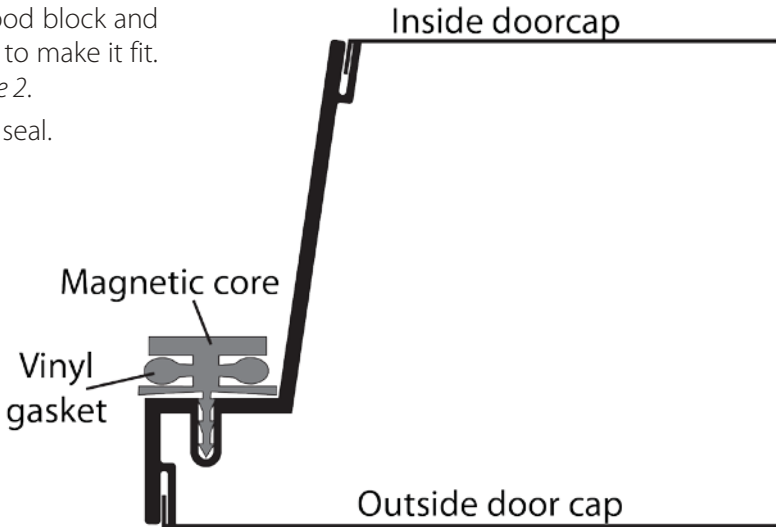
B. Position the new gasket, starting at the top corners. Tap it into place with a wood block and hammer. Do not stretch the gasket to make it fit. Be sure the gasket lies flat. *See Figure 2*.

C. Check door for proper operation and seal.

Part Numbers:

#016543 – 24" x 78"
#017402 – 30" x 78"
#017403 – 30" x 84"
#016546 – 34" x 78"
#016547 34" x 84"
#054117 – 36" x 78"
#054119 – 36" x 84"
#032999 – 42" x 78"
#032999 – 42" x 84"
#016548 – 48" x 84"
#016549 – 60" x 84"

Figure 2



A. Open the door 90 degrees.

B. Grasp the old gasket and pull it away from the interior skin of the door. Clean the surface where the new gasket is to be placed.

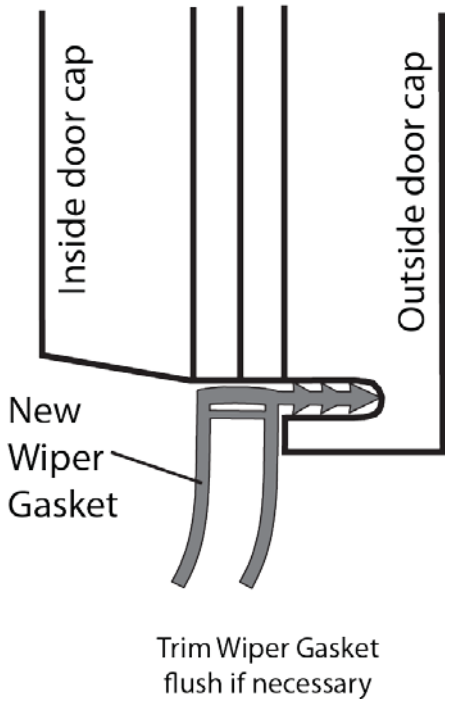
C. Position the new gasket; tap it into place with a wood block and hammer. Do not force the gasket into place; excessive force may damage the door cap.

D. If the gasket binds when the door is closed, the gasket is too wide. Be sure the gasket is properly centered, and trim the ends as needed. *See Figure. 3*.

Part Numbers:

#016614 – 30" Door
#016611 – 34" Door
#054028 – 36" Door
#016612 – 42" & 48" Doors
#016613 – 60" Door

Figure 3



HINGED WALK-IN DOORS

Replacing the D-1000 touch latch on Walk-Ins

A. Remove the defective latch assembly. First remove the handle spring clip from under the handle at the back of the latch base, using a pair of needle-nose pliers. *See Figure 4.*

B. Using a hammer and punch, drive out and remove the latch handle pin from the handle. Remove the three ¼-20 oval-head machine screws from the latch base and remove the base.

C. From the inside of the Walk-In, drill out the roll pin from the safety release handle and remove the handle. (Doors prior to 1995) Current production doors are provided with an interior mounted safety knob which is threaded directly onto the strike bolt. Loosen the allen screw located in the side of the knob using a 5/32 allen key and turn counter clockwise until disengaged from the strike bolt. Pull the strike bolt from the outside away from the Walk-In wall. The strike plate will fall away.

D. Secure the new D-1000 latch base to the Walk-In door with three ¼-20 oval-head machine screws.

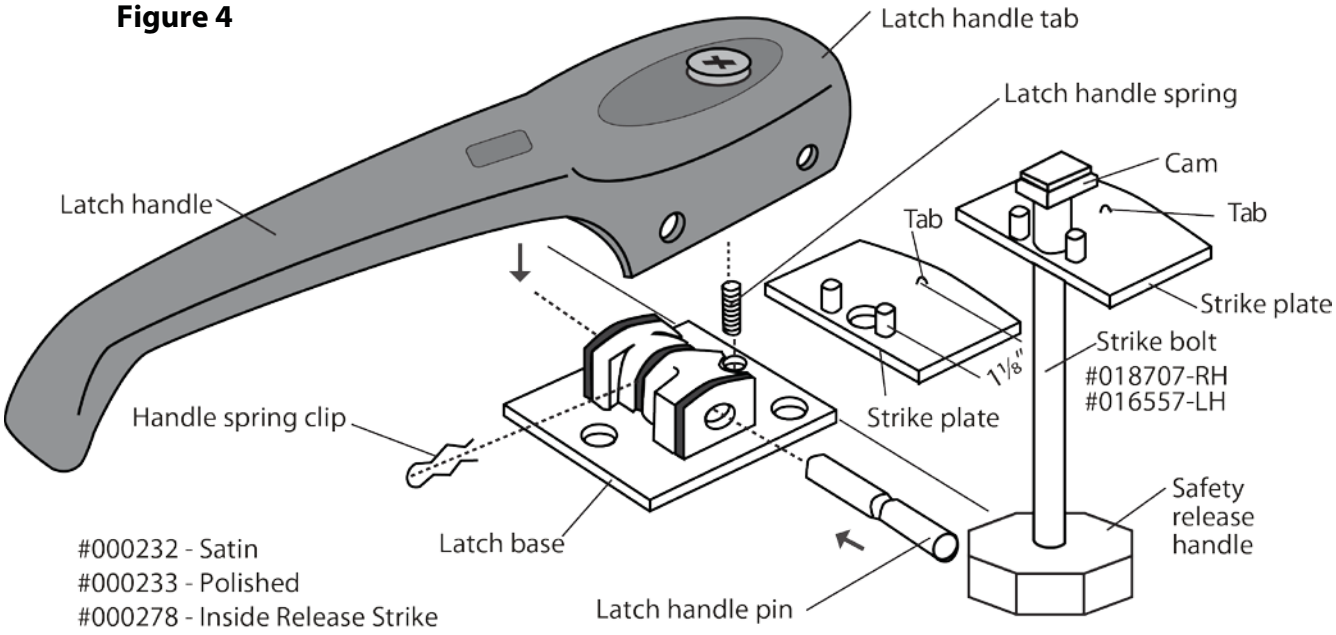
E. Insert the new strike bolt with attached strike plate into the holes on the door jamb panel.

F. Screw the new inside knob onto the strike bolt until adequate tension is applied to the rod to hold the assembly firmly in place. Tighten the set screw on the side of the knob using a 5/32 allen key to allow for ¼ turn safety release operation Check to be certain that the "T" rod rotates freely when turning the inside knob.

G. Insert the latch handle spring into the indicated hole on the latch base. Slip the latch handle over the latch base and align all holes. Be sure the latch handle spring engages the latch handle tab on the underside of the handle. Insert the latch handle pin through the handle and base. Using needle-nose pliers, insert the spring clip through the slot in the latch base assembly. Make certain to align the slot in the latch handle pin with the slot in the base before inserting the clip. This will firmly secure the latch handle in place for use.

H. Open and close the door several times to assure proper operation of the latch.

Figure 4



IM-268S-11 2013 © Bally Refrigerated Boxes, Inc.

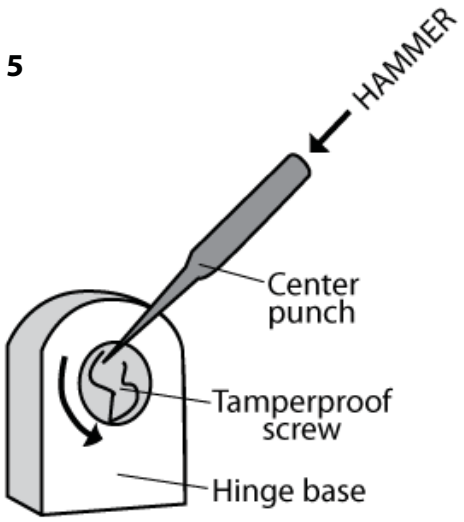
Replacing D-1250 spring-loaded hinges on Walk-In door panels

A. Close the door. Securely hold the door in place by shimming between the outside doorcap and the door frame. Remove the slotted machine screws from the hinge base and blade. If tamperproof screws are used *See Figure 5*. Remove the defective hinge assembly. Secure the new hinge assembly with a screwdriver by tightening the machine screws in the same holes.

B. Remove the shims from around the perimeter of the door frame.

C. Open the door and check for proper operation and seal.

Figure 5



Bally also offers a screw remover tool. Call the factory for details.

Shimming Walk-In door hinges

A. If the Walk-In door is installed properly, no shimming is required. Shim only where misapplication or poor installation of the door panel have caused the door cap to seal improperly. If the door cap toes outward at the top or bottom of the latch side of the panel, shim the diagonally opposite hinge base outward, forcing the corner of the door cap back into alignment with the door frame for a positive seal. *See Figure 6*.

B. To shim hinges on Walk-In doors, loosen the machine screws on the base of the hinge enough to slip the required number of shims into place behind the base. *See Figure 7*. Where tamper-proof screws are used, loosen them by tapping the screw head counterclockwise with a center-punch and hammer as shown in *Figure 5*.

C. Retighten machine screws and check door cap for proper seal.

Figure 6

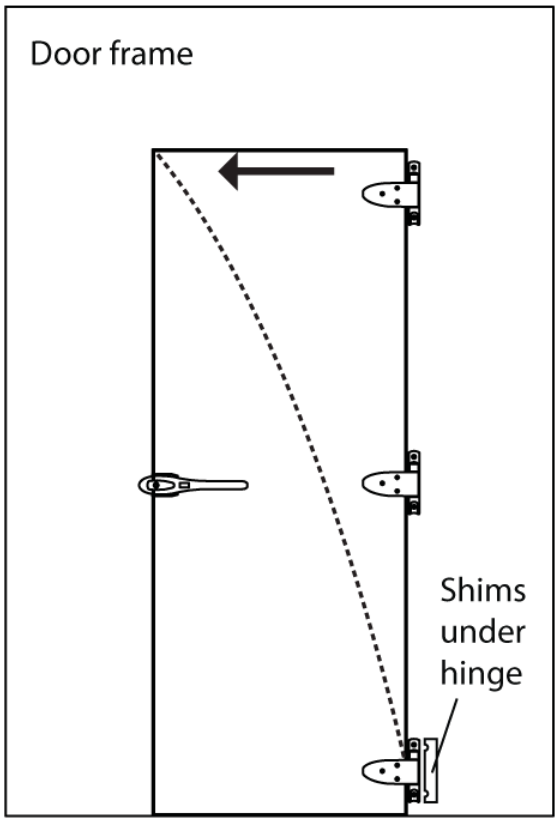
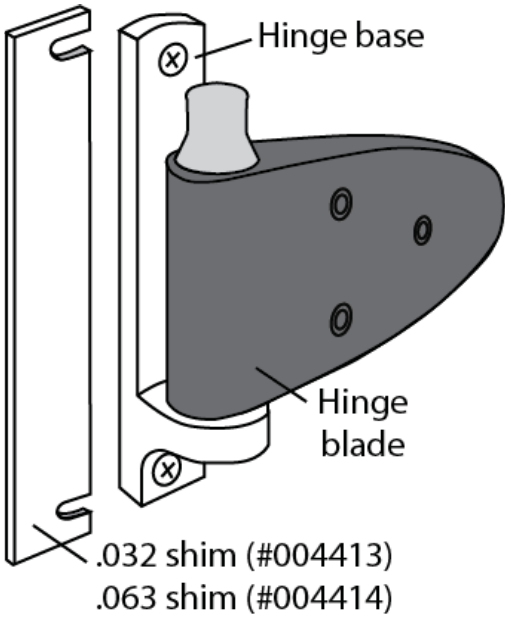


Figure 7



ANTI-CONDENSATE HEATER

Replacing anti-condensate heater element around door frame of hinged Walk-In doors

A. Disconnect the outside power source leading to the door frame light junction box. Open the door 180 degrees. A large piece of cardboard can be used to close off the open doorway until the heater is replaced.

B. Remove the light switch on the exterior of the door panel. Disconnect the heater wire leads by unscrewing the wire nuts. Remember how the wires are connected so you can attach the proper leads on the new wire.

C. Remove the screws from the door strikes around the door frame. Remove the strikes. *See Figure 8.*

D. Remove the screws which secure the stepplate. Remove the stepplate.

E. Remove the defective heater element from the door frame and the grooved hardboard at the base of the frame. Take note of the position of the heater element in the grooved hardboard before removing it. (For replacement or updated heaters, a new hardboard will be supplied with an installation diagram.)

F. Apply a small bead of silicone caulking around the perimeter of the door frame to retain the new heater element until the door strikes can be reinstalled.

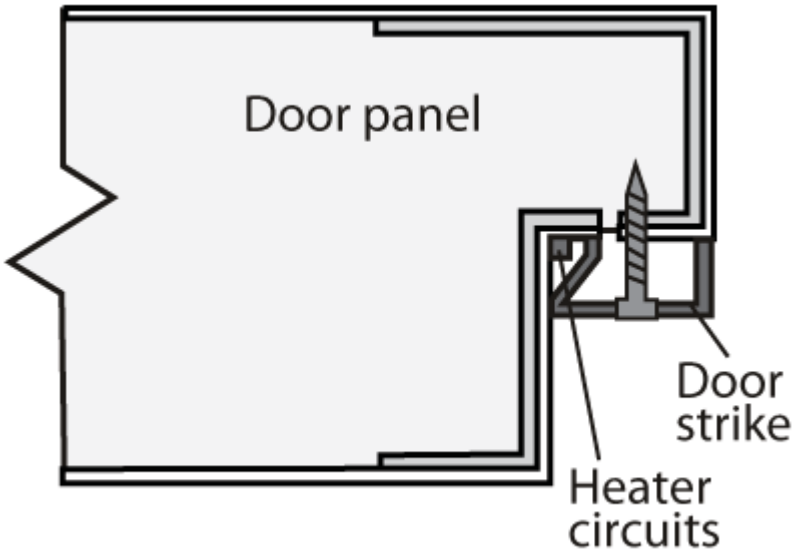
G. Guide the leads of the new heater element into the switch box containing the light switch. Note: Only heater wire leads are to protrude into the switch box-- this will prevent premature heater burnout. Press the heater element firmly into the corner around the perimeter of the door frame. Locate and press the heater element back into the grooved hardboard exactly the same way it was removed. When the heaters are first energized, they will contract. If the wire is not pressed into the corners, it could short out by pulling too tight against the edges of the strikes and sillplate.

H. Replace and secure the stepplate to the Walk-In floor. Replace the door strikes. Be careful not to pinch the wires when remounting the hardware.

I. Reconnect the new heater element to the heater wire leads. Recaulk the opening in the door frame where the heater wire passes through into the junction box. This is very important.

J. Re-energize the outside power source to the door frame light junction box. Check for proper operation.

Figure 8



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REACH-IN DOORS

Replacing magnetic gasket on Reach-In doors

Part Numbers:
#016582 – 18½" x 30"
#016584 – 20" x 30"
#016583 – 30" x 30"

A. To replace the magnetic door gasket, it may be necessary to remove the door from the Walk-In. Simply open the door and lift it off the hinge bases. Lay the door facedown on a flat working surface.

B. Remove the defective gasket and clean the surface where the new gasket will be placed.

C. Position the new gasket and tap firmly into place with a wood block and hammer. Be sure the gasket lies flat. *See Figure 2.*

D. Place the door back on the hinges. Check the door for proper operation and seal.

Adjusting self-closing hinges on Reach-In doors

A. Do not oil door hinges. If dirt accumulates on the Delrin cams and causes them to bind, apply dry silicone spray lubricant.

B. Begin by determining whether the hinge is correctly adjusted. When the strap of the hinge is flush with the flange, there must be clearance as shown in *Figure 9.* Without clearance, the door may not close. Adjust the hinge by following these steps:

1. Open the door 90 degrees and lift the door from its hinge bases.
2. Adjust the hinges as shown in *Figure 10*
    a. Put a pencil mark on cam and on hinge; this enables you to see how much the cam is being turned.
    b. Loosen bottom nut and turn half way off.
    c. Tap against bottom of nut with a hammer until pin and cam are loose. The reason for this is the pin has a tapered shaft.
    d. Turn cam in direction of the arrow in increase clearance; opposite direction to decrease.
    e. Hold cam in position and tighten bottom nut securely.
3. Replace the door on its hinge bases. Check to make sure door operates properly.

Figure 9

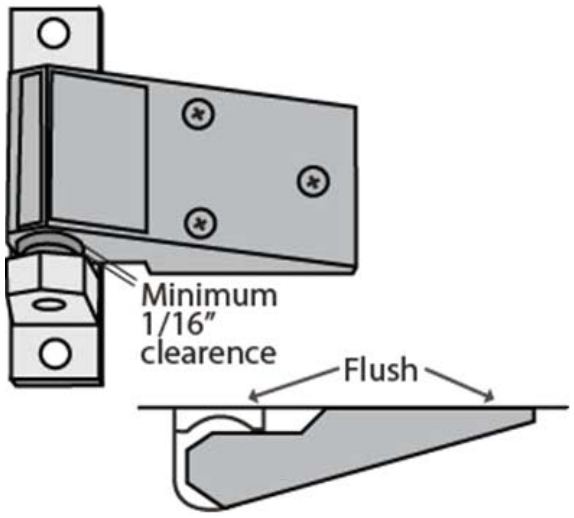
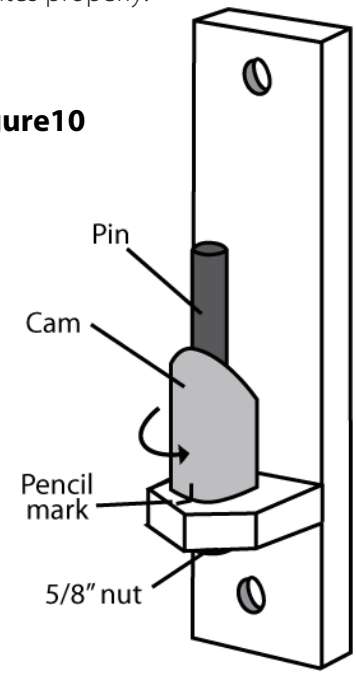


Figure10



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Replacing hinges on Reach-In door panels

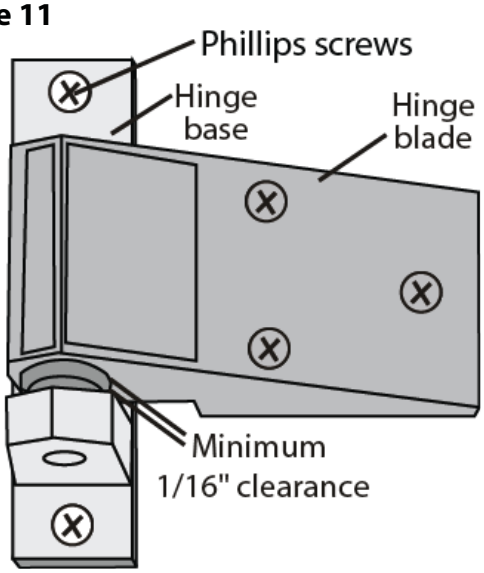
A. Close the door and shim the cap securely around the perimeter of the frame. Remove the slotted machine screws from the hinge base and blade. If tamperproof screws are used *Refer to Figure. 5*. Remove the defective hinge assembly. *See Figure 11*.

B. Secure the new hinge assembly using a screwdriver to tighten the slotted machine screws in the same holes.

C. Remove the shims around the perimeter of the door frame.

D. Open the door and check for proper

Figure 11



Replacing anti-condensate heater element around door frame of Reach-In doors

A. De-energize the outside power source leading to the door frame junction box. Open the door a full 180 degrees and lift it from the hinge bases.

B. Remove the screws from the stainless steel door strikes around the door frame. Remove the strikes. *See Figure 12.*

C. Remove the cover plate from the junction box on the inside of the door frame. Locate and disconnect the defective heater element from the door frame.

D. Remove the defective heater element from the door frame.

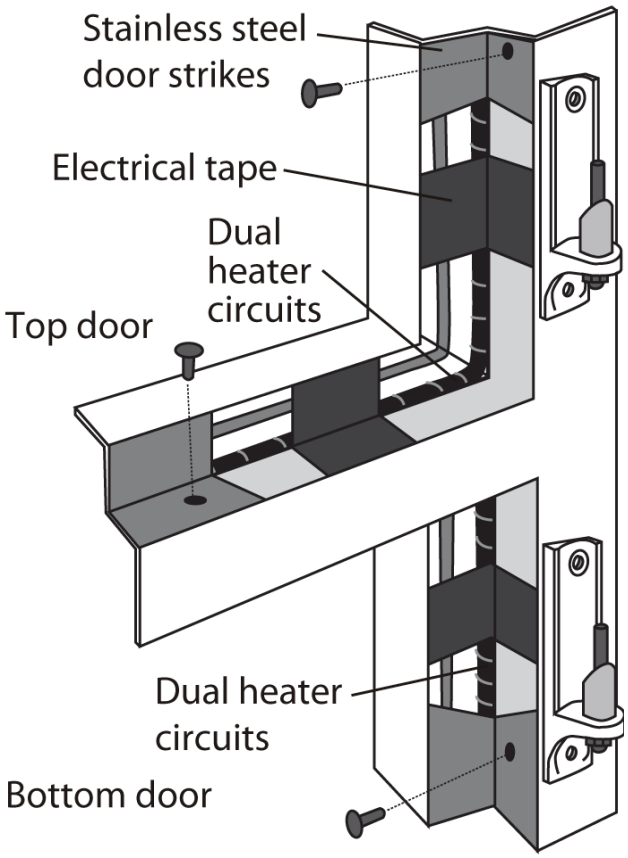
E. Apply a small bead of silicone sealant around the perimeter of the door frame to retain the new heater element. Press the new heater element firmly into the corner around the perimeter of the door frame. The heater element may also be taped into position with UL-approved electrical tape.(Remove) *See Figure 12*. Run the heater leads into the junction box.

F. Reconnect the heater element to the outside power source. Recaulk the opening in the door where the heater wire passes into the junction box.

G. Replace the door strikes and junction box cover plate. (Be careful not to break or pinch the heater element.) Replace the door on the hinge bases.

H. Re-energize the power source to the door frame junction box. Check the door for proper operation and seal.

Figure 12



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Pressure Relief Ports (PRP)

Replacing magnetic gasket on PRP

A. Remove the port door by removing the screws from the poly-hinge at the top of the port door. *See Figure 14.*

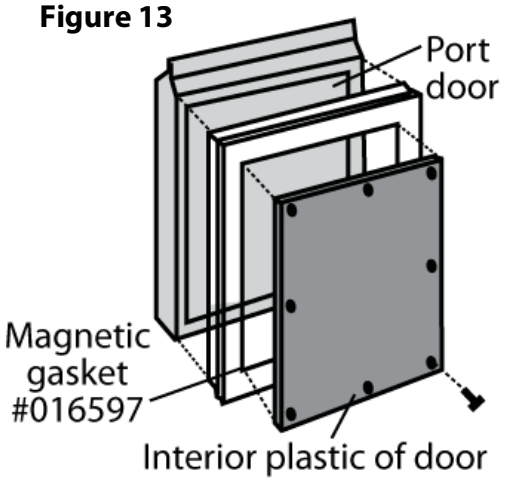
B. Remove the interior plastic panel from the door by removing the screws around its perimeter beneath the magnetic gasket.

C. Remove and discard the defective gasket.

D. Position the new gasket (#016597) and the interior plastic panel on the door; secure with screws.

E. Reinstall the port door.

Figure 13



Replacing anti-condensate heaters on PRP

A. Disconnect the power supply at its source, and remove the port door by removing the two screws from the poly-hinge at the top of the door. *See Figure 14.*

B. Remove the stainless steel door strikes by removing the two screws in the top and bottom flanges.

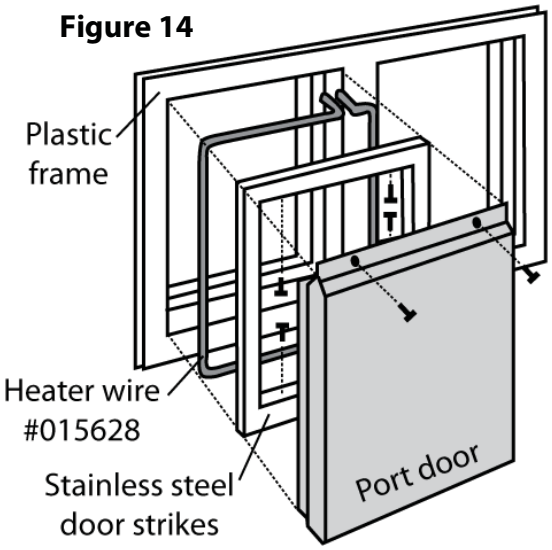
C. Disconnect the defective anti-condensate heater in the junction box at the top of the door. Discard the old heater.

D. Insert the new heater (#015628) and reassemble the door strikes. Exercise care not to pinch the heater wire beneath the door strikes.

E. Replace the port door and refasten the screws.

F. Reconnect the electrical power.

Figure 14



Replacing klixon on PRP

A. Disconnect power at its source, and remove the electrical junction box cover above the port.

B. Remove the screws located in flanges on the exterior of the port, and lift the unit from the panel.

C. Disconnect the appropriate wire nuts in the junction box. Remove and replace the defective klixon (#017083). *See Figure 15.*

D. Caulk around the perimeter of the opening, and replace the port. Rewire and replace the junction box cover. Reconnect electrical power. *See Figure 16.*

Figure 15

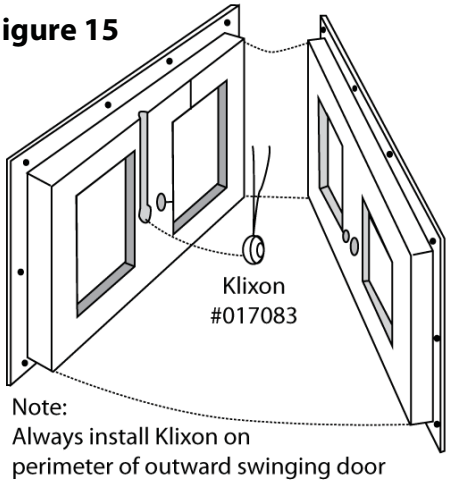
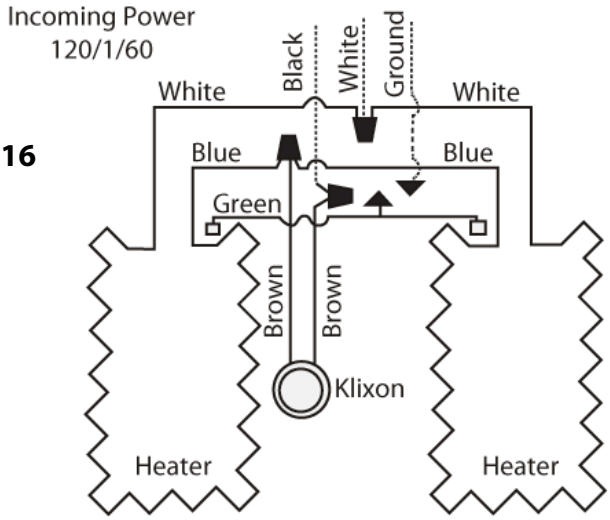


Figure 16



Replacing Door Closer

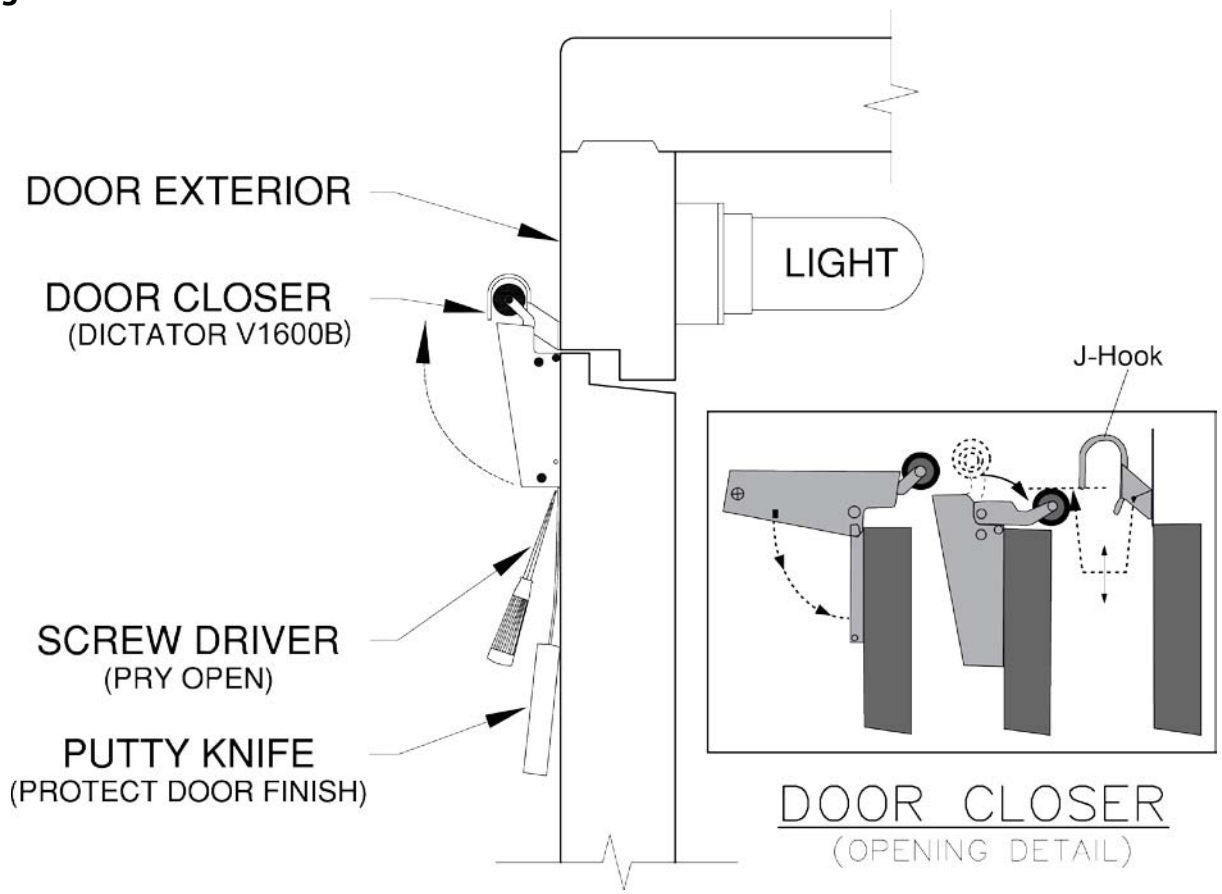
A. Position a putty knife against the base of the bottom of the closer cover to protect the door surface as shown. *See figure 17*. Pry open the cover using a small flat bladed screw driver. The closer cover is friction fit onto its base and will pry out and upward away from the door.

B. Remove all mounting screws from the closer base on the door and from the "J" hook mounted on the door frame.

C. Install new closer and "J" hook onto door and frame using the existing holes. If for any reason the existing holes do not line up with the holes in the new closer you will be required to drill and tap the door at the location of the holes for the new closer mounting base. Once firmly secured, rotate the cover back down over the base and snap into place.

D. Adjust the "J" hook, if required, to align the rubber wheel of the closer with the tip of the hook. When properly aligned the tip of the hook should touch the top of the rubber wheel as the wheel passed into the hook.

Figure 17



Part Number: #031349 – Dictator Hydraulic Door Closer V1600B

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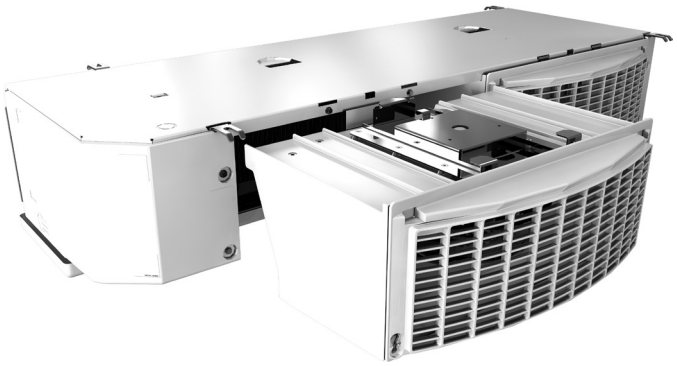
HEATCRAFT™ Worldwide Refrigeration

Installation and Operations Manual

H-IM-UC **August 2012** **Part No. 25008201**

Replaces None. Information formerly included in H-IM-64L

Unit Coolers



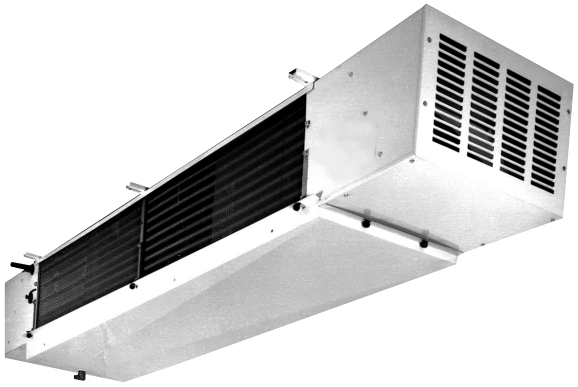






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General Safety Information

1. Installation and maintenance to be performed only by qualified personnel who are familiar with this type of equipment

2. Some units are pressurized with dry air or inert gas. All units must be evacuated before charging the system with refrigerant.

3. Make sure that all field wiring conforms to the requirements of the equipment and all applicable national and local codes.

4. Avoid contact with sharp edges and coil surfaces. They are a potential injury hazard.

5. Make sure all power sources are disconnected before any service work is done on units.

WARNING: Refrigerant can be harmful if it is inhaled. Refrigerant must be used and recovered responsibly.
Failure to follow this warning may result in personal injury or death.

Inspection

Responsibility should be assigned to a dependable individual at the job site to receive material. Each shipment should be carefully checked against the bill of lading. The shipping receipt should not be signed until all items listed on the bill of lading have been accounted. Check carefully for concealed damage. Any shortage or damages should be reported to the delivering carrier. Damaged material becomes the delivering carrier's responsibility, and should not be returned to the manufacturer unless prior approval is given to do so. When uncrating, care should be taken to prevent damage. Heavy equipment should be left on its shipping base until it has been moved to the final location. Check the serial tag information with invoice. Report any discrepancies to your Heatcraft Refrigeration Products Sales Representative.

Warranty Statement

Seller warrants to its direct purchasers that products, including Service Parts, manufactured by SELLER shall be of a merchantable quality, free of defects in material or workmanship, under normal use and service for a period of one **(1) year from date of original installation, or eighteen (18) months from date of shipmen**t by SELLER, whichever first occurs. Any product covered by this order found to Seller's satisfaction to be defective upon examination at Seller's factory will at SELLER's option, be repaired or replaced and returned to Buyer via lowest common carrier, or SELLER may at its option grant Buyer a credit for the purchase price of the defective article. Upon return of a defective product to SELLER's plant, freight prepaid, by Buyer, correction of such defect by repair or replacement, and return freight via lowest common carrier, shall constitute full performance by SELLER of its obligations hereunder.

SELLER shall have no liability for expenses incurred for repairs made by Buyer except by prior, written authorization. Every claim on account of breach of warranty shall be made to SELLER in writing within the warranty period specified above – otherwise such claim shall be deemed waived. Seller shall have no warranty obligation whatsoever if its products have been subjected to alteration, misuse, negligence, free chemicals in system, corrosive atmosphere, accident, or if operation is contrary to SELLER's or manufacturer's recommendations, or if the serial number has been altered, defaced, or removed.

Seller makes no express warranties except as noted above. All implied warranties are limited to the duration of the Express Warranty. Liability for incidental and consequential damages is excluded.
The forgoing is in lieu of all other warranties, express or implied, notwithstanding the provisions of the uniform commercial code, the Magnuson-Moss Warranty - Federal Trade Commission Improvement Act, or any other statutory or common law, federal or state.

SELLER makes no warranty, express or implied, of fitness for any particular purpose, or of any nature whatsoever, with respect to products manufactures or sold by seller hereunder, except as specifically set forth above and on the face hereof. It is expressly understood and agreed that SELLER shall not be liable to buyer, or any customer of buyer, for direct or indirect, special, incidental, consequential or penal damages, or for any expenses incurred by reason of the use or misuse by buyer or third parties of said products. To the extent said products may be considered "consumer products," As defined in Sec. 101 of the Magnuson-Moss Warranty - Federal Trade Commission Improvement Act, SELLER makes no warranty of any kind, express or implied, to "consumers," except as specifically set forth above and on the face hereof.

The following conditions should be adhered to when installing this unit to maintain the manufacturers warranty:

(a) System piping must be in accordance with good refrigeration practices.
(b) **Inert gas must be charged into the piping during brazing.**
(c) The power supply to the unit must meet the following conditions:
  A. Three phase voltages must be +/- 10% of nameplate ratings. Single phase must be within +10% or -5% of nameplate ratings.
  B. Phase imbalance cannot exceed 2%.
(d) All control and safety switch circuits must be properly connected according to the wiring diagram.
(e) The factory installed wiring and piping must not be changed without written factory approval.
(f) All equipment is installed in accordance with Heatcraft Refrigeration Products specified minimum clearances

Recommended Unit Cooler Placement

Some general rules for evaporator placement which must be followed are:

1. The air pattern must cover the entire room.
2. **NEVER** locate evaporators over doors.
3. Location of aisles, racks, etc. must be known.
4. Location relative to compressors for minimum pipe runs.
5. Location of condensate drains for minimum run.

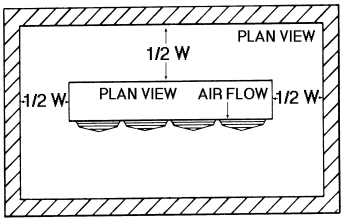
The size and shape of the storage will generally determine the type and number of evaporators to be used and their location. The following are some typical examples:

NOTE: Leave space equal to unit height between bottom of unit and product. Do not stack product in front of fans.

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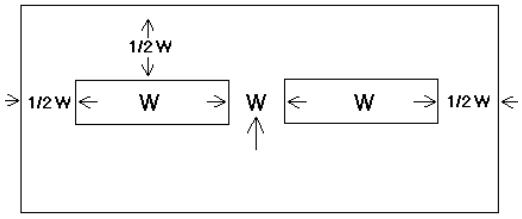
Minimum Unit Clearances

Figure 1. Medium Profile and Large Unit Coolers



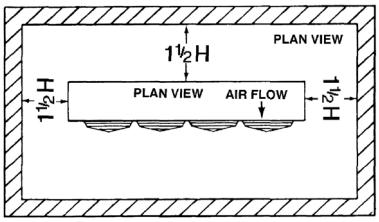
One evaporator

NOTE:
W = Total width of evaporator coil surface.



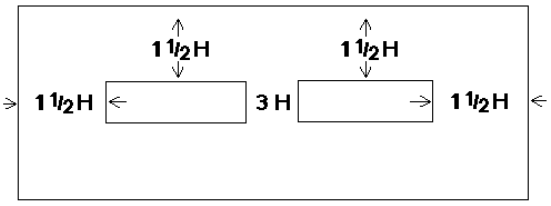
Two evaporators

Figure 2. Low Profile Unit Coolers



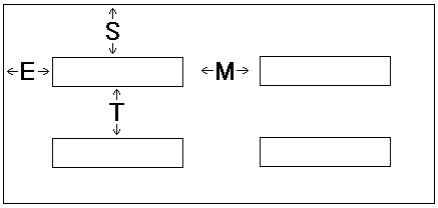
One evaporator

NOTE:
H = Total height of evaporator coil surface.



Two evaporators

Figure 3. Center Mount Unit Coolers

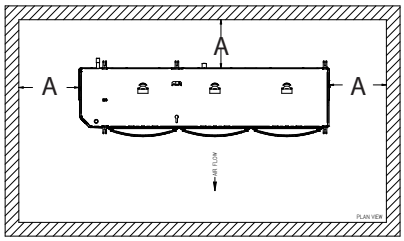




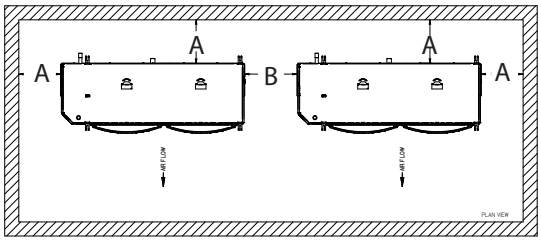
Recommended Maximum - Minimum Dimensions for Center Mount Unit Cooler Installations.

E		S		M		T	
Max. 25'	Min. 2'	Max. 20'	Min. 3'	Max. 40'	Min. 3'	Max. 40'	Min. 6'

Figure 3A. Slim Contour Unit Coolers



	Min
A	18"
B	36"



Unit Cooler Mounting

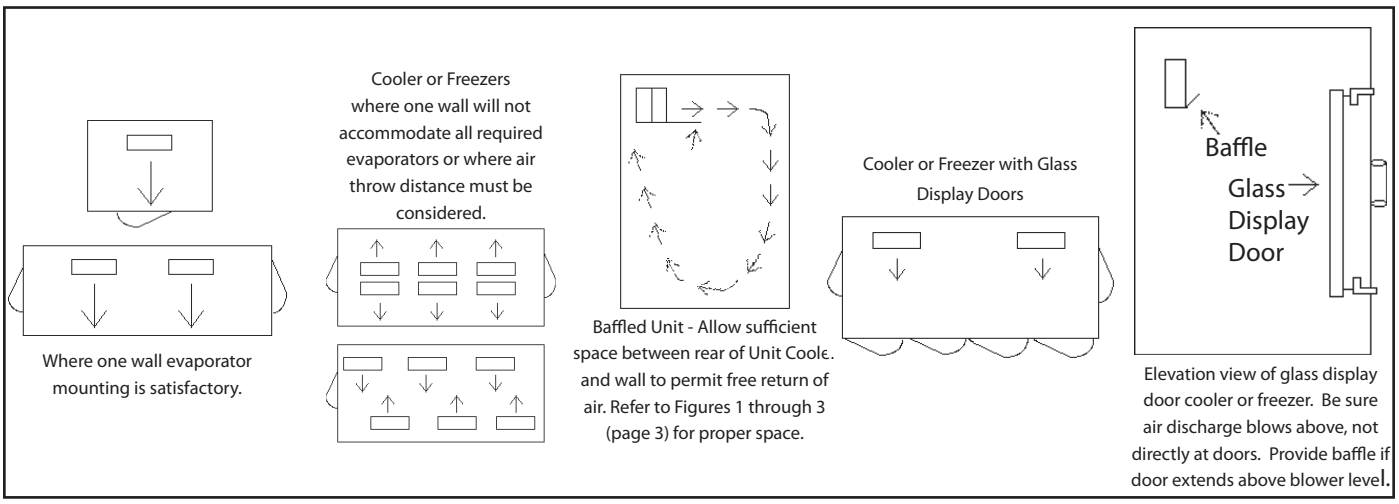
Most evaporators can be mounted with rod hangers, lag screws, or bolts. Use 5/16" bolt and washers or rod for up to 250 pounds, 3/8" for up to 600 pounds and 5/8" for over 600 pounds. Care should be taken to mount the units level so that condensate drains properly. Note that some unit cooler designs achieve drain pan slope by using different height mounting brackets. In this situation, the top of the mounting brackets should be level. Adequate support must be provided to hold the weight of the unit.

When using rod hangers, allow adequate space between the top of the unit and the ceiling for cleaning. To comply with NSF Standard 7, the area above the unit cooler must be sealed or exposed in such a way to facilitate hand cleaning without the use of tools. When lagging or bolting the unit flush to the ceiling, seal the joint between the top and the ceiling with an NSF listed sealant and ends of open hanger channels must be sealed to prevent accumulation of foreign matter.

When locating unit coolers in a cooler or freezer, refer to Figures 1 through 4 for guidelines.

NOTE: Always avoid placement of Unit Coolers direct above doors and door openings.

Figure 4. Large Coolers and Freezers Placement.



Defrost Troubleshooting

Fan Motor

If the motor does not operate or it cycles on thermal overload, remove motor leads from terminal block and apply correct voltage across the leads. If motor still does not operate satisfactorily, it must be replaced. Before starting the unit, rotate fan blades to make sure they turn freely and have sufficient clearance.

Fan Delay & Defrost Termination Control

This control is a single pole double throw switch. The red lead wire is wired to common. The black wire is wired in series with the fan motors. The brown wire is wired in series with the defrost termination solenoid in the timer. The brown and red contacts close and the black and red contacts open when the temperature is above 55°F. The black and red contacts close and the brown and red contacts open when the temperature is below 35°F.

On initial "pull down" of a warm box the fan will not start until the coil temperature reaches approximately 35°F. If the box is still comparatively warm (60°F) when the fan starts, then blowing this warm air over the coil may cause it to warm up to 55°F and thus stop the fan. Therefore, the fan may recycle on initial "pull down." This control cannot be adjusted.

If the fan motor fails to start when the control is below 35°F, disconnect the fan motor leads and check the motor as described for fan motors. Also check whether current is being supplied at "N" and "4" from the timer. The fan delay control must be below 35°F when checking for a closed circuit.

Defrost Heater

If unit shows very little or no defrosting and does not heat, disconnect heater and check to find if it is burned out. To test, apply correct voltage across heater or use continuity flashlight battery tester.

Drain Pan

If drain pan has an ice build-up, drain line may be frozen. The drain line should be pitched sharply and exit cabinet as quickly as possible. Sometimes location and ambient at the drain outside of cabinet may cause freeze-up. A drain line heater may be required to correct the freeze-up. Any traps in the drain line must be located in a **warm ambient.**

Field Wiring

The field wiring should enter the areas as provided on the unit. The wiring diagram for each unit is located on the inside of the electrical panel door. All field wiring should be done in a professional manner and in accordance with all governing codes. Before operating unit, double check all wiring connections, including the factory terminals. Factory connections can vibrate loose during shipment.

1. The serial data tag on the unit is marked with the electrical characteristic for wiring the unit.
2. Consult the wiring diagram in the unit cooler and in the condensing unit for proper connections.
3. Wire type should be of copper conductor only and of the proper size to handle the connected load.
4. The unit must be grounded.
5. For multiple evaporator systems, the defrost termination controls should be wired in series. Follow the wiring diagrams for multiple evaporator systems carefully. This will assure complete defrost of all evaporators in the system.
6. Multiple evaporator systems should operate off of one thermostat.
7. If a remote defrost timer is to be used, the timer should be located outside the refrigerated space.

WARNING: All wiring must be done in accordance with applicable codes and local ordinances.

Condensate Drain Lines

Either copper or steel drain lines should be used and properly protected from freezing. In running drain lines, provide a minimum 1/4 inch per foot pitch for proper drainage. Drain lines should be at least as large as the evaporator drain connection. All plumbing connections should be made in accordance with local plumbing codes. All condensate drain lines must be trapped, and run to an open drain. They must never be connected directly to the sewer system. Traps in the drain line must be located in a warm ambient. We recommend a trap on each evaporator drain line prior to any tee connections. Traps located outside, or extensive outside runs of drain line must be wrapped with a drain line heater. The heater should be connected so that it operates continuously. It is recommended that the drain line be insulated to prevent heat loss. A heat input of 20 watts per linear foot of drain line for 0˚F (-18˚C) room applications and 30 watts per linear foot for -20˚F (-29˚C) rooms is satisfactory. In freezers, the evaporator drain pan fitting should be included when heating and insulating the drain line.

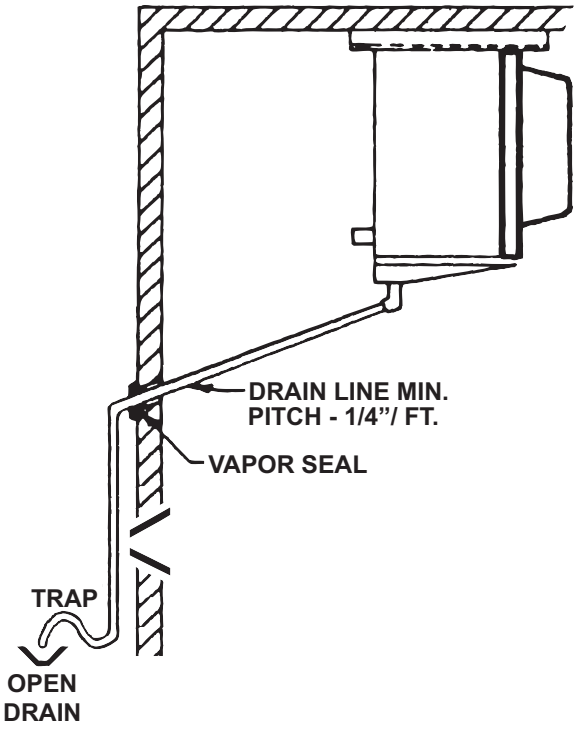
Inspect drain pan periodically to insure free drainage of condensate. If drain pan contains standing water, check for proper installation. The drain pan should be cleaned regularly with warm soapy water.

WARNING: All power must be disconnected before cleaning. Drain pan also serves as cover of hazardous moving parts. Operation of unit without drain pan constitutes a hazard.

Traps on low temperature units must be outside of refrigerated enclosures. Traps subject to freezing temperatures must be wrapped with heat tape and insulated.

NOTE: Always trap single evaporator system drain lines individually to prevent humidity migration.

Figure 5. Condensate Drain Lines



Check Out and Start Up

NOTE: All adjustable controls and valves must be field adjusted to meet desired operation. There are no factory preset controls or valve adjustments. This includes low pressure, high pressure, adjustable head pressure systems and expansion valves.

After the installation has been completed, the following points should be covered before the system is placed in operation:

(a) Check all electrical and refrigerant connections. Be sure they are all tight.
(b) Check the room thermostat for normal operation and adjust.
(c) Wiring diagrams, instruction bulletins, etc. attached to the condensing units should be read and filed for future reference.
(d) All fan motors on evaporators should be checked for proper rotation. Fan motor mounts should be carefully checked for tightness and proper alignment.
(e) Electric and hot gas evaporator fan motors should be temporarily wired for continuous operation until the room temperature has stabilized.
(f) Do not leave unit unattended until the system has reached normal operating conditions and the oil charge has been properly adjusted to maintain the oil level between 1/4 and bottom of the sight glass.
(g) Make sure all Schrader valve caps are in place and tight.

Operational Check Out

After the system has been charged and has operated for at least two hours at normal operating conditions without any indication of malfunction, it should be allowed to operate overnight on automatic controls. Then a thorough recheck of the evaporator operation should be made as follows:

(a) Check liquid line sight glass and expansion valve operation. If there are indications that more refrigerant is required, leak test all connections and system components and repair any leaks before adding refrigerant.
(b) Thermostatic expansion valves must be checked for proper superheat settings. Feeler bulbs must be in positive contact with the suction line and should be insulated. Valves set at high superheat will lower refrigeration capacity. Low superheat promotes liquid slugging and compressor bearing washout.
(c) Check defrost controls for initiation and termination settings, and length of defrost period. Set fail safe at length of defrost + 25%.
Example: 20 minute defrost + 5 minutes = 25 minute fail safe
(d) Check drain pan for proper drainage.
(e) Install instruction card and control system diagram for use of building manager or owner.

Evaporator Superheat

Check Your Superheat. After the box temperature has reached or is close to reaching the desired temperature, the evaporator superheat should be checked and adjustments made if necessary. Generally, systems with a design TD of 10˚F should have a superheat value of 6˚ to 10˚F for maximum efficiency. For systems operating at higher TD's, the superheat can be adjusted to 12˚ to 15˚F as required.

NOTE:	**Minimum compressor suction superheat of 20˚F may override these recommendations on some systems with short line runs.**

To properly determine the superheat of the evaporator, the following procedure is the method Heatcraft recommends:

WARNING:	**If the condensing unit has no flooded condenser head pressure control, the condensing unit must have the discharge pressure above the equivalent 105˚F condensing pressure.**

1. Measure the temperature of the suction line at the point the bulb is clamped.

2. Obtain the suction pressure that exists in the suction line at the bulb location by either of the following methods:

   a. A gauge in the external equalized line will indicate the pressure directly and accurately.

   b. A gauge directly in the suction line near the evaporator or directly in the suction header of the evaporator will yield the same reading as 2a above.

3. Convert the pressure obtained in 2a or 2b above to saturated evaporator temperature by using a temperature-pressure chart.

4. Subtract the saturated temperature from the actual suction line temperature. The difference is Superheat.

Figure 6. Bulb and Contact Location

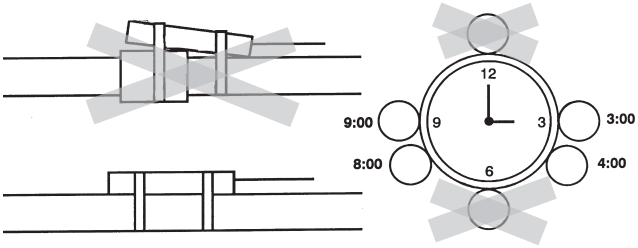
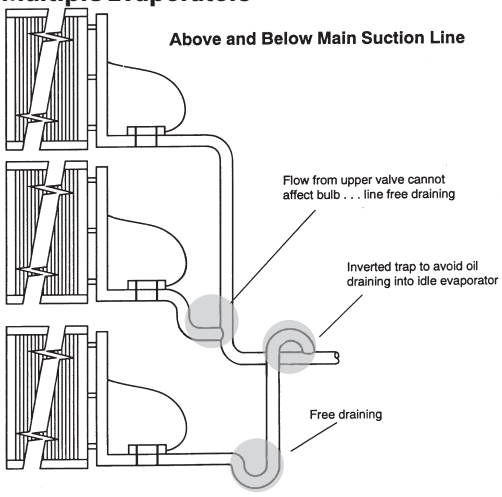


Figure 7. Multiple Evaporators



Alternative Superheat Method

The most accurate method of measuring superheat is found by following the previous procedure, Temperature/Pressure method. However, that method may not always be practical. An alternative method which will yield fairly accurate results is the temperature / temperature method:

1. Measure the temperature of the suction line at the point the bulb is clamped (outlet).

2. Measure the temperature of one of the distributor tubes close to the evaporator coil (inlet).

3. Subtract the inlet temperature from the outlet temperature. The difference is Superheat.

This method will yield fairly accurate results as long as the pressure drop through the evaporator coil is low.

Slim Contour Exclusive Information

The Slim Contour has several exclusive features that improve the servicability .

Cassette Removal/Replacement

Removal of modular cassettes in the Slim Contour improve access and the speed required to service the unit cooler.

1. Turn off electrical feed to the unit.

2. Remove the fan guard (2 Screws).

3. Remove screws from modular cassette and pull cassette forward, but do not fully remove cassette. (Figure 8)

4. With the cassette slightly removed, reach behind the cassette and unplug wired connection. This will separate the cassette from unit cooler. (Figure 9)

5. Once the cassette has been removed from the unit cooler, the cassette can be stored on the unit by using the service clip feature. (Figure 10)

6. To reinstall cassette, reconnect plug and slide cassette back into place. Re-secure the cassette by placing screws in place.

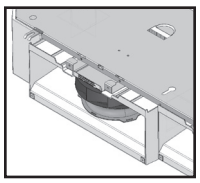


Figure 8.
Cassette Removal (Step 3)

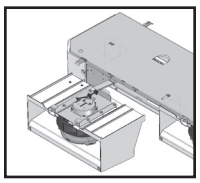


Figure 9.
Cassette Removal (Step 4)

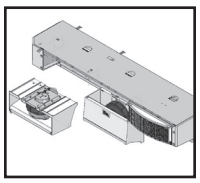


Figure 10.
Cassette Removal (Step 5)

Service Clip Feature

The Slim Contour features a service clip on all of its modular cassettes. The service clip is exclusive to Slim Contour cassettes and is designed to improve the serviceability of the unit cooler. The service clip features two separate hooks that can be used to aide in common maintenance.

The service clip that is featured on top of the cassettes motor can be used to suspend the cassette while being removed to assist in removing the power connection of the cassette(Figure 11.). The Slim Contour cassette also can be suspended from the drain pan using the screw mounts (Figure 12.)

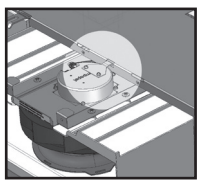


Figure 11.
Service Clip (Feature 1)

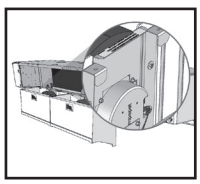


Figure 12.
Service Clip (Feature 2)

Table 1. Expansion Valve Selection For 100# Head Pressure Valve

BTUH at about 10° T.D.	R-507/R404A -20˚F/-29˚C Evap.		R-507/R404A +25˚F/-4˚C Evap.		R-22 -20˚F/-29˚C Evap.		R-22 +25˚F/-4˚C Evap.	
	Sporlan	ALCO	Sporlan	ALCO	Sporlan	ALCO	Sporlan	ALCO
3,000-5,000	EGSE 1/2 ZP	HFESC-1/2-RZ	EGSE 1/2 C	HFESC-1/2-RC	EGVE 1/2 Z	HFESC-1-HZ	EGVE 1/2 C	HFESC-1/2-HC
5,500-7000	EGSE 1/2 ZP	HFESC-1/2-RZ	EGSE 1 C	HFESC-1/2-RC	EGVE 1 ZP	HFESC-1-HZ	EGVE 1 C	HFESC-1-HC
7500-8000	EGSE 1 ZP	HFESC-1/2-RZ	EGSE 1 C	HFESC-1-RC	EGVE 1 ZP	HFESC-1 1/2-HZ	EGVE 1 C	HFESC-1-HC
8500-10,000	EGSE 1 ZP	HFESC-1-RZ	EGSE 11/2 C	HFESC-1 1/4-RC	EGVE 11/2 ZP	HFESC-1 1/2-HZ	EGVE 1 C	HFESC-1-HC
10,500-11,000	EGSE 1 ZP	HFESC-1 1/4-RZ	EGSE 11/2 C	HFESC-1 1/4-RC	EGVE 11/2 ZP	HFESC-2-HZ	EGVE 11/2 C	HFESC-1-HC
11,500-13,000	EGSE 11/2 ZP	HFESC-1 1/2-RZ	EGSE 11/2 C	HFESC-1 1/4-RC	EGVE 11/2 ZP	HFESC-2-HZ	EGVE 11/2 C	HFESC-1-HC
13,500-15,000	EGSE 11/2 ZP	HFESC-2-RZ	EGSE 2 C	HFESC-1 1/2-RC	EGVE 2 ZP	HFESC-2 1/2-HZ	EGVE 11/2 C	HFESC-2-HC
15,500-17,000	EGSE 2 ZP	HFESC-2-RZ	EGSE 2 C	HFESC-2-RC	EGVE 2 ZP	HFESC-2 1/2-HZ	EGVE 2 C	HFESC-2-HC
17,500-20,000	EGSE 2 ZP	HFESC-3 1/2-RZ	SSE 3 C	HFESC-2-RC	EGVE 3 ZP	HFESC-3-HZ	EGVE 2 C	HFESC-2 1/2-HC
20,500-24,000	SSE 3 ZP	HFESC-3 1/2-RZ	SSE 3 C	HFESC-3-RC	SVE 3 ZP	HFESC-3-HZ	SVE 3 C	HFESC-3-HC
24,500-28,000	SSE 3 ZP	HFESC-3 1/2-RZ	SSE 4 C	HFESC-3-RC	SVE 4 ZP	HFESC-5 1/2-HZ	SVE 3 C	HFESC-3-HC
28,500-34,000	SSE 4 ZP	HFESC-5-RZ	SSE 4 C	HFESC-3-RC	SVE 5 ZP	HFESC-5 1/2-HZ	SVE 4 C	HFESC-5 1/2-HC
34,500-40,000	OSE 6 ZP	HFESC-5-RZ	SSE 6 C	HFESC-5-RC	SVE 8 ZP	HFESC-5 1/2-HZ	SVE 4 C	HFESC-5 1/2-HC
40,500-50,000	OSE 8 ZP	HFESC-7-RZ	OSE 8 C	HFESC-5-RC	SVE 10 ZP	HFESC-8-HZ	SVE 5 C	HFESC-5 1/2-HC
50,500-60,000	OSE 9 ZP	HFESC-10-RZ	OSE 9 C	HFESC-7-RC	SVE 10 ZP	HFESC-8-HZ	SVE 8 C	HFESC-8-HC
60,500-70,000	OSE 9 ZP	HFESC-10-RZ	OSE 9 C	HFESC-10-RC	OVE 15 ZP	HFESC-10-HZ	SVE 8 C	HFESC-8-HC
70,500-80,000	OSE 12 ZP	HFESC-10-RZ	OSE 12 C	HFESC-10-RC	OVE 15 ZP	HFESC-15-HZ	SVE 10 C	HFESC-10-HC
80,500-90,000	OSE 12 ZP	HFESC-13-RZ	OSE 12 C	HFESC-10-RC	OVE 15 ZP	HFESC-15-HZ	SVE 10 C	HFESC-10-HC
90,500-100,000	OSE 12 ZP	HFESC-13-RZ	OSE 12 C	HFESC-13-RC	OVE 15 ZP	HFESC-15-HZ	OVE 15 C	HFESC-15-HC
100,500-110,000	OSE 21 ZP	TRAE-20-RZ	OSE 21 C	HFESC-13-RC	OVE 20 ZP	HFESC-20-HZ	OVE 15 C	HFESC-15-HC
110,500-120,000	OSE 21 ZP	TRAE-20-RZ	OSE 21 C	HFESC-13-RC	OVE 20 ZP	HFESC-20-HZ	OVE 15 C	HFESC-15-HC
120,500-130,000	OSE 21 ZP	TRAE-20-RZ	OSE 21 C	TRAE-20-RC	OVE 20 ZP	HFESC-20-HZ	OVE 15 C	HFESC-15-HC

NOTES:

1. Valve selections assume standard conditions and 100°F vapor-free liquid.
2. Equivalent valve may be used in place of selection.
3. For "Medium Temp R-507," valve designation will use "P" for refrigerant code.

Table 2. Expansion Valve Selection 180# Head Pressure Valve

BTUH at about 10° T.D.	R-507/R404A -20˚F/-29˚C Evap.		R-507/R404A +25˚F/-4˚C Evap.		R-22 -20˚F/-29˚C Evap.		R-22 +25˚F/-4˚C Evap.	
	Sporlan	ALCO	Sporlan	ALCO	Sporlan	ALCO	Sporlan	ALCO
3,000-5,000	EGSE 1/2 ZP	HFESC-1/2-RZ	EGSE 1/2 C	HFESC-1/2-RC	EGVE 1/2 ZP	HFESC-1/2-HZ	EGVE 1/2 C	HFESC-1/2-HC
5,500-7000	EGSE 1/2 ZP	HFESC-1-RZ	EGSE 1 C	HFESC-1/2-RC	EGVE 1 ZP	HFESC-1-HZ	EGVE 1/2 C	HFESC-1-HC
7500-8000	EGSE 1 ZP	HFESC-1-RZ	EGSE 1 C	HFESC-1/2-RC	EGVE 1 ZP	HFESC-1-HZ	EGVE 1 C	HFESC-1-HC
8500-10,000	EGSE 1 ZP	HFESC-1-RZ	EGSE 1 C	HFESC-1-RC	EGVE11/2 ZP	HFESC-1 1/2-HZ	EGVE 1 C	HFESC-1-HC
10,500-11,000	EGSE 1 ZP	HFESC-1 1/4-RZ	EGSE 11/2 C	HFESC-1-RC	EGVE 11/2 ZP	HFESC-1 1/2-HZ	EGVE 1 C	HFESC-1-HC
11,500-13,000	EGSE 1 1/2 ZP	HFESC-1 1/4-RZ	EGSE 11/2 C	HFESC-1 1/4-RC	EGVE 11/2 ZP	HFESC-2-HZ	EGVE 1 C	HFESC-1 1/2-HC
13,500-15,000	EGSE 2 ZP	HFESC-1 1/2-RZ	EGSE 11/2 C	HFESC-1 1/4-RC	EGVE 2 ZP	HFESC-2-HZ	EGVE 11/2 C	HFESC-1 1/2-HC
15,500-17,000	EGSE 2 ZP	HFESC-2-RZ	EGSE 2 C	HFESC-1 1/2-RC	EGVE 2 ZP	HFESC-2 1/2-HZ	EGVE 11/2 C	HFESC-1 1/2-HC
17,500-20,000	EGSE 2 ZP	HFESC-2-RZ	EGSE 2 C	HFESC-1 1/2-RC	EGVE 3 ZP	HFESC-2 1/2-HZ	EGVE 11/2 C	HFESC-2-HC
20,500-24,000	SSE 3 ZP	HFESC-3-RZ	SSE 3 C	HFESC-2-RC	SVE 3 ZP	HFESC-3-HZ	SVE 2 C	HFESC-2-HC
24,500-28,000	SSE 4 ZP	HFESC-3-RZ	SSE 3 C	HFESC-2-RC	SVE 4 ZP	HFESC-3-HZ	SVE 3 C	HFESC-2 1/2-HC
28,500-34,000	SSE 4 ZP	HFESC-5-RZ	SSE 4 C	HFESC-3 1/2-RC	SVE 4 ZP	HFESC-5 1/2-HZ	SVE 3 C	HFESC-3-HC
34,500-40,000	SSE 6 ZP	HFESC-5-RZ	SSE 6 C	HFESC-3 1/2-RC	SVE 5 ZP	HFESC-5 1/2-HZ	SVE 3 C	HFESC-3-HC
40,500-50,000	OSE 9 ZP	HFESC-7-RZ	SSE 6 C	HFESC-3 1/2-RC	SVE 8 ZP	HFESC-5 1/2-HZ	SVE 4 C	HFESC-5 1/2-HC
50,500-60,000	OSE 9 ZP	HFESC-7-RZ	OSE 9 C	HFESC-5-RC	SVE 10 ZP	HFESC-8-HZ	SVE 5 C	HFESC-5 1/2-HC
60,500-70,000	OSE 9 ZP	HFESC-10-RZ	OSE 9 C	HFESC-7-RC	OVE 15 ZP	HFESC-8-HZ	SVE 5 C	HFESC-5 1/2-HC
70,500-80,000	OSE 12 ZP	HFESC-10-RZ	OSE 12 C	HFESC-7-RC	OVE 15 ZP	HFESC-10-HZ	SVE 8 C	HFESC-8-HC
80,500-90,000	OSE 12 ZP	HFESC-10-RZ	OSE 12 C	HFESC-10-RC	OVE 15 ZP	HFESC-10-HZ	SVE 8 C	HFESC-8-HC
90,500-100,000	OSE 12 ZP	HFESC-13-RZ	OSE 12 C	HFESC-10-RC	OVE 15 ZP	HFESC-15-HZ	SVE 10 C	HFESC-8-HC
100,500-110,000	OSE 12 ZP	HFESC-13-RZ	OSE 12 C	HFESC-10-RC	OVE 20 ZP	HFESC-15-HZ	SVE 10 C	HFESC-10-HC
110,500-120,000	OSE 12 ZP	HFESC-13-RZ	OSE 12 C	HFESC-10-RC	OVE 20 ZP	HFESC-15-HZ	SVE 10 C	HFESC-10-HC
120,500-130,000	OSE 21 ZP	HFESC-13-RZ	OSE 12 C	HFESC-13-RC	OVE 20 ZP	HFESC-15-HZ	OVE 15 C	HFESC-10-HC

Table 3. Evaporator Troubleshooting Chart

SYMPTOMS	POSSIBLE CAUSES	POSSIBLE CORRECTIVE STEPS
Fan(s) will not operate.	1. Main switch open. 2. Blown fuses. 3. Defective motor. 4. Defective timer or defrost thermostat. 5. Unit in defrost cycle. 6. Coil does not get cold enough to reset thermostat.	1. Close switch. 2. Replace fuses. Check for short circuits or overload conditions. 3. Replace motor. 4. Replace defective component. 5. Wait for completion of cycle. 6. Adjust fan delay setting of thermostat. See Defrost Thermostat Section of this bulletin.
Room temperature too high.	1. Room thermostat set too high. 2. Superheat too high. 3. System low on refrigerant. 4. Coil iced-up. 5. Unit cooler located too close to doors. 6. Heavy air infiltration.	1. Adjust thermostat. 2. Adjust thermal expansion valve. 3. Add refrigerant. 4. Manually defrost coil. Check defrost controls for malfunction. 5. Relocate unit cooler or add strip curtain to door opening. 6. Seal unwanted openings in room.
Ice accumulating on ceiling around evaporator and/or on fan guards venturi or blades.	1. Defrost duration is too long. 2. Fan delay not delaying fans after defrost period. 3. Defective defrost thermostat or timer. 4. Too many defrosts.	1. Adjust defrost termination thermostat. 2. Defective defrost thermostat or not adjusted properly. 3. Replace defective component. 4. Reduce number of defrosts.
Coil not clearing of frost during defrost cycle.	1. Coil temperature not getting above freezing point during defrost. 2. Not enough defrost cycles per day. 3. Defrost cycle too short. 4. Defective timer or defrost thermostat.	1. Check heater operation. 2. Adjust timer for more defrost cycles. 3. Adjust defrost thermostat or timer for longer cycle. 4. Replace defective component.
Ice accumulating in drain pan	1. Defective heater. 2. Unit not pitched properly. 3. Drain line plugged. 4. Defective drain line heater. 5. Defective timer or thermostat.	1. Replace heater. 2. Check and adjust if necessary. 3. Clean drain line. 4. Replace heater. 5. Replace defective component.
Uneven coil frosting	1. Defective heater. 2. Located too close to door or opening. 3. Defrost termination set too low. 4. Incorrect or missing distributor nozzle.	1. Replace heater. 2. Relocate evaporator. 3. Adjust defrost termination setting higher. 4. Add or replace nozzle with appropriately sized orifice for conditions.

Replacement Parts by InterLINK

Commercial Refrigeration Parts

InterLink is your link to a complete line of dependable and certified commercial refrigeration parts, accessories and innovative electronic controls for all Heatcraft Refrigeration Products (HRP) brands - including Bohn, Larkin, Climate Control and Chandler. At InterLink, we provide our wholesalers with a comprehensive selection of product solutions and innovative technologies for the installed customer base. And every product is built to ensure the same high performance standards with which all HRP brands are built — backed by a dedicated team to serve every customer need, delivering at the best lead times in the industry.

Replacement parts should be obtained from your local InterLink wholesaler. Replacement parts, which are covered under the terms of the warranty statement on page 2 of this manual, will be reimbursed for total part cost only. The original invoice from the parts supplier must accompany all warranty claims for replacement part reimbursement. Heatcraft Refrigeration Products reserves the right to adjust the compensation amount paid on any parts submitted for warranty reimbursement when a parts supplier's original invoice is not provided with a claim. **For more information, call 800-686-7278 or visit www.interlinkparts.com.**

For more detailed information on the following topics, please visit http://heatcraftrpd.com/service/publibrary.asp for our complete Refrigeration Systems Installation and Operation Manual (H-IM-64L).

Defrost Thermostat
Expansion Valves & Nozzles
Refrigerant Oils
Recommended Refrigerant Piping Practices
Line Sizing Charts
Hot Gas Defrost Systems
Evacuation and Leak Detection
Refrigerant Charging Instructions
System Balancing — Compressor Superheat
General Sequence and Operation
Troubleshooting Guides
Preventive Maintenance Guidelines
Typical Wiring Diagrams

Since product improvement is a continuing effort, we reserve the right to make changes in specifications without notice.

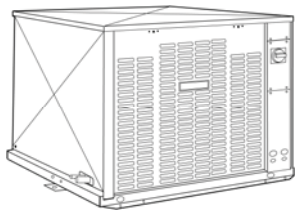
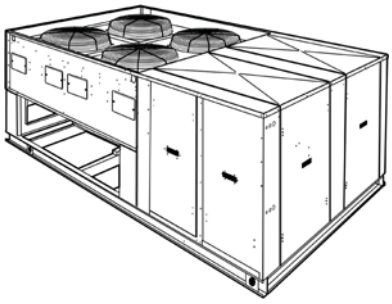
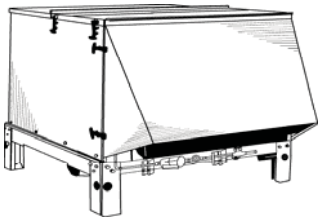
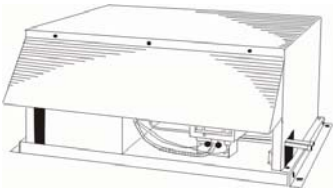
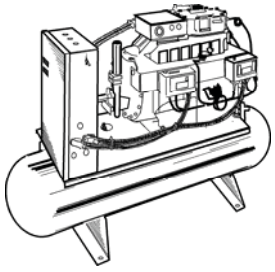
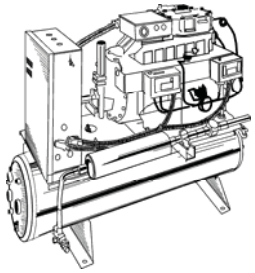
KeepRite®
REFRIGERATION

K40-CU-IM-13
1068155

Installation and Maintenance Instructions

for

Air-Cooled, Remote and Water-Cooled Condensing Units

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General Safety

IMPORTANT SAFETY NOTE

Only a qualified refrigeration mechanic who is familiar with refrigeration systems and components, including all controls should perform the installation and start-up of the system. To avoid potential injury, use care when working around coil surfaces (if applicable) or sharp edges of metal cabinets. All piping and electrical wiring should be installed in accordance with all applicable codes, ordinances and local by-laws.

WARNING

Always **disconnect and lock off** the main power supply on any system that will be worked on to avoid accidental start up of the equipment.

Inspection

Inspect all equipment before unpacking for visible signs of damage or loss. Check shipping list against material received to ensure shipment is complete.

IMPORTANT: Remember, you, the consignee, must make any claim necessary against the transportation company. Shipping damage or missing parts, when discovered at the outset, will prevent later unnecessary and costly delays. **If damage or loss during transport is evident, make claim to carrier, as this will be their responsibility, not that of the manufacturer.**

Should carton be damaged, but damage to equipment is not obvious, a claim should be filed for “concealed damage” with the carrier.

IMPORTANT: Check the **electrical ratings** on the unit to make sure they correspond to those ordered and to electrical power available at the job site. Save all shipping papers, tags, and instruction sheets for reference by installer and owner.

Handling, Placement and Installation

IMPORTANT: When selecting a location for the condensing unit, consideration should be given to some of the following:

(a) Loading capacity of the floor or roof. Check building codes for weight distribution requirements.
(b) Distance to suitable electrical supply.
(c) Distance to the evaporator.
(d) Adequate air circulation and ventilation.
(e) Close proximity to water source and floor drains (water-cooled units)
(f) Accessibility for maintenance.
(g) Local building codes.
(h) Adjacent buildings relative to noise levels.
(i) Wishes of the end user / owner.

When all of the above points have been considered and a specific location chosen, it is advisable to obtain written approval of this location from the building and/or condensing unit owner. This may be a means of avoiding disagreement and expense at a later date.

A fully qualified and properly equipped crew with the necessary tackle and rigging should be engaged to locate the condensing unit in position. When lifting the unit, spreader bars and chafing gear should be used to prevent damage.

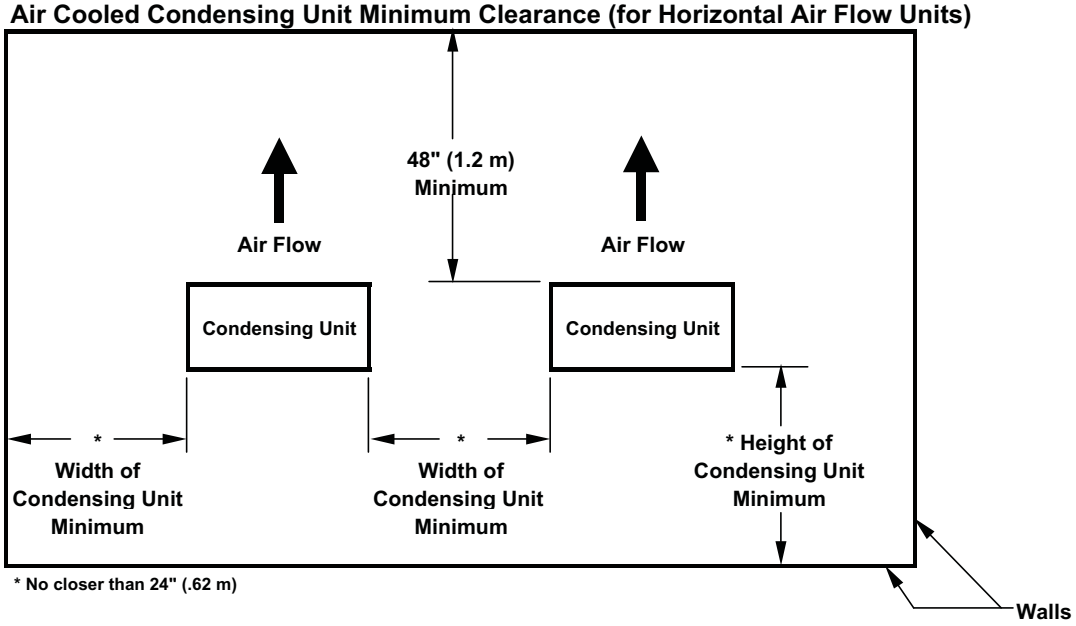
The unit should be placed on a base, which is level and even. Units should be lagged to sleepers or support base. Place unit where it will not be subject to damage by traffic or flooding. On critical installations where noise is liable to be transmitted through the floor structure, vibration isolators should be installed. Isolators should be installed under mounting base and may be rubber or cork or equal.

DO NOT USE THE SHIPPING SKID AS A PERMANENT BASE.

The condensing unit should be positioned to allow adequate space for performing service work.

Indoor and outdoor air-cooled condensing units should be positioned using the guidelines shown below.

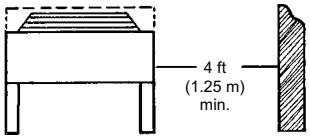
Air Cooled Condensing Unit Minimum Clearance (for Horizontal Air Flow Units)



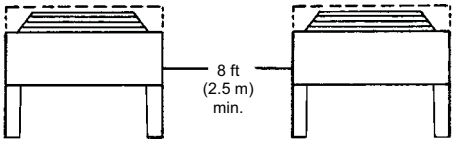
SPECIAL NOTE FOR LARGE AIR COOLED CONDENSING UNITS: Vertical flow air cooled condensing units are large and heavy pieces of mechanical equipment and must be handled as such. A fully qualified and properly equipped crew with the necessary tackle and rigging should be engaged to locate the condensing unit into location. The unit can be lifted by means of lifting holes located in the base frame of the unit. Spreader bars should be used to prevent damage to the sides of the unit. Do not sling directly around the base of unit. The unit should be placed on a base which is level and even.

Air Cooled Condensing Unit Minimum Clearance (For Vertical Air Flow Units)

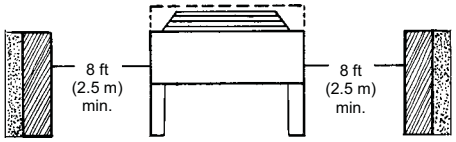
WALLS OR OBSTRUCTIONS
All sides of the unit must be a minimum of 4 feet (1.25 m) away from the wall or obstruction. Overhead obstructions are not permitted. If enclosed by three walls, the unit must be installed as indicated for units in a pit.



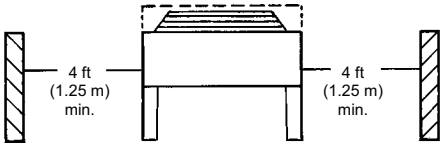
MULTIPLE UNITS
A minimum of 8 feet (2.5 m) is required between multiple units placed side by side. If placed end to end, the minimum distance between units is 4 feet (1.25 m)



UNITS IN PITS:
The top of the unit must be level with, or above the top of the pit. In addition, a minimum of 8 feet (2.5 m) is required between the unit and the pit walls.



LOUVERS / FENCES:
Louvers/fences must have a minimum of 80% free area and 4 feet (1.25 m) minimum clearance between the unit and the louver/fence. Height of louver/fence must not exceed top of unit.



Units equipped with spring-mounted compressors have shipping spacers that are designed to hold the compressor rigidly during transit to prevent possible damage. Before operating the unit, it is necessary to remove these spacers. To remove the shipping spacers, follow these steps:

(a) Remove the upper nuts / washers.
(b) Discard the shipping spacers.
(c) Install the rubber cone washers (located in the electrical box).
(d) Replace the upper mounting nuts / washers.
(e) Allow 1/16 inch space between the mounting nuts / washers and the compressor foot.

On units equipped with rigid mounted compressors, check the compressor mounting bolts to insure they have not vibrated loose during shipping.

Ventilation

If the compressors or condensing units are to be located in machine rooms, adequate ventilation air must be provided in order to avoid an excessive temperature rise in the room. Air requirements vary with ambient air temperatures and the refrigeration load, however the following rule of thumb may be used to approximate ventilating air quantities:

Model Type	Air Quantity
Air-cooled condensing units (for horizontal air flow units)	1,000 cfm (472 L/s) per Hp
Air-cooled compressors (with remote condensers)	250 cfm (118 L/s) per Hp
Suction cooled or water-cooled compressors (with remote or water cooled condensers)	200 cfm (94 L/s) per Hp

All of the above mentioned air quantities are based on relatively short discharge line runs within the machine rooms. If using long uninsulated discharge line runs are unavoidable in the machine room, additional ventilation air is required to offset the heat added to the room by the discharge gas.

Electrical Information

WARNING

All wiring and connections to the unit must be made in accordance with national as well as local electrical codes and by-laws.

Electrical wiring should be sized in accordance with the minimum circuit ampacities shown on the unit nameplate and applicable electrical codes. The unit power connections are approved for copper wire only.

Connect the field power supply through a fused branch circuit disconnect switch. The entering service fuse must not exceed the maximum overcurrent protection (MOP) value on the unit data plate.

Field connected control circuit wires are terminated directly at the control circuit terminal block in accordance with the appropriate wiring diagram.

Voltage at the unit terminals must not vary more than the allowable variation during start-up and while under full load. If the voltage is normal at the supply with the compressor not running and drops considerably when the switch is closed and the motor is trying to start, there is a high resistance due to undersized wires or faulty connections. Voltage drop between inoperative and full load must not exceed 3% of line voltage. In addition, the phase imbalance at the motor terminals should be within 2% on three phase units.

60 Hz Supply		50 Hz Supply	
Power	**Allowable Variation**	**Power**	**Allowable Variation**
115-1-60	103-127 V	100-1-50	90-110 V
208/230-1-60	197-254 V	200/220-1-50	190-242 V
208/230-3-60	187-254 V	200/220-3-50	180-242 V
460-3-60	414-506 V	380/400-3-50	342-440 V
575-3-60	518-632 V		

All systems should use a liquid line solenoid valve (installed at the evaporator) and should be energized by the room or fixture thermostat. For systems with a defrost time clock, the liquid line solenoid and thermostat should be energized by the time clock. Initially set the defrost time clock (model 8145) as follows:

Air defrost evaporators; 3 per day (every 8 hours) with the time termination at 45 minutes.

Electric defrost evaporators; 4 per day (every 6 hours) with time termination set (Fail Safe) at 30 minutes. Check that the wiring from the defrost termination thermostat is wired to terminal “X” on the clock and terminates the defrost cycle when the evaporator coil reaches approximately 55 ^{o}F. The fan delay thermostat wiring should also be checked for proper operation. This ensures that all water droplets have been refrozen to the coil before the evaporator fan starts back up.

Note: *The above settings are guidelines only and must be re-adjusted to suit local field conditions and actual evaporator equipment specifications.*

Refer to the evaporator installation manual for further information.

An evaporator airflow interlock is recommended on some installations so that the compressor will pump down and shut off in the event that the evaporator fan is off for any reason. This is wired into the control circuit in series with the thermostat and solenoid valve.

Refer to the following wiring diagrams for typical air defrost and electric defrost wiring arrangements.

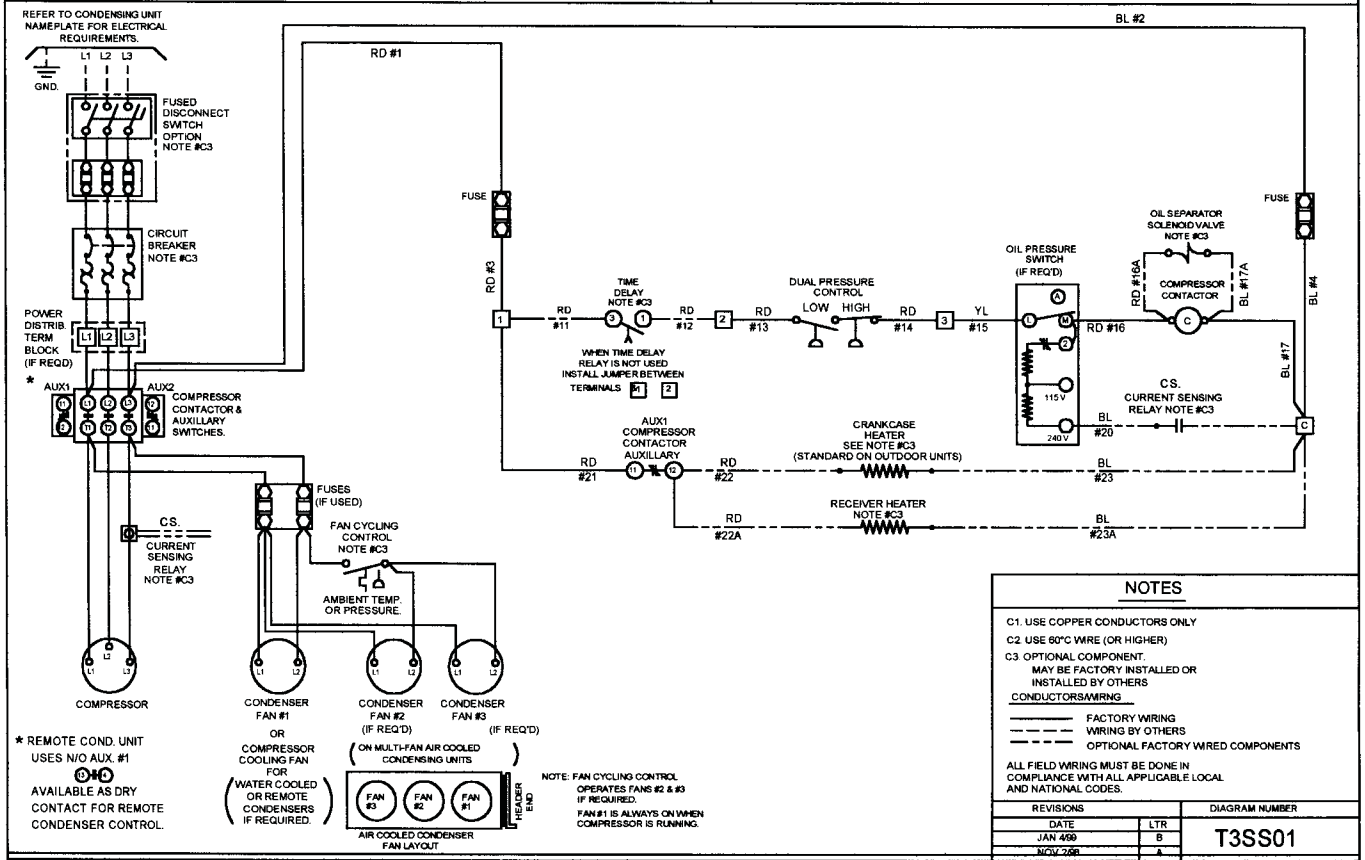
WARNING

Any deviation or change to the electrical components or wiring as supplied on the original equipment, or noncompliance with the voltage and phase balance requirements without written authorization will void the warranty.

Electrical Wiring Diagram – Horizontal Air Flow Condensing Units (K-Line)

CONDENSING UNIT WIRING DIAGRAM

- 208-230/3/60 & 200-220/3/50
- STANDARD COMPRESSOR, UP TO 3 CYLINDER.
- STANDARD CONTROL CIRCUIT.



NOTES

C1. USE COPPER CONDUCTORS ONLY

C2. USE 60°C WIRE (OR HIGHER)

C3. OPTIONAL COMPONENT. MAY BE FACTORY INSTALLED OR INSTALLED BY OTHERS

CONDUCTORS/WIRING

——— FACTORY WIRING
– – – – WIRING BY OTHERS
— — — — OPTIONAL FACTORY WIRED COMPONENTS

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

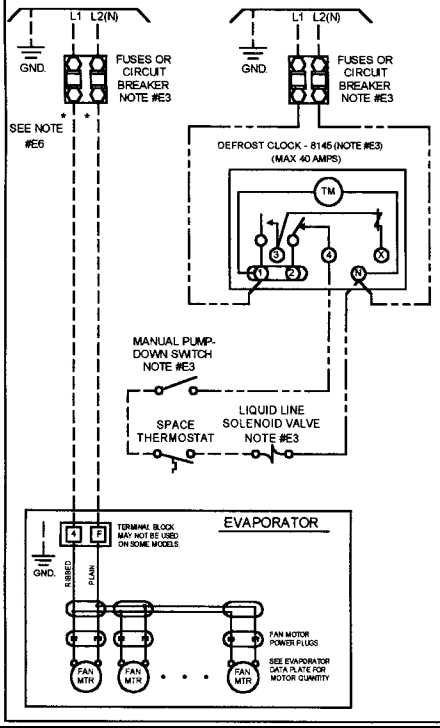
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NOV 2/98	A	

TYPICAL EVAPORATOR WIRING:

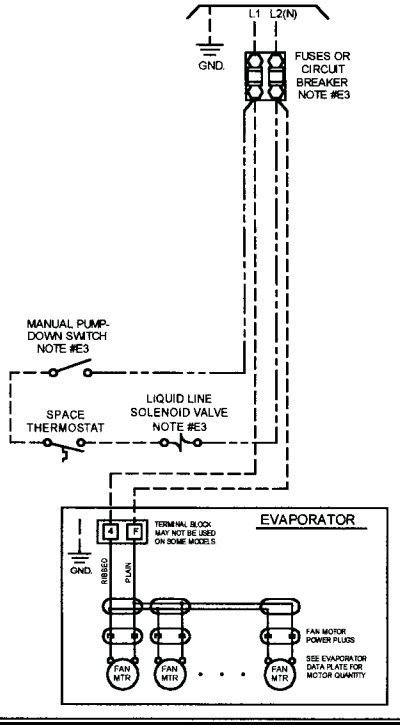
FOR KUCB, TLP, BA, TWB, TTW OR BTW SERIES AIR DEFROST EVAPORATORS

WITH OR WITHOUT DEFROST TIME CLOCK

TYPICAL AIR DEFROST EVAPORATOR FIELD WIRING WITH TIME CLOCK



TYPICAL AIR DEFROST EVAPORATOR FIELD WIRING WITHOUT TIME CLOCK



NOTES

E1. USE COPPER CONDUCTORS ONLY

E2. USE 60°C WIRE (OR HIGHER)

E3. OPTIONAL COMPONENT. MAY BE FACTORY INSTALLED OR SUPPLIED BY OTHERS.

E5. OVERCURRENT PROTECTION FOR EACH EVAPORATOR MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATES.

E6. IF FAN POWER SAME VOLTAGE AS CONTROL VOLTAGE WIRE TO 1 AND N ON TIME CLOCK.

TERMINALS

- ○ -COMPONENT TERMINAL - MARKED
- ○ -COMPONENT TERMINAL - UNMARKED (IDENTIFIABLE BY LOCATION)
- ○ -COMPONENT TERMINAL - UNMARKED (UNIDENTIFIABLE)
- □ -TERMINAL BLOCK TERMINAL
- • -WIRE SPLICE

CONDUCTORS/WIRING

——— FACTORY WIRING
– – – – WIRING BY OTHERS
— — — — OPTIONAL COMPONENT WIRING (SOME OPTIONAL COMPONENTS MAY BE FACTORY WIRED.)

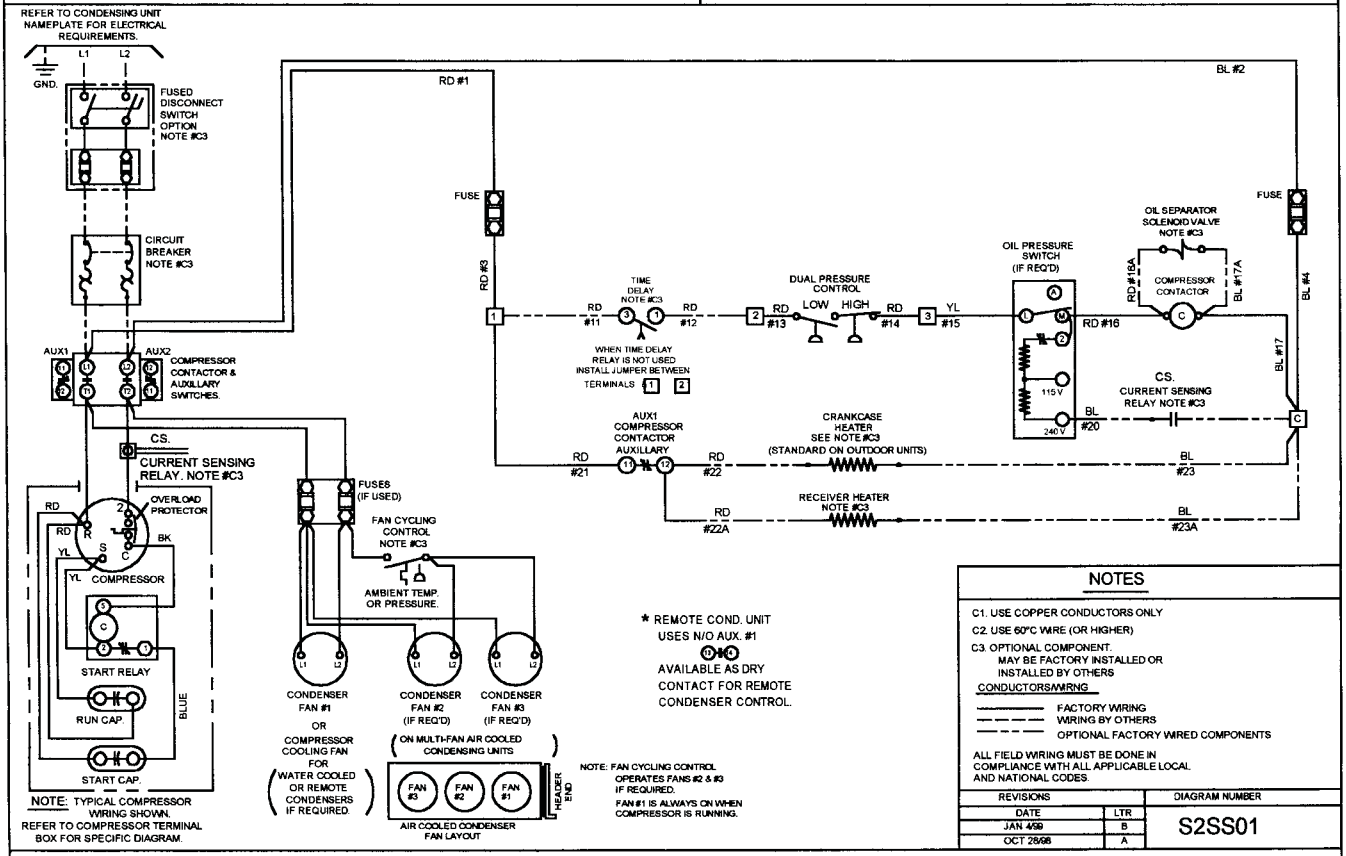
ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

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DATE	LTR	KSA01
JULY 11/01	B	
NOV 1/98	A	

Electrical Wiring Diagram – Horizontal Air Flow Condensing Units (K-Line)

CONDENSING UNIT WIRING DIAGRAM

- 208-230/1/60 & 200-220/1/50
- STANDARD COMPRESSOR, UP TO 3 CYLINDER.
- STANDARD CONTROL CIRCUIT.



NOTES

C1. USE COPPER CONDUCTORS ONLY
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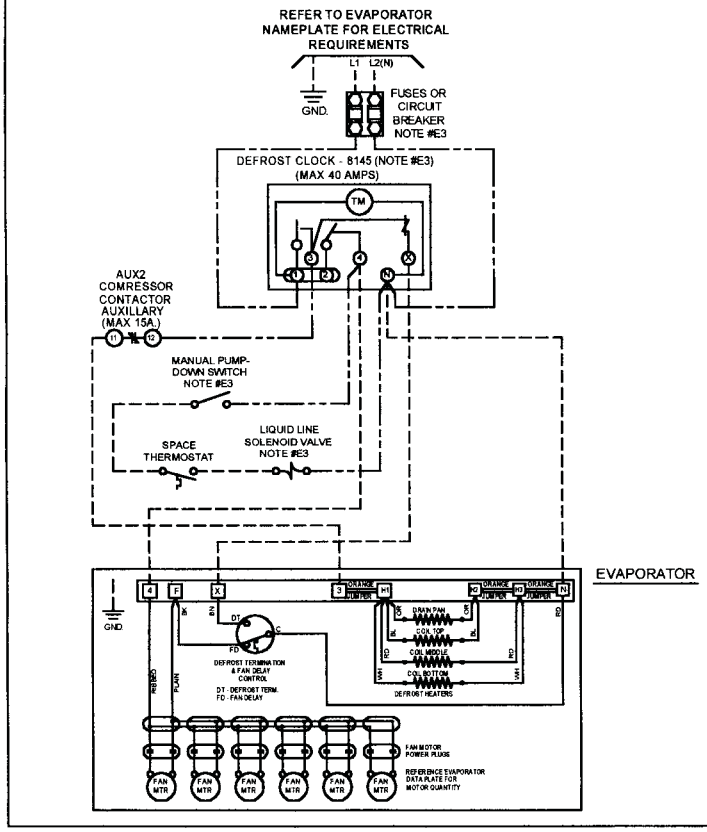
CONDUCTORS/WIRING
- FACTORY WIRING
- WIRING BY OTHERS
- OPTIONAL FACTORY WIRED COMPONENTS

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

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DATE	LTR	S2SS01
JAN 4/99	B	
OCT 28/98	A	

TYPICAL EVAPORATOR WIRING: FOR KUCB, TLP, OR BF SERIES, ELECTRIC DEFROST EVAPORATOR

WITH DEFROST TIME CLOCK / WITHOUT DEFROST CONTACTOR



NOTES

E1) USE COPPER CONDUCTORS ONLY
E2) USE 60°C WIRE (OR HIGHER)
E3) OPTIONAL COMPONENT. MAY BE FACTORY INSTALLED OR SUPPLIED BY OTHERS.
E4) HEATER LOADS ARE NOT CONCURRENT WITH REFRIGERATION LOADS.
E5) OVERCURRENT PROTECTION FOR EACH EVAPORATOR MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATES.

TERMINALS
- -COMPONENT TERMINAL - MARKED
- -COMPONENT TERMINAL - UNMARKED (IDENTIFIABLE BY LOCATION)
- -COMPONENT TERMINAL - UNMARKED (UNIDENTIFIABLE)
- -TERMINAL BLOCK TERMINAL
- -WIRE SPLICE

CONDUCTORS/WIRING
- FACTORY WIRING
- WIRING BY OTHERS
- OPTIONAL COMPONENT WIRING (SOME OPTIONAL COMPONENTS MAY BE FACTORY WIRED.)

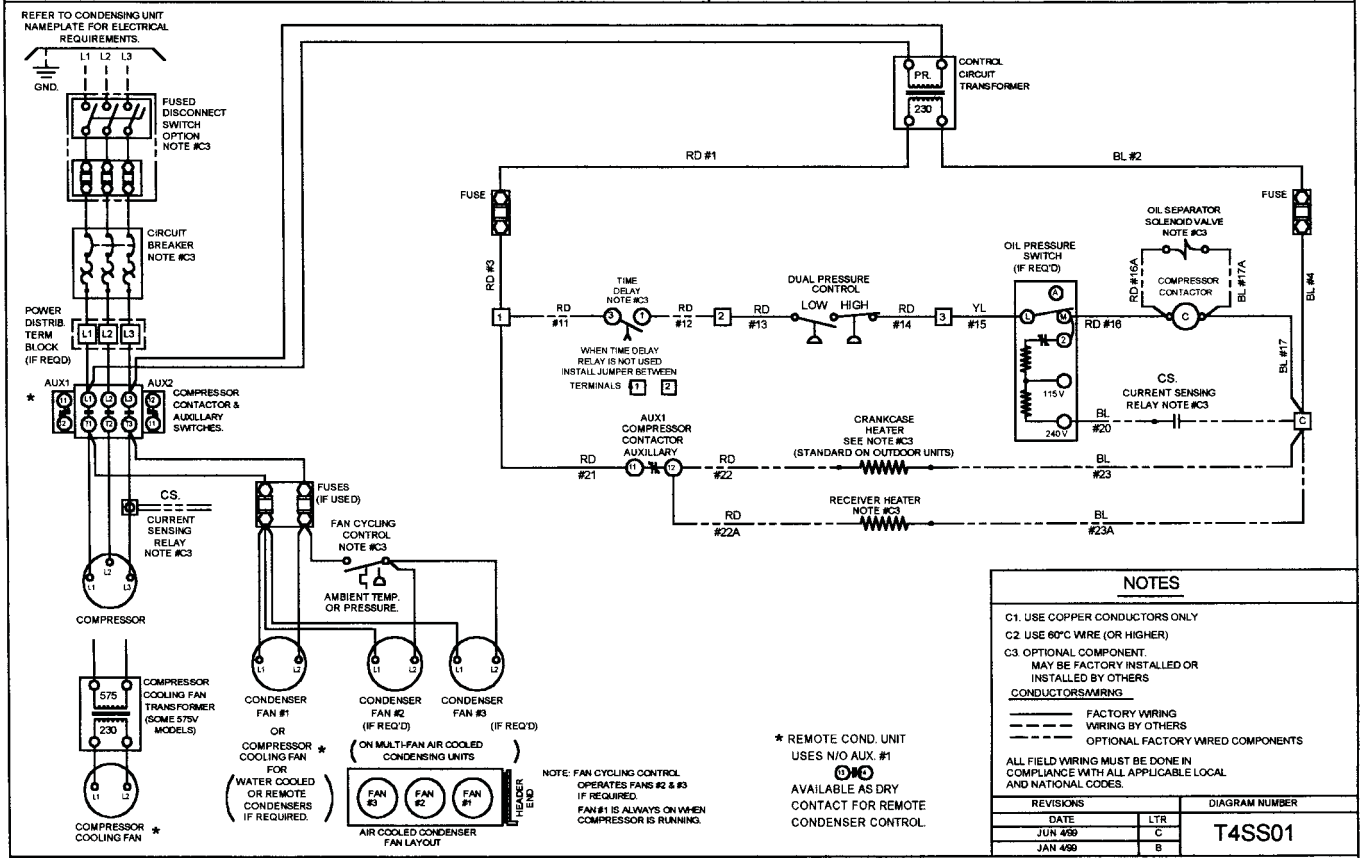
ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

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DATE	LTR	KSE01
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Electrical Wiring Diagram – Horizontal Air Flow Condensing Units (K-Line)

CONDENSING UNIT WIRING DIAGRAM

- 460/3/60, 575/3/60 or 380-400/3/50
- STANDARD COMPRESSOR, UP TO 3 CYLINDER.
- STANDARD CONTROL CIRCUIT.



NOTES

C1. USE COPPER CONDUCTORS ONLY

C2. USE 60°C WIRE (OR HIGHER)

C3. OPTIONAL COMPONENT. MAY BE FACTORY INSTALLED OR INSTALLED BY OTHERS

CONDUCTORS/WIRING

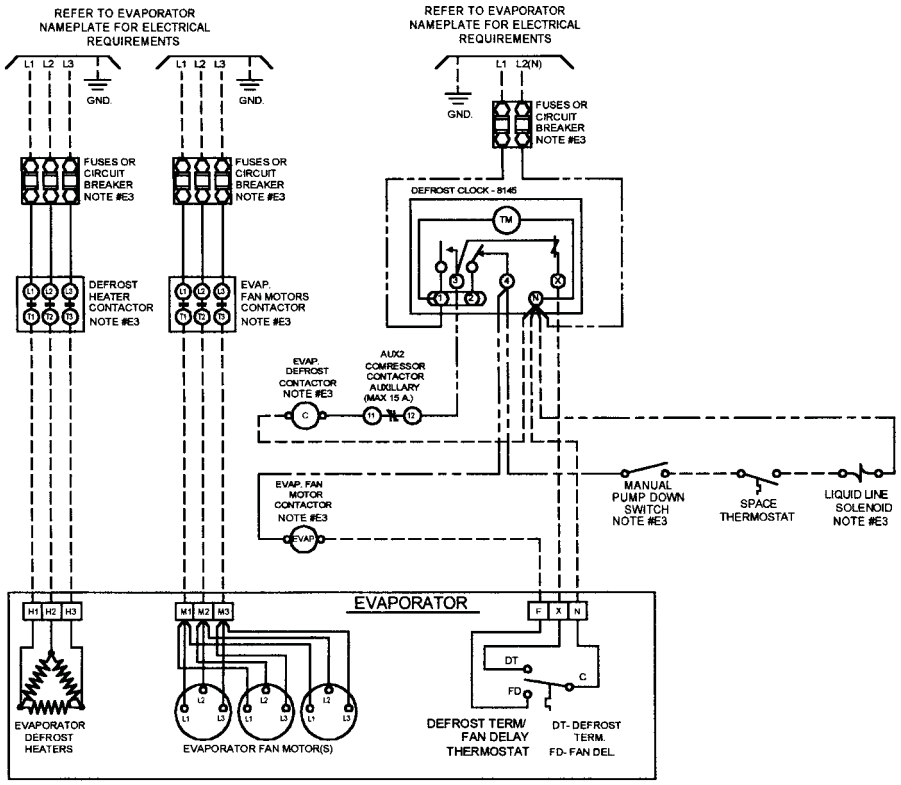
- FACTORY WIRING
- WIRING BY OTHERS
- OPTIONAL FACTORY WIRED COMPONENTS

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

REVISIONS		DIAGRAM NUMBER
DATE	LTR	T4SS01
JUN 4/99	C	
JAN 4/99	B	

TYPICAL EVAPORATOR WIRING: FOR THREE PHASE JUCC, JUCT OR BB SERIES ELECTRIC DEFROST EVAPORATOR

WITH DEFROST TIME CLOCK, EVAPORATOR FAN CONTACTOR AND DEFROST HEATER CONTACTOR.



NOTES

E1) USE COPPER CONDUCTORS ONLY

E2) USE 60°C WIRE (OR HIGHER)

E3) OPTIONAL COMPONENT. MAY BE FACTORY INSTALLED OR SUPPLIED BY OTHERS.

E4) HEATER LOADS ARE NOT CONCURRENT WITH REFRIGERATION LOADS.

E5) OVERCURRENT PROTECTION FOR EACH EVAPORATOR MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATES.

TERMINALS

- ○ -COMPONENT TERMINAL - MARKED
- ○ -COMPONENT TERMINAL - UNMARKED (IDENTIFIABLE BY LOCATION)
- ○ -COMPONENT TERMINAL - UNMARKED (UNIDENTIFIABLE)
- □ -TERMINAL BLOCK TERMINAL
- • -WIRE SPLICE

CONDUCTORS/WIRING

- FACTORY WIRING
- WIRING BY OTHERS
- OPTIONAL COMPONENT WIRING (SOME OPTIONAL COMPONENTS MAY BE FACTORY WIRED.)

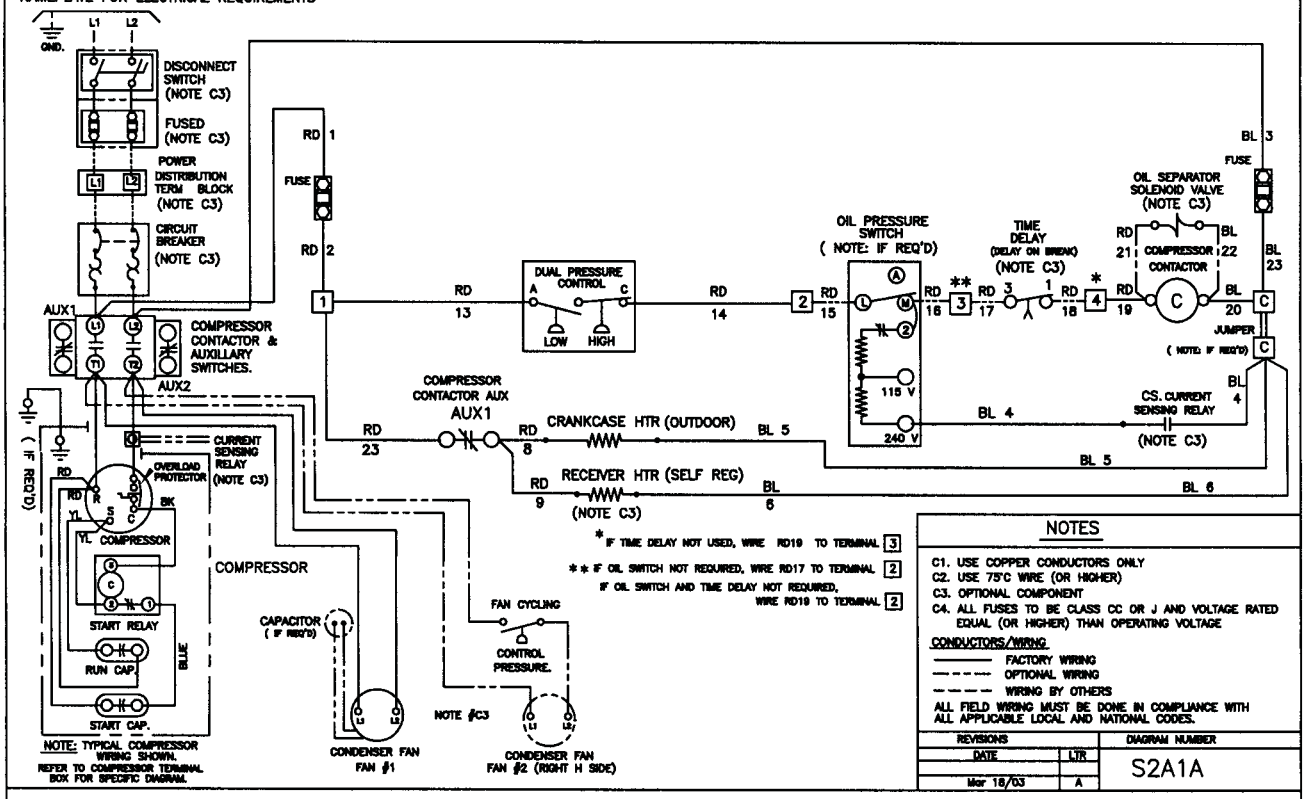
ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

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Electrical Wiring Diagram – Horizontal Air Flow Condensing Units (KE-Line)

CONDENSING UNIT WIRING DIAGRAM

- 208/230V–1–60 or 200/220V–1–50 Hz
- INHERENT LINE BREAK MOTOR PROTECTION
- STANDARD CONTROL CIRCUIT



NOTES

C1. USE COPPER CONDUCTORS ONLY
C2. USE 75°C WIRE (OR HIGHER)
C3. OPTIONAL COMPONENT
C4. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

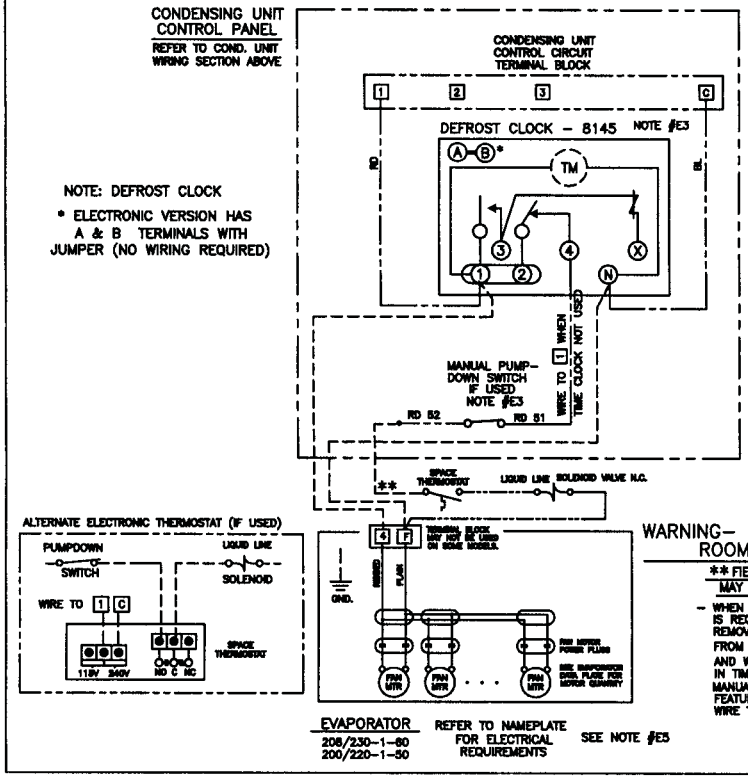
* IF TIME DELAY NOT USED, WIRE RD19 TO TERMINAL 3
** IF OIL SWITCH NOT REQUIRED, WIRE RD17 TO TERMINAL 2
IF OIL SWITCH AND TIME DELAY NOT REQUIRED, WIRE RD19 TO TERMINAL 2

CONDUCTORS/WIRING
——— FACTORY WIRING
– – – – OPTIONAL WIRING
– – – – WIRING BY OTHERS
ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

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Mar 18/03	A	S2A1A

TYPICAL EVAPORATOR WIRING: FOR SINGLE AIR DEFROST EVAPORATOR– SINGLE POINT

FOR USE WITH: 208/230–1–60, 200/220–1–50 OR 208/230–3–60, 200/220–3–50 CONDENSING UNITS WITH OR WITHOUT DEFROST TIME CLOCK AND FOR TOTAL EVAP FAN AMPS NOT EXCEEDING 12A



WARNING– FOR PRE–INSTALLED ROOM T'STATS

** FIELD MODIFICATION MAY BE REQUIRED

– WHEN DEFROST TIME CLOCK IS REQUIRED. REMOVE THERMOSTAT WIRE FROM TERMINAL 4 IN UNIT COOLER, AND WIRE TO TERMINAL ④ IN TIME CLOCK. OR IF MANUAL PUMP DOWN SWITCH FEATURE IS ALSO REQUIRED, WIRE TO SWITCH AS SHOWN

NOTES

E1. USE COPPER CONDUCTORS ONLY
E2. USE 75°C WIRE (OR HIGHER)
E3. OPTIONAL COMPONENT. MAY BE FACTORY INSTALLED IN CONDENSING UNIT, OR SUPPLIED BY OTHERS.
E5. OVERCURRENT PROTECTION FOR EVAPORATOR MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATE.
E6. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

TERMINALS
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• –WIRE SPLICE

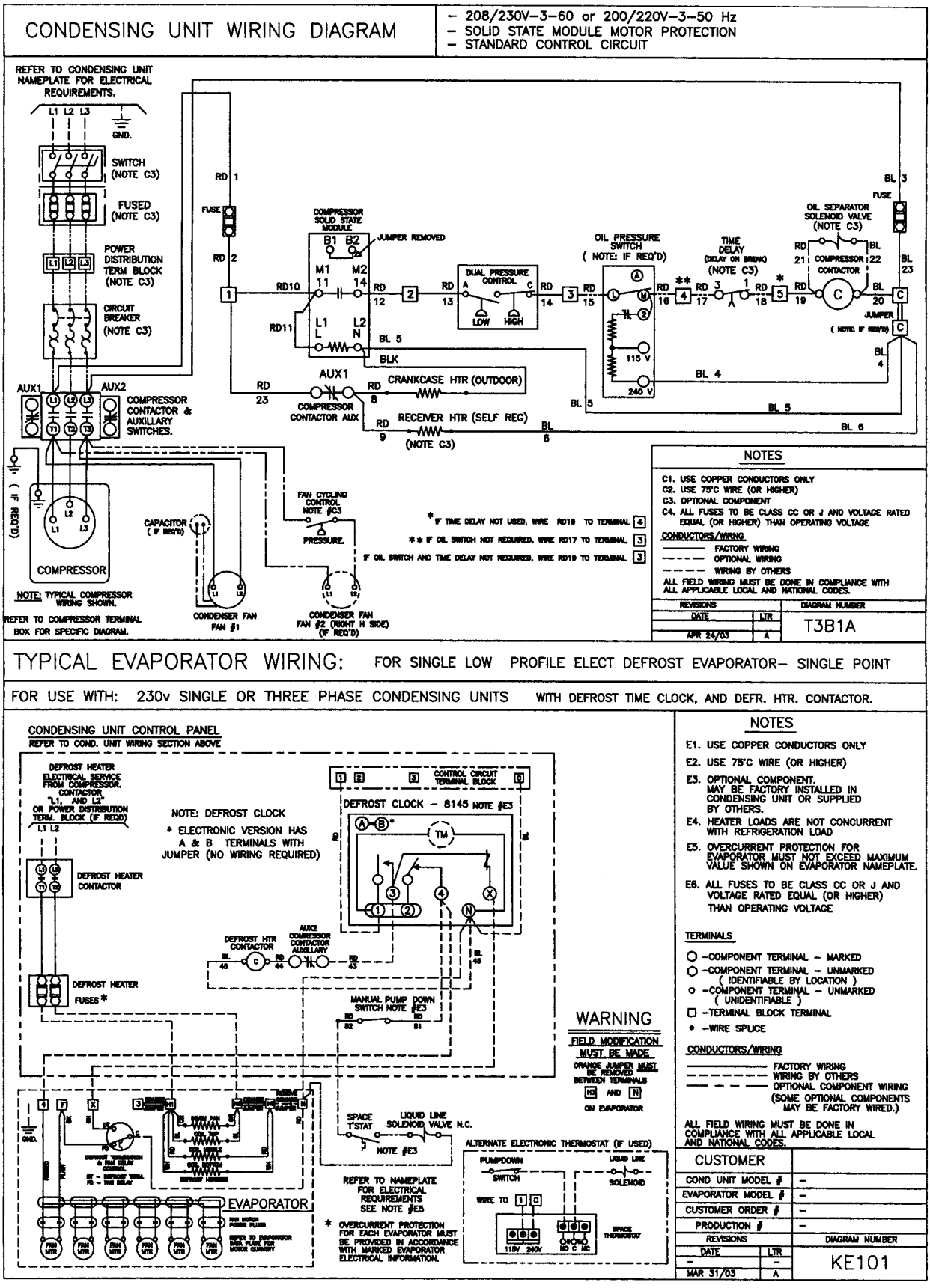
CONDUCTORS/WIRING
——— FACTORY WIRING
– – – – – – WIRING BY OTHERS
——— – – ——— OPTIONAL COMPONENT WIRING (SOME OPTIONAL COMPONENTS MAY BE FACTORY WIRED.)

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

CUSTOMER	
COND UNIT MODEL #	–
EVAPORATOR MODEL #	–
CUSTOMER ORDER #	–
PRODUCTION #	–

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MAR26/03	A	

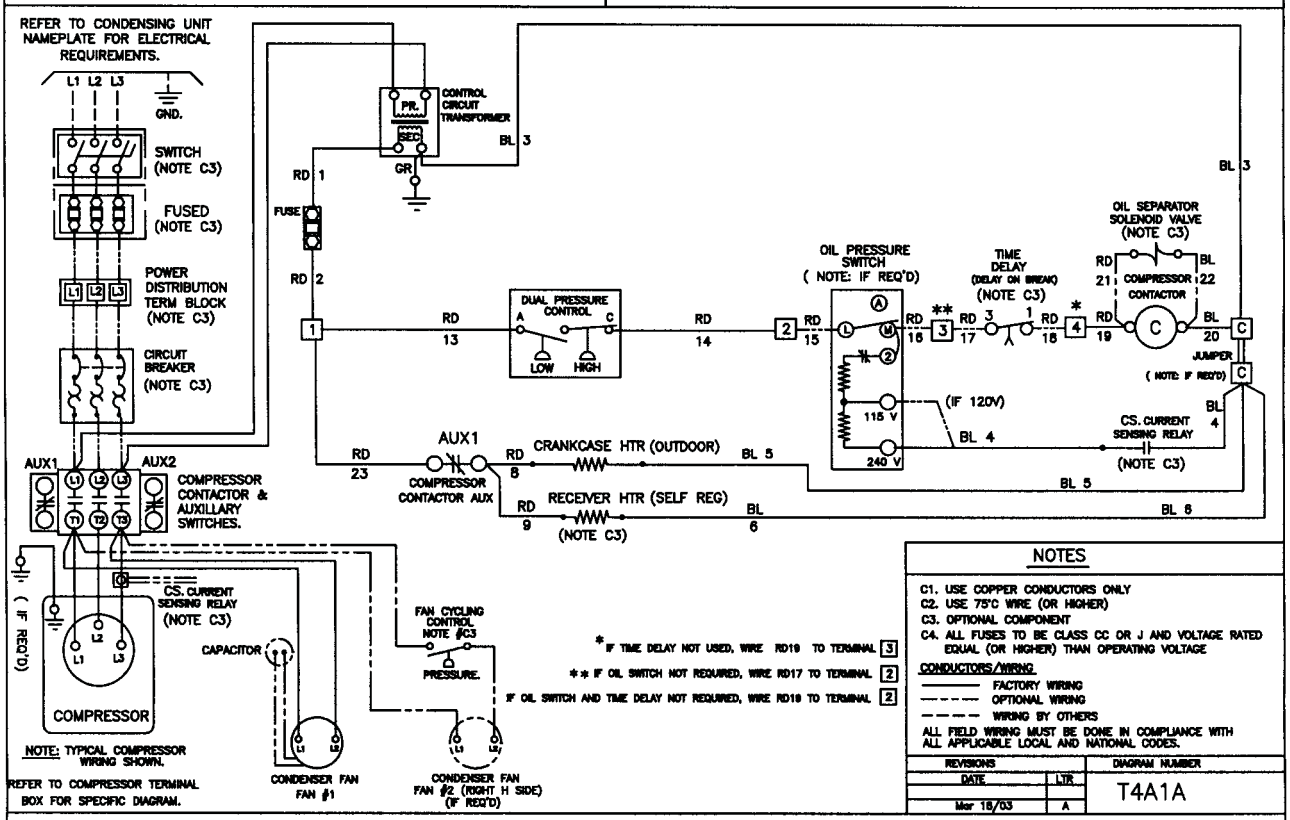
Electrical Wiring Diagram – Horizontal Air Flow Condensing Units (KE-Line)



Electrical Wiring Diagram – Horizontal Air Flow Condensing Units (KE-Line)

CONDENSING UNIT WIRING DIAGRAM

- 460V–3–60 , 575V–3–60 or 380/400V–3–50 Hz
- INHERENT LINE BREAK MOTOR PROTECTION
- STANDARD CONTROL CIRCUIT



NOTES

C1. USE COPPER CONDUCTORS ONLY
C2. USE 75°C WIRE (OR HIGHER)
C3. OPTIONAL COMPONENT
C4. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

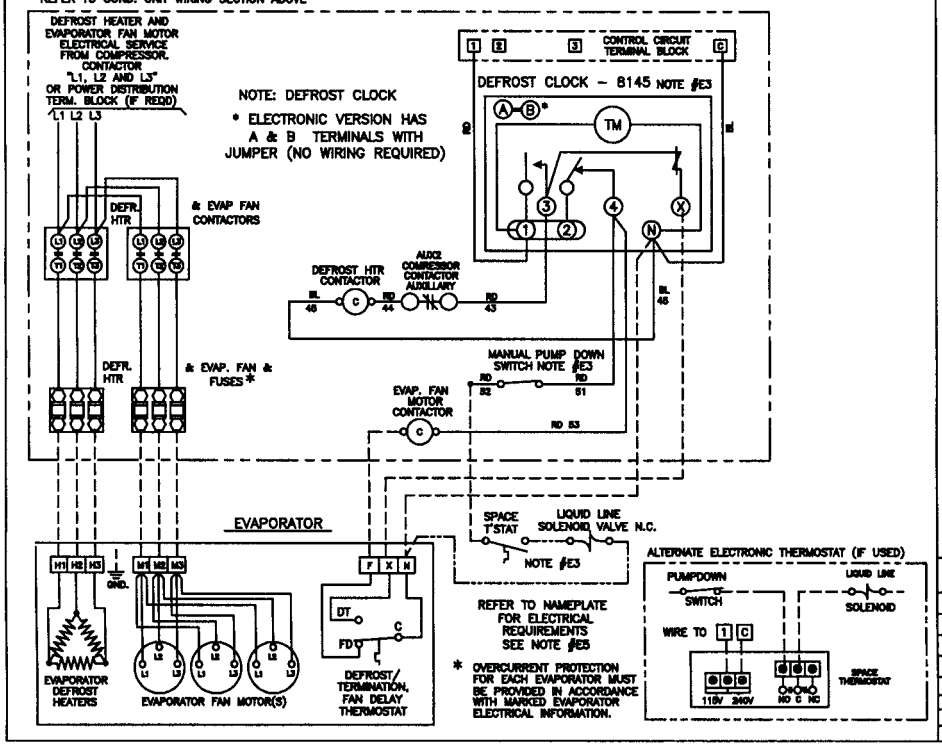
CONDUCTORS/WIRING
——— FACTORY WIRING
– – – – OPTIONAL WIRING
– – – – WIRING BY OTHERS

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

REVISIONS		DIAGRAM NUMBER
DATE	LTR	T4A1A
Mar 18/03	A	

TYPICAL EVAPORATOR WIRING: FOR SINGLE MED PROFILE ELECT DEFROST EVAPORATOR– SINGLE POINT

FOR USE WITH: THREE PHASE CONDENSING UNITS WITH DEFROST TIME CLOCK, & EVAP FAN AND DEFR. HTR. CONTACTORS.



NOTES

E1. USE COPPER CONDUCTORS ONLY
E2. USE 75°C WIRE (OR HIGHER)
E3. OPTIONAL COMPONENT. MAY BE FACTORY INSTALLED IN CONDENSING UNIT OR SUPPLIED BY OTHERS.
E4. HEATER LOADS ARE NOT CONCURRENT WITH REFRIGERATION LOAD
E5. OVERCURRENT PROTECTION FOR EVAPORATOR MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATE.
E6. ALL FUSES TO BE CLASS CC OR J AND VOLTAGE RATED EQUAL (OR HIGHER) THAN OPERATING VOLTAGE

TERMINALS
○ –COMPONENT TERMINAL – MARKED
○ –COMPONENT TERMINAL – UNMARKED (IDENTIFIABLE BY LOCATION)
○ –COMPONENT TERMINAL – UNMARKED (UNIDENTIFIABLE)
□ –TERMINAL BLOCK TERMINAL
• –WIRE SPLICE

CONDUCTORS/WIRING
——— FACTORY WIRING
– – – – – – WIRING BY OTHERS
— – – – – OPTIONAL COMPONENT WIRING (SOME OPTIONAL COMPONENTS MAY BE FACTORY WIRED.)

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

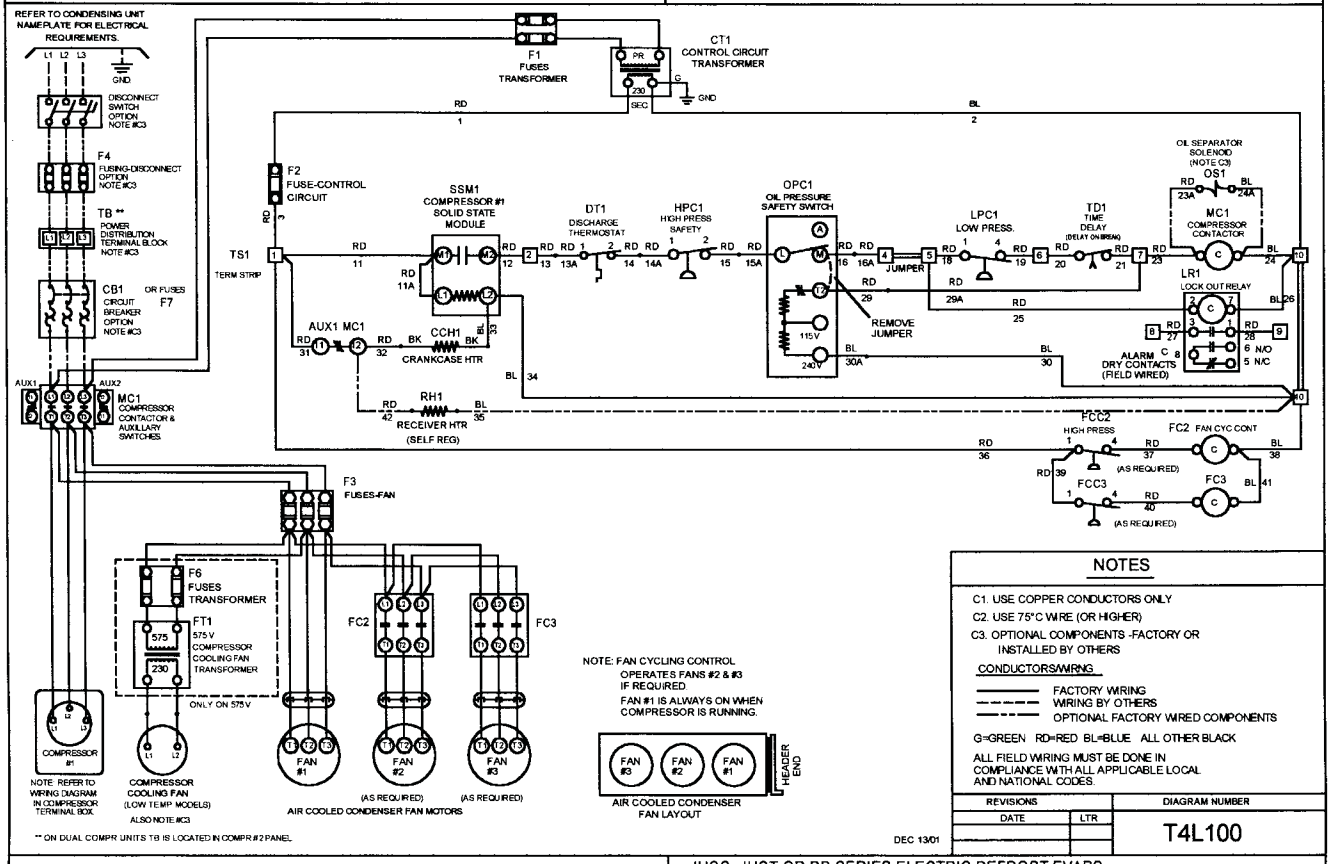
CUSTOMER	
COND UNIT MODEL #	–
EVAPORATOR MODEL #	–
CUSTOMER ORDER #	–
PRODUCTION #	–

REVISIONS		DIAGRAM NUMBER
DATE	LTR	JE101
–	–	
MAR26/03	A	

Electrical Wiring Diagram – Vertical Air Flow Condensing Units

CONDENSING UNIT WIRING DIAGRAM: COMPRESSOR #1

- 460/3/60, 575/3/60 or 380-400/3/50
- SOLID STATE MODULE COPELAND COMPRESSORS (4D-6D-8D)
- STANDARD (230 V) CONTROL CIRCUIT



NOTES

C1. USE COPPER CONDUCTORS ONLY
C2. USE 75°C WIRE (OR HIGHER)
C3. OPTIONAL COMPONENTS -FACTORY OR INSTALLED BY OTHERS

CONDUCTORS/WIRING

- FACTORY WIRING
- WIRING BY OTHERS
- OPTIONAL FACTORY WIRED COMPONENTS

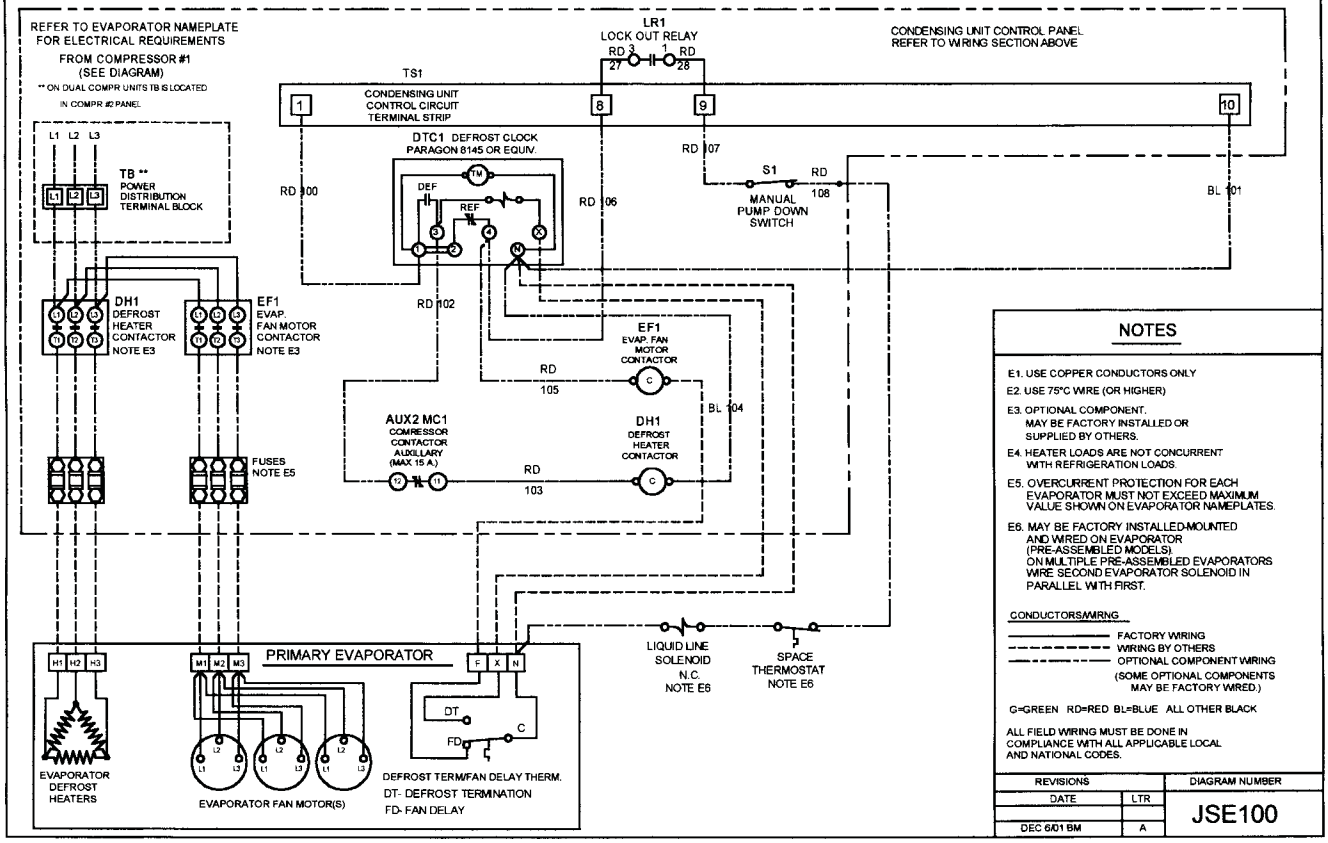
G=GREEN RD=RED BL=BLUE ALL OTHER BLACK

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

REVISIONS		DIAGRAM NUMBER
DATE	LTR	T4L100

EVAPORATOR WIRING DIAGRAM: COMPRESSOR #1

- JUCC, JUCT OR BB SERIES ELECTRIC DEFROST EVAPS
- WITH DEFROST TIME CLOCK, EVAP FAN CONTACTOR AND DEFROST HEATER CONTACTOR. (ONE EVAP)



NOTES

E1. USE COPPER CONDUCTORS ONLY
E2. USE 75°C WIRE (OR HIGHER)
E3. OPTIONAL COMPONENT. MAY BE FACTORY INSTALLED OR SUPPLIED BY OTHERS.
E4. HEATER LOADS ARE NOT CONCURRENT WITH REFRIGERATION LOADS.
E5. OVERCURRENT PROTECTION FOR EACH EVAPORATOR MUST NOT EXCEED MAXIMUM VALUE SHOWN ON EVAPORATOR NAMEPLATES.
E6. MAY BE FACTORY INSTALLED-MOUNTED AND WIRED ON EVAPORATOR (PRE-ASSEMBLED MODELS). ON MULTIPLE PRE-ASSEMBLED EVAPORATORS WIRE SECOND EVAPORATOR SOLENOID IN PARALLEL WITH FIRST.

CONDUCTORS/WIRING

- FACTORY WIRING
- WIRING BY OTHERS
- OPTIONAL COMPONENT WIRING (SOME OPTIONAL COMPONENTS MAY BE FACTORY WIRED.)

G=GREEN RD=RED BL=BLUE ALL OTHER BLACK

ALL FIELD WIRING MUST BE DONE IN COMPLIANCE WITH ALL APPLICABLE LOCAL AND NATIONAL CODES.

REVISIONS		DIAGRAM NUMBER
DATE	LTR	JSE100
DEC 6/01 BM	A	

Refrigerant Piping

WARNING

All local codes must be observed in the installation of refrigerant piping.

IMPORTANT PIPING NOTE

Appropriate line sizing practices must be used throughout the installation of the refrigeration system. Special consideration must be taken when the condensing unit is installed above the evaporator. **REFRIGERATION GRADE COPPER TUBING MUST BE USED FOR PIPING SYSTEMS.**

Piping practice and line sizing charts as recommended by A.S.H.R.A.E. or other reputable refrigeration standards must be followed to ensure minimum pressure drop and correct oil return. An inert gas such as dry nitrogen should be passed through the piping during welding or brazing operations. This reduces or eliminates oxidation of the copper and formation of scale inside the piping. For specific piping requirements refer to your local distributor or sales representative.

Correct line sizing is most critical because of the several factors involved:

(a) Minimum pressure drop to ensure efficient compressor performance.
(b) Sufficient gas velocity to maintain proper oil return to the compressor under all load conditions.
(c) Elimination of conditions on multiple evaporators whereby oil may log in an idle evaporator.

Suction lines should be sized on the basis of a maximum total pressure drop equivalent to a 2°F (1.1°C) change in saturated temperature. At 40°F (4.4°C) suction temperature, this is approximately 3 psig (20.7 kPa) for R-22. At -20°F (-28.9°C) suction temperature, this is approximately 1.3 psig (9.0 kPa) for R-404A.

Horizontal liquid lines should be sized on a basis of a maximum pressure drop equivalent to a 2°F (1.1°C) drop in the sub-cooling temperature. If the lines must travel up vertically then adequate sub-cooling must be provided to overcome the vertical liquid head pressures. A head of two feet of liquid refrigerant is approximately equivalent to 1 psig (6.9 kPa). Liquid line velocities should not exceed 300 fpm (1.52 m/s). This will prevent possible liquid hammering when the solenoid valve closes.

Pressure Loss of Liquid Refrigerant in Liquid Line Risers

(Expressed in Pressure Drop PSIG and Subcooling Loss °F)

Refrigerant	Liquid Line Rise in Feet									
	10'		15'		20'		25'		30'	
	PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F
R-134a	4.9	2.0	7.4	2.9	9.8	4.1	12.3	5.2	14.7	6.3
R-22	4.8	1.6	7.3	2.3	9.7	3.1	12.1	3.8	14.5	4.7
R-404A, R-507	4.1	1.1	6.1	1.6	8.2	2.1	10.2	2.7	12.2	3.3

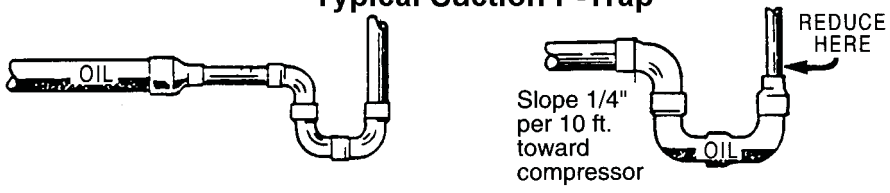
Refrigerant	Liquid Line Rise in Feet							
	40'		50'		75'		100'	
	PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F
R-134a	19.7	8.8	24.6	11.0	36.8	17.0	49.1	23.7
R-22	19.4	6.2	24.2	8.0	36.3	12.1	48.4	16.5
R-404A, R-507	16.3	14.1	20.4	5.6	30.6	8.3	40.8	11.8

Based on 110 °F liquid temperature at bottom of riser.

At the temperatures encountered in the condenser, receiver and liquid line a certain amount of oil is always being circulated with the refrigerant through the system by the compressor. However, at the evaporator temperature, and with the refrigerant in a vapor state, the oil and refrigerant separate. This oil can only be returned to the compressor by gravity or by entrainment in the suction gas. Roof installations leave no alternative but by entrainment for oil return, so suction gas velocity and correct line sizing to maintain this velocity are imperative. Care must be taken not to oversize the suction line in the desire for maximum performance.

Gas velocity in vertical suction lines must not be less than 1,000 fpm (5 m/s) and preferably 1,250 to 1,500 fpm (6 to 8 m/s).
Important: A suction trap must be installed at the base of all suction risers of four (4) feet or more in order to trap oil and allow entrainment in the suction gas.

Typical Suction P-Trap

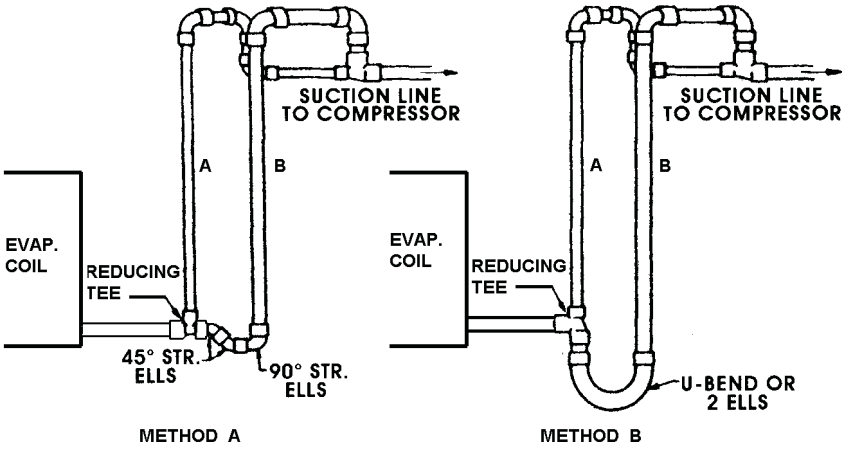


"INCORRECT" **"CORRECT"**

IMPORTANT PIPING NOTE

If steps of capacity control are supplied on a compressor, provisions must be made for oil return by sizing suction risers to maintain adequate gas velocities at reduced refrigerant flow.

Typical Double Riser Construction



During the lower capacity running mode (compressor capacity control energized) oil will collect in the elbow or at U-bend below pipe “B”. This will divert the gas and oil to flow up the smaller pipe “A” at a higher velocity.

IMPORTANT: When welding service valves or any components that may be damaged by heat, manufacturer’s installation instructions must be adhered to. Wrapping components with a wet cloth will help to prevent damage from heat.

IMPORTANT: All suction lines outside of the refrigerated space must be insulated.

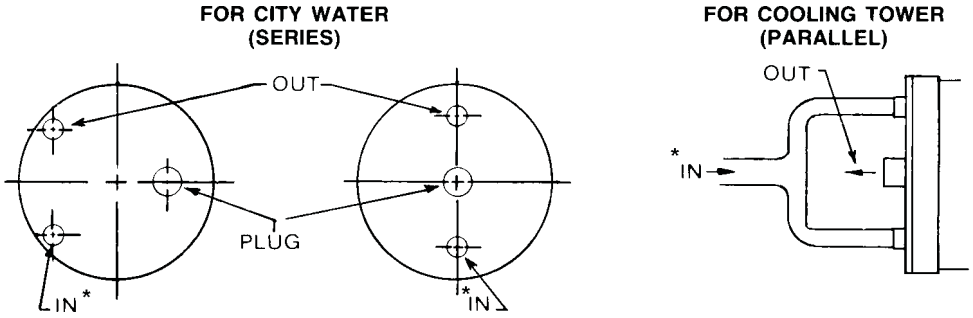
Water-Cooled Condensers

WARNING

All water and drain connections to the unit must be made in accordance with national as well as local plumbing codes and by-laws.

Cooling water circuits in some shell and tube water-cooled condensers may be either series or parallel as required by the particular application. The “series” flow is usually for city water where lower entering water temperatures exist and higher-pressure drops can be tolerated (such as city water supplies). The “parallel” circuit flows are usually required when the water temperatures enter at 85°F (29.4°C) or higher requiring lower water pressure drops (such as closed loop cooling tower supplies).

On some condensers, the water circuiting may be entirely internal with only an inlet and outlet water fitting. The water inlet is always at the bottom connection.



*** From compressor cooling coil (if equipped) and water regulating valve**

All water-cooled condensers require a water regulating valve that must be installed upstream of the condenser. The water-regulating valve is adjustable and is set to provide the desired condensing pressure. As the condensing pressure rises, the valve will open and allow more water to flow. As the condensing pressure lowers the valve will start to close to reduce the amount of water flow into the condenser. If water supply pressure is excessive, a pressure-reducing valve must be used since the allowable working pressure of water valves and condensers is normally 150 psig (1136 kPa). Typical condensing temperatures normally range between 90 to 110 °F. The actual water inlet temperature and water supply flow capacity available at the site determines the suitable condensing temperature. Lower inlet water temperatures (below 70 °F) allow the condensing unit to run at a lower condensing temperature without resulting in a high water flow rate (consumption). Higher water inlet temperatures (above 85 °F) require the condensing temperature to be higher to avoid excessive water flow rates. Refer to the water flow rate chart to estimate the flow rate (GPM-US gallon per minute) at given water temperatures and loads. The TD (temperature difference) is the difference between the condensing temperature and the water inlet temperature.

Example: Given 80 °F inlet water available, +25 °F evaporating temperature application and 1 ton (12,000Btuh) evaporator load. The results are:

20 °F TD = 100 °F Cond.Temp., series flow is .148 x 12 = 1.78 GPM, parallel flow = .185 x 12 = 2.22 GPM
30 °F TD = 110 °F Cond.Temp., series flow is .103 x 12 = 1.24 GPM, parallel flow = .128 x 12 = 1.54 GPM

Knowing the GPM you can estimate the pressure drop through the condenser (and compressor, if with body coil). Refer to the Typical Pressure Drop tables and use the appropriate flow to estimate the resulting pressure drop. If using a condenser that has only ONE water circuit (two connections) use the “parallel” column on the GPM flow rate chart.

Care should be exercised in locating the condensing unit so that the condenser will never be exposed to temperatures below freezing.

Excessive water velocities or cavitation on the waterside of the condenser tubes may damage a water-cooled condenser. In order to prevent operating difficulties, care should be taken to follow the instructions outlined below:

(a) Water velocities through the condenser should not exceed 7 fps (2.13 m/s). Higher velocities can result in “impingement corrosion”. In order to maintain water velocities at an acceptable level, parallel circuiting of the condenser may be necessary when high water flow is required.

(b) If a water-circulating pump is used, it should be installed so that the condenser is fed from the discharge side of the pump.

(c) If the condenser is installed more than 5 ft (1.52 m) higher than the outlet drain point of the condenser, a vacuum breaker or open vent line should be provided to prevent the outlet line from creating a partial vacuum condition.

CONSULT THE FACTORY OR LOCAL SALES REPRESENTIVE FOR FURTHER INFORMATION.

WATER FLOW REQUIREMENTS

(Gallon Per Minute Per 1 MBH Evaporator Load)

HIGHER WATER FLOW RATES

20 ° TD (Condensing Temperature - Entering Water Temperature)						
Evaporating Temperature	SERIES Condensing Temperature			PARALLEL Condensing Temperature		
	90 °F	100 °F	110 °F	90 °F	100 °F	110 °F
45	0.135	0.137	0.142	0.168	0.172	0.175
25	0.144	0.148	0.153	0.179	0.185	0.189
15	0.148	0.153	0.158	0.185	0.192	0.197
-10	0.167	0.173	0.182	0.208	0.217	0.225
-30	0.183	0.190	0.200	0.227	0.237	0.250

LOWER WATER FLOW RATES

30 ° TD (Condensing Temperature - Entering Water Temperature)						
Evaporating Temperature	SERIES			PARALLEL		
	90 °F	100 °F	110 °F	90 °F	100 °F	110 °F
45	0.092	0.093	0.095	0.113	0.115	0.118
25	0.097	0.100	0.103	0.121	0.125	0.128
15	0.100	0.103	0.107	0.125	0.130	0.133
-10	0.113	0.118	0.123	0.142	0.147	0.153
-30	0.123	0.128	0.135	0.153	0.160	0.168

Typical Pressure Drops (PSIG) Condensers

Model (HP)	Flow (GPM)	Pressure Drop		Water Valve Size
		Series	Parallel	
1,1 1/2 , 2	1		0.6	1/2
	2		2	
	3		4.2	
3, 3 1/2, 4	2	2.4	0.3	3/4
	4	8.7	1.2	
	6	18.6	2.5	
5, 6	2	2.7	0.4	1
	4	9.9	1.4	
	6	21	2.9	
7 1/2, 9	3	2.7	0.4	1
	5	7.2	1	
	9	21	2.9	
10	5	2.6	0.35	1 1/4
	10	9	1.25	
	15	18	2.7	
15	10		0.7	1 1/4
	15		1.4	
	25		3.4	
20, 25	10		0.4	1 1/2
	20		1.3	
	40		4.6	
30, 35, 40	Consult factory for Data			

Typical Pressure Drops (PSIG) Compressor Coil (smaller models only)

Compressor Model Family	Flow (GPM)	Pressure Drop
KW	1	1.7
	2	6.2
	3	13.5
EW / 3W	1	0.5
	2	1.3
	3	2.8
	4	5.9

Larger compressor models use fans in place of water cooling coils.

System Accessories

In order to ensure trouble free operation of the refrigeration system it is important that the following system accessories be reviewed and installed.

(a) A **moisture indicating LIQUID SIGHT GLASS** should be installed in the liquid line between the receiver and as close as possible to the expansion valve on the evaporator. If it is mounted on the condensing unit, it will be mounted downstream of the receiver outlet service valve and immediately after the liquid line drier. It will change color if there is moisture present in the system. It also allows the contractor to detect a shortage of refrigerant or flash gas in the liquid line. Bubbles are not normally visible in the sight glass of a properly charged system, however it is normal to see bubbles appear in the sight glass for a few minutes when the compressor starts. **Bubbles in a sight glass installed on the condensing unit must never be used as the final indicator for shortage of refrigerant in the system.**

(b) A **LIQUID LINE FILTER DRIER** (sealed or replaceable core) should be installed in the system to remove foreign matter and moisture that may have entered the system during installation. Liquid line driers should be installed downstream of the receiver outlet valve and upstream of the liquid line solenoid valve (if supplied). Liquid line driers may or may not have access valves, depending on the size and application. They should be replaced whenever there is excessive pressure drop across the filter, or when the system becomes contaminated due to system leaks, compressor burn-outs, acid formation, or moisture accumulation as indicated by the moisture indicating sight glass. Refer to the specific manufacturer's recommendation for servicing.

(c) A **DISCHARGE MUFFLER** may be used to help minimize the noise created in the discharge line of the compressor. This noise my be the result of variations in piping configuration, the pattern of the gas flow, line sizes, operating pressures or compressor and unit mounting. A particular combination of gas flow and piping will result in a resonant frequency, which may amplify the sound and vibration to an undesirable level. Gas pulsations from the compressor discharge may also be amplified in a similar manner.

(d) A **DISCHARGE OIL SEPARATOR** may be used with flooded systems, low temperature systems and systems with long runs of piping or other factors that tend to cause oil return problems. They help maintain oil volume levels in the compressor oil sump.

(e) A **LIQUID LINE SOLENOID VALVE** must be installed at the evaporator. Installing a solenoid valve will allow all of the refrigerant to be pumped out of the low side (evaporator and suction line) when the thermostat has been satisfied. This reduces the risk of refrigerant migrating or flooding back to the compressor. Locating the solenoid at the evaporator (instead of the condensing unit) will minimize the pump-down time and refrigerant capacity required by the receiver.

(f) A **SUCTION LINE FILTER** (sealed or replaceable core) when used are always installed upstream of the compressor suction service valve and any accumulators or other options that may be installed. Suction filters are equipped with "Schrader" type access valves that allow plugged filters and elements to be identified quickly when the pressure drops get too high. Refer to the specific manufacturer's recommendation for servicing.

(g) Units equipped with spring-mounted compressors should have **VIBRATION ELIMINATORS** in both the suction and discharge lines. They minimize noise transmission and provide flexibility if it is ever necessary to remove a compressor. Vibration eliminators should be installed at ninety degrees to the vibration for best results and whenever possible, in a horizontal position, parallel to the compressor crankshaft. Suction vibration eliminators **MUST be insulated** on low temperature systems to prevent refreezing of condensate, causing expansion damage to the bellows inside the eliminator. This expansion can eventually fatigue the copper bellows causing rupture and loss of refrigerant.

(h) A **SUCTION LINE ACCUMULATOR** is used to prevent liquid refrigerant from reaching the compressor. Liquid flood back can occur for various reasons such as a malfunctioning expansion valve, refrigerant overcharge, hot gas defrost cycle or extremely low load on the evaporator. An accumulator should be used if frost or dirt collect on the evaporator coil(s). This can reduce the heat transfer. Some suction line accumulators are equipped with a built in suction to liquid line heat exchangers. All hot gas defrost systems must use an accumulator.

(i) A **SUCTION TO LIQUID HEAT EXCHANGER** should be used if a system requires long liquid lines from the receiver to the evaporator or if the liquid has to rise vertically upward any distance. It can help prevent excessive frosting on the compressor body and increase superheat in the suction line reducing the possibility of liquid refrigerant from returning to the compressor.

(j) A **PHASE / VOLTAGE MONITOR** protects the system against phase loss (single phasing), phase reversal (improper sequence), high voltage and low voltage (brownouts).

Leak Testing

IMPORTANT: All system piping, including the condensing unit and accessories should be thoroughly tested for leaks prior to start up and charging. The system should be initially pressurized to a maximum of 150 psig (1136 kPa) with dry nitrogen to ensure that the system is free of major leaks. With the system free of major leaks, a more detailed leak check should be performed. Discharge the initial dry nitrogen charge and add enough refrigerant to raise the system pressure up to 10 psig (170 kPa) (tracer amount). Add dry nitrogen to increase the system pressure to a maximum of 150 psig (1136 kPa). It is recommended that an electronic leak detector be used when checking for leaks because of its greater sensitivity to small leaks. As a further check it is recommended that this pressure be held for a minimum of 12 hours and then rechecked. The system must be leak free for satisfactory operation.

WARNING

HFC-134a has been shown to be combustible at pressures as low as 5.5 psig (140 kPa) at 350 ^{o}F (176.7 ^{o}C) when mixed with air at concentrations more than 60% air by volume. At lower temperature, higher pressures are required to support combustion. Therefore, air should never be mixed with HFC-134a for leak detection.

IMPORTANT ENVIRONMENTAL NOTE

When conventional leak detection methods are employed using HCFC or CFC tracer gas, all of the tracer gas must be reclaimed and disposed of in a proper manner.

Evacuation and Dehydration

When the system is completely free of refrigerant leaks, an evacuation of the entire system should be completed by using a “high vacuum” pump. This evacuation, if completed correctly, will ensure long life for the system as well as elimination of moisture and non-condensable gas problems. **Moisture problems causing compressor failure will void warranty. Follow the recommended procedure carefully.**

CAUTION

Do not use the refrigeration compressor to evacuate the system. Never start the compressor or perform a megger insulation test while the system is in a vacuum.

Dehydration Procedure

Use only a “high vacuum” pump capable of drawing a vacuum of 100 microns. Change the vacuum pump oil frequently. Gauges or vacuum measuring instruments should be suitable to measure conditions at any stage of the process in order to give the operator indications of progress. For specific recommendations, refer to the vacuum pump supplier for these instruments.

Copper jumper lines should be used to interconnect both high and low-pressure sides of the system. These lines should be at least 3/8” O.D. in order to handle the light density vapor at high vacuum obtained at completion of operation. Lines smaller than 3/8” O.D. will slow down the process considerably as well as making final system vacuum questionable. The entire system temperature should be over 60 ^{o}F (16 ^{o}C) for evacuation to be effective. If the temperature is less than 60 ^{o}F (16 ^{o}C) the final vacuum should be 50 microns. Double evacuation with a “sweeping “ of dry nitrogen is recommended. First evacuation should be to at least 750-micron depth. When this point is reached, break the vacuum with refrigerant or dry nitrogen to melt any moisture, which may have frozen during the first vacuum stage.

IMPORTANT ENVIRONMENTAL NOTE

When conventional leak detection methods are employed using HCFC or CFC tracer gas, all of the tracer gas must be reclaimed and disposed of in the proper manner.

Reclaim any tracer gas from the system and re-evacuate to a final vacuum of at least 100 microns at a minimum 60 ^{o}F (16 ^{o}C) system temperature. With this degree of evacuation, all moisture and non-condensables will be removed from the entire system.

Line Insulation

After the final system leak test is complete, it is important that all refrigerant lines exposed to high ambient conditions must be insulated to reduce the heat pick-up and prevent the formation of flash gas in the liquid lines. Suction lines should be insulated with 3/4 inch wall insulation, Armstrong “Armaflex” or equal. To prevent rupture due to condensate re-freezing, all suction vibration eliminators on low temperature systems **must be completely insulated**. Liquid lines exposed to high ambient temperatures should be insulated with 1/2 inch wall insulation or better. Any insulation that is to be located in an outdoor environment should be protected from UV exposure to prevent deterioration of the insulating value.

Refrigerant Charging

Condensing units must be charged only with the refrigerant for which they were designed. The type of refrigerant to be used is specified on the name plate of the unit. Installing a liquid line drier between the service gauge and the liquid service port when charging a unit will ensure the refrigerant supplied to the system is clean and dry. This is especially important when charging a low temperature system. Blend type refrigerants (400 series, i.e. R404A) **must not be vapor charged** unless the cylinder is completely emptied into the system.

Weigh the refrigerant drum before and after charging in order to keep an accurate record of the weight of refrigerant put into the system.

IMPORTANT REFRIGERANT CHARGING NOTE

Overcharging a system can result in poor system performance, personal injury and / or compressor damage. **DO NOT** charge strictly by the holding capacity of the receiver. **DO NOT** assume that bubbles in a sight glass, when located at the condensing unit, indicates the system is undercharged.

Note: *To estimate the total system requirement, refer to the manufacturer’s evaporator and condensing unit specifications on typical operating charges and include the amount for the liquid lines (see tables below). Allow an extra 10% to 15% safety factor. Ensure the receiver can handle the required charge during the pump down mode. (Refer to the condensing unit brochure pump down specifications).*

Break the vacuum by charging liquid refrigerant into the receiver side only (charge through the receiver outlet valve gauge port with the valve in the open position). Close the valve and then continue to charge through the gauge port feeding the liquid line and evaporator. Start the compressor and continue to charge.

Refrigerant may be added at the compressor through the compressor suction service valve **in gas form only**. When liquid charging is used, a liquid charging valve must be installed. While charging the system, special attention should be paid to the oil level in the compressor.

If charging to the “bubble” method (observing liquid line sight glass), always use a sight glass located directly before the TXV (thermostatic expansion valve) for the final indicator.

On units that use an adjustable flooded condenser pressure-regulating valve (Sporlan ORI-6 or ORI-10) the proper adjustment must be set. Sporlan set their controls at 120 psig (929 kPa). These controls should be re-adjusted to the following pressures:

185 psig (1377 kPa) for R-22 (2 1/2 turns in clockwise for ORI-6, 4 turns in for ORI-10)
200 psig (1480 kPa) for R-404A (3 turns in clockwise for ORI-6, 5 turns in for ORI-10)

Refer to Sporlan’s installation instructions (bulletins 90-30-1 and 90-31) for further details.

Typical Air-Cooled Condensing Unit (with Horizontal Airflow Condensers)
Refrigerant Operating Charges (LBS) (Less Evaporator and Liquid Lines)

Warm Ambients * (above 50 °F) ambient application		
Model HP	**R-22**	**R-404A / R-507**
1/2 H, M	2.0	1.7
1/2 L	2.0	1.7
3/4 H, M	2.4	2.1
3/4 L	2.0	1.7
1 H, M & L	3.2	2.8
1 1/2 H, L	4.2	3.7
1 1/2 M	5.1	4.4
2 H, M, L	5.1	4.4
3 H, M, L	6.5	5.7
3 1/2 M	6.1	5.3
3 1/2 L	8.3	7.2
4 H, M	7.7	6.7
4 L	8.5	7.4
5 H	7.7	6.7
5 M	13.4	11.7
6 L	11.5	10.0
7 1/2 M †	19.6	17.1
7 1/2+M †	25.5	22.2
7 1/2 L †	16.3	14.2
9 L	19.6	17.1
10 M, L	23.5	20.4
15 M, L	32.6	28.3
20 M	47.9	41.7
20 L	36.7	31.9
25 M, L	47.9	41.7
30 M, L	47.9	41.7

Cold Ambients ** (below 50 °F) (outdoor winter operation with flooded head pressure control)		
Model HP	**R-22**	**R-404A / R-507**
1/2 H, M	3.3	2.9
1/2 L	3.3	2.9
3/4 H, M	4.2	3.6
3/4 L	3.3	2.9
1 H, M & L	4.9	4.3
1 1/2 H, L	6.1	5.3
1 1/2 M	7.6	6.6
2 H, M, L	7.6	6.6
3 H, M, L	10.2	8.9
3 1/2 M	9.8	8.5
3 1/2 L	13.5	11.8
4 H, M	13.1	11.4
4 L	13.7	11.9
5 H	13.1	11.4
5 M	22.8	19.8
6 L	19.3	16.8
7 1/2 M †	28.5	24.8
7 1/2+M †	38.9	33.0
7 1/2 L †	22.8	19.8
9 L	28.5	24.8
10 M, L	38.0	33.0
15 M, L	54.3	47.2
20 M	65.3	56.8
20 L	54.3	47.2
25 M, L	72.2	62.8
30 M, L	72.2	62.8

* Above conditions are with condenser 40 % full and receiver 10 % full.

** Above conditions are with condenser flooded at between 60 - 80 % full with fan cycling where available and receiver 10 % full.

H = High temperature M = Medium temperature L = Low temperature

† = on KE 7.5 HP machines, use refrigerant charge indicated for 6 HP

For R-134a charges consult factory.

Refrigerant Charge (LBS) for Liquid Lines (per 10 Feet)

Line Size (inches)	R-134a, R-22	R-404A, R-507
3/8	0.4	0.34
1/2	0.74	0.64
5/8	1.19	1.03
7/8	2.47	2.12
1 1/8	4.22	3.61
1 3/8	6.42	5.5
1 5/8	9.1	7.8

Typical Air-Cooled Condensing Unit (with Vertical Airflow Condensers) Refrigerant Operating Charges (LBS) (Less Evaporator and Liquid Lines)

TYPE	HP	WARM AMBIENTS* AMBIENT TEMP>50F		COLD AMBIENTS** AMBIENT TEMP.			
				+40F	-40F	+40F	-40F
		R22	R404A	R22		R404A	
SINGLE CIRCUIT UNITS	15 H	25.7	---	30.0	47.7	---	---
	20 H	25.7	---	30.0	47.7	---	---
	25 H	31.2	---	36.3	57.9	---	---
	30 H	39.6	---	46.2	74.1	---	---
	35 H	46.8	---	46.8	83.7	---	---
	40 H	49.7	---	49.7	94.6	---	---
	50 H	64.4	---	64.4	117.8	---	---
	15 M	31.2	29.5	35.4	53.1	33.1	48.5
	20 M	31.2	29.5	35.4	53.1	33.1	48.5
	25 M	38.2	36.0	43.3	64.9	40.5	59.2
	30 M	48.3	45.6	54.9	82.8	51.3	75.6
	35 M	56.8	53.7	56.8	93.8	53.7	85.9
	40 M	62.6	58.7	62.6	107.4	58.7	97.7
	50 M	80.1	75.4	80.1	133.5	75.4	121.9
	10L	19.1	18.5	28.9	32.0	26.9	29.7
	15L	27.7	26.8	43.1	48.0	40.1	44.4
	22L	28.2	27.2	40.3	53.3	37.7	49.0
	27L	34.4	33.2	49.2	65.0	46.0	59.7
	30L	37.5	36.0	54.9	73.5	51.1	67.3
	40L	51.0	49.1	73.5	97.4	68.6	89.5
DUAL CIRCUIT UNITS	30 H	51.5	---	59.9	95.3	---	---
	40 H	51.5	---	59.9	95.3	---	---
	50 H	62.4	---	72.7	115.8	---	---
	60 H	79.2	---	92.4	148.2	---	---
	70 H	93.6	---	93.6	167.5	---	---
	80 H	99.5	---	99.5	189.2	---	---
	100 H	128.8	---	128.8	235.7	---	---
	30 M	62.4	58.9	70.8	106.2	66.2	97.0
	40 M	62.4	58.9	70.8	106.2	66.2	97.0
	50 M	76.4	72.1	86.6	129.7	81.0	118.5
	60 M	96.6	91.1	109.9	165.6	102.6	151.1
	70 M	113.6	107.4	113.6	187.6	107.4	171.7
	80 M	125.1	117.4	125.1	214.8	117.4	195.4
	100 M	160.2	150.9	160.2	267.1	150.9	243.9
	20L	38.3	36.9	57.8	64.0	53.9	59.3
	30L	55.4	53.5	86.1	95.9	80.2	88.7
	44L	56.5	54.4	80.7	106.6	75.5	98.0
	54L	68.9	66.4	98.3	129.9	92.0	119.5
	60L	75.0	72.0	109.7	146.9	102.2	134.6
	80L	102.1	98.3	146.9	194.9	137.3	179.0

These figures are guidelines only
--- Not Applicable
* Based on condenser summer charge +receiver 15% full +
sub-cooling circuit 100% full (where applicable)
** Based on condenser summer charge +condensers flooded
(between 60-80% full with fan cycling-- where applicable)
+receiver 15% full + sub-cooling circuit 100% full (where applicable)

Compressor Oils

Check to see that the oil level is 1/8 to 1/3 up on the compressor sight glass on compressors so equipped before starting the compressor and after 15 to 20 minutes of operation.

CAUTION: Oil levels should not be allowed to go above the centre or 1/2 of the sight glass. Excessive oil levels in the compressor can result in excessive compressor noise, higher power consumption or internal compressor damage.

Welded hermetic compressors normally do not have sight glasses or means of determining their oil level. This type of compressor is usually installed in packaged systems or in close proximity to the fixture.

All welded hermetic compressors are factory charged with enough oil to compensate for any piping losses up to about 35 ft (10.7 m) (one way) remote location. In the event of any substantial oil loss due to a leak or excessive line run, recharge as per the table below.

Add approximately 1/3 fl oz per foot (32 ml per meter) for any remote location over 35 ft (10.7 m). If in doubt of an actual oil level, the only positive check is to remove the compressor and drain the oil (through the suction connection) and recharge with the correct factory charge (refer to unit specifications). **DO NOT** re-use drained oil that has been exposed to the atmosphere. **DO NOT** re-fill, at any one time more than a total of 110 % of the compressor's factory specified charge. Allow time for some of the oil to circulate into the system.

Refrigeration Oils - Copeland Semi-Hermetic Reciprocating Compressors

Lubricant Type		Traditional Refrigerants		Interims R-401A, R-401B, R402A, R-408A, R409A (MP-39, MP-66, HP-80, FX-10, FX-56)	HFC's R-134a, R-404A, R-507, R-407C, R-410A
		R-12	R-22, R-502		
POE's	Copeland Ultra 22CC	NOT ACCEPTABLE	A	A	P
	Mobil EAL ARTIC 22 CC		A	A	P
	ICI (Virginia KMP) Emkarate RL 32CF		A	A	P
	Thermal Zone 22CC		A	A	P
Mineral Oils	Witco Suniso 3GS	P	P	PM	NOT ACCEPTABLE
	Texaco Capella WF32	P	P	PM	
	Calumet RO15 (Witco)	P	P	PM	
	Witco LP-200*	P	P		
	Penreco* Sontex 200-LT Shritene	P	P		
A/B	Copeland Ultra 200	A	A	PM	NOT ACCEPTABLE
	Shreve Zerol 200 TD	A	A	PM	
	Soltex AB200A	A	A	PM	
	Thermal Zone 200	A	A	PM	
A/B M/O Mix	Shell 22-12	A	A	P	NOT ACCEPTABLE
	Witco R-195-0	A	A	P	

Legend P = Preferred Lubricant Choice A = Acceptable Alternative M = Mixture of Mineral Oil and AlkylBenzene (AB) with 50 % AB.

* BR, QR and Scroll A/C applications

Refrigeration Oils--Bitzer Semi-Hermetic Reciprocating Compressors: 2KC-05.2(Y) to 6F-50.2(Y)

Lubricant Type		(H)CFC R-22	Interim Blends R-401A, R-401B, R-402A, R-408A, R-409A, (MP-39, MP-66, HP-80, FX-10, FX56)	HFC's R-134a, R-404A, R-507, R-407C
Polyol Ester	ICI (Virgina KMP) Emkarate RL32S	A*	A*	P
	Mobil EAL Arctic 32	A*	A*	P
	Castrol Icematic SW32	A*	A*	P
Mineral Oils	Suniso 3GS	A	A	Not Acceptable
	Suniso 4GS	A	A	
	Capella Oil WF32	A	A	
	Capella Oil WF68	A	A	
	Esso Zerice R68	A	A	
Alkyl Benzene	Zerol 150	P	P	Not Acceptable
	Zerol 300	P	P	
	Icematic 2284	P	P	
	Esso Zerice S46	P	P	
	Esso Zerice S68	P	P	
A/B M/O Mix	Shell Clavus SD 2212	P	P	Not Acceptable
	Esso Zerice R46	A	A	

Legend: P = Preferred A= Acceptable Alternative

- Compressor with "Y" designation are factory charged with polyolester oil

* NOTE: When operating (H)CFC with ester oils the quantity of refrigerant dissolved in the oil is more than doubled as compared with conventional lubricants. Special care should be taken. Refer to Bitzer Technical Bulletin KT-510-2, section 5 for additional information.

Refrigeration Oils--Carlyle Semi-Hermetic Reciprocating Compressors: 06D/E and 06CC

Lubricant Type		(H)CFC R-22	HFC's R-134a, R-404A, R-507, R-407C
Polyol Ester	Totaline P903-1001,1701	Not Approved	A
	Castrol E68		A
	ICI Emkerarate RL68H		A
	CPI CP-2916S		A
	CPI Solest 68		A
	BP Marine Enersyn MP-S68		A
Mineral/Alkyl Benzene	Witco Suniso 3GS	A	Not Approved
	Totaline P903-2001	A	
	Texaco Capella Oil WFI-32-150	A	
	IGI Cryol -150	A	
	Shrieve Zerol-150	A	

A = Approved

Some restrictions may apply.For further information consult Carlyle factory or Carlyle web site.

Due to the extreme hygroscopic (moisture absorbing) characteristics of Polyol Ester (POE) oils, systems MUST NEVER be left open to the atmosphere for any extended period of time. Simply pulling a deep vacuum on the system during the evacuation and dehydration procedure WILL NOT remove moisture that is absorbed into POE oils.

System Start-up Check List

IMPORTANT START-UP NOTE

Only a qualified refrigeration mechanic who is familiar with compressor performance and the function and adjustment of all controls and components should start up the compressor. Finishing up work on the installations should be planned so that a qualified mechanic is on the job for at least the first full day that the unit is in operation.

Before any refrigeration system is started, the following items should be checked:

(1) Check that all electrical and refrigeration connections are tight.
(2) Check compressor crankcase oil level (if equipped with sight glass). It should be from 1/8 to 1/2 full in the sight glass.
(3) Insure that compressor shipping spacers (spring mounted compressors) or hold down nut (solid mounted compressors are properly in place.
(4) Check that the compressor discharge and suction shut-off valves are open.
(5) Ensure that the high and low pressure controls (see table below) pressure regulating valves, oil pressure safety controls and any other safety controls are adjusted properly.
(6) Check that the room thermostat is set for normal operation and adjust if required.
(7) Check all motors, fans and pump bearings in the condenser and evaporator. If they are the type that require oil or grease, make sure that this is attended to in accordance with the tag, which will be attached. Fan blades and pumps should be checked for correct rotation, tightness and alignment. Air should draw air through the condenser (air cooled condensing unit models).
(8) Electric and hot gas evaporator fan motors should be temporarily wired for continuous operation until the room temperature has stabilized.
(9) Observe the system pressures during the charging and initial operation process. **DO NOT** add oil while the system is low on refrigerant charge unless the oil level is dangerously low.
(10) Continue to charge the system until it has enough charge for proper operation. **DO NOT OVERCHARGE THE SYSTEM.** Note that bubbles in the sight glass may not necessarily mean a shortage of refrigerant. It could be caused by a restriction.
(11) **DO NOT** leave the system unattended until the system has reached its normal operating condition and the oil charge has properly adjusted itself to maintain the proper level in the sight glass.
(12) Compressor performance, and that of all of the moving components, should be watched carefully throughout the first operating cycle and then checked periodically during the first day of operation. **Careful attention to details at this time will pay dividends in trouble-free performance of the entire system.**
(13) Check that the wiring diagrams, instructions bulletins etc. are read and attached to the unit for future reference. Ensure that the Warranty Activation Certificate is filled in and either faxed or mailed back to the number or address provided.

CAUTION

Extreme care must be used when starting a compressor for the first time after the system has been charged. During this time liquid refrigerant may have migrated to the compressor crankcase, creating a condition that could cause the compressor damage due to slugging. Energizing a crankcase heater (if so equipped) 24 hours prior to start-up is recommended. If the compressor is not equipped with a crankcase heater, directing a 500 watt heat lamp or other safe heat source on the lower shell or crankcase of the compressor for approximately thirty minutes is recommended.

WARNING

Three phase scroll compressors must be checked for correct rotation. During the initial start up, observe the suction and discharge gauges to ensure the suction pressure drops and the discharge pressure rises.

Pressure Control Settings

Minimum Temperature °F *	R-134a		R-22		R-404A, R-507	
	Cut-in (PSIG)	Cut-out (PSIG)	Cut-in (PSIG)	Cut-out (PSIG)	Cut-in (PSIG)	Cut-out (PSIG)
50	35	5	70	20	85	30
40	25	5	55	20	70	30
30	17	5	40	20	50	30
20	12	0	30	10	40	20
10	7	5" Hg	20	0	30	10
0	5	5" Hg	15	0	20	5
-10	-	-	15	0	15	0
-20	-	-	10	0	10	0
-30	-	-	10	0	6	3" Hg

* The coldest Temperature of either the fixture or outdoor ambient.

High Pressure Control Settings

Refrigerant	Maximum Cut-out (PSIG)	
	Air-Cooled Units	Water Cooled Units
R-134a	250	200
R-22	370	315
R-404A	400	315

Low Temperature Room Pull-Down

It can take up to two weeks to properly start-up and pull-down a large freezer. Large freezers should be pull-down to temperature in stages. Too fast a pull-down can cause structural problems in pre-fabricated rooms and will damage (crack) concrete floors. Reduce room temperature by 10 to 15 °F (5.6 to 8.4 °C) per day. Hold this temperature for 24 to 48 hours at 35 °F (1.7 °C) and again at 25 °F (-3.9 °C). Monitor the amount of defrost water during this pull down stage.

Once the room is pulled down to temperature, expect frost on the compressor end bell and any exposed suction line. A lack of frost in these areas probably indicates too high of suction superheat. Reduce defrost frequency to 30 minutes every 6 hours if possible. Adjust the defrost termination (and time clock) so that the coil and drain pan are **COMPLETELY** free of frost / ice at termination. Too short of a defrost cycle will allow residual ice to grow. Too long of a defrost will allow the coil(s) to steam at the end of the cycle. The steam will condense and freeze fans, fan guards and create frosting on the ceiling of the room. The evaporator fan delay must allow any condensate left on the coil surface to refreeze before the fans start.

Checking Superheat

IMPORTANT SYSTEM BALANCING NOTE

To obtain maximum system capacity and insure trouble free operation it is necessary to check both the compressor and evaporator superheat.

Compressor Superheat

Compressor suction superheat must be checked. To check the superheat at the compressor the following steps should be followed:

(1) Measure the suction pressure at the suction service valve of the compressor. Determine the saturated temperature corresponding to this pressure from a "Pressure- Temperature" chart.
(2) Measure the suction temperature of the suction line about 6 inches (15 cm) back from the compressor suction valve using an accurate thermometer.
(3) Subtract the saturated temperature (from step 1) from the actual suction line temperature (from step 2). This difference is the **actual superheat at the compressor**.

System capacity decreases as the suction superheat increases. For maximum system capacity, the suction superheat should be kept as low as is practical. The superheat at the compressor should range within 20 to 45 ^{o}F (11.2 to 25.2 ^{o}C) Superheat.

NOTE: Too low of a suction superheat can result in liquid being returned to the compressor. This can cause dilution of the oil and eventually cause failure of the bearings and rings through wash out as well as liquid slugging.

NOTE: Too high of a suction superheat will cause excessive discharge temperatures which cause a break down of the oil and will result in piston ring wear, piston and cylinder wall damage.

If adjustment to the suction superheat is required, it should be done either by adjusting the thermostatic expansion valve at the evaporator, the use of liquid to suction heat exchanger or suitable use of suction line insulation.

Evaporator Superheat

Once the refrigerated space is at its design temperature or close to design temperature, the evaporator superheat must be checked. To check the suction superheat at the evaporator the following steps should be followed:

(1) Measure the suction pressure in the suction line at the bulb location by either,
  (a) A gauge in the external equalizer line will indicate the pressure directly and accurately.
  (b) A gauge directly in the suction line near the evaporator or directly in the suction header will suffice.
(2) Measure the temperature of the suction line at the point where the thermostatic expansion valve bulb is clamped to the suction line.
(3) Convert the pressure obtained in step 1 above to a saturated evaporator temperature from a "Pressure-Temperature" chart.
(4) Subtract the saturated temperature (from step 1) from the actual suction line temperature (from step 2). This difference is the **actual superheat at the evaporator**.

The superheat at the evaporator should be a minimum of 6 to 10 ^{o}F (3.4 to 5.6 ^{o}C) for systems with a 10 ^{o}F (5.6 ^{o}C) design TD (temperature difference) to a maximum of 12 to 15 ^{o}F (6.7 to 8.4 ^{o}C) for systems with a higher operating TD.

Low temperature applications (freezers) should be set at superheats of 4 to 6 ^{o}F (2.2 to 3.4 ^{o}C).

TD = Box temperature – evaporating temperature.

System Operational Check List

When the system has been running trouble free for an extended time (two weeks or more) and design conditions are satisfied, the following check list should be followed:

(1) Check that compressor **discharge and suction pressures** are operating within the allowable design limits for the compressor. If not, take the necessary corrective action.

(2) Check the liquid line sight glass and expansion valve operation. If there is an indication that the system is low on refrigerant, thoroughly **check the system for leaks before adding refrigerant**.

(3) Check the **level of the oil** in the compressor sight glass (if so equipped). Add oil as necessary.

(4) The thermostatic expansion valve must be checked for **proper superheat settings**. The sensing bulb must have positive contact with the suction line and should be insulated. Valves operating at a high superheat setting results in low refrigeration capacity. Low superheat settings can cause liquid slugging and compressor bearing washout. (Refer to the section on compressor and evaporator superheats)

(5) Check the **voltage and amperage** readings at the compressor terminals. Voltage reading must be within the recommended guidelines. Normal operating amperages can be much lower than the compressor nameplate values.

(6) To check the **high pressure control setting** it is necessary to build up the head pressure to the cut-out point of the control. This can be done by stopping the condenser fan(s) (air cooled condensing units) or pump and watching the pressure rise on a high pressure gauge to make sure the high pressure control is operating at the setting.

(7) Check the **low pressure settings** by throttling the compressor shut-off valve and allowing the compressor to pump down. This operation must be done with extreme caution to avoid too sudden a reduction in crankcase pressure, which will cause oil slugging and possible damage to the compressor valves. Close the valve a turn at a time while watching the compound gauge for change and allowing time for the crankcase pressure to equalize with the pressure control bellows pressure. The slower the pressure is reduced, the more accurate will be the check on the pressure control setting.

(8) Recheck all **safety and operating controls** for proper operation and adjust as necessary.

(9) Check **defrost controls for initiation and termination settings**, and the length of defrost period. Set the fail safe on the time clock at the length of defrost plus 25 %.

(10) If the system is equipped with winter head pressure controls (fan cycling or flooded valves), **check for operation.**

(11) Fill in the **Service Log** in the back of this Installation Manual.

System Troubleshooting

The following System Troubleshooting Guide lists the most common types of malfunctions encountered with refrigeration systems. These simple troubleshooting techniques can save time and money minimizing unnecessary downtime and end-user dissatisfaction.

Contact the factory or your local sales representative for further information or assistance.

System Troubleshooting Guide	
Condensing Unit Problem	**Possible Causes**
Compressor will not run. Does not try to start.	1. Main power switch open. 2. Fuse blown or tripped circuit breaker. 3. Thermal overloads tripped. 4. Defective contactor or coil. 5. System shut down by safety devices. 6. Open thermostat or control. No cooling required. 7. Liquid line solenoid will not open. 8. Loose wiring.
Compressor hums, but will not start.	1. Improperly wired. 2. Low line voltage. 3. Loose wiring. 4. Defective start or run capacitor. 5. Defective start relay. 6. Motor windings damaged. 7. Internal compressor mechanical damage.
Compressor starts, but trips on overload protector.	1. Improperly wired. 2. Low line voltage. 3. Loose wiring. 4. Defective start or run capacitor. 5. Defective start relay. 6. Excessive suction or discharge pressure. 7. Tight bearings or mechanical damage in compressor. 8. Defective overload protector. 9. Motor windings damaged. 10. Overcharged system. 11. Shortage of refrigerant. 12. Suction or discharge pressure too high. 13. Inadequate ventilation. 14. Operating system beyond design conditions.
Compressor short cycles.	1. Low pressure control differential set too low. 2. Shortage of refrigerant. 3. Low airflow at evaporator(s). 4. Discharge pressure too high. 5. Compressor internal discharge valves leaking. 6. Incorrect unit selection (oversized).
Start relay burns out.	1. Improperly wired. 2. Low or high line voltage. 3. Short cycling. 4. Improper mounting of relay. 5. Incorrect start or run capacitor. 6. Incorrect relay.
Contact welded stuck on start relay	1. Short cycling. 2. No bleed resistor on start capacitor.
Start capacitor burns out	1. Improperly wired. 2. Short cycling. 3. Low line voltage. 4. Relay contacts sticking. 5. Incorrect capacitor. 6. Start winding remaining in circuit for prolonged period.

Condensing Unit Problem	Possible Causes
Compressor noisy or vibrating.	1. Flood back of refrigerant. 2. Improper piping support on the suction or discharge lines. 3. Broken or worn internal compressor parts. 4. Incorrect oil level. 5. Scroll compressor rotating in reverse (three phase). 6. Improper mounting on unit base.
Discharge pressure too high.	1. Non-condensables in the system. 2. System overcharged with refrigerant. 3. Discharge service valve partially closed. 4. Condenser fan not running. 5. Dirty condenser coil.(air-cooled condensers) 6. Dirty tubes. .(water-cooled condensers) 7. Defective or improperly set water regulating valve. (water-cooled condensers) 8. Defective or improperly set flooded head pressure control.
Discharge pressure too low.	1. Low suction pressure. 2. Cold ambient air. 3. Suction service valve partially closed. 4. Shortage of refrigerant. 5. Defective or improperly set water regulating valve. (water-cooled condensers) 6. Defective or improperly set flooded head pressure control.
Suction pressure too high.	1. Excessive load. 2. Compressor internal valves broken. 3. Incorrect unit selection (undersized). 4. Improper TXV bulb charge.
Suction pressure too low.	1. Shortage of refrigerant. 2. Evaporator dirty or iced up. 3. Clogged liquid line filter drier. 4. Clogged suction line filter or compressor suction strainers. 5. Expansion valve malfunctioning. 6. Condensing temperature too low. 7. Improper TX valve selection. 8. Evaporator distributor feed problems.
Low or no oil pressure.	1. Low oil level. (trapped oil in evaporator or suction line) 2. Clogged suction oil strainer. 3. Excessive liquid refrigerant in the crankcase. 4. Worn oil pump. 5. Oil pump reversing gear sticking in the wrong position. 6. Worn bearings. 7. Loose fitting on oil line. 8. Pump housing gasket leaking.
Compressor loses oil.	1. Refrigerant leak. 2. Short cycling. 3. Excessive compressor ring blowby. 4. Refrigerant flood back. 5. Improper piping or traps. 6. Trapped oil in evaporator.
Compressor runs continuously	1. Excessive load. 2. Too low of a system thermostat setting or defective thermostat. 3. Shortage of refrigerant. 4. Leaking compressor internal valves. 5. Malfunctioning liquid line solenoid. 6. Incorrect unit selection (undersized).

System Troubleshooting Guide	
Fixture Problem	**Possible Causes**
Room temperature too high.	1. Defective room thermostat or improper differential / setting. 2. Malfunctioning liquid line solenoid valve. 3. Insufficient air across evaporator coil (iced up coil, product blocking evaporator, fan blade / motor problem). 4. Improper evaporator superheat (low refrigerant charge, plugged TXV strainer, poor TXV bulb contact, incorrect TXV setting). 5. Malfunctioning condensing unit.
Room temperature too low.	1. Defective room thermostat or improper differential / setting. 2. Malfunctioning liquid line solenoid valve.
Ice accumulating on ceiling.	1. Defrost on too long (improper setting / defective termination thermostat, improper setting / defective time clock). 2. Too many defrosts per day. 3. Fans not delayed after defrost (improper setting / defective fan delay thermostat).
Evaporator coil not clear of ice after defrost.	1. Defrost on too short (improper setting / defective termination thermostat, improper setting / defective time clock). 2. Electric heaters defective / miswired / low voltage. 3. Not enough defrosts per day. 4. Air defrost evaporator operating at too low of temperature (require electric defrost). 5. Defective / miswired interlock at compressor contactor. 6. Defective defrost contactor or coil.
Ice building up in drain pan.	1. Improper slope in pan. 2. Blocked drain line (unheated , not insulated). 3. Electric heater in drain pan defective / miswired / low voltage). 4. Not enough defrosts per day. 5. Lack of or improper P-trap in drain line.
Evaporator fans will not operate.	1. Main power switch open. 2. Fuse blown or tripped circuit breaker. 3. Defective contactor or coil. 4. Room temperature too high (fan delay thermostat open). 5. Fan delay thermostat improper setting / defective. 6. Defective fan motor (low voltage / tripped on thermal overload). 7. Defective time clock. 8. Normal mode during defrost cycle (electric defrost type evaporator).

IMPORTANT TROUBLESHOOTING NOTE

Before any components are changed on the refrigeration system, the cause of the failure must be identified. Further problems will exist unless the true cause or problem is identified and corrected.

Customer Instructions

Maintenance Program

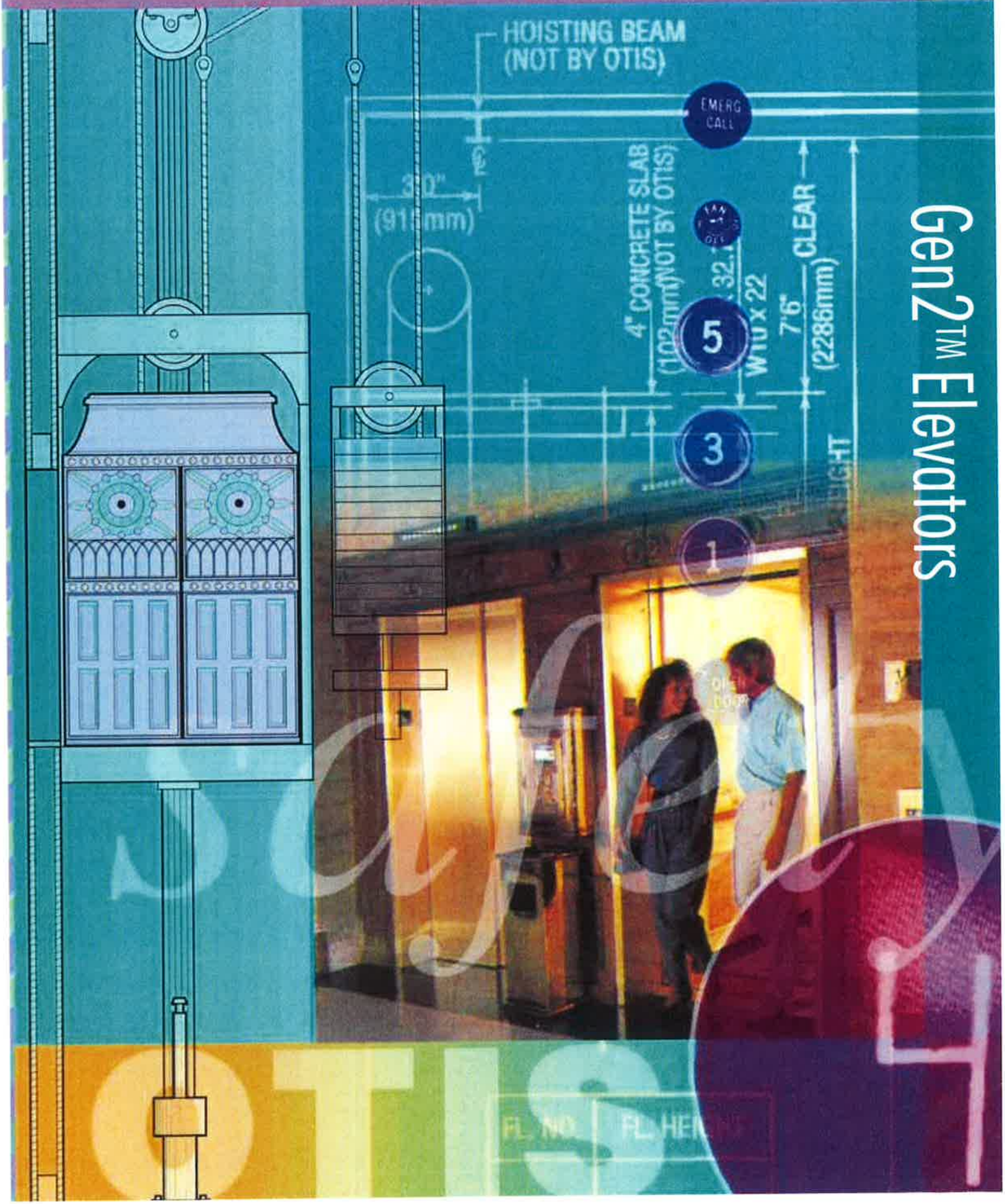
In order to ensure that the refrigeration system runs trouble free for many years, a follow-up maintenance program (consisting of a minimum of two inspections per year) should be set up. A qualified refrigeration service mechanic should carry out this semi-annual inspection. The main power supply **must be disconnected and locked off** to avoid accidental start up of the equipment.

(1) Check electrical components and tighten any loose connections.
(2) Check all wiring and electrical insulators.
(3) Check contactors to ensure proper operation and contact point for wear.
(4) Check that fan motors (if applicable) are operational, ensure fan blades are tight and all mounting bolts are tight.
(5) Check oil and refrigerant levels in the system.
(6) Ensure that the condenser surface (if applicable) is cleaned and free of dirt and debris.
(7) Check the operation of the control system. Make certain that all of the safety controls are operational and functioning properly.
(8) Check all refrigeration piping. Make sure that all mechanical joints and flare nuts are tight.

Service Parts Availability

Genuine replacement service parts should be used whenever possible. Refer to the Service Parts List on the back cover of this Installation and Maintenance Manual or attached to the unit. Parts may be obtained by contacting your local sales representative or authorized distributor.

Owner's Information Manual



Gen2™ Elevators

Owner's Information Manual

Gen2® Elevators

Otis Elevator Company

Publisher: Technical Publications Department, Otis Elevator Company

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This publication is intended for those individuals or organizations in ownership of Gen2® elevator system and equipment manufactured and sold by Otis Elevator Company. It is expressly designed to be informative and to offer a limited understanding of the operation of these systems. It is not intended to be a guide for servicing or repairing or installing elevator equipment. Professional providers of those services should be contacted to perform any work in a safe and professional manner.

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Owner's Information Manual

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Preface

Thank you for your recent purchase of the Otis Elevator Gen2® system. Your new Gen2 system meets the highest safety and performance standards available in the market today.

Otis has built a reputation based on quality, reliability and an OSHA-proven record of safety that's the best in the business. We continue to pursue a policy of innovation to ensure our customers receive the highest level of service in the industry. We look forward to the opportunity to continue to serve you and your elevator needs for years to come.

The information in this book will provide you and your staff with information about the Otis Elevator Company, the Gen2 system and its maintenance requirements.

Otis personnel have access to the latest information in support of our maintenance practices. We continuously look for ways to improve our processes; not only in support of your equipment, but in the ways we deliver information throughout our company.

To learn more about what genuine Otis maintenance can mean for you and your business, or to locate the Otis representative nearest you, please visit our website at www.otis.com.

How This Book Is Organized

This Owner's Information Manual is divided into five chapters.

The first chapter gives a history of Otis Elevator Company.

Chapter 2 is designed to make elevator owners more aware of their responsibilities, including passenger safety, code requirements, and emergency procedures. It also explains how Otis emphasizes safety in its everyday operations.

Chapter 3 provides information about how your Gen2 elevator operates, a description of its major components, and available features.

Chapter 4 describes the necessary maintenance needed on your new system.

Chapter 5 contains information about Otis' service and maintenance programs.

Chapter 6 provides unique procedures for Gen2 maintenance.

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Use of Warnings

It is essential that you realize your Otis elevator is a complex piece of machinery and should be serviced only by a trained, authorized elevator mechanic. Tampering with the equipment is hazardous to you, to the person performing maintenance, to the passengers, and may be detrimental to the elevator itself.

Some of the topics in this manual deal with the inherent dangers of elevator operation, whether electrical, mechanical, or otherwise. These are identified by warning symbols placed near the application paragraphs. Some of the potential dangers include electrical shock from high voltage, crushing hazards, and flammable or combustible materials. Additionally, other symbols are used to reflect important information. The symbols used in this manual are:



WARNING



RISK OF ELECTRICAL SHOCK



NOTE



CRUSH HAZARD

Please contact your nearest Otis office if you have any question or require assistance with your elevator equipment.

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Chapter 1: About Otis Elevator

Otis Elevator Company has a long and interesting history that began in the mid-nineteenth century with its founder, Elisha Graves Otis.

In 1852, while employed by the Yonkers Bedstead Manufacturing Company in Yonkers, New York, Otis built a hoisting machine with a safety mechanism that prevented the platform from falling if the hoisting rope broke. The following year, he opened his own shop in Yonkers, called Union Elevator Works.

It was at the 1854 New York World's Fair—also known as the Exhibition of the Industry of All Nations—that Otis introduced his first safety hoist to the public. His demonstration of riding up and down on the platform and cutting the hoisting rope without plummeting to the ground attracted huge crowds. The event became famous and the safety hoist's debut was a resounding success.



1854: Safety Hoist Elevator at the Crystal Palace, New York World's Fair

Elevators during the 1850s were used to hoist freight, and Otis and his sons sold their product on the existing market as a hoist. He also realized the safety mechanism made it possible to safely carry passengers, thus potentially opening up a whole new market.



1854: E.G. Otis Calling Card

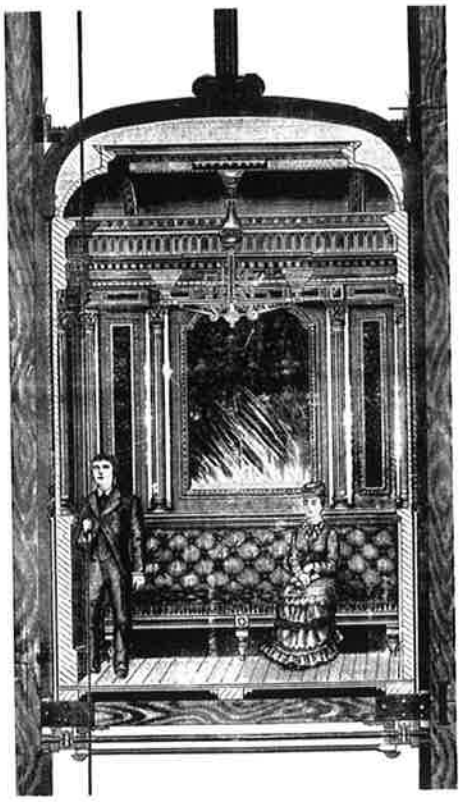
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The next problem to overcome was development of a power source to run passenger elevators. Factories and warehouses with freight elevators were near water, but passenger elevators would be installed in stores, office buildings, and hotels, away from any central power source (this was 22 years before the opening of the first U.S. electric power station).

Otis' solution was to invent a small, oscillating steam engine to power each elevator. So in 1857, he designed, built, and installed the first Otis safety passenger elevator, in the E.V. Haughwout Store in New York City.



1857: The first passenger elevator ever built was installed in the E.V. Haughwout Store in New York City



1873: The elevator operator manipulates the control rope, regulating the direction and speed of the car.

Elisha Otis was a master mechanic and engineer. He obtained many patents in the 1850s, including the safety device he invented in 1852, the oscillating steam engine, a brake, steam plows, and a rotary oven for bakeries.

Unfortunately, at the age of 50, Otis died suddenly during a diphtheria epidemic in 1861. His sons, Charles and Norton, took over the business and utilized the elevator expertise their father taught them. They renamed the company N.P. Otis & Brother, then in the late 1860s changed it to Otis Brothers & Company.

Otis Brothers & Co. patented some 53 new advancements in elevator equipment, including hoisting apparatus, brakes, steam hoist, and pulleys. The brothers continued to use world's fairs and industrial fairs to showcase their elevator technology and create an international market for Otis elevators.

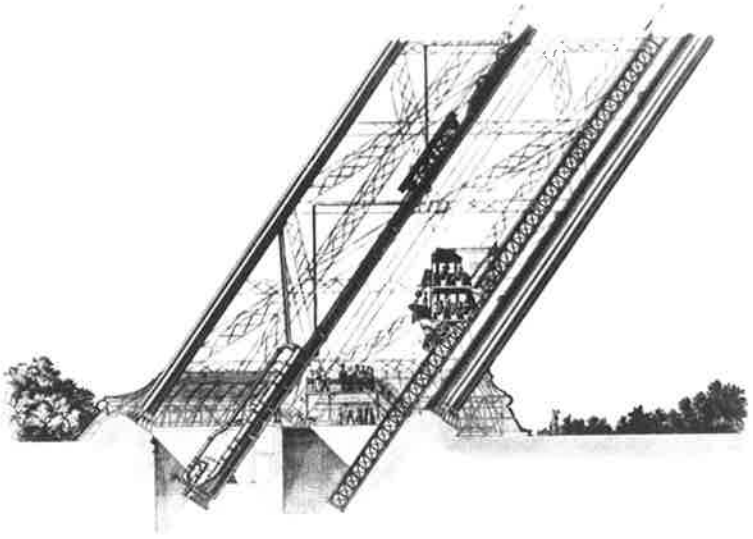
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An Otis two-cylinder steam elevator machine and platform were exhibited at the second world's fair to be held in the U.S., the Centennial Exposition of 1876 in Philadelphia. Judges commended Otis for its adaptation of the freight hoist to passenger elevator and for its attention to safety.

Otis elevators were prominently displayed in 1889 at the Universal Exposition in Paris. The French government built the Eiffel Tower specifically for the world's fair and wanted an all-French monument to represent the construction and technological expertise. But no French company could overcome the structural demands of putting elevators inside the tower's curved legs. Otis Elevator successfully installed elevators, giving the company a chance to display its product at the fair's centerpiece attraction.

Post-Civil War era use of structural steel made it possible to construct taller buildings. Otis technology kept up with the construction pace during this "Era of the Skyscraper."

Otis opened offices in England, France, Canada, Germany, and Belgium, and had sales agents representing the company throughout the world. Its most famous elevator installations included the Eiffel Tower, the London Underground, and three elevators for Russian Emperor Nicholas II's private quarters in the Kremlin.



1889: Otis Elevators Inside the Curved Legs of the Eiffel Tower

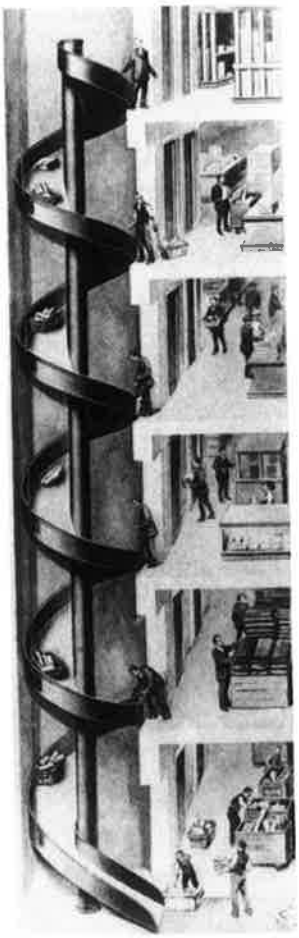
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Modern day Otis came into being during the late 1800s and the early 1900s, a time when "big business" flourished. Otis Brothers & Co. merged in 1898 with several U.S. elevator companies in Boston, Chicago, and Philadelphia to become the Otis Elevator Company. Forty more, small, independent elevator companies were acquired during the period prior to World War I.

The company expanded its product line by acquiring the patents for modern escalator technology from Charles D. Seenberger and Jesse W. Reno. The world's leading elevator manufacturer unveiled its new "escalator" (a term trademarked and owned by Otis for 50 years) at the Paris World's Fair of 1900.



1920: Freight Incline



1900: Gravity Conveyers

In 1903, Otis introduced what would become the "backbone" of the elevator industry, the gearless traction electric elevator. It could be used in buildings of any height and operated at greater speeds than steam elevators.

As skyscrapers got taller and taller, more Otis elevators were installed, particularly in New York City. For example, the 20-story Flatiron building was built in 1902 and had six Otis elevators. In 1912, the Woolworth building rose to 60 floors and was equipped with 26 elevators.

Skyscrapers reached a new pinnacle in 1931 when the world's tallest building—the Empire State Building—opened, serviced by 67 Otis elevators.

More tall buildings meant more elevators and a greater need to keep them in good running condition. Otis recognized this and in 1921 introduced the first preventive maintenance service. Today, maintenance represents 50 percent of Otis' overall business.

From its early days under Elisha Otis until late 1960s, Otis Elevator explored many different product lines outside its core business of elevators and escalators: the rotary oven for bakeries in the 1850s, a haymaker in the 1870s, gravity conveyors around 1900, the Sultan automobile from 1909–1912, and passenger and freight inclines in the 1920–1930s.

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Otis converted to military production during World War I, World War II, and the Korean War. It manufactured crank cases for fighter planes, anti-aircraft guns, ammunition hoists, gun recoil mechanisms, depth charge throwers, and airplane elevators for aircraft carriers.

The wars disrupted the normal production, but they also changed Otis' business. Automatic elevators have been sold to homeowners since the 1890s, while most public buildings used elevator operators to run elevators well into the 1940s. But labor shortages during World War II brought the need for automated public elevators to the forefront. So, in 1950 the first group of Otis automatic elevators was installed in Texas.



1921: Preventive Maintenance



1969: Electric Cart

Following the Korean War, Otis continued to diversify its product line, producing military electronics, material handling equipment, and automatic bowling pinsetters. One of its more unique operations was the manufacture of electric buses, vans, and golf carts.



1969: Electric Golf Cart

By the late 1960s and early 1970s, Otis officials chose to concentrate on the core elevator and escalator business and divested the company's other holdings.

United Technologies purchased the Otis Elevator Company in 1975. Otis became a wholly owned subsidiary in 1976.

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One of the most significant developments in elevator technology was the use of computer chips to make elevator control decisions. Prior to this development, elevators relied on large collections of relays and switches. These relay-based systems required a lot more maintenance and occupied significant space.

In the early 1980s, Otis developed the first microprocessor control elevator system, called the Elevonic® 101. It was a watershed event and paved the way for future developments utilizing computer technology.

Advances in microprocessor and data communications technology led to Otis' first Remote Elevator Monitoring (REM®) system, which was introduced in 1985 and installed at an Otis elevator site in the United Kingdom.

REM systems monitor elevators 24 hours a day and provide diagnostic information via a telephone line to our technical center. This information assists our technicians in preventing elevator disruptions.



1985: Remote Elevator Monitoring (REM®) systems monitor elevators 24 hours a day.

Another important technological advance—the Elevonic® 411 software based control system—was released by Otis in 1990. These sophisticated Elevonic systems made "real-time" dispatching rules based on changing traffic conditions in a building. They also managed elevator ride quality, energy consumption, motor performance, and all the in-car information displays.

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Elevonic Hall Position Indicator



1990: Elevonic® Hall Button

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Some other Otis products include:

- **Gen2™ Elevator System:** The first major breakthrough in elevator lifting technology in nearly 150 years. Gen2, an elevator system for low- and mid-rise buildings, is the first to use flat coated steel belts to lift the elevator cars. The belts are 1 in. (25 mm) wide and 0.1 in. (2.5 mm) thick, quieter, lighter, easily bend around a 4 in. (101 mm) diameter sheave, and last up to two to three times longer than traditional steel ropes. That means the Gen2 system requires a machine one-quarter the size of a traditional machine, eliminating the need for a separate machine room.

- **TRAV-O-LATOR®:** Moving walkways for expansive facilities such as airport terminals and shopping centers.



1996: TRAV-O-LATOR®

Otis is focused on advanced technology that will improve its operations and products in three key areas: quality, efficiency, and safety. For example:

- Otis dispatching technology improves service dramatically by analyzing and adapting to a building's traffic pattern, then assigning elevators to respond to variations in passenger traffic within the building. This is critical to an integrated building transit system because traffic patterns in the buildings of the future will be more complex than in today's buildings.

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- Otis engineers are also designing sophisticated remote elevator monitoring systems. The more closely an elevator is monitored, the easier it can be maintained with fewer costly shutdowns.



Elevator monitoring systems provide comprehensive information about elevator condition, status, and performance.

Today, Otis is recognized as the elevator industry leader, maintaining more than 1.7 million elevators and escalators worldwide. It is an $11.6 billion (U.S. dollars) company with 60,000 employees.

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Chapter 2: Performance and Safety

If anything improper is discovered, corrective action must be taken immediately. Do not attempt to repair the equipment. For safety reasons, only a trained, authorized elevator mechanic should ever service your elevator.

Knowing what to look for is probably the most important aspect of elevator awareness. When you know how to spot issues in performance, you can influence the efficiency of your equipment by taking care of issues before they become problems. The following information suggests ways you can look after your investment and help keep it running at optimum performance. More information about general maintenance procedures can be found in Chapter 4.

You or a member of your building staff should go through the following procedures regularly with each elevator car:



Emergency Lighting/Alarm Bell system provides passenger reassurance in emergencies

1. **Test the operations and safety devices.**

   Test alarm bells, stop switches, intercoms, telephone connections, and emergency lighting systems to make sure they will work in an emergency.

2. **Ride the elevators.**

   Ride the elevator and pay attention to the smoothness of starting and stopping, to any unusual sounds (such as squeaks or scrapes), and to any unusual movements, vibrations, or odors. Close your eyes to increase awareness of irregularities.

3. **Listen during rush hours.**

   Stand in the lobby during peak traffic periods listening to passengers' comments.

You should be aware of several things in order to prevent equipment failure and/or potential hazards. The following seven-point safety and performance checklist can be applied on a regular basis to most elevator systems.

- **How long must passengers wait for an elevator at the lobby?**

Well-timed arrivals and departures, as well as proper acceleration and deceleration, are critical to fast, efficient service.

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- **Do the passengers have enough time to enter and exit before the doors close?**

There are a number of variables that determine the door's opening cycle. The minimum time may depend on the number of elevators in the bank and on the distance from a point in the center of the lobby to each elevator. Time may also be measured from notification that a car is arriving by a lantern and audible signal. Times might also be longer for elevators that service elderly or disabled persons.

- **Do the doors reverse direction without touching passengers?**

  Your elevator is equipped with an electronic detector to sense passengers in the door zone. This detector enables a closing door to reverse direction without touching passengers. Reversal should take place as soon as any portion of the passenger enters the door zone when the doors have begun to close.



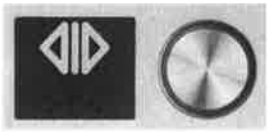
Electronic detectors enable a closing door to reverse direction without touching passengers.

- **Does the car stop level with the hall floor?**

  Leveling is the process of the elevator platform attaining a stop position that is even with the landing. The car should stop within +/- 0.2 in. (+/-5 mm) of the hall floor, and leveling should be consistent whether the car is full or empty.

- **Does the alarm bell work?**

  The alarm bell should be tested once a week by pressing the alarm button on the car operating panel. This quick and simple procedure ensures that the bell will work when and if it is needed.



Door Open Button



Alarm Bell



Stop Switch

- **Is the intercom or telephone in good working order?**

  Intercoms and telephones should be tested regularly. Passengers can be spared inconvenience when minor mechanical difficulties occur by following instructions

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received over the intercom or telephone. During an emergency, communication with passengers helps to alleviate or avert panic. At these times, information from passengers can be of great assistance to emergency personnel.

- **Is the interior of the elevator adequately lit?**

  Check that all light switches are on, all lamps are lit, and all light diffusers are clean to permit maximum transmission of light.

Only use the elevator for the purposes for which it was designed. The elevator has been designed to transport passengers and goods within a building, carrying loads up to the maximum weight indicated inside the elevator car, running at the speed for a rated traffic condition. Overloading will result in visual and/or audible signals in the car and further movements will be prevented until the overload condition has disappeared.

It is extremely important that planned maintenance be recorded with a reputable maintenance company. Maintenance is necessary to ensure the safe and correct operation of the equipment. Inspections of the equipment should be carried out in accordance with local regulations. Any irregularities in the operation or performance of the elevator should be reported to the elevator maintenance company immediately. Any alterations or changes to the building that may affect the elevator should also be discussed with the maintenance company.

The control room and access areas for servicing the elevator equipment should remain clean and free of debris at all times. For proper operation, the control room temperature must be between 32° F (0° C) and 104° F (40° C). Areas subject to excessive heat must have proper ventilation.

The elevator's two-way voice communication system must be kept in good working order. This includes the communication line between the car and a rescue service.

State-of-the-art elevator and escalator engineering has developed mechanisms that greatly reduce the risks to life and property in emergency situations. However, building personnel still play a vital role in directing occupants to safety, in monitoring equipment, and in operating controls that initiate emergency routines.

The proper handling of elevators and escalators in an emergency could mean the difference between life and death. You should ensure that all your building personnel are familiar with emergency procedures suitable to your building structure and all of its equipment in the event of accidents, fire, earthquake, or power failure. Contact your local authorities and fire department for appropriate advice, inspections, and drills.

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Fireman's Service—SES

Fire service varies based on local code requirements. Contact your local authorities and fire department for appropriate advice, inspections, and drills.

Firemen's Service/Special Emergency Service allows control of elevator operation in the event of fire or other time-sensitive emergencies, particularly where immediate access to specific building areas or floors is necessary. Fireman's Service has two separate operations, or phases.

Firefighter's Service Phase 1

When a smoke or heat sensor is activated on any level (except the main fire return floor), a signal is sent to the elevator control system to return the elevator to the main fire return floor or main designated return landing. The elevator then proceeds immediately to this landing and parks with the door open.

If a smoke or heat sensor is activated at the main fire return floor, the elevator is placed in a "fire recall" status; however, the elevator will proceed to the alternate fire return floor, and park with the door open.

Firefighter's Service Phase 2

This feature is activated by the fire fighters using a keyswitch in the car, which places the elevator under their control. This feature includes the call cancel button and keyswitch in car. When the call cancel button is activated, all registered calls are cancelled and the car stops at the next landing.

Emergency Power Option

In the event of a power failure, your building's emergency power supply operates the elevator during the failure, but only if you have selected the Emergency Power Option for your elevators.

If your elevator system's Emergency Power Option is set to the AUTO mode, each car will automatically travel directly to the lobby (or the previously designated floor) and the doors will open to allow passengers to exit. After the cars arrive at the lobby, they remain parked there until one or more cars are selected to provide service under Emergency Power.

If your elevator system's Emergency Power Option does not have an AUTO mode, or if that mode is not turned on, the cars may be brought to the lobby by manually selecting them, one at a time, using the emergency power strip switch.

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Chapter 3: Your Gen2® Elevator

Introduction

Today's elevators provide a safe, rapid means of passenger transportation. In large part, this is due to advances in elevator technology. The intent of the information presented here is to provide you with a general understanding of how your Gen2 elevator system is designed and how it operates.

At the core of the Gen2 elevator is a revolutionary new technology—flexible steel cords inside a tough polyurethane coating.

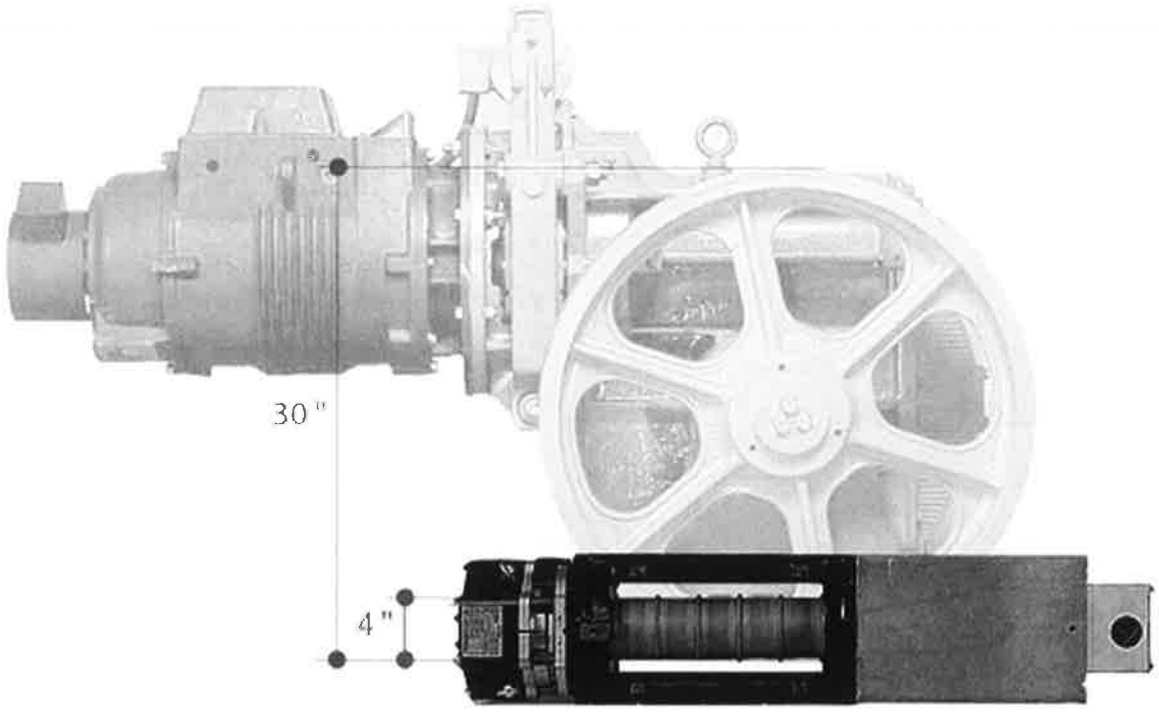


Coated Steel Belts

The coated steel belt technology rearranges the steel found in traditional ropes to form a flat belt. Each belt holds the same lifting capacity of the equivalent rope. Each cord of the belt has many strands of wires. Each coated steel belt has multiple steel cords within it. These wires are made of high tensile strength steel and are zinc plated to prevent corrosion. The wires are then coated with polyurethane that prevents the wires from rubbing against each other (referred to as fretting), thus allowing them to last up to two to three times longer than conventional round ropes. Each Gen2 system uses multiple coated steel belts, based on the application.

The coated steel belts are the "enablers" of the Gen2 system. Their flexibility allows us to use a small gearless machine. Elevator codes dictate the size of the sheave based on the diameter of the rope required to lift the load of the elevator system—this is referred to as the d/D ratio (d = diameter of rope, D = diameter of sheave). This ratio by code needs to be 1 to 40, which would require a 40 in. sheave for every inch of rope width.

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On conventional round-roped elevators, a 0.5 in. round rope is typically used to lift a 3500 lb. elevator cab while with Gen2® elevators, we use a 0.1 in. coated steel belt. As an added benefit, the d/D ratio for Gen2 is 60 to 1, thereby improving the overall durability of the belts. The sheave diameter changes from 20–30 inches (on some conventional traction machines) to a mere 4–6 inch diameter with the Gen2 system.

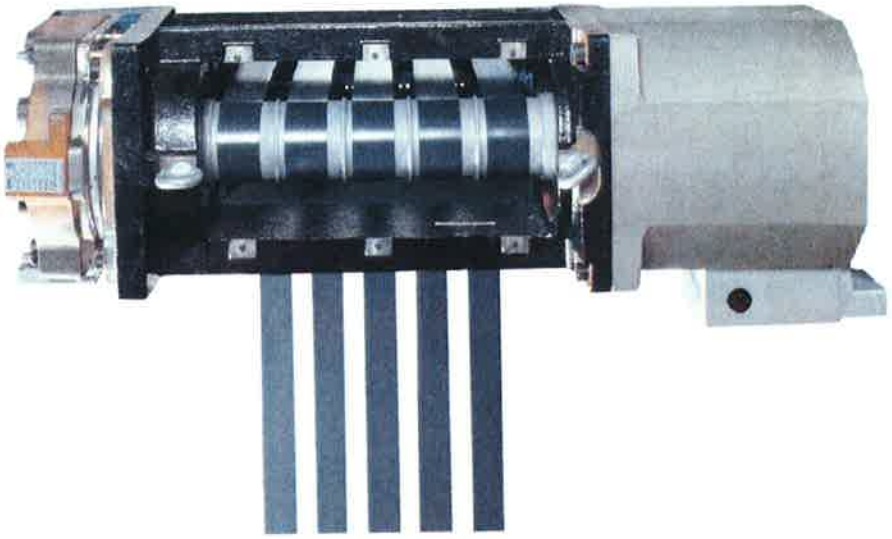
Permanent Magnet Gearless Hoist Machine

The hoist machine performs the muscle work of lifting and lowering the elevator car. The choice of hoist machine is classified according to the height of a building, the elevator car's load requirements, and the speed at which the load must move (passenger or material). The hoist machines used for the Gen2 elevator systems are referred to as gearless machines.

The Gen2 gearless machine's principal components consist of a high efficiency Permanent Magnet (PM) AC-motor, brake assembly, support frame, and grooved drive sheave. The motor and brake assembly are attached to the support frame and have a common rotating shaft. The pulley or drive sheave for the Gen2 elevator machine is an integral part of this common shaft. The Gen2 gearless machines do not use a gear reduction system; the motor and drive sheave turn at the same speed. The elimination of the gear reduction system simplifies the design and improves reliability and efficiency.

The Gen2 features a regenerative drive that reduces net power consumption. Matched with the efficiency of the permanent magnet motor, the Gen2 system delivers superior performance and ride quality with environmental sensitivity.

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Gen2® PM Machine



Gen2 Machine (foreground) Compared to a Traditional Traction Machine (background)

Typical Sequence of Operation

In order to gain further understanding of how a Gen2® elevator system works, let's take you through a typical sequence of operation. A passenger registering an elevator call sets into motion a series of actions. The signal is first picked up by the controller, which acknowledges the request by illuminating an indicator on or near

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the call button. Also placed into memory is the location of the call for pickup or delivery. All hall calls are sent to all elevators, if part of a group. (Multiple elevators within a building are referred to as a "group" of elevators.) Each elevator in the group calculates its response time to the call and the elevator with the shortest response time is dispatched to pick up the passenger.

The elevator checks itself against a preflight checklist before permission to run is given. Of particular importance is determining the integrity of the elevator's safety related devices prior to starting the run. In addition, the elevator contains a safety chain to prohibit elevator motion in response to an unsafe condition. The safety chain consists of electronic and electromechanical switches placed at strategic locations in the elevator system. Connected in series, they act as a safety circuit ensuring various elevator apparatus is in the correct operating state for the elevator to make a run. Any one device not in its expected state breaks the chain and the elevator does not operate. An emergency stop is initiated whenever a safety chain device "opens" while the elevator is in motion.

When the controller (the brain of the elevator) receives a request for service, it reviews a sequence of questions and issues instructions according to the responses.

Controller Sequence of Questions

Where do I need to send the elevator?

What is the weight in the car?

Is it safe to move the elevator?

While I'm moving, how do I know where I am in the hoistway?

How do I stop once I've reached the destination?

What do I do after I've stopped?

The Controller now has instructions to move the elevator car in response to the passenger call and has completed its safety check confirming that the elevator is safe to move. It then sends instructions to the elevator motor and car telling it the load in the elevator car and the speed at which to move the elevator car.

The technology driving your system is known as variable-voltage, variable-frequency (VF) control. Traditionally, most elevators were driven by direct-current (DC) hoist machines. This was necessary to achieve the precise control of speed applied to the hoist machine to assure smooth acceleration, cruise, and stopping speeds of the elevator. Doing so required converting the building's alternating current (AC) to DC and, in most cases, required a constantly operating motor-generator and a more complex DC operated hoist machine. Both pieces of equipment require more components, which may be subject to increased maintenance and repair.

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Your AC-VF drive is able to use your building's AC power to precisely control the speed and torque of the permanent magnet gearless machine. The AC motor offers robust performance and is economical.

The hoist machine lifts or lowers the elevator car. Through the use of a counterweight, we can reduce the amount of work required to move the elevator. The counterweight is sized to equal the weight of the elevator cab assembly plus approximately 50% of the rated capacity. In this way, the hoisting machine never has to lift more than half the rated load.

The Controller continually compares the stored floor location of the target landing against the position of the elevator. When the car is within its "stopping distance" from the target landing, it begins to decelerate. Position is continuously monitored in order to stop the car level with the target floor. A vane is installed at each landing to provide a redundant means for checking position at floor level. A reader, located on the car, uses the vane to verify the car is level with the floor.

Once the elevator hoist machine stops the brake drops. The main purpose of the brake is to hold the car in place, not to stop the elevator car. Even in the event of a power failure, the brake will drop and hold the elevator.

When the elevator has reached the target floor, the doors automatically open to allow the passenger to leave the elevator. Just as the doors automatically open at the conclusion of a run, they also automatically close when demand for the elevator is present.

Gen2® Safety Features

The Elevator Safety and Governor System

Beneath the elevator car is the elevator safety mechanism. It is tied to a device called a governor. It is an independent system from the coated steel belts and is designed to operate if the elevator car exceeds its rated speed.

The governor performs two actions when the car exceeds 125% of its rated speed. First it attempts to stop the car electrically by activating a switch opening the safety chain circuit. The open circuit interrupts power to the hoist machine and stops the elevator movement. If the elevator car does not stop, the governor's second action is to mechanically stop the elevator by clamping the steel cable, which is fastened to the safety-releasing mechanism on the elevator car. This causes the car safeties to activate and grab the rails on which the car rides. The frictional forces generated between the rails and car safeties bring the elevator car to a controlled stop.

Door Operators and Control Devices

Safe and rapid response to elevator calls is an important measurement of elevator performance. How quickly passengers can enter and exit the car contributes to the

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overall performance of the elevator system. The speed at which the doors can safely open and close is a contributing factor to achieving this goal.

At each landing there is a set of hoistway doors. The hoistway doors and car doors open in unison because of the door vanes and interlock system. Each entrance landing is furnished with an interlock and switch. The door vane is fastened to the elevator car door. When the elevator stops at a landing and its door starts to open, the vane engages the roller of the hoistway door interlock. This causes the lock to separate from the switch and open the entrance door along with the car door. If the car doors do not completely close within a predetermined time, they will reopen and then begin to close at a reduced speed. The car will extinguish its hall and car direction lanterns, sound the in-car buzzer, and, if part of a group, remove itself from group operation. If the car cannot close its doors after three attempts, it will shut down and park with the doors open. Every two minutes the car will retry closing its doors.

The latest door operators designed by Otis use closed-loop control technology. Environmental conditions, such as debris caught in the door closing path or excessive wind in the hoistway, can prevent a door operator from performing 100 percent efficiently. Closed-loop control compares the door's actual opening/closing speed to the speed stored in computer memory and then adjusts the door speed accordingly.

Car Door Protection Device

The car door protection system features an invisible "safety net" of infrared beams that help ensure the physical well being of passengers.

Using infrared emitters and detectors to create an invisible safety net across the entrance, the system continually scans for interrupted beams. If a beam is interrupted, the car door protection system reopens the door instantly. When an obstruction is present, the doors remain open until the obstruction is removed. If the obstruction enters the doorway as the doors are closing, the doors stop closing and reverse direction.

Remote Elevator Monitoring (REM®)

Information from the elevator's controller is transmitted to a product called Remote Elevator Monitoring (REM®), which is available only with Otis service. REM reacts to three types of information:

Alarms. Defined as a problem that indicates the elevator may be shut down.

Alerts. Defined as a problem that indicates elevator performance degradation, but the elevator continues operating.

Performance Data. Defined as routine elevator information, such as the number of elevator runs and number of door operations.

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This microprocessor-based product adds a new dimension to the service and repair of elevator systems. The REM hardware transmits information concerning the status of the elevator to a technical center. If a repair is needed, the technical center places a call to the appropriate Otis representative.

Otis' automated record keeping system provides a personal history of your elevator, which is used for planning maintenance and determining elevator efficiency. This information increases overall elevator performance, decreases downtime, and reduces tenant complaints.

Ideally, service is made on an elevator before any significant problems arise. This is the best possible method to keep your investment running. The history of your elevator's performance is maintained on line and can be viewed by you through our e*Service tool on otis.com. As Otis continues to move forward with technological advancements, we can utilize this historical information to help us with implementing new procedures and improved capabilities. Our goal is to continually reduce the amount of service required.

Emergency Lighting

Your elevator has a supplemental emergency power supply. If main power is lost, power is switched automatically to the emergency supply and lights two lamps inside the elevator. The lamps remain lit for at least four hours.

The alarm button and emergency stop switch located in the car operating panel are wired into the emergency power circuitry. When operated, an alarm bell located on the car top sounds continuously.

Emergency Communication Devices

The choice depends on the equipment and services specified for your particular elevator, including:

- Hands-free telephone (code-compliant).
- Intercom system (provided by other than Otis)

Fixtures

Fixtures are the components passengers use to interact with the elevator. The passenger activates a call for the elevator car at the landing entrance or at the elevator car operating panels. The fixtures perform additional actions that provide feedback to the passenger. For example, a hall lantern illuminates to indicate the car's next direction of travel as the elevator car stops at a floor.

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The information that follows describes the types of fixtures used in elevator systems. Some of these fixtures are located at the entrance landings (hall fixtures) others are within the elevator car (car fixtures).

Field Interface Panel

A Field Interface Panel is provided on the door jamb for the Gen2-150. The Field Interface Panel features lockable disconnects for main line power and car lighting circuits for use by Elevator Personnel.

Hall Panel Fixture Assembly

Hall Panels are located at the entrance landings. They contain buttons, keyswitches, and jewels. Activation, through pressing a button or turning a key, registers a call for the elevator to service the landing.

Car Operating Panel

The Car Operating Panel is located in the elevator car. It contains buttons for entering destination requests, door opening and closing, and alarms (activate the alarm bell and/or initiate a phone call). The buttons may illuminate, come in vandal-resistant versions, and have adjacent Braille markings available. The car operating panel also contains keyswitches, jewels, position indicator, and audible signal devices (buzzer, landing passing tone, speech synthesis, etc.).

Lantern Fixture Assembly

Lanterns are located at entrance landings or in the elevator car. They provide passengers with a visual representation of the elevator's next direction of travel. Arrival of the elevator car at a landing sounds a lantern chime: once for up direction and twice for down direction.

Position Indicator

Position Indicators are located at entrance landings and in the car operating panel. They provide passengers with a visual identification of the car's floor position within the hoistway.

Access Fixture Assembly

Access Fixtures are usually mounted in the entrance jamb and are used by service technicians. They contain keyswitch/es for special operation of zoned access, which allows the elevator to be moved (within defined distance and speed limits) with the landing and car doors open.

Buttons

Buttons come either illuminated or non-illuminated, with a raised or flush target, and in either standard or vandal-resistant versions. Pressure applied to a button

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registers an elevator call or other operation, such as opening or closing the doors or sounding an alarm.

Keyswitches

Keyswitches operate electrical contacts by turning a key to set positions. They may offer one, two, or three key positions and are of spring and non-spring return types. Activating initiates special actions that are described in the pages that follow.

Jewels

Jewels are located in both hall and car fixture assemblies. These fixtures are illuminated lenses with printed or graphic information. They inform passengers of various elevator activities, operating most often in conjunction with keyswitch activation.

Emergency Stop

An Emergency Stop is a toggle or keyswitch wired within the elevator's safety chain. Activation causes a break in the chain, bringing the elevator to a stop. The emergency stop function is mandatory for all elevators in the U.S.

Braille Character Insert

Braille Character Inserts are raised letter/graphic markings and Braille characters for buttons to be used by the visually impaired.

Utility Outlet

A Utility Outlet is a receptacle offering access to 110 VAC power supply.

Audible Signal Device

An Audible Signal Device is a device that provides an audible tone each time the elevator car passes a landing.

Buzzer

A Buzzer is a device that provides a continuous alert when firemen's service operation is activated or when the doors are nudging closed.

Telephone/Service Cabinet

A telephone cabinet is an optional cabinet mounted below the car operating panel and contains a communication device (telephone or intercom provided by others). A service cabinet can contain special keyswitches as ordered.

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Hands-Free Phone

A Hands-Free Phone is a device that helps trapped or disabled passengers call for help. No handset is required, allowing for hands-free operation.

Fixtures can perform special features for security, emergencies, or management operations to a single elevator or group of elevators. These are generally keyswitches operated by designated persons or emergency personnel, such as firemen. Some of these fixtures are standard equipment, while others are optional or variable and dependent on other features your system may employ.

Control Features

The elevator is capable of enhanced functionality well beyond the basic elevator operation of moving your passengers between the building's landings. For example, you may want to override passenger calls and place the elevator under your direct control or have the elevator bypass particular floors. There are numerous control feature options that your elevator is capable of performing. In most cases the action occurs automatically by software instructions or by direct user control, such as activating a key operated switch, or by a combination of the two. The feature may perform an individual action, a combination of actions, and may apply to a single elevator or a group of elevators. The following is a complete feature listing, divided into feature groups, and how they are initiated. The features included with your Gen2 system are listed on documents prepared by your Otis representative at the time of the sale.

Group: Car Operation Features

Full Collective Operation

Full Collective Operation answers calls in the order in which floors are reached, regardless of the sequence in which the calls were registered. Only car calls and up hall calls will be answered when the car is traveling up, and only car calls and down hall calls will be answered when the car is traveling down. When the car reaches the last registered call for the established direction, it reverses and proceeds to answer calls in the opposite direction (if they are present). In the absence of further calls, the car remains at the floor where the last call was answered with doors closed (or park at an alternate landing).

Simplex Operation

Simplex Operation is a single car operating in full collective operation, answering calls in the order in which floors are reached, regardless of the sequence in which the calls were registered. See "Full Collective Operation" for further information.

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Anti-Nuisance

If an excessive number of car calls are registered, the elevator will determine whether calls should be canceled. This is a function of passenger load and predetermined weight settings.

Automatic Car Return Operation

Automatic Car Return Operation causes the car to park at a specified landing when there is no further demand. The car parks at the specified Automatic Car Return Landing whenever the car becomes idle. The operation is keyswitch activated, and overrides normal zoned parking. The car can be pre-programmed to park at the automatic car return position with its doors open.

Auxiliary Car Operating Panel

An Auxiliary Car Operating Panel is a second car operating panel, usually located on the opposite side of the main car operating panel on elevators with center opening doors. If an elevator has two openings, the rear opening is designated as the auxiliary car operating panel.

Call Parking Recognition

With Call Parking Recognition, doors only open in response to car and hall demand. Cars parked without a demand are parked without door operation.

Car Buttons—Illuminated

Car Fixtures employ mechanical LED illuminated buttons.

Direction Preference

Direction Preference is given to the hall passenger that registers a car call for the original direction of travel before the doors close. The elevator will not reverse direction for a passenger waiting at another floor.

Direction Reversal

A car without registered car calls arriving at a floor where both up and down hall calls are registered will first respond to the hall call in the direction that the car was traveling. If no car call is registered for further travel in that direction, the car will close its doors and immediately reopen them in response to the hall call in the opposite direction. The hall lantern always shows the direction the car will travel when it leaves a floor.

Emergency Exit Contacts

This feature consists of safety chain contacts for top emergency exits. The feature prevents the car from moving when the car top exit is open.

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Fan and Light Sleep Mode

The cab's fan and light automatically turn off if the car is idle for a set period of time to save energy.

Hall Buttons—Illuminated

Hall Fixtures employ mechanical LED illuminated buttons.

Hall Button Protection

If the hall button communication network link fails, all of the cars in the group enter Hall Button Protection operation. Each car answers all pending car calls. When each car has no further demand, each car travels to the lobby and parks with the doors open. As an option, Hall Button Protection can also be configured to automatically activate Wild Car Operation. For more information, please refer to the section on Wild Car Operation.

Landing Passing Tone

A Landing Passing Tone is an audible signal, located in the car operating panel, that sounds when the car passes or stops at a landing.

Load Weighing Bypass

When a car is loaded above a predetermined percent of capacity, further hall calls will be bypassed. (This operation eliminates stopping for additional passengers who would be unable to enter an already filled elevator.) Load Weighing Bypass will not affect the stopping of the car in response to car buttons.

Platform Load Weighing

Platform Load Weighing measures car load so that proper starting torque is applied to the motor.

Group: Door Operation Features

Adjustable Door Time

The time interval that elevator doors remain open after a stop is independently adjustable for car call stops and hall call stops. Normally, more time is allowed for a passenger to enter the car from the corridor than for a passenger to leave the car because the waiting passenger in the corridor is usually further from the entrance of the arriving car than the riding passenger. Additionally, the lobby door time is normally longer than the time at other landings to allow extra passenger traffic at the lobby. Door timing is adjusted to suit the needs of the building, including handicapped code requirements. The door open time after obstruction detection and hall calls answered by a parked car are also adjustable.

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Advanced Door Opening

To enhance performance time, the doors begin opening while the car is approaching to the landing.

Cafeteria Position

At a landing with a cafeteria, longer than normal door times may be selected to handle additional traffic.

Cancel Door Dwell Time

When the door close button or car call button is pressed (either/or; not both), any remaining door dwell time is canceled and the doors begin to close immediately. Note that some regions have handicapped codes that do not allow the cancellation of door dwell times.

Parking with Doors Open

Front and rear, the elevator car doors can be programmed to remain open or to remain closed when the car is parked at each landing.

Door Time Monitoring

When the car door protective device is activated after the car has stopped to answer a hall call, the door open time is reduced from the normal setting for a hall call stop. Other aspects of door operation continue normally. This feature can be enabled at all landings, or at all landings except the lobby and cafeteria positions.

Nudging Operation

If the doors are prevented from closing for a fixed time period and there is further demand on the system, the door protective device is rendered inoperable, the in-car buzzer sounds, and the doors close at a reduced speed. Normal operation resumes at the next landing.

Group: Operation Features

The group operates in one of two independent modes. Whenever hall calls are registered, the operating mode is "relative system response dispatching." When no hall calls are registered, the operating mode is "zoned car parking." Optimized response to hall calls is achieved through use of RSR Plus® time computed for each hall call registered. The computation of each car's relative system response time to a call is based on, but not limited to, such relevant factors as distance, service to previously assigned car and hall calls, direction, door and car motion status, and coincidence of car and hall calls. To even waiting times and eliminate particularly long waits while maintaining optimal system performance, the weighting of the factors varies with system traffic. The car with the least relative system response is

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assigned the call. Relative system response computations for each hall call are repeated several times a second and the hall call assignment changed if a more suitable car is found. The RSR Plus dispatching software continuously evaluates the efficiency of its dispatching and varies the weighting of the bonuses and penalties to optimize the dispatching efficiency.

Zoned Car Parking

The section of a building served by a group of elevators is divided into a number of fixed zones equal to the number of cars in the group. The assignment of landings to zones is selectable. Each zone comprises a section of the hoistway consisting of one or more consecutive floors. Each zone normally is assigned to one car. This feature is used to park cars with doors closed in the absence of call demand.

Expanded Lobby Zone

Several landings above lobby are made part of the lobby zone. One lobby zone car always parks at the lobby.

Excluded Zone Operation

This feature prevents cars from parking in certain zones, and thus freeing these cars for service elsewhere. The excluded floors (a zone) will not appear as demand to an unassigned car unless a hall call exists in that zone.

Separate Basement Zone

This feature is used where substantial traffic is expected from the basement area (such as would occur in a large basement garage) and there are sufficient elevators in the group to create a single floor lobby zone and a separate basement zone.

Park and Shutdown Operation

Park and Shutdown Operation, activated by either a keyswitch or EMS, parks the car at the lobby. When activated, the car is removed from group operations. If the car has pending car calls, it answers any remaining car calls. Once the car has no further demand, the car travels to the lobby and parks with the doors closed (parking with doors open is available). The car remains out of service until the keyswitch is placed in the OFF position. If a lobby panel is provided, a jewel illuminates when operation is complete.

Delayed Car Protection

Any car not responding to a demand for service within a predetermined time interval is removed from group operation. This allows other cars in the group to pick up calls previously assigned to the delayed car.

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Transfer Floor Service

The transfer floor is the common landing at the top floor of the low-rise group of elevators and the first landing above the lobby of the high-rise group of elevators.

Uneven Stops / Travel

Odd travel occurs when one or more cars in a group serve additional or different landings in a building. Mid-building travel occurs when certain cars within the group do not serve landings located in the middle of the building (also referred to as an express zone). When a car is traveling through such a zone, the position indicator displays "EZ".

Double Riser of Hall Button Operation

Double-Riser Operation allows two hall buttons at a landing to work in parallel and to illuminate simultaneously. When either of the hall buttons at the landing is pressed, the call is registered.

Separate Hall Button Riser

This operation uses two sets of hall buttons, one for normal group operation and the other for providing expeditious service to certain landings during specified periods of the day. Separate riser operation is initiated by a keyswitch. When activated, those cars connected to the separate riser answer hall calls registered on it and ignore the hall calls on the primary riser. Cars operating on the separate riser are not subject to group dispatching features such as Moderate Incoming Traffic.

Split Group Operation

In a building with two major tenants, it is often desirable to divide a group of elevators into two subgroups during certain periods of the day. Each subgroup serves one of the tenants.

Group: Group Dispatching Features

Relative System Response Dispatching

Relative System Response (RSR) is a numeric index that indicates the desirability of having a given car respond to a given hall call based on the car's parameters (position, direction, load, etc.) and the car's previously assigned demands for service (car and hall calls). The calculation of RSR involves the summation of applicable time increments associated with various operating states of the elevator. The car with the best (lowest) RSR is assigned to respond to a hall call.

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Car to Landing Operation

An optional three-position car-to-landing keyswitch is available in a lobby panel or hall station fixture. The designations on the switch are: "Doors" (the neutral position), "Open" (calls the car to the lobby), and "Close" (which locks the car out of service when the car is placed on independent service).

Cars Parked at Lobby

In a multi-car group, the number of cars parked at the lobby is selectable. The normal condition is one car, but some configurations may require additional cars to handle constant heavy traffic at the lobby.

Moderate Incoming Traffic

When traffic at the lobby floor increases, as indicated by two cars leaving the lobby in the "UP" direction, or as activated by the up peak clock, cars assigned to upper zones are called to the lobby without waiting for a call from the lobby landing. Cars are automatically dispatched from the lobby when they become loaded to or near capacity. They also are dispatched if not loaded to capacity within a predetermined time after the previous car is dispatched. The cars continue to operate in this manner until the lobby traffic is reduced to a predetermined level.

Up Peak Clock Operation

This feature initiates Moderate Incoming Traffic operation after a designated Up Peak Clock period begins and one car leaves the lobby landing loaded to a predetermined percent of capacity (see Load Weighing Dispatch). Up Peak Clock maintains a group of elevators in this mode for the remainder of the designated Up Peak Clock period.

Load Weighing Dispatch

This feature is a variable in Moderate Incoming Traffic. The elevator is dispatched up from the lobby as soon as the weight-sensing device determines that the car is loaded to a predetermined percent of capacity. The load setting for dispatch is adjusted independently of load weighing operations other than Moderate Incoming Traffic.

Basement Service

This feature activates during Moderate Incoming Traffic operation and prevents a car from parking at a basement landing. During Moderate Incoming Traffic operation all cars park at a designated entrance floor and are selected for up-dispatch. The doors open and an "UP" lantern illuminates. Basement hall calls are served by the first down traveling car that answers the basement hall call, provided the "No Lobby Car Bypass" feature is not in effect. Basement service should not be specified if substantial traffic is expected at the basement. Instead use Separate Basement

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Zone operation. During periods of the day when the system is not operating in the Moderate Incoming Traffic mode, the basement (which is assumed to be part of the lobby zone) is served as any other floor in the zone.

No-Lobby-Car Bypass

This feature is a variable of Moderate Incoming Traffic operation and speeds the return of cars to the lobby during Up Peak Operation. In the absence of a lobby car, cars travel only to the highest car call and then reverse direction to the lobby. Cars bypass hall calls, stopping only in response to car calls. This operation remains in effect until a car arrives at the lobby.

Rotational Selection

This feature is a variable of Moderate Incoming Traffic operation. It provides for the selection of elevators for dispatch at the lobby in a prearranged sequence if more than one car is at the lobby at once.

Variable Interval Dispatching

This feature is part of Moderate Incoming Traffic operation. The assigned car with higher demand is dispatched at the expiration of a time interval. A car at the lobby and loaded to a preset percentage of its weight capacity is dispatched immediately.

Moderate Outgoing Traffic

Moderate Outgoing Traffic provides additional service during periods of heavy down hall call demand above the lobby. When activated, cars assigned to lobby or basement zones are dispatched to handle hall call demand above the lobby. Moderate Outgoing Traffic commences following the arrival at the lobby of two cars loaded to their preset weight capacity within a selectable time interval. Moderate Outgoing Traffic remains in effect for the same interval after the arrival of the last car loaded to a percentage of its preset capacity weight.

Down-Peak Clock

This feature initiates the Moderate Outgoing Traffic operation after a designated Down-Peak Clock period begins and one car arrives at the lobby loaded to a percentage of its preset capacity weight. Down-Peak Clock maintains a group of elevators in this mode for the remainder of the designated Down Peak Clock period.

Up Hall Call Bypass

During Down-Peak Clock Operation, any car traveling down with a "nonstop" load causes designated cars to bypass up hall calls. The number of cars operating in this bypass mode is adjustable as a function of building traffic. The operation remains in effect for the duration of Down-Peak-Clock Operation.

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Group: Firefighters' Service



Local code requirements must be determined to ensure that Firefighters' Service Operations are correctly configured.

Firefighters' Service Phase I

When a building's smoke sensor or a keyswitch located at the designated return landing is activated, the car performs an emergency return to that designated landing. The return operation is in compliance with applicable codes. A buzzer alerts passengers that the car is returning and a message indicator in the car operating panel shows "Please Exit When Doors Open."

Remote Firefighters' Service Phase I Keyswitch

Adding a second Phase I keyswitch to a remote location can complement the primary Phase I keyswitch.

Alternate Return Landing for Phase I

The car, while responding to a Firefighters' Phase I operation, returns to the "alternate" landing if the smoke detector at the designated return landing is activated.

Heat and Smoke Sensing Device

The elevator controller is designed to receive signals from the devices (furnished by others) that sense heat and smoke or products of combustion. These devices provide normally closed contacts that open when heat and smoke is sensed.

Firefighters' Service Phase II

This feature is activated by the firefighters using a keyswitch mounted in the cab, and places the elevator under their control. The operation is in compliance with applicable codes. In the U.S. this feature includes the call cancel button in the cab. When the car cancel button is pressed, all registered calls are cancelled and a traveling car stops at the next landing. The car responds to car calls, but will only open its doors due to constant pressure on the door open button. The doors will remain open until the door close button is activated. When the Phase II keyswitch is in the hold position, the car parks with its door open, the door closed button is disabled, and car calls cannot be registered.

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Group: Security Features

Anti-Crime Protection

Anti-Crime Protection, when activated, forces each car in the group to stop at a predetermined floor and open its doors. This allows a security guard or others at the floor to visually inspect the passengers of the elevator before the car completes its run.

Car Secure Access

This feature allows each car call button to be secured or cleared. If a car call button is secured, it will not register a call unless a landing access code is correctly entered on the car operating buttons within a predetermined time period after the secured car button is pressed. Selection and changing of the landing access codes is done on each car operating panel using the Car Secure Access keyswitch. Activation of Car Secure Access is done using the Group Secure Access keyswitch located in the hall or lobby. Activation illuminates the "Group Secured" lamp located in the hallway. A car call to a secured landing illuminates the "Restricted Landing" lamp in the car's cab car operating panel. It remains illuminated for a set time period, or until a valid landing access code is entered.



Landings that are secured by Car Secure Access are available when the car is operating under Independent Service Override (optional) or Firefighter's Service Phase II.

Car Secure Access is activated by a 3-position keyswitch located in the car operating panel. The three positions are CLEAR, SECURE, and an unlabeled position. The "Restricted Landing" lamp accompanies this switch.

Card Reader in Car

When car card reader security is activated, car calls to restricted landings do not register. When a passenger inserts a valid card into the card reader, they are allowed to register a car call to selected restricted landings. Car Secure Access, Express Priority Service, and Firefighters' Service Phases I and II, override the Card Reader in Car operation. Independent Service operation may selectively override Card Reader in Car operation.

Card Reader in Hall

When the Card Reader in Hall operation security is enabled, a valid card read by the reader is needed to register a hall call. Connections for Card Reader in Hall security are part of the elevator's hall link communication network. This allows a card reader mounted in the lobby, or the implementation of a card reader-type security, to use keyswitches.

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Card Reader Lockdown

When this feature is enabled, the car responds only to hall calls from a card reader. When Card Reader in Hall security is activated, the Card Reader Lockdown feature parks the car at a specified landing and takes it out of service, removing it from group operation. If the car is set to park with its doors closed, the car moves to the specified landing, opens its front doors for the maximum hall door time then closes its doors and takes the elevator out of service.

Group Floor Cutoff Service

Group Floor Cutoff Service allows selected landings or calls to be secured for an entire elevator group. A keyswitch activates the feature. Any landings secured are still accessible during Firefighters' Service Phase II operation.

Car Call Cut-Off (Selected Landings)

Car Call Cut-Off operates from a keyswitch. The operation disregards and does not register car calls to pre-selected landings.

Generic Group Security

This feature utilizes keyswitches or clock inputs to cut off car and hall calls on specified cars at specified landings through a software matrix setup.

Special Security

When Special Security operation is activated, all cars in the group return to the lobby after first answering all pending car and hall calls. Once at the lobby, each car is capable of answering a single hall call, after which it returns immediately to the lobby and opens the car doors. When a hall call is entered, the following steps are followed:

- A car is dispatched from the lobby to answer the call. Each car is only assigned a single hall call.
- Once answered, no further hall calls are allowed for that car until it returns to the lobby.
- Once at the hall landing, if no car calls are entered, the car automatically returns to its designated landing and opens its doors.



Car call security, if desired, is handled separately. To secure car calls, some variation of Card Reader in Car security is suggested.

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Hall Call Cut-Off—All Landings

Activating the keyswitch disables all hall calls. The car answers all registered car calls parking itself at its last landing with the doors open.

Hall Call Cut-Off—Selected Landings

Hall Call Cut-Off operates from a keyswitch. The operation disregards and does not register hall calls to pre-selected landings. All car calls are handled normally.

Riot Operation

This feature is invoked by a keyswitch that prevents cars from returning to the main lobby during periods of riot control.

Group: Enhanced Service and Operation Features

Attendant Operation

Attendant operation is activated from a keyswitch mounted in the car operating panel. Initiating the operation cancels all registered car calls and places the car in a semi-automatic control of the attendant to decide:

- Car Loading
- Door Closing
- Hall Call Bypass

Automatic door open operation is in effect for all hall and car calls. Manual door closing by the Door Close button is required. Doors automatically reopen if the Door Close button is released before the doors fully close. Door operation and starting of the car are the same as during independent service in that the start signal is not given until the door close button is operated. Constant pressure on the Non-Stop button will cause the car to bypass all hall calls. Nudging is disabled during Attendant Operation. Load weighing bypass and door protection devices are inhibited during Attendant Operation. This feature includes the "FURTHER DEMAND" message indicator and a Non-Stop button.

Independent Service

Activating the Independent Service keyswitch in the car operating panel removes the car from normal group operation. It responds only to calls registered on car buttons and disregards all hall calls. The doors are closed manually pressing the Door Close button. Car and hall lantern operation is suspended. The car independent service switch can be complemented with a hall independent switch, if specified. Independent Service includes a Call Cancel Button. When the button is activated, all registered calls are canceled and a traveling car will stop at the next landing.

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Emergency Hospital Service

Turning a hall mounted keyswitch operates the car according to Express Priority Service (Hospital) rules. Once at the hall landing, a second action is required to activate the Emergency Hospital Service keyswitch in the car. When both actions are complete, the car is under the direction of Emergency Hospital Service operation. The operation function removes the car from normal group operation, responds only to registered car buttons, and door closing is a manual operation that requires pressing the Door Close button. The car resumes normal operation only after the car's Emergency Hospital Service keyswitch is turned to its OFF position.

Express Priority Service (Hospital)

A keyswitch initiates Express Priority Service at each landing requiring this service. The car able to respond in the shortest time answers the call after first canceling all registered car calls. When the car reaches the landing, one of the following occurs:

- If no car call is entered within a preset time, the car will close its doors and resume normal operation.
- If a car call is entered and the Door Close button is pressed, the car will serve the call, then resume normal operation.

This operation can be modified so that the car remains in Express Priority Service until no further car calls are present. When no car call is entered within a preset time, the car closes its doors and resumes normal operation. If an Emergency Hospital Service keyswitch is activated, the car will switch to Emergency Hospital Service until the keyswitch is deactivated. At that time, the car resumes normal operation. This feature includes a Priority Service Light in the hall panels and a message indicator on the car operating panel.

Executive Priority Service

A keyswitch is furnished for each hall landing performing Executive Priority Service Operation. When activated, the car within a group, calculated with the fastest response time, answers the call after first completing all existing car calls. When the car reaches the landing initiating the operation, one of the following occurs:

- If no call is entered within a preset time, the car closes its doors and resumes normal operation.
- If a car call is entered the car will serve the registered call then resume normal operation.
- If an Independent Service keyswitch is activated, the car will remain in Independent Service until the keyswitch is deactivated. At that time, the car resumes normal operation.

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This feature includes a Priority Service Light in the hall panels and a message indicator on the car operating panel.

Priority Penthouse Access

A separate hall button is furnished for each hall landing performing Priority Penthouse Access operation. When this button is activated, the car, calculated with the fastest response time answers the call after completing existing car calls. Once at the landing, the car performs its normal door open and close operations and then moves automatically to the designated penthouse landing. At the penthouse landing, the car again performs its normal door open and close operations. It then exits Priority Penthouse Access operation and returns to normal operation.

Sabbath Operation

Some religious beliefs do not allow work to be performed on the Sabbath, which includes pressing elevator call buttons. Sabbath operation shall cycle designated elevators to every landing without requiring a hall or car call. When the car reaches a terminal landing, it reverses direction and continues making stops in the opposite direction. Either a timed device or keyswitch normally activates this operation.

Wild Car Operation

Wild Car Operation is an option used when communications carrying registrations for hall calls fails. In that event, all elevators that make up the group complete their car calls until there is no further demand and then each elevator in the group parks at its lobby and takes itself out of service. Activating the Wild Car keyswitch places the elevator group into a programmed operation. Each car in the group moves to assigned floors to pick up passengers and at least two cars in each group are assigned duplicate floors. Car calls are answered normally.

Earthquake Operation (Seismic)

Earthquake emergency operation, actuated by a seismic switch and/or counterweight displacement switch, is required on all traction elevators operating at a rated speed of 0.76 M/s (150 ft./min.) or more in Seismic Risk Zone 2 or greater. Earthquake emergency operation is not required for Risk Zone 2 if the car and counterweight guide rail systems conform to the requirements for Zone 3 or greater. Resetting the elevator system after an earthquake is performed via a button located in the machine room. This feature is used in conjunction with a Major Component Displacement Detector, which produces a signal if the counterweight breaks free of the counterweight rails. Upon receipt of the signal, a car in motion will make a controlled emergency stop, then move at slow speed in a direction away from the counterweight. When the car reaches the next door zone, the car will open its doors and remove itself from service. The car will remain out of service until manually inspected and reset. In the event of a power failure, earthquake operation will remain active, even after power is restored.

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Non-Otis Seismic Sensor Activation

This feature is used in conjunction with a seismic detector, which produces a signal if seismic activity occurs. Upon receipt of the signal, a car in motion will stop at its next committed floor, open its doors, and remove itself from service. The car will remain out of service until manually inspected and reset.

Building Sway Operation

This feature is used in conjunction with a building's motion detector. The elevator's speed is reduced to a secondary contract speed when a signal is received from the motion detector.

Emergency Medical Operation

Emergency Medical Operation operates from a hall mounted keyswitch. When activated, a buzzer in the car sounds and visual illumination alerts appear in car and hall landing fixtures. The operation cancels any existing car calls, reassigns all hall calls for the car, and returns the car non-stop to its designated emergency medical landing, where the doors open and the buzzer stops. Once at the landing, the car follows the rules for Emergency Medical Car Operation. If the emergency medical car switch is not activated within 60 seconds after the doors are fully open, the operation is cancelled.

Emergency Medical Car Operation

A landing designated as the emergency medical floor is specially programmed in the control software. A car positioned at this landing with its doors open performs either of two operations based on a 60-second interval:

- If the Emergency Medical Car keyswitch in the car is activated and a car call registered, the doors close and the car moves to the target landing, opens its doors, and holds them open until the next car call is registered. It repeats the operation with the next registered car call.
- Without further keyswitch action, the car disregards any signals for car calls and the door close buttons. After 60 seconds, the car automatically returns to normal operation.

To remove the car from Emergency Medical Car Operation, the car must return to the medical landing and the Emergency Medical Car keyswitch must be deactivated. When the car is on emergency Medical Car Operation, Fire Service Operation cannot be initiated.

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Group: Remote Communications, Monitoring, and Control

EMS Panorama® (Elevator Management System)

EMS Panorama is a monitoring and control system used by building management and security personnel to observe and modify elevator operation and performance. Parnorama can provide time-based control of security access. Depending on the building requirements, a machine room display terminal and keyboard, a lobby display terminal, a security station system, and a fire station display terminal and keyboard are also available. The security station supports interactive operations such as security assignment (car and floor access), electroluminescent display message, and the storage of events and alarms. The personal computer allows display of up to eight 8-car groups on the same monitor.

Intercom (Provision)

An optional provision is made in the main car operating panel (auxiliary car operating panel if the main car operating panel includes speech synthesis) for a speaker and/or microphone.

Remote Elevator Monitoring (REM®)

REM is a robust monitoring system that records data on many aspects of your elevator's equipment and operation.

Group: Maintenance Operation Features

Zoned Access at Bottom Landing

Zoned Access operation is activated by a keyswitch typically located in the entrance frame. Under this operation, the car is permitted to move at a reduced speed with the hoistway door at the bottom landing and car door open. The operation is used to permit trained maintenance personnel to access the elevator's pit. Movement of the car away from the bottom landing is limited or "zoned" to prevent excessive movement.

Zoned Access at Upper Landing

Zoned Access operation is activated by a keyswitch typically located in the entrance frame. Under this operation, the car is permitted to move at a reduced speed with the hoistway door at an upper landing (typically the top landing) with the car door open. The operation is used to permit trained maintenance personnel to access the elevator's car top. Movement of the car away from the upper landing is limited or "zoned" to prevent excessive movement.

Top-of-Car Inspection

Top-of-Car Inspection is provided on the roof of the elevator. This feature allows authorized, trained personnel to move the elevator at a controlled, reduced speed.

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Group: Standby Power Operations

Standby Power Operation (Automatic with Manual Override)

The number of cars that can operate simultaneously under standby power is designated by contract. Standby Power Operation returns the cars automatically to a designated landing. Preference is given to cars with passengers to reduce passenger waiting time. Any car that does not begin a return within 60 seconds is placed in a "Not Available" mode while the responding cars move. A second attempt is made to recover any car that failed to move. If again unsuccessful, they remain in the "Not Available" mode and only operate manually. Cars returned to their designated landing then go on automatic selection and run on normal operation. The priority of selection is as follows:

- Car(s) on Firefighters' Service Phase II.
- Car(s) designated by contract to be selected.
- First available car beyond the car(s) designated by contract.

If a car selected for normal operation under Standby Power Operation is delayed for 60 seconds, it is placed in a "Not Available" mode and another car is selected for normal operation based on the priorities listed above. Manual override of Standby Power Operation is operated by a strip of switches. A manually selected car may run either as a return operation to a designated landing or in normal operation under Standby Power Operation. If a manually selected car has not first returned to its designated landing, it will do so and then immediately go into normal operation. If a manually selected car is delayed, no other car can be selected in the group unless it is manually selected.

If car selection is changed by Manual Override while a car is running in return or normal operation under Standby Power Operation, the newly selected car is not permitted to run until the car that is running has stopped, opened its doors, and gone into the Standby Power Wait state.

Inter-Group Standby Power Operation

This operation monitors and controls the status of cars in multiple elevator groups in one or more machine rooms during Standby Power Operation. Initially, each group is enabled to return cars to their designated return landing. Once return operations are complete in all groups, a predetermined group or groups are enabled for automatic or manual selection for normal operation under Standby Power Operation protocols. To ensure the number of cars run by the standby power system is not exceeded by manual selections, a software interlocking system is used. If a manually selected car would exceed the total allowable number of running cars, it cannot move until another already moving car stops at its next committed landing, opened its doors, and is placed in the Standby Power Wait state.

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Split Feeder Operation

This operation is required when two standby power feeders supply one group of elevators. Each feeder supplies power to some (but not all) cars in the group, causing a split group. A car operates under normal or standby power depending on the condition of its feeder. The two subgroups share the same designated return landing. If only one of the two feeders goes on standby power, the car(s) associated with the feeder begin Standby Power Operations (see "Standby Power Operation Automatic and Manual"). The rest of the group remains on normal operation under normal power. If the second feeder also goes on standby power, all the cars perform standby operations as a single group. To do this, the cars already on Standby Power Operation reset and again perform the return operation to the designated landing. Automatic selection for normal operation under Standby Power Operation occurs after the full group performs the designated return floor operation. Manual Override at this time is also available. Cars returned to normal power first enter Emergency Power Transfer mode, which performs a timed transition between the power supplies recounting the number of cars remaining under Standby Power Operation.

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Chapter 4: Maintaining Your Gen2® Elevator

It is in your best interest as an owner to ensure your elevator system is well maintained. This will minimize the incidence, inconvenience, and cost of unexpected breakdown. This chapter should serve as a guide to understanding the maintenance recommended by the Otis Elevator Company. This chapter is not intended as a guide or instruction manual for performing elevator maintenance. Some of the routines listed may not be relevant to your particular installation, based on the specific features chosen.

Failure to use genuine Otis parts may invalidate any guarantee and may adversely affect the safety of your elevator. Refer to Otis Elevator Company for further information.



For safety reasons, only a trained elevator maintenance technician may perform the operations listed in this chapter. The elevator must be removed from normal service and warning signs displayed. Safety barriers must be used if doors are opened without the car present.

From Inside the Car

1. Inspect car interior for damage and repair sharp and protruding edges.
2. Observe starting and stopping for signs of deterioration or malfunctions.
3. Observe floor leveling to ensure it is within tolerance.
4. Check operation of car and landing doors and ensure all reversal devices function properly.
5. Check operation of all controls within the car, especially alarm devices.
6. Check operation of normal and emergency car lighting.

Controller



The cabinet contains high voltage equipment. Power must be off unless suitable live working methods are employed.

Settings of resistors and other adjustable components should not be altered without a full understanding of their function. If in doubt, contact Otis Elevator Company. Fault finding must not be performed without the correct diagram and a full knowledge of the equipment.

1. Check all electrical connections for tightness.

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2. Ensure ventilation fans and grills are clean and functioning.
3. Keep all parts clean.
4. Ensure cabinet doors are locked shut after inspection.

Landing Fixtures



Turn off power before working on any fixtures.

1. Check the operation of all fixtures.
2. Ensure correct operation of the fire service switch and any other special service switches.

Landing Entrances



Do not open doors without a barrier in place if the car is not present. Turn off power or place the car on inspection operation and activate the stop switch before any inspection.

1. Clean landing door tracks.
2. Check doors for free operation.
3. Check that the doors close due to gravity or spring force.
4. Check correct lock engagement and contact wipe.
5. Check for excessive play in bottom door guides (gibs).
6. Check the condition of the air cords or other coupling devices.
7. Check that all bolts are tight.
8. Check the condition of the panels for damage.
9. Check the correct setting of upthrust devices.
10. Check the condition of the tracks and the sills.

Guide Rails

1. Check the condition of all hardware, rail fastenings, and brackets.
2. Remove any debris or dust.

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Belts and Terminations

1. Inspect coated steel belts for signs of wear.
2. Check condition of all coated steel belt terminations.
3. Check and adjust lengths to maintain correct counterweight run-by.
4. Ensure that the tension on all belts is equal.

Car Entrance and Operator



Do not ride on the car top unless the cart is on inspection operation. Whenever the car is stopped, immediately activate the emergency stop switch. When working on the car doors, ensure the main power is off.

1. Clean the car door track of any debris.
2. Check the condition of all hardware.
3. Check the condition and adjustment of the door coupling mechanism.
4. Check the door gibs for excessive movement.
5. Check the upthrust rollers for recommended clearance.
6. Check electrical cables for signs of damage.
7. Check the security of all door tracks.
8. Check the clearances between door panels and returns.
9. Ensure correct operation of the door locking mechanism.
10. Check the door closing speed and force.
11. Check the operation of the door open button and all other reversal devices.

Hoistway Switches



Do not make adjustments without a full understanding of any item.

1. Clean the switches and check the arms and rollers for free movement.
2. Check the function of all terminal switches.

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3. Check the running clearance of the inductors and vanes.

Car Frame Equipment



Lock off power at the mains before inspection.

1. Clean off lint and dust.
2. Check the condition of all hardware.
3. Investigate any unusual noise, heat, or vibration.
4. Check the operation of the safety gear linkage.
5. Ensure adequate clearance is maintained between the safeties and the rails.
6. Check the safety gear for correct engagement.
7. Check the condition and adjustment of the cab steadier devices.
8. Check the traveling cables and compensation for correct hang and signs of damage.
9. Check the condition of cartop sheave.

Gearless Traction Machine & Brake



Lock off power at the main switch before inspection.

1. Investigate for any unusual noise, heat, vibration, or excessive movement of parts.
2. Check the condition of all bolts and attachments.
3. Check the condition of the machine sheave.
4. Inspect all sheaves for wear and damage.
5. Check the condition of all electrical connections.
6. Ensure all guards are in place.

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Counterweight



Ensure the car is on inspection operation with the stop switch activated or lock off power at the main switch.

1. Check the condition of the filler weights.
2. Check the roller guides for correct position and lubrication.
3. Check the condition of the sheave, frame, compensation chain, and guiding devices.



No lubricating of counterweight sheave bearings is required.

1. Check and observe the operation of any safety gear linkage.
2. Ensure the recommended clearance is maintained between safeties and rails.
3. Check the safeties for correct operation and engagement.

Pit Equipment



Do not enter the pit without the power switched off or the pit stop switch activated.

1. Check for free movement of the governor tension frame and check for recommended switch adjustment.
2. Check the condition of the buffer (hydraulic or spring type).
3. Check for the correct hang and loop of the compensating chain(s).

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Cleaning



For safety reasons, the elevator must be immobilized for cleaning operations. Do not operate any electrical appliance inside the elevator car using a trailing power cord to an external power source, unless automatic elevator operation has been overridden and the car is safely parked with doors open. Do not leave car unattended while power cords pass through the door opening. The car is a confined space. Do not use cleaning agents that require good ventilation.

The car top must be kept clean of oil, lint, and debris to minimize the risk of fire.

The pit floor and its equipment must be kept clean, dry, and free of debris to minimize the risk of fire.

Car Interior Surfaces

The interior of your elevator car, including the doors and frames, are designed to retain their finish and to last for many years. To ensure that they do, follow these instructions:

Clean the surfaces regularly in accordance with the following advice.

Protect all vulnerable surfaces from damage, especially when an elevator is used for moving furniture or equipment or similar non-passenger activities. Protective pads may be obtained from Otis to protect your elevator.

Otis Elevator Company recommends the following cleaning techniques:

Glass

Clean with a non-abrasive glass cleaner and a soft lint-free cloth.

Stainless Steel

Use a soft lint-free cloth with a reputable stainless steel cleaner. Follow the grain of brushed stainless steel. Do not use any other types of cleaning powders or creams or any grade of steel wool.

Bronze-Tinted Stainless Surfaces

Use a soft lint-free cloth dampened with soap and water and finish with a soft dry cloth. Do not use any cleaning agents designed for un-lacquered brass or abrasive materials.

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Laminated Surfaces

Use a soft lint-free cloth dampened with soap and water. Do not use any cleaning powders, creams, or sprays.

Painted Surfaces

Use a soft lint-free cloth dampened with soap and water. Do not use any cleaning powders or creams.

Landing Doors and Frames

Landing doors and frames should be cleaned in accordance with the preceding recommendations and protected against damage when necessary.

Car and Landing Door Sills

It is essential to regularly clean all debris from the car and landing door sill grooves. First immobilize the elevator (see note below) with the doors open at a convenient landing.

Then carefully brush out accumulated dirt and extract with a vacuum cleaner.



Use your independent service keyswitch or other supervisory system control lock (i.e., recall to the lobby) to immobilize the elevator. If you are unsure about carrying out the task safely, please call Otis first.

Inspection Requirements

Controllers

Wires. Examine all wiring for breaks, loose lugs, or loose connections.

Resistance Tubes. Inspect for loose connections. Examine tubes for breaks in the enamel. Replace broken resistance tubes with tubes of equal value.

Motors

Connections. Tighten all motor and field connections. Be sure to check all grounds and the bonding of all conduits, and the controller frame, etc.

Gen2® Brake Inspection Details

Check brake connections and wiring. Measure between the brake pad and magnet housing using a metric feeler gauge to ensure that brake clearance is within recommended tolerances. The Gen2 brake requires no lubrication or adjustment.

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Governors

Check and clean dust and debris from the governor parts. Ensure that all covers are replaced after inspection. Check the wiring and connections on all solenoids and overspeed switch. No lubrication or adjustments required. Do not lubricate governor rope.

Sheaves

Check all sheaves for wear and debris. Clean if needed. **Do not use any solvents, cleaners, or chemicals on sheave surfaces.** Dust with a dry cloth only if needed.

Sheave bearings are sealed and do not require periodic lubrication.

Car

Flooring. Inspect for worn or loose flooring.

Emergency Exits. Check operation of top exit and switch.

Lighting and Fans. Check for cleanliness, burnt out lamps, and for lubrication. Be sure that globes are fastened.

Fixture Jewels and Lenses. Replace if any are cracked or broken. Glass used in the car should be in accordance with codes.

Car Operating Devices

Pushbuttons. Buttons should not stick and should work properly. Replace worn buttons and switches.

Indicators

Position Indicators. Position Indicators should be tested for proper operation and checked for burnt out lamps.

Car Door

Fastenings. Examine fastenings and check the door opening range. Examine for broken springs and loose connections.

Hangers. Check for worn tracks and rollers, making certain that the door cannot come out of its guides or jam at any point.

Bottom Guides (Gibs). Examine for wear, looseness, or the possibility of the guides coming out of the threshold.

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Car

Fastenings. Check and tighten the fastenings if required.

Cab Steadier Plates. Check and tighten cab steadier plates if needed.

Roller Guides. Check the roller guides for wear, proper clearances, and adjustments.

Doors and Door Operators

Wear. Examine thoroughly the doors and door operator for wear, friction, or obstructions that may prevent proper operation.

Adjustment. Clean, align, and adjust the door operator for quiet operation and proper opening and closing speed. Test and observe operation.

Safety Operated Switch

Adjustment. Be sure that safety operated switch will function if the governor trips.

Releasing Carrier

Spring Tension. Ensure that the releasing carrier will operate properly if the governor trips. Check all setscrews, keys, levers, pins, nuts, and lock nuts.

Coated Steel Belts

Condition. Visually inspect Coated Steel Belts for wear, cuts, breaks, or damage. **Do not use any lubricants, cleaners, solvents, or chemicals to clean belts.** If cleaning is needed, use only a dry cloth.

Traveling Cables

Fastenings. Check the supportive device fastenings.

Condition. Examine the outside coverings for wear. Look for any abrasion from concrete or steel supports.

Hoistway Door and Operation

Adjustment. Examine each door carefully. Check for structural defects. Examine the doors to see if they can be opened without releasing the interlock. If the lock is worn or the door has sagged so that interlock does not engage properly, arrange for repairs at once. Clean, lubricate and inspect all pins, bushings, guides, etc. as needed. Be sure that bumpers are in place and in good condition.

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Hangers. Examine the hangers for proper operation, wear, upthrust adjustment, and condition of the guides (gibs) in the bottom of the doors. Checks tracks for wear and alignment, and tighten all fastenings if needed.

Interlocks. It is extremely important that all lock failures be repaired immediately. Check contacts and the point at which they close. Try to pull the door open with the car outside the range of the lock. Carefully check clearances and tightness of bolts and screws to avoid future shutdowns.

Conduit

Check the fastenings and ensure the conduit has not pulled out of the fittings and that the duct is securely fastened to the wall.

Counterweight

Roller Guides. Check for wear, proper clearances, and adjustment.

Filler Weight Rods and Nuts. Tighten the rods and nuts, if necessary, and check cotter pins.

Limit Switches and Cams

Rollers. Check the roller guides for wear and replace if they do not engage cams properly.

Wiring. Be sure that all wiring connections are tight.

Test Operation. See that all switches and cams are in correct alignment. Check the operation of final limits.

Rails

Check the brackets, rail fastenings, and fishplates for loose bolts. Tighten and clean when required.

Buffers and Springs

Operation. Run the car at slow speed onto the buffers. Fastenings—Check for loose nuts and bolts and tighten if needed.

Sheaves (Governor)

Bearings. Check for the bearing wear, especially those on the governor tension frames.

Fastenings. Check all fastenings and tighten as needed.

Switches. Check all contacts and switch operation.

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Clearances

Pit of Counterweight. Check the pit and striking blocks to be sure the counterweight will land before the car strikes the overhead.

Governor Tension Frames. Check to determine whether or not the rope should be shortened.

Hall Buttons. Check for broken or sticking buttons, and ensure that all screws are in place and the plates are properly fastened. If lights are used, inspect for proper operation.

Emergency Door Opening Keys. Check the operation of keys on doors arranged for their use. Use by people unfamiliar with elevators may result in an accident if the door is opened when the car is not at that floor. Emergency keys should be stored securely in compliance with all elevator codes.

Safety Devices

Check clearance between the safeties and rails. Check all machine screws in the links and rods, and be sure that all pins, nuts, and keys are in place and tight.

Governor Test of Safety. If a recent safety test is not a matter of record, and then a standard safety test at slow speed should be performed. Be sure to check local code requirements. All equipment should be thoroughly inspected before and after conducting the test.

Traveling Cables

Check traveling cables for signs of wear and ensure the attachment points at the car and hoistway are secure.

Environmental Requirements

The Gen2 uses sealed bearings and does not generate waste lubricant.

Escape/Evacuation Procedures

Occasionally passengers may become trapped in an elevator that has stalled due to power failures or other conditions. This section briefly outlines the process for emergency evacuation of passengers from a stalled elevator.

Manual Rescue Operation

Qualified personnel can use the Gen2 Manual Rescue Operation function to move the elevator when main power is lost, by remotely lifting the machine brake from the controller.

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Manual Rescue Operation is to be used only after all other means to evacuate trapped passengers have been considered.

Basic Escape/Evacuation Rules

These rules apply in all cases and must be followed with any type of evacuation.



Never attempt an evacuation on your own. *Immediately call an experienced elevator mechanic to the site to perform an evacuation. Passengers need to be removed as quickly as possible but never with the risk of injury to the passengers, building personnel, or mechanics.*

A trained elevator mechanic must perform these basic rules, which include:

- **Lock out and tag the main line before removing passengers from any exit (except under normal operation). This rule applies even if there has been a power failure.**
- Do not open the doors unless someone is at the landing to assist the passengers when they are exiting the elevator.
- Communicate with passengers. Identify yourself and reassure passengers that they are safe and that steps are being taken to evacuate them from the car. Ask questions:
    - How many passengers are in the car?
    - Are any passengers ill, injured, or do any require special assistance?
    - Are the lights on in the elevator car?
    - Are the car doors open or closed?
    - What were the conditions leading up to the entrapment?
    - How long have passengers been trapped?
- Keep passengers informed of the steps being taken throughout the evacuation process:
    - Instruct the passengers to stay away from front door.
    - Instruct the passengers not to touch any buttons unless asked to do so.

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- Return the car to normal operation (if possible).
- Ask passengers to:
  - Check that the car Emergency Stop Switch is in the "RUN" position.
  - Try pushing the door open button.
  - Check car doors to make sure they are fully closed.
- A trained mechanic should perform a quick diagnostic check from the machine room to:
  - Check for power.
  - Check for blown fuses.
  - Check for tripped overload.
  - Check for contact(s) not making.
  - Check that the safety circuit ("safety chain") is closed.
- Restore normal operation (if possible) and ensure that passengers exit safely.



Do not open the doors unless someone is at the landing to assist the passengers when they are exiting the elevator. If the car is more than 30 cm (1 ft.) from floor level, a ladder should be used. In many cases, an additional rescue person is needed—one person in the car and the other at the landing—to assist the passengers. Have the ladder available before opening door; passengers will not wait for the ladder once doors are opened.

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Chapter 5: Otis Maintenance and Service

Elevator maintenance is more than just returning an elevator to service after an elevator shutdown occurs. Since elevator systems are a significant investment, proper maintenance on this equipment is critical to extend the life of the equipment and reduce the possibility of unscheduled disruptions or shutdowns.

Otis utilizes the vast knowledge it has accumulated over the years as the world's leader in the elevator and escalator industry to provide superior maintenance to extend elevator life. That means not only developing better, longer-lasting products, but also the technology to scrutinize their maintenance performance along with the technology to place valuable information into the hands of well-trained mechanics.

Otis Elite™ Service simplifies your day by taking one important responsibility off your mind. Through investments in new technology, Otis Elite service ensures a level of expedience previously unavailable in the industry. We'll respond to service issues in record time—typically in minutes; we'll provide you with status updates in real time; we'll even modify key elevator functions to align with changing patterns the moment you assess the need. You play a central role in optimizing the flow and efficiency of your building. With Otis Elite service, we'll make sure your elevator does also.

Otis Maintenance Management System (OMMS®) is a dynamic program that takes into account your elevators' maintenance needs, use and component life. Otis can tailor inspections and maintenance schedules based on your elevators' use in advance.

OMMS procedures are performed on your equipment at predetermined intervals. Components are replaced before their normal life cycle ends and their performance deteriorates. Although we cannot guarantee that no malfunctions will occur, OMMS procedures greatly minimize shutdowns. In addition, Otis continually re-evaluates and improves these procedures. Engineering testing is constantly underway to update and improve OMMS maintenance techniques and OMMS materials.

OMMS is a system tailored specifically to your environment, equipment and needs. Its standardized work practices and predetermined task scheduling ensure the right maintenance at the right time – today and for the extended life of your equipment. It is based not only on engineered, certified best methods, but on constant analysis of the work performed, to ensure consistent, high quality maintenance. This ultimately protects your elevator investment and ensures satisfied tenants.

The Otis Maintenance Management System is the single most advanced and effective support system available in the elevator industry.

Another Otis technological advance is **Remote Elevator Monitoring (REM®)**. REM uses advanced data communications and microprocessor technology to provide 24-

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hour, on-site elevator monitoring. Sensors located in key areas of elevator operation provide diagnostic data in an effort to discover and correct problems before a failure occurs.

Because REM constantly monitors an elevator's performance, it can identify imminent problems that are fixable during a routine maintenance visit. If it finds a major problem, REM automatically sends a message to a customer care center and an Otis service mechanic is dispatched within minutes of the call.

REM continuously monitors your elevators 24 hours a day, 365 days a year. It reduces service interruptions and provides accurate operation information to identify and correct most problems quickly. For fast response, the REM® system makes the service calls for you. A mechanic is dispatched immediately for urgent problems and elevators are often back in service before you or your passengers know there is a problem.

Otis invests in the tools and technology necessary to make technical information easily accessible to Otis personnel. For instance, **OtisWave** is a fully searchable online library of technical documents providing up-to-date information. Otis service personnel now access information faster and easier using the OtisWave library. A maintenance supervisor at a work site needs only a few minutes on his laptop computer to identify a specific part, review a maintenance routine, or find replacement part numbers. The hours previously spent searching through thousands of pages of paper documents in the office are now history.

Otis continuously strives to provide exceptional service to our customers. Evidence of this commitment can be found in facilities such as **OTISLINE®**. OTISLINE is a 24-hour-a-day, centralized communications center that enables you to contact Otis at any time of the day or night. Customer service representatives are available at toll-free phone numbers to provide a prompt and professional response.

e*Service through Otis.com provides direct access 24 hours a day 7 days a week into your building's service history. You can access e*Service using your existing computer and internet browser – just log-in to otis.com and register for e*Service. Knowledge about all service calls and maintenance completed on your elevators or escalators is at your fingertips. E*Service also provides access to your financial statement of account information.

Otis is driven to develop products that improve an elevator's performance, safety, and reliability. Many of these products are incorporated directly into production at the factory for new elevator systems or are added to older equipment to modernize it.

Among the key elements in Otis' overall maintenance program are its customer service centers and testing facilities. For example, the **Otis Service Center (OSC)** in Bloomfield, Connecticut provides maintenance, repair, and modernization services to all Otis maintenance customers throughout the U.S. and Canada. The 220,000-

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square-foot facility stocks, manufactures, and sources elevator and escalator parts. Printed circuit board repair and testing are also performed at OSC.

The **Otis Test Tower** and **Quality Assurance Center (QAC)** in Bristol, Connecticut serve as examples of Otis' commitment to minimizing elevator/escalator downtime through continuous improvement. A combination of real-world testing and computer simulation at this facility means faster, quieter, more efficient, and reliable equipment for Otis customers. Engineers not only test products, but also perfect installation and service methods before they are implemented.

Finally, Otis offers many forms of preventative maintenance programs designed to extend the life of elevator and escalator equipment. Monitoring and maintaining equipment properly also allows for the safest, most reliable performance possible. Please contact your Otis sales or customer service representative for more information about these services.

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Chapter 6: Unique or Product-Specific Procedures or Methods for Inspection or Testing / ASME A17.1b-2009/CSA B44b-09 : Requirement 8.6.1.2.1(f)



When it is necessary to access the car top or the pit, individuals should safely access them using a safe, industry-accepted procedure (for example, see NEII/Elevator World's Elevator Industry Field Employees' Safety Handbook*).*

Testing Procedures for GCS Controllers with Software Level BAH, or AAB or Later

Overspeed Test Instruction

PREPARING FOR TEST

This test allows you to run the car at normal speed and, on some systems, at governor tripping speed, to activate the safeties. This is to check that the safeties will apply and stop a fully loaded car in the down direction (or empty car in the up direction) within the distance determined by code.

Take control of the car, making sure there is no one in the elevator.

Test the brake's spring tension to ensure it will hold full load.

Leave the full load on the elevator for the safety test.

If the building has counterweight safeties, they must be tied down before testing the car (this is to prevent the counterweight safeties from setting during the test).

If you are performing a counterweight test then the car safeties must be tied down (this prevents the car safeties from setting during the test).

From the wiring diagram, determine both the car governor's overspeed switch (OS) and the counterweight governor's overspeed switch (CWOS), if present. These switches must be jumped out during the test.

Running Test

Read and become thoroughly familiar with the test instructions before beginning any test.

Plug the tool into the service tool maintenance port on the controller.

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof.

Disable OCSS to MCSS communication by going to menu (Module-2-4-7-2) on the tool.



This gives you control of the elevator.

1. Go to menu (Module-2-2-5-1-1-1). The tool will display the screen below.

Read Ovrspd Inst
Enter Code ????

2. Enter the code from Step 12, and then push [Blue + Enter] buttons. The tool screen will display:

Car Test = 1
CWT Test = 2

3. Select which test you want to run, by entering 1 for car or 2 for counterweight.
4. The tool will confirm the correct car position for the test selected.
5. If 1 was selected and the car is at the correct landing, the tool will display the screen below.

Ena Safety Test
1 = Yes 2 = End

6. If 1 was selected and the car is not at the correct landing, the following display will come up on the tool.

Car Not at Top
Landing <ENTER>

7. Push the [Blue + Enter] buttons on the tool; follow the instruction to move the car to the correct landing. At the end of run the tool will display the screen below.

Ena Safety Test
1 = Yes 2 = End

8. Enter 1 to select the safety test or 2 to abort the test.
9. If 1 is selected, the tool will show both test velocity and uncontrolled motion velocity.

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Test V = UCM V =

10. Push the [GO ON] button and the tool will display the screen below.

Read Ovrspd Inst Enter Code ????

11. Enter code from Step 11, then push buttons [Blue + Enter] on the tool. The tool will display the screen below.

Run Test? 1=Yes 2=No

12. Selecting 1 causes the elevator to run towards the bottom landing at the test velocity.



Pushing 1 disables the safety control. The safety function will be disabled for only one run.



You are about to run the car. Performing this test requires operating the elevator in a potentially unsafe and hazardous condition that may result in personal injury or property damage, including death, and damage to your elevator. In addition, not restoring the elevator to service properly at the completion of this test could result in a safety hazard. The code for Step 5 is 2655 and the code for Step 9 is 5429.

13. If your jurisdiction requires the governor to be tested at contract speed, then trip the governor manually.

14. If the jurisdiction requires overspeeding of the elevator, the safeties will set when the elevator reaches the governor's tripping speed. The following sequence would occur if 2 were selected in Step 6.

15. If 2 is selected and the car is at the correct landing, the tool will display the screen shown below.

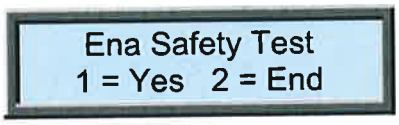
Ena Safety Test 1 = Yes 2 = End

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof.

16. If 2 is selected and the car is not at the correct landing, the following will be displayed on the tool.



17. Push [Blue + Enter] on the tool. Follow the tool instruction to move the car to the correct landing. At the end of the run the tool will display the screen below.



18. Select 1 and follow Steps 8 through 11. The car will run toward the top landing at the counterweight test velocity.

19. If the jurisdiction requires the governor to be tested at contract speed, then trip the governor manually.

20. If the jurisdiction requires overspeeding of the elevator, the counterweight safeties will set when the elevator reaches the counterweight's tripping speed.

21. Push Module on the tool to exit the test and restore safety controls.

22. Confirm all tie downs and jumpers have been removed before putting the elevator back onto normal operation.



Not removing all jumpers and restoring the elevator to normal service properly at the completion of this test could result in a safety hazard.

23. Restore OCSS to MCSS communication by going to menu (Module -2-4-7-1).

Buffer Test Instruction

Preparing for Test

This test allows you to run the elevator or the counterweight at **Buffer Striking Speed** onto the buffer. This is to check that the buffer will retard the elevator or the counterweight if they run into the terminal. When the elevator or the counterweight is raised off the buffer, the buffer plunger must return to its normal position within 90 seconds.

Take control of the car, making sure there is no one in the elevator.

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Test the brake's spring tension to ensure it will hold a full load.

Leave the full load on the elevator for the car buffer test.

If the building has counterweight safeties, they must be tied down before testing the car buffer. This is to prevent the counterweight safeties from setting during the test.

Before doing the counterweight buffer test, the car safeties must be tied down (this prevents the car safeties from setting during the test.).

The controller is calibrated in millimeters per seconds of car speed. To convert feet per minute to millimeters per second 5.08 x FPM (= mm/sec.) Calculate car speed in mm/s. The buffer striking speed is a speed the buffer is designed to absorb. This speed can be found on the buffer data plate.

Position the car at a landing in the middle of the building, in preparation for the test.

Running Test

Read and become thoroughly familiar with the test instructions before beginning any test.

Remove power from the controller. Log out/tag out the mainline disconnect.

Remove and tape the ends of wires from terminal P21-1 and P21-2.



If the wires are not removed and the jumpers installed for the test, the sensors will be destroyed when power is applied to the controller.

Install jumpers between P21-10 to P21-1 and P21-2.

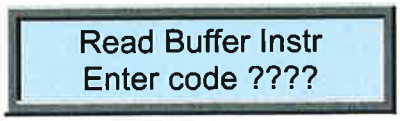
Plug the tool in the service tool maintenance port on the controller.

Disable OCSS to MCSS communication, by going to menu (Module-2-4-7-2) on the tool.



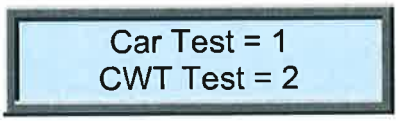
This will give you total control over the elevator.

1. Go to menu (Module-2-2-5-1-1-2) and follow the instruction to get to the buffer test.



WARNING: The use and ownership of this work is defined in the legend upon the front page hereof.

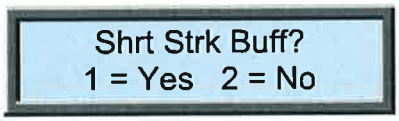
2. Enter code found in Step 15 and push [Blue+Enter], the following display below should be shown on the screen.



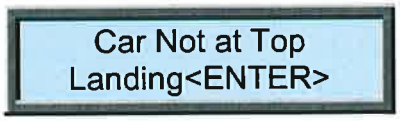
3. Select which test you want to run, by entering 1 for car test or 2 for counterweight test.

4. The tool will confirm the correct car position for the test selected.

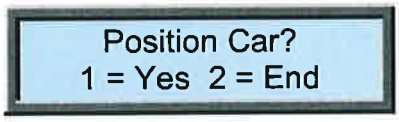
5. If 1 was selected and the car is at the correct landing, the tool will ask if the buffer is full stroke or short stoke by the display shown.



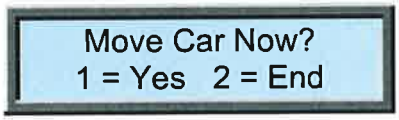
6. If 1 was selected and the car is not at the correct landing, the following display will come up on the tool.



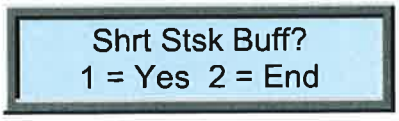
7. Push the [Blue+Enter] buttons on the tool and follow the instruction.



8. If 1 is selected, the display will show:



9. Select 1 and the car will move toward the top floor and then the tool will display.



10. If 1 is selected, the tool will display the buffer striking speed, which should be 85% of contract speed.

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Buffer Test Velocity xxxx

11. Push the [GO ON] button on the tool, to display the following screen:

Ena Buffer Test ? 1 = Yes 2 = End

12. Pushing 1 will disable the safety control. The safety function will be disabled for only one run.



13. *You are about to run the car. Performing this test requires operating the elevator in a potentially unsafe and hazardous condition that may result in personal injury or property damage, including death to persons and damage to your elevator. In addition, not restoring the elevator to service properly at the completion of this test could result in a safety hazard. The code for Step 8 is 3877 and the code for Step 17 is 3974.*

14. Press 1 to initiate the test or press 2 to abort the test and restore the safety controls.

15. Key in the code from Step 15 and press Blue + Enter.

Read Buffer Instr Enter Code> ????

16. When the correct code is entered, the tool will display a final decision selection:

Run Test? 1=Yes 2=No

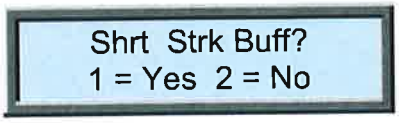
17. Selecting 1 will cause the elevator to run towards the bottom landing at 85% of contract velocity.

18. The following sequence will occur if the 2 is selected for the counterweight buffer test in Step 6.

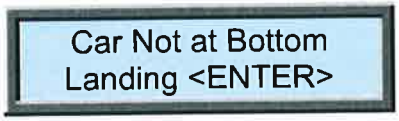
19. The tool will confirm the correct car position for the test selected.

20. If 2 is selected and the car is at the correct landing, the tool will ask what type of buffer.

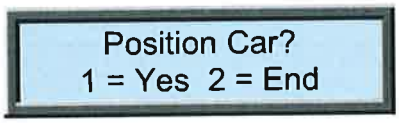
WARNING: The use and ownership of this work is defined in the legend upon the front page hereof.



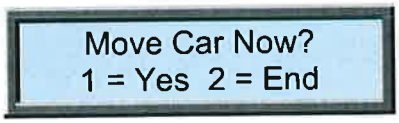
21. If 2 is selected and the car is not at the correct landing, the following display will come up on the tool.



22. Push the [GO ON] button on the tool and follow the instruction, until the display below appears on the tool.



23. Select 1 to position the car.



24. The software is designed to prevent the elevator from operating under unsafe conditions, so certain software safety controls must be disabled for each test, they will automatically be restored after each attempt.

25. Follow instructions in Steps 8–14.

26. Selecting 1 will cause the elevator to run towards the top landing at the velocity selected in Step 8.

27. Push Module on the tool to exit the test and restore safety controls.

28. Confirm all the tie downs and jumpers have been removed before putting elevator back onto service.

29. Remove power from the controller. Lock out/Tag out the mainline disconnect.

30. Remove jumpers from the P21-10, P21-1, and P21-2 and then install the wires that were removed earlier.



31. Not removing all jumpers and restoring the elevator to normal service properly at the completion of this test, could result in a safety hazard.

32. Restore OCSS to MCSS communication by going to menu (Module -2-4-7-1).

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NTSD Dynamic Test Instruction

Preparing for Test

This test demonstrates the operation of the Normal Terminal Slowdown Device (NTSD) at the top and/or bottom landings. The normal stopping means is inhibited so that the car is forced to slowdown when it encounters the NTSD device. This test must be done before the NTSD static test.

Take control of the car, making sure there is no one in the elevator.

Running Test

Read and become thoroughly familiar with the test instructions before beginning any test.

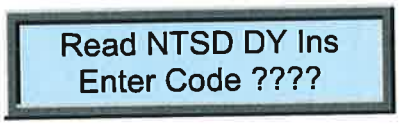
Plug the Customer Tool into the service tool maintenance port on the controller.

Disable OCSS to MCSS communication, by going to menu (Module-2-4-7-2) on the tool.



This will give you total control over the elevator.

1. Go to menu (Module-2-2-5-1-1-3) and follow the instruction to get to NTSD dynamic test.
2. Enter code to proceed (see code is in Step 9).



3. The tool will display.



4. Select which test you want to run, by entering 1 or 2.
5. The tool will confirm the correct car position for the test selected.

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6. If 1 was selected and the car is at the correct landing, the tool will display "Enable Dynamic Test".

Enable Dyna Test?
1 = Yes 2 = End

7. If 1 was selected and the car is not at the correct landing, the following display will be on the tool.

Car Not at Bottom
Landing <ENTER

8. Push the [Blue+Enter] buttons on the tool, the car will move to the correct landing. When it stop the display below will appear on the tool.

Enable Dynamic Test?
1 = Yes 2 = End

9. Pushing 1 will disable the safety control. The safety function will be disabled for only one run. The next display will request the NTSD dynamic test code.



10. *You are about to run the car. Performing this test requires operating the elevator in a potentially unsafe and hazardous condition that may result in personal injury or property damage, including death to persons and damage to your elevator. In addition, not restoring the elevator to service properly at the completion of this test could result in a safety hazard. The code for Step 5 is 4964 and the code for Step 11 is 5525.*

11. Press 1 to initiate the test or press 2 to abort the test and restore the safety controls.

Read NTSD Dy Inst
Enter Code > ????

12. Enter the correct code from Step 9 and then push [Blue+ Enter}. The tool will display a final decision selection.

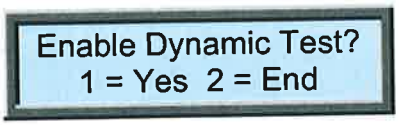
Run Test?
1 = Yes 2 = No

13. Selecting 1 will cause the elevator to run toward the top landing, to perform the test.

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14. The following sequence would occur if 2 were selected in Step 7.

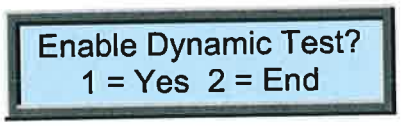
15. If 2 was selected and the car is at the correct landing, the tool will display "Enable Dynamic Test".



16. If 2 was selected and the car is not at the correct landing, the following display will be on the tool.



17. Push the [Blue+Enter] buttons on the tool. The car will run to the correct landing and when it stop, the display below will appear on the tool.



18. Follow instructions from Steps 9–11 to run the test.

19. Push module on the tool to exit the test and restore safety controls.

20. Get ready to do NTSD static test.

21. To restore normal service, go to menu (Module-2-4-7-1) on the tool.

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof.

NTSD Static Test Instruction

Preparing for Test

This test demonstrates the operation of the Normal Terminal Slowdown Device (NTSD) at the top and/or bottom landings. The normal stopping means is inhibited so that the car is forced to slowdown when it encounters the NTSD device. **The NTSD Dynamic Test must be performed before this test**.

Take control of the car, making sure there is no one in the elevator.

Running Test

Read and become thoroughly familiar with the test instructions before beginning any test.

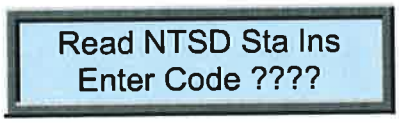
Plug the customer tool into the service tool maintenance port on the controller.

Disable OCSS to MCSS communication, by going to menu (Module-2-4-7-2) on the tool.



This will give you total control over the elevator.

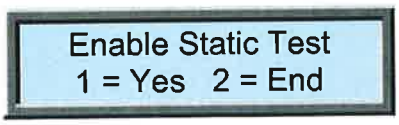
1. Go to menu M-2-2-5 -1-1-4. The tool will display the screen below.



2. Enter code found in Step 9, then push the [Blue+Enter] buttons on the tool.



3. Select which test you want to run, by entering 1 or 2.
4. The tool will confirm the correct car position for the test selected.
5. If 1 was selected and the car is at the correct landing, the tool will display.



6. If 1 was selected and the car is not at the correct landing, the following display will be on the tool.

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof

Car Not at Bot Landing<ENTER>

7. Push buttons [Blue+Enter] on the tool, the car will travel to the correct position. When it stop, the tool will display.

Enable Static Test? 1 = Yes 2 = End

8. Pushing 1 will disable the safety control. The safety function will be disabled for only one run. The next display will request the NTSD Static test code.



9. *You are about to run the car. Performing this test requires operating the elevator in a potentially unsafe and hazardous condition that may result in personal injury or property damage, including death to persons and damage to your elevator. In addition, not restoring the elevator to service properly at the completion of this test could result in a safety hazard. The code for Step 5 is 9642 and the code for Step 11 is 7489.*

10. Press 1 to initiate the test or press 2 to abort the test and restore the safety controls. If 1 is pressed, the tool screen will display as shown below.

Read NTSD Static Inst Enter Code >????

11. Enter the code from Step 9, and then push [Blue+ Enter}. The tool will display a final decision selection.

Run Test? 1 = Yes 2 = No

12. Selecting 1 will cause the elevator to run toward the top landing, to perform the test.

13. The following sequence would occur if 2 was selected in Step 5.

14. If 2 was selected and the car is at the correct landing the tool will display.

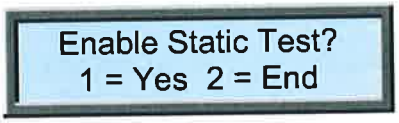
Enable Static Test? 1 = Yes 2 = End

15. If 2 was selected and the car is not at the correct landing, the following display will be on the tool.

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof.



16. Push the [Blue+Enter] buttons on the tool, the car will move to the correct landing and then display the screen below when it stops.



17. Follow instructions from Steps 8–11 to run the test.

18. Push Module on the tool to exit the test and restore safety control.

19. To put the car back into normal service go to tool menu (Module-2-4-7-1).

ETSD Test Instruction

Preparing for Test

This test verifies the operation of the Emergency Terminal Stopping Devices (ETSD) at the top and /or bottom landing. During test the normal stopping means and the NTSD slowdown response are BOTH inhibited so that the car is forced to stop when it encounters the ETSD switch. This causes an emergency stop, and immediate application of the brake.

Take control of the car, making sure there is no one in the elevator.

Test the brake's spring tension to ensure it will hold a full load.

Leave the full load on the elevator for the ETSD test.

If the building has counterweight safeties, they must be tied down before performing the test. This is to prevent the counterweight safeties from setting during the test.

If the counterweight test is being performed, then the car safeties must be tied down. This is to prevent the car safeties from setting.

Running Test

Read and become thoroughly familiar with the test instructions before beginning any test.

Insert the tool in the service tool maintenance port on the controller.

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof

Disable OCSS to MCSS communication, by going to menu (Module-2-4-7-2) on the tool.



This will give you total control over the elevator.

1. Go to menu M-2-2-5-1-1-6, the screen will show the display below:

Read ETSD Instr
Enter Code ????

2. Enter code from Step 10 and then push [Blue+Enter].
3. The tool will display the screen below.

ETSD Test Top = 1
ETSD Test Bot = 2

4. Select which test you want to run by entering 1 or 2.
5. The tool will confirm the correct position for the test selected.
6. If 1 was selected and the car is at the correct landing, the tool will display:

Enable ETSD Test
1 = yes 2 = End

7. If 1 was selected and the car is not at the correct landing. The tool display will look as shown below.

Car Not at Bot
Landing <ENTER>

8. Push the [Blue+ Enter] buttons on the tool, the car will move to the correct landing. When the car stops the display below appear on the tool.

Enable ETSD Test
1 = Yes 2 = End

9. Press 1, the tool display will show the screen below.

Read ETSD Inst
Enter Code ????

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof.

10. Enter code from this step, then push [Blue+Enter].



11. *You are about to run the car. Performing this test requires operating the elevator in a potentially unsafe and hazardous condition that may result in personal injury or property damage, including death to persons and damage to your elevator. In addition, not restoring the elevator to service properly at the completion of this test could result in a safety hazard. The code for Step 5 is 3484; the code for Step 10 is 3698.*

12. When the correct code is entered, the tool will display a final decision selection.

Run Test? 1 = Yes 2 = No

13. Selecting 1 will cause the elevator to run towards the bottom landing at contract velocity. The tool display will show.

Test in Progress MODULE when done

14. If 2 is selected in Step 7, the following occurs.

15. The tool will confirm the correct position for the test selected.

16. If 2 is selected and the car is at the correct landing, the tool will display "enable ETSD Test".

Enable ETSD Test 1 = yes 2 = End

17. If 2 is selected and the car is not at the correct landing. The tool display will look as shown below.

Car not at Top Landing <ENTER>

18. Push the [Blue+Enter] buttons. The car will move to the correct landing, and when it stops, the tool display the screen below.

Enable ETSD Test 1 = Yes 2 = End

19. Follow instructions in Steps 8–11.

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof

20. Selecting 1 will cause the elevator to run towards the top landing at contract velocity.

21. Push module on the tool to exit the test and restore safety controls.

22. Confirm all the tie downs and jumpers have been removed, before putting the elevator back in service.

23. To restore normal service, go to menu (Module-2-4-7-1).

Traction Test Instruction

Preparing for Test

This test allows you to override software direction limits and land the car (or counterweight) on its respective buffer, while on Inspection, to demonstrate that the hoist ropes will break traction and the drive sheave will spin under the stationary ropes.

Take control of the car making sure there is no one in the elevator.

Test the brake's spring tension to ensure it will hold full load.

Leave the full load on the elevator for the traction test.

Running Test

Read and become thoroughly familiar with the test instructions before beginning any test.

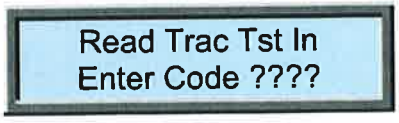
Insert the tool into service tool maintenance port on the controller.

Disable OCSS to MCSS communication, by going to menu (Module-2-4-7-2) on the tool.



This will give you total control over the elevator.

1. Go to menu M-2-2-5-1-1-5 for Traction test. The tool will display:



2. Enter the code from Step 5 and then push [Blue+Enter].

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof.

3. The tool will instruct you to put the car on machine room inspection.

Put Car on CRI

4. Put the controller on inspection, then push [GO ON] button on the tool, the screen below will appear.

Enable Traction Test 1 = Yes 2 = No

5. Press 1 and the tool will display the screen below.

Read trac Tst Inst Enter Code ????

5. Enter the code from this Step and then push [Blue+Enter].



You are about to run the car. Performing this test requires operating the elevator in a potentially unsafe and hazardous condition that may result in personal injury or property damage, including death to persons and damage to your elevator. In addition, not restoring the elevator to service properly at the completion of this test could result in a safety hazard. The code for Step 2 is 4596; the code for Step 5 is 2792.

6. When the correct code is entered, the tool will display a final decision selection.

Run Test? 1 = Yes 2 = No

7. If 1 is selected, the tool will display.

Run Car on CRI

8. Run the elevator up to fully compress the counterweight buffer.

9. Attempt to run the elevator up again; the ropes must slip traction.

10. Push Module on the tool to exit the test and restore safety control.

11. Confirm all jumpers have been removed before putting the elevator back in normal service.

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof

12. To restore normal service go to tool menu (Module -2-4-7-1), and then take the car off machine room inspection.

Cab-Mounted Governor (CMG) Trip Test

Preparing for Test

This test allows you to run the car at the governor electrical overspeed, check that when the car reaches the trip speed, immediately performs a timed deceleration, then shuts down.

1. Take control of the car, making sure there is no one on the elevator.
2. Test the brake's spring tension to ensure it will hold full load.

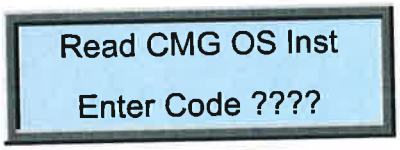
Running Test

1. Please review the flow chart in Figure 1 for a complete sequence map.
2. Plug the tool into the Service Tool Maintenance port on the controller
3. Disable OCSS to MCSS communication by going to menu (Module -2-4-7-2 on the tool

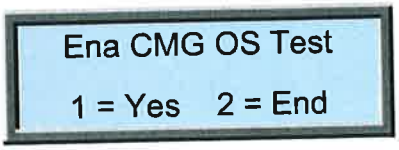


This will give you total control over the elevator.

4. Go to menu Module-2-2-5-1-1-B and the tool will display:

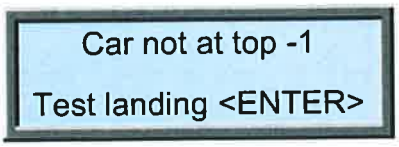


5. Enter code **1737** and then push [Blue+Enter] buttons. The tool screen will display the following screen if the car is at the correct landing:

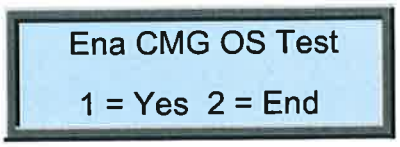


WARNING: The use and ownership of this work is defined in the legend upon the front page hereof.

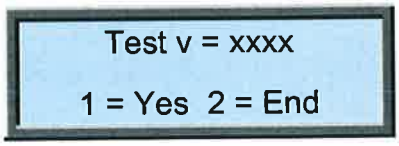
6. If the car was not at the correct landing when the code was entered in Step 5, the tool will display the following.



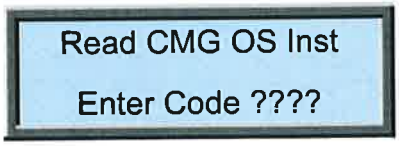
7. Push the [Blue+Enter] buttons on the tool and follow the instructions to move the car to the correct landing. At the end of the run the tool will display the screen below:



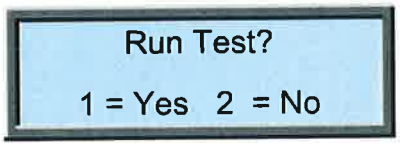
8. Select 1 on the tool, and it will display the speed the car will run to enable the test.



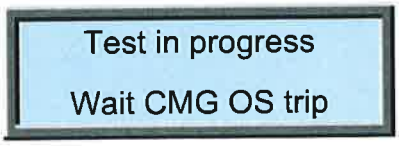
9. Select 1 on the tool and it will display:



10. Enter the code **3465** and the push [Blue+Enter]. The screen below the warning will be displayed.

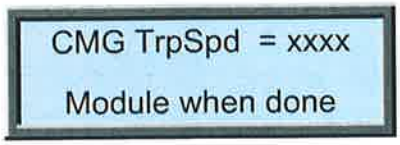


11. Select 1 and the elevator will run at the test speed, while the tool displays:



WARNING: The use and ownership of this work is defined in the legend upon the front page hereof

12. When the elevator trips the overspeed, the tool will display the speed at which it trips.



13. Push the Module button on the tool, the display will show:



14. Go to menu M-2-2-2 and the tool display should confirm that the car is shut down with an overspeed fault.



15. Push the "Manual Reset" button on the input/output board.

16. Push Module, then Enter M-2-2-3-1. This should reset the controller.

17. Push Module on the tool, then enter M-2-4-7-1. This will put the car back in service.

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof.

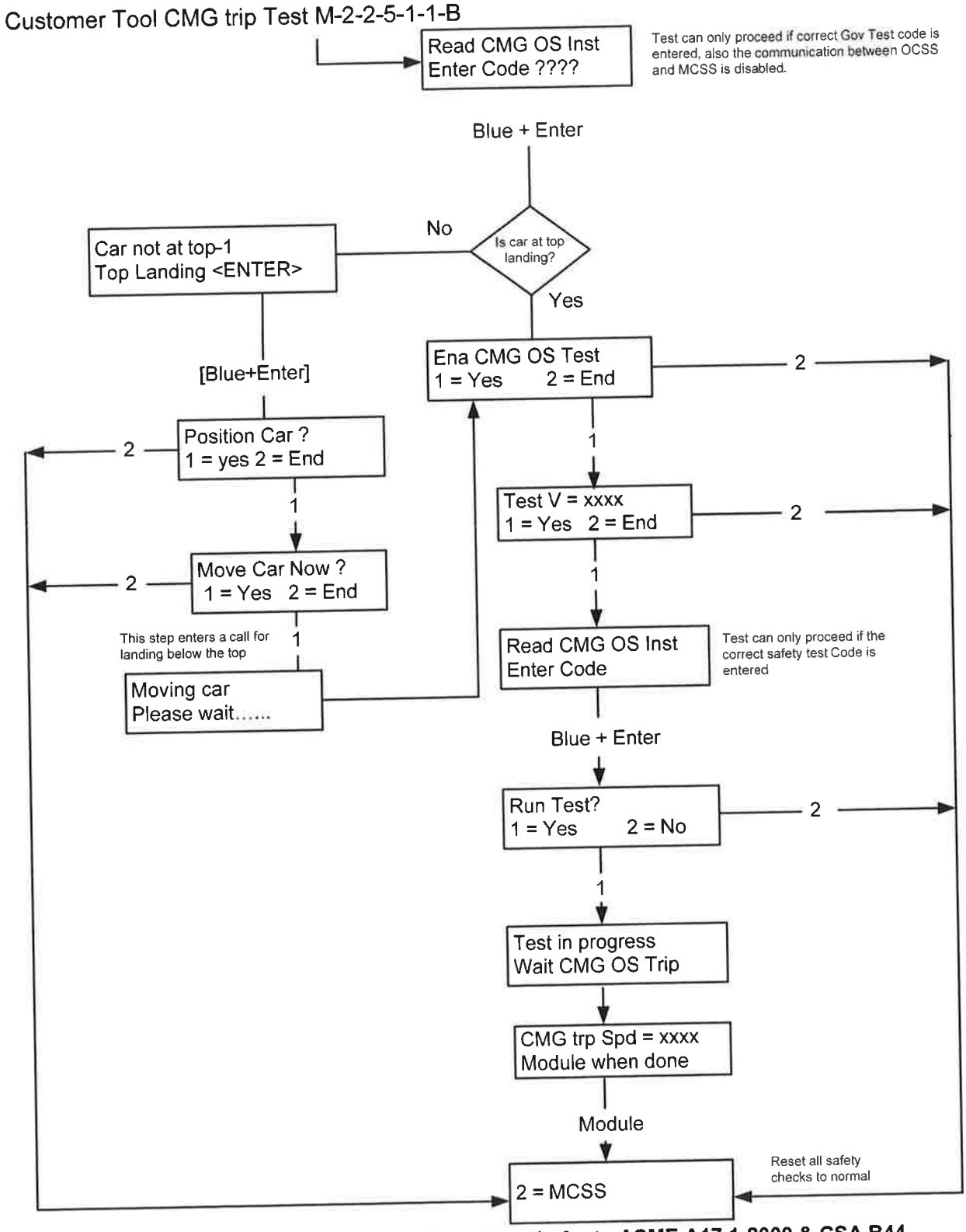


Figure 1: Unintended Car Movement Protection (refer to ASME A17.1-2000 & CSA B44, Section 2.19.2)

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof

Unintended Car Movement Protection instructions

If the car leaves the door zone with an open door, the emergency brake must be able to stop the car within 48 inches of the door zone. This test verifies that operation.



This test will only work with A__31256___ baseline and later.

Preparing for Test

1. Run the car to the bottom landing with no load in the car.
2. Verify the doors are closed and there is no one in the car.
3. Disable the OCSS-to-MCSS communication by going to the customer tool menu M-2-4-7-2.
4. Verify the doors are closed and there is no one in the car.
5. Remove power from the controller.
6. From the wiring diagram, find the connections for the hoistway door locks (FDS) and gate switch (FGS). Remove the field wires from the controller terminals.
7. Locate and remove PX jumper from the J1 plug in the controller and connect it to the J4 plug (see Figures 2 and 3).

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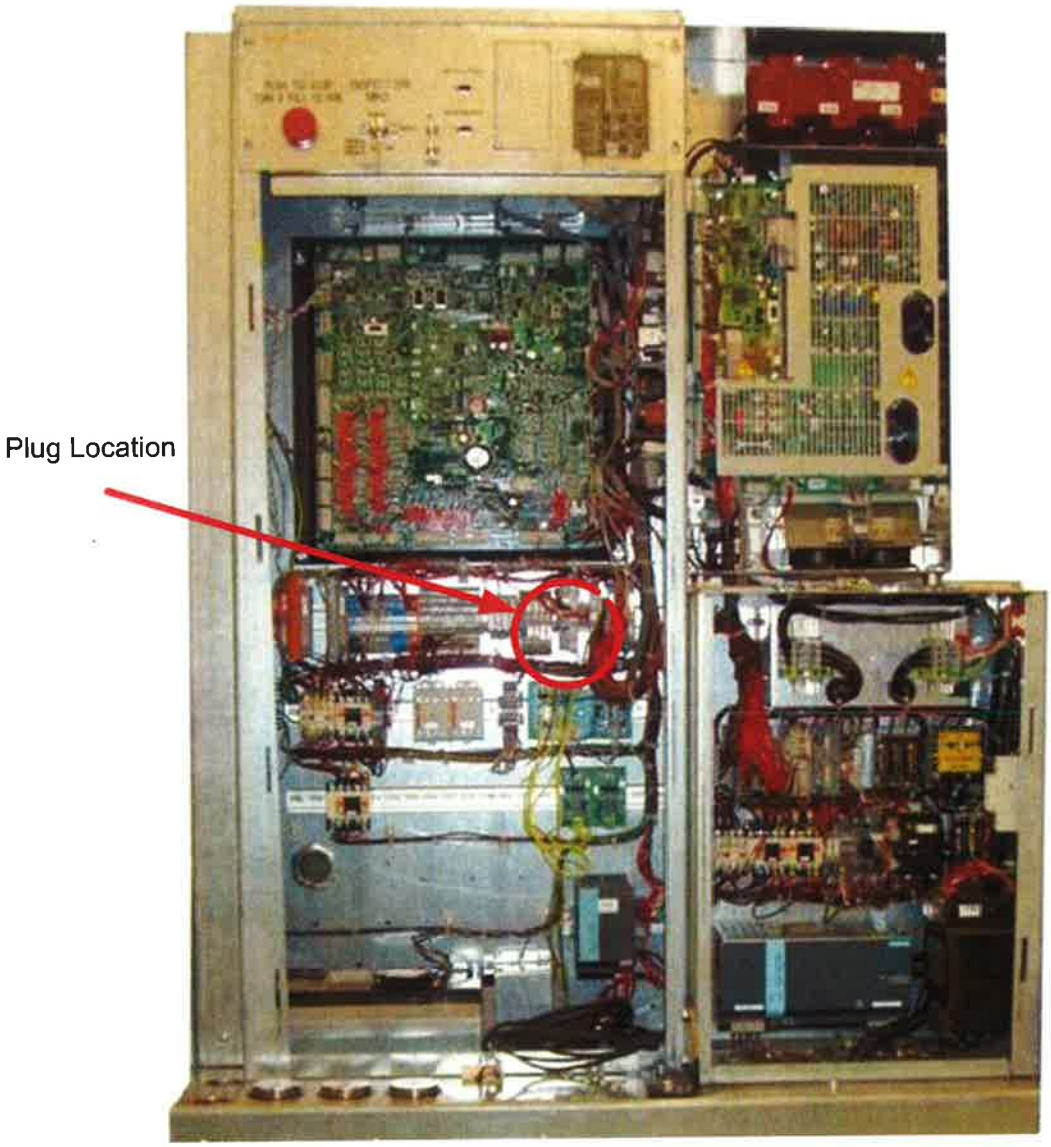


Figure 2: Plug Assembly Location

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof

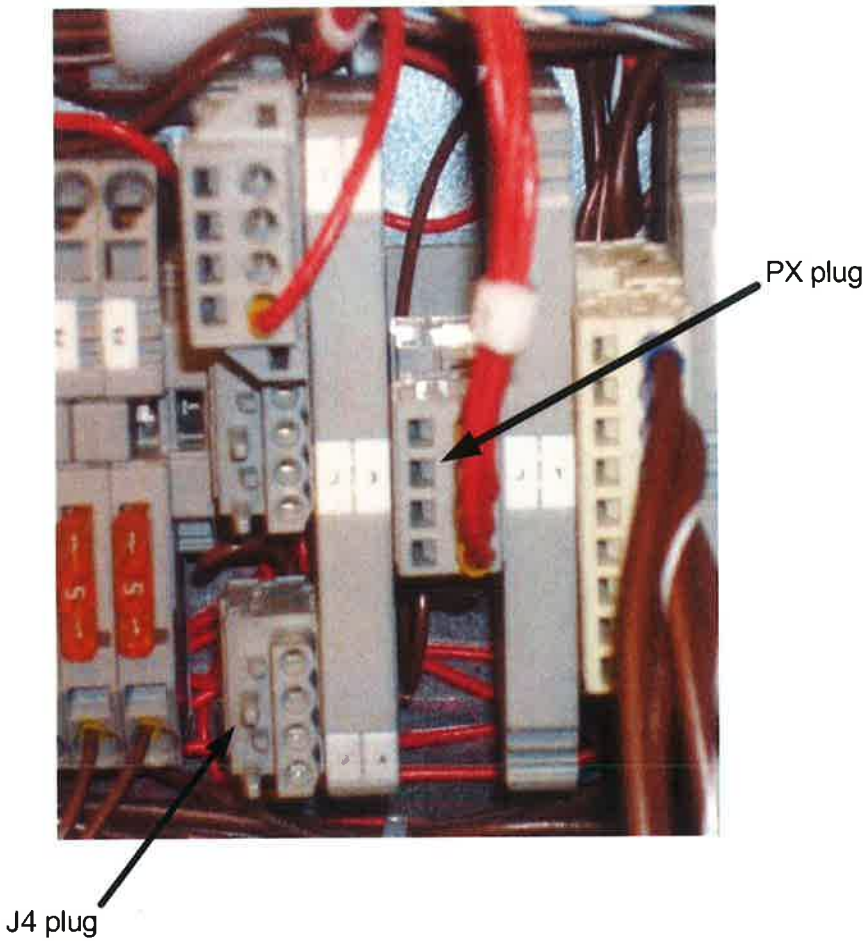
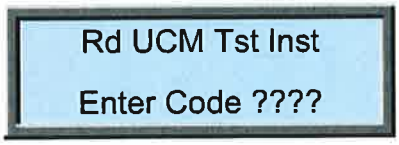


Figure3: Plug Location

8. Restore power to the controller and confirm that the UCM relay is out.
9. Place the Inspection switch (CIS) to the BAT ON position.
10. Go to menu Module-2-2-5-1-1-C—this should energize the UCM relay.

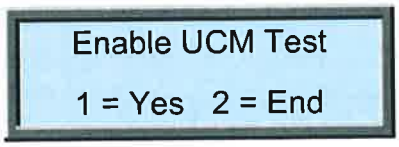


To get C on the tool enter [Blue+6].

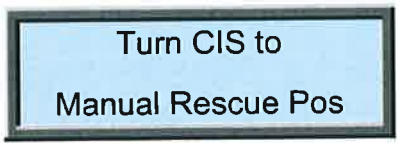


WARNING: The use and ownership of this work is defined in the legend upon the front page hereof.

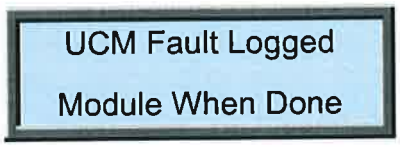
11.. Enter code **1927** and the tool will display:



12. Select 1 and then rotate the inspection switch clockwise to the "Manual Rescue Position" and hold. The tool will display:



13. The car should start to move and the emergency brake should stop the car within 48 inches of movement. The tool will display:



14. Push Module on the tool to disable the test.



15. Remove power from the controller and reconnect the door lock and gate switch field wire.

16. Move PX plug back to the J1 plug.

17. Turn the Inspection switch counterclockwise to the Inspection position.

18. Restore power to the controller and run it on Inspection.

19. Push the Manual Reset button on the input output board and on the tool go Module -2-2-3-1.

20. Turn the CIS switch to the Normal position.

21. Go to menu M-2-1-2 and go to the GTN command, run the elevator to a landing.

22. On the tool restore communication between OCSS and MCSS by going to Module-2-4-7-1.

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof

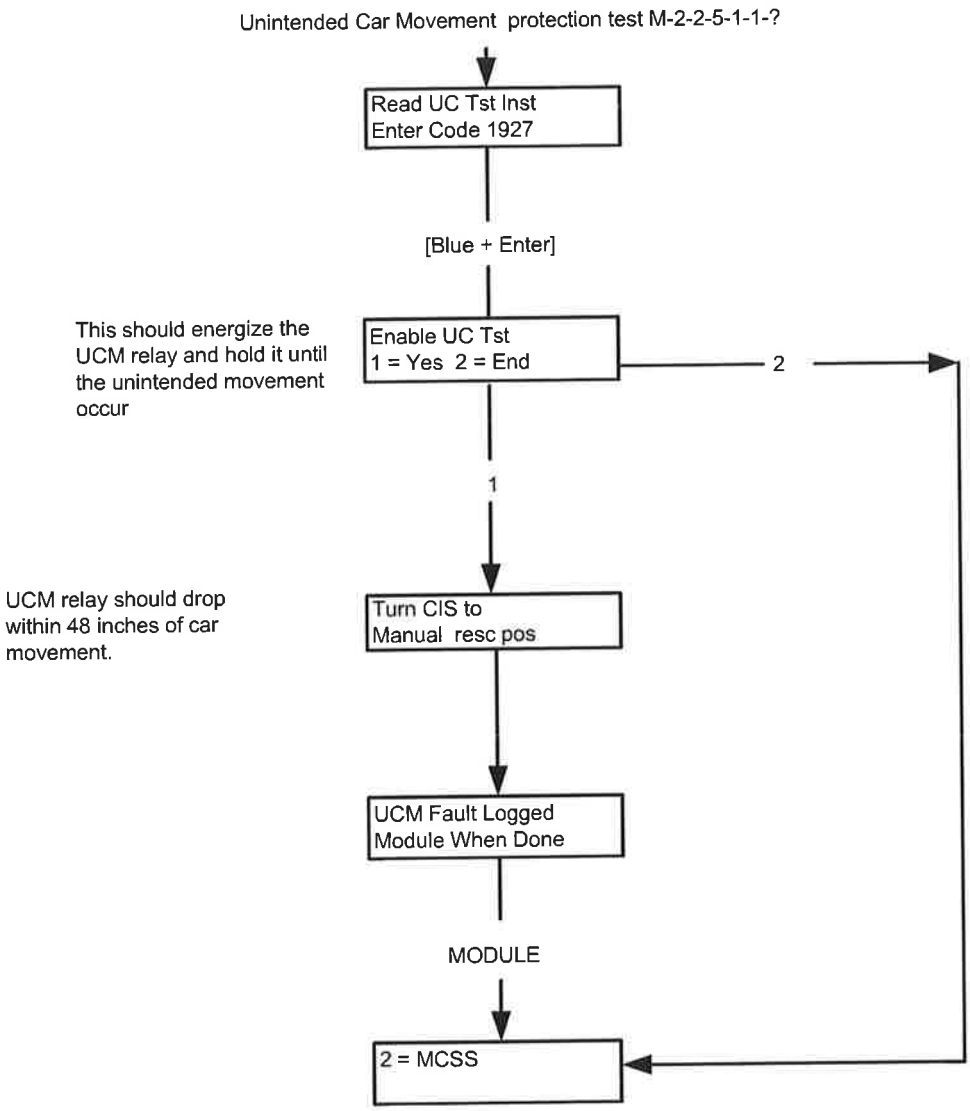


Figure 4: Unintended Car Movement

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof.

Maintenance:

Coated-Steel Belt Inspection : Visual Inspection



When it is necessary to access the car top or the pit, individuals should safely access them using a safe, industry-accepted procedure (for example, see NEII/Elevator World's Elevator Industry Field Employees' Safety Handbook*).*

Even though coated-steel belts are designed to last two to three times longer than traditional elevator wire ropes, an annual visual inspection is recommended.

This procedure defines the technique for the visual inspection of coated-steel belts. There are two main criteria for coated-steel belt replacement: evidence of wire strand breakage or evidence of polyurethane degradation that may expose belt cords to wear.

1. Turn Cartop Inspection Switch (CIS) to INSPECT. Using Control Room Inspection (CRI), position car top near floor level at the top landing.

2. Access the top of the elevator. Using top-of-car inspection, run the elevator from the top of hoistway to the bottom of the hoistway.



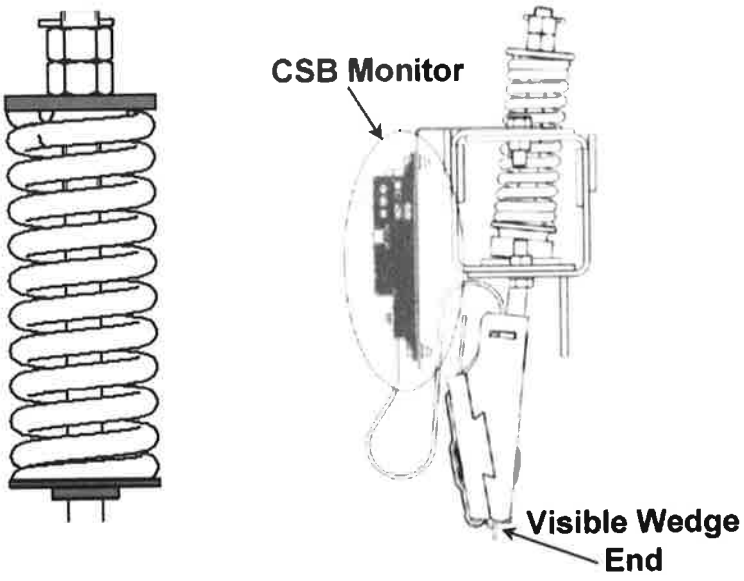
When it is necessary to access the car top or the pit, individuals should safely access them using a safe, industry-accepted procedure (for example, see NEII/Elevator World's Elevator Industry Field Employees' Safety Handbook*).*

3. Stop as needed to inspect the coated-steel belts using the following images for comparison and recommended action.

4. Inspect coated-steel belt installation, terminations, springs, nuts, cotter pins, wedges and rod condition.

   - Springs, no cracks
   - Wedges, tip visible just below termination basket
   - Nuts, two installed on each rod
   - Cotter pin present and tip bent to secure in place
   - All belts in the set should be installed facing the same direction to the drive sheave (if belt has chevron grooves on bottom) and all belts in the set should be installed running the same direction as the direction arrows printed on the belts

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof



5. Egress the car top.

When it is necessary to access the car top or the pit, individuals should safely access them using a safe, industry-accepted procedure (for example, see NEII/Elevator World's Elevator Industry Field Employees' Safety Handbook*).*

6. Return the Cartop Inspection Switch (CIS) to the NORMAL position.

7 Close the hoistway doors

Coated-Steel Belt (CSB) Inspection Using the Pulse™ Continuous Monitoring System

Pulse™ is the Otis commercial solution to CSB inspection. It monitors the condition of the steel cords inside the CSB continuously and signals the car controller with the CSB status. The CSB status is communicated as an alert or an alarm as detected. When in ALARM the elevator will go out of service immediately after allowing passengers to exit. If the system has REM® installed, alerts, alarms, and Pulse system health is reported to local personnel. If the system does not have REM, alerts, alarms, and Pulse system health are reported on the device. The Pulse unit is either located in the overhead of the hoistway mounted to the underside of the machine structure on MRL or located in the machine room mounted to the top-side of the machine bedplate when used in a machine room configuration.

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof.



Below is the label applied to the Pulse unit, explaining the faults.

LED FLASH	FAULT DESCRIPTION
OFF	NO BELT OR CSB NOT MONITORED
1	ALL WELL
2	RESERVED
3	RESERVED
4	RESERVED
5	ALERT - SCHEDULE CSB REPLACEMENT
6	ALARM - REPLACE CSB IMMEDIATELY
7	CHECK RSL WIRING AND COMMUNICATION
8	UNUSED
9	REPLACE EEPROM
10	REPLACE BOARD, USE EXISTING EEPROM
11	BAD CSB CONNECTION AT LEARN
12	STARTING RESISTANCE ERROR AT LEARN
13	HOISTWAY - OVER-TEMPERATURE
14	UNUSED
15	STANDBY - LEARN REQUIRED

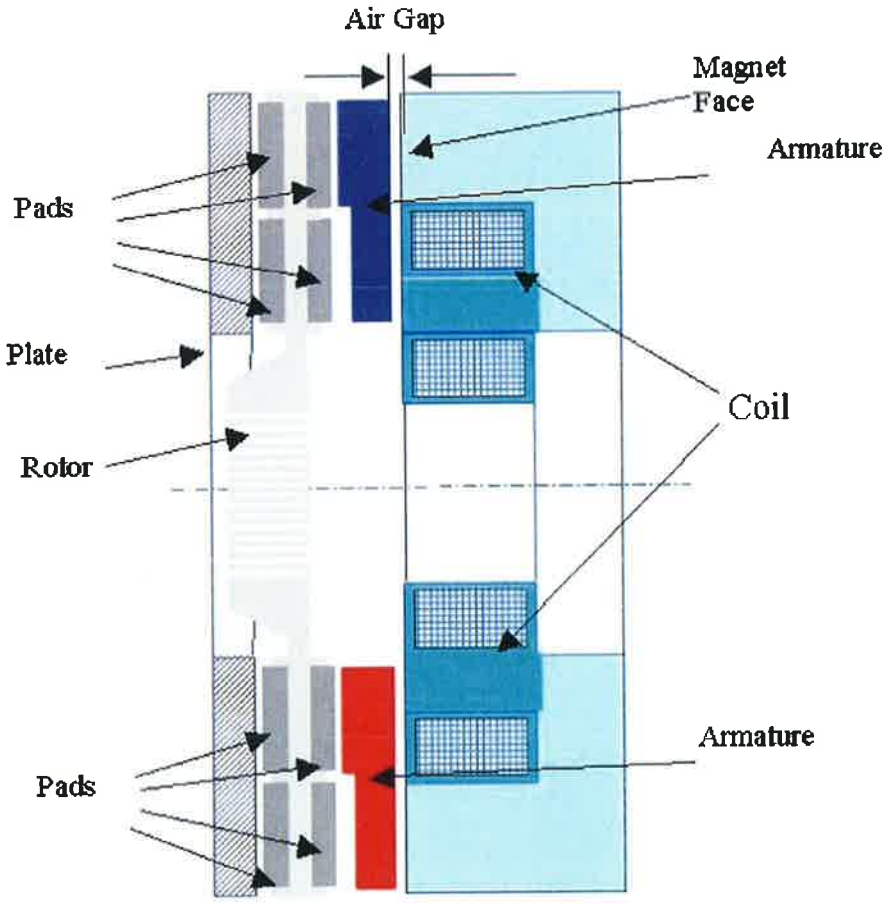
WARNING: The use and ownership of this work is defined in the legend upon the front page hereof

Machine and Emergency Brake Wear Inspection

1. Access the brake.
2. With the brake de-energized, measure between the brake armature and magnet housing using a feeler gauge. Measure each of the brake/armature segments.

A new brake will have an air gap of 0.21 mm to 0.5 mm.

3. An air gap of > 0.60 mm or 0.024 inches requires brake replacement.

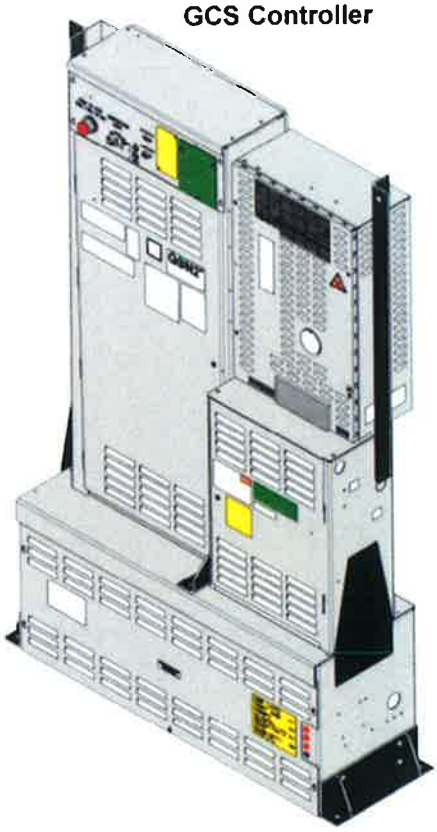


Gen2 Brake Details

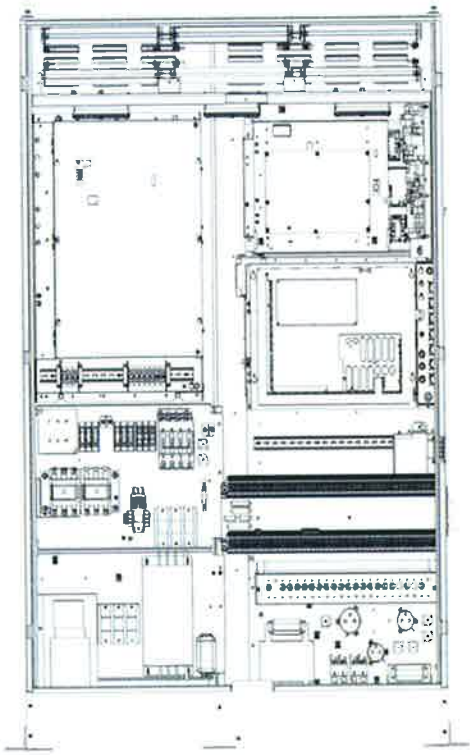
WARNING: The use and ownership of this work is defined in the legend upon the front page hereof.

Other Operations

GCS Controller



NGGC Controller



MRO (Manual Rescue Operation)

Only properly trained, authorized and qualified personnel should perform Manual Rescue Operation.

1. Remove power to the elevator, lock out, tag out, test, and verify.
2. Verify that all hoistway and car doors are closed completely.
3. Set CB2 circuit breaker to the OFF position (for NGGC controller only).
4. Ensure the CB1 circuit breaker is in the ON position.
5.
   A. With the NGGC controller; insert the Manual Rescue (Group One Security: UTE) key in the INSP/Manual Rescue Enable Keyswitch on controller under the service panel board.
   B. With the GCS Controller the MRO keyswitch can be found top center of the outside of the controller.

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof

The MRO key should not be left in the MRO keyswitch or stored in the controller.

6. Turn and hold the MRO keyswitch to the ENABLED position and then depress and hold the BRB1 button located on the service panel board. The elevator should move in short pulses in the direction of system overbalance.

7. Direction and movement of elevator will be displayed on the service panel board LEDs. Car position will be on the service panel board display when car motion stops. The DZ light on the service panel board will illuminate when the car is in the door zone ±3 in. (±76 mm).

8. The elevator should automatically stop at the next door zone if constant pressure is maintained on BRB1 and the MRO keyswitch.

9. Release the BRB1 button and release the MRO keyswitch.

10. (Only during testing) Test and verify that the elevator can move to the next landing, if not already at a terminal landing by turning the MRO keyswitch to the ENABLED position again and then depress the BRB1 button. The elevator should move in short pulses in the direction of imbalance to the next door zone and stop.

11. When testing is complete, remove the MRO key from the MRO keyswitch.

12. On the NGGC controller, return CB2 to the normal position.

13. Return the car to service following proper procedures.

Car Top Access Using Zoned Access*



When it is necessary to access the car top or the pit, individuals should safely access them using a safe, industry-accepted procedure (for example, see NEII/Elevator World's Elevator Industry Field Employees' Safety Handbook*).*

1. Call the elevator to the top landing.

2. Using the inspection keyswitch in the car operating panel place elevator on INSPECTION.

3. Place a barricade in front of the hoistway door.

4. Move the elevator down using the zoned access keyswitch located adjacent to the doorjamb to a height where the car top can be accessed safely.

5. Turn on the cartop work light.

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof.

6. Place the car top stop switch to the STOP position and the cartop inspection switch to the INSPECTION position.

7. Access the car top and assume a safe position.

8. Test and verify the performance of the top of car run station buttons and features.

9. Close hoistway door and move elevator using car top inspection station buttons.

HAD, Pit Inspection Lock and TCI Lock Fault Description and Reset

If Hoistway Access Detection (HAD) determines that the pit or top of car have not been accessed following required procedures, it will not allow the elevator to return to normal service until the fault is reset. Below are the procedures.

Hoistway Access Detection (HAD)



When it is necessary to access the car top or the pit, individuals should safely access them using a safe, industry-accepted procedure (for example, see NEII/Elevator World's Elevator Industry Field Employees' Safety Handbook*).*

The car is on automatic operation and the hoistway door is opened for 4 seconds or more if the car is in flight or stopped between floors, or if a hoistway door is opened when the car is at a landing with the car and hoistway doors closed.

Resetting

The Hoistway Access Detection condition shall be reset under the following conditions:

- Toggling Pit Emergency Stop Switch
- Entering Top of Car Inspection mode

Pit Inspection Lock



When it is necessary to access the car top or the pit, individuals should safely access them using a safe, industry-accepted procedure (for example, see NEII/Elevator World's Elevator Industry Field Employees' Safety Handbook*).*

The hoistway door must be opened and blocked open with a door wedge device before either the pit stop switch or the inspection switch are placed back in normal operation.

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof

A Pit Inspection Lock condition will occur if the pit is not egressed following the prescribed procedure. If the correct procedure is not followed, the elevator will shut down with a Pit Inspection Lock fault. This is to prevent the car from moving if the pit safety switches have been turned back to Normal, but the hoistway door has not been opened.

Resetting

Toggling PIT EMERGENCY STOP SWITCH with the hoistway doors open (Bottom floor only)

Top of Car Inspection Lock



When it is necessary to access the car top or the pit, individuals should safely access them using a safe, industry-accepted procedure (for example, see NEII/Elevator World's Elevator Industry Field Employees' Safety Handbook*).*

Hoistway door must be opened and blocked open with a door wedge device before either the top of car stop switch or the inspection switch are placed back in the normal run position.

A Top of Car Inspection Lock condition will occur if the top of the car is not exited following the proper procedure. If the correct procedure is not followed, the elevator will shut down with a Top of Car Inspection Lock fault. This is to prevent the car from moving if the top of car safety switches have been turned back to Normal, but the hoistway door has not been opened.

Resetting

A Mode change from something other than Top of Car Inspection to (e.g. NORMAL, Access, and Controller Inspection) and then back to Top of Car Inspection will reset the lock-up. (This is done to prevent a mechanic who may have accidentally turned the inspection switch from inspection to normal from being stuck on top of the car due to a Top of Car Inspection Lock condition.)

Manual Reset of the Governor Overspeed Switch



When it is necessary to access the car top or the pit, individuals should safely access them using a safe, industry-accepted procedure (for example, see NEII/Elevator World's Elevator Industry Field Employees' Safety Handbook*).*

1. Place controller on CRI for Control Room Inspection.

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof.

2. Place temporary jumper on the required terminals (C-074 and C-075) in the elevator controller to bypass governor overspeed switch. Location to place jumper can be found in the controller wiring diagrams. Installing jumpers should only be carried out by trained and qualified elevator personnel.

3. Run car on CRI to a spot in the hoistway where safe car top access is possible.

4. Place service barricades. Open hoistway door.

5. Place top of car emergency stop switch to the STOP position. Place car on car top inspection by turning the Car Top Inspection switch to INSPECTION and turn on car top light.

6. Test and verify the top of car emergency stop switch, access the car top* and test and verify the UP/DOWN commands.

7. Using top of car inspection ride car top up to access governor.

8. Remove top cover from governor.

9. Inspect governor for any visual damage.

10. Manually reset governor overspeed switch (see photos).

OS in the Tripped Position



OS in the Reset or Normal Position



11. Re-install cover on governor.

12. Ride car down to the floor from where the cartop was accessed, open and mechanically block the hoistway door, then egress car top.

13. Turn off car top light, place top of car inspection switch to the NORMAL position and the car top stop switch to the RUN position.

14. Close hoistway door.

15. Place controller circuit breaker (CB1) to the off position.

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof

16. Remove temporary jumper C-074 to C-075, installed from in step 2.

17. Place controller circuit breaker (CB1) to the ON position.

18. Run the car using CRI to confirm correct operation. Turn CRI key switch back to NORMAL and ride car to verify performance.

Remote Governor Trip & Reset Confirmation

Due to the location of the governor(s) with the machine-room-less Gen2 system, remote trip and reset features are provided to facilitate testing the governor and resetting the overspeed switch.

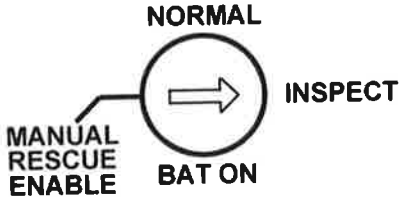
The following procedure is provided to confirm operation of the remote governor trip and reset feature.

To protect the governor trip mechanism, the controller software will not enable governor trip operation if the car is running in a direction opposite to that required for governor activation.

Car Governor

1. Position the elevator one floor below the top terminal landing.

2.. Turn the CIS / MRO keyswitch to the INSPECT position.



3. Place a temporary jumper on GCS I/O board terminals P26-4 to P26-5 (OS switch).

4. Select the service tool sequence (M-2-2-5-1) to access the safety function display. Press the GO ON button to select Safety Checks and set as follows to enable car governor trip feature.

   - CAR Gov Trp:enab (Car Governor Trip: Enabled)

This setting will revert to "disabled" after one start.

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof.

5.. Using the controller inspection station, initiate a down inspection run. With the car running down on inspection, press the "GOV TRIP / RESET" button on the GCS I/O board to activate the governor trip solenoid. Confirm that the car stops when the governor trips and the car safeties are applied.



Hold the "GOV TRIP / RESET" button for a period long enough to allow the governor sheave to rotate as least 180 degrees, as it may take that long for the mechanical governor linkages to engage.

6. Release the buttons as soon as the car stops to prevent belt damage.
7. **TURN OFF THE MAINLINE DISCONNECT SWITCH. LOTO - TEST & VERIFY.**
8. Place a temporary jumper on the GCS I/O board P22-8 and P22-7 to bridge the safety-operated switch (SOS).
9. Turn ON the main line disconnect switch.
10. Using the controller inspection station, run the elevator up to release the car safeties and reset the governor mechanism.
11. **TURN OFF THE MAIN LINE DISCONNECT SWITCH. LOTO - TEST & VERIFY.**
12. **Remove the temporary jumper from GCS I/O board plug P26-4 to p26-5 (OS switch).**
13. Turn ON the main line disconnect switch.
14. Select the service tool sequence (M-2-2-5-1) to access the safety function display. Press the GO ON button to select Safety Checks and set as follows to enable Car Governor Reset feature.

    CAR Gov Rst:enab (Car Governor Reset: Enabled)

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof

15..Press the "GOV TRIP / RESET" button on the GCS I/O board to activate the governor reset solenoid. It may be necessary to repeat the procedure several times to reset the car governor switch. Press the "MANUAL RESET" button on the GCS I/O board, cycle the main line disconnect switch and then confirm that the safety circuit is restored indicating that the governor overspeed switch and reset confirmation switch is reset.





16. **TURN OFF THE MAIN LINE DISCONNECT SWITCH. LOTO - TEST & VERIFY.**

17. **Remove the temporary jumper from GCS I/O board plug P22-8 to P22-7 (SOS switch).**

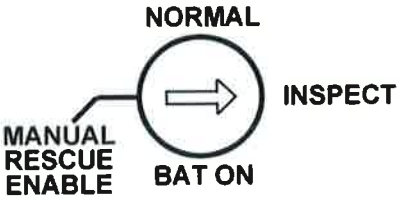
18. Turn ON the main line disconnect switch.

19. Run the car and ensure that the safeties have reset and are not dragging.

Counterweight Governor (if applicable)

1. Position the elevator one floor above the bottom terminal landing.

2.. Turn the CIS / MRO keyswitch to the INSPECT position.



3. Place a temporary jumper on GCS I/O board plug P27-4 to P27-5 (CWOS).

4. Select the service tool sequence (M-2-2-5-1) to access the safety function display. Press the GO ON button to select Safety Checks and set as follows to enable CWT governor trip feature.

   CWT Gov Trp:enab (Counterweight Governor Trip: Enabled)



This setting will revert to "disabled" after one start.

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof.

5. Using the controller inspection station, initiate an up inspection run. With the car running up on inspection, press the "GOV TRIP / RESET" button on the GCS I/O board to activate the governor trip solenoid. Confirm that the counterweight stops when the governor trips and the counterweight safeties are applied.



Hold the "GOV TRIP / RESET" button for a period long enough to allow the governor sheave to rotate as least 180 degrees, as it may take that long for the mechanical linkages to engage.

6. Release the buttons as soon as the car stops to prevent belt damage.

7. Using the controller inspection station, run the elevator down to release the counterweight safeties and reset the governor mechanism.

8. **Remove the temporary jumper on GCS I/O board plug P27-4 to P27-5 (CWOS switch).**

9. Select the service tool sequence (M-2-2-5-1) to access the safety function display. Press the GO ON button to select safety checks and set as follows to enable CWT governor reset feature.

   CWT Gov Rst:enab (Counterweight Governor Reset: Enabled)

10. Press the "GOV TRIP / RESET" button on the GCS I/O board to activate the governor reset solenoid. It may be necessary to repeat the procedure several times to reset the counterweight governor switch. Press the "MANUAL RESET" button on the GCS I/O board, cycle the main line disconnect switch and then confirm that the safety circuit is restored indicating that the governor overspeed switch and reset confirmation switch is reset.

11. Run the car to ensure the safeties have reset and are not dragging

WARNING: The use and ownership of this work is defined in the legend upon the front page hereof

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WARNING: The use and ownership of this work is defined in the legend upon the front page hereof

2675 Scott Ave., Suite C
St. Louis, MO 63103
main 314.535.4544 | fax 314.535.0144
www.ahernfire.com

Webster University ISB

8274 Big Bend Blvd
Webster Groves, MO 63119

Fire Protection
Operating & Maintenance Manual

OPERATING & MAINTENANCE MANUAL

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8.Inspection Services
9.Code Requirements for Visual Inspection
10. Learn More About Ahern Fire Protection Services

2675 Scott Ave., Suite C
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September 8, 2017

Doug Mayhew
Paric Corporation
77 Westport Plaza Drive Suite 250
St. Louis, MO 63146
Ph: 636.561.9500
Fax: (636) 561-9501
Email: ddmayhew@paric.com

RE: PROJECT NAME: WEBSTER UNIVERSITY
FIRE PROTECTION SYSTEM WARRANTY
AFP PROJECT No.: 461259

Dear Mr. Mayhew:

Please be hereby advised that our above referenced Automatic Fire Protection System was placed in service on September 1, 2017.

Beginning with the above installation date, the system's materials and workmanship will be under warranty for one (1) year. However, we do not guarantee the operation of the installation due to factors beyond our control, i.e. potentially closed valves or depleted municipal water supply.

Thank you for this opportunity to be of service.

Very truly yours,

AHERN FIRE PROTECTION
A division of J. F. Ahern Co.



Casey Jackson
Vice President

CJ\kab
cc: File

Z:\Fire\416DATA\461259\O&M\Warranty Letter.doc

AHERN FIRE PROTECTION - ST. LOUIS

Contractor's Material and Test Certificate for ABOVE GROUND PIPING

PROCEDURE

Upon completion of work, inspection and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.

A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.

PROPERTY NAME:	**WEBSTER UNIV - ISB**	AFP # 461259
ADDRESS:	**8274 BIG BEND BLVD., WEBSTER GROVES, MO**	

PLANS

ACCEPTED BY APPROVING AUTHORITIES (NAMES)
1 CITY OF WEBSTER GROVES
2

ADDRESS
1
2

INSTALLATION CONFORMS TO ACCEPTED PLANS	[x] YES	[ ] NO
EQUIPMENT USED IS APPROVED	[x] YES	[ ] NO
IF NO, EXPLAIN DEVIATIONS		

INSTRUCTIONS

HAS PERSON IN CHARGE OF FIRE EQUIPMENT BEEN INSTRUCTED AS TO LOCATION OF CONTROL VALVES AND CARE AND MAINTENANCE OF EQUIPMENT?	[x] YES	[ ] NO
IF NO, EXPLAIN.		

HAVE COPIES OF THE FOLLOWING BEEN LEFT ON THE PREMISES?	[x] YES	[ ] NO
1. SYSTEM COMPONENTS INSTRUCTIONS		
2. CARE AND MAINTENANCE INSTRUCTIONS		
3. NFPA 25		

LOCATION OF SYSTEM

SYSTEM 1 (INCLUDING BASEMENT)

SPRINKLERS

MAKE	MODEL	YEAR OF MANUFACTURE	ORIFICE SIZE/ K FACTOR	QTY.	TEMP.
VIKING	VK300 - BRZ UPR	2016	5.6	1	155
VIKING	VK350 - BRZ UPR	2016	8.0	62	200
VIKING	VK462 - CONCLD	2016	5.6	35	155
VIKING	VK634 - EC CONCLD	2016	8.0	66	155
VIKING	VK464 -CONCLD	2016	8.0	18	200
VIKING	VK532 - EC BRZ UPR	2016	11.2	15	200
RELIABLE	RA5114 - DRY PND CONCLD	2016	5.6	1	155

PIPE AND FITTINGS

1-2.5" S40 BLK PIPE AND 3-6" S10 BLK PIPE, BLK GRVD FITTINGS, BLK DI THRD FITTINGS

ALARM VALVE OR FLOW INDICATOR

ALARM DEVICE TYPE	ALARM DEVICE MAKE	ALARM DEVICE MODEL	MAXIMUM TIME TO OPERATE THROUGH TEST CONNECTION MIN.	MIN.	SEC.
VANE TYPE	SYSTEM SENSOR	WFD			47

TAMPER SWITCHES

TYPE	MAKE	MODEL	QTY.	DID TAMPER SWITCH / SWITCHES WORK?
BUTTERFLY	VICAULIC	705-W	1	

DRY PIPE OPERATING TEST

DRY VALVE MAKE & MODEL	DRY VALVE SERIAL NO.	Q. O. D. MAKE & MODEL	Q. O. D. SERIAL NO.

	TIME TO TRIP TEST CONNECTION* MIN.	TIME TO TRIP TEST CONNECTION* SEC.	WATER PRESSURE PSI	AIR PRESSURE PSI	TRIP POINT AIR PRESSURE PSI	TIME WATER REACHED TEST OUTLET * MIN.	TIME WATER REACHED TEST OUTLET * SEC.	ALARM OPERATED YES / NO
WITHOUT Q. O. D.								
WITH Q. O. D.								

IF NO, EXPLAIN:

* MEASURED FROM TIME INSPECTORS TEST CONNECTION IS OPENED.

DELUGE & PREACTION VALVES

OPERATION: [ ] PNEUMATIC [ ] ELECTRIC [ ] HYDRAULIC

PIPING SUPERVISED [ ] YES [ ] NO | DETECTING MEDIA SUPERVISED [ ] YES [ ] NO

DOES VALVE OPERATE FROM THE MANUAL TRIP AND/OR REMOTE CONTROL STATIONS? [ ] YES [ ] NO

IS THERE AN ACCESSIBLE FACILITY IN EACH CIRCUIT FOR TESTING? [ ] YES [ ] NO

IF NO, EXPLAIN:

MAKE	MODEL	DOES EACH CIRCUIT OPERATE SUPERVISION LOSS ALARM?		DOES EACH CIRCUIT OPERATE VALVE RELEASE?		MAXIMUM TIME TO OPERATE RELEASE	
		YES	NO	YES	NO	MIN.	SEC.

PRESSURE REDUCING VALVE TEST

LOC. & FLOOR	MAKE	MODEL	SETTING	STATIC PRESSURE		RESIDUAL PRESSURE		FLOW RATE
				INLET (PSI)	OUTLET (PSI)	INLET (PSI)	OUTLET (PSI)	

TEST DESCRIPTION

HYDROSTATIC: Hydrostatic tests shall be made at not less than 200 psi (13.6 bars) for two hours or 50 psi (3.4 bars) above static pressure in excess of 150 psi (10.2 bars) for two hours. Differential dry-pipe valve clappers shall be left open during test to prevent damage. All aboveground piping leakage shall be stopped.

PNEUMATIC: Establish 40 psi (2.7 bars) air pressure and measure drop, which shall not exceed 1-1/2 psi (0.1 bars) in 24 hours. Test pressure tanks normal water level and air pressure and measure air pressure drop, which shall not exceed 1-1/2 psi (0.1 bars) in 24 hours.

TESTS

ALL PIPING HYDROSTATICALLY TESTED AT: 225 PSI FOR 2 HRS. | IF NO, STATE REASON:

DRY PIPING PNEUMATICALLY TESTED: [ ] YES [ ] NO

EQUIPMENT OPERATES PROPERLY: [ ] YES [ ] NO

DO YOU CERTIFY AS THE SPRINKLER CONTRACTOR THAT ADDITIVES AND CORROSIVE CHEMICALS, SODIUM SILICATE OR DERIVATIVES OF SODIUM SILICATE, BRINE, OR OTHER CORROSIVE CHEMICALS WERE NOT USED FOR TESTING SYSTEMS OR STOPPING LEAKS? [X] YES [ ] NO

DRAIN TEST: READING OF GAGE LOCATED NEAR WATER SUPPLY TEST CONNECTION: _____ PSI

RESIDUAL PRESSURE WITH VALVE IN TEST CONNECTION OPEN WIDE: _____ PSI

UNDERGROUND MAINS AND LEAD IN CONNECTIONS TO SYSTEM RISERS FLUSHED BEFORE CONNECTION MADE TO SPRINKLER PIPING.

VERIFIED BY COPY OF THE U FORM NO. 85B: [X] YES [ ] NO | IF NO, EXPLAIN:

FLUSHED BY INSTALLER OF UNDERGROUND SPRINKLER PIPING: [X] YES [ ] NO

HYDROSTATIC SIGNATURES

HYDROSTATIC TESTS WITNESSED BY:

FOR PROPERTY OWNER/REPRESENTATIVE (SIGNATURE)	TITLE	DATE
FOR SPRINKLER CONTRACTOR (SIGNATURE)	TITLE	DATE

WELDING

WELDING PIPE: [X] YES [ ] NO

IF YES:

1. DO YOU CERTIFY AS THE SPRINKLER CONTRACTOR THAT WELDING PROCEDURES COMPLY WITH THE REQUIREMENTS OF AT LEAST AWS D10.9, LEVEL AR-3? [X] YES [ ] NO
2. DO YOU CERTIFY THAT THE WELDING WAS PERFORMED BY WELDERS QUALIFIED IN COMPLIANCE WITH THE REQUIREMENTS OF AT LEAST AWS D 10.9, LEVEL AR-3? [X] YES [ ] NO
3. DO YOU CERTIFY THAT WELDING WAS CARRIED OUT IN COMPLIANCE WITH A DOCUMENTED QUALITY CONTROL PROCEDURE TO INSURE THAT ALL DISCS ARE RETRIEVED, THAT OPENINGS IN PIPING ARE SMOOTH, THAT SLAG AND OTHER WELDING RESIDUE ARE REMOVED, AND THAT INTERNAL DIAMETERS OF PIPING ARE NOT PENETRATED: [X] YES [ ] NO

CUTOUTS

DO YOU CERTIFY THAT YOU HAVE A CONTROL FEATURE TO ENSURE ALL CUTOUTS (DISCS) ARE RETRIEVED? [X] YES [ ] NO

HYDRAULIC DATA NAME PLATE

NAMEPLATE PROVIDED? [X] YES [ ] NO

IF NO, EXPLAIN:

REMARKS

DATE LEFT IN SERVICE WITH ALL CONTROL VALVES OPEN: ----------

ALARM TEST/ FINALS SIGNATURES

NAME OF SPRINKLER CONTRACTOR:

AHERN FIRE PROTECTION / 2675 Scott Ave. Suite C / St. Louis, MO 63103 / 314/535-4544

TESTS WITNESSED BY:

FOR PROPERTY OWNER (SIGNATURE)	TITLE	DATE
FOR SPRINKLER CONTRACTOR (SIGNATURE)	TITLE	DATE
Steve Summers	Foreman	

ADDITIONAL EXPLANATION AND NOTES:

AHERN FIRE PROTECTION - ST. LOUIS

Contractor's Material and Test Certificate for ABOVE GROUND PIPING

PROCEDURE

Upon completion of work, inspection and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.

A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.

PROPERTY NAME:	**WEBSTER UNIV - ISB**	AFP # 461259
ADDRESS:	**8274 BIG BEND BLVD., WEBSTER GROVES, MO**	

PLANS

ACCEPTED BY APPROVING AUTHORITIES (NAMES)
1 CITY OF WEBSTER GROVES
2

ADDRESS
1
2

INSTALLATION CONFORMS TO ACCEPTED PLANS	[x] YES	[ ] NO
EQUIPMENT USED IS APPROVED	[x] YES	[ ] NO
IF NO, EXPLAIN DEVIATIONS		

INSTRUCTIONS

HAS PERSON IN CHARGE OF FIRE EQUIPMENT BEEN INSTRUCTED AS TO LOCATION OF CONTROL VALVES AND CARE AND MAINTENANCE OF EQUIPMENT?	[x] YES	[ ] NO
IF NO, EXPLAIN.		
HAVE COPIES OF THE FOLLOWING BEEN LEFT ON THE PREMISES?	[x] YES	[ ] NO

1. SYSTEM COMPONENTS INSTRUCTIONS
2. CARE AND MAINTENANCE INSTRUCTIONS
3. NFPA 25

LOCATION OF SYSTEM: **SYSTEM 2**

SPRINKLERS

MAKE	MODEL	YEAR OF MANUFACTURE	ORIFICE SIZE/ K FACTOR	QTY.	TEMP.
VIKING	VK300 - BRZ UPR	2016	5.6	-	155
VIKING	VK350 - BRZ UPR	2016	8.0	4	200
VIKING	VK462 - CONCLD	2016	5.6	22	155
VIKING	VK634 - EC CONCLD	2016	8.0	70	155
VIKING	VK464 -CONCLD	2016	8.0	8	200
VIKING	VK532 - EC BRZ UPR	2016	11.2	-	200
RELIABLE	RA5114 - DRY PND CONCLD	2016	5.6	22	155

PIPE AND FITTINGS: **1-2.5" S40 BLK PIPE AND 3-6" S10 BLK PIPE, BLK GRVD FITTINGS, BLK DI THRD FITTINGS**

ALARM VALVE OR FLOW INDICATOR

ALARM DEVICE TYPE	ALARM DEVICE MAKE	ALARM DEVICE MODEL	MAXIMUM TIME TO OPERATE THROUGH TEST CONNECTION MIN.	SEC.
VANE TYPE	SYSTEM SENSOR	WFD		43

TAMPER SWITCHES

TYPE	MAKE	MODEL	QTY.	DID TAMPER SWITCH / SWITCHES WORK?
BUTTERFLY	VICAULIC	705-W	1	

DRY PIPE OPERATING TEST

DRY VALVE MAKE & MODEL	DRY VALVE SERIAL NO.	Q. O. D. MAKE & MODEL	Q. O. D. SERIAL NO.

	TIME TO TRIP TEST CONNECTION* MIN.	TIME TO TRIP TEST CONNECTION* SEC.	WATER PRESSURE PSI	AIR PRESSURE PSI	TRIP POINT AIR PRESSURE PSI	TIME WATER REACHED TEST OUTLET * MIN.	TIME WATER REACHED TEST OUTLET * SEC.	ALARM OPERATED YES / NO
WITHOUT Q. O. D.								
WITH Q. O. D.								

IF NO, EXPLAIN:

* MEASURED FROM TIME INSPECTORS TEST CONNECTION IS OPENED

DELUGE & PREACTION VALVES

OPERATION: [ ] PNEUMATIC [ ] ELECTRIC [ ] HYDRAULIC

PIPING SUPERVISED [ ] YES [ ] NO | DETECTING MEDIA SUPERVISED [ ] YES [ ] NO

DOES VALVE OPERATE FROM THE MANUAL TRIP AND/OR REMOTE CONTROL STATIONS? [ ] YES [ ] NO

IS THERE AN ACCESSIBLE FACILITY IN EACH CIRCUIT FOR TESTING? [ ] YES [ ] NO

IF NO, EXPLAIN:

MAKE	MODEL	DOES EACH CIRCUIT OPERATE SUPERVISION LOSS ALARM?		DOES EACH CIRCUIT OPERATE VALVE RELEASE?		MAXIMUM TIME TO OPERATE RELEASE	
		YES	NO	YES	NO	MIN.	SEC.

PRESSURE REDUCING VALVE TEST

LOC. & FLOOR	MAKE	MODEL	SETTING	STATIC PRESSURE		RESIDUAL PRESSURE		FLOW
				INLET (PSI)	OUTLET (PSI)	INLET (PSI)	OUTLET (PSI)	RATE

TEST DESCRIPTION

HYDROSTATIC: Hydrostatic tests shall be made at not less than 200 psi (13.6 bars) for two hours or 50 psi (3.4 bars) above static pressure in excess of 150 psi (10.2 bars) for two hours. Differential dry-pipe valve clappers shall be left open during test to prevent damage. All aboveground piping leakage shall be stopped.

PNEUMATIC: Establish 40 psi (2.7 bars) air pressure and measure drop, which shall not exceed 1-1/2 psi (0.1 bars) in 24 hours. Test pressure tanks normal water level and air pressure and measure air pressure drop, which shall not exceed 1-1/2 psi (0.1 bars) in 24 hours.

TESTS

ALL PIPING HYDROSTATICALLY TESTED AT: 225 PSI FOR 2 HRS. | IF NO, STATE REASON:

DRY PIPING PNEUMATICALLY TESTED: [ ] YES [ ] NO

EQUIPMENT OPERATES PROPERLY: [ ] YES [ ] NO

DO YOU CERTIFY AS THE SPRINKLER CONTRACTOR THAT ADDITIVES AND CORROSIVE CHEMICALS, SODIUM SILICATE OR DERIVATIVES OF SODIUM SILICATE, BRINE, OR OTHER CORROSIVE CHEMICALS WERE NOT USED FOR TESTING SYSTEMS OR STOPPING LEAKS? [X] YES [ ] NO

DRAIN TEST: READING OF GAGE LOCATED NEAR WATER SUPPLY TEST CONNECTION: _____ PSI

RESIDUAL PRESSURE WITH VALVE IN TEST CONNECTION OPEN WIDE: _____ PSI

UNDERGROUND MAINS AND LEAD IN CONNECTIONS TO SYSTEM RISERS FLUSHED BEFORE CONNECTION MADE TO SPRINKLER PIPING.

VERIFIED BY COPY OF THE U FORM NO. 85B: [X] YES [ ] NO | IF NO, EXPLAIN:

FLUSHED BY INSTALLER OF UNDERGROUND SPRINKLER PIPING: [X] YES [ ] NO

HYDROSTATIC SIGNATURES

HYDROSTATIC TESTS WITNESSED BY:

FOR PROPERTY OWNER/REPRESENTATIVE (SIGNATURE)	TITLE	DATE

FOR SPRINKLER CONTRACTOR (SIGNATURE)	TITLE	DATE

WELDING

WELDING PIPE: [X] YES [ ] NO

IF YES:

1. DO YOU CERTIFY AS THE SPRINKLER CONTRACTOR THAT WELDING PROCEDURES COMPLY WITH THE REQUIREMENTS OF AT LEAST AWS D10.9, LEVEL AR-3? [X] YES [ ] NO
2. DO YOU CERTIFY THAT THE WELDING WAS PERFORMED BY WELDERS QUALIFIED IN COMPLIANCE WITH THE REQUIREMENTS OF AT LEAST AWS D 10.9, LEVEL AR-3? [X] YES [ ] NO
3. DO YOU CERTIFY THAT WELDING WAS CARRIED OUT IN COMPLIANCE WITH A DOCUMENTED QUALITY CONTROL PROCEDURE TO INSURE THAT ALL DISCS ARE RETRIEVED, THAT OPENINGS IN PIPING ARE SMOOTH, THAT SLAG AND OTHER WELDING RESIDUE ARE REMOVED, AND THAT INTERNAL DIAMETERS OF PIPING ARE NOT PENETRATED: [X] YES [ ] NO

CUTOUTS

DO YOU CERTIFY THAT YOU HAVE A CONTROL FEATURE TO ENSURE ALL CUTOUTS (DISCS) ARE RETRIEVED? [X] YES [ ] NO

HYDRAULIC DATA NAME PLATE

NAMEPLATE PROVIDED? [X] YES [ ] NO

IF NO, EXPLAIN:

REMARKS

DATE LEFT IN SERVICE WITH ALL CONTROL VALVES OPEN: ----------

ALARM TEST/ FINALS SIGNATURES

NAME OF SPRINKLER CONTRACTOR:

AHERN FIRE PROTECTION / 2675 Scott Ave. Suite C / St. Louis, MO 63103 / 314/535-4544

TESTS WITNESSED BY:

FOR PROPERTY OWNER (SIGNATURE)	TITLE	DATE
Steve Summers		

FOR SPRINKLER CONTRACTOR (SIGNATURE)	TITLE	DATE
Steve Summers	Foreman	

ADDITIONAL EXPLANATION AND NOTES:

AHERN FIRE PROTECTION - ST. LOUIS

Contractor's Material and Test Certificate for ABOVE GROUND PIPING

PROCEDURE

Upon completion of work, inspection and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.

A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.

PROPERTY NAME:	**WEBSTER UNIV - ISB**	AFP # 461259
ADDRESS:	**8274 BIG BEND BLVD., WEBSTER GROVES, MO**	

PLANS

ACCEPTED BY APPROVING AUTHORITIES (NAMES)
1 CITY OF WEBSTER GROVES
2

ADDRESS
1
2

INSTALLATION CONFORMS TO ACCEPTED PLANS	[x] YES	[ ] NO
EQUIPMENT USED IS APPROVED	[x] YES	[ ] NO
IF NO, EXPLAIN DEVIATIONS		

INSTRUCTIONS

HAS PERSON IN CHARGE OF FIRE EQUIPMENT BEEN INSTRUCTED AS TO LOCATION OF CONTROL VALVES AND CARE AND MAINTENANCE OF EQUIPMENT?	[x] YES	[ ] NO
IF NO, EXPLAIN.		

HAVE COPIES OF THE FOLLOWING BEEN LEFT ON THE PREMISES?	[x] YES	[ ] NO
1. SYSTEM COMPONENTS INSTRUCTIONS		
2. CARE AND MAINTENANCE INSTRUCTIONS		
3. NFPA 25		

LOCATION OF SYSTEM: **SYSTEM 3**

SPRINKLERS

MAKE	MODEL	YEAR OF MANUFACTURE	ORIFICE SIZE/ K FACTOR	QTY.	TEMP.
VIKING	**VK300 - BRZ UPR**	**2016**	**5.6**	**-**	**155**
VIKING	**VK534 - WHT PND**	**2016**	**11.2**	**3**	**200**
VIKING	**VK462 - CONCLD**	**2016**	**5.6**	**46**	**155**
VIKING	**VK634 - EC CONCLD**	**2016**	**8.0**	**71**	**155**
VIKING	**VK464 -CONCLD**	**2016**	**8.0**	**2**	**200**
VIKING	**VK532 - EC BRZ UPR**	**2016**	**11.2**	**3**	**200**
RELIABLE	**RA5114 - DRY PND CONCLD**	**2016**	**5.6**	**1**	**155**

PIPE AND FITTINGS: **1-2.5" S40 BLK PIPE AND 3-6" S10 BLK PIPE, BLK GRVD FITTINGS, BLK DI THRD FITTINGS**

ALARM VALVE OR FLOW INDICATOR

ALARM DEVICE TYPE	ALARM DEVICE MAKE	ALARM DEVICE MODEL	MAXIMUM TIME TO OPERATE THROUGH TEST CONNECTION MIN.	MAXIMUM TIME TO OPERATE THROUGH TEST CONNECTION SEC.
VANE TYPE	**SYSTEM SENSOR**	**WFD**		45

TAMPER SWITCHES

TYPE	MAKE	MODEL	QTY.	DID TAMPER SWITCH / SWITCHES WORK?
BUTTERFLY	**VICAULIC**	**705-W**	1	

DRY PIPE OPERATING TEST

DRY VALVE MAKE & MODEL	DRY VALVE SERIAL NO.	Q. O. D. MAKE & MODEL	Q. O. D. SERIAL NO.

	TIME TO TRIP TEST CONNECTION* MIN.	TIME TO TRIP TEST CONNECTION* SEC.	WATER PRESSURE PSI	AIR PRESSURE PSI	TRIP POINT AIR PRESSURE PSI	TIME WATER REACHED TEST OUTLET * MIN.	TIME WATER REACHED TEST OUTLET * SEC.	ALARM OPERATED YES / NO
WITHOUT Q. O. D.								
WITH Q. O. D.								

IF NO, EXPLAIN:

* MEASURED FROM TIME INSPECTORS TEST CONNECTION IS OPENED

DELUGE & PREACTION VALVES

OPERATION: [ ] PNEUMATIC [ ] ELECTRIC [ ] HYDRAULIC

PIPING SUPERVISED [ ] YES [ ] NO | DETECTING MEDIA SUPERVISED [ ] YES [ ] NO

DOES VALVE OPERATE FROM THE MANUAL TRIP AND/OR REMOTE CONTROL STATIONS? [ ] YES [ ] NO

IS THERE AN ACCESSIBLE FACILITY IN EACH CIRCUIT FOR TESTING? [ ] YES [ ] NO

IF NO, EXPLAIN:

MAKE	MODEL	DOES EACH CIRCUIT OPERATE SUPERVISION LOSS ALARM?		DOES EACH CIRCUIT OPERATE VALVE RELEASE?		MAXIMUM TIME TO OPERATE RELEASE	
		YES	NO	YES	NO	MIN.	SEC.

PRESSURE REDUCING VALVE TEST

LOC. & FLOOR	MAKE	MODEL	SETTING	STATIC PRESSURE		RESIDUAL PRESSURE		FLOW RATE
				INLET (PSI)	OUTLET (PSI)	INLET (PSI	OUTLET (PSI)	

TEST DESCRIPTION

HYDROSTATIC: Hydrostatic tests shall be made at not less than 200 psi (13.6 bars) for two hours or 50 psi (3.4 bars) above static pressure in excess of 150 psi (10.2 bars) for two hours. Differential dry-pipe valve clappers shall be left open during test to prevent damage. All aboveground piping leakage shall be stopped.

PNEUMATIC: Establish 40 psi (2.7 bars) air pressure and measure drop, which shall not exceed 1-1/2 psi (0.1 bars) in 24 hours. Test pressure tanks normal water level and air pressure and measure air pressure drop, which shall not exceed 1-1/2 psi (0.1 bars) in 24 hours.

TESTS

ALL PIPING HYDROSTATICALLY TESTED AT: 225 PSI FOR 2 HRS. | IF NO, STATE REASON:

DRY PIPING PNEUMATICALLY TESTED: [ ] YES [ ] NO

EQUIPMENT OPERATES PROPERLY: [ ] YES [ ] NO

DO YOU CERTIFY AS THE SPRINKLER CONTRACTOR THAT ADDITIVES AND CORROSIVE CHEMICALS, SODIUM SILICATE OR DERIVATIVES OF SODIUM SILICATE, BRINE, OR OTHER CORROSIVE CHEMICALS WERE NOT USED FOR TESTING SYSTEMS OR STOPPING LEAKS? [X] YES [ ] NO

DRAIN TEST: READING OF GAGE LOCATED NEAR WATER SUPPLY TEST CONNECTION: _____ PSI

RESIDUAL PRESSURE WITH VALVE IN TEST CONNECTION OPEN WIDE: _____ PSI

UNDERGROUND MAINS AND LEAD IN CONNECTIONS TO SYSTEM RISERS FLUSHED BEFORE CONNECTION MADE TO SPRINKLER PIPING.

VERIFIED BY COPY OF THE U FORM NO. 85B: [X] YES [ ] NO | IF NO, EXPLAIN:

FLUSHED BY INSTALLER OF UNDERGROUND SPRINKLER PIPING: [X] YES [ ] NO

HYDROSTATIC SIGNATURES

HYDROSTATIC TESTS WITNESSED BY:

FOR PROPERTY OWNER/REPRESENTATIVE (SIGNATURE)	TITLE	DATE

FOR SPRINKLER CONTRACTOR (SIGNATURE)	TITLE	DATE

WELDING

WELDING PIPE: [X] YES [ ] NO

IF YES:

1. DO YOU CERTIFY AS THE SPRINKLER CONTRACTOR THAT WELDING PROCEDURES COMPLY WITH THE REQUIREMENTS OF AT LEAST AWS D10.9, LEVEL AR-3? [X] YES [ ] NO
2. DO YOU CERTIFY THAT THE WELDING WAS PERFORMED BY WELDERS QUALIFIED IN COMPLIANCE WITH THE REQUIREMENTS OF AT LEAST AWS D 10.9, LEVEL AR-3? [X] YES [ ] NO
3. DO YOU CERTIFY THAT WELDING WAS CARRIED OUT IN COMPLIANCE WITH A DOCUMENTED QUALITY CONTROL PROCEDURE TO INSURE THAT ALL DISCS ARE RETRIEVED, THAT OPENINGS IN PIPING ARE SMOOTH, THAT SLAG AND OTHER WELDING RESIDUE ARE REMOVED, AND THAT INTERNAL DIAMETERS OF PIPING ARE NOT PENETRATED: [X] YES [ ] NO

CUTOUTS

DO YOU CERTIFY THAT YOU HAVE A CONTROL FEATURE TO ENSURE ALL CUTOUTS (DISCS) ARE RETRIEVED? [X] YES [ ] NO

HYDRAULIC DATA NAME PLATE

NAMEPLATE PROVIDED? [X] YES [ ] NO

IF NO, EXPLAIN:

REMARKS

DATE LEFT IN SERVICE WITH ALL CONTROL VALVES OPEN: ----------

ALARM TEST/ FINALS SIGNATURES

NAME OF SPRINKLER CONTRACTOR:

AHERN FIRE PROTECTION / 2675 Scott Ave. Suite C / St. Louis, MO 63103 / 314/535-4544

TESTS WITNESSED BY:

FOR PROPERTY OWNER (SIGNATURE)	TITLE	DATE

FOR SPRINKLER CONTRACTOR (SIGNATURE)	TITLE	DATE
Steve Summers	Foreman	

ADDITIONAL EXPLANATION AND NOTES:

AHERN FIRE PROTECTION - ST. LOUIS

Contractor's Material and Test Certificate for ABOVE GROUND PIPING

PROCEDURE

Upon completion of work, inspection and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.

A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.

PROPERTY NAME:	**WEBSTER UNIV - ISB**	AFP # 461259
ADDRESS:	**8274 BIG BEND BLVD., WEBSTER GROVES, MO**	

PLANS

ACCEPTED BY APPROVING AUTHORITIES (NAMES)
1 CITY OF WEBSTER GROVES
2

ADDRESS
1
2

INSTALLATION CONFORMS TO ACCEPTED PLANS	[x] YES	[ ] NO
EQUIPMENT USED IS APPROVED	[x] YES	[ ] NO
IF NO, EXPLAIN DEVIATIONS		

INSTRUCTIONS

HAS PERSON IN CHARGE OF FIRE EQUIPMENT BEEN INSTRUCTED AS TO LOCATION OF CONTROL VALVES AND CARE AND MAINTENANCE OF EQUIPMENT?	[x] YES	[ ] NO
IF NO, EXPLAIN.		

HAVE COPIES OF THE FOLLOWING BEEN LEFT ON THE PREMISES?	[x] YES	[ ] NO
1. SYSTEM COMPONENTS INSTRUCTIONS		
2. CARE AND MAINTENANCE INSTRUCTIONS		
3. NFPA 25		

LOCATION OF SYSTEM

SYSTEM 4

SPRINKLERS

MAKE	MODEL	YEAR OF MANUFACTURE	ORIFICE SIZE/ K FACTOR	QTY.	TEMP.
VIKING	VK300 - BRZ UPR	2016	5.6	1	155
VIKING	VK350 - BRZ UP	2016	8.0	2	200
VIKING	VK462 - CONCLD	2016	5.6	33	155
VIKING	VK634 - EC CONCLD	2016	8.0	57	155
VIKING	VK464 -CONCLD	2016	8.0	1	200
VIKING	VK532 - EC BRZ UPR	2016	11.2	2	200
VIKING	VK305 - WHT HSW	2016	5.6	2	200

PIPE AND FITTINGS

1-2.5" S40 BLK PIPE AND 3" S10 BLK PIPE, BLK GRVD FITTINGS, BLK DI THRD FITTINGS

ALARM VALVE OR FLOW INDICATOR

ALARM DEVICE TYPE	ALARM DEVICE MAKE	ALARM DEVICE MODEL	MAXIMUM TIME TO OPERATE THROUGH TEST CONNECTION MIN.	MIN. SEC.
VANE TYPE	SYSTEM SENSOR	WFD		49

TAMPER SWITCHES

TYPE	MAKE	MODEL	QTY.	DID TAMPER SWITCH / SWITCHES WORK?
BUTTERFLY	VICAULIC	705-W	1	

DRY PIPE OPERATING TEST

DRY VALVE MAKE & MODEL	DRY VALVE SERIAL NO.	Q.O.D. MAKE & MODEL	Q.O.D. SERIAL NO.

	TIME TO TRIP TEST CONNECTION* MIN.	TIME TO TRIP TEST CONNECTION* SEC.	WATER PRESSURE PSI	AIR PRESSURE PSI	TRIP POINT AIR PRESSURE PSI	TIME WATER REACHED TEST OUTLET * MIN.	TIME WATER REACHED TEST OUTLET * SEC.	ALARM OPERATED YES / NO
WITHOUT Q.O.D.								
WITH Q.O.D.								

IF NO, EXPLAIN:

* MEASURED FROM TIME INSPECTORS TEST CONNECTION IS OPENED.

DELUGE & PREACTION VALVES

OPERATION: [ ] PNEUMATIC [ ] ELECTRIC [ ] HYDRAULIC

PIPING SUPERVISED [ ] YES [ ] NO | DETECTING MEDIA SUPERVISED [ ] YES [ ] NO

DOES VALVE OPERATE FROM THE MANUAL TRIP AND/OR REMOTE CONTROL STATIONS? [ ] YES [ ] NO

IS THERE AN ACCESSIBLE FACILITY IN EACH CIRCUIT FOR TESTING? [ ] YES [ ] NO

IF NO, EXPLAIN:

MAKE	MODEL	DOES EACH CIRCUIT OPERATE SUPERVISION LOSS ALARM?		DOES EACH CIRCUIT OPERATE VALVE RELEASE?		MAXIMUM TIME TO OPERATE RELEASE	
		YES	NO	YES	NO	MIN.	SEC.

PRESSURE REDUCING VALVE TEST

LOC. & FLOOR	MAKE	MODEL	SETTING	STATIC PRESSURE		RESIDUAL PRESSURE		FLOW RATE
				INLET (PSI)	OUTLET (PSI)	INLET (PSI)	OUTLET (PSI)	

TEST DESCRIPTION

HYDROSTATIC: Hydrostatic tests shall be made at not less than 200 psi (13.6 bars) for two hours or 50 psi (3.4 bars) above static pressure in excess of 150 psi (10.2 bars) for two hours. Differential dry-pipe valve clappers shall be left open during test to prevent damage. All aboveground piping leakage shall be stopped.

PNEUMATIC: Establish 40 psi (2.7 bars) air pressure and measure drop, which shall not exceed 1-1/2 psi (0.1 bars) in 24 hours. Test pressure tanks normal water level and air pressure and measure air pressure drop, which shall not exceed 1-1/2 psi (0.1 bars) in 24 hours.

TESTS

ALL PIPING HYDROSTATICALLY TESTED AT: 225 PSI FOR 2 HRS. | IF NO, STATE REASON:

DRY PIPING PNEUMATICALLY TESTED: [ ] YES [ ] NO

EQUIPMENT OPERATES PROPERLY: [ ] YES [ ] NO

DO YOU CERTIFY AS THE SPRINKLER CONTRACTOR THAT ADDITIVES AND CORROSIVE CHEMICALS, SODIUM SILICATE OR DERIVATIVES OF SODIUM SILICATE, BRINE, OR OTHER CORROSIVE CHEMICALS WERE NOT USED FOR TESTING SYSTEMS OR STOPPING LEAKS? [X] YES [ ] NO

DRAIN TEST: READING OF GAGE LOCATED NEAR WATER SUPPLY TEST CONNECTION: _____ PSI

RESIDUAL PRESSURE WITH VALVE IN TEST CONNECTION OPEN WIDE: _____ PSI

UNDERGROUND MAINS AND LEAD IN CONNECTIONS TO SYSTEM RISERS FLUSHED BEFORE CONNECTION MADE TO SPRINKLER PIPING.

VERIFIED BY COPY OF THE U FORM NO. 85B: [X] YES [ ] NO | IF NO, EXPLAIN:

FLUSHED BY INSTALLER OF UNDERGROUND SPRINKLER PIPING: [X] YES [ ] NO

HYDROSTATIC SIGNATURES

HYDROSTATIC TESTS WITNESSED BY:

FOR PROPERTY OWNER/REPRESENTATIVE (SIGNATURE)	TITLE	DATE
FOR SPRINKLER CONTRACTOR (SIGNATURE)	TITLE	DATE

WELDING

WELDING PIPE: [X] YES [ ] NO

IF YES:

1. DO YOU CERTIFY AS THE SPRINKLER CONTRACTOR THAT WELDING PROCEDURES COMPLY WITH THE REQUIREMENTS OF AT LEAST AWS D10.9, LEVEL AR-3? [X] YES [ ] NO
2. DO YOU CERTIFY THAT THE WELDING WAS PERFORMED BY WELDERS QUALIFIED IN COMPLIANCE WITH THE REQUIREMENTS OF AT LEAST AWS D 10.9, LEVEL AR-3? [X] YES [ ] NO
3. DO YOU CERTIFY THAT WELDING WAS CARRIED OUT IN COMPLIANCE WITH A DOCUMENTED QUALITY CONTROL PROCEDURE TO INSURE THAT ALL DISCS ARE RETRIEVED, THAT OPENINGS IN PIPING ARE SMOOTH, THAT SLAG AND OTHER WELDING RESIDUE ARE REMOVED, AND THAT INTERNAL DIAMETERS OF PIPING ARE NOT PENETRATED: [X] YES [ ] NO

CUTOUTS

DO YOU CERTIFY THAT YOU HAVE A CONTROL FEATURE TO ENSURE ALL CUTOUTS (DISCS) ARE RETRIEVED? [X] YES [ ] NO

HYDRAULIC DATA NAME PLATE

NAMEPLATE PROVIDED? [X] YES [ ] NO

IF NO, EXPLAIN:

REMARKS

DATE LEFT IN SERVICE WITH ALL CONTROL VALVES OPEN: ----------

ALARM TEST/ FINALS SIGNATURES

NAME OF SPRINKLER CONTRACTOR:

AHERN FIRE PROTECTION / 2675 Scott Ave. Suite C / St. Louis, MO 63103 / 314/535-4544

TESTS WITNESSED BY:

FOR PROPERTY OWNER (SIGNATURE)	TITLE	DATE
FOR SPRINKLER CONTRACTOR (SIGNATURE) Steve Summers	TITLE Foreman	DATE

ADDITIONAL EXPLANATION AND NOTES:

AHERN FIRE PROTECTION - ST. LOUIS

Contractor's Material and Test Certificate for ABOVE GROUND PIPING

PROCEDURE

Upon completion of work, inspection and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.

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PROPERTY NAME:	**WEBSTER UNIV - ISB**	AFP # 461259
ADDRESS:	**8274 BIG BEND BLVD., WEBSTER GROVES, MO**	

PLANS

ACCEPTED BY APPROVING AUTHORITIES (NAMES)
1 CITY OF WEBSTER GROVES
2

ADDRESS
1
2

INSTALLATION CONFORMS TO ACCEPTED PLANS	[x] YES	[ ] NO
EQUIPMENT USED IS APPROVED	[x] YES	[ ] NO
IF NO, EXPLAIN DEVIATIONS		

INSTRUCTIONS

HAS PERSON IN CHARGE OF FIRE EQUIPMENT BEEN INSTRUCTED AS TO LOCATION OF CONTROL VALVES AND CARE AND MAINTENANCE OF EQUIPMENT?	[x] YES	[ ] NO
IF NO, EXPLAIN.		

HAVE COPIES OF THE FOLLOWING BEEN LEFT ON THE PREMISES?	[x] YES	[ ] NO
1. SYSTEM COMPONENTS INSTRUCTIONS		
2. CARE AND MAINTENANCE INSTRUCTIONS		
3. NFPA 25		

LOCATION OF SYSTEM: **PREACTION SYSTEM**

SPRINKLERS

MAKE	MODEL	YEAR OF MANUFACTURE	ORIFICE SIZE/ K FACTOR	QTY.	TEMP.
VIKING	**VK462 - CONCLD**	**2016**	**5.6**	**7**	**155**

PIPE AND FITTINGS: **S40 GALV ON PREACTION, BLK GRVD FITTINGS, BLK DI THRD FITTINGS**

ALARM VALVE OR FLOW INDICATOR

ALARM DEVICE			MAXIMUM TIME TO OPERATE THROUGH TEST CONNECTION	
TYPE	MAKE	MODEL	MIN.	SEC.
PRESSURE SWITCH	**POTTER**	**PS-10**		

TAMPER SWITCHES

TYPE	MAKE	MODEL	QTY.	DID TAMPER SWITCH / SWITCHES WORK?
BUTTERFLY	**VICAULIC**	**705-W**	1	
PRESSURE SWITCH	**POTTER**	**PS-40**	1	

DRY PIPE OPERATING TEST

DRY VALVE		Q. O. D.	
MAKE & MODEL	SERIAL NO.	MAKE & MODEL	SERIAL NO.

	TIME TO TRIP TEST CONNECTION*		WATER PRESSURE	AIR PRESSURE	TRIP POINT AIR PRESSURE	TIME WATER REACHED TEST OUTLET *		ALARM OPERATED
	MIN.	SEC.	PSI	PSI	PSI	MIN.	SEC.	YES / NO
WITHOUT Q. O. D.								
WITH Q. O. D.								

IF NO, EXPLAIN:

* MEASURED FROM TIME INSPECTORS TEST CONNECTION IS OPENED

DELUGE & PREACTION VALVES

OPERATION: ☑ PNEUMATIC ☑ ELECTRIC ☐ HYDRAULIC

PIPING SUPERVISED ☑ YES ☐ NO | DETECTING MEDIA SUPERVISED ☑ YES ☐ NO

DOES VALVE OPERATE FROM THE MANUAL TRIP AND/OR REMOTE CONTROL STATIONS? ☑ YES ☐ NO

IS THERE AN ACCESSIBLE FACILITY IN EACH CIRCUIT FOR TESTING? ☑ YES ☐ NO

IF NO, EXPLAIN:

MAKE	MODEL	DOES EACH CIRCUIT OPERATE SUPERVISION LOSS ALARM? YES	NO	DOES EACH CIRCUIT OPERATE VALVE RELEASE? YES	NO	MAXIMUM TIME TO OPERATE RELEASE. MIN.	SEC.
Viking	TotalPa	☑	☐	☑	☐	0	35

PRESSURE REDUCING VALVE TEST

LOC. & FLOOR	MAKE	MODEL	SETTING	STATIC PRESSURE INLET (PSI)	STATIC PRESSURE OUTLET (PSI)	RESIDUAL PRESSURE INLET (PSI)	RESIDUAL PRESSURE OUTLET (PSI)	FLOW RATE

TEST DESCRIPTION

HYDROSTATIC: Hydrostatic tests shall be made at not less than 200 psi (13.6 bars) for two hours or 50 psi (3.4 bars) above static pressure in excess of 150 psi (10.2 bars) for two hours. Differential dry-pipe valve clappers shall be left open during test to prevent damage. All aboveground piping leakage shall be stopped.

PNEUMATIC: Establish 40 psi (2.7 bars) air pressure and measure drop, which shall not exceed 1-1/2 psi (0.1 bars) in 24 hours. Test pressure tanks normal water level and air pressure and measure air pressure drop, which shall not exceed 1-1/2 psi (0.1 bars) in 24 hours.

TESTS

ALL PIPING HYDROSTATICALLY TESTED AT: 200 PSI FOR 2 HRS. | IF NO, STATE REASON:

DRY PIPING PNEUMATICALLY TESTED: ☑ YES ☐ NO

EQUIPMENT OPERATES PROPERLY: ☑ YES ☐ NO

DO YOU CERTIFY AS THE SPRINKLER CONTRACTOR THAT ADDITIVES AND CORROSIVE CHEMICALS, SODIUM SILICATE OR DERIVATIVES OF SODIUM SILICATE, BRINE, OR OTHER CORROSIVE CHEMICALS WERE NOT USED FOR TESTING SYSTEMS OR STOPPING LEAKS? ☐YES ☐NO

DRAIN TEST: READING OF GAGE LOCATED NEAR WATER SUPPLY TEST CONNECTION: 85 PSI

RESIDUAL PRESSURE WITH VALVE IN TEST CONNECTION OPEN WIDE: 71 PSI

UNDERGROUND MAINS AND LEAD IN CONNECTIONS TO SYSTEM RISERS FLUSHED BEFORE CONNECTION MADE TO SPRINKLER PIPING.

VERIFIED BY COPY OF THE U FORM NO. 85B: ☑ YES ☐ NO | IF NO, EXPLAIN:

FLUSHED BY INSTALLER OF UNDERGROUND SPRINKLER PIPING: ☑ YES ☐ NO

HYDROSTATIC SIGNATURES

HYDROSTATIC TESTS WITNESSED BY:

FOR PROPERTY OWNER/REPRESENTATIVE (SIGNATURE)	TITLE	DATE
	Superintendent	4/20/17
FOR SPRINKLER CONTRACTOR (SIGNATURE) Steve Summers	TITLE Foreman	DATE 4/20/17

WELDING

WELDING PIPE: ☐ YES ☑ NO

IF YES:

1. DO YOU CERTIFY AS THE SPRINKLER CONTRACTOR THAT WELDING PROCEDURES COMPLY WITH THE REQUIREMENTS OF AT LEAST AWS D10.9, LEVEL AR-3? ☐ YES ☐ NO
2. DO YOU CERTIFY THAT THE WELDING WAS PERFORMED BY WELDERS QUALIFIED IN COMPLIANCE WITH THE REQUIREMENTS OF AT LEAST AWS D 10.9, LEVEL AR-3? ☐ YES ☐ NO
3. DO YOU CERTIFY THAT WELDING WAS CARRIED OUT IN COMPLIANCE WITH A DOCUMENTED QUALITY CONTROL PROCEDURE TO INSURE THAT ALL DISCS ARE RETRIEVED, THAT OPENINGS IN PIPING ARE SMOOTH, THAT SLAG AND OTHER WELDING RESIDUE ARE REMOVED, AND THAT INTERNAL DIAMETERS OF PIPING ARE NOT PENETRATED: ☐ YES ☐ NO

CUTOUTS

DO YOU CERTIFY THAT YOU HAVE A CONTROL FEATURE TO ENSURE ALL CUTOUTS (DISCS) ARE RETRIEVED? ☐ YES ☐ NO

HYDRAULIC DATA NAME PLATE

NAMEPLATE PROVIDED? ☑ YES ☐ NO

IF NO, EXPLAIN:

REMARKS

DATE LEFT IN SERVICE WITH ALL CONTROL VALVES OPEN:

ALARM TEST/ FINALS SIGNATURES

NAME OF SPRINKLER CONTRACTOR: Ahern Fire Protection 2675 Scott Ave. Suite C St. Louis, MO 63103

TESTS WITNESSED BY:

FOR PROPERTY OWNER (SIGNATURE)	TITLE	DATE
	Superintendent	6/29/17
FOR SPRINKLER CONTRACTOR (SIGNATURE) Steve Summers	TITLE Foreman	DATE 6/29/17

ADDITIONAL EXPLANATION AND NOTES:

BRODZ SALES & ENGINEERING CO.
10751 Indian Head Industrial Blvd.
St. Louis, MO 63132
PH: (314) 890-8201
Fax: (314) 890-8204

AC Pump
8200 N. Austin
Morton Grove, IL 60063
PH: (847) 966-3700

Fire Pump Test

Location:	**Webster University - ISB**	Contractor:	**Ahern**		Date:	**6/26/2017**	
Address:	**8274 Big Bend Blvd**	City:	**Webster**	State: **MO**	Zip:	**63119**	

Pump

Fire Pump Manufacturer:	**AC**	Model:	**8100**	Serial #	**17-078136-01-01/QKZ959**
Size:	**8X6X12F-S**	Rated GPM:	**1000**	Rated Head:	**55** PSI

Driver

Drive	Electric	**X**	Manufacturer:	**WEG**	HP: **40**	RPM:	**1775**
	Diesel						
Model:	**040180P3EFP324TS**		Serial #	**01JUN2016 1032424340**	Voltage **460**	FLA	**49.4**

Controller

MFG	**EATON**	Model:	**FT70-40-D-L1-USB**	Serial #	**16D2695E**	Voltage **480**	AIC **100K**
JOCKEY MFG	**EATON**	Model:	**XTJP-G02-L1**	Serial #	**16D2695J**	Voltage	AIC **50K**

Pump Test Results

DRIVER		PUMP PRESSURE				NOZZLE SIZE - PRESSURE - GPM						TOTALS	
VOLTS	**AMPS**	**RPM**	**SUCT**	**DISC**	**NET**	**1**	**2**	**3**	**4**	**5**	**6**	**GPM**	**%**
475	**30**												
476	**29**	**1789**	**78**	**145**	**67**	AT SHUT OFF						**0**	**0**
476	**29**												
474	**39**					1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4		
474	**37**	**1783**	**70**	**130**	**60**	**32**	**0**	**0**	**0**	**0**	**0**	**502**	**50**
476	**39**					**502**	**0**	**0**	**0**	**0**	**0**		
473	**49**					1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4		
473	**47**	**1782**	**48**	**103**	**55**	**32**	**32**	**0**	**0**	**0**	**0**	**1004**	**100**
475	**48**					**502**	**502**	**0**	**0**	**0**	**0**		
474	**55**					1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4		
474	**53**	**1776**	**10**	**52**	**42**	**18**	**18**	**18**	**18**	**0**	**0**	**1504**	**150**
476	**54**					**376**	**376**	**376**	**376**	**0**	**0**		

Jockey Pump Pressure (PSIG) Fire Pump Presure (PSIG)

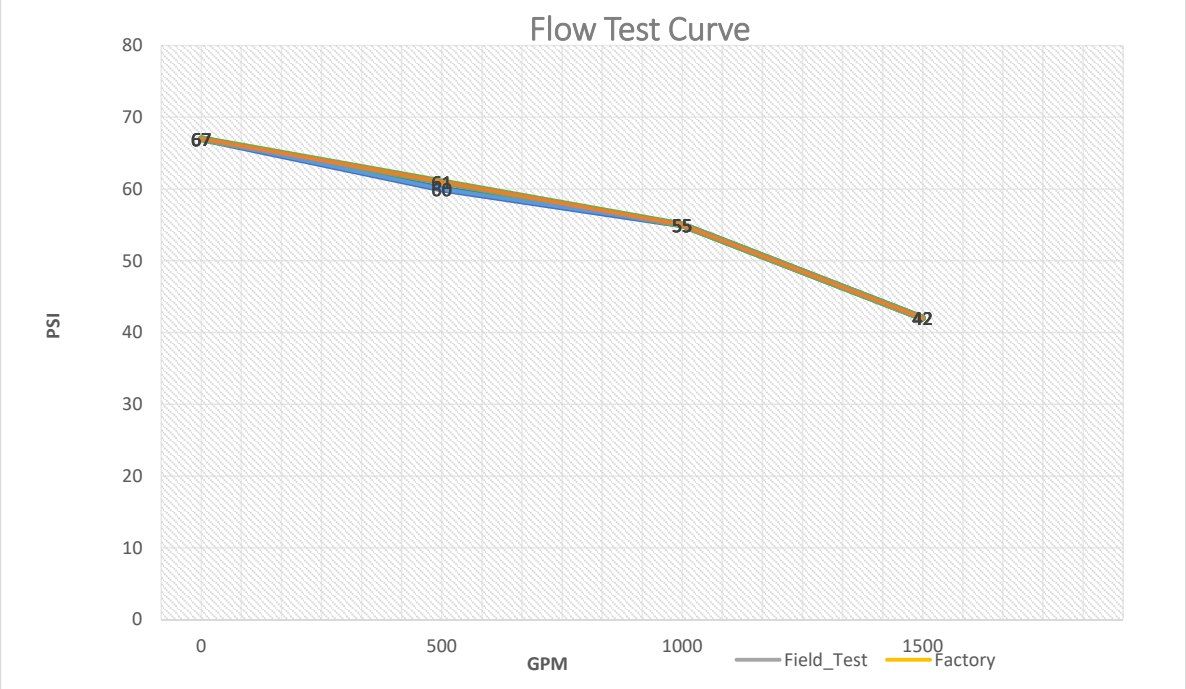
ON	**120**	OFF **135**	ON	**110**	OFF **135**		Manual Stop
						X	Automatic Stop @ 10 Minutes

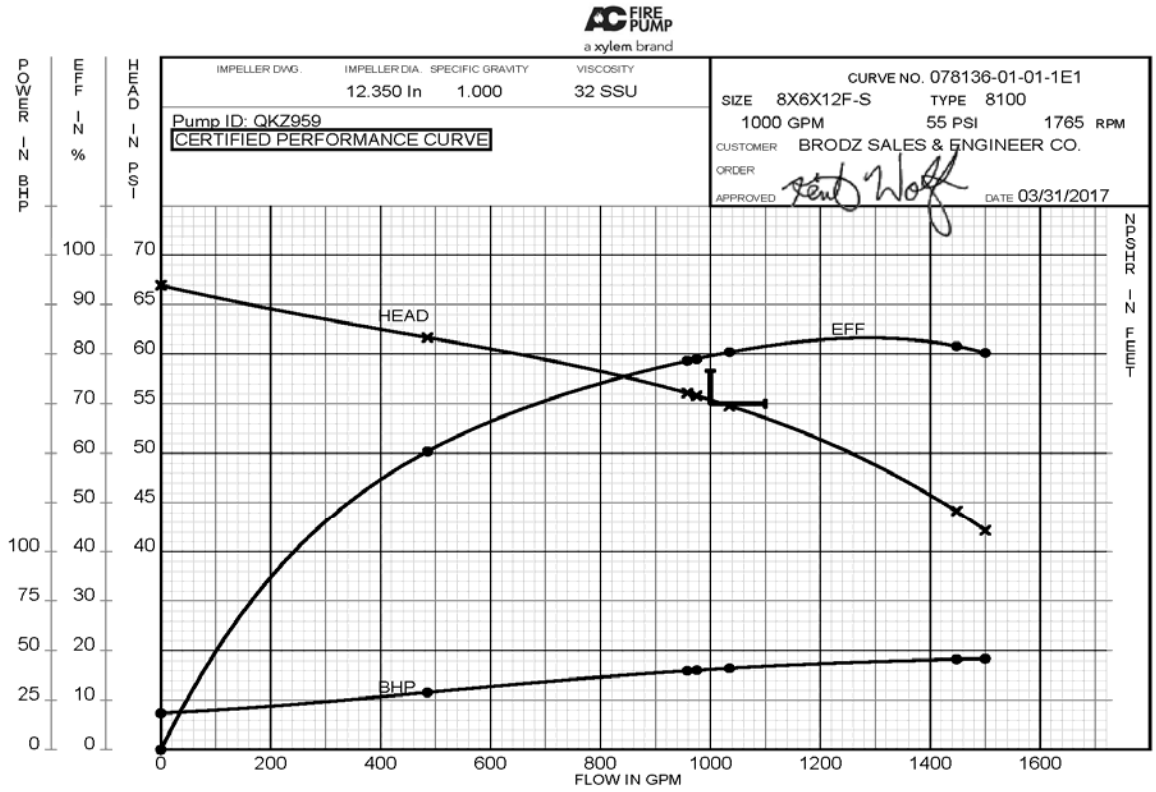
Manual Starts Normal **5** Emerg **4**	Automatic Starts Normal **4** Emerg **3**	Other:

Personnel at Test **Steve Summers - Ahern** **Liz Kelly - Ahern** **Dan Wagoner - Guarantee Electric** **Steve Carey - Brodz / AC Fire Pump**	Comments	
	Submitted By:	Steve Carey

Location:	Webster University - ISB	Contractor:	Ahern	Date:	6/26/2017
Address:	8274 Big Bend Blvd	City:	Webster	State:	MO
Zip:	63119				

Fire Pump Manufacturer:	AC	Model:	8100	Serial #	17-078136-01-01/QKZ959
Size:	8X6X12F-S	Rated GPM:	1000	Rated Head:	55 PSI





MISSOURI DEPARTMENT OF NATURAL RESOURCES
WATER PROTECTION PROGRAM
PUBLIC DRINKING WATER BRANCH

BACKFLOW PREVENTION ASSEMBLY TEST DATA AND MAINTENANCE REPORT

CUSTOMER	CUSTOMER NUMBER	FILE NUMBER
Webster University		

MAILING ADDRESS: 8274 Big Bend Blvd. Webster Groves, MO 63119

SERVICE LOCATION	METER NUMBER
ISB pump room	

DATE OF TEST	TIME	SUPPLY PRESSURE	AIR GAP (2 X SUPPLY DIAM.)	
8/7/17	8 am A.M. P.M.	85 LBS.	SUPPLY ____ IN. GAP ____ IN.	☐ PASS ☐ FAIL

TYPE OF ASSEMBLY	MANUFACTURER	MODEL	SIZE	SERIAL NUMBER
Double Check	Zurn Wilkins		6"	50099

HEIGHT OFF FLOOR	PROTECTION FROM:	COMMENTS:	NEW INSTALLATION
3 ft (IN./FT.)	FREEZING ☑ YES ☐ NO FLOODING ☑ YES ☐ NO		YES ☑ NO ☐

INITIAL TEST	Passed	Failed
REDUCED PRESSURE PRINCIPLE ASSEMBLY:	☐	☐
RELIEF VALVE OPENED AT ____ *PSID (2 PSID or more)	☐	☐
2ND CHECK held backpressure	☐	☐
NO. 2 SHUTOFF VALVE leak tight	☐	☐
1ST CHECK held in direction of flow ____ *PSID (5 PSID or more)	☐	☐
DIFFERENCE (1st check - relief) ____ PSID (3 PSID or more)	☐	☐

NOTE: Failure of any of the above items, requires repair.

FINAL TEST AFTER REPAIR	Passed	Failed
REDUCED PRESSURE PRINCIPLE ASSEMBLY:	☐	☐
RELIEF VALVE OPENED AT ____ PSID (2 PSID or more)	☐	☐
2ND CHECK held backpressure	☐	☐
NO. 2 SHUTOFF VALVE leak tight	☐	☐
1ST CHECK held in direction of flow ____ PSID (5 PSID or more)	☐	☐
DIFFERENCE (1st check - relief) ____ PSID (3 PSID or more)	☐	☐

*Pounds per Square Inch Differential

INITIAL TEST	Passed	Failed
DOUBLE CHECK VALVE ASSEMBLY:	☑	☐
1ST CHECK held in direction of flow 3 PSID (1 PSID or more)	☑	☐
2ND CHECK held in direction of flow 3 PSID (1 PSID or more)	☑	☐

NOTE: Failure of any of the above items, requires repair.

FINAL TEST AFTER REPAIR	Passed	Failed
DOUBLE CHECK VALVE ASSEMBLY:	☐	☐
1ST CHECK held in direction of flow ____ PSID (1 PSID or more)	☐	☐
2ND CHECK held in direction of flow ____ PSID (1 PSID or more)	☐	☐

APPLICATION:

☐ COMMERCIAL
☑ FIRE LINE
☐ IRRIGATION
☐ OTHER (EXPLAIN)

COMMENTS

THE ABOVE REPORT IS CERTIFIED TO BE TRUE, ACCURATE AND COMPLETE

TESTED BY (PRINT)	(SIGNATURE)	REPAIRED BY (PRINT)	(SIGNATURE)
Steve Summers.			
COMPANY		FINAL TEST BY (PRINT)	(SIGNATURE)
Ahern Fire Protection 2675 Scott Ave. Suite C St. Louis, MO			

CERTIFICATION NUMBER AND EXPIRATION DATE	OWNER OR OWNER'S REPRESENTATIVE	DATE
SF-9120. 3/31/19	Steve Ray. Paric Superintendent	8/7/17

Missouri state regulation 10 CSR 60-11.010(6)(E) requires testers to report results of tests and inspections to the customer and the water supplier.

Figure 10-1(b) Contractor's material and test certificate for underground piping.

Contractor's Material and Test Certificate for Underground Piping

PROCEDURE

Upon completion of work, inspection and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.

A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.

Property name: WEBSTER UNIVERSITY — Date: 5/3/2017

Property address: 8274 BIG BEND

Plans	Accepted by approving authorities (names)	
	Address	
	Installation conforms to accepted plans	☒ Yes ☐ No
	Equipment used is approved	☒ Yes ☐ No
	If no, state deviations	
Instructions	Has person in charge of fire equipment been instructed as to location of control valves and care and maintenance of this new equipment? If no, explain	☐ Yes ☐ No
	Have copies of appropriate instructions and care and maintenance charts been left on premises? If no, explain	☐ Yes ☐ No
Location	Supplies buildings	
Underground pipes and joints	Pipe types and class: DUCTILE — Type joint: MJ	
	Pipe conforms to _____ standard	☒ Yes ☐ No
	Fittings conforms to _____ standard	☒ Yes ☐ No
	If no, explain	
	Joints needed anchorage clamped, strapped, or blocked in accordance with _____ standard	☒ Yes ☐ No
	If no, explain	
Test description	Flushing: Flow the required rate until water is clear as indicated by no collection of foreign material in burlap bags at outlets such as hydrants and blow-offs. Flush at flows not less than 390 gpm (1476 L/min) for 4-in. pipe, 880 gpm (3331 L/min) for 6-in. pipe, 1560 gpm (5905 L/min) for 8-in. pipe, 2440 gpm (9235 L/min) for 10-in. pipe, and 3520 gpm (13,323 L/min) for 12-in. pipe. When supply cannot produce stipulated flow rates, obtain maximum available. Hydrostatic: Hydrostatic tests shall be made at not less than 200 psi (13.8 bar) for 2 hours or 50 psi (3.4 bar) above static pressure in excess of 150 psi (10.3 bar) for 2 hours. Leakage: New pipe laid with rubber gasketed joints shall, if the workmanship is satisfactory, have little or no leakage at the joints. The amount of leakage at the joints shall not exceed 2 quarts per hour (1.89 L/hr) per 100 joints irrespective of pipe diameter. The leakage shall be distributed over all joints. If such leakage occurs at a few joints, the installation shall be considered unsatisfactory and necessary repairs made. The amount of allowable leakage specified above can be increased by 1 fluid ounce per inch valve diameter per hr. (30 mL/25 mm/hr) for each metal seated valve isolating the test section. If dry barrel hydrants are tested with the main valve open so the hydrants are under pressure, an additional 5 ounces per minute (150 mL/min) leakage is permitted for each hydrant.	
Flushing tests	New underground piping flushed according to AWWA standard by (company) HAUSER CONST. INC — If no, explain: FLOW EXCEEDED 3 FT/SEC	☒ Yes ☐ No
	How flushing flow was obtained: ☒ Public water ☐ Tank or reservoir ☐ Fire pump — Through what type opening: ☐ Hydrant butt ☒ Open pipe	
	Lead-ins flushed according to _____ standard by (company) — If no, explain	☐ Yes ☐ No
	How flushing flow was obtained: ☐ Public water ☐ Tank or reservoir ☐ Fire pump — Through what type opening: ☐ Y connection to flange and spigot ☐ Open pipe	

Figure 10-1(b) *(Continued)*

Hydrostatic test	All new underground piping hydrostatically tested at 140 psi for 2 hours PSI TESTED MAY 2, 2017		Joints covered ☒ Yes ☐ No
Leakage test	Total amount of leakage measured — gallons — hours		
	Allowable leakage — gallons — hours		
Hydrants	Number installed 0	Type and make —	All operate satisfactorily ☐ Yes ☐ No
Control valves	Water control valves left wide open ☐ Yes ☒ No If no, state reason NEW CONSTRUCTION. INSIDE NOT COMPLETE WET TAP VALVE CLOSED Hose threads of fire department connections and hydrants interchangeable with those of fire department answering alarm ☐ Yes ☐ No		
Remarks	Date left in service		
Signatures	Name of installing contractor CASTLE CONSTRUCTION INC.		
	Tests witnessed by		
	For property owner (signed)	Title	Date
	For installing contractor (signed) Joe Harvey, HARVEY CONST. INC.	Title PSI TEST + FLUSH ONLY	Date MAY 3, 2017
Additional explanation and notes * MIKE HARVEY, CITY OF WG. WITNESS PRESSURE TEST OF UNDERGROUND SYSTEM * Tom Yates Fire Marshal - Witness Flush of Domestic/Sprinkler Supply			

10-2 Acceptance Requirements.

10-2.1* **Flushing of Piping.** Fire service mains (from the water supply to the system riser) and lead-in connections to system risers shall be completely flushed before connection is made to sprinkler piping. The flushing operation shall be continued for a sufficient time to ensure thorough cleaning. The minimum rate of flow shall be not less than one of the following:

(1) The hydraulically calculated water demand rate of the system including any hose requirements

(2) That flow necessary to provide a velocity of 10 ft/sec (3.1 m/sec) *[see Table 10-2.1(2)]*

(3) The maximum flow rate available to the system under fire conditions

10-2.2 Hydrostatic Tests.

10-2.2.1* All piping and attached appurtenances subjected to system working pressure shall be hydrostatically tested at 200 psi (13.8 bar) and shall maintain that pressure without loss for 2 hours. Loss shall be determined by a drop in gauge pressure or visual leakage. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

Exception No. 1: Portions of systems normally subjected to system working pressure of 150 psi (10.3 bar) or less shall be permitted to be tested at that pressure for 2 hours.

Exception No. 2: Where cold weather will not permit testing with water, an interim air test shall be permitted to be conducted as described in 10-2.3.

Exception No. 3: Modifications affecting 20 or fewer sprinklers shall not require testing in excess of system working pressure.

Exception No. 4: Where addition or modification is made to an existing system affecting more than 20 sprinklers, the new portion shall be isolated and tested at not less than 200 psi (13.8 bar) for 2 hours.

Exception No. 5: Modifications that cannot be isolated, such as relocated drops, shall not require testing in excess of system working pressure.

Exception No. 6: In buried pipe, leakage shall be permitted as follows:

(a) The amount of leakage at the joints shall not exceed 2 qt/hr (1.89 L/hr) per 100 gaskets or joints, irrespective of pipe diameter.*

(b) The amount of allowable leakage specified in item (a) of this exception shall be permitted to be increased by 1 fluid ounce (30 ml) per inch valve diameter per hour for each metal seated valve isolating the test section.*

(c) If dry barrel hydrants are tested with the main valve open so the hydrants are under pressure, an additional 5 oz/min (150 ml/min) of leakage shall be permitted for each hydrant.

(d) The amount of leakage in buried pipe shall be measured at

2675 Scott Avenue, Suite C
St. Louis, MO 63103
(877) 237-1785

Calculation Riser Placard for **AREA/DENSITY** Designed Systems.
System Design Area: **RA2 - Dock**
At: **Webster ISB**
Contract No.: **461259** Print No.(s): **FP-101.A** Dated: **12/2/16**

This system, as shown on **Ahern Fire Protection** drawing, is designed for **22** sprinklers to discharge at a density of **0.20** GPM/SqFt over a minimum area of **2,506.00** SqFt when supplied with water at the rate of **742.16** GPM at a pressure of **111.26** PSI at the **base of system riser**.

Occupancy Classification: **HC-2**
Commodity Classification: **N/A**
Inside Hose Stream added at base of riser: **0** GPM
Outside Hose Stream added at source: **250** GPM
Standard / Issue: **NFPA 13, 2010**

Antifreeze System Solution: **N/A**
Antifreeze System Capacity: **N/A** Gallons; **N/A**% Antifreeze

Storage Height (max.): **N/A**
Other Storage: **N/A**

General Information	Yes	No
High Pile	☐	☒
Rack Storage	☐	☒
Hazardous Material	☐	☒
Idle Pallets	☐	☒
Flammable/Combustible Liquids	☐	☒
Solid Shelving	☐	☒
Encapsulation	☐	☒
Aisle Width (min.)	_____	**Feet**

Sprinkler Head Quantity & Type:

Qty.	Make/Vendor	Model/Type	K-Factor	Temp.
9	Viking	VK350	8.0	200° F
2	Viking	VK462	5.6	155° F
8	Viking	VK464	8.0	200° F
9	Viking	VK634	8.0	200 F

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St. Louis, MO 63103
(877) 237-1785

Calculation Riser Placard for **AREA/DENSITY** Designed Systems.
System Design Area: **RA1 - Lobby**
At: **Webster ISB**
Contract No.: **461259** Print No.(s): **FP-102.B** Dated: **12/2/16**

This system, as shown on **Ahern Fire Protection** drawing, is designed for **11** sprinklers to discharge at a density of **0.10** GPM/SqFt over a minimum area of **1,552.00** SqFt when supplied with water at the rate of **426.86** GPM at a pressure of **118.90** PSI at the **base of system riser**.

Occupancy Classification: **HC-1**
Commodity Classification: **N/A**
Inside Hose Stream added at base of riser: **0** GPM
Outside Hose Stream added at source: **250** GPM
Standard / Issue: **NFPA 13, 2010**

Antifreeze System Solution: **N/A**
Antifreeze System Capacity: **N/A** Gallons; **N/A**% Antifreeze

Storage Height (max.): **N/A**
Other Storage: **N/A**

General Information	Yes	No
High Pile	☐	☒
Rack Storage	☐	☒
Hazardous Material	☐	☒
Idle Pallets	☐	☒
Flammable/Combustible Liquids	☐	☒
Solid Shelving	☐	☒
Encapsulation	☐	☒
Aisle Width (min.)	_____	**Feet**

Sprinkler Head Quantity & Type:

Qty.	Make/Vendor	Model/Type	K-Factor	Temp.
11	Viking	VK634	8.0	155° F

2675 Scott Avenue, Suite C
St. Louis, MO 63103
(855) 289-0071

Calculation Riser Placard for **Standpipe** Systems.

System Design Area: **Entire**

At: **Webster University ISB**

Contract No.: **461259** Print No.(s): **FP-101.A** Dated: **12/2/16**

This system, as shown on **Ahern Fire Protection** drawing, is designed for **500.00** gallons per minute from the most remote standpipe at a minimum pressure of **100.00** pounds per square inch and **250.00** gallons per minute flowing from the remaining **(1)** standpipes for a total flow of **750.00** gallons per minute when supplied with water at the rate of **750.00** gallons per minute at a pressure of **131.63** pounds per square inch at the **fire pump outlet**.

Standpipe Classification: **Class I**
Standard / Issue: **NFPA 14 2010 Edition**
Antifreeze System Solution: **N/A**
Antifreeze System Capacity: Gallons; % Antifreeze

2675 Scott Avenue, Suite C
St. Louis, MO 63103
(877) 237-1785

Calculation Riser Placard for **AREA/DENSITY** Designed Systems.
System Design Area: **Preaction**
At: **Webster ISB**
Contract No.: **461259** Print No.(s): **FP-101.B** Dated: **12/2/16**

This system, as shown on **Ahern Fire Protection** drawing, is designed for **7** sprinklers to discharge at a density of **0.10** GPM/SqFt over a minimum area of **583.00** SqFt when supplied with water at the rate of **109.80** GPM at a pressure of **57.92** PSI at the **base of system riser**.

Occupancy Classification: **HC-1**
Commodity Classification: **N/A**
Inside Hose Stream added at base of riser: **0** GPM
Outside Hose Stream added at source: **250** GPM
Standard / Issue: **NFPA 13, 2010**

Antifreeze System Solution: **N/A**
Antifreeze System Capacity: **N/A** Gallons; **N/A**% Antifreeze

Storage Height (max.): **N/A**
Other Storage: **N/A**

General Information	Yes	No
High Pile	☐	☒
Rack Storage	☐	☒
Hazardous Material	☐	☒
Idle Pallets	☐	☒
Flammable/Combustible Liquids	☐	☒
Solid Shelving	☐	☒
Encapsulation	☐	☒
Aisle Width (min.)	_____	**Feet**

Sprinkler Head Quantity & Type:

Qty.	Make/Vendor	Model/Type	K-Factor	Temp.
7	Viking	VK462	5.6	155
	Viking			
	Viking			

Fire Protection
Equipment Submittal

Webster University
Interdisciplinary Science Bldg.

8274 Big Bend
Webster Groves, MO 63119

AHERN SINCE 1880

FIRE PROTECTION EQUIPMENT DATA

J. F. AHERN CO.
2675 SCOTT AVE. SUITE C
ST. LOUIS, MO 63103
T: 314.535.4544
F: 314.535.0144

NAME OF PROJECT: **Webster University Interdisciplinary Science Building**
8274 Big Bend Blvd.
Webster Groves, MO 63119

AHERN PROJECT NO.: **461259**

SPECIFICATION NO.:

SUBMITTAL NO.:

STAMP

Prepared By: *Dana Mitchell*

Dana Mitchell,
Senior Designer

EQUIPMENT/MANUFACTURER

Pipe

SHEET 100

Pipe—NFPA 13, UL/FM as noted

Schedule 10 Steel Pipe

SHEET 101

Pipe—NFPA-13, UL/FM

Schedule 40 Steel Pipe

Valves

SHEET 208

Gate valve—*(2 1/2" thru 12")* 250-lb. wwp iron body gate valve—meets AWWA C-509 standard, flanged—UL/FM

Nibco Fig F-607-RW

SHEET 211

Grooved-end butterfly valve with built-in tamper switch *(2" thru 12")* ductile iron—UL/FM as noted—two (2) factory mounted internal supervisory switches

Victaulic 705 Firelock® Butterfly Valve

SHEET 213

Grooved swing check valve *(2-1/2", 3", 4", 6", and 8")* 175 psi—UL/FM as noted, rubber faced check valve approved for use in fire service systems. Valve may be installed vertically or horizontally.

Viking Model D-1/G-1

SHEET 215

Bronze OS & Y gate valve, threaded ends *(1" - 2")*, 175 psi—UL/FM

Nibco T-104-O

SHEET 216

Bronze angle valve, 175-lb. wwp, *(1-1/4" - 2")*, threaded ends, renewable disc

Nibco T-301-W

Valves (Cont.)

SHEET 217

Bronze globe valve, 175-lb. wwp, *(1/2" - 1")*, threaded ends, renewable disc

Nibco KT-65UL

SHEET 219

Bronze globe valve—175-lb. wwp, *(1-1/4"- 2")*, threaded ends—UL as noted

Nibco KT-211-W-UL

SHEET 220

Bronze side outlet globe valve *(1/4")*, 3-way, 400-lb. wwp, threaded ends

Nibco KT-291-W3

SHEET 222

Soft-seat Swing Check Valve, threaded top, 200-lb. wwp

Nibco Bronze Check Valve Model KT-403-W

SHEET 223

Bronze ball valve *(domestic use only)*, 300-lb. wwp, *(1/4" - 3")*, threaded ends—UL/FM as noted

Nibco KT-580/585-70-UL

SHEET 224

Bronze ball valve—provides slow opening & closing properties in a quarter turn valve with built-in tamper switch—two (2) sets of contacts—UL/FM (threaded ends Victaulic 1"- 2"); (grooved ends Victaulic 1-1/4"- 2" and Milwaukee 2-1/2")

Victaulic Series 728 FireLock® / Milwaukee BB-SC Series Ball Valves

SHEET 225

Pressure relief valve—1/2" & 3/4" inlet, all bronze construction & stainless steel spring, calibrated—adjustable range 50-175 psi

Watts 530C

Valves (Cont.)

SHEET 226

Inspector's test/pressure relief valve for gridded systems

AGF Model 1011A

SHEET 228A

Double check valve assembly *(2-1/2" thru 10")* flanged, flanged by grooved, or grooved by grooved, 175 psi—UL/FM as noted—backflow prevention to prevent potable water contamination caused by cross connection

Zurn® Wilkins Model 350A-OSY (FxF), 350A-OSYFG (FxG), & 350ABGVIC (GxG)

SHEET 240

Two-piece, full port, chrome plated, threaded ends forged brass ball valve *(1/2 thru 2-1/2")* PTFE seats—UL/FM as noted

Threaded Ball Valve KITZ Code #58 (AKSZA)

Hangers

SHEET 300

Standard duty loop hanger for suspension of non-insulated stationary pipe lines—UL/FM as noted

Pentair Standard Duty Loop Hanger 115

SHEET 301

Steel Beam clamp (1/2") with set screw—structural attachment to top or bottom of metal beams or bar joists—UL Listed/FM Approved as noted

Pentair/Caddy® Universal Beam Clamp 300

SHEET 301A

Beam clamp *(3/8")* cold rolled steel with a plated hardened cup point set screw and lock nut—structural attachment to top or bottom of metal beams or bar joists—UL/FM as noted

Globe's Silver Hawk Series 100 Universal Beam Clamp

Hangers (Cont.)

SHEET 302

Carbon steel screw anchor with an internally threaded hex washer head (1/4" X 1-5/8" | 3/8")—ICC-ES Listed and FM Approved as noted

Hilti KWIK HUS-EZ Screw Anchor

SHEET 303

Riser clamp for use with steel pipe—UL Listed & FM Approved for 3/4" thru 8" sizes. Complies with Federal Specification A-A-1192A (Type 8) and Manufacturers' Standardization Society ANSI/SP-69 and SP-58 (Type 8)

PHD Manufacturing, Inc. Riser Clamp Fig. 551

SHEET 308

Retains the beam clamp in its attached position to the structural member for use in preventing hanger failure—UL Listed as noted

Afcon #162 Universal Restraining Strap

SHEET 309

Pipe Clamp for use on smaller pipe sizes allowing the restraining clamps to be attached to the pipe—UL/FM as noted

B-Line, by Eaton, Pipe Clamp for Sway Bracing Fig. B3140 (Tolco Fig. 4)

SHEET 310

Sleeve expansion anchors—UL/FM as noted

Powers® Lok-Bolt™ Sleeve Expansion Anchors

SHEET 312

12-gauge steel channel for use with trapeze hangers

Gregory Strut Products Model G132OS, G582OS, G582A, G712OS, & G712A

SHEET 315

Surge restrainer used to restrict the upward movement of smaller branch line piping *(1/2" - 2")* during sprinkler operation—UL Listed

Pentair Hanger Surge Restraint SR6

Hangers (Cont.)

SHEET 322

Direct vertical attachment in Metal Deck and Purlin for 1/4" and 3/8" rod—UL/FM as noted

Sammy Xpress™ Model XP 20 & XP 35

SHEET 325

Steel Bar Joist Attachment (#CSBBARJEG) and Universal Structural Attachment (#CSBUNIV05EG/CSBUNIV075EG)

Pentair Structural Attachments

SHEET 326

Easy (1" thru 6") and Standard (8" and 10") Universal Sway Brace

Pentair Longitudinal Sway Brace

SHEET 327

Quick Grip Lateral Sway Brace (Jr. 1" thru 2") and (2-1/2" thru 8")

Pentair Lateral Sway Brace

Sprinklers

SHEET 423

Quick response dry pendent sprinkler head, 5.6 K-Factor—UL/FM as noted

Viking QR Dry Pendent Sprinkler VK176

SHEET 427

Quick response upright sprinkler head—small thermosensitive glass bulb spray sprinkler, 5.6 K-Factor, UL/FM as noted

Viking Microfast® QR Upright Sprinkler VK300

SHEET 428

Quick response pendent sprinkler head—small thermosensitive glass bulb spray sprinkler, 5.6 K-Factor—UL/FM as noted

Viking Microfast® Pendent Sprinkler VK302

Sprinkler (Cont.)

SHEET 429

Quick response, horizontal sidewall sprinkler head, 5.6 K-Factor—UL/FM as noted

Viking Microfast® Horizontal Sidewall VK305

SHEET 430

Quick response upright sprinkler head—small thermosensitive glass bulb spray sprinkler, 8.0 K-Factor—UL/FM as noted

Viking Microfast® QR Upright Sprinkler VK350

SHEET 431

Quick response pendent sprinkler head—small thermosensitive glass bulb spray sprinkler, 8.0 K-Factor—UL/FM as noted

Viking Microfast® Pendent Sprinkler VK352

SHEET 432

Standard and quick response concealed pendent sprinkler heads, standard orifice, 5.6 K-Factor—UL/FM as noted

Viking Mirage® Concealed Pendent Sprinkler VK462

SHEET 449

Spare sprinkler cabinet for ESFR and other large frame heads (6) (ESFR, Large Drop, ELO)—red enamel steel with close fitting hinge

Fire Protection Products

SHEET 451

Spare head cabinet & appropriate sprinkler wrench (12)—red enamel steel all welded joints and close fitting hinge

Tyco Spare Head Cabinet

SHEET 452

Slip-on Style Model E-1 Recessed Escutcheon and Model F-1 Adjustable Escutcheon—UL/FM as noted (Expansion Plate optional)

Viking Model E-1 and F-1 Escutcheons

Sprinkler (Cont.)

SHEET 453

One-piece sprinkler head guard—UL/FM as noted

Viking Model D-1 Sprinkler Guard

SHEET SP-1

Standard/Quick Response extended coverage upright sprinkler**—UL/FM as noted**

Viking Model VK532

SHEET SP-2

Standard/Quick Response extended coverage pendent sprinkler**—UL/FM as noted**

Viking Model VK534

SHEET SP-3

Mirage Quick Response extended coverage concealed pendent sprinkler**—UL/FM as noted**

Viking

SHEET SP-4

RA5114 Reliable Model G5-56 Dry Pnd Concld**—UL/FM as noted**

Reliable

Fittings

SHEET 500

Flexible couplings for Fire Protection Systems—UL/FM

Victaulic Style 75 Flexible Coupling

SHEET 501

Reducing coupling *(2 x 1" through 8 x 6")*—UL/FM

Victaulic Style 750 Reducing Couplings

SHEET 503

FireLock fittings—elbows, tees, & caps—UL/FM

Victaulic FireLock Fittings

Fittings (Cont.)

SHEET 504

FireLock rigid couplings *(1-1/4" through 8")* use with C-shaped gasket on wet-type system installations and use with FlushSeal gasket on dry-type system installations—UL/FM

Victaulic Style 005 FireLock Rigid Couplings

SHEET 505

Grooved flange *(2" through 8")*—UL/FM

Victaulic Style 744 FireLock Flange Adapter

SHEET 506

Mechanical tees—grooved or threaded, bolted branch outlets—UL/FM

Victaulic Styles 920 and 920N

SHEET 508

Rigid, installation-ready coupling for fire protection pipe joining—UL Listed and FM Approved for standard pipe services up to 365-psi

Victaulic FireLock EZ® Rigid Coupling Style 009N

SHEET 510

Threaded Mechanical Branch Tee-type used in 1-1/4 thru 2-1/2"—UL/FM as noted

Anvil Star / Anvil International Fittings MT-30

SHEET 513

Schedule 10 and Schedule 40 Grooved Weld Outlet Fittings for use in fire sprinkler systems 300-PSI, UL/FM as noted

Grooved Welded Pipe Outlets Cerieco Brand™

SHEET 514

Threaded weld outlet fittings, 300 psi—UL/FM

Welded Steel Pipe Outlets Cerieco Brand™

Fittings (Cont.)

SHEET 515

Ductile Iron threaded pipe fittings joining arrangement for piping 4" and smaller 500-psi service—UL/FM as noted

AnvilStar™ SPF™ Ductile Iron Threaded Fittings

SHEET 517A

Galvanized Malleable Iron pipe fittings—UL/FM as noted

Smith-Cooper International Galvanized Malleable Iron Pipe Fittings

SHEET 518

Braided Flexible Hose Assemblies connect the branch line to the sprinkler head using a flexible stainless steel hose and steel bracket assembly, available in 31" to 72" length, in 1/2" and 3/4" outlet sizes—UL/FM as noted ***(Braided AH2/AB7 FM Approved; Braided AH2/AB1 UL Listed & FM Approved)***

Victaulic® VicFlex™ Series AH2 Braided Flexible Hose Assembly

Alarms

SHEET 600

Waterflow Detector with retard, vane-type for use on wet systems, S10 & S40 steel pipe, *(2" – 8")*—UL/FM as noted

System Sensor WFD Series

SHEET 602

Supervisory switch, 1/2" NPT, adjustable nipple, weather resistant—UL/FM - for use with post indicator valve

Potter PCVS-2

SHEET 606

6" Model PBA1206 electric vibrating type bell

Potter Electric Signal Company PBA1206

SHEET 608

Air/Water Pressure Gauge, used to monitor water pressure at system riser *(3-1/2")*—UL/FM

Air/Water Gauges

Hose

SHEET 802

2-1/2" Female to Male Hose Valve

Potter Roemer Model 4065

SHEET 803

(4615) **1-1/2" or** ***(4625)*** **2-1/2" Caps and Chains**

Potter Roemer 4600 Series

Miscellaneous

SHEET 900

Wall/Ceiling escutcheon plates, used to trim piping through walls & ceilings

Plastic Wall Plates

SHEET 902

Sprinkler identification signs with enamel finish—for use in identifying all system control, main and auxiliary drain, and inspectors test valves

Sprinkler ID Signs

SHEET 906

Firestop sealant—intumescent caulk for use in restoring fire rating to wall penetrations for steel and plastic pipe—UL/FM as noted

STI SpecSeal Series LCI Intumescent Sealant

SHEET 913

Pipe markers for indoor and outdoor line service identification and system color coding

MS-900 Self Adhesive Pipe Markers

SHEET M-1

Free standing fire department connection inlet connections

Potter Roemer Model/Series No. 5761-5792

SHEET M-2

TotalPac 3 self contained – double interlocl preaction system electric / pneumatic release

Fire Pump

SHEETS ATTACHED

Equipment Submittal Table of Contents.docx

SCHEDULE 10 STEEL PIPE

The Schedule 10 ferrous steel piping, black or galvanized, used on this project shall meet or exceed one of the following NFPA 13 (2007 Edition) standards found in Section 6.3, Aboveground Pipe and Tube:

1. ASTM A795 -- Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.

2. ANSI/ASTM A53 -- Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

3. ASTM A135 -- Specification for Electric Resistance -- Welded Steel Pipe.

The following is a list of ferrous piping Manufacturers that Ahern Fire Protection may use on this project. This list also indicates the ASTM conformance standard(s) as well as the current UL Listing (VIZY-2005) and/or FM Approval (STEEL PIPE-2006) for each brand of pipe.

Allied Tube and Conduit Corp.
- UL Listed Sizes 1-1/4" through 8"
- FM Approved Sizes 1-1/4" through 8"
- ASTM A135 & ASTM A123

Bull Moose Tube Co.
- UL Listed Sizes 1" through 4"
- FM Approved Sizes 3/4" through 4"
- ASTM A135, ASTM A795, & ASTM A53

Wheatland Tube Co.
- UL Listed Sizes 1-1/4" through 4" *(black only)*
- FM Approved Sizes 1-1/4" through 8" *(black only)*
- ASTM A135 & ASTM A795

Youngstown Tube Company
- UL Listed Sizes 1-1/4" through 8"
- FM Approved Sizes 1-1/4" through 6" *(black only)*
- ASTM A795 Type E, Grade A, NH standards

Nominal	Minimum I.D.
1	1.097
1.25	1.442
1.5	1.682
2	2.157
2.5	2.635
3	3.26
4	4.26
5	5.295
6	6.357
8	8.249

If necessary, the Manufacturer's Technical Data Sheets for each of these products can be obtained from Ahern Fire Protection. Please contact the Ahern Fire Protection District office indicated on the cover of this submittal package.

SCHEDULE 40 STEEL PIPE

The Schedule 40 ferrous steel piping, black or galvanized, used on this project shall meet or exceed one of the following NFPA 13 (2007 Edition) standards found in Section 6.3, Aboveground Pipe and Tube:

1. ASTM A795 -- Specification for Black and Hot-Dipped Zinc Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
2. ANSI/ASTM A53 -- Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A135 -- Specification for Electric Resistance -- Welded Steel Pipe.

The following is a list of ferrous piping Manufacturers that Ahern Fire Protection may use on this project. This list also indicates the ASTM conformance standard(s) as well as the current UL Listing (VIZY-2005) and/or FM Approval (STEEL PIPE-2006) for each brand of pipe.

Allied Tube and Conduit Corp.
- UL Listed Sizes 1" through 2-1/2"
- FM Approved Sizes 1" through 2-1/2"
- ASTM A135 & ASTM A123

Bull Moose Tube Co.
- UL Listed Sizes 1" through 4"
- FM Approved Sizes 1" through 4"
- ASTM A135 & ASTM A795

Wheatland Tube Co.
- UL Listed Sizes 1" through 2"
- FM Approved Sizes 1" through 2"
- ASTM A135, ASTM A795, & ASTM A53F 1" through 6"

Youngstown Tube Company
- Black UL Listed / FM Approved Sizes 1" through 2"
- Galvanized UL Listed only – 1" through 2"
- ASTM A135/A795 Type E, Grade A, NH standards

Nominal	Minimum I.D.
1	1.049
1.25	1.38
1.5	1.61
2	2.067
2.5	2.469
3	3.068
4	4.026

If necessary, the Manufacturer's Technical Data Sheets for each of these products can be obtained from Ahern Fire Protection. Please contact the Ahern Fire Protection District office indicated on the cover of this submittal package.

210523 - Valves for Fire Protection Piping

250 PSI WWP Iron Body Gate Valves

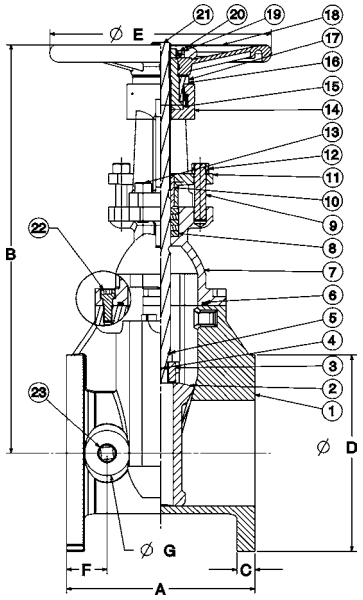
Fire Protection Valve • Outside Screw and Yoke • **Resilient Wedge** • Epoxy Coated Interior/Exterior • Pre-Grooved Stem for Supervisory Switch • Drilled, Tapped and Plugged at Boss Location A**

250 PSI/17.2 Bar Non-Shock Cold Working Pressure (160° F/71° C max. operating temperature)

UL/ULC LISTED† • FM APPROVED • AWWA C509 & 515 • NEW YORK CITY M.E.A. APPROVED 236-93E• CERTIFIED LEAD-FREE* BY IAPMO R&T TO NSF/ANSI 372



F-607-RW
Flanged



F-607-RW
Flg x Flg

MATERIAL LIST

	PART	SPECIFICATION
1.	Valve Body	Ductile Iron ASTM A536
2.	Resilient Wedge	Ductile Iron ASTM A536/EPDM ASTM D2000
3.	Wedge Nut	Bronze ASTM B584 UNS C83600
4.	Dowel Pin	Stainless Steel ASTM A276 UNS S42000 4" - 12" ASTM B584 UNS C92200 2½" - 3"
5.	Stem Back Seat O-Ring	EPDM ASTM D2000
6.	Bonnet Gasket	EPDM ASTM D2000
7.	Bonnet	Ductile Iron ASTM A536
8.	Stem Packing	EPDM ASTM D2000
9.	Threaded Rod	Carbon Steel Zinc Plated
10.	Gland Bushing	Bronze ASTM B584
11.	Gland	Cast Iron ASTM A126 Class B
12.	Gland Nut	Stainless Steel 18-8
13.	Yoke Screw	Alloy Steel ASTM A574M Zinc Plated
14.	Yoke	Cast Iron ASTM A126 Class B
15.	Yoke Bushing	Bronze ASTM B584
16.	Flat Point Set Screw	Alloy Steel ASTM F912M Black Oxide
17.	Yoke Bushing Retainer	Cast Iron ASTM A126 Class B
18.	Handwheel	Ductile Iron ASTM A536
19.	Handwheel Nut	Carbon Steel Zinc Plated
20.	Flat Head Screw	Carbon Steel Zinc Plated
21.	Stem	Bronze ASTM B150 UNS C61400
22.	Bonnet Screw	Alloy Steel ASTM A574M Zinc Plated
23.	NPT Pipe Plug	Malleable Iron ANSI B16.3 (Epoxy Coated)
24.	UL/FM Label (not shown)	Aluminum

NOTE: Electrostatically applied fusion-bonded epoxy coated inside and outside per AWWA C-550. Epoxy NSF and FDA certification

****Drilled, tapped and plugged at Position A with ½" valve sizes 2½"–4", ¾" on 6"–8", 1" on 10"–12".**

† Compliance with the Standard for Gate Valves for Fire Protection Service, UL 262, and the Canadian Requirements, ULC/ORD-C262.

NOTE: Flanged valve is consistent with ANSI B16.1 Class 125.

DIMENSIONS—WEIGHTS—QUANTITIES

Size		Dimensions A		B Open		B Closed		C		D		E		F		G		Bolt Circle		Flange	Turns	Weight	
In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	Holes	To Open	Lbs.	Kg.
2½	65	7.5	190	17.8	453	14.9	378	0.69	17.5	7.0	178	7.9	200	1.50	38	1.6	40	5.50	140	4	8.8	45	20
3	80	8.0	203	19.7	500	15.9	405	0.75	19.0	7.5	191	7.9	200	1.73	44	2.1	54	6.00	152	4	10.5	53	24
4	100	9.0	229	21.0	534	16.6	422	0.94	24.0	9.0	229	10.2	260	2.13	54	2.1	54	7.50	191	8	10.4	94	43
6	150	10.5	267	29.3	744	22.9	581	1.00	25.4	11.0	279	12.4	315	2.24	57	2.5	64	9.50	241	8	15.7	154	70
8	200	11.5	292	37.0	939	28.5	724	1.13	28.6	13.5	343	14.8	375	2.48	63	2.8	70	11.75	298	8	17.2	247	112
10	250	13.0	330	44.8	1139	34.5	877	1.19	30.2	16.0	406	16.4	416	2.56	65	2.8	70	14.25	362	12	21.4	349	159
12	300	14.0	356	52.2	1326	39.9	1014	1.25	31.8	19.0	483	17.5	445	2.91	74	3.4	86	17.00	432	12	25.5	484	220

c UL LISTED FM APPROVED

*Weighted average lead content ≤ 0.25%

FREEZING WEATHER PRECAUTION: Subsequent to testing a piping system, valves should be left in an open position to allow complete drainage.

NIBCO INC. WORLD HEADQUARTERS • 1516 MIDDLEBURY ST. • ELKHART, IN 46516-4740 • USA • PH: 1.800.234.0227
TECH SERVICES PH: 1.888.446.4226 • FAX: 1.888.336.4226 • INTERNATIONAL OFFICE PH: +1.574.295.3327 • FAX: +1.574.295.3455
www.nibco.com

FireLock® Butterfly Valve
Style 705 with Weatherproof Actuator

10.81



Approvals/Listings:

c UL us LISTED | FM | VdS # G410001 | LPCB 104j/04 | CE TP

See Victaulic Publication 10.01 for more details.

Product Description:

The Series 705 Butterfly Valve features a weatherproof actuator housing Approved for indoor or outdoor use, a ductile iron body and disc with EPDM seats. Designed for fire protection services only. Victaulic FireLock Series 705 Butterfly Valve is cULus Listed, LPCB Listed, FM and VdS Approved for 300 psi/2068 kPa service. Contact Victaulic for details of agency approvals.

Material Specifications:

Body: Ductile iron conforming to ASTM A-536, grade 65-45-12

End Face, 2 – 6"/50 – 150 mm: Ductile iron conforming to ASTM A-536, grade 65-45-12

Seal Retainer, 8 – 12"/200 – 300 mm: Ductile iron conforming to ASTM A-536, grade 65-45-12

Coating: Black alkyd enamel

Disc: Ductile iron conforming to ASTM A-536, grade 65-45-12, with electroless nickel coating conforming to ASTM B-733

Seat:

☐ Grade “E” EPDM

Stems: 416 stainless steel conforming to ASTM A-582

Stem Seal Cartridge: C36000 brass

Bearings: Stainless Steel with TFE lining

Stem Seals: EPDM

Stem Retaining Ring: Carbon steel

Actuator:

☐ 2 – 8"/50 – 200mm: Brass or bronze traveling nut on a steel lead screw, in a ductile iron housing

☐ 10 – 12"/250 – 300mm: Steel worm and cast iron quadrant gear, in a cast iron housing

Job/Owner

System No.	
Location	

Contractor

Submitted By	
Date	

Engineer

Spec Section	
Paragraph	
Approved	
Date	

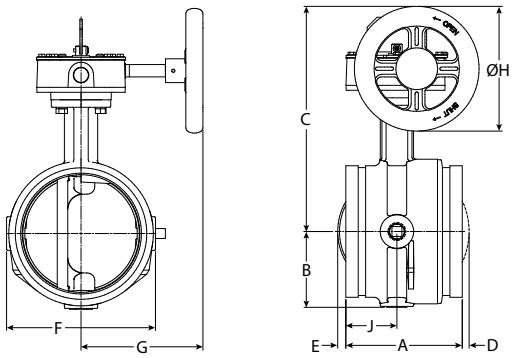
10.81 5662 Rev F Updated 11/2014 © 2014 Victaulic Company. All rights reserved.

Approvals and Listings:

Size	Approval/Listing Service Pressures			
	Series 705 Butterfly Valve			
	cULus	FM	Vds	LPCB
2"/50 mm	up to 300psi/2068kPa	n/a	up to 300psi/2068kPa	up to 300psi/2068kPa
2½"/65 mm	up to 300psi/2068kPa	up to 300psi/2068kPa	n/a	up to 300psi/2068kPa
76.1 mm	up to 300psi/2068kPa	up to 300psi/2068kPa	up to 300psi/2068kPa	up to 300psi/2068kPa
3"/80 mm	up to 300psi/2068kPa	up to 300psi/2068kPa	up to 300psi/2068kPa	up to 300psi/2068kPa
4"/100 mm	up to 300psi/2068kPa	up to 300psi/2068kPa	up to 300psi/2068kPa	up to 300psi/2068kPa
5"/125 mm	up to 300psi/2068kPa	up to 300psi/2068kPa	n/a	up to 300psi/2068kPa
139.7 mm	up to 300psi/2068kPa	up to 300psi/2068kPa	up to 300psi/2068kPa	up to 300psi/2068kPa
6"/150 mm	up to 300psi/2068kPa	up to 300psi/2068kPa	up to 300psi/2068kPa	up to 300psi/2068kPa
165.1 mm	up to 300psi/2068kPa	up to 300psi/2068kPa	n/a	up to 300psi/2068kPa
8"/200 mm	up to 300psi/2068kPa	up to 300psi/2068kPa	up to 300psi/2068kPa	up to 300psi/2068kPa
10"/250 mm	up to 300psi/2068kPa	up to 300psi/2068kPa	n/a	up to 300psi/2068kPa
12"/300 mm	up to 300psi/2068kPa	up to 300psi/2068kPa	n/a	up to 300psi/2068kPa

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Dimensions:



NOTE: OPTIONAL ½"/15MM TAP AVAILABLE.
CONTACT VICTAULIC FOR DETAILS.

Nominal Size	Actual Outside Diameter	Dimensions								
		E to E A	B	C	D	E	F	G	DIA H	J
inches mm	inches mm	inches mm	inches mm	inches mm	inches mm	inches mm	inches mm	inches mm	inches mm	inches mm
2 60.3	2.375 60.3	4.25 108.0	2.28 57.9	6.41 162.8	–	–	4.00 101.6	4.22 107.2	4.50 114.3	2.12 53.8
2½ 73	2.875 73.0	3.77 95.8	2.28 57.9	7.54 191.5	–	–	4.00 101.6	4.22 107.2	4.50 114.3	1.77 45.0
76.1 mm	3.000 76.1	3.77 95.8	2.28 57.9	7.54 191.5	–	–	4.00 101.6	4.22 107.2	4.50 114.3	1.77 45.0
3 88.9	3.500 88.9	3.77 95.8	2.53 64.3	7.79 197.9	–	–	4.50 114.3	4.22 107.2	4.50 114.3	1.77 45.0
108 mm	4.250 108.0	4.63 117.6	2.88 73.2	8.81 223.8	–	–	5.50 139.7	4.22 107.2	4.50 114.3	2.20 55.9
4 114.3	4.500 114.3	4.63 117.6	2.88 73.2	8.81 223.8	–	–	5.50 139.7	4.22 107.2	4.50 114.3	2.20 55.9
133 mm	5.250 133.0	5.88 149.4	3.35 85.1	10.88 276.4	–	–	6.56 166.6	6.19 157.2	6.30 160.0	2.58 65.5
139.7 mm	5.500 139.7	5.88 149.4	3.35 85.1	10.88 276.4	–	–	6.56 166.6	6.19 157.2	6.30 160.0	2.58 65.6
5 141.3	5.563 141.3	5.88 149.4	3.35 85.1	10.88 276.4	–	–	6.56 166.6	6.19 157.2	6.30 160.0	2.58 65.5
159 mm	6.250 159.0	5.88 149.4	3.84 97.5	11.38 289.1	–	0.41 10.4	7.52 191.0	6.19 157.2	6.30 160.0	2.58 65.5
165.1mm	6.500 165.1	5.88 149.4	3.84 97.5	11.38 289.1	–	0.41 10.4	7.52 191.0	6.19 157.2	6.30 160.0	2.58 65.5
6 168.3	6.625 168.3	5.88 149.4	3.84 97.5	11.38 289.1	–	0.41 10.4	7.52 191.0	6.19 157.2	6.30 160.0	1.90 48.3
8 219.1	8.625 219.1	5.33 135.4	5.07 128.8	13.53 343.6	0.80 20.3	1.47 37.3	10.00 254.0	6.19 157.2	8.10 205.7	2.33 59.2
10 273	10.750 273.0	6.40 162.6	6.37 161.8	15.64 397.3	1.41 35.8	1.81 46.0	12.25 311.2	8.10 205.7	9.00 228.6	–
12 323.9	12.750 323.9	6.50 165.1	7.36 186.9	16.64 422.7	2.30 58.4	2.80 71.1	14.25 362.0	8.10 205.7	9.00 228.6	–

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Performance:

The chart expresses the frictional resistance of Victaulic Series 705 Butterfly Valve in equivalent feet/meters of straight pipe.

Nominal Size mm inches	**Outside Diameter** mm inches	**Equivalent** Feet/m of pipe
2 50	2.375 60.3	6 1.8
2½ 65	2.875 73.0	6 1.8
76.1 mm	3.000 76.1	6 1.8
3 80	3.500 88.9	7 2.1
4 100	4.500 114.3	8 2.4
108 mm	108 mm	8 2.4
5 125	5.563 141.3	12 3.7
133 mm	133 mm	12 3.7
139.7 mm	5.500 139.7	12 3.7
6 150	6.625 168.3	14 4.2
159 mm	159 mm	14 4.3
165.1 mm	6.500 165.1	14 4.2
8 200	8.625 219.1	16 4.9
10 250	10.750 273.0	18 5.5
12 300	12.750 323.9	19 5.8

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Performance:

C_V values for flow of water at +60°F/+16°C through a fully open valve are shown in the table below. For additional details, contact Victaulic.

Formulas for C_V values

$\Delta P = Q^2/C_V^2$

$Q = C_V \times \sqrt{\Delta P}$

Where:

Flow Coefficient	C_V
Q (Flow)	GPM
ΔP (Pressure Drop)	psi

Formulas for K_V values

$\Delta P = Q^2/K_V^2$

$Q = K_V \times \sqrt{\Delta P}$

Where:

Flow Factor	K_V
Q (Flow)	m^3/hr
ΔP (Pressure)	bar

Valve Size		Full Open
Nominal Size inches mm	**Actual Outside Diameter** inches mm	**Flow Coefficient** C_V
2 50	2.375 60.3	170
2½ 65	2.875 73.0	260
76.1 mm	3.000 76.1	260
3 80	3.500 88.9	440
4 100	4.500 114.3	820
108 mm	108 mm	820
5 125	5.563 141.3	1200
133 mm	133 mm	1200
139.7 mm	5.500 139.7	1200
6 150	6.625 168.3	1800
159 mm	159 mm	1800
165.1 mm	6.500 165.1	1800
8 200	8.625 219.1	3400
10 250	10.750 273.0	5800
12 300	12.750 323.9	9000

Valve Size		Full Open
Nominal Size inches mm	**Actual Outside Diameter** inches mm	**Flow Coefficient** K_V
2 50	2.375 60.3	147
2½ 65	2.875 73.0	225
76.1 mm	3.000 76.1	225
3 80	3.500 88.9	380
4 100	4.500 114.3	710
108 mm	108 mm	710
5 125	5.563 141.3	1040
133 mm	133 mm	1040
139.7 mm	5.500 139.7	1040
6 150	6.625 168.3	1560
159 mm	159 mm	1560
165.1 mm	6.500 165.1	1560
8 200	8.625 219.1	2940
10 250	10.750 273.0	5020
12 300	12.750 323.9	7790

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Switch and Wiring:

1. The supervisory switch contains two single pole, double throw, pre-wired switches.
2. Switches are rated:

   10 amps @ 125 or 250 VAC/60 Hz

   0.50 amps @ 125 VDC

   0.25 amps @ 250 VDC
3. Switches supervise the valve in the “OPEN” position.
5. One switch has two #18 insulated wires per terminal, which permit complete supervision of leads (refer to diagrams and notes below). The second switch has one #18 insulated wire per terminal. This double circuit provides flexibility to operate two electrical devices at separate locations, such as an indicating light and an audible alarm, in the area that the valve is installed.
6. A #14 insulated ground lead (green) is provided.

   Switch #1 = S1

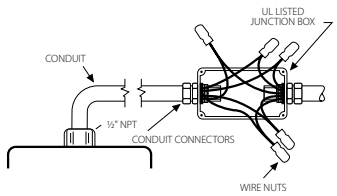
   For connection to the supervisory circuit of a UL Listed alarm control panel

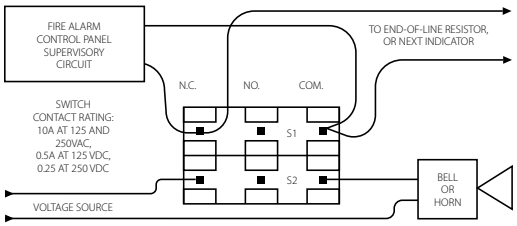
   Switch #2 = S2

   Auxiliary switch that may be connected to auxiliary devices, per the authority having jurisdiction

S1
- Normally Closed: (2) Blue
- Common: (2) Yellow

S2
- Normally Closed: Blue with Orange Stripe
- Normally Open: Brown with Orange Stripe
- Common: Yellow with Orange Stripe





Switch 1: 2 leads per terminal
Switch 2: 1 lead per terminal

NOTE: The above diagram shows a connection between the common terminal (yellow – S1 and yellow-with-orange stripe – S2) and the normally closed terminal (blue – S1 and blue-with-orange stripe – S2). In this example, the indicator light and alarm will stay on until the valve is fully open. When the valve is fully open, the indicator light and alarm will go out. Cap off any unused wires (e.g. brown with orange stripe).

Only S1 (two leads per terminal) may be connected to the fire alarm control panel.

The connection of the alarm switch wiring shall be in accordance with NFPA 72 and the auxiliary switch per NFPA 70 (NEC).

Installation
Reference should always be made to the I-100 Victaulic Field Installation Handbook for the product you are installing. Handbooks are included with each shipment of Victaulic products for complete installation and assembly data, and are available in PDF format on our website at www.victaulic.com.

Warranty
Refer to the Warranty section of the current Price List or contact Victaulic for details.

Note
This product shall be manufactured by Victaulic or to Victaulic specifications. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

Trademarks
Victaulic® is a registered trademark of Victaulic Company.

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TECHNICAL DATA

SWING CHECK VALVE
MODEL D-1 & G-1

213

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION



The Viking Swing Check Valve is a general purpose rubber-faced check valve approved for use in fire protection systems. The Swing Check Valve is manufactured with a ductile iron body, brass seat, and a rubber-faced clapper assembly, hinged to a removable access cover for easy inspection and maintenance.

The valve may be installed vertically or horizontally with access cover facing up. For availability of flanged-flanged and grooved-grooved options, refer to Table 1. Tapped openings (with plugs) and gauge connections are provided on both the inlet and outlet chambers of the valve.

FEATURES

A. Ductile iron body for less weight and extra strength.
B. Rated to 300 psi (20.7 bar) water working pressure.
C. Rubber-faced clapper hinged to access cover for quick removal and easy servicing. All moving parts can be serviced without removing the valve from the installed position.
D. With the cover/clapper assembly removed, the clapper rubber replacement requires removal of only one screw.
E. Can be installed vertically or horizontally with access cover facing up.

2. LISTINGS AND APPROVALS

cULus Listed: Guide No. HMER
FM Approved: Single Check Valves
NYC Department of Buildings: MEA 89-92-E, Vol. XI

3. TECHNICAL DATA

Specifications:

Rated to 300 psi (20.7 bar) water working pressure.
Factory tested hydrostatically to 600 psi (41.4 bar).
Standard Flanged Connections: ANSI B16.42 Class 150 (mates with ANSI Class 125 and Class 150 flanges).
Standard Grooved Connections: ANSI/AWWA C606
Tapped Bosses: 2-1/2” (DN65), 3” (DN80) and 4” (DN100): Two 1/2” (15 mm) NPT
6” (DN150) and 8” (DN200): Two 3/4” (20 mm) NPT

Viking Technical Data may be found on The Viking Corporation’s Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

Material Standards: Refer to Figure 1.

Ordering Information: Refer to Table 1 for part numbers and shipping weight.

Table 1

Size Valve Nominal	Inlet Type	Outlet Type	Friction Loss*	Shipping Weight	Part No.
2-1/2" (DN65)	Groove	Groove	6 ft.(1.8 m)	16 lbs. (7 kg)	05497C
3" (DN80)	Goove	Groove	10 ft. (3.1 m)	20 lbs. (9 kg)	08536
4" (DN100)	Flange	Flange	13 ft. (4.0 m)	47 lbs. (21 kg)	08538
4" (DN100)	Groove	Groove	13 ft. (4.0 m)	27 lbs. (12 kg)	08539
6" (DN150)	Flange	Flange	20 ft. (6.0 m)	75 lbs. (34 kg)	08542
6" (DN150)	Groove	Groove	20 ft. (6.0 m)	51 lbs. (23 kg)	08543
8" (DN200)	Flange	Flange	23 ft. (7.0 m)	135 lbs. (61 kg)	08546
8" (DN200)	Groove	Groove	23 ft. (7.0 m)	106 lbs. (48 kg)	08547

*Expressed in equivalent length of Schedule 40 pipe based on Hazen & Williams formula: C = 120.

Systems with water working pressures above 175 psi (12 bar) may require extra-heavy pattern fittings. Viking Swing Check Valve flanges are Ductile Iron ANSI B16.42, Class 150, with a maximum water working pressure of 300 psi (20.7 bar). ANSI B16.42, Class 150 flanges are NOT compatible with ANSI Class 250 or Class 300 flanges. To mate the Viking Swing Check Valve with ANSI Class 250 or Class 300 flanges, use the grooved-inlet/grooved-outlet style installed with listed grooved/ flanged adapters of the appropriate pressure rating. For piping with grooved connections, the grooved-inlet/grooved-outlet style Swing Check Valve may be installed with listed grooved couplings of the appropriate pressure rating.

VIKING®

TECHNICAL DATA

SWING CHECK VALVE
MODEL D-1 & G-1

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4. INSTALLATION

The Swing Check Valve must be installed in an area not subject to physical damage. When corrosive atmospheres and/or contaminated water supplies are present, it is the owner's responsibility to verify compatibility with the Swing Check Valve and associated equipment. Prior to installing the valve, thoroughly flush the water supply piping to verify that no foreign matter is present. The Swing Check Valve may be installed in the vertical position with direction of flow up, or in the horizontal position with the access cover up.

Systems with water working pressures above 175 psi (12 bar) may require extra-heavy pattern fittings. Viking Swing Check Valve flanges are Ductile Iron ANSI B16.42, Class 150, with a maximum water working pressure of 300 psi (20.7 bar). ANSI B16.42, Class 150 flanges are not compatible with ANSI Class 250 or Class 300 flanges. To mate the Viking Swing Check Valve with ANSI Class 250 or Class 300 flanges, use the grooved-inlet/grooved-outlet style installed with listed grooved/flanged adapters of the appropriate pressure rating. For piping with grooved connections, the grooved-inlet/grooved-outlet style Swing Check Valve may be installed with listed grooved couplings of the appropriate pressure rating.

5. OPERATION (Refer to Figure 1)

Flow through the Viking Swing Check Valve lifts the rubber-gasketed clapper (8, and 9) off the seat (12) to enter the sprinkler piping. When flow through the valve stops, the clapper (8) closes quickly. The rubber gasket (9) forms a tight seal against the brass water seat (12), trapping pressure above the clapper and preventing reverse flow from sprinkler piping.

Hydrostatic Test:

The Swing Check Valve is manufactured and listed for use at a maximum water working pressure of 300 psi (20.7 bar). The valve is factory tested at 600 psi (41.4 bar). Check Valves may be hydrostatically tested (in accordance with NFPA 13) at 350 psi (24.1 bar) and/or 50 psi (3.4 bar) above the normal water working pressure for limited periods of time (two hours) for the purpose of acceptance by the Authority Having Jurisdiction. If air testing is required, do not exceed 40 psi (2.8 bar) air pressure.

6. INSPECTIONS, TESTS AND MAINTENANCE

NOTICE: The owner is responsible for maintaining the fire-protection system and devices in proper operating condition.

The Viking Swing Check Valve must be kept free of foreign matter, freezing conditions (when used on wet systems), corrosive atmospheres, contaminated water supplies, and any condition that could impair its operation or damage the device.

It is imperative that the system be inspected and tested on a regular basis. The frequency of the inspections may vary due to contaminated water supplies, corrosive water supplies, and corrosive atmospheres. For minimum maintenance and inspection requirements, refer to NFPA 25. In addition, the Authority Having Jurisdiction may have additional maintenance, testing, and inspection requirements that must be followed.

WARNING: Any system maintenance which involves placing a control valve or detection system out of service may eliminate the fire-protection capabilities of that system. Prior to proceeding, notify all the Authority Having Jurisdiction. Consideration should be given to employment of a fire patrol in the affected areas.

6-A. Five-Year Internal Inspection

Internal inspection of Swing Check Valves is recommended every five years unless inspections and tests indicate more frequent inspections are required.

(Refer to Figure 1)

1. Notify the Authority Having Jurisdiction, remote station alarm monitors, and those in the area affected that the system will be taken out of service. Consideration should be given to employment of a fire patrol in the affected areas.
2. Close the water supply main control valve, placing the system out of service.
3. Open the main drain. If necessary, open the system test valve to vent and completely drain the system.
4. Use the appropriate wrench to loosen and remove the cover screws (14), and remove the cover/clapper assembly (2-11).
5. Inspect the water seat (12). Wipe away all contaminants, dirt, and mineral deposits. DO NOT use solvents or abrasives.
6. Inspect the cover/clapper assembly (2-11) and the cover gasket (13). Test the hinged clapper (8) for freedom of movement. Renew or replace damaged or worn parts as required.

CAUTION: Never apply any lubricant to seats, gaskets, or any internal operating parts of the valve. Petroleum-based grease or oil will damage rubber components and may prevent proper operation.

7. When Internal inspection of the Check Valve is complete, perform step 6 of paragraph 11. VALVE MAINTENANCE to reinstall the cover/clapper assembly (2-11).

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6-B. Valve Maintenance

(Refer to Figure 1)

1. Perform steps 1 through 5 of paragraph 6.A - FIVE-YEAR INTERNAL INSPECTION.
2. To remove clapper rubber (9):
   a. Use the appropriate wrenches to loosen and remove the button-head socket screw (11), hex nut (6), sealing washer (7), and rubber retainer (10).
   b. Remove the clapper rubber (9) for inspection. If the clapper rubber shows signs of wear, such as cracking, cuts, or excessively deep grooves where the rubber contacts the water seat, replace the rubber.
3. To re-install clapper rubber (9):
   a. Place the clapper rubber (9) over the center hub of the rubber retainer (10).
   b. Position the retainer (10) (with rubber in place) against the clapper (8) as shown in Figure 1.
   c. Replace and tighten the button-head socket screw (11), sealing washer (7), and hex nut (6). The sealing washer (7) and hex nut (6) must be located on the top side of the clapper as shown in Figure 1. Do not over-tighten.
4. To remove clapper (8), and/or hinge pin (4):
   a. Remove the hinge pin retaining rings (5) to free the hinge pin (4) for removal. After the hinge pin (4) is removed, the clapper (8) can be removed.
5. To re-install clapper (8), and/or hinge pin (4):
   a. Verify that the clapper rubber (9) is in good condition and that it is properly installed.
   b. Position the clapper (8) with the elongated hinge holes aligned between the holes of the hinge bracket welded inside the cover (2). The system (top) side of the clapper (8) must face the direction indicated by the flow arrow stamped inside the cover (2).
   c. Insert the hinge pin (4) through the holes at one end of the hinge assembly. Continue to push the hinge pin (4) through the holes at the remaining end of the hinge assembly.
   d. Re-install the hinge pin retaining rings (5).
6. To re-install cover/clapper assembly (2-11):
   a. Verify that cover gasket (13) is in position and in good condition.
   b. Slide the cover/clapper assembly (2-11) into the Swing Check Valve so that the clapper rubber (9) contacts the water seat (12).
   c. Replace the cover screws (14). Use the appropriate wrench to cross-tighten all screws to the torque value shown in Table 2 for the valve used. DO NOT over-tighten.

7. AVAILABILITY

The Viking Swing Check Valve is available through a network of domestic and international distributors. See the Viking Corp. Web site for closest distributor or contact The Viking Corporation.

8. GUARANTEES

For details of warranty, refer to Viking's current list price schedule or contact The Viking Corporation directly.

Table 2: Torque Values for Viking Swing Check Valve Cover Screws

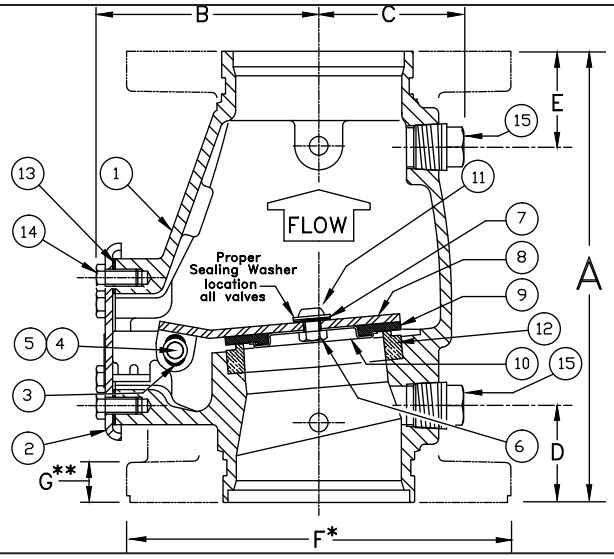
Valve Size	Screw Size	Torque Values
2-1/2" (DN65)	3/8"-16 HHC	19 ft-lbs 2.63 kg-m
3" (DN80)	3/8"-16 HHC	19 ft-lbs 2.63 kg-m
4" (DN100)	3/8"-16 HHC	19 ft-lbs 2.63 kg-m
6" (DN150)	1/2"-13 HHC	45 ft-lbs 6.23 kg-m
8" (DN200)	5/8"-11 HHC	93 ft-lbs 12.9 kg-m

TECHNICAL DATA

SWING CHECK VALVE MODEL D-1 & G-1

213

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Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com



SIZE	A	B	C	D	E	F	G**
2-1/2" (65mm)	9" (228,6)	4-1/2" (114,3)	2-5/8" (66,7)	2" (50,8)	2" (50,8)	Flg-Flg Not Available	
3" (80mm)	10-1/8" (257)	4-13/16" (122,2)	2-11/16" (68,3)	2-9/32" (58.1)	2-9/32" (58.1)	Flg-Flg Not Available	
4" (100mm)	10-5/8" (269,9)	5-3/16" (131,8)	3-1/8" (79.4)	2-1/4" (57.2)	2-1/4" (57,2)	9" (228,6)	15/16" (23,81)
6" (150mm)	13-3/8" (340)	6-13/16" (173,3)	4-1/16" (103.2)	2-1/4" (57,2)	2-1/4" (57,2)	11" (279,4)	1" (25,4)
8" (200mm)	17" (431,8)	8-13/16" (223,4)	5" (127)	2-1/2" (63,4)	2-7/8" (73,0)	13-1/2" (342,9)	1-1/8" (28,58)

Dimensions shown in parentheses are millimeters.

** 4", 6", and 8" valves are manufactured with sculptured flanges. Dimension indicates thickness of flange at bolt holes.

Figure 1

ITEM NO.	PART NUMBER D-1 2-1/2" (DN65)	G-1 3" (DN80)	G-1 4" (DN100)	G-1 6" (DN150)	G-1 8" (DN200)	DESCRIPTION	MATERIAL	NO. REQ'D 2-1/2"	3"	4"	6"	8"
1	--	--	--	--	--	Body	Ductile Iron, ASTM A536 (65-45-12)	1	1	1	1	1
2	--	--	--	--	--	Cover Assembly, 300 PSI WWP	E-Coated HSLA Steel, A715 and Stainless Steel, UNS-S30400	1	1	1	1	1
3	07576	07576	07576	07576	None	Bushing	Lubricomp 189 Ryton	2	2	2	2	0
4	05355A	05355A	04900A	04991A	05334A	Clapper Hinge Pin	Stainless Steel, UNS-S30400	1	1	1	1	1
5	05445A	05445A	05445A	05445A	05369A	Hinge Pin Retaining Ring	Stainless Steel, UNS-S15700	2	2	2	2	2
6	01755A					Clapper Hex Jam Nut #10-24 UNC	Stainless Steel, UNS-S30400	1	0	0	0	0
		08159	08159			Clapper Hex Jam Nut 3/8"-24 UNF	Stainless Steel, UNS-S30400	0	1	1	0	0
				08144	08144	Clapper Hex Jam Nut ½"-20 UNC	Stainless Steel, UNS-S30400	0	0	0	1	1
7	06595A	08158	08158	08143	08143	Sealing Washer	EPDM and Stainless Steel	1	1	1	1	1
8	*	*	*	*	*	Clapper	Teflon® Coated HR Steel UNS-G10180	1	1	1	1	1
9	*	*	*	*	*	Clapper Rubber	EPDM, ASTM D2000	1	1	1	1	1
10	*	*	*	*	*	Clapper Rubber Retainer	Stainless Steel, UNS-S30400	1	1	1	1	1
11	06595A					H.H.C. Screw #10-24 UNC x 1/2" (12.7 mm) lg.	Stainless Steel, UNS-S30400	1	0	0	0	0
		10194	10194			Screw, Button Head, Socket, 3/8" - 24 UNF x 1/2"	Stainless Steel, UNS-S30400	0	1	1	0	0
				10308		Screw, Button Head, Socket, 1/2" - 20 UNF x 3/4" (19.1 mm) lg.	Stainless Steel, UNS-S30400	0	0	0	1	1
					10686	Screw, Button Head, Socket, 1/2" - 20 UNF x 7/8"	Stainless Steel, UNS-S30400	0	0	0	0	1
12	--	--	--	--	--	Seat	Brass, UNS-C84400	1	1	1	1	1
13	05354B	05354B	04649B	04992B	05339C	Cover Gasket	EPDM, ASTM D2000	1	1	1	1	1
14	01517A	01517A	01517A			H.H.C. Screw 3/8"-16 UNC x 3/4" (19,1 mm) lg.	Steel, Zinc Plated	4	4	6	0	0
				04993A		H.H.C. Screw ½"-13 UNC x 7/8" (22.2 mm) lg.	Steel, Zinc Plated	0	0	0	6	0
					01922A	H.H.C. Screw 5/8"-11 UNC x 1-1/4" (31.8 mm) lg.	Steel, Zinc Plated	0	0	0	0	6
15	--	--	--			1/2" (15 mm) NPT Pipe Plug	Steel	2	2	2	0	0
				--	--	3/4" (20 mm) NPT Pipe Plug	Steel	0	0	0	2	2

-- Indicates replacement part is not available

* Indicates replacement part only available in a Sub-Assembly listed below.

Sub-Assemblies

3, 6-11	05499B	08518	08519	08520	08521	Clapper Assembly
9, 10	--	14864	14865	14866	--	Replacement Clapper Rubber Kit*

*Clapper rubbers are different on 3", 4", & 6" G-1 valve than original manufacture. If clapper rubber requires replacement, order replacement rubber kit.

210523 - Valves for Fire Protection Piping

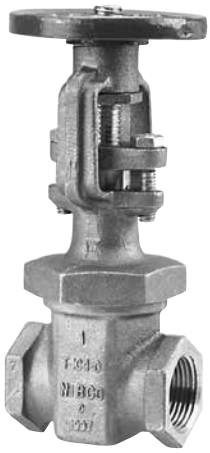
175 PSI WWP Bronze Gate Valves

Dezincification Resistant

Fire Protection Valve • Screw-over Bonnet •
Outside Screw and Yoke • Solid Wedge

175 PSI/12.1 Bar Non-Shock Cold Water
(400 PSI Non-Shock CWP General Service)

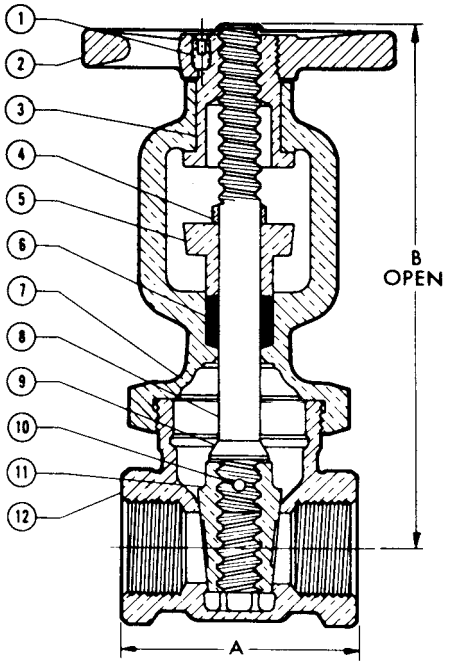
UL/ULC LISTED* • FM APPROVED •
APPROVED BY THE NEW YORK CITY B.S.A. 143-69-SA



T-104-0
Threaded

MATERIAL LIST

PART		SPECIFICATION
1.	Set Screw	Steel ASTM A307
2.	Handwheel	Malleable Iron
3.	Yoke Bushing	Brass ASTM B16
4.	Gland Bolts	Steel ASTM A307 Zinc Plated
5.	Packing Gland	Bronze ASTM B62
6.	Packing	Non Asbestos Aramid Fibers w/Graphite
7.	Bonnet	Bronze ASTM B62
8.	Stem	Silicon Bronze ASTM B371 Alloy C69430
9.	Stem Collar	Silicon Bronze ASTM B371 Alloy C69430
10.	Wedge Pin	Bronze ASTM B140 Alloy C31400
11.	Wedge	Bronze ASTM B62
12.	Body	Bronze ASTM B62



T-104-0
NPT x NPT

DIMENSIONS—WEIGHTS—QUANTITIES

Size		Dimensions A		Dimensions B		Handwheel Diameter		Handwheel Weight		Box	Master
In.	mm.	In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.	Qty.	Ctn. Qty.
½	15	2.19	59	5.88	149	3.25	88	2.28	1.04	1	20
¾	20	2.44	62	6.44	164	3.25	88	2.83	1.29	1	20
1	25	2.88	73	7.44	189	3.25	88	3.67	1.67	1	10
1¼	32	3.13	79	8.69	221	4.00	100	5.83	2.65	1	10
1½	40	3.38	84	9.38	238	4.00	100	6.84	3.11	1	10
2	50	3.44	87	10.59	269	3.50	89	9.74	4.44	1	6

*** Compliance with Standard for Gate Valves for Fire Protection Service, UL 262, and the Canadian Requirements.**

c UL US LISTED FM APPROVED

210523 - Valves for Fire Protection Piping

175 PSI WWP Bronze Angle Valves

Fire Protection Valve • Screw-in Bonnet • Integral Seat • Renewable Disc

Dezincification Resistant

175 PSI/12.1 Bar Non-Shock Cold Water

CONFORMS TO MSS SP-80 • UL/ULC LISTED*

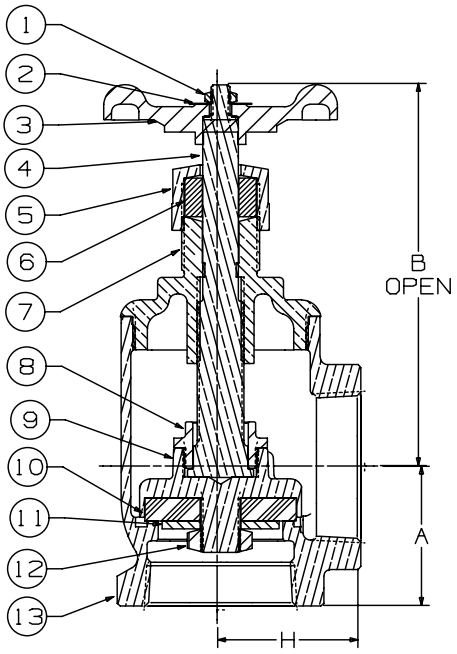


T-301-W
Threaded

MATERIAL LIST

	PART	SPECIFICATION
1.	Handwheel Nut	300 Series Stainless Steel
2.	Identification Plate	Aluminum
3.	Handwheel	Aluminum Commercial Alloy C38000
4.	Stem	Silicon Bronze ASTM B371 Alloy C69430
5.	Packing Gland	Bronze ASTM B62/ ASTM B16†/ ASTM B584 Alloy C84400
6.	Packing Nut	Bronze ASTM B62/ ASTM B584 Alloy C84400/ASTM B16
7.	Packing	Non Asbestos Aramid Fibers w/Graphite
8.	Bonnet	Bronze ASTM B62 Alloy C83600
9.	Disc Holder Nut	Bronze ASTM B62 Alloy C83600
10.	Disc Holder	Bronze ASTM B62 Alloy C83600
11.	Seat Disc	Nitrile (W) (1¼" - 2") PTFE (Y) (2½" - 3")
12.	Seat Disc Nut	Bronze ASTM B62‡/ ASTM B96 Alloy C65100 w/SS Washer
13.	Body	Bronze ASTM B62/B584 Alloy C83600

‡ 2½" and 3" size only.
† Not on 2"



T-301-W
NPT x NPT

DIMENSIONS—WEIGHTS—QUANTITIES

Size		Dimensions A		B		H		Weight		Box	Master
In.	mm.	In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.	Qty.	Ctn. Qty.
1¼	32	2.19	56	6.13	156	2.19	56	3.71	1.69	1	10
1½	40	2.38	60	7.19	183	2.38	60	5.54	2.52	1	10
2	50	2.25	57	7.25	184	2.25	57	6.72	3.05	1	10
**2½	65	3.19	81	10.56	268	3.19	81	16.13	7.33	1	2
**3	80	3.88	86	11.13	283	3.88	86	21.72	9.87	1	2

*** UL/ULC Listed for sizes for trim and drain use (Subject 258) - Sizes 1¼", 1½", 2".**
**** Sizes 2½" and 3" supplied as T-311-Y with PTFE seat disc. Subject to AHJ Approval.**
NOTE: See KT-67-UL for 1/2"-1" sizes.

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210523 - Valves for Fire Protection Piping

175 PSI WWP Bronze Globe Valves

Fire Protection Valve • Threaded Ends • Rubber Disc • Screw Over Bonnet

Dezincification Resistant

175 PSI/12.1 Bar Non-Shock Cold Water

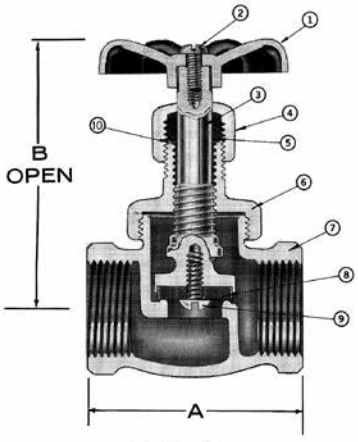


KT-65-UL
Threaded

UL LISTED*

MATERIAL LIST

	PART	SPECIFICATION
1.	Handwheel	Aluminum
2.	Handwheel Screw	Carbon Steel Stainless Steel (1")
3.	Stem	Bronze ASTM B584 Alloy C84400 or ASTM B505 Alloy C84400
4.	Packing Nut	Bronze ASTM B584 Alloy C83600 or ASTM B16
5.	Packing	Graphite Impregnated (Non Asbestos)
6.	Bonnet	Bronze ASTM B584 Alloy C84400
7.	Body	Bronze ASTM B584 Alloy C84400
8.	Seat Disc	EPDM Rubber (1/4" - 3/8") Nitrile (1/2" - 1")
9.	Seat Screw	Stainless Steel
10.	Pack Washer	Sheet Brass



KT-65-UL
NPT x NPT

DIMENSIONS—WEIGHTS—QUANTITIES

Size		Dimensions A		Dimensions B		Weight		Box	Master
In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.	Qty.	Ctn. Qty.
†¼	8	2.00	50	2.75	70	.48	.22	10	100
†⅜	10	2.00	50	2.75	70	.45	.20	10	100
½	15	2.28	58	3.12	79	.68	.31	10	60
¾	20	2.28	58	3.12	79	.74	.34	10	60
1	25	3.12	79	4.50	114	1.68	.76	5	25

*** UL Listed for Trim and Drain use (Subject 258) – sizes ½", ¾" , 1".**
Size ¼" and ⅜" supplied as KT-65 (Not UL Listed). Subject to AHJ Approval.

† **NOTE: See KT-211-W-UL for 1 ¼" -2" sizes.**

210523 - Valves for Fire Protection Piping

175 PSI WWP Bronze Globe Valves

Fire Protection Valve • Screw-in Bonnet • Integral Seat • Renewable Disc

Dezincification Resistant

175 PSI/12.1 Bar Non-Shock Cold Water



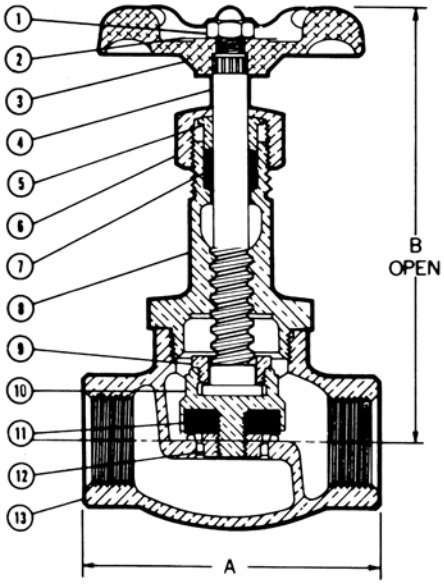
KT-211-W-UL
Threaded

CONFORMS TO MSS SP-80 • UL LISTED*

MATERIAL LIST

	PART	SPECIFICATION
1.	Handwheel Nut	300 Series Stainless Steel
2.	Identification Plate	Aluminum
3.	Handwheel	Aluminum Commercial Alloy 380
4.	Stem	Silicon Bronze ASTM B371 Alloy C69430
5.	Packing Gland	Bronze ASTM B62 or ASTM B584 Alloy C84400 or ASTM B282 or ASTM B16
6.	Packing Nut	Bronze ASTM B62 or ASTM B584 Alloy C84400 or ASTM B16
7.	Packing	Non Asbestos Aramid Fibers w/Graphite
8.	Bonnet	Bronze ASTM B62
9.	Disc Holder Nut	Bronze ASTM B140 Alloy C31400 or B62
10.	Disc Holder	Bronze ASTM B62‡/ ASTM B 9 Alloy C65100 w/SS Washer
11.	Seat Disc	Nitrile (W) (1¼" - 2") PTFE (Y) (2½" - 3")
‡12.	Disc Nut	Bronze ASTM B62/ASTM 89 Alloy C65100 w/SS Washer
13.	Body	Bronze ASTM B62

‡ 2½" and 3" size only.



KT-211-W-UL
NPT x NPT

DIMENSIONS—WEIGHTS—QUANTITIES

Size		Dimensions A		Dimensions B		Weight		Box	Master
In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.	Qty.	Ctn. Qty.
1¼	32	4.31	110	6.13	156	3.55	1.61	2	10
1½	40	4.69	119	7.19	183	5.50	2.49	2	10
2	50	5.38	143	7.94	202	8.25	3.75	2	6
**2½	65	6.63	168	10.19	259	15.40	7.00	1	2
**3	80	7.75	197	11.19	284	22.44	10.20	1	2

*** UL Listed for Trim and Drain use (Subject 258) – sizes 1¼", 1½", 2".**

**** Sizes 2½" and 3" supplied as T-211-Y with PTFE seat disc. Subject to AHJ Approval.**

NOTE: See KT-65-UL for ½"-1" sizes.

NIBCO INC. WORLD HEADQUARTERS • 1516 MIDDLEBURY ST. • ELKHART, IN 46516-4740 • USA • PH: 1.800.234.0227
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www.nibco.com

210523 - Valves for Fire Protection Piping

400 PSI WWP Bronze Side Outlet Globe Valves

Dezincification Resistant

220

Fire Protection Valve • 3-Way Valve • Screw-in Bonnet • Integral Seat • Renewable Disc

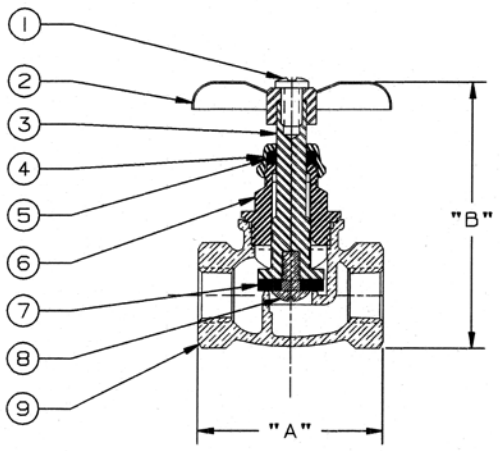
400 PSI/27.6 Bar Non-Shock Cold Water



KT-291-W3
Threaded

MATERIAL LIST

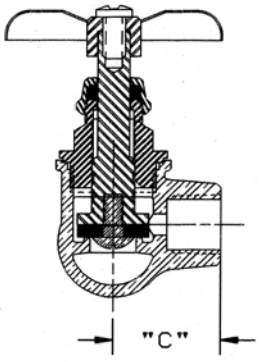
	PART	SPECIFICATION
1.	Handwheel Screw	Zinc Plated Steel
2.	Handwheel	Aluminum ASTM B85 Alloy C38000
3.	Stem	ASTM B133 Alloy C10200
4.	Packing Nut	ASTM B16 Alloy C36000
5.	Packing	Non Asbestos Aramid Fibers w/Graphite
6.	Bonnet	Bronze ASTM B584 Alloy C84400
7.	Disc	Nitrile
8.	Disc Screw	Stainless Steel ASTM A276 Alloy S43000
9.	Body	Bronze ASTM B584 Alloy C84400



KT-291-W3
NPT x NPT x NPT

DIMENSIONS—WEIGHTS—QUANTITIES

Size		Dimensions A		B		C		Weight		Box Qty.	Master Ctn. Qty.
In.	mm.	In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.		
¼	8	1.75	44	2.25	57	.94	24	.41	.19	10	100



210523 - Valves for Fire Protection Piping

200 PSI WWP Bronze Check Valves

Fire Protection Valve • Horizontal Swing • Rubber Disc

Dezincification Resistant

200 PSI/13.8 Bar Non-Shock Cold Water



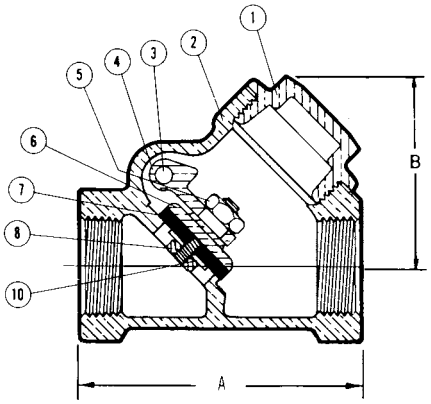
KT-403-W
Threaded

CONFORMS TO MSS SP-80

MATERIAL LIST

PART	SPECIFICATION
1. Bonnet	Bronze ASTM B62 or B584 Alloy C84400
2. Body	Bronze ASTM B62 or B584 Alloy C84400
3. Hinge Pin	Bronze ASTM B140 Alloy C31400 or B134 Alloy C23000
4. Disc Hanger	Bronze ASTM B62
5. Hanger Nut	Bronze ASTM B97 Alloy C65500 or Brass ASTM B16
6. Disc Holder	Bronze ASTM B62
7. Seat Disc	Nitrile (W) PTFE (Y)‡
8. Seat Disc Nut	Brass ASTM B16 or B97 Alloy C65500
9. Hinge Pin Plug	Bronze ASTM B140 Alloy C32000 (Not Shown)
*10. Seat Disc Washer	Stainless Steel

*** Sizes ¾", 1" , 1¼" and 1½" only.**
‡ 2½" and 3" size only.



KT-403-W
NPT x NPT

DIMENSIONS—WEIGHTS—QUANTITIES

Size		Dimensions A		Dimensions B		Weight		Box	Master.
In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.	Qty.	Ctn. Qty.
½	15	2.44	62	1.69	43	.58	.26	10	50
¾	20	2.94	75	1.88	48	.92	.42	10	50
1	25	3.56	90	2.31	59	1.55	.70	5	30
1¼	32	4.19	106	2.69	68	2.32	1.05	5	20
1½	40	4.50	114	2.94	75	3.00	1.36	2	10
2	50	5.25	133	3.81	97	4.87	2.21	2	10
2½	65	8.00	203	5.06	129	11.48	5.22	1	5
3	80	9.25	235	6.25	159	17.53	7.97	1	4

Sizes 2½" and 3" supplied as T-433-Y with PTFE seat disc.

NIBCO check valves may be installed in both horizontal and vertical lines with upward flow or in any intermediate position.

WARNING - Valve must be installed downstream of receiver tank if used in line with reciprocating air compressor.

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www.nibco.com

210523 - Valves for Fire Protection Piping

300 PSI WWP Bronze Ball Valves

Dezincification Resistant

Fire Protection Valve • Two-Piece Body • Chrome Plated Ball • Blowout-Proof Stem • Reinforced PTFE Seats

300 PSI/20.7 Bar Non-Shock Cold Water

CONFORMS TO MSS SP-110 • UL LISTED† • FM APPROVED†



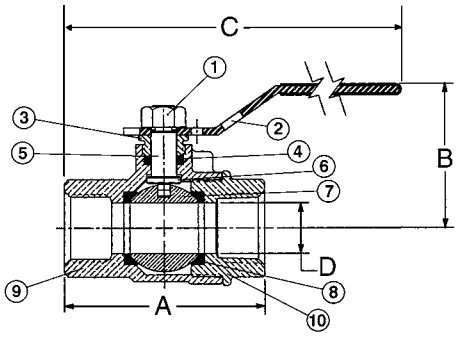
KT-585-70-UL
¼" - 1" Full Port
Threaded

KT-580-70-UL
1¼" - 2" Standard Port
Threaded

MATERIAL LIST

	PART	SPECIFICATION
1.	Handle Nut	Zinc Plated Steel
2.	Handle	Zinc Plated Steel Clear Chromate with Plastisol Grip
3.	Threaded Pack Gland	Brass ASTM B16
4.	Packing	PTFE
5.	Stem	Silicon Bronze ASTM B371 Alloy C69430 or ASTM B99 Alloy C65100
6.	Thrust Washer	Reinforced PTFE
7.	Ball	Brass ASTM B124 Alloy C37700 or ASTM B16 Alloy C36000 with Hard Chrome Plate
8.	Seat Ring (2)	Reinforced PTFE
9.	Body	Cast Red Bronze ASTM B584 Alloy C84400
10.	Body End Piece	Cast Red Bronze ASTM B584 Alloy C84400

¼" and ⅜" size only has A304 stainless steel grounding washer.



KT-585-70-UL
Full Port
NPT x NPT

KT-580-70-UL
Standard Port
NPT x NPT

DIMENSIONS—WEIGHTS—QUANTITIES

KT-585-70-UL Dimensions

Size		A		B		C		D Port		Weight		Box	Master
In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.	Qty.	Ctn. Qty.
¼	8	2.00	51	1.75	44	5.00	127	.38	10	.45	.20	10	100
⅜	10	2.00	51	1.75	44	5.00	127	.38	10	.45	.20	10	100
½	15	2.44	62	1.88	48	5.19	132	.50	13	.64	.29	10	100
¾	20	2.94	75	2.25	57	6.25	159	.75	19	1.33	.60	5	50
1	25	3.34	85	2.38	59	6.44	164	1.00	25	1.79	.81	5	20

KT-580-70-UL Dimensions

Size		A		B		C		D Port		Weight		Box	Master
In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.	Qty.	Ctn. Qty.
1 ¼	32	3.94	100	2.63	67	6.75	171	1.00	25	2.17	.99	5	20
1 ½	40	4.31	110	3.00	76	8.91	228	1.25	32	3.27	1.49	5	20
2	50	4.63	117	3.25	83	9.06	230	1.50	38	5.09	2.31	5	10
*2½	65	5.84	148	3.53	90	9.66	245	2.00	51	8.25	3.79	2	6
*3	80	7.09	202	4.41	112	11.53	293	2.50	64	15.65	7.11	1	4

† UL Listed, FM Approved for trim and drain use (UL Subject 258) – 585-70-UL ¼" thru 1" – 580-70-UL 1¼" thru 2".

***2½-3" supplied as T-580-70-UL subject to AHJ approval.**

DO NOT USE FOR NATURAL GAS

FM APPROVED

FireLock® Ball Valve

SEE VICTAULIC PUBLICATION 10.01 FOR DETAILS

224

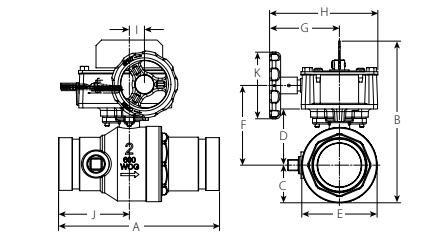
SERIES 728

210523 - Valves for Fire Protection Piping

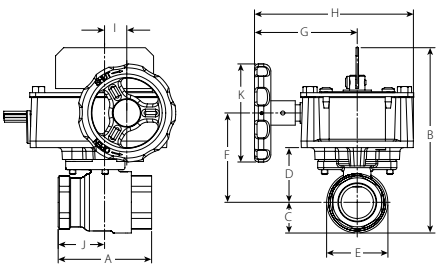
The Series 728 FireLock valve is a full port, ball valve that is UL/FM rated for 365psi/25 BAR service in all sizes (LPCB and VdS listed for 20 BAR services). Available with grooved or threaded ends (NPT), the valve body is brass. The ball is chrome plated brass with a stainless steel stem. Reinforced seats aid ease of operation and provide a durable, corrosion-free seat. Flow characteristics exceed UL Specification 1091 and FM Approval Standard 1112. The valve is approved for indoor and outdoor use.



DIMENSIONS



GROOVED X GROOVED



THREADED X THREADED

Size	Dimensions – Inches/mm											Approx. Wgt. Each
Nominal Inches/mm	E to E A	Height B	C	D	E	F	G	H	I	J	K	Lbs. kg
1/25 Thd. X Thd.	2.84 72	4.74 120	0.91 23	1.67 42	1.82 46	2.40 61	3.15 80	4.86 123	0.68 17	1.42 36	3.00 76	5.1 2.3
1 ¼/32 Thd. X Thd.	3.31 84	4.95 126	1.10 28	1.88 48	2.20 56	2.61 66	3.15 80	4.86 123	0.68 17	1.65 42	3.00 76	5.8 2.6
1 ½/40 Thd. X Thd.	3.66 92	5.13 130	1.29 33	2.06 52	2.58 66	2.79 71	3.15 80	4.86 123	0.68 17	1.83 47	3.00 76	6.6 3.0
2/50 Thd. X Thd.	4.33 110	5.49 140	1.69 43	2.42 62	3.38 86	3.15 80	3.15 80	4.86 123	0.68 17	2.16 55	3.00 76	8.5 3.9
1 ¼/32 Grv. X Grv.	7.25 184	4.95 126	1.10 28	1.87 48	2.20 56	2.61 66	3.15 80	4.86 123	0.68 17	3.19 81	3.00 76	7.5 3.4
1 ½/40 Grv. X Grv.*	7.25 184	5.17 131	1.29 33	2.10 53	2.58 66	2.83 72	3.15 80	4.86 123	0.68 17	3.19 81	3.00 76	8.5 3.9
2/50 Grv. X Grv.*	7.25 184	5.47 139	1.69 43	2.40 61	3.38 86	3.13 80	3.15 80	4.86 123	0.68 17	3.19 81	3.00 76	10.5 4.8

* 1½ and 2"/40 and 50mm sizes feature a ½"/12mm tap (Groove by Groove only).

PERFORMANCE

SIZE Nominal Inches/mm	Equivalent Feet/meters of Pipe	SIZE Nominal Inches/mm	Equivalent Feet/meters of Pipe
1/25 Thread X Thread	0.5 0.2	1 ¼/32 Groove X Groove	0.7 0.2
1 ¼/32 Thread X Thread	1.0 0.3	1 ½/40 Groove X Groove	0.7 0.2
1 ½/40 Thread X Thread	1.0 0.3	2/50 Groove X Groove	0.7 0.2
2/50 Thread X Thread	1.0 0.3		

JOB/OWNER

System No. _____

Location _____

CONTRACTOR

Submitted By _____

Date _____

ENGINEER

Spec Sect _____ Para _____

Approved _____

Date _____

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FireLock® Ball Valve

224

SERIES 728

SWITCH AND WIRING

1. The supervisory switch contains two single pole, double throw, pre-wired switches.
2. Switches are rated:

   10 amps @ 125 or 250 VAC/60 Hz

   0.50 amps @ 125 VDC

   0.25 amps @ 250 VDC

3. Switches supervise the valve in the "OPEN" position.

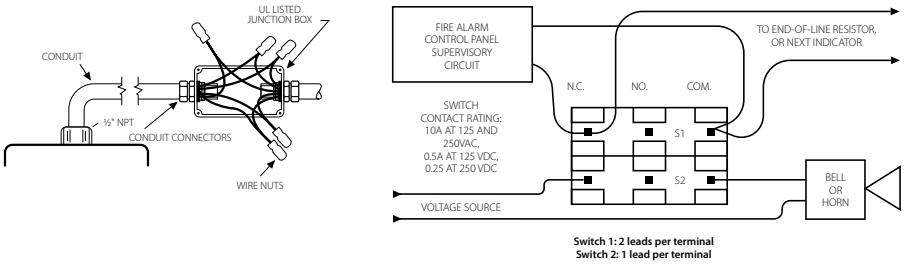
4. One switch has two #18 insulated wires per terminal, which permit complete supervision of leads (refer to diagrams and notes below). The second switch has one #18 insulated wire per terminal. This double circuit provides flexibility to operate two electrical devices at separate locations, such as an indicating light and an audible alarm, in the area that the valve is installed.
5. A #14 insulated ground lead (green) is provided.

   Switch #1 = S1 For connection to the supervisory circuit of a UL Listed alarm control panel

   Switch #2 = S2 Auxiliary switch that may be connected to auxiliary devices, per the authority having jurisdiction

S1
- Normally Closed: (2) Blue
- Common: (2) Yellow

S2
- Normally Closed: Blue with Orange Stripe
- Normally Open: Brown with Orange Stripe
- Common: Yellow with Orange Stripe



NOTE: The above diagram shows a connection between the common terminal (yellow – S1 and yellow-with-orange stripe – S2) and the normally closed terminal (blue – S1 and blue-with-orange stripe – S2). In this example, the indicator light and alarm will stay on until the valve is fully open. When the valve is fully open, the indicator light and alarm will go out. Cap off any unused wires (e.g. brown with orange stripe).

Only S1 (two leads per terminal) may be connected to the fire alarm control panel.

The connection of the alarm switch wiring shall be in accordance with NFPA 72 and the auxiliary switch per NFPA 70 (NEC).

MATERIAL SPECIFICATIONS

Valve Body: Brass ASTM B124

Ball: Chrome Plated Brass

Ball Valve Stem: 316 Stainless Steel

Seat: Carbon Filled (TFE) tetrafluoroethylene

Stem Nut: Brass ASTM B-16 C36000

Actuator: Brass traveling nut, on a steel lead screw, in a ductile iron housing

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FireLock® Ball Valve

224

SERIES 728

INSTALLATION

Reference should always be made to the I-100 Victaulic Field Installation Handbook for the product you are installing. Handbooks are included with each shipment of Victaulic products for complete installation and assembly data, and are available in PDF format on our website at www.victaulic.com.

WARRANTY

Refer to the Warranty section of the current Price List or contact Victaulic for details.

NOTE

This product shall be manufactured by Victaulic or to Victaulic specifications. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

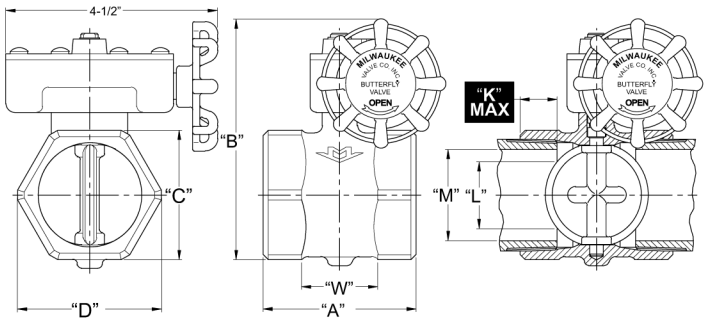
10.17 2226 REV H UPDATED 05/2011

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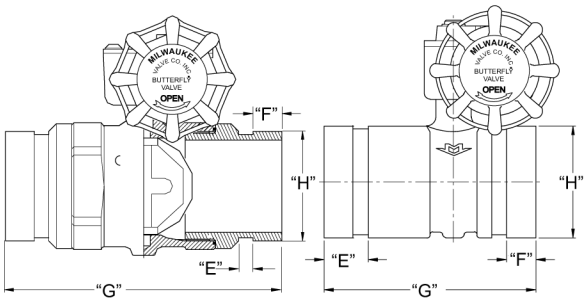
INDOOR/OUTDOOR

butterball® BUTTERFLY VALVES

VALVES LESS SUPERVISORY TAMPER SWITCH ASSEMBLY



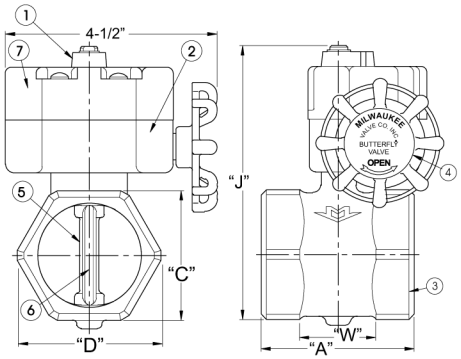
BB-SC100 (Threaded Ends)
Sizes 1", 1-1/4", 1-1/2", 2",2-1/2"



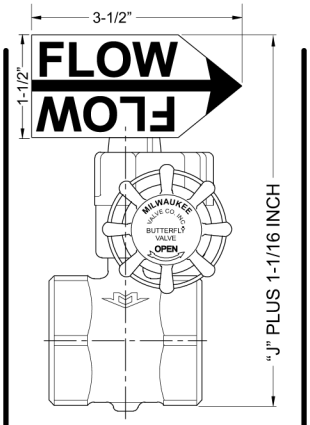
BBVSC100
3 piece with
Grooved Ends
Size 2"

BBVSC100
Uni-body with
Grooved Ends
Size 2-1/2"

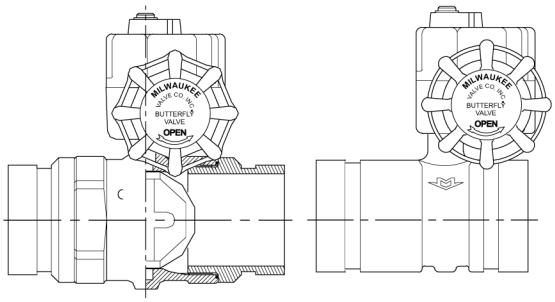
VALVES WITH SUPERVISORY TAMPER SWITCH ASSEMBLY



THREADED ENDS
BB-SCS02



NYC INDICATOR
(Available on both switched and non-switched models.)



BBVSCS02
3 piece with
Grooved Ends
Size 2"

BBVSCS02
Uni-body with
Grooved Ends
Size 2-1/2"

ALL DIMENSIONS-INCHES

	Threaded				Grooved		
SIZE	**1'**	**1-1/4"**	**1-1/2"**	**2"**	**SIZE**	**2"**	**2-1/2"**
A	2-1/8	2-5/8	2-7/8	3-1/4	A	-	4-1/8
B	3-15/16	4-9/32	4-1/2	5	B	5	5-13/32
C	1-9/16	1-15/16	2-3/16	2-3/4	C	2-3/4	3-3/16
D	1-23/32	2-7/64	2-3/8	3-1/16	D	3-1/16	3-1/2
J	4-15/16	5-1/8	5-19/32	6-1/8	E	5/8	15/16
K	.66	.73	.73	.79	F	5/16	5/8
L	.83	.90	.99	1.41	G	6	4-1/2
M-40	1.05	1.38	1.61	2.07	H	2-3/8	2-7/8
M-80	.96	1.28	1.50	1.94	J	6-1/8	6-1/4
N-40	2.25	2	2.5	2.25	K	.79	1.18
W	1-1/8	1-1/4	1-13/32	1-11/16	L	1.41	1.29
					M-40	2.07	2.47
					M-80	1.94	2.32
					N-40	2.25	10
					W	-	1-3/4

M-40 ARE DIMENSIONS USING SCHEDULE 40 PIPE
M-80 ARE DIMENSIONS USING SCHEDULE 80 PIPE
N-40 IS FLOW RESISTANCE EXPRESSEDIN EQUIVALENT LENGTH OF SCHEDULE 40 PIPE
W IS THE WRENCH MAKE-UP LENGTH

MATERIAL LIST

NO.	PART	MATERIAL	SPECIFICATION
1	Indicator	Sintered Iron	F0008P
2	Housing	Bronze	ASTM 584
3	Body	Bronze	ASTM 584
4	Handle	Brass	
5	Disc	Stainless Steel	Type 304
6	Disc Seal	EPDM Elastomer	
7	Switch Housing	Die Cast Aluminum	

For Commercial, Institutional and Industrial Applications

Job Name _____ Contractor _____

Job Location _____ Approval _____

Engineer _____ Contractor's P.O. No. _____

Approval _____ Representative _____

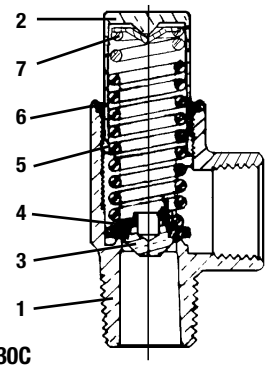
Series 530C

Calibrated Pressure Relief Valves

Sizes: ½" or ¾" (15 or 20mm)

Series 530C Calibrated Pressure Relief Valves are spring operated brass valves designed for use only as protection from the build up of excessive pressure in systems containing water, oil or air. Series 530C valves incorporate a calibrated adjustment feature for setting the valve to the relief pressure required. These valves are ideally suited for bypass thermal expansion relief.





Model 530C

Features

- Calibrated adjustment feature for setting valve to relief pressure required
- Adjustable range 50 – 175psi (3.4 – 12.1 bar)
- All brass construction
- All stainless steel spring
- Buna-N disc on machined body seat
- Inlet (bottom), male NPT threaded
- Outlet (side), female NPT threaded

Materials

1. Body	Brass
2. Bonnet	Brass
3. Disc Holder	Brass
4. Disc	Buna-N (Nitrile)
5. Adjustable Spring	Stainless Steel
6. O-ring	Buna-N (Nitrile)
7. Spring Washer	Brass

Pressure – Temperature

Maximum Temperature: 180°F (82°C)

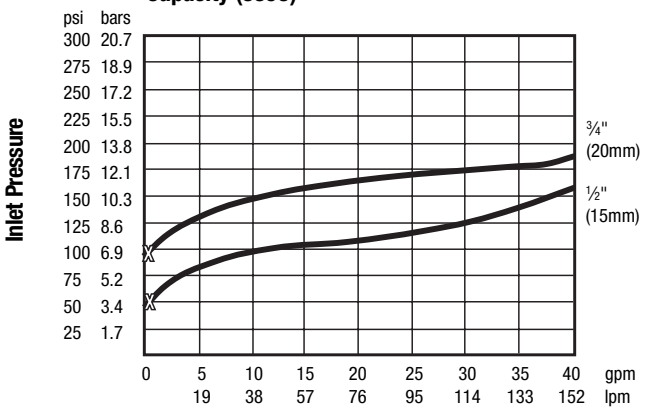
Spring Ranges

½" or ¾" (15 or 20mm): 50 – 175psi (3.4 – 12.1 bar)
¾" (20mm): 100 – 300psi (6.9 – 20.7 bar)

Application Note: The Watts Series 530C are not ASME approved safety relief valves and should not be used in system application with this requirement.

MODEL	SIZE (DN)		DIMENSIONS				WEIGHT	
			Height		Width			
	in.	*mm*	*in.*	*mm*	*in.*	*mm*	*lbs.*	*kg.*
530C	½ or ¾	15 or 20	3	76	1⅝	41	.37	0.17

Capacity (530C)



X = Set Point Flow

Watts product specifications in U.S. customary units and metric are approximate and are provided for reference only. For precise measurements, please contact Watts Technical Service. Watts reserves the right to change or modify product design, construction, specifications, or materials without prior notice and without incurring any obligation to make such changes and modifications on Watts products previously or subsequently sold.

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WATTS®

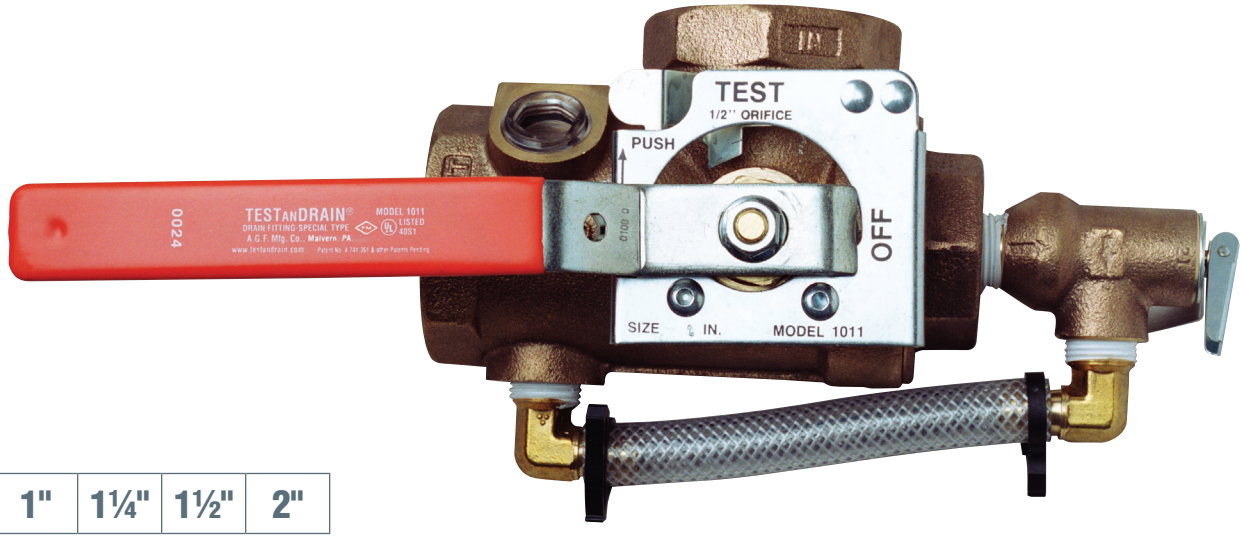
Water Safety & Flow Control Products

USA: 815 Chestnut St., No. Andover, MA 01845-6098; www.watts.com
Canada: 5435 North Service Rd., Burlington, ONT. L7L 5H7; www.wattscanada.ca

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Model 1011A TESTANDRAIN®

Sectional Floor Control Test and Drain Valve for Systems Requiring Pressure Relief Valve



Sizes:

¾"	1"	1¼"	1½"	2"

The AGF **Model 1011A TESTANDRAIN®** provides the test and express drain functions for wet fire sprinkler systems on multi-story installations requiring pressure relief (NFPA 13 and NFPA 13R). The **Model 1011A** features a **Model 7000 Pressure Relief Valve** with drain pipe.

The **Model 1011A** is available in a full range of sizes (¾" to 2") with NPT connections (BSPT available). The **Model 7000 Pressure Relief Valve** (UL/FM) features a flushing handle and a 175 PSI factory rating (other pressure ratings available).

- Complies with NFPA 13 and NFPA 13R Requirements
- Compact, Single-Handle Ball Valve
- Tamper-Resistant Test Orifice and Sight Glasses
- 300 PSI rated.
- Specifiable orifice sizes: ⅜" (2.8K), 7⁄16" (4.2K), ½" (5.6K), 17⁄32" (8.0K), ⅝" (11.2K, ELO), ¾" (14.0K, ESFR), and K25
- Relieves Excess System Pressure caused by Surges or Temperature Changes
- Shipped with Relief Valve and Bypass Drain Ports Plugged to Expedite Pressure Testing
- Locking Kit Available

Repair kits are available for all **TESTANDRAIN®** valves. Kit includes: Adapter Gasket (1), Ball (1), Valve Seats (2), Stem Packing (1), and Stem Washer (1). ***Valve and orifice size must be specified when ordering.***

NOTE: It is important to note that the pressure rating of the relief valve indicates an operating range of pressure for both opening and closing of the valve. Standard relief valves are required to OPEN in a range of pressure between 90% and 105% of their rating. The valves are required to CLOSE at a pressure above 80% of that rating. The relief valve should be installed where it is easily accessible for maintenance. Care should be taken that the relief valve CANNOT be isolated from the system when the system is operational. A relief valve should NEVER have a shutoff valve or a plug downstream of its outlet.

Reliability, Versatility, Code Compatibility

TESTANDRAIN® is a registered trademark of AGF Manufacturing Inc.

Model 1011A TEST AN DRAIN®

Model 1011A 300 PSI Bronze Ball Valve, Model 7000 Pressure Relief Valve
Factory Rated at 175 PSI with other setting available

Dimensions

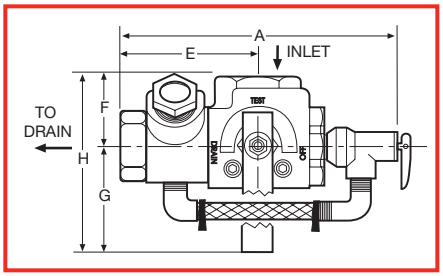
SIZE	A	B	C	D	E	F	G	H
¾"	7 9/16" (191 mm)	1 1/2" (37.5 mm)	2 3/16" (57 mm)	3 5/8" (93 mm)	3 3/8" (86 mm)	1 13/16" (46 mm)	4 9/16" (117 mm)	6 3/8" (162.5 mm)
1"	7 9/16" (191 mm)	1 1/2" (37.5 mm)	2 3/16" (57 mm)	3 5/8" (93 mm)	3 3/8" (86 mm)	1 13/16" (46 mm)	4 9/16" (117 mm)	6 3/8" (162.5 mm)
1¼"	7 15/16" (201 mm)	1 11/16" (43 mm)	2 9/16" (65 mm)	4 1/4" (108 mm)	3 5/8" (91 mm)	1 15/16" (51 mm)	5 9/16" (141 mm)	7 1/2" (192 mm)
1½"	8 15/16" (227 mm)	1 13/16" (45 mm)	3 1/4" (81.5 mm)	5 1/16" (127 mm)	3 7/8" (99 mm)	2 5/8" (67 mm)	8 1/4" (207 mm)	10 7/8" (274 mm)
2"	8 15/16" (227 mm)	1 13/16" (45 mm)	3 1/4" (81.5 mm)	5 1/16" (127 mm)	3 7/8" (99 mm)	2 5/8" (67 mm)	8 1/4" (207 mm)	10 7/8" (274 mm)

The Model 1011A provides the following…

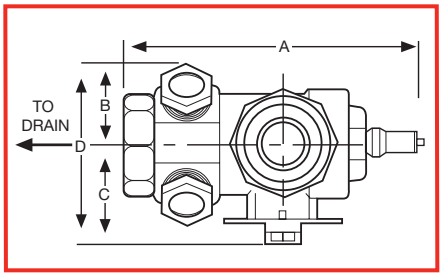
From the 2013 Edition of NFPA 13

Chapter 8.16.2.4.1*	Provisions shall be made to properly drain all parts of the system.
Chapter 8.16.2.4.2 & 8.16.2.4.3	Drain connections, interior sectional or floor control valve(s) – shall be provided with a drain connection having a minimum size as shown in Table 8.16.2.4.2.
Chapter 8.16.2.4.4	Drains shall discharge outside or to a drain capable of handling the flow of the drain.
Chapter A.8.17.4.2	(Wet Pipe System) test connection is permitted to terminate into a drain capable of accepting full flow… using an approved sight test connection containing a smooth bore corrosion-resistant orifice giving a flow equivalent to one sprinkler…
Chapter 8.17.4.2.2	The test connection valve shall be accessible.
Chapter 8.17.4.2.4	shall be permitted to be installed in any location… downstream of the waterflow alarm.
Chapter 8.17.4.3.1	(Dry Pipe System) a trip test connection not less than 1" in diameter, terminating in a smooth bore corrosion-resistant orifice, to provide a flow equivalent to one sprinkler…
Chapter 8.17.4.3.2	The trip test connection… with a shutoff valve and plug not less than 1", at least one of which shall be brass.
Chapter 7.1.2	- a wet pipe system shall be provided with a listed relief valve set to operate at 175 PSI or 10 PSI in excess of the maximum system pressure, whichever is greater.
Chapter 8.16.1.2.3*	A listed relief valve of not less than ½" in size shall be provided on the discharge side of the pressure-reducing valve set to operate at a pressure not exceeding rated pressure of the system.
Chapter A.8.16.1.2.3	- consideration should be given to piping the discharge from the (pressure relief) valve

Model 1011A - Front View



Model 1011A - Plan View



Orifice Sizes

⅜", 7/16", ½", 17/32", ⅝" ELO*, ¾" ESFR*, and K25**

Materials

Handle ..... Steel
Stem ..... Rod Brass
Ball..... C.P. Brass
Body ..... Bronze
Valve Seat..... Impregnated Teflon®
Indicator Plate .... Steel
Relief Valve ..... Bronze
Bypass Fittings... Brass
Bypass Tubing.... Nylobraid

Approvals

UL and ULC Listed:
(EX4019 & EX4533)
FM Approved
NYC-BSA No. 720-87-SM

MADE IN U.S.A.

USA Patent # 4741361 and Other Patents Pending

AGF Manufacturing Inc.
100 Quaker Lane, Malvern, PA 19355
Phone: 610-240-4900
Fax: 610-240-4906
www.testandrain.com

Job Name:_____
Architect:_____
Engineer:_____
Contractor:_____

*Available on 1¼" to 2" size units only • **Available on 1½" and 2" size units only

Model 350A

Double Check Valve Assembly

228A

Application

Designed for installation on potable water lines to protect against both backsiphonage and backpressure of polluted water into the potable water supply. The Model 350A shall provide protection where a potential health hazard does not exist. Ideal for use where Lead-Free* valves are required.

Standards Compliance (Horizontal & Vertical)

- ASSE® Listed 1015
- AWWA Compliant C510 (with gates only), and C550
- IAPMO® Listed
- Certified to NSF/ANSI 372* by IAPMO R&T
- CSA® Certified
- UL® Classified
- C-UL® Classified
- FM® Approved
- NYC MEA 220-04-M Vol 2 (2 1/2" - 8")
- Approved by the Foundation for Cross Connection Control and Hydraulic Research at the University of Southern California
- NSF® Listed-Standard 61, Annex G*

*(0.25% MAX. WEIGHTED AVERAGE LEAD CONTENT)

Materials

Main valve body	Ductile Iron ASTM A 536 Grade 4
Access covers	Ductile Iron ASTM A 536 Grade 4
Coatings	FDA Approved electrostatic epoxy finish
Internals	Stainless steel, 300 Series NORYL™, NSF Listed
Fasteners & springs	Stainless Steel, 300 Series
Seal ring	EPDM (FDA approved)
O-ring	Buna Nitrile (FDA approved)

Features

Sizes: 2 1/2", 3", 4", 6", 8", 10"

Maximum working water pressure	175 PSI
Maximum working water temperature	140˚F
Hydrostatic test pressure	350 PSI
End connections	
(Grooved for steel pipe)	AWWA C606
(Flanged)	ANSI B16.1 Class 125



(with OSY gates)



(with BG valves)

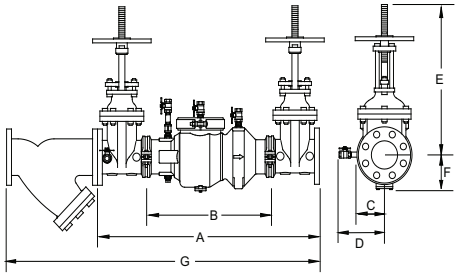
Options (Suffixes can be combined)

- ☐ - with flanged end NRS gate valves (standard)
- ☐ FSC - with epoxy coated wye type strainer (flanged only)
- ☐ G - with grooved end connections
- ☐ GF - with grooved inlet connection and flanged outlet connection
- ☐ FG - with flanged inlet connection and grooved outlet connection
- ☐ L - less shut-off valves (grooved body connections)
- ☐ OSY - with flanged end OS&Y gate valves
- ☐ OSYG - with grooved end OS&Y gate valves
- ☐ PI - with Post Indicator Gate Valves
- ☐ BG - with grooved end butterfly valves with integral supervisory switches
- ☐ BF - with flanged end butterfly valves with integral supervisory switches

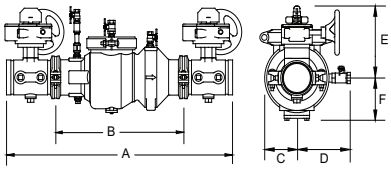
Accessories

- ☐ Repair kit (rubber only)
- ☐ Thermal expansion tank (Model XT)
- ☐ OS & Y Gate valve tamper switch (OSY-40)

MODEL 350A with OSY & FSC option



MODEL 350A with BG option



Dimensions & Weights (do not include pkg.)

MODEL 350A SIZE		WEIGHT													
		LESS SHUTOFF VALVES		NRS GATE VALVES FLANGED		NRS GATE VALVES GROOVED		OSY GATE VALVES FLANGED		OSY GATE VALVES GROOVED		BUTTERFLY VALVES FLANGED		BUTTERFLY VALVES GROOVED	
in.	mm	lbs.	kg	lbs.	kg	lbs.	kg	lbs.	kg	lbs.	kg	lbs.	kg	lbs.	kg
2 1/2	65	90	41	184	83	176	80	192	87	184	83	142	65	132	60
3	80	89	40	204	93	194	88	210	95	200	91	147	66	133	61
4	100	76	34	220	100	194	88	230	104	204	93	147	66	124	56
6	150	126	57	346	157	316	143	362	164	332	151	231	105	200	91
8	200	286	130	738	335	738	335	762	346	738	335	476	216	430	195
10	250	339	154	966	438	844	383	1024	464	902	409	613	278	555	252

MODEL 350A SIZE		DIMENSION (approximate)																							
		A		A WITH BUTTERFLY VALVES		B LESS GATE VALVES		C		D		E OS&Y OPEN		E OS&Y CLOSED		E NRS GATE		E WITH BUTTERFLY VALVES		F		G WITH GATE VALVES		G WITH BUTTERFLY VALVES	
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
2 1/2	65	35 1/8	892	32 1/8	816	20 1/8	511	4 1/2	114	7 1/4	184	17 3/4	451	15 3/8	391	11 1/2	292	8 1/4	210	6	152	45 1/4	1149	42 1/4	1073
3	80	36 1/8	918	33	838	20 1/8	511	4 1/2	114	7 1/4	184	20 1/4	514	17	432	12 3/4	324	8 1/2	216	6	152	46 7/8	1191	43 3/4	1111
4	100	38 1/4	972	33 1/4	845	19 7/8	505	4 1/2	114	8	203	22 1/2	572	18 1/4	464	14 1/2	368	9	229	6	152	53 3/8	1356	48 3/8	1229
6	150	47 1/4	1200	40 1/4	1022	25 7/8	657	5 1/2	140	10	254	30 1/2	775	24 1/4	616	18	457	10 1/4	260	7	178	65 3/8	1661	58 3/8	1483
8	200	62	1575	55	1397	38 1/2	978	10	254	11	279	37	940	28 1/2	724	21 1/8	537	12	305	8 1/2	216	86 3/8	2194	79 3/8	2016
10	250	64 5/8	1641	58 1/2	1486	38 1/2	978	10	254	12	305	45 5/8	1159	34 3/4	883	24 3/4	629	13	330	8 1/2	216	94 3/8	2397	88 1/4	2242

Attention: Model 350A (grooved body) & Model 350 (flange body) have different lay lengths.

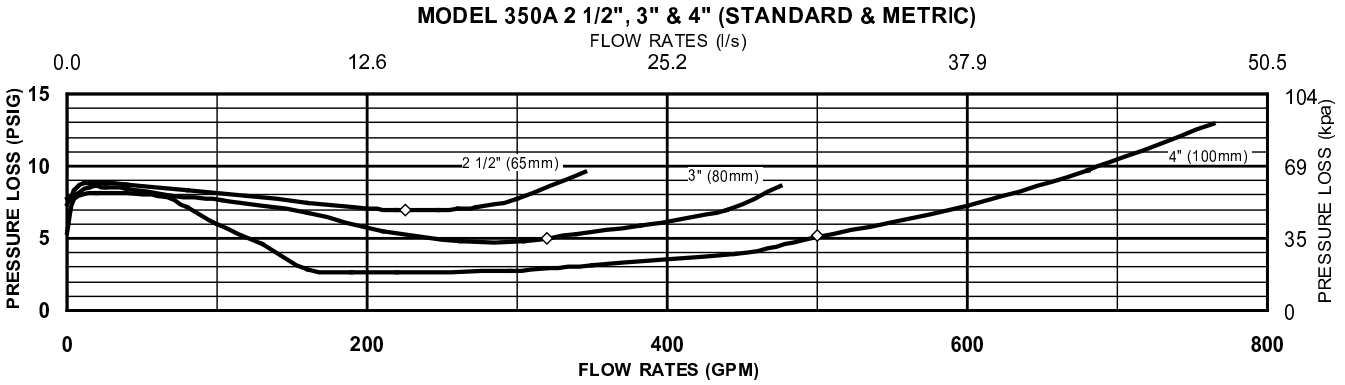
Zurn Industries, LLC | Wilkins
1747 Commerce Way, Paso Robles, CA U.S.A. 93446 Ph. 855-663-9876, Fax 805-238-5766
In Canada | **Zurn Industries Limited**
3544 Nashua Drive, Mississauga, Ontario L4V 1L2 Ph. 905-405-8272, Fax 905-405-1292
www.zurn.com

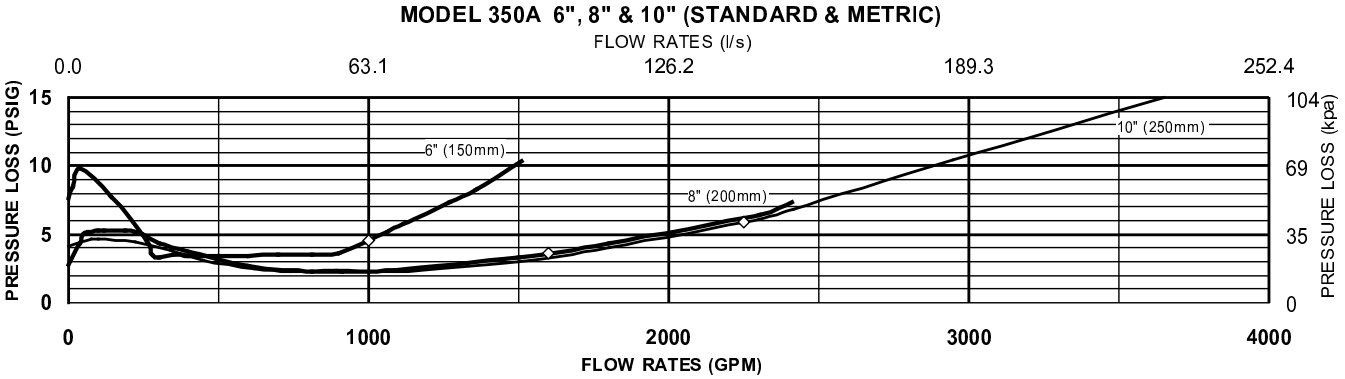
Rev. D
Date:1/15
Document No. BF-350A
Patent No. 5, 913, 331
Product No. Model 350A

Flow Characteristics

◇ Rated Flow (established by approval agencies)

228A

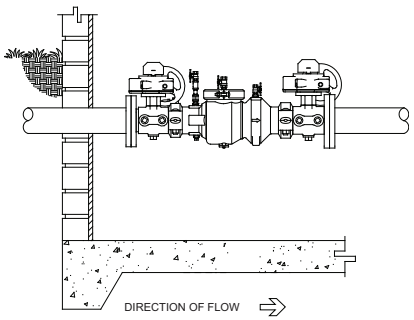




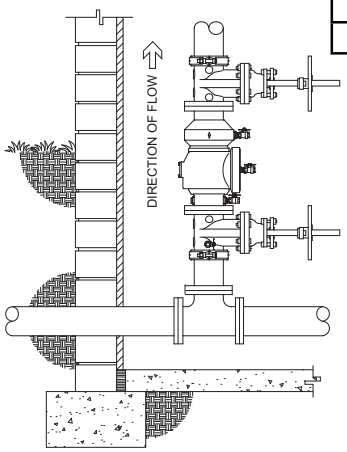
Typical Installation

Local codes shall govern installation requirements. Unless otherwise specified, the assembly shall be mounted at a minimum of 12" (305mm) and a maximum of 30" (762mm) above adequate drains with sufficient side clearance for testing and maintenance. The installation shall be made so that no part of the unit can be submerged.

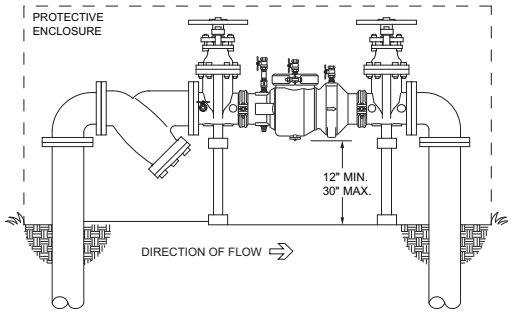
Capacity thru Schedule 40 Pipe (GPM)				
Pipe size	5 ft/sec	7.5 ft/sec	10 ft/sec	15 ft/sec
2 1/2"	75	112	149	224
3"	115	173	230	346
4"	198	298	397	595
6"	450	675	900	1351
8"	780	1169	1559	2339
10"	1229	1843	2458	3687
12"	1763	2644	3525	5288



INDOOR INSTALLATION MODEL 350ABF



INDOOR INSTALLATION (VERT.) MODEL 350A



OUTDOOR INSTALLATION MODEL 350AFS

Specifications

The Double Check Backflow Prevention Assembly shall be certified to NSF/ANSI 372, ASSE® Listed 1015, and supplied with full port gate valves. The main body and access cover shall be epoxy coated ductile iron (ASTM A 536 Grade 4), the seat ring and check valve shall be NORYL™, the stem shall be stainless steel (ASTM A 276) and the seat disc elastomers shall be EPDM. The checks shall be accessible for maintenance without removing the device from the line. The Double Check Backflow Prevention Assembly shall be a ZURN WILKINS Model 350A.

Zurn Industries, LLC | Wilkins
1747 Commerce Way, Paso Robles, CA U.S.A. 93446 Ph. 855-663-9876, Fax 805-238-5766
In Canada | **Zurn Industries Limited**
3544 Nashua Drive, Mississauga, Ontario L4V 1L2 Ph. 905-405-8272, Fax 905-405-1292
www.zurn.com

FORGED BRASS BALL VALVE

240

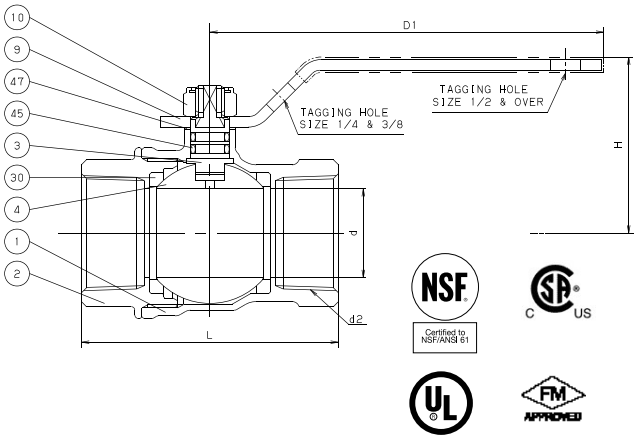
MAINTENANCE FREE DOUBLE O-RING STEM SEALS

Two Piece Body • Full Port • Chrome Plated

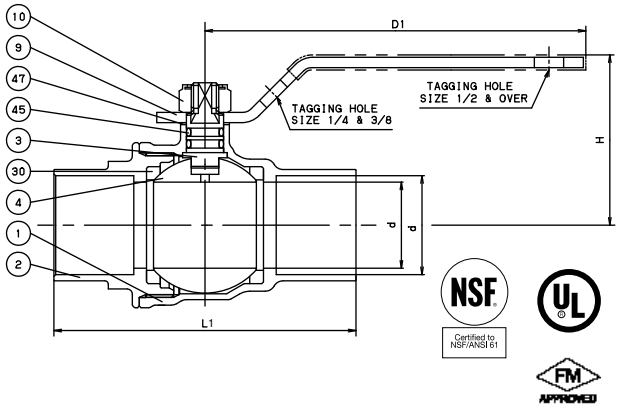
Blowout Proof Stem (Ni Plated) • PTFE Seats

NSF • CSA (US/C) • UL • FM

CODE # 58
FIPS X FIPS



CODE # 59
CxC*



OPTIONS

OVAL HANDLE
EXTENDED STEM
MEMORY STOP

KITZ Code No. 58 (AKSZA) Threaded Ends
59 (CSZA) Solder Ends

STANDARDS	
END TO END	KITZ
THREADED ENDS	ANSI B1.20.1
SOLDER JOINT ENDS	ANSI B16.18
WALL THICKNESS	KITZ
DESIGN	MSS SP-110

PRESSURE/TEMPERATURE

150 PSI SATURATED STEAM TO 366ºF
600 PSI - NON-SHOCK COLD WATER, OIL OR GAS

* SEE VALVE INSTALLATION INSTRUCTIONS/PRESSURE TEMPERATURE LIMITATIONS FOR COPPER TUBE AND SOLDER JOINT VALVES - PAGE BV-29 & 30.

MATERIAL LIST

NO.	NAME OF PART	SPECIFICATION
1	BODY	FORGED BRASS (B283, C37700)
2	BODY CAP	FORGED BRASS (B283, C37700)
3	STEM	K-METAL
4	BALL	(1) FORGED BRASS (B283, C37700) STRAIGHT OR HOLLOW BALL
9	HANDLE	(2) CARBON STEEL
10	HANDLE NUT	CARBON STEEL
30	BALL SEATS	PTFE
45	O-RINGS	FPM
47	THRUST WASHER	PBT

NOTES: (1) TEA PLATED
(2) ELECTROPLATED ZINC WITH PLASTIC COVERING

DIMENSIONS - WEIGHTS - QUANTITIES

d2 SIZE	d	H	D1	L	L1	d1 Max.	d1 Min.	APPROX. NET WT.	CARTON QTY
1/4	.39	1.46	2.76	1.65	1.05	.381	.377	29	120
3/8	.39	1.46	2.76	1.65	1.11	.506	.502	29	120
1/2	.59	1.57	3.15	2.08	1.13	.631	.627	29	96
3/4	.79	1.69	3.15	2.36	1.37	.881	.877	45	60
1	.98	1.97	4.33	2.83	1.64	1.132	1.128	60	36
1 1/4	1.26	2.16	4.33	3.31	2.00	1.382	1.378	68	24
1 1/2	1.57	2.52	5.90	3.62	2.35	1.633	1.628	50	16
2	1.97	2.83	5.90	4.33	2.83	2.133	2.128	71	16

CERTIFICATIONS:

NSF/ANSI STANDARDS 61-8, C-HOT (180ºF/82ºC)
CAS (US/C):
- CGA 9.1b-2001/ANSI 21.15b-2006 - .5G
- CGA CR 91-002 - 2G
- ASME B16.44 - 5G
- CAN/CGA 3.16-M88 - 125G
- ASME B16.33-2002-125G

UL-258 - 175 WWP (Fire Trim Protection Valves)
FM-1140 - 175 WWP (Fire Protection Systems)

115 Standard Duty Loop Hanger



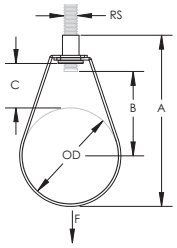






The 115 Standard Duty Loop Hanger is ideal for suspending stationary, non-insulated pipe lines, including CPVC pipes, in fire sprinkler systems. A knurled insert nut helps simplify vertical adjustments and flared edges on the base (1/2" to 4" sizes) help protect pipes from coming into contact with any sharp edges of the hanger.

- Flared edges help prevent any sharp surfaces from coming into contact with the pipe (1/2" to 4" sizes)
- Retained insert nut helps ensure the loop hanger and insert nut stay together
- Recommended for the suspension of stationary non-insulated pipe lines
- Manufactured to use the minimum rod size permitted by NFPA® for fire sprinkler piping
- Conforms with Federal Specification WW-H-171 (Type 10), Manufacturers Standardization Society (MSS) SP-58 (Type 10)



Material: Steel
Finish: Pregalvanized

Part Number	Pipe Size	Outer Diameter OD	Rod Size RS	A	B	C	Static Load F	Certifications
1150050EG	1/2"	0.840"	3/8"	2 13/16"	1 1/8"	1"	300 lb	cULus
1150075EG	3/4"	1.050"	3/8"	3"	1 3/16"	15/16"	300 lb	cULus, FM
1150100EG	1"	1.315"	3/8"	3 1/4"	1 3/8"	15/16"	300 lb	cULus, FM
1150125EG	1 1/4"	1.660"	3/8"	3 9/16"	1 1/2"	15/16"	300 lb	cULus, FM
1150150EG	1 1/2"	1.900"	3/8"	3 13/16"	1 5/8"	15/16"	300 lb	cULus, FM
1150200EG	2"	2.375"	3/8"	4 1/4"	1 7/8"	15/16"	300 lb	cULus, FM
1150250EG	2 1/2"	2.875"	3/8"	5 9/16"	2 13/16"	1 9/16"	525 lb	cULus, FM
1150300EG	3"	3.500"	3/8"	6 9/16"	3 1/2"	1 15/16"	525 lb	cULus, FM
1150350EG	3 1/2"	4.000"	3/8"	7 1/16"	3 3/4"	1 15/16"	585 lb	cULus, FM
1150400EG	4"	4.500"	3/8"	7 9/16"	4"	1 15/16"	650 lb	cULus, FM
1150500EG	5"	5.563"	1/2"	9 13/16"	4 3/4"	2 1/4"	1,000 lb	cULus, FM
1150600EG	6"	6.625"	1/2"	11 5/16"	6 5/16"	3 5/16"	1,000 lb	cULus, FM
1150800EG	8"	8.625"	1/2"	12 7/8"	6 7/8"	2 7/8"	1,000 lb	cULus, FM

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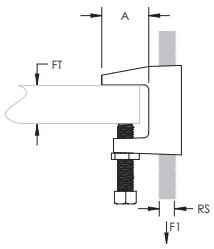


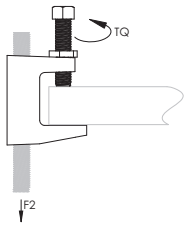
300 Universal Beam Clamp





- Conforms with Federal Specification WW-H-171 (Type 23), Manufacturers Standardization Society ANSI®/MSS-SP-58 (Type 19 and 23)





Material: Steel

Part Number	Rod Size RS	Flange Thickness FT	A	Torque TQ	Static Load 1 F1	Static Load 2 F2	Certifications	Standard Packaging Quantity
Finish: Plain								
3000037PL	3/8"	13/16" Max	1 1/8"	5 ft lb	500 lb	250 lb	cULus, FM	100 pc
3000050PL	1/2"	13/16" Max	1 1/8"	8 ft lb	950 lb	760 lb	cULus, FM	50 pc
3000062PL	5/8"	13/16" Max	1 1/8"	5 ft lb	950 lb	760 lb	cULus	50 pc
3000075PL	3/4"	13/16" Max	1 1/8"	5 ft lb	950 lb	760 lb	cULus	50 pc
3000087PL	7/8"	13/16" Max	1 1/8"	5 ft lb	950 lb	760 lb	cULus	50 pc
Finish: Electrogalvanized								
3000037EG	3/8"	13/16" Max	1 1/8"	5 ft lb	500 lb	250 lb	cULus, FM	100 pc
3000050EG	1/2"	13/16" Max	1 1/8"	8 ft lb	950 lb	760 lb	cULus, FM	50 pc
3000062EG	5/8"	13/16" Max	1 1/8"	5 ft lb	950 lb	760 lb	cULus	50 pc
3000075EG	3/4"	13/16" Max	1 1/8"	5 ft lb	950 lb	760 lb	cULus	50 pc
3000087EG	7/8"	13/16" Max	1 1/8"	5 ft lb	950 lb	760 lb	cULus	50 pc

Setscrew must be tightened and torqued onto the sloped side of the I-beam.

Recognizing that torque wrenches are generally not used or available on many job sites, the setscrew should be tightened so it contacts the I-beam and then an additional 1/4 to 1/2 turn added.

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211313 - Wet-Pipe Sprinkler System

301A

Globe Pipe Hanger Products, Inc.
14601 Industrial Pkwy
Cleveland, OH, 44135, US
Phone: 216.362.6300
Toll-free: (800) 338-3555
Email: sales@globepipehanger.com
Website: http://www.globepipehanger.com

SilverHawk 100 Series Universal Beam Clamp

Check up to five results to perform an action.

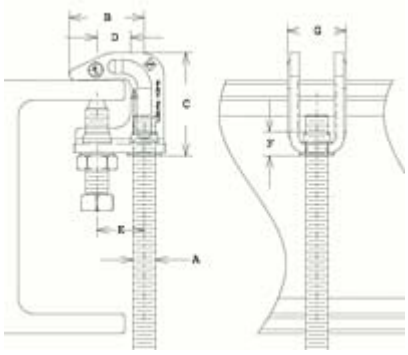
SilverHawk Top Beam Clamps are our strongest, lightweight top beam clamps. Made from cold rolled steel with a zinc plated finish, they are rust and corrosion resistant. These super strong SilverHawk clamps exceed UL and FM testing requirements. Zinc finish aesthetically works with plated rods and plated swivel ring hangers.

Tested by industry professionals, SilverHawk installation is quick and easy. Their unique counter balance design makes it easy to “spin” them onto threaded rods so installation goes faster. The open back shape provides visual verification during installation.

- Made in USA.
- Supports 3/8” rod – metric also available
- 90° angle fits I-beam or T-bar up to 3/4” thick
- Extruded tap holes meet FM Approvals requirements
- Accommodates retaining strap usage
- Competitively priced domestic par



larger image



larger image

Results 1 - 1 of 1 **1**

Item #	A	B	C	D	E	F	G	Max. Recommended Load
103-101S	3/8 inches	1 3/16 inches	1 5/8 inches	17/32 inches	3/4 inches	3/8 (min.) inches	15/16 inches	400 lbs

Results 1 - 1 of 1 **1**

Print Back

3.3.5 KWIK HUS-EZ I (KH-EZ I) Carbon Steel Screw Anchor

3.3.5.1 Product Description
3.3.5.2 Material Specifications
3.3.5.3 Technical Data
3.3.5.4 Installation Instructions
3.3.5.5 Ordering Information



Listings/Approvals

ICC-ES (International Code Council)
ESR-3027
(Cracked & Uncracked Concrete)
FM Approved

Independent Code Evaluation

IBC® / IRC® 2009 (AC 193 / ACI 355.2)
IBC® / IRC® 2006 (AC 193 / ACI 355.2)
IBC® / IRC® 2003 (AC 193 / ACI 355.2)

3.3.5.1 Product Description

Hilti KWIK HUS-EZ I (KH-EZ I) anchors are comprised of a body with an internally threaded hex washer head. The anchor is manufactured from carbon steel and is heat treated. It has a minimum 0.0003 inch (8 µm) zinc coating in accordance with DIN EN ISO 4042. The internally threaded head is larger than the diameter of the anchor and is formed with serrations on the underside. The anchor body is formed with threads running most of the length of the anchor body. The anchor is installed in a predrilled hole with a powered impact wrench or torque wrench. The anchor threads cut into the concrete on the sides of the hole and interlock with the base material during installation. Applicable base materials include normal-weight concrete, structural lightweight concrete and lightweight concrete over metal deck.

Guide Specifications

Screw anchors shall be KWIK HUS-EZ I as supplied by Hilti, Inc. Anchors shall be manufactured from heat treated carbon steel material, zinc plated to a minimum thickness of 8µm. Anchors shall be installed using a drill bit of same nominal diameter as anchor.

Product Features

- Suitable for cracked and uncracked normal weight and lightweight concrete, and lightweight concrete over metal deck.
- Suitable for seismic and nonseismic loads.
- Quick and easy to install.
- Thread design enables quality setting and exceptional load values in wide variety of base material strengths.
- Anchor is fully removable
- Anchor size is same as drill bit size and uses standard ANSI B212.15 – 1994 drill bits.
- Suitable for reduced edge distances and spacing.

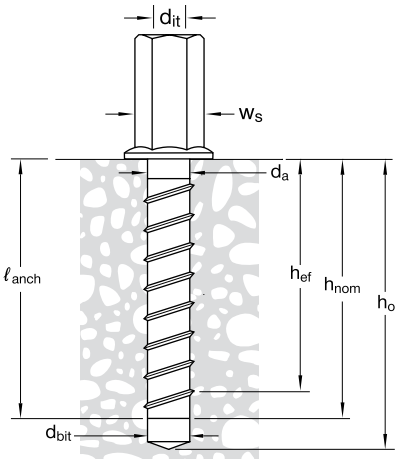
3.3.5.2 Material Specifications

Hilti KWIK HUS-EZ I anchors are manufactured from carbon steel. The anchors are bright zinc plated to a minimum thickness of 8µm.

3.3.5.3 Technical Data

The data contained in Tables 1-4 of this section have been evaluated in accordance with AC 193. For more detail, see ICC-ES ESR 3027.

Figure 1 — KWIK HUS-EZ I anchor installation details



KWIK HUS-EZ I (KH-EZ I) Carbon Steel Screw Anchor 3.3.5

Table 1 – KWIK HUS-EZ I (KH-EZ I)

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Design Guidelines For KWIK HUS-EZ I[1]				
Values for Normal Weight and Lightweight Concrete				
Characteristic	Symbol	Units	Value	
Internal Thread Diameter of Head	d_{it}	in.	1/4 or 3/8	
Wrench Socket Size	w_s	in.	3/8 or 1/2	
Nominal Diameter	d_a	in.	1/4	
Drill Bit Diameter	d_{bit}	in.	1/4	
Maximum Installation Torque[4]	$T_{inst,max}$	ft-lbf	18	
Maximum Impact Wrench Torque Rating[3]	$T_{impact,max}$	ft-lbf	114	137
Minimum Nominal Embedment Depth	h_{nom}	in.	1 5/8	2 1/2
Minimum Hole Depth	h_{hole}	in.	2	2 7/8
Critical Edge Distance[2]	c_{ac}[5]	in.	2.00	2.78
Minimum Spacing at Critical Edge Distance	$s_{min,cac}$[5]	in.	1.50	
Minimum Edge Distance	c_{min}[5]	in.	1.50	
Minimum Spacing at Minimum Edge Distance	s_{min}[5]	in.	3.0	
Minimum Concrete Thickness	h_{min}	in.	3.25	4.125
Anchor Category			3	1
Steel Strength in Tension (ACI 318 D.5.2)				
Tension Resistance of Steel	N_{sa}	lb.	6,070	
Reduction Factor for Steel Strength	Φ_{sa}	-	0.65	
Concrete Breakout Strength in Tension (ACI 318 D.5.2)				
Effective Embedment Depth	h_{ef}	in.	1.18	1.92
Effectiveness Factor - Uncracked Concrete	K_{uncr}	-	24	
Effectiveness Factor - Cracked Concrete	K_{cr}	-	17	
Modification Factor for cracked and uncracked concrete	$\Psi_{c,N}$	-	1	
Reduction Factor for Concrete Breakout Strength	Φ_{cb}	-	0.45	0.65
Pullout Strength in Tension (ACI 318 D.5.3)				
Characteristic pullout strength, uncracked concrete (2500 psi)	$N_{p,uncr}$	lb	1305[6]	2358[7]
Characteristic pullout strength, cracked concrete	$N_{p,cr}$	lb	667[6]	1166[7]
Reduction Factor for pullout strength	Φ_p	-	0.45	0.65
Characteristic Pullout Strength, Seismic (2500 psi)	$N_{p,eq}$	lb	534[6]	1166[7]
Reduction Factor for pullout strength	Φ_{eq}	-	0.45	0.65
Values for Installation in the underside of Concrete-Filled Profile Steel Deck Assemblies[2]				
Pullout Resistance, (uncracked concrete) - Lower Flute	$N_{p,deck,uncr}$	lb	1210[8]	1875[9]
Pullout Resistance, (uncracked concrete) - Upper Flute	$N_{p,deck,uncr}$	lb	1490[8]	1960[9]
Pullout Resistance, (cracked concrete and seismic loads) - Lower Flute	$N_{p,deck,cr}$	lb	620[8]	930[9]
Pullout Resistance, (cracked concrete and seismic loads) - Upper Flute	$N_{p,deck,cr}$	lb	760[8]	975[9]

1 The data presented in this table is to be used in conjunction with the design criteria of ACI 318 Appendix D.

2 For installations through the soffit of steel deck into concrete, anchors installed in the lower flute may be installed with a maximum one inch offset in either direction from the center of the flute. See Figure 2.

3 Because of variability in measurement procedures, the published torque of an impact tool may not correlate properly with the above setting torques. Over-torquing can damage the anchor and/or reduce its holding capacity.

4 $T_{inst,max}$ applies to installations using a calibrated torque wrench.

5 Additional combinations for minimum edge distance, c_{min} and minimum spacing distance, s_{min} or $s_{min,cac}$ may be derived by linear interpolation between the given boundary values.

6 The characteristic pullout resistance for concrete compressive strengths greater than 2,500 psi may be increased by multiplying the value in the table by $(f'c/2{,}500)^{0.3}$

7 The characteristic pullout for concrete compressive strengths greater than 2,500 psi may be increased by multiplying the value in the table by $(f'c/2{,}500)^{0.5}$

8 The characteristic pullout resistance for concrete compressive strengths greater than 3,000 psi may be increased by multiplying the value in the table by $(f'c/3{,}000)^{0.3}$

9 The characteristic pullout for concrete compressive strengths greater than 2,500 psi may be increased by multiplying the value in the table by $(f'c/2{,}500)^{0.5}$

3.3.5 KWIK HUS-EZ I (KH-EZ I) Carbon Steel Screw Anchor

Table 2 - Calculated ACI 318-08 Appendix D Strength Design Capacity for Single anchor in Tension[3,4,5,6,7]

Anchor Size (in.)	Internally Threaded Head (in.)	Nominal Embedment Depth (in.)	Normal Weight Concrete						LWCOMD			
			2500 psi[1]			4000 psi			3000 psi[2]			
			Uncracked Concrete	Cracked Concrete	Seismic	Uncracked Concrete	Cracked Concrete	Seismic	Uncracked Concrete		Cracked Concrete	
									Lower Flute	Upper Flute	Lower Flute	Upper Flute
1/4 x 1-5/8	1/4	1-5/8	587	300	240	675	346	277	545	670	280	342
	3/8	1-5/8	587	300	240	675	346	277	545	670	280	342
1/4 x 2-1/2	1/4	2-1/2	1533	758	758	1940	958	958	1218	1275	605	634
	3/8	2-1/2	1533	758	758	1940	958	958	1218	1275	605	634

1 Values for other strengths can be calculated per $(f'c/2500)^{0.3}$ for 1-5/8" embedment and $(f'c/2500)^{0.5}$ for 2-1/2" embedment

2 Values for other strength can be calculated per $(f'c/3000)^{0.3}$ for 1-5/8" embedment and $(f'c/3000)^{0.5}$ for 2-1/2" embedment

3 Based on single anchor with edge and spacing values greater than those given as critical values in Table 1.

4 Based on lower value of concrete breakout or pullout strength

5 These loads are factored resistance loads in accordance with Chapter 9 of ACI 318-08 (ΦN_n).

6 Interpolation of values for other embedments is not permitted

7 Minimum concrete thickness and edge distance must comply with Table 1.

Table 3 – KWIK HUS-EZ I (KH-EZ I) Allowable Stress Design Values for Illustrative Purposes[1,2,3,4,5,6,7,8,9,10,11]

Internal Thread Diameter of Head (in.)	Nominal Anchor Diameter (in.)	Embedment Depth, h_{nom} (in.) (mm)	Effective Embedment Depth, h_{ef} (in.) (mm)	Allowable Tension Load lb (kN)
1/4 or 3/8	1/4	1-5/8 (41)	1.18 (30)	470 (2.1)
		2-1/2 (64)	1.92 (49)	1340 (6.0)

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N.

1 Single anchor with static tension load only.

2 Concrete determined to remain uncracked for the life of the anchorage.

3 Load combinations are taken from ACI 318 Section 9.2 (no seismic loading).

4 40% dead load and 60% live load, controlling load combination 1.2D + 1.6L.

5 Calculation of weighted average for conversion factor α = 1.2(0.4) + 1.6(0.6) = 1.44.

6 f'_c = 4,000 psi (27.6 MPa) (normal weight concrete).

7 $c_{a1} = c_{a2} \geq c_{ac}$, see Table 1.

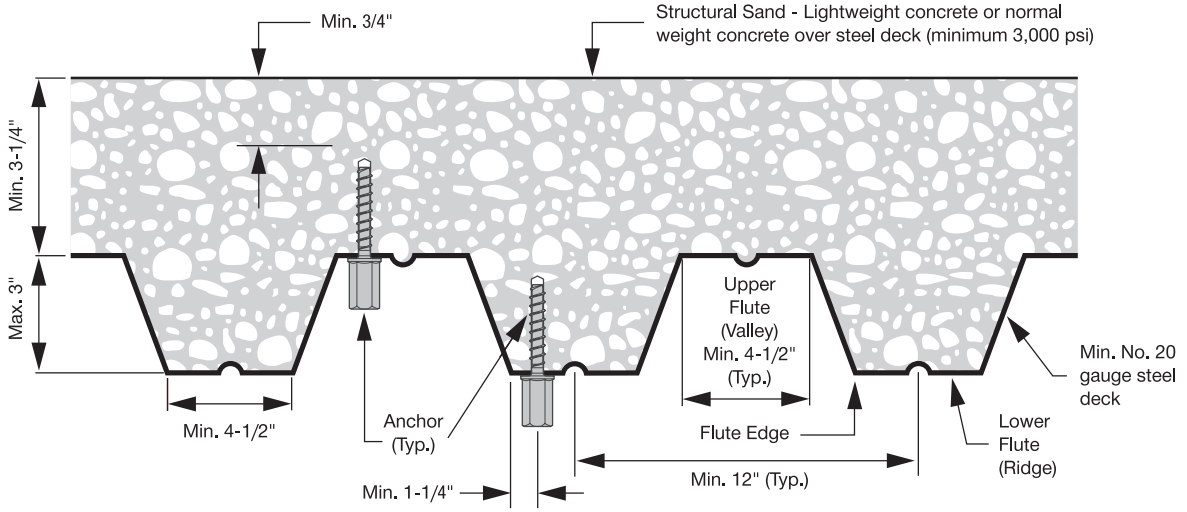
8 $h \geq h_{min}$, see Table 1.

9 Values are for Condition B where supplementary reinforcement in accordance with ACI 318 D.4.4 is not provided.

10 Allowable Tension Load = factored Load (Lesser of N_p or Concrete Breakout from Table 1) ÷ 1.44

11 Values are for single anchors installed without influence of base material edge distance or adjacent anchors.

Figure 2 – Installation of KWIK HUS-EZ I (KH-EZ I) in Soffit of Concrete Over Steel Deck Floor and Roof Assemblies



1 Anchors may be placed in the upper or lower flute of the steel deck profile provided the minimum concrete cover above the drilled hole is satisfied. Anchors in the lower flute may be installed with a maximum 1-inch offset in either direction from the center of the flute. The offset distance may be increased proportionally for profiles with lower flute widths greater than those shown provided the minimum lower flute edge distance is also satisfied.

KWIK HUS-EZ I (KH-EZ I) Carbon Steel Screw Anchor 3.3.5

Table 4 - KWIK HUS EZ I (KH-EZ I) Allowable Stress Design Tension Values for Installations in Soffit of Concrete Over Steel Deck Floor and Roof Assemblies

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Internal Thread Diameter of Head (in.)	Nominal Anchor Diameter (in.)	Embedment Depth (in.) (mm)	Effective Embedment Depth (in.) (mm)	Allowable Tension Load lb (kN)	
				Upper Flute	Lower Flute
1/4 or 3/8	1/4	1-5/8 (41)	1.18 (30)	466 (2.1)	378 (1.7)
		2-1/2 (64)	1.92 (49)	885 (3.9)	846 (3.7)

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N.

1 Single anchor with static tension load only.
2 Concrete determined to remain uncracked for the life of the anchorage.
3 Load combinations are taken from ACI 318 Section 9.2 (no seismic loading).
4 40% dead load and 60% live load, controlling load combination 1.2D + 1.6L.
5 Calculation of weighted average for conversion factor α = 1.2(0.4) + 1.6(0.6) = 1.44.
6 f'_c = 3,000 psi (27.6 MPa) (light weight concrete).
7 $c_{a1} = c_{a2} \geq c_{ac}$, see Table 1.
8 $h \geq h_{min}$, see Table 1.
9 Values are for Condition B where supplementary reinforcement in accordance with ACI 318 D.4.4 is not provided.
10 Allowable Tension Load = factored Load (Lesser of N_p or Concrete Breakout from Table 1) ÷ 1.44
11 Values are for single anchors installed without influence of base material edge distance or adjacent anchors.

Table 5 - Kwik HUS-EZ I (KH-EZ) Tested Load Values for FM Approval for Automatic Sprinkler Systems

Hanger Rod Size (in.)	Screw Length (in.)	FM Test Load Tension lb (kN))	FM Maximum Pipe Diameter (in.)
3/8	1 5/8	1475 (6.6)	4
	2 1/2		

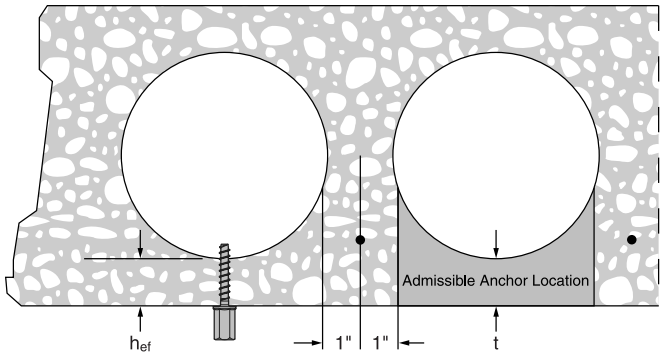
1 Tested in accordance with FM Approval Standard for Pipe Hanger Components for Automatic Sprinklers Systems Class Numbers 1951, 1952 and 1953.

Table 6 - Kwik HUS-EZ I (KH-EZ I) Allowable Stress Design Values for Installations into Hollow Core Concrete Panels[1,2]

Hanger Rod Size (in.)	Min. Effective Embedment h_{ef} (in.)	Allowable Load[3]		Ultimate Load	
		Tension lb (kN)	Shear lb (kN)[4,5]	Tension lb (kN)	Shear lb (kN)[4,5]
1/4	1 3/8	455 (2.0)	485 (2.2)	1810 (8.1)	1,930 (8.6)
3/8			755 (3.4)		3,025 (13.5)

1 The Admissible Anchor Location must be established to prevent damage to the prestressed cable during the drilling process. Verify the location and height of the cable with the hollow core plank supplier to confirm Admissible Anchor Location.
2 Minimum compressive strength of prestressed concrete is 7,000 psi. Published ultimate loads represent the average results conducted in local base materials. Due to variations in materials and dimensionl configurations, on-site testing is required to determine the actual performance.
3 Allowable loads calculated with a 4:1 factor of safety.
4 The bottom of the shear plane adjacent to the top of the coupler.
5 Shear values controlled by the steel strength of ASTM A193, Grade B7 (min. tensile strength 125 ksi) screws used to fasten the shear fixturing. Shear values should consider the screw or threaded rod strength.

Figure 3 – Installation of KWIK HUS–EZ I (KH-EZ I) in Hollow Core Concrete



3.3.5.4 Installation Instructions

Use the installation instructions that are including with the Kwik HUS-EZ I packaging box. To obtain a digital copy of the Installation Instructions, visit www.us.hilti.com, www.hilti.ca or contact Hilti Technical Support.

3.3.5 KWIK HUS-EZ I (KH-EZ I) Carbon Steel Screw Anchor

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The data below is developed from testing performed in accordance with ACI 355.2. It is intended for applications designed according to CSA A23.3-04 Update No. 3 (August 2009) Design Of Concrete Structures Annex D and is generally suitable for the conditions described in the introduction of Annex D.

Table 7 – KWIK HUS-EZ I (KH-EZ I)

Design Guidelines For KWIK HUS-EZ I[1]				
Values for Normal Weight and Lightweight Concrete				
Characteristic	Symbol	Units	Value	
Internal Thread Diameter of Head		in.	1/4 or 3/8	
Wrench Socket Size		in.	3/8 or 1/2	
Nominal Diameter	d_a	in.	1/4	
Drill Bit Diameter	d_{bit}	in.	1/4	
Maximum Installation Torque[4]	$T_{inst,max}$	ft-lbf (Nm)	18 (24)	
Maximum Impact Wrench Torque Rating[3]	$T_{impact,max}$	ft-lbf (Nm)	114 (154)	137 (186)
Minimum Nominal Embedment Depth	h_{nom}	mm	41	64
Concrete material resistance factor	Φ_c	-	0.65	
Steel material resistance factor	Φ_s	-	0.85	
Ultimate Strength of anchor steel	f_{ut}	MPa	924	
Effective cross-sectional area of anchor	A_{se}	mm^2	29.0	
Minimum Hole Depth	h_{hole}	mm	51	73
Minimum Spacing at Critical Edge Distance	$s_{min,cac}$[5]	mm	38	
Minimum Edge Distance	c_{min}[5]	mm	38	
Minimum Spacing at Minimum Edge Distance	s_{min}[5]	mm	76	
Minimum Concrete Thickness	h_{min}	mm	83	105
Anchor Category			3	1
Steel Strength in Tension (CSA A23.3 D.6.1)				
Factored Steel Resistance in Tension	N_{sr}	kN	15.9	
Reduction Factor for Steel Strength	R	-	0.70	
Concrete Breakout Strength in Tension (CSA A23.3 D.6.2)				
Effective Embedment Depth	h_{ef}	mm	30	49
Critical Edge Distance[2]	c_{ac}[5]	mm	51	71
Effectiveness Factor - Uncracked Concrete	K_{uncr}	-	10	
Effectiveness Factor - Cracked Concrete	K_{cr}	-	7	
Modification Factor for cracked and uncracked concrete	$\Psi_{c,N}$	-	1.4	
Reduction Factor for Concrete Breakout Strength	R	-	0.70	1.00
Pullout Strength in Tension - Non Seismic Applications (CSA A23.3 D.6.3}				
Factored Pullout Resistance, uncracked concrete (17.23 MPa)	$N_{pr,uncr}$	kN	2.6[6]	6.8[7]
Factored Pullout Resistance, cracked concrete (17.23 MPa)	$N_{pr,cr}$	kN	1.3[6]	3.4[7]
Concrete Resistance Factor for pullout strength	$\Phi_{c,pull}$	-	0.65	
Factored Pullout Strength, Seismic (17.23 MPa)	$N_{pr,eq}$	kN	1.1[6]	3.4[7]
Concrete Resistance Factor for pullout strength	$\Phi_{c,seis}$	-	0.65	
Values for Installation in the underside of Concrete-Filled Profile Steel Deck Assemblies[2]				
Factored Pullout Resistance, (uncracked concrete 20.68 MPa) - Lower Flute	$N_{pr,deck,uncr}$	kN	2.4[8]	5.4[9]
Factored Pullout Resistance, (uncracked concrete 20.68 MPa) - Upper Flute	$N_{pr,deck,uncr}$	kN	3.0[8]	5.7[9]
Factored Pullout Resistance, (cracked concrete and seismic loads 20.68 MPa) - Lower Flute	$N_{pr,deck,cr}$	kN	1.3[8]	2.7[9]
Factored Pullout Resistance, (cracked concrete and seismic loads 20.68 MPa) - Upper Flute	$N_{pr,deck,cr}$	kN	1.5[8]	2.8[9]

1 The data presented in this table is to be used in conjunction with the design criteria of CSA A23.3-04.

2 For installations through the soffit of steel deck into concrete, anchors installed in the lower flute may be installed with a maximum one inch offset in either direction from the center of the flute.

3 Because of variability in measurement procedures, the published torque of an impact tool may not correlate properly with the above setting torques. Over-torquing can damage the anchor and/or reduce its holding capacity.

4 $T_{inst,max}$ applies to installations using a calibrated torque wrench.

5 Additional combinations for minimum edge distance, c_{min} and minimum spacing distance, $s_{min\ or\ smin,cac}$ may be derived by linear interpolation between the given boundary values.

6 The characteristic pullout resistance for concrete compressive strengths greater than 17.23 MPa may be increased by multiplying the value in the table by $(f'c/17.23)^{0.3}$

7 The characteristic pullout for concrete compressive strengths greater than 17.23MPa may be increased by multiplying the value in the table by $(f'c/17.23)^{0.5}$

8 The characteristic pullout resistance for concrete compressive strengths greater than 20.68 MPa may be increased by multiplying the value in the table by $(f'c/20.68)^{0.3}$

9 The characteristic pullout for concrete compressive strengths greater than 20.68 MPa may be increased by multiplying the value in the table by $(f'c/20.68)^{0.5}$

KWIK HUS-EZ I (KH-EZ I) Carbon Steel Screw Anchor 3.3.5

3.3.5.6 Ordering Information

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Order Information

Description	Internal Thread Diameter	Internal Thread Length	Hole Diameter	Minimum Embedment	Qty (pcs) / Box
**KH-EZ 1/4"x1-5/8"	1/4"**	1/4"	3/8"	1/4"	1-5/8"	100
**KH-EZ 1/4"x2-1/2"	1/4"**	1/4"	3/8"	1/4"	2-1/2"	100
**KH-EZ 1/4"x1-5/8"	3/8"**	3/8"	7/16"	1/4"	1-5/8"	100
**KH-EZ 1/4"x2-1/2"	3/8"**	3/8"	7/16"	1/4"	2-1/2"	100

RISER CLAMPS

FUNCTION: Designed for supporting and stabilizing vertical pipe runs. The PVC coating on Fig. 553 protects the pipe from the metal surface of the clamp. This product is not intended for use with hanger rods. Clamp is designed for standard iron pipe O.D. and must be considered when sizing other types of piping.

APPROVALS: Underwriters' Laboratories Listed in the U.S. (UL) and Factory Mutual Approved for sizes 3/4" (20mm) to 8" (200mm) only. Complies with Federal Specifications A-A-1192A (Type 8) and Manufacturers' Standardization Society ANSI/SP-69 and SP-58 (Type 8).

MATERIAL: Low carbon steel

ORDERING: Specify pipe size and figure number.

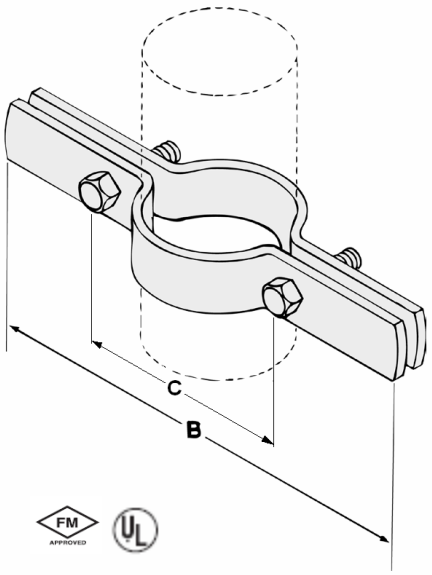
Fig. 550, 551 & 553 RISER CLAMP

Fig. 550* PLAIN

Fig. 551 ELECTRO-GALVANIZED

Fig. 553 PLAIN WITH PVC COATING

*Available in stainless steel. To order, specify 304 or 316 and add suffix SS to figure number. Price on request.



Pipe Size		B		C		Bolt Size	Max. Rec. Load		Wt. Each	
							lbs.	kN	lbs.	kg
1/2	(15)	9	(228.60)	2 1/2	(63.50)	3/8 x 1 1/4	220	(0.98)	1.05	(.48)
3/4	(20)	8 7/8	(225.43)	2 3/8	(60.33)	3/8 x 1 1/4	220	(0.98)	1.05	(.48)
1	(25)	8 3/4	(222.25)	2 1/4	(57.15)	3/8 x 1 1/4	220	(0.98)	1.05	(.48)
1 1/4	(32)	9 1/4	(234.95)	2 3/4	(69.85)	3/8 x 1 1/4	250	(1.11)	1.10	(.50)
1 1/2	(40)	10	(254.00)	2 3/4	(69.85)	3/8 x 1 1/4	250	(1.11)	1.17	(.53)
2	(50)	10 1/4	(260.35)	3 1/2	(88.90)	3/8 x 1 1/4	300	(1.33)	1.20	(.54)
2 1/2	(65)	11 1/8	(282.58)	3 3/4	(95.25)	3/8 x 1 1/2	400	(1.78)	1.89	(.86)
3	(80)	11 3/4	(298.45)	4 5/8	(117.48)	3/8 x 1 1/2	500	(2.22)	1.99	(.90)
3 1/2	(90)	12 1/2	(317.50)	5 1/4	(133.35)	3/8 x 1 1/2	600	(2.67)	2.17	(.98)
4	(100)	13	(330.20)	6	(152.40)	1/2 x 1 3/4	750	(3.34)	2.21	(1.00)
5	(125)	14 1/4	(361.95)	6 1/2	(165.10)	1/2 x 1 3/4	1500	(6.67)	3.24	(1.47)
6	(150)	15 3/8	(390.53)	7 3/4	(196.85)	1/2 x 1 3/4	1600	(7.12)	3.89	(1.76)
8	(200)	18 1/2	(469.90)	8 7/8	(225.43)	5/8 x 2	2500	(11.12)	7.60	(3.45)
10	(250)	20 1/2	(520.70)	12	(304.80)	5/8 x 2	2500	(11.12)	11.10	(5.03)
12	(300)	22 1/2	(571.50)	14	(355.60)	5/8 x 2 1/2	2700	(12.01)	16.50	(7.48)
14	(350)	25 1/8	(638.18)	16	(406.40)	5/8 x 3	2700	(12.01)	17.70	(8.03)
16	(400)	26 1/4	(666.75)	18 5/8	(473.08)	3/4 x 3 1/2	2900	(12.90)	30.40	(13.79)
18	(450)	27 7/8	(708.03)	20 3/4	(527.05)	3/4 x 3 1/2	2900	(12.90)	33.30	(15.10)
20	(500)	30	(762.00)	22 3/8	(568.33)	3/4 x 3 1/2	2900	(12.90)	36.30	(16.47)
24	(600)	35	(889.00)	24 1/2	(622.30)	7/8 x 3 1/2	2900	(12.90)	48.68	(22.08)
30	(750)	42 3/8	(1076.33)	29 1/2	(749.30)	7/8 x 3 1/2	2900	(12.90)	60.16	(27.29)

Installation practice for Model 550 Riser Clamps

When possible the clamp should be placed under a coupling, hub or welded lugs on steel pipe. Bolt torques should be per industry standards.

Recommended Torque For Pipe Clamp Hardware

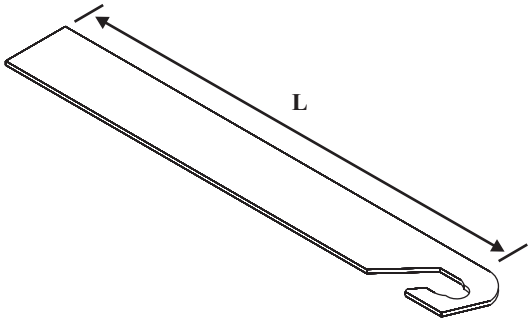
Bolt Size	1/4"-20	5/16"-18	3/8"-16	1/2"-13	5/8"-11	3/4"-10 & Larger
ft/lbs	6	11	19	50	65	75
N/m	(8)	(15)	(26)	(68)	(88)	(102)

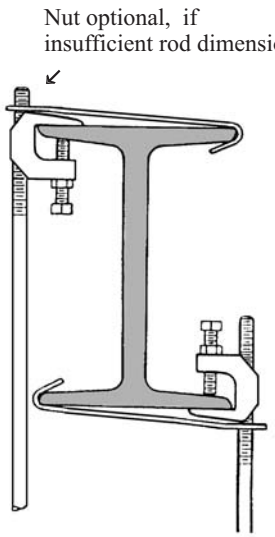
Unless otherwise specified, all dimensions on drawings and in charts are in inches and dimensions shown in parentheses are in millimeters.

P.O. Box 3365 South El Monte, CA 91733 626.444.0541 Fax 626.444.3887 www. Afcon.org

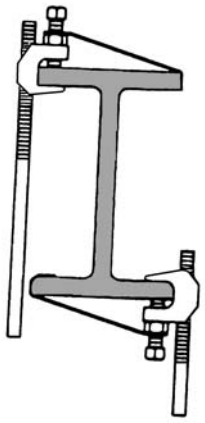
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UNIVERSAL RESTRAINING STRAP





SIZE- One size fits both 3/8" and 1/2" rod or set screw.
Available lengths 4" and longer.
MATERIAL - Carbon Steel.
FINISH - Mil. Galvanized.
LISTINGS -
c UL us **203-EX 2551**
PATENT - No. 5,897,088
FUNCTION - To enhance hanger attachment in areas subject to Earthquakes.
INSTALLATION - Install tight to structure and component parts
Minimum return on strap: 1”
L-dimension is measured from hanger rod center to the strap end.
FEATURES
* Fast installation for new construction or retrofit.
* Requires no hanger disassembly to install.
IMPORTANT NOTE: **“No Nut Is Required”**
When installed tight to structure and component parts. (See drawings provided)
ORDERING - Part # and L-dimension.



CAD

Pipe Clamps

B3140 - Standard Pipe Clamp (TOLCO Fig. 4)
B3140F - Standard Pipe Clamp Felt Lined for Copper Tubing (TOLCO Fig. 4F)
B3140C - Standard Pipe Clamp PVC Coated (TOLCO Fig. 4PVC)

Component of State of California OSHPD Approved Seismic Restraints System

Size Range: B3140/B3140C Size 1/2" (15mm) thru 30" (750mm) pipe. B3140F Size 1/2" (15mm) thru 2 1/2" (65mm) copper tubing

Material: Steel

Function: Recommended for the suspension of non-insulated pipe or insulated pipe with B3151 shields. (Use B3200 weldless eye nut, B3210 eye rod or B3211 welded eye rod.) B3140F and B3140C are designed to reduce noise and vibration and/or prevent electrolysis.

Approvals: Underwriters Laboratories Listed in the USA **(UL)**, Canada **(cUL)** 3/4" (20mm) - 12" (300mm), and approved by Factory Mutual Engineering **(FM)**, 3/4" (20mm) - 8" (200mm). Federal Specification WW-H-171E & A-A-1192A, Type 4, and Manufacturers Standardization Society ANSI/MSS SP-69 & SP-58, Type 4. Included in our Seismic Restraints Catalog approved by the State of California Office of Statewide Health Planning and Development **(OSHPD)**. For additional load, spacing and placement information relating to OSHPD projects, please refer to the Seismic Restraint Systems Guidelines.

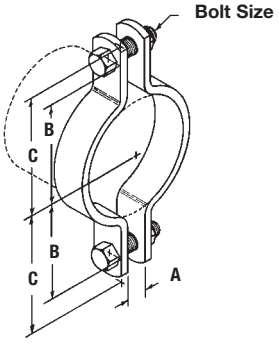
Note: For piping that requires sway bracing refer to Fig. 4A.

Maximum Temperature: — 750°F (399°C)

Finish: Plain. Contact B-Line for alternative finishes and materials.

Order By: Part number, pipe size and finish.

Order Note: When ordering B3140F allow for 3/16" (4.8mm) felt on each half of clamp.





B3140



B3140F



B3140C

Pipe Clamps

All dimensions in charts and on drawings are in inches. Dimensions shown in parentheses are in millimeters unless otherwise specified.

B3140 - Standard Pipe Clamp (TOLCO Fig. 4)
B3140F - Standard Pipe Clamp Felt Lined (TOLCO Fig. 4F)
B3140C - Standard Pipe Clamp PVC Coated (TOLCO Fig. 4PVC) Cont.

Part No.	Pipe Size in.	(mm)	A in.	(mm)	B in.	(mm)	C in.	(mm)	Bolt Size
B3140-1/2	1/2"	(15)	3/8"	(9.5)	31/32"	(24.6)	1 17/32"	(38.9)	5/16"-18
B3140-3/4	3/4"	(20)	9/16"	(14.3)	1 3/32"	(27.8)	1 21/32"	(42.0)	5/16"-18
B3140-1	1"	(25)	9/16"	(14.3)	1 5/16"	(33.3)	1 7/8"	(47.6)	5/16"-18
B3140-1 1/4	1 1/4"	(32)	17/32"	(13.5)	1 7/16"	(36.5)	2"	(50.8)	5/16"-18
B3140-1 1/2	1 1/2"	(40)	19/32"	(15.1)	1 21/32"	(42.0)	2 7/32"	(56.4)	5/16"-18
B3140-2	2"	(50)	9/16"	(14.3)	2 1/8"	(54.0)	2 3/4"	(69.8)	1/2"-13
B3140-2 1/2	2 1/2"	(65)	5/8"	(15.9)	2 21/32"	(67.5)	3 9/32"	(83.3)	1/2"-13
B3140-3	3"	(75)	5/8"	(15.9)	2 15/16"	(74.6)	3 9/16"	(90.5)	1/2"-13
B3140-3 1/2	3 1/2"	(90)	5/8"	(15.9)	3 5/32"	(80.1)	3 25/32"	(96.0)	1/2"-13
B3140-4	4"	(100)	3/4"	(19.0)	3 9/16"	(90.5)	4 5/16"	(109.5)	5/8"-11
B3140-5	5"	(125)	3/4"	(19.0)	4 1/8"	(104.8)	4 7/8"	(123.8)	5/8"-11
B3140-6	6"	(150)	7/8"	(22.2)	4 15/16"	(125.4)	5 13/16"	(147.6)	3/4"-10
B3140-8	8"	(200)	1"	(25.4)	6 1/16"	(154.0)	6 15/16"	(176.2)	3/4"-10
B3140-10	10"	(250)	1"	(25.4)	7 3/8"	(187.3)	8 11/16"	(220.7)	7/8"-9
B3140-12	12"	(300)	1"	(25.4)	8 7/16"	(214.3)	9 3/4"	(247.6)	7/8"-9
B3140-14	14"	(350)	1 1/8"	(28.6)	9 1/4"	(234.9)	10 5/8"	(269.9)	7/8"-9
B3140-16	16"	(400)	1 1/8"	(28.6)	10 1/4"	(260.3)	11 5/8"	(295.3)	7/8"-9
B3140-18	18"	(450)	1 1/4"	(31.7)	11 7/8"	(301.6)	13 1/4"	(336.5)	1"-8
B3140-20	20"	(500)	1 3/8"	(34.9)	12 3/4"	(323.8)	14 1/8"	(358.8)	1 1/8"-7
B3140-24	24"	(600)	1 5/8"	(41.3)	15 1/4"	(387.3)	16 7/8"	(428.6)	1 1/4"-7
B3140-30	30"	(750)	2 1/4"	(57.1)	18 5/8"	(473.1)	21"	(533.4)	1 1/2"-6

Part No.	Pipe Size in.	(mm)	Max. Design Load 650°F (343°C) lbs.	(kN)	750°F (399°C) lbs.	(kN)	Approx. Wt./100 lbs.	(kg)
B3140-1/2	1/2"	(15)	500	(2.22)	390	(1.73)	30	(13.6)
B3140-3/4	3/4"	(20)	500	(2.22)	390	(1.73)	31	(14.0)
B3140-1	1"	(25)	500	(2.22)	390	(1.73)	33	(14.5)
B3140-1 1/4	1 1/4"	(32)	500	(2.22)	390	(1.73)	39	(17.7)
B3140-1 1/2	1 1/2"	(40)	800	(3.56)	620	(2.76)	41	(18.6)
B3140-2	2"	(50)	1040	(4.62)	810	(3.60)	118	(53.5)
B3140-2 1/2	2 1/2"	(65)	1040	(4.62)	810	(3.60)	130	(58.9)
B3140-3	3"	(75)	1040	(4.62)	810	(3.60)	150	(68.0)
B3140-3 1/2	3 1/2"	(90)	1040	(4.62)	810	(3.60)	158	(71.6)
B3140-4	4"	(100)	1040	(4.62)	810	(3.60)	239	(108.4)
B3140-5	5"	(125)	1040	(4.62)	810	(3.60)	272	(123.4)
B3140-6	6"	(150)	1615	(7.18)	1260	(5.60)	541	(245.4)
B3140-8	8"	(200)	1615	(7.18)	1260	(5.60)	642	(291.2)
B3140-10	10"	(250)	2490	(11.07)	1950	(8.67)	1366	(619.6)
B3140-12	12"	(300)	2490	(11.07)	1950	(8.67)	1543	(699.9)
B3140-14	14"	(350)	2490	(11.07)	1950	(8.67)	2077	(942.1)
B3140-16	16"	(400)	2490	(11.07)	1950	(8.67)	2289	(1038.3)
B3140-18	18"	(450)	3060	(13.61)	2390	(10.63)	3206	(1454.2)
B3140-20	20"	(500)	3060	(13.61)	2390	(10.63)	3616	(1640.2)
B3140-24	24"	(600)	3060	(13.61)	2390	(10.63)	5161	(2341.0)
B3140-30	30"	(750)	3500	(15.57)	2740	(12.14)	10460	(4744.6)

All dimensions in charts and on drawings are in inches. Dimensions shown in parentheses are in millimeters unless otherwise specified.

Lok-Bolt™ *Sleeve Expansion Anchor*

PRODUCT DESCRIPTION

The Lok-Bolt is a pre-assembled single unit sleeve anchor available in carbon steel and stainless steel which can be used in concrete, block, brick, and stone. The Lok-Bolt is designed to draw the fixture into full bearing against the base material through the action of its unique and flexible compression ring. This helps to increase the resistance of the anchor to loosening when subjected to vibratory loads. As the anchor is being tightened, the nylon compression ring will compress if necessary, so that the fixture is tightly secured against the face of the base material. Under load, the specially tapered plow bolt is drawn further into the expansion sleeve to develop increased locking action against the walls of the hole. Extension sleeves are added for longer lengths.

GENERAL APPLICATIONS AND USES

- Door and Window Frame Installations
- Mounting fixtures on walls
- Mounting of Handrails and Fencing
- Shelving and Storage
- Masonry Applications
- Electrical and Mechanical Attachments

FEATURES AND BENEFITS

- Multiple head styles for multiple applications and finished appearance
- Fits standard fixture holes – No need to undersize anchors for proper fit
- Immediate Loading – Minimizes downtime
- Sleeve has 360° contact area and reduces concrete stress
- Versatile and ideal for concrete, or masonry
- Available in carbon steel and Type 304 stainless steel

APPROVALS AND LISTINGS

Factory Mutual Research Corporation (FM Approvals) Serial No. 26692, J.I. OJ8A1.AH, J.I. OJ9A9.AH

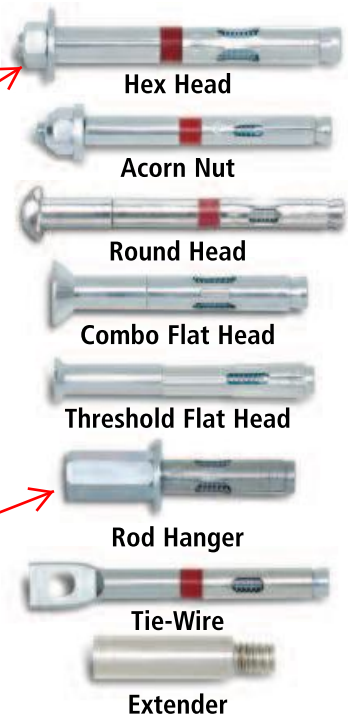
Underwriters Laboratory (UL Listed) File No. EX 1289 (N) See listing for applicable sizes and styles.

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastenings.* Sleeve Anchors shall be Lok-Bolt anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

General Information 1
Installation Specifications 2
Material Specifications 2
Performance Data 3
Design Criteria 5
Ordering Information 8



HEAD STYLES

Hex Head
Acorn Nut
Round Head
Combo Flat Head
Threshold Flat Head
Rod Hanger
Tie-Wire

ANCHOR MATERIALS

Zinc Plated Carbon Steel
Type 304 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

1/4" diameter x 5/8" length to
3/4" diameter x 7-1/2" length

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Structural Lightweight Concrete
Grouted Concrete Masonry
Hollow Concrete Masonry

(b)

INSTALLATION SPECIFICATIONS

Acorn Nut and Hex Head Lok-Bolt

Dimension	Anchor Size, *d*					
	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	5/16	3/8	1/2	5/8	3/4
Fixture Clearance Hole, d_h (in.)	5/16	3/8	7/16	9/16	11/16	15/16
Plow Bolt Size (UNC)	10-24	1/4-20	5/16-18	3/8-16	1/2-13	5/8-11
Nut Height (in.)	3/16	7/32	17/64	21/64	7/16	35/64
Washer O.D., d_w (in.)	1/2	5/8	13/16	1	1 3/8	1 3/4
Wrench Size (in.)	3/8	7/16	1/2	9/16	3/4	15/16

Round Head Lok-Bolt

Dimension	Anchor Size, *d*		
	1/4"	5/16"	3/8"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	5/16	3/8
Fixture Clearance Hole, d_h (in.)	5/16	3/8	7/16
Plow Bolt Size (UNC)	10-24	1/4-20	5/16-18
Head Height (in.)	11/64	13/64	15/64
Head Width, d_{hd} (in.)	29/64	9/16	43/64

Combo Flat Head Lok-Bolt

Dimension	Anchor Size, *d*		
	1/4"	5/16"	3/8"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	5/16	3/8
Fixture Clearance Hole, d_h (in.)	5/16	3/8	7/16
Plow Bolt Size (UNC)	10-24	1/4-20	5/16-18
Head Height (in.)	5/32	3/16	15/64
Head Width, d_{hd} (in.)	1/2	5/8	3/4

Rod Hanger Lok-Bolt

Dimension	Anchor Size, *d*		
	1/4"	3/8"	1/2"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	3/8	1/2
Plow Bolt Size (UNC)	1/4-20	5/16-18	3/8-16
Coupling Height (in.)	7/8	1	1 1/4
Washer O.D., d_w (in.)	5/8	13/16	1
Coupling Wrench Size (in.)	7/16	1/2	11/16

Threshold Lok-Bolt

Dimension	Anchor Size, *d*
	1/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/4
Fixture Clearance Hole, d_h (in.)	5/16
Plow Bolt Size (UNC)	10-24
Head Height (in.)	5/64
Head Width, d_{hd} (in.)	23/64

Tire-Wire Lok-Bolt

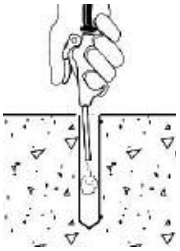
Dimension	Anchor Size, *d*
	5/16"
ANSI Drill Bit Size, d_{bit} (in.)	5/16
Fixture Clearance Hole, d_h (in.)	1/4
Plow Bolt Size (UNC)	1/4-20
Head Height (in.)	1 9/16
Head Width, d_{hd} (in.)	31/64

Installation Guidelines

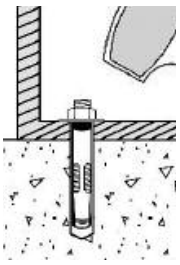
Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/2" or one anchor diameter deeper than the embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



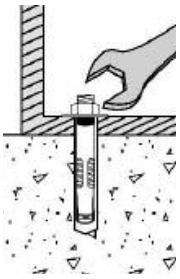
Blow the hole clean of dust and other material. Do not expand the anchor prior to installation.



Drive the anchor through the fixture into the anchor hole until the head is firmly seated against the fixture. Be sure the anchor is driven to the required embedment depth.



Tighten the anchor by turning the nut of head 3 to 5 turns past finger tight or by applying the guide installation torque from the finger tight position.



MATERIAL SPECIFICATIONS

General Lok-Bolt Components

Anchor Component	Component Material	
	Carbon Steel	Stainless Steel
Plow Bolt	AISI 1010 / 1018	Type 18-8 SS
Expansion Sleeve	AISI 1010 / 1020	Type 304 SS
Extension Sleeve	AISI 1010 / 1020	Type 304 SS
Compression Ring	Nylon	Nylon
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)	N/A

Lok-Bolt Head Components

Anchor Component	Component Material	
	Carbon Steel	Stainless Steel
Hex Nut	ASTM A 563, Grade A	Type 304 SS
Acorn Nut	AISI 1010 / 1018	Type 304 SS
Washer	ASTM F 844	Type 18-8 SS
Round Head	AISI 1010 / 1018	Type 304 SS
Flat Head	AISI 1010 / 1018	Type 304 SS
Rod Coupling	AISI 12L14	Type 18-8 SS
Threshold	AISI 1010 / 1018	N/A
Tie-Wire	AISI 1010 / 1018	N/A
Zinc Plating	ASTM B 633, SC1, Type III (Fe/Zn 5)	N/A

(b)

PERFORMANCE DATA

Ultimate Load Capacities for Carbon and Stainless Steel Lok-Bolt in Normal-Weight Concrete[1]

Anchor Diameter d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Maximum Tightening Torque T_{max} ft.-lbs.		Minimum Concrete Compressive Strength (f'_c)					
				2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Carbon	Stainless	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	3-4	2-3	540 (2.4)	1,000 (4.5)	620 (2.8)	1,200 (5.4)	680 (3.1)	1,200 (5.4)
	1 1/8 (28.6)			1,000 (4.5)	1,520 (6.8)	1,150 (5.1)	1,520 (6.8)	1,150 (5.1)	1,520 (6.8)
5/16 (7.9)	1 1/2 (38.1)	6-8	–	2,000 (8.9)	1,520 (6.8)	2,040 (9.0)	1,520 (6.8)	2,040 (9.0)	1,520 (6.8)
3/8 (9.5)	1 5/8 (41.3)	12-16	8-11	2,450 (11.1)	2,440 (11.0)	2,680 (12.1)	2,440 (11.0)	2,700 (12.2)	2,440 (11.0)
1/2 (12.7)	2 1/4 (57.2)	20-28	15-20	4,770 (21.5)	4,210 (19.0)	5,015 (22.6)	4,220 (19.0)	5,275 (23.7)	4,210 (19.0)
5/8 (15.9)	2 1/4 (57.2)	45-60	30-40	3,270 (14.7)	7,200 (32.4)	5,860 (26.4)	7,200 (32.4)	6,250 (28.1)	7,200 (32.4)
	2 3/4 (69.9)			6,060 (27.3)	7,820 (35.2)	6,620 (29.8)	7,820 (35.2)	6,800 (30.6)	7,810 (35.2)
3/4 (19.1)	2 1/4 (57.2)	70-90	45-60	4,480 (20.2)	9,840 (44.3)	8,420 (37.9)	11,670 (52.5)	8,940 (40.2)	11,670 (52.5)
	3 3/8 (85.7)			6,790 (30.6)	12,600 (56.7)	8,720 (39.2)	12,600 (56.7)	8,940 (40.2)	12,600 (56.7)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.

Allowable Load Capacities for Carbon and Stainless Steel Lok-Bolt in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Maximum Tightening Torque T_{max} ft.-lbs.		Minimum Concrete Compressive Strength (f'_c)					
				2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Carbon	Stainless	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	3-4	2-3	135 (0.6)	250 (1.1)	155 (0.7)	300 (1.4)	170 (0.8)	300 (1.4)
	1 1/8 (28.6)			250 (1.0)	380 (1.7)	285 (1.3)	380 (1.7)	285 (1.8)	380 (1.7)
5/16 (7.9)	1 1/2 (38.1)	6-8	–	500 (2.2)	380 (1.7)	510 (2.2)	380 (1.7)	510 (2.2)	380 (1.7)
3/8 (9.5)	1 5/8 (41.3)	12-16	8-11	615 (2.2)	610 (2.7)	670 (3.0)	610 (2.7)	675 (3.0)	610 (2.7)
1/2 (12.7)	2 1/4 (57.2)	20-28	15-20	1,195 (5.4)	1,055 (4.7)	1,255 (5.6)	1,055 (4.7)	1,320 (5.9)	1,055 (4.7)
5/8 (15.9)	2 1/4 (57.2)	45-60	30-40	818 (3.7)	1,800 (8.1)	1,465 (6.6)	1,800 (8.1)	1,565 (7.0)	1,800 (8.1)
	2 3/4 (69.9)			1,515 (6.8)	1,955 (8.8)	1,655 (7.4)	1,955 (8.8)	1,700 (7.7)	1,955 (8.8)
3/4 (19.1)	2 1/4 (57.2)	70-90	40-60	1,120 (5.0)	2,460 (11.1)	2,105 (9.5)	2,918 (13.1)	2,235 (10.1)	2,920 (13.1)
	3 3/8 (85.7)			1,700 (7.7)	3,150 (14.2)	2,180 (9.8)	3,150 (14.2)	2,235 (10.1)	3,150 (14.2)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.

(b)

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Carbon and Stainless Steel Lok-Bolt in Structural Lightweight Concrete[1,2]

Anchor Dia. d in. (mm)	Min. Embed. Depth h_v in. (mm)	Maximum Tightening Torque T_{max} ft.-lbs.	Minimum Concrete Compressive Strength							
			f'_c = 3,000 psi (20.7 MPa)				f'_c = 5,000 psi (34.5 MPa)			
			Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1/4 (6.4)	2-3	1,040 (4.7)	1,160 (5.2)	260 (1.2)	290 (1.3)	1,240 (5.6)	1,160 (5.2)	310 (1.4)	290 (1.3)
5/16 (7.9)	5/16 (7.9)	5-6	1,140 (5.1)	1,560 (7.0)	285 (1.3)	390 (1.8)	1,720 (7.7)	1,560 (7.0)	430 (1.9)	390 (1.8)
3/8 (9.5)	3/8 (9.5)	8-11	1,180 (5.3)	2,600 (11.7)	295 (1.3)	650 (2.9)	1,720 (7.7)	2,600 (11.7)	430 (1.9)	650 (2.9)
1/2 (12.7)	1/2 (12.7)	15-20	2,400 (10.8)	4,020 (18.1)	600 (2.7)	1,005 (4.5)	3,780 (17.0)	4,020 (18.1)	945 (4.3)	1,005 (4.5)
5/8 (15.9)	5/8 (15.9)	30-40	3,740 (16.8)	6,420 (28.9)	935 (4.2)	1,605 (7.2)	4,640 (20.9)	6,420 (28.9)	1,160 (5.2)	1,605 (7.2)
3/4 (19.1)	3/4 (19.1)	40-60	3,740 (16.8)	10,440 (47.0)	935 (4.2)	2,610 (11.7)	4,640 (20.9)	10,440 (47.0)	1,160 (5.2)	2,610 (11.7)

1. The values listed above are ultimate and allowable load capacities for anchors in sand-lightweight concrete.
2. Allowable load capacities are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.

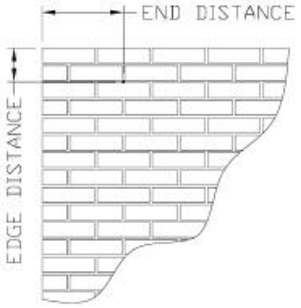
Ultimate and Allowable Load Capacities for Carbon and Stainless Steel Lok-Bolt Installed Through Metal Deck into Structural Lightweight Concrete[1,2,3,4]

Anchor Dia. d in. (mm)	Min. Embed. Depth h_v in. (mm)	Maximum Tightening Torque T_{max} ft.-lbs.	Lightweight Concrete Over Minimum 20 Ga. Metal Deck $f'_c \geq$ 3,000 (20.7 MPa)							
			Minimum 1-1/2" Wide Deck				Minimum 4-1/2" Wide Deck			
			Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
			Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	2-3	1,080 (4.9)	1,920 (8.6)	270 (1.2)	480 (2.2)	1,080 (4.9)	1,920 (8.6)	270 (1.2)	480 (2.2)
5/16 (7.9)	1 1/2 (38.1)	5-6	1,080 (4.9)	1,920 (8.6)	270 (1.2)	480 (2.2)	1,080 (4.9)	1,920 (8.6)	270 (1.2)	480 (2.2)
3/8 (9.5)	2 (50.8)	8-11	1,080 (4.9)	2,480 (11.2)	270 (1.2)	620 (2.8)	1,080 (4.9)	1,920 (8.6)	270 (1.2)	480 (2.2)
1/2 (12.7)	2 1/2 (63.5)	15-20	1,940 (8.7)	2,480 (11.2)	485 (2.2)	620 (2.8)	2,840 (12.8)	4,640 (20.9)	710 (3.2)	1,160 (5.2)
5/8 (15.9)	2 3/4 (69.9)	30-40	–	–	–	–	2,840 (12.8)	4,640 (20.9)	710 (3.2)	1,160 (5.2)
3/4 (19.1)	3 (76.2)	40-60	–	–	–	–	4,440 (20.0)	9,060 (40.8)	1,110 (5.0)	2,265 (10.2)

1. The values listed above are ultimate and allowable load capacities for anchors in sand-lightweight concrete over metal deck.
2. Allowable loads capacities are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
3. Tabulated load values are for anchors installed in the center of the flute. Spacing distances shall be in accordance with the spacing lightweight concrete table listed in the Design Criteria section.
4. Anchors are permitted to be installed in the lower or upper flute of the metal deck provided the proper installed procedures are maintained.

PERFORMANCE DATA

1. Tabulated load values are for carbon and stainless steel anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal-weight concrete masonry units. Mortar must be minimum Type N. Masonry prism compressive strength must be 1,500 psi minimum at the time of installation.
2. Allowable loads are for carbon and stainless steel anchors and are based on average ultimate values using a safety factor of 5.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
3. Linear interpolation may be used for allowable loads for intermediate embedment depths.
4. The tabulated values are for anchors installed at a minimum of 12 anchor diameters on center for 100 percent capacity. Spacing distances may be reduced to 6 anchor diameters on center provided the capacities are reduced by 50 percent. Linear interpolation may be used for intermediate spacings.
5. Anchors with diameters of 1/2" and larger installed in hollow concrete masonry units are limited to one anchor per unit cell.
6. Anchors shall be of suitable length for the masonry wall thickness and attachment.



Ultimate and Allowable Load Capacities for Lok-Bolt in Hollow or Solid Concrete Masonry[1,2,3,4,5,6]

Anchor Dia. d in. (mm)	Min. Embed. Depth h_v in. (mm)	Maximum Tightening Torque T_{max} ft.-lbs.	Min. Edge Dist. in. (mm)	Min. End Dist. in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
					Ultimate Load		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	1-3	3 3/4 (95.3)	3 3/4 (95.3)	230 (1.0)	1,000 (4.5)	45 (0.2)	200 (0.9)
	1 1/8 (28.6)	1-3	3 3/4 (95.3)	8 (203.2)	1,200 (5.4)	1,270 (5.7)	240 (1.1)	255 (1.1)
5/16 (7.9)	1 1/2 (38.1)	4-6	3 3/4 (95.3)	8 (203.2)	1,430 (6.4)	1,970 (8.9)	285 (1.3)	395 (1.8)
3/8 (9.5)	1 1/2 (38.1)	8-11	12 (304.8)	12 (304.8)	1,700 (7.7)	2,180 (9.8)	340 (1.5)	435 (2.0)
1/2 (12.7)	1 1/2 (38.1)	16-20	12 (304.8)	12 (304.8)	2,460 (11.1)	2,840 (12.8)	490 (2.2)	570 (2.6)

Ultimate and Allowable Load Capacities for Lok-Bolt in Hollow or Solid Clay Brick Masonry[1,2,3,4]

Anchor Dia. d in. (mm)	Min. Embed. Depth h_v in. (mm)	Maximum Tightening Torque T_{max} ft.-lbs.	Min. Edge Dist. in. (mm)	Min. End Dist. in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
					Ultimate Load		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	5/8 (15.9)	1-3	4 (101.6)	4 (101.6)	800 (3.6)	1,120 (5.0)	160 (0.7)	225 (1.0)
	1 1/8 (28.6)	1-3			950 (4.3)	1,120 (5.0)	190 (0.9)	225 (1.0)
5/16 (7.9)	1 1/2 (38.1)	4-6			1,230 (5.5)	1,120 (5.0)	245 (1.1)	225 (1.0)
3/8 (9.5)	1 1/2 (38.1)	8-11	8 (203.2)	8 (203.2)	1,860 (8.4)	1,260 (5.7)	370 (1.7)	250 (1.1)
1/2 (12.7)	1 1/2 (38.1)	16-20			3,520 (15.8)	4,010 (18.0)	705 (3.2)	800 (3.6)

1. Tabulated load values are for carbon and stainless steel anchors installed in Grade SW multiple wythe, solid brick masonry conforming to ASTM C62.
2. Allowable loads are calculated using an applied safety factor of 5.0.Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
3. The tabulated values are for anchors installed at a minimum of 12 anchor diameters on center for 100 percent capacity. Spacing distances may be reduced to 6 anchor diameters on center provided the capacities are reduces by 50 percent. Linear interpolation may be used for intermediate spacings.
4. Anchors length shall be of suitable length for the concrete masonry wall thickness and attachment.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right)^{\frac{5}{3}} + \left(\frac{V_u}{V_n}\right)^{\frac{5}{3}} \leq 1 \quad \text{OR} \quad \left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 3.0h_v$	$F_N = F_V = 1.0$	$s_{min} = 1.5h_v$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{min} = 5d$	$F_N = 0.70$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 5d$	$F_V = 0.45$

Anchor Installed in Lightweight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 3.0h_v$	$F_N = F_V = 1.0$	$s_{min} = 1.5h_v$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{min} = 5d$	$F_N = 0.85$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 5d$	$F_V = 0.40$

1. Allowable load values found in the performance data tables are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances. Linear interpolation is allowed for intermediate anchor spacing and edge distances between critical and minimum distances. When an anchor is affected by both reduced spacing and edge distance, the spacing and edge reduction factors must be combined (multiplied). Multiple reduction factors for anchor spacing and edge distance may be required depending on the anchor group configuration.

(b)

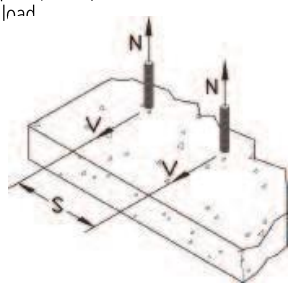
DESIGN CRITERIA

Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_N) & Shear (F_V)							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
h_v (in.))		1 1/4	1 1/2	2	2 1/2	2 3/4	3
s_{cr} (in.)		3 3/4	4 1/2	6	7 1/2	8 1/4	9
s_{min} (in.)		1 7/8	2 1/4	3	3 3/4	4 1/8	4 1/2
Spacing, s (inches)	1 7/8	0.50					
	2 1/4	0.56	0.50				
	3	0.80	0.67	0.50			
	3 3/4	1.00	0.83	0.63	0.50		
	4		0.89	0.67	0.53		
	4 1/8		0.92	0.69	0.55	0.50	
	4 1/2		1.00	0.75	0.60	0.55	0.50
	6			1.00	0.80	0.73	0.67
	7 1/2				1.00	0.91	0.83
	8 1/4					1.00	0.92
	9						1.00

Notes: For anchors loaded in tension and shear, the critical spacing *(s_{cr})* is equal to 3 embedment depths ($3h_v$) at which the anchor achieves 100% of load.

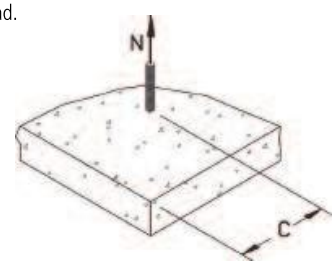
Minimum spacing *(s_{min})* is equal to 1.5 embedment depths ($1.5h_v$) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_N)							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	3 3/4	4 1/2	6	7 1/2	9
c_{min} (in.)		1 1/4	1 5/8	1 7/8	2 1/2	3 1/8	3 3/4
Edge Distance, c (inches)	1 1/4	0.70					
	1 5/8	0.76	0.70				
	1 7/8	0.81	0.74	0.70			
	2 1/2	0.91	0.83	0.77	0.70		
	3	1.00	0.90	0.83	0.74		
	3 1/8		0.91	0.84	0.75	0.70	
	3 3/4		1.00	0.91	0.81	0.74	0.70
	4 1/2			1.00	0.87	0.79	0.74
	6				1.00	0.90	0.81
	7 1/2					1.00	0.84
	9						1.00

Notes: For anchors loaded in tension, the critical edge distance *(c_{cr})* is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.

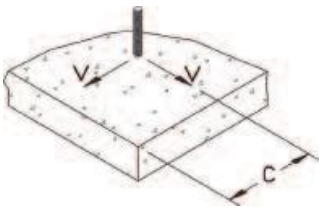
Minimum edge distance *(c_{min})* is equal to 5 anchor diameters ($5d$) at which the anchor achieves 70% of load.



Edge Distance, Shear (F_V)							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	3 3/4	4 1/2	6	7 1/2	9
c_{min} (in.)		1 1/4	1 5/8	1 7/8	2 1/2	3 1/8	3 3/4
Edge Distance, c (inches)	1 1/4	0.45					
	1 5/8	0.57	0.45				
	1 7/8	0.65	0.53	0.45			
	2 1/2	0.84	0.69	0.58	0.45		
	3	1.00	0.81	0.69	0.53		
	3 1/8		0.84	0.71	0.55	0.45	
	3 3/4		1.00	0.84	0.65	0.53	0.45
	4 1/2			1.00	0.76	0.62	0.53
	6				1.00	0.81	0.69
	7 1/2					1.00	0.84
	9						1.00

Notes: For anchors loaded in shear, the critical edge distance *(c_{cr})* is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.

Minimum edge distance *(c_{min})* is equal to 5 anchor diameters ($5d$) at which the anchor achieves 45% of load.



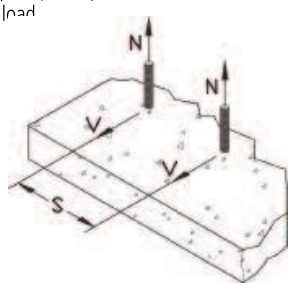
DESIGN CRITERIA

Load Adjustment Factors for Lightweight Concrete

Spacing, Tension (F_N) & Shear (F_V)							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
h_v (in.)		1 1/4	1 1/2	2	2 1/2	2 3/4	3
s_{cr} (in.)		3 3/4	4 1/2	6	7 1/2	8 1/4	9
s_{min} (in.)		1 7/8	2 1/4	3	3 3/4	4 1/8	4 1/2
Spacing, s (inches)	1 7/8	0.50					
	2 1/4	0.56	0.50				
	3	0.80	0.67	0.50			
	3 3/4	1.00	0.83	0.63	0.50		
	4		0.89	0.67	0.53		
	4 1/8		0.92	0.69	0.55	0.50	
	4 1/2		1.00	0.75	0.60	0.55	0.50
	6			1.00	0.80	0.73	0.67
	7 1/2				1.00	0.91	0.83
	8 1/4					1.00	0.92
	9						1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 3 embedment depths ($3h_V$) at which the anchor achieves 100% of load.

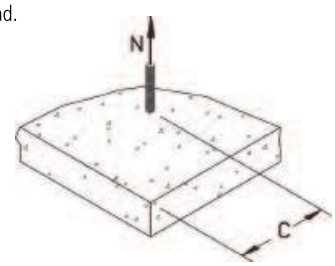
Minimum spacing (s_{min}) is equal to 1.5 embedment depths ($1.5h_V$) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_N)							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	3 3/4	4 1/2	6	7 1/2	9
c_{min} (in.)		1 1/4	1 5/8	1 7/8	2 1/2	3 1/8	3 3/4
Edge Distance, c (inches)	1 1/4	0.85					
	1 5/8	0.88	0.85				
	1 7/8	0.90	0.87	0.85			
	2 1/2	0.96	0.91	0.89	0.85		
	3	1.00	0.95	0.91	0.87		
	3 1/8		0.96	0.92	0.88	0.85	
	3 3/4		1.00	0.96	0.90	0.87	0.85
	4 1/2			1.00	0.94	0.90	0.87
	6				1.00	0.95	0.91
	7 1/2					1.00	0.92
	9						1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.

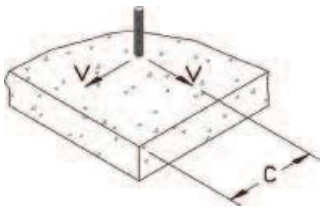
Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 85% of load.



Edge Distance, Shear (F_V)							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	3 3/4	4 1/2	6	7 1/2	9
c_{min} (in.)		1 1/4	1 5/8	1 7/8	2 1/2	3 1/8	3 3/4
Edge Distance, c (inches)	1 1/4	0.40					
	1 5/8	0.53	0.40				
	1 7/8	0.61	0.49	0.40			
	2 1/2	0.83	0.66	0.54	0.40		
	3	1.00	0.79	0.66	0.49		
	3 1/8		0.83	0.69	0.51	0.40	
	3 3/4		1.00	0.83	0.61	0.49	0.40
	4 1/2			1.00	0.74	0.59	0.49
	6				1.00	0.79	0.66
	7 1/2					1.00	0.83
	9						1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 40% of load.



(b)

ORDERING INFORMATION

Hex Nut Lok-Bolt

Catalog Number		Size	Bolt Length	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
Carbon	Stainless							
5005	–	5/16" x 1-1/2"	1 13/16"	5/16"	1 3/8"	100	1,000	4 1/4
5010	–	5/16" x 2 3/8"	2 11/16"	5/16"	1 1/2"	100	500	5 3/4
5015	6152	3/8" x 1 7/8"	2 3/16"	3/8"	1 5/8"	50	500	7
5020	6153	3/8" x 3"	3 5/16"	3/8"	1 5/8"	50	500	10
5022	–	3/8" x 4"	4 5/16"	3/8"	1 5/8"	50	500	16
5025	6156	1/2" x 2 1/4"	2 7/8"	1/2"	2 1/8"	25	250	14
5030	6157	1/2" x 3"	3 3/8"	1/2"	2 1/4"	25	250	17 1/4
5034	6160	1/2" x 4"	4 3/8"	1/2"	2 1/4"	25	125	22
5033	–	1/2" x 5 1/4"	6 1/8"	1/2"	2 1/4"	25	125	27
5032	–	1/2" x 6"	6 3/4"	1/2"	2 1/4"	10	100	35
5035	–	5/8" x 2 1/4"	3 3/16"	5/8"	2 1/8"	25	125	25 1/2
5038	–	5/8" x 3"	3 3/4"	5/8"	2 3/4"	25	125	34
5040	6164	5/8" x 4 1/4"	5"	5/8"	2 3/4"	10	100	41
5045	–	5/8" x 6"	6 1/4"	5/8"	2 3/4"	10	100	49
5050	–	3/4" x 2 3/4"	3 5/8"	3/4"	2 1/8"	10	100	46
5055	6168	3/4" x 4 1/4"	5 1/8"	3/4"	3 3/8"	10	40	70
5060	–	3/4" x 6 1/4"	7 1/8"	3/4"	3 3/8"	10	30	90
5065	–	3/4" x 8 1/4"	9"	3/4"	3 3/8"	10	30	115



The published minimum length is measured from below the washer to the end of the anchor. Actual anchor lengths may be slightly longer.

Acorn Nut Lok-Bolt

Catalog Number		Size	Bolt Length	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
Carbon	Stainless							
*5125	–	1/4" x 5/8"	1 1/32"	1/4"	1/2"	100	1,000	2
5150	6150	1/4" x 1 3/8"	1 21/32"	1/4"	1 1/8"	100	1,000	2 3/4
5175	–	1/4" x 2 1/4"	2 9/16"	1/4"	1 1/8"	100	1,000	3 1/4



The published minimum length is measured from below the washer to the end of the anchor. Actual anchor lengths may be slightly longer.
*This size does not have a compression ring.

Round Head Lok-Bolt, Slotted

Catalog Number		Size	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
Carbon	Stainless						
*5205	–	1/4" x 1 1/8"	5/16"	1 3/8"	100	1,000	4 1/4
5210	6180	1/4" x 2"	5/16"	1 1/2"	100	500	5 3/4
5215	–	1/4" x 2 3/4"	3/8"	1 5/8"	50	500	7
5235	–	3/8" x 2 1/2"	1/2"	2 1/4"	25	250	17 1/4
5240	–	3/8" x 3 3/4"	1/2"	2 1/4"	25	125	22



The published length is measured from below the head to the end of the anchor.
*This size does not have a compression ring.

ORDERING INFORMATION

Combo Flat Head Lok-Bolt

Catalog Number		Size	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
Carbon	Stainless						
5305	–	1/4" x 1 1/8"	1/4"	1"	100	1,000	2
5310	6170	1/4" x 2"	1/4"	1 1/8"	100	1,000	2 3/4
5315	6172	1/4" x 3"	1/4"	1 1/8"	100	1,000	3 3/4
5320	–	1/4" x 4"	1/4"	1 1/8"	100	500	4 1/2
5325	–	1/4" x 5 1/4"	1/4"	1 1/8"	100	500	6 1/2
5330	–	5/16" x 2 1/2"	5/16"	1 1/2"	100	1,000	4 1/2
5340	–	3/8" x 2 3/4"	3/8"	1 5/8"	50	500	7 1/2
5345	6174	3/8" x 4"	3/8"	1 5/8"	50	250	10 3/4
5350	6175	3/8" x 5"	3/8"	1 5/8"	50	250	14
5360	6176	3/8" x 6"	3/8"	1 5/8"	50	250	16

The published length is the minimum overall length of the anchor. Combo Flat Head Lok-Bolts do not have a compression ring.



Threshold Flat Head Lok-Bolt, Slotted

Catalog Number		Size	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
Carbon	Stainless						
5500	–	1/4" x 2"	1/4"	1 1/8"	100	1,000	2 1/2

The published length is the minimum overall length of the anchor. Threshold Flat Head Lok-Bolts do not have a compression ring.



Rod Hanger Lok-Bolt

Catalog Number		Size	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
Carbon	Stainless						
5810	–	1/4" x 1 1/2"	5/16"	1 1/2"	50	250	5 1/2
5815	–	3/8" x 1 7/8"	3/8"	1 5/8"	50	250	9
5825	–	1/2" x 2 1/4"	1/2"	2 1/4"	25	125	21

The published length is measured from below the washer to the end of the anchor.
Rod Hanger Lok-Bolts do not have a compression ring.



Tie-Wire Lok-Bolt

Catalog Number		Size	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
Carbon	Stainless						
5700	–	5/16" x 1 1/2"	5/16"	1 1/2"	100	1,000	5 1/4

The published length is measured from below the head to the end of the anchor.



Lok-Bolt Extenders

Catalog Number		Size	Drill Diameter	Minimum Embed.	Standard Box	Standard Carton	Wt./ 100
Carbon	Stainless						
5684	5689	3/8" x 1"	3/8"	1 5/8"	50	500	3

Extenders are used for added length on all head styles.



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Engineering Data

Mill certification physical/mechanical properties, specification and engineering data for G-STRUT® Channel are as follows:

PRODUCT(S) PROFILE TYPES	AVG. YIELD STRENGTH	AVG. TENSILE STRENGTH	ROCKWELL B (RB VALUE)
ALL 1-5/8 industry standard strut profiles in sizes inclusive from 13/16" through 3-1/4"	42,700	62,600	62 –74

G-STRUT® Metal Framing Channel is interchangeable with industry-standard 1-5/8" strut profiles.

G-STRUT® is cold roll-formed, structural grade (33,000MY, CS Type B), prime carbon steel.

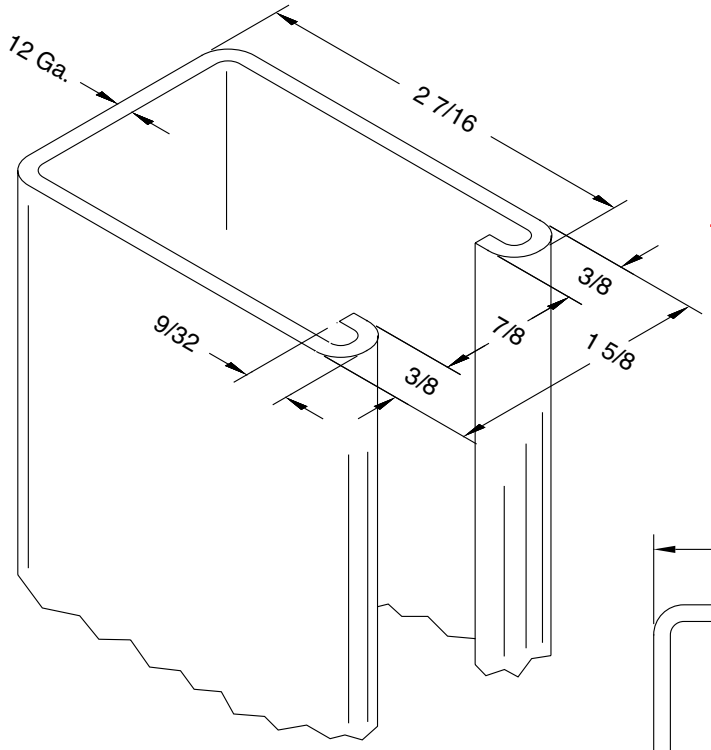
G-STRUT® conforms to ASTM 1011 for hot rolled steel and ASTM 653 for pre-galvanized steel.

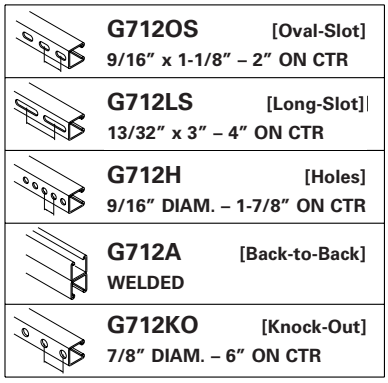
Standard finishes include pre-galvanized (G-90 coating weight), painted, galvannealed, pickle & oil plain, and hot dip galvanized.

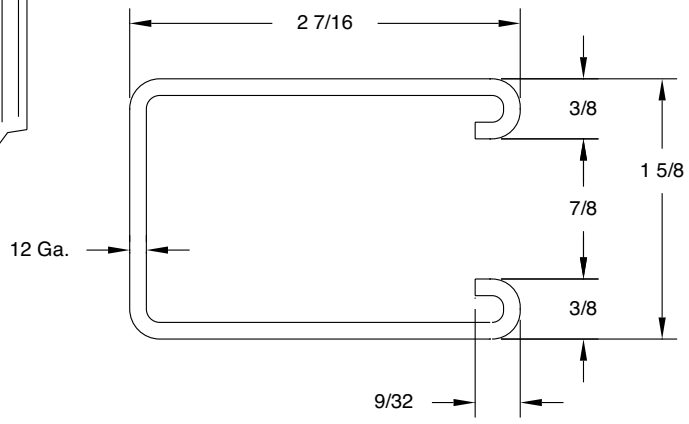
Painted available in polyester urethane powder coat finish or electro deposition cathodic epoxy e-coating.

Engineering/Load factors (see following pages by channel part number)

G-STRUT® Channel is manufactured exclusively in the USA, Canton, Ohio.







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ITEM	QNT'Y	DESCRIPTION	MATERIAL

ROLLFORM TOLERANCES

LENGTH ± 0.125"

ALL OTHER DIMENSIONS ± 0.020"

SCALE	FULL	CHK'D BY	
DWN BY	IDI	02-02-02	APP'D BY

G-STRUT CHANNEL, PART # G712

CAD FILENAME: G712

LAST PLOT DATE: 02-02-02

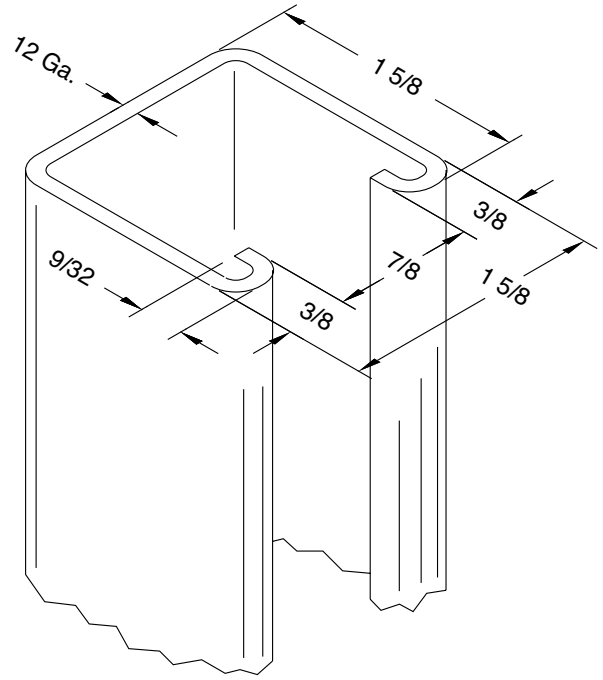
GREGORY STRUT PRODUCTS
Division of Gregory Industries
4100 13th Street SW; Canton, OH 44710
PH: 330-477-4800 FX: 330-477-0626

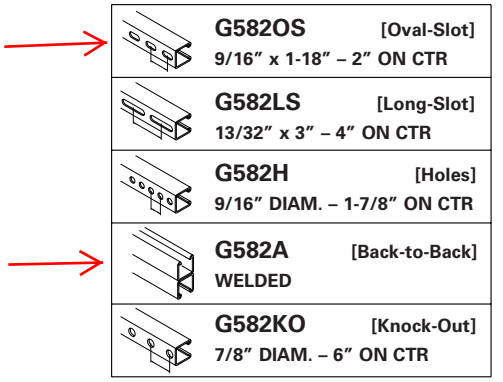
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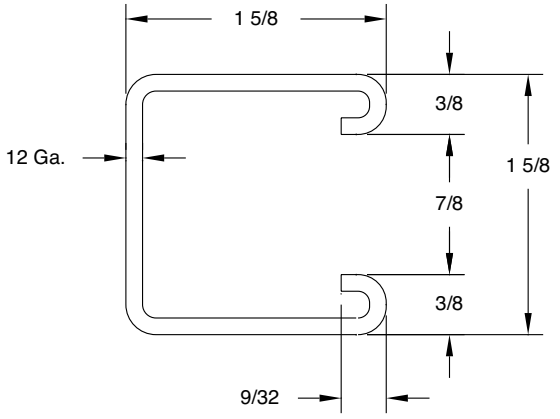
DRWG No.

G712

ENGINEERING DATA







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ITEM	QNT'Y	DESCRIPTION	MATERIAL

ROLLFORM TOLERANCES

LENGTH ± 0.125"

ALL OTHER DIMENSIONS ± 0.020"

SCALE	FULL	CHK'D BY
DWN BY	IDI 02-02-02	APP'D BY

G-STRUT CHANNEL, PART # G582

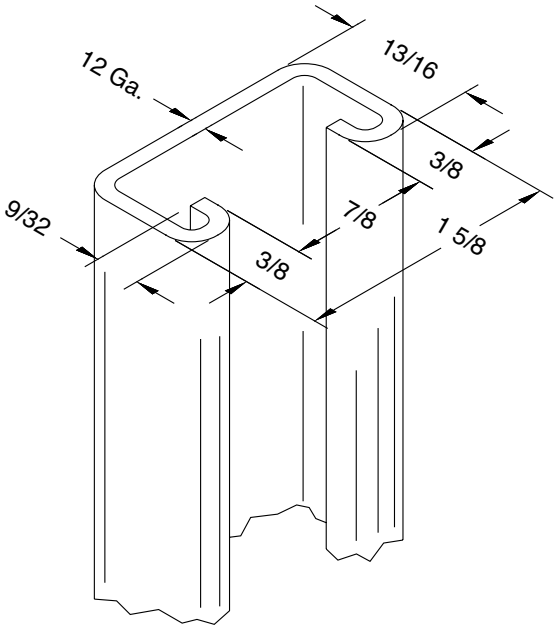
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LAST PLOT DATE: 02-02-02

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4100 13th Street SW; Canton, OH 44710
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REF. No.

DRWG No. G582



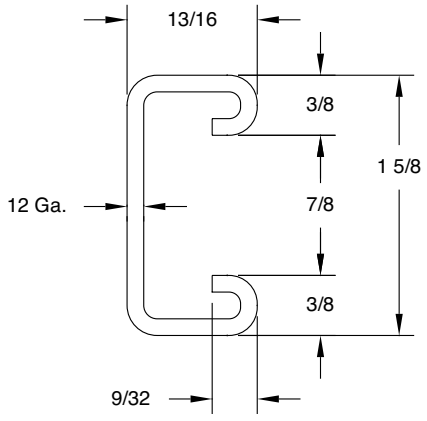
G132OS [Oval-Slot]
9/16" x 1-1/8" – 2" ON CTR

G132LS [Long-Slot]
13/32" x 3" – 4" ON CTR

G132H [Holes]
9/16" DIAM. – 1-7/8" ON CTR

G132A [Back-to-Back]
WELDED

G132KO [Knock-Out]
7/8" DIAM. – 6" ON CTR



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ITEM	QNT'Y	DESCRIPTION	MATERIAL

ROLLFORM TOLERANCES

LENGTH ± 0.125"

ALL OTHER DIMENSIONS ± 0.020"

SCALE	FULL	CHK'D BY	
DWN BY	IDI	02-02-02	APP'D BY

G-STRUT CHANNEL, PART #G132

CAD FILENAME: G132

LAST PLOT DATE: 02-02-02

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Division of Gregory Industries
4100 13th Street SW; Canton, OH 44710
PH: 330-477-4800 FX: 330-477-0626

REF. No.

DRWG No. G132

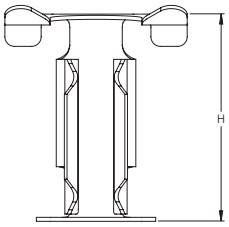
ENGINEERING DATA

115 Surge Restraint



315

- Accommodates multiple sizes of 115 standard duty loop hangers
- Complies with NFPA® 13 standard by restricting the upward surge movement of activated fire sprinkler systems
- Grips the loop hanger, not the nut, allowing fine tuning for height adjustment
- Easily installs by hand before or after pipe is positioned in hanger



Material: Spring Steel
Finish: CADDY ARMOUR

Part Number	Pipe Size	Height H
SR6	1/2" – 2"	1.3"

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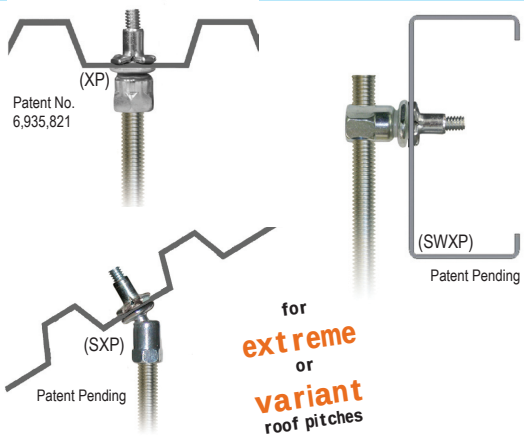
SAMMY X-PRESS®

SAMMYS®

STEEL STEEL STEEL STEEL

Sammy X-Press® *Installs into Metal Deck, Purlin, or Tubular Steel*

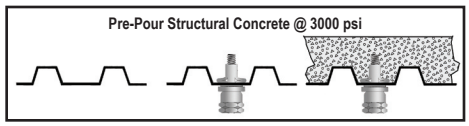


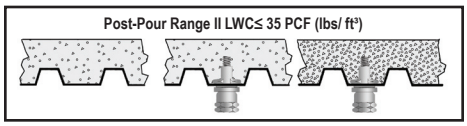


Product Features

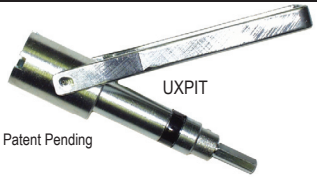
- The ***Sammy X-Press*** expands to provide direct vertical attachment in:
  - Metal Deck (22-16 gauge)
  - Z-Purlin (18-16 gauge)
- The ***Sammy X-Press Swivel*** allows you to hang plumb in extreme roof pitches:
  - 89° in Z-Purlin
  - 45° in metal deck for 12/12 pitch
- The ***Sammy X-Press Sidewinder*** expands to provide horizontal attachment in:
  - 16 ga - 3/16" steel - purlin, tubular steel.
- Installs in seconds, saving time & installation costs.
- Use in applications where access to the back of the installed fastener is prohibited. ie. metal roof deck, tubular steel, or vapor barrier fabric.
- Less jobsite material needed.
- No retaining nut required.
- Provides design flexibility.

Approvals	Rod Size	Part Number	Model	Description	Ultimate Pullout (lbs)	UL Test Load (lbs)	FM Test Load (lbs)	Min Thick	Max Thick	Box Qty	Case Qty	Application
VERTICAL MOUNT												
UL	1/4"	8181922	XP 200	X-Press 200	1146 (22 ga)	185 (Luminaire) 250 (Luminaire)		.027" .056"	.125"	25	125	Metal Deck
UL FM	3/8"	8150922	XP 20	X-Press 20	1146 (22 ga)	850 (2½" Pipe) 185 (Luminaire) 250 (Luminaire) 283 (Conduit & Cable)	940 (2" Pipe) 1475 (4" Pipe)	.027" .027" .056"	.125"	25	125	Metal Deck
UL FM	3/8"	8153922	XP 35	X-Press 35	1783 (16 ga)	1250 (3½" Pipe) 85 (Luminaire) 250 (Luminaire) 416 (Conduit & Cable)	940 (2" Pipe) 1475 (4" Pipe)	.060" .105" .027" .056"	.125"	25	125	Purlin
UL FM	3/8"	8294922	SXP 20	Swivel X-Press 20	1061 (22 ga Vertical) 829 (45° Off Vertical)	750 (2" Pipe) 170 vertical (Luminaire) 80 @ 45° (Luminaire) 283 vertical (Conduit & Cable) 233 @ 45° (Conduit & Cable)	635 (2" Pipe)	.027"	.125"	25	125	Metal Deck
UL FM	3/8"	8295922	SXP 35	Swivel X-Press 35	1675 (16 ga Vertical) 1558 (89° Off Vertical)	1250 (3½" Pipe) 250 vertical (Luminaire) 80 @ 90° (Luminaire) 500 vertical (Conduit & Cable) 333 @ 89° (Conduit & Cable)	635 (2" Pipe)	.060"	.125"	25	125	Purlin
UL	3/8"	8150922	XP 20	Sammy X-Press 20	1146 (22 ga)	850 (2½ Pipe)	Pre-Pour Structural Concrete@ 3000 psi Post-Pour Range II LWC≤ 35 PCF (lbs/ft³)			25	125	Metal Deck (Pre-Pour) Metal Deck (Post-Pour)
HORIZONTAL MOUNT												
UL	3/8"	8293957	SWXP 35	Sidewinder X-Press 35	1798 (16 ga)	1250 (3¼" Pipe) 80 (Luminaire) 416 (Conduit & Cable)		.060"	.125"	25	125	Purlin



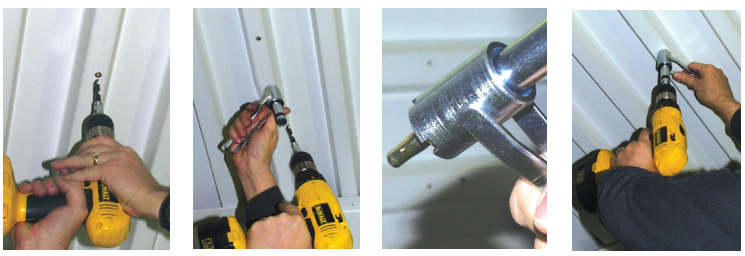


Sammy X-Press It® INSTALLATION TOOL



Part Number	Model	Description	Each Qty
8194910	UXPIT*	Universal X-Press It Tool	1
8195910	RXPIT	Retro Socket for 8151910	1
8152910	XPDB	25/64" Drill Bit	1

*Tool Includes: Sleeve, Bit Receiver, Hex Wrench, and 25/64" Drill Bit.

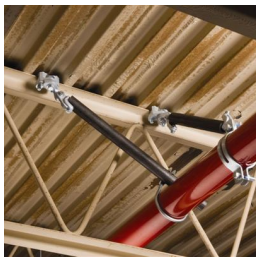


To watch a video demonstration of the Sammy X-Press, visit http://www.sammysuperscrew.com/sammyxpress.htm

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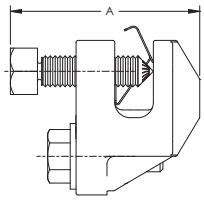
RoHS Compliant

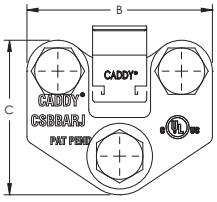
Bar Joist Attachment

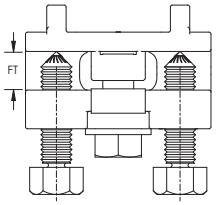



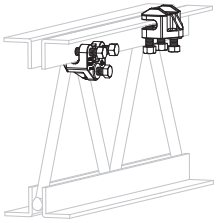



- Can be installed on bar joists or I-beams
- Thumb spring retainer allows for ease of positioning
- Snap-off bolt head helps enable easy installation and inspection of seismic sway braces
- No assembly required
- No loose parts
- Meets NFPA®-13 requirements for seismic sway bracing









Material: Steel

Part Number	Finish	Flange Thickness FT	A	B	C
CSBBARJEG	Electrogalvanized	1/4" – 1/2"	2"	3"	2 1/2"
CSBBARJHD	Hot-Dip Galvanized	1/4" – 1/2"	2"	3"	2 1/2"

UL Loads		
Brace Direction to Structure	Service Pipe Size	Rating
Parallel	1" - 10"	3,000 lb
Perpendicular	1" - 12"	3,740 lb

FM Loads					
Brace Direction to Structure	Service Pipe Size	Horizontal Capacity per Installation Angle from Vertical			
		30° - 44°	45° - 59°	60° - 74°	75° - 90°
Parallel	N/A	1,410 lb	2,110 lb	2,540 lb	2,830 lb
Perpendicular	N/A	1,740 lb	1,710 lb	2,060 lb	2,300 lb

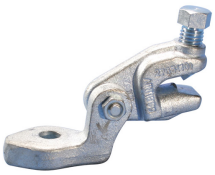
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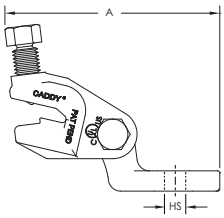
Universal Structural Attachment

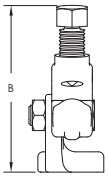


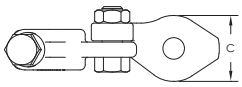




- Universal design allows one product to attach directly to concrete, wood, bar joist or I-beam adapters
- Snap-off bolt head helps enable easy installation and inspection of seismic sway braces
- Use for both lateral and longitudinal sway brace applications
- Works with 1" through 2" brace pipes and 1/4" angle iron braces to reduce inventory
- Center bolt does not require tightening
- Meets NFPA®-13 requirements for seismic sway bracing







Material: Steel

Part Number	Finish	Hole Size HS	A	B	C
CSBUNIV050EG	Electrogalvanized	9/16"	5 1/4"	4"	1 5/8"
CSBUNIV075EG	Electrogalvanized	13/16"	5 1/4"	4"	1 5/8"
CSBUNIV050HD	Hot-Dip Galvanized	9/16"	5 1/4"	4"	1 5/8"

UL Loads		
Brace Type	Service Pipe Size	Rating
Pipe	1" - 10"	3,000 lb
1/4" Thick Angle	1" - 8"	2,015 lb

FM Loads					
Brace Type	Service Pipe Size	Horizontal Capacity per Installation Angle from Vertical			
		30° - 44°	45° - 59°	60° - 74°	75° - 90°
Pipe	N/A	1,620 lb	2,300 lb	2,820 lb	3,140 lb

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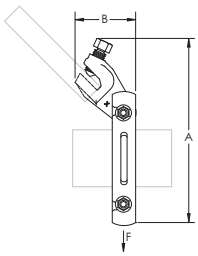
Easy Universal Sway Brace

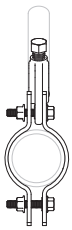






- Use for both lateral and longitudinal sway brace applications
- Unique slotted holes provide for easy slip-on installation eliminating loose hardware
- Snap-off bolt head helps enable easy installation and inspection of seismic sway braces
- Works with 1" through 2" brace pipes and 1/4" angle iron braces to reduce inventory
- Meets NFPA®-13 requirements for seismic sway bracing





Material: Steel
Finish: Electrogalvanized

Part Number	Pipe Size	A	B
CSBEZU0100EG	1"	6 7/8"	1"
CSBEZU0125EG	1 1/4"	7 3/8"	1"
CSBEZU0150EG	1 1/2"	7 3/4"	1"
CSBEZU0200EG	2"	8 1/8"	1 3/16"
CSBEZU0250EG	2 1/2"	8 7/8"	1 3/16"
CSBEZU0300EG	3"	9 3/8"	1 3/16"
CSBEZU0400EG	4"	10 5/8"	1 1/2"
CSBEZU0500EG	5"	12 1/8"	1 1/2"
CSBEZU0600EG	6"	13 5/8"	2"

UL Loads (Listed for Restraints)			
Part Number	Dyna-Flow® Service Pipe	Sch 10 Service Pipe	Sch 40 Service Pipe
CSBEZU0100EG	N/A	655 lb	655 lb
CSBEZU0125EG	655 lb	655 lb	655 lb
CSBEZU0150EG	655 lb	655 lb	655 lb

UL Loads (Listed for Sway Braces)								
Part Number	Lateral				Longitudinal			
	Dyna-Flow® Service Pipe	EZ FLOW™ Service Pipe	Sch 10 Service Pipe	Sch 40 Service Pipe	Dyna-Flow® Service Pipe	Mega-Flow Service Pipe	Sch 10 Service Pipe	Sch 40 Service Pipe
CSBEZU0200EG	3,000 lb	N/A	3,000 lb	3,000 lb	N/A	N/A	N/A	N/A
CSBEZU0250EG	3,000 lb	N/A	3,000 lb	3,000 lb	1,265 lb	N/A	1,265 lb	1,265 lb
CSBEZU0300EG	3,000 lb	N/A	3,000 lb	3,000 lb	1,265 lb	N/A	1,265 lb	1,265 lb
CSBEZU0400EG	3,000 lb	3,000 lb	3,000 lb	3,000 lb	1,265 lb	N/A	1,265 lb	1,265 lb
CSBEZU0500EG	N/A	3,000 lb	3,000 lb	3,000 lb	N/A	1,600 lb	1,600 lb	1,600 lb
CSBEZU0600EG	N/A	3,000 lb	3,000 lb	3,000 lb	N/A	1,600 lb	1,600 lb	1,600 lb

FM Loads (Lightwall, Sch 10 and Sch 40 Service Pipes)								
Part Number	Horizontal Capacity per Installation Angle from Vertical							
	Lateral				Longitudinal			
	30° - 44°	45° - 59°	60° - 74°	75° - 90°	30° - 44°	45° - 59°	60° - 74°	75° - 90°
CSBEZU0100EG	860 lb	1,220 lb	1,500 lb	1,670 lb	390 lb	550 lb	670 lb	750 lb
CSBEZU0125EG	860 lb	1,220 lb	1,500 lb	1,670 lb	390 lb	550 lb	670 lb	750 lb
CSBEZU0150EG	860 lb	1,220 lb	1,500 lb	1,670 lb	390 lb	550 lb	670 lb	750 lb
CSBEZU0200EG	1,530 lb	2,160 lb	2,650 lb	2,960 lb	520 lb	690 lb	830 lb	930 lb
CSBEZU0250EG	1,530 lb	2,160 lb	2,650 lb	2,960 lb	520 lb	690 lb	830 lb	930 lb
CSBEZU0300EG	1,530 lb	2,160 lb	2,650 lb	2,960 lb	520 lb	690 lb	830 lb	930 lb
CSBEZU0400EG	1,570 lb	2,220 lb	2,720 lb	3,030 lb	630 lb	900 lb	1,100 lb	1,230 lb
CSBEZU0500EG	1,570 lb	2,220 lb	2,720 lb	3,030 lb	630 lb	900 lb	1,100 lb	1,230 lb
CSBEZU0600EG	1,980 lb	2,810 lb	3,440 lb	3,840 lb	730 lb	1,000 lb	1,230 lb	1,370 lb

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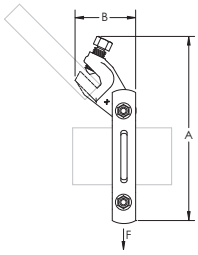
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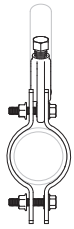
Standard Universal Sway Brace





- Use for both lateral and longitudinal sway brace applications
- Snap-off bolt head helps enable easy installation and inspection of seismic sway braces
- Works with 1" through 2" brace pipes and 1/4" angle iron braces to reduce inventory
- Slotted design grabs service pipe for added gripping strength
- Meets NFPA®-13 requirements for seismic sway bracing





Material: Steel

Part Number	Pipe Size	A	B
Finish: Electrogalvanized			
CSBSTU0100EG	1"	6 7/8"	1"
CSBSTU0125EG	1 1/4"	7 3/8"	1"
CSBSTU0150EG	1 1/2"	7 3/4"	1"
CSBSTU0200EG	2"	8 1/8"	1 3/16"
CSBSTU0250EG	2 1/2"	8 7/8"	1 3/16"
CSBSTU0300EG	3"	9 3/8"	1 3/16"
CSBSTU0400EG	4"	10 5/8"	1 1/2"
CSBSTU0500EG	5"	12 1/8"	1 1/2"
CSBSTU0600EG	6"	13 5/8"	2"
CSBSTU0800EG	8"	15 3/4"	2"
CSBSTU1000EG	10"	18"	2"
Finish: Hot-Dip Galvanized			
CSBSTU0100HD	1"	6 7/8"	1"
CSBSTU0125HD	1 1/4"	7 3/8"	1"
CSBSTU0150HD	1 1/2"	7 3/4"	1"
CSBSTU0200HD	2"	8 1/8"	1 3/16"
CSBSTU0250HD	2 1/2"	8 7/8"	1 3/16"
CSBSTU0300HD	3"	9 3/8"	1 3/16"
CSBSTU0400HD	4"	10 5/8"	1 1/2"
CSBSTU0500HD	5"	12 1/8"	1 1/2"

Part Number	Pipe Size	A	B
CSBSTU0600HD	6"	13 5/8"	2"
CSBSTU0800HD	8"	15 3/4"	2"
CSBSTU1000HD	10"	18"	2"

UL Loads (Listed for Restraints)			
Part Number	Dyna-Flow® Service Pipe	Sch 10 Service Pipe	Sch 40 Service Pipe
CSBSTU0100xx	N/A	655 lb	655 lb
CSBSTU0125xx	655 lb	655 lb	655 lb
CSBSTU0150xx	655 lb	655 lb	655 lb

UL Loads (Listed for Sway Braces)								
Part Number	Lateral				Longitudinal			
	Dyna-Flow® Service Pipe	EZ FLOW™ Service Pipe	Sch 10 Service Pipe	Sch 40 Service Pipe	Dyna-Flow® Service Pipe	EZ FLOW™ Service Pipe	Sch 10 Service Pipe	Sch 40 Service Pipe
CSBSTU0200xx	3,000 lb	N/A	3,000 lb	3,000 lb	N/A	N/A	N/A	N/A
CSBSTU0250xx	3,000 lb	N/A	3,000 lb	3,000 lb	2,015 lb	N/A	2,015 lb	2,015 lb
CSBSTU0300xx	3,000 lb	N/A	3,000 lb	3,000 lb	2,015 lb	N/A	2,015 lb	2,015 lb
CSBSTU0400xx	3,000 lb	3,000 lb	3,000 lb	3,000 lb	2,015 lb	N/A	2,015 lb	2,015 lb
CSBSTU0500xx	N/A	3,000 lb	3,000 lb	3,000 lb	N/A	N/A	2,015 lb	2,015 lb
CSBSTU0600xx	N/A	3,000 lb	3,000 lb	3,000 lb	N/A	2,015 lb	2,015 lb	2,015 lb
CSBSTU0800xx	N/A	N/A	3,000 lb	3,000 lb	N/A	N/A	2,015 lb	2,015 lb
CSBSTU1000xx	N/A	N/A	3,000 lb	3,000 lb	N/A	N/A	3,000 lb	3,000 lb

FM Loads (Lightwall, Sch 10 and Sch 40 Service Pipes)								
Part Number	Horizontal Capacity per Installation Angle from Vertical							
	Lateral				Longitudinal			
	30° - 44°	45° - 59°	60° - 74°	75° - 90°	30° - 44°	45° - 59°	60° - 74°	75° - 90°
CSBSTU0100xx	860 lb	1,220 lb	1,500 lb	1,670 lb	970 lb	720 lb	860 lb	960 lb
CSBSTU0125xx	860 lb	1,220 lb	1,500 lb	1,670 lb	970 lb	720 lb	860 lb	960 lb
CSBSTU0150xx	860 lb	1,220 lb	1,500 lb	1,670 lb	970 lb	720 lb	860 lb	960 lb
CSBSTU0200xx	1,530 lb	2,160 lb	2,650 lb	2,960 lb	870 lb	690 lb	830 lb	930 lb
CSBSTU0250xx	1,530 lb	2,160 lb	2,650 lb	2,960 lb	870 lb	690 lb	830 lb	930 lb
CSBSTU0300xx	1,530 lb	2,160 lb	2,650 lb	2,960 lb	870 lb	690 lb	830 lb	930 lb
CSBSTU0400xx	1,570 lb	2,220 lb	2,720 lb	3,030 lb	1,550 lb	1,390 lb	1,680 lb	1,870 lb
CSBSTU0500xx	1,570 lb	2,220 lb	2,720 lb	3,030 lb	1,550 lb	1,390 lb	1,680 lb	1,870 lb
CSBSTU0600xx	1,980 lb	2,810 lb	3,440 lb	3,840 lb	1,470 lb	1,170 lb	1,410 lb	1,570 lb

FM Loads (0.188" wall and Sch 40 Service Pipes)								
Part Number	Horizontal Capacity per Installation Angle from Vertical							
	Lateral				Longitudinal			
	30° - 44°	45° - 59°	60° - 74°	75° - 90°	30° - 44°	45° - 59°	60° - 74°	75° - 90°
CSBSTU0800xx	2,040 lb	2,890 lb	3,540 lb	3,950 lb	1,200 lb	1,700 lb	2,090 lb	2,330 lb
CSBSTU1000xx	2,040 lb	2,890 lb	3,540 lb	3,950 lb	1,200 lb	1,700 lb	2,090 lb	2,330 lb

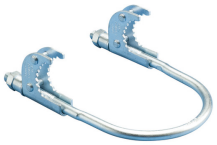
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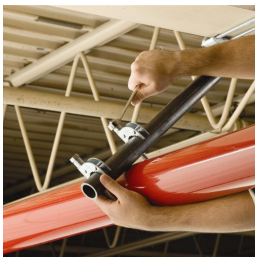
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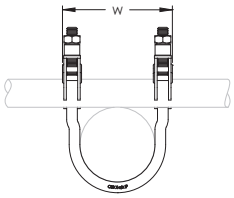
Quick Grip Jr. Lateral Sway Brace

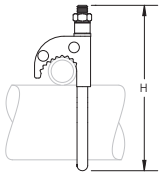






- Easy two-step installation elminates extra trips between structure and service pipe
- Works with 1" and 1 1/4" (25 mm and 32 mm) brace pipes to reduce inventory
- Snap-off bolt head helps enable easy installation and inspection of seismic sway braces
- Meets NFPA®-13 requirements for seismic sway bracing





Material: Steel
Finish: Electrogalvanized

Part Number	Pipe Size	Height H	Width W
CSBQIKCL0100EG	1"	5 1/8"	2 5/8"
CSBQIKCL0125EG	1 1/4"	5 3/8"	3"
CSBQIKCL0150EG	1 1/2"	5 5/8"	3 1/4"
CSBQIKCL0200EG	2"	6 3/8"	3 5/8"

UL Loads (Listed for Restraints)			
Part Number	Service Pipe Schedule	Lateral	
		1" Brace Pipe	1 1/4" Brace Pipe
CSBQIKCL0100EG	Dyna-Flow®	N/A	N/A
	10	655 lb	655 lb
	40	655 lb	655 lb
CSBQIKCL0125EG	Dyna-Flow®	655 lb	540 lb
	10	655 lb	540 lb
	40	655 lb	540 lb
CSBQIKCL0150EG	Dyna-Flow®	750 lb	655 lb
	10	750 lb	655 lb
	40	750 lb	655 lb
CSBQIKCL0200EG	Dyna-Flow®	750 lb	540 lb
	10	750 lb	540 lb
	40	750 lb	540 lb

FM Loads					
Part Number	Service Pipe Schedule	Lateral			
		Horizontal Capacity per Installation Angle from Vertical			
		30° - 44°	45° - 59°	60° - 74°	75° - 90°
CSBQIKCL0100EG	Lightwall	290 lb	410 lb	495 lb	550 lb
	10	150 lb	210 lb	280 lb	315 lb
	40	475 lb	665 lb	825 lb	925 lb
CSBQIKCL0125EG	Lightwall	290 lb	410 lb	495 lb	550 lb
	10	150 lb	210 lb	280 lb	315 lb
	40	475 lb	665 lb	825 lb	925 lb
CSBQIKCL0150EG	Lightwall	290 lb	410 lb	495 lb	550 lb
	10	150 lb	210 lb	280 lb	315 lb
	40	475 lb	665 lb	825 lb	925 lb
CSBQIKCL0200EG	Lightwall	390 lb	550 lb	670 lb	750 lb
	10	350 lb	500 lb	620 lb	690 lb
	40	490 lb	690 lb	850 lb	950 lb

Dyna-Flow is a registered trademark of Allied Tube & Conduit Corporation. FM is a registered certification mark of FM Approvals LLC, LTD. NFPA is a registered trademark of National Fire Protection Association, Inc. UL, UR, cUL, cUR, cULus and cURus are registered certification marks of UL LLC.

WARNING
Pentair products shall be installed and used only as indicated in Pentair's product instruction sheets and training materials. Instruction sheets are available at erico.pentair.com and from your Pentair customer service representative. Improper installation, misuse, misapplication or other failure to completely follow Pentair's instructions and warnings may cause product malfunction, property damage, serious bodily injury and death and/or void your warranty.

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Quick Grip Lateral Sway Brace

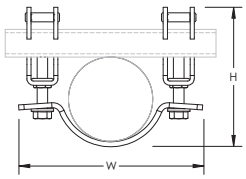


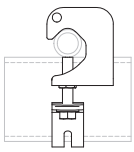




The Quick Grip Lateral Brace, part of the CADDY line of fire sprinkler bracing systems from Pentair, is designed to help simplify installations when bracing service pipe for seismic or other catastrophic events. It features an innovative design for quick attachment of brace pipe to service pipe saving time and money.

- Easy two-step installation elminates extra trips between structure and service pipe
- Works with 1" and 1 1/4" (25 mm and 32 mm) brace pipes to reduce inventory
- Yellow tips provide a visual indicator that the bolts have been properly torqued
- Easy installation with an impact wrench from the bottom side of the clamp
- Meets NFPA®-13 requirements for seismic sway bracing





Material: Steel
Finish: Electrogalvanized

Part Number	Pipe Size	Height H	Width W
CSBQG0250EG	2 1/2"	5 7/16" – 5 7/8"	6 3/4"
CSBQG0300EG	3"	6 1/8" – 6 1/2"	7 1/2"
CSBQG0400EG	4"	7 1/8" – 7 1/2"	8 3/4"
CSBQG0600EG	6"	9 1/4" – 9 5/8"	11 3/4"
CSBQG0800EG	8"	11 3/8" – 11 13/16"	13 7/8"

UL Loads			
Part Number	Service Pipe Schedule	Lateral	
		1" Brace Pipe	1 1/4" Brace Pipe
CSBQG0250EG	Dyna-Flow®	2,015 lb	2,015 lb
	10	2,015 lb	2,015 lb
	40	2,015 lb	2,015 lb
CSBQG0300EG	Dyna-Flow®	2,015 lb	2,015 lb
	10	2,015 lb	2,015 lb
	40	2,015 lb	2,015 lb
CSBQG0400EG	Dyna-Flow®	2,015 lb	2,015 lb
	10	2,015 lb	2,015 lb
	40	2,015 lb	2,015 lb

UL Loads			
Part Number	Service Pipe Schedule	Lateral	
		1" Brace Pipe	1 1/4" Brace Pipe
CSBQG0600EG	Mega-Flow	2,015 lb	2,015 lb
	10	2,015 lb	2,015 lb
	40	2,015 lb	2,015 lb
CSBQG0800EG	10	2,015 lb	2,015 lb
	40	2,015 lb	2,015 lb

FM Loads					
Part Number	Service Pipe Schedule	Lateral			
		Horizontal Capacity per Installation Angle from Vertical			
		30° - 44°	45° - 59°	60° - 74°	75° - 90°
CSBQG0250EG	Lightwall	1,410 lb	2,000 lb	2,450 lb	2,740 lb
	10	1,410 lb	2,000 lb	2,450 lb	2,740 lb
	40	1,410 lb	2,000 lb	2,450 lb	2,740 lb
CSBQG0300EG	Lightwall	1,190 lb	1,680 lb	2,060 lb	2,300 lb
	10	1,190 lb	1,680 lb	2,060 lb	2,300 lb
	40	1,190 lb	1,680 lb	2,060 lb	2,300 lb
CSBQG0400EG	Lightwall	1,190 lb	1,680 lb	2,060 lb	2,300 lb
	10	1,190 lb	1,680 lb	2,060 lb	2,300 lb
	40	1,190 lb	1,680 lb	2,060 lb	2,300 lb
CSBQG0600EG	Lightwall	870 lb	1,230 lb	1,510 lb	1,690 lb
	10	870 lb	1,230 lb	1,510 lb	1,690 lb
	40	970 lb	1,370 lb	1,680 lb	1,870 lb
CSBQG0800EG	0.188" (Wall Thickness)	790 lb	1,110 lb	1,360 lb	1,520 lb
	40	790 lb	1,110 lb	1,360 lb	1,520 lb

Dyna-Flow is a registered trademark of Allied Tube & Conduit Corporation. FM is a registered certification mark of FM Approvals LLC, LTD. NFPA is a registered trademark of National Fire Protection Association, Inc. UL, UR, cUL, cUR, cULus and cURus are registered certification marks of UL LLC.

WARNING
Pentair products shall be installed and used only as indicated in Pentair's product instruction sheets and training materials. Instruction sheets are available at erico.pentair.com and from your Pentair customer service representative. Improper installation, misuse, misapplication or other failure to completely follow Pentair's instructions and warnings may cause product malfunction, property damage, serious bodily injury and death and/or void your warranty.

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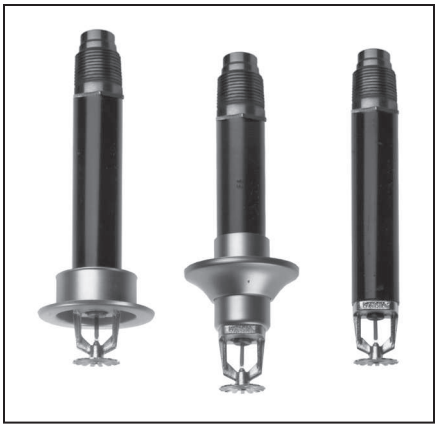
VIKING®

TECHNICAL DATA

QUICK RESPONSE DRY PENDENT SPRINKLERS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION



Viking Quick Response Dry Pendent Sprinklers are thermosensitive spray sprinklers suitable for use in areas subject to freezing. The sprinklers are designed for dry systems and preaction systems where it is necessary to prevent water or condensation from entering the drop nipple before sprinkler operation. They may also be installed in spaces subject to freezing and supplied from a wet system in an adjacent heated area.

Viking Quick Response Dry Pendent Sprinklers are available in various finishes and temperature ratings to meet design requirements. The special Polyester and Electroless Nickel PTFE (ENT) coatings have been investigated for installation in corrosive atmospheres and are listed/approved as corrosion resistant as indicated in the Approval Charts. (Note: FM Global has no approval classification for Polyester coatings as corrosion resistant.)

NOTE: When installed in some corrosive environments, the Polyester finish may change color. This natural discoloration over time is not in itself an indication of corrosion and should not be treated as such. All sprinklers installed in corrosive environments should be replaced or tested as described in NFPA 25 on a more frequent basis.

2. LISTINGS AND APPROVALS

cULus Listed: Category VNIV

FM Approved: Classes 2013 and 2015

NYC Approved: MEA 89-92-E Volume 15

Refer to Approval Chart 1 and Design Criteria on page 105d for cULus Listing requirements, and refer to Approval Chart 2 and Design Criteria on page 105e for FM Approval requirements that must be followed.

3. TECHNICAL DATA

Specifications:

Minimum Operating Pressure: 7 psi (0.5 bar)
Maximum Working Pressure: 175 psi (12 bar).
Factory tested pneumatically to 100 psi (6.89 bar)
Thread size: 1” NPT or 25 mm BSP
Nominal K-Factor: 5.6 U.S. (80.6 metric*) for all listed and approved lengths.

* Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

Glass-bulb fluid temperature rated to -65 °F (-55 °C)
Covered by the following U.S. Patents: 8,636,075

Material Standards:

Frame Casting: Brass UNS-C84400
Deflector: Brass UNS-C26000
Bulb: Glass, nominal 3 mm diameter
Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with PTFE Tape
Compression Screw: Brass UNS-C36000
Pip Cap: Brass UNS-C31400 or UNS-C31600
Pip Cap Adapter: Brass UNS-C36000
Orifice: Copper UNS-C22000 or UNS-C11000
Tube: ERW Hydraulic Steel Tube
Support (Internal): Stainless Steel UNS-S30400
Barrel: Steel Pipe UNS-G10260, Electrodeposited Epoxy Base finish
Barrel End and Threads: QM Brass
Sleeve (for Adjustable Standard style only): Brass UNS-C26000 or UNS-C26800

Escutcheon Materials:

Adjustable Standard Dry Escutcheons: Brass UNS-C26000 or UNS-C26800
Recessed Dry Escutcheons: Cold Rolled Steel UNS-G10080

Viking Technical Data may be found on The Viking Corporation’s Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

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TECHNICAL DATA

QUICK RESPONSE
DRY PENDENT SPRINKLERS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

ENT Coated Adjustable and Recessed Escutcheons: Stainless Steel UNS-S30400

Ordering Information: (Also refer to the current Viking price list.)

Order Quick Response Dry Pendent Sprinklers by first adding the appropriate suffix for the sprinkler finish, the appropriate suffix for the temperature rating, and then the suffix for the length ("A" dimension) to sprinkler base part number. Order in a specific length noted as the "A" dimension. The "A" dimension is the distance from the face of the fitting (tee) to the desired finished surface of the ceiling.

These sprinklers are listed and approved in lengths from 1-1/2" to 45-1/2" (38.1 mm to 1,156 mm) for the adjustable standard style, 3" to 47" (76.2 mm to 1,194 mm) for the plain barrel style, and 3-1/4" to 47-1/2" (82.5 mm to 1,207 mm) for the adjustable recessed style.

Lengths exceeding the standard lengths are available, with no approvals, on a "made-to-order" basis: Recessed Dry Pendent up to 65-1/2" (1,664 mm). Adjustable Standard Dry Pendent up to 63-1/2" (1,613 mm). Plain Barrel Dry Pendent up to 65" (1,651 mm). Contact the manufacturer for more information.

Finish Suffix: Brass = A, Chrome = F, White Polyester = M-/W, and ENT = JN

Temperature Suffix: 155 °F (68 °C) = B, 175 °F (79 °C) = D, 200 °F (93 °C) = E, 286 °F (141 °C) = G

For example, sprinkler VK176 with a Chrome finish and a 155 °F (68 °C) temperature rating, and "A" length of 10" = Part No. 08383UFB10.

Available Finishes And Temperature Ratings: Refer to Table 1.

Accessories: (Also refer to the "Sprinkler Accessories" section of the Viking data book.)

Sprinkler Wrenches:

A. Standard Wrench: Part No. 07297W/B (available since 1991)

B. Wrench for recessed sprinklers: Part No. 07565W/B** (available since 1991)

**A ½" ratchet is required (not available from Viking).

Sprinkler Guard: Chrome, with no listings or approvals, for installation on dry pendent sprinklers made after May 1994 only (Part No. 08954).

Replacement Escutcheons:

A. Adjustable Standard Dry Escutcheon: Base Part No. 07741

B. Recessed Dry Escutcheon Cup: Base Part No. 05459A

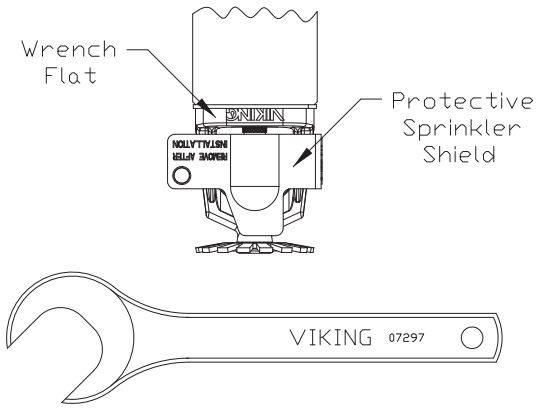


Figure 1: Standard Sprinkler Wrench 07297W/B

4. INSTALLATION

Refer to appropriate NFPA Installation Standards.

5. OPERATION

During fire conditions, the heat-sensitive liquid in the glass bulb expands, causing the glass to shatter, releasing the internal parts to open the waterway. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS & MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

The Viking Quick Response Dry Pendent Sprinkler is available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

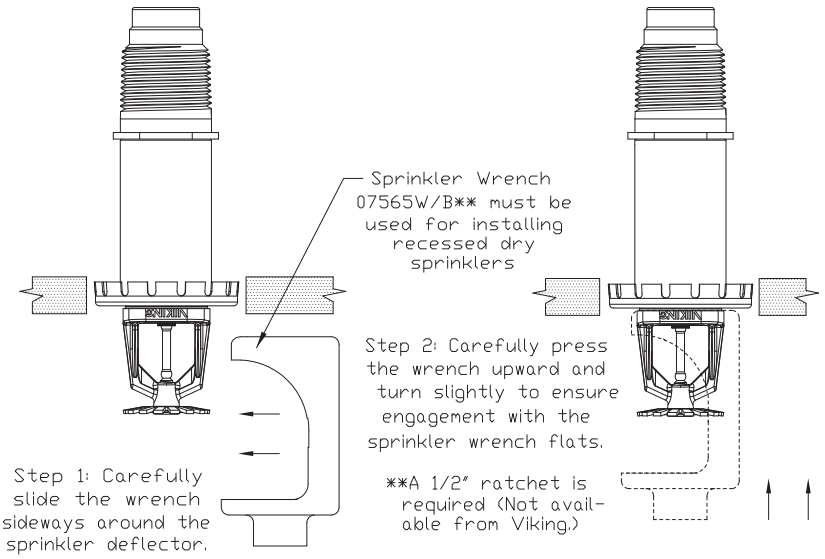


Figure 2: Wrench 07565W/B for Adjustable Recessed Dry Pendent Sprinklers

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TECHNICAL DATA

QUICK RESPONSE DRY PENDENT SPRINKLERS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating[1]	Maximum Ambient Ceiling Temperature[2]	Bulb Color
Ordinary	155 °F (68 °C)	100 °F (38 °C)	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	Yellow
Intermediate	200 °F (93 °C)	150 °F (65 °C)	Green
High	286 °F (141 °C)	225 °F (107 °C)	Blue

Sprinkler Finishes: Brass, Chrome, White Polyester, and ENT

Corrosion-Resistant Coating[3,4]: White Polyester and ENT in all temperature ratings

Footnotes

[1] The sprinkler temperature rating is stamped on the deflector.

[2] Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

[3] The corrosion-resistant Polyester and ENT coatings have passed the standard corrosion test required by the approving agencies indicated in the Approval Charts. These tests cannot and do not represent all possible corrosive environments. Note: These coatings are NOT corrosion proof. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. Polyester and ENT coatings are applied to the exposed exterior surfaces only. Note that the spring is exposed on sprinklers with Polyester and ENT coatings.

[4] When installed in some corrosive environments, the Polyester finish may change color. This natural discoloration over time is not in itself an indication of corrosion and should not be treated as such. All sprinklers installed in corrosive environments should be replaced or tested as described in NFPA 25 on a more frequent basis.

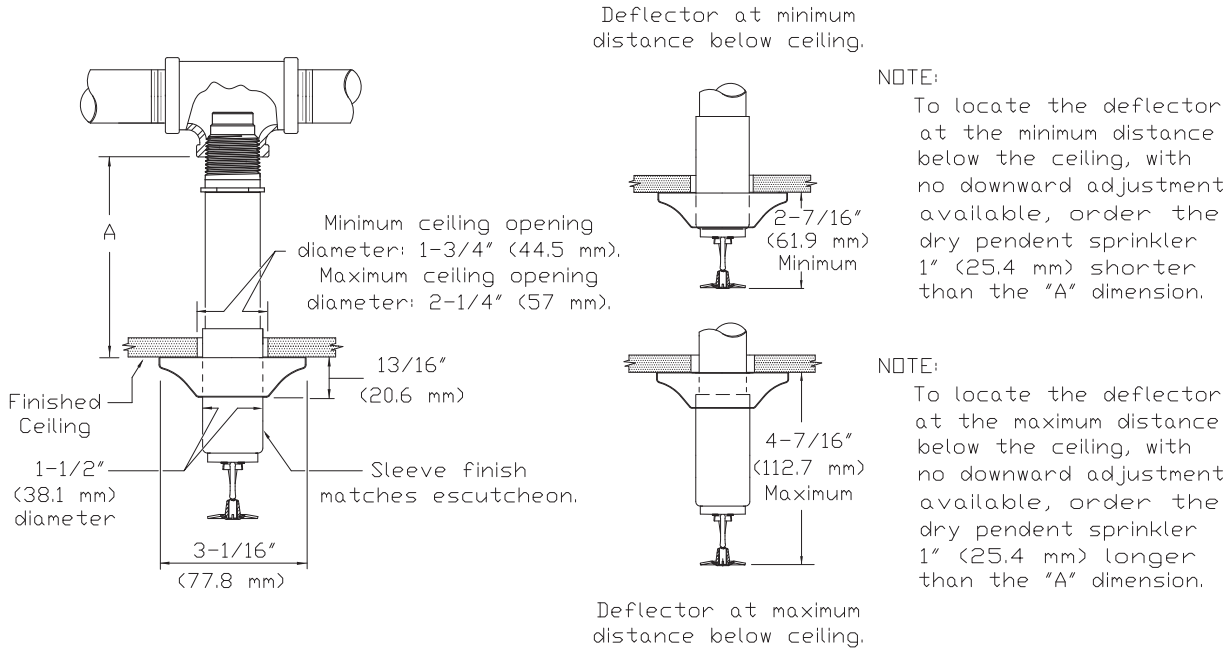


Figure 3: Adjustable Standard Dry Pendent Sprinkler

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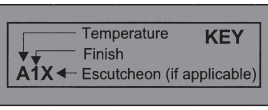
TECHNICAL DATA

QUICK RESPONSE DRY PENDENT SPRINKLERS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Approval Chart 1 (UL)

Quick Response Dry Pendent Sprinklers
Maximum 175 PSI (12 bar) WWP



Sprinkler Base Part No.[1]	SIN	Style	Thread Size		Nominal K-Factor[2]		Order Length Increment		Listings and Approvals[4] (Refer also to Design Criteria below.)					
			NPT	BSP	U.S.	metric[3]	Inches	mm	cULus[5]	NYC[6]	VdS	LPCB	CE	
08383U	VK176	Adjustable Standard	1”	--	5.6	80.6	1/2”	12.7	A1, A5	A1	--	--	--	--
16457U			--	25 mm	--	80.6	1/2”	12.7	A1, A5	--	--	--	--	--
08385U	VK180	Adjustable Recessed	1”	--	5.6	80.6	1/4”	6.35	B2, B6	B2	--	--	--	--
16453U			--	25 mm	--	80.6	1/4”	6.35	B2, B6	--	--	--	--	--
08387U	VK172	Plain Barrel	1”	--	5.6	80.6	1/2”	12.7	A3	A4	--	--	--	--
16455U			--	25 mm	--	80.6	1/2”	12.7	A3	--	--	--	--	--

Approved Temperature Ratings

A - 155 °F (68 °C), 175 °F (79°C), 200 °F (93 °C), and 286 °F (141 °C)
B - 155 °F (68 °C), 175 °F (79°C), and 200 °F (93 °C)

Approved Finishes and “A” Dimensions

1 - Chrome or White Polyester[7] sprinkler with a Chrome or White Polyester Sleeve and Escutcheon with “A” dimensions 1-1/2” to 45-1/2” (38.1 mm to 1,156 mm)
2 - Chrome or White Polyester[7] with “A” dimensions 3-1/4” to 47-1/2” (82.5 mm to 1,207 mm)
3 - Chrome, Brass, White Polyester[7], or ENT[7] with “A” dimensions 3” to 47” (76.2 mm to 1,194 mm)
4 - Chrome or Brass with “A” dimensions 3” to 47” (76.2 mm to 1,194 mm)
5 - ENT[7] sprinkler with an ENT[7] Sleeve and Escutcheon with “A” dimensions 1-1/2” to 45-1/2” (38.1 mm to 1,156 mm)
6 - ENT[7] with “A” dimensions 3-1/4” to 47-1/2” (82.5 mm to 1,207 mm)

Footnotes

[1] Part number shown is the base part number. For complete part number, refer to current Viking price list schedule.

[2] K-Factor applies for standard lengths (“A” Dimensions indicated above).

[3] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

[4] This chart shows the listings and approvals available at the time of printing. Other approvals may be in process. Check with the manufacturer for any additional approvals.

[5] Listed by Underwriter’s Laboratories for use in the U.S. and Canada.

[6] Accepted for use, City of New York Department of Buildings, MEA Number 89-92-E, Vol. 15.

[7] cULus Listed as corrosion resistant.

DESIGN CRITERIA - UL

(Also refer to Approval Chart 1 above.)

NOTE: When using CPVC fittings with Viking dry sprinklers, use only new Nibco Model 5012-S-BI tees. When selecting other CPVC fittings, contact Viking Technical Services.

cULus Listing Requirements:

Standard Dry Pendent Sprinklers are cULus Listed as indicated in Approval Chart 1 for installation in accordance with the latest edition of NFPA 13 for standard spray sprinklers.

- Designed for use in Light and Ordinary Hazard occupancies.
- The sprinkler installation and obstruction rules contained in NFPA 13 for standard spray pendent sprinklers must be followed.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page DRY1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

VIKING®

TECHNICAL DATA

QUICK RESPONSE DRY PENDENT SPRINKLERS

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Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Approval Chart 2 (FM)

Quick Response Dry Pendent Sprinklers
Maximum 175 PSI (12 bar) WWP

KEY: A1X — Temperature, Finish, Escutcheon (if applicable)

Sprinkler Base Part No.[1]	SIN	Style	Thread Size		Nominal K-Factor[2]		Order Length Increment		FM Approvals[4] (Refer also to Design Criteria below.)
			NPT	BSP	U.S.	metric[3]	Inches	mm	
08383U	VK176	Adjustable Standard	1"	--	5.6	80.6	1/2"	12.7	A1
16457U			--	25 mm	--	80.6	1/2"	12.7	A1
08385U	VK180	Adjustable Recessed	1"	--	5.6	80.6	1/4"	6.35	B2
16453U			--	25 mm	--	80.6	1/4"	6.35	B2
08387U	VK172	Plain Barrel	1"	--	5.6	80.6	1/2"	12.7	A3
16455U			--	25 mm	--	80.6	1/2"	12.7	A3

Approved Temperature Ratings

A - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141 °C)

B - 155 °F (68 °C), 175 °F (79°C), and 200 °F (93 °C)

Approved Finishes and "A" Dimensions

1 - Brass, Chrome, White Polyester, or ENT[5] sprinkler with a Brass, Chrome, White Polyester, or ENT[5] Sleeve and Escutcheon with "A" dimensions 1-1/2" to 45-1/2" (38.1 mm to 1,156 mm)
2 - Brass, Chrome, White Polyester, or ENT[5] with "A" dimensions 3-1/4" to 47-1/2" (82.5 mm to 1,207 mm)
3 - Brass, Chrome, White Polyester, or ENT[5] with "A" dimensions 3" to 47" (76.2 mm to 1,194 mm)

Footnotes

[1] Part number shown is the base part number. For complete part number, refer to current Viking price list schedule.
[2] K-Factor applies for standard lengths ("A" Dimensions indicated above).
[3] Metric K-Factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.
[4] This chart shows the FM Approvals available at the time of printing. Other approvals may be in process. Check with the manufacturer for any additional approvals.
[5] FM approved as corrosion resistant.

DESIGN CRITERIA - FM

(Also refer to Approval Chart 2 above.)

NOTE: When using CPVC fittings with Viking dry sprinklers, use only new Nibco Model 5012-S-Bl tees. When selecting other CPVC fittings, contact Viking Technical Services.

FM Approval Requirements:

The Dry Pendent Sprinklers in the Approval Chart above are FM Approved as quick response **Non-storage** standard spray sprinklers as indicated in the FM Approval Guide. For specific application and installation requirements, reference the latest applicable FM Loss Prevention Data Sheets (including 2-0) and Technical Advisory Bulletins. FM Global Loss Prevention Data Sheets and Technical Advisory Bulletins contain guidelines relating to, but not limited to: minimum water supply requirements, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector distance below the ceiling.

NOTE: The FM installation guidelines may differ from cULus and/or NFPA criteria.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page DRY1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

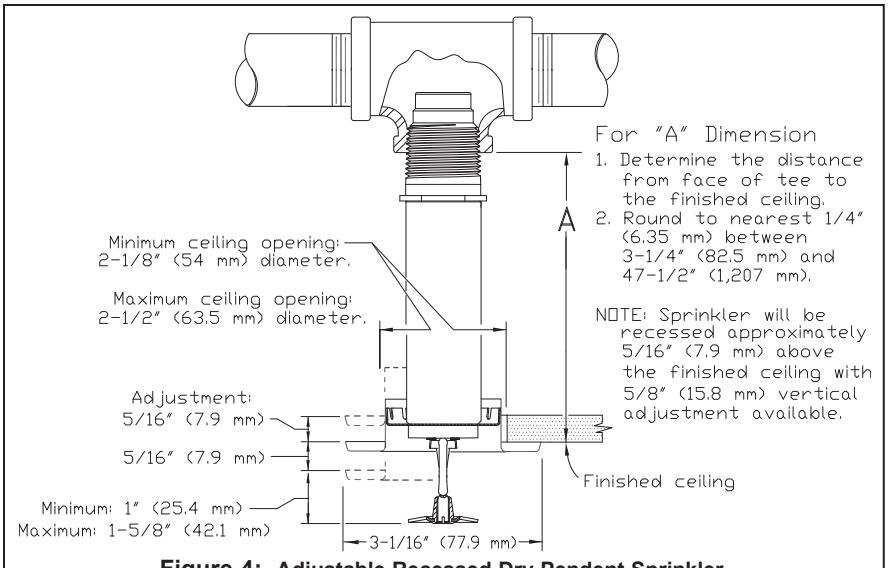


Figure 4: Adjustable Recessed Dry Pendent Sprinkler

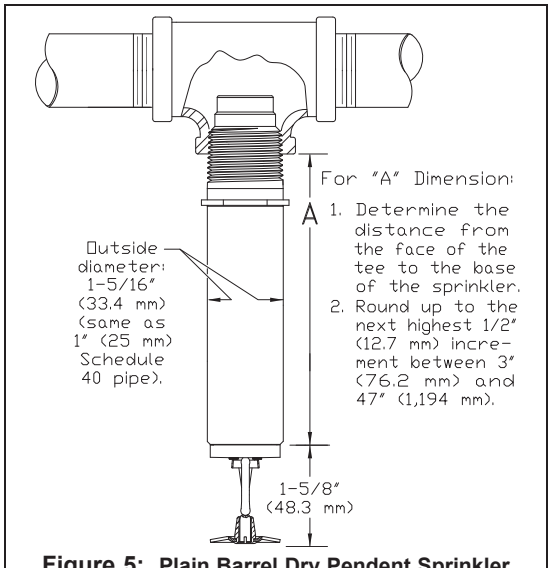


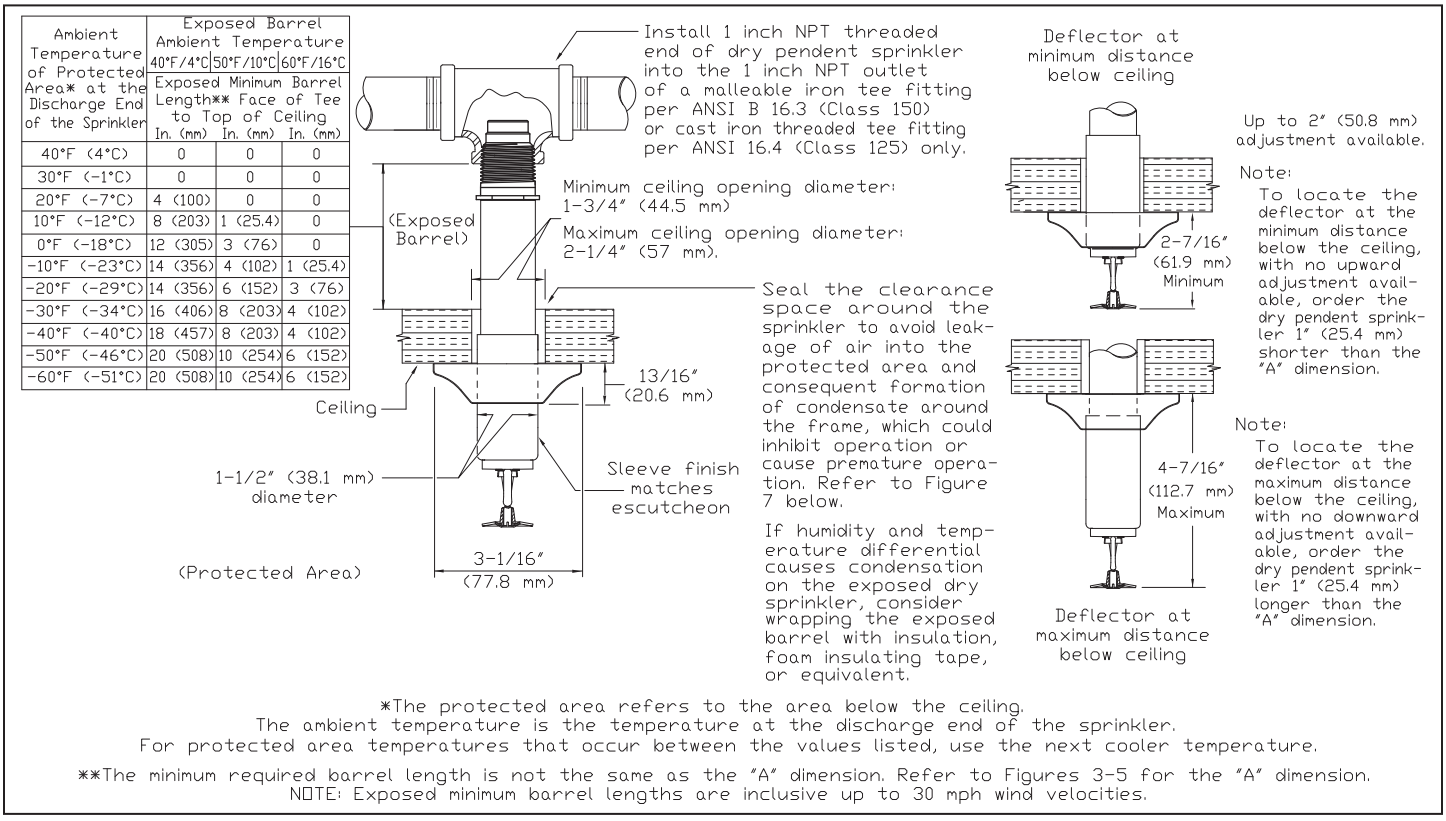
Figure 5: Plain Barrel Dry Pendent Sprinkler

VIKING®

TECHNICAL DATA

QUICK RESPONSE DRY PENDENT SPRINKLERS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com



Ambient Temperature of Protected Area* at the Discharge End of the Sprinkler	Exposed Barrel Ambient Temperature 40°F/4°C	50°F/10°C	60°F/16°C
	Exposed Minimum Barrel Length** Face of Tee to Top of Ceiling In. (mm)	In. (mm)	In. (mm)
40°F (4°C)	0	0	0
30°F (-1°C)	0	0	0
20°F (-7°C)	4 (100)	0	0
10°F (-12°C)	8 (203)	1 (25.4)	0
0°F (-18°C)	12 (305)	3 (76)	0
-10°F (-23°C)	14 (356)	4 (102)	1 (25.4)
-20°F (-29°C)	14 (356)	6 (152)	3 (76)
-30°F (-34°C)	16 (406)	8 (203)	4 (102)
-40°F (-40°C)	18 (457)	8 (203)	4 (102)
-50°F (-46°C)	20 (508)	10 (254)	6 (152)
-60°F (-51°C)	20 (508)	10 (254)	6 (152)

*The protected area refers to the area below the ceiling.
The ambient temperature is the temperature at the discharge end of the sprinkler.
For protected area temperatures that occur between the values listed, use the next cooler temperature.

**The minimum required barrel length is not the same as the "A" dimension. Refer to Figures 3-5 for the "A" dimension.
NOTE: Exposed minimum barrel lengths are inclusive up to 30 mph wind velocities.

Figure 6: **Dry Pendent Sprinkler Required Minimum Barrel Length Based on Ambient Temperature in the Protected Area (Adjustable Standard Dry Pendent Sprinkler is Shown)**

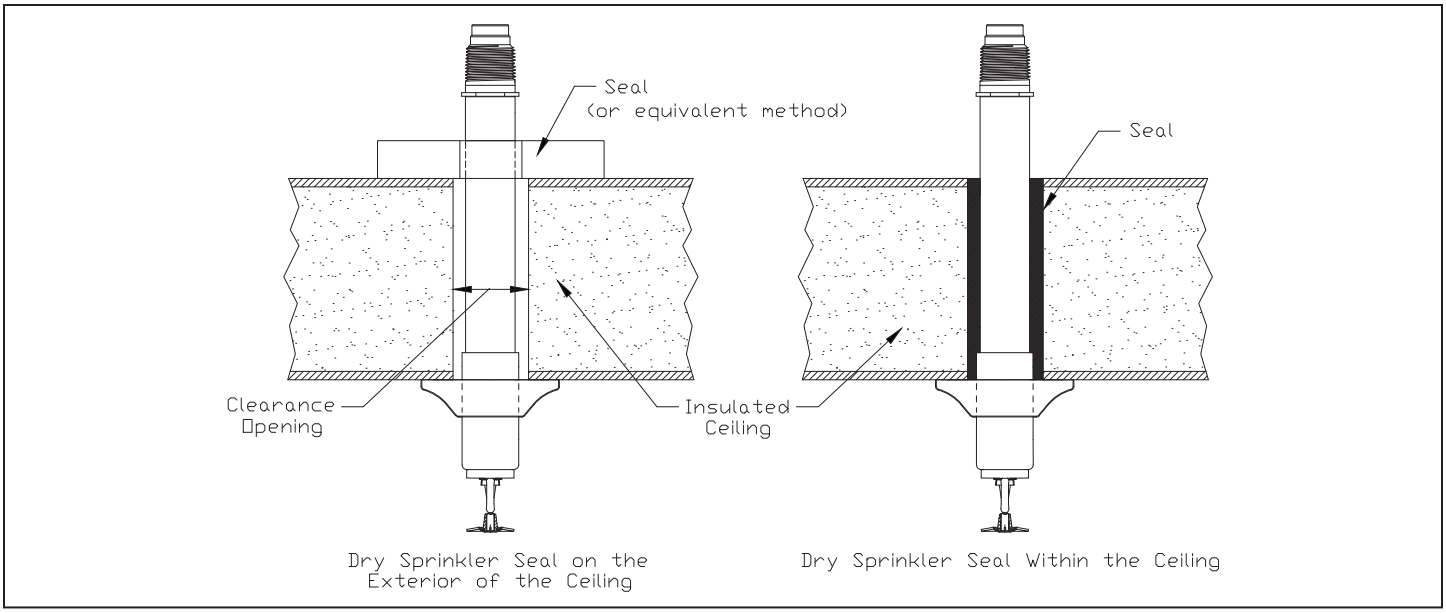


Figure 7: **Dry Sprinkler Seal (Adjustable Standard Dry Pendent Sprinkler is Shown)**

MICROFAST® QUICK RESPONSE UPRIGHT SPRINKLER VK300 (K5.6)

TECHNICAL DATA

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION

The Viking Microfast® Quick Response Upright Sprinkler VK300 is a small, thermosensitive, glass-bulb spray sprinkler available in several different finishes and temperature ratings to meet design requirements. The special Polyester and Electroless Nickel PTFE (ENT) coatings can be used in decorative applications where colors are desired. In addition, these coatings have been investigated for installation in corrosive atmospheres and are listed/approved as corrosion resistant as indicated in the Approval Charts. (Note: **FM global approves the ENT coating as corrosion resistant.** FM Global has no approval classification Polyester coatings as corrosion resistant.)



2. LISTINGS AND APPROVALS

cULus Listed: Category VNIV
FM Approved: Classes 2002 and 2020

Refer to Approval Chart 1 and Design Criteria on for cULus Listing requirements and refer to Approval Chart 2 and Design Criteria FM Approval requirements that must be followed.

3. TECHNICAL DATA

Specifications:

Minimum Operating Pressure: 7 psi (0.5 bar)*
Maximum Working Pressure: 175 psi (12 bar) wwp.
Factory tested hydrostatically to 500 psi (34.5 bar)
Testing: U.S.A. Patent No. 4,831,870
Thread size: 1/2” NPT, 15 mm BSP
Nominal K-Factor: 5.6 U.S. (80.6 metric**)
Glass-bulb fluid temperature rated to -65 °F (-55 °C)
Overall Length: 2-3/16” (56 mm)

*cULus Listing, FM Approval, and NFPA 13 installs require a minimum of 7 psi (0.5 bar). The minimum operating pressure for LPCB and CE Approvals ONLY is 5 psi (0.35 bar).

Material Standards:

Frame Casting: Brass UNS-C84400 or QM Brass
Deflector: Brass UNS-C23000 or Copper UNS-C19500
Bulb: Glass, nominal 3 mm diameter
Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with PTFE Tape
Screw: Brass UNS-C36000
Pip Cap and Insert Assembly: Copper UNS-C11000 and Stainless Steel UNS-S30400
For Polyester Coated Sprinklers: Belleville Spring-Exposed
For ENT Coated Sprinklers: Belleville Spring-Exposed, Screw and Pipcap - ENT plated

Viking Technical Data may be found on The Viking Corporation’s Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

Ordering Information: (Also refer to the current Viking price list.)

Order Viking Microfast® Quick Response Upright Sprinkler VK300 by first adding the appropriate suffix for the sprinkler finish and then the appropriate suffix for the temperature rating to the sprinkler base part number.
Finish Suffix: Brass = A, Chrome = F, White Polyester = M-/W, Black Polyester = M-/B, and ENT = JN
Temperature Suffix (°F/°C): 135°/57° = A, 155°/68° = B, 175°/79° = D, 200°/93° = E, and 286°/141° = G
For example, sprinkler VK300 with a 1/2” NPT thread, Brass finish and a 155 °F/68 °C temperature rating = Part No. 12978AB
Available Finishes And Temperature Ratings: Refer to Table 1.
Accessories: (Also refer to the “Sprinkler Accessories” section of the Viking data book.)
Sprinkler Wrench: Standard Wrench: Part No. 10896W/B (available since 2000)
Sprinkler Cabinets:
A. Six-head capacity: Part No. 01724A (available since 1971)
B. Twelve-head capacity: Part No. 01725A (available since 1971)

4. INSTALLATION

Refer to appropriate NFPA Installation Standards.

VIKING®

TECHNICAL DATA

MICROFAST® QUICK RESPONSE UPRIGHT SPRINKLER VK300 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

5. OPERATION

During fire conditions, the heat-sensitive liquid in the glass bulb expands, causing the glass to shatter, releasing the pip cap and sealing spring assembly. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

The Viking Microfast® Quick Response Upright Sprinkler VK300 is available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating[1]	Maximum Ambient Ceiling Temperature[2]	Bulb Color
Ordinary	135 °F (57 °C)	100 °F (38 °C)	Orange
Ordinary	155 °F (68 °C)	100 °F (38 °C)	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	Yellow
Intermediate	200 °F (93 °C)	150 °F (65 °C)	Green
High	286 °F (141 °C)	225 °F (107 °C)	Blue

Sprinkler Finishes: Brass, Chrome, White Polyester, Black Polyester, and ENT

Corrosion-Resistant Coatings[3]: White Polyester, Black Polyester, and Black PTFE. ENT in all temperature ratings except 135 °F (57 °C)

Footnotes

[1] The sprinkler temperature rating is stamped on the deflector.
[2] Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.
[3] The corrosion-resistant coatings have passed the standard corrosion test required by the approving agencies indicated in the Approval Charts. These tests cannot and do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. For automatic sprinklers, the coatings indicated are applied to the exposed exterior surfaces only. Note that the spring is exposed on sprinklers with Polyester, ENT, and PTFE coatings. For ENT coated automatic sprinklers, the waterway is coated.

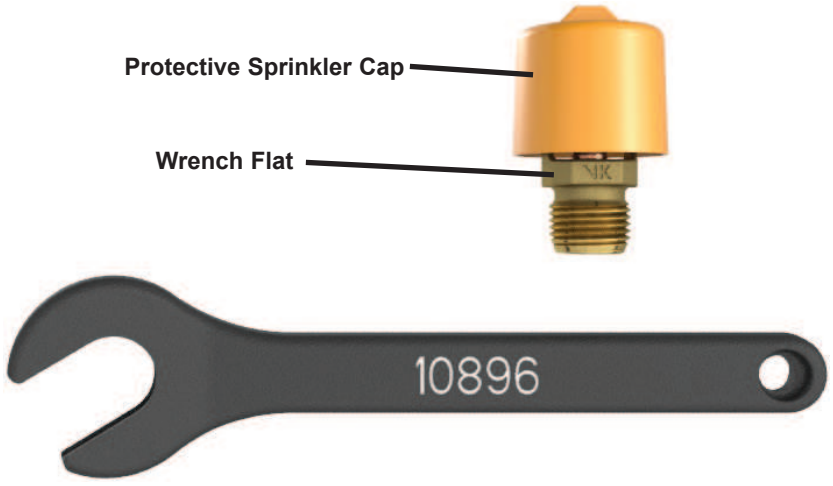


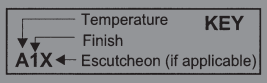
Figure 1:
Standard Sprinkler Wrench 10896W/B

VIKING®	TECHNICAL DATA	MICROFAST® QUICK RESPONSE UPRIGHT SPRINKLER VK300 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Approval Chart 1 (UL)

Microfast® Quick Response Upright Sprinkler VK300
Maximum 175 PSI (12 bar) WWP



Base Part Number[1]	SIN	Thread Size		Nominal K-Factor		Overall Length		Listings and Approvals[3]				
		NPT	BSP	U.S.	metric[2]	Inches	mm	cULus	VdS	LPCB	NYC[8]	CE
12978	VK300	1/2”	15 mm	5.6	80.6	2-3/16	56	A1, B2	--	--	See footnote 7.	--
NOTICE - Product Below - Limited Availability (Contact Local Viking Office)												
06661B	VK300	1/2”	15 mm	5.6	80.6	2-3/16	56	A1, B2	--	--	See footnote 7.	--

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141°C)
B - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141°C)

Approved Finishes

1 - Brass, Chrome, White Polyester[5,6], and Black Polyester[5,6]
2 - ENT[6]

Footnotes

[1] Base part number is shown. For complete part number, refer to Viking’s current price schedule.
[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.
[3] This table shows the listings and approvals available at the time of printing. Check with the manufacturer for any additional approvals.
[4] Listed by Underwriters Laboratories Inc. for us in the U.S. and Canada
[5] Other colors are available on request with the same Listings and Approvals as the standard colors.
[6] cULus Listed as corrosion resistant.
[7] Meets New York City requirements, effective July 1, 2008
[8] Accepted for use, City of New York Board of Standards and Appeals, Calendar Number 219-76-SA and City of New York Department of Buildings, MEA 89-92-E, Vol. 16.

DESIGN CRITERIA - UL

(Also refer to Approval Chart 1 above.)

cULus Listing Requirements:

The Viking Microfast® Quick Response Upright Sprinkler VK300 is cULus Listed as indicated in Approval Chart 1 for installation in accordance with the latest edition of NFPA 13 for standard spray sprinklers.

- Designed for use in Light and Ordinary Hazard occupancies.
- The sprinkler installation rules contained in NFPA 13 for standard spray upright sprinklers must be followed.

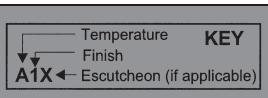
IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page QR1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

VIKING®	TECHNICAL DATA	MICROFAST® QUICK RESPONSE UPRIGHT SPRINKLER VK300 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Approval Chart 2 (FM)

Microfast® Quick Response Upright Sprinkler VK300
Maximum 175 PSI (12 bar) WWP



Base Part Number[1]	SIN	Thread Size		Nominal K-Factor		Overall Length		FM Approvals[3] (Refer also to Design Criteria below.)
		NPT	BSP	U.S.	metric[2]	Inches	mm	
12978	VK300	1/2"	15 mm	5.6	80.6	2-3/16	56	A1, B2
NOTICE - Product Below - Limited Availability (Contact Local Viking Office)								
06661B	VK300	1/2"	15 mm	5.6	80.6	2-3/16	56	A1, B2

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141°C)
B - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141°C)

Approved Finishes

1 - Brass, Chrome, White Polyester[5], and Black Polyester[5]
2 - ENT[6]

Footnotes

[1] Base part number is shown. For complete part number, refer to Viking's current price schedule.

[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

[3] This table shows the FM Approvals available at the time of printing. Check with the manufacturer for any additional approvals.

[5] Other colors are available on request with the same Approvals as the standard colors.

[6] FM approved as corrosion resistant.

DESIGN CRITERIA - FM

(Also refer to Approval Chart 2 above.)

FM Approval Requirements:

The Microfast® Quick Response Upright Sprinkler VK300 is FM Approved as a quick response **Non-Storage** upright sprinkler as indicated in the FM Approval Guide. For specific application and installation requirements, reference the latest applicable FM Loss Prevention Data Sheets (including Data Sheet 2-0). FM Global Loss Prevention Data Sheets contain guidelines relating to, but not limited to: minimum water supply requirements, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector distance below the ceiling.

NOTE: The FM installation guidelines may differ from cULus and/or NFPA criteria.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page QR1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

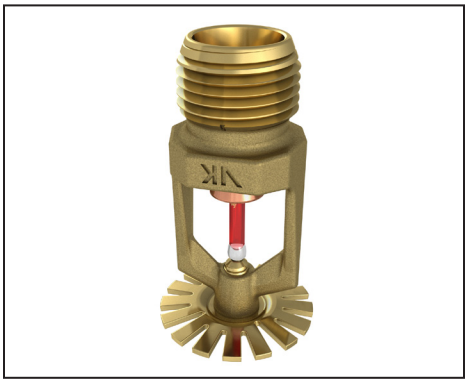
TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK302 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION

The Viking Microfast® Quick Response Pendent Sprinkler VK302 is a small thermosensitive glass bulb spray sprinkler available with various finishes and temperature ratings to meet design requirements. The special Polyester, Polytetrafluoroethelyne (PTFE), and Electroless Nickel PTFE (ENT) coatings can be used in decorative applications where colors are desired. In addition, these coatings have been investigated for installation in corrosive atmospheres and are listed/approved as corrosion resistant as indicated in the Approval Charts. (Note: **FM Global approves ENT finish as corrosion resistant.** FM Global has no approval classification for PTFE and Polyester coatings as corrosion resistant.)



2. LISTINGS AND APPROVALS

cULus Listed: Category VNIV

FM Approved: Class Series 2000

VdS Approved: Certificates G414009 and G414010

LPCB Approved

CE Certified: Standard EN 12259-1:1999, A3:2006 Certificate of Constancy of Performance 0832-CPR-S0021

CCCF Approved: Approved by the China Certification Center for Fire Products (CCCF)

Refer to Approval Chart 1 and Design Criteria cULus Listing requirements, and refer to Approval Chart 2 and Design Criteria for FM Approval requirements that must be followed.

3. TECHNICAL DATA

Viking Technical Data may be found on The Viking Corporation's Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

Specifications:
Minimum Operating Pressure: 7 psi (0.5 bar)
Rated to 175 psi (12 bar) water working pressure
Factory tested hydrostatically to 500 psi (34.5 bar)
Thread size: 1/2" NPT, 15 mm BSP
Nominal K-Factor: 5.6 U.S. (80.6 metric**)
Glass-bulb fluid temperature rated to -65 °F (-55 °C)
Overall Length: 2-1/4" (58 mm)

*cULus Listing, FM Approval, and NFPA 13 installs require a minimum of 7 psi (0.5 bar). The minimum operating pressure for LPCB and CE Approvals ONLY is 5 psi (0.35 bar).

Material Standards:
Frame Casting: Brass UNS-C84400 or QM Brass
Deflector: Phosphor Bronze UNS-C51000 or Copper UNS-C19500
Bulb: Glass, nominal 3 mm diameter
Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with PTFE Tape
Screw: Brass UNS-C36000
Pip Cap and Insert Assembly: Copper UNS-C11000 and Stainless Steel UNS-S30400
For PTFE Coated Sprinklers: Belleville Spring-Exposed, Screw-Nickel Plated, Pip Cap-PTFE Coated
For Polyester Coated Sprinklers: Belleville Spring-Exposed
For ENT Coated Sprinklers: Belleville Spring-Exposed, Screw and Pipcap - ENT plated.

Ordering Information: (Also refer to the current Viking price list.)
Order Quick Response Pendent Sprinklers by first adding the appropriate suffix for the sprinkler finish and then the appropriate suffix for the temperature rating to the sprinkler base part number.
Finish Suffix: Brass = A, Chrome = F, White Polyester = M-/W, Black Polyester = M-/B, Black PTFE = N, and ENT = JN
Temperature Suffix: 135 °F (57 °C) = A, 155 °F (68 °C) = B, 175 °F (79 °C) = D, 200 °F (93 °C) = E, 286 °F (141 °C) = G
For example, sprinkler VK302 with a Brass finish and a 155 °F (68 °C) temperature rating = Part No. 12979AB

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Available Finishes And Temperature Ratings: Refer to Table 1.
Accessories: (Also refer to the "Sprinkler Accessories" section of the Viking data book.)
Sprinkler Wrenches:
A. Standard Wrench: Part No. 10896W/B (available since 2000).
B. Wrench for Recessed Pendent Sprinklers: Part No. 13655W/B** (available since 2006)
C. Optional Protective Sprinkler Cap Remover/Escutcheon Installer Tool*** Part No. 15915 (available since 2010)
**A ½" ratchet is required (not available from Viking).
***Allows use from the floor by attaching a length of 1" diameter CPVC tubing to the tool. Ideal for sprinkler cabinets. Refer to Bulletin F_051808.
Sprinkler Cabinets:
A. Six-head capacity: Part No. 01724A (available since 1971)
B. Twelve-head capacity: Part No. 01725A (available since 1971)

4. INSTALLATION

Refer to appropriate NFPA Installation Standards.

5. OPERATION

During fire conditions, the heat-sensitive liquid in the glass bulb expands, causing the glass to shatter, releasing the pip cap and sealing spring assembly. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

The Viking Microfast® Quick Response Pendent Sprinkler VK302 is available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

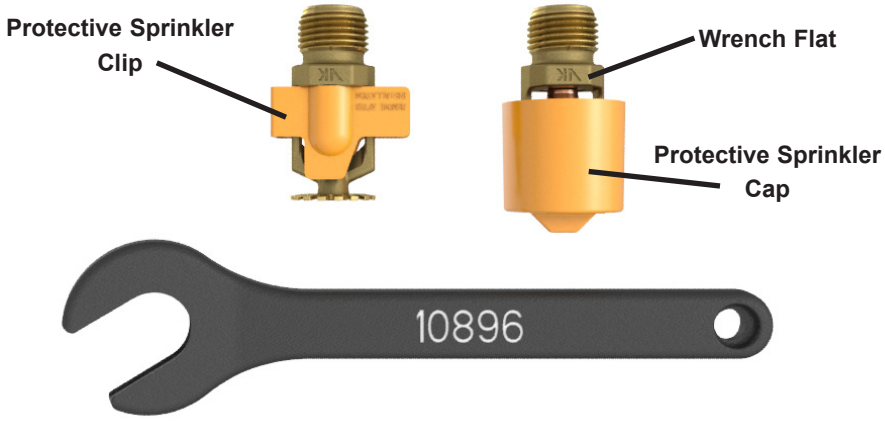


Figure 1: Standard Sprinkler Wrench 10896W/B

VIKING®

TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK302 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating[1]	Maximum Ambient Ceiling Temperature[2]	Bulb Color
Ordinary	135 °F (57 °C)	100 °F (38 °C)	Orange
Ordinary	155 °F (68 °C)	100 °F (38 °C)	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	Yellow
Intermediate	200 °F (93 °C)	150 °F (65 °C)	Green
High	286 °F (141 °C)	225 °F (107 °C)	Blue

Sprinkler Finishes: Brass, Chrome, White Polyester, Black Polyester, Black PTFE, and ENT

Corrosion-Resistant Coatings[3]: White Polyester, Black Polyester, and Black PTFE. ENT in all temperature ratings except 135 °F (57 °C)

Footnotes

[1] The sprinkler temperature rating is stamped on the deflector.

[2] Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

[3] The corrosion-resistant coatings have passed the standard corrosion test required by the approving agencies indicated in the Approval Charts. These tests cannot and do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. For automatic sprinklers, the coatings indicated are applied to the exposed exterior surfaces only. Note that the spring is exposed on sprinklers with Polyester, PTFE, and ENT coatings. For ENT coated automatic sprinklers, the waterway is coated

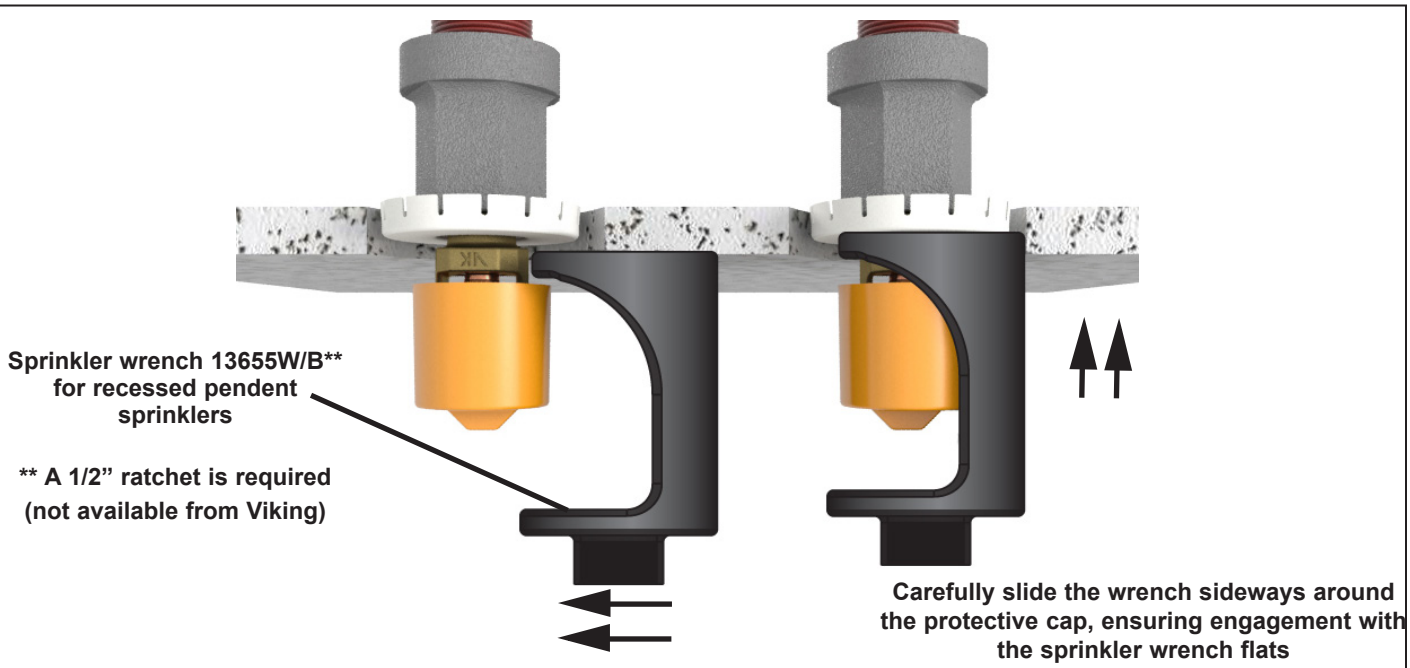


Figure 2: Wrench 13655W/B for Recessed Pendent Sprinklers

VIKING®

TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK302 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Approval Chart 1 (UL)

The Viking Microfast® Quick Response Pendent Sprinkler VK302
Maximum 175 PSI (12 Bar) WWP

KEY: A1X ← Temperature, Finish, Escutcheon (if applicable)

Base Part Number[1]	SIN	Sprinkler Style	Thread Size		Nominal K-Factor		Overall Length		Listings and Approvals[3] (Refer also to Design Criteria.)					
			NPT	BSP	U.S.	metric[2]	Inches	mm	cULus[4]	VdS	LPCB	CE[7]		
12979	VK302	Pendent	1/2”	15 mm	5.6	80.6	2-1/4	58	A1Z, B1Y, D2, C2X	A1	A1Z, B1Y	D1Z, C1Y	--	D3Z
NOTICE - Product Below - Limited Availability (Contact Local Viking Office)														
06662B	VK302	Pendent	1/2”	15 mm	5.6	80.6	2-1/4	58	A1Z, B1Y, D2, C2X	--	--	--	--	--
18021	VK302	Pendent	1/2”	15 mm	5.6	80.6	2-1/4	58	A1X, B1Y	A1	A1X, B1Y	D1X, C1Y[8]	D1X, C1Y[9]	--

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), 286 °F (141 °C)
B - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)
C - 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)
D - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), 286 °F (141 °C)

Approved Finishes

1 - Brass, Chrome, White Polyester[5,6], Black Polyester[5,6]
2 - ENT[5]
3 - Chrome

Approved Escutcheons

X - Standard surface-mounted escutcheon or the Viking Micromatic® Model E-1 Recessed Escutcheon
Y - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon, or recessed with the Viking Micromatic® Model E-1, E-2, or E-3 Recessed Escutcheon
Z - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon

Footnotes

[1] Base part number shown. For complete part number, refer to Viking’s current price schedule.
[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.
[3] This table shows the listings and approvals available at the time of printing. Other approvals may be in process.
[4] Listed by Underwriters Laboratories Inc. for use in the U.S. and Canada.
[5] cULus Listed as corrosion-resistant.
[6] Other colors are available on request with the same Listings and Approvals as the standard colors.
[7] CE Certified, Standard EN 12259-1, EC-certificate of conformity 0832-CPD-2001.
[8] CE Certified, Standard EN 12259-1, EC-certificates of conformity 0832-CPD-2001 and 0832-CPD-2003.
[9] MED Certified, Standard EN 12259-1, EC-certificates of conformity 0832-MED-1003 and 0832-MED-1008.

DESIGN CRITERIA - UL

(Also refer to Approval Chart 1 above.)

cULus Listing Requirements:

The Viking Microfast® Quick Response Pendent Sprinkler VK302 is cULus Listed as indicated in the Approval Chart for installation in accordance with the latest edition of NFPA 13 for standard spray sprinklers.

- Designed for use in Light and Ordinary occupancies.
- The sprinkler installation rules contained in NFPA 13 for standard spray pendent sprinklers must be followed.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page QR1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

VIKING®

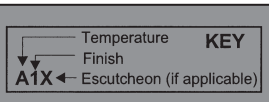
TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK302 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Approval Chart 2 (FM)

The Viking Microfast® Quick Response Pendent Sprinkler VK302
Maximum 175 PSI (12 Bar) WWP



Base Part Number[1]	SIN	Sprinkler Style	Thread Size		Nominal K-Factor		Overall Length		FM Approvals[3] (Refer also to Design Criteria.)
			NPT	BSP	U.S.	metric[2]	Inches	mm	
12979	VK302	Pendent	1/2”	15 mm	5.6	80.6	2-1/4	58	A1Z, B1Y, D2X, C2
NOTICE - Product Below - Limited Availability (Contact Local Viking Office)									
06662B	VK302	Pendent	1/2”	15 mm	5.6	80.6	2-1/4	58	A1Z, B1Y, D2X, C2
18021	VK302	Pendent	1/2”	15 mm	5.6	80.6	2-1/4	58	A1Z, B1Y

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), 286 °F (141 °C)
B - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)
C - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), 286 °F (141 °C)
D - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C)

Approved Finishes

1 - Brass, Chrome, White Polyester[4], and Black Polyester[4]
2 - ENT[5]

Approved Escutcheons

X - Standard surface-mounted escutcheon or the Viking Micromatic® Model E-1 Recessed Escutcheon
Y - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon, or recessed with the Viking Micromatic® Model E-1 or E-2 Recessed Escutcheon
Z - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon

Footnotes

[1] Base part number shown. For complete part number, refer to Viking’s current price schedule.
[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.
[3] This table shows the FM Approvals available at the time of printing. Other approvals may be in process.
[4] Other colors are available on request with the same Approvals as the standard colors.
[5] FM approved as corrosion resistant.

DESIGN CRITERIA - FM

(Also refer to Approval Chart 2 above.)

FM Approval Requirements:

The Viking Microfast® Quick Response Pendent Sprinkler VK302 is FM Approved as quick response **Non-storage** upright and pendent sprinklers as indicated in the FM Approval Guide. For specific application and installation requirements, reference the latest applicable FM Loss Prevention Data Sheets (including Data Sheet 2-0). FM Global Loss Prevention Data Sheets contain guidelines relating to, but not limited to: minimum water supply requirements, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector distance below the ceiling.

NOTE: The FM installation guidelines may differ from cULus and/or NFPA criteria.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page QR1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

VIKING®

TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK302 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

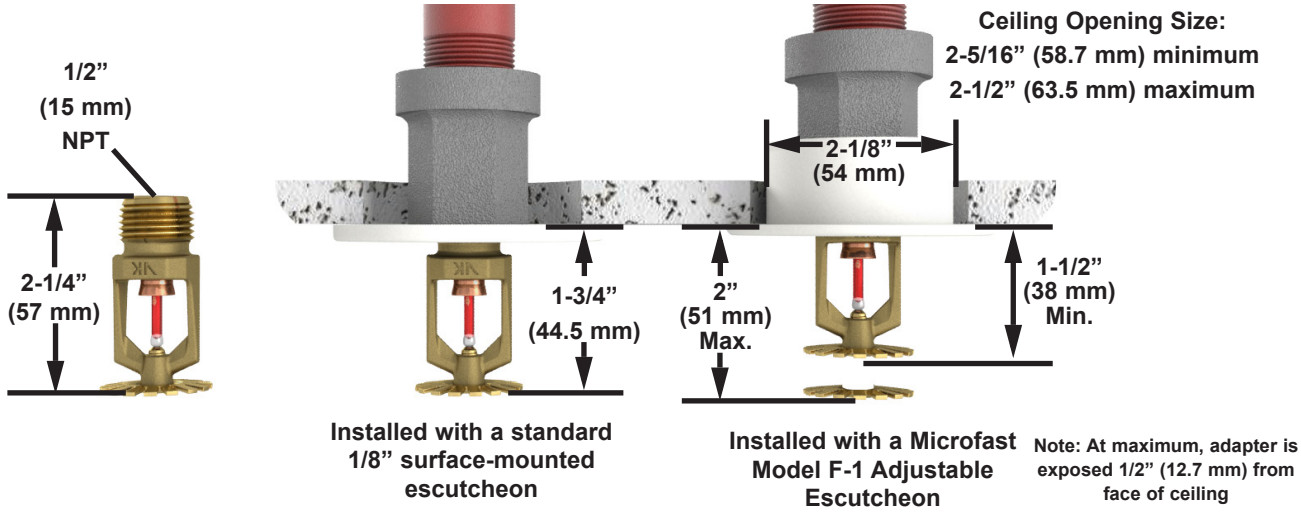


Figure 3: Sprinkler Dimensions with a Standard Escutcheon and the Model F-1 Adjustable Escutcheon

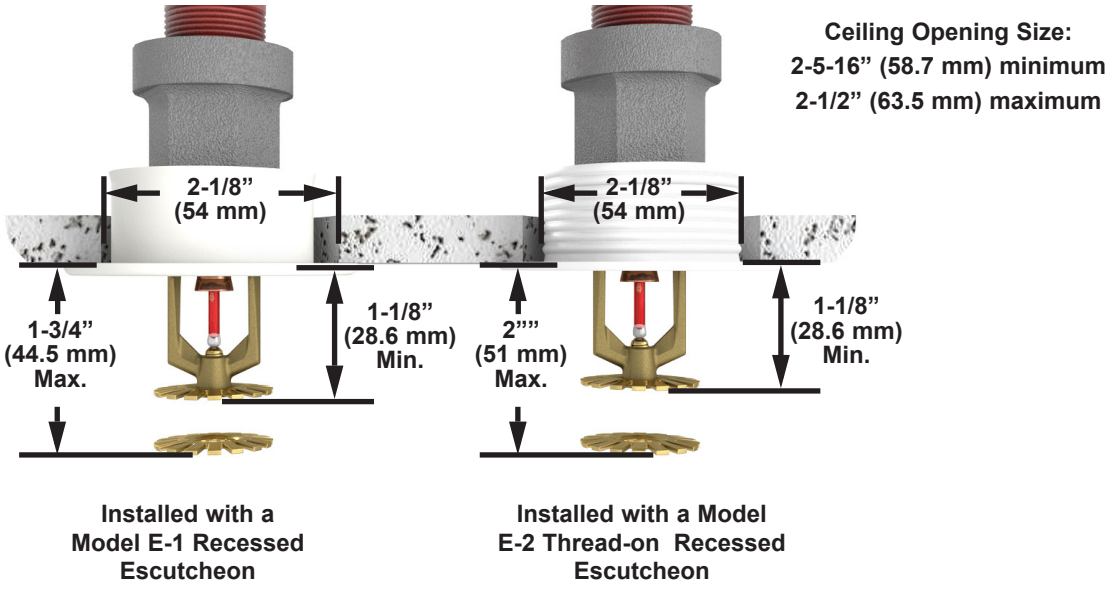


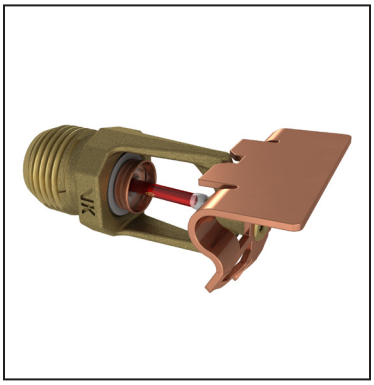
Figure 4: Sprinkler Dimensions with the Model E-1 and E-2 Recessed Escutcheons

VIKING	TECHNICAL DATA	MICROFAST® QUICK RESPONSE HORIZONTAL SIDEWALL SPRINKLER VK305 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION

The Viking Microfast® Quick Response Horizontal Sidewall Sprinkler VK305 is a small thermosensitive glass bulb spray sprinkler available with various finishes and temperature ratings to meet design requirements. The special Polyester and Electroless Nickel PTFE (ENT) coatings can be used in decorative applications where colors are desired. In addition, these coatings have been investigated for installation in corrosive atmospheres and are listed/approved as corrosion resistant as indicated in Approval Charts.



2. LISTINGS AND APPROVALS

cULus Listed: Category VNIV

FM Approved: Class 2020

Refer to Approval Chart 1 and Design Criteria for cULus Listing requirements, and refer to Approval Chart 2 and Design Criteria for FM Approval requirements that must be followed.

3. TECHNICAL DATA

Specifications:

Minimum Operating Pressure: 7 psi (0.5 bar)
Rated to 175 psi (12 bar) water working pressure
Factory tested hydrostatically to 500 psi (34.5 bar)
Nominal K-Factor: 5.6 U.S. (80.6 metric*)

* Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

Overall Length: 2-3/4" (68 mm)

Viking Technical Data may be found on The Viking Corporation's Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

Material Standards:

Frame Casting: Brass UNS-C84400 or QM Brass
Deflector: Copper UNS-C19500
Bulb: Glass, nominal 3 mm diameter
Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with PTFE Tape
Screw: Brass UNS-C36000
Pip Cap and Insert Assembly: Copper UNS-C11000 and Stainless Steel UNS-S30400
For Polyester Coated Sprinklers: Belleville Spring-Exposed
For ENT Coated Sprinklers: Belleville Spring - Exposed, Screw and Pip cap - ENT plated.

Ordering Information: (Also refer to the current Viking price list.)

Order Viking Microfast® Quick Response Horizontal Sidewall Sprinkler VK305 by first adding the appropriate suffix for the sprinkler finish and then the appropriate suffix for the temperature rating to the sprinkler base part number.
Finish Suffix: Brass = A, Chrome = F, White Polyester = M-/W, Black Polyester = M-/B, and ENT = JN
Temperature Suffix: 135 °F / 57 °C = A, 155 °F / 68 °C = B, 175 °F / 79 °C = D, 200 °F / 93 °C = E, and 286 °F / 141 °C = G
For example, sprinkler 12997 with a Brass finish and a 155 °F / 68 °C temperature rating = Part No. 12997AB

Available Finishes And Temperature Ratings: Refer to Table 1.

Accessories: (Also refer to the "Sprinkler Accessories" section of the Viking data book.)

Sprinkler Wrenches:

A. Standard Wrench: Part No. 10896W/B (available since 2000).
B. Wrench for recessed and/or wax coated sprinklers: Part No. 13655W/B** (available since 2006)
**A ½" ratchet is required (not available from Viking).

Sprinkler Cabinets:

A. Six-head capacity: Part No. 01724A (available since 1971)
B. Twelve-head capacity: Part No. 01725A (available since 1971)

VIKING	TECHNICAL DATA	MICROFAST® QUICK RESPONSE HORIZONTAL SIDEWALL SPRINKLER VK305 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

4. INSTALLATION

Refer to appropriate NFPA Installation Standards.

5. OPERATION

During fire conditions, the heat-sensitive fusible link disengages, the pip cap and spring are released, and the waterway is opened. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

Viking Microfast® Quick Response Horizontal Sidewall Sprinkler VK305 is available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

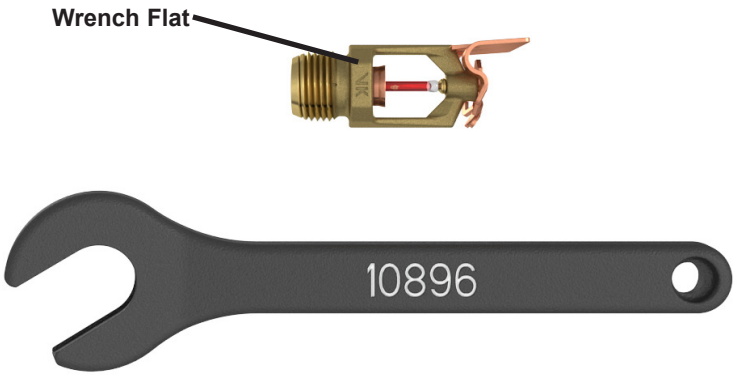


Figure 1:
Standard Sprinkler Wrench 10896W/B

VIKING	TECHNICAL DATA	MICROFAST® QUICK RESPONSE HORIZONTAL SIDEWALL SPRINKLER VK305 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating[1]	Maximum Ambient Ceiling Temperature[2]	Bulb Color
Ordinary	135 °F (57 °C)	100 °F (38 °C)	Orange
Ordinary	155 °F (68 °C)	100 °F (38 °C)	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	Yellow
Intermediate	200 °F (93 °C)	150 °F (65 °C)	Green
High	286 °F (141 °C)	225 °F (107 °C)	Blue

Sprinkler Finishes: Brass, Chrome, White Polyester, Black Polyester, and ENT

Corrosion-Resistant Coatings[3]: White Polyester, Black Polyester, and ENT

Footnotes

[1] The sprinkler temperature rating is stamped on the deflector.

[2] Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

[3] The corrosion-resistant coatings have passed the standard corrosion test required by the approving agencies indicated in the Approval Charts. These tests cannot and do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. For automatic sprinklers, the coatings indicated are applied to the exposed exterior surfaces only. For ENT coated sprinklers, the waterway is coated. Note that the spring is exposed on sprinklers with Polyester, and ENT coatings.

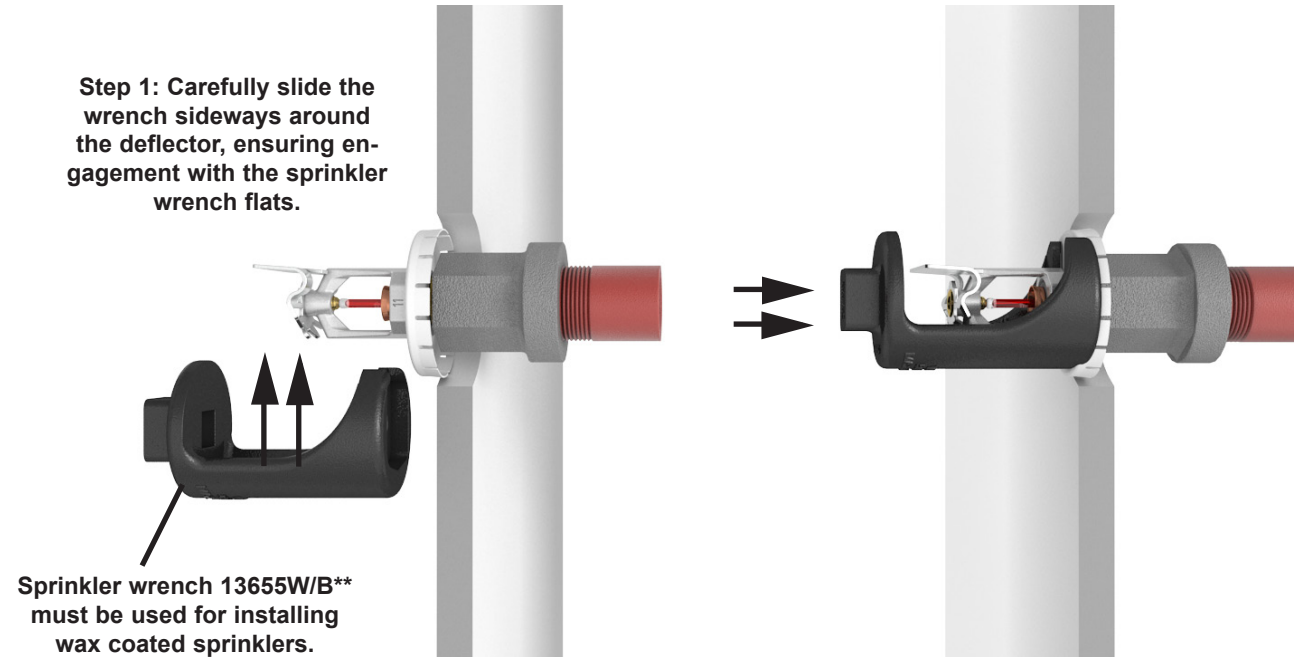


Figure 2: Wrench 13655W/B for Recessed Sprinklers

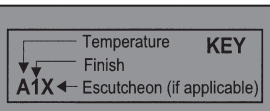
MICROFAST® QUICK RESPONSE HORIZONTAL SIDEWALL SPRINKLER VK305 (K5.6)

TECHNICAL DATA

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Approval Chart 1 (UL)

Microfast® Quick Response Horizontal Sidewall Sprinkler VK305
For Light or Ordinary Hazard Occupancies
Maximum 175 PSI (12 Bar) WWP
Deflector must be located 4" to 12" (102 mm to 305 mm) below the ceiling.



Base Part Number[1]	SIN	Sprinkler Style	Thread Size		Nominal K-Factor		Overall Length		Listings and Approvals[3] (Refer also to Design Criteria on page 43x.)			
			NPT	BSP	U.S.	metric[2]	Inches	mm	cULus[4]	LPCB	CE	
12997	VK305	HSW	1/2"	15 mm	5.6	80.6	2-11/16	68	A1Y, B1X, C2W, D2Z	--	--	--
NOTICE - Product Below - Limited Availability (Contact Local Viking Office)												
12121	VK305	HSW	1/2"	15 mm	5.6	80.6	1-11/16	68	A1Y, B1X, C2W, D2Z	--	--	--

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141 °C)
B - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)
C - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141 °C)
D - 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)

Approved Finishes

1 - Brass, Chrome, White Poly-ester[5,6], and Black Polyester[5,6]
2 - ENT[5]

Approved Escutcheons

W - Installed with standard surface-mounted escutcheons
X - Installed with standard surface-mounted escutcheons or the Viking Microfast® Model F-1 Adjustable Escutcheon, **or** recessed with the Viking Micromatic® Model E-1, E-2, or G-1 Recessed Escutcheon
Y - Installed with standard surface-mounted escutcheons or the Viking Microfast® Model F-1 Adjustable Escutcheon
Z - Installed with standard surface-mounted escutcheons or recessed with the Viking Micromatic Model E-1

Footnotes

[1] Base part number shown. For complete part number, refer to Viking's current price schedule.
[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.
[3] This table shows the listings and approvals available at the time of printing. Other approvals may be in process.
[4] Listed by Underwriters Laboratories Inc. for use in the U.S. and Canada.
[5] cULus Listed as corrosion-resistant.
[6] Other colors are available on request with the same Listings and Approvals as the standard colors.

DESIGN CRITERIA - UL

(Also refer to Approval Chart 1.)

cULus Listing Requirements:

Quick Response Horizontal Sprinkler VK305 is cULus Listed as indicated in Approval Chart 1 for installation in accordance with the latest edition of NFPA 13 for sidewall standard spray sprinklers.

- Designed for use in Light and Ordinary Hazard occupancies.
- Locate with the deflector 4" to 12" (102 mm to 305 mm) below the ceiling.
- Protection areas and maximum spacing shall be in accordance with the tables provided in NFPA 13.
- Minimum spacing allowed is 6 ft. (1.8 m).
- Align the top of the deflector parallel with the ceiling.
- Locate no less than 4" (102 mm) from end walls.
- Maximum distance from end walls shall be no more than one-half of the allowable distance between sprinklers. The distance shall be measured perpendicular to the wall.
- The sprinkler installation and obstruction rules contained in NFPA 13 for sidewall standard spray sprinklers must be followed.

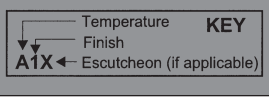
IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page QR1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

VIKING	TECHNICAL DATA	MICROFAST® QUICK RESPONSE HORIZONTAL SIDEWALL SPRINKLER VK305 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Approval Chart 2 (FM)

Quick Response Sidewall Sprinklers
Maximum 175 PSI WWP



Base Part Number[1]	SIN	Thread Size		Nominal K-Factor		Overall Length		FM Approvals[3,4] (Refer also to Design Criteria below.)
		NPT	BSP	U.S.	metric[2]	Inches	mm	
12997	VK305	1/2"	15 mm	5.6	80.6	2-11/16	68	A1Y, B1X
NOTICE - Product Below - Limited Availability (Contact Local Viking Office)								
12121	VK305	1/2"	15 mm	5.6	80.6	2-11/16	68	A1Y, B1X

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141 °C)
B - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)

Approved Finishes

1 - Brass

Approved Escutcheons

X - Installed with standard surface-mounted escutcheons or the Viking Microfast® Model F-1 Adjustable Escutcheon, **or** recessed with the Viking Micromatic® Model E-1, E-2, E-3, or G-1 Recessed Escutcheon
Y - Installed with standard surface-mounted escutcheons or the Viking Microfast® Model F-1 Adjustable Escutcheon

Footnotes

[1] Base part number shown. For complete part number, refer to Viking's current price schedule.

[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

[3] This table shows the FM Approvals available at the time of printing. Other approvals may be in process.

[4] Viking vertical sidewall sprinklers may be installed pendent or upright.

DESIGN CRITERIA - FM

(Also refer to Approval Chart 2 above.)

FM Approval Requirements:

Horizontal Sidewall Sprinkler VK305 is FM Approved as a quick response **Non-Storage** sidewall sprinkler as indicated in the FM Approval Guide. For specific application and installation requirements, reference the latest applicable FM Loss Prevention Data Sheets (including Data Sheet 2-0). FM Global Loss Prevention Data Sheets contain guidelines relating to, but not limited to: minimum water supply requirements, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector distance below the ceiling.

NOTE: The FM installation guidelines may differ from cULus and/or NFPA criteria.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page QR1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

VIKING

TECHNICAL DATA

MICROFAST® QUICK RESPONSE HORIZONTAL SIDEWALL SPRINKLER VK305 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

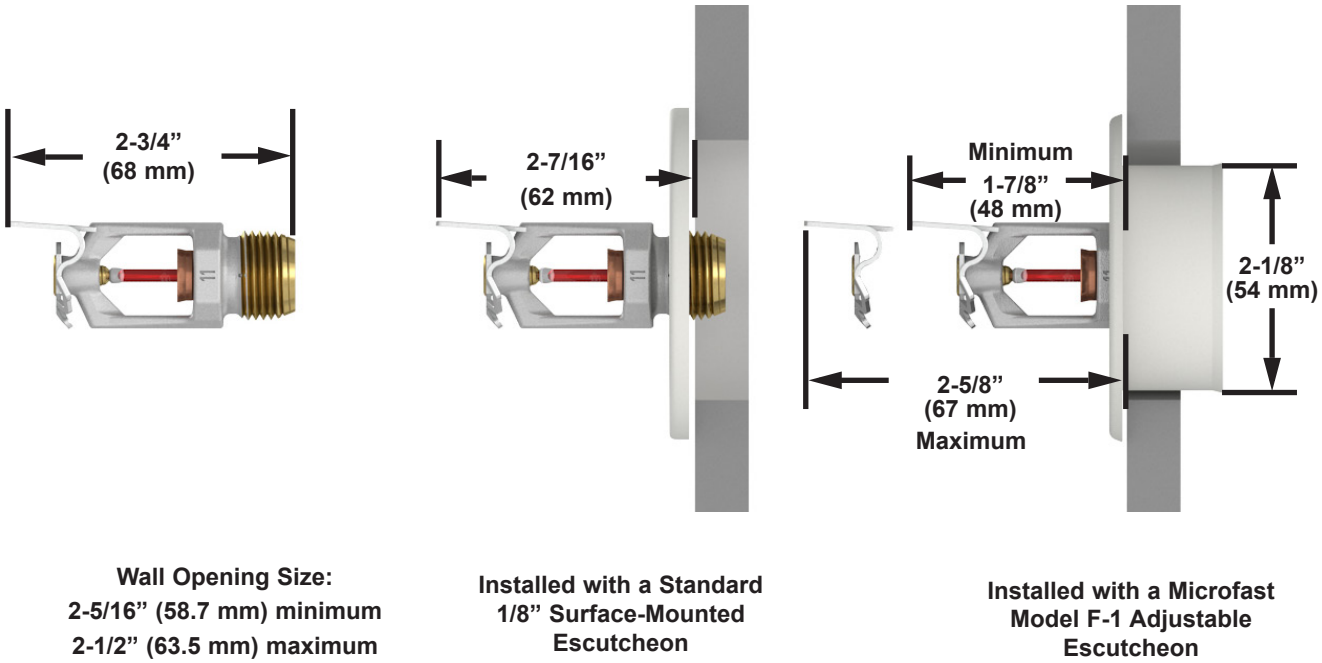


Figure 3: Sidewall Sprinkler Dimensions with a Standard Escutcheon and the Model F-1 Adjustable Escutcheon

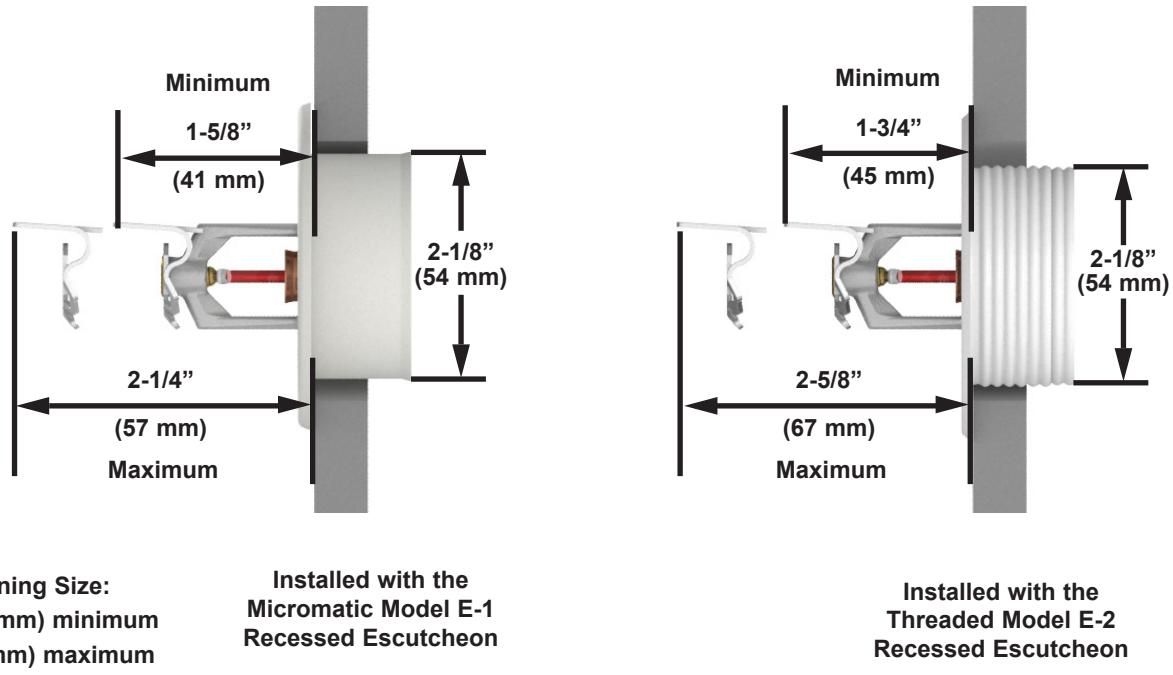


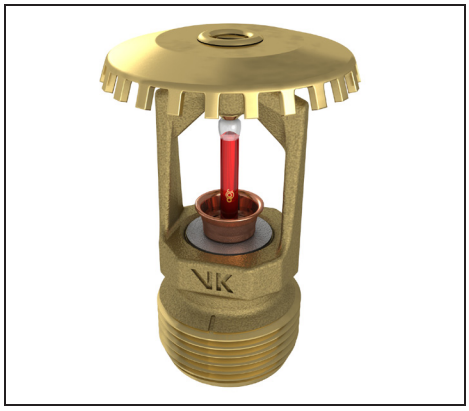
Figure 4: Sidewall Sprinkler VK305 Dimensions with the Model E-1 and E-2 Recessed Escutcheons

TECHNICAL DATA

MICROFAST® QUICK RESPONSE UPRIGHT SPRINKLER VK350 (K8.0)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION



The Viking Microfast® Quick Response Upright Sprinkler VK350 is a small, thermosensitive, glass-bulb spray sprinkler available in several different finishes, temperature ratings, and K-Factors to meet design requirements. The special Polyester, Polytetrafluoroethylene (PTFE), and Electroless Nickel PTFE (ENT) coatings can be used in decorative applications where colors are desired. In addition, these coatings have been investigated for installation in corrosive atmospheres and are listed/approved as corrosion resistant as indicated in the Approval Charts. (Note: **FM Global approves the ENT coating as corrosion resistant.** FM Global has no approval classification for PTFE and Polyester coatings as corrosion resistant.)

2. LISTINGS AND APPROVALS

cULus Listed: Category VNIV
FM Approved: Class Series 2000
VdS Approved: Certificates G414017 and G414018
LPCB Approved
CE Certified: Standard EN 12259-1, EC-certificate of conformity 0832-CPD-2001 and 0786-CPD-40278

NOTE: Other International approval certificates are available upon request.

Refer to Approval Chart 1 and Design Criteria cULus Listing requirements, and refer to Approval Chart 2 and Design Criteria FM Approval requirements that must be followed.

3. TECHNICAL DATA

Specifications:

Minimum Operating Pressure: 7 psi (0.5 bar)*
Maximum Working Pressure: 175 psi (12 bar) wwp.
Factory tested hydrostatically to 500 psi (34.5 bar)
Testing: U.S.A. Patent No. 4,831,870
Thread size: 1/2” NPT, 15 mm BSP, 3/4” NPT, 20 mm BSP
Nominal K-Factor: 8.0 U.S. (115.2 metric**)
Glass-bulb fluid temperature rated to -65 °F (-55 °C)
Overall Length: 2-5/16” (59 mm)

*cULus Listing, FM Approval, and NFPA 13 installs require a minimum of 7 psi (0.5 bar). The minimum operating pressure for LPCB and CE Approvals ONLY is 5 psi (0.35 bar).

Viking Technical Data may be found on The Viking Corporation’s Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

Material Standards:

Frame Casting: Brass UNS-C84400
Deflector: Copper UNS-C19500
Bulb: Glass, nominal 3 mm diameter
Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with PTFE Tape
Screw: Brass UNS-C36000
Pip Cap and Insert Assembly: Copper UNS-C11000 and Stainless Steel UNS-S30400
For PTFE Coated Sprinklers: Belleville Spring-Exposed, Screw-Nickel Plated, Pip Cap-PTFE Coated
For Polyester Coated Sprinklers: Belleville Spring-Exposed
For ENT Coated Sprinklers: Belleville Spring-Exposed, Screw and Pipcap - ENT plated.

Ordering Information: (Also refer to the current Viking price list.)

Order Viking Microfast® Quick Response Upright Sprinkler VK350 by first adding the appropriate suffix for the sprinkler finish and then the appropriate suffix for the temperature rating to the sprinkler base part number.
Finish Suffix: Brass = A, Chrome = F, White Polyester = M-/W, Black Polyester = M-/B, and Black PTFE = N, ENT = JN
Temperature Suffix (°F/°C): 135°/57° = A, 155°/68° = B, 175°/79° = D, 200°/93° = E, and 286°/141° = G
For example, sprinkler VK350 with a 1/2” thread, Brass finish and a 155 °F/68 °C temperature rating = Part No. 18259AB
Available Finishes And Temperature Ratings: Refer to Table 1.
Accessories: (Also refer to the “Sprinkler Accessories” section of the Viking data book.)
Sprinkler Wrench: Standard Wrench: Part No. 10896W/B (available since 2000)
Sprinkler Cabinets:

VIKING®

TECHNICAL DATA

MICROFAST® QUICK RESPONSE UPRIGHT SPRINKLER VK350 (K8.0)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

A. Six-head capacity: Part No. 01724A (available since 1971)
B. Twelve-head capacity: Part No. 01725A (available since 1971)

4. INSTALLATION

Refer to appropriate NFPA Installation Standards.

5. OPERATION

During fire conditions, the heat-sensitive liquid in the glass bulb expands, causing the glass to shatter, releasing the pip cap and sealing spring assembly. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

The Viking Microfast® Quick Response Upright Sprinkler VK350 is available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating[1]	Maximum Ambient Ceiling Temperature[2]	Bulb Color
Ordinary	135 °F (57 °C)	100 °F (38 °C)	Orange
Ordinary	155 °F (68 °C)	100 °F (38 °C)	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	Yellow
Intermediate	200 °F (93 °C)	150 °F (65 °C)	Green
High	286 °F (141 °C)	225 °F (107 °C)	Blue

Sprinkler Finishes: Brass, Chrome, White Polyester, Black Polyester, Black PTFE, and ENT

Corrosion-Resistant Coatings[3]: White Polyester, Black Polyester, and Black PTFE. ENT in all temperature ratings except 135 °F (57 °C)

Footnotes

[1] The sprinkler temperature rating is stamped on the deflector.
[2] Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.
[3] The corrosion-resistant coatings have passed the standard corrosion test required by the approving agencies indicated on pages 51c-e. These tests cannot and do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. For automatic sprinklers, the coatings indicated are applied to the exposed exterior surfaces only. Note that the spring is exposed on sprinklers with Polyester, ENT, and PTFE coatings. For ENT coated automatic sprinklers, the waterway is coated.

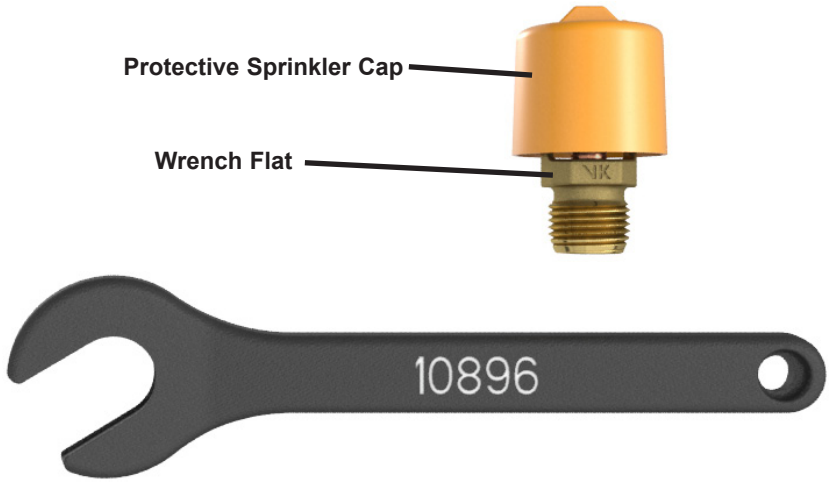


Figure 1:
Standard Sprinkler Wrench 10896W/B

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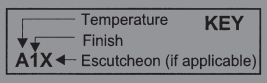
TECHNICAL DATA

MICROFAST® QUICK RESPONSE UPRIGHT SPRINKLER VK350 (K8.0)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Approval Chart 1 (UL)

Microfast® Quick Response Upright Sprinkler VK350
Maximum 175 PSI (12 bar) WWP



Base Part Number[1]	SIN	Thread Size		Nominal K-Factor		Overall Length		Listings and Approvals[3] (Refer also to Design Criteria.)			
		NPT	BSP	U.S.	metric[2]	Inches	mm	cULus[4]	VdS	LPCB	CE
18257	VK350	3/4”	--	8.0	115.2	2-5/16	59	A1, B2	A1	A1	B1[7]
18278	VK350	--	20 mm	8.0	115.2	2-5/16	59	A1, B2	A1	A1	B1[7]
18259[9]	VK350	1/2”	15 mm	8.0	115.2	2-5/16	59	A1, B2	A1	--	B1[8]
NOTICE - Product Below - Limited Availability (Contact Local Viking Office)											
06665B	VK350	3/4”	--	8.0	115.2	2-5/16	59	A1, B2	A1	A1	B1[7]
14817	VK350	--	20 mm	8.0	115.2	2-5/16	59	A1, B2	A1	A1	B1[7]
06764B[9]	VK350	1/2”	15 mm	8.0	115.2	2-5/16	59	A1, B2	A1	--	A1[8]

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141°C)
B - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141°C)

Approved Finishes

1 - Brass, Chrome, White Polyester[5,6], and Black Polyester[5,6]
2 - ENT[5]

Footnotes

[1] Base part number is shown. For complete part number, refer to Viking’s current price schedule.
[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.
[3] This table shows the listings and approvals available at the time of printing. Check with the manufacturer for any additional approvals.
[4] Listed by Underwriters Laboratories Inc. for use in the U.S. and Canada.
[5] cULus Listed as corrosion resistant.
[6] Other colors are available on request with the same Listings and Approvals as the standard colors.
[7] CE Certified, Standard EN 12259-1, EC-certificate of conformity 0832-CPD-2001 and 0832-CPD-2003.
[8] CE Certified, Standard EN 12259-1, EC-certificate of conformity 0786-CPD-40278.
[9] The 1/2” NPT Large Orifice Sprinkler is listed and approved for retrofit only when installed in accordance with NFPA 13.

DESIGN CRITERIA - UL

(Also refer to Approval Chart 1)

cULus Listing Requirements:

The Microfast® Quick Response Upright Sprinkler VK350 is cULus Listed as indicated in Approval Chart 1 for installation in accordance with the latest edition of NFPA 13 for standard spray sprinklers.

- Designed for use in Light and Ordinary Hazard occupancies.
- The sprinkler installation rules contained in NFPA 13 for standard spray upright sprinklers must be followed.

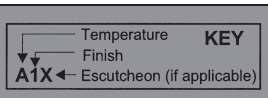
IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page QR1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

VIKING®	TECHNICAL DATA	MICROFAST® QUICK RESPONSE UPRIGHT SPRINKLER VK350 (K8.0)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Approval Chart 2 (FM)

Microfast® Quick Response Upright Sprinkler VK350
Maximum 175 PSI (12 bar) WWP



Base Part Number[1]	SIN	Thread Size		Nominal K-Factor		Overall Length		FM Approvals[3] (Refer also to Design Criteria below.)
		NPT	BSP	U.S.	metric[2]	Inches	mm	
18257	VK350	3/4"	--	8.0	115.2	2-5/16	59	A1, B2
18278	VK350	--	20 mm	8.0	115.2	2-5/16	59	A1, B2
18259[5]	VK350	1/2"	15 mm	8.0	115.2	2-5/16	59	A1, B2
NOTICE - Product Below - Limited Availability (Contact Local Viking Office)								
06665B	VK350	3/4"	--	8.0	115.2	2-5/16	59	A1, B2
14817	VK350	--	20 mm	8.0	115.2	2-5/16	59	A1, B2
06764B[5]	VK350	1/2"	15 mm	8.0	115.2	2-5/16	59	A1, B2

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141°C)
B - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141°C)

Approved Finishes

1 - Brass, Chrome, White Polyester[4], and Black Polyester[4]
2 - ENT[6]

Footnotes

[1] Base part number is shown. For complete part number, refer to Viking's current price schedule.

[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

[3] This table shows the FM Approvals available at the time of printing. Check with the manufacturer for any additional approvals.

[4] Other colors are available on request with the same Approvals as the standard colors.

[5] The 1/2" NPT Large Orifice Sprinkler is listed and approved for retrofit only when installed in accordance with NFPA 13.

[6] FM approved as corrosion resistant.

DESIGN CRITERIA - FM

(Also refer to Approval Chart 2 above.)

FM Approval Requirements:

The Microfast® Quick Response Upright Sprinkler VK350 is FM Approved as a quick response **Non-Storage** upright sprinkler as indicated in the FM Approval Guide. For specific application and installation requirements, reference the latest applicable FM Loss Prevention Data Sheets (including Data Sheet 2-0). FM Global Loss Prevention Data Sheets contain guidelines relating to, but not limited to: minimum water supply requirements, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector distance below the ceiling.

NOTE: The FM installation guidelines may differ from cULus and/or NFPA criteria.

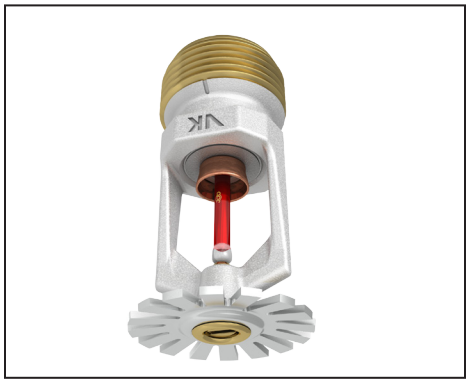
IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page QR1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK352 (K8.0)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION



The Viking Microfast® Quick Response Pendent Sprinkler VK352 is a small thermosensitive glass bulb spray sprinkler available with various finishes and temperature ratings to meet design requirements. The special Polyester, Polytetrafluoroethelyne (PTFE), and Electroless Nickel PTFE (ENT) coatings can be used in decorative applications where colors are desired. In addition, these coatings have been investigated for installation in corrosive atmospheres and are listed/approved as corrosion resistant as indicated in the Approval Charts. (Note: **FM Global approves ENT finish as corrosion resistant.** FM Global has no approval classification for PTFE and Polyester coatings as corrosion resistant.)

2. LISTINGS AND APPROVALS

cULus Listed: Category VNIV

FM Approved: Class Series 2000

VdS Approved: Certificates G414019 and G414020

LPCB Approved

CE Certified: Standard EN 12259-1, EC-certificate of conformity 0832-CPD-2001 and 0786-CPD-40279

Refer to Approval Chart 1 and Design Criteria cULus Listing requirements, and refer to Approval Chart 2 and Design Criteria for FM Approval requirements that must be followed.

3. TECHNICAL DATA

Specifications:

Minimum Operating Pressure: 7 psi (0.5 bar)
Rated to 175 psi (12 bar) water working pressure
Factory tested hydrostatically to 500 psi (34.5 bar)
Thread size: 3/4” NPT, 20 mm BSP
Nominal K-Factor: 8.0 U.S. (115.2 metric**)
Glass-bulb fluid temperature rated to -65 °F (-55 °C)
Overall Length: 2-1/4” (58 mm)

Viking Technical Data may be found on The Viking Corporation’s Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

*cULus Listing, FM Approval, and NFPA 13 installs require a minimum of 7 psi (0.5 bar). The minimum operating pressure for LPCB and CE Approvals ONLY is 5 psi (0.35 bar).

Material Standards:

Frame Casting: Brass UNS-C84400
Deflector: Phosphor Bronze UNS-C51000 or Copper UNS-C19500
Bulb: Glass, nominal 3 mm diameter
Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with PTFE Tape
Screw: Brass UNS-C36000
Pip Cap and Insert Assembly: Copper UNS-C11000 and Stainless Steel UNS-S30400
For PTFE Coated Sprinklers: Belleville Spring-Exposed, Screw-Nickel Plated, Pip Cap-PTFE Coated
For Polyester Coated Sprinklers: Belleville Spring-Exposed
For ENT Coated Sprinklers: Belleville Spring-Exposed, Screw and Pipcap - ENT plated.

Ordering Information: (Also refer to the current Viking price list.)

Order Quick Response Upright and Pendent Sprinklers by first adding the appropriate suffix for the sprinkler finish and then the appropriate suffix for the temperature rating to the sprinkler base part number.
Finish Suffix: Brass = A, Chrome = F, White Polyester = M-/W, Black Polyester = M-/B, Black PTFE = N, and ENT = JN
Temperature Suffix: 135 °F (57 °C) = A, 155 °F (68 °C) = B, 175 °F (79 °C) = D, 200 °F (93 °C) = E, 286 °F (141 °C) = G
For example, sprinkler VK352 with a Brass finish and a 155 °F (68 °C) temperature rating = Part No. 18258AB

Available Finishes And Temperature Ratings: Refer to Table 1.

Accessories: (Also refer to the “Sprinkler Accessories” section of the Viking data book.)

Sprinkler Wrenches:

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

A. Standard Wrench: Part No. 10896W/B (available since 2000).
B. Wrench for Recessed Pendent Sprinklers: Part No. 13655W/B** (available since 2006)
C. Optional Protective Sprinkler Cap Remover/Escutcheon Installer Tool*** Part No. 15915 (available since 2010)

**A ½" ratchet is required (not available from Viking).

***Allows use from the floor by attaching a length of 1" diameter CPVC tubing to the tool. Ideal for sprinkler cabinets. Refer to Bulletin F_051808.

Sprinkler Cabinets:

A. Six-head capacity: Part No. 01724A (available since 1971)
B. Twelve-head capacity: Part No. 01725A (available since 1971)

4. INSTALLATION

Refer to appropriate NFPA Installation Standards.

5. OPERATION

During fire conditions, the heat-sensitive liquid in the glass bulb expands, causing the glass to shatter, releasing the pip cap and sealing spring assembly. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

The Viking Microfast® Quick Response Pendent Sprinkler VK352 is available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

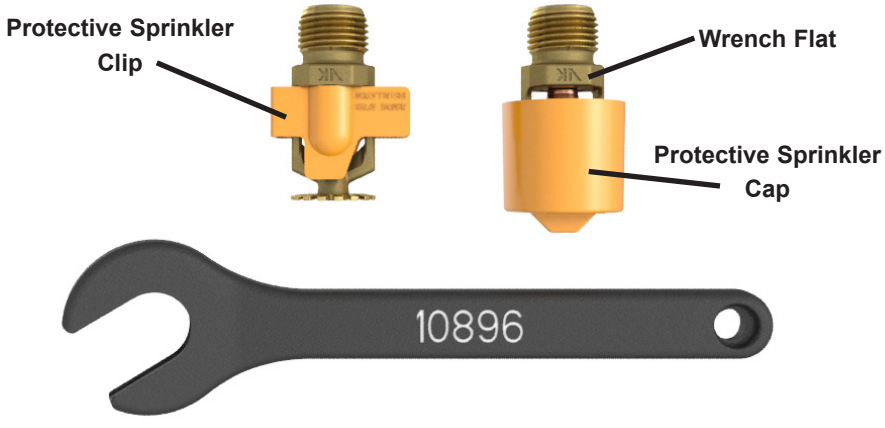


Figure 1: Standard Sprinkler Wrench 10896W/B

VIKING®

TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK352 (K8.0)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating[1]	Maximum Ambient Ceiling Temperature[2]	Bulb Color
Ordinary	135 °F (57 °C)	100 °F (38 °C)	Orange
Ordinary	155 °F (68 °C)	100 °F (38 °C)	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	Yellow
Intermediate	200 °F (93 °C)	150 °F (65 °C)	Green
High	286 °F (141 °C)	225 °F (107 °C)	Blue

Sprinkler Finishes: Brass, Chrome, White Polyester, Black Polyester, Black PTFE, and ENT

Corrosion-Resistant Coatings[3]: White Polyester, Black Polyester, and Black PTFE. ENT in all temperature ratings except 135 °F (57 °C)

Footnotes

[1] The sprinkler temperature rating is stamped on the deflector.

[2] Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

[3] The corrosion-resistant coatings have passed the standard corrosion test required by the approving agencies indicated in the Approval Charts. These tests cannot and do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. For automatic sprinklers, the coatings indicated are applied to the exposed exterior surfaces only. Note that the spring is exposed on sprinklers with Polyester, PTFE, and ENT coatings. For ENT coated automatic sprinklers, the waterway is coated

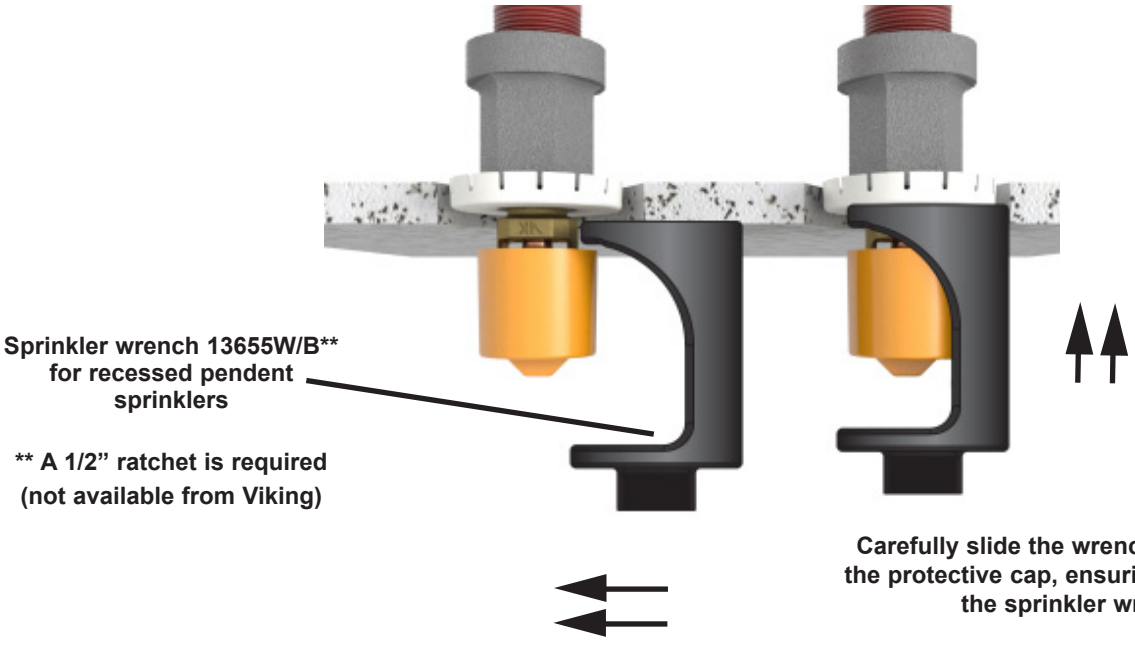


Figure 2: Wrench 13655W/B for Recessed Pendent Sprinklers

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TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK352 (K8.0)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Approval Chart 1 (UL)

The Viking Microfast® Quick Response Pendent Sprinkler VK352
Maximum 175 PSI (12 Bar) WWP

KEY: A1X — A = Temperature, 1 = Finish, X = Escutcheon (if applicable)

Base Part Number[1]	SIN	Sprinkler Style	Thread Size		Nominal K-Factor		Overall Length		Listings and Approvals[3] (Refer also to Design Criteria.)			
			NPT	BSP	U.S.	metric[2]	Inches	mm	cULus[4]	VdS	LPCB	CE
18258	VK352	Pendent	3/4”	20 mm	8.0	115.2	2-1/4	58	A1Z, B1Y, C2X, D2	A3	A3Z	D3[8]
18260[7]	VK352	Pendent	1/2”	15 mm	8.0	115.2	2-1/4	58	A1Z, B1Y, C2X, D2	A3	--	D3[9]
NOTICE - Product Below - Limited Availability (Contact Local Viking Office)												
06666B	VK352	Pendent	3/4”	20 mm	8.0	115.2	2-3/8	60	A1Z, B1Y, C2X, D2	A3	A3Z	D3[8]
06765B[7]	VK352	Pendent	1/2”	15 mm	8.0	115.2	2-3/8	60	A1Z, B1Y, C2X, D2	A3	--	A3[9]

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), 286 °F (141 °C)
B - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)
C - 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)
D - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), 286 °F (141 °C)

Approved Finishes

1 - Brass, Chrome, White Polyester[5,6], Black Polyester[5,6], and Black PTFE
2 - ENT[5]
3 - Brass, Chrome, White Polyester[5,6], and Black Polyester[5,6]

Approved Escutcheons

X - Standard surface-mounted escutcheon or the Viking Micromatic® Model E-1 Recessed Escutcheon
Y - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon, or recessed with the Viking Micromatic® Model E-1 or E-2 Recessed Escutcheon
Z - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon

Footnotes

[1] Base part number shown. For complete part number, refer to Viking’s current price schedule.
[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.
[3] This table shows the listings and approvals available at the time of printing. Other approvals may be in process.
[4] Listed by Underwriters Laboratories Inc. for use in the U.S. and Canada.
[5] cULus Listed as corrosion-resistant.
[6] Other colors are available on request with the same Listings and Approvals as the standard colors.
[7] The 1/2” NPT Large Orifice Sprinkler is listed and approved for retrofit only when installed in accordance with NFPA 13.
[8] CE Certified, Standard EN 12259-1, EC-certificates of conformity 0832-CPD-2001 and 0832-CPD-2003.
[9] CE Certified, Standard EN 12259-1, EC-certificate of conformity 0786-CPD-40279.

DESIGN CRITERIA - UL

(Also refer to Approval Chart 1 above.)

cULus Listing Requirements:

The Viking Microfast® Quick Response Pendent Sprinkler VK352 is cULus Listed as indicated in the Approval Chart for installation in accordance with the latest edition of NFPA 13 for standard spray sprinklers.

- Designed for use in Light, Ordinary, and Extra Hazard occupancies.
- The sprinkler installation rules contained in NFPA 13 for standard spray pendent sprinklers must be followed.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page QR1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

VIKING®

TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK352 (K8.0)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Approval Chart 2 (FM)

The Viking Microfast® Quick Response Pendent Sprinkler VK352

Maximum 175 PSI (12 Bar) WWP

KEY: A1X — Temperature, Finish, Escutcheon (if applicable)

Base Part Number[1]	SIN	Sprinkler Style	Thread Size		Nominal K-Factor		Overall Length		FM Approvals[3] (Refer also to Design Criteria.)
			NPT	BSP	U.S.	metric[2]	Inches	mm	
18258	VK352	Pendent	3/4”	20 mm	8.0	115.2	2-1/4	58	A1Z, B1Y, D2X, C2
18260[6]	VK352	Pendent	1/2”	15 mm	8.0	115.2	2-1/4	58	A1Z, B1Y, D2X, C2
NOTICE - Product Below - Limited Availability (Contact Local Viking Office)									
06666B	VK352	Pendent	3/4”	20 mm	8.0	115.2	2-38	60	A1Z, B1Y, D2X, C2
06765B[6]	VK352	Pendent	1/2”	15 mm	8.0	115.2	2-38	60	A1Z, B1Y, D2X, C2

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), 286 °F (141 °C)
B - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)
C - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), 286 °F (141 °C)
D - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C)

Approved Finishes

1 - Brass, Chrome, White Polyester[4], and Black Polyester[4]
2 - ENT[5]

Approved Escutcheons

X - Standard surface-mounted escutcheon or the Viking Micromatic® Model E-1 Recessed Escutcheon
Y - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon, or recessed with the Viking Micromatic® Model E-1 or E-2 Recessed Escutcheon
Z - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon

Footnotes

[1] Base part number shown. For complete part number, refer to Viking’s current price schedule.

[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

[3] This table shows the FM Approvals available at the time of printing. Other approvals may be in process.

[4] Other colors are available on request with the same Approvals as the standard colors.

[5] FM approved as corrosion resistant.

[6] The 1/2” NPT Large Orifice Sprinkler is listed and approved for retrofit only when installed in accordance with NFPA 13.

DESIGN CRITERIA - FM

(Also refer to Approval Chart 2 above.)

FM Approval Requirements:

The Viking Microfast® Quick Response Pendent Sprinkler VK352 is FM Approved as quick response **Non-storage** upright and pendent sprinklers as indicated in the FM Approval Guide. For specific application and installation requirements, reference the latest applicable FM Loss Prevention Data Sheets (including Data Sheet 2-0). FM Global Loss Prevention Data Sheets contain guidelines relating to, but not limited to: minimum water supply requirements, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector distance below the ceiling.

NOTE: The FM installation guidelines may differ from cULus and/or NFPA criteria.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page QR1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

VIKING®

TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK352 (K8.0)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

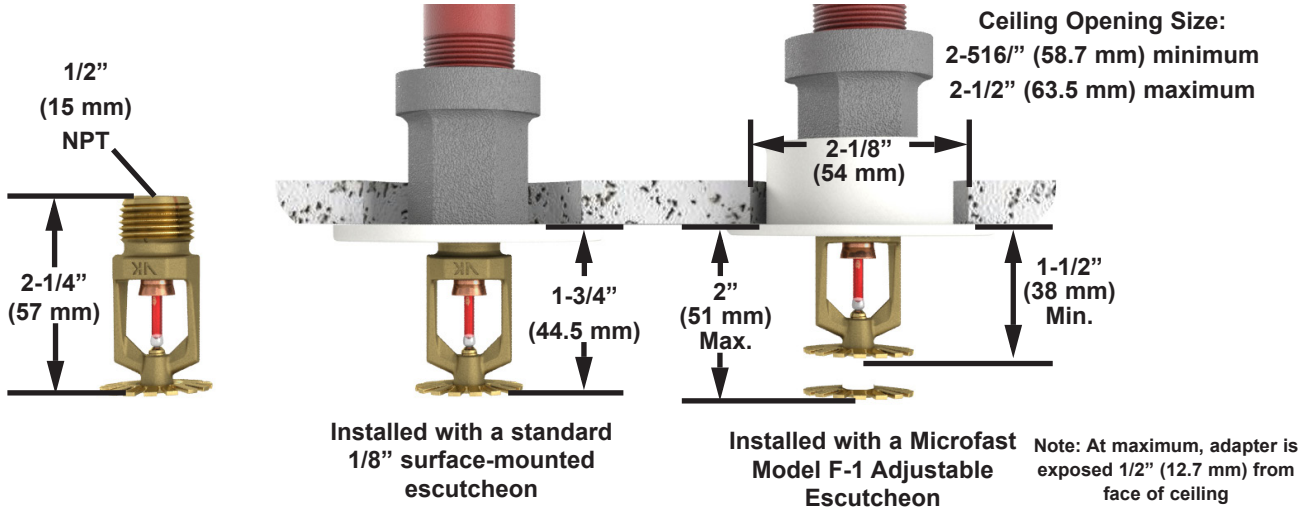


Figure 3: Sprinkler Dimensions with a Standard Escutcheon and the Model F-1 Adjustable Escutcheon

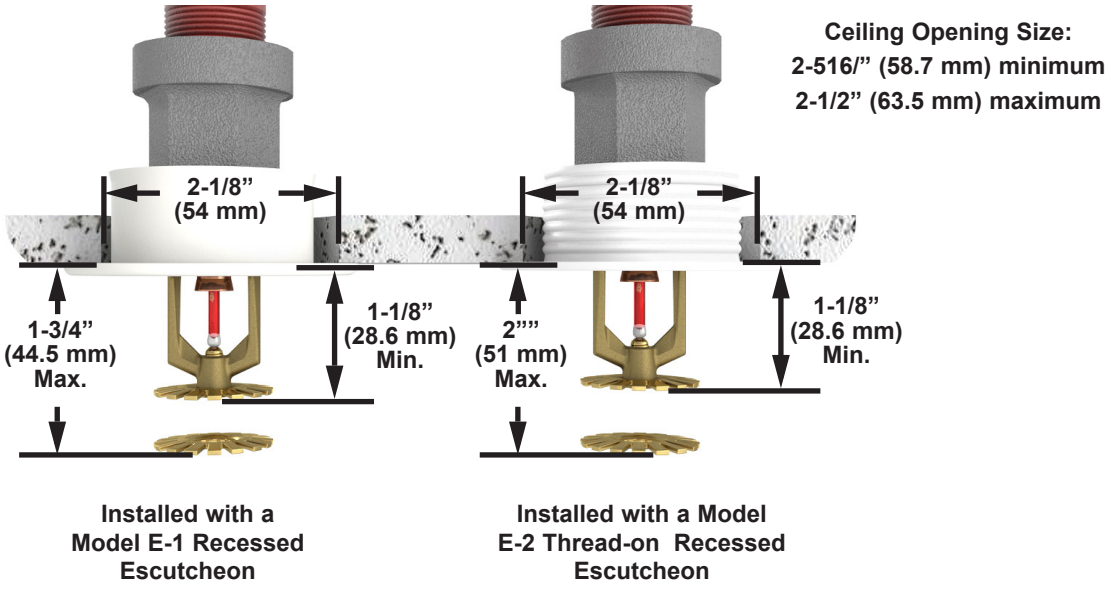


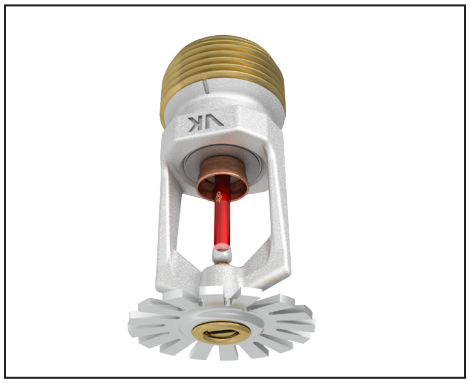
Figure 4: Sprinkler Dimensions with the Model E-1 and E-2 Recessed Escutcheons

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK352 (K8.0)

TECHNICAL DATA

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION



The Viking Microfast® Quick Response Pendent Sprinkler VK352 is a small thermosensitive glass bulb spray sprinkler available with various finishes and temperature ratings to meet design requirements. The special Polyester, Polytetrafluoroethelyne (PTFE), and Electroless Nickel PTFE (ENT) coatings can be used in decorative applications where colors are desired. In addition, these coatings have been investigated for installation in corrosive atmospheres and are listed/approved as corrosion resistant as indicated in the Approval Charts. (Note: **FM Global approves ENT finish as corrosion resistant.** FM Global has no approval classification for PTFE and Polyester coatings as corrosion resistant.)

2. LISTINGS AND APPROVALS

cULus Listed: Category VNIV

FM Approved: Class Series 2000

VdS Approved: Certificates G414019 and G414020

LPCB Approved

CE Certified: Standard EN 12259-1, EC-certificate of conformity 0832-CPD-2001 and 0786-CPD-40279

Refer to Approval Chart 1 and Design Criteria cULus Listing requirements, and refer to Approval Chart 2 and Design Criteria for FM Approval requirements that must be followed.

3. TECHNICAL DATA

Specifications:

Minimum Operating Pressure: 7 psi (0.5 bar)
Rated to 175 psi (12 bar) water working pressure
Factory tested hydrostatically to 500 psi (34.5 bar)
Thread size: 3/4” NPT, 20 mm BSP
Nominal K-Factor: 8.0 U.S. (115.2 metric**)
Glass-bulb fluid temperature rated to -65 °F (-55 °C)
Overall Length: 2-1/4” (58 mm)

Viking Technical Data may be found on The Viking Corporation’s Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

*cULus Listing, FM Approval, and NFPA 13 installs require a minimum of 7 psi (0.5 bar). The minimum operating pressure for LPCB and CE Approvals ONLY is 5 psi (0.35 bar).

Material Standards:

Frame Casting: Brass UNS-C84400
Deflector: Phosphor Bronze UNS-C51000 or Copper UNS-C19500
Bulb: Glass, nominal 3 mm diameter
Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with PTFE Tape
Screw: Brass UNS-C36000
Pip Cap and Insert Assembly: Copper UNS-C11000 and Stainless Steel UNS-S30400
For PTFE Coated Sprinklers: Belleville Spring-Exposed, Screw-Nickel Plated, Pip Cap-PTFE Coated
For Polyester Coated Sprinklers: Belleville Spring-Exposed
For ENT Coated Sprinklers: Belleville Spring-Exposed, Screw and Pipcap - ENT plated.

Ordering Information: (Also refer to the current Viking price list.)

Order Quick Response Upright and Pendent Sprinklers by first adding the appropriate suffix for the sprinkler finish and then the appropriate suffix for the temperature rating to the sprinkler base part number.
Finish Suffix: Brass = A, Chrome = F, White Polyester = M-/W, Black Polyester = M-/B, Black PTFE = N, and ENT = JN
Temperature Suffix: 135 °F (57 °C) = A, 155 °F (68 °C) = B, 175 °F (79 °C) = D, 200 °F (93 °C) = E, 286 °F (141 °C) = G
For example, sprinkler VK352 with a Brass finish and a 155 °F (68 °C) temperature rating = Part No. 18258AB

Available Finishes And Temperature Ratings: Refer to Table 1.

Accessories: (Also refer to the “Sprinkler Accessories” section of the Viking data book.)

Sprinkler Wrenches:

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

A. Standard Wrench: Part No. 10896W/B (available since 2000).
B. Wrench for Recessed Pendent Sprinklers: Part No. 13655W/B** (available since 2006)
C. Optional Protective Sprinkler Cap Remover/Escutcheon Installer Tool*** Part No. 15915 (available since 2010)

**A ½" ratchet is required (not available from Viking).

***Allows use from the floor by attaching a length of 1" diameter CPVC tubing to the tool. Ideal for sprinkler cabinets. Refer to Bulletin F_051808.

Sprinkler Cabinets:

A. Six-head capacity: Part No. 01724A (available since 1971)
B. Twelve-head capacity: Part No. 01725A (available since 1971)

4. INSTALLATION

Refer to appropriate NFPA Installation Standards.

5. OPERATION

During fire conditions, the heat-sensitive liquid in the glass bulb expands, causing the glass to shatter, releasing the pip cap and sealing spring assembly. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

The Viking Microfast® Quick Response Pendent Sprinkler VK352 is available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

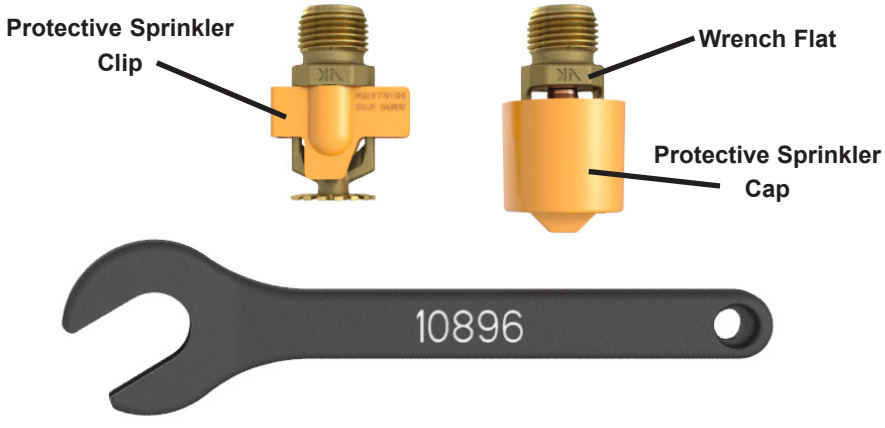


Figure 1: Standard Sprinkler Wrench 10896W/B

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TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK352 (K8.0)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating[1]	Maximum Ambient Ceiling Temperature[2]	Bulb Color
Ordinary	135 °F (57 °C)	100 °F (38 °C)	Orange
Ordinary	155 °F (68 °C)	100 °F (38 °C)	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	Yellow
Intermediate	200 °F (93 °C)	150 °F (65 °C)	Green
High	286 °F (141 °C)	225 °F (107 °C)	Blue

Sprinkler Finishes: Brass, Chrome, White Polyester, Black Polyester, Black PTFE, and ENT

Corrosion-Resistant Coatings[3]: White Polyester, Black Polyester, and Black PTFE. ENT in all temperature ratings except 135 °F (57 °C)

Footnotes

[1] The sprinkler temperature rating is stamped on the deflector.

[2] Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

[3] The corrosion-resistant coatings have passed the standard corrosion test required by the approving agencies indicated in the Approval Charts. These tests cannot and do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. For automatic sprinklers, the coatings indicated are applied to the exposed exterior surfaces only. Note that the spring is exposed on sprinklers with Polyester, PTFE, and ENT coatings. For ENT coated automatic sprinklers, the waterway is coated

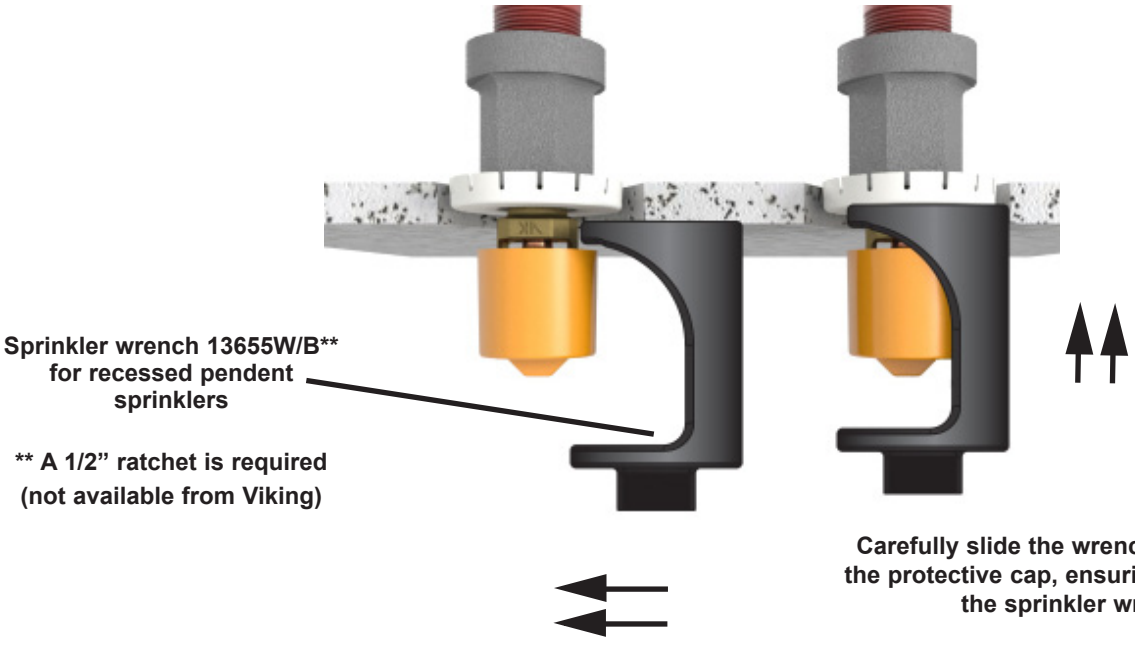


Figure 2: Wrench 13655W/B for Recessed Pendent Sprinklers

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TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK352 (K8.0)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Approval Chart 1 (UL)

The Viking Microfast® Quick Response Pendent Sprinkler VK352
Maximum 175 PSI (12 Bar) WWP

KEY: A1X — A = Temperature, 1 = Finish, X = Escutcheon (if applicable)

Base Part Number[1]	SIN	Sprinkler Style	Thread Size		Nominal K-Factor		Overall Length		Listings and Approvals[3] (Refer also to Design Criteria.)			
			NPT	BSP	U.S.	metric[2]	Inches	mm	cULus[4]	VdS	LPCB	CE
18258	VK352	Pendent	3/4”	20 mm	8.0	115.2	2-1/4	58	A1Z, B1Y, C2X, D2	A3	A3Z	D3[8]
18260[7]	VK352	Pendent	1/2”	15 mm	8.0	115.2	2-1/4	58	A1Z, B1Y, C2X, D2	A3	--	D3[9]
NOTICE - Product Below - Limited Availability (Contact Local Viking Office)												
06666B	VK352	Pendent	3/4”	20 mm	8.0	115.2	2-3/8	60	A1Z, B1Y, C2X, D2	A3	A3Z	D3[8]
06765B[7]	VK352	Pendent	1/2”	15 mm	8.0	115.2	2-3/8	60	A1Z, B1Y, C2X, D2	A3	--	A3[9]

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), 286 °F (141 °C)
B - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)
C - 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)
D - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), 286 °F (141 °C)

Approved Finishes

1 - Brass, Chrome, White Polyester[5,6], Black Polyester[5,6], and Black PTFE
2 - ENT[5]
3 - Brass, Chrome, White Polyester[5,6], and Black Polyester[5,6]

Approved Escutcheons

X - Standard surface-mounted escutcheon or the Viking Micromatic® Model E-1 Recessed Escutcheon
Y - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon, or recessed with the Viking Micromatic® Model E-1 or E-2 Recessed Escutcheon
Z - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon

Footnotes

[1] Base part number shown. For complete part number, refer to Viking’s current price schedule.
[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.
[3] This table shows the listings and approvals available at the time of printing. Other approvals may be in process.
[4] Listed by Underwriters Laboratories Inc. for use in the U.S. and Canada.
[5] cULus Listed as corrosion-resistant.
[6] Other colors are available on request with the same Listings and Approvals as the standard colors.
[7] The 1/2” NPT Large Orifice Sprinkler is listed and approved for retrofit only when installed in accordance with NFPA 13.
[8] CE Certified, Standard EN 12259-1, EC-certificates of conformity 0832-CPD-2001 and 0832-CPD-2003.
[9] CE Certified, Standard EN 12259-1, EC-certificate of conformity 0786-CPD-40279.

DESIGN CRITERIA - UL

(Also refer to Approval Chart 1 above.)

cULus Listing Requirements:

The Viking Microfast® Quick Response Pendent Sprinkler VK352 is cULus Listed as indicated in the Approval Chart for installation in accordance with the latest edition of NFPA 13 for standard spray sprinklers.

- Designed for use in Light, Ordinary, and Extra Hazard occupancies.
- The sprinkler installation rules contained in NFPA 13 for standard spray pendent sprinklers must be followed.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page QR1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

VIKING®

TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK352 (K8.0)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Approval Chart 2 (FM)

The Viking Microfast® Quick Response Pendent Sprinkler VK352

Maximum 175 PSI (12 Bar) WWP

KEY: A1X — Temperature, Finish, Escutcheon (if applicable)

Base Part Number[1]	SIN	Sprinkler Style	Thread Size		Nominal K-Factor		Overall Length		FM Approvals[3] (Refer also to Design Criteria.)
			NPT	BSP	U.S.	metric[2]	Inches	mm	
18258	VK352	Pendent	3/4”	20 mm	8.0	115.2	2-1/4	58	A1Z, B1Y, D2X, C2
18260[6]	VK352	Pendent	1/2”	15 mm	8.0	115.2	2-1/4	58	A1Z, B1Y, D2X, C2
NOTICE - Product Below - Limited Availability (Contact Local Viking Office)									
06666B	VK352	Pendent	3/4”	20 mm	8.0	115.2	2-38	60	A1Z, B1Y, D2X, C2
06765B[6]	VK352	Pendent	1/2”	15 mm	8.0	115.2	2-38	60	A1Z, B1Y, D2X, C2

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), 286 °F (141 °C)
B - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)
C - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), 286 °F (141 °C)
D - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C)

Approved Finishes

1 - Brass, Chrome, White Polyester[4], and Black Polyester[4]
2 - ENT[5]

Approved Escutcheons

X - Standard surface-mounted escutcheon or the Viking Micromatic® Model E-1 Recessed Escutcheon
Y - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon, or recessed with the Viking Micromatic® Model E-1 or E-2 Recessed Escutcheon
Z - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon

Footnotes

[1] Base part number shown. For complete part number, refer to Viking’s current price schedule.

[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

[3] This table shows the FM Approvals available at the time of printing. Other approvals may be in process.

[4] Other colors are available on request with the same Approvals as the standard colors.

[5] FM approved as corrosion resistant.

[6] The 1/2” NPT Large Orifice Sprinkler is listed and approved for retrofit only when installed in accordance with NFPA 13.

DESIGN CRITERIA - FM

(Also refer to Approval Chart 2 above.)

FM Approval Requirements:

The Viking Microfast® Quick Response Pendent Sprinkler VK352 is FM Approved as quick response **Non-storage** upright and pendent sprinklers as indicated in the FM Approval Guide. For specific application and installation requirements, reference the latest applicable FM Loss Prevention Data Sheets (including Data Sheet 2-0). FM Global Loss Prevention Data Sheets contain guidelines relating to, but not limited to: minimum water supply requirements, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector distance below the ceiling.

NOTE: The FM installation guidelines may differ from cULus and/or NFPA criteria.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page QR1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

VIKING®

TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK352 (K8.0)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

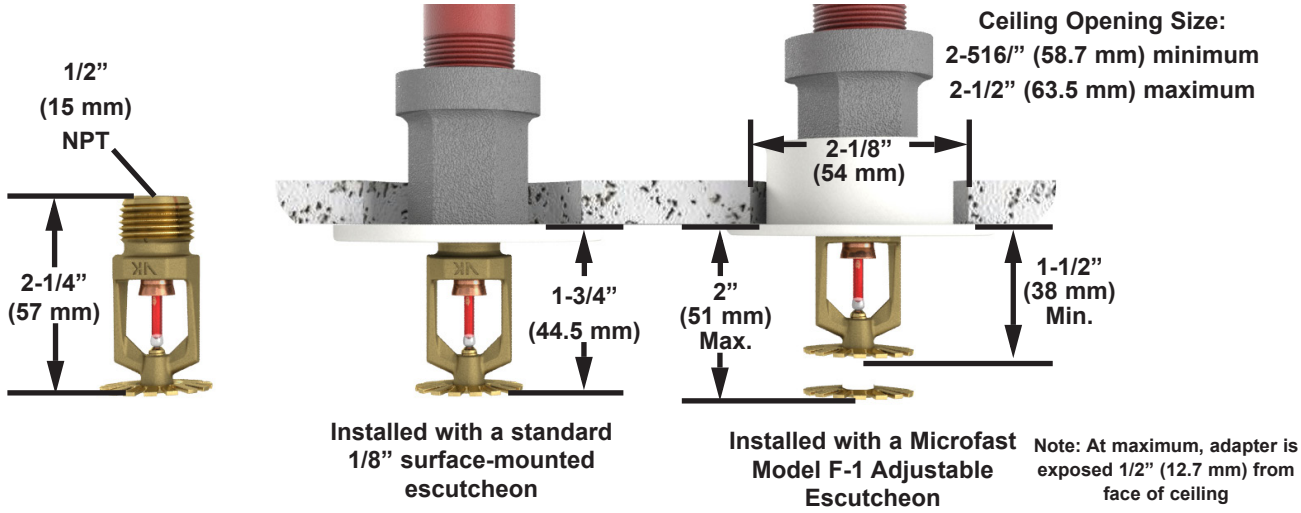


Figure 3: Sprinkler Dimensions with a Standard Escutcheon and the Model F-1 Adjustable Escutcheon

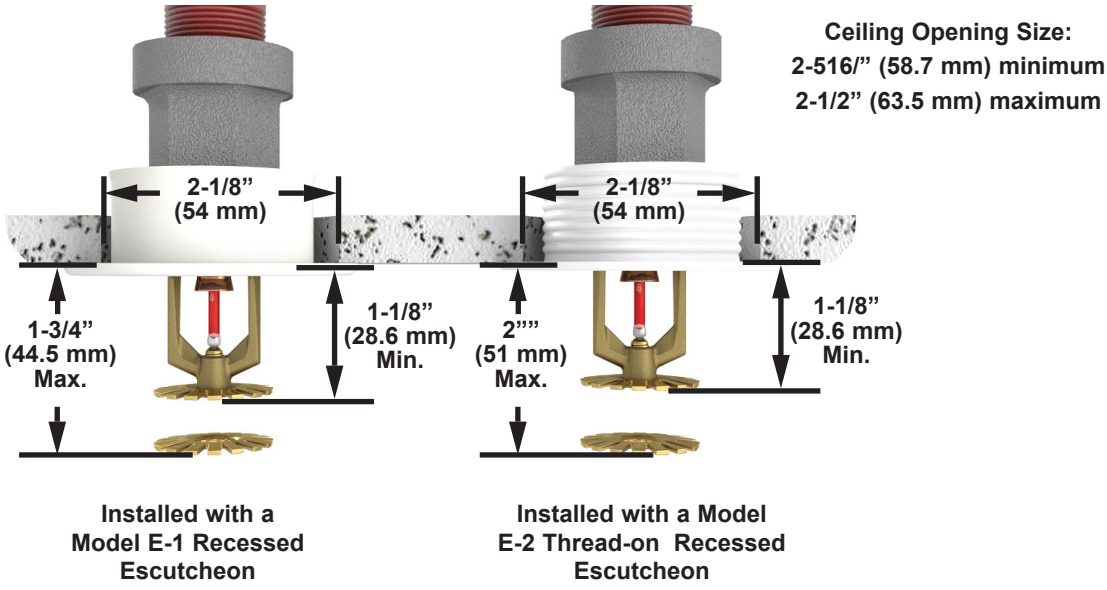


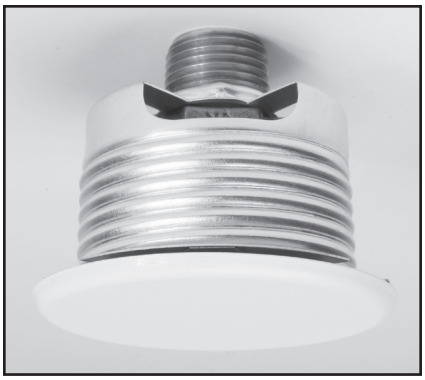
Figure 4: Sprinkler Dimensions with the Model E-1 and E-2 Recessed Escutcheons

TECHNICAL DATA

MIRAGE® STANDARD AND QR CONCEALED PENDENT SPRINKLER VK462 AND HP SPRINKLER VK463 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION



Viking Mirage® Standard and Quick Response Concealed Pendent Sprinkler VK462 and HP Sprinkler VK463 are thermosensitive glass-bulb spray sprinklers designed for installation on concealed pipe systems where the appearance of a smooth ceiling is desired.

The sprinkler is pre-assembled with a threaded adapter for installation with a low-profile cover assembly that provides up to ½" (12.7 mm) of vertical adjustment. The two-piece design allows installation and testing of the sprinkler prior to installation of the cover plate. The "push-on", "thread-off" design of the concealed cover plate assembly allows easy installation of the cover plate after the system has been tested and the ceiling finish has been applied. The cover assembly can be removed and reinstalled, allowing temporary removal of ceiling panels without taking the sprinkler system out of service or removing the sprinkler. The Electroless Nickel PTFE (ENT) coating has been investigated for installation in corrosive atmospheres and is cULus Listed as corrosion resistant as indicated in the Approval Charts. The ENT finish is only available for the sprinkler assembly, the cover plate is not plated.

Viking Technical Data may be found on The Viking Corporation's Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

2. LISTINGS AND APPROVALS

cULus Listed: Category VNIV

FM Approval: Class 2015

NYC Approved: MEA 89-92-E, Volume 32

VdS Approved: Certificate G4080021

LPCB Approved: Ref. No. 096e/12

CE Certified: Standard EN 12259-1, EC-certificate of conformity 0832-CPD-2032

CCCF Approved: Approved by the China Certification Center for Fire Products (CCCF)

Refer to Approval Chart 1 Design Criteria for cULus Listing requirements, and refer to Approval Chart 2 and Design Criteria on page for FM Approval requirements that must be followed.

3. TECHNICAL DATA

Specifications:
Available since 2006.
Minimum Operating Pressure: 7 psi (0.5 bar)*
Maximum Working Pressure: Sprinkler VK463 is rated for use with water working pressures ranging from the minimum 7 psi (0.5 bar) up to 250 psi (17.2 bar) for high-pressure systems. High-pressure (HP) sprinklers can be identified by locating "250" stamped on the deflector. Sprinkler VK462 is rated to a maximum 175 psi (12 bar) wwp.
Factory tested hydrostatically to 500 psi (34.5 bar)
Thread size: 1/2" (15 mm) NPT
Nominal K-Factor: 5.6 U.S. (80.6 metric†)
Glass-bulb fluid temperature rated to -65°F (-55°C)
Patents Pending

*cULus Listing, FM Approval, and NFPA 13 installs require a minimum of 7 psi (0.5 bar). The minimum operating pressure for LPCB and CE Approvals ONLY is 5 psi (0.35 bar).

†Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

Material Standards:
Sprinkler Body: Brass UNS-C84400
Deflector: Copper UNS-C19500 for Sprinkler VK462
Phosphor Bronze UNS-C51000 for Sprinkler VK463
Deflector Pins: Stainless Steel Alloy
Bulb: Glass, nominal 3 mm diameter
Pip Cap and Insert Assembly: Copper UNS-C11000 and Stainless Steel UNS-S30400
Button: Brass UNS-C36000
Screws: 18-8 Stainless Steel
Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with Teflon Tape
Yoke: Phosphor Bronze UNS-C51000
Cover Adapter: Cold Rolled Steel UNS-G10080, Finish: Clear Chromate over Zinc Plating

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Cover Assembly Materials:
Cover: Copper UNS-C11000
Base: Brass UNS-C26000 or UNS-C26800
Springs: Nickel Alloy
Solder: Eutectic

Ordering Information: (Also refer to the current Viking price list.)
Viking Mirage® Standard and Quick Response Concealed Pendent Sprinklers and Cover Plate Assemblies must be ordered separately:
Sprinkler: Base Part No. VK462 - 13503A for Brass finish and 13503JN for ENT finish. VK463 - HP Base Part No. 13667A
Specify sprinkler temperature rating by adding the appropriate suffix for the temperature rating to the base part number:
Temperature Suffix: 155 °F (68 °C) = B, 175 °F (79 °C) = D, 200 °F (93 °C) = E
For example, sprinkler VK463 with a 155 °F (68 °C) temperature rating = 13667AB.
Cover Plate Assembly: Base Part No. 13504 (2-3/4" diameter), Base Part No. 13642 (3-5/16" diameter), or Base Part No. 15394 (square cover plate, 3-5/16" diameter)
Specify finish and temperature rating of the cover plate assembly by adding the appropriate suffixes for the finish and the cover temperature rating to the base part number:
Finish Suffix: Polished Chrome = F, Brushed Chrome = F-/B, Bright Brass = B, Antique Brass = B-/A, Brushed Brass = B-/B, Brushed Copper = E-/B, Painted White = M-/W, Painted Ivory = M-/I, Painted Black = M-/B
Temperature Suffix: 135 °F (57 °C) UL (139 °F (59 °C) FM and LPCB) = A, 165 °F (74 °C) = C
For example, cover 13504 with a Polished Chrome finish and a 165 °F (74 °C) temperature rating = 13504FC.

Note: Square cover plate 15394 cULus Listing is for the 135 °F (57 °C) temperature rated cover plate only. Refer to the Approval Chart.

Available Finishes And Temperature Ratings: Refer to Table 1.

Accessories: (Also refer to the "Sprinkler Accessories" section of the Viking data book.)
Sprinkler Wrenches:**
A. Heavy Duty Wrench Part No. 14047W/B (available since 2006), or
B. Head Cabinet Wrench Part No. 14031*** (available since 2006)
C. Optional Concealed Cover Plate Installer Tool Part No. 14412 for cover 13504, or Part No. 14867 for the large diameter cover (available since 2007)

**Requires a ½" ratchet (not available from Viking). ***Optional for removal of the protective cap. Ideal for sprinkler cabinets.

Sprinkler Cabinet: Part No. 01731A (available since 1971)

4. INSTALLATION

Refer to appropriate NFPA Installation Standards.

5. OPERATION

During fire conditions, when the temperature around the sprinkler approaches its operating temperature, the cover plate detaches. Continued heating of the exposed sprinkler causes the heat-sensitive liquid in the glass bulb to expand and the bulb to shatter, releasing the yoke, pip-cap and sealing spring assembly. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

Viking Sprinklers VK462 and VK463 are available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

VIKING®

TECHNICAL DATA

MIRAGE® STANDARD AND QR CONCEALED PENDENT SPRINKLER VK462 AND HP SPRINKLER VK463 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating[1]	Maximum Ambient Ceiling Temperature[2]	Temperature Rating of Cover Assembly (Required)	Bulb Color
Ordinary	155 °F (68° C)	100 °F (38 °C)	135 °F (57 °C) cULus 139 °F (59 °C) FM and LPCB	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	165 °F (74 °C)	Yellow
Intermediate	200 °F (93 °C)	150 °F (65 °C)	165 °F (74 °C)	Green

Cover Plate Finishes: Polished Chrome, Brushed Chrome, Bright Brass, Antique Brass, Brushed Brass, Brushed Copper, Painted White, Painted Ivory, or Painted Black

Sprinkler Finishes: Brass and ENT

Corrosion Resistant Coatings[3]: ENT

Footnotes

[1] The sprinkler temperature rating is stamped on the sprinkler deflector.

[2] Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

[3] The corrosion resistant coatings have passed the standard corrosion test required by the approving agencies indicated in the Approval Charts. These tests cannot and do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. For automatic sprinklers, the ENT coating is applied to all exposed exterior surfaces, including the waterway, but the Belleville spring is exposed.

Approval Chart 1 (UL)

Mirage® Concealed Pendent Sprinklers VK462 and VK463

Sprinkler Temperature Rating
Cover Plate Temperature Rating
AW1 Cover Plate Finish **KEY**

Sprinkler Base Part No.[1]	SIN	NPT Thread Size		Nominal K-Factor		Maximum Water Working Pressure	Listings and Approvals[4] (Refer also to Design Criteria)					
		Inch	mm	U.S.	metric[2]		cULus[5]	NYC	VdS[7]	LPCB	CE	
Standard Response Applications												
13503A	VK462	1/2"	15	5.6	80.6	175 psi (12 bar)	--	--	AY1, CZ1	AY1, BZ1	AY1, CZ1[8]	AV1, CW1
Quick Response Applications												
13503A	VK462	1/2"	15	5.6	80.6	175 psi (12 bar)	AV1, BX1	AV1, BW1[6]	–	–	--	--
13503JN[11]	VK462	1/2"	15	5.6	80.6	175 psi (12 bar)	AV1, BX1	AV1, BW1[6]	–	–	--	--
13667A	VK463	1/2"	15	5.6	80.6	250 psi (17.2 bar)[3]	AV1, BX1	AV1, BW1[6]	--	--	--	--

Sprinkler Temperature Ratings

A - 155 °F (68 °C)
B - 175 °F (79 °C) and 200 °F (93 °C)
C - 200 °F (93 °C)

Cover Plate Assembly Temperature Ratings[9]

V - 135 °F (57 °C) cULus Listed cover 13504[1], 13642[1] (large diameter), or 15394[1] (square cover plate)
W - 165 °F (74 °C) cover 13504[1] or 13642[1] (large diameter)
X - 165 °F (74 °C) cover 13504[1], or 13642[1] (large diameter)
Y - 135 °F (57 °C) cover 13504[1] *LPCB Approved as 139 °F (59 °C)*
Z - 165 °F (74 °C) cover 13504[1]

Cover Plate Assembly Finishes[10]

1 - Polished Chrome, Brushed Chrome, Bright Brass, Antique Brass, Brushed Brass, Brushed Copper, Painted White, Painted Ivory, or Painted Black

Footnotes

[1] Part number shown is the base part number. For complete part number, refer to current Viking price list schedule.

[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

[3] The Water Working Pressure rating is stamped on the deflector.

[4] This chart shows the listings and approvals available at the time of printing. Other approvals may be in process. Check with the manufacturer for any additional approvals.

[5] Listed by Underwriter's Laboratories for use in the U.S. and Canada.

[6] Accepted for use, City of New York Department of Buildings, MEA Number 89-92-E, Vol. 32.

[7] VdS Approved, standards VdS 2344:2005-12, VdS 2100-25:2008-01, and EN 12259-1:1999 + A1:2001 + A2:2004 + A3:2006, Certificate G4080021.

[8] CE Certified, Standard EN 12259-1, EC-certificate of conformity 0832-CPD-2032.

[9] The 135/139 °F cover has an orange label. The 165 °F (74 °C) cover has a white label.

[10] Painted finish consists of Polyester Baked Enamel. Other paint colors are available on request with the same listings as the standard paint colors. Listings and approvals apply for any paint manufacturer. Contact Viking for additional information.

[11] cULus Listed as corrosion resistant.

NOTE: Custom colors are indicated on a label inside the cover assembly. Refer to Figure 1.

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TECHNICAL DATA

MIRAGE® STANDARD AND QR CONCEALED PENDENT SPRINKLER VK462 AND HP SPRINKLER VK463 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

DESIGN CRITERIA - UL

(Also refer to Approval Chart 1)

cULus Listing Requirements:

Mirage® Concealed Pendent Sprinklers VK462 and VK463 are cULus Listed as quick response for installation in accordance with the latest edition of NFPA 13 for standard coverage pendent spray sprinklers as indicated below.

- For hazard occupancies up to and including Ordinary Hazard, Group II.
- Protection areas and maximum spacing shall be in accordance with the tables provided in NFPA 13. Maximum spacing allowed is 15 ft. (4.6 m).
- Minimum spacing allowed is 6 ft. (1.8 m) unless baffles are installed in accordance with NFPA 13.
- Minimum distance from walls is 4 in. (102 mm).
- Maximum distance from walls shall be no more than one-half of the allowable distance between sprinklers. The distance shall be measured perpendicular to the wall.
- The sprinkler obstruction rules contained in NFPA 13 for standard coverage pendent spray sprinklers must be followed.

NOTE: Concealed sprinklers must be installed in neutral or negative pressure plenums only.

VdS Approval Requirements:

a) The sprinkler can be installed in a concrete ceiling (massive ceiling) or in a false ceiling made of light materials.

b) This sprinkler is deflector fixed type and can be only activated by heat. The housing is not tight.

c) Follow installation guidelines of current standards, CEA4001VdS and EN12845. These sprinklers can only be installed in LH and OH occupancies, except in OH4.

NOTES: Due to the design the sprinkler type 'Domed-CCP' shall not be installed in false ceilings in which the false ceiling space is protected by a water extinguishing system.

Due to the design the sprinkler type 'Domed-CCP' shall not be installed in false ceilings in which during a fire the pressure above the false ceiling may be assumed to be higher than the pressure below the false ceiling.

The criterion for the dropping of the cover relevant for this approval is heat.

Steps of installation:

1. Prepare the sprinkler key.
2. Remove the plastic cover.
3. Hold the sprinkler with the wrench and fasten it.
4. Replace the plastic cover and do not remove until the cover is installed.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page SR1-3 or QR1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.



Identification of Custom Paint Color:
All custom color painted cover plates will have an identifying label affixed to the inside of the cover that indicates custom color and will have a representative sample (a paint dot) of the paint on the label.

Figure 1: Identification of Custom Paint Color for Concealed Covers

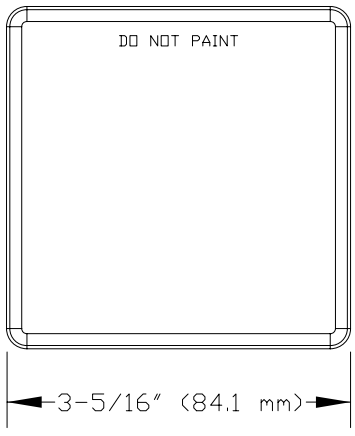


Figure 2: Square Cover Assembly 15394

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TECHNICAL DATA

MIRAGE® STANDARD AND QR CONCEALED PENDENT SPRINKLER VK462 AND HP SPRINKLER VK463 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
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Approval Chart 2 (FM)

Mirage® Standard Response Concealed Pendent Sprinkler VK462



Sprinkler Base Part No.[1]	SIN	NPT Thread Size		Nominal K-Factor		Maximum Water Working Pressure	FM Approvals[3] (Refer also to Design Criteria below.)
		Inch	mm	U.S.	metric[2]		
13503A	VK462	1/2”	15	5.6	80.6	175 psi (12 bar)	AW1, BX1

Sprinkler Temperature Ratings

A - 155 °F (68 °C)

B - 175 °F (79 °C) and 200 °F (93 °C)

Cover Plate Assembly Temperature Ratings[4]

W - 139 °F (59 °C) cover 13504[1], 13642[1] (large diameter), or 15394[1] (square cover plate)

X - 165 °F (74 °C) cover 13504[1], 13642[1] (large diameter), or 15394[1] (square cover plate)

Cover Plate Assembly Finishes[5]

1 - Polished Chrome, Brushed Chrome, Bright Brass, Antique Brass, Brushed Brass, Brushed Copper, Painted White, Painted Ivory, or Painted Black

Footnotes

[1] Part number shown is the base part number. For complete part number, refer to current Viking price list schedule.

[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

[3] This chart shows the FM Approvals available at the time of printing. Other approvals may be in process. Check with the manufacturer for any additional approvals.

[4] The 139 °F (59 °C) cover has an orange label. The 165 °F (74 °C) cover has a white label.

[5] Painted finish consists of Polyester Baked Enamel. Other paint colors are available on request with the same listings as the standard paint colors. Listings and approvals apply for any paint manufacturer. Contact Viking for additional information.

NOTE: Custom colors are indicated on a label inside the cover assembly. Refer to Figure 1.

DESIGN CRITERIA - FM

(Also refer to Approval Chart 2 above.)

FM Approval Requirements:

Viking Concealed Pendent Sprinkler VK462 is FM Approved as a standard response **Non-Storage** concealed pendent sprinkler as indicated in the FM Approval Guide. For specific application and installation requirements, reference the latest applicable FM Loss Prevention Data Sheets (including Data Sheet 2-0). FM Global Loss Prevention Data Sheets contain guidelines relating to, but not limited to: minimum water supply requirements, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector distance below the ceiling.

NOTE: The FM installation guidelines may differ from cULus and/or NFPA criteria.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page SR1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

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TECHNICAL DATA

MIRAGE® STANDARD AND QR CONCEALED PENDENT SPRINKLER VK462 AND HP SPRINKLER VK463 (K5.6)

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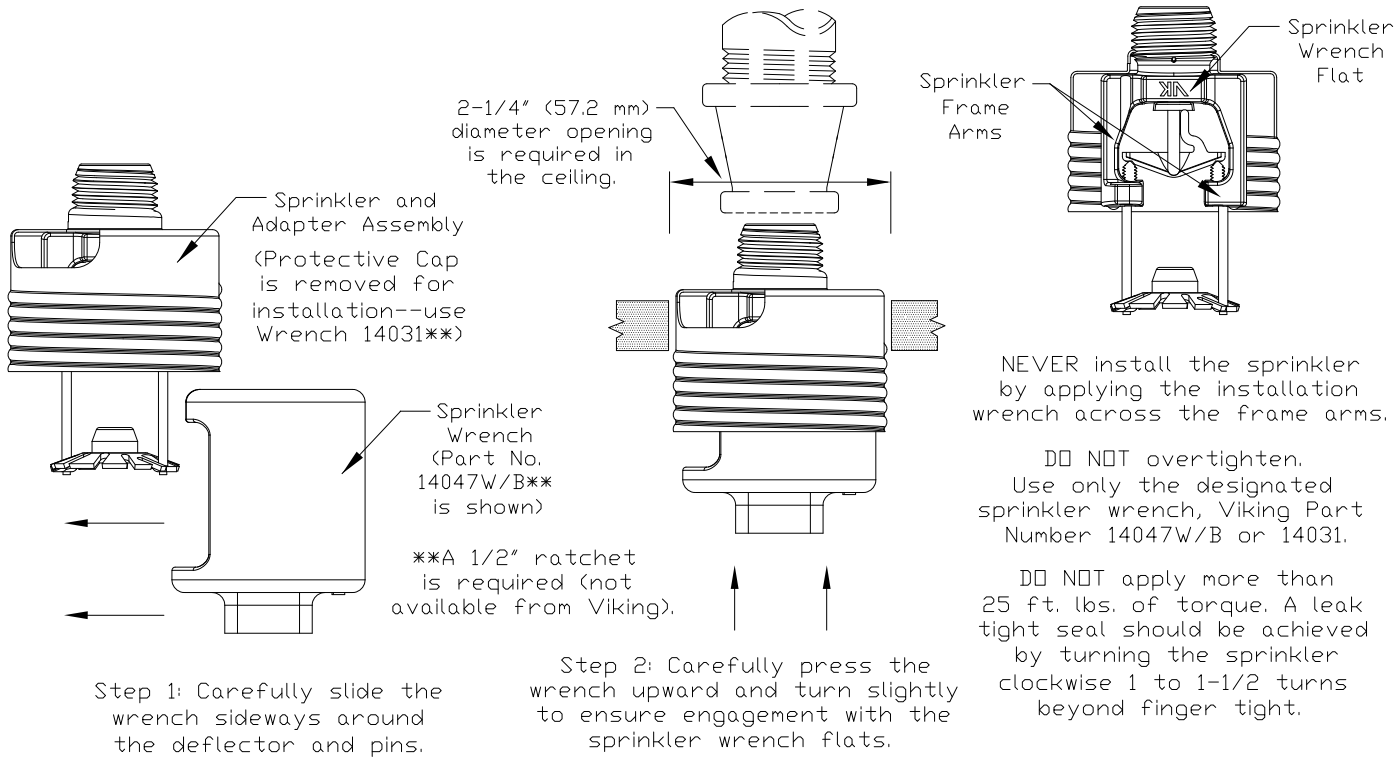


Figure 3: **Sprinkler Installation and Correct Use of Wrenches**

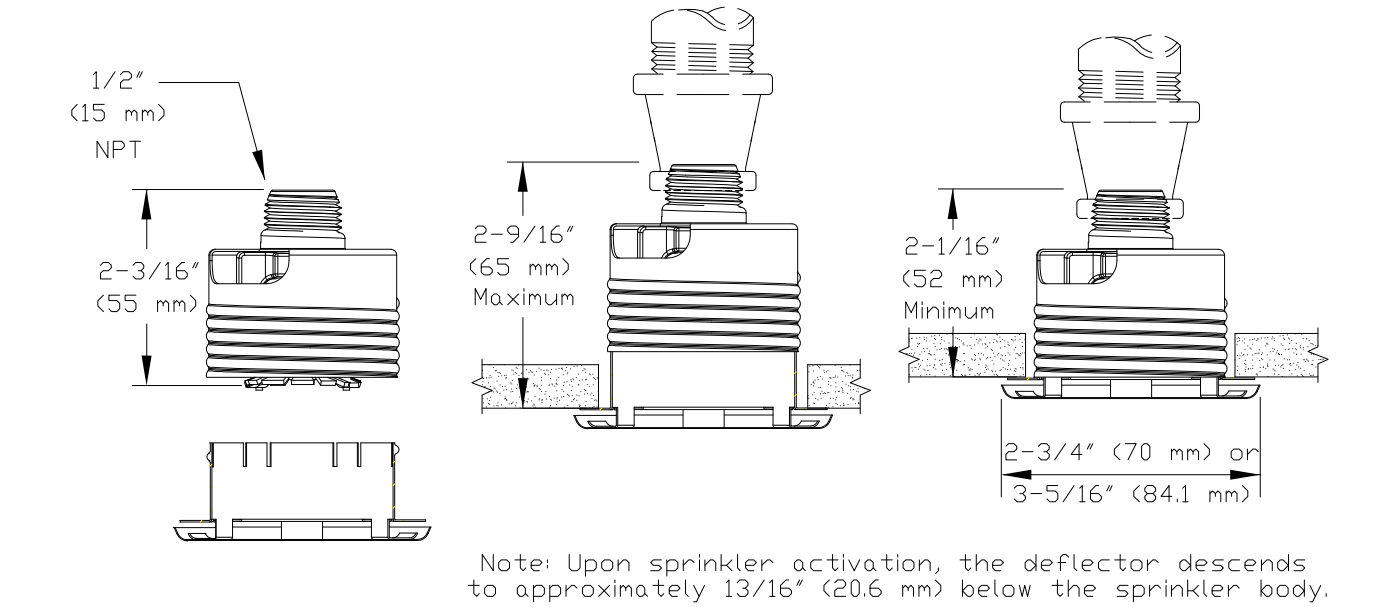


Figure 4: **Sprinkler Dimensions and Cover Installation**

Spare Sprinkler Head Storage Cabinet

INSIST ON FPPI®

211313 - Wet-Pipe Sprinkler System

449

Description



Fire Protection Products, Inc. Spare Sprinkler Head Cabinets are designed to allow for spare sprinkler head storage as required by NFPA guidelines. The Spare Sprinkler Head Cabinets are available in six configurations. Three head, six head, six head ESFR, twelve head, twenty-four head and thirty-six head. All six styles are manufactured with “knockouts” to accommodate the most common size sprinklers. The shelf is located to allow for the storage of a typical sprinkler head wrench. Each cabinet is finished with a red enamel finish. Each spare head cabinet comes with a hinged door which remains closed to protect the spare sprinklers from the elements and features two holes on the back panel to allow for attachment to most surfaces utilizing the appropriate fasteners. Not intended for exposed or harsh environments.

Installation

Select the correct Spare Sprinkler Head Cabinet in accordance with the Automatic Sprinkler Systems Handbook. As per the 1989 Edition the correct number of spare sprinkler is as follows:

0-300 sprinklers, not less than 6; 300-1000, not less than 12; 1000 or more, not less than 24. Stock of spare sprinklers shall include all types and ratings installed.*

Once the correct Spare Sprinkler Head Cabinet has been selected, installation is accomplished by inserting the correct fastener in each of the two holes inside the cabinet, securing the cabinet securely to the wall. The insert the correct number and type of sprinklers in accordance with the “handbook”.

**Final determination is subject to approval by the AHJ.*

Specifications

Material:
Painted Plain Steel

Finish:
Red enamel

Styles:
3 Spare sprinklers, ½ or ¾
6 Spare sprinklers, ½ or ¾
6 Spare, ESFR, ½, ¾ or 1”
12 Spare sprinklers ½ or ¾
24 Spare sprinklers
36 Spare sprinklers

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tyco / Fire & Building Products

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Technical Services: Tel: (800) 381-9312 / Fax: (800) 791-5500

Sprinkler Cabinets
3, 6, & 12 Sprinklers, 1/2 or 3/4 Inch NPT
6 ESFR Sprinklers, 3/4 or 1 Inch NPT

General Description

Tyco® Sprinkler Cabinets are constructed of metal enclosures with hinged covers designed to provide on-site storage of an emergency supply of sprinklers and a sprinkler wrench.

NFPA 13 requires a representative number of each type of sprinkler used in a sprinkler system to be stored in a cabinet on-site to allow for immediate removal and replacement of sprinklers that may have operated or become damaged.

Sprinkler Cabinets are manufactured of heavy gauge steel with knock-outs to accommodate NPT threaded sprinklers and are painted an attractive red enamel.

WARNINGS

The Sprinkler Cabinets described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. ***Failure to do so may impair the performance of these devices.***

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.



Technical Data

Material
Carbon Steel

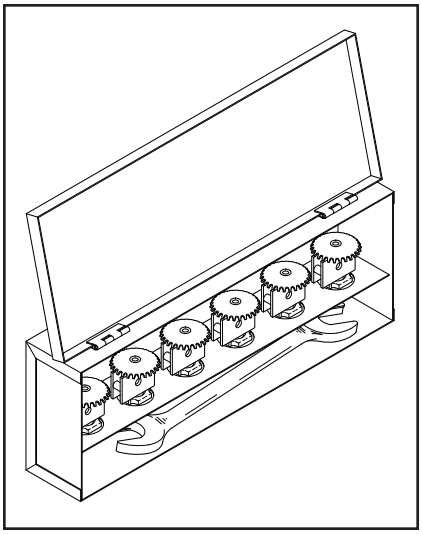
Weights

3 Sprinkler Cabinet . . . . . 1.5 Lbs. (0,68 kg)

6 Sprinkler Cabinet . . . . . 2.3 Lbs. (1,04 kg)

12 Sprinkler Cabinet . . . . . 4.0 Lbs. (1,81 kg)

6 ESFR Sprinkler Cabinet . . . . . 3.3 Lbs. (1,36 kg)



VIKING®

TECHNICAL DATA

SPRINKLER ESCUTCHEONS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION



Viking sprinkler escutcheons are ornamental plates used with 3/8" NPT (10 mm BSP)*, ½" NPT (15 mm BSP)*, and ¾" NPT (20 mm BSP)* frame-style pendent and sidewall* sprinklers. The escutcheons are installed between the sprinklers and the ceiling or wall for a pleasing appearance. They are available with several finish options to meet design requirements.

Viking recessed and adjustable escutcheons provide a low-profile decorative recessed sprinkler installation. The E-1 Recessed Escutcheon may be recessed up to 5/8" (16 mm). The Model G-1 Recessed Escutcheon allows horizontal sidewall sprinklers to be recessed up to 1/2" (12.7 mm). The Model F-1 Adjustable Escutcheon has ½" (12.7 mm) total adjustment available.

The two-piece design of Viking's recessed and adjustable escutcheons allows installation and testing of the sprinklers prior to installing the ceiling or wall. Viking's Model E-1, F-1, and G-1 Escutcheons feature a slip-on design, while the Model E-2 and E-3 escutcheons are threaded (outer cup threads onto the adapter).

The Viking adjustable and recessed escutcheons are made to allow for minor adjustments due to pipe or ceiling pitch. These escutcheons can be removed and reinstalled, allowing access above removable ceiling panels for servicing building equipment without shutting down the sprinkler system and removing the sprinkler.

Viking standard 1/8" (3 mm) style flat and 1" (25 mm) style raised surface-mounted escutcheons have a one-piece design.

***Refer to the specific sprinkler technical data page for the escutcheon(s) listed and approved for use with the sprinkler.**

2. LISTINGS AND APPROVALS

Refer to the specific sprinkler technical data pages for sprinkler listings and approvals. Sprinklers must be specifically listed and/or approved for recessed installation. When using Viking Model E-1, E-2, E-3, F-1, and G-1 escutcheons for recessed applications, refer to technical data describing the sprinkler model to be used to verify whether the sprinkler is listed and/or approved for recessed installations. **NOTE**: Viking's thread-on style Model E-2 and E-3 Recessed Escutcheons carry the same listings and approvals as the slip-on style Model E-1 Recessed Escutcheons. **Model E-3 Recessed Escutcheon also meets IBC-ASCE/SEI 7 Codes for Seismic Areas C, D, and E.**

3. TECHNICAL DATA

Specifications:

A. Slip-on Style Model E-1 Recessed Escutcheons

Depth of Outer Cup: 1-1/16" (26.9 mm)
Outside Diameter of Outer Cup: 3-1/16" (77.7 mm)
Depth of Center Adapter Ring: 11/32" (8.7 mm) +/- 1/32" (0.8 mm)
Adjustment Range: Flush to 5/8" (16 mm) recessed
NOTE: Escutcheon adapter is stamped "Viking Model E-1".
Available since 1987.

B. Threaded Style Model E-2 Recessed Escutcheons

Depth of Outer Cup: 13/16" (20.6 mm)
Outside Diameter of Outer Cup: 3-1/8" (79.4 mm)
Depth of Center Adapter Ring: 21/32" (16.6 mm)
Adjustment Range: 27/32" (21.4 mm) total adjustment with ½" (12.7 mm) maximum recess available. **Note**: Face of escutcheon adapter may extend up to 11/32" (8.7 mm) beyond edge of escutcheon cup.
Available since 2000.

Viking Technical Data may be found on The Viking Corporation's Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

VIKING® TECHNICAL DATA SPRINKLER ESCUTCHEONS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
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C. Threaded Style Model E-3 Recessed Escutcheons
Depth of Outer Cup: 13/16" (20.6 mm)
Outside Diameter of Outer Cup: 5-1/8" (130.2 mm). (See Figure 4)
Depth of Center Adapter Ring: 21/32" (16.6 mm)
Adjustment Range: 27/32" (21.4 mm) total adjustment with ½" (12.7 mm) maximum recess available. **Note**: Face of escutcheon adapter may extend up to 11/32" (8.7 mm) beyond edge of escutcheon cup.
Available since 2012.

D. Model F-1 Adjustable Escutcheons
Depth of Outer Cup: 1-1/16" (26.9 mm)
Outside Diameter of Outer Cup: 3-1/16" (77.7 mm)
Depth of Center Adapter Ring: 23/32" (18.3 mm)
Adjustment Range: ½" (12.7 mm) total adjustment with ¼" (6.4 mm) maximum recess available. **Note**: The face of escutcheon adapter may extend up to ¼" (6.4 mm) beyond the edge of the escutcheon cup.
NOTE: Escutcheon adapter is stamped "Viking Model F-1".
Available since 1988.

E. Slip-on Style Model G-1 Recessed Escutcheons (US Patent No. 8,376,060)
Depth of Outer Cup: 1-1/16" (26.9 mm)
Outside Diameter of Outer Cup: 4" (101.6 mm)
Depth of Center Adapter Ring: 1-7/16" (36.5 mm)
Adjustment Range: Up to 5/8" (16 mm) total adjustment available for use with ceilings sloped up to 8/12 (33.7°). May be recessed up to ½" (12.7 mm), depending on degree of slope. **Note**: The face of escutcheon adapter may extend up to 1/2" (12.7 mm) beyond the edge of the escutcheon cup.
NOTE: Escutcheon adapter is stamped "Viking Model G-1".
Available since 2007.

F. Expansion Plate (optional)

1. Base Part No. 12620 for use with Model E-1, E-2, and F-1 Escutcheons. May also be used with dry recessed sprinklers, dry standard adjustable sprinklers, and flat plate concealed sprinklers.
   Outside Diameter: 5" (127 mm)
   Inside Diameter: 2-3/16" (55.5 mm)
   Available since 2005.
2. Base Part No. 13128 for use with Domed Concealed Sprinklers.
   Outside Diameter: 5" (127 mm)
   Inside Diameter: 2-15/32" (62.7 mm) for Part No. 13128.
   Available since 2005.
3. Base Part No. 16340 for use with Concealed Sprinkler VK636.
   Outside Diameter: 5-5/16" (135 mm)
   Inside Diameter: 2-3/8" (60.6 mm)
   Available since 2010.

G. Standard Flat and Raised Surface-Mounted Escutcheons
Depth of Escutcheons: Flat: 1/8" (3.2 mm), Raised: 1" (25 mm)
Available since 1972.

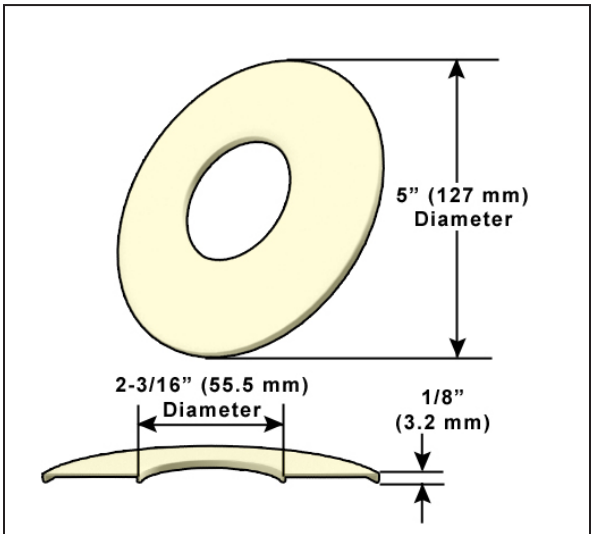


Figure 1: Expansion Plate Part No. 12620

Material Standards:

A. Slip-on Style Model E-1 Recessed Escutcheons:
Cold Rolled Steel UNS-G10080 or Stainless Steel UNS-S30400

B. Threaded Style Model E-2 and E-3 Recessed Escutcheons:
24 ga. (0.61 mm) thick 1010-1018 mild steel

C. Model G-1 Recessed Escutcheons and Model F-1 Adjustable Escutcheons: Cold Rolled Steel UNS-G10080

D. Expansion Plate (optional): Cold Rolled Steel UNS-G10080

E. Standard Flat and Raised Surface-Mounted Escutcheons:
Flat Style Part Numbers 01960A, 01015A, 02960A, and 05464A: Cold Rolled Steel UNS-G10080.
Flat Style Part Numbers 09488, 07526, and 09596*: Stainless Steel

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UNS-S43000

* These may also be special ordered and manufactured from Brass (non-magnetic material). Contact the manufacturer for more information.

Raised Style Part Numbers 01961B and 01016A: Brass UNS-C26000 or UNS-C26800.

Ordering Information: (Also refer to the current Viking price list.)

Viking recessed and adjustable escutcheons are available as escutcheon packages (includes outer cup and adapter). Escutcheon cups are also available to order separately as individual pieces for Model E-1, E-2, E3, or F-1 Escutcheons (refer to Table 1 on page 5. Order Viking escutcheons by adding the appropriate suffix for the finish to the base part number.

A. Model F-1 Adjustable and Model E-1, E-2, E-3, and G-1 Recessed Escutcheons:

1. To order as an escutcheon package (includes outer cup and adapter), specify the appropriate package part number from Table 1.
2. To order individual outer cup separately for Model E-1, E-2, E-3, or F-1 Escutcheons, specify the appropriate part number for the individual piece from Table 1.

B. Standard Flat and Raised Surface-Mounted Escutcheons: Specify the flat or raised escutcheon part number from Table 1.

Finish Suffix: Bright Brass = B, Polished Chrome = F, White Polyester = M-/W, and Black Polyester = M-/B.

For example, the Model E-1 Recessed Escutcheon for 1/2” NPT sprinkler, Brass finish = Part No. 06419AB. The 1/2” Model E-1 Recessed Escutcheon is also available in Antique Brass, Brushed Copper, Brushed Chrome, and Brushed Brass as standard finishes.

NOTE: Sprinklers are not included and must be ordered separately.

4. INSTALLATION

A. If the proposed installation of Model E-1, E-2, E-3, F-1, or G-1 Escutcheons requires recessing any of the heat-sensitive operating element, some Authorities Having Jurisdiction may limit the use, depending on the occupancy classification. Refer to the Authority Having Jurisdiction prior to installation. The use of quick response sprinklers may also be limited due to occupancy and hazard. Refer to the Authority Having Jurisdiction prior to installation.

B. All escutcheon styles are made to thread onto the sprinkler head prior to installing the sprinkler into the fitting. The escutcheon must be attached to the sprinkler prior to applying pipe-joint compound or PTFE tape to the sprinkler threads. **NOTE**: Sprinklers with protective caps or bulb shields must be contained within the caps or shields before applying pipe-joint compound or tape.

C. Refer to the appropriate sprinkler technical data page for additional warnings and installation instructions and then install the escutcheons according to the following sequence.

D. Model F-1 Adjustable and Model E-1, E-2, E-3, and G-1 Recessed Escutcheons:

(Refer to Figures 2-5.)

Step 1: Install all piping and cut the sprinkler nipple so that the reducing coupling is at the desired location and centered in a minimum 2-5/16” (59 mm) to a maximum 2-1/2” (64 mm) diameter opening in the ceiling or wall for Model E-1, E-2, or F-1 Escutcheons, 2-5/16” (59 mm) to 4-1/2” (115mm) for Model E-3, or 2-5/8” (66 mm) to 3-3/4 (95 mm) for Model G-1 Escutcheons.

Step 2: Secure the escutcheon adapter onto the sprinkler by hand turning the adapter clockwise onto the sprinkler threads. The face of the adapter should rest on the shoulder of the sprinkler wrench boss.

Step 3: Apply a small amount of pipe-joint compound or PTFE tape to the external threads of the sprinkler only, taking care not to allow a build-up of compound in the sprinkler inlet. **NOTE**: Sprinklers with protective caps or bulb shields must be contained within the caps or shields before applying pipe-joint compound or tape.

Step 4: Install the sprinkler into the coupling using the special recessed sprinkler wrench only, taking care not to over-tighten or damage the sprinkler operating parts. DO NOT use the escutcheon, sprinkler deflector, or fusible element to start or thread the sprinkler into a fitting.

Step 5: Test the system as required and repair all leaks. If a thread leak occurs, normally the unit must be removed, new pipe-joint compound or PTFE tape applied, and then reinstalled. This is due to the fact that when the joint seal leaks, the sealing compound or tape is washed out of the joint.

Step 6: **Remove plastic protective sprinkler caps and bulb shields AFTER the wall or ceiling finish work is completed where the sprinkler is installed and there no longer is a potential for mechanical damage to the sprinkler operating elements.** To remove the bulb shields, simply pull the ends of the shields apart where they are snapped together. To remove caps from frame style sprinklers, turn the caps slightly and pull them off the sprinklers. **SPRINKLER CAPS AND BULB SHIELDS MUST BE REMOVED FROM SPRINKLERS BEFORE PLACING THE SYSTEM IN SERVICE!** Retain a protective cap in the spare sprinkler cabinet.

Step 7: After installing the ceiling or wall with the required opening size, press on or thread on (depends on the style of escutcheon used) the outer escutcheon cup until the flanges touch the surface of the ceiling or wall.

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(**NOTE**: If the optional escutcheon expansion plate is used, first slide it onto the escutcheon cup. The flange on the expansion plate should touch the surface of the ceiling or wall.)

With the slip-on style Model E-1 Recessed Escutcheon, the maximum adapter recess is 5/8" (16 mm).

With the threaded style Model E-2 and E-3 Recessed Escutcheons, the maximum recess is ½" (12.7 mm). **Note**: The face of the escutcheon adapter may extend up to 11/32" (8.7 mm) beyond edge of escutcheon cup, resulting in 27/32" (21.4 mm) total adjustment range.

With the Model F-1 Adjustable Escutcheon, the maximum recess is ¼" (6.4 mm). **Note**: The face of the escutcheon adapter may extend up to ¼" (6.4 mm) beyond the edge of the escutcheon cup, resulting in ½" (12.7 mm) total adjustment range.

With the slip-on style Model G-1 Recessed Escutcheon, the maximum adapter recess is 1/2" (12.7 mm).

DO NOT modify the unit. If necessary, re-cut the sprinkler drop nipple as required.

E. Standard Flat and Raised Surface-Mounted Escutcheons:

Step 1: Install all piping and cut the sprinkler nipple so that the reducing coupling is at the desired location and centered in a maximum 2-1/2" (64 mm) diameter opening in the ceiling or wall.

Step 2: Secure the escutcheon onto the sprinkler by hand turning the escutcheon clockwise onto the sprinkler threads. (The convex surface of the escutcheon must face toward the deflector of the sprinkler.)

Step 3: Apply a small amount of pipe-joint compound or PTFE tape to the external threads of the sprinkler only, taking care not to allow a build-up of compound in the sprinkler inlet. **NOTE**: Sprinklers with protective caps or bulb shields must be contained within the caps or shields before applying pipe-joint compound or tape.

Step 4: Install the sprinkler into the coupling using the special sprinkler wrench only, taking care not to over-tighten or damage the sprinkler operating parts. DO NOT use the escutcheon, sprinkler deflector, or fusible element to start or thread the sprinkler into a fitting.

Step 5: After installation, the entire sprinkler system must be tested. The test must be conducted to comply with the installation standards. Make sure the sprinkler is properly tightened. If a thread leak occurs, normally the unit must be removed, new pipe-joint compound or tape applied, and then reinstalled. This is due to the fact that when the joint seal leaks, the sealing compound or tape is washed out of the joint.

Step 6: **Remove plastic protective sprinkler caps and bulb shields AFTER the wall or ceiling finish work is completed where the sprinkler is installed and there no longer is a potential for mechanical damage to the sprinkler operating elements.** To remove the bulb shields, simply pull the ends of the shields apart where they are snapped together. To remove caps from frame style sprinklers, turn the caps slightly and pull them off the sprinklers. **SPRINKLER CAPS AND BULB SHIELDS MUST BE REMOVED FROM SPRINKLERS BEFORE PLACING THE SYSTEM IN SERVICE!** Retain a protective cap in the spare sprinkler cabinet.

DO NOT modify the unit. If necessary, re-cut the sprinkler drop nipple as required.

F. Disassembly:

The outer cups of Viking adjustable and recessed escutcheons can be removed and reinstalled without removing the sprinklers to allow access above the ceiling or to replace it, if necessary.

1. For slip-on style Model E-1 or G-1 Recessed Escutcheons and Model F-1 Adjustable Escutcheons, remove the outer cup simply by pulling it outward and away from the wall or ceiling.
2. To remove the outer cup of the threaded style Model E-2 and E-3 Recessed Escutcheons, turn it counterclockwise to unthread it from the adapter.

If it is necessary to remove the entire unit, the system must be removed from service. Refer to maintenance instructions on the appropriate sprinkler technical data page and follow all warnings and instructions.

5. OPERATION

Refer to the sprinkler technical data page for the sprinkler model used.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

Viking sprinklers and escutcheons are available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

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TECHNICAL DATA

SPRINKLER ESCUTCHEONS

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Base Part Number	Material	Style	Sprinkler Thread Size	Available Finishes	Outside Diameter
Standard Flat and Raised Surface-Mounted Escutcheons					
01960A	Steel	Flat	1/2” (15 mm)	B, F	3-5/16” (84.1 mm)
09488	Stainless Steel††	Flat	1/2” (15 mm)	F, JN	3-5/16” (84.1 mm)
01015A	Steel	Flat	3/4” (20 mm)	F	3-5/16” (84.1 mm)
02960A	Steel	Flat	1/2” (15 mm)	B, F, M/W, M/B	2-3/4” (69.9 mm)
07526	Stainless Steel††	Flat	1/2” (15 mm)	F, M/W, JN	2-3/4” (69.9 mm)
05464A	Steel	Flat	3/4” (20 mm)	B, F, M/W	2-3/4” (69.9 mm)
09596	Stainless Steel††	Flat	3/4” (20 mm)	F, JN	2-3/4” (69.9 mm)
01961B	Brass	Raised	1/2” (15 mm)	F	3-1/16” (77.7 mm)
01016A	Brass	Raised	3/4” (20 mm)	F	3-1/16” (77.7 mm)
E-1 Slip-on Style Recessed Escutcheon Packages (includes adapter and outer cup)					
11123	Steel	Recessed Slip-on	3/8” (10 mm)	F, M/W	3-1/16” (77.7 mm)
06419A	Steel	Recessed Slip-on	1/2” (15 mm)	B, F, M/W, M/B	3-1/16” (77.7 mm)
07902	Stainless Steel	Recessed Slip-on	1/2” (15 mm)	F, M/W, JN	3-1/16” (77.7 mm)
13220	Stainless Steel	Recessed Slip-on	3/4” (20 mm)	F, M/W, JN	3-1/16” (77.7 mm)
06420A	Steel	Recessed Slip-on	3/4” (20 mm)	B, F, M/W, M/B	3-1/16” (77.7 mm)
E-2 Threaded Style Recessed Escutcheon Packages (includes adapter and outer cup)					
11038	Steel	Recessed Threaded	1/2” (15 mm)	F, M/W	3-1/8” (79.4 mm)
11625	Steel	Recessed Threaded	3/4” (20 mm)	F, M/W	3-1/8” (79.4 mm)
E-3 Threaded Style Recessed Escutcheon Packages (includes adapter and outer cup)					
18347	Steel	Recessed Threaded	1/2” (15 mm)	F, M/W	5 -1/8” (130.2mm)
18348	Steel	Recessed Threaded	3/4” (20 mm)	F, M/W	5 -1/8” (130.2mm)
F-1 Adjustable Escutcheon Packages (includes adapter and outer cup)					
06911A	Steel	Adjustable	1/2” (15 mm)	B, F, M/W, M/B	3-1/16” (77.7 mm)
06912A	Steel	Adjustable	3/4” (20 mm)	B, F, M/W, M/B	3-1/16” (77.7 mm)
G-1 Recessed Escutcheon Package (includes adapter and outer cup)					
14315	Steel	Recessed Slip-on	1/2” (15 mm)	B, F, M/W, M/B	4” (101.6 mm)
14955	Steel	Recessed Slip-on	3/4” (20 mm)	B, F, M/W, M/B	4” (101.6 mm)
Optional Expansion Plates Available Separately					
12620	Steel	E-1, E-2 Recessed & F-1 Adjustable	3/8”, 1/2”, & 3/4” (10, 15, & 20 mm)	B, F, M/W, M/B, M/SW1641, B/B, F/B, E/B	5” (127 mm)
13128	Steel	Domed Concealed	1/2” & 3/4” (15 & 20 mm)	F, M/W	5” (127 mm)
16340	Steel	Concealed (for Sprinkler VK636)	3/4” (20 mm)	F, M/W	5-5/16” (135 mm)

Escutcheon Finishes: B = Bright Brass, F = Polished Chrome, M/W = White Polyester, M/B = Black Polyester, JN = Electroless Nickel PTFE, M/SW1641 = Navajo White Paint, B/A = Antique Brass, B/B = Brushed Brass, F/B = Brushed Chrome, E/B = Brushed Copper. **Note**: Other colors are available on request with the same listings and approvals as the standard colors. See Sherwin-Williams® Color Answers™ Interior Color Selection color chart.

††Escutcheons 09488, 07526, and 09596 may also be special ordered and manufactured from Brass (non-magnetic material). Contact the manufacturer for more details.

Table 1

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TECHNICAL DATA

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IMPORTANT NOTES

Per the current edition of NFPA 13: "Escutcheons used with recessed, flush-type, or concealed sprinklers shall be part of a listed sprinkler assembly." The Viking Corporation will not authorize the sale of unlisted recessed sprinkler assemblies nor assume any liability involving recessed sprinkler assemblies that are not considered cULus Listed, FM Approved, or in full compliance with NFPA requirements".

Listings and approvals vary, depending on the sprinkler model, temperature rating, finish, and occupancy classification.

⚠WARNING Viking products are manufactured and tested to meet the rigid requirements of the approving agency. The sprinklers are designed to be installed in accordance with recognized installation standards. Deviation from the standards or any alteration to the sprinkler after it leaves the factory including, but not limited to: painting , plating, coating, or modification, may render the sprinkler inoperative and will nullify the approval and any guarantee made by The Viking Corporation.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to the appropriate sprinkler data page. Viking sprinklers are designed to be installed in accordance with the latest edition of Viking technical data, the latest standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards whenever applicable. The use of certain types of sprinklers may be limited due to occupancy and hazard. Refer to the Authority Having Jurisdiction prior to installation.

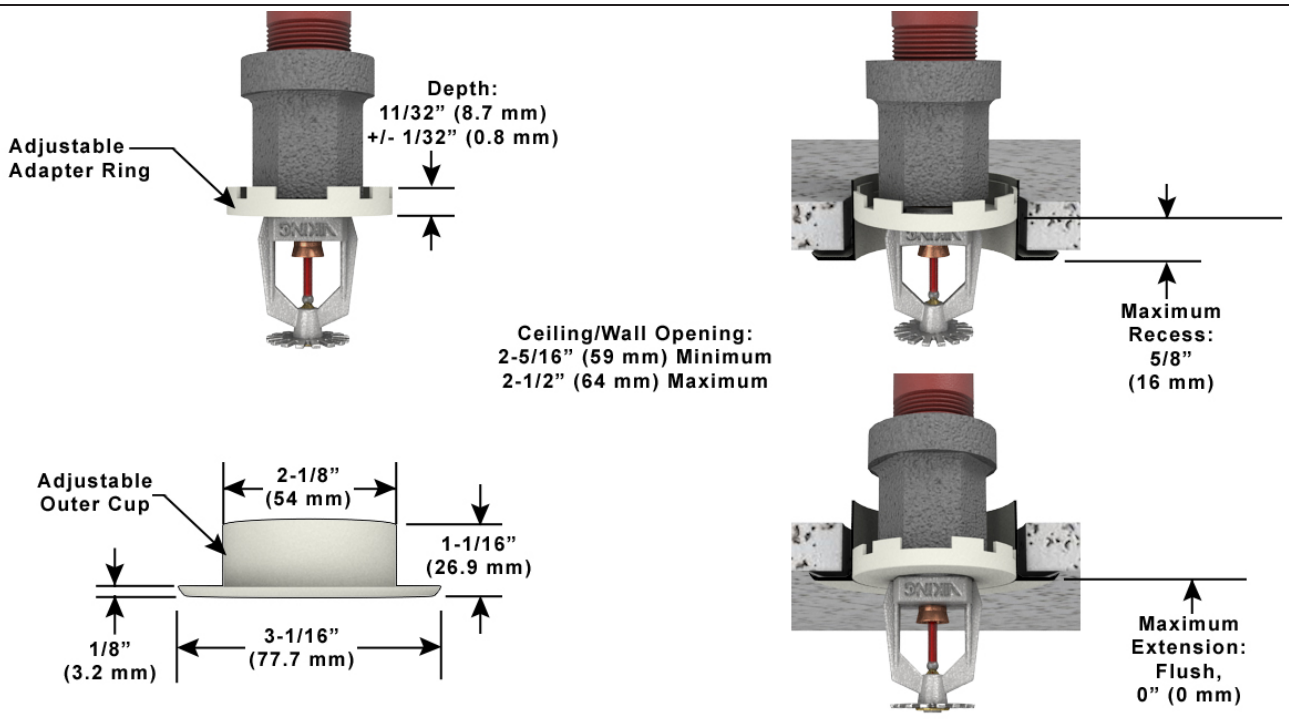


Figure 2: Installation of a Slip-on Style Model E-1 Recessed Escutcheon with 5/8" (16 mm) Maximum Recess.

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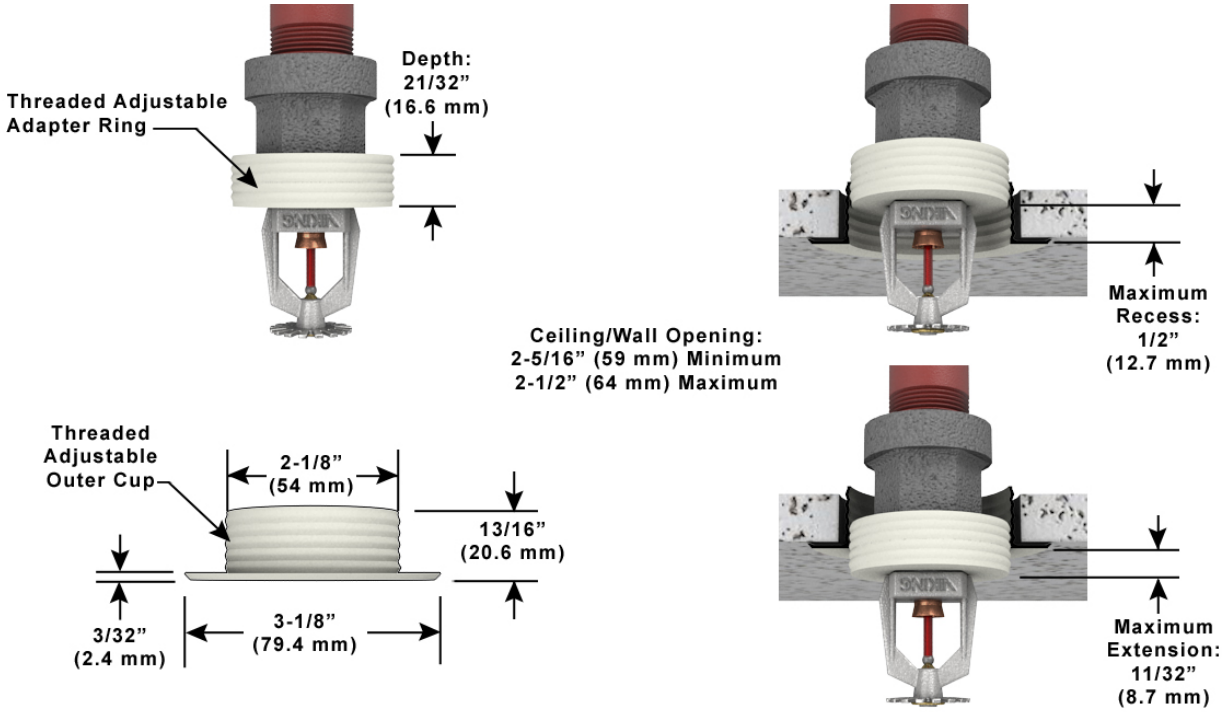


Figure 3: Installation of a Thread-on Style Model E-2 Recessed Escutcheon with 27/32" (21 mm) Total Adjustment.

Model E-3 Recessed Escutcheon meets IBC-ASCE/SEI 7 Codes for Seismic Areas C, D, and E

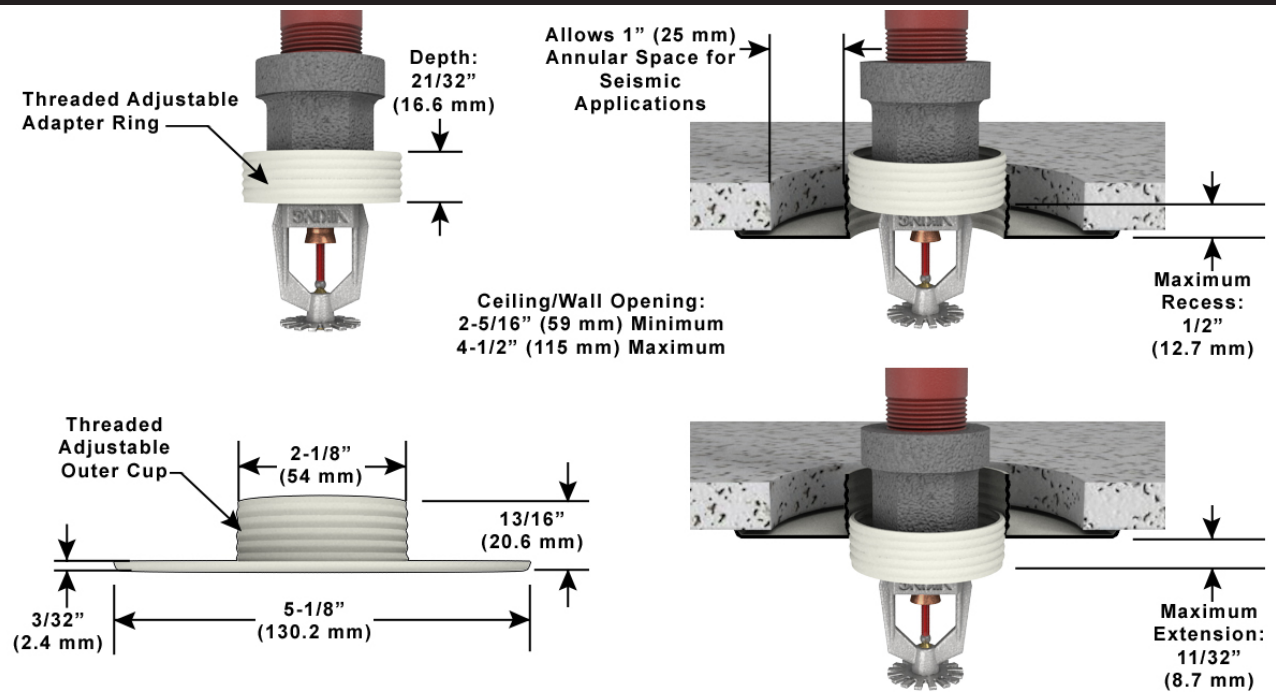


Figure 4: Installation of a Thread-on Style Model E-3 Recessed Escutcheon with 27/32" (21 mm) Total Adjustment.

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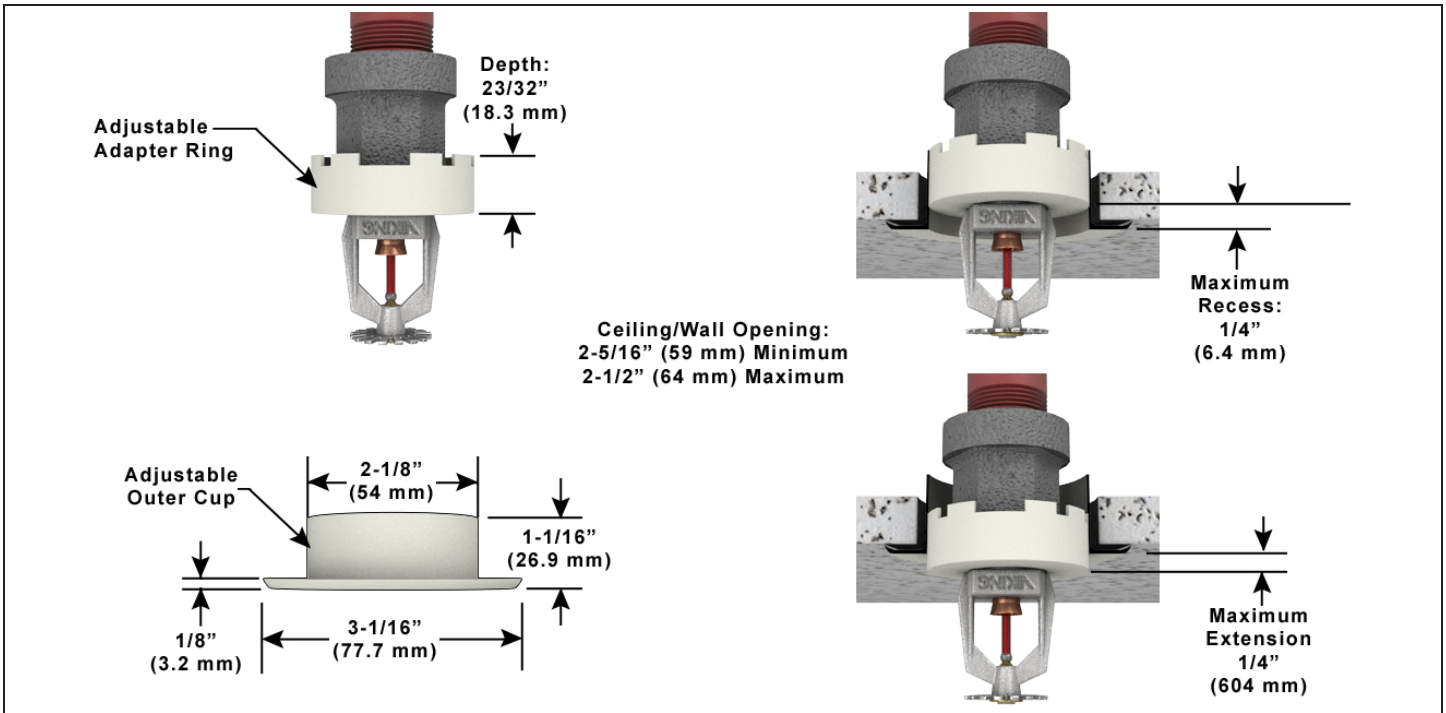


Figure 5: Installation of a Model F-1 Adjustable Escutcheon with ½" (12 mm) Total Adjustment.

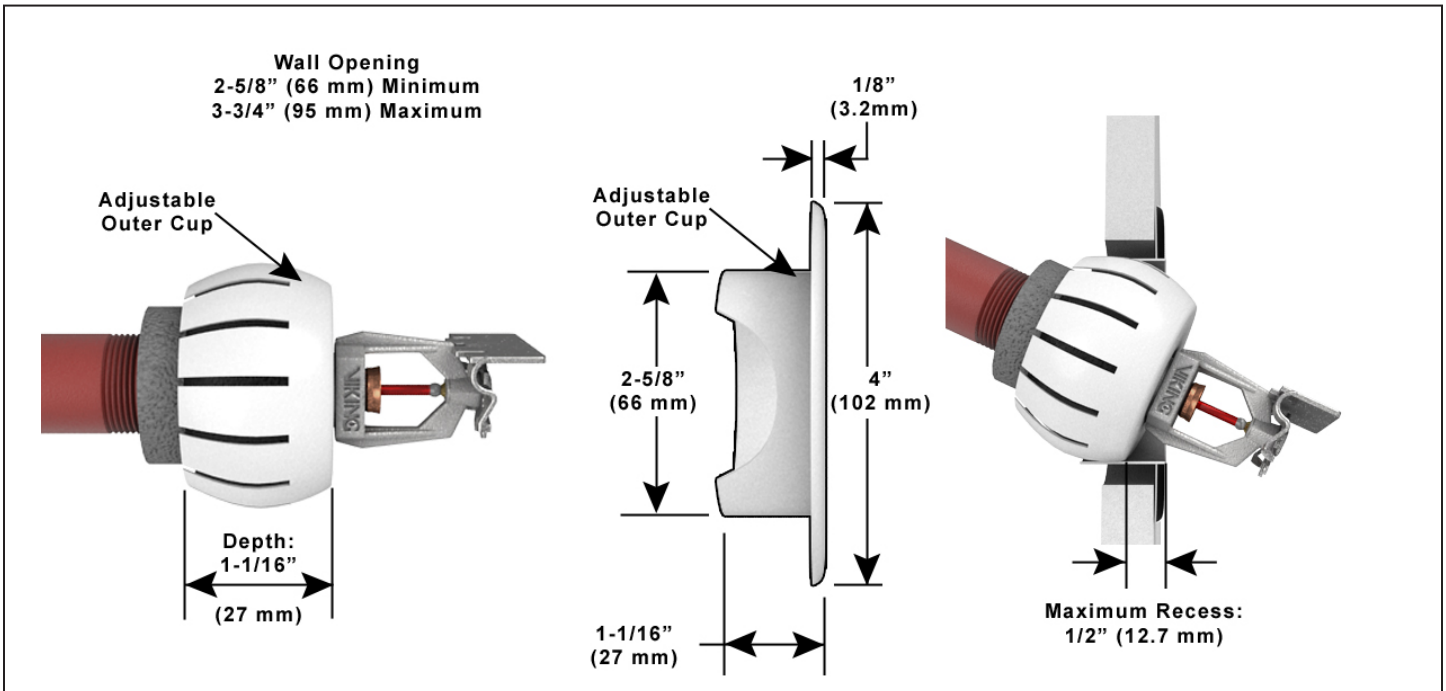


Figure 6: Installation of the Model G-1 Recessed Escutcheon with up to 1/2" (12.7 mm) Adjustment.

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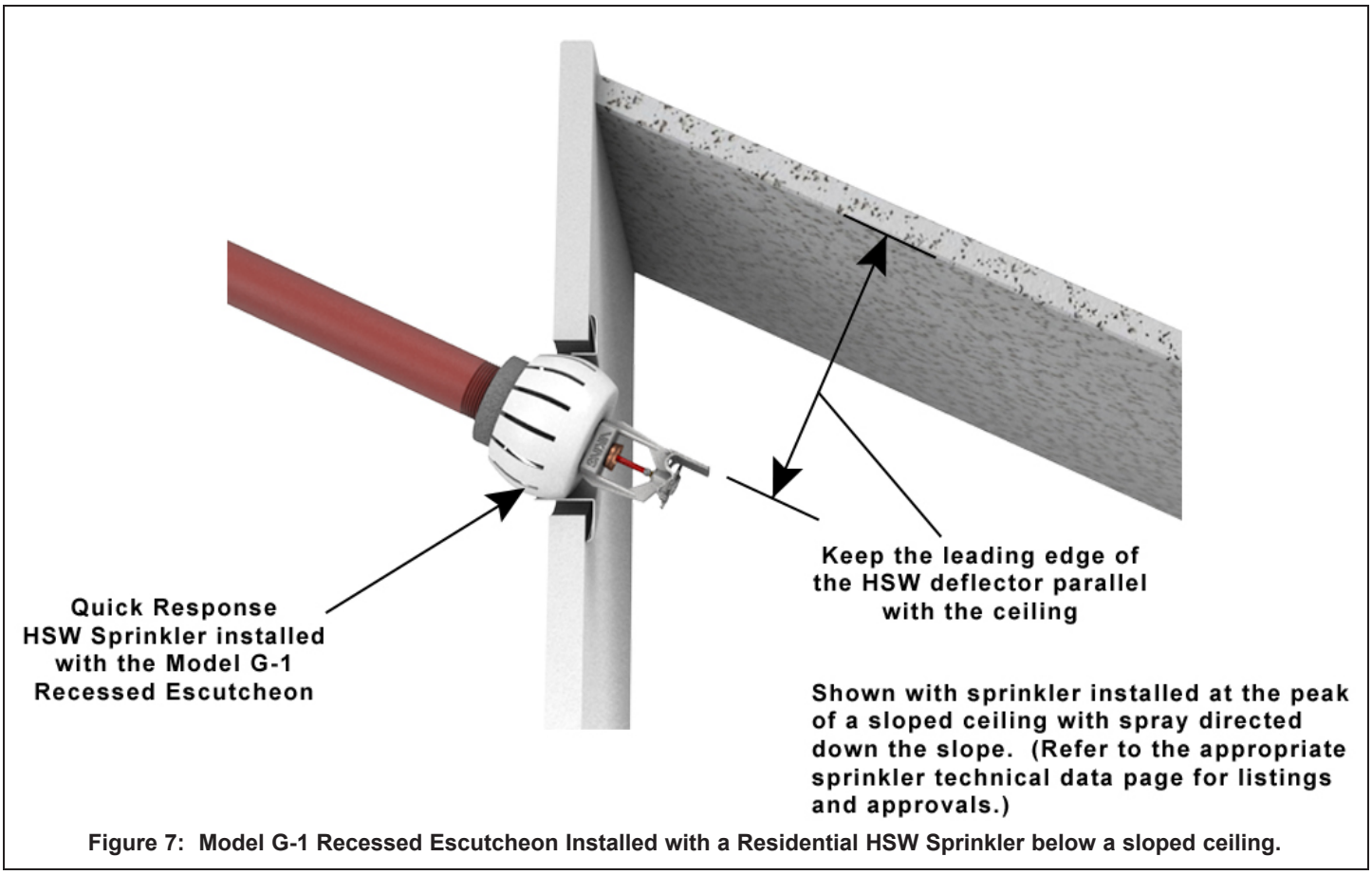


Figure 7: Model G-1 Recessed Escutcheon Installed with a Residential HSW Sprinkler below a sloped ceiling.

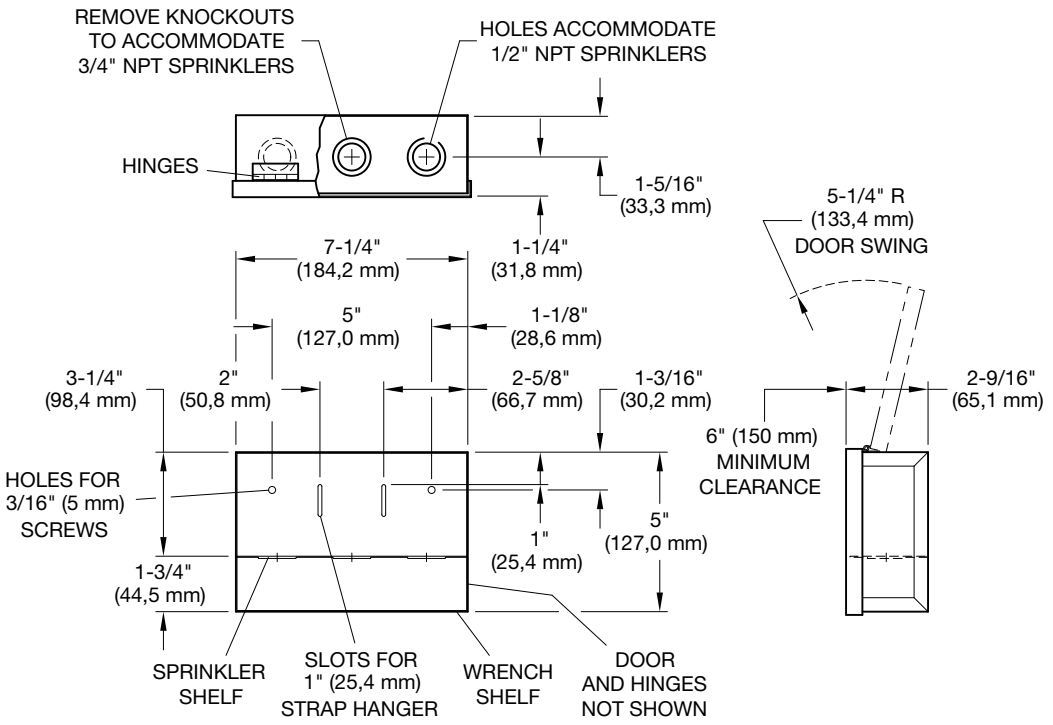


FIGURE 1
3 SPRINKLER CABINET

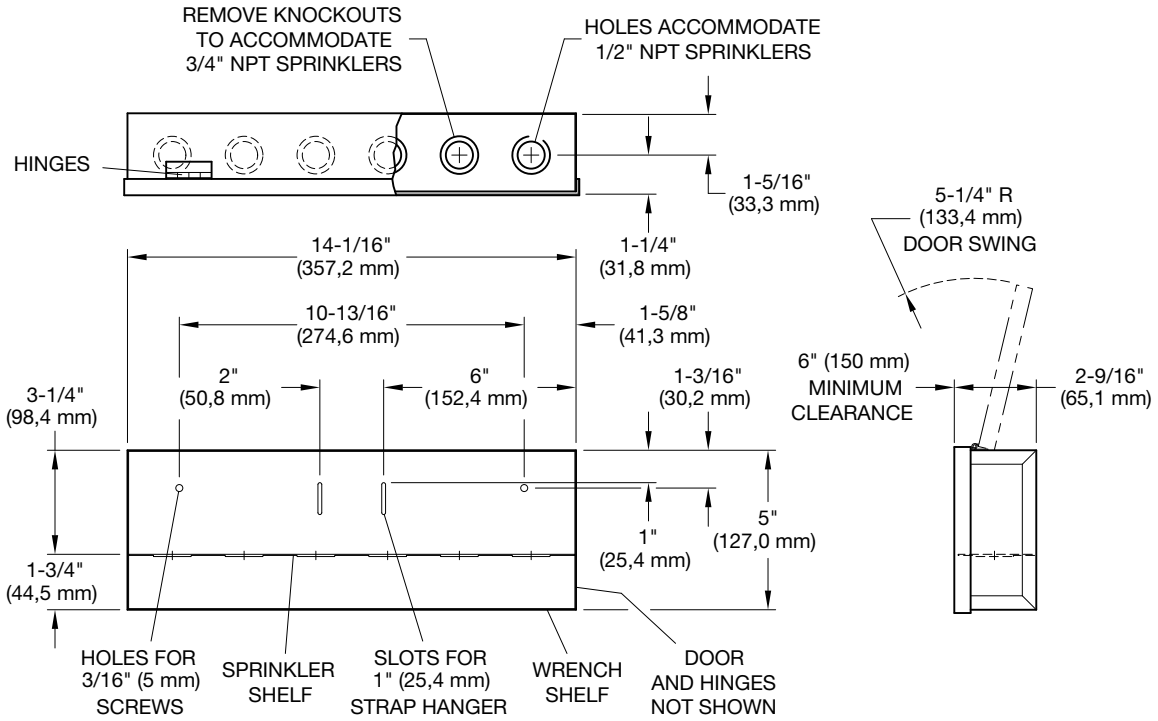


FIGURE 2
6 SPRINKLER CABINET

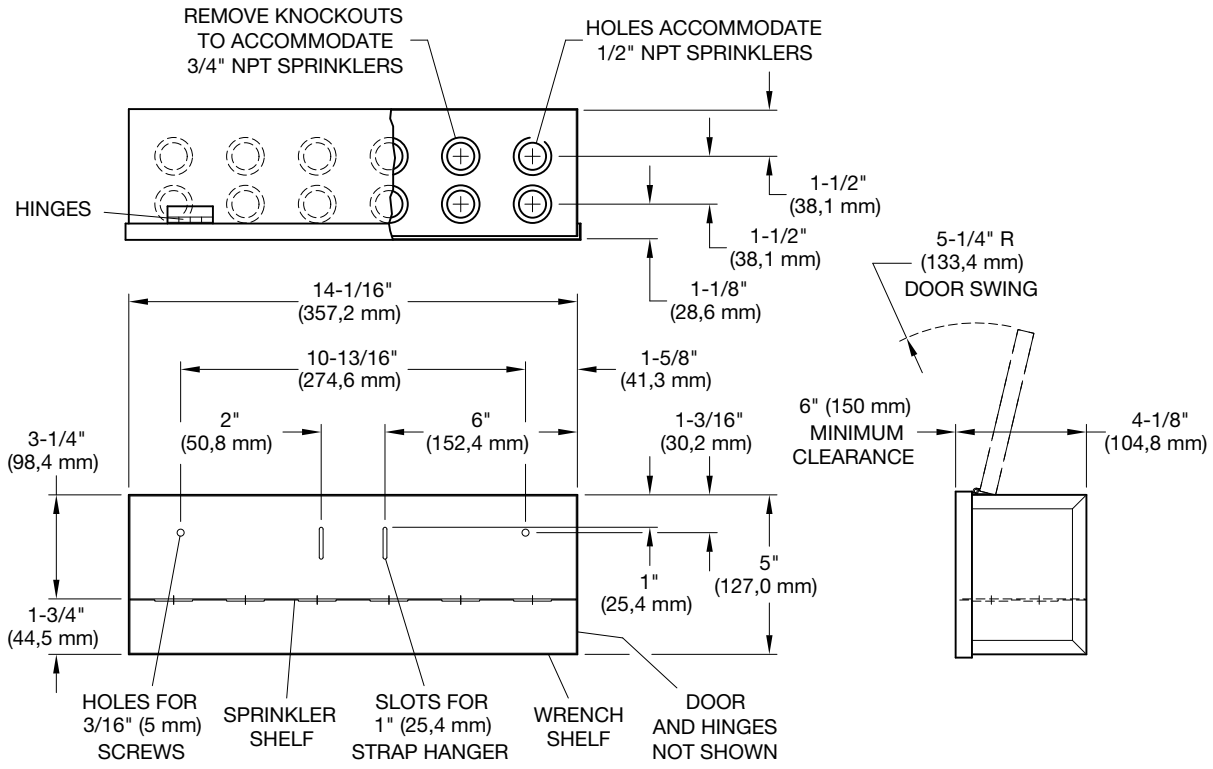


FIGURE 3
12 SPRINKLER CABINET

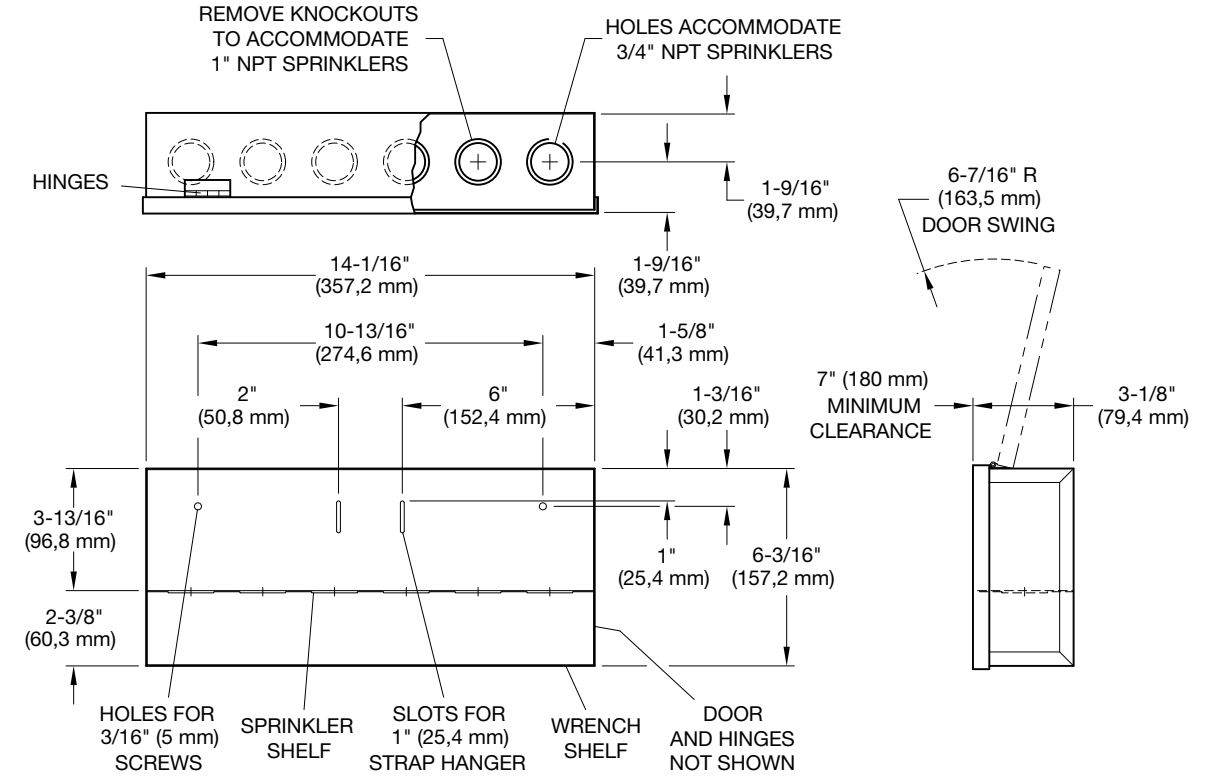


FIGURE 4
6 ESFR SPRINKLER CABINET

Installation

Sprinkler Cabinets are designed with two 3/16 Inch (4,7 mm) diameter holes for wall mounting or direct attachment to the system riser with a strap-type hanger. The Sprinkler Cabinet should be installed at or near the system control valve and must be stocked with an adequate supply of spare sprinklers and a sprinkler wrench.

The stock of spare sprinklers should include sprinklers of each type and temperature rating as are installed in the sprinkler system, in the following quantities:

Sprinklers In System	Spare Sprinklers Required
Under 300	6
300-1000	12
Over 1000	24

The 3, 6, and 12 Sprinkler Cabinets are designed to accept both 1/2 & 3/4 Inch NPT threaded sprinklers, whereas the 6 ESFR Sprinkler Cabinets are designed to accept both 3/4 & 1 Inch NPT threaded sprinklers. As necessary, insert a screwdriver blade from the front top of the shelf and under the near bottom part of the knockout annular ring. Press the screwdriver handle down to remove the knockout ring.

Care and Maintenance

The Sprinkler Cabinet, wrench, and stock of spare sprinklers should be inspected at least quarterly. The following items should be checked:

- The Sprinkler Cabinet should be readily accessible, and not exposed to a corrosive atmosphere or temperatures in excess of 100°F (38°C).
- The stock of spare sprinklers should include an adequate number of each type and temperature rating.
- The stock of sprinklers must be in good condition.
- A sprinkler wrench of the appropriate type must be included in the Sprinkler Cabinet.

Limited Warranty

Products manufactured by Tyco Fire & Building Products (TFBP) are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by TFBP. No warranty is given for products or components manufactured by companies not affiliated by ownership with TFBP or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by TFBP to be defective shall be either repaired or replaced, at TFBP's sole option. TFBP neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. TFBP shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

In no event shall TFBP be liable, in contract, tort, strict liability or under any other legal theory, for incidental, indirect, special or consequential damages, including but not limited to labor charges, regardless of whether TFBP was informed about the possibility of such damages, and in no event shall TFBP's liability exceed an amount equal to the sales price.

The foregoing warranty is made in lieu of any and all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

This limited warranty sets forth the exclusive remedy for claims based on failure of or defect in products, materials or components, whether the claim is made in contract, tort, strict liability or any other legal theory.

This warranty will apply to the full extent permitted by law. The invalidity, in whole or part, of any portion of this warranty will not affect the remainder.

Ordering Procedure

When placing an order, indicate the full product name. Contact your local distributor for availability.

Sprinkler Cabinet:
Specify: (Description), P/N (specify).

3 Sprinkler Cabinet. . . . . P/N 1177
6 Sprinkler Cabinet. . . . . P/N 1119
12 Sprinkler Cabinet. . . . . P/N 1124
6 ESFR Sprinkler Cabinet . . . . . P/N 1111

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TECHNICAL DATA

SPRINKLER GUARDS

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The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION

The Viking Sprinkler Guard is a hard-wire cage designed to encase the sprinkler and protect it from mechanical damage. It is recommended for areas where the sprinkler is installed at a low elevation and/or near areas of high human or mechanical activity.

The Model D-1 Sprinkler Guard is for use with Viking standard and large orifice, standard and quick response upright and pendent frame style sprinklers.

The Dry Pendent Sprinkler Guard is for use with Viking standard and large orifice, standard and quick response dry upright, dry vertical sidewall, and dry pendent sprinklers.

2. LISTINGS AND APPROVALS

A. Model D-1 Sprinkler Guard:

cULus Listed: Category VFJV

FM Approved: Class 2091

cULus Listed and/or FM Approved for use with standard and large orifice, standard and quick response upright and pendent frame style sprinklers, including the following: VK001, VK003, VK100, VK102, VK108, VK110, VK122, VK124, VK130, VK132, VK200, VK202, VK204, VK206, VK300, VK301, VK302, VK303, VK350, VK352, VK377, and VK536.

B. Dry Sprinkler Guard: No Listings or Approvals

3. TECHNICAL DATA

Specifications:

A. Model D-1 Sprinkler Guard

Dimensions: 3-1/8" (79 mm) diameter, 3-1/8" (79 mm) high.

B. Dry Sprinkler Guard:

Dimensions: 2" (51 mm) diameter, 2-1/8" (54 mm) high.

Viking Technical Data may be found on The Viking Corporation's Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

Material Standards:

A. Model D-1 Sprinkler Guard:

Guard: Bright Basic Steel UNS-G10100
Guard Finish: Clear Chromate over Zinc Plating
Screws: Two Self-Tapping 6-32 x ½" (Combination Head): Steel
Screw Finish: Zinc Plated
Stainless Steel Model D-1 Sprinkler Guard:
Guard: T302/T304 Electro-Polished Stainless Steel
Screws: Two 6-32 x ½" (Combination Head): Stainless Steel UNS-S41000

B. Dry Sprinkler Guard:

Guard and Ring: Bright Basic Steel UNS-G10100
Finish: Clear Chromate over Zinc Plating

Ordering Information: (Also refer to the current Viking price list.)

A. Model D-1 Sprinkler Guard:

The Model D-1 Sprinkler Guard may be ordered separately or factory installed on Viking upright and pendent standard or large orifice, standard or quick response frame style sprinklers.

NOTICE **The Model D-1 Sprinkler Guard is NOT designed to be used on sidewall sprinklers, or sprinklers installed in recessed escutcheons.**

To order the Model D-1 Sprinkler Guard separately (Figure 1 - Top):

1. Order Viking Part No. 10325 or
2. Order Viking Part No. 12198 (Stainless Steel)

To order the Model D-1 Sprinkler Guard factory installed:

1. Refer to the Viking Price Book to select the appropriate base part number (plus appropriate suffixes for temperature and finish) for the sprinkler used.



Model D-1 Sprinkler Guard
Order Sprinkler Guard Separately or Factory Installed
(See Ordering Instructions)



Model D-1 Sprinkler Guard on Upright and Pendent Frame-Style Sprinklers*



*The standard response sprinklers with 5 mm glass bulb shown above are representative only. The Model D-1 Guard may be used with standard and large orifice, upright or pendent standard response sprinklers with 5 mm glass bulbs; standard response fusible link sprinklers; and quick response sprinklers with 3 mm glass bulbs and QR fusible element sprinklers VK301 and VK303.

Figure 1

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

2. To order the Model D-1 Sprinkler Guard factory installed on the sprinkler, add the suffix "G".

B. To order the Viking Dry Sprinkler Guard (Figure 2 - Top): Order Viking Part No. 08954.

NOTICE **The Dry Sprinkler Guard is NOT Listed or Approved.**

Accessories: (Also refer to the "Sprinkler Accessories" section of the Viking data book.)

Sprinkler Wrenches:

For frame style sprinklers equipped with Model D-1 Sprinkler Guard, use Wrench Part No. 10896W/B (available since 2000) or 05000CW/B (no longer available). For ELO sprinklers use Wrench Part No. 05118CW/B.

Model E-1 Water Shield for frame style upright sprinklers equipped with Model D-1 Sprinkler Guards: Part No. 10326 (see form F_012498).

Model F-1 Water Shield for frame style pendent sprinklers equipped with Model D-1 Sprinkler Guards (see form F_012498):

- For use on ½" NPT Sprinklers, order Part No. 10323
- For use on 3/4" NPT Sprinklers (standard and large orifice only, NOT ELO), order Part No. 10324



Dry Sprinkler Guard
(Order sprinkler guard separately from sprinklers.)



The standard response dry pendent sprinkler with 5 mm glass bulb shown above is representative only. The Dry Sprinkler Guard may be used with Viking standard or quick response dry upright, dry vertical sidewall, and dry pendent (including adjustable recessed) sprinklers.

Figure 2

4. INSTALLATION

A. Installing the Model D-1 Sprinkler Guard: Model D-1 Sprinkler Guards can be retrofitted onto sprinklers that have already been installed on the system. However, it is recommended to install the guard onto the sprinkler prior to installing the sprinkler on the system and prior to applying any pipe-joint compound or tape to the external threads of the sprinkler. Consider ordering the guard factory installed on the sprinkler used.

a. Loosen the screws in the brackets at the base of the sprinkler guard.
b. Spread and hold the two bracket halves (at the base of the sprinkler guard) apart just enough to place the guard over the deflector and wrench boss of the sprinkler.
c. With the sprinkler inside the sprinkler guard, position the guard so the two halves of the bracket grip the sprinkler just below the wrench boss, but above the threads.

NOTICE **Orient the sprinkler guard so the screw openings in the base of the guard are located at the ends of the sprinkler wrench boss** (where the sprinkler frame arms contact the wrench boss). See Figure 1.

d. Thread both screws into the openings provided in the opposite bracket half and tighten to secure the base of the guard to the sprinkler.
e. Apply a small amount of pipe-joint compound or tape to the external threads only, taking care not to allow a build-up of compound in the sprinkler orifice.
f. Install the sprinkler on the piping using the special sprinkler wrench. DO NOT use the guard to start or thread the sprinkler into the fitting.

B. Installing the Dry Sprinkler Guard: Dry sprinklers must be installed on the system prior to installing the guard onto the dry sprinklers. Note: When installing the Dry Sprinkler Guard on recessed Dry Pendent or recessed Vertical Dry Sidewall Sprinklers, the Viking Recessed Escutcheon Cup must be removed and the sprinkler centered in a minimum 2-1/8" (54 mm) diameter hole prior to installation of the Dry Sprinkler Guard.

a. Remove the retaining ring from the Dry Sprinkler Guard.
b. Spread and hold the two "C" shaped halves of the bracket (at the base of the guard) apart just enough to place the guard over the deflector and wrench boss of the sprinkler.
c. With the sprinkler inside the guard, position the guard so the "C" shaped bracket halves of the guard grip the sprinkler in the slot provided just below the wrench boss.

NOTICE **Orient the sprinkler guard so two of the four guard wires align with the frame arms of the sprinkler.** See Figure 2.

d. Push the retaining ring over the guard toward the base of the sprinkler until the ring snaps firmly into the depression provided on each of the four wire members of the guard.
e. For recessed dry pendent or recessed vertical dry sidewall sprinklers, re-install the Viking recessed escutcheon cup.

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NOTICE

The Model D-1 Sprinkler Guard is NOT designed to be used on sidewall sprinklers, or sprinklers installed in recessed escutcheons.

The Model D-1 Sprinkler Guard is cULus Listed and/or FM Approved for use with standard and large orifice, standard and quick response upright and pendent frame style sprinklers, including the following: VK001, VK003, VK100, VK102, VK108, VK110, VK122, VK124, VK130, VK132, VK200, VK202, VK204, VK206, VK300, VK301, VK302, VK303, VK350, VK352, VK377, and VK536.

Model D-1 Sprinkler Guards can be retrofitted onto sprinklers that have already been installed on the system. However, it is recommended to install the guard onto the sprinkler prior to installing the sprinkler on the system and prior to applying any pipe-joint compound or tape to the external threads of the sprinkler. Consider ordering the guard factory installed on the sprinkler used.

⚠WARNING Viking products are manufactured and tested to meet the rigid requirements of the approving agency. The sprinklers are designed to be installed in accordance with recognized installation standards. Deviation from the standards or any alteration to the sprinkler after it leaves the factory including, but not limited to: painting, plating, coating, or modification, may render the sprinkler inoperative and will nullify the approval and any guarantee made by The Viking Corporation.

The Dry Sprinkler Guard is NOT Listed or Approved.

NOTICE **Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to the appropriate sprinkler data page. Viking sprinklers are designed to be installed in accordance with the latest edition of Viking technical data, the latest standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards whenever applicable. The use of certain types of sprinklers may be limited due to occupancy and hazard. Refer to the Authority Having Jurisdiction prior to installation.**

5. OPERATION

Refer to the sprinkler technical data page for the sprinkler model used. The Sprinkler Guard is a hard-wire cage designed to encase the sprinkler and protect it from mechanical damage.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

Viking sprinklers and sprinkler guards are available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

VIKING®	TECHNICAL DATA	STANDARD/QUICK RESPONSE EXTENDED COVERAGE UPRIGHT SPRINKLER VK532 (K11.2)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION



Viking EC/QREC Upright Sprinkler VK532 is a thermosensitive spray sprinkler available in several different finishes and temperature ratings to meet varying design requirements. The extra-large orifice produces the flows required to meet Light and Ordinary Hazard density requirements at lower pressures than standard orifice or large orifice sprinklers. The glass bulb operating element and special deflector characteristics meet the challenges of quick response extended coverage standards. Upright Sprinkler VK532 is cULus Listed as standard and quick response and FM Approved as quick response. The special Polyester and Electroless Nickel PTFE (ENT) coatings can be used in decorative applications where colors are desired. In addition, ENT coating has been investigated for installation in corrosive atmospheres. See Approval Charts.

2. LISTINGS AND APPROVALS

cULus Listed: Category VNIV

FM Approved: Class 2022

Refer to Approval Chart 1 and Design Criteria for cULus Listing requirements, and refer to Approval Chart 2 and Design Criteria for FM Approval requirements that must be followed.

3. TECHNICAL DATA

Specifications:

Minimum Operating Pressure: Refer to the Approval Charts.
Maximum Working Pressure: 175 psi (12 Bar). Factory tested hydrostatically to 500 psi (34.5 bar).
Factory tested hydrostatically to 500 psi (34.5 bar).
Thread size: 3/4" (20 mm) NPT
Nominal K-Factor: 11.2 U.S. (161.3 metric†)

† Metric K-factor measurement shown is in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

Glass-bulb fluid temperature rated to -65 °F (-55 °C)
Overall Length: 2-5/16 (59 mm)

Material Standards:

Sprinkler Frame: Brass UNS-C84400
Deflector: Copper UNS-C19500
Bulb: Glass, nominal 3 mm diameter
Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with Teflon Tape
Screw: Brass UNS-C36000
Pip Cap and Insert Assembly: Copper UNS-C11000 and Stainless Steel UNS-S30400
For Polyester Coated Sprinklers: Belleville Spring-Exposed
For ENT Coated Sprinkler: Belleville Spring-Exposed, Screw and Pipcap-ENT plated.

Viking Technical Data may be found on The Viking Corporation's Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

Ordering Information: (Also refer to the current Viking price list.)

Order Viking EC/QREC Upright Sprinkler VK532 by first adding the appropriate suffix for the sprinkler finish and then the appropriate suffix for the temperature rating to the sprinkler base part number.
Finish Suffix: Brass = A, Chrome = F, White Polyester = M-/W, Black Polyester = M-/B, and ENT = JN
Temperature Suffix: 135 °F (57 °C) = A, 155 °F (68 °C) = B, 175 °F (79 °C) = D, 200 °F (93 °C) = E, and 286 °F (141 °C) = G
For example, sprinkler VK532 with a Brass finish and a 155 °F (68 °C) temperature rating = Part No. 08687AB

Available Finishes And Temperature Ratings:

Refer to Table 1.

Accessories: (Also refer to the "Sprinkler Accessories" section of the Viking data book.)

Sprinkler Wrenches:

A. Standard Wrench: Part No. 05118CW/B (available since 1981)
B. Wrench for recessed pendent sprinkler: Part No. 11663W/B** (available since 2001)
**A ½" ratchet is required (not available from Viking).

VIKING®	TECHNICAL DATA	STANDARD/QUICK RESPONSE EXTENDED COVERAGE UPRIGHT SPRINKLER VK532 (K11.2)

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Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Sprinkler Cabinets:

A. Six-head capacity: Part No. 01724A (available since 1971)
B. Twelve-head capacity: Part No. 01725A (available since 1971)

4. INSTALLATION

Refer to appropriate NFPA Installation Standards.

5. OPERATION

During fire conditions, the heat-sensitive liquid in the glass bulb expands, causing the glass to shatter, releasing the pip cap and sealing spring assembly. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

Viking Sprinkler VK532 is available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

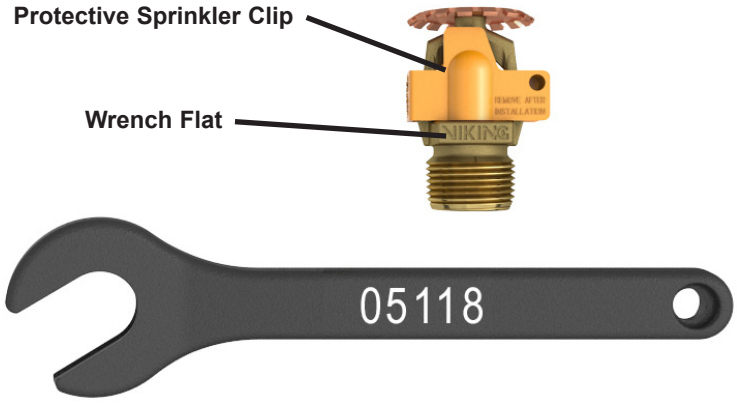


Figure 1:
Standard Sprinkler Wrench 05118CW/B

VIKING®	TECHNICAL DATA	STANDARD/QUICK RESPONSE EXTENDED COVERAGE UPRIGHT SPRINKLER VK532 (K11.2)

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TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating[1]	Maximum Ambient Ceiling Temperature[2]	Bulb Color
Ordinary	135 °F (57 °C)	100 °F (38 °C)	Orange
Ordinary	155 °F (68 °C)	100 °F (38 °C)	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	Yellow
Intermediate	200 °F (93 °C)	150 °F (65 °C)	Green
High	286 °F (141 °C)	225 °F (107 °C)	Blue

Sprinkler Finishes: Brass, Chrome, White Polyester[3], Black Polyester[3], and ENT

Corrosion-Resistant Coatings[4]: ENT

Footnotes

[1] The sprinkler temperature rating is stamped on the deflector.

[2] Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

[3] For automatic sprinklers, the coatings indicated are applied to the exposed exterior surfaces only. Note that the spring is exposed on sprinklers with Polyester.

[4] The corrosion-resistant coatings have passed the standard corrosion test required by the approving agencies indicated in the Approval Chart. These tests cannot and do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. For ENT sprinklers, all exposed surfaces and the waterway are coated, but note that the spring is exposed.

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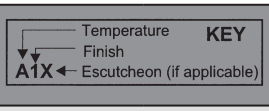
TECHNICAL DATA

STANDARD/QUICK RESPONSE EXTENDED COVERAGE UPRIGHT SPRINKLER VK532 (K11.2)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
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Approval Chart 1 (UL)

SR/QR EC Upright Sprinkler VK532



Sprinkler Base Part Number[1]	SIN	NPT Thread Size		Nominal K-Factor		Maximum Water Working Pressure	Overall Length	
		Inches	mm	U.S.	metric[2]		Inches	mm
08687 Upright	VK532	3/4	20	11.2	161.3	175 psi (12 Bar)	2-5/16	59

Max. Sprinkler Spacing (L x W[7])	Maximum Area per Sprinkler	Minimum Water Supply Requirements[5]			Listings and Approvals[3] (Refer also to UL Design Criteria)
		Light Hazard	Ordinary Hazard Group I	Ordinary Hazard Group II	
		Flow / Pressure	Flow / Pressure	Flow / Pressure	cULus[4]
Standard Response					
16 ft. x 16 ft. (4.9 m x 4.9 m)	256 ft² (23.8 m²)	--	38 gpm @ 11.5 psi (143.9 L/min @ .79 Bar)	51 gpm @ 20.7 psi (193.1 L/min @ 1.43 Bar)	C1, C2
18 ft. x 18 ft. (5.5 m x 5.5 m)	324 ft² (30.1 m²)	--	49 gpm @ 19.1 psi (185.5 L/min @ 1.32 Bar)	65 gpm @ 33.7 psi (246.1 L/min @ 2.32 Bar)	C1, C2
20 ft. x 20 ft. (6.1 m x 6.1 m)	400 ft² (37.2 m²)	--	60 gpm @ 28.7 psi (227.1 L/min @ 1.98 Bar)	80 gpm @ 51.0 psi (302.8 L/min @ 3.52 Bar)	C1, C2
Quick Response					
12 ft. x 12 ft. (3.7 m x 3.7 m)	144 ft² (13.4 m²)	--	30 gpm @ 7.2 psi (113.6 L/min @ .50 Bar)	39 gpm @ 12.1 psi (147.7 L/min @ .84 Bar)	D1, D2
14 ft. x 14 ft. (4.3 m x 4.3 m)	196 ft² (18.2 m²)	--	30 gpm @ 7.2 psi (113.6 L/min @ .50 Bar)	39 gpm @ 12.1 psi (147.7 L/min @ .84 Bar)	D1, D2
16 ft. x 16 ft. (4.9 m x 4.9 m)	256 ft² (23.8 m²)	30 gpm @ 7.2 psi (113.6 L/min @ .50 Bar)	--	--	B1, E2
18 ft. x 18 ft. (5.5 m x 5.5 m)	324 ft² (30.1 m²)	33 gpm @ 8.7 psi (124.9 L/min @ .60 Bar)	--	--	B1, E2
20 ft. x 20 ft. (6.1 m x 6.1 m)	400 ft² (37.2 m²)	40 gpm @ 12.8 psi (151.4 L/min @ .88 Bar)	--	--	A1, F2

Approved Temperature Ratings

A - 135 °F (57 °C) and 175 °F (79 °C)
B - 135 °F (57 °C), 155 °F (68 °C), and 175 °F (79 °C)
C - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141 °C)
D - 155 °F (68 °C)
E - 155 °F (68 °C), and 175 °F (79 °C)
F - 175 °F (79 °C)

Approved Finishes

1 - Brass, Chrome, White Polyester, and Black Polyester
2 - ENT[6]

Footnotes

[1] Part number shown is the base part number. For complete part number, refer to current Viking price list schedule.

[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

[3] This chart shows listings and approvals available at time of printing. Check with the manufacturer for any additional approvals.

[4] cULus Listed for use in the U.S. and Canada.

[5] To determine "Minimum Water Supply Requirement" for areas of coverage where length and width of actual sprinkler spacing are not equal, select the "Maximum Sprinkler Spacing" from the chart that is equal to or greater than the larger of the actual spacing (length or width) dimensions used. Example: When using 10'-6" x 13'-0" sprinkler spacing, provide the "Minimum Water Supply Requirement" listed in the chart for 14'-0" x 14'-0" spacing. For areas of coverage smaller than shown, use the "Minimum Water Supply Requirement" in the appropriate hazard group for the next larger area listed. The distance from sprinklers to walls shall not exceed one-half the "Maximum Sprinkler Spacing" listed for the "Minimum Water Supply Requirement" used.

[6] cULus Listed as corrosion-resistant.

VIKING®	TECHNICAL DATA	STANDARD/QUICK RESPONSE EXTENDED COVERAGE UPRIGHT SPRINKLER VK532 (K11.2)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

DESIGN CRITERIA - UL

(Also refer to Approval Chart 1.)

cULus Listing Requirements:

EC-ELO Upright Sprinkler VK532 is cULus Listed as indicated in Approval Chart 1 for installation in accordance with the latest edition of NFPA 13 for extended coverage upright sprinklers as indicated below:

- The minimum water supplies and maximum areas of coverage shown in Approval Chart 1 are designed to provide the following design densities: 0.10 gpm/ft² (4.1 mm/min) for Light Hazard densities; 0.15 gpm/ft² (6.1 mm/min) for Ordinary-Hazard Group I densities; 0.2 gpm/ft.² (8.1 mm/min) for Ordinary-Hazard Group II densities.
- The sprinkler installation rules contained in NFPA 13 for extended coverage upright and pendent spray sprinklers must be followed.
- Viking EC-ELO Upright Sprinklers are cULus Listed for use in unobstructed construction, and noncombustible obstructed construction consisting of solid steel and/or concrete beams as defined in the latest edition of NFPA 13.
- Ceiling slope not to exceed 2/12 (9.5°).

Also, Viking ECOH-ELO Upright Sprinkler VK532 is specifically cULus Listed for Ordinary Hazard Occupancies:

- For non-combustible obstructed construction within trusses or bar joists having non-combustible web members greater than 1" (25.4 mm) when applying the 4 times obstruction criteria rule as defined in NFPA 13 under "Obstructions to Sprinkler Discharge Pattern Development".
- For installation under concrete tees when installed as follows:
  1. The stems of the concrete tee construction must be spaced between 3 ft (0.9 m) and 7 ft-6 in (2.3 m) on center. The depth of the concrete tees must not exceed 30 in (762 mm). The maximum permitted concrete tee length is 32 ft (9.8 m). However, where the concrete tee length exceeds 32 ft (9.8 m), non-combustible baffles, equal in height to the depth of the tees, can be installed so that the space between the tees does not exceed 32 ft (9.8 m).
  2. The sprinkler deflector is to be located in a horizontal plane at or above 1" (25.4 mm) below the bottom of the concrete tee stems.
  3. When the sprinkler deflector is located higher than a horizontal plane 1" (25.4 mm) beneath the bottom of the concrete tee stems, the obstruction to sprinkler discharge criteria requirements of NFPA 13 for extended coverage upright sprinklers applies.

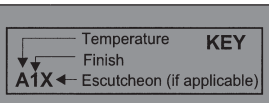
IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to pages EC1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

VIKING®	TECHNICAL DATA	STANDARD/QUICK RESPONSE EXTENDED COVERAGE UPRIGHT SPRINKLER VK532 (K11.2)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Approval Chart 2 (FM)

Quick Response Extended Coverage ELO Upright Sprinkler VK532
For HC-1, HC-2, and HC-3 Occupancies
Maximum 175 PSI (12 Bar) WWP



Maximum Sprinkler Spacing (L x W[2])	Maximum Area per Sprinkler	Refer to Design Criteria below.	FM Approval[1] Upright Sprinkler VK532
16 ft. x 16 ft. (4.9 m x 4.9 m)	256 ft² (23.8 m²)	NOTE: FM installation guidelines may differ from cULus and/or NFPA criteria. Refer to the latest applicable FM Loss Prevention Data Sheets (including 2-0 and 3-26).	A1
18 ft. x 18 ft. (5.5 m x 5.5 m)	324 ft² (30.1 m²)		A1
20 ft. x 20 ft. (6.1 m x 6.1 m)	400 ft² (37.2 m²)		A1

Approved Temperature Ratings	Approved Finishes
A - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141 °C)	1 - Brass, Chrome, White Polyester, Black Polyester, ENT[3]

Footnotes

[1] This chart shows the FM Approvals available at time of printing. Check with the manufacturer for any additional approvals.

[2] To determine "Minimum Water Supply Requirement" for areas of coverage where length and width of actual sprinkler spacing are not equal, select the "Maximum Sprinkler Spacing" from the chart that is equal to or greater than the larger of the actual spacing (length or width) dimensions used. Example: When using 10'-6" x 13'-0" sprinkler spacing, provide the "Minimum Water Supply Requirement" listed in the chart for 14'-0" x 14'-0" spacing. For areas of coverage smaller than shown, use the "Minimum Water Supply Requirement" in the appropriate hazard group for the next larger area listed. The distance from sprinklers to walls shall not exceed one-half the "Maximum Sprinkler Spacing" listed for the "Minimum Water Supply Requirement" used.

[3] FM Approved as corrosion-resistant.

DESIGN CRITERIA - FM

(Also refer to Approval Chart 2 above.)

FM Approval Requirements:

Sprinkler VK532 is FM Approved as a quick response **Non-Storage** extended coverage upright sprinkler as indicated in the FM Approval Guide for use in occupancy hazard classifications HC-1, HC-2, and HC-3. For specific application and installation requirements, reference the latest applicable FM Loss Prevention Data Sheets (including Data Sheets 2-0 and 3-26). FM Global Loss Prevention Data Sheets contain guidelines relating to, but not limited to: minimum water supply requirements, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector distance below the ceiling.

NOTE: The FM installation guidelines may differ from cULus and/or NFPA criteria.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page EC1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

VIKING®	TECHNICAL DATA	STANDARD/QUICK RESPONSE EXTENDED COVERAGE PENDENT SPRINKLER VK534 (K11.2)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION



Viking EC/QREC Pendent Sprinkler VK534 is a thermosensitive spray sprinkler available in several different finishes and temperature ratings to meet varying design requirements. The extra-large orifice produces the flows required to meet Light and Ordinary Hazard density requirements at lower pressures than standard orifice or large orifice sprinklers. The glass bulb operating element and special deflector characteristics meet the challenges of quick response extended coverage standards. Pendent Sprinkler VK534 is cULus Listed as standard and quick response. The special Polyester and Electroless Nickel PTFE (ENT) coatings can be used in decorative applications where colors are desired. In addition, ENT coating has been investigated for installation in corrosive atmospheres. See Approval Charts.

2. LISTINGS AND APPROVALS

c(UL)us **cULus Listed:** Category VNIV
Refer to Approval Chart 1 and Design Criteria cULus Listing requirements.

3. TECHNICAL DATA

Specifications:
Minimum Operating Pressure: Refer to the Approval Charts.
Maximum Working Pressure: 175 psi (12 Bar). Factory tested hydrostatically to 500 psi (34.5 bar).
Factory tested hydrostatically to 500 psi (34.5 bar).
Thread size: 3/4" (20 mm) NPT
Nominal K-Factor: 11.2 U.S. (161.3 metric†)
† Metric K-factor measurement shown is in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.
Glass-bulb fluid temperature rated to -65 °F (-55 °C)
Overall Length: 2-3/8" (61 mm)

Material Standards:
Sprinkler Frame: Brass UNS-C84400
Deflector: Brass UNS-C26000
Bulb: Glass, nominal 3 mm diameter
Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with PTFE Tape
Screw: Brass UNS-C36000
Pip Cap and Insert Assembly: Copper UNS-C11000 and Stainless Steel UNS-S30400
For Polyester Coated Sprinklers: Belleville Spring-Exposed
For ENT Coated Sprinkler: Belleville Spring-Exposed, Screw and Pipcap-ENT plated.

Viking Technical Data may be found on The Viking Corporation's Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

Ordering Information: (Also refer to the current Viking price list.)
Order Viking EC/QREC Pendent Sprinkler VK534 by first adding the appropriate suffix for the sprinkler finish and then the appropriate suffix for the temperature rating to the sprinkler base part number.
Finish Suffix: Brass = A, Chrome = F, White Polyester = M-/W, Black Polyester = M-/B, and ENT = JN
Temperature Suffix: 135 °F (57 °C) = A, 155 °F (68 °C) = B, 175 °F (79 °C) = D, 200 °F (93 °C) = E, and 286 °F (141 °C) = G
For example, sprinkler VK534 with a Brass finish and a 155 °F (68 °C) temperature rating = Part No. 08340AB

Available Finishes And Temperature Ratings:
Refer to Table 1.

Accessories: (Also refer to the "Sprinkler Accessories" section of the Viking data book.)

Sprinkler Wrenches:
A. Standard Wrench: Part No. 05118CW/B (available since 1981)
B. Wrench for recessed pendent sprinkler: Part No. 11663W/B** (available since 2001)
**A ½" ratchet is required (not available from Viking).

Sprinkler Cabinets:
A. Six-head capacity: Part No. 01724A (available since 1971)
B. Twelve-head capacity: Part No. 01725A (available since 1971)

VIKING®	TECHNICAL DATA	STANDARD/QUICK RESPONSE EXTENDED COVERAGE PENDENT SPRINKLER VK534 (K11.2)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

4. INSTALLATION

Refer to appropriate NFPA Installation Standards.

5. OPERATION

During fire conditions, the heat-sensitive liquid in the glass bulb expands, causing the glass to shatter, releasing the pip cap and sealing spring assembly. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

Viking EC/QREC Pendent Sprinkler VK534 is available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

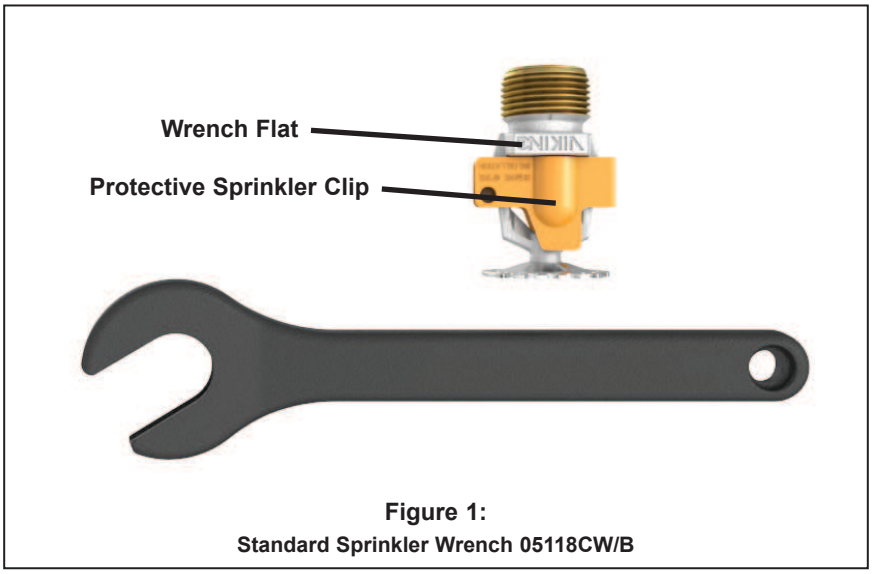


Figure 1:
Standard Sprinkler Wrench 05118CW/B

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The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
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TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating[1]	Maximum Ambient Ceiling Temperature[2]	Bulb Color
Ordinary	135 °F (57 °C)	100 °F (38 °C)	Orange
Ordinary	155 °F (68 °C)	100 °F (38 °C)	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	Yellow
Intermediate	200 °F (93 °C)	150 °F (65 °C)	Green
High	286 °F (141 °C)	225 °F (107 °C)	Blue

Sprinkler Finishes: Brass, Chrome, White Polyester[3], Black Polyester[3], and ENT

Corrosion-Resistant Coatings[4]: ENT

Footnotes

[1] The sprinkler temperature rating is stamped on the deflector.

[2] Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

[3] For automatic sprinklers, the coatings indicated are applied to the exposed exterior surfaces only. Note that the spring is exposed on sprinklers with Polyester coatings.

[4] The corrosion-resistant coatings have passed the standard corrosion test required by the approving agencies indicated in the Approval Chart. These tests cannot and do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. For ENT sprinklers, all exposed surfaces and the waterway are coated, but note that the spring is exposed.

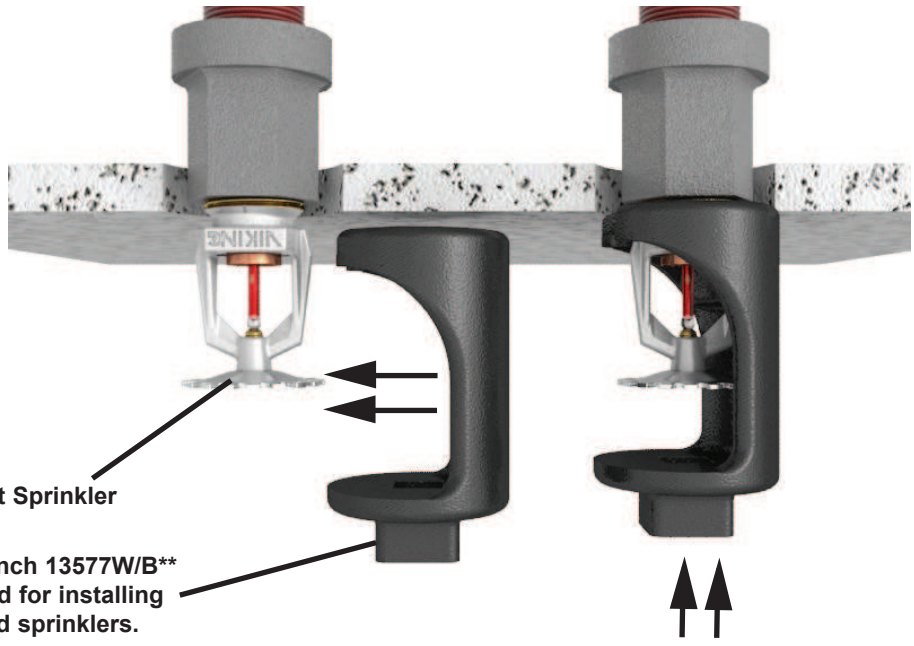


Figure 2: Wrench 11663W/B for Recessed Pendent Sprinkler VK534

VIKING®

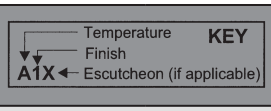
TECHNICAL DATA

STANDARD/QUICK RESPONSE EXTENDED COVERAGE PENDENT SPRINKLER VK534 (K11.2)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Approval Chart 1 (UL)

SR/QR EC Pendent Sprinkler VK534



Sprinkler Base Part Number[1]	SIN	NPT Thread Size		Nominal K-Factor		Maximum Water Working Pressure	Overall Length	
		Inches	mm	U.S.	metric[2]		Inches	mm
08340 Pendent	VK534	3/4	20	11.2	161.3	175 psi (12 Bar)	2-5/16	59

Max. Sprinkler Spacing (L x W[7])	Maximum Area per Sprinkler	Minimum Water Supply Requirements[5]			Listings and Approvals[3] (Refer also to UL Design Criteria)
		Light Hazard	Ordinary Hazard Group I	Ordinary Hazard Group II	
		Flow / Pressure	Flow / Pressure	Flow / Pressure	cULus[4]
Standard Response					
16 ft. x 16 ft. (4.9 m x 4.9 m)	256 ft² (23.8 m²)	--	38 gpm @ 11.5 psi (143.9 L/min @ .79 Bar)	51 gpm @ 20.7 psi (193.1 L/min @ 1.43 Bar)	C1X, D1Y, D2Z, C2W
18 ft. x 18 ft. (5.5 m x 5.5 m)	324 ft² (30.1 m²)	--	49 gpm @ 19.1 psi (185.5 L/min @ 1.32 Bar)	65 gpm @ 33.7 psi (246.1 L/min @ 2.32 Bar)	C1X, D1Y, D2Z, C2W
20 ft. x 20 ft. (6.1 m x 6.1 m)	400 ft² (37.2 m²)	--	60 gpm @ 28.7 psi (227.1 L/min @ 1.98 Bar)	80 gpm @ 51.0 psi (302.8 L/min @ 3.52 Bar)	C1X, D1Y, D2Z, C2W
Quick Response					
12 ft. x 12 ft. (3.7 m x 3.7 m)	144 ft² (13.4 m²)	--	30 gpm @ 7.2 psi (113.6 L/min @ .50 Bar)	39 gpm @ 12.1 psi (147.7 L/min @ .84 Bar)	E1Y, E2Z
14 ft. x 14 ft. (4.3 m x 4.3 m)	196 ft² (18.2 m²)	--	30 gpm @ 7.2 psi (113.6 L/min @ .50 Bar)	39 gpm @ 12.1 psi (147.7 L/min @ .84 Bar)	E1Y, E2Z
16 ft. x 16 ft. (4.9 m x 4.9 m)	256 ft² (23.8 m²)	30 gpm @ 7.2 psi (113.6 L/min @ .50 Bar)	--	--	B1Y, F2Z
18 ft. x 18 ft. (5.5 m x 5.5 m)	324 ft² (30.1 m²)	33 gpm @ 8.7 psi (124.9 L/min @ .60 Bar)	--	--	B1Y, F2Z
20 ft. x 20 ft. (6.1 m x 6.1 m)	400 ft² (37.2 m²)	40 gpm @ 12.8 psi (151.4 L/min @ .88 Bar)	--	--	A1Y, G2Z

Approved Temperature Ratings

A - 135 °F (57 °C) and 175 °F (79 °C)
B - 135 °F (57 °C), 155 °F (68 °C), and 175 °F (79 °C)
C - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141 °C)
D - 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)
E - 155 °F (68 °C)
F - 155 °F (68 °C), and 175 °F (79 °C)
G - 175 °F (79 °C)

Approved Finishes

1 - Brass, Chrome, White Polyester, and Black Polyester
2 - ENT[6]

Approved Escutcheons

W - Standard surface-mounted escutcheons only
X - Standard surface-mounted escutcheons or the Micro-fast® Model F-1 Adjustable Escutcheon
Y - Standard surface-mounted escutcheons or the Microfast® Model F-1 Adjustable Escutcheon, or recessed with the Micromatic® Model E-1, E-2, or E-3 Recessed Escutcheon
Z - Standard surface-mounted escutcheons or the Micromatic Model E-1 Recessed Escutcheon.

Footnotes

[1] Part number shown is the base part number. For complete part number, refer to current Viking price list schedule.

[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

[3] This chart shows listings and approvals available at time of printing. Check with the manufacturer for any additional approvals.

[4] cULus Listed for use in the U.S. and Canada.

[5] To determine "Minimum Water Supply Requirement" for areas of coverage where length and width of actual sprinkler spacing are not equal, select the "Maximum Sprinkler Spacing" from the chart that is equal to or greater than the larger of the actual spacing (length or width) dimensions used. Example: When using 10'-6" x 13'-0" sprinkler spacing, provide the "Minimum Water Supply Requirement" listed in the chart for 14'-0" x 14'-0" spacing. For areas of coverage smaller than shown, use the "Minimum Water Supply Requirement" in the appropriate hazard group for the next larger area listed. The distance from sprinklers to walls shall not exceed one-half the "Maximum Sprinkler Spacing" listed for the "Minimum Water Supply Requirement" used.

[6] cULus Listed as corrosion-resistant.

VIKING®	TECHNICAL DATA	STANDARD/QUICK RESPONSE EXTENDED COVERAGE PENDENT SPRINKLER VK534 (K11.2)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

DESIGN CRITERIA - UL

(Also refer to Approval Chart 1.)

cULus Listing Requirements:

EC-ELO Pendent Sprinkler VK534 is cULus Listed as indicated in Approval Chart 1 for installation in accordance with the latest edition of NFPA 13 for extended coverage pendent spray sprinklers as indicated below:

- The minimum water supplies and maximum areas of coverage shown in Approval Chart 1 are designed to provide the following design densities: 0.10 gpm/ft^2 (4.1 mm/min) for Light Hazard densities; 0.15 gpm/ft^2 (6.1 mm/min) for Ordinary-Hazard Group I densities; 0.2 gpm/ft.^{2} (8.1 mm/min) for Ordinary-Hazard Group II densities.
- The sprinkler installation rules contained in NFPA 13 for extended coverage pendent spray sprinklers must be followed.
- Viking EC-ELO Pendent Sprinklers are cULus Listed for use in unobstructed construction, and noncombustible obstructed construction consisting of solid steel and/or concrete beams as defined in the latest edition of NFPA 13.
- Ceiling slope not to exceed 2/12 (9.5°).

Also, Viking ECOH-ELO Pendent Sprinkler VK534 is specifically cULus Listed for Ordinary Hazard Occupancies:

- For non-combustible obstructed construction within trusses or bar joists having non-combustible web members greater than 1" (25.4 mm) when applying the 4 times obstruction criteria rule as defined in NFPA 13 under "Obstructions to Sprinkler Discharge Pattern Development".
- For installation under concrete tees when installed as follows:
  1. The stems of the concrete tee construction must be spaced between 3 ft (0.9 m) and 7 ft-6 in (2.3 m) on center. The depth of the concrete tees must not exceed 30 in (762 mm). The maximum permitted concrete tee length is 32 ft (9.8 m). However, where the concrete tee length exceeds 32 ft (9.8 m), non-combustible baffles, equal in height to the depth of the tees, can be installed so that the space between the tees does not exceed 32 ft (9.8 m).
  2. The sprinkler deflector is to be located in a horizontal plane at or above 1" (25.4 mm) below the bottom of the concrete tee stems.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to pages EC1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

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TECHNICAL DATA

STANDARD/QUICK RESPONSE EXTENDED COVERAGE PENDENT SPRINKLER VK534 (K11.2)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

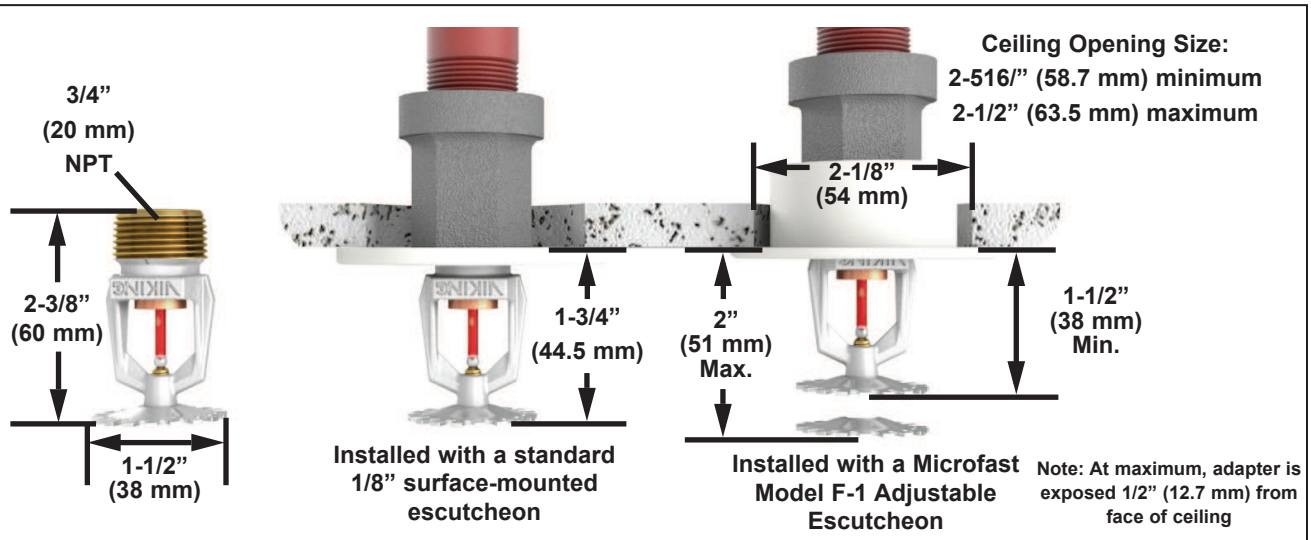


Figure 3: Sprinkler Dimensions with a Standard Escutcheon and the Model F-1 Adjustable Escutcheon

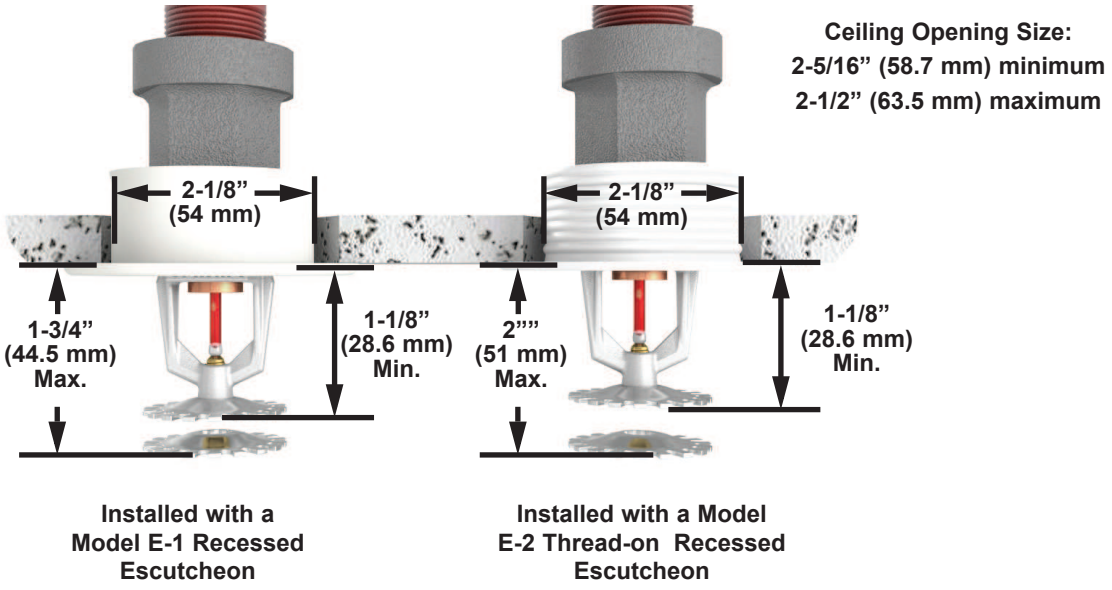


Figure 4: Sprinkler Dimensions with the Model E-1 and E-2 Recessed Escutcheons

TECHNICAL DATA

MIRAGE® QUICK RESPONSE EXTENDED COVERAGE CONCEALED PENDENT SPRINKLERS (VK632 AND VK634)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION

Viking Mirage® Quick Response Extended Coverage Concealed Pendent Sprinkler VK632 and VK634 are thermosensitive glass-bulb spray sprinkler designed for installation on concealed pipe systems where the appearance of a smooth ceiling is desired. The glass bulb operating element and special deflector characteristics meet the challenges of quick response extended coverage standards.

The sprinkler is pre-assembled with a threaded adapter for installation with a low-profile cover assembly that provides up to ½" (12.7 mm) of vertical adjustment. The two-piece design allows installation and testing of the sprinkler prior to installation of the cover plate. The "push-on", "thread-off" design of the concealed cover plate assembly allows easy installation of the cover plate after the system has been tested and the ceiling finish has been applied. The cover assembly can be removed and reinstalled, allowing temporary removal of ceiling panels without taking the sprinkler system out of service or removing the sprinkler.



For Light Hazard Occupancies Only

2. LISTINGS AND APPROVALS

c(UL)us **cULus Listed:** Category VNIV

Refer to the Approval Chart on page 92c and Design Criteria on page 92d for cULus Listing requirements that must be followed.

3. TECHNICAL DATA

Specifications:

Available since 2007.
Minimum Operating Pressure: 7 psi (0.5 bar)
Maximum Working Pressure: 175 psi (12 Bar).
Factory tested hydrostatically to 500 psi (34.5 bar)
Thread sizes: Sprinkler VK632: 1/2" (15 mm) NPT,
Sprinkler VK634: 3/4" (20 mm) NPT
Nominal K-Factors: Sprinkler VK632: 5.6 U.S. (80.6 metric*)
Sprinkler VK634: 8.0 U.S. (115.2 metric*)

Viking Technical Data may be found on The Viking Corporation's Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

* Metric K-factor measurement shown is in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

Glass-bulb fluid temperature rated to -65 °F (-55 °C)
Patents Pending

Material Standards:

Sprinkler Body: Brass UNS-C84400
Deflector: Copper UNS-C19500
Deflector Pins: Stainless Steel Alloy
Bulb: Glass, nominal 3 mm diameter
Pip Cap: Leaded Bronze UNS-C31400 or UNS-C31600, or Pip Cap and Insert Assembly: Copper UNS-C11000 and Stainless Steel UNS-S30400
Button: Brass UNS-C36000
Screws: 18-8 Stainless Steel
Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with PTFE Tape
Yoke: Phosphor Bronze UNS-C51000
Cover Adapter: Cold Rolled Steel UNS-G10080, Finish: Clear Chromate over Zinc Plating

Cover Assembly Materials:

Cover: Copper UNS-C11000
Base: Brass UNS-C26000 or UNS-C26800
Springs: Nickel Alloy
Solder: Eutectic

Ordering Information: (Also refer to the current Viking price list.)

VIKING®

TECHNICAL DATA

MIRAGE® QUICK RESPONSE EXTENDED COVERAGE CONCEALED PENDENT SPRINKLERS (VK632 AND VK634)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Viking Mirage® Quick Response Extended Coverage Concealed Pendent Sprinklers and Cover Plate Assemblies must be ordered separately:

Sprinkler: Base Part No. 14613A or 14535A

Specify sprinkler temperature rating by adding the appropriate suffix for the temperature rating to the base part number:

Temperature Suffix: 135 °F (57 °C) = A, 155 °F (68 °C) = B, 175 °F (79 °C) = D, 200 °F (93 °C) = E

For example, sprinkler VK634 with a 155 °F (68 °C) temperature rating = 14535AB.

Cover Plate Assembly: Base Part No. 13504 (2-3/4" diameter), Base Part No. 13642 (3-5/16" diameter), or Base Part No. 15394 (square cover plate, 3-5/16" diameter)

Specify finish and temperature rating of the cover plate assembly by adding the appropriate suffixes for the finish and the cover temperature rating to the base part number:

Finish Suffix: Polished Chrome = F, Brushed Chrome = F-/B, Bright Brass = B, Antique Brass = B-/A, Brushed Brass = B-/B, Brushed Copper = E-/B, Painted White = M-/W, Painted Ivory = M-/I, Painted Black = M-/B

Temperature Suffix: 135 °F (57 °C) = A , 165 °F (74 °C) = C

For example, cover 13504 with a Polished Chrome finish and a 165 °F (74 °C) temperature rating = 13504FC.

Note: Square cover plate 15394 cULus Listing is for the 135°F (57°C) temperature rated cover plate only. Refer to the Approval Chart.

Available Finishes And Temperature Ratings:

Refer to Table 1.

Accessories: (Also refer to the "Sprinkler Accessories" section of the Viking data book.)

Sprinkler Wrenches:**

A. Heavy Duty Wrench Part No. 14047W/B or

B. Head Cabinet Wrench Part No. 14031***

C. Optional Concealed Cover Plate Installer Tool Part No. 14412 for cover 13504, or Part No. 14867 for the large diameter cover (available since 2007)

**Requires a ½" ratchet (not available from Viking). ***Also optional for removal of the protective cap. Ideal for sprinkler cabinets.

Sprinkler Cabinet: Part No. 01731A (available since 1971)

4. INSTALLATION

Refer to appropriate NFPA Installation Standards.

5. OPERATION

During fire conditions, when the temperature around the sprinkler approaches its operating temperature, the cover plate detaches. Continued heating of the exposed sprinkler causes the heat-sensitive liquid in the glass bulb to expand and the bulb to shatter, releasing the yoke, pip-cap and sealing spring assembly. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

Viking Sprinklers VK632 and VK634 are available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

May 20, 2013 Sprinkler 92c

TECHNICAL DATA

MIRAGE® QUICK RESPONSE EXTENDED COVERAGE CONCEALED PENDENT SPRINKLERS (VK632 AND VK634)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating[1]	Maximum Ambient Ceiling Temperature[2]	Temperature Rating of Cover Assembly (Required)	Bulb Color
Ordinary	135 °F (57 °C)	100 °F (38 °C)	135 °F (57 °C)	Orange
Ordinary	155 °F (68 °C)	100 °F (38 °C)	135 °F (57 °C)	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	165 °F (74 °C)	Yellow
Intermediate	200 °F (93 °C)	150 °F (65 °C)	165 °F (74 °C)	Green

Cover Plate Finishes: Polished Chrome, Brushed Chrome, Bright Brass, Antique Brass, Brushed Brass, Brushed Copper, Painted White, Painted Ivory, and Painted Black

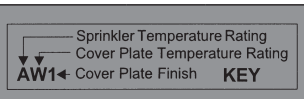
Footnotes

[1] The sprinkler temperature rating is stamped on the deflector.

[2] Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

Approval Chart

Mirage® QR Extended Coverage Concealed Pendent Sprinklers
For Light Hazard Occupancies Only.
Maximum 175 PSI (12 Bar) WWP



Sprinkler Base Part Number[1]	SIN	NPT Thread Size		Nominal K-Factor		Maximum Areas of Coverage[4]	Minimum Water Supply Requirements[4] Flow/Pressure	Listings and Approvals[3] (Refer also to Design Criteria on page 92d.)		
		Inches	mm	U.S.	metric[2]			cULus[5]	FM	NYC
Standard Orifice										
14613A	VK632	1/2	15	5.6	80.6	16' x 16' (4.9 m x 4.9 m)	26 gpm @ 21.6 psi (98.4 L/min @ 1.49 Bar)	AW1, BX1	--	See Footnote 6.
14613A	VK632	1/2	15	5.6	80.6	18' x 18' (5.5 m x 5.5 m)	33 gpm @ 34.7 psi (124.9 L/min @ 2.39 Bar)	AW1, BX1	--	See Footnote 6.
14613A	VK632	1/2	15	5.6	80.6	20' x 20' (6.1 m x 6.1 m)	40 gpm @ 51.0 psi (151.4 L/min @ 3.52 Bar)	CW1, DX1	--	See Footnote 6.
Large Orifice										
14535A	VK634	3/4	20	8.0	115.2	16' x 16' (4.9 m x 4.9 m)	26 gpm @ 10.6 psi (98.4 L/min @ 0.73 Bar)	AW1, BX1	--	See Footnote 6.
14535A	VK634	3/4	20	8.0	115.2	18' x 18' (5.5 m x 5.5 m)	33 gpm @ 17.0 psi (124.9 L/min @ 1.17 Bar)	AW1, BX1	--	See Footnote 6.
14535A	VK634	3/4	20	8.0	115.2	20' x 20' (6.1 m x 6.1 m)	40 gpm @ 25.0 psi (151.4 L/min @ 1.72 Bar)	CW1, DX1	--	See Footnote 6.

Sprinkler Temperature Ratings
A - 135 °F (57 °C) and 155 °F (68 °C)
B - 175 °F (79 °C) and 200 °F (93 °C)
C - 135 °F (57 °C)
D - 175 °F (79 °C)

Cover Plate Temperature Ratings[7]
W - 135 °F (57 °C) cover 13504[1], 13642[1] (large diameter), or 15394[1] (square cover plate)
X - 165 °F (74 °C) cover 13504[1], 13642[1] (large diameter)

Cover Plate Finishes[8]
1 - Polished Chrome, Brushed Chrome, Bright Brass, Antique Brass, Brushed Brass, Brushed Copper, Painted White, Painted Ivory, and Painted Black

Footnotes

[1] Part number shown is the base part number. For complete part number, refer to current Viking price list schedule.
[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.
[3] This chart shows the listings and approvals available at the time of printing. Other approvals may be in process. Check with the manufacturer for any additional approvals.
[4] For areas of coverage smaller than shown, use the "Minimum Water Supply Requirement" for the next larger area listed. Flows and pressures listed are per sprinkler.
[5] Listed by Underwriter's Laboratories, Inc. for use in the U.S. and Canada for Light Hazard occupancies with smooth, flat, horizontal ceilings only.
[6] Meets New York City requirements, effective July 1, 2008.
[7] The 135 °F (57 °C) cover has an orange label. The 165 °F (74 °C) cover has a white label.
[8] Painted finish consists of Polyester Baked Enamel. Other paint colors are available on request with the same listings as the standard paint colors. Listings and approvals apply for any paint manufacturer. Contact Viking for additional information.

NOTE: Custom colors are indicated on a label inside the cover assembly. Refer to Figure 1.

MIRAGE® QUICK RESPONSE EXTENDED COVERAGE CONCEALED PENDENT SPRINKLERS (VK632 AND VK634)

TECHNICAL DATA

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

DESIGN CRITERIA

(Also refer to the Approval Chart on page 92c.)

cULus Listing Requirements: Mirage® Quick Response Extended Coverage Concealed Pendent Sprinklers VK632 and VK634 are cULus Listed for installation in accordance with the latest edition of NFPA 13 for extended coverage pendent spray sprinklers:

- Limited to Light Hazard occupancies, with smooth, flat, horizontal ceilings only.
- Minimum spacing allowed is 8 ft. (2.4 m) unless baffles are installed in accordance with NFPA 13.
- Minimum distance from walls is 4 in. (102 mm).
- Maximum distance from walls shall be no more than one-half of the allowable distance between sprinklers. The distance shall be measured perpendicular to the wall.
- The sprinkler installation and obstruction rules contained in NFPA 13 for extended coverage pendent spray sprinklers must be followed.

NOTE: Concealed sprinklers must be installed in neutral or negative pressure plenums only.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to pages EC1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.



Identification of Custom Paint Color:
All custom color painted cover plates will have an identifying label affixed to the inside of the cover that indicates custom color and will have a representative sample (a paint dot) of the paint on the label.

Figure 1: Identification of Custom Paint Color for Concealed Covers

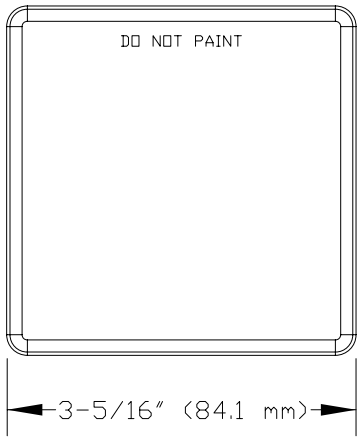


Figure 2: Square Cover Assembly 15394

MIRAGE® QUICK RESPONSE EXTENDED COVERAGE CONCEALED PENDENT SPRINKLERS (VK632 AND VK634)

TECHNICAL DATA

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

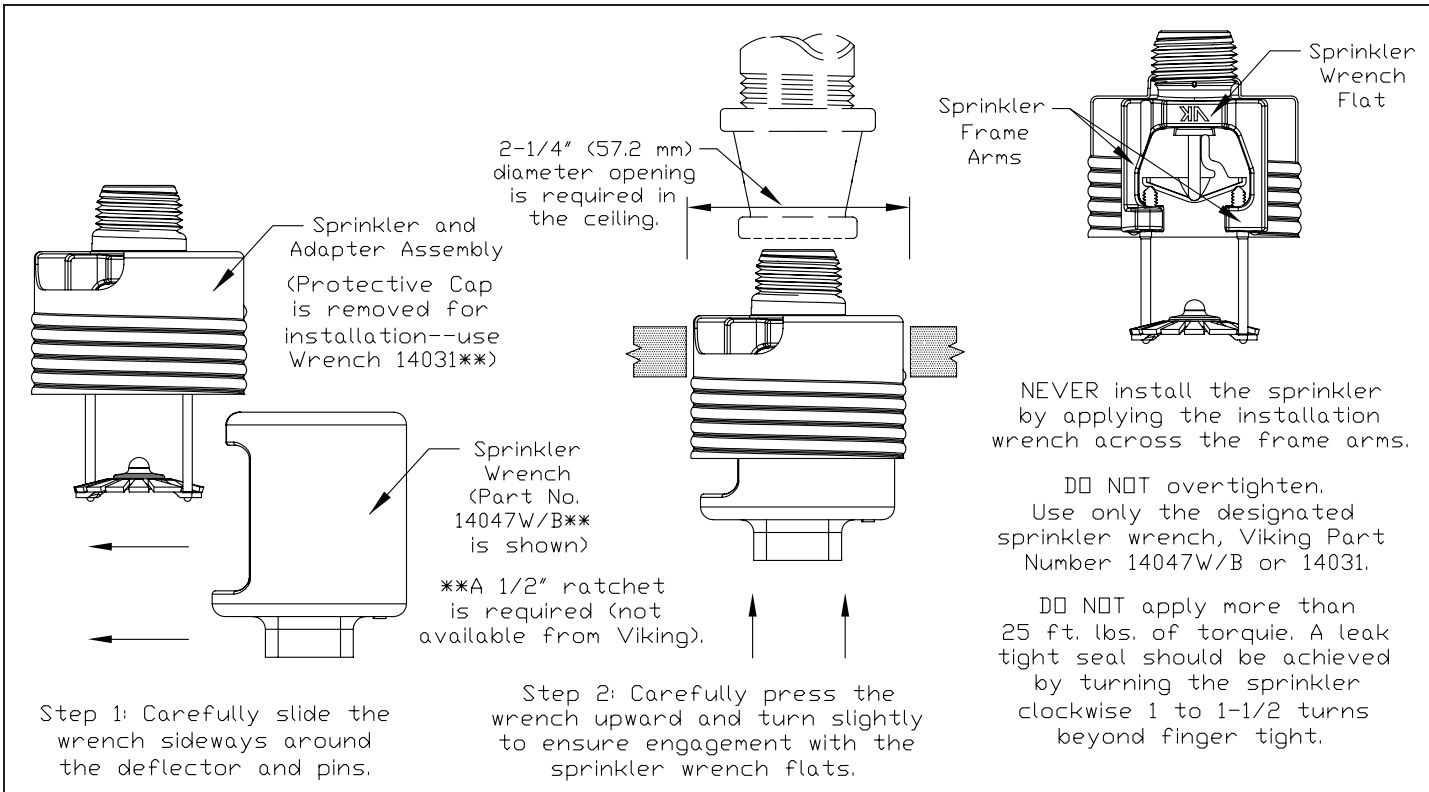


Figure 3: Sprinkler Installation and Correct Use of Wrenches (Sprinkler VK632 is Shown)

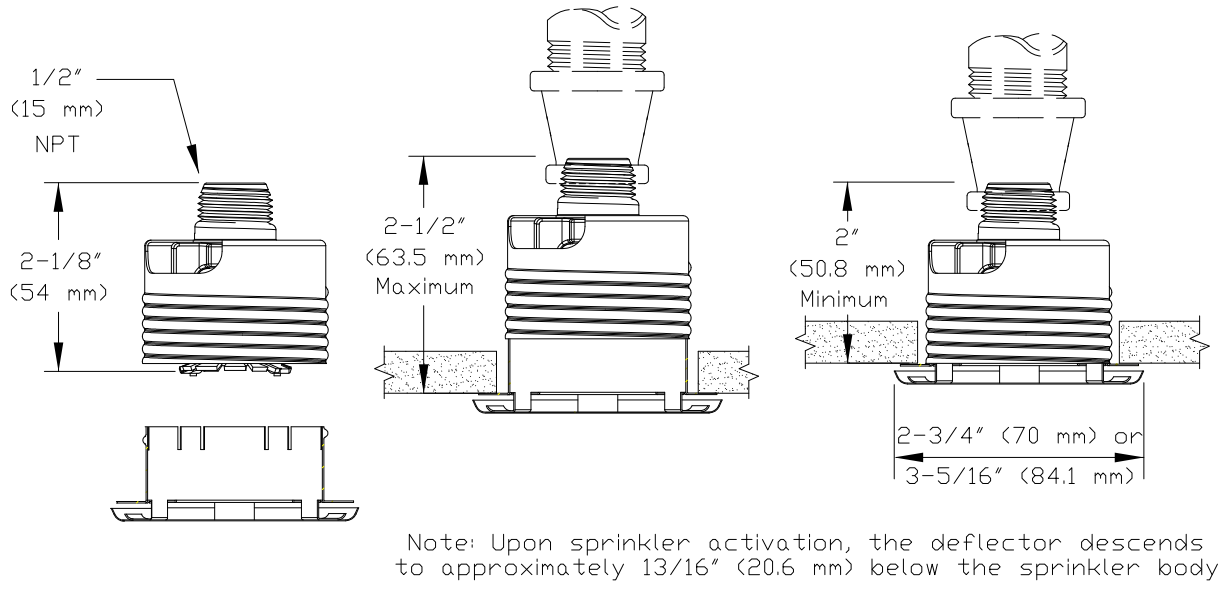


Figure 4: Sprinkler VK632 Dimensions and Cover Installation

MIRAGE® QUICK RESPONSE EXTENDED COVERAGE CONCEALED PENDENT SPRINKLERS (VK632 AND VK634)

TECHNICAL DATA

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

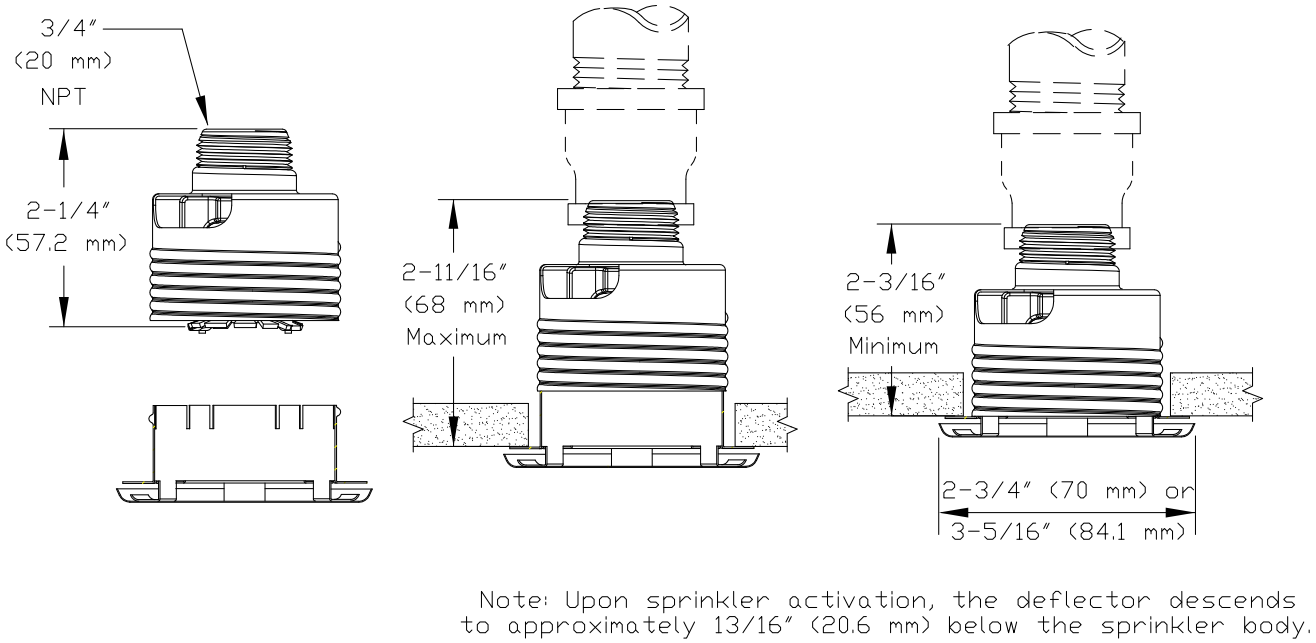


Figure 5: **Sprinkler VK634 Dimensions and Cover Installation**

Bulletin 051 Rev. B

Model G5-56 Dry (SIN RA5114) K5.6 (80 metric) Concealed Dry Pendent Sprinkler

UL Quick Response
FM Standard Response
½" (13mm) Cover plate Adjustment

Features

1. Flat cover plate with threaded attachment.
2. Solid or perforated cover plate available in chrome and white as Standard Finishes.
   Also available in a wide variety of Special Application Finishes.
3. Cover plates with gaskets are available to limit dust and air movement through the ceiling.
4. Available in Ordinary or Intermediate temperature rating.
5. Sprinkler available in lengths from 4¼ inches (108mm) to 48 inches (1219mm) in ¼-inch (6.35mm) increments (see Fig. 1).

Approvals & Listings

1. Listed by Underwriters Laboratories and Certified for Canada (cULus) as a Quick-response sprinkler for Light and Ordinary Hazard occupancies. UL Guide Number VNIV, Sprinklers, Automatic and Open.
2. FM Approved as a Standard-response sprinkler.

Patents

The Model G5-56 Dry is covered by the following patents:
U.S. 5,775,431
U.S. 5,967,240

Application

The Model G5-56 Dry is a cULus Listed Quick Response Concealed Dry Pendent sprinkler intended for use in accordance with NFPA 13. The Model G5-56 Dry sprinkler is cULus Listed for use in Light and Ordinary Hazard occupancies.

The Model G5-56 Dry is FM Approved as a Standard Response Concealed Dry Pendent sprinkler intended for use in accordance with FM Loss Prevention Data Sheet 2.0.

Product Description

The Reliable Model G5-56 Dry sprinkler is a Dry Pendent sprinkler, where the sealing washer is located at the inlet end of the sprinkler assembly. The position of the sealing washer is controlled by a fusible element at the opposite end of the sprinkler assembly. The sprinkler is installed with the fusible element at the ceiling of a protected space that may be subject to freezing temperatures and the inlet orifice located in a heated area above the ceiling. Operation of the fusible element allows the sealing washer to move out of the inlet orifice admitting water from the supply piping. The sprinkler uses a fast-response fusible element with an Ordinary, 165°F (74°C), or Intermediate, 212°F (100°C), temperature classification.



Model G5-56 Dry Sprinkler

The Model G5-56 Dry sprinkler has a dropdown deflector design that allows the sprinkler to be recessed into the ceiling and concealed by a flat cover plate. The cover plate assembly threads into the sprinkler's cup and provides ½-inch (13mm) of cover adjustment. The cover plate assembly consists of a flat cover plate that is attached to the skirt using either 135°F (57°C) or 165°F (74°C) temperature rated solder. The 135°F (57°C) cover plates are for use with Ordinary temperature classification sprinklers and the 165° (74°C) cover plates are for use with Intermediate temperature classification sprinklers.

The Model G5-56 Dry sprinkler is available in lengths ranging from 4¼ inches (108mm) to 48 inches (1219mm) in ¼-inch (6.35mm) increments (see Fig. 1). The length of the sprinkler must be selected to provide the Exposed Minimum Barrel Length in a Heated Area required by Fig. 2.

The Model G5-56 Dry sprinkler is available with 1-inch NPT or ISO 7-1 R1 threaded inlet fittings. The standard inlet fitting includes a long inlet designed to minimize the potential for water, scale, and sediment to accumulate on the sprinkler inlet in wet- and dry-pipe sprinkler systems. For wet-pipe sprinkler system applications where the standard inlet interferes with installation into existing plastic pipe fittings, an inlet fitting is available with a short ("PL") inlet. See Fig. 3 for further information.

Technical Data:

Nominal Orifice Size: ½-inch (15mm)
Thread Size: 1-inch NPT per ANSI B2.1 or ISO 7-1 R1
Nominal K Factor: 5.6 (80 metric)
Maximum Working Pressure: 175 psi (12 bar) – 100% factory hydrostatically tested to 500 psi (34.5 bar)
Sprinkler Installation Wrench: Model FC wrench
Sprinkler Identification Number (SIN): RA5114
Materials: See Fig. 4

Temperature Rating

Classification	Sprinkler	Cover Plate	Max. Ambient Temp.
Ordinary	165°F (74°C)	135°F (57°C)	100°F (38°C)
Intermediate	212°F (100°C)	165°F (74°C)	150°F (66°C)

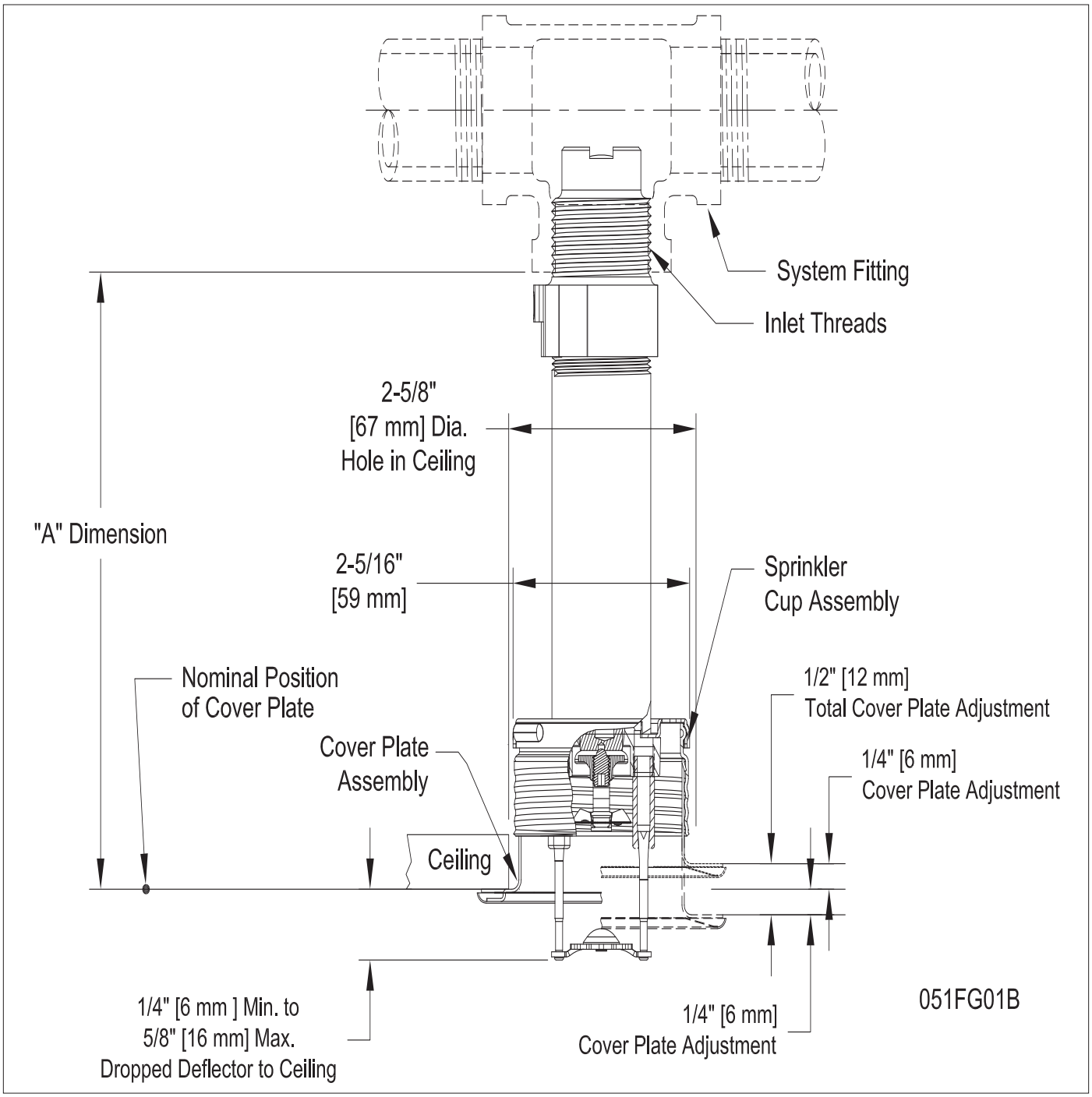


Figure. 1

Note: The "A" dimension is based on a nominally gauged pipe thread "make-up" of 0.600" (15mm) per ANSI B2.1 [7½ threads approximately].

"A" Dim.	4¼" to 48" (108mm to 1219mm) in ¼" (6.35mm) increments

Cover Plate Finishes

Standard Finishes
White Paint
Chrome
Special Application Finishes
Off White Paint
Black Paint
Custom Color Paint – Specify[1]
Raw Brass (Lacquered)
Bright Brass
Finished Bronze
Black Plated
Satin Chrome
Stainless Steel Clad[2]



Model FC
Sprinkler Wrench

[1] Custom color paint is semi-gloss, unless specified otherwise.

[2] Stainless steel clad cover plates are Type 316 Stainless Steel on the finished side and C102 Copper Alloy on the back side. Cover plates are not listed or approved as corrosion resistant. Stainless steel clad cover plates are not available perforated.

Optional Cover Plate with Gasket*



Model G4 QR Gasket
Cover Plate
(cULus Listed)



Model G4 SR Gasket
Cover Plate
(FM Approved)

* Model G4 QR Gasket and Model G4 SR Gasket cover plates are sold as assembled units including both the cover plate and gasket. Model G4 QR Gasket and Model G4 SR Gasket cover plates and gaskets are not interchangeable.

Installation Instructions

Model G5-56 Dry sprinklers must only be installed in standard (ANSI B 16.3 class 150 and ANSI B 16.4 class 125) pipe tees in the horizontal position, even at branch line ends. Model G5-56 Dry sprinklers shall not be installed into elbows or pipe couplings located on drop nipples to the sprinklers. In all installations, including into CPVC piping, the dry sprinkler shall be installed with protrusion into the fitting in accordance with the installation diagrams in this Bulletin.

Installation of the Model G5-56 Dry sprinkler is not recommended in copper pipe systems, as this may reduce the life expectancy of the sprinkler. Do not install Model G5-56 Dry sprinklers with the standard (long) inlet fitting into CPVC adapter fittings or tees that have an internal obstruction (see Fig. 3); this will damage the sprinkler, the fitting, or both. A short inlet ("PL") version of the Model G5-56 Dry sprinkler is available for use in existing installations with CPVC adapter fittings or tees having an internal obstruction; Model G5-56 sprinklers with the short inlet fitting shall not be used on dry-pipe sprinkler systems. The Model G5-56 Dry sprinkler and the cover plate assembly are not intended for installation in corrosive environments, including, but not limited to, those with salt aerosols or chlorine.

Model G5-56 Dry sprinklers must be installed with the Exposed Minimum Barrel Length required by Fig. 2 located in a Heated Area. Do NOT install the sprinkler in ceilings which have positive pressure in the space above.

The following steps must be followed for installation:

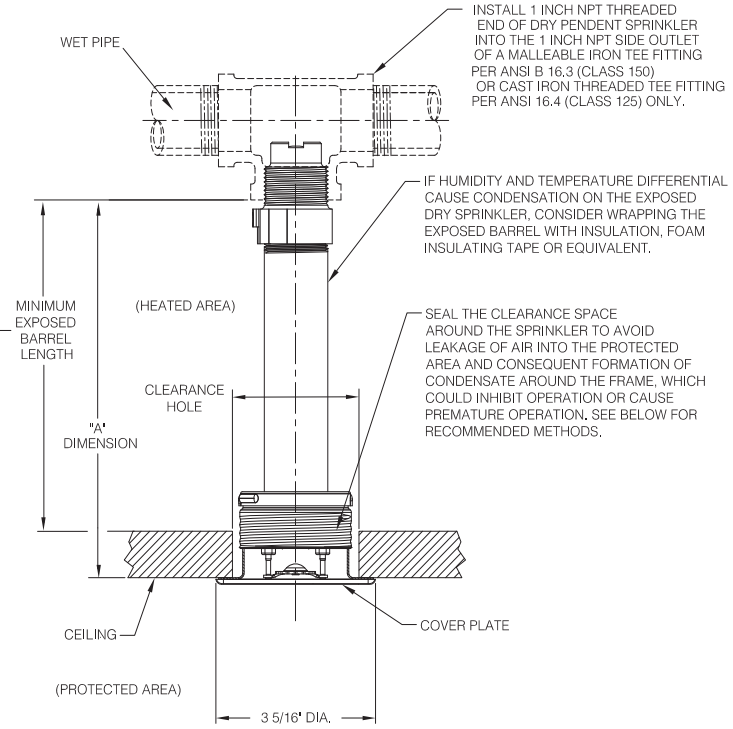
1. Cut a $2\frac{5}{8}$-inch (67mm) diameter hole in the ceiling directly in-line with the outlet of the tee.
2. Apply pipe joint compound or Polytetrafluoroethylene (PTFE) tape to the threads of the sprinkler's inlet fitting.
3. A protective cap is provided to protect the drop-down sprinkler deflector from damage which could occur during construction before the cover plate is installed. The cap is factory installed inside the sprinkler cup. Remove the cap to install sprinkler, Step 4, then reinstall cap until the cover plate is installed.
4. Install the sprinkler in the tee using the Model FC wrench. The Model FC wrench has a socket drive which is inserted into the sprinkler's cup and around the body of the sprinkler prior to installation of the sprinkler. Do NOT wrench any of the part of the sprinkler/cup assembly. The sprinkler is then tightened into the pipe fitting to achieve a leak free connection. The recommended minimum to maximum installation torque is 22-30 lb-ft (30 – 40 N-m). When inserting or removing the wrench from the sprinkler/cup assembly, care should be taken to prevent damage to the sprinkler. Reinstall the protective cap following installation of the sprinkler, until the cover plate is installed.
   a. Alternatively, where access to the outer tube of the sprinkler is available, the Model G5-56 Dry sprinkler may be installed using a pipe wrench. The protective cap should not be removed to install the sprinkler with a pipe wrench. The pipe wrench shall only be permitted to interface with the steel outer tube portion of the sprinkler (Item #8 in Fig. 4). Do NOT wrench any other portion of the sprinkler/cup assembly. A pipe wrench can install the sprinkler into the fitting with a large amount of torque; consideration should be given to the need for future removal of the sprinklers because the installation torque will have to be matched or exceeded to remove the sprinkler. The recommended minimum to maximum installation torque is 22-30 lb-ft (30 – 40 N-m).
5. To install the cover plate, remove the protective cap and install the cover plate by hand turning the cover in the clockwise direction until it is tight against the ceiling. For Model G4 QR Gasket and Model G4 SR Gasket cover plates, the gasket should be attached to the flange of the cover plate skirt only. Do not glue the gasket in place or allow the gasket to overlap both the cover plate and the flange of the skirt.

RECOMMENDED EXPOSED MINIMUM BARREL LENGTH BASED ON AMBIENT TEMPERATURE IN THE PROTECTED AREA

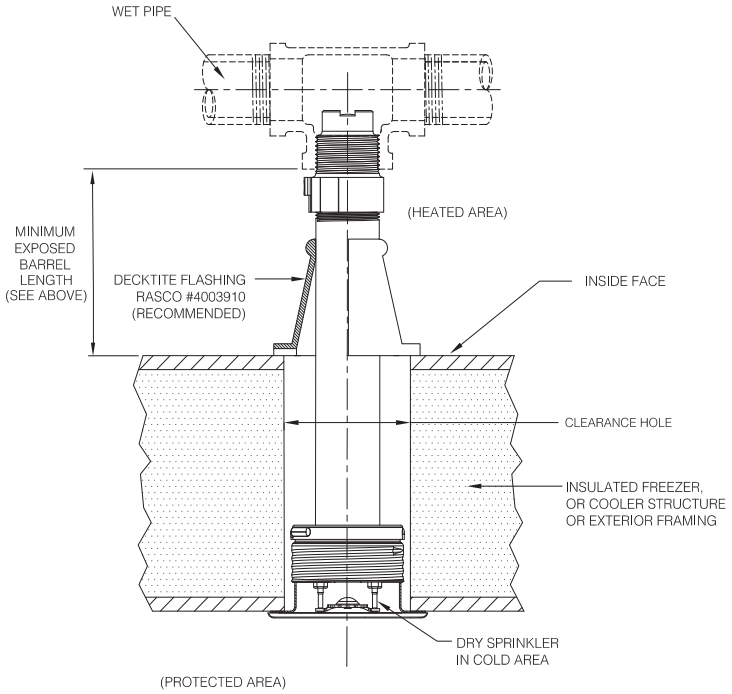
AMBIENT TEMPERATURE OF PROTECTED AREA* AT THE DISCHARGE END OF THE SPRINKLER	EXPOSED BARREL AMBIENT TEMPERATURE		
	40°F/4°C	50°F/10°C	60°F/16°C
	EXPOSED MINIMUM BARREL LENGTH** (FACE OF TEE TO TOP OF CEILING)		
	IN. (MM)	IN. (MM)	IN. (MM)
40°F (4°C)	0	0	0
30°F (-1°C)	0	0	0
20°F (-7°C)	4 (100)	0	0
10°F (-12°C)	8 (200)	1 (25)	0
0°F (-18°C)	12 (300)	3 (75)	0
-10°F (-23°C)	14 (350)	4 (100)	1 (25)
-20°F (-29°C)	14 (350)	6 (150)	3 (75)
-30°F (-34°C)	16 (400)	8 (200)	4 (100)
-40°F (-40°C)	18 (450)	8 (200)	4 (100)
-50°F (-46°C)	20 (500)	10 (250)	6 (150)
-60°F (-51°C)	20 (500)	10 (250)	6 (150)

* FOR AMBIENT TEMPERATURES EXPOSED TO THE DISCHARGE END OF THE SPRINKLER THAT OCCUR BETWEEN THE VALUES LISTED, USE THE NEXT COOLER TEMPERATURE.

** THE MINIMUM EXPOSED BARREL LENGTH IS NOT THE SAME AS THE "A" DIMENSION. THE MINIMUM EXPOSED BARREL LENGTH IS BASED ON A PROPERLY SEALED PENETRATION WITH A MAXIMUM WIND VELOCITY PN THE EXPOSED SPRINKLER OF 30 MPH (48 KM/H). LONGER EXPOSED BARREL LENGTHS WILL HELP AVOID FREEXING OF THE WET PIPING WHERE HIGHER WIND VELOCITY IS EXPECTED.



RECOMMENDED DRY SPRINKLER SEAL ARRANGEMENT



051FG02

Figure 2

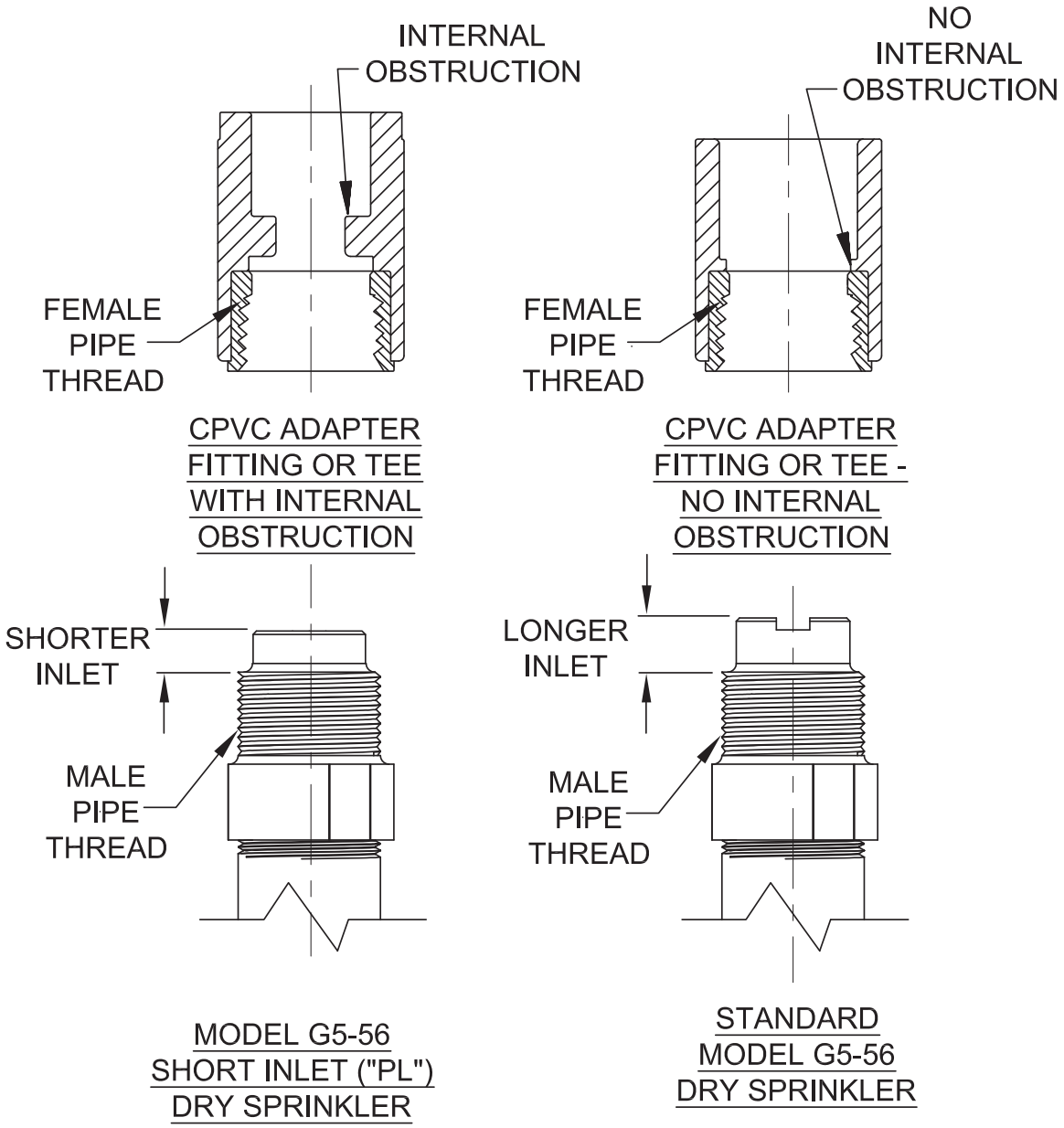
CAUTION

DO NOT INSTALL MODEL G5-56 DRY SPRINKLERS WITH STANDARD INLETS INTO CPVC ADAPTER FITTINGS OR TEES THAT HAVE AN INTERNAL OBSTRUCTION; THIS WILL DAMAGE THE SPRINKLER, THE FITTING, OR BOTH.

CPVC ADAPTER FITTINGS AND TEES WITH INTERNAL OBSTRUCTIONS ARE COMMONLY FOUND DURING THE RETROFITTING PROCESS OF RELIABLE'S OLDER MODEL G3 DRY SPRINKLERS.

A SHORT INLET ("PL") VERSION OF THE MODEL G5-56 DRY SPRINKLER IS AVAILABLE FOR USE IN EXISTING INSTALLATIONS WITH CPVC ADAPTER FITTINGS OR TEES HAVING AN INTERNAL OBSTRUCTION; THE SHORT INLET VERSION SHALL NOT BE USED ON DRY-PIPE SPRINKLER SYSTEMS.

VERIFY SPRINKLER AND FITTING DIMENSIONS PRIOR TO INSTALLATION TO AVOID INTERFERENCE.



BE SURE TO ORDER THE CORRECT SPRINKLERS FOR YOUR APPLICATION

051FG03

Figure 3

Maintenance

The Model G5-56 Dry should be inspected and the sprinkler system maintained in accordance with NFPA 25. Do not clean sprinklers with soap and water, ammonia or any other cleaning fluids. Replace any sprinkler that has been painted (other than factory applied) or damaged in any way. Concealed sprinklers cover plates can not be painted in the field, after installation or have any other coating applied other than the factory finish. A stock of spare sprinklers should be maintained to allow quick replacement of damaged or operated sprinklers. Prior to installation, sprinkler should be maintained in the original cartons and packaging to minimize the potential for damage to sprinklers that would cause improper operation or non-operation.

Engineering Specification

Model G5-56 Dry Pendent Concealed Sprinkler

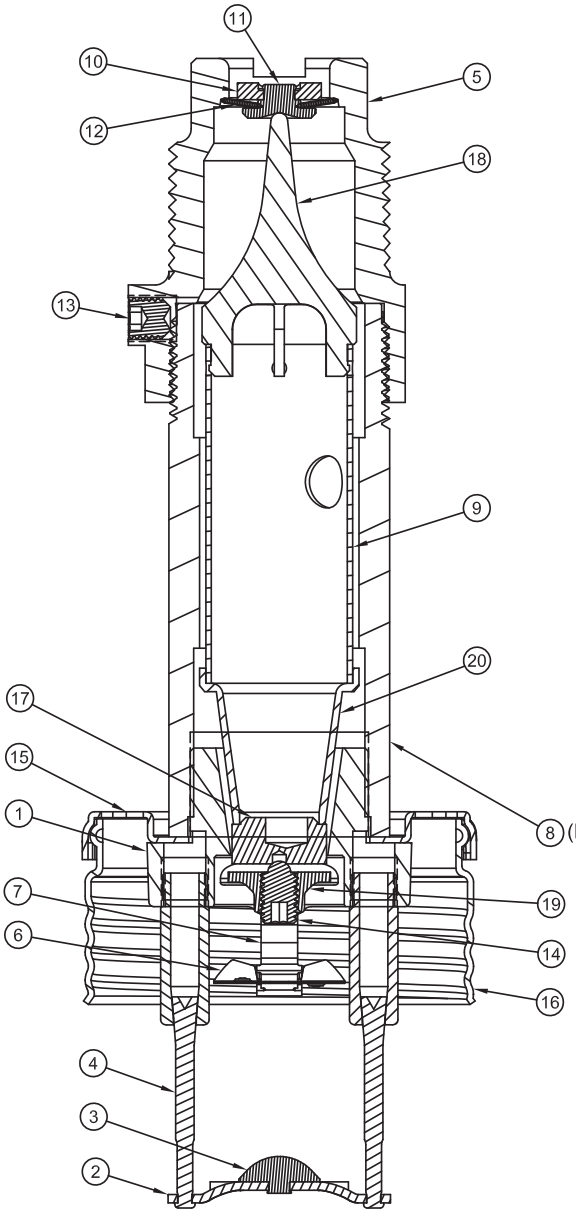
Dry pendent sprinklers shall be dry pendent concealed sprinklers with a flat cover plate. Sprinklers shall be cULus Listed as Quick Response for Light and Ordinary Hazard applications as well as FM Approved as Standard Response. Sprinklers shall be available in lengths from 4¼ inches (108mm) to 48 inches (1219mm) in ¼-inch (6.35mm) increments based on face of fitting to finished ceiling distance. Sprinkler length shall be selected to provide the Exposed Minimum Barrel Length based on the minimum design temperature in the protected area and the minimum temperature in the conditioned space where the barrel is located in accordance with the Manufacturer's written installation instructions. Sprinklers shall have [1-inch NPT][ISO 7-1 R1] threaded inlet fittings with [standard length inlets designed for use with wet- or dry-pipe sprinkler systems][short length inlets designed for use with wet-pipe sprinkler systems having pipe fittings with internal obstructions that prevent the insertion of standard length inlets]. Sprinklers shall have a PTFE coated beryllium nickel Belleville spring washer inlet seal and brass alloy cap that prevent water entry from the sprinkler system piping into the sprinkler prior to actuation. Sprinklers shall have a fast-response fusible link that controls the movement of the inlet seal and cap through a mechanism consisting of link arms, a seat adapter, an orifice adapter, an inner tube, and a yoke. Sprinklers shall use a drop down deflector supported by tapered pins. Sprinklers shall have a galvanized steel cup for threaded attachment of the flat cover plate assembly. Cover plate attachment shall provide up to ½-inch (13mm) of adjustment. Sprinklers shall be [Ordinary temperature classification, 165°F (74°C), with 135°F temperature rated cover plates][Intermediate temperature classification, 212°F, with 165°F temperature rated cover plates]. Cover plates shall be [solid][perforated] with factory applied [White][Chrome][Special Application – Specify] finish. Dry pendent concealed sprinklers shall be Reliable Model G5-56 Dry (SIN RA5114).

Ordering Information

Specify:

1. Sprinkler: Model G5-56 Dry
2. Threads: [1-inch NPT - standard][ISO 7/1 R1 - optional]
3. Inlet Length: [Standard][Short ("PL")– for existing wet-pipe installations only]
4. Cover Plate Finish: [White][Chrome][Special Application – Specify]
5. Sprinkler/Cover Plate Temperature Rating: [Ordinary – 165°F sprinkler with 135°F cover plate][Intermediate – 212°F sprinkler with 165°F cover plate]
6. Nominal Sprinkler Length (face of fitting to face of ceiling - "A" Dimension from Fig. 1): [Specify length – Lengths available from 4¼ inches to 48 inches (108mm to 1219mm) in ¼-inch (6.35mm) increments]

MATERIAL SPECIFICATIONS



ITEM #	DESCRIPTION	MATERIAL
1	BODY, MACH.	DZR BRASS
2	DEFLECTOR	COPPER ALLOY
3	DEFL. SPLITTER	BRASS ALLOY
4	DEFL. PIN	STAINLESS STEEL
5	MEGA-INLET	DZR BRASS
6	LINK ASSY.	NICKEL/BERYLLIUM NICKEL
7	LEVER	COPPER ALLOY
8	OUTER TUBE	GALVANIZED STEEL
9	INNER TUBE	BRASS ALLOY
10	FLIP DISK	BRASS ALLOY
11	CAP	BRASS ALLOY
12	WASHER	PTFE COATED BERYLLIUM NICKEL
13	SET SCREW	STAINLESS OR ALLOY STEEL
14	LOAD SCREW	STAINLESS STEEL
15	BOTTOM CUP	GALVANIZED STEEL
16	TOP CUP	GALVANIZED STEEL
17	ADJ. SEAT ADAPTER	BRASS ALLOY
18	YOKE	BRASS ALLOY
19	CLOSURE YOKE	BRASS ALLOY
20	ORIFICE ADAPTER	BRASS ALLOY

(PIPE WRENCH MAY ONLY BE USED ON OUTER STEEL PIPE OF SPRINKLER)

051FG04

Figure 4

Reliable...For Complete Protection

Reliable offers a wide selection of sprinkler components. Following are some of the many precision-made Reliable products that guard life and property from fire around the clock.

- Automatic sprinklers
- Flush automatic sprinklers
- Recessed automatic sprinklers
- Concealed automatic sprinklers
- Adjustable automatic sprinklers
- Dry automatic sprinklers
- Intermediate level sprinklers
- Open sprinklers
- Spray nozzles
- Alarm valves
- Retarding chambers
- Dry pipe valves
- Accelerators for dry pipe valves
- Mechanical sprinkler alarms
- Electrical sprinkler alarm switches
- Water flow detectors
- Deluge valves
- Detector check valves
- Check valves
- Electrical system
- Sprinkler emergency cabinets
- Sprinkler wrenches
- Sprinkler escutcheons and guards
- Inspectors test connections
- Sight drains
- Ball drips and drum drips
- Control valve seals
- Air maintenance devices
- Air compressors
- Pressure gauges
- Identification signs
- Fire department connection

The equipment presented in this bulletin is to be installed in accordance with the latest published Standards of the National Fire Protection Association, Factory Mutual Research Corporation, or other similar organizations and also with the provisions of governmental codes or ordinances whenever applicable.

Products manufactured and distributed by Reliable have been protecting life and property for almost 100.

Manufactured by

Reliable®

Reliable Automatic Sprinkler Co., Inc.
(800) 431-1588 Sales Offices
(800) 848-6051 Sales Fax
(914) 829-2042 Corporate Offices
www.reliablesprinkler.com Internet Address

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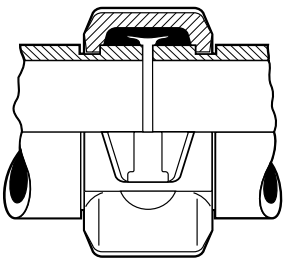
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Victaulic® Flexible Coupling Style 75

06.05





Exaggerated for clarity

WARNING

- **Victaulic RX roll sets must be used when grooving light-wall/thin-wall stainless steel pipe for use with Victaulic Couplings.**

Failure to use Victaulic RX roll sets when grooving light-wall/thin-wall stainless steel pipe may cause joint failure, resulting in serious personal injury and/or property damage.

Approvals/Listings

See Victaulic publication 10.01 for details

See Victaulic publication 02.06 for portable water approvals if applicable.

NOTICE

- **Victaulic RX grooving rolls must be ordered separately. They are identified by a silver color and the designation RX on the front of the roll sets.**

Product Description

Style 75 is available where moderate pressures are expected or weight considerations are a factor. Up to 50% lighter in weight than the Style 77, the Style 75 coupling is recommended for service up to 500 psi/3450 kPa depending on size. Housings are cast in two identical pieces in all sizes. Hot-dip galvanized and special coatings are available for all sizes.

The Victaulic standard flexible coupling offering for grade “EHP” or “T” gaskets is the Style 177 installation-ready flexible coupling. For all available sizes, the Style 177 is the standard flexible coupling Victaulic supplies in North America for piping systems using Grade “EHP” or “T” gaskets. Contact Victaulic for further details.

Performance data presented in this document is based on use with standard wall, carbon steel pipe. For use with stainless steel pipe, please reference publication 17.09 for pressure ratings and end loads. When used on light wall stainless steel pipe, the Victaulic RX roll set must be used to roll groove the pipe. For further information regarding roll grooving stainless steel, refer to publication 17.01.

Job/Owner

System No.	
Location	

Contractor

Submitted By	
Date	

Engineer

Spec Section	
Paragraph	
Approved	
Date	

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Material Specifications

Housing:

Ductile iron conforming to ASTM A-536, grade 65-45-12. Ductile iron conforming to ASTM A-395, grade 65-45-15, is available upon special request.

Housing Coating: (specify choice)

- ☐ Standard: Orange enamel.
- ☐ Optional: Hot dipped galvanized and others.

Gasket: (specify choice[1])

NOTE: Additional gasket styles are available. Contact Victaulic for details.

- ☐ **Grade "E" EPDM**
  EPDM (Green stripe color code). Temperature range –30°F to +230°F/–34°C to +110°C. May be specified for cold and hot water service within the specified temperature range plus a variety of dilute acids, oil-free air and many chemical services. UL Classified in accordance with ANSI/NSF 61 for cold +73°F/+23°C and hot +180°F/+82°C potable water service and ANSI/NSF 372. NOT COMPATIBLE FOR PETROLEUM SERVICES.
- ☐ **Grade "T" Nitrile**
  Nitrile (Orange stripe color code). Temperature range 20°F to +180°F/29°C to +82°C. May be specified for petroleum products, air with oil vapors, vegetable and mineral oils within the specified temperature range. Not compatible for hot water services over +150°F/+66°C or for hot dry air over +140°F/+60°C.

1 Services listed are General Service Guidelines only. It should be noted that there are services for which these gaskets are not compatible. Reference should always be made to the latest Victaulic Gasket Selection Guide for specific gasket service guidelines and for a listing of services which are not compatible.

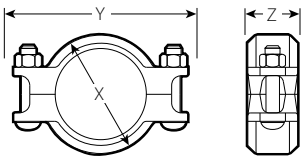
Bolts/Nuts:

Heat-treated plated carbon steel, trackhead meeting the physical and chemical requirements of ASTM A-449 and physical requirements of ASTM A-183

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Dimensions

Style 75



Nominal Size	Actual Outside Diameter	Maximum Working Pressure [2]	Maximum End Load [2]	Allow. Pipe End Separation[3]	Deflection from Centerline[3]		Bolt/Nut[4]	Dimensions			Approx. Weight Each
								X	Y	Z	
inches mm	inches mm	psi kPa	lbs. N	inches mm	Per Cplg. Degrees	Pipe inches/ft. mm/m	(No.) size inches	inches mm	inches mm	inches mm	lbs. kg
1 25	1.315 33.4	500 3450	680 3025	0–0.06 0–1.6	2°–43′	0.57 48	2– ⅜ x 2	2.38 61	4.27 108	1.77 45	1.3 0.6
1 ¼ 32	1.660 42.2	500 3450	1080 4805	0–0.06 0–1.6	2°–10′	0.45 38	2– ⅜ x 2	2.68 68	4.61 117	1.77 45	1.4 0.6
1 ½ 40	1.900 48.3	500 3450	1420 6320	0–0.06 0–1.6	1°–56′	0.40 33	2– ⅜ x 2	2.91 74	4.82 122	1.77 45	1.5 0.6
2 50	2.375 60.3	500 3450	2215 9860	0–0.06 0–1.6	1°–31′	0.32 26	2– ⅜ x 2	3.43 87	5.22 133	1.88 48	1.7 0.8
2 ½ 65	2.875 73.0	500 3450	3245 14440	0–0.06 0–1.6	1°–15′	0.26 22	2– ⅜ x 2	3.88 98	5.68 144	1.88 48	1.9 0.9
76.1 mm	3.000 76.1	500 3450	3535 15730	0–0.06 0–1.6	1°–12′	0.26 22	2– ⅜ x 2	4.00 102	5.90 150	1.88 48	1.9 0.9
3 80	3.500 88.9	500 3450	4800 21360	0–0.06 0–1.6	1°–2′	0.22 18	2– ½ x 2 ¾	4.50 114	7.00 178	1.88 48	2.9 1.3
3 ½ 90	4.000 101.6	500 3450	6300 28035	0–0.06 0–1.6	0°-54′	0.19 16	2– ½ x 2 ¾	5.00 127	7.50 191	1.88 48	2.9 1.3
4 100	4.500 114.3	500 3450	7950 35380	0–0.13 0–3.2	1°–36′	0.34 28	2– ½ x 2 ¾	5.80 147	8.03 204	2.13 54	4.1 1.9
108.0 mm	4.250 108.0	450 3100	6380 28395	0–0.13 0–3.2	1°–41′	0.35 29	2– 12 x 70	5.55 141	7.79 198	2.13 54	3.7 1.7
4 ½ 120	5.000 127.0	450 3100	8820 39250	0–0.13 0–3.2	1°–26′	0.25 21	2– ⅝ x 3 ¼	6.13 156	9.43 240	2.13 54	5.5 2.5
5 125	5.563 141.3	450 3100	10935 48660	0–0.13 0–3.2	1°–18′	0.27 23	2– ⅝ x 3 ¼	6.88 175	10.07 256	2.13 54	5.8 2.6
133.0 mm	5.250 133.0	450 3100	9735 43325	0–0.13 0–3.2	1°–21′	0.28 24	2– 16 x 82.5	6.55 166	9.37 238	2.13 54	6.0 2.7
139.7 mm	5.500 139.7	450 3100	10665 47460	0–0.13 0–3.2	1°–18′	0.28 24	2– ⅝ x 3 ¼	6.80 173	9.59 244	2.13 54	6.3 2.9
152.4 mm	6.000 152.4	450 3100	12735 56670	0–0.13 0–3.2	1°–12′	0.21 18	2– ⅝ x 3 ¼	7.38 187	10.48 266	1.88 48	6.2 2.8
6 150	6.625 168.3	450 3100	15525 69085	0–0.13 0–3.2	1°–5′	0.23 18	2– ⅝ x 3 ¼	8.00 203	11.07 281	2.13 54	7.0 3.2
159.0 mm	6.250 159.0	450 3100	13800 61405	0–0.13 0–3.2	1°–9′	0.24 20	2– 16 x 82.5	7.63 194	10.49 266	2.13 54	6.8 3.1
8 200	8.625 219.1	450 3100	26280 116945	0–0.13 0–3.2	0°–50′	0.18 14	2– ¾ x 4 ¼	10.34 263	13.97 355	2.13 59	12.4 5.6

2 Working Pressure and End Load are total, from all internal and external loads, based on standard weight (ANSI) steel pipe, standard **roll** or **cut** grooved in accordance with Victaulic specifications. Contact Victaulic for performance on other pipe.

3 Allowable Pipe End Separation and Deflection figures show the maximum nominal range of movement available at each joint for standard **roll** grooved pipe. Figures for standard **cut** grooved pipe may be doubled. These figures are maximums; for design and installation purposes these figures should be reduced by: 50% for ¾ – 3 ½"/20 – 90 mm; 25% for 4"/100 mm and larger.

4 Number of bolts required equals number of housing segments.

General Notes

Metric thread size bolts are available (color coded gold) for all coupling sizes upon request. Contact Victaulic for details.

WARNING: FOR ONE TIME FIELD TEST ONLY, the Maximum Joint Working Pressure may be increased to 1½ times the figures shown.

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Installation
Reference should always be made to the I-100 Victaulic Field Installation Handbook for the product you are installing. Handbooks are included with each shipment of Victaulic products for complete installation and assembly data, and are available in PDF format on our website at www.victaulic.com.

Warranty
Refer to the Warranty section of the current Price List or contact Victaulic for details.

Note
This product shall be manufactured by Victaulic or to Victaulic specifications. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

Trademarks
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Reducing Coupling

SEE VICTAULIC PUBLICATION 10.01 FOR DETAILS

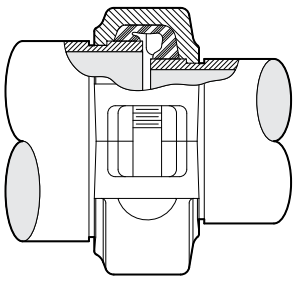
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STYLE 750

211313 - Wet-Pipe Sprinkler System

The Style 750 Reducing Coupling permits direct reduction on the piping run. Designed to replace two couplings and a reducing fitting, the Style 750 features a special reducing gasket for pressure responsive sealing. A steel washer which prevents telescoping of the smaller pipe inside the larger pipe during vertical systems assembly is available upon request.





Exaggerated for clarity

MATERIAL SPECIFICATIONS

Housing: Ductile iron conforming to ASTM A-536, grade 65-45-12. Ductile iron conforming to ASTM A-395, grade 65-45-15, is available upon special request.

Housing Coating: Orange enamel

- **Optional:** Hot dipped galvanized and others

Gasket: (Specify choice*):

- **Grade "E" EPDM (All other sizes)**
  EPDM (Green color code). Temperature range –30°F to +230°F/–34°C to +110°C. Recommended for cold and hot water service within the specified temperature range plus a variety of dilute acids, oil-free air and many chemical services. UL classified in accordance with ANSI/NSF 61 for cold +86°F/+30°C and hot +180°F/+82°C potable water service. NOT RECOMMENDED FOR PETROLEUM SERVICES.

- **Grade "T" nitrile**
  Nitrile (Orange color code). Temperature range –20°F to +180°F/–29°C to +82°C. Recommended for petroleum products, air with oil vapors, vegetable and mineral oils within the specified temperature range. Not recommended for hot water services over +150°F/+66°C or for hot dry air over +140°F/+60°C.

* Services listed are General Service Recommendations only. It should be noted that there are services for which these gaskets are not recommended. Reference should always be made to the latest Victaulic Gasket Selection Guide for specific gasket service recommendations and for a listing of services which are not recommended.

- **Optional:** Assembly Washer: Galvanized, carbon steel

Bolts/Nuts: Heat-treated plated carbon steel, trackhead meeting the physical and chemical requirements of ASTM A-449 and physical requirements of ASTM A-183.

JOB/OWNER
System No. _____
Location _____

CONTRACTOR
Submitted By _____
Date _____

ENGINEER
Spec Sect _____ Para _____
Approved _____
Date _____

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Reducing Coupling

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STYLE 750

DIMENSIONS

Size			Max. Work Pressure *	Max. End Load *	Allow. Pipe End Sep. †	Deflect. Fr. C_L†		Bolt/Nut@ No - Size	Dimensions – Inches/mm			Approx. Wgt. Each
Nominal Size Inches/mm			psi kPa	Lbs. N	Inches/ mm	Per Cplg. Deg.	Pipe In./Ft. mm/m	Inches	X	Y	Z	Lbs. kg
2 50	×	1 25	350 2410	500 2225	0 – 0.07 0 – 1.8	0° – 57'	0.20 17	2 – ⅜ x 2	3.38 85	5.28 134	1.88 48	2.7 1.2
		1½ 40	350 2410	1000 4450	0 – 0.07 0 – 1.8	0° – 57'	0.20 17	2 – ⅜ x 2	3.38 85	5.28 134	1.88 48	2.0 1.0
2½ 65	×	2 50	500 3450	2215 9850	0 – 0.07 0 – 1.8	0° – 47'	0.16 14	2 – ⅜ x 2	4.00 102	5.93 151	1.88 48	3.1 1.4
76.1 mm	×	2 50	350 2410	1550 6900	0 – 0.07 0 – 1.8	0° – 47'	0.16 14	2 – ½ x 2¾	4.38 111	6.63 168	1.88 48	4.6 2.1
3 80	×	2 50	350 2410	1550 6900	0 – 0.07 0 – 1.8	0° – 39'	0.13 11	2 – ½ x 2¾	4.75 121	7.13 181	1.88 48	4.9 2.2
		2½ 65	500 3450	3250 14460	0 – 0.07 0 – 1.8	0° – 39'	0.13 11	2 – ½ x 2¾	4.75 121	7.13 181	1.88 48	4.3 2.0
88.9 mm	×	76.1 mm	350 2410	2475 11010	0 – 0.07 0 – 1.8	0° – 39'	0.13 11	2 – ½ x 2¾	4.75 121	7.13 181	1.88 48	4.2 1.9
4 100	×	2 50	350 2410	1550 6900	0 – 0.13 0 – 3.2	1° – 19'	0.28 25	2 – ⅝ x 3¼	6.25 159	8.90 226	2.25 57	8.1 3.7
		2½ 65	350 2410	2275 10125	0 – 0.13 0 – 3.2	1° – 19'	0.28 25	2 – ⅝ x 3¼	6.25 159	8.90 226	2.25 57	8.6 3.9
		3 80	500 3450	4810 21400	0 – 0.13 0 – 3.2	1° – 19'	0.28 25	2 – ⅝ x 3¼	6.00 152	8.90 226	2.25 57	6.7 3.0
114.3 mm	×	76.1 mm	350 2410	2475 11014	0 – 0.13 0 – 3.2	1° – 19'	0.28 25	2 – ⅝ x 3¼	6.25 159	8.90 226	2.25 57	6.9 3.1
5 125	×	4 100	350 2410	5565 24765	0 – 0.13 0 – 3.2	1° – 3'	0.22 19	2 – ¾ x 4¼	7.18 182	10.70 272	2.13 54	11.2 5.1
6 150	×	4 100	350 2410	5565 24765	0 – 0.13 0 – 3.2	0° – 52'	0.18 15	2 – ¾ x 4¼	8.63 181	11.90 302	2.25 57	16.7 7.6
		5 125	350 2410	8500 37825	0 – 0.13 0 – 3.2	0° – 52'	0.18 15	2 – ¾ x 4¼	8.31 211	11.90 302	2.25 57	12.9 5.9
165.1 mm	×	4 100	350 2410	5565 24765	0 – 0.13 0 – 3.2	0° – 55'	0.19 16	2 – ¾ x 4¼	8.63 219	11.90 302	2.25 57	15.2 6.9
8 200	×	6 150	350 2410	12060 53645	0 – 0.13 0 – 3.2	0° – 38'	0.13 11	2 – ⅞ x 5	10.81 275	14.88 378	2.50 64	22.4 10.2
219.1 mm	×	165.1 mm	350 2410	11610 51645	0 – 0.13 0 – 3.2	0° – 38'	0.13 11	2 – ⅞ x 5	10.75 273	14.88 378	2.50 64	23.2 10.5
10 273	×	8 219.1	350 2410	20450 90970	0 – 0.13 0 – 3.2	0° – 25'	0.9 8	2 – 1 x 5½	13.12 333	17.26 438	2.62 67	31.4 14.2

Style 750 Reducing couplings should not be used with end caps (#60) in systems where a vacuum may be developed. Contact Victaulic for details.

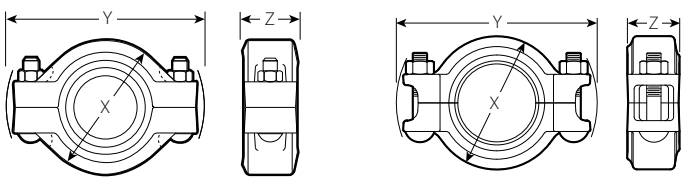
* Working Pressure and End Load are total, from all internal and external loads, based on standard weight (ANSI) steel pipe, standard **roll** or **cut** grooved in accordance with Victaulic specifications. Contact Victaulic for performance on other pipe. Maximum working pressure rating based on larger pipe size. Maximum End Load rating based on smaller pipe size. WARNING: FOR ONE TIME FIELD TEST ONLY, the Maximum Joint Working Pressure may be increased to 1½ times the figures shown.

† Allowable Pipe End Separation and Deflection figures show the maximum nominal range of movement available at each joint for standard **roll** grooved pipe. Figures for standard **cut** grooved pipe may be doubled. These figures are maximums; for design and installation purposes these figures should be reduced by: 50% for ¾ – 3½"/20 – 90 mm; 25% for 4"/100 mm and larger.

@ Number of bolts required equals number of housing segments.

Metric thread size bolts are available (color coded gold) for all coupling sizes upon request. Contact Victaulic for details.

WARNING: Depressurize and drain the piping system before attempting to install, remove, or adjust any Victaulic piping products.



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Reducing Coupling

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STYLE 750

FLOW DATA

HEAD LOSS

The head loss across Style 750 Reducing coupling is very small and is essentially the same as for standard short body reducing pipe fittings.

Equivalent lengths of standard weight steel pipe are shown in the tables. All data is based on water flowing at ambient temperature.

FLOW REDUCING

Size			Equiv. Pipe Length
Nominal Size Inches/mm			Sm. Dia. Feet/m
2 50	×	1 25	5.9 1.8
		1½ 40	2.0 0.6
2½ 65	×	2 50	1.9 0.6
76.1 mm	×	2 50	1.9 0.6
3 80	×	2 50	5.5 1.7
		2½ 65	3.8 1.2
88.9 mm	×	76.1 mm	3.8 1.2
4 100	×	2 50	6.0 1.8
		2½ 65	6.0 1.8
		3 80	6.0 1.8
114.3 mm	×	76.1 mm	6.0 1.8
5 125	×	4 100	3.0 0.9
6 150	×	4 100	6.0 1.8
		5 125	4.5 1.4
165.1 mm	×	4 100	6.0 1.8
8 200	×	6 150	7.3 2.2
219.1 mm	×	165.1 mm	7.3 2.23
10 273	×	8 219.1	8.7 2.65

FLOW EXPANDING

Size			Equiv. Pipe Length
Nominal Size Inches/mm			Sm. Dia. Feet/m
1 25	×	2 50	2.7 0.8
1½ 40	×	2 50	1.9 0.6
2 50	×	2½ 65	1.0 0.3
		76.1 mm	1.0 0.3
		3 80	3.5 1.1
		4 100	3.0 0.9
2½ 65	×	3 80	2.5 0.8
		4 100	3.0 0.9
76.1 mm	×	88.9 mm	2.5 0.8
		114.3 mm	3.0 0.9
3 80	×	4 100	2.5 0.8
4 100	×	5 125	3.3 1.0
		6 150	4.6 1.4
		165.1 mm	4.6 1.4
5 125	×	6 150	2.3 0.7
6 150	×	8 200	6.0 1.8
165.1 mm	×	219.1 mm	5.4 1.65
8 219.1	×	10 273	6.3 19.2

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Reducing Coupling

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STYLE 750

INSTALLATION

Reference should always be made to the I-100 Victaulic Field Installation Handbook for the product you are installing. Handbooks are included with each shipment of Victaulic products for complete installation and assembly data, and are available in PDF format on our website at www.victaulic.com.

WARRANTY

Refer to the Warranty section of the current Price List or contact Victaulic for details.

NOTE

This product shall be manufactured by Victaulic or to Victaulic specifications. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

06.08 1536 REV J UPDATED 08/2012

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FireLock® Fittings

10.03



Material Specifications:

Fitting:

Ductile iron conforming to ASTM A-536, grade 65-45-12.

Fitting Coating:

- ☐ Orange enamel
- ☐ Red enamel in Europe, Middle East, Africa, and India
- ☐ Optional: Hot dipped galvanized

Approvals/Listings:

c UL us LISTED FM LPCB VdS

Product Description:

FireLock® products comprise a unique system specifically designed for fire protection services. FireLock full-flow elbows and tees feature CAD-developed, hydrodynamic design, affording a shorter center-to-end dimension than standard fittings. A noticeable bulge allows the water to make a smoother turn to maintain similar flow characteristics as standard full flow fittings.

FireLock fittings are designed for use exclusively with Victaulic couplings that have been Listed or Approved for Fire Protection Services. Use of other couplings or flange adapters may result in bolt pad interference.

Refer to the appropriate listing agency or approval body for pressure ratings. Pressure ratings vary by agency.

Job/Owner

System No.	
Location	

Contractor

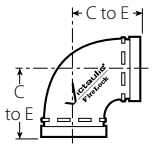
Submitted By	
Date	

Engineer

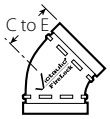
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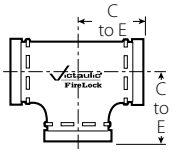
Dimensions:



NO. 001



NO. 003



NO. 002



No. 006

Nominal Size inches mm	Actual Outside Diameter inches mm	No. 001 90° Elbow C to E inches mm	No. 001 90° Elbow Approx. Weight Each Lbs. kg	No. 003 45° Elbow C to E inches mm	No. 003 45° Elbow Approx. Weight Each Lbs. kg	No. 002 Straight Tee C to E inches mm	No. 002 Straight Tee Approx. Weight Each Lbs. kg	No. 006 Cap C to E inches mm	No. 006 Cap Approx. Weight Each Lbs. kg
1 ¼ 32	1.660 42.4	— —	— —	— —	— —	— —	— —	0.82 21	0.3 0.1
1 ½ 40	1.900 48.3	— —	— —	— —	— —	— —	— —	0.82 21	0.4 0.2
2 50	2.375 60.3	2.75 70	1.7 0.8	2.00 51	1.8 0.8	2.75 70	2.4 1.1	0.88 22	0.6 0.3
2 ½ 65	2.875 73.0	3.00 76	3.1 1.4	2.25 57	2.2 1.0	3.00 76	3.6 1.6	0.88 22	1.0 0.5
76.1 mm	3.000 76.1	3.00 76	3.30 1.5	2.25 57	2.4 1.1	3.00 76.2	3.8 1.7	—	—
3 80	3.500 88.9	3.38 86	4.0 1.8	2.50 64	3.1 1.4	3.38 86	5.3 2.4	0.88 22	1.2 0.5
108 mm	4.250 108.0	4.00 102	5.7 2.6	3.00 76	5.1 2.3	4.00 102	7.5 3.4	—	—
4 100	4.500 114.3	4.00 102	6.7 3.0	3.00 76	5.6 2.5	4.00 102	8.7 3.9	1.00 25	2.4 1.1
5 125	5.563 141.3	4.88 124	12.6 5.7	3.25 83	8.3 3.8	4.88 124	15.7 7.1	1.00 25	4.1 1.9
139.7 mm	5.500 139.7	4.88 124.0	12.4 5.6	3.25 82.6	8.2 3.7	4.88 124.0	15.4 6.9	—	—
159 mm	6.250 158.8	5.50 140	12.6 5.7	3.50 89	9.2 4.2	5.50 140	17.9 8.0	—	—
6 150	6.625 168.3	5.50 140	18.3 8.3	3.50 89	11.7 5.3	5.50 140	22.7 10.3	1.00 25	5.9 2.7
165.1 mm	6.500 165.1	5.43 139.7	17.6 7.9	3.50 88.9	11.4 5.2	5.50 139.7	22.0 9.9	—	—
8 200	8.625 219.1	6.81 173	25.5 11.6	4.25 108	20.4 9.3	6.94 176	38.7 17.6	1.13 29	12.7 5.8

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Flow Data:

Nominal Size inches mm	Actual Outside Diameter inches mm	Frictional Resistance Equivalent Feet/meters of Straight Pipe[1]			
		Elbows		No. 002 Straight Tee	
		No. 001 90° Elbow	No. 003 45° Elbow	Branch	Run
1 ¼ 32	1.660 42.4	— —	— —	— —	— —
1 ½ 40	1.900 48.3	— —	— —	— —	— —
2 50	2.375 60.3	3.5 1.1	1.8 0.5	8.5 2.6	3.5 1.1
2½ 65	2.875 73.0	4.3 1.3	2.2 0.7	10.8 3.3	4.3 1.3
76.1 mm	3.000 76.1	4.5 1.4	2.3 0.7	11.0 3.4	4.5 1.4
3 80	3.500 88.9	5.0 1.5	2.6 0.8	13.0 4.0	5.0 1.5
108 mm	4.250 108.0	6.4 2.0	3.2 0.9	15.3 4.7	6.4 2.0
4 100	4.500 114.3	6.8 2.1	3.4 1.0	16.0 4.9	6.8 2.1
5 125	5.563 141.3	8.5 2.6	4.2 1.3	21.0 6.4	8.5 2.6
139.7 mm	5.500 139.7	8.3 2.5	4.1 1.3	20.6 6.3	8.3 2.5
159 mm	6.250 158.8	9.4 2.9	4.9 1.5	25.0 7.6	9.6 2.9
6 150	6.625 168.3	10.0 3.0	5.0 1.5	25.0 7.6	10.0 3.0
165.1 mm	6.500 165.1	9.8 3.0	4.9 1.5	24.5 7.5	9.8 3.0
8 200	8.625 219.1	13.0 4.0	5.0 1.5	33.0 10.1	13.0 4.0

[1] The flow data listed is based upon the pressure drop of Schedule 40 pipe.

General Notes:

NOTE: When assembling FireLock EZ couplings onto end caps, take additional care to make certain the end cap is fully seated against the gasket end stop. For FireLock EZ Style 009N/009H couplings, use FireLock No. 006 end caps containing the “EZ” marking on the inside face or No. 60 end caps containing the “QV EZ” marking on the inside face. Non-Victaulic end cap products shall not be used with Style 009/009V/009H couplings.

Installation
Reference should always be made to the I-100 Victaulic Field Installation Handbook for the product you are installing. Handbooks are included with each shipment of Victaulic products for complete installation and assembly data, and are available in PDF format on our website at www.victaulic.com.

Warranty
Refer to the Warranty section of the current Price List or contact Victaulic for details.

Note
This product shall be manufactured by Victaulic or to Victaulic specifications. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

Trademarks
Victaulic® is a registered trademark of Victaulic Company.

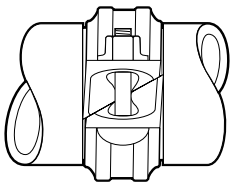
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FireLock® Rigid Coupling
Style 005H
with Vic-Plus™ Gasket System

Victaulic
10.02



Patented



Exaggerated for clarity

VicPlus Gasket System

Approvals/Listings:

c UL us LISTED · FM · CTP · VdS · LPCB

104-1a/02

See Victaulic Publication 10.01 for more details.

LPC and VdS Approved, see notes on page 3

Product Description:

FireLock Style 005H rigid coupling has a unique, patented angle-pad design which allows the housings to offset while clamping the grooves. By permitting the housings to slide on the angled bolt pads, rigidity is obtained.

Support and hanging requirements correspond to NFPA 13 Sprinkler Systems. Angle-pad design permits assembly by removing one nut/bolt and swinging the housing over the gasket. This reduces components to handle during assembly.

Style 005H FireLock coupling are designed and recommended for use ONLY on fire protection systems.

Vic-Plus™ Gasket System:

Victaulic offers a gasket system which requires no field lubrication on wet pipe systems that are hydrostatically tested. The Vic-Plus System (patented) is dry, clean, and non-toxic. It reduces assembly time substantially and eliminates the mess and chance of over-lubrication. Please refer to the latest copy of the Victaulic Field Installation Handbook (I-100) for supplemental lubrication requirements and dry pipe fire protection system notes.

Material Specifications:

Housing: Ductile iron conforming to ASTM A-536, grade 65-45-12. Ductile iron conforming to ASTM A-395, grade 65-45-15, is available upon special request.

Housing Coating: (specify choice)

Standard: Orange enamel (North America); red enamel (Europe)

☐ Optional: Hot dipped galvanized

Coupling Gasket: (specify choice)

NOTE: Additional gasket styles are available. Contact Victaulic for details.

☐ Grade “E” EPDM Type A Vic-Plus™ Gasket System[1]

EPDM (Violet color code). FireLock products have been Listed by Underwriters Laboratories Inc. and Approved by Factory Mutual Research for wet and dry (oil free air) sprinkler services up to the rated working pressure using the Grade “E” Type A Vic-Plus™ Gasket System, requiring no field lubrication for most installation conditions.

☐ Grade “L” silicone

Recommended for dry heat, air without hydrocarbons to +350°F and certain chemical services.

For dry services, Victaulic continues to recommend the use of Grade “E” Type A FlushSeal® Gasket. Contact Victaulic for details.

Bolts/Nuts: Heat-treated plated carbon steel, trackhead meeting the physical and chemical requirements of ASTM A-449 and physical requirements of ASTM A-183.

[1] Standard gasket and FlushSeal gasket approved for dry pipe systems to –40°F/–40°C. Based on “typical” pipe surface conditions, supplemental lubricant is recommended for services installed below 0°F/–18°C and for all dry pipe systems or systems to be subjected to air tests prior to being filled with water. Supplemental lubrication may also be required on pipe with raised or undercut weld seams or pipe that has voids and/or cracks at the weld seams. Victaulic continues to recommend the use of FlushSeal gaskets for dry services.

Job/Owner

System No.	
Location	

Contractor

Submitted By	
Date	

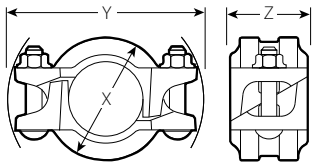
Engineer

Spec Section	
Paragraph	
Approved	
Date	

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Victaulic

Dimensions:



Rated for wet and dry sprinkler systems at 350 psi/2413 kPa for 1 ¼ – 4"/32 – 100 mm sizes and 300 psi /2068 kPa for 4 ¼ – 8"/108 – 200 mm sizes; Schedule 10 roll grooved or Schedule 40 cut or roll grooved steel pipe. Style 005H is rigid and does not accommodate expansion, contraction or angular deflection.

Nominal Size inches mm	Actual Outside Diameter inches mm	Maximum Working Pressure[1,4] psi kPa	Maximum End Load[1] lbs. N	Allow. Pipe End Separation[2] inches mm	Bolt/Nut[3] No. – size inches	Dimensions			Approx. Weight Each lbs. kg
						X inches mm	Y inches mm	Z inches mm	
1 ¼ 32	1.660 42.4	350 2413	755 3370	0.05 1.2	2 – ⅜ × 2 ¼	2.75 70	4.50 114	1.88 48	1.2 0.5
1 ½ 40	1.900 48.3	350 2413	990 4415	0.05 1.2	2 – ⅜ × 2 ¼	3.00 76	4.75 121	1.88 48	1.2 0.5
2 50	2.375 60.3	350 2413	1550 6900	0.07 1.7	2 – ⅜ × 2 ½	3.50 89	5.25 133	1.88 48	1.6 0.7
2 ½ 65	2.875 73.0	350 2413	2270 10110	0.07 1.7	2 – ⅜ × 2 ½	4.00 102	5.75 146	1.88 48	1.9 .09
76.1 mm	3.000 76.1	350 2413	2475 11010	0.07 1.7	2 – ⅜ × 2 ½	4.13 105	5.75 146	1.88 48	1.9 0.9
3 80	3.500 88.9	350 2413	3365 14985	0.07 1.7	2 – ⅜ × 2 ½	4.63 118	6.13 156	1.88 48	2.1 1.0
4 100	4.500 114.3	350 2413	5565 24770	0.16 4.1	2 – ⅜ × 2 ½	5.75 146	7.25 184	2.13 54	3.1 1.4
108.0 mm	4.250 108.0	300 2068	4255 18940	0.16 4.1	2 – ⅜ × 2 ½	5.63 143	7.25 184	2.13 54	3.1 1.4
5 125	5.563 141.3	300 2068	7290 32445	0.16 4.1	2 – ½ × 3	6.88 175	9.00 229	2.13 54	4.5 2.0
133.0 mm	5.250 133.0	300 2068	6495 28900	0.16 4.1	2 – ½ × 2 ¾	6.63 168	9.00 229	2.13 54	4.5 2.0
139.7 mm	5.500 139.7	300 2068	7125 31715	0.16 4.1	2 – ½ × 2 ¾	6.88 175	9.00 229	2.13 54	4.8 2.2
6 150	6.625 168.3	300 2068	10340 46020	0.16 4.1	2 – ½ × 3	8.00 203	10.00 254	2.13 53	5.0 2.3
159.0 mm	6.250 159.0	300 2068	9200 40955	0.16 4.1	2 – ½ × 2 ¾	7.63 194	10.00 254	2.13 54	5.5 2.5
165.1 mm	6.500 165.1	300 2068	9955 44295	0.16 4.1	2 – ½ × 3	8.15 207	10.00 254	2.13 54	5.5 2.5
8 200	8.625 219.1	300 2068	17525 78000	0.19 4.8	2 – ⅝ × 4 ¼	10.50 267	13.14 334	2.63 67	11.3 5.1

1 Working Pressure and End Load are total, from all internal and external loads, based on standard weight (ANSI) steel pipe, standard roll or cut grooved in accordance with Victaulic specifications. Contact Victaulic for performance on other pipe. WARNING: FOR ONE TIME FIELD TEST ONLY, the Maximum Joint Working Pressure may be increased to 1½ times the figures shown.

2 The allowable pipe separation dimension shown is for system layout purposes only. Style 005H couplings are considered rigid connections and will not accommodate expansion or contraction of the piping system.

3 Number of bolts required equals number of housing segments. Metric thread size bolts are available (color coded gold) for all coupling sizes upon request. Contact Victaulic for details.

4 Style 005H couplings are VdS and LPC Approved to 16 Bar/235 psi.

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Listings/Approvals:

The information provided below is based on the latest listing and approval data at the time of publication. Listings/Approvals are subject to change and/or additions by the approvals agencies.

Contact Victaulic for performance on other pipe and the latest listings and approvals.

Related Working Pressure psi					Related Working Pressure psi					Related Working Pressure psi				
Pipe Sch.	**Size** inches	**UL**	**ULC**	**FM**	**Pipe Sch.**	**Size** inches	**UL**	**ULC**	**FM**	**Pipe Sch.**	**Size** inches	**UL**	**ULC**	**FM**
5	1¼ – 3	175	175	175	EL	1¼ – 2	300	N/A	N/A	MT	1¼ – 2	300	N/A	N/A
10, 40	1¼ – 3	350	350	350	ET	1¼ – 2	300	N/A	N/A	STF	1¼ – 4	N/A	N/A	300
	5 – 8	300	300	300	EZ	4 – 6	300[6]	N/A	300	Steady Thd.	1¼ – 2	N/A	N/A	300
BLT	1¼ – 2	300	300	N/A	FF	1¼ – 4	N/A	N/A	300	TF	3 – 8	N/A	N/A	300
DF	1¼ – 4	300	300	300	GAL -7	1¼ – 2	300	N/A	N/A	WLS	1¼ – 2	300	300	N/A
DT	1¼ – 2	300	300	N/A	MLT	1¼ – 2	300	N/A	N/A	XL	1¼ – 3	300	300	300
EF	1¼ – 4	175[7]	N/A	175	MF	1¼ – 4	300	N/A	300[5]					

5 FM approved for service in 1 1/2 – 4" pipe.

6 UL Listed for service up to 4" pipe only.

7 UL Listed for service up to 3" only.

Installation
Reference should always be made to the I-100 Victaulic Field Installation Handbook for the product you are installing. Handbooks are included with each shipment of Victaulic products for complete installation and assembly data, and are available in PDF format on our website at www.victaulic.com.

Warranty
Refer to the Warranty section of the current Price List or contact Victaulic for details.

Note
This product shall be manufactured by Victaulic or to Victaulic specifications. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

Trademarks
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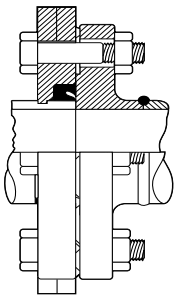
Style 744 FireLock® Flange Adapter

with Vic-Plus™ Gasket System

PRODUCT DESCRIPTION



2 - 8" Sizes



(Exaggerated for clarity)

Style 744 FireLock Flange adapter is designed for directly incorporating flanged components with ANSI CL. 125 or CL. 150 bolt hole patterns into a grooved pipe system. Sizes 2 - 8" (50 - 200 mm) are hinged for easy handling with integral end tabs which facilitate assembly.

The design incorporates small teeth inside the key shoulder I.D. to prevent rotation.

Because of the outside flange dimension, FireLock Flange adapters should not be used on FireLock fittings. When wafer or lug-type valves are used adjoining a Victaulic fitting, check disc dimensions to assure proper clearance.

FireLock Flange adapters should not be used as anchor points for tie-rods across nonrestrained joints. Mating rubber faced flanges, valves, etc., require the use of a FireLock Flange washer.

FireLock Flange adapters with Vic-Plus gaskets do not require lubrication. The gasket must always be assembled with the color coded lip on the pipe and the other lip facing the mating flange.

Style 744 FireLock Flange Adapters with the Vic-Plus™ Gasket System are designed and recommended for use ONLY on fire protection systems.

Vic-Plus Gasket System:
Victaulic® now offers a gasket system which requires no field lubrication on wet pipe systems. The Vic-Plus™ System (patented) is dry, clean, and non-toxic. It reduces assembly time substantially and eliminates the mess and chance of over-lubrication. Please refer to the latest copy of the Victaulic Field Installation Handbook (I-100) for supplemental lubrication requirements.

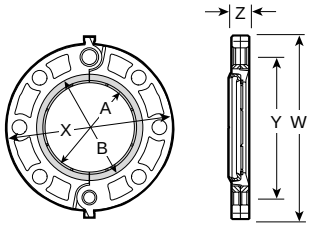
UL ULC FM

See Victaulic publication 10.01 for details.

DIMENSIONS

Style 744

Sizes 2 - 8" (50 - 200 mm)
ANSI Class 125 and 150 Flange



Note: Gray area of mating face must be free from gouges, undulations or deformities of any type for effective sealing.

Pipe Size		Max. Work Press.* PSI kPa	Max. End Load* Lbs. N	No. Bolts † Req'd.	Bolt Size † Inches	Sealing Surface Inches/mm		Dimensions Inches/millimeters				Aprx. Wgt. Each Lbs. kg
Nominal Diameter In./mm	Actual Outside Diameter In./mm					"A" Max.	"B" Min.	W	X	Y	Z	
2 50	2.375 60,3	175 1200	775 3450	4	5/8 X 2 3/4	2.38 60	3.41 87	6.75 172	6.00 152	4.75 121	0.75 19	2.7 1,2
2 1/2 65	2.875 73,0	175 1200	1135 5050	4	5/8 X 3	2.88 73	3.91 99	7.88 200	7.00 178	5.50 140	0.88 22	4.2 1,9
3 80	3.500 88,9	175 1200	1685 7500	4	5/8 X 3	3.50 89	4.53 115	8.44 214	7.50 191	6.00 152	0.94 24	4.8 2,2
4 100	4.500 114,3	175 1200	2780 11045	8	5/8 X 3	4.50 114	5.53 141	9.94 252	9.00 229	7.50 191	0.94 24	7.1 3,2
5 125	5.563 141,3	175 1200	4250 18920	8	3/4 X 3 1/2	5.56 141	6.71 171	11.00 279	10.00 254	8.50 216	1.00 25	8.3 3,8
6# 150	6.625 168,3	175 1200	6030 26840	8	3/4 X 3 1/2	6.63 168	7.78 198	12.00 305	11.00 279	9.50 241	1.00 25	9.3 4,2
8# 200	8.625 219,1	175 1200	10219 45475	8	3/4 X 3 1/2	8.63 219	9.94 252	14.63 372	13.50 343	11.75 298	1.13 29	13.9 6,3

*Refer to notes below.

†Total bolts required to be supplied by installer. Bolt sizes for conventional flange-to-flange connection. Larger bolts are required when Vic-Flange adapter is utilized with wafer-type valves.

Not available with Vic-Plus gasket system. Lubrication is required.

NOTES

* Working Pressure and End Load are total, from all internal and external loads, based on standard weight steel pipe, standard roll or cut grooved in accordance with Victaulic specifications. Contact Victaulic for performance on other pipe.

WARNING: FOR ONE TIME FIELD TEST ONLY, the Maximum Joint Working Pressure may be increased to 1½ times the figures shown.

Style 744 FireLock Flange adapters provide rigid joints when used on pipe with standard roll or cut groove dimensions and consequently allow no linear or angular movement at the joint.

WARNING: Depressurize and drain the piping system before attempting to install, remove, or adjust any Victaulic piping products.

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VIC-FLANGE ADAPTER NOTES

1 The Style 744 (2 - 8"/50 - 200 mm) design incorporates small teeth inside the key shoulder I.D. to prevent rotation.

2 FireLock Flange adapter should not be used on FireLock fittings. When wafer or lug-type valves are used adjoining a Victaulic fitting, check disc dimensions to assure proper clearance.

3 FireLock Flange adapters should not be used as anchor points for tie-rods across nonrestrained joints. Mating rubber faced flanges, valves, etc. require the use of a FireLock Flange washer.

4 Area A-B noted in the above drawing must be free from gouges, undulations or deformities of any type for effective sealing.

5 FireLock Flange adapter gaskets must always be assembled with the color coded lip on the pipe and the other lip facing the mating flange.

6 Flange Washers: FireLock Flange adapters require a smooth hard surface at the mating flange face for effective sealing. Some applications for which the Vic-Flange adapter is otherwise well suited do not provide an adequate mating surface. In such cases, it is recommended that a metal Flange Washer be inserted between the FireLock Flange adapter and the mating flange to provide the necessary sealing surface.

Typical applications where a Flange Washer should be used are:

A When mating to a serrated flange: a standard flat flange gasket should be used adjacent to the serrated flange and then the Flange Washer is inserted between the FireLock Flange adapter and the flange gasket.

B When mating to a wafer valve: where typical valves are rubber lined and partially rubber faced (smooth or not), the Flange Washer is placed between the valve and the FireLock Flange adapter.

C When mating a rubber faced flange: the Flange Washer is placed between the FireLock Flange adapters and the rubber faced flange.

D When mating AWWA cast flanges to IPS flanges: the Flange Washer is placed between two FireLock Flanges. The hinge points must be oriented approximately 90° to each other. If one flange is not a FireLock Flange adapter (e.g. flanged valve), then a standard flat flange gasket must be placed adjacent to that flange and the Flange Washer inserted between the flange gasket and the FireLock Flange adapter.

E When mating to components (valves, strainers, etc.) where the component flange face has an insert: follow the same arrangement as in Application 1.

F When mating to a Series 705-W Butterfly valve, Style 744 may only be used on one side of the connection.

When ordering Flange Washers, always specify product style (Style 744) and size to assure proper Flange Washer is supplied.

MATERIAL SPECIFICATIONS

Flange Housing: Ductile iron conforming to ASTM A-536, grade 65-45-12. Ductile iron conforming to ASTM A-395, grade 65-45-15, is available upon special request.

Coating: Black enamel

- **Optional:** Hot dipped galvanized

Bolts/Nuts: Supplied by installer

Gasket:

- **Grade “E” EPDM - Type A Vic-Plus Gasket System Δ**
  (Violet color code). FireLock products have been Listed by Underwriters Laboratories Inc. and Approved by Factory Mutual Research for wet and dry (oil free air) sprinkler services up to the rated working pressure using the Grade “E” Type A Vic-Plus Gasket System, requiring no field lubrication for most installation conditions.

Δ Standard gasket approved for dry pipe systems to –40°F (–40°C). Based on “typical” pipe surface conditions, supplemental lubricant is recommended for services installed below 0°F (-18°C) and for all dry pipe systems or systems to be subjected to air tests prior to being filled with water. Supplemental lubrication may also be rquired on pipe with raised or undercut weld seams or pipe that has voids and/or cracks at the weld seams.

This product shall be manufactured by Victaulic Company. All products to be installed in accordance with current Victaulic installation/assembly instructions.
Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

Mechanical-T® Bolted Branch Outlets

SEE VICTAULIC PUBLICATION 10.01 FOR DETAILS

STYLES 920 AND 920N

211313 - Wet-Pipe Sprinkler System

Victaulic Mechanical-T® Outlet provides a direct branch connection at any location a hole can be cut in pipe. The hole is cut oversize to receive a "holefinder" locating collar which secures the outlet in position permanently. A pressure responsive gasket seals on the pipe O.D.

Cross-type connections can be achieved by utilizing two upper housings of the same style and size, with the same or differing branch size connections. NOTE: Style 920 and Style 920N housings cannot be mated to each other to achieve a cross connection.

Style 920 and Style 920N Mechanical-T outlets are available with grooved or female threaded outlet. Specify choice on order. Units are supplied painted with plated bolts. Galvanized housings are available, supplied with plated bolts.

All sizes of Style 920 and 920N are rated at 500 psi/3450 kPa working pressure on Schedule 10 and 40 carbon steel pipe. They may also be used on high density polyethylene or polybutylene (HDPE) pipe. Pressure ratings on HDPE are dependent on the pipe rating. Contact Victaulic for ratings on other pipe. **Style 920 and 920N are not recommended for use on PVC plastic pipe.**

Standard piping practices dictate that the Mechanical-T Styles 920 and 920N must be installed so that the main and branch connections are a true 90° angle when permanently attached to the pipeline surface.

Additionally, the Vic-Tap II® hole cutting tool, which allows for hole cutting capabilities on pressurized systems, utilizes the Style 920 Mechanical-T in conjunction with the Series 726 Vic-Ball Valve to create the Style 931 Vic-Tap II Mechanical-T unit. See page 8 for further information.



STYLES 920 AND 920N



STYLE 920 CROSS

PATENTED

MATERIAL SPECIFICATIONS

Housing/Coating: Ductile iron conforming to ASTM A-536, grade 65-45-12, with orange enamel coating. Ductile iron conforming to ASTM A-395, grade 65-45-15, is available upon special request.

- **Optional:** Hot dipped galvanized

Gasket: (Specify choice*)

- **Grade "E" EPDM**
  EPDM (Green color code). Temperature range –30°F to +230°F/–34°C to +110°C. Recommended for cold and hot water service within the specified temperature range plus a variety of dilute acids, oil-free air and many chemical services. UL Classified in accordance with ANSI/NSF 61 for cold +86°F/+30°C and hot +180°F/+82°C. NOT RECOMMENDED FOR PETROLEUM SERVICES.

- **Grade "T" nitrile**
  Nitrile (Orange color code). Temperature range –20°F to +180°F/–29°C to +82°C. Recommended for petroleum products, air with oil vapors, vegetable and mineral oils within the specified temperature range. Not recommended for hot water services over +150°F/+66°C or for hot dry air over +140°F/+60°C.

*Services listed are General Service Recommendations only. It should be noted that there are services for which these gaskets are not recommended. Reference should always be made to the latest Victaulic Gasket Selection Guide for specific gasket service recommendations and for a listing of services which are not recommended.

Bolts/Nuts: Heat-treated plated carbon steel, trackhead meeting the physical and chemical requirements of ASTM A-449 and physical requirements of ASTM A-183.

JOB/OWNER	CONTRACTOR	ENGINEER
System No. _____	Submitted By _____	Spec Sect _____ Para _____
Location _____	Date _____	Approved _____
		Date _____

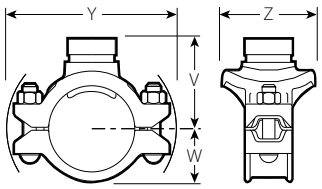
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Mechanical-T® Bolted Branch Outlets

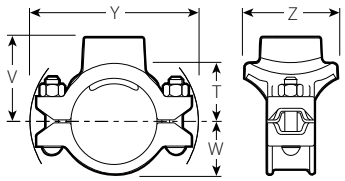
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STYLES 920 AND 920N

DIMENSIONS



GROOVED OUTLET



FEMALE THREADED OUTLET

- Provides a direct branch connection at any location where a hole can be cut in the pipe
- A pressure responsive gasket provides the seal
- Request Publication 11.03 for Mechanical-T cross assemblies
- Pressure rated up to 500 psi/3450 kPa on steel pipe; also available for use with HDPE pipe
- Sizes from 2 × ½"/50 × 15 mm through 8 × 4"/200 × 100 mm

Size			Style No.	Max. Work Pressure@	Dimensions							Approx. Weight Each	
Run × Branch Nominal Size Inches mm			920 or 920N	psi kPa	Hole Diameter +0.13 -0.00	T** Inches mm	V ‡ # Thd. Inches mm	V ‡ Grv. Inches mm	W Inches mm	Y Inches mm	Z Inches mm	Female Thd. Lbs. kg	Grv. Lbs. kg
2 50	×	½ (a) ¤ 15	920N	500 3450	1.50 38.1	2.00 51	2.53 64	—	1.61 41	5.35 136	2.75 70	3.1 1.5	—
		¾ (a) ¤ 20	920N	500 3450	1.50 38.1	1.97 50	2.53 64	—	1.61 41	5.35 136	2.75 70	3.1 1.5	—
		1 (a) ¤ 25	920N	500 3450	1.50 38.1	1.85 47	2.53 64	—	1.61 41	5.35 136	2.75 70	3.0 1.4	—
		1 ¼ (a) †¤ 32	920N	500 3450	1.75 44.5	2.05 52	2.75 70	3.00 76	1.61 41	5.35 136	3.00 76	3.5 1.7	3.2 1.5
		1 ½ (a) †¤ 40	920N	500 3450	1.75 44.5	2.03 52	2.75 70	3.12 79	1.61 41	5.35 136	3.25 83	3.6 1.7	3.2 1.5
2 ½ 65	×	½ (a) §¤ 15	920N	500 3450	1.50 38.1	2.21 56	2.74 70	—	1.82 46	5.64 143	2.75 70	3.0 1.4	—
		¾ (a) §¤ 20	920N	500 3450	1.50 38.1	2.18 55	2.74 70	—	1.82 46	5.64 143	2.75 70	3.0 1.4	—
		1 (a) §¤ 25	920N	500 3450	1.50 38.1	2.06 52	2.74 70	—	1.82 46	5.64 143	2.75 70	2.9 1.4	—
		1 ¼ † (a) ¤ 32	920N	500 3450	1.75 44.5	2.30 58	3.00 76	3.25 83	1.82 46	6.29 160	3.00 76	3.5 1.7	3.2 1.5
		1 ½ † (a) ¤ 40	920N	500 3450	2.00 50.8	2.28 58	3.00 76	3.25 83	1.82 46	6.26 159	3.25 83	3.6 1.7	3.3 1.6
76.1	×	½ (a) 15	920N	300 2065	1.50 38.1	2.22 56	2.75 70	—	2.25 57	6.46 164	3.18 81	3.9 1.8	—
		¾ (a) 20	920N	300 2065	1.50 38.1	2.19 56	2.75 70	—	2.25 57	6.46 164	3.18 81	3.9 1.8	—
		1 (a) 25	920N	300 2065	1.50 38.1	2.07 53	2.75 70	—	2.25 57	6.46 164	3.18 81	3.8 1.7	—
		1 ¼ (a) ¤ 32	920N	500 3450	1.75 44.5	2.30 58	3.00 76	3.31 84	1.92 49	6.29 160	3.00 76	3.5 1.6	3.2 1.5
		1 ½ (a) ¤ 40	920N	500 3450	2.00 50.8	2.28 58	3.00 76	3.31 84	1.92 49	6.29 160	3.25 83	3.5 1.6	3.3 1.5
3 80	×	½ (a) ¤ 15	920N	500 3450	1.50 38.1	2.52 64	3.05 78	—	2.28 58	6.15 156	2.75 70	3.4 1.6	—
		¾ (a) ¤ 20	920N	500 3450	1.50 38.1	2.49 63	3.05 78	—	2.28 58	6.15 156	2.75 70	3.4 1.6	—
		1 (a) 25	920N	500 3450	1.50 38.1	2.38 61	3.06 78	—	2.28 58	6.15 156	2.75 70	3.3 1.6	—
		1 ¼ (a) †¤ 32 (b)	920N	500 3450	1.75 44.5	2.55 65	3.25 83	3.56 90	2.28 58	6.15 156	3.00 76	3.8 1.8	3.7 1.8
		1 ½ (a) †¤ 40 (b)	920N	500 3450	2.00 50.8	2.78 71	3.50 89	3.56 90	2.28 58	6.15 156	3.25 83	4.1 1.9	3.8 1.8
		2 (a) ¤ 50	920N	500 3450	2.50 63.5	2.75 70	3.50 89	3.56 90	2.28 58	6.75 172	3.88 99	4.9 2.3	4.6 2.1
3 ½ 90	×	2 50	920N	500 3450	2.50 63.5	3.00 76	—	3.75 95	2.44 62	6.72 171	3.88 99	—	3.8 1.8

TABLE CONTINUED ON PG. 3

IMPORTANT NOTES:

Style 920 and Style 920N housings cannot be mated to one another to achieve cross connections.

** Center of run to engaged pipe end, female threaded outlet only (dimensions approximate).

† Available with grooved or female threaded outlet. Specify choice on order.

‡ Center of run to end of fitting.

Female threaded outlets are available to NPT and BSPT specifications.

@ See page 7 for Fire Protection approvals and pressure ratings.

(a) British Standard female pipe threaded outlet is available as listed. Specify "BSPT" clearly on order.

(b) For 76.1 mm threaded outlet, specify 2½" BSPT clearly on order.

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¤ LPCB approved for fire protection services

Ø Approved for use in China by Tianjin Approvals Company.

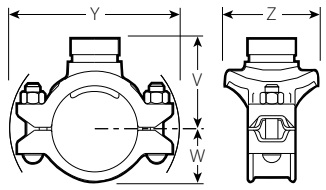
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Mechanical-T® Bolted Branch Outlets

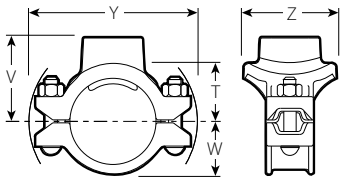
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STYLES 920 AND 920N

DIMENSIONS



GROOVED OUTLET



FEMALE THREADED OUTLET

- Provides a direct branch connection at any location where a hole can be cut in the pipe
- A pressure responsive gasket provides the seal
- Request Publication 11.03 for Mechanical-T cross assemblies
- Pressure rated up to 500 psi/3450 kPa on steel pipe; also available for use with HDPE pipe
- Sizes from 2 × ½"/50 × 15 mm through 8 × 4"/200 × 100 mm

Size		Style No.	Max. Work Pressure@	Dimensions							Approx. Weight Each	
Run × Branch Nominal Size Inches mm		920 or 920N	psi kPa	Hole Diameter +0.13 -0.00	T** Inches mm	V ‡ # Thd. Inches mm	V ‡ Grv. Inches mm	W Inches mm	Y Inches mm	Z Inches mm	Female Thd. Lbs. kg	Grv. Lbs. kg
TABLE CONTINUED FROM PAGE 2												
4 100 ×	½ (a) ¤ 15	920N	500 3450	1.50 38.1	3.03 77	3.56 90	—	2.69 68	7.01 178	2.75 70	3.7 1.8	—
	¾ (a) ¤ 20	920N	500 3450	1.50 38.1	3.00 76	3.56 90	—	2.69 68	7.01 178	2.75 70	3.7 1.8	—
	1 (a) ¤ 25	920N	500 3450	1.50 38.1	2.88 73	3.56 90	—	2.69 68	7.01 178	2.75 70	3.6 1.8	—
	1 ¼ (a) †¤ 32 (b)	920N	500 3450	1.75 44.5	3.08 78	3.78 96	4.00 102	2.69 68	7.01 178	3.00 76	4.0 1.9	3.6 1.8
	1 ½ (a) †¤ 40 (b)	920N	500 3450	2.00 50.8	3.28 83	4.00 102	4.00 102	2.69 68	7.01 178	3.25 83	4.2 2.0	3.9 1.9
	2 (a) †¤ 50	920N	500 3450	2.50 63.5	3.25 83	4.00 102	4.00 102	2.69 68	7.01 178	3.88 99	5.0 2.3	4.6 2.1
	2 ½ (a) † 65	920	500 3450	2.75 69.9	2.88 73	4.00 102	4.00 102	2.69 68	7.34 186	4.63 118	5.8 2.6	5.0 2.3
	76.1 mm	920	500 3450	2.75 69.9	2.88 73	—	4.00 102	2.69 68	7.34 186	4.63 118	—	6.4 2.9
	3 (a) † 80	920	500 3450	3.50 88.9	3.31 84	4.50 114	4.12 105	2.69 68	7.73 196	5.12 130	8.4 3.8	6.4 2.9
108.0 ×	1 ¼ (a)¤ 32	920N	500 3450	1.75 44.5	3.08 78	3.78 96	—	2.63 67	7.64 194	3.05 78	5.0 2.3	—
	1 ½ (a)¤ 40	920N	500 3450	2.00 50.8	3.28 83	4.00 102	—	2.63 67	7.64 194	3.25 83	5.0 2.3	—
	2 (a) 50	920N	500 3450	2.50 63.5	3.25 83	4.00 102	—	2.63 67	7.64 194	4.00 102	4.0 1.9	—
	76.1 mm	920	500 3450	2.75 69.9	2.88 73	4.00 102	4.00 102	2.63 67	7.64 194	4.29 109	8.0 3.6	7.8 3.5
	3 (a) 80	920	500 3450	3.50 88.9	3.31 84	4.50 114	4.50 114	2.63 67	7.63 194	4.88 124	6.8 3.1	6.5 3.0
5 125 ×	1 ½ (a) † 40	920	500 3450	2.00 50.8	4.03 102	4.75 121	4.75 121	3.16 80	9.70 246	3.69 94	7.4 3.4	7.6 3.4
	2 (a) † 50	920	500 3450	2.50 63.5	4.00 102	4.75 121	4.75 121	3.16 80	9.70 246	4.38 111	8.2 3.7	8.0 3.6
	2 ½ (a) † 65	920	500 3450	2.75 69.9	3.63 92	4.75 121	4.75 121	3.16 80	9.70 246	4.63 118	8.3 3.8	7.9 3.6
	76.1 mm ¤	920	500 3450	2.75 69.9	3.75 95	—	4.75 121	3.16 80	9.70 246	4.63 118	—	8.0 3.6
	3 (a) † 80	920	500 3450	3.50 88.9	3.81 97	5.00 127	4.63 118	3.16 80	9.70 246	5.31 135	8.4 3.8	8.8 4.0
133.0 ×	2 50	920N	500 3450	2.50 63.5	3.75 95	4.50 114	—	3.17 81	8.00 203	3.88 99	8.0 3.6	—
	3 80	920	500 3450	3.50 88.9	3.81 97	5.00 127	—	3.00 76	9.46 240	5.31 135	8.0 3.6	—
TABLE CONTINUED ON PG. 4												

IMPORTANT NOTES:

Style 920 and Style 920N housings cannot be mated to one another to achieve cross connections.

** Center of run to engaged pipe end, female threaded outlet only (dimensions approximate).

† Available with grooved or female threaded outlet. Specify choice on order.

‡ Center of run to end of fitting.

Female threaded outlets are available to NPT and BSPT specifications.

@ See page 7 for Fire Protection approvals and pressure ratings.

(a) British Standard female pipe threaded outlet is available as listed. Specify "BSPT" clearly on order.

(b) For 76.1 mm threaded outlet, specify 2½" BSPT clearly on order.

§ Vds approved for fire protection services

¤ LPCB approved for fire protection services

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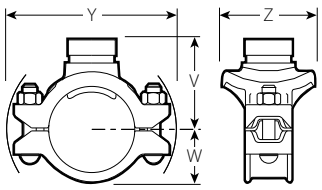
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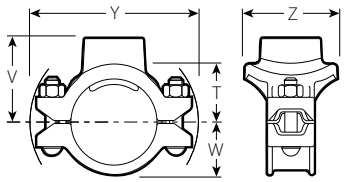
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STYLES 920 AND 920N

DIMENSIONS



GROOVED OUTLET



FEMALE THREADED OUTLET

- Provides a direct branch connection at any location where a hole can be cut in the pipe
- A pressure responsive gasket provides the seal
- Request Publication 11.03 for Mechanical-T cross assemblies
- Pressure rated up to 500 psi/3450 kPa on steel pipe; also available for use with HDPE pipe
- Sizes from 2 × ½"/50 × 15 mm through 8 × 4"/200 × 100 mm

IMPORTANT NOTES:

Style 920 and Style 920N housings cannot be mated to one another to achieve cross connections.

Size		Style No.	Max. Work Pressure@	Dimensions							Approx. Weight Each	
Run × Branch Nominal Size Inches mm		920 or 920N	psi kPa	Hole Diameter +0.13 -0.00	T** Inches mm	V ‡ # Thd. Inches mm	V ‡ Grv. Inches mm	W Inches mm	Y Inches mm	Z Inches mm	Female Thd. Lbs. kg	Grv. Lbs. kg
TABLE CONTINUED FROM PAGE 3												
139.7 ×	1 ½ † 40	920N	500 3450	2.00 50.8	3.78 96	4.50 114	—	3.30 84	8.23 209	3.25 83	7.0 3.2	—
	2 † 50	920N	500 3450	2.50 63.5	3.75 95	4.50 114	—	3.30 84	8.23 209	3.88 99	9.0 4.1	—
6 150 ×	1 ¼ (a) 32 (b)	920N	500 3450	1.75 44.5	4.43 112	5.13 130	5.13 130	3.79 96	9.15 232	3.25 83	5.1 2.3	4.8 2.2
	1 ½ (a) †¤ 40 (b)	920N	500 3450	2.00 50.8	4.40 112	5.13 130	5.13 130	3.79 96	9.15 232	3.25 83	5.4 2.4	5.1 2.3
	2 (a) †¤ 50	920N	500 3450	2.50 63.5	4.38 111	5.13 130	5.13 130	3.79 96	9.15 232	3.88 99	6.0 2.7	5.6 2.5
	2 ½ 65	920	500 3450	2.75 69.9	4.01 110	5.13 130	5.12 130	3.69 94	10.51 267	4.63 118	8.3 3.8	7.6 3.4
	76.1 mm ¤	920	500 3450	2.75 69.9	4.15 105	—	5.21 132	3.69 94	10.51 267	4.63 118	—	8.4 3.8
	3 (a) † 80	920	500 3450	3.50 88.9	4.31 110	5.50 140	5.13 130	3.69 94	10.51 267	5.31 135	9.9 4.5	8.4 3.8
	4 (a) †¤ 100	920	500 3450	4.50 114.3	3.81 97	5.75 146	5.38 137	3.69 94	10.51 267	6.25 159	10.1 4.6	10.1 4.6
159.0 ×	1 ½ (a) 40	920N	500 3450	2.00 50.8	4.41 112	5.13 130	—	3.63 92	9.40 239	3.25 83	7.8 3.5	—
	2 (a) 50	920N	500 3450	2.50 63.5	4.38 111	5.13 130	—	3.63 92	9.40 239	3.88 99	8.0 3.6	—
	76.1 mm	920	500 3450	2.75 69.9	4.38 111	5.50 140	5.13 130	3.63 92	9.40 239	4.63 118	9.5 4.3	9.5 4.3
	3 80	920	500 3450	3.50 88.9	4.31 110	5.50 140	5.13 130	3.63 92	9.40 239	5.31 135	8.1 3.7	14.0 6.4
	108.0 mm	920	500 3450	4.50 114.3	4.45 113	—	5.38 137	3.63 92	9.40 239	6.12 155	—	10.0 4.5
	4 100	920	500 3450	4.50 114.3	3.81 96.80	5.75 146	—	3.63 92	9.40 239	6.25 159	18.0 8.2	—
TABLE CONTINUED ON PG. 5												

** Center of run to engaged pipe end, female threaded outlet only (dimensions approximate).

† Available with grooved or female threaded outlet. Specify choice on order.

‡ Center of run to end of fitting.

Female threaded outlets are available to NPT and BSPT specifications.

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(a) British Standard female pipe threaded outlet is available as listed. Specify "BSPT" clearly on order.

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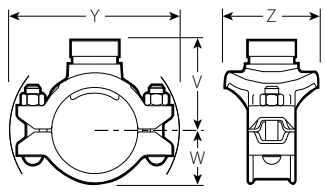
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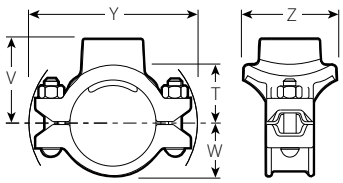
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STYLES 920 AND 920N

DIMENSIONS



GROOVED OUTLET



FEMALE THREADED OUTLET

- Provides a direct branch connection at any location where a hole can be cut in the pipe
- A pressure responsive gasket provides the seal
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- Pressure rated up to 500 psi/3450 kPa on steel pipe; also available for use with HDPE pipe
- Sizes from 2 × ½"/50 × 15 mm through 8 × 4"/200 × 100 mm

Size		Style No.	Max. Work Pressure@	Dimensions							Approx. Weight Each	
Run × Branch Nominal Size Inches mm		920 or 920N	psi kPa	Hole Diameter +0.13 -0.00	T** Inches mm	V ‡ # Thd. Inches mm	V ‡ Grv. Inches mm	W Inches mm	Y Inches mm	Z Inches mm	Female Thd. Lbs. kg	Grv. Lbs. kg
TABLE CONTINUED FROM PAGE 4												
165.1 ×	1 25	920N	500 3450	1.50 38.1	3.88 99	4.56 116	—	3.79 96	9.34 237	2.75 70	8.0 3.6	—
	1 ¼ ¤ 32	920N	500 3450	1.75 44.5	4.43 113	5.13 130	—	3.79 96	9.34 237	3.25 83	8.4 3.8	—
	1 ½ (a) †¤ 40	920N	500 3450	2.00 50.8	4.41 112	5.13 130	5.13 130	3.79 96	9.34 237	3.25 83	8.4 3.8	5.4 2.4
	2 (a) † 50	920N	500 3450	2.50 63.5	4.38 111	5.13 130	5.13 130	3.79 96	9.34 237	3.88 99	8.5 3.9	6.0 2.7
	76.1 mm	920	500 3450	2.75 69.9	4.01 110	5.13 130	5.21 132	3.63 92	10.51 267	4.63 118	8.6 3.9	7.6 3.4
	3 (a) † ø 80	920	500 3450	3.50 88.9	4.31 110	5.50 140	5.13 130	3.63 92	10.51 267	5.31 135	10.2 4.6	8.4 3.8
	4 (a) †¤ 100	920	500 3450	4.50 114.3	3.81 97	5.75 146	5.38 137	3.63 92	10.51 267	6.25 159	10.5 4.8	8.4 3.8
8 200 ×	2 (a) † 50	920	500 3450	2.75 69.9	5.44 138	6.19 157	6.25 159	4.81 122	12.42 316	4.50 114	11.6 5.3	11.6 5.3
	2 ½ (a) † 65	920	500 3450	2.75 69.9	5.07 129	6.19 157	6.19 157	4.81 122	12.42 316	4.50 114	11.6 5.3	11.6 5.3
	76.1 mm ¤	920	500 3450	2.75 69.9	5.25 133	—	6.25 159	4.81 122	12.42 316	4.56 116	—	11.6 5.3
	3 (a) †¤ 80	920	500 3450	3.50 88.9	5.31 135	6.50 165	6.50 165	4.81 122	12.42 316	5.31 135	12.6 5.7	11.6 5.3
	4 (a) †¤ 100	920	500 3450	4.50 114.3	4.81 122	6.75 171	6.38 162	4.81 122	12.42 316	6.25 159	15.3 6.9	12.5 5.7

** Center of run to engaged pipe end, female threaded outlet only (dimensions approximate).

† Available with grooved or female threaded outlet. Specify choice on order.

‡ Center of run to end of fitting.

Female threaded outlets are available to NPT and BSPT specifications.

@ See page 7 for Fire Protection approvals and pressure ratings.`

(a) British Standard female pipe threaded outlet is available as listed. Specify "BSPT" clearly on order.

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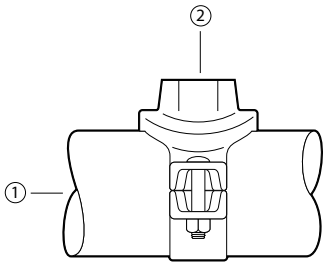
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STYLES 920 AND 920N

FLOW DATA



Exaggerated for clarity

Flow test data has shown that the total head loss between point (1) and (2) for the Style 920, 920N and 929 Mechanical-T® fittings can best be expressed in terms of the pressure difference across the inlet and branch. The pressure difference can be obtained from the relationship below.

C_V and Kv Values

Values for flow of water at +60°F/+16°C are shown in the table below.

Formulas for C_V /K_v Values:

$$\Delta P = \frac{Q^2}{C_v^2}$$

$$Q = C_v \times \sqrt{\Delta P}$$

Where:
Q = Flow (GPM)
ΔP = Pressure Drop (psi)
C_v = Flow Coefficient

$$\Delta P = \frac{Q^2}{K_v}$$

$$Q = K_v \times \sqrt{\Delta P}$$

Where:
Q = Flow (m^3/h)
ΔP = Pressure Drop (bar)
K_v = Flow Coefficient

OUTLET SIZE		Equivalent Length of Outlet Size Schedule 40 Carbon Steel Pipe (per UL 213, Sec. 16) (C = 120)ŧ FT		C_V/K_V Values	
NOMINAL DIAMETER In/mm	ACTUAL O.D. In/mm	GROOVED	THREADED	GROOVED	THREADED
½ 15	0.840 21.3	-	2	-	11 9.4
¾ 20	1.050 26.7	-	4	-	16 13.7
1 25	1.315 33.7	-	8	-	21 1.8
1 ¼ 32	1.660 42.7	5 ½	6	50 42.9	48 41.1
1 ½ 40	1.900 98.3	11	11	53 45.4	53 45.4
2 50	2.375 60.3	9	10 ½	112 96	104 89.1
2 ½ 65	2.875 73.0	20	12 ½	119 102	150 128.5
76.1 mm	3.000 76.1	16*	-	161 138.1	-
3 80	3.500 88.9	14	15 ½	249 213.4	237 203.1
4 100	4.500 114.3	20	22	421 360.8	401 343.6

ŧ Hazen-Williams coefficient of friction is 120.
* Pipe with a wall thickness of 0.165in./4.2mm.

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Mechanical-T® Bolted Branch Outlets

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STYLES 920 AND 920N

FIRE PROTECTION APPROVALS AND PRESSURE RATINGS

The information provided below is based on the latest listing and approval data at the time of publication. Listings/Approvals are subject to change and/or additions by the approvals agencies. Contact Victaulic for performance on other pipe and the latest listings and approvals.

Run Size		Outlet Size	Pipe	Approval Agency Rated Working Pressures – psi/kPa					
Nominal Size Inches/mm	Actual Outside Diameter Inches/mm	Inches/mm	Schedule	UL	ULC	FM	LPCB	Vds (Style 920)	Vds (Style 920N)
21/2 - 6 65 - 150	2.875 - 6.625 73.0 - 168.3	All	10, 40	400 2755	400 2755	400 2755	290 1999	232 1599	362 2496
21/2 - 4 65 - 100	2.875 - 4.500 73.0 - 114.3	All	DF	300 2065	300 2065	300 2065	290 1999	232 1599	362 2496
21/2 - 4 65 - 100	2.875 - 4.500 73.0 - 114.3	All	SF	300 2065	300 2065	300 2065	290 1999	232 1599	362 2496
6 150	6.625 168.3	3, 4	10	300 2065	300 2065	250 1724	290 1999	232 1599	362 2496
6 150	6.625 168.3	3,4	30, 40	300 2065	300 2065	300 2065	290 1999	232 1599	362 2496
8 200	8.625 219.1	21/2	10, 40	400 2755	—	—	—	145 1000	—
8 200	8.625 219.1	3,4	10	300 2065	—	250 1724	—	145 1000	—
8 200	8.625 219.1	3,4	30, 40	300 2065	—	300 2065	—	145 1000	—

NOTES:

10 refers to Listed/Approved Schedule 10 steel sprinkler pipe.

40 refers to Listed/Approved Schedule 40 steel sprinkler pipe.

DF refers to Listed/Approved Dyna-Flow steel sprinkler pipe manufactured by American Tube Company.

SF refers to Listed/Approved Super-Flo steel sprinkler pipe manufactured by Allied Tube and Conduit Corporation.

VIC-TAP II HOLE CUTTING TOOL FOR 4 - 8"/100 - 200 MM CARBON STEEL PIPE



The Vic-Tap II hole cutting tool is designed for use with the Style 931 Vic-Tap II Mechanical-T unit, which is a combination of the Style 920 Mechanical-T and Series 726 Vic-Ball Valve. The Vic-Tap II is capable of tapping into carbon steel pipe systems under pressures up to 500 psi/3450 kPa.

The Style 931 Vic-Tap II Mechanical-T unit is a full port ball valve which can be mounted on 4"/100 mm, 5"/125 mm, 6"/150 mm and 8"/200 mm diameter pipe. The Style 931 comes with a 2½"/65 mm grooved outlet.

The drill motor is an electric motor with ground fault circuit interrupter (GFCI) in accordance with safety codes.

For more information, refer to publication 24.01.

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Mechanical-T® Bolted Branch Outlets

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STYLES 920 AND 920N

INSTALLATION

Reference should always be made to the I-100 Victaulic Field Installation Handbook for the product you are installing. Handbooks are included with each shipment of Victaulic products for complete installation and assembly data, and are available in PDF format on our website at www.victaulic.com.

WARRANTY

Refer to the Warranty section of the current Price List or contact Victaulic for details.

NOTE

This product shall be manufactured by Victaulic or to Victaulic specifications. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

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211313 - Wet-Pipe Sprinkler System

Victaulic® Firelock™ Rigid Coupling Style 009N

10.64



Patented

1.0 CERTIFICATION/LISTINGS

C104-1a/36

2.0 PRODUCT DESCRIPTION

- The FireLock EZ™ Style 009N Installation-ReadyTM Rigid Coupling is for use in the fire protection market.
- The coupling's unique design eliminates loose parts, promotes consistent installation and provides substantial gains in productivity.
- **IMPORTANT:** FireLock EZ™ Style 009N couplings are recommended for use ONLY on fire protection systems.

3.0 MATERIAL SPECIFICATIONS

Housing: Ductile iron conforming to ASTM A 536, Grade 65-45-12. Ductile iron conforming to ASTM A 395, Grade 65-45-15, is available upon special request.

Housing Coating: (specify choice)

☐ Orange enamel (North America, Asia Pacific)

☐ Red enamel (Europe)

☐ Hot dipped galvanized

Gasket: (specify choice[1])

☐ **Grade "E" EPDM (Type A)**
FireLock EZ products have been Listed by Underwriters Laboratories Inc., Underwriters Laboratories of Canada Limited, and Approved by Factory Mutual Research for wet and dry (oil free air) sprinkler services within the rated working pressure.

1 Services listed are General Service Guidelines only. It should be noted that there are services for which these gaskets are not compatible. Reference should always be made to the latest Victaulic Gasket Selection Guide for specific gasket service guidelines and for a listing of services which are not compatible.

Bolts/Nuts: Zinc electroplated carbon steel, trackhead meeting the physical and chemical requirements of ASTM A 449 and physical requirements of ASTM A 183.

System No.		Location		Spec Section		Paragraph	
Submitted By		Date		Approved		Date	

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4.0 LISTINGS/APPROVAL [2]

The information provided below is based on the latest listing and approval data at the time of publication. Listings/Approvals are subject to change and/or additions by the approvals agencies. Contact Victaulic for performance on other pipe and the latest listings and approvals.

Nominal Size	cULus			FM			Vds	LPCB
inches mm	Sch. 5 psi kPa	Sch. 10 psi kPa	Sch. 40 psi kPa	Sch. 5 psi kPa	Sch. 10 psi kPa	Sch. 40 psi kPa	psi kPa	psi kPa
1 ¼ 32	232 1600	365 2517	365 2517	175 1205	363 2502	363 2502	363 2500	363 2500
1 ½ 40	232 1600	365 2517	365 2517	175 1205	363 2502	363 2502	363 2500	363 2500
2 50	363 2502	365 2517	365 2517	175 1205	363 2502	363 2502	363 2500	363 2500
2 ½ 65	N/A	365 2517	365 2517	175 1205	363 2502	363 2502	363 2500	363 2500
76.1 mm	N/A	365 [3] 2517 [3]	N/A	N/A	363 [4] 2502 [4]	N/A	363 2500	363 2500
3 80	N/A	365 2517	365 2517	175 1205	363 2502	363 2502	363 2500	363 2500
4 100	N/A	365 2517	365 2517	175 1205	363 2502	363 2502	363 2500	363 2500
108.0 mm	N/A	N/A	N/A	175 1205	363 2502	363 2502	N/A	N/A
5 125	N/A	290 2000	365 2517	N/A	363 2502	363 2502	232 1600	N/A
133.0 mm	N/A	N/A	N/A	N/A	363 [4] 2502 [4]	N/A	N/A	N/A
139.7 mm	N/A	290 [5] 2000 [5]	N/A	N/A	363 [4] 2502 [4]	N/A	232 1600	N/A
159.0 mm	N/A	N/A	N/A	N/A	363 [4] 2502 [4]	N/A	N/A	N/A
165.1 mm	N/A	290 [6] 2000 [6]	N/A	N/A	363 [4] 2502 [4]	N/A	N/A	N/A
6 150	N/A	290 2000	365 2517	N/A	363 2502	363 2502	232 1600	N/A
216.0 mm	N/A	N/A	N/A	N/A	363 [4] 2502 [4]	N/A	N/A	N/A
8 200	N/A	290 2000	365 2517	N/A	363 2502	363 2502	232 1600	N/A

2 Listed/Approved for wet and dry pipe systems (> –40°F/–40°C) for continuous use in freezing conditions, use of Style 005H Coupling with Silicone Gasket is recommended.
Please see the Victaulic Installation Manual I-009N/009H for details concerning when supplemental lubrication is required.

3 cULus listed for DIN 2458 2.6 mm pipe wall.

4 FM approved for BS 1387 Medium 3.6 mm pipe wall.

5 cULus listed for EN 10220 4.0 mm pipe wall.

6 cULus listed for EN 10255 4.5 mm pipe wall.

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4.1 LISTINGS/APPROVAL

Speciality Pipe

Pipe	Size	Pressure Rating		Pipe	Size	Pressure Rating		Pipe	Size	Pressure Rating	
	inches	**cULus** psi kPa	**FM** psi kPa		inches	**cULus** psi kPa	**FM** psi kPa		inches	**cULus** psi kPa	**FM** psi kPa
BLT	1 ¼ – 2	300 2068	365 2517	EZT	1 ¼ – 2	300 2068	365 2517	MT	1 ¼ – 2	300 2068	365 2517
DF	1 ¼ – 4	300 2068	365 2517	FF	1 ¼ – 4	300 2068	365 2517	MLT	1 ¼ – 2	N/A	365 2517
DT	1 ¼ – 2	300 2068	365 2517	FLF	1 ¼ – 4	N/A	365 2517	ST	1 ¼ – 2	N/A	365 2517
EF	1 ¼ – 4	175 1206	175 1206	FLT	1 ¼ – 2	N/A	365 2517	STF	1 ¼ – 4	N/A	365 2517
EL	1 ¼ – 2	300 2068	365 2517	FLTL	1 ¼ – 2	N/A	365 2517	TF	2 ¼ – 4	N/A	365 2517
ET40	1 ¼ – 2	300 2068	365 2517	GL	1 ¼ – 2	300 2068	365 2517	WLS	1 ¼ – 2	300 2068	365 2517
EZF	3 – 4	300 2068	365 2517	MF	1 ¼ – 4	300 2068	365 2517	WST	1 ¼ – 2	N/A	365 2517
								XL	1 ¼ – 2	300 2068	365 2517

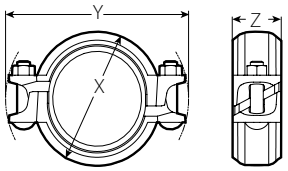
NOTES

- BLT = BLT steel pipe manufactured by Allied Tube & Conduit Corp.
- DF = DYNA-FLOW steel pipe manufactured by Allied Tube & Conduit Corp.
- DT = DYNA-FLOW steel pipe manufactured by Allied Tube & Conduit Corp.
- EF = EDDY FLOW steel pipe manufactured by Bull Moose Tube Co.
- EL = EDDYLITE steel pipe manufactured by Bull Moose Tube Co.
- ET40 = Eddythread 40 steel pipe manufactured by Bull Moose Tube Co.
- EZF = EZ-Flow steel pipe manufactured by Northwest Pipe Co.
- EZT = EZ-Thread steel pipe manufactured by Youngstown Tube Co.
- FF = Fire-Flo steel pipe manufactured by Youngstown Tube Co.
- FLF = Fire-Line Flow steel pipe manufactured by Western International Forest Products Inc.
- FLT = Fire-Line Threadable steel pipe manufactured by Western International Forest Products Inc.
- FLTL = Fire-Line Threadable Light steel pipe manufactured by Western International Forest Products Inc.
- GL = GL steel pipe manufactured by Wheatland Tube Co.
- MF = Mega-Flow steel pipe manufactured by Wheatland Tube Co.
- MT = Mega-Thread steel pipe manufactured by Wheatland Tube Co.
- MLT = MLT steel pipe manufactured by Wheatland Tube Co
- ST = STD wall pipe in accordance with ASTM A53.
- STF = Steady Flow steel pipe manufactured by AMS Tube Corp.
- TF = Tex-Flow steel pipe manufactured by Tex-Tube Co.
- WLS = WLS steel pipe manufactured by Wheatland Tube Co.
- WST = WST steel pipe manufactured by Wheatland Tube Company.
- XL = XL steel pipe manufactured by Allied Tube & Conduit Corp.

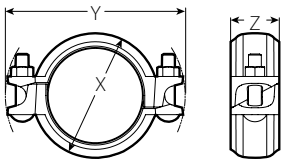
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5.0 DIMENSIONS

Style 009N



Style 009N Pre-Assembled
(Push On Condition)



Style 009N Joint Assembled

Nominal Size	Actual Outside Diameter	Maximum Working Pressure [7]	Maximum End Load [7]	Allow. Pipe End Separation [8]	Bolt/Nut [9] Size		Dimensions					Approx. Weight Each
							Pre-assembled (Push On Condition)		Joint Assembled			
							X	Y	X	Y	Z	
inches mm	inches mm	psi kPa	lbs. N	inches mm	No.	inches mm	inches mm	inches mm	inches mm	inches mm	inches mm	lbs. kg
1 ¼ 32	1.660 42.4	365 2517	790 3514	0.10 2.54	2	⅜ × 2 M10 x 2	3.13 79	5.00 127	2.75 70	5.00 127	2.00 51	1.4 0.6
1 ½ 40	1.900 48.3	365 2517	1035 4604	0.10 2.54	2	⅜ × 2 M10 x 2	3.38 86	5.13 130	3.00 76	5.13 130	2.00 51	1.5 0.7
2 50	2.375 60.3	365 2517	1616 7193	0.12 3.05	2	⅜ ×2 ½ M10 x 2 ½	4.00 102	5.63 143	3.50 89	5.63 143	2.00 51	1.9 0.9
2 ½ 65	2.875 73.0	365 2517	2370 10542	0.12 3.05	2	⅜ × 2 ½ M10 x 2 ½	4.50 114	6.13 156	4.00 102	6.13 156	2.00 51	2.1 1.0
76.1 mm	3.000 76.1	365 2517	2580 11476	0.12 3.05	2	⅜ × 2 ½ M10 x 2 ½	4.63 118	6.00 152	4.13 105	6.13 156	2.00 51	2.1 1.0
3 80	3.500 88.9	365 2517	3512 15622	0.12 3.05	2	⅜ × 2 ½ M10 x 2 ½	5.13 130	6.75 171	4.63 117	6.75 171	2.00 51	2.3 1.0
4 100	4.500 114.3	365 2517	5805 25822	0.17 4.32	2	⅜ × 2 ½ M10 x 2 ½	6.00 152	7.88 200	5.63 143	7.50 191	2.13 54	2.9 1.3
108.0 mm	4.250 108.0	365 2517	5175 23020	0.17 4.32	2	⅜ × 2 ½ M10 x 2 ½	5.63 152	7.38 1.87	5.38 137	7.38 187	2.13 54	3.1 1.4
5 125	5.563 141.3	365 2000	8870 39456	0.17 4.32	2	½ × 3 M12 x 3	7.25 184	9.25 235	6.75 171	9.13 232	2.25 57	5.0 2.3
133.0 mm	5.250 133.0	365 2517	7897 35106	0.17 4.32	2	½ × 3 M12 x 3	6.63 168	9.00 229	6.38 162	9.00 229	2.25 57	4.8 2.2
139.7 mm	5.500 139.7	365 2517	8667 38529	0.17 4.32	2	½ × 3 M12 x 3	6.88 175	9.25 235	6.75 171	9.13 232	2.25 57	4.9 2.2
159.0 mm	6.250 159.0	365 2517	11192 49753	0.17 4.32	2	½ × 3 ¼ M12 x 3 ¼	7.88 200	10.00 254	7.38 187	9.88 251	2.25 57	5.6 2.5
165.1 mm	6.500 165.1	365 2517	12105 53813	0.17 4.32	2	½ × 3 ¼ M12 x 3 ¼	8.00 203	10.25 260	7.75 197	10.13 257	2.25 57	6.0 2.7
6 150	6.625 168.3	365 2000	12582 44469	0.17 4.32	2	½ × 3 ¼ M12 x 3 ¼	8.38 213	10.38 264	7.88 200	10.13 257	2.25 57	6.0 2.7
216.0 mm	8.500 216.0	365 2517	20712 55968	0.17 4.32	2	⅝ × 4 M16 x 4	10.63 270	13.25 337	10.25 260	10.13 257	2.63 67	11.4 5.2
8 200	8.625 219.1	365 1620	21326 94863	0.17 4.32	2	⅝ × 4 M16 x 4	10.88 276	13.38 340	10.25 260	13.13 333	2.50 64	11.4 5.2

7 Working Pressure and End Load are total, from all internal and external loads, based on standard weight (ANSI) steel pipe, standard roll or cut grooved in accordance with Victaulic specifications. See the Listings/Approvals section of this publication for ratings on other pipe.

8 The allowable pipe separation dimension shown is for system layout purposes only. FireLock EZ™ couplings are considered rigid connections and will not accommodate expansion or contraction of the piping system.

9 Number of bolts required equals number of housing segments.

NOTES

- When assembling FireLock EZ™ couplings onto end caps, take additional care to make certain the end cap is fully seated against the gasket end stop. For FireLock EZ™ Style 009N couplings, use FireLock No. 006 end caps containing the "EZ" marking on the inside face or No. 60 end caps containing the "QV EZ" marking on the inside face. Non-Victaulic end cap products shall not be used with Style 009N couplings. IMPORTANT: Gaskets intended for the Style 009 or Style 009V couplings cannot be used with the Style 009N coupling. There is no interchanging of gaskets or housings between coupling styles.
- **Use Of Flushseal Gaskets For Dry Pipe Systems** FireLock EZ™ couplings are supplied with FireLock EZ™ Grade "E" Type A gaskets. These gaskets include an integral pipe stop, that once installed provides the similar benefits as a FlushSeal gasket for dry pipe systems. It should be noted that standard Victaulic Flush-Seal™ gaskets are not compatible and cannot be used with the FireLock EZ™ couplings.

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6.0 REFERENCE MATERIALS

Publication 05.01: Seal Selection Guide

I-009N/009H: Installation Instructions FireLock EZ™ Rigid Coupling

User Responsibility for Product Selection and Suitability
Each user bears final responsibility for making a determination as to the suitability of Victaulic products for a particular end-use application, in accordance with industry standards and project specifications, as well as Victaulic performance, maintenance, safety, and warning instructions. Nothing in this or any other document, nor any verbal recommendation, advice, or opinion from any Victaulic employee, shall be deemed to alter, vary, supersede, or waive any provision of Victaulic Company's standard conditions of sale, installation guide, or this disclaimer.

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Note
This product shall be manufactured by Victaulic or to Victaulic specifications. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

Installation
Reference should always be made to the I-009N/I-009H Firelock EZ Rigid Coupling Installation Instructions for the product you are installing. Handbooks are included with each shipment of Victaulic products, providing complete installation and assembly data, and are available in PDF format on our website at www.victaulic.com.

Warranty
Refer to the Warranty section of the current Price List or contact Victaulic for details.

Trademarks
Victaulic, FireLock EZ™, Flush-Seal™, and Installation-Ready™ are trademarks or registered trademarks of Victaulic Company, and/or its affiliated entities, in the U.S. and/or other countries.

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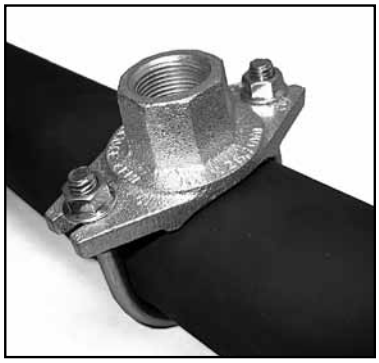
FIG. MT-30 Threaded Mechanical Branch Tee

SPF/ANVIL

510

The MT-30 mechanical tee serves the same function as the MT-1 and MT-8, but uses a steel electro-plated u-bolt to save space and for easier installation in tight places.The MT-30 is ideal for direct connections with sprinkler heads and drop nipples. The MT-90 is the BSPT equivalent.

For the latest UL/ULC listed, LPCB, VdS and FM Approved pressure ratings versus pipe schedule, see www.anvilintl.com or contact your local Anvil Representative.





c UL us LISTED FM APPROVED

For Listings/Approval Details and Limitations, visit our website at www.anvilintl.com or contact an Anvil® Sales Representative.

MATERIAL SPECIFICATIONS

HOUSING:
Ductile Iron conforming to ASTM A-536, Grade 65-45-12

U-BOLT & NUTS:
U-bolt is carbon steel SAE J429 Gr. 2, zinc plated complete with hex flanged lock nuts conforming to ASTM A-563 Gr. A or B of SAE J995 Gr. 2.

THREADS:
NPT per ANSI/ASME B1.20.1.

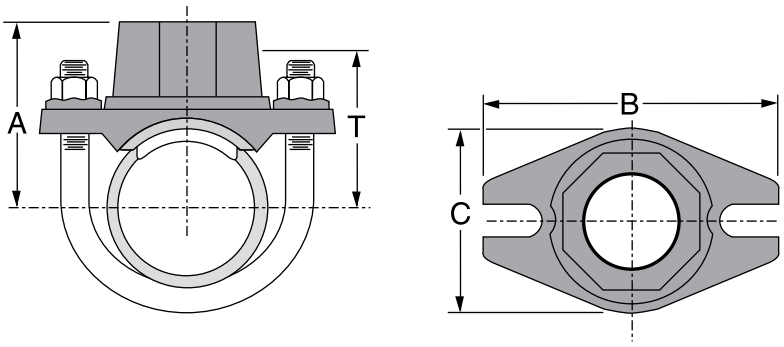
COATINGS:
☐ Zinc Electroplated
☐ Other available options: Example: RAL3000 or RAL9000 Series

GASKETS: Materials
Properties as designated in accordance with ASTM D-2000.

☐ **Grade "E" EPDM** (Green color code)
-40°F to 230°F (Service Temperature Range)(-40°C to 110°C)
Recommended for water service, diluted acids, alkalies solutions, oil-free air and many chemical services not involving hydrocarbons, oils or gases.
NOT FOR USE WITH HYDROCARBONS.

PROJECT INFORMATION	APPROVAL STAMP
Project:	☐ **Approved**
Address:	☐ **Approved as noted**
Contractor:	☐ **Not approved**
Engineer:	**Remarks:**
Submittal Date:	
Notes 1:	
Notes 2:	

FIG. MT-30 Threaded Mechanical Branch Tee



MT-30 THREADED MECHANICAL BRANCH TEE

Nominal Size	O.D.	Hole Dimensions		Max. Working Pressure▲	Dimensions				Approx. Wt. Ea.
		Min. Diameter	Max. Diameter		A	B	C	T Take-out	
In./DN(mm)	*In./mm*	*In./mm*	*In./mm*	*PSI/bar*	*In./mm*	*In./mm*	*In./mm*	*In./mm*	*Lbs./Kg*
1¼ x ½	1.660 x 0.840	1³⁄₁₆	1⁵⁄₁₆	300	2⅛	3½	2¼	1⅝	0.8
32 x 12	*42.4 x 21.3*	*30*	*33*	*20.7*	*54*	*89*	*57.2*	*42*	*0.4*
1¼ x ¾	1.660 x 1.050	1³⁄₁₆	1⁵⁄₁₆	300	2⅛	3½	2¼	1⅝	0.8
32 x 19	*42.4 x 26.7*	*30*	*33*	*20.7*	*54*	*89*	*57.2*	*42*	*0.4*
1¼ x 1	1.660 x 1.315	1³⁄₁₆	1⁵⁄₁₆	300	2¼	3½	2¼	1⅝	1.1
32 x 25	*42.4 x 33.7*	*30*	*33*	*20.7*	*58*	*89*	*57.2*	*41*	*0.5*
1½ x ½	1.900 x 0.840	1³⁄₁₆	1⁵⁄₁₆	300	2¼	3½	2¼	1¾	0.8
40 x 12	*48.3 x 21.3*	*30*	*33*	*20.7*	*57*	*89*	*57.2*	*48*	*0.4*
1½ x ¾	1.900 x 1.050	1³⁄₁₆	1⁵⁄₁₆	300	2¼	3½	2¼	1¾	0.9
40 x 19	*48.3 x 26.7*	*30*	*33*	*20.7*	*57*	*89*	*57.2*	*48*	*0.4*
1½ x 1	1.900 x 1.315	1³⁄₁₆	1⁵⁄₁₆	300	2⅜	3½	2¼	1¾	1.1
40 x 25	*48.3 x 33.7*	*30*	*33*	*20.7*	*61*	*89*	*57.2*	*48*	*0.5*
2 x ½	2.375 x 0.840	1³⁄₁₆	1⁵⁄₁₆	300	2½	3¾	2¼	2	0.9
50 x 12	*60.3 x 21.3*	*30*	*33*	*20.7*	*64*	*95*	*57.2*	*51*	*0.4*
2 x ¾	2.375 x 1.050	1³⁄₁₆	1⁵⁄₁₆	300	2½	3¾	2¼	2	0.9
50 x 19	*60.3 x 26.7*	*30*	*33*	*20.7*	*64*	*95*	*57.2*	*51*	*0.4*
2 x 1	2.375 x 1.315	1³⁄₁₆	1⁵⁄₁₆	300	2⅝	3¾	2¼	2	1.1
50 x 25	*60.3 x 33.7*	*30*	*33*	*20.7*	*67*	*95*	*57.2*	*50*	*0.5*
2½ x ½	2.875 x 0.840	1³⁄₁₆	1⁵⁄₁₆	300	2¾	4¼	2¼	2¼	0.9
65 x 12	*73.0 x 21.3*	*30*	*33*	*20.7*	*70*	*108*	*57.2*	*57*	*0.4*
2½ x ¾	2.875 x 1.050	1³⁄₁₆	1⁵⁄₁₆	300	2¾	4¼	2¼	2¼	0.9
65 x 19	*73.0 x 26.7*	*30*	*33*	*20.7*	*70*	*108*	*57.2*	*57*	*0.4*
2½ x 1	2.875 x 1.315	1³⁄₁₆	1⁵⁄₁₆	300	2⅞	4¼	2¼	2¼	1.1
65 x 25	*73.0 x 33.7*	*30*	*33*	*20.7*	*73*	*108*	*57.2*	*56*	*0.5*

BSP equivalent is available as a MT-90.

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, FM, VdS and LPCB pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

Note: Tighten nuts alternately to a recommended torque of 18-22 ft.-lbs. (25-30 Nm) on pipe wall less than schedule 10 (Din 2440) or 23-27 ft.-lbs. (31-37 Nm) on pipe walls schedule 10 (DIN 2440) and above.

⚠ WARNING

For dry pipe systems and freezer applications lubrication of the gasket is required, Gruvlok® Xtreme™ Lubricant is required.

EFFECTIVE JANUARY 1, 2013

Vandewater International Inc.

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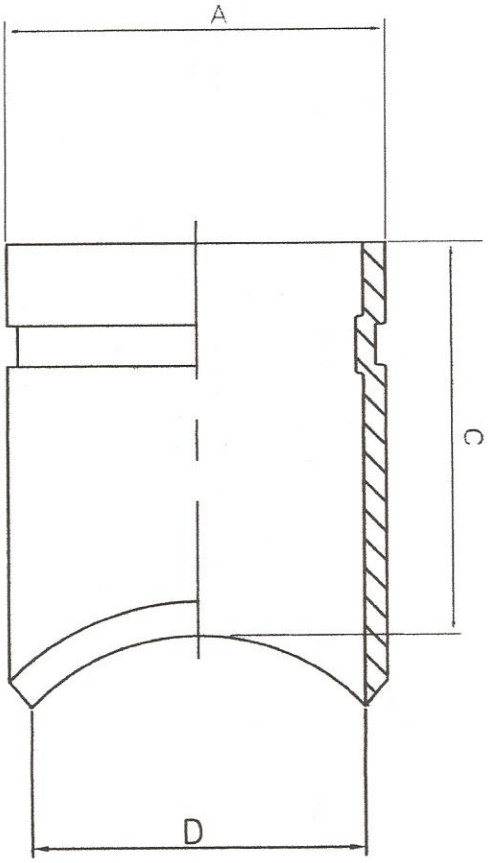
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Email: VandeH20in@aol.com ■ Website: vandewaterinc.com

UL LISTED FM

CERIECO BRAND™

GROOVED WELDED STEEL PIPE OUTLETS

- Approved for use in fire sprinkler systems installed in accordance with the requirements of NFPA 13.
- **Pressure Data**: Schedule 40: 300 psi; Schedule 10: 300 psi



MATERIAL SPECIFICATION: ASTM A-53 (ERW) PIPE

Physical Properties	
Tensile Strength	70,000 psi. min.
Yield Strength	30,000 psi. min.
Brinell Hardness	187 max.

DIMENSIONS & WEIGHTS Schadule 40 CG (Standard Cut & Groove)							
OUTLET SIZE	HEADER SIZES	C STD. LENGTH	D INSIDE DIA.	A OUTSIDE DIA.	WALL THICK-NESS (MIN.)	BOX QTY.	WEIGHT PER BOX
1-1/4"	1-1/4" - 8"	3"	1.368	1.660	0.140	50	28
1-1/2"	1-1/2" - 8"	3"	1.610	1.900	0.145	50	35
2"	2" - 8"	3"	2.067	2.375	0.154	50	45
2-1/2"	2-1/2" - 8"	3"	2.469	2.875	0.188	32	45
3"	3" - 8"	3"	3.068	3.500	0.188	20	42
4"	4" - 8"	4"	4.026	4.500	0.203	10	34
6"	6" - 8"	4"	6.065	6.625	0.213	4	28
8"	8"	4"	7.981	8.625	0.213	2	24
DIMENSIONS & WEIGHTS Schedule 10 RG (Lightweight Roll Groove)							
2"	2" - 8"	3"	2.157	2.375	0.065	50	35
2-1/2"	2-1/2" - 8"	3"	2.635	2.875	0.083	32	32
3"	3" - 8"	3"	3.260	3.500	0.083	20	24
4"	4" - 8"	4"	4.260	4.500	0.083	10	21
6"	6" - 8"	4"	6.357	6.625	0.109	4	15
8"	8"	4"	8.329	8.625	0.109	2	12

SCHEDULE 40				
SIZE		PART NUMBER	QTY. PER CARTON	WEIGHT PER BOX
1-1/4" x 1-1/4"	40CG	40CG125125	50	28
1-1/4" x 1-1/2"	40CG	40CG125150	50	28
1-1/4" x 2"	40CG	40CG125200	50	28
1-1/4" x 2-1/2"	40CG	40CG125250	50	28
1-1/4" x 3"	40CG	40CG125300	50	28
1-1/4" x 4"	40CG	40CG125400	50	28
1-1/4" x 6"	40CG	40CG125600	50	28
1-1/4" x 8"	40CG	40CG125800	50	28
1-1/2" x 1-1/2"	40CG	40CG150150	50	35
1-1/2" x 2"	40CG	40CG150200	50	35
1-1/2" x 2-1/2"	40CG	40CG150250	50	35
1-1/2" x 3"	40CG	40CG150300	50	35
1-1/2" x 4"	40CG	40CG150400	50	35
1-1/2" x 6"	40CG	40CG150600	50	35
1-1/2" x 8"	40CG	40CG150800	50	35
2" x 2"	40CG	40CG200200	50	45
2" x 2-1/2"	40CG	40CG200250	50	45
2" x 3"	40CG	40CG200300	50	45
2" x 4"	40CG	40CG200400	50	45
2" x 6"	40CG	40CG200600	50	45
2" x 8"	40CG	40CG200800	50	45
2-1/2" x 2-1/2"	40CG	40CG250250	32	45
2-1/2" x 3"	40CG	40CG250300	32	45
2-1/2" x 4"	40CG	40CG250400	32	45
2-1/2" x 6"	40CG	40CG250600	32	45
2-1/2" x 8"	40CG	40CG250800	32	45
3" x 3"	40CG	40CG300300	20	42
3" x 4"	40CG	40CG300400	20	42
3" x 6"	40CG	40CG300600	20	42
3" x 8"	40CG	40CG300800	20	42
4" x 4"	40CG	40CG400400	10	34
4" x 6"	40CG	40CG400600	10	34
4" x 8"	40CG	40CG400800	10	34
6" x 6"	40CG	40CG600600	4	28
6" x 8"	40CG	40CG600800	4	28
8" x 8"	40CG	40CG800800	2	24

SCHEDULE 10				
SIZE		PART NUMBER	QTY. PER CARTON	WEIGHT PER BOX
2" x 2"	10RG	10RG200200	50	35
2" x 2-1/2"	10RG	10RG200250	50	35
2" x 3"	10RG	10RG200300	50	35
2" x 4"	10RG	10RG200400	50	35
2" x 6"	10RG	10RG200600	50	35
2" x 8"	10RG	10RG200800	50	35
2-1/2" x 2-1/2"	10RG	10RG250250	32	32
2-1/2" x 3"	10RG	10RG250300	32	32
2-1/2" x 4"	10RG	10RG250400	32	32
2-1/2" x 6"	10RG	10RG250600	32	32
2-1/2" x 8"	10RG	10RG250800	32	32
3" x 3"	10RG	10RG300300	20	24
3" x 4"	10RG	10RG300400	20	24
3" x 6"	10RG	10RG300600	20	24
3" x 8"	10RG	10RG300800	20	24
4" x 4"	10RG	10RG400400	10	21
4" x 6"	10RG	10RG400600	10	21
4" x 8"	10RG	10RG400800	10	21
6" x 6"	10RG	10RG600600	4	15
6" x 8"	10RG	10RG600800	4	15
8" x 8"	10RG	10RG800800	2	12

EFFECTIVE MAY 1, 2010

Vandewater International Inc.

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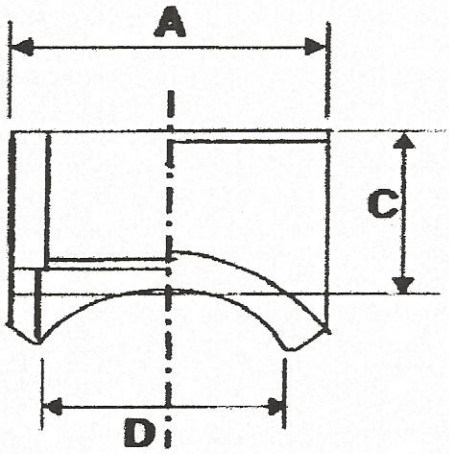
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UL LISTED FM

CERIECO BRAND™

WELDED STEEL PIPE OUTLETS

All threads are carefully machines in accordance to the requirements of ANSI ASME B1.20.1, for NPT 300 lb. Class, and national standard for tapered pipe threads.



Dimensions – Weights					
OUTLET	A OUTSIDE DIA.	C LENGTH	D INSIDE DIA.	WEIGHT	BOX QTY.
1/2”	1.125	1.000	.07	0.150	400
3/4”	1.375	1.000	.09	0.220	240
1”	1.597	1.000	1.145	0.260	160
1-1/4”	1.949	1.250	1.49	0.370	90
1-1/2”	2.200	1.250	1.61	0.460	70
2”	2.700	1.500	2.067	0.750	40
2-1/2”	3.164	1.755	2.469	1.030	25

MATERIAL SPECIFICATION: ASTM A-105 Forged Steel

Chemical Properties	
Ca	0.035% max.
Ma	0.6 ~1.05%
P	0.04% max.
Su	0.05% max.
Si	0.035% max.

Physical Properties	
Tensile Strength	70,000 psi. min.
Yield Strength	30,000 psi. min.
Brinell Hardness	187 max.

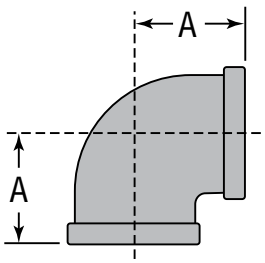
Dimensions & Corresponding Part Numbers

PART NUMBER	OUTLET SIZE	INSIDE DIA.*	HEADER SIZE	WEIGHT EACH	QTY. PER BOX	WEIGHT PER BOX	BOXES PER PALLET	QTY. PER PALLET	WEIGHT PER PALLET
05012	1/2"	.07	1-1/4" – 1-1/2"	0.150	400	59.9	27	10,800	1,618
05020	1/2"	.07	2" – 2-1/2"	0.154	400	61.7	27	10,800	1,665
05025	1/2"	.07	3" – 8"	0.145	400	58.1	27	10,000	1,570
07012	3/4"	.09	1-1/4" – 1-1/2"	0.220	240	52.9	27	6,480	1,427
07020	3/4"	.09	2" – 2-1/2"	0.218	240	51.8	27	6,480	1,399
07025	3/4"	.09	3" – 8"	0.203	240	48.6	27	6,480	1,313
10012	1"	1.145	1-1/4" – 1-1/2"	0.264	160	42.3	27	4,320	1,142
10020	1"	1.145	2" – 2-1/2"	0.251	160	40.2	27	4,320	1,085
10030	1"	1.145	3" – 4"	0.264	160	42.3	27	4,320	1,142
10050	1"	1.145	5" – 8"	0.251	160	40.2	27	4,320	1,085
12012	1-1/4"	1.49	1-1/4" – 1-1/2"	0.427	90	38.5	27	2,430	1,038
12020	1-1/4"	1.49	2" – 2-1/2"	0.379	90	34.1	27	2,430	921
12030	1-1/4"	1.49	3" – 4"	0.374	90	33.7	27	2,430	910
12050	1-1/4"	1.49	5" – 8"	0.352	90	31.7	27	2,430	856
15020	1-1/2"	1.61	2"	0.463	70	32.4	27	1,890	874
15025	1-1/2"	1.61	2-1/2"	0.458	70	32.1	27	1,890	866
15030	1-1/2"	1.61	3" – 4"	0.445	70	31.1	27	1,890	841
15050	1-1/2"	1.61	5" – 8"	0.427	70	29.9	27	1,890	808
20025	2"	2.067	2-1/2"	0.749	40	30.0	27	1,890	809
20030	2"	2.067	3"	0.705	40	28.2	27	1,080	761
20040	2"	2.067	4"	0.758	40	30.3	27	1,080	818
20050	2"	2.067	5"	0.661	40	26.4	27	1,080	714
20060	2"	2.067	6"	0.639	40	25.6	27	1,080	690
20080	2"	2.067	8"	0.687	40	27.5	27	1,080	742
25030	2-1/2"	2.469	3"	1.088	25	27.2	27	1,080	734
25040	2-1/2"	2.469	4"	1.022	25	25.6	27	675	690
25050	2-1/2"	2.469	5"	1.035	25	25.9	27	675	699
25060	2-1/2"	2.469	6"	1.057	25	26.4	27	675	714
25080	2-1/2"	2.469	8"	1.031	25	25.8	27	675	696

* The hole size should be the full inside diameter of the outlet prior to welding.

FIG. 3201

90˚ Elbow





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FIGURE 3201 - 90° ELBOW

Nominal Size	Maximum Working Pressure▲	Dimension A	Approx. Wt. Each
In. (mm)	*PSI (kPa)*	*In. (mm)*	*Lbs. (kg)*
1 *20*	500 *3450*	1.50 *38.10*	0.62 *0.28*
1¼ *32*	500 *3450*	1.75 *44.45*	0.90 *0.41*
1½ *40*	500 *3450*	1.94 *49.276*	1.20 *0.54*
2 *50*	500 *3450*	2.25 *57.15*	1.85 *0.84*

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

MATERIAL SPECIFICATIONS

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

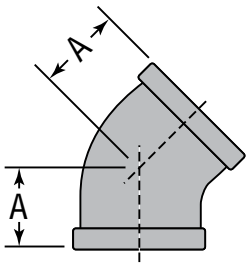
NOTICE: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

PROJECT INFORMATION	APPROVAL STAMP
Project:	☐ **Approved**
Address:	☐ **Approved as noted**
Contractor:	☐ **Not approved**
Engineer:	**Remarks:**
Submittal Date:	
Notes 1:	
Notes 2:	

DUCTILE IRON THREADED FITTINGS

FIG. 3202

45˚ Elbow





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FIGURE 3202 - 45° ELBOW

Nominal Size	Maximum Working Pressure▲	Dimension A	Approx. Wt. Each
In. (mm)	*PSI (kPa)*	*In. (mm)*	*Lbs. (kg)*
1 *25*	500 *3450*	1.12 *28.44*	0.46 *0.21*
1¼ *32*	500 *3450*	1.29 *32.76*	0.73 *0.33*
1½ *40*	500 *3450*	1.43 *36.32*	0.92 *0.42*
2 *50*	500 *3450*	1.68 *42.67*	1.50 *0.68*

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

MATERIAL SPECIFICATIONS

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

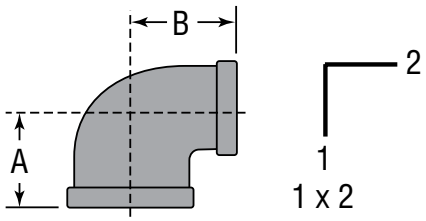
NOTICE: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

PROJECT INFORMATION	APPROVAL STAMP
Project:	☐ **Approved**
Address:	☐ **Approved as noted**
Contractor:	☐ **Not approved**
Engineer:	**Remarks:**
Submittal Date:	
Notes 1:	
Notes 2:	

DUCTILE IRON THREADED FITTINGS

FIG. 3201R

Reducing 90° Elbow





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FIGURE 3201R - REDUCING 90° ELBOW

Nominal Size 1 x 2	Max. Working Pressure▲	Dimensions A	Dimensions B	Approx. Wt. Each
In. (mm)	*PSI (kPa)*	*In. (mm)*	*In. (mm)*	*Lbs. (kg)*
1 x ½ *25 x 15*	500 *3450*	1.26 *32.00*	1.36 *34.54*	0.44 *0.20*
1 x ¾ *25 x 20*	500 *3450*	1.37 *34.79*	1.45 *36.83*	0.52 *0.24*
1¼ x ½ *32 x 15*	500 *34550*	1.34 *34.03*	1.53 *38.86*	0.64 *0.29*
1¼ x ¾ *32 x 20*	500 *3450*	1.45 *36.83*	1.62 *41.14*	0.72 *0.33*
1¼ x 1 *32 x 25*	500 *3450*	1.58 *40.13*	1.67 *42.41*	0.75 *0.34*
1½ x 1 *40 x 25*	500 *3450*	1.65 *41.91*	1.80 *45.72*	0.92 *0.42*
1½ x 1¼ *40 x 32*	500 *3450*	1.82 *46.22*	1.88 *47.75*	1.08 *0.49*
2 x ½ *50 x 15*	500 *3450*	1.49 *37.84*	1.88 *47.75*	1.08 *0.49*
2 x ¾ *50 x 20*	500 *3450*	1.60 *40.64*	1.97 *50.03*	1.24 *0.56*
2 x 1 *50 x 25*	500 *3450*	1.73 *43.94*	2.02 *51.30*	1.40 *0.64*
2 x 1¼ *50 x 32*	500 *3450*	1.90 *48.26*	2.10 *53.34*	1.52 *0.70*
2 x 1½ *50 x 40*	500 *3450*	2.02 *51.30*	2.16 *54.86*	1.65 *0.75*

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

MATERIAL SPECIFICATIONS

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

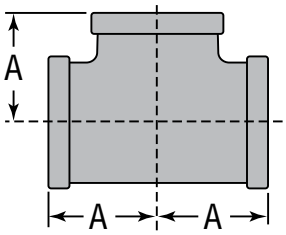
NOTICE: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

PROJECT INFORMATION	APPROVAL STAMP
Project:	☐ **Approved**
Address:	☐ **Approved as noted**
Contractor:	☐ **Not approved**
Engineer:	**Remarks:**
Submittal Date:	
Notes 1:	
Notes 2:	

DUCTILE IRON THREADED FITTINGS

FIG. 3205

Straight Tee





c UL us LISTED FM APPROVED

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FIGURE 3205 - STRAIGHT TEE

Nominal Size	Maximum Working Pressure▲	Dimension A	Approx. Wt. Each
In. (mm)	*PSI (kPa)*	*In. (mm)*	*Lbs. (kg)*
1 *25*	500 *3450*	1.50 *38.10*	0.85 *0.39*
1¼ *32*	500 *3450*	1.75 *44.45*	1.22 *0.55*
1½ *40*	500 *3450*	1.94 *49.27*	1.55 *0.70*
2 *50*	500 *3450*	2.25 *57.15*	2.45 *1.11*

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

MATERIAL SPECIFICATIONS

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

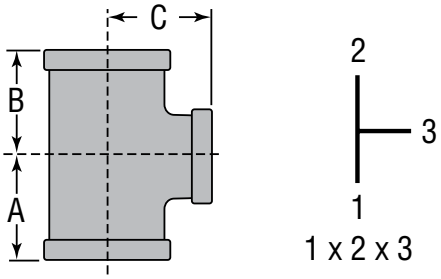
Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

NOTICE: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

PROJECT INFORMATION	APPROVAL STAMP
Project:	☐ **Approved**
Address:	☐ **Approved as noted**
Contractor:	☐ **Not approved**
Engineer:	**Remarks:**
Submittal Date:	
Notes 1:	
Notes 2:	

FIG. 3205R

Reducing Tee





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FIGURE 3205R - REDUCING TEE

Nominal Size 1 x 2 x 3	Max. Working Pressure▲	Dimensions A	Dimensions B	Dimensions C	Approx. Wt. Each
In. (mm)	*PSI (kPa)*	*In. (mm)*	*In. (mm)*	*In. (mm)*	*Lbs. (kg)*
1 x ½ x 1 *25 x 15 x 25*	500 *3450*	1.50 *38.10*	1.36 *34.54*	1.50 *38.10*	0.64 *0.29*
1 x ¾ x 1 *25 x 20 x 25*	500 *3450*	1.50 *38.10*	1.45 *36.83*	1.50 *38.10*	0.73 *0.33*
1 x 1 x ½ *25 x 25 x 15*	500 *3450*	1.26 *32.00*	1.26 *32.00*	1.36 *34.54*	0.71 *0.32*
1 x 1 x ¾ *25 x 25 x 20*	500 *3450*	1.37 *34.80*	1.37 *34.80*	1.45 *36.83*	0.76 *0.34*
1 x 1 x 1¼* *25 x 25 x 32*	500 *3450*	1.67 *42.41*	1.67 *42.41*	1.58 *40.13*	0.98 *0.44*
1 x 1 x 1½* *25 x 25 x 40*	500 *3450*	1.80 *45.72*	1.80 *45.72*	1.65 *41.91*	1.16 *0.53*
1¼ x 1 x ½* *32 x 25 x 15*	500 *3450*	1.34 *34.04*	1.26 *32.00*	1.53 *38.86*	0.82 *0.37*
1¼ x 1 x ¾ *32 x 25 x 20*	500 *3450*	1.45 *36.83*	1.37 *34.80*	1.62 *41.15*	0.90 *0.41*
1¼ x 1 x 1 *32 x 25 x 25*	500 *3450*	1.58 *40.13*	1.50 *38.10*	1.67 *42.42*	1.00 *0.45*
1¼ x 1 x 1¼ *32 x 25 x 32*	500 *3450*	1.75 *44.45*	1.67 *42.42*	1.75 *44.45*	1.08 *0.49*
1¼ x 1 x 1½ *32 x 25 x 40*	500 *3450*	1.88 *47.75*	1.80 *45.72*	1.82 *46.22*	1.42 *0.64*
1¼ x 1¼ x ½ *32 x 32 x 15*	500 *3450*	1.34 *34.04*	1.34 *34.04*	1.53 *38.86*	0.86 *0.39*

MATERIAL SPECIFICATIONS

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

NOTICE: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

FIGURE 3205R - REDUCING TEE

Nominal Size 1 x 2 x 3	Max. Working Pressure▲	Dimensions A	Dimensions B	Dimensions C	Approx. Wt. Each
In. (mm)	*PSI (kPa)*	*In. (mm)*	*In. (mm)*	*In. (mm)*	*Lbs. (kg)*
1¼ x 1¼ x ¾ *32 x 32 x 20*	500 *3450*	1.45 *36.83*	1.45 *36.83*	1.62 *41.15*	0.92 *0.42*
1¼ x 1¼ x 1 *32 x 32 x 25*	500 *3450*	1.58 *40.13*	1.58 *40.13*	1.67 *42.42*	0.95 *0.43*
1¼ x 1¼ x 1½* *32 x 32 x 40*	500 *3450*	1.88 *47.75*	1.88 *47.75*	1.82 *46.22*	1.45 *0.66*

▲ Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

* Part supplied as "Bull Head Tee".

PROJECT INFORMATION	APPROVAL STAMP
Project:	☐ **Approved**
Address:	☐ **Approved as noted**
Contractor:	☐ **Not approved**
Engineer:	**Remarks:**
Submittal Date:	
Notes 1:	
Notes 2:	

FIG. 3205R

Reducing Tee

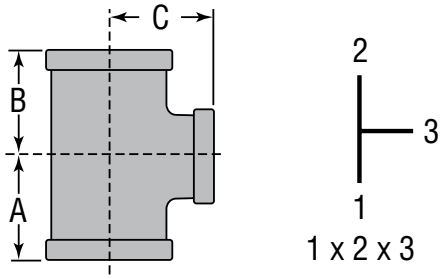


FIGURE 3205R - REDUCING TEE					
Nominal Size	Max. Working Pressure▲	Dimensions			Approx. Wt. Each
1 x 2 x 3		A	B	C	
In. (mm)	*PSI (kPa)*	*In. (mm)*	*In. (mm)*	*In. (mm)*	*Lbs. (kg)*
1¼ x 1¼ x 2* *32 x 32 x 50*	500 *3450*	2.10 *53.34*	2.10 *53.34*	1.90 *48.26*	1.75 *0.79*
1½ x 1 x ½ *40 x 25 x 15*	500 *3450*	1.41 *35.81*	1.34 *34.04*	1.66 *42.16*	0.95 *0.43*
1½ x 1 x ¾ *40 x 25 x 20*	500 *3450*	1.52 *38.61*	1.37 *34.80*	1.75 *44.45*	1.14 *0.52*
1½ x 1 x 1 *40 x 25 x 25*	500 *3450*	1.65 *41.91*	1.50 *38.10*	1.80 *45.72*	1.17 *0.53*
1½ x 1 x 1¼ *40 x 25 x 32*	500 *3450*	1.82 *46.23*	1.67 *42.42*	1.88 *47.75*	1.34 *0.61*
1½ x 1 x 1½ *40 x 25 x 40*	500 *3450*	1.94 *49.28*	1.80 *45.72*	1.94 *49.28*	1.45 *0.66*
1½ x1¼ x ½ *40 x 32 x 15*	500 *3450*	1.41 *35.81*	1.34 *34.04*	1.66 *42.16*	1.05 *0.48*
1½ x1¼ x ¾ *40 x 32 x 20*	500 *3450*	1.52 *38.61*	1.45 *36.83*	1.75 *44.45*	1.15 *0.5*
1½ x 1¼ x 1 *40 x 32 x 25*	500 *3450*	1.65 *41.91*	1.58 *40.13*	1.80 *45.72*	1.25 *0.57*
1½ x 1¼ x 2* *40 x 32 x 50*	500 *3450*	2.16 *54.86*	2.10 *53.34*	2.02 *51.30*	1.90 *0.86*
1½ x 1½ x ½ *40 x 40 x 15*	500 *3450*	1.41 *35.81*	1.41 *35.81*	1.16 *29.46*	1.15 *0.52*
1½ x 1½ x ¾ *40 x 40 x 20*	500 *3450*	1.52 *38.61*	1.52 *38.61*	1.75 *44.45*	1.24 *0.56*
1½ x 1½ x 1 *40 x 40 x 25*	500 *3450*	1.65 *41.91*	1.65 *41.91*	1.80 *45.72*	1.30 *0.59*
1½ x 1½ x 1¼ *40 x 40 x 32*	500 *3450*	1.82 *46.23*	1.82 *46.23*	1.88 *47.75*	1.48 *0.67*

FIGURE 3205R - REDUCING TEE					
Nominal Size	Max. Working Pressure▲	Dimensions			Approx. Wt. Each
1 x 2 x 3		A	B	C	
In. (mm)	*PSI (kPa)*	*In. (mm)*	*In. (mm)*	*In. (mm)*	*Lbs. (kg)*
1½ x 1½ x 2* *40 x 40 x 50*	500 *3450*	2.16 *54.86*	2.16 *54.86*	2.02 *51.30*	1.98 *0.90*
2 x 1 x 2 *50 x 25 x 50*	500 *3450*	2.25 *57.15*	2.02 *51.31*	2.25 *57.15*	2.15 *0.98*
2 x 1¼ x 2 *50 x 32 x 50*	500 *3450*	2.25 *57.15*	2.10 *53.34*	2.25 *57.15*	2.30 *1.04*
2 x 1½ x ½ *50 x 40 x 15*	500 *3450*	1.49 *37.85*	1.41 *35.81*	1.88 *47.75*	1.50 *0.68*
2 x 1½ x ¾ *50 x 40 x 20*	500 *3450*	1.60 *40.64*	1.52 *38.61*	1.97 *50.04*	1.62 *0.73*
2 x 1½ x 1 *50 x 40 x 25*	500 *3450*	1.73 *43.94*	1.65 *41.91*	2.02 *51.31*	1.64 *0.74*
2 x 1½ x 1¼ *50 x 40 x 32*	500 *3450*	1.90 *48.26*	1.82 *46.23*	2.10 *53.34*	1.80 *0.82*
2 x 1½ x 1½ *50 x 40 x 40*	500 *3450*	2.02 *51.31*	1.94 *49.28*	2.16 *54.86*	2.00 *0.91*
2 x 1½ x 2 *50 x 40 x 50*	500 *3450*	2.25 *57.15*	2.16 *54.86*	2.25 *57.15*	2.35 *1.07*
2 x 2 x ½ *50 x 50 x 15*	500 *3450*	1.49 *37.85*	1.49 *37.85*	1.88 *47.75*	1.60 *0.73*
2 x 2 x ¾ *50 x 50 x 20*	500 *3450*	1.60 *40.64*	1.60 *40.64*	1.97 *50.04*	1.68 *0.76*
2 x 2 x 1 *50 x 50 x 25*	500 *3450*	1.73 *43.94*	1.73 *43.94*	2.02 *51.31*	1.85 *0.84*
2 x 2 x 1¼ *50 x 50 x 32*	500 *3450*	1.90 *44.45*	1.90 *42.42*	2.10 *44.45*	2.04 *0.93*
2 x 2 x 1½ *50 x 50 x 40*	500 *3450*	2.02 *44.45*	2.02 *42.42*	2.16 *44.45*	2.18 *0.99*

▲ Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

* Part supplied as "Bull Head Tee".

BULL HEAD TEE

AnvilStar™
Fire Products Division of Anvil® International

SPF/ANVIL™

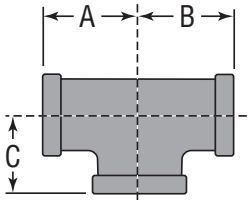
Ductile Iron

Submittal Sheet



BULL HEAD TEE

Nominal Size	Anvil Item Number	Universal Number	Max. Working Pressure	Dimensions			Approx. Wt. Each
				A	B	C	
In. (mm)			*PSI (kPa)*	*In. (mm)*	*In. (mm)*	*In. (mm)*	*Lbs. (kg)*
1 x 1 x 1¼ *25 x 25 x 32*	840004238	DT334	500 *3450*	1.67 *42.41*	1.67 *42.41*	1.58 *40.13*	0.98 *0.44*
1 x 1 x 1½ *25 x 25 x 40*	840004246	DT335	500 *3450*	1.80 *45.72*	1.80 *45.72*	1.65 *41.91*	1.16 *0.53*
1¼ x 1 x 1½ *32 x 25 x 40*	840004295	DT435	500 *3450*	1.88 *47.75*	1.80 *45.72*	1.82 *46.22*	1.42 *0.64*
1¼ x 1¼ x 1½ *32 x 32 x 40*	840004337	DT445	500 *3450*	1.88 *47.75*	1.88 *47.75*	1.82 *46.22*	1.45 *0.66*
1¼ x 1¼ x 2 *32 x 32 x 50*	840004345	DT446	500 *3450*	2.10 *53.34*	2.10 *53.34*	1.90 *48.26*	1.75 *0.79*
1½ x 1¼ x 2 *40 x 32 x 50*	840004436	DT546	500 *3450*	2.16 *54.86*	2.10 *53.34*	2.02 *51.30*	1.90 *0.86*
1½ x 1½ x 2 *40 x 40 x 50*	840004485	DT556	500 *3450*	2.16 *54.86*	2.16 *54.86*	2.02 *51.30*	1.98 *0.90*



MATERIAL SPECIFICATIONS

Ductile iron threaded fittings are UL & ULC Listed & Factory Mutual Approved for 500 psi service. Ductile iron per ASTM A536 Class 65-45-12.

Dimensions conform to ASME B16.3 Class 150. Threads are NPT per ANSI/ASME B1.20.1.

UL ULC FM
APPROVED

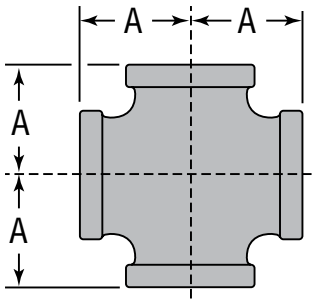
For Listing/Approval Details and Limitations visit our Web Site *www.anvilintl.com* or contact an Anvil®/AnvilStar™ Sales Representative.

NOTICE: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened three turns beyond hand tight, but no more than four turns.

PROJECT INFORMATION:		APPROVAL STAMP:
Project:		
Date:	**Phone:**	
Architect / Engineer:		
Contractor:		
Address:		
Notes 1:		
Notes 2:		

FIG. 3207

Cross





c UL us LISTED
FM APPROVED

For Listings/Approval Details and Limitations, visit our website at www.anvilintl.com or contact an Anvil® Sales Representative.

FIGURE 3207 - CROSS

Nominal Size	Maximum Working Pressure▲	Dimension A	Approx. Wt. Each
In. (mm)	*PSI (kPa)*	*In. (mm)*	*Lbs. (kg)*
1 *25*	500 *3450*	1.50 *38.10*	0.98 *0.44*
1¼ *32*	500 *3450*	1.75 *44.45*	1.50 *0.68*
1½ *40*	500 *3450*	1.94 *49.27*	1.90 *0.86*
2 *50*	500 *3450*	2.25 *57.15*	2.95 *1.34*

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

MATERIAL SPECIFICATIONS

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

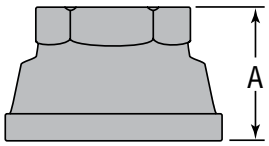
Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

NOTICE: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

PROJECT INFORMATION	APPROVAL STAMP
Project:	☐ **Approved**
Address:	☐ **Approved as noted**
Contractor:	☐ **Not approved**
Engineer:	**Remarks:**
Submittal Date:	
Notes 1:	
Notes 2:	

FIG. 3221R

Reducing Coupling





c UL us LISTED FM APPROVED

For Listings/Approval Details and Limitations, visit our website at www.anvilintl.com or contact an Anvil® Sales Representative.

FIGURE 3221R - REDUCING COUPLING

Nominal Size	Maximum Working Pressure▲	Dimension A	Approx. Wt. Each
In. (mm)	*PSI (kPa)*	*In. (mm)*	*Lbs. (kg)*
1 x ½ *25 x 15*	500 *3450*	1.69 *42.92*	0.39 *0.18*
1 x ¾ *25 x 20*	500 *3450*	1.69 *42.92*	0.53 *0.24*

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

MATERIAL SPECIFICATIONS

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

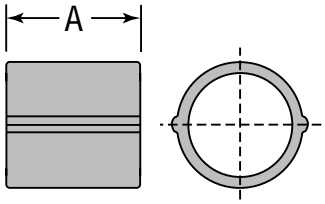
Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

NOTICE: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

PROJECT INFORMATION	APPROVAL STAMP
Project:	☐ **Approved**
Address:	☐ **Approved as noted**
Contractor:	☐ **Not approved**
Engineer:	**Remarks:**
Submittal Date:	
Notes 1:	
Notes 2:	

FIG. 3221

Coupling





LISTED APPROVED

For Listings/Approval Details and Limitations, visit our website at www.anvilintl.com or contact an Anvil® Sales Representative.

FIGURE 3221 - COUPLING

Nominal Size	Maximum Working Pressure▲	Dimension A	Approx. Wt. Each
In. (mm)	*PSI (kPa)*	*In. (mm)*	*Lbs. (kg)*
1 *25*	500 *3450*	1.67 *42.42*	0.40 *0.18*
1¼ *32*	500 *3450*	1.93 *49.02*	0.57 *0.26*
1½ *40*	500 *3450*	2.15 *54.61*	0.75 *0.34*
2 *50*	500 *3450*	2.53 *64.26*	1.15 *0.52*

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

MATERIAL SPECIFICATIONS

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

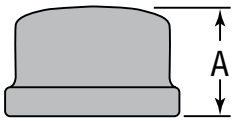
Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

NOTICE: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

PROJECT INFORMATION	APPROVAL STAMP
Project:	☐ **Approved**
Address:	☐ **Approved as noted**
Contractor:	☐ **Not approved**
Engineer:	**Remarks:**
Submittal Date:	
Notes 1:	
Notes 2:	

FIG. 3224

Cap





c UL us LISTED FM APPROVED

For Listings/Approval Details and Limitations, visit our website at www.anvilintl.com or contact an Anvil® Sales Representative.

FIGURE 3224 - CAP

Nominal Size	Maximum Working Pressure▲	Dimension A	Approx. Wt. Each
In. (mm)	*PSI (kPa)*	*In. (mm)*	*Lbs. (kg)*
1 *25*	500 *3450*	1.16 *29.46*	0.32 *0.15*
1¼ *32*	500 *3450*	1.28 *32.51*	0.43 *0.20*
1½ *40*	500 *3450*	1.33 *33.78*	0.60 *0.27*
2 *50*	500 *3450*	1.45 *36.83*	0.91 *0.41*

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

MATERIAL SPECIFICATIONS

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

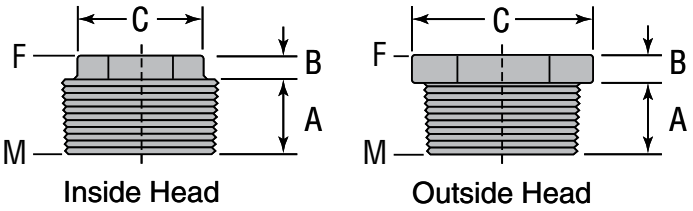
Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

NOTICE: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

PROJECT INFORMATION	APPROVAL STAMP
Project:	☐ **Approved**
Address:	☐ **Approved as noted**
Contractor:	☐ **Not approved**
Engineer:	**Remarks:**
Submittal Date:	
Notes 1:	
Notes 2:	

FIG. 3283

Bushings





c UL us LISTED FM APPROVED

For Listings/Approval Details and Limitations, visit our website at www.anvilintl.com or contact an Anvil® Sales Representative.

FIGURE 3283 - BUSHINGS

Nominal Size Male (M) x Female (F)	Max. Working Pressure▲	Dimensions A	Dimensions B	Dimensions C	Style	Approx. Wt. Each
In. (mm)	*PSI (kPa)*	*In. (mm)*	*In. (mm)*	*In. (mm)*		*Lbs. (kg)*
1 x ½ *25 x 15*	500 *3450*	0.75 *19.05*	0.25 *6.35*	1.42 *36.06*	Outside	0.22 *0.10*
1 x ¾ *25 x 20*	500 *3450*	0.75 *19.05*	0.25 *6.35*	1.42 *36.06*	Outside	0.17 *0.08*
1¼ x 1 *32 x 25*	500 *3450*	0.80 *20.32*	0.28 *7.11*	1.76 *44.70*	Outside	0.28 *0.13*
1½ x 1 *40 x 25*	500 *3450*	0.83 *21.08*	0.31 *7.874*	2.00 *50.80*	Outside	0.45 *0.20*
1½ x 1¼ *40 x 32*	500 *3450*	0.83 *21.08*	0.31 *7.874*	2.00 *50.80*	Outside	0.30 *0.14*
2 x 1 *50 x 25*	500 *3450*	0.88 *22.35*	0.41 *10.414*	1.95 *49.53*	Inside	0.67 *0.30*
2 x 1¼ *50 x 32*	500 *3450*	0.88 *22.35*	0.34 *8.636*	2.48 *62.99*	Outside	0.73 *0.33*
2 x 1½ *50 x 40*	500 *3450*	0.88 *22.35*	0.34 *8.636*	2.48 *62.99*	Outside	0.61 *0.28*

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

MATERIAL SPECIFICATIONS

Dimensions: ASME B16.14

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

NOTICE: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

PROJECT INFORMATION	APPROVAL STAMP
Project:	☐ **Approved**
Address:	☐ **Approved as noted**
Contractor:	☐ **Not approved**
Engineer:	**Remarks:**
Submittal Date:	
Notes 1:	
Notes 2:	

Malleable Iron Threaded Fittings

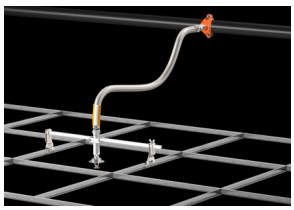
Class 150 and Class 300 Specifications

- SCI® branded Class 150 fittings are UL Listed and FM Approved at 300 psi
- SCI® branded Class 300 fittings are UL Listed
- Hot-dipped galvanized fittings are certified to; NSF/ANSI 61-4 and California AB1953 Lead Free
- Canadian Registration Numbers available at www.smithcooper.com
- Malleable castings conform to ASTM A197
- Hot-dipped galvanized fittings conform to ASTM A153
- Malleable fitting dimensions conform to ASME B16.3
- Malleable bushings, plugs and locknuts conform to ASME B16.14
- Malleable unions conform to ASME B16.39
- NPT threads on all fittings conform to ASME B1.20.1
- Independent lab verification that fittings meet applicable chemical & mechanical properties
- Manufacturing facilities are ISO 9001:2008 and ISO 14001
- SCI® branded fittings are 100% air tested
- ProPak™ Packaging



Victaulic® Vic-Flex™ Sprinkler Fittings
Series AH2 Braided Flexible Hose

10.85



1.0 PRODUCT DESCRIPTION

Available Sizes by Component

- **Series AH2 Braided Hose:** 31, 36, 48, 60, 72"/790, 914, 1220, 1525, 1830 mm. Note: length includes adapter nipple and 5.75"/140 mm straight reducer.
- **Sprinkler Reducers:** ½" and ¾"/15 and 20 mm sprinkler connections and 5.75"/140 mm, 9"/230 mm, 13"/330 mm straight lengths and short, long 90° elbows. Note: The short 90° elbow is typically used with concealed sprinklers while the long 90° elbow is typically used in the installation of recessed pendent sprinklers.
- **Adapter Nipples:** 1"/25 mm NPT or BSPT adapter nipples for attaching to pipe and fittings outlined in NFPA standards. ¾"/20 mm NPT or BSPT available for VdS. 1 ¼"/ 32mm BSPT available for LPCB.
- **Brackets:**
  - Style AB1 for suspended and hard-lid ceilings, allows installation before most ceiling tiles in place
  - Style AB2 for suspended and hard-lid ceilings, allows for vertical sprinkler adjustment, and installation before most ceiling tiles in place
  - Style AB3 for surface mount applications, wood, metal and block walls
  - Style AB4 for hard-lid ceilings with hat furring channel grid systems, allows for vertical sprinkler adjustment
  - Style AB7 for suspended and hard-lid ceilings
  - Style AB7 Adjustable for suspended and hard-lid ceilings
  - Style AB8 for hard-lid ceilings with CD 60/27 profile metal studs (regionally available)
  - Style AB9 for hard-lid ceilings with hat furring channel grid systems
  - Style AB10 for Armstrong® TechZone™ ceilings

Maximum Working Temperature

- 225°F/107°C

Maximum Working Pressure

- 200 psi/1375 kPa (FM Approval)
- 175 psi/1206 kPa (cULus Listed)
- 1600 kPa/232 psi (VdS/LPCB Approved)

ALWAYS REFER TO ANY NOTIFICATIONS AT THE END OF THIS DOCUMENT REGARDING PRODUCT INSTALLATION, MAINTENANCE OR SUPPORT.

System No.		Location	
Submitted By		Date	

Spec Section		Paragraph	
Approved		Date	

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1.0 PRODUCT DESCRIPTION (Continued)

Connections

- To adapter nipple (inlet) via 1"/25.4 mm NPT or BSPT male thread

OR

- To adapter nipple (inlet) via ¾"/20 mm BSPT male thread(VdS only)
- To sprinkler head (outlet) via ½" or ¾"/15 mm or 20 mm

Minimum Bend Radius

- 7"/178 mm (FM Approval)
- 2"/51 mm (cULus Listed)
- 3"/76.2 mm (VdS/LPCB Approved)

Maximum Allowable Sprinkler K-Factors

- FM (½"/15mm reducer) K5.6/8,1 (S.I.), (¾"/20mm reducer) K14.0/20,2 (S.I.)
- cULus (½"/15mm reducer) K8.0/11,5 (S.I.), (¾"/20mm reducer) K14.0/20,2 (S.I.)
- VdS/LPCB (½"/15mm reducer) K5.6/8,1 (S.I.), (¾"/20mm reducer) K8.0/11,5 (S.I.)

2.0 CERTIFICATION/LISTINGS

FM c UL us LISTED VdS LPCB

3.0 SPECIFICATIONS – MATERIAL

Series AH2

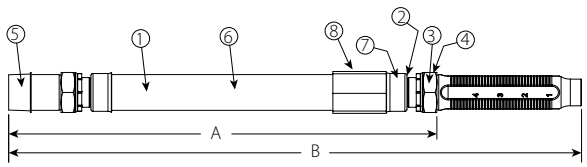
- **Flexible Hose:** 300-series Stainless Steel
- **Collar/Weld Fitting:** 300-series Stainless Steel
- **Gasket Seal:** Victaulic EPDM
- **Isolation Ring:** Nylon
- **Nut and Nipple:** Carbon Steel, Zinc Plated
- **Reducer (½ or ¾"):** Carbon Steel, Zinc-Plated

Brackets: Carbon Steel, Zinc-Plated

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4.0 DIMENSIONS

Product Details - Series AH2 Braided Hose



Item	Description
1	Flexible Hose
2	Isolation Ring
3	Gasket
4	Nut
5	Adapter Nipple
6	Braid
7	Collar/Weld Fitting
8	Sleeve

Hose Length Dimensions

Hose Length inches mm	A inches mm	B inches mm
31/790	25.25/641	31/790
36/915	31.25/794	36/915
48/1220	42.25/1073	48/1220
60/1525	54.25/1378	60/1525
72/1830	66.25/1683	72/1830

Standard Reducer

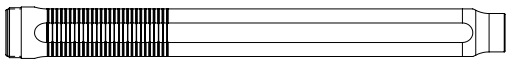


5.75"/140 mm straight reducer

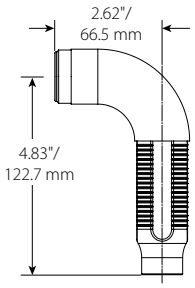
Optional Reducers



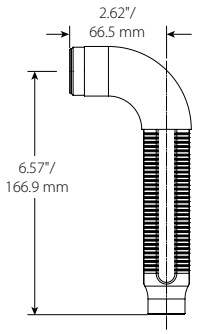
9.0"/229 mm straight reducer



13.0"/330 mm straight reducer



Short 90° elbow reducer



Long 90° elbow reducer

NOTE

- The Short 90° elbow reducer is typically used with concealed sprinklers while the longer 90 elbow is typically used in the installation of recessed pendent sprinklers.

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4.1 DIMENSIONS

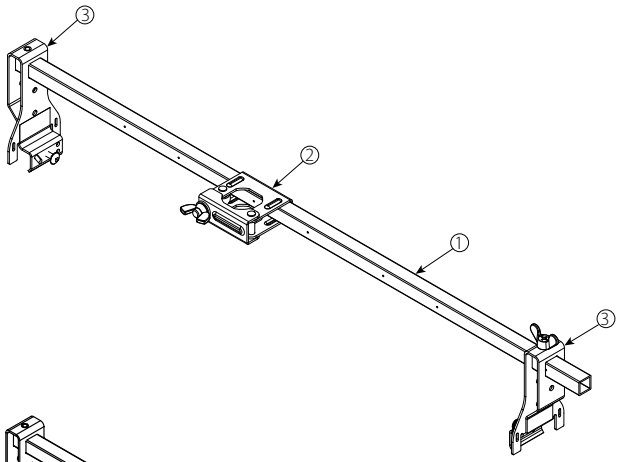
VicFlex Brackets

Style AB1

- Suspended Ceilings
- Hard-Lid Ceilings (FM Only)

Item	Description
1	24"/610 mm or 48"/1220 mm Square Bar*
2	Patented Center Bracket
3	End Bracket

*Both sizes FM/VdS/LPCB approved, cULus listed

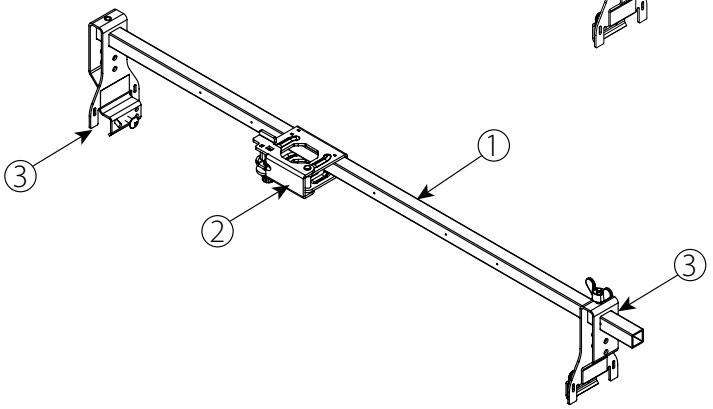


Style AB2

- Suspended Ceilings
- Hard-Lid Ceilings

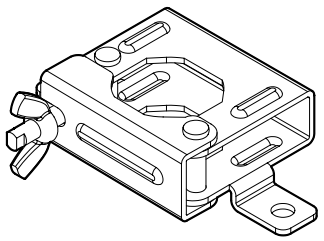
Item	Description
1	24"/610 mm or 48"/1220 mm Square Bar*
2	Patent-Pending adjustable Center bracket
3	End Bracket

*Both sizes FM/VdS/LPCB approved, cULus listed



Style AB3

- Surface Mount Applications
- FM Approved



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4.2 DIMENSIONS

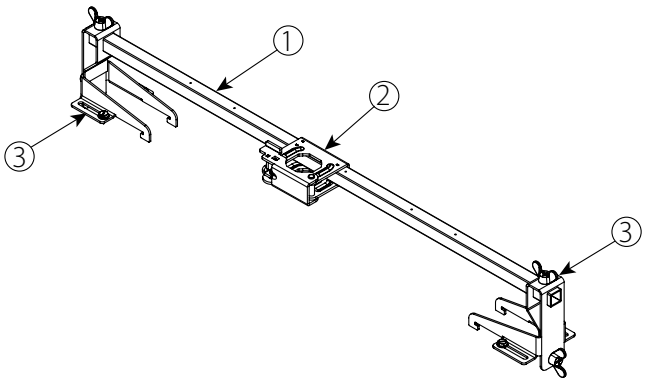
VicFlex Brackets

Style AB4

- Hard-Lid Ceilings with Hat furring channel grid system

Item	Description
1	24"/610 mm or 48"/1220 mm Square Bar*
2	Patent-Pending adjustable Center bracket
3	End Bracket for Hat Furring Channel

*Both sizes FM/VdS approved, cULus listed

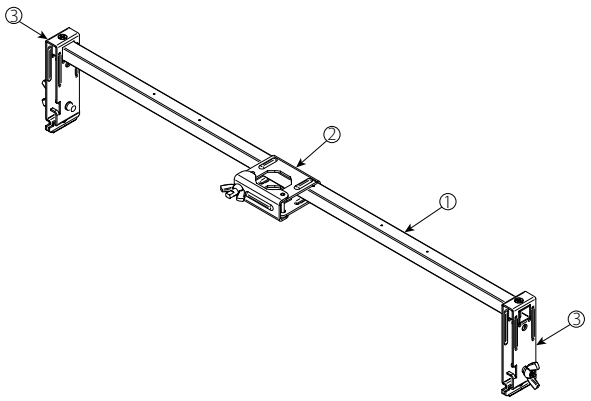


Style AB7

- Suspended Ceilings
- Hard-Lid Ceilings

Item	Description
1	24"/610 mm or 48"/1220 mm Square Bar*
2	Patented 1-Bee2® Center Bracket
3	End Bracket

*Both sizes FM/VdS approved.

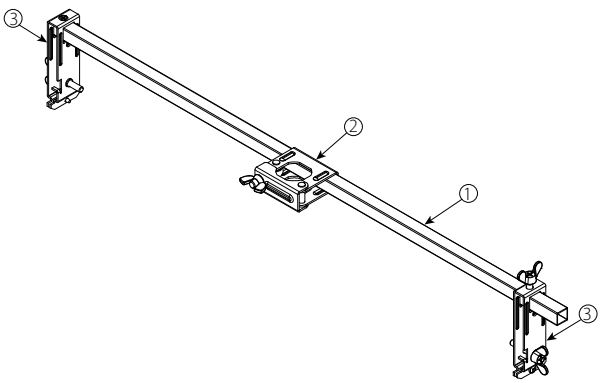


Style AB7 Adjustable

- Suspended Ceilings
- Hard-Lid Ceilings

Item	Description
1	700 mm or 1400 mm Square Bar*
2	Patented 1-Bee2® Center Bracket
3	End Bracket (adjustable)

*Both sizes FM/VdS approved.



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4.3 DIMENSIONS

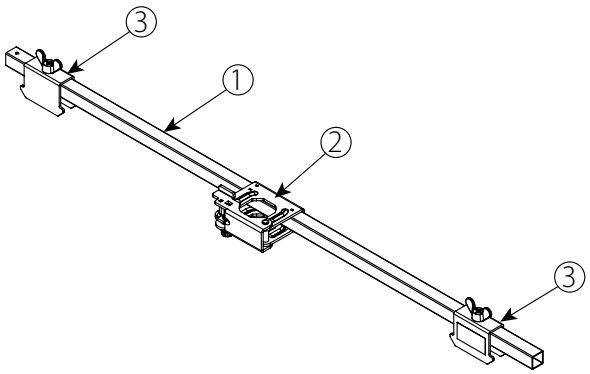
VicFlex Brackets

Style AB8

- Hard-Lid Ceilings

Item	Description
1	700 mm or 1400 mm Square Bar*
2	Patent-pending adjustable center bracket
3	*Both sizes FM/VdS

*Both sizes FM/VdS approved.

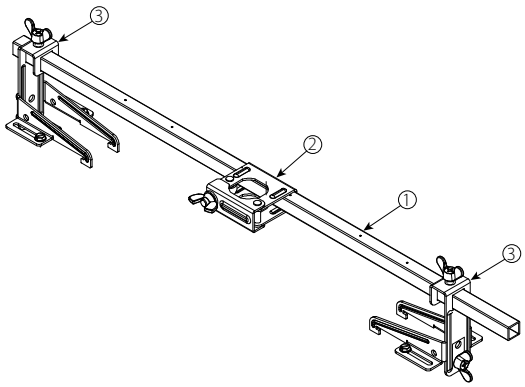


Style AB9

- Hard-Lid ceilings with Hat furring channel grid system

Item	Description
1	24"/610 mm or 48"/1220 mm Square Bar*
2	Patented 1-Bee2® Center Bracket
3	End Bracket for Hat Furring Channel

*Both sizes FM/VdS approved.

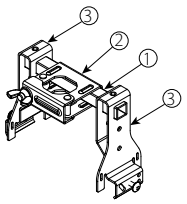


Style AB10

- Suspended ceilings
- Armstrong® TechZone™

Item	Description
1	6"/152 mm Square Bar*
2	Patented 1-Bee2® Center Bracket
3	End Bracket

*FM/VdS approved, cULus listed.



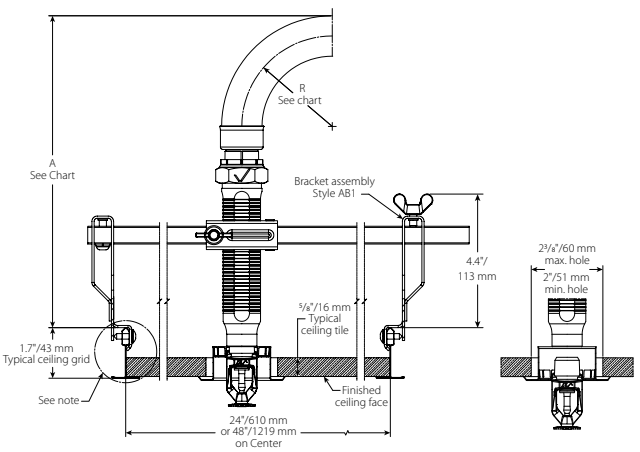
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4.4 DIMENSIONS

CLEARANCES ABOVE CEILING

Series AH2 Braided Hose and Style AB1 Bracket

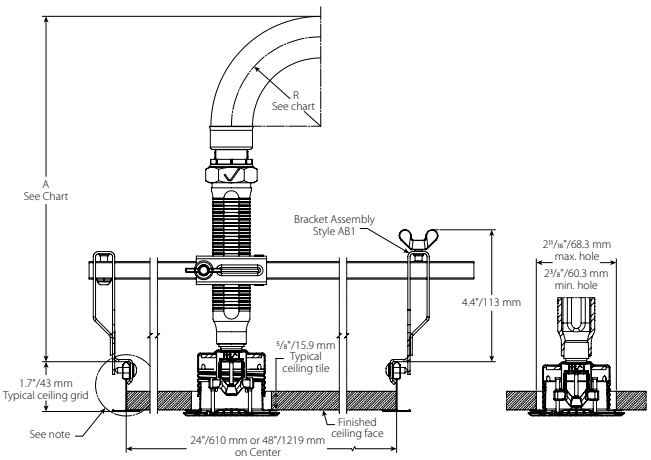
Suspended Ceiling Grid with Recessed Sprinkler



V2707 ¾"/19mm Max. Recess

Hose Clearance Chart							
Dimension		inches mm	inches mm	inches mm	inches mm	inches mm	inches mm
R	Minimum Bend Radius	2 50	3 80	4 100	5 125	6 150	7 175
A	Min.	10.75 273	11.75 298.5	12.75 324	13.75 349	14.75 375	15.75 400

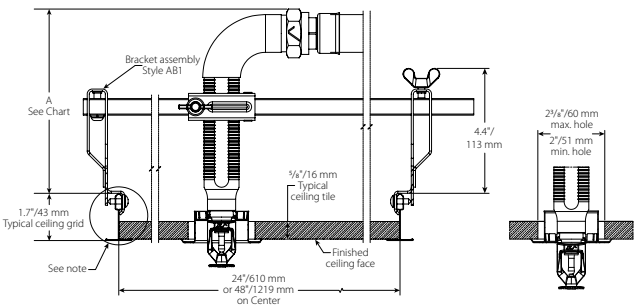
Suspended Ceiling Grid with Concealed Sprinkler



V3802 ½"/12.7mm Max. Recess

Hose Clearance Chart							
Dimension		inches mm	inches mm	inches mm	inches mm	inches mm	inches mm
R	Minimum Bend Radius	2 50	3 80	4 100	5 125	6 150	7 175
A	Min.	10.1 269	11.1 281	12.1 307	13.1 333	14.1 358	15.1 383

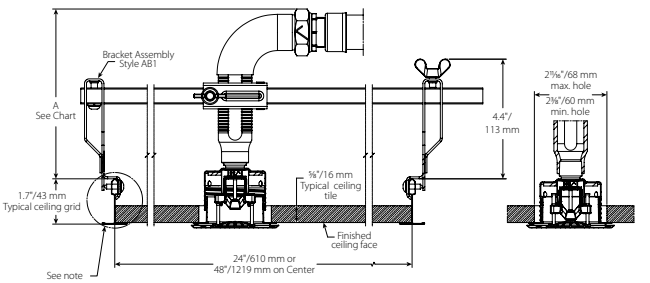
Suspended Ceiling Grid with Recessed Sprinkler with 90° Elbow (Long)



V2707 ¾"/19mm Max. Recess

Hose Clearance Chart		
Dimension		inches mm
A	Min.	8 200

Suspended Ceiling Grid with Concealed Sprinkler with 90° Elbow (Short)



V3802 ½"/12.7mm Max. Recess

Hose Clearance Chart		
Dimension		inches mm
A	Min.	5.8 147

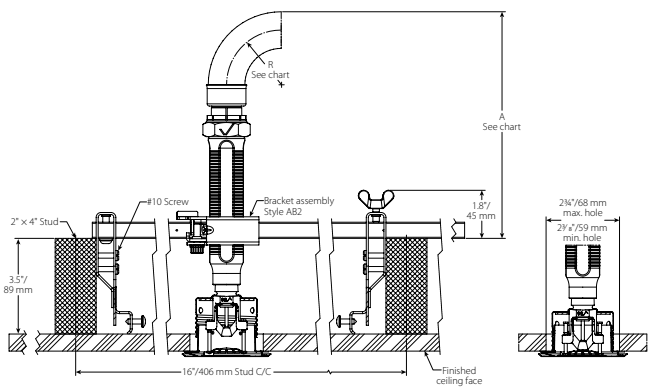
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4.4 DIMENSIONS (Continued)

CLEARANCES ABOVE CEILING

Series AH2 Braided Hose and Style AB2 Bracket

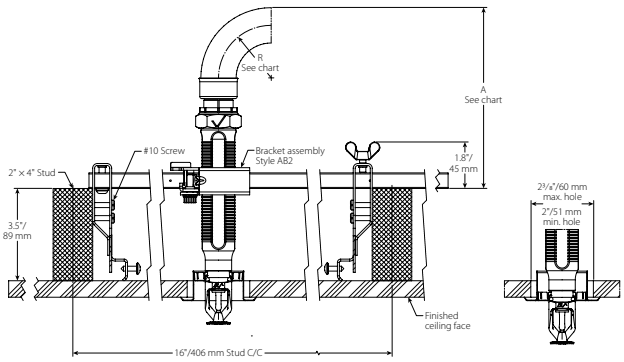
Hard-lid Ceiling with Concealed Sprinkler



V3802 ½"/12.7mm Max. Recess

Hose Clearance Chart							
Dimension		inches mm	inches mm	inches mm	inches mm	inches mm	inches mm
R	Minimum Bend Radius	2 50	3 80	4 100	5 125	6 150	7 175
A	Min.	7.63 193	8.63 218	9.63 244	10.63 269	11.63 295	12.63 320

Hard-lid Ceiling with Recessed Sprinkler



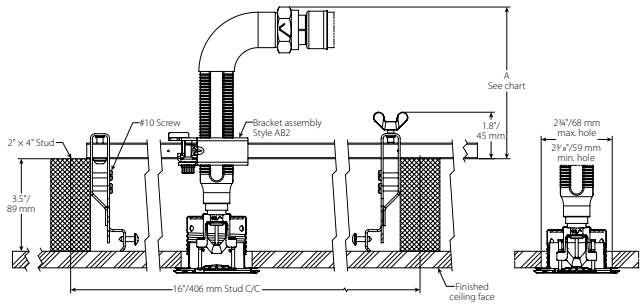
V2707 ¾"/19mm Max. Recess

Hose Clearance Chart							
Dimension		inches mm	inches mm	inches mm	inches mm	inches mm	inches mm
R	Minimum Bend Radius	2 50	3 80	4 100	5 125	6 150	7 175
A	Min.	6.13 155	7.13 180	8.13 206	9.13 231	10.13 256	11.13 282

NOTE

- Variations of ceiling grids, sprinkler heads, brackets, and hoses are permitted but may result in clearance differences from the figures above.

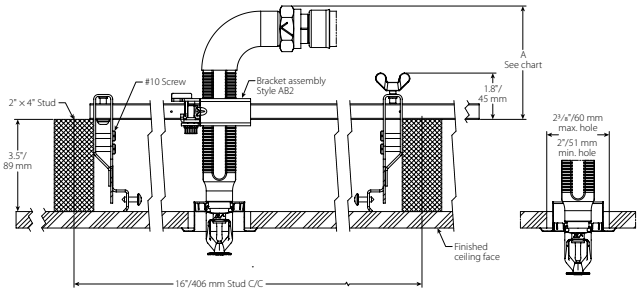
Hard-lid Ceiling Grid with Concealed Sprinkler with 90° Elbow (Short)



V3802 ½"/12.7mm Max. Recess

Hose Clearance Chart		
Dimension		inches mm
A	Min.	5 127

Hard-lid Ceiling with Recessed Sprinkler with 90° Elbow (Long)



V2707 ¾"/19mm Max. Recess

Hose Clearance Chart		
Dimension		inches mm
A	Min.	3.63 91

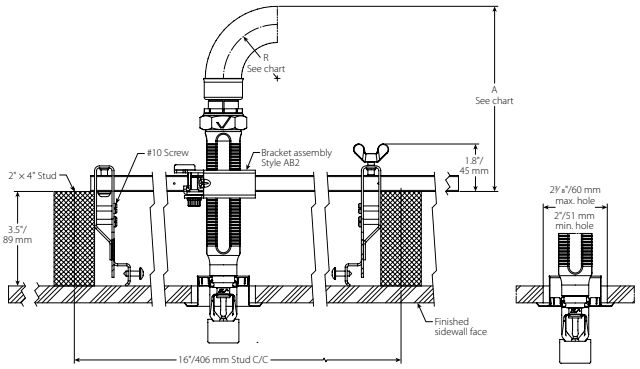
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4.5 DIMENSIONS

CLEARANCES WITHIN SIDEWALL

Series AH2 Braided Hose and Style AB2 Bracket

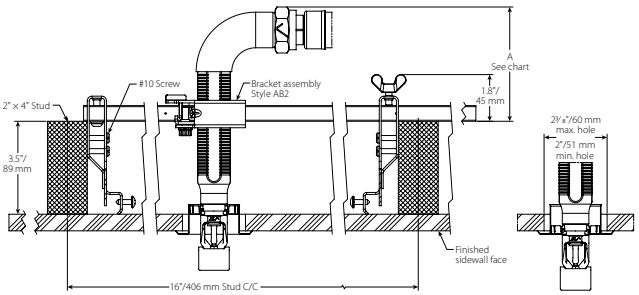
Horizontal Sidewall Sprinkler



V2707 ¾"/19mm Max. Recess

Hose Clearance Chart							
Dimension		inches mm	inches mm	inches mm	inches mm	inches mm	inches mm
R	Minimum Bend Radius	2 50	3 80	4 100	5 125	6 150	7 175
A	Min.	6.13 155	7.13 180	8.13 206	9.13 231	10.13 256	11.13 282

Horizontal Sidewall Sprinkler with 90° Elbow (Long)



V2707 ¾"/19mm Max. Recess

Hose Clearance Chart		
Dimension		inches mm
A	Min.	3.63 91

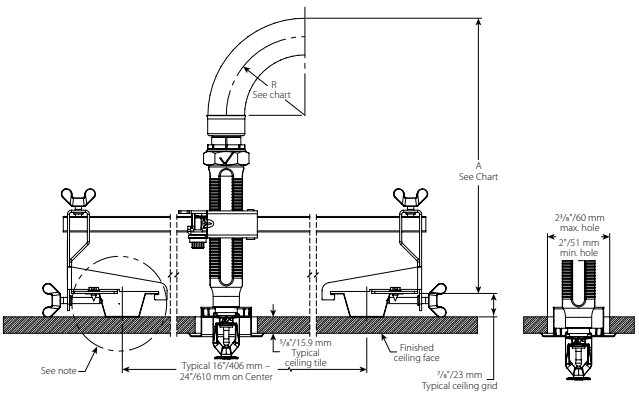
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4.6 DIMENSIONS

CLEARANCES ABOVE CEILING

Series AH2 Braided Hose and Style AB4 Bracket

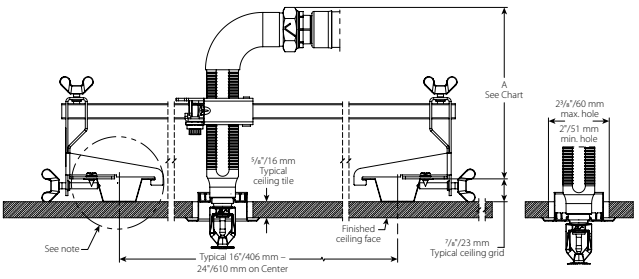
Hat Furring Channel Grid with Recessed Sprinkler



V2707 ¾"/19mm Max. Recess

Hose Clearance Chart							
Dimension		inches mm	inches mm	inches mm	inches mm	inches mm	inches mm
R	Minimum Bend Radius	2 50	3 80	4 100	5 125	6 150	7 175
A	Min.	10.3 262	11.3 287	12.3 313	13.3 338	14.3 363.5	15.3 389

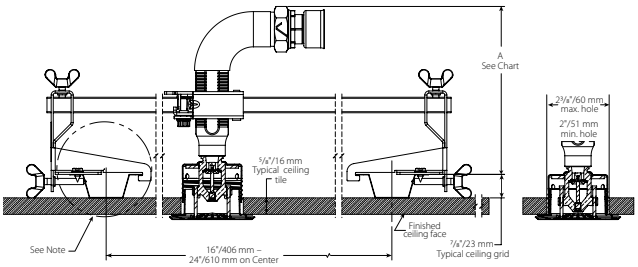
Hat Furring Channel Grid with Recessed Sprinkler with 90° Elbow (Long)



V2707 ¾"/19mm Max. Recess

Hose Clearance Chart		
Dimension		inches mm
A	Min.	8 200

Hat Furring Channel Grid with Concealed Sprinkler with 90° Elbow (Short)



V2707 ¾"/19mm Max. Recess

Hose Clearance Chart		
Dimension		inches mm
A	Min.	5.9 149

NOTE

- Variations of ceiling grids, sprinkler heads, brackets, and hoses are permitted but may result in clearance differences from the figures above.

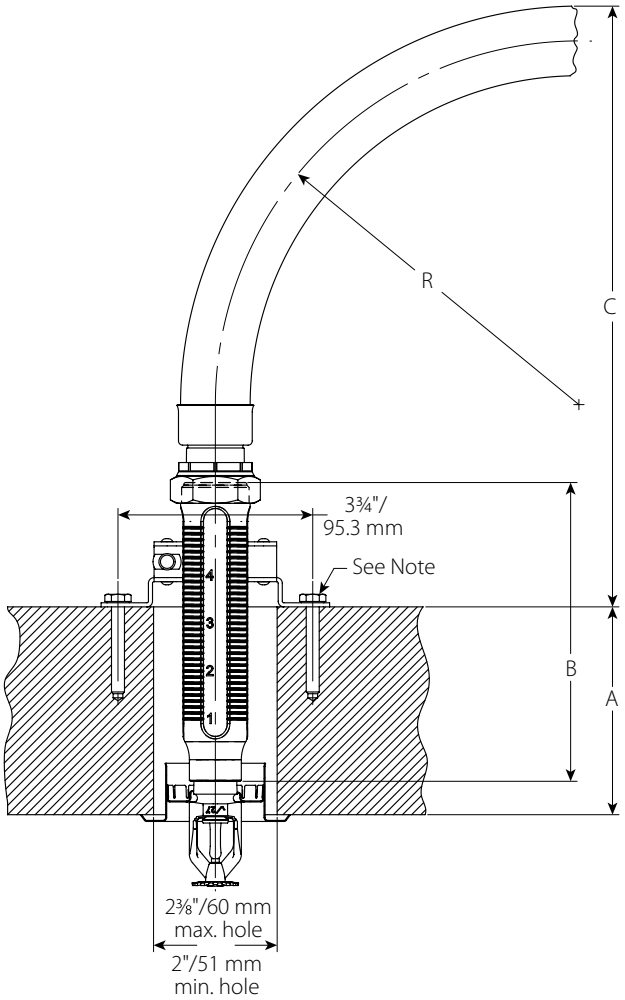
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4.6 DIMENSIONS (Continued)

CLEARANCES ABOVE CEILING

Series AH2 Braided Hose and Style AB3 Bracket

Surface Mount Application with Recessed Sprinkler



Hose Clearances																				
Wall Thickness "A"	2 50			4 100			6 150		8 200	10 250	2 50			4 100			6 150		8 200	10 250
Outlet Length "B"	5.75 146.1	9 228.6	13 330.2	5.75 146.1	9 228.6	13 330.2	9 228.6	13 330.2	13 330.2	13 330.2	5.75 146.1	9 228.6	13 330.2	5.75 146.1	9 228.6	13 330.2	9 228.6	13 330.2	13 330.2	13 330.2
Hose Clearance "C"	11.6 294	14.8 376	18.8 478	9.6 243	12.8 325	16.8 427	10.8 275	14.8 376	12.8 325	10.8 275	12.6 319	15.8 402	19.8 503	10.6 268	13.8 351	17.8 452	11.8 300	15.8 402	13.8 351	11.8 300
Bend Radius "R"	7 175										8 200									

NOTE

- Variations of ceiling grids, sprinkler heads, brackets, and hoses are permitted but may result in clearance differences from the figures above.
- See installation instructions for mounting screw type and size.

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5.0 PERFORMANCE – FRICTION LOSS DATA

Series AH2 Braided Hose with Straight 5.75" Reducers
Style AB1, AB2, AB4, and AB10 Brackets

Length of Stainless Steel Flexible Hose inches/mm	Outlet Size inches/mm/type	Series AH2 Hose	
		Equivalent Length of 1"/33.7 mm Sch. 40 Pipe (C=120) feet/meters	Maximum Number of 90° Bends at 2"/51 mm Bend Radius
31/775	½"/15/Straight	16/4.9	4
	¾"/20/Straight	17/5.2	4
36/900	½"/15/Straight	21/6.4	5
	¾"/20/Straight	23/7.0	5
48/1200	½"/15/Straight	32/9.8	8
	¾"/20/Straight	37/11.3	8
60/1500	½"/15/Straight	46/14.0	10
	¾"/20/Straight	46/14.0	10
72/1800	½"/15/Straight	55/16.8	12
	¾"/20/Straight	53/16.2	12

Series AH2 Braided Hose Equivalent Length Design Guide

Equivalent length values at various numbers of 90 degree bends at 2"/51 mm center line bend radius

Length of Stainless Steel Flexible Hose inches/mm	Outlet Size inches/mm	1 Bend feet/meters	2 Bends feet/meters	3 Bends feet/meters	4 Bends feet/meters	5 Bends feet/meters	6 Bends feet/meters	7 Bends feet/meters	8 Bends feet/meters	9 Bends feet/meters	10 Bends feet/meters	11 Bends feet/meters	12 Bends feet/meters
31/775	½"/15	8.5/2.6	11.0/3.4	13.0/4.0	16.0/4.9	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A
	¾"/20	10.0/3.0	12.5/3.8	14.0/4.3	17.0/5.2	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A
36/900	½"/15	13.5/4.1	16.0/4.9	18.0/5.5	19.0/5.8	21.0/6.4	N.A	N.A	N.A	N.A	N.A	N.A	N.A
	¾"/20	14.0/4.3	17.0/5.2	19.5/5.9	20.0/6.1	23.0/7.0	N.A	N.A	N.A	N.A	N.A	N.A	N.A
48/1200	½"/15	15.5/4.7	17.0/5.2	19.5/5.9	20.0/6.1	21.0/6.4	22.0/6.7	28.0/8.5	32.0/9.8	N.A	N.A	N.A	N.A
	¾"/20	17.0/5.2	19.0/5.8	21.5/6.6	24.5/7.5	26.0/7.9	27.0/8.2	30.0/9.1	37.0/11.3	N.A	N.A	N.A	N.A
60/1500	½"/15	21.5/6.6	24.0/7.3	27.0/8.2	28.5/8.7	30.0/9.1	31.0/9.4	37.0/11.3	42.0/12.8	44.0/13.4	46.0/14.0	N.A	N.A
	¾"/20	23.0/7.0	24.0/7.3	28.0/8.5	29.5/9.0	30.5/9.3	31.0/9.4	38.0/11.6	42.0/12.8	44.0/13.4	46.0/14.0	N.A	N.A
72/1800	½"/15	30.0/9.1	32.0/9.8	36.5/11.1	37.5/11.4	40.5/12.5	41.0/12.8	42.0/12.8	46.0/14.0	49.0/14.9	52.0/15.8	54.0/16.5	55.0/16.8
	¾"/20	32.0/9.8	32.5/9.9	35.0/10.7	35.5/10.8	40.0/12.3	40.5/12.3	41.0/12.5	46.0/14.0	50.0/15.2	51.0/15.5	52.0/15.8	53.0/16.2

NOTES:

- Values for use with 5.75" straight reducers.

How to use this Design Guide:

- For some systems, it may be advantageous for the designer to calculate the system hydraulics using shorter equivalent lengths associated with fewer than the maximum allowable number of bends. In this case, the designer may select a design number of bends for the job and use the associated equivalent length from the design guide to determine the system hydraulics.
- It is possible that the actual installed condition of some of the flexible drops may have more bends than the designer selected. When this happens, the design guide may be used to find equivalent lengths based on the actual installed number of bends for particular sprinkler installations. The system hydraulics can be recalculated using actual equivalent lengths to verify the performance of the system.

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5.1 PERFORMANCE – FRICTION LOSS DATA

Series AH2 Braided Hose
Style AB1, AB2, AB3, AB4, AB7, AB7 Adj., AB8, AB9 and AB10 VicFlex Brackets

Length of Stainless Steel Flexible Hose inches/mm	K-Factor Imperial/S.I.	Outlet Size inches/mm/type	Series AH2 Hose	
			Equivalent Length of 1"/33.7mm Sch. 40 Pipe feet/meters	Maximum Number of 90° Bends at 7"/178mm Bend Radius
31/775	5.6/8.1	½"/15/Straight	23.5/7.1	2
		½"/15/90° Elbow	23/7.0	
36/900	5.6/8.1	½"/15/Straight	27.8/8.5	2
		½"/15/90° Elbow	27.7/8.4	
48/1200	5.6/8.1	½"/15/Straight	38.2/11.6	3
		½"/15/90° Elbow	37.4/11.4	
60/1500	5.6/8.1	½"/15/Straight	42.4/12.9	4
		½"/15/90° Elbow	43/13.1	
72/1800	5.6/8.1	½"/15/Straight	46.6/14.2	4
		½"/15/90° Elbow	48.5/14.7	
31/775	8.0/11.5	¾"/20/Straight	20.7/6.3	2
		¾"/20/90° Elbow	20.5/6.2	
36/900	8.0/11.5	¾"/20/Straight	25.0/7.6	2
		¾"/20/90° Elbow	24.6/7.5	
48/1200	8.0/11.5	¾"/20/Straight	35.5/10.8	3
		¾"/20/90° Elbow	34.7/10.6	
60/1500	8.0/11.5	¾"/20/Straight	39.6/12.1	4
		¾"/20/90° Elbow	40.1/12.2	
72/1800	8.0/11.5	¾"/20/Straight	43.5/13.2	4
		¾"/20/90° Elbow	45.2/13.7	
31/775	11.2/16.1	¾"/20/Straight	17.8/5.4	2
		¾"/20/90° Elbow	18/5.5	
36/900	11.2/16.1	¾"/20/Straight	22.2/6.7	2
		¾"/20/90° Elbow	22.1/6.7	
48/1200	11.2/16.1	¾"/20/Straight	32.9/10.0	3
		¾"/20/90° Elbow	32.1/9.8	
60/1500	11.2/16.1	¾"/20/Straight	36.8/11.2	4
		¾"/20/90° Elbow	37.1/11.3	
72/1800	11.2/16.1	¾"/20/Straight	40.5/12.3	4
		¾"/20/90° Elbow	41.9/12.7	
31/775	14.0/20.2	¾"/20/Straight	14.9/4.5	2
		¾"/20/90° Elbow	15.5/4.72	
36/900	14.0/20.2	¾"/20/Straight	19.4/5.9	2
		¾"/20/90° Elbow	19.6/5.9	
48/1200	14.0/20.2	¾"/20/Straight	30.3/9.2	3
		¾"/20/90° Elbow	29.5/8.9	
60/1500	14.0/20.2	¾"/20/Straight	33.9/10.3	4
		¾"/20/90° Elbow	34.1/10.4	
72/1800	14.0/20.2	¾"/20/Straight	37.5/11.4	4
		¾"/20/90° Elbow	38.6/11.7	

FM NOTES:

- Series AH2 has been tested and Approved by FM Global for use in wet, dry and preaction systems per NFPA 13, 13R, and 13D and FM data sheets 2-0, 2-5, and 2-8. FM 1637 and Vds standards for safety include, but are not limited to, pressure cycling, corrosion resistance, flow characterisitics, vibration resistance, leakage, mechanical and hydrostatic strength.
- Differences in equivalent lengths are due to varying test methods, per FM 1637 and VdS standards. Refer to these standards for additional information regarding friction loss test methods.
- EXAMPLE: A 48-inch hose installed with two 30° bends and two 90° bends at a 7-inch bend radius is permitted and considered equivalent to the data in the table shown above. In this example, the total number of degrees is 240°, which is less than the allowable 270°.

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5.2 PERFORMANCE – FRICTION LOSS DATA

Series AH2 Braided Hose
Style AB1, AB2, AB4, AB7, AB7 Adj., AB8, AB9, and AB10 Brackets

Length of Stainless Steel Flexible Hose mm/inches	Outlet Size mm/inches type	Series AH2 Hose: Equivalent Length of steel pipe according to EN 10255 DN 25 (33,7 x 3,25) meters/feet	Series AH2 Hose: Maximum Number of 90° Bends at 3"/76.2mm Bend Radius meters/feet
775/31	15mm/½"/Straight 20 mm/¾"/Straight	5.5/18.0	3
900/36	15mm/½"/Straight 20 mm/¾"/Straight	6.4/21.0	3
1200/48	15mm/½"/ Straight 20 mm/¾"/Straight	8.5/27.9	3
1500/60	15mm/½"/Straight 20 mm/¾"/Straight	10.7/35.1	4
1800/72	15mm/½"/Straight 20 mm/¾"/Straight	12.8/42.0	4

VDS CEILING MANUFACTURERS LIST

AB1, AB2, AB7, AB10

1. AMF
2. Armstrong
3. Chicago Metallic
4. Dipling
5. Durlum
6. Geipel
7. Gema-Armstrong
8. Hilti
9. Knauf
10. Lafarge
11. Linder
12. Odenwald
13. Richter
14. Rigips
15. Rockfon Pagos
16. Suckow & Fischer
17. USG Donn

AB4/9

No specific approval

AB8

1. Hilti
2. Knauf
3. Lafarge
4. Lindner
5. Rigips

Series AH2 Braided Hose
Style AB1 Bracket

Length of Stainless Steel Flexible Hose mm/inches	Outlet Size mm/inches/type	Series AH2 Hose: Equivalent Length of steel pipe according to EN 10255 DN 25 (33,7 x 3,25) meters/feet	Series AH2 Hose: Maximum Number of 90° Bends at 3"/76.2mm Bend Radius
775/31	15mm/½"/Straight 20 mm/¾"/Straight	1.8/6.0	2
900/36	15mm/½"/Straight 20 mm/¾"/Straight	3.6/11.9	3
1200/48	15mm/½"/Straight 20 mm/¾"/Straight	4.3/14.0	3
1500/60	15mm/½"/Straight 20 mm/¾"/Straight	4.1/13.6	3
1800/72	15mm/½"/Straight 20 mm/¾"/Straight	5.5/18.1	3

Length of Stainless Steel Flexible Hose mm/inches	Outlet Size mm/inches/type	Series AH2 Hose: Equivalent Length of steel pipe according to EN 10255 DN 25 (33,7 x 3,25) meters/feet	Series AH2 Hose: Maximum Number of 90° Bends at 3"/76.2mm Bend Radius
775/31	15mm/½"/90° Elbow 20 mm/¾"/90° Elbow	1.3/4.3	2
900/36	15mm/½"/90° Elbow 20 mm/¾"/90° Elbow	2.8/9.1	3
1200/48	15mm/½"/90° Elbow 20 mm/¾"/90° Elbow	4.1/13.4	3
1500/60	15mm/½"/90° Elbow 20 mm/¾"/90° Elbow	4.6/15.2	3
1800/72	15mm/½"/90° Elbow 20 mm/¾"/90° Elbow	5.3/17.4	3

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6.0 NOTIFICATIONS

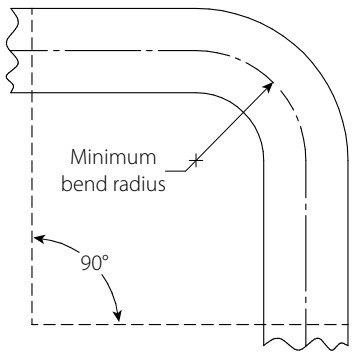
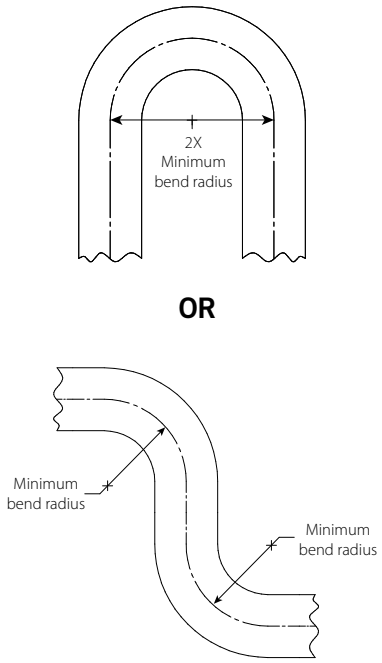
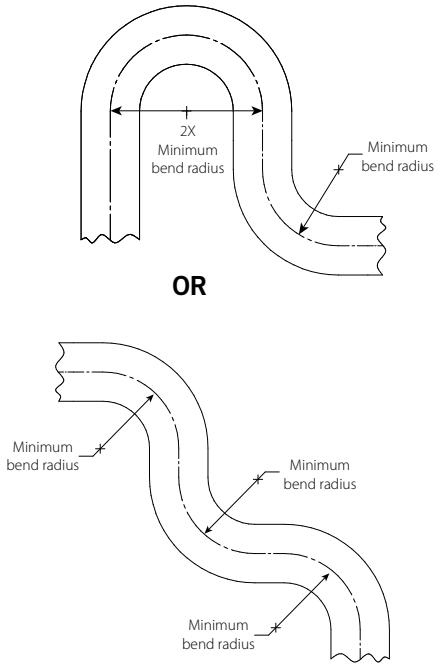
WARNING

- **It is the responsibility of the system designer to verify suitability of 300-series stainless steel flexible hose for use with the intended fluid media within the piping system and external environments.**
- **The effect of chemical composition, pH level, operating temperature, chloride level, oxygen level, and flow rate on 300-series stainless steel flexible hose must be evaluated by the material specifier to confirm system life will be acceptable for the intended service.**

Failure to follow these instructions could cause product failure, resulting in serious personal injury and/or property damage.

7.0 REFERENCE MATERIALS – CHARACTERISTICS

Flexible Hose In-Plane Bend Characteristics

One Bend	Two Bends	Three Bends
		

NOTE

- For out-of-plane (three-dimensional) bends, care must be taken to avoid imparting torque on the hose.

User Responsibility for Product Selection and Suitability
Each user bears final responsibility for making a determination as to the suitability of Victaulic products for a particular end-use application, in accordance with industry standards and project specifications, as well as Victaulic performance, maintenance, safety, and warning instructions. Nothing in this or any other document, nor any verbal recommendation, advice, or opinion from any Victaulic employee, shall be deemed to alter, vary, supersede, or waive any provision of Victaulic Company's standard conditions of sale, installation guide, or this disclaimer.

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Note
This product shall be manufactured by Victaulic or to Victaulic specifications. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

Installation
Reference should always be made to I-VICFLEX-AB1-AB2-AB10, I-VICFLEX-AB4-AB9, I-VICFLEX-AB7, or I-VICFLEX-AB8 for the product you are installing. Handbooks are included with each shipment of Victaulic products for complete installation and assembly data, and are available in PDF format on our website at www.victaulic.com.

Warranty
Refer to the Warranty section of the current Price List or contact Victaulic for details.

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SYSTEM SENSOR®

WFD Series Waterflow Detector



The System Sensor WFD series is compatible with schedule 10 through 40 steel pipe, sizes 2˝ through 8˝, and can be mounted in a vertical or horizontal position.

Features

- Two-inch mounting hole provided in new WFD30-2 models
- UL-listed models are NEMA 4 rated
- Sealed retard mechanism immune to dust and other contaminants
- Visual switch activation
- Field-replaceable retard mechanism and SPDT switches
- Rugged, dual SPDT switches enclosed in a durable terminal block
- Accommodates up to 12 AWG wire
- Designed for both indoor and outdoor use
- 100 percent synchronization activates both alarm panel and local bell
- Tamper-resistant cover screws

Robust Construction. The WFD series consists of a rugged, NEMA 4-rated enclosure. Designed for both indoor and outdoor use, the WFD series operates across a wide temperature range, from 32°F to 120°F.

Reliable Performance. UL-listed models are equipped with tamper-resistant cover screws to prevent unauthorized entry. Inside, two sets of SPDT (Form C) synchronized switches are enclosed in a durable terminal block to assure reliable performance.

False Alarm Immunity. The WFD series incorporates a mechanical retard feature, which minimizes the risk of false alarm due to pressure surges or air trapped in the sprinkler system. In addition, the mechanical retard's unique sealed design is immune to dust and other contaminants.

Simplified Operation. The WFD series is designed to simplify installation. Two conduit openings permit easy attachment to the local alarm system. The retard mechanism and dual SPDT switches are field-replaceable.

Agency Listings

UL LISTED S739 | ULC CS169 | 7770-1653:114 | MEA approved 167-93-E | FM APPROVED 3006195

Waterflow Detector Specifications

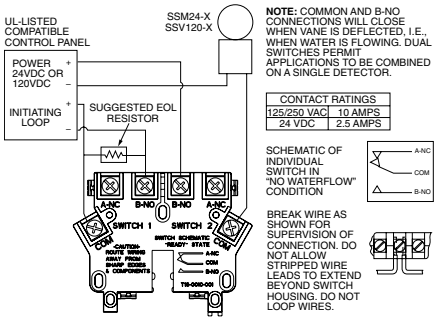
Engineering Specifications

Vane-type waterflow detectors shall be installed on system piping as designated on the drawing and/or as specified herein. Detectors shall mount on any clear pipe span of the appropriate nominal size, either a vertical upflow or horizontal run, at least 6″ from any fittings that may change water direction, flow rate, or pipe diameter or no closer than 24″ from a valve or drain. Detectors shall have a sensitivity in the range of 4 to 10 gallons per minute and a static pressure rating of 450 psi* for 2″ – 8″ pipes. The detector shall respond to waterflow in the specified direction after a preset time delay that is field adjustable. The delay mechanism shall be a sealed mechanical pneumatic unit with visual indication of actuation. The actuation mechanism shall include a polyethylene vane inserted through a hole in the pipe and connected by a mechanical linkage to the delay mechanism. Outputs shall consist of dual SPDT switches (Form C contacts). Two conduit entrances for standard fittings of commonly used electrical conduit shall be provided on the detectors. A grounding provision is provided. Unless noted, enclosures shall be NEMA 4 listed by Underwriters Laboratories Inc. All detectors shall be listed by Underwriters Laboratories Inc. for indoor or outdoor use.

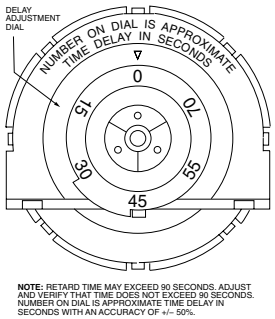
Standard Specifications

Static Pressure Rating	450 PSI*	**Operating Temperature Range**	32°F to 120°F (0°C to 49°C)
Maximum Surge	18 Feet Per Second (FPS)	**Enclosure Rating***	NEMA 4 – suitable for indoor/outdoor use
Triggering Threshold Bandwidth (Flow Rate)	4–10 GPM	**Cover Tamper Switch**	Standard with ULC models, optional for UL models, part no. 546-7000
Conduit Entrances	Two openings for ½″ conduit. One open, one knock-out type	**Service Use**	Automatic Sprinkler: NFPA-13 One or Two Family Dwelling: NFPA 13D Residential Occupancies up to 4 Stories: NFPA 13R National Fire Alarm Code: NFPA-72
Contact Ratings	Two sets of SPDT (Form C) 10.0 A, ½ HP @ 125/250 VAC 2.5 A @ 6/12/24 VDC	**U.S. Patent Numbers**	5,213,205
Compatible Pipe	Steel water pipe, schedule 10 through 40	**Warranty**	3 Years

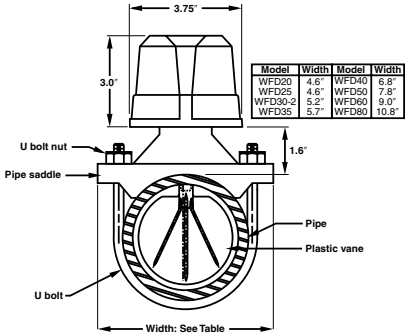
WFD Field Wiring Diagram



Delay Adjustment Dial



Overall Dimensions, Installed



Model	Width	Model	Width
WFD20	4.6″	WFD40	6.8″
WFD25	4.6″	WFD50	7.8″
WFD30-2	5.2″	WFD60	9.0″
WFD35	5.7″	WFD80	10.8″

Ordering Information

UL Model	ULC Model	Pipe Size	Hole Size	Shipping Weight
WFD20	WFD20A	2″	1¼″	4.2 lbs.
WFD25	WFD25A	2½″	1¼″	4.3 lbs.
WFD30-2	WFD30-2A	3″	2″	4.5 lbs.
WFD35	WFD35A	3½″	1¼″	4.7 lbs.
WFD40	WFD40A	4″	2″	5.2 lbs.
WFD50	WFD50A	5″	2″	6.3 lbs.
WFD60*	WFD60A	6″	2″	6.8 lbs.
WFD80*	WFD80A	8″	2″	7.5 lbs.
Accessories				
A3008-00	Retard mechanism			
A77-01-02	Terminal block			
546-7000	Tamper-proof switch kit			
WFDW	Tamper-proof wrench for cover			
WFDN4	Gasket kit			

*Maximum pressure rating 400 psi as approved by Factory Mutual.

SYSTEM SENSOR®
3825 Ohio Avenue • St. Charles, IL 60174
Phone: 800-SENSOR2 • Fax: 630-377-6495

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A05-0180-013 • 1/09 • #1922

POTTER
The Symbol of Protection

PCVS Series

Control Valve Supervisory Switch

602

Features

- NEMA 4X* (IP 65) and 6P (IP 67)

  **Enclosure is 4X. For additional corrosion protection of mounting hardware, use model PCVS-2 CRH*
- -40º to 140º (-40ºC to 60ºC) operating temperature range
- Visual Switch Indicators
- Two conduit entrances
- Adjustable length trip rod
- Accomodates up to 12AWG wire
- Switch detects tampering and valve closure
- RoHS compliant
- Two SPDT contacts



NOTICE

Before any work is done on the fire sprinkler or fire alarm system, the building owner or their authorized representative shall be notified. Before opening any closed valve, ensure that opening the valve will not cause any damage from water flow due to open or missing sprinklers, piping, etc.

Important: This document contains important information on the installation and operation of PCVS valve supervisory switches. Please read all instructions carefully before beginning installation. A copy of this document is required by NFPA 72 to be maintained on site.

Description

The Model PCVS is a weather proof and tamper resistant switch for monitoring the open position of fire sprinkler control valves of the wall and yard post indicator and butterfly types. Two SPDT (Form C) contacts are provided which will operate when the valve position is altered from an open state.

The unit mounts in a 1/2" NPT tapped hole in the post indicator or butterfly valve housing. The device is engaged by the indicating assembly of the post indicator or the operating mechanism of the butterfly valve, actuating switches when the valve is fully open. The unit should be installed where it is accessible for service.

The cover is held in place by two tamper resistant screws that require a special tool to remove. The tool is furnished with each device.

Testing

The operation of the PCVS and its associated protective monitoring system shall be tested upon completion of the installation and inspected, tested and maintained in accordance with all applicable local and national codes and standards and/or the Authority Having Jurisdiction, (manufacturer recommends quarterly or more frequently). A minimum test shall consist of turning the valve operating mechanism towards the closed position. The PCVS shall operate within the first two revolutions of the operating mechanism. Fully close the valve and ensure the PCVS does not restore. Fully open the valve and ensure that the PCVS restores to normal.

Technical Specifications

Dimensions	See Fig 10
Weight	1.0 lbs (0,45 kg)
Enclosure	Cover: Die Cast Finish: Red Powder Coat Base: Die Cast Finish: Black Powder Coat All parts have corrosion resistant finishes
Cover Tamper	Tamper Resistant Screws Optional Cover Tamper Switch Available
Contact Ratings	PCVS-2: Two Sets of SPDT (Form C) 10.0 Amps at 125/250 VAC 2.0 Amps at 30VDC Resistive 10 mAmps minimum at 24 VDC
Environmental Limitations	-40º F to 140ºF (-40ºC to 60ºC) NEMA 4X (IP 65) and NEMA 6P Enclosure (IP67) (Use suitably rated conduit and connector) Indoor or Outdoor Use (See PIVSU-EX Bulletin 5400694 for Hazardous locations)
Conduit Entrances	Two Knockouts for 1/2" conduit provided (See Notice on Page 7 and Fig. 11 on Page 6)
Service Use	NFPA 13, 13D, 13R, 72

Specifications subject to change without notice

Theory Of Operation

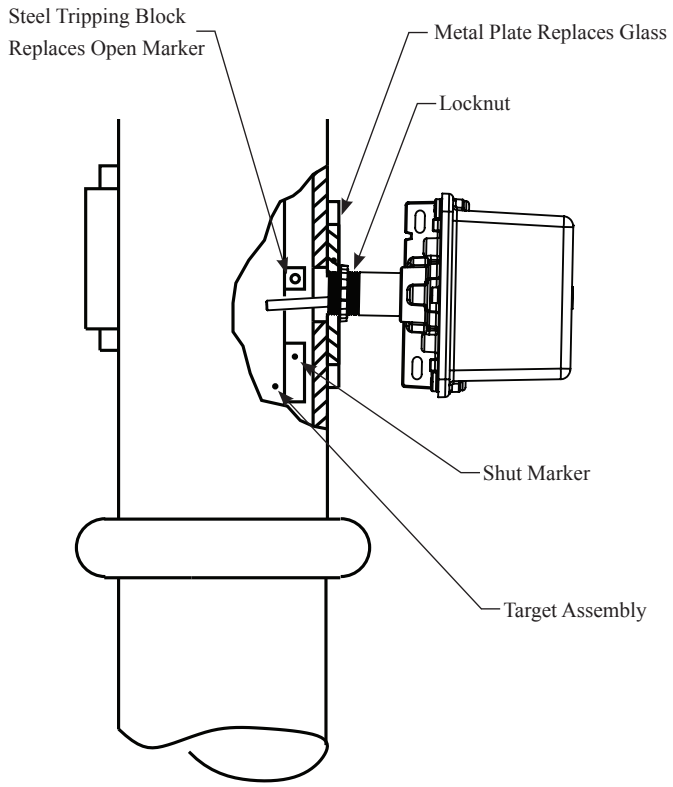
The PCVS is a spring loaded switch. It is in normal position when the trip rod is pulling against the spring force. Normal is when the switch is installed on the valve and the valve is fully open. As the valve closes, the valve actuator moves away from the trip rod of the PCVS and the spring on the PCVS pulls the trip rod over and trips the switch.

Alternate Window Installation and Moving Hood Installation

Target Moves Up as Valve is Shut

Fig 1

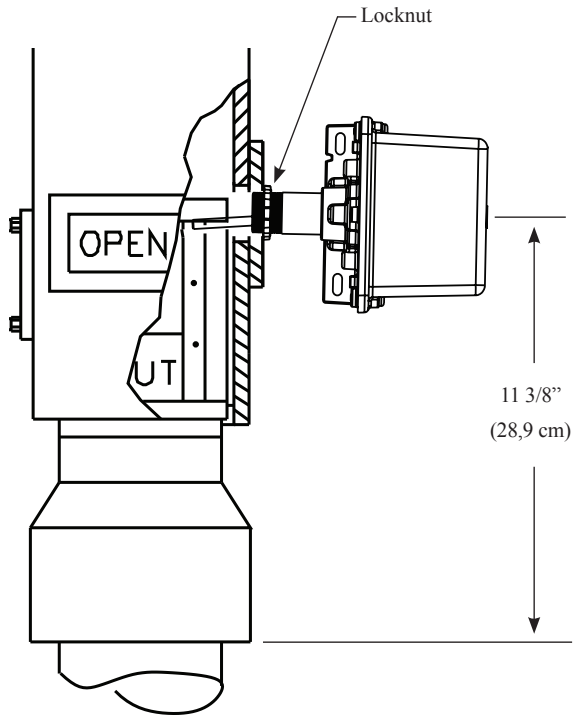
Subject to the approval of the "authority having jurisdiction" the alternate method of installation shown in Fig. 1 may be used. In this method, one of the glass windows of the housing is replaced with a 1/4" thick metal plate that is cut to fit in place of the glass and drilled and tapped to recieve 1/2" NPT pipe nipple. In some cases it may be necessary to attach an angle bracket to the target assembly to engage the PCVS trip rod.



Hood Moves Down as Valve is Shut

Fig 2

If the target is stationary and a hood arrangement is used, such as is shown in Fig. 2, the hood must be drilled with a 23/32" drill and tapped with a 1/2" NPT. The center line of this hole should be 1/8" below the portion of target assembly that strikes the PCVS trip rod. The 11 3/8" dimension shown is for a Clow Valve. Flexible conduit must be used for this type of installation. (More on pg. 3).



Typical Installations On Post Indicator Valve Housings

Fig 3

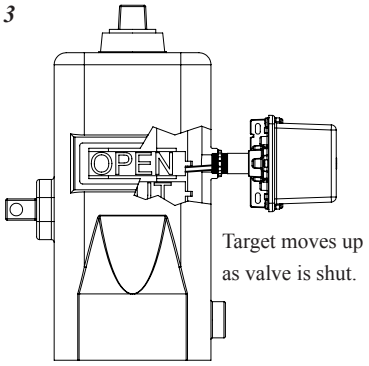
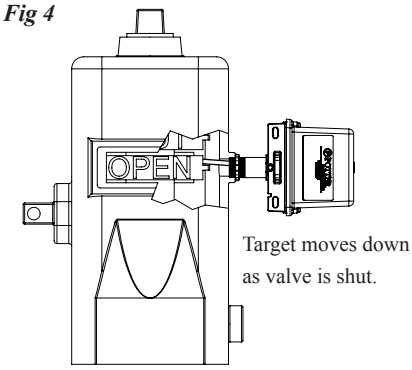


Fig 4



NOTE: Before any work is done on the fire sprinkler or fire alarm system, the building owner or their authorized representative shall be notified. Before opening any closed valve, ensure that opening the valve will not cause any damage from water flow due to open or missing sprinklers, piping, etc.

1. Position the valve to fully open ("OPEN" should appear in the window of the housing). Partially close the valve while observing the direction that the target assembly moves. Reopen the valve. If the valve housing is predrilled with a 1/2" NPT for installation of a monitoring switch, remove the 1/2" plug and fully open the valve. Make sure that "OPEN" appears in the window of the housing. GO TO STEP NO. 6.
2. If the valve is not pre-drilled for 1/2" NPT, remove the head and target assembly (consultation with valve manufacturer is recommended).
3. If the target assembly moved up as the valve was closed, measure the distance from the bottom of the head to the lower part of the target assembly that will contact the trip rod of the PCVS (see Fig. 3). This is usually a plate or bar on the target assembly, on a side adjacent to the "OPEN/SHUT" plates. Subtract 1/8" from the measurement. If the target moved down as the valve was closed, measure the distance from the bottom of the head to the upper portion of the target assembly that will contact the trip rod of the PCVS (see Fig. 4). Add 1/8" (3,2mm) to this measurement.
4. Mark the housing at the proper location. Using a 23/32" (18,2mm) drill bit, drill and then tap a 1/2" NPT in the housing on the side that coincides with the portion of the target assembly that will engage the trip rod of the PCVS.
5. Replace the head and target assembly.
6. Loosen the socket head screw that holds the nipple in the PCVS and remove the nipple.
7. Screw the locknut that is provided onto the nipple.
8. Screw the nipple into the 1/2" NPT hole in the valve housing hand tighten. Tighten the locknut against the valve housing to secure the nipple firmly in place.
9. Insert a scale or probe thru the nipple to measure the distance from the open end of the nipple to the target assembly. Subtract 1/2" (12,5mm) from this measurement.

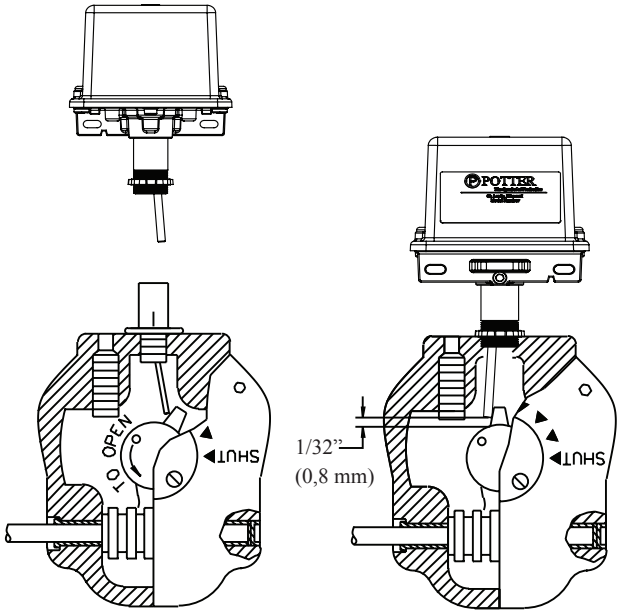
NOTE: In some cases, it may be necessary to attach an angle bracket to the target assembly to engage the PCVS trip rod.

10. Using the special tool provided, loosen the two cover screws and remove the cover from the PCVS.
11. Loosen the locking screw that holds the trip rod in place and adjust the rod length, from the end of the collar to the end of the rod, using the dimension determined in Step 9. Tighten the locking screw to 5 in-lbs minimum to hold the rod in place and properly seal the enclosure.
12. Partially close the valve to move the target assembly away (3 to 4 revolutions of the handle/hand wheel).
13. With the PCVS positioned so the spring will pull the trip rod to follow the target as the valve is closing, slide the PCVS over the nipple. Tighten the socket head screw in the collar.
14. Carefully open the valve to the fully open position. As the target moves to the open position it should engage the trip rod and actuate the switch(es). There should be a minimum overtravel of 1/2 revolution of the handle/hand wheel after the switch(es) actuate (a continuity meter connected to each set of contacts is one method that could be used to determine this).
15. Slowly close the valve. The switch must operate during the first two revolutions of the handle/hand wheel or during 1/5 of the travel distance of the valve control apparatus from its normal condition.

    NOTE: Small adjustments of the target position may be necessary (consultation with valve manufacturer is recommended).
16. Complete the required electrical wiring, connections and tests. The valve should be operated through the entire cycle of fully closed and fully open to determine the integrity of the PCVS installation and the signaling system. Check that all electrical and mechanical connections are secure.
17. Reinstall the cover and tighten the cover screws to 15 in-lbs minimum to properly seal the enclosure.
18. When the installation and testing are complete, return valve to its proper position.
19. Alternative installation for other post indicator valve housing shown in Fig. 1 and 2.

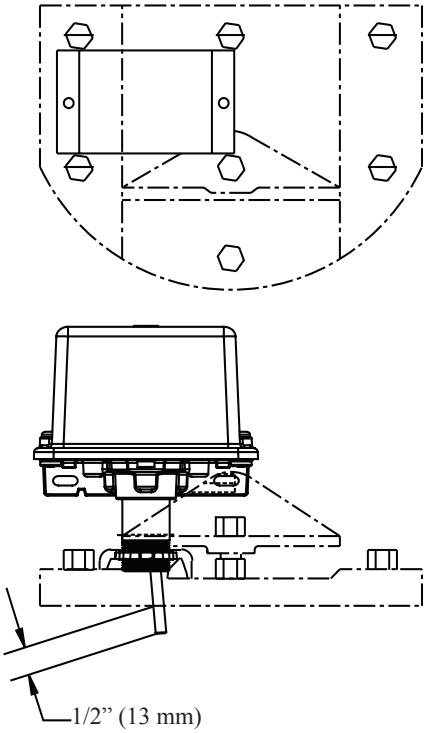
Typical Installation on a Butterfly Valve

Fig 5 Typical Indicating Butterfly Valve



Valve Partially Closed Valve Open

Fig 6 Dresser Indicating Butterfly Valve



1. Remove the 1/2" NPT plug from the gear operator case.
2. Loosen the set screw that holds the nipple in the PCVS and remove the nipple.
3. Screw the locknut that is provided onto the nipple.
4. Screw the nipple into the 1/2" NPT hole in the gear operator-hand tighten. Tighten the locknut against the case, to secure the nipple firmly in place
5. Partially close the valve to move the boss on the gear hub out of the way (3 or 4 revolutions of the hand wheel or crank).
6. Using the special tool provided, loosen the two cover screws and remove the cover from the PCVS.
7. Orient the PCVS so the spring will pull up the trip rod to follow the actuating cam inside the valve.

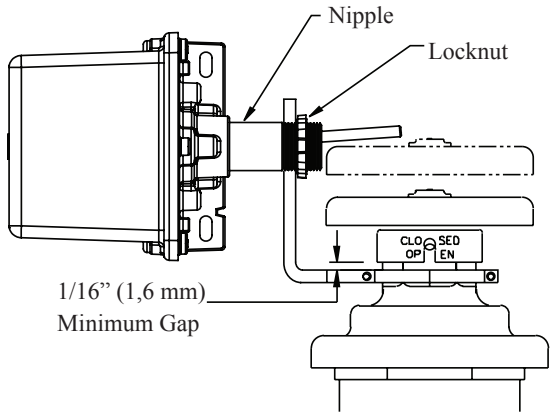
   NOTE: If trip rod length is excessive, loosen the locking screw and remove the trip rod from the trip lever. Using pliers, break off the one (1) inch long notched section (see Fig. 12). Reinstall the trip rod, tightening the screw to 5 in-lbs minimum, and repeat Step 7 procedure.
8. Remove device from nipple and shorten the trip rod 1/32" (0,80mm) (this is to prevent the trip rod from dragging on the gear hub inside the valve). Tighten the locking screw to hold the rod in place. Re-install the device on the nipple. Tighten the screw in the collar against the nipple.

   NOTE: In some cases it may be necessary to remove the gear box cover to ensure correct operation (consultation with the valve manufacturer is recommended).
9. Carefully open the valve to its full open position, as the boss on the gear hub moves to the open position it must engage the PCVS trip rod and actuate the switch(es). There should be a minimum overtravel or revolution of the crank or hand wheel after the switch(es) actuate (a continuity meter connected to each set of contacts is one method that could be used to determine this).

   NOTE: Slight adjustment of gear stops may be necessary to prevent overtravel of the trip rod (consultation with valve manufacture is recommended).
10. Carefully close the valve. The switch(es) must operate during the first two revolutions of the crank or hand wheel or during 1/5 of the travel distance of the valve control apparatus from its normal condition.
11. Complete the required electrical wiring, connections and tests. The valve should be operated through the entire cycle of fully closed and fully open to determine the integrity of the PCVS installation and signaling system.
12. Reinstall the cover and tighten the screws to 15 in-lbs minimum to properly seal the enclosure.
13. When the installation and testing are complete, return valve to its proper position.

Typical Pressure Reducer Type Valve Installation

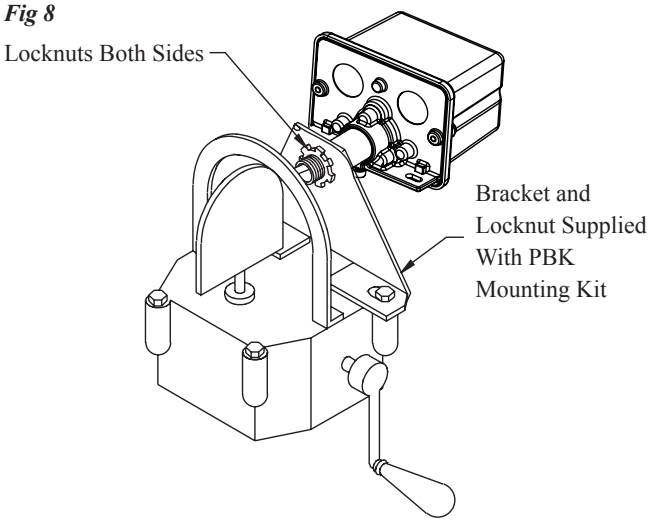
Fig 7



This figure shows the Model PCVS mounted on the valve yoke, with a bracket supplied by the valve manufacturer, to supervise a pressure reducer type valve.
NOTE: This application is subject to the approval of the authority having jurisdiction.

PBK - Butterfly Valve Kit for Valves with Internal Supervisory Switches

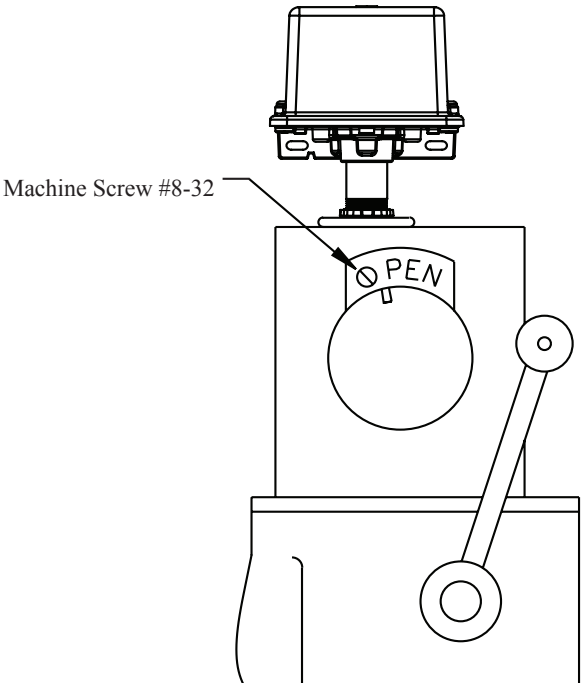
Fig 8



Pratt Butterfly Valve Kit as used to mount a PCVS on a Pratt Model IBV Valve.
Kits contain: Bracket, nuts and instructions
NOTE: Due to changes in valves, brackets may need to be modified by installer. This application is subject to the approval of the authority having jurisdiction.

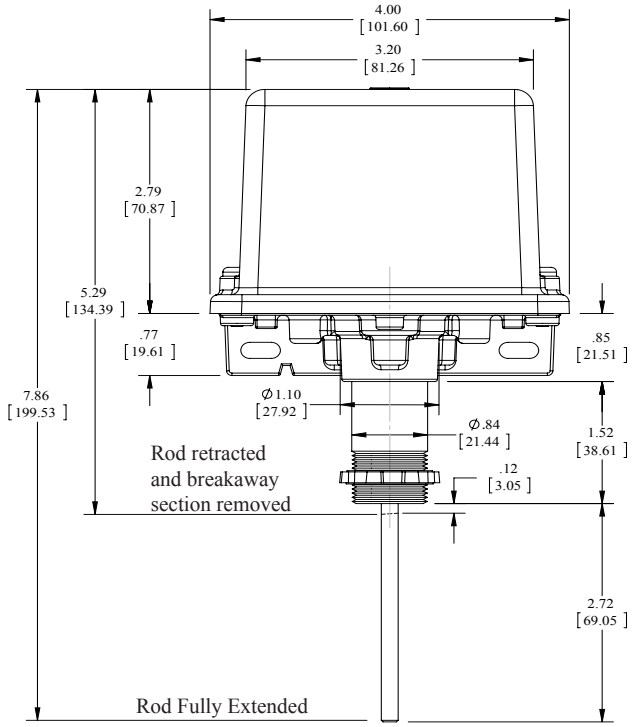
PVK - Pratt PIVA Post Indicator Valve Kit

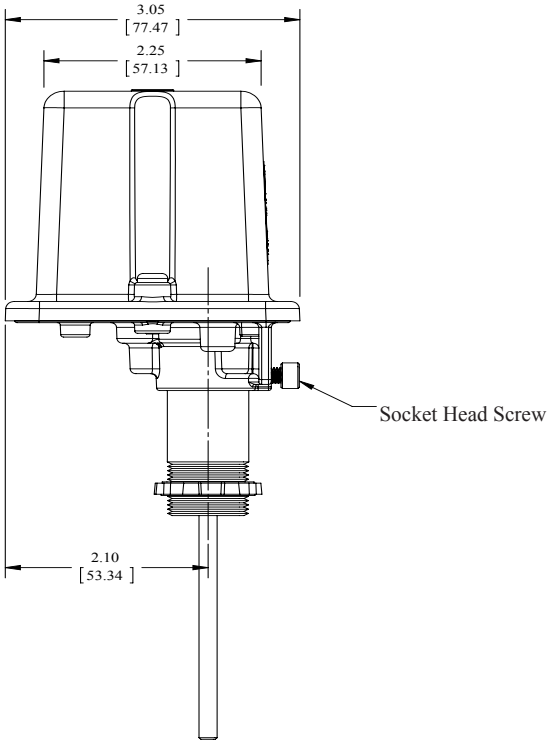
Fig 9

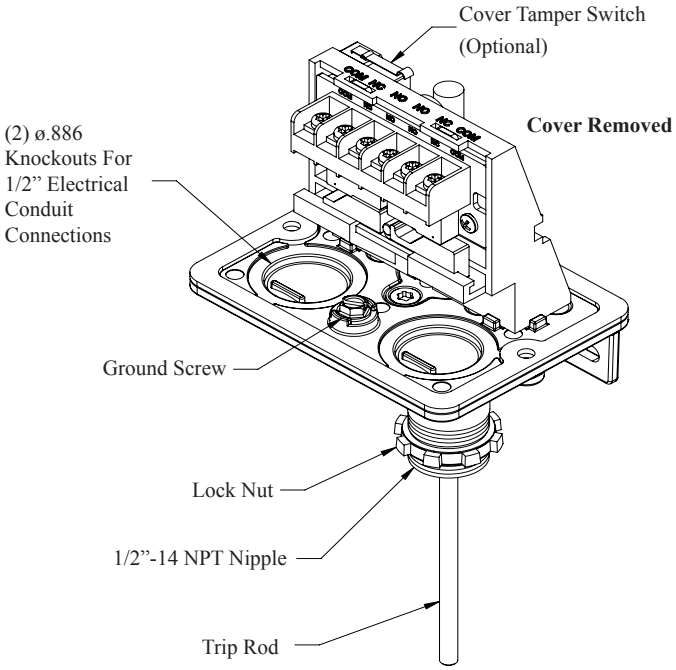


Pratt Valve Kit as used to mount a PCVS on a Pratt Model PIVA Valve.
Kit contains: Instructions, template, screw and nut.
NOTE: This application is subject to the approval of the authority having jurisdiction.

Dimensions
Fig 10

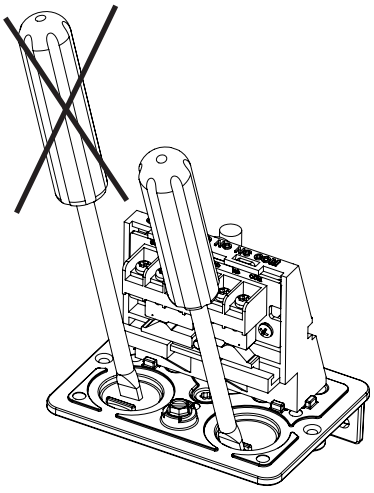






Knockout Removal
Fig 11

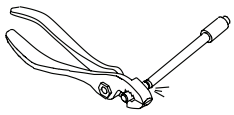
To remove knockouts: Place screwdriver at inside edge of knockouts, not in the center.



NOTE: Do not drill into the base as this creates metal shavings which can create electrical hazards and damage the device. Drilling voids the warranty.

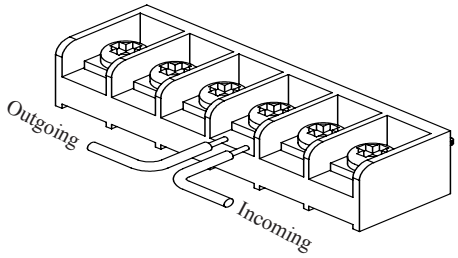
Breaking Excessive Rod Length

Fig 12



Switch Terminal Connections Clamping Plate Terminal

Fig 13



⚠ WARNING

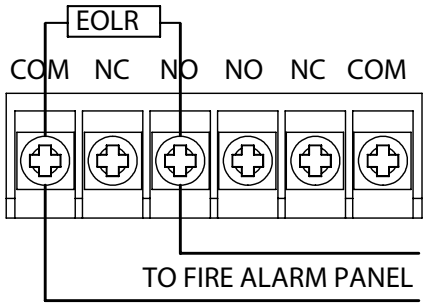
An uninsulated section of a single conductor should not be looped around the terminal and serve as two separate connections. The wire must be severed, thereby providing supervision of the connection in the event that the wire become dislodged from under the terminal. Failure to sever the wire may render the device inoperable risking severe property damage and loss of life. Do not strip wire beyond 3/8" of length or expose an uninsulated conductor beyond the edge of the terminal block. When using stranded wire, capture all strands under the clamping plate.

NOTICE

All conduit and connectors selected for the installation of this product shall be suitable for the environment for which it is to be used and shall be installed to the manufacturer's installation instructions. For NEMA 4, 4X, 6, 6P installations, the cover screws are recommended to be tightened to 15 in-lbs minimum and the trip rod locking screw tightened to 5 in-lbs minimum to properly seal the enclosure.

Typical Electrical Connections

Fig 14



Ordering Information

Model	Description	Stock No.
PCVS-2	Potter Control Valve Switch (double switch)	1010203
PCVS-2 CRH	Potter Control Valve Switch (double switch). Corrosion resistant 316 stainless steel hardware.	1010211
--	Cover Screw	5490424
--	Hex Key for Cover Screws and Installation Adjustments	5250062
PBK-S	Pratt Butterfly Valve Kit - 3" (75mm) to 12" (30mm)	0090133
PBK-M	Pratt Butterfly Valve Kit - 14" (355 mm) and 16" (406 mm)	0090146
PBK-L	Pratt Butterfly Valve Kit - 18" (457mm) to 24" (610 mm)	0090132
PVK	Pratt Valve Kit	1000060
--	Optional Cover Tamper Switch Kit	0090200
KBK	Kennedy Butterfly Valve Kit	0090143
TBK	Tycho Butterfly Valve Kit	0090150

For pressure reducer type valve installation kits (if required) contact valve manufacturer.

Engineering Specifications: Post Indicator & Butterfly Valves

UL, CUL Listed / FM Approved and CE Marked valve supervisory switches shall be furnished and installed on all post Indicator and Butterfly valves that can be used to shut off the flow of water to any portion of the fire sprinkler system, where indicated on the drawings and plans and as required by applicable local and national codes and standards. The supervisory switch shall be NEMA 4X and 6P rated and capable of being mounted in any position indoors or out and be completely submerged without allowing water to enter the enclosure. The enclosure shall be held captive by tamper resistant screws. The device shall contain two conduit entrances and two Single Pole Double Throw (SPDT) switches. The device shall contain a removable 1/2" NPT nipple and adjustable trip rod, the trip rod shall be held captive by a set screw accessible upon removal of the cover. The switch contacts shall be rated at 10A, 125/250VAC and 2A, 30VDC. Post Indicator and Butterfly Valve supervisory switch shall be model PCVS-2 manufactured by Potter Electric Signal Company LLC

NOTICE

Supervisory switches have a normal service life of 10-15 years. However, the service life may be significantly reduced by local environmental conditions.

POTTER
The Symbol of Protection

BELLS

PBA-AC & MBA-DC



UL, ULC, and FM Approved
Sizes Available: 6" (150mm), 8" (200mm) and 10" (250mm)
Voltages Available: 24VAC
120VAC
12VDC (10.2 to 15.6) Polarized
24VDC (20.4 to 31.2) Polarized
Service Use: Fire Alarm
General Signaling
Burglar Alarm
Environment: Indoor or outdoor use (See Note 1)
-40° to 150°F (-40° to 66°C)
(Outdoor use requires weatherproof backbox.)
Termination: AC Bells - 4 No. 18 AWG stranded wires
DC Bells - Terminal strip
Finish: Red powder coating
Optional: Model BBK-1 weatherproof backbox
Model BBX-1 deep weatherproof backbox

These vibrating type bells are designed for use as fire, burglar or general signaling devices. They have low power consumption and high decibel ratings. The unit mounts on a standard 4" (101mm) square electrical box for indoor use or on a model BBK-1 weatherproof backbox or BBX-1 deep weatherproof backbox for outdoor applications. Weatherproof backbox model BBK-1, Stock No. 1500001.

Notes:
1. Minimum dB ratings are calculated from integrated sound pressure measurements made at Underwriters Laboratories as specified in UL Standard 464. UL temperature range is -30° to 150°F (-34° to 66°C).
2. Typical dB ratings are calculated from measurements made with a conventional sound level meter and are indicative of output levels in an actual installation.
3. ULC only applies to MBA DC bells.

Size inches (mm)	Voltage	Model Number	Stock Number	Current (Max.)	Typical dB at 10 ft. (3m) (2)	Minimum dB at 10 ft. (3m) (1)
6 (150)	12VDC	MBA-6-12	1750070	.12A	85	76
8 (200)	12VDC	MBA-8-12	1750080	.12A	90	77
10 (250)	12VDC	MBA-10-12	1750060	.12A	92	78
6 (150)	24VDC	MBA-6-24	1750100	.06A	87	77
8 (200)	24VDC	MBA-8-24	1750110	.06A	91	79
10 (250)	24VDC	MBA-10-24	1750090	.06A	94	80
6 (150)	24VAC	PBA246	1806024*	.17A	91	78
8 (200)	24VAC	PBA248	1808024*	.17A	94	77
10 (250)	24VAC	PBA2410	1810024*	.17A	94	78
6 (150)	120VAC	PBA1206	1806120*	.05A	92	83
8 (200)	120VAC	PBA1208	1808120*	.05A	99	84
10 (250)	120VAC	PBA12010	1810120*	.05A	99	86

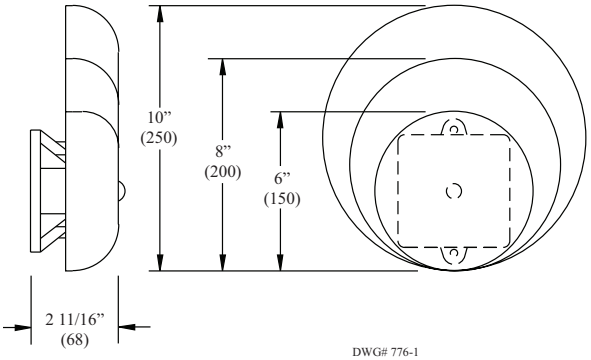
All DC bells are polarized and have built-in transient protection.
* Does not have ULC listing.

⚠ WARNING

In outdoor or wet installations, bell must be mounted with weatherproof backbox, BBK-1 or BBX-1. Standard electrical boxes will not provide a weatherproof enclosure. If the bell and/or assembly is exposed to moisture, it may fail or create an electrical hazard.

BELLS
PBA-AC & MBA-DC

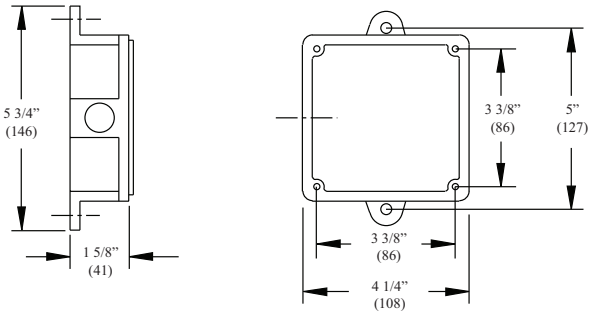
Bells Dimensions Inches (mm)
Fig. 1



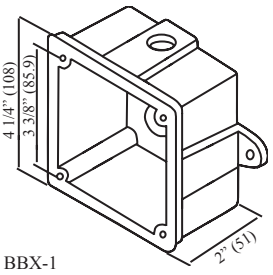
DWG# 776-1

Weatherproof Backbox Dimensions Inches (mm)
Fig. 2

Box has one threaded 1/2" conduit entrance

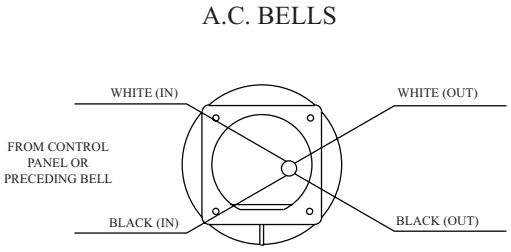


DWG# 776-2



BBX-1

Wiring (rear view)
Fig. 3

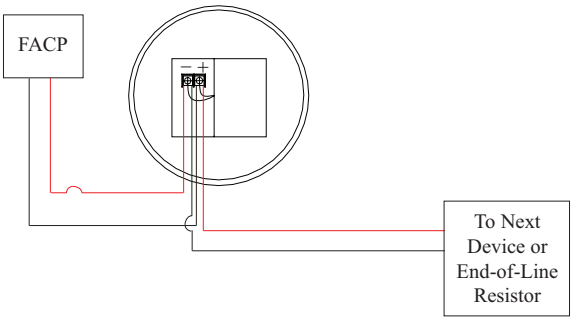


CAUTION:
WHEN ELECTRICAL SUPERVISION IS REQUIRED USE IN AND OUT LEADS AS SHOWN.

NOTES:

1. WHEN USING AC BELLS, TERMINATE EACH EXTRA WIRE SEPARATELY AFTER LAST BELL.
2. END-OF-LINE RESISTOR IS NOT REQUIRED ON AC BELLS.

DWG# 776-3



Installation
1. The bell shall be installed in accordance with NFPA 13, 72, or local AHJ. The top of the device shall be no less than 90" AFF and not less than 6" below the ceiling.
2. Remove the gong.
3. Connect wiring (see Fig. 3).
4. Mount bell mechanism to backbox (bell mechanism must be mounted with the striker pointing down).
5. Reinstall the gong (be sure that the gong positioning pin, in the mechanism housing, is in the hole in the gong).
6. Test all bells for proper operation and observe that they can be heard where required (bells must be heard in all areas as designated by the authority having jurisdiction).

⚠ WARNING

Failure to install striker down will prevent bell from operating.

ASHCROFT®

Fire Protection, Sprinkler Service Gauge Type 1005P, XUL ASME B 40.1 Grade B (±3-2-3% of span)

- ***Underwriters Laboratory listed and Factory Mutual approved***
- ***Corrosion-resistant ABS case***
- ***Heat-resistant polycarbonate push-in window***
- ***Patented PowerFlex™ movement with polyester segment***
- ***True Zero™ indication, a unique safety feature***

Ashcroft® fire protection sprinkler gauges are Underwriters Laboratory listed and Factory Mutual approved for fire protection sprinkler service. The case material on Type 1005P, XUL gauges is ABS. The 0-300 psi pressure range is used on "wet" systems where water is available to the sprinkler heads. The 0-80 retard to 250 psi pressure range is used on dry systems where the lines are filled with air pressure until system activation.

The patented Power*Flex* movement with polyester segment is designed to provide unequalled shock and vibration resistance resulting in superior performance and extended gauge life.



True Zero indication, a standard feature on these gauges, reduces the potential risk of installing a damaged gauge on your equipment.

GAUGE SPECIFICATIONS

Type no.: 1005P, XUL

Accuracy: ASME B 40.1 Grade B (±3-2-3% of span)

Size: 3½″

Case: ABS (Polycarbonate blend)

Ring: None

Window: Polycarbonate, push-in

Dial: Black figures on white background

Pointer: Black, aluminum

Bourdon tube: "C" shaped bronze

Movement: Patented Power*Flex* with polyester segment

Socket: Brass

Restrictor: None

Operating temperature: –40°F to 150°F

Connection: ¼ NPT lower

Ranges: 0-300 psi (water)
0-80 retard to 250 psi (air)
UL 393 Listed, UL of Canada Listed and FM approved.
Equivalent (single or dual scale) metric scales are available

GAUGE OPTIONS

Customized dials

Other UL listed ranges on application

NOTES

UL LISTED

FM

LOOK FOR THESE AGENCY MARKS ON OUR PRODUCTS

TO ORDER THIS TYPE 1005P, XUL GAUGE:

Select:	35	W	1005	P	H	02L	XUL	300#

1. Dial Size: 3½″
2. Patented Power*Flex*™ Movement
3. Case Type Number: 1005
4. Case Type Material: ABS
5. Socket Material: Brass
6. Connection Size/Location: ¼ NPT lower
7. UL listed, FM approved
8. Range: 300 psi

POTTER ROEMER FIRE PRO™
Member of Morris Group International™

VALVES
ANGLE HOSE VALVES

Model/Series No.
4060-4075 SERIES

SPECIFICATIONS

ANGLE VALVES

FEMALE X MALE
Cast brass valve with red hand wheel, Female N.P.T. inlet x male hose thread outlet. 300 psi

DOUBLE FEMALE
Cast brass valve with red hand wheel. Female N.P.T. inlet and outlet. 300 psi



MODEL 4065 (Shown)

MODEL SELECTION

VALVES

- ❑ **4060** 1-1/2” Female x Male Angle Valve ◄FM►
- ❑ **4065** 2-1/2” Female x Male Angle Valve ◄FM►
- ❑ **4065-500** 2-1/2” Female x Male Angle Valve 500 psi
- ❑ **4070** 1-1/2” Double Female Angle Valve ◄FM►
- ❑ **4075** 2-1/2” Double Female Angle Valve ◄FM►
- ❑ **4075-500** 2-1/2” Double Female Angle Valve 500 psi

OPTIONAL CAPS & FLANGES

- ❑ **4615** 1-1/2” Cap w/ Chain
- ❑ **4625** 2-1/2” Cap w/ Chain
- ❑ **4711** 1-1/2” Flange 3” O.D.
- ❑ **4712** 2-1/2” Flange 6-1/4” O.D.

PRODUCT OPTIONS

FINISHES:

- ❑ -B Polished Brass
- ❑ -C Rough Chrome Plated
- ☑ -D Polished Chrome Plated

THREADS:

- ☑ N.S.T.
- ❑ Other _____

VARIATIONS:

- ❑ Extended Stem Up to 24”
  Specify _____
- ❑ Rocker Lugs (Cap Models Only)
- ❑ -GRV Grooved Inlet (4065 Only)

Call Potter Roemer - Fire Pro for current listings and approvals. Dimensions are subject to manufacturer's tolerance and may change without notice. Potter Roemer-Fire Pro assumes no responsibility for use of void or superceded data. © Copyright Potter Roemer- Fire Pro, Member of Morris Group International ™ Please visit ***potterroemer.com*** *for most current specifications.*

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POTTER ROEMER FIRE PRO™
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VALVES
ANGLE HOSE VALVES

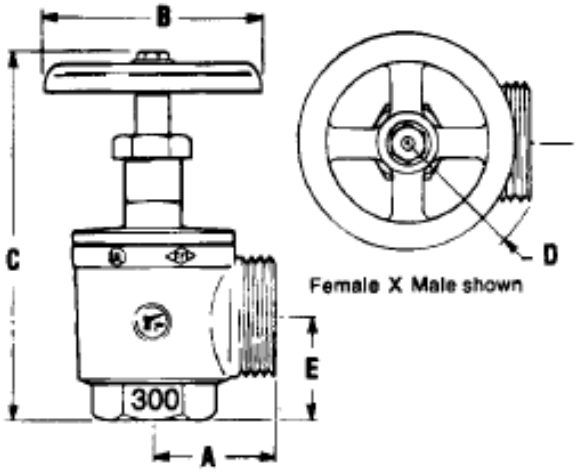
Model/Series No.
4060-4075 SERIES

MODEL DIMENSIONS

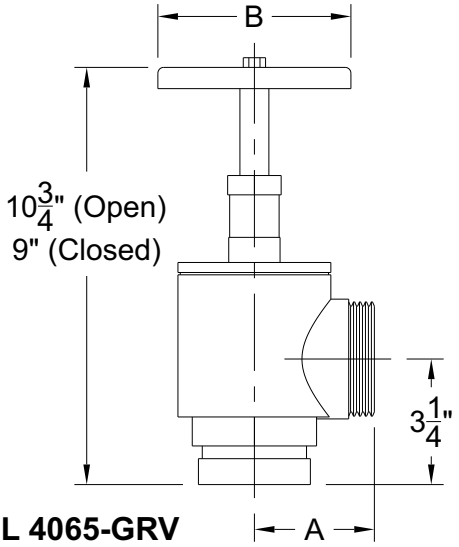
Size	Closed			Open		
	A	B	C	C	D	E
1-1/2	2-1/4	3-1/2	6-1/2	7-1/2	2-1/2	2
2-1/2	3-1/2	5	9-1/2	11-1/2	3-1/2	2-3/4

ALL DIMENSIONS IN INCHES



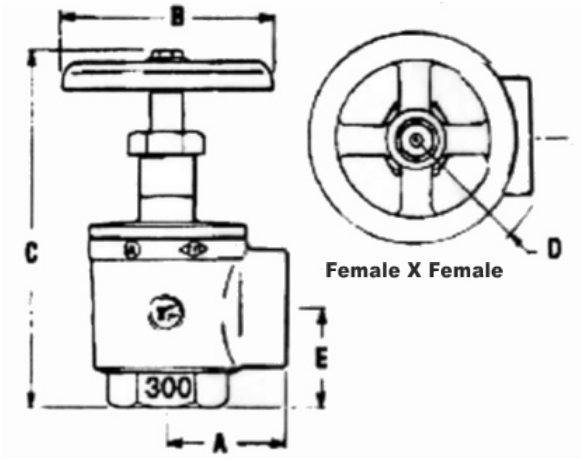


MODEL 4060-4065



MODEL 4065-GRV





MODEL 4070-4075

Call Potter Roemer - Fire Pro for current listings and approvals. Dimensions are subject to manufacturer's tolerance and may change without notice. Potter Roemer-Fire Pro assumes no responsibility for use of void or superceded data. © Copyright Potter Roemer- Fire Pro, Member of Morris Group International ™ Please visit ***potterroemer.com*** *for most current specifications.*

MEMBERSHIP

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Los Angeles Area
800-366-3473
626-855-4890

Also in:
New York (800) 526-4592
Chicago (800) 547-3473
Atlanta (800) 762-0542
Miami (866) 961-3473
Dallas (866) 644-3473

www.potterroemer.com

POTTER ROEMER FIRE PRO™
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VALVES ACCESSORIES

Model/Series No.
4605-4733 SERIES

SPECIFICATIONS

CAPS

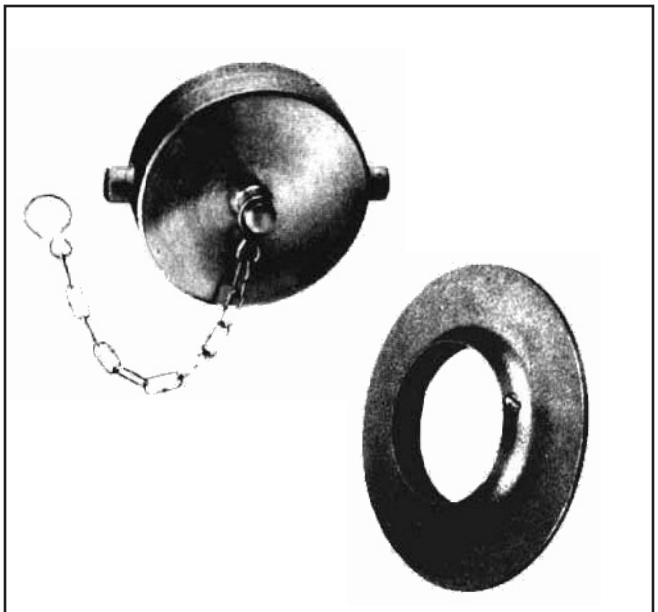
Used to cover and protect male threads on valves and hydrants. Discourages entry of foreign materials.

Cast brass cap with female hose thread. Pin lug and chain.

FLANGES

Used to trim pipe entry.

Cast brass flange with set screw.



MODEL 4630 & 4713 (Shown)

MODEL SELECTION

CAPS

- ❑ **4605** 3/4”
- ❑ **4610** 1”
- ❑ **4615** 1-1/2”
- ❑ **4625** 2-1/2”
- ❑ **4630** 3”
- ❑ **4640** 4”

FLANGES

- ❑ **4711** 1-1/2”
- ❑ **4712** 2-1/2”
- ❑ **4713** 3”
- ❑ **4733** 3” Chrome plated stamped steel split ring flange

PRODUCT OPTIONS

FINISHES: (Caps)

- ❑ -B Polished Brass
- ❑ -C Rough Chrome Plated
- ☑ -D Polished Chrome Plated

VARIATIONS: (Caps)

- ❑ -RL Rocker Lugs (Model 4625 & 4630 Only)
  - ❑ -P Plastic

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Chicago (800) 547-3473
Atlanta (800) 762-0542
Miami (866) 961-3473
Dallas (866) 644-3473

www.potterroemer.com

Floor & Ceiling Plates (Plastic)

These 1-piece flexible plastic plates come with a split for ease of installation.

Available in White or Chrome.



Part No.	Description	Box Qty.
ESPLFCPC0050	1/2" C.P.	12
ESPLFCPC0075	3/4" C.P.	12
ESPLFCPC0100	1" C.P.	12
ESPLFCPC0125	1-1/4" C.P.	12
ESPLFCPC0150	1-1/2" C.P.	12
ESPLFCPC0200	2" C.P.	12
ESPLFCPC0250	2-1/2" C.P.	12
ESPLFCPC0300	3" C.P.	12
ESPLFCPC0400	4" C.P.	12
ESPLFCPC0500	5" C.P.	6
ESPLFCPC0600	6" C.P.	6
ESPLFCPC0800	8" C.P.	6
ESPLFCPW0050	1/2" WHITE	12
ESPLFCPW0075	3/4" WHITE	12
ESPLFCPW0100	1" WHITE	12
ESPLFCPW0125	1-1/4" WHITE	12
ESPLFCPW0150	1-1/2" WHITE	12
ESPLFCPW0200	2" WHITE	12
ESPLFCPW0250	2-1/2" WHITE	12
ESPLFCPW0300	3" WHITE	12
ESPLFCPW0400	4" WHITE	12
ESPLFCPW0500	5" WHITE	6
ESPLFCPW0600	6" WHITE	6
ESPLFCPW0800	8" WHITE	6


Auxiliary Drain
AHERN SINCE 1880


Control Valve
AHERN SINCE 1880


Main Control
AHERN SINCE 1880


Main Drain
AHERN SINCE 1880


Inspectors Test
AHERN SINCE 1880

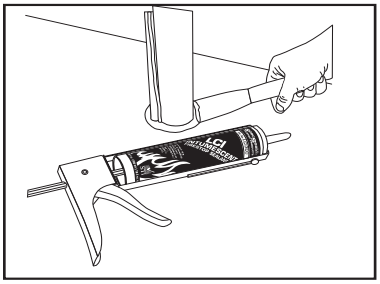
SERIES LCI INTUMESCENT SEALANT

906

APPLICATIONS

SpecSeal® LCI Sealant has a broad application base designed to seal a wide variety of common penetrations and construction joints. Penetrant types include insulated and non-insulated metallic pipes and tubes, non-metallic pipes and tubes, and common electrical service and power distribution, telephone, data, and TV cabling. This product is also used in conjunction with other SpecSeal® Products such as SpecSeal® Firestop Collars and Wrap Strips to protect larger plastic pipes. See Table A for a summary application list.





PHYSICAL PROPERTIES

Properties	Series LCI
Color	Red
Odor	Mild Latex
Density	9.0 lb/gal (1.08 kg/L)
pH	9.0
Solids Content By Weight	80%
Solids Content By Volume	66.9%
In Service Temperature	≤ 185°F (85°C)
Flame Spread	0*
Smoke Developed	0*
STC Rating (ASTM E90/ASTM C919)	62
VOC Content (EPA Method 24/ASTM D3960)	32.7 g/L
Shelf Life	2 yrs
Volume Expansion	10X Free Expansion
Storage Temp.	40°F (4°C) - 95°F (35°C)

* Tested to ASTM E84 (UL723) at 14% surface coverage (modified test for sealants and caulks)

PRODUCT DESCRIPTION

211313 - Wet-Pipe Sprinkler System

SpecSeal® LCI Sealant is a versatile and economical intumescent sealant that has excellent caulking properties as well as high build properties on vertical or overhead surfaces. This single grade may be caulked (standard cartridge or bulk loaded), knifed or troweled. In addition, SpecSeal® LCI Sealant does not contain PCB's or asbestos.

SpecSeal® LCI Sealant is storage stable (when stored according to the manufacturer's recommendations), and will not separate or shrink when dried. SpecSeal® Series LCI Sealant will adhere to all common construction and penetrant materials and contains no solvents that might adversely effect plastic pipes or cable jackets.

FEATURES

- **Economical**: High performance without the high price!
- **Highly Intumescent**: Expands up to 8 times.
- **Excellent Smoke Seal**
- **Water Resistant** : Will not re-emulsify when dry.
- **Water-Based** for easy installation, cleanup, and disposal.
- **Acoustically Tested**: Reduces noise transmission
- **Safe...**Low VOC's, No Solvents, Non-Halogenated
- **Paintable**

PERFORMANCE

SpecSeal® LCI Sealant is the basis for systems that meet the exacting criteria of ASTM E814 (UL1479) and ASTM E1966 (UL2079) as well as to the time-temperature requirements of ASTM E119 (UL263). LCI provides up to a 4-hour fire rating for typical service penetrations through concrete or wood floors, concrete or masonry walls, as well as gypsum board walls. SpecSeal® LCI Sealant meets Class A finish requirements for Flame Spread and Smoke Development when tested in accordance with ASTM E84 (UL723). Meets or exceeds the requirements of ASTM C834, Type C, Grade 0. SpecSeal® LCI Sealant is also acoustically tested, demonstrating excellent sound attenuation properties.

FBC SYSTEM COMPATIBLE

FBC™ System Compatible indicates that this product has been tested, and is monitored on an ongoing basis, to assure its chemical compatibility with FlowGuard Gold®, BlazeMaster® and Corzan® pipe and fittings. FBC, FlowGuard Gold, BlazeMaster and Corzan are licensed trademarks of The Lubrizol Corporation.

CLASSIFIED C UL US

FILL, VOID OR CAVITY MATERIALS FOR USE IN JOINT SYSTEMS AND THROUGH-PENETRATION FIRESTOP SYSTEMS. SEE UL FIRE RESISTANCE DIRECTORY. 3L73

FM APPROVED

SPEARS

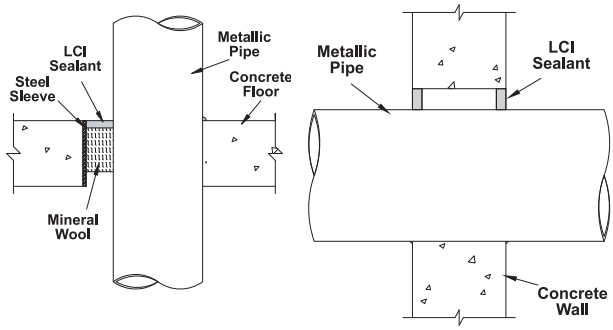
SPECIFICATIONS

The firestopping sealant shall be a water-resistant, intumescent latex sealant. The sealant when exposed to high heat or flame shall exhibit a free expansion of up to 10 times its original volume. The firestopping sealant shall contain no water soluble nor hygroscopic ingredients and shall be acoustically tested. The sealant shall be UL Classified and/or FM approved and tested to the requirements of ASTM E814 (UL1479), CAN/ULC S115 and shall meet Class A finish requirements when tested in accordance with ASTM E84 (UL723).

SPECIFIED DIVISIONS

DIV.	7	07840	Through-Penetration Firestopping
DIV.	13	13900	Special Construction Fire Suppression & Supervisory Systems
DIV.	15	15250	Mechanical Insulation – Fire Protection
DIV.	16	16050	Basic Electrical Materials & Methods

Fig 1: METALLIC PIPES - Concrete/Masonry Floors & Walls



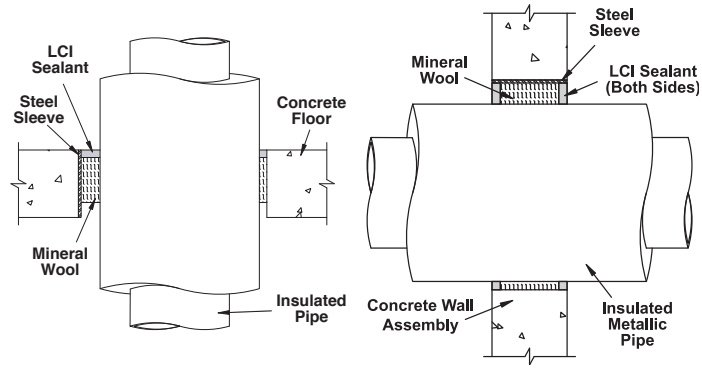
UL System No. C-AJ-1353

F Rating: 3 Hr • T Rating: 0 Hr
Steel or Iron Pipe: <12", Copper Pipe: <4"
Annulus: 0" to 2"
Sealant Depth: 1/4"
Forming Material: Nom 4 pcf mineral wool (2 1/4" Depth)

UL System No. W-J-1098

F Rating: 2 Hr • T Rating: 1/4, 3/4 & 1 Hr
Steel or Iron Pipe: <8", Copper Pipe: <4"
Annulus: 0" to 2"
Sealant Depth: 5/8"

Fig 2: INSULATED METALLIC PIPES - Concrete/Masonry Floors & Walls



UL System No. C-AJ-5138

F Rating: 2 Hr • T Rating: 3/4 or 1 Hr
Steel or Iron Pipe: 6", Copper Pipe: 4"
Pipe Covering: Max. 2" fiber glass or mineral wool pipe insulation.
Annulus: 1/4" to 1-5/8" • Sealant: 1/2"
Forming: Nom. 4 pcf mineral wool (3" depth)

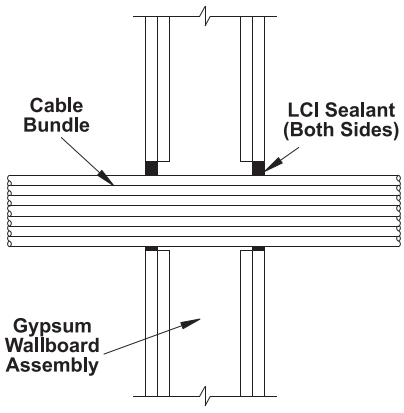
SEALANT REQUIREMENTS IN CUBIC INCHES PER 1/4 INCH OF INSTALLED DEPTH*

		Diameter of Opening - in. (mm)											
PIPE SIZE		1.5 (38)	2.0 (51)	3.0 (76)	4.0 (102)	5.0 (127)	6.0 (152)	7.0 (178)	8.0 (203)	10 (254)	12 (305)	14 (356)	26 (660)
Trade Size in. (mm)	Pipe O.D. in. (mm)												
0.5 (13)	0.840 (21)	0.3 (4.9)	0.6 (9.8)	1.6 (26.2)	3.0 (49.2)	4.8 (78.7)	6.9 (113.0)	9.5 (155.7)	12.4 (203.2)	19.5 (319.5)	28.1 (460.5)	38.3 (627.6)	132.6 (2173)
1.0 (25)	1.315 (33)	0.1 (1.6)	0.4 (6.6)	1.4 (22.9)	2.8 (45.9)	4.6 (75.4)	6.7 (109.8)	9.3 (152.4)	12.2 (200.0)	19.3 (316.3)	27.9 (457.2)	38.1 (624.3)	132.4 (2170)
1.5 (38)	1.900 (48)			1.1 (18.0)	2.4 (39.3)	4.2 (68.8)	6.4 (104.9)	8.9 (145.8)	11.9 (195.0)	18.9 (309.0)	27.6 (452.3)	37.8 (619.4)	132.0 (2163)
2.0 (51)	2.375 (60)			0.7 (11.5)	2.0 (32.8)	3.8 (62.3)	6.0 (98.3)	8.5 (139.2)	11.5 (188.4)	18.5 (309.7)	27.2 (445.7)	37.4 (568.6)	131.6 (2157)
2.5 (64)	2.875 (73)			0.1 (1.6)	1.5 (24.6)	3.3 (54.1)	5.4 (88.4)	8.0 (131.1)	10.9 (178.6)	18.0 (295.0)	26.7 (437.5)	36.9 (604.7)	131.1 (2148)
3.0 (76)	3.500 (79)				0.7 (11.5)	2.5 (41.0)	4.7 (77.0)	7.2 (118.0)	10.2 (167.1)	17.2 (281.9)	25.9 (424.4)	36.1 (591.6)	130.3 (2135)
3.5 (89)	4.000 (102)					1.8 (29.5)	3.9 (63.9)	6.5 (106.5)	9.4 (154.0)	16.5 (270.4)	25.1 (411.3)	35.3 (578.5)	129.6 (2124)
4.0 (102)	4.500 (114)					0.8 (13.1)	3.0 (49.2)	5.6 (91.8)	8.5 (139.3)	15.6 (255.6)	24.2 (396.6)	34.4 (563.7)	128.7 (2109)
6.0 (152)	6.625 (168)							1.1 (18.0)	4.0 (65.5)	11.1 (181.9)	19.7 (322.8)	29.9 (490.0)	124.2 (2035)
8.0 (203)	8.625 (219)									4.9 (80.3)	13.6 (222.9)	23.8 (390.0)	118.0 (1934)
10.0 (254)	10.750 (273)										5.6 (91.8)	15.8 (259.0)	110.0 (1803)
12.0 (305)	12.750 (324)											6.6 (108.1)	100.8 (1652)
24.0 (610)	24.000 (610)												19.6 (321.2)

*Different Sealant Depth?

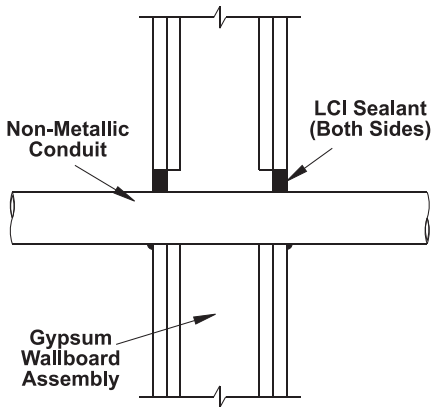
1/2" (12.7)	Multiply by 2
5/8" (15.9)	Multiply by 2.5
1" (25.4)	Multiply by 4
1-1/4" (31.8)	Multiply by 5

Fig. 3: ELECTRICAL, DATA OR COMMUNICATIONS - Gypsum Walls



UL System No. W-L-3169

F Rating: 1, 2 Hr • T Rating: 1/4 and 3/4
Up to 4-1/2˝ cable bundle
Annulus: 0˝ to 1/2˝ • Sealant: 5/8˝



UL System No. W-L-2241

F Rating: 1, 2 Hr • T Rating: 0, 1/4, 1, 1-3/4
<2˝ Rigid PVC or ENMT, CPVC, ABS
Annulus: 0-1˝ • Sealant 5/8˝

TABLE A: APPLICATIONS

TESTED AND CLASSIFIED FOR FIRE RESISTANCE

- **Metallic Pipes** including steel, iron, or copper pipe and tubing.
- **Nonmetallic Pipes, Conduits & Tubing** including PVC, CPVC, ABS, and PEX.
- **Electrical & Electronic Cabling** including service entrance, power distribution, computer, telephone, and television.
- **Metal Ductwork** including HVAC, bath and dryer vents.
- **Insulated Pipes** including heating, cooling, and condensation applications.
- **Complete Wood Floor firestopping package** for electrical, plumbing, HVAC, telephone, and television.

INSTALLATION INSTRUCTIONS

906

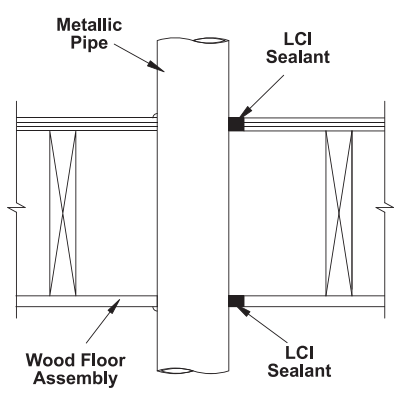
GENERAL: Areas to be protected must be clean and free of oil, loose dirt, rust or scale. Installation temperatures must be between 35°F (2°C) and 100°F (38°C). Allow product to dry a minimum of 24 hours before exposure to moisture.

SYSTEM SELECTION: Selection of an appropriate firestop system design is critical to the fire protection process. Space limitations preclude highly detailed information pertaining to individual application systems. Please consult the Product & Application Guide as well as the UL® Fire Resistance Directory for additional information.

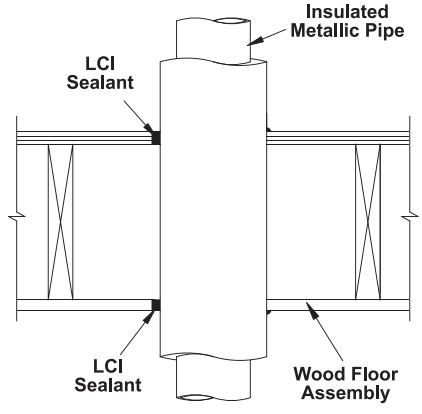
FORMING: Some installations may require forming as either an integral part of the system or as an option to facilitate installation. In systems where forming is required, mineral wool batts with a minimum nominal density of 4 PCF (64 kg/m^3) are generally required. Cut forming material oversize to allow for tight packing. Position forming material to allow for the proper depth of fill material.

FILL MATERIAL: SpecSeal® LCI Sealant may be installed by caulking using a standard caulking gun or from bulk containers using a bulk loading caulk gun, or by manually troweling using a mason's trowel or putty knife. If the sealant tends to pull back from a surface, clean the surface with a damp rag or sponge and reapply. Work sealant into all areas exercising care to eliminate voids or seams. The surface of the sealant can be smoothed using a putty knife dipped in water. Adding water to the sealant itself is not recommended. Sealant (when dry) may be painted using most non-solvent based paints.

Fig. 4: BARE & INSULATED METALLIC PIPES - Wood Floor Assemblies



UL System No. F-C-1074
F Rating: 1 & 2 Hr • T Rating: 1/4, 1/2 and 1 Hr
Steel, Iron or Copper: 4″ • Chase wall optional.
Annulus: 0″ to 1″ • Sealant: 5/8″ bottom, 3/4″ top



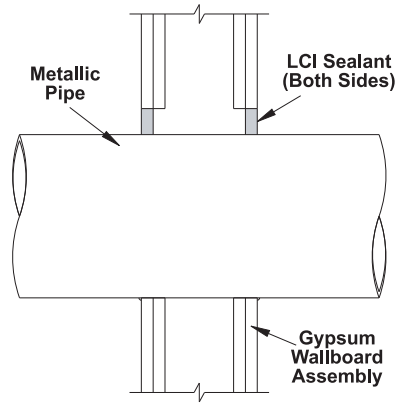
UL System No. F-C-5043
F Rating: 1 & 2 Hr • T Rating: 3/4 and 1 Hr
Steel, Iron or Copper: 4″
Pipe covering: 1″ Fiber Glass, Mineral fiber or AB/PVC • Chase wall optional.
Annulus: 0″ to 1″ • Sealant: 5/8″ bottom, 3/4″ top.

In gypsum wallboard penetrations, apply a minimum cove bead of 1/4" (6 mm) at the interface of the penetrant with both exterior wall surfaces.

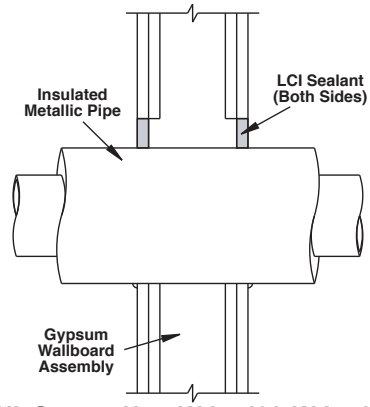
SMOKE SEALING: In some applications including firestop collars, SpecSeal® LCI Sealant is recommended as a smoke seal. It is suggested in these applications that the sealant be applied to both sides of walls. In floor applications, a sealing bead is suggested top and bottom.

LIMITATIONS: SpecSeal® LCI Sealant is water-based and cures through the evaporation of water. Low temperatures as well as high humidity may retard drying. Non-porous or impermeable backing materials, plates, or coatings may retard the drying process. Do not paint or seal in any way that prevents contact with air until sealant has dried through completely. This product has been designed to be safe with plastics and has been used extensively and successfully with a variety of different types of plastic pipes, tubes, and plastic cable insulations. Variations in these materials however, make it impossible to guarantee compatibility. STI strongly recommends that the user consult with the manufacturer of the pipe, tubing, or cable in question regarding any known sensitivities or potential restrictions before applying this product.

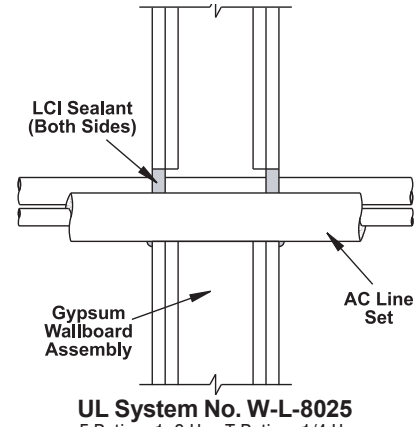
Fig. 5: BARE & INSULATED METALLIC PIPES - Gypsum Walls



UL System No. W-L-1222
F Rating: 1, 2 Hr • T Rating: 1/4, 3/4, 1 Hr
Steel or Iron pipe: 8″, Copper pipe: 4″
Annulus: 0″ to 2″ • Sealant: 5/8″



UL System Nos. W-L-5121, W-L-5122
F Rating: 1, 2 Hr • T Rating: 1 Hr & 1/4 Hr
Steel or Iron pipe: 6″, Copper pipe: 4″
Pipe covering: Max. 2″ fiber glass, 3/4″ AB/PVC or 2″ mineral fiber
Annulus: 0″ to 1-1/2″ • Sealant: 5/8″



UL System No. W-L-8025
F Rating: 1, 2 Hr • T Rating: 1/4 Hr
AC Line Set: Two copper tubes, one with 3/4″ AB/PVC and thermostat wire
Annulus: 0″ to 1″ • Sealant 5/8″

MAINTENANCE

No maintenance is normally required, however a periodic inspection of rated barriers is recommended to make sure that any new openings, modifications of previously installed firestops, or areas exhibiting physical damage, have been properly sealed or repaired. Subsequent sealing or repairs should be accomplished using SpecSeal® products per the original approved design.

RETROFIT: When adding or removing penetrants, care should be taken to minimize damage to the seal. Reseal using SpecSeal® products per the approved design. NOTE: New penetrants of a different nature than the original design may require a totally new firestop design or extensive modifications to the existing design. Reseal all openings as per the requirements of the modified design.

TECHNICAL SERVICE

Specified Technologies Inc. provides toll free technical support to assist in product selection and appropriate installation design. UL Systems, Material Safety Data Sheets and other technical information is available through the Technical Library at www.stifirestop.com.

PRECAUTIONARY INFORMATION

Consult Material Safety Data Sheet for additional information on the safe handling and disposal of this material.

AVAILABILITY

SpecSeal® Series LCI Sealant is available from authorized STI distributors. Consult factory or website for the names and locations of the nearest sales representatives or distributors.

ORDERING INFORMATION

CAT. NO.	DESCRIPTION	
LCI300	Sealant 10.1 oz Tube	18.2 Cu In (300 ml)
LCI305	Sealant 5 Gal Pail	1,155 Cu In (19.0 L)
LCI320	Sealant 20 oz Sausage	36 Cu in. (592 ml)
LCI329	Sealant 29 oz Quart Tube	52 Cu in. (858 ml)



Additional SpecSeal Products...

Series SSS Sealant
The industry's most versatile sealant provides the firestopping solutions for a wide range of combustible and noncombustible applications. Water-based intumescent sealant expands up to 8X!

Intumescent Wrap Strips
Three grades of intumescent wrap strips provide an unmatched combination of flexibility, economy, and expansion (up to 30X). Systems for plastic pipes including FR Polypropylene up to 8" trade size!

SSC & LCC Firestop Collars
Easy to install, economical protection for ABS and PVC pipes (both solid and foam core) as well as CPVC, PVDF, and FRPP. LCC Collars are available up to 4" and SSC Collars are available up to 6" trade size.

Firestop Mortar
Lightweight, versatile and economical! The best choice for large or complex installations.

SSP Firestop Putty
Available both in bar form and in pads, putty provides easy retrofit for through-penetrations and economical protection for electrical boxes.

SIL Silicones
Sealants and foam for through-penetrations and construction joints. Unexcelled aging characteristics and flexibility.

Elastomeric Joint Seals
Economical products for sealing construction joints. Choose caulk or spray applied products tested to UL2079.

IMPORTANT NOTICE: All statements, technical information, and recommendations contained herein are based upon testing believed to be reliable, but the accuracy and completeness thereof is not guaranteed.

LIMITED WARRANTY: STI warrants that its products will be free of defects for one year from the date of purchase. In the event a product does not conform to this warranty, the sole and exclusive remedy is, at STI's option, replacement of the product or refund of the purchase price. The warranty provided herein shall be void and of no effect in the event that the product is not installed in accordance with STI's published instructions, listed systems and applicable building and safety codes. THIS WARRANTY IS IN LIEU OF ALL OTHER REPRESENTATIONS AND EXPRESSED OR IMPLIED WARRANTIES (including the implied warranties of merchantability or fitness for a particular use) AND UNDER NO CIRCUMSTANCES SHALL STI BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING, WITHOUT LIMITATION, ANY LOSS OF REVENUE, PROFIT OR USE. Prior to use, the user shall determine the suitability of the product for its intended use, and the user assumes all risks and liability for subsequent use. No person other than an officer of STI is authorized to bind STI to any other warranty for any product for which this warranty is issued.

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Specified Technologies Inc.

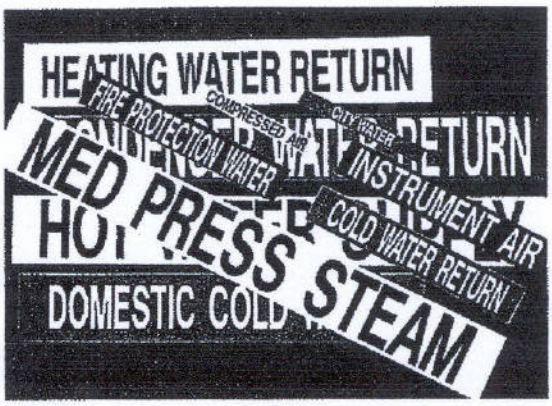
Specified Technologies Inc. • 210 Evans Way, Somerville, NJ 08876 USA • Phone: 800.992.1180 • Fax: 908.526.9623

MS-900 Self-Adhesive Pipe Markers

For indoor or outdoor line service identification and system color coding.

- Complies with the ASME A13.1 "Scheme for the Identification of Piping Systems" regarding color, label size and letter size
- Printed on premium-quality, fade-resistant, outdoor-grade vinyl with durable, indoor/outdoor adhesive
- Adheres well to pipe and insulation with only limited surface preparation
- Legend markers can be used with arrow tape or separate arrow markers to indicate flow direction
- Fast turnaround with off-the-shelf delivery on stock legends

See page 11 for MS-900 Arrow Tape and Color Banding Tape.



STYLE	PIPE DIAMETER with insulation	MARKER SIZE	LETTER SIZE
A	3/4" thru 2-1/4"	1" x 8"	3/4"
B	2-1/2" thru 7-7/8"	2-1/4" x 13"	1-3/4"
C	8" thru 10"	4" x 24"	2-1/2"
D	over 10"	4" x 32"	3-1/2"

LEGEND	BACKGROUND COLOR	STYLE A	B	C	D
2 PSI GAS	YELLOW	91100	92100		
2 PSI NATURAL GAS	YELLOW	91545	92545		
ACETYLENE GAS	YELLOW	91101	92101		
ACID	YELLOW	91102	92102		
ACID VENT	YELLOW	91400	92400		
ACID WASTE	YELLOW	91322	92322		
AIR	YELLOW	91103	92103		
AIR	BLUE	91211	92211		
AMMONIA	YELLOW	91105	92105		
ARGON	GREEN	91106	92106		
ARROWS →	YELLOW	91208	92208	93208	94208
ARROWS →	GREEN	91209	92209	93209	94209
ARROWS →	RED	91210	92210	93210	94210
ARROWS →	BLUE	91212	92212	93212	94212
ASBESTOS FREE INSULATION	BLUE	91107	92107		
BOILER BLOWDOWN	YELLOW	91108	92108		
BOILER FEED	YELLOW	91109	92109		
BOILER FEEDWATER	YELLOW	91110	92110	93110	94110
BREATHING AIR	BLUE	91401	92401		
CARBON DIOXIDE	YELLOW	91111	92111		
CARBON DIOXIDE	GREY	91112	92112		
CAUSTIC	YELLOW	91113	92113		
CHEMICAL FEED	YELLOW	91213	92213		
CHILLED WATER	GREEN	91114	92114	93114	94114
CHILLED WATER RETURN	GREEN	91115	92115	93115	94115
CHILLED WATER SUPPLY	GREEN	91116	92216	93116	94116
CHLORINE	YELLOW	91117	92117		
CHLORINE SOLUTION	YELLOW	91402	92402		
CIRCULATING WATER	GREEN	91118	92118		
CITY WATER	GREEN	91119	92119	93119	
CLEAN DRY AIR	BLUE	91403	92403		
COLD WATER	GREEN	91120	92120		
COLD WATER RETURN	GREEN	91121	92121		
COLD WATER SUPPLY	GREEN	91122	92122		
COMPRESSED AIR	YELLOW	91123	92123		
COMPRESSED AIR	BLUE	91284	92284		
CONDENSATE	YELLOW	91124	92124	93124	94124
CONDENSATE DRAIN	YELLOW	91285	92285		
CONDENSATE RETURN	YELLOW	91125	92125	93125	94125
CONDENSER WATER	GREEN	91128	92128	93128	94128
CONDENSER WATER RETURN	GREEN	91129	92129	93129	94129
CONDENSER WATER SUPPLY	GREEN	91130	92130	93130	94130

LEGEND	BACKGROUND COLOR	STYLE A	B	C	D
COOLING WATER	GREEN	91131	92131	93131	
COOLING WATER RETURN	GREEN	91286	92286		
COOLING WATER SUPPLY	GREEN	91287	92287		
DEIONIZED WATER	GREEN	91132	92132		
DEMINERALIZED WATER	GREEN	91214	92214		
DIESEL	YELLOW	91304	92304		
DISCHARGE	YELLOW	91134	92134		
DOMESTIC COLD WATER	GREEN	91136	92136	93136	
DOMESTIC HOT WATER	YELLOW	91135	92135	93135	
DOMESTIC HOT WATER RECIRC	YELLOW	91314	92314		
DOMESTIC HOT WATER RET	YELLOW	91288	92288		
DOMESTIC HOT WATER SUPPLY	YELLOW	91423	92423		
DOMESTIC WATER	GREEN	91325	92325		
DRAIN	GREEN	91137	92137	93137	
DRAIN	YELLOW	91215	92215	93215	
DUAL TEMP RETURN	YELLOW	91289	92289		
DUAL TEMP SUPPLY	YELLOW	91290	92290		
EVACUATION VACUUM	YELLOW	91404	92404		
EXHAUST	YELLOW	91139	92139		
EXHAUST AIR	YELLOW	91326	92326	93326	
FEEDWATER	YELLOW	91140	92140		
FILTERED WATER	GREEN	91253	92253	93253	94253
FIRE PROTECTION WATER	RED	91142	92142	93142	
FIRE SPRINKLER WATER	RED	91143	92143		
FREON	GREEN	91144	92144		
FUEL GAS	YELLOW	91145	92145		
FUEL OIL	YELLOW	91146	92146		
FUEL OIL RETURN	YELLOW	91332	92332		
FUEL OIL SUPPLY	YELLOW	91333	92333		
GAS	YELLOW	91147	92147		
GASOLINE	YELLOW	91148	92148		
GLYCOL	YELLOW	91149	92149	93149	
GLYCOL RETURN	YELLOW	91315	92315		
GLYCOL SUPPLY	YELLOW	91316	92316		
HALON	RED	91150	92150		
HEATING	YELLOW	91151	92151		
HEATING HOT WATER RET	YELLOW	91291	92291	93291	
HEATING HOT WATER SUP	YELLOW	91292	92292	93292	
HEATING RETURN	YELLOW	91152	92152	93152	
HEATING SUPPLY	YELLOW	91153	92153	93153	
HEATING WATER RETURN	YELLOW	91293	92293	93293	
HEATING WATER SUPPLY	YELLOW	91294	92294	93294	
HI PRESS AIR	YELLOW	91154	92154		
HI PRESS AIR	BLUE	91218	92218		

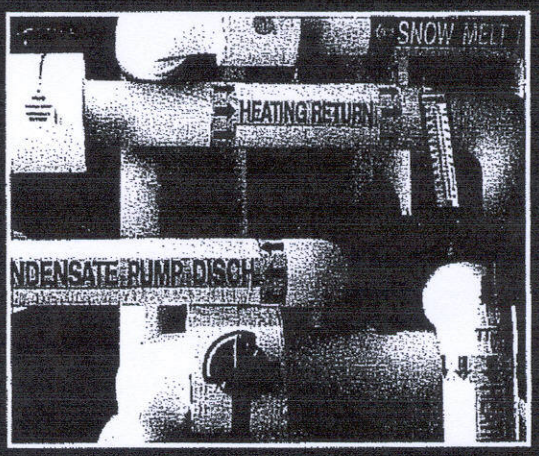
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TO ORDER STOCK MARKERS:
Specify part number and quantity of markers required. Combine total quantity of stock markers of all styles for best price. All markers are individual pieces.

STOCK PRICING PER MARKER				
Style	1-249	250-499	500-999	1,000+
A	$ 57	.45	.40	CALL FOR A QUOTE
B	1 30	1 22	1.06	
C	2.65	2.50	2 17	
D	3 96	3 89	3 69	

TO ORDER FLOW DIRECTION ARROWS:
Specify part number (on page 8) and quantity required. Combine total quantity of stock arrows of all styles for best price. All arrows are individual pieces and are half the length of the corresponding pipe markers.

ARROW PRICING PER MARKER				
Style	1-249	250-499	500-999	1,000+
A	$ 35	30	.28	CALL FOR A QUOTE
B	71	69	.64	
C	1.59	1 50	1 31	
D	1.98	1.97	1.85	



Arrow tape shown on page 11.

LEGEND	BACKGROUND COLOR	STYLE A	B	C	D
HI PRESS CONDENSATE	YELLOW	91126	92126	93126	94126
HI PRESS GAS	YELLOW	91155	92155		
HI PRESS STEAM	YELLOW	91156	92156	93156	94156
HOT GAS	YELLOW	91327	92327		
HOT WATER	YELLOW	91157	92157	93157	
HOT WATER RETURN	YELLOW	91158	92158	93158	
HOT WATER SUPPLY	YELLOW	91159	92159	93159	
120° HOT WATER	YELLOW	91425	92425		
140° HOT WATER	YELLOW	91426	92426		
160° HOT WATER	YELLOW	91427	92427		
HOUSE VACUUM	YELLOW	91405	92405	93405	
HYDRAULIC FLUID	YELLOW	91257	92257		
HYDROCHLORIC ACID	YELLOW	91160	92160		
HYDROGEN	YELLOW	91161	92161		
HYDROGEN PEROXIDE	YELLOW	91305	92305		
HYDROGEN SULFIDE	YELLOW	91306	92306		
INDUSTRIAL COLD WATER	GREEN	91295	92295		
INDUSTRIAL HOT WATER	YELLOW	91296	92296		
INDUSTRIAL WASTE	YELLOW	91328	92328		
INSTRUMENT AIR	GREEN	91162	92162	93162	
INSTRUMENT AIR	BLUE	91219	92219		
INSTRUMENT NITROGEN	BLUE	91406	92406		
LO PRESS AIR	GREEN	91163	92163		
LO PRESS CONDENSATE	YELLOW	91127	92127	93127	94127
LO PRESS GAS	YELLOW	91164	92164		
LO PRESS STEAM	YELLOW	91165	92165	93165	94165
LUBE OIL	YELLOW	91166	92166		
LUBE OIL RETURN	YELLOW	91407	92407		
LUBE OIL SUPPLY	YELLOW	91408	92408		
MAKE UP WATER	GREEN	91167	92167		
MED PRESS CONDENSATE	YELLOW	91409	92409	93409	94409
MED PRESS STEAM	YELLOW	91189	92189	93189	94189
MEDICAL AIR	YELLOW	91410	92410		
MEDICAL VACUUM	WHITE	91411	92411		
MILL AIR	BLUE	91260	92260	93260	
MILL WATER	GREEN	91261	92261	93261	94261
NATURAL GAS	YELLOW	91168	92168	93168	
NITROGEN	BLACK	91169	92169		
NITROGEN	BLUE	91317	92317		
NITROUS OXIDE	BLUE	91412	92412		
NON POTABLE WATER	YELLOW	91170	92170		
OIL	YELLOW	91171	92171		
OIL FREE AIR	BLUE	91413	92413		
OUTSIDE AIR	BLUE	91329	92329	93329	
OXYGEN	YELLOW	91172	92172		
OXYGEN	GREEN	91330	92330		
PLANT AIR	GREEN	91173	92173		
PLANT WATER	GREEN	91174	92174		
POTABLE WATER	GREEN	91175	92175		
POTABLE COLD WATER	GREEN	91414	92414		
POTABLE HOT WATER	YELLOW	91415	92415		
PROCESS WATER	YELLOW	91176	92176		
PROCESS WATER	GREEN	91220	92220		
PROCESS COOLING WATER RET	GREEN	91416	92416	93416	94416

LEGEND	BACKGROUND COLOR	STYLE A	B	C	D
PROCESS COOLING WATER SUP	GREEN	91417	92417	93417	94417
PROCESS VACUUM	YELLOW	91418	92418		
PROPANE GAS	YELLOW	91177	92177		
PUMPED CONDENSATE	YELLOW	91297	92297		
RAINWATER	GREEN	91419	92419		
RAW WATER	GREEN	91178	92178	93178	94178
RECIRCULATING HOT WATER	YELLOW	91424	92424		
REFRIGERANT	YELLOW	91179	92179		
REFRIGERANT LIQUID	YELLOW	91180	92180		
REFRIGERANT SUCTION	YELLOW	91181	92181		
RELIEF AIR	BLUE	91281	92281	93281	
RETURN AIR	BLUE	91282	92282	93282	
RETURN	YELLOW	91182	92182	93182	
RETURN	GREEN	91183	92183	93183	
ROOF DRAIN	GREEN	91184	92184	93184	
SANITARY DRAIN	GREEN	91236	92236	93236	
SANITARY SEWER	GREEN	91185	92185	93185	
SANITARY VENT	GREEN	91318	92318		
SANITARY WASTE	GREEN	91298	92298		
SEAL WATER	GREEN	91267	92267		
SERVICE AIR	YELLOW	91221	92221		
SLUDGE	YELLOW	91186	92186		
SODIUM HYDROXIDE	YELLOW	91310	92310		
SOFT WATER	GREEN	91187	92187		
STEAM	YELLOW	91188	92188	93188	94188
STORM DRAIN	GREEN	91299	92299	93299	
STORM SEWER	GREEN	91300	92300	93300	
STORM WATER	GREEN	91301	92301	93301	
SUCTION	YELLOW	91190	92190		
SULFURIC ACID	YELLOW	91191	92191		
SUMP PUMP DISCHARGE	YELLOW	91331	92331		
SUPPLY	YELLOW	91192	92192	93192	
SUPPLY	GREEN	91193	92193	93193	
SUPPLY AIR	BLUE	91283	92283	93283	
TEMPERED WATER	YELLOW	91302	92302		
TOLUENE	YELLOW	91194	92194		
TOWER WATER	GREEN	91195	92195	93195	
TOWER WATER RETURN	GREEN	91319	92319	93319	
TOWER WATER SUPPLY	GREEN	91320	92320	93320	
TREATED WATER	GREEN	91196	92196		
ULTRA PURE WATER	GREEN	91420	92420		
UTILITY NITROGEN	GREEN	91421	92421		
UTILITY WATER	GREEN	91422	92422		
VACUUM	GREEN	91197	92197	93197	
VACUUM	YELLOW	91198	92198		
VENT	GREEN	91199	92199	93199	
VENT	YELLOW	91200	92200	93200	
WAGD	PURPLE	91432	92432		
WASTE	YELLOW	91202	92202		
WASTE WATER	YELLOW	91201	92201		
WATER	GREEN	91203	92203	93203	
WATER	YELLOW	91204	92204	93204	
WELL WATER	GREEN	91321	92321		

POTTER ROEMER FIRE PRO™
Member of Morris Group International™

CONNECTIONS (FDC)
FREE STANDING FIRE DEPT. INLET CONNECTIONS

Model/Series No.
5761-5792 SERIES

SPECIFICATIONS

Cast brass angle body, or red glossy polysester coated ductile iron angle body, size of outlet and number and type of inlets as selected by model number. 18" long polished brass cover sleeve; cast brass identification base plate; cast brass plugs and chains on each pin lug swivel.



MODEL 5785 (Shown)

MODEL SELECTION

TWO-WAY WITH CLAPPER BODY
- ☐ ***5761**
- ☐ ***5762**
- ☐ ***5763**
- ☐ ***5764**

THREE-WAY WITH CLAPPER BODY
- ☐ **5771**
- ☐ **5773**

FOUR-WAY SQUARE
- ☑ **5775**
- ☐ ***5776**
- ☐ **5780**
- ☐ ***5781**

FOUR-WAY WITH CLAPPER BODY
- ☐ **5785**
- ☐ ***5786**

SIX-WAY WITH CLAPPER BODY
- ☐ **5791**
- ☐ **5792**

NOTE: * = U/L Listed

NOTE: Model 5792 8" furnished less base plate, with identification on seamed sleeve

PRODUCT OPTIONS

FINISHES: (Brass Body)
- ☐ -B Polished Brass
- ☐ -C Rough Chrome Plated Body; Polished Chrome Plated Trim.
- ☑ -D Polished Chrome Plated

FINISHES: (Ductile Body)
- ☐ -B Red Glossy Polyester Coated Body; Polished Brass Trim
- ☐ -C Red Glossy Polyester Body; Polished Chrome Plated Trim

VARIATIONS:
- ☑ Additional length sleeve up to 36"
  Specify Length 30"

THREADS:
- ☑ N.S.T.
- ☐ Other _____

LETTERING AVAILABLE:
- ☐ AUTO. SPKR.
- ☑ AUTO. SPKR. Standpipe
- ☐ Standpipe
- ☐ Dry Standpipe

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5761-5792 SERIES Date: 09/29/14

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www.potterroemer.com

POTTER ROEMER FIRE PRO™
Member of Morris Group International™

CONNECTIONS (FDC)
FREE STANDING FIRE DEPT. INLET CONNECTIONS

Model/Series No.
5761-5792 SERIES

MODEL DIMENSIONS

TWO-WAY WITH CLAPPER BODY

Model No.	Size	Body	Radius of Body Swing	Overall Height
*5761	4" x 2-1/2"	Brass	7-1/4"	24"
*5762	4" x 3"	Brass		
*5763	6" x 2-1/2"	Brass		
*5764	6" x 3"	Brass		

NOTE: * = U/L Listed



THREE-WAY WITH CLAPPER BODY

Model No.	Size	Body	Radius of Body Swing	Overall Height
5771	4" x 2-1/2"	Brass	8"	24"
5773	6" x 2-1/2"	Brass		



FOUR-WAY SQUARE

Model No.	Size	Body	Radius of Body Swing	Overall Height
5775	6" x 2-1/2"	Brass	8"	34"
*5776		Ductile		
5780		Brass		
*5781		Ductile		

NOTE: * = U/L Listed



FOUR-WAY & SIX-WAY WITH CLAPPER BODY

Model No.	Size	Body	Radius of Body Swing	Overall Height
5785	6" x 2-1/2"	Brass	17"	26-1/2"
*5786	6" x 2-1/2"	Ductile		

NOTE: * = U/L Listed



SIX-WAY WITH CLAPPER BODY

Model No.	Size	Body	Radius of Body Swing	Overall Height
5791	6" x 2-1/2"	Brass	25"	26-1/2"
5792	8" x 2-1/2"	Brass		



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TOTALPAC® 3

Datasheet

Self contained - Double interlock Preaction system
Electric / Pneumatic release

211316 - Dry-Pipe Pre-Action Sprinkler Systems



DESCRIPTION

This **TOTALPAC®3** integrated fire protection system by FireFlex Systems Inc. consists of a preaction system trim totally pre-assembled, pre-wired and factory tested. All electrical and mechanical components of the system are contained in one single unit

TOTALPAC®3 preaction systems are built around the Viking trim using deluge valves model F-1.

Electric/pneumatic controlled, double interlock preaction systems requires a pneumatic actuator, normally held closed by supervisory pressure maintained in the sprinkler system AND a normally closed electric solenoid valve controlled by an approved system releasing control panel with compatible detection system. Both the electric detection system AND supervisory pressure must be relieved from the sprinkler system before the deluge valve will open and fill the sprinkler system with water.
Activation of a releasing device alone or operation of a sprinkler alone will sound an alarm but will NOT cause the system to fill with water.

All the valves are rated up to a maximum of 250 psi WWP (1724 kPa) max. and are available in the following diameters:

- ☐ 1½" (40 mm)
- ☐ 2" (50 mm)
- ☐ 3" (80 mm)
- ☐ 4" (100 mm)
- ☐ 6" (150 mm)
- ☐ 8" (200 mm)

Standard features

- cULus Listed & FM Approved as an assembled unit
- Factory assembled and tested under ISO-9001 standards
- Prewired to the Viking VFR-400 releasing control panel.
- Easy and compact installation
- OSHPD certification pre-approval: OSP-0341-10
- Viking conventional trim rated at 250 psi (1724 kPa)
- Galvanized trim piping
- Serial number for easy reference
- Corrosion resistant cabinet with flush type handle and lock
- No open drain cup inside the unit
- Remote controlled unit pre-wired to a terminals strip.
- numerous modular options to meet the most demanding jobsite requirements
- Four styles of modular air supply options
- Inlet & outlet hydrostatic test ports
- User-friendly standardized operation & installation manual
- Free interactive simulator

TOTALPAC® 3

Datasheet
Self contained - Double interlock Preaction system
Electric / Pneumatic release

Cabinet

The **TOTALPAC®3** cabinets are made of sturdy 14 gauge steel, they are available in four (4) sizes;

23" x 25" x 77" (58.4 x 63.5 x 195.6 cm) for 1½", and 2" systems,

36" x 25" x 77" (91.4 x 63.5 x 195.6 cm) for 3" and 4" system,

46" x 25" x 77" (116.8 x 63.5 x 195.6 cm) for 6" system

54" x 31" x 81" (137.2 x 78.7 x 205.7 cm) for 8" system

All surfaces are rust proof coated, inside and outside, with fire red, oven baked polyester powder on phosphate base. Cabinet is provided with one or two doors, all provided with a neoprene gasket to absorb vibrations.

A field wiring electrical junction boxes is integrated with the cabinet for connection of detection system, auxiliary contacts and signaling devices. All inputs & outputs are factory wired to a terminal strip (TBA) for contractor's field wiring.

Gauges to indicate air, water supply pressure and priming water pressure are all visible through clear Lexan windows.

IMPORTANT: TOTALPAC®3 units are NOT designed to be installed where they will be subjected to outdoors and/or freezing conditions. Refer to environmental data for additional details. Subjecting the unit to conditions outside these limitations might tamper the normal operation of the system.

Cabinet doors are provided with hinges that can easily be disassembled on site to remove the door assemblies for servicing. The cabinet assembly is pre-assembled, pre-wired, and factory tested under ISO-9001 conditions.

Multiple unit installations are easily achieved by manifolding units together at their water inlets but drains shall remain separate and open.

Sequence of operation (see trim diagram)

In a fire condition, when the detection system operates, system releasing control panel energizes solenoid valve *(F1)* open. Alarms activate, but the deluge valve will NOT open until a sprinkler opens relieving supervisory pressure from the sprinkler system. When a sprinkler opens, supervisory pressure in the sprinkler piping is reduced causing the pneumatic actuator *(F3)* to open.

Pressure is released from the priming chamber of the deluge valve *(A1)* to the open drain manifold faster than it is supplied through the restricted orifice *(B3)*. The deluge valve clapper opens to allow water to flow into the system piping and alarm devices, causing the alarm pressure switch *(C1)* and optional water motor alarm *(C2)* to activate. Water will flow from any open sprinklers and/or other opening in the sprinkler piping.

When the deluge valve operates, the sensing end of the PORV *(B9)* is pressurized, causing the PORV to open. When the PORV opens, it drains the priming water pressure to the priming chamber, preventing the deluge valve *(A1)* from resetting, even if the open releasing devices close. The deluge valve can only be reset after the system is taken out of service, and the outlet chamber of the deluge valve and associated trim piping is depressurized and drained.

Systems hydraulic limitations

WARNING The information contained herewith is for estimation and evaluation purposes only. Its use remains the responsibility of the designer.
Designers should refer to the appropriate NFPA Standards and any other applicable codes for their final design. Also refer to FireFlex Systems Inc. appropriate user manuals and to manufacturer's data sheets for additional details.
Systems limitations indicated below are nominal flow limitations.

System size (in.)	Usage Range (gpm)	Piping Equivalent Lengths w/o shut off valve		Piping Equivalent Lengths c/w shut off valve		Drain flow @ 250 PSIG w.p.
		(m.)	(ft.)	(m.)	(ft.)	GPM
1½	0 – 210	8.3	27.2	8.5	27.9	272
2	0 – 360	11.65	38.2	11.85	38.9	272
3	100 - 700	16.8	55.1	20.33	66.7	762
4	200 – 1400	21.89	71.8	25.33	83.1	1597
6	400 - 3500	33.28	109.15	37.28	122.3	1597
8	750 - 5250	41.15	135	44.71	146.7	1597

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Self contained - Double interlock Preaction system
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Standard equipments

Releasing control panel

- ❑ 120 VAC / 60 Hz, 165VA.
- ❑ 220 VAC / 50 Hz, 185VA.
- ❑ 12VDC / 7Ah batteries. (factory installed)
- ❑ 12VDC / 12Ah batteries. (optional)
- ❑ Single Zone detection
  (Activated by Zone 1 **or** Zone 2)
- ❑ Crossed-Zone detection
  (Activated by Zone 1 **and** Zone 2)

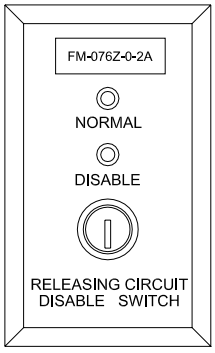
The releasing control panel integrated into the **TOTALPAC®3** cabinet is Viking's Model **VFR-400**. This panel includes four Class B, programmable detection zones (optional Class A); two Class B supervisory zones and four Class B, programmable output circuits (optional Class A). It is also provided with menu driven programming, including a specific program assigned at the factory.
The panel is compatible with many types of fire alarm & supervisory devices such as linear heat detectors, spot-type heat and smoke detectors, water flow and release indicators, low and high air pressure switches, manual pull stations.

The releasing control panel also includes an alphanumeric display with 2 lines of 16 characters describing all the system conditions, as well as a set of red and yellow LED lamps individually indicating each of the alarm and trouble conditions of the system

Easy to operate control buttons are also provided to activate and operate the system's various functions.

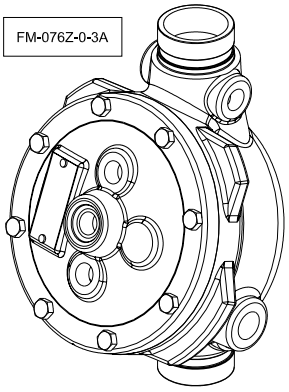
Releasing circuit disable switch

The releasing circuit disable switch is used to disable the releasing solenoid. When the key is set to “Disable”, the releasing solenoid will be disconnected from the control panel’s releasing circuit, causing a trouble signal and preventing accidental discharge during maintenance or inspection.



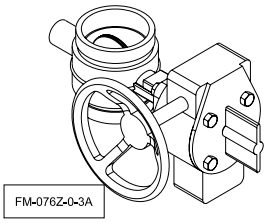
Deluge valve

The Viking Model deluge valve is a quick-opening, differential diaphragm, flood valve with one moving mechanism. The deluge valve is used to control water flow in deluge and preaction sprinkler systems. The valve is held closed by system water pressure trapped in the priming chamber, keeping the outlet chamber and system piping dry. In fire conditions, when the releasing system operates, pressure is released from the priming chamber. The deluge valve clapper opens to allow water to flow into the system piping.



Water supply control valve

The water inlet control valve is a supervised, indicating butterfly valve. Purpose of this vale is to manually shutoff the preaction system.



TOTALPAC® 3

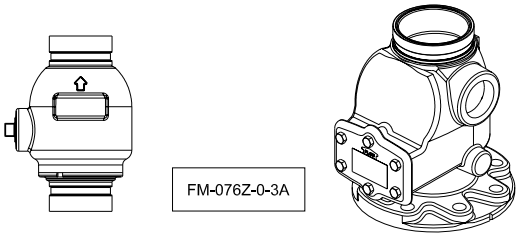
Datasheet
Self contained - Double interlock Preaction system
Electric / Pneumatic release

Standard equipments (continued)

Preaction riser check valve

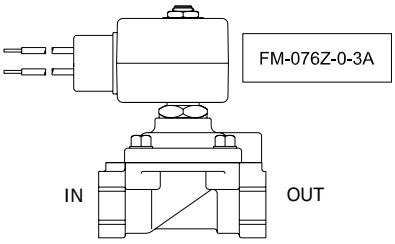
The Viking spring loaded In-Line check valve is a general purpose rubber-faced check valve approved for use in fire-service systems. The Spring Loaded In-Line check valve is manufactured with a brass body, brass seat, and a rubber-faced clapper assembly.

The Viking Easy Riser® Swing check valve is a general purpose rubber-faced check valve approved for use in fire service systems. The valve is for use in preaction system risers.



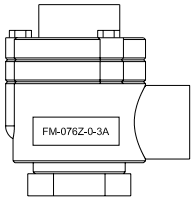
Solenoid valve

The high pressure solenoid valve is a two-way type with one inlet and one outlet. It is a packless, internal pilot operated valve, suitable for use in releasing water pressure from the priming chamber of Viking deluge valves. The solenoid valve has floating diaphragm construction, which requires a minimum pressure drop across the valve to operate properly.



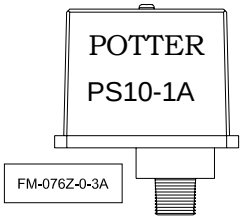
Pneumatic actuator

Used in conjunction with the solenoid valve, the Viking Pneumatic Actuator is a spring loaded, rolling diaphragm and piston operated valve. It is used wherever a combination is required between the detection and system's loss of air.



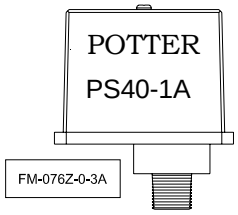
Alarm pressure switch

The alarm pressure switch monitors the water flow within the sprinkler piping. Should the Deluge Valve clapper opens to allow water to flow into the sprinkler piping. The alarm pressure switch will activate, indicating a water flow signal.



Low air supervisory switch

The low pressure switches monitors the pressure within the sprinkler piping should a loss pressure of the air below 25PSI occurs. The pressure switch contacts transfer indicating supervisory signal.



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Datasheet
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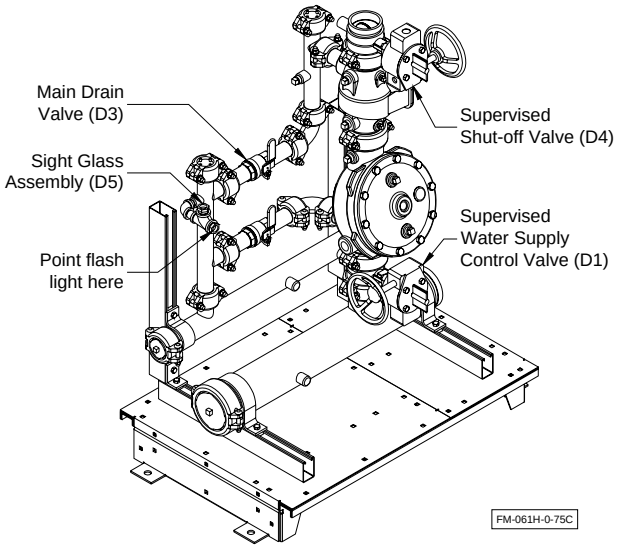
Optional mechanical equipments

❑ **Shut-off valve & sight glass option**

The Shut-off valve & sight glass option is intended to be used for applications where testing of the system operation without filling the sprinkler piping network is desirable and where it is critical that all functions of the preaction system be tested under actual discharge conditions. Examples of such applications are freezers, ovens, museums, data processing and other hazards where the possibility of water leaking from the piping system is to be avoided at all costs.

Warning: Shut-off valve & sight glass option is **not available** on 8" systems.

Warning: Shut-off valve is **not available** combined with Fire department connection on 6" systems.

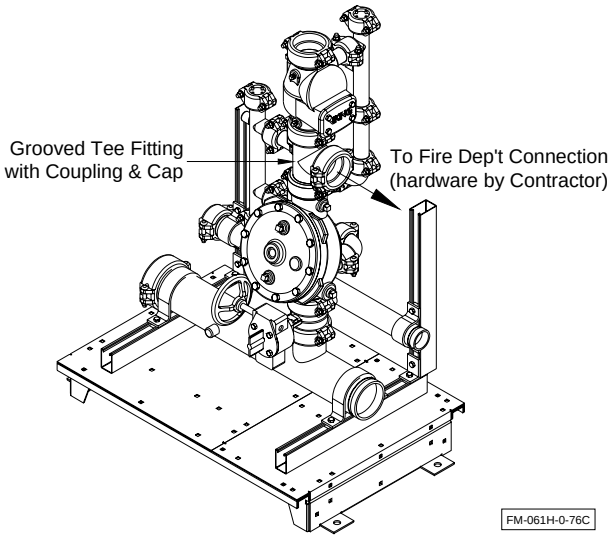


❑ **Fire department connection**

The fire department connection option consists of a grooved tee fitting installed at the outlet of the deluge valve *(A1)*. An access hole of the proper diameter is factory pre-drilled on the side of the **TOTALPAC®3** enclosures for connection of the piping going to the fire department connection.

Note: The fire department connection hardware itself (drain, Siamese, etc.) is NOT provided with this option and shall be provided by the installing contractor. Refer to NFPA-13 Standard for additional information about the equipment layout and installation.

Warning: Fire department connection is **not available** on 8" systems.



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Datasheet
Self contained - Double interlock Preaction system
Electric / Pneumatic release

Optional mechanical equipments (continued)

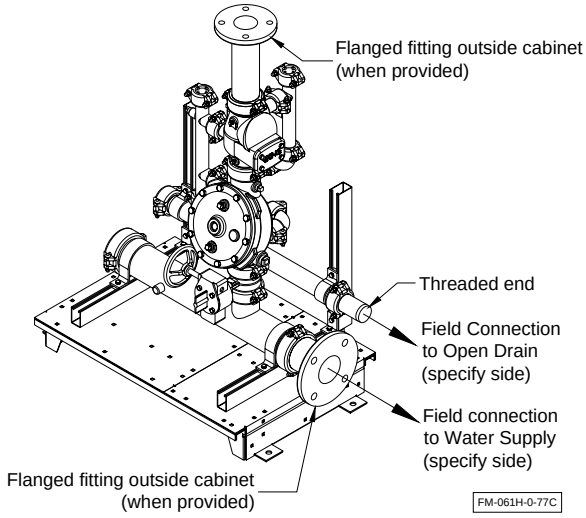
❑ **Semi and full flanged option**

When required by the user, **TOTALPAC®3** units can be provided in either a semi-flanged of full flanged configuration.

The semi flanged option provides flanged fittings only on the water inlet pipe (side needs to be specified at the time of order) and on the system riser outlet. The drain manifold is then provided with a threaded end that also needs to have its side specified (left or right). The rest of the fittings are the same as usual with the main components being provided in the standard grooved -grooved configuration.

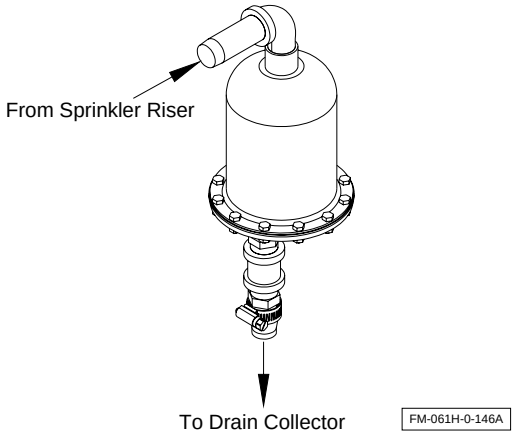
The full flanged option is the same as above but goes a step further with the main components being also provided with a flanged-flanged configuration.

When provided, the face of the flanges will always be situated 6 inches from the outside face of the mounting base or cabinet surface.



❑ **Anti-column device option**

The model LD-1 anti-column device is an optional trim component designed for use with preaction sprinkler systems. The anti-column device automatically prevents an unwanted water column from establishing within the system riser. On preaction sprinkler systems the anti-column device prevents water from columning downstream of the easy riser check valve.



TOTALPAC® 3

Datasheet

Self contained - Double interlock Preaction system
Electric / Pneumatic release

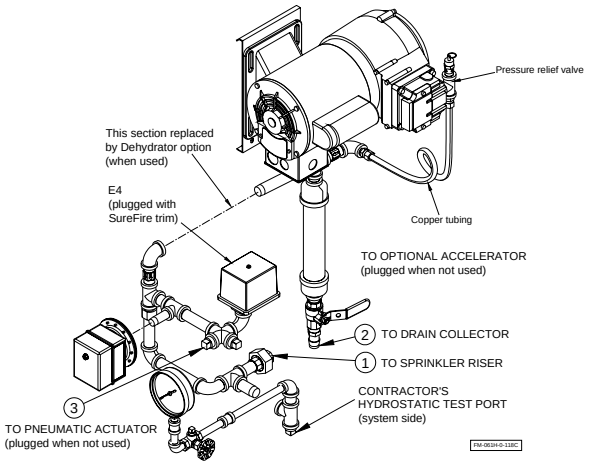
Air supply

❑ **Direct air compressor (Style "A")**

Used only for the sprinkler piping network of the preaction system. Air supply style "A" includes the air compressor mounted inside the **TOTALPAC®3** cabinets with its supervisory trim and options. Compressors are of the tankless, oiless piston type and are factory piped to the sprinkler system riser, all within the **TOTALPAC®3** cabinets.

Compressors are available in six (6) sizes:

☐ 1/6HP ☐ 1/2HP ☐ 1-1/2HP
☐ 1/3HP ☐ 1HP ☐ 2HP



Compressor Service Factor Amp (S.F.A) rating

Compressor Size (HP)	115Vac / 60Hz	230Vac / 60Hz	220Vac / 50Hz
1/6	5.0 Amp.	2.5 Amp.	1.3 Amp.
1/3	7.4 Amp.	3.7 Amp.	2.5 Amp.
1/2	10.0 Amp.	5.0 Amp.	4.0 Amp.
1	18.0 Amp.	9.0 Amp.	6.0 Amp.
1-1/2	16.6 Amp.	8.3 Amp.	6.3 Amp.
2	N/A	11.0 Amp.	N/A.

115 / 230 Vac – 60Hz air compressor selection Table:

H.P	CFM @ 40 PSI	System capacity to fill system to 35 PSI in 30 minutes *	System capacity to fill system to 55 PSI in 30 minutes **
1/6	1.33	142 gal.	90 gal.
1/3	2.61	285 gal.	181 gal.
1/2	4.06	417 gal.	265 gal.
1	7.40	702 gal.	447 gal.
1-1/2	7.40	1045 gal.	665 gal.
2	7.40	1400 gal.	890 gal.

220 / 240 Vac – 50Hz air compressor selection Table:

H.P	LPM @ 40 PSI	System capacity to fill system to 35 PSI in 30 minutes *	System capacity to fill system to 55 PSI in 30 minutes **
1/6	35.4	442 L	268 L
1/3	68	855 L	545 L
1/2	4.06	1302 L	825 L
1	7.40	2244 L	1427 L
1-1/2	7.40	3278 L	2085 L

* For systems with maximum water supply pressure of 175 PSI (1206 kPa)

** For systems with water supply pressure between 175 PSI (1207 kPa) and 250 PSI (1724 kPa)

WARNING The information contained herewith is for estimation and evaluation purposes only. Its use remains the responsibility of the designer.

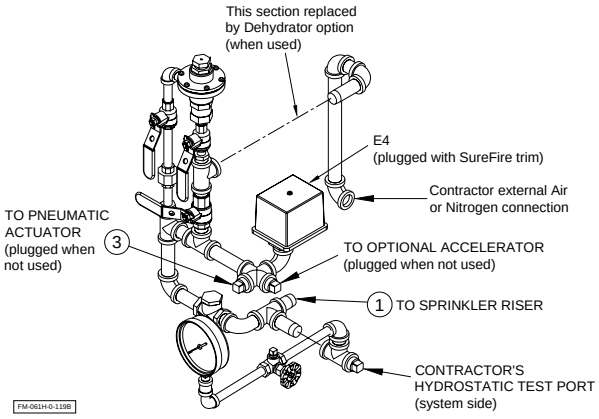
TOTALPAC® 3

Datasheet
Self contained - Double interlock Preaction system
Electric / Pneumatic release

Air supply (continued)

❑ **Air Pressure Maintenance Device (Style "B")**

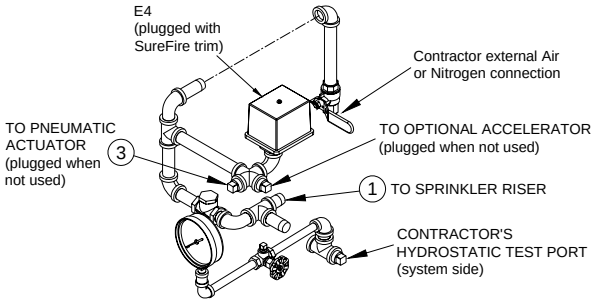
Used only for the sprinkler piping network of the preaction system, when an external air supply is provided by others (tank mounted compressor, plant air or dry nitrogen cylinders) and piped to the air inlet port of the unit. Air supply style "B" provides an Air Pressure Maintenance Device (APMD) trim, factory mounted in the **TOTALPAC®3** cabinets.



❑ **Direct air, external compressor (Style "D")**

Mainly used with Preaction systems protecting refrigerated spaces and freezers, where a special dry external air supply unit is piped directly to the system riser inside the freezer itself, as shown in NFPA-13. Air supply Style "D" provides only an air supervisory and shut-off trim.

Warning: When air supplies style "B" or "D" is selected, the air supply should be provided and installed by the sprinkler contractor OUTSIDE of the **TOTALPAC®3** cabinet. It is NOT provided with the unit.



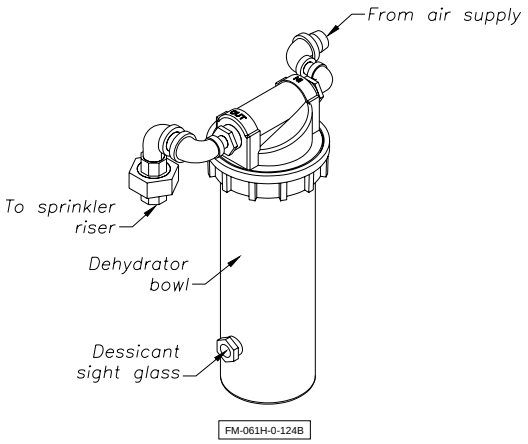
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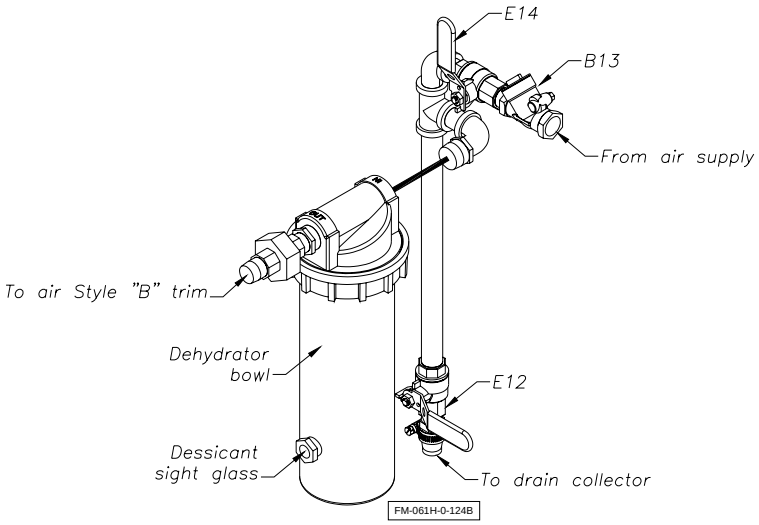
Optional air supply equipments

❑ Dehydrator option

The Viking Dehydrator is a manually regenerated desiccant-type air dryer. The desiccant acts as a moisture indicator by changing color, and is visible through the sight gauge.
The Dehydrator directs the incoming air down through the silica gel desiccant. The silica gel absorbs the moisture without physically changing. As the relative humidity increases, the silica gel begins to change color from dark blue to light pink, indicating the desiccant must be replaced.



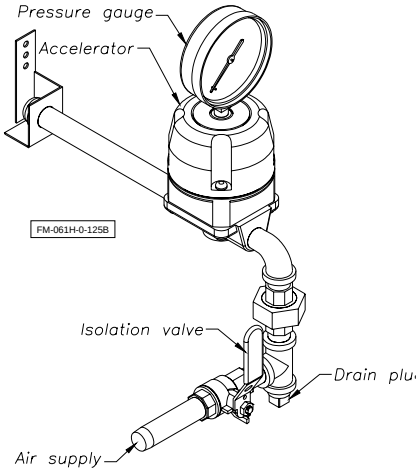
Style "A" layout



Style "B" layout

❑ Accelerator option

The Viking Model E-1 Accelerator is a quick-opening device. The Viking Model E-1 Accelerator may be used without the Anti-flood device to speed the action of a pneumatic release system on a preaction system.

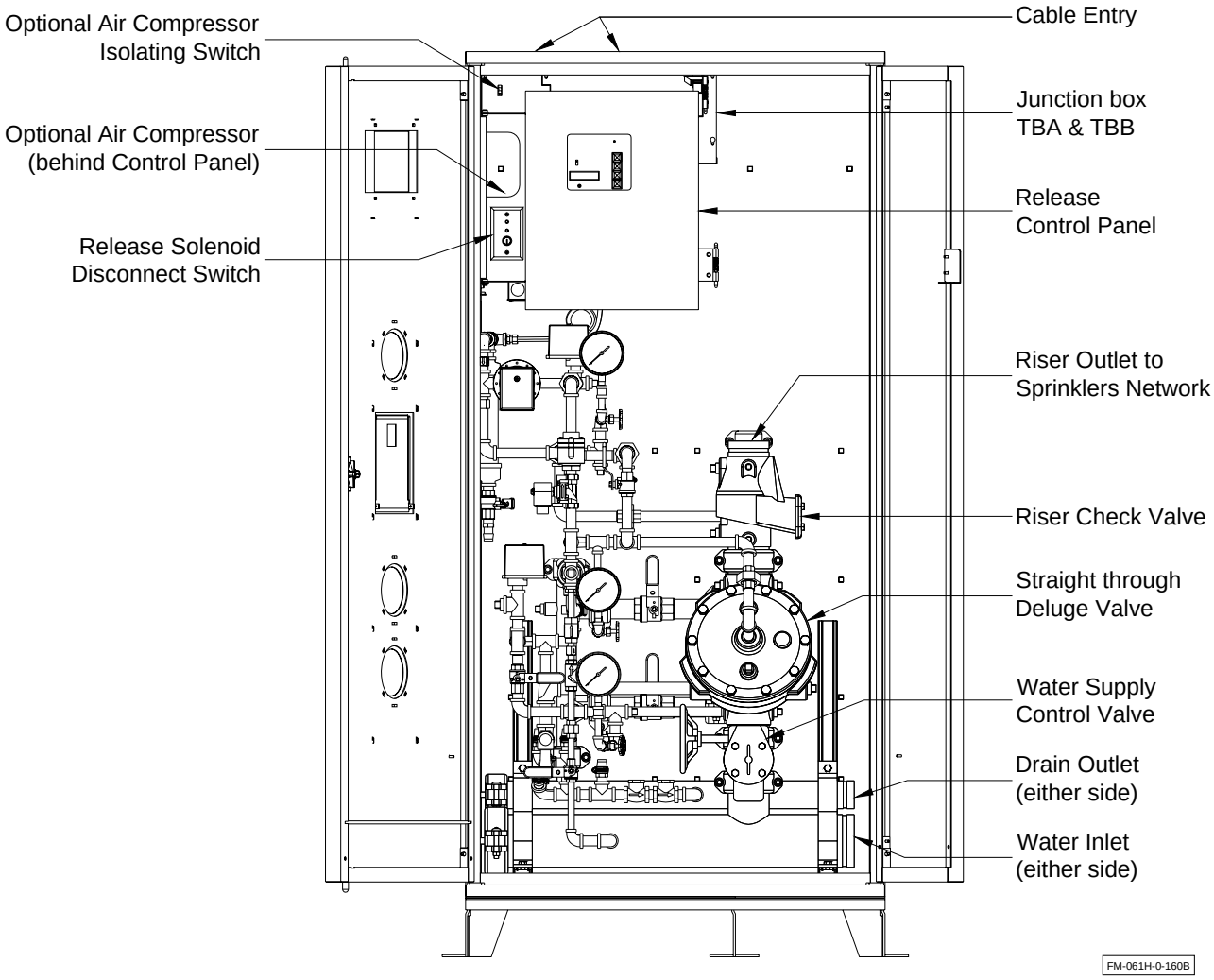


TOTALPAC® 3

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Self contained - Double interlock Preaction system
Electric / Pneumatic release

Details & field wiring diagrams

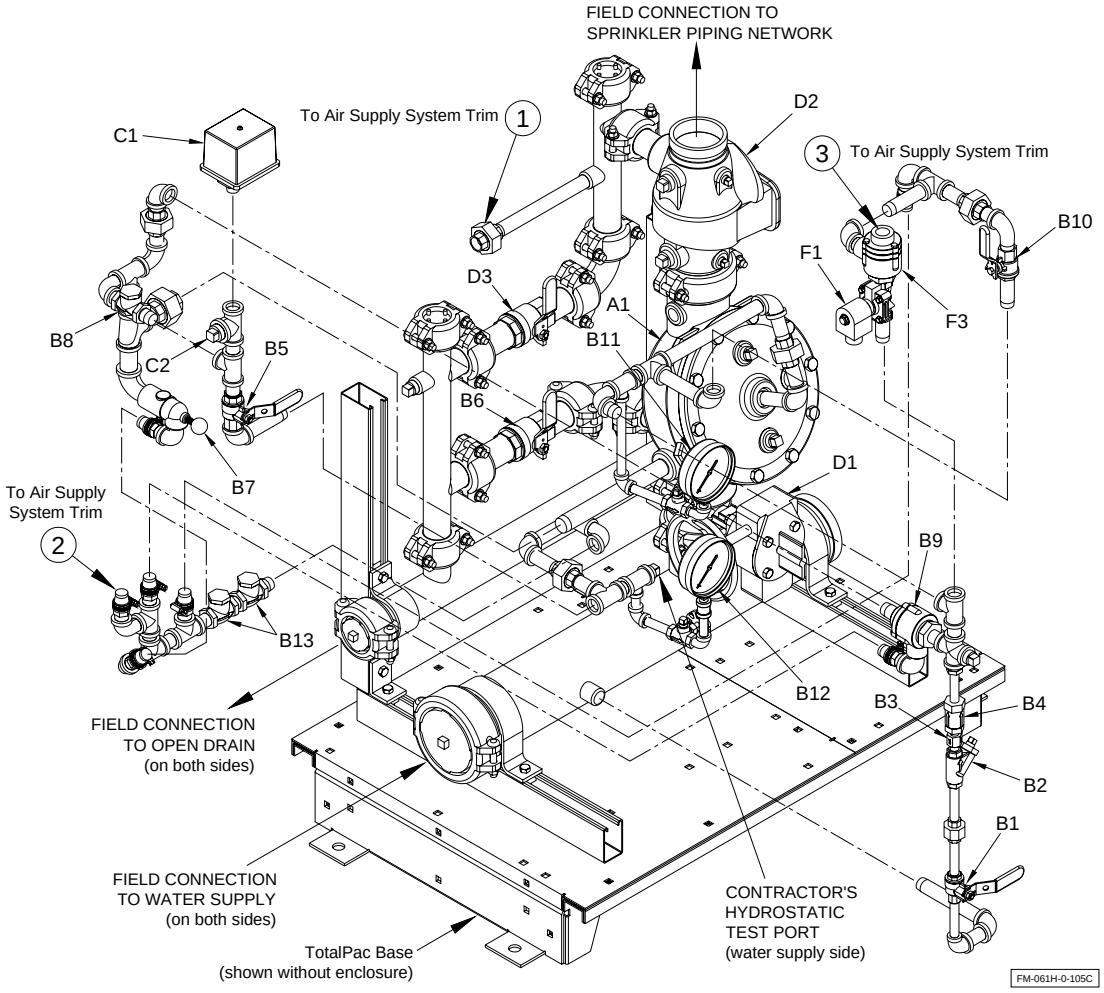
Cabinet with main components - Configuration with releasing control panel, shown with air style "A"



TOTALPAC® 3

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Trim diagram



Trim Components:

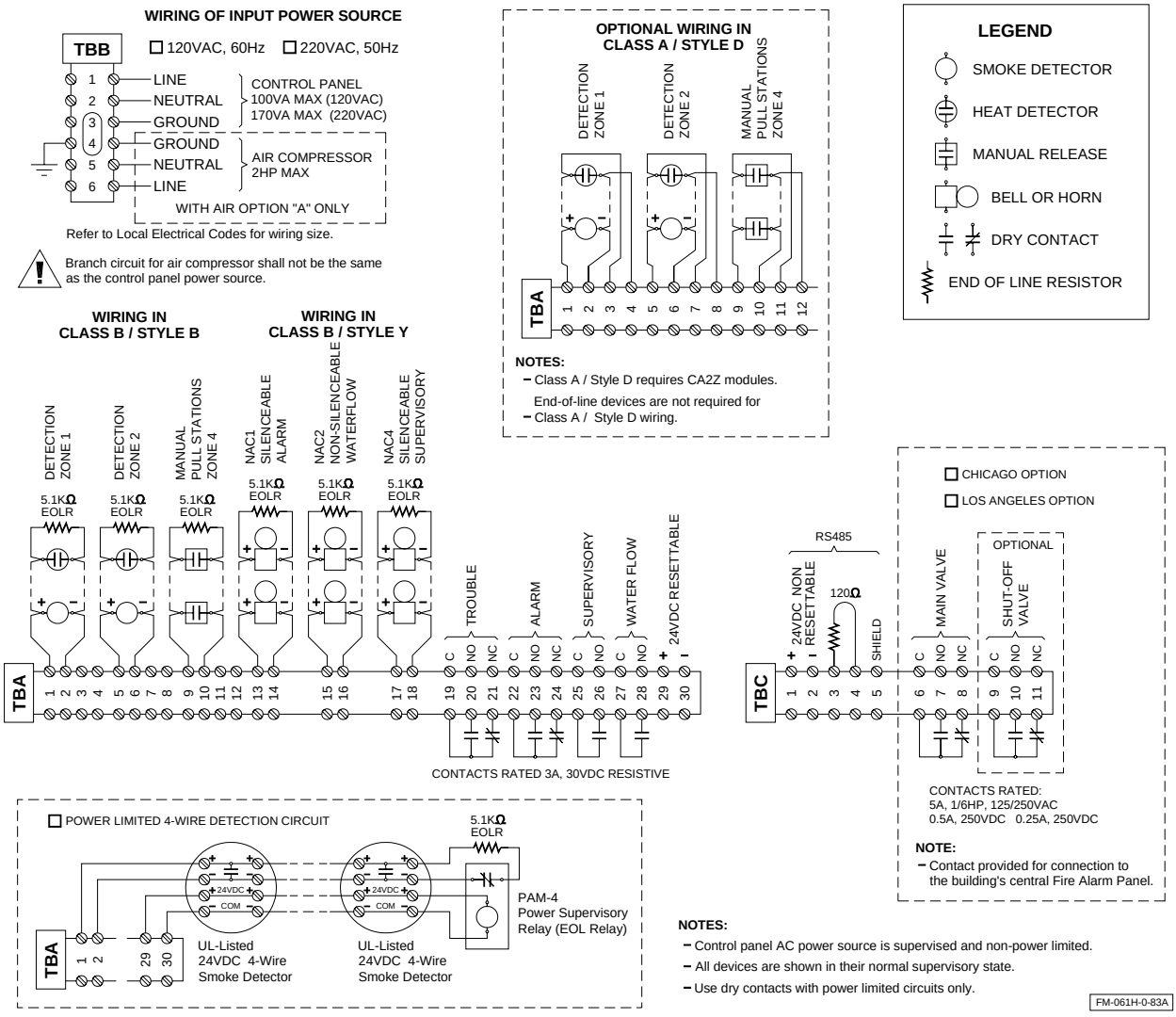
A1	Deluge valve
B1	Priming valve
B2	Strainer
B3	1/16" Restricted orifice
B4	Spring loaded check valve
B5	Alarm test valve
B6	Flow test valve
B7	Drip check valve
B8	Drain check valve
B9	Pressure operated relief valve (PORV)
B10	Emergency release valve
B11	Prime pressure water gauge & valve
B12	Water supply pressure gauge & valve
B13	Clapper check valve
C1	Alarm pressure switch
C2	Connection to water motor gong (strainer supplied by contractor)
D1	Water supply control valve
D2	Riser check valve
D3	Main drain valve
F1	N.C. Solenoid Valve – 24Vdc
F3	Pneumatic actuator

TOTALPAC® 3

Datasheet

Self contained - Double interlock Preaction system
Electric / Pneumatic release

Field wiring diagrams, Double interlock Electric / Pneumatic, Self-Contained:



Power Limited (supervised) Initiating Device Circuits
Detection Zone 1, 2, 3, and 4.
Max. loop resistance: 100 ohms
End of line: 5.1K ohms, 1/4W
Leave ELR (provided) on all unused circuits.
Refer to Device Compatibility in the VFR-400 Releasing control panel Manual.

Power Limited (supervised) Initiating Device Circuits
Supervision Zone 1, and 2.
Max. loop resistance: 100 ohms
End of line: 5.1K ohms, 1/4W
Leave ELR (provided) on all unused circuits.
For dry contact supervisory devices such as tamper, low air, or high air switches. (Class-B only)

Power Limited (supervised) Notification Appliance Circuits
Output Circuit 1, 2, 3, and 4
Maximum operating voltage: 27Vdc (ripple: 0.3Vdc)
Maximum usable current per circuit: 1.0A
Total current available (all circuits): 2.5A
Polarity is reversed in supervisory condition.
Leave ELR (provided) on all unused circuits.
Refer to Device Compatibility in the VFR-400 Releasing control panel Manual.

Auxiliary Power 24Vdc Regulated Source
Total current available: 0.2A
Resettable for 4 wires smoke detectors

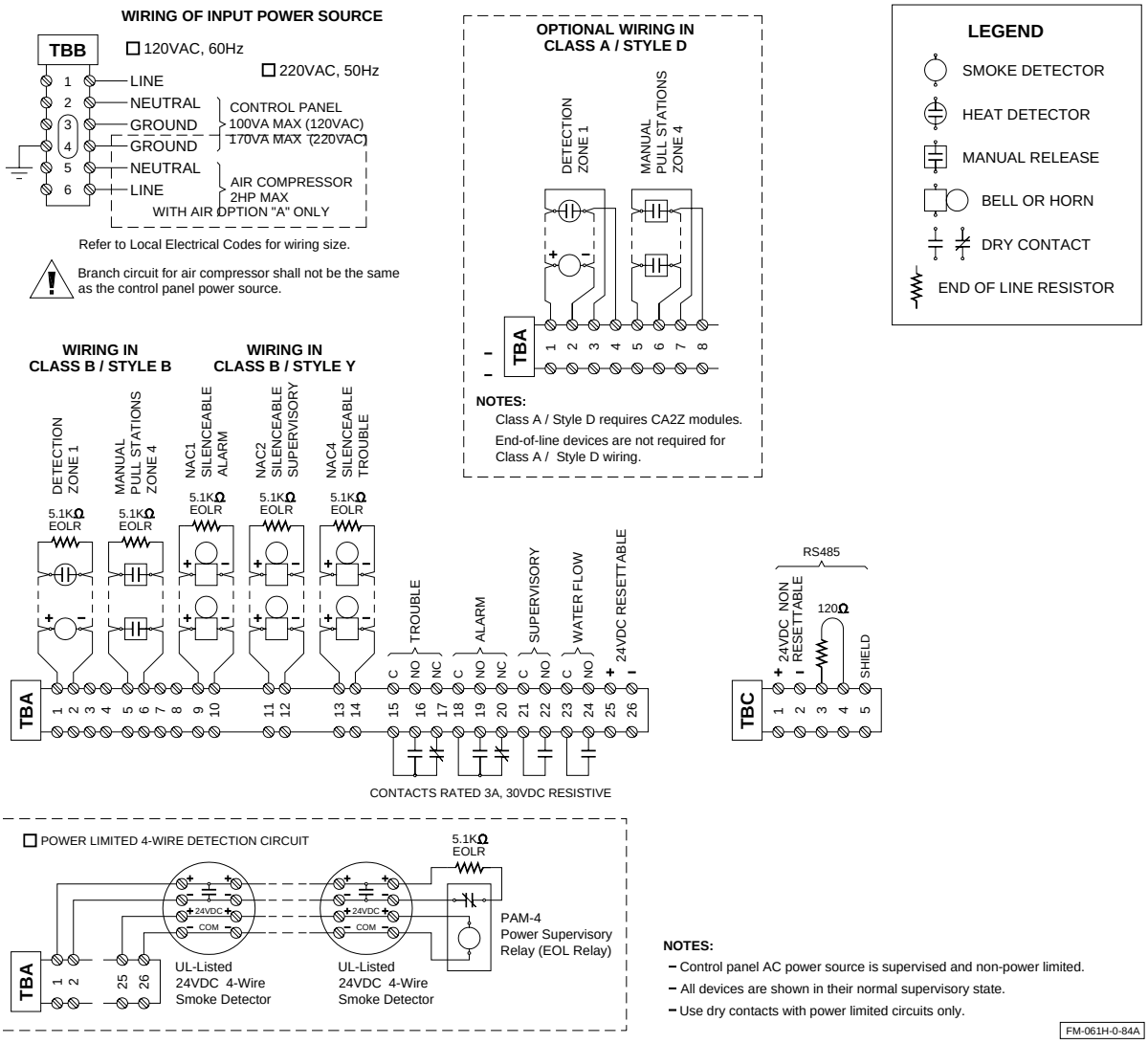
WARNING Releasing control panel shall be supplied by a dedicated circuit breaker, as per NFPA 70, Section 760 and Canadian Electrical Code, Section 32.

TOTALPAC® 3

Datasheet

Self contained - Double interlock Preaction system
Electric / Pneumatic release

Field wiring diagrams, Double interlock Electric / Pneumatic, Self-Contained, New York City:



Power Limited (supervised) Initiating Device Circuits
Detection Zone 1, 2, 3, and 4.
Max. loop resistance: 100 ohms
End of line: 5.1K ohms, 1/4W
Leave ELR (provided) on all unused circuits.
Refer to Device Compatibility in the VFR-400 Releasing control panel Manual.

Power Limited (supervised) Initiating Device Circuits
Supervision Zone 1, and 2.
Max. loop resistance: 100 ohms
End of line: 5.1K ohms, 1/4W
Leave ELR (provided) on all unused circuits.
For dry contact supervisory devices such as tamper, low air, or high air switches. (Class-B only)

Power Limited (supervised) Notification Appliance Circuits
Output Circuit 1, 2, 3, and 4
Maximum operating voltage: 27Vdc (ripple: 0.3Vdc)
Maximum usable current per circuit: 1.0A
Total current available (all circuits): 2.5A
Polarity is reversed in supervisory condition.
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Refer to Device Compatibility in the VFR-400 Releasing control panel Manual.

Auxiliary Power 24Vdc Regulated Source
Total current available: 0.2A
Resettable for 4 wires smoke detectors

WARNING Releasing control panel shall be supplied by a dedicated circuit breaker, as per NFPA 70, Section 760 and Canadian Electrical Code, Section 32.

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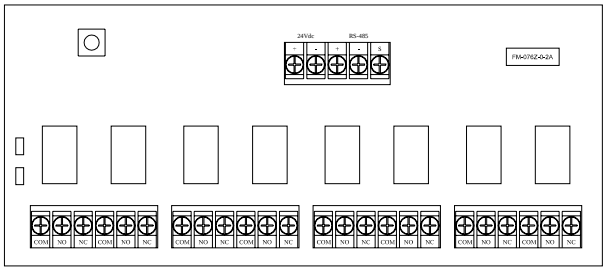
Datasheet

Self contained - Double interlock Preaction system
Electric / Pneumatic release

Optional electrical equipments

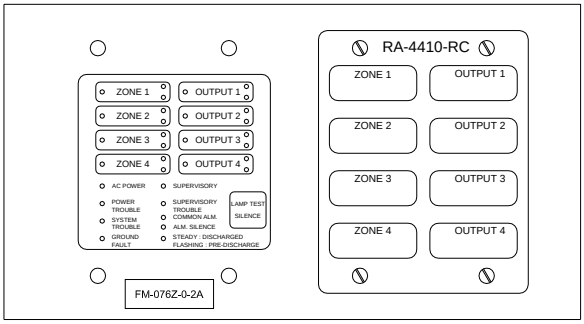
❑ Relay module ARM-44

The ARM-44 is an auxiliary relay module designed to operate with the Viking **VFR-400** releasing control panel to provide 4 independent form C relay outputs. The 4 output circuits each have a dedicated relay. Each relay is rated for 3 amps at 24 volts DC resistive load. The relay module mounts directly to the back of the cabinet and is connected to the main board. All of the relay terminals are wired back to the field wiring junction box. A disable switch is available for disabling the relays when the system is being tested or serviced.



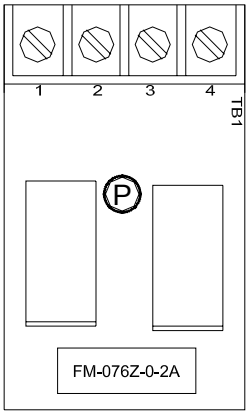
❑ Remote Annunciator RA-4410-RC

The RA-44410-RC remote annunciator is designed to operate with the Viking **VFR-400** releasing control panel. There are 34 LED's to indicate a change in panel status. There is a buzzer on the annunciator that sounds for any trouble or supervisory condition. The release releasing control panel supervises and communicates with the annunciator via separate connections for the RS-485 communication and the 24VDC power requirement of the RA-4410-RC. Separate cables should be used for power and communication. Shielded cable MUST be used for the RS-485 communication line.



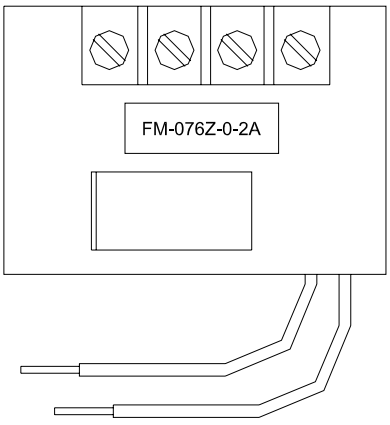
❑ Class A initiating device module CA2Z

The Model CA2Z Class A Module is designed to be used with the Viking **VFR-400** releasing control panel to convert from two (Class B) initiating device circuits to two (Class A) circuits.
The module is to be mounted in the upper right hand corner of the panel. All the connections are wired back to the field wiring junction box.



❑ CLASS A INDICATING APPLIANCE CIRCUIT MODULE

The Model CAM Class A Module is designed to be used with the Viking **VFR-400** releasing control panel to convert a single (Class B) indicating appliance circuit to a (Class A) circuit (one module is required for each indicating appliance circuit). After installing the CAM, the indicating circuit should be activated to ensure proper operation and connections. The module is provided with double-sided foam tape and should be mounted in the field wiring junction box so that the terminals are accessible.



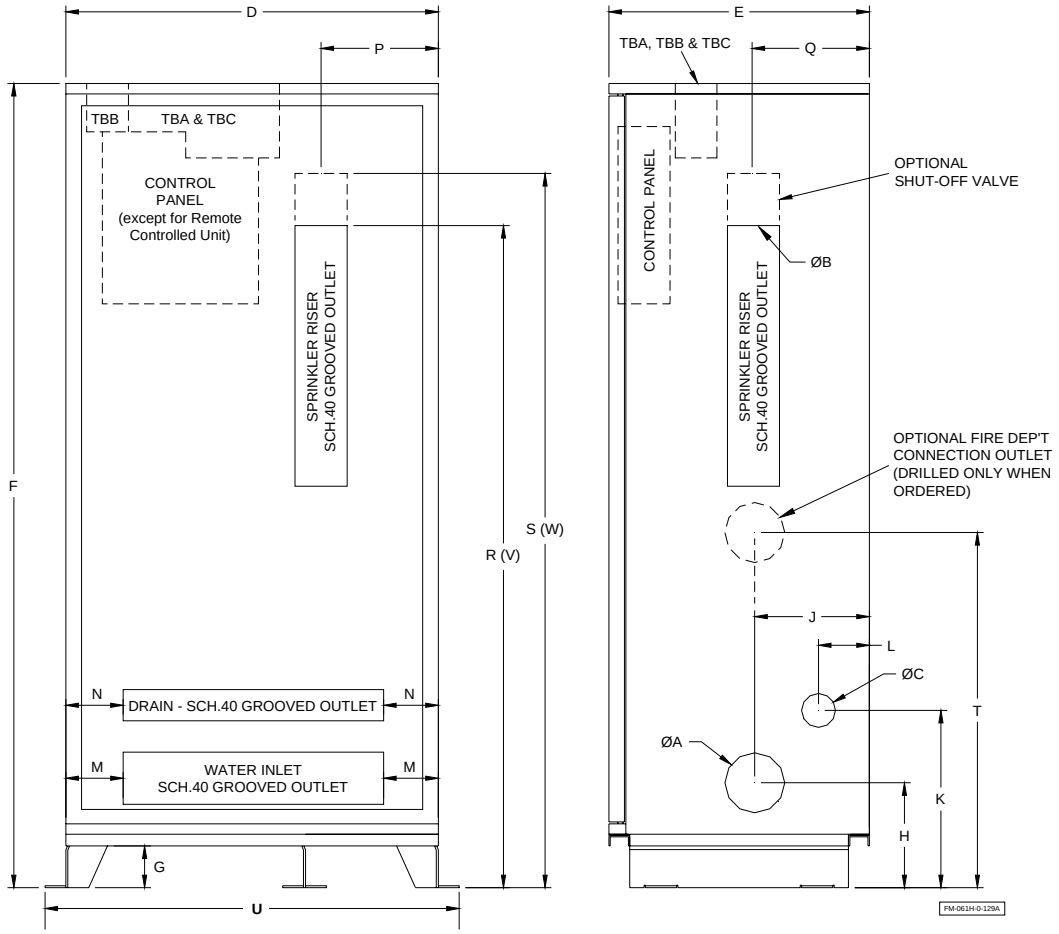
TOTALPAC® 3

Datasheet

Self contained - Double interlock Preaction system
Electric / Pneumatic release

Dimensions

Figure 1 – Cabinet dimensions:



Dimensions are nominal and may vary ±¼".
Dimensions V and W are with the optional Fire Department Connection

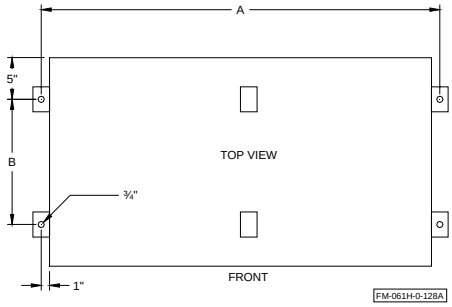
System Size	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V	W
1½"	2"	1½"	2"	23"	25"	77¼"	4"	8¾"	11½"	13¾"	3¾"	2¾"	2¾"	8"	11½"	37½"	44¾"	47½"	27"	43"	50¼"
2"	2"	2"	2"	23"	25"	77¼"	4"	8¾"	11½"	13¾"	3¾"	2¾"	2¾"	8"	11½"	37¾"	45"	47¾"	27"	43¼"	50½"
3"	4"	3"	2"	35¾"	25"	77¼"	4"	10"	11½"	13¾"	3¾"	2¾"	2¾"	11¾"	11½"	44"	47¾"	51¼"	39¾"	51"	54¾"
4"	4"	4"	2"	35¾"	25"	77¼"	4"	10"	11½"	13¾"	3¾"	2½"	2½"	12"	11½"	48½"	53"	59"	39¾"	56½"	61"
6"	6"	6"	2"	46"	25"	77¼"	4"	11"	11½"	13¾"	3¾"	5¼"	5¼"	17¾"	11½"	59¼"	65"	70½"	50"	70¼"	n/a
8"	8"	8"	2"	54"	31"	81¼"	4"	12"	13¼"	17"	3¾"	9"	6¾"	27"	13¼"	70"	75½"	n/a	58"	n/a	n/a

SYSTEMS WEIGHTS		
Cabinets with control panel		
System Description	Weight (lbs)	Weight (Kg)
1½" Preaction cabinet unit	475	215
2" Preaction cabinet unit	480	218
3" Preaction cabinet unit	755	342
4" Preaction cabinet unit	770	349
6" Preaction cabinet unit	1050	476
8" Preaction cabinet unit	1500	680

TOTALPAC® 3

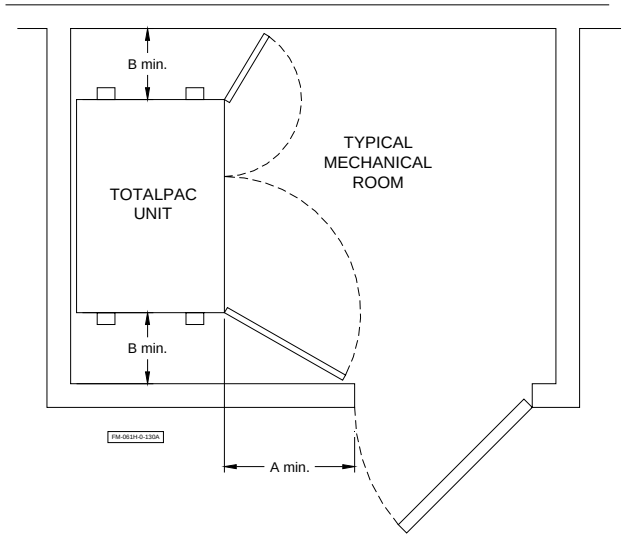
Datasheet
Self contained - Double interlock Preaction system
Electric / Pneumatic release

Figure 2 – Anchoring dimensions:



System Size	A	B
1½"	25"	15"
2"	25"	15"
3"	37¾"	15"
4"	37¾"	15"
6"	48"	15"
8"	56"	21"

Figure 3 – Cabinet clearance dimensions



System Size	A	B
1½"	24"	12"
2"	24"	12"
3"	24"	12"
4"	24"	12"
6"	24"	12"
8"	32"	12"

Figure 4 – Knockouts detail

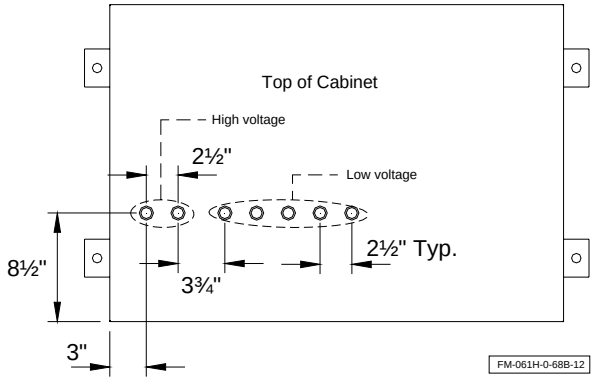
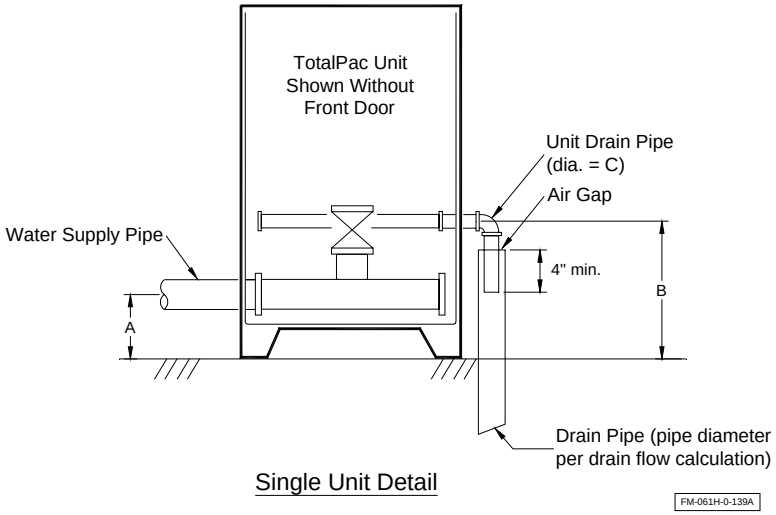
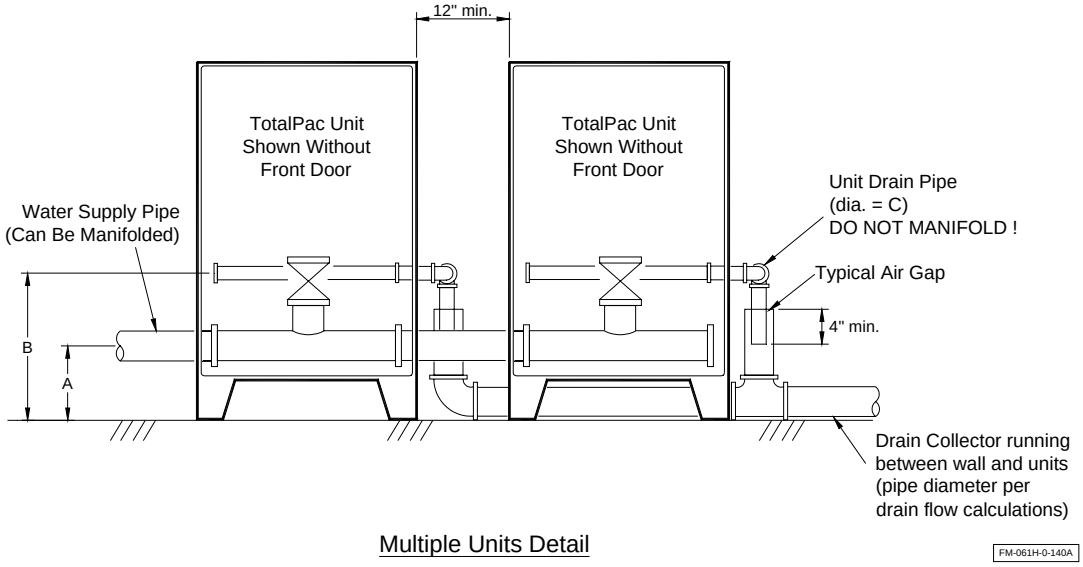


Figure 5: Open drain details for single unit:
(See dimensions in table below)



Single Unit Detail

Figure 6: Open drain details for multiple units:
(See dimensions in table below)



Multiple Units Detail

Dimension table

Unit Size:	1½"	2"	3"	4"	6"	8"
A	8¾"	8¾"	10"	10"	11"	12"
B	13¾"	13¾"	13¾"	13¾"	13¾"	17"
C	2"	2"	2"	2"	2"	2"

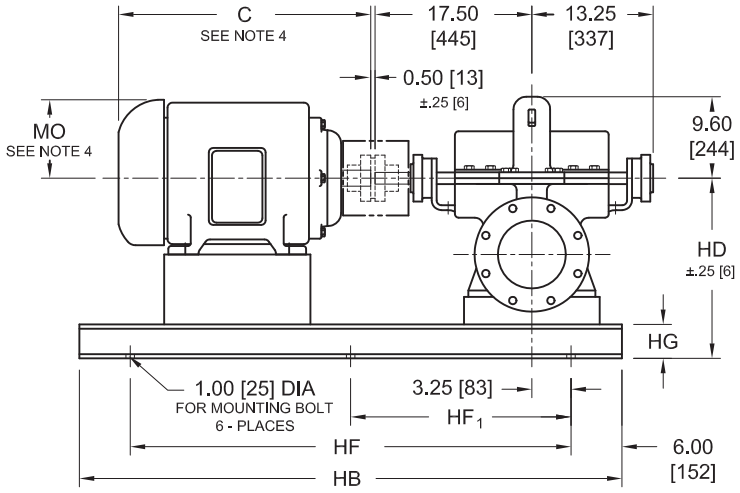
Notes:
1. Supply and drain pipes can be connected on either sides of cabinet.
2. All pipes and fittings should meet applicable codes.
3. Actual drain collector diameter shall be determined with detailed hydraulic calculations and is the responsibility of the system designer.

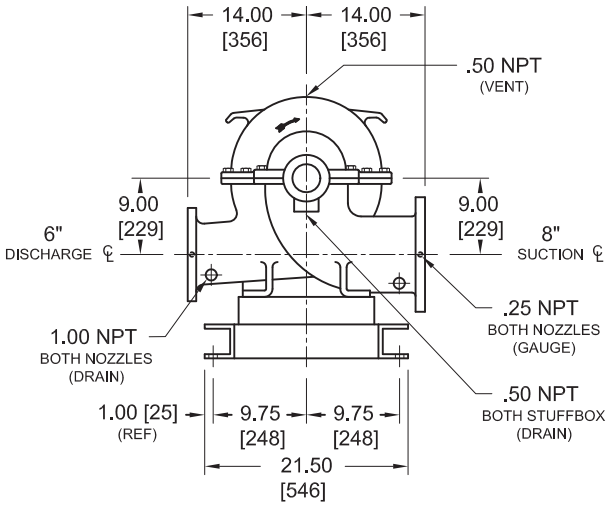
1935, Lionel-Bertrand Blvd.
Boisbriand QC Canada J7H 1N8
Tel.: 450-437-3473 • Fax: 450-437-1930
Toll Free: 866-347-3353
Email: info@fireflex.com • Web: www.fireflex.com

210513 - Motor Requirements for Fire Suppression

213113 - Electric-Drive, Centrifugal Fire Pumps

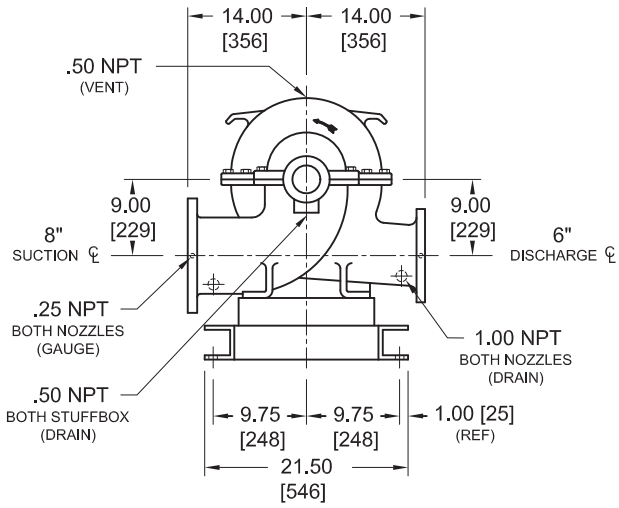
(H)8x6x12F – *8100 SERIES*





CW ROTATION VIEWED FROM COUPLING END

MOTOR FRAME	C	MO	HB	HF	HF_1	HD	HG
254 256	23.30 [592] 25.00 [635]	7.10 [181]	54.00 [1372]	42.00 [1067]	21.00 [534]	21.25 [540]	4.0 [102]
284 286	24.80 [630] 26.30 [669]	7.80 [199]					
324 ~~326~~	28.20 [717] ~~29.70 [755]~~	8.60 [219]					
364 365	30.00 [762] 31.00 [788]	9.20 [234]	60.00 [1524]	48.00 [1220]	24.00 [610]		



CCW ROTATION VIEWED FROM COUPLING END

NOTES:

1. ALL DIMENSIONS ARE INCHES [mm].
2. SUCTION AND DISCHARGE CONNECTIONS ARE DRILLED PER 125# ANSI B16.1. PUMPS WITH "H" PREFIX HAVE DISCHARGE CONNECTION DRILLED PER 250# ANSI B16.1. FLANGE HOLES STRADDLE CENTERLINE.
3. BASE PLATE SETTING (BEFORE PIPING), GROUTING PROCEDURES, AND FINAL ALIGNMENT MUST BE IN ACCORDANCE WITH A-C FIRE PUMPS SYSTEMS RECOMMENDED PROCEDURES OUTLINED IN THE INSTRUCTION MANUAL ASSOCIATED WITH THIS PUMP TYPE.
4. MOTOR DIMENSIONS ARE APPROXIMATE FOR A GIVEN NEMA FRAME. CONSULT FACTORY IF SPACE IS LIMITED.
5. BOTH SUCTION AND DISCHARGE PIPES MUST BE SUPPORTED INDEPENDENTLY NEAR THE PUMP TO REDUCE STRAIN ON THE PUMP CASING. ALSO EXPANSION JOINTS, IF USED, MUST NOT EXERT FORCE ON CASING.
6. COUPLING GUARD MEETS ANSI/OSHA REQUIREMENTS.
7. CONSULT FACTORY FOR BASE MOUNTED CONTROLLER.

NOT FOR CONSTRUCTION, INSTALLATION OR APPLICATION PURPOSES UNLESS CERTIFIED

CERTIFIED FOR: Webster University - ISB

APPROVAL: UL [X] FM [X] ULC [ ]

CUSTOMER ORDER NO.: | TAG NO. | FLANGES

	SIZE	MODEL	CURVE NO.	GPM	HEAD	ROTATION	SUCTION	DISCH.
PUMP DATA	8X6X12F	8100	A-7524-6	1000	45 PSI	Specify	8" 125#	6" 125#
MOTOR DATA	HP	RPM	VOLTS	PHASE	HERTZ	FRAME SIZE	ENCLOSURE	
	40	1770	460	3	60	324	ODP	

SHOP ORDER: | CERTIFIED BY: | DATE:

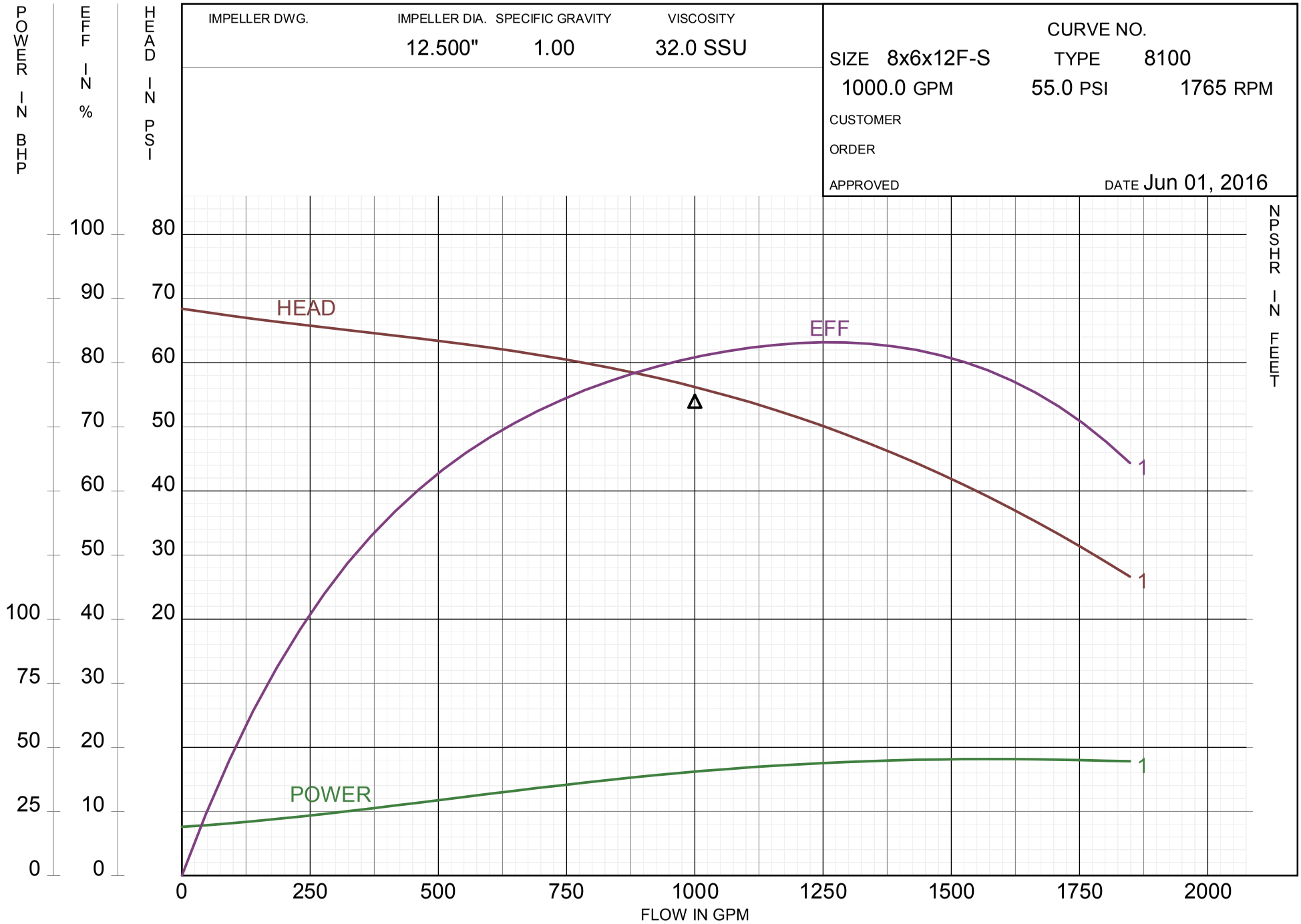
1000 GPM

★

RATED PSI	PUMP SIZE	SERIES	RPM	MOTOR HP	MAX HP	UL	FM
40	8x6x12F-S	8100	1765	30	30	x	x
45	8x6x12F-S	8100	1765	30	32	x	x
	8x6x13F	8100	1780	40	39	x	x
50	8x6x13F	8100	1780	40	44	x	x
	8x6x12F-S	8100	1765	40	40	x	x
→ 55	8x6x12F-S	8100	1765	40	45	x	x
	~~8x6x13F~~	~~8100~~	~~1780~~	~~50~~	~~50~~	~~x~~	~~x~~
60	8x6x12F-S	8100	1765	50	51	x	x
	8x6x13F	8100	1780	60	67	x	x
65	8x6x12F-S	8100	1765	50	54	x	x
70	8x6x9F	8100	3550	50	57	x	x
75	8x6x9F	8100	3550	60	60	x	x
	8x6x18F	8100	1780	75	70	x	x
80	8x6x9F	8100	3550	60	66	x	x
	8x6x18F	8100	1780	75	75	x	x
85	8x6x9F	8100	3550	75	73	x	x
	8x6x18F	8100	1780	75	81	x	x
90	8x6x9F	8100	3550	75	82	x	x
	8x6x18F	8100	1780	75	86	x	x
95	8x6x9F	8100	3550	75	84	x	x
	8x6x18F	8100	1780	100	91	x	x
100	8x6x9F	8100	3550	75	86	x	x
	8x6x18F	8100	1780	100	96	x	x
105	8x6x9F	8100	3550	100	93	x	x
	8x6x18F	8100	1780	100	102	x	x
110	8x6x9F	8100	3550	100	100	x	x
	8x6x18F	8100	1780	100	108	x	x
115	8x6x9F	8100	3550	100	106	x	x
	8x6x18F	8100	1780	125	116	x	x

★ WHEN SHUT OFF HEAD PLUS SUCTION PRESSURE EXCEEDS MAXIMUM ALLOWABLE DISCHARGE PRESSURE PLEASE SPECIFY (H) INDICATING DUCTILE IRON CONSTRUCTION AND OR 250# FLANGES WHERE APPLICABLE.

AC FIRE PUMP
a xylem brand



AC FIRE PUMP
a xylem brand

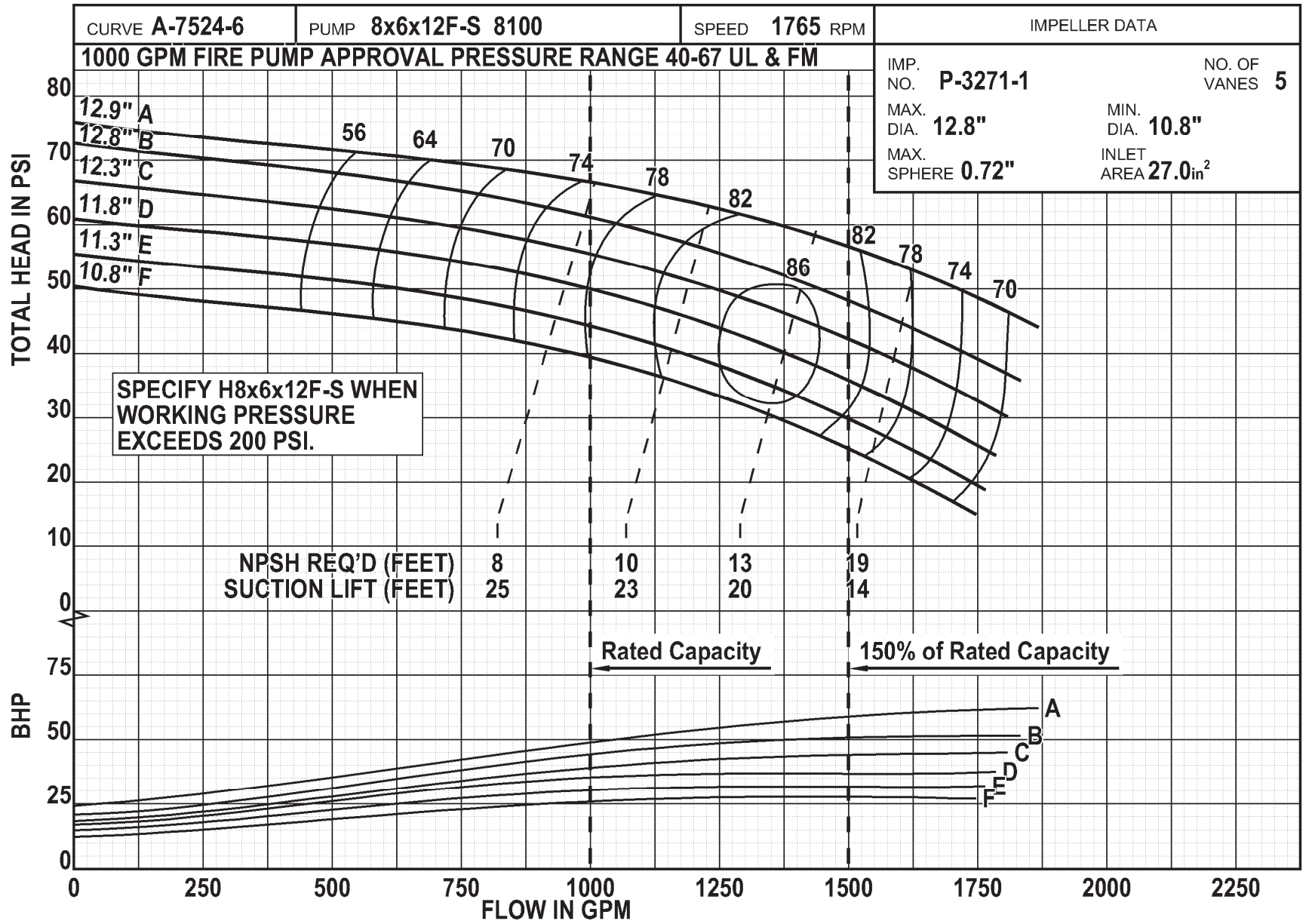
PERFORMANCE CURVES

1000 GPM

FP 2.0

OCTOBER 2012

SUPERSEDES ALL PREVIOUS ISSUES



Curves show performance with clear water at 85°F. If specific gravity is other than 1.0, BHP must be corrected.

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Supersedes all previous issues

①

PUMP	SIZE	8x6x12F-S	H8x6x12F-S	8x6x12F-M	H8x6x12F-M	8x6x13F	H8x6x13F
	TYPE	8100	8100	8100	8100	8100	8100
STAGES		1	1	1	1	1	1

CASING DESIGN

FLANGE RATING	SUCTION	125	250	125	250	125	250
	DISCHARGE	125	250	125	250	125	250
CASING MATERIAL		*CAST IRON ASTM A48 CLASS 35*	*DUCTILE IRON ASTM A536 GR 65-45-12*	*CAST IRON ASTM A48 CLASS 35*	*DUCTILE IRON ASTM A536 GR 65-45-12*	*CAST IRON ASTM A48 CLASS 35*	*DUCTILE IRON ASTM A536 GR 65-45-12*
MAX DISCHARGE PRESSURE (PSIG)		200	375	200	375	200	375
MAX SUCTION PRESSURE (PSIG)		100	200	100	200	75	200
MAX HYDROSTATIC PRESSURE (PSIG)		338	563	375	563	375	563
CASING WALL THICKNESS		0.44	0.44	0.5	0.44	0.44	0.44

STUFFING BOX DESIGN

BORE	2.62	2.62	3.25	3.25	3.25	3.25
DEPTH	2.56	2.56	3.50	3.50	3.50	3.50
PACKING: # RINGS / SIZE SQUARE	5 / .38	5 / .38	5 / .50	5 / .50	5 / .50	5 / .50
SEAL CAGE WIDTH	0.50	0.50	0.75	0.75	0.75	0.75
SHAFT SLEEVE O.D.	1.88	1.88	2.25	2.25	2.25	2.25

IMPELLER DESIGN

# OF VANES	5	5	5	5	7	7
INLET AREA (IN^2)	27.00	27.00	19.60	19.60	44.40	44.40
MAX DIAMETER	12.80	12.80	11.60	11.60	13.10	13.10
MIN DIAMETER	7.00	7.00	6.50	6.50	7.00	7.00
MAX SPHERE	0.72	0.72	0.70	0.70	1.00	1.00
WR^2 FOR MAX DIA ($LBS\text{-}FT^2$)	3.60	3.60	3.00	3.00	5.30	5.30
WEAR RING CLEARANCE - DIAMETRICAL	.015-.017	.015-.017	.015-.017	.015-.017	.015-.017	.015-.017

SHAFT AND BEARING DATA

DIA THRU IMPELLER		1.687	1.687	1.937	1.937	1.937	1.937
DIA THRU SLEEVE		1.499	1.499	1.874	1.874	1.874	1.874
DIA AT COUPLING		1.125	1.125	1.375	1.375	1.375	1.375
SHAFT SPAN - BRG TO BRG		22.90	22.90	25.25	25.25	27.25	27.25
BALL BEARING	INBOARD BRG #	6206	6206	6208	6208	6208	6208
	DIA THRU BRG	1.1816	1.1816	1.5753	1.5753	1.5753	1.5753
	OUTBOARD BRG #	5206	5206	5307	5307	5307	5307
	DIA THRU BRG	1.1816	1.1816	1.3785	1.3785	1.3785	1.3785
FRAME NUMBER		F20-C4	F20-C4	F20-B4	F20-B4	F20-D4	F20-D4
INSTRUCTION BOOK		AC2515	AC2515	AC2515	AC2515	AC2515	AC2515

① "H" PREFIX INDICATES HIGH PRESSURE CASING

213900 - Controllers for Fire-Pump Drivers

Part Number / Options Selection Guide
Electric Fire Pump Controllers & Transfer Switches

~~FD / FDF~~
FT / ~~FTF~~ 70 40 D L1

Model
FD / FDF = Stand Alone Controller
FT / FTF = Controller c/w Transfer Switch

Starting Type
20 = Limited Service
30 = Across the Line
40 = Part Winding
50 = Primary Resistor
60 = Autotransformer
70 = Wye Delta (Star-Delta) Open
80 = Wye Delta (Star-Delta) Closed
90 = Soft Start

Horsepower						
5	20	50	125	300	500	700
7.5	25	60	150	350	550	
10	30	75	200	400	600	
15	**40**	100	250	450	650	

* Higher Horsepowers not available on all models. Consult Factory for pricing.

Voltage
A = 208V - 60HZ
B = 240V - 60HZ
C = 380V - 50HZ
D = 480V - 60HZ
E = 600V - 60HZ
F = 415V - 50HZ
H = 380V - 60HZ
J = 400V - 50HZ
K = 400V - 60HZ
G2 = 240V 60 HZ Single Phase*

* Only available on Limited Service Controllers

Language
L1 = English
L2 = French
L4 = Italian
L5 = Spanish
L6 = Portuguese
L7 = Chinese
L8 = Polish
L9 = Dutch
L11 = Turkish

Options	
A	Built-in Alarm System
B	Alarm Bell
C1	Extra Contacts "Pump Run" (Two Form-C)
C2	Extra Contacts "AC Power Failure" (Two Form-C)
C3	Extra Contacts "Phase Rev." (Two Form-C)
C4	Remote Contacts (2 Form C) Low Reservoir
C5	Remote Contacts (2 Form C) High Reservoir
COM	Communications Option
CX	Extra Contacts (Two Form-C; Specify Function)
E1	NEMA 3R - Raintight Enclosure
E2	NEMA 4 - Watertight Enclosure
E3	NEMA 12 - Industrial Dust Tight Enclosure
E5	NEMA 4X - 304 Stainless Steel Enclosure
E8	Tropicalization
E9	NEMA 4X - Painted Steel
E10	NEMA 4X - 316 Stainless Steel Enclosure
EX	Export Crating
F2	Floor Stand - 2 Inch Height**
H	High Withstand Rating (refer to tables)
I	Intermediate Withstand Rating (refer to tables)
LX	Extra Light (Specify Description)
P5	Proof Pressure Switch - ALCO 15-290 PSI
P7	Low Suction Pressure Switch
P8	Low Suction Shutdown (Requires P7)
P10	Pressure Transducer - Sea Water Rated
P13	Externally Mounted Pressure Transducer**
R1	Space Heater (120 / 220V)
R2	Space Heater c/w Thermostat
R3	Space Heater c/w Humidistat
R4	Low Pump Room Temperature Switch
R5	Space Heater (Externally powered - 120V)
USB	Externally Mounted USB Port
X1	Printer
X2	4 Inch Chart Recorder (10 - 300 psi fresh water)

** Not available for NEMA 4 or NEMA 4X units.

N. Y. C. APPROVED

LMR Plus Electric Fire Pump Controllers

Typical Specifications

1. **Approvals**
   A. The Fire Pump Controller shall meet the requirements of the latest edition of NFPA 20 and shall be listed by [Underwriters Laboratories (UL)]and approved by [Factory Mutual Research (FM)] [Canadian Standards Association (CSA)] [New York Department of Buildings (NYSB)] and carry the CE marking for fire pump service.
2. **Starting Type**
   A. The controller shall be of the combined manual and automatic type designed for [~~Full Voltage Starting~~] [~~Part Winding Starting~~] [~~Primary Resistor Starting~~] [~~Autotransformer Starting~~] [Wye-Delta (Star-Delta) Open Transition Starting] [~~Wye-Delta (Star-Delta) Closed Transition Starting~~] [~~Solid State Soft Start Starting~~]
3. **Ratings**
   A. The Controller shall have a withstand rating of 100,000 RMS symmetrical amperes @ [~~208V~~] [~~240V~~] [~~380V~~] [~~400V~~] [~~415V~~] [480V] [~~25,000 @ 600VAC~~].
4. **Construction**
   A. The controller shall include a motor rated combination isolating switch and circuit breaker, mechanically interlocked and operated with a single externally mounted handle.
   B. The isolating switch shall be rated to disconnect the motor load.
   C. The isolating switch/circuit breaker combination shall be mechanically interlocked such that the enclosure door cannot be opened when the handle is in the on position except by a tool operated defeater mechanism.
   D. The controller manufacturer shall manufacture the contactor, isolating switch, circuit breaker, pushbuttons, and enclosures. Brand-labeled components will not be accepted.
5. **Enclosure**
   A. The controller shall be housed in a NEMA Type 2 (IEC IP11) drip-proof, powder baked finish, freestanding enclosure.
   B. Optional Enclosures:
      1. NEMA 3R (IEC IP14) rain-tight enclosure.
      2. NEMA 4 (IEC IP66) watertight enclosure.
      3. NEMA 4X (IEC IP66) watertight 304 stainless steel enclosure.
      4. NEMA 4X (IEC IP66) watertight 316 stainless steel enclosure.
      5. NEMA 4X (IEC IP66) watertight corrosion resistant enclosure.
      6. NEMA 12 (IEC IP52) dust-tight enclosure.
6. **Microprocessor Control**
   A. The controller shall come complete with a 4 line by 40 character LCD display mounted on a panel opening in the front door. The LCD display shall indicate the following:
      1. Main screen displaying system pressure, three-phase voltage and amperage readings, system frequency, date, and time.
      2. Set point review screen displaying the programmed pressure start and stop points, and weekly test time.
      3. Controller statistics screen, including:
         a. Powered Time
         b. Motor Run Time
         c. Number of Calls to Start
         d. Number of Starts
         e. Last Motor Start Time
         f. Last Motor Run Time
         g. Last Low Pressure Start
         h. Minimum System Voltage
         i. Maximum System Voltage
         j. Minimum System Frequency
         k. Maximum System Frequency
         l. Minimum System Pressure
         m. Maximum System Pressure
         n. Last System Startup
         o. Last Phase Failure
         p. Last Phase Reversal
         q. Last Locked Rotor Trip
         r. Maximum Run Current
         s. Last Locked Rotor Current
      4. Controller diagnostics screen, including:
         a. Date & Time
         b. Firmware Version
         c. Shop Order Number
         d. Customer Order Number
         e. Transformer Output Voltage
         f. Current Transformer Outputs
         g. Pressure Transducer Calibrated Settings
         h. Input Status
         i. Output Status
      5. Display last messages screen that will display up to 10,000 alarms/messages stored in the controllers' memory.
      6. Display up to ten (10) custom messages of up to 100 characters each, which will continually scroll across the fourth line of the display.
      7. Remaining time left on active timers.
   B. The controller shall be supplied with ten (10) green status LED's for the following:
      1. Power On
      2. Pump Running
      3. Local Start
      4. Remote Start
      5. Deluge Valve
      6. Emergency Start

LMR Plus Electric Fire Pump Controllers

7. Interlock On
8. Low Pressure
9. Auto Shutdown Enabled
10. Programmable LED #1

C. The controller shall be supplied with ten (10) red alarm LED's to indicate the following:
1. Phase Reversal
2. Phase Failure
3. Fail to Start
4. Undervoltage
5. Overvoltage
6. Low Room Temperature
7. Locked Rotor Trip
8. Low Suction Pressure
9. Source 2 Disconnected
10. Programmable LED #2

D. The microprocessor logic board shall be available with:
1. A USB port for transference of message history, controller status, diagnostics, and statistics and the ability to update firmware.
2. An optional Ethernet port for direct connection to a computer for data transfer.
3. An optional RS485 Serial port for communication to various external software programs.

E. The controller shall be available with an embedded web page to allow viewing of the controllers' current status, data values, programmed set points, and history.

F. A Fail-to-Start alarm shall occur if the motor controller sees less than 20% of the motor full load amps after an adjustable time delay of 1-90 seconds.

G. Locked rotor protection shall be provided. After a trip condition and restoration of power, the LCD display shall indicate "LOCKED ROTOR TRIP".

H. A sequential start timer and weekly test timer shall be provided as standard.

I. A restart time delay of two (2) seconds shall be provided to allow the residual voltage of the motor to decay prior to re-starting the motor. In the event that the pump motor continues to run after a request to stop, then the controller must display a fail to stop message to indicate this condition.

J. Overvoltage (5-20%) and undervoltage (5-30%) sensing and alarming shall be provided as standard.

K. The controller shall be supplied with interlock and shutdown circuits as standard. A flashing green LED shall indicate an interlock on condition.

L. Where shutdown of the pump(s) due to low suction pressure is required, it shall be accomplished without the addition of a separate panel or enclosure. The LCD display shall indicate low suction shutdown. Resetting of the condition shall be automatic or manual as selected by the user.

M. Means shall be provided to test the operation of all LED's to ensure their functionality.

7. Programming Menu

A. The programming menu shall have the ability to enable an entry password.

B. The programming menu shall be limited to two (2) levels of password protection.

C. The controller shall have three (3) languages as a standard, English, French, and Spanish, with the ability to add a fourth language.

D. The programming menu shall be grouped into 6 main menu headings as follows:
1. Regional Settings
2. Pressure Settings
3. Timer Values
4. Alarm Set points
5. Input/Output Menu
6. System Configuration (password protected)

8. Pressure Sensor

A. A solid-state 4-20mA pressure sensor shall be provided. The pressure Start and Stop points shall be adjustable in increments of one (1) PSI. A low pressure pre-alarm, indicated with a flashing green LED, shall denote a potential pump starting condition and will remain lit once the pump has started to indicate the starting cause.

9. Custom Inputs/Outputs

A. The controller shall come standard with nine (9) future inputs, two (2) future LED indicators, and one (1) future output, with the ability to add up to another 8 outputs via optional relay boards.

B. The user shall be able to program the future inputs/outputs through the main programming menu.

C. The inputs shall be selectable based on the following criteria:
1. User selected message or thirteen (13) predetermined messages.
2. Energize the common alarm relay when the input is received.
3. Link to a future relay and/or LED indicator.
4. Alarm latched until reset.
5. Normally open or closed input.
6. On-delay timer.

D. The LED indicators shall be selectable based on the following criteria:
1. Indication based on a minimum of twelve (12) predetermined alarms or a custom input.

E. The future relays shall be selectable based on the following criteria:
1. Output based on a minimum of twenty-seven (27) predetermined alarms, controller status or a custom input.
2. Latched until reset.
3. Energized under normal conditions.
4. On or off delay timer on the output.

LMR Plus Electric Fire Pump Controllers

10. Alarm Relays

A. All relays shall be of the plug-in type. An LED on the relay panel shall indicate the energized state of the relay. All relay contacts shall be rated @ 8A, 277VAC/30VDC. Two (2) sets of Form-C contacts shall be provided for each of the following:
   1. Phase Reversal
   2. Phase Failure
   3. Common Alarm
   4. Future #1
   5. Pump Run.

B. The Common Alarm and Phase Failure relays shall be energized under normal conditions.

11. Audible Alarm Buzzer

An audible alarm buzzer, capable of being heard while the motor is operating, shall operate if Fail to Start, Hardware Malfunction or any Common Alarm condition exists.

12. Manufacturer

A. The controller shall be of the LMR Plus type as manufactured by Eaton Corporation.

Powering Business Worldwide

Fire Pump Controllers Features

FT Series Transfer Switches

June 2010

Typical Specifications

1. Approvals

A. The Fire Pump Controller and Transfer Switch combination shall meet the requirements of the latest edition of NFPA 20 and shall be listed by [Underwriters Laboratories (UL)] and approved by [Factory Mutual] (FM) **, [Canadian Standards Association (CSA)] and [New York Department of Buildings (NYSB)] for fire pump service.

B. The transfer switch shall meet UL 1008 and shall be regularly subjected to Endurance, Interrupting Capacity, and Dielectric Voltage-Withstand test as outlined by UL 489 standards.

2. Ratings

A. The transfer switch shall be suitable for the available short circuit current at the line terminals of the controller.

B. The transfer switch shall have an ampere rating not less than 115% of the motor full-load current.

3. Construction

A. The transfer switch shall be installed in a barriered compartment of the fire pump controller. The complete assembly, controller and transfer switch, shall be shipped as a single unit.

B. A single uni-gear motor shall electrically operate the transfer mechanism. It shall also be capable of being operated manually and shall have suitable provisions for readily disengaging the gear motor when necessary.

C. The transfer switch shall be mechanically and electrically interlocked so that it shall not be possible for the load circuits to be connected to normal and emergency sources simultaneously, regardless of whether the switch is electrically or mechanically operated. The switch shall have a manual neutral.

D. The alternate side shall be provided with an isolation switch sized to a minimum of 115% of the motor full-load current and a circuit breaker having a continuous current rating not less than 115% of the motor full load amps, have overcurrent sensing elements of the non-thermal type, and instantaneous short-circuit overcurrent protection.
The isolating switch and circuit breaker shall be mechanically interlocked and operated by a single handle. The isolating switch shall be supervised to indicate when it is open by audible and visual alarms.

E. An auxiliary contact shall be provided to prevent sending of the signal for starting of the alternate source generator when the transfer switch commands it, if the isolation switch on the alternate source side of the transfer switch is open.

F. The transfer switch shall be provided with locked rotor overcurrent protection. The locked rotor protector shall be calibrated and set to a minimum of 300% of the motor full-load current and have a tripping time between 8 and 20 seconds.

4. Enclosure

A. The controller shall be housed in a NEMA Type 2 (IEC IP11) drip-proof, powder baked finish, freestanding enclosure.

5. Microprocessor Control

A. A solid state sensing and control logic panel shall be separately mounted from the power-switching portion of the transfer switch. The two sections shall be connected together by control cables and plug-in connectors. The control section shall be capable of being isolated from the power section for maintenance.

B. The normal power source shall be set to pickup at 95% and drop out at 85% of nominal supply. The voltage sensing on the alternate supply shall be set to pickup at 90% of nominal voltage.

C. All voltage sensing, frequency sensing, and timer set points shall be field adjustable.

D. The transfer switch shall automatically transfer its load circuit to an emergency or alternate power supply upon failure of the normal or original supply. In order to override momentary fluctuations in the system, a time delay transfer from normal to alternate power supply shall be adjustable up to 1800 seconds. Upon restoration of the normal supply, the transfer switch shall automatically retransfer its load circuits to the normal supply. Mechanically held transfer mechanisms shall be energized only momentarily during transfer or retransfer.

E. If the emergency / standby power should fail while carrying the load, transfer to the normal supply shall be made instantaneously upon restoration of the normal source to satisfactory conditions.

F. The transfer switch shall come complete with five LED's to provide visual indication of the unit status, source 1 available, source 1 connected, source 2 available, and source 2 connected.

G. An engine test button shall be provided that will initiate an engine test.

H. A silence alarm button shall be provided that will silence the alarm buzzer.

6. Alarm Relays

A. 2 Form-C contacts shall be provided for remote indication for source 1 connected or source 2 connected.

B. 2 Form-A contacts shall be provided for remote indication for the alternate source-isolating switch open.

7. Manufacturer

A. The manufacturer of the assembly shall be the manufacturer of major components and control modules installed within the assembly.

B. The Transfer Switch Fire Pump Controller shall be of the LMR Plus type as manufactured by Eaton Corporation.

C. Models:

~~FT20 Limited Service~~
~~FT30 Across the Line~~
~~FT40 Part Winding~~
~~FT50 Primary Resistor~~
~~FT60 Autotransformer~~
→ FT70 Wye-Delta (Star Delta) Open Transition
~~FT80 Wye-Delta (Star Delta) Closed Transition~~
~~FT90 Soft Start~~

** NOTE: As of January 1, 2009 – FT20 Limited Service Transfer Switch controllers, do not carry FM Approval.



Product Description

The Automatic Transfer Switch Option may be added to any FD type Fire Pump Controller whenever automatic transfer from normal to alternate power is required.
The automatic Transfer Switch and Fire Pump Controller are mounted in the same enclosure or in separate enclosures to form one unit and interwired - depending on the horsepower and voltage required.

Engine Test Button

An engine test button is provided on the ATC-300 controller that can be used to test the Source 2 (generator) engine. The operator can select the engine run test time (0-600 minutes). As well, a silence pushbutton is provided which de-energizes the alarm bell.

Electrically and Mechanically Interlocked

The FT Series transfer switch operating mechanisms are mechanically interlocked to prevent the normal and alternate source from connecting at the same time.
The switch operates upon signals received from the ATC-300 Plus controller.

ATC-300 Plus



The panel mounted, multi-function, microprocessor based ATC-300 Plus controller accurately monitors two power sources and provides the necessary intelligence to reliably operate the transfer switch through a series of programmed sensing and timing functions.

Keypad Programming

The ATC-300 Plus controller membrane is equipped with seven keypad input buttons which are used to program the controller as well as set operating parameters.

LED Status Indication

Five LED's indicate the status of the power sources.

Source 1 Available	Source 1 Connected
Source 2 Available	Source 2 Connected
Unit Status	

Automatic Transfer



The FT Series Transfer Switches will perform an automatic transfer from Normal to Alternate source when the Voltage drops to 85% of normal, or there is a loss of any phase and/or Phase Reversal.

Voltage and Frequency Sensing

The ATC-300 Plus continuously monitors the normal source for out of range setpoint values. When the source is outside the dropout setpoints, the source will become unavailable. This prompts a transfer to the alternate source. Retransfer occurs when the normal source's frequency and/or voltage return within pickup setpoints.

Alarm Relay

The alarm relay is de-energized to indicate an absence of an alarm state and energized to indicate the presence of an alarm condition.
Alarm conditions include:
Improper Circuit Breaker Operation
Motor Operator Failure
Lockout
Failsafe Condition
Aborted Engine Test
Aborted Plant Exerciser
Unsuccessful in-phase Transition

Product Features

The FT70 Transfer Switch Controllers use a method of connecting the pump motor windings into wye configuration to start, then switching to a delta configuration to run.
This reduces the starting current of the motor significantly.
Wye-Delta starting is the only method that has a starting torque efficiency of 100%. The FT70 can be programmed for either fully automatic or semi-automatic operations.

Logic Controller Board

Communication

The controller can be ordered with the option to display and output current values and status, on command, from various software protocols through the appropriate port(s).

Embedded Web Page

The web page is a multifunction tool that allows the user to view the controller's current status, data values, programmed set points and history. It is accessed using the optional ethernet port.

USB Port / USB Drive

The logic controller board is equipped with a USB port that can be used to transfer data to and from a portable USB Drive device (memory stick).



Ethernet Port

An optional ethernet port is used for direct connection to a computer for data transfer.

RS485 Serial Port

An optional RS485 serial port can be provided for communication to various external software programs.

Buzzer

A buzzer is mounted on the logic board which will operate if Fail to Start, Hardware Malfunction or any Common Alarm condition exists.

Power I/O Board

Transformers

Incoming line voltage is run directly to the I/O board from the incoming lines. The three transformers mounted on the I/O board will accept voltage inputs between 100 and 600V.

Customer Connection Terminals

Connection terminals for external customer connections, are located on the top of the Power I/O board.



Output Relays

Seven socket mount, 8 Amp, 2 Form - C (DPDT) output relays are provided standard on each power I/O board. They are designated for:
Common Alarm,
Phase Failure,
Phase Reversal,
Pump Run,
Startup,
Acceleration
and Future # 1.
Each socket has an LED mounted on the I/O board which indicates each relay's coil status.

Optional Output Relay Boards

There is provision to add up to eight additional relay outputs, via optional relay output boards. Each board contains a maximum of 2 additional relays. The Power I/O Board will accept a maximum of 4 optional boards which mount in a snap-on configuration.
Each board provides an area for the user to label the terminal number and relay name.

Door Mount
The membrane keypad is accessible from the front door of the controller.

NEMA Rating
The standard membrane keypad is rated for NEMA 2, 3R, 4, 4X and 12.

LCD Display
The Logic Control Board contains a 4 Line by 40 Characters wide, backlit, LCD display which is capable of generating multiple languages.

Alarm & Status LED's
A total of 20, (10 Status - 10 Alarm) LED's provide indication on the membrane keypad.



Status LED's	Alarm LED's
Power On	Phase Reversal
Pump Running	Phase Failure
Local Start	Fail To Start
Remote Start	Undervoltage
Deluge Valve	Overvoltage
Emergency Start	Low Room Temperature
Interlock On	Locked Rotor Trip
Low Pressure	Low Suction Pressure
Auto Shutdown Enabled	Source 2 Disconnected
Programmable LED # 1	Programmable LED # 2

Silence Button
A silence pushbutton on the membrane can be used to silence the buzzer. When an alarm condition exists, the alarm buzzer will sound. If the Silence Alarm button is pressed, the alarm buzzer will turn off. If a subsequent alarm condition occurs after the silence button is pressed, the buzzer will re-sound. Pressing the Silence Alarm button again, will silence the buzzer.

Motor Test Button
The motor test button on the membrane can be used to simulate an automatic start.

Automatic Shutdown Enabled
When the Automatic Shutdown function is enabled, a Green LED will indicate on the controller membrane.

MAIN DISPLAY
General
The main display will show the current system pressure, time and date, voltage and amps reading for all three phases, the system frequency and any custom messages, alarms or timers.



Programmed Set-Point
The set-point display will show programmed pressure start point, pressure stop point and weekly test timer setting.

Statistics
The statistics display will allow the user to scroll through all of the measured statistics stored in memory. Refer to LMR Plus operation manual IM05805020K for specific details.

Diagnostics
The diagnostics display will allow the user to scroll thorough eleven diagnostic points to assist with troubleshooting the system.

Message History
The user will be able to scroll through all of the messages stored in the memory of the controller with the most recent message being displayed first.

PRINT Menu
Description
All fault and alarm information is sent to the USB and Printer ports on demand, as well as the status of each output. The LMR Plus will store up to 10K events which are time and date stamped. All information can also be retrieved and displayed on the LCD display.

Saving to USB Drive
The controller will save four separate text files, one CSV file and the embedded webpage to the USB external drive. The files, at maximum size, can be saved multiple times on one 128MB USB drive.
Files to be saved are: Status Report, Diagnostics Report, Statistics Report, Configuration File and Last 10K Messages.

Print Menu
The printer menu is accessed in order to select the desired print function.
Functions include: Print Messages, Last XX Messages, Date & Time, Status Report, Diagnostics Report and Statistics Report.

Custom Messages
When this item is selected, custom messages can be cleared from memory or downloaded from the USB external drive.

Firmware Update
Firmware revisions are updated from an external USB drive. All previously programmed settings will remain intact when updating is completed. Should there be an update failure, the controller will automatically revert back to the previous version of firmware.

Embedded Webpage

General
The embedded webpage is a multifunction tool that will allow the user to view the current status of the controller as well as display all current readings, set points, and history. An external computer can be connected via the optional Ethernet port to access the page. When connected, the controller set points can be programmed via the webpage.



Multiple Pages
There are 5 viewable pages that show the Main Display, Statistics, Diagnostics, History and Programmed Set Points.

Pressure Points
The pressure reports recorded in memory can be graphed and/or sorted based on date and time.

Programmed Set Points
All of the programmed set points and their current status can be viewed via the webpage.

Custom Messages
Users can create custom messages on a computer and upload to the controller using a USB Drive (memory stick). Up to 10 custom messages of up to 100 characters each, will continuously scroll across the fourth line of the LCD display once uploaded.



Trigger Points
The message can be programmed to appear at specific trigger points such as specific date and time, specific number of operations, specific number of hours run or at any individual alarm point.
All of the trigger points can be selected as And/Or values.

Product Features

Programming Menu
General
The LMR Plus programming menu is divided into 8 different sub-menus. Each sub-menu contains information relative to it's particular function. A brief description of each sub-menu is listed below.

Language
The language sub-menu allows the user to select English, French or Spanish or Other languages to be viewed on the LCD Display. Several other languages can be uploaded into the controller. Contact the factory for details.

Regional
Regional settings include the ability to program the date by adjusting the Month, Day, Year and Day of Week. As well, the Current Time can be adjusted on the 24 hour clock.

Pressure
A variety of pressure settings can be programmed in the pressure sub-menu. These settings include disabling the pressure transducer; setting of the start point, stop point, low pressure alarm, high pressure alarm, stop mode, proof pressure switch (for foam units), low suction shutdown (low foam shutdown), pressure deviation and hourly pressure recording. Refer to the LMR Plus operation manual IM05805020K for details.

Timers
Timers in the LMR Plus that can be programmed include: Run Period Timer (RPT), RPT Start Mode, Acceleration Timer (AT), Weekly Test Timer, Fail to Start Timer (FST) and Sequential Start Timer (SST). Refer to the LMR Plus operation manual IM05805020K for details.

Alarm Set Points
There are five settable alarm points that can be programmed by the user. They include: Phase Rotation, Over Voltage (OV), Under Voltage (UV), Over Frequency (OF) and Under Frequency (UF). Refer to the LMR Plus operation manual IM05805020K for details.

Custom Inputs / Outputs
There is provision on the Power I/O Board to accept up to 9 additional inputs and 9 additional outputs. The inputs can be labeled using one of 11 pre-set input descriptions or assigned a custom description that is programmed by the user. The optional outputs can be programmed to indicate up to 25 output conditions. As well, two optional alarm LED's can be programmed for up to 12 alarm conditions. All optional inputs, outputs and LED's can be linked, as required.
Inputs can be programmed to energize the common alarm output, link to relays and optional LED's and latch until reset by the user. Outputs can be programmed for fail safe and latch until reset by the user. Optional inputs and outputs can be programmed with time delay functions.

USB External Drive
General
When using an external USB Drive, the drive should conform to the following minimum specifications:



Min: 128mb
Max: 2 Gig
FAT16 protocol
USB 1.0 or 2.0

Drain Valve Solenoid
All LMR Plus electric controllers are equipped with a drain valve solenoid used for weekly test purposes.



NEMA 2 Enclosures
All LMR Plus controllers come standard with NEMA 2 enclosures unless otherwise ordered. Available options include: NEMA 3R, 4, 4X, 12.

Emergency Start Operator
A mechanically operated emergency start handle activates the motor contactor independent of any electrical control circuits or pressure switch input.

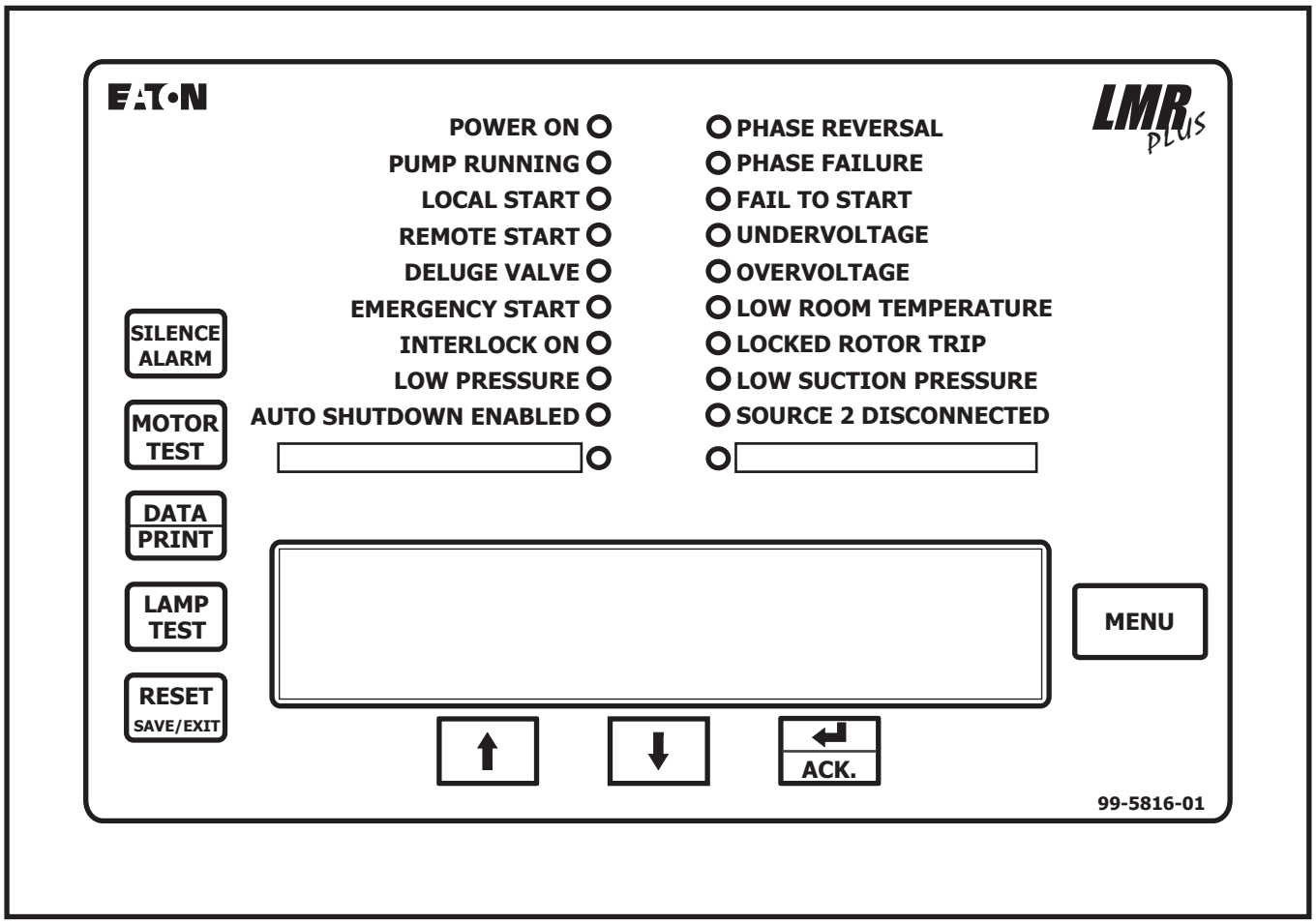


Standards & Certification

The LMR Plus Electric Fire Pump Controllers meet or exceed the requirements of Underwriters Laboratories, Underwriters Laboratories Canada, Factory Mutual, the Canadian Standards Association, New York City building code, CE mark and U.B.C / C.B.C. Seismic requirements, and are built to NFPA 20 standards.

c UL us FM APPROVED CSA N. Y. C. APPROVED CE SEISMIC QUALIFIED U.B.C. and C.B.C.

Main Display

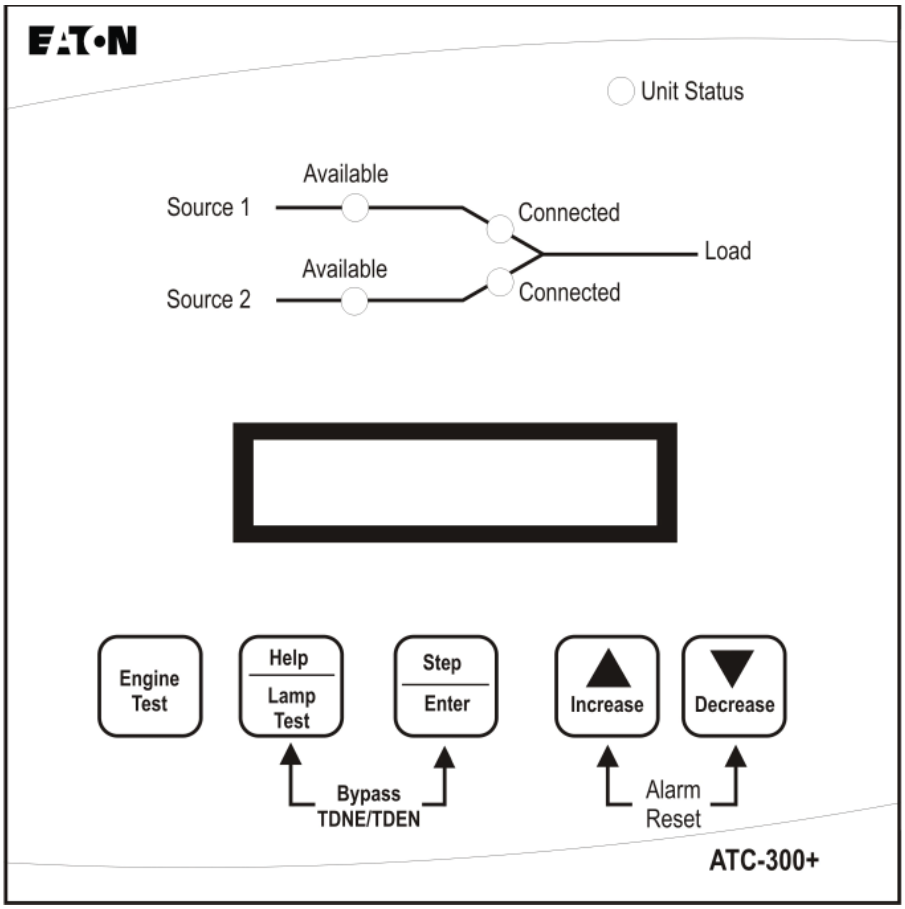


NOTES:
1. Refer to the LMR Plus technical manual for detail and setup information, as well as programming and custom labelling for Programmable LED # 1 and Programmable LED # 2.

N. Y. C. APPROVED

NOTE: As of January 1, 2009 - All Limited Service Controllers will not carry FM Approval.

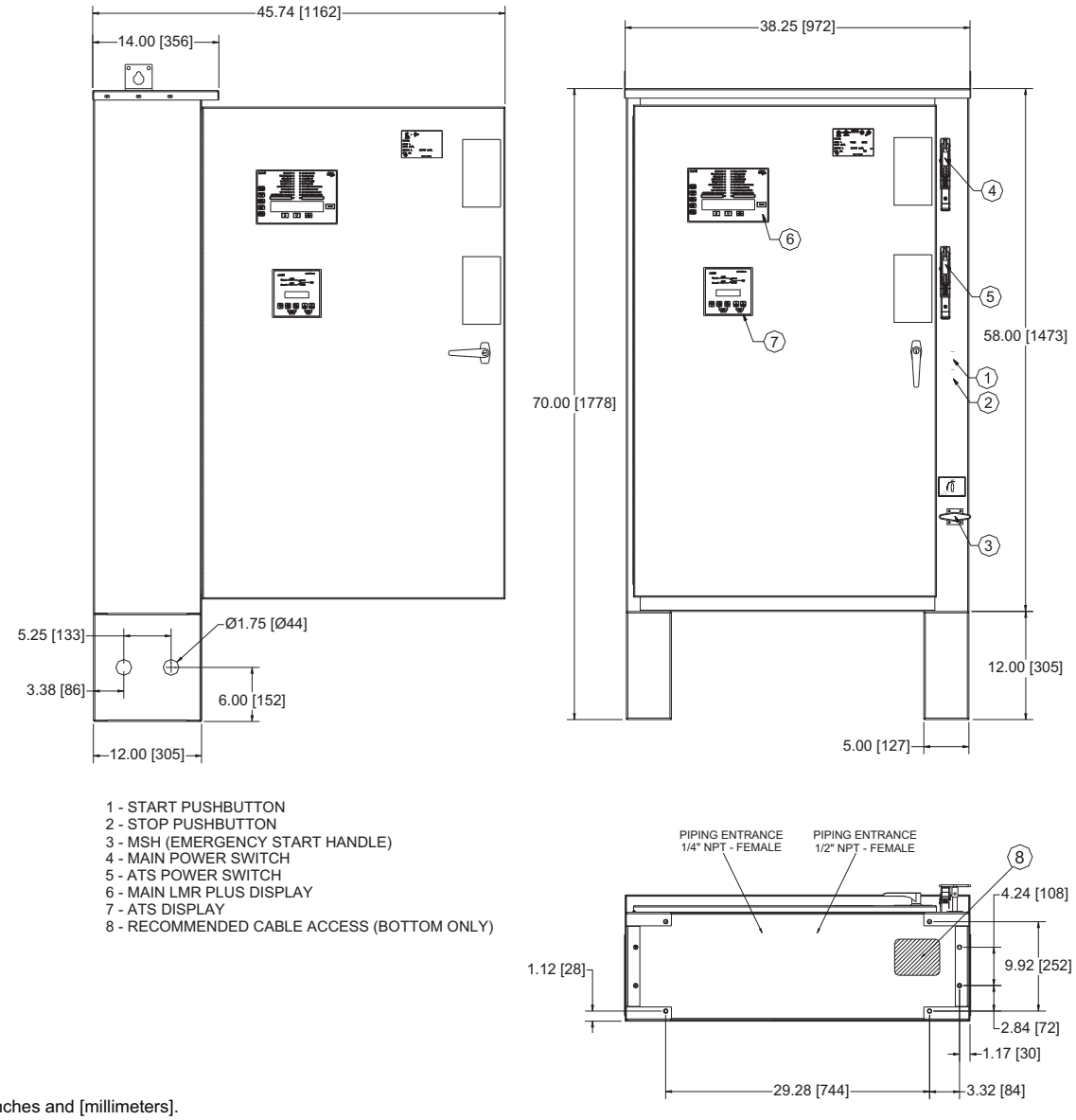
Main Display



Note: For setup and programming information, refer to the Operation Manual for the EATON ATC-300 Plus Automatic Transfer Switch Controller - IM05805022K

Dimensions

Standard Enclosure - Type NEMA 2, 3R, 4, 4X, 12



Dimensions in inches and [millimeters].

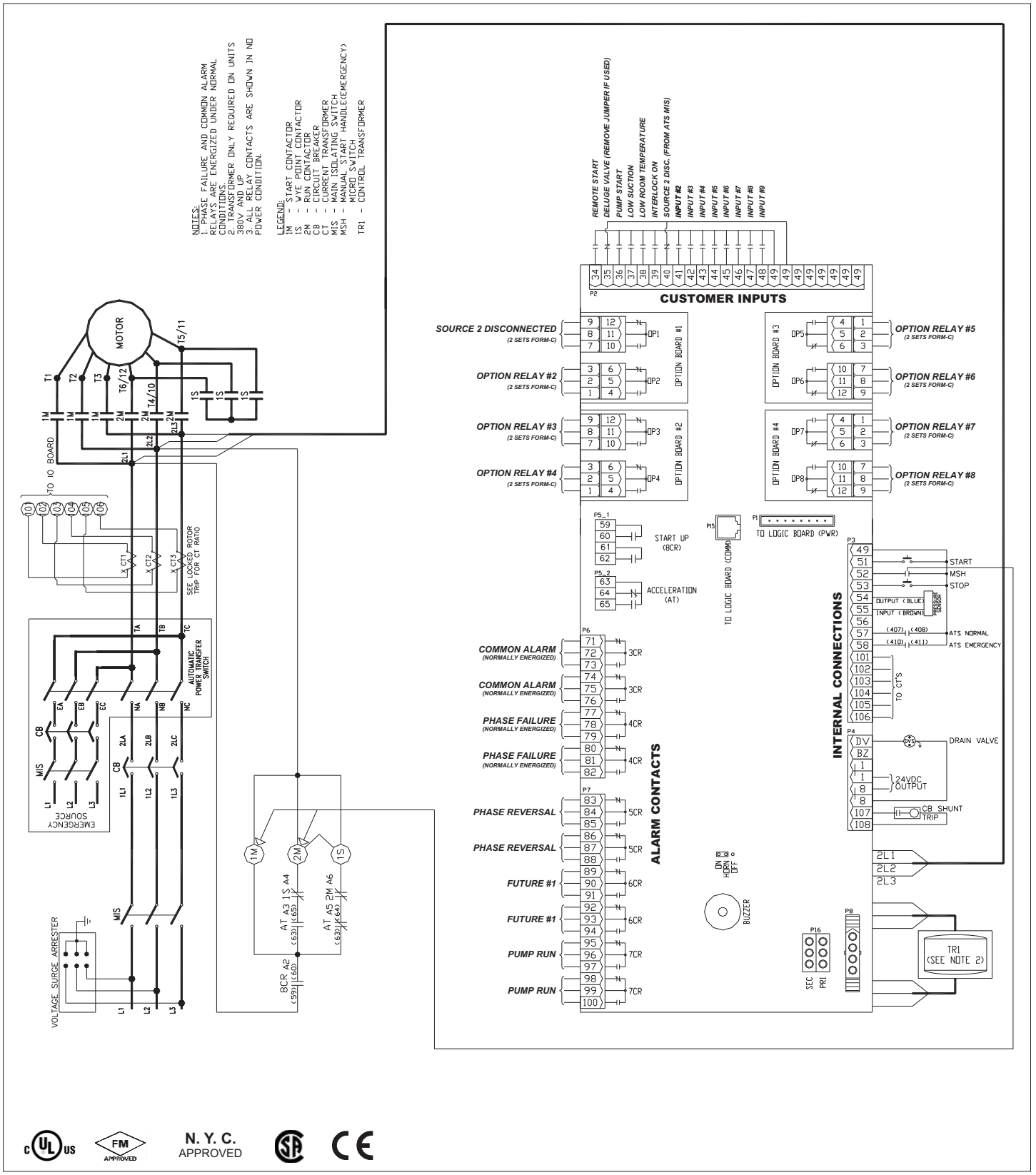
Motor Hp	Line Voltage	Withstand Rating			Approx. Weight Lbs. (Kg)
		Standard	Intermediate	High	
5 - 40	200 - 208V	100,000	150,000	200,000	425 (193)
5 - 50	220 - 240V				
5 - 75	* 380 - 415V				
→ 5 - 100	440 - 480V				
5 - 100	550 - 600V	25,000	100,000		

* Coils Available: 380V-50Hz, 380V-60Hz, 415V-50Hz, 415V-60Hz

N. Y. C. APPROVED

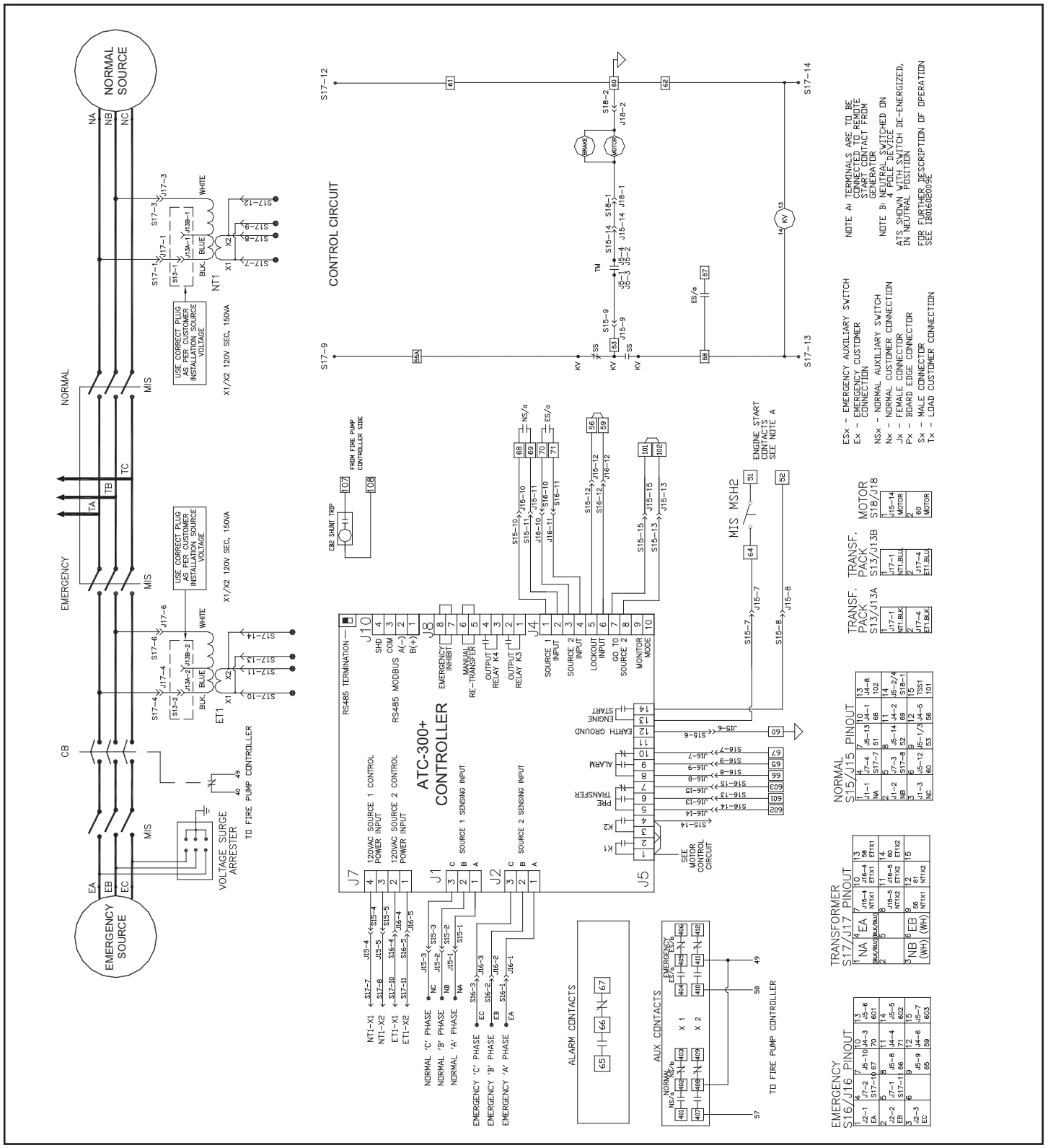
NOTES:
1. All enclosures finished in FirePump red.
2. Cable Entrance bottom only.
3. Standard Enclosure type NEMA 2.

Electrical Wiring Schematic



N. Y. C. APPROVED

Electrical Wiring Schematic



Field Connections

Line Terminals (Incoming Cables)

	Line Terminals on Main Isolation Switch (Incoming Cables)						
	LINE VOLTAGE					Qty. & Cable Sizes	Service Entrance GND. LUG Qty. & Cable Sizes
	200 - 208	220 - 240	*380 - 415	440 - 480	550 - 600		
Max HP	25	30	40	60	75	(1)#14-1/0 PER Ø (CU/AL)	(1)#14-2/0 (CU/AL)
	40	50	75	100	100	(1)#4-4/0 PER Ø (CU)	(1)#4-350MCM (CU/AL)
	75	75	150	200	200	(1)#3-350MCM PER Ø (CU/AL)	(1)#4-350MCM (CU/AL)
	100	125	200	250	300	(2)3/0-250MCM PER Ø (CU/AL)	(2)1/0-750MCM (CU/AL)
	150	200	300	400	400	(2)250-350MCM PER Ø (CU/AL)	(2)1/0-750MCM (CU/AL)
	200	-	350	450	550	(2)#1-500MCM PER Ø (CU/AL)	(2)1/0-750MCM (CU/AL)
	250	300	500	600	700	(3)3/0-400MCM PER Ø (CU/AL)	(2)1/0-750MCM (CU/AL)

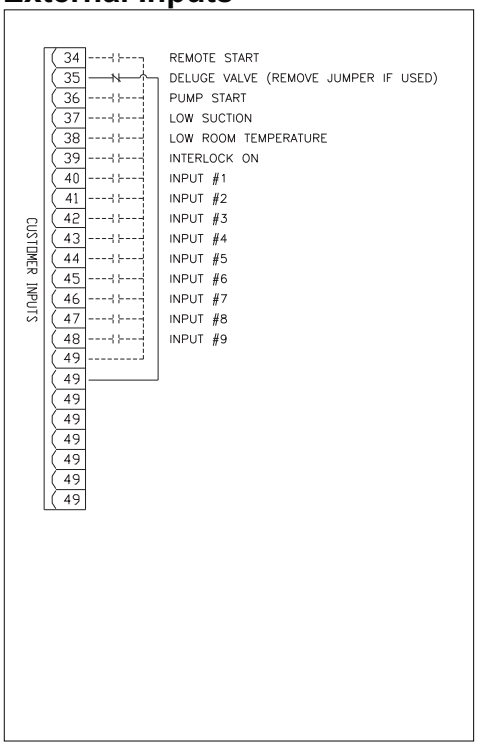
* Coils available: 380V-50Hz, 380V-60Hz, 415V-50Hz, 415V-60Hz.

Load Terminals (To Motor)

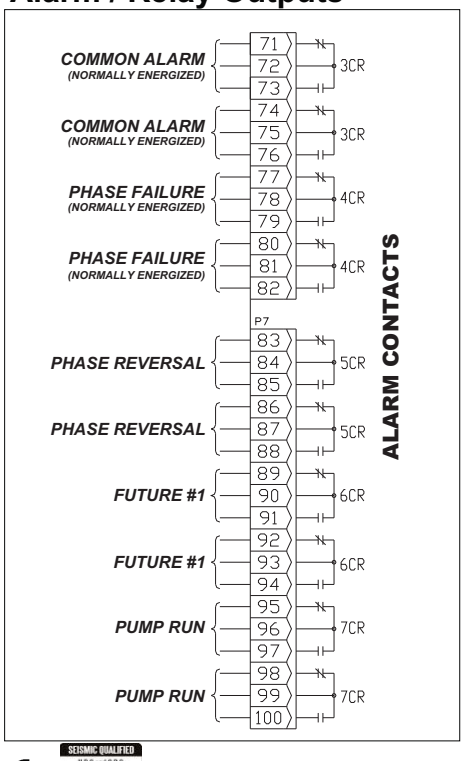
	Load Terminals (To Motor)						
	Line Voltage					Qty and Cable Sizes	
	200-208	220-240	380-415	440-480	550-600	Single Run	Double Run
Max HP	15	20	30	40	50	(1) #14 - #8 PER Ø (CU/AL)	-
	40	50	75	100	100	(1) #14 - #1 PER Ø (CU/AL)	-
	75	100	150	200	150	(1) #8 - 3/0 PER Ø (CU/AL)	-
	150	150	250	300	300	(2) #2 - 250MCM PER Ø (CU/AL)	(2) 1/0 - 250MCM PER (CU/AL)
	250	300	500	600	700	(2) 1/0 - 500MCM PER Ø (CU/AL)	(2) 1/0 - 500MCM PER (CU/AL)

For ambient temperatures above 30C (86F), the temperature rating of motor conductors is recommended to be a minimum of 90C (194F)
For Proper Cable Size Refer to National Electrical Code NFPA-70

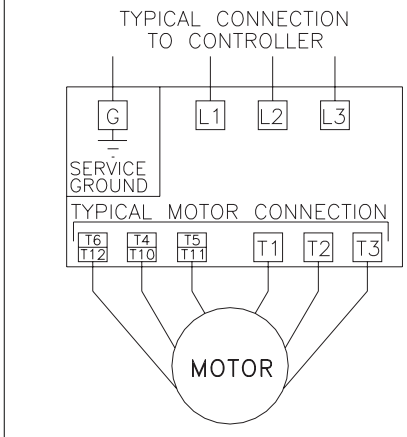
External Inputs



Alarm / Relay Outputs



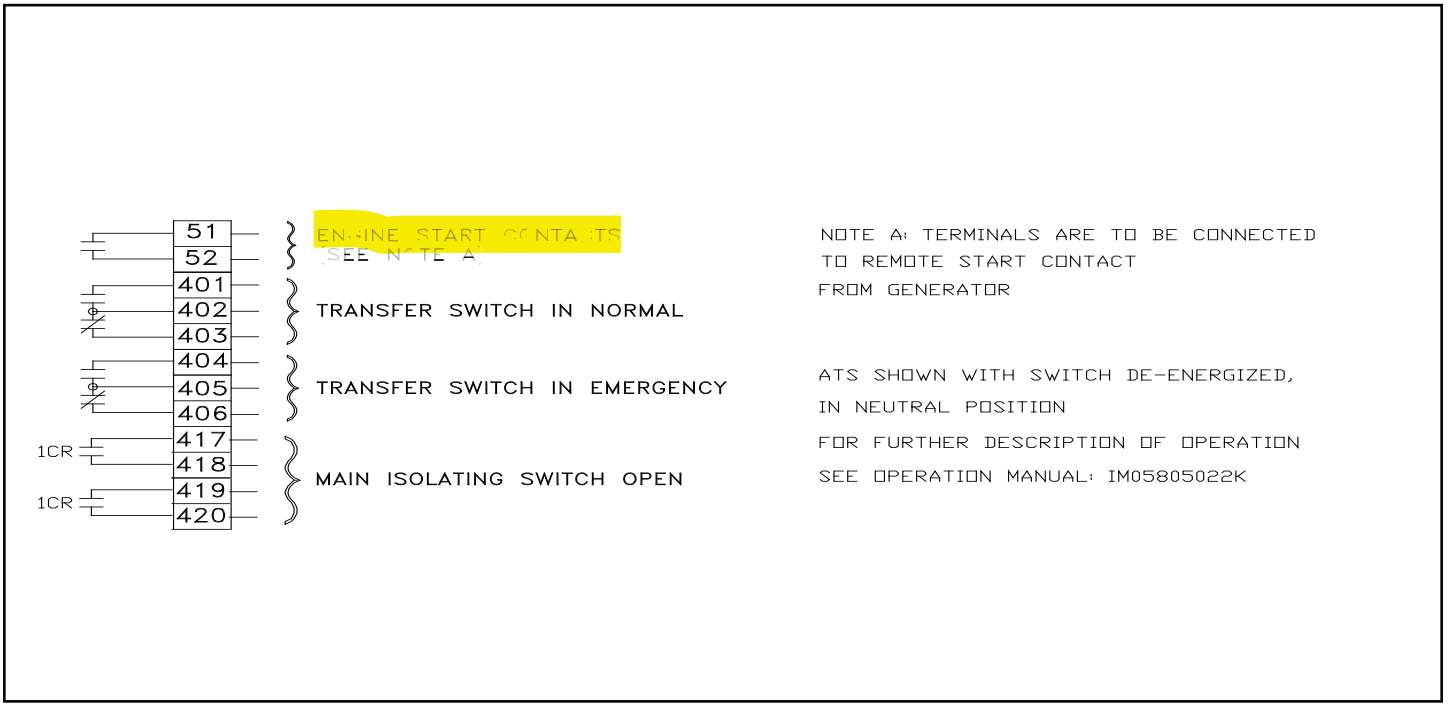
Typical Controller Connection



NOTE:
1. MOTOR CONNECTIONS VARY, PLEASE REFER TO SPECIFIC MOTOR CONNECTION DIAGRAM.
2. PLEASE OBSERVE PROPER PHASE ROTATION, A,B,C-L1,L2,L3 AS CONTROLLER IS PHASE SENSITIVE.
3. CABLE SIZE TO BE 125% OF FULL LOAD CURRENT. REFER TO WIRE SIZE TABLE IN NFPA 70.

N. Y. C. APPROVED

Electrical Wiring Schematic



Technical Data and Specifications

Line Terminals (Incoming Cables)

	Line Terminals on Main Isolation Switch (Incoming Cables)						
	LINE VOLTAGE					Qty. & Cable Sizes	Service Entrance GND. LUG Qty. & Cable Sizes
	200 - 208	220 - 240	*380 - 415	440 - 480	550 - 600		
Max HP	25	30	40	60	75	(1)#14-1/0 PER Ø (CU/AL)	(1)#14-2/0 (CU/AL)
	40	50	75	100	100	(1)#4-4/0 PER Ø (CU)	(1)#4-350MCM (CU/AL)
	75	75	150	200	200	(1)#3-350MCM PER Ø (CU/AL)	(1)#4-350MCM (CU/AL)
	100	125	200	250	300	(2)3/0-250MCM PER Ø (CU/AL)	(2)1/0-750MCM (CU/AL)
	150	200	350	400	400	(2)250-350MCM PER Ø (CU/AL)	(2)1/0-750MCM (CU/AL)

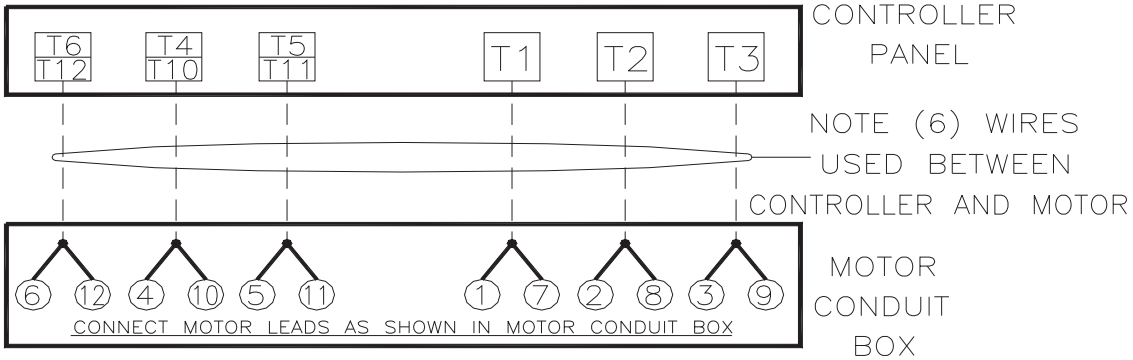
March 2010

Electric Motor Connections

NOTE: 6 motor leads required.

NOTE: Field verify motor connections.

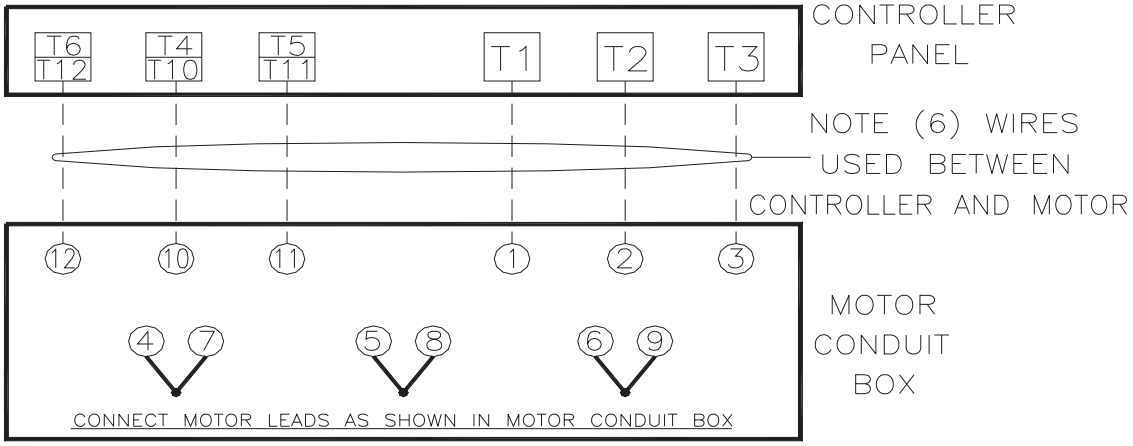
Wye-Delta Lower Nameplate Voltage



NOTE:

1. MOTOR CONNECTIONS VARY PLEASE REFER TO SPECIFIC MOTOR MANUFACTURER'S CONNECTION DIAGRAM.
2. **FOR SINGLE VOLTAGE 12 LEAD MOTORS USE LOWER VOLTAGE CONNECTION DIAGRAM**

Wye-Delta Higher Nameplate Voltage



NOTE:

1. MOTOR CONNECTIONS VARY PLEASE REFER TO SPECIFIC MOTOR MANUFACTURER'S CONNECTION DIAGRAM.
2. **FOR SINGLE VOLTAGE 12 LEAD MOTORS USE LOWER VOLTAGE CONNECTION DIAGRAM**

ITT

A-C FIRE PUMP SYSTEMS

DIMENSIONS AND ENGINEERING DATA
VERTICAL MULTI STAGE JOCKEY PUMPS
e-SV SERIES

SUPERSEDES ALL PREVIOUS ISSUES

1SV (e-SV)
60 Hz 3500 RPM

CONSTRUCTION: 304 STAINLESS STEEL
NOMINAL FLOW: 9 GPM
CAPACITIES: 2 - 12 GALLONS PER MINUTE
HEADS: 13 – 372 PSI TDH
STAGING: 2 – 30
MINIMUM FLOW: 2 GPM
MAXIMUM WORKING PRESSURE: 360 PSI (25 BAR) FOR THE ANSI FLANGE VERSION
TEMPERATURES: STANDARD LIQUID TEMPERATURES FROM -20ºF TO 250ºF (-30ºC TO 120ºC)

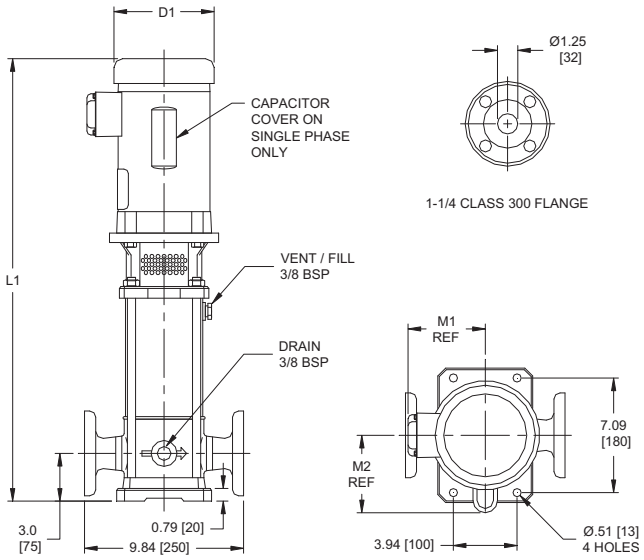
MOTOR

- STANDARD NEMA TC FRAME MOTORS IN OPEN DRIP PROOF OR TOTALLY ENCLOSED FAN COOLED ENCLOSURES.
- STANDARD VOLTAGE:
  - SINGLE PHASE: 115-208/230V UP TO 3 HP OR 208-230V FOR 5 HP
  - THREE PHASE, 2 POLE: 208-230/460V, 60 HZ UP 75 HP

COMPONENT	MATERIAL
PUMP BODY	AISI 304 STAINLESS STEEL
IMPELLER	AISI 304 STAINLESS STEEL
DIFFUSER	AISI 304 STAINLESS STEEL
CASING	AISI 316L STAINLESS STEEL
SHAFT	AISI 316 STAINLESS STEEL
ADAPTER	ASTM CLASS 35/40B CAST IRON
BASE	A384.0-F ALUMINUM
COUPLING	A384.0-F ALUMINUM
SEAL PLATE	AISI 316L STAINLESS STEEL
ELASTOMERS	VITON (OPT. EPDM)
COUPLING GUARD	AISI 304 STAINLESS STEEL
SHAFT SLEEVE AND BUSHING	TUNGSTEN CARBIDE
FILL/DRAIN PLUGS	AISI 316 STAINLESS STEEL
TIE RODS	A29 GR. 1045 CARBON STEEL / ZINC PLATED
WEAR RING	PPS
SEAL GLAND	AISI 316 STAINLESS STEEL

MECHANICAL SEAL

CODE NO.	ROTATING FACE 1	STATIONARY FACE 2	ELASTOMERS 3
0	CARBON	SILICON CARBIDE GRAPHITE FILLED	VITON



STAGE	MOTOR HP	MOTOR NEMA FRAME ODP 1Φ	ODP 3Φ	TEFC 1Φ	TEFC 3Φ	DIMENSIONS (IN.) L1 ODP 1Φ	ODP 3Φ	TEFC 1Φ	TEFC 3Φ	M (REF.)	D1 (MAX.) TEFC 1Φ	ODP 1Φ	TEFC 3Φ	ODP 3Φ	WEIGHT (LBS.) PUMP & MOTOR TEFC 1Φ	ODP 1Φ	TEFC 3Φ	ODP 3Φ
5	1/2	56C				21.68		21.81		5.19	6.19				44	44	42	42
7	3/4	56C				~~24.88~~	~~23.25~~	~~24.00~~	23.38	5.19	6.19				~~54~~	~~52~~	46	~~46~~
9	1	56C				26.33	24.83	26.86	24.96	5.74	7.19	6.19			66	58	49	49
11	1 1/2	56C				27.91		28.43	27.15	5.74	7.19	6.19			68	60	56	58
13						29.88		30.40	29.12	5.74					71	63	59	61
15						31.46		31.98	30.70	5.74					73	65	61	63
17	2	56C				33.54		34.42	33.15	5.74	7.19		6.19		88	80	70	69
19						35.12		36.00	34.73	5.74					90	82	72	71
20						35.91		36.79	35.52	6.52					91	83	73	72
22	3	56C				37.87	37.48	39.74	37.46	5.75	7.19	6.62	7.19	7.16	106	91	86	83
24						38.66	38.27	40.53	38.25	5.75					110	95	90	87
26						41.42	41.03	43.29	41.01	6.53					112	97	92	89
28						42.99	42.60	44.86	42.58	6.53					114	99	94	91
30						44.56	44.17	46.43	44.15	7.31					115	100	95	92

NOT FOR CONSTRUCTION, INSTALLATION OR APPLICATION PURPOSES UNLESS CERTIFIED.

CERTIFIED FOR:

CUSTOMER ORDER NO: **IDENTIFICATION NO:**

							FLANGES	
PUMP DATA	SIZE	MODEL	CURVE NO.	GPM	HEAD (FT)	ROTATION	SUCTION	DISCHARGE
	1.25x1.25	e1SV	7	10	65 PSI	CW	300 #	300 #
MOTOR DATA	HP	RPM	VOLTS	PHASE	HERTZ	FRAME SIZE	ENCLOSURE	
	3/4	3450	460	3	60	56C	TEFC	

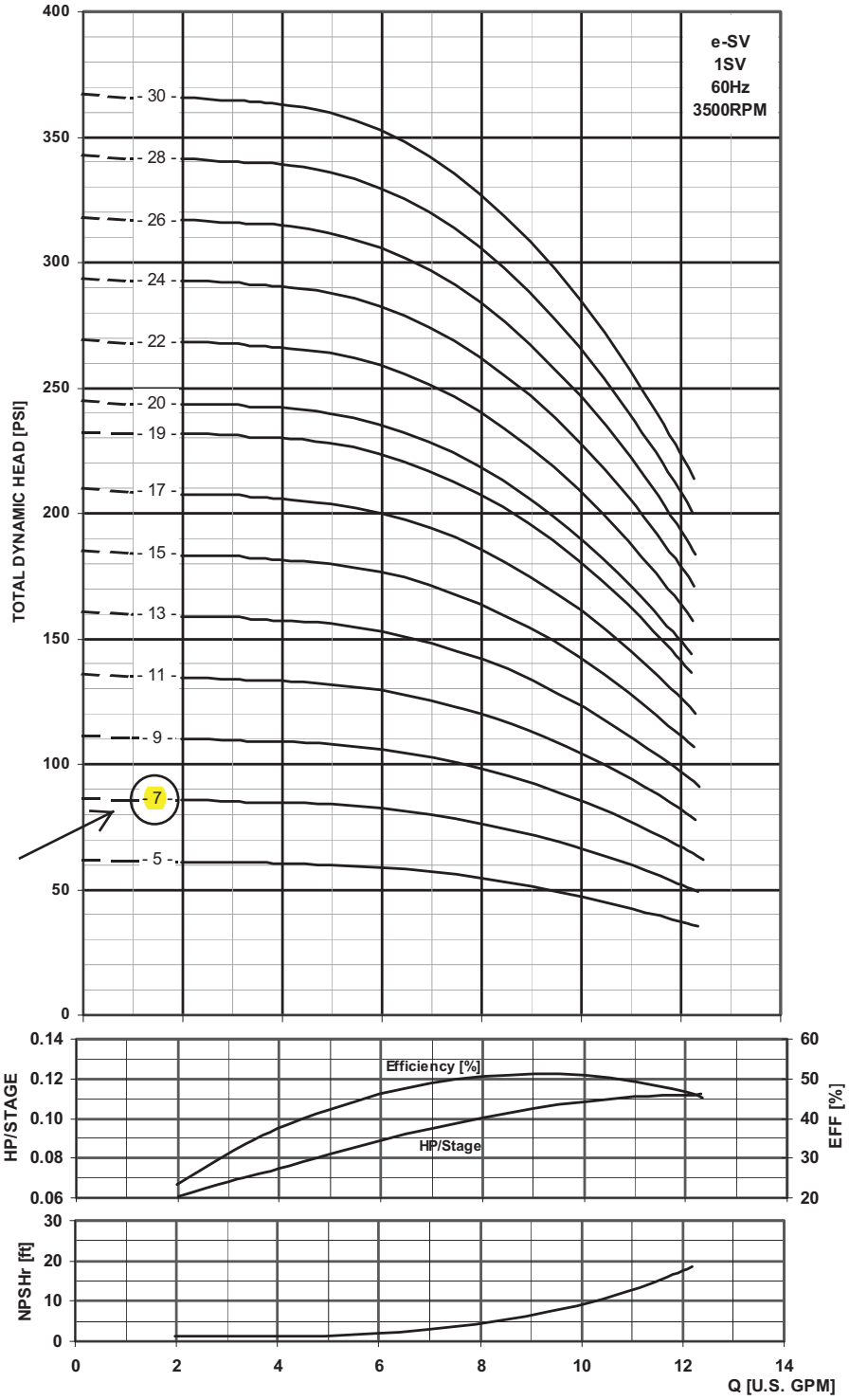
SHOP ORDER: **CERTIFIED BY:** **DATE**

ITT

A-C FIRE PUMP SYSTEMS

PERFORMANCE – CURVES
VERTICAL MULTI STAGE JOCKEY PUMPS
e-SV SERIES

SUPERSEDES ALL PREVIOUS ISSUES



213900 - Controllers for Fire-Pump Drivers

Part Number / Options Selection Guide
XTJP / XTJY Jockey Pump Controllers

XTJP
~~XTJY~~ 3/4 D L1 _____

Horsepower (KW)	
1/3	(0.25)
1/2	(0.373)
3/4	(0.56)
1	(0.75)
1.5	(1.1)
2	(1.5)
3	(2.25)
4	(2.94)
5	(3.75)
7.5	(5.6)
10	(7.5)
15	(11)
20	(15)
25	(18.6)
30	(22)
40	(30)
50	(37)

Voltage	
A =	200 - 208V 60 HZ
B =	220 - 240V 60 HZ
C =	380 - 50 / 60 HZ
D =	440 - 480V 60 HZ
E =	550 - 600V 60 HZ
F =	415 - 50 / 60 HZ
G1 =	120V Single Phase (XTJP only)
G2 =	240V Single Phase (XTJP only)

Options	
C1	Extra Contacts "Pump Run"
C2	Extra Contacts "AC Power Failure"
E1	NEMA 3R - Raintight Enclosure
E2	NEMA 4 - Watertight Enclosure
E3	NEMA 12 - Industrial Dust Tight Enclosure
E5	NEMA 4X - Stainless Steel Enclosure
E8	Tropicalization
E9	NEMA 4X - Painted Steel
E10	NEMA 4X - 316 Stainless Steel Enclosure
EX	Export Crating
POL	"Power-On" Light
PRL	"Pump Run" Light
P7	Low Suction Pressure Switch and Alarm Pilot Light
P8	Low Suction Shutdown (Requires P7)
P10	Pressure Switch (0-500psi) - Sea Water
R1	Space Heater (120 / 220V)
R2	Space Heater c/w Thermostat
R3	Space Heater c/w Humidistat
S	Sequential Start
T	Running Period Timer
Z	Elapsed Run Time Meter

Languages	
L1	English Language *
L2	French Language *
L5	Spanish Language *
L11	Turkish Language *

* Other languages available. Consult factory for details.

N. Y. C. APPROVED

XTJP / XTJY Jockey Pump Controllers

JOCKEY Touch™

Typical Jockey Pump Controller Specifications

Approvals
The Jockey Pump Controller shall meet the requirements of the latest edition of NFPA 20 as well as meeting CE mark requirements. It shall meet or exceed the requirements of UL 508 [Underwriters Laboratories (UL)] standards and be approved by [Canadian Standards Association (CSA)].

Starting Type
The controller shall be Across-the-Line ~~or Wye-Delta (Star Delta~~) type designed for full voltage starting.

Ratings
The Controller shall have a minimum withstand rating of 10,000 symmetrical amperes @ ~~[208V] [240V] [380V] [400V] [415V]~~ [480V] ~~[600V] [120V Single Phase] [240V Single Phase].~~

The horsepower rating of the controller shall not exceed 50Hp for three (3) phase units or 10Hp on single phase units.

Construction
The controller shall include a combination Circuit Breaker / Overload Motor Protector.

The motor circuit protector shall be mechanically interlocked such that the enclosure door cannot be opened when the handle is in the on position except by a tool operated defeater mechanism.

The controller manufacturer shall manufacture the contactor, motor circuit protector, touchscreen display, and enclosure. Brand-labeled components will not be accepted.

Supply Voltage
The jockey pump controller shall auto-detect three phase voltage supply from 200VAC to 600VAC, 50/60Hz and single phase from 110VAC to 240VAC, 50/60Hz, without the use of a control transformer.

Coil Voltages
The jockey pump controller shall have the following available coil voltages
120VAC 50/60 Hz or 24VDC

Enclosure
The controller shall be housed in a NEMA Type 2 (IEC IP11) drip-proof, powder baked finish, freestanding enclosure.

Optional Enclosures
1. NEMA 3R (IEC IP14) rain-tight enclosure.
2. NEMA 4 (IEC IP66) watertight enclosure.
3. NEMA 4X (IEC IP66) watertight 304 stainless steel enclosure.
4. NEMA 4X (IEC IP66) watertight 316 stainless steel enclosure.
5. NEMA 4X (IEC IP66) watertight corrosion resistant enclosure.
6. NEMA 12 (IEC IP52) dust-tight enclosure.

Languages
The controller shall be available in a variety of languages including, but not limited to:
English, French, Spanish, Portuguese, Turkish.

Touchscreen Display
The controller shall be supplied with a color touchscreen display that shall indicate the following: Supply Voltage on all phases, Current Pressure, Start Pressure and Stop Pressure.

The touchscreen display shall be supplied with a solid-state 4-20mA pressure sensor. The pressure Start and Stop points shall be adjustable in increments of one (1) PSI or 0.1 BAR.

The touchscreen display shall be a door-mount type that permits exterior programming with the controller door secured.

Options
The jockey pump controller shall have provision to be supplied with the following options:

C1 Extra Contacts " Pump Run"
C2 Extra Contacts "AC Power Failure"
CX Extra Contacts (One Form-C; Specify Function)
E1 NEMA 3R – Raintight Enclosure
E2 NEMA 4 – Watertight Enclosure
E3 NEMA 12 – Industrial Dust Tight Enclosure
E5 NEMA 4X – 304 Stainless Steel Enclosure
E8 Tropicalization
E9 NEMA 4X - Painted Steel
E10 NEMA 4X - 316 Stainless Steel Enclosure
EX Export Crating
FTS Extra Contacts "Fail to Start"
LX Virtual LED (Specify Description)
POL "Power On" Virtual LED
PRL "Pump Run" Virtual LED
P7 Low Suction Pressure Switch and Alarm Virtual LED
P8 Low Suction Shutdown (Requires P7)
P10 Pressure Transducer – Sea Water
R1 Space Heater (120 / 220V)
R2 Space Heater c/w Thermostat
R3 Space Heater c/w Humidistat

Manufacturer
The controller shall be of the XTJP Across-the-Line or XTJY Wye Delta (Star-Delta) type as manufactured by EATON.

Jockey Pump Controllers

JOCKEY Touch™

Microprocessor Based with Color Touchscreen



Product Description

ACROSS THE LINE

JOCKEY PUMP CONTROLLERS

The JOCKEY Touch - Jockey Pump Controllers operate across-the-line. Full voltage is applied to the motor for starting by the use of a single motor starter. Starting inrush current is approximately 600% of rated full load amperes.

WYE-DELTA (Star-Delta)

JOCKEY PUMP CONTROLLERS

When six or twelve-lead delta connected jockey pump motors are started wye (star) connected, approximately 58% of line voltage is applied to each winding. The motor develops 33% of full-voltage starting torque and draws 33% of normal locked-rotor current from the line. After an adjustable time delay (during which the motor accelerates), it is reconnected for normal operation.

Product Features

Combination Motor Controllers

All JOCKEY Touch controllers are supplied with EATON combination motor controllers, which combine the circuit breaker and overload in one device.



Sealed Rotary Handle Mechanism

The rotary handle mechanism can be padlocked in the OFF position.

XT Power Controls

The JOCKEY Touch - Jockey Pump Controllers incorporate Eaton's XT Power Controls which are designed for the global marketplace. The XT controls carry global ratings, are small in size and are available in a wide variety of operating voltages. They are easy to install and maintain, due to their modular, plug-in design.

Universal Supply Voltage

The controllers will auto-detect three phase voltage supply from 200VAC to 600VAC, 50/60Hz and single phase from 110VAC to 240VAC, 50/60Hz, without the use of a control transformer.

NEMA 2 Enclosures

Enclosures have an oven baked powder paint finish and are supplied with NEMA 2 rating, unless otherwise ordered. Available options include: NEMA 3R, 4, 4X, 12.

Programmable Functions

Inputs, Outputs, Timers and Virtual LED's are programmable via the touchscreen display.

Starting Methods

There are four methods of starting the controller: Auto, Hand, Remote Start and Pump Start.

Diagnostics / Statistics

Eight diagnostics and seven statistics parameters can be monitored.

Alarm Setpoints

Four alarm setpoints can be programmed from the Alarm Setpoints sub-menu.

Color Touchscreen Display

The JOCKEY Touch - Jockey Pump Controllers are supplied with a microprocessor based, color touchscreen. The touchscreen display allows the user to monitor and program functions and values.
Pressure input is provided by a 4-20mA pressure sensor.



Technical Data

ACROSS-THE-LINE (Direct On Line)

JOCKEY PUMP CONTROLLERS

Line Voltage						
200-208V	220-240V	380-415V	440-480V	550-600V	120V-1Ph	240V-1Ph
Motor Horsepower						
1/3-20Hp	1/3-20Hp	1/3-40Hp	1/3-50Hp	1/3-50Hp	1/3-2Hp	1/3-5Hp

WYE-DELTA (Star-Delta)

JOCKEY PUMP CONTROLLERS

Line Voltage				
200-208V	220-240V	380-415V	440-480V	550-600V
Motor Horsepower				
1/3-40Hp (0.74-29.42Kw)	1/3-40Hp (0.74-29.42Kw)	1/3-50Hp (0.74-36.78Kw)	1/3-50Hp (0.74-36.78Kw)	1/3-50Hp (0.74-36.78Kw)

Standards & Certification

The JOCKEY Touch - Jockey Pump Controllers meet the requirements of the latest edition of NFPA 20 as well as meeting CE mark requirements. They meet or exceed the requirements of UL 508 [Underwriters Laboratories (UL)] and are approved by [Canadian Standards Association (CSA)].

JOCKEY Touch™

Microprocessor - Color Touchscreen Display

Supply Voltage
3 phase – 200VAC to 600VAC, 50/60Hz
1 phase – 110VAC to 240VAC, 50/60Hz
True RMS measurement of 3 phase voltage inputs

Power Supply Output
Two 24VDC outputs

1	Power the pressure sensor
2	Energize the contactor coil

Ratings
NEMA 4 / 4X

Memory
Programmed settings saved in Non Volatile memory

Battery Backup
Real Time Clock kept intact during power failures

Ambient Temperature Rating
0C to 55C

Languages *
English
French
Spanish
Portuguese
Turkish
* Other languages available - consult factory for details

USB Port
Download Message History
Upload Firmware Updates

Programmable Inputs (2)
Each input can be programmed for one of seven different functions.

1	Interlock
2	Motor Overload
3	Fail to Start
4	Remote Start
5	Pump Start
6	Input = Output
7	Disabled

Programmable Outputs (2)
Each output can be programmed for one of twenty three different functions.

1	Power On	13	Overvoltage
2	Pump Run	14	Transducer Failure
3	Hand Mode	15	Motor Overload
4	Off Mode	16	Common Alarm
5	Auto Mode	17	Acceleration Timer
6	Low Pressure Alarm	18	Remote Start
7	High Pressure Alarm	19	Pump Start
8	Below Start Point	20	Interlock On
9	Phase Reversal	21	Input #1
10	Phase Failure	22	Input # 2
11	Fail to Start	23	Disabled
12	Undervoltage		

Timers (5)
Programmable Types

1	Minimum Run Timer
2	Sequential Start Timer
3	Pump Run Restart Timer
4	Acceleration Timer
5	Fail to Start Timer

Virtual LED's (2)
Programmable Functions (22)

1	Power On	12	Undervoltage
2	Pump Run	13	Overvoltage
3	Hand Mode	14	Transducer Failure
4	Off Mode	15	Motor Overload
5	Auto Mode	16	Common Alarm
6	Low Pressure Alarm	17	Remote Start
7	High Pressure Alarm	18	Pump Start
8	Below Start Point	19	Interlock On
9	Phase Reversal	20	Input #1
10	Phase Failure	21	Input # 2
11	Fail to Start	22	Disabled

Programmable Indication (5)

1	Red
2	Orange
3	Yellow
4	Green
5	Blue

Operation
Starting Methods (4)

1	Auto
2	Hand
3	Remote Start
4	Pump Start

Alarm Set Points (4)

1	Phase Reversal
2	Phase Failure
3	Over Voltage Alarm
4	Under Voltage Alarm

Message History (10K)
Messages time and date stamped

Diagnostics (8)

1	Firmware Version
2	Transducer Output
3	Transducer Current 1
4	Transducer Current 2
5	Input #1 Status
6	Input #2 Status
7	Relay #1 Status
8	Relay #2 Status
9	24VDC Output

Statistics (7)

1	Total Powered Time
2	Pump Run Total Time
3	Motor Starts
4	Minimum Voltage
5	Maximum Voltage
6	Minimum Pressure
7	Maximum Pressure

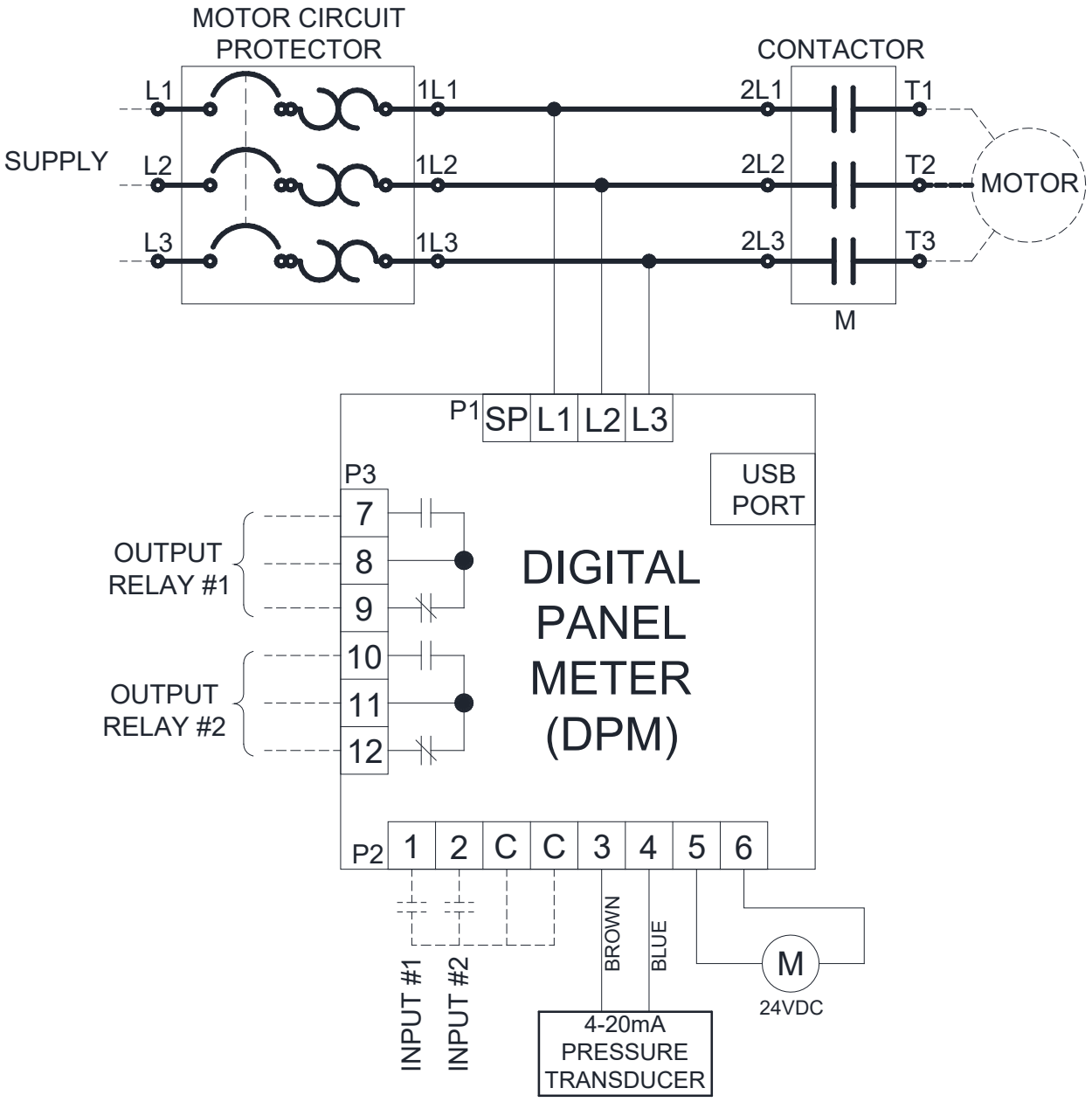


Powering Business Worldwide

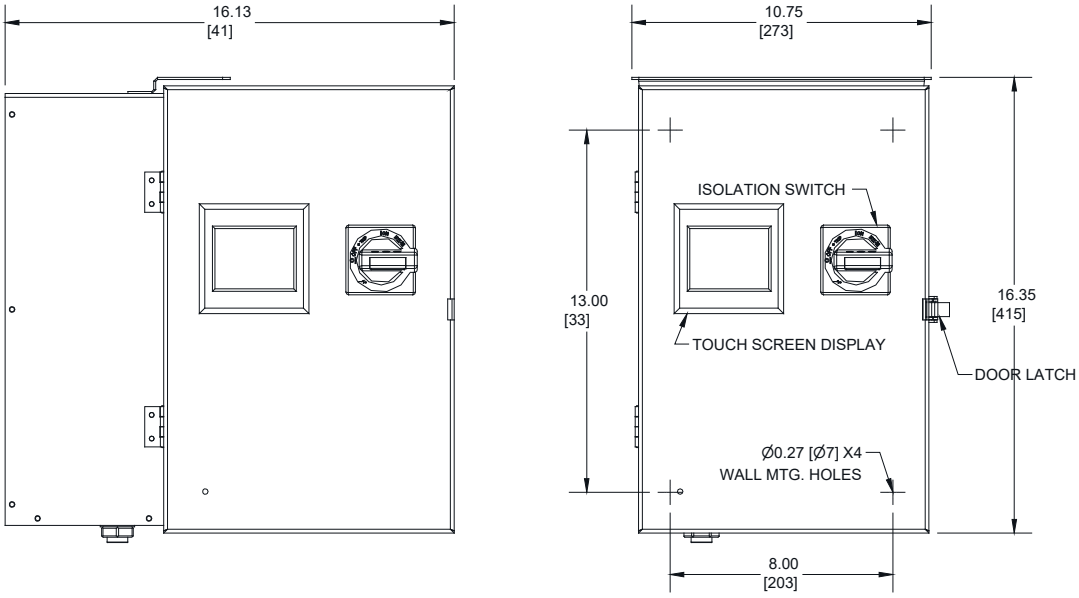
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Calgary, AB T3N0A4
Canada
www.chfire.com

JOCKEY Touch™



JOCKEY Touch™



200-208V		220-240V		380-415V		440-480V		550-600V	
Motor Hp	Withstand Rating (kA)	Motor Hp	Withstand Rating (kA)	Motor Hp	Withstand Rating (kA)	Motor Hp	Withstand Rating (kA)	Motor Hp	Withstand Rating (kA)
0.33 - 0.75	50	0.33 - 0.75	50	0.33 - 1.5	50	0.33 - 2	50	0.33 - 7.5	50
1 - 2	65	1 - 3	65	2 - 5	65	3 - 5	65	10 - 30	10 *
3 - 4	42	4 - 5	42	7.5	42	7.5 - 10	42		
5 - 10	18	7.5 - 10	18	10 - 15	18	15 - 20	18		

120V 1ph		208V 1ph		240V 1ph		Approx. Weight
Motor Hp	Withstand Rating (kA)	Motor Hp	Withstand Rating (kA)	Motor Hp	Withstand Rating (kA)	Lbs (Kg)
0.33 - 0.5	65	0.33 - 1	65	0.33	50	18 (8)
0.75 - 1	42	1.5 - 2	42	0.5 - 1.5	65	
1.5 - 2	18	3 - 4	18	2	42	
				3 - 5	18	

NOTES:
1. * Upstream circuit breaker required to maintain kA rating.
2. All enclosures finished in FirePump red.
3. Cable Entrance either top or bottom.
4. Standard Enclosure type NEMA 2

POTTER ROEMER FIRE PRO™
Member of Morris Group International™

CONNECTIONS (FDC)
FLUSH FIRE PUMP TEXT
CONNECTIONS AND VARIATIONS

Model/Series No.
5862-5865 SERIES

SPECIFICATIONS

PUMP TEST CONNECTION

Cast brass body with end inlet, size and number of outlets as selected by model number. Brass plate lettered “PUMP TEST CONNECTION,” Brass NRS hose gate valves with loose bonnets, 3” female, NPT inlet x 2-1/2” Male hose thread outlet, with caps and chains.

VARIATIONS

-1 - Ductile Iron Body with red glossy polyester coating. Inlet size, location and number of outlets as selected by model number and as indicated on Variation Chart.

-2, -3 - Brass or ductile iron body. Inlet size, location and number of outlets as selected by model number and as indicated on Variation Chart.

-4, -5 - Square four way brass or ductile iron body. Back or angle inlet as selected and indicated on Variation Chart.

-6 - Male 2-1/2” hose thread snoots with cap and chain instead of affixed valves. Number of outlets as selected by model number and as indicated on Variation Chart.

-7 - Male 2-1/2” hose thread snoots, caps and chains, and removable swivel hose gate valves.

MODEL SELECTION

- ❑ **5862**
- ❑ **5863**
- ☑ **5864** 6" X 4 Way
- ❑ **5865**

VARIATION SELECTION

BODY MATERIAL:

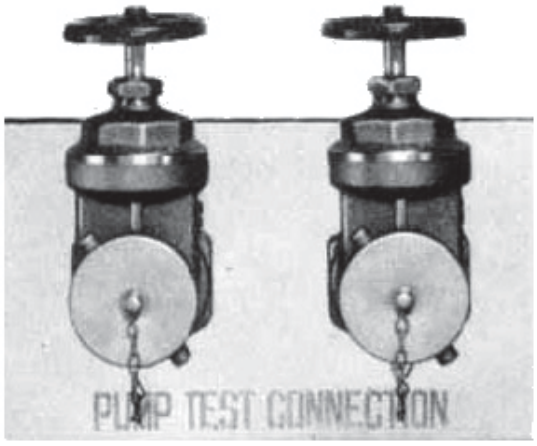
- ❑ **-1** Ductile Iron
- ☑ **-1.5** Steel

BODY INLET: Confirm Inlet Style

- ❑ **-2** Back
- ☑ **-3** Angle
- ❑ **-4** Square Back, Brass or Ductile
- ❑ **-5** Square Angle, Brass or Ductile

~~OUTLETS~~:

- ❑ **-6** ~~Male Snoots, Caps, and Chains~~
- ❑ **-7** ~~Male Snoots, Caps, and Chains and Removable Swivel Hose Gate Valves (Valves normally furnished rough brass)~~



MODEL 5862 (Shown)

PRODUCT OPTIONS

FINISHES:

- ❑ -B Polished Brass
- ❑ -C Polished Chrome Trim, Rough Chrome Valves
- ☑ -D Polished Chrome Plated

THREADS:

- ☑ N.S.T.
- ❑ Other _____

*Call Potter Roemer - Fire Pro for current listings and approvals. Dimensions are subject to manufacturer’s tolerance and may change without notice. Potter Roemer-Fire Pro assumes no responsibility for use of void or superceded data. © Copyright Potter Roemer- Fire Pro, Member of Morris Group International ™ Please visit **potterroemer.com** for most current specifications.*

MEMBERSHIP

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Dallas (866) 644-3473

www.potterroemer.com

POTTER ROEMER FIRE PRO™
Member of Morris Group International™

CONNECTIONS (FDC)
FLUSH FIRE PUMP TEXT
CONNECTIONS AND VARIATIONS

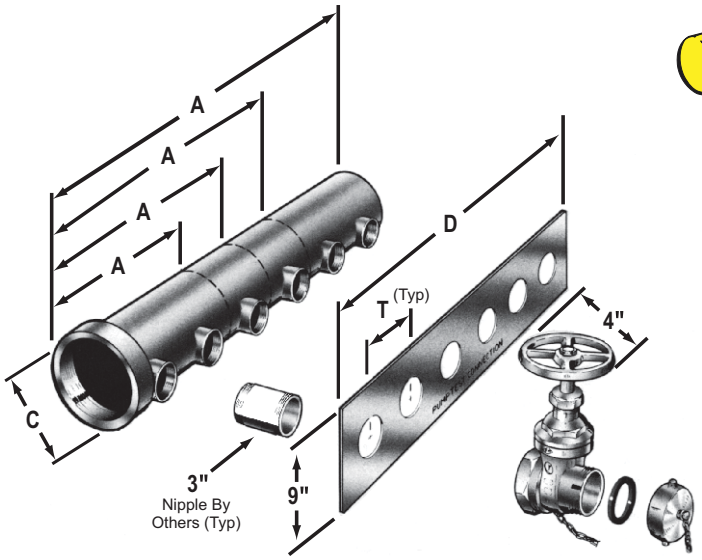
Model/Series No.
5862-5865 SERIES

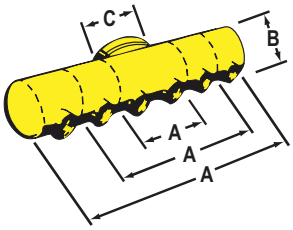
AVAILABLE VARIATIONS BY MODEL NUMBER

Suffix No.	Model No.			
	5862	5863	5864	5865
Body Material				
-1 Ductile	Yes	No	Yes	No
Body Inlet				
-2 Back	Yes	No	Yes	Yes
-3 Angle	Yes	No	Yes	Yes
-4 Sq. Back, Brass or Ductile	No	No	Yes	No
-5 Sq. Angle, Brass or Ductile	No	No	Yes	No
Outlets				
-6 Male Snoots, Caps, and Chains	Yes	Yes	Yes	Yes
-7 Male Snoots, Caps and Chains, and Removable Swivel Hose Gate Valves	Yes	Yes	Yes	Yes

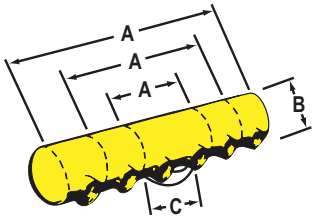
MODEL DIMENSIONS

Model No.	Pump Size G.P.M.	Inlet Size	Number Outlets	A	B	C	D
5862	500	4"	2	15-1/4	5-1/4	6	16
5863	750	6"	3	22-1/4	6-1/4	6-3/4	23
5864	1000	6"	4	28-3/4	7-3/4	7-3/4	30
5865	2000	8"	6	43	7-3/4	9-3/4	44

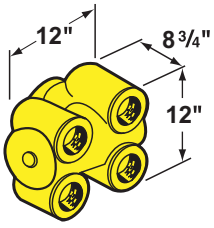




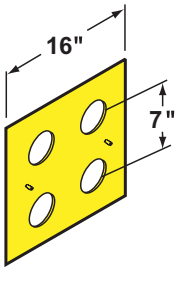
-2 BACK INLET

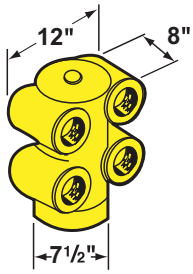


-3 ANGLE INLET



-4 SQUARE BODY BACK INLET





-5 SQUARE BODY ANGLE INLET

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5862-5865 SERIES Date: 07/09/15

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www.potterroemer.com

55L-60 — MODEL —

Pressure Relief Valve/ Pump Casing Relief Valve



Available in a wide range of materials including nickel aluminum bronze and stainless steel. Certified to meet low lead requirements

- **UL Listed**
- **Factory Mutual Approved**
- **UL Listed/FM Approved for use as a fire pump casing relief valve**
- **Direct Acting - Precise Pressure Control**
- **Positive Dependable Opening**
- **Drip Tight Closure**
- **No Packing Glands or Stuffing Boxes**
- **Sensitive to Small Pressure Variations**

The Cla-Val Model 55L-60 **(UL Listed, FM approved)** Pressure Relief Valve is a direct-acting, spring loaded, diaphragm type relief valve. The valve may be installed in any position and will open and close within very close pressure limits. The bottom plug may be removed and installed in the inlet to convert it to an angle pattern flow path.

The Model 55L-60 is normally held closed by the force of the compression spring above the diaphragm. When the controlling pressure applied under the diaphragm exceeds the spring setting, the disc is lifted off its seat, permitting flow through the control. When control pressure drops below the spring setting, the spring forces the control back to its normally closed position. The controlling pressure is applied to the chamber beneath the diaphragm through an internal passage. Gauge Port is provided for accurate pressure setting.

Pressure adjustment is done by turning the adjusting screw to vary the spring load on the diaphragm. The 55L-60 is available in pressure ranges suited to agency approval tests. To prevent tampering, the adjustment cap can be wire sealed by using the lock wire holes provided in the cap and cover.

UL LISTED

FM APPROVED

Fire Protection System Service
The **Model 55L-60** is typically used in a fire protection system to trim water pressure, thus preventing pressure build-up whenever line pressure exceeds the setting of the spring.

The 55L-60 will relieve excess pressure to atmosphere to prevent damage to the distribution network.

NOTE: Model 55L-60 is not suitable for discharging the full-rated pump capacity of a fire pump. See Model 50B-4KG1 Fire Pump Relief Valve for such applications.

Typical Application for Fresh Water or Seawater Service







Fire Pump Casing Relief Valve

Specifications

Size	3/4" Threaded NPT
Temperature Range	Water, Air: to 180°F Max.
Materials	
Body & Cover:	Cast Bronze UNS C87850 Stainless Steel ASTM A743-CF-16Fa
Trim:	303 Stainless Steel
Rubber:	Buna-N® Synthetic Rubber
Pressure Ratings	Cast Bronze 400 psi Max. Stainless Steel 400 psi Max.
Other Materials	Available on special order
Adjustment Ranges	
UL Listed & FM Approved	0 to 75 psi 20 to 200 psi 100 to 300 psi
UL Listed	20 to 175 psi

UL Listed/FM Approved 55L-60 Range psi	Approximate Increase for Each Clockwise Turn of Adjusting Screw
0 to 75	8.5 psi
20 to 200	28.0 psi
100 to 300	18.0 psi

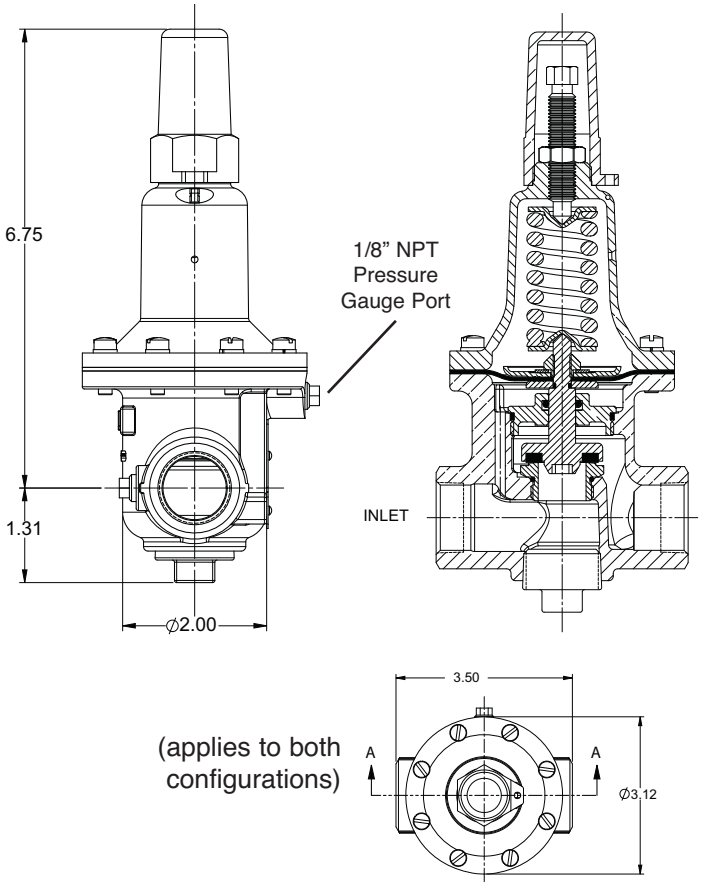
Pressure Drop Chart (Full Open Valve)

Valve Size	C_V Factor	Flow of Water - Gallons Per Minute				
		5	10	16	20	30
1/2"	6	0.7	2.7	6	11	--
3/4"	8.5	0.3	1.4	3.1	5.5	12.2

When Ordering, Please Specify

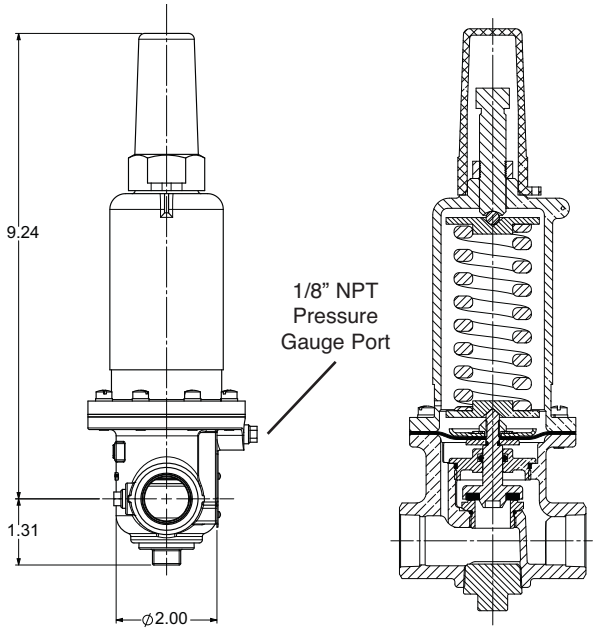
1. Catalog No. 55L-60
2. Valve Size
3. Adjustment Range Desired
4. Optional Materials

Dimensions: 0 to 75 and 20 to 200 psi design



(applies to both configurations)

Dimensions: 100 - 300 psi design



CLA-VAL

PO Box 1325 Newport Beach CA 92659-0325

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Fax: 905-563-4040
E-mail sales@cla-val.ca

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Lausanne, Switzerland
Phone: 41-21-643-15-55
Fax: 41-21-643-15-50
E-mail: cla-val@cla-val.ch

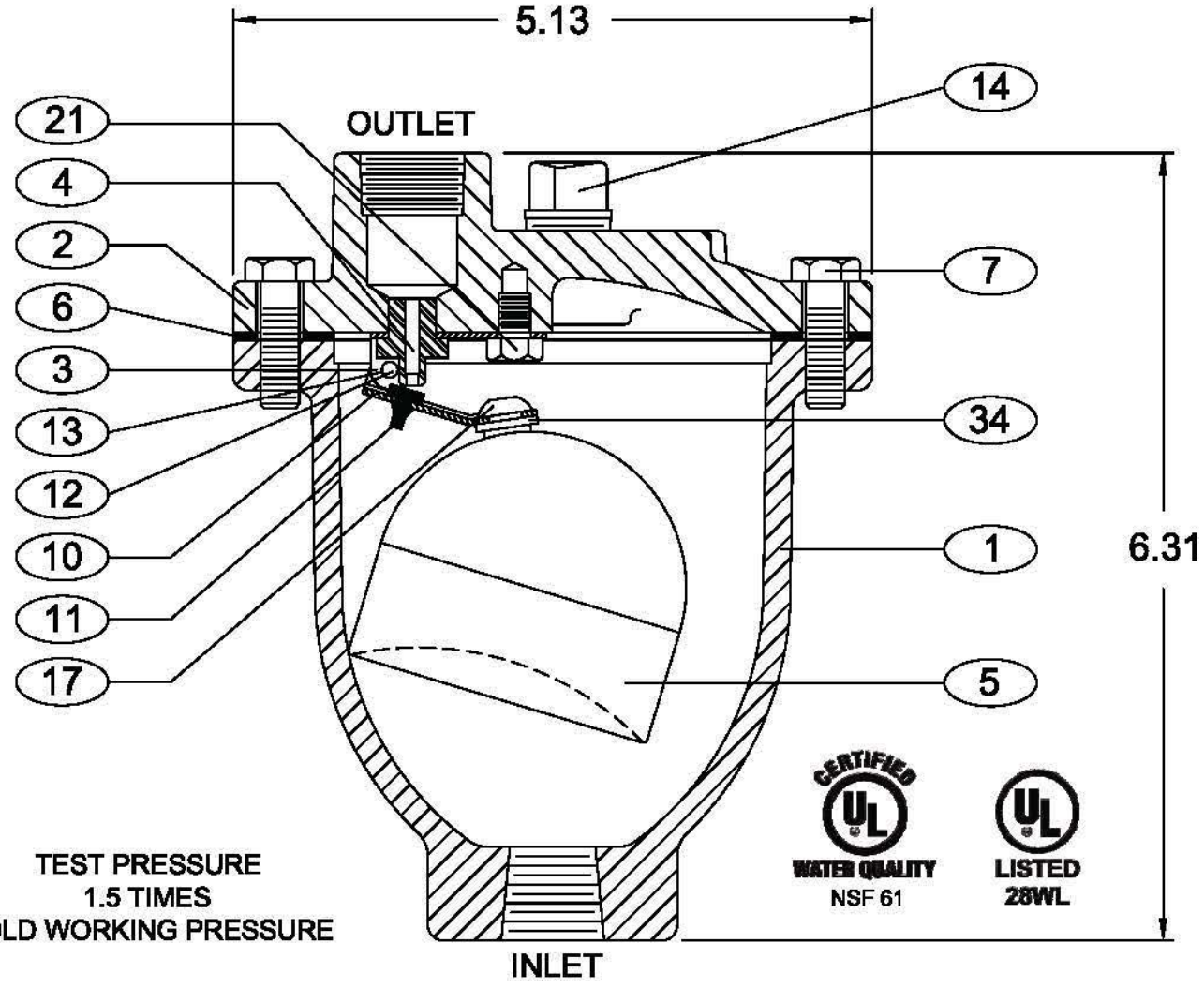
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Kent TN1 2 DH England
Phone: 44-1892-514-400
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Porte du Grand Lyon 1
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E-mail: cla-val@cla-val.fr

CLA-VAL PACIFIC
45 Kennaway Road
Woolston, Christchurch, 8023
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Fax: 64-39644786
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E-55L-60 (R-05/2014)

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TEST PRESSURE
1.5 TIMES
COLD WORKING PRESSURE

CERTIFIED WATER QUALITY NSF 61

LISTED 28WL

SEE DRAWING NO. VM-22-M FOR STANDARD MATERIALS OF CONSTRUCTION

VALVE SIZE	MODEL NUMBER	INLET SIZE	OUTLET SIZE	MAX. W.P. P.S.I.	ORIFICE SIZE
1/2" - 3/4"	22.4	3/4" NPT	1/2" NPT	175	3/32"
1"	22.3	1" NPT	1/2" NPT	175	3/32"
1/2"	22.7	1/2" NPT	1/2" NPT	300	1/16"
→ 1/2"-3/4"-1"	22.9	1" NPT	1/2" NPT	300	1/16"

FM APPROVED

WHEN MULTIPLE SIZE INLETS ARE INDICATED FOR A SPECIFIC MODEL NUMBER, THE VALVE IS THREADED FOR THE LARGEST SIZE INDICATED AND A REDUCER BUSHING IS PROVIDED FOR THE SMALLER SIZES.

1 BODY
2 COVER
3 LEVER FRAME
4 SEAT
5 FLOAT
6 GASKET
7 COVER BOLT
10 FLOAT ARM
11 ORIFICE BUTTON
12 PIVOT PIN
13 RETAINING RING (NOT SHOWN)
14 PIPE PLUG
17 FLOAT RETAINER
21 LOCATOR
34 LOCK WASHER

AIR RELEASE VALVE

DATE 1-18-11

DRWG. NO. VMC-22

VAL-MATIC VALVE AND MANUFACTURING CORP.

Allenco Series AG-1000L

Liquid Filled Fire Pump Suction and Discharge Gauges

Our Allenco Series AG-1000L-FP liquid filled gauges were specifically designed for use with fire pumps. These high quality gauges are 1% accurate over the entire gauge range and are manufactured to conform to both ANSI B40.1 Grade 1A standards and NFPA 20-2013(14.2.6.1.2.2) as it relates to gauge accuracy requirements for field acceptance testing.

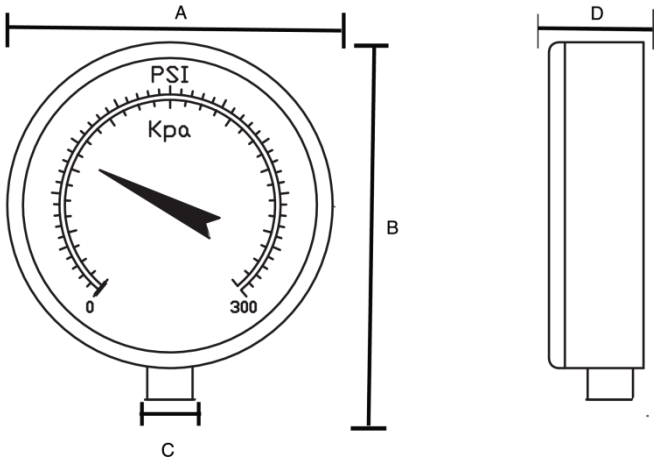


The standard glycerin filling helps dampen the effects of pump vibration while also lubricating the gauge movement which helps to extend the gauge life. Gauges are labeled on the dial face as "Fire Pump Suction" for the 30”/0/150 PSI range and "Fire Pump Discharge" for other available ranges.



Specifications

- Dial Size: 4”
- Connection Size: ¼” (M) NPT
- Stainless Steel Case and Bezel
- Brass Internals and Connection
- Phosphor Bronze Bourdon Tube
- Liquid Filled
- Accuracy: 1%
- Dual Scale: PSI & BAR (x100=kPa)
- Ambient Temperature: 30°F to 160°F



PSI Range	Major Inc.	Minor Inc.
30”/0/150	20	2
0/300	50	5
0/400	50	5
0/600	100	10

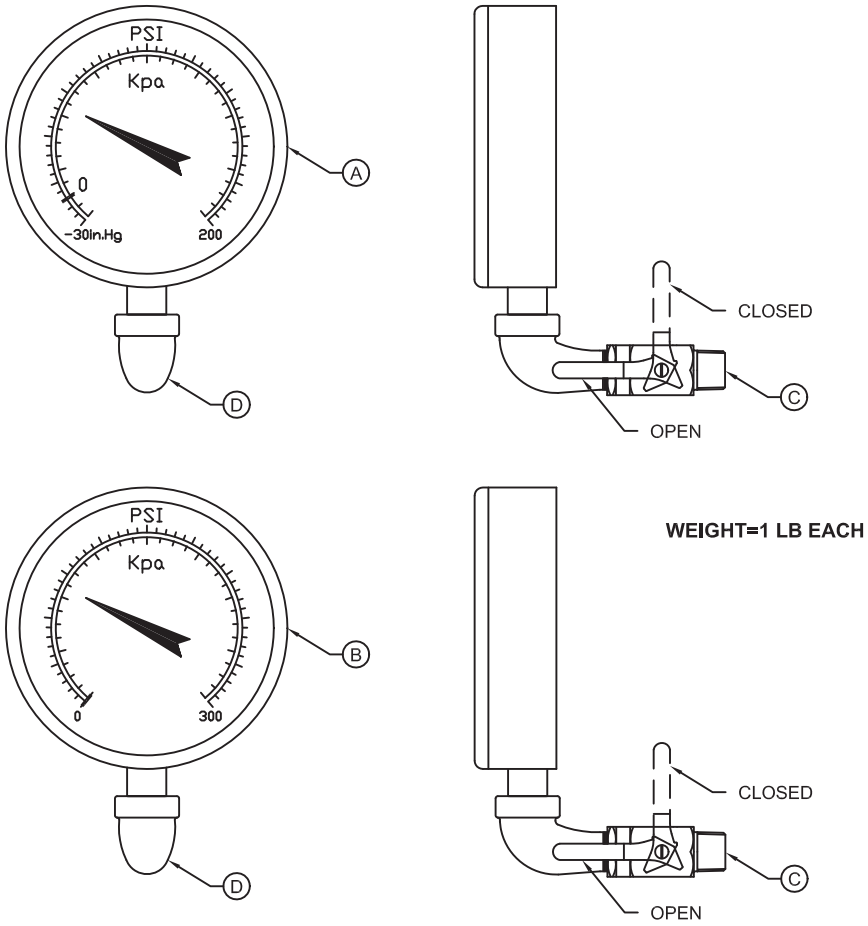
	A	B	C	D
In.	4.32”	5.57”	¼” MNPT	1.25”
MM	110	141		32

ITT

A-C FIRE PUMP SYSTEMS
List Prices Fire Pump Fittings & Accessories

Supersedes all previous issues

SUCTION AND DISCHARGE GAUGE ASSEMBLY



WEIGHT=1 LB EACH

ITEM	DESCRIPTION
A	SUCTION PRESSURE GAUGE
B	DISCHARGE PRESSURE GAUGE
C	1/4" NPT TWO WAY BALL VALVE
D	1/4" NPT STREET ELBOW

NOT FOR CONSTRUCTION, INSTALLATION OR APPLICATION PURPOSES UNLESS CERTIFIED		
CERTIFIED FOR:		
CUSTOMER ORDER NO.:	TAG NO.	
SHOP ORDER:	CERTIFIED BY:	DATE:

POTTER ROEMER FIRE PRO™
Member of Morris Group International™

CONNECTIONS (FDC)
FLUSH FIRE PUMP TEXT CONNECTIONS AND VARIATIONS

Model/Series No.
5862-5865 SERIES

SPECIFICATIONS

PUMP TEST CONNECTION

Cast brass body with end inlet, size and number of outlets as selected by model number. Brass plate lettered “PUMP TEST CONNECTION,” Brass NRS hose gate valves with loose bonnets, 3” female, NPT inlet x 2-1/2” Male hose thread outlet, with caps and chains.

VARIATIONS

-1 - Ductile Iron Body with red glossy polyester coating. Inlet size, location and number of outlets as selected by model number and as indicated on Variation Chart.

-2, -3 - Brass or ductile iron body. Inlet size, location and number of outlets as selected by model number and as indicated on Variation Chart.

-4, -5 - Square four way brass or ductile iron body. Back or angle inlet as selected and indicated on Variation Chart.

-6 - Male 2-1/2” hose thread snoots with cap and chain instead of affixed valves. Number of outlets as selected by model number and as indicated on Variation Chart.

-7 - Male 2-1/2” hose thread snoots, caps and chains, and removable swivel hose gate valves.

MODEL SELECTION

- ❑ **5862**
- ❑ **5863**
- ☑ **5864**
- ❑ **5865**

VARIATION SELECTION

BODY MATERIAL:

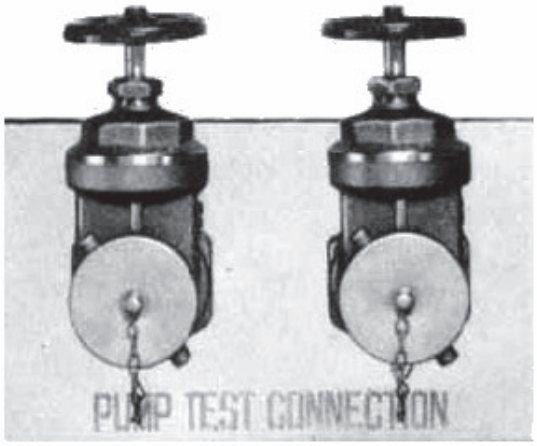
- ❑ **-1** Ductile Iron
- ❑ **-1.5** Steel

BODY INLET:

- ❑ **-2** Back
- ❑ **-3** Angle
- ❑ **-4** Square Back, Brass or Ductile
- ❑ **-5** Square Angle, Brass or Ductile

OUTLETS:

- ☑ **-6** Male Snoots, Caps, and Chains
- ❑ **-7** Male Snoots, Caps, and Chains and Removable Swivel Hose Gate Valves (Valves normally furnished rough brass)



MODEL 5862 (Shown)

PRODUCT OPTIONS

FINISHES:

- ❑ -B Polished Brass
- ❑ -C Polished Chrome Trim, Rough Chrome Valves
- ☑ -D Polished Chrome Plated

THREADS:

- ☑ N.S.T.
- ❑ Other _____

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CONNECTIONS (FDC)
FLUSH FIRE PUMP TEXT
CONNECTIONS AND VARIATIONS

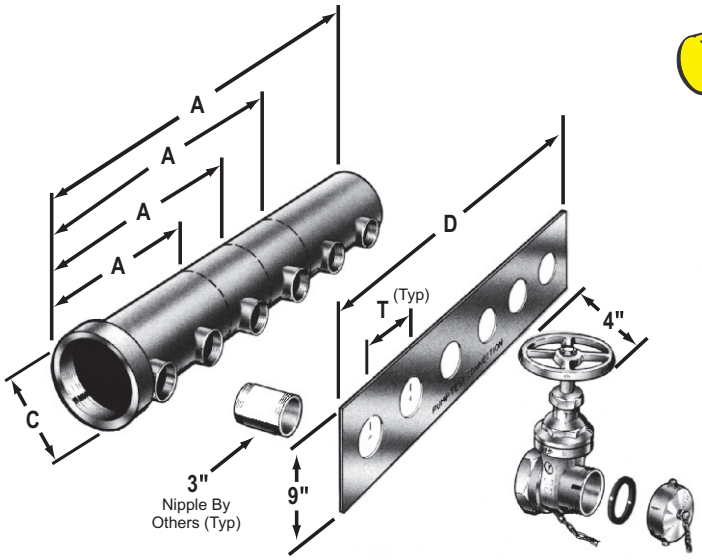
Model/Series No.
5862-5865 SERIES

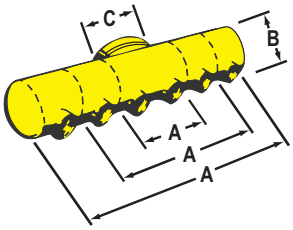
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-1 Ductile	Yes	No	Yes	No
Body Inlet				
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-3 Angle	Yes	No	Yes	Yes
-4 Sq. Back, Brass or Ductile	No	No	Yes	No
-5 Sq. Angle, Brass or Ductile	No	No	Yes	No
Outlets				
-6 Male Snoots, Caps, and Chains	Yes	Yes	Yes	Yes
-7 Male Snoots, Caps and Chains, and Removable Swivel Hose Gate Valves	Yes	Yes	Yes	Yes

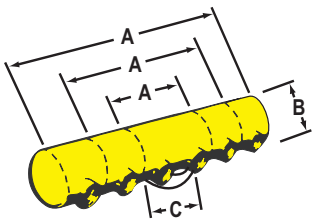
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5865	2000	8"	6	43	7-3/4	9-3/4	44

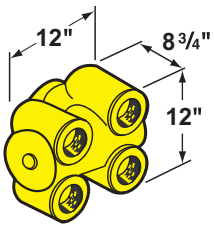


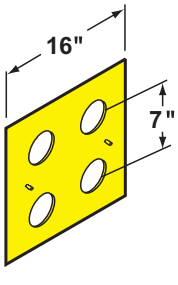


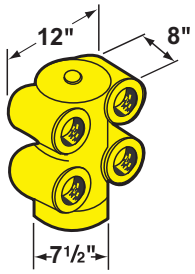
-2 BACK INLET



-3 ANGLE INLET







-4 SQUARE BODY BACK INLET

-5 SQUARE BODY ANGLE INLET

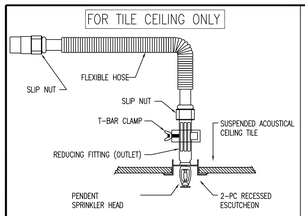
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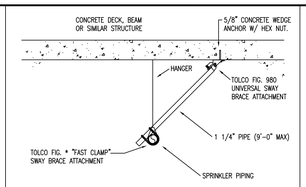
SPRINKLER DROP HOSES
NO SCALE

TYPICAL SPRINKLER HEAD SYMBOL



TYPICAL HANGER
TYPICAL HANGER #03P
NO SCALE

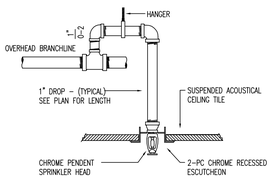
1 — HILTI KWIK HUS-EZ 1 ANCHOR WITH COUPLING (3/8" = 1" THROUGH 4" PIPE)
1 — ALL THREAD ROD
1 — ADJUSTABLE HANGER RING



NFPA "LATERAL" SWAY BRACE @ CONCRETE
NO SCALE

(PLAN SYMBOL)

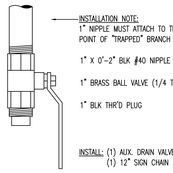
* FIG. 1000 FOR BRACED PIPE 1" THRU 2", AND 1" OR 1-1/4" BRACING
* FIG. 1001 IS FOR BRACED PIPE 2-1/2" THRU 8", AND 1" OR 1-1/4" BRACING
* FIG. 2002 IS FOR BRACED PIPE 2-1/2" THRU 8", AND 1-1/2" OR 2" BRACING



TYPICAL DROP DETAIL #2
NO SCALE

RETURN BEND FROM "UPRIGHT" OUTLET

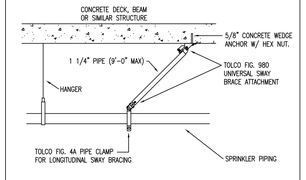
TYPICAL SPRINKLER HEAD SYMBOL



"WET" AUX. DRAIN CONN. #3A
NO SCALE

NOTE: THIS ARRANGEMENT CAN BE INSTALLED FOR ANY VOLUME OF "TRAPPED WATER" ON A WET SYSTEM.

AUX. DRAINS ARE INDICATED ON THE PLAN BY THIS SYMBOL:



NFPA "LONGITUDINAL" SWAY BRACE @ CONCRETE
NO SCALE

(PLAN SYMBOL)

* FIG. 4 IS FOR BRACED PIPE 1" THRU 3"
* FIG. 4A IS FOR BRACED PIPE 4" THRU 8"

G E N E R A L N O T E S :

BLACK SCHEDULE #10

BLACK SCH. #10 SYS MAINS – 3" AND LARGER TO BE SCHEDULE 10 BLACK STEEL "SHOP CUT" TO THE LENGTHS INDICATED ON THE PLAN, SHOP ROLL GROOVED AT BOTH ENDS, SHOP WELDED OUTLETS IF APPLICABLE, FIELD JOINED WITH GROOVED FITTINGS AND COUPLINGS UNLESS OTHERWISE NOTED.

BLACK SCHEDULE #40

BLACK SCH. #40 BR. LINES – 2-1/2" AND SMALLER TO BE SCHEDULE 40 BLACK STEEL PIPE "SHOP CUT" TO THE LENGTHS INDICATED ON THE PLAN, SHOP THREADED AT BOTH ENDS, FIELD JOINED WITH BLACK IRON DUCTILE THREADED FITTINGS, UNLESS OTHERWISE NOTED.

GALVANIZED SCHEDULE #10 – PREACTION SYSTEM

GALV SCH. #10 SYS MAINS – 3" AND LARGER TO BE SCHEDULE 10 GALVANIZED STEEL "SHOP CUT" TO THE LENGTHS INDICATED ON THE PLAN, SHOP ROLL GROOVED AT BOTH ENDS, SHOP WELDED OUTLETS IF APPLICABLE, FIELD JOINED WITH GROOVED FITTINGS AND COUPLINGS UNLESS OTHERWISE NOTED.

GALVANIZED SCHEDULE #40 – PREACTION SYSTEM

GALV SCH. #40 BR. LINES – 2-1/2" AND SMALLER TO BE SCHEDULE 40 GALVANIZED STEEL PIPE "SHOP CUT" TO THE LENGTHS INDICATED ON THE PLAN, SHOP THREADED AT BOTH ENDS, FIELD JOINED WITH GALVANIZED IRON DUCTILE THREADED FITTINGS, UNLESS OTHERWISE NOTED.

FIRE ALARM SYSTEM NOTE – TAMPER SWITCHES HAVE BEEN PROVIDED ON ALL PRIMARY CONTROL VALVES. THESE SWITCHES MUST BE CONNECTED TO THE FIRE ALARM SYSTEM PER NFPA 72. ALSO, THE WATER FLOW DETECTING SWITCH SHALL ACTIVATE THE FIRE ALARM SYSTEM.
ALL WIRING AND FIRE ALARM SYSTEMS TO BE SUPPLIED AND INSTALLED BY "OTHERS".

STD SYSTEM HANGER NOTES – PIPE HANGERS SHALL BE SIZED, SPACED, AND INSTALLED AS REQUIRED BY THE NFPA #13 STANDARDS. NO OTHER PIPING AND/OR DEVICES ARE TO BE ATTACHED TO THE SPRINKLER HANGING SYSTEM UNLESS THE HANGER HAS BEEN SPECIFICALLY DESIGNED FOR THE ADDITIONAL LOADING. THIS CONTRACTOR DOES NOT INCLUDE THE MATERIAL OR DEVICES TO IMPROVE THE STRUCTURAL STRENGTH OF THE BUILDING TO IT TO CARRY THE LOAD OF THE FIRE PROTECTION SYSTEM. SEE THE CAD DETAILS ON THIS SHEET FOR SPECIFIC HANGER ASSEMBLIES USED FOR THIS INSTALLATION PROJECT.

HANGER SPACING PER NFPA 13, 2010 EDITION
TABLE 9.2.2.1(A) MAXIMUM DISTANCE BETWEEN HANGERS (FT. – IN.)

PIPE TYPE	NOMINAL PIPE SIZE (IN.)											
	3/4	1	1-1/4	1-1/2	2	2-1/2	3	3-1/2	4	5	6	8
STEEL PIPE EXCEPT THREADED LIGHTWALL	N/A	12-0	12-0	15-0	15-0	15-0	15-0	15-0	15-0	15-0	15-0	15-0

F.D.C. NOTE FOR FITTERS – 4-OUTLET FREESTANDING FIRE DEPARTMENT CONNECTION SHALL BE ON THE WEST SIDE OF BUILDING AND SHALL BE LOCATED AND ARRANGED SO THAT HOSE CAN BE READILY AND CONVENIENTLY ATTACHED TO THE INLET WITHOUT INTERFERENCE FROM ANY NEARBY OBJECTS. WHEN THE FDC SERVICES ONLY A PORTION OF A BUILDING, A SIGN SHALL BE ATTACHED INDICATING THE PORTIONS OF THE BUILDING SERVED. NFPA RECOMMENDS THAT THE FDC BE LOCATED NOT LESS THAN 18" AND NOT MORE THAN 48" ABOVE FINISHED EXTR. GRADE.

SYSTEM HYDROSTATIC TEST – (NFPA 13 –2010, SECTION 24.2.1) UNLESS PERMITTED BY 24.2.1.2 THROUGH 24.2.1.8, ALL PIPING AND ATTACHED APPURTENANCES SUBJECTED TO SYSTEM WORKING PRESSURE SHALL BE HYDROSTATICALLY TESTED AT 200 PSI (13.8 BAR) AND SHALL MAINTAIN THAT PRESSURE WITHOUT LOSS FOR 2 HOURS.

24.2.1.3 WHERE COLD WEATHER WILL NOT PERMIT TESTING WITH WATER, AN INTERIM AIR TEST SHALL BE PERMITTED TO BE CONDUCTED AS DESCRIBED IN 24.2.2. THIS PROVISION SHALL NOT REMOVE OR REPLACE THE REQUIREMENT FOR CONDUCTING THE HYDROSTATIC TEST AS DESCRIBED IN 24.2.1.1.
24.2.1.7 LOSS SHALL BE DETERMINED BY A DROP IN GAUGE PRESSURE OR VISUAL LEAKAGE.
24.2.1.8 THE TEST PRESSURE SHALL BE READ FROM A GAUGE LOCATED AT THE LOW ELEVATION POINT OF THE SYSTEM OR PORTION BEING TESTED THE PRESSURES IN PIPING AT HIGHER ELEVATIONS SHALL BE PERMITTED TO BE LESS THAN 200 PSI WHEN ACCOUNTING FOR ELEVATION LOSSES. SYSTEMS OR PORTIONS OF SYSTEMS THAT CAN BE ISOLATED SHALL BE PERMITTED TO BE TESTED SEPARATELY.
24.2.1.9 ADDITIVES, CORROSIVE CHEMICALS SUCH AS SODIUM SILICATE, OR DERIVATIVES OF SODIUM SILICATE BRINE, OR SIMILAR ACTING CHEMICALS SHALL NOT BE USED WHILE HYDROSTATICALLY TESTING SYSTEMS OR FOR STOPPING LEAKS.
24.2.1.10 PIPING BETWEEN THE EXTERIOR FIRE DEPARTMENT CONNECTION AND THE CHECK VALVE IN THE FIRE DEPARTMENT INLET PIPE SHALL BE HYDROSTATICALLY TESTED IN THE SAME MANNER AS THE BALANCE OF THE SYSTEM. AFTER REPAIR OR REPLACEMENT WORK AFFECTING THE FIRE DEPARTMENT CONNECTION, THE PIPING BETWEEN THE EXTERIOR AND THE CHECK VALVE IN THE FIRE DEPARTMENT INLET PIPE SHALL BE ISOLATED AND HYDROSTATICALLY TESTED AT 150 PSI (10.3 BAR)
24.2.1.11 WHEN SYSTEMS ARE BEING HYDROSTATICALLY TESTED, IT SHALL BE PERMITTED TO CONDUCT TEST WITH PENDENT SPRINKLERS OR PLUGS INSTALLED IN FITTINGS. ANY PLUGS SHALL BE REPLACED WITH PENDENT SPRINKLERS AFTER THE TEST IS COMPLETED.
24.2.1.12 PROVISIONS SHALL BE MADE FOR THE PROPER DISPOSAL OF WATER USED FOR FLUSHING AND TESTING.

(NFPA 20 –2010, SECTION 14.1.2.1) SUCTION AND DISCHARGE PIPING SHALL BE HYDROSTATICALLY TESTED AT NOT LESS THAN 200 PSI (13.8 BAR) PRESSURE, OR AT 50 PSI (3.4 BAR) IN EXCESS OF THE MAXIMUM PRESSURE TO BE MAINTAINED IN THE SYSTEM, WHICHEVER IS GREATER. 14.1.2.2 THE PRESSURE SHALL BE MAINTAINED FOR TWO HOURS.

WET PIPE SYSTEM DESCRIPTION A SPRINKLER SYSTEM EMPLOYING AUTOMATIC SPRINKLERS ATTACHED TO A PIPING SYSTEM CONTAINING WATER AND CONNECTED TO A WATER SUPPLY SO THAT WATER DISCHARGES IMMEDIATELY FROM SPRINKLERS OPENED BY HEAT FROM A FIRE. UPON OPERATION, THE SPRINKLERS DISTRIBUTE WATER OVER A SPECIFIC AREA TO CONTROL OR EXTINGUISH THE FIRE. AS THE WATER FLOWS THROUGH THE SYSTEM PIPING, AN ALARM IS ACTIVATED TO INDICATE THAT THE SYSTEM IS OPERATING. SPRINKLERS IMMEDIATELY OVER OR ADJACENT TO THE FIRE OPERATE – MINIMIZING WATER DAMAGE.

WET PIPE SYSTEM NOTES – THE SYSTEM IS DESIGNED AND INSTALLED IN ACCORDANCE WITH NFPA 13 – 2010 STANDARDS AND ALL LOCAL CODES.

ALL MATERIALS AND DEVICES ESSENTIAL TO THE SYSTEM OPERATION ARE TO BE UL LISTED AND/OR FM APPROVED.

A TOTAL OF 12 SPARE SPRINKLERS (IN CABINET WITH HEAD WRENCH) WILL BE PROVIDED IN ACCORDANCE WITH NFPA 13, SECTION 6.2.9

ALL CONTROL, DRAIN, AND TEST CONNECTION VALVES TO BE PROVIDED WITH THE PROPER IDENTIFICATION PER NFPA 13, SECTION 6.7.4

FIRE DEPARTMENT CONNECTION TO BE PROVIDED WITH THREADS MATCHING LOCAL REQUIREMENTS (NST UNLESS NOTED OTHERWISE).

WATERFLOW DETECTING AND ALARM APPARATUS FOR WET PIPE SYSTEMS WILL BE PROVIDED AND INSTALLED. ANY NECESSARY WIRING OF THE ELECTRICAL DEVICES PROVIDED BY AHERN FIRE PROTECTION WILL BE PERFORMED BY OTHERS. REMOTE CENTRAL ALARM STATIONS (IF REQUIRED) ARE THE RESPONSIBILITY OF THE OWNER.

EACH WET PIPE SYSTEM WILL BE PROVIDED WITH RELIEF VALVE NOT LESS THAN 1/2" IN SIZE SET TO OPERATE AT 175 PSI OR 10 POUNDS IN EXCESS OF THE MAXIMUM SYSTEM PRESSURE WHICHEVER IS GREATER. THE RELIEF VALVE WILL BE INSTALLED AT THE REMOTE INSPECTION TEST VALVE OR AT THE SYSTEM RISER.

AUXILIARY DRAIN VALVES ARE TO BE SIZED & LOCATED AT THE LOW POINTS OF ALL TRAPPED SECTIONS OF PIPE PER SECTION 8.16.2

THE OWNER IS RESPONSIBLE FOR PROVIDING ADEQUATE HEAT (MAINTAINED AT OR ABOVE 40° F) THROUGHOUT THE ENTIRE AREA PROTECTED BY A WET PIPE SYSTEM.

HYDRAULIC DESIGN INFORMATION SIGNS WILL BE PROVIDED FOR EACH REMOTE AREA AND THEY WILL BE ATTACHED TO THE APPROPRIATE RISERS.

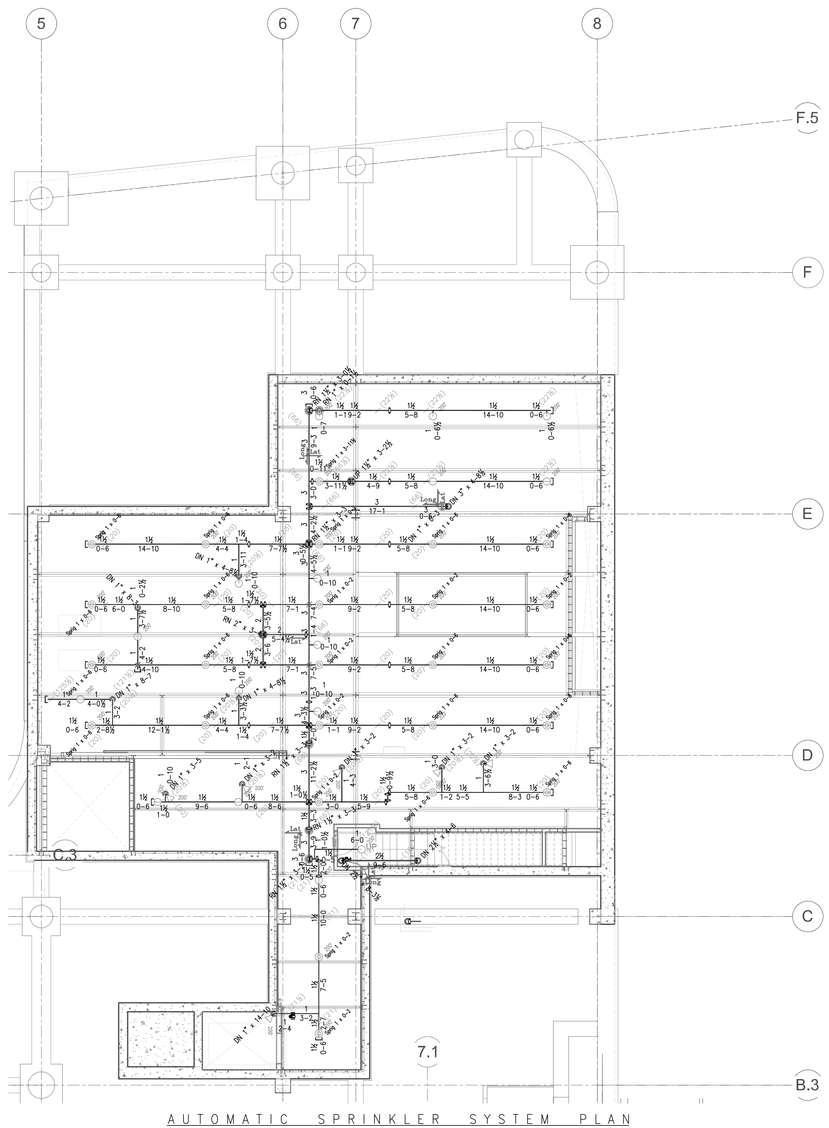
ALL DIMENSIONS AND ELEVATIONS SHOWN ARE TO THE CENTERLINE OF PIPE (UNLESS NOTED OTHERWISE).

SPRINKLER HEADS SHOWN ARE NOT NECESSARILY LOCATED IN THE CENTERLINE OF CEILING TILES.

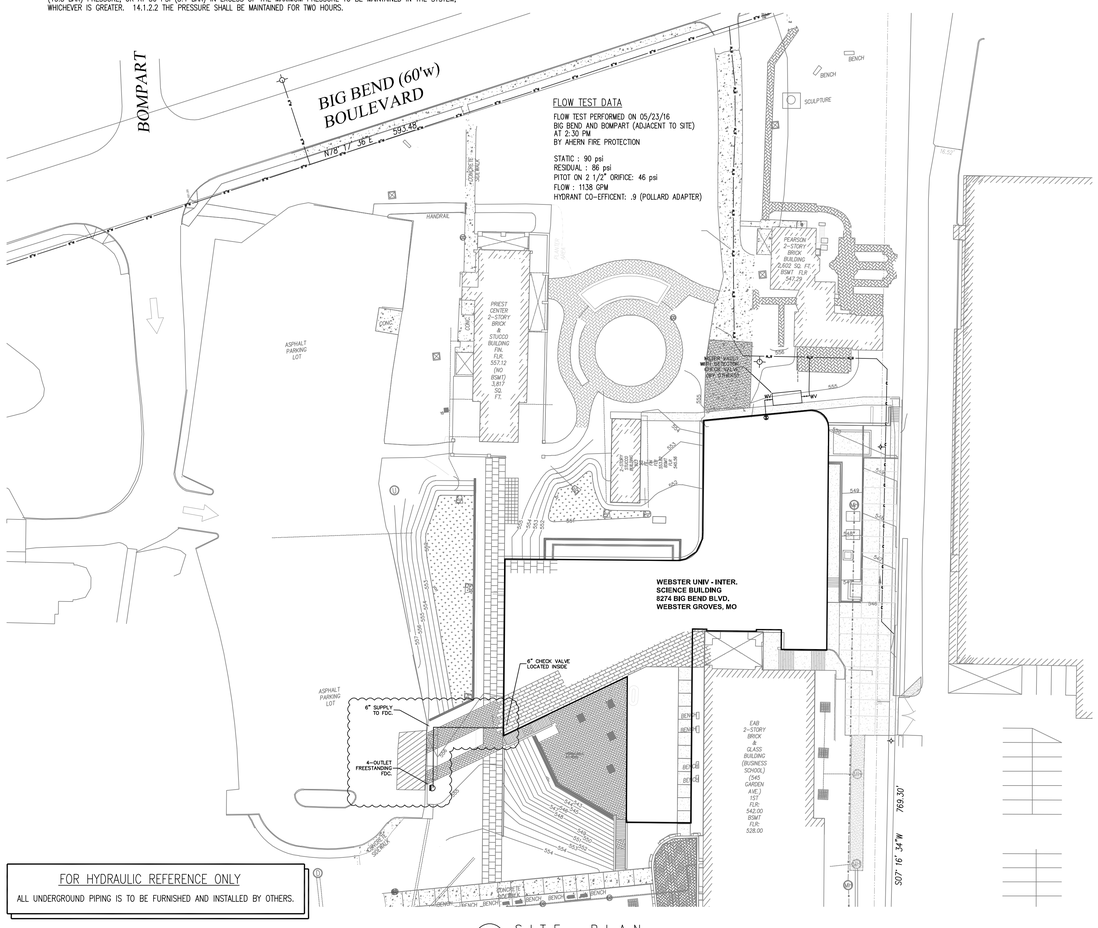
PAINTING OF PIPE AND FITTINGS (IF REQUIRED) IS TO BE PERFORMED BY OTHERS UNLESS SPECIFIED IN THE CONTRACT.

PREACTION SYSTEM DESCRIPTION A SPRINKLER SYSTEM EMPLOYING AUTOMATIC SPRINKLERS ATTACHED TO A PIPING SYSTEM THAT CONTAINS AIR THAT MIGHT OR MIGHT NOT BE UNDER PRESSURE WITH A SUPPLEMENT DETECTION SYSTEM INSTALLED IN THE SAME AREAS AS THE SPRINKLERS.

DOUBLE-INTERLOCKED = THE SYSTEM UTILIZES BOTH A DETECTOR SYSTEM AND PRESSURIZED AIR OR GAS WITHIN THE SPRINKLER PIPING. THE PREACTION VALVE (DELUGE TYPE) IS ARRANGED SO THAT THE VALVE WILL OPEN ONLY IF BOTH THE PRESSURE WITHIN THE SPRINKLER PIPING IS REDUCED AND THE DETECTION SYSTEM IS OPERATED/TRIPPED. IF "ONLY" THE DETECTION SYSTEM OPERATES DUE TO DAMAGE, FIRE, OR A MALFUNCTION, THE VALVE WILL NOT OPEN. IF "ONLY" THE SPRINKLER PIPING OR A SPRINKLER IS DAMAGED OR BROKEN, THE VALVE WILL NOT OPEN. THE PRESSURIZED AIR OR GAS WITHIN THE PIPING SYSTEM IS USUALLY SUPERVISED. THE WATER FLOWS ONLY FROM SPRINKLERS OPENED BY THE HEAT FROM A FIRE AFTER THE VALVE IS TRIPPED BY BOTH THE DETECTORS AND



AUTOMATIC SPRINKLER SYSTEM PLAN
SCALE 1/8" = 1'-0"



FLOW TEST DATA
FLOW TEST PERFORMED ON 05/23/16
BIG BEND AND BOMPART (ADJACENT TO SITE)
AT 2:30 PM
BY AHERN FIRE PROTECTION

STATIC : 90 psi
RESIDUAL : 86 psi
PITOT ON 2 1/2" ORIFICE: 46 psi
FLOW : 1138 GPM
HYDRANT CO-EFFICENT: .9 (POLLARD ADAPTER)

FOR HYDRAULIC REFERENCE ONLY
ALL UNDERGROUND PIPING IS TO BE FURNISHED AND INSTALLED BY OTHERS.

1 SITE PLAN
SCALE N.T.S.

SPRINKLERS

MAKE / VENDOR	MODEL	SIN	TYPE	RESPONSE TYPE	THREAD SIZE	NOM. "K"	CALC'D COVERAGE	DEFLECT. DISTANCE	TEMP.	FINISH	ESC.	WRENCH	SYMB.	QUANTITY
VIKING	M	VK300	UPR	QR	1/2"	5.6	225 SQ FT	1-12"	155°	BRZ	N/A	10896W/B		–
VIKING	M	VK350	UPR	QR	3/4"	8.0	130 SQ FT	1-12"	200°	BRZ	N/A	10896W/B		42
VIKING	EC	VK532	UPR	QR	3/4"	11.2	400 SQ FT	1-12"	200°	BRZ	N/A	05115CW/B		–
VIKING	MIRAGE	VK462	PND	QR	1/2"	5.6	225 SQ FT	1-12"	155°	WHT	CONCLD	14047W/B		–
VIKING	MIRAGE	VK464	PND	QR	3/4"	8.0	130 SQ FT	1-12"	200°	WHT	CONCLD	14047W/B		–
VIKING	MIRAGE EC	VK634	PND	QR	3/4"	8.0	400 SQ FT	1-12"	155°	WHT	CONCLD	14047W/B		–
VIKING	DRY	VK194	PND	QR	1"	5.6	225 SQ FT	1-12"	155°	WHT	DOME CNCLD	07565W/B		–
VIKING	M	VK305	HSW	QR	1/2"	5.6	196 SQ FT	4-6"	200 °	BRZ	N/A	10896W/B		6
TOTAL SPRINKLERS ON THIS CONTRACT:		560										TOTAL SPRINKLERS ON THIS SHEET:		48

"AS-BUILTS"
08-01-2017

REV	DATE	REVISION DESCRIPTION
		REVISION HISTORY
1	08/05/16	FM SCOPE REVIEW
2	10/26/16	PERMIT SET
3	11/18/16	INSTALLATION SET

AUTOMATIC SPRINKLER DESIGN BASED ON THE FOLLOWING NFPA STANDARD

■ NFPA 13—— 2010 ☐ NFPA 14—— 2003
☐ NFPA 13 D– 2002 ☐ NFPA 20—— 2003
☐ NFPA 13 R– 2002 ☐ OTHER

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KEYPLAN

WEBSTER UNIV - INTER. SCIENCE BUILDING
8274 BIG BEND BLVD.
WEBSTER GROVES, MO

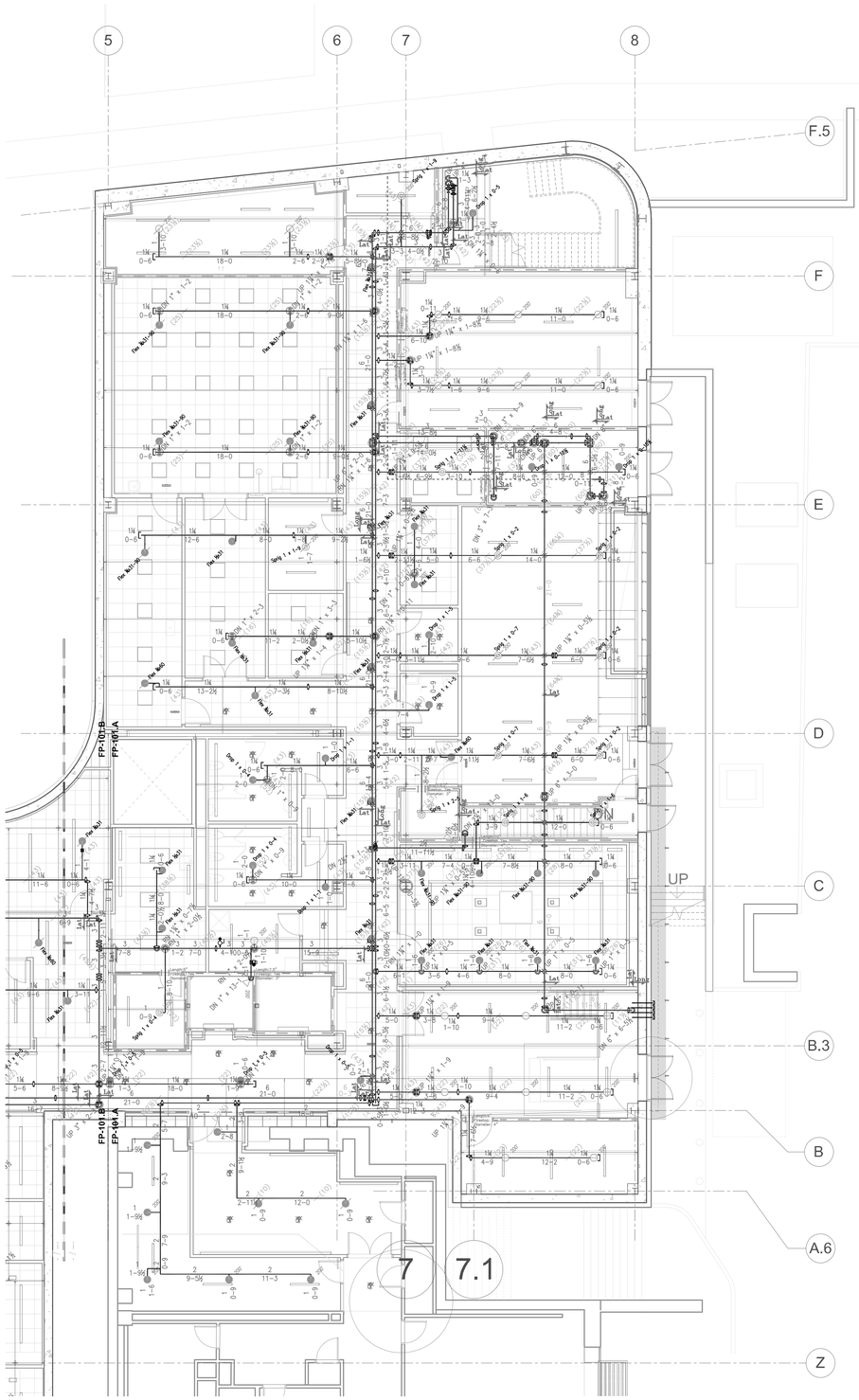
FIRE PROTECTION PLAN - LEVEL 0

0 2 4 8 16 24 FT

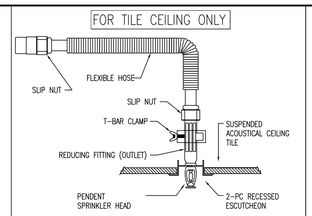
SCALE: 1/8" = 1'-0"
DRAWN BY: DANA MITCHELL
PROJECT MNGR: KURT REUTHER
DATE: 07/25/2016
CONTRACT NO: 461259

CONSTRUCTION DOCUMENTS

FP-100.A

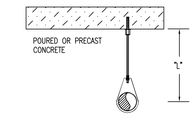


AUTOMATIC SPRINKLER SYSTEM PLAN
SCALE 1/8" = 1'-0"



SPRINKLER DROP HOSES
NO SCALE

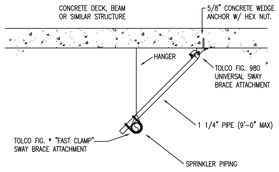
TYPICAL SPRINKLER HEAD SYMBOL



TYPICAL HANGER

TYPICAL HANGER #03P
NO SCALE

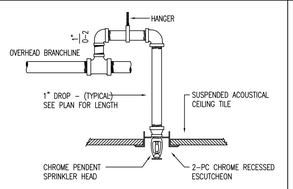
1 -- HILTI KWIK HUS-EZ 1 ANCHOR WITH COUPLING (3/8" = 1" THROUGH 4" PIPE)
1 -- ALL THREAD ROD
1 -- ADJUSTABLE HANGER RING



NFPA "LATERAL" SWAY BRACE @ CONCRETE
NO SCALE

LAT
(PLAN SYMBOL)

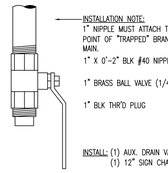
* FIG. 1000 FOR BRACED PIPE 1" THRU 2", AND 1" OR 1-1/4" BRACING
* FIG. 1001 IS FOR BRACED PIPE 2-1/2" THRU 8", AND 1" OR 1-1/4" BRACING
* FIG. 2002 IS FOR BRACED PIPE 2-1/2" THRU 8", AND 1-1/2" OR 2" BRACING



TYPICAL DROP DETAIL #2
NO SCALE

RETURN BEND FROM "UPRIGHT" OUTLET

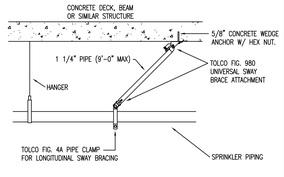
TYPICAL SPRINKLER HEAD SYMBOL



"WET" AUX. DRAIN CONN. #3A
NO SCALE

NOTE: THIS ARRANGEMENT CAN BE INSTALLED FOR ANY VOLUME OF "TRAPPED WATER" ON A WET SYSTEM.

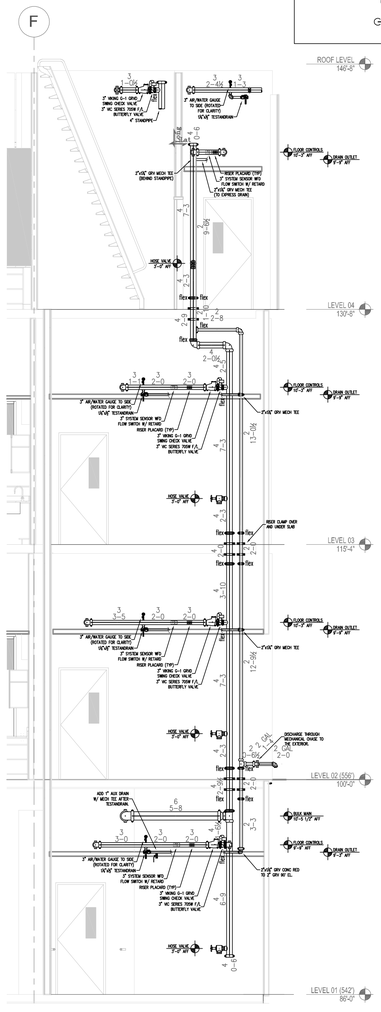
AUX. DRAINS ARE INDICATED ON THE PLAN BY THIS SYMBOL:



NFPA "LONGITUDINAL" SWAY BRACE @ CONCRETE
NO SCALE

LONG
PIPE
(PLAN SYMBOL)

* FIG. 4 IS FOR BRACED PIPE 1" THRU 3"
* FIG. 4A IS FOR BRACED PIPE 4" THRU 8"



1 SECTION
SCALE 1/4" = 1'-0"

2 SECTION
SCALE 1/4" = 1'-0"

3 SECTION
SCALE 1/4" = 1'-0"

4 SECTION
SCALE 1/4" = 1'-0"

STOCKLIST NOTES

PRELIST NUMBER: 1
SYSTEM MAIN LETTERS: STA,STB,XD
STOCK LIST NUMBER: 0007
REQUEST FOR MAT'L NO.: 123737
LIST COLOR CODE: YELLOW
BRANCH LINE NUMBERS: HV

SPRINKLERS

MAKE / VENDOR	MODEL	SIN	TYPE	RESPONSE TYPE	THREAD SIZE	NOM. "K"	CALC'D COVERAGE	DEFLECT. DISTANCE	TEMP.	FINISH	ESC.	WRENCH	SYMB.	QUANTITY
VIKING	M	VK300	UPR	QR	1/2"	5.6	225 SQ FT	1-12"	155°	BRZ	N/A	10899W/B		–
VIKING	M	VK350	UPR	QR	3/4"	8.0	130 SQ FT	1-12"	200°	BRZ	N/A	10899W/B		13
VIKING	EC	VK532	UPR	QR	3/4"	11.2	400 SQ FT	1-12"	200°	BRZ	N/A	05118W/B		15
VIKING	MIRAGE	VK462	PND	QR	1/2"	5.6	225 SQ FT	1-12"	155°	WHT	CONCLD	14047W/B		14
VIKING	MIRAGE	VK464	PND	QR	3/4"	8.0	130 SQ FT	1-12"	200°	WHT	CONCLD	14047W/B		17
VIKING	MIRAGE EC	VK634	PND	QR	3/4"	8.0	400 SQ FT	1-12"	155°	WHT	CONCLD	14047W/B		20
VIKING	DRY	VK194	PND	QR	1"	5.6	225 SQ FT	1-12"	155°	WHT	DOME CNCLD	07540W/B		–
VIKING	M	VK305	HSW	QR	1/2"	5.6	196 SQ FT	4-6"	200 °	BRZ	N/A	10899W/B		1
TOTAL SPRINKLERS ON THIS CONTRACT:		560										TOTAL SPRINKLERS ON THIS SHEET:		80

"AS-BUILTS"
08-01-2017

REV	DATE	REVISION DESCRIPTION
1	08/05/16	FM SCOPE REVIEW
2	10/26/16	PERMIT SET
3	12/2/16	INSTALLATION SET
4	12/19/16	HANGER REVISION
5	1/3/17	INSTALLATION – STANDPIPES

REVISION HISTORY

AUTOMATIC SPRINKLER DESIGN BASED ON THE FOLLOWING NFPA STANDARD

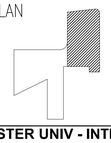
- ■ NFPA 13 — 2010
- □ NFPA 13 D — 2002
- □ NFPA 13 R — 2002
- □ NFPA 14 — 2003
- □ NFPA 20 — 2003
- □ OTHER

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KEYPLAN



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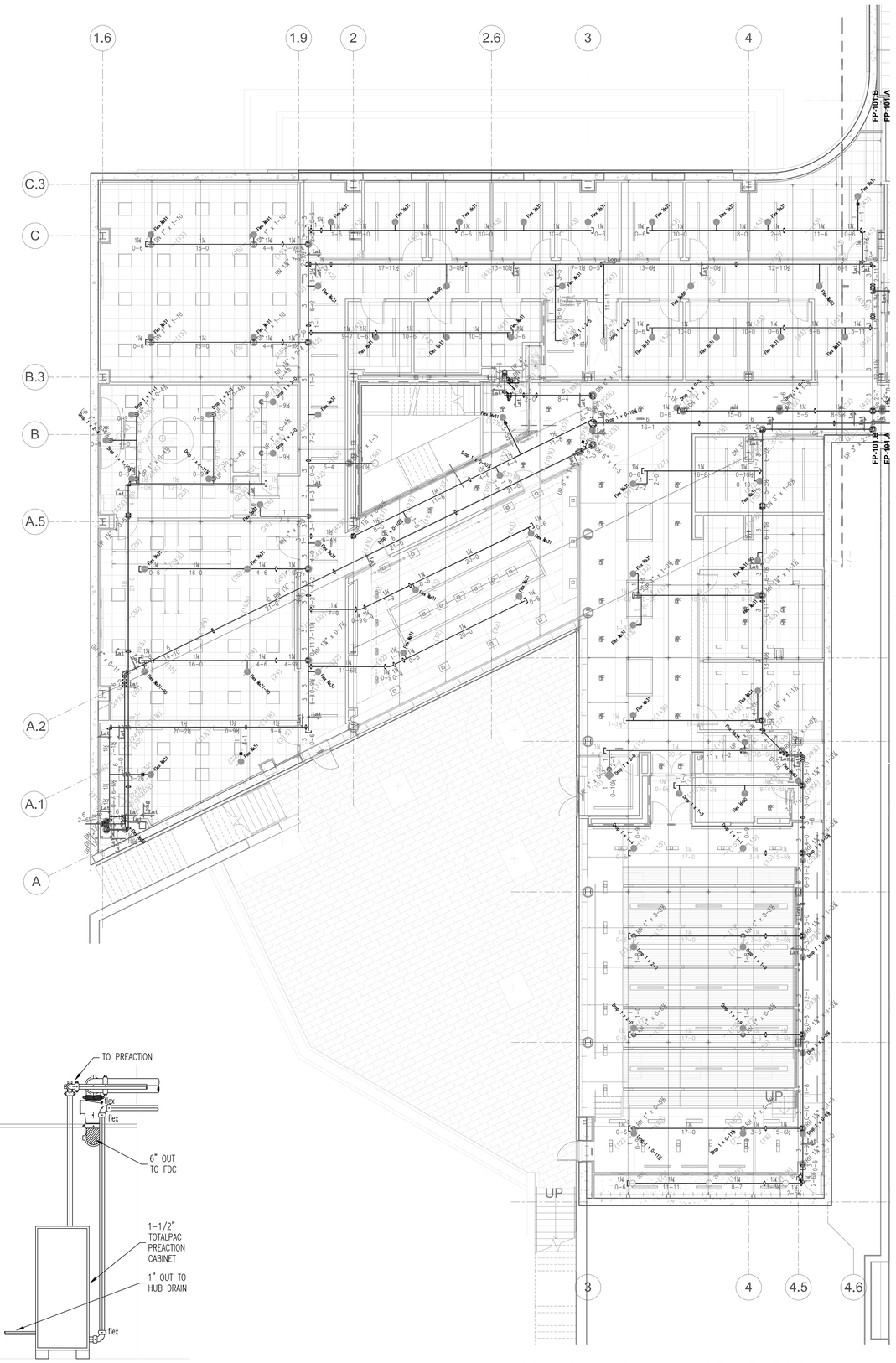
FIRE PROTECTION PLAN - LEVEL 1 - AREA A

0 2 4 8 16 24 FT

SCALE: 1/8" = 1'-0"
DRAWN BY: KURT REUTHER
PROJECT MNGR: KURT REUTHER
DATE: 07/25/2016
CONTRACT NO: 461259

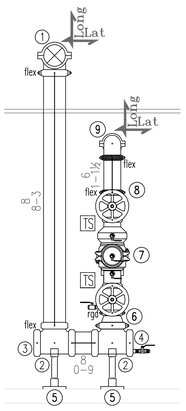
CONSTRUCTION DOCUMENTS

FP-101.A

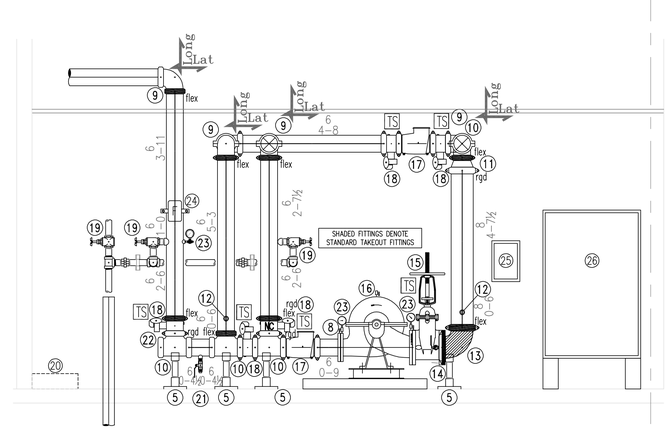


AUTOMATIC SPRINKLER SYSTEM PLAN
SCALE 1/8" = 1'-0"

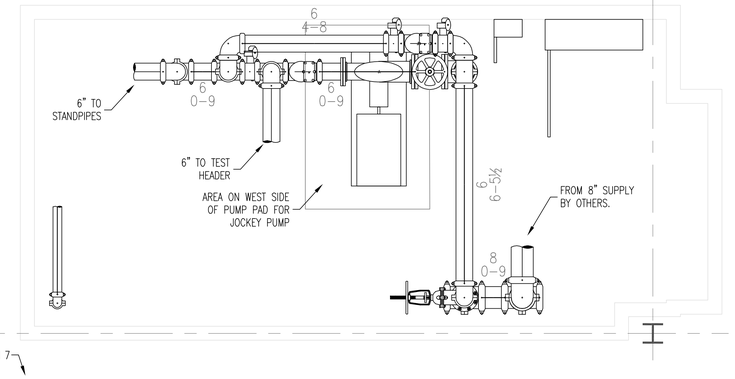
4 SECTION
SCALE 1/2" = 1'-0"



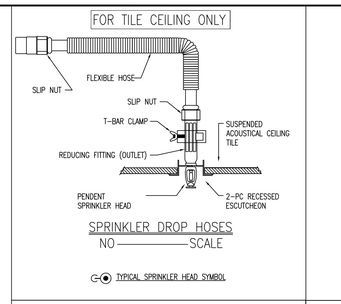
2 SECTION
SCALE 1/2" = 1'-0"



3 SECTION
SCALE 1/2" = 1'-0"

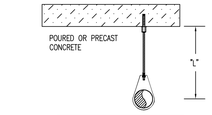


E1 SECTION
SCALE 1/2" = 1'-0"



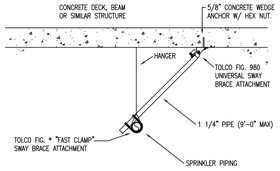
SPRINKLER DROP HOSES
NO SCALE

TYPICAL SPRINKLER HEAD SYMBOL



TYPICAL HANGER
TYPICAL HANGER #03P
NO SCALE

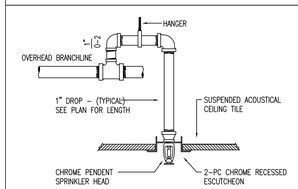
1 -- HILTI KWIK HUS-EZ 1 ANCHOR WITH COUPLING (3/8" = 1" THROUGH 4" PIPE)
1 -- ALL THREAD ROD
1 -- ADJUSTABLE HANGER RING



NFPA "LATERAL" SWAY BRACE @ CONCRETE
NO SCALE

LAT
PIPE
(PLAN SYMBOL)

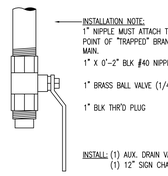
* FIG. 1000 FOR BRACED PIPE 1" THRU 2", AND 1" OR 1-1/4" BRACING
* FIG. 1001 IS FOR BRACED PIPE 2-1/2" THRU 8", AND 1" OR 1-1/4" BRACING
* FIG. 2002 IS FOR BRACED PIPE 2-1/2" THRU 8", AND 1-1/2" OR 2" BRACING



TYPICAL DROP DETAIL #2
NO SCALE

RETURN BEND FROM "UPRIGHT" OUTLET

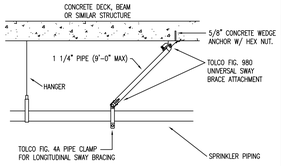
TYPICAL SPRINKLER HEAD SYMBOL



"WET" AUX. DRAIN CONN. #3A
NO SCALE

NOTE: THIS ARRANGEMENT CAN BE INSTALLED FOR ANY VOLUME OF "TRAPPED WATER" ON A WET SYSTEM.

AUX. DRAINS ARE INDICATED ON THE PLAN BY THIS SYMBOL:



NFPA "LONGITUDINAL" SWAY BRACE @ CONCRETE
NO SCALE

LONG
PIPE
(PLAN SYMBOL)

* FIG. 4 IS FOR BRACED PIPE 1" THRU 3"
* FIG. 4A IS FOR BRACED PIPE 4" THRU 8"

1 8 FIRELOCK GALV GRVD 90° ELL
2 8 FIRELOCK GALV GRVD TEE
3 8 FIRELOCK GALV GRVD CAP
4 8 GALV GRVD DRAIN CAP & GALV AUX DRAIN
5 8 PIPE STAND ASSEMBLY
6 8x6 GALV GRVD CONC REDUCER
7 6 WILKENS 350AOSYG BACKFLOW GxG W/ OS&Y TAMPERS
8 6 FIRELOCK STYLE 75 FLEX COUPLING
9 6 FIRELOCK GRVD 90° ELL
10 6 FIRELOCK GRVD TEE
11 –
12 1¼ OUTLETS FOR JOCKEY PUMP CONNECTION
13 8 TYCO 510 GRV 90 ELL
14 8 FIRELOCK STYLE 744 GRVD FLANGE
15 8 NIBCO RW GATE VALVE W/ OS&Y TAMPER
16 A–C FIRE 8X6X12F – 8100 SERIES 1000 GPM FIRE PUMP – 40HP/460V – 1¼ JOCKEY PUMP
17 6 VIKING G-1 GRVD CHECK VALVE
18 6 VIC SERIES 705-W F/L BUTTERFLY VALVE
19 2 ANGLE VALVE (MAIN DRAIN PIPE TO HUB DRAIN
20 MOP SINK (ROUTE PACKING GLAND DRAIN–CPVC)
21 1 AUXILLARY DRAIN
22 6 FIRELOCK GRVD CAP
23 ¼" SYSTEM AIR/WATER PRESS. GAUGE ASSM
24 6 SYSTEM SENSOR WFD SERIES FLOW SWITCHES
25 JOCKEY PUMP CONTROLLER
26 FIRE PUMP CONTROLLER

PRESSURE REGULATION SETTINGS

SMALL SYSTEM PRV'S	@ 175 PSI
JOCKEY PUMP OFF	@ 161 PSI
JOCKEY PUMP ON	@ 150 PSI
FIRE PUMP ON	@ 145 PSI

SPRINKLER POWER REQUIREMENTS

@ PUMP ROOM

FIRE PUMP	460 VAC, 3 PHASE, 40 HP
JOCKEY PUMP	460 VAC, 3 PHASE, .75 HP
HORN STROBE	120 VAC, SINGLE PHASE

STOCKLIST NOTES

PRELIST NUMBER: 1
SYSTEM MAIN LETTERS: S
STOCK LIST NUMBER: 0008
REQUEST FOR MAT'L NO.: N/A
LIST COLOR CODE: BROWN
BRANCH LINE NUMBERS: DRN

SPRINKLERS

MAKE / VENDOR	MODEL	SIN	TYPE	RESPONSE TYPE	THREAD SIZE	NOM. "K"	CALC'D COVERAGE	DEFLECT. DISTANCE	TEMP.	FINISH	ESC.	WRENCH	SYMB.	QUANTITY
VIKING	M	VK300	UPR	QR	1/2"	5.6	225 SQ FT	1–12"	155°	BRZ	N/A	10899W/B		1
VIKING	M	VK350	UPR	QR	3/4"	8.0	130 SQ FT	1–12"	200°	BRZ	N/A	10899W/B		3
VIKING	EC	VK532	UPR	QR	3/4"	11.2	400 SQ FT	1–12"	200°	BRZ	N/A	05118CW/B		2
VIKING	MIRAGE	VK462	PND	QR	1/2"	5.6	225 SQ FT	1–12"	155°	WHT	CONCLD	14047W/B		30
VIKING	MIRAGE	VK464	PND	QR	3/4"	8.0	130 SQ FT	1–12"	200°	WHT	CONCLD	14047W/B		1
VIKING	MIRAGE EC	VK634	PND	QR	3/4"	8.0	400 SQ FT	1–12"	155°	WHT	CONCLD	14047W/B		46
VIKING	DRY	VK194	PND	QR	1"	5.6	225 SQ FT	1–12"	155°	WHT	DOME CNCLD	07540W/B		1
VIKING	M	VK305	HSW	QR	1/2"	5.6	196 SQ FT	4–6"	200°	BRZ	N/A	10899W/B		–
TOTAL SPRINKLERS ON THIS CONTRACT:		560										TOTAL SPRINKLERS ON THIS SHEET:		84

"AS-BUILTS"
08-01-2017

REV	DATE	REVISION DESCRIPTION
1	08/05/16	FM SCOPE REVIEW
2	10/26/16	PERMIT SET
3	12/2/16	INSTALLATION SET
4	12/19/16	HANGER REVISION
5	1/3/17	INSTALLATION – STANDPIPES
6	1/6/17	INSTALLATION – PUMP ROOM

REVISION HISTORY

AUTOMOTIC SPRINKLER DESIGN BASED ON THE FOLLOWING NFPA STANDARD

- ■ NFPA 13— 2010
- □ NFPA 13 D– 2002
- □ NFPA 13 R– 2002
- □ NFPA 14— 2003
- □ NFPA 20— 2003
- □ OTHER

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KEYPLAN

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WEBSTER GROVES, MO

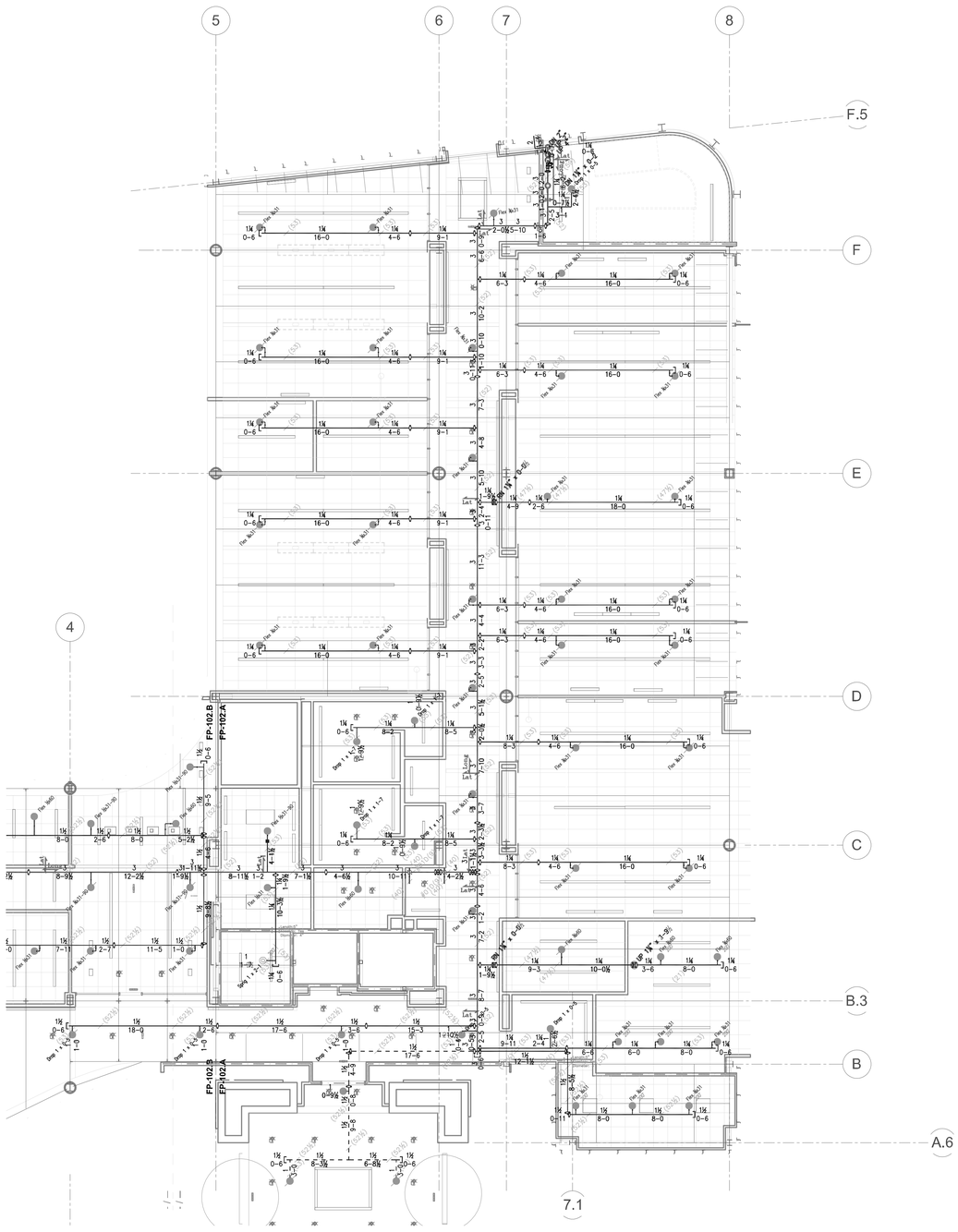
FIRE PROTECTION PLAN - LEVEL 1 - AREA B

0 2 4 8 16 24 FT

SCALE: 1/8" = 1'-0"
DRAWN BY: KURT REUTHER
PROJECT MNGR: KURT REUTHER
DATE: 07/25/2016
CONTRACT NO: 461259

CONSTRUCTION DOCUMENTS

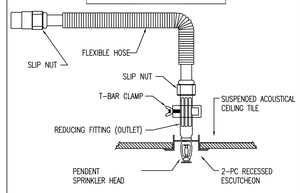
FP-101.B



AUTOMATIC SPRINKLER SYSTEM PLAN

SCALE 1/8" = 1'-0"

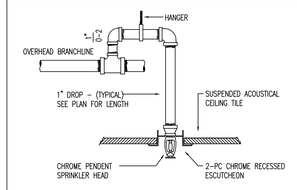
FOR TILE CEILING ONLY



SPRINKLER DROP HOSES

NO SCALE

TYPICAL SPRINKLER HEAD SYMBOL

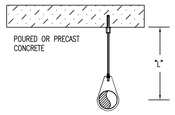


TYPICAL DROP DETAIL #2

NO SCALE

RETURN BEND FROM "UPRIGHT" OUTLET

TYPICAL SPRINKLER HEAD SYMBOL

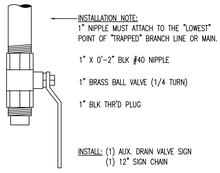


TYPICAL HANGER

TYPICAL HANGER #03P

NO SCALE

1 -- HILTI KWIK HUS-EZ 1 ANCHOR WITH COUPLING (3/8" = 1" THROUGH 4" PIPE)
1 -- ALL THREAD ROD
1 -- ADJUSTABLE HANGER RING

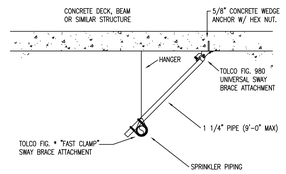


"WET" AUX. DRAIN CONN. #3A

NO SCALE

NOTE: THIS ARRANGEMENT CAN BE INSTALLED FOR ANY VOLUME OF "TRAPPED WATER" ON A WET SYSTEM.

AUX. DRAINS ARE INDICATED ON THE PLAN BY THIS SYMBOL:



NFPA "LATERAL" SWAY BRACE @ CONCRETE

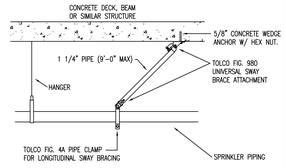
NO SCALE

LAT

PIPE

(PLAN SYMBOL)

* FIG. 1000 FOR BRACED PIPE 1" THRU 2", AND 1" OR 1-1/4" BRACING
* FIG. 1001 IS FOR BRACED PIPE 2-1/2" THRU 8", AND 1" OR 1-1/4" BRACING
* FIG. 2002 IS FOR BRACED PIPE 2-1/2" THRU 8", AND 1-1/2" OR 2" BRACING



NFPA "LONGITUDINAL" SWAY BRACE @ CONCRETE

NO SCALE

LONG

PIPE

(PLAN SYMBOL)

* FIG. 4 IS FOR BRACED PIPE 1" THRU 3"
* FIG. 4A IS FOR BRACED PIPE 4" THRU 8"

SPRINKLERS

MAKE / VENDOR	MODEL	SIN	TYPE	RESPONSE TYPE	THREAD SIZE	NOM. "K"	CALC'D COVERAGE	DEFLECT. DISTANCE	TEMP.	FINISH	ESC.	WRENCH	SYMB.	QUANTITY
VIKING	M	VK300	UPR	QR	1/2"	5.6	225 SQ FT	1-12"	155°	BRZ	N/A	10896W/B		–
VIKING	M	VK350	UPR	QR	3/4"	8.0	130 SQ FT	1-12"	200°	BRZ	N/A	10896W/B		1
VIKING	EC	VK532	UPR	QR	3/4"	11.2	400 SQ FT	1-12"	200°	BRZ	N/A	05118CW/B		–
VIKING	MIRAGE	VK462	PND	QR	1/2"	5.6	225 SQ FT	1-12"	155°	WHT	CONCLD	14047W/B		9
VIKING	MIRAGE	VK464	PND	QR	3/4"	8.0	130 SQ FT	1-12"	200°	WHT	CONCLD	14047W/B		8
VIKING	MIRAGE EC	VK634	PND	QR	3/4"	8.0	400 SQ FT	1-12"	155°	WHT	CONCLD	14047W/B		37
RELIABLE	05-56 DRY	R45114	PND	QR	1"	5.6	225 SQ FT	1-12"	155°	WHT	CONCLD	MODEL FC		–
VIKING	M	VK305	HSW	QR	1/2"	5.6	196 SQ FT	4-6"	200°	BRZ	N/A	10896W/B		–
TOTAL SPRINKLERS ON THIS CONTRACT:		560										TOTAL SPRINKLERS ON THIS SHEET:		55

"AS-BUILTS"

08-01-2017

REV	DATE	REVISION DESCRIPTION
3	08/05/16	FM SCOPE REVIEW
2	10/26/16	PERMIT SET
1	12/06/16	INSTALLATION SET

REVISION HISTORY

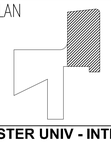
AUTOMATIC SPRINKLER DESIGN BASED ON THE FOLLOWING NFPA STANDARD

- [x] NFPA 13— 2010
- [ ] NFPA 13 D— 2002
- [ ] NFPA 13 R— 2002
- [ ] NFPA 14— 2003
- [ ] NFPA 20— 2003
- [ ] OTHER

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KEYPLAN



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FIRE PROTECTION PLAN - LEVEL 2 - AREA A

0 2 4 8 16 24 FT

SCALE: 1/8" = 1'-0"

DRAWN BY: DANA MITCHELL

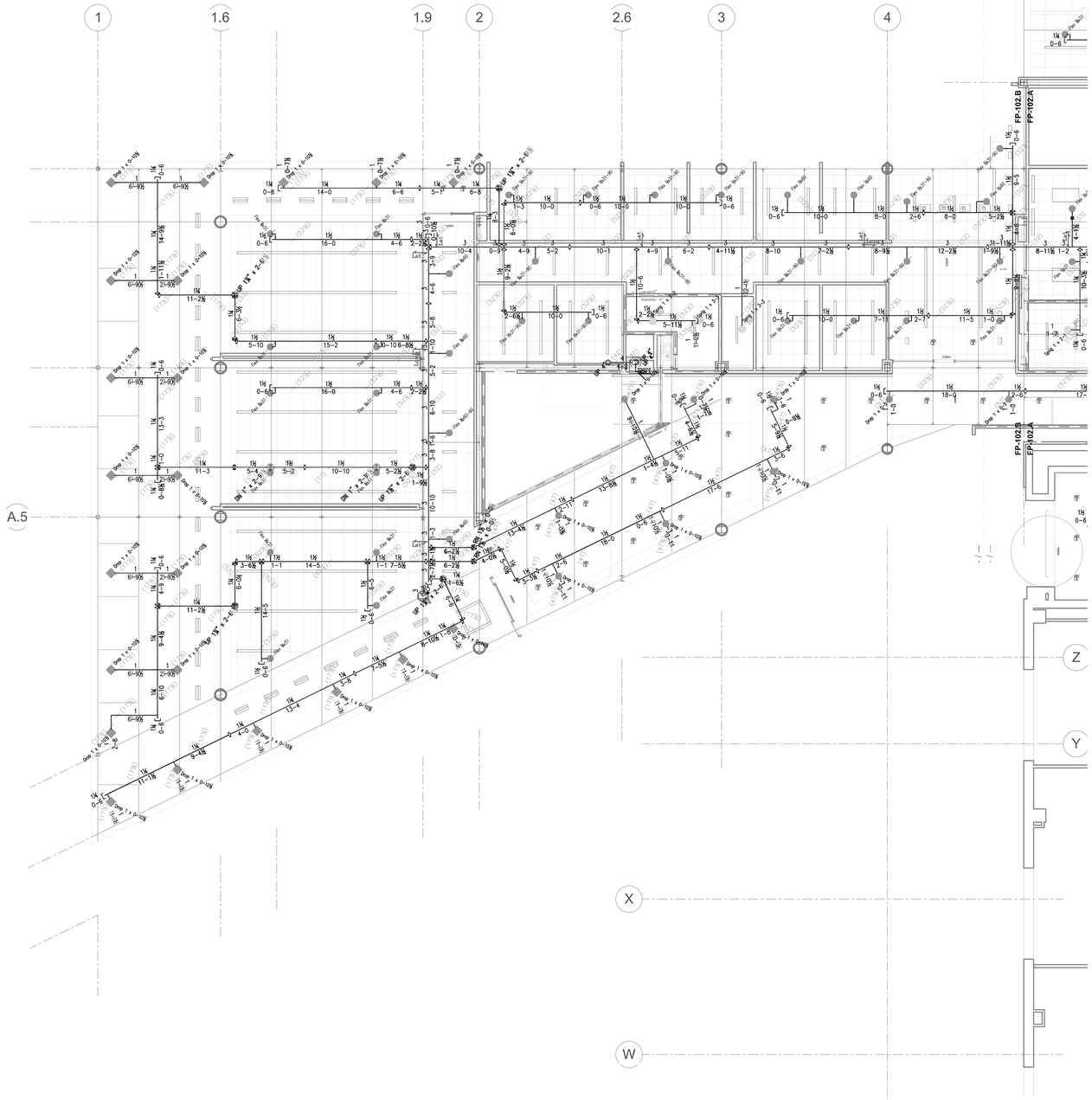
PROJECT MNGR: KURT REUTHER

DATE: 07/25/2016

CONTRACT NO: 461259

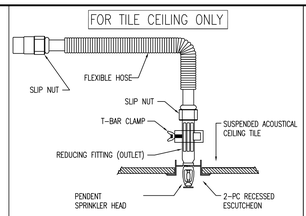
CONSTRUCTION DOCUMENTS

FP-102.A



AUTOMATIC SPRINKLER SYSTEM PLAN

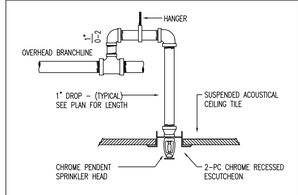
SCALE 1/8" = 1'-0"



SPRINKLER DROP HOSES

NO SCALE

TYPICAL SPRINKLER HEAD SYMBOL

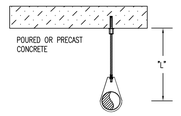


TYPICAL DROP DETAIL #2

NO SCALE

RETURN BEND FROM "UPRIGHT" OUTLET

TYPICAL SPRINKLER HEAD SYMBOL

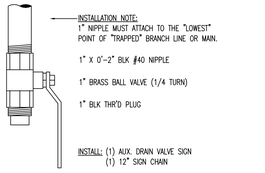


TYPICAL HANGER

TYPICAL HANGER #03P

NO SCALE

1 -- HILTI KWIK HUS-EZ 1 ANCHOR WITH COUPLING (3/8" = 1" THROUGH 4" PIPE)
1 -- ALL THREAD ROD
1 -- ADJUSTABLE HANGER RING

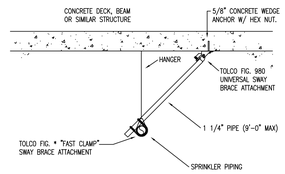


"WET" AUX. DRAIN CONN. #3A

NO SCALE

NOTE: THIS ARRANGEMENT CAN BE INSTALLED FOR ANY VOLUME OF "TRAPPED WATER" ON A WET SYSTEM.

AUX. DRAINS ARE INDICATED ON THE PLAN BY THIS SYMBOL:



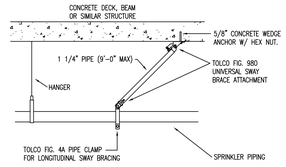
NFPA "LATERAL" SWAY BRACE @ CONCRETE

NO SCALE

LAT / PIPE

(PLAN SYMBOL)

* FIG. 1000 FOR BRACED PIPE 1" THRU 2", AND 1" OR 1-1/4" BRACING
* FIG. 1001 IS FOR BRACED PIPE 2-1/2" THRU 8", AND 1" OR 1-1/4" BRACING
* FIG. 2002 IS FOR BRACED PIPE 2-1/2" THRU 8", AND 1-1/2" OR 2" BRACING



NFPA "LONGITUDINAL" SWAY BRACE @ CONCRETE

NO SCALE

LONG / PIPE

(PLAN SYMBOL)

* FIG. 4 IS FOR BRACED PIPE 1" THRU 3"
* FIG. 4A IS FOR BRACED PIPE 4" THRU 8"

SPRINKLERS

MAKE / VENDOR	MODEL	SIN	TYPE	RESPONSE TYPE	THREAD SIZE	NOM. "K"	CALC'D COVERAGE	DEFLECT. DISTANCE	TEMP.	FINISH	ESC.	WRENCH	SYMB.	QUANTITY
VIKING	M	VK300	UPR	QR	1/2"	5.6	225 SQ FT	1-12"	155°	BRZ	N/A	10899W/B		–
VIKING	M	VK350	UPR	QR	3/4"	8.0	130 SQ FT	1-12"	200°	BRZ	N/A	10899W/B		3
VIKING	EC	VK532	UPR	QR	3/4"	11.2	400 SQ FT	1-12"	200°	BRZ	N/A	05118CW/B		–
VIKING	MIRAGE	VK462	PND	QR	1/2"	5.6	225 SQ FT	1-12"	155°	WHT	CONCLD	14047W/B		13
VIKING	MIRAGE	VK464	PND	QR	3/4"	8.0	130 SQ FT	1-12"	200°	WHT	CONCLD	14047W/B		–
VIKING	MIRAGE EC	VK634	PND	QR	3/4"	8.0	400 SQ FT	1-12"	155°	WHT	CONCLD	14047W/B		33
RELIABLE	QS-56 DRY	RA5114	PND	QR	1"	5.6	225 SQ FT	1-12"	155°	WHT	CNCLD	MODEL FC		–
VIKING	M	VK305	HOW	QR	1/2"	5.6	196 SQ FT	4-6"	200°	BRZ	N/A	10899W/B		–
TOTAL SPRINKLERS ON THIS CONTRACT:		560										TOTAL SPRINKLERS ON THIS SHEET:		71

"AS-BUILTS"

08-01-2017

REV	DATE	REVISION DESCRIPTION
A	08/05/16	FM SCOPE REVIEW
B	10/26/16	PERMIT SET
C	12/06/16	INSTALLATION SET

REVISION HISTORY

AUTOMATIC SPRINKLER DESIGN BASED ON THE FOLLOWING NFPA STANDARD

- [x] NFPA 13 — 2010
- [ ] NFPA 13 D — 2002
- [ ] NFPA 13 R — 2002
- [ ] NFPA 14 — 2003
- [ ] NFPA 20 — 2003
- [ ] OTHER

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KEYPLAN



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WEBSTER GROVES, MO

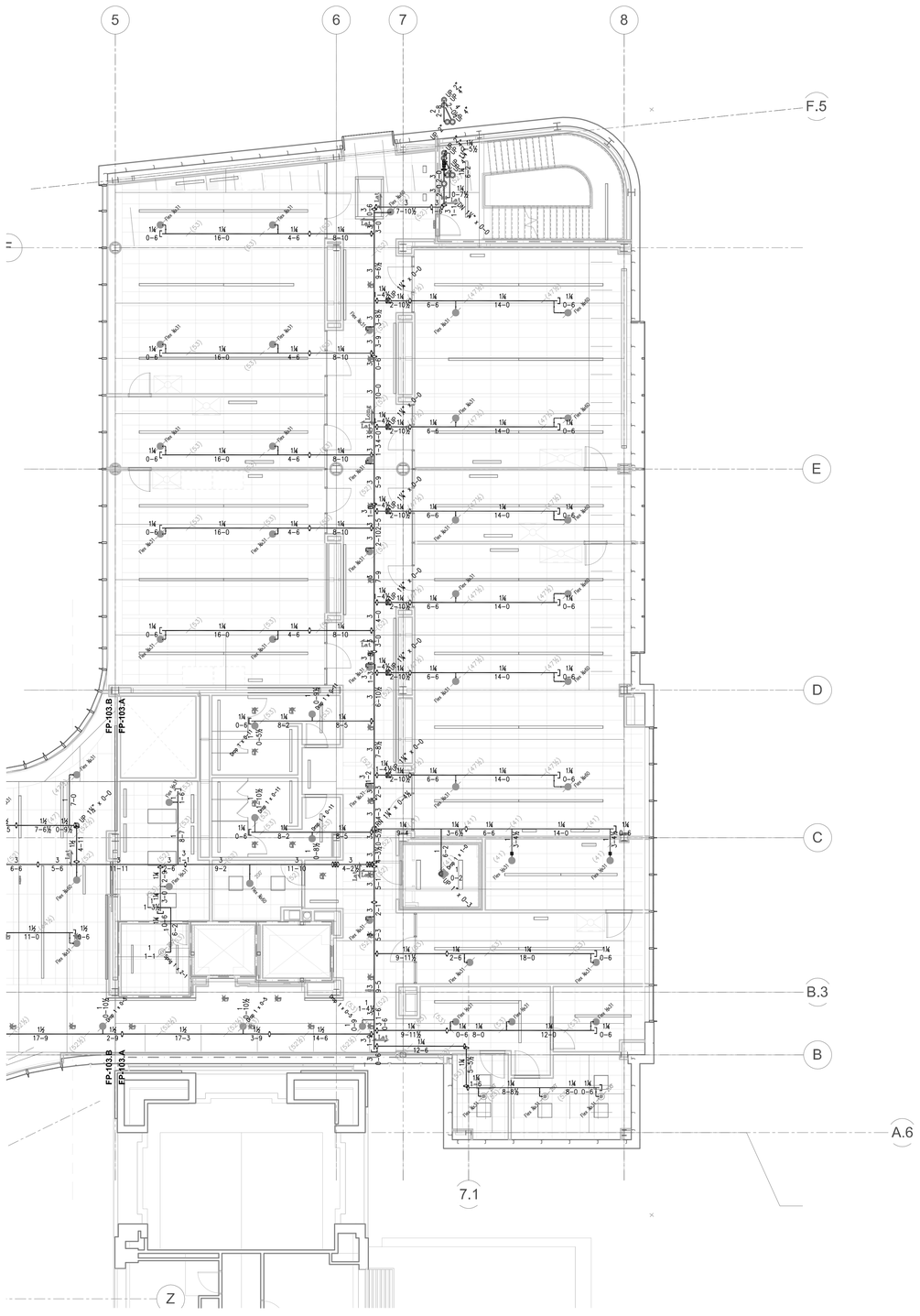
FIRE PROTECTION PLAN - LEVEL 2 - AREA B

0 2 4 8 16 24 FT

SCALE: 1/8" = 1'-0"
DRAWN BY: DANA MITCHELL
PROJECT MNGR: KURT REUTHER
DATE: 07/25/2016
CONTRACT NO: 461259

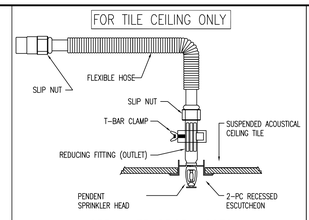
CONSTRUCTION DOCUMENTS

FP-102.B



AUTOMATIC SPRINKLER SYSTEM PLAN

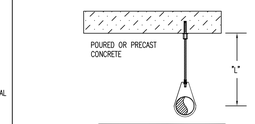
SCALE 1/8" = 1'-0"



SPRINKLER DROP HOSES

NO SCALE

TYPICAL SPRINKLER HEAD SYMBOL

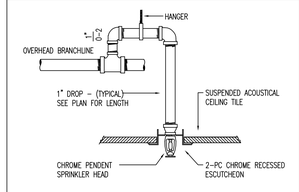


TYPICAL HANGER

TYPICAL HANGER #03P

NO SCALE

1 -- HILTI KWIK HUS-EZ 1 ANCHOR WITH COUPLING
(3/8" = 1" THROUGH 4" PIPE)
1 -- ALL THREAD ROD
1 -- ADJUSTABLE HANGER RING

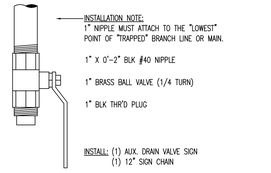


TYPICAL DROP DETAIL #2

NO SCALE

RETURN BEND FROM "UPRIGHT" OUTLET

TYPICAL SPRINKLER HEAD SYMBOL

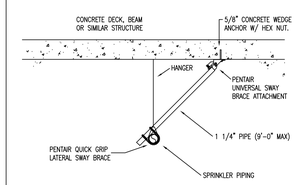


"WET" AUX. DRAIN CONN. #3A

NO SCALE

NOTE: THIS ARRANGEMENT CAN BE INSTALLED FOR ANY VOLUME OF "TRAPPED WATER" ON A WET SYSTEM.

AUX. DRAINS ARE INDICATED ON THE PLAN BY THIS SYMBOL:

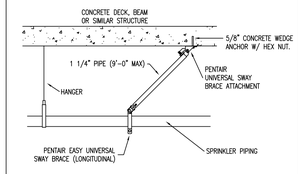


NFPA "LATERAL" SWAY BRACE @ CONCRETE

NO SCALE

LAT

(PLAN SYMBOL)



NFPA "LONGITUDINAL" SWAY BRACE @ CONCRETE

NO SCALE

LONG

PIPE

(PLAN SYMBOL)

SPRINKLERS

MAKE / VENDOR	MODEL	SIN	TYPE	RESPONSE TYPE	THREAD SIZE	NOM. "K"	CALC'D COVERAGE	DEFLECT. DISTANCE	TEMP.	FINISH	ESC.	WRENCH	SYMB.	QUANTITY
VIKING	M	VK300	UPR	QR	1/2"	5.6	225 SQ FT	1-12"	155°	BRZ	N/A	10896W/B		–
VIKING	M	VK350	UPR	QR	3/4"	8.0	130 SQ FT	1-12"	200°	BRZ	N/A	10896W/B		–
VIKING	EC	VK532	UPR	QR	3/4"	11.2	400 SQ FT	1-12"	200°	BRZ	N/A	05118CW/B		1
VIKING	MIRAGE	VK462	PND	QR	1/2"	5.6	225 SQ FT	1-12"	155°	WHT	CONCLD	14047W/B		11
VIKING	MIRAGE	VK464	PND	QR	3/4"	8.0	130 SQ FT	1-12"	200°	WHT	CONCLD	14047W/B		1
VIKING	MIRAGE EC	VK634	PND	QR	3/4"	8.0	400 SQ FT	1-12"	155°	WHT	CONCLD	14047W/B		33
VIKING	DRY	VK194	PND	QR	1"	5.6	225 SQ FT	1-12"	155°	WHT	DOME CNCLD	07565W/B		1
VIKING	EC	VK534	PND	QR	3/4"	11.2	100 SQ FT	1'-12"	200 °	CHR	E-1	05118CW/B		3
TOTAL SPRINKLERS ON THIS CONTRACT:		560	TOTAL SPRINKLERS ON THIS SHEET:											50

"AS-BUILTS"

08-01-2017

REV	DATE	REVISION DESCRIPTION
1	08/05/16	FM SCOPE REVIEW
2	10/26/16	PERMIT SET
3	12/12/16	INSTALLATION SET

REVISION HISTORY

AUTOMATIC SPRINKLER DESIGN BASED ON THE FOLLOWING NFPA STANDARD

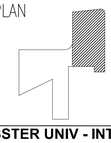
- ■ NFPA 13— 2010
- □ NFPA 13 D— 2002
- □ NFPA 13 R— 2002
- □ NFPA 14— 2003
- □ NFPA 20— 2003
- □ OTHER

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KEYPLAN



WEBSTER UNIV - INTER. SCIENCE BUILDING
8274 BIG BEND BLVD.
WEBSTER GROVES, MO

FIRE PROTECTION PLAN - LEVEL 3 - AREA A

0 2 4 8 16 24 FT

SCALE: 1/8" = 1'-0"

DRAWN BY: DANA MITCHELL

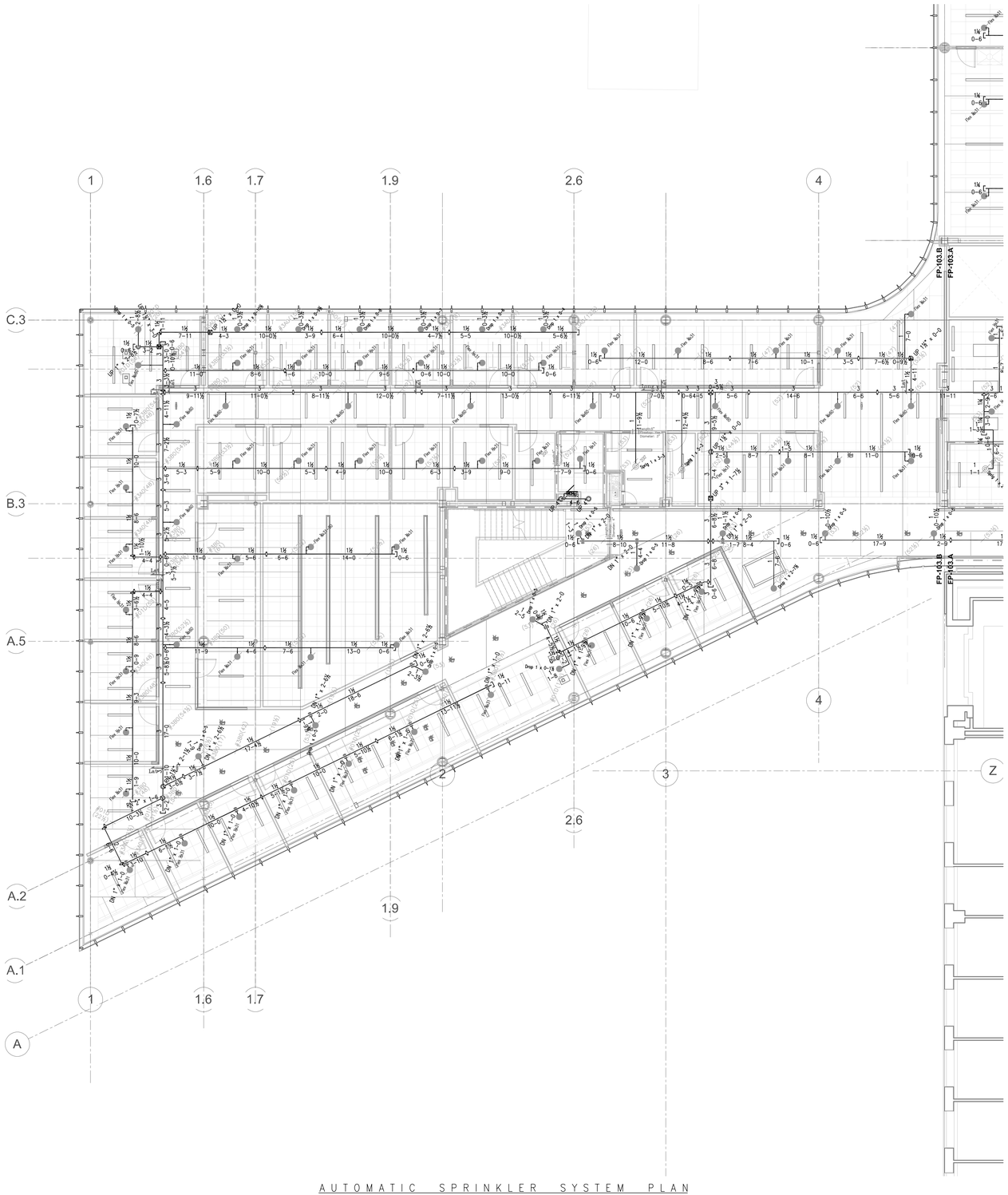
PROJECT MNGR: KURT REUTHER

DATE: 07/25/2016

CONTRACT NO: 461259

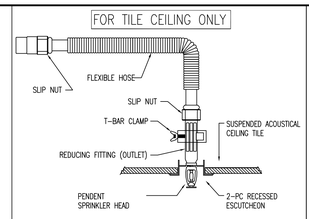
CONSTRUCTION DOCUMENTS

FP-103.A



AUTOMATIC SPRINKLER SYSTEM PLAN

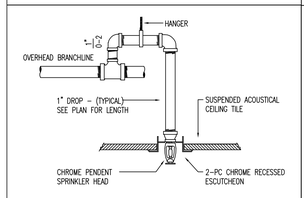
SCALE 1/8" = 1'-0"



SPRINKLER DROP HOSES

NO SCALE

TYPICAL SPRINKLER HEAD SYMBOL

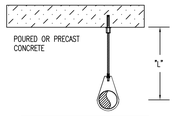


TYPICAL DROP DETAIL #2

NO SCALE

RETURN BEND FROM "UPRIGHT" OUTLET

TYPICAL SPRINKLER HEAD SYMBOL

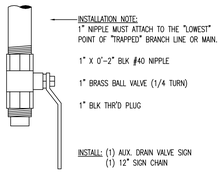


TYPICAL HANGER

TYPICAL HANGER #03P

NO SCALE

1 -- HILTI KWIK HUS-EZ 1 ANCHOR WITH COUPLING
(3/8" = 1" THROUGH 4" PIPE)
1 -- ALL THREAD ROD
1 -- ADJUSTABLE HANGER RING

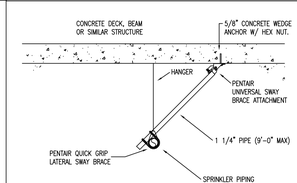


"WET" AUX. DRAIN CONN. #3A

NO SCALE

NOTE: THIS ARRANGEMENT CAN BE INSTALLED FOR ANY VOLUME OF "TRAPPED WATER" ON A WET SYSTEM.

AUX. DRAINS ARE INDICATED ON THE PLAN BY THIS SYMBOL:

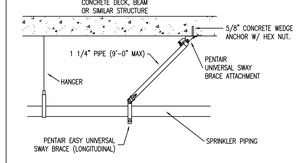


NFPA "LATERAL" SWAY BRACE @ CONCRETE

NO SCALE

LAT.

(PLAN SYMBOL)



NFPA "LONGITUDINAL" SWAY BRACE @ CONCRETE

NO SCALE

LONG.

PIPE

(PLAN SYMBOL)

SPRINKLERS

MAKE / VENDOR	MODEL	SIN	TYPE	RESPONSE TYPE	THREAD SIZE	NOM. "K"	CALC'D COVERAGE	DEFLECT. DISTANCE	TEMP.	FINISH	ESC.	WRENCH	SYMB.	QUANTITY
VIKING	M	VK300	UPR	QR	1/2"	5.6	225 SQ FT	1-12"	155°	BRZ	N/A	10896W/B		–
VIKING	M	VK350	UPR	QR	3/4"	8.0	130 SQ FT	1-12"	200°	BRZ	N/A	10896W/B		–
VIKING	EC	VK532	UPR	QR	3/4"	11.2	400 SQ FT	1-12"	200°	BRZ	N/A	05118CW/B		2
VIKING	MIRAGE	VK462	PND	QR	1/2"	5.6	225 SQ FT	1-12"	155°	WHT	CONCLD	14047W/B		35
VIKING	MIRAGE	VK464	PND	QR	3/4"	8.0	130 SQ FT	1-12"	200°	WHT	CONCLD	14047W/B		1
VIKING	MIRAGE EC	VK634	PND	QR	3/4"	8.0	400 SQ FT	1-12"	155°	WHT	CONCLD	14047W/B		38
VIKING	DRY	VK194	PND	QR	1"	5.6	225 SQ FT	1-12"	155°	WHT	DOME CNCLD	07565W/B		–
VIKING	M	VK305	HSW	QR	1/2"	5.6	196 SQ FT	4-6"	200 °	BRZ	N/A	10896W/B		–
TOTAL SPRINKLERS ON THIS CONTRACT:		560										TOTAL SPRINKLERS ON THIS SHEET:		76

"AS-BUILTS"

08-01-2017

REV	DATE	REVISION DESCRIPTION
3	08/05/16	FM SCOPE REVIEW
2	10/26/16	PERMIT SET
1	12/12/16	INSTALLATION SET

REVISION HISTORY

AUTOMATIC SPRINKLER DESIGN BASED ON THE FOLLOWING NFPA STANDARD

- ■ NFPA 13— 2010
- □ NFPA 13 D– 2002
- □ NFPA 13 R– 2002
- □ NFPA 14— 2003
- □ NFPA 20— 2003
- □ OTHER

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KEYPLAN



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8274 BIG BEND BLVD.
WEBSTER GROVES, MO

FIRE PROTECTION PLAN - LEVEL 3 - AREA B

0 2 4 8 16 24 FT

SCALE: 1/8" = 1'-0"

DRAWN BY: DANA MITCHELL

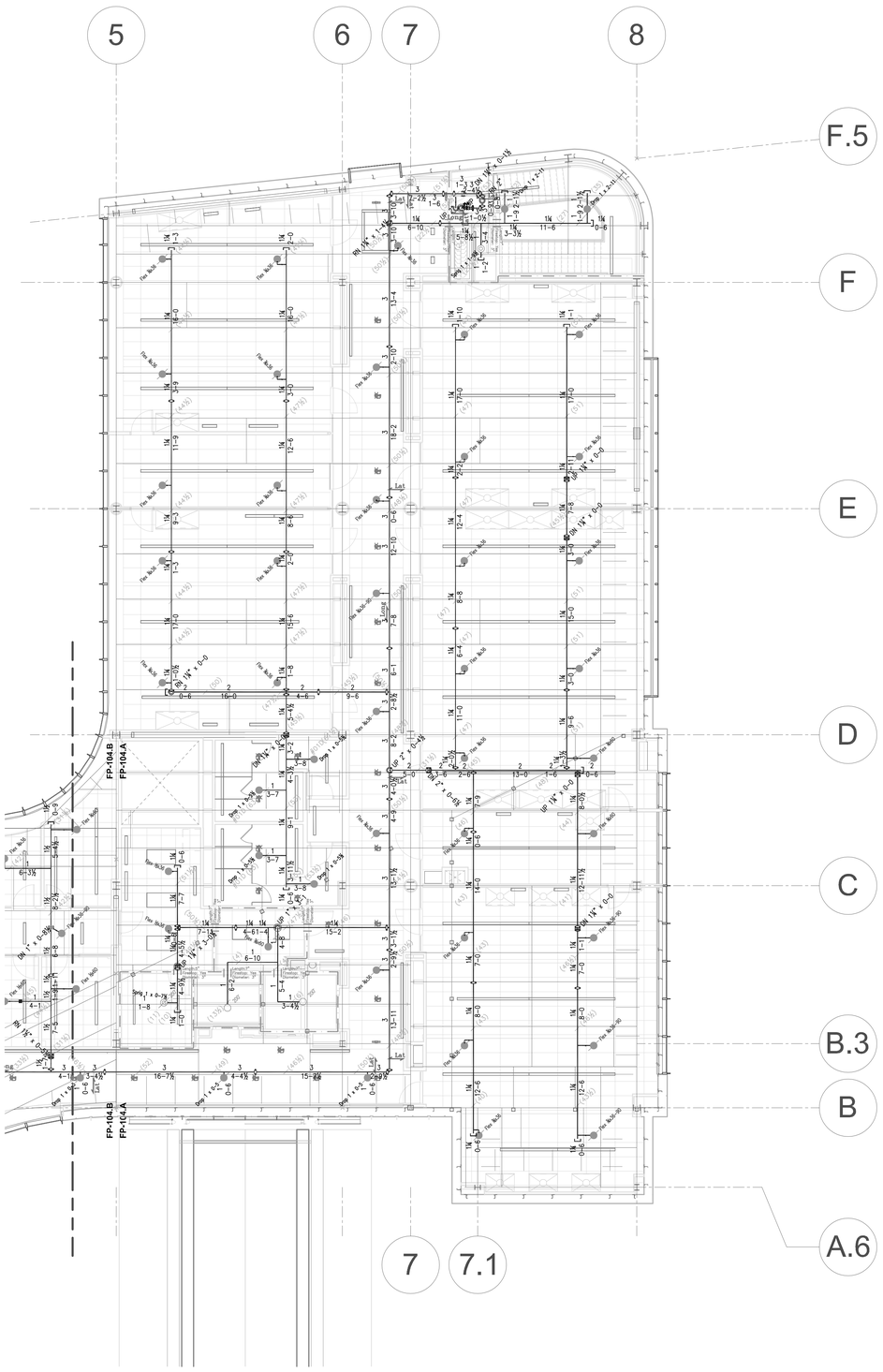
PROJECT MNGR: KURT REUTHER

DATE: 07/25/2016

CONTRACT NO: 461259

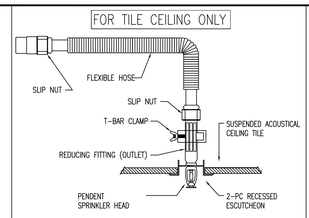
CONSTRUCTION DOCUMENTS

FP-103.B



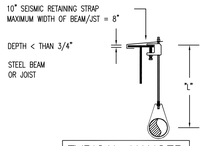
AUTOMATIC SPRINKLER SYSTEM PLAN

SCALE 1/8" = 1'-0"



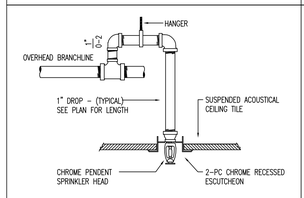
SPRINKLER DROP HOSES
NO SCALE

TYPICAL SPRINKLER HEAD SYMBOL



TYPICAL HANGER
TYPICAL HANGER #1A0
NO SCALE

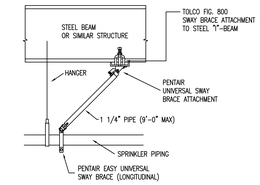
1 -- JR. TOP BEAM CLAMP
(3/8" = 1" THROUGH 4" PIPE)
(1/2" = 5" THROUGH 8" PIPE)
1 -- 10" SEISMIC RETAINING STRAP
1 -- HEX NUT (3/8" OR 1/2")
1 -- FLAT WASHER (3/8" OR 1/2")
1 -- ALL THREAD ROD (3/8" OR 1/2")
1 -- ADJUSTABLE HANGER RING



TYPICAL DROP DETAIL #2
NO SCALE

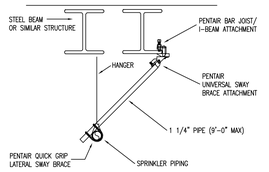
RETURN BEND FROM "UPRIGHT" OUTLET

TYPICAL SPRINKLER HEAD SYMBOL



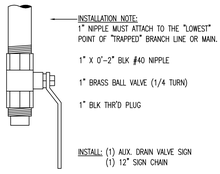
NFPA "LONGITUDINAL" SWAY BRACE @ BEAMS
NO SCALE

LONG
PIPE
(PLAN SYMBOL)



NFPA "LATERAL" SWAY BRACE @ BEAMS
NO SCALE

LAT
PIPE
(PLAN SYMBOL)



"WET" AUX. DRAIN CONN. #3A
NO SCALE

NOTE: THIS ARRANGEMENT CAN BE INSTALLED FOR ANY VOLUME OF "TRAPPED WATER" ON A WET SYSTEM.

AUX. DRAINS ARE INDICATED ON THE PLAN BY THIS SYMBOL:

SPRINKLERS

MAKE / VENDOR	MODEL	SIN	TYPE	RESPONSE TYPE	THREAD SIZE	NOM. "K"	CALC'D COVERAGE	DEFLECT. DISTANCE	TEMP.	FINISH	ESC.	WRENCH	SYMB.	QUANTITY
VIKING	M	VK300	UPR	QR	1/2"	5.6	225 SQ FT	1-12"	155°	BRZ	N/A	10898W/B		1
VIKING	M	VK350	UPR	QR	3/4"	8.0	130 SQ FT	1-12"	200°	BRZ	N/A	10898W/B		2
VIKING	EC	VK532	UPR	QR	3/4"	11.2	400 SQ FT	1-12"	200°	BRZ	N/A	05118CW/B		–
VIKING	MIRAGE	VK462	PND	QR	1/2"	5.6	225 SQ FT	1-12"	155°	WHT	CONCLD	14047W/B		6
VIKING	MIRAGE	VK464	PND	QR	3/4"	8.0	130 SQ FT	1-12"	200°	WHT	CONCLD	14047W/B		2
VIKING	MIRAGE EC	VK634	PND	QR	3/4"	8.0	400 SQ FT	1-12"	155°	WHT	CONCLD	14047W/B		39
VIKING	DRY	VK194	PND	QR	1"	5.6	225 SQ FT	1-12"	155°	WHT	DOME CNCLD	07565W/B		–
VIKING	M	VK305	HSW	QR	1/2"	5.6	196 SQ FT	4-6"	200 °	BRZ	N/A	10898W/B		–
TOTAL SPRINKLERS ON THIS CONTRACT:			560									TOTAL SPRINKLERS ON THIS SHEET:		50

"AS-BUILTS"
08-01-2017

REV	DATE	REVISION DESCRIPTION
1	08/05/16	FM SCOPE REVIEW
2	10/26/16	PERMIT SET
3	12/29/16	INSTALLATION SET

REVISION HISTORY

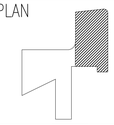
AUTOMATIC SPRINKLER DESIGN BASED ON THE FOLLOWING NFPA STANDARD

- ■ NFPA 13— 2010
- □ NFPA 13 D— 2002
- □ NFPA 13 R— 2002
- □ NFPA 14— 2003
- □ NFPA 20— 2003
- □ OTHER

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KEYPLAN



WEBSTER UNIV - INTER. SCIENCE BUILDING
8274 BIG BEND BLVD.
WEBSTER GROVES, MO

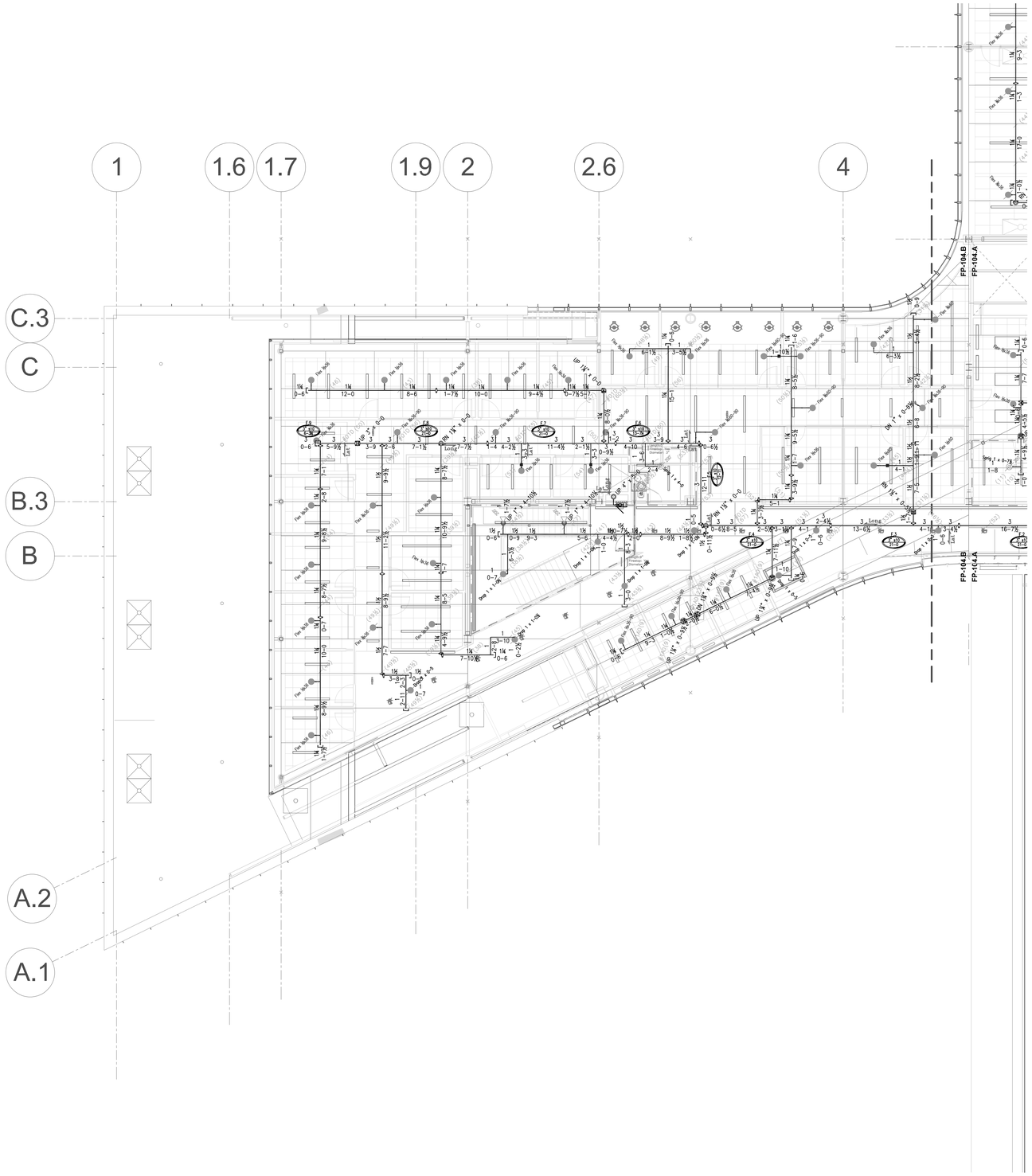
FIRE PROTECTION PLAN - LEVEL 4 - AREA A

0 2 4 8 16 24 FT

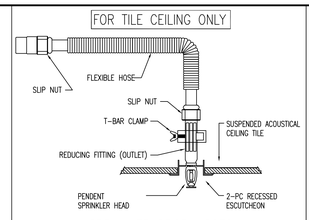
SCALE: 1/8" = 1'-0"
DRAWN BY: DANA MITCHELL
PROJECT MNGR: KURT REUTHER
DATE: 07/25/2016
CONTRACT NO: 461259

CONSTRUCTION DOCUMENTS

FP-104.A

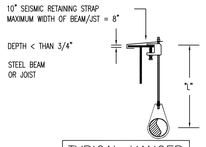


AUTOMATIC SPRINKLER SYSTEM PLAN
SCALE 1/8" = 1'-0"



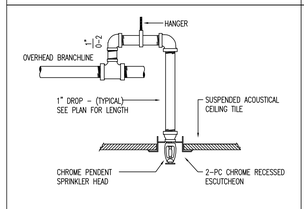
SPRINKLER DROP HOSES
NO SCALE

TYPICAL SPRINKLER HEAD SYMBOL



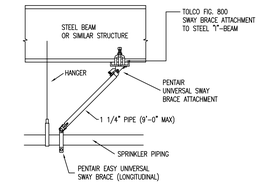
TYPICAL HANGER
TYPICAL HANGER #1A0
NO SCALE

1 -- JR. TOP BEAM CLAMP
(3/8" = 1" THROUGH 4" PIPE)
(1/2" = 5" THROUGH 8" PIPE)
1 -- 10" SEISMIC RETAINING STRAP
1 -- HEX NUT (3/8" OR 1/2")
1 -- FLAT WASHER (3/8" OR 1/2")
1 -- ALL THREAD ROD (3/8" OR 1/2")
1 -- ADJUSTABLE HANGER RING

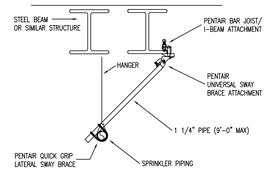


TYPICAL DROP DETAIL #2
NO SCALE
RETURN BEND FROM "UPRIGHT" OUTLET

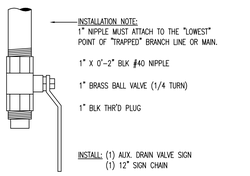
TYPICAL SPRINKLER HEAD SYMBOL



NFPA "LONGITUDINAL" SWAY BRACE @ BEAMS
NO SCALE
LONG
PIPE
(PLAN SYMBOL)



NFPA "LATERAL" SWAY BRACE @ BEAMS
NO SCALE
LAT
PIPE
(PLAN SYMBOL)



"WET" AUX. DRAIN CONN. #3A
NO SCALE
NOTE: THIS ARRANGEMENT CAN BE INSTALLED FOR ANY VOLUME OF "TRAPPED WATER" ON A WET SYSTEM.
AUX. DRAINS ARE INDICATED ON THE PLAN BY THIS SYMBOL:

SPRINKLERS

MAKE / VENDOR	MODEL	SIN	TYPE	RESPONSE TYPE	THREAD SIZE	NOM. "K"	CALC'D COVERAGE	DEFLECT. DISTANCE	TEMP.	FINISH	ESC.	WRENCH	SYMB.	QUANTITY
VIKING	M	VK300	UPR	QR	1/2"	5.6	225 SQ FT	1-12"	155°	BRZ	N/A	10898W/B		–
VIKING	M	VK350	UPR	QR	3/4"	8.0	130 SQ FT	1-12"	200°	BRZ	N/A	10898W/B		–
VIKING	EC	VK532	UPR	QR	3/4"	11.2	400 SQ FT	1-12"	200°	BRZ	N/A	05118CW/B		1
VIKING	MIRAGE	VK462	PND	QR	1/2"	5.6	225 SQ FT	1-12"	155°	WHT	CONCLD	14047W/B		27
VIKING	MIRAGE	VK464	PND	QR	3/4"	8.0	130 SQ FT	1-12"	200°	WHT	CONCLD	14047W/B		–
VIKING	MIRAGE EC	VK634	PND	QR	3/4"	8.0	400 SQ FT	1-12"	155°	WHT	CONCLD	14047W/B		18
VIKING	DRY	VK194	PND	QR	1"	5.6	225 SQ FT	1-12"	155°	WHT	DOME CNCLD	07565W/B		–
VIKING	M	VK305	HSW	QR	1/2"	5.6	196 SQ FT	4-6"	200 °	BRZ	N/A	10898W/B		2
TOTAL SPRINKLERS ON THIS CONTRACT:			560									TOTAL SPRINKLERS ON THIS SHEET:		48

"AS-BUILTS"
08-01-2017

REV	DATE	REVISION DESCRIPTION
1	08/05/16	FM SCOPE REVIEW
2	10/26/16	PERMIT SET
3	12/29/16	INSTALLATION SET
4		
5		
6		
7		
8		
9		
10		

REVISION HISTORY

AUTOMATIC SPRINKLER DESIGN BASED ON THE FOLLOWING NFPA STANDARD

- ■ NFPA 13— 2010
- □ NFPA 13 D— 2002
- □ NFPA 13 R— 2002
- □ NFPA 14— 2003
- □ NFPA 20— 2003
- □ OTHER

Terrence D. Shofner, P.E.
2675 Scott Avenue
Suite C
St. Louis, MO 63103

DATE: _____

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FIRE PROTECTION CONTRACTORS
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KEYPLAN



WEBSTER UNIV - INTER. SCIENCE BUILDING
8274 BIG BEND BLVD.
WEBSTER GROVES, MO

FIRE PROTECTION PLAN - LEVEL 4 - AREA B

0 2 4 8 16 24 FT

SCALE: 1/8" = 1'-0"
DRAWN BY: DANA MITCHELL
PROJECT MNGR: KURT REUTHER
DATE: 07/25/2016
CONTRACT NO: 461259

CONSTRUCTION DOCUMENTS

FP-104.B



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name	:	46125900 Webster ISB - Basement Lvl - RA3
Building	:	Webster ISB
Location	:	8274 Big Bend Blvd
System	:	SYS1
Contract	:	461259
Data File	:	46125900 Webster ISB - Basement Lvl - RA3.WXF

Hydraulic Design Information Sheet

Name - 46125900 Webster ISB - Basement Lvl - RA3 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - SYS1
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-100.A
Construction: ( ) Combustible (X) Non-Combustible Ceiling Height - 9-6
Occupancy - HC-2

SYSTEM

( ) NFPA 13 ( ) Lt. Haz. Ord.Haz.Gp. ( ) 1 ( ) 2 ( ) 3 ( ) Ex.Haz.
( ) NFPA 231 ( ) NFPA 231C ( ) Figure Curve
Other Factory Mutual - HC-2
Specific Ruling Made By Date

DESIGN

Area of Sprinkler Operation - 2506	System Type	Sprinkler/Nozzle
Density - .20	(X) Wet	Make Viking
Area Per Sprinkler - 130	( ) Dry	Model VK350
Elevation at Highest Outlet - 84.458	( ) Deluge	Size 3/4"
Hose Allowance - Inside - 50	( ) Preaction	K-Factor 8.0
Rack Sprinkler Allowance - n/a	( ) Other	Temp.Rat.200
Hose Allowance - Outside - 200		

Note

Calculation Summary: Flow Required - 643.33 Press Required - 106.307 SYS1
C-Factor Used: 120 Overhead 140 Underground

WATER SUPPLY

Water Flow Test:	Pump Data:	Tank or Reservoir:
Date of Test - 05/23/16		Cap. -
Time of Test - 2:30 PM	Rated Cap.- 1000	Elev.-
Static Press - 90	@ Press - 55	
Residual Press - 86	Elev. - 87.375	Well
Flow - 1140		Proof Flow
Elevation - 104		

Location - 8274 Big Bend Blvd

Source of Information - Ahern Fire Protection

COMMODITY

Commodity Class Location
Storage Ht. Area Aisle W.
Storage Method: Solid Piled % Palletized % Rack

( ) Single Row ( ) Conven. Pallet ( ) Auto. Storage ( ) Encap.
( ) Double Row ( ) Slave Pallet ( ) Solid Shelf ( ) Non
( ) Mult. Row ( ) Open Shelf

STORAGE RACK

Flue Spacing Clearance:Storage to Ceiling
Longitudinal Transverse

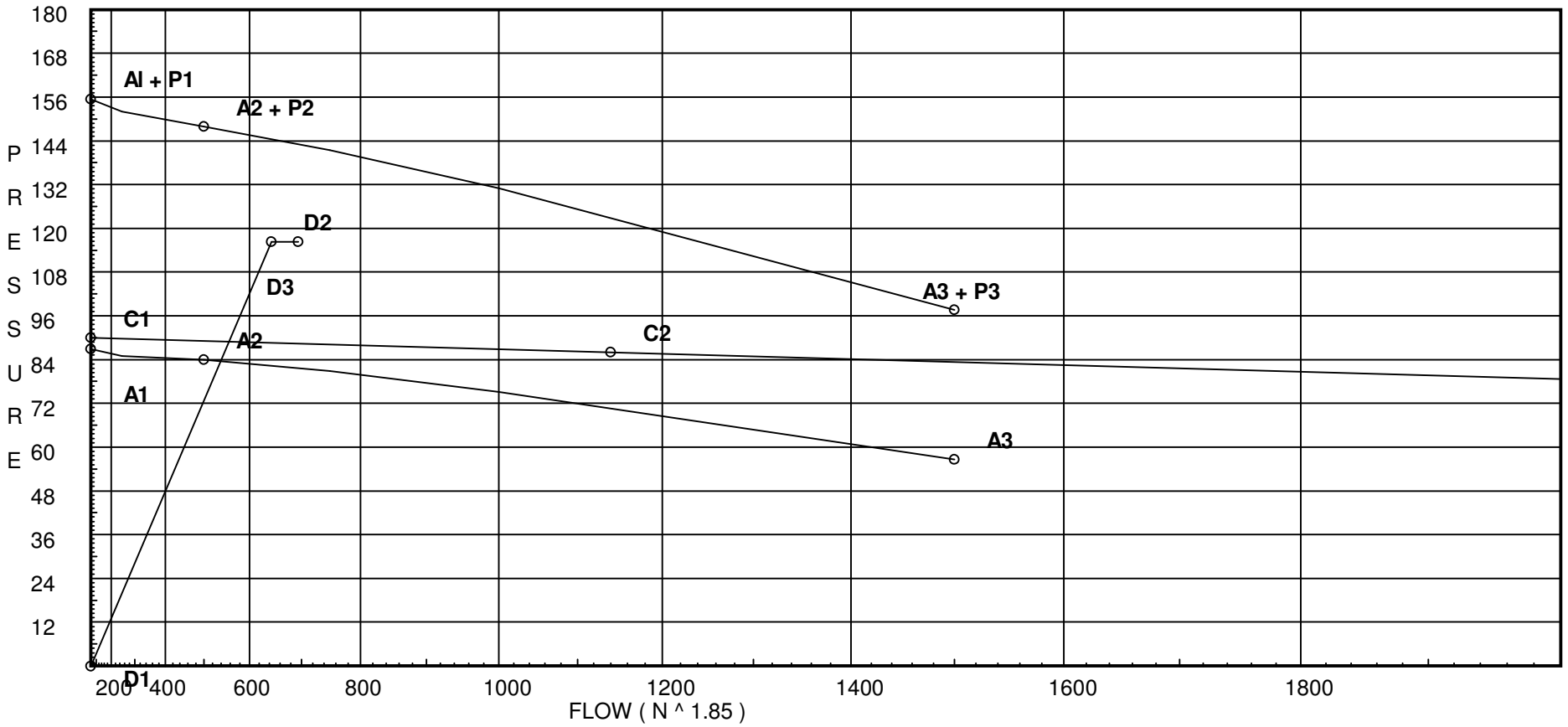
Horizontal Barriers Provided:

City Water Supply:
- C1 - Static Pressure : 90
- C2 - Residual Pressure: 86
- C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow
- A1 - Adjusted Static: 86.869
- A2 - Adj Resid : 83.879 @ 500
- A3 - Adj Resid : 56.554 @ 1500

Pump Data:
- P1 - Pump Churn Pressure : 68.5
- P2 - Pump Rated Pressure : 64
- P2 - Pump Rated Flow : 500
- P3 - Pump Pressure @ Max Flow : 41
- P3 - Pump Max Flow : 1500
- City Residual Flow @ 0 = 6135.00
- City Residual Flow @ 20 = 5355.71
- City Water @ 150% of Pump = 83.35

Demand:
- D1 - Elevation : -8.463
- D2 - System Flow : 643.329
- D2 - System Pressure : 116.240
- Hose (Demand) : 50
- D3 - System Demand : 693.329
- Hose (Adj City) : 200
- Safety Margin : 26.839



Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
Jx	Standard Grooved Tee	0	0	4.5	4.8	5.8	8.0	9.8	12.2	17	16.3	20.5	24.8	32.8	41.3	49.7	65	78	88	98	120
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkens 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Fittings Used Summary

Pressure / Flow Summary - STANDARD

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S1	84.04	8	17.68	na	33.64	0.2	110	7.0
S2	84.04	8	18.07	na	34.0	0.2	110	7.0
S4	84.46	8	10.56	na	26.0	0.2	130	7.0
S5	84.46	8	10.91	na	26.43	0.2	130	7.0
S6	84.04	8	12.97	na	28.81	0.2	130	7.0
S9	84.46	8	11.91	na	27.61	0.2	130	7.0
S10	84.46	8	12.31	na	28.07	0.2	130	7.0
S11	84.04	8	14.01	na	29.95	0.2	130	7.0
S12	84.46	8	12.28	na	28.03	0.2	130	7.0
S13	84.46	8	12.68	na	28.49	0.2	130	7.0
S14	84.46	8	10.93	na	26.45	0.2	130	7.0
S15	84.46	8	11.29	na	26.88	0.2	130	7.0
S16	84.04	8	12.88	na	28.71	0.2	130	7.0
S17	84.46	8	13.35	na	29.23	0.2	130	7.0
S18	84.46	8	13.79	na	29.71	0.2	130	7.0
S19	84.46	8	11.39	na	27.0	0.2	130	7.0
S20	84.46	8	11.77	na	27.44	0.2	130	7.0
S21	84.04	8	13.41	na	29.29	0.2	130	7.0
S22	84.46	8	15.41	na	31.4	0.2	130	7.0
X1	83.54		19.77	na				
X2	83.54		20.19	na				
S3	83.54	8	21.73	na	37.29	0.2	130	7.0
X4	83.62		12.16	na				
X5	83.62		12.55	na				
X6	83.62		14.54	na				
Z1	83.62		14.82	na				
S7	83.62	8	13.37	na	29.26	0.2	130	7.0
S8	83.62	8	13.72	na	29.63	0.2	130	7.0
X9	83.62		13.66	na				
X10	83.62		14.09	na				
X11	83.62		15.68	na				
Z2	83.62		16.0	na				
X12	83.62		14.06	na				
X13	83.62		14.51	na				
X14	83.62		12.56	na				
X15	83.62		12.96	na				
X16	83.62		14.44	na				
Z3	83.62		17.32	na				
Z4	83.62		19.53	na				
X17	83.62		15.25	na				
X18	83.62		15.73	na				
X19	83.62		13.08	na				
X20	83.62		13.49	na				
X21	83.62		15.02	na				
Z5	83.62		18.02	na				
X22	83.62		17.52	na				
D1	79.75		30.45	na				
D2	79.75		30.51	na				
D3	79.75		31.32	na				
D4	79.75		33.72	na				
D5	79.75		40.9	na				
D6	79.75		56.45	na				
D7	94.0		58.55	na				
B10	95.75		79.07	na				
B11	95.75		99.3	na				
SYS2	110.25		102.38	na				
HV12	103.0		105.52	na				
HV11	89.0		109.22	na	50.0			
SYS1	95.75		106.31	na				
BLK1	97.625		107.84	na				
BLK2	98.167		109.47	na				

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
TOR	96.167		111.09	na				
BOR	87.375		115.64	na				
PO	87.375		116.24	na				
PI	87.375		81.68	na				
BYPS	94.0		78.91	na				
BKFL	87.5		86.54	na				
SPIG	96.875		82.96	na				
UG1	96.875		87.8	na	200.0			
TEST	104.0		87.45	na				

The maximum velocity is 27.92 and it occurs in the pipe between nodes D4 and D5

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
*								
S1	33.64	1.049	T	5.0	0.500	17.681		K Factor = 8.00
to		120.0		0.0	5.000	0.217		
X1	33.64	0.3405		0.0	5.500	1.873		Vel = 12.49
	0.0							
	33.64					19.771		K Factor = 7.57
S2	34.00	1.049	T	5.0	0.500	18.066		K Factor = 8.00
to		120.0		0.0	5.000	0.217		
X2	34.0	0.3473		0.0	5.500	1.910		Vel = 12.62
	0.0							
	34.00					20.193		K Factor = 7.57
S4	26.00	1.049	T	5.0	0.830	10.562		K Factor = 8.00
to		120.0		0.0	5.000	0.364		
X4	26.0	0.2115		0.0	5.830	1.233		Vel = 9.65
	0.0							
	26.00					12.159		K Factor = 7.46
S5	26.43	1.049	T	5.0	0.830	10.914		K Factor = 8.00
to		120.0		0.0	5.000	0.364		
X5	26.43	0.2178		0.0	5.830	1.270		Vel = 9.81
	0.0							
	26.43					12.548		K Factor = 7.46
S6	28.82	1.049	T	5.0	0.420	12.973		K Factor = 8.00
to		120.0		0.0	5.000	0.182		
X6	28.82	0.2557		0.0	5.420	1.386		Vel = 10.70
	0.0							
	28.82					14.541		K Factor = 7.56
S9	27.61	1.049	T	5.0	0.830	11.914		K Factor = 8.00
to		120.0		0.0	5.000	0.364		
X9	27.61	0.2362		0.0	5.830	1.377		Vel = 10.25
	0.0							
	27.61					13.655		K Factor = 7.47
S10	28.06	1.049	T	5.0	0.830	12.307		K Factor = 8.00
to		120.0		0.0	5.000	0.364		
X10	28.06	0.2434		0.0	5.830	1.419		Vel = 10.42
	0.0							
	28.06					14.090		K Factor = 7.48
S11	29.95	1.049	T	5.0	0.420	14.013		K Factor = 8.00
to		120.0		0.0	5.000	0.182		
X11	29.95	0.2745		0.0	5.420	1.488		Vel = 11.12
	0.0							
	29.95					15.683		K Factor = 7.56
S12	28.03	1.049	T	5.0	0.830	12.278		K Factor = 8.00
to		120.0		0.0	5.000	0.364		
X12	28.03	0.2429		0.0	5.830	1.416		Vel = 10.41
	0.0							
	28.03					14.058		K Factor = 7.48

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
S13	28.49	1.049	T	5.0	0.830	12.682		K Factor = 8.00
to		120.0		0.0	5.000	0.364		
X13	28.49	0.2504		0.0	5.830	1.460		Vel = 10.58
	0.0							
	28.49					14.506		K Factor = 7.48
S14	26.45	1.049	T	5.0	0.830	10.928		K Factor = 8.00
to		120.0		0.0	5.000	0.364		
X14	26.45	0.2182		0.0	5.830	1.272		Vel = 9.82
	0.0							
	26.45					12.564		K Factor = 7.46
S15	26.88	1.049	T	5.0	0.830	11.291		K Factor = 8.00
to		120.0		0.0	5.000	0.364		
X15	26.88	0.2247		0.0	5.830	1.310		Vel = 9.98
	0.0							
	26.88					12.965		K Factor = 7.47
S16	28.71	1.049	T	5.0	0.420	12.877		K Factor = 8.00
to		120.0		0.0	5.000	0.182		
X16	28.71	0.2541		0.0	5.420	1.377		Vel = 10.66
	0.0							
	28.71					14.436		K Factor = 7.56
S17	29.24	1.049	T	5.0	0.830	13.354		K Factor = 8.00
to		120.0		0.0	5.000	0.364		
X17	29.24	0.2628		0.0	5.830	1.532		Vel = 10.85
	0.0							
	29.24					15.250		K Factor = 7.49
S18	29.71	1.049	T	5.0	0.830	13.792		K Factor = 8.00
to		120.0		0.0	5.000	0.364		
X18	29.71	0.2705		0.0	5.830	1.577		Vel = 11.03
	0.0							
	29.71					15.733		K Factor = 7.49
S19	27.00	1.049	T	5.0	0.830	11.389		K Factor = 8.00
to		120.0		0.0	5.000	0.364		
X19	27.0	0.2268		0.0	5.830	1.322		Vel = 10.02
	0.0							
	27.00					13.075		K Factor = 7.47
S20	27.44	1.049	T	5.0	0.830	11.766		K Factor = 8.00
to		120.0		0.0	5.000	0.364		
X20	27.44	0.2336		0.0	5.830	1.362		Vel = 10.19
	0.0							
	27.44					13.492		K Factor = 7.47
S21	29.29	1.049	T	5.0	0.420	13.409		K Factor = 8.00
to		120.0		0.0	5.000	0.182		
X21	29.29	0.2637		0.0	5.420	1.429		Vel = 10.87
	0.0							
	29.29					15.020		K Factor = 7.56
S22	31.40	1.049	T	5.0	0.830	15.409		K Factor = 8.00
to		120.0		0.0	5.000	0.364		
X22	31.4	0.2998		0.0	5.830	1.748		Vel = 11.66

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
	0.0							
	31.40					17.521		K Factor = 7.50
*								
X1	33.64	1.61		0.0	10.000	19.771		
to		120.0		0.0	0.0	0.0		
X2	33.64	0.0422		0.0	10.000	0.422		Vel = 5.30
X2	34.00	1.61		0.0	10.000	20.193		
to		120.0		0.0	0.0	0.0		
S3	67.64	0.1540		0.0	10.000	1.540		Vel = 10.66
S3	37.30	1.61	2lx	4.6	7.810	21.733		K Factor = 8.00
to		120.0	T	8.0	12.600	1.641		
D1	104.94	0.3468		0.0	20.410	7.079		Vel = 16.54
	0.0							
	104.94					30.453		K Factor = 19.02
*								
X4	26.00	1.61		0.0	14.840	12.159		
to		120.0		0.0	0.0	0.0		
X5	26.0	0.0262		0.0	14.840	0.389		Vel = 4.10
X5	26.43	1.61	2lx	4.6	16.140	12.548		
to		120.0		0.0	4.600	0.0		
X6	52.43	0.0961		0.0	20.740	1.993		Vel = 8.26
X6	28.81	1.61		0.0	1.270	14.541		
to		120.0		0.0	0.0	0.0		
Z1	81.24	0.2165		0.0	1.270	0.275		Vel = 12.80
Z1	58.89	1.61	lx	2.3	7.570	14.816		
to		120.0	Jx	5.8	16.100	1.676		
D2	140.13	0.5922	T	8.0	23.670	14.017		Vel = 22.08
	0.0							
	140.13					30.509		K Factor = 25.37
*								
S7	29.26	1.61		0.0	10.500	13.373		K Factor = 8.00
to		120.0		0.0	0.0	0.0		
S8	29.26	0.0327		0.0	10.500	0.343		Vel = 4.61
S8	29.62	1.61		0.0	9.230	13.716		K Factor = 8.00
to		120.0		0.0	0.0	0.0		
Z1	58.88	0.1192		0.0	9.230	1.100		Vel = 9.28
	0.0							
	58.88					14.816		K Factor = 15.30
*								
X9	27.61	1.61		0.0	14.830	13.655		
to		120.0		0.0	0.0	0.0		
X10	27.61	0.0293		0.0	14.830	0.435		Vel = 4.35
X10	28.07	1.61		0.0	14.830	14.090		
to		120.0		0.0	0.0	0.0		
X11	55.68	0.1074		0.0	14.830	1.593		Vel = 8.77
X11	29.94	1.61		0.0	1.320	15.683		
to		120.0		0.0	0.0	0.0		
Z2	85.62	0.2379		0.0	1.320	0.314		Vel = 13.49

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
Z2	56.53	1.61	lx	2.3	6.340	15.997		
to		120.0	Jx	5.8	16.100	1.676		
D3	142.15	0.6081	T	8.0	22.440	13.646		Vel = 22.40
	0.0							
	142.15					31.319		K Factor = 25.40
*								
X12	28.03	1.61		0.0	14.830	14.058		
to		120.0		0.0	0.0	0.0		
X13	28.03	0.0302		0.0	14.830	0.448		Vel = 4.42
X13	28.49	1.61		0.0	13.510	14.506		
to		120.0		0.0	0.0	0.0		
Z2	56.52	0.1104		0.0	13.510	1.491		Vel = 8.91
	0.0							
	56.52					15.997		K Factor = 14.13
*								
X14	26.45	1.61		0.0	14.830	12.564		
to		120.0		0.0	0.0	0.0		
X15	26.45	0.0270		0.0	14.830	0.401		Vel = 4.17
X15	26.88	1.61		0.0	14.830	12.965		
to		120.0		0.0	0.0	0.0		
X16	53.33	0.0992		0.0	14.830	1.471		Vel = 8.40
X16	28.71	1.61	Jx	5.8	7.320	14.436		
to		120.0		0.0	5.800	0.0		
Z3	82.04	0.2199		0.0	13.120	2.885		Vel = 12.93
Z3	58.94	2.067	J	8.5	3.960	17.321		
to		120.0		0.0	8.500	0.0		
Z4	140.98	0.1774		0.0	12.460	2.210		Vel = 13.48
Z4	115.14	2.067	I	3.5	9.880	19.531		
to		120.0	T	10.0	13.500	1.676		
D4	256.12	0.5353		0.0	23.380	12.515		Vel = 24.49
	0.0							
	256.12					33.722		K Factor = 44.10
*								
X17	29.24	1.61		0.0	14.830	15.250		
to		120.0		0.0	0.0	0.0		
X18	29.24	0.0326		0.0	14.830	0.483		Vel = 4.61
X18	29.70	1.61	Jx	5.8	7.510	15.733		
to		120.0		0.0	5.800	0.0		
Z3	58.94	0.1193		0.0	13.310	1.588		Vel = 9.29
	0.0							
	58.94					17.321		K Factor = 14.16
*								
X19	27.00	1.61		0.0	14.830	13.075		
to		120.0		0.0	0.0	0.0		
X20	27.0	0.0281		0.0	14.830	0.417		Vel = 4.26
X20	27.44	1.61		0.0	14.830	13.492		
to		120.0		0.0	0.0	0.0		
X21	54.44	0.1030		0.0	14.830	1.528		Vel = 8.58

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
X21	29.29	1.61	Jx	5.8	7.320	15.020		
to		120.0		0.0	5.800	0.0		
Z5	83.73	0.2284		0.0	13.120	2.997		Vel = 13.20
Z5	31.41	2.067	J	8.5	3.920	18.017		
to		120.0		0.0	8.500	0.0		
Z4	115.14	0.1219		0.0	12.420	1.514		Vel = 11.01
	0.0							
	115.14					19.531		K Factor = 26.05
*								
X22	31.40	1.61	Jx	5.8	7.510	17.521		
to		120.0		0.0	5.800	0.0		
Z5	31.4	0.0373		0.0	13.310	0.496		Vel = 4.95
	0.0							
	31.40					18.017		K Factor = 7.40
*								
D1	104.94	3.068		0.0	3.750	30.453		
to		120.0		0.0	0.0	0.0		
D2	104.94	0.0149		0.0	3.750	0.056		Vel = 4.55
D2	140.12	3.068		0.0	11.230	30.509		
to		120.0		0.0	0.0	0.0		
D3	245.06	0.0721		0.0	11.230	0.810		Vel = 10.64
D3	142.15	3.068		0.0	14.300	31.319		
to		120.0		0.0	0.0	0.0		
D4	387.21	0.1680		0.0	14.300	2.403		Vel = 16.80
D4	256.12	3.068		0.0	16.710	33.722		
to		120.0		0.0	0.0	0.0		
D5	643.33	0.4298		0.0	16.710	7.182		Vel = 27.92
D5	0.0	3.068	I	5.0	18.170	40.904		
to		120.0	J	13.0	18.000	0.0		
D6	643.33	0.4298		0.0	36.170	15.546		Vel = 27.92
D6	0.0	3.068	I	5.0	14.250	56.450		
to		120.0		0.0	5.000	-6.172		
D7	643.33	0.4298		0.0	19.250	8.274		Vel = 27.92
D7	0.0	3.068	2I	10.0	26.500	58.552		
to		120.0	J	13.0	23.000	-0.758		
B10	643.33	0.4298		0.0	49.500	21.275		Vel = 27.92
B10	0.0	3.068	2I	10.0	37.083	79.069		
to		120.0		0.0	10.000	0.0		
B11	643.33	0.4298		0.0	47.083	20.236		Vel = 27.92
B11	0.0	4.026	I	6.8	9.390	99.305		
to		120.0	T	20.0	51.800	0.0		
SYS1	643.33	0.1144	B	12.0	61.190	7.002		Vel = 16.21
			C	13.0				
	0.0							
	643.33					106.307		K Factor = 62.40

*

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
SYS2	0.0	4.026		0.0	7.250	102.376	0.0	
to		120.0		0.0	0.0	3.140	0.0	
HV12	0.0	0.0		0.0	7.250	0.0	0.0	Vel = 0
HV12	0.0	4.026	J	16.0	5.375	105.516	0.0	
to		120.0		0.0	16.000	2.328	0.0	
BLK1	0.0	0.0		0.0	21.375	0.0	0.0	Vel = 0
	0.0							
	0.0					107.844		K Factor = 0
HV11	50.00	4.026		0.0	6.750	109.224		Qa = 50
to		120.0		0.0	0.0	-2.923		
SYS1	50.0	0.0009		0.0	6.750	0.006		Vel = 1.26
SYS1	643.33	4.026	J	16.0	1.875	106.307		
to		120.0		0.0	16.000	-0.812		
BLK1	693.33	0.1314		0.0	17.875	2.349		Vel = 17.47
BLK1	0.0	6.065	2I	20.0	46.209	107.844		
to		120.0	H	5.0	58.000	-0.235		
BLK2	693.33	0.0179	B	8.0	104.209	1.862		Vel = 7.70
			J	25.0				
BLK2	0.0	6.065	2I	20.0	22.083	109.471		
to		120.0		0.0	20.000	0.866		
TOR	693.33	0.0179		0.0	42.083	0.752		Vel = 7.70
TOR	0.0	6.065	B	8.0	8.792	111.089		
to		120.0	J	25.0	33.000	3.808		
BOR	693.33	0.0179		0.0	41.792	0.746		Vel = 7.70
BOR	0.0	6.065	B	8.0	5.417	115.643		
to		120.0	C	20.0	28.000	0.0		
PO	693.33	0.0179		0.0	33.417	0.597		Vel = 7.70
	0.0							
	693.33					116.240		K Factor = 64.31
System Demand Pressure						116.240		
Safety Margin						26.839		
Continuation Pressure						143.079		
Pressure @ Pump Outlet						143.079		
Pressure From Pump Curve						-61.397		
Pressure @ Pump Inlet						81.682		
*								
PI	0.0	7.981	Ix	13.1	8.292	81.682		
to		120.0		0.0	13.100	-2.869		
BYPS	693.33	0.0047		0.0	21.392	0.100		Vel = 4.45
BYPS	0.0	6.065	2J	50.0	13.417	78.913		
to		120.0	I	10.0	60.000	6.315		* * Fixed Loss = 3.5
BKFL	693.33	0.0179	Zib	0.0	73.417	1.312		Vel = 7.70
BKFL	0.0	7.981	G	4.0	85.291	86.540		
to		120.0	Ix	13.1	17.100	-4.060		
SPIG	693.33	0.0047		0.0	102.391	0.480		Vel = 4.45
SPIG	0.0	8.39	2G	13.572	80.000	82.960		
to		140.0	Zac	0.0	134.023	4.251		* * Fixed Loss = 4.251
UG1	693.33	0.0028	2V	61.074	214.023	0.592		Vel = 4.02

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125900 Webster ISB - Basement Lvl - RA3

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
			X	59.377				
UG1	200.00	8.39	2G	13.572	500.000	87.803		Qa = 200
to		140.0	3U	45.805	118.754	-3.086		
TEST	893.33	0.0044	X	59.377	618.754	2.735		Vel = 5.18
	0.0							
	893.33					87.452		K Factor = 95.53



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name	:	46125901 Webster ISB - 1st Lvl - RA1
Building	:	Webster ISB
Location	:	8274 Big Bend Blvd
System	:	SYS1
Contract	:	461259
Data File	:	46125901 Webster ISB - 1st Lvl - RA1.WXF

Hydraulic Design Information Sheet

Name - 46125901 Webster ISB - 1st Lvl - RA1 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - SYS1
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-101.B
Construction: ( ) Combustible (X) Non-Combustible Ceiling Height - 9-6
Occupancy - HC-1

SYSTEM

( ) NFPA 13 ( ) Lt. Haz. Ord.Haz.Gp. ( ) 1 ( ) 2 ( ) 3 ( ) Ex.Haz.
( ) NFPA 231 ( ) NFPA 231C ( ) Figure Curve
Other Factory Mutual - HC-1
Specific Ruling Made By Date

DESIGN

Area of Sprinkler Operation - 1542	System Type	Sprinkler/Nozzle
Density - .10	(X) Wet	Make Viking
Area Per Sprinkler - 400	( ) Dry	Model VK632
Elevation at Highest Outlet - 95	( ) Deluge	Size 3/4"
Hose Allowance - Inside - 50	( ) Preaction	K-Factor 8.0
Rack Sprinkler Allowance - n/a	( ) Other	Temp.Rat.155
Hose Allowance - Outside - 200		

Note

Calculation Summary: Flow Required - 402.75 Press Required - 130.188 SYS1
C-Factor Used: 120 Overhead 140 Underground

WATER SUPPLY

Water Flow Test:	Pump Data:	Tank or Reservoir:
Date of Test - 05/23/16		Cap. -
Time of Test - 2:30 PM	Rated Cap.- 1000	Elev.-
Static Press - 90	@ Press - 55	
Residual Press - 86	Elev. - 87.375	Well
Flow - 1140		Proof Flow
Elevation - 104		

Location - 8274 Big Bend Blvd

Source of Information - Ahern Fire Protection

STORAGE

Commodity Class Location
Storage Ht. Area Aisle W.
Storage Method: Solid Piled % Palletized % Rack

( ) Single Row	( ) Conven. Pallet	( ) Auto. Storage	( ) Encap.
( ) Double Row	( ) Slave Pallet	( ) Solid Shelf	( ) Non
( ) Mult. Row		( ) Open Shelf	

RACK

Flue Spacing Clearance:Storage to Ceiling
Longitudinal Transverse

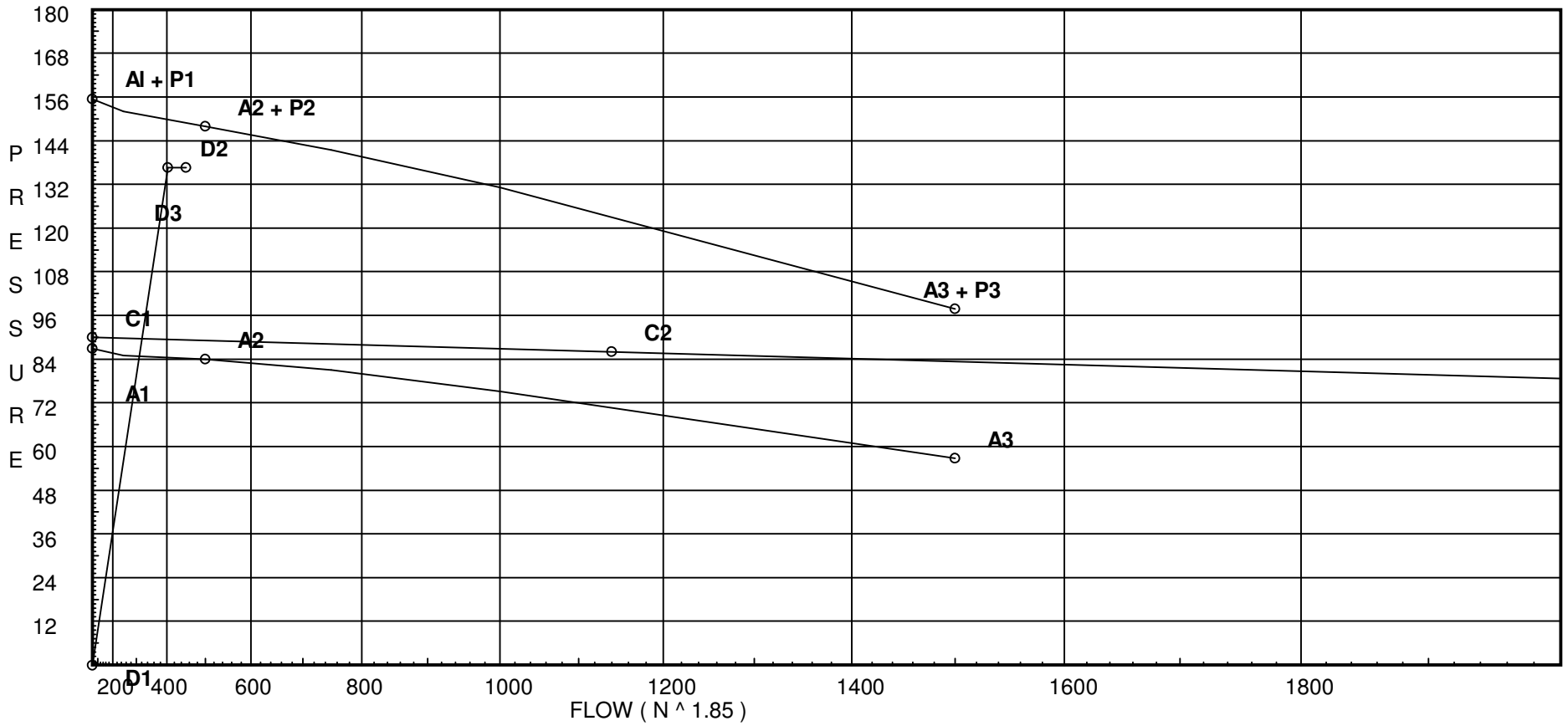
Horizontal Barriers Provided:

City Water Supply:
- C1 - Static Pressure : 90
- C2 - Residual Pressure: 86
- C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow
- A1 - Adjusted Static: 86.869
- A2 - Adj Resid : 83.909 @ 500
- A3 - Adj Resid : 56.783 @ 1500

Pump Data:
- P1 - Pump Churn Pressure : 68.5
- P2 - Pump Rated Pressure : 64
- P2 - Pump Rated Flow : 500
- P3 - Pump Pressure @ Max Flow : 41
- P3 - Pump Max Flow : 1500
- City Residual Flow @ 0 = 6135.00
- City Residual Flow @ 20 = 5355.71
- City Water @ 150% of Pump = 83.35

Demand:
- D1 - Elevation : -3.898
- D2 - System Flow : 402.751
- D2 - System Pressure : 136.518
- Hose (Demand) : 50
- D3 - System Demand : 452.751
- Hose (Adj City) : 200
- Safety Margin : 12.512



Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
Hx	Standard Grooved 45 Ell	0	0	.8	1.0	1.2	1.6	2.0	2.4	0	3.3	4.1	5.0	6.6	8.3	9.9	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkens 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Fittings Used Summary

Pressure / Flow Summary - STANDARD

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S1	95.0	8	41.54	na	51.56	0.1	400	25.0
S2	95.0	8	35.95	na	47.97	0.1	400	25.0
S3	95.0	8	38.36	na	49.55	0.1	400	25.0
S4	95.0	8	35.51	na	47.67	0.1	400	25.0
S5	95.0	8	37.89	na	49.24	0.1	400	25.0
S6	95.0	8	25.0	na	40.0	0.1	400	25.0
S7	95.0	5.6	33.8	na	32.56	0.1	82	7.0
S8	95.0	8	25.85	na	40.67	0.1	256	10.6
S9	95.0	8	29.61	na	43.53	0.1	256	10.6
X2	95.75		52.49	na				
X3	95.75		55.95	na				
X4	95.75		51.87	na				
X5	95.75		55.28	na				
X6	96.21		43.48	na				
X7	96.21		44.16	na				
X8	96.21		44.92	na				
X9	96.21		51.3	na				
Z1	96.21		57.58	na				
A1	95.75		71.6	na				
A2	95.75		71.61	na				
A3	95.75		71.8	na				
A4	95.75		72.41	na				
A5	95.75		78.1	na				
A6	95.4		95.7	na				
A7	95.4		100.92	na				
C1	95.29		95.75	na				
C2	95.29		95.75	na				
C3	95.29		95.75	na				
C4	95.29		95.75	na				
C5	95.29		95.75	na				
C6	95.29		95.75	na				
C7	95.29		95.75	na				
C8	95.29		95.75	na				
C9	98.0		94.57	na				
C10	95.75		95.55	na				
B1	95.75		106.33	na				
B2	95.75		106.33	na				
B3	95.75		106.33	na				
B4	95.75		106.33	na				
B5	95.75		106.33	na				
B6	95.75		106.33	na				
B7	95.75		106.51	na				
B8	95.75		107.6	na				
B9	95.75		107.94	na				
B10	95.75		115.81	na				
B11	95.75		122.6	na				
SYS2	110.25		124.95	na				
HV12	103.0		128.09	na				
HV11	89.0		133.11	na	50.0			
SYS1	95.75		130.19	na				
BLK1	97.625		130.42	na				
BLK2	98.167		130.95	na				
TOR	96.167		132.12	na				
BOR	87.375		136.26	na				
PO	87.375		136.52	na				
PI	87.375		84.33	na				
BYPS	94.0		81.51	na				
BKFL	87.5		88.4	na				
SPIG	96.875		84.55	na				
UG1	96.875		90.13	na	200.0			
TEST	104.0		88.57	na				

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.

The maximum velocity is 24.7 and it occurs in the pipe between nodes X9 and Z1

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
*DROPS								
S1	51.56	1.049	T	5.0	0.001	41.539		K Factor = 8.00
to		120.0	Eql	35.5	40.500	-0.325		
A1	51.56	0.7504		0.0	40.501	30.390		Vel = 19.14
	0.0							
	51.56					71.604		K Factor = 6.09
S2	47.96	1.049	T	5.0	0.001	35.948		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.325		
X2	47.96	0.6564		0.0	25.701	16.871		Vel = 17.80
	0.0							
	47.96					52.494		K Factor = 6.62
S3	49.55	1.049	T	5.0	0.001	38.357		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.325		
X3	49.55	0.6971		0.0	25.701	17.915		Vel = 18.39
	0.0							
	49.55					55.947		K Factor = 6.62
S4	47.67	1.049	T	5.0	0.001	35.510		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.325		
X4	47.67	0.6490		0.0	25.701	16.681		Vel = 17.70
	0.0							
	47.67					51.866		K Factor = 6.62
S5	49.24	1.049	T	5.0	0.001	37.891		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.325		
X5	49.24	0.6892		0.0	25.701	17.714		Vel = 18.28
	0.0							
	49.24					55.280		K Factor = 6.62
S6	40.00	1.049	T	5.0	0.001	25.000		K Factor = 8.00
to		120.0	Eql	35.5	40.500	-0.524		
X6	40.0	0.4691		0.0	40.501	19.000		Vel = 14.85
	0.0							
	40.00					43.476		K Factor = 6.07
S7	32.56	1.049	T	5.0	5.420	33.805		K Factor = 5.60
to		120.0	Eql	23.5	28.500	-0.524		
X7	32.56	0.3206		0.0	33.920	10.874		Vel = 12.09
	0.0							
	32.56					44.155		K Factor = 4.90
S8	40.67	1.049	T	5.0	0.001	25.846		K Factor = 8.00
to		120.0	Eql	35.5	40.500	-0.524		
X8	40.67	0.4838		0.0	40.501	19.594		Vel = 15.10
	0.0							
	40.67					44.916		K Factor = 6.07
S9	43.53	1.049	T	5.0	0.001	29.609		K Factor = 8.00
to		120.0	Eql	35.5	40.500	-0.524		
X9	43.53	0.5486		0.0	40.501	22.219		Vel = 16.16
	0.0							
	43.53					51.304		K Factor = 6.08

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
*BRANCHLINES								
*								
X2	47.96	1.38		0.0	20.000	52.494		
to		120.0		0.0	0.0	0.0		
X3	47.96	0.1726		0.0	20.000	3.453		Vel = 10.29
X3	49.55	1.38	Ix	1.9	15.510	55.947		
to		120.0	Hx	1.0	8.900	0.0		
A2	97.51	0.6415	T	6.0	24.410	15.659		Vel = 20.92
	0.0							
	97.51					71.606		K Factor = 11.52
*								
X4	47.67	1.38		0.0	20.000	51.866		
to		120.0		0.0	0.0	0.0		
X5	47.67	0.1707		0.0	20.000	3.414		Vel = 10.23
X5	49.25	1.38	Ix	1.9	17.140	55.280		
to		120.0	Hx	1.0	8.900	0.0		
A3	96.92	0.6343	T	6.0	26.040	16.516		Vel = 20.79
	0.0							
	96.92					71.796		K Factor = 11.44
*								
X6	40.00	1.61		0.0	11.660	43.476		
to		120.0		0.0	0.0	0.0		
X7	40.0	0.0582		0.0	11.660	0.679		Vel = 6.30
X7	32.56	1.61		0.0	4.340	44.155		
to		120.0		0.0	0.0	0.0		
X8	72.56	0.1753		0.0	4.340	0.761		Vel = 11.43
X8	40.67	1.61		0.0	16.000	44.916		
to		120.0		0.0	0.0	0.0		
X9	113.23	0.3992		0.0	16.000	6.388		Vel = 17.84
X9	43.53	1.61		0.0	8.608	51.304		
to		120.0		0.0	0.0	0.0		
Z1	156.76	0.7287		0.0	8.608	6.273		Vel = 24.70
Z1	0.0	1.61	2Ix	4.6	7.482	57.577		
to		120.0	T	8.0	12.600	0.199		
A4	156.76	0.7288		0.0	20.082	14.636		Vel = 24.70
	0.0							
	156.76					72.412		K Factor = 18.42
*MAINS								
A1	51.56	3.26		0.0	0.790	71.604		
to		120.0		0.0	0.0	0.0		
A2	51.56	0.0025		0.0	0.790	0.002		Vel = 1.98
A2	97.51	3.26		0.0	8.900	71.606		
to		120.0		0.0	0.0	0.0		
A3	149.07	0.0213		0.0	8.900	0.190		Vel = 5.73
A3	96.92	3.26		0.0	11.400	71.796		
to		120.0		0.0	0.0	0.0		
A4	245.99	0.0540		0.0	11.400	0.616		Vel = 9.46

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
A4	156.76	3.26		0.0	42.330	72.412		
to		120.0		0.0	0.0	0.0		
A5	402.75	0.1345		0.0	42.330	5.692		Vel = 15.48
A5	0.0	3.26	J	17.471	92.110	78.104		
to		120.0	3I	20.159	37.630	0.152		
A6	402.75	0.1345		0.0	129.740	17.445		Vel = 15.48
A6	0.0	3.26	J	17.471	21.370	95.701		
to		120.0		0.0	17.471	0.0		
A7	402.75	0.1344		0.0	38.841	5.222		Vel = 15.48
A7	0.0	3.26	2H	6.989	16.860	100.923		
to		120.0	J	17.471	24.460	-0.152		
B6	402.75	0.1345		0.0	41.320	5.557		Vel = 15.48
	0.0							
	402.75					106.328		K Factor = 39.06
*								
C1	0.0	3.26		0.0	4.740	95.748	0.0	
to		120.0		0.0	0.0	0.0	0.0	
C2	0.0	0.0		0.0	4.740	0.0	0.0	Vel = 0
C2	0.0	3.26		0.0	0.810	95.748	0.0	
to		120.0		0.0	0.0	0.0	0.0	
C3	0.0	0.0		0.0	0.810	0.0	0.0	Vel = 0
C3	0.0	3.26		0.0	11.690	95.748	0.0	
to		120.0		0.0	0.0	0.0	0.0	
C4	0.0	0.0		0.0	11.690	0.0	0.0	Vel = 0
C4	0.0	3.26		0.0	2.910	95.748	0.0	
to		120.0		0.0	0.0	0.0	0.0	
C5	0.0	0.0		0.0	2.910	0.0	0.0	Vel = 0
C5	0.0	3.26		0.0	12.090	95.748	0.0	
to		120.0		0.0	0.0	0.0	0.0	
C6	0.0	0.0		0.0	12.090	0.0	0.0	Vel = 0
C6	0.0	3.26		0.0	3.240	95.748	0.0	
to		120.0		0.0	0.0	0.0	0.0	
C7	0.0	0.0		0.0	3.240	0.0	0.0	Vel = 0
C7	0.0	3.26	I	6.72	28.260	95.748	0.0	
to		120.0		0.0	6.720	0.0	0.0	
C8	0.0	0.0		0.0	34.980	0.0	0.0	Vel = 0
C8	0.0	3.26	4I	26.879	57.440	95.748	0.0	
to		120.0	2H	6.989	33.868	-1.174	0.0	
C9	0.0	0.0		0.0	91.308	0.0	0.0	Vel = 0
C9	0.0	3.26	2I	13.44	22.280	94.574	0.0	
to		120.0		0.0	13.440	0.974	0.0	
C10	0.0	0.0		0.0	35.720	0.0	0.0	Vel = 0
C10	0.0	3.26	2H	6.989	18.800	95.549	0.0	
to		120.0	J	17.471	24.460	0.152	0.0	
A6	0.0	0.0		0.0	43.260	0.0	0.0	Vel = 0
	0.0							

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
	0.0					95.701		K Factor = 0
*								
B1	0.0	3.26		0.0	1.040	106.328	0.0	
to		120.0		0.0	0.0	0.0	0.0	
B2	0.0	0.0		0.0	1.040	0.0	0.0	Vel = 0
B2	0.0	3.26		0.0	2.370	106.328	0.0	
to		120.0		0.0	0.0	0.0	0.0	
B3	0.0	0.0		0.0	2.370	0.0	0.0	Vel = 0
B3	0.0	3.26		0.0	8.130	106.328	0.0	
to		120.0		0.0	0.0	0.0	0.0	
B4	0.0	0.0		0.0	8.130	0.0	0.0	Vel = 0
B4	0.0	3.26		0.0	6.130	106.328	0.0	
to		120.0		0.0	0.0	0.0	0.0	
B5	0.0	0.0		0.0	6.130	0.0	0.0	Vel = 0
B5	0.0	3.26		0.0	3.160	106.328	0.0	
to		120.0		0.0	0.0	0.0	0.0	
B6	0.0	0.0		0.0	3.160	0.0	0.0	Vel = 0
B6	402.75	3.26		0.0	1.340	106.328		
to		120.0		0.0	0.0	0.0		
B7	402.75	0.1343		0.0	1.340	0.180		Vel = 15.48
B7	0.0	3.26		0.0	8.100	106.508		
to		120.0		0.0	0.0	0.0		
B8	402.75	0.1344		0.0	8.100	1.089		Vel = 15.48
B8	0.0	3.26		0.0	2.560	107.597		
to		120.0		0.0	0.0	0.0		
B9	402.75	0.1344		0.0	2.560	0.344		Vel = 15.48
B9	0.0	3.26		0.0	58.497	107.941		
to		120.0		0.0	0.0	0.0		
B10	402.75	0.1345		0.0	58.497	7.866		Vel = 15.48
B10	0.0	3.26	2I	13.44	37.083	115.807		
to		120.0		0.0	13.440	0.0		
B11	402.75	0.1345		0.0	50.523	6.793		Vel = 15.48
B11	0.0	3.26	I	6.72	9.390	122.600		
to		120.0	T	20.159	47.039	0.0		
SYS1	402.75	0.1345	B	6.72	56.429	7.588		Vel = 15.48
			C	13.44				
	0.0							
	402.75					130.188		K Factor = 35.30
*								
SYS2	0.0	4.26		0.0	7.250	124.949	0.0	
to		120.0		0.0	0.0	3.140	0.0	
HV12	0.0	0.0		0.0	7.250	0.0	0.0	Vel = 0
HV12	0.0	4.26	J	21.067	5.375	128.089	0.0	
to		120.0		0.0	21.067	2.328	0.0	
BLK1	0.0	0.0		0.0	26.442	0.0	0.0	Vel = 0
	0.0							

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
	0.0					130.417		K Factor = 0
HV11	50.00	4.26		0.0	6.750	133.106		Qa = 50
to		120.0		0.0	0.0	-2.923		
SYS1	50.0	0.0007		0.0	6.750	0.005		Vel = 1.13
SYS1	402.75	4.26	J	21.067	1.875	130.188		
to		120.0		0.0	21.067	-0.812		
BLK1	452.75	0.0454		0.0	22.942	1.041		Vel = 10.19
BLK1	0.0	6.357	2I	25.147	46.209	130.417		
to		120.0	H	6.287	72.926	-0.235		
BLK2	452.75	0.0065	B	10.059	119.135	0.769		Vel = 4.58
			J	31.433				
BLK2	0.0	6.357	2I	25.147	22.083	130.951		
to		120.0		0.0	25.147	0.866		
TOR	452.75	0.0065		0.0	47.230	0.306		Vel = 4.58
TOR	0.0	6.357	B	10.059	8.792	132.123		
to		120.0	J	31.433	41.492	3.808		
BOR	452.75	0.0064		0.0	50.284	0.324		Vel = 4.58
BOR	0.0	6.357	B	10.059	5.417	136.255		
to		120.0	C	25.147	35.206	0.0		
PO	452.75	0.0065		0.0	40.623	0.263		Vel = 4.58
	0.0							
	452.75					136.518		K Factor = 38.75
System Demand Pressure						136.518		
Safety Margin						12.512		
Continuation Pressure						149.030		
Pressure @ Pump Outlet						149.030		
Pressure From Pump Curve						-64.697		
Pressure @ Pump Inlet						84.332		
*								
PI	0.0	8.249	Ix	15.386	8.292	84.332		
to		120.0		0.0	15.386	-2.869		
BYPS	452.75	0.0018		0.0	23.678	0.043		Vel = 2.72
BYPS	0.0	6.357	2J	62.867	13.417	81.506		
to		120.0	I	12.573	75.440	6.315		* * Fixed Loss = 3.5
BKFL	452.75	0.0065	Zib	0.0	88.857	0.575		Vel = 4.58
BKFL	0.0	7.981	G	4.0	85.291	88.396		
to		120.0	Ix	13.1	17.100	-4.060		
SPIG	452.75	0.0021		0.0	102.391	0.218		Vel = 2.90
SPIG	0.0	8.39	2G	13.572	80.000	84.554		
to		140.0	Zac	0.0	134.023	5.307		* * Fixed Loss = 5.307
UG1	452.75	0.0013	2V	61.074	214.023	0.269		Vel = 2.63
			X	59.377				
UG1	200.00	8.39	2G	13.572	500.000	90.130		Qa = 200
to		140.0	3U	45.805	118.754	-3.086		
TEST	652.75	0.0025	X	59.377	618.754	1.530		Vel = 3.79
	0.0							
	652.75					88.574		K Factor = 69.36

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*******	Notes	******



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name	:	46125901 Webster ISB - 1st Lvl - RA2
Building	:	Webster ISB
Location	:	8274 Big Bend Blvd
System	:	SYS1
Contract	:	461259
Data File	:	46125901 Webster ISB - 1st Lvl - RA2.WXF

Hydraulic Design Information Sheet

Name - 46125901 Webster ISB - 1st Lvl - RA2 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - SYS1
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-101.A
Construction: ( ) Combustible (X) Non-Combustible Ceiling Height - 13-5 1/2
Occupancy - HC-2

SYSTEM

( ) NFPA 13 ( ) Lt. Haz. Ord.Haz.Gp. ( ) 1 ( ) 2 ( ) 3 ( ) Ex.Haz.
( ) NFPA 231 ( ) NFPA 231C ( ) Figure Curve
Other Factory Mutual - HC-2
Specific Ruling Made By Date

DESIGN

Area of Sprinkler Operation - 2506	System Type	Sprinkler/Nozzle
Density - .20	(X) Wet	Make Viking
Area Per Sprinkler - 130	( ) Dry	Model VK350
Elevation at Highest Outlet - 98.458	( ) Deluge	Size 3/4"
Hose Allowance - Inside - 50	( ) Preaction	K-Factor 8.0
Rack Sprinkler Allowance - n/a	( ) Other	Temp.Rat.200
Hose Allowance - Outside - 200		

Note

Calculation Summary: Flow Required - 742.16 Press Required - 111.267 SYS1
C-Factor Used: 120 Overhead 140 Underground

WATER SUPPLY

Water Flow Test:	Pump Data:	Tank or Reservoir:
Date of Test - 05/23/16		Cap. -
Time of Test - 2:30 PM	Rated Cap.- 1000	Elev.-
Static Press - 90	@ Press - 55	
Residual Press - 86	Elev. - 87.375	Well
Flow - 1140		Proof Flow
Elevation - 104		

Location - 8274 Big Bend Blvd

Source of Information - Ahern Fire Protection

STORAGE

Commodity Class Location
Storage Ht. Area Aisle W.
Storage Method: Solid Piled % Palletized % Rack

( ) Single Row ( ) Conven. Pallet ( ) Auto. Storage ( ) Encap.
( ) Double Row ( ) Slave Pallet ( ) Solid Shelf ( ) Non
( ) Mult. Row ( ) Open Shelf

RACK

Flue Spacing Clearance:Storage to Ceiling
Longitudinal Transverse

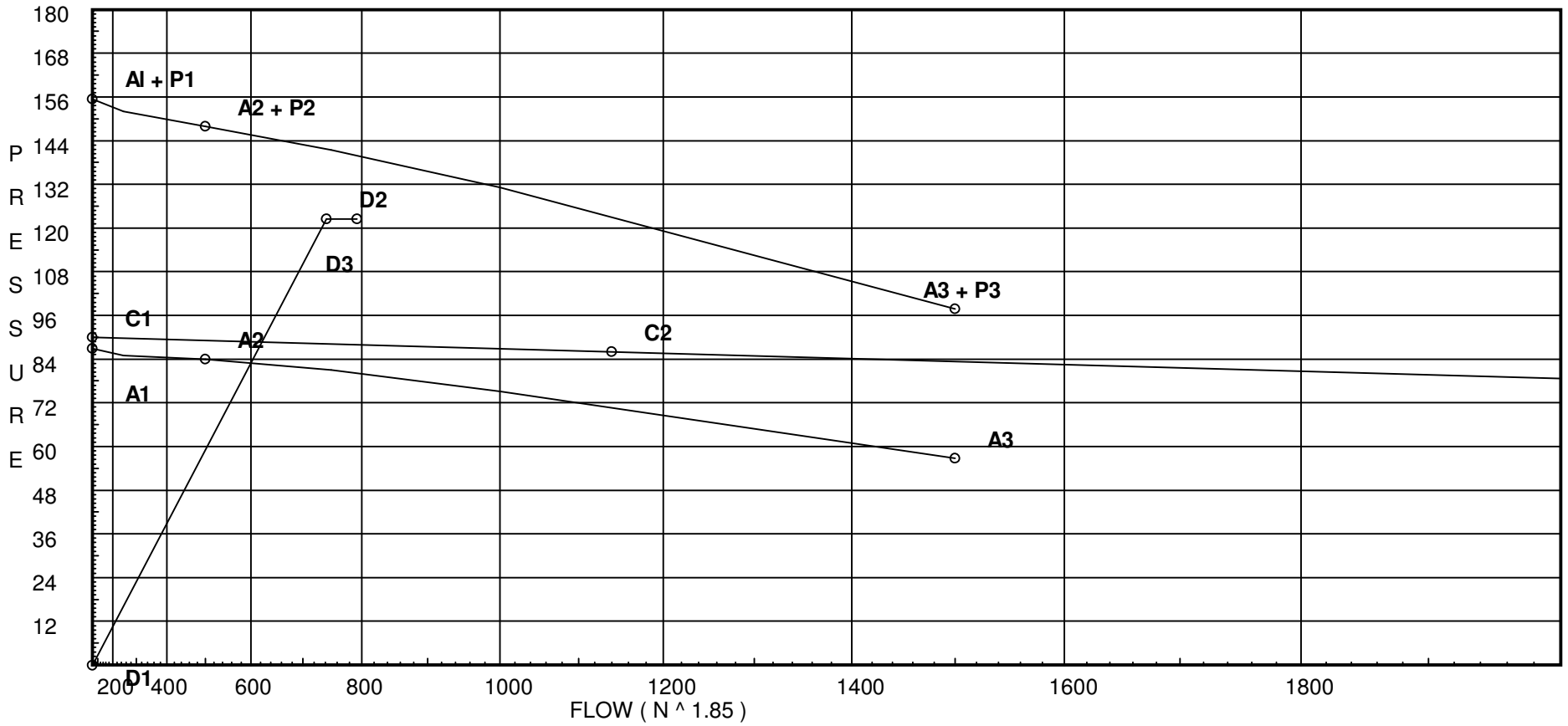
Horizontal Barriers Provided:

City Water Supply:
- C1 - Static Pressure : 90
- C2 - Residual Pressure: 86
- C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow
- A1 - Adjusted Static: 86.869
- A2 - Adj Resid : 83.909 @ 500
- A3 - Adj Resid : 56.783 @ 1500

Pump Data:
- P1 - Pump Churn Pressure : 68.5
- P2 - Pump Rated Pressure : 64
- P2 - Pump Rated Flow : 500
- P3 - Pump Pressure @ Max Flow : 41
- P3 - Pump Max Flow : 1500
- City Residual Flow @ 0 = 6135.00
- City Residual Flow @ 20 = 5355.71
- City Water @ 150% of Pump = 83.35

Demand:
- D1 - Elevation : -3.898
- D2 - System Flow : 742.163
- D2 - System Pressure : 122.501
- Hose (Demand) : 50
- D3 - System Demand : 792.163
- Hose (Adj City) : 200
- Safety Margin : 17.561



Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
E	90' Standard Elbow Thrd	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
Jx	Standard Grooved Tee	0	0	4.5	4.8	5.8	8.0	9.8	12.2	17	16.3	20.5	24.8	32.8	41.3	49.7	65	78	88	98	120
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkens 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Fittings Used Summary

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S11	95.0	8	23.89	na	39.1	0.1	324	17.0
S17	95.0	8	25.0	na	40.0	0.1	400	25.0
S21	95.5	8	11.91	na	27.61	0.2	102	7.0
S22	95.5	8	12.23	na	27.98	0.2	96	7.0
S23	95.5	8	13.41	na	29.3	0.2	96	7.0
S24	95.5	8	16.0	na	32.0	0.2	96	7.0
S25	97.5	8	32.14	na	45.35	0.2	107	7.0
S26	95.0	8	26.93	na	41.52	0.1	400	25.0
S27	94.33	5.6	26.91	na	29.05	0.1	139	7.0
S28	94.33	5.6	30.5	na	30.93	0.1	118	7.0
S29	95.5	8	11.92	na	27.62	0.2	102	7.0
S30	95.5	8	12.2	na	27.95	0.2	96	7.0
S31	95.5	8	13.25	na	29.12	0.2	96	7.0
S32	95.5	8	15.53	na	31.52	0.2	96	7.0
X11	97.5		34.36	na				
S12	97.5	8	20.66	na	36.36	0.2	122	7.0
S13	97.5	8	21.92	na	37.46	0.2	122	7.0
S14	97.5	8	17.11	na	33.09	0.2	117	7.0
S15	97.5	8	18.08	na	34.02	0.2	117	7.0
S16	97.5	8	21.67	na	37.24	0.2	117	7.0
S18	97.5	8	17.31	na	33.29	0.2	117	7.0
S19	97.5	8	18.3	na	34.22	0.2	117	7.0
S20	97.5	8	21.92	na	37.46	0.2	117	7.0
X21	96.75		18.37	na				
X22	96.75		18.86	na				
X23	96.75		20.68	na				
X24	96.75		24.65	na				
X27	95.75		37.51	na				
X28	95.75		38.19	na				
X29	96.21		21.18	na				
X30	96.21		21.68	na				
X31	96.21		23.5	na				
X32	96.21		27.45	na				
A1	95.75		38.85	na				
A2	95.75		38.85	na				
A3	95.75		38.85	na				
A4	95.75		38.85	na				
A5	95.75		38.85	na				
A6	95.4		39.0	na				
A7	95.4		39.07	na				
C1	95.29		38.97	na				
C2	95.29		38.97	na				
C3	95.29		38.97	na				
C4	95.29		38.97	na				
C5	95.29		38.97	na				
C6	95.29		38.97	na				
C7	95.29		38.97	na				
C8	95.29		38.97	na				
C9	98.0		37.8	na				
C10	95.75		38.77	na				
B1	95.75		37.75	na				
B2	95.75		37.76	na				
B3	95.75		37.83	na				
B4	95.75		38.18	na				
B5	95.75		38.73	na				
B6	95.75		39.23	na				
B7	95.75		39.52	na				
B8	95.75		41.56	na				
B9	95.75		42.34	na				
B10	95.75		66.71	na				
B11	95.75		87.76	na				

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
SYS2	110.25		107.92	na				
HV12	103.0		111.06	na				
HV11	89.0		114.18	na	50.0			
SYS1	95.75		111.27	na				
BLK1	97.625		113.38	na				
BLK2	98.167		115.32	na				
TOR	96.167		117.04	na				
BOR	87.375		121.76	na				
PO	87.375		122.5	na				
PI	87.375		80.24	na				
BYPS	94.0		77.5	na				
BKFL	87.5		85.43	na				
SPIG	96.875		81.98	na				
UG1	96.875		86.67	na	200.0			
TEST	104.0		86.91	na				

The maximum velocity is 28.53 and it occurs in the pipe between nodes B9 and B10

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
*DROPS								
S11	39.10	1.049	T	5.0	0.001	23.886		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-1.083		
X11	39.1	0.4498		0.0	25.701	11.560		Vel = 14.51
	0.0							
	39.10					34.363		K Factor = 6.67
S17	40.00	1.049	T	5.0	2.333	25.000		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.325		
B3	40.0	0.4691		0.0	28.033	13.151		Vel = 14.85
	0.0							
	40.00					37.826		K Factor = 6.50
S21	27.61	1.049	E	2.0	1.917	11.911		K Factor = 8.00
to		120.0	T	5.0	27.700	-0.541		
X21	27.61	0.2362	Eql	20.7	29.617	6.997		Vel = 10.25
	0.0							
	27.61					18.367		K Factor = 6.44
S22	27.98	1.049	E	2.0	1.917	12.233		K Factor = 8.00
to		120.0	T	5.0	27.700	-0.541		
X22	27.98	0.2422	Eql	20.7	29.617	7.172		Vel = 10.39
	0.0							
	27.98					18.864		K Factor = 6.44
S23	29.30	1.049	E	2.0	1.917	13.411		K Factor = 8.00
to		120.0	T	5.0	27.700	-0.541		
X23	29.3	0.2637	Eql	20.7	29.617	7.809		Vel = 10.88
	0.0							
	29.30					20.679		K Factor = 6.44
S24	32.00	1.049	E	2.0	1.917	15.998		K Factor = 8.00
to		120.0	T	5.0	27.700	-0.541		
X24	32.0	0.3104	Eql	20.7	29.617	9.193		Vel = 11.88
	0.0							
	32.00					24.650		K Factor = 6.45
S25	45.35	1.049	E	2.0	3.170	32.141		K Factor = 8.00
to		120.0	T	5.0	7.000	0.910		
A7	45.35	0.5917		0.0	10.170	6.018		Vel = 16.84
	0.0							
	45.35					39.069		K Factor = 7.26
S26	41.52	1.049	T	5.0	0.001	26.930		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.325		
B7	41.52	0.5025		0.0	25.701	12.915		Vel = 15.41
	0.0							
	41.52					39.520		K Factor = 6.60
S27	29.05	1.049	T	5.0	0.001	26.911		K Factor = 5.60
to		120.0	Eql	38.2	43.200	-0.615		
X27	29.05	0.2596		0.0	43.201	11.215		Vel = 10.78
	0.0							
	29.05					37.511		K Factor = 4.74

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
S28	30.93	1.049	T	5.0	0.001	30.501		K Factor = 5.60
to		120.0	Eql	23.5	28.500	-0.615		
X28	30.93	0.2915		0.0	28.501	8.308		Vel = 11.48
	0.0							
	30.93					38.194		K Factor = 5.00
S29	27.62	1.049	T	5.0	0.001	11.918		K Factor = 8.00
to		120.0	Eql	35.5	40.500	-0.308		
X29	27.62	0.2364		0.0	40.501	9.575		Vel = 10.25
	0.0							
	27.62					21.185		K Factor = 6.00
S30	27.95	1.049	T	5.0	0.001	12.203		K Factor = 8.00
to		120.0	Eql	35.5	40.500	-0.308		
X30	27.95	0.2417		0.0	40.501	9.788		Vel = 10.38
	0.0							
	27.95					21.683		K Factor = 6.00
S31	29.12	1.049	T	5.0	0.001	13.246		K Factor = 8.00
to		120.0	Eql	35.5	40.500	-0.308		
X31	29.12	0.2607		0.0	40.501	10.558		Vel = 10.81
	0.0							
	29.12					23.496		K Factor = 6.01
S32	31.52	1.049	T	5.0	0.001	15.527		K Factor = 8.00
to		120.0	Eql	35.5	40.500	-0.308		
X32	31.52	0.3020		0.0	40.501	12.230		Vel = 11.70
	0.0							
	31.52					27.449		K Factor = 6.02
*BRANCHLINES								
X11	39.10	1.38	2Jx	9.6	21.250	34.363		
to		120.0		0.0	9.600	0.758		
C10	39.1	0.1183		0.0	30.850	3.649		Vel = 8.39
	0.0							
	39.10					38.770		K Factor = 6.28
*								
S12	36.36	1.38		0.0	12.170	20.661		K Factor = 8.00
to		120.0		0.0	0.0	0.0		
S13	36.36	0.1035		0.0	12.170	1.259		Vel = 7.80
S13	37.46	1.38	3Ix	5.7	27.620	21.920		K Factor = 8.00
to		120.0	T	6.0	11.700	0.758		
B1	73.82	0.3833		0.0	39.320	15.072		Vel = 15.83
	0.0							
	73.82					37.750		K Factor = 12.01
*								
S14	33.09	1.38		0.0	11.170	17.109		K Factor = 8.00
to		120.0		0.0	0.0	0.0		
S15	33.09	0.0869		0.0	11.170	0.971		Vel = 7.10
S15	34.02	1.38		0.0	11.170	18.080		K Factor = 8.00
to		120.0		0.0	0.0	0.0		
S16	67.11	0.3213		0.0	11.170	3.589		Vel = 14.40

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
S16	37.24	1.38	2lx	3.8	11.280	21.669		K Factor = 8.00
to		120.0	T	6.0	9.800	0.758		
B2	104.35	0.7272		0.0	21.080	15.329		Vel = 22.38
	0.0							
	104.35					37.756		K Factor = 16.98
*								
S18	33.29	1.38		0.0	11.170	17.314		K Factor = 8.00
to		120.0		0.0	0.0	0.0		
S19	33.29	0.0878		0.0	11.170	0.981		Vel = 7.14
S19	34.21	1.38		0.0	11.170	18.295		K Factor = 8.00
to		120.0		0.0	0.0	0.0		
S20	67.5	0.3248		0.0	11.170	3.628		Vel = 14.48
S20	37.46	1.38	2lx	3.8	11.280	21.923		K Factor = 8.00
to		120.0	T	6.0	9.800	0.758		
B4	104.96	0.7352		0.0	21.080	15.497		Vel = 22.51
	0.0							
	104.96					38.178		K Factor = 16.99
*								
X21	27.61	1.38		0.0	8.000	18.367		
to		120.0		0.0	0.0	0.0		
X22	27.61	0.0621		0.0	8.000	0.497		Vel = 5.92
X22	27.98	1.38		0.0	8.000	18.864		
to		120.0		0.0	0.0	0.0		
X23	55.59	0.2269		0.0	8.000	1.815		Vel = 11.92
X23	29.30	1.38		0.0	8.000	20.679		
to		120.0		0.0	0.0	0.0		
X24	84.89	0.4964		0.0	8.000	3.971		Vel = 18.21
X24	31.99	1.38	lx	1.9	7.310	24.650		
to		120.0	T	6.0	7.900	0.433		
B5	116.88	0.8970		0.0	15.210	13.643		Vel = 25.07
	0.0							
	116.88					38.726		K Factor = 18.78
*								
X27	29.05	1.38		0.0	10.000	37.511		
to		120.0		0.0	0.0	0.0		
X28	29.05	0.0683		0.0	10.000	0.683		Vel = 6.23
X28	30.93	1.38	T	6.0	6.910	38.194		
to		120.0		0.0	6.000	0.0		
B8	59.98	0.2610		0.0	12.910	3.370		Vel = 12.87
	0.0							
	59.98					41.564		K Factor = 9.30
*								
X29	27.62	1.38		0.0	8.000	21.185		
to		120.0		0.0	0.0	0.0		
X30	27.62	0.0622		0.0	8.000	0.498		Vel = 5.92
X30	27.94	1.38		0.0	8.000	21.683		
to		120.0		0.0	0.0	0.0		
X31	55.56	0.2266		0.0	8.000	1.813		Vel = 11.92

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
X31	29.12	1.38		0.0	8.000	23.496		
to		120.0		0.0	0.0	0.0		
X32	84.68	0.4941		0.0	8.000	3.953		Vel = 18.16
X32	31.52	1.38	2Ix	3.8	6.760	27.449		
to		120.0	T	6.0	9.800	0.199		
B9	116.2	0.8873		0.0	16.560	14.694		Vel = 24.93
	0.0							
	116.20					42.342		K Factor = 17.86
*MAINS								
A1	0.0	3.26		0.0	0.790	38.848	0.0	
to		120.0		0.0	0.0	0.0	0.0	
A2	0.0	0.0		0.0	0.790	0.0	0.0	Vel = 0
A2	0.0	3.26		0.0	8.900	38.848	0.0	
to		120.0		0.0	0.0	0.0	0.0	
A3	0.0	0.0		0.0	8.900	0.0	0.0	Vel = 0
A3	0.0	3.26		0.0	11.400	38.848	0.0	
to		120.0		0.0	0.0	0.0	0.0	
A4	0.0	0.0		0.0	11.400	0.0	0.0	Vel = 0
A4	0.0	3.26		0.0	42.330	38.848	0.0	
to		120.0		0.0	0.0	0.0	0.0	
A5	0.0	0.0		0.0	42.330	0.0	0.0	Vel = 0
A5	0.0	3.26	J	17.471	92.110	38.848	0.0	
to		120.0	3I	20.159	37.630	0.152	0.0	
A6	0.0	0.0		0.0	129.740	0.0	0.0	Vel = 0
A6	39.10	3.26	J	17.471	21.370	39.000		
to		120.0		0.0	17.471	0.0		
A7	39.1	0.0018		0.0	38.841	0.069		Vel = 1.50
A7	45.35	3.26	2H	6.989	16.860	39.069		
to		120.0	J	17.471	24.460	-0.152		
B6	84.45	0.0075		0.0	41.320	0.310		Vel = 3.25
	0.0							
	84.45					39.227		K Factor = 13.48
*								
C1	0.0	3.26		0.0	4.740	38.970	0.0	
to		120.0		0.0	0.0	0.0	0.0	
C2	0.0	0.0		0.0	4.740	0.0	0.0	Vel = 0
C2	0.0	3.26		0.0	0.810	38.970	0.0	
to		120.0		0.0	0.0	0.0	0.0	
C3	0.0	0.0		0.0	0.810	0.0	0.0	Vel = 0
C3	0.0	3.26		0.0	11.690	38.970	0.0	
to		120.0		0.0	0.0	0.0	0.0	
C4	0.0	0.0		0.0	11.690	0.0	0.0	Vel = 0
C4	0.0	3.26		0.0	2.910	38.970	0.0	
to		120.0		0.0	0.0	0.0	0.0	
C5	0.0	0.0		0.0	2.910	0.0	0.0	Vel = 0
C5	0.0	3.26		0.0	12.090	38.970	0.0	
to		120.0		0.0	0.0	0.0	0.0	
C6	0.0	0.0		0.0	12.090	0.0	0.0	Vel = 0

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
C6	0.0	3.26		0.0	3.240	38.970	0.0	
to		120.0		0.0	0.0	0.0	0.0	
C7	0.0	0.0		0.0	3.240	0.0	0.0	Vel = 0
C7	0.0	3.26	I	6.72	28.260	38.970	0.0	
to		120.0		0.0	6.720	0.0	0.0	
C8	0.0	0.0		0.0	34.980	0.0	0.0	Vel = 0
C8	0.0	3.26	4I	26.879	57.440	38.970	0.0	
to		120.0	2H	6.989	33.868	-1.174	0.0	
C9	0.0	0.0		0.0	91.308	0.0	0.0	Vel = 0
C9	0.0	3.26	2I	13.44	22.280	37.796	0.0	
to		120.0		0.0	13.440	0.974	0.0	
C10	0.0	0.0		0.0	35.720	0.0	0.0	Vel = 0
C10	39.10	3.26	2H	6.989	18.800	38.770		
to		120.0	J	17.471	24.460	0.152		
A6	39.1	0.0018		0.0	43.260	0.078		Vel = 1.50
	0.0							
	39.10					39.000		K Factor = 6.26
*								
B1	73.82	3.26		0.0	1.040	37.750		
to		120.0		0.0	0.0	0.0		
B2	73.82	0.0058		0.0	1.040	0.006		Vel = 2.84
B2	104.35	3.26		0.0	2.370	37.756		
to		120.0		0.0	0.0	0.0		
B3	178.17	0.0295		0.0	2.370	0.070		Vel = 6.85
B3	40.00	3.26		0.0	8.130	37.826		
to		120.0		0.0	0.0	0.0		
B4	218.17	0.0433		0.0	8.130	0.352		Vel = 8.39
B4	104.96	3.26		0.0	6.130	38.178		
to		120.0		0.0	0.0	0.0		
B5	323.13	0.0894		0.0	6.130	0.548		Vel = 12.42
B5	116.88	3.26		0.0	3.160	38.726		
to		120.0		0.0	0.0	0.0		
B6	440.01	0.1585		0.0	3.160	0.501		Vel = 16.91
B6	84.46	3.26		0.0	1.340	39.227		
to		120.0		0.0	0.0	0.0		
B7	524.47	0.2187		0.0	1.340	0.293		Vel = 20.16
B7	41.51	3.26		0.0	8.100	39.520		
to		120.0		0.0	0.0	0.0		
B8	565.98	0.2523		0.0	8.100	2.044		Vel = 21.75
B8	59.98	3.26		0.0	2.560	41.564		
to		120.0		0.0	0.0	0.0		
B9	625.96	0.3039		0.0	2.560	0.778		Vel = 24.06
B9	116.20	3.26		0.0	58.497	42.342		
to		120.0		0.0	0.0	0.0		
B10	742.16	0.4166		0.0	58.497	24.370		Vel = 28.53
B10	0.0	3.26	2I	13.44	37.083	66.712		
to		120.0		0.0	13.440	0.0		
B11	742.16	0.4166		0.0	50.523	21.047		Vel = 28.53

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
B11	0.0	3.26	I	6.72	9.390	87.759		
to		120.0	T	20.159	47.039	0.0		
SYS1	742.16	0.4166	B	6.72	56.429	23.508		Vel = 28.53
			C	13.44				
	0.0							
	742.16					111.267		K Factor = 70.36
*								
SYS2	0.0	4.26		0.0	7.250	107.917	0.0	
to		120.0		0.0	0.0	3.140	0.0	
HV12	0.0	0.0		0.0	7.250	0.0	0.0	Vel = 0
HV12	0.0	4.26	J	21.067	5.375	111.057	0.0	
to		120.0		0.0	21.067	2.328	0.0	
BLK1	0.0	0.0		0.0	26.442	0.0	0.0	Vel = 0
	0.0							
	0.0					113.385		K Factor = 0
HV11	50.00	4.26		0.0	6.750	114.185		Qa = 50
to		120.0		0.0	0.0	-2.923		
SYS1	50.0	0.0007		0.0	6.750	0.005		Vel = 1.13
SYS1	742.16	4.26	J	21.067	1.875	111.267		
to		120.0		0.0	21.067	-0.812		
BLK1	792.16	0.1277		0.0	22.942	2.929		Vel = 17.83
BLK1	0.0	6.357	2I	25.147	46.209	113.384		
to		120.0	H	6.287	72.926	-0.235		
BLK2	792.16	0.0182	B	10.059	119.135	2.167		Vel = 8.01
			J	31.433				
BLK2	0.0	6.357	2I	25.147	22.083	115.316		
to		120.0		0.0	25.147	0.866		
TOR	792.16	0.0182		0.0	47.230	0.859		Vel = 8.01
TOR	0.0	6.357	B	10.059	8.792	117.041		
to		120.0	J	31.433	41.492	3.808		
BOR	792.16	0.0182		0.0	50.284	0.914		Vel = 8.01
BOR	0.0	6.357	B	10.059	5.417	121.763		
to		120.0	C	25.147	35.206	0.0		
PO	792.16	0.0182		0.0	40.623	0.738		Vel = 8.01
	0.0							
	792.16					122.501		K Factor = 71.57
System Demand Pressure						122.501		
Safety Margin						17.561		
Continuation Pressure						140.062		
Pressure @ Pump Outlet						140.062		
Pressure From Pump Curve						-59.818		
Pressure @ Pump Inlet						80.244		
*								
PI	0.0	8.249	Ix	15.386	8.292	80.244		
to		120.0		0.0	15.386	-2.869		
BYPS	792.16	0.0051		0.0	23.678	0.121		Vel = 4.76

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
BYPS	0.0	6.357	2J	62.867	13.417	77.496		
to		120.0	I	12.573	75.440	6.315		* * Fixed Loss = 3.5
BKFL	792.16	0.0182	Zib	0.0	88.857	1.616		Vel = 8.01
BKFL	0.0	7.981	G	4.0	85.291	85.427		
to		120.0	Ix	13.1	17.100	-4.060		
SPIG	792.16	0.0060		0.0	102.391	0.614		Vel = 5.08
SPIG	0.0	8.39	2G	13.572	80.000	81.981		
to		140.0	Zac	0.0	134.023	3.933		* * Fixed Loss = 3.933
UG1	792.16	0.0035	2V	61.074	214.023	0.757		Vel = 4.60
			X	59.377				
UG1	200.00	8.39	2G	13.572	500.000	86.671		Qa = 200
to		140.0	3U	45.805	118.754	-3.086		
TEST	992.16	0.0054	X	59.377	618.754	3.321		Vel = 5.76
	0.0							
	992.16					86.906		K Factor = 106.43



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name	:	46125901 Webster ISB - 1st Lvl - RA4
Building	:	Webster ISB
Location	:	8274 Big Bend Blvd
System	:	SYS1
Contract	:	461259
Data File	:	46125901 Webster ISB - 1st Lvl - RA4.WXF

Hydraulic Design Information Sheet

Name - 46125901 Webster ISB - 1st Lvl - RA4 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - SYS1
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-101.B
Construction: ( ) Combustible (X) Non-Combustible Ceiling Height - 10-2
Occupancy - HC-1,HC-2

SYSTEM

( ) NFPA 13 ( ) Lt. Haz. Ord.Haz.Gp. ( ) 1 ( ) 2 ( ) 3 ( ) Ex.Haz.
( ) NFPA 231 ( ) NFPA 231C ( ) Figure Curve
Other Factory Mutual - HC-1,HC-2
Specific Ruling Made By Date

DESIGN

Area of Sprinkler Operation - 1527	System Type	Sprinkler/Nozzle
Density - .10\.20	(X) Wet	Make Viking
Area Per Sprinkler - 400	( ) Dry	Model VK632
Elevation at Highest Outlet - 96.125	( ) Deluge	Size 3/4"
Hose Allowance - Inside - 50	( ) Preaction	K-Factor 8.0
Rack Sprinkler Allowance - n/a	( ) Other	Temp.Rat.155
Hose Allowance - Outside - 200		

Note

Calculation Summary: Flow Required - 374.92 Press Required - 93.937 SYS1
C-Factor Used: 120 Overhead 140 Underground

WATER SUPPLY

Water Flow Test:	Pump Data:	Tank or Reservoir:
Date of Test - 05/23/16		Cap. -
Time of Test - 2:30 PM	Rated Cap.- 1000	Elev.-
Static Press - 90	@ Press - 55	
Residual Press - 86	Elev. - 87.375	Well
Flow - 1140		Proof Flow
Elevation - 104		

Location - 8274 Big Bend Blvd

Source of Information - Ahern Fire Protection

COMMODITY STORAGE METHOD

Commodity Class Location
Storage Ht. Area Aisle W.
Storage Method: Solid Piled % Palletized % Rack

( ) Single Row	( ) Conven. Pallet	( ) Auto. Storage	( ) Encap.	
( ) Double Row	( ) Slave Pallet	( ) Solid Shelf	( ) Non	
( ) Mult. Row		( ) Open Shelf		

RACK

Flue Spacing Clearance:Storage to Ceiling
Longitudinal Transverse

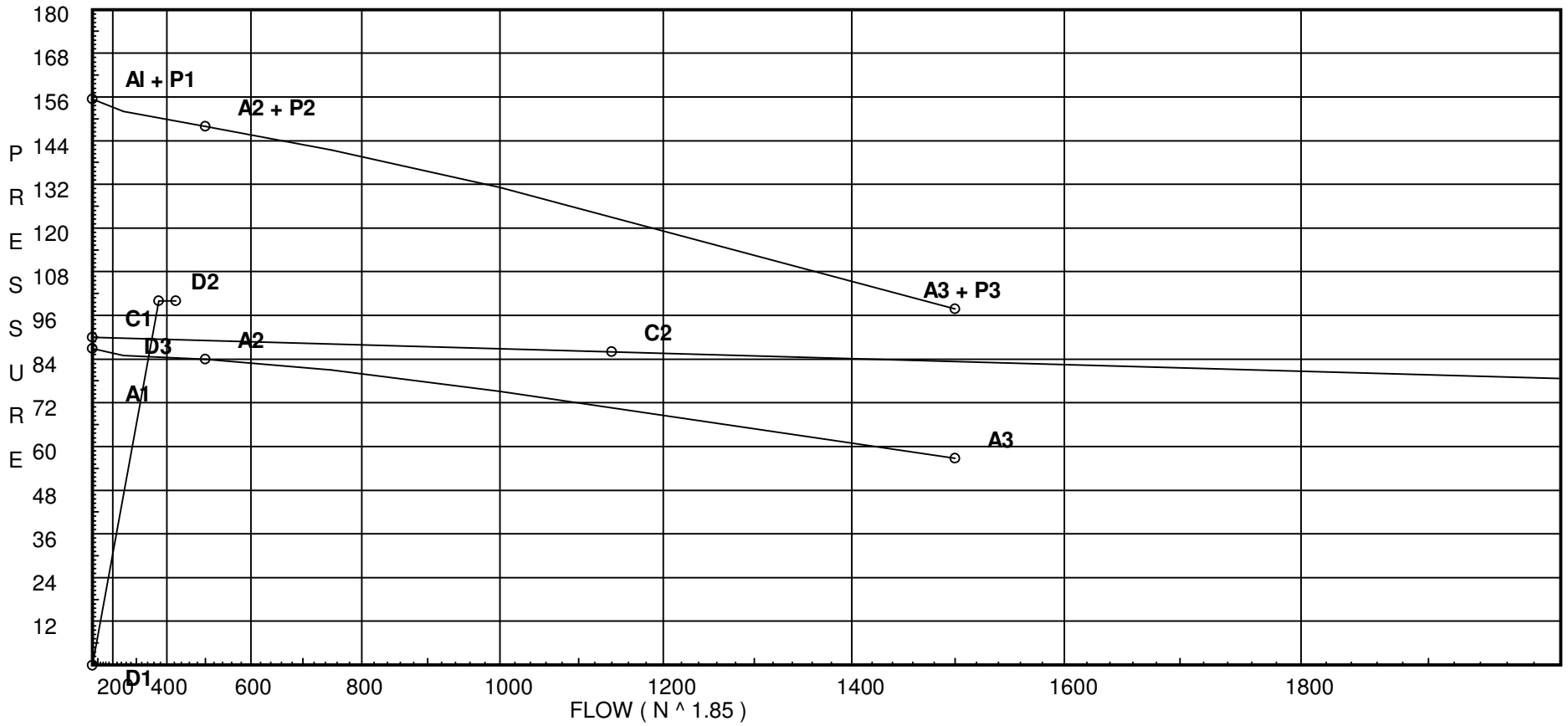
Horizontal Barriers Provided:

City Water Supply:
- C1 - Static Pressure : 90
- C2 - Residual Pressure: 86
- C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow
- A1 - Adjusted Static: 86.869
- A2 - Adj Resid : 83.909 @ 500
- A3 - Adj Resid : 56.783 @ 1500

Pump Data:
- P1 - Pump Churn Pressure : 68.5
- P2 - Pump Rated Pressure : 64
- P2 - Pump Rated Flow : 500
- P3 - Pump Pressure @ Max Flow : 41
- P3 - Pump Max Flow : 1500
- City Residual Flow @ 0 = 6135.00
- City Residual Flow @ 20 = 5355.71
- City Water @ 150% of Pump = 83.35

Demand:
- D1 - Elevation : -3.608
- D2 - System Flow : 374.917
- D2 - System Pressure : 99.968
- Hose (Demand) : 50
- D3 - System Demand : 424.917
- Hose (Adj City) : 200
- Safety Margin : 49.672



Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkens 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Fittings Used Summary

Pressure / Flow Summary - STANDARD

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S44	94.0	5.6	30.06	na	30.7	0.1	75	7.0
S45	95.67	8	17.0	na	32.98	0.1	324	17.0
S46	95.67	8	17.85	na	33.8	0.1	324	17.0
S47	94.0	5.6	30.44	na	30.9	0.1	100	7.0
S48	95.04	8	17.41	na	33.38	0.1	324	17.0
S49	95.04	8	18.28	na	34.21	0.1	324	17.0
S50	94.0	5.6	31.34	na	31.35	0.1	100	7.0
S51	95.04	8	21.36	na	36.97	0.1	324	17.0
S41	96.12	8	19.03	na	34.9	0.2	41	7.0
S42	95.86	8	20.28	na	36.03	0.2	41	7.0
S43	95.62	8	24.62	na	39.7	0.2	41	7.0
X45	96.25		30.05	na				
X46	96.25		31.51	na				
X48	96.68		30.3	na				
X49	96.41		31.91	na				
X51	96.41		37.19	na				
A1	95.75		63.6	na				
A2	95.75		63.6	na				
A3	95.75		63.6	na				
A4	95.75		63.6	na				
A5	95.75		63.6	na				
A6	95.4		63.75	na				
A7	95.4		68.32	na				
C1	95.29		37.64	na				
C2	95.29		37.7	na				
C3	95.29		37.71	na				
C4	95.29		38.17	na				
C5	95.29		38.32	na				
C6	95.29		39.3	na				
C7	95.29		39.62	na				
C8	95.29		43.74	na				
C9	98.0		53.32	na				
C10	95.75		58.5	na				
B1	95.75		73.04	na				
B2	95.75		73.04	na				
B3	95.75		73.04	na				
B4	95.75		73.04	na				
B5	95.75		73.04	na				
B6	95.75		73.04	na				
B7	95.75		73.19	na				
B8	95.75		74.15	na				
B9	95.75		74.45	na				
B10	95.75		81.34	na				
B11	95.75		87.29	na				
SYS2	110.25		88.58	na				
HV12	103.0		91.72	na				
HV11	89.0		96.86	na	50.0			
SYS1	95.75		93.94	na				
BLK1	97.625		94.05	na				
BLK2	98.167		94.5	na				
TOR	96.167		95.64	na				
BOR	87.375		99.73	na				
PO	87.375		99.97	na				
PI	87.375		84.56	na				
BYPS	94.0		81.73	na				
BKFL	87.5		88.56	na				
SPIG	96.875		84.69	na				
UG1	96.875		90.36	na	200.0			
TEST	104.0		88.68	na				

The maximum velocity is 23.73 and it occurs in the pipe between nodes S43 and C1

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
*DROPS								
S44	30.70	1.049	T	5.0	0.001	30.058		K Factor = 5.60
to		120.0	Eql	23.5	28.500	-0.559		
C2	30.7	0.2876		0.0	28.501	8.196		Vel = 11.40
	0.0							
	30.70					37.695		K Factor = 5.00
S45	32.98	1.049	T	5.0	0.001	17.000		K Factor = 8.00
to		120.0	Eql	35.5	40.500	-0.251		
X45	32.98	0.3284		0.0	40.501	13.299		Vel = 12.24
	0.0							
	32.98					30.048		K Factor = 6.02
S46	33.80	1.049	T	5.0	0.001	17.851		K Factor = 8.00
to		120.0	Eql	35.5	40.500	-0.251		
X46	33.8	0.3435		0.0	40.501	13.914		Vel = 12.55
	0.0							
	33.80					31.514		K Factor = 6.02
S47	30.90	1.049	T	5.0	0.001	30.441		K Factor = 5.60
to		120.0	Eql	23.5	28.500	-0.559		
C4	30.9	0.2909		0.0	28.501	8.292		Vel = 11.47
	0.0							
	30.90					38.174		K Factor = 5.00
S48	33.38	1.049	T	5.0	0.001	17.410		K Factor = 8.00
to		120.0	Eql	35.5	40.500	-0.710		
X48	33.38	0.3357		0.0	40.501	13.596		Vel = 12.39
	0.0							
	33.38					30.296		K Factor = 6.06
S49	34.21	1.049	T	5.0	0.001	18.282		K Factor = 8.00
to		120.0	Eql	35.5	40.500	-0.593		
X49	34.21	0.3512		0.0	40.501	14.223		Vel = 12.70
	0.0							
	34.21					31.912		K Factor = 6.06
S50	31.35	1.049	T	5.0	0.001	31.344		K Factor = 5.60
to		120.0	Eql	23.5	28.500	-0.559		
C6	31.35	0.2989		0.0	28.501	8.520		Vel = 11.64
	0.0							
	31.35					39.305		K Factor = 5.00
S51	36.97	1.049	T	5.0	0.001	21.360		K Factor = 8.00
to		120.0	Eql	35.5	40.500	-0.593		
X51	36.97	0.4056		0.0	40.501	16.426		Vel = 13.72
	0.0							
	36.97					37.193		K Factor = 6.06
*BRANCHLINES								
S41	34.90	1.38		0.0	11.900	19.028		K Factor = 8.00
to		120.0		0.0	0.0	0.113		
S42	34.9	0.0958		0.0	11.900	1.140		Vel = 7.49
S42	36.02	1.38		0.0	11.900	20.281		K Factor = 8.00
to		120.0		0.0	0.0	0.104		
S43	70.92	0.3560		0.0	11.900	4.236		Vel = 15.21

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
S43	39.70	1.38	2Ix	3.8	6.090	24.621		K Factor = 8.00
to		120.0	T	6.0	9.800	0.143		
C1	110.62	0.8101		0.0	15.890	12.873		Vel = 23.73
	0.0							
	110.62					37.637		K Factor = 18.03
*								
X45	32.98	1.38		0.0	16.980	30.048		
to		120.0		0.0	0.0	0.0		
X46	32.98	0.0863		0.0	16.980	1.466		Vel = 7.07
X46	33.81	1.38	Ix	1.9	10.250	31.514		
to		120.0	T	6.0	7.900	0.416		
C3	66.79	0.3185		0.0	18.150	5.781		Vel = 14.33
	0.0							
	66.79					37.711		K Factor = 10.88
*								
X48	33.38	1.38		0.0	16.980	30.296		
to		120.0		0.0	0.0	0.117		
X49	33.38	0.0883		0.0	16.980	1.499		Vel = 7.16
X49	34.21	1.38	Ix	1.9	10.300	31.912		
to		120.0	T	6.0	7.900	0.485		
C5	67.59	0.3256		0.0	18.200	5.926		Vel = 14.50
	0.0							
	67.59					38.323		K Factor = 10.92
*								
X51	36.97	1.38	Ix	1.9	10.300	37.193		
to		120.0	T	6.0	7.900	0.485		
C7	36.97	0.1067		0.0	18.200	1.942		Vel = 7.93
	0.0							
	36.97					39.620		K Factor = 5.87
*MAINS								
A1	0.0	3.26		0.0	0.790	63.596	0.0	
to		120.0		0.0	0.0	0.0	0.0	
A2	0.0	0.0		0.0	0.790	0.0	0.0	Vel = 0
A2	0.0	3.26		0.0	8.900	63.596	0.0	
to		120.0		0.0	0.0	0.0	0.0	
A3	0.0	0.0		0.0	8.900	0.0	0.0	Vel = 0
A3	0.0	3.26		0.0	11.400	63.596	0.0	
to		120.0		0.0	0.0	0.0	0.0	
A4	0.0	0.0		0.0	11.400	0.0	0.0	Vel = 0
A4	0.0	3.26		0.0	42.330	63.596	0.0	
to		120.0		0.0	0.0	0.0	0.0	
A5	0.0	0.0		0.0	42.330	0.0	0.0	Vel = 0
A5	0.0	3.26	J	17.471	92.110	63.596	0.0	
to		120.0	3I	20.159	37.630	0.152	0.0	
A6	0.0	0.0		0.0	129.740	0.0	0.0	Vel = 0
A6	374.92	3.26	J	17.471	21.370	63.748		
to		120.0		0.0	17.471	0.0		
A7	374.92	0.1178		0.0	38.841	4.575		Vel = 14.41

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
A7	0.0	3.26	2H	6.989	16.860	68.323		
to		120.0	J	17.471	24.460	-0.152		
B6	374.92	0.1178		0.0	41.320	4.867		Vel = 14.41
	0.0							
	374.92					73.038		K Factor = 43.87
*								
C1	110.62	3.26		0.0	4.740	37.637		
to		120.0		0.0	0.0	0.0		
C2	110.62	0.0122		0.0	4.740	0.058		Vel = 4.25
C2	30.70	3.26		0.0	0.810	37.695		
to		120.0		0.0	0.0	0.0		
C3	141.32	0.0198		0.0	0.810	0.016		Vel = 5.43
C3	66.79	3.26		0.0	11.690	37.711		
to		120.0		0.0	0.0	0.0		
C4	208.11	0.0396		0.0	11.690	0.463		Vel = 8.00
C4	30.89	3.26		0.0	2.910	38.174		
to		120.0		0.0	0.0	0.0		
C5	239.0	0.0512		0.0	2.910	0.149		Vel = 9.19
C5	67.59	3.26		0.0	12.090	38.323		
to		120.0		0.0	0.0	0.0		
C6	306.59	0.0812		0.0	12.090	0.982		Vel = 11.78
C6	31.35	3.26		0.0	3.240	39.305		
to		120.0		0.0	0.0	0.0		
C7	337.94	0.0972		0.0	3.240	0.315		Vel = 12.99
C7	36.98	3.26	I	6.72	28.260	39.620		
to		120.0		0.0	6.720	0.0		
C8	374.92	0.1178		0.0	34.980	4.120		Vel = 14.41
C8	0.0	3.26	4I	26.879	57.440	43.740		
to		120.0	2H	6.989	33.868	-1.174		
C9	374.92	0.1178		0.0	91.308	10.754		Vel = 14.41
C9	0.0	3.26	2I	13.44	22.280	53.320		
to		120.0		0.0	13.440	0.974		
C10	374.92	0.1178		0.0	35.720	4.207		Vel = 14.41
C10	0.0	3.26	2H	6.989	18.800	58.501		
to		120.0	J	17.471	24.460	0.152		
A6	374.92	0.1178		0.0	43.260	5.095		Vel = 14.41
	0.0							
	374.92					63.748		K Factor = 46.96
*								
B1	0.0	3.26		0.0	1.040	73.038	0.0	
to		120.0		0.0	0.0	0.0	0.0	
B2	0.0	0.0		0.0	1.040	0.0	0.0	Vel = 0
B2	0.0	3.26		0.0	2.370	73.038	0.0	
to		120.0		0.0	0.0	0.0	0.0	
B3	0.0	0.0		0.0	2.370	0.0	0.0	Vel = 0
B3	0.0	3.26		0.0	8.130	73.038	0.0	
to		120.0		0.0	0.0	0.0	0.0	
B4	0.0	0.0		0.0	8.130	0.0	0.0	Vel = 0

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
B4	0.0	3.26		0.0	6.130	73.038	0.0	
to		120.0		0.0	0.0	0.0	0.0	
B5	0.0	0.0		0.0	6.130	0.0	0.0	Vel = 0
B5	0.0	3.26		0.0	3.160	73.038	0.0	
to		120.0		0.0	0.0	0.0	0.0	
B6	0.0	0.0		0.0	3.160	0.0	0.0	Vel = 0
B6	374.92	3.26		0.0	1.340	73.038		
to		120.0		0.0	0.0	0.0		
B7	374.92	0.1172		0.0	1.340	0.157		Vel = 14.41
B7	0.0	3.26		0.0	8.100	73.195		
to		120.0		0.0	0.0	0.0		
B8	374.92	0.1178		0.0	8.100	0.954		Vel = 14.41
B8	0.0	3.26		0.0	2.560	74.149		
to		120.0		0.0	0.0	0.0		
B9	374.92	0.1180		0.0	2.560	0.302		Vel = 14.41
B9	0.0	3.26		0.0	58.497	74.451		
to		120.0		0.0	0.0	0.0		
B10	374.92	0.1178		0.0	58.497	6.890		Vel = 14.41
B10	0.0	3.26	2I	13.44	37.083	81.341		
to		120.0		0.0	13.440	0.0		
B11	374.92	0.1178		0.0	50.523	5.950		Vel = 14.41
B11	0.0	3.26	I	6.72	9.390	87.291		
to		120.0	T	20.159	47.039	0.0		
SYS1	374.92	0.1178	B	6.72	56.429	6.646		Vel = 14.41
			C	13.44				
	0.0							
	374.92					93.937		K Factor = 38.68
*								
SYS2	0.0	4.26		0.0	7.250	88.583	0.0	
to		120.0		0.0	0.0	3.140	0.0	
HV12	0.0	0.0		0.0	7.250	0.0	0.0	Vel = 0
HV12	0.0	4.26	J	21.067	5.375	91.723	0.0	
to		120.0		0.0	21.067	2.328	0.0	
BLK1	0.0	0.0		0.0	26.442	0.0	0.0	Vel = 0
	0.0							
	0.0					94.051		K Factor = 0
HV11	50.00	4.26		0.0	6.750	96.855		Qa = 50
to		120.0		0.0	0.0	-2.923		
SYS1	50.0	0.0007		0.0	6.750	0.005		Vel = 1.13
SYS1	374.92	4.26	J	21.067	1.875	93.937		
to		120.0		0.0	21.067	-0.812		
BLK1	424.92	0.0404		0.0	22.942	0.926		Vel = 9.56
BLK1	0.0	6.357	2I	25.147	46.209	94.051		
to		120.0	H	6.287	72.926	-0.235		
BLK2	424.92	0.0057	B	10.059	119.135	0.684		Vel = 4.30
			J	31.433				

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
BLK2	0.0	6.357	2I	25.147	22.083	94.500		
to		120.0		0.0	25.147	0.866		
TOR	424.92	0.0058		0.0	47.230	0.272		Vel = 4.30
TOR	0.0	6.357	B	10.059	8.792	95.638		
to		120.0	J	31.433	41.492	3.808		
BOR	424.92	0.0057		0.0	50.284	0.288		Vel = 4.30
BOR	0.0	6.357	B	10.059	5.417	99.734		
to		120.0	C	25.147	35.206	0.0		
PO	424.92	0.0058		0.0	40.623	0.234		Vel = 4.30
	0.0							
	424.92					99.968		K Factor = 42.50
System Demand Pressure						99.968		
Safety Margin						49.672		
Continuation Pressure						149.640		
Pressure @ Pump Outlet						149.640		
Pressure From Pump Curve						-65.080		
Pressure @ Pump Inlet						84.560		
*								
PI	0.0	8.249	Ix	15.386	8.292	84.560		
to		120.0		0.0	15.386	-2.869		
BYPS	424.92	0.0016		0.0	23.678	0.038		Vel = 2.55
BYPS	0.0	6.357	2J	62.867	13.417	81.729		
to		120.0	I	12.573	75.440	6.315		* * Fixed Loss = 3.5
BKFL	424.92	0.0058	Zib	0.0	88.857	0.511		Vel = 4.30
BKFL	0.0	7.981	G	4.0	85.291	88.555		
to		120.0	Ix	13.1	17.100	-4.060		
SPIG	424.92	0.0019		0.0	102.391	0.194		Vel = 2.73
SPIG	0.0	8.39	2G	13.572	80.000	84.689		
to		140.0	Zac	0.0	134.023	5.430		* * Fixed Loss = 5.43
UG1	424.92	0.0011	2V	61.074	214.023	0.239		Vel = 2.47
			X	59.377				
UG1	200.00	8.39	2G	13.572	500.000	90.358		Qa = 200
to		140.0	3U	45.805	118.754	-3.086		
TEST	624.92	0.0023	X	59.377	618.754	1.412		Vel = 3.63
	0.0							
	624.92					88.684		K Factor = 66.36



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name	:	46125902 Webster ISB - 2nd Lvl - RA1
Building	:	Webster ISB
Location	:	8274 Big Bend Blvd
System	:	SYS2
Contract	:	461259
Data File	:	46125902 Webster ISB - 2nd Lvl - RA1.WXF

Hydraulic Design Information Sheet

Name - 46125902 Webster ISB - 2nd Lvl - RA1 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - SYS2
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-102.B
Construction: ( ) Combustible (X) Non-Combustible Ceiling Height - 9-6
Occupancy - HC-1

SYSTEM

( ) NFPA 13 ( ) Lt. Haz. Ord.Haz.Gp. ( ) 1 ( ) 2 ( ) 3 ( ) Ex.Haz.
( ) NFPA 231 ( ) NFPA 231C ( ) Figure Curve
Other Factory Mutual - HC1
Specific Ruling Made By Date

DESIGN

Area of Sprinkler Operation - 1552	System Type	Sprinkler/Nozzle
Density - .10	(X) Wet	Make Viking
Area Per Sprinkler - 400	( ) Dry	Model VK634
Elevation at Highest Outlet - 109.5	( ) Deluge	Size 3/4"
Hose Allowance - Inside - 50	( ) Preaction	K-Factor 8.0
Rack Sprinkler Allowance - n/a	( ) Other	Temp.Rat.155
Hose Allowance - Outside - 200		

Note

Calculation Summary: Flow Required - 426.86 Press Required - 118.909 SYS2
C-Factor Used: 120 Overhead 140 Underground

WATER SUPPLY

Water Flow Test:	Pump Data:	Tank or Reservoir:
Date of Test - 05/23/16		Cap. -
Time of Test - 2:30 PM	Rated Cap.- 1000	Elev.-
Static Press - 90	@ Press - 55	
Residual Press - 86	Elev. - 87.375	Well
Flow - 1140		Proof Flow
Elevation - 104		

Location - 8274 Big Bend Blvd

Source of Information - Ahern Fire Protection

COMMODITY

Commodity Class Location
Storage Ht. Area Aisle W.
Storage Method: Solid Piled % Palletized % Rack

( ) Single Row	( ) Conven. Pallet	( ) Auto. Storage	( ) Encap.
( ) Double Row	( ) Slave Pallet	( ) Solid Shelf	( ) Non
( ) Mult. Row		( ) Open Shelf	

STORAGE RACK

Flue Spacing Clearance:Storage to Ceiling
Longitudinal Transverse

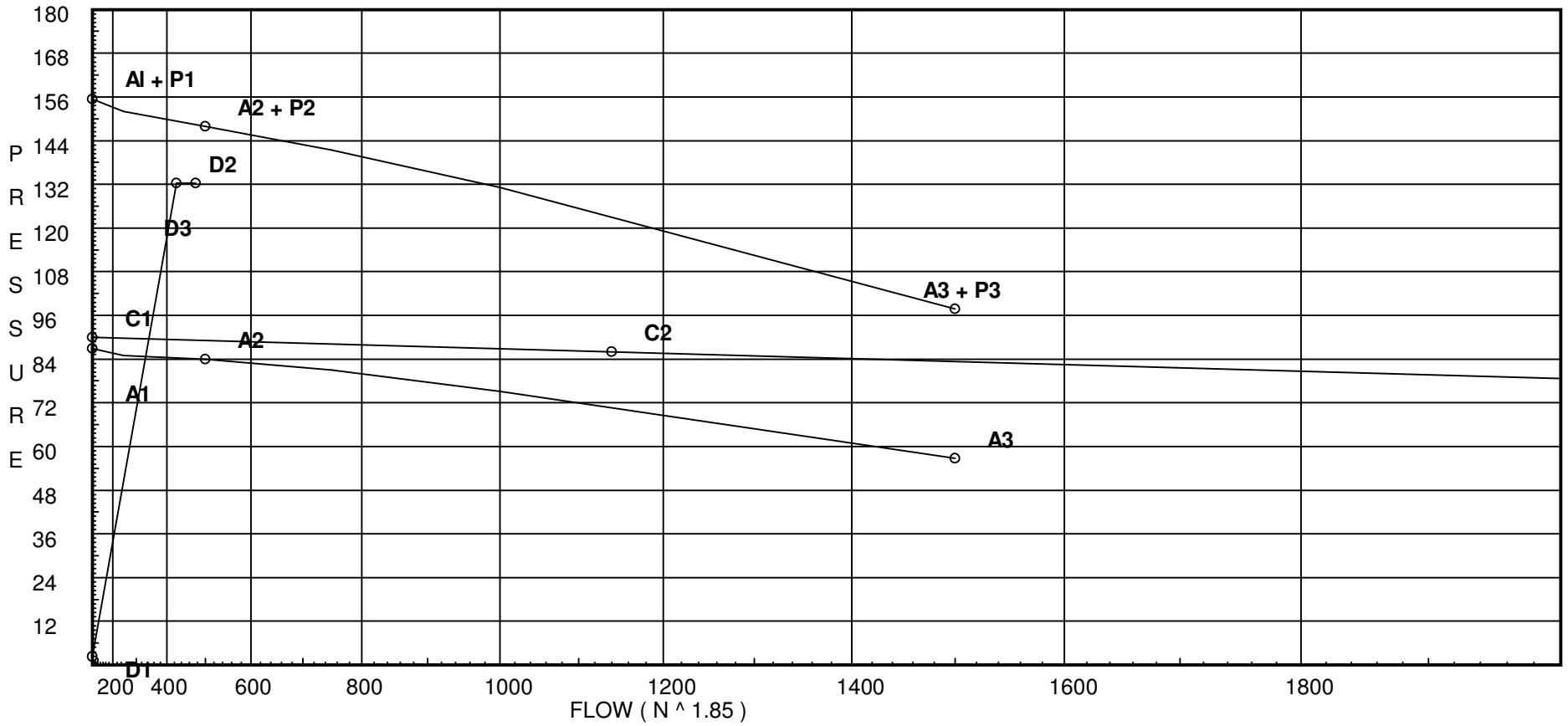
Horizontal Barriers Provided:

City Water Supply:
- C1 - Static Pressure : 90
- C2 - Residual Pressure: 86
- C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow
- A1 - Adjusted Static: 86.869
- A2 - Adj Resid : 83.909 @ 500
- A3 - Adj Resid : 56.783 @ 1500

Pump Data:
- P1 - Pump Churn Pressure : 68.5
- P2 - Pump Rated Pressure : 64
- P2 - Pump Rated Flow : 500
- P3 - Pump Pressure @ Max Flow : 41
- P3 - Pump Max Flow : 1500
- City Residual Flow @ 0 = 6135.00
- City Residual Flow @ 20 = 5355.71
- City Water @ 150% of Pump = 83.35

Demand:
- D1 - Elevation : 2.382
- D2 - System Flow : 426.86
- D2 - System Pressure : 132.261
- Hose (Demand) : 50
- D3 - System Demand : 476.86
- Hose (Adj City) : 200
- Safety Margin : 16.209



Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkens 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Fittings Used Summary

Pressure / Flow Summary - STANDARD

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S1	109.5	8	17.0	na	32.98	0.1	324	17.0
S2	109.5	8	17.28	na	33.26	0.1	324	17.0
S3	109.5	8	18.83	na	34.72	0.1	324	17.0
S4	109.5	8	22.22	na	37.71	0.1	324	17.0
S5	109.5	8	19.62	na	35.43	0.1	256	10.6
S6	109.5	8	19.98	na	35.76	0.1	324	17.0
S7	109.5	8	21.61	na	37.19	0.1	256	10.6
S8	109.5	8	23.69	na	38.94	0.1	324	17.0
S9	109.5	8	33.64	na	46.4	0.1	256	10.6
S10	109.5	8	34.47	na	46.97	0.1	256	10.6
S11	109.5	8	35.26	na	47.5	0.1	256	10.6
X1	110.71		29.81	na				
X2	110.71		30.3	na				
X3	110.71		32.97	na				
X4	110.71		38.78	na				
Z1	110.71		42.26	na				
X5	110.71		34.32	na				
X6	110.71		34.93	na				
X7	110.71		35.16	na				
X8	110.71		41.28	na				
Z2	110.71		50.11	na				
A2	110.25		63.19	na				
A3	110.25		63.23	na				
A4	110.25		63.32	na				
A5	110.25		64.34	na				
A6	110.25		64.82	na				
A7	110.25		66.27	na				
A8	110.25		68.67	na				
A9	110.25		94.31	na				
A10	110.25		107.98	na				
SYS2	110.25		118.91	na				
HV12	103.0		122.34	na	50.0			
HV11	89.0		129.73	na				
SYS1	95.75		126.8	na				
BLK1	97.625		125.99	na				
BLK2	98.167		126.6	na				
TOR	96.167		127.81	na				
BOR	87.375		131.97	na				
PO	87.375		132.26	na				
PI	87.375		84.12	na				
BYPS	94.0		81.3	na				
BKFL	87.5		88.25	na				
SPIG	96.875		84.43	na				
UG1	96.875		89.92	na	200.0			
TEST	104.0		88.48	na				

The maximum velocity is 23.22 and it occurs in the pipe between nodes X8 and Z2

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
*								
S1	32.98	1.049	T	5.0	0.100	17.000		K Factor = 8.00
to		120.0	Eql	35.5	40.500	-0.524		
X1	32.98	0.3284		0.0	40.600	13.332		Vel = 12.24
	0.0							
	32.98					29.808		K Factor = 6.04
S2	33.26	1.049	T	5.0	0.100	17.285		K Factor = 8.00
to		120.0	Eql	35.5	40.500	-0.524		
X2	33.26	0.3334		0.0	40.600	13.538		Vel = 12.35
	0.0							
	33.26					30.299		K Factor = 6.04
S3	34.72	1.049	T	5.0	0.100	18.833		K Factor = 8.00
to		120.0	Eql	35.5	40.500	-0.524		
X3	34.72	0.3610		0.0	40.600	14.656		Vel = 12.89
	0.0							
	34.72					32.965		K Factor = 6.05
S4	37.71	1.049	T	5.0	0.100	22.222		K Factor = 8.00
to		120.0	Eql	35.5	40.500	-0.524		
X4	37.71	0.4207		0.0	40.600	17.079		Vel = 14.00
	0.0							
	37.71					38.777		K Factor = 6.06
S5	35.43	1.049	T	5.0	0.100	19.618		K Factor = 8.00
to		120.0	Eql	35.5	40.500	-0.524		
X5	35.43	0.3749		0.0	40.600	15.221		Vel = 13.15
	0.0							
	35.43					34.315		K Factor = 6.05
S6	35.76	1.049	T	5.0	0.100	19.976		K Factor = 8.00
to		120.0	Eql	35.5	40.500	-0.524		
X6	35.76	0.3812		0.0	40.600	15.478		Vel = 13.28
	0.0							
	35.76					34.930		K Factor = 6.05
S7	37.19	1.049	T	5.0	8.625	21.612		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.524		
X7	37.19	0.4100		0.0	34.325	14.074		Vel = 13.81
	0.0							
	37.19					35.162		K Factor = 6.27
S8	38.94	1.049	T	5.0	0.100	23.688		K Factor = 8.00
to		120.0	Eql	35.5	40.500	-0.524		
X8	38.94	0.4463		0.0	40.600	18.121		Vel = 14.46
	0.0							
	38.94					41.285		K Factor = 6.06
S9	46.40	1.049	T	5.0	0.100	33.639		K Factor = 8.00
to		120.0	Eql	43.5	48.500	-0.325		
A4	46.4	0.6173		0.0	48.600	30.003		Vel = 17.22
	0.0							
	46.40					63.317		K Factor = 5.83

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
S10	46.97	1.049	T	5.0	0.100	34.466		K Factor = 8.00
to		120.0	Eql	43.5	48.500	-0.325		
A6	46.97	0.6314		0.0	48.600	30.684		Vel = 17.44
	0.0							
	46.97					64.825		K Factor = 5.83
S11	47.50	1.049	T	5.0	0.100	35.258		K Factor = 8.00
to		120.0	Eql	43.5	48.500	-0.325		
A7	47.5	0.6448		0.0	48.600	31.337		Vel = 17.63
	0.0							
	47.50					66.270		K Factor = 5.83
*								
X1	32.98	1.61	lx	2.3	9.750	29.808		
to		120.0		0.0	2.300	0.0		
X2	32.98	0.0407		0.0	12.050	0.491		Vel = 5.20
X2	33.26	1.61		0.0	18.000	30.299		
to		120.0		0.0	0.0	0.0		
X3	66.24	0.1481		0.0	18.000	2.666		Vel = 10.44
X3	34.72	1.61		0.0	18.000	32.965		
to		120.0		0.0	0.0	0.0		
X4	100.96	0.3229		0.0	18.000	5.812		Vel = 15.91
X4	37.71	1.61		0.0	6.000	38.777		
to		120.0		0.0	0.0	0.0		
Z1	138.67	0.5810		0.0	6.000	3.486		Vel = 21.85
Z1	0.0	1.61	4l	10.4	17.280	42.263		
to		120.0	T	8.0	18.400	0.199		
A2	138.67	0.5809		0.0	35.680	20.726		Vel = 21.85
	0.0							
	138.67					63.188		K Factor = 17.44
*								
X5	35.43	1.61	lx	2.3	10.910	34.315		
to		120.0		0.0	2.300	0.0		
X6	35.43	0.0466		0.0	13.210	0.615		Vel = 5.58
X6	35.76	1.61		0.0	1.370	34.930		
to		120.0		0.0	0.0	0.0		
X7	71.19	0.1693		0.0	1.370	0.232		Vel = 11.22
X7	37.19	1.61		0.0	16.630	35.162		
to		120.0		0.0	0.0	0.0		
X8	108.38	0.3682		0.0	16.630	6.123		Vel = 17.08
X8	38.94	1.61		0.0	13.590	41.285		
to		120.0		0.0	0.0	0.0		
Z2	147.32	0.6496		0.0	13.590	8.828		Vel = 23.22
Z2	0.0	1.61	2lx	4.6	7.280	50.113		
to		120.0	T	8.0	12.600	0.199		
A3	147.32	0.6497		0.0	19.880	12.916		Vel = 23.22
	0.0							
	147.32					63.228		K Factor = 18.53

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
*								
A2	138.67	3.26		0.0	2.110	63.188		
to		120.0		0.0	0.0	0.0		
A3	138.67	0.0190		0.0	2.110	0.040		Vel = 5.33
A3	147.32	3.26		0.0	1.250	63.228		
to		120.0		0.0	0.0	0.0		
A4	285.99	0.0712		0.0	1.250	0.089		Vel = 10.99
A4	46.40	3.26		0.0	10.830	63.317		
to		120.0		0.0	0.0	0.0		
A5	332.39	0.0943		0.0	10.830	1.021		Vel = 12.78
A5	0.0	3.26		0.0	5.170	64.338		
to		120.0		0.0	0.0	0.0		
A6	332.39	0.0942		0.0	5.170	0.487		Vel = 12.78
A6	46.97	3.26		0.0	12.000	64.825		
to		120.0		0.0	0.0	0.0		
A7	379.36	0.1204		0.0	12.000	1.445		Vel = 14.58
A7	47.50	3.26		0.0	16.030	66.270		
to		120.0		0.0	0.0	0.0		
A8	426.86	0.1497		0.0	16.030	2.400		Vel = 16.41
A8	0.0	3.26	4I	26.879	126.920	68.670		
to		120.0	J	17.471	44.350	0.0		
A9	426.86	0.1497		0.0	171.270	25.644		Vel = 16.41
A9	0.0	3.26		0.0	91.250	94.314		
to		120.0		0.0	0.0	0.0		
A10	426.86	0.1497		0.0	91.250	13.663		Vel = 16.41
A10	0.0	3.26	2I	13.44	19.250	107.977		
to		120.0	B	6.72	53.759	0.0		
SYS2	426.86	0.1497	C	13.44	73.009	10.932		Vel = 16.41
			T	20.159				
	0.0							
	426.86					118.909		K Factor = 39.15
*								
SYS2	426.86	4.26		0.0	7.250	118.909		
to		120.0		0.0	0.0	3.140		
HV12	426.86	0.0407		0.0	7.250	0.295		Vel = 9.61
HV12	50.00	4.26	J	21.067	5.375	122.344		Qa = 50
to		120.0		0.0	21.067	2.328		
BLK1	476.86	0.0499		0.0	26.442	1.320		Vel = 10.73
	0.0							
	476.86					125.992		K Factor = 42.48
HV11	0.0	4.26		0.0	6.750	129.728	0.0	
to		120.0		0.0	0.0	-2.923	0.0	
SYS1	0.0	0.0		0.0	6.750	0.0	0.0	Vel = 0
SYS1	0.0	4.26	J	21.067	1.875	126.804	0.0	
to		120.0		0.0	21.067	-0.812	0.0	
BLK1	0.0	0.0		0.0	22.942	0.0	0.0	Vel = 0

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
BLK1	476.86	6.357	2I	25.147	46.209	125.992		
to		120.0	H	6.287	72.926	-0.235		
BLK2	476.86	0.0071	B	10.059	119.135	0.848		Vel = 4.82
			J	31.433				
BLK2	0.0	6.357	2I	25.147	22.083	126.605		
to		120.0		0.0	25.147	0.866		
TOR	476.86	0.0071		0.0	47.230	0.336		Vel = 4.82
TOR	0.0	6.357	B	10.059	8.792	127.807		
to		120.0	J	31.433	41.492	3.808		
BOR	476.86	0.0071		0.0	50.284	0.357		Vel = 4.82
BOR	0.0	6.357	B	10.059	5.417	131.972		
to		120.0	C	25.147	35.206	0.0		
PO	476.86	0.0071		0.0	40.623	0.289		Vel = 4.82
	0.0							
	476.86					132.261		K Factor = 41.46
System Demand Pressure						132.261		
Safety Margin						16.209		
Continuation Pressure						148.470		
Pressure @ Pump Outlet						148.470		
Pressure From Pump Curve						-64.349		
Pressure @ Pump Inlet						84.122		
*								
PI	0.0	8.249	Ix	15.386	8.292	84.122		
to		120.0		0.0	15.386	-2.869		
BYPS	476.86	0.0020		0.0	23.678	0.047		Vel = 2.86
BYPS	0.0	6.357	2J	62.867	13.417	81.300		
to		120.0	I	12.573	75.440	6.315		* * Fixed Loss = 3.5
BKFL	476.86	0.0071	Zib	0.0	88.857	0.631		Vel = 4.82
BKFL	0.0	7.981	G	4.0	85.291	88.246		
to		120.0	Ix	13.1	17.100	-4.060		
SPIG	476.86	0.0023		0.0	102.391	0.240		Vel = 3.06
SPIG	0.0	8.39	2G	13.572	80.000	84.426		
to		140.0	Zac	0.0	134.023	5.201		* * Fixed Loss = 5.201
UG1	476.86	0.0014	2V	61.074	214.023	0.297		Vel = 2.77
			X	59.377				
UG1	200.00	8.39	2G	13.572	500.000	89.924		Qa = 200
to		140.0	3U	45.805	118.754	-3.086		
TEST	676.86	0.0026	X	59.377	618.754	1.638		Vel = 3.93
	0.0							
	676.86					88.476		K Factor = 71.96



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name	:	46125902 Webster ISB - 2nd Lvl - RA2
Building	:	Webster ISB
Location	:	8274 Big Bend Blvd
System	:	SYS2
Contract	:	461259
Data File	:	46125902 Webster ISB - 2nd Lvl - RA2.WXF

Hydraulic Design Information Sheet

Name - 46125902 Webster ISB - 2nd Lvl - RA2 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - SYS2
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-102.B
Construction: ( ) Combustible (X) Non-Combustible Ceiling Height - 11-2
Occupancy - HC-1

SYSTEM
( ) NFPA 13 ( ) Lt. Haz. Ord.Haz.Gp. ( ) 1 ( ) 2 ( ) 3 ( ) Ex.Haz.
( ) NFPA 231 ( ) NFPA 231C ( ) Figure Curve
Other Factory Mutual - HC1
Specific Ruling Made By Date

DESIGN

Area of Sprinkler Operation - 1542	System Type	Sprinkler/Nozzle
Density - .10	(X) Wet	Make Viking
Area Per Sprinkler - 225	( ) Dry	Model VK178
Elevation at Highest Outlet - 111.167	( ) Deluge	Size 1/2"
Hose Allowance - Inside - 50	( ) Preaction	K-Factor 5.6
Rack Sprinkler Allowance - n/a	( ) Other	Temp.Rat.155
Hose Allowance - Outside - 200		

Note

Calculation Summary: Flow Required - 212.37 Press Required - 47.074 SYS2
C-Factor Used: 120 Overhead 140 Underground

WATER SUPPLY

Water Flow Test:	Pump Data:	Tank or Reservoir:
Date of Test - 05/23/16		Cap. -
Time of Test - 2:30 PM	Rated Cap.- 1000	Elev.-
Static Press - 90	@ Press - 55	
Residual Press - 86	Elev. - 87.375	Well
Flow - 1140		Proof Flow
Elevation - 104		

Location - 8274 Big Bend Blvd

Source of Information - Ahern Fire Protection

COMMODITY

Commodity Class Location
Storage Ht. Area Aisle W.
Storage Method: Solid Piled % Palletized % Rack

( ) Single Row	( ) Conven. Pallet	( ) Auto. Storage	( ) Encap.	
( ) Double Row	( ) Slave Pallet	( ) Solid Shelf	( ) Non	
( ) Mult. Row		( ) Open Shelf		

RACK

Flue Spacing Clearance:Storage to Ceiling
Longitudinal Transverse

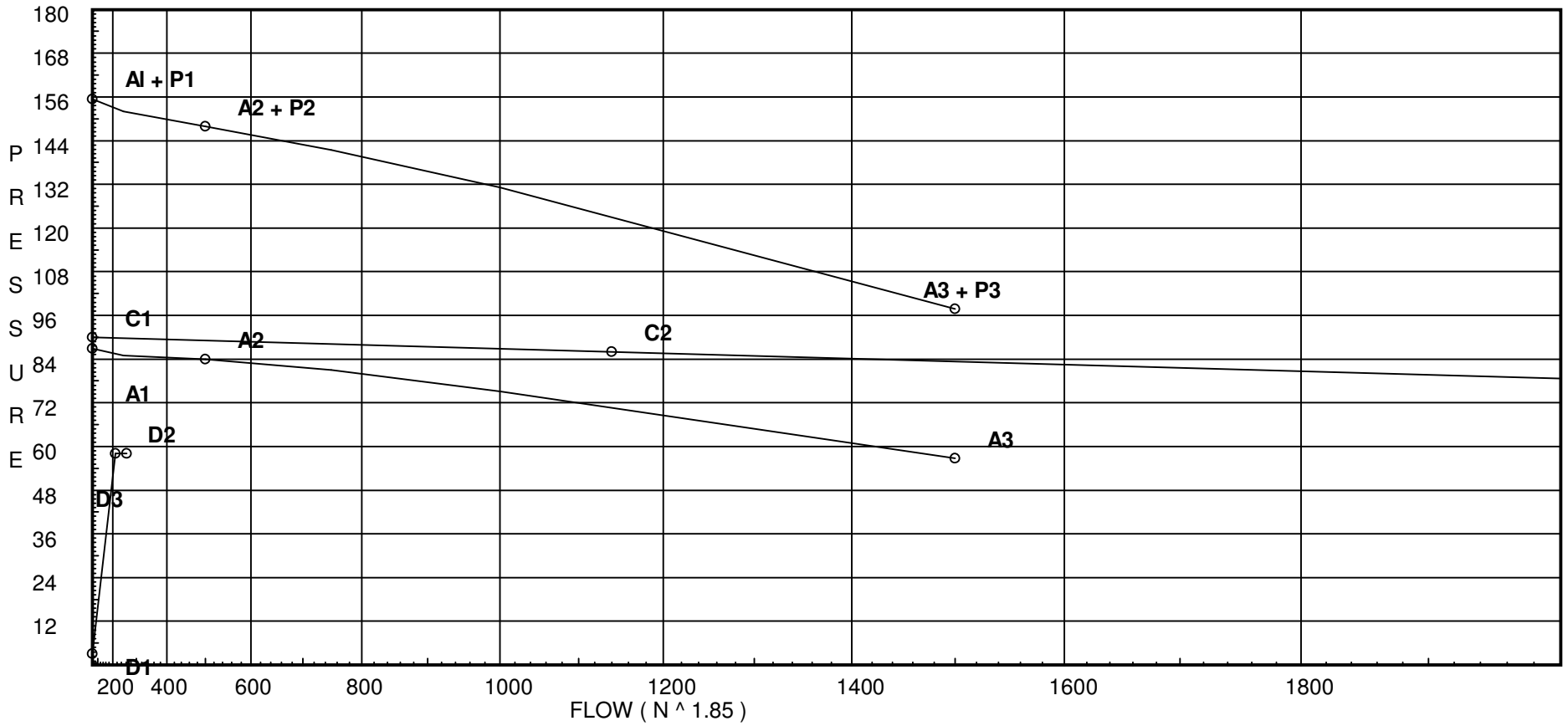
Horizontal Barriers Provided:

City Water Supply:
- C1 - Static Pressure : 90
- C2 - Residual Pressure: 86
- C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow
- A1 - Adjusted Static: 86.869
- A2 - Adj Resid : 83.909 @ 500
- A3 - Adj Resid : 56.783 @ 1500

Pump Data:
- P1 - Pump Churn Pressure : 68.5
- P2 - Pump Rated Pressure : 64
- P2 - Pump Rated Flow : 500
- P3 - Pump Pressure @ Max Flow : 41
- P3 - Pump Max Flow : 1500
- City Residual Flow @ 0 = 6135.00
- City Residual Flow @ 20 = 5355.71
- City Water @ 150% of Pump = 83.35

Demand:
- D1 - Elevation : 3.105
- D2 - System Flow : 212.371
- D2 - System Pressure : 58.105
- Hose (Demand) : 50
- D3 - System Demand : 262.371
- Hose (Adj City) : 200
- Safety Margin : 94.106



Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
E	90' Standard Elbow Thrd	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
Jx	Standard Grooved Tee	0	0	4.5	4.8	5.8	8.0	9.8	12.2	17	16.3	20.5	24.8	32.8	41.3	49.7	65	78	88	98	120
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkens 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Fittings Used Summary

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S21	111.17	5.6	7.01	na	14.82	0.1	104	7.0
S22	111.17	5.6	7.2	na	15.03	0.1	119	7.0
S23	111.17	5.6	8.05	na	15.89	0.1	116	7.0
S24	111.17	5.6	9.91	na	17.63	0.1	117	7.0
S25	111.17	5.6	12.77	na	20.01	0.1	117	7.0
S26	111.17	5.6	7.0	na	14.82	0.1	104	7.0
S27	111.17	5.6	7.41	na	15.24	0.1	146	7.0
S28	111.17	5.6	7.68	na	15.52	0.1	150	7.0
S29	111.17	5.6	8.32	na	16.16	0.1	147	7.0
S30	111.17	5.6	8.63	na	16.45	0.1	147	7.0
S31	111.17	5.6	20.23	na	25.19	0.1	147	7.0
S32	111.17	5.6	20.93	na	25.62	0.1	147	7.0
X21	113.25		7.1	na				
X22	113.25		7.32	na				
X23	113.25		8.28	na				
X24	113.25		10.39	na				
X25	113.25		13.61	na				
Z3	113.25		18.77	na				
X26	113.25		7.87	na				
X27	113.25		8.01	na				
X29	113.25		9.1	na				
Z4	113.25		9.52	na				
Z5	110.25		23.6	na				
X31	113.38		23.08	na				
Z6	113.38		23.31	na				
Z7	113.38		26.47	na				
A1	110.25		31.53	na				
A2	110.25		31.55	na				
A3	110.25		31.6	na				
A4	110.25		31.63	na				
A5	110.25		31.9	na				
A6	110.25		32.11	na				
A7	110.25		32.61	na				
A8	110.25		33.27	na				
A9	110.25		40.31	na				
A10	110.25		44.07	na				
SYS2	110.25		47.07	na				
HV12	103.0		50.3	na	50.0			
HV11	89.0		56.8	na				
SYS1	95.75		53.87	na				
BLK1	97.625		53.06	na				
BLK2	98.167		53.11	na				
TOR	96.167		54.08	na				
BOR	87.375		58.01	na				
PO	87.375		58.1	na				
PI	87.375		85.32	na				
BYPS	94.0		82.46	na				
BKFL	87.5		89.26	na				
SPIG	96.875		85.28	na				
UG1	96.875		91.52	na	200.0			
TEST	104.0		89.25	na				

The maximum velocity is 17.89 and it occurs in the pipe between nodes X25 and Z3

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
*								
S21	14.82	1.049	2T	10.0	3.380	7.006		K Factor = 5.60
to		120.0		0.0	10.000	-0.901		
X21	14.82	0.0747		0.0	13.380	1.000		Vel = 5.50
	0.0							
	14.82					7.105		K Factor = 5.56
S22	15.03	1.049	2T	10.0	3.380	7.199		K Factor = 5.60
to		120.0		0.0	10.000	-0.901		
X22	15.03	0.0767		0.0	13.380	1.026		Vel = 5.58
	0.0							
	15.03					7.324		K Factor = 5.55
S23	15.89	1.049	2T	10.0	3.380	8.047		K Factor = 5.60
to		120.0		0.0	10.000	-0.901		
X23	15.89	0.0850		0.0	13.380	1.137		Vel = 5.90
	0.0							
	15.89					8.283		K Factor = 5.52
S24	17.63	1.049	2T	10.0	3.380	9.915		K Factor = 5.60
to		120.0		0.0	10.000	-0.901		
X24	17.63	0.1031		0.0	13.380	1.380		Vel = 6.54
	0.0							
	17.63					10.394		K Factor = 5.47
S25	20.01	1.049	2T	10.0	3.380	12.768		K Factor = 5.60
to		120.0		0.0	10.000	-0.901		
X25	20.01	0.1303		0.0	13.380	1.743		Vel = 7.43
	0.0							
	20.01					13.610		K Factor = 5.42
S26	14.82	1.049	E	2.0	11.750	7.000		K Factor = 5.60
to		120.0	2T	10.0	12.000	-0.901		
X26	14.82	0.0747		0.0	23.750	1.774		Vel = 5.50
	0.0							
	14.82					7.873		K Factor = 5.28
S27	15.24	1.049	2T	10.0	9.080	7.407		K Factor = 5.60
to		120.0		0.0	10.000	-0.901		
X27	15.24	0.0787		0.0	19.080	1.502		Vel = 5.66
	0.0							
	15.24					8.008		K Factor = 5.39
S28	15.52	1.049	2T	10.0	5.080	7.681		K Factor = 5.60
to		120.0		0.0	10.000	-0.901		
X27	15.52	0.0814		0.0	15.080	1.228		Vel = 5.76
	0.0							
	15.52					8.008		K Factor = 5.48
S29	16.16	1.049	2T	10.0	9.080	8.325		K Factor = 5.60
to		120.0		0.0	10.000	-0.901		
X29	16.16	0.0877		0.0	19.080	1.673		Vel = 6.00
	0.0							
	16.16					9.097		K Factor = 5.36

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
S30	16.45	1.049	2T	10.0	5.080	8.631		K Factor = 5.60
to		120.0		0.0	10.000	-0.901		
X29	16.45	0.0906		0.0	15.080	1.367		Vel = 6.11
	0.0							
	16.45					9.097		K Factor = 5.45
S31	25.19	1.049	2T	10.0	9.080	20.229		K Factor = 5.60
to		120.0		0.0	10.000	-0.957		
X31	25.19	0.1994		0.0	19.080	3.804		Vel = 9.35
	0.0							
	25.19					23.076		K Factor = 5.24
S32	25.62	1.049	2T	10.0	5.080	20.930		K Factor = 5.60
to		120.0		0.0	10.000	-0.957		
X31	25.62	0.2058		0.0	15.080	3.103		Vel = 9.51
	0.0							
	25.62					23.076		K Factor = 5.33
*								
X21	14.82	1.38		0.0	11.130	7.105		
to		120.0		0.0	0.0	0.0		
X22	14.82	0.0197		0.0	11.130	0.219		Vel = 3.18
X22	15.03	1.38		0.0	13.360	7.324		
to		120.0		0.0	0.0	0.0		
X23	29.85	0.0718		0.0	13.360	0.959		Vel = 6.40
X23	15.88	1.38		0.0	13.350	8.283		
to		120.0		0.0	0.0	0.0		
X24	45.73	0.1581		0.0	13.350	2.111		Vel = 9.81
X24	17.64	1.38		0.0	11.130	10.394		
to		120.0		0.0	0.0	0.0		
X25	63.37	0.2889		0.0	11.130	3.216		Vel = 13.59
X25	20.01	1.38		0.0	10.750	13.610		
to		120.0		0.0	0.0	0.0		
Z3	83.38	0.4802		0.0	10.750	5.162		Vel = 17.89
Z3	0.0	1.38	3lx	5.7	12.160	18.772		
to		120.0	T	6.0	11.700	1.299		
A1	83.38	0.4802		0.0	23.860	11.457		Vel = 17.89
	0.0							
	83.38					31.528		K Factor = 14.85
*								
X26	14.82	1.38		0.0	6.850	7.873		
to		120.0		0.0	0.0	0.0		
X27	14.82	0.0197		0.0	6.850	0.135		Vel = 3.18
X27	30.76	1.38		0.0	9.610	8.008		
to		120.0		0.0	0.0	0.0		
Z4	45.58	0.1571		0.0	9.610	1.510		Vel = 9.78
	0.0							
	45.58					9.518		K Factor = 14.77
X29	32.61	1.38		0.0	4.970	9.097		
to		120.0		0.0	0.0	0.0		
Z4	32.61	0.0847		0.0	4.970	0.421		Vel = 6.99

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
Z4	45.58	1.38	2Ix	3.8	21.390	9.518		
to		120.0	Jx	4.8	8.600	1.299		
Z5	78.19	0.4263		0.0	29.990	12.785		Vel = 16.77
Z5	0.0	1.61	Ix	2.3	29.180	23.602		
to		120.0	T	8.0	10.300	0.0		
A2	78.19	0.2012		0.0	39.480	7.945		Vel = 12.32
	0.0							
	78.19					31.547		K Factor = 13.92
*								
X31	50.81	1.38		0.0	1.220	23.076		
to		120.0		0.0	0.0	0.0		
Z6	50.81	0.1918		0.0	1.220	0.234		Vel = 10.90
Z6	0.0	1.38	Jx	4.8	11.667	23.310		
to		120.0		0.0	4.800	0.0		
Z7	50.81	0.1920		0.0	16.467	3.162		Vel = 10.90
Z7	0.0	1.61	2Ix	4.6	32.313	26.472		
to		120.0	T	8.0	12.600	1.356		
A5	50.81	0.0906		0.0	44.913	4.071		Vel = 8.01
	0.0							
	50.81					31.899		K Factor = 9.00
*								
A1	83.38	3.26		0.0	2.625	31.528		
to		120.0		0.0	0.0	0.0		
A2	83.38	0.0072		0.0	2.625	0.019		Vel = 3.20
A2	78.18	3.26		0.0	2.110	31.547		
to		120.0		0.0	0.0	0.0		
A3	161.56	0.0251		0.0	2.110	0.053		Vel = 6.21
A3	0.0	3.26		0.0	1.250	31.600		
to		120.0		0.0	0.0	0.0		
A4	161.56	0.0240		0.0	1.250	0.030		Vel = 6.21
A4	0.0	3.26		0.0	10.830	31.630		
to		120.0		0.0	0.0	0.0		
A5	161.56	0.0248		0.0	10.830	0.269		Vel = 6.21
A5	50.81	3.26		0.0	5.170	31.899		
to		120.0		0.0	0.0	0.0		
A6	212.37	0.0412		0.0	5.170	0.213		Vel = 8.16
A6	0.0	3.26		0.0	12.000	32.112		
to		120.0		0.0	0.0	0.0		
A7	212.37	0.0412		0.0	12.000	0.494		Vel = 8.16
A7	0.0	3.26		0.0	16.030	32.606		
to		120.0		0.0	0.0	0.0		
A8	212.37	0.0412		0.0	16.030	0.660		Vel = 8.16
A8	0.0	3.26	4I	26.879	126.920	33.266		
to		120.0	J	17.471	44.350	0.0		
A9	212.37	0.0412		0.0	171.270	7.048		Vel = 8.16
A9	0.0	3.26		0.0	91.250	40.314		
to		120.0		0.0	0.0	0.0		
A10	212.37	0.0412		0.0	91.250	3.755		Vel = 8.16

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
A10	0.0	3.26	2I	13.44	19.250	44.069		
to		120.0	B	6.72	53.759	0.0		
SYS2	212.37	0.0412	C	13.44	73.009	3.005		Vel = 8.16
			T	20.159				
	0.0							
	212.37					47.074		K Factor = 30.95
*								
SYS2	212.37	4.26		0.0	7.250	47.074		
to		120.0		0.0	0.0	3.140		
HV12	212.37	0.0112		0.0	7.250	0.081		Vel = 4.78
HV12	50.00	4.26	J	21.067	5.375	50.295		Qa = 50
to		120.0		0.0	21.067	2.328		
BLK1	262.37	0.0165		0.0	26.442	0.437		Vel = 5.91
	0.0							
	262.37					53.060		K Factor = 36.02
HV11	0.0	4.26		0.0	6.750	56.796	0.0	
to		120.0		0.0	0.0	-2.923	0.0	
SYS1	0.0	0.0		0.0	6.750	0.0	0.0	Vel = 0
SYS1	0.0	4.26	J	21.067	1.875	53.872	0.0	
to		120.0		0.0	21.067	-0.812	0.0	
BLK1	0.0	0.0		0.0	22.942	0.0	0.0	Vel = 0
BLK1	262.37	6.357	2I	25.147	46.209	53.060		
to		120.0	H	6.287	72.926	-0.235		
BLK2	262.37	0.0024	B	10.059	119.135	0.281		Vel = 2.65
			J	31.433				
BLK2	0.0	6.357	2I	25.147	22.083	53.106		
to		120.0		0.0	25.147	0.866		
TOR	262.37	0.0024		0.0	47.230	0.111		Vel = 2.65
TOR	0.0	6.357	B	10.059	8.792	54.083		
to		120.0	J	31.433	41.492	3.808		
BOR	262.37	0.0023		0.0	50.284	0.118		Vel = 2.65
BOR	0.0	6.357	B	10.059	5.417	58.009		
to		120.0	C	25.147	35.206	0.0		
PO	262.37	0.0024		0.0	40.623	0.096		Vel = 2.65
	0.0							
	262.37					58.105		K Factor = 34.42
System Demand Pressure						58.105		
Safety Margin						94.106		
Continuation Pressure						152.211		
Pressure @ Pump Outlet						152.211		
Pressure From Pump Curve						-66.892		
Pressure @ Pump Inlet						85.319		
*								
PI	0.0	8.249	Ix	15.386	8.292	85.319		
to		120.0		0.0	15.386	-2.869		
BYPS	262.37	0.0006		0.0	23.678	0.015		Vel = 1.58

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
BYPS	0.0	6.357	2J	62.867	13.417	82.465		
to		120.0	I	12.573	75.440	6.585		* * Fixed Loss = 3.77
BKFL	262.37	0.0024	Zib	0.0	88.857	0.209		Vel = 2.65
BKFL	0.0	7.981	G	4.0	85.291	89.259		
to		120.0	Ix	13.1	17.100	-4.060		
SPIG	262.37	0.0008		0.0	102.391	0.079		Vel = 1.68
SPIG	0.0	8.39	2G	13.572	80.000	85.278		
to		140.0	Zac	0.0	134.023	6.147		* * Fixed Loss = 6.147
UG1	262.37	0.0005	2V	61.074	214.023	0.099		Vel = 1.52
			X	59.377				
UG1	200.00	8.39	2G	13.572	500.000	91.524		Qa = 200
to		140.0	3U	45.805	118.754	-3.086		
TEST	462.37	0.0013	X	59.377	618.754	0.809		Vel = 2.68
	0.0							
	462.37					89.247		K Factor = 48.94



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name	:	46125903 Webster ISB - 3rd Lvl - RA1
Building	:	Webster ISB
Location	:	8274 Big Bend Blvd
System	:	SYS3
Contract	:	461259
Data File	:	46125903 Webster ISB - 3rd Lvl - RA1.WXF

Hydraulic Design Information Sheet

Name - 46125903 Webster ISB - 3rd Lvl - RA1 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - SYS3
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-103.A
Construction: ( ) Combustible (X) Non-Combustible Ceiling Height - 9-6
Occupancy - HC-1,HC-2,HC-3

SYSTEM DESIGN

( ) NFPA 13 ( ) Lt. Haz. Ord.Haz.Gp. ( ) 1 ( ) 2 ( ) 3 ( ) Ex.Haz.
( ) NFPA 231 ( ) NFPA 231C ( ) Figure Curve
Other Factory Mutual - HC-1,HC-2,HC-3
Specific Ruling Made By Date

Area of Sprinkler Operation - 1536	System Type	Sprinkler/Nozzle
Density - .1/.2/.3	(X) Wet	Make Viking
Area Per Sprinkler - 100	( ) Dry	Model VK534
Elevation at Highest Outlet - 124.833	( ) Deluge	Size 3/4"
Hose Allowance - Inside - 100	( ) Preaction	K-Factor 11.2
Rack Sprinkler Allowance - n/a	( ) Other	Temp.Rat.200
Hose Allowance - Outside - 400		

Note

Calculation Summary: Flow Required - 600.28 Press Required - 85.557 SYS3
C-Factor Used: 120 Overhead 140 Underground

WATER SUPPLY

Water Flow Test:	Pump Data:	Tank or Reservoir:
Date of Test - 05/23/16		Cap. -
Time of Test - 2:30 PM	Rated Cap.- 1000	Elev.-
Static Press - 90	@ Press - 55	
Residual Press - 86	Elev. - 87.375	Well
Flow - 1140		Proof Flow
Elevation - 104		

Location - 8274 Big Bend Blvd

Source of Information - Ahern Fire Protection

COMMODITY STORAGE

Commodity Class Location
Storage Ht. Area Aisle W.
Storage Method: Solid Piled % Palletized % Rack

( ) Single Row	( ) Conven. Pallet	( ) Auto. Storage	( ) Encap.	
( ) Double Row	( ) Slave Pallet	( ) Solid Shelf	( ) Non	
( ) Mult. Row		( ) Open Shelf		

Flue Spacing Clearance:Storage to Ceiling
Longitudinal Transverse

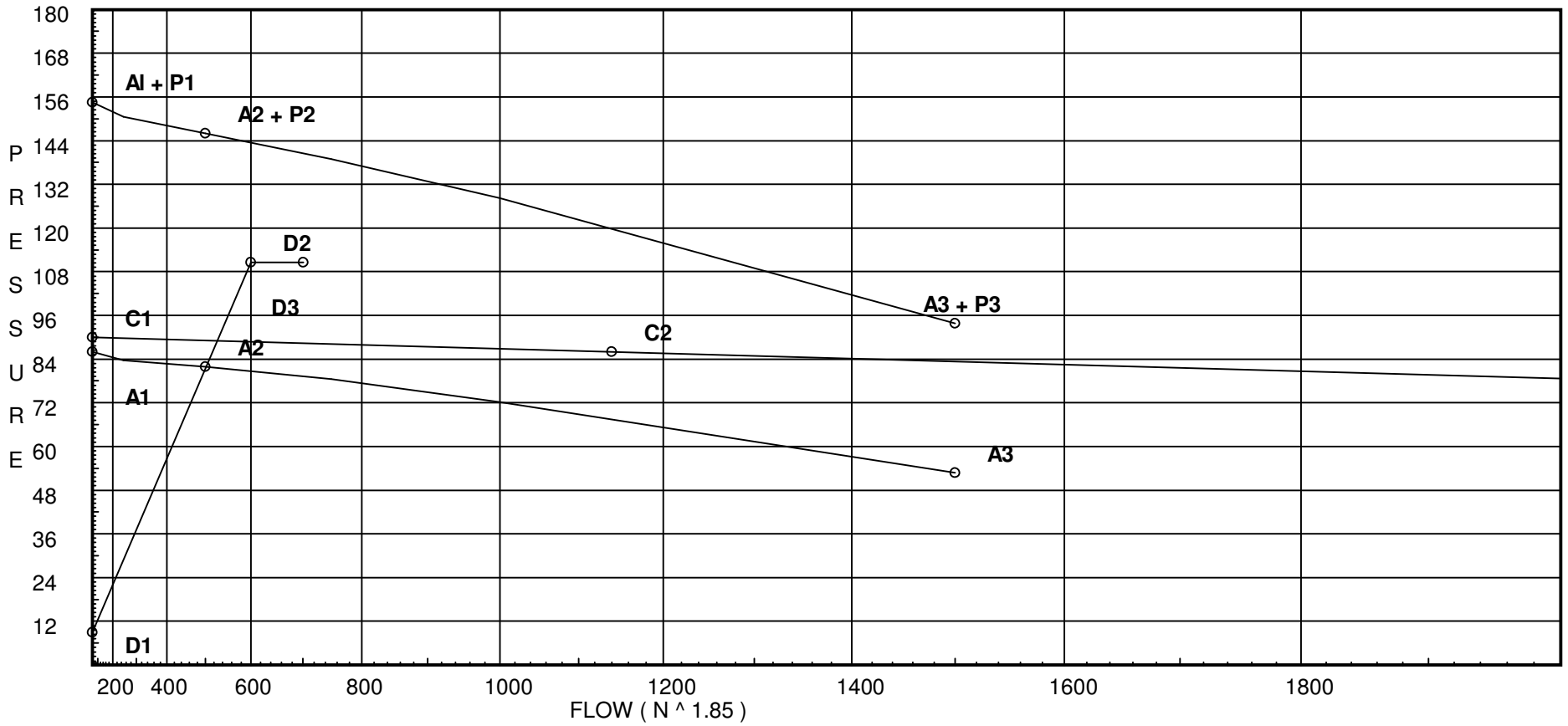
Horizontal Barriers Provided:

City Water Supply:
- C1 - Static Pressure : 90
- C2 - Residual Pressure: 86
- C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow
- A1 - Adjusted Static: 86.006
- A2 - Adj Resid : 81.917 @ 500
- A3 - Adj Resid : 52.814 @ 1500

Pump Data:
- P1 - Pump Churn Pressure : 68.5
- P2 - Pump Rated Pressure : 64
- P2 - Pump Rated Flow : 500
- P3 - Pump Pressure @ Max Flow : 41
- P3 - Pump Max Flow : 1500
- City Residual Flow @ 0 = 6135.00
- City Residual Flow @ 20 = 5355.71
- City Water @ 150% of Pump = 83.35

Demand:
- D1 - Elevation : 9.021
- D2 - System Flow : 600.28
- D2 - System Pressure : 110.629
- Hose (Demand) : 100
- D3 - System Demand : 700.28
- Hose (Adj City) : 400
- Safety Margin : 29.899



Fittings Used Summary

Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkens 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Fittings Used Summary

Pressure / Flow Summary - STANDARD

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S1	124.83	11.2	7.72	na	31.13	0.3	100	7.0
S2	124.83	11.2	8.05	na	31.78	0.3	100	7.0
S3	124.83	11.2	9.36	na	34.26	0.3	100	7.0
S4	124.83	8	25.0	na	40.0	0.1	400	25.0
S5	124.83	5.6	22.18	na	26.37	0.1	151	7.0
S6	124.83	5.6	22.72	na	26.69	0.1	167	7.0
S7	124.83	5.6	24.05	na	27.46	0.1	101	7.0
S8	124.83	8	26.12	na	40.89	0.1	400	25.0
S9	124.83	8	20.18	na	35.94	0.1	324	17.0
S10	124.83	8	21.44	na	37.04	0.1	324	17.0
S11	124.83	8	26.82	na	41.43	0.1	400	25.0
S12	124.33	8	27.54	na	41.99	0.2	104	7.0
S13	124.33	5.6	26.24	na	28.68	0.1	139	7.0
S14	124.33	5.6	29.64	na	30.49	0.1	94	7.0
S15	124.83	5.6	22.61	na	26.63	0.1	196	7.0
S16	124.83	5.6	23.24	na	27.0	0.1	196	7.0
S17	124.83	5.6	27.62	na	29.43	0.1	113	7.0
S18	124.83	8	28.99	na	43.08	0.1	400	25.0
X1	125.58		15.01	na				
X2	125.58		15.63	na				
X3	125.58		18.12	na				
X4	125.58		36.78	na				
X5	125.58		28.06	na				
X6	125.58		28.75	na				
X7	125.58		30.41	na				
X9	125.58		29.79	na				
X10	125.58		31.61	na				
X13	125.58		36.67	na				
X14	125.58		37.22	na				
X15	126.58		28.82	na				
X16	126.58		29.63	na				
X17	126.58		31.69	na				
A6	125.58		40.24	na				
B1	125.58		38.32	na				
B2	125.58		38.33	na				
B3	125.58		38.34	na				
B4	125.58		38.4	na				
B5	125.58		38.97	na				
B6	125.58		39.41	na				
B7	125.58		40.34	na				
B8	125.58		40.99	na				
B9	125.58		41.08	na				
B10	125.58		42.55	na				
B11	125.58		65.96	na				
SYS3	125.583		85.56	na				
HV13	118.333		89.25	na	100.0			
SYS2	110.25		93.57	na				
HV12	103.0		97.45	na				
HV11	89.0		106.2	na				
SYS1	95.75		103.28	na				
BLK1	97.625		102.47	na				
BLK2	98.167		103.96	na				
TOR	96.167		105.51	na				
BOR	87.375		110.04	na				
PO	87.375		110.63	na				
PI	87.375		79.24	na				
BYPS	94.0		76.47	na				
BKFL	87.5		84.07	na				
SPIG	96.875		80.5	na				
UG1	96.875		85.32	na	400.0			
TEST	104.0		86.25	na				

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.

The maximum velocity is 23.07 and it occurs in the pipe between nodes B10 and B11

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
*								
S1	31.13	1.049	T	5.0	0.100	7.724		K Factor = 11.20
to		120.0	Eql	20.7	25.700	-0.325		
X1	31.13	0.2950		0.0	25.800	7.611		Vel = 11.56
	0.0							
	31.13					15.010		K Factor = 8.04
S2	31.78	1.049	T	5.0	0.100	8.049		K Factor = 11.20
to		120.0	Eql	20.7	25.700	-0.325		
X2	31.78	0.3065		0.0	25.800	7.907		Vel = 11.80
	0.0							
	31.78					15.631		K Factor = 8.04
S3	34.26	1.049	T	5.0	0.100	9.357		K Factor = 11.20
to		120.0	Eql	20.7	25.700	-0.325		
X3	34.26	0.3522		0.0	25.800	9.088		Vel = 12.72
	0.0							
	34.26					18.120		K Factor = 8.05
S4	40.00	1.049	T	5.0	0.100	25.000		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.325		
X4	40.0	0.4691		0.0	25.800	12.104		Vel = 14.85
	0.0							
	40.00					36.779		K Factor = 6.60
S5	26.37	1.049	T	5.0	0.100	22.178		K Factor = 5.60
to		120.0	Eql	23.5	28.500	-0.325		
X5	26.37	0.2171		0.0	28.600	6.209		Vel = 9.79
	0.0							
	26.37					28.062		K Factor = 4.98
S6	26.69	1.049	T	5.0	0.100	22.723		K Factor = 5.60
to		120.0	Eql	23.5	28.500	-0.325		
X6	26.69	0.2220		0.0	28.600	6.349		Vel = 9.91
	0.0							
	26.69					28.747		K Factor = 4.98
S7	27.46	1.049	T	5.0	0.100	24.046		K Factor = 5.60
to		120.0	Eql	23.5	28.500	-0.325		
X7	27.46	0.2340		0.0	28.600	6.691		Vel = 10.19
	0.0							
	27.46					30.412		K Factor = 4.98
S8	40.89	1.049	T	5.0	0.100	26.120		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.325		
B4	40.89	0.4885		0.0	25.800	12.604		Vel = 15.18
	0.0							
	40.89					38.399		K Factor = 6.60
S9	35.94	1.049	T	5.0	0.100	20.182		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.325		
X9	35.94	0.3849		0.0	25.800	9.930		Vel = 13.34
	0.0							
	35.94					29.787		K Factor = 6.59

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
S10	37.04	1.049	T	5.0	0.100	21.435		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.325		
X10	37.04	0.4069		0.0	25.800	10.499		Vel = 13.75
	0.0							
	37.04					31.609		K Factor = 6.59
S11	41.43	1.049	T	5.0	0.100	26.822		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.325		
B6	41.43	0.5007		0.0	25.800	12.917		Vel = 15.38
	0.0							
	41.43					39.414		K Factor = 6.60
S12	41.98	1.049	T	5.0	0.100	27.543		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.541		
A6	41.98	0.5131		0.0	25.800	13.238		Vel = 15.58
	0.0							
	41.98					40.240		K Factor = 6.62
S13	28.68	1.049	T	5.0	0.100	26.235		K Factor = 5.60
to		120.0	Eql	38.2	43.200	-0.541		
X13	28.68	0.2535		0.0	43.300	10.978		Vel = 10.65
	0.0							
	28.68					36.672		K Factor = 4.74
S14	30.49	1.049	T	5.0	0.100	29.640		K Factor = 5.60
to		120.0	Eql	23.5	28.500	-0.541		
X14	30.49	0.2838		0.0	28.600	8.118		Vel = 11.32
	0.0							
	30.49					37.217		K Factor = 5.00
S15	26.63	1.049	T	5.0	3.000	22.612		K Factor = 5.60
to		120.0	Eql	23.5	28.500	-0.758		
X15	26.63	0.2210		0.0	31.500	6.961		Vel = 9.89
	0.0							
	26.63					28.815		K Factor = 4.96
S16	27.00	1.049	T	5.0	3.000	23.245		K Factor = 5.60
to		120.0	Eql	23.5	28.500	-0.758		
X16	27.0	0.2267		0.0	31.500	7.142		Vel = 10.02
	0.0							
	27.00					29.629		K Factor = 4.96
S17	29.43	1.049	2T	10.0	8.167	27.619		K Factor = 5.60
to		120.0		0.0	10.000	-0.758		
X17	29.43	0.2659		0.0	18.167	4.831		Vel = 10.93
	0.0							
	29.43					31.692		K Factor = 5.23
S18	43.08	1.049	T	5.0	0.100	28.993		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.325		
B10	43.08	0.5380		0.0	25.800	13.881		Vel = 15.99
	0.0							
	43.08					42.549		K Factor = 6.60

*

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
X1	31.13	1.38		0.0	8.010	15.010		
to		120.0		0.0	0.0	0.0		
X2	31.13	0.0775		0.0	8.010	0.621		Vel = 6.68
X2	31.77	1.38		0.0	8.730	15.631		
to		120.0		0.0	0.0	0.0		
X3	62.9	0.2851		0.0	8.730	2.489		Vel = 13.49
X3	34.26	1.38	2I	4.2	21.490	18.120		
to		120.0	T	6.0	10.200	0.0		
B1	97.16	0.6373		0.0	31.690	20.195		Vel = 20.84
	0.0							
	97.16					38.315		K Factor = 15.70
*								
X4	40.00	1.61	T	8.0	18.670	36.779		
to		120.0		0.0	8.000	0.0		
B2	40.0	0.0582		0.0	26.670	1.553		Vel = 6.30
	0.0							
	40.00					38.332		K Factor = 6.46
*								
X5	26.37	1.38		0.0	12.000	28.062		
to		120.0		0.0	0.0	0.0		
X6	26.37	0.0571		0.0	12.000	0.685		Vel = 5.66
X6	26.70	1.38		0.0	8.000	28.747		
to		120.0		0.0	0.0	0.0		
X7	53.07	0.2081		0.0	8.000	1.665		Vel = 11.38
X7	27.46	1.38	T	6.0	11.610	30.412		
to		120.0		0.0	6.000	0.0		
B3	80.53	0.4503		0.0	17.610	7.929		Vel = 17.27
	0.0							
	80.53					38.341		K Factor = 13.01
*								
X9	35.94	1.38		0.0	18.000	29.787		
to		120.0		0.0	0.0	0.0		
X10	35.94	0.1012		0.0	18.000	1.822		Vel = 7.71
X10	37.04	1.38	T	6.0	13.610	31.609		
to		120.0		0.0	6.000	0.0		
B5	72.98	0.3753		0.0	19.610	7.359		Vel = 15.65
	0.0							
	72.98					38.968		K Factor = 11.69
*								
X13	28.68	1.38		0.0	8.170	36.672		
to		120.0		0.0	0.0	0.0		
X14	28.68	0.0667		0.0	8.170	0.545		Vel = 6.15
X14	30.49	1.38	T	6.0	8.830	37.217		
to		120.0		0.0	6.000	0.0		
B8	59.17	0.2546		0.0	14.830	3.776		Vel = 12.69
	0.0							

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
	59.17					40.993		K Factor = 9.24
*								
X15	26.63	1.38		0.0	14.000	28.815		
to		120.0		0.0	0.0	0.0		
X16	26.63	0.0581		0.0	14.000	0.814		Vel = 5.71
X16	27.00	1.38		0.0	9.720	29.629		
to		120.0		0.0	0.0	0.0		
X17	53.63	0.2122		0.0	9.720	2.063		Vel = 11.50
X17	29.43	1.38	lx	1.9	10.880	31.692		
to		120.0	T	6.0	7.900	0.433		
B9	83.06	0.4767		0.0	18.780	8.953		Vel = 17.82
	0.0							
	83.06					41.078		K Factor = 12.96
*								
A6	41.98	3.26	4H	13.977	17.730	40.240		
to		120.0	J	17.471	31.448	0.0		
B7	41.98	0.0021		0.0	49.178	0.101		Vel = 1.61
	0.0							
	41.98					40.341		K Factor = 6.61
*								
B1	97.16	3.26		0.0	1.730	38.315		
to		120.0		0.0	0.0	0.0		
B2	97.16	0.0098		0.0	1.730	0.017		Vel = 3.73
B2	40.00	3.26		0.0	0.500	38.332		
to		120.0		0.0	0.0	0.0		
B3	137.16	0.0180		0.0	0.500	0.009		Vel = 5.27
B3	80.53	3.26		0.0	1.350	38.341		
to		120.0		0.0	0.0	0.0		
B4	217.69	0.0430		0.0	1.350	0.058		Vel = 8.37
B4	40.89	3.26		0.0	9.600	38.399		
to		120.0		0.0	0.0	0.0		
B5	258.58	0.0593		0.0	9.600	0.569		Vel = 9.94
B5	72.98	3.26		0.0	4.760	38.968		
to		120.0		0.0	0.0	0.0		
B6	331.56	0.0937		0.0	4.760	0.446		Vel = 12.74
B6	41.43	3.26		0.0	7.940	39.414		
to		120.0		0.0	0.0	0.0		
B7	372.99	0.1168		0.0	7.940	0.927		Vel = 14.34
B7	41.98	3.26		0.0	4.590	40.341		
to		120.0		0.0	0.0	0.0		
B8	414.97	0.1420		0.0	4.590	0.652		Vel = 15.95
B8	59.17	3.26		0.0	0.470	40.993		
to		120.0		0.0	0.0	0.0		
B9	474.14	0.1809		0.0	0.470	0.085		Vel = 18.22
B9	83.06	3.26		0.0	6.000	41.078		
to		120.0		0.0	0.0	0.0		
B10	557.2	0.2452		0.0	6.000	1.471		Vel = 21.42

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
B10	43.08	3.26		0.0	83.200	42.549		
to		120.0		0.0	0.0	0.0		
B11	600.28	0.2813		0.0	83.200	23.408		Vel = 23.07
B11	0.0	3.26	2I	13.44	15.910	65.957		
to		120.0	B	6.72	53.759	-0.001		
SYS3	600.28	0.2813	C	13.44	69.669	19.601		Vel = 23.07
			T	20.159				
	0.0							
	600.28					85.557		K Factor = 64.90
*								
SYS3	600.28	4.26		0.0	7.250	85.557		
to		120.0		0.0	0.0	3.140		
HV13	600.28	0.0764		0.0	7.250	0.554		Vel = 13.51
HV13	100.00	4.26		0.0	8.083	89.251		Qa = 100
to		120.0		0.0	0.0	3.501		
SYS2	700.28	0.1016		0.0	8.083	0.821		Vel = 15.76
SYS2	0.0	4.26		0.0	7.250	93.573		
to		120.0		0.0	0.0	3.140		
HV12	700.28	0.1017		0.0	7.250	0.737		Vel = 15.76
HV12	0.0	4.26	J	21.067	5.375	97.450		
to		120.0		0.0	21.067	2.328		
BLK1	700.28	0.1017		0.0	26.442	2.689		Vel = 15.76
	0.0							
	700.28					102.467		K Factor = 69.18
HV11	0.0	4.26		0.0	6.750	106.202	0.0	
to		120.0		0.0	0.0	-2.923	0.0	
SYS1	0.0	0.0		0.0	6.750	0.0	0.0	Vel = 0
SYS1	0.0	4.26	J	21.067	1.875	103.279	0.0	
to		120.0		0.0	21.067	-0.812	0.0	
BLK1	0.0	0.0		0.0	22.942	0.0	0.0	Vel = 0
BLK1	700.28	6.357	2I	25.147	46.209	102.467		
to		120.0	H	6.287	72.926	-0.235		
BLK2	700.28	0.0145	B	10.059	119.135	1.724		Vel = 7.08
			J	31.433				
BLK2	0.0	6.357	2I	25.147	22.083	103.956		
to		120.0		0.0	25.147	0.866		
TOR	700.28	0.0145		0.0	47.230	0.684		Vel = 7.08
TOR	0.0	6.357	B	10.059	8.792	105.506		
to		120.0	J	31.433	41.492	3.808		
BOR	700.28	0.0145		0.0	50.284	0.728		Vel = 7.08
BOR	0.0	6.357	B	10.059	5.417	110.042		
to		120.0	C	25.147	35.206	0.0		
PO	700.28	0.0144		0.0	40.623	0.587		Vel = 7.08
	0.0							
	700.28					110.629		K Factor = 66.58
System Demand Pressure						110.629		
Safety Margin						29.899		
Continuation Pressure						140.528		

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
Pressure @ Pump Outlet						140.528		
Pressure From Pump Curve						-61.290		
Pressure @ Pump Inlet						79.238		
*								
PI	0.0	8.249	lx	15.386	8.292	79.238		
to		120.0		0.0	15.386	-2.869		
BYPS	700.28	0.0041		0.0	23.678	0.096		Vel = 4.20
BYPS	0.0	6.357	2J	62.867	13.417	76.465		
to		120.0	I	12.573	75.440	6.315		* * Fixed Loss = 3.5
BKFL	700.28	0.0145	Zib	0.0	88.857	1.286		Vel = 7.08
BKFL	0.0	7.981	G	4.0	85.291	84.066		
to		120.0	lx	13.1	17.100	-4.060		
SPIG	700.28	0.0048		0.0	102.391	0.489		Vel = 4.49
SPIG	0.0	8.39	2G	13.572	80.000	80.495		
to		140.0	Zac	0.0	134.023	4.220		* * Fixed Loss = 4.22
UG1	700.28	0.0028	2V	61.074	214.023	0.603		Vel = 4.06
			X	59.377				
UG1	400.00	8.39	2G	13.572	500.000	85.318		Qa = 400
to		140.0	3U	45.805	118.754	-3.086		
TEST	1100.28	0.0065	X	59.377	618.754	4.022		Vel = 6.39
	0.0							
	1100.28					86.254		K Factor = 118.47



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name	:	46125903 Webster ISB - 3rd Lvl - RA2
Building	:	Webster ISB
Location	:	8274 Big Bend Blvd
System	:	SYS3
Contract	:	461259
Data File	:	46125903 Webster ISB - 3rd Lvl - RA2.WXF

Hydraulic Design Information Sheet

Name - 46125903 Webster ISB - 3rd Lvl - RA2 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - SYS3
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-103.B
Construction: ( ) Combustible (X) Non-Combustible Ceiling Height - 17-7
Occupancy - HC-1

SYSTEM DESIGN

( ) NFPA 13 ( ) Lt. Haz. Ord.Haz.Gp. ( ) 1 ( ) 2 ( ) 3 ( ) Ex.Haz.
( ) NFPA 231 ( ) NFPA 231C ( ) Figure Curve
Other Factory Mutual - HC-1
Specific Ruling Made By Date

Area of Sprinkler Operation - 1555	System Type	Sprinkler/Nozzle
Density - .10	(X) Wet	Make Viking
Area Per Sprinkler - 400	( ) Dry	Model VK634
Elevation at Highest Outlet - 132.916	( ) Deluge	Size 3/4"
Hose Allowance - Inside - 50	( ) Preaction	K-Factor 8.0
Rack Sprinkler Allowance - n/a	( ) Other	Temp.Rat.155
Hose Allowance - Outside - 200		

Note

Calculation Summary: Flow Required - 354.10 Press Required - 106.269 SYS3
C-Factor Used: 120 Overhead 140 Underground

WATER SUPPLY

Water Flow Test:	Pump Data:	Tank or Reservoir:
Date of Test - 05/23/16		Cap. -
Time of Test - 2:30 PM	Rated Cap.- 1000	Elev.-
Static Press - 90	@ Press - 55	
Residual Press - 86	Elev. - 87.375	Well
Flow - 1140		Proof Flow
Elevation - 104		

Location - 8274 Big Bend Blvd

Source of Information - Ahern Fire Protection

COMMODITY STORAGE

Commodity Class Location
Storage Ht. Area Aisle W.
Storage Method: Solid Piled % Palletized % Rack

( ) Single Row ( ) Conven. Pallet ( ) Auto. Storage ( ) Encap.
( ) Double Row ( ) Slave Pallet ( ) Solid Shelf ( ) Non
( ) Mult. Row ( ) Open Shelf

RACK STORAGE

Flue Spacing Clearance:Storage to Ceiling
Longitudinal Transverse

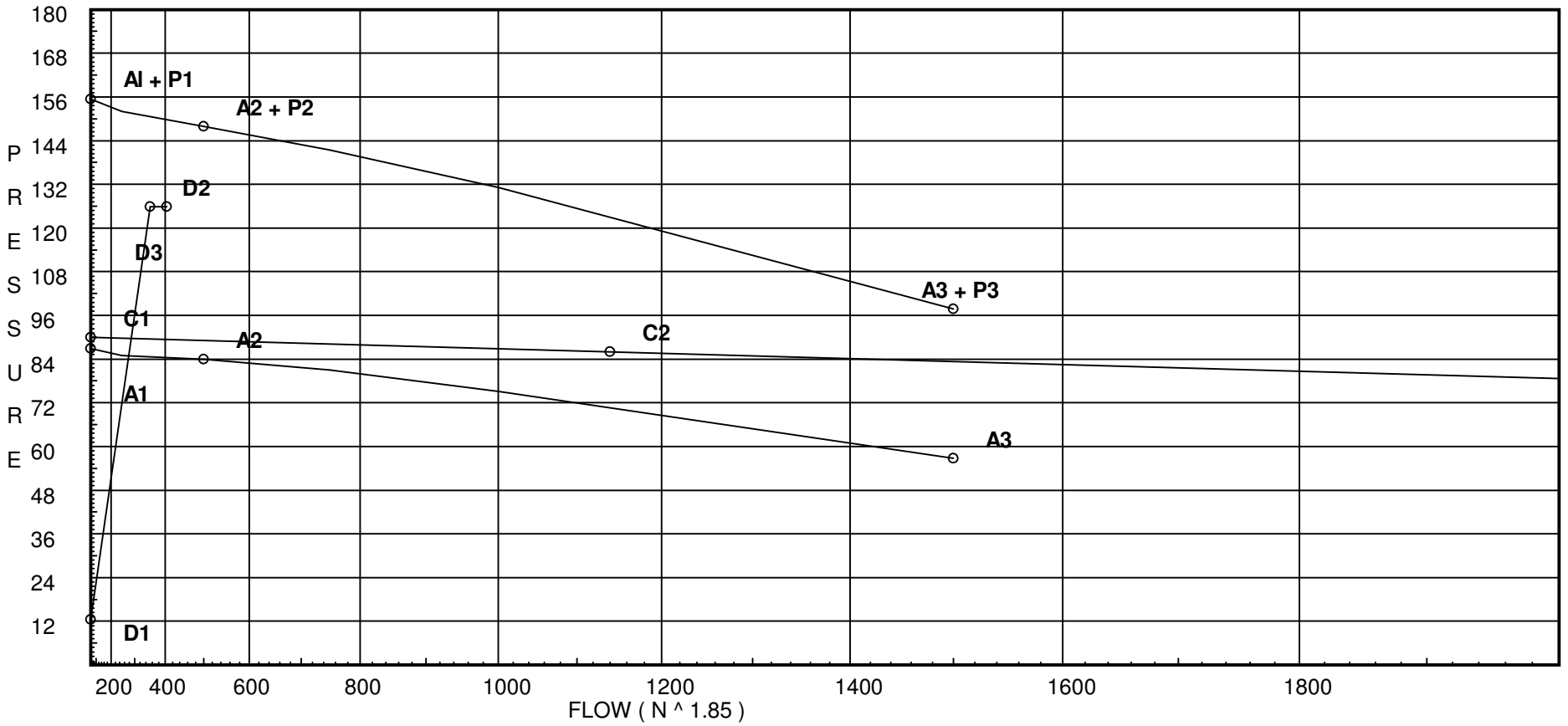
Horizontal Barriers Provided:

City Water Supply:
- C1 - Static Pressure : 90
- C2 - Residual Pressure: 86
- C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow
- A1 - Adjusted Static: 86.869
- A2 - Adj Resid : 83.909 @ 500
- A3 - Adj Resid : 56.783 @ 1500

Pump Data:
- P1 - Pump Churn Pressure : 68.5
- P2 - Pump Rated Pressure : 64
- P2 - Pump Rated Flow : 500
- P3 - Pump Pressure @ Max Flow : 41
- P3 - Pump Max Flow : 1500
- City Residual Flow @ 0 = 6135.00
- City Residual Flow @ 20 = 5355.71
- City Water @ 150% of Pump = 83.35

Demand:
- D1 - Elevation : 12.525
- D2 - System Flow : 354.097
- D2 - System Pressure : 125.908
- Hose (Demand) : 50
- D3 - System Demand : 404.097
- Hose (Adj City) : 200
- Safety Margin : 24.165



Fittings Used Summary

Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
E	90' Standard Elbow Thrd	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkens 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Fittings Used Summary

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S21	132.92	8	17.0	na	32.98	0.1	324	17.0
S22	131.46	8	17.79	na	33.75	0.1	256	10.6
S23	130.17	8	19.35	na	35.19	0.1	256	10.6
S24	129.12	5.6	25.86	na	28.48	0.1	121	7.0
S25	124.83	8	25.61	na	40.48	0.1	400	25.0
S26	124.83	8	26.22	na	40.97	0.1	400	25.0
S27	124.83	8	28.59	na	42.77	0.1	400	25.0
S28	124.83	8	38.29	na	49.5	0.1	324	17.0
S29	124.83	8	39.01	na	49.97	0.1	256	10.6
X21	134.83		25.65	na				
X22	133.35		26.86	na				
X23	132.07		29.22	na				
X24	131.01		32.96	na				
Z1	131.01		48.84	na				
X25	128.33		45.8	na				
X26	128.33		46.9	na				
X27	128.33		51.1	na				
X28	125.58		55.92	na				
X29	125.58		56.96	na				
A1	125.58		61.95	na				
A2	125.58		61.98	na				
A3	125.58		63.29	na				
A4	125.58		67.72	na				
A5	125.58		79.05	na				
A6	125.58		85.13	na				
B7	125.58		88.86	na				
B8	125.58		89.35	na				
B9	125.58		89.4	na				
B10	125.58		90.04	na				
B11	125.58		98.85	na				
SYS3	125.583		106.27	na				
HV13	118.333		109.62	na	50.0			
SYS2	110.25		113.42	na				
HV12	103.0		116.82	na				
HV11	89.0		123.86	na				
SYS1	95.75		120.93	na				
BLK1	97.625		120.12	na				
BLK2	98.167		120.51	na				
TOR	96.167		121.62	na				
BOR	87.375		125.7	na				
PO	87.375		125.91	na				
PI	87.375		84.72	na				
BYPS	94.0		81.89	na				
BKFL	87.5		88.67	na				
SPIG	96.875		84.78	na				
UG1	96.875		90.52	na	200.0			
TEST	104.0		88.76	na				

The maximum velocity is 20.55 and it occurs in the pipe between nodes X24 and Z1

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
*								
S21	32.98	1.049	E	2.0	1.167	17.000		K Factor = 8.00
to		120.0	T	5.0	27.700	-0.827		
X21	32.98	0.3284	Eql	20.7	28.867	9.479		Vel = 12.24
	0.0							
	32.98					25.652		K Factor = 6.51
S22	33.75	1.049	E	2.0	1.167	17.793		K Factor = 8.00
to		120.0	T	5.0	27.700	-0.819		
X22	33.75	0.3425	Eql	20.7	28.867	9.888		Vel = 12.53
	0.0							
	33.75					26.862		K Factor = 6.51
S23	35.19	1.049	E	2.0	1.167	19.353		K Factor = 8.00
to		120.0	T	5.0	27.700	-0.823		
X23	35.19	0.3702	Eql	20.7	28.867	10.686		Vel = 13.06
	0.0							
	35.19					29.216		K Factor = 6.51
S24	28.48	1.049	E	2.0	1.167	25.858		K Factor = 5.60
to		120.0	T	5.0	30.500	-0.819		
X24	28.48	0.2502	Eql	23.5	31.667	7.923		Vel = 10.57
	0.0							
	28.48					32.962		K Factor = 4.96
S25	40.48	1.049	E	2.0	2.750	25.607		K Factor = 8.00
to		120.0	T	5.0	42.500	-1.516		
X25	40.48	0.4796	Eql	35.5	45.250	21.704		Vel = 15.03
	0.0							
	40.48					45.795		K Factor = 5.98
S26	40.97	1.049	E	2.0	2.750	26.224		K Factor = 8.00
to		120.0	T	5.0	42.500	-1.516		
X26	40.97	0.4903	Eql	35.5	45.250	22.188		Vel = 15.21
	0.0							
	40.97					46.896		K Factor = 5.98
S27	42.77	1.049	E	2.0	2.750	28.588		K Factor = 8.00
to		120.0	T	5.0	42.500	-1.516		
X27	42.77	0.5311	Eql	35.5	45.250	24.031		Vel = 15.88
	0.0							
	42.77					51.103		K Factor = 5.98
S28	49.50	1.049	T	5.0	0.100	38.291		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.325		
X28	49.5	0.6959		0.0	25.800	17.955		Vel = 18.38
	0.0							
	49.50					55.921		K Factor = 6.62
S29	49.97	1.049	T	5.0	0.100	39.014		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.325		
X29	49.97	0.7081		0.0	25.800	18.268		Vel = 18.55
	0.0							
	49.97					56.957		K Factor = 6.62

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
*								
X21	32.98	1.61		0.0	13.970	25.652		
to		120.0		0.0	0.0	0.641		
X22	32.98	0.0407		0.0	13.970	0.569		Vel = 5.20
X22	33.75	1.61		0.0	11.990	26.862		
to		120.0		0.0	0.0	0.554		
X23	66.73	0.1501		0.0	11.990	1.800		Vel = 10.52
X23	35.19	1.61		0.0	10.000	29.216		
to		120.0		0.0	0.0	0.459		
X24	101.92	0.3287		0.0	10.000	3.287		Vel = 16.06
X24	28.48	1.61		0.0	30.625	32.962		
to		120.0		0.0	0.0	0.0		
Z1	130.4	0.5184		0.0	30.625	15.876		Vel = 20.55
Z1	0.0	2.067	3lx	9.6	50.510	48.838		
to		120.0	T	10.0	19.600	2.352		
A1	130.4	0.1535		0.0	70.110	10.764		Vel = 12.47
	0.0							
	130.40					61.954		K Factor = 16.57
*								
X25	40.48	1.61		0.0	18.500	45.795		
to		120.0		0.0	0.0	0.0		
X26	40.48	0.0595		0.0	18.500	1.101		Vel = 6.38
X26	40.97	1.61		0.0	19.380	46.896		
to		120.0		0.0	0.0	0.0		
X27	81.45	0.2171		0.0	19.380	4.207		Vel = 12.84
X27	42.77	1.61	lx	2.3	10.150	51.103		
to		120.0	T	8.0	10.300	1.191		
A2	124.22	0.4739		0.0	20.450	9.691		Vel = 19.58
	0.0							
	124.22					61.985		K Factor = 15.78
*								
X28	49.50	1.61		0.0	12.000	55.921		
to		120.0		0.0	0.0	0.0		
X29	49.5	0.0863		0.0	12.000	1.036		Vel = 7.80
X29	49.97	1.61	T	8.0	12.160	56.957		
to		120.0		0.0	8.000	0.0		
A3	99.47	0.3142		0.0	20.160	6.334		Vel = 15.68
	0.0							
	99.47					63.291		K Factor = 12.50
*								
A1	130.40	3.26		0.0	1.850	61.954		
to		120.0		0.0	0.0	0.0		
A2	130.4	0.0168		0.0	1.850	0.031		Vel = 5.01
A2	124.22	3.26		0.0	22.680	61.985		
to		120.0		0.0	0.0	0.0		
A3	254.62	0.0576		0.0	22.680	1.306		Vel = 9.79

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
A3	99.48	3.26		0.0	41.750	63.291		
to		120.0		0.0	0.0	0.0		
A4	354.1	0.1060		0.0	41.750	4.424		Vel = 13.61
A4	0.0	3.26	J	17.471	89.490	67.715		
to		120.0		0.0	17.471	0.0		
A5	354.1	0.1060		0.0	106.961	11.334		Vel = 13.61
A5	0.0	3.26		0.0	57.420	79.049		
to		120.0		0.0	0.0	0.0		
A6	354.1	0.1060		0.0	57.420	6.085		Vel = 13.61
A6	0.0	3.26	J	17.471	17.730	85.134		
to		120.0		0.0	17.471	0.0		
B7	354.1	0.1060		0.0	35.201	3.730		Vel = 13.61
	0.0							
	354.10					88.864		K Factor = 37.56
*								
B7	354.10	3.26		0.0	4.590	88.864		
to		120.0		0.0	0.0	0.0		
B8	354.1	0.1059		0.0	4.590	0.486		Vel = 13.61
B8	0.0	3.26		0.0	0.470	89.350		
to		120.0		0.0	0.0	0.0		
B9	354.1	0.1064		0.0	0.470	0.050		Vel = 13.61
B9	0.0	3.26		0.0	6.000	89.400		
to		120.0		0.0	0.0	0.0		
B10	354.1	0.1060		0.0	6.000	0.636		Vel = 13.61
B10	0.0	3.26		0.0	83.200	90.036		
to		120.0		0.0	0.0	0.0		
B11	354.1	0.1060		0.0	83.200	8.816		Vel = 13.61
B11	0.0	3.26	2I	13.44	16.250	98.852		
to		120.0	T	20.159	53.759	-0.001		
SYS3	354.1	0.1060	B	6.72	70.009	7.418		Vel = 13.61
			C	13.44				
	0.0							
	354.10					106.269		K Factor = 34.35
*								
SYS3	354.10	4.26		0.0	7.250	106.269		
to		120.0		0.0	0.0	3.140		
HV13	354.1	0.0288		0.0	7.250	0.209		Vel = 7.97
HV13	50.00	4.26		0.0	8.083	109.618		Qa = 50
to		120.0		0.0	0.0	3.501		
SYS2	404.1	0.0367		0.0	8.083	0.297		Vel = 9.10
SYS2	0.0	4.26		0.0	7.250	113.416		
to		120.0		0.0	0.0	3.140		
HV12	404.1	0.0367		0.0	7.250	0.266		Vel = 9.10
HV12	0.0	4.26	J	21.067	5.375	116.822		
to		120.0		0.0	21.067	2.328		
BLK1	404.1	0.0368		0.0	26.442	0.972		Vel = 9.10

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
	0.0							
	404.10					120.122		K Factor = 36.87
HV11	0.0	4.26		0.0	6.750	123.858	0.0	
to		120.0		0.0	0.0	-2.923	0.0	
SYS1	0.0	0.0		0.0	6.750	0.0	0.0	Vel = 0
SYS1	0.0	4.26	J	21.067	1.875	120.934	0.0	
to		120.0		0.0	21.067	-0.812	0.0	
BLK1	0.0	0.0		0.0	22.942	0.0	0.0	Vel = 0
BLK1	404.10	6.357	2I	25.147	46.209	120.122		
to		120.0	H	6.287	72.926	-0.235		
BLK2	404.1	0.0052	B	10.059	119.135	0.624		Vel = 4.08
			J	31.433				
BLK2	0.0	6.357	2I	25.147	22.083	120.511		
to		120.0		0.0	25.147	0.866		
TOR	404.1	0.0052		0.0	47.230	0.247		Vel = 4.08
TOR	0.0	6.357	B	10.059	8.792	121.624		
to		120.0	J	31.433	41.492	3.808		
BOR	404.1	0.0052		0.0	50.284	0.263		Vel = 4.08
BOR	0.0	6.357	B	10.059	5.417	125.695		
to		120.0	C	25.147	35.206	0.0		
PO	404.1	0.0052		0.0	40.623	0.213		Vel = 4.08
	0.0							
	404.10					125.908		K Factor = 36.01
System Demand Pressure						125.908		
Safety Margin						24.165		
Continuation Pressure						150.073		
Pressure @ Pump Outlet						150.073		
Pressure From Pump Curve						-65.352		
Pressure @ Pump Inlet						84.721		
*								
PI	0.0	8.249	Ix	15.386	8.292	84.721		
to		120.0		0.0	15.386	-2.869		
BYPS	404.1	0.0015		0.0	23.678	0.035		Vel = 2.43
BYPS	0.0	6.357	2J	62.867	13.417	81.887		
to		120.0	I	12.573	75.440	6.315		* * Fixed Loss = 3.5
BKFL	404.1	0.0052	Zib	0.0	88.857	0.465		Vel = 4.08
BKFL	0.0	7.981	G	4.0	85.291	88.667		
to		120.0	Ix	13.1	17.100	-4.060		
SPIG	404.1	0.0017		0.0	102.391	0.177		Vel = 2.59
SPIG	0.0	8.39	2G	13.572	80.000	84.784		
to		140.0	Zac	0.0	134.023	5.522		* * Fixed Loss = 5.522
UG1	404.1	0.0010	2V	61.074	214.023	0.218		Vel = 2.35
			X	59.377				
UG1	200.00	8.39	2G	13.572	500.000	90.524		Qa = 200
to		140.0	3U	45.805	118.754	-3.086		
TEST	604.1	0.0021	X	59.377	618.754	1.327		Vel = 3.51

Final Calculations - Hazen-Williams

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*******	Notes	******
	0.0									
	604.10					88.765		K Factor = 64.12		



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name	:	46125904 Webster ISB - 4th Lvl - RA1
Building	:	Webster ISB
Location	:	8274 Big Bend Blvd
System	:	SYS4
Contract	:	461259
Data File	:	46125904 Webster ISB - 4th Lvl - RA1.WXF

Hydraulic Design Information Sheet

Name - 46125904 Webster ISB - 4th Lvl - RA1 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - SYS4
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-104.B
Construction: ( ) Combustible (X) Non-Combustible Ceiling Height - 9-6
Occupancy - HC-1

SYSTEM DESIGN

( ) NFPA 13 ( ) Lt. Haz. Ord.Haz.Gp. ( ) 1 ( ) 2 ( ) 3 ( ) Ex.Haz.
( ) NFPA 231 ( ) NFPA 231C ( ) Figure Curve
Other Factory Mutual - HC1
Specific Ruling Made By Date

Area of Sprinkler Operation - 1536	System Type	Sprinkler/Nozzle
Density - .10	(X) Wet	Make Viking
Area Per Sprinkler - 400	( ) Dry	Model VK634
Elevation at Highest Outlet - 140.667	( ) Deluge	Size 3/4"
Hose Allowance - Inside - 50	( ) Preaction	K-Factor 8.0
Rack Sprinkler Allowance - n/a	( ) Other	Temp.Rat.155
Hose Allowance - Outside - 200		

Note

Calculation Summary: Flow Required - 405.01 Press Required - 104.329 SYS4
C-Factor Used: 120 Overhead 140 Underground

WATER SUPPLY

Water Flow Test:	Pump Data:	Tank or Reservoir:
Date of Test - 05/23/16		Cap. -
Time of Test - 2:30 PM	Rated Cap.- 1000	Elev.-
Static Press - 90	@ Press - 55	
Residual Press - 86	Elev. - 87.375	Well
Flow - 1140		Proof Flow
Elevation - 104		

Location - 8274 Big Bend Blvd

Source of Information - Ahern Fire Protection

COMMODITY STORAGE

Commodity Class Location
Storage Ht. Area Aisle W.
Storage Method: Solid Piled % Palletized % Rack

( ) Single Row ( ) Conven. Pallet ( ) Auto. Storage ( ) Encap.
( ) Double Row ( ) Slave Pallet ( ) Solid Shelf ( ) Non
( ) Mult. Row ( ) Open Shelf

RACK STORAGE

Flue Spacing Clearance:Storage to Ceiling
Longitudinal Transverse

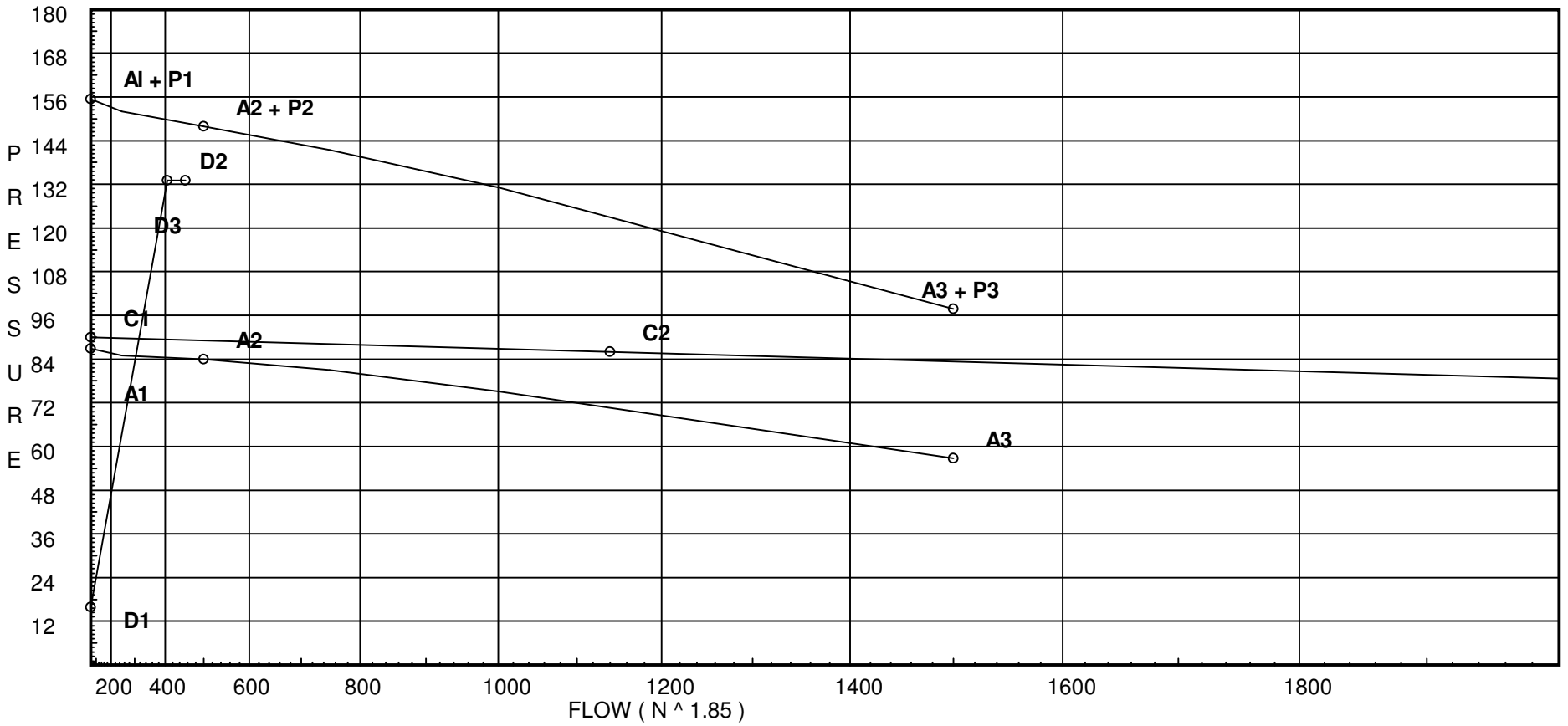
Horizontal Barriers Provided:

City Water Supply:
- C1 - Static Pressure : 90
- C2 - Residual Pressure: 86
- C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow
- A1 - Adjusted Static: 86.869
- A2 - Adj Resid : 83.909 @ 500
- A3 - Adj Resid : 56.783 @ 1500

Pump Data:
- P1 - Pump Churn Pressure : 68.5
- P2 - Pump Rated Pressure : 64
- P2 - Pump Rated Flow : 500
- P3 - Pump Pressure @ Max Flow : 41
- P3 - Pump Max Flow : 1500
- City Residual Flow @ 0 = 6135.00
- City Residual Flow @ 20 = 5355.71
- City Water @ 150% of Pump = 83.35

Demand:
- D1 - Elevation : 15.880
- D2 - System Flow : 405.01
- D2 - System Pressure : 133.014
- Hose (Demand) : 50
- D3 - System Demand : 455.01
- Hose (Adj City) : 200
- Safety Margin : 15.963



Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
E	90' Standard Elbow Thrd	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
Jx	Standard Grooved Tee	0	0	4.5	4.8	5.8	8.0	9.8	12.2	17	16.3	20.5	24.8	32.8	41.3	49.7	65	78	88	98	120
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkens 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Fittings Used Summary

Pressure / Flow Summary - STANDARD

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S1	140.667	5.6	18.82	na	24.29	0.1	153	7.0
S2	140.667	5.6	19.16	na	24.51	0.1	138	7.0
S3	140.667	5.6	20.57	na	25.4	0.1	126	7.0
S4	140.667	5.6	23.39	na	27.08	0.1	134	7.0
S5	140.667	5.6	28.72	na	30.01	0.1	128	7.0
S6	140.667	8	25.0	na	40.0	0.1	400	25.0
S7	140.667	8	28.11	na	42.41	0.1	400	25.0
S8	140.667	8	31.19	na	44.68	0.1	400	25.0
S9	140.667	5.6	32.48	na	31.92	0.1	137	7.0
S10	140.667	5.6	33.13	na	32.23	0.1	124	7.0
S11	140.667	5.6	35.68	na	33.45	0.1	124	7.0
S12	140.667	8	37.55	na	49.02	0.1	400	25.0
X1	141.58		23.74	na				
X2	141.58		24.17	na				
X3	141.58		25.95	na				
X4	141.58		29.5	na				
X5	141.58		36.18	na				
X6	140.92		41.01	na				
X7	140.92		41.44	na				
X8	140.92		45.87	na				
X9	141.58		40.89	na				
X10	141.58		41.7	na				
X11	141.58		44.89	na				
A1	141.58		54.16	na				
A2	140.92		54.86	na				
A3	140.92		55.01	na				
A4	140.92		55.59	na				
A5	140.92		65.03	na				
A6	140.92		77.08	na				
A7	140.92		82.79	na				
A8	140.92		94.6	na				
SYS4	140.92		104.33	na				
HV14	133.667		107.74	na	50.0			
SYS3	125.583		112.54	na				
HV13	118.333		116.02	na				
SYS2	110.25		119.89	na				
HV12	103.0		123.36	na				
HV11	89.0		130.63	na				
SYS1	95.75		127.71	na				
BLK1	97.625		126.9	na				
BLK2	98.167		127.44	na				
TOR	96.167		128.61	na				
BOR	87.375		132.75	na				
PO	87.375		133.01	na				
PI	87.375		84.31	na				
BYPS	94.0		81.49	na				
BKFL	87.5		88.38	na				
SPIG	96.875		84.54	na				
UG1	96.875		90.11	na	200.0			
TEST	104.0		88.57	na				

The maximum velocity is 28.16 and it occurs in the pipe between nodes X5 and A1

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
*								
S1	24.29	1.049	T	5.0	0.001	18.818		K Factor = 5.60
to		120.0	Eql	23.5	28.500	-0.395		
X1	24.29	0.1864		0.0	28.501	5.314		Vel = 9.02
	0.0							
	24.29					23.737		K Factor = 4.99
S2	24.51	1.049	T	5.0	0.001	19.160		K Factor = 5.60
to		120.0	Eql	23.5	28.500	-0.395		
X2	24.51	0.1896		0.0	28.501	5.403		Vel = 9.10
	0.0							
	24.51					24.168		K Factor = 4.99
S3	25.40	1.049	T	5.0	0.001	20.571		K Factor = 5.60
to		120.0	Eql	23.5	28.500	-0.395		
X3	25.4	0.2025		0.0	28.501	5.771		Vel = 9.43
	0.0							
	25.40					25.947		K Factor = 4.99
S4	27.08	1.049	T	5.0	0.001	23.392		K Factor = 5.60
to		120.0	Eql	23.5	28.500	-0.395		
X4	27.08	0.2280		0.0	28.501	6.499		Vel = 10.05
	0.0							
	27.08					29.496		K Factor = 4.99
S5	30.01	1.049	T	5.0	0.001	28.717		K Factor = 5.60
to		120.0	Eql	23.5	28.500	-0.395		
X5	30.01	0.2756		0.0	28.501	7.856		Vel = 11.14
	0.0							
	30.01					36.178		K Factor = 4.99
S6	40.00	1.049	E	2.0	6.667	25.000		K Factor = 8.00
to		120.0	T	5.0	27.700	-0.110		
X6	40.0	0.4691	Eql	20.7	34.367	16.123		Vel = 14.85
	0.0							
	40.00					41.013		K Factor = 6.25
S7	42.41	1.049	T	5.0	0.001	28.108		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.110		
X7	42.41	0.5228		0.0	25.701	13.437		Vel = 15.74
	0.0							
	42.41					41.435		K Factor = 6.59
S8	44.68	1.049	T	5.0	0.001	31.188		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.110		
X8	44.68	0.5756		0.0	25.701	14.794		Vel = 16.59
	0.0							
	44.68					45.872		K Factor = 6.60
S9	31.92	1.049	T	5.0	0.001	32.480		K Factor = 5.60
to		120.0	Eql	23.5	28.500	-0.395		
X9	31.92	0.3089		0.0	28.501	8.805		Vel = 11.85
	0.0							
	31.92					40.890		K Factor = 4.99

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
S10	32.23	1.049	T	5.0	0.001	33.130		K Factor = 5.60
to		120.0	Eql	23.5	28.500	-0.395		
X10	32.23	0.3146		0.0	28.501	8.967		Vel = 11.96
	0.0							
	32.23					41.702		K Factor = 4.99
S11	33.45	1.049	T	5.0	0.001	35.683		K Factor = 5.60
to		120.0	Eql	23.5	28.500	-0.395		
X11	33.45	0.3370		0.0	28.501	9.604		Vel = 12.42
	0.0							
	33.45					44.892		K Factor = 4.99
S12	49.02	1.049	T	5.0	0.001	37.550		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.110		
A3	49.02	0.6835		0.0	25.701	17.566		Vel = 18.20
	0.0							
	49.02					55.006		K Factor = 6.61
*								
X1	24.29	1.38		0.0	8.780	23.737		
to		120.0		0.0	0.0	0.0		
X2	24.29	0.0491		0.0	8.780	0.431		Vel = 5.21
X2	24.51	1.38		0.0	9.980	24.168		
to		120.0		0.0	0.0	0.0		
X3	48.8	0.1783		0.0	9.980	1.779		Vel = 10.47
X3	25.40	1.38		0.0	9.170	25.947		
to		120.0		0.0	0.0	0.0		
X4	74.2	0.3870		0.0	9.170	3.549		Vel = 15.92
X4	27.09	1.38		0.0	9.710	29.496		
to		120.0		0.0	0.0	0.0		
X5	101.29	0.6882		0.0	9.710	6.682		Vel = 21.73
X5	30.01	1.38	T	6.0	10.170	36.178		
to		120.0		0.0	6.000	0.0		
A1	131.3	1.1123		0.0	16.170	17.986		Vel = 28.16
	0.0							
	131.30					54.164		K Factor = 17.84
*								
X6	40.00	1.61		0.0	7.250	41.013		
to		120.0		0.0	0.0	0.0		
X7	40.0	0.0582		0.0	7.250	0.422		Vel = 6.30
X7	42.41	1.61		0.0	20.000	41.435		
to		120.0		0.0	0.0	0.0		
X8	82.41	0.2218		0.0	20.000	4.437		Vel = 12.99
X8	44.68	1.61	T	8.0	10.180	45.872		
to		120.0		0.0	8.000	0.0		
A2	127.09	0.4943		0.0	18.180	8.986		Vel = 20.03
	0.0							
	127.09					54.858		K Factor = 17.16
*								

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
X9	31.92	1.38		0.0	10.000	40.890		
to		120.0		0.0	0.0	0.0		
X10	31.92	0.0812		0.0	10.000	0.812		Vel = 6.85
X10	32.23	1.38		0.0	10.792	41.702		
to		120.0		0.0	0.0	0.0		
X11	64.15	0.2956		0.0	10.792	3.190		Vel = 13.76
X11	33.45	1.38	Ix	1.9	9.500	44.892		
to		120.0	Jx	4.8	6.700	0.286		
A4	97.6	0.6426		0.0	16.200	10.410		Vel = 20.94
	0.0							
	97.60					55.588		K Factor = 13.09
*								
A1	131.30	3.26	2I	13.44	10.708	54.164		
to		120.0		0.0	13.440	0.286		
A2	131.3	0.0169		0.0	24.148	0.408		Vel = 5.05
A2	127.09	3.26		0.0	2.500	54.858		
to		120.0		0.0	0.0	0.0		
A3	258.39	0.0592		0.0	2.500	0.148		Vel = 9.93
A3	49.02	3.26		0.0	7.130	55.006		
to		120.0		0.0	0.0	0.0		
A4	307.41	0.0816		0.0	7.130	0.582		Vel = 11.82
A4	97.60	3.26	2I	13.44	56.042	55.588		
to		120.0		0.0	13.440	0.0		
A5	405.01	0.1359		0.0	69.482	9.440		Vel = 15.57
A5	0.0	3.26	I	6.72	81.958	65.028		
to		120.0		0.0	6.720	0.0		
A6	405.01	0.1359		0.0	88.678	12.048		Vel = 15.57
A6	0.0	3.26		0.0	42.035	77.076		
to		120.0		0.0	0.0	0.0		
A7	405.01	0.1359		0.0	42.035	5.711		Vel = 15.57
A7	0.0	3.26	I	6.72	80.245	82.787		
to		120.0		0.0	6.720	0.0		
A8	405.01	0.1359		0.0	86.965	11.815		Vel = 15.57
A8	0.0	3.26	2I	13.44	17.840	94.602		
to		120.0	T	20.159	53.759	0.0		
SYS4	405.01	0.1359	B	6.72	71.599	9.727		Vel = 15.57
			C	13.44				
	0.0							
	405.01					104.329		K Factor = 39.65
*								
SYS4	405.01	4.26		0.0	7.250	104.329		
to		120.0		0.0	0.0	3.141		
HV14	405.01	0.0370		0.0	7.250	0.268		Vel = 9.12
HV14	50.00	4.26	2I	17.907	10.580	107.738		Qa = 50
to		120.0		0.0	17.907	3.501		
SYS3	455.01	0.0458		0.0	28.487	1.305		Vel = 10.24

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
SYS3	0.0	4.26		0.0	7.250	112.544		
to		120.0		0.0	0.0	3.140		
HV13	455.01	0.0458		0.0	7.250	0.332		Vel = 10.24
HV13	0.0	4.26		0.0	8.083	116.016		
to		120.0		0.0	0.0	3.501		
SYS2	455.01	0.0458		0.0	8.083	0.370		Vel = 10.24
SYS2	0.0	4.26		0.0	7.250	119.887		
to		120.0		0.0	0.0	3.140		
HV12	455.01	0.0458		0.0	7.250	0.332		Vel = 10.24
HV12	0.0	4.26	J	21.067	5.375	123.359		
to		120.0		0.0	21.067	2.328		
BLK1	455.01	0.0458		0.0	26.442	1.210		Vel = 10.24
	0.0							
	455.01					126.897		K Factor = 40.39
HV11	0.0	4.26		0.0	6.750	130.633	0.0	
to		120.0		0.0	0.0	-2.923	0.0	
SYS1	0.0	0.0		0.0	6.750	0.0	0.0	Vel = 0
SYS1	0.0	4.26	J	21.067	1.875	127.709	0.0	
to		120.0		0.0	21.067	-0.812	0.0	
BLK1	0.0	0.0		0.0	22.942	0.0	0.0	Vel = 0
BLK1	455.01	6.357	2I	25.147	46.209	126.897		
to		120.0	H	6.287	72.926	-0.235		
BLK2	455.01	0.0065	B	10.059	119.135	0.777		Vel = 4.60
			J	31.433				
BLK2	0.0	6.357	2I	25.147	22.083	127.439		
to		120.0		0.0	25.147	0.866		
TOR	455.01	0.0065		0.0	47.230	0.308		Vel = 4.60
TOR	0.0	6.357	B	10.059	8.792	128.613		
to		120.0	J	31.433	41.492	3.808		
BOR	455.01	0.0065		0.0	50.284	0.328		Vel = 4.60
BOR	0.0	6.357	B	10.059	5.417	132.749		
to		120.0	C	25.147	35.206	0.0		
PO	455.01	0.0065		0.0	40.623	0.265		Vel = 4.60
	0.0							
	455.01					133.014		K Factor = 39.45
System Demand Pressure						133.014		
Safety Margin						15.963		
Continuation Pressure						148.977		
Pressure @ Pump Outlet						148.977		
Pressure From Pump Curve						-64.665		
Pressure @ Pump Inlet						84.312		
*								
PI	0.0	8.249	Ix	15.386	8.292	84.312		
to		120.0		0.0	15.386	-2.869		
BYPS	455.01	0.0018		0.0	23.678	0.043		Vel = 2.73
BYPS	0.0	6.357	2J	62.867	13.417	81.486		
to		120.0	I	12.573	75.440	6.315		* * Fixed Loss = 3.5
BKFL	455.01	0.0065	Zib	0.0	88.857	0.580		Vel = 4.60

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
BKFL	0.0	7.981	G	4.0	85.291	88.381		
to		120.0	Ix	13.1	17.100	-4.060		
SPIG	455.01	0.0021		0.0	102.391	0.220		Vel = 2.92
SPIG	0.0	8.39	2G	13.572	80.000	84.541		
to		140.0	Zac	0.0	134.023	5.298		* * Fixed Loss = 5.298
UG1	455.01	0.0013	2V	61.074	214.023	0.271		Vel = 2.64
			X	59.377				
UG1	200.00	8.39	2G	13.572	500.000	90.110		Qa = 200
to		140.0	3U	45.805	118.754	-3.086		
TEST	655.01	0.0025	X	59.377	618.754	1.541		Vel = 3.80
	0.0							
	655.01					88.565		K Factor = 69.60



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name	:	46125904 Webster ISB - 4th Lvl - RA2
Building	:	Webster ISB
Location	:	8274 Big Bend Blvd
System	:	SYS4
Contract	:	461259
Data File	:	46125904 Webster ISB - 4th Lvl - RA2.WXF

Computer Programs by Hydratec Inc. Route 111 Windham N.H. USA 03087

Hydraulic Design Information Sheet

Name - 46125904 Webster ISB - 4th Lvl - RA2 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - SYS4
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-104.A
Construction: ( ) Combustible (X) Non-Combustible Ceiling Height - 9-6
Occupancy - HC-1

SYSTEM DESIGN

( ) NFPA 13 ( ) Lt. Haz. Ord.Haz.Gp. ( ) 1 ( ) 2 ( ) 3 ( ) Ex.Haz.
( ) NFPA 231 ( ) NFPA 231C ( ) Figure Curve
Other Factory Mutual - HC1
Specific Ruling Made By Date

Area of Sprinkler Operation - 1629	System Type	Sprinkler/Nozzle
Density - .10	(X) Wet	Make Viking
Area Per Sprinkler - 324	( ) Dry	Model VK634
Elevation at Highest Outlet - 140.17	( ) Deluge	Size 3/4"
Hose Allowance - Inside - 50	( ) Preaction	K-Factor 8.0
Rack Sprinkler Allowance - n/a	( ) Other	Temp.Rat.155
Hose Allowance - Outside - 200		

Note

Calculation Summary: Flow Required - 285.49 Press Required - 111.043 SYS4
C-Factor Used: 120 Overhead 140 Underground

WATER SUPPLY

Water Flow Test:	Pump Data:	Tank or Reservoir:
Date of Test - 05/23/16		Cap. -
Time of Test - 2:30 PM	Rated Cap.- 1000	Elev.-
Static Press - 90	@ Press - 55	
Residual Press - 86	Elev. - 87.375	Well
Flow - 1140		Proof Flow
Elevation - 104		

Location - 8274 Big Bend Blvd

Source of Information - Ahern Fire Protection

STORAGE

Commodity Class Location
Storage Ht. Area Aisle W.
Storage Method: Solid Piled % Palletized % Rack

( ) Single Row ( ) Conven. Pallet ( ) Auto. Storage ( ) Encap.
( ) Double Row ( ) Slave Pallet ( ) Solid Shelf ( ) Non
( ) Mult. Row ( ) Open Shelf

RACK

Flue Spacing Clearance:Storage to Ceiling
Longitudinal Transverse

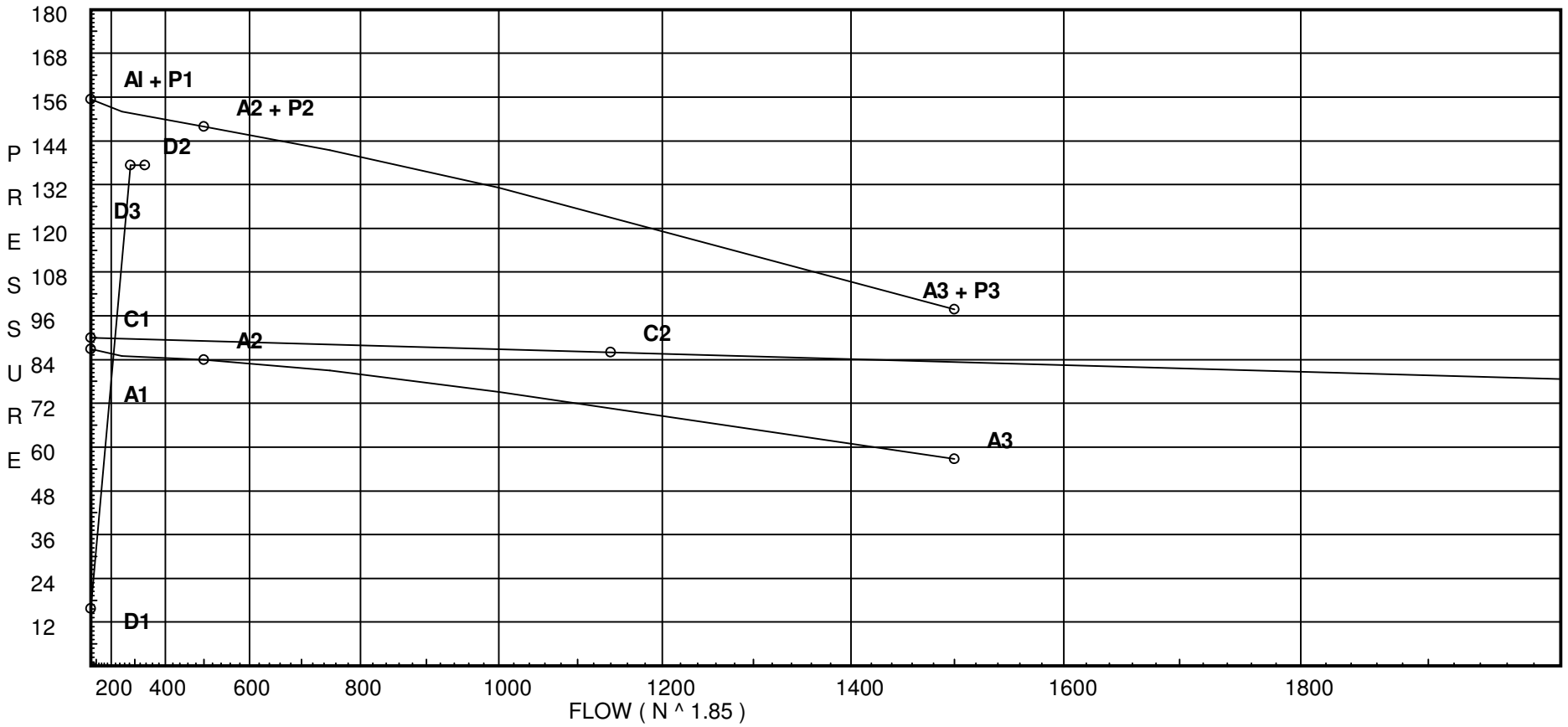
Horizontal Barriers Provided:

City Water Supply:
- C1 - Static Pressure : 90
- C2 - Residual Pressure: 86
- C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow
- A1 - Adjusted Static: 86.869
- A2 - Adj Resid : 83.909 @ 500
- A3 - Adj Resid : 56.783 @ 1500

Pump Data:
- P1 - Pump Churn Pressure : 68.5
- P2 - Pump Rated Pressure : 64
- P2 - Pump Rated Flow : 500
- P3 - Pump Pressure @ Max Flow : 41
- P3 - Pump Max Flow : 1500
- City Residual Flow @ 0 = 6135.00
- City Residual Flow @ 20 = 5355.71
- City Water @ 150% of Pump = 83.35

Demand:
- D1 - Elevation : 15.665
- D2 - System Flow : 285.489
- D2 - System Pressure : 137.348
- Hose (Demand) : 50
- D3 - System Demand : 335.489
- Hose (Adj City) : 200
- Safety Margin : 14.030



Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkens 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Fittings Used Summary

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S21	140.17	8	17.0	na	32.98	0.1	324	17.0
S22	140.17	8	18.01	na	33.95	0.1	324	17.0
S23	140.17	8	23.07	na	38.43	0.1	324	17.0
S24	140.17	8	30.77	na	44.38	0.1	324	17.0
S25	140.17	8	29.27	na	43.28	0.1	324	17.0
S26	140.17	8	30.71	na	44.33	0.1	324	17.0
S27	140.17	8	36.21	na	48.14	0.1	324	17.0
X21	140.92		25.12	na				
X22	140.92		26.59	na				
X23	140.92		33.95	na				
X24	140.92		45.06	na				
X25	140.92		42.9	na				
X26	140.92		44.97	na				
X27	140.92		52.87	na				
B1	140.92		73.65	na				
B2	140.92		76.72	na				
A7	140.92		99.76	na				
A8	140.92		105.95	na				
SYS4	140.92		111.04	na				
HV14	133.667		114.32	na	50.0			
SYS3	125.583		118.57	na				
HV13	118.333		121.9	na				
SYS2	110.25		125.61	na				
HV12	103.0		128.94	na				
HV11	89.0		135.69	na				
SYS1	95.75		132.77	na				
BLK1	97.625		131.95	na				
BLK2	98.167		132.16	na				
TOR	96.167		133.2	na				
BOR	87.375		137.2	na				
PO	87.375		137.35	na				
PI	87.375		85.21	na				
BYPS	94.0		82.37	na				
BKFL	87.5		88.99	na				
SPIG	96.875		85.06	na				
UG1	96.875		91.04	na	200.0			
TEST	104.0		89.01	na				

The maximum velocity is 32.12 and it occurs in the pipe between nodes X24 and B1

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
*								
S21	32.98	1.049	T	5.0	0.010	17.000		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.325		
X21	32.98	0.3284		0.0	25.710	8.443		Vel = 12.24
	0.0							
	32.98					25.118		K Factor = 6.58
S22	33.95	1.049	T	5.0	0.010	18.007		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.325		
X22	33.95	0.3463		0.0	25.710	8.904		Vel = 12.60
	0.0							
	33.95					26.586		K Factor = 6.58
S23	38.43	1.049	T	5.0	0.010	23.073		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.325		
X23	38.43	0.4356		0.0	25.710	11.198		Vel = 14.27
	0.0							
	38.43					33.946		K Factor = 6.60
S24	44.38	1.049	T	5.0	0.010	30.768		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.325		
X24	44.38	0.5685		0.0	25.710	14.615		Vel = 16.48
	0.0							
	44.38					45.058		K Factor = 6.61
S25	43.28	1.049	T	5.0	0.010	29.272		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.325		
X25	43.28	0.5429		0.0	25.710	13.957		Vel = 16.07
	0.0							
	43.28					42.904		K Factor = 6.61
S26	44.33	1.049	T	5.0	0.010	30.710		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.325		
X26	44.33	0.5674		0.0	25.710	14.589		Vel = 16.46
	0.0							
	44.33					44.974		K Factor = 6.61
S27	48.14	1.049	T	5.0	0.010	36.208		K Factor = 8.00
to		120.0	Eql	20.7	25.700	-0.325		
X27	48.14	0.6608		0.0	25.710	16.990		Vel = 17.87
	0.0							
	48.14					52.873		K Factor = 6.62
*								
X21	32.98	1.38		0.0	17.000	25.118		
to		120.0		0.0	0.0	0.0		
X22	32.98	0.0864		0.0	17.000	1.468		Vel = 7.07
X22	33.95	1.38	4lx	7.6	15.417	26.586		
to		120.0		0.0	7.600	0.0		
X23	66.93	0.3198		0.0	23.017	7.360		Vel = 14.36
X23	38.43	1.38		0.0	15.010	33.946		
to		120.0		0.0	0.0	0.0		
X24	105.36	0.7403		0.0	15.010	11.112		Vel = 22.60

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
X24	44.38	1.38	T	6.0	14.160	45.058		
to		120.0		0.0	6.000	0.0		
B1	149.74	1.4184		0.0	20.160	28.594		Vel = 32.12
	0.0							
	149.74					73.652		K Factor = 17.45
*								
X25	43.28	1.38		0.0	14.500	42.904		
to		120.0		0.0	0.0	0.0		
X26	43.28	0.1428		0.0	14.500	2.070		Vel = 9.28
X26	44.34	1.38		0.0	15.010	44.974		
to		120.0		0.0	0.0	0.0		
X27	87.62	0.5262		0.0	15.010	7.899		Vel = 18.79
X27	48.13	1.38	T	6.0	14.160	52.873		
to		120.0		0.0	6.000	0.0		
B2	135.75	1.1831		0.0	20.160	23.852		Vel = 29.12
	0.0							
	135.75					76.725		K Factor = 15.50
*								
B1	149.74	2.067		0.0	15.500	73.652		
to		120.0		0.0	0.0	0.0		
B2	149.74	0.1983		0.0	15.500	3.073		Vel = 14.32
B2	135.75	2.067	T	10.0	11.208	76.725		
to		120.0	4l	14.0	24.000	0.0		
A7	285.49	0.6543		0.0	35.208	23.037		Vel = 27.30
	0.0							
	285.49					99.762		K Factor = 28.58
*								
A7	285.49	3.26	l	6.72	80.245	99.762		
to		120.0		0.0	6.720	0.0		
A8	285.49	0.0711		0.0	86.965	6.187		Vel = 10.97
A8	0.0	3.26	2l	13.44	17.840	105.949		
to		120.0	T	20.159	53.759	0.0		
SYS4	285.49	0.0711	B	6.72	71.599	5.094		Vel = 10.97
			C	13.44				
	0.0							
	285.49					111.043		K Factor = 27.09
*								
SYS4	285.49	4.26		0.0	7.250	111.043		
to		120.0		0.0	0.0	3.141		
HV14	285.49	0.0193		0.0	7.250	0.140		Vel = 6.43
HV14	50.00	4.26	2l	17.907	10.580	114.324		Qa = 50
to		120.0		0.0	17.907	3.501		
SYS3	335.49	0.0261		0.0	28.487	0.743		Vel = 7.55
SYS3	0.0	4.26		0.0	7.250	118.568		
to		120.0		0.0	0.0	3.140		
HV13	335.49	0.0261		0.0	7.250	0.189		Vel = 7.55

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
HV13	0.0	4.26		0.0	8.083	121.897		
to		120.0		0.0	0.0	3.501		
SYS2	335.49	0.0260		0.0	8.083	0.210		Vel = 7.55
SYS2	0.0	4.26		0.0	7.250	125.608		
to		120.0		0.0	0.0	3.140		
HV12	335.49	0.0261		0.0	7.250	0.189		Vel = 7.55
HV12	0.0	4.26	J	21.067	5.375	128.937		
to		120.0		0.0	21.067	2.328		
BLK1	335.49	0.0261		0.0	26.442	0.689		Vel = 7.55
	0.0							
	335.49					131.954		K Factor = 29.21
HV11	0.0	4.26		0.0	6.750	135.689	0.0	
to		120.0		0.0	0.0	-2.923	0.0	
SYS1	0.0	0.0		0.0	6.750	0.0	0.0	Vel = 0
SYS1	0.0	4.26	J	21.067	1.875	132.766	0.0	
to		120.0		0.0	21.067	-0.812	0.0	
BLK1	0.0	0.0		0.0	22.942	0.0	0.0	Vel = 0
BLK1	335.49	6.357	2I	25.147	46.209	131.954		
to		120.0	H	6.287	72.926	-0.235		
BLK2	335.49	0.0037	B	10.059	119.135	0.442		Vel = 3.39
			J	31.433				
BLK2	0.0	6.357	2I	25.147	22.083	132.161		
to		120.0		0.0	25.147	0.866		
TOR	335.49	0.0037		0.0	47.230	0.175		Vel = 3.39
TOR	0.0	6.357	B	10.059	8.792	133.202		
to		120.0	J	31.433	41.492	3.808		
BOR	335.49	0.0037		0.0	50.284	0.187		Vel = 3.39
BOR	0.0	6.357	B	10.059	5.417	137.197		
to		120.0	C	25.147	35.206	0.0		
PO	335.49	0.0037		0.0	40.623	0.151		Vel = 3.39
	0.0							
	335.49					137.348		K Factor = 28.63
System Demand Pressure						137.348		
Safety Margin						14.030		
Continuation Pressure						151.378		
Pressure @ Pump Outlet						151.378		
Pressure From Pump Curve						-66.168		
Pressure @ Pump Inlet						85.210		
*								
PI	0.0	8.249	Ix	15.386	8.292	85.210		
to		120.0		0.0	15.386	-2.869		
BYPS	335.49	0.0011		0.0	23.678	0.025		Vel = 2.01
BYPS	0.0	6.357	2J	62.867	13.417	82.366		
to		120.0	I	12.573	75.440	6.295		* * Fixed Loss = 3.48
BKFL	335.49	0.0037	Zib	0.0	88.857	0.329		Vel = 3.39
BKFL	0.0	7.981	G	4.0	85.291	88.990		
to		120.0	Ix	13.1	17.100	-4.060		
SPIG	335.49	0.0012		0.0	102.391	0.126		Vel = 2.15

Final Calculations - Hazen-Williams

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
SPIG	0.0	8.39	2G	13.572	80.000	85.056		
to		140.0	Zac	0.0	134.023	5.826		* * Fixed Loss = 5.826
UG1	335.49	0.0007	2V	61.074	214.023	0.154		Vel = 1.95
			X	59.377				
UG1	200.00	8.39	2G	13.572	500.000	91.036		Qa = 200
to		140.0	3U	45.805	118.754	-3.086		
TEST	535.49	0.0017	X	59.377	618.754	1.062		Vel = 3.11
	0.0							
	535.49					89.012		K Factor = 56.76



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name : 46125901 Webster ISB - Preaction - RA1
Building : Webster ISB
Location : 8274 Big Bend Blvd
System : Preaction
Contract : 461259
Data File : 46125901 Webster ISB - Preaction - RA1.WXF

Hydraulic Design Information Sheet

Name - 46125901 Webster ISB - Preaction - RA1 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - Preaction
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-101.B
Construction: ( ) Combustible (X) Non-Combustible Ceiling Height - 9-6
Occupancy - HC-1

SYSTEM

( ) NFPA 13 ( ) Lt. Haz. Ord.Haz.Gp. ( ) 1 ( ) 2 ( ) 3 ( ) Ex.Haz.
( ) NFPA 231 ( ) NFPA 231C ( ) Figure Curve
Other Factory Mutual - HC-1
Specific Ruling Made By Date

DESIGN

Area of Sprinkler Operation - 583	System Type	Sprinkler/Nozzle
Density - .10	(X) Wet	Make Viking
Area Per Sprinkler - 225	( ) Dry	Model VK302
Elevation at Highest Outlet - 95	( ) Deluge	Size 1/2"
Hose Allowance - Inside - 50	( ) Preaction	K-Factor 5.6
Rack Sprinkler Allowance - n/a	( ) Other	Temp.Rat.155
Hose Allowance - Outside - 200		

Note

Calculation Summary: Flow Required - 109.80 Press Required - 57.927 PA
C-Factor Used: 120 Overhead 140 Underground

WATER SUPPLY

Water Flow Test:	Pump Data:	Tank or Reservoir:
Date of Test - 05/23/16		Cap. -
Time of Test - 2:30 PM	Rated Cap.- 1000	Elev.-
Static Press - 90	@ Press - 55	
Residual Press - 86	Elev. - 87.375	Well
Flow - 1140		Proof Flow
Elevation - 104		

Location - 8274 Big Bend Blvd

Source of Information - Ahern Fire Protection

COMMODITY STORAGE METHOD

Commodity Class Location
Storage Ht. Area Aisle W.
Storage Method: Solid Piled % Palletized % Rack

( ) Single Row	( ) Conven. Pallet	( ) Auto. Storage	( ) Encap.	
( ) Double Row	( ) Slave Pallet	( ) Solid Shelf	( ) Non	
( ) Mult. Row		( ) Open Shelf		

RACK STORAGE

Flue Spacing Clearance:Storage to Ceiling
Longitudinal Transverse

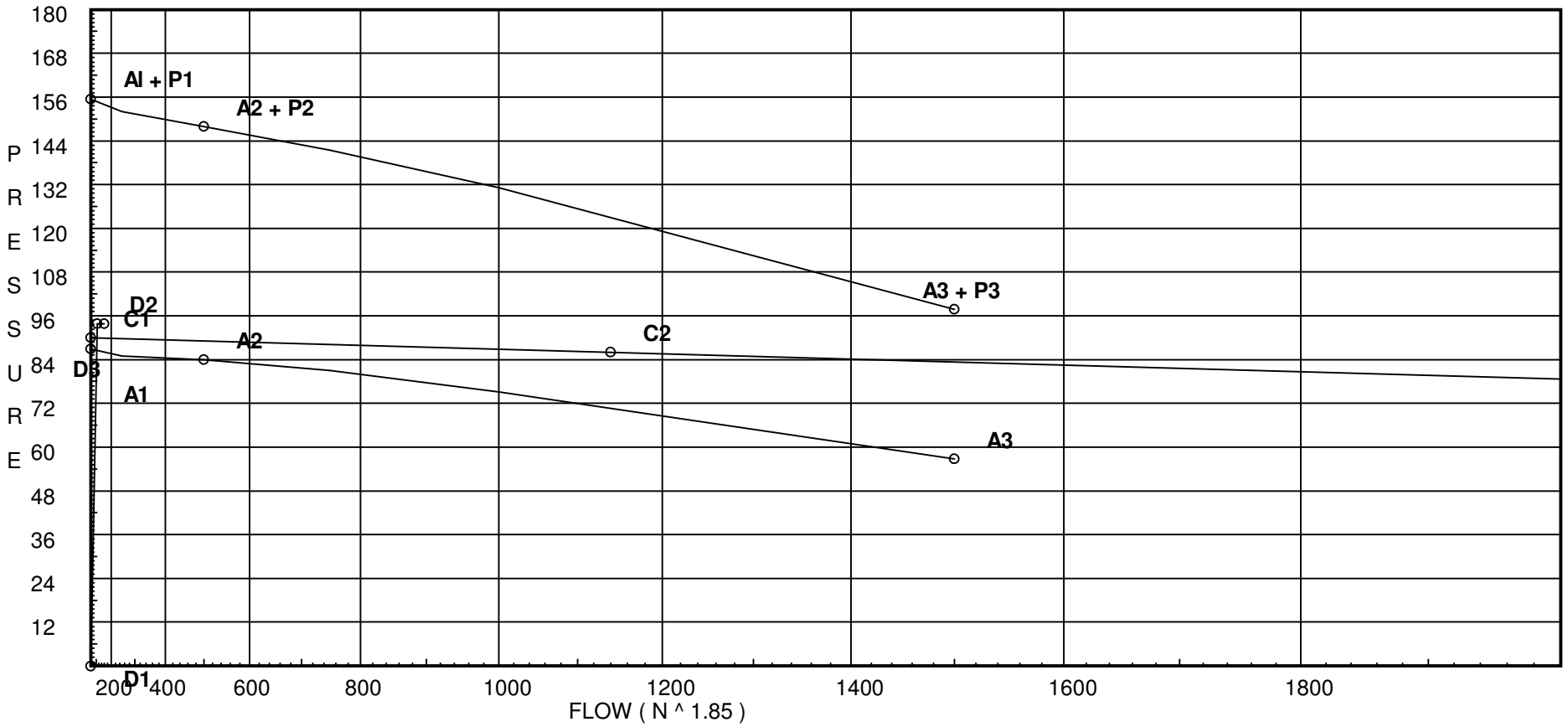
Horizontal Barriers Provided:

City Water Supply:
- C1 - Static Pressure : 90
- C2 - Residual Pressure: 86
- C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow
- A1 - Adjusted Static: 86.869
- A2 - Adj Resid : 83.909 @ 500
- A3 - Adj Resid : 56.783 @ 1500

Pump Data:
- P1 - Pump Churn Pressure : 68.5
- P2 - Pump Rated Pressure : 64
- P2 - Pump Rated Flow : 500
- P3 - Pump Pressure @ Max Flow : 41
- P3 - Pump Max Flow : 1500
- City Residual Flow @ 0 = 6135.00
- City Residual Flow @ 20 = 5355.71
- City Water @ 150% of Pump = 83.35

Demand:
- D1 - Elevation : -3.898
- D2 - System Flow : 109.802
- D2 - System Pressure : 93.823
- Hose (Demand) : 50
- D3 - System Demand : 159.802
- Hose (Adj City) : 200
- Safety Margin : 58.540



Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
E	90' Standard Elbow Thrd	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkens 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Fittings Used Summary

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S61	95.0	5.6	7.23	na	15.06	0.1	99	7.0
S62	95.0	5.6	7.78	na	15.62	0.1	100	7.0
S63	95.0	5.6	8.14	na	15.97	0.1	120	7.0
S64	95.0	5.6	8.91	na	16.71	0.1	144	7.0
S65	95.0	5.6	7.13	na	14.95	0.1	120	7.0
S66	95.0	5.6	7.0	na	14.82	0.1	31	7.0
S67	95.0	5.6	8.86	na	16.67	0.1	145	7.0
X61	97.583		7.09	na				
X62	97.583		7.7	na				
X63	97.583		8.09	na				
X64	97.583		8.95	na				
X65	97.583		6.96	na				
X66	97.583		7.26	na				
X67	97.583		8.89	na				
D1	97.583		10.5	na				
D2	97.583		10.81	na				
D3	97.583		12.44	na				
PA	86.75		57.93	na				
BLK4	95.75		81.69	na				
A1	95.75		84.33	na				
A2	95.75		84.34	na				
A3	95.75		84.44	na				
A4	95.75		84.58	na				
A5	95.75		85.1	na				
A6	95.4		86.82	na				
A7	95.4		87.3	na				
C1	95.29		86.87	na				
C2	95.29		86.87	na				
C3	95.29		86.87	na				
C4	95.29		86.87	na				
C5	95.29		86.87	na				
C6	95.29		86.87	na				
C7	95.29		86.87	na				
C8	95.29		86.87	na				
C9	98.0		85.7	na				
C10	95.75		86.67	na				
B1	95.75		87.65	na				
B2	95.75		87.65	na				
B3	95.75		87.65	na				
B4	95.75		87.65	na				
B5	95.75		87.65	na				
B6	95.75		87.65	na				
B7	95.75		87.66	na				
B8	95.75		87.76	na				
B9	95.75		87.79	na				
B10	95.75		88.5	na				
B11	95.75		89.12	na				
SYS2	110.25		83.67	na				
HV12	103.0		86.81	na				
HV11	89.0		92.72	na	50.0			
SYS1	95.75		89.8	na				
BLK1	97.625		89.14	na				
BLK2	98.167		89.02	na				
TOR	96.167		89.93	na				
BOR	87.375		93.78	na				
PO	87.375		93.82	na				
PI	87.375		84.52	na				
BYPS	94.0		81.65	na				
BKFL	87.5		91.22	na				
SPIG	96.875		87.2	na				
UG1	96.875		92.1	na	200.0			

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
TEST	104.0		89.53	na				

The maximum velocity is 17.3 and it occurs in the pipe between nodes D3 and PA

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
*DROPS								
S61	15.06	1.049	2E	4.0	3.624	7.234		K Factor = 5.60
to		120.0	T	5.0	9.000	-1.119		
X61	15.06	0.0770		0.0	12.624	0.972		Vel = 5.59
	0.0							
	15.06					7.087		K Factor = 5.66
S62	15.62	1.049	2E	4.0	3.624	7.782		K Factor = 5.60
to		120.0	T	5.0	9.000	-1.119		
X62	15.62	0.0824		0.0	12.624	1.040		Vel = 5.80
	0.0							
	15.62					7.703		K Factor = 5.63
S63	15.97	1.049	2E	4.0	3.500	8.137		K Factor = 5.60
to		120.0	T	5.0	9.000	-1.119		
X63	15.97	0.0859		0.0	12.500	1.074		Vel = 5.93
	0.0							
	15.97					8.092		K Factor = 5.61
S64	16.71	1.049	2E	4.0	3.458	8.906		K Factor = 5.60
to		120.0	T	5.0	9.000	-1.119		
X64	16.71	0.0934		0.0	12.458	1.163		Vel = 6.20
	0.0							
	16.71					8.950		K Factor = 5.59
S65	14.95	1.049	2E	4.0	3.458	7.129		K Factor = 5.60
to		120.0	T	5.0	9.000	-1.119		
X65	14.95	0.0759		0.0	12.458	0.946		Vel = 5.55
	0.0							
	14.95					6.956		K Factor = 5.67
S66	14.82	1.049	3E	6.0	7.458	7.000		K Factor = 5.60
to		120.0	T	5.0	11.000	-1.119		
X66	14.82	0.0747		0.0	18.458	1.379		Vel = 5.50
	0.0							
	14.82					7.260		K Factor = 5.50
S67	16.66	1.049	2E	4.0	3.416	8.856		K Factor = 5.60
to		120.0	T	5.0	9.000	-1.119		
X67	16.66	0.0929		0.0	12.416	1.153		Vel = 6.18
	0.0							
	16.66					8.890		K Factor = 5.59
*BRANCHLINES								
*								
X61	15.06	1.049		0.0	8.000	7.087		
to		120.0		0.0	0.0	0.0		
X62	15.06	0.0770		0.0	8.000	0.616		Vel = 5.59
X62	15.62	1.049	T	5.0	4.750	7.703		
to		120.0		0.0	5.000	0.0		
D1	30.68	0.2873		0.0	9.750	2.801		Vel = 11.39
	0.0							
	30.68					10.504		K Factor = 9.47

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
*								
X63	15.97	1.049		0.0	10.000	8.092		
to		120.0		0.0	0.0	0.0		
X64	15.97	0.0858		0.0	10.000	0.858		Vel = 5.93
X64	16.72	1.049	T	5.0	0.750	8.950		
to		120.0		0.0	5.000	0.0		
D2	32.69	0.3230		0.0	5.750	1.857		Vel = 12.14
	0.0							
	32.69					10.807		K Factor = 9.94
*								
X65	14.95	1.049		0.0	4.000	6.956		
to		120.0		0.0	0.0	0.0		
X66	14.95	0.0760		0.0	4.000	0.304		Vel = 5.55
X66	14.82	1.049		0.0	6.000	7.260		
to		120.0		0.0	0.0	0.0		
X67	29.77	0.2717		0.0	6.000	1.630		Vel = 11.05
X67	16.66	1.049	T	5.0	0.750	8.890		
to		120.0		0.0	5.000	0.0		
D3	46.43	0.6181		0.0	5.750	3.554		Vel = 17.24
	0.0							
	46.43					12.444		K Factor = 13.16
*MAINS								
D1	30.68	1.61		0.0	8.500	10.504		
to		120.0		0.0	0.0	0.0		
D2	30.68	0.0356		0.0	8.500	0.303		Vel = 4.83
D2	32.69	1.61		0.0	12.000	10.807		
to		120.0		0.0	0.0	0.0		
D3	63.37	0.1364		0.0	12.000	1.637		Vel = 9.99
D3	46.43	1.61	5lx	11.5	68.750	12.444		
to		120.0	Eql	27.9	39.400	4.692		
PA	109.8	0.3772		0.0	108.150	40.791		Vel = 17.30
PA	0.0	1.61	4lx	9.2	56.125	57.927		
to		120.0	T	8.0	17.200	-3.898		
BLK4	109.8	0.3772		0.0	73.325	27.657		Vel = 17.30
BLK4	0.0	1.682		0.0	8.667	81.686		
to		120.0		0.0	0.0	0.0		
A1	109.8	0.3047		0.0	8.667	2.641		Vel = 15.85
	0.0							
	109.80					84.327		K Factor = 11.96
*								
A1	109.80	3.26		0.0	0.790	84.327		
to		120.0		0.0	0.0	0.0		
A2	109.8	0.0127		0.0	0.790	0.010		Vel = 4.22
A2	0.0	3.26		0.0	8.900	84.337		
to		120.0		0.0	0.0	0.0		
A3	109.8	0.0121		0.0	8.900	0.108		Vel = 4.22

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
A3	0.0	3.26		0.0	11.400	84.445		
to		120.0		0.0	0.0	0.0		
A4	109.8	0.0122		0.0	11.400	0.139		Vel = 4.22
A4	0.0	3.26		0.0	42.330	84.584		
to		120.0		0.0	0.0	0.0		
A5	109.8	0.0121		0.0	42.330	0.514		Vel = 4.22
A5	0.0	3.26	J	17.471	92.110	85.098		
to		120.0	3I	20.159	37.630	0.152		
A6	109.8	0.0121		0.0	129.740	1.575		Vel = 4.22
A6	0.0	3.26	J	17.471	21.370	86.825		
to		120.0		0.0	17.471	0.0		
A7	109.8	0.0122		0.0	38.841	0.472		Vel = 4.22
A7	0.0	3.26	2H	6.989	16.860	87.297		
to		120.0	J	17.471	24.460	-0.152		
B6	109.8	0.0121		0.0	41.320	0.502		Vel = 4.22
	0.0							
	109.80					87.647		K Factor = 11.73
*								
C1	0.0	3.26		0.0	4.740	86.873	0.0	
to		120.0		0.0	0.0	0.0	0.0	
C2	0.0	0.0		0.0	4.740	0.0	0.0	Vel = 0
C2	0.0	3.26		0.0	0.810	86.873	0.0	
to		120.0		0.0	0.0	0.0	0.0	
C3	0.0	0.0		0.0	0.810	0.0	0.0	Vel = 0
C3	0.0	3.26		0.0	11.690	86.873	0.0	
to		120.0		0.0	0.0	0.0	0.0	
C4	0.0	0.0		0.0	11.690	0.0	0.0	Vel = 0
C4	0.0	3.26		0.0	2.910	86.873	0.0	
to		120.0		0.0	0.0	0.0	0.0	
C5	0.0	0.0		0.0	2.910	0.0	0.0	Vel = 0
C5	0.0	3.26		0.0	12.090	86.873	0.0	
to		120.0		0.0	0.0	0.0	0.0	
C6	0.0	0.0		0.0	12.090	0.0	0.0	Vel = 0
C6	0.0	3.26		0.0	3.240	86.873	0.0	
to		120.0		0.0	0.0	0.0	0.0	
C7	0.0	0.0		0.0	3.240	0.0	0.0	Vel = 0
C7	0.0	3.26	I	6.72	28.260	86.873	0.0	
to		120.0		0.0	6.720	0.0	0.0	
C8	0.0	0.0		0.0	34.980	0.0	0.0	Vel = 0
C8	0.0	3.26	4I	26.879	57.440	86.873	0.0	
to		120.0	2H	6.989	33.868	-1.174	0.0	
C9	0.0	0.0		0.0	91.308	0.0	0.0	Vel = 0
C9	0.0	3.26	2I	13.44	22.280	85.699	0.0	
to		120.0		0.0	13.440	0.974	0.0	
C10	0.0	0.0		0.0	35.720	0.0	0.0	Vel = 0
C10	0.0	3.26	2H	6.989	18.800	86.673	0.0	
to		120.0	J	17.471	24.460	0.152	0.0	
A6	0.0	0.0		0.0	43.260	0.0	0.0	Vel = 0

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
	0.0							
	0.0					86.825		K Factor = 0
*								
B1	0.0	3.26		0.0	1.040	87.647	0.0	
to		120.0		0.0	0.0	0.0	0.0	
B2	0.0	0.0		0.0	1.040	0.0	0.0	Vel = 0
B2	0.0	3.26		0.0	2.370	87.647	0.0	
to		120.0		0.0	0.0	0.0	0.0	
B3	0.0	0.0		0.0	2.370	0.0	0.0	Vel = 0
B3	0.0	3.26		0.0	8.130	87.647	0.0	
to		120.0		0.0	0.0	0.0	0.0	
B4	0.0	0.0		0.0	8.130	0.0	0.0	Vel = 0
B4	0.0	3.26		0.0	6.130	87.647	0.0	
to		120.0		0.0	0.0	0.0	0.0	
B5	0.0	0.0		0.0	6.130	0.0	0.0	Vel = 0
B5	0.0	3.26		0.0	3.160	87.647	0.0	
to		120.0		0.0	0.0	0.0	0.0	
B6	0.0	0.0		0.0	3.160	0.0	0.0	Vel = 0
B6	109.80	3.26		0.0	1.340	87.647		
to		120.0		0.0	0.0	0.0		
B7	109.8	0.0119		0.0	1.340	0.016		Vel = 4.22
B7	0.0	3.26		0.0	8.100	87.663		
to		120.0		0.0	0.0	0.0		
B8	109.8	0.0122		0.0	8.100	0.099		Vel = 4.22
B8	0.0	3.26		0.0	2.560	87.762		
to		120.0		0.0	0.0	0.0		
B9	109.8	0.0121		0.0	2.560	0.031		Vel = 4.22
B9	0.0	3.26		0.0	58.497	87.793		
to		120.0		0.0	0.0	0.0		
B10	109.8	0.0121		0.0	58.497	0.710		Vel = 4.22
B10	0.0	3.26	2I	13.44	37.083	88.503		
to		120.0		0.0	13.440	0.0		
B11	109.8	0.0122		0.0	50.523	0.614		Vel = 4.22
B11	0.0	3.26	I	6.72	9.390	89.117		
to		120.0	T	20.159	47.039	0.0		
SYS1	109.8	0.0121	B	6.72	56.429	0.685		Vel = 4.22
			C	13.44				
	0.0							
	109.80					89.802		K Factor = 11.59
*								
SYS2	0.0	4.26		0.0	7.250	83.674	0.0	
to		120.0		0.0	0.0	3.140	0.0	
HV12	0.0	0.0		0.0	7.250	0.0	0.0	Vel = 0
HV12	0.0	4.26	J	21.067	5.375	86.814	0.0	
to		120.0		0.0	21.067	2.328	0.0	
BLK1	0.0	0.0		0.0	26.442	0.0	0.0	Vel = 0

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
	0.0							
	0.0					89.142		K Factor = 0
HV11	50.00	4.26		0.0	6.750	92.720		Qa = 50
to		120.0		0.0	0.0	-2.923		
SYS1	50.0	0.0007		0.0	6.750	0.005		Vel = 1.13
SYS1	109.80	4.26	J	21.067	1.875	89.802		
to		120.0		0.0	21.067	-0.812		
BLK1	159.8	0.0066		0.0	22.942	0.152		Vel = 3.60
BLK1	0.0	6.357	2I	25.147	46.209	89.142		
to		120.0	H	6.287	72.926	-0.235		
BLK2	159.8	0.0009	B	10.059	119.135	0.112		Vel = 1.62
			J	31.433				
BLK2	0.0	6.357	2I	25.147	22.083	89.019		
to		120.0		0.0	25.147	0.866		
TOR	159.8	0.0010		0.0	47.230	0.045		Vel = 1.62
TOR	0.0	6.357	B	10.059	8.792	89.930		
to		120.0	J	31.433	41.492	3.808		
BOR	159.8	0.0009		0.0	50.284	0.047		Vel = 1.62
BOR	0.0	6.357	B	10.059	5.417	93.785		
to		120.0	C	25.147	35.206	0.0		
PO	159.8	0.0009		0.0	40.623	0.038		Vel = 1.62
	0.0							
	159.80					93.823		K Factor = 16.50
System Demand Pressure						93.823		
Safety Margin						58.540		
Continuation Pressure						152.363		
Pressure @ Pump Outlet						152.363		
Pressure From Pump Curve						-67.845		
Pressure @ Pump Inlet						84.518		
*								
PI	0.0	8.249	Ix	15.386	8.292	84.518		
to		120.0		0.0	15.386	-2.869		
BYPS	159.8	0.0003		0.0	23.678	0.006		Vel = 0.96
BYPS	0.0	6.357	2J	62.867	13.417	81.655		
to		120.0	I	12.573	75.440	9.486		* * Fixed Loss = 6.671
BKFL	159.8	0.0009	Zib	0.0	88.857	0.084		Vel = 1.62
BKFL	0.0	7.981	G	4.0	85.291	91.225		
to		120.0	Ix	13.1	17.100	-4.060		
SPIG	159.8	0.0003		0.0	102.391	0.032		Vel = 1.02
SPIG	0.0	8.39	2G	13.572	80.000	87.197		
to		140.0	Zac	0.0	134.023	4.868		* * Fixed Loss = 4.868
UG1	159.8	0.0002	2V	61.074	214.023	0.039		Vel = 0.93
			X	59.377				
UG1	200.00	8.39	2G	13.572	500.000	92.104		Qa = 200
to		140.0	3U	45.805	118.754	-3.086		
TEST	359.8	0.0008	X	59.377	618.754	0.509		Vel = 2.09

Final Calculations - Hazen-Williams

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*******	Notes	******
	0.0									
	359.80					89.527		K Factor = 38.03		



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name	:	46125901 Webster ISB - Standpipes
Building	:	Webster ISB
Location	:	8274 Big Bend Blvd
System	:	Standpipe
Contract	:	461259
Data File	:	46125901 Webster ISB - Standpipes.WXF

HYDRAULIC DESIGN INFORMATION SHEET

Name - 46125901 Webster ISB - Standpipes
Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB
System No. - Standpipe
Contractor - Ahern Fire Protection
Contract No. - 461259
Calculated By - Dana Mitchell
Drawing No. - FP-101.A
Occupancy - n/a

SYSTEM DESIGN

( )NFPA 14 Number of Standpipes ( )1 (X)2 ( )3 ( )4 ( )
( )Other
( )Specific Ruling Made by Date

Flow at Top Most Outlet	- 500 Gpm	System Type
Pres. at Top Most Outlet	- 100 Psi	(X) Wet ( ) Dry
Flow For Ea. Additional Standpipe	- 250 Gpm	
Total Additional Flow	- 750 Gpm	
Elevation at Highest Outlet	- 133-8 Feet	

Hose Valve Connection ( )1 1/2" (X)2 1/2"
Class Service (X)I ( )II ( )III
Note:

Calculation Summary: Gpm Required 750 Psi Required 131.630 BOR
C-Factor Used: Overhead 120 Underground 140

WATER SUPPLY

Water Flow Test:		Pump Data:		Tank or Reservoir:
Date of Test	- 05/23/16			Cap.
Time of Test	- 2:30 PM	Rated Cap.	1000	Elev.
Static (Psi)	- 90	@ Psi	55	
Residual (Psi)	- 86	Elev.	87.375	Well
Flow (Gpm)	- 1140			Proof Flow Gpm
Elevation	- 104			

Location: 8274 Big Bend Blvd

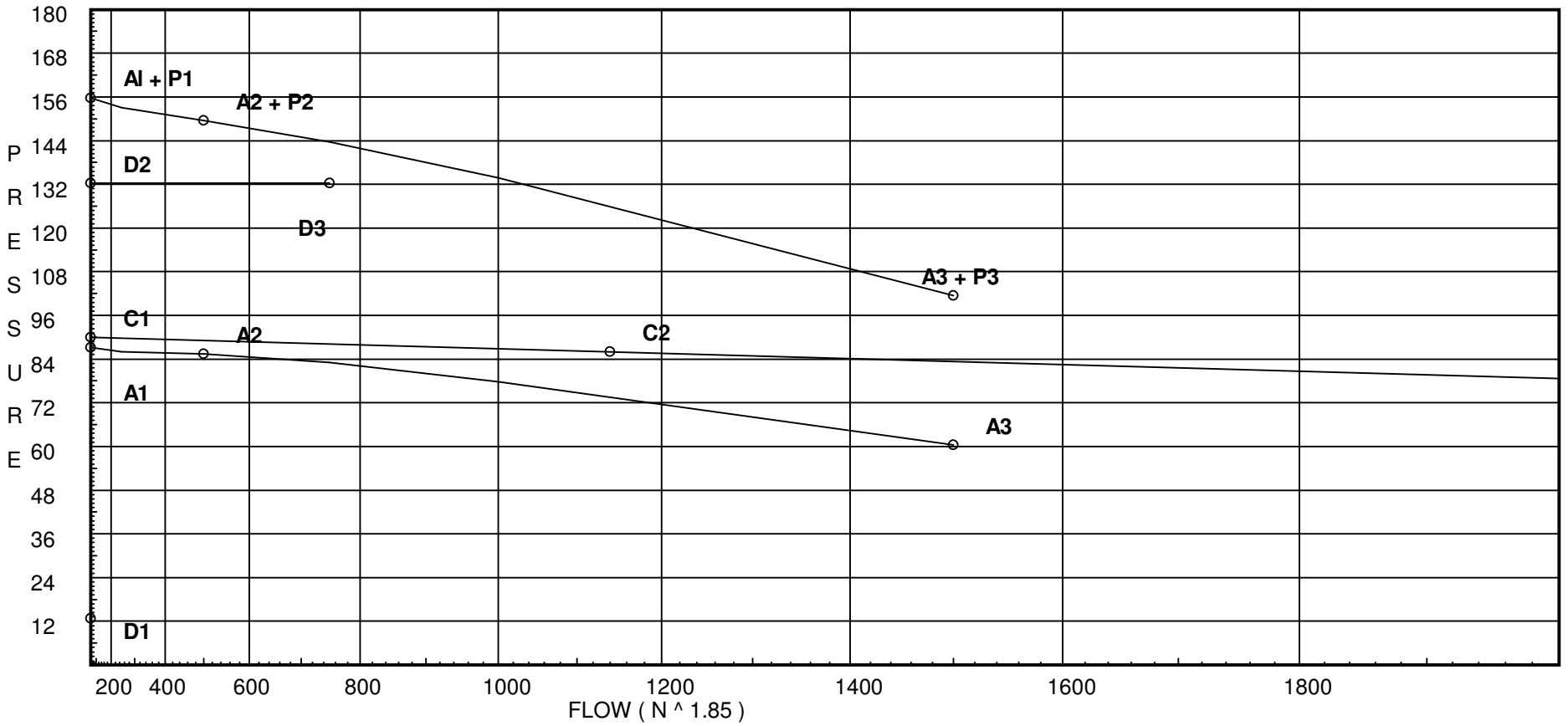
Source of Information: Ahern Fire Protection

City Water Supply:
- C1 - Static Pressure : 90
- C2 - Residual Pressure: 86
- C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow
- A1 - Adjusted Static: 87.200
- A2 - Adj Resid : 85.468 @ 500
- A3 - Adj Resid : 60.373 @ 1500

Pump Data:
- P1 - Pump Churn Pressure : 68.5
- P2 - Pump Rated Pressure : 64
- P2 - Pump Rated Flow : 500
- P3 - Pump Pressure @ Max Flow : 41
- P3 - Pump Max Flow : 1500
- City Residual Flow @ 0 = 6135.00
- City Residual Flow @ 20 = 5355.71
- City Water @ 150% of Pump = 83.35

Demand:
- D1 - Elevation : 12.849
- D2 - System Flow : _____
- D2 - System Pressure : 132.298
- Hose (Demand) : 750
- D3 - System Demand : 750
- Safety Margin : 11.270



Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
E	90' Standard Elbow Thrd	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkens 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Fittings Used Summary

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
HF14	133.667		105.86	na	250.0			
HF13	118.333		115.73	na				
HF24	133.667		100.0	na	250.0			
HF23	118.333		107.16	na	250.0			
HV24	133.667		104.27	na				
HV23	118.333		111.48	na				
HV22	103.0		120.16	na				
HV21	89.0		127.13	na				
BLK4	96.167		124.03	na				
BLK3	97.583		123.88	na				
HV14	133.667		108.55	na				
SYS3	125.583		112.48	na				
HV13	118.333		115.73	na				
SYS2	110.25		119.36	na				
HV12	103.0		122.6	na				
HV11	89.0		129.07	na				
SYS1	95.75		126.14	na				
BLK1	97.625		125.33	na				
BLK2	98.167		125.35	na				
TOR	96.167		127.0	na				
BOR	87.375		131.63	na				
PO	87.375		132.3	na				
PI	87.375		83.07	na				
BYPS	94.0		80.31	na				
BKFL	87.5		88.08	na				
SPIG	96.875		84.58	na				
UG1	96.875		89.26	na				
TEST	104.0		88.16	na				

The maximum velocity is 16.75 and it occurs in the pipe between nodes HF14 and HV14

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
*								
HF14	250.00	2.469	T	12.0	0.500	105.858		Qa = 250
to		120.0		0.0	12.000	0.0		
HV14	250.0	0.2154		0.0	12.500	2.692		Vel = 16.75
	0.0							
	250.00					108.550		K Factor = 24.00
HF13	0.0	2.469	T	12.0	0.500	115.732	0.0	
to		120.0		0.0	12.000	0.0	0.0	
HV13	0.0	0.0		0.0	12.500	0.0	0.0	Vel = 0
	0.0							
	0.0					115.732		K Factor = 0
*								
HF24	250.00	2.469	E	6.0	1.833	100.000		Qa = 250
to		120.0	T	12.0	18.000	0.0		
HV24	250.0	0.2154		0.0	19.833	4.272		Vel = 16.75
	0.0							
	250.00					104.272		K Factor = 24.48
HF23	250.00	2.469	E	6.0	2.084	107.158		Qa = 250
to		120.0	T	12.0	18.000	0.0		
HV23	250.0	0.2154		0.0	20.084	4.326		Vel = 16.75
	0.0							
	250.00					111.484		K Factor = 23.68
*								
HV24	250.00	4.26	2I	17.907	19.832	104.272		
to		120.0		0.0	17.907	6.641		
HV23	250.0	0.0151		0.0	37.739	0.571		Vel = 5.63
HV23	250.00	4.26	2I	17.907	19.500	111.484		
to		120.0		0.0	17.907	6.641		
HV22	500.0	0.0545		0.0	37.407	2.039		Vel = 11.25
HV22	0.0	4.26	I	8.954	7.666	120.164		
to		120.0		0.0	8.954	2.959		
BLK4	500.0	0.0545		0.0	16.620	0.906		Vel = 11.25
	0.0							
	500.00					124.029		K Factor = 44.90
HV21	0.0	2.469	T	12.0	7.167	127.134	0.0	
to		120.0	B	5.0	17.000	-3.104	0.0	
BLK4	0.0	0.0		0.0	24.167	0.0	0.0	Vel = 0
BLK4	500.00	6.357	3I	37.72	22.334	124.029		
to		120.0		0.0	37.720	-0.613		
BLK3	500.0	0.0078		0.0	60.054	0.466		Vel = 5.05
BLK3	0.0	6.357	J	31.433	171.916	123.882		
to		120.0	H	6.287	50.293	-0.253		
BLK2	500.0	0.0078	I	12.573	222.209	1.725		Vel = 5.05
	0.0							
	500.00					125.354		K Factor = 44.66

*

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
HV14	250.00	4.26	2I	17.907	10.580	108.550		
to		120.0		0.0	17.907	3.501		
SYS3	250.0	0.0151		0.0	28.487	0.431		Vel = 5.63
SYS3	0.0	4.26		0.0	7.250	112.482		
to		120.0		0.0	0.0	3.140		
HV13	250.0	0.0152		0.0	7.250	0.110		Vel = 5.63
HV13	0.0	4.26		0.0	8.083	115.732		
to		120.0		0.0	0.0	3.501		
SYS2	250.0	0.0151		0.0	8.083	0.122		Vel = 5.63
SYS2	0.0	4.26		0.0	7.250	119.355		
to		120.0		0.0	0.0	3.140		
HV12	250.0	0.0150		0.0	7.250	0.109		Vel = 5.63
HV12	0.0	4.26	J	21.067	5.375	122.604		
to		120.0		0.0	21.067	2.328		
BLK1	250.0	0.0151		0.0	26.442	0.400		Vel = 5.63
	0.0							
	250.00					125.332		K Factor = 22.33
HV11	0.0	4.26		0.0	6.750	129.068	0.0	
to		120.0		0.0	0.0	-2.923	0.0	
SYS1	0.0	0.0		0.0	6.750	0.0	0.0	Vel = 0
SYS1	0.0	4.26	J	21.067	1.875	126.144	0.0	
to		120.0	B	15.8	36.867	-0.812	0.0	
BLK1	0.0	0.0		0.0	38.742	0.0	0.0	Vel = 0
BLK1	250.00	6.357	2I	25.147	46.209	125.332		
to		120.0	H	6.287	72.926	-0.235		
BLK2	250.0	0.0022	B	10.059	119.135	0.257		Vel = 2.53
			J	31.433				
BLK2	500.00	6.357	2I	25.147	22.083	125.354		
to		120.0		0.0	25.147	0.866		
TOR	750.0	0.0164		0.0	47.230	0.776		Vel = 7.58
TOR	0.0	6.357	B	10.059	8.792	126.996		
to		120.0	J	31.433	41.492	3.808		
BOR	750.0	0.0164		0.0	50.284	0.826		Vel = 7.58
BOR	0.0	6.357	B	10.059	5.417	131.630		
to		120.0	C	25.147	35.206	0.0		
PO	750.0	0.0164		0.0	40.623	0.668		Vel = 7.58
	0.0							
	750.00					132.298		K Factor = 65.21
System Demand Pressure						132.298		
Safety Margin						11.270		
Continuation Pressure						143.568		
Pressure @ Pump Outlet						143.568		
Pressure From Pump Curve						-60.500		
Pressure @ Pump Inlet						83.068		
*								
PI	0.0	8.249	Ix	15.386	8.292	83.068		
to		120.0		0.0	15.386	-2.869		
BYPS	750.0	0.0046		0.0	23.678	0.109		Vel = 4.50

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	******* Notes ******
BYPS	0.0	6.357	2J	62.867	13.417	80.308		
to		120.0	I	12.573	75.440	6.315		* * Fixed Loss = 3.5
BKFL	750.0	0.0164	Zib	0.0	88.857	1.460		Vel = 7.58
BKFL	0.0	7.981	G	4.0	85.291	88.083		
to		120.0	Ix	13.1	17.100	-4.060		
SPIG	750.0	0.0054		0.0	102.391	0.555		Vel = 4.81
SPIG	0.0	8.39	2G	13.572	80.000	84.578		
to		140.0	Zac	0.0	134.023	4.000		* * Fixed Loss = 4
UG1	750.0	0.0032	2V	61.074	214.023	0.685		Vel = 4.35
			X	59.377				
UG1	0.0	8.39	2G	13.572	500.000	89.263		
to		140.0	3U	45.805	118.754	-3.086		
TEST	750.0	0.0032	X	59.377	618.754	1.979		Vel = 4.35
	0.0							
	750.00					88.156		K Factor = 79.88

2675 Scott Ave., Suite C
St. Louis, MO 63103
main 314.535.4544 | fax 314.535.0144
www.ahernfire.com

Webster University

8274 Big Bend Blvd
Webster Groves, MO 63119

Fire Suppression
Operating & Maintenance Manual

OPERATING & MAINTENANCE MANUAL

Webster University ISB
8274 Big Bend Blvd.
Webster Groves, MO 63119

Preaction Detection Added to Provided TotalPac with Built-In Panel

AFP #391073

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2. Commissioning Reports
   - Fire Suppression and Detection System Test Report
   - Confirmation of Arming
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4. As-Built Drawings FX-1 thru FX-2
5. Inspection Requirements – Preaction

2675 Scott Ave., Suite C
St. Louis, MO 63103
main 314.535.4544 | fax 314.535.0144
www.ahernfire.com

July 6, 2017

Mr. Doug Mayhew
Webster University ISB
8274 Big Bend Blvd
Webster Groves, MO 63119
Phone: 636.561.9500

RE: PREACTION DETECTION ADDED TO PROVIDED TOTALPAC WITH BUILT-IN PANEL
WEBSTER UNIVERSITY ISB
8274 BIG BEND BLVD
WEBSTER GROVES, MO 63119
AHERN FIRE PROTECTION CONTRACT NO. 391073

Dear Mr. Mayhew:

Please be hereby advised that our above-referenced Preaction Detection added to Provided TotalPac with built-in panel was placed in service on June 29, 2017.

Beginning with the above installation date, the system's materials and workmanship will be under warranty for one (1) year. However, we do not guarantee the operation of the installation due to factors beyond our control such as disabled devices or depleted municipal water supply.

Thank you once again for this opportunity to be of service.

Respectfully Submitted,

AHERN FIRE PROTECTION
A division of J. F. Ahern Co.

William Cavill

William Cavill
Special Hazards Project Manager

BJC/mmd
\\JFAHERN.LOCAL\UNIVERSAL\FDL\SHARED\FIRE\319DATA\391073 - WEBSTER UNIVERSITY ISB\DESIGN ADMIN\O&M TEMPLATES\1. WARRANTY LETTER.DOC

Contract/ WO # 391073	LID

Type of Tests

- [x] Commission New Installation
- [ ] Semi-Annual [ ] Annual Inspection, Testing and Maintenance
- [ ] Other, Explain

FIRE SUPPRESSION AND DETECTION SYSTEM TEST

Invoice To:				**Phone #:**	
Street:			**City, State, Zip:**		
Location:	Webster University ISB		**Building Name:**		
Street:	8274 Big Bend Blvd		**City, State, Zip:**	Webster Groves, MO 63119	
Phone #:		**Fax #:**	**Foreman:**		
Date:		**Signature:**			

Protected Area:
System Type(s): Preaction
Manufacturer(s): Viking
Control Panel(s): Total Pack/VFR 400

Mechanical Section	**OK**	**N/A**	**Comments**
Agent Containers Secure:	[ ]	[x]	
Agent Piping Secure:	[ ]	[x]	
Pipe Gauge and Size:	[x]	[ ]	
Nozzles Installed:	[x]	[ ]	
Deluge Valves:	[ ]	[x]	
Preaction Valves:	[x]	[ ]	
Solenoid/Pilot Actuators:	[x]	[ ]	
Pilot Controls:	[x]	[ ]	
Waterflow Switches:	[x]	[ ]	
Tamper Switches:	[x]	[ ]	
Selector Valves:	[ ]	[x]	
Pneumatic Release:	[x]	[ ]	
Gauges/Hoses, etc.:	[x]	[ ]	
System Alterations:	[ ]	[x]	
Room Sealed Properly:	[ ]	[x]	
Equipment Condition:	[x]	[ ]	
Valves Trip Tested:	[x]	[ ]	
Low Air Switches Adjusted:	[x]	[ ]	
Normal Air: 35	Alarm Point: 20		Trip: 0

Field Device Tests	**OK**	**N/A**	**Comments**
Audible Alarm Devices:	[ ]	[x]	
Visual Alarm Devices:	[ ]	[x]	
Remote Annunciators:	[ ]	[x]	
Audible Trouble Devices:	[ ]	[x]	
Visual Trouble Devices:	[ ]	[x]	
Pressure Switches:	[ ]	[x]	
Abort Switches:	[ ]	[x]	
Electric Release Stations:	[ ]	[x]	
Auxiliary Control Lockouts:	[ ]	[x]	
Remote/Aux. Relays:	[ ]	[x]	
Main/Reserve Switches:	[ ]	[x]	
Initiator/Solenoid Devices:	[x]	[ ]	
Addressable Devices:	[ ]	[x]	
System Alterations:	[ ]	[x]	
Equipment Condition:	[x]	[ ]	

Foam System Testing	**Report Attached**	**N/A**
Foam Test:	[ ]	[x]

Contract/WO # 391073	LID

Type of Tests

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- [ ] Other, Explain

FIRE SUPPRESSION AND DETECTION SYSTEM TEST

Control Panel Tests	OK	N/A	Comments
AC Power (120) VAC:	[x]	[ ]	
Panel 24 V Power Supply (27) VDC:	[x]	[ ]	
Battery Load Test:	[x]	[ ]	
13 VDC at 8 (time) to 13 VDC at 8 (time)			
Lamp Test:	[x]	[ ]	
Fuses/Wiring:	[x]	[ ]	
Alarm Tests:	[x]	[ ]	
Supervisory Tests:	[x]	[ ]	
Trouble Tests (Ground/Open):	[x]	[ ]	
Dip Switch:	[x]	[ ]	
System Program:	[x]	[ ]	
Sequence of Operation:	[x]	[ ]	
System Time Delays:	[ ]	[x]	
Printers:	[ ]	[x]	
Modem Control:	[ ]	[x]	
Equipment Condition:	[x]	[ ]	

Interlocks	OK	N/A	Comments
Air Conditioners:	[ ]	[x]	
Air Handlers/Heaters:	[ ]	[x]	
Process Interlock:	[ ]	[x]	
Fuel Shutoff:	[ ]	[x]	
Computer Shutdown:	[ ]	[x]	
EPO Switches:	[ ]	[x]	
Door Closers:	[ ]	[x]	
Door Strikes:	[ ]	[x]	
Dampers:	[ ]	[x]	
Other:	[ ]	[x]	

Important

Please see comments section on Page 3 for notes pertaining to those items containing a number in the comment box. A number in this box indicates a possible problem or a situation in which a particular device or function was not tested due to inaccessibility or the potential for business interruption. **Ahern Fire Protection** assumes no liability for those items identified.

Remote Monitor	OK	N/A	Comments
Alarm:	[x]	[ ]	
Supervisory:	[x]	[ ]	
Trouble:	[x]	[ ]	
Pre-Release:	[ ]	[x]	
Release:	[ ]	[x]	
Agency:			
Building Fire Alarm:			
Other:			

*System has been tested for remote monitoring only. Receipt of the correct signal to the central monitoring station shall be by others.

Detection Devices

Devices Tested	OK	Qty.	Comments	Devices Tested	OK	Qty.	Comments
Photoelectric Smoke Detector:	[ ]			Spark Detectors:	[ ]		
Ionization Smoke Detectors:	[ ]			Beam Smoke Detectors:	[ ]		
Heat Detectors, Temp:	[x]	2	5601P 135°	Combustible Gas Detectors:	[ ]		
Flame-UV/IR:	[ ]			Incipient Fire Detectors:	[ ]		
Duct Smoke Detectors:	[ ]			Water Leak Detectors:	[ ]		

See addressable panel test history (file name):

Was sensitivity test performed on smoke detectors:

Last known date of smoke detector sensitivity test:

Contract/WO # 391073	LID

Type of Tests

- [x] Commission New Installation
- [ ] Semi-Annual [ ] Annual Inspection, Testing and Maintenance
- [ ] Other, Explain

FIRE SUPPRESSION AND DETECTION SYSTEM TEST

Linear Heat Detection

Zone Number	Protected Area	Temp	Test Method	Resistance	Length

Fire Extinguishing Cylinder Record

Serial #	Gross	Net	Tare	PSI	Temp	LLI	Hydro	Act. Date	Location

Service/Checkout List	OK	N/A	Comments
System(s) Armed:	[x]	[ ]	
Control Interlocks Rearmed:	[x]	[ ]	
System(s) Status Normal:	[x]	[ ]	
Customer Training:	[ ]	[x]	
Authorities Notified:	[x]	[ ]	
Monitoring Systems Armed:	[x]	[ ]	
Building Systems Armed:	[x]	[ ]	
Solenoids/Cylinders Connected:	[x]	[ ]	
Warning Signs in Place:	[ ]	[x]	

Service Notes: Describe Special Disarming procedures

System Comments

Ahern Fire Protection Technician:

Signature: _____

Fire Department:

Fire Inspector:

Signature: _____

Customer or Owner:

Customer or Owner Rep:

Signature: _____

Insurance Company:

Representative:

Signature: _____

Customer Copy: [ ] **Yes** [ ] **No**

Comments:

CONFIRMATION OF ARMING

AFP CONTRACT / WO #: 391073

JOB NAME: Webster University ISB

ADDRESS: 8274 Big Bend Blvd
Webster Groves, MO 63119

SYSTEM TYPE: Preaction

OF SYSTEMS:

LOCATION OF SYSTEM(S):

EQUIPMENT MANUFACTURER:

Ahern Fire Protection has completed the installation and testing of the Clean Agent, Preaction, Deluge or Foam Fire Suppression Systems~~. At your request, the automatic release mechanism of the system(s) was left disabled~~. Ahern Fire Protection was on site today to arm the system(s) and place your system(s) into full service. By signing and dating this correspondence, you are confirming your system(s) are now complete and in-service.

Steve Ray

Building Owner Representative Signature — Date: 06/29/2017

Ahern Fire Protection Representative Signature — Date: 06/29/2017

Fire Suppression Equipment Submittal

Webster University ISB

8274 Big Bend Blvd
Webster Groves, MO 63119

AHERN SINCE 1880

FIRE SUPPRESSION EQUIPMENT DATA

AHERN FIRE PROTECTION
2675 Scott Ave., Suite C
St. Louis, Missouri 63103
main: 314.535.4544 | fax: 314.535.0144
w w w . a h e r n f i r e. c o m

NAME OF PROJECT: **Webster University ISB**
8274 Big Bend Blvd
Webster Groves, MO 63119

Preaction Detection added to
Provided TotalPac with built-in panel

AHERN FIRE PROTECTION CONTRACT NO.: **391073**

SPECIFICATION NO.:

SUBMITTAL NO.:

STAMP

Prepared By: *William Cawill*
Special Hazards Design/ Project Manager

BJC/abc

EQUIPMENT/MANUFACTURER DATA LIST

ITEM	PART NUMBER	DESCRIPTION	MANUFACTURER
1	5601P	135 Degree Heat Detector	System sensor
2	S-1275	12V 7.5 AH Batteries	Sbs

5600 Series Mechanical Heat Detectors

System Sensor's 5600 series mechanical heat detectors offer a low-cost means for property protection against fire, and for non-life-safety installations where smoke detectors are inappropriate.



5621

Features

- Multiple configurations for installations:
  – Single- and dual-circuit models
  – Fixed temp and combination fixed- temp/rate-of-rise 135°F or 194°F ratings.
- Plain housing for residential installations (Model 5601P)
- Easy-to-use terminal screws
- A broad range of back box mounting options:
  – Single gang
  – 3.5″ and 4″ Octagonal
  – 4″ square with square to round plaster ring
- Reversible mounting bracket

Multiple configurations. The 5600 series offers a full-line of configurations to accommodate a broad range of applications. Both single- and dual-circuit models are available for low- and high-temperature ratings with either fixed temperature or combination fixed temperature/rate-of-rise (ROR) activation. The ROR element of the fixed/ROR models is restorable to accommodate field-testing.

Installation flexibility. To satisfy a variety of installation needs, the 5600 series easily mounts to single-gang and octagonal back boxes. And these models accommodate four-square back boxes, when used with a square to round plaster ring. The reversible mounting bracket permits both flush- and surface-mount back box installations.

Visual identification. The 5600 series provides clear markings on the exterior of the unit to ensure that the proper detector is being used. Alphanumeric characters identify the activation method, as well as the temperature rating, in Fahrenheit and Celsius degrees. Fixed temperature models are identified FX, while combination fixed/rate-of-rise units are marked FX/ROR. The 5600 series also provides a post-activation indicator in the form of a collector. When the detector is activated, the collector drops from the unit, making it easy to identify the unit in alarm.

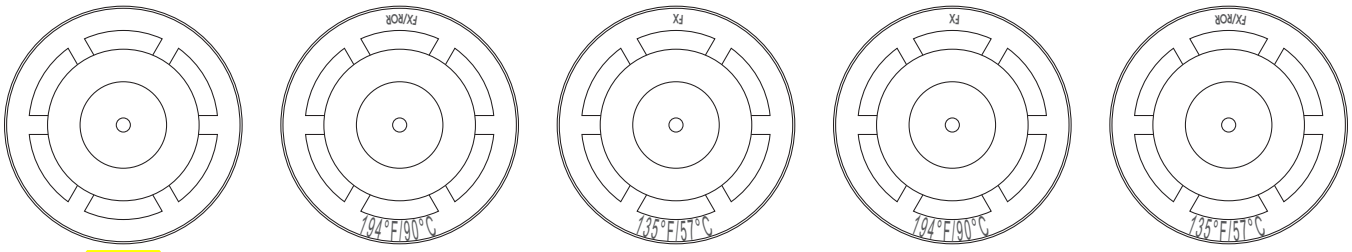
Agency Listings

UL LISTED S2101 · FM APPROVED 3016008 · ULC CS630 · 7270-1653:0167

Specifications

Architectural/Engineering Specifications
Mechanical heat detector shall be a System Sensor 5600 series model number _____, listed to Underwriters Laboratories UL 521 for Heat Detectors for Fire Protective Signaling Systems. The detector shall be either a single-circuit or a dual-circuit type, normally open. The detector shall be rated for activation at either 135°F (57°C) or 194°F (90°C), and shall activate by means of a fixed temperature thermal sensor, or a combination fixed temperature/rate-of-rise thermal sensor. The rate-of-rise element shall be activated by a rapid rise in temperature, approximately 15°F (8.3°C) per minute. The detector shall include a reversible mounting bracket for mounting to 3½-inch and 4-inch octagonal, single gang, and 4-inch square back boxes with a square to round plaster ring. Wiring connections shall be made by means of SEMS screws that shall accommodate 14–22AWG wire. The detector shall contain alphanumeric markings on the exterior of the housing to identify its temperature rating and activation method. The rate-of-rise element of combination fixed temperature/rate-of-rise models shall be restorable, to allow for field-testing. The detectors shall include an external collector that shall drop upon activation to identify the unit in alarm.

Physical/Operating Specifications	
Maximum Installation Temperature	5601P, 5603, 5621, and 5623: 100°F (38°C) 5602, 5604, 5622, and 5624: 150°F (65.6°C)
Operating Humidity Range	5 to 95% RH non-condensing
Dimensions with mounting bracket	Diameter: 4.57 inches (11.6cm) Height: 1.69 inches (4.3cm)
Alarm Temperature	5601P, 5603, 5621, and 5623: 135°F (57°C) 5602, 5604, 5622, and 5624: 194°F (90°C)
Weight	6 oz. (170 grams)
Rate-of-Rise Threshold	15°F (8.3°C) rise per minute (models 5601P, 5602, 5621, and 5622 only)
Mounting	3½-inch octagonal back box 4-inch octagonal back box Single gang back box 4-inch square back box with a square to round plaster ring
Electrical Specifications	
Operating Voltage / Contact Ratings	6–125VAC / 3A 6–28VDC / 1A 125VDC / 0.3A 250VDC / 0.1A
Input Terminals	14–22 AWG



5601P **5602, 5622** **5603, 5623** **5604, 5624** **5621**

Ordering Information

Model	Circuit	Identification Method on Exterior	Temperature Rating	Activation	UL Protected Spacing – 10 Foot Ceiling*
5601P	Single	None	135°F (57°C)	Fixed Temperature / Rate-of-Rise	50 feet × 50 feet (15.24m × 15.2m)
5602	Single	Lettering	194°F (90°C)	Fixed Temperature / Rate-of-Rise	50 feet × 50 feet (15.24m × 15.2m)
5603	Single	Lettering	135°F (57°C)	Fixed Temperature	25 feet × 25 feet (7.62m × 7.62m)
5604	Single	Lettering	194°F (90°C)	Fixed Temperature	25 feet × 25 feet (7.62m × 7.62m)
5621	Dual	Lettering	135°F (57°C)	Fixed Temperature / Rate-of-Rise	50 feet × 50 feet (15.24m × 15.2m)
5622	Dual	Lettering	194°F (90°C)	Fixed Temperature / Rate-of-Rise	50 feet × 50 feet (15.24m × 15.2m)
5623	Dual	Lettering	135°F (57°C)	Fixed Temperature	25 feet × 25 feet (7.62m × 7.62m)
5624	Dual	Lettering	194°F (90°C)	Fixed Temperature	25 feet × 25 feet (7.62m × 7.62m)

*NOTE: Refer to NFPA72 guidelines for spacing reductions when ceiling heights exceed 10 feet.

SYSTEM SENSOR®
3825 Ohio Avenue • St. Charles, IL 60174
Phone: 800-SENSOR2 • Fax: 630-377-6495
www.systemsensor.com

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Product specifications subject to change without notice. Visit systemsensor.com for current product information, including the latest version of this data sheet.
SPDS30001 • 7/13

STORAGE BATTERY SYSTEMS, INC.

SBS S Series Batteries

1.2AH - 200AH AGM (6V and 12V)



The sealed construction of the SBS "VRLA" series battery allows trouble-free, safe operation in any position. There is no need to add electrolyte since gases generated during charging are recombined in a unique "Oxygen Cycle."

Applications:

- UPS systems
- Switchgear/controls
- Telecommunications
- Emergency lighting
- Alarm systems
- Machine tools

Features:

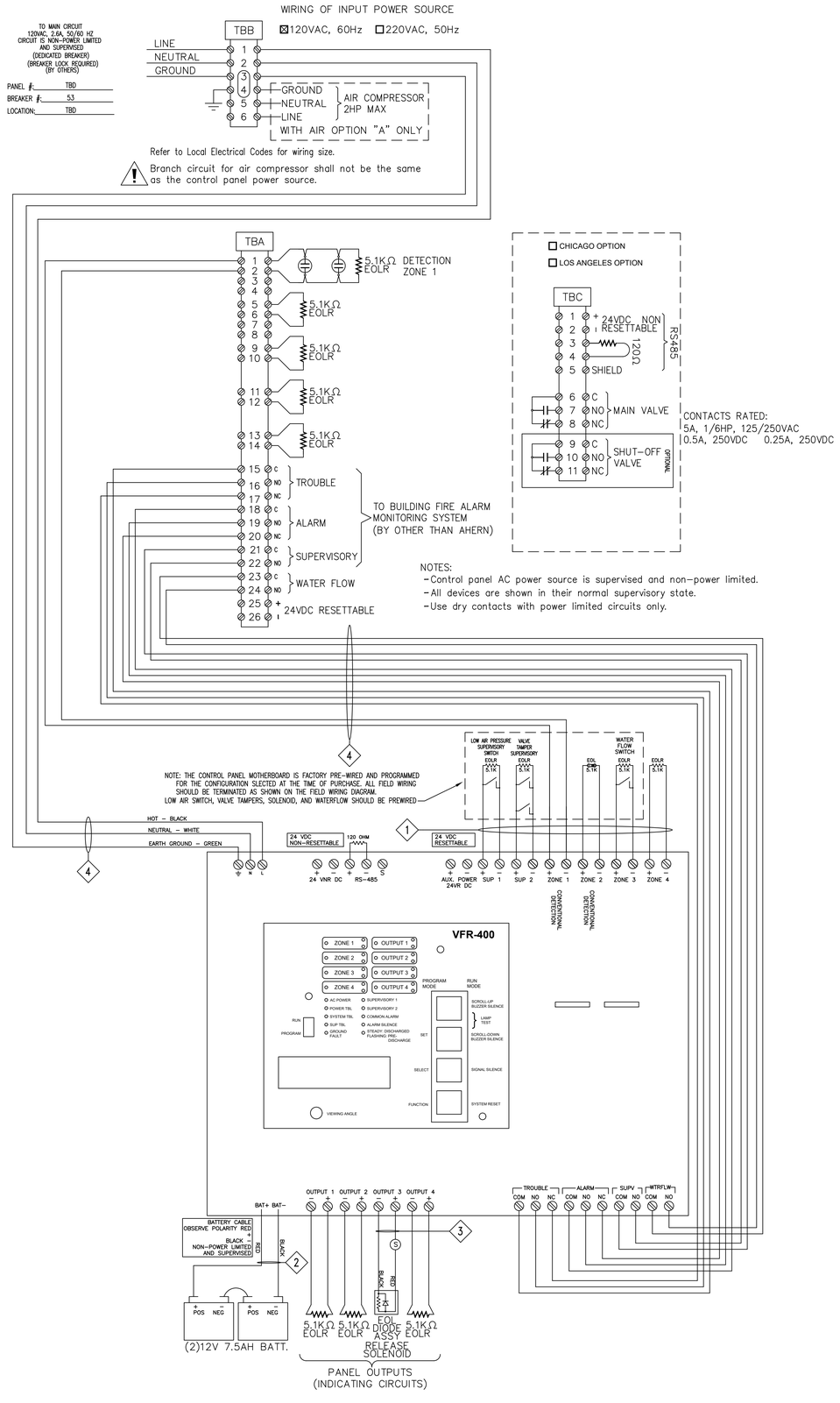
- Maintenance-free operation
- Economical
- Low self-discharge (long shelf life)
- Spill-proof construction
- Compact
- Wide operating temperature
- Deep discharge recovery
- 100% memory-free
- Non-restricted for air transportation
- UL recognized #MH19767
- Design life of 4-8 years in float service
- 1 year warranty

Construction	
Plates	Lead-tin-calcium alloy
Separator	Microporous glass fiber (AGM)
Casing Material	ABS
Float Voltage	2.25-2.30V/cell
Equalize Voltage	2.35-2.48V/cell
Temperature Range	5°F to +122°F (-15°C to +50°C)
Service Life	4-8 years

Terminals	
F1:	.187" Spade
F2:	250" Spade
F3:	5.5mm Lug
F4:	6.5mm Lug
F5:	8.0mm Lug
F8:	10.0mm Lug
F10:	9.0mm Lug
F11:	10.5mm Lug
F12:	10 x M5 Button
F13:	14 x M6 Button
F14:	5 x M6 Button
F15:	16 x M6 Button
F16:	20 x M6 Button
F17:	20 x M8 Button

Technical Data*

Part No.	Volt (V)	AH/ 20HR	Length in	Length mm	Width in	Width mm	Height in	Height mm	Weight (Approx) lb	Weight (Approx) kg	I.R. mOhms	Terminal Type	Assembly Figure
S-612	6	1.2	3.82	97	0.94	24	2.28	58	0.68	0.31	39.0	F1	+ –
S-650A	6	5	2.76	70	1.85	47	4.21	107	2.05	0.93	16.0	F1	+ –
S-675	6	7.5	5.94	151	1.34	34	3.98	101	3.09	1.40	11.0	F1	+ –
S-6120	6	12	5.94	151	1.97	50	3.98	101	4.56	2.07	7.00	F1	+ –
S-6600	6	60	7.24	184	4.41	112	8.35	212	21.4	9.70	4.00	F17	+ –
S-6V180	6	180	12.05	306	6.65	169	8.90	226	66.8	30.3	1.60	F17	– +
S-6V220	6	220	12.68	322	6.97	177	9.06	230	79.4	36.0	1.50	F17	+ –
S-1213	12	1.3	3.82	97	1.69	43	2.28	58	1.30	0.59	39.0	F1	– +
S-1250	12	5	3.54	90	2.76	70	4.21	107	4.03	1.83	33.0	F1	+ –
S-1275	12	7.5	5.94	151	2.56	65	3.98	101	6.02	2.73	19.0	F1	+ –
S-12120	12	12	5.94	151	3.90	99	3.98	101	9.26	4.20	14.0	F1	+ –
S-12180	12	18	7.13	181	3.03	77	6.57	167	13.9	6.30	12.0	F3	– +
S-12220	12	22	7.13	181	3.03	77	6.57	167	14.8	6.70	11.0	F12	– +
S-12260	12	26	6.54	166	4.96	126	6.85	174	20.1	9.10	10.0	F13	+ –
S-12330	12	33	7.72	196	5.16	131	7.09	180	180	11.0	9.00	F5	+ –
S-12400	12	40	7.80	198	6.54	166	6.85	174	33.1	15.0	9.00	F13	– +
S-12550	12	55	9.02	229	5.43	138	8.35	212	39.7	18.0	8.00	F15	+ –
S-12750	12	75	10.24	260	6.65	169	8.46	215	62.2	28.2	5.00	F15	+ –
S-12900	12	90	12.09	307	6.65	169	8.46	215	67.5	30.6	4.00	F15	+ –
S-12V100	12	100	13.03	331	6.89	175	9.41	239	75.6	34.3	3.50	F11	+ –
S-12V120	12	120	13.03	331	6.89	175	9.41	239	77.2	35.0	3.00	F11	– +
S-12V200	12	200	20.87	530	8.23	209	8.58	218	144	65.5	2.30	F17	– +



PREACTION CONTROL PANEL WIRING
LOCATED INSIDE TOTALPAC UNIT
SCALE: NTS

EQUIPMENT LIST

SYMBOL	ITEM	QTY	P/N	DESCRIPTION	MANUFACTURER
135°	1	2	5601P	135 DEGREE HEAT DETECTOR	SYSTEM SENSOR
	2	2	S-1275	12V 7.5 AH BATTERIES	SBS

ELECTRICAL NOTES

A. INSTALLATION SHALL BE IN ACCORDANCE WITH THE MINIMUM REQUIREMENTS OF THE NATIONAL FIRE PROTECTION ASSOCIATION (NFPA 72, CURRENT EDITION), NATIONAL ELECTRICAL CODE (NEC, CURRENT EDITION), THE EQUIPMENT MANUFACTURER, INSURANCE REPRESENTATIVE, AND LOCAL AUTHORITY HAVING JURISDICTION.
B. USE #10 OR 1/4" FASTENERS TO MOUNT THE CONTROL ENCLOSURE IN THE READILY ACCESSIBLE AND EASILY VISIBLE LOCATION INDICATED ON THE SYSTEM DRAWINGS AT 6'-0" AFF FROM THE TOP OF ENCLOSURE, MAXIMUM.
C. LOCATE SENSORS, SIGNAL DEVICES, MANUAL PULL STATIONS, ETC. FROM THE DRAWINGS SPECIFICALLY PREPARED FOR THE INSTALLATION.
D. INSTALL CONDUIT AND COMPLETE FIELD WIRING, LEAVING SUFFICIENT WIRE INSIDE THE CONTROL ENCLOSURE FOR FINAL CONNECTIONS.
E. WIRING MUST BE IN CONDUIT OR LISTED RACEWAY. RACEWAY TO MEET NEC REQUIREMENTS FOR RATED AREAS AND END USER'S SITE REQUIREMENTS, AS IT APPLIES TO THE INSTALLATION.
F. FIELD WIRE TERMINATIONS/CONDUCTOR PULLS SHALL BE CONTINUOUS FROM DEVICE TO DEVICE.
G. THE 120VAC CIRCUIT MUST BE IN A SEPARATE CONDUIT AND CONNECTED TO THE BUILDING POWER THROUGH A SEPARATE DEDICATED 15 AMP CIRCUIT. PROVIDE CIRCUIT BREAKER LOCK-ON CLIP. DO NOT COMBINE 120VAC CIRCUITS AND 24VDC FIRE SYSTEM CIRCUITS IN THE SAME RACEWAY.
H. CAUTION: PROPER CARE MUST BE EXERCISED WHEN HANDLING THE ELECTRIC CIRCUIT BOARDS. STATIC ELECTRICITY MAY DAMAGE CIRCUITRY IF HANDLED IMPROPERLY. HANDLE CIRCUIT BOARDS BY THE EDGES ONLY AND AVOID TOUCHING THE CONNECTION PINS. THESE CONNECTORS NEED TO BE KEPT CLEAN AND STATIC FREE TO INSURE RELIABLE OPERATION OF THE ELECTRONICS. WHEN HANDLING THE CIRCUIT BOARDS, IT IS ADVISABLE TO WEAR A WRIST STRAP WHICH IS PROPERLY GROUNDED TO DRAIN ANY STATIC CHARGES. KEEP THE CIRCUIT BOARDS IN THEIR PROTECTIVE STATIC BAGS UNTIL THEY ARE TO BE INSTALLED IN THE PANEL. THEN HANDLE THEM CAREFULLY (KEEPING YOURSELF GROUNDED) WHILE INSTALLING THEM. DISCHARGE STATIC ELECTRICITY BY TOUCHING GROUNDED SURFACE BEFORE HANDLING ANY ELECTRONIC COMPONENTS.
I. CONNECT ALL FIELD WIRING TERMINATION'S ACCORDING TO THE SYSTEM WIRING DIAGRAMS FOR THIS INSTALLATION.
J. SMOKE DETECTORS (IF APPLICABLE) SHALL NOT BE LOCATED WITHIN 3'-0" OF SUPPLY AIR DIFFUSERS.
K. DETECTORS SHALL BE LOCATED WITHIN PLUS OR MINUS 0'-6" OF LOCATIONS INDICATED ON SYSTEM PLANS. NOTIFY AHERN FIRE PROTECTION PROJECT MANAGER (PM) PRIOR TO EXCEEDING THE SPECIFIED TOLERANCES.
L. SYSTEM START-UP SHALL BE PERFORMED JOINTLY BY THE ELECTRICAL CONTRACTOR AND AHERN FIRE PROTECTION. START-UP SHALL BE CONDUCTED ONLY WHEN ALL SYSTEM COMPONENTS AND WIRING ARE INSTALLED AND TERMINATED.
M. THE 120VAC POWER INPUT AND/OR BATTERIES SHALL NOT BE ENERGIZED TO CONTROL UNIT UNTIL SYSTEM START-UP HAS BEEN PERFORMED BY AHERN FIRE PROTECTION.
N. THE INSTALLING CONTRACTOR SHALL CORRECT AND/OR TROUBLESHOOT ANY AND ALL FIELD INSTALLATION WIRING DISCREPANCIES.
O. DETECTOR AND INITIATOR WIRING (IF APPLICABLE) SHALL BE TESTED FOR GROUND FAULTS, SHORTS, AND TESTED POINT-TO POINT BY AHERN FIRE PROTECTION BEFORE ELECTRICAL COMPONENTS ARE INSTALLED ON CIRCUITS.
P. CLEAN AGENT SUPPRESSION SYSTEMS – ALL SUPPLY, RETURN, OR EXHAUST DUCTWORK ENTERING OR EXITING THE CLEAN AGENT PROTECTED SPACE SHALL BE SUPPLIED WITH A RATED LOW LEAKAGE SMOKE/FIRE DAMPER, ANY CLOSEABLE OPENINGS ON THE PERIMETER WALLS, FLOORS, OR CEILING OF THE CLEAN AGENT PROTECTED SPACE SHALL BE PROPERLY SEALED WITH FIRE RATED MATERIALS. DAMPERS SHALL BE INTERFACED AND CONTROLLED BY THE CLEAN AGENT CONTROL PANEL. DAMPERS, UNLESS NOTED OTHERWISE, ARE SUPPLIED, INSTALLED, AND WIRED BY OTHERS.
Q. ALL VARIATIONS FROM DRAWINGS MUST BE COORDINATED WITH AHERN FIRE PROTECTION BEFORE PROCEEDING WITH CHANGES.
R. INSTALLING CONTRACTOR IS RESPONSIBLE FOR VERIFYING CORRECT INSTALLATION OF DEVICES PER INSTALLATION DOCUMENTS PROVIDED WITH DEVICES.
S. ANY VARIATIONS FROM DRAWINGS SHALL BE CLEARLY INDICATED ON THE FIELD MARK-UP BY THE ELECTRICAL CONTRACTOR AND AHERN FIRE PROTECTION.

SEQUENCE OF OPERATIONS:

DOUBLE INTERLOCK – ELECTRIC/PNEUMATIC

NORMAL CONDITION
GREEN POWER ON LED LIT, ALL OTHER LEDS & SOUNDER OFF.

ALARM CONDITION
UPON RECEPT OF AN ALARM FROM SMOKE/HEAT DETECTOR ON ZONE 1 OR 2:
1) ALARM LED FLASHES, REMAINS STEADY AFTER SILENCING.
2) SOUNDER ON.
3) ALARM RELAY ACTIVATES SENDING SIGNAL TO BLDG FIRE ALARM PANEL.
4) PREACTION SOLENOID IS ACTIVATED.

UPON LOSS OF SYSTEM AIR PRESSURE FROM A FUSED SPRINKLER HEAD AFTER ALARM FROM ANY SMOKE/HEAT DETECTOR ON ZONE 1 OR 2:
1) ALARM LED FLASHES, REMAINS STEADY AFTER SILENCED.
2) SOUNDER ON.
3) ALARM LOW AIR PRESSURE SWITCH ACTIVATED.
4) WATERFLOW PRESSURE SWITCH ACTIVATED.
5) PREACTION CONTROL VALVES OPEN, FILLING SPRINKLER PIPE WITH WATER AND DISCHARGES OUT OF ALL OPEN HEADS.

SUPERVISORY CONDITION
UPON RECEIPT OF A SUPERVISORY SIGNAL.
1) SUPERVISORY LED FLASHES, REMAINS STEADY AFTER SILENCING.
2) SOUNDER WARBLE UNTIL SILENCED.
3) SUPERVISORY RELAY ACTIVATES SENDING SIGNAL TO BLDG FIRE ALARM PANEL.

TROUBLE CONDITION
UPON RECEIPT OF A TROUBLE SIGNAL.

1) YELLOW TROUBLE LED FLASHES, REMAINS STEADY AFTER SILENCING.
2) SOUNDER STEADY UNTIL SILENCED.
3) TROUBLE RELAY ACTIVATES SENDING SIGNAL TO BLDG FIRE ALARM PANEL.
4) DIAGNOSTIC LED DISPLAYS CODE/S.

ALL ALARM OR TROUBLE CONDITIONS

OPERATION OF SILENCE SWITCH.

1) YELLOW PANEL SILENCE LED FLASHES.
2) SOUNDER OFF.
3) SIGNAL CIRCUIT DEVICES OFF.
4) A SUBSEQUENT ALARM WILL TURN SIGNAL CIRCUIT DEVICES ON.

SYMBOLS AND ABBREVIATION LEGEND

SYMBOL	DESCRIPTION
PACP	PREACTION RELEASE PANEL
APS	ALARM PRESSURE SWITCH
LPS	LOW AIR PRESSURE SWITCH
SOL	PRE-ACTION SPRINKLER SOLENOID VAVLE
TS	TAMPER SWITCH
135°	135° HEAT DETECTOR

VFR-400 BATTERY CALCULATION FORM

NORMAL OPERATION BACK-UP HOURS REQUIRED: 24 HOURS

NORMAL OPERATION

MODULE	QTY	NORMAL CURRENT	TOTALS
VFR-400 PANEL	1	0.121 AMPS	0.121 AMPS
HEAT DETECTOR	2	0.000045 AMPS	0.000009 AMPS
		NORMAL TOTAL	0.121585 AMPS

NORMAL TOTAL 0.121109 X 24 HOURS = 2.9066 AH

ALARM OPERATION

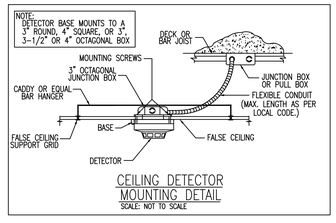
MODULE/DEVICE	QTY	ALARM CURRENT	TOTALS
SOLENOID VALVE	1	0.410 AMPS	0.410 AMPS
VFR-400 PANEL	1	0.274 AMPS	0.274 AMPS
HEAT DETECTOR	2	0.30 AMPS	0.600 AMPS
		ALARM TOTAL	1.284 AMPS

ALARM TOTAL 1.284 X 0.167 HOURS (10 MIN.) = 0.214 AH

NORMAL TOTAL: 2.9066 + ALARM TOTAL: 0.214 = 3.12 AH
3.12 AH X 1.2 (SAFETY FACTOR) = 3.744 AH
TOTAL POWER REQUIRED = 3.74 AH
BATTERY SIZE = 7.5 AH

WIRE TAG LIST

TAG	CIRCUIT DESCRIPTION	GENERAL WIRE DESCRIPTION
1	DETECTION CKTS	THHN 18AWG MIN.
2	BATTERY	THHN 12AWG
3	AUX. 24VDC AND RELEASE CKT	THHN 14AWG
4	PREWIRED CONNECTIONS	WIRING BY MANUFACTURER



CEILING DETECTOR
MOUNTING DETAIL
SCALE: NOT TO SCALE

PROGRAM #1 OUTPUT AND RELAY CIRCUITS ACTIVATED BY DETECTION CIRCUITS:
TYPICAL ALL SYSTEMS

PROGRAM 1 SINGLE HAZARD SINGLE ZONE	OUTPUT CIRCUITS				RELAY CIRCUITS			
INPUT CIRCUITS	# ALARM BELL	WATERFLOW BELL	RELEASE SOLENOID	SUPERVISORY BELL	ALARM RELAY	TROUBLE RELAY (CKT FAULT)	WATERFLOW RELAY	SUPERVISORY RELAY
SUPERVISORY ZONE 1 (LOW AIR)						●		●
SUPERVISORY ZONE 2 (VALVE TAMPER)						●		●
DETECTION ZONE 1 (HEAT DETECTORS)			●		●	●		
DETECTION ZONE 2 (NOT USED)			●		●	●		
DETECTION ZONE 3 (WATERFLOW)					●	●	●	
DETECTION ZONE 4 (NOT USED)						●		

NOTE: THE CONTROL PANEL MOTHERBOARD IS FACTORY PRE-WIRED AND PROGRAMMED FOR THE CONFIGURATION SLECTED AT THE TIME OF PURCHASE. ALL FIELD WIRING SHOULD BE TERMINATED AS SHOWN ON THE FIELD WIRING DIAGRAM.

PARENT JOB #461259

KEYPLAN

AS-BUILTS
07/05/2017

REV	DATE	REVISION DESCRIPTION
1	7/5/17	AS BUILT

REVISION HISTORY

FIRE PROTECTION DESIGN BASED ON THE CURRENTLY ADOPTED FOLLOWING NFPA STANDARD

☐ NFPA 12	■ NFPA 70
☐ NFPA 13	■ NFPA 72
☐ NFPA 17	☐ NFPA 2001

FIRE SPRINKLER CONTRACTOR — AHERN FIRE PROTECTION LIC.NO. MISSOURI 00396785

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AHERN Since 1880

J. F. AHERN CO.
FIRE PROTECTION CONTRACTORS
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
(314) 535-4544 p (314) 535-0144 f
www.jfahern.com

WEBSTER UNIV - INTER SCIENCE BUILDING
8274 BIG BEND BLVD.
WEBSTER GROVES, MO

PRE-ACTION DETECTION AND CONTROL DETAILS

IF DRAWING IS PLOTTED CORRECTLY THIS BAR SHOULD MEASURE 2"

DRAWN BY:	APA
PROJECT MNGR:	BJC
DATE:	1/16/17
CONTRACT NO:	391073

CONSTRUCTION DOCUMENTS

FX-1

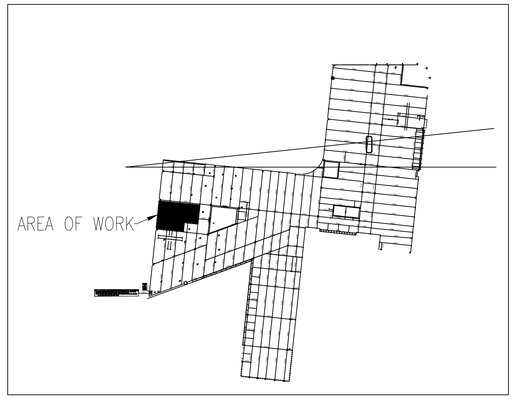
SYMBOLS AND ABBREVIATION LEGEND

SYMBOL	DESCRIPTION
PACP	PREACTION RELEASE PANEL
APS	ALARM PRESSURE SWITCH
LPS	LOW AIR PRESSURE SWITCH
SOL	PRE-ACTION SPRINKLER SOLENOID VAVLE
TS	TAMPER SWITCH
135°	135° HEAT DETECTOR



NOTE: 1. THE CONTROL PANEL MOTHERBOARD IS FACTORY PRE-WIRED AND PROGRAMMED FOR THE CONFIGURATION SELECTED AT THE TIME OF PURCHASE. ALL FIELD WIRING SHOULD BE TERMINATED AS SHOWN ON THE FIELD WIRING DIAGRAM. LOW AIR SWITCH, VALVE TAMPERS, SOLENOID, AND WATERFLOW SHOULD BE PREWIRED
2. ALL HEAT DETECTORS ARE FIELD WIRED.

FIRST FLOOR PLAN VIEW
SCALE: 1/4" = 1'-0"



KEYPLAN
SCALE: N.T.S.

PARENT JOB #461259

KEYPLAN

AS-BUILTS
07/05/2017

REV	DATE	REVISION DESCRIPTION
1	7/5/17	AS BUILT

REVISION HISTORY

FIRE PROTECTION DESIGN BASED ON THE CURRENTLY ADOPTED FOLLOWING NFPA STANDARD

- ☐ NFPA 12
- ☐ NFPA 13
- ☐ NFPA 17
- ■ NFPA 70
- ■ NFPA 72
- ☐ NFPA 2001

FIRE SPRINKLER CONTRACTOR
AHERN FIRE PROTECTION LIC.NO. MISSOURI 70039578

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www.jfahern.com

WEBSTER UNIV - INTER SCIENCE BUILDING
8274 BIG BEND BLVD.
WEBSTER GROVES, MO

1ST FLOOR PLAN VIEW LAYOUT

IF DRAWING IS PLOTTED CORRECTLY THIS BAR SHOULD MEASURE 2"

DRAWN BY:	APA
PROJECT MNGR:	BJC
DATE:	1/16/17
CONTRACT NO:	391073

CONSTRUCTION DOCUMENTS

FX-2

2675 Scott Ave., Suite C
St. Louis, MO 63103
main 314.535.4544 | fax 314.535.0144
www.ahernfire.com

Inspection Requirements

Job No.: 391073

Date: July 6, 2017

System Owner: Webster University ISB

Type of System: Preaction

NFPA Standards: 72

Manufacturer: Viking

State Code:

Type of Control Panel: VFR-400

System Component	Weekly	Monthly	Quarterly	Semi Annual	Annual	Other
Control Panel(s):						
Control Panel(s)					T	
Function					T	
Fuses					T	
Interfaced Equipment (Dialer)					T	
Lamps, LEDs					T	
Power Supplies					T	
Battery Charger					T	
2 Hour Battery Test					T	
Battery Load Voltage Test					T	
Battery Replacement						4 to 5 yrs.
Devices:						
Smoke Detectors				V	T	
Heat Detectors				V	T	
Pull Stations				V	T	
Abort Stations				V	T	
Horns and Strobes				V	T	
Alarm Switches				T		
Solenoids					T	
Supervisory Switches			T			
Tamper Switches				T		

Note: If system is not connected to a supervising station, control panel function tests are required quarterly.

T = Test V = Visual Inspection (by owner)

2675 Scott Ave., Suite C
St. Louis, MO 63103
main 314.535.4544 | fax 314.535.0144
www.ahernfire.com

Inspection Services

Ahern Fire Protection performs inspection services for all types of fire protection systems. Inspections are conducted in accordance with NFPA standards, including full testing of systems and devices to ensure that components are in prime working condition. We offer inspection services geared to provide automatic periodic inspections required by authorities having jurisdiction and insurance carriers. **Ahern Fire Protection** maintains your inspection schedule so you do not have to. Our full-range inspection packages are cost effective. We offer the following inspections and services:

- **Wet Fire Sprinkler System Inspection**
- **Dry Fire Sprinkler System Inspection**
- **Backflow Device Inspection and filing with the Proper Authorities**
- **Fire Pump Inspection**
- **Preaction Sprinkler System Inspection**
- **Deluge Fire Sprinkler System Inspection**
- **Anti-Freeze Loop Inspections**
- **Private Fire Hydrant Inspections**
- **Foam System Testing and Inspections**
- **MIC® (Microbiologically Influenced Corrosion) Testing and Inspections**

Regulations for inspections of fire safety systems are determined by the National Fire Protection Association. Cities and states use these regulations as a guideline, and then make appropriate amendments according to their needs.

Required Inspections

How often should your fire sprinkler suppression system be tested? The National Fire Protection Association publishes NFPA 25 Inspection, Testing and Maintenance of Water-Based Fire Protection Systems; this document will provide recommendations on proper testing of your system. You may call **Ahern Fire Protection**, check with NFPA 25 or the manufactures' literature for details.

At least once each year, a full sprinkler system inspection should be performed by a knowledgeable professional. **Ahern Fire Protection** offers economical long-term service agreements. We will provide you with inspection reports and test certificates which will comply with your insurance company and local fire department inspection requirements.

You can contact our Service Department for the proper requirements in your area.

Ahern Fire Protection
2675 Scott Ave. Suite C
St. Louis, MO 63103
T-314/535-4544
After hours: 877/237-1785

Water Based Fire Protection Systems
Code Requirements for Visual Inspection

Weekly

- Cold Weather Enclosures (daily/weekly)
- Fire Pumps
  - Pump House heating & ventilation
  - Pump system visual observation
  - Casing Relief Valves
  - Pressure Relief Valves
- Valves, Valve Components, & Trim
  - Sealed control valves
- Gauges (dry, preaction, deluge systems & standpipe)

Monthly

- Valves, Valve Components, & Trim
  - Locked/Supervised control valves
  - Alarm Valves/System Riser Check Valves
    - Exterior
  - Preaction & Deluge Valves
    - Exterior
  - Dry Pipe Valve/Quick-Opening Device
    - Exterior
- Backflow Prevention Assemblies
  - Reduced Pressure
  - Reduced Pressure Detector
- Gauges (wet system)
- Waterflow alarm devices
- Supervisory alarm devices

Quarterly

- Valves, Valve Components, & Trim
  - Pressure Reducing & Relief Valves
    - System Valves
- Fire Department Connections
- Private Fire Service
  - Hose Houses
- Hydraulic Nameplate
- Standpipe & Hose Systems
  - Hose Valves

Semi-Annually

- Private Fire Service
  - Monitor Nozzles

Annually

- Valves, Valve Components, & Trim
  - Preaction & Deluge Valves
    - Interior (internal reset valves)
  - Dry Pipe Valve/Quick-Opening Device
    - Interior
  - Pressure Reducing & Relief Valves
    - Hose Connection & Rack Assembly
- Building Temperatures (min 40 degrees areas of water filled pipe)
- Pipe & Fittings (from floor level)
- Hangers & Seismic Bracing (from floor level)
- Sprinklers (from floor level)
- Spare Sprinklers
- Information Sign
- Standpipe & Hose Systems
  - Cabinet
  - Hose
  - Hose Storage Device
  - Hose Nozzle
  - Hydraulic design information sign
- Private Fire Service
  - Hydrants
  - Mainline Strainers

5-Year

- Valves, Valve Components, & Trim
  - Alarm Valves
    - Interior
    - Strainers
    - Filters
    - Orifices
  - Preaction & Deluge Valves
    - Interior (external reset valves)
    - Strainers
    - Filters
    - Orifices
  - Dry Pipe Valve/Quick-Opening Device
    - Strainers
    - Filters
    - Orifices
  - Check Valves
    - Interior
- Pipe (interior)

Water Based Fire Protection Systems
Code Requirements for Functional Testing & Maintenance

Weekly

Fire Pumps
- No-Flow churn test (diesel)

Monthly

Fire Pumps
- No-Flow churn test (electric)

Quarterly

Waterflow alarm devices (mechanical)
Main Drain
Valves, Valve Components, & Trim
- Preaction & Deluge Valves
  - Priming Water
  - Low Air Pressure Alarm
- Dry Pipe Valve
  - Priming Water
  - Low Air Pressure Alarm
  - Quick- Opening Device
- Pressure Reducing & Relief Valves
  - Master Pressure Reducing Valve (partial flow)

Semi-Annually

Waterflow alarm devices (vane & pressure)
Valves, Valve Components, & Trim
- Control Valves
  - Supervisory alarm devices

Annually

Air Pressure Maintenance Device
Valves, Valve Components, & Trim
- Control Valves
  - Position & Operation
  - Maintenance
- Preaction & Deluge Valves
  - Full Flow
- Dry Pipe Valve
  - Trip Test (short trip)
- Pressure Reducing & Relief Valves
  - Master Pressure Reducing Valve (full flow)
  - Circulation Relief
  - Pressure Relief Valve

Annually

Backflow Prevention Assemblies
- Full Forward Flow Test
- Backflow Test (check local AHJ)

Antifreeze Solution

Standpipe & Hose Systems
- Hose Storage Device
- Hose Valve (operation & position)

Private Fire Service
- Monitor Nozzles (flow)
- Hydrants (flow & maintenance)

Sprinklers protecting cooking and ventilation systems (inspect/replace)

Fire Pumps
- Full Flow Condition Test
- Alarm Signals
- Annual Maintenance

3-Year

Valves, Valve Components, & Trim
- Dry Pipe Valve
  - Full Flow Trip Test
  - Air Leakage Test

Standpipe & Hose Systems
- Hose

5-Year

Valves, Valve Components, & Trim
- Pressure Reducing & Relief Valves
  - System Valves (full flow)
  - Hose Connection & Rack Assembly (full flow)

Gauges

Sprinklers-Extra High Temperature

Standpipe & Hose Systems
- Hose
- Hydrostatic Test
- Flow Test

Private Fire Service
- Piping Underground & Exposed (flow test)

10-Year & Greater

Sprinklers- Dry (10 years and every 10 years thereafter)

Sprinklers- Fast Response (20 years and every 10 years thereafter)

Sprinklers- Standard Response (50 years and every 10 years thereafter)

Sprinklers- Standard Response (75 years and every 5 years thereafter)

Other Required Maintenance &Testing

Low Point Drains

Air Compressors

Water Storage Tanks, Water Spray Systems & Foam Systems (not included in list)

Inspection and Testing Requirements for Fire Sprinkler Systems

	Sprinkler Systems	Monthly	Quarterly	Semi-annual	Annual	Other	Code	NFPA 25-2011 Edition
	Inspection							
	Gauges - Dry, PreAction & Deluge						5.2.4.2	Gauges on dry, preaction, and deluge systems shall be inspected weekly to ensure that normal air and water pressures are being maintained.
	Gauges - Wet Pipe Systems						5.2.4.1	Gauges on wet pipe sprinkler systems shall be inspected monthly to ensure that they are in good condition and that normal water supply pressure is being maintained.
	Control Valves							(See "Valves" below)
	Alarm Devices						5.2.5	Alarm devices shall be inspected quarterly to verify that they are free of physical damage.
	Hydraulic Nameplate						5.2.6	The hydraulic nameplate, if provided, shall be inspected quarterly to verify that it is attached securely to the sprinkler riser and is legible.
	Buildings						5.1.1	Annually, prior to the onset of freezing weather, buildings with wet pipe systems shall be inspected to verify that windows, skylights, doors, ventilators, other openings and closures, blind spaces, unused attics, stair towers, roof houses, and low spaces
	Hangers/Bracing						5.2.3	Sprinkler pipe hangers and seismic braces shall be inspected annually from the floor level.
	Pipe & Fittings						5.2.2	Sprinkler pipe and fittings shall be inspected annually from the floor level.
	Sprinkler Heads						5.2.1.1	Sprinklers shall be inspected from the floor level annually.
	Spare Sprinkler Heads						5.2.1.4	The supply of spare sprinklers shall be inspected annually…
	Valves (All Types)							(See "Valves" below)
	Testing							
	Alarm Devices						5.3.3	Waterflow alarm devices including, but not limited to, mechanical water motor gongs, vane-type waterflow devices, and pressure switches that provide audible or visual signals shall be tested quarterly.
	Main Drain							(See "Valves" below)
	Antifreeze Solution						5.3.4	The freezing point of solutions in antifreeze shall be tested annually by measuring the specific gravity with a hydrometer or refractometer and adjusting the solutions if necessary.
	Gauges						5.3.2	Gauges shall be replaced every 5 years or tested every 5 years by comparison with a calibrated gauge. Gauges not accurate to within 3 percent of the full scale shall be recalibrated or replaced.
	Sprinkler Heads						5.3.1.1.1	Where sprinklers have been in service for 50 years, they shall be replaced or representative samples from one or more sample areas shall be submitted to a recognized testing laboratory acceptable to the authority having jurisdiction for field service test
	Sprinkler Heads - Extra High Temp						5.3.1.1.1.4	Exception No. 3*: Representative samples of solder-type sprinklers with a temperature classification of extra high [325°F (163°C)] or greater that are exposed to semicontinuous to continuous maximum allowable ambient temperature conditions shall be tested
	Sprinkler Heads - Fast Response						5.3.1.1.1.3	Exception No. 2: Sprinklers manufactured using fast response elements that have been in service for 20 years shall be tested. They shall be retested at 10-year intervals.
	Maintenance							
	Valves (All Types)							(See "Valves" below)

	Obstruction Investigation						14.2.1	Systems shall be examined internally for obstructions where conditions exist that could cause obstructed piping. If the condition has not been corrected or the condition is one that could result in obstruction of piping despite any previous flushing procedures.
	Valves	Monthly	Quarterly	Semi-annual	Annual	Other		
	Inspection							
	Control Valves						13.3.2.1	All valves shall be inspected weekly.
	Alarm Valves						13.4.1.1	Alarm valves shall be externally inspected monthly.
	Check Valves						13.4.2.1	Valves shall be inspected internally every 5 years to verify that all components operate properly, move freely, and are in good condition.
	Preaction/Deluge Valves						13.4.3.1.7	The interior of the preaction or deluge valve and the condition of detection devices shall be inspected annually when the trip test is conducted.
	Dry Pipe Valves/Quick						13.4.4.1.5	The interior of the dry pipe valve shall be inspected annually when the trip test is conducted.
	Backflow Prevention Assemblies						13.6.2	All backflow preventers installed in fire protection system piping shall be tested annually…
	Testing							
	Main Drain						13.2.5	A main drain test shall be conducted quarterly at each water-based fire protection system riser to determine whether there has been a change in the condition of the water supply piping and control valves.
	Waterflow Alarm						13.2.6	All waterflow alarms shall be tested quarterly in accordance with the manufacturer's instructions.
	Control Valves						13.3.1	Each control valve shall be operated annually through its full range and returned to its normal position.
	Preaction/Deluge Valves						13.4.3	Each deluge or preaction valve shall be trip tested annually at full flow in warm weather and in accordance with the manufacturer's instructions.
	Dry Pipe Valves/Quick						13.4.4	Each dry pipe valve shall be trip tested annually during warm weather.
	Backflow Prevention Assemblies						13.6.2	All backflow preventers installed in fire protection system piping shall be tested annually…
	Maintenance							
	Control Valves						13.3.4.1	The operating stems of outside screw and yoke valves shall be lubricated annually.
	Preaction/Deluge Valves						13.4.3.3.2	During the annual trip test, the interior of the preaction or deluge valve shall be cleaned thoroughly and the parts replaced or repaired as necessary.
	Dry Pipe Valves/Quick Opening Devices						13.4.4.3.1	During the annual trip test, the interior of the dry pipe valve shall be cleaned thoroughly and parts replaced or repaired as necessary.



Before It's Too Late.

Fire Sprinkler Facts

- Approximately 4,000 people die in buildings without fire sprinkler systems every year. In buildings equipped with sprinkler systems, the number drops to about 20.*
- Of those 20 deaths, 18% are due to the fact that the fire originated in an area of the building with no fire sprinklers.*
- Fire sprinkler systems must be installed, inspected, and serviced properly to ensure peak operation.
- Ahern Fire Protection offers complete fire protection solutions for your facility.

Don't Wait Until It's Too Late!

Wisconsin
Appleton Area
Tel: 920-954-8242

Eau Claire Area
Tel: 715-233-1841

Fond du Lac Area
Tel: 920-921-9020

Madison Area
Tel: 608-216-0283

Milwaukee Area
Tel: 262-252-5921

Illinois
Chicago Area
Tel: 630-775-0670

Rockford Area
Tel: 815-633-9372

Indiana
Fort Wayne Area
Tel: 877-815-1551

Iowa
Quad Cities Area
Tel: 563-388-0060

Michigan
Grand Rapids Area
Tel: 616-647-0054

Minnesota
Twin Cities Area
Tel: 763-268-0515

Missouri
St. Louis Area
Tel: 314-535-4544

Nebraska
Omaha Area
Tel: 402-894-1045



AHERN SINCE 1880
FIRE PROTECTION

*Source: National Fire Sprinkler Association

Our Customers

Ahern has the resources to tackle projects of all sizes, from $100 to over $50 million. No matter which Ahern trade you hire, our qualified experts give you the personalized service that has made us an industry leader for over 125 years.

We work in a variety of business sectors including:
Commercial | Industrial | Institutional | Municipal

We execute projects in both the private and public sectors, and are equally comfortable in the role of a prime contractor or subcontractor.

The majority of J. F. Ahern Co.'s contracting projects are concentrated in the upper Midwest. However, the Company has worked throughout the United States and will continue to do so for selected projects. In addition to general contractors and construction managers, the Company regularly performs work for commercial and industrial business owners and developers.

Some of our clients include:

- General Motors
- Agnesian Health Care
- John Deere
- Aurora Health Care
- Alliant Energy
- Charter Steel
- Target stores
- State of Wisconsin
- Quad/Graphics
- Mercury Marine
- ACE Ethanol
- Harley-Davidson
- Milwaukee Metropolitan Sewerage District (MMSD)

Our Experience

Beginning as a storefront steam heat and plumbing shop in 1880, J. F. Ahern Co. has since become one of the largest, most respected mechanical contractors in the nation. Over 125 years of commitment to excellence and continued growth set us apart from the competition.

We consistently rank among the largest mechanical contractors in the country, according to surveys compiled by *Engineering News Record* and *Contractor* magazine. J. F. Ahern Co. posted sales of $212 million for fiscal year 2008.

Safety

J. F. Ahern Co.'s excellent safety record has earned us numerous safety awards, including:

- Wisconsin Corporate Safety Award – Three time winner of this honor.
- Fond du Lac Area Safety Council — Achieved best safety record among specialty trade contractors; Safety Honor Roll since 1985.
- Milwaukee Construction Industry Safety Council — "Best of the Best" award for an accident rate less than one-half the industry average.
- Associated General Contractors (AGC) — 12 consecutive years of achieving one of the best safety records in the state for specialty contractors; five consecutive years of maintaining a loss ratio 50% below national average.





Our Mission

In striving for excellence, J. F. Ahern Co. must be a reliable, cost-effective and performance-oriented member of the construction team.

By working with and not just for our customers, and by utilizing our experienced management team of recognized industry leaders, J. F. Ahern Co. provides constructive solutions to our customers' mechanical and fire protection needs.

This commitment to excellence — a vision shared by all employees of the Company — assures the success of our customers' projects and continued success of the J. F. Ahern Co.

www.jfahern.com





OPERATIONS & MAINTENANCE MANUAL

Webster University

PROJECT

Deluca Plumbing

CONTRACTOR

June 20, 2017

DATE

3820 DR. MARTIN LUTHER KING DRIVE

ST. LOUIS, MO 6313

314-533-1500 (P) 314-533-1588 (F)

TABLE OF CONTENTS

VENDOR	VENDOR PART	DESCRIPTION
HEATER		
LOCHINVAR CORPORATION	SNA401125	SNA401125 WATER HEATER

SECTION NAME:

HEATER

ITEMS CONTAINED IN SECTION:

- SNA401125 WATER HEATER

Lochinvar®
HIGH EFFICIENCY BOILERS & WATER HEATERS

SHIELD™ WATER HEATER Submittal Sheet

SWH-Sub-04

SHIELD COMMERCIAL GAS WATER HEATER

JOB NAME _____
LOCATION _____
ENGR. _____
WHOLESALER _____
MECH. CONTRACTOR _____
MODEL NO. _____
TYPE GAS _____
Btu/hr INPUT _____
RECOVERY RATE IN GPH _____ **@** _____ **°F RISE**
NOTES

Standard Features

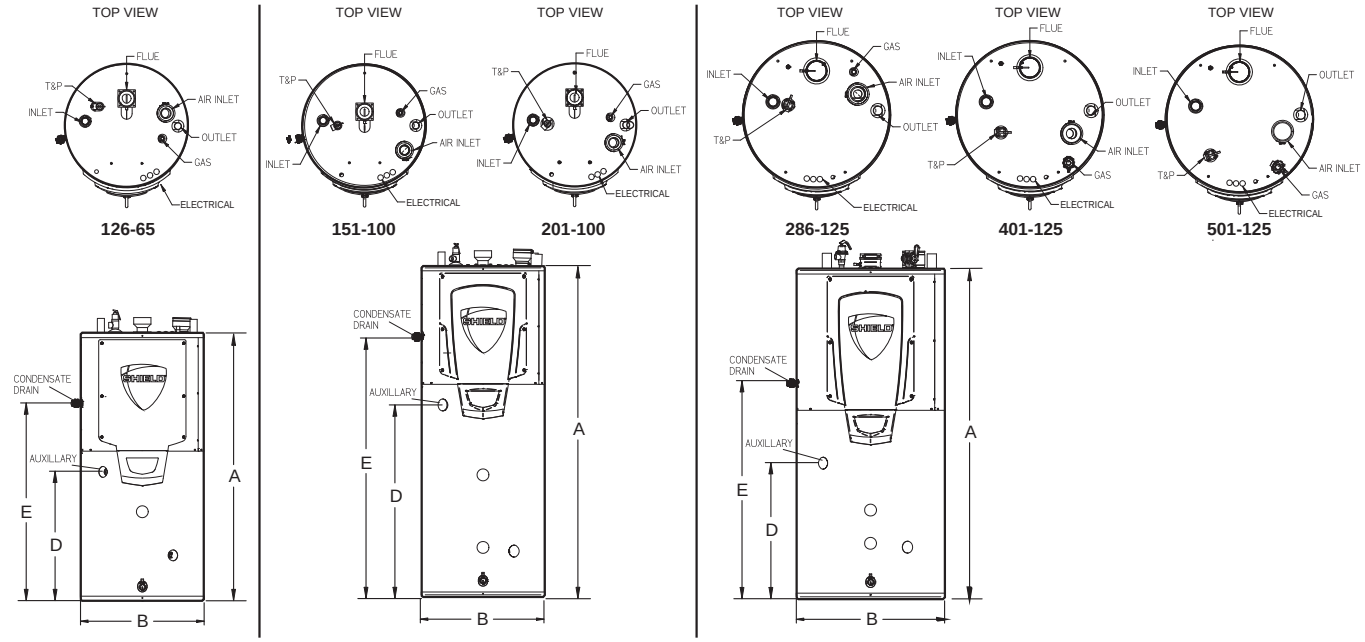
- 96% Thermal Efficiency
- Modulating Burner with 5:1 Turndown
- Operates at Temperatures up to 180˚F for Sanitizing Applications
- Stainless Steel Heat Exchanger
- Glass-Lined Steel Tank
- Magnesium Anode Rods
- 150 PSI Working Pressure
- ASME Construction (SNA151–501)
- ASME Temperature and Pressure Relief Valve
- Zero Clearances to Combustible Material
- PVC, CPVC, Polypropylene and Stainless Steel Venting up to 100 Equivalent Feet
- Direct-Vent Sealed Combustion
- Rooftop and Sidewall Venting
- Sidewall Vent Termination
- Advanced SMART Control, with:
  - LCD Display
  - Time Clock
  - Night Setback
  - Alarm Contacts
  - Runtime Contacts
  - Manual Reset High Limit
  - 3 Water Temperature Sensors
  - Flue Temperature Sensor
  - Contacts for Louvers
  - Adjustable Pump Delay
  - Security Protection
- Low-NOx Operation
- Low Gas Pressure Operation
- Direct-Spark Ignition
- Certified for Installation on Combustible Floors
- Full Port Brass Drain Valve
- 8-Foot Power Cord
- 3-Year Limited Warranty
- 1-Year Parts Warranty

Optional Equipment

Place an X in the box by all options that apply

☐ CON·X·US® Remote Connectivity
☐ Alarm Bell
☐ Concentric Vent Kit
☐ Condensate Neutralization Kit
☐ Low Water Cutoff
☐ Tank Side Tappings for Alternate Heat Source

SHIELD Commercial Gas Water Heater Dimensions & Specifications



Model Number	Btu/hr Input	Capacity (Gal)	GPH @ 100° Rise	First Hour	A	B	D	E	Gas Conn.	Water Conn.	Air Inlet	Vent Size	Shipping Wt. (lbs.)
☐SNR126-065	125,000	65	145	197	60-1/4"	28"	29-1/2"	45-1/4"	1/2"	1-1/2"	3"	3"	508
☐SNR151-100	150,000	90	175	247	75-1/2"	28"	44"	59-1/2"	1/2"	1-1/2"	3"	3"	588
☐SNR201-100	199,999	90	233	305	75-1/2"	28"	44"	59-1/2"	1/2"	1-1/2"	3"	3"	601
☐SNA151-100*	150,000	90	175	247	75-1/2"	28"	44"	59-1/2"	1/2"	1-1/2"	3"	3"	645
☐SNA201-100*	199,999	90	233	305	75-1/2"	28"	44"	59-1/2"	1/2"	1-1/2"	3"	3"	657
☐SNA286-125*	285,000	120	332	428	75-1/2"	34"	31"	49"	3/4"	2"	4"	4"	831
☐SNA401-125*	399,999	120	465	561	75-1/2"	34"	31"	49"	1"	2"	4"	4"	889
☐SNA501-125*	500,000	120	582	678	75-1/2"	34"	31"	49"	1"	2"	4"	4"	909

Change N to L for LP gas. *Field convertible to LP Gas* *Electrical Requirements: 120 VAC/60Hz/Phase* **A = ASME Construction* *All Information is subject to change.*

Lochinvar®
HIGH EFFICIENCY BOILERS & WATER HEATERS

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Lebanon, Tennessee 37090
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Lochinvar.com

LOW LEAD CONTENT
HLW

3/17—Printed in U.S.A.

SHIELD™
COMMERCIAL WATER HEATERS

Installation & Service Manual

Models: SNR126-065, SNR151-100, SNR201-100, SNA151-100, SNA201-100, SNA286-125, SNA401-125, AND SNA501-125

WARNING: If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death.

-- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

-- WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Immediately call your gas supplier from a near by phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

-- Installation and service must be performed by a qualified installer, service agency, or the gas supplier.



IMG00460

DESIGN CERTIFIED®

CERTIFIED®

⚠ WARNING This manual must only be used by a qualified heating installer / service technician. Read all instructions in this manual before installing. Perform steps in the order given. Failure to comply could result in severe personal injury, death, or substantial property damage.

Save this manual for future reference.

Lochinvar®
HIGH EFFICIENCY BOILERS & WATER HEATERS

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Please read before proceeding

Hazard definitions

The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels or to important information concerning the life of the product.

⚠ DANGER DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE NOTICE indicates special instructions on installation, operation, or maintenance that are important but not related to personal injury or property damage.

⚠ WARNING **Installer –** Read all instructions, in this manual before installing. Perform steps in the order given.

Have this water heater serviced/inspected by a qualified service technician, at least annually.

Failure to comply with the above could result in severe personal injury, death or substantial property damage.

NOTICE When calling or writing about the water heater – Please have the water heater model and serial number from the water heater rating plate.

Consider piping and installation when determining water heater location.

Any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.

Factory warranty (shipped with unit) does not apply to units improperly installed or improperly operated.

⚠ WARNING Failure to adhere to the guidelines on this page can result in severe personal injury, death, or substantial property damage.

⚠ WARNING DO NOT install units in rooms or environments that contain corrosive contaminants (see Table 1A on page 10). Failure to comply could result in severe personal injury, death, or substantial property damage.

When servicing the water heater –

- To avoid electric shock, disconnect electrical supply before performing maintenance.
- To avoid severe burns, allow the water heater to cool before performing maintenance.

⚠ WARNING If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death

-- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

-- WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Immediately call your gas supplier from a near by phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

-- Installation and service must be performed by a qualified installer, service agency, or the gas supplier.

Water heater operation –

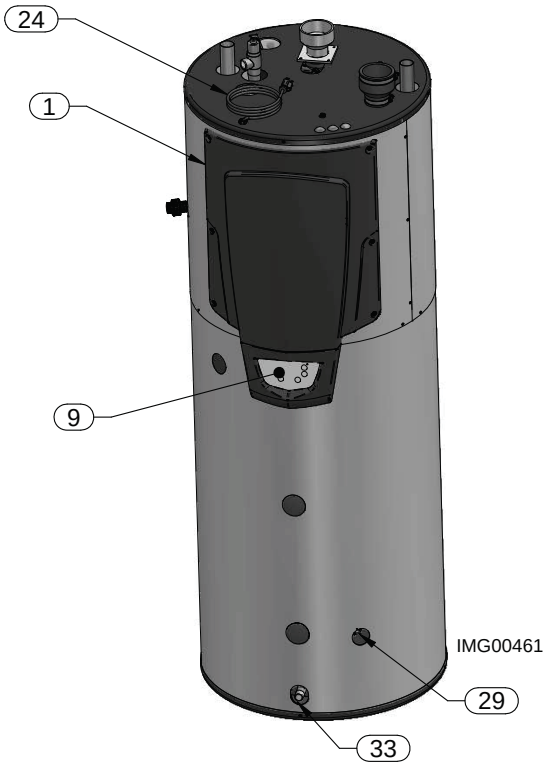
- Do not block flow of combustion or ventilation air to the water heater.
- Should overheating occur or gas supply fail to shut off, do not turn off or disconnect electrical supply to circulator. Instead, shut off the gas supply at a location external to the appliance.
- Do not use this water heater if any part has been under water. The possible damage to a flooded appliance can be extensive and present numerous safety hazards. Any appliance that has been under water must be replaced.

The Shield - How it works...

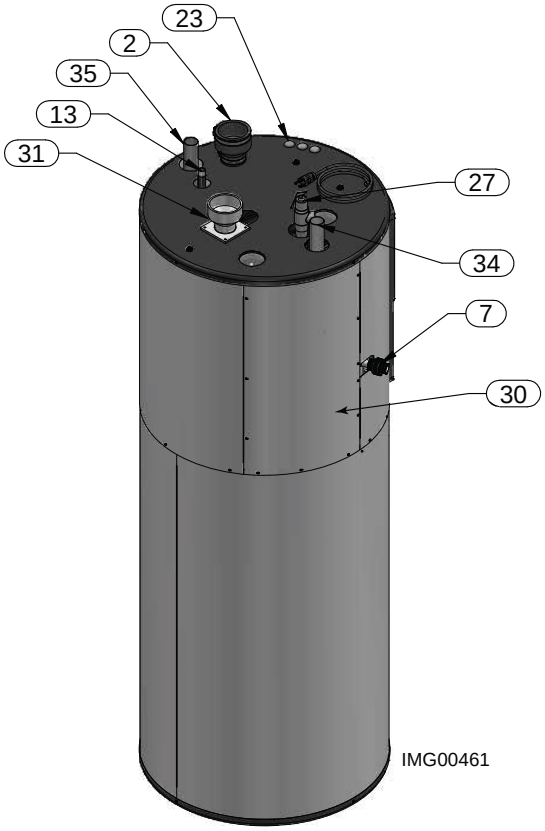
1. **Access cover - front**
   Provides access to the gas train, heat exchanger and controls.
2. **Air intake adapter**
   Allows for the connection of the PVC air intake pipe to the water heater.
3. **Air pressure switch**
   The air pressure switch detects blocked inlet conditions.
4. **Air shroud (501-125 Model Only_Not Shown)**
   The air shroud directs air and gas flow into the blower.
5. **Blower**
   The blower pulls in air and gas through the venturi (item 32). Air and gas mix inside the blower and are pushed into the burner, where they burn inside the combustion chamber.
6. **Burner (not shown)**
   Made with metal fiber and stainless steel construction, the burner uses pre-mixed air and gas and provides a 5 to 1 firing rate.
7. **Condensate drain connection**
   Connects the condensate drain line to 1/2" PVC.
8. **Electronic Control Module**
   The electronic control responds to internal and external signals and controls the blower, gas valve, and pump to meet the demand.
9. **Electronic display**
   The electronic display consists of 4 buttons, and a liquid crystal display. The display is used to make adjustments and read water heater status.
10. **Flame inspection window (not shown)**
    The quartz glass window provides a view of the burner surface and flame.
11. **Flame sensor**
    Used by the control module to detect the presence of burner flame.
12. **Flue gas sensor (not shown)**
    This sensor monitors the flue gas exit temperature. The control module will modulate and shut down the water heater if the flue gas temperature gets too hot. This protects the flue pipe from overheating.
13. **Gas connection pipe**
    Threaded pipe connection, either 1/2", 3/4", or 1", depending on the model. This pipe should be connected to the incoming gas supply for the purpose of delivering gas to the water heater.
14. **Gas shutoff switch (151-100 - - 286-125 Models Only)**
    An electrical switch designed to cut power from the gas valve to prevent gas flow to the burner.
15. **Gas shutoff valve (401-125 -- 501-125 Models Only)**
    Manual valve used to isolate the gas valve from the gas supply.
16. **Gas valve**
    The gas valve senses the negative pressure created by the blower, allowing gas to flow only if the gas valve is powered and combustion air is flowing.
17. **Heat exchanger access cover**
    Allows access to the combustion side of the heat exchanger coils.
18. **Heat exchanger inlet temperature sensor**
    This sensor monitors the inlet water temperature to the heat exchanger.
19. **Heat exchanger outlet temperature sensor**
    This sensor monitors heat exchanger outlet water temperature.
20. **Ignition electrode**
    Provides direct spark for igniting the burner.
21. **Line voltage junction box**
    The junction box contains the connection points for the line voltage power.
22. **Low voltage connection board**
    The connection board is used to connect external low voltage devices.
23. **Low voltage wiring connections (knockouts)**
    Conduit entryway for the low voltage connection board.
24. **Power cord**
    The power cord allows for quick connection to 120V supply.
25. **Pump**
    Circulates water between the tank and the heat exchanger.
26. **Pump relay**
    Switches power to the pump.
27. **Relief valve**
    Protects the heat exchanger from over pressure and temperature conditions. The relief valve is set at 150 PSI.
28. **Stainless steel heat exchanger**
    Allows water to flow through specially designed coils for maximum heat transfer, while providing protection against flue gas corrosion. The coils are encased in a jacket that contains the combustion process.
29. **Tank sensor**
    Used by the control to monitor the temperature of the tank.
30. **Pump access panel**
    Panel used to gain access to the pump and condensate trap; also used to gain access to the outlet water sensor on Models 286-125 -- 501-125 only.
31. **Vent pipe connection**
    Allows for the connection of the vent pipe system to the water heater.
32. **Venturi**
    The venturi controls air and gas flow into the burner.
33. **Water heater drain valve**
    Location from which the water heater can be drained.
34. **Water inlet**
    Copper sweat connection for cold water supply that returns water from the system to the heat exchanger, either 1-1/2" or 2", depending on the model.
35. **Water outlet**
    Copper sweat connection that supplies hot water to the system, either 1-1/2" or 2", depending on the model.
36. **Over-temp switch (286-125 --501-125 Models Only)**
    An electrical switch designed to shut down water heater operation in the event the outer back of the heat exchanger, directly above the flue connection exceeds 604°F (318°C). This is a one time switch and could warrant a heat exchanger replacement. Check the integrity of the rear refractory at the back of the upper coil if the switch opens.
37. **Burner door temperature switch (Models 286-125 - 501-125 Only)**
    An electrical switch designed to shut down water heater operation in the event the combustion chamber access cover exceeds 500°F (260°C). This switch may only be reset by a qualified service technician AFTER the underlying cause has been identified and corrected. Check the integrity of the front refractory on the inside of the combustion chamber access cover if the switch opens.

The Shield - How it works... *(continued)*

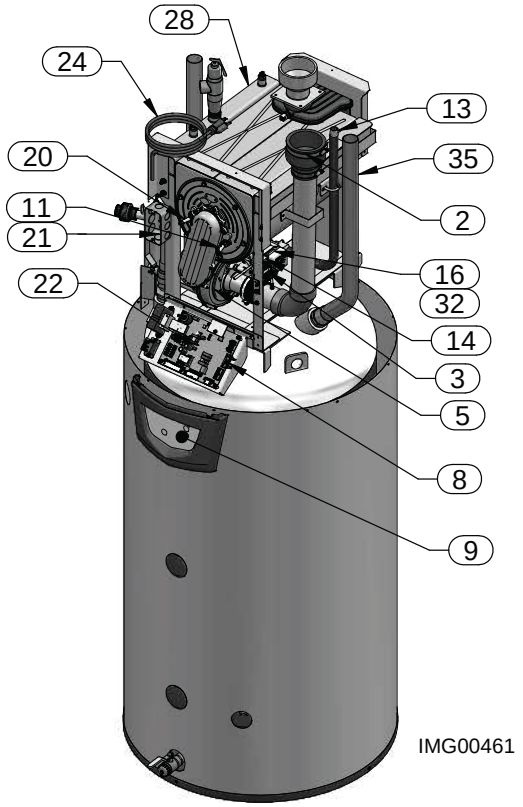
Models 126-065 – 201-100



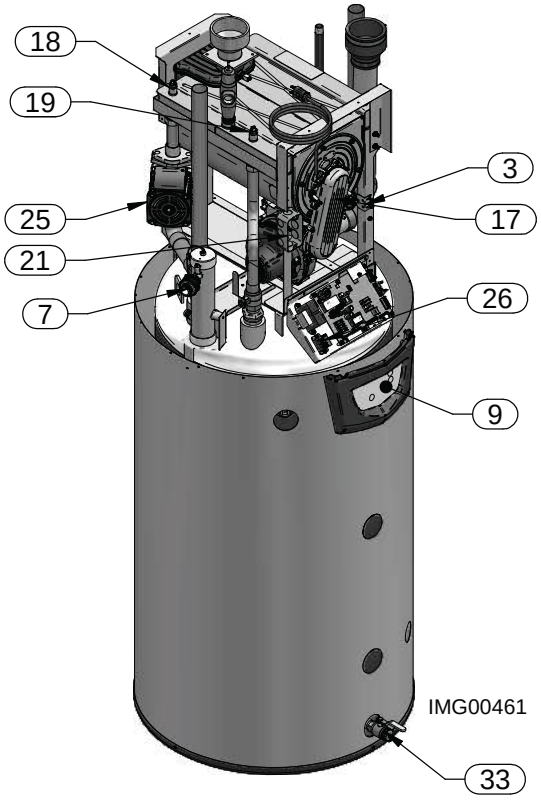
Front View - Models 126-065 -- 201-100



Rear View - Models 126-065 -- 201-100



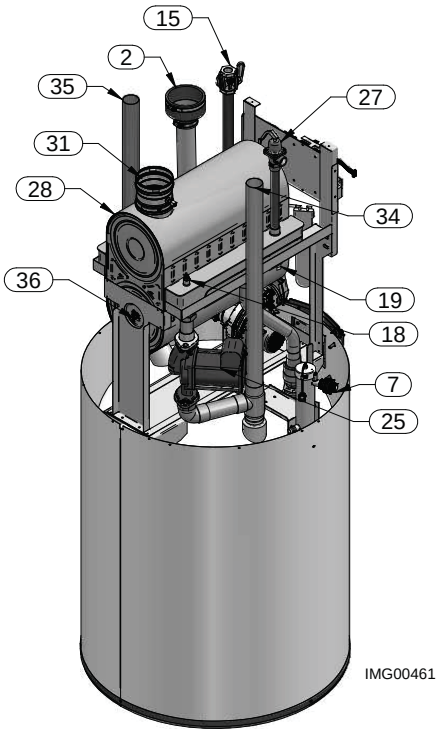
Left Side (inside unit) -- Models 126-065 -- 201-100



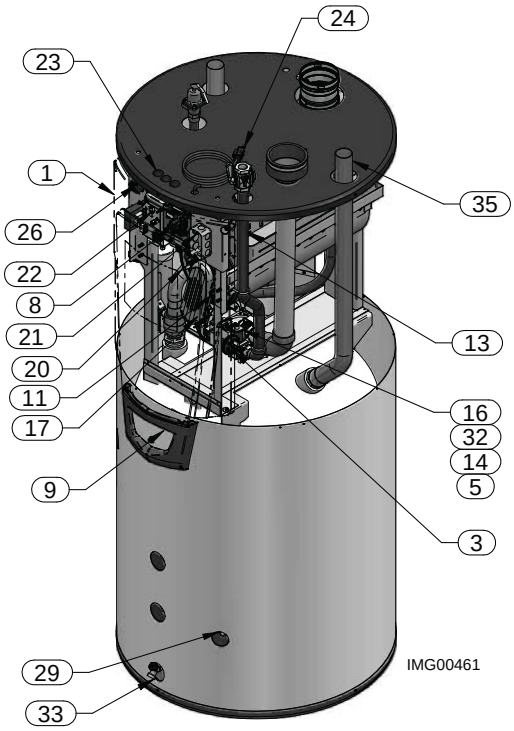
Right Side (inside unit) -- Models 126-065 -- 201-100

The Shield - How it works...

Models 286-125 -- 401-125

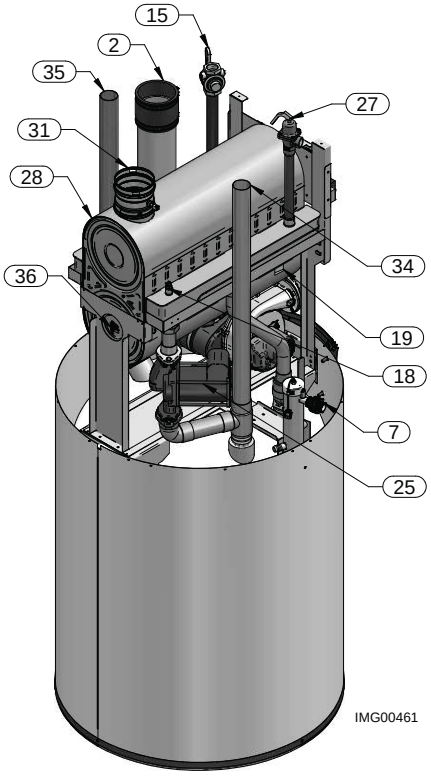


Rear View - Models 286-125 -- 401-125

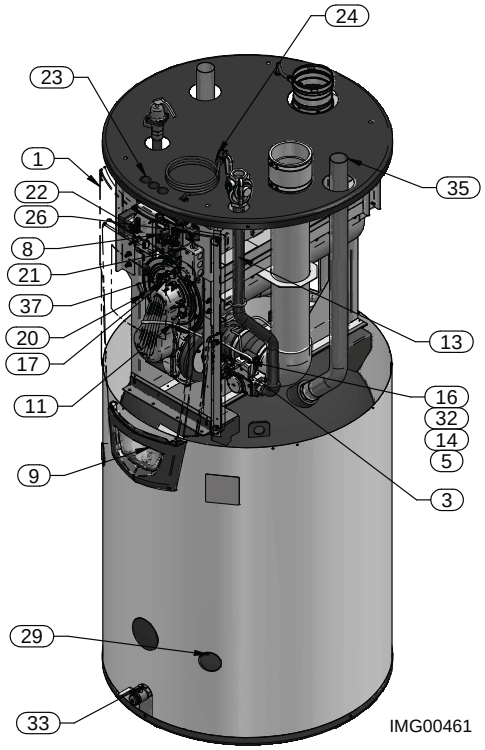


Right Side (inside unit) - Models 286-125 -- 401-125

Model 501-125



Rear View - Model 501-125



Right Side (inside unit) - Model 501-125

Ratings

HLW

LOW LEAD CONTENT

Model Number Note: Change "N" to "L" for L.P. gas models.	CSA Input Modulation Btu/hr (Note 2)		Water Content Gallons	Water Connections	Gas Connections	Vent/Air Size (Note 1,4)
	Min	Max				
SNR126-065	25,000 - 125,000		68	1-1/2"	1/2"	3"
SNR151-100	30,000 - 150,000		91	1-1/2"	1/2"	3"
SNA151-100	30,000 - 150,000		91	1-1/2"	1/2"	3"
SNR201-100	40,000 - 200,000		91	1-1/2"	1/2"	3"
SNA201-100	40,000 - 200,000		91	1-1/2"	1/2"	3"
SNA286-125	57,000 - 285,000		116	2"	3/4"	4"
SNA401-125	80,000 - 400,000		117	2"	1"	4"
SNA501-125	100,000 - 500,000		117	2"	1"	4"

NOTICE Maximum allowed working pressure is located on the rating plate.

Notes:

1. Shield water heaters require special gas venting. Use only the vent materials and methods specified in the Shield Installation and Service Manual.
2. Standard Shield water heaters are equipped to operate from sea level to 4,500 feet **only** with no adjustments. The water heater will de-rate by 4% for each 1,000 feet above sea level up to 4,500 feet.
3. High altitude Shield water heaters are equipped to operate from 3,000 to 12,000 feet **only**. The water heater will de-rate by 2% for each 1,000 feet above sea level. High altitude models are manufactured with a different control module for altitude operation, but the operation given in this manual remains the same as the standard models. A high altitude label (as shown in FIG. A) is also affixed to the unit.

   Derate values are based on proper combustion calibration and CO_2's adjusted to the recommended levels.
4. The Shield 286-125 model can be alternatively vented using a 3" vent/air size. If the 3" vent/air size is used, the maximum vent/air pipe lengths are limited to 60 equivalent feet each.



Figure A *High Altitude Label Location*

1 Determine water heater location

Installation must comply with:

- Local, state, provincial, and national codes, laws, regulations, and ordinances.
- National Fuel Gas Code, ANSI Z223.1 – latest edition.
- National Electrical Code.
- For Canada only: B149.1 Installation Code, CSA C22.1 Canadian Electrical Code Part 1 and any local codes.

NOTICE The Shield water heater gas manifold and controls met safe lighting and other performance under tests specified in ANSI Z21.10.3 – latest edition.

Before locating the water heater, check:

1. Check for nearby connection to:
   - Water piping
   - Venting connections
   - Gas supply piping
   - Electrical power
2. Locate the appliance so that if water connections should leak, water damage will not occur. When such locations cannot be avoided, it is recommended that a suitable drain pan, adequately drained, be installed under the appliance. Under no circumstances is the manufacturer to be held responsible for water damage in connection with this appliance, or any of its components.
3. Check area around the water heater. Remove any combustible materials, gasoline and other flammable liquids.

⚠ WARNING Failure to keep water heater area clear and free of combustible materials, gasoline, and other flammable liquids and vapors can result in severe personal injury, death, or substantial property damage.

4. The Shield water heater must be installed so that gas control system components are protected from dripping or spraying water or rain during operation or service.

⚠ WARNING This appliance is certified as an indoor appliance. Do not install the appliance outdoors or locate where the appliance will be exposed to freezing temperatures or to temperatures that exceed 100°F.

Do not install the appliance where the relative humidity may exceed 93%. Do not install the appliance where condensation may form on the inside or outside of the appliance, or where condensation may fall onto the appliance.

Failure to install the appliance indoors could result in severe personal injury, death, or substantial property damage.

⚠ WARNING This appliance requires a special venting system. The vent connection to the appliance must be made with the CPVC pipe section provided with the appliance. The field provided vent fittings must be cemented to the CPVC pipe section. Use only the vent materials, primer and cement specified in this manual to make the vent connections. Failure to follow this warning could result in fire, personal injury, or death.

Closet and alcove installations

A closet is any room the water heater is installed in which is less than 433 cubic feet for 126-065 and 201-100 models and 638 cubic feet for the 286-125 through 501-125 models.

An alcove is any room which meets the criteria for a closet with the exception that it does not have a door.

Example: Room dimensions = 6 feet long, 6 feet wide, and 9 foot ceiling = 6 x 6 x 9 = 324 cubic feet. This would be considered a closet for a Shield Water Heater.

⚠ WARNING For closet and alcove installations as shown in FIG.'s 1-1 and 1-2, CPVC or stainless steel vent material must be used inside the structure. The ventilating air openings shown in FIG.'s 1-1 and 1-2 are required for this arrangement. Failure to follow this warning could result in fire, personal injury, or death.

Provide clearances:

Clearances from combustible materials

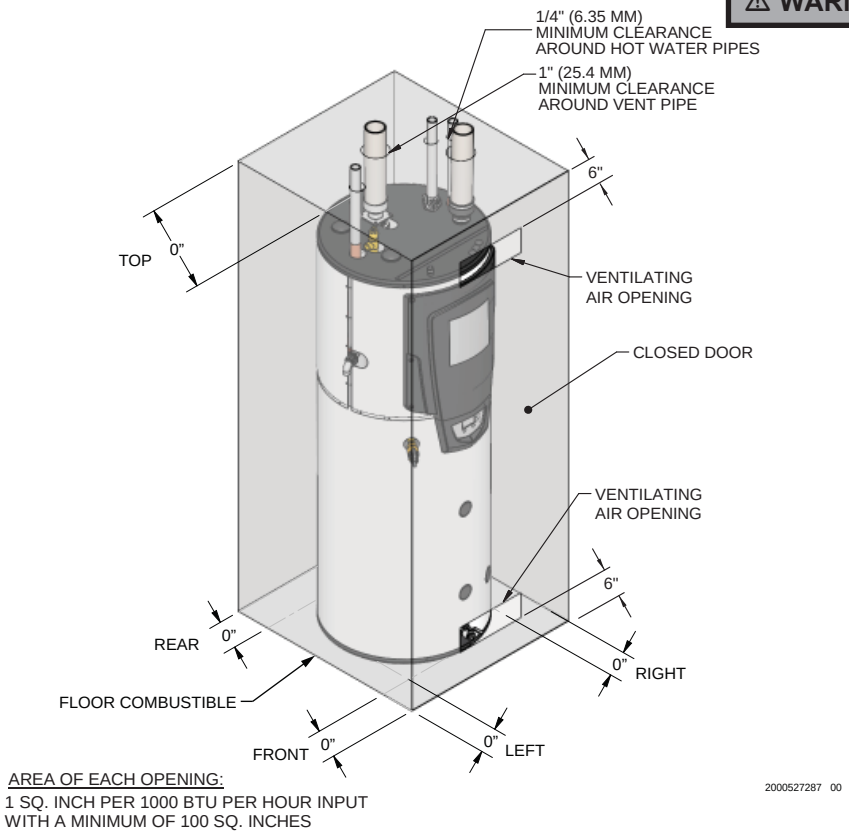
1. Hot water pipes—at least 1/4" from combustible materials.
2. Vent pipe – at least 1" from combustible materials.
3. See FIG.'s 1-1 and 1-2 on page 9 for other clearance minimums.

Clearances for service access

1. See FIG.'s 1-1 and 1-2 on page 9 for recommended service clearances. If you do not provide the minimum clearances shown, it may not be possible to service the water heater without removing it from the space.

1 Determine water heater location *(continued)*

Figure 1-1 *Closet Installation - Minimum Required Clearances*



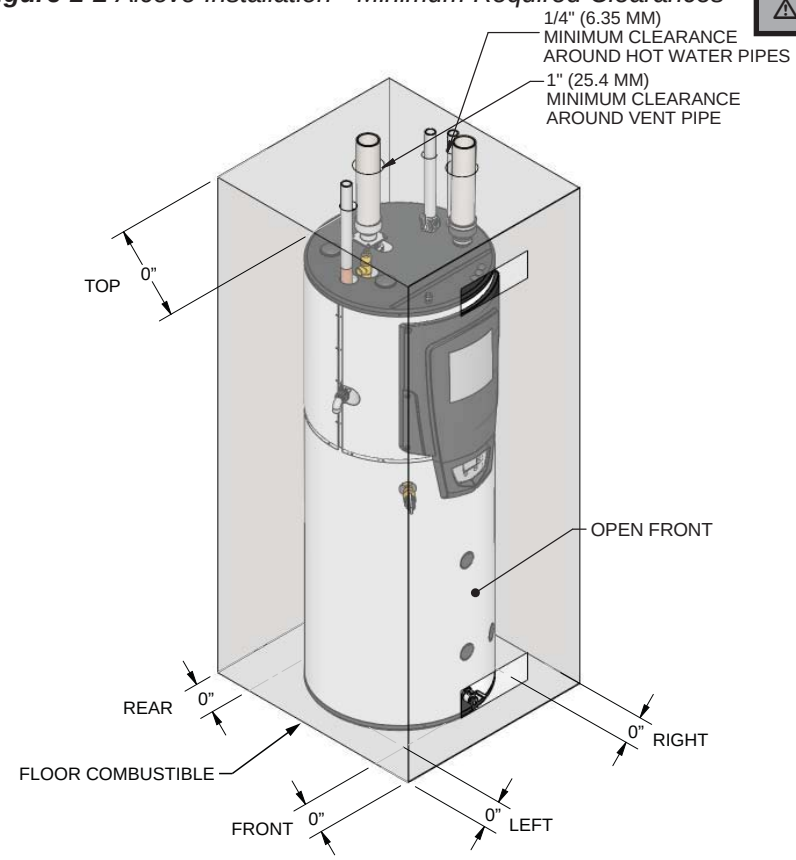
⚠ WARNING

For closet installations, CPVC, polypropylene or stainless steel vent material MUST BE used in a closet structure due to elevated temperatures. Failure to follow this warning could result in fire, personal injury, or death.

RECOMMENDED SERVICE CLEARANCES:

Top -	18" (457 mm)
Left/Right Side -	24" (610 mm)
Front -	24" (610 mm)

Figure 1-2 *Alcove Installation - Minimum Required Clearances*



⚠ WARNING

For alcove installations, CPVC, polypropylene or stainless steel vent material MUST BE used in an alcove structure due to elevated temperatures. Failure to follow this warning could result in fire, personal injury, or death.

RECOMMENDED SERVICE CLEARANCES:

Top -	18" (457 mm)
Left/Right Side -	24" (610 mm)
Front -	24" (610 mm)

1 Determine water heater location

Table 1A *Corrosive Contaminants and Sources*

Products to avoid:
Spray cans containing chloro/fluorocarbons
Permanent wave solutions
Chlorinated waxes/cleaners
Chlorine-based swimming pool chemicals
Calcium chloride used for thawing
Sodium chloride used for water softening
Refrigerant leaks
Paint or varnish removers
Hydrochloric acid/muriatic acid
Cements and glues
Antistatic fabric softeners used in clothes dryers
Chlorine-type bleaches, detergents, and cleaning solvents found in household laundry rooms
Adhesives used to fasten building products and other similar products
Areas likely to have contaminants
Dry cleaning/laundry areas and establishments
Swimming pools
Metal fabrication plants
Beauty shops
Refrigeration repair shops
Photo processing plants
Auto body shops
Plastic manufacturing plants
Furniture refinishing areas and establishments
New building construction
Remodeling areas
Garages with workshops

Flooring and foundation

Flooring

The Shield water heater is approved for installation on combustible flooring, but must never be installed on carpeting.

⚠ WARNING Do not install the water heater on carpeting even if foundation is used. Fire can result, causing severe personal injury, death, or substantial property damage.

When local codes require compliance with NSF 5, the heater must be sealed to the floor with a food grade silicone to prevent debris and harborage of vermin under the heater.

If flooding is possible, elevate the water heater sufficiently to prevent water from reaching the water heater.

Remove water heater from wood pallet

1. Remove the sides and the top of the crate.
2. Remove the blocks on the base of the crate to allow for easier removal.
3. The water heater can then be slid off the base of the crate for installation.

NOTICE Do not drop the water heater or bump the jacket on the floor or pallet. Damage to the water heater can result.

Prevent combustion air contamination

Install air inlet piping for the Shield water heater as described in this manual. Do not terminate vent/air in locations that can allow contamination of combustion air. Refer to Table 1A, for products and areas which may cause contaminated combustion air.

⚠ WARNING Ensure that the combustion air will not contain any of the contaminants in Table 1A. Contaminated combustion air will damage the water heater, resulting in possible severe personal injury, death or substantial property damage. Do not pipe combustion air near a swimming pool, for example. Also, avoid areas subject to exhaust fumes from laundry facilities. These areas will always contain contaminants.

1 Determine water heater location *(continued)*

When using an existing vent system to install a new water heater:

⚠ WARNING Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

Check the following venting components before installing:

- **Material** - For materials listed for use with this appliance, see Section 2 - General Venting. For polypropylene or stainless steel venting, an adapter of the same manufacturer must be used at the flue collar connection.
- **Size** - To ensure proper pipe size is in place, see Table 2A. Check to see that this size is used throughout the vent system.
- **Manufacturer** - For a stainless steel or polypropylene application, you must use only the listed manufacturers and their type product listed in Tables 2E and 2G for CAT IV positive pressure venting with flue producing condensate.
- **Supports** - Non-combustible supports must be in place allowing a minimum 1/4" rise per foot. The supports should adequately prevent sagging and vertical slippage, by distributing the vent system weight. For additional information, consult the vent manufacturer's instructions for installation.
- **Terminations** - Carefully review Sections 2 through 4 to ensure requirements for the location of the vent and air terminations are met and orientation of these fit the appropriate image from the Sidewall or Vertical options listed in the General Venting Section. For stainless steel vent, only use terminations listed in Table 2H for the manufacturer of the installed vent.
- **Seal** - With prior requirements met, the system should be tested to the procedure listed in parts (c) through (f) of the Removal of an Existing Water Heater Section, this page.

With polypropylene and stainless steel vent, seal and connect all pipe and components as specified by the vent manufacturer used; with PVC/CPVC vent, see the Installing Vent or Air Piping Section on page 20.

⚠ WARNING If any of these conditions are not met, the existing system must be updated or replaced for that concern. Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

When removing a water heater from existing common vent system:

⚠ DANGER Do not install the Shield water heater into a common vent with any other appliance. This will cause flue gas spillage or appliance malfunction, resulting in possible severe personal injury, death, or substantial property damage.

⚠ WARNING Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

At the time of removal of an existing water heater, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

a. Seal any unused openings in the common venting system.

b. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion, or other deficiencies, which could cause an unsafe condition.

c. Test vent system – Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.

d. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.

e. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar, or pipe.

f. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined herein, return doors, windows, exhaust fans, fireplace dampers, and any other gas-burning appliance to their previous conditions of use.

g. Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CAN/CSA B149.1, Natural Gas and Propane Installation Code. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Part 11 of the National Fuel Gas Code, ANSI Z223.1/NFPA and/or CAN/CSA B149.1, Natural Gas and Propane Installation Code.

1 Determine water heater location

Maintain minimum specified clearances for adequate operation. All installations must allow sufficient space for servicing the vent connections, water pipe connections, piping and other auxiliary equipment, as well as the appliance.

Multiple appliances may be installed in a modular water heater installation. Multiple appliances may be installed side by side with no clearance between adjacent appliances because this appliance is approved for zero clearance from combustible surfaces.

Consult the *Venting* section of this manual for specific installation instructions for the appropriate type of venting system that you will be using.

Combustion and ventilation air requirements for appliances drawing air from the equipment room

Provisions for combustion and ventilation air must be in accordance with Air for Combustion and Ventilation, of the latest edition of the National Fuel Gas Code, ANSI Z223.1, in Canada, the latest edition of CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment, or applicable provisions of the local building codes.

The equipment room MUST be provided with properly sized openings to assure adequate combustion air and proper ventilation.

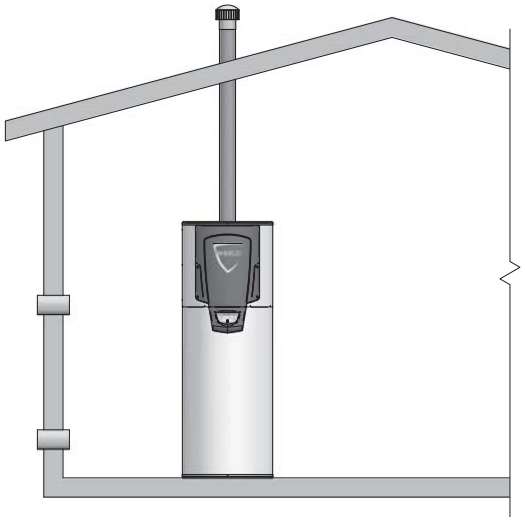


***Figure 1-3**_Combustion Air Direct from Outside*

1. If air is taken directly from outside the building with no duct, provide two permanent openings to the equipment room (see FIG. 1-3):

   (a) Combustion air opening, with a minimum free area of one square inch per 4000 Btu/hr input (5.5 cm^2 per KW). This opening must be located within 12" (30 cm) of the bottom of the enclosure.

   (b) Ventilation air opening, with a minimum free area of one square inch per 4000 Btu/hr input (5.5 cm^2 per kW). This opening must be located within 12" (30 cm) of the top of the enclosure.

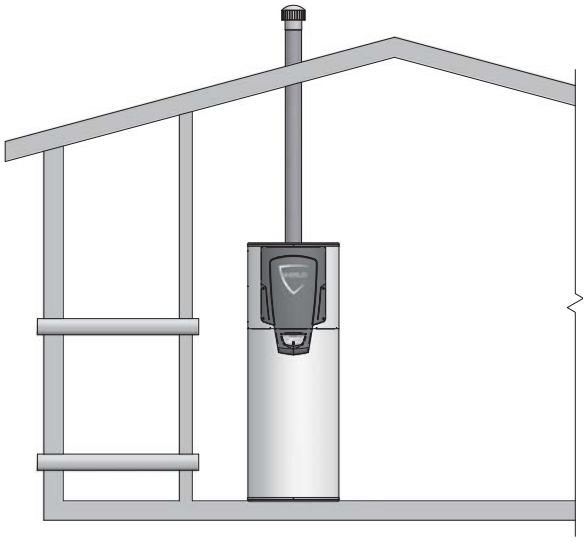


***Figure 1-4**_Combustion Air Through Ducts*

2. If combustion and ventilation air is taken from the outdoors using a duct to deliver the air to the equipment room, each of the two openings should be sized based on a minimum free area of one square inch per 2000 Btu/hr (11 cm^2 per kW) of input (see FIG. 1-4).

1 Determine water heater location *(continued)*

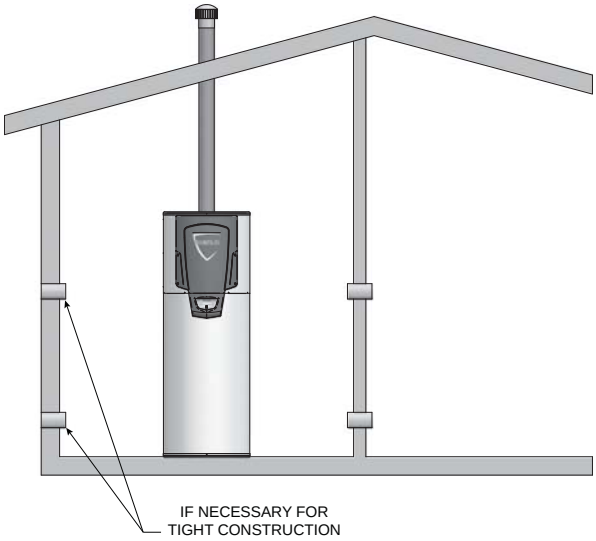


***Figure 1-5**_Combustion Air from Interior Space*

3. If air is taken from another interior space, each of the two openings specified above should have a net free area of one square inch for each 1000 Btu/hr (22 cm^2 per kW) of input, but not less than 100 square inches (645 cm^2) (see FIG. 1-5).

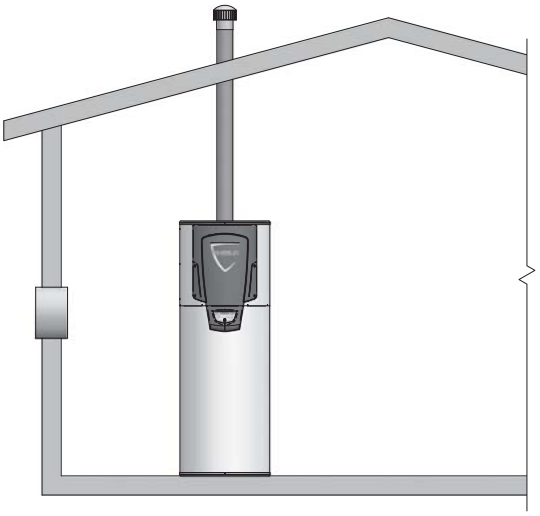


***Figure 1-6**_Combustion Air from Outside - Single Opening*

4. If a single combustion air opening is provided to bring combustion air in directly from the outdoors, the opening must be sized based on a minimum free area of one square inch per 3000 Btu/hr (7 cm^2 per kW). This opening must be located within 12" (30 cm) of the top of the enclosure (see FIG. 1-6).

TABLE - 1B
MINIMUM RECOMMENDED COMBUSTION AIR SUPPLY TO EQUIPMENT ROOM

Model Number	FIG. 1-3		FIG. 1-4		FIG. 1-5		FIG. 1-6
	*Outside Air from 2 Openings Directly from Outdoors		*Outside Air from 2 Ducts Delivered from Outdoors		**Inside Air from 2 Ducts Delivered from Interior Space		*Outside Air from 1 Opening Directly from Outdoors, in^2
	Top Opening, in^2	Bottom Opening, in^2	Top Opening, in^2	Bottom Opening, in^2	Top Opening, in^2	Bottom Opening, in^2	
126-065	32 (207 cm^2)	32 (207 cm^2)	63 (407 cm^2)	63 (407 cm^2)	125 (807 cm^2)	125 (807 cm^2)	42 (271 cm^2)
151-100	38 (246 cm^2)	38 (246 cm^2)	75 (484 cm^2)	75 (484 cm^2)	150 (968 cm^2)	150 (968 cm^2)	50 (323 cm^2)
201-100	50 (323 cm^2)	50 (323 cm^2)	100 (646 cm^2)	100 (646 cm^2)	200 (1,291 cm^2)	200 (1,291 cm^2)	67 (433 cm^2)
286-125	72 (465 cm^2)	72 (465 cm^2)	143 (923 cm^2)	143 (923 cm^2)	285 (1,839 cm^2)	285 (1,839 cm^2)	95 (613 cm^2)
401-125	100 (646 cm^2)	100 (646 cm^2)	200 (1,291 cm^2)	200 (1,291 cm^2)	400 (2,581 cm^2)	400 (2,581 cm^2)	134 (865 cm^2)
501-125	125 (807 cm^2)	125 (807 cm^2)	250 (1,613 cm^2)	250 (1,613 cm^2)	500 (3,226 cm^2)	500 (3,226 cm^2)	167 (1,078 cm^2)

*Outside air openings shall directly communicate with the outdoors. When combustion air is drawn from the outside through a duct, the net free area of each of the two openings must have twice (2 times) the free area required for Outside Air/2 Openings. The above requirements are for the water heater only; additional gas fired appliances in the equipment room will require an increase in the net free area to supply adequate combustion air for all appliances.

Combined interior space must be 50 cubic feet per 1,000 Btu/hr input. **Buildings MUST NOT be of *"Tight Construction". For buildings of ***"Tight Construction",** provide air openings into the building from outside.

*No combustion air openings are needed when the water heater is installed in a space with a volume NO LESS than 50 cubic feet per 1,000 Btu/hr of all installed gas fired appliances. **Buildings MUST NOT be of *"Tight Construction".**

***"Tight Construction"** is defined as a building with less than 0.40 ACH (air changes per hour).

1 Determine water heater location

Combustion air requirements are based on the latest edition of the National Fuel Gas Code, ANSI Z223.1; in Canada refer to the latest edition of CGA Standard CAN B149.1. Check all local code requirements for combustion air.

All dimensions based on net free area in square inches. Metal louvers or screens reduce the free area of a combustion air opening a minimum of approximately 25%. Check with louver manufacturers for exact net free area of louvers. Where two openings are provided, one must be within 12" (30cm) of the ceiling and one must be within 12" (30cm) of the floor of the equipment room. Each opening must have net free area as specified in the chart above (Table 1B). Single openings shall commence within 12" (30cm) of the ceiling.

⚠ CAUTION Under no circumstances should the equipment room ever be under negative pressure. Particular care should be taken where exhaust fans, attic fans, clothes dryers, compressors, air handling units, etc., may take away air from the unit.

The combustion air supply must be completely free of any flammable vapors that may ignite or chemical fumes which may be corrosive to the appliance. Common corrosive chemical fumes which must be avoided are fluorocarbons and other halogenated compounds, most commonly present as refrigerants or solvents, such as Freon, trichlorethylene, perchlorethylene, chlorine, etc. These chemicals, when burned, form acids which quickly attack the stainless steel heat exchanger, headers, flue collectors, and the vent system.

The result is improper combustion and a non-warrantable, premature appliance failure.

EXHAUST FANS: Any fan or equipment which exhausts air from the equipment room may deplete the combustion air supply and/or cause a downdraft in the venting system. Spillage of flue products from the venting system into an occupied living space can cause a very hazardous condition that must be immediately corrected. If a fan is used to supply combustion air to the equipment room, the installer must make sure that it does not cause drafts which could lead to nuisance operational problems with the appliance.

2 General venting

Direct venting options - Sidewall Vent

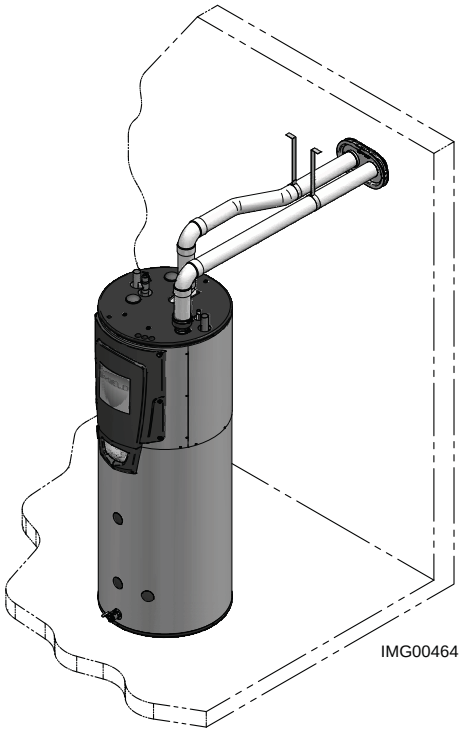


Figure 2-1 *Two-Pipe Sidewall Termination - See page 23 for more details*

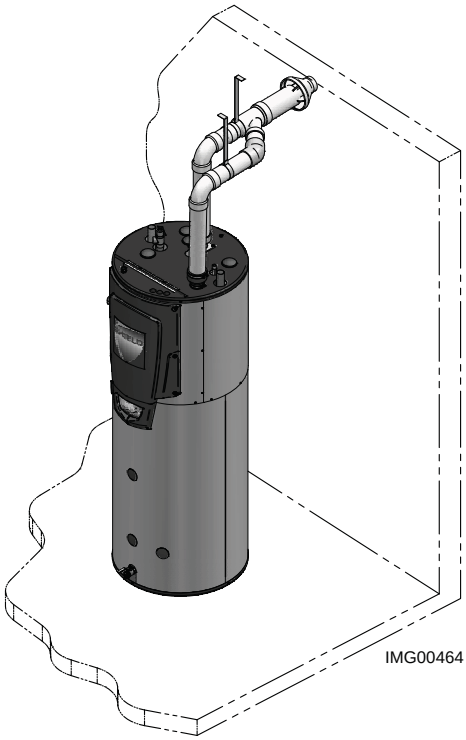


Figure 2-2 *PVC/CPVC Concentric Sidewall Termination - See page 30 for more details*

Direct venting options - Vertical Vent

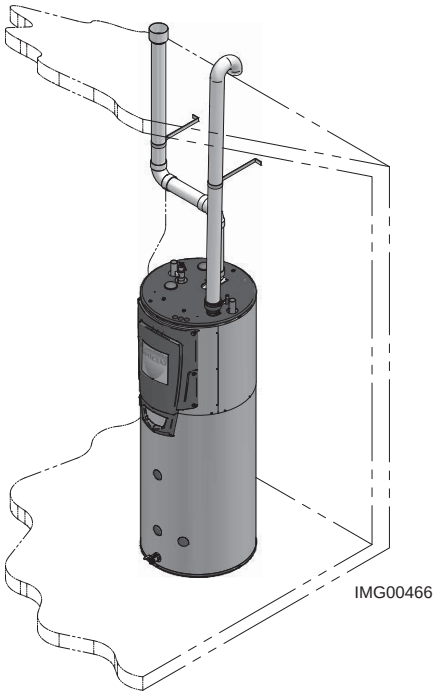


Figure 2-3 *Two-Pipe Vertical Termination - See page 33 for more details*

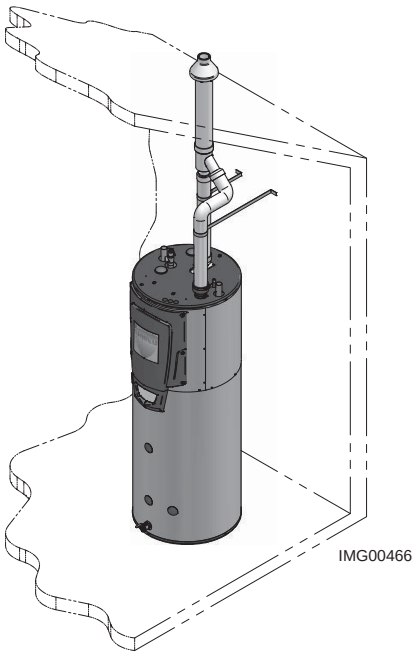


Figure 2-4 *PVC/CPVC Concentric Vertical Termination - See page 35 for more details*

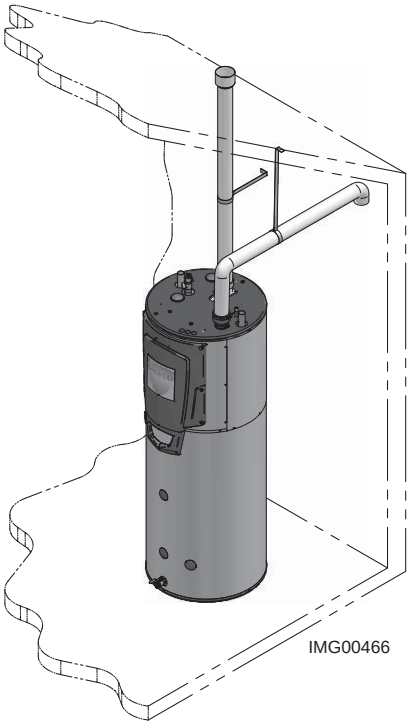


Figure 2-5 *Vertical Vent, Sidewall Air*

2 General venting

Install vent and combustion air piping

⚠ DANGER The Shield water heater must be vented and supplied with combustion and ventilation air as described in this section. Ensure the vent and air piping and the combustion air supply comply with these instructions regarding vent system, air system, and combustion air quality. See also Section 1 of this manual.

Inspect finished vent and air piping thoroughly to ensure all are airtight and comply with the instructions provided and with all requirements of applicable codes.

Failure to provide a properly installed vent and air system will cause severe personal injury or death.

⚠ WARNING This appliance requires a special venting system. Use only approved stainless steel, PVC, CPVC or polypropylene pipe and fittings listed in Tables 2D, 2E, and 2G for vent pipe, and fittings. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ WARNING DO NOT mix components from different systems. The vent system could fail, causing leakage of flue products into the living space. Mixing of venting materials will void the warranty and certification of the appliance.

NOTICE Installation must comply with local requirements and with the National Fuel Gas Code, ANSI Z223.1 for U.S. installations or CSA B149.1 for Canadian installations.

⚠ WARNING For closet and alcove installations, CPVC, polypropylene or stainless steel material MUST BE used in a closet/alcove structure. Failure to follow this warning could result in fire, personal injury, or death.

⚠ CAUTION Improper installation of venting systems may result in injury or death.

NOTICE Follow the instructions in Section 1, page 11 of this manual when removing a water heater from an existing vent system.

⚠ WARNING Do not connect any other appliance to the vent pipe or multiple water heaters to a common vent pipe. Failure to comply could result in severe personal injury, death, or substantial property damage.

The Shield water heater vent and air piping can be installed through the roof or through a sidewall. Follow the procedures in this manual for the method chosen. Refer to the information in this manual to determine acceptable vent and air piping length.

You may use any of the vent/air piping methods covered in this manual. Do not attempt to install the Shield water heater using any other means.

You must also install air piping from outside to the water heater air intake adapter unless following the Optional Room Air instructions on page 19 of this manual. The resultant installation is direct vent (sealed combustion).

Air intake/vent connections

1. **Combustion Air Intake Connector** (FIG. 2-6) - Used to provide combustion air directly to the unit from outdoors. A fitting is provided on the unit for final connection. Combustion air piping must be supported per guidelines listed in the National Mechanical Code, Section 305, Table 305.4 or as local codes dictate.
2. **Vent Connector** (FIG.'s 2-7 thru 2-10) - Used to provide a passageway for conveying combustion gases to the outside. A transition fitting is provided on the unit for final connection. Vent piping must be supported per the National Building Code, Section 305, Table 305.4 or as local codes dictate.

Figure 2-6 *Near Water Heater Air Piping*



2 General venting *(continued)*

Requirements for installation in Canada

1. Installations must be made with a vent pipe system certified to ULC-S636.
2. The first three (3) feet of plastic vent pipe from the appliance flue outlet must be readily accessible for visual inspection.
3. The components of the certified vent system must not be interchanged with other vent systems or unlisted pipe/fittings. For concentric vent installations, the inner vent tube must be replaced with field supplied certified vent material to comply with this requirement.
4. The 3" Concentric Vent Kit available from Lochinvar (see Section 3 – *Sidewall Termination – Optional Concentric Vent*) and the 3" Concentric Vent Kit available from IPEX are both approved for use on the Shield water heater. Both kits are listed to the ULC-S636 standard for use in Canada.

Sizing

The Shield water heater uses model specific combustion air intake and vent piping sizes as detailed in Table 2A below.

Table 2A *Air Intake/Vent Piping Sizes*

Model	Air Intake	Vent
126-065 -- 201-100	3 inches	3 inches
286-125 -- 501-125	4 inches	4 inches

NOTICE Increasing or decreasing combustion air or vent piping sizes is not authorized.

Minimum / Maximum allowable combustion air and vent piping lengths are as follows:

Combustion Air = 12 equivalent feet minimum / 100 equivalent feet maximum

Vent = 12 equivalent feet minimum / 100 equivalent feet maximum

NOTICE When using the alternative 3" vent and combustion air piping with a Shield 286-125 model, the maximum allowable combustion air and vent piping lengths are limited to 60 equivalent feet each. The minimum allowable combustion air and vent pipe lengths remain 12 equivalent feet each.

When determining equivalent combustion air and vent length, add 5 feet for each 90° elbow and 3 feet for each 45° elbow.

EXAMPLE: 20 feet of PVC pipe + (4) 90° elbows + (2) 45° elbows + (1) concentric vent kit (100140480) = 49 equivalent feet of piping.

NOTICE The appliance output rating will reduce by up to 1.5% for each 25 feet of vent length, except when using the alternative 3" vent for the Shield 286-125 model which may de-rate by up to 4% for each 25 feet of vent length.

Table 2B *Concentric Vent Kit Equivalent Vent Lengths*

Model	Kit Number	Equivalent Vent Length
126-065 -- 201-100	100140480	3 feet
286-125	100140484	3 feet
401-125	100140484	5 feet
501-125	100140484	30 feet

2 General venting

Materials

Air inlet pipe materials:

The air inlet pipe(s) must be sealed. Choose acceptable combustion air inlet pipe materials from the following list:

PVC, CPVC, Polypropylene or ABS
Dryer Vent or Sealed Flexible Duct (not recommended for rooftop air inlet)
Galvanized steel vent pipe with joints and seams sealed as specified in this section.
Type "B" double-wall vent with joints and seams sealed as specified in this section.
AL29-4C, stainless steel material to be sealed to specification of its manufacturer.

*Plastic pipe may require an adapter (not provided) to transition between the air inlet connection on the appliance and the plastic air inlet pipe.

⚠ WARNING Using air intake materials other than those specified can result in personal injury, death or property damage.

NOTICE The use of double-wall vent or insulated material for the combustion air inlet pipe is recommended in cold climates to prevent the condensation of airborne moisture in the incoming combustion air.

Sealing of Type "B" double-wall vent material or galvanized vent pipe material used for air inlet piping on a sidewall or vertical rooftop Combustion Air Supply System:

a. Seal all joints and seams of the air inlet pipe using either Aluminum Foil Duct Tape meeting UL Standard 723 or 181A-P or a high quality UL Listed silicone sealant such as those manufactured by Dow Corning or General Electric.

b. Do not install seams of vent pipe on the bottom of horizontal runs.

c. Secure all joints with a minimum of three (3) sheet metal screws or pop rivets. Apply Aluminum Foil Duct Tape or silicone sealant to all screws or rivets installed in the vent pipe.

d. Ensure that the air inlet pipes are properly supported.

The PVC, CPVC, or ABS air inlet pipe should be cleaned and sealed with the pipe manufacturer's recommended solvents and standard commercial pipe cement for the material used. The PVC, CPVC, ABS, Dryer Vent or Flex Duct air inlet pipe should use a silicone sealant to ensure a proper seal at the appliance connection and the air inlet cap connection. Dryer vent or flex duct should use a screw type clamp to seal the vent to the appliance air inlet and the air inlet cap. Proper sealing of the air inlet pipe ensures that combustion air will be free of contaminants and supplied in proper volume.

Follow the polypropylene manufacturer's instructions when using polypropylene material as an inlet pipe.

When a sidewall or vertical rooftop combustion air supply system is disconnected for any reason, the air inlet pipe must be resealed to ensure that combustion air will be free of contaminants and supplied in proper volume.

⚠ DANGER Failure to properly seal all joints and seams as required in the air inlet piping may result in flue gas recirculation, spillage of flue products and carbon monoxide emissions causing severe personal injury or death.

2 General venting *(continued)*

Optional room air

NOTICE

Optional room air is intended for commercial applications. Combustion air piping to the outside is recommended for residential applications.

Commercial applications utilizing the Shield water heater may be installed with a single pipe carrying the flue products to the outside while using combustion air from the equipment room. In order to use the room air venting option the following conditions and considerations must be followed.

- The unit MUST be installed with the appropriate room air provisions.
- The equipment room MUST be provided with properly sized openings to assure adequate combustion air. Please refer to instructions provided with the room air kit (100157615 - Models 126-065 -- 201-100 and 100157616 - Models 286-125 -- 501-125).
- There will be a noticeable increase in the noise level during normal operation from the inlet air opening.
- Using the room air configuration makes the unit vulnerable to combustion air contamination from within the building. Please review Section 1, Prevent Combustion Air Contamination, to ensure proper installation.
- Vent system and terminations must comply with the standard venting instructions set forth in this manual.

⚠ WARNING

When utilizing the single pipe method, provisions for combustion and ventilation air must be in accordance with Air for Combustion and Ventilation, of the latest edition of the National Fuel Gas Code, ANSI Z223.1, in Canada, the latest edition of CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment, or applicable provisions of the local building codes.

Air contamination

Pool and laundry products and common household and hobby products often contain fluorine or chlorine compounds. When these chemicals pass through the water heater, they can form strong acids. The acid can eat through the water heater wall, causing serious damage and presenting a possible threat of flue gas spillage or water heater water leakage into the building.

Please read the information given in Table 1A, page 10, listing contaminants and areas likely to contain them. If contaminating chemicals will be present near the location of the water heater combustion air inlet, have your installer pipe the water heater combustion air and vent to another location, per this manual.

⚠ WARNING

If the water heater combustion air inlet is located in a laundry room or pool facility, for example, these areas will always contain hazardous contaminants.

⚠ WARNING

To prevent the potential of severe personal injury or death, check for areas and products listed in Table 1A, page 10 before installing the water heater or air inlet piping.

If contaminants are found, you MUST:

- Remove contaminants permanently.

—OR—

- Relocate air inlet and vent terminations to other areas.

2 General venting

PVC/CPVC

This product has been approved for use with the PVC/CPVC vent materials listed in Table 2D.

Installing vent and air piping

⚠ WARNING The vent connection to the appliance must be made with the starter CPVC pipe section provided with the 286-501 models (starter piece is factory installed on the 126-201 models) if PVC/CPVC vent is to be used. The field provided vent fittings must be cemented to the CPVC pipe section using an "All Purpose Cement" suitable for PVC and CPVC pipe. Use only the vent materials, primer, and cement specified in Table 2D to make the vent connections. Failure to follow this warning could result in fire, personal injury, or death.

NOTICE Use only cleaners, primers, and solvents that are approved for the materials which are joined together.

NOTICE All PVC vent pipes must be glued, properly supported, and the exhaust must be pitched a minimum of a 1/4 inch per foot back to the water heater (to allow drainage of condensate).

⚠ WARNING Insulation should not be used on PVC or CPVC venting materials. The use of insulation will cause increased vent wall temperatures, which could result in vent pipe failure.

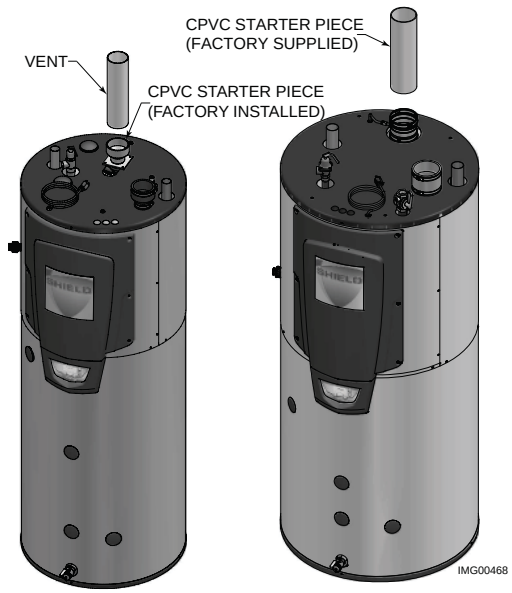
1. Work from the water heater to vent or air termination. Do not exceed the lengths given in this manual for the air or vent piping.
2. Cut pipe to the required lengths and deburr the inside and outside of the pipe ends.
3. Chamfer outside of each pipe end to ensure even cement distribution when joining.
4. Clean all pipe ends and fittings using a clean dry rag. (Moisture will retard curing and dirt or grease will prevent adhesion.)
5. Dry fit vent or air piping to ensure proper fit up before assembling any joint. The pipe should go a third to two-thirds into the fitting to ensure proper sealing after cement is applied.
6. Priming and Cementing:
   a. Handle fittings and pipes carefully to prevent contamination of surfaces.
   b. Apply a liberal even coat of primer to the fitting socket and to the pipe end to approximately 1/2" beyond the socket depth.
   c. Apply a second primer coat to the fitting socket.
   d. While primer is still wet, apply an even coat of approved cement to the pipe equal to the depth of the fitting socket along with an even coat of approved cement to the fitting socket.
   e. Apply a second coat of cement to the pipe.
   f. While the cement is still wet, insert the pipe into the fitting, if possible twist the pipe a 1/4 turn as you insert it. **NOTE:** If voids are present, sufficient cement was not applied and joint could be defective.
   g. Wipe excess cement from the joint removing ring or beads as it will needlessly soften the pipe.

Table 2D *PVC/CPVC Vent Pipe, and Fittings*

Approved PVC/CPVC Vent Pipe and Fittings		
Item	**Material**	**Standard**
Vent pipe	PVC Schedule 40, 80	ANSI/ASTM D1785
	PVC - DWV	ANSI/ASTM D2665
	CPVC Schedule 40, 80	ANSI/ASTM F441
Vent fittings	PVC Schedule 40	ANSI/ASTM D2466
	PVC Schedule 80	ANSI/ASTM D2467
	CPVC Schedule 80	ANSI/ASTM F439
	PVC - DWV	ANSI/ASTM D2665
Pipe Cement / Primer	PVC	ANSI/ASTM D2564
	CPVC	ANSI/ASTM F493
NOTICE: DO NOT USE CELLULAR (FOAM) CORE PIPE		

NOTE: In Canada, CPVC and PVC vent pipe, ttings and cement/ primer must be ULC-S636 certi ed.

Figure 2-7 *Near Water Heater PVC/CPVC Venting*



MODELS: 126-065 - 201-100 MODELS: 286-125 - 501-125

2 General venting *(continued)*

Polypropylene

This product has been approved for use with polypropylene vent with the manufacturers listed in Table 2E.

All terminations must comply with listed options in this manual and be a single-wall vent offering.

For support and special connections required, see the manufacturer's instructions. All vent is to conform to standard diameter and equivalent length requirements established.

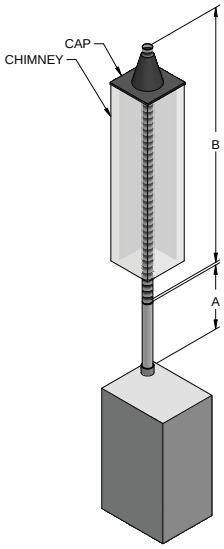
When determining equivalent combustion air and vent length for polypropylene single-wall piping:

- 1 foot of Duravent 4 inch single-wall pipe is equivalent to 1.6 feet of piping

Flexible polypropylene

For use of flex pipe, it is recommended to have the vent material in 32°F or higher ambient space before bending at installation. No bends should be made to greater than 45° and ONLY installed in vertical or near vertical installations (FIG. 2-8).

Figure 2-8 *Near Boiler Flexible Polypropylene Venting*



Duravent 3"

"A" DIM	"B" DIM	
3" RIGID	3" FLEX	4" FLEX
10 FT	60 FT	90 FT
20 FT	53 FT	80 FT
30 FT	47 FT	70 FT
40 FT	40 FT	60 FT
50 FT	33 FT	50 FT
60 FT	27 FT	40 FT
70 FT	20 FT	30 FT
80 FT	13 FT	20 FT
90 FT	7 FT	10 FT

Duravent 4"

"A" DIM	"B" DIM	
4" RIGID	4" FLEX	5" FLEX
10 FT	30 FT	90 FT
20 FT	27 FT	80 FT
30 FT	23 FT	70 FT
40 FT	20 FT	60 FT
50 FT	17 FT	50 FT
60 FT	13 FT	40 FT
70 FT	10 FT	30 FT
80 FT	7 FT	20 FT
90 FT	3 FT	10 FT

Centrotherm 3"

"A" DIM	"B" DIM	
3" RIGID	3" FLEX	4" FLEX
10 FT	45 FT	90 FT
20 FT	40 FT	80 FT
30 FT	35 FT	70 FT
40 FT	30 FT	60 FT
50 FT	25 FT	50 FT
60 FT	20 FT	40 FT
70 FT	15 FT	30 FT
80 FT	10 FT	20 FT
90 FT	5 FT	10 FT

Centrotherm 4"

"A" DIM	"B" DIM
4" RIGID	4" FLEX
10 FT	33 FT
20 FT	29 FT
30 FT	26 FT
40 FT	22 FT
50 FT	18 FT
60 FT	15 FT
70 FT	11 FT
80 FT	7 FT
90 FT	4 FT

*NOTES: 1) FLEX PIPE MAY ONLY BE RUN IN A VERTICAL ORIENTATION
2) ALL VENT LENGTHS REPRESENTED IN ABOVE CHARTS ARE EQUIVALENT LENGTHS.
3) SECTION A IS EQUIVALENT FEET OF RIGID PIPE, WHICH MAY INCLUDE 45 AND 90° ELBOWS. PLEASE SEE SIZING SECTION FOR DETERMINING EQUIVALENT FEET.

IMG00840

NOTICE The installer must use a specific vent starter adapter at the flue collar connection. The adapter is supplied by the vent manufacturer to adapt to its vent system. See Table 2F for approved vent adapters. Discard CPVC starter piece.

NOTICE All vent connections MUST be secured by the vent manufacturer's joint connector (FIG. 2-9).

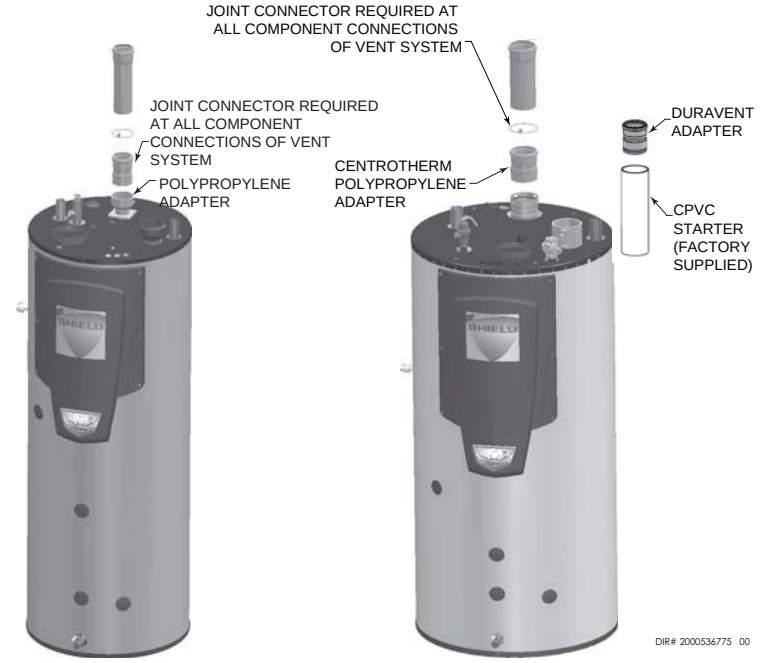
⚠ WARNING Insulation should not be used on polypropylene venting materials. The use of insulation will cause increased vent wall temperatures, which could result in vent pipe failure.

⚠ WARNING Use only the adapters and vent system listed in Tables 2E and 2F. DO NOT mix vent systems of different types or manufacturers. Failure to comply could result in severe personal injury, death, or substantial property damage.

NOTICE Installations must comply with applicable national, state, and local codes. For Canadian installation, polypropylene vent must be listed as a ULC-S636 approved system.

NOTICE Installation of a polypropylene vent system should adhere to the vent manufacturer's installation instructions supplied with the vent system.

Figure 2-9 *Near Water Heater Polypropylene Venting*



MODELS: 126-065 - 201-100

MODELS: 286-125 - 501-125

Table 2E *Polypropylene Vent Pipe and Fittings*

Approved Polypropylene Vent Manufacturers	
Make	**Model**
Centrotherm Eco Systems	InnoFlue SW/Flex
Duravent (M & G Group)	PolyPro Single-Wall / PolyPro Flex

Table 2F *Approved PolypropyleneTerminations*

Model	Centrotherm InnoFlue SW				Duravent Polypro		
	Polypropylene Adapter	Joint Connector	Sidewall Retaining Bracket*	Sidewall Adapter*	Polypropylene Adapter	Joint Connector	Sidewall Kit*
126-065 -- 201-100	ISAAL0303	IANS03	IATP0303	ISTAGL0303	3PPS-ADL	3PPS-LB	3PPS-HLK
286-125 -- 501-125	ISAAL0404	IANS04	IATP0404	ISTAGL0404	4PPS-AD-M	4PPS-LB	4PPS-HLK

* These parts are only needed if the sidewall termination assembly is used (see FIG. 3-4B on page 28).

2 General venting

Stainless steel vent

This product has been approved for use with stainless steel using the manufacturers listed in Table 2G. This unit requires Category IV venting.

⚠ WARNING Use only the materials, vent systems, and terminations listed in Tables 2G and 2H. DO NOT mix vent systems of different types or manufacturers. Failure to comply could result in severe personal injury, death, or substantial property damage.

NOTICE The installer must use a specific vent starter adapter at the flue collar connection, supplied by the vent manufacturer to adapt to its vent system. See Table 2H for approved vent adapters. Discard CPVC starter piece.

NOTICE Installations must comply with applicable national, state, and local codes. Stainless steel vent systems must be listed as a UL-1738 approved system for the United States and a ULC-S636 approved system for Canada.

NOTICE Installation of a stainless steel vent system should adhere to the stainless steel vent manufacturer's installation instructions supplied with the vent system.

Figure 2-10 *Near Water Heater Stainless Steel Venting*

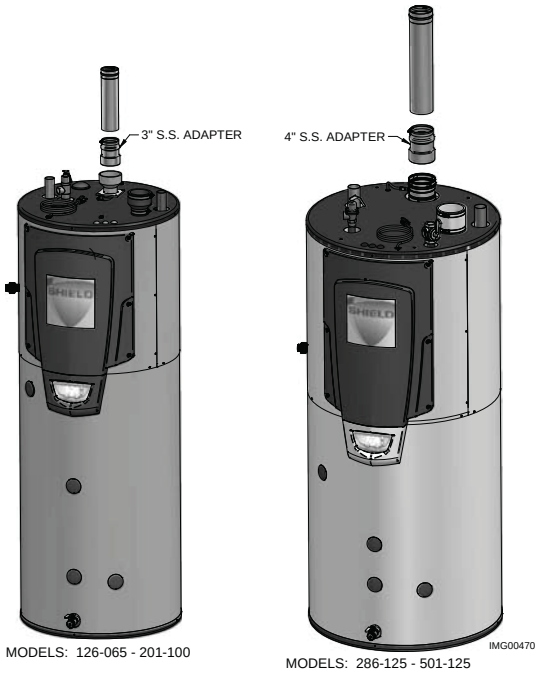


Table 2G *Stainless Steel Vent Pipe and Fittings*

Approved Stainless Steel Vent Manufacturers	
Make	**Model**
Dura Vent (M & G Group)	FasNSeal Vent / FasNSeal Flex* Vent
Z-Flex (Nova Flex Group)	Z-Vent
Heat Fab (Selkirk Corporation)	Saf-T Vent
Metal Fab	Corr/Guard
Security Chimney	Secure Seal

*Use of FasNSeal Flex smooth inner wall vent is to be used in vertical or near vertical sections only, taking precaution to ensure no sagging occurs of the vent system. Connect to the FasNSeal rigid vent using specially designed adapters and sealing method, see manufacturer's instructions.

Table 2H *Approved Stainless Steel (S.S.) Terminations and Adapters*

Model	ProTech			Heat Fab			Z Flex		
	FasNSeal			Saf-T Vent			Z-Vent		
	S.S. Adapter	Flue Termination	Intake Air Termination	S.S. Adapter	Flue Termination	Intake Air Termination	S.S. Adapter	Flue Termination	Intake Air Termination
126-065 -- 201-125	300715	FSBS3 FSRC3(R.C)	303889	9301PVC	9392 5300CI	9314TERM	2SVSLA03	2SVSTP03 2SVSRCX03	2SVSTEX0390
286-125 -- 501-125	F303759	FSBS4 FSRC4(R.C.)	FSAIH04 303888	9401PVC	9492 5400CI	9414TERM	2SVSLA04	2SVSTP04 2SVSRCX04	2SVSTEX0490
Metal Fab				**Security Chimney**					
Corr/Guard				Secure Seal					
126-065 -- 201-125	3CGIA	3CGSWHT 3CGSWC	3CGSW90LT	--	--	--			
286-125 -- 501-125	4CGIA	4CGSWHT 4CGSWC	4CGSW90LT	SS4PVCU	SS4STU SS4RCBU	SS4ST90AU			

3 Sidewall direct venting

Vent/air termination – sidewall

⚠ WARNING Follow instructions below when determining vent location to avoid possibility of severe personal injury, death, or substantial property damage.

⚠ WARNING A gas vent extending through an exterior wall shall not terminate adjacent to a wall or below building extensions such as eaves, parapets, balconies, or decks. Failure to comply could result in severe personal injury, death, or substantial property damage.

Determine location

Locate the vent/air terminations using the following guidelines:

1. The total length of piping for vent or air must not exceed the limits given in the General Venting Section on page 17 of this manual.
2. You must consider the surroundings when terminating the vent and air:
   a. Position the vent termination where vapors will not damage nearby shrubs, plants or air conditioning equipment or be objectionable.
   b. The flue products will form a noticeable plume as they condense in cold air. Avoid areas where the plume could obstruct window views.
   c. Prevailing winds could cause freezing of condensate and water/ice buildup where flue products impinge on building surfaces or plants.
   d. Avoid possibility of accidental contact of flue products with people or pets.
   e. Do not locate the terminations where wind eddies could affect performance or cause recirculation, such as inside building corners, near adjacent buildings or surfaces, window wells, stairwells, alcoves, courtyards, or other recessed areas.

⚠ WARNING Sidewall vent and air inlet terminations must terminate in the same pressure zone.

   f. Do not terminate above any door or window. Condensate can freeze, causing ice formations.
   g. Locate or guard vent to prevent condensate damage to exterior finishes.
   h. Do not locate the terminations over public walkways.
   i. Do not locate the terminations near soffit vents, crawl space vents, or other areas where condensate or vapor could create a nuisance, hazard, or cause property damage.
   j. Do not locate the terminations where condensate vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.

Figure 3-1A *PVC/CPVC/Polypropylene Sidewall Termination of Air and Vent*

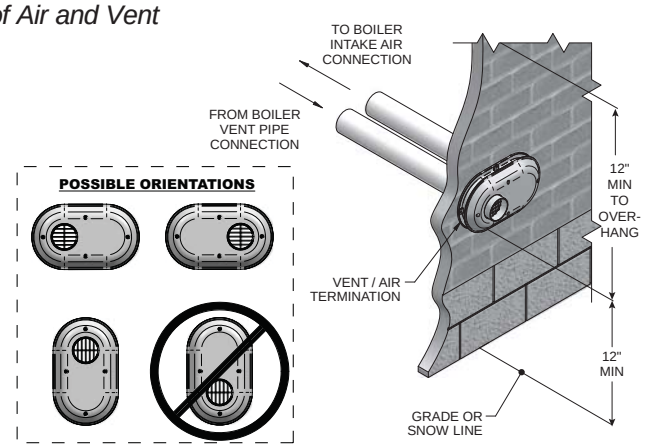


Table 3A *Sidewall Vent Kits*

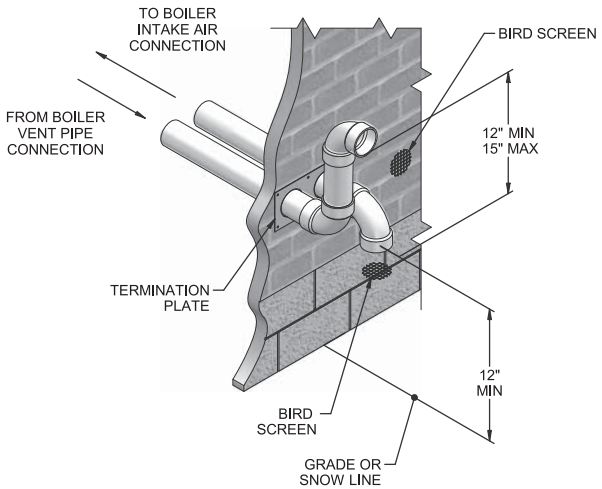
Model	Kit Number	Vent Size
126-065 -- 201-100	100157610	3 inch vent
286-125 -- 501-125	100157611	4 inch vent

If using the alternate sidewall termination:

3. The air piping must terminate in a down-turned elbow as shown in FIG. 3-1B. This arrangement avoids recirculation of flue products into the combustion air stream.
4. The vent piping must terminate in an elbow pointed outward or away from the air inlet, as shown in FIG. 3-1B.

⚠ WARNING Do not exceed the maximum lengths of the outside vent piping shown in FIG. 3-1B. Excessive length exposed to the outside could cause freezing of condensate in the vent pipe, resulting in potential water heater shutdown.

Figure 3-1B *Alternate PVC/CPVC/Polypropylene Sidewall Termination of Air and Vent w/Field Supplied Fittings*



3 Sidewall direct venting

Vent/air termination – sidewall

Figure 3-1C *Alternate PVC/CPVC/SS/ Polypropylene Venting Arrangement (if Space Allows) w/Field Supplied Fittings*

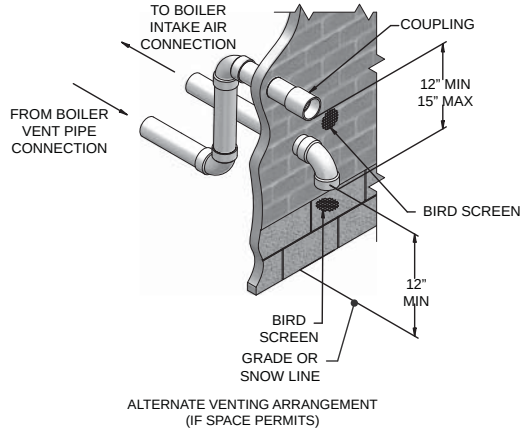
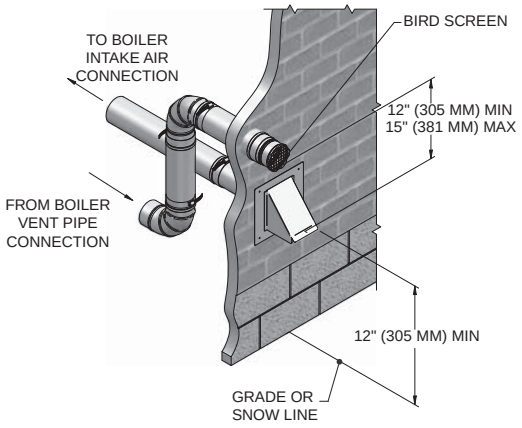


Figure 3-1D *Alternate SS Venting Arrangement - Typical Stainless Steel Sidewall Termination of Air and Vent w/Field Supplied Fittings, Utilizing a Hood Intake*



5. Maintain clearances as shown in FIG.'s 3-1A thru 3-3B, pages 23 - 27. Also maintain the following:
   a. Vent must terminate:
      • At least 6 feet from adjacent walls.
      • No closer than 12 inches below roof overhang.
   b. Air inlet must terminate at least 12 inches above grade or snow line; at least 12 inches below the vent termination; and the vent pipe must not extend more than 24 inches vertically outside the building as shown in FIG. 3-1B. Condensate could freeze and block vent pipe.
   c. Do not terminate closer than 4 feet horizontally from any electric meter, gas meter, regulator, relief valve, or other equipment. Never terminate above or below any of these within 4 feet horizontally.
6. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

Figure 3-2A *Clearance to Gravity Air Inlets*

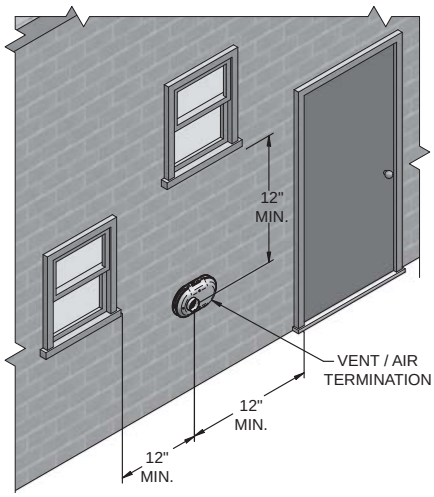
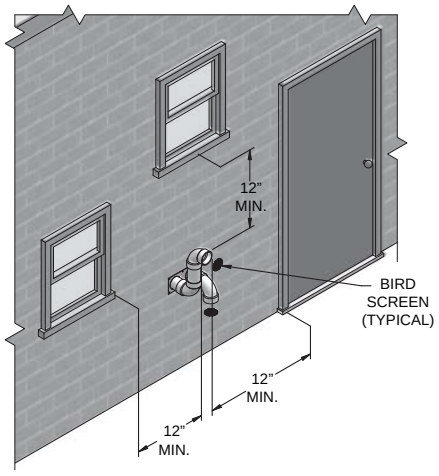


Figure 3-2B *Alternate Clearance to Gravity Air Inlets w/ Field Supplied Fittings*



3 Sidewall direct venting *(continued)*

Figure 3-3A *Direct Vent Terminal Clearances*

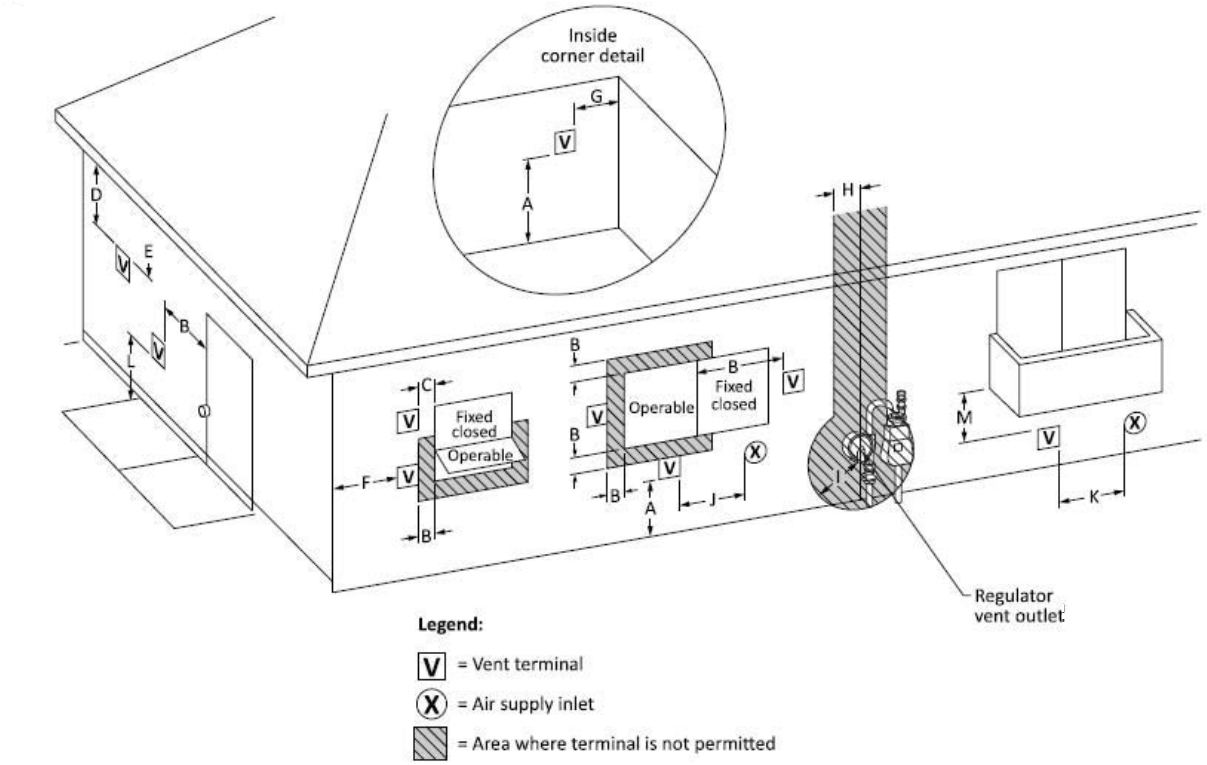


Table 3B *Direct Vent Terminal Clearances*

		Canadian Installations[1]	US Installations[2]
A =	Clearance above grade, veranda, porch, deck, or balcony	12 in (30 cm)	12 in (30 cm)
B =	Clearance to window or door that may be opened	6 in (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 12 in (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36 in (91 cm) for appliances > 100,000 Btuh (30 kW)	6 in (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 9 in (23 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 50,000 Btuh (15 kW), 12 in (30 cm) for appliances > 50,000 Btuh (15 kW)
C =	Clearance to permanently closed window	*	*
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 ft (61 cm) from the center line of the terminal.	*	*
E =	Clearance to unventilated soffit	*	*
F =	Clearance to outside corner	*	*
G =	Clearance to inside corner	*	*
H =	Clearance to each side of center line extended above meter / regulator assembly	*	*
I =	Clearance to service regulator vent outlet	Above a regulator within 3 ft (91 cm) horizontally of the vertical center line of the regulator vent outlet to a maximum vertical distance of 15 ft (4.5 m)	*

3 Sidewall direct venting

***Table 3B** Direct Vent Terminal Clearances (continued)*

J =	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	6 in (15 cm) for appliances ≤ 10,000 Btuh (3kW), 12 in (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36 in (91 cm) for appliances > 100,000 Btuh (30 kW)	6 in (15 cm) for appliances ≤ 10,000 Btuh (3kW), 9 in (23 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 50,000 Btuh (15 kW), 12 in (30 cm) for appliances > 50,000 Btuh (15 kW)
K =	Clearance to a mechanical air supply inlet	6 ft (1.83 m)	3 ft (91 cm) above if within 10 ft (3 m) horizontally
L =	Clearance above paved sidewalk or paved driveway located on public property	7 ft (2.13 m)†	*
M =	Clearance under veranda, porch, deck, or balcony	12 in (30 cm)‡	*

* Clearance in accordance with local installation codes and the requirements of the gas supplier.

† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

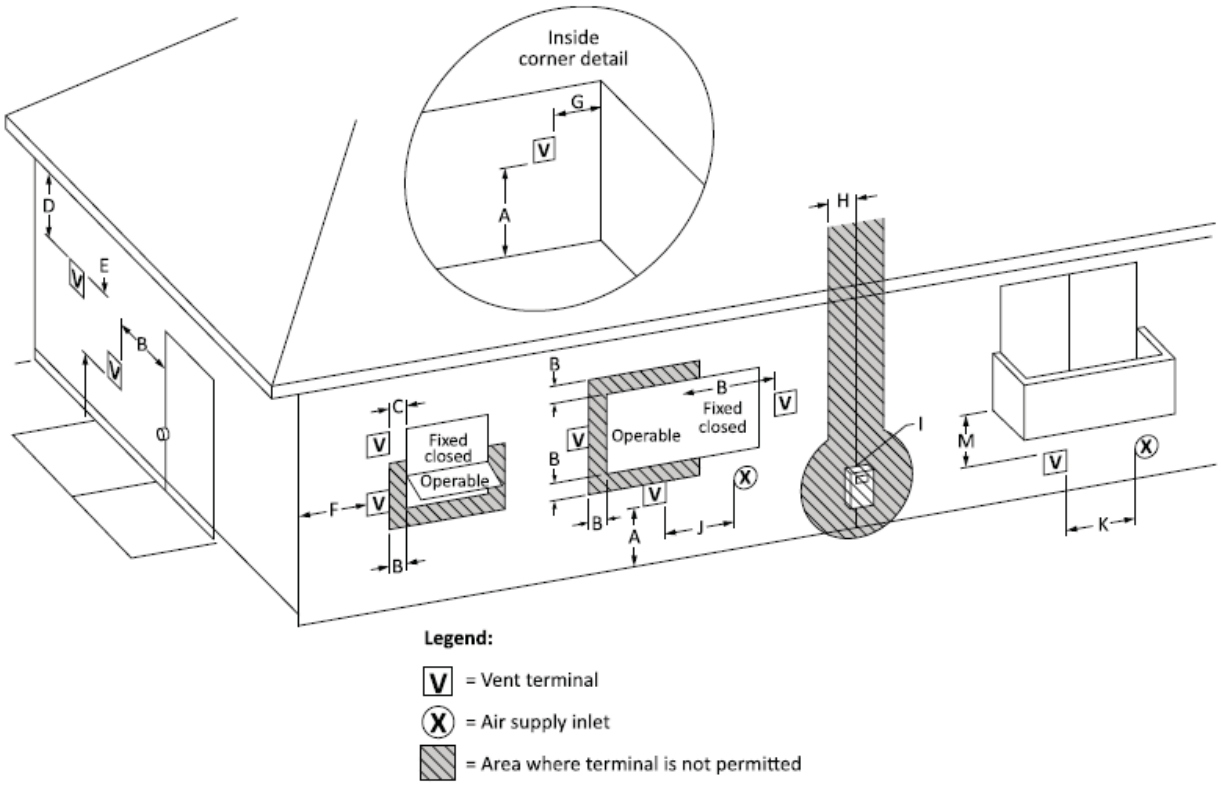
‡ Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath he oor.

NOTES:

1) In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code

2) In accordance with the current ANSI Z223.1/NFPA 54, National Fuel Gas Code

***Figure 3-3B** Other than Direct Vent Terminal Clearances*



3 Sidewall direct venting *(continued)*

***Table 3C** Other than Direct Vent Terminal Clearances*

		Canadian Installations[1]	US Installations[2]
A =	Clearance above grade, veranda, porch, deck, or balcony	12 in (30 cm)	12 in (30 cm)
B =	Clearance to window or door that may be opened	6 in (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 12 in (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36 in (91 cm) for appliances > 100,000 Btuh (30 kW)	4 ft (1.2 m) below or to side of opening; 1 ft (300 mm) above opening
C =	Clearance to permanently closed window	*	*
D =	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 ft (61 cm) from the center line of the terminal.	*	*
E =	Clearance to unventilated soffit	*	*
F =	Clearance to outside corner	*	*
G =	Clearance to inside corner	*	*
H =	Clearance to each side of center line extended above meter / regulator assembly	*	*
I =	Clearance to service regulator vent outlet	Above a regulator within 3 ft (91 cm) horizontally of the vertical center line of the regulator vent outlet to a maximum vertical distance of 15 ft (4.5 m)	*
J =	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	6 in (15 cm) for appliances ≤ 10,000 Btuh (3kW), 12 in (30 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 100,000 Btuh (30 kW), 36 in (91 cm) for appliances > 100,000 Btuh (30 kW)	4 ft (1.2 m) below or to side of opening; 1 ft (300 mm) above opening
K =	Clearance to a mechanical air supply inlet	6 ft (1.83 m)	3 ft (91 cm) above if within 10 ft (3 m) horizontally
L =	Clearance above paved sidewalk or paved driveway located on public property	7 ft (2.13 m)†	7 ft (2.13 m)
M =	Clearance under veranda, porch, deck, or balcony	12 in (30 cm)‡	*

* Clearance in accordance with local installation codes and the requirements of the gas supplier.

† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

‡ Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath he oor.

NOTES:

1) In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code

2) In accordance with the current ANSI Z223.1/NFPA 54, National Fuel Gas Code

3 Sidewall direct venting

Prepare wall penetrations

1. Use the factory supplied wall plate as a template to locate the vent and air intake holes and mounting holes.
   Air pipe penetration:
   a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
   Vent pipe penetration:
   a. Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole with at least a 1/2 inch clearance around the vent pipe outer diameter:
      • 4½ inch hole for 3 inch vent pipe
      • 5½ inch hole for 4 inch vent pipe
   Drill 3/16" diameter holes for inserting the plastic anchors into the wall.
2. For Polypropylene Only: Install the vent and air intake sidewall adapters from Table 2F on page 21 into the vent plate. Slide the sidewall retaining bracket down the sidewall adapters flush to the vent plate (FIG. 3-4B).
3. For PVC/CPVC Only: Install the vent and air intake piping through the wall into the vent plate openings. Use RTV silicone sealant to seal the air pipe. Use the cement/primer listed in Table 2D on page 20 to seal the vent pipe.
4. Mount and secure the vent plate to the wall, using stainless steel screws.
5. Seal all gaps between the pipes and wall. Seal around the plate to the wall assuring no air gaps.
6. Assemble the vent cap to the vent plate (see FIG.'s 3-4A and 3-4B). Insert the stainless steel screws into the vent cap screw hole openings and securely attach the vent cap to the vent plate.
7. Seal all wall cavities.
8. PVC/CPVC terminations are designed to accommodate any wall thickness of standard constructions per the directions found in this manual.
9. Stainless steel terminations are designed to penetrate walls with a thickness up to 9.25 inches of standard construction.

Figure 3-4A *PVC/CPVC Sidewall Termination Assembly*

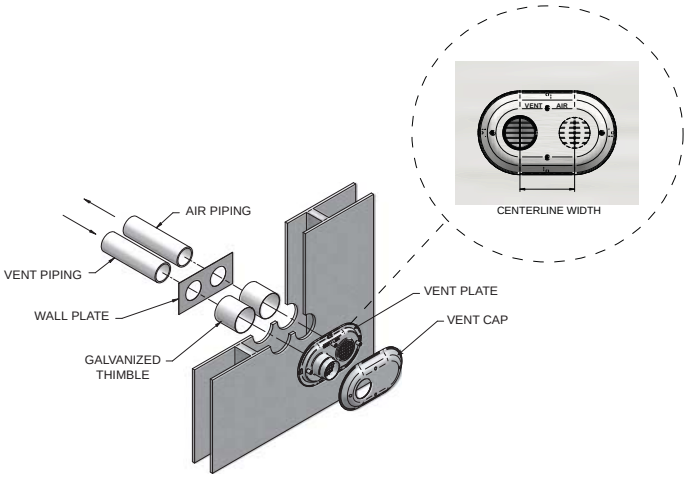
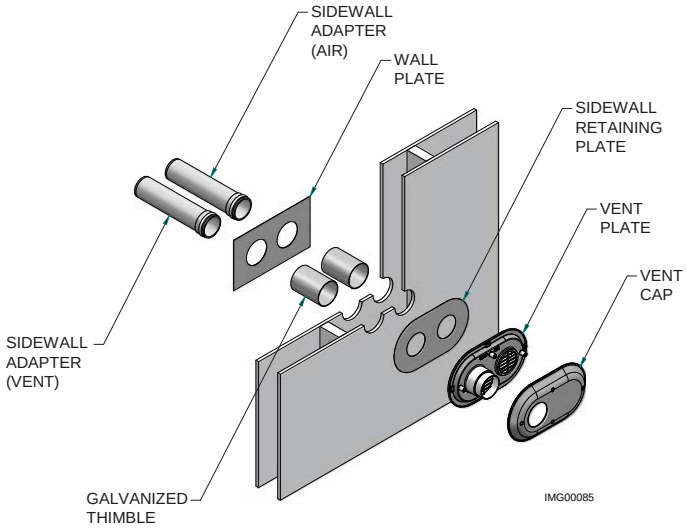


Table 3D *Sidewall Vent Centerline Dimensions*

Model	Air	Vent	Centerline Width
126-065 -- 201-100	3"	3"	5 5/8"
286-125 -- 501-125	4"	4"	5 5/8"

Figure 3-4B *Polypropylene Sidewall Termination Assembly*

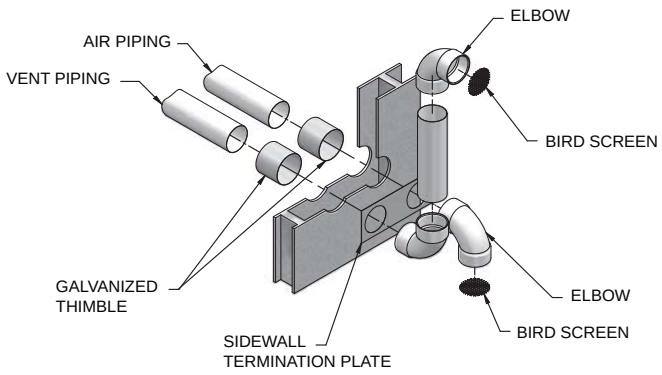


3 Sidewall direct venting *(continued)*

Prepare wall penetrations (Alternate - Field Supplied Option)

1. Air pipe penetration:
   a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
2. Vent pipe penetration:
   a. Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole with at least a 1/2 inch clearance around the vent pipe outer diameter:
      • 4½ inch hole for 3 inch vent pipe
      • 5½ inch hole for 4 inch vent pipe
   b. Insert a galvanized metal thimble in the vent pipe hole as shown in FIG. 3-4C.
3. Use a sidewall termination plate as a template for correct location of hole centers.
4. Follow all local codes for isolation of vent pipe when passing through floors or walls.
5. Seal exterior openings thoroughly with exterior caulk.

***Figure 3-4C** Alternate Sidewall Termination Assembly w/Field Supplied Fittings*



Multiple vent/air terminations

1. When terminating multiple Shield water heaters terminate each vent/air connection as described in this manual (FIG. 3-5A).

⚠ WARNING All vent pipes and air inlets must terminate at the same height to avoid possibility of severe personal injury, death, or substantial property damage.

2. Place wall penetrations to obtain minimum clearance of 12 inches between edge of air inlet and adjacent vent outlet, as shown in FIG. 3-5A for U.S. installations. For Canadian installations, provide clearances required by CSA B149.1 Installation Code.
3. The air inlet of a Shield water heater is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent water heater vents.

***Figure 3-5A** Multiple Vent Terminations (must also comply with **Figure 3-1A**)*

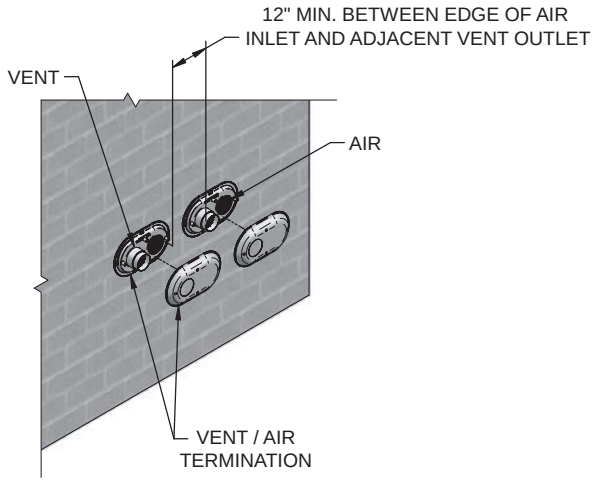
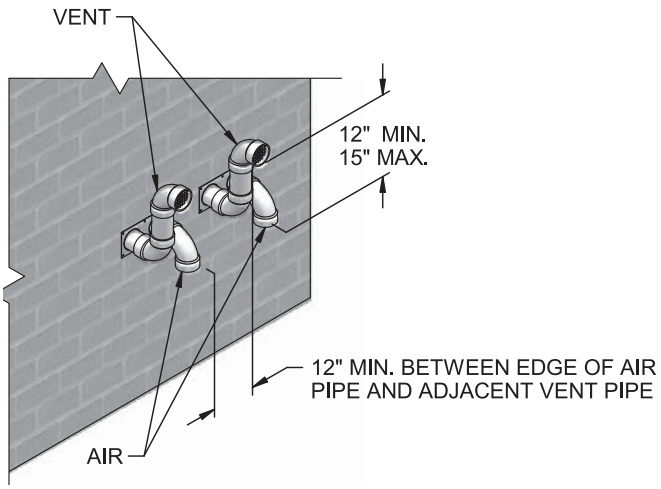


***Figure 3-5B** Alternate Multiple Vent Terminations w/Field Supplied Fittings (must also comply with **Figure 3-1B**)*



3 Sidewall direct venting

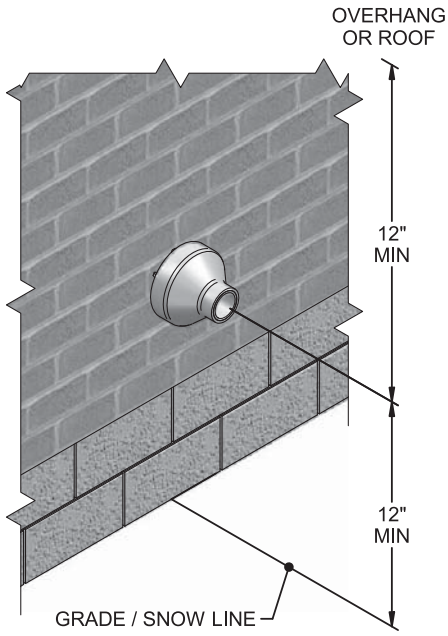
Sidewall termination – optional concentric vent

Description and usage

Lochinvar offers optional concentric combustion air and vent pipe termination kits (Factory Kit #100140480 for 3" diameter - Models 126-065 - 201-100 and #100140484 for 4" diameter - Models 286-125 - 501-125). Both combustion air and vent pipes must attach to the termination kit. The termination kits must terminate outside the structure and must be installed as shown in FIG. 3-6.

The required combustion vent pipe materials are listed in Table 2D, on page 20 of this manual.

Figure 3-6 *Concentric Sidewall Termination*



Sidewall termination installation

1. Determine the best location for the termination kit (see FIG. 4-6).

2. Reference the *Determine Location Section* on page 23 of this manual for general termination considerations.

3. Cut one (1) hole (5 inch diameter for #100140480 installations or 7 inch diameter for #100140484 installations) into the structure to install the termination kit.

4. Partially assemble the concentric vent termination kit. Clean and cement using the procedures found in these instructions.

   a. Cement the Y concentric fitting to the larger kit pipe (FIG.'s 3-7 and 3-8).
   b. Cement the rain cap to the smaller diameter kit pipe (FIG.'s 3-7 and 3-8).

Figure 3-7 *Kit Contents_100140480 - 126-065 -- 201-100*

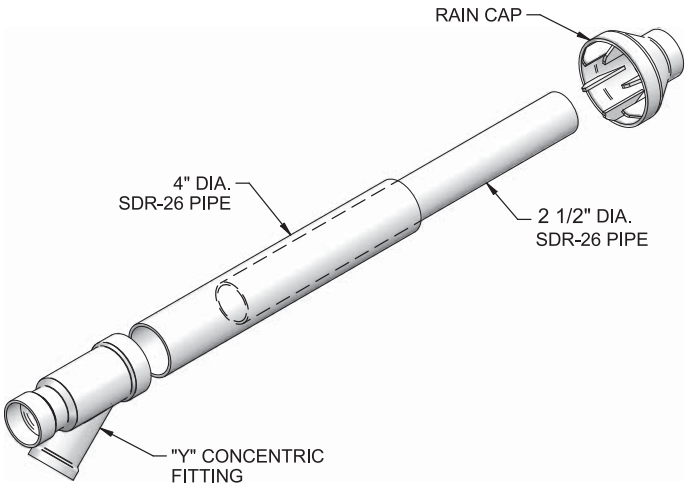
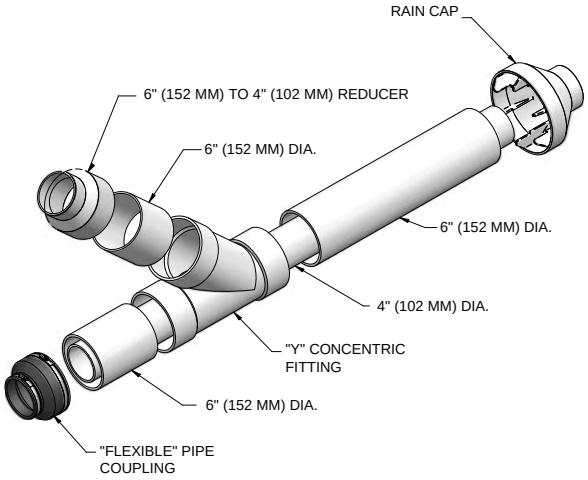


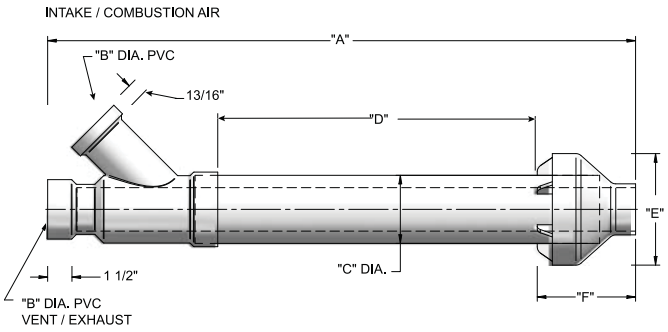
Figure 3-8 *Kit Contents_100140484 - 286-125 -- 501-125*



3 Sidewall direct venting *(continued)*

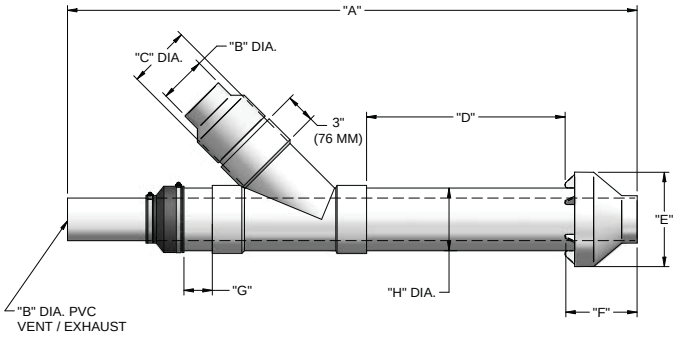
Sidewall termination – optional concentric vent

Figure 3-9 *Concentric Vent Dimensional Drawing - Models 126-065 -- 201-100 / 100140480*



A	B	C	D*	E	F
38 7/8"	3"	4 1/2"	21 1/8"	7 3/8"	6 1/2"

Figure 3-10 *Concentric Vent Dimensional Drawing - Models 286-125 -- 501-125 / 100140484*



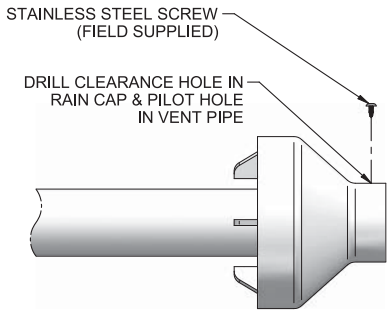
A	B	C	D	E	F	G	H
60"	4"	6"	21 1/8"	10"	7 5/8"	3"	6 5/8"

NOTICE Instead of cementing the smaller pipe to the rain cap, a field-supplied stainless steel screw may be used to secure the two (2) components together when field disassembly is desired for cleaning (see FIG. 3-11).

⚠ WARNING When using the alternate screw assembly method, drill a clearance hole in the rain cap and a pilot hole in the vent pipe for the screw size being used. Failure to drill adequate holes may cause cracking of PVC components, allowing combustion products to be recirculated. Failure to follow this warning could result in personal injury or death.

⚠ WARNING Do not operate the appliance with the rain cap removed or recirculation of combustion products may occur. Water may also collect inside the larger combustion air pipe and flow to the burner enclosure. Failure to follow this warning could result in product damage or improper operation, personal injury, or death.

Figure 3-11 *Rain Cap to Vent Pipe Alternate Assembly*



6. Install the Y concentric fitting and pipe assembly through the structure's hole.

NOTICE Do not allow insulation or other materials to accumulate inside the pipe assembly when installing through the hole.

7. Install the rain cap and small diameter pipe assembly into the Y concentric fitting and large pipe assembly. Ensure small diameter pipe is bottomed and cemented in the Y concentric fitting for #100140480 installations and fastened tightly into the rubber adapter for #100140484 installations.

8. Secure the assembly to the structure as shown in FIG. 3-12 using field-supplied metal strapping or equivalent support material.

NOTICE Ensure termination location clearance dimensions are as shown in FIG. 3-6.

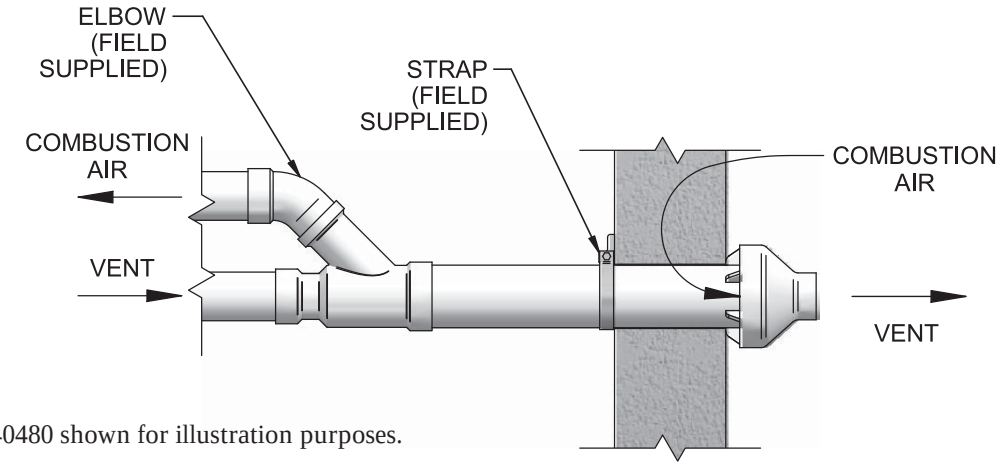
NOTICE If assembly needs to be extended to allow sidewall thickness requirement, the two (2) pipes supplied in the kit may be replaced by using the same diameter, field-supplied SDR-26 PVC (D2241) pipe for 100140480 and standard schedule 40 PVC for 100140484. Do not extend dimension D* more than 60 inches (see FIG.'s 3-9 and 3-10).

NOTICE If assembly depth needs to be reduced, dimension D can be as short as possible.

3 Sidewall direct venting

Sidewall termination – optional concentric vent

Figure 3-12 *Concentric Vent Sidewall Attachment*



Note: 100140480 shown for illustration purposes.

CAUTION DO NOT use field-supplied couplings to extend pipes. Airflow restriction will occur and may cause intermittent operation.

9. Cement appliance combustion air and vent pipes to the concentric vent termination assembly. See FIG. 3-12 for proper pipe attachment.

10. Operate the appliance one (1) heat cycle to ensure combustion air and vent pipes are properly connected to the concentric vent termination connections.

Multiventing sidewall terminations

When two (2) or more direct vent appliances are vented near each other, each appliance must be individually vented (see FIG. 3-13). NEVER common vent or breach vent this appliance. When two (2) or more direct vent appliances are vented near each other, two (2) vent terminations may be installed as shown in FIG. 3-13. It is important that vent terminations be made as shown to avoid recirculation of flue gases.

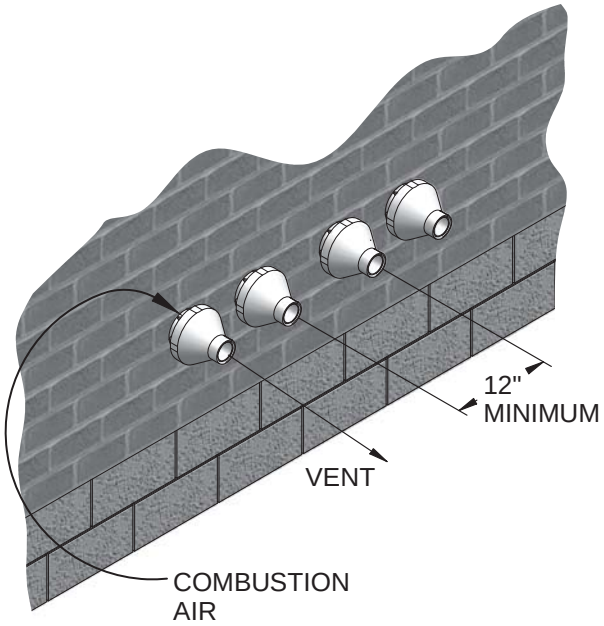


Figure 3-13 *Concentric Vent and Combustion Air Termination*

4 Vertical direct venting

Vent/air termination – vertical

⚠ WARNING Follow instructions below when determining vent location to avoid possibility of severe personal injury, death or substantial property damage.

Determine location

Locate the vent/air terminations using the following guidelines:

1. The total length of piping for vent or air must not exceed the limits given in the General Venting Section on page 17 of this manual.
2. Prepare the vent termination and the air termination elbow (FIG. 4-1A) by inserting bird screens. Bird screens should be obtained locally.
3. The vent must terminate at least 3 feet above the highest place in which the vent penetrates the roof and at least 2 feet above any part of a building within 10 horizontal feet.
4. The air piping must terminate in a down-turned 180° return pipe no further than 2 feet from the center of the vent pipe. This placement avoids recirculation of flue products into the combustion air stream.
5. The vent piping must terminate in an up-turned coupling as shown in FIG. 4-1A. The top of the coupling must be at least 1 foot above the air intake. When the vent termination uses a rain cap as illustrated in FIG. 4-1B maintain at least 36" (914 mm) above the air inlet. The air inlet pipe and vent pipe can be located in any desired position on the roof, but must always be no further than 2 feet (.6 m) apart and with the vent termination at least 1 foot for PVC and 3 feet for stainless steel, above the air intake.
6. Maintain the required dimensions of the finished termination piping as shown in FIG. 4-1A.
7. Do not extend exposed vent pipe outside of building more than shown in this document. Condensate could freeze and block vent pipe.

⚠ WARNING Rooftop vent and air inlet terminations must terminate in the same pressure zone, unless vertical vent sidewall air is set up as shown in the General Venting - Vertical Vent, Sidewall Air Section.

Figure 4-1A *Vertical Termination of Air and Vent*

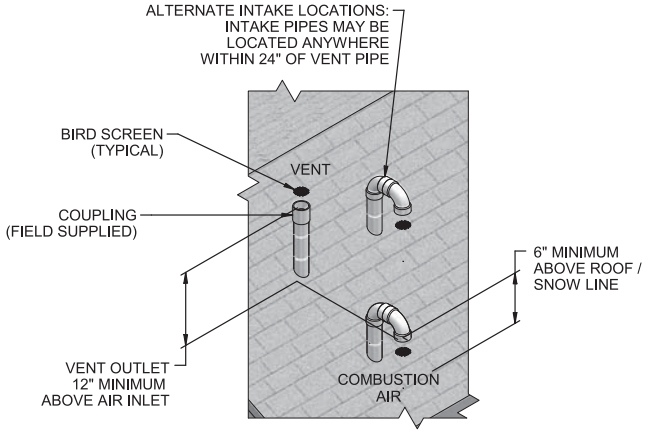
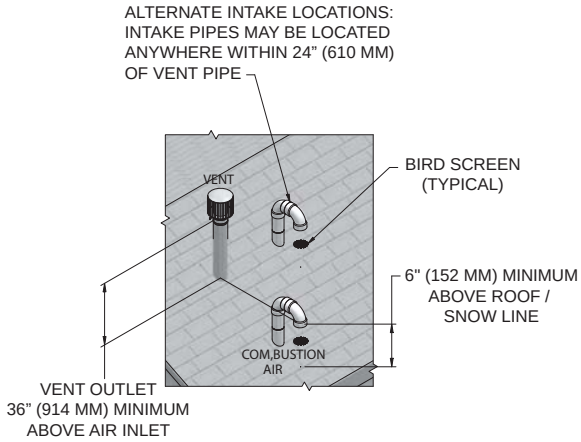


Figure 4-1B *Stainless Steel Vertical Termination of Air and Vent*



8. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

4 Vertical direct venting

Vent/air termination – vertical

Prepare roof penetrations

1. Air pipe penetration:
   a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
2. Vent pipe penetration:
   a. Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole with at least a 1/2 inch clearance around the vent pipe outer diameter:
      • 4½ inch hole for 3 inch vent pipe
      • 5½ inch hole for 4 inch vent pipe
   b. Insert a galvanized metal thimble in the vent pipe hole.
3. Space the air and vent holes to provide the minimum spacing shown in FIG. 4-1A, page 33.
4. Follow all local codes for isolation of vent pipe when passing through floors, ceilings, and roofs.
5. Provide flashing and sealing boots sized for the vent pipe and air pipe.

Multiple vent/air terminations

1. When terminating multiple Shield water heaters, terminate each vent/air connection as described in this manual (FIG. 4-2).

⚠ WARNING Terminate all vent pipes at the same height and all air pipes at the same height to avoid possibility of severe personal injury, death, or substantial property damage.

2. Place roof penetrations to obtain minimum clearance of 12 inches between edge of air intake elbow and adjacent vent pipe of another water heater for U.S. installations (see FIG. 4-2). For Canadian installations, provide clearances required by CSA B149.1 Installation Code.
3. The air inlet of a Shield water heater is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent water heater vents.

Figure 4-2 *Vertical Terminations with Multiple Water Heaters*

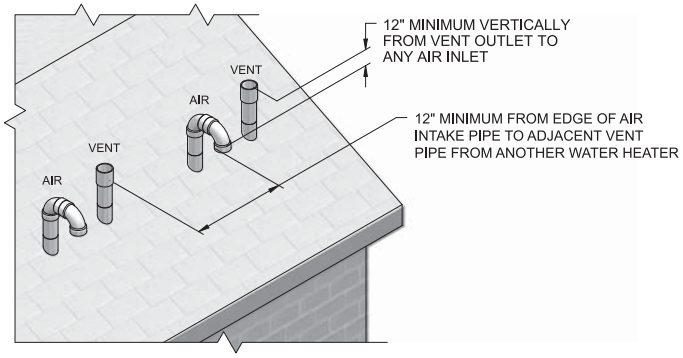
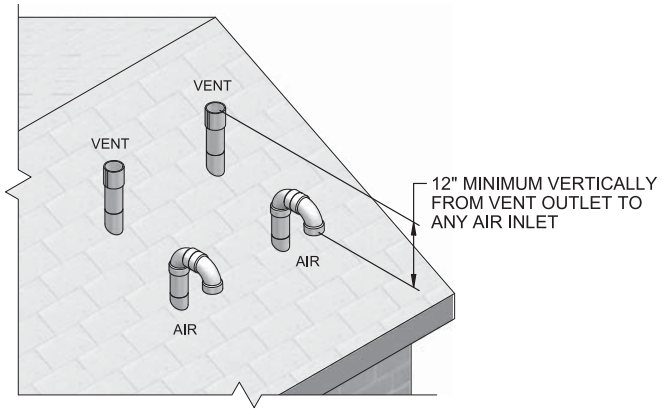


Figure 4-3 *Alternate Vertical Terminations with Multiple Water Heaters*



4 Vertical direct venting *(continued)*

Vertical termination – optional concentric vent

Description and usage

Lochinvar offers an optional concentric combustion air and vent pipe termination kit. Both combustion air and vent pipes must attach to the termination kit. The termination kit must terminate outside the structure and must be installed as shown in FIG. 4-4.

Field supplied pipe and fittings are required to complete the installation.

The required combustion air and vent pipe fittings are listed in Table 2D, on page 20 of this manual.

Vertical termination installation

1. See Section 4, Vertical Direct Venting - Determine Location (where applicable).
2. Cut one (1) hole (5 inch diameter for #100140480 installations or 7 inch diameter for #100140484 installations) into the structure to install the termination kit.
3. Partially assemble the concentric vent termination kit. Clean and cement following the cleaning procedures in these instructions.
   a. Cement the Y concentric fitting to the larger diameter kit pipe (see FIG.'s 3-7 and 3-8, page 30).
   b. Cement rain cap to the smaller diameter kit pipe (see FIG.'s 3-7 and 3-8, page 30).
   c. Do not attach a U-Bent to the rain cap. Doing so could cause recirculation (see FIG. 4-5).

Figure 4-4 *Concentric Vertical Termination*

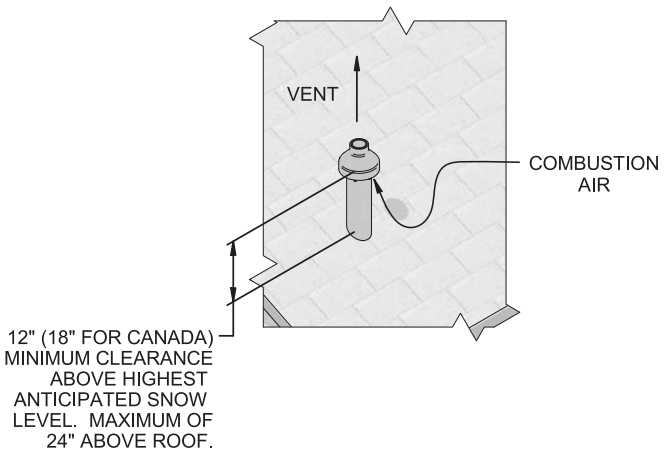


Figure 4-5 *Do Not Install U-Bent to Rain Cap*



NOTICE Instead of cementing the smaller pipe to the rain cap, a field supplied stainless steel screw may be used to secure the two (2) components together when field disassembly is desired for cleaning (see FIG. 3-11, page 31).

⚠ WARNING When using the alternate screw assembly method, drill a clearance hole in the rain cap and a pilot hole in the vent pipe for the screw size being used. Failure to drill adequate holes may cause cracking of PVC components, allowing combustion products to be recirculated. Failure to follow this warning could result in personal injury or death.

4 Vertical direct venting

Vertical termination – optional concentric vent

⚠ WARNING Do not operate the appliance with the rain cap removed or recirculation of combustion products may occur. Water may also collect inside the larger combustion air pipe and flow to the burner enclosure. Failure to follow this warning could result in product damage or improper operation, personal injury, or death.

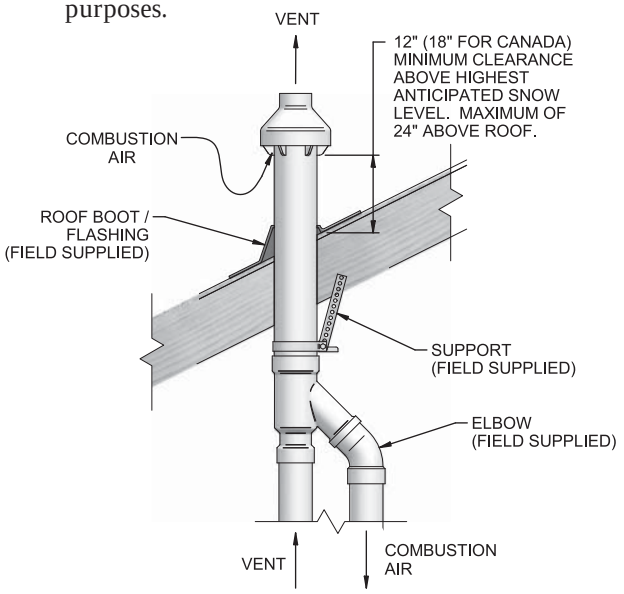
4. Install the Y concentric fitting pipe assembly up through the structure's hole and field supplied roof boot/flashing.

NOTICE Do not allow insulation or other materials to accumulate inside the pipe assembly when installing through the hole.

5. Secure the assembly to the roof structure as shown below in FIG. 4-6 using field supplied metal strapping or equivalent support material.

Figure 4-6 *Concentric Vent Roof Installation*

Note: 100140480 shown for illustration purposes.



NOTICE Ensure termination height is above the roof surface or anticipated snow level (12 inches in U.S.A. or 18 inches in Canada) as shown in FIG. 4-4, page 35.

NOTICE If assembly is too short to meet height requirement, the two (2) pipes supplied in the kit may be replaced by using the same diameter, field supplied SDR-26 PVC (D2241) pipe for #100140480 and standard schedule 40 PVC for #100140484. Do not extend dimension D* more than 60 inches (see FIG.'s 3-9 and 3-10, page 31).

CAUTION DO NOT use field-supplied couplings to extend pipes. Airflow restriction will occur.

6. Install the rain cap and the small diameter pipe assembly into the roof penetration assembly. Ensure the small diameter pipe is cemented and bottomed in the Y concentric fitting for #100140480 installations and fastened tightly into the rubber adapter for #100140484 installations.

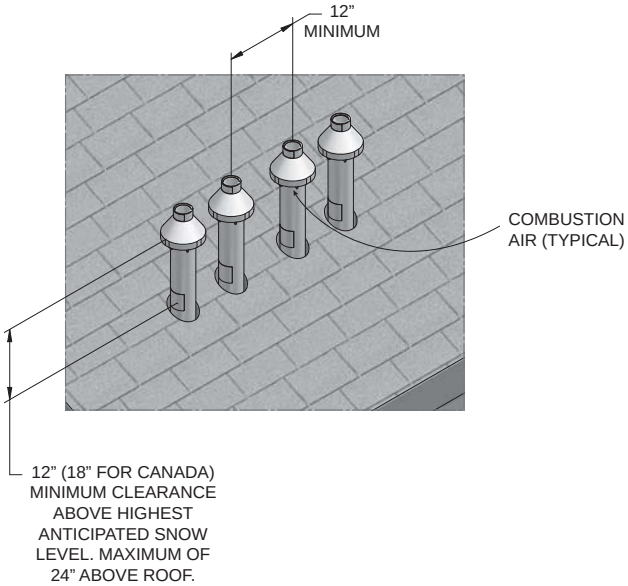
7. Cement the appliance combustion air and vent pipes to the concentric vent termination assembly. See FIG. 4-6 for proper pipe attachment.

8. Operate the appliance through one (1) heat cycle to ensure combustion air and vent pipes are properly connected to the concentric vent termination connections.

Multiventing vertical terminations

When two (2) or more direct vent appliances are vented near each other, each appliance must be individually vented (see FIG. 4-7). NEVER common vent or breach vent this appliance. When two (2) or more direct vent appliances are vented near each other, two (2) vent terminations may be installed as shown in FIG. 4-7. It is important that vent terminations be made as shown to avoid recirculation of flue gases.

Figure 4-7 *Concentric Vent and Combustion Air Vertical Termination*



5 System piping

System water piping methods

Observe a minimum of one inch clearance around all un-insulated hot water pipes when openings around the pipes are not protected by non-combustible materials.

⚠ WARNING Failure to install and maintain a new, listed temperature and pressure relief valve will release the manufacturer from any claim, which might result from excessive temperature and pressures.

Keep clear of the combination temperature and pressure relief valve discharge line outlet. The discharge may be hot enough to cause scald injury. The water is under pressure and may splash.

Hydrogen gas can be produced in an operating water heater that has not had water drawn from the tank for a long period of time (generally two weeks or more). HYDROGEN GAS IS EXTREMELY FLAMMABLE. To prevent the possibility of injury under these conditions, we recommend the hot water faucet to be open for several minutes at the kitchen sink before you use any electrical appliance, which is connected to the hot water system. If hydrogen is present, there will be an unusual sound such as air escaping through the pipes as hot water begins to flow. Do not smoke or have an open flame near the faucet at the time it is open.

General piping information

Basic steps are listed below along with illustrations on the following pages (FIG.'s 5-2 thru 5-4), which will guide you through the installation of the Shield water heater.

1. BEFORE PROCEEDING WITH THE INSTALLATION, CLOSE THE MAIN WATER SUPPLY VALVE. After shutting off the main water supply, open a faucet to relieve the water line pressure to prevent any water from leaking out of the pipes while making the water connections to the water heater. The COLD water inlet and HOT water outlet are identified on the water heater. Make the proper plumbing connections between the water heater and the plumbing system to the building. Install a shutoff valve in the cold water supply line.
2. If this water heater is installed in a closed water supply system, such as the one having a backflow preventer in the cold water supply, provisions must be made to control thermal expansion. DO NOT operate this water heater in a closed system without provisions for controlling thermal expansion. Warranties do not cover damages from thermal expansion such as pressure bulges and/or deformities. Your water supplier or local plumbing inspector should be contacted on how to control this situation.
3. After installation of the water lines, open the main water supply valve and fill the water heater. While the water heater is filling, open several hot water faucets to allow air to escape from the water system. When a steady stream of water flows through the faucets, close them and check all water connections for possible leaks.
4. Never operate the water heater without first being certain it is filled with water.

Scalding

This water heater can deliver scalding temperature water at any faucet in the system. Be careful whenever using hot water to avoid scalding injury. Certain appliances such as dishwashers and automatic clothes washers may require increased temperature water. By setting the thermostat on this water heater to obtain the increased temperature water required by these appliances, you may create the potential for scald injury. To protect against injury, you should install an ASSE approved mixing valve in the water system. This valve will reduce point of discharge temperature by mixing cold and hot water in branch supply lines. Such valves are available from the local plumbing supplier.

Figure 5-1 *Scald Warning*



Water temperatures over 125°F (52°C) can cause severe burns instantly or death from scalds.
Children, disabled, and elderly are at highest risk of being scalded.

See instruction manual before setting the thermostat at the water heater.

Feel water before bathing or showering.

Temperature limiting valves are available, consult local plumbing supplier.

5 System piping

The following chart (Table 5A) details the relationship of water temperature and time with regard to scald injury and may be used as a guide in determining the safest water temperature for your applications.

***Table 5A** Approximate Time / Temperature Scald Chart*

APPROXIMATE TIME / TEMPERATURE RELATIONSHIPS IN SCALDS	
120°F	More than 5 minutes
125°F	1 1/2 to 2 minutes
130°F	About 30 seconds
135°F	About 10 seconds
140°F	Less than 5 seconds
145°F	Less than 3 seconds
150°F	About 1 1/2 seconds
155°F	About 1 second

Water chemistry

NOTICE The Shield water heater is designed for heating potable water with a hardness of 5 to 20 grains per gallon and a total dissolved solids not exceeding 350 ppm.

The water must be treated if it is not between 5 to 25 grains per gallon or above 350 ppm of total dissolved solids. Hardness exceeding 25 grains or 350 ppm can cause non-warrantable premature failure of the heat exchanger. Water with a hardness of less than 5 grains per gallon will usually have a pH which can be aggressive and corrosive causing non-warrantable damage to the pump and associated piping. Corrosion due to water chemistry generally shows up first in the hot water system because heated water increases the rate of corrosive chemical reactions.

Piping components

Check valves:

Field supplied. Check valves are recommended for installation as shown in FIG.'s 5-2 thru 5-4.

Water heater isolation valves:

Field supplied. Full port ball valves are required. Failure to use full port ball valves could result in a restricted flow rate through the water heater.

Anti-scald mixing valve:

Field supplied. An anti-scald mixing valve is recommended when storing domestic hot water above 115°F.

Unions:

Field supplied. Recommended for unit serviceability.

Temperature and pressure relief valve:

Factory supplied on water heaters. The temperature and pressure relief valve is sized to ASME specifications.

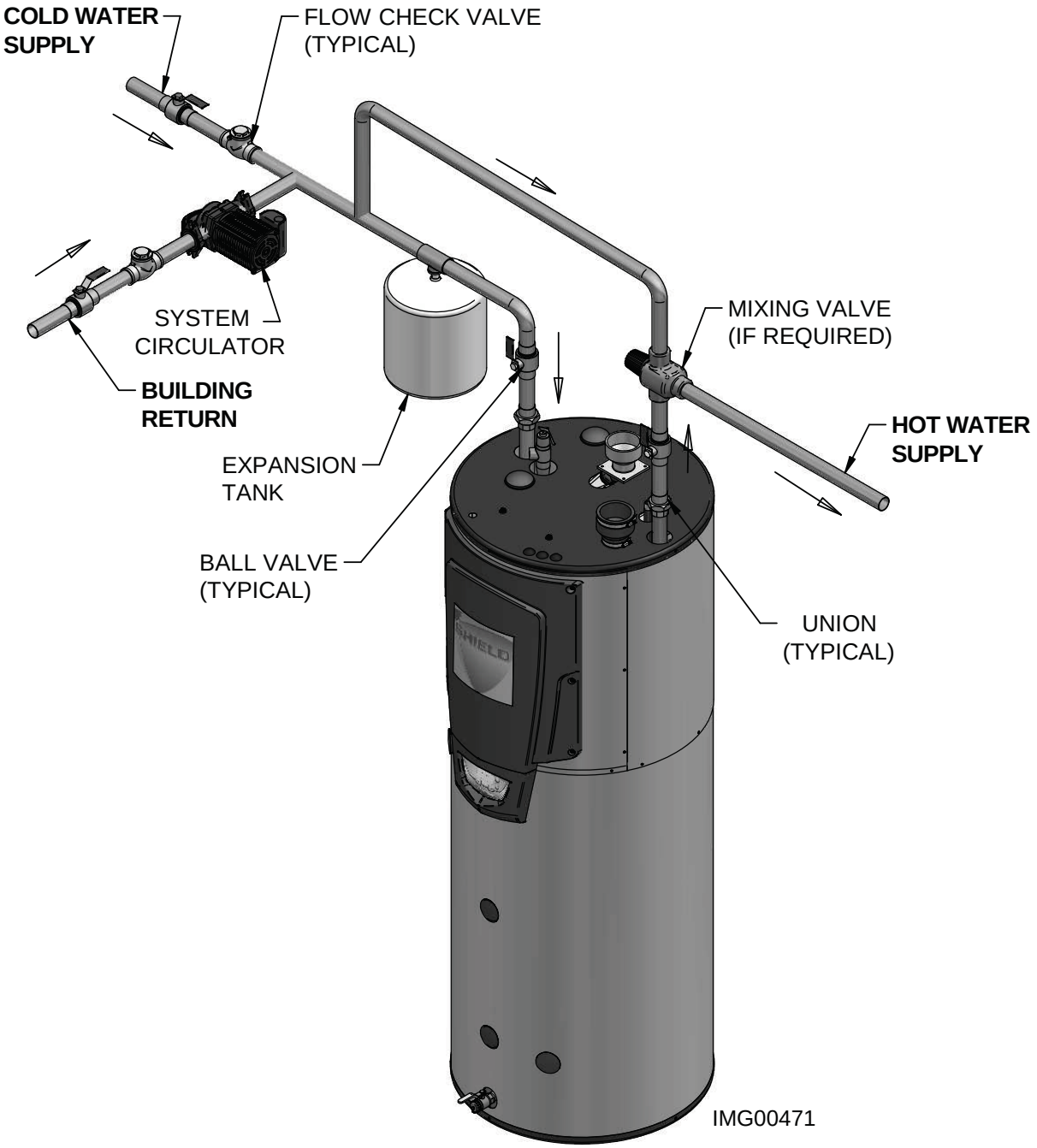
⚠ CAUTION No valves shall be placed between the relief valve, heat exchanger, or tank. The relief valve shall be piped to a suitable drain as close as possible to the heater with no reducing couplings or other restrictions. The piping must be sloping away from the heater at all times.

See the * piping illustrations included in this section, FIG.'s 5-2 thru 5-4 for suggested guidelines in piping the Shield water heater.

NOTICE *Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

5 System piping *(continued)*

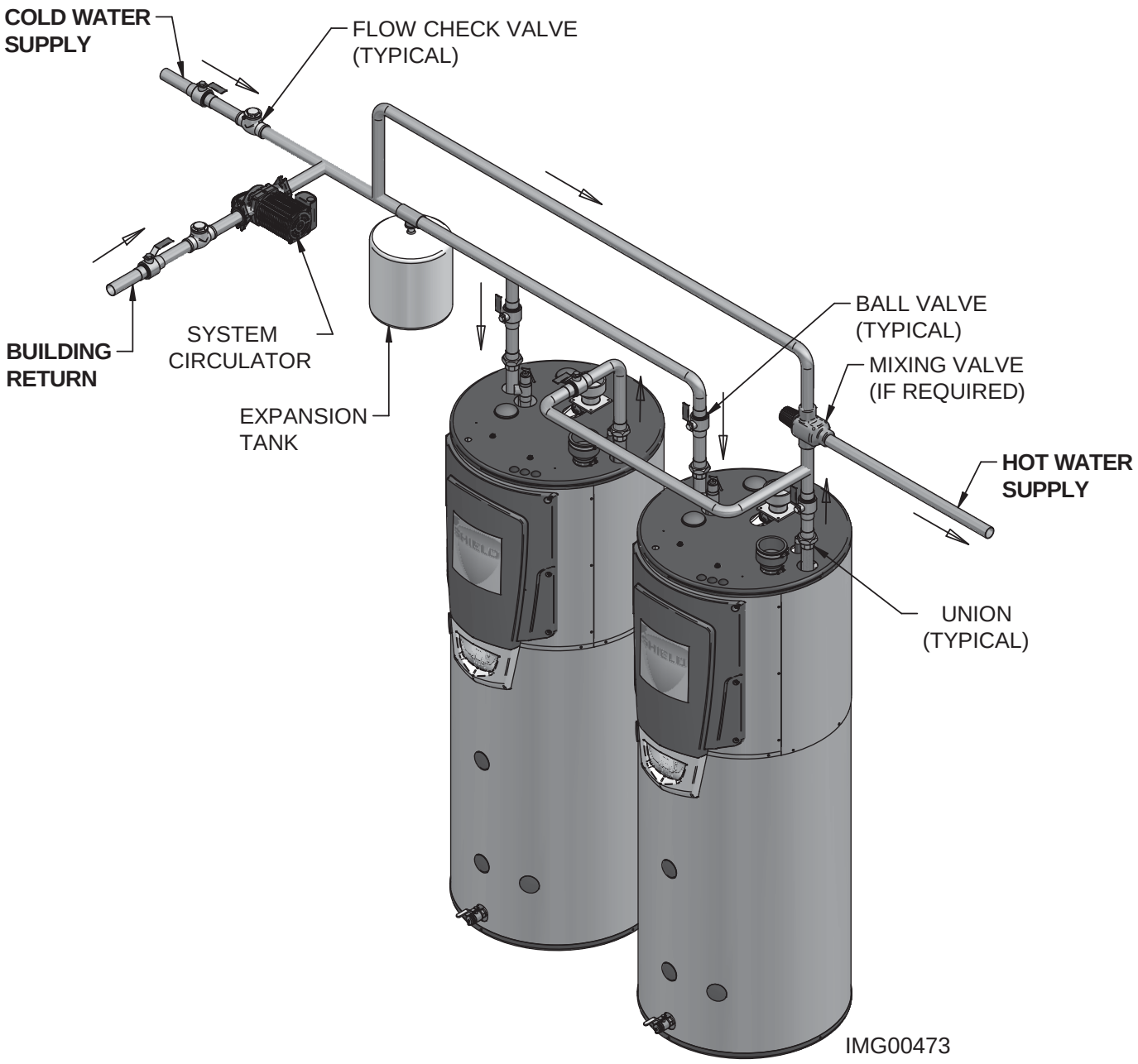
Figure 5-2 *Single Unit*



NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

5 System piping

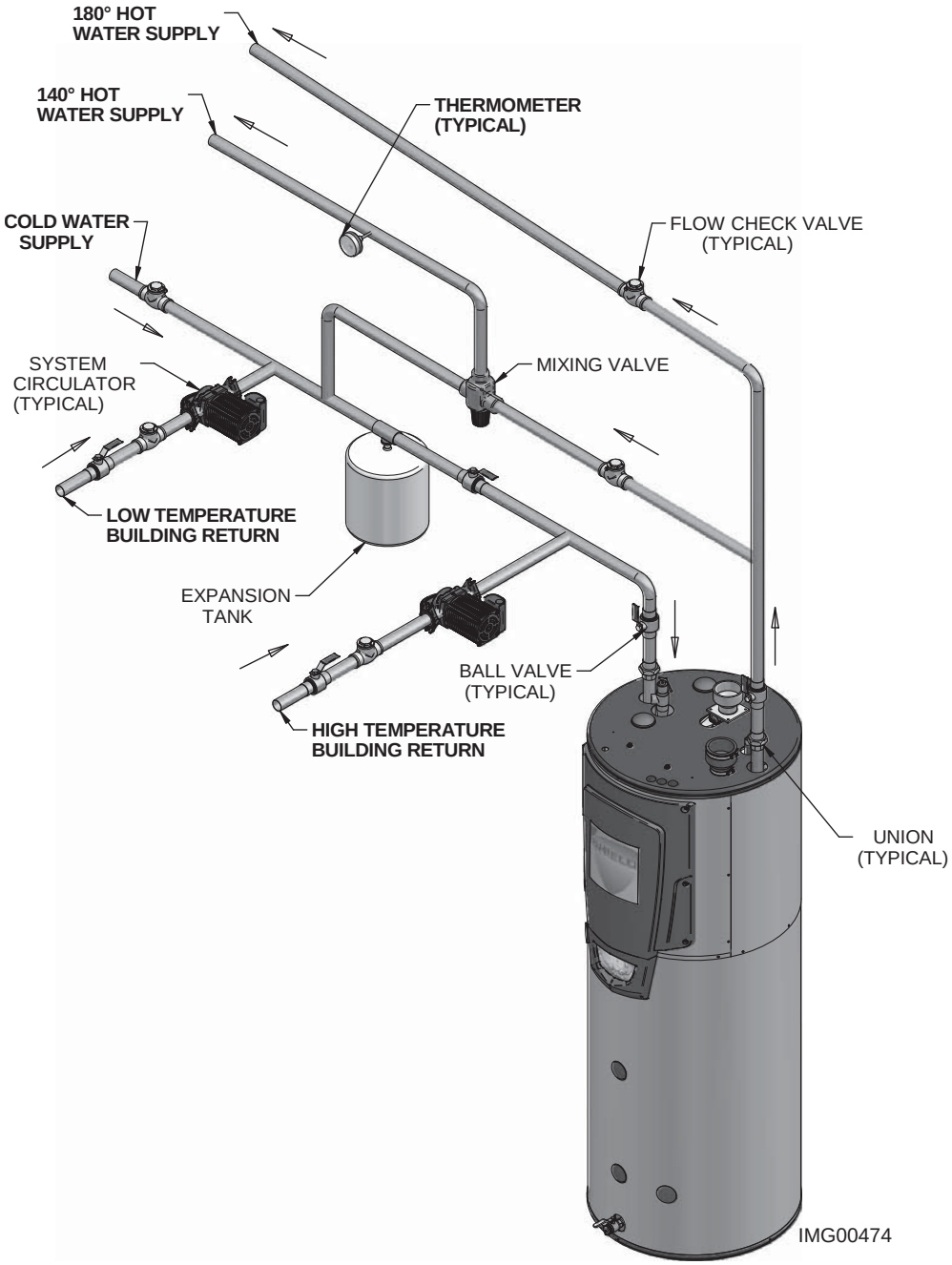
Figure 5-3 *Multiple Units*



NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

5 System piping *(continued)*

Figure 5-4 *Two Temperature - Single Unit*



NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

6 Gas connections

Connecting gas supply piping

1. Install ground joint union for servicing, when required.

2. On Models 126-065 -- 286-125 install a manual shutoff valve in the gas supply piping outside water heater jacket when required by local codes or utility requirements.

3. In Canada – When using manual main shutoff valves, it must be identified by the installer.

Figure 6-1 *Gas Supply Piping - Models 126-065 -- 286-125*

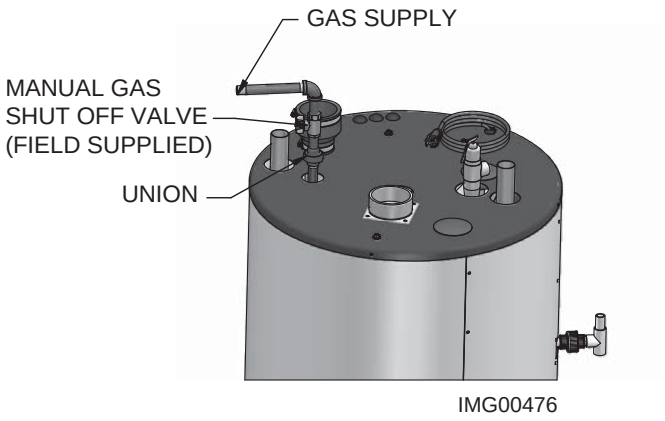
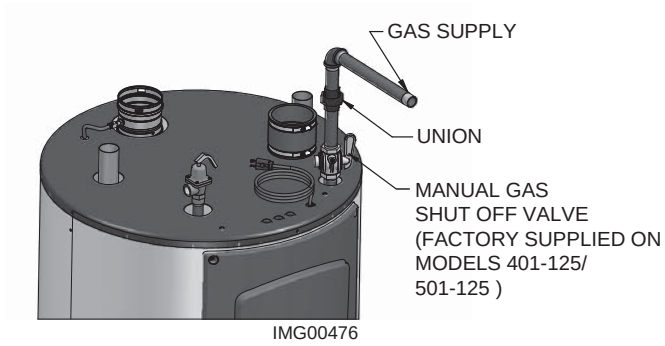


Figure 6-2 *Gas Supply Piping - Models 401-125 -- 501-125*



4. Support piping with hangers, not by the water heater or its accessories.

⚠ WARNING The gas valve and blower will not support the weight of the piping. Do not attempt to support the weight of the piping with the water heater or its accessories. Failure to comply could result in severe personal injury, death, or substantial property damage.

5. Purge all air from the gas supply piping.

6. Before placing the water heater in operation, check the water heater and its gas connection for leaks.

   a. The appliance must be disconnected from the gas supply piping system during any pressure testing of that system at a test pressure in excess of 1/2 PSIG (3.5 kPa).

   b. The appliance must be isolated from the gas supply piping system by closing a manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 PSIG (3.5 kPa).

   c. The appliance and its gas connection must be leak tested before placing it in operation.

⚠ WARNING Do not check for gas leaks with an open flame – use the bubble test. Failure to use the bubble test or check for gas leaks can cause severe personal injury, death, or substantial property damage.

7. Use pipe sealing compound compatible with propane gases. Apply sparingly only to male threads of the pipe joints so that pipe dope does not block gas flow.

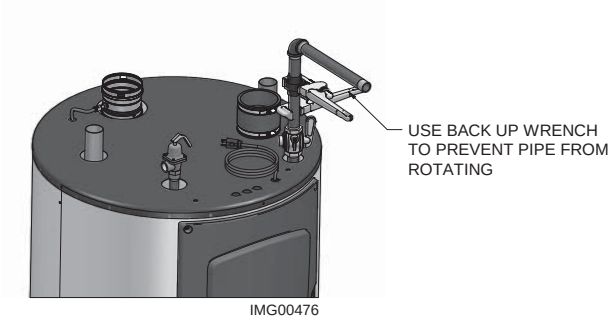
6 Gas connections *(continued)*

⚠ WARNING Failure to apply pipe sealing compound as detailed in this manual can result in severe personal injury, death, or substantial property damage.

⚠ WARNING Shield water heaters are typically shipped ready to fire on natural gas. Check the water heater rating plate to determine which fuel the water heater is set for. In order to operate on LP gas contact the factory, an orifice MUST BE installed or a gas valve adjustment MUST BE made. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ WARNING Use two wrenches when tightening gas piping at water heater (FIG. 6-3), using one wrench to prevent the water heater gas line connection from turning. Failure to support the water heater gas connection pipe to prevent it from turning could damage gas line components.

Figure 6-3 *Inlet Pipe with Backup Wrench*



NOTICE Maximum inlet gas pressure must not exceed the value specified. Minimum value listed is for the purposes of input adjustment.

⚠ WARNING Ensure that the high gas pressure regulator is at least 10 feet upstream of the appliance.

Natural gas:

Pipe sizing for natural gas

1. Refer to Table 6A for pipe length and diameter. Based on rated water heater input (divide by 1,000 to obtain cubic feet per hour).
   a. Table 6A is only for natural gas with specific gravity 0.60 inches, with a pressure drop through the gas piping of 0.30 inches w.c.
   b. For additional gas pipe sizing information, refer to ANSI Z223.1 (or B149.1 for Canadian installations).

Natural gas supply pressure requirements

1. Pressure required at the gas valve inlet pressure port:
   • Maximum 14 inches w.c. with no flow (lockup) or with water heater on.
   • Minimum 4 inches w.c. with gas flowing (verify during water heater startup).

2. Install 100% lockup gas pressure regulator in supply line if inlet pressure can exceed 14 inches w.c. at any time. Adjust lockup regulator for 14 inches w.c. maximum.

Propane gas:

⚠ WARNING Shield water heaters are typically shipped ready to fire on natural gas. Check water heater rating plate to determine which fuel the water heater is set for. In order to operate on LP gas contact the factory, an orifice MUST BE installed or a gas valve adjustment MUST BE made. Failure to comply could result in severe personal injury, death, or substantial property damage.

Pipe sizing for propane gas

1. Contact gas supplier to size pipes, tanks, and 100% lockup gas pressure regulator.

Propane Supply Pressure Requirements

1. Adjust propane supply regulator provided by the gas supplier for 14 inches w.c. maximum pressure.

2. Pressure required at gas valve inlet pressure port:
   • Maximum 14 inches w.c. with no flow (lockup) or with water heater on.
   • Minimum 8 inches w.c. with gas flowing (verify during water heater startup).

6 Gas connections

Table 6A *Natural Gas Pipe Size Chart*

Capacity of Schedule 40 Metallic Pipe in Cubic Feet of Natural Gas Per Hour (based on .60 specific gravity, 0.30" w.c. pressure drop)														
Pipe Size (Inches)	Length of Pipe in Straight Feet													
	10	20	30	40	50	60	70	80	90	100	125	150	175	200
1/2	131	90	72	62	55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3/4	273	188	151	129	114	104	95	89	83	79	70	63	58	N/A
1	514	353	284	243	215	195	179	167	157	148	131	119	109	102
1 1/4	1,060	726	583	499	442	400	368	343	322	304	269	244	224	209
1 1/2	1,580	1,090	873	747	662	600	552	514	482	455	403	366	336	313
2	3,050	2,090	1,680	1,440	1,280	1,160	1,060	989	928	877	777	704	648	602
2 1/2	4,860	3,340	2,680	2,290	2,030	1,840	1,690	1,580	1,480	1,400	1,240	1,120	1,030	960
3	8,580	5,900	4,740	4,050	3,590	3,260	3,000	2,790	2,610	2,470	2,190	1,980	1,820	1,700
4	17,500	12,000	9,660	8,270	7,330	6,640	6,110	5,680	5,330	5,040	4,460	4,050	3,720	3,460

⚠ WARNING Shield water heaters are typically shipped ready to fire on natural gas. Check the water heater rating plate to determine which fuel the water heater is set for. In order to operate on LP gas contact the factory, an orifice MUST BE installed or a gas valve adjustment MUST BE made. Failure to comply could result in severe personal injury, death, or substantial property damage.

Check inlet gas supply

NOTICE CSA or UL listed flexible gas connections are acceptable, but you must exercise caution to ensure that the line has adequate capacity to allow your water heater to fire at full rate. Consult with local codes for proper installation or service procedures.

⚠ WARNING DO NOT attempt to measure gas valve outlet pressure. The gas valve is factory-set for the correct outlet pressure. This setting is suitable for natural gas and propane (when configured for LP), requiring no field adjustment. Attempting to measure the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death, or substantial property damage.

The gas piping must be sized for the proper flow and length of pipe, to avoid excessive pressure drop. Both the gas meter and the gas regulator must be properly sized for the total gas load.

If you experience a pressure drop greater than 1 inch w.c., the meter, regulator, or gas line is undersized or in need of service. Perform the steps below when checking inlet gas supply:

1. Disconnect power from the appliance.
2. Shut off gas to the appliance.
3. Loosen the set screw one (1) full turn from inside the pressure tap on top of the gas valve. Place the tubing of the manometer over the tap once the set screw is loosened as shown in FIG.'s 6-4 thru 6-6.
4. Slowly turn on the gas supply at the field installed manual gas valve.
5. Reconnect power to the appliance.
6. Adjust the temperature set point on the control panel of the electronic control module to call for heat.
7. Observe the gas supply pressure as the burner fires at 100% of rated input. Percent of burner input will be displayed on the control panel.
8. Ensure inlet pressure is within specified range. Minimum and maximum gas supply pressures are specified in this section of the manual.
9. If gas supply pressure is within normal range and no adjustments are needed, proceed on to Step 11.
10. If the gas pressure is out of range, contact the gas utility, gas supplier, qualified installer or service agency to determine the necessary steps to provide proper gas pressure to the control.
11. Disconnect power from the appliance.
12. Shut off the gas to the appliance.
13. Remove the manometer from the pressure tap on top of the gas valve. Re-tighten the set screw inside the pressure tap.

⚠ WARNING When re-tightening the set screw, be sure to tighten securely to prevent gas leaks.

Do not check for gas leaks with an open flame -- use the bubble test. Failure to use the bubble test or check for gas leaks can cause severe personal injury, death, or substantial property damage.

14. Reconnect gas to the appliance.
15. Reconnect power to the appliance.
16. Adjust the temperature set point on the control panel of the electronic control module to the desired water temperature so the appliance will call for heat.

6 Gas connections *(continued)*

17. Check burner performance by cycling the system while you observe burner response. The burner should ignite promptly. Flame pattern should be stable. Turn system off and allow burner to cool, then cycle burner again to ensure proper ignition and flame characteristics.

Figure 6-4 *Inlet Gas Supply Check - Models 126-065 -- 286-125*

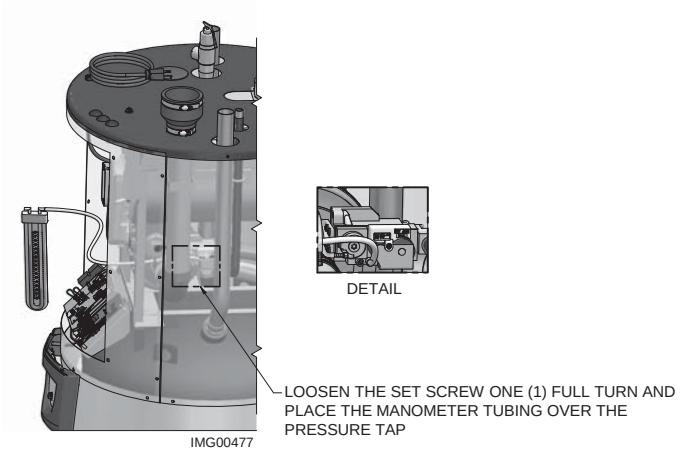


Figure 6-5 *Inlet Gas Supply Check - Model 401-125*

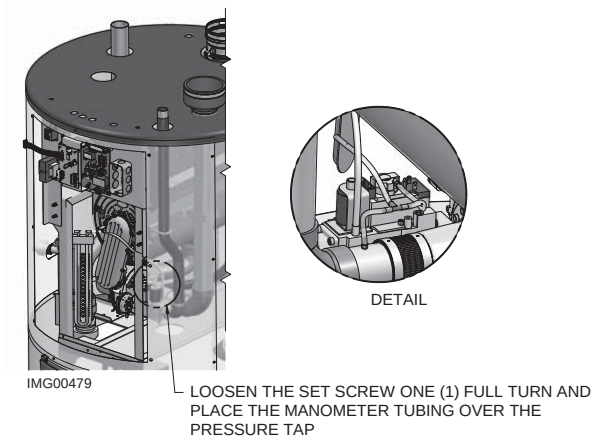
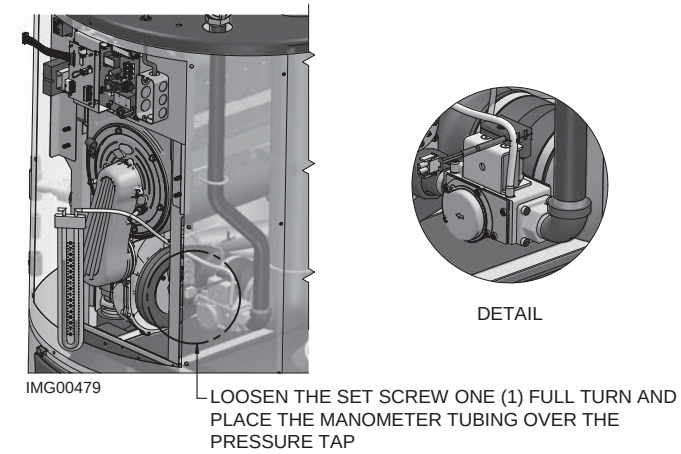


Figure 6-6 *Inlet Gas Supply Check - Model 501-125*



Gas pressure

The gas pressure must remain between 4 inches w.c. (natural), 8 inches w.c. (LP) minimum and 14 inches w.c. (natural and LP) maximum during stand-by (static) mode and while in operating (dynamic) mode. If an in-line regulator is used, it must be a minimum of 10 feet from the Shield water heater. It is very important that the gas line is properly purged by the gas supplier or utility company. Failure to properly purge the lines or improper line sizing, will result in ignition failure.

The problem is especially noticeable in NEW LP installations and also in empty tank situations. This can also occur when a utility company shuts off service to an area to provide maintenance to their lines.

Gas valve replacement

The gas valve MUST NOT be replaced with a conventional gas valve under any circumstances. As an additional safety feature, this gas valve has a flanged connection to the venturi and blower.

⚠ WARNING Failure to follow all precautions could result in fire, explosion, or death!

⚠ WARNING DO NOT attempt to measure gas valve outlet pressure. The gas valve is factory-set for the correct outlet pressure. This setting is suitable for natural gas and propane (when configured for LP), requiring no field adjustment. Attempting to measure the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death, or substantial property damage.

7 Field wiring

⚠ WARNING ELECTRICAL SHOCK HAZARD – For your safety, turn off electrical power supply before making any electrical connections to avoid possible electric shock hazard. Failure to do so can cause severe personal injury or death.

NOTICE Wiring must be N.E.C. Class 1.

If original wiring as supplied with the water heater must be replaced, use only type 105°C wire or equivalent.

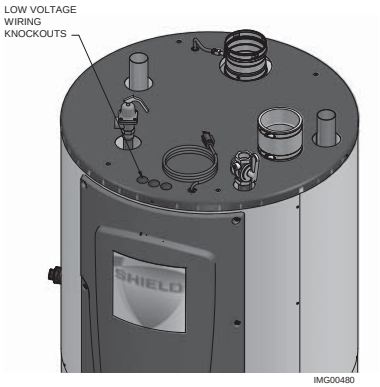
The water heater must be electrically grounded as required by National Electrical Code ANSI/NFPA 70 – latest edition.

⚠ CAUTION Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

Low voltage connections

1. Route all low voltage wires through the knockouts in the top of the water heater, as shown in FIG. 7-1.
2. Connect low voltage wiring to low voltage connection board as shown in FIG. 7-3 on page 47 of this manual and the water heater wiring diagram.

Figure 7-1 *Routing Field Wiring*



Enable switch

An external switch or contact may be used to enable/disable the water heater. To connect the enable switch, remove the jumper wire from across the ENABLE terminals on the low voltage connection board and connect the wires from the switch in its place. Note that the freeze protection feature will still fire the heater even though the enable input is open.

Louver relay output / louver proving switch input

When installed using the optional room air configuration, the heater is able to control powered louvers used to allow outside air into the room. Connect the 24VAC control relay coil to the LOUVER RELAY output on the low voltage connection board. Remove the jumper wire from the LOUVER PROVING SWITCH terminals on the low voltage connection board and connect the louver proving switch wires in its place.

Installation must comply with:

1. National Electrical Code and any other national, state, provincial, or local codes, or regulations.
2. In Canada, CSA C22.1 Canadian Electrical Code Part 1, and any local codes.

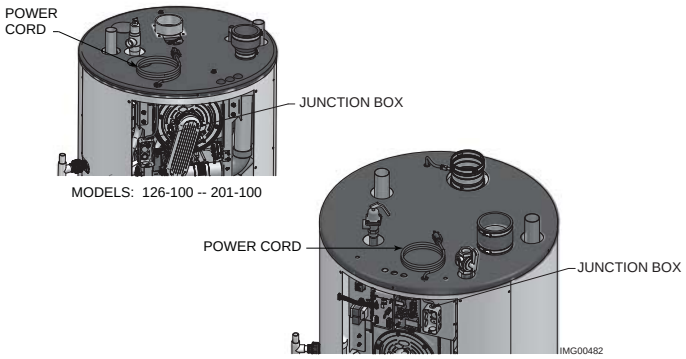
Power cord connection

This water heater is designed to operate with 120 VAC and 60 Hz power supply. If allowed by local codes, connect the power cord provided with the heater to a GFI protected outlet on a separate circuit and breaker (15 amp recommended). Ensure the circuit cannot be interrupted by a switch used to control lights or other appliances.

If local codes do not allow for the use of the power cord, remove the cord from the junction box found on the side of the control support bracket (FIG. 7-2) and attach conduit to the junction box. Route the wires out of the appliance to a GFI protected outlet on a separate circuit and breaker (15 amp recommended).

⚠ WARNING Use of an extension cord is NOT allowed. If a suitable electrical outlet is not within reach of the supplied power cord, a new receptacle must be installed or the power cord must be replaced with hard conduit as described above.

Figure 7-2 *Remove Power Cord*



Runtime contacts

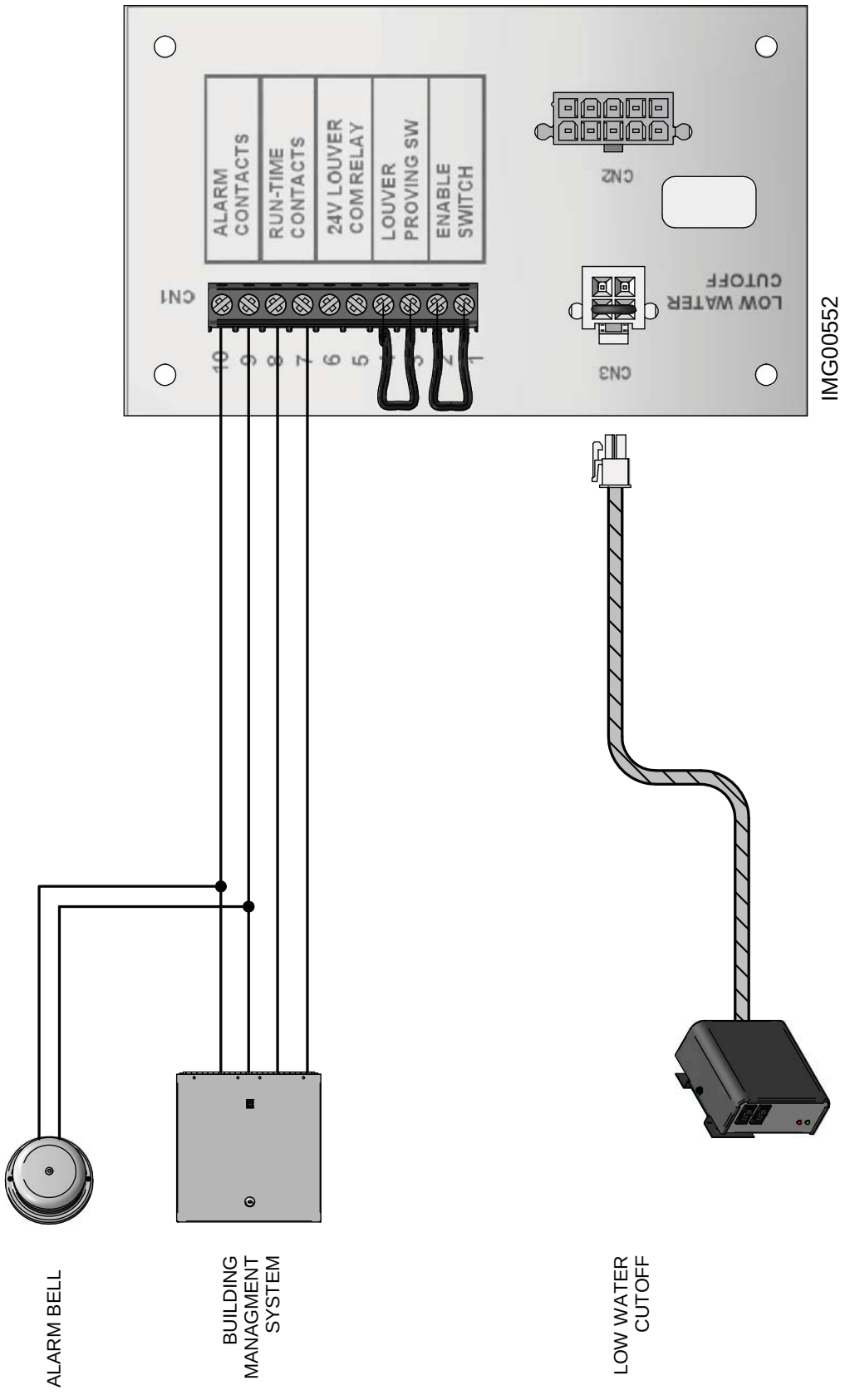
The electronic control closes a set of dry contacts whenever the burner is running. This is typically used by Building Management Systems to verify that the water heater is responding to a call for heat.

Alarm contacts

The electronic control closes another set of contacts whenever the water heater is locked out or the power is turned off. This can be used to turn on an alarm, or signal a Building Management System that the water heater is down. Note that the alarm contacts will close momentarily after each call for heat.

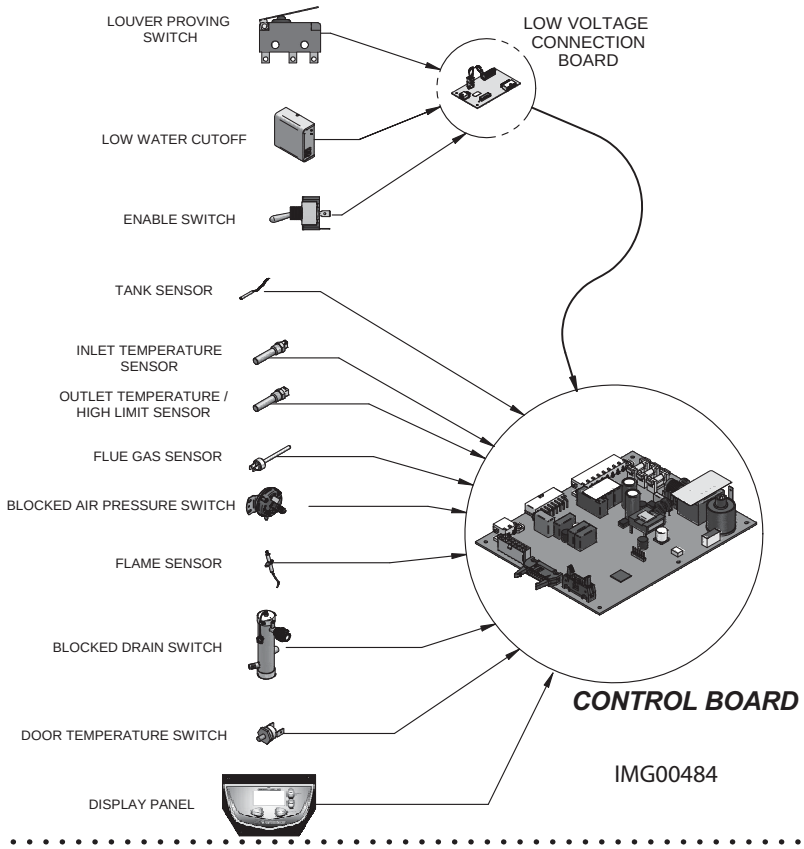
7 Field wiring *(continued)*

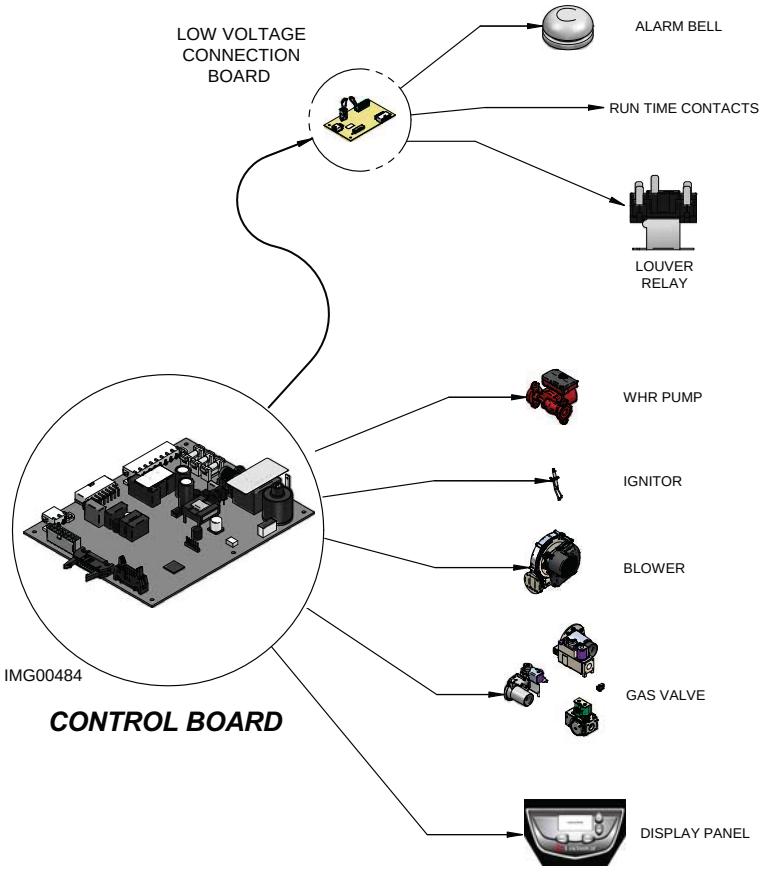
Figure 7-3 *Low Voltage Field Wiring Connections*



7 Field wiring

Figure 7-4 *Control Inputs/Outputs*





8 Condensate disposal

Condensate drain

1. This water heater is a high efficiency appliance that produces condensate.
2. Slope condensate tubing down and away from the water heater into a drain or condensate neutralizing filter. Condensate from the Shield water heater will be slightly acidic (typically with a pH from 3 to 5). Install a neutralizing filter if required by local codes.

   A Neutralizer Kit is available from the factory (100157721).

Note: The Neutralizer Kit MUST BE installed horizontally.

3. Do not expose condensate line to freezing temperatures.

NOTICE

Use materials approved by the authority having jurisdiction. In the absence of other authority, PVC and CPVC pipe must comply with ASTM D1785 or D2845. Cement and primer must comply with ASME D2564 or F493. For Canada use CSA or ULC certified PVC or CPVC pipe, fittings, and cement.

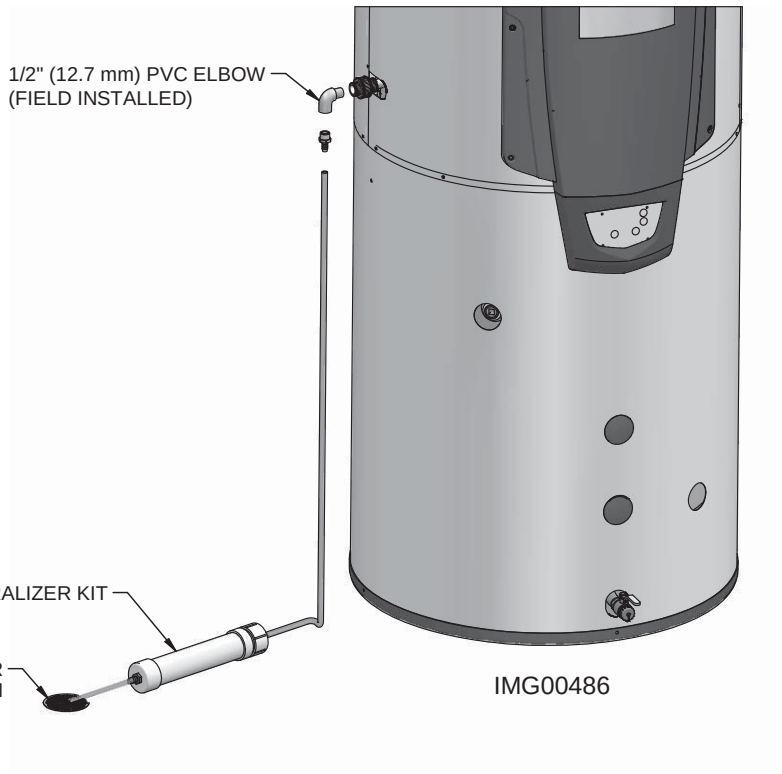
NOTICE

To allow for proper drainage on large horizontal runs, a second line vent may be required and tubing size may need to increase to 1 inch.

The condensate line must remain unobstructed, allowing free flow of condensate. If condensate is allowed to freeze in the line or if the line is obstructed in any other manner, condensate can exit from the water heater condensate trap, resulting in potential water damage to property.

4. A condensate removal pump is required if the water heater is below the drain. When installing a condensate pump, select one approved for use with condensing water heaters and furnaces. The pump should have an overflow switch to prevent property damage from condensate spillage. The switch should be wired to the auxiliary device proving switch terminals on the low voltage connection board.

Figure 8-1 *Condensate Disposal*



9 Start-up

Chlorine concentration less than 200 ppm

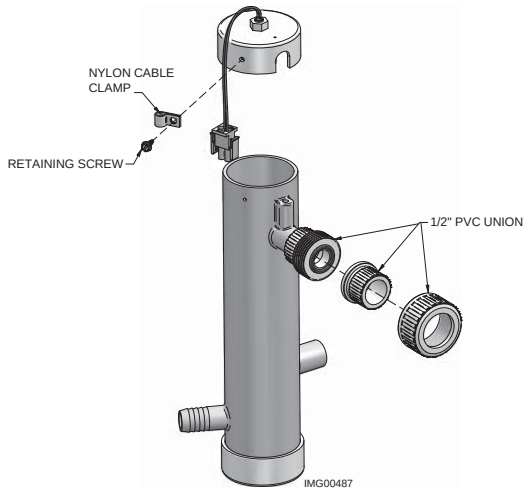
1. Do not fill the water heater or operate with water containing chlorine in excess of 200 ppm.
2. Filling with chlorinated fresh water should be acceptable since drinking water chlorine levels are much lower.
3. Do not use the water heater to directly heat swimming pool or spa water.
4. At initial fill and during water heater startup and testing, check system thoroughly for any leaks. Repair all leaks before proceeding further.

Check for gas leaks

⚠ WARNING Before starting the water heater, and during initial operation, smell near the floor and around the water heater for gas odorant or any unusual odor. Remove the top access panel and smell the interior of the water heater enclosure. Do not proceed with startup if there is any indication of a gas leak. Use an approved leak detection solution. Repair any leaks at once.

⚠ WARNING DO NOT attempt to measure gas valve outlet pressure. The gas valve is factory-set for the correct outlet pressure. This setting is suitable for natural gas and propane (when configured for LP), requiring no field adjustment. Attempting to measure the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death, or substantial property damage.

Figure 9-1 *Condensate Trap*



⚠ WARNING Propane water heaters only – Your propane supplier mixes an odorant with the propane to make its presence detectable. In some instances, the odorant can fade, and the gas may no longer have an odor. Before startup (and periodically thereafter), have the propane supplier verify the correct odorant level in the gas.

Inspect/fill condensate system

Inspect/check condensate lines and fittings

1. Inspect the condensate drain line, condensate PVC fittings and condensate trap.

Fill condensate trap with water

1. Remove the PVC cap retaining screw from the PVC cap (FIG. 9-1).
2. Remove the 2 inch PVC cap with the switch located at the top of the trap (FIG. 9-1).
3. Fill with fresh water until the water begins to pour out of the drain.
4. Replace the cap. Press the cap onto the trap until the cap makes contact with the drain.
5. Replace the retaining screw.

⚠ WARNING The condensate trap (FIG. 9-1) must be filled with water during all times of water heater operation to avoid flue gas emission from the condensate drain line. Failure to fill the trap could result in severe personal injury or death.

Final checks before starting the water heater

- ❑ Read this manual to familiarize yourself with electronic control module operation. Read pages 52 and 53 for proper steps to start the water heater.
- ❑ Verify the water heater and system are full of water and all system components are correctly set for operation.
- ❑ Verify the preparation procedures of Section 9, pages 50 and 51 have been completed.
- ❑ Fill the vent condensate trap with water (removing the retaining screw in order to remove the 2 inch PVC cap with the switch located at the top of the trap). Replace the cap. Press the cap onto the trap until the cap makes contact with the drain. Replace the retaining screw.
- ❑ Verify electrical connections are correct and securely attached.
- ❑ Inspect vent piping and air piping for signs of deterioration from corrosion, physical damage or sagging. Verify air piping and vent piping are intact and correctly installed per this manual.

9 Start-up *(continued)*

Start the water heater

1. Read and follow the Operating instructions in FIG.'s 9-2 and 9-3, pages 52 and 53.

If water heater does not start correctly

1. Check for loose connections, blown fuse or service switch off.
2. Is external limit control (if used) open? Is water temperature above 200°F?
3. Is tank set point set below tank temperature?
4. Is gas turned on at meter and water heater?
5. Is incoming gas pressure less than 4 inches w.c.?

If none of the above corrects the problem, refer to the *Troubleshooting* section of this manual.

Check system and water heater

❑ Check water piping

1. Check system piping for leaks. If found, shut down the water heater and repair immediately.
2. Check Delta T. Ensure Delta T is less than 25°F, if not, reference *Section 12 - Troubleshooting.*
3. Vent any remaining air from the system using manual vents. Air in the system will interfere with circulation and cause hot water distribution problems and noise.

❑ Check vent piping and air piping

1. Check for gastight seal at every connection, seam of air piping, and vent piping.

⚠ WARNING Venting system must be sealed gastight to prevent flue gas spillage and carbon monoxide emissions, which will result in severe personal injury or death.

❑ Check gas piping

1. Check around the water heater for gas odor following the procedure on page 42 of this manual *(Connecting Gas Supply Piping).*

⚠ WARNING If you discover evidence of any gas leak, shut down the water heater at once. Find the leak source with a bubble test and repair immediately. Do not start the water heater again until corrected. Failure to comply could result in severe personal injury, death, or substantial property damage.

Check flame and combustion

1. Shut the water heater down by pressing the UP button for five (5) seconds.
2. Locate the flue sensor in the vent connection. Remove the flue sensor and grommet from the unit. **Note:** Combustion measurements will be made at this point.
3. Place the water heater in active position by pressing the UP button for five (5) seconds.
4. Press ENTER plus the UP button for five (5) seconds to enter Service Mode.
5. Insert the probe from a combustion analyzer into the hole left by the removal of the flue temperature sensor.
6. Once the water heater has modulated up to full fire, measure the combustion. The values should be in the range listed in Table 9A. The CO levels should be less than 150 ppm for a properly installed unit.

   If the combustion is not within the specified range, reference the *Troubleshooting* section of this manual for possible causes and corrective actions.
7. Once the combustion analysis is complete, exit Service Mode.

***Table 9A** Flue Products Chart*

Natural Gas		Propane	
CO_2	O_2	CO_2	O_2
8.0% - 10%	3.0% - 6.5%	9.0% - 11%	4.1% - 6.9%

8. Replace the flue sensor and grommet into the vent connection.
9. Place the Shield water heater back into normal operation.

⚠ WARNING You must replace the flue sensor to prevent flue gas spillage into the room. Failure to comply could result in severe personal injury, death, or substantial property damage.

9 Start-up

Figure 9-2 *Operating Instructions - Models 126-065 -- 286-125*

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS

Do not try to light any appliance.

Do not touch any electric switch; do not use any phone in your building.

Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.

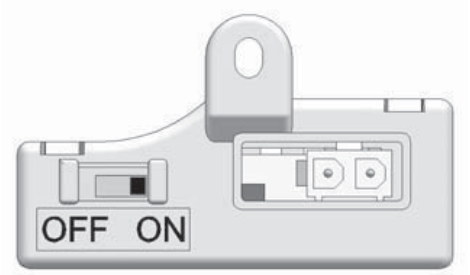
If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to move the gas control switch. Never use tools. If the switch will not move by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. **STOP!** Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Remove front door.
6. Move switch to the "OFF" position.
7. Wait five (5) minutes to clear out any gas. If you then smell gas, **STOP!** Follow "B" in the safety information above this label. If you don't smell gas, go to next step.
8. Move the switch to the "ON" position.
9. Install front door.
10. Turn on all electric power to appliance.
11. Set thermostat to desired setting.
12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.



TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove front door.
4. Move switch the "OFF" position.
5. Install front door.

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9 Start-up *(continued)*

Figure 9-3 *Operating Instructions - Models 401-125 -- 501-125*

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS

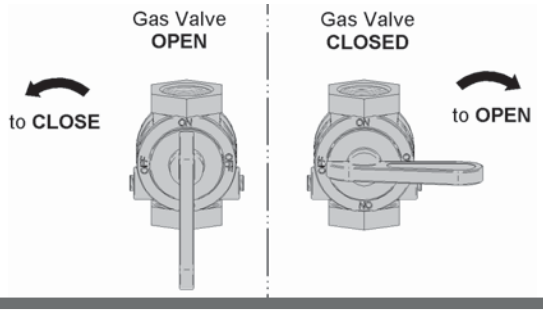
- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to turn the gas control knob. Never use tools. If the handle will not turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. **STOP!** Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Remove top cover.
6. Turn gas shutoff valve counterclockwise to "OFF". Handle will be perpendicular to pipe. Do not force.
7. Wait five (5) minutes to clear out any gas. If you then smell gas, **STOP!** Follow "B" in the safety information above this label. If you don't smell gas, go to next step.
8. Turn gas shutoff valve clockwise to "ON". Handle will be parallel to pipe.
9. Install top cover.
10. Turn on all electric power to appliance.
11. Set thermostat to desired setting.
12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.



TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove top cover.
4. Turn gas shut off valve counterclockwise to "OFF". Handle will be perpendicular to pipe. Do not force
5. Install top cover.

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10 Operating information

General

How the water heater operates

The Shield water heater combines an advanced stainless steel heat exchanger, electronic control module, and tank that allows fully condensing operation. The blower pulls in air and pushes flue products out of the heat exchanger and flue piping. The control module regulates blower speed to control the water heater firing rate. The gas valve senses the amount of air flowing into the water heater and allows only the right amount of gas to flow. An internal pump circulates the water between the tank and heater and mixes the incoming water to provide maximum efficiency.

Temperature control

Modulation

The Shield water heater is capable of modulating its firing rate from a minimum of 20% to a maximum of 100%. The firing rate is dictated by the hot water draw and various other temperature limitations.

Night setback

The controller may be programmed to reduce the tank set point during a certain time each day. There are seven (7) start and seven (7) stop triggers.

Flame current support

To prevent nuisance shutdowns when the water heater is firing at minimum rates, the control will increase fan speed when the flame signal drops too low.

Protection features

Outlet temperature, flue temperature, and temperature rise limiting

The heat exchanger outlet temperature is monitored by the heat exchanger outlet temperature sensor. When the heat exchanger outlet temperature exceeds 190°F, the unit will reduce the fan speed. If the heat exchanger outlet water temperature exceeds 198°F the control will shut the unit down until it cools off.

The control module monitors the flue temperature by a sensor located in the flue exhaust. If the flue temperature exceeds 215°F the control will reduce the maximum fan speed. If the flue temperature exceeds 225°F (107°C) the control will shut the unit down. The unit will restart automatically once the flue temperature drops 10°F (6°C) and the minimum off time has expired.

The control monitors the temperature difference between the heat exchanger inlet and the heat exchanger outlet sensors. If this difference exceeds 25°F the control will reduce the fan speed. If the temperature difference exceeds 30°F the control will shut the unit down. The unit will restart automatically once the temperature difference has dropped below 25°F and the minimum off time has expired.

Freeze protection

DO NOT install the water heater in a room likely to freeze.

The following integral feature of the electronic control module provides some protection for the water heater.

- The electronic control module provides freeze-up protection as follows when the water heater water temperature drops below 45°F:
- Below 45°F, the internal pump operates constantly.
- Below 37°F, the burner turns on.
- The burner and pump will turn off if water heater water temperature rises above 45°F.

⚠ CAUTION This feature of the electronic control module does not eliminate the possibility of freezing. The installation must still use recognized design, installation and maintenance practice to prevent freeze potential for the water heater.

Runtime and alarm outputs

The water heater provides dry contacts for indicating when the water heater is running, and when it is unable to operate.

Error logging

The control will hold in memory the last 10 faults. The date and time of the occurrence will be recorded as well. Only the 10 most current occurrences will be held in memory.

10 Operating information *(continued)*

Water heater temperature regulation

Operating temperature (target)

The electronic control module senses water temperature in the tank and regulates water heater ignition and firing rate to achieve a target temperature. The target temperature can be set between 60°F and 185°F.

High limit operations

The Shield water heater is equipped with a fixed automatic reset high limit and an adjustable manual reset high limit. The automatic reset high limit has a set point of 200°F and the manual reset high limit has a maximum set point of 210°F.

When the outlet temperature exceeds 200°F, the automatic high limit action occurs. The water heater shuts down until the outlet water temperature cools below 190°F, and a 60 second timer has expired. If the outlet temperature continues to increase, the manual reset high limit action will occur at 210°F.

High limit test procedure

NOTICE Please note that the brackets ([]) denote screen status.

1. Connect the water heater to 120V power.
2. Note the outlet temperature shown on the display.
3. Press and hold the ENTER and DOWN keys until “P01” appears in the lower digits on the display.
4. Press and hold the DOWN key until the set point shown in the upper digits is less than the outlet temperature (or it reaches its minimum setting, whichever is higher).
5. Press the ENTER key four (4) times. The word “SET” will appear on the display.
6. Once the outlet temperature reaches the new Manual Reset High Limit setting, the control will lock out, run the blower and DHW pump, and display “E15” in the lower digits on the display. It may be necessary to activate Service Mode to bring the outlet temperature above the Manual Reset High Limit set point. Press and hold the ENTER and UP keys for 5 seconds to activate Service Mode.
7. Press the ENTER and DOWN keys again until ‘P01” appears in the lower digits.
8. Press and hold the UP key to readjust the set point to the desired setting.
9. Press the ENTER key four (4) times. The word “SET” will appear on the display.
10. Press the RESET key to clear the Manual Reset High Limit.
11. If Service Mode was activated, press ENTER for 5 seconds to deactivate Service Mode.

Adjustable control parameters

Date and time

The control uses an internal clock for the night setback feature and for logging of events. For these features to work correctly, the clock must be set when the water heater is first installed or anytime the water heater has been powered off for more than 15 minutes. Note that hours are displayed as 24 hour time (2:00PM = 14:00). Days are displayed as a number (Monday = 1, Tuesday = 2, ..., Sunday = 7).

NOTICE The internal clock does not adjust for Daylight Savings Time and therefore, will require a manual adjustment.

User adjustable parameters

To access the User Adjustable Parameter Menu, press and hold the ENTER button for five (5) seconds. Once pressed, the temperature unit’s adjustment will be shown. Press the ENTER button to cycle to other adjustment values. Once you have cycled through all of the values, the new values will be saved.

***Table 10A** User Adjustable Parameters*

Code	Description
u01	Temperature Units (°C/°F)
u02	Hot Water Set Point
u03	Year
u04	Month
u05	Day
u06	Hour
u07	Minute

Installer settings

Set the Hot Water (HW) Temperature as follows:

1. Press and hold the ENTER button for five (5) seconds.
2. Press ENTER again and the u02 Screen should appear.
3. Press the UP and DOWN buttons to set the temperature.
4. Once you have successfully set the temperature, press the ENTER button seven (7) times to save your data.

10 Operating information

***Table 10B** Temperature Parameter Settings*

Code	Description	Factory Default	Min	Max
p01	Manual Reset High Limit Set Point	210	32	210
p02	Night Setback Set Point	0	0	90
p03	Maximum Tank Set Point	125	32	190
p04	HW Pump Delay	0:30	0:00	0:40:00
--	HW Temp	125	60	185

Installer adjustable parameters

To access the Installer Adjustable Parameter Menu, press and hold the ENTER and DOWN buttons simultaneously for five (5) seconds. Once pressed, the temperature unit's adjustment will be shown. Press the OK button to cycle to other adjustment values. Once you have cycled through all of the values, the new values will be saved.

***Table 10C** Installer Adjustable Parameters*

Code	Description
p01	Manual Reset High Limit
p02	Night Setback Offset
p03	Maximum Tank Set Point
p04	Pump Delay Time

Night setback

Access the Night Setback Menu by pressing the UP and DOWN buttons simultaneously for five (5) seconds.

This feature allows the user to lower the tank set point at certain times each week. The Night Setback Offset (see *Installer Adjustable Parameters*, this page) determines how much the set point is lowered. The times at which the set point is lowered are controlled by seven (7) start triggers and seven (7) stop triggers. Each trigger can be set to any time on any day. When the internal clock (see *User Adjustable Parameters*, page 55) reaches a start trigger, Night Setback will begin. When the internal clock reaches a stop trigger, Night Setback will end. When a start trigger and a stop trigger are programmed to the same day and time, the stop trigger will have priority, so Night Setback will not become active. (The default settings are all set to the same day and time.) Use the following procedure to adjust the triggers:

1. Press the UP and DOWN buttons simultaneously for five (5) seconds.
2. The top digits on the display will show the trigger type. To change from ON to OFF, or back, press the UP or DOWN button, then press the ENTER button.
3. The trigger number will then appear. Press the UP or DOWN buttons to change the trigger number you are programming, then press the ENTER button.
4. The day of the week (1 - 7) for that trigger will then appear in the lower digits on the display (1 = Monday, 2 = Tuesday, etc.,). Press the UP or DOWN buttons to change the day of the week, then press the ENTER button.
5. The time for that trigger then appears in a 24 hour format (for example, 2:00 PM = 1400), with the hours digits flashing. Use the UP and DOWN buttons to adjust the hours, then press the ENTER button.
6. The minutes digits will then start flashing. Press the UP and DOWN buttons to adjust the minutes. If you are finished programming all of the triggers, press and hold the ENTER key for 5 seconds. Otherwise, press the ENTER button once. The bottom digits will clear and the top digits will show ON or OFF again. Go back to Step 2 of this procedure.

Low water cutoff protection

The electronic control module uses sensing of both heat exchanger supply and return temperatures. If the flow rate is too low or either temperature too high, the control module modulates and shuts the burner down. This ensures water heater shutdown in the event of low water or low flow conditions in the heat exchanger.

To turn the heater ON/OFF

To turn the heater ON, press the UP button and hold it for five (5) seconds. To turn the heater OFF, press the UP button and hold again for five (5) seconds.

Service mode

To control the modulation of the heater for troubleshooting procedures, the Service Mode can be accessed by pressing the ENTER and UP buttons simultaneously, holding them for five (5) seconds. Once in the Service Mode, the UP and DOWN buttons control the speed of the blower. To toggle between the maximum and minimum speeds, press the ENTER button momentarily. When ready to return to the normal state, press the ENTER button for five (5) seconds. The control will also leave Service Mode in the event of a lockout.

Error logging

To access the error log, press the DOWN button for five (5) seconds. The error codes will be displayed beginning with the most recent. The top number indicating the error number starting with "1" being the most recent. The bottom of the display will show the following information in two (2) second intervals:

1. Error Code
2. Hour and Minute of the Error
3. Date of the Error
4. Year of the Error

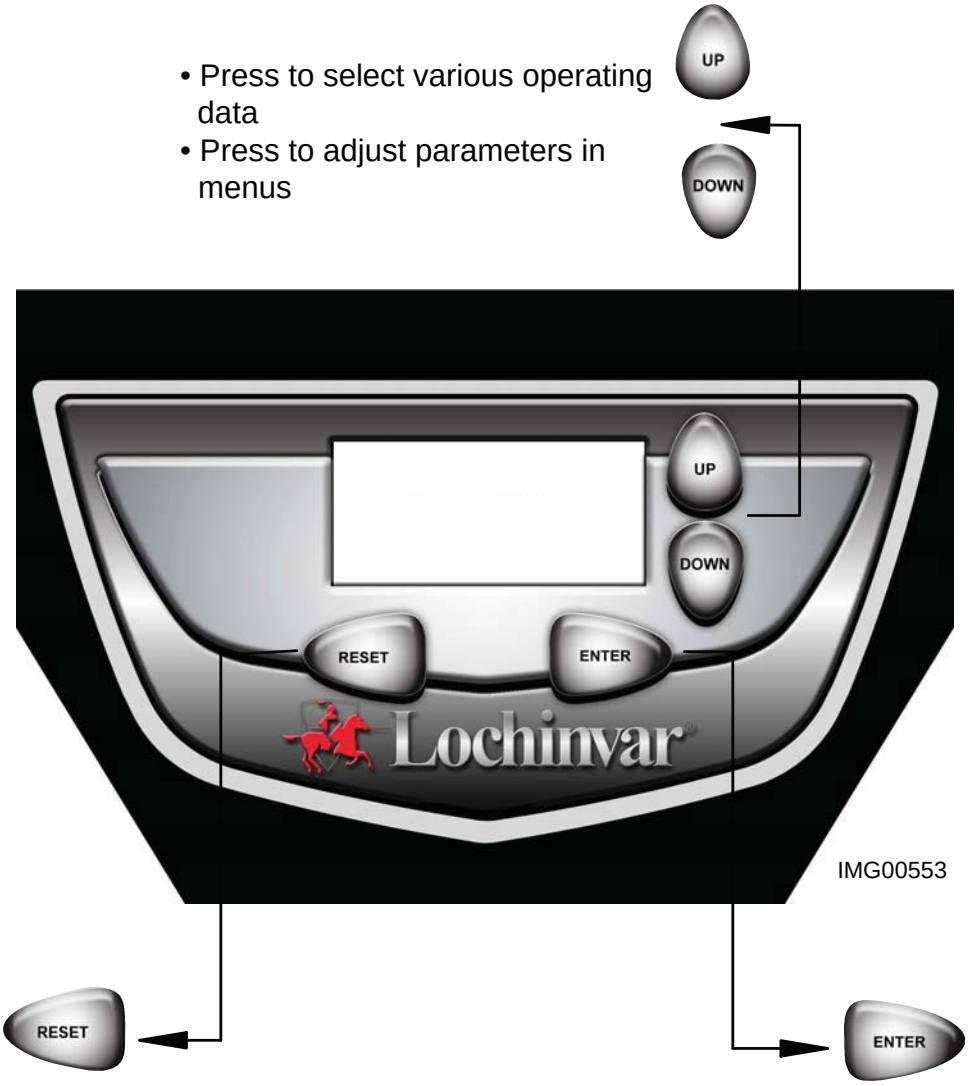
To view the next error press the UP button. To pause the information on the screen, press and hold the ENTER button, when released it will skip to the next value. To leave the Error Log Menu press and hold the DOWN button for five (5) seconds.

10 Operating information *(continued)*

Shield control module

Use the control panel (FIG. 10-1) to set temperatures, operating conditions, and monitor water heater operation.

Figure 10-1 *Control Panel*



11 Maintenance

Maintenance and annual startup

Table 11A *Service and Maintenance Schedules*

Service technician (see the following pages for instructions)		Owner maintenance	
ANNUAL START-UP	**General:** • Address reported problems • Inspect interior; clean and vacuum if necessary; • Clean condensate trap and fill with fresh water • Check for leaks (water, gas, flue, condensate) • Verify flue and air lines in good condition and sealed tight • Check system water pressure/system piping/expansion tank • Check control settings • Check ignition and flame sense electrodes (sand off any deposits; clean and reposition) • Check wiring and connections • Perform start-up checkout and performance verification per Section 9 in this manual. • Flame inspection (stable, uniform) • Flame signal (at least 10 microamps at high fire) • Clean the heat exchanger if flue temperature is more than 54°F above return water temperature. • Check anode rods. • Check Delta T (Temperature Rise) **If combustion or performance indicate need:** • Clean heat exchanger • Remove and clean burner using compressed air only • Clean the blower wheel	**Daily**	• Check water heater area
		Monthly	• Check vent piping • Check air piping • Check relief valve • Check condensate drain system • Check Delta T (Temperature Rise)
		Every 6 months	• Check water heater piping (gas and water) for leaks • Operate relief valve

11 Maintenance *(continued)*

⚠ WARNING Follow the service and maintenance procedures given throughout this manual and in component literature shipped with the water heater. Failure to perform the service and maintenance could result in damage to the water heater or system. Failure to follow the directions in this manual and component literature could result in severe personal injury, death, or substantial property damage.

⚠ WARNING The water heater should be inspected annually only by a qualified service technician. In addition, the maintenance and care of the water heater designated in Table 11A and explained on the following pages must be performed to assure maximum water heater efficiency and reliability. Failure to service and maintain the water heater and system could result in equipment failure.

⚠ WARNING Electrical shock hazard – Turn off power to the water heater before any service operation on the water heater except as noted otherwise in this instruction manual. Failure to turn off electrical power could result in electrical shock, causing severe personal injury or death.

Address reported problems

1. Inspect any problems reported by the owner and correct before proceeding.

Inspect water heater area

1. Verify that water heater area is free of any combustible materials, gasoline and other flammable vapors and liquids.
2. Verify that air intake area is free of any of the contaminants listed in Section 1 of this manual. If any of these are present in the water heater intake air vicinity, they must be removed. If they cannot be removed, reinstall the air and vent lines per this manual.

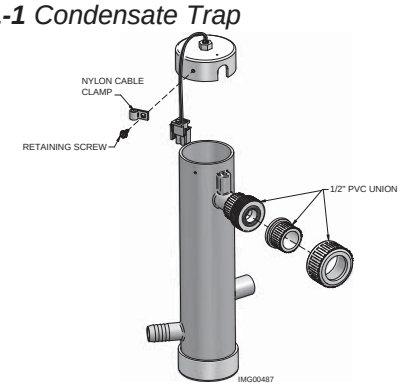
Inspect water heater interior

1. Remove the pump access panel and inspect the interior of the water heater.
2. Vacuum any sediment from inside the water heater and components. Remove any obstructions.

Clean condensate trap

1. Inspect the condensate drain line, condensate PVC fittings, and condensate trap.
2. Remove the PVC cap retaining screw from the PVC cap (FIG. 11-1).
3. Remove the 2 inch PVC cap with the switch located at the top of the trap (FIG. 11-1).
4. Remove any sediment in the trap.
5. Fill with fresh water until the water begins to pour out of the drain.
6. Replace the cap. Press the cap onto the trap until the cap makes contact with the drain.
7. Replace the retaining screw.

Figure 11-1 *Condensate Trap*



⚠ WARNING The condensate trap must be filled with water during all times of water heater operation to avoid flue gas emission from the condensate drain line. Failure to fill the trap could result in severe personal injury or death.

Check all piping for leaks

⚠ WARNING Eliminate all system or water heater leaks. Leaking water may cause severe property damage.

1. Inspect all water and gas piping and verify to be leak free.
2. Look for signs of leaking lines and correct any problems found.
3. Check gas line using the procedure found in Section 7 - Gas Connections.

Flue vent system and air piping

1. Visually inspect the entire flue gas venting system and air piping for blockage, deterioration or leakage. Repair any joints that show signs of leakage. Verify that air inlet pipe is connected and properly sealed.
2. Verify that water heater vent discharge and air intake are clean and free of obstructions.

⚠ WARNING Failure to inspect for the above conditions and have them repaired can result in severe personal injury or death.

Check water system

1. Verify all system components are correctly installed and operational.
2. Check the cold fill pressure for the system. Verify it is correct (must be a minimum of 12 PSI).
3. Watch the system pressure as the water heater heats up (during testing) to ensure pressure does not rise too high. Excessive pressure rise indicates expansion tank sizing or performance problem.
4. Inspect automatic air vents and air separators. Remove air vent caps and briefly push valve to flush vent. Replace caps. Make sure vents do not leak. Replace any leaking vents.

11 Maintenance

Check expansion tank

1. Expansion tanks provide space for water to move in and out as the water expands due to temperature increase or contracts as the water cools. Tanks must be approved for potable water systems. See Section 5 - System Piping for suggested best location of expansion tanks.

Check water heater relief valve

1. Inspect the relief valve and lift the lever to verify flow. Before operating any relief valve, ensure that it is piped with its discharge in a safe area to avoid severe scald potential. Read Section 5 - System Piping before proceeding further.

⚠ WARNING Safety relief valves should be re-inspected AT LEAST ONCE EVERY THREE YEARS, by a licensed plumbing contractor or authorized inspection agency, to ensure that the product has not been affected by corrosive water conditions and to ensure that the valve and discharge line have not been altered or tampered with illegally. Certain naturally occurring conditions may corrode the valve or its components over time, rendering the valve inoperative. Such conditions are not detectable unless the valve and its components are physically removed and inspected. This inspection must only be conducted by a plumbing contractor or authorized inspection agency – not by the owner. Failure to re-inspect the water heater relief valve as directed could result in unsafe pressure buildup, which can result in severe personal injury, death, or substantial property damage.

⚠ WARNING Following installation, the valve lever must be operated AT LEAST ONCE A YEAR to ensure that waterways are clear. Certain naturally occurring mineral deposits may adhere to the valve, rendering it inoperative. When manually operating the lever, water will discharge and precautions must be taken to avoid contact with hot water and to avoid water damage. Before operating lever, check to see that a discharge line is connected to this valve directing the flow of hot water from the valve to a proper place of disposal. Otherwise severe personal injury may result. If no water flows, valve is inoperative. Shut down the water heater until a new relief valve has been installed.

2. After following the warning directions, if the relief valve weeps or will not seat properly, replace the relief valve. Ensure that the reason for relief valve weeping is the valve and not over-pressurization of the system due to expansion tank waterlogging or undersizing.

Inspect ignition and flame sense electrodes

1. Remove the ignition and flame sense electrodes from the water heater heat exchanger access cover.
2. Remove any deposits accumulated on the ignition/flame sense electrode using sandpaper. If the electrodes cannot be cleaned satisfactorily, replace with new ones.
3. Replace ignition/flame sense electrode, making sure gasket is in good condition and correctly positioned.

Check ignition ground wiring

1. Inspect water heater ground wire from the heat exchanger access cover to ground terminal strip.
2. Verify all wiring is in good condition and securely attached.
3. Check ground continuity of wiring using continuity meter.
4. Replace ground wires if ground continuity is not satisfactory.

Check all water heater wiring

1. Inspect all water heater wiring, making sure wires are in good condition and securely attached.

Check control settings

1. Set the control module display to Parameter Mode and check all settings. Adjust settings if necessary. See Section 10 of this manual for adjustment procedures.
2. Check settings of external limit controls (if any) and adjust if necessary.

Perform start-up and checks

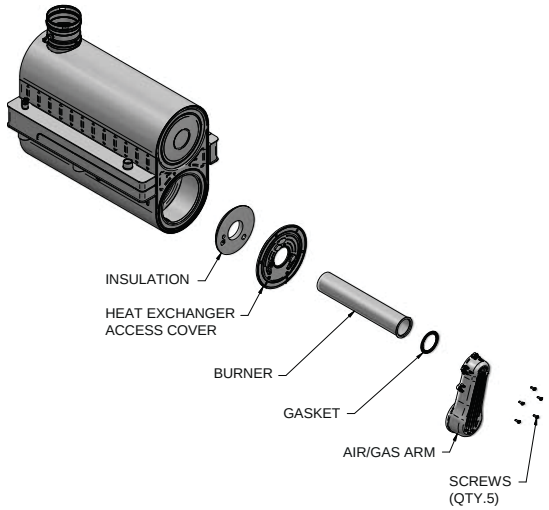
1. Start water heater and perform checks and tests specified in Section 9 - Start-up.
2. Verify cold fill pressure is correct and that operating pressure does not go too high.

11 Maintenance *(continued)*

Check burner flame

1. Inspect flame through observation window.
2. If the flame is unsatisfactory at either high fire or low fire, turn off water heater and allow water heater to cool down. Remove the burner and clean it thoroughly using a vacuum cleaner or compressed air. Do not use compressed air to clean burner if performed inside a building.
3. Remove the burner, reference FIG. 11-2 below.
4. When replacing the burner, ensure gasket is in good condition and positioned correctly (FIG. 11-2).

***Figure 11-2** Burner Assembly*



Check flame signal

1. At high fire the flame signal shown on the display should be at least 10 microamps.
2. A lower flame signal may indicate a fouled or damaged flame sense electrode. If cleaning the flame sense electrode does not improve, ground wiring is in good condition, and ground continuity is satisfactory, replace the flame sense electrode.
3. See Section 12 - Troubleshooting for other procedures to deal with low flame signal.

Review with owner

1. Emphasize the need to perform the maintenance schedule specified in this manual.
2. Remind the owner of the need to call a licensed contractor should the water heater or system exhibit any unusual behavior.

Handling ceramic fiber materials

REMOVAL OF COMBUSTION CHAMBER LINING

⚠ WARNING The combustion chamber insulation in this appliance contains ceramic fiber material. Ceramic fibers can be converted to cristobalite in very high temperature applications. The International Agency for Research on Cancer (IARC) has concluded, “Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1).” Normal operating temperatures in this appliance are below the level to convert ceramic fibers to cristobalite. Abnormal operating conditions would have to be created to convert the ceramic fibers in this appliance to cristobalite.

The ceramic fiber material used in this appliance is an irritant; when handling or replacing the ceramic materials it is advisable that the installer follow these safety guidelines.

- Avoid breathing dust and contact with skin and eyes.
  - Use NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for cristobalite at the time this document was written. Other types of respirators may be needed depending on the job site conditions. Current NIOSH recommendations can be found on the NIOSH website at http://www.cdc.gov/niosh/homepage.html. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this website.
  - Wear long-sleeved, loose fitting clothing, gloves, and eye protection.
- Apply enough water to the combustion chamber lining to prevent airborne dust.
- Remove the combustion chamber lining from the appliance and place it in a plastic bag for disposal.
- Wash potentially contaminated clothes separately from other clothing. Rinse clothes washer thoroughly.

NIOSH stated First Aid.

- Eye: Irrigate immediately.
- Breathing: Fresh air.

Cleaning heat exchanger

For recommended materials; including brush, appropriate extension(s), refractory cover, and detailed instructions see Table 11B - Heat Exchanger Cleaning Kits on page 62.

1. Shut down water heater:
   - Follow the “To Turn Off Gas to Appliance” instructions for the water heater in Section 9 - Startup.
   - Do not drain the water heater unless it will be exposed to freezing temperatures. If using freeze prevention fluid in system, do not drain.
2. Allow time for the water heater to cool to room temperature if it has been firing.

11 Maintenance

3. Remove the nuts securing the heat exchanger access cover to the heat exchanger and set aside.
4. Remove the heat exchanger access cover, burner, and gas/air arm assembly.

⚠ WARNING The water heater contains ceramic fiber materials. Use care when handling these materials per instructions in this manual. Failure to comply could result in severe personal injury.

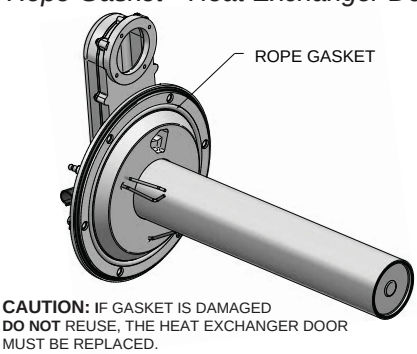
5. Remove the condensate hose from the heat exchanger end. Connect a field supplied 3/4" diameter hose to a drain pan. Using field supplied means, cover the refractory in the back of the combustion chamber of the heat exchanger.
6. Use a vacuum cleaner to remove any accumulation on the water heater heating surfaces. Do not use any solvent.
7. Brush the heat exchanger while dry using a nylon bristle brush. **Caution:** DO NOT use a metal brush. Re-vacuum the heat exchanger.
8. Finish cleaning using a clean cloth dampened with warm water. Rinse out debris with a low pressure water supply.
9. Allow the heat exchanger to thoroughly dry.
10. Remove the field supplied rear refractory cover from the back of the combustion chamber of the heat exchanger and reassemble.
11. Close isolation valves on piping to isolate water heater from system. Attach a hose to the water heater drain and flush water heater thoroughly with clean water by using purging valves to allow water to flow through the water make-up line to the water heater.
12. Perform start-up and check-out procedures in the Check Flame and Combustion - Section 9 - Startup on page 51 of this manual.
13. Replace the access cover and restore water heater to operation.

Table 11B *Heat Exchanger Cleaning Kits*

Model	Kit Number	Part Number	Component Description
126-065 -- 201-100 286-125 -- 401-125	100157627	100140243	Rear Refractory Cover
		100162565*	Nylon 4" Wheel Brush*
		100162566	3mm Allen Wrench
		100162568	1/4" x 24" Drill Extension
501-125	100157628	100140243	Rear Refractory Cover
		100162565*	Nylon 4" Wheel Brush*
		100162567	1/4" x 12" Drill Extension
		100162568	1/4" x 24" Drill Extension

⚠ CAUTION * Do NOT use a metal brush. Only use the kit provided brush or an equivalent replacement nylon brush.

Figure 11-3 *Rope Gasket - Heat Exchanger Door*



NOTICE Rope gasket is intended for sealing combustion (FIG. 11-3). If damaged DO NOT reuse, the heat exchanger door must be replaced. Consult factory for replacement heat exchanger door (kit 100173749).

Oiled bearing circulators

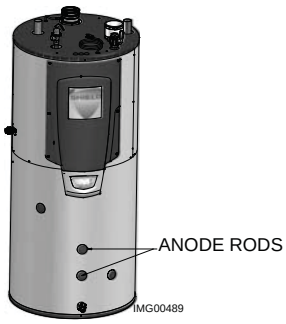
1. The circulator shipped with the Shield water heater is water-lubricated. No oiling is required.
2. Check other circulators in the system. Oil any circulators requiring oil, following circulator manufacturer's instructions. Over-oiling will damage the circulator.

Magnesium anode rod inspection

Glass lined storage tanks have a magnesium anode(s) (FIG. 11-4) to provide cathodical protection of the lining and minimize corrosion. Aggressive water conditions in some areas of the country may accelerate the deterioration of the anode(s). The anode(s) should be periodically removed and inspected to determine if replacement is necessary.

The heater must be valved off from the system and fully drained to remove an anode for inspection. Anodes are supplied in threaded fittings on the side of the tank. Adequate service clearance is required to allow removal of an anode. The anode(s) should be replaced when more than six inches of the core wire is exposed at either end of the rod.

Figure 11-4 *Anode Location*



NOTICE Anode rods showing excessive decomposition may indicate electrolysis. An earth ground should be attached to the vessel to divert stray current and prevent tank damage.

12 Troubleshooting

⚠ WARNING Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Always disconnect power to the water heater before servicing. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ WARNING Never jumper (bypass) any device except for momentary testing as outlined in the Troubleshooting chart. Severe personal injury, death, or substantial property damage can result.

Before troubleshooting:

1. Have the following items:
   a. Voltmeter that can check 120 VAC, 24 VAC, and 12 VDC.
   b. Continuity checker.
   c. Contact thermometer.

2. Check for 120 VAC (minimum 102 VAC to maximum 132 VAC) to water heater.

3. Make sure the tank is calling for heat.

4. Make sure all external limit controls are installed and operating.

Check the following:

1. Wire connectors to control module and connection board are securely plugged in.

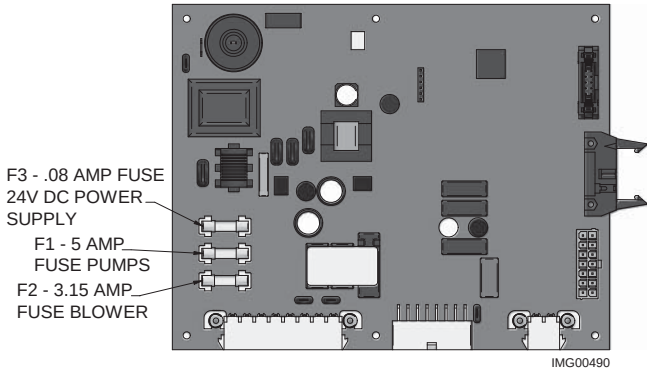
2. Gas pressures:
   - Maximum: 14 inches w.c. (natural and LP) with no flow (lockup) or with water heater on
   - Minimum: 4 inches w.c. (natural), 8 inches w.c. (LP) with gas flowing (verify during water heater startup)

Check control module fuses

NOTICE ALWAYS check control module fuses before replacing control module or any major components (blower, etc.). If one of these fuses is blown, it can prevent the control module or other components from operating.

1. Turn OFF power to the water heater at the external disconnect switch.
2. Remove front access cover.
3. Remove the control module cover.
4. Inspect fuses F2, F3, F4, and F5, see FIG. 12-1 below.

Figure 12-1 *Control Module Fuses*



5. The water heater is shipped with three (3) spare fuses in a plastic bag attached to the control module cover.

6. If necessary, replace open fuse (F3 is 1.25 amps, F2 and F4 are 3.15 amps, and F5 is 5 amps).

Note: Fuses F2 - F5 are all slow blow fuses.

⚠ WARNING Do not jumper fuse or replace with any fuse except as specified. Failure to comply could result in severe personal injury, death, or substantial property damage.

7. Install control module cover and front access cover after fuse inspection.

8. Restore power to the water heater at the external disconnect switch and verify water heater operation (Section 9 - Start-up) after completing water heater service.

12 Troubleshooting

Table 12A *Troubleshooting Chart - No Display*

FAULT	CAUSE	CORRECTIVE ACTION
No Display	- No 120 VAC supplied to unit.	• Check external line switch, fuse, or breaker. • Check wiring harness connection between display board and main control board. Connect harness at both points.
	- Bad display board.	• Replace board.
	- Bad main control board.	• Replace the main control board.
	- Blown fuse.	• Replace fuse F3 on the main control board, see page 63 of this manual.
No Burner Operation	- Tank temperature set point satisfied.	• Review temperature setting.
	- Unit locked out on fault.	• Consult display for specific fault. Refer to fault descriptions on page 67 of this manual for corrective actions.
Unit Does Not Modulate Above 50%	- Flue sensor open.	• Verify that the flue sensor is located in the flue outlet. • Check wiring connections at the flue sensor. • Check the resistance of the flue sensor and compare to Table 12C on page 65 of this manual.

12 Troubleshooting *(continued)*

Checking temperature sensors

The water heater temperature sensors (inlet water, outlet water, tank water, and flue) are all resistance type devices. The following tables show the correct values for the sensors at various temperatures. Use an ohmmeter to read the resistance of the sensor at a known temperature. If the resistance of the sensor does not closely match its corresponding table, replace the sensor.

Table 12B - *Inlet/Outlet Tank Sensor Resistance vs. Temperature*

Temperature °F	Resistance Ω	Temperature °F	Resistance Ω
50	18,780	158	1,990
68	12,263	176	1,458
86	8,194	194	1,084
104	5,592	212	817
122	3,893	--	--
140	2,760	--	--

Table 12C - *Flue Temperature Sensor Resistance vs. Temperature*

Temperature °F	Resistance Ω	Temperature °F	Resistance Ω
68	14,773	176	1,707
86	9,804	194	1,266
104	6,652	212	952
122	4,607	230	726
140	3,252	248	560
158	2,337	--	--

12 Troubleshooting

Table 12D *Troubleshooting Chart - Noisy System*

FAULT	CAUSE	CORRECTIVE ACTION
Noisy Operation	- Supply gas problem. Natural gas pressures should be between 4 inches w.c. and 14 inches w.c. LP gas pressures should be between 8 inches w.c. and 14 inches w.c.	• Refer to Section 6 - Gas Connections for detailed information concerning the gas supply.
	- Gas/air mixture problem.	• Refer to the Gas Valve Adjustment Procedure on page 74 of this manual for the proper gas valve setting. Verify that the vent/air intake lengths do not exceed the maximum listed in the General Venting section.
	- Dirty/damaged burner.	• Refer to page 62 in this manual for the burner removal and inspection procedure. Clean or replace the burner as necessary.
	- Low water flow through the heat exchanger.	• Very pump operation.
	- Air in the piping system.	• Properly purge all air from the piping system.
No Pump Operation	- Blown fuse.	• Replace fuse F5 on the control board, see page 63 of this manual.
	- Faulty pump.	• Replace pump.
	- Faulty pump relay.	• Replace pump relay.
	- Internal fault on control board.	• Replace main control board.
Relief Valve Opening	- System pressure exceeds relief valve setting.	• Lower the system pressure below the 150 PSI rating of the supplied relief valve.

12 Troubleshooting *(continued)*

***Table 12E** Troubleshooting Chart - Fault Messages Displayed on Water Heater Interface*

ERROR CODE	DESCRIPTION	CORRECTIVE ACTION
E00	Invalid lockout code.	• Reset control module. • Switch power OFF and ON. • Replace control module.
E01	The control module has detected parameter settings that are corrupted.	• Replace control module.
E02 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The actual fan RPM is more than 30% above or below the fan speed RPM target.	• Vent/air intake lengths exceed the maximum allowed lengths. Refer to Section 2 - General Venting for proper lengths. • Check for obstruction or blockage in the vent/air intake pipes or at terminations. • Check the wiring connections at the fan and at the main control board. • Replace the fan. • Replace the main control board.
	Blown fuse.	• Replace fuse F2 on the control board, see page 63 of this manual.
E04 (will require a manual reset once condition has been corrected. Press the RESET button on the display to reset.)	Either the optional flow switch or the optional low water cutoff is not making.	• Check pump operation on a call for heat. • Check for closed valves or obstructions in the piping. • Verify system is full of water and all air has been purged from the system. • Check for loose or misplaced jumpers if flow switch or LWCO is not installed.
	Blown fuse.	• Replace fuse F3 on the control board, see page 63 of this manual.
E05 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The flame detector circuit is seeing a flame signal when the gas valve is closed.	• Verify flame is not present. If present, turn off gas supply and replace gas valve. • Check supply voltage for proper polarity. • Check external wiring for voltage feedback. • Check the flame rod and make sure it is clean. • Check the internal wiring for bad connections. • Replace main control board.

12 Troubleshooting

***Table 12E** (continued from previous page) Troubleshooting Chart - Fault Messages Displayed on Water Heater Interface*

ERROR CODE	DESCRIPTION	CORRECTIVE ACTION
E06	The outlet water temperature has exceeded the setting of the automatic reset high limit.	• Adjust the set point of the auto reset limit to a higher setting up to a maximum of 200°F. Reference Section 10 - Operating Information for adjusting procedures. • Verify that the system is full of water and that all air has been properly purged from the system. • Verify that the boiler is piped properly into the heating system. Refer to Section 5 - System Piping for the proper piping methods for the Shield water heater. • Check 120 vac to boiler pump motor on a call for heat. If voltage is not present, check wiring back to the main control board. • Replace the main control board if necessary. • If 120 vac is present on a call for heat and the pump is not operating, replace the pump. • If operating on something other than an outlet sensor, check temperature setting of the main control board. • If the optional manual reset high limit has tripped, check setting of the device. • Check resistance of water sensors and compare to Table 12B on page 65 of this manual. Replace sensor if necessary.
E07 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	Either the air pressure switch, the O-temp heat exchanger switch, or the burner door temperature switch has opened. **⚠ WARNING** If the burner door temperature switch trips, the burner door and the burner door temperature switch will be extremely HOT. Allow the unit to cool before touching. Failure to follow this warning could result in severe personal injury, death, or substantial property damage.	**AIR PRESSURE SWITCH** • Check the wiring connections to switch. Wires should be connected to the common and normally closed terminals. • Air intake lengths exceed the maximum allowed lengths. Refer to Section 2 - General Venting for proper lengths. • Check for obstruction or blockage in the air intake pipes or at terminations. • Check reference hoses connected to the air pressure switch for blockage or obstruction. • Inspect the burner. Reference page 61 of this manual for removal and cleaning procedures. Replace if necessary. • Inspect the heat exchanger. Reference page 61 of this manual for removal and cleaning procedures. • Faulty air pressure switch. Replace switch. **O-TEMP HEX SWITCH (Applies to the 286 Model Only):** • Check the wiring connections to the fuse on the heat exchanger. • Check continuity across the thermal fuse. If open, replace heat exchanger. **BURNER DOOR TEMPERATURE SWITCH (Applies to the 286-125 -- 501-125 Models Only):** • The underlying cause of the fault must be identified and resolved by a qualified service technician before resetting the burner door temperature switch. • Check continuity across two contacts. Wires should be connected at both poles of the normally closed switch. • Faulty burner door temperature switch. Replace burner door temperature switch.

12 Troubleshooting *(continued)*

***Table 12E** (continued from previous page) Troubleshooting Chart - Fault Messages Displayed on Water Heater Interface*

ERROR CODE	DESCRIPTION	CORRECTIVE ACTION
E08	Louver proving switch open.	• Check wiring to louver proving switch. • Check louver proving switch.
E09	The blocked drain switch has detected excessive condensate build up inside the unit.	• Check condensate tube from unit to floor drain for proper installation and obstructions. • Inspect condensate trap for blockage. Clean if necessary. • Check for loose wiring connection at wire harness plug. • Bad blocked drain switch. Replace switch.
E11 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The unit has lost flame signal four (4) times during a call for heat.	• Inspect spark electrode and associated wiring for damage and connection. Reference page 60 of this manual for removal and cleaning procedures. Replace if necessary. • Check for proper electrical grounding of the unit. • Check incoming supply gas pressure. Natural gas pressures should be between 4 - 14 inches w.c. and LP gas pressures should be between 8 - 14 inches w.c. Refer to Section 6 - Gas Connections for detailed information concerning the gas supply. • Verify that the plastic hose from the gas valve to the air inlet is connected and is not damaged. • Verify that the vent/air intake pipes are correctly installed and that there are no obstructions. • Check for 24 vac to the gas valve at the 2-pin connection on the side of the main control board during the ignition attempt. If no voltage is present, replace the main control board. • If 24 vac is present at the main control board, check the wiring between the main control board and the gas valve. Replace the wiring if necessary. Do not disconnect the wiring from the gas valve and attempt to measure voltage at that point. The main control board can detect if the gas valve is not connected and will display the Gas Valve or Gas Valve Fail fault. • If 24 vac is present, check the outlet of the valve to ensure the valve is flowing gas. With a manometer connected to the outlet tap of the gas valve, when the unit is in the prepurge period, there should be a negative pressure present. When the valve is energized a change in pressure should occur. If the pressure change does not occur, the gas valve is not opening. Replace the gas valve. • Inspect flame sensor and associated wiring. Reference page 60 of this manual for removal and cleaning procedures. Replace if necessary. • Inspect and clean the heat exchanger as necessary. Reference page 61 of this manual for cleaning procedures. • Inspect the burner. Reference page 61 of this manual for removal and cleaning procedures. Replace if necessary. • Replace the main control board.
E12 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The unit has failed to prove main burner ignition after four (4) attempts.	
n05	The fan speed is being increased due to the flame current going below 5 microamps.	

12 Troubleshooting

***Table 12E** (continued from previous page) Troubleshooting Chart - Fault Messages Displayed on Water Heater Interface*

ERROR CODE	DESCRIPTION	CORRECTIVE ACTION
E13	The flue temperature has exceeded 250°F.	• Inspect the heat exchanger. Reference page 61 of this manual for the procedure on how to clean the flue side of the heat exchanger. • Inspect the flue sensor and associated wiring. Measure the resistance of the flue sensor and compare to Table 12C on page 65 of this manual. Replace the sensor if necessary. • Verify that the vent/air intake pipes are properly installed and that there are no obstructions. • Replace the main control board.
b05	The flue temperature has exceeded 240°F.	
n04	The fan speed is being limited due to the flue temperature exceeding 215°F.	
E15 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The outlet water temperature has exceeded the 210°F manual reset high limit (MRHL) setting.	• Verify that the system is full of water and that all air has been properly purged from the system. • Verify that the boiler is piped properly into the heating system. Refer to Section 5 - System Piping for the proper piping methods for the Shield water heater. • Check 120 vac to pump motor on a call for heat. If voltage is not present, check wiring back to the main control board. • Replace the main control board if necessary. • If 120 vac is present on a call for heat and the boiler pump is not operating, replace the pump. • If operating on something other than an outlet sensor, check temperature setting of the main control board. • Check resistance of water sensors and compare to Table 12B on page 65 of this manual. Replace sensor if necessary.
b03	The outlet water temperature has exceeded 195°F.	
n02	The fan speed is being limited due to the outlet temperature exceeding 185°F.	
E18 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The control module reads an excessive temperature difference between the two outlet sensors.	• Check wiring to sensor. Make sure wiring is connected and not damaged. Reconnect / repair wiring if necessary. • Measure the resistance of the sensor and compare to the resistance in Table 12B on page 65 of this manual. Replace sensor if necessary. • Replace control module.
E19 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	One or both of the flue sensors is open or shorted.	• Inspect the flue sensor and associated wiring. Measure the resistance of the flue sensor and compare to Table 12C on page 65 of this manual. Replace the sensor if necessary. • Replace the main control board.

12 Troubleshooting *(continued)*

***Table 12E** (continued from previous page) Troubleshooting Chart - Fault Messages Displayed on Water Heater Interface*

ERROR CODE	DESCRIPTION	CORRECTIVE ACTION
E21 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	One or both of the outlet sensors has opened or shorted.	• Check the sensor and its associated wiring. Repair or replace the sensor or wiring if damaged. • Measure the resistances of the sensors and compare the resistances to the tables on page 65. Replace if necessary.
E22 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The inlet sensor is open.	• Check the sensor and its associated wiring. Repair or replace the sensor or wiring if damaged.
E23 (will require a manual reset once the condition has been corrected. Press the RESET button on the display to reset.)	The inlet sensor is shorted.	
b01	The temperature has reached the set point + 4°F.	• None
b02	The main control board has received a call for heat too quickly after the previous call for heat has ended.	• The control board will release the call for heat after 60 seconds. • The control board will release the call for heat if the outlet temperature drops 10°F.
b04	The temperature rise across the heat exchanger has exceeded 30°F.	• Verify that the system is full of water and that all air has been properly purged from the system. • Check for 120 vac to the pump motor on a call for heat. If voltage is not present, check the wiring on the pump relay back to the main control board. Replace the main control board if necessary. • If 120 vac is present on a call for heat and the pump is not operating, replace the pump. • Scale accumulation in the heat exchanger. Verify that the water chemistry meets the requirements listed in Section 5 - System Piping.
n03	The fan speed is being limited due to the temperature rise across the heat exchanger exceeding 25°F.	

12 Troubleshooting

Table 12E *(continued from previous page) Troubleshooting Chart - Fault Messages Displayed on Water Heater Interface*

ERROR CODE	DESCRIPTION	CORRECTIVE ACTION
b06	120 vac input to the main control board has dropped below 80 vac.	• Check 120 vac supply to the transformer. • Check wiring connections at the low voltage terminal strip. • Check the wire size/length to remote devices. • Replace the transformer. • Check 24V.
n01	The flue temperature did not change after the burner started firing.	• Verify that the flue sensor is installed. • Check the sensor and its associated wiring. Repair or replace the sensor or wiring if damaged.
n06	Tank sensor is not connected.	• Check the tank sensor and its associated wiring. Repair or replace as needed.
n07	The inlet sensor has been disconnected.	• Check the sensors and their associated wiring. Repair or replace the sensor or wiring if damaged. • Measure the resistance of the sensors and compare the resistance to the tables on page 65 of this manual. • Replace the sensor if necessary.
n08	The inlet sensor has been shorted.	• Check the sensors and their associated wiring. Repair or replace the sensor or wiring if damaged. • Measure the resistance of the sensors and compare the resistance to the tables on page 65 of this manual. • Replace the sensor if necessary.

12 Troubleshooting *(continued)*

Combustion Analysis Procedure

1. Shut the water heater down by pressing the UP button for five (5) seconds.
2. Locate the flue sensor in the vent connection. Remove the flue sensor and grommet from the unit. **Note:** Combustion measurements will be made at this point.
3. Place the water heater in active position by pressing the UP button for five (5) seconds.
4. Press ENTER plus the UP button for five (5) seconds to enter Service Mode.
5. Insert the probe from a combustion analyzer into the hole left by the removal of the flue temperature sensor.
6. Once the water heater has modulated up to full fire, measure the combustion. The values should be in the range listed in Table 12F. The CO levels should be less than 150 ppm for a properly installed unit.

   If the combustion is not within the specified range, reference the *Troubleshooting* section of this manual for possible causes and corrective actions.
7. Once the combustion analysis is complete, exit Service Mode.
8. Replace the flue sensor and grommet into the vent connection.
9. Place the Shield water heater back into normal operation.

⚠ WARNING You must replace the flue sensor to prevent flue gas spillage into the room. Failure to comply could result in severe personal injury, death, or substantial property damage.

***Table 12F** Flue Products*

Natural Gas		Propane	
CO_2	O_2	CO_2	O_2
8.0% - 10%	3.0% - 6.5%	9.0% - 11%	4.1% - 6.9%

***Table 12G** Troubleshooting Chart - Combustion Levels*

POSSIBLE CAUSE	CORRECTIVE ACTION
Vent/Air Intake Length or Obstruction	• Refer to Section 2 - General Venting for the proper venting and air intake methods for the Shield water heater. • Check for obstructions at the vent/air intake terminals.
Gas Supply Pressure	• Refer to Section 7 - Gas Connections for the proper gas supply for the Shield water heater.
Dirty/Damaged Burner	• Refer to page 61 of this manual for burner removal and cleaning procedures. • Replace burner if necessary.
Gas Valve Adjustment	• Refer to page 74 of this manual for the gas valve adjustment procedure.

12 Troubleshooting

Gas valve adjustment procedure

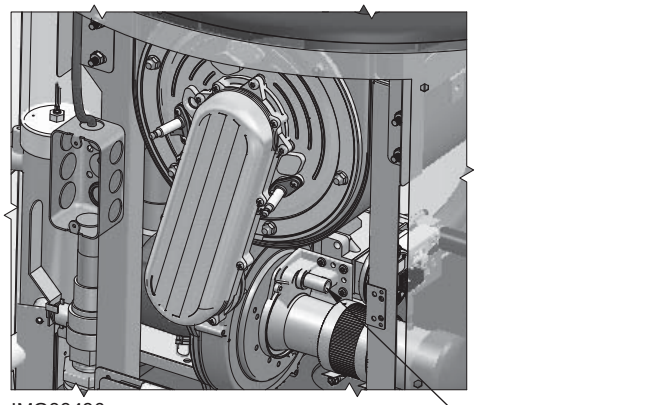
If adjustment of the gas valve is deemed necessary, use the following procedures: (**Note:** The procedures below are model specific.)

Models 126-065 -- 286-125

Locate the throttle adjustment screw on the side of the venturi valve (FIG. 12-2). Using a screwdriver, turn the screw a 1/4 turn **clockwise** to decrease CO_2 levels or a 1/4 turn **counterclockwise** to increase CO_2 levels. After performing one adjustment on the valve, follow the Combustion Analysis Procedure on page 73 of this manual to measure the combustion.

If combustion is still not within the specified range, repeat the procedure. This procedure SHOULD NOT be performed more than four (4) times. If after four (4) adjustments and the combustion is still not within the specified range, revisit the possible causes in Table 12G on page 73 or replace the gas valve.

Figure 12-2 *Gas Valve Adjustment: Models 126-065 -- 286-125*

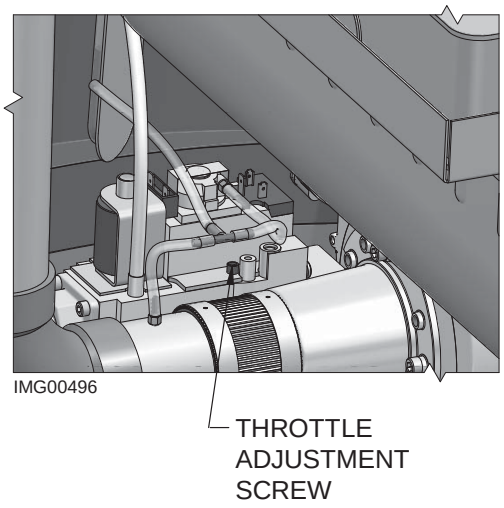


Model 401-125

Locate the throttle adjustment screw on the top of the gas valve, see FIG. 12-3. Using a screwdriver, turn the screw 1/8 turn **counterclockwise** to increase CO_2 levels or 1/8 turn **clockwise** to decrease CO_2 levels. After one adjustment on the valve, follow the Combustion Analysis Procedure on page 73 of this manual to measure the combustion.

If combustion is still not within the specified range, repeat the procedure. This procedure SHOULD NOT be performed more than four (4) times. If after four (4) adjustments and the combustion is still not within the specified range, revisit the possible causes in Table 12G on page 73 or replace the gas valve.

Figure 12-3 *Gas Valve Adjustment: Model 401-125*

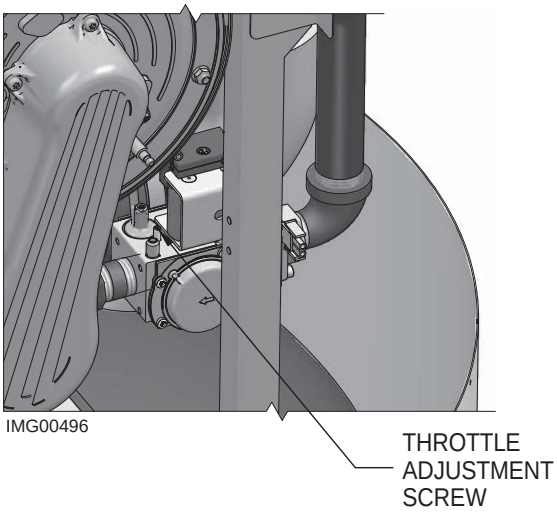


Model 501-125

Locate the throttle adjustment screw on top of the gas valve, see FIG. 12-4. Using a screwdriver, turn the screw a 1/4 turn **counterclockwise** to increase CO_2 levels or a 1/4 turn **clockwise** to decrease CO_2 levels. After one adjustment on the valve, follow the Combustion Analysis Procedure on page 73 of this manual to measure the combustion.

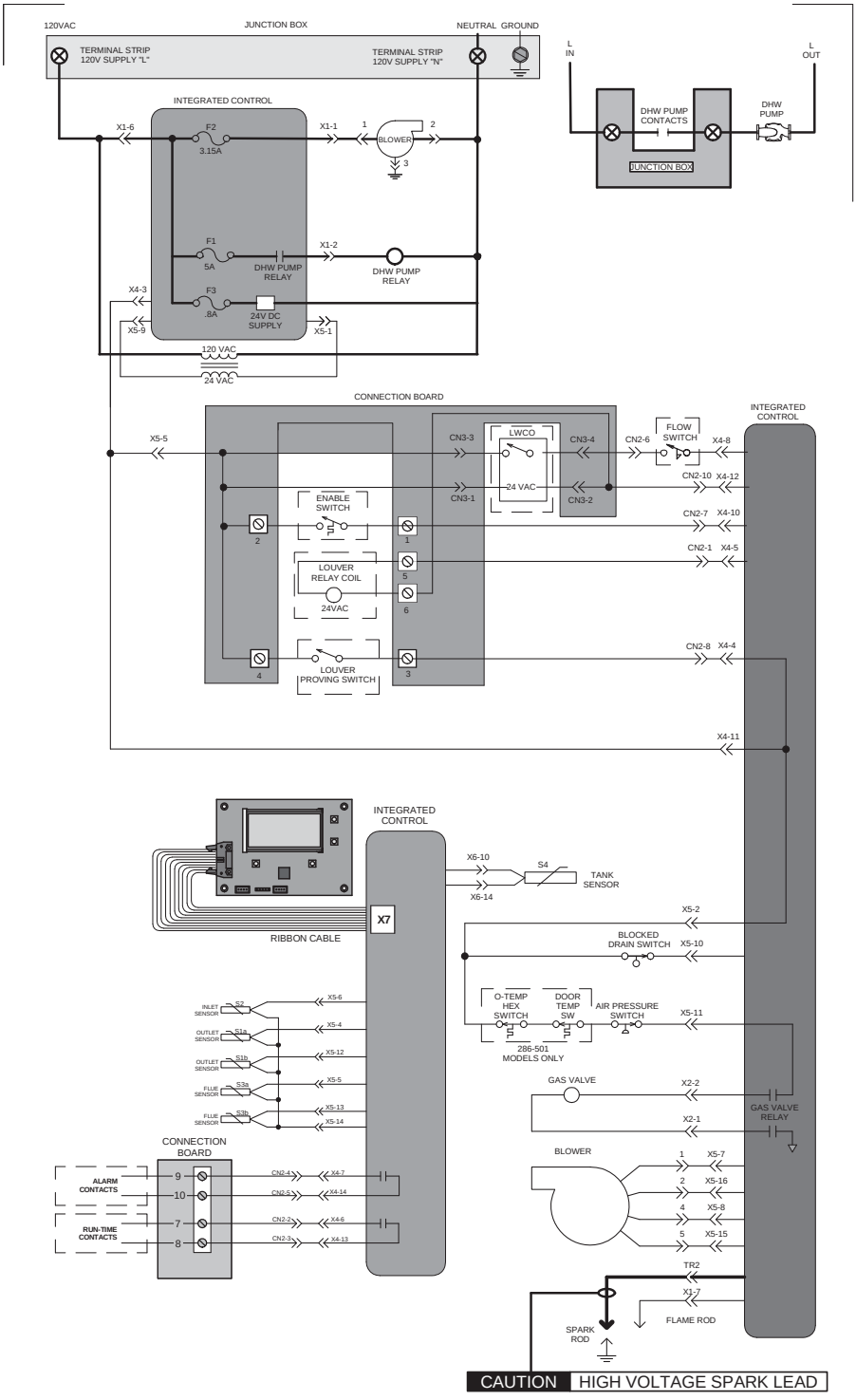
If combustion is still not within the specified range, repeat the procedure. This procedure SHOULD NOT be performed more than four (4) times. If after four (4) adjustments and the combustion is still not within the specified range, revisit the possible causes in Table 12G on page 73 or replace the gas valve.

Figure 12-4 *Gas Valve Adjustment: Model 501-125*



13 Diagrams

Figure 13-1 *Ladder Diagram*



NOTES:

1. **Where possible, switches are shown without utilities (gas, water or electricity) connected to the unit. As such, actual switch states may vary from those shown on diagrams depending upon whether utilities are connected or a fault condition is present.**
2. **See wiring diagram for additional notes.**

⚠WARNING

DISCONNECT POWER BEFORE SERVICING

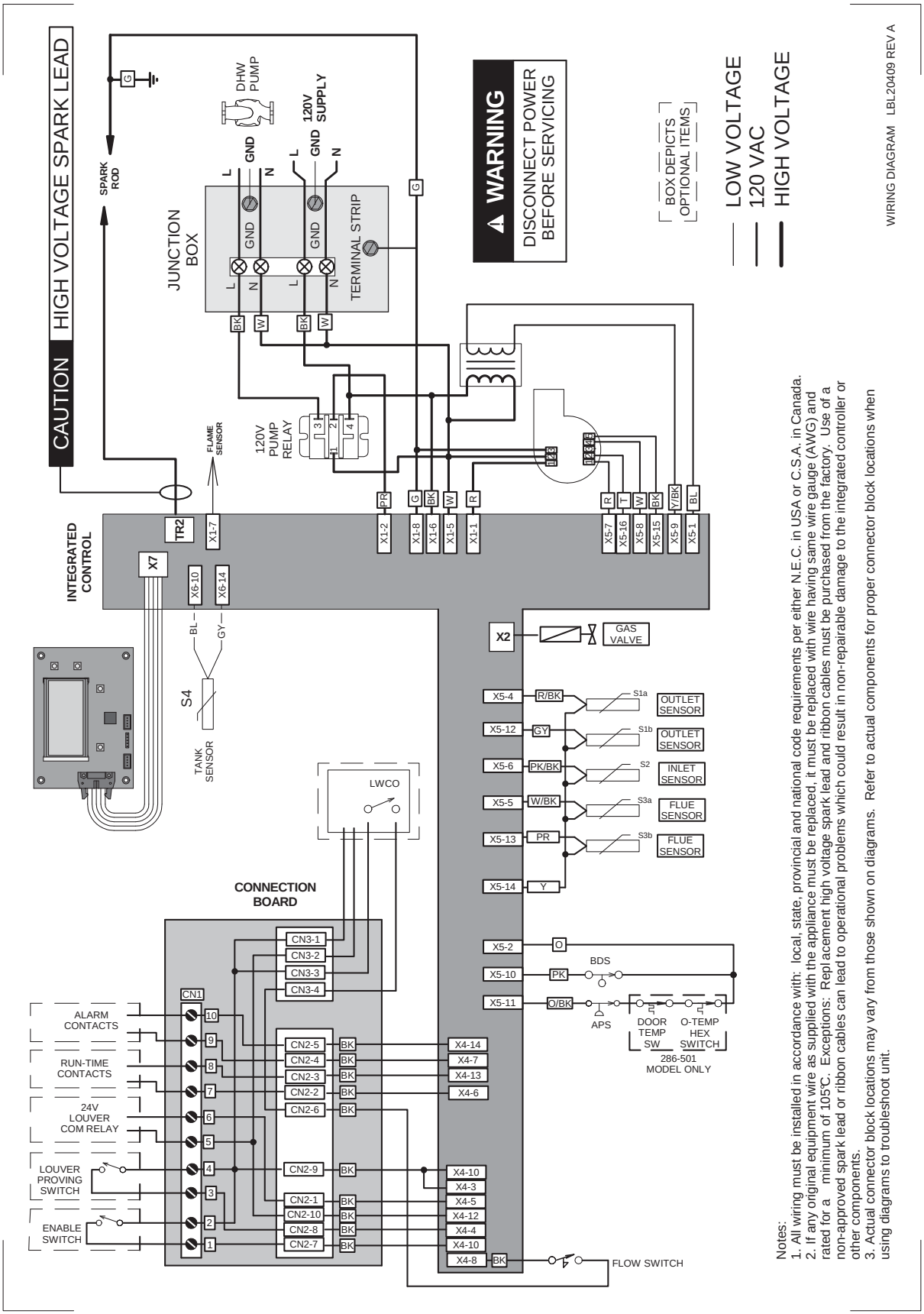
BOX DEPICTS OPTIONAL ITEMS

LOW VOLTAGE
120 VAC
HIGH VOLTAGE

LADDER DIAGRAM
LBL20408 REV A

13 Diagrams

Figure 13-2 *Wiring Diagram*



Notes

Notes

Notes

Revision Notes: *Revision A (ECO #C12258) initial release.*

Revision B (ECO #C12665) reflects the addition of the CSA Low Lead Content logo.

Revision C (ECO #C11814) reflects the addition of Metal Fab and Security Chimney to the manual.

Revision D (ECO #C13833) reflects the removal of the page number reference on page 15, the addition of the corrosive contaminant warning on page 3 (R06313), changes made to Table 6A - Gas Piping Chart on page 41 (R6621), the addition of the Temperature Parameter Setting Table and HW Temperature Setting instructions on pages 52 and 53 (R6658), edits made to the callouts on page 5 (R06493), along with updating the flex piping information (R06464) on page 21.

Revision E (ECO #C14411) reflects a note that the SNA286-125 model can be vented using 3" diameter pipe up to a maximum of 60 equivalent feet, pages 7 and 17, along with changing out LBL20026 and LBL20025 (R6979).

Revision F (ECO #C14713) reflects high altitude updates.

Revision G (ECO #C14988) reflects the correction of FIG. 2-2 on page 15.

Revision H (ECO #C15251) reflects the addition of the burner door temperature switch updates (R6322).

Revision I (ECO C16918) reflects the update of ratings information on page 7 (R07744), FIG. 3-13 description on page 29 (R07478), water chemistry information on page 35 (R07142), and water column information on page 40.

Revision K (Change #500000930) reflects edits made to FIG 4-7 on page 33.

Revision L (PCP# 3000001537 / CN# 500001784) reflects the addition of a note that the starter is factory installed on the 126-201 models under General Venting on page 20.

Revision M (PCP# 3000000426 / CN# 500000623) reflects the addition of combustion clearance dimensions in FIG.'s 1-1 and 1-2 on page 9.

Revision N (PCP# 3000004287 / CN# 500004864) reflects a change to the numbers of the Polypropylene Adapters in Table 2F on page 21. Figure 2-9 has also been updated.

Revision P (PCP# 3000005143 / CN# 500006666) reflects the addition of new venting category information on pages 25 through 27.

Revision R (PCP# 3000004438 / CN# 500005574) reflects an update to the flue temperatures on page 54.

Revision T (PCP# 3000006133 / CN# 500007549) reflects the addition of a PVC-DWV vent fitting in Table 2D on page 20.

SHW-I-S_MM #100161683_DIR #2000017192_Rev T
04/17

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0413 15417

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			Page
WC-1 & WC-2 WATER CLOSET			6
A3351101020	AMERICAN STANDARD	ELONGATED BOWL *EVERCL TOP SPUD AFWALL WHITE	7
S3370400	SLOAN	1.6 / 1.1 GALLONS PER FLUSH EXP CLOSET FLUSH VALVE *ECOS	10
UR-1 URINAL PER ADDENDUM #2-1			18
A6590001020	AMERICAN STANDARD	0.125 GALLONS PER FLUSH URINAL TOP SPUD WHITE	19
S3250424	SLOAN	0.5 GALLONS PER FLUSH 8186.05 GAUGE URINAL FLUSH VALVE POWER SENSOR	21
LAV-1 LAVATORY			29
A0496221020	AMERICAN STANDARD	19 X 16 VITREOUS CHINA UNDERCOUNTER MOUNT LAVATORY *OVALYN WHITE	30
SYMS202G05	SYMMONS	LEAD LAW COMPLIANT 1 HANDLE LEVER LAVATORY FAUCET SYMMETRIX 0.5 GPM	33
LAV-2 LAVATORY			36
A0355012020	AMERICAN STANDARD	21 X 18 4 VITREOUS CHINA LAVATORY WHITE LUCERN WHITE	37
SYMS202G05	SYMMONS	LEAD LAW COMPLIANT 1 HANDLE LEVER LAVATORY FAUCET SYMMETRIX 0.5 GPM	39
CSS-1 CLINICAL SERVICE SINK PER ADDENDUM #2-1			42
A9512999020	AMERICAN STANDARD	CLINIC SERV SINK WALL	43
A8345115002	AMERICAN STANDARD	HERT SERV FTG BOT BRCE-STPS 1	44
S3010500	SLOAN	6.5 GALLONS PER FLUSH 117 ROYAL SERVICE SINK FLUSH VALVE WITH SWEAT	47
SS-1 SCRUB SINK			51
EEWSF13026SACC	ELKAY	SURGEON SINK PACKAGE	52
SK-1 SINK PER ADDENDUM #2-1			54
EGECR25213	ELKAY	25X21X5-3/8" 3-HOLE 20-GA SS SNGLE SINK	55
C200AABCP	CHICAGO	CCN LEAD LAW COMPLIANT 2 HANDLE 4 HOLE KITCHEN FAUCET WITH SPRAY 2.2	61
SK-2 SINK PER ADDENDUM #2-1			67
ELRAD1517653	ELKAY	LRAD1517-6.5-3 18 GA 304 S.S. SINGLE BOWL SINK	68
C895317GN2AE29ABCP	CHICAGO	CCN LEAD LAW COMPLIANT 2 HANDLE WRISTBLADE HANDLE KITCHEN FAUCET CHROME 2.2	74

SK-3 SINK			81
C786GN2BVBE32AB CP	CHICAGO	LF CONC H&C WTR SINK 2.2 GPM	82
MS-1 MOP SINK PER ADDENDUM #2-1			88
FTSB3000501	FIAT	24X24X12 TERRAZZO MOP SERV BASIN	89
SYMS2490	SYMMONS	NOT FOR POTABLE USE 2 HANDLE SINK FAUCET 2.2 GPM CHROME	91
EWC-1 ELECTRIC WATER COOLER			93
ELRPBGRNMV28RAK	ELKAY	GREE FLTRD SWIRLFLO VR 2L REV	94
SP-1 / SP-1 SUMP PUMP			101
W2224	WEIL	TWO (2) WEIL 2224 VERTICAL 4” WASTEWATER PUMPS. THE PUMPS WILL BE CAPABLE OF HANDLING 2- 1/2” SOLIDS, WILL HAVE A CAPACITY OF 350GPM AT 25TDH, AND WILL BE POWERED BY A 5HP, 1750RPM, TEFC, 460/3 MOTOR.	102
ESP-1 / ESP-2 ELEVATOR SUMP PUMP			108
W1411OSS	WEIL	ONE (1) WEIL 1411-OSS ELEVATOR PUMP SYSTEM. THE SYSTEM WILL CONSIST OF A 2” SUBMERSIBLE PUMP, ON/OFF PUMP SWITCH, AND ALARM SYSTEM. THE PUMP WILL BE POWERED BY A 1/2HP, 1750RPM, 115/1 MOTOR WITH 15’ 3 CONDUCTOR CABLE AND A GROUNDED PLUG.	109
SP-3			113
W1411	WEIL	WEIL SUMP PUMP SYSTEM	114
EW-1 EMERGENCY EYE / FACE WASH			125
BS19270HD	BRADLEY	EYE WASH SWG DWN CP	126
ES-1 EMERGENCY SHOWER			158
GGBF2150	GUARDIAN	REC SAF STN W/ DRN PAN EXP SHWRHD	159
TMV-1 THERMOSTATIC MIXING VALVE			161
BS593130BP	BRADLEY	HL130 HIGH-LOW MIXING VALVE CONSIST OF A LIQUID FILLED THERMOSTAT AND A STAINLESS STEEL PISTON AND LINER WITH POSITIVE SHUT-OFF HOT WATER WHEN COLD WATER SUPPLY IS LOST, INTEGRAL STRAINER CHECK STOPS ON INLETS, ADJUSTABLE SET POINT WITHIN TEMPERATURE	162

TMV-2 THERMOSTATIC MIXING VALVE			169
BS192100BP	BRADLEY	EMERGENCY FIXTURE THERMOSTATIC MIXING VALVE FOR THE USE OF DRENCH SHOWERS AND/OR EYEWASH APPLICATIONS.	170
TMV-3 THERMOSTATIC MIXING VALVE PER ADDENDUM #2-1			178
BS192000B	BRADLEY	EMERGENCY THERMOSTATIC MIXING VALVE ROUGH BRONZE W/ WALL MOUNTING BRACKET	179
HS-1 HOSE STATION PER ADDENDUM #2-1			187
A8156SSLF	ACORN	LFNP *NCSH STAINLESS STEEL HOSE BOX WITH FLANGE DOOR	188
ET-1 EXPANSION TANK			189
AST60VC	AMTROL	25 GAL TANK VOL THERM-X-TROL THERMAL EXPANSION TANK ASME CONST	190
HWP-1 HOT WATER CIRCULATING PUMP			194
B103418LF	B&G	LF 1/25HP BRZ NBF25 CIRC PUMP 115V	195
BFP-1 BACKFLOW PREVENTER PER ADDENDUM #2-1			199
W375ASTP	WILKINS	LEAD LAW COMPLIANT 4 STAINLESS STEEL RPP ASSEMBLY STAINLESS STEEL BODY FLGXFLG	200
WZW209P	WILKINS	LF 4 PRESSURE REDUCING VALVE 150# FXF	204
BFP-2 BACKFLOW PREVENTER			209
W375XLSF	WILKINS	3/4" LF RPP ASSEMBLY COMP VES FNPT STR	210
BFP-3 BACKFLOW PREVENTER PER ADDENDUM #2-1			214
W375XLSG	WILKINS	1" LF RPP ASSEMBLY COMP VES FNPT STR	215
BFP-4 BACKFLOW PREVENTER PER ADDENDUM #2-1			219
W375XLSH	WILKINS	1-1/4" LF RPP ASSEMBLY COMP VES FNPT STR	220
GI-1 GREASE INTERCEPTOR			224
W5100NH35418XT	WADE	GREASE INTERCEPTOR, A.R.C. STEEL - 4" NO HUB, HEAVY DUTY COVER, EXTENSION (UP TO 6")	
WH-1 WALL HYDRANT PER ADDENDUM #2-1			225
S5518SSBXCL	JR SMITH	5518 HYDRANT W/BOX W/(-SS-CL)SS HYD BOX W/CL LK	226
KS-1 KITCHEN SINK			228
C1102202358AB	CHICAGO	CCN LEAD LAW COMPLIANT 2 HANDLE SINK FAUCET WITH SRPY CHROME 2.2	229
KS-2 KITCHEN SINK PER ADDENDUM #2-1			231

C1102GN8AE3317AB	CHICAGO	LF H&C WTR SINK FAUCET 2.2 GPM	232

KS-3 KITCHEN SINK 234

C895317ABCP	CHICAGO	CCN LEAD LAW COMPLIANT 2 HANDLE DECK MOUNT SINK FAUCET CHROME 2.2 GALLONS PER MINUTE	235

WC-1		**WC-1 & WC-2 WATER CLOSET**
A3351101020	AMERICAN STANDARD	ELONGATED BOWL *EVERCL TOP SPUD AFWALL WHITE
S3370400	SLOAN	1.6 / 1.1 GALLONS PER FLUSH EXP CLOSET FLUSH VALVE *ECOS

INSTALLATION INSTRUCTIONS

AFWALL® MILLENNIUM™ FLUSHOMETER WALL-MOUNTED TOILETS

Models 3351.101, 3352.101, 3353.101, 3354.101, 2257.101, 2257.101.NAF, 2633.101, 2634.101

Meets the American Disabilities Act Guidelines and ANSI A117.1 Requirements for the Physically Challenged

Thank you for selecting American Standard – the benchmark of fine quality for over 100 years. To ensure this product is installed properly, please read these instructions carefully before you begin. (Certain installations may require professional help.) Also be sure your installation conforms to local codes.

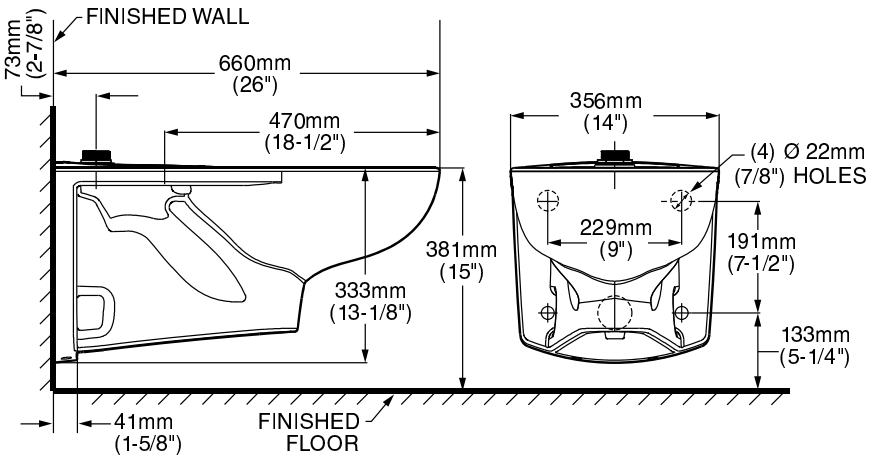
⚠ CAUTION: PRODUCT IS FRAGILE. TWO PEOPLE ARE RECOMMENDED FOR HANDLING TO AVOID BREAKAGE AND POSSIBLE INJURY!

NOTE: *For proper operation product requires a minimum of 30 psi working line pressure*

RECOMMENDED TOOLS AND MATERIALS

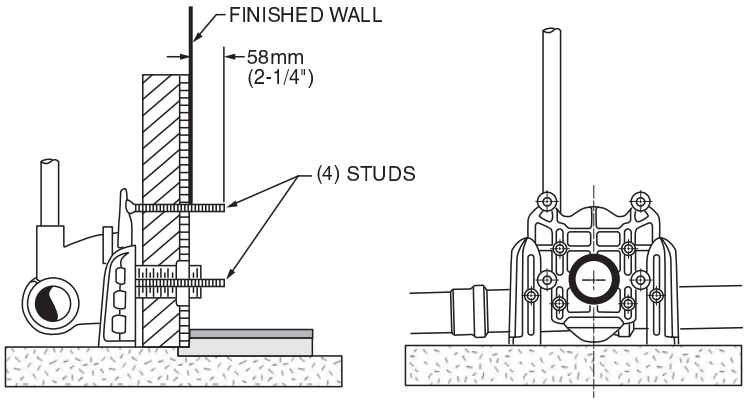
Closet Carrier Support	Regular Screwdriver	Sealant	Carpenters Level
Putty Knife	Adjustable Wrench	Tape Measure	Flush Valve

1 **Pictures may not exactly define contour of china**



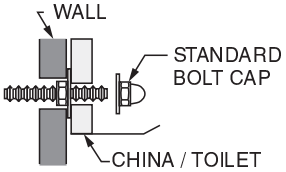
2 **FIXTURE MOUNTING**

Fixture studs should project 58mm (2-1/4") from face of finished wall.

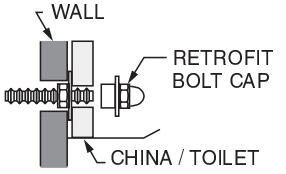


NOTE: If carrier bolt does not extend or is flush with china, use retrofit caps 7381285-200.0070A (sold separately).

STANDARD BOLT CAP



RETROFIT BOLT CAP



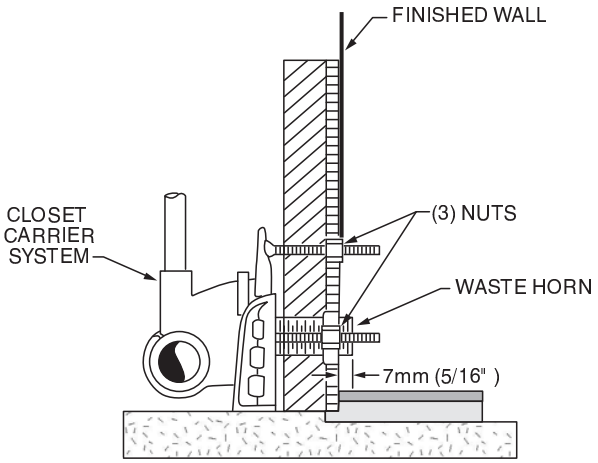
SAVE FOR FUTURE USE

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7301962-100 Rev. D

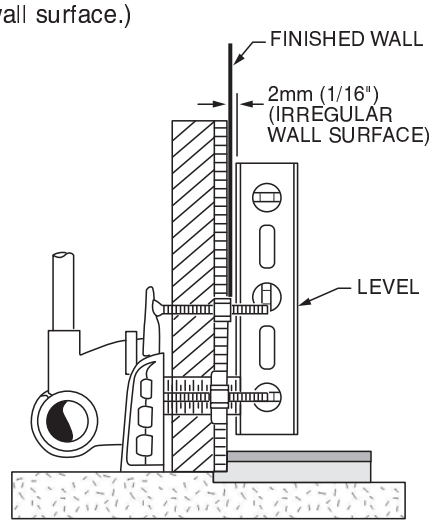
3

- Place back-up nuts on both bottom bolts, and the top left-hand bolt only.
- Adjust the two lower back-up nuts so that front face of nuts is flush with finished wall.
- Adjust waste horn to project 7mm (5/16") from finished wall.



4

- Using a level, adjust the top left back-up nut so that it is in the same vertical plane as the lower left back-up nut. (If wall surface is irregular, the three back-up nuts must be positioned to allow a minimum 1/16" (2mm) gap between fixture and wall surface.)



5

- NOTE: Bearing nuts and washers must be set to take full loading from the fixture allowing 1/16" (2mm) clearance between fixture and wall.
- Follow support manufacturer's recommended setting of closet outlet connection.
- Place felt or neoprene gasket (wax ring not recommended) on closet outlet.
- When the fixture is installed, closet outlet gasket must be compressed sufficiently to assure a gas and watertight seal.

The following steps require a helper:

- Install bowl on support using cap nuts and fiber washers with the back-up nuts and washers.

  DO NOT APPLY TOP RIGHT FIBER WASHER AND CAP NUT UNTIL OTHER CAP NUTS HAVE BEEN FIRMLY TIGHTENED USING A WRENCH.

- Install top right cap nut with fiber washer and run up hand tight. Wrench tighten approximately 1/4 turn.

- Apply sealant to gap between bowl and finished wall. Remove excess sealant.

In the United States:
American Standard Brands
P.O. Box 6820
Piscataway, New Jersey 08855
Attention: Director of Customer Care
For residents of the United States, warranty information may also be obtained by calling the following toll free number: (800) 442-1902
www.americanstandard.com

In Canada:
AS Canada, ULC
5900 Avebury Rd.
Mississauga, Ontario
Canada L5R 3M3
Toll Free: (800) 387-0369
www.americanstandard.ca

In Mexico:
American Standard B&K Mexico
S. de R.L. de C.V.
Via Morelos #330
Col. Santa Clara
Ecatepec 55540 Edo. Mexico
Toll Free: 01-800-839-1200
www.americanstandard.com.mx

AS AMERICA, INC. ONE YEAR LIMITED WARRANTY FOR COMMERCIAL FIXTURES

If inspection of this AS America, Inc. ("American Standard®") plumbing product, within one year after its initial purchase, confirms that it is defective in materials or workmanship, American Standard® will repair or, at its option, exchange the product for a similar model.

If the commercial fixture is purchased with a matching American Standard flush valve, American Standard will extend the limited commercial warranty for the commercial fixture to five years. Proof of purchase is required and must show that the commercial fixture and flush valve are purchased together and in the same proof of purchase document.

This limited warranty applies only to the original purchaser and installation of these products. In the event of a limited warranty claim, proof of purchase will be required – **save sales receipt.**

This limited warranty does not apply to local building code compliance. Since local building codes vary considerably, the purchaser of this product should check with a local building or plumbing contractor to insure local code compliance before installation.

This limited warranty is void if the product has been moved from its initial place of installation; if it has been subjected to faulty maintenance, abuse, misuse, accident or other damages; if it was not installed in accordance with American Standard®'s instructions; or if it has been modified in a manner inconsistent with the product as shipped by American Standard®.

American Standard®'s option to repair or exchange the product under this limited warranty does not cover any labor or other costs of removal or installation. IN NO EVENT WILL AMERICAN STANDARD® BE LIABLE FOR THE COST OF REPAIR OR REPLACEMENT OF ANY INSTALLATION MATERIALS, INCLUDING BUT NOT LIMITED TO, TILES, MARBLE, ETC. American Standard® will not be responsible for any other incidental or consequential damages attributable to a product defect or to the repair or exchange of a defective product, all of which are expressly excluded from this limited warranty. This limited warranty does not cover any liability for consequential or incidental damages, all of which are hereby expressly disclaimed, or the extension beyond the duration of this limited warranty of any implied limited warranties, including those of merchantability or fitness for an intended purpose. (Some states or provinces do not allow the exclusion or limitation of implied limited warranties, so this exclusion may not apply to you.)

This limited warranty gives you specific legal rights. You may have other statutory rights that vary from state to state or from province to province, in which case this limited warranty does not affect such statutory rights.

AS AMERICA, INC. LIMITED WARRANTY FOR CHAMPION® PRO AND CHAMPION®4 TOILETS

This toilet comes with a limited lifetime warranty on chinaware, a limited 10 year warranty on all mechanical parts of the toilet and a limited 1 year warranty on the toilet seat if included with product. If inspection of this AS America, Inc. ("American Standard®") plumbing product, inclusive of the chinaware and all mechanical parts, confirms that it is defective in materials or workmanship, American Standard® will repair or, at its option, exchange the product for the same or a similar model.

This limited warranty applies only to the original non-commercial purchaser and installation of the products. In the event of a limited warranty claim, proof of purchase will be required – **save sales receipt.**

For this warranty to become effective, the warranty registration process must be completed via the internet or telephone per the warranty registration instructions.

This limited warranty does not apply to commercial installations. The warranty for commercial installations is 1 year on chinaware and mechanical parts and 1 year on the toilet seat if included with product.

This warranty **does not apply** to local building code compliance. Since local building codes vary considerably, the purchaser of the product should check with a local building or plumbing contractor to ensure local code compliance before installation.

This warranty **will be void** if the product has been moved from its initial place of installation; if it has been subjected to faulty maintenance, abuse, misuse, accident or other damage; if it was not installed in accordance with American Standard®'s instructions; or if it has been modified in a manner inconsistent with the product as shipped by American Standard®.

WARNING: This warranty **DOES NOT COVER** any damages caused by the use of in-tank cleaners. These products can seriously corrode the fittings in the tank. This damage can cause leakage and property damage. **American Standard® will not be responsible or liable for any damage caused by the use of in-tank cleaners.**

American Standard®'s option to repair or exchange the product under this warranty does not cover any labor or other costs of removal or installation including any costs of any surrounding material such as tile or marble. **American Standard® is not responsible for any other incidental or consequential damages attributed to a product defect or to the repair or exchange of a defective product, all of which are expressly excluded from this warranty.** (Some states or provinces do not allow the exclusion or limitation of implied warranties, so this exclusion may not apply to you.)

This warranty gives you specific rights. You may have other statutory rights that may vary from state to state or province to province, in which case this warranty does not affect such statutory rights.

SLOAN ECOS

Code No. 0816721
Rev. 4 (12/11)

INSTALLATION INSTRUCTIONS FOR RETROFIT AND COMPLETE SLOAN ECOS® VALVE INSTALLATION

HET HIGH-EFFICIENCY TOILET

HEU HIGH-EFFICIENCY URINAL

Reducing Your Water Footprint™



8100 HET Complete Flushometer Models

8111 Series Sloan ECOS® Electronic Flush valves are complete Flushometer valves and ideal for new installations.

3370400-8111



Shown without optional Override Button

8186 HEU Complete Flushometer Models

High Efficiency Sloan ECOS® Electronic Urinal Flush valves are complete flushometer valves and ideal for new installations.



RESS Series Retrofit Conversion Kit Models

RESS Sloan ECOS® Electronic models are used to convert existing Royal, Sloan, and Regal style Flushometers to sensor operation.

Sloan ECOS® Electronic Dual Flush Water Closet Models can be furnished for the following:

1.6 gpf/6.0 Lpf	For Low Consumption Bowls

Sloan ECOS® Electronic Single Flush Models can be furnished for the following:

1.28 gpf/4.8 Lpf	For High Efficiency Bowls
0.5 gpf/1.9 Lpf	For High Efficiency Urinals
0.25 gpf/1.0 Lpf	For High Efficiency Urinals
0.125 gpf/0.5 Lpf	For High Efficiency Urinals

LIMITED WARRANTY

Unless otherwise noted, Sloan Valve Company warrants this product, manufactured and sold for commercial or industrial uses, to be free from defects in material and workmanship for a period of three (3) years (one (1) year for special finishes, SF faucets, PWT electronics and 30 days for PWT software) from date of purchase. During this period, Sloan Valve Company will, at its option, repair, replace, or refund the purchase price of any product which fails to conform with this warranty under normal use and service. This shall be the sole and exclusive remedy under this warranty. Products must be returned to Sloan Valve Company, at customer's cost. No claims will be allowed for labor, transportation or other costs. This warranty extends only to persons or organizations who purchase Sloan Valve Company's products directly from Sloan Valve Company for purpose of resale. This warranty does not cover the life of the batteries.

THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. IN NO EVENT IS SLOAN VALVE COMPANY RESPONSIBLE FOR ANY CONSEQUENTIAL DAMAGES OF ANY MEASURE WHATSOEVER.

PRIOR TO INSTALLING THE SLOAN ECOS® ELECTRONIC FLUSHOMETER

Prior to installing the Sloan ECOS® Electronic Flushometer, install the items listed below as illustrated in the Rough-in Diagram. (New installations only.)

- Closet fixture
- Drain line
- Water supply line

Important:

- **ALL PLUMBING SHOULD BE INSTALLED IN ACCORDANCE WITH APPLICABLE CODES AND REGULATIONS.**
- **WATER SUPPLY LINES MUST BE SIZED TO PROVIDE AN ADEQUATE VOLUME OF WATER FOR EACH FIXTURE.**
- **WHEN INSTALLING A FLUSHOMETER, IT IS IMPORTANT THAT THE FLUSH MODEL MATCHES THE REQUIREMENTS OF THE PLUMBING FIXTURE.**
- **FLUSH ALL WATER LINES PRIOR TO MAKING CONNECTIONS.**

The Sloan ECOS® is designed to operate with 15 to 100 PSI (104 to 689 kPa) of water pressure. **THE MINIMUM PRESSURE REQUIRED TO THE VALVE IS DETERMINED BY THE TYPE OF FIXTURE SELECTED.** Consult fixture manufacturer for pressure requirements.

Most Low Consumption water closets (1.6 gallon/6 liter) require a minimum flowing pressure of 25 psi (172 kPa).

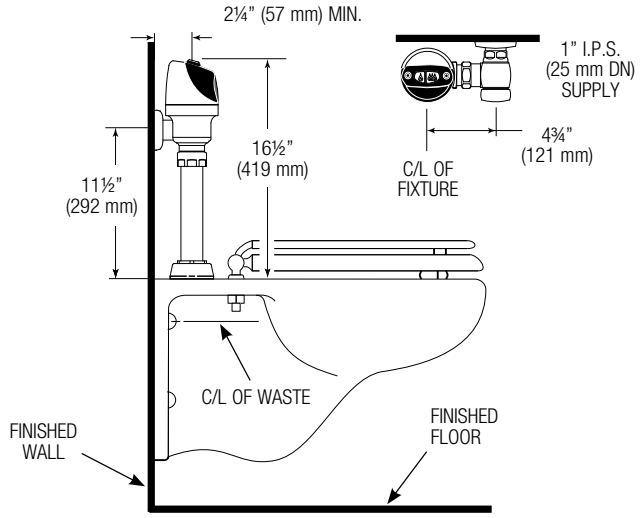
TOOLS REQUIRED FOR INSTALLATION

- Slotted screwdriver to adjust control stop.
- Sloan A-50 Super-Wrench™, Sloan A-109 Plier Wrench or smooth jawed spud wrench for couplings.
- Trimpot adjustment screwdriver (supplied) to adjust range, if necessary.
- Strap wrench (supplied) to install Sloan ECOS® Electronic to valve body.
- 7/64" hex wrench (supplied) to secure Sloan ECOS® Electronic cover to base plate.

VALVE ROUGH-IN

Typical Water Closet Installation

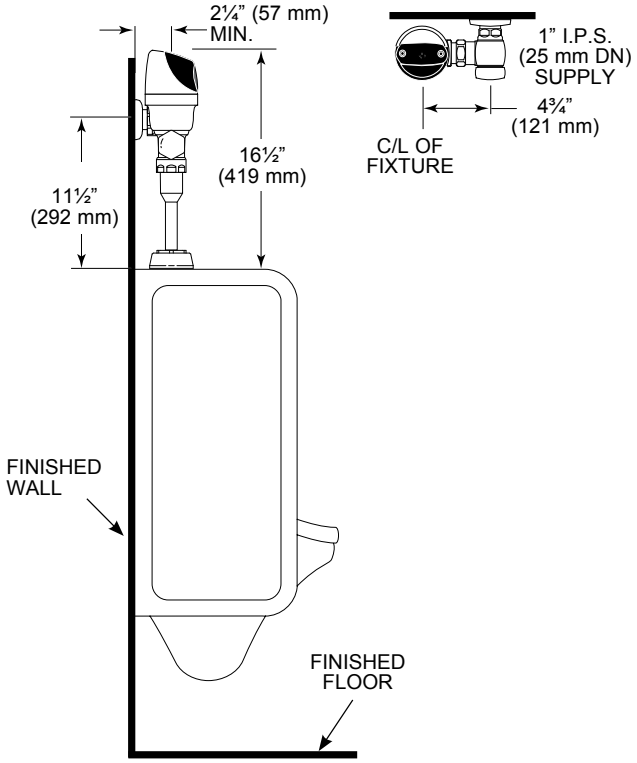
Model 8110/8111
Reference for RESS-C Retrofit



When installing the Sloan ECOS® Electronic in a handicap stall:
Per the ADA Guidelines (section 604.9.4) it is recommended that the grab bars be split or shifted to the wide side of the stall.

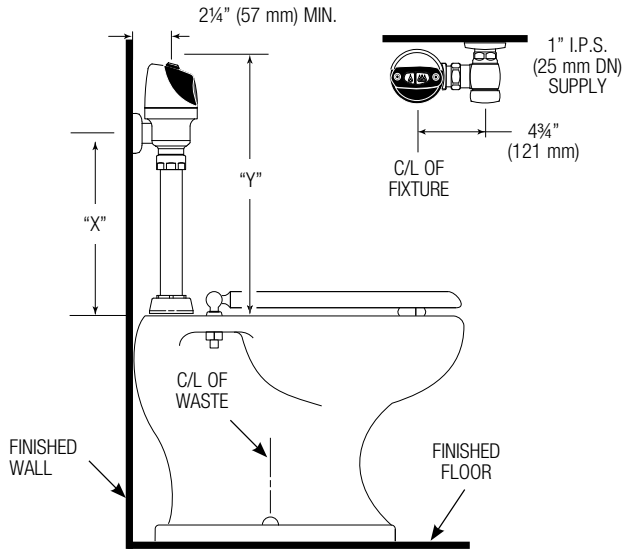
Urinal Installation

Models 8186-0.13, 8186-0.25, 8186-0.5



High Rough-in Water Closet Installation

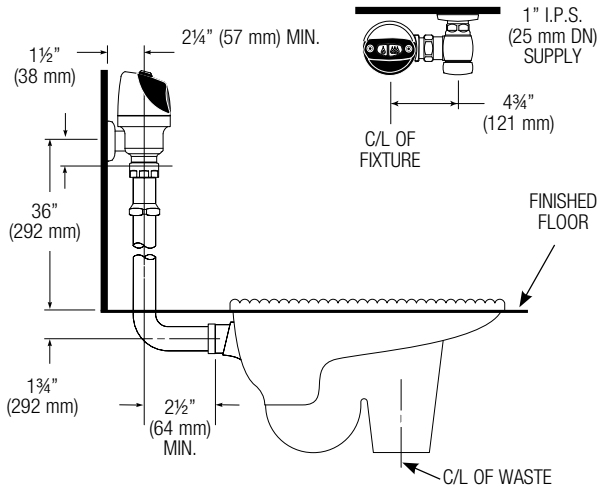
Models 8113, 8115 & 8116



MODEL	"X"	"Y"
8113	16" (406 mm)	21" (533 mm)
8115	24" (610 mm)	29" (737 mm)
8116	27" (686 mm)	32" (813 mm)

Squat Toilet Water Closet Installation

Model 8137



Model 8115 & 8116 valves are designed for installations where the water supply is roughed-in 24" - 27" (610 mm - 686 mm) above the top of the water closet.

For new installations, Sloan strongly recommends the use of our Model 8111 which has a shorter installation height.

!!! IMPORTANT !!!

PROTECT THE CHROME OR SPECIAL FINISH OF SLOAN FLUSHOMETERS — DO NOT USE TOOTHED TOOLS TO INSTALL OR SERVICE THESE VALVES. USE A SLOAN A-50 SUPER-WRENCH™, SLOAN A-109 PLIER WRENCH OR SMOOTH JAWED SPUD WRENCH TO SECURE ALL COUPLINGS. ALSO SEE "CARE AND CLEANING" SECTION

!!! IMPORTANT !!!

THIS PRODUCT CONTAINS MECHANICAL AND/OR ELECTRICAL COMPONENTS THAT ARE SUBJECT TO NORMAL WEAR. THESE COMPONENTS SHOULD BE CHECKED ON A REGULAR BASIS AND REPLACED AS NEEDED TO MAINTAIN THE VALVE'S PERFORMANCE.

!!! IMPORTANT !!!

WITH THE EXCEPTION OF CONTROL STOP INLET, DO NOT USE PIPE SEALANT OR PLUMBING GREASE ON ANY VALVE COMPONENT OR COUPLING!

!!! IMPORTANT !!!

THE STRAP WRENCH PROVIDED WITH SLOAN ECOS® ELECTRONIC IS A CONVENIENCE TOOL AND IS NOT TO BE USED TO REMOVE OR INSTALL THE FLUSHOMETER COUPLINGS. USE STRAP WRENCH ONLY TO INSTALL SLOAN ECOS® ELECTRONIC LOCKING RING.

When further assistance is required, please contact your local Sloan Representative or call Sloan Technical Support at: 1-888-SLOAN-14 (1-888-756-2614)

1 - FOR COMPLETE VALVE INSTALLATION, START HERE. FOR RESS RETROFIT INSTALLATIONS, START AT STEP 6. INSTALL OPTIONAL SWEAT SOLDER ADAPTER (ONLY IF YOUR SUPPLY PIPE DOES NOT HAVE A MALE THREAD).

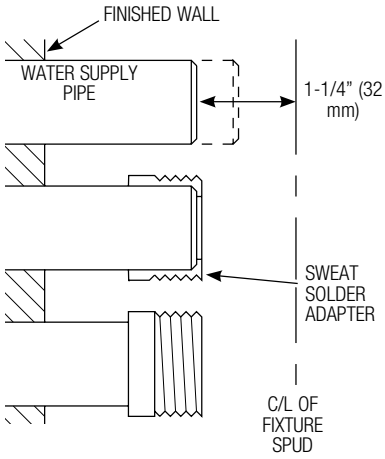
A Measure from finished wall to C/L of Fixture Spud. Cut pipe 1¼" (32 mm) shorter than this measurement. Chamfer O.D. and I.D. of water supply pipe.

B Slide Threaded Adapter fully onto pipe.

C Sweat solder the Adapter to pipe.

!!! IMPORTANT !!!

WITH THE EXCEPTION OF CONTROL STOP INLET, DO NOT USE PIPE SEALANT OR PLUMBING GREASE ON ANY VALVE COMPONENT OR COUPLING!



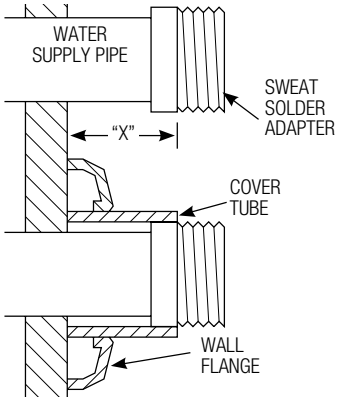
2 - INSTALL COVER TUBE, WALL FLANGE AND CONTROL STOP TO SUPPLY PIPE

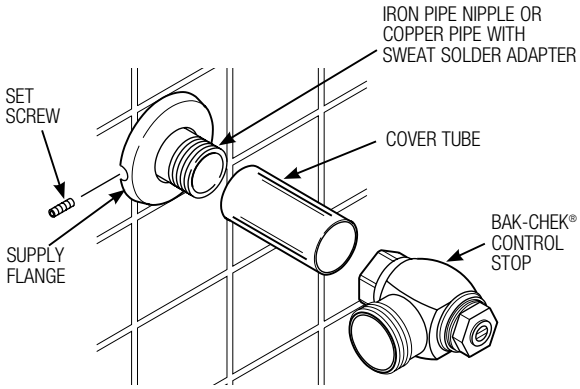
A Measure from finished wall to first thread of Adapter or threaded supply pipe (dimension "X"). Cut Cover Tube to this length.

B Slide Cover Tube over pipe. Slide Wall Flange over Cover Tube until against wall.

C Thread Control Stop onto pipe. Tighten with a wrench.

D Tighten Set Screw with a 1/16" hex wrench. DO NOT install Vandal Resistant Stop Cap at this time.





3 - FLUSH OUT SUPPLY LINE

A Open Control Stop.

B Turn on water supply to flush line of any debris or sediment.

C Close Control Stop.



4 - INSTALL VACUUM BREAKER FLUSH CONNECTION

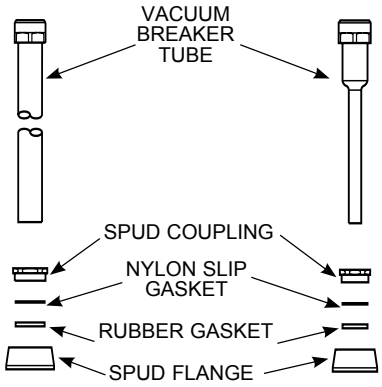
NOTE

If cutting Vacuum Breaker Tube to size, note that Critical Line (C/L) on Vacuum Breaker must typically be 6" (152 mm) above fixture. Consult Code for details.

A. Slide Spud Coupling, Nylon Slip Gasket, Rubber Gasket and Spud Flange over Vacuum Breaker Tube.

B. Insert Tube into Fixture Spud.

C. Hand tighten Spud Coupling onto Fixture Spud.



5 - INSTALL FLUSHOMETER

A. Lubricate tailpiece O-ring with water. Insert Adjustable Tailpiece into Control Stop. Tighten Tailpiece Coupling by hand.

B. Align Flushometer directly above the Vacuum Breaker Flush Connection by sliding the Flushometer Body IN or OUT as needed. Tighten Vacuum Breaker Coupling by hand.

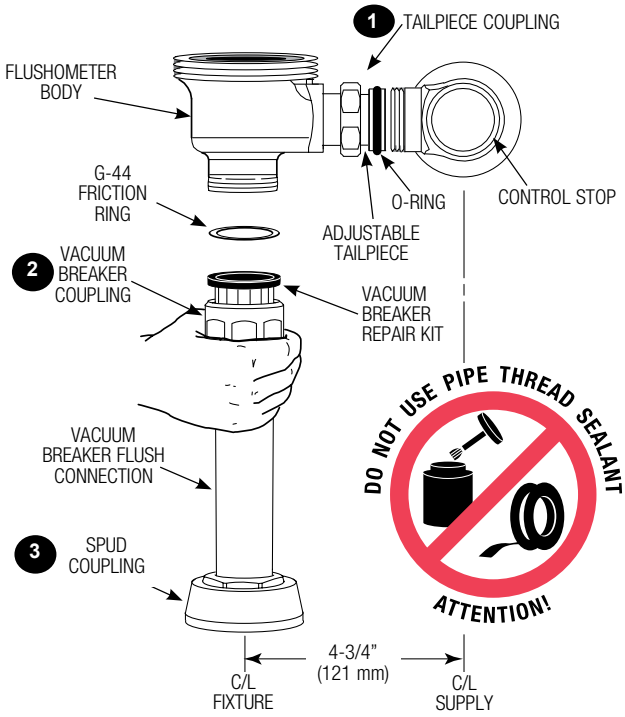
NOTE

Maximum adjustment of the Sloan Adjustable Tailpiece is 1/2" (13 mm) IN or OUT from the standard 4-3/4" (121 mm) (centerline of Flushometer to centerline of Control Stop).

If roughing-in measurement exceeds 5-1/4" (133 mm), consult factory for longer tailpiece.

C. Align Flushometer Body and securely tighten first the Tailpiece Coupling (1), then the Vacuum Breaker Coupling (2), and finally the Spud Coupling (3). Use a wrench to tighten these couplings in the order shown.

D. Install Chrome Handle Cap with Gasket to handle opening on Flushometer Body. Tighten Chrome Handle Cap securely.



6 - WHEN RETROFITTING AN EXISTING VALVE, START HERE. REMOVE COMPONENTS FROM EXISTING FLUSHOMETER (RESS RETROFIT INSTALLATIONS ONLY)

A. Remove Control Stop Cap.

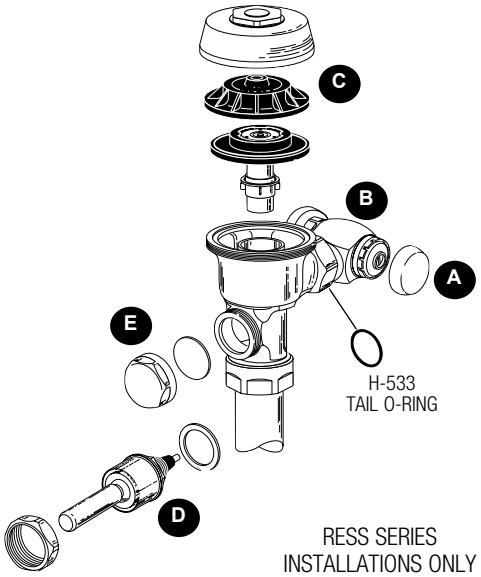
B. Turn off water supply at Control Stop. Push Valve Handle to relieve water pressure.

C. Remove Outside and Inside Covers and old Inside Parts Kit.

D. Remove old Handle Assembly and Gasket.

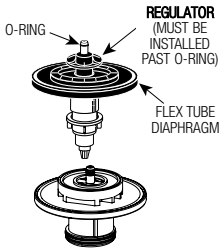
E. Install Chrome Handle Cap with Gasket to handle opening on Flushometer Body. Tighten Chrome Handle Cap securely.

NOTE: An extra H-533 Tail O-ring is included in the event leakage occurs if the valve is repositioned during the installation of the new Sloan ECOS® Electronic. Use only as needed.



7 - SLOAN ECOS® ELECTRONIC FLUSH VOLUMES (RESS RETROFIT INSTALLATIONS ONLY)

The Flush Volume of the Sloan ECOS® Electronic is controlled by the Flex Tube Diaphragm Kit (or Cartridge Assembly). Regulators are identified by color.

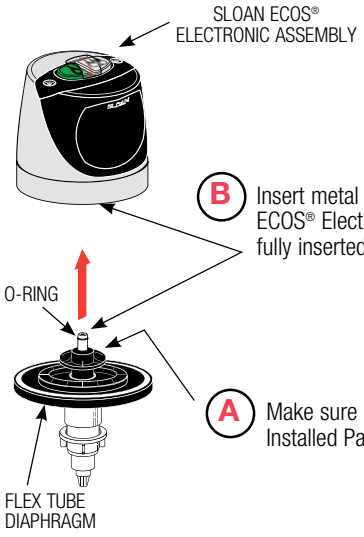


RESS-C Sloan ECOS® Electronic valves are supplied with it's lowest flush volume configuration.

When installing a new Regulator on a Flex Tube Diaphragm Kit, be sure to push the Regulator past the O-ring when installing.

Note: Never use more water than needed. Low Consumption water closets will not function properly on excess water.

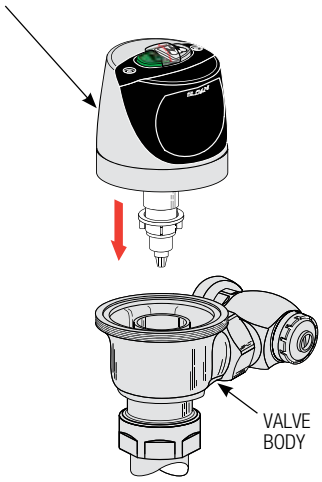
8 - ASSEMBLE FLEX TUBE DIAPHRAGM (OR CARTRIDGE ASSEMBLY) TO SLOAN ECOS® ELECTRONIC ASSEMBLY



B Insert metal end into hole in base of Sloan ECOS® Electronic Assembly. O-ring must be fully inserted into the hole.

A Make sure Flush Volume Regulator is Installed Past O-ring.

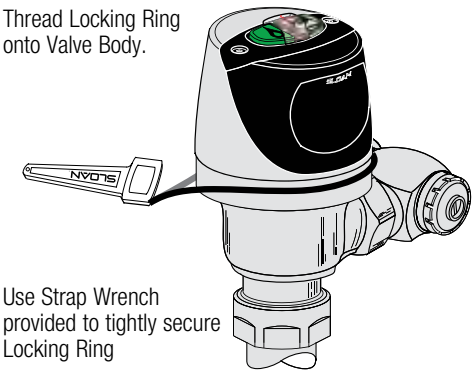
C Push Diaphragm securely against underside of Sloan ECOS® Electronic Assembly. Place entire Assembly onto the Valve Body.



To facilitate installation, the O-ring on the diaphragm assembly must be wet for easier insertion. NOTE: Sensor Lens must face directly forward. Rotating the Sensor to either side will decrease the Sensor's ability to detect a target.

9 - TIGHTEN LOCKING RING AND REMOVE TAB TO ACTIVATE SENSOR MODULE

A Thread Locking Ring onto Valve Body.



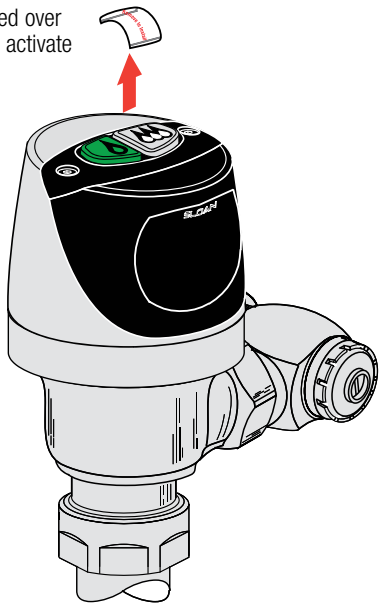
B Use Strap Wrench provided to tightly secure Locking Ring

Important: The Locking Ring must be installed down past the valve body threads by at least one thread. If difficulty is experienced installing the Locking Ring, turn the Locking Ring back and forth, each time working it further down the threads. The Locking Ring will act as a thread chaser in the event there has been a build-up of matter on the threads of the old valve body.

If retrofitting the Sloan ECOS Electronic onto a Zurn valve body, a special Locking Ring must be used (identified by a machined groove around the ring).

Order the Sloan ECOS™ Electronic Dual Flush with the "Z" variation to receive the unit supplied with this Ring.

A Remove the Tab located over the Override Button to activate the Sensor Module.

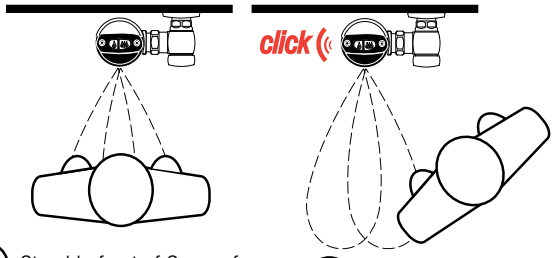


B For the first ten (10) minutes of operation, a Visible Light flashes in the Sensing Window of the Sloan ECOS™ Electronic Dual Flush Flushometer when a user is detected.

10 - TEST SENSOR OPERATION, ADJUST CONTROL STOP AND INSTALL VANDAL RESISTANT STOP CAP

The Sloan ECOS® Electronic has a factory set sensing range:
Water Closet Models - 22" to 42" (559 mm to 1067 mm)
Urinal Models - 15" to 30" (381 mm to 762 mm)

A Test Sensor with Cover in Place.

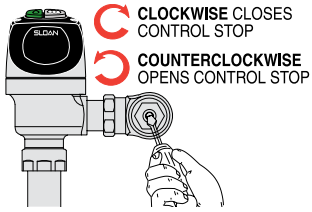


B Stand in front of Sensor for ten (10) seconds.

C Step away from Sensor and listen for "CLICK."

The Factory setting should be satisfactory for most installations. If a range adjustment is required, refer to the Range Adjustment instructions on this page.

D Open Control Stop COUNTERCLOCKWISE ½ turn from closed position.



E Activate Flushometer by placing hand in front of Sloan ECOS® Electronic Sensor Lens for ten (10) seconds (or press override button) and then moving it away.

F Adjust Control Stop after each flush until the rate of flow delivered properly cleanses the fixture.

G Install Control Stop Cap onto Control Stop. For RESS retrofit applications, reuse Stop Cap from existing valve. In complete valve installations, a new Stop Cap is provided. Follow the instructions packaged with the Free Spinning Vandal Resistant Stop Cap.

!!! IMPORTANT !!!

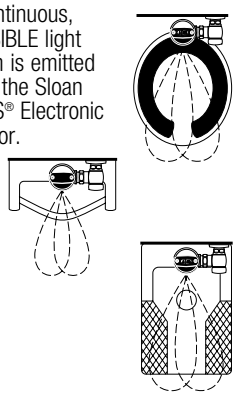
SLOAN FLUSHOMETERS ARE ENGINEERED FOR QUIET OPERATION. EXCESSIVE WATER FLOW CREATES NOISE, WHILE TOO LITTLE WATER FLOW MAY NOT SATISFY THE NEEDS OF THE FIXTURE. PROPER ADJUSTMENT IS MADE WHEN PLUMBING FIXTURE IS CLEANSED AFTER EACH FLUSH WITHOUT SPLASHING WATER OUT FROM THE LIP AND A QUIET FLUSHING CYCLE IS ACHIEVED.

!!! IMPORTANT !!!

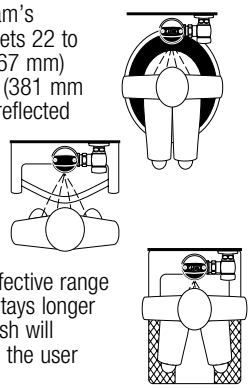
THE CONTROL STOP SHOULD NEVER BE OPENED TO THE POINT WHERE THE FLOW FROM THE VALVE EXCEEDS THE FLOW CAPABILITY OF THE FIXTURE. IN THE EVENT OF A VALVE FAILURE, THE FIXTURE MUST BE ABLE TO ACCOMMODATE A CONTINUOUS FLOW FROM THE VALVE.

OPERATION

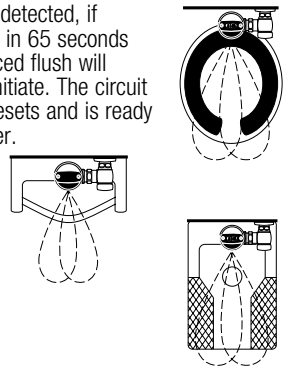
1. A continuous, INVISIBLE light beam is emitted from the Sloan ECOS® Electronic Sensor.



2. As the user enters the beam's effective range, water closets 22 to 42 inches (559 mm to 1067 mm) or urinals 15 to 30 inches (381 mm to 762 mm), the beam is reflected into the Scanner Window to activate the Output Circuit. Once activated, the Output Circuit continues in a "hold" mode for as long as the user remains within the effective range of the sensor. If the user stays longer than 65 seconds, a full flush will automatically initiate when the user leaves.



3. Once a user is detected, if the user leaves in 65 seconds or less, a reduced flush will automatically initiate. The circuit automatically resets and is ready for the next user.



RANGE ADJUSTMENT (ADJUST ONLY IF NECESSARY)

The Sloan ECOS® Electronic has a factory set sensing range:
Water Closet Models - 22" to 42" (559 mm to 1067 mm)
Urinal Models - 15" to 30" (381 mm to 762 mm)

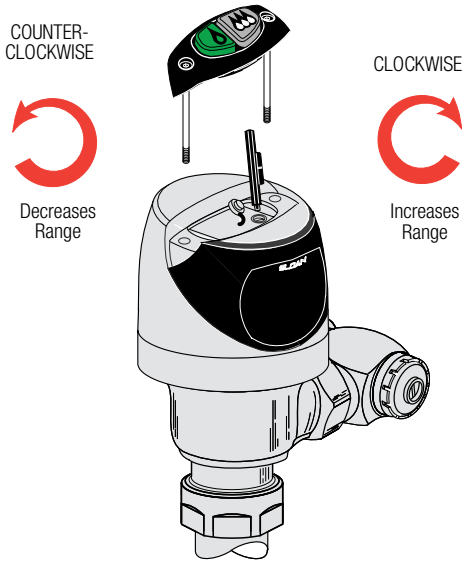
The Factory setting should be satisfactory for most installations.

If the range is too short (i.e., not picking up users) or too long (i.e., picking up opposite wall or stall door) the range can be adjusted. Note: Water does not have to be turned off to adjust range.

Loosen the two Screws on top of the unit. Remove the Override Button. Remove the Rubber Plug from top of Electronic Sensor Module to uncover the Potentiometer.

RANGE ADJUSTMENT PROCEDURE

For the first ten (10) minutes of operation, a Visible Light flashes in the Sensing Window of the Sloan ECOS when a user is detected. This Visible Light feature can be reactivated after ten (10) minutes by opening and closing the Battery Compartment Door. Check the range by stepping toward the unit until the Light flashes, indicating the Sensor's maximum detection limit. Adjust the Range Potentiometer Screw located on top of the Sensor Module a few degrees CLOCKWISE to increase the range or a few degrees COUNTERCLOCKWISE to decrease the range. Repeat this adjustment until the desired range is achieved. Always Determine the Sensing Range with Metal Cover and Lens Window On Top of the Unit. I**MPORTANT: ADJUST IN SMALL INCREMENTS ONLY!** Range Potentiometer Adjustment Screw rotates only ¾ of a turn; DO NOT over-rotate. When range adjustment is satisfactory, replace the Rubber Plug. Reinstall Override Button and tighten the two Screws on top of the unit.



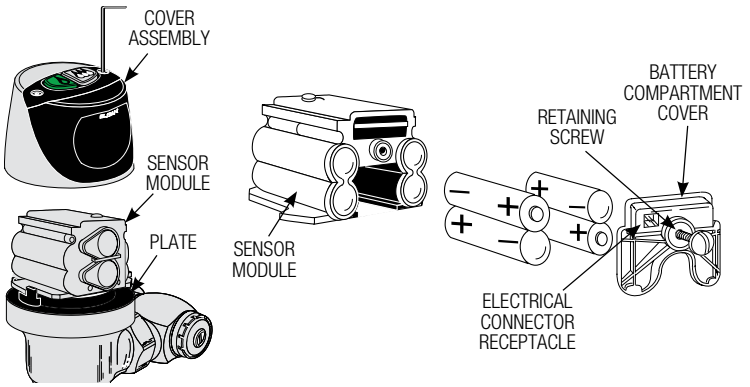
BATTERY REPLACEMENT

When required, replace batteries with four (4) Alkaline AA-Size batteries.

Note: Water does not have to be turned off to replace batteries.

Loosen the two (2) screws on top of unit. Remove the complete cover assembly. Lift the sensor module from its plate. Unplug the electrical connector from battery compartment cover. Loosen the retaining screw on battery compartment cover and remove battery compartment cover. Install four (4) Alkaline AA-Size batteries exactly as illustrated.

Install battery compartment cover and secure with Retaining Screw. Make certain that battery compartment cover is fully compressed against gasket to provide a seal; DO NOT overtighten. Plug the electrical connector into the battery compartment cover. Reinstall the sensor module onto the plate. Reinstall the complete cover assembly onto the plate. Tighten the two (2) screws on top of the unit.



TROUBLESHOOTING GUIDE

1. Sensor Flashes Continuously Only When User Steps Within Range.
- A. Unit in Start-Up mode; no problem. This feature is active for the first ten (10) minutes of operation.

2. Valve Does Not Flush; Sensor Not Picking Up User.
- A. Range too short; increase the range.

3. Valve Does Not Flush; Sensor Picking Up Opposite Wall or Surface, or Only Flushes When Someone Walks By. Light Flashes Continuously for First 10 Minutes Even with No One in Front of the Sensor.
- A. Range too long; shorten range.

4. Valve Does Not Flush Even After Adjustment.
- A. Range Adjustment Potentiometer set at full "max" or full "min" setting. Readjust Potentiometer away from full "max" or "min" setting.
- B. Batteries completely used up; replace batteries.
- C. Problem with Electronic Sensor Module; replace Electronic Sensor Module.

5. Unit Flashes 4 Quick Times When User Steps Within Range.
- A. Batteries low; replace batteries.

6. Valve Does Not Shut Off.
- A. Bypass Orifice in Diaphragm is clogged with dirt or debris, or Bypass is clogged by an invisible gelatinous film due to "over-treated" water. Remove Flex Tube Diaphragm and wash under running water. Note: Size of Orifice in the Bypass is of utmost importance for the proper metering of water by the valve. **DO NOT ENLARGE OR DAMAGE THIS ORIFICE.** Replace Flex Tube Diaphragm if cleaning does not correct the problem.
- B. Dirt or debris fouling Stem or Flex Tube Diaphragm. Remove Flex Tube Diaphragm and wash under running water.
- C. O-ring on Stem of Flex Tube Diaphragm is damaged or worn. Replace O-ring if necessary.
- D. Problem with Electronic Sensor Module; replace Sensor Module.

7. Not Enough Water to Fixture.
- A. Wrong Flush Volume Regulator installed in Flex Tube Diaphragm Kit. Install the correct Regulator (see Step 7 of these instructions).
- B. Wrong Sloan ECOS® Electronic model installed; i.e., 1.6 gpf model installed on 3.5 gal. closet fixture.
- C. Enlarged Bypass in Diaphragm. Replace Flex Tube Diaphragm.
- D. Control Stop not adjusted properly. Readjust Control Stop.
- E. Inadequate volume or pressure at supply. Increase water pressure or supply (flow) to valve. Consult factory for assistance.

8. Too Much Water to Fixture.
- A. Wrong Flush Volume Regulator installed in Flex Tube Diaphragm Kit. Install the correct Regulator (see Step 7 of these instructions).
- B. Control Stop not adjusted properly. Readjust Control Stop.
- C. Wrong Sloan ECOS Electronic model installed; i.e., 3.5 gpf. model installed on 1.6 gal. fixture. Replace with proper Sloan ECOS Electronic model.
- D. Dirt in Diaphragm Bypass. Clean under running water or replace Flex Tube Diaphragm.

Note: The EBV-46-A Beam Deflector is no longer required or available for the Sloan ECOS.

When further assistance is required, please contact your local Sloan Representative or Sloan Technical Support at: 1-888-SLOAN-14 (1-888-756-2614) or visit us online at: www.sloanvalve.com

!!! IMPORTANT !!!

PROTECT THE CHROME OR SPECIAL FINISH OF SLOAN FLUSHOMETERS — DO NOT USE TOOTHED TOOLS TO INSTALL OR SERVICE THESE VALVES. USE A SLOAN A-50 SUPER-WRENCH™, SLOAN A-109 PLIER WRENCH OR SMOOTH JAWED SPUD WRENCH TO SECURE ALL COUPLINGS. ALSO SEE "CARE AND CLEANING" SECTION

!!! IMPORTANT !!!

THIS PRODUCT CONTAINS MECHANICAL AND/OR ELECTRICAL COMPONENTS THAT ARE SUBJECT TO NORMAL WEAR. THESE COMPONENTS SHOULD BE CHECKED ON A REGULAR BASIS AND REPLACED AS NEEDED TO MAINTAIN THE VALVE'S PERFORMANCE.

!!! IMPORTANT !!!

LAWS AND REGULATIONS PROHIBIT THE USE OF HIGHER FLUSHING VOLUMES THAN LISTED ON FIXTURE OR FLUSHOMETER

!!! IMPORTANT !!!

THE CONTROL STOP SHOULD NEVER BE OPENED TO THE POINT WHERE THE FLOW FROM THE VALVE EXCEEDS THE FLOW CAPABILITY OF THE FIXTURE. IN THE EVENT OF A VALVE FAILURE, THE FIXTURE MUST BE ABLE TO ACCOMMODATE A CONTINUOUS FLOW FROM THE VALVE.

!!! IMPORTANT !!!

WITH THE EXCEPTION OF CONTROL STOP INLET, DO NOT USE PIPE SEALANT OR PLUMBING GREASE ON ANY VALVE COMPONENT OR COUPLING!

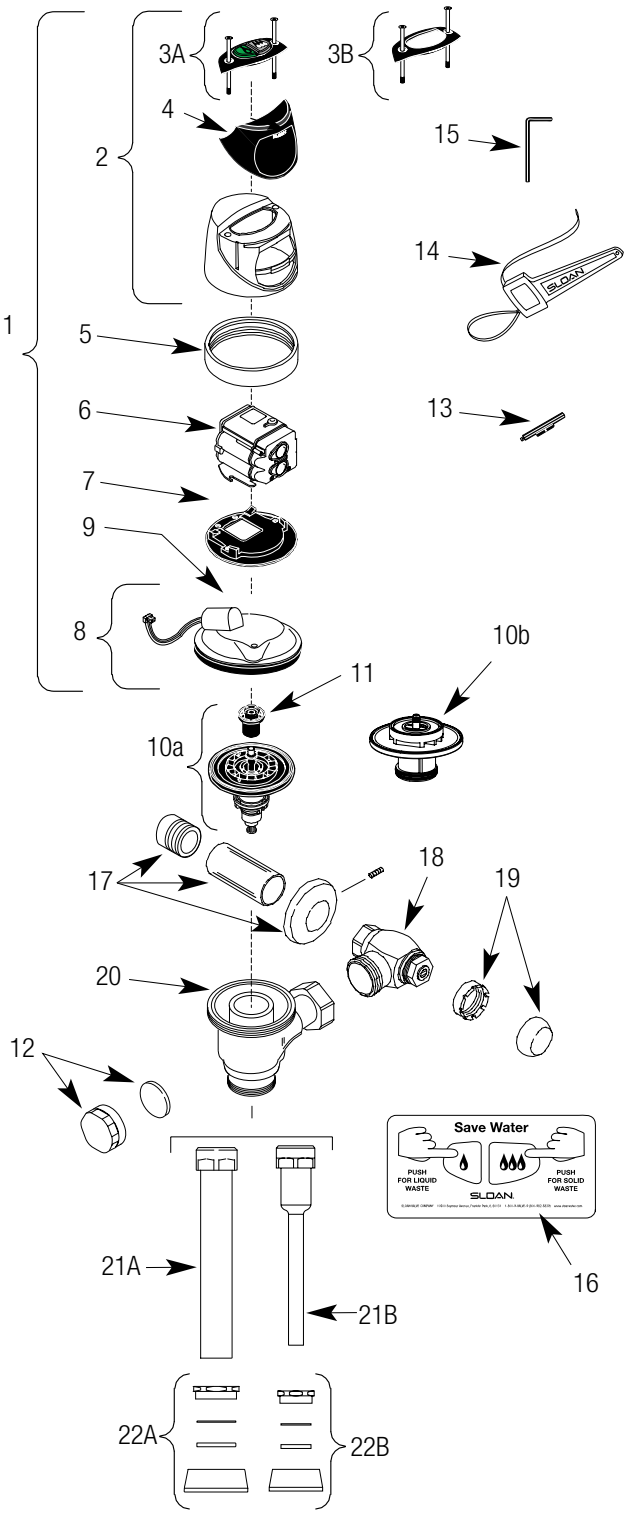
!!! IMPORTANT !!!

THE STRAP WRENCH PROVIDED WITH SLOAN ECOS® ELECTRONIC IS A CONVENIENCE TOOL AND IS NOT TO BE USED TO REMOVE OR INSTALL THE FLUSHOMETER COUPLINGS. USE STRAP WRENCH ONLY TO INSTALL SLOAN ECOS® ELECTRONIC LOCKING RING.

PARTS LIST

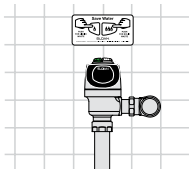
Item #	Part #	Description
Items Included with RESS Retrofit and Complete Sloan ECOS Flush Valves		
1	WES-55-A	Cover/Ring/Sensor Assembly - Dual Flush WC
	EBV-138-A	Cover/Ring/Sensor Assembly - Single Flush WC
	EBV-139-A	Cover/Ring/Sensor Assembly - Single Flush Urinal
	WES-60-A	Cover/Ring/Sensor Assembly w/ Zurn ring - Dual Flush WC
	EBV-149-A	Cover/Ring/Sensor Assembly w/ Zurn ring - Single Flush Water Closet
	EBV-150-A	Cover/Ring/Sensor Assembly w/ Zurn Ring - Single Flush Urinal
2	EBV-191-A	Cover Assembly - Dual Flush
	EBV-142-A	Cover Assembly - Single Flush
3A	WES-23-A	Button Cover Assembly with Screws - Dual Flush
	EBV-130-A	Button Cover Assembly with Screws - Single Flush
3B	EBV-132-A	Screws (2) and Hex Wrench Only
4	EBV-131	Lens Window Cover
5	EBV-168	Locking Ring
	EBV-172	Locking Ring - for Zurn valves
6	EBV-196-A	Module - ECOS Electronic Dual Flush
7	EBV-177	Cover Rest Plate
8	EBV-145-A	Inside Cover Assembly (includes solenoid)
9	EBV-136-A	Solenoid
10A	†	Flex Tube Diaphragm Assembly
10B	†	Cartridge Assembly
11	†	Flush Volume Regulator
12	EBV-1017-A	Handle Cap (RESS Retrofit Models only)
13	EBV-91	Range Adjustment Tool
14	EBV-22	Strap Wrench
15	EBV-137	7/64" Hex Wrench
16	WES-19	English Operation Instruction Plate
	WES-22	Spanish Operation Instruction Plate
Items Included with Complete Sloan ECOS Valves Only		
17	H-633-AA	1" (25 mm) Sweat Solder Kit
18	H-700-A	1" (25 mm) Bak-Chek® Control Stop
19	H-1010-A	Vandal Resistant Stop Cap
20	EBV-36-A	Valve Body
21	V-600-AA	1½" (38 mm) x 10" (254 mm) Vacuum Breaker (Model 8110)
	V-600-AA	1½" (38 mm) x 23" (584 mm) Vacuum Breaker (Model 8115)
	V-600-AA	1½" (38 mm) x 26" (660 mm) Vacuum Breaker (Model 8116)
22	F-5-AT	1½" Spud Coupling Assembly (Water Closet Models)

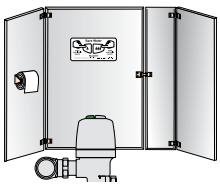
† Part No. varies with valve model variation; consult factory.



RECOMMENDED WALL PLATE LOCATIONS

- Centered over Flushometer
- On stall door





CARE AND CLEANING

DO NOT use abrasive or chemical cleaners to clean flushometers as they may dull the luster and attack the chrome or special decorative finishes. Use ONLY soap and water, then wipe dry with clean cloth or towel.

While cleaning the bathroom tile, the Flushometer should be protected from any splattering of cleaner. Acids and cleaning fluids can discolor or remove chrome plating.

Manufactured in the U.S.A. by Sloan Valve Company under one or more of the following patents: U.S. Patents. 4,839,039; 5,195,720; 5,295,655; 5,542,718; 5,558,120; 5,564,460; 5,887,848; 5,967,182; 6,212,697; 6,382,586; 6,619,614; 6,685,158; 6,691,979; Des. 411,609.

Other Pats. Pending. BAK-CHEK®, CID®, COURTESY FLUSH®, PARA-FLO®, PERMEX®, TURBO-FLO®.

The information contained in this document is subject to change without notice.

SLOAN HEADQUARTERS • 10500 SEYMOUR AVENUE • FRANKLIN PARK, IL 60131
Phone: 1-800-9-VALVE-9 or 1-847-671-4300 • Fax: 1-800-447-8329 or 1-847-671-4380 • www.sloanvalve.com

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Code No. 0816721 — Rev. 4 (12/11)

UR-1		**UR-1 URINAL PER ADDENDUM #2-1**
A6590001020	AMERICAN STANDARD	0.125 GALLONS PER FLUSH URINAL TOP SPUD WHITE
S3250424	SLOAN	0.5 GALLONS PER FLUSH 8186.05 GAUGE URINAL FLUSH VALVE POWER SENSOR

INSTALLATION INSTRUCTIONS

American Standard
Style That Works Better

WASHBROOK URINAL
6590 & 6515 SERIES

Thank you for selecting American Standard – the benchmark of fine quality for over 100 years. To ensure this product is installed properly, please read these instructions carefully before you begin. (Certain installations may require professional help.) Also be sure your installation conforms to local codes.

BEFORE YOU BEGIN

⚠ **CAUTION: PRODUCT IS FRAGILE. TO AVOID BREAKAGE AND POSSIBLE INJURY HANDLE WITH CARE!**

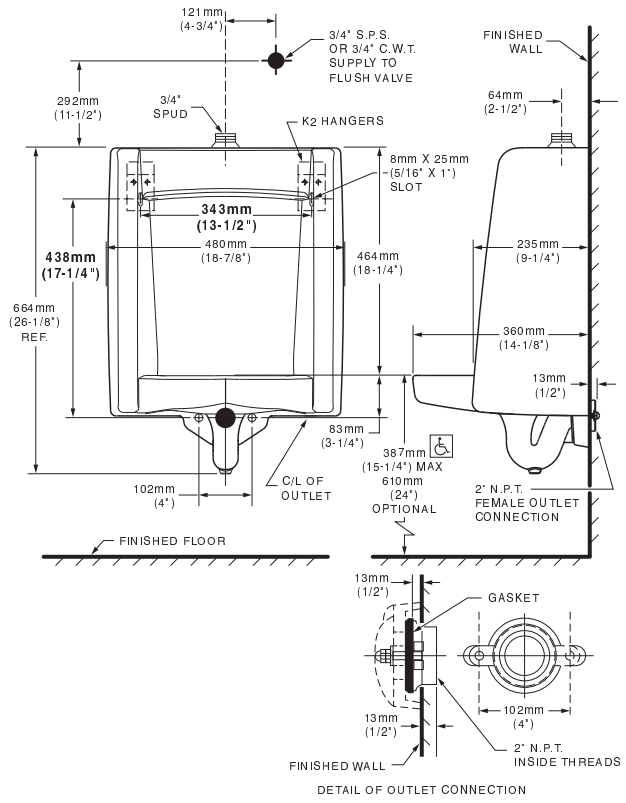
NOTES:

- *Pictures may not exactly define contour of china and components.*
- *Observe all local plumbing and building codes.*
- *Refer to local codes and manufacturer's instructions for flush valve requirements.*
- *Carefully inspect the new urinal for damage.*
- *Fixture dimensions are nominal and conform to tolerances by ASME Standard A112.19.2.*
- *Site preparation may require additional tools and hardware.*

RECOMMENDED TOOLS AND MATERIALS

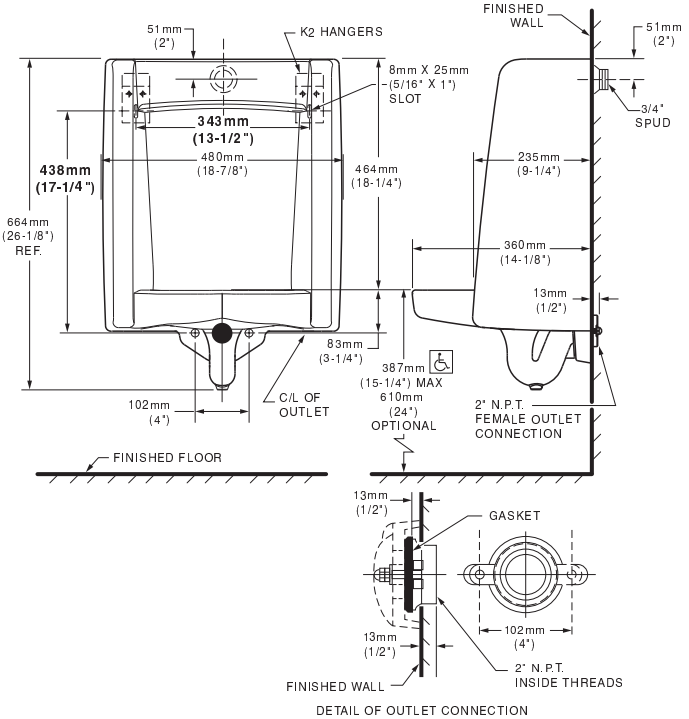
Safety Glasses	Tape Measure	Adjustable Wrench	Blade Screwdriver	Pencil	Levels
Thread Sealant	1/4" Ratchet	Hole Cutting Equipment			

Top Spud



DETAIL OF OUTLET CONNECTION

Back Spud



DETAIL OF OUTLET CONNECTION

SAVE FOR FUTURE USE

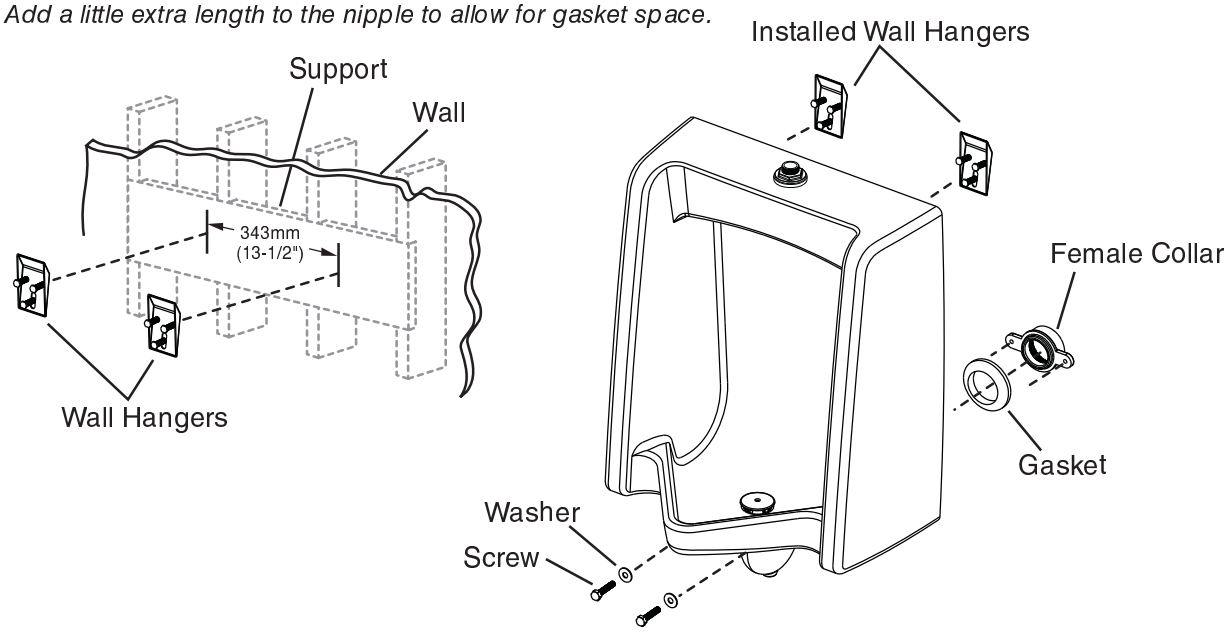
Product names listed herein are trademarks of AS America Inc.
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7301778-100

1 PREPARATION

a. Turn the water supply OFF.
b. Install or relocate the supply tubing and waste pipe as necessary to conform to the roughing in dimensions.
c. Install the shut off valve.
d. Install adequate support framing for the wall hangers as needed.
e. Determine the position of the waste pipe nipple. When establishing the nipple length, take into account the length of the urinal outlet spud and the distance the female collar will thread onto the waste pipe nipple.

NOTE: *Add a little extra length to the nipple to allow for gasket space.*



2 INSTALL THE URINAL

⚠ CAUTION: RISK OF PERSONAL INJURY OR PRODUCT DAMAGE. HANDLE WITH CARE. VITREOUS CHINA CAN BREAK OR CHIP IF THE PRODUCT IS HANDLED CARELESSLY.

⚠ CAUTION: RISK OF PRODUCT DAMAGE. DO NOT OVERTIGHTEN THE BOLTS.

a. Install the wall hangers according to the roughing in illustration.
b. Apply thread sealant tape to the pipe threads and install the female collar to the waste pipe.
c. Place the gasket onto the female collar with the beveled surface facing away from the collar.
d. Carefully position the urinal on the wall hangers.
e. Secure the urinal to the female collar using the screws and washers provided.

3 COMPLETE THE INSTALLATION

a. Install the flush valve according to the manufacturer's instructions.
b. Connect the water supply and complete the waste pipe connections.
c. Turn on the water supply.
d. Flush and check the entire installation for leaks.

CARE & CLEANING

Wash with mild soapy water and rinse thoroughly. Dry with a soft cloth. Avoid detergents, disinfectants or cleaning products in aerosol cans as they may damage fittings.

In the United States:
American Standard Brands
P.O. Box 6820
Piscataway, New Jersey 08855
Attention: Director of Customer Care
For residents of the United States, warranty information may also be obtained by calling the following toll free number: (800) 442-1902
www.americanstandard.com

In Canada:
AS Canada, ULC
5900 Avebury Rd.
Mississauga, Ontario
Canada L5R 3M3
Toll Free: (800) 387-0369
www.americanstandard.ca

In Mexico:
American Standard B&K Mexico
S. de R.L. de C.V.
Via Morelos #330
Col. Santa Clara
Ecatepec 55540 Edo. Mexico
Toll Free: 01-800-839-1200
www.americanstandard.com.mx

Water Connects Us®

Code No. 0816452
Rev. 5 (06/16)

INSTALLATION INSTRUCTIONS FOR RETROFIT AND COMPLETE VALVE INSTALLATION



8100 Series Complete Flushometer Models

8100 Series Optima Plus valves are complete flushometer valves and ideal for new installations.



RESS Series Retrofit Conversion Kit Models

RESS Optima Plus models are used to convert existing Royal, Regal and Sloan style flushometers to sensor activation.

Optima Plus Water Closet Models can be furnished for the following:

1.6 gpf/6.0 Lpf	For Low Consumption Bowls
2.4 gpf/9.0 Lpf	For 9 Liter European Water Closets
3.5 gpf/13.2 Lpf	For older Water Closets

Optima Plus Urinal Models can be furnished for the following:

0.5 gpf/1.9 Lpf	For Wash Down Urinals
1.0 gpf/3.8 Lpf	For Low Consumption Urinals
1.5 gpf/5.7 Lpf	For older Siphon Jet Urinals
3.5 gpf/13.2 Lpf	For older Blow Out Urinals

Made in the U.S.A.

LIMITED WARRANTY

Unless otherwise noted, Sloan Valve Company warrants this product, manufactured and sold for commercial or industrial uses, to be free from defects in material and workmanship for a period of three (3) years (one (1) year for special finishes, SF faucets, PWT electronics and 30 days for PWT software) from the date of first purchase. During this period, Sloan Valve Company will, at its option, repair, replace, or refund the purchase price of any product which fails to conform with this warranty under normal use and service. This shall be the sole and exclusive remedy under this warranty. Products must be returned to Sloan Valve Company, at customer's cost. No claims will be allowed for labor, transportation or other costs. Damage caused by misuse or improper installation are all excluded from this warranty. This warranty extends only to person or organizations who purchase Sloan Valve Company's products directly from Sloan Valve Company for purpose of resale. This warranty does not cover the life of the batteries.

THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. IN NO EVENT IS SLOAN VALVE COMPANY RESPONSIBLE FOR ANY CONSEQUENTIAL DAMAGES OF ANY MEASURE WHATSOEVER.

PRIOR TO INSTALLATION

Prior to installing the Optima Plus flushometer, install the items listed below as illustrated in the Rough-in Diagram. (New installations only.)

- Closet or Urinal fixture
- Drain line
- Water supply line

Important:

- **ALL PLUMBING SHOULD BE INSTALLED IN ACCORDANCE WITH APPLICABLE CODES AND REGULATIONS.**
- **WATER SUPPLY LINES MUST BE SIZED TO PROVIDE AN ADEQUATE VOLUME OF WATER FOR EACH FIXTURE.**
- **WHEN INSTALLING A FLUSHOMETER, IT IS IMPORTANT THAT THE FLUSH MODEL MATCHES THE REQUIREMENTS OF THE PLUMBING FIXTURE.**
- **FLUSH ALL WATER LINES PRIOR TO MAKING CONNECTIONS.**

The Optima Plus is designed to operate with 15 to 100 PSI (104 to 689 kPa) of water pressure. **THE MINIMUM PRESSURE REQUIRED TO THE VALVE IS DETERMINED BY THE TYPE OF FIXTURE SELECTED.** Consult fixture manufacturer for pressure requirements.

Most Low Consumption water closets (1.6 gallon/6 liter) require a minimum flowing pressure of 25 psi (172 kPa).

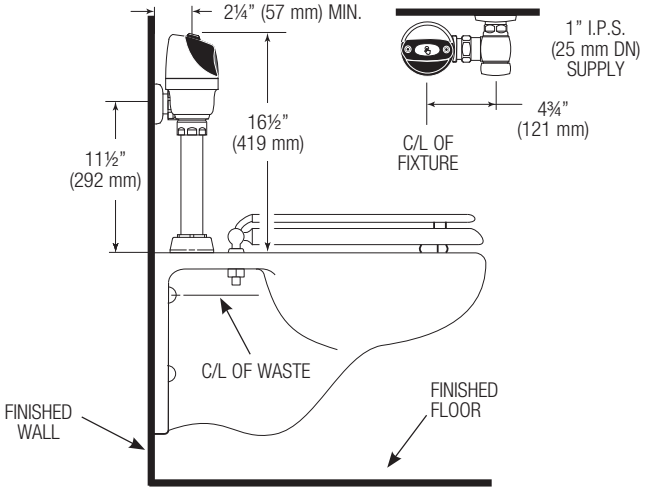
TOOLS REQUIRED FOR INSTALLATION

- Slotted screwdriver to adjust control stop.
- Sloan A-50 Super-Wrench™, Sloan A-109 Plier Wrench or smooth jawed spud wrench for couplings.
- Strap wrench (supplied) to install Optima Plus to valve body.
- 7/64" hex wrench (supplied) to secure Optima Plus cover to base plate.

VALVE ROUGH-IN

Typical Water Closet Installation

Model 8110/8111
Reference for RESS-C Retrofit



When installing the Optima Plus in a handicap stall:

Per the ADA Guidelines (section 604.9.4) it is recommended that the grab bars be split or shifted to the wide side of the stall.

!!! IMPORTANT !!!

With the exception of Control Stop Inlet, DO NOT use pipe sealant or plumbing grease on any valve component or coupling!

!!! IMPORTANT !!!

Protect the chrome or special finish of Sloan Flushometers — DO NOT USE toothed tools to install or service these valves. Use a Sloan A-50 Super-Wrench™, Sloan A-109 Plier Wrench or smooth jawed spud wrench to secure all couplings. Also see "Care and Cleaning" section of this manual.

!!! IMPORTANT !!!

LAWS AND REGULATIONS PROHIBIT THE USE OF HIGHER FLUSHING VOLUMES THAN LISTED ON FIXTURES OR FLUSHOMETERS.

!!! IMPORTANT !!!

This product contains mechanical and/or electrical components that are subject to normal wear. These components should be checked on a regular basis and replaced as needed to maintain the valve's performance.

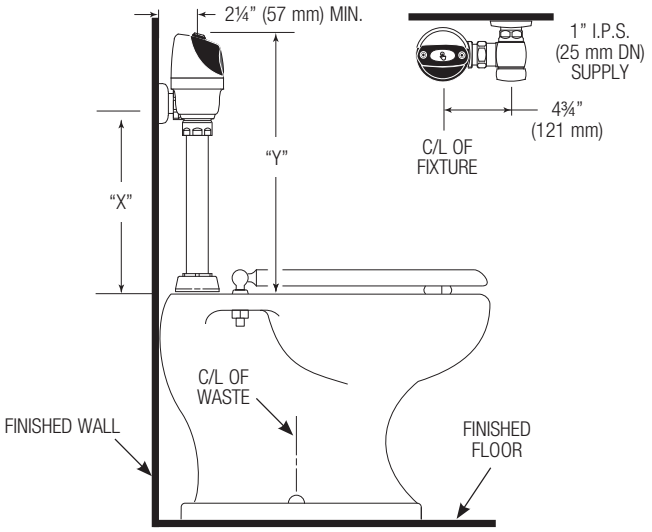
!!! IMPORTANT !!!

The Strap Wrench provided with Optima Plus is a convenience tool and is not to be used to remove or install the Flushometer Couplings. Use Strap Wrench ONLY to install Optima Plus Locking Ring.

When assistance is required, please contact Sloan Technical Support at: 1-888-SLOAN-14 (1-888-756-2614) or visit us online at: www.sloanvalve.com

High Rough-in Water Closet Installation

Models 8113, 8115 & 8116



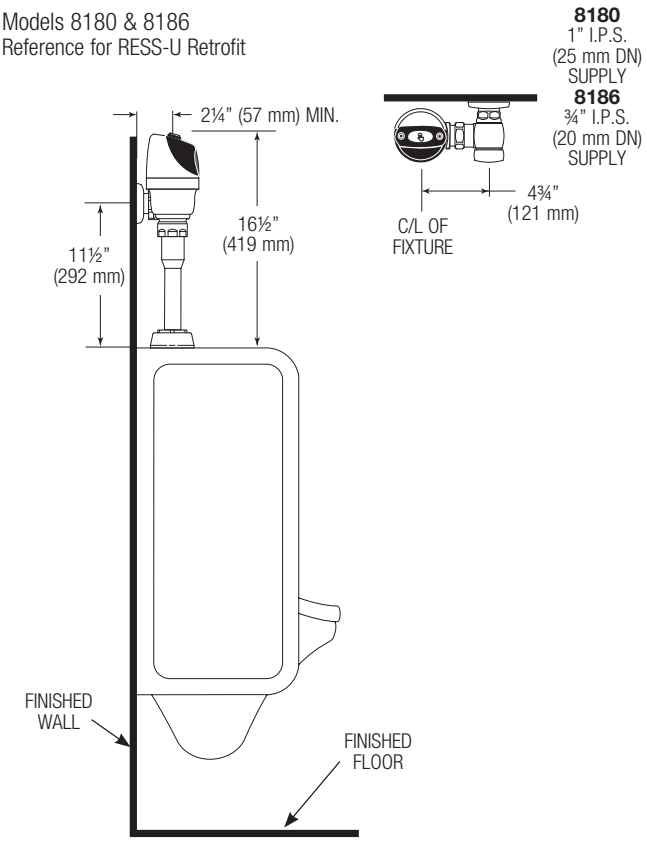
Model 8115 & 8116 valves are designed for installations where the water supply is roughed-in 24" - 27" (610 mm - 686 mm) above the top of the water closet.

For new installations, Sloan strongly recommends the use of our Model 8111 which has a shorter installation height.

Model	"X"	"Y"
8113	16" (406 mm)	21" (533 mm)
8115	24" (610 mm)	29" (737 mm)
8116	27" (686 mm)	32" (813 mm)

Typical Urinal Installation

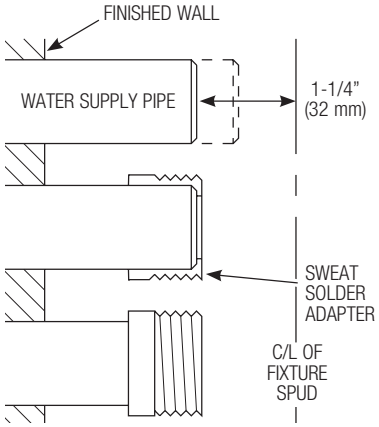
Models 8180 & 8186
Reference for RESS-U Retrofit



1 - FOR COMPLETE VALVE INSTALLATION START HERE. FOR RESS RETROFIT INSTALLATION, START AT STEP 6. INSTALL OPTIONAL SWEAT SOLDER ADAPTER (ONLY IF YOUR SUPPLY PIPE DOES NOT HAVE A MALE THREAD)

A Measure from finished wall to C/L of Fixture Spud. Cut pipe 1¼" (32 mm) shorter than this measurement. Chamfer O.D. and I.D. of water supply pipe.

B Slide Threaded Adapter fully onto pipe.



C Sweat solder the Adapter to pipe.

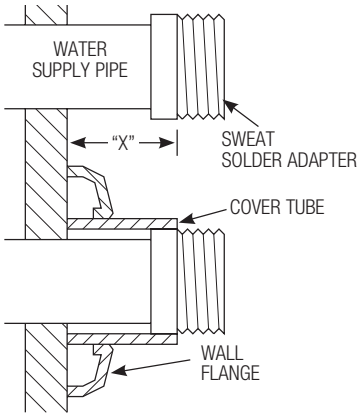
!!! IMPORTANT !!!

With the exception of Control Stop Inlet, DO NOT use pipe sealant or plumbing grease on any valve component or coupling!

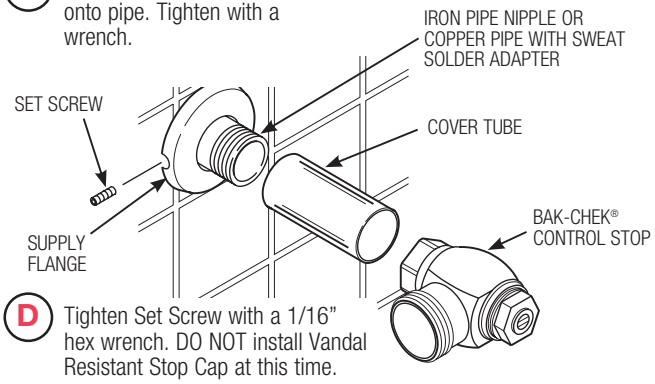
2 - INSTALL COVER TUBE, WALL FLANGE AND CONTROL STOP TO SUPPLY PIPE

A Measure from finished wall to first thread of Adapter or threaded supply pipe (dimension "X"). Cut Cover Tube to this length.

B Slide Cover Tube over pipe. Slide Wall Flange over Cover Tube until against wall.



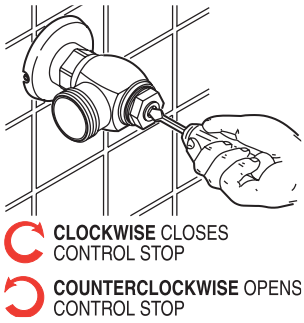
C Thread Control Stop onto pipe. Tighten with a wrench.



D Tighten Set Screw with a 1/16" hex wrench. DO NOT install Vandal Resistant Stop Cap at this time.

3 - FLUSH OUT SUPPLY LINE

A Open Control Stop.



B Turn on water supply to flush line of any debris or sediment.

C Close Control Stop.

4 - INSTALL VACUUM BREAKER FLUSH CONNECTION

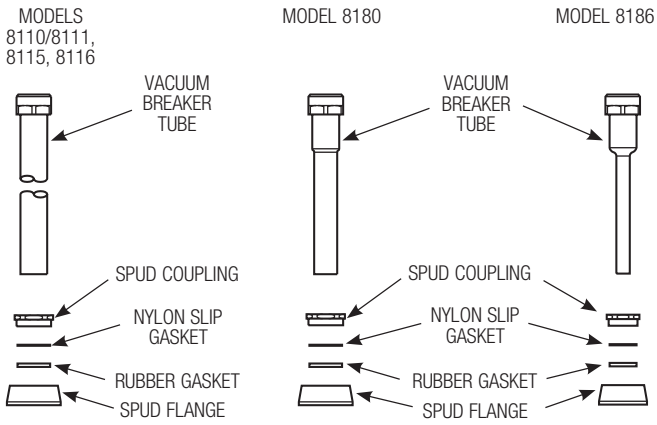
NOTE

If cutting Vacuum Breaker Tube to size, note that Critical Line (C/L) on Vacuum Breaker must typically be 6" (152 mm) above fixture. Consult Code for details.

A Slide Spud Coupling, Nylon Slip Gasket, Rubber Gasket and Spud Flange over Vacuum Breaker Tube.

B Insert Tube into Fixture Spud.

C Hand tighten Spud Coupling onto Fixture Spud.



5 - INSTALL FLUSHOMETER

A Lubricate tailpiece O-ring with water. Insert Adjustable Tailpiece into Control Stop. Tighten Tailpiece Coupling by hand.



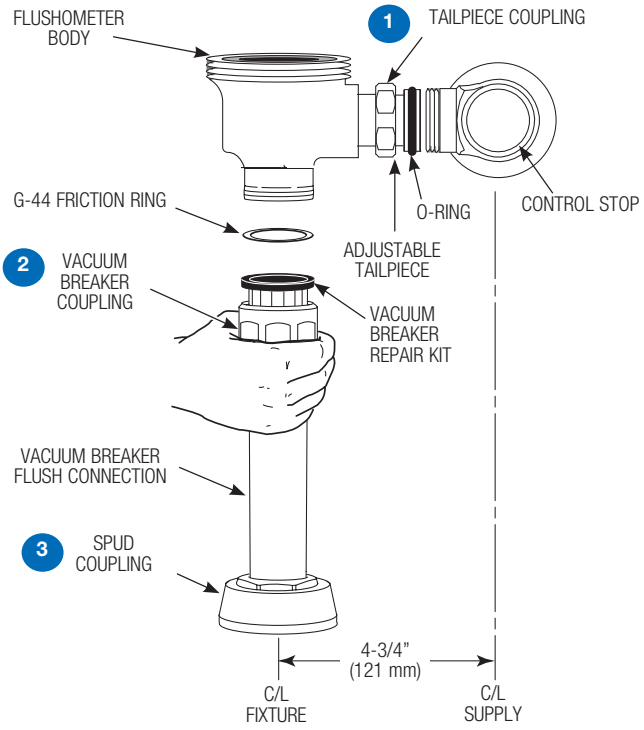
B Align Flushometer directly above the Vacuum Breaker Flush Connection by sliding the Flushometer Body IN or OUT as needed. Tighten Vacuum Breaker Coupling by hand.

NOTE

Maximum adjustment of the Sloan Adjustable Tailpiece is 1/2" (13 mm) IN or OUT from the standard 4-3/4" (121 mm) (centerline of Flushometer to centerline of Control Stop).

If roughing-in measurement exceeds 5-1/4" (133 mm), consult factory for longer tailpiece.

C Align Flushometer Body and securely tighten first the Tailpiece Coupling (1), then the Vacuum Breaker Coupling (2), and finally the Spud Coupling (3). Use a wrench to tighten these couplings in the order shown.



6 - WHEN RETROFITTING AN EXISTING VALVE, START HERE. REMOVE COMPONENTS FROM EXISTING FLUSHOMETER (RESS RETROFIT INSTALLATIONS ONLY)

A Remove Control Stop Cap.

B Turn off water supply at Control Stop. Push Valve Handle to relieve water pressure.

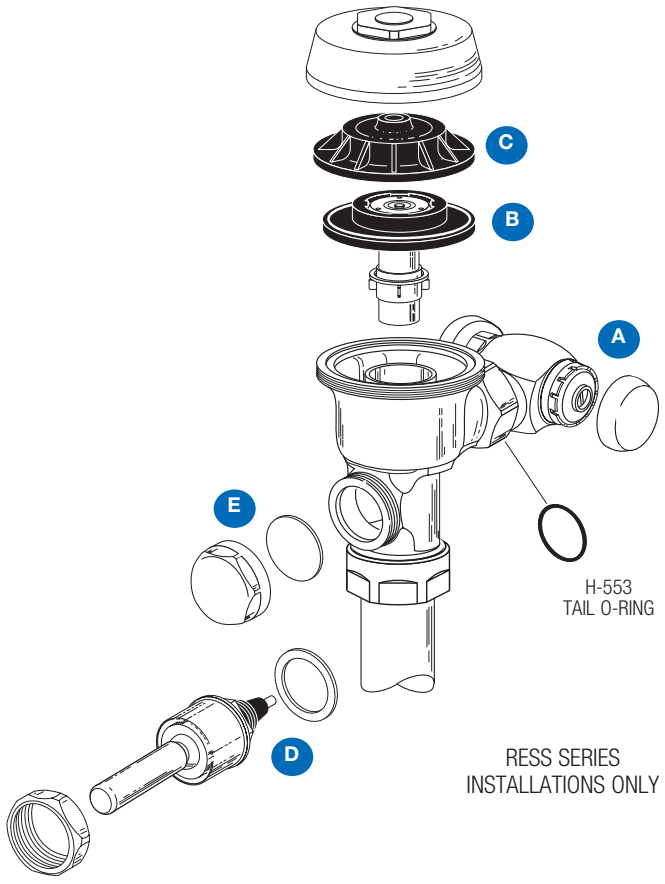
C Remove Outside and Inside Covers and old Inside Parts Kit.

D Remove old Handle Assembly and Gasket.

E Install Chrome Handle Cap with Gasket to handle opening on Flushometer Body. Tighten Chrome Handle Cap securely.

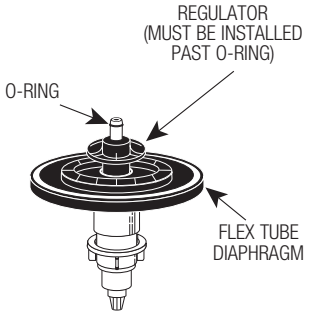
NOTE

An extra H-553 Tail O-ring is included in the event leakage occurs if the valve is repositioned during the installation of the new Optima Plus. USE ONLY AS NEEDED.



7 - OPTIMA PLUS FLUSH VOLUME

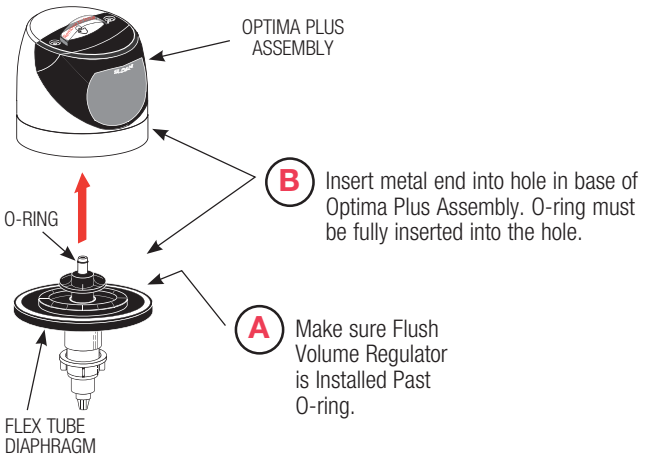
The Flush Volume of the Optima Plus is controlled by the Regulator in the Flex Tube Diaphragm Kit. Regulators are identified by color.



!!! IMPORTANT !!!

LAWS AND REGULATIONS PROHIBIT THE USE OF HIGHER FLUSHING VOLUMES THAN LISTED ON FIXTURES OR FLUSHOMETERS.

8 - ASSEMBLE FLEX TUBE DIAPHRAGM TO OPTIMA PLUS ASSEMBLY

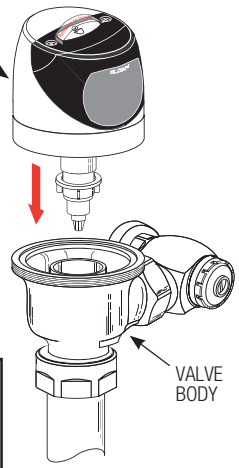


B Insert metal end into hole in base of Optima Plus Assembly. O-ring must be fully inserted into the hole.

A Make sure Flush Volume Regulator is Installed Past O-ring.

To facilitate installation, wet the diaphragm assembly (on top or completely).

C Push Diaphragm securely against underside of Optima Plus Assembly. Place entire Assembly onto the Valve Body.



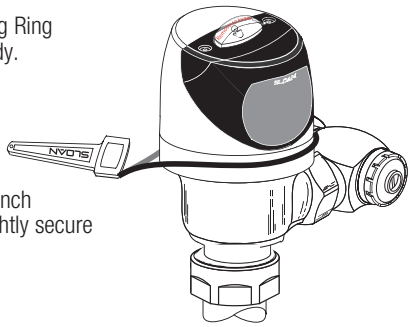
NOTE

Sensor Lens must face directly forward. Rotating the Sensor to either side will decrease the Sensor's ability to detect a target.

9 - TIGHTEN LOCKING RING

A Thread Locking Ring onto Valve Body.

B Use Strap Wrench provided to tightly secure Locking Ring.



!!! IMPORTANT !!!

The Locking Ring must be installed down past the valve body threads by at least one thread. If difficulty is experienced installing the Locking Ring, turn the Locking Ring back and forth, each time working it further down the threads. The Locking Ring will act as a thread chaser in the event there has been a build-up of matter on the threads of the old valve body.

If retrofitting the Optima Plus onto a Zurn valve body, a special Locking Ring must be used (identified by a machined groove around the ring).

Order the Optima Plus with the "Z" variation to receive the unit supplied with this Ring.

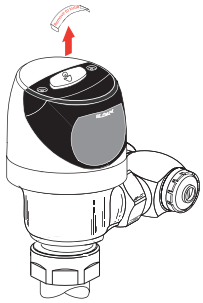
10 - REMOVE TAB TO ACTIVATE SENSOR MODULE

A Remove all removable objects in sensor view area and remove the Tab located over the Override Button to activate the Sensor Module. The sensor module will perform the start-up routine for one minute with LED blinking.

B For the first ten (10) minutes of operation, a Visible Red Light flashes in the Sensing Window of the Optima Plus Flushometer when a user is detected.

NOTE

The self adaptive sensor automatically adapts to the surrounding enviroment when the tab on the override button is removed. No manual adjustments are required. Start-up mode will take approximately one (1) minute to complete its cycle and it is important that no non-permanent (i.e. a wall or stall door) target is present at this time. If the target is permanent, the sensor will adapt itself around this target. A 3 seconds long Red light on and followed with slow Red light blinking in sensor window indicates sensor is in the start-up mode. When the start-up cycle is completed after one (1) (indicate new lithium battery installed) or two (2) (indicate new alkaline battery installed) 2 seconds long Red lights, there will be no light visible in the sensor window.

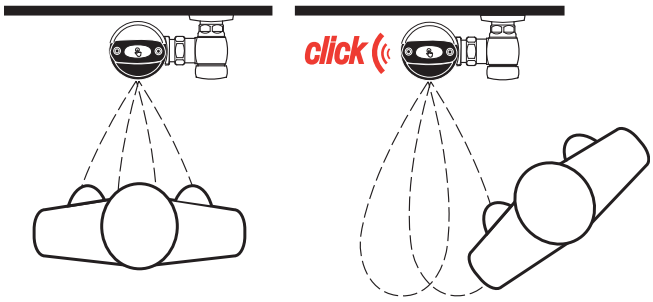


11 - TEST SENSOR OPERATION

The Optima Plus has a factory set sensing range:
Water Closet Models - 22" to 42" (559 mm to 1067 mm)
Urinal Models - 15" to 30" (381 mm to 762 mm)

The factory setting should be satisfactory for most installations. If a range adjustment is required, refer to the Range Adjustment instructions on this page.

A Test Sensor with Cover in Place.



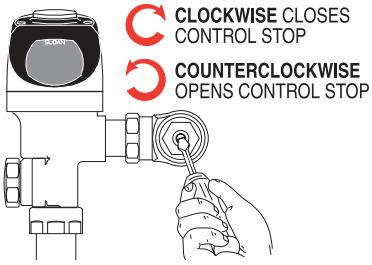
B Stand in front of Sensor for ten (10) seconds

C Step away from Sensor and listen for "CLICK."

12 - ADJUST CONTROL STOP AND INSTALL VANDAL RESISTANT STOP CAP

A Open Control Stop COUNTERCLOCKWISE ½ turn from closed position.

B Activate Flushometer by placing hand in front of Optima Plus Sensor Lens for ten (10) seconds (or press override button) and then moving it away.



C Adjust Control Stop after each flush until the rate of flow delivered properly cleanses the fixture.

!!! IMPORTANT !!!

The flushometer is engineered for quiet operation. Excessive water flow creates noise, while too little water flow may not satisfy the needs of the fixture. Proper adjustment is made when plumbing fixture is cleansed after each flush without splashing water out from the lip AND a quiet flushing cycle is achieved.

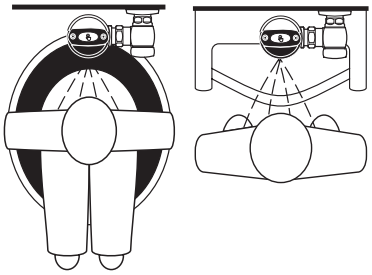
!!! IMPORTANT !!!

The Control Stop should never be opened to the point where the flow from the valve exceeds the flow capability of the fixture. In the event of a valve failure, the fixture must be able to accommodate a continuous flow from the valve.

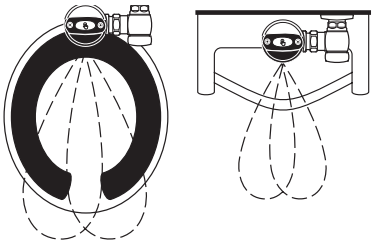
D Install Control Stop Cap onto Control Stop. For RESS retrofit applications, reuse Stop Cap from existing valve. In complete valve installations, a new Stop Cap is provided.
For G2 models, follow the instructions packaged with the Free Spinning Vandal Resistant Stop Cap.

OPERATION

1. A continuous, INVISIBLE light beam is emitted from the Optima Plus Sensor.
2. As the user enters the beam's effective range, 22 to 42 inches (559 mm to 1067 mm) for closet installations and 15 to 30 inches (381 mm to 762 mm) for urinal installations, the beam is reflected into the Scanner Window to activate the Output Circuit. Once activated, the Output Circuit continues in a "hold" mode for as long as the user remains within the effective range of the sensor.



3. When the user steps away, the loss of reflected light initiates an electrical "one-time" signal that activates the flushing cycle to flush the fixture. The Circuit automatically resets and is ready for the next user.



RANGE ADJUSTMENT (ADJUST ONLY IF NECESSARY)

The Optima Plus has a factory set sensing range:
Water Closet Models - 22" to 42" (559 mm to 1067 mm)
Urinal Models - 15" to 30" (381 mm to 762 mm)

The Factory setting should be satisfactory for most installations.

If the range is too short (i.e., not picking up users) or too long (i.e., picking up opposite wall or stall door) the range can be adjusted.

Note: Water does not have to be turned off to adjust range.

RANGE ADJUSTMENT PROCEDURE

For the first ten (10) minutes of operation, a Visible Red Light flashes in the Sensing Window of the Optima Plus Flushometer when a user is detected. This Visible Red Light feature can be reactivated by pushing the manual override button more than one minute.

RANGE ADJUSTMENT (ADJUST ONLY IF NECESSARY) - CONTINUED

Make sure to remove all the non-permanent targets in sensor view area. Push manual override button for 20-30 seconds. the Red LED in the G2 sensor starts slow blinking. Release the button during the LED blinking. The G2 will into distance setting mode. The setting mode will run for one minute.

!!! IMPORTANT !!!

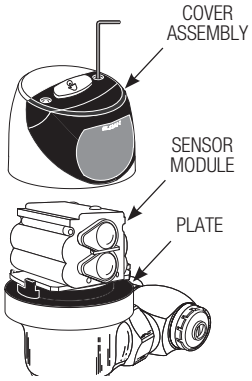
WHEN ADJUSTING RANGE FOR URINAL SENSOR, MAKE SURE TO SET-UP A PROPER TARGET IN FRONT OF URINAL SENSOR.

BATTERY REPLACEMENT

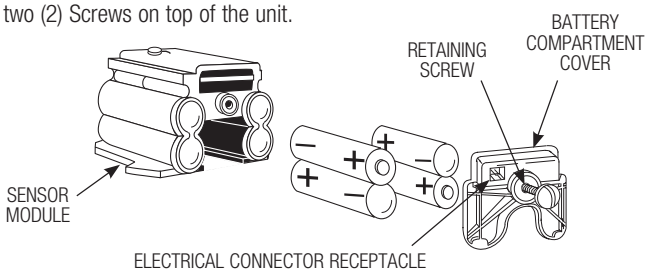
When required, replace batteries with four (4) Alkaline AA-Size Batteries.

Note: Water does not have to be turned off to replace Batteries.

Loosen the two (2) Screws on top of unit. Remove the complete Cover Assembly. Lift the Sensor Module from its Plate. Unplug the Electrical Connector from Battery Compartment Cover. Loosen the Retaining Screw on Battery Compartment Cover and remove Battery Compartment Cover. Install four (4) Alkaline AA-Size Batteries exactly as illustrated.



Install Battery Compartment Cover and secure with Retaining Screw. Make certain that Battery Compartment Cover is fully compressed against Gasket to provide a seal; Do Not overtighten. Plug the Electrical Connector into the Battery Compartment Cover. Reinstall the Sensor Module onto the Plate. Reinstall the complete Cover Assembly onto the Plate. Tighten the two (2) Screws on top of the unit.



TROUBLESHOOTING

1. Sensor Flashes Continuously Only When User Steps Within Range.
- A. Unit in Start-Up mode; no problem. This feature is active for the first ten (10) minutes of operation.

2. Valve Does Not Flush; Sensor Not Picking Up User.
- A. Range too short; increase the range.

3. Valve Does Not Flush; Sensor Picking Up Opposite Wall or Surface, or Only Flushes When Someone Walks By. Red Light Flashes Continuously for First 10 Minutes Even with No One in Front of the Sensor.
- A. Range too long; shorten range.

4. Valve Does Not Flush Even After Adjustment.
- A. Improper Range Adjustment; Follow Instructions and repeat steps.
- B. Batteries completely used up; replace batteries.
- C. Problem with Electronic Sensor Module; replace Electronic Sensor Module.

5. Unit Flashes 4 Quick Times When User Steps Within Range.
- A. Batteries low; replace batteries.

6. Valve Does Not Shut Off.
- A. Bypass orifice in diaphragm is clogged with dirt or debris, or bypass is clogged by an invisible gelatinous film due to "over-treated" water. Remove flex tube diaphragm and wash under running water.
  Note: Size of Orifice in the Bypass is of utmost importance for the proper metering of water by the valve. DO NOT ENLARGE OR DAMAGE THIS ORIFICE. Replace flex tube diaphragm if cleaning does not correct the problem.
- B. Dirt or debris fouling stem or flex tube diaphragm. Remove flex tube diaphragm and wash under running water.
- C. O-ring on stem of flex tube diaphragm is damaged or worn. Replace O-ring if necessary.
- D. Problem with Electronic Sensor Module; replace Sensor Module.

7. Not Enough Water to Fixture.
- A. Wrong Flush Volume Regulator installed in Flex Tube Diaphragm Kit. Install the correct Regulator (see Step 7 of these instructions).
- B. Wrong Optima Plus model installed; i.e., 1 gpf. urinal installed on 3.5 gal. closet fixture. Replace with proper Optima Plus model, or refer to the G2 Optima Plus Conversion Guide to convert existing unit to the proper model.
- C. Enlarged Bypass in Diaphragm. Replace Flex Tube Diaphragm.
- D. Control Stop not adjusted properly. Readjust Control Stop.
- E. Inadequate volume or pressure at supply. Increase water pressure or supply (flow) to valve. Consult factory for assistance.

8. Too Much Water to Fixture.
- A. Wrong flush volume regulator installed in flex tube diaphragm kit. Install the correct regulator (see Step 7 of these instructions).
- B. Control Stop not adjusted properly. Readjust Control Stop.
- C. Wrong Optima Plus model installed; i.e., 3 gpf. model installed on 1.0 or 1.5 gal. urinal fixture. Replace with proper Optima Plus model, or refer to the G2 Optima Plus Conversion Guide to convert existing unit to the proper model.
- D. Dirt in diaphragm bypass. Clean under running water or replace flex tube diaphragm.

Note: The EBV-46-A Beam Deflector is no longer required or available for the G2 Optima Plus.

When further assistance is required,
please contact Sloan Technical Support at:
1-888-SLOAN-14 (1-888-756-2614)
or visit us online at: www.sloanvalve.com

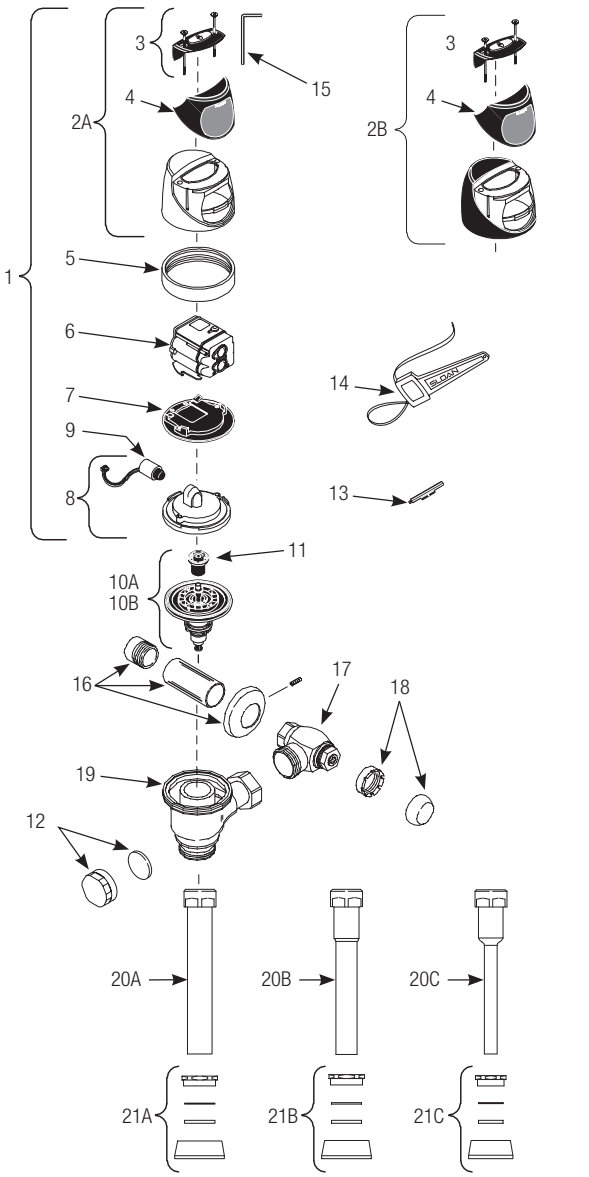
!!! IMPORTANT !!!

LAWS AND REGULATIONS PROHIBIT THE USE OF HIGHER FLUSHING VOLUMES THAN LISTED ON FIXTURES OR FLUSHOMETERS.

PARTS LIST

Item #	Part #	Description
Items Included with RESS Retrofit and Complete Optima Plus Valves		
1	–	Cover/Ring/Sensor Assembly
2A	EBV-142-A	Cover Assembly (G2 Optima Plus models)
2B	EBV-192-A	Cover Assembly (Sloan Optima Plus models)
3	EBV-130-A	Override Button Assembly (includes screws & hex wrench)
	EBV-132-A	Screws (2) and Hex Wrench Only
4	EBV-131	Lens Window Cover
5	EBV-168	Locking Ring
	EBV-172	Locking Ring - for Zurn valves
6	EBV-129-A-C	Electronic Module - Water Closet
	EBV-129-A-U	Electronic Module - Urinal
7	EBV-134	Cover Rest Plate
8	EBV-145-A	Inside Cover Assembly (includes solenoid)
9	EBV-136-A	Solenoid
10A	†	G2 Optima Plus Flex Tube Diaphragm Assembly
10B	†	Sloan Optima Plus Flex Tube Diaphragm Assembly
11	†	Flush Volume Regulator
12	EBV-1017-A	Handle Cap
13	EBV-91	Range Adjustment Tool
14	EBV-22	Strap Wrench
15	EBV-137	7/64" Hex Wrench
Items Included with Complete Optima Plus Valves Only		
16	H-633-AA	1" (25 mm) Sweat Solder Kit
	H-636-AA	¾" (19 mm) Sweat Solder Kit
17	H-700-A	1" (25 mm) Bak-Chek® Control Stop
	H-700-A	¾" (19 mm) Bak-Chek® Control Stop
18	H-1010-A	Vandal Resistant Stop Cap
19	EBV-36-A	Valve Body
20A	V-600-AA	1½" (38 mm) Vacuum Breaker
20B	V-600-AA	1¼" (32 mm) Vacuum Breaker (Model 8180)
20C	V-600-AA	¾" (19 mm) Vacuum Breaker (Model 8186)
21A	F-5-AT	1½" Spud Coupling Assembly (Models 8110, 8111, 8115 & 8116)
21B	F-5-AU	1¼" Spud Coupling Assembly (Model 8180)
21C	F-5-AW	¾" Spud Coupling Assembly (Model 8186)

† Part No. various depending on valve model, please contact your local Sloan Representative or Sloan Technical Support at: 1-888-SLOAN-14 (1-888-756-2614)





Optima Plus Valve Models Feature Sloan's Exclusive Flex Tube Diaphragm for the ultimate in valve performance, reliability and chloramines resistance.

CARE AND CLEANING

DO NOT use abrasive or chemical cleaners to clean flushometers as they may dull the luster and attack the chrome or special decorative finishes. Use ONLY soap and water, then wipe dry with clean cloth or towel.

While cleaning the bathroom tile, the Flushometer should be protected from any splattering of cleaner. Acids and cleaning fluids can discolor or remove chrome plating.

Manufactured in the U.S.A. by Sloan Valve Company under one or more of the following patents: U.S. Patents: D598,975; 7,124,997. Other Patents Pending. BAK-CHEK®, PARA-FLO®, PERMEX®, TURBO-FLO®.

The information contained in this document is subject to change without notice.

SLOAN • 10500 SEYMOUR AVENUE • FRANKLIN PARK, IL 60131
Phone: 1-800-9-VALVE-9 or 1-800-982-5839 • Fax: 1-800-447-8329 or 1-847-671-4380 • www.sloan.com

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Code No: 0816452 – Rev. 5 (06/16)

LAV-1		**LAV-1 LAVATORY**
A0496221020	AMERICAN STANDARD	19 X 16 VITREOUS CHINA UNDERCOUNTER MOUNT LAVATORY *OVALYN WHITE
SYMS202G05	SYMMONS	LEAD LAW COMPLIANT 1 HANDLE LEVER LAVATORY FAUCET SYMMETRIX 0.5 GPM

INSTALLATION INSTRUCTIONS

0496221020

American Standard
Style That Works Better

Undercounter Sink
Oval Shaped Models: 0495, 0496, 0497, 0630, 0632

Introduction: Thank you for selecting our products...products which have been the benchmarks of fine quality for years. To help ensure that the installation process will proceed smoothly, please read these instructions carefully before you begin. Also, review the recommended tools and materials list; carefully unpack and examine your new plumbing fixture.

⚠ **CAUTION: PRODUCT IS FRAGILE. TO AVOID BREAKAGE AND POSSIBLE INJURY HANDLE WITH CARE!**
NOTE: *Pictures may not exactly define contour of china and components.*

Observe Local Plumbing and Building Codes.

Product names listed herein are trademarks of American Standard Inc. unless otherwise noted.

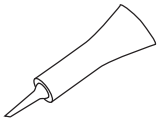
Recommended Tools & Materials


Putty Knife


Adjustable Wrench

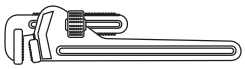

Plumbers' Putty


Channel Lock Pliers

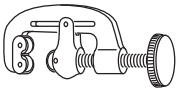

Silicone Adhesive



Tape Measure

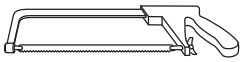

Pipe Wrench

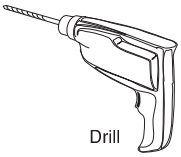

Basin Wrench


Tubing Cutter

Phillips Screwdriver

Regular Screwdriver

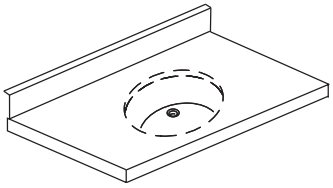

Hacksaw


Drill


Saber Saw

NOTE: More specialized tools may be necessary to install this sink to countertop materials other than wood or wood composites.

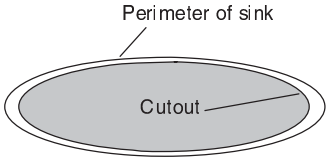
1



NOTE: To avoid damage to countertop, install sink such that future removal from underneath the countertop is possible.

First, make sure the clearance between the backsplash, faucet, fixtures and cabinets are acceptable for the new sink.

2

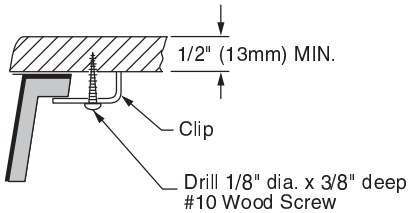


Carefully cut out the enclosed template, then position and trace the template on the countertop as shown on the template. Make a mark of the faucet hole centerline on the countertop. Drill a 1/2" pilot hole on the inside of the cut line. Use a saber saw or a keyhole saw to cut out the countertop opening.

3

FOR WOOD COUNTERTOP

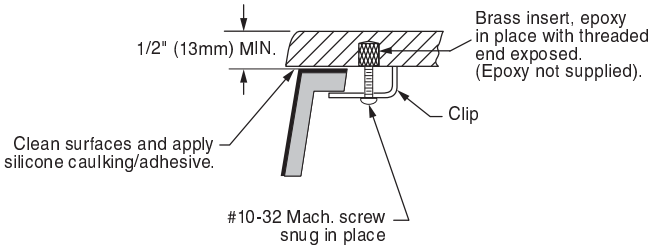
Mark and pre-drill the wood screw holes as located on the enclosed template. Waterproof any exposed areas of wood.



4

FOR MARBLE OR SOLID SURFACE COUNTERTOP

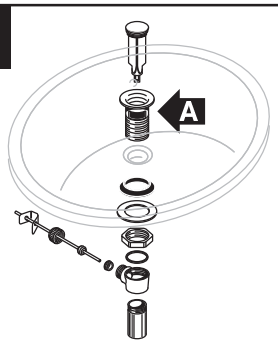
To protect countertop, place it on a foam padding and drill 3/8" Dia. x 1/4" deep hole as per location shown on template. Clean countertop surface and sink surface where silicone caulking/adhesive is applied.



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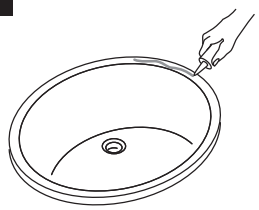
730431-100 Rev. F

5



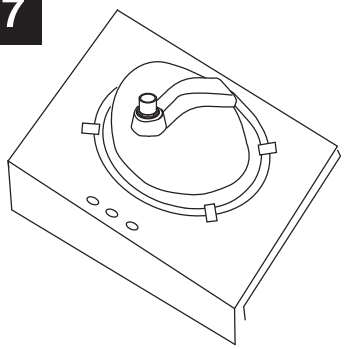
Mount the drain assembly (not included) on the sink, following faucet manufacturer's instructions. Be certain to apply a bead of sealing putty on the underside of the drain (Part "A") in order to ensure a watertight seal between the sink and drain. Remove excess putty after installing drain on sink.

6



After checking fit and alignment of sink to cut out, apply a bead of silicone caulking/adhesive to rim of sink.

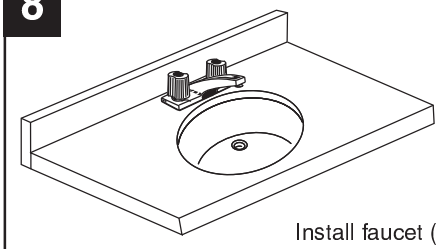
7



Center bowl over cutout and tighten screws (see step 4) to secure bowl to countertop. Remove excess sealant from inside lip.

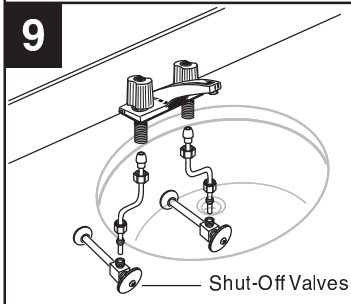
NOTE: The screws provided should be used on countertops with a minimum 1" thickness. For thinner countertops, use appropriate anchors and fasteners.

8



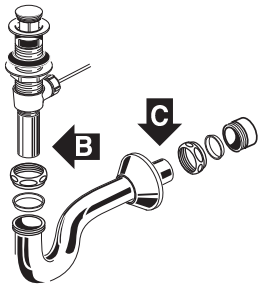
Install faucet (not included) and countertop (not included) following manufacturers instructions.

9



Connect supply line to faucet (finger tight) and carefully bend tubes to engage with the supply shut-off valves. Tighten connections at faucet and shut-off valves for water tight seal.

10



Connect trap to drain assembly hand tight to check alignment. It may be necessary to cut off part of the tailpiece (area "B") or part of the horizontal leg of the trap (area "C"). Secure joints for watertight assembly.

AS AMERICA, INC. ONE YEAR LIMITED WARRANTY

If inspection of this AS America, Inc. ("American Standard") plumbing product, within one year after its initial purchase, confirms that it is defective in materials or workmanship, American Standard will repair or, at its option, exchange the product for a similar model.

This limited warranty applies only to the original purchaser and installation of these products. In the event of a limited warranty claim, proof of purchase will be required—save sales receipt.

This limited warranty does not apply to local building code compliance. Since local building codes vary considerably, the purchaser of this product should check with a local building or plumbing contractor to insure local code compliance before installation.

This limited warranty is void if the product has been moved from its initial place of installation; if it has been subjected to faulty maintenance, abuse, misuse, accident or other damages; if it was not installed in accordance with American Standard's instructions; or if it has been modified in a manner inconsistent with the product as shipped by American Standard.

American Standard's option to repair or exchange the product under this limited warranty does not cover any labor or other costs of removal or installation. IN NO EVENT WILL AMERICAN STANDARD BE LIABLE FOR THE COST OF REPAIR OR REPLACEMENT OF ANY INSTALLATION MATERIALS, INCLUDING BUT NOT LIMITED TO, TILES, MARBLE, ETC. American Standard will not be responsible for any other incidental or consequential damages attributable to a product defect or to the repair or exchange of a defective product, all of which are expressly excluded from this limited warranty. This limited warranty does not cover any liability for consequential or incidental damages, all of which are hereby expressly disclaimed, or the extension beyond the duration of this limited warranty of any implied limited warranties, including those of merchantability or fitness for an intended purpose. (Some states or provinces do not allow the exclusion or limitation of implied limited warranties, so this exclusion may not apply to you.)

This limited warranty gives you specific legal rights. You may have other statutory rights that vary from state to state or from province to province, in which case this limited warranty does not affect such statutory rights.

In the United States:
American Standard Brands
P.O. Box 6820
Piscataway, New Jersey 08855
Attention: Director of Customer Care
For residents of the United States, warranty information may also be obtained by calling the following toll free number: (800) 442-1902
www.americanstandard.com

In Canada:
AS Canada, ULC
5900 Avebury Rd.
Mississauga, Ontario
Canada L5R 3M3
Toll Free: (800) 387-0369
www.americanstandard.ca

In Mexico:
American Standard B&K Mexico
S. de R.L. de C.V.
Via Morelos #330
Col. Santa Clara
Ecatepec 55540 Edo. Mexico
Toll Free: 01-800-839-1200
www.americanstandard.com.mx

AS AMERICA, INC. ONE YEAR LIMITED WARRANTY

If inspection of this AS America, Inc. ("American Standard") plumbing product, within one year after its initial purchase, confirms that it is defective in materials or workmanship, American Standard will repair or, at its option, exchange the product for a similar model.

This limited warranty applies only to the original purchaser and installation of these products. In the event of a limited warranty claim, proof of purchase will be required—save sales receipt.

This limited warranty does not apply to local building code compliance. Since local building codes vary considerably, the purchaser of this product should check with a local building or plumbing contractor to insure local code compliance before installation.

This limited warranty is void if the product has been moved from its initial place of installation; if it has been subjected to faulty maintenance, abuse, misuse, accident or other damages; if it was not installed in accordance with American Standard's instructions; or if it has been modified in a manner inconsistent with the product as shipped by American Standard.

American Standard's option to repair or exchange the product under this limited warranty does not cover any labor or other costs of removal or installation. IN NO EVENT WILL AMERICAN STANDARD BE LIABLE FOR THE COST OF REPAIR OR REPLACEMENT OF ANY INSTALLATION MATERIALS, INCLUDING BUT NOT LIMITED TO, TILES, MARBLE, ETC. American Standard will not be responsible for any other incidental or consequential damages attributable to a product defect or to the repair or exchange of a defective product, all of which are expressly excluded from this limited warranty. This limited warranty does not cover any liability for consequential or incidental damages, all of which are hereby expressly disclaimed, or the extension beyond the duration of this limited warranty of any implied limited warranties, including those of merchantability or fitness for an intended purpose. (Some states or provinces do not allow the exclusion or limitation of implied limited warranties, so this exclusion may not apply to you.)

This limited warranty gives you specific legal rights. You may have other statutory rights that vary from state to state or from province to province, in which case this limited warranty does not affect such statutory rights.

AS AMERICA, INC. LIMITED WARRANTY FOR LXP, BOULEVARD® DUAL FLUSH, CHAMPION® PRO, CHAMPION®4, TITAN® PRO TOILETS

This toilet comes with a limited lifetime warranty on chinaware, a limited 10 year warranty on all mechanical parts of the toilet, and a limited 1 year warranty on the toilet seat if included with product. If inspection of this AS America, Inc. ("American Standard") plumbing product, inclusive of the chinaware and all mechanical parts, confirms that it is defective in materials or workmanship, American Standard will repair or, at its option, exchange the product for the same or a similar model.

This limited warranty applies only to the original non-commercial purchaser and installation of the products. In the event of a limited warranty claim, proof of purchase will be required – save sales receipts.

For this warranty to become effective, the warranty registration process must be completed via the internet or telephone per the warranty registration instructions.

This limited warranty does not apply to commercial installations. The warranty for commercial installations is 10 years on chinaware and mechanical parts, and 1 year on the toilet seat if included with product.

This warranty **does not apply** to local building code compliance. Since local building codes vary considerably, the purchaser of the product should check with a local building or plumbing contractor to ensure local code compliance before installation.

This warranty **will be void** if the product has been moved from its initial place of installation; if it has been subjected to faulty maintenance, abuse, misuse, accident or other damage; if it was not installed in accordance with American Standard's instructions; or if it has been modified in a manner inconsistent with the product as shipped by American Standard.

WARNING: This warranty **DOES NOT COVER** any damages caused by the use of in-tank cleaners. These products can seriously corrode the fittings in the tank. This damage can cause leakage and property damage. **American Standard will not be responsible or liable for any damage caused by the use of in-tank cleaners.**

American Standard's option to repair or exchange the product under this warranty does not cover any labor or other costs of removal or installation including any costs of any surrounding material such as tile or marble. **American Standard is not responsible for any other incidental or consequential damages attributed to a product defect or to the repair or exchange of a defective product, all of which are expressly excluded from this warranty.** (Some states or provinces do not allow the exclusion or limitation of implied warranties, so this exclusion may not apply to you.)

This warranty gives you specific rights. You may have other statutory rights that may vary from state to state or province to province, in which case this warranty does not affect such statutory rights.

S202G05

SYMMONS® Symmetrix®
the smart choice™

Lavatory Faucet S-20 Series

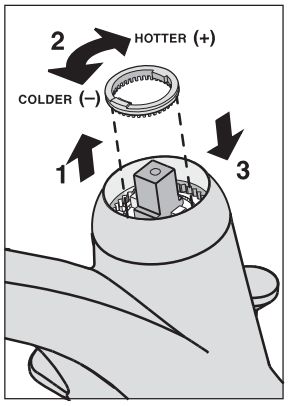
Installation and Service Instructions



Installation

Caution: Be sure to turn off hot and cold water supplies before installing or servicing faucet.

1. Loosely install the anchor bar (KN-23), spacer (KN-26) and nut (L-36) on the mounting bolts and place gasket on base of faucet. Push faucet supplies and anchor bolt/spacer/nut assemblies with gasket through holes in sink. Secure faucet to sink by tightening nuts from underside. (If sink or counter surface is uneven, use putty or sealant to make proper seal under base.)
2. Connect hot supply to left tube and cold supply to right tube using appropriate connectors.
3. Pop-up drain installation:
   a) Remove pop-up plug, tail piece and flange from the drain body. Make sure that locknut is threaded all the way down onto the body with flat friction washer in middle and beveled washer on top.
   b) Apply plumbers putty or sealant to bottom of flange.
   c) Install drain body through drain opening in lavatory and screw flange onto the drain body making sure that the threads are completely engaged for proper sealing and strength of the connection. Apply joint compound to all threaded parts to insure proper seal. Apply putty or teflon tape to tail piece before attaching to drain body.
   d) Tighten locknut to compress the beveled flange evenly across the bottom of the drain opening taking care not to over tighten the locknut, causing damage to the lavatory.
   e) Remove one of two ball washers from inside the threaded cavity. Insert pop-up plug and pivot rod into body. Add one ball washer (the second ball washer should remain inside the body) to the outside of the ball. Tighten the retaining nut until the ball is seated on the internal and external ball washers.
   Note: The pop-up plug can be installed either in the removable or non-removable position, depending on the location of the hole located in the guide at the bottom of the plug.
   f) Slide the pivot rod through one side of the spring clip, then the appropriate adjustment hole and then other side of the spring clip.
   g) Insert lift rod through faucet housing and the top of the lift strap and secure it in place by tightening the screw.
   Note: To ensure proper operation of lift rod and pop-up, some adjustment of the linkage may be required. There are two possible adjustment points: 1) lift strap to lift rod and 2) lift strap to pivot rod.
4. It is very important to thoroughly flush the supply lines to prevent foreign matter, i.e. copper chips, sand, stones, etc. from damaging the sealing surfaces of cartridge. Remove aerator and turn valve handle on to full cold position, open cold supply. Without closing, turn handle to full hot and open hot supply. Let water run in hot only and cold only positions long enough to flush supply lines thoroughly. Shut off faucet and replace aerator. Check for leaks.
5. The handle limit stop can be set to limit handle turn to the hot position. The limit mechanism is factory set to allow full handle travel. To adjust the limit stop, turn handle to the full hot position and lift handle to open faucet approximately half way to obtain a smooth flow for correct initial temperature measurement.



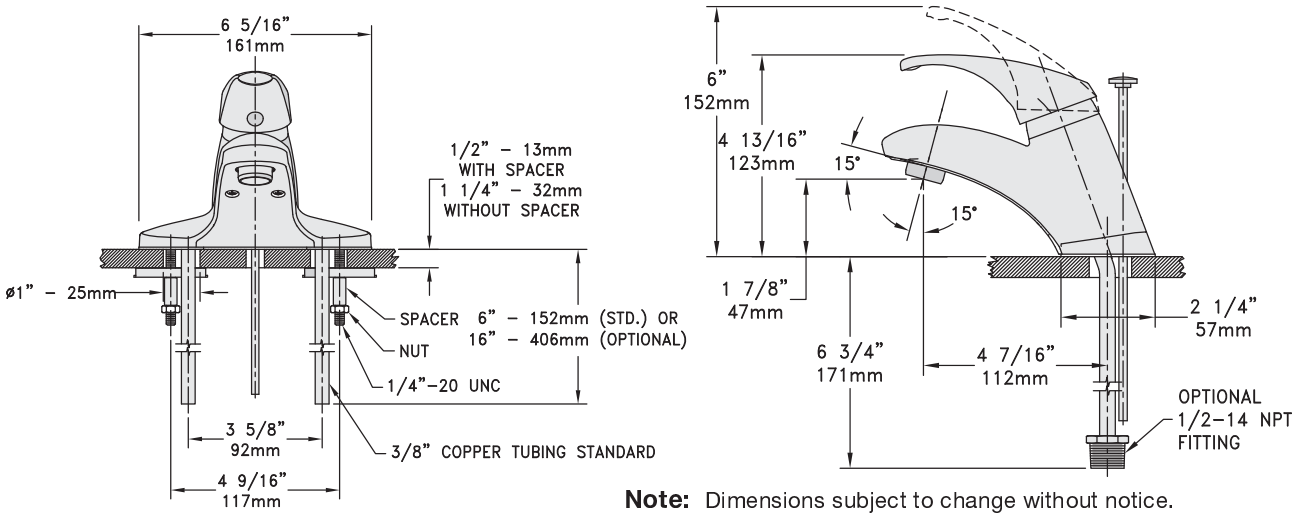
Stop limit adjust

6. If when faucet is on and in full hot position and water is too hot, remove plug button (KN-157), loosen set screw (L-22) and remove handle (KN-3RB, KN-3BRB or LN-135). Lift limit stop ring (KN-4L) using a small flat head screw driver and rotate counter clockwise to lower temperature. If water is not hot enough, rotate clockwise (See Figure 1 on reverse side). After correct temperature is achieved, reattach handle, reversing procedure above.

Replacing cartridge (KN-4)

1. Remove plug button (KN-157), loosen set screw (L-22) and remove handle (KN-3RB, KN-3BRB or LN-135).
2. Engage tabs in cartridge wrench (LN-34) with slots in compression ring (KN-2) and use screwdriver in wrench holes or pliers on wrench and turn counter clockwise until compression ring engages with cap (LN-8). Continue turning counter clockwise so that cap/ring assembly is removed from the body (LN-371). Remove cartridge and three ring seal (KN-4).
3. Install new cartridge while taking care to maintain position of the three ring seal at the base of the cartridge. Match posts in base of cartridge with alignment holes in valve body during assembly.
4. Reassemble faucet in reverse fashion. Thread cap onto body firmly by hand. Do not use a wrench which may damage the finish. Tighten compression ring (KN-2) finger tight using the wrench (LN-34) then 1/4 to 1/2 turn further.
5. Set hot water limit stop in accordance with installation step 5 above.

Dimensions Symmetrix Lavatory Faucet, *S-20-2*



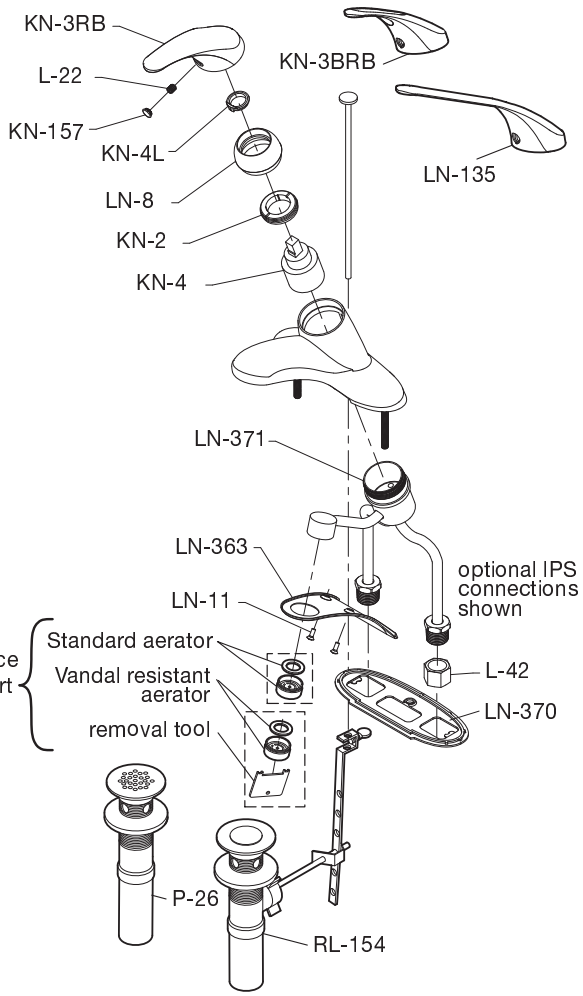
Note: Dimensions subject to change without notice.

Parts Assembly Symmetrix Lavatory Faucet, *S-20 Series*

KN-2	Compression ring
KN-3RB*	Solid handle
KN-3BRB*	Loop handle
KN-4	Cartridge
KN-4L	Limit stop ring
KN-23	Anchor bar (2)
KN-26	Mounting spacer (2)
KN-157	Plug button
LN-8*	Valve cap
LN-11*	Screw (2)
LN-15*	Aerator without removal key
LN-34	Cartridge wrench (not shown)
LN-135	6" lever handle with red/blue indicators
LN-363*	Undercover plate
LN-370	Mounting gasket
LN-371	Cartridge housing assembly
L-22	Set screw
L-36	Mounting nut (2)
L-42	Nut (2)
RL-154*	Pop-up drain assembly (complete)
P-26	Grid drain assembly (complete)

For Decorative Finish Faucets add suffix to parts marked with an asterisk as follows:

Suffix -STN Radiance® Satin finish



Aerator (flow regulator)	Part Number	
	Standard Aerators	Vandal Resistant with removal tool
2.2 gpm (8.3L/min)	LN-15*	LN-101*
1.5 gpm (5.7L/min)	FLR-110-1.5*	----
1.0 gpm (3.8L/min)	FLR-110-1.0*	----
.5 gpm (1.9L/min)	----	LN-100*
Removal tool part number, LL-60K		

Symmons Industries, Inc. 31 Brooks Drive ▪ Braintree, MA 02184 ▪ Phone: (800)796-6667 ▪ Fax: (800)961-962
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Lifetime Limited Warranty

All warranty claims MUST be pre-approved by Symmons.

Symmons warrants to the original consumer purchaser/end-user that any Symmons product will be free of defects in material and workmanship during normal domestic use for the life of your home. All other purchasers including industrial, commercial or business users are warranted for a period of 5 years from the date of purchase.

At our option, we will either have you send the defective part or product prepaid to us for inspection, or we may elect to send you the replacement part or product without investigation. A replacement for any defective part will be supplied FREE OF CHARGE for installation by the purchaser only. Installation, repair, replacement, and any related costs associated with replacement or repair are not covered under this warranty, and are the responsibility of the purchaser. Failure or damage caused by the use of replacement product other than Symmons Genuine Replacement Parts will void this warranty.

This warranty is applicable only to Symmons products purchased after July 1, 1998 and shall be effective from the date of purchase as shown on the purchaser's receipt.

Damage to the chrome and/or other decorative finishes on Symmons products may be a result of improper handling or abusive treatment. Finishes should only be cleaned with a soft, damp cloth or sponge. Use of polish, abrasive cleaners, solvents, or acid cleaners will damage the finish and void this warranty.

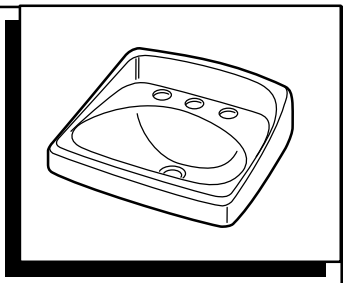
This warranty excludes product damage due to installation error, product abuse, or product misuse whether performed by a contractor, service company or yourself. There are no other express warranties on this product and ALL WARRANTIES OF MERCHANTABILITY AND OTHER IMPLIED WARRANTIES ARE LIMITED IN ACCORDANCE WITH APPLICABLE LAW. SYMMONS INDUSTRIES, INC., EXPRESSLY DISCLAIMS CONTINGENT LIABILITY AND CONSEQUENTIAL DAMAGE OF EVERY KIND. Since some states do not allow limitations on how long an implied warranty lasts or an exclusion or limitation of incidental or consequential damages, the above limitation or exclusion may not be applicable. This warranty gives specific legal rights. Other rights may vary from state to state.

To obtain warranty service, please contact Symmons Customer Service between the hours of 7:30 AM to 7:00 PM Eastern at: 1-800-796-6667, or via email at: gethelp@symmons.com.

LAV-2		**LAV-2 LAVATORY**
A0355012020	AMERICAN STANDARD	21 X 18 4 VITREOUS CHINA LAVATORY WHITE LUCERN WHITE
SYMS202G05	SYMMONS	LEAD LAW COMPLIANT 1 HANDLE LEVER LAVATORY FAUCET SYMMETRIX 0.5 GPM

American Standard **INSTALLATION INSTRUCTIONS**

Wall Hung Bathroom Sink



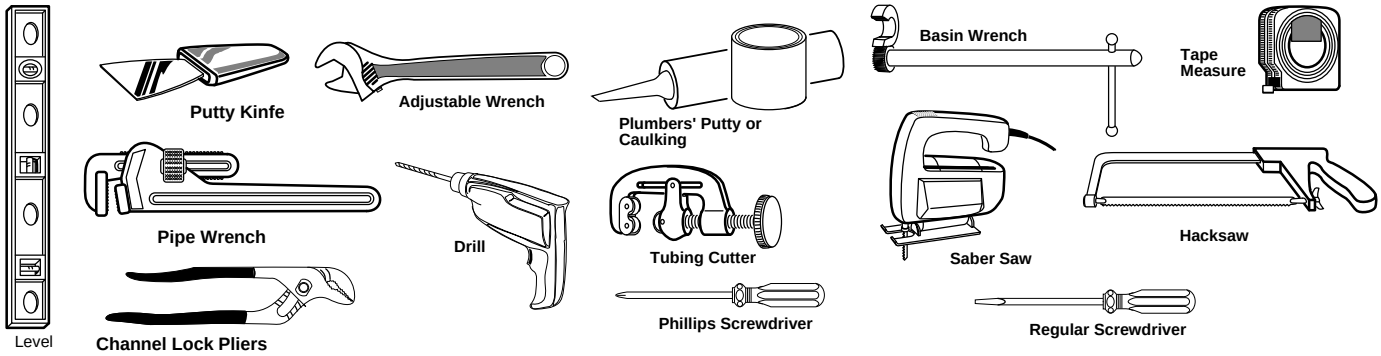
***NOTE:** For installation of models using concealed or exposed arms, follow instruction provided by arms manufacturer.

Introduction: Thank you for selecting our products...products which have been the benchmarks of fine quality for years. To help insure that the installation process will proceed smoothly, please read these instructions carefully before you begin. Also, review the recommended tools and materials list; carefully unpack and examine your new plumbing fixture.

⚠ **CAUTION: PRODUCT IS FRAGILE. TO AVOID BREAKAGE AND POSSIBLE INJURY HANDLE WITH CARE!**

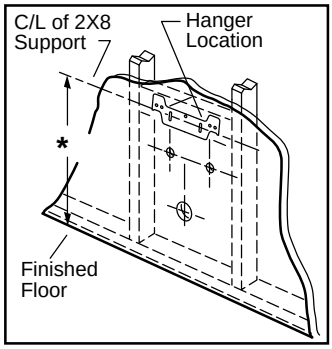
NOTE: *Pictures may not exactly define contour of china and components.*

Recommended Tools & Materials



1 Provide suitable reinforcement behind finished wall for lavatory hanger mounting screws. *Determine horizontal center line location of support from the table listed in Step 2. (Make sure support bottom extends to lavatory back wall bottom.)

NOTE: If replacing an existing sink be certain to shut off water supply before removing old sink.

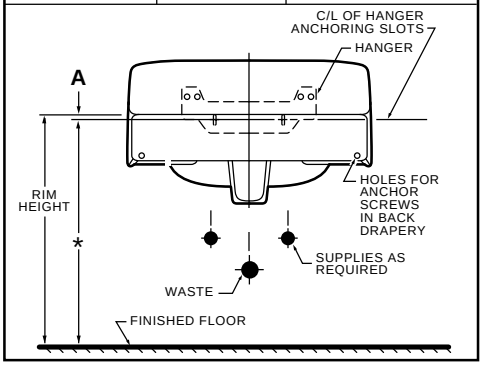


2 Determine the desired rim height (for example 32") then select from the Table at right the height of the hanger mounting bolts centerline

EXAMPLE:

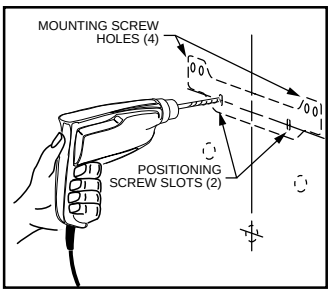
For Lucerne:
32"-1"=31"
For Ledgewood:
32"+2-7/8"=34-7/8"

TABLE		
Part #	**Model**	**Distance "A"**
0124	Comrade	- 2-1/2" (64mm)
0321	Declyn	- 2-3/4" (70mm)
0355/0356	Lucerne	- 1" (25mm)
0372/0373	Penlyn	- 1/8" (3mm)
4300	Ledgewood	+ 2-7/8" (73mm)
4867/4869	Regalyn	+ 2-3/4" (70mm)
5300	Ledgemere	+ 2-1/2" (64mm)



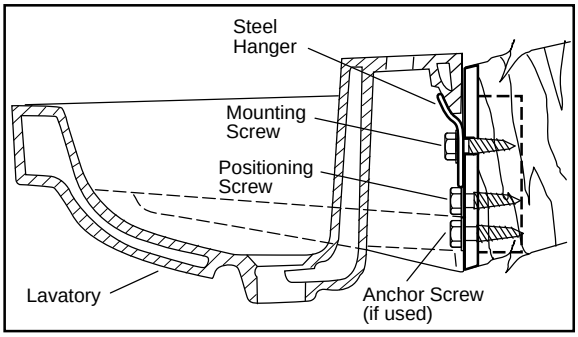
3 Position hanger according to Step 2, making sure its center is aligned with the waste hole centerline. Mark the hanger screw locations through its mounting holes.

4 Drill pilot holes in positioning screw slots of hanger. (Note: Some models are supplied with anchor screws, or steel hangers for lavatory installations. Other models are not provided with mounting hardware which can be purchased at local hardware outlets. Lavator-ies with bottom anchor screw holes should be secured with anchor screws in addition to hangers.

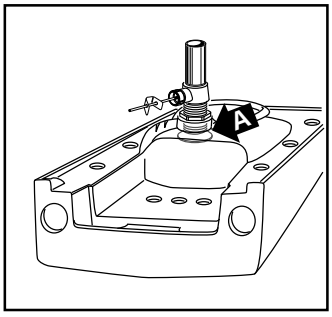


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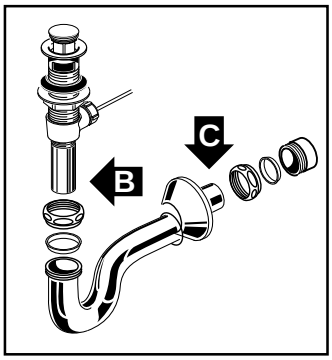
5 Affix hanger to wall (hand tighten only). Mount lavatory for positioning, level the deck, and mark bottom anchor screw holes (if applicable). Remove lavatory, tighten the hanger positioning screws and drill pilot holes for anchor screws and 4 mounting screws. Install and tighten the mounting screws.



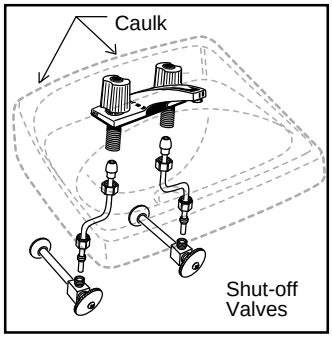
6 Following manufacturers instructions, install faucet and drain assembly. (Not included). Be certain to apply a bead of sealing putty on the underside of the drain (Part "A") in order to ensure a watertight seal between the lavatory and drain. Remove excess putty after installing drain on lavatory.



7 Return the fitted lavatory to the installed position. Connect trap to drain assembly hand tight to check alignment. It may be necessary to cut off part of the tailpiece (area "B") or part of the horizontal leg of the trap (area "C").



8 Secure lavatory on hanger as shown in **5**. Insert and tighten anchor screws if applicable. Connect hot and cold supply lines to the shut-off valves. Tighten trap joints for watertight assembly. Apply a bead of caulk around the edge which contacts the wall as shown.



American Standard Ideal Standard Incesa Standard Sadosa Standard Cedelca Saniwares

AMERICAN STANDARD ONE-YEAR LIMITED WARRANTY

If inspection of this American Standard plumbing product, within one year after its initial installation, confirms that it is defective in materials or workmanship, American Standard will repair or, at its option, exchange the product for a similar model.

This limited warranty **does not apply** to local building code compliance; since local building codes vary considerably, the purchaser of this product should check with a local building or plumbing contractor to insure local code compliance before installation.

This warranty **shall be void** if the product has been moved from its initial place of installation; if it has been subjected to faulty maintenance, abuse, misuse, accident or other damage; if it was not installed in accordance with American Standard's instructions; or if it has been modified in a manner inconsistent with the product as shipped by American Standard.

American Standard's option to repair or exchange the product under this warranty does not cover any labor or other costs of removal or installation, **nor shall American Standard be responsible for any other incidental or consequential damages attributable to a product defect or to the repair or exchange of a defective product, all of which are expressly excluded from this warranty.** (Some states or provinces do not allow the exclusion or limitation of implied warranties, so this exclusion may not apply to you.)

This warranty gives you specific legal rights. You may have other statutory rights that vary from state to state or from province to province, in which case this warranty does not affect such statutory rights.

For service under this warranty, it is suggested that a claim be made through the contractor or dealer from or through whom the product was purchased, or that a service request (including a description of the product model and of the defect) be sent to the following address:

In the United States:
American Standard, Inc.
One Centennial Ave.
Piscataway, New Jersey 08855
Attention: Director of Consumer Affairs

Toll Free: (800) 442-1902

In Canada:
American Standard, Inc.
2480 Stanfield Rd.,
Mississauga, Ontario
Canada L4Y 1S2
Toll Free: (800) 387-0369

In Mexico:
Customer Service Manager
American Standard, Inc.
Via Morelos #330
Col. Santa Clara
Ecatepec 55540 Edo. Mexico

730427-100 Rev. B

S202G05

SYMMONS® Symmetrix®

the smart choice™

Lavatory Faucet S-20 Series

Installation and Service Instructions



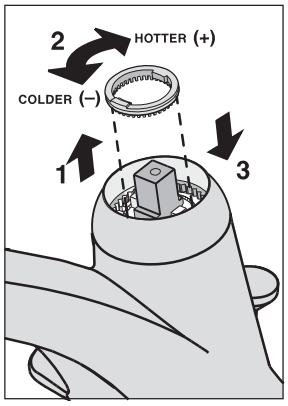
Installation

Caution: Be sure to turn off hot and cold water supplies before installing or servicing faucet.

1. Loosely install the anchor bar (KN-23), spacer (KN-26) and nut (L-36) on the mounting bolts and place gasket on base of faucet. Push faucet supplies and anchor bolt/spacer/nut assemblies with gasket through holes in sink. Secure faucet to sink by tightening nuts from underside. (If sink or counter surface is uneven, use putty or sealant to make proper seal under base.)
2. Connect hot supply to left tube and cold supply to right tube using appropriate connectors.
3. Pop-up drain installation:
   a) Remove pop-up plug, tail piece and flange from the drain body. Make sure that locknut is threaded all the way down onto the body with flat friction washer in middle and beveled washer on top.
   b) Apply plumbers putty or sealant to bottom of flange.
   c) Install drain body through drain opening in lavatory and screw flange onto the drain body making sure that the threads are completely engaged for proper sealing and strength of the connection. Apply joint compound to all threaded parts to insure proper seal. Apply putty or teflon tape to tail piece before attaching to drain body.
   d) Tighten locknut to compress the beveled flange evenly across the bottom of the drain opening taking care not to over tighten the locknut, causing damage to the lavatory.
   e) Remove one of two ball washers from inside the threaded cavity. Insert pop-up plug and pivot rod into body. Add one ball washer (the second ball washer should remain inside the body) to the outside of the ball. Tighten the retaining nut until the ball is seated on the internal and external ball washers.

      Note: The pop-up plug can be installed either in the removable or non-removable position, depending on the location of the hole located in the guide at the bottom of the plug.
   f) Slide the pivot rod through one side of the spring clip, then the appropriate adjustment hole and then other side of the spring clip.
   g) Insert lift rod through faucet housing and the top of the lift strap and secure it in place by tightening the screw.

      Note: To ensure proper operation of lift rod and pop-up, some adjustment of the linkage may be required. There are two possible adjustment points: 1) lift strap to lift rod and 2) lift strap to pivot rod.
4. It is very important to thoroughly flush the supply lines to prevent foreign matter, i.e. copper chips, sand, stones, etc. from damaging the sealing surfaces of cartridge. Remove aerator and turn valve handle on to full cold position, open cold supply. Without closing, turn handle to full hot and open hot supply. Let water run in hot only and cold only positions long enough to flush supply lines thoroughly. Shut off faucet and replace aerator. Check for leaks.
5. The handle limit stop can be set to limit handle turn to the hot position. The limit mechanism is factory set to allow full handle travel. To adjust the limit stop, turn handle to the full hot position and lift handle to open faucet approximately half way to obtain a smooth flow for correct initial temperature measurement.



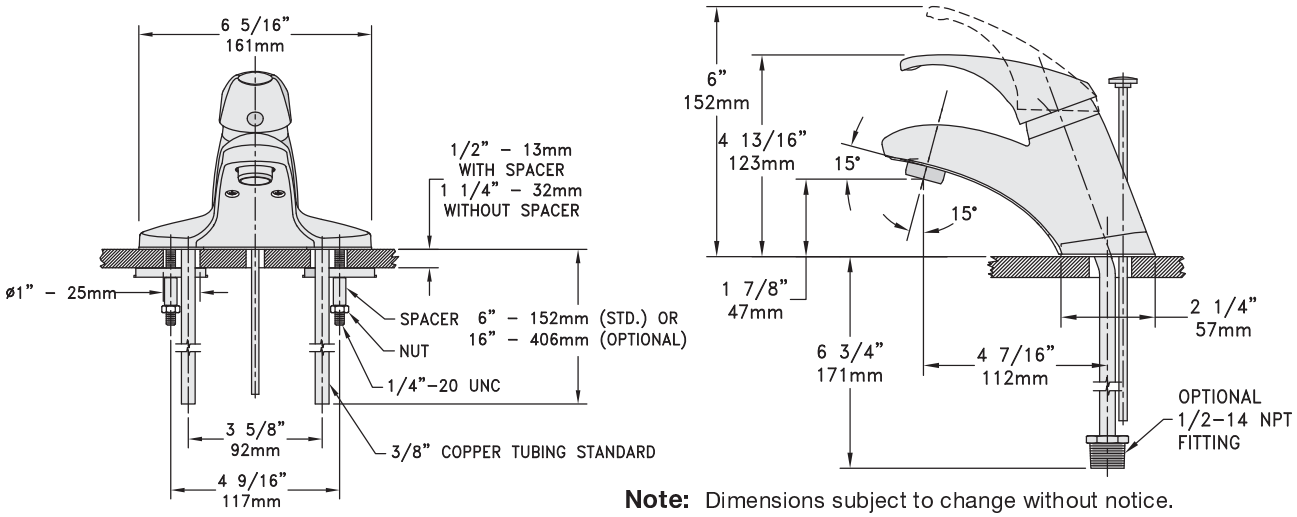
Stop limit adjust

6. If when faucet is on and in full hot position and water is too hot, remove plug button (KN-157), loosen set screw (L-22) and remove handle (KN-3RB, KN-3BRB or LN-135). Lift limit stop ring (KN-4L) using a small flat head screw driver and rotate counter clockwise to lower temperature. If water is not hot enough, rotate clockwise (See Figure 1 on reverse side). After correct temperature is achieved, reattach handle, reversing procedure above.

Replacing cartridge (KN-4)

1. Remove plug button (KN-157), loosen set screw (L-22) and remove handle (KN-3RB, KN-3BRB or LN-135).
2. Engage tabs in cartridge wrench (LN-34) with slots in compression ring (KN-2) and use screwdriver in wrench holes or pliers on wrench and turn counter clockwise until compression ring engages with cap (LN-8). Continue turning counter clockwise so that cap/ring assembly is removed from the body (LN-371). Remove cartridge and three ring seal (KN-4).
3. Install new cartridge while taking care to maintain position of the three ring seal at the base of the cartridge. Match posts in base of cartridge with alignment holes in valve body during assembly.
4. Reassemble faucet in reverse fashion. Thread cap onto body firmly by hand. Do not use a wrench which may damage the finish. Tighten compression ring (KN-2) finger tight using the wrench (LN-34) then 1/4 to 1/2 turn further.
5. Set hot water limit stop in accordance with installation step 5 above.

Dimensions Symmetrix Lavatory Faucet, *S-20-2*



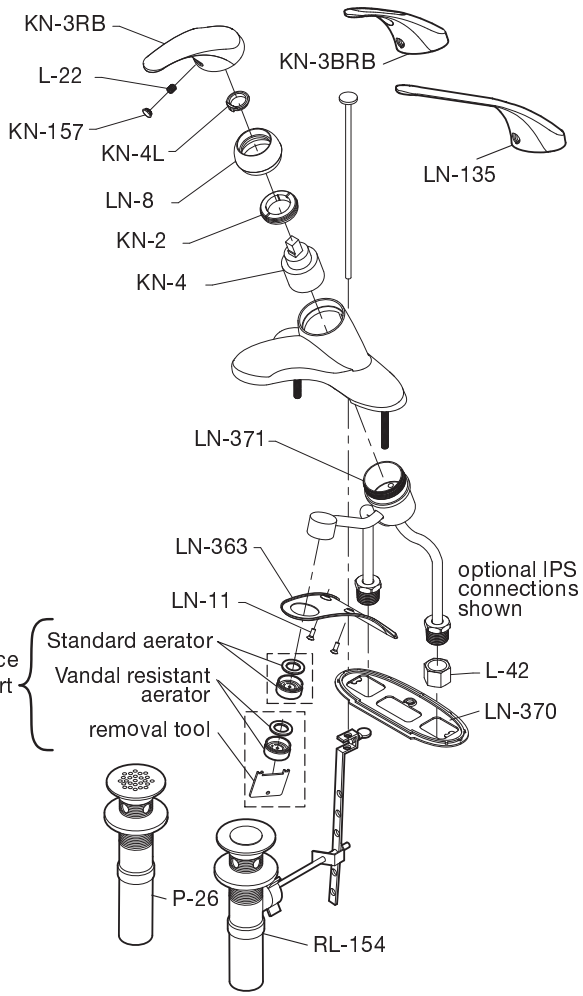
Note: Dimensions subject to change without notice.

Parts Assembly Symmetrix Lavatory Faucet, *S-20 Series*

KN-2	Compression ring
KN-3RB*	Solid handle
KN-3BRB*	Loop handle
KN-4	Cartridge
KN-4L	Limit stop ring
KN-23	Anchor bar (2)
KN-26	Mounting spacer (2)
KN-157	Plug button
LN-8*	Valve cap
LN-11*	Screw (2)
LN-15*	Aerator without removal key
LN-34	Cartridge wrench (not shown)
LN-135	6" lever handle with red/blue indicators
LN-363*	Undercover plate
LN-370	Mounting gasket
LN-371	Cartridge housing assembly
L-22	Set screw
L-36	Mounting nut (2)
L-42	Nut (2)
RL-154*	Pop-up drain assembly (complete)
P-26	Grid drain assembly (complete)

For Decorative Finish Faucets add suffix to parts marked with an asterisk as follows:

Suffix -STN Radiance® Satin finish



Aerator (flow regulator)	Part Number	
	Standard Aerators	Vandal Resistant with removal tool
2.2 gpm (8.3L/min)	LN-15*	LN-101*
1.5 gpm (5.7L/min)	FLR-110-1.5*	----
1.0 gpm (3.8L/min)	FLR-110-1.0*	----
.5 gpm (1.9L/min)	----	LN-100*
Removal tool part number, LL-60K		

Symmons Industries, Inc. 31 Brooks Drive ▪ Braintree, MA 02184 ▪ Phone: (800)796-6667 ▪ Fax: (800)961-962
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Lifetime Limited Warranty

All warranty claims MUST be pre-approved by Symmons.

Symmons warrants to the original consumer purchaser/end-user that any Symmons product will be free of defects in material and workmanship during normal domestic use for the life of your home. All other purchasers including industrial, commercial or business users are warranted for a period of 5 years from the date of purchase.

At our option, we will either have you send the defective part or product prepaid to us for inspection, or we may elect to send you the replacement part or product without investigation. A replacement for any defective part will be supplied FREE OF CHARGE for installation by the purchaser only. Installation, repair, replacement, and any related costs associated with replacement or repair are not covered under this warranty, and are the responsibility of the purchaser. Failure or damage caused by the use of replacement product other than Symmons Genuine Replacement Parts will void this warranty.

This warranty is applicable only to Symmons products purchased after July 1, 1998 and shall be effective from the date of purchase as shown on the purchaser's receipt.

Damage to the chrome and/or other decorative finishes on Symmons products may be a result of improper handling or abusive treatment. Finishes should only be cleaned with a soft, damp cloth or sponge. Use of polish, abrasive cleaners, solvents, or acid cleaners will damage the finish and void this warranty.

This warranty excludes product damage due to installation error, product abuse, or product misuse whether performed by a contractor, service company or yourself. There are no other express warranties on this product and ALL WARRANTIES OF MERCHANTABILITY AND OTHER IMPLIED WARRANTIES ARE LIMITED IN ACCORDANCE WITH APPLICABLE LAW. SYMMONS INDUSTRIES, INC., EXPRESSLY DISCLAIMS CONTINGENT LIABILITY AND CONSEQUENTIAL DAMAGE OF EVERY KIND. Since some states do not allow limitations on how long an implied warranty lasts or an exclusion or limitation of incidental or consequential damages, the above limitation or exclusion may not be applicable. This warranty gives specific legal rights. Other rights may vary from state to state.

To obtain warranty service, please contact Symmons Customer Service between the hours of 7:30 AM to 7:00 PM Eastern at: 1-800-796-6667, or via email at: gethelp@symmons.com.

FERGUSON ENTERPRISES, INC.®

CSS-1 CLINICAL SERVICE SINK PER ADDENDUM #2-1

A9512999020	AMERICAN STANDARD	CLINIC SERV SINK WALL
A8345115002	AMERICAN STANDARD	HERT SERV FTG BOT BRCE-STPS 1
S3010500	SLOAN	6.5 GALLONS PER FLUSH 117 ROYAL SERVICE SINK FLUSH VALVE WITH SWEAT

AS AMERICA, INC.
ONE YEAR LIMITED WARRANTY

If inspection of this AS America, Inc. (“American Standard®”) plumbing product, within one year after its initial purchase, confirms that it is defective in materials or workmanship, American Standard® will repair or, at its option, exchange the product for a similar model.

This limited warranty applies only to the original purchaser and installation of these products. In the event of a limited warranty claim, proof of purchase will be required **– save sales receipt.**

This limited warranty does not apply to local building code compliance. Since local building codes vary considerably, the purchaser of this product should check with a local building or plumbing contractor to insure local code compliance before installation.

This limited warranty is void if the product has been moved from its initial place of installation; if it has been subjected to faulty maintenance, abuse, misuse, accident or other damages; if it was not installed in accordance with American Standard®’s instructions; or if it has been modified in a manner inconsistent with the product as shipped by American Standard®.

American Standard®’s option to repair or exchange the product under this limited warranty does not cover any labor or other costs of removal or installation. IN NO EVENT WILL American Standard® BE LIABLE FOR THE COST OF REPAIR OR REPLACEMENT OF ANY INSTALLATION MATERIALS, INCLUDING BUT NOT LIMITED TO, TILES, MARBLE, ETC. American Standard® will not be responsible for any other incidental or consequential damages attributable to a product defect or to the repair or exchange of a defective product, all of which are expressly excluded from this limited warranty. This limited warranty does not cover any liability for consequential or incidental damages, all of which are hereby expressly disclaimed, or the extension beyond the duration of this limited warranty of any implied limited warranties, including those of merchantability or fitness for an intended purpose. (Some states or provinces do not allow the exclusion or limitation of implied limited warranties, so this exclusion may not apply to you.)

This limited warranty gives you specific legal rights. You may have other statutory rights that vary from state to state or from province to province, in which case this limited warranty does not affect such statutory rights.

AS AMERICA, INC. LIMITED WARRANTY FOR LXP®, BOULEVARD® DUAL FLUSH, CHAMPION® PRO, CHAMPION®4 TOILETS

This toilet comes with a limited lifetime warranty on chinaware, a limited 10 year warranty on all mechanical parts of the toilet, and a limited 1 year warranty on the toilet seat if included with product. If inspection of this AS America, Inc. (“American Standard®”) plumbing product, inclusive of the chinaware and all mechanical parts, confirms that it is defective in materials or workmanship, American Standard® will repair or, at its option, exchange the product for the same or a similar model.

This limited warranty applies only to the original non-commercial purchaser and installation of the products. In the event of a limited warranty claim, proof of purchase will be required **– save sales receipt.**

For this warranty to become effective, the warranty registration process must be completed via the internet or telephone per the warranty registration instructions.

This limited warranty does not apply to commercial installations. The warranty for commercial installations is 10 years on chinaware and mechanical parts, and 1 year on the toilet seat if included with product.

This warranty **does not apply** to local building code compliance. Since local building codes vary considerably, the purchaser of the product should check with a local building or plumbing contractor to ensure local code compliance before installation.

This warranty **will be void** if the product has been moved from its initial place of installation; if it has been subjected to faulty maintenance, abuse, misuse, accident or other damage; if it was not installed in accordance with American Standard®’s instructions; or if it has been modified in a manner inconsistent with the product as shipped by American Standard®.

WARNING: This warranty **DOES NOT COVER** any damages caused by the use of in-tank cleaners. These products can seriously corrode the fittings in the tank. This damage can cause leakage and property damage. **American Standard® will not be responsible or liable for any damage caused by the use of in-tank cleaners.**

American Standard®’s option to repair or exchange the product under this warranty does not cover any labor or other costs of removal or installation including any costs of any surrounding material such as tile or marble. **American Standard® is not responsible for any other incidental or consequential damages attributed to a product defect or to the repair or exchange of a defective product, all of which are expressly excluded from this warranty.** (Some states or provinces do not allow the exclusion or limitation of implied warranties, so this exclusion may not apply to you.)

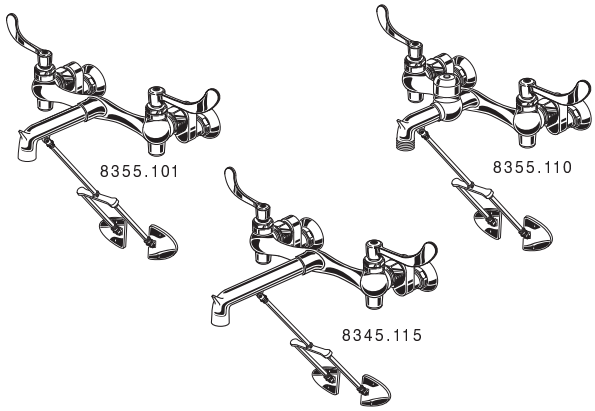
This warranty gives you specific rights. You may have other statutory rights that may vary from state to state or province to province, in which case this warranty does not affect such statutory rights.

American Standard

Installation Instructions

Exposed Yoke Wall Mount Utility Faucet with Bottom Brace

✔ **8355.110.002**
8355.101.002
8345.115.002



Thank you for selecting American-Standard... the benchmark of fine quality for over 100 years.

To ensure that your installation proceeds smoothly– please read these instructions carefully before you begin.

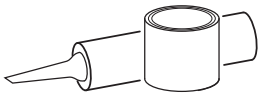
Certified to comply with ANSI A112.18.1M

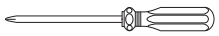
M965042 Rev.1.4

RECOMMENDED TOOLS

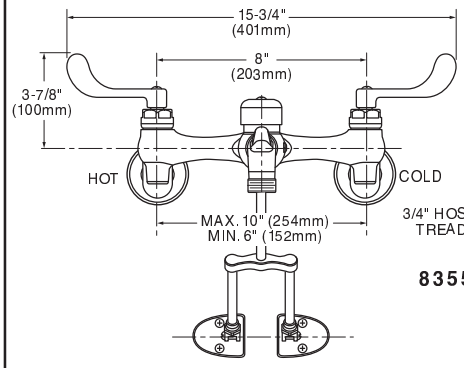

Channel Locks

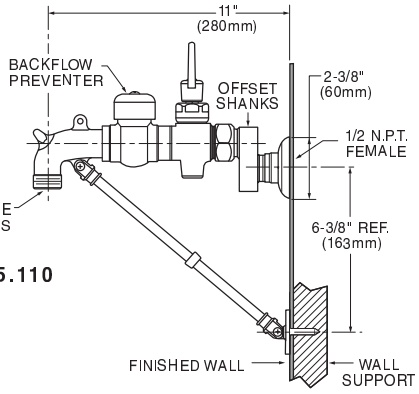

Adjustable Wrench

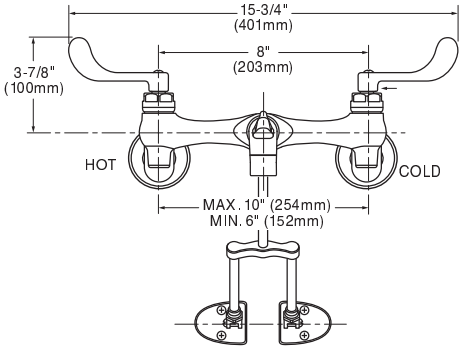

Plumbers' Putty or Caulking

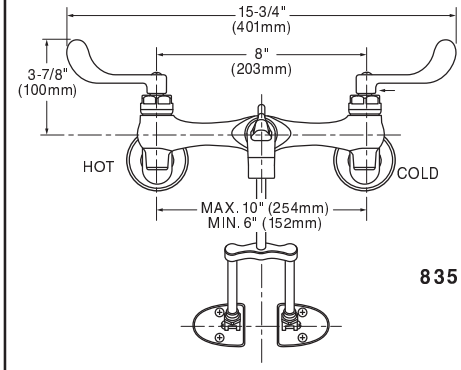

Phillips Screwdriver

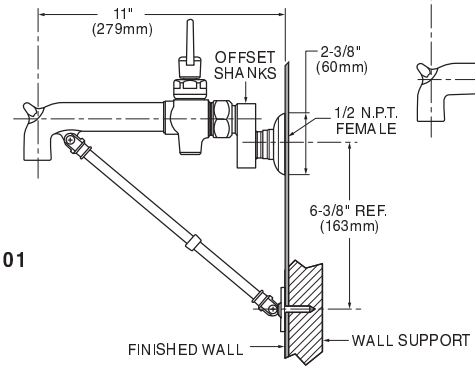
ROUGHING-IN DIMENSIONS

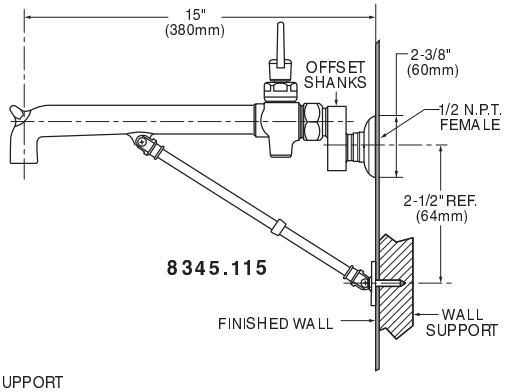






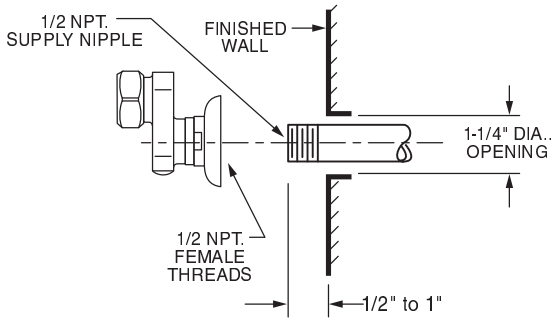






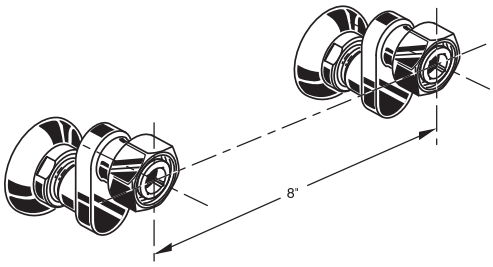
1 ROUGH-IN

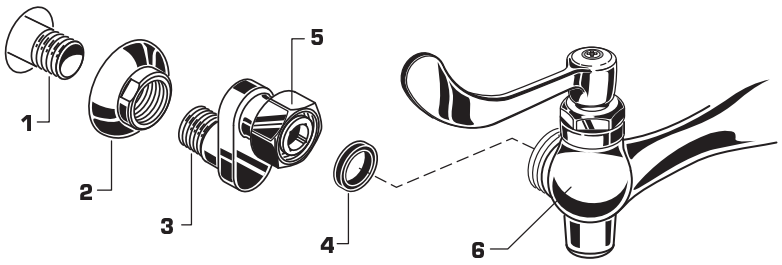
- Prepare water supply lines per "Roughing-in Dimensions". Install 1/2" NPT. SUPPLY NIPPLES



2 FINISH INSTALLATION

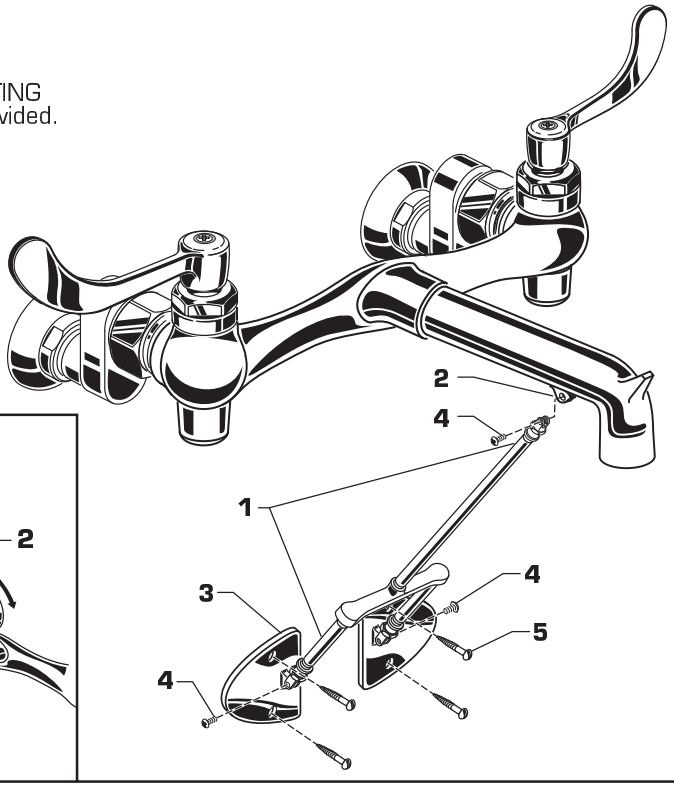
- Apply thread sealant or teflon tape to SUPPLY NIPPLES **(1)**.
- Thread ESCUTCHEONS **(2)** fully onto INLET SHANKS **(3)**.
- Thread INLET SHANKS **(3)** onto SUPPLY NIPPLES **(1)**. Distance between INLET SHANK **(3)** outlets must be 8" to match the VALVE.
- Insert RUBBER WASHERS **(4)** into COUPLING NUTS **(5)**.
- Attach VALVE **(6)** to INLET SHANKS **(3)**. Tighten both COUPLING NUTS **(5)** firmly.





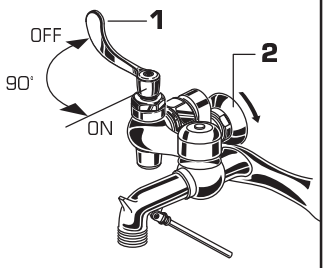
3 ATTACH SPOUT BRACE

- Attach SPOUT BRACE **(1)** to SPOUT **(2)** and WALL MOUNTING PLATES **(3)** with the three SPOUT BRACE SCREWS **(4)** provided.
- IF WALL MOUNTING PLATES **(3)** are not fastened to a wall support within the wall, use wall anchors with MOUNTING SCREWS **(5)**.
- Mark mounting hole location on wall and fasten MOUNTING PLATE **(3)** to wall with MOUNTING SCREWS **(5)** provided.



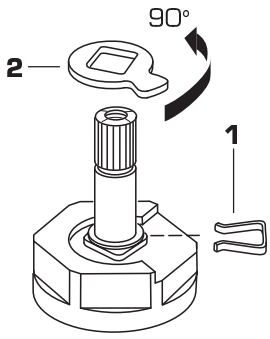
4 TEST FAUCET

- Turn HANDLES **(1)** TO **OFF** POSITION.
- Slowly turn water supplies on and check all connections for leaks.
- Operate HANDLES to flush water lines thoroughly.
- Turn HANDLES to **OFF** position.
- Thread ESCUTCHEONS **(2)** against finished wall.



5 SERVICE

- To change direction of handle rotation, proceed as follows:
  - Turn HANDLE to OFF position.
  - Remove HANDLE SCREW and HANDLE.
  - Remove SPRING CLIP **(1)**.
  - Lift STOP WASHER **(2)**, turn 90° and replace.
  - Replace SPRING CLIP **(1)**.
  - Replace HANDLE and HANDLE SCREW.
- If spout drips, operate handles several times from OFF to ON position. Do not force - handles turn only 90°.



CARE INSTRUCTIONS:

DO: SIMPLY RINSE THE PRODUCT CLEAN WITH CLEAR WATER. DRY WITH A SOFT COTTON FLANNEL CLOTH.

DO NOT: DO NOT CLEAN THE PRODUCT WITH SOAPS, ACID, POLISH, ABRASIVES, HARSH CLEANERS, OR A CLOTH WITH A COARSE SURFACE.

M965042 Rev.1.4

AS AMERICA, INC. FAUCET
LIMITED LIFETIME FUNCTION AND FINISH WARRANTY

FOR RESIDENTIAL INSTALLATIONS: AS America, Inc. ("American Standard") warrants this product to be free from defects in materials or workmanship for as long as the original consumer purchaser owns this product. Proof of purchase (original sales receipt) from the original consumer purchaser must be made available to American Standard for all warranty claims. This warranty is non transferable. It does not apply in the event of product damage due to the use of other than genuine American Standard replacement parts, installation error, abuse, misuse or improper care and maintenance (whether performed by a plumber, contractor, service provider or member of the purchaser's household). The warranty excludes damage due to aggressive air or water conditions, or harsh or abrasive cleaners and/or materials.

FOR COMMERCIAL INSTALLATIONS: For all industrial, commercial and business usage the warranty period is five years, from date of purchase and except for duration, all other aforementioned warranty terms apply. For both Residential and Commercial warranties, batteries are not included in the warranty.

American Standard will provide free of charge, at it's sole option, replacement part(s) or product (or if no longer available, a comparable product) to replace those which have proven defective in materials or workmanship.

This warranty does not cover labor charges incurred and/or damage sustained in installation, repair or replacement, nor incidental or consequential damages. This warranty is applicable only to American Standard faucets manufactured after June 1, 1996 and installed in the United States, Mexico and/or Canada.

THIS WARRANTY IS EXCLUSIVELY IN LIEU OF ALL OTHER WARRANTIES, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

This warranty gives the original consumer purchaser of an American Standard faucet specific legal rights which may vary from state to state or from province to province. In some states or provinces the exclusion or limitation of incidental or consequential damages is not allowed, so those exclusions may not apply to you.

For service under these warranties, it is suggested that a claim be made through the contractor or dealer from or through whom the product was purchased, or that a service request (including a description of the product model and of the defect) be sent to the following address:

In the United States:
American Standard Brands
P.O. Box 6820
Piscataway, New Jersey 08855
Attention: Director of Consumer Affairs

For residents of the United States, warranty information may also be obtained by calling the following toll free number: (800) 442-1902

www.americanstandard.com

In Canada:
AS Canada ULC
5900 Avebury Rd.
Mississauga, Ontario
Canada L5R 3M3

Toll Free: (800) 387-0369

www.americanstandard.ca

In Mexico:
American Standard B&K Mexico
S. de R.L. de C.V.
Via Morelos #330
Col. Santa Clara
Ecatepec 55540 Edo. Mexico

Toll Free: 01-800-839-1200

www.americanstandard.com.mx

SLOAN®

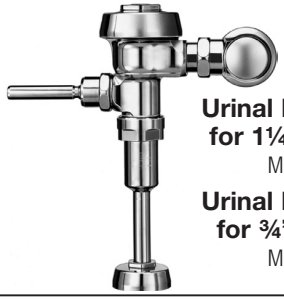
Code No. 0816195
Rev. 6 (02/15)

INSTALLATION INSTRUCTIONS FOR EXPOSED ROYAL® FLUSHOMETERS



Closet Flushometer for 1½" Top Spud
MODELS 110/111, 113, 115 & 116

Service Sink Flushometer for 1½" Top Spud
MODEL 117



Urinal Flushometer for 1¼" Top Spud
MODEL 180

Urinal Flushometer for ¾" Top Spud
MODEL 186



Closet Flushometer for 1½" Back Spud
MODELS 120, 121 & 122

LIMITED WARRANTY

Unless otherwise noted, Sloan Valve Company warrants this product, manufactured and sold for commercial or industrial uses, to be free from defects in material and workmanship for a period of three (3) years (one (1) year for special finishes, SF faucets, PWT electronics and 30 days for PWT software) from date of first purchase. During this period, Sloan Valve Company will, at its option, repair, replace, or refund the purchase price of any product which fails to conform with this warranty under normal use and service. This shall be the sole and exclusive remedy under this warranty. Products must be returned to Sloan Valve Company, at customer's cost. No claims will be allowed for labor, transportation or other costs. This warranty extends only to persons or organizations who purchase Sloan Valve Company's products directly from Sloan Valve Company for purpose of resale. This warranty does not cover the life of the batteries.

THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. IN NO EVENT IS SLOAN VALVE COMPANY RESPONSIBLE FOR ANY CONSEQUENTIAL DAMAGES OF ANY MEASURE WHATSOEVER.

PRIOR TO INSTALLATION

Before you install the flushometer, be sure the items listed below are installed. Also, refer to the rough-in diagram below.

• Closet fixture • Drain line • Water supply line

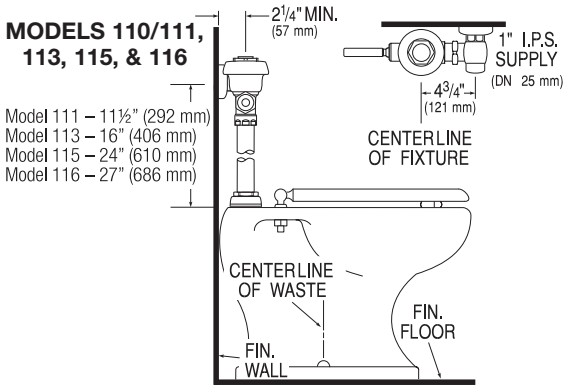
IMPORTANT:

- **ALL PLUMBING SHOULD BE INSTALLED IN ACCORDANCE WITH APPLICABLE CODES AND REGULATIONS.**
- **WATER SUPPLY LINES MUST BE SIZED TO PROVIDE AN ADEQUATE VOLUME OF WATER FOR EACH FIXTURE.**
- **FLUSH ALL WATER LINES PRIOR TO MAKING CONNECTIONS.**

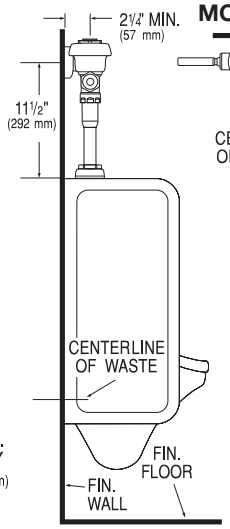
Sloan's flushometers are designed to operate with 15 to 80 psi (103 to 552 kPa) of water pressure. **THE MINIMUM PRESSURE REQUIRED TO THE VALVE IS DETERMINED BY THE TYPE OF FIXTURE SELECTED.** Consult fixture manufacturer for minimum pressure requirements. Most High Efficiency water closets require a minimum flowing pressure of 25 psi (172 kPa). Many building codes and the ASME A112.19.2 fixture standard list Maximum static water pressure as 80 PSI (552 kPa).

ROUGH-INS

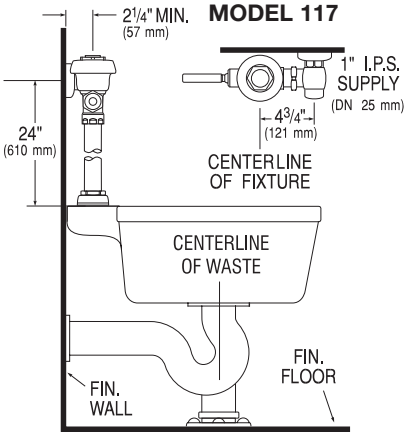
MODELS 110/111, 113, 115, & 116



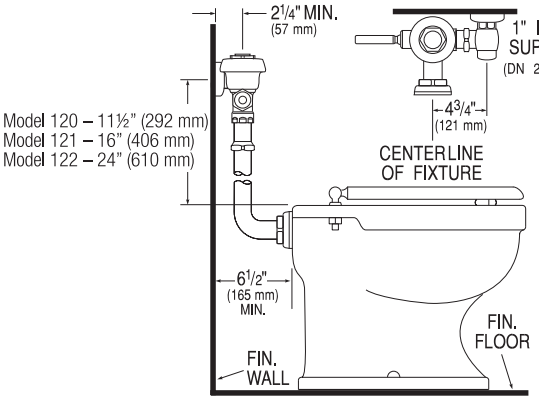
MODELS 180/186



MODEL 117



MODELS 120, 121, & 122



!!! IMPORTANT !!!

WHEN MOUNTED ON AN ADA ACCESSIBLE BOWL, THE ROUGH-IN TO THE SUPPLY INLET SHOULD BE NO HIGHER THAN 37½" OR THE HANDLE WILL EXCEED MAXIMUM HEIGHT ALLOWANCES UNDER ADA GUIDELINES.

TOOLS REQUIRED FOR INSTALLATION

- Straight blade screwdriver
- Sloan A-50 Super-Wrench™, Sloan A-109 Plier Wrench or smooth jawed spud wrench

!!! IMPORTANT !!!

PROTECT THE CHROME OR SPECIAL FINISH OF SLOAN FLUSHOMETERS — DO NOT USE TOOTHED TOOLS TO INSTALL OR SERVICE THESE VALVES. USE A SLOAN A-50 SUPER-WRENCH™, SLOAN A-109 PLIER WRENCH OR SMOOTH JAWED SPUD WRENCH TO SECURE ALL COUPLINGS. SEE "CARE AND CLEANING" SECTION.

!!! IMPORTANT !!!

NEVER OPEN CONTROL STOP TO WHERE THE FLOW FROM THE VALVE EXCEEDS THE FLOW CAPABILITY OF THE FIXTURE. IN THE EVENT OF A VALVE FAILURE, THE FIXTURE MUST BE ABLE TO ACCOMMODATE A CONTINUOUS FLOW FROM THE VALVE.

!!! IMPORTANT !!!

WITH THE EXCEPTION OF CONTROL STOP INLET, DO NOT USE PIPE SEALANT OR PLUMBING GREASE ON ANY VALVE COMPONENT OR COUPLING!

!!! IMPORTANT !!!

THIS PRODUCT CONTAINS MECHANICAL AND/OR ELECTRICAL COMPONENTS THAT ARE SUBJECT TO NORMAL WEAR. THESE COMPONENTS SHOULD BE CHECKED ON A REGULAR BASIS AND REPLACED AS NEEDED TO MAINTAIN THE VALVE'S PERFORMANCE.

Please take the time to read this manual to ensure proper product installation and longevity.

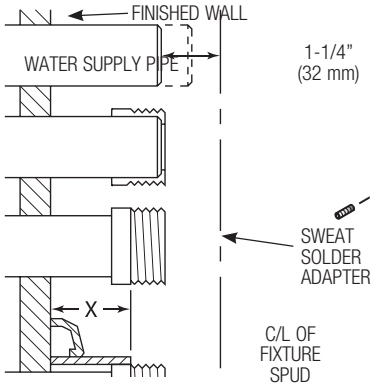
When further assistance is required, please contact your local Sloan Representative or Sloan Technical Support at: 1-888-SLOAN-14 (1-888-756-2614)

1 - INSTALL OPTIONAL SWEAT SOLDER ADAPTER (ONLY IF YOUR SUPPLY PIPE DOES NOT HAVE A MALE THREAD)

A Measure from finished wall to C/L of fixture spud. Cut pipe 1¼" (32 mm) shorter than this measurement. Chamfer O.D. and I.D. of water supply pipe.

B Slide threaded adapter fully onto pipe.

C Sweat solder the Adapter to pipe.

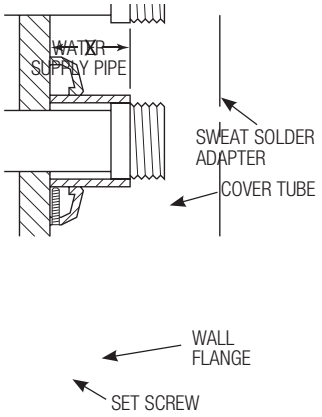


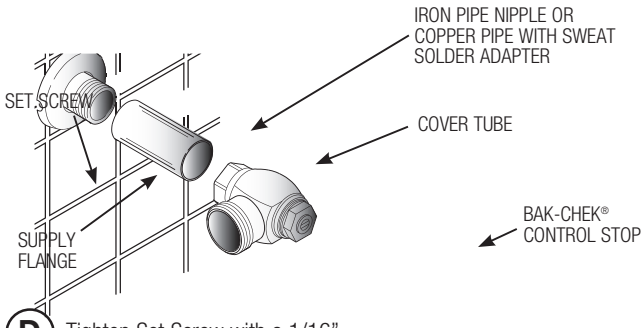
2 - INSTALL COVER TUBE, WALL FLANGE AND CONTROL STOP TO SUPPLY PIPE

A Measure from finished wall to first thread of Adapter or threaded supply pipe (dimension "X"). Cut Cover Tube to this length.

B Slide Cover Tube over pipe. Slide Wall Flange over Cover Tube until against wall.

C Thread Control Stop onto pipe. Tighten with a wrench.





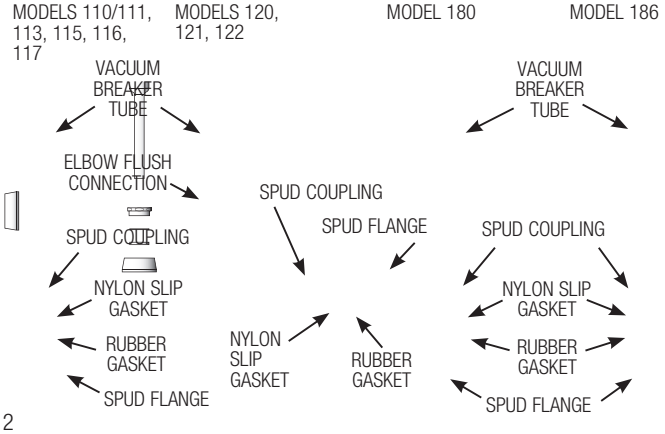
D Tighten Set Screw with a 1/16" hex wrench. DO NOT install Vandal Resistant Stop Cap at this time.

3 - INSTALL VACUUM BREAKER FLUSH CONNECTION

A Slide Spud Coupling, Nylon Slip Gasket, Rubber Gasket and Spud Flange over Vacuum Breaker Tube.

B Insert Tube into Fixture Spud.

C Hand tighten Spud Coupling onto Fixture Spud.



4 - INSTALL FLUSHOMETER AND TRIPLE SEAL HANDLE ASSEMBLY

NOTE

For high efficiency urinal flushometers (0.5, 0.25 and 0.125 gpf), it is necessary to first insert the flow control component into the tailpiece assembly. See the H1015A flow control kit and separate instructions for details on how to install.

A Lubricate tailpiece O-ring with water. Insert Adjustable Tailpiece into Control Stop. Tighten Tailpiece Coupling by hand.

B Align Flushometer directly above the Vacuum Breaker Flush Connection by sliding the Flushometer Body IN or OUT as needed. Tighten Vacuum Breaker Coupling by hand.

NOTE

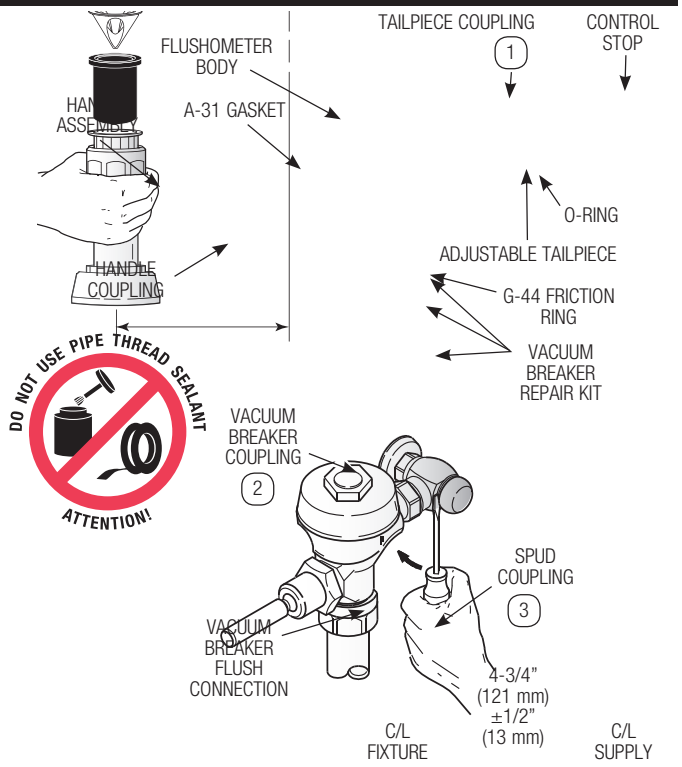
Maximum adjustment of the Sloan Adjustable Tailpiece is 1/2" (13 mm) IN or OUT from the standard 4-3/4" (121 mm) (centerline of Flushometer to centerline of Control Stop).

If roughing-in measurement exceeds 5-1/4" (133 mm), consult factory for longer tailpiece.

C Align Flushometer Body and securely tighten first the Tailpiece Coupling (1), then the Vacuum Breaker Coupling (2), and finally the Spud Coupling (3). Use a wrench to tighten these couplings in the order shown.

D Install the red A-31 Handle Gasket on the Handle Assembly. Insert the Handle Assembly into the Handle opening in the Flushometer Body. Securely tighten the Handle coupling with a wrench.

Sloan's triple-sealed Flushometer Handle is ADA-complaint.



5 - FLUSH OUT SUPPLY LINE

A Make sure Control Stop is CLOSED and remove Flushometer Outer Cover.

B Remove Inside Cover and lift out Inside Parts Assembly.

C Reinstall Outside and Inside Cover wrench tight. Open Control Stop to flush supply line. Close Control Stop and remove Outside and Inside Cover.

D Reinstall Inside Parts Assembly, Inside Cover and Outside Cover wrench tight.

6 - ADJUST CONTROL STOP AND INSTALL VANDAL RESISTANT STOP CAP

A Open Control Stop COUNTERCLOCKWISE one FULL turn from closed position.

B Activate Flushometer.

TURN COUNTER-CLOCKWISE TO OPEN

C Adjust Control Stop after each flush until the rate of flow delivered properly cleanses the fixture.

TURN CLOCKWISE TO CLOSE

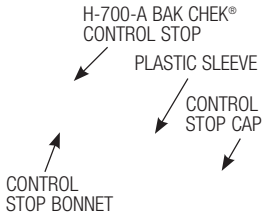
!!! IMPORTANT !!!

Sloan's flushometers are engineered for quiet operation. Excessive water flow creates noise, while too little water flow may not satisfy the needs of the fixture. Proper adjustment is made when plumbing fixture is cleansed after each flush without splashing water out from the lip AND a quiet flushing cycle is achieved.

Never open Control Stop to where the flow from the valve exceeds the flow capability of the fixture. In the event of a valve failure, the fixture must be able to accommodate a continuous flow from the valve.

D Install Vandal Resistant Control St
- Thread the Plastic Sleeve onto t (tighten only by hand; do not use
- Place the metal Control Stop Ca use the palm of the hand to push fingers of the Plastic Sleeve. The

Important: DO NOT install Cap onto Sle threaded onto Control Stop Bonnet. If th off of the Control Stop, the Sleeve WILL NOT come apart from the Cap.



VANDAL RESISTANT CONTROL STOP CAP REMOVAL

Use a large flat screwdriver as a lever to remove the Cap from the Control Stop. Insert the screwdriver blade between the bottom edge of the Cap and the flat surface of the Control Stop body as shown. Push the screwdriver handle straight back toward the wall to gently lift the Cap. If necessary, work the screwdriver around the diameter of the Cap until you can grasp the Cap and lift it completely off the Sleeve. The Sleeve should remain attached to the bonnet of the Control Stop.

TROUBLESHOOTING GUIDE

1. Flushometer does not function (no flush).

A. Control stop or main valve is closed. Open control stop or main valve.
B. Handle assembly is damaged. Replace handle or install handle repair kit.
C. Relief Valve is damaged. Replace relief valve.

2. Volume of water is not sufficient to siphon fixture.

A. Control stop is not open wide enough. Adjust control stop for desired delivery of water volume.
B. Diaphragm assembly is damaged. Replace diaphragm assembly.
C. Incorrect diaphragm assembly is installed in flushometer; for instance, urinal assembly inside a closet flushometer, or low consumption assembly inside a higher consumption fixture. Determine the flush volume required by the fixture and replace diaphragm. Use valve label and markings on fixture for reference.
D. Water supply volume or pressure is inadequate. If no gauges are available to properly measure supply pressure or volume of water at the flushometer, then remove the relief valve from the diaphragm assembly, reassemble the flushometer and completely open the control stop.
- If the fixture siphons, more water volume is required. Install a higher flushing volume diaphragm. **IMPORTANT – LAWS AND REGULATIONS PROHIBIT THE USE OF HIGHER FLUSHING VOLUMES THAN LISTED ON FIXTURE OR FLUSHOMETER.**
- If the fixture DOES NOT siphon or if a low consumption flush is required, steps must be taken to increase the water supply pressure and/or volume. Contact the fixture manufacturer for minimum water supply requirements of the fixture.

3. Length of flush is too short (short flush).

A. Diaphragm assembly is worn or damaged. Replace diaphragm assembly.
B. Handle assembly is damaged. Replace handle or install handle repair kit.
C. Incorrect diaphragm assembly is installed in flushometer; for instance, urinal assembly inside a closet flushometer, or low consumption assembly inside a higher consumption fixture. Determine the flush volume required by the fixture and replace diaphragm. Use valve label and markings on fixture for reference.

4. Length of flush is too long (long flush) or continuous.

A. Metering bypass hole (upper filter ring) in diaphragm is clogged. Remove the diaphragm assembly. Remove the primary and secondary filter rings from the diaphragm, wash under running water, and reassemble. Replace as necessary.
B. Diaphragm or relief valve is damaged. Replace diaphragm or relief valve.
C. Incorrect diaphragm assembly is installed in flushometer; for instance, closet assembly inside a urinal flushometer, or water saver assembly inside a low consumption flushometer. Determine the flush volume required by the fixture and replace the diaphragm. Use valve label and markings on fixture for reference.
D. Inside cover is damaged. Replace Inside cover.
E. Supply line water pressure has dropped and is not sufficient to close the valve. close control stop until pressure is restored.
F. Relief valve is not seated properly. Disassemble diaphragm components (relief valve, filter rings, and diaphragm unit), wash under running water, and reassemble. Replace as necessary.

5. Chattering noise is heard during flush.

A. Inside cover is damaged. Replace inside cover.
B. Relief valve or diaphragm is damaged. Replace relief valve or diaphragm assembly.

6. Handle Leaks.

A. Handle seal or assembly is damaged. Replace handle or install handle repair kit.

7. Water splashes from fixture.

A. Control stop is open wider than necessary. Adjust control stop for desired delivery of water volume.
B. Water saver/conventional diaphragm assembly is installed on low consumption fixture or closit diaphragm assembly is installed on urinal fixture. Determine the required flush volume (see label on valve or markings on fixture). Replace diaphragm assembly or relief valve for appropriate flush volume of fixture.

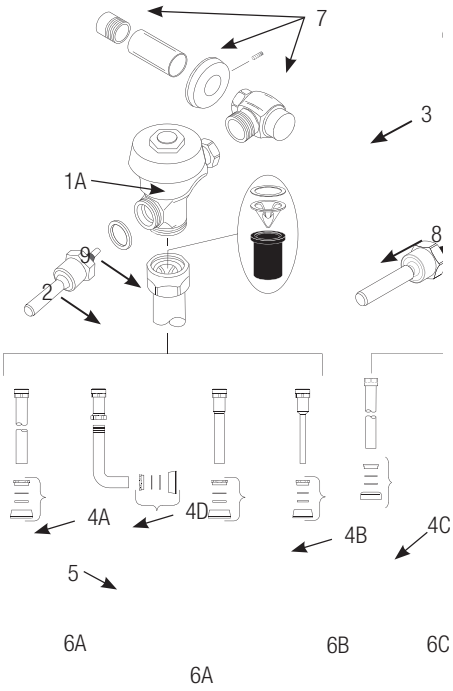
When assistance is required, please contact your local Sloan Representative or Sloan Technical Support at: 1-888-SLOAN-14 (1-888-756-2614)

CARE AND CLEANING

DO NOT use abrasive or chemical cleaners (including chlorine bleach) to clean Flushometers that may dull the luster and attack the chrome or special decorative finishes. Use ONLY mild soap and water, then wipe dry with clean cloth or towel.

While cleaning the bathroom tile, protect the Flushometer from any splattering of cleaner. Acids and cleaning fluids will discolor or remove chrome plating.

PARTS LIST



Item No.	Part No.	Description
1	†	Valve Assembly
2	B-73-A	ADA Compliant Handle Assembly
3	H-700-A	Bak-Chek® Control Stop
4A	V-600-AA	1½" (38 mm) Vacuum Breaker Assembly ‡
4B	V-600-AA	1¼" (32 mm) Vacuum Breaker Assembly
4C	V-600-AA	¾" (19 mm) Vacuum Breaker Assembly
4D	V-600-A	Vacuum Breaker Assembly
5	F-109	1½" (38 mm) Elbow Flush Connection
6A	F-56-A	1½" (38 mm) Spud Coupling Assembly
6B	F-57-A	1¼" (32 mm) Spud Coupling Assembly
6C	F-58-A	¾" (19 mm) Spud Coupling Assembly
7	H-634-AA	1" (25 mm) Sweat Solder Kit with Cast Set Screw Flange
	H-636-AA	¾" (19 mm) Sweat Solder Kit with Cast Set Screw Flange
8	V-651-A	High Back Pressure Vacuum Breaker Repair Kit
9	A-31	Handle Gasket

† Part number varies with valve model variation; consult factory.
‡ Length varies with valve model variation; consult factory.

NOTE: The information contained in this document is subject to change without notice.

SLOAN • 10500 SEYMOUR AVENUE • FRANKLIN PARK, IL 60131
Phone: 1-800-982-5839 • Fax: 1-800-447-8329 • www.sloanvalve.com

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Code No. 0816195 Rev. 6 (02/15)

FERGUSON ENTERPRISES, INC.®

SS-1 SCRUB SINK

EEWSF13026SACC	ELKAY	SURGEON SINK PACKAGE

IMPORTANT END USER INFORMATION

Care and Cleaning Instructions

1) Never use any cleaner or cleanser based cleaning material on this product.

2) Keep the faucet dry! While drying your hands, dry the faucet as well. The water in certain parts of the world can be very caustic. Any standing water around the faucet could damage the intrinsic coating; remove it as soon as possible.

Discover why the professional's choice for sinks and faucets is also the right choice to take care of all of your home's stainless surfaces and accessories. Visit **www.byelkay.com** for more information or for a complete list of all domestic showrooms in your area visit **www.elkayusa.com, where to buy**.

ELKAY LIMITED FIVE YEAR FAUCET WARRANTY ON COMMERCIAL FAUCETS

Limited Five Year Functional and Finish Warranty
Elkay warrants to the original consumer purchaser that the Elkay faucet will be free from defects in material and workmanship for Five Years from the original installation date. Elkay will, at its option, supply replacement parts (or if no longer available a comparable product) if the faucet fails due to a defect in material or workmanship. This warranty does not apply in the event of produce surface damage caused by abuse, misuse or improper care and maintenance. This warranty excludes damage caused by harsh or abrasive cleaners and/or materials. This warranty includes all industrial, commercial and business use. Product replacement does not include transportation cost or labor installation cost. Elkay reserves the right to examine product in question and its installation prior to replacement.

OTHER WARRANTY CONDITIONS ON FAUCETS
Our warranty does not cover product failure or damage caused by abusive treatment, misuse, environmental factors, improper care and cleaning, or damage due to handling or faulty installations. This warranty is extended only to the original consumer purchaser of the product. This warranty does not cover shipping costs, labor costs, or any other charges for such items as installation or replacement of the sink, diagnosis or replacement of any faucet or component part, or any other expense or loss.

ALL INCIDENTAL OR CONSEQUENTIAL DAMAGES ARE SPECIFICALLY EXCLUDED. NO ADDITIONAL WARRANTIES, EXPRESS OR IMPLIED ARE GIVEN. ANY IMPLIED WARRANTY, INCLUDING ONE OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, IS LIMITED TO THE DURATION OF THIS WRITTEN WARRANTY.

Some states do not allow the exclusion or limitation of incidental or consequential damages or limitations on how long an implied warranty lasts, so the above limitations or exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

TO OBTAIN SERVICE UNDER WARRANTY
1. Write to: Elkay
   Attention: Consumer Services
   2222 Camden Court
   Oak Brook, IL 60523
2. Include a letter containing the following information:
   a. Date of purchase and installation
   b. Description of nature of defect
   c. Model number or description of model and/or component part if possible.

Product Specifications

Power: (a) DC – Alkaline AA Batteries (4); (b) AC/DC alternatively
Water Supply pipe size: NPSM 1/2-1/4
Working Pressure: 2.8 – 213 psi
Ambient Temp. Range: 36°F – 194°F
Sensing Distance: 7/8" – 6-3/4"
Sensing Range Setup: Digital
Response Time: Default 0.3 sec
Off Delay Time: Default 1 sec
Fresh Battery Life Cycle: 400,000
Weak Power Indicator: Steady red LED

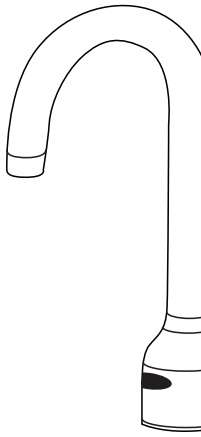
Sensor Range Setup (Default range is preset at 5-1/2")

NOTE – Do not attempt to open control module to adjust sensing range
1. Press and hold On/Off button for 5-7 seconds. Red LED on.
2. Release button. Red LED off.
3. Place hand 2-3" from spout. Wait 5-10 seconds until red LED flashes.
4. Place hand at desired sensor distance. Hold hand in place and press the On/Off button.

ELKAY®
commercial products

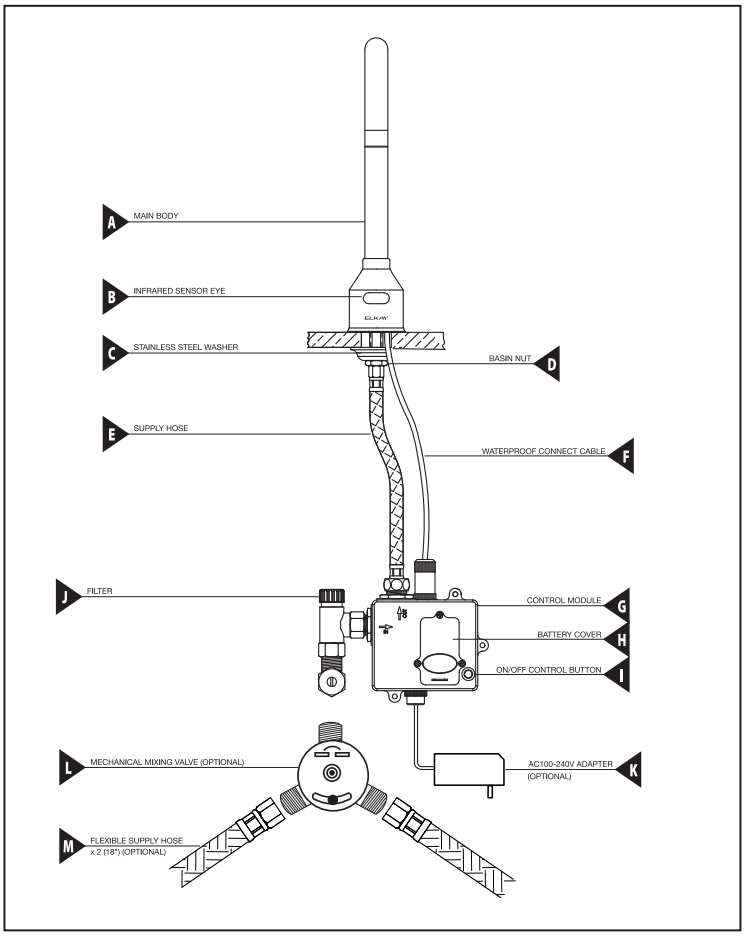
Installation Instructions fo

Elkay® Electronic Sensor A
Deck Mounted Lavatory Fa
LKB721C and LKB721CNC (Ba

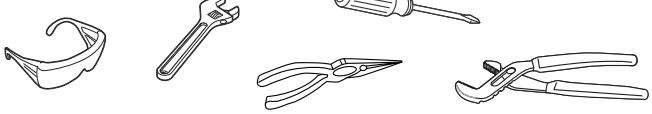


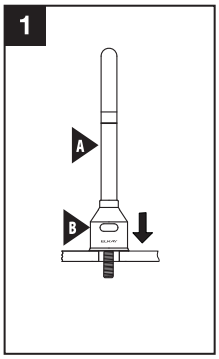
Printed in U.S.A.
Elkay Manufacturing
2222 Camden Court
Oak Brook, Illinois 60523 USA
98519C

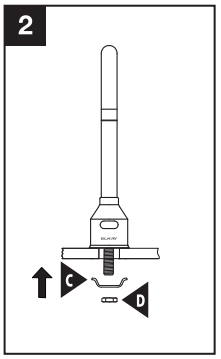
SAVE FOR END USER

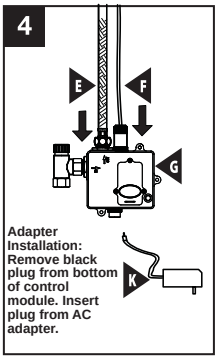

A MAIN BODY
B INFRARED SENSOR EYE
C STAINLESS STEEL WASHER
D BASIN NUT
E SUPPLY HOSE
F WATERPROOF CONNECT CABLE
J FILTER
G CONTROL MODULE
H BATTERY COVER
I ON/OFF CONTROL BUTTON
L MECHANICAL MIXING VALVE (OPTIONAL)
K AC100-240V ADAPTER (OPTIONAL)
M FLEXIBLE SUPPLY HOSE x 2 (18") (OPTIONAL)

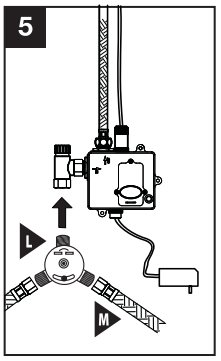
Tools:

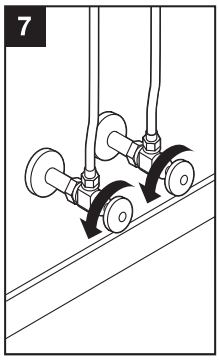


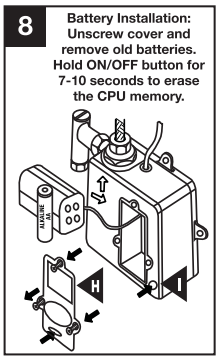

1
A
B


2
C
D


4
E
F
G
K
Adapter Installation: Remove black plug from bottom of control module. Insert plug from AC adapter.


5
L
M


7


8
Battery Installation: Unscrew cover and remove old batteries. Hold ON/OFF button for 7-10 seconds to erase the CPU memory.
H
I

2

SK-1 **SK-1 SINK PER ADDENDUM #2-1**

EGECR25213	ELKAY	25X21X5-3/8" 3-HOLE 20-GA SS SNGLE SINK
C200AABCP	CHICAGO	CCN LEAD LAW COMPLIANT 2 HANDLE 4 HOLE KITCHEN FAUCET WITH SPRAY 2.2

ELKAY STAINLESS STEEL SINKS
FREGADEROS DE ACERO INOXIDABLE ELKAY

MANUAL CON ILUSTRACTIONES PARA INSTALAR SU FREGADERO DE ACERO INOXIDABLE

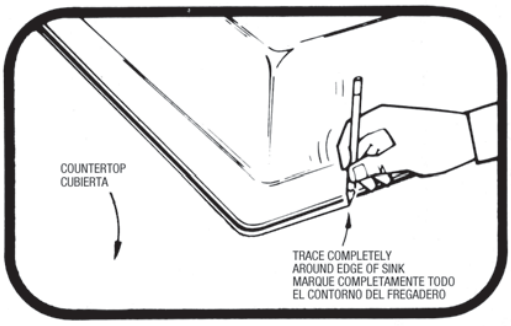
STEP ONE

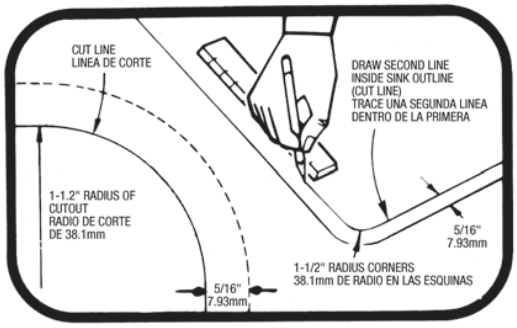
If counter top must be cut out, locate sink cutout by turning sink upside down and position so bowl compartments are located directly over sink cabinet. Position sink, front to rear, so that sink rim will fit flat on top surface and that sink compartments will fit into cabinet without interfering with cabinet.

PASO UNO

Si la cubierta no tiene el corte hecho, coloque el fregadero boca abajo sobre la cubierta, para proceder a trazar la linea de corte. Asegúrese que el fregadero quede de atras para adelante, de forma que el borde de éste calce perfectamente y que los compartimientos no interfieran con el gabinete.

STEP TWO / PASO DOS





STEP THREE

Check your dimensions. Measure the cut line you have drawn on the counter top or check your pre cut opening to make sure it conforms to the following sample sizes.

Cutout is 5/8" shorter than overall size of sink.

SAMPLE CUTOUT SIZES

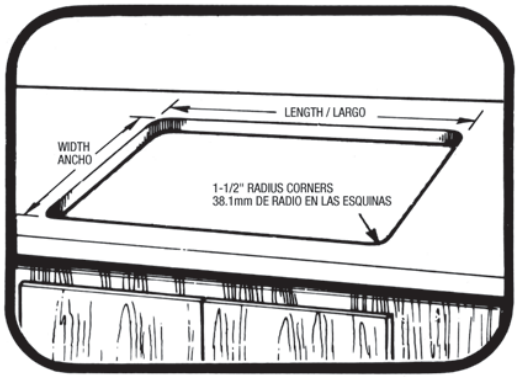
SINK SIZE	CUTOUT LENGTH	CUTOUT WIDTH
25×22	24⅜	21⅜
33×22	32⅜	21⅜
37×22	36⅜	21⅜
38×22	37⅜	21⅜
40×22	39⅜	21⅜
43×22	42⅜	21⅜
48×22	47⅜	21⅜
54×22	53⅜	21⅜

PASO TRES

Verifique las medidas. Asegúrese antes de empezar a cortar, que la linea de corte sea 15.9mm más pequeña que la medida de su fregadero.

EJEMPLOS DE LINEA DE CORTE

Medida de Fregadero	Longitud del Corte	Anchura del Corte
635mm× 558mm	619.1mm	542.9mm
838.2mm× 558mm	822.3mm	542.9mm
939.8× 558mm	923.9mm	542.9mm
965.2× 558mm	949.3mm	542.9mm
1016× 558mm	1000.1mm	542.9mm
1092.2× 558mm	1076.3mm	542.9mm
1219.2× 558mm	1203.3mm	542.9mm
1371.6× 558mm	1355.7mm	542.9mm

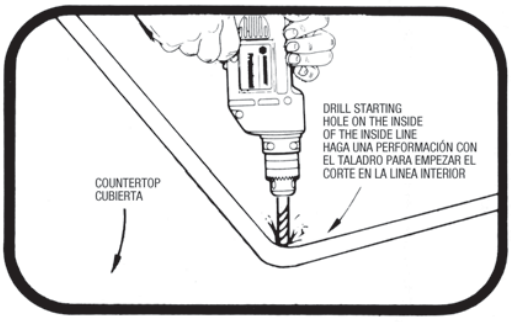


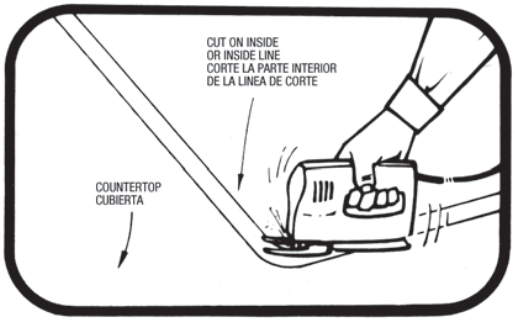
STEP FOUR

Cut hole in counter top.

PASO CUATRO

Haga una perforación con el taladro para empezar el corte en la linea interior. Con una sierra de mano corte a todo lo largo de la linea de corte.



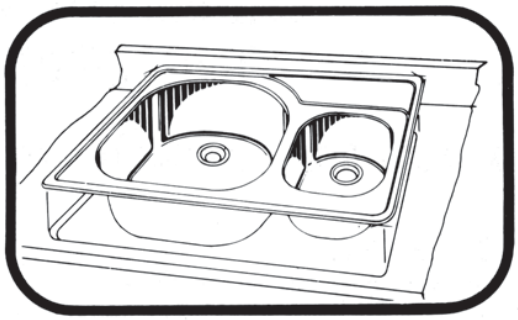


STEP FIVE

Check the countertop cutout opening to be sure it is sized properly. The easiest way to do this is to set the new sink into the opening to see if it fits. The sink rim must set uniformly on the countertop. If the sink does not fit, enlarge the cut-out opening with a sabre saw, or keyhole saw.

PASO CINCO

Verifique el tamaño de la apertura. La manera más sencilla de hacerlo es colocar el fregadero y ver si las dimensiones son las correctas. Si no, hacer los ajustes necesarios con lima o sierra.

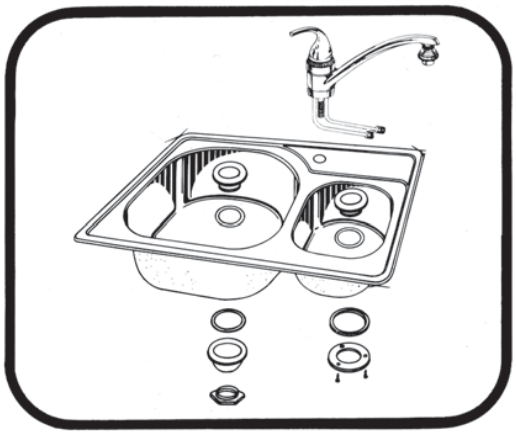


STEP SIX

Attach faucet, drain fittings and accessories according to the manufacturer's instructions.

PASO SEIS

Colocar la llave, tubería de desagüe y accesorios como lo indique el fabricante.



STEP SEVEN

Apply a bead of good quality caulk to the underside of sink flange and position sink into counter top opening.

PASO SIETE

Aplique una capa de empaque o silicón de buena calidad por debajo del marco del fregadero y colocar éste sobre la cubierta.

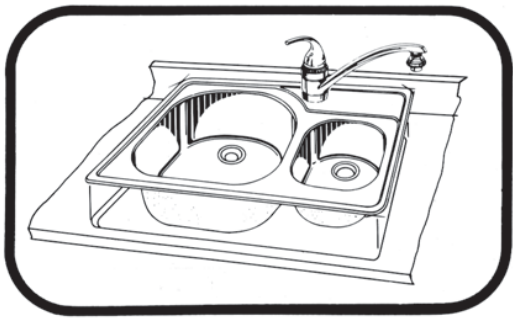
STEP EIGHT

Assemble and Insert Sink Fasteners

Note: Screws and clips contained in this sink package will secure this sink to a countertop not exceeding 7/8″ thickness. For thicker countertop applications, up to 1-1/2″ in thickness, order Model 364 14 pc - Long Screw Only Kit or Model 363 14 pc - Long Screw and Clip Kit.

Assemble the screws into the clamps as shown. (Note: Screws are designed to insert into the clamps with backward threading, so that in mounting, they will turn the normal direction.)

With your screwdriver, tighten the fasteners. Begin with the fasteners located in the middle of each side, tighten the remaining fasteners until the entire rim is sealed with no gaps. It may be necessary to slide a fastener to a different position to compensate for an uneven counter. (**Be careful not to over-tighten.** It is only necessary to draw the rim down snugly to the counter.)

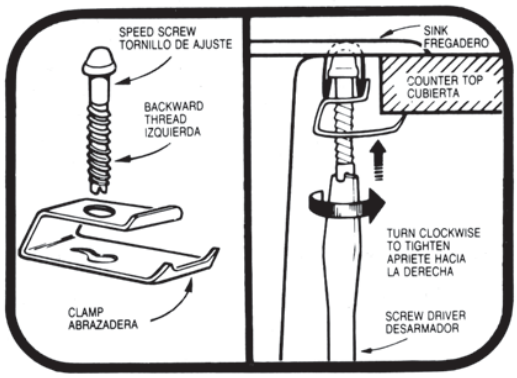


PASO OCHO

Coloque los tornillos de ajuste del fregadero, Nota: las abrazaderas y tornillos que vienen con el fregadero servirán para fijar éste a una cubierta de 22.2mm de espesor. Si la cubierta mide mas de 38.1mm de espesor ordene el modelo 364 de 14 piezas con tornillos largos solamente o el modelo 366 con tornillos largos y juego de abrazaderas.

Coloque las abrazaderas y tornillos como lo indica la ilustración. Los tornillos se colocan a las abrazaderas al revés para voltearlas al momento de instalarlas.

Con un desarmador del gado y largo apriete los tornillos, empezando con los que están en medio de cada lado, posteriormente apriete los demás hasta que no quede ningún espacio sin sellar. Es posible que tenga que mover algun tornillo de lugar para nivelar el fregadero. Tenga cuidado de no apretar demasiado. Solo es necesario unir el borde firmemente a la cubierta.



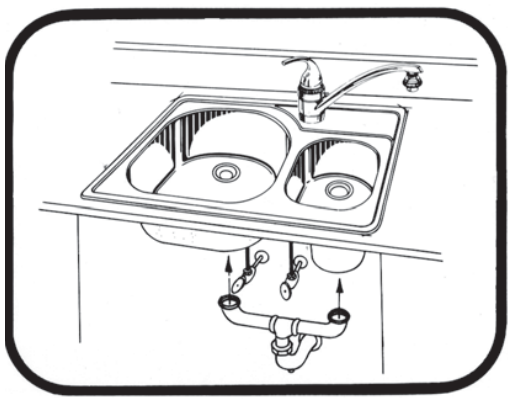
STEP NINE

Connect Faucet Supplies and Drain Fittings

Connect the faucet supply fittings and the drain trap fittings. Turn on the water supply. Check for possible leaks at these locations: (1) Supply riser tubes to faucet, and (2) Supply riser tubes to shut-off valves (or, lower connections). Next fill the sink bowl with water and check for possible leaks around the drain flange(s). (This would show up as dripping into the cabinet below.) Release water from sink and check for possible leaks at drain connections. Tighten any joints which leak.

PASO NEUVE

Conecte llaverías y tubería de desagüe. Conecte los tubos de desagüe y luego las llaves de paso, abra la llave general del agua. Verifíque que no haya fugas o goteras en los siguientes lugares: 1) En la llavería y las llaves de paso 2) En las conexiones. Llene el fregadero con agua, asegúrese que no gotée en el interior del mueble. Vacíe el fregadero y apriete las conexiones que gotéen.



USE AND CARE HINTS

Congratulations on purchasing your new ELKAY sink. Your sink is made from the best nickel bearing stainless steel and with proper care and maintenance will give you a lifetime of service.

Elkay sinks are designed for the demanding use of today's fast paced kitchen environment. The sink is finished through a series of sophisticated processes to develop its unique satin finish that requires minimal maintenance.

What You Should Know About Elkay's Stainless Steel Finish

An Elkay stainless steel sink is made of the finest nickel-bearing stainless steel available. Its mellow satin surface harmonizes with any color scheme...any decor. Timeless. Elegant. And, like fine silver, its beautiful finish develops an heirloom patina...actually becoming lovelier with use and age. Your Elkay sink is solid stainless steel. There is no coating which will wear off.

Elkay Satin Finish

Elkay's original highlighted satin finish is produced by an abrasive grinding operation which lends a uniform pattern of grain lines to the metal surface. All exposed areas then undergo a series of progressive machine and hand polishing operations. It is this careful polishing that makes an Elkay satin luster finish so beautiful...and so easy to clean and maintain! Please remember that a fine Elkay sink is not self cleaning. It will require a small amount of maintenance to retain its lustrous finish.

Reasons For Cleaning Your Stainless Steel Sink

Your stainless steel sink has been produced of the finest material to provide a quality product for many years of service. Like all quality products it does require some maintenance to assure that the finish will continue to look bright and sanitary.

Easy Cleaning Instructions

Rinsing is the most important part of sink care. An Elkay stainless steel sink finish will retain its original bright appearance if the sink is **rinsed** thoroughly after each use. "Thorough" rinsing can be done by running the water from the spray hose for a few minutes. Typically, a rinse and towel drying after each use takes care of most everyday clean ups. Ideally, once a week the sink should be scoured with a mildly abrasive cleanser, such as Comet. Rubbing back and forth in the direction of the polish or grain lines will not only remove stubborn stains and greasy film buildups, but will blend usage scratches into the satin finish of the sink. After scouring, rinse thoroughly and wipe dry. Your sink will shine like new!

Scratching

Like most metals, your new stainless steel sink will scratch. The feature benefit of the unique satin finish is the ease with which these scratches blend into the uniform finish of the sink. This is accomplished with a periodic scouring with a mildly abrasive kitchen cleanser, such as Comet.

Rubber Mats

The resiliency of stainless steel makes it unnecessary to use rubber mats to protect your sink, dishes and glassware. However, if you do use mats, please remove them after each use. If left in the sink, the water trapped underneath could cause discoloration.

Discoloration, Rust and Possible Pitting

Wet sponges, clothes, cleaning pads and rubber mats left on the sink can lead to discoloration. Steel wool pads should never be used to clean your sink as they leave small iron particles in the grain lines which rust and can damage the sink. Continued usage in this manner may eventually lead to the sink itself rusting and pitting.

Liquid Soap

Do not allow concentrated liquid detergent to dry on your sink. Most brands contain chemical additives which will affect the original high luster finish.

Chlorides

Today, chlorides are found in almost all soaps, detergents, bleaches and cleansers. Chlorides are not friendly to the stainless steel surface. They should not come in contact with the surface of the sink for extended periods. When these chemicals are used in your sink, it should be thoroughly rinsed. This is especially noticed when clothes are soaked in a diluted bleach mixture. This mixture can attack the sink at the water line and cause rusting and pitting.

Knives

Your sink is designed to serve as many things but not as a cutting board or chopping block. This type of use will lead to deep scratches in the sink finish and will dull your knives. Elkay does offer various cutting boards to fit over the compartment of your sink that will give you additional work area.

Spotting

The quality of your water can affect your sink's appearance. In areas with hard water, a brown surface stain can form on the sink giving the appearance of rust. This phenomena also occurs in water with high iron content. Additionally, in areas with a high concentration of minerals, or with over-softened water, a white film may develop on the sink. To combat this problem, we suggest that the sink be towel dried after use.

Foods

Heavy salt concentration or foods containing high levels of salt should not be allowed to dry onto the sink surface. Rinse your sink thoroughly after use.

What To Do If You Have A Problem

Elkay Manufacturing Company is proud of the quality of its stainless steel sinks.

If you feel you have a defective sink, please contact your plumber for the name of your local Elkay factory representative, or contact the Consumer Service Department of Elkay Manufacturing Company. Please provide your sink model number, the date of installation, and description of the problem.

For a full warranty explanation, and limitations, please consult your warranty sheet.

Accessories

Elkay colanders, drain trays and vinyl covered rinsing baskets are not designed as "Dishwasher Safe". These products should be hand washed in mild detergent, rinsed thoroughly and hand dried. Wood cutting boards should never be soaked in water. Rinse after use and then dry. This should be all the care required.

CUIDADO Y LIMPIEZA DE SU FREGADERO

Lo felicitamos por haber comprado un fregadero Elkay, fabricado con el acero inoxidable de más alta calidad, con un alto contenido de niquel. Con el cuidado debido, puede durarle toda la vida.

Los fregaderos Elkay están diseñados para satisfacer las necesidades de las cocinas modernas, y fabricados trás de una serie de sofisticados procesos, que le darán ese terminado satinado que requiere cuidados mínimos.

LO QUE DEBE USTED SABER Á CERCA DE LOS FREGADEROS ELKAY

Cada fregadero Elkay está fabricado con el acero inoxidable de más alta calidad. Su terminado satinado armoniza con cualquier estilo y decoración de cocina, sin que pase de moda, siempre elegante, al igual que la plata fina, embellece con los años.

EL TERMINADO SATINADO DE LOS PRODUCTOS ELKAY

El terminado satinado con reflejos es exclusivo de Elkay y se logra gracias a un sofisticado proceso que incluye pulidos a mano para darle ese acabado brillante y satinado tan sencillo de mantener, pero recuerde que los fregaderos Elkay no son auto limpiantes y requieren un mínimo de cuidado para conservar su brillo.

RAZONES POR LAS QUE USTED DEBE LIMPIAR SU FREGADERO

Aunque los fregaderos de acero inoxidable Elkay han sido fabricados con el material de más alta calidad, requieren, como cualquier producto de primera, de cierto mantenimiento para conservar su brillo.

INSTRUCCIONES FÁCILES PARA SU LIMPIEZA

Enjuagarlos es la parte más importante del cuidado de su fregadero. Si usted lo hace después de usarlo, siempre brillará como nuevo. Enjuague con agua corriente, con la manguera auxiliar o con cualquier recipiente, séquelo con trapo o toalla de cocina. Una vez a la semana se recomienda tallarlo con algún polvo limpiador como ajax, siguiendo la dirección en la que fué pulido. Esto no se hace para quitar manchas o acumulación de grasa si no para desvanecer cualquier rallón que se le haya hecho al fregadero. Después de tallar, enjuague y seque fuertemente. Su fregadero brillará como nuevo!

RALLONES

Como todos los productos de metal, su fregadero puede rallarse con utencilios de cocina, es por eso que se recomienda esta limpieza periódica con polvo limpiador.

PROTECTORES DE HULE

La resistencia de nuestros productos de acero inoxidable, hace innecesario el uso de protectores de hule. Sin embargo, si usted prefiere usarlos, es conveniente que los quite una vez que termine de usar su fregadero, el dejarlos puede causar decoloración en su fregadero.

DECOLORACIÓN, SARRO Y PICADURAS

Esponjas mojadas, trapos húmedos, estropajos, protectores de hule pueden decolorarlo. Fibras metálicas no deberán nunca usarse para limpiarlos, pues dejan partículas pequeñas de metal que se oxidan y pueden a su vez oxidar el fregadero.

JABON LIQUIDO

No deje nunca que los jabones líquidos o de trastes se queden en su fregadero, pues contienen abrasivos y químicos que dañarán su brillo.

CLORO

Casi todos los jabones, detergentes y polvos limpiadores contienen cloro, químico que no se recomienda para limpiar acero inoxidable, por ésta razón insistimos que después de usar cualquier producto de limpieza, enjuague perfectamente su fregadero y enseguida lo seque. Recuerde, no dejar nunca trapos mojados o esponjas con jabón en su fregadero porque puede causar manchas y oxidarlo.

CUCHILLOS

Su fregadero tiene muchos usos, pero no lo utilize como tabla de partir. Los cuchillos pueden hacer rallas profundas en el acero inoxidable, además de que éstos pierden su filo. Elkay le ofrece tablas de cortar que se adaptan perfectamente al compartimiento y le permiten contar con un area más amplia de trabajo en su cocina.

MANCHAS

La calidad del agua puede afectar la apariencia de su fregadero. En lugares con agua dura pueden formarse manchas con aparienca de óxido en el acero inoxidable. Éste fenómeno ocurre también en lugares con agua que tiene un alto contenido en minerales y en fierro, o un agua demasiado blanda. Para combatir ésto le recomendamos secar su fregadero después de usarlo.

COMIDA

No deje por tiempo prolongado en su fregadero comida con alto contenido de sal. Recuerde siempre enjuagarlo después.

QUE HACER ANTE CUALQUIER PROBLEMA

Elkay es una compañía que está orgullosa de la calidad de sus productos.

Si usted piensa que su fregadero tiene algún defecto, póngase en contacto con el representante de Elkay más cercano o diréctamente con el departamento de servicio al cliente, proporciónele el número de modelo de su fregadero y una descripción del problema. Consulte su certificado de garantía que contiene una completa explicación de sus derechos y limitaciones.

ACCESORIOS

Elkay le ofrece coladeras metálicas con cubierta de vinilo, que se adaptan perfectamente al tamaño del compartimiento, éstas no deben lavarse en el lava-trastes, sino a mano con jabon suave, enjuagando y secando después.

CERTIFICADO DE GARANTÍA LIMITADA DE POR VIDA DE FREGADEROS ELKAY

Elkay garantiza al comprador inicial de fregaderos de acero inoxidable Elkay que reemplazará sin cargo todo producto que falle debido a defectos de fabricación durante todo el período normal de uso residencial. El reemplazo del producto no incluye el costo del transporte o de la mano de obra para la instalación. Esta garantía cubre únicamente el fregadero de acero inoxidable y las piezas necesarias para el montaje cuando se instalen fregaderos con borde autoadherente embutidos en sobremuebles comunes o se instale un fregadero de montaje por debajo en un sobremueble con superficie sólida común, únicamente en usos residenciales. Elkay se reserva el derecho de examinar el producto y su instalación antes de efectuar el reemplazo.

NO SE GARANTIZAN LOS ACCESORIOS Y CONEXIONES PARA EL DESAGÜE

OTRAS CONDICIONES EN LA GARANTÍA DE FREGADEROS Y LLAVES MEZCLADORAS

Nuestra garantía no cubre las fallas o daños causados por maltrato o uso indebido, factores ambientales, cuidado o limpieza inadecuados o los daños causados por instalaciones incorrectas o defectuosas. Esta garantía se extiende sólo al comprador inicial del producto. La garantía no cubre los costos de envío de mano de obra y ningún otro costo ocasionado la instalación o reemplazo del fregadero, el diagnóstico o reemplazo de llaves mezcladoras o piezas y ningún otro gasto o pérdida.

Todos los daños incidentales o consecuentes están específicamente excluidos. No se extiende ninguna otra garantía adicional expresa o implícita. Toda garantía implícita e inclusive toda garantía de comerciabilidad o adecuación a un uso en particular, se limita a la duración de esta garantía escrita.

Algunos estados no permiten la exclusión o limitación de los daños consecuentes o incidentales así como tampoco la limitación en la duración de la garantía implícita, quedando invalidada por lo tanto en dichos casos la limitación precedente.

Esta garantía le otorga derechos legales específicos y usted puede tener además otros derechos que dependen del estado en donde resida.

CÓMO HACER EFECTIVA LA GARANTÍA

1. Escriba a: Elkay Manufacturing Company
   Atención: Consumer Services
   2222 Camden Court
   Oak Brook, IL 60523
   USA

2. Incluya una carta con la siguiente información:
   Fecha de compra y de instalación
   Descripción del defecto
   Número o descripción del modelo y/o, de ser posible, de la piezas que lo componen

ELKAY MANUFACTURING COMPANY
2222 CAMDEN COURT
OAK BROOK, ILLINOIS 60523
(630) 574-8484

IMPRESO EN LOS EE.UU.
F-2734
NO. DE PIEZA 74180147-C

ELKAY®

LIMITED LIFETIME SINK WARRANTY

Elkay warrants to the original purchaser of an Elkay stainless steel sink, that Elkay will, at its option, replace, without charge, such product if it fails due to a manufacturing defect for a lifetime of normal residential use. Product replacement does not include transportation cost or labor installation cost. This warranty covers only the stainless steel sink and mounting hardware when a self-rimming drop-in sink is installed in a conventional countertop surface or an undermount sink is installed in a conventional solid surface countertop in residential applications only. Elkay reserves the right to examine product in question and its installation prior to replacement.

WASTE FITTINGS AND ACCESSORIES ARE NOT WARRANTED

OTHER WARRANTY CONDITIONS ON SINKS AND FAUCETS

Our warranty does not cover product failure or damage caused by abusive treatment, misuse, environmental factors, improper care and cleaning, or damage due to handling or faulty installations. This warranty is extended only to the original consumer purchaser of the product. This warranty does not cover shipping costs, labor costs, or any other charges for such items as installation or replacement of the sink, diagnosis or replacement of any faucet or component part, or any other expense or loss.

All incidental or consequential damages are specifically excluded. No additional warranties, express or implied are given. Any implied warranty, including one of merchantability or fitness for a particular purpose, is limited to the duration of this written warranty.

Some states do not allow the exclusion or limitation of incidental or consequential damages or limitations on how long an implied warranty lasts, so the above limitations or exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

TO OBTAIN SERVICE UNDER WARRANTY

1. Write to: Elkay Manufacturing Company
   Attention: Consumer Services
   2222 Camden Court
   Oak Brook, IL 60523

2. Include a letter containing the following information:
   a. Date of purchase and installation
   b. Description of nature of defect
   c. Model number or description of model and/or component part if possible.

ELKAY MANUFACTURING COMPANY
2222 CAMDEN COURT
OAK BROOK, ILLINOIS 60523
(630) 574-8484

PRINTED IN U.S.A.
F-2734
PART NO. 74180147-C

Installation should be in accordance with local plumbing codes. Flush all pipes thoroughly before installation.

La instalación se debe hacer solo de acuerdo con los códigos de plomería locales. Nivele bien todas las tuberías antes de instalar.

L'installation doit se faire conformément aux codes de plomberie locaux. Videz tous les tuyaux entièrement avant de commencer l'installation.

Limited Warranty

The CHICAGO FAUCET COMPANY ("Chicago Faucets") extends to the original consumer the following warranties for Genuine Chicago Faucets manufactured products and components, or other components under the Chicago Faucets Warranties, (collectively, the "Products") .

Lifetime Faucet Warranty The "Faucet", defined as any metal cast, forged, stamped of formed portion of the Product, not including electronic or moving parts or water restricting components, or other components covered under the Chicago Faucet warranties, is warranted against defects for the life of the product.

Five Year Cartridge Warranty The "Cartridge", defined as the metal portion of any Product typically referred to by the product numbers containing 1-099X, 1-100X, 217-X, 377-X, 274-X excluding any rubber or plastic components, is warranted against manufacturing defects for a period of five (5) years from the date of Product purchase.

One Year Finish Warranty The finish of the Product is warranted against manufacturing defects for a period of one (1) year from the date of Product purchase.

Garantía limitada

CHICAGO FAUCET COMPANY ("Chicago Faucets") extiende al consumidor original las siguientes garantías para los productos y los componentes fabricados de Genuine Chicago Faucets, o cualquier otro componente de las garantías de Chicago Faucets, (en conjunto, los "Productos").

Garantía de por vida del grifo El "Grifo", definido como cualquier porción formada de metal fundido, forjado, estampado del Producto, que no incluye piezas electrónicas o movibles, o componentes limitados por agua, u otro componente que se incluya en las garantías de Chicago Faucet , está garantizada por los defectos de la vida del producto.

Garantía del cartucho de cinco años El "Cartucho", definido como la porción de metal de cualquier Producto generalmente indicado por los números del producto con 1-099X, 1-100X, 217-X, 377-X, 274-X sin contar ningún componente de goma o de plástico, está garantizado por defectos de fabricación durante cinco (5) años a partir de la fecha de compra del Producto.

Garantía para el acabado de un año El acabado del Producto está garantizado por defectos de fabricación durante un (1) año a partir de la fecha de compra del Producto.

Garantie limitée

CHICAGO FAUCET COMPANY (Chicago Faucets) offre au consommateur initial les garanties suivantes pour les produits fabriqués par Genuine Chicago Faucets et leurs composants, ou les autres composants couverts par les garanties de Chicago Faucets (collectivement appelés les « produits »).

Garantie à vie du robinet: Le robinet, défini comme toute partie en métal moulé, forgée, estampée ou formée du produit, mais ne comprenant pas les pièces électroniques ou amovibles ni les composants servant à contenir l'eau, ni les autres composants couverts par les garanties de Chicago Faucet, est garanti contre les défauts pendant la durée de vie du produit.

Garantie de cinq ans de la cartouche : La cartouche est définie comme la portion métallique de tout produit auquel on fait habituellement référence par les numéros de produit contenant 1-099X, 1-100X, 217-X, 377-X, 274-X, à l'exception des composants en caoutchouc ou en plastique, et elle est garantie contre les défauts de fabrication pour une période de cinq (5) ans à compter de la date d'achat du produit.

GGarantie de un an sur le fini : Le fini du produit est garanti contre les défauts de fabrication pour une période de un (1) an à partir de la date d'achat du produit.

CHICAGO FAUCETS®

a Geberit company

Care & Maintenance

All Chicago Faucet fittings are designed and engineered to meet or exceed industry performance standards. Care should be taken cleaning this product. Do not use abrasive cleaners, chemicals or solvents as they can result in surface damage. Use mild soap with warm water for cleaning and protecting the life of Chicago Faucets fittings.

Cuidado y mantenimiento

Todos los accesorios de Chicago Faucet están diseñados para cumplir o superar las normas de rendimiento de la industria. Este producto se debe limpiar con cuidado. No utilice limpiadores abrasivos, productos químicos o solventes ya que pueden dañar la superficie. Para limpiar y proteger la vida útil de los accesorios Chicago Faucet, utilice jabón suave con agua tibia.

Entretien

Tous les accessoires Chicago Faucet sont conçus et élaborés pour respecter et dépasser les normes de rendement de l'industrie. Ce produit doit être nettoyé soigneusement. N'utilisez pas de produits nettoyants abrasifs, de produits chimiques ni de solvants, ils risqueraient d'endommager la surface. Utilisez un savon doux et de l'eau tiède pour nettoyer et assurer la durée de vie des accessoires Chicago Faucets.

* 4 9 5 8 6 *

The Chicago Faucet Company
2100 South Clearwater Drive
Des Plaines, IL 60018
Phone: 847/803-5000
Fax: 847/803-5454
Technical: 800/832-8783
www.chicagofaucets.com

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Installation Instructions for

WIDESPREAD FITTINGS

Models: 200, 404, 794, all "HZ" models, all "PO" models

Instrucciones para la instalación de

ACCESORIOS DE LAVABO

Los modelos: 200, 404, 794, todos los modelos de "HZ", todos los modelos de "PO"

Instructions pour l'installation des

ACCESSOIRES DU ROBINET À GRAND ÉCARTEMENT

Modèles : 200, 404, 794, tous les modèles d' « Hz », tout le « PO » modèle



SK-1 SINK PER ADDENDUM #2-1

Widespread Faucet Installation Instructions —

These installation instructions apply to all products with the following fitting base numbers: 200, 404, 794, all “HZ” models, all “PO” models

Instrucciones de instalación del grifo del lavamanos —

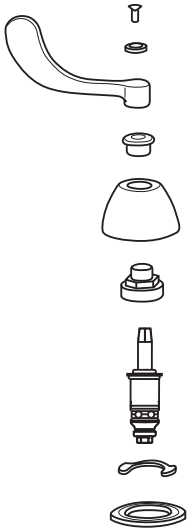
Estas instrucciones de instalación se aplican a todo los productos con los siguientes números base de accesorios: 200, 404, 794, todos los modelos “HZ”, todos los modelos “PO”

Instructions pour l'installation du robinet à grand écartement —

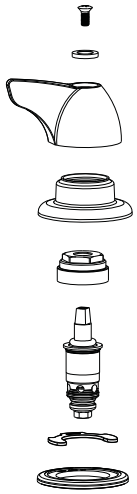
Ces instructions pour l’installation s’appliquent à tous les produits dont les accessoires ont les numéros de base suivants : 200, 404, 794, tous les modèles « HZ », tous les modèles “PO”

Exploded Views: / Vista despiezada / Vues éclatées

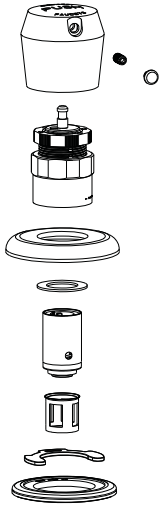
Tall Stem Cartridge /
Cartucho de barra alta /
Cartouche avec tige longue



Short Stem Cartridge /
Cartucho de barra corta /
Cartouche avec tige courte

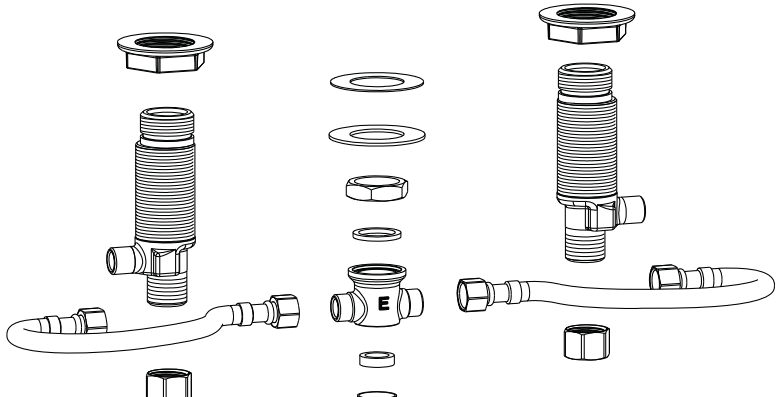


Metering /
Medición /
Avec cartouche de dosage



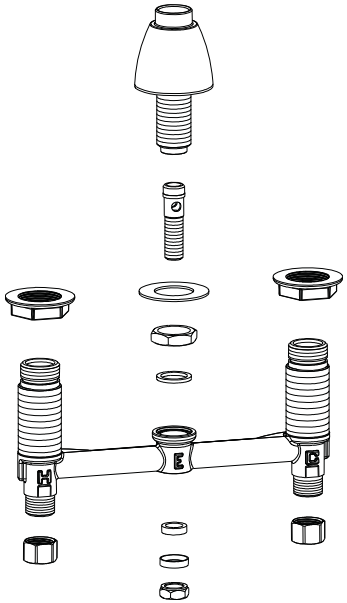
“HZ” Models with Flexible Supply Hoses /

Cuerpo completamente ajustable con mangueras de suministro flexibles /
Corps entièrement ajustable avec tuyaux d’alimentation flexibles

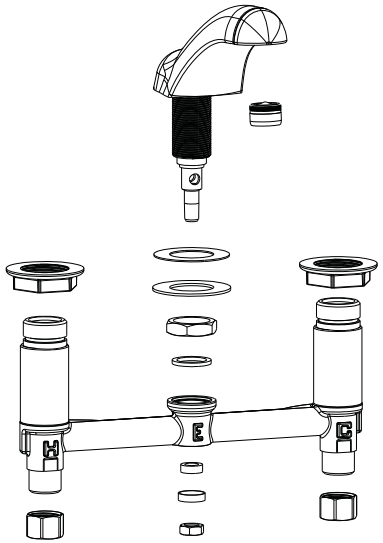


Other Configurations: / Otras Configuraciones: / Autres Configurations :

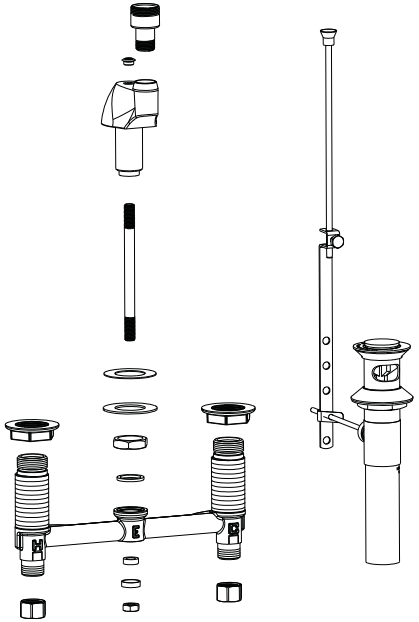
200 Series /
Serie 200 / Série 200



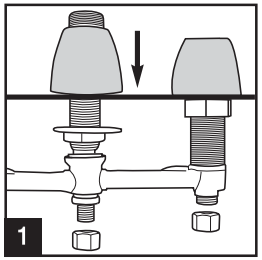
404 Series /
Serie 404 / Série 404



404 or 794 Series - “PO” Models /
Serie 404 o 794 – PO Modela /
Série 404 o 794 – «PO» Modèle



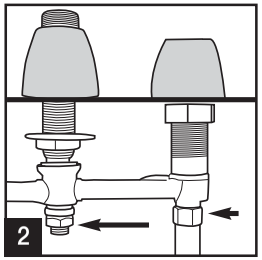
One-Piece Body Installation / Instalación de cuerpo de una pieza / Installation du corps monopièce



Drop in spout body.

Deje caer en el cuerpo de la boquilla.

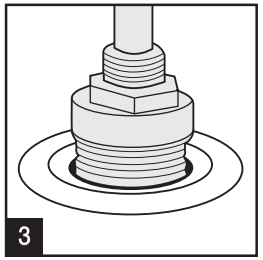
Posez le corps du bec.



Tighten water connection.

Apriete la conexión de agua.

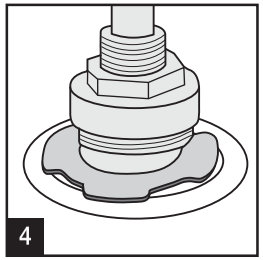
Serrez les raccordements des conduites d’eau.



Place a sealing washer over each handle stem. Be sure to have recessed rim of washer facing up. See Illustration A.

Coloque una arandela madre overeach manejar. Asegúrese de tener el borde empotrado de la lavadora hacia arriba. Vea ilustración A.

Placez une tige rondelle d'étanchéité gérer overeach. Soyez sûr d'avoir la jante en retrait de le rondelle vers le

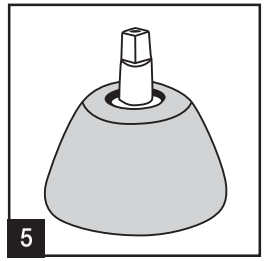


Insert retaining clips firmly into channel on each valve body. Remove hanger from spout hole.



Coloque firmemente las abrazaderas en la canaleta del cuerpo de cada válvula. Retire el colgador del orificio de la boquilla.

Insérez les attaches de retenue fermement dans la rainure du corps de chaque robinet. Retirez le support du trou du bec.

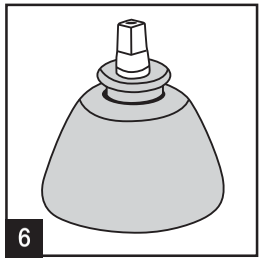


Place handle escutcheons over handle stems. Handles should cover the sealing washers.



Coloque las manijas de los escudos de la bocallaves sobre las barras de la manija. Las manijas deben cubrir las arandelas de sellado.

Placez les écussons de la poignée sur les tiges de la poignée. Les poignées devraient couvrir les rondelles

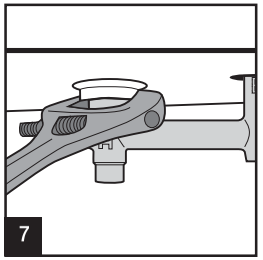


Place a hold–down nut onto each handle stem and hand tighten.



Coloque una tuerca de fijación en cada barra de la manija y apriete manualmente.

Posez un écrou de retenue sur la tige de chaque poignée et serrez à la main.

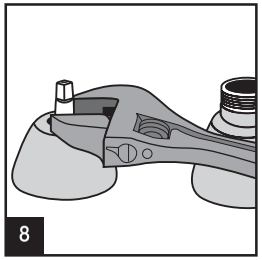


Using adjustable wrench, tighten underbody nuts.



Utilice una llave inglesa ajustable para apretar las tuercas en la parte inferior.

À l’aide d’une clé à molette, serrez les écrous de dessous.

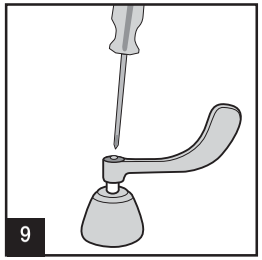


Using adjustable wrench, tighten handle hold–down nuts.

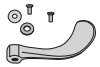


Utilice una llave inglesa ajustable para apretar las tuercas de fijación.

À l'aide d'une clé à molette, serrez les écrous de retenue de la poignée.



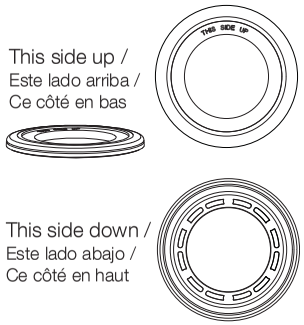
Align both handles on stem as desired. Insert index buttons, screws, and tighten.



Alinee ambas manijas en la barra, según lo desee. Coloque los botones indicadores, los tornillos, y apriételos.

Alignez les deux poignées sur la tige comme vous le souhaitez. Insérez les capuchons indicateurs, les vis, puis serrez.

Illustration A / ilustración A / l'Illustration A

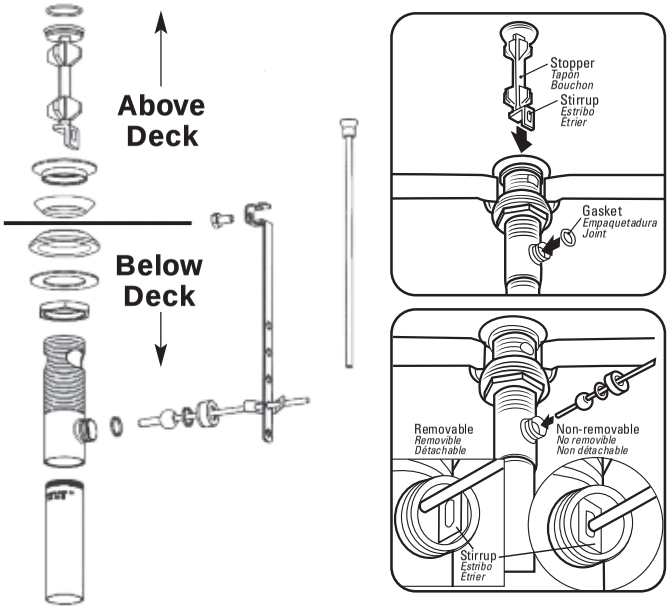


Sealing washer must be placed on mounting suface as indicated. /

La arandela de sellado debe ser colocada en el suface creciente como indicado. /

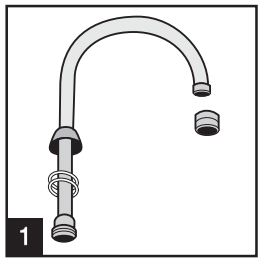
Sceller la rondelle doit être placée sur monter de suface comme indiqué.

Waste Fitting / Montaje Para Desechos / Tuyau d'évacuation



Spout Installation / Instalación de la boquilla / Installation du bec

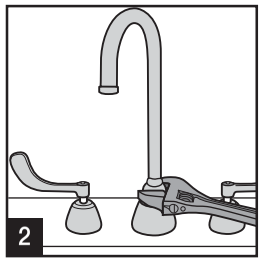
Swing Spout / Boquilla giratoria / Bec pivotant



Remove outlet from spout. Place two split rings on spout near the base. Slide spout nut onto spout.

Retire la salida de la boquilla. Coloque dos anillos divididos en la boquilla cercana a la base. Deslice la tuerca de la boquilla hasta la boquilla.

Retirez l'embout de sortie du bec. Posez deux bagues fendues sur le bec près de la base. Glissez l'écrou du bec sur le bec.

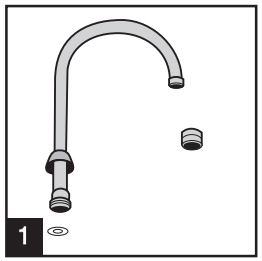


Place spout onto valve body until fully seated. Tighten spout nut with wrench. Connect water supplies, flush line, and attach outlet.

Coloque la boquilla sobre el cuerpo de la válvula hasta que esté completamente en su lugar. Apriete la tuerca de la boquilla con la llave inglesa. Conecte la tubería de suministro y descarga, y coloque la salida.

Posez le bec sur le corps du robinet jusqu'à ce qu'il soit bien en place. Serrez l'écrou du bec à l'aide d'une clé. Raccordez les conduites d'alimentation en eau, rincez la conduite, puis remettez en place l'embout de sortie.

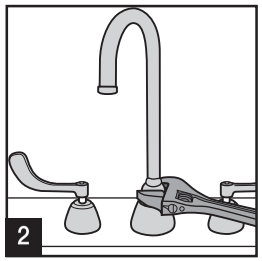
Rigid Spout / Boquilla rígida / Bec fixe



Remove outlet from spout. Slide spout nut onto spout. Place solid white washer into base outlet.

Retire la salida de la boquilla. Deslice la tuerca de la boquilla hasta la boquilla. Coloque la arandela sólida blanca sobre la salida base.

Retirez l'embout de sortie du bec. Posez deux bagues fendues sur la base près du tuyau du bec. Glissez l'écrou du bec sur le bec.

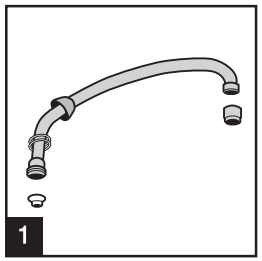


Place spout onto valve body until fully seated. Tighten spout nut with wrench. Connect water supplies, flush line, and attach outlet.

Coloque la boquilla sobre el cuerpo de la válvula hasta que esté completamente en su lugar. Apriete la tuerca de la boquilla con la llave inglesa. Conecte la tubería de suministro y descarga, y coloque la salida.

Posez le bec sur le corps du robinet jusqu'à ce qu'il soit bien en place. Serrez l'écrou du bec à l'aide d'une clé. Raccordez les conduites d'alimentation en eau, rincez la conduite, puis remettez en place l'embout de sortie.

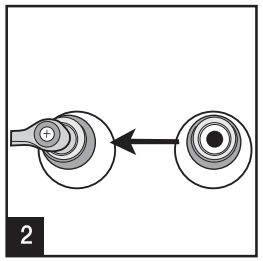
Restricted Swing Spout / Boquilla giratoria con límite / Bec à pivot restreint



Remove outlet from spout. Place two split rings on spout tubing near base. Slide spout nut onto spout.

Retire la salida de la boquilla. Coloque dos anillos divididos en las tuberías de la boquilla cercana a la base. Deslice la tuerca de la boquilla hasta la boquilla.

Retirez l'embout de sortie du bec. Posez deux bagues fendues sur la base près du tuyau du bec. Glissez l'écrou du bec sur le bec.

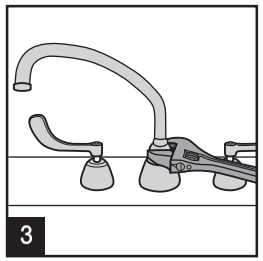


Place restricted swing adaptor into valve body and align with internal valve body tab. Position small opening (70º) or large opening (120º) toward "hot" side of body.



Coloque el adaptador giratorio con límites en el cuerpo de la válvula y alinee con la ranura del cuerpo de la válvula interna. Coloque la pequeña abertura (70º) o la abertura grande (120º) contra el lado "caliente" del cuerpo.

Posez l'adaptateur à pivot restreint sur le corps du robinet et alignez-le sur la languette du corps du robinet interne. Placez la petite ouverture (70 °) ou la grande ouverture (120 °) en direction du côté « eau chaude » du corps.

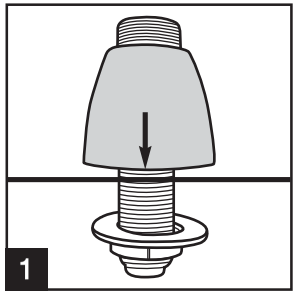


Place spout into stem. Tighten spout nut with wrench. Connect water supplies, flush line, and attach outlet.

Coloque la boquilla en la barra. Apriete la tuerca de la boquilla con la llave inglesa. Conecte la tubería de suministro y descarga, y coloque la salida.

Posez le bec sur la tige. Serrez l'écrou du bec à l'aide d'une clé. Raccordez les conduites d'alimentation en eau, rincez la conduite, puis remettez en place l'embout de sortie.

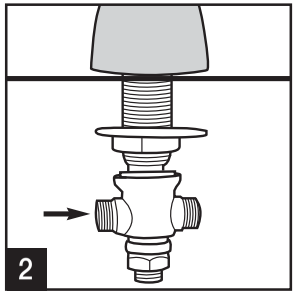
Fully Adjustable Body Installation / Instalación del cuerpo completamente ajustable / Installation du corps entièrement réglable



Drop in spout body.

Deje caer en el cuerpo de la boquilla.

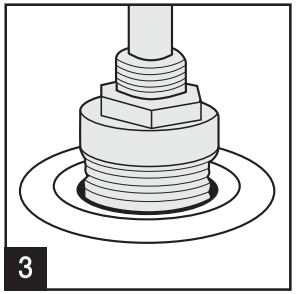
Posez le corps du bec.



Tighten water connection.

Apriete la conexión de agua.

Serrez les raccordements des conduites d'eau.

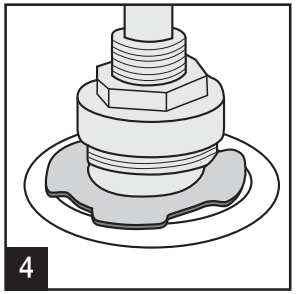


Place a sealing washer over each handle stem. Be sure to have recessed rim of washer facing up. See Illustration A.



Coloque una arandela de sellado sobre cada barra de la manija. Asegúrese de que el reborde de la arandela empotrado se encuentre hacia arriba. Vea ilustración A.

Posez une rondelle d'étanchéité sur la tige de chaque poignée. Assurez-vous que le bord renfoncé de la rondelle est face vers le haut. Voir A d'illustration.

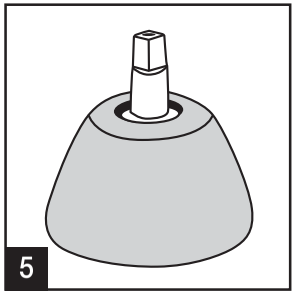


Insert retaining clips firmly into channel on each valve body. Remove hanger from spout hole.



Coloque firmemente las abrazaderas en la canaleta del cuerpo de cada válvula. Retire el colgador del orificio de la boquilla.

Insérez les attaches de retenue fermement dans la rainure du corps de chaque robinet. Retirez le support du trou du bec.

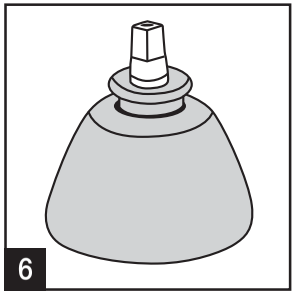


Place handle escutcheons over handle stems. Handles should cover the sealing washers.



Coloque las manijas de los escudos de la bocallaves sobre las barras de la manija. Las manijas deben cubrir las arandelas de sellado.

Placez les écussons de la poignée sur les tiges de la poignée. Les poignées devraient couvrir les rondelles d'étanchéité.

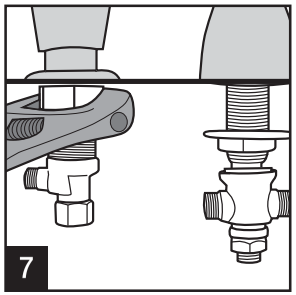


Place a hold–down nut onto each handle stem and hand tighten.



Coloque una tuerca de fijación en cada barra de la manija y apriete manualmente.

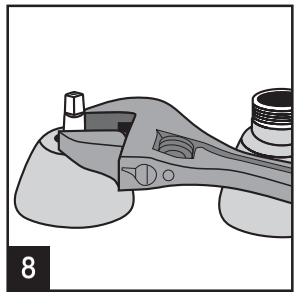
Posez un écrou de retenue sur la tige de chaque poignée et serrez à la main.



Using adjustable wrench, tighten underbody nuts.

Utilice una llave inglesa ajustable para apretar las tuercas en la parte inferior.

À l'aide d'une clé à molette, serrez les écrous de dessous.

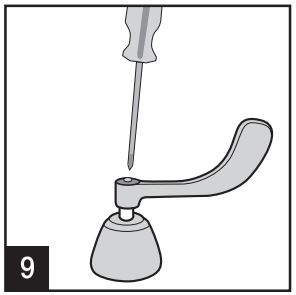


Using adjustable wrench, tighten handle hold–down nuts.



Utilice una llave inglesa ajustable para apretar las tuercas de fijación.

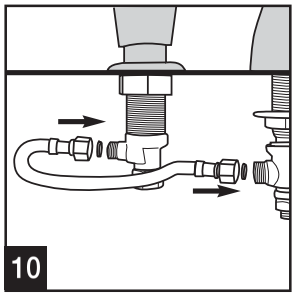
À l'aide d'une clé à molette, serrez les écrous de retenue de la poignée.



Align both handles on stem as desired. Insert index buttons, screws, and tighten.

Alinee ambas manijas en la barra, según lo desee. Coloque los botones indicadores, los tornillos, y apriételos.

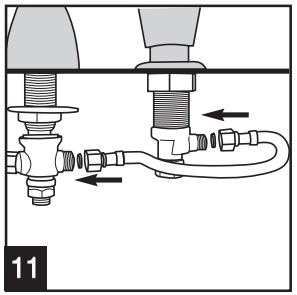
Alignez les deux poignées sur la tige comme vous le souhaitez. Insérez les capuchons indicateurs, les vis, puis serrez.



Connect left supply line to left handle and left side of water connector.

Conecte la tubería de suministro izquierda a la manija izquierda y al lado izquierdo del conector de agua.

Raccordez la conduite d'alimentation de gauche à la poignée gauche et au raccord d'alimentation en eau de gauche.



Connect right supply line to right handle and right side of water connector.

Conecte la tubería de suministro derecha a la manija derecha y al lado derecho del conector de agua.

Raccordez la conduite d'alimentation de droite à la poignée droite et au raccord d'alimentation en eau de droite.

Timing Adjustment on an MVP Metering Cartridge

Ajuste de temporización en un cartucho de medición MVP /
Réglage de la durée de distribution d'une cartouche de dosage MVP

1 **With cartridge and handle installed in body and water supply turned on, purge cartridge of air by pushing handle completely down 4-8 times repeatedly, then check timing cycle.**

Después de haber instalado el cartucho y la manija en el cuerpo y de haber encendido el suministro de agua, presione la manija por completo hacia abajo 4 a 8 veces seguidas para purgar el cartucho de aire. Luego, verifique el tiempo.

Pendant que la cartouche et la poignée sont installées sur le corps et que l'alimentation en eau est activée, évacuez l'air de la cartouche en poussant la poignée en bas complètement de quatre à huit fois, à répétition, puis vérifiez le cycle de distribution.

2 **To change cycle time, remove index button, then handle using a 3/32 hex wrench. (Figure 'A')**

Para cambiar el tiempo de ciclo, retire el botón indicador y luego la manija con una llave Allen de 3/32. (Figura 'A')

Pour modifier le cycle de distribution, retirez le capuchon indicateur, puis la poignée à l'aide d'une clé hexagonale de 3/32 po. (Figure A)

3 **Using your fingers change height of adjustment nut by 1/4 turn only. Turn adjustment nut clockwise to increase cycle time or counter-clockwise to decrease cycle time. (Figure 'B')**

Con los dedos, cambie la altura de la tuerca de ajuste con un solo giro de 1/4. Gire la tuerca de ajuste en dirección de las manecillas del reloj para aumentar el tiempo, o gírela en dirección contraria para disminuirlo. (Figura 'B')

Utilisez vos doigts pour modifier la hauteur de l'écrou de réglage en le tournant de un quart de tour seulement. Tournez l'écrou de réglage dans le sens des aiguilles d'une montre pour augmenter la durée du cycle ou dans le sens contraire des aiguilles d'une montre pour en diminuer la durée. (Figure B)

4 **Reinstall handle and verify desired cycle time. NOTE: TIMING MUST BE CHECKED WITH HANDLE IN PLACE.**

Vuelva a colocar la manija y verifique que el tiempo sea el deseado. NOTA: EL TIEMPO SE DEBE REVISAR CON LA MANIJA EN SU LUGAR.

Réinstallez la poignée et vérifiez si la durée du cycle est celle que vous souhaitez. REMARQUE : LA DURÉE DOIT ÊTRE VÉRIFIÉE ALORS QUE LA POIGNÉE EST EN PLACE.

5 **If additional adjustment is necessary, repeat steps 3 and 4 until desired cycle time is achieved.**

Si necesita de un ajuste adicional, repita los pasos 3 y 4 hasta obtener el tiempo deseado.

Si un réglage supplémentaire est nécessaire, répétez les étapes 3 et 4 jusqu'à ce que vous ayez la durée de cycle souhaitée.

6 **Attach handle and tighten screw. If index button is included, snap into handle.**

Instale el mango en el vástago del actuante, luego apriete firmemente el tornillo de ajuste con el mango en la posición inferior. Oprima el botón o tapa de presión hasta que se ajuste en su sitio.

Insérer la manette sur la tige de l'actionneur et serrer la vis de réglage en positionnant la manette vers le bas. Appuyer sur la coiffe indicatrice de la manette jusqu'à ce qu'elle soit assise.

Note: Some new installations might produce a slight closing noise. This is normally the result of air trapped in the cartridge and noise will dissipate over time.

Nota: Algunas instalaciones nuevas podrían generar un leve ruido al cerrar. Generalmente, se produce debido al aire atrapado en el cartucho. El ruido desaparecerá con el tiempo.

Remarque : Certaines nouvelles installations pourraient produire un léger bruit de fermeture. Cela est normalement dû au fait que de l'air est emprisonné

FIGURE 'A' / ILUSTRACIÓN 'A' / FIGURE « A »

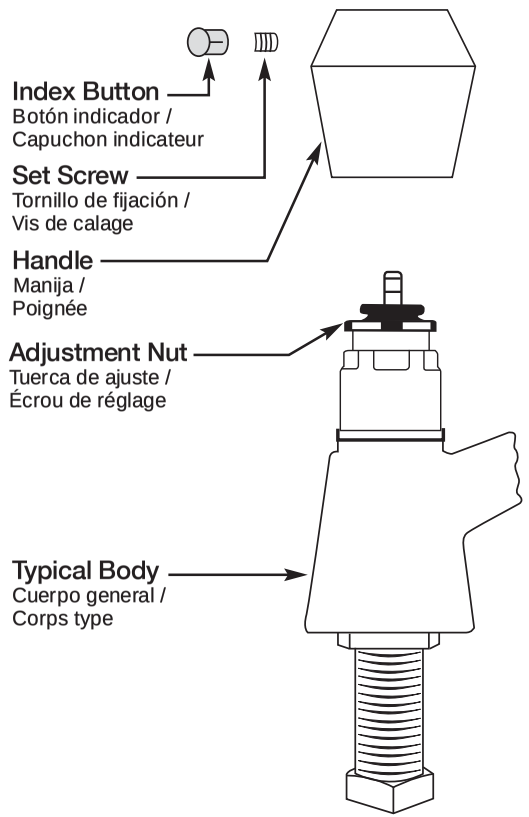
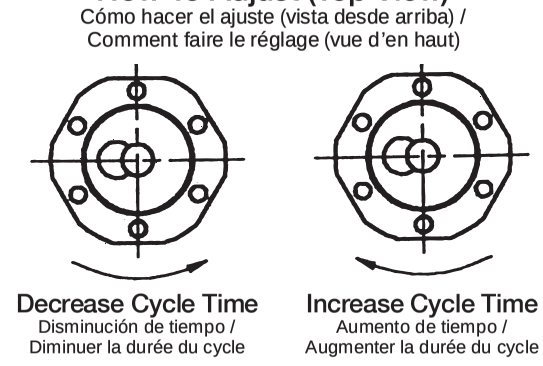


FIGURE 'B' / ILUSTRACIÓN 'B' / FIGURE « B »



MVP Metering Cartridges */ Cartuchos de medición MVP / Cartouches de dosage MVP*

1. If filter and lower valve cartridge have been removed from fitting, replace them by inserting filter first.
Si se retiró el filtro y el cartucho de la válvula inferior del accesorio, para colocarlo nuevamente, ingrese primero el filtro.
Si le filtre et la cartouche du robinet inférieur ont été retirés du raccord, replacez-les en commençant par le filtre.

2. If gasket has been removed from the actuator assembly, replace it by inserting into bottom of actuator assembly.
Si se retiró la empaquetadura del ensamble del activador, reemplácela e ingrésela en la parte inferior del ensamble del activador.
Si le joint a été retiré de l'ensemble de l'actionneur, replacez-le en l'insérant au bas de l'ensemble de l' actionneur.

3. Assemble actuator assembly to body and tighten to 12-15 FT. LBS. torque.
Arme el ensamble del activador al cuerpo y apriete a 1,81-2,26 Kgf M.
Assemblez l'ensemble de l'actionneur au corps et serrez jusqu'à ce que le couple soit de 12 à 15 LB-PI.

4. Assemble handle and check timing, adjust if necessary.
Arme la manija y verifique el tiempo, ajuste de ser necesario.
Assemblez la poignée et vérifiez la durée de distribution, réglezla au besoin.

5. Tighten set screw with a 3/32 allen wrench.
Apriete el tornillo de fijación con una llave Allen de 3/32.
errez la vis de calage à l'aide d'une clé hexagonale de 3/32 po.

6. Insert index button into handle.
Coloque el botón indicador en la manija.
Insérez le capuchon indicateur sur la poignée.

SK-2

SK-2 SINK PER ADDENDUM #2-1

ELRAD1517653	ELKAY	LRAD1517-6.5-3 18 GA 304 S.S. SINGLE BOWL SINK
C895317GN2AE29A BCP	CHICAGO	CCN LEAD LAW COMPLIANT 2 HANDLE WRISTBLADE HANDLE KITCHEN FAUCET CHROME 2.2

ELKAY STAINLESS STEEL SINKS
FREGADEROS DE ACERO INOXIDABLE ELKAY

MANUAL CON ILUSTRACTIONES PARA INSTALAR SU FREGADERO DE ACERO INOXIDABLE

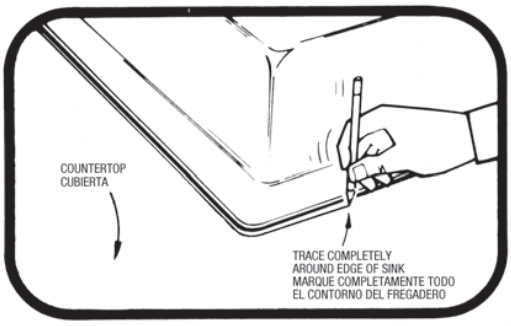
STEP ONE

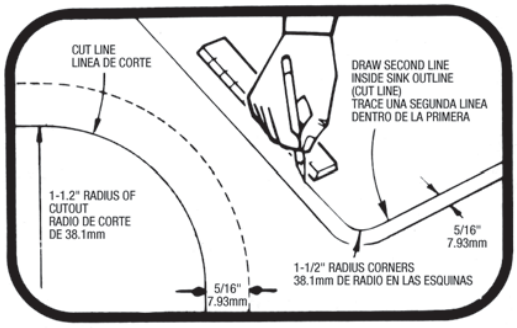
If counter top must be cut out, locate sink cutout by turning sink upside down and position so bowl compartments are located directly over sink cabinet. Position sink, front to rear, so that sink rim will fit flat on top surface and that sink compartments will fit into cabinet without interfering with cabinet.

PASO UNO

Si la cubierta no tiene el corte hecho, coloque el fregadero boca abajo sobre la cubierta, para proceder a trazar la linea de corte. Asegúrese que el fregadero quede de atras para adelante, de forma que el borde de éste calce perfectamente y que los compartimientos no interfieran con el gabinete.

STEP TWO / PASO DOS





STEP THREE

Check your dimensions. Measure the cut line you have drawn on the counter top or check your pre cut opening to make sure it conforms to the following sample sizes.

Cutout is 5/8" shorter than overall size of sink.

SAMPLE CUTOUT SIZES

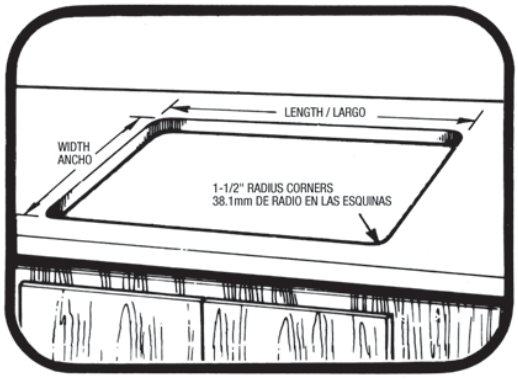
SINK SIZE	CUTOUT LENGTH	CUTOUT WIDTH
25×22	24⅜	21⅜
33×22	32⅜	21⅜
37×22	36⅜	21⅜
38×22	37⅜	21⅜
40×22	39⅜	21⅜
43×22	42⅜	21⅜
48×22	47⅜	21⅜
54×22	53⅜	21⅜

PASO TRES

Verifique las medidas. Asegúrese antes de empezar a cortar, que la linea de corte sea 15.9mm más pequeña que la medida de su fregadero.

EJEMPLOS DE LINEA DE CORTE

Medida de Fregadero	Longitud del Corte	Anchura del Corte
635mm× 558mm	619.1mm	542.9mm
838.2mm× 558mm	822.3mm	542.9mm
939.8× 558mm	923.9mm	542.9mm
965.2× 558mm	949.3mm	542.9mm
1016× 558mm	1000.1mm	542.9mm
1092.2× 558mm	1076.3mm	542.9mm
1219.2× 558mm	1203.3mm	542.9mm
1371.6× 558mm	1355.7mm	542.9mm

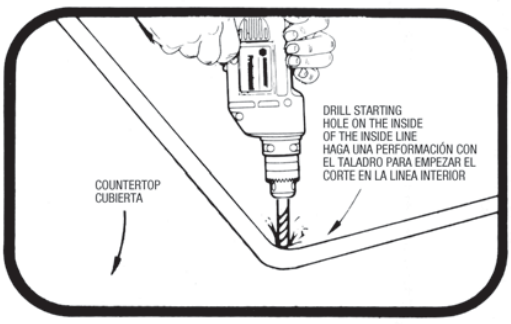


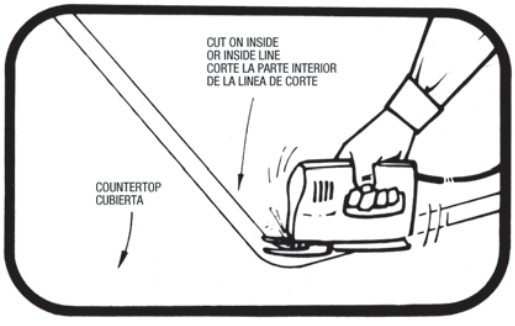
STEP FOUR

Cut hole in counter top.

PASO CUATRO

Haga una perforación con el taladro para empezar el corte en la linea interior. Con una sierra de mano corte a todo lo largo de la linea de corte.



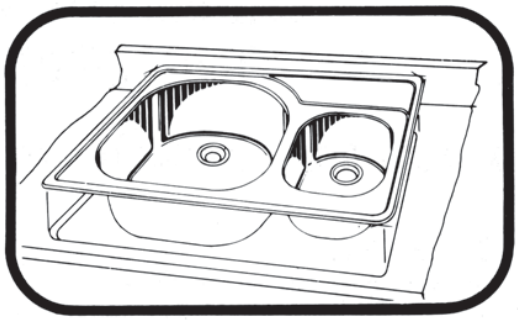


STEP FIVE

Check the countertop cutout opening to be sure it is sized properly. The easiest way to do this is to set the new sink into the opening to see if it fits. The sink rim must set uniformly on the countertop. If the sink does not fit, enlarge the cut-out opening with a sabre saw, or keyhole saw.

PASO CINCO

Verifique el tamaño de la apertura. La manera más sencilla de hacerlo es colocar el fregadero y ver si las dimensiones son las correctas. Si no, hacer los ajustes necesarios con lima o sierra.

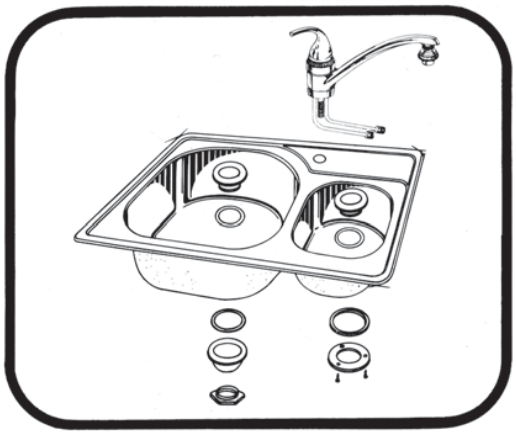


STEP SIX

Attach faucet, drain fittings and accessories according to the manufacturer's instructions.

PASO SEIS

Colocar la llave, tubería de desagüe y accesorios como lo indique el fabricante.



STEP SEVEN

Apply a bead of good quality caulk to the underside of sink flange and position sink into counter top opening.

PASO SIETE

Aplique una capa de empaque o silicón de buena calidad por debajo del marco del fregadero y colocar éste sobre la cubierta.

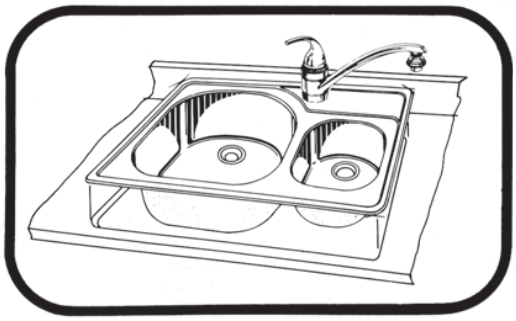
STEP EIGHT

Assemble and Insert Sink Fasteners

Note: Screws and clips contained in this sink package will secure this sink to a countertop not exceeding 7/8″ thickness. For thicker countertop applications, up to 1-1/2″ in thickness, order Model 364 14 pc - Long Screw Only Kit or Model 363 14 pc - Long Screw and Clip Kit.

Assemble the screws into the clamps as shown. (Note: Screws are designed to insert into the clamps with backward threading, so that in mounting, they will turn the normal direction.)

With your screwdriver, tighten the fasteners. Begin with the fasteners located in the middle of each side, tighten the remaining fasteners until the entire rim is sealed with no gaps. It may be necessary to slide a fastener to a different position to compensate for an uneven counter. (**Be careful not to over-tighten.** It is only necessary to draw the rim down snugly to the counter.)

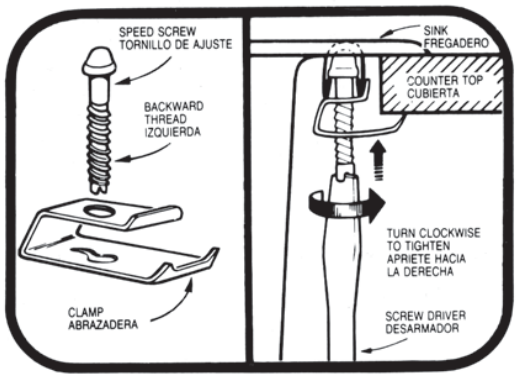


PASO OCHO

Coloque los tornillos de ajuste del fregadero, Nota: las abrazaderas y tornillos que vienen con el fregadero servirán para fijar éste a una cubierta de 22.2mm de espesor. Si la cubierta mide mas de 38.1mm de espesor ordene el modelo 364 de 14 piezas con tornillos largos solamente o el modelo 366 con tornillos largos y juego de abrazaderas.

Coloque las abrazaderas y tornillos como lo indica la ilustración. Los tornillos se colocan a las abrazaderas al revés para voltearlas al momento de instalarlas.

Con un desarmador del gado y largo apriete los tornillos, empezando con los que están en medio de cada lado, posteriormente apriete los demás hasta que no quede ningún espacio sin sellar. Es posible que tenga que mover algun tornillo de lugar para nivelar el fregadero. Tenga cuidado de no apretar demasiado. Solo es necesario unir el borde firmemente a la cubierta.



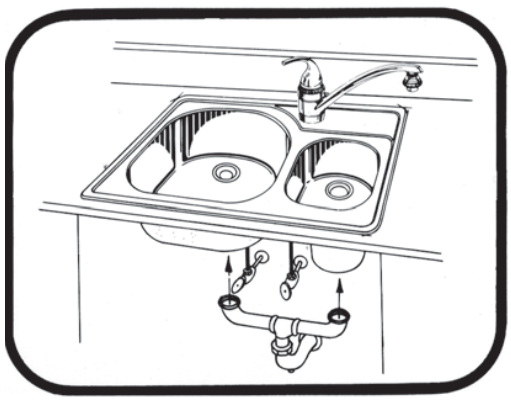
STEP NINE

Connect Faucet Supplies and Drain Fittings

Connect the faucet supply fittings and the drain trap fittings. Turn on the water supply. Check for possible leaks at these locations: (1) Supply riser tubes to faucet, and (2) Supply riser tubes to shut-off valves (or, lower connections). Next fill the sink bowl with water and check for possible leaks around the drain flange(s). (This would show up as dripping into the cabinet below.) Release water from sink and check for possible leaks at drain connections. Tighten any joints which leak.

PASO NEUVE

Conecte llaverías y tubería de desagüe. Conecte los tubos de desagüe y luego las llaves de paso, abra la llave general del agua. Verifíque que no haya fugas o goteras en los siguientes lugares: 1) En la llavería y las llaves de paso 2) En las conexiones. Llene el fregadero con agua, asegúrese que no gotée en el interior del mueble. Vacíe el fregadero y apriete las conexiones que gotéen.



USE AND CARE HINTS

Congratulations on purchasing your new ELKAY sink. Your sink is made from the best nickel bearing stainless steel and with proper care and maintenance will give you a lifetime of service.

Elkay sinks are designed for the demanding use of today's fast paced kitchen environment. The sink is finished through a series of sophisticated processes to develop its unique satin finish that requires minimal maintenance.

What You Should Know About Elkay's Stainless Steel Finish

An Elkay stainless steel sink is made of the finest nickel-bearing stainless steel available. Its mellow satin surface harmonizes with any color scheme...any decor. Timeless. Elegant. And, like fine silver, its beautiful finish develops an heirloom patina...actually becoming lovelier with use and age. Your Elkay sink is solid stainless steel. There is no coating which will wear off.

Elkay Satin Finish

Elkay's original highlighted satin finish is produced by an abrasive grinding operation which lends a uniform pattern of grain lines to the metal surface. All exposed areas then undergo a series of progressive machine and hand polishing operations. It is this careful polishing that makes an Elkay satin luster finish so beautiful...and so easy to clean and maintain! Please remember that a fine Elkay sink is not self cleaning. It will require a small amount of maintenance to retain its lustrous finish.

Reasons For Cleaning Your Stainless Steel Sink

Your stainless steel sink has been produced of the finest material to provide a quality product for many years of service. Like all quality products it does require some maintenance to assure that the finish will continue to look bright and sanitary.

Easy Cleaning Instructions

Rinsing is the most important part of sink care. An Elkay stainless steel sink finish will retain its original bright appearance if the sink is **rinsed** thoroughly after each use. "Thorough" rinsing can be done by running the water from the spray hose for a few minutes. Typically, a rinse and towel drying after each use takes care of most everyday clean ups. Ideally, once a week the sink should be scoured with a mildly abrasive cleanser, such as Comet. Rubbing back and forth in the direction of the polish or grain lines will not only remove stubborn stains and greasy film buildups, but will blend usage scratches into the satin finish of the sink. After scouring, rinse thoroughly and wipe dry. Your sink will shine like new!

Scratching

Like most metals, your new stainless steel sink will scratch. The feature benefit of the unique satin finish is the ease with which these scratches blend into the uniform finish of the sink. This is accomplished with a periodic scouring with a mildly abrasive kitchen cleanser, such as Comet.

Rubber Mats

The resiliency of stainless steel makes it unnecessary to use rubber mats to protect your sink, dishes and glassware. However, if you do use mats, please remove them after each use. If left in the sink, the water trapped underneath could cause discoloration.

Discoloration, Rust and Possible Pitting

Wet sponges, clothes, cleaning pads and rubber mats left on the sink can lead to discoloration. Steel wool pads should never be used to clean your sink as they leave small iron particles in the grain lines which rust and can damage the sink. Continued usage in this manner may eventually lead to the sink itself rusting and pitting.

Liquid Soap

Do not allow concentrated liquid detergent to dry on your sink. Most brands contain chemical additives which will affect the original high luster finish.

Chlorides

Today, chlorides are found in almost all soaps, detergents, bleaches and cleansers. Chlorides are not friendly to the stainless steel surface. They should not come in contact with the surface of the sink for extended periods. When these chemicals are used in your sink, it should be thoroughly rinsed. This is especially noticed when clothes are soaked in a diluted bleach mixture. This mixture can attack the sink at the water line and cause rusting and pitting.

Knives

Your sink is designed to serve as many things but not as a cutting board or chopping block. This type of use will lead to deep scratches in the sink finish and will dull your knives. Elkay does offer various cutting boards to fit over the compartment of your sink that will give you additional work area.

Spotting

The quality of your water can affect your sink's appearance. In areas with hard water, a brown surface stain can form on the sink giving the appearance of rust. This phenomena also occurs in water with high iron content. Additionally, in areas with a high concentration of minerals, or with over-softened water, a white film may develop on the sink. To combat this problem, we suggest that the sink be towel dried after use.

Foods

Heavy salt concentration or foods containing high levels of salt should not be allowed to dry onto the sink surface. Rinse your sink thoroughly after use.

What To Do If You Have A Problem

Elkay Manufacturing Company is proud of the quality of its stainless steel sinks.

If you feel you have a defective sink, please contact your plumber for the name of your local Elkay factory representative, or contact the Consumer Service Department of Elkay Manufacturing Company. Please provide your sink model number, the date of installation, and description of the problem.

For a full warranty explanation, and limitations, please consult your warranty sheet.

Accessories

Elkay colanders, drain trays and vinyl covered rinsing baskets are not designed as "Dishwasher Safe". These products should be hand washed in mild detergent, rinsed thoroughly and hand dried. Wood cutting boards should never be soaked in water. Rinse after use and then dry. This should be all the care required.

CUIDADO Y LIMPIEZA DE SU FREGADERO

Lo felicitamos por haber comprado un fregadero Elkay, fabricado con el acero inoxidable de más alta calidad, con un alto contenido de niquel. Con el cuidado debido, puede durarle toda la vida.

Los fregaderos Elkay están diseñados para satisfacer las necesidades de las cocinas modernas, y fabricados trás de una serie de sofisticados procesos, que le darán ese terminado satinado que requiere cuidados mínimos.

LO QUE DEBE USTED SABER Á CERCA DE LOS FREGADEROS ELKAY

Cada fregadero Elkay está fabricado con el acero inoxidable de más alta calidad. Su terminado satinado armoniza con cualquier estilo y decoración de cocina, sin que pase de moda, siempre elegante, al igual que la plata fina, embellece con los años.

EL TERMINADO SATINADO DE LOS PRODUCTOS ELKAY

El terminado satinado con reflejos es exclusivo de Elkay y se logra gracias a un sofisticado proceso que incluye pulidos a mano para darle ese acabado brillante y satinado tan sencillo de mantener, pero recuerde que los fregaderos Elkay no son auto limpiantes y requieren un mínimo de cuidado para conservar su brillo.

RAZONES POR LAS QUE USTED DEBE LIMPIAR SU FREGADERO

Aunque los fregaderos de acero inoxidable Elkay han sido fabricados con el material de más alta calidad, requieren, como cualquier producto de primera, de cierto mantenimiento para conservar su brillo.

INSTRUCCIONES FÁCILES PARA SU LIMPIEZA

Enjuagarlos es la parte más importante del cuidado de su fregadero. Si usted lo hace después de usarlo, siempre brillará como nuevo. Enjuague con agua corriente, con la manguera auxiliar o con cualquier recipiente, séquelo con trapo o toalla de cocina. Una vez a la semana se recomienda tallarlo con algún polvo limpiador como ajax, siguiendo la dirección en la que fué pulido. Esto no se hace para quitar manchas o acumulación de grasa si no para desvanecer cualquier rallón que se le haya hecho al fregadero. Después de tallar, enjuague y seque fuertemente. Su fregadero brillará como nuevo!

RALLONES

Como todos los productos de metal, su fregadero puede rallarse con utencilios de cocina, es por eso que se recomienda esta limpieza periódica con polvo limpiador.

PROTECTORES DE HULE

La resistencia de nuestros productos de acero inoxidable, hace innecesario el uso de protectores de hule. Sin embargo, si usted prefiere usarlos, es conveniente que los quite una vez que termine de usar su fregadero, el dejarlos puede causar decoloración en su fregadero.

DECOLORACIÓN, SARRO Y PICADURAS

Esponjas mojadas, trapos húmedos, estropajos, protectores de hule pueden decolorarlo. Fibras metálicas no deberán nunca usarse para limpiarlos, pues dejan partículas pequeñas de metal que se oxidan y pueden a su vez oxidar el fregadero.

JABON LIQUIDO

No deje nunca que los jabones líquidos o de trastes se queden en su fregadero, pues contienen abrasivos y químicos que dañarán su brillo.

CLORO

Casi todos los jabones, detergentes y polvos limpiadores contienen cloro, químico que no se recomienda para limpiar acero inoxidable, por ésta razón insistimos que después de usar cualquier producto de limpieza, enjuague perfectamente su fregadero y enseguida lo seque. Recuerde, no dejar nunca trapos mojados o esponjas con jabón en su fregadero porque puede causar manchas y oxidarlo.

CUCHILLOS

Su fregadero tiene muchos usos, pero no lo utilize como tabla de partir. Los cuchillos pueden hacer rallas profundas en el acero inoxidable, además de que éstos pierden su filo. Elkay le ofrece tablas de cortar que se adaptan perfectamente al compartimiento y le permiten contar con un area más amplia de trabajo en su cocina.

MANCHAS

La calidad del agua puede afectar la apariencia de su fregadero. En lugares con agua dura pueden formarse manchas con aparienca de óxido en el acero inoxidable. Éste fenómeno ocurre también en lugares con agua que tiene un alto contenido en minerales y en fierro, o un agua demasiado blanda. Para combatir ésto le recomendamos secar su fregadero después de usarlo.

COMIDA

No deje por tiempo prolongado en su fregadero comida con alto contenido de sal. Recuerde siempre enjuagarlo después.

QUE HACER ANTE CUALQUIER PROBLEMA

Elkay es una compañía que está orgullosa de la calidad de sus productos.

Si usted piensa que su fregadero tiene algún defecto, póngase en contacto con el representante de Elkay más cercano o diréctamente con el departamento de servicio al cliente, proporciónele el número de modelo de su fregadero y una descripción del problema. Consulte su certificado de garantía que contiene una completa explicación de sus derechos y limitaciones.

ACCESORIOS

Elkay le ofrece coladeras metálicas con cubierta de vinilo, que se adaptan perfectamente al tamaño del compartimiento, éstas no deben lavarse en el lava-trastes, sino a mano con jabon suave, enjuagando y secando después.

CERTIFICADO DE GARANTÍA LIMITADA DE POR VIDA DE FREGADEROS ELKAY

Elkay garantiza al comprador inicial de fregaderos de acero inoxidable Elkay que reemplazará sin cargo todo producto que falle debido a defectos de fabricación durante todo el período normal de uso residencial. El reemplazo del producto no incluye el costo del transporte o de la mano de obra para la instalación. Esta garantía cubre únicamente el fregadero de acero inoxidable y las piezas necesarias para el montaje cuando se instalen fregaderos con borde autoadherente embutidos en sobremuebles comunes o se instale un fregadero de montaje por debajo en un sobremueble con superficie sólida común, únicamente en usos residenciales. Elkay se reserva el derecho de examinar el producto y su instalación antes de efectuar el reemplazo.

NO SE GARANTIZAN LOS ACCESORIOS Y CONEXIONES PARA EL DESAGÜE

OTRAS CONDICIONES EN LA GARANTÍA DE FREGADEROS Y LLAVES MEZCLADORAS

Nuestra garantía no cubre las fallas o daños causados por maltrato o uso indebido, factores ambientales, cuidado o limpieza inadecuados o los daños causados por instalaciones incorrectas o defectuosas. Esta garantía se extiende sólo al comprador inicial del producto. La garantía no cubre los costos de envío de mano de obra y ningún otro costo ocasionado la instalación o reemplazo del fregadero, el diagnóstico o reemplazo de llaves mezcladoras o piezas y ningún otro gasto o pérdida.

Todos los daños incidentales o consecuentes están específicamente excluidos. No se extiende ninguna otra garantía adicional expresa o implícita. Toda garantía implícita e inclusive toda garantía de comerciabilidad o adecuación a un uso en particular, se limita a la duración de esta garantía escrita.

Algunos estados no permiten la exclusión o limitación de los daños consecuentes o incidentales así como tampoco la limitación en la duración de la garantía implícita, quedando invalidada por lo tanto en dichos casos la limitación precedente.

Esta garantía le otorga derechos legales específicos y usted puede tener además otros derechos que dependen del estado en donde resida.

CÓMO HACER EFECTIVA LA GARANTÍA

1. Escriba a: Elkay Manufacturing Company
   Atención: Consumer Services
   2222 Camden Court
   Oak Brook, IL 60523
   USA

2. Incluya una carta con la siguiente información:
   Fecha de compra y de instalación
   Descripción del defecto
   Número o descripción del modelo y/o, de ser posible, de la piezas que lo componen

ELKAY MANUFACTURING COMPANY
2222 CAMDEN COURT
OAK BROOK, ILLINOIS 60523
(630) 574-8484

IMPRESO EN LOS EE.UU.
F-2734
NO. DE PIEZA 74180147-C

ELKAY®

LIMITED LIFETIME SINK WARRANTY

Elkay warrants to the original purchaser of an Elkay stainless steel sink, that Elkay will, at its option, replace, without charge, such product if it fails due to a manufacturing defect for a lifetime of normal residential use. Product replacement does not include transportation cost or labor installation cost. This warranty covers only the stainless steel sink and mounting hardware when a self-rimming drop-in sink is installed in a conventional countertop surface or an undermount sink is installed in a conventional solid surface countertop in residential applications only. Elkay reserves the right to examine product in question and its installation prior to replacement.

WASTE FITTINGS AND ACCESSORIES ARE NOT WARRANTED

OTHER WARRANTY CONDITIONS ON SINKS AND FAUCETS

Our warranty does not cover product failure or damage caused by abusive treatment, misuse, environmental factors, improper care and cleaning, or damage due to handling or faulty installations. This warranty is extended only to the original consumer purchaser of the product. This warranty does not cover shipping costs, labor costs, or any other charges for such items as installation or replacement of the sink, diagnosis or replacement of any faucet or component part, or any other expense or loss.

All incidental or consequential damages are specifically excluded. No additional warranties, express or implied are given. Any implied warranty, including one of merchantability or fitness for a particular purpose, is limited to the duration of this written warranty.

Some states do not allow the exclusion or limitation of incidental or consequential damages or limitations on how long an implied warranty lasts, so the above limitations or exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

TO OBTAIN SERVICE UNDER WARRANTY

1. Write to: Elkay Manufacturing Company
   Attention: Consumer Services
   2222 Camden Court
   Oak Brook, IL 60523

2. Include a letter containing the following information:
   a. Date of purchase and installation
   b. Description of nature of defect
   c. Model number or description of model and/or component part if possible.

ELKAY MANUFACTURING COMPANY
2222 CAMDEN COURT
OAK BROOK, ILLINOIS 60523
(630) 574-8484

PRINTED IN U.S.A.
F-2734
PART NO. 74180147-C

CHICAGO FAUCETS®
a Geberit company

Installation Instructions for
DECK MOUNTED FAUCETS

Instrucciones para la instalación de
GRIFOS MONTADOS SOBRE CUBIERTAS

Instructions d'installation
ROBINETS DE COMPTOIR



Installation should be in accordance with local plumbing codes. Flush all pipes thoroughly before installation.

La instalación debe ajustarse a los códigos de plomería locales. Lave a fondo todos los tubos antes de la instalación.

L'installation doit se conformer aux normes locales de plomberie. Rincer à fond toute la tuyauterie avant de procéder à l'installation.

Limited Warranty

The CHICAGO FAUCET COMPANY ("Chicago Faucets") extends to the original consumer the following warranties for Genuine Chicago Faucets manufactured products and components, or other components under the Chicago Faucets Warranties, (collectively, the "Products") .

Lifetime Faucet Warranty The "Faucet", defined as any metal cast, forged, stamped of formed portion of the Product, not including electronic or moving parts or water restricting components, or other components covered under the Chicago Faucet warranties, is warranted against defects for the life of the product.

Five Year Cartridge Warranty The "Cartridge", defined as the metal portion of any Product typically referred to by the product numbers containing 1-099X, 1-100X, 217-X, 377-X, 274-X excluding any rubber or plastic components, is warranted against manufacturing defects for a period of five (5) years from the date of Product purchase.

One Year Finish Warranty The finish of the Product is warranted against manufacturing defects for a period of one (1) year from the date of Product purchase.

Garantía Limitada

La CHICAGO FAUCET COMPANY (en adelante «Chicago Faucets») ofrece las siguientes garantías al consumidor comprador original para los productos manufacturados Genuine Chicago Faucets, u otros componentes bajo las garantías de Chicago Faucets, (en adelante colectivamente los «Productos»).

Garantía para toda la vida del Grifo El «Grifo», definido como cualquier parte moldeada, forjada, estampada o formada del Producto, que no sean partes móviles, electrónicas, o de restricción de agua, u otros componentes cubiertos bajo las garantías de Chicago Faucets, goza del respaldo de una garantía contra defectos por la vida del producto.

Garantía de cinco años del cartucho. El «Cartucho», definido como la parte metálica de cualquier Producto, típicamente aludido por los números de producto que contienen 1-099X, 1-100X, 217-X, 377-X, 274-X excluyendo cualesquiera elementos de caucho o plástico, está respaldado por una garantía contra defectos de fabricación por un lapso de cinco (5) años de la fecha de la compra del Producto.

Un año de garantía para el acabado. El acabado del producto está respaldado por una garantía por un lapso de un (1) año de la fecha de la compra del producto.

Garantie limitée

CHICAGO FAUCET COMPANY (« Chicago Faucets ») offre au consommateur original les garanties suivantes sur les produits et les pièces authentiques fabriqués par Chicago Faucets, ou sur toute autre pièce couverte par sa garantie (appelés collectivement les « Produits »).

Garantie à vie du robinet : Le « robinet », défini comme toutes les pièces en métal moulé, les parties forgées, marquées ou ouvrées du produit (excluant les composants électroniques, les pièces mobiles et les pièces susceptibles d'être endommagées par l'eau), ainsi que toutes autres pièces couvertes par la garantie de Chicago Faucets, sont garantis à vie contre les vices de fabrication.

Garantie de cinq (5) ans de la cartouche : La « cartouche », définie comme la partie en métal d'un produit auquel on réfère habituellement par les numéros de produit contenant 1-099X, 1-100X, 217-X, 377-X, 274-X (à l'exclusion des composants de caoutchouc ou de plastique), est garantie contre les vices de fabrication pour une période de cinq (5) ans à compter de la date d'achat du produit.

Garantie d'un (1) an de la finition : La finition du produit est garantie contre les vices de fabrication pour une période d'un (1) an à compter de la date d'achat du produit.

Care & Maint

All Chicago Fauce
to meet or exceed
should be taken
abrasive cleaners,
in surface damag
cleaning and prote

Cuidado y manten

Todos los accesorios
con un fundamento e
estándares de desem
al limpiar este produc
químicos o solventes
suave con agua tibia
Chicago Faucets.

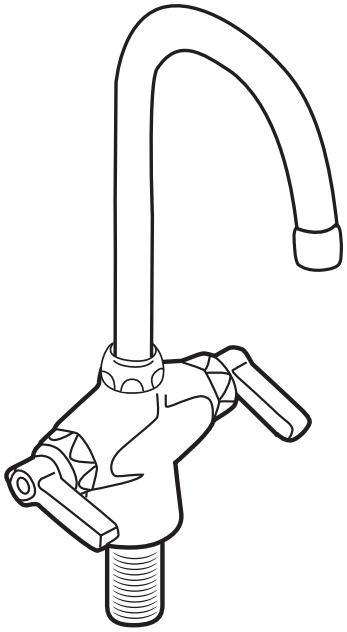
Entretien

Tous les produits de
fabriqués de manière
de l'industrie. Le ne
certaines précaution
produits chimiques c
la finition des produi
Chicago Faucet en u
pour ainsi protéger la

© 200

Single Hole Mixing Fittings
Accesorios de mezclado de un único agujero /
Mitigeurs à trou unique

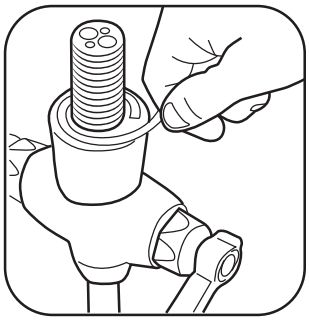
Base numbers/Números de base/Numéros d'appareil :
50, 50T, 51, 51T.



1 **Apply putty or rubber washer to underside of faucet body to assure a good seal and level fit.**

Enmasille o ponga una arandela de caucho a la cara inferior del cuerpo del grifo para asegurar un buen sellado y ajuste nivelado.

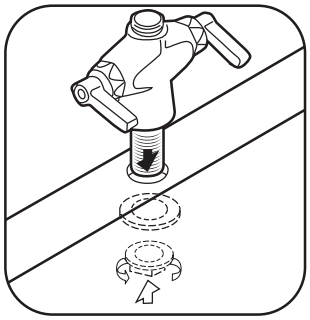
Appliquer du mastic ou placer la rondelle de caoutchouc sous le socle du bec afin d'assurer l'étanchéité et le réglage des surfaces.



2 **Place shank through hole in sink and assemble mounting hardware.**

Meta el vástago por el agujero en el lavaplatos y arme los dispositivos de montura.

Passer l'about du robinet dans le trou de l'évier et fixer les pièces de montage sur l'about.

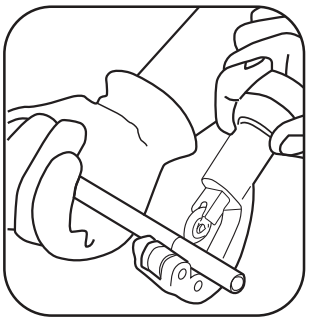


Copper Tube Installation / Instalación del tubo de cobre / Installation de tubes de cuivre

3a **Cut off plain end of tubes to desired length.**

Corte el extremo sencillo de los tubos para obtener la longitud deseada.

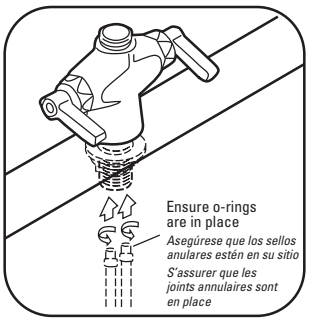
Couper le bout lisse des tubes à la longueur voulue.



3b **Hand tighten tubes into bottom of shank. Tighten each tube another 1/4 turn using a wrench. Bend and shape tubes as needed.**

Apriete con la mano los tubos al fondo del vástago. Apriete cada tubo otro 1/4 de vuelta con una llave de tuercas. Doble y forme los tubos según haga falta.

Visser les tubes à la main au bas de l'about du corps de robinet. Serrer chaque tube d'un quart de tour supplémentaire à l'aide d'une clé à molette. Cintrer et façonner les tubes d'arrivée d'eau selon les besoins.



Mixing Tee Installatio / Installation d'un T m

4a **Install tee gasket ov pins and secure cou of tee to body shank**

Instale la empaquetadura d mezclador en T sobre las e guía y asegure la tuerca de la T al vástago del cuerpo.

Installer le joint du T sur les guidage et fixer les écrous du T à l'about du robinet.

4b **Secure coupling nut to body shank. Tighten securely.**

Asegure la tuerca de unión del cuerpo. Apriete firmeme

Attacher les écrous de ser à l'about du robinet et ser précautions.

4c **Attach supply lines with coupling nuts. Tighten securely.**

Fije las tuberías de suminis con las tuercas de unión. A firmemente.

Attacher les tuyaux d'arrivé aux écrous de serrage et s précautions.

5 **Remove outlet and Replace outlet.**

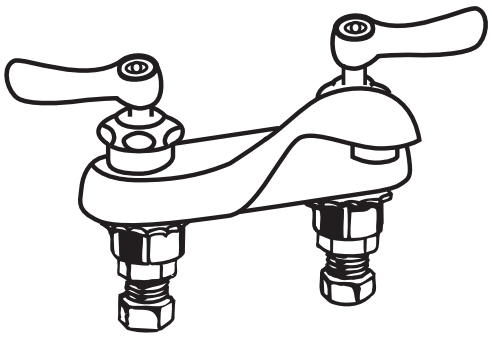
Quite la boca de salida y la nuevamente la boca de sa

Enlever l'embout et rincer Remettre l'embout en plac

Centerset and Single Basin Fittings

Accesorios para un solo tazón fijados al centro /
Robinetterie pour évier double et évier simple

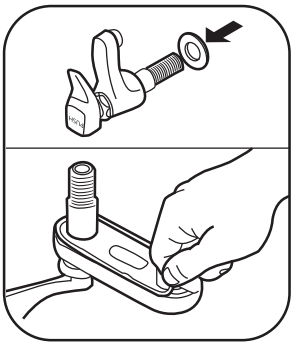
Base numbers / Números de base / Numéros d'appareil :
333, 335, 349, 350, 525, 526, 527, 700, 701, 730, 797, 802, 894, 895, 1895, 891, 1891, 1100, 1102



1 **Apply putty or rubber washer to underside of faucet body to assure a good seal and level fit.**

Enmasille o ponga una arandela de caucho a la cara inferior del cuerpo del grifo para asegurar un buen sellado y ajuste nivelado.

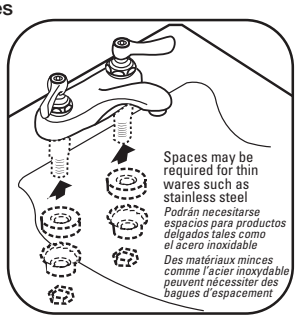
Appliquer du mastic ou placer la rondelle de caoutchouc sous le socle du bec afin d'assurer l'étanchéité et le réglage des surfaces.



2 **Place shank(s) through holes in sink and assemble mounting hardware. Use spacers if necessary.**

Meta el vástago por los agujeros en el lavaplatos y arme los dispositivos de montura. Use separadores si hace falta.

Passer l'about(s) du robinet dans le trou de l'évier et fixer les pièces de montage sur l'about. Utiliser des bagues d'espacement au besoin.



3 **Attach supply line coupling nuts and securely. Attach s provided separate**

Fije las tuberías de sumin con las tuercas de unió firmemente. Fije el pico se suministra separada

Attacher les tuyaux d'a aux écrous de serrage avec précautions. Fixer chons s'ils ne le sont p

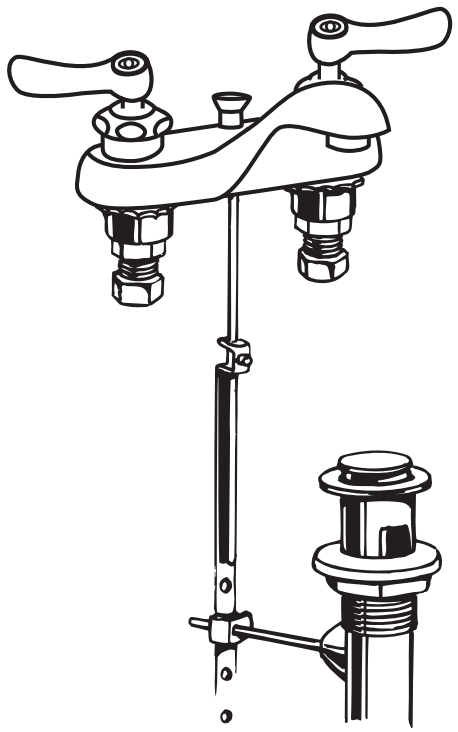
4 **Remove outlet an lines for about on Replace outlet.**

Quite la boca de salida tubos por cerca de un Coloque nuevamente la salida.

Enlever l'embout et rinc tuyauterie pendant env minute. Remettre l'emb en place.

Pop-Up Drain Installation

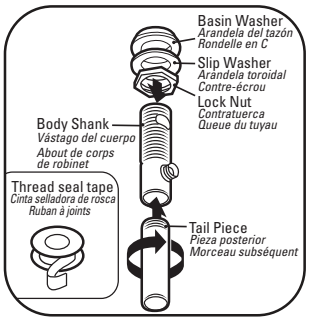
Instalación del drenaje de tapón expulsable por varillaje /
Installation d'une évacuation mécanique



1 **Assemble tail piece to body shank with thread seal tape. Assemble lock nut, slip washer, and basin washer to body shank.**

Ensamble la pieza posterior al vástago del cuerpo con cinta selladora de rosca. Ensamble la contratuerca, la arandela toroidal y la arandela del tazón en el vástago del cuerpo.

Installer la queue du tuyau à l'about du corps de robinet à l'aide du ruban à joints. Installer le contre-écrou, la rondelle en C et la rondelle conique au corps de robinet.



2 **Fully assemble the seat and spud flan body shank assem**

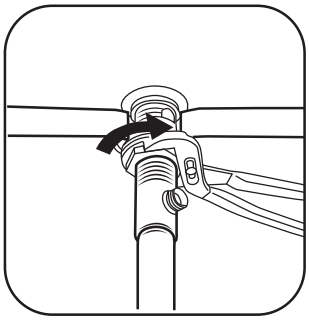
Ensamble plenamente e del tazón y el collarín al del vástago del cuerpo.

Fixer complètement le s cuvette et la collerette d à l'about du corps de ro

3 **Position body shank toward the lift rod. Tighten lock nut until properly sealed.**

Coloque el vástago del cuerpo hacia la varilla de elevación. Apriete la contratuerca hasta que esté debidamente sellada.

Placer l'about du corps de robinet vers la tige de levage. Serrer le contre-écrou jusqu'à ce que ce soit bien étanche.



4 **Place stopper into shank cavity orien stirrup for removal non-removable st desired. (see #6)**

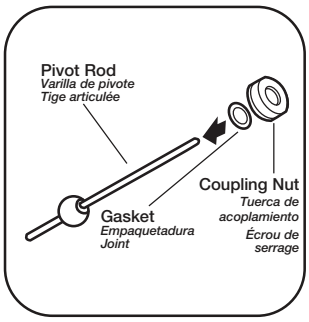
Coloque el tapón en la c vástago del cuerpo, orie estribo para un tapón fij pueda quitar. (Consulte la il

Placer le bouchon dans de l'about du corps de orientant l'étrier de man soit possible ou non, se de retirer le bouchon (vo

5 **Insert pivot ball rod assembly through pivot rod gasket and coupling nut.**

Inserte la ensambladura de la varilla de la bola de pivote a través de la empaquetadura de la varilla de la bola de pivote y de la tuerca de acoplamiento.

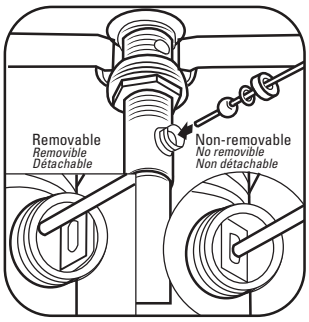
Insérer la tige de la rotule articulée à travers l'écrou de fixation de la tige de la rotule articulé et l'écrou de serrage.



6 **Attach pivot rod assembly to body shank.**

Agregue la ensambladura de la varilla de pivote al vástago del cuerpo.

Attacher la tige de la rotule articulée à l'embout du corps de robinet.



7 **Tighten pivot rod a nut as required to provide smooth op**

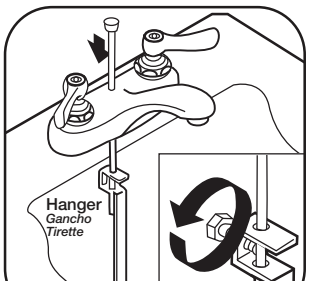
Apriete la tuerca de la en de la varilla de pivote co necesario para sellar y d funcionamiento suave.

Serrer l'écrou de la tige articulée afin de sceller e un bon fonctionnement.

8 **Insert pop up rod through holes in hanger and hand tighten.**

Inserte la varilla del tapón expulsable y apriete con la mano.

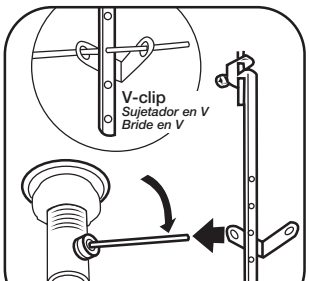
Insérer la tige de manoeuvre dans les trous de la tirette et serrer à la main.



9 **Push pivot ball rod to lowest position squeeze v-clip and slide pivot ball rod through v-clip and appropriate hole in hanger.**

Empuje la varilla de la bola de pivote, apriete el sujetador en V y deslice la varilla de la bola de pivote a través del sujetador en V y el agujero apropiado en el gancho.

Abaisser la tige de la rotule articulée à son plus bas. Pincer ensuite la bride en V et glisser la tige de la rotule articulée dans la bride en V et dans le trou approprié de la tirette.



10 **Test the assembly function and make adjustments as ne Once set, tighten s**

Pruebe el funcionamiento ensambladura y haga los necesarios. Una vez fijad firmemente.

S'assurer que le mécani fonctionne bien et régler Une fois terminé, serrer précautions.

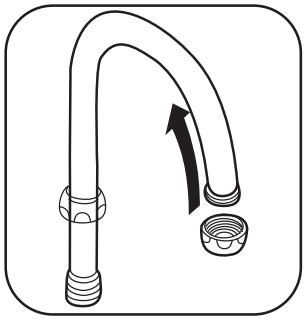
Rigid/Swing Convertible Spout Installation

Instalación de pico convertible; rígido o giratorio /
Installation des becs de robinet rigides ou pivotants col de cygne

1 **Remove outlet and assemble spout nut over outlet end, until it rests on shoulder of spout joint.**

Quite la punta de la salida y meta la tuerca del pico por el extremo de salida, hasta que descanse en el hombro de la junta del pico.

Retirer l'embout et glisser l'écrou au long du bec, jusqu'au joint.

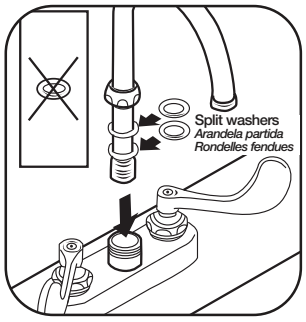


For Swing Spouts/Para Surtidores Giratorios/Becs pivotants

2a **Assemble two plastic split washers to spout joint and discard 1/8" thick plastic washer**

Ensamble dos arandelas de plástico a la junta del pico y deseche la arandela de plástico de 1/8" (3.2mm).

Insérer les deux rondelles fendues en plastique dans le joint du bec. Jeter la rondelle de plastique de 32 mm d'épaisseur (1/8 po).

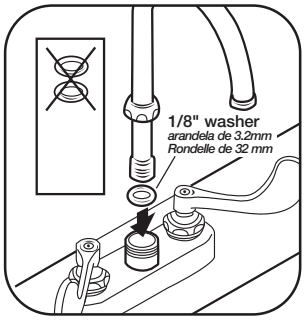


For Rigid Spouts Only/Sólo para picos rígidos/Becs rigides

2b **Place 1/8" thick plastic washer into spout base bore and discard plastic split washers**

Coloque la arandela de plástico de 1/4" (6.35mm) de espesor sobre el extremo de la base del pico y deseche las arandelas partidas de plástico.

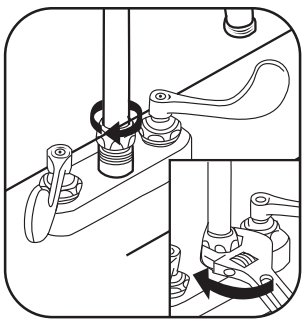
Insérer la rondelle fendue en plastique de 32 mm d'épaisseur (1/8 po) à la base du bec. Jeter les rondelles de plastique.



3 **Assemble spout assembly into spout base and tighten spout nut.**

Monte la ensambladura a la base del pico y apriete la tuerca del pico.

Fixer le bec à sa base et serrer l'écrou du robinet.



RGD1 and RGD

Instalación de pico s
Installation des becs

1 **Apply supplied adh threads of spout ar spout into base. Ba necessary for cente**

Aplique el adhesivo sumi las roscas del pico y apri dentro de la base. Retroc sea necesario para centra

Appliquer un adhésif sur bec et maintenir le bec d Reculer au besoin pour s le bec est bien centré.

2 **Hand tighten sleev until flush with bod**

Apriete a mano el mangu quede parejo con el cuer

Serrer les manchons à la jusqu'à ce qu'ils s'encas corps de robinet.

Timing Adjustment on an MVP Metering Cartridge

Ajuste de temporización en un cartucho MVP de mediciónon /
Réglage de la durée d'écoulement des cartouches MVP

1 **With cartridge and handle installed in body and water supply turned on, purge cartridge of air by pushing handle completely down 4-8 times repeatedly, then check timing cycle.**

Con el cartucho y el mango instalados en el cuerpo y el suministro de agua abierto, purgue el cartucho de aire empujando el mango completamente hacia abajo 4 a 8 veces repetidamente, luego verifique el ciclo de temporización.

Une fois la cartouche et la manette fixées au corps de robinet et les robinets d'arrivée ouverts, purger l'air de la cartouche en enfonçant complètement la manette à plusieurs reprises (de 4 à 8 fois). Vérifier ensuite le cycle d'écoulement.

2 **To change cycle time, remove index button, then handle using a 3/32 hex wrench. (Figure 'A')**

Para cambiar el tiempo de ciclo, quite el botón de tapa de presión, luego ajuste con la llave de de 3/32" (2.38mm) (Ilustración 'A') 3.

Pour changer le temps de cycle, enlever la coiffe indicatrice et se servir d'une clé hexagonale de 3/32 po (Figure « A »).

3 **Using your fingers change height of adjustment nut by 1/4 turn only. Turn adjustment nut clockwise to increase cycle time or counter-clockwise to decrease cycle time. (Figure 'B')**

Con sus dedos cambie la altura de la tuerca de ajuste sólo 1/4" de vuelta. Gire la tuerca de ajuste en la dirección de las manecillas del reloj para aumentar el tiempo del ciclo o en dirección contraria a las manecillas del reloj para disminuir el tiempo del ciclo. (Ilustración 'B')

L'utilisation des doigts changera la hauteur de l'écrou de réglage de 1/4 de tour seulement. Tourner l'écrou de réglage dans le sens horaire pour augmenter le temps de cycle, ou dans le sens antihoraire pour le réduire (Figure « B »).

4 **Replace handle and verify desired cycle time. NOTE: TIMING MUST BE CHECKED WITH HANDLE IN PLACE.**

Coloque el mango nuevamente y verifique el tiempo de ciclo deseado. NOTA: LA TEMPORIZACIÓN DEBE VERIFICARSE CON EL MANGO EN SU LUGAR.

Remettre la manette en place et vérifier que le temps de cycle est celui désiré. NOTE : LA VÉRIFICATION DE LA DURÉE D'ÉCOULEMENT DOIT ÊTRE EFFECTUÉE UNE FOIS LA MANETTE REMISE EN PLACE.

5 **If additional adjustment is necessary, repeat steps 3 and 4 until desired cycle time is achieved.**

Si hace falta ajustes adicionales, repita los pasos 3 y 4 hasta que se logre el tiempo de ciclo deseado.

Si des réglages supplémentaires sont nécessaires, répéter les étapes 3 et 4 jusqu'à ce que le temps de cycle désiré soit atteint.

6 **Instale el mango en el vástago del actuante, luego apriete firmemente el tornillo de ajuste con el mango en la posición inferior. Oprima el botón o tapa de presión hasta que se ajuste en su sitio.**

Instale el mango en el vástago del actuante, luego apriete firmemente el tornillo de ajuste con el mango en la posición inferior. Oprima el botón o tapa de presión hasta que se ajuste en su sitio.

Insérer la manette sur la tige de l'actionneur et serrer la vis de réglage en positionnant la manette vers le bas. Appuyer sur la coiffe indicatrice de la manette jusqu'à ce qu'elle soit assise.

Note: Some new installations might produce a slight closing noise. This is normally the result of air trapped in the cartridge and noise will dissipate over time.

Nota: Algunas instalaciones nuevas podrían producir un ligero ruido al cerrar. Esto es normalmente el resultado de aire atrapado en el cartucho y el ruido disminuirá con el tiempo.

Note : Un appareil neuf peut émettre un léger bruit à la fermeture, à cause de l'air retenu dans la cartouche. Ce bruit disparaîtra avec le temps.

FIGURE 'A' / ILUSTRACIÓN 'A' / FIGURE « A »

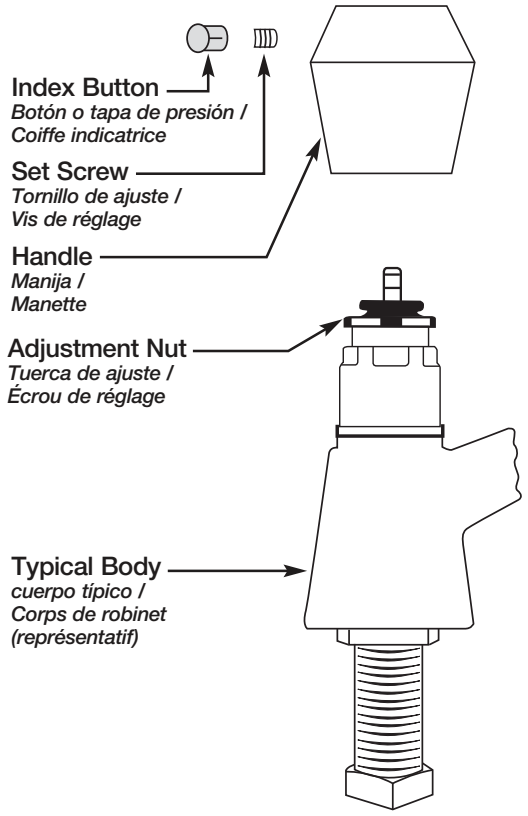
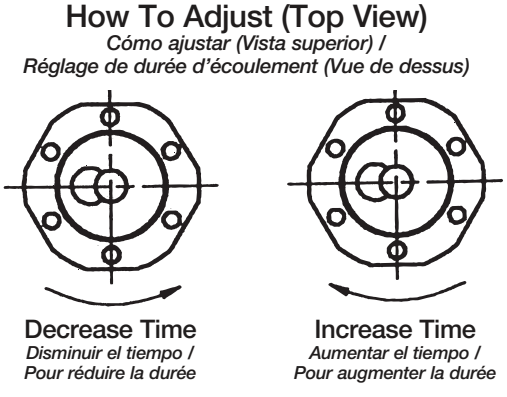


FIGURE 'B' / ILUSTRACIÓN 'B' / FIGURE « B »



Timing Adjustm
Tip-Tap Self-C

Ajuste de temporizaci
«Tip-Tap» /
Réglage de la durée d'
à manette basculante

1 **Turn off water su**

Cierre el suministro de a
Fermer les robinets d'ar

2 **Remove cartridge**
Use care to preve

Quite el cartucho del cu
de 1 1/4" (31.75mm). T
hexagonal de sombrere
Retirer la cartouche du lo
onale de 1 1/4 po. Procé
l'écrou à chapeau hexago

3 **Locate timing hex**
clockwise to increa
decrease cycle tim
increments for eac
water into the das
cartridge and plac

Ubique la tuerca hexago
Gire la tuerca hexagonal
reloj para aumentar el tie
manecillas del reloj para
Nota: Gire en incremento
Coloque unas pocas got
el fondo del cartucho y c

Localiser l'écrou de réglag
l'écrou de réglage dans le
ou dans le sens antihorair
90o pour chaque réglage
l'amortisseur, le glisser au
cartouche en place dans

4 **Re-install cartridge**
to 15-25 FT. LB to
on water and verify
by depressing car
Note: Insure that c
is in place within c
assembly into valv

Reinstale el cartucho y ap
a 25 FT. LB. (2 a 3.46 kil
Abra el suministro de agu
erifique el tiempo de ciclo
completamente el cartuc
Asegúrese que la empaq
de tapa esté en su lugar
la tapa antes del ensamb
cuerpo de la válvula.

Réinstaller la cartouche et
à 25 livres/pied carré. Ouv
d'arrivée d'eau et vérifier le
cycle en abaissant comple
cartouche. Remarque : S'
le joint de chapeau est à s
le chapeau avant d'installe
dans le logement du corp

Timing Adjustment on a Push-Tilt Self-Closing Cartridge

Ajuste de la temporización en un cartucho de cierre automático de palanca basculante (push-tilt) /
Réglage de la durée d'écoulement des cartouches à autofermeture à manette basculante

The internal timing adjustment procedure is identical to Push Button Self Closing Cartridges, except for an external timing adjustment feature that is integral to Push-Tilt handles. This adjustment can be used for minor cycle time changes without the need to remove the cartridge from the body.

El procedimiento de ajuste de temporización interna es idéntico al de los cartuchos de cierre automático de pulsador, salvo por una característica externa de ajuste que es integral a las manijas de palanca basculante. Este ajuste puede usarse para cambios menores de ciclos de temporización sin necesidad de sacar el cartucho del cuerpo.

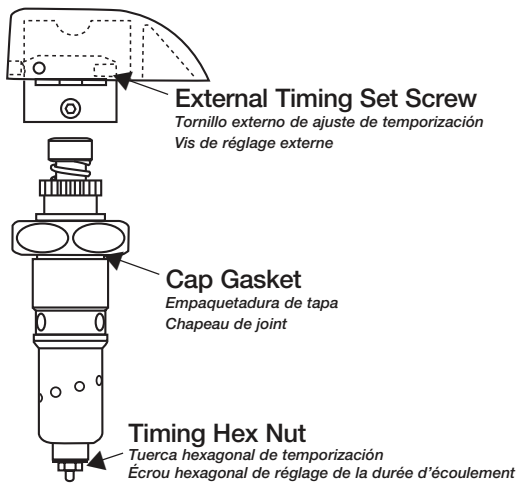
La procédure de réglage interne de la durée d'écoulement est identique à celle des cartouches à bouton-poussoir à autofermeture, à l'exception d'une particularité : le réglage externe de la durée d'écoulement à l'aide d'une manette basculante. Ce mode de réglage peut être utilisé pour effectuer des modifications mineures du cycle de temps sans devoir retirer la cartouche du corps de robinet.

1 **For external adjustment, lift handle slightly to expose 1/16" hex socket set screw (Figure "D"). Turn adjustment set screw clockwise to increase cycle time or counter-clockwise to decrease cycle time.**

Para ajustes externos, levante la manija ligeramente para exponer el tornillo de ajuste con cabeza para llave hexagonal de 1/16" (1,59mm). Gire el tornillo de ajuste en la dirección de las manecillas del reloj para aumentar el tiempo del ciclo o en dirección contraria a las manecillas del reloj para disminuir el tiempo del ciclo.

Pour un réglage externe, soulever légèrement la manette afin d'exposer la douille de la vis de réglage à tête hexagonale (figure « D »). Tourner la vis de réglage dans le sens horaire pour augmenter le temps de cycle, ou dans le sens antihoraire pour le réduire.

FIGURE 'D' / ILUSTRACIÓN 'D' / FIGURE « D »



Cartridge Installation Instructions / *Instrucciones de instalaci*
Instructions d'installation de la cartouche

NAIAD Push Button and Tip-Tap Self-Closing Cartridges
Cartuchos de cierre automático «Tip-Tap» y de pulsador NAIAD
Cartouche Naiad à bouton-poussoir et tip-tap à fermeture automatiquee

Place cartridge into body and fully tighten cap nut with wrench to 15-25 FT. LB. torque.
Coloque el cartucho en el cuerpo y apriete completamente la tuerca de tapa con llave a una torsión de 12 a 25 FT. LB. (1.66 a 3.46 kilográmetros).
Placer la cartouche dans le corps de robinet et serrer, à l'aide d'une clé, l'écrou à chapeau de 15 à 25 livres/pied carré.

MVP Metering Cartric
Cartouches MVP

1. **If filter and lower v fitting, replace the**
   Si el filtro y el cartu del accesorio, colóc
   Si le logement infér du robinet, les rem
2. **If gasket has been replace it by inser**
   Si la empaquetadu actuante.
   Si le joint a été enle de l'actionneur.
3. **Assemble actuato FT. LBS. torque.**
   Monte la ensambla una torsión de 15
   Fixer l'actionneur a livres/pied carré.
4. **Assemble handle**
   Ensamble la manija
   Installer la manette réglage au besoin
5. **Tighten set screw**
   Apriete el tornillo de
   Serrer la vis de rég
6. **If index button is**
   Si el botón o tapa c
   Si une coiffe indica

SK-3

C786GN2BVBE32AB CHICAGO CP

SK-3 SINK

LF CONC H&C WTR SINK 2.2 GPM

Installation should be in accordance with local plumbing codes. Flush all pipes thoroughly before installation.

La instalación se debe hacer solo de acuerdo con los códigos de plomería locales. Nivele bien todas las tuberías antes de instalar.

L'installation doit se faire conformément aux codes de plomberie locaux. Videz tous les tuyaux entièrement avant de commencer l'installation.

Limited Warranty

The CHICAGO FAUCET COMPANY ("Chicago Faucets") extends to the original consumer the following warranties for Genuine Chicago Faucets manufactured products and components, or other components under the Chicago Faucets Warranties, (collectively, the "Products").

Lifetime Faucet Warranty The "Faucet", defined as any metal cast, forged, stamped of formed portion of the Product, not including electronic or moving parts or water restricting components, or other components covered under the Chicago Faucet warranties, is warranted against defects for the life of the product.

Five Year Cartridge Warranty The "Cartridge", defined as the metal portion of any Product typically referred to by the product numbers containing 1-099X, 1-100X, 217-X, 377-X, 274-X excluding any rubber or plastic components, is warranted against manufacturing defects for a period of five (5) years from the date of Product purchase.

One Year Finish Warranty The finish of the Product is warranted against manufacturing defects for a period of one (1) year from the date of Product purchase.

Garantía limitada

CHICAGO FAUCET COMPANY ("Chicago Faucets") extiende al consumidor original las siguientes garantías para los productos y los componentes fabricados de Genuine Chicago Faucets, o cualquier otro componente de las garantías de Chicago Faucets, (en conjunto, los "Productos").

Garantía de por vida del grifo El "Grifo", definido como cualquier porción formada de metal fundido, forjado, estampado del Producto, que no incluye piezas electrónicas o movibles, o componentes limitados por agua, u otro componente que se incluya en las garantías de Chicago Faucet , está garantizada por los defectos de la vida del producto.

Garantía del cartucho de cinco años El "Cartucho", definido como la porción de metal de cualquier Producto generalmente indicado por los números del producto con 1-099X, 1-100X, 217-X, 377-X, 274-X sin contar ningún componente de goma o de plástico, está garantizado por defectos de fabricación durante cinco (5) años a partir de la fecha de compra del Producto.

Garantía para el acabado de un año El acabado del Producto está garantizado por defectos de fabricación durante un (1) año a partir de la fecha de compra del Producto.

Garantie limitée

CHICAGO FAUCET COMPANY (Chicago Faucets) offre au consommateur initial les garanties suivantes pour les produits fabriqués par Genuine Chicago Faucets et leurs composants, ou les autres composants couverts par les garanties de Chicago Faucets (collectivement appelés les « produits »).

Garantie à vie du robinet: Le robinet, défini comme toute partie en métal moulé, forgée, estampée ou formée du produit, mais ne comprenant pas les pièces électroniques ou amovibles ni les composants servant à contenir l'eau, ni les autres composants couverts par les garanties de Chicago Faucet, est garanti contre les défauts pendant la durée de vie du produit.

Garantie de cinq ans de la cartouche : La cartouche est définie comme la portion métallique de tout produit auquel on fait habituellement référence par les numéros de produit contenant 1-099X, 1-100X, 217-X, 377-X, 274-X, à l'exception des composants en caoutchouc ou en plastique, et elle est garantie contre les défauts de fabrication pour une période de cinq (5) ans à compter de la date d'achat du produit.

GGarantie de un an sur le fini : Le fini du produit est garanti contre les défauts de fabrication pour une période de un (1) an à partir de la date d'achat du produit.

CHICAGO FAUCETS®

a Geberit company

Care & Maintenance

All Chicago Faucet fittings are designed and engineered to meet or exceed industry performance standards. Care should be taken cleaning this product. Do not use abrasive cleaners, chemicals or solvents as they can result in surface damage. Use mild soap with warm water for cleaning and protecting the life of Chicago Faucets fittings.

Cuidado y mantenimiento

Todos los accesorios de Chicago Faucet están diseñados para cumplir o superar las normas de rendimiento de la industria. Este producto se debe limpiar con cuidado. No utilice limpiadores abrasivos, productos químicos o solventes ya que pueden dañar la superficie. Para limpiar y proteger la vida útil de los accesorios Chicago Faucet, utilice jabón suave con agua tibia.

Entretien

Tous les accessoires Chicago Faucet sont conçus et élaborés pour respecter et dépasser les normes de rendement de l'industrie. Ce produit doit être nettoyé soigneusement. N'utilisez pas de produits nettoyants abrasifs, de produits chimiques ni de solvants, ils risqueraient d'endommager la surface. Utilisez un savon doux et de l'eau tiède pour nettoyer et assurer la durée de vie des accessoires Chicago Faucets.

* 4 9 5 6 4 *

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786GN2BVBE32ABCP

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Installation Instructions for
WIDESPREAD FITTINGS
Models: 201, 786

Instrucciones para la instalación de
ACCESORIOS DE LAVABO
Los modelos: 201, 786

Instructions pour l'installation des
ACCESSOIRES DU ROBINET À GRAND ÉCARTEMENT
Modèles : 201, 786



SK-3 SINK

Widespread Faucet Installation Instructions —

These installation instructions apply to all products with the following fitting base numbers: 201, 786

Instrucciones de instalación del grifo del lavamanos —

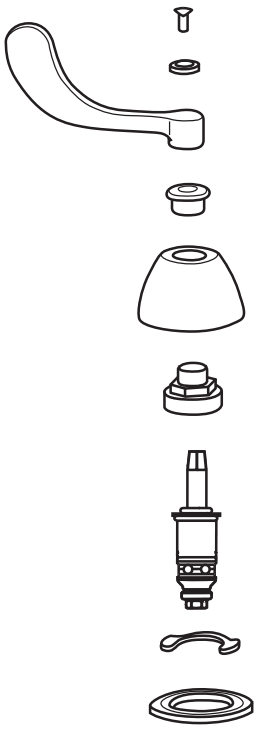
Estas instrucciones de instalación se aplican a todo los productos con los siguientes números base de accesorios: 201, 786

Instructions pour l'installation du robinet à grand écartement —

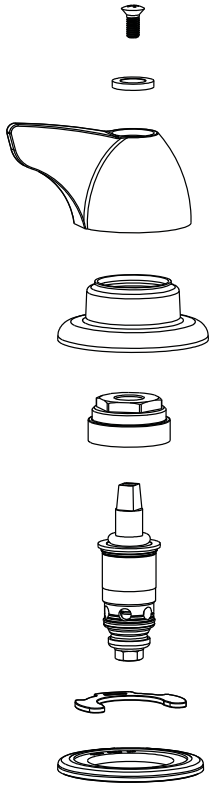
Ces instructions pour l'installation s'appliquent à tous les produits dont les accessoires ont les numéros de base suivants : 201, 786

Exploded Views: / Vista despiezada / Vues éclatées

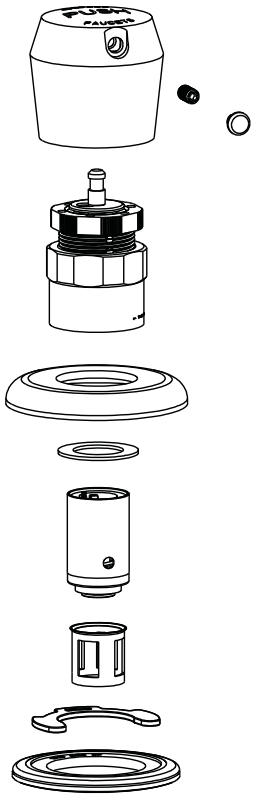
Tall Stem Cartridge /
Cartucho de barra alta /
Cartouche avec tige longue



Short Stem Cartridge /
Cartucho de barra corta /
Cartouche avec tige courte

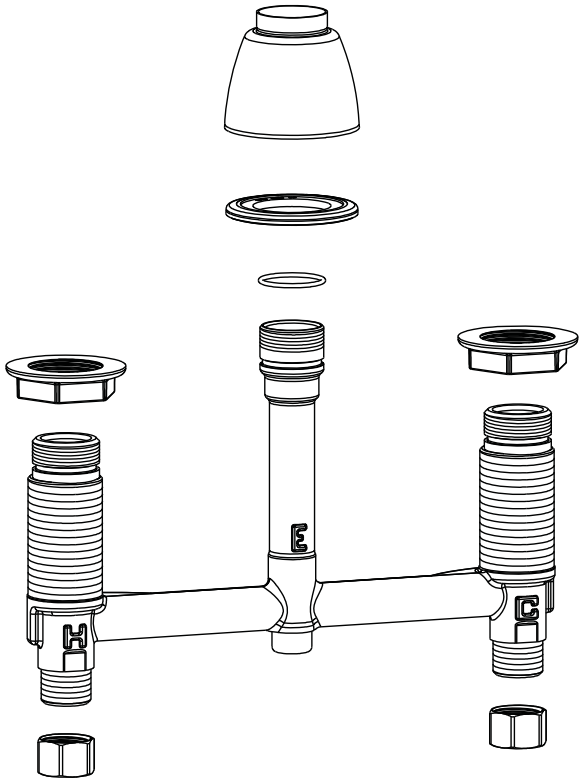


Metering /
Medición /
Avec cartouche de dosage



Other Configurations: / Otras Configuraciones: / Autres Configurations :

8" Rigid / Rígido de 20 cm / Avec tuyaux rigides, de 20,32 cm



8" Rigid with Third Water Hook-up / Rígido de 20 cm con un tercer gancho para agua / Avec tuyaux rigides, de 20,32 cm et troisième prise d'eau

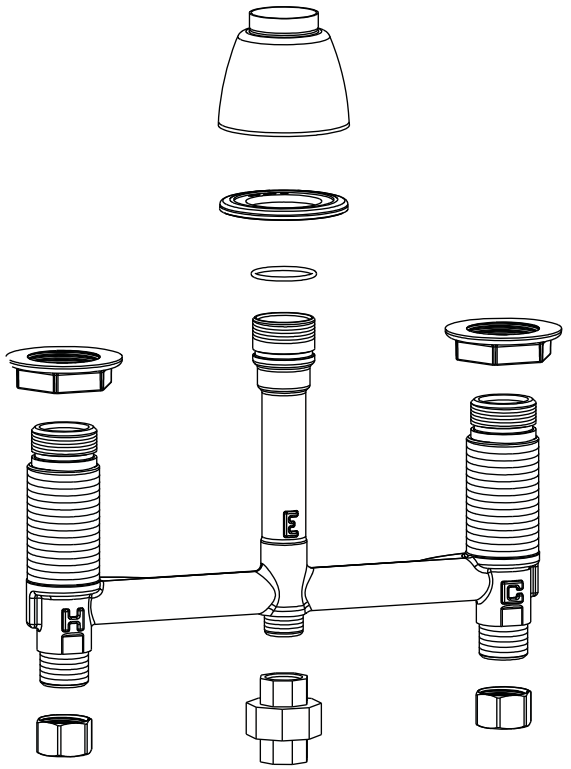
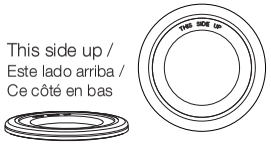


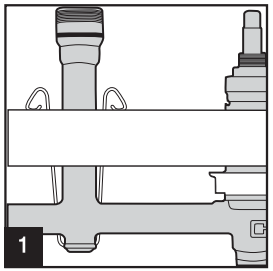
Illustration A: / ilustración A: / l'illustration A :





Sealing washer must be placed on mounting suface as indicated. /
La arandela de sellado debe ser colocada en el suface creciente como indicado. /
Sceller la rondelle doit être placée sur monter de suface comme indiqué.

One-Piece Body Installation / De una sola pieza de instalación del Órgano / Installation du corps monopièce

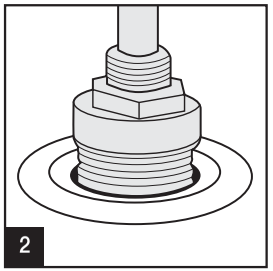


Attach hanger to body and hang faucet from spout hole in sink. Hand tighten mounting nuts.



Coloque la suspensión en el cuerpo y colgar la llave de agua el agujero del surtidor en el fregadero. Apriete a mano las tuercas de montaje.

Fixez le support au corps et accrochez le robinet en utilisant le trou du bec dans l'évier. Serrez les écrous de montage à la main.

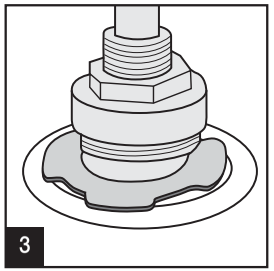


Place a sealing washer over each handle stem. Be sure to have recessed rim of washer facing up. See Illustration A.



Coloque una arandela de sellado en cada espiga de la manija. Asegúrese de tener a empotrar el borde de la arandela hacia arriba. Vea ilustración A.

Posez une rondelle d'étanchéité sur la tige de chaque poignée. Assurez-vous que le bord renfoncé de la rondelle est face vers le haut. Voir A d'illustration.

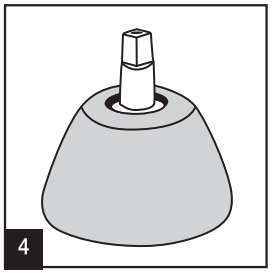


Insert retaining clips firmly into channel on each valve body. Remove hanger from spout hole.



Inserte los clips firmemente en el canal en cada cuerpo de la válvula. Retirar el sostén en la salida del agujero.

Insérez les attaches de retenue fermement dans la rainure du corps de chaque robinet. Retirez le support du trou du bec.

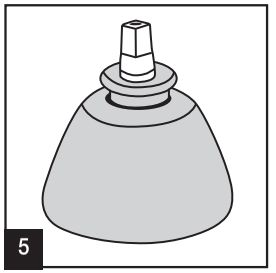


Place handle escutcheons over handle stems. Handles should cover the sealing washers.



Coloque la manija chapetones sobre manejar los tallos. Maneja debe cubrir las arandelas de sellado.

Placez les écussons de la poignée sur les tiges de la poignée. Les poignées devraient couvrir les rondelles d'étanchéité.

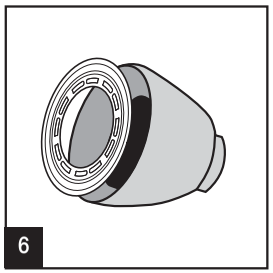


Place a hold–down nut onto each handle stem and hand tighten.



Coloque una tuerca de apriete en cada espiga de la manija y apriete la mano.

Posez un écrou de retenue sur la tige de chaque poignée et serrez à la main.

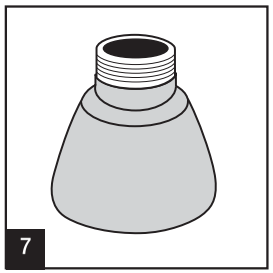


Place spout seat washer into spout escutcheon. See illustration A.



Placez le bec rondelle siège en rosace de bec. Vea ilustración A.

Placez la rondelle de siège du bec sur l'écusson du bec. Voir A d'illustration.

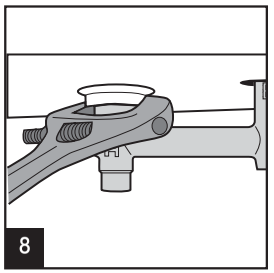


Place spout escutcheon over spout stem until it rests flush to surface.



Coloque el pico chapetón sobre surtidor madre hasta que quede a ras de superficie.

Placez l'écusson du bec sur la tige du bec jusqu'à ce qu'il soit de niveau avec la surface.

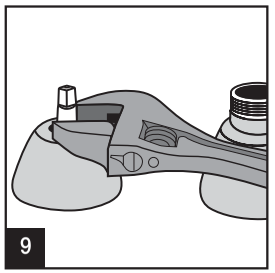


Using adjustable wrench, tighten underbody nuts.

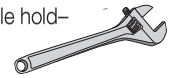


Usando una llave ajustable, apriete las tuercas de la parte de abajo.

À l'aide d'une clé à molette, serrez les écrous de dessous.

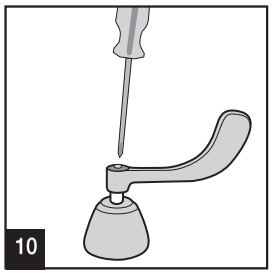


Using adjustable wrench, tighten handle hold–down nuts.

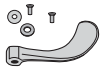


Usando una llave ajustable, apriete las tuercas de manija de sujeción.

À l'aide d'une clé à molette, serrez les écrous de retenue de la poignée.



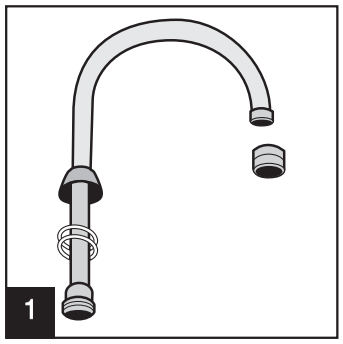
Align both handles on stem as desired. Insert index buttons, screws, and tighten.



Alinear las dos asas en el tallo como se desee. Insertar botones de índice, tornillos y apriete.

Alignez les deux poignées sur la tige comme vous le souhaitez. Insérez les capuchons indicateurs, les vis, puis serrez.

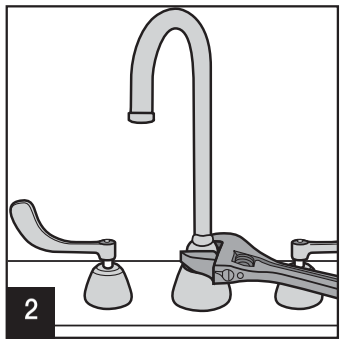
Swing Spout / Boquilla giratoria / Bec pivotant



Remove outlet from spout.
Place two split rings on spout near the base. Slide spout nut onto spout.

Retire la salida de la boquilla. Coloque dos anillos divididos en la boquilla cercana a la base. Deslice la tuerca de la boquilla hasta la boquilla.

Retirez l'embout de sortie du bec. Posez deux bagues fendues sur le bec près de la base. Glissez l'écrou du bec sur le bec.

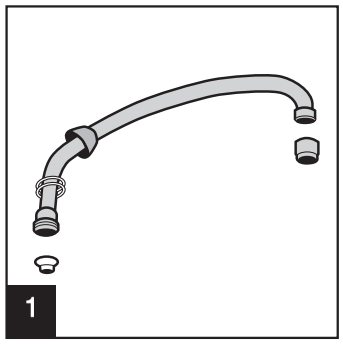


Place spout onto valve body until fully seated. Tighten spout nut with wrench. Connect water supplies, flush line, and attach outlet.

Coloque la boquilla sobre el cuerpo de la válvula hasta que esté completamente en su lugar. Apriete la tuerca de la boquilla con la llave inglesa. Conecte la tubería de suministro y descarga, y coloque la salida.

Posez le bec sur le corps du robinet jusqu'à ce qu'il soit bien en place. Serrez l'écrou du bec à l'aide d'une clé. Raccordez les conduites d'alimentation en eau, rincez la conduite, puis remettez en place l'embout de sortie.

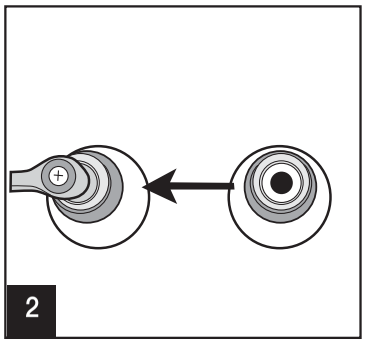
Restricted Swing Spout / Boquilla giratoria con límite / Bec à pivot restreint



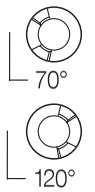
Remove outlet from spout. Place two split rings on spout tubing near base. Slide spout nut onto spout.

Retire la salida de la boquilla. Coloque dos anillos divididos en las tuberías de la boquilla cercana a la base. Deslice la tuerca de la boquilla hasta la boquilla.

Retirez l'embout de sortie du bec. Posez deux bagues fendues sur la base près du tuyau du bec. Glissez l'écrou du bec sur le bec.



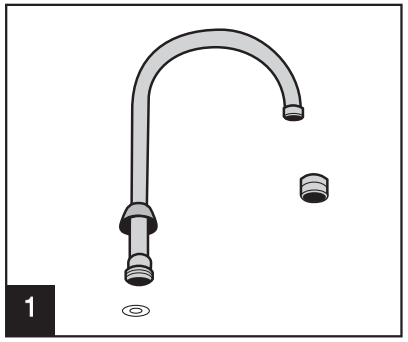
Place restricted swing adaptor into valve body and align with internal valve body tab.
Position small opening (70º) or large opening (120º) toward "hot" side of body.



Coloque el adaptador giratorio con límites en el cuerpo de la válvula y alinee con la ranura del cuerpo de la válvula interna. Coloque la pequeña abertura (70º) o la abertura grande (120º) contra el lado "caliente" del cuerpo.

Posez l'adaptateur à pivot restreint sur le corps du robinet et alignez-le sur la languette du corps du robinet interne. Placez la petite ouverture (70 °) ou la grande ouverture (120 °) en direction du côté « eau chaude » du corps.

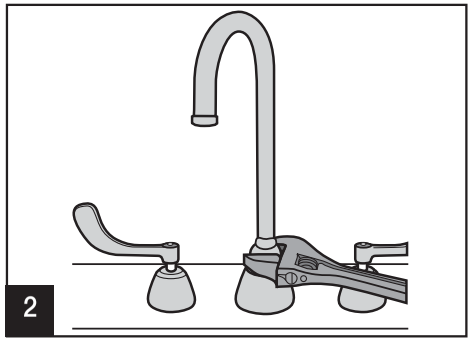
Rigid Spout / Boquilla rígida / Bec fixe



Remove outlet from spout. Slide spout nut onto spout. Place solid white washer into base outlet.

Retire la salida de la boquilla. Deslice la tuerca de la boquilla hasta la boquilla. Coloque la arandela sólida blanca sobre la salida base.

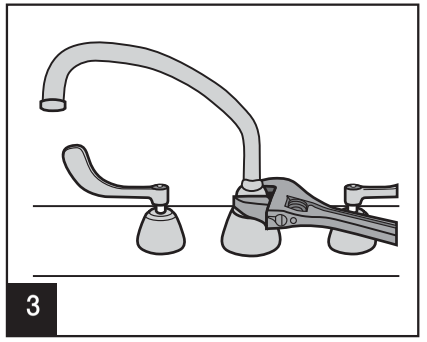
Retirez l'embout de sortie du bec. Posez deux bagues fendues sur la base près du tuyau du bec. Glissez l'écrou du bec sur le bec.



Place spout onto valve body until fully seated. Tighten spout nut with wrench. Connect water supplies, flush line, and attach outlet.

Coloque la boquilla sobre el cuerpo de la válvula hasta que esté completamente en su lugar. Apriete la tuerca de la boquilla con la llave inglesa. Conecte la tubería de suministro y descarga, y coloque la salida.

Posez le bec sur le corps du robinet jusqu'à ce qu'il soit bien en place. Serrez l'écrou du bec à l'aide d'une clé. Raccordez les conduites d'alimentation en eau, rincez la conduite, puis remettez en place l'embout de sortie.



Place spout into stem. Tighten spout nut with wrench. Connect water supplies, flush line, and attach outlet.

Coloque la boquilla en la barra. Apriete la tuerca de la boquilla con la llave inglesa. Conecte la tubería de suministro y descarga, y coloque la salida.

Posez le bec sur la tige. Serrez l'écrou du bec à l'aide d'une clé. Raccordez les conduites d'alimentation en eau, rincez la conduite, puis remettez en place l'embout de sortie.

Timing Adjustment on an MVP Metering Cartridge

Ajuste de temporización en un cartucho de medición MVP /
Réglage de la durée de distribution d'une cartouche de dosage MVP

1 With cartridge and handle installed in body and water supply turned on, purge cartridge of air by pushing handle completely down 4-8 times repeatedly, then check timing cycle.

Después de haber instalado el cartucho y la manija en el cuerpo y de haber encendido el suministro de agua, presione la manija por completo hacia abajo 4 a 8 veces seguidas para purgar el cartucho de aire. Luego, verifique el tiempo.

Pendant que la cartouche et la poignée sont installées sur le corps et que l'alimentation en eau est activée, évacuez l'air de la cartouche en poussant la poignée en bas complètement de quatre à huit fois, à répétition, puis vérifiez le cycle de distribution.

2 To change cycle time, remove index button, then handle using a 3/32 hex wrench. (Figure 'A')

Para cambiar el tiempo de ciclo, retire el botón indicador y luego la manija con una llave Allen de 3/32. (Figura 'A')

Pour modifier le cycle de distribution, retirez le capuchon indicateur, puis la poignée à l'aide d'une clé hexagonale de 3/32 po. (Figure A)

3 Using your fingers change height of adjustment nut by 1/4 turn only. Turn adjustment nut clockwise to increase cycle time or counter-clockwise to decrease cycle time. (Figure 'B')

Con los dedos, cambie la altura de la tuerca de ajuste con un solo giro de 1/4. Gire la tuerca de ajuste en dirección de las manecillas del reloj para aumentar el tiempo, o gírela en dirección contraria para disminuirlo. (Figura 'B')

Utilisez vos doigts pour modifier la hauteur de l'écrou de réglage en le tournant de un quart de tour seulement. Tournez l'écrou de réglage dans le sens des aiguilles d'une montre pour augmenter la durée du cycle ou dans le sens contraire des aiguilles d'une montre pour en diminuer la durée. (Figure B)

4 Reinstall handle and verify desired cycle time. NOTE: TIMING MUST BE CHECKED WITH HANDLE IN PLACE.

Vuelva a colocar la manija y verifique que el tiempo sea el deseado. NOTA: EL TIEMPO SE DEBE REVISAR CON LA MANIJA EN SU LUGAR.

Réinstallez la poignée et vérifiez si la durée du cycle est celle que vous souhaitez. REMARQUE : LA DURÉE DOIT ÊTRE VÉRIFIÉE ALORS QUE LA POIGNÉE EST EN PLACE.

5 If additional adjustment is necessary, repeat steps 3 and 4 until desired cycle time is achieved.

Si necesita de un ajuste adicional, repita los pasos 3 y 4 hasta obtener el tiempo deseado.

Si un réglage supplémentaire est nécessaire, répétez les étapes 3 et 4 jusqu'à ce que vous ayez la durée de cycle souhaitée.

6 Attach handle and tighten screw. If index button is included, snap into handle.

Instale el mango en el vástago del actuante, luego apriete firmemente el tornillo de ajuste con el mango en la posición inferior. Oprima el botón o tapa de presión hasta que se ajuste en su sitio.

Insérer la manette sur la tige de l'actionneur et serrer la vis de réglage en positionnant la manette vers le bas. Appuyer sur la coiffe indicatrice de la manette jusqu'à ce qu'elle soit assise.

Note: Some new installations might produce a slight closing noise. This is normally the result of air trapped in the cartridge and noise will dissipate over time.

Nota: Algunas instalaciones nuevas podrían generar un leve ruido al cerrar. Generalmente, se produce debido al aire atrapado en el cartucho. El ruido desaparecerá con el tiempo.

Remarque : Certaines nouvelles installations pourraient produire un léger bruit de fermeture. Cela est normalement dû au fait que de l'air est emprisonné dans la cartouche et le bruit cessera au fil du temps.

FIGURE 'A' / ILUSTRACIÓN 'A' / FIGURE « A »

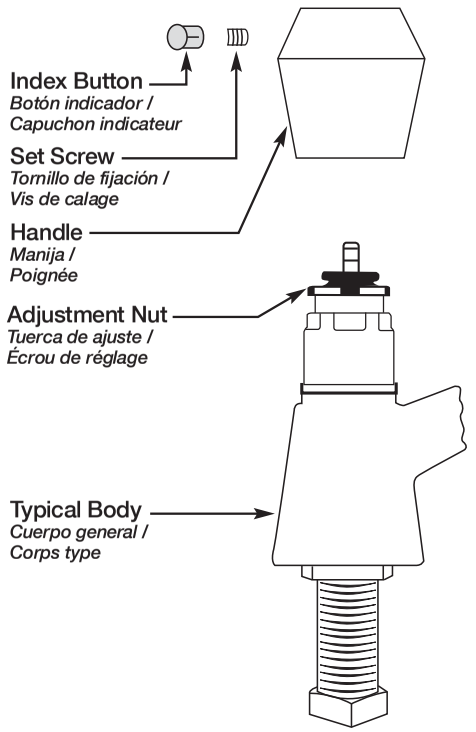
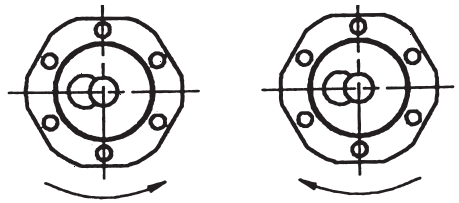


FIGURE 'B' / ILUSTRACIÓN 'B' / FIGURE « B »



MVP Metering Cartridges / *Cartuchos de medición MVP / Cartouches de dosage MVP*

1. **If filter and lower valve cartridge have been removed from fitting, replace them by inserting filter first.**
   Si se retiró el filtro y el cartucho de la válvula inferior del accesorio, para colocarlo nuevamente, ingrese primero el filtro.
   Si le filtre et la cartouche du robinet inférieur ont été retirés du raccord, replacez-les en commençant par le filtre.

2. **If gasket has been removed from the actuator assembly, replace it by inserting into bottom of actuator assembly.**
   Si se retiró la empaquetadura del ensamble del activador, reemplácela e ingrésela en la parte inferior del ensamble del activador.
   Si le joint a été retiré de l'ensemble de l'actionneur, replacez-le en l'insérant au bas de l'ensemble de l' actionneur.

3. **Assemble actuator assembly to body and tighten to 12-15 FT. LBS. torque.**
   Arme el ensamble del activador al cuerpo y apriete a 1,81-2,26 Kgf M.
   Assemblez l'ensemble de l'actionneur au corps et serrez jusqu'à ce que le couple soit de 12 à 15 LB-PI.

4. **Assemble handle and check timing, adjust if necessary.**
   Arme la manija y verifique el tiempo, ajuste de ser necesario.
   Assemblez la poignée et vérifiez la durée de distribution, réglezla au besoin.

5. **Tighten set screw with a 3/32 allen wrench.**
   Apriete el tornillo de fijación con una llave Allen de 3/32.
   errez la vis de calage à l'aide d'une clé hexagonale de 3/32 po.

6. **Insert index button into handle.**
   Coloque el botón indicador en la manija.
   Insérez le capuchon indicateur sur la poignée.

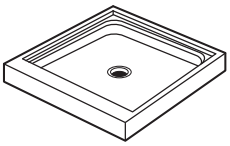
MS-1 **MS-1 MOP SINK PER ADDENDUM #2-1**

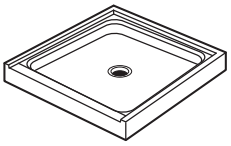
FTSB3000501	FIAT	24X24X12 TERRAZZO MOP SERV BASIN
SYMS2490	SYMMONS	NOT FOR POTABLE USE 2 HANDLE SINK FAUCET 2.2 GPM CHROME

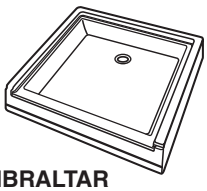
Installation Instructions – Terrazzo
Precast Shower Floors & Mop Basins

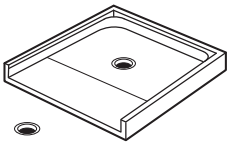
FIAT® PRODUCTS

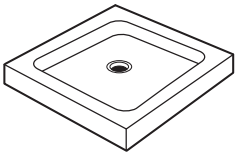
DO NOT STACK OR STORE TERRAZZO FLAT


MONTEREY


SIERRA


GIBRALTAR


ADAT, ADAW, WTR WHEELCHAIR ACCESS


MOP SERVICE BASIN

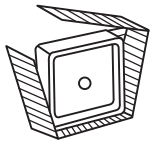
1. REMOVE CRATE AT INSTALLATION POINT. DO NOT ROCK TERRAZZO ON EDGES IN ORDER TO PREVENT DAMAGES TO CORNERS.
2. CHECK ALL SIDES OF PRODUCT FOR TRANSPORTATION DAMAGES.

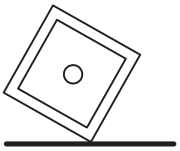
A: WIPE FACE OF THE TERRAZZO WITH A WATERED CLOTH.

B: AFTER WATER EVAPORATES, CHECK FOR CRACKS OR DAMAGE.

NOTE: FIAT PRODUCTS IS NOT RESPONSIBLE FOR SHOWER INSTALLATIONS ADHERING TO A.D.A. GUIDELINES. CHECK LOCAL AUTHORITY FOR CODE AND INSTALLATION REQUIREMENTS.

DO NOT LIFT SHOWER BY FLANGE


REMOVE CRATE WITH CARE

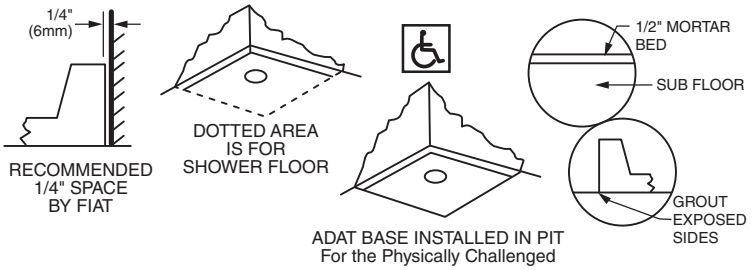

DO NOT STAND ON END

LEVEL PRODUCT CAREFULLY

2A. ESTABLISH PROPER CLEARANCE BETWEEN UNIT AND WALL. PLACE A 1/2" LAYER OF MORTAR WHERE THE SHOWER FLOOR IS TO BE INSTALLED. THIS PROCEDURE IS REQUIRED BY FIAT TO PROVIDE SUPPORT OF THE UNIT IN CASE THE SUB FLOOR IS UNEVEN. LAYER OF GROUT SHOULD BE AT LEAST 1/4" THICK AND COVER ENTIRE AREA UNDER THE UNIT.

2B. ADAT AND ADAW SHOWERS ARE FOR A.D.A. OR PHYSICALLY CHALLENGED USE. THE SHOWER ENTRY SHOULD BE NO MORE THAN 1/4" HIGHER THAN THE FINISHED FLOOR OF THE ROOM. THE ADAT SHOWER SHOULD BE INSTALLED INTO A RECESSED PIT 2 INCHES DEEP TO MEET CODE REQUIREMENTS.

2C. IT IS RECOMMENDED THAT A FLOOR DRAIN AT OR NEAR THE ENTRANCE TO ALL ADAT, ADAW AND WTR SHOWER FLOORS BE INCLUDED.



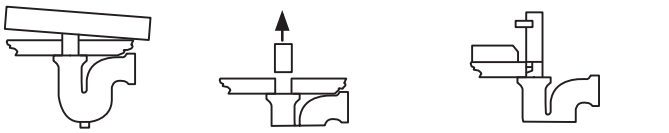
FAILURE TO INSTALL TERRAZZO ON A 1/2" MORTAR BED WILL VOID WARRANTY.

WARNING

3. DO NOT DROP UNIT OVER EXPOSED PIPE. IT IS ADVISABLE TO REMOVE DRAIN PIPE AND SET UNIT IN PLACE. INSERT PIPE THROUGH DRAIN IN FLOOR BACK INTO "P" TRAP.

TIGHTEN METAL CONNECTIONS WITH AN INTERNAL PIPE WRENCH.

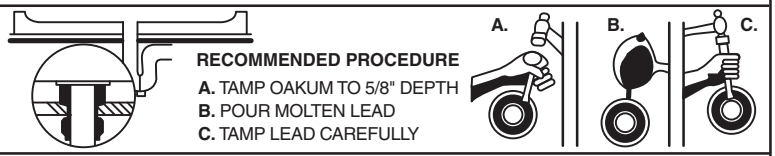
IF USING PLASTIC WASTE PIPE, FIT AND SOLVENT WELD.



4A. METHOD OF DRAIN CONNECTION: METAL WASTE PIPE

USE OAKAM AND MOLTEN LEAD.

THIS LEAD CAULKED JOINT PERMITS LIMITED MOVEMENTS SUCH AS NORMAL STRUCTURAL SETTLEMENT WITHOUT LEAKAGE.



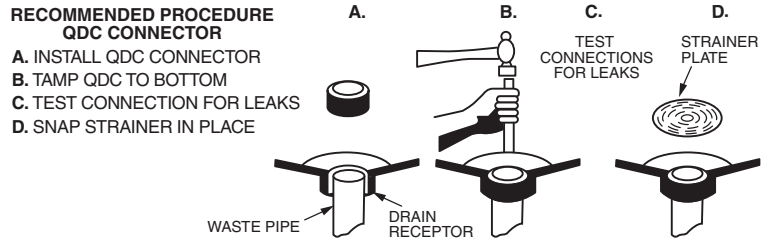
4B. METHOD OF DRAIN CONNECTION: PLASTIC WASTE PIPE

WHEN USING PLASTIC WASTE PIPE , IT IS NECESSARY TO USE THE QDC QUICK DRAIN CONNECTOR.

INSTALL PIPE THROUGH RECEPTOR.

LUBRICATE QDC CONNECTOR WITH SOAP, STRETCH QDC CONNECTOR OVER PIPE WITH LETTERS FACING UP.

TAMP CONNECTOR WITH A HAMMER AND PIECE OF WOOD. WORK AROUND CONNECTOR WITH A SERIES OF BLOWS UNTIL IT BOTTOMS. TOP OF PIPE SHOULD BE EVEN WITH TOP OF CONNECTOR.

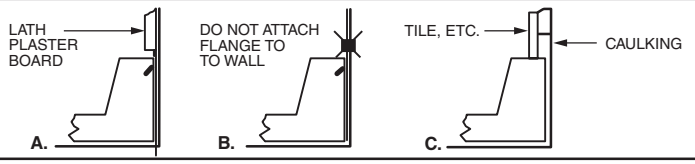


WARNING: MODELS WITH TILING FLANGE OPTIONS

5A. DO NOT LET ROUGH WALL MATERIAL OVERLAP FLANGE.

5B. DO NOT ATTACH FLANGE TO BUILDING.

5C. LET FINISHED WALL (TILE, ETC) OVERLAP AND REST ON SHOULDER.



Product names listed herein are trademarks of FIAT
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710088-100 Rev. B

Sealers - New Installations

Immediately following installation of a new floor or thorough cleaning of an older floor, the floor can be sealed with a penetrating sealer. Such sealers are available at paint or tile stores and **must** state that they are approved for use on Terrazzo products. Sealers are not permanent and can be reapplied (after a thorough cleaning) approximately once a year, or as recommended by the manufacturer of the sealer.

RECOMMENDED CLEANING & MAINTENANCE PROCEDURES FOR TERRAZZO PRECAST SHOWER FLOORS AND MOP SERVICE BASINS

Regular Cleaning
To maintain the original terrazzo surface appearance, clean regularly with a liquid detergent such as Joy, Liquid Ajax, or Spic n Span (for the latter, prepare a solution containing 1/2 cup of Spic n Span in a gallon of water). Scrub with a stiff bristled, non-metallic scrub brush and then rinse thoroughly.

NOTE: Do *not* use any acid (ie, muratic) or cleaning agents that contain acid.

Special or Unusual Conditions

A. Scum on Surface caused by soap, makeup, etc.:	Use a cleaning powder, such as Ajax, plus lots of elbow grease.
B. Surface cleaning:	Heel marks, plaster, etc. may require abrasive removal. This can be done with a wet emery cloth. If emery cloth is ineffective, use an 80 to 100 grit aluminum oxide coated paper. Abrasive cloth or paper will result in a very faint grinding away of the floor surface.
C. Penetrated stains:	Stains such as caused by oil, putty, etc., may be removed by scouring with a cleanser and then soaking floor overnight, if need be, with a commercial bleach such as Linco, etc.

FIAT PRODUCTS®
LIMITED ONE YEAR WARRANTY

AS America, Inc. offers a limited warranty on Fiat Products to the original Purchaser consumer, both residential and commercial, that products of its own manufacture shall be free of defects in material and workmanship for a period of One Year.

Under this warranty Fiat Products will, at its sole discretion, upon receipt of a written claim and proof of purchase, either (1) repair the product, (2) replace the product or any part therein with a Fiat Product of equal or similar type and size, or (3) refund to the consumer the wholesale price of the product received by Fiat Products. If Fiat Products elects to refund the wholesale price to the consumer, Fiat Products shall have no further obligation to its wholesale customer, or any contractor with respect to such product. Goods proven to be defective will be replaced after proper inspection, but no claims for damages incurred or for work done thereon will be allowed. Replacements when supplied will be shipped at no cost to the consumer.

This warranty **does not apply** to local building code compliance. Since local building codes vary considerably, the purchaser of the product should check with a local building or plumbing contractor to ensure local code compliance before installation.

This warranty **will be void** if:
1) the product has been moved from its initial place of installation; 2) if it has been subjected to faulty maintenance, abuse, misuse, accident or other damage; 3) if it was not installed in accordance with Fiat Products instructions; or 4) if it has been modified in a manner inconsistent with the product as shipped by Fiat Products.

This warranty **DOES NOT COVER** any damages caused by the use of non-approved cleaners, improper installations or excessive abuse.

Fiat Products' right to repair or exchange the product under this warranty does not cover any labor or other costs of removal or installation including any costs of any surround material such as tile or marble.

Fiat Products is not responsible for any other incidental or consequential damages attributed to a product defect or to the repair or exchange of a defective product, all of which are expressly excluded from this warranty. (Some states or provinces do not allow the exclusion or limitation of implied warranties, so this exclusion may not apply to you.)

This warranty gives you specific rights. You may have other statutory rights that may vary from state to state or province to province, in which case this warranty does not affect such statutory rights.

In the United States:
American Standard Brands
P.O. Box 6820
Piscataway, New Jersey 08855
Attention: Director of Consumer Affairs
Toll free: (800) 442-1902
www.americanstandard.com

In Canada:
AS Canada, ULC
5900 Avebury Road
Mississauga, Ontario
Canada L5R 3M3
Toll Free: (800) 387-0369
www.americanstandard.ca

In Mexico:
Customer Service Manager
AS Maquila, S.A. de C.V.
Via Morelos #330
Col. Santa Clara
Ecatepec 55540 Edo. Mexico
www.americanstandard.com.mx

THIS WARRANTY IS NOT TRANSFERABLE FROM ORIGINAL CONSUMER PURCHASER.

S2490 ✔

SYMMONS® Symmetrix™

Service Sink Faucet S-2490, S-2490-CHKS

Installation Brief



Model Numbers

S-2490	Service sink faucet
S-2490-CHKS	Service sink faucet with integral checks

Tools & Materials



Caution - For installation with atmospheric vacuum breakers

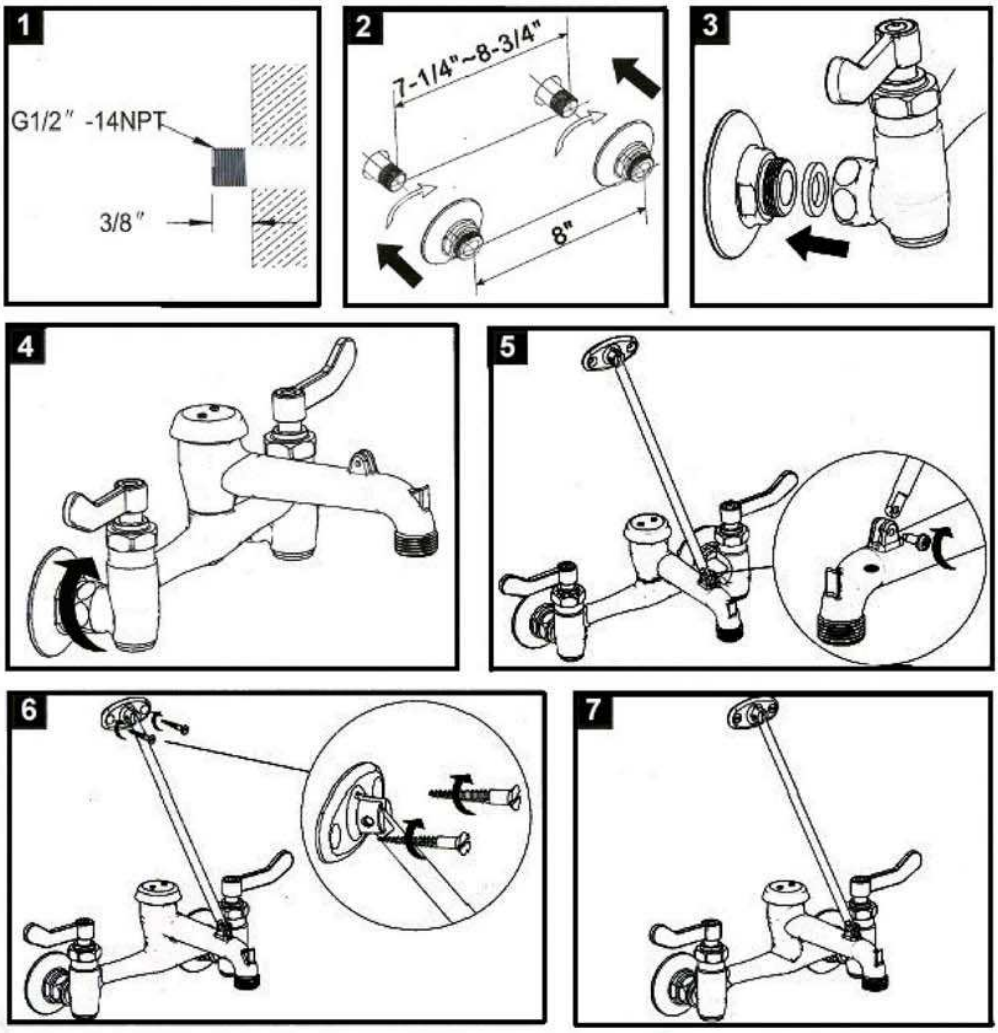
Faucet should never be used in installations that are under continuous pressure when installed with spouts having atmospheric vacuum breakers (AVB'S). Therefore, never place a self closing, shut-off valve down stream of an AVB.

☎ Need Help?

Symmons customer service:
(800) 796-6667, (781) 848-2250
customerservice@symmons.com
Mon - Fri 7:30 am - 7:00 pm EST
www.symmons.com/service

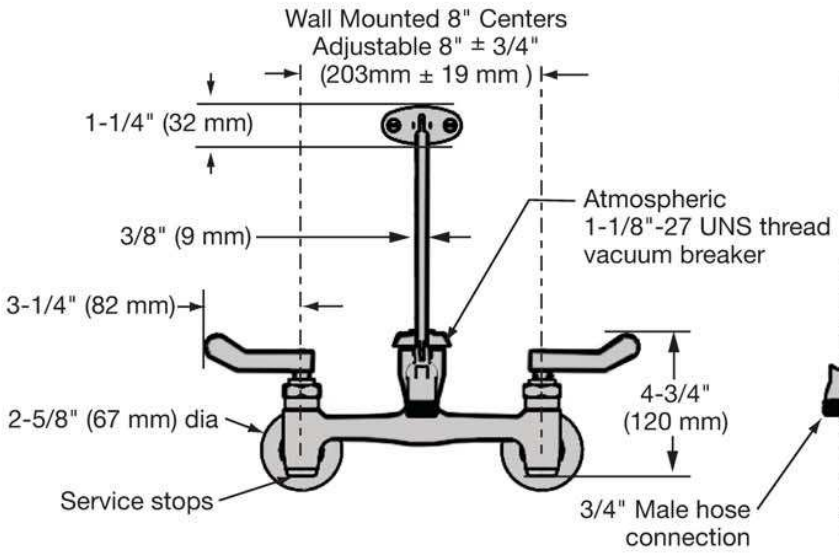
- Technical help
- Product information
- Warranty policy

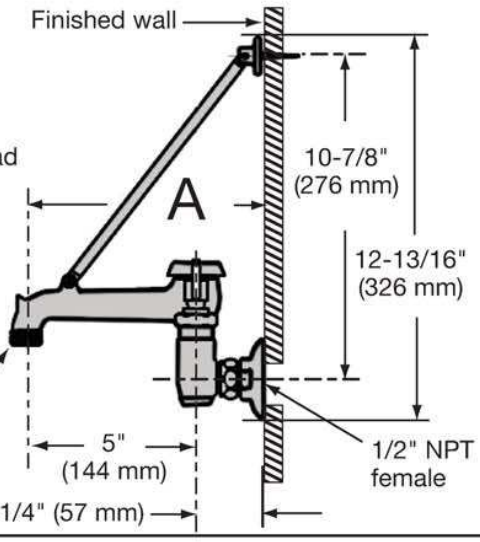
Installation Guide Symmetrix Service Sink Faucet S-2490, S-2490-CHKS



Dimensions Symmetrix Service Sink Faucet *S-2490, S-2490-CHKS*

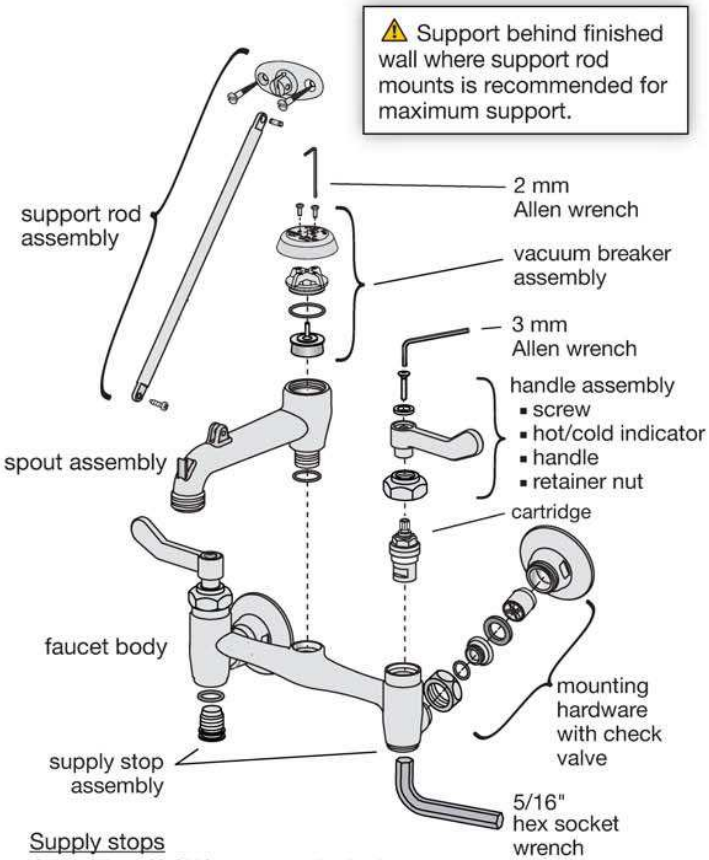
Measurements		
A	S-2490	7 7/8", 201 mm
	S-2490-CHKS	8 1/8", 206 mm





Note: Dimensions subject to change without notice.

Parts Assembly Symmetrix Service Sink Faucet *S-2490, S-2490-CHKS*



Supply stops
OFF - Turn (CCW) counter clockwise
ON - Turn (CW) clockwise a maximum of three complete turns

Symmons Part Number	Replacement Parts
RL-050	Mounting hardware kit
RL-147 (-CHKS only)	Mounting hardware kit with check valves
RL-051	Handle assembly kit (2 handles included)
RL-052 RL-053	Cartridge, HOT Cartridge, COLD
RL-054	Supply stop assembly kit (Includes both hot and cold supply stop assemblies)
RL-055	Vacuum breaker assembly kit
RL-056	Support rod assembly kit

Ordering replacement parts:
Call Symmons customer service at (800) 796-6667, (781) 848-2250 M-F 7:30 am - 7:00 pm EST
Check our website at www.symmons.com for a list of Symmons distributors.

Symmons Industries, Inc. ▪ 31 Brooks Drive ▪ Braintree, MA 02184 ▪ (800)796-6667 ▪ Fax (800)961-9621
©2014 Symmons Industries, Inc. ▪ www.symmons.com ▪gethelp@symmons.com ▪ ZV-1035 ▪ 022814

EWC-1

ELRPBGRNMV28RA ELKAY K

EWC-1 ELECTRIC WATER COOLER

GREE FLTRD SWIRLFLO VR 2L REV

ERPB2-8C, ERPB2-8RAC, ERPBV2-8C, ERPBV2-8RAC, LRPB2-8C, LRPB2-8RAC, ERPB2-8C*2C, ERPB2-8C*3C
ERPB2-8GRNC*A, ERPB2-8GRNRAC*A, LRPB2-8GRNC*A, LRPB2-8GRNRAC*A

ELKAY® With FLEXI-GUARD®

INSTALLATION, CARE & USE MANUAL

SWIRLFLO® Refrigerated fountains with FLEXI-GUARD®



ERPB2-8C



ERPB2-8RAC

INSTALLER

⚠ CAUTION: Review these instructions before beginning installation. Be sure that installation conforms to all plumbing, electrical and other applicable codes.

⚠ WARNING: When installation is complete, ensure these instructions are left in the plastic bag provided inside the installed unit for future reference.

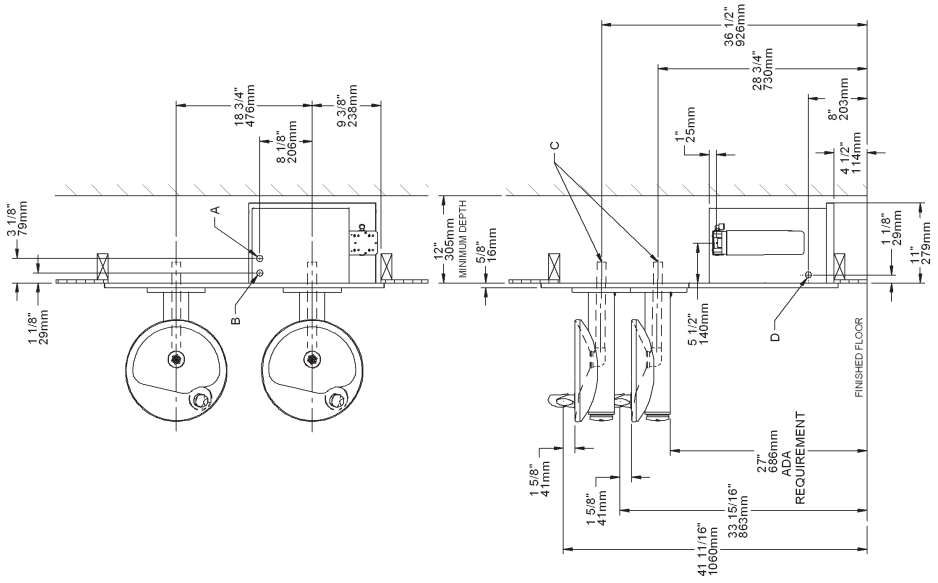
⚠ WARNING: Service to be performed by authorized service personnel only.

NOTE: It is common practice to ground electrical hardware such as telephones, computers and other devices to available water lines. This can, however, cause electrical feedback in the plumbing circuit, which results in an “electrolysis” effect occurring in the fountain. This may result in water which has a metallic taste to it or has a noticeable increase in the metallic content of the water.

When inspecting plumbing circuit, remember the line may be grounded some distance from the installation, and may occur outside the building or area in which the unit is being installed.

This condition can be avoided (in most cases) by using recommended materials during installation. Any drain fittings provided by the installer should be made of ***plastic*** which will *electronically isolate* the fountain from the remainder of the building’s plumbing circuits.

Model LRPB2-8RAC



Model LRPB2-8C

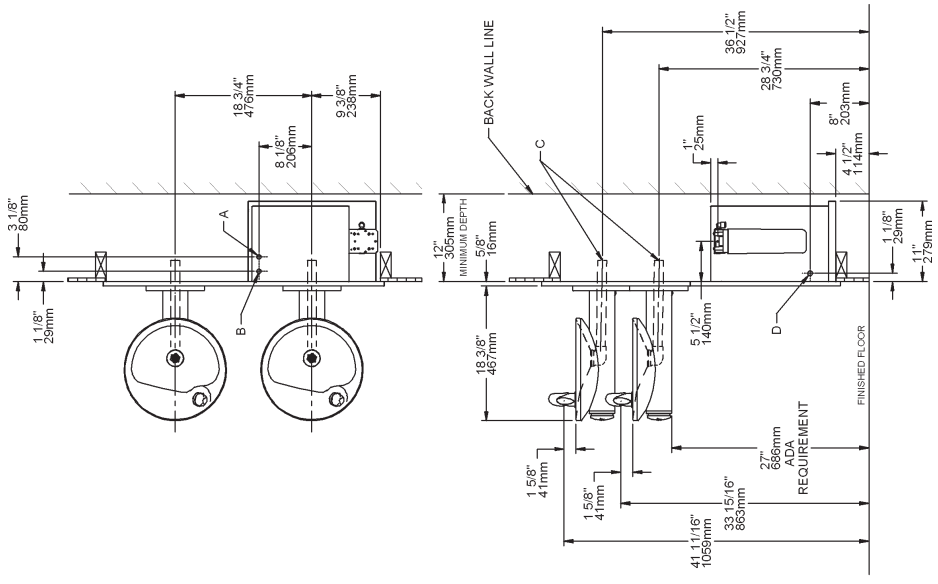


Figure 1 - Rough-in Dimensions

LEGEND
A = 1/4" O.D. Tube - Water Outlet Connection
B = 3/8" O.D. Tube - Water Inlet Connection
C = 1-1/4" Waste Tube
D = ELECTRICAL INLET

ERPB2-8C, ERPB2-8RAC, ERPBV2-8C, ERPBV2-8RAC, LRPB2-8C, LRPB2-8RAC, ERPB2-8C*2C, ERPB2-8C*3C
ERPB2-8GRNC*A, ERPB2-8GRNRAC*A, LRPB2-8GRNC*A, LRPB2-8GRNRAC*A

Note: Danger! Electric shock hazard. Disconnect power before servicing unit.

Uses HFC-134A refrigerant

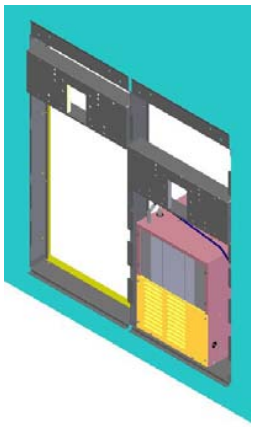


Figure 2 - Chiller Installation

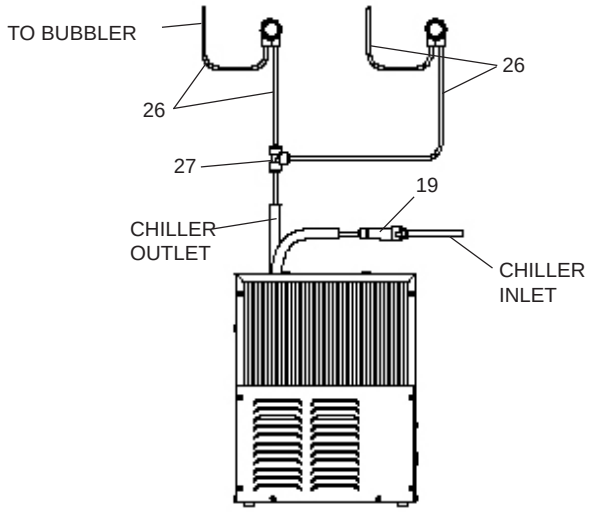


Figure 3 - ERPB Tube Routing

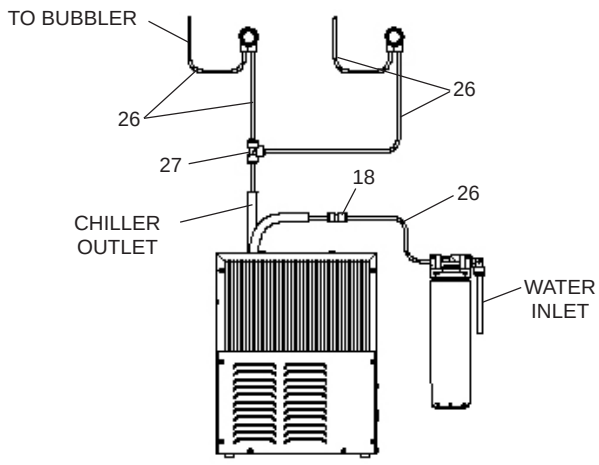


Figure 4 - LRPB Tube Routing

REQUIRED TOOLS AND MATERIALS

These tables show special tools and/or additional materials (not provided) which are necessary to complete installation of these units:

Special Tools

Item	Description	Quantity
	NONE	

Additional Materials

Item	Description	Quantity
1	Unplated copper inlet pipe	
2	Service Stop	

1. **Install chiller:** Remove front panel of chiller. **Remove and discard cardboard inner pack from between compressor and side panel.** Slide chiller onto the shelf and position it to the left as per dimensions in Figure 1.

   Note: Building construction must allow for adequate air flow on both sides, top and back of chiller. A minimum of 4" (102mm) on both sides and top is required. See chiller installation for additional instructions.

2. **Make** water supply connections. Install a shut-off valve and union connection to building water supply (valve and union not provided). Turn on water supply and flush the line thoroughly.

3. **ERPB Models:** Make connection between remote chiller and building supply line. Inlet port is marked on the chiller (1/4" O.D. copper tube). Bend the copper tube (provided) at an appropriate length from chiller to opening in frame. Install the in-line strainer (provided with chiller) by pushing it until it reaches a positive stop, approximately 3/4" (19mm) on the marked chiller inlet port. Connect building supply line to strainer. (See Figure 3)

   Caution: DO NOT SOLDER tubes inserted into the strainer as damage to o-rings may result.

4. **LRPB Models:** Mount filter head assembly to side of chiller (See Figure 4). Make connections between filter and building supply line (3/8" O.D. tube not provided). Inlet port is marked on the chiller (1/4" O. D. copper tube). Install a 1/4" x 1/4" union (provided) on the marked chiller inlet port. Insert the 1/4" poly tubing (provided) into the fitting on filter and connect the union to the chiller. (See Figure 4)

   Caution: DO NOT SOLDER tubes inserted into the strainer as damage to o-rings may result.

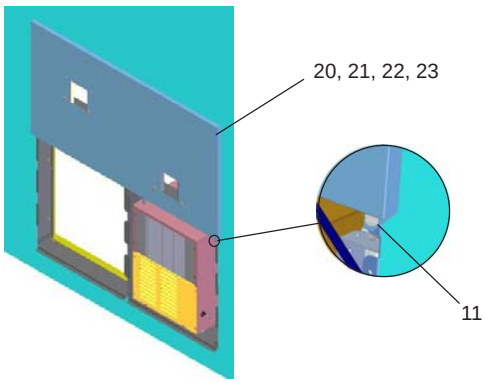
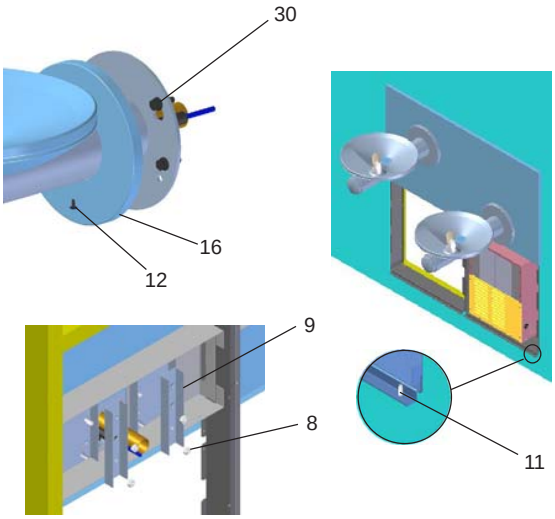


Figure 5 - Upper Panel Installation



View From Rear

Figure 6 - Fountain Installation

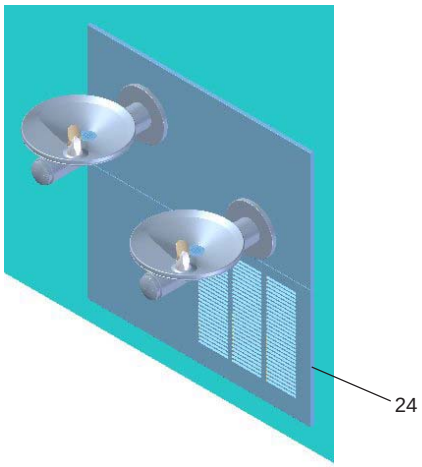


Figure 7 - Lower Panel Installation

5. **Hang** the upper panel on the mounting frame hanger. Be sure that the panel is engaged with hanger at the top of frame before releasing it. Align holes in the panel with holes in the mounting frame. Install two (2) #10-24 x 5/8" (16mm) screws (Item 11 - Figure 5) in holes and tighten securely.

6. **Install** the fountain. Remove the screw (Item 12) from cover plate and slide cover plate (Item 16) toward basin. Mount the fountain to the upper panel and frame with (4) 5/16" x 1" (25mm) bolts (Item 27), brackets (Item 9) and nuts (Item 8) provided. Tighten securely. **Brackets (Item 9) must be installed as shown to properly support fountains.** (See Figure 6)

7. **Attach waste tube** (1-1/4" O.D.) to 1-1/4" O.D. slip trap (provided by others).

8. **ERPB Models:** Make connections between remote chiller outlet tube and fountain. Outlet port is marked on the chiller (1/4" O.D. copper tube). Install a 1/4" x 1/4" tee (provided) on the marked chiller outlet port. Insert the 1/4" poly tubing coming from the fountain into the union. Turn on the water supply and check for leaks.

   CAUTION: DO NOT SOLDER tubes inserted into the strainer as damage to o-rings may result.

   LRPB Models: Make connections between remote chiller outlet tube and fountain. Outlet port is marked on the chiller (1/4" O.D. copper tube). Install a 1/4" x 1/4" tee (provided) on the marked chiller outlet port. Insert the 1/4" poly tubing coming from the fountain into the union.

   CAUTION: DO NOT SOLDER tubes inserted into the strainer as damage to o-rings may result.

9. **These products are designed to operate on 20-105 PSI supply line pressure.** If inlet pressure is above 105 PSI, a pressure regulator must be installed in the supply line.

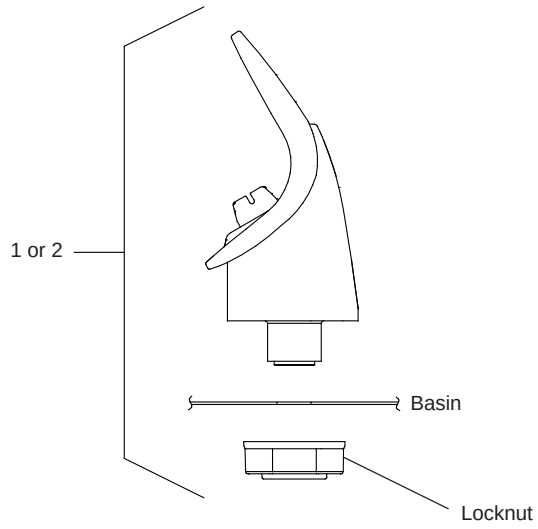
   CAUTION: Any damage caused by connecting these products to a supply line with pressure lower than 20 PSI or higher than 105 PSI IS NOT covered under warranty.

10. **Make electrical connections to the chiller.** See chiller instructions.

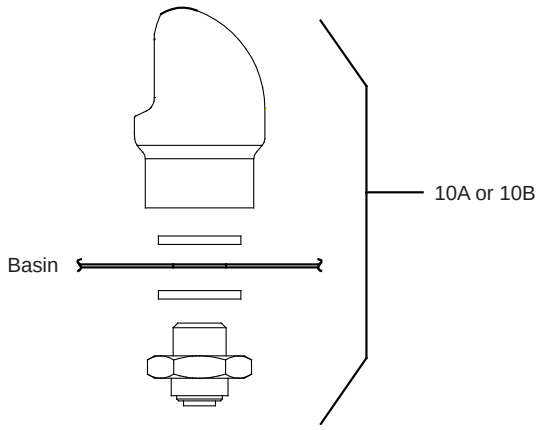
11. **Check stream height from bubbler.** Stream height is factory set at 35 PSI. If supply pressure varies greatly from this, remove push button (Item 3 - Figure 11) and adjust the screw on the regulator (Item 4 - Figure 11). To remove push button, remove set screw from bottom of sleeve (Item 6). Insert a small punch in screw hole and push up while grasping the push button and pull forward removing the push button. Clockwise adjustment will raise stream height and counterclockwise movement will lower stream height. For best adjustment stream should hit basin approximately 6-1/2" from the bubbler. Reassemble push button by pushing in on button until the push button catches in the sleeve. Reinstall the setscrew (Item 6) in the sleeve (Item 17).

12. **Mount lower panel.** Loosen the three (3) #10-24 x 5/8" (16mm) screws (Item 11 - Figure 6) at frame bottom lip. Slide upper tongue of lower panel under lower edge of already installed upper panel. Tighten previously loosened screws securely. (See Figure 7)

ERPB2-8C, ERPB2-8RAC, ERPBV2-8C, ERPBV2-8RAC, LRPB2-8C, LRPB2-8RAC, ERPB2-8C*2C, ERPB2-8C*3C
ERPB2-8GRNC*A, ERPB2-8GRNRAC*A, LRPB2-8GRNC*A, LRPB2-8GRNRAC*A



FLEXI-GUARD® BUBBLER DETAIL or
FLEXI-GUARD® STREAMSAVER™ BUBBLER DETAIL



VANDAL RESISTANT BUBBLER DETAIL or
VANDAL RESISTANT STREAMSAVER BUBBLER DETAIL

NOTE:
When installing replacement bubbler and pedestal, tighten locknut only to hold parts snug in position. Do Not Overtighten.

Figure 8 - Bubbler Details

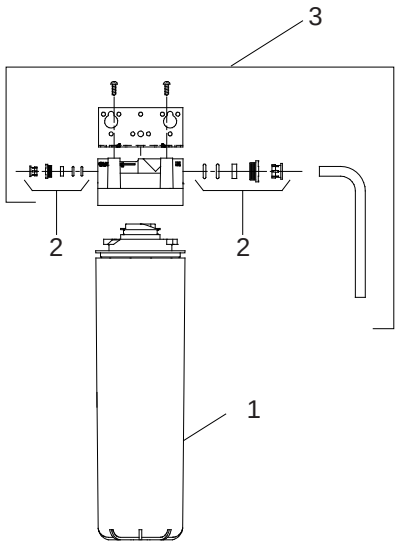


Figure 9 - Filter Assembly
(When provided)

WaterSentry® Filter Detail

WATERSENTRY® FILTER PARTS LIST (See Fig. 9)		
ITEM NO.	PART NO.	DESCRIPTION
1	51299C	Filter Assy - 1500 Gallon
2	98926C	Kit-Filter Head Fitting Includes John Guest Fittings
3	51469C	Assy-Filter Head & Mounting Bracket/John Guest Ftgs/Screws

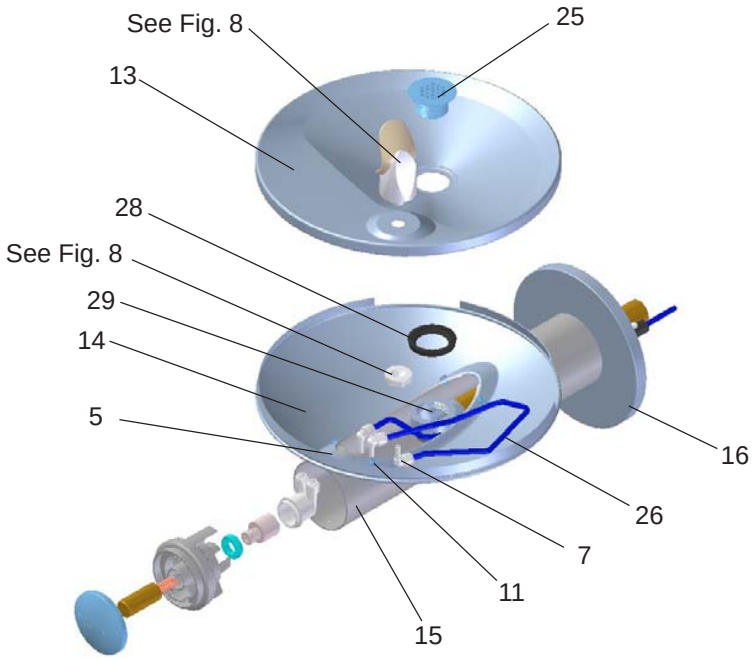


Figure 10 - Fountain Body Assembly

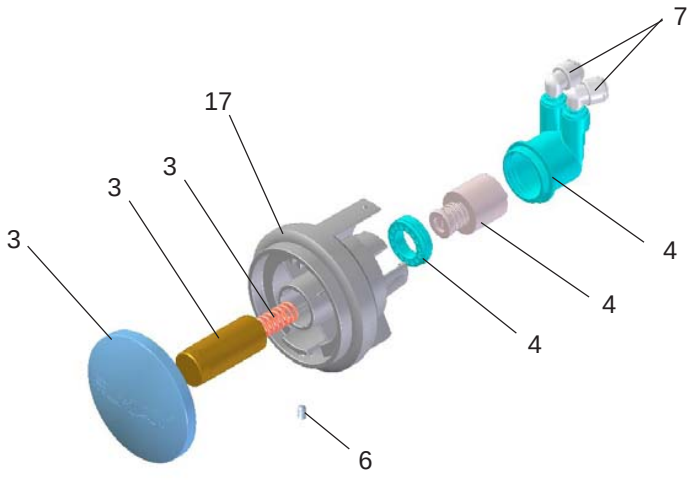


Figure 11 - Push Button Assembly

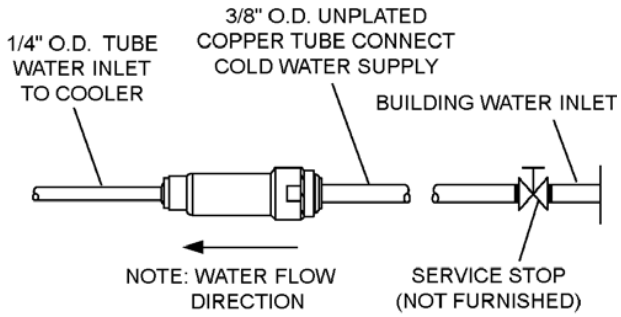


Figure 12 – Water Supply Connections

PARTS LIST		
ITEM NO.	PART NO.	DESCRIPTION
1	56073C	Bubbler Assy
2	98501C	Bubbler Assy (Stream Saver)
3	98871C	Kit - Push Button/Spring/Washer
4	98530C	Kit - Regulator/Holder/Nut
5	38417001	Screw - #8-18 x .37 HHSM
6	75632C	Setscrew - #10-32 x .38
7	70817C	Fttng - Elbow 1/4 x 1/4
8	70020C	Nut - Hex 5/16-18
9	28395C	Bracket - Support
10A	97446C	Bubbler Assembly VR
10B	98481C	Bubbler Assy. VR StreamSaver
11	111008343890	Screw - #10-24 x .62 HHSM
12	70432C	Screw - #8-32 x .38 THSM
13	28708C	Basin - Swirlflow
14	28473C	Lower Shell
15	45767C	Fountain Body
16	28343C	Cover Plate
17	45781C	Sleeve
18	1000002162	Kit - Union 1/4" x 1/4" (3 Pack)
19	55996C	Strainer (Provided with Chiller)
20	28383C	Back Panel RH ADA
21	28384C	Back Panel LH ADA
22	1000003513	Back Panel RH ADA (Green Spec)
23	1000003514	Back Panel LH ADA (Green Spec)
24	27026C	Lower Panel
25	45768C	Drain - Plug 1-1/2"
26	56092C	Poly Tubing (Cut To Length)
27	1000001994	Kit - Tee - 1/4" (3 Pack)
28	56163C	Gasket - Drain
29	45769C	Assy - Drain/Tailpipe
30	75560C	Screw - 5/16-18 x 1.00 HHMS

Installation Package

The components for installation are packed in three separate boxes, regardless of the type of unit being installed. The boxes contain the following:

Box No. 1: Wall Frame(s)
Box No. 2: Remote Chiller, ECH8
Box No. 3: Fountain Arm and Panels

Additional materials, as noted in the Parts List, are also shipped in these boxes.

TROUBLESHOOTING & MAINTENANCE

Orifice Assembly: Mineral deposits on orifice can cause water flow to spurt or not regulate. Mineral deposits may be removed from the orifice by poking with a small round file not over 1/8" diameter, or using a small diameter wire.

CAUTION: DO NOT file or cut orifice material.

Stream Regulator: If orifice is clean, regulate flow as in Step 11 of the installation instructions. If replacement is necessary, see parts list for correct regulator part number.

Actuation of Quick Connect Water Fittings:
Cooler is provided with lead-free connectors which utilize an o-ring water seal. To remove tubing from the fitting, relieve water pressure, push in on the gray collar while pulling on the tubing. (See Figure 13) To insert tubing, push tube straight into fitting until it reaches a positive stop approximately 3/4").

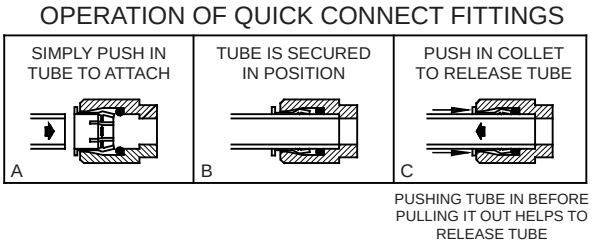


Figure 13 – Quick Connect Fittings

SP-1

SP-1 / SP-1 SUMP PUMP

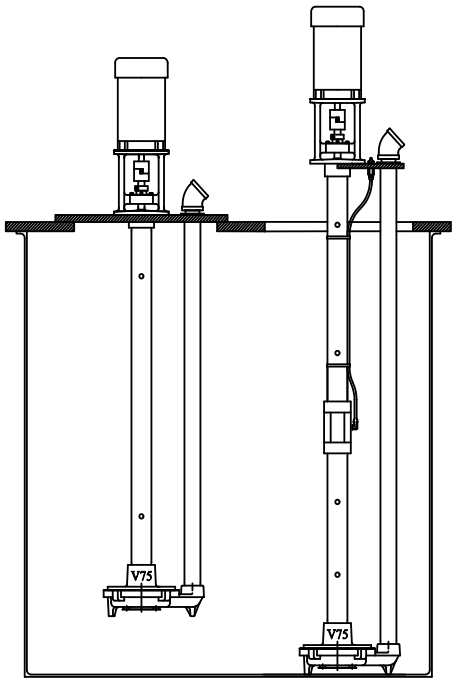
W2224	WEIL	TWO (2) WEIL 2224 VERTICAL 4” WASTEWATER PUMPS. THE PUMPS WILL BE CAPABLE OF HANDLING 2- 1/2” SOLIDS, WILL HAVE A CAPACITY OF 350GPM AT 25TDH, AND WILL BE POWERED BY A 5HP, 1750RPM, TEFC, 460/3 MOTOR.

WEIL VERTICAL WASTEWATER PUMP
INSTALLATION OPERATION MAINTENANCE

1100 1200
1300 2100
2200 4500

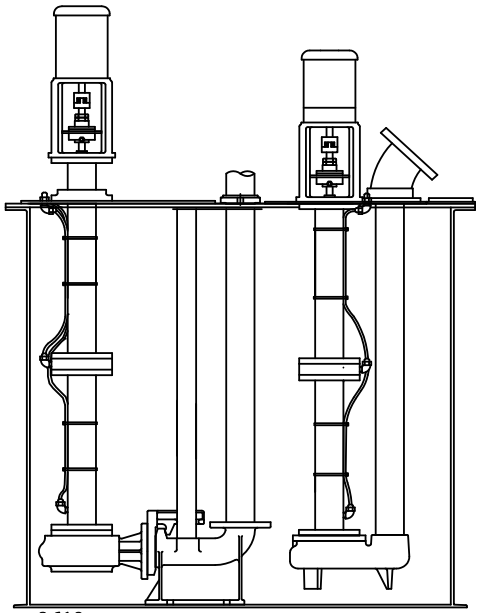
OWNERS INFORMATION

Manufacturer's Number	Date Code



Cover Mount Floor Mount

Manufacturer's Number	Date Code



2613 Removal Mount Cover mount

WEIL VERTICAL WASTEWATER PUMP
INSTALLATION OPERATION MAINTENANCE

INTRODUCTION

This manual contains instruction for installation, operation and maintenance of your vertical wastewater pump. Read and study this manual before using the equipment. The pump is a well designed and sturdily constructed machine. When properly installed and given reasonable care and maintenance, it will give many years of service.

SAFETY PRECAUTIONS

Always disconnect the electrical power supply to the motor before working on the unit. **Failure to do so can cause severe electrical shock or death.** If the floor is wet or flooded, do not walk on floor until the electrical power has been disconnected. Exercise caution when working in the exposed areas of rotating parts.

RECEIVING

Immediately upon arrival, the equipment should be checked for any shortages and/or damage. Any shortages or damage should be noted on the bill of lading and freight bill and promptly reported to the transportation company. Claims for shortages or damage must be made in writing to Weil Pump Company Inc., Cedarburg, Wisconsin within 14 days of receipt of equipment.

STORAGE

Pumping equipment should be installed and put into operation as soon as possible. If it is necessary to store the equipment for extended periods, precautions should be taken to prevent corrosion or oxidation. It is recommended that the equipment be stored indoors. The storage area should be dry and have a relatively constant temperature. Exposed machined surfaces should be coated with a rust preventative. The entire unit should be sealed in heavy plastic bag. A desiccant should be placed in the bag before it is sealed.

During storage, the plastic bag should be opened at least once a month, and the rotating assembly of the pump turned several times by hand. This helps prevent point of contact corrosion and maintains rotational integrity. Add desiccant before the bag is resealed. For additional information regarding rust prevention, refer to the American Society for Metals Handbook, under **"Rust Prevention Compounds."**

INSTALLATION

Clean wet well thoroughly before installing pump. Sand, mud, cinders, etc. are abrasives which will damage the sleeve bearings.

The pump is ready for installation as shipped. Except as noted above, no lubrication or adjustment is required before initial operation.

Raise and lower pump with steel chain or lifting strap connected to the motor pedestal. **Do not use the motor for this purpose.** Set the pump in its final location before installing motor and connecting the electrical power. Provide adequate headroom above the wet well for future maintenance of the pump. Install the associated level controls so that the pump is properly immersed. For **intermittent service**, the minimum liquid level must be at least 1" above the pump case.

MOUNTING MOTOR

(Refer to Figures 1 & 2)

The pump and motor are shipped from the factory with the flexible coupling halves mounted on the pump and motor shafts as shown in figure 1. Before proceeding, make certain that the mounting parts are clean and free of debris and foreign matter.

1. Place the rubber spider between the jaws on the pump coupling half.
2. Set the motor in place on the motor pedestal, ensuring that the motor coupling jaws line up with the slots in the rubber spider. Be sure that the motor male register fits properly into the motor pedestal female register and that the fastening holes are aligned. Bolt the motor to motor pedestal.

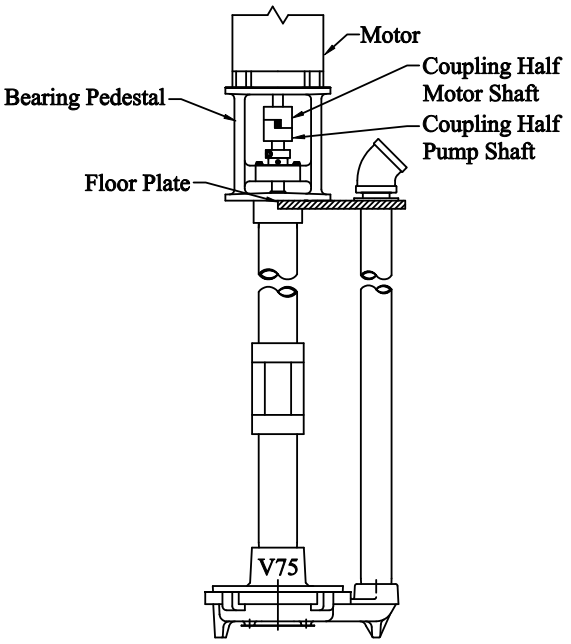


Figure 1

3. Position the coupling bodies equal distance ontheir respective shafts, leaving 1/16" between each jaw and the body.
4. Check for angular and parallel coupling alignment at 2 points, 90° apart as shown in Figure 2. If misalignment occurs, reposition motor as required.

WARNING

UNDER NO CIRCUMSTANCES SHOULD THE EQUIPMENT BE OPERATED WITH MISALIGNMENT. DAMAGE MAY RESULT TO THE MOTOR AND PUMP BEARINGS. DOING SO WILL VOID THE WARRANTY.

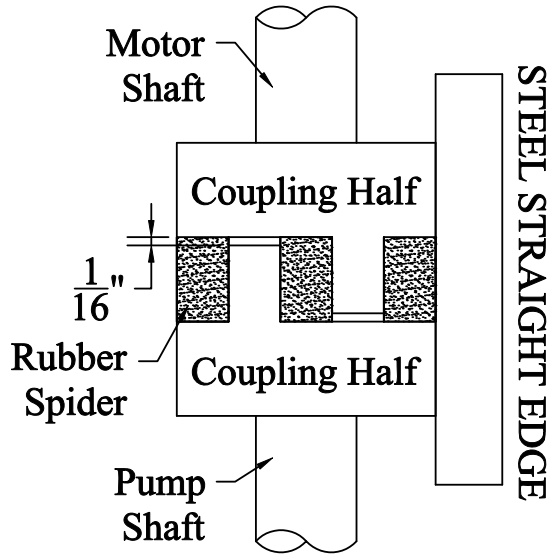


Figure 2

PIPING

(Refer to Figure 1)

1. Piping should be as short as possible using a minimum number of fittings to avoid excessive friction loss.
2. Pipes should line up "naturally" with the pump discharge and should never be forced together.
3. Discharge piping must be supported by appropriate supports.
4. In a duplex installation, each pump must have its own check valve.

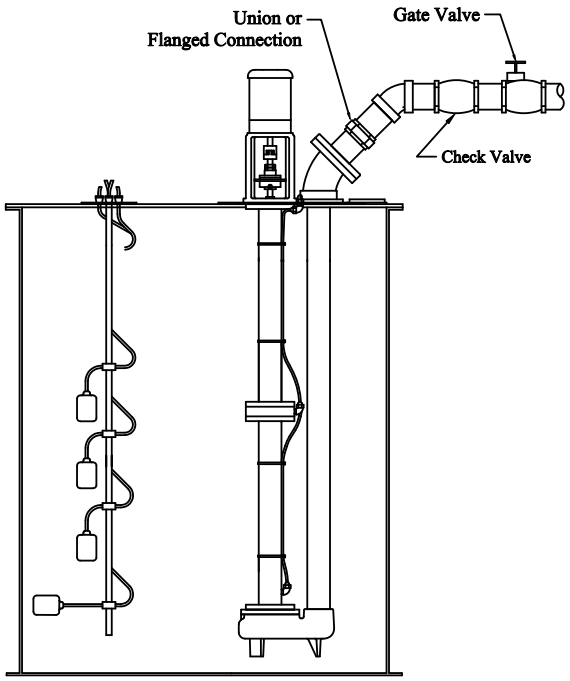


Figure 3

CAUTION

Piping not properly aligned and supported can cause the shaft to bind, resulting in bearing wear, vibration and can cause damage to the impeller and casing.

After piping is completed, turn shaft by hand to check that shaft turns freely. If shaft binds, recheck coupling alignment and piping connections.

START-UP PROCEDURE

Before placing pump into general operation, check the following items to insure that no damage will occur to pump motor.

1. Turn shaft manually to ensure it is turning freely.
2. Check voltage, phase, and frequency of the motor, making sure that the same is supplied to unit.
3. Make sure there is proper motor circuit protection.
4. Review piping installation, per "Piping" instructions.
5. Recheck basin to make sure it is free of debris.
6. With pump laying down on its side, apply momentary power to confirm proper impeller rotation.

7. Verify proper operation in a "wet" test startup: check GPM, pressure, amps, volts, audible noise and vibration.
8. Check measured parameters to design conditions.

SAFETY PRECAUTIONS

1. Disconnect and lockout the electrical supply to the motor before working on the unit, or if maintenance is to be performed on the pump in a flooded area.
2. Exercise caution when working in the exposed areas of the rotating parts.
3. In case of severe vibration or unusual noise, shut off pump at once and determine the cause.
4. If frequent tripping of the overload protection occurs, troubleshoot the pump to correct the problem.

TROUBLESHOOTING PUMP

Problem	Probable Cause
Insufficient or No Water Flow	1. Blown fuses or open circuit breakers 2. Poor switch contact 3. Discharge head too high 4. Clogged or damaged impeller 5. Binding shaft 6. Check or gate valve closed 7. Water level below casing
Insufficient Pressure	1. Low voltage 2. Clogged or damaged impeller 3. Motor incorrectly wired 4. Pump may be air-bound
Noisy or Vibrating Pump	1. Misaligned or bent shaft 2. Worn bearings 3. Lack of lubrication 4. Water level below casing 5. Impeller rubbing or damaged 6. Clogged impeller

LUBRICATION

Proper pump lubrication is a primary factor in satisfactory pump operation. Follow lubrication instructions carefully.
The sleeve bearings are lubricated by means of alemite grease fittings. These bearings should be serviced once per month or as needed, depending on operational conditions.
The motor has sealed bearings and requires no lubrication unless otherwise specified on the nameplate.

Recommended Lubricants - The use of a high grade multipurpose lithium No. 1 or a calcium complex No.1 soap grease is recommended. Both greases mentioned have excellent water resistant qualities, and have good mechanical and chemical stability.

PERIODIC INSPECTION

Periodic inspection of the pump should be performed at six month intervals. The pump should be cleaned of accumulated abrasive particles and debris. The wet well should also be cleaned of accumulated abrasive particles.

Check the motor housing and the seal chamber for moisture in the following manner:

1. Loosen set screws in pump or motor couplings.
2. Check voltage, phase, and frequency of the motor, making sure that the same is supplied to the unit.

Also check the following items:

1. See that the motor comes up to speed and maintains a constant rotation rate.
2. If pump has been idle for a long time, momentarily actuate motor manually to insure pump is running satisfactorily.
3. Wipe off any moisture, dirt or oil from motor and switch.
4. See that pump empties basin to predetermined level.

IMPORTANT NOTICE
For warranty consideration contact your local Weil representative before disassembly or repair.

NOTE
See separate instructions for pump assembly and disassembly.

WEIL Vertical Wastewater Pump

1371 2219
1373 2223
1374 2224

INSTALLATION
OPERATION
MAINTENANCE
PARTS BREAKDOWN

KEY NO.		DESCRIPTION
1		Case
1B	●	Sleeve Bearing (2 pc)
2		Impeller
4		Motor
4A		Key, Motor Shaft
6		Shaft
9		Suction Cover
10A		Coupling Guard
11	●	Stuffing Box Cover
13	●	Square Packing
17	●	Packing Gland
18	●	Ball Bearing
18A	●	Ball Bearing Thrust Assy. (See Fig. 1)
24	●	Impeller Locknut
24L	●	Lock Washer
32	●	Key, Impeller
42		Coupling Half, Motor Shaft
42A		Spider Coupling
44		Coupling Half, Pump Shaft
46	●	Key, Pump Shaft Coupling
47	●	Lip Seal
66	●	Locking Nut
71		Lower Bearing Pedastal
71B	●	Sleeve Bearing
72A	●	Thrust Collar
81		Bearing Pedestal
81A		Motor Pedestal
100		Floor Plate
101		Pump Leg
102		Discharge Pipe
105		Discharge Elbow
105B		Weil Oval Gasket
193*		Intermediate Bearing Housing
193B*		Sleeve Bearing
209		Strainer (1300 Model's Only)
230		Case Discharge Flange
230A		O-Ring, Case Disch. Flange
L*		Grease Line Kit

* Only when required

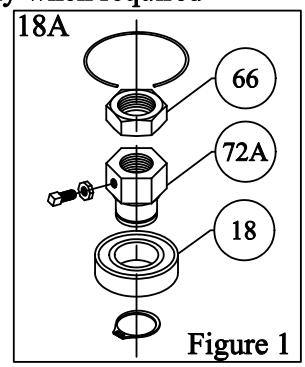
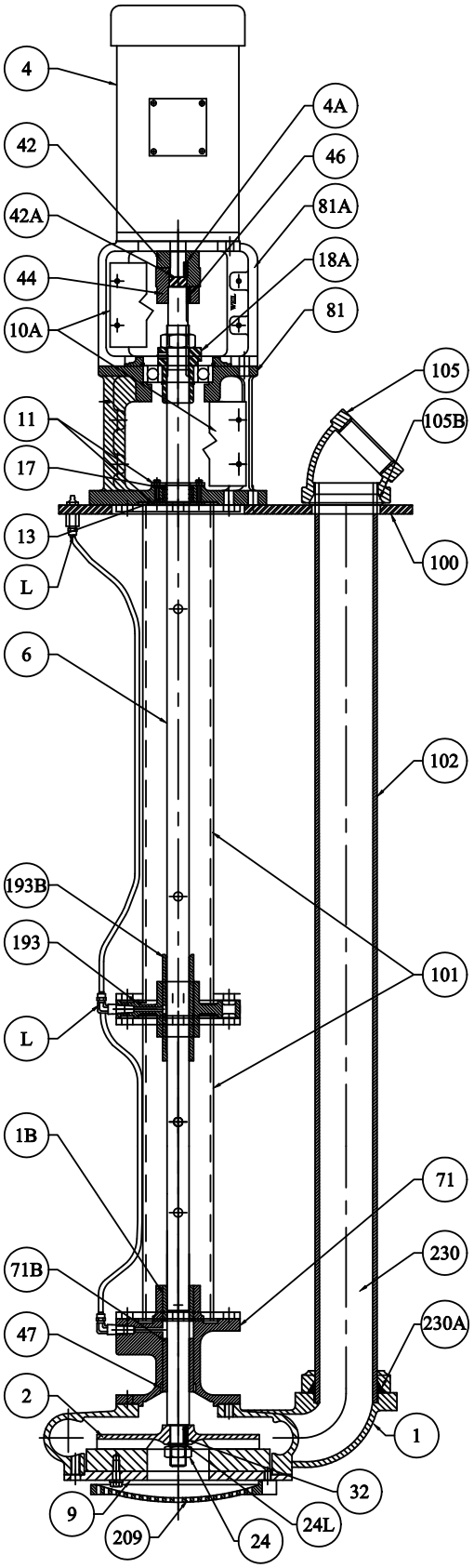


Figure 1



Items marked with (●) are included in repair kit 201.396.101 for standard construction pumps.

EM-1371-1

KF

Impeller Adjustment

The impeller has been adjusted at the factory to provide a 0.040" to 0.060" clearance between it and the case. Do not change this clearance unless rubbing takes place or a drop in pump performance is observed. To make adjustments, proceed as follows:

1. Remove coupling guard.
2. Hold thrust collar (72A) stationary while loosening locking nut (66).
3. Loosen set screw in thrust collar and in lower half of coupling (44).
4. While holding the shaft (6) stationary with the coupling, turn the thrust collar clockwise to raise and counter clockwise to lower the rotating assembly. One quarter turn equals approximately 0.020". One of the set screw holes in the thrust collar must line up with the slot in the shaft.
5. Tighten set screw in thrust collar and in lower coupling half (44) when proper clearance has been set.
6. Rotate shaft by hand after tightening set screws to make sure that rotating parts are running free.
7. Tighten locking nut while holding thrust collar stationary.
8. Reinstall coupling guard.

Disassembly

Disassemble only what is required for inspection or maintenance of pump. When ordering replacement parts, give the Weil representative in your area the pump model number and the manufactures number found under "OWNER'S INFORMATION" on page 1 of this manual or on the pump name plate. To disassemble, proceed as follows:

1. Pump down liquid level in basin and close gate valve in discharge line of pump.
2. Disconnect and lockout electrical supply to motor.

Caution
Make certain that electrical power supply cannot be accidentally turned on while pump is being serviced.

3. Remove coupling guard.
4. Remove motor (4) but do not remove motor half coupling (42). Remove spider coupling (42A). Loosen set screws in pump half of coupling (44) and remove coupling and key (46).
5. Disconnect piping at flange nearest to pump discharge elbow (105).
6. Remove floor plate mounting screws and lift pump out of basin. Lay pump across saw horses or similar support to facilitate dismantling.
7. Loosen and remove lubrication tubing (L) from case (1) and intermediate bearing housing(s) (193). DO NOT disconnect tubing at upper fitting or remove cable tie. If pump has intermediate bearings, mark legs (101) at intermediate bearing housing to assure proper alignment of lubrication lines (L) during re-assembly.
8. Remove locking nut (66) (this thread is right hand) and snap ring holding ball bearing (18). Loosen set screw and remove thrust collar and ball bearing.
9. Remove screws holding suction cover (9) to case (1).
10. Remove shaft (6) and impeller (2) from bottom of pump.
11. Remove impeller locknut (24). Place a wooden block on back shroud of impeller and tap gently until impeller is free.

Important
Protect threads if shaft is to be reused. Also file off all burrs on shaft made by set screws.

12. Remove screws holding case to lower leg.
13. Remove Packing Gland (17) and Packing (13).
14. If pump has intermediate bearing housing, remove screws and disassemble lower bearing housing.
15. Press sleeve bearing (193B) out of intermediate bearing housing. Press sleeve bearing (1B) out of case.

Reassembly

Reverse the above procedure with the following additions:

1. Flush out bearing bore with an EPA approved degreaser removing old grease and any abrasives.
2. Be certain that all parts that have been removed are clean and that all burrs are removed.
3. Replace O-rings (47).
4. Assemble sleeve bearings as follows:
   a. Thoroughly clean bores of bearing housings (71) & (193). Avoid abrasives.
   b. Remove all burrs from bearing bores and registers for tongue and groove connections.
   c. Press sleeve bearings (71B) & (193B) into their respective housings (71) & (193). Lubrication grooves must face up and holes in sleeve bearings must line up with lubrication holes in intermediate bearing housing (193) and lower bearing housing (71).
5. When assembly is complete, rotate shaft (6) manually to check for binding and check impeller to suction cover clearance. If adjustment is needed, refer to paragraph entitled "IMPELLER ADJUSTMENT".
6. Locate all grease fittings and lubricate per lubrication paragraph before placing pump into service.

Note
See separate Vertical Sump Pump instructions for general Installation Operation and Maintenance.

ESP-1 / ESP-2 ELEVATOR SUMP PUMP

W1411OSS	WEIL	ONE (1) WEIL 1411-OSS ELEVATOR PUMP SYSTEM. THE SYSTEM WILL CONSIST OF A 2” SUBMERSIBLE PUMP, ON/OFF PUMP SWITCH, AND ALARM SYSTEM. THE PUMP WILL BE POWERED BY A 1/2HP, 1750RPM, 115/1 MOTOR WITH 15’ 3 CONDUCTOR CABLE AND A GROUNDED PLUG.

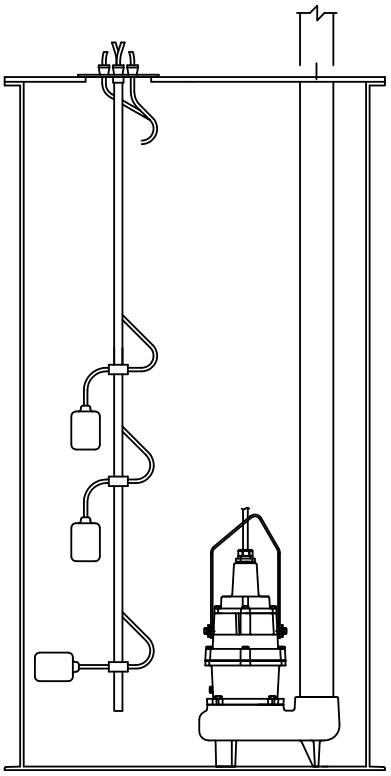
WEIL

SUBMERSIBLE WASTEWATER PUMP
INSTALLATION OPERATION MAINTENANCE

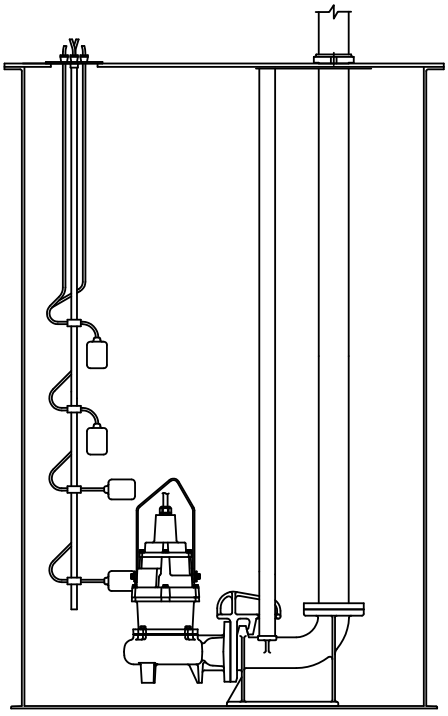
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OWNERS INFORMATION

Manufacturer's Number	Date Code



Manufacturer's Number	Date Code



IOM JACKET (SINGLE SEAL)-A

WEIL SUBMERSIBLE WASTEWATER PUMP
INSTALLATION OPERATION MAINTENANCE

INTRODUCTION

This manual contains instruction for installation, operation and maintenance of your pump equipment. Read and study this manual before using the equipment. The pump is a well designed and sturdily constructed machine. When properly installed and given reasonable care and maintenance, it will give many years of service.

SAFETY PRECAUTIONS

Always disconnect the electrical power supply to the motor before working on the unit. **Failure to do so can cause severe electrical shock or death.** If the basement floor is wet or flooded, do not walk on floor until the electrical power has been disconnected. Exercise caution when working in the exposed areas of rotating parts.

RECEIVING

Immediately upon arrival, the equipment should be checked for any shortages and/or damage. Any shortages or damage should be noted on the bill of lading and freight bill, and promptly reported to the Transportation Company. Claims for shortages or damage must be made in writing to Weil Pump Company Inc., Cedarburg, Wisconsin within 14 days of receipt of equipment.

STORAGE

Pumping equipment should be installed and put into operation as soon as possible. If it is necessary to store the equipment for extended periods, precautions should be taken to prevent corrosion or oxidation. It is recommended that the equipment be stored indoors. The storage area should be dry and have a relatively constant temperature. Exposed machined surfaces should be coated with a rust preventative. The entire unit should be sealed in heavy plastic bag. A desiccant should be placed in the bag before it is sealed. Before sealing the bag, arrange the power cable, and moisture/temperature sensor cable, (if so equipped) in gently curved loops to prevent cables from taking a permanent set.

During storage, the plastic bag should be opened at least once a month, and the rotating assembly of the pump turned several times by hand. This helps prevent point of contact corrosion and maintains rotational integrity. Add desiccant before the bag is resealed. For additional information regarding rust prevention, refer to the American Society for Metals Handbook, under **"Rust Prevention Compounds."**

INSTALLATION

Clean wet well thoroughly before installing pump. Sand, mud, cinders, etc. are abrasives which will damage the mechanical seals.

The pump is ready for installation as shipped. Except as noted above, no lubrication or adjustment is required before initial operation.

Raise and lower the unit by means of a chain or steel cable fastened to the lifting handle provided. **Do not raise, lower, or support the unit by means of the electrical power cable or the moisture sensor cable.** When moving the pump, avoid putting strain on the electrical cables. Set the pump in its final location before connecting the cable(s). Provide adequate headroom above the wet well for future maintenance of the equipment. Install the associated level controls so that the pump is properly immersed. for **intermittent service**, the minimum liquid level must be at least 1" above the pump case.

POWER CABLE

The electrical characteristics shown on the pump nameplate describes the power supply required to operate the pump motor. The user is responsible for providing appropriate branch circuit, motor starter, and overload protection in accordance with local code requirements.

Electrical connections made in the pit, even though above the highest water level, must be sealed to prevent moisture penetration into power or sensor cables through junction boxes or other. Wiring diagrams for the pump motor are provided. It is important to make connections according to the diagram provided. Incorrect electrical connections will void the warranty.

PIPING

(Refer to Figure 1)

1. Piping should be as short as possible using a minimum number of fittings to avoid excessive friction loss.
2. Pipes should line up "naturally" with the pump discharge and should never be forced together.
3. Discharge piping must be supported by appropriate supports.
4. In a duplex installation, each pump must have its own check valve.

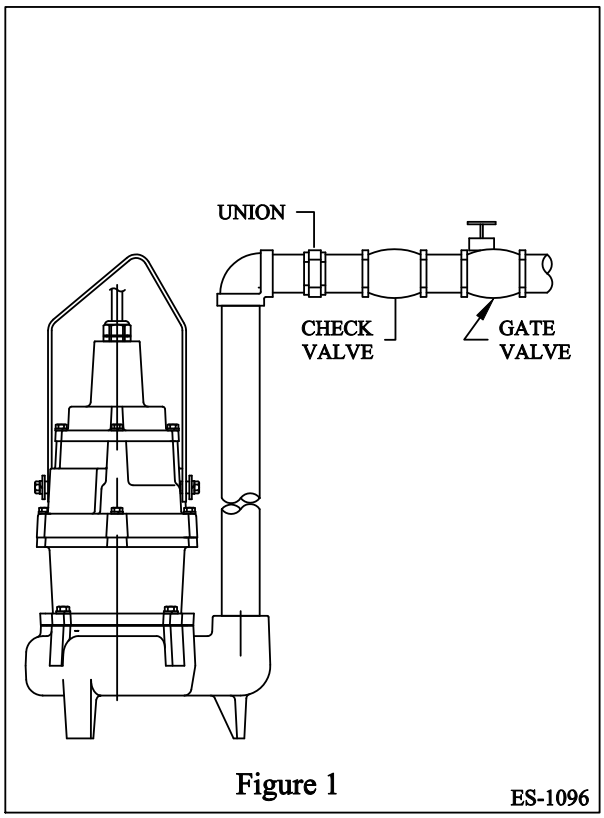


Figure 1

ES-1096

MOISTURE SENSOR OPTION

(Refer to Figure 2)

The pump is equipped with a moisture sensor when this option is ordered. Connect the moisture sensor to the Weil Alarm-Test Panel as shown in Figure 2. Power supplied to the Alarm-Test Panel must be 115 volts, regardless of the voltage supplied to the pump motor.

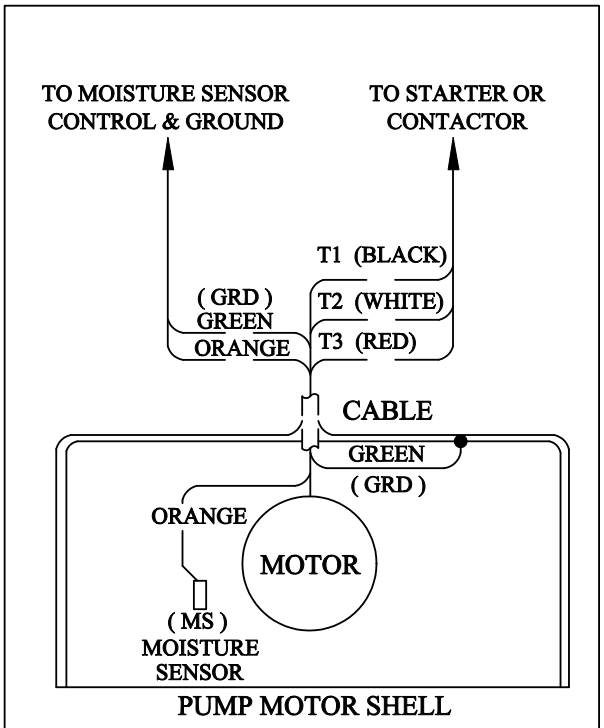


Figure 2

START-UP PROCEDURE

Before placing pump into general operation, check the following items to insure that no damage will occur to pump motor.

1. Turn shaft manually to ensure it is turning freely.
2. Check voltage, phase, and frequency of the motor, making sure that the same is supplied to unit.
3. Make sure there is proper motor circuit protection.
4. Review piping installation, per "Piping" instructions.
5. Recheck basin to make sure it is free of debris.
6. With pump laying down on its side, apply momentary power to confirm proper impeller rotation.
7. Verify proper operation in a "wet" test startup: check GPM, Pressure, amps, volts, audible noise and vibration.
8. Check measured parameters to design conditions.

SAFETY PRECAUTIONS

1. Disconnect and lockout the electrical supply to the motor before working on the unit, or if maintenance is to be performed on the pump in a flooded area.
2. Exercise caution when working in the exposed areas of the rotating parts.
3. In case of severe vibration or unusual noise, shut off pump at once and determine the case.
4. If frequent tripping of the overload protection occurs, troubleshoot the pump to correct the problem.

TROUBLESHOOTING PUMP

Problem	Probable Cause
Insufficient or No Water Flow	1. Blown fuses or open circuit breakers 2. Poor switch contact 3. Discharge head too high 4. Clogged or damaged impeller 5. Binding shaft 6. Check or gate valve closed 7. Water level below casing
Insufficient pressure	1. Low voltage 2. Clogged or damaged impeller 3. Motor incorrectly wired 4. Pump maybe air-bound
Noisy or Vibrating Pump	1. Misaligned or bent shaft 2. Worn bearings 3. Lack of lubrication 4. Water level below casing 5. Impeller rubbing or damaged 6. Clogged impeller

NOTE

Submersible motors have an air relief slot on the lower mounting flange area. This slot is to prevent air lock. Under normal operation water will spray out of the air relief slot. The normal water level should be above the slot at shut off.

PERIODIC INSPECTION

Periodic inspection of the pump should be performed at six month intervals. The pump should be cleaned of accumulated abrasive particles and debris. The wet well should also be cleaned of accumulated abrasive particles.

Check the motor housing and the seal chamber for moisture in the following manner:

1. Place the pump in a horizontal position in a V-block with the seal chamber plugs facing downward.
2. Remove the plugs and drain the contents of the seal chamber in a transparent container and allow the drained liquid to settle.
3. If no water settles to the bottom of the container, the chamber can be refilled with clean oil and the plugs replaced.
4. If water settles in the container, the source of the liquid must be determined and worn and/or damaged seals, O-rings, etc., must be replaced.
5. Turn the pump over, remove the motor shell plug, drain the motor housing into a transparent container.
6. If no liquid is present, replace the plug.
7. If oil or oil and water are present, the upper seal must be inspected.
8. If only water is present the leakage source is most likely in the motor housing and the condition of the O-rings should be inspected.

REPLACEMENT PUMPS

Single phase units have starting modules built into the motor. When replacing existing pumps, check for any existing external modules, control panel mounted or separately mounted. These must be removed or bypassed for proper operation of the pumping unit.

IMPORTANT NOTICE

For warranty consideration contact your local Weil representative before disassembly or repair.

NOTE

See seperate instructions for pump assembly and disassembly.

FERGUSON ENTERPRISES, INC.®

SP-3

W1411	WEIL	WEIL SUMP PUMP SYSTEM

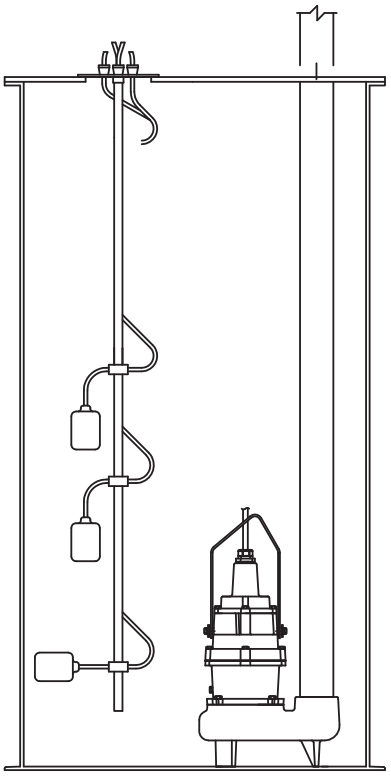
WEIL SUBMERSIBLE WASTEWATER PUMP
INSTALLATION OPERATION MAINTENANCE

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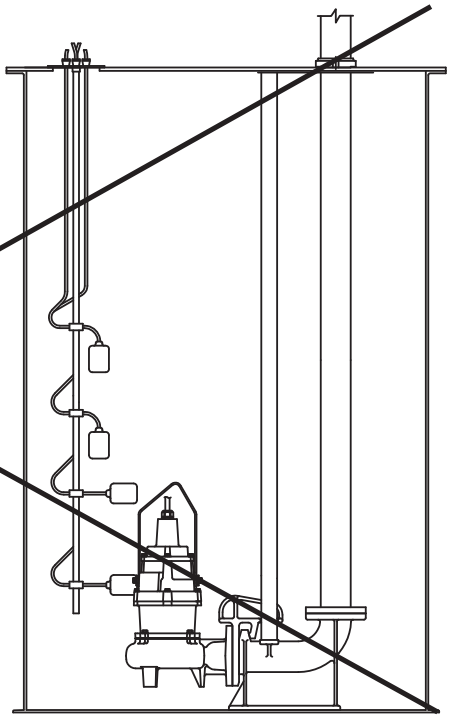
OWNERS INFORMATION

Manufacturer's Number	Date Code
SO#TBD- equipment not ordered yet	TBD

2- Weil model # 1411 submersible sump pump, 2" npt discharge, 1/2 HP, 115v, 15' power cord.
1- Weil model #8131 duplex alternating control panel, with high water alarm circuit.
4- #8233 tethered float switch with 20' cord, mounting bracket and pole.
1- 36" dia. x 72" deep fiberglass basin.
1- 40" OD steel lid with appropriate openings.



Manufacturer's Number	Date Code



FOR SUBMITTAL PURPOSES ONLY.
EQUIPMENT NOT YET ORDERED.

IOM JACKET (SINGLE SEAL)-A

WEIL SUBMERSIBLE WASTEWATER PUMP
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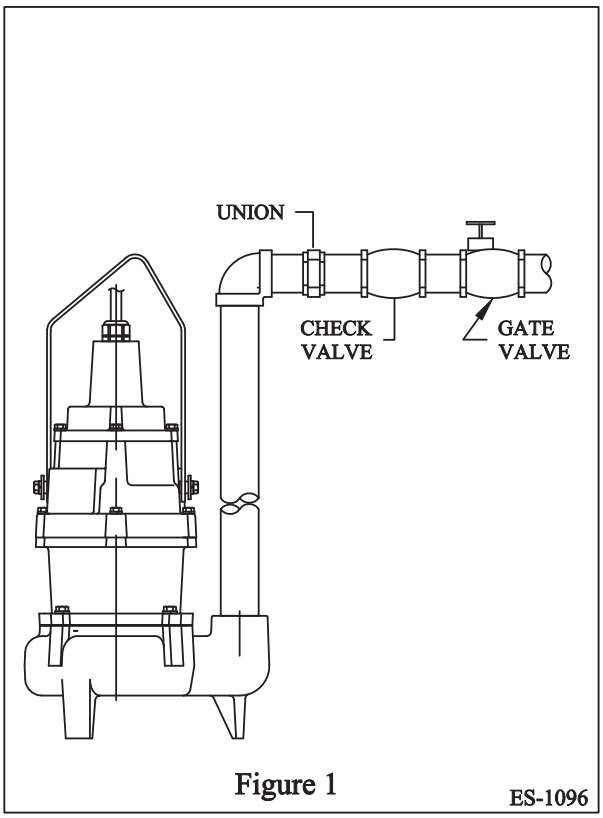


Figure 1

ES-1096

MOISTURE SENSOR OPTION

(Refer to Figure 2)

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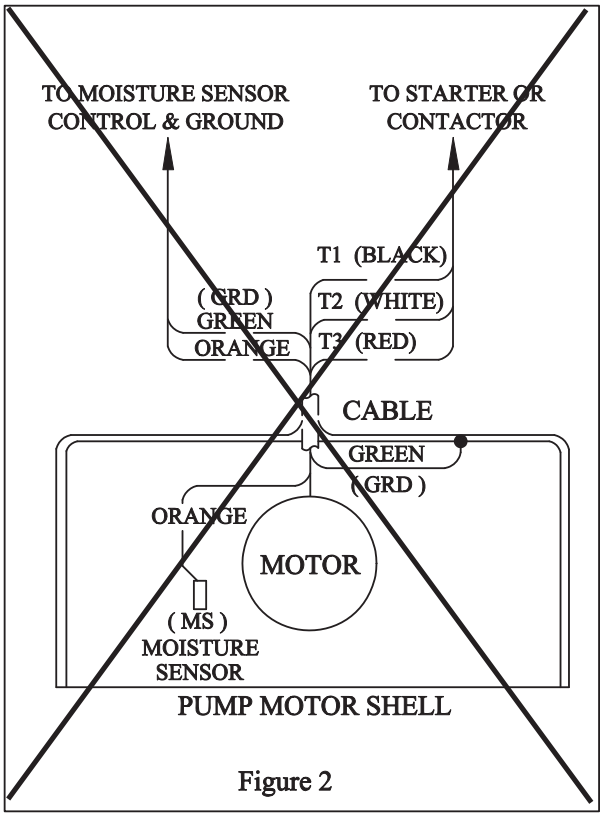


Figure 2

START-UP PROCEDURE

Before placing pump into general operation, check the following items to insure that no damage will occur to pump motor.

1. Turn shaft manually to ensure it is turning freely.
2. Check voltage, phase, and frequency of the motor, making sure that the same is supplied to unit.
3. Make sure there is proper motor circuit protection.
4. Review piping installation, per "Piping" instructions.
5. Recheck basin to make sure it is free of debris.
6. With pump laying down on its side, apply momentary power to confirm proper impeller rotation.
7. Verify proper operation in a "wet" test startup: check GPM, Pressure, amps, volts, audible noise and vibration.
8. Check measured parameters to design conditions.

FOR SUBMITTAL PURPOSES ONLY.
EQUIPMENT NOT YET ORDERED.

SAFETY PRECAUTIONS

1. Disconnect and lockout the electrical supply to the motor before working on the unit, or if maintenance is to be performed on the pump in a flooded area.
2. Exercise caution when working in the exposed areas of the rotating parts.
3. In case of severe vibration or unusual noise, shut off pump at once and determine the case.
4. If frequent tripping of the overload protection occurs, troubleshoot the pump to correct the problem.

TROUBLESHOOTING PUMP

Problem	Probable Cause
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NOTE

Submersible motors have an air relief slot on the lower mounting flange area. This slot is to prevent air lock. Under normal operation water will spray out of the air relief slot. The normal water level should be above the slot at shut off.

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Periodic inspection of the pump should be performed at six month intervals. The pump should be cleaned of accumulated abrasive particles and debris. The wet well should also be cleaned of accumulated abrasive particles.

Check the motor housing and the seal chamber for moisture in the following manner:

1. Place the pump in a horizontal position in a V-block with the seal chamber plugs facing downward.
2. Remove the plugs and drain the contents of the seal chamber in a transparent container and allow the drained liquid to settle.
3. If no water settles to the bottom of the container, the chamber can be refilled with clean oil and the plugs replaced.
4. If water settles in the container, the source of the liquid must be determined and worn and/or damaged seals, O-rings, etc., must be replaced.
5. Turn the pump over, remove the motor shell plug, drain the motor housing into a transparent container.
6. If no liquid is present, replace the plug.
7. If oil or oil and water are present, the upper seal must be inspected.
8. If only water is present the leakage source is most likely in the motor housing and the condition of the O-rings should be inspected.

REPLACEMENT PUMPS

Single phase units have starting modules built into the motor. When replacing existing pumps, check for any existing external modules, control panel mounted or separately mounted. These must be removed or bypassed for proper operation of the pumping unit.

IMPORTANT NOTICE

For warranty consideration contact your local Weil representative before disassembly or repair.

NOTE

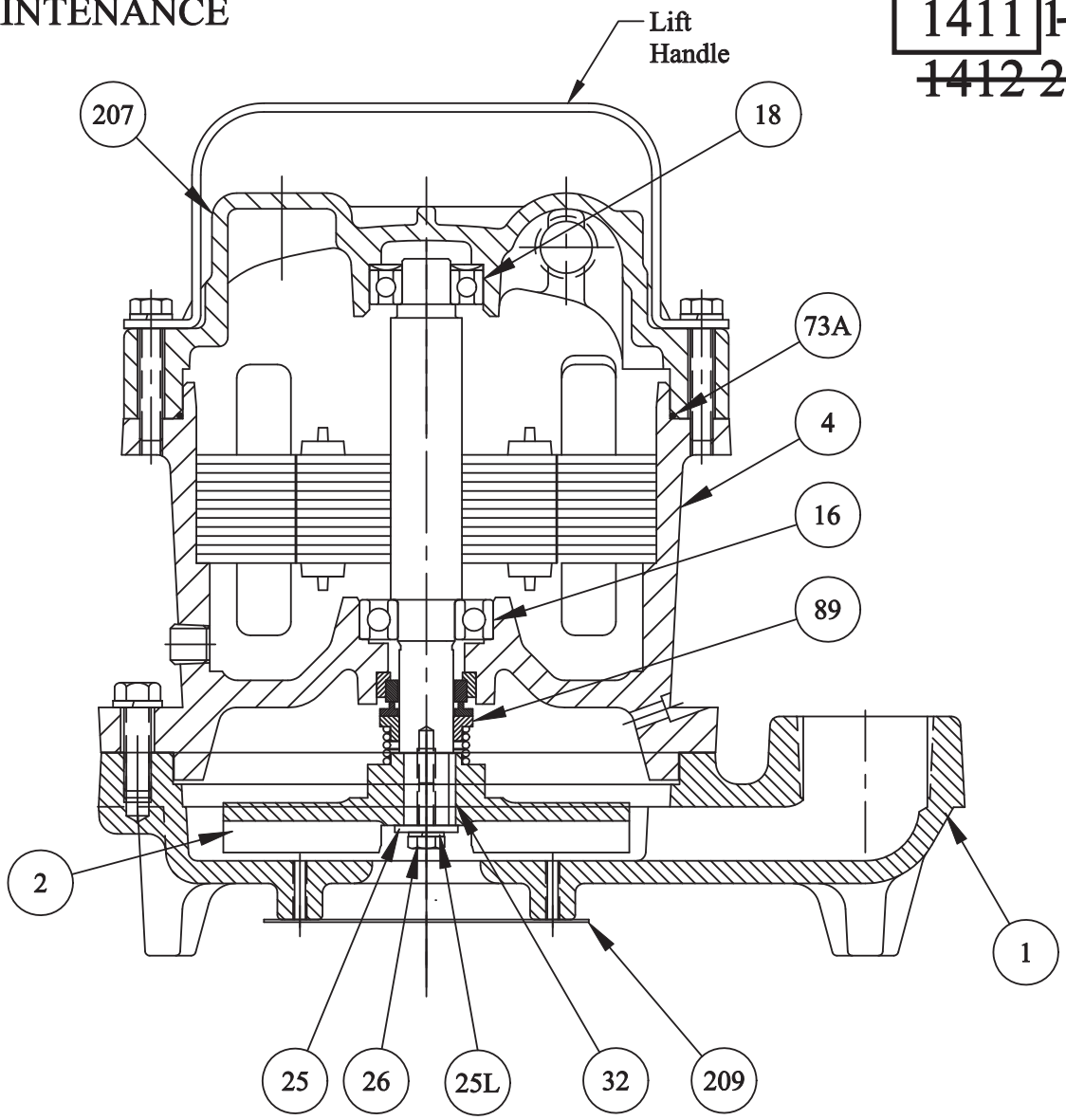
See seperate instructions for pump assembly and disassembly.

FOR SUBMITTAL PURPOSES ONLY.
EQUIPMENT NOT YET ORDERED.

WEIL Submersible Wastewater Pump

INSTALLATION
OPERATION
MAINTENANCE

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~~1412 2411~~



PARTS BREAKDOWN

KEY NO.		DESCRIPTION
1		Case
2		Impeller
4		Motor
16	•	Ball Bearing, Lower
18	•	Ball Bearing, Upper
25	•	Washer
25L	•	Lockwasher
26	•	Impeller Retaining Screw
32	•	Impeller Key
73A	•	Gasket, (O-Ring)
89	•	Seal, Lower
207		Motor Cover Assembly
209		Strainer (1400 Models Only)
		Lift Handle

Items marked with (•) are included in repair kit 206.706.001 for pumps with motor W-9724.

FOR SUBMITTAL PURPOSES ONLY.
EQUIPMENT NOT YET ORDERED.

ASSEMBLY AND DISASSEMBLY INSTRUCTIONS

1. Disconnect and lock out the electrical supply to the motor before working on the unit.
2. Lift the pump from the pit with a steel cable or chain attached to the lifting handle at the top of the pump. DO NOT USE THE POWER CABLE FOR THIS PURPOSE.
3. Move the pump to a clean and dry location.

LUBRICATION

The Weil submersible pump is equipped with double sealed prelubricated bearings which require no further lubrication.

CLEANING OR REPLACEMENT OF IMPELLER

1. With the pump standing vertically, remove the screws holding the motor (4) to the case (1).
2. Carefully lift the motor assembly out of the case.
3. Lay the unit on its side in V-blocks with the impeller (2) overhanging.
4. Remove the impeller retaining screw (26) and washer (25) with a socket wrench.
5. Tap the impeller hub with a soft hammer to loosen and pry the impeller off the shaft using opposed pry bars. Set aside the impeller key (32). Do not remove the mechanical seal parts above the impeller.
6. Scrape off any deposits on the impeller and inspect it for any breaks, cracks, or wear.
7. To reassemble the impeller on the shaft, insert the impeller key in its seat and coat exposed areas of shaft with anti-seize compound. Align the impeller keyway with the key and carefully push the impeller onto the shaft, tapping gently with a soft hammer. Be sure that the mechanical seal spring fits over the shoulder on the back of the impeller.
8. When the impeller is seated on the shaft, place washer over the end of the shaft and install and tighten the impeller retaining screw. Rotate the impeller by hand to ensure that it turns freely.
9. Set the motor assembly into the case and insert and tighten the screw.

REPLACEMENT OF MECHANICAL SEAL

1. Disassemble case and remove impeller as described in "CLEANING OR REPLACEMENT OF IMPELLER".
2. Pry the mechanical seal off the shaft with opposed straight bladed screwdrivers. TAKE CARE NOT TO SCORE THE SHAFT.
3. Clean the shaft and the seat for the stationary ring of any adhering particles or deposits before installing the replacement seal.
4. Check the replacement seal to ensure that it is the same type, shaft size and [illegible] the original seal.
5. Apply a thin coating of lubricating oil or glycerin to the stationary ring. TAKE CARE NOT TO MAR OR DAMAGE THE SEAL FACE.
6. Position the stationary ring with its face toward the end of the shaft. Using a seal pusher, gently press the seal ring into its seat until it is fully seated. APPLY EVEN PRESSURE TO SEAL FACE.
7. Install the rotating ring with spring and bellows over the shaft until seal faces touch.
8. Assemble the impeller and case as described under "CLEANING OR REPLACEMENT OF IMPELLER."

DISASSEMBLY - BALL BEARINGS

1. Disassemble case and remove impeller as described in "REPLACEMENT OF IMPELLER".
2. Remove mechanical seal as described in "REPLACEMENT OF MECHANICAL SEAL."
3. Match mark motor cover and motor.
4. Remove motor cover and place it in an upside down position, but do not disconnect any wiring between motor cover and motor. Do not disconnect wiring to stator.
5. Locate wave spring inside bearing bore. Be sure that motor cover is adequately supported to avoid placing undue strain on the wiring.
6. Lift rotor assembly out of motor housing.
7. Using a bearing puller, remove small upper bearing (18), and larger lower bearing (16).

ASSEMBLY - BALL BEARINGS

1. Clean shaft of any dirt and deposits, making sure that it is free of any burrs.
2. Check replacement bearings to ensure that they are the same type and size as the originals.
3. Press on new bearings until seated. APPLY NO FORCE TO OUTER RACE OF EITHER BEARING. PRESS ONLY ON INNER RACE.
4. Insert rotor into motor shell until lower bearing is seated.
5. Place new o-ring into position at top of motor housing and place wave spring into bearing bore using a small dab of grease to hold it in position. Tabs on wave spring must face toward bearing.
6. Align match marks on motor cover and motor and carefully lower motor cover over upper bearing while keeping the wiring to the stator taut.
7. When mating surfaces of motor cover and motor touch, insert and tighten the hex head cap screw.
8. Assemble mechanical seal and impeller as previously described.

NOTE

See separate Submersible Sump Pump sheet for general Installation Operation and Maintenance instructions.

FOR SUBMITTAL PURPOSES ONLY.
EQUIPMENT NOT YET ORDERED.

WEIL CEDA 7/20/2016 7:58 AM H8131-CL11 Custom Layout 1-115- Volts .dwg

Bill Of Material W-8131-CL-11

PANEL NAME
PLATE INCLUDES:
- -System Voltage
- -Motor Amp Range
- -MAX Panel Amps
- -Phase & HZ
- -Enclosure Type

Installer to Supply Disconnect Switch & Branch Circuit & or Overload Protection in accordance with NEC & Local Codes. Fuses (LP-J) or equivalent) For Branch Circuit Protection: 1.15 X Full Load Amps of Mtr 1 + FLA of Mtr 2 + 2 Amps for C.P..

Dotted lines (– – – – –) represent Field Connections.

Wire Colors: Black = Power Green = Ground
Red = Control White = Common (Neutral)
Yellow = Alarm Circuit

Pump should rotate in the direction of the Arrow on the pump case. Change rotation of the pump at the control panel. Interchange wires:
T1 And T2 On M1 For Pump 1.
T1 And T2 On M2 For Pump 2.

Wires are Individually Numbered.

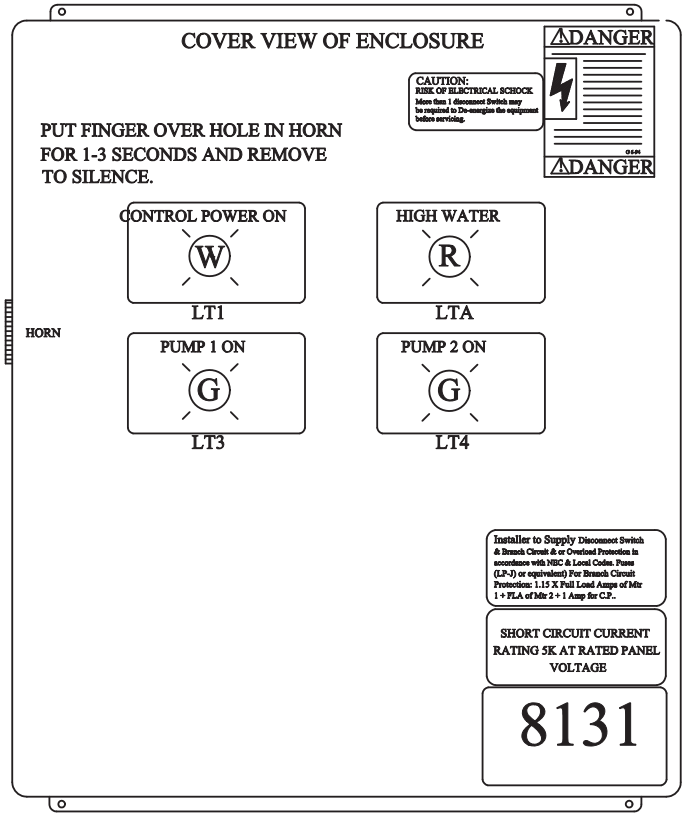
M1 & M2 = Motor Contactors

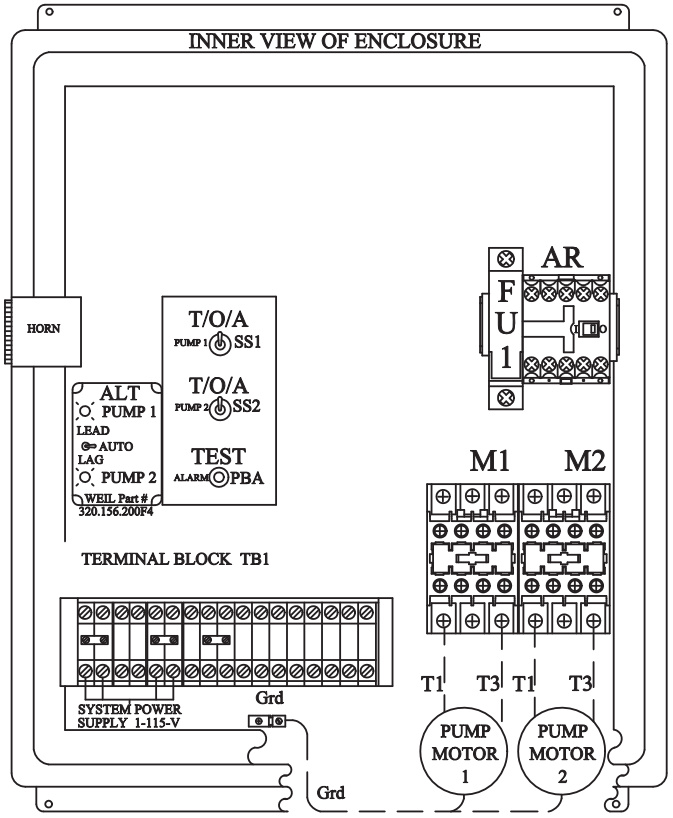
MP1 & MP2 = Motor Circuit Protectors

SS1 &SS2 = Spring Return Test To Off

= Component Coil
= Numbers on Terminal Blocks (TB1 or TB2).
= Numbers on Components.
= Normally Open Contact on Components.
= Normally Closed Contact on Components.

Caution: Connection of any other device to the Control Power Source of this Panel will cause improper operation and Void the Warranty.





CONNECT EACH WIRE TO MATCHING NUMBER ON TERMINAL BLOCK

TERMINAL BLOCK

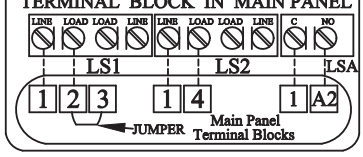
L	L			N	N	GRD	1	1	2	3	4	A2	R1	R2	R3	R4

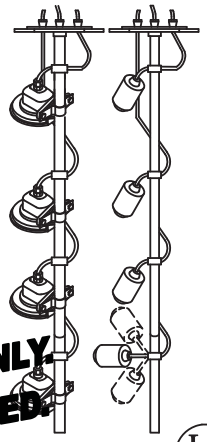
FIELD CONNECTIONS

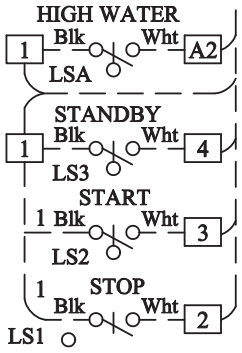
LEVEL SWITCH CONNECTIONS

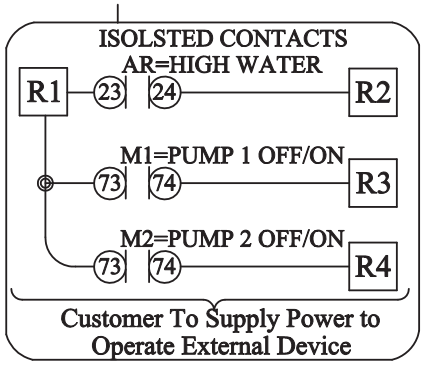
SYSTEM POWER SUPPLY 1-115-V

CONNECTIONS FROM 8213 Non Alternating Mechanical Level Switch To TERMINAL BLOCK IN MAIN PANEL









FOR SUBMITTAL PURPOSES ONLY. EQUIPMENT NOT YET ORDERED.

LS3 & LSA float positions May Be Changed to activate High Water Alarm, before Lag Pump is called for.

GND 1/4/2016

WEIL CEDA 6/29/2016 8:19 AM H8131-CL11 Custom Schematic 1-115- Volts .dwg

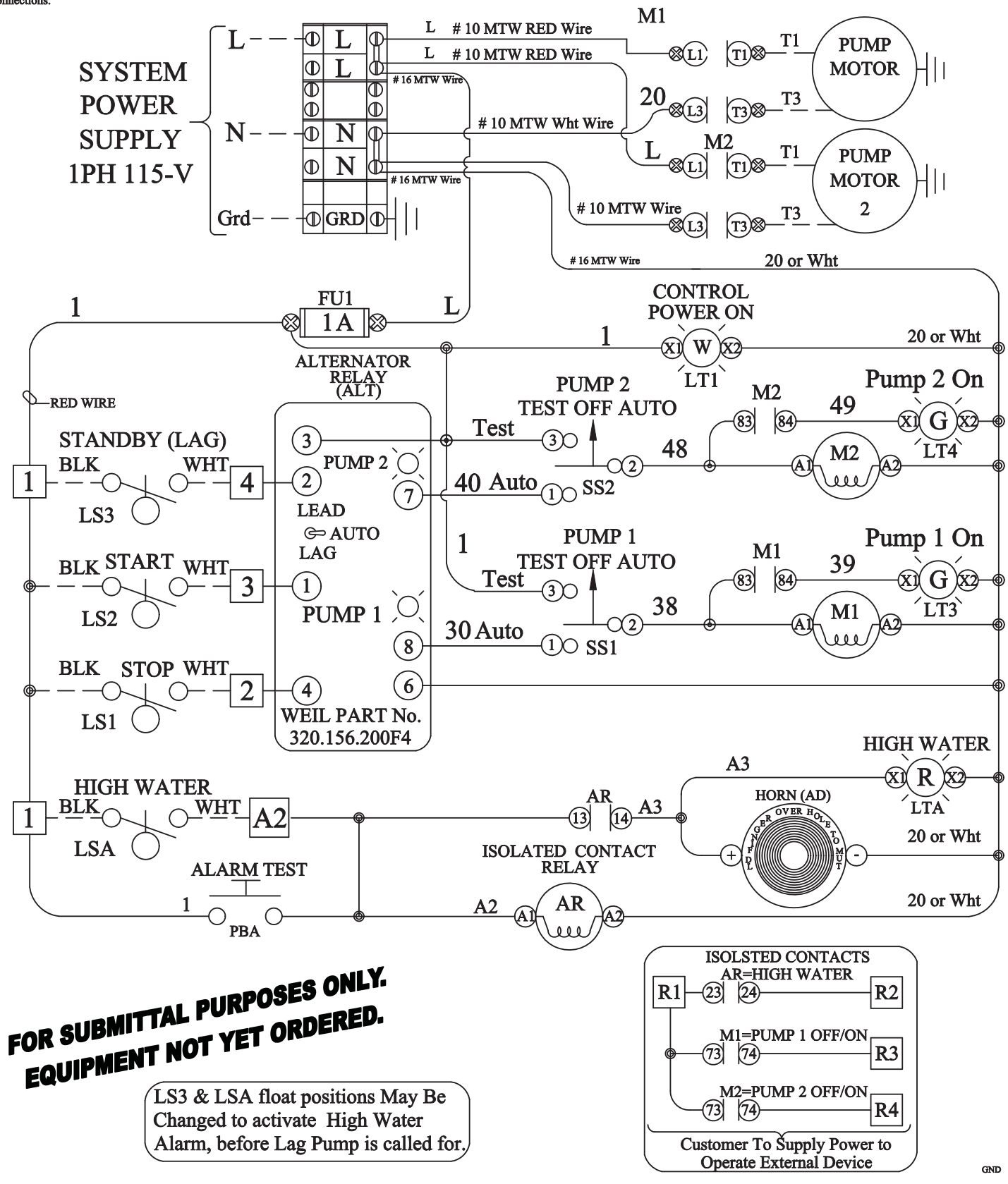
PANEL NAME PLATE INCLUDES:
-System Voltage
-Motor Amp Range
-MAX Panel Amps
-Phase & HZ
-Enclosure Type

Dotted lines (– – – – –) represent Field Connections.

Installer to Supply Disconnect Switch & Branch Circuit & or Overload Protection in accordance with NEC & Local Codes. Fuses (LP-J) or equivalent) For Branch Circuit Protection: 1.15 X Full Load Amps of Mtr 1 + FLA of Mtr 2 + 2 Amps for C.P..

Wire Colors: Black = Power Green = Ground
Red = Control White = Common (Neutral)
Yellow = Alarm Circuit
Wires are Individually Numbered.
M1 & M2 = Motor Contactors
MP1 & MP2 = Motor Circuit Protectors
SS1 &SS2 = Spring Return Test To Off

= Component Coil
= Numbers on Terminal Blocks (TB1 or TB2).
= Numbers on Components.
= Normally Open Contact on Components.
= Normally Closed Contact on Components.
Caution: Connection of any other device to the Control Power Source of this Panel will cause improper operation and Void the Warranty.



FOR SUBMITTAL PURPOSES ONLY.
EQUIPMENT NOT YET ORDERED.

LS3 & LSA float positions May Be Changed to activate High Water Alarm, before Lag Pump is called for.

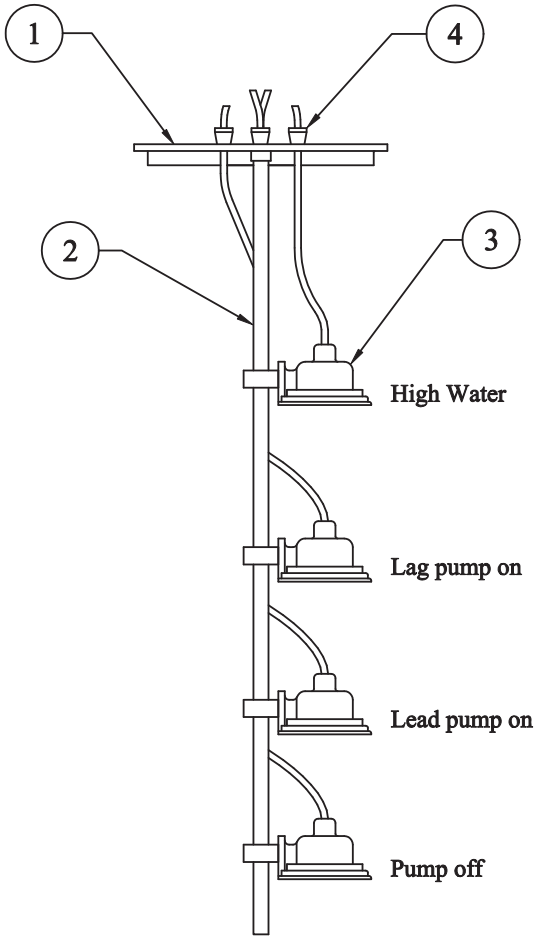
GND 1/4/2016

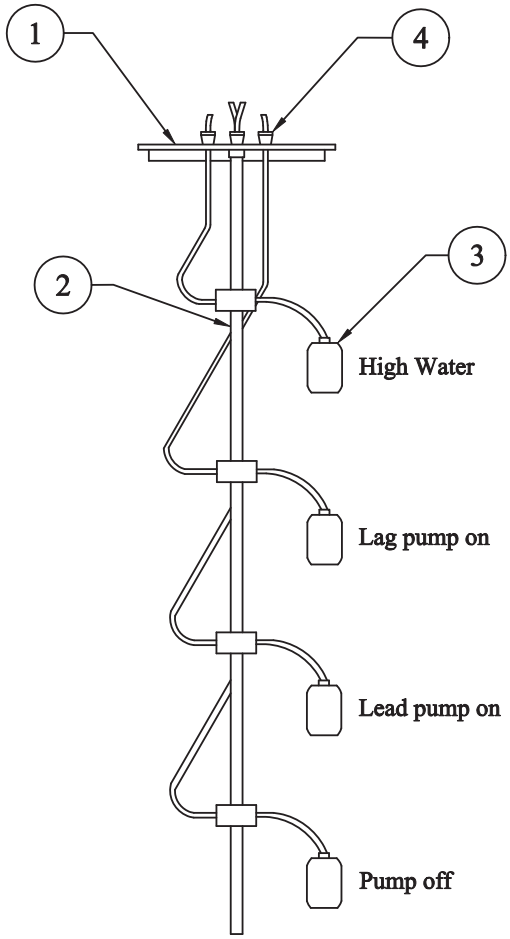
WEIL
INSTALLATION
OPERATION
MAINTENANCE

Pressure Diaphragm Level Control
Tethered Float Level Control

~~8223~~ 8233
~~8234~~
~~8235~~

Duplex Configuration





PARTS BREAKDOWN

ITEM NO.	DESCRIPTION
1.	Mounting Plate or Bracket
2.	Mounting Pole
3.	Level Control Switch
4.	Cord Grip

Typical Configuration	Switch Qty.
Simplex	2
Simplex with High Water	3
Duplex	3
Duplex with High Water	4

FOR SUBMITTAL PURPOSES ONLY.
EQUIPMENT NOT YET ORDERED.

INTRODUCTION

This manual contains instructions for installation, operation and maintenance of your liquid level control switches. Read and study this manual before using the equipment.

These switches are well designed and sturdily constructed. When properly installed and given reasonable care and maintenance, it will give many years of service.

SAFETY PRECAUTIONS

Always disconnect the electrical power supply before working on the unit. **Failure to do so can cause severe electrical shock or death.**

RECEIVING

Immediately upon arrival, the equipment should be checked for any shortages and/or damage. Any shortages or damage should be noted on the bill of lading and freight bill, and promptly reported to the transportation company. Claims for shortages or damage must be made in writing to Weil Pump Company Inc. Cedarburg, Wisconsin within 14 days of receipt of equipment.

STORAGE

The equipment should be installed and put into operation as soon as possible. If it is necessary to store the equipment for extended periods, precautions should be taken to prevent damage due to corrosion or oxidation. It is recommended that the equipment be stored indoors. The storage area should be dry and have a relatively constant temperature. The entire unit should be sealed in a heavy plastic bag. A desiccant should be placed in the bag before it is sealed.

INSTALLATION

1. The Level Control equipment should be installed in an easily accesible location.
2. Allow adequate headroom for installation and removal of Level Control equipment.
3. Do not install the Level Control equipment at the inlet to the wet-well to avoid turbulence of the in-flow.

PERIODIC INSPECTION

A periodic inspection of the Level Control equipment should be conducted to determine that it is operating properly. This inspection can be conducted at the same time the pump is inspected for proper operation.

Check for debris or grease in the wet-well which could cause erratic operation of the switches.

The switches should be cleaned of any adhering deposits.

FOR SUBMITTAL PURPOSES ONLY.
EQUIPMENT NOT YET ORDERED.

OPERATION

Pressure Diaphragm Level Control - 8223

The 8223 level control senses liquid by means of a pressure actuated micro switch. Rising water applies pressure to the diaphragm and diaphragm plate causing actuation of the switch. The switch is normally open, closing on liquid rise.

The switch cord has a breather tube for equalization to atmospheric pressure. Keep the breather tube open when connecting the cord to a control panel. The cord should be free of any sharp kinks, which could close the breather tube.

Tethered Level Control - 8233, 8234 & 8235

The 8233, 8234 & 8235 level controls sense liquid by means of change of angle and elevation. As water rises, the tethered float rises and actuates the switch inside the float housing. The switches are normally open, closing on liquid rise.

MOUNTING

The switch housing is fastened to a mounting pipe. The mounting pipe may be suspended from either a mounting plate fastened to the wet-well cover or a bracket fastened to the wall. The mounting plate fits most Weil wet-well covers and has holes to fit the cord grips supplied with the switch.

SYSTEM OPERATION

Simplex

- The pump starts when the liquid level activates the Start switch.
- The pump will run until the liquid level deactivates the Stop switch.
- If the liquid level activates the High Water switch, the HWA circuit will turn on.

Duplex

- The lead pump starts when the liquid level activates the Lead/Start switch. The lead pump will run until the liquid level deactivates the Stop switch.
- The lag pump will start if the liquid level activates the Lag/Standby switch. Both pumps continue to run until the liquid level deactivates the Stop switch.
- If the liquid level activates the High Water switch, the HWA circuit will turn on.

Typical Configuration	Switch Qty.
Simplex	2
Simplex with High Water	3
Duplex	3
Duplex with High Water	4

WEIL WARRANTY

Weil Pump Company Inc., Limited Warranty Statement:

Manufacturer shall warrant the product being supplied to the owner against defects in workmanship and material for a period of (see below) , under normal use, operation and service.
The obligation of this warranty statutory or otherwise, is limited to the replacement or repair at our factory, or at a point designated by the factory, of such part shall appear to us, upon inspection at such point to have been defective in material or workmanship.

This warranty does not obligate seller to bear the cost of labor or transportation charges in connection with the replacement or repair of defective parts, nor shall it apply to a machine upon which repairs or alterations have been made unless authorized by us. Seller shall not be liable, under any circumstances, for any special, consequential or incidental damages including, but not limited to personal injuries or labor costs, temporary operating equipment, or removal and installation of equipment.

WARRANTY DISCLAIMERS: THE LIMITED WARRANTY NOTED ABOVE SHALL BE IN LIEU OF ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICLULAR PURPOSE.

Returned goods: Written permission must be obtained before returning any material. Material returned for credit will be subject to factory inspection. Returns must be shipped with transportation charges pre-paid. Credit for returned freight will be issued if products are covered by warranty. Special, non-catalog items cannot be returned.

FOR SUBMITTAL PURPOSES ONLY.
EQUIPMENT NOT YET ORDERED.

SO #: TBD

SHIP DATE: _____

Weil Pump Company Inc., Product Warranty Periods:

Submersible pumps:

- [x] Single seal motor pumps: 1 year from start-up, not to exceed (16) months from factory shipment date.
- [ ] Double seal motor pumps: (5) year pro-rated from factory shipment date:
  - 1-16 months 100% coverage
  - 17-24 months 70% coverage
  - 25-36 months 55% coverage
  - 37-48 months 35% coverage
  - 49-60 months 20% coverage

- [ ] Vertical, dry pit, condensate and turbine pumps: 1 year from start-up, not to exceed (16) months from factory shipment date.
- [x] Wet well covers, accessories, control panels, level control assemblies: (1) year from factory shipment date.

FERGUSON ENTERPRISES, INC.®

EW-1 EMERGENCY EYE / FACE WASH

BS19270HD	BRADLEY	EYE WASH SWG DWN CP

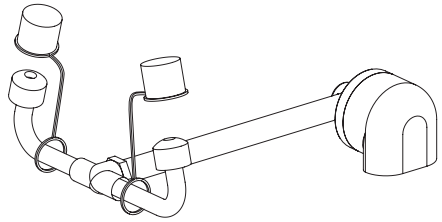
Installation

S19-270HD, S19-270HW, S19-270JD, S19-270JW, S19274HD, S19274HDR, S19274HW, S19274JD, S19274JW

Swing-Down Eyewash and Eye/Face Wash Units, Wall and Deck Mount

Douche oculaire et oculaire/faciale activée par bras mobile, support de mur ou de comptoir

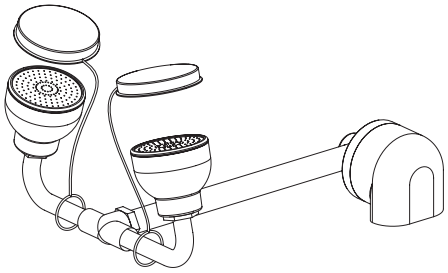
Lavador de ojos y de ojos/rostro activado por brazo oscilante, montaje de la pared o de mostrador



Deck-mounted eyewash (S19-270HD) is shown.
Wall-mounted eyewash (S19-270HW) is similar.

Une douche oculaire qui est montée au comptoir (S19-270HD) est montrée.
Une douche oculaire qui est montée au mur (S19-270HW) est similaire.

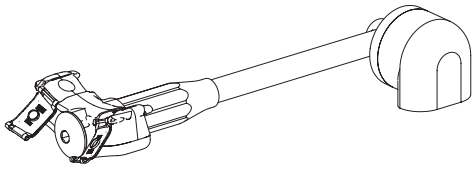
Se muestra una lavador de ojos que se monta a la mostrador (S19-270HD).
Un lavador de ojos que se monta a la mostrador (S19-270HW) es similar.



Deck-mounted eye/face wash (S19-270JD) is shown.
Wall-mounted eye/face wash (S19-270JW) is similar.

Une douche oculaire/faciale qui est montée au comptoir (S19-270JD) est montrée.
Une douche oculaire/faciale qui est montée au mur (S19-270JW) est similaire.

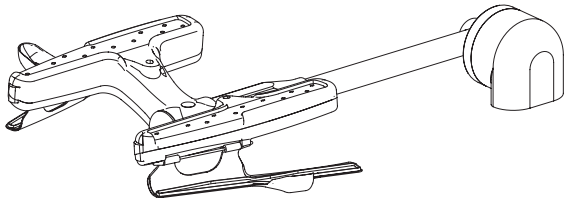
Se muestra una lavador de ojos/rostro que se monta a la mostrador (S19-270JD).
Un lavador de ojos/rostro que se monta a la mostrador (S19-270JW) es similar.



Deck-mounted Halo™ eyewash (S19274HD) is shown.
Deck-mounted Halo™ eyewash (S19274HDR) is similar.
Wall-mounted Halo™ eyewash (S19274HW) is similar.

Une douche oculaire Halo™ qui est montée au comptoir (S19274HD) est montrée. Une douche oculaire Halo™ qui est montée au comptoir (S19274HDR) est similaire. Une douche oculaire Halo™ qui est montée au mur (S19274HW) est similaire.

Se muestra una lavador de ojos Halo™ que se monta a la mostrador (S19274HD). una lavador de ojos Halo™ que se monta a la mostrador (S19274HDR) es similar. Un lavador de ojos Halo™ que se monta a la mostrador (S19274HW) es similar.



Deck-mounted Halo™ eye/face wash (S19274JD) is shown.
Wall-mounted Halo™ eye/face wash (S19274JW) is similar.

Une douche oculaire/faciale Halo™ qui est montée au comptoir (S19274JD) est montrée.
Une douche oculaire/faciale Halo™ qui est montée au mur (S19274JW) est similaire.

Se muestra una lavador de ojos/rostro Halo™ que se monta a la mostrador (S19274JD).
Un lavador de ojos/rostro Halo™ que se monta a la mostrador (S19274JW) es similar.

215-1408 Rev. R; ECN 15-05-064
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P.O. Box 309, Menomonee Falls, WI USA 53052-0309
PHONE 800.BRADLEY (800.272.3539) FAX 262.251.5817
bradleycorp.com

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WARNING

Flush the water supply lines before beginning installation and after installation is complete. Test the unit for leaks and adequate water flow. Main water supply to the eyewash should be "ON" at all times. Provisions shall be made to prevent unauthorized shutoff.

CAUTION

Emergency equipment must be supplied with tepid water (60°F to 100°F/15.6°C to 37.8°C). Any prolonged exposure to near freezing water affects the body's ability to maintain body temperature, increasing the risk of hypothermia.

NOTICE

Before installing this product, ensure that there are adequate clearances around the product and activation of the product does not interfere with other products or obstructions.

Avoid cleaners containing organic solvents, alcohols and hydrocarbons. Rinse with water after cleaning.

IMPORTANT

The installation and location of all safety drench showers, eye and eye/face washes must comply with the requirements of ANSI/ISEA Z358.1.

Read this installation manual completely to ensure proper installation, then file it with the owner or maintenance department. Compliance and conformity to drain requirements and other local codes and ordinances is the responsibility of the installer.

Separate parts from packaging and make sure all parts are accounted for before discarding any packaging material. If any parts are missing, do not begin installation until you obtain the missing parts.

The ANSI/ISEA Z358.1 standard requires an uninterrupted supply of flushing fluid. Bradley plumbed emergency fixtures require a minimum of 30 PSI (0.21MPa) flowing pressure.

Self-closing spring-loaded valves are not UL classified to ANSI/ISEA Z358.1.

Weekly activation must be conducted on all plumbed emergency equipment to ensure a suitable flushing fluid supply is present and any sediment build-up in the supply line is cleared. Emergency equipment should be inspected monthly to address any maintenance issues ensuring the equipment is in good operating condition and that there are no signs of wear.

Workers who may come in contact with potentially hazardous materials should be trained regarding the placement and proper operation of emergency equipment per ANSI/ISEA Z358.1.

For questions regarding the operation or installation of this product, visit www.bradleycorp.com or call 800-BRADLEY (272.3539).

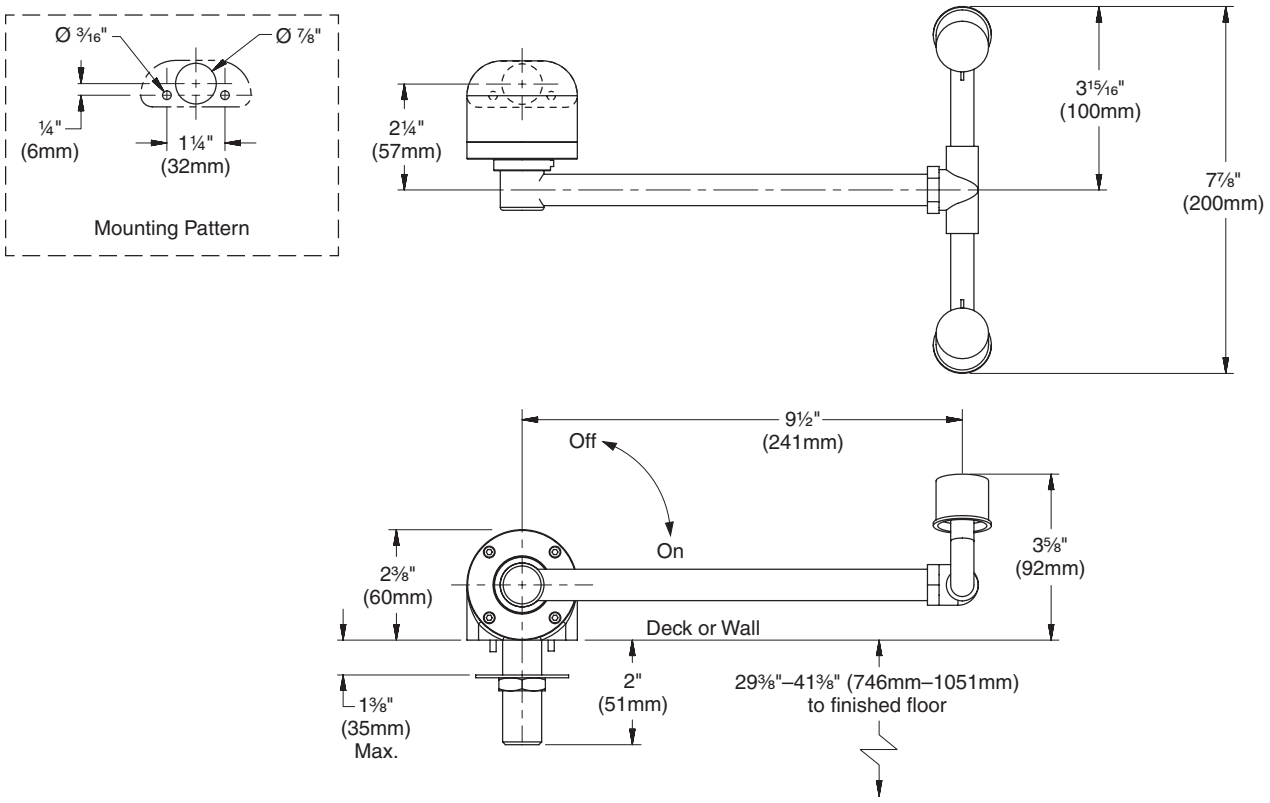
Product warranties and parts information may also be found under "Products" on our web site at bradleycorp.com.

Supplies Required:

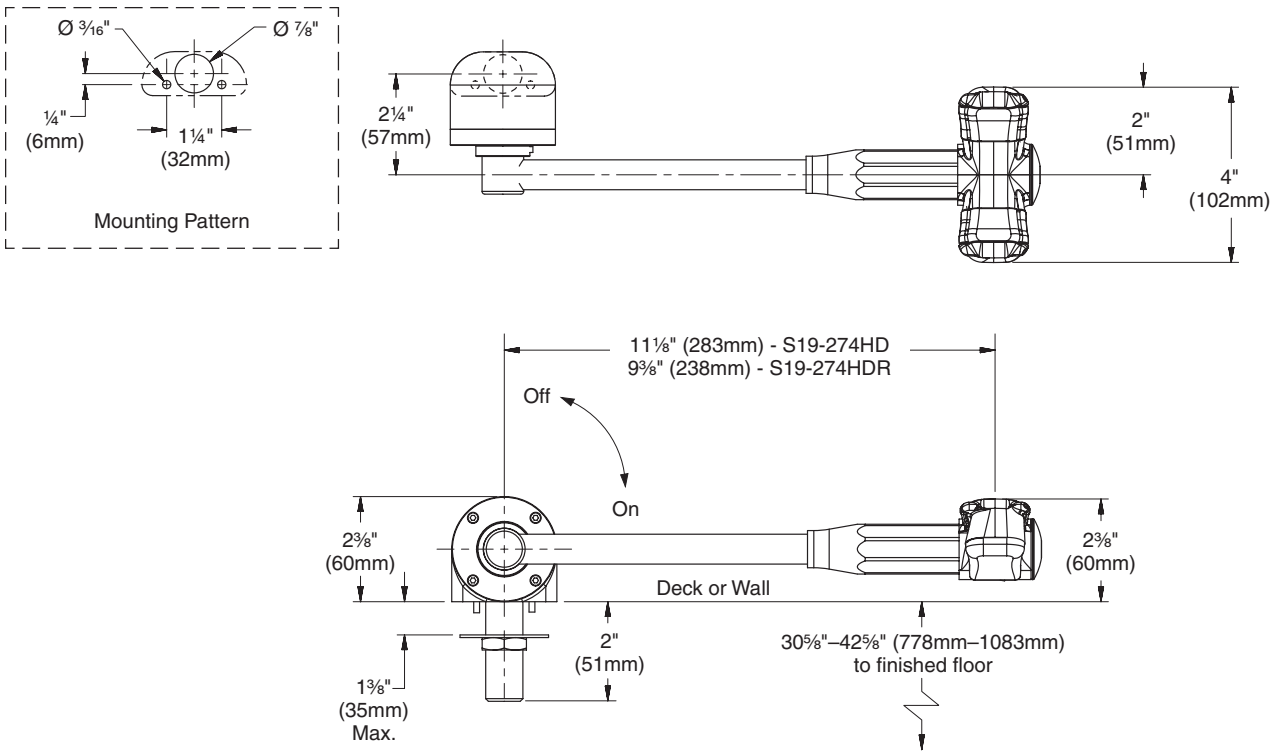
- Piping to ½" NPT water supply inlet on unit
- Pipe sealant
- Sign-mounting hardware

Local codes may require the installation of a backflow prevention valve to complete proper installation. Compliance with local codes is the responsibility of the installer. Valve must be tested annually to verify that it is functioning properly. Backflow prevention valves are not included with the fixture and may be supplied by the contractor or purchased from Bradley Corporation.

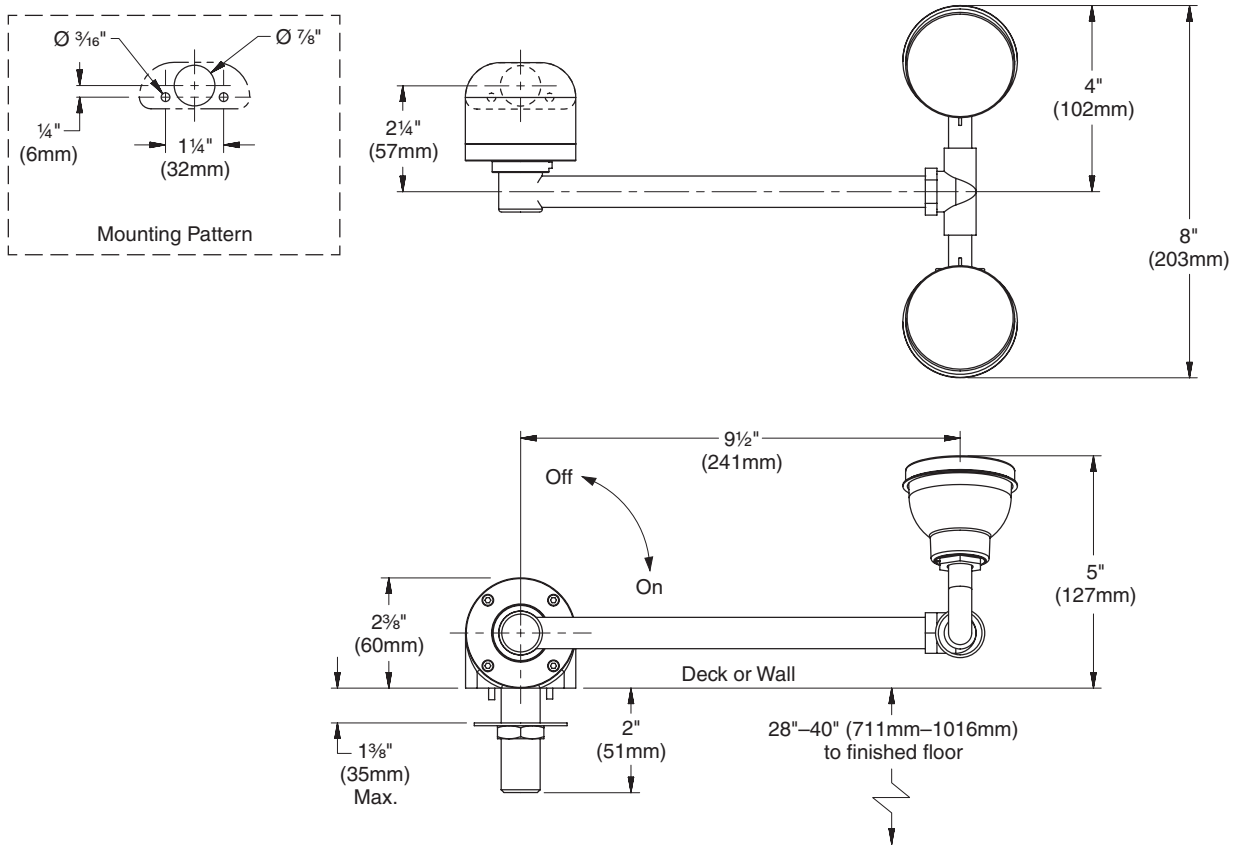
Dimensions — S19-270HD, S19-270HW (deck-mounted unit shown)



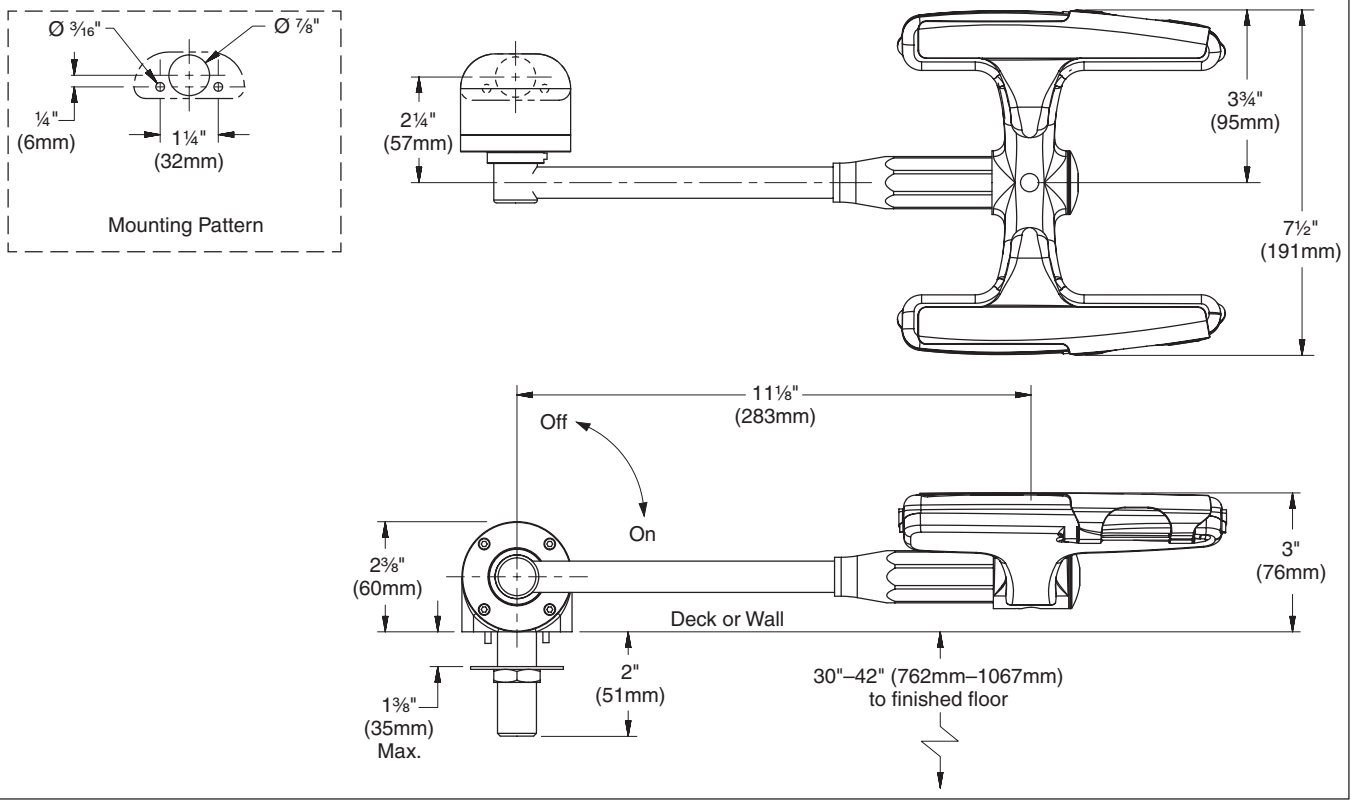
Dimensions — S19274HD, S19274HDR, S19274HW (deck-mounted unit shown)



Dimensions — S19-270JD, S19-270JW (deck-mounted unit shown)



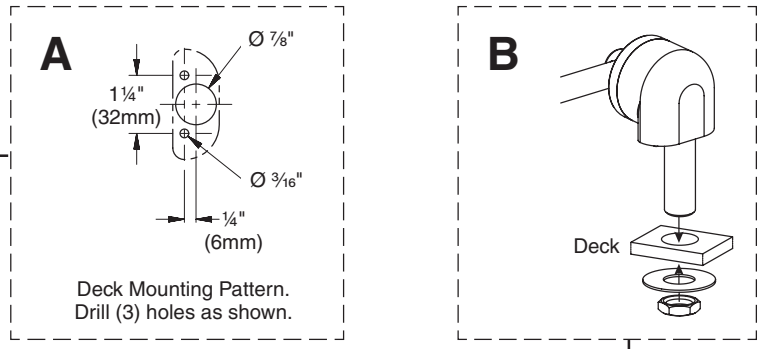
Dimensions — S19274JD, S19274JW (deck-mounted unit shown)

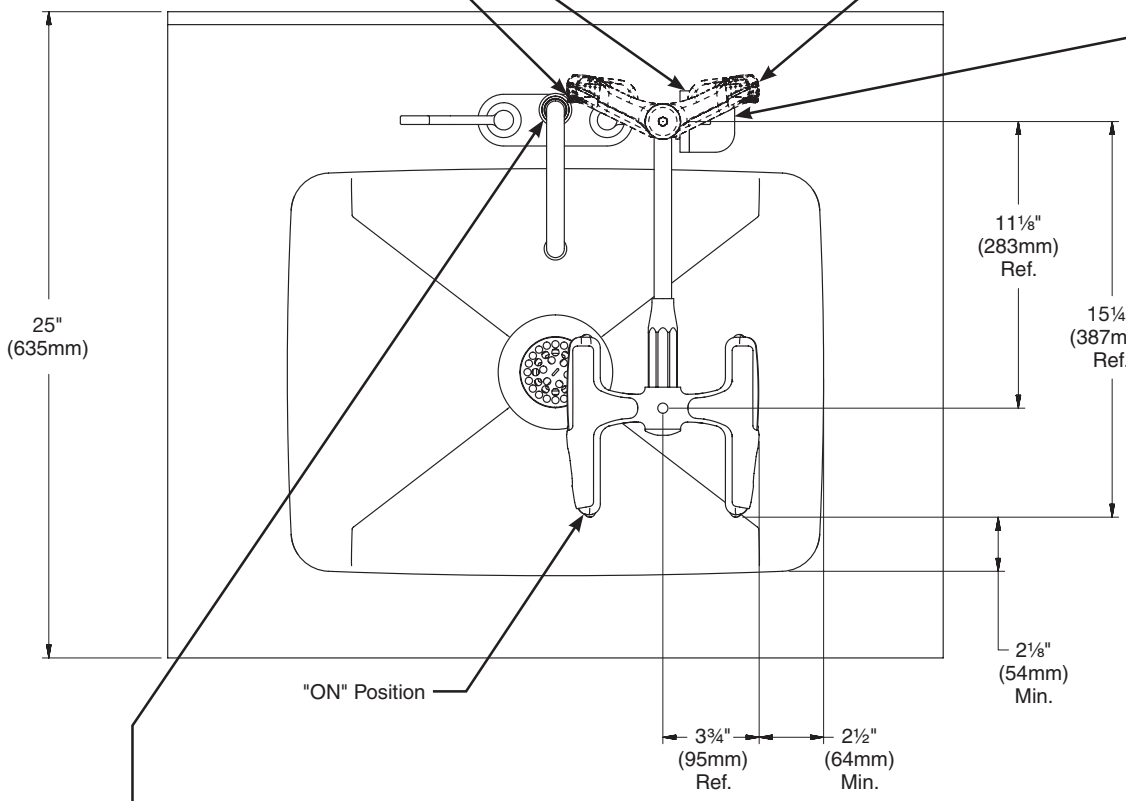


Installation

- ☑ *Halo eye/face wash unit is shown on a sample 25" (635mm) deck. Other units are similar.*
- ☑ *Minimum dimensions necessary to contain splashing from Halo units are shown.*
- ☑ *Apply pipe sealant (supplied by installer) to all male-threaded pipe joints. The top of the eyewash heads should be positioned a minimum of 33" (838mm) and a maximum of 45" (1143mm) from the floor and 6" (152mm) from the nearest obstruction.*

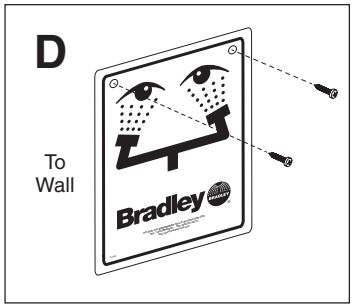
☑ *Proper faucet shank/handle clearance and recommended minimum splash containment dimensions must be considered when selecting the desired location for mounting.*





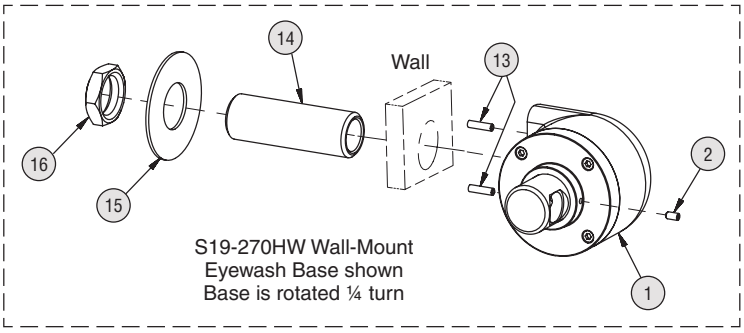
C Connect the water supply using piping (supplied by installer) with ½" NPT female threaded end.

E Slowly open the water supply lines to relieve air and pressurize the valve. Test the unit for leaks and adequate flow.

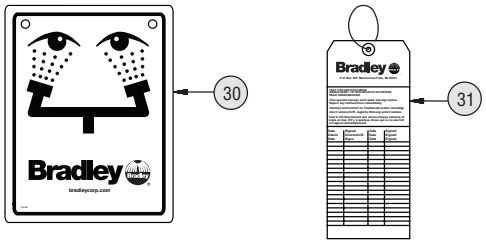


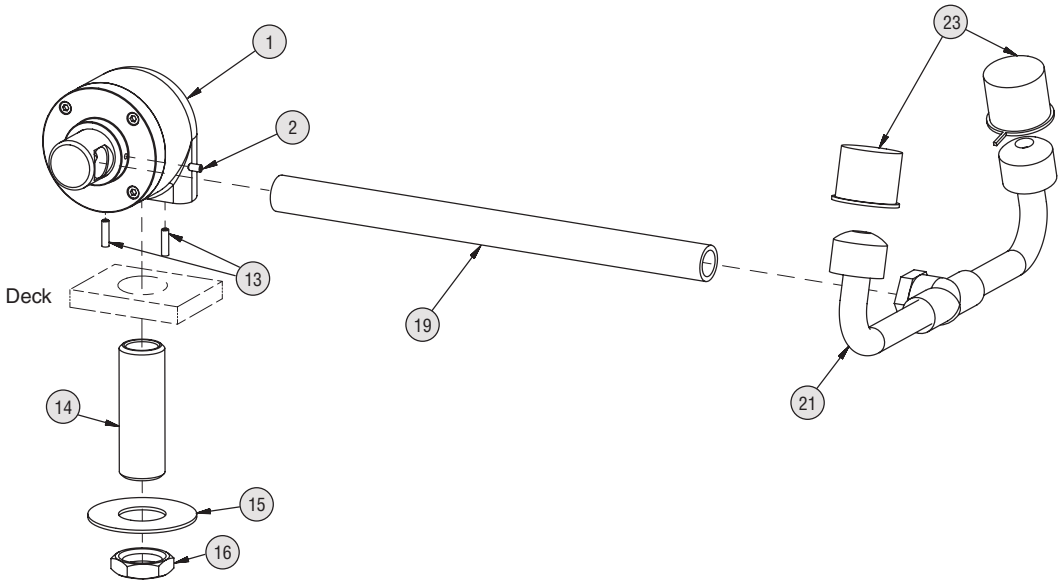
Assembly of Components — S19-270HD, S19-270HW

☑ *Shown in the "ON" position.*



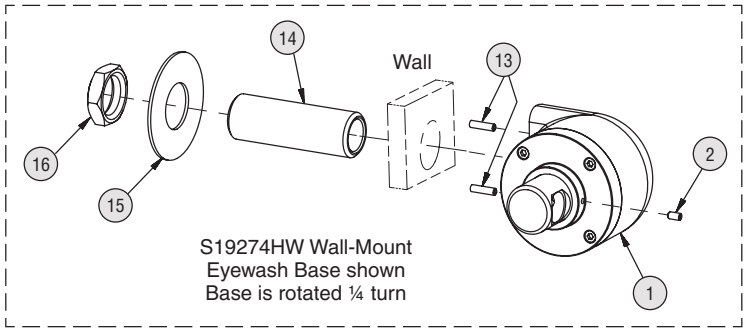
S19-270HW Wall-Mount
Eyewash Base shown
Base is rotated ¼ turn



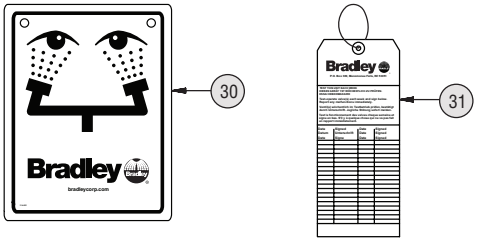


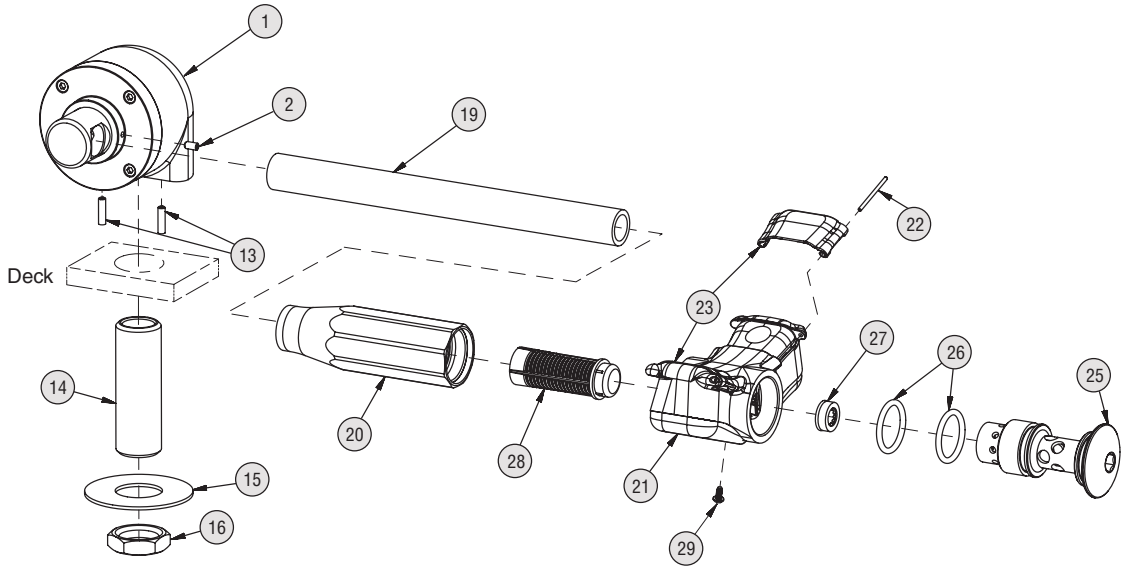
Assembly of Components — S19274HD, S19274HW

☑ *Shown in the "ON" position.*



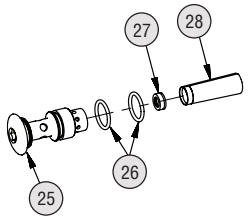
S19274HW Wall-Mount
Eyewash Base shown
Base is rotated ¼ turn



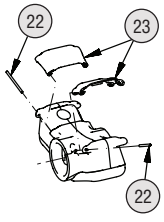


Prepack S65-339 includes items 26, 27, 28

Prepack S88-068 includes items 25, 26, 27, 28



Eyewash Cover Prepack
S45-2675 includes items
22 and 23



Parts List — S19-270HD, S19-270HW

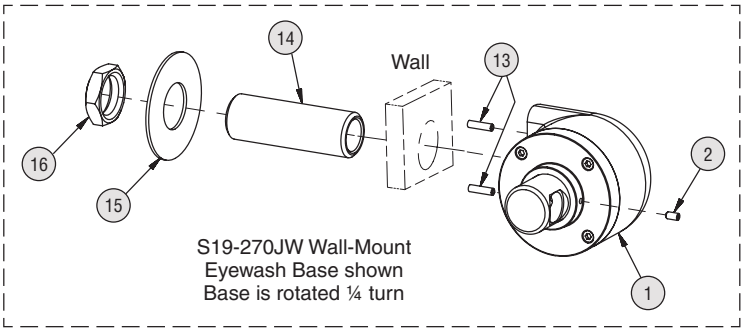
Item	Part No.	Qty	Description
1	S65-386CE	1	Replacement Valve Assembly, Swing-Down Classic Eyewash, Deck-Mount
1	S65-387CE	1	Replacement Valve Assembly, Swing-Down Classic Eyewash, Wall-Mount
2	160-473	1	Screw, Set
13	160-474	2	Screw, Set
14	113-514	1	Shank, ½" x 2½"
15	142-002CB	1	Washer, Flat ⅞" x 2"
16	110-115	1	Nut, Brass ½"-14 NPSM
19	113-1075	1	Pipe, ⅜" x 9" Chrome Red Brass
21	S05-092	1	Eyewash Yoke 90°
23	107-371	2	Tethered Dust Cover
30	114-051	1	Safety Sign
31	204-421	1	Emergency Inspection Tag

Parts List — S19274HD, S19274HDR, S19274HW

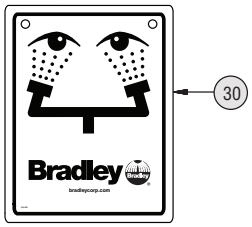
Item	Part No.	Qty	Description
1	S65-386	1	Replacement Valve Assembly, Swing-Down, Deck-Mount
1	S65-387	1	Replacement Valve Assembly, Swing-Down, Wall-Mount
2	160-473	1	Screw, Set
13	160-474	2	Screw, Set
14	113-514	1	Shank, ½" x 2½"
15	142-002CB	1	Washer, Flat ⅞" x 2"
16	110-115	1	Nut, Brass ½"-14 NPSM
19	113-1227	1	Pipe, ⅜" x 7¼" Chrome Red Brass (S19274HD)
19	113-1236	1	Pipe, ⅜" x 5½" Chrome Red Brass (S19274HDR)
20	171-006	1	Body, Mount ⅜" NPT Female
21	S05-190	1	Sprayhead Ass'y Eyewash (includes)
22	in service kit	2	Pivot Pin
23	in service kit	2	Flip Cover, Eyewash
25	115-158	1	Cap
26	125-157	2	O-Ring
27	125-175	1	Flow Control
28	S65-340	1	Screen (incl. 3 per pack)
29	160-500	1	Screw, Weep
30	114-051	1	Safety Sign
31	204-421	1	Emergency Inspection Tag

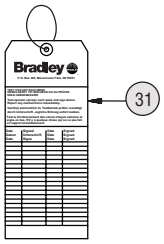
Assembly of Components — S19-270JD, S19-270JW

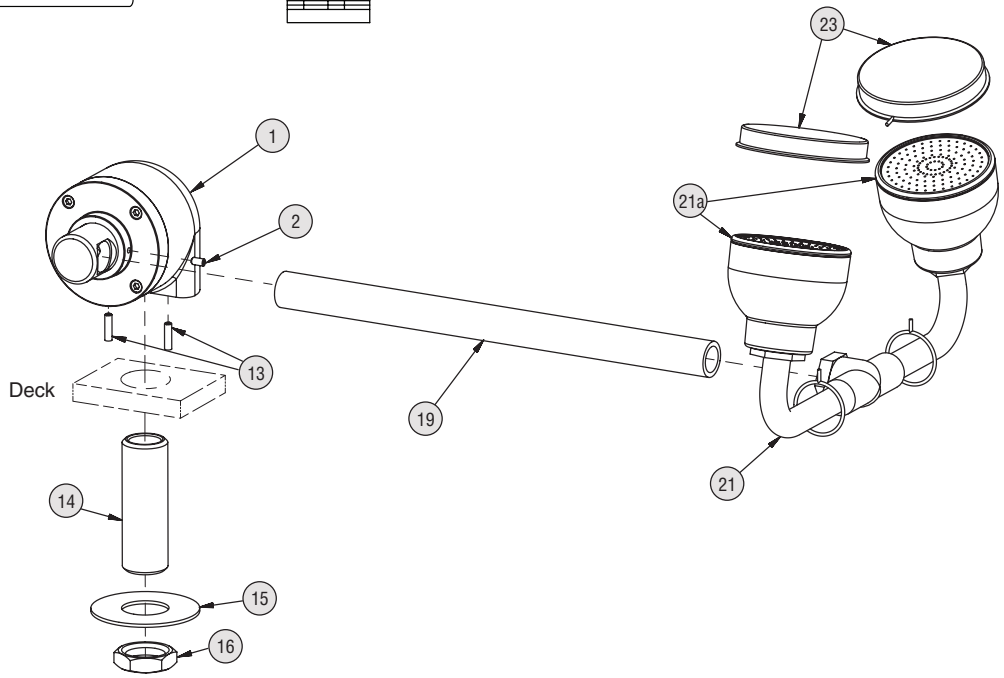
☑ *Shown in the "ON" position.*



S19-270JW Wall-Mount
Eyewash Base shown
Base is rotated ¼ turn

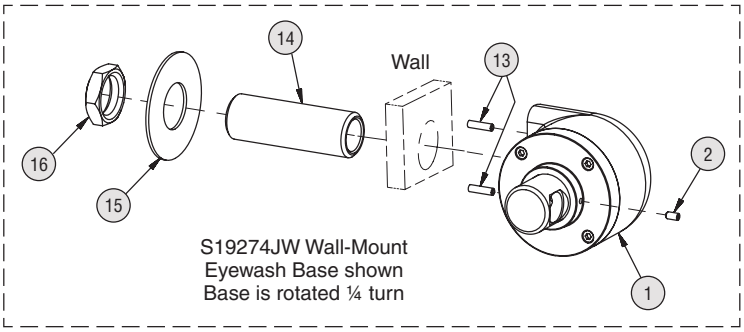




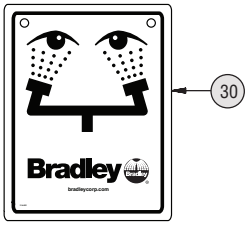


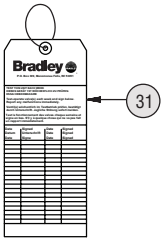
Assembly of Components — S19274JD, S19274JW

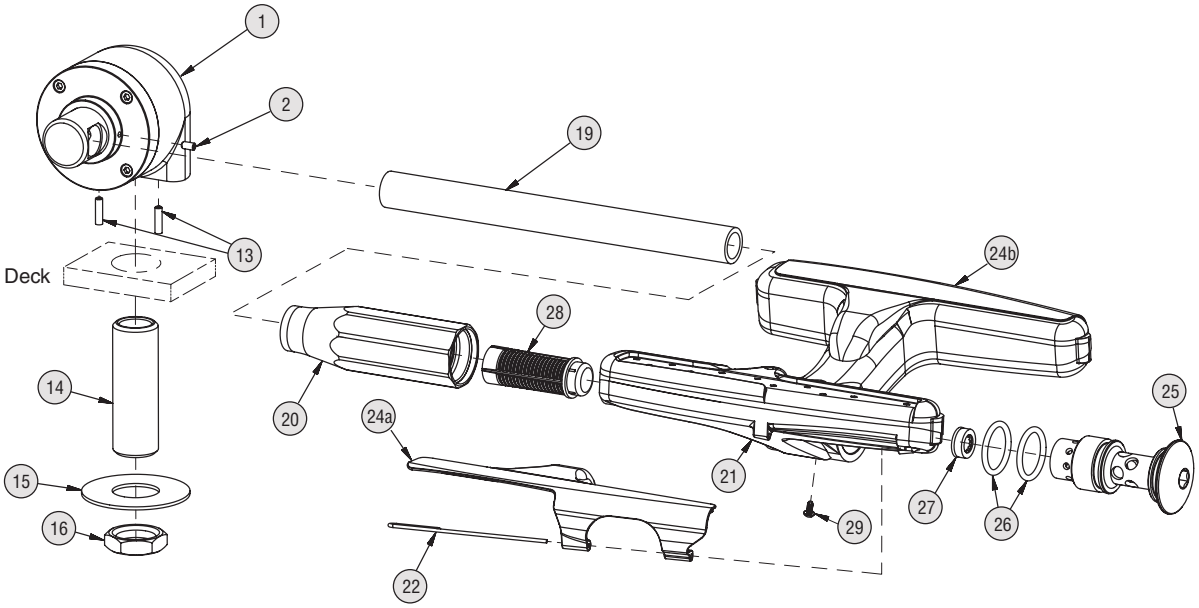
☑ *Shown in the "ON" position.*



S19274JW Wall-Mount
Eyewash Base shown
Base is rotated ¼ turn

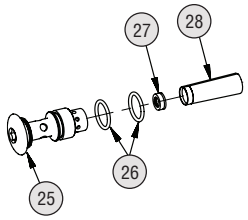




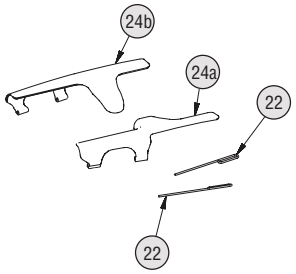


Prepack S65-339 includes items 26, 27, 28

Prepack S88-068 includes items 25, 26, 27, 28



Eye/Face Wash Cover
Prepack S45-2676 includes
items 22, 24a and 24b



Parts List — S19-270JD, S19-270JW

Item	Part No.	Qty	Description
1	S65-386	1	Replacement Valve Assembly, Swing-Down, Deck-Mount
1	S65-387	1	Replacement Valve Assembly, Swing-Down, Wall-Mount
2	160-473	1	Screw, Set
13	160-474	2	Screw, Set
14	113-514	1	Shank, ½" x 2½"
15	142-002CB	1	Washer, Flat ⅞" x 2"
16	110-115	1	Nut, Brass ½"-14 NPSM
19	113-1075	1	Pipe, ⅜" x 9" Chrome Red Brass
21	S05-206	1	Eye/Face Wash Assembly
21A	S45-2453	1	Service Kit EFW - Black Sprayheads
23	S53-063	2	Tethered Dust Cover
30	114-051	1	Safety Sign
31	204-421	1	Emergency Inspection Tag

Parts List — S19274JD, S19274JW

Item	Part No.	Qty	Description
1	S65-386	1	Replacement Valve Assembly, Swing-Down, Deck-Mount
1	S65-387	1	Replacement Valve Assembly, Swing-Down, Wall-Mount
2	160-473	1	Screw, Set
13	160-474	2	Screw, Set
14	113-514	1	Shank, ½" x 2½"
15	142-002CB	1	Washer, Flat ⅞" x 2"
16	110-115	1	Nut, Brass ½"-14 NPSM
19	113-1227	1	Pipe, ⅜" x 7¼" Chrome Red Brass
20	171-006	1	Body, Mount ⅜" NPT Female
21	S05-192	1	Sprayhead Ass'y Eye/Face Wash (incl.)
22	in service kit	2	Pivot Pin
24a	in service kit	1	Flip Cover, Right
24b	in service kit	1	Flip Cover, Left
25	115-158	1	Cap
26	125-157	2	O-Ring
27	125-175	1	Flow Control
28	S65-340	1	Screen (incl. 3 per pack)
29	160-500	1	Screw, Weep
30	114-051	1	Safety Sign
31	204-421	1	Emergency Inspection Tag

AVERTISSEMENT

Rincez la conduite d'alimentation avant et apres l'installation. Assurez-vous que le débit d'eau est adéquat et qu'il n'y a pas de fuites. L'alimentation principale en eau doit être toujours OUVERTE. On devra prévoir des dispositions pour empêcher tout arrêt non autorisé.

ATTENTION

Le matériel d'urgence doit être alimenté en eau tiède (15,6 °C à 37,8 °C/60 °F à 100 °F). Toute exposition prolongée à de l'eau proche de la température de congélation peut altérer la capacité de l'organisme à maintenir la température corporelle, ce qui accroît le risque d'hypothermie.

AVIS

Avant d'installer ce produit, vérifier qu'il y a des dégagements suffisants autour du produit et que l'activation du produit n'est pas entravée par d'autres produits ou obstructions.

Éviter les produits nettoyants qui contiennent des solvants organiques, des alcools et des hydrocarbures. Rincer à l'eau après nettoyage.

IMPORTANT

L'installation et l'emplacement de toutes les douches d'urgence, oculaires et oculaires-faciales doivent être conformes aux exigences d'ANSI/ISEA Z358.1.

Lire ce manuel d'installation dans son intégralité pour garantir une installation appropriée. Une fois celle-ci terminée, classer ce manuel auprès du service à la clientèle ou d'entretien. L'installateur est responsable de la conformité de l'installation aux codes pour des drain et codes et règlements en vigueur.

Assurez-vous que toutes les pièces sont incluses dans l'emballage et qu'il n'en manque aucune avant de jeter l'emballage. Ne commencez pas l'assemblage avant de recevoir les pièces manquantes.

La norme ANSI/ISEA Z358.1 prévoit une alimentation ininterrompue du liquide de rinçage. Les appareils d'urgence Bradley raccordés au réseau nécessitent une pression d'écoulement d'au moins 30 PSI (0,21 MPa).

Les soupapes à ressort à fermeture automatique ne sont pas classifiées UL selon ANSI/ISEA Z358.1.

Une activation hebdomadaire doit être effectuée sur tout le matériel d'urgence à tuyauterie d'alimentation pour vérifier que l'arrivée de liquide de rinçage est suffisante et éliminer tout dépôt de sédiment de la conduite d'alimentation. Le matériel d'urgence doit être contrôlé chaque mois pour régler tout problème d'entretien éventuel et s'assurer que le matériel est en bon état de marche et ne présente aucun signe d'usure.

Les ouvriers susceptibles d'entrer en contact avec des matières potentiellement dangereuses doivent recevoir une formation sur la mise en place et le bon fonctionnement du matériel d'urgence conformément à la norme ANSI/ISEA Z358.1.

Pour toute question concernant le fonctionnement ou l'installation de ce produit, consulter le site www.bradleycorp.com ou appeler le 1-800-BRADLEY.

Les garanties de produits figurent sous la rubrique « Informations techniques » sur notre site Internet à www.bradleycorp.com.

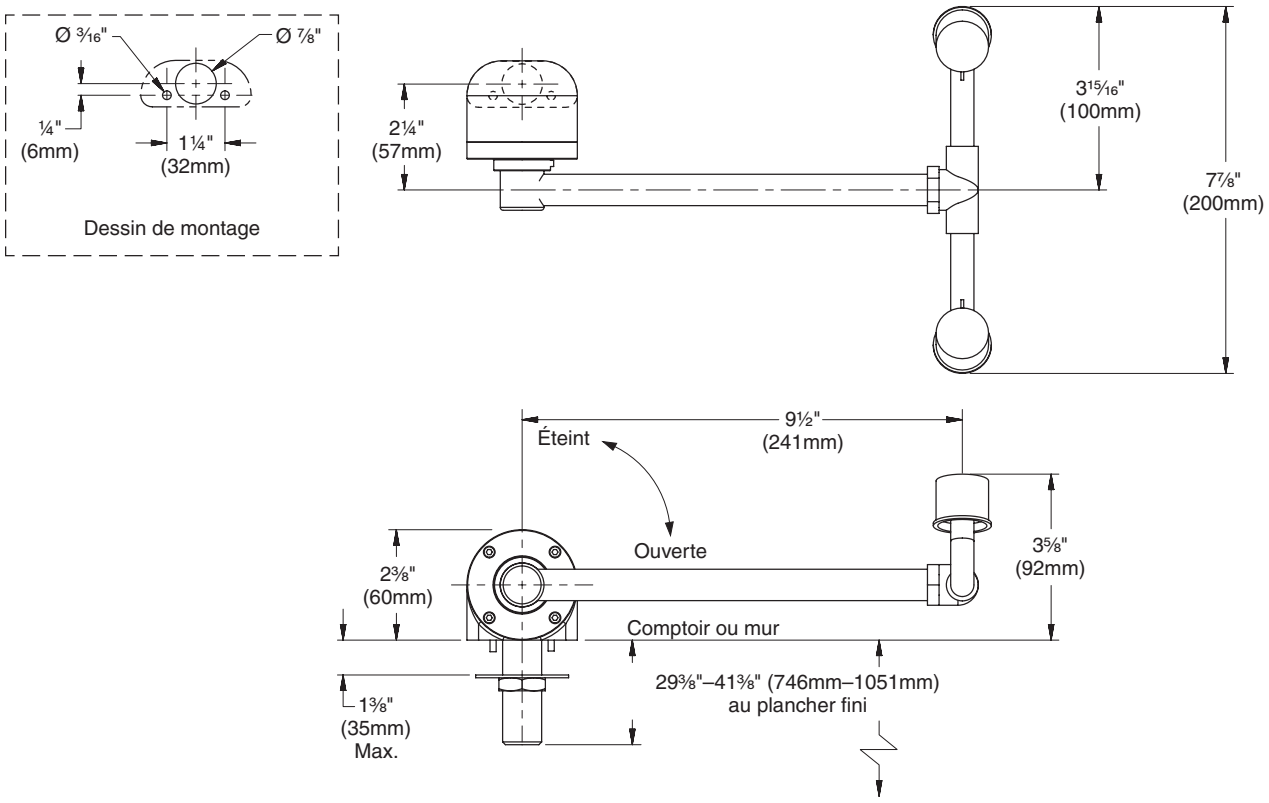
Equipements nécessaires :

- Amener la tuyauterie à l'entrée ½" NPT d'approvisionnement en eau de la douche oculaire
- Produit d'étanchéité pour tuyau
- Quincaillerie pour l'installation de l'enseigne

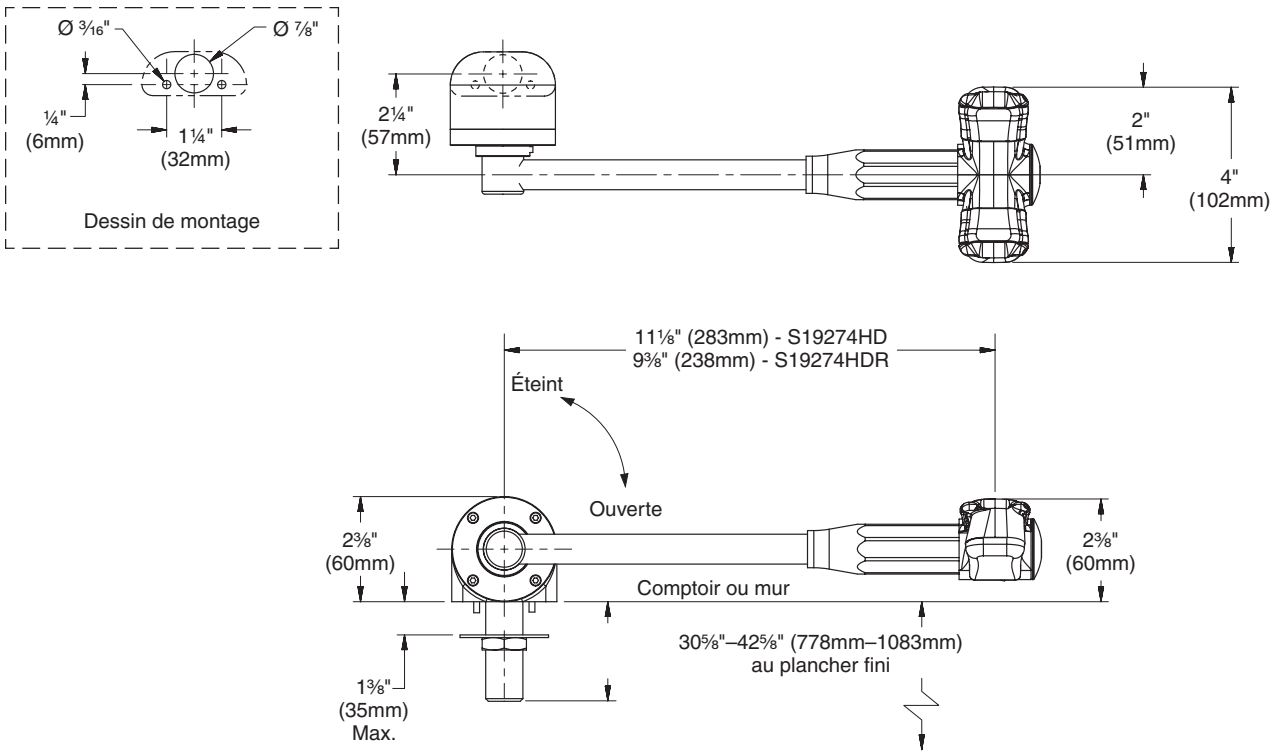


Les codes locaux peuvent exiger l' installation d'une soupape de prévention d'écoulement de retour pour réaliser une installation appropriée. L'installateur est responsable de la conformité aux codes locaux. La soupape doit être testée une fois par an pour vérifier qu'elle fonctionne correctement. Les soupapes de prévention d'écoulement de retour ne sont pas fournies avec l'appareil et peuvent être fournies par l'entrepreneur ou achetées auprès de Bradley Corporation.

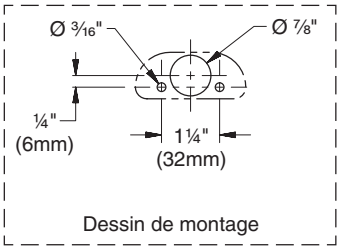
Dimensions — S19-270HD, S19-270HW (une douche oculaire qui est montée au comptoir est montrée)

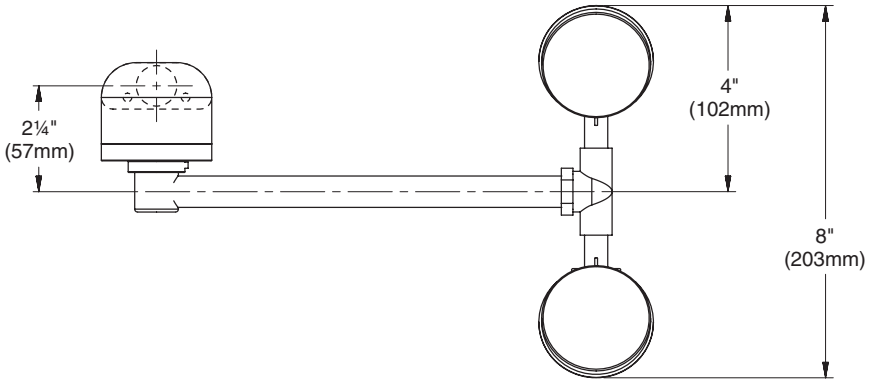


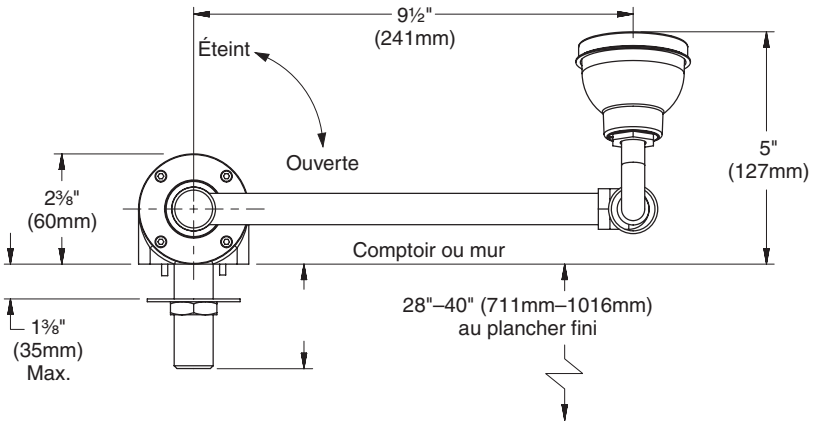
Dimensions — S19274HD, S19274HDR, S19274HW (une douche oculaire qui est montée au comptoir est montrée)



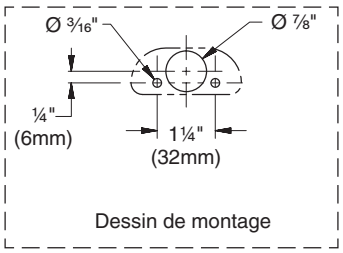
Dimensions — S19-270JD, S19-270JW (une douche oculaire qui est montée au comptoir est montrée)

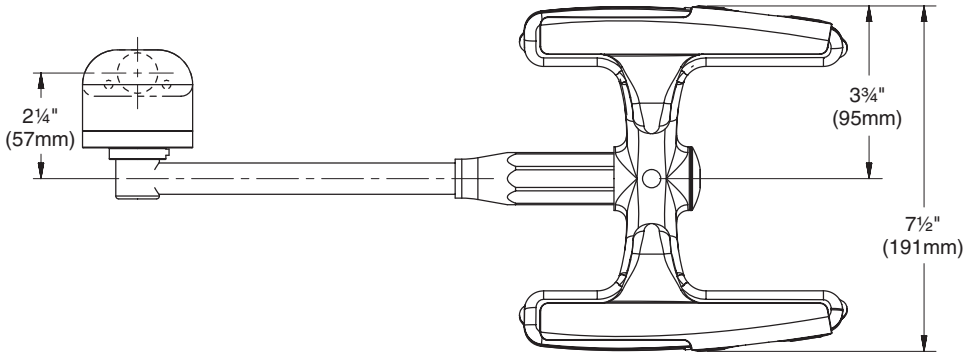


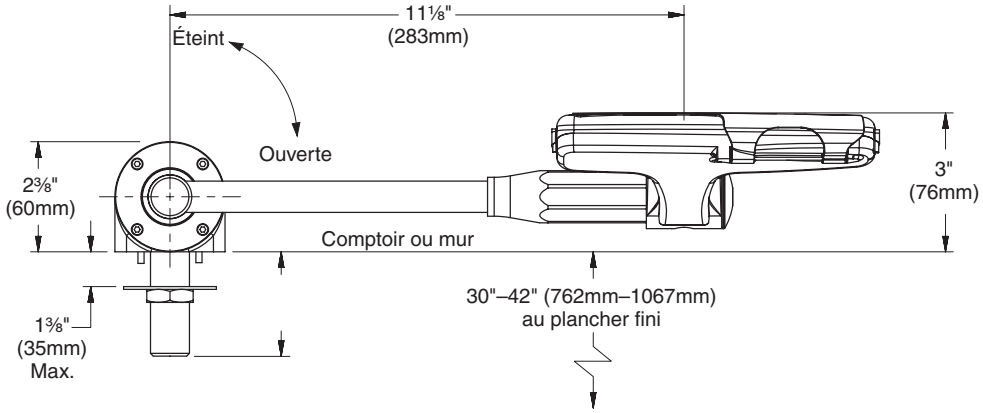




Dimensions — S19274JD, S19274JW (une douche oculaire qui est montée au comptoir est montrée)



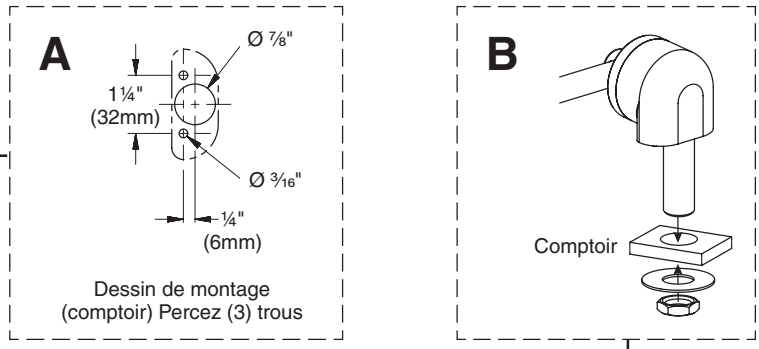


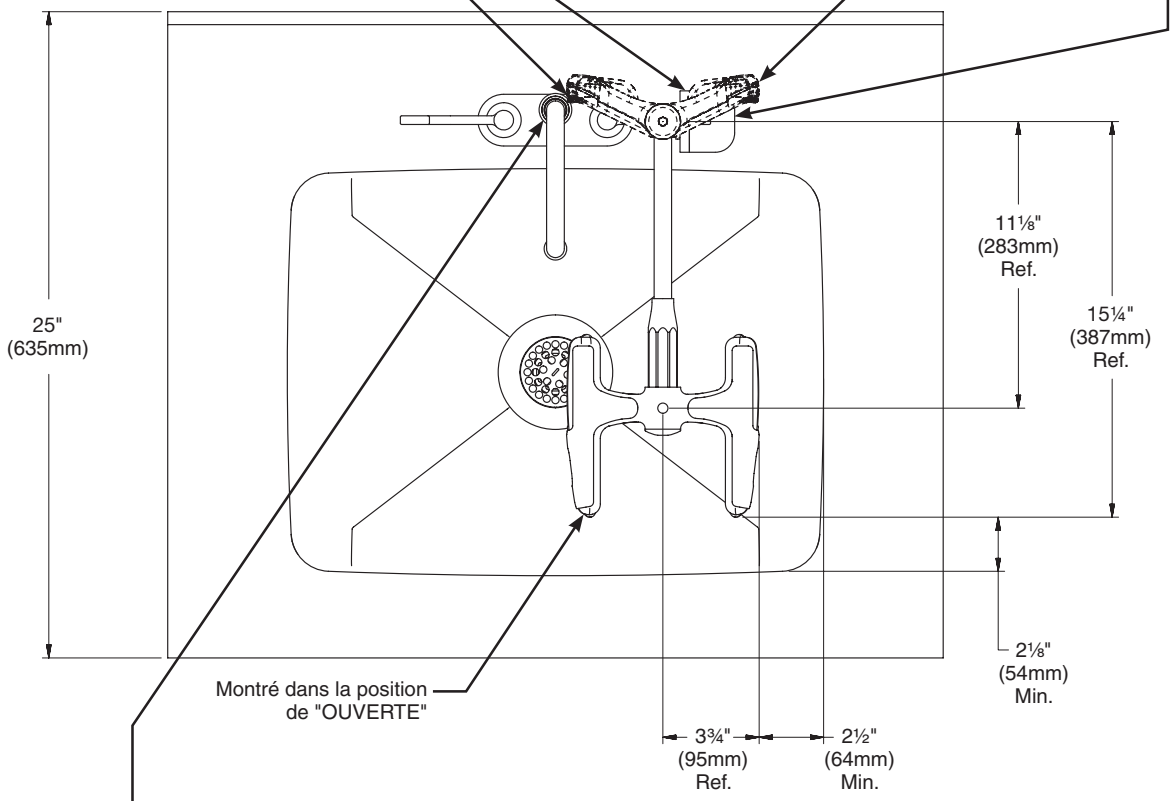


Installation

- ☑ *La douche oculaire/faciale Halo est montrée sur un exemple de comptoir de 25" (635 mm). Les autres unités sont similaires.*
- ☑ *Les dimensions minimales nécessaires pour contenir les éclaboussures des unités Halo sont indiquées.*
- ☑ *Mettez du produit d'étanchéité (non fourni) sur tous les filetages mâles. Le dessus des érogateurs de la douche oculaire doit être situé à une taille minimum de 83cm (33 po) et à une hauteur maximum de 115 cm (45 po) du plancher et de 15 cm (6 po) de l'obstruction la plus proche.*

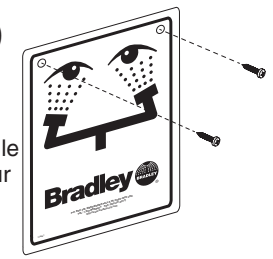
☑ *Le dégagement pour les poignées et le tube montant du robinet et les dimensions minimales pour contenir les éclaboussures doivent être pris en compte lors du choix de l'emplacement de pose.*





C Un boyau flexible fileté femelle ½" NPT (fourni par l'installateur) peut également être utilisé.

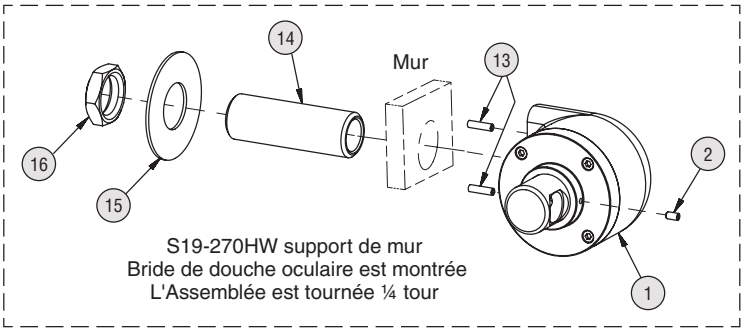
D



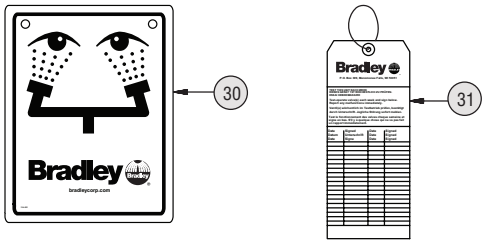
E Ouvrir les arrivées d'eau lentement pour libérer l'air et mettre le robinet sous pression. Vérifier s'il y a des fuites et si le débit d'eau est adéquat.

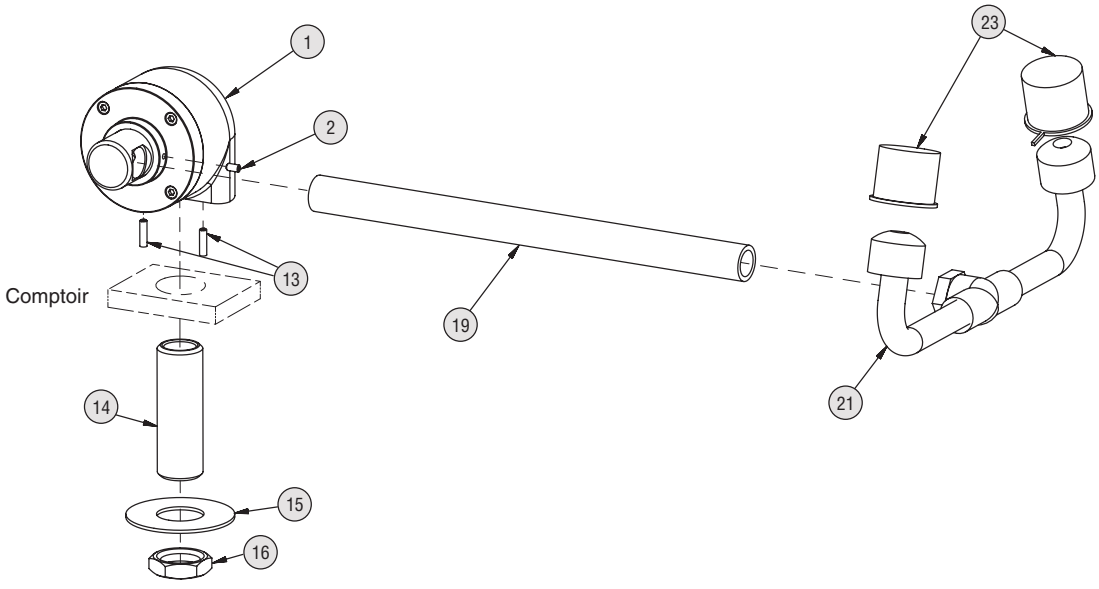
Assemblage des composantes — S19-270HD, S19-270HW

☑ *Montré dans la position de "OUVERTE"*



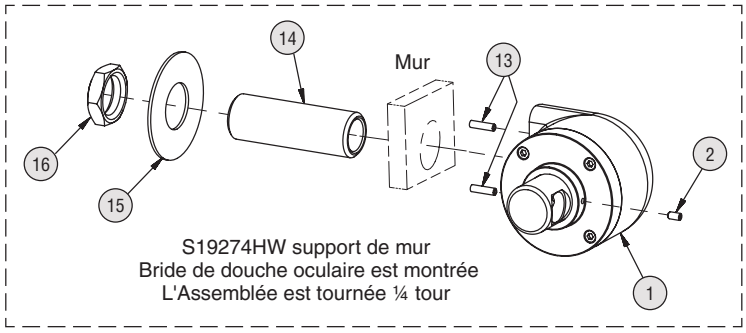
S19-270HW support de mur
Bride de douche oculaire est montrée
L'Assemblée est tournée ¼ tour



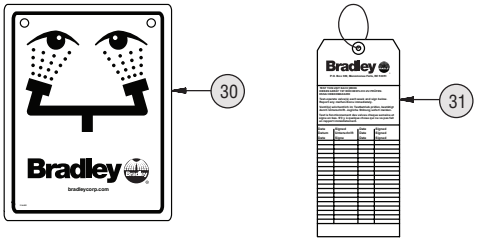


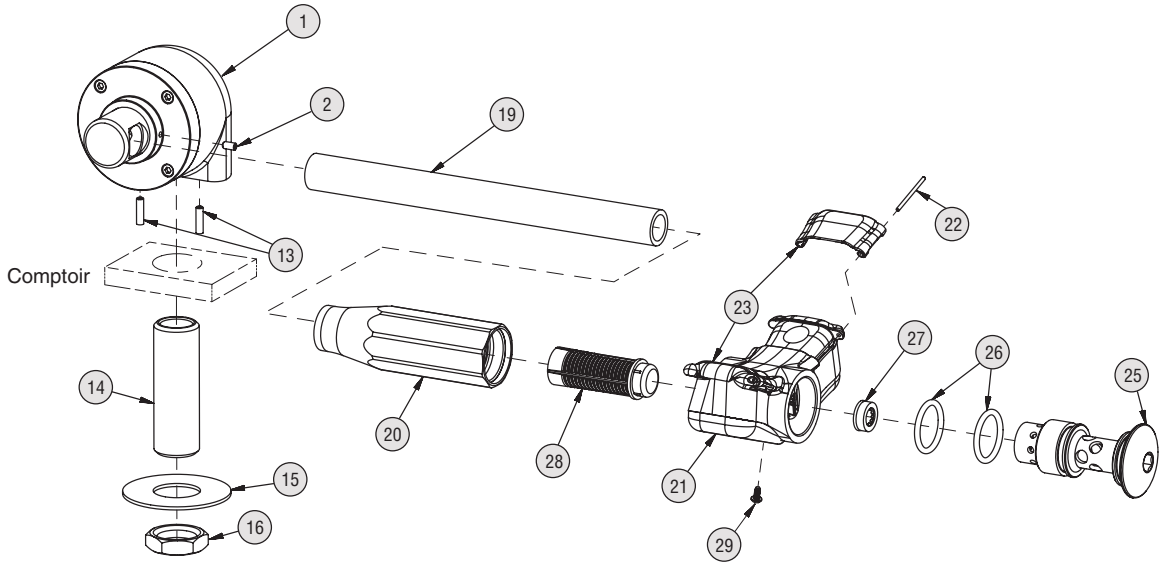
Assemblage des composantes — S19274HD, S19274HW

☑ *Montré dans la position de "OUVERTE"*



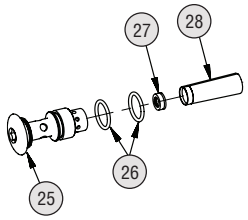
S19274HW support de mur
Bride de douche oculaire est montrée
L'Assemblée est tournée ¼ tour



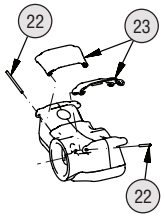


Paquet S65-339 comprend les éléments 26, 27, 28

Prepack S88-068 comprend les éléments 25, 26, 27, 28



Paquet couvertures à bascule (douche oculaire) S45-2675 comprend les éléments 22 et 23



Liste des pièces — S19-270HD, S19-270HW

Piéce	Réf.	Qté	Description
1	S65-386CE	1	Remplacement de la robinet rabattable, douche oculaire classique, support du comptoir
1	S65-387CE	1	Remplacement de la robinet rabattable, douche oculaire classique, support du mur
2	160-473	1	Vis de reglage
13	160-474	2	Vis de reglage
14	113-514	1	Tige ½" x 2½"
15	142-002CB	1	Rondelle ⅞" x 2"

Piéce	Réf.	Qté	Description
16	110-115	1	Écrou ½"-14 NPSM
19	113-1075	1	Tuyau, ⅜" x 9" laiton poli
21	S05-092	1	Douche oculaire 90°
23	107-371	2	Cache-poussière ancré
30	114-051	1	Enseigne de sécurité
31	204-421	1	Etiquette d'inspection

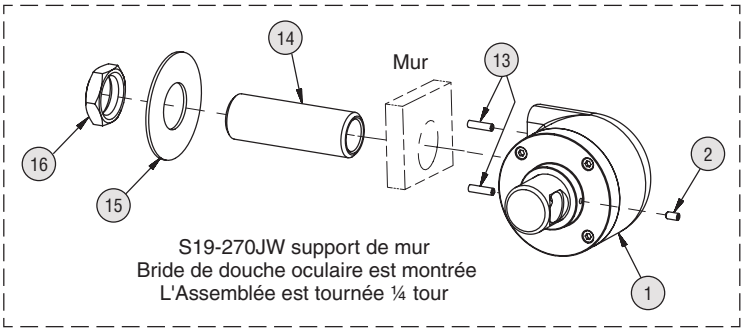
Liste des pièces — S19274HD, S19274HDR, S19274HW

Piéce	Réf.	Qté	Description
1	S65-386	1	Remplacement de la robinet rabattable, support du comptoir
	S65-387	1	Remplacement de la robinet rabattable, support du mur
2	160-473	1	Vis de reglage
13	160-474	2	Vis de reglage
14	113-514	1	Tige ½" x 2½"
15	142-002CB	1	Rondelle ⅞" x 2"
16	110-115	1	Écrou ½"-14 NPSM
19	113-1227	1	Tuyau ⅜" x 7¼" laiton chromé rouge (S19274HD)
19	113-1236	1	Tuyau ⅜" x 5½" laiton chromé rouge (S19274HDR)
20	171-006	1	Corps ⅜" NPT femelle

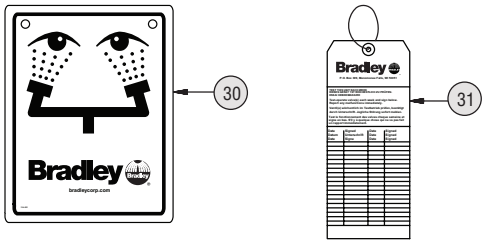
Piéce	Réf.	Qté	Description
21	S05-190	1	Douche oculaire (comprend)
22	dans la trousse d'entretien	2	Axe de pivotement (kit de remplacement)
23	dans la trousse d'entretien	2	Couverture à bascule (kit de remplacement)
25	115-158	1	Bouchon
26	125-157	2	Bague
27	125-175	1	Contrôle du débit
28	S65-340	1	Filtrer (paquet de 3)
29	160-500	1	Vis, purge
30	114-051	1	Enseigne de sécurité
31	204-421	1	Etiquette d'inspection

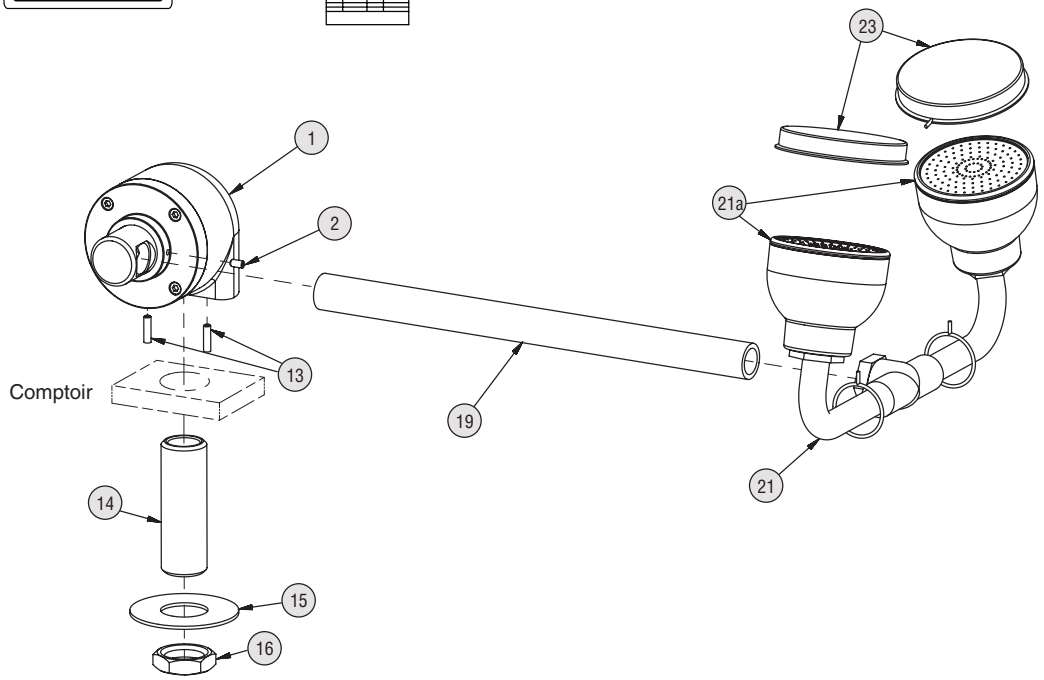
Assemblage des composantes — S19-270JD, S19-270JW

☑ *Montré dans la position de "OUVERTE"*



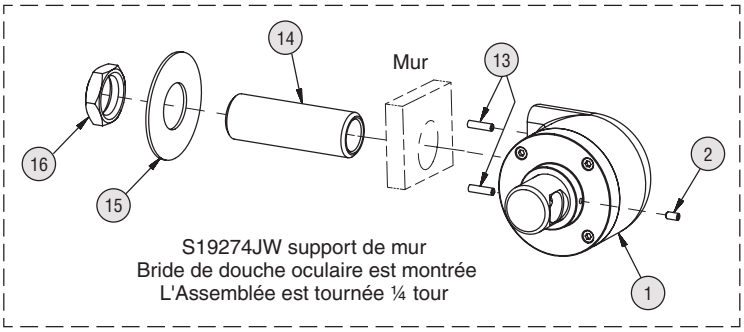
S19-270JW support de mur
Bride de douche oculaire est montrée
L'Assemblée est tournée ¼ tour



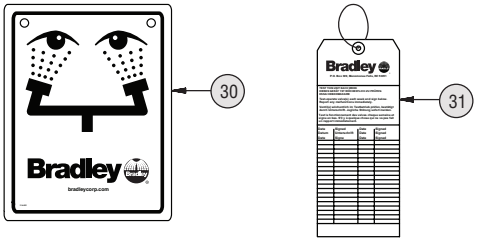


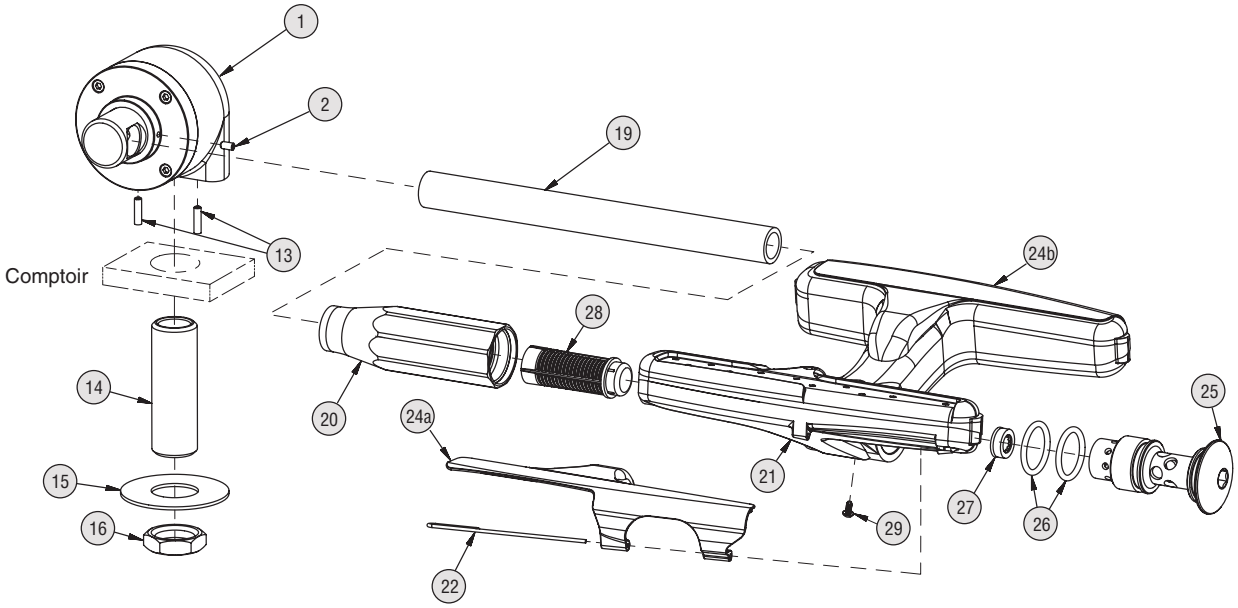
Assemblage des composantes — S19274JD, S19274JW

☑ *Montré dans la position de "OUVERTE"*



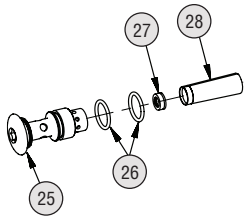
S19274JW support de mur
Bride de douche oculaire est montrée
L'Assemblée est tournée ¼ tour



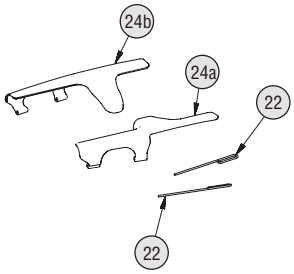


Paquet S65-339 comprend les éléments 26, 27, 28

Paquet S88-068 comprend les éléments 25, 26, 27, 28



Paquet couvertures à bascule (douche oculaire/ faciale) S45-2676 comprend les éléments 22, 24a et 24b



Liste des pièces — S19-270JD, S19-270JW

Piéce	Réf.	Qté	Description
1	S65-386	1	Remplacement de la robinet rabattable, support du comptoir
1	S65-387	1	Remplacement de la robinet rabattable, support du mur
2	160-473	1	Vis de reglage
13	160-474	2	Vis de reglage
14	113-514	1	Tige ½" x 2½"
15	142-002CB	1	Rondelle Flat ⅞" x 2"

Piéce	Réf.	Qté	Description
16	110-115	1	Écrou ½"-14 NPSM
19	113-1075	1	Tuyau, ⅜" x 9" laiton poli
21	S05-206	1	Douche oculaire/faciale
21A	S45-2453	1	Trousse d'entretien EFW - Diffuseurs noirs
23	S53-063	2	Cache-poussière ancré
30	114-051	1	Enseigne de sécurité
31	204-421	1	Etiquette d'inspection

Liste des pièces — S19274JD, S19274JW

Piéce	Réf.	Qté	Description
1	S65-386	1	Remplacement de la robinet rabattable, support du comptoir
	S65-387	1	Remplacement de la robinet rabattable, support du mur
2	160-473	1	Vis de reglage
13	160-474	2	Vis de reglage
14	113-514	1	Tige ½" x 2½"
15	142-002CB	1	Rondelle ⅞" x 2"
16	110-115	1	Écrou ½"-14 NPSM
19	113-1227	1	Tuyau, ⅜" x 7¼" laiton chromé rouge
20	171-006	1	Corps ⅜" NPT femelle
21	S05-192	1	Douche oculaire/faciale (comprend)

Piéce	Réf.	Qté	Description
22	dans la trousse d'entretien	2	Axe de pivotement (kit de remplacement)
24a	dans la trousse d'entretien	1	Couverture à bascule (kit de remplacement)
24b	dans la trousse d'entretien	1	Couverture à bascule (kit de remplacement)
25	115-158	1	Bouchon
26	125-157	2	Bague
27	125-175	1	Contrôle du débit
28	S65-340	1	Filtrer (paquet de 3)
29	160-500	1	Vis, purge
30	114-051	1	Enseigne de sécurité
31	204-421	1	Etiquette d'inspection

ADVERTENCIA

Aclarar el conducto del suministro de agua antes y después de la instalación. Verificar que no haya fugas y que el flujo de agua sea adecuado. El suministro principal de agua a la unidad debe estar siempre en posición "ON" (abierto). Se deben tomar medidas a fin de evitar el corte no autorizado del suministro.

ATTENCIÓN

Los equipos de emergencia deben contar con agua tibia (entre 15,6 °C y 37,8 °C). Cualquier exposición prolongada a aguas bajo cero afecta la capacidad del cuerpo para mantener su temperatura, lo que incrementa el riesgo de hipotermia.

AVISO

Antes de instalar este producto, asegúrese de que haya espacio adecuado alrededor del producto y de que su activación no interfiera con otros productos u obstrucciones.

Evite los limpiadores que contengan solventes orgánicos, alcoholes e hidrocarburos. Enjuague con agua después de limpiar.

IMPORTANTE

La instalación y ubicación de todas las duchas, lavaojos y lavaojos/lavacara de seguridad deben cumplir con los requisitos de ANSI/ISEA Z358.1.

Lea en su totalidad este manual de instalación para garantizar una instalación adecuada. Una vez que termine la instalación, entregue este manual al propietario o al Departamento de Mantenimiento. Es responsabilidad de quien instale el equipo cumplir con los códigos para desagüe y otra códigos y ordenanzas locales.

Separar todas las piezas del material de embalaje y asegurarse que todas las piezas estén incluídas antes de desechar cualquier material de embalaje.

La norma ANSI/ISEA Z358.1 exige un suministro ininterrumpido de líquido de limpieza. Los equipos de emergencia con tuberías de Bradley requieren una presión de flujo mínima de 0,21 MPa (30 PSI).

Las válvulas con funcionamiento a resorte de autocerrado no cuentan con clasificación UL para ANSI/ISEA Z358.1.

Se deben llevar a cabo activaciones semanales de todos los equipos de emergencia conectados a la plomería para garantizar que hay un suministro de líquido de limpieza adecuado presente y liberar la tubería de suministro de cualquier acumulación de sedimento. Los equipos de emergencia se deben inspeccionar mensualmente para solucionar cualquier problema de mantenimiento; esto garantizará que los equipos están en buenas condiciones de funcionamiento y que no hay señales de desgaste.

Los trabajadores que puedan tener contacto con materiales potencialmente peligrosos deben recibir capacitación sobre la ubicación y operación adecuada de los equipos de emergencia en conformidad con la norma ANSI/ISEA Z358.1.

Para consultas sobre la operación o instalación de este producto, visite www.bradleycorp.com o llame al 1-800-BRADLEY.

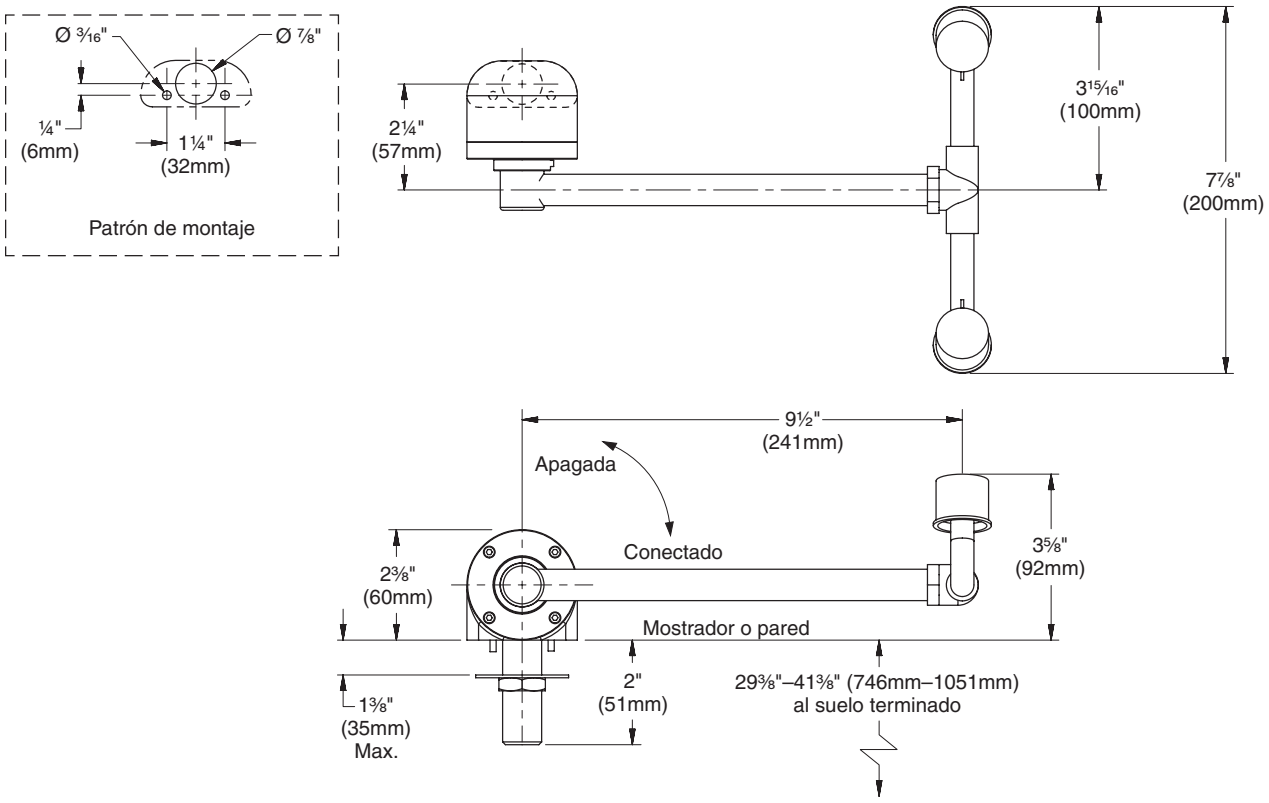
Las garantías del producto se pueden encontrar en "Información del producto" o en nuestro sitio Web, www.bradleycorp.com.

Materiales necesarios:

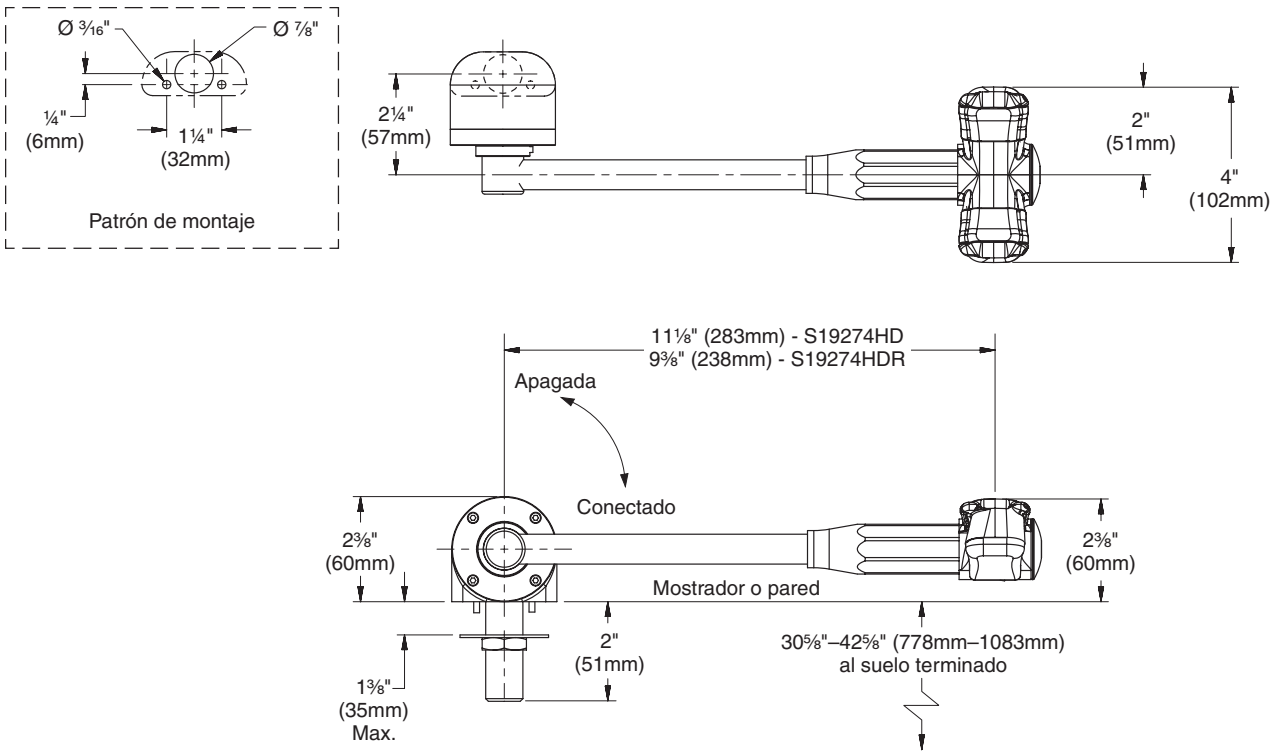
- Proporcione la tubería a la toma de ½" NPT del suministro de agua del lavador de ojos
- Sellador de tubería
- Tornillería para montar el aviso de seguridad

☑ *Los códigos locales pueden exigir la instalación de una válvula de prevención de contraflujo para completar la instalación correcta. La conformidad con los códigos locales es de responsabilidad del instalador. La válvula se debe probar anualmente para verificar que funcione de manera correcta. Las válvulas de prevención de contraflujo no se incluyen con el accesorio y las puede proporcionar el contratista o las puede comprar en Bradley Corporation.*

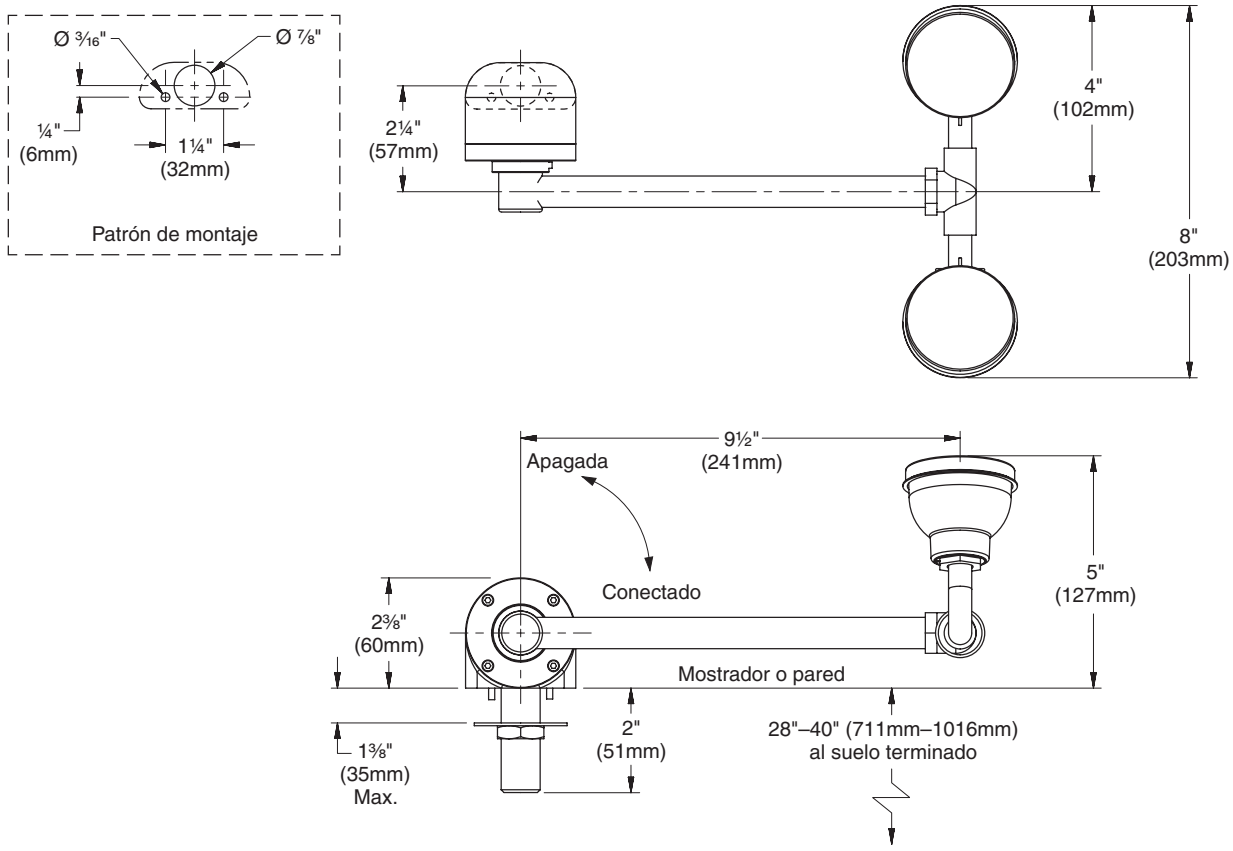
Dimensiones — S19-270HD, S19-270HW (se muestra una unidad que se monta a la mostrador)



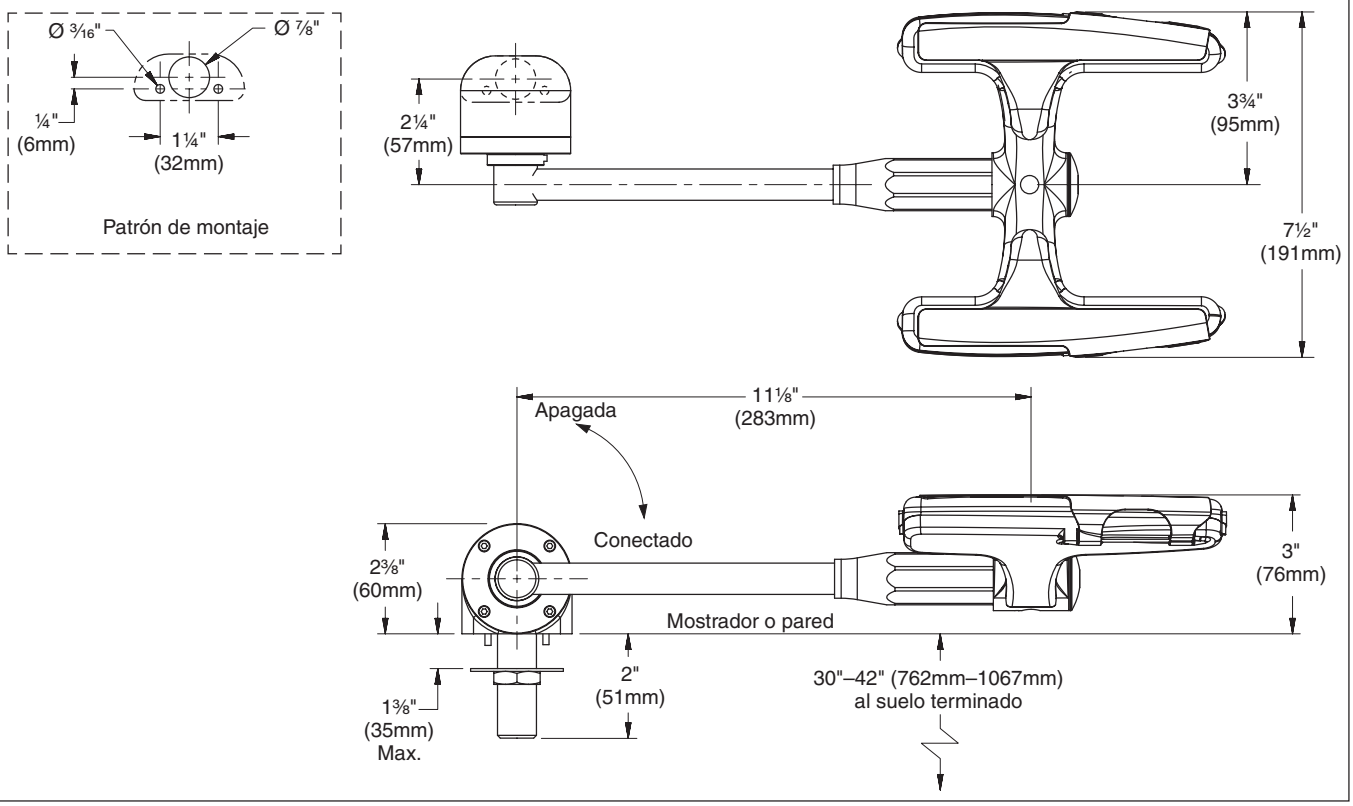
Dimensiones — S19274HD, S19274HDR, S19274HW (se muestra una unidad que se monta a la mostrador)



Dimensiones — S19-270JD, S19-270JW (se muestra una unidad que se monta a la mostrador)



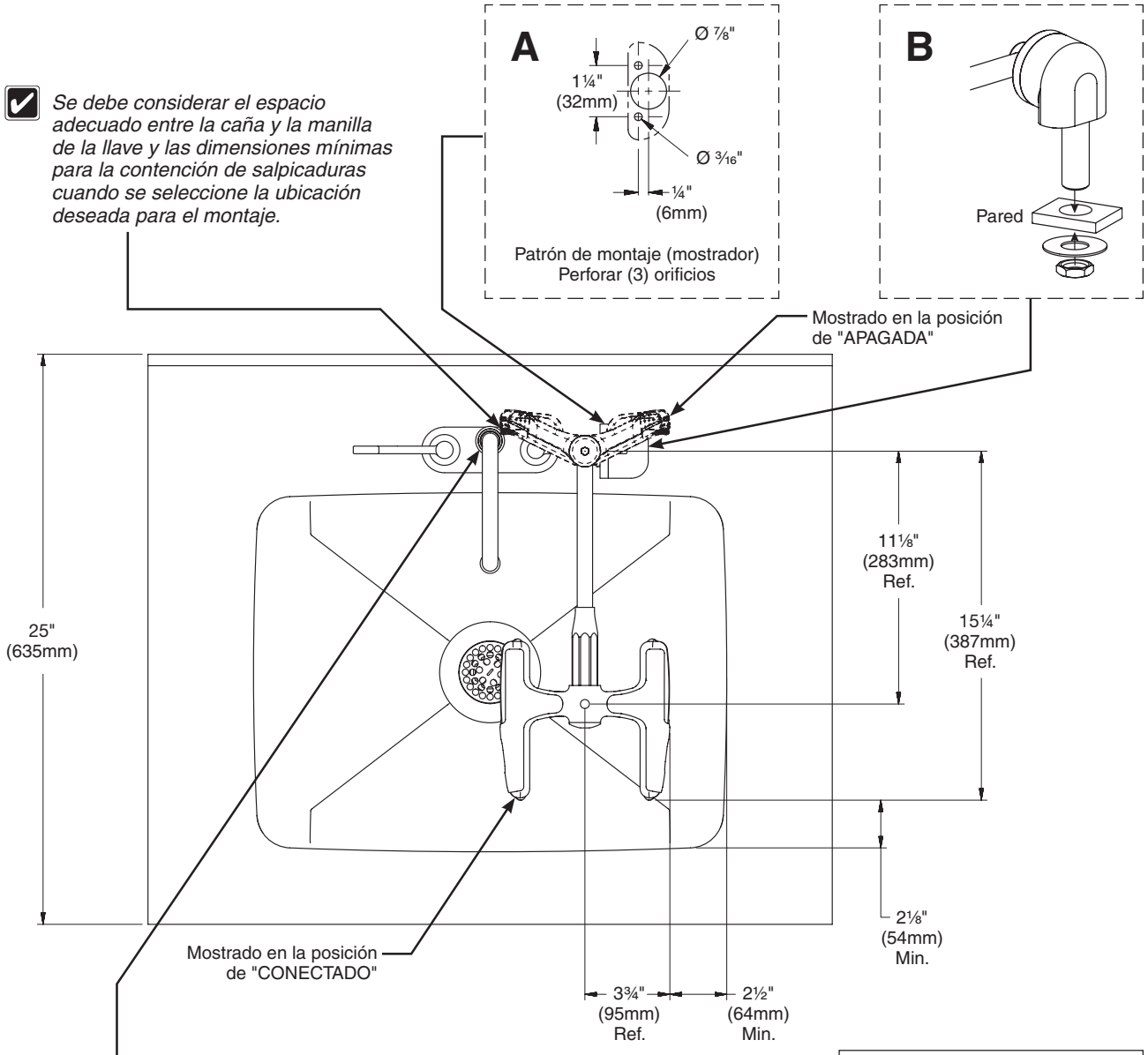
Dimensiones — S19274JD, S19274JW (se muestra una unidad que se monta a la mostrador)



Instalación

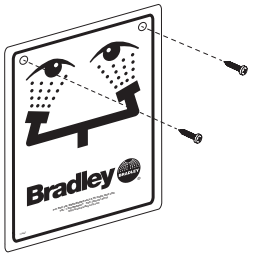
- ☑ *Se observa la unidad de lavado ocular y facial Halo en una cubierta de muestra de 25" (635 mm). Las otras unidades son similares.*
- ☑ *Se muestran las dimensiones mínimas necesarias para contener las salpicaduras de las unidades Halo.*
- ☑ *Aplicar sellador de tubería o cinta (suministrados por el instalador) a las juntas de tubería de rosca macho. La parte superior de los rociadores del lavador de ojos debe colocarse a una altura máxima de 33 pulgadas (83 cm) y a una altura mínimo de 45 pulg. (115 cm) del piso y 6 pulg. (15 cm) de la obstrucción más cercana.*

☑ *Se debe considerar el espacio adecuado entre la caña y la manilla de la llave y las dimensiones mínimas para la contención de salpicaduras cuando se seleccione la ubicación deseada para el montaje.*



C Se puede usar también una manguera flexible (provista por el instalador) con terminación de rosca hembra de ½" (12,8 mm) NPT.

D

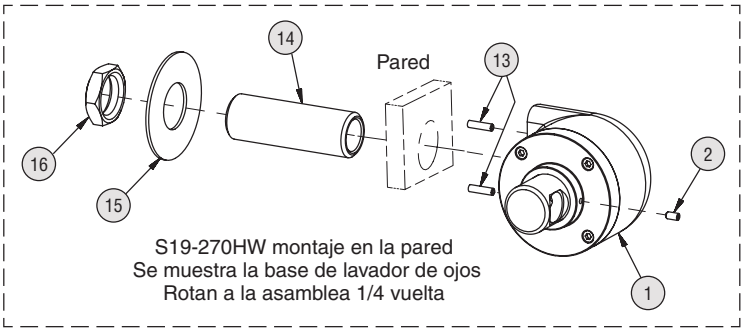


a la pared

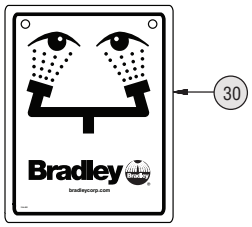
E Abra lentamente las tuberías de suministro de agua para liberar el aire y presurizar la válvula. Revise si existen fugas y verifique si el flujo de agua es adecuado.

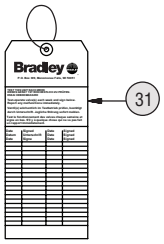
Armado de los componentes — S19-270HD, S19-270HW

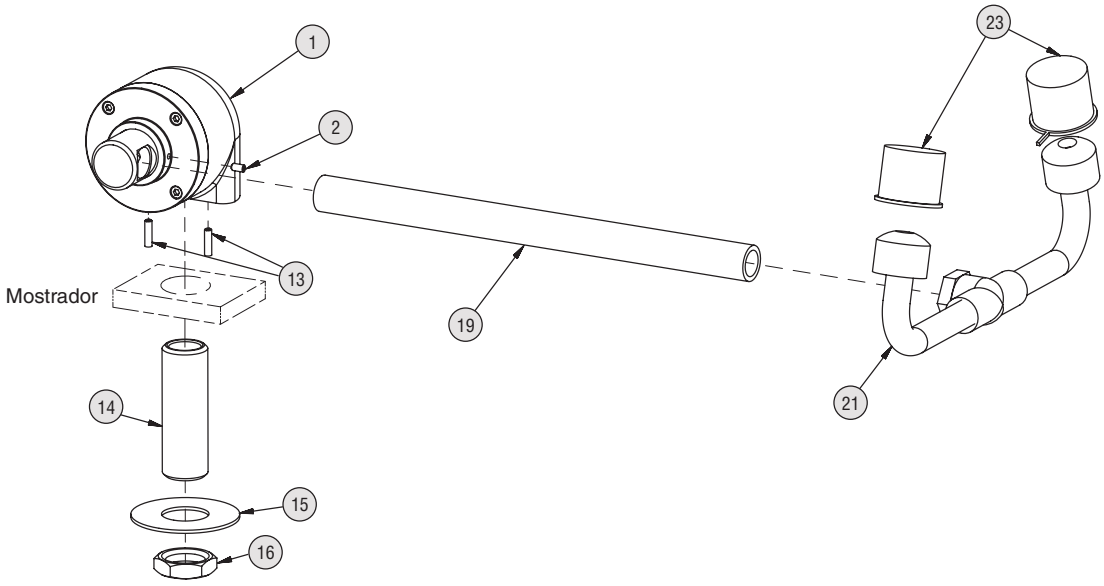
☑ *Mostrado en la posición de "CONECTADO"*



S19-270HW montaje en la pared
Se muestra la base de lavador de ojos
Rotan a la asamblea 1/4 vuelta

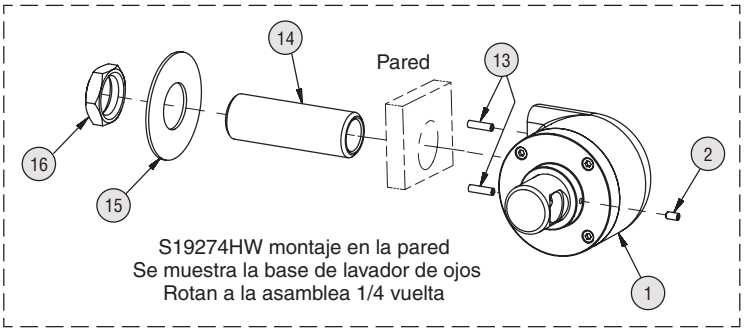




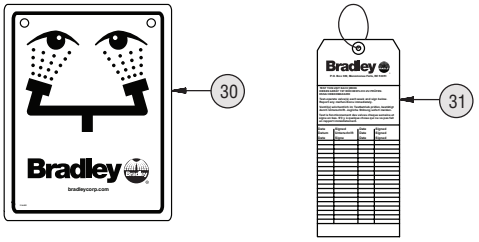


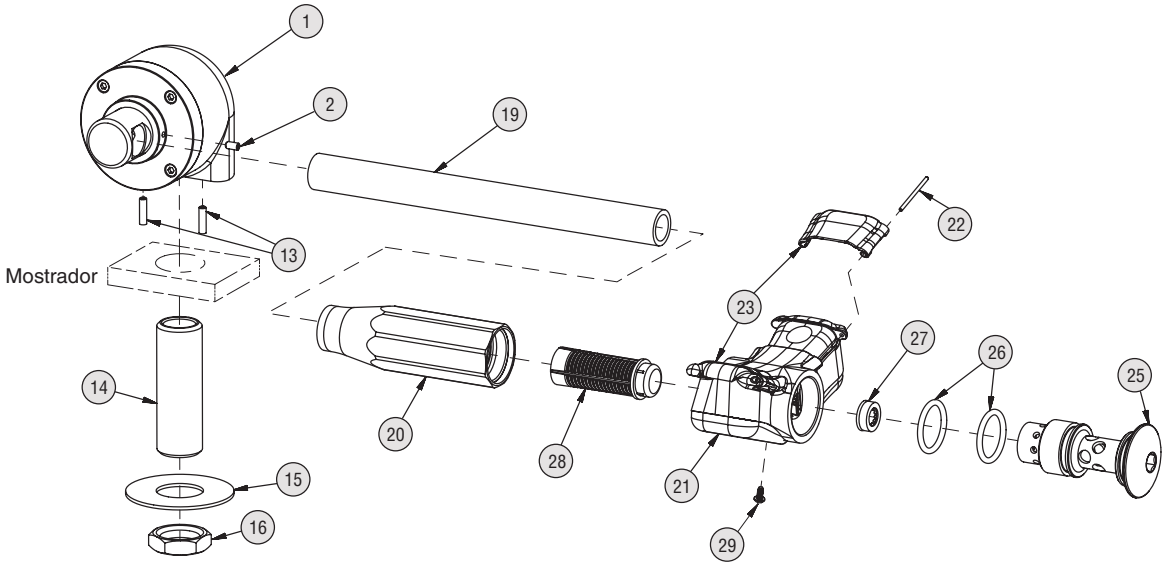
Armado de los componentes — S19274HD, S19274HW

☑ *Mostrado en la posición de "CONECTADO"*



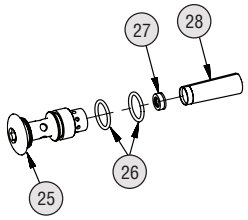
S19274HW montaje en la pared
Se muestra la base de lavador de ojos
Rotan a la asamblea 1/4 vuelta



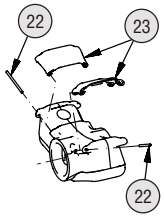


Paquete S65-339 incluye art. 26, 27, 28

Paquete S88-068 incluye art. 25, 26, 27, 28



Paquete tapa protectora lavaojos S45-2675 incluye art. 22 and 23



Lista de piezas — S19-270HD, S19-270HW

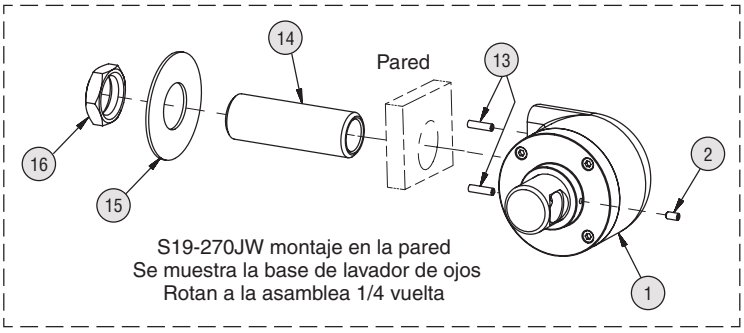
Art.	Pieza N°	Ctd.	Descripción
1	S65-386CE	1	Reemplazo de conjunto de válvula, lavador de ojos clásico, montaje de mostrador
1	S65-387CE	1	Reemplazo de conjunto de válvula, lavador de ojos clásico, montaje de la pared
2	160-473	1	Tornillo prisionero
13	160-474	2	Tornillo prisionero
14	113-514	1	Varilla tornillante ½" x 2½"
15	142-002CB	1	Arandela ⅞" x 2"
16	110-115	1	Tuerca ½"-14 NPSM
19	113-1075	1	Tubo ⅜" x 9" latón pulido
21	S05-092	1	Lavador de ojos 90°
23	107-371	2	Cubierta contrapolvo
30	114-051	1	Aviso de seguridad
31	204-421	1	Etiqueta de inspección

Lista de piezas — S19274HD, S19274HDR, S19274HW

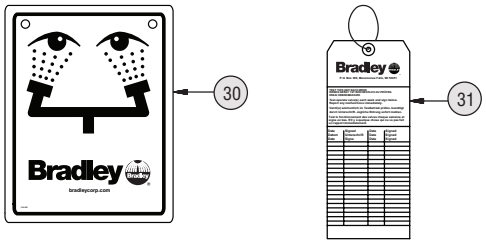
Art.	Pieza N°	Ctd.	Descripción
1	S65-386	1	Reemplazo de conjunto de válvula, montaje de mostrador
	S65-387	1	Reemplazo de conjunto de válvula, montaje de la pared
2	160-473	1	Tornillo prisionero
13	160-474	2	Tornillo prisionero
14	113-514	1	Varilla tornillante ½" x 2½"
15	142-002CB	1	Arandela ⅞" x 2"
16	110-115	1	Tuerca ½"-14 NPSM
19	113-1227	1	Tubo ⅜" x 7¼" cromado latón rojo (S19274HD)
19	113-1236	1	Tubo ⅜" x 5½" cromado latón rojo (S19274HDR)
20	171-006	1	Cuerpo ⅜" NPT hembra
21	S05-190	1	Lavador de ojos (incluye)
22	En el kit de mantenimiento	2	Pasador de pivote (juego de repuesto)
23	En el kit de mantenimiento	2	Tapa protectora (juego de repuesto)
25	115-158	1	Tapa
26	125-157	2	Arosello
27	125-175	1	Control del flujo
28	S65-340	1	Filtro (paquete de 3)
29	160-500	1	Tornillo, Drenaje
30	114-051	1	Aviso de seguridad
31	204-421	1	Etiqueta de inspección

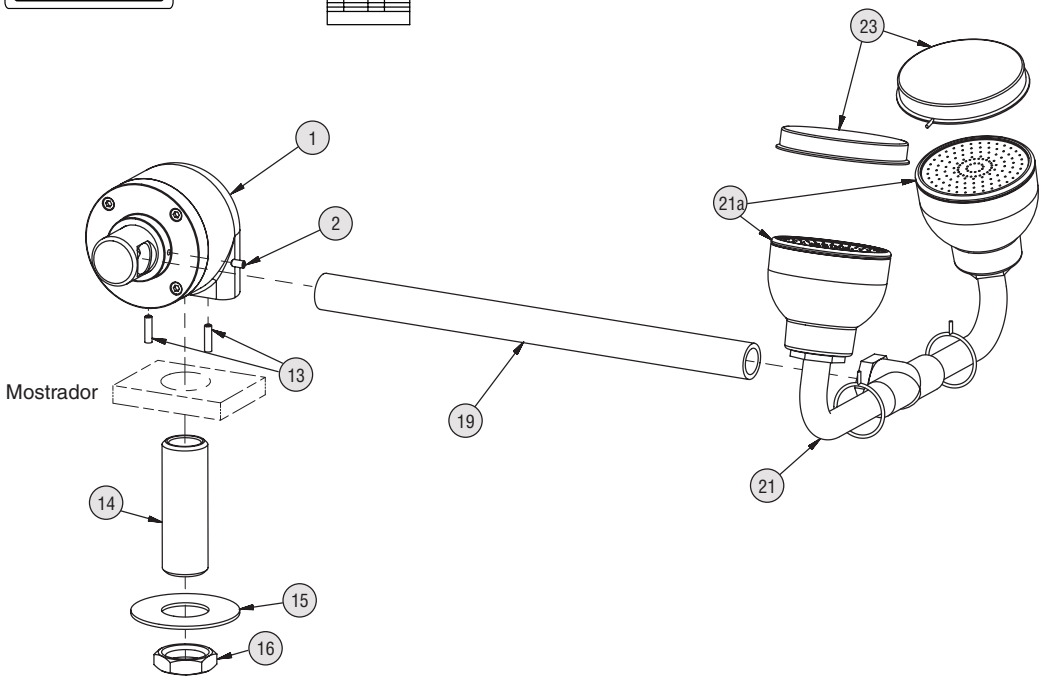
Armado de los componentes — S19-270JD, S19-270JW

☑ *Mostrado en la posición de "CONECTADO"*



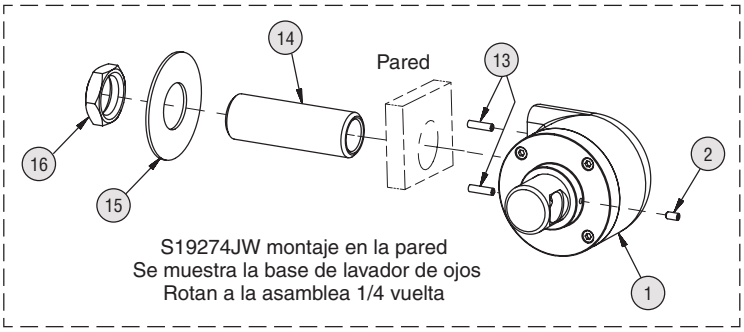
S19-270JW montaje en la pared
Se muestra la base de lavador de ojos
Rotan a la asamblea 1/4 vuelta



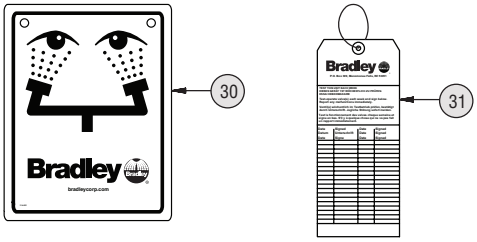


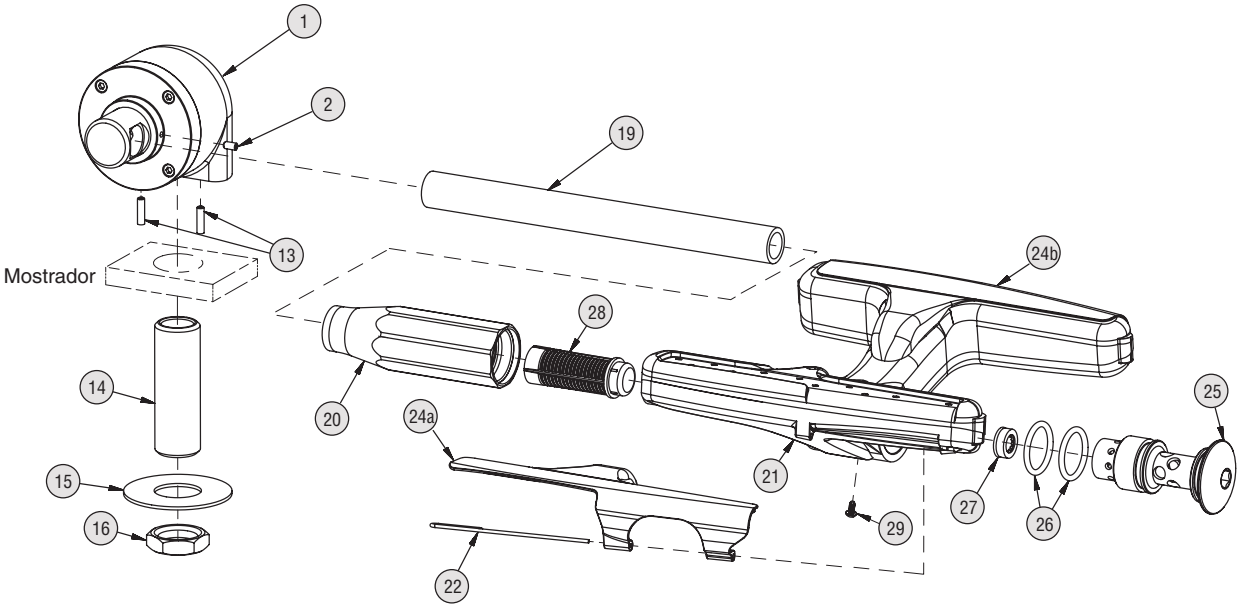
Armado de los componentes — S19274JD, S19274JW

☑ *Mostrado en la posición de "CONECTADO"*



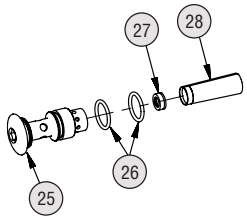
S19274JW montaje en la pared
Se muestra la base de lavador de ojos
Rotan a la asamblea 1/4 vuelta



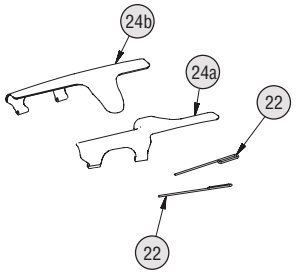


Paquete S65-339 incluye art. 26, 27, 28

Paquete S88-068 incluye art. 25, 26, 27, 28



Paquete tapa protectora lavaojos/rostro S45-2676 incluye art. 22, 24a y 24b



Lista de piezas — S19-270JD, S19-270JW

Art.	Pieza N°	Ctd.	Descripción
1	S65-386	1	Reemplazo de conjunto de válvula, montaje de mostrador
1	S65-387	1	Reemplazo de conjunto de válvula, montaje de la pared
2	160-473	1	Tornillo prisionero
13	160-474	2	Tornillo prisionero
14	113-514	1	Varilla tornillante ½" x 2½"
15	142-002CB	1	Arandela ⅞" x 2"
16	110-115	1	Tuerca ½"-14 NPSM

Art.	Pieza N°	Ctd.	Descripción
19	113-1075	1	Tubo ⅜" x 9" latón pulido
21	S05-206	1	Lavador de ojos/rostro
21A	S45-2453	1	Kit de mantenimiento para lavado de ojos y rostro: Boquillas rociadoras negras
23	S53-063	2	Cubierta contrapolvo con ligaduras
30	114-051	1	Aviso de seguridad
31	204-421	1	Etiqueta de inspección

Lista de piezas — S19274JD, S19274JW

Art.	Pieza N°	Ctd.	Descripción
1	S65-386	1	Reemplazo de conjunto de válvula, montaje de mostrador
	S65-387	1	Reemplazo de conjunto de válvula, montaje de la pared
2	160-473	1	Tornillo prisionero
13	160-474	2	Tornillo prisionero
14	113-514	1	Varilla tornillante ½" x 2½"
15	142-002CB	1	Arandela ⅞" x 2"
16	110-115	1	Tuerca ½"-14 NPSM
19	113-1227	1	Tubo ⅜" x 7¼" cromado latón rojo
20	171-006	1	Cuerpo ⅜" NPT hembra
21	S05-192	1	Lavado de ojos y rostro (incluye)

Art.	Pieza N°	Ctd.	Descripción
22	En el kit de mantenimiento	2	Pasador de pivote (juego de repuesto)
24a	En el kit de mantenimiento	1	Tapa protectora (juego de repuesto)
24b	En el kit de mantenimiento	1	Tapa protectora (juego de repuesto)
25	115-158	1	Tapa
26	125-157	2	Arosello
27	125-175	1	Control del flujo
28	S65-340	1	Filtro (paquete de 3)
29	160-500	1	Tornillo, Drenaje
30	114-051	1	Aviso de seguridad
31	204-421	1	Etiqueta de inspección

ES-1 EMERGENCY SHOWER

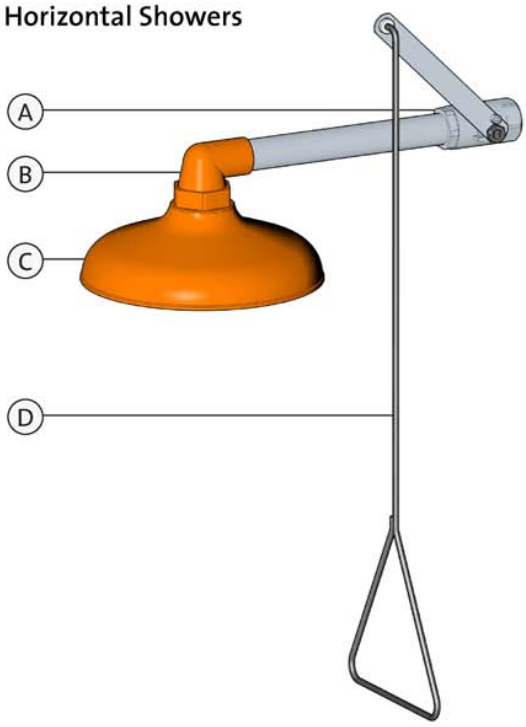
GGBF2150	GUARDIAN	REC SAF STN W/ DRN PAN EXP SHWRHD

Guardian

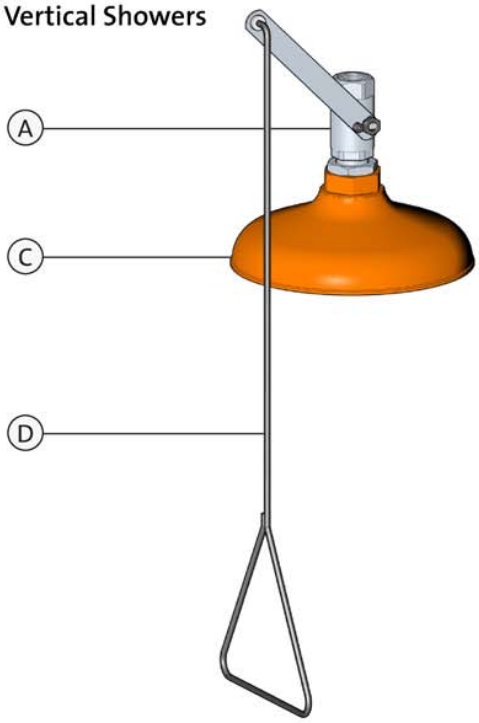
Parts List
Emergency Shower

Item	Part number	Description
Valve/Arm Assemblies		
A	**AP600-335H**	1" IPS Chrome Plated Brass Stay-Open Ball Valve, Horizaontal, Single Activation
	AP600-335V	1" IPS Chrome Plated Brass Stay-Open Ball Valve, Vertical, Single Activation
	AP600-345H	1" IPS Chrome Plated Brass Self-Closing Ball Valve, Horizontal
	AP600-345V	1" IPS Chrome Plated Brass Self-Closing Ball Valve, Vertical
	AP600-340H	1" IPS Chrome Plated Brass Stay-Open, Dual Activation Valve, Horizontal
	AP600-340V	1" IPS Chrome Plated Brass Stay-Open, Dual Activation Valve, Vertical
	Note: Above Assemblies include stainless steel actuaing arm.	
Elbows		
B	**330-12-08RSE-OR**	Orange ABS Plastic
	330-12-08RSE-GR	Green ABS Plastic
	330-12-08RSE-YE	Yellow ABS Plastic
	300-08SE	1" IPS Galvanized Steel Street Elbow
	320-08SE	1" IPS Stainless Steel Street Elbow
Shower heads		
C	**AP450-032ORG**	Orange ABS Plastic Shower Head
	AP450-032GRN	Green ABS Plastic Shower Head
	AP450-032YEL	Yellow ABS Plastic Shower Head
	AP450-048	10" Diameter Stainless Steel
	AP450-062	10" Dia. Recessed Flanged Stainless Steel
	AP450-016	8" Dia. Chrome Plated Brass
Actuating Components		
D	**AP050-079**	29" Stainless Steel Pull Rod
	AP050-080	47-1/2" Stainless Steel Pull Rod
	AP050-081	Extended Length Stainless Steel Pull Rod
	050-049	Stainless Steel Guide Plate

Horizontal Showers



Vertical Showers



Guardian Equipment
1440 N North Branch
Chicago, IL 60642

312 447 8100 TELEPHONE
312 447 8101 FACSIMILE
gesafety.com

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Guardian

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RETURNED GOODS. No material may be returned without prior written authorization. All returns are subject to a 25% or $50.00 minimum handling charge and any expense necessary to put material in saleable condition. Special fixtures and coated products are not subject to return.

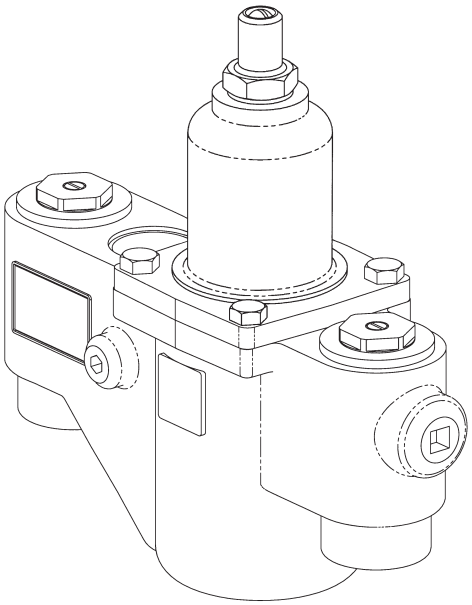
PRODUCT CHANGES. Due to the continuing improvement of products and other factors, the Company reserves the right to substitute material and/or to make changes in design, rough-in dimensions or other specifications shown and described in any of our printed literature. Such changes may be made without notice to the Buyer.

The above terms and conditions and any terms and conditions contained in the Company's printed acknowledgment or invoice apply regardless of any printed terms on the Buyer's order.

TMV-1 **TMV-1 THERMOSTATIC MIXING VALVE**

BS593130BP	BRADLEY	HL130 HIGH-LOW MIXING VALVE CONSIST OF A LIQUID FILLED THERMOSTAT AND A STAINLESS STEEL PISTON AND LINER WITH POSITIVE SHUT-OFF HOT WATER WHEN COLD WATER SUPPLY IS LOST, INTEGRAL STRAINER CHECK STOPS ON INLETS, ADJUSTABLE SET POINT WITHIN TEMPERATURE

Installation



ASSE 1017 & UPC Certified

S59-3130

Thermostatic Mixing Valve (HL130)

Table of Contents

Supplies Required 2
Installation Instructions 3
Troubleshooting 5

Inlet Connections: 1-1/4" NPT

Outlet Connection: 1-1/2" NPT

Temperature Range: 90 – 120°F

Maximum Pressure: 125 PSIG

Inlet Temperature Hot: 120 – 200° F

Inlet Temperature Cold: 33 – 80° F

Minimum Temperature Differential (from valve set point): 20° F

215-1302 Rev. K; ECN 14-09-029
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P.O. Box 309, Menomonee Falls, WI USA 53052-0309
800 BRADLEY (800 272 3539) +1 262 251 6000
bradleycorp.com

IMPORTANT

WARNING! Make sure that all water supply lines have been flushed and then completely turned off before beginning installation. Debris in supply lines can cause valves to malfunction.

WARNING! Failure to comply with proper installation and maintenance instructions could contribute to a valve failure resulting in severe bodily injury including scalding, chilling and/or death depending upon system water pressure changes and/or supply water temperature changes.

This thermostatic mixing valve is designed to be installed at or near the boiler or water heater. It is not designed to compensate for system pressure fluctuations and should not be used where ASSE standard 1016, 1069 or 1070 devices are required. These valves should never be used to provide "anti-scald" or "anti-chill" service. This valve does not provide protection from pipe freezing.

Consult local building and plumbing codes prior to installation. Should these codes differ from the information in the manual, follow the local codes. Inquire with governing authorities for additional local requirements.

Regular checking and cleaning of the valve's internal components and check stops is necessary for maximum life and proper product function. Periodic inspection and yearly maintenance by a licensed contractor is required. Corrosive water conditions and/or unauthorized adjustments or repairs could render the valve ineffective for it's intended service. Frequency of cleaning and inspection depends upon local water conditions.

Output temperature of the valve must be checked and adjusted at initial installation and on a quarterly basis.

Read this entire installation manual to ensure proper installation. When finished with the installation, file this manual with the owner or maintenance department. Compliance and conformity to local codes and ordinances is the responsibility of the installer.

Separate parts from packaging and make sure all parts are accounted for before discarding packaging material. If any parts are missing, do not begin installation until you obtain the missing parts.

Product warranties may be found under “Products” on our web site at bradleycorp.com.

Supplies recommended for installation

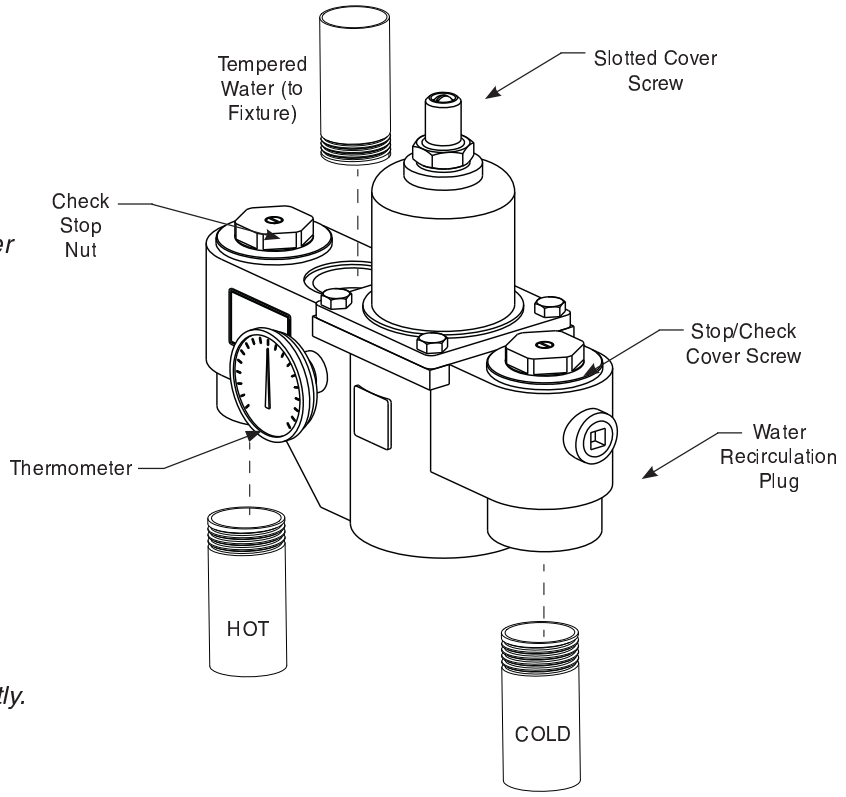
- Lockable shut-off on the outlet if tempered water is supplied to one or more remote fixtures
- Lockable shut-off on the inlets/supplies
- (6) 3/8" wall anchors and fasteners for surface-mounted cabinet
- (4) 1/4" and (2) 3/8" fasteners (and wall anchors, if necessary) for recess-mounted cabinet
- Unions on all connections to facilitate removal of valve

Tools required for temperature adjustment

- 5/32" Allen wrench
- Blade screwdriver

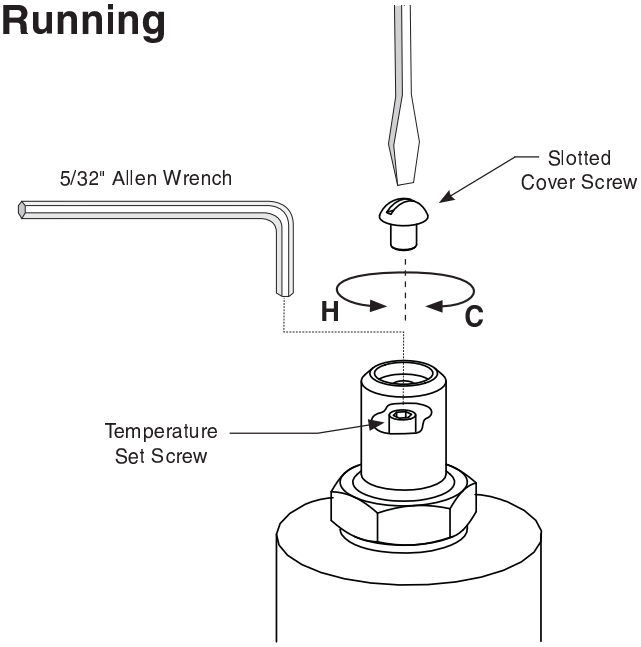
1 Connect Supply Lines and Install Thermometer

- ☑ *Flush the supply lines before beginning installation.*
- ☑ *When the check valves are in the open (operating) position, the cover screw for the stop/check stem will be flush with the valve cap.*
- ☑ *Install Optional Thermometer using pipe sealant or teflon tape.*
- ☑ *Check for leaks by pressurizing unit SLOWLY.*
- ☑ *Valve appearance may differ slightly.*



2 Adjust Temperature with Water Running

- ☑ *Check the temperature when approximately 10 GPM water flow is reached (equivalent to four standard showers).*
- ☑ *This device must be checked for final temperature and adjusted as necessary. The standard preset factory temperature setting is 105°F (40°C).* [the range of the valve is 90°F – 120°F (32°C – 49°C)]. *Consult proper medical and/or safety authorities for the optimum temperature recommended for your particular application.*



3 Test Unit

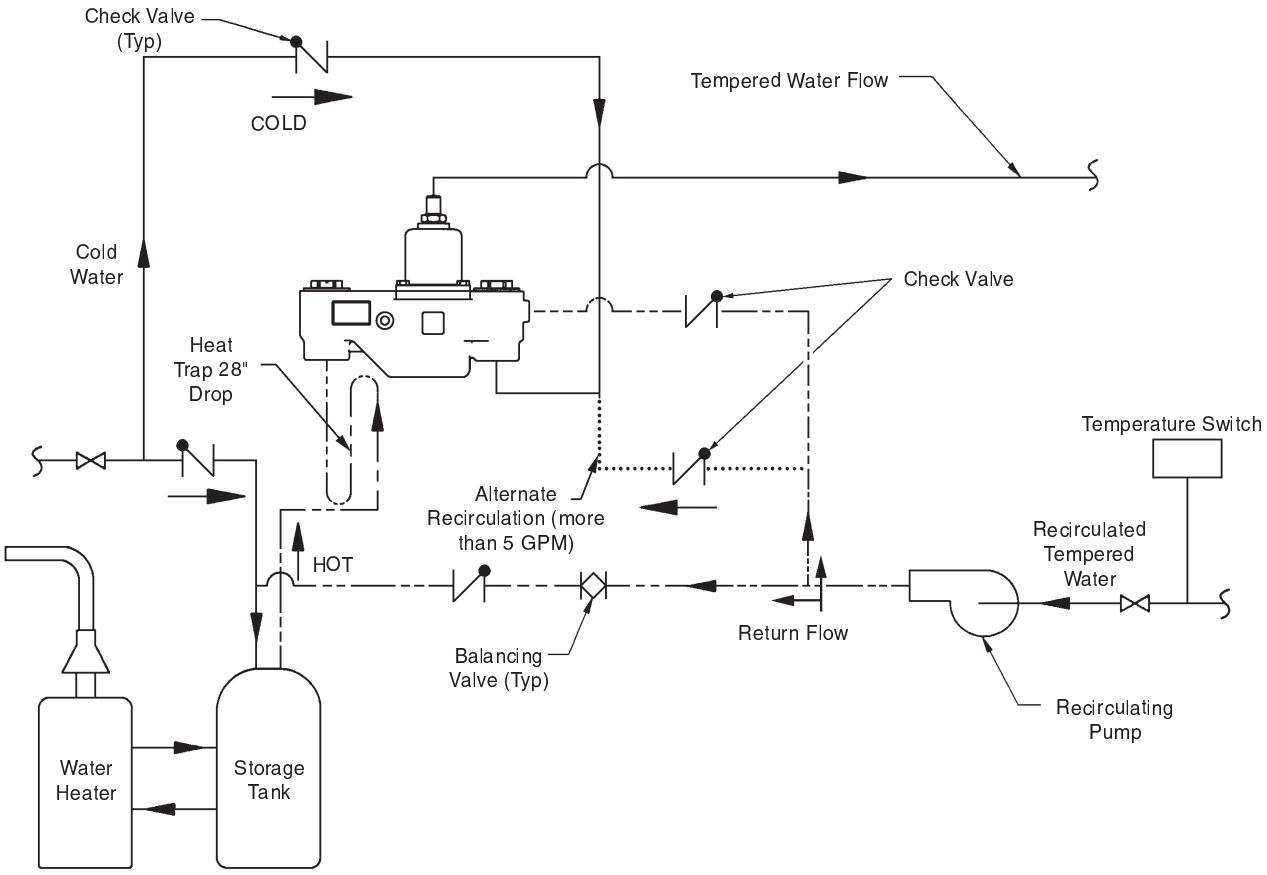
DO NOT SKIP THIS STEP!!!

Shut the hot water supply off by closing hot water inlet valve or supply check valve. While the hot water supply is turned off, check to make sure the cold water is significantly reduced. If the cold water is reduced properly, reopen the hot water supply.

Shut the cold water supply off by closing the cold water inlet valve or supply check valve. While the cold water supply is off, check to make sure that the hot water flow has shut down. If hot water is shut down, reopen cold water supply. Test unit weekly for proper function and desired set temperature.

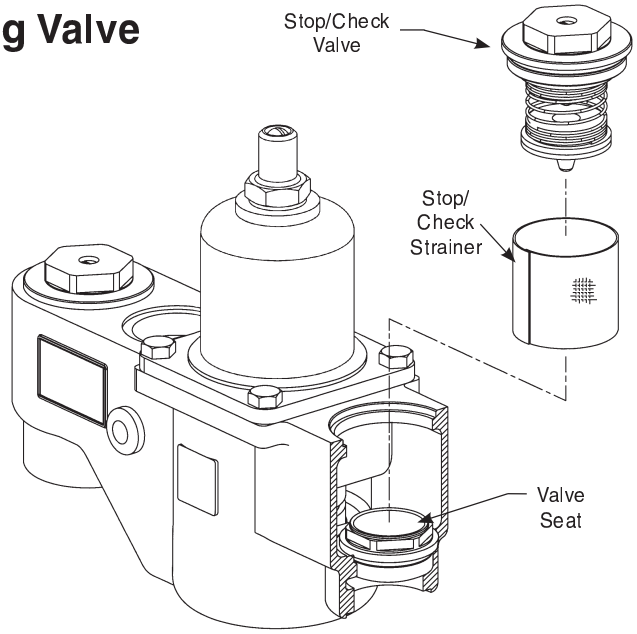
4 Optional Water Recirculation Setup

Recirculating the water in the system provides constant regulation of the water temperature. Flush the supply lines thoroughly after completing installation. Close off all fixtures and label them as not available for use during the recirculating process.



1. Turn off the recirculating pump and turn on the water supply (a water flow rate of 10-15 GPM is required).
2. Let the water run through the system until a consistent temperature is obtained. If you do not obtain the required temperature, refer to step #2 on previous page for temperature readjustment.
3. As soon as the water reaches the proper temperature, turn on the recirculating pump (make certain the proper system temperature has been achieved before proceeding).
4. Check the water temperature at the return pump. If the temperature exceeds the appropriate level by 2°F, adjust the temperature high-limit switch (this will turn off the pump). Wait until the return water temperature is 5°F below the appropriate level and adjust the low-limit switch (this will turn the pump back on).
5. Open the balancing valve completely.
6. Turn off all fixtures and make sure there is no water running through the system (the cold inlet pipe should feel warm to the touch).
7. Let the system run for 30 minutes or longer without water. If, after 30 minutes, the water temperature increases, you may readjust the temperature by slowly closing the balancing valve until the appropriate temperature is reached.

Troubleshooting Thermostatic Mixing Valve



Before attempting to troubleshoot the valve or disassemble the components, check for the following:

- Stop/check valves are fully open (the slotted stem must be flush with the stop/check cap) and that all inlet and outlet shut-off valves are open
- Hot and cold inlet pipes are connected properly, and that there are no cross-connections or leaking stop/check valves
- Water heater output is at least 15° F above the set temperature.

Be sure to close the appropriate shut-off valves prior to disassembly of the valve and reopen the valves after inspection and repair is complete.

Valve appearance may differ slightly.

Problem	Cause	Solution
External leaks in the system	Either the NPT joints or the o-rings have been damaged.	Replace the NPT joints and/or o-rings where necessary. For replacement of o-rings, contact your Bradley representative and ask for O-Ring Seal Kit (S65-215).
No hot water flow (cold water flow only)	The thermostat has failed and, subsequently, the safety shut-off has engaged.	**Inspect Thermostat:** 1. Remove the top cap and pull out the push rod and thermostat. 2. Insert a 7/16" dia. rod into the thermostat bellows. 3. Mark the length of the thermostat bellows (at room temperature, with 10 lb. of force, the bellows length should be approx. 2-25/35" to 3-1/4"). 4. If the thermostat bellows length is not in the proper range, the thermostat must be replaced (it cannot be repaired). Contact your Bradley representative and ask for Thermostat Kit (S65-194).
Limited water flow	The inlet shut-off valve may be partially closed or there has been a significant decrease in water pressure.	
	Dirt and debris have collected on the check screen or seat, limiting the movement of the stop and checks.	**Clean Stop and Check Valves:** Remove the stop and checks, clean the screen and seat and reassemble the valve. Do not remove the seat. The components may be scraped with a screwdriver to remove debris. A pair of tweezers works well for pulling debris out from the seat. If the stop and checks need to be replaced, contact your Bradley representative and ask for Check/Stop Kit (S65-212).
Temperature fluctuation or improper Temperature	The stop and check sections of the valve do not move freely.	Clean Stop and Check Valves as described above.
	Thermostat is slowly failing.	Check Thermostat as described above, or replace.
	Inlet supply line to the mixing valve is being shared by other pieces of equipment that are used only periodically, such as laundry appliances or washdown stations. It may reduce the inlet pressure to the mixing valve to less than 10 PSI. The supply line size may not be large enough to supply both the valve and the other appliances.	Enlarge the supply line size, reconfigure the supply line or regulate the supply usage.
	Recirculation is not balanced.	Review recirculation set up on page 5.
	Piston does not move freely and must be cleaned.	See next page for piston disassembly and cleaning directions.

Troubleshooting: Piston Disassembly and Cleaning

WARNING! To prevent injuries, use proper protective equipment for eyes and skin when using a propane torch.

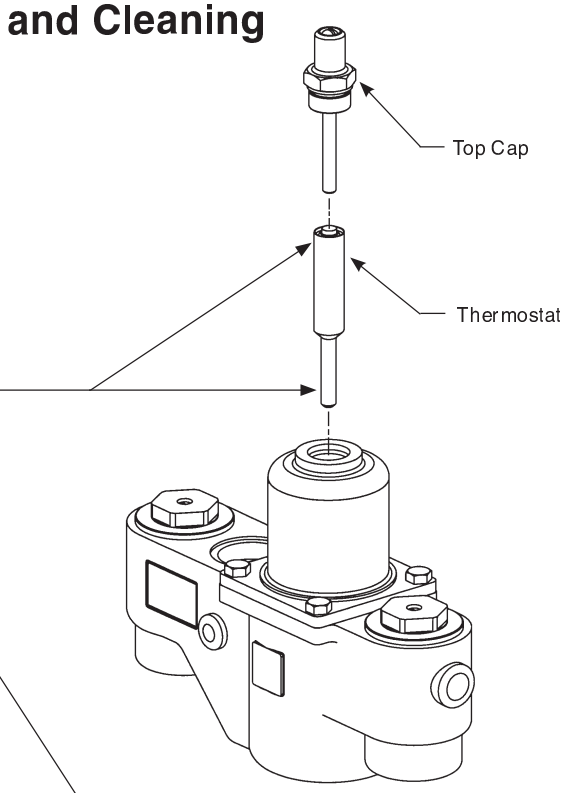
A Remove the valve's top cap and pull out the thermostat and push rod. You may use a needle-nose pliers to remove the thermostat from the valve body if desired.

B Insert a 7/16" dia. rod into the valve and into the piston overheat chamber. Mark the length of the rod inside the valve. Push the rod until the piston stops and mark the new length.

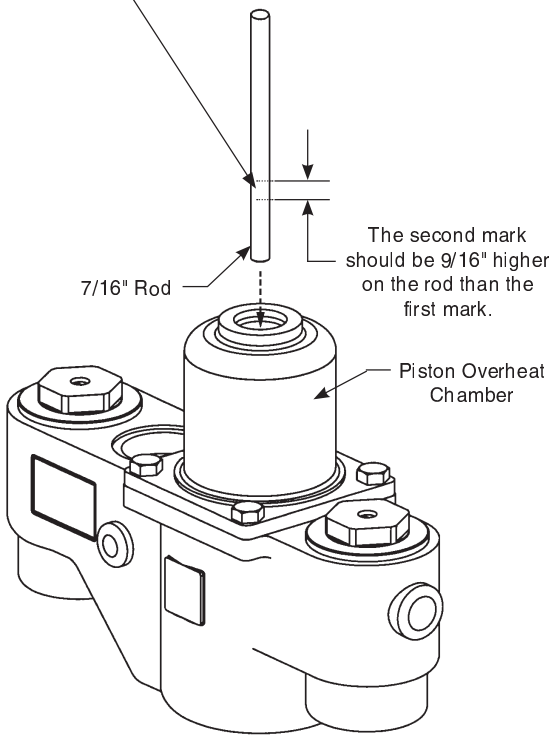
C If the rod travels less than 9/16", the piston is not moving freely within the liner and they must be cleaned:

1. Remove the control section assembly, top cap and thermostat.
2. Unthread the liner from the cap (it is glued together; the o-rings must be removed and heat should be applied to melt the glue and loosen the liner).
3. Clean the piston and liner with any cleaner suitable for brass and stainless steel (400-grit sandpaper may be used to polish and hone the piston and liner).

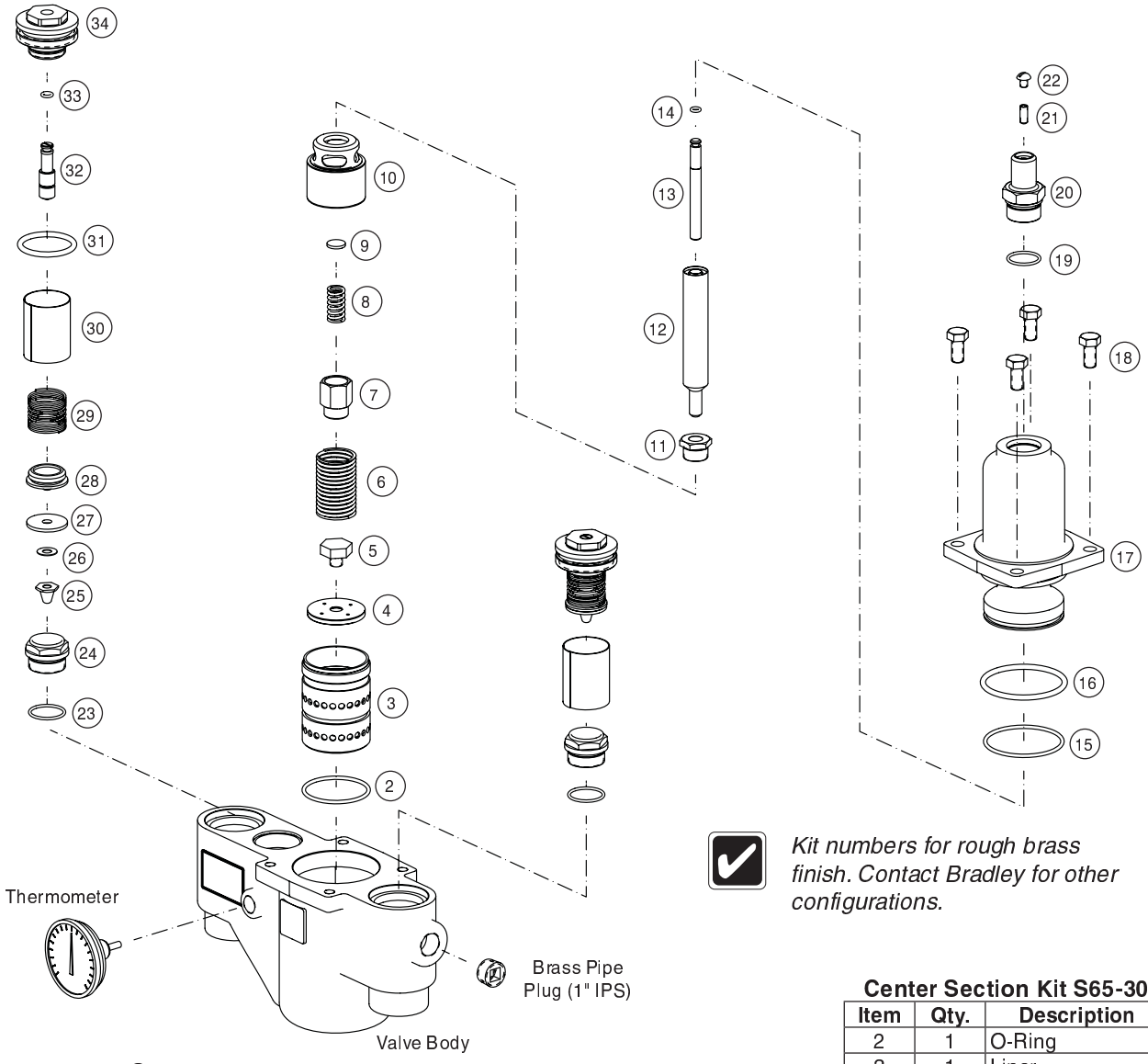
D Push the mechanism up and down several times to make sure the piston moves smoothly and consistently. If it is not consistent, repeat Procedure C until it moves freely, or replace. Contact your Bradley representative and ask for Piston/Liner Kit (part number S65-216).



Valve appearance may differ slightly.



Parts Breakdown



Kit numbers for rough brass finish. Contact Bradley for other configurations.

Thermostat Kit S65-194

Item	Qty.	Description
12	1	Thermostat
14	1	O-Ring
19	1	O-Ring

Piston & Liner Kit S65-216

Item	Qty.	Description
2	1	O-Ring
3	1	Liner
4	1	Washer
5	1	Screw
6	1	Spring
7	1	Lower Chamber
8	1	Spring
9	1	Washer
10	1	Piston
11	1	Upper Chamber

Washer/Seal Kit S65-320

Item	Qty.	Description
4	1	Washer
9	1	Washer
26	2	Washer
27	2	Seal

O-Ring Kit S65-215

Item	Qty.	Description
2	1	O-Ring
14	1	O-Ring
15	1	O-Ring
16	1	O-Ring
19	1	O-Ring
23	2	O-Ring
31	2	O-Ring
33	2	O-Ring

Check/Stop Kit S65-212

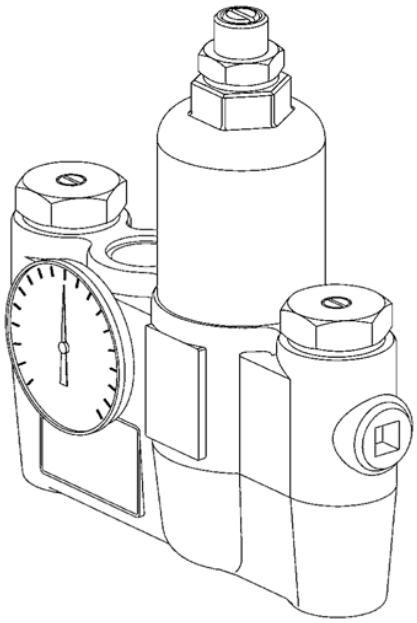
Item	Qty.	Description
23	2	O-Ring
24	2	Seat
25	2	Nut
26	2	Washer
27	2	Seal
28	2	Holder (for Seal)
29	2	Spring
30	2	Strainer
31	2	O-Ring
32	2	Stem
33	2	O-Ring
34	2	Cap

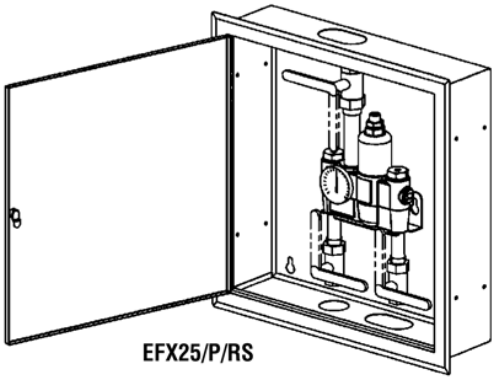
Center Section Kit S65-301

Item	Qty.	Description
2	1	O-Ring
3	1	Liner
4	1	Washer
5	1	Screw
6	1	Spring
7	1	Lower Chamber
8	1	Spring
9	1	Piston
10	1	Push Rod
11	1	Upper Chamber
12	1	Thermostat
13	1	Push Rod
14	1	O-Ring
15	1	O-Ring
16	1	O-Ring
17	1	Control Cap
18	4	Bolt
19	1	O-Ring
20	1	Top Cap
21	1	Set Screw
22	1	Screw

TMV-2 **TMV-2 THERMOSTATIC MIXING VALVE**

BS192100BP	BRADLEY	EMERGENCY FIXTURE THERMOSTATIC MIXING VALVE FOR THE USE OF DRENCH SHOWERS AND/OR EYEWASH APPLICATIONS.





EFX25/P/RS

Installation

EFX 25/S19-2100

Thermostatic Mixing Valve with Optional Cabinet

Robinet thermostatique mélangeur avec cabinet facultatif

Válvula mezcladora termostática con armario opcional

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Desglose de piezas 22

Inlet Connections: 3/4" NPT
Outlet Connection: 1" NPT
Temperature Range: 65˚—95° F
Maximum Pressure: 125 PSI
Inlet Temperature Hot: 120˚—180˚ F
Inlet Temperature Cold: 33˚—80˚ F
Minimum Temperature Differential (from valve set point): 20˚ F

Raccords d'arrivée : 3/4 po NPT
Raccord de sortie : 1 po NPT
Plage de température : 65 – 95 °F
Pression maximum : 125 lb/po²
Température d'arrivée, eau chaude : 120 – 180 °F
Température d'arrivée, eau froide : 33 – 80 °F
Différence de température minimum (à partir de valeur de consigne de robinet) : 20 °F

Conexiones de entrada: NPT de 3/4 pulg.
Conexión de salida: NPT de 1 pulg.
Rango de temperaturas: 65 – 95 °F
Presión máxima: 125 PSI
Temperatura de entrada, caliente: 120 – 180 °F
Temperatura de entrada, fría: 33 – 80 °F
Diferencial de temperatura mínima (desde el punto de ajuste de la válvula): 20 °F

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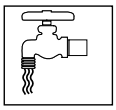
⚠ IMPORTANT! ⚠



Read this entire installation manual to ensure proper installation. When finished with the installation, file this manual with the owner or maintenance department. Compliance and conformity to local codes and ordinances is the responsibility of the installer.



Separate parts from packaging and make sure all parts are accounted for before discarding packaging material. If any parts are missing, do not begin installation until you obtain the missing parts.



Make sure that all water supply lines have been flushed and then completely turned off before beginning installation. Debris in supply lines can cause valves to malfunction.



Product warranties may be found under “Products" on our web site at bradleycorp.com.

Supplies recommended for installation

- Lockable shut-off on the outlet if tempered water is supplied to one or more emergency fixtures
- Lockable shut-off on the inlets/supplies
- (6) 3/8" wall anchors and fasteners for surface-mounted cabinet
- (4) 1/4" fasteners (and wall anchors, if necessary) for recess-mounted cabinet
- Unions on all connections to facilitate removal of valve

Tools required for temperature adjustment

- 5/32" Allen wrench
- Blade screwdriver

1 Install Optional Cabinet (If not installing cabinet, skip to Step 2)

Recessed Cabinet:

1. Rough-in wall opening 24-1/2" W x 24-1/2".

2. Insert the cabinet and secure to wall with four 1/4" fasteners properly anchored (supplied by installer.)

3. Install two anchors and screws through the valve bracket in back of the cabinet into a secure brace (supplied by installer) or into wall. This will support the valve.

4. Install the valve nipples and one-half of the union ball valve using pipe sealant or teflon tape. Install the other half of the union ball valve onto inlet and outlet pipe.

5. Insert the valve into the bracket in the cabinet (right side goes in first). Continue with the valve installation procedure.

6. Position the wall flange tight to the wall and caulk in place.

Surface-Mounted Cabinet:

1. Measure and mark the cabinet mounting hole locations at the dimensions shown on next page. Install six 3/8" wall anchors (supplied by installer).

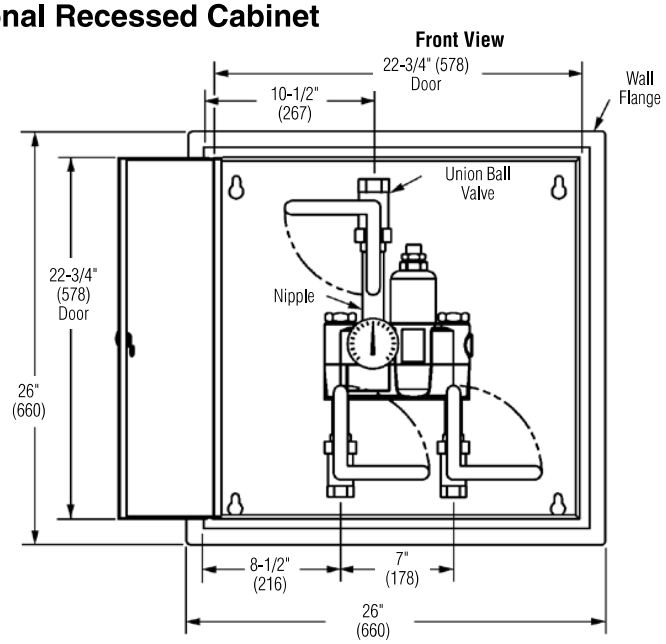
2. Position the cabinet onto the wall and secure into place with six 3/8" wall fasteners (supplied by installer).

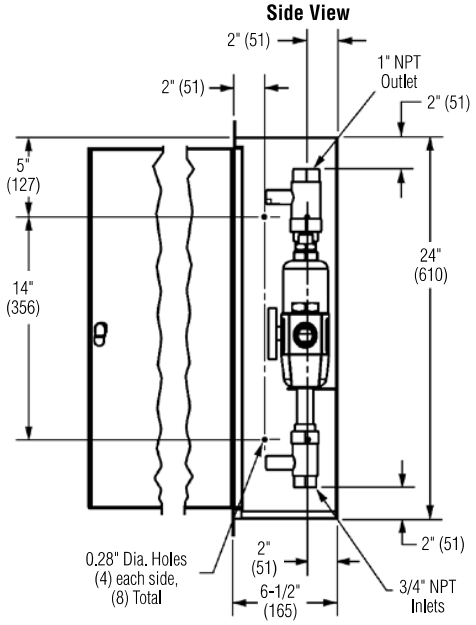
3. Install the valve nipples and one-half of the union ball valve using pipe sealant or teflon tape. Then install the other half of the union ball valve onto the inlet and outlet piping.

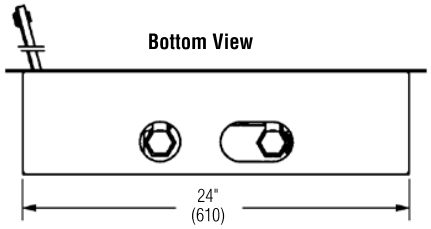
4. Insert the valve into the bracket in the cabinet (right side of the valve goes in first). Continue with the valve installation procedure.

Optional Recessed Cabinet

(mm)

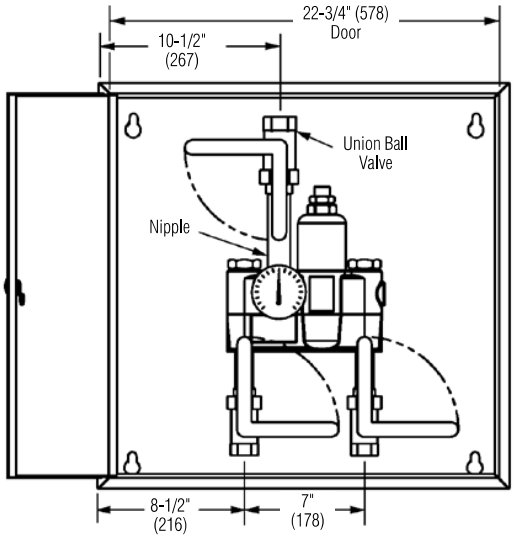


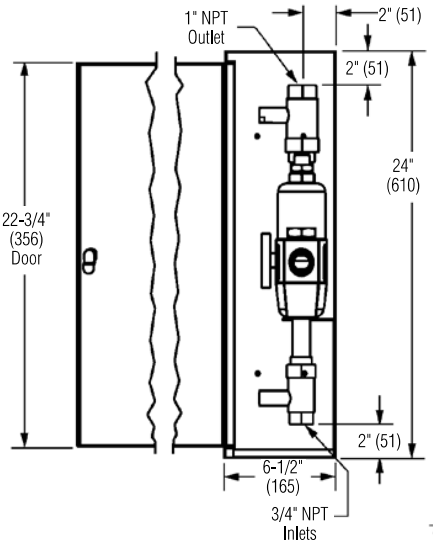


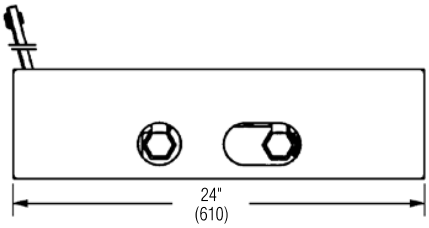


Wall Opening:
24-1/2" W x 24-1/2" H

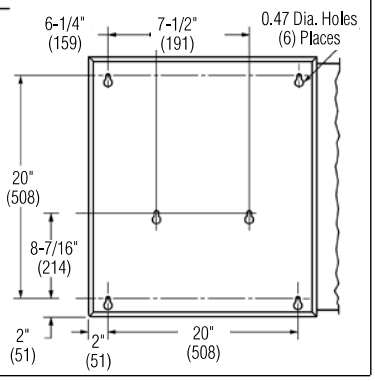
Optional Surface-Mounted Cabinet





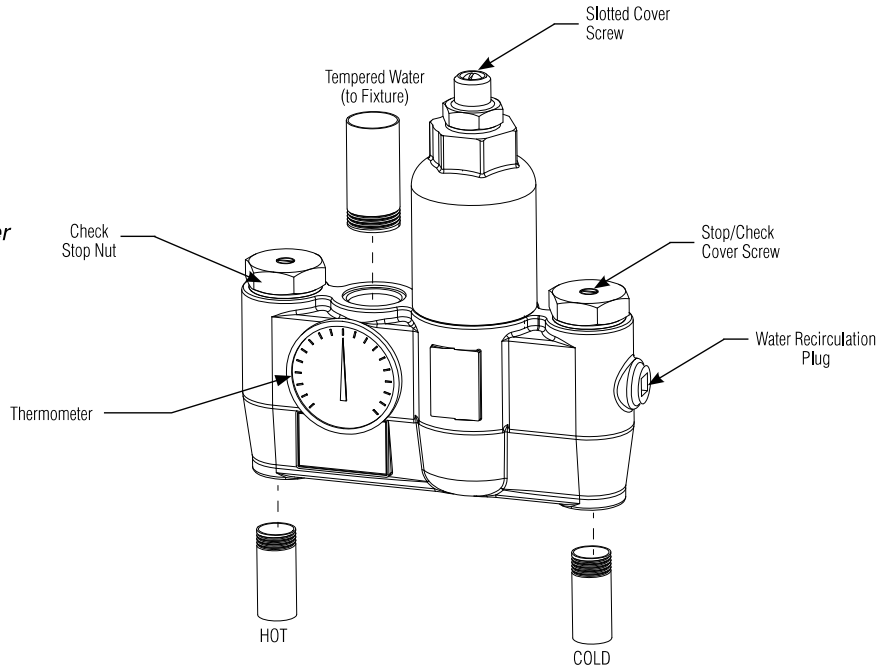


Mounting Hole Locations



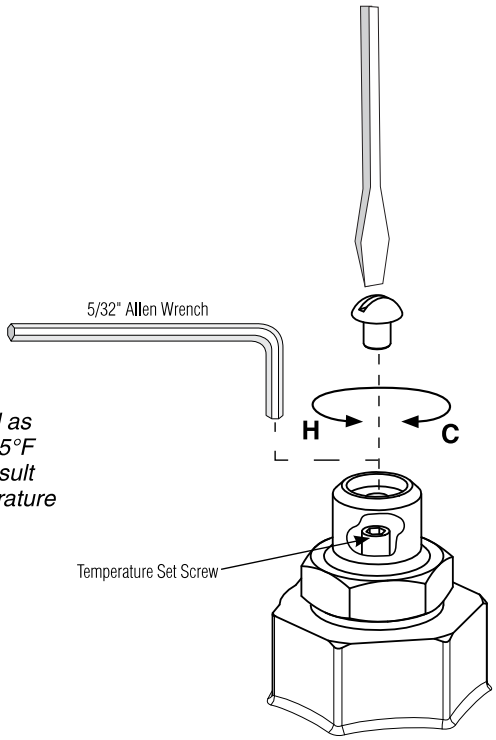
2 Connect Supply Lines and Install Thermometer

- ☑ *When the check valves are in the open (operating) position, the cover screw for the stop/check stem will be flush with the valve cap.*
- ☑ *Install Thermometer using pipe sealant or teflon tape.*
- ☑ *Check for leaks by pressurizing unit SLOWLY.*



3 Adjust Temperature with Water Running

- ☑ *Check the temperature when approximately 10 GPM water flow is reached (equivalent to two face washes)*
- ☑ *No single emergency fixture supplied by this device has a minimum flow rate less than 1.5 GPM (5.7 L/m).*
- ☑ *This device must be checked for final temperature and adjusted as necessary. The standard preset factory temperature setting is 85°F (29°C). [the range of the valve is 65°F–95°F (18°C–35°C)]. Consult proper medical and/or safety authorities for the optimum temperature recommended for your particular application.*



4 Test Unit

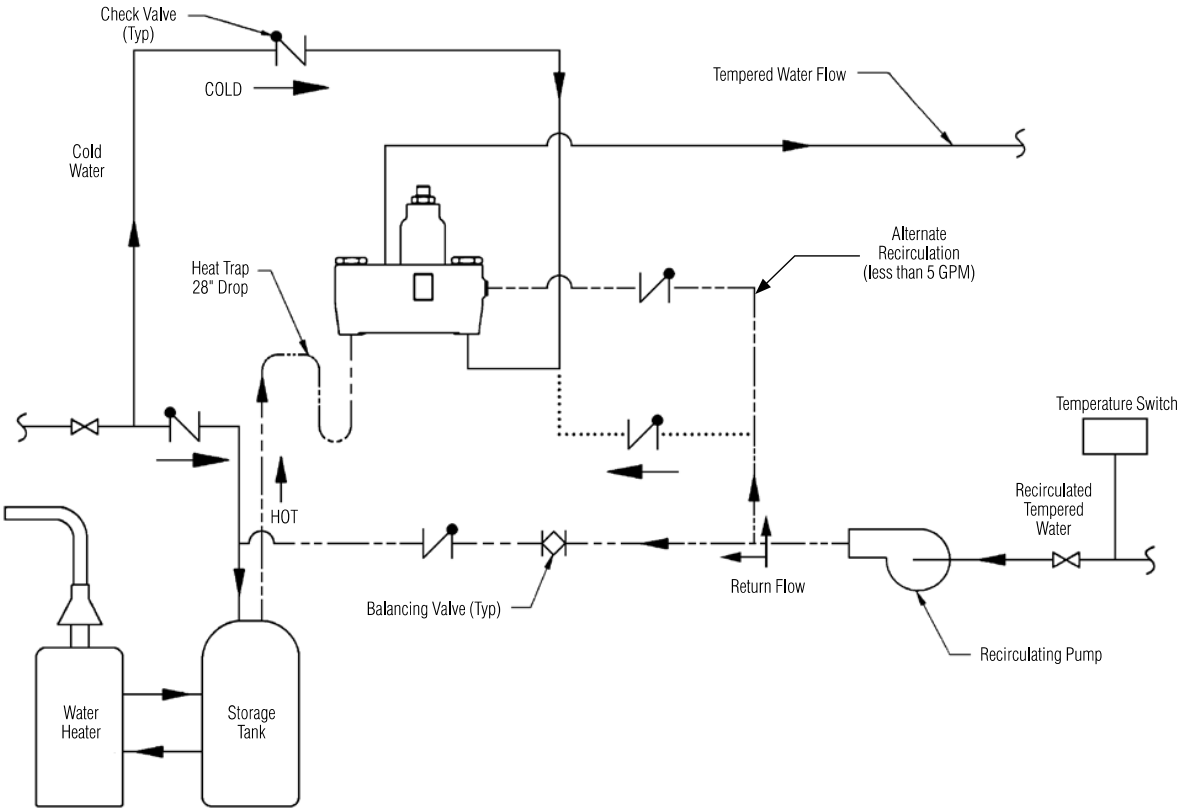
⚠ **DO NOT SKIP THIS STEP!!!**

Shut the hot water supply off by closing hot water inlet valve or supply check valve. While the hot water supply is turned off, check to make sure the cold water continues to flow. If the cold water is flowing properly, reopen the hot water supply.

Shut the cold water supply off by closing the cold water inlet valve or supply check valve. While the cold water supply is off, check to make sure that the hot water flow has shut down. If hot water is shut down, reopen cold water supply. Test unit weekly for proper function and desired set temperature.

5 Optional Water Recirculation Setup

Recirculating the water in the system provides constant regulation of the water temperature. Flush the supply lines thoroughly after completing installation. Close off all fixtures and label them as not available for use during the recirculating process.



1. Turn off the recirculating pump and turn on the water supply at emergency fixture (a water flow rate of 10-15 GPM is required).

2. Let the water run through the system until a consistent temperature is obtained. If you do not obtain the required temperature, refer to step #3 on previous page for temperature readjustment.

3. As soon as the water reaches the proper temperature, turn on the recirculating pump (make certain the proper system temperature has been achieved before proceeding).

4. Check the water temperature at the return pump. If the temperature exceeds the appropriate level by 2°F, adjust the temperature high-limit switch (this will turn off the pump). Wait until the return water temperature is 5°F below the appropriate level and adjust the low-limit switch (this will turn the pump back on).

5. Open the balancing valve completely.

6. Turn off all fixtures and make sure there is no water running through the system (the cold inlet pipe should feel warm to the touch).

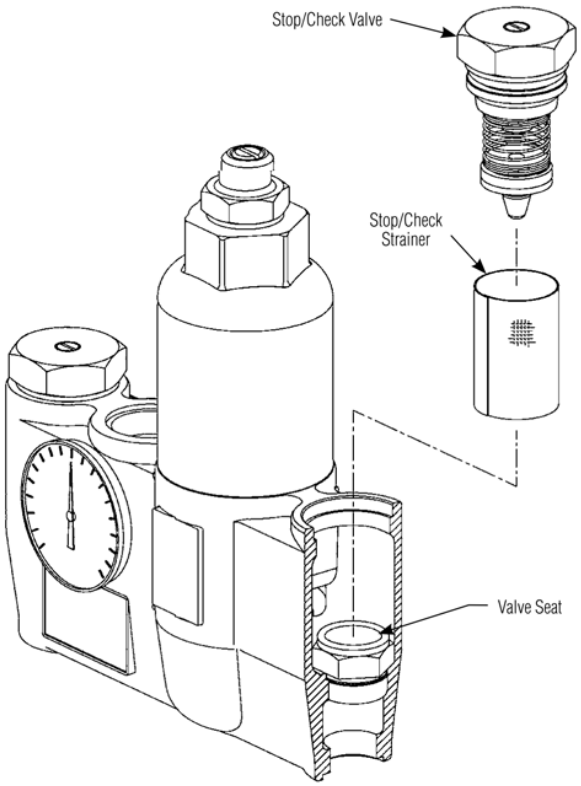
7. Let the system run for 30 minutes or longer without water. If, after thirty minutes, the water temperature increases, you may readjust the temperature by slowly closing the balancing valve until the appropriate temperature is reached.

Troubleshooting Thermostatic Mixing Valve

Before attempting to troubleshoot the valve or disassemble the components, check for the following:

- *Stop/check valves are fully open (the slotted stem must be flush with the stop/check cap) and that all inlet and outlet shut-off valves are open*
- *Hot and cold inlet pipes are connected properly, and that there are no cross-connections or leaking stop/check valves*
- *Water heater output is at least 15° F above the set temperature.*

Be sure to close the appropriate shut-off valves prior to disassembly of the valve and reopen the valves after inspection and repair is complete.

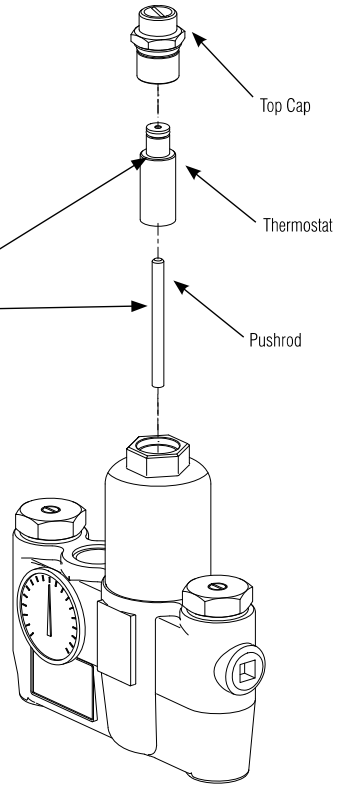


Problem	Cause	Solution
External leaks in the system	Either the NPT joints or the o-rings have been damaged.	Replace the NPT joints and/or o-rings where necessary. For replacement of o-rings, contact your Bradley representative and ask for O-Ring Seal Kit (S65-173).
No hot water flow (cold water flow only)	The thermostat has failed and, subsequently, the safety shut-off has engaged.	**Inspect Thermostat:** 1. Remove the top cap and pull out the push rod and thermostat. 2. Insert a 7/16" dia. rod into the thermostat bellows. 3. Mark the length of the thermostat bellows (at room temperature, with 10 lb. of force, the bellows length should be approx. 1-3/16"—1-1/2"). 4. If the thermostat bellows length is not in the proper range, the thermostat must be replaced (it cannot be repaired). Contact your Bradley representative and ask for Thermostat Kit (S65-174).
Limited water flow	The inlet shut-off valve may be partially closed or there has been a significant decrease in water pressure.	
	Dirt and debris have collected on the check screen or seat, limiting the movement of the stop and checks.	**Clean Stop and check Valves:** Remove the stop and checks, clean the screen and seat and reassemble the valve. Do not remove the seat. The components may be scraped with a screwdriver to remove debris. A pair of tweezers works well for pulling debris out from the seat. If the stop and checks need to be replaced, contact your Bradley representative and ask for Check/Stop Kit (S65-337).
Temperature fluctuation or improper Temperature	The stop and check sections of the valve do not move freely.	Clean Stop and Check Valves as described above.
	Thermostat is slowly failing.	Check Thermostat as described above, or replace.
	Inlet supply line to the mixing valve is being shared by other pieces of equipment that are used only periodically, such as laundry appliances or washdown stations. It may reduce the inlet pressure to the mixing valve to less than 10 PSI. The supply line size may not be large enough to supply both the valve and the other appliances.	Enlarge the supply line size, reconfigure the supply line or regulate the supply usage.
	Recirculation is not balanced.	Review recirculation set up on page 5.
	Piston does not move freely and must be cleaned.	See next page for piston disassembly and cleaning directions.

Troubleshooting: Piston Disassembly and Cleaning

To prevent injuries, use proper protective equipment for eyes and skin when using a propane torch.

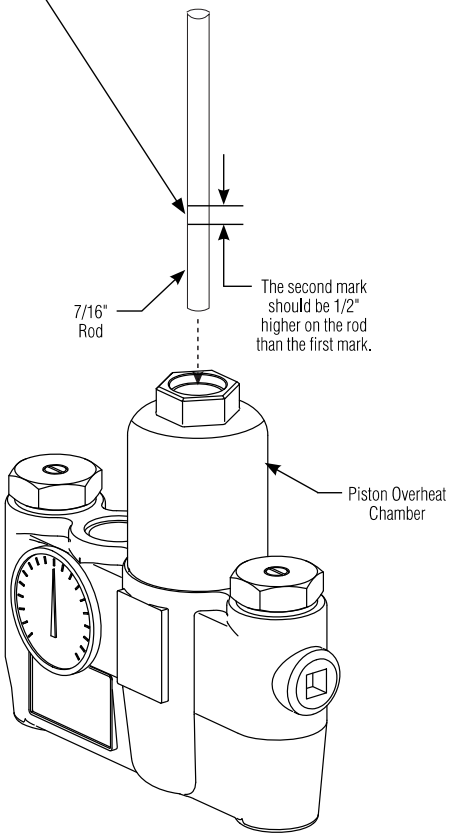
A Remove the valve's top cap and pull out the push rod and then the thermostat. You may use a needle-nose pliers to remove the thermostat from the valve body if desired.



B Insert a 7/16" dia. rod into the valve and into the piston overheat chamber. Mark the length of the rod inside the valve. Push the rod until the piston stops and mark the new length.

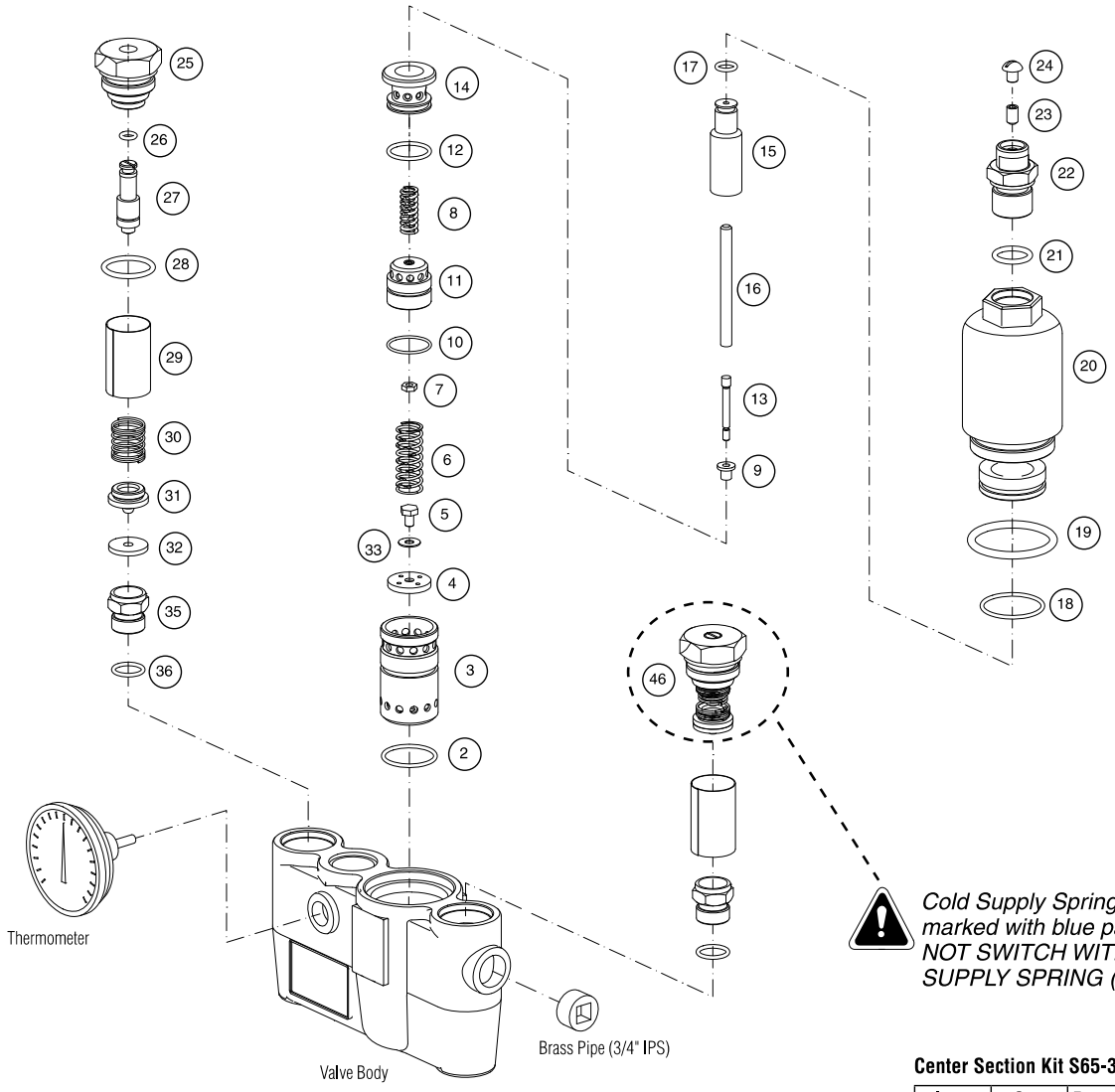
C If the rod travels less than1/2", the piston is not moving freely within the liner and they must be cleaned:

1. Remove the control section assembly, top cap and thermostat.
2. Unthread the liner from the cap (it is glued together; the o-rings must be removed and heat should be applied to melt the glue and loosen the liner).
3. Clean the piston and liner with any cleaner suitable for brass and stainless steel (400-grit sandpaper may be used to polish and hone the piston and liner).



D Push the mechanism up and down several times to make sure the piston moves smoothly and consistently. If it is not consistent, repeat Procedure C until it moves freely, or replace. Contact your Bradley representative and ask for Piston/Liner Kit (part number S65-175).

Parts Breakdown



Kit numbers for rough brass finish and standard range thermostat. Contact Bradley for other configurations.

Thermostat Kit S65-174

Item	Qty.	Description
15	1	Thermostat
17	1	O-Ring
21	1	O-Ring

Piston & Liner Kit S65-175

Item	Qty.	Description
2	1	O-Ring
3	1	Liner
4	1	Washer
5	1	Screw
6	1	Spring
7	1	#10-24 Hex Nut
8	1	Spring
9	1	Retainer
10	1	O-Ring
11	1	Piston
12	1	O-Ring
13	1	Overheat Screw
14	1	Upper Seat
33	1	Washer

Washer/Seal Kit S65-310

Item	Qty.	Description
4	1	Washer
32	2	Seal
33	1	Washer

O-Ring/Seal Kit S65-173

Item	Qty.	Description
2	1	O-Ring
10	1	O-Ring
12	1	O-Ring
17	1	O-Ring
18	1	O-Ring
19	1	O-Ring
21	1	O-Ring
26	2	O-Ring
28	2	O-Ring
36	2	O-Ring

Check/Stop Kit S65-337

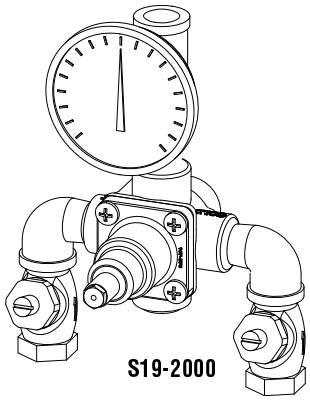
Item	Qty.	Description
25	2	Cap
26	2	O-Ring
27	2	Stem
28	2	O-Ring
29	2	Strainer
30	1	Hot Supply Spring
31	2	Holder (for Seal)
32	2	Seal
35	2	Seat
36	2	O-Ring
46	1	Cold Supply Spring (Blue)

Center Section Kit S65-304

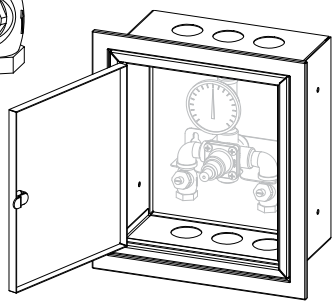
Item	Qty.	Description
2	1	O-Ring
3	1	Liner
4	1	Washer
5	1	Screw
6	1	Spring
7	1	#10-24 Hex Nut
8	1	Spring
9	1	Retainer
10	1	O-Ring
11	1	Piston
12	1	O-Ring
13	1	Overhead Screw
14	1	Upper Seat
15	1	Thermostat
16	1	Pushrod
17	1	O-Ring
18	1	O-Ring
19	1	O-Ring
20	1	Mixing Valve Cap
21	1	O-Ring
22	1	Control Cap
23	1	Set Screw
24	1	Screw
33	1	Washer

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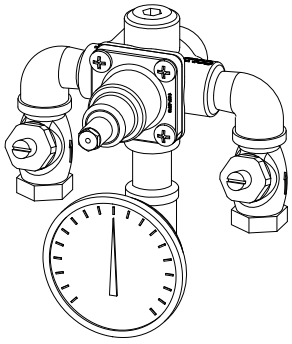
		TMV-3 THERMOSTATIC MIXING VALVE PER ADDENDUM #2-1
TMV-3		
BS192000B	BRADLEY	EMERGENCY THERMOSTATIC MIXING VALVE ROUGH BRONZE W/ WALL MOUNTING BRACKET



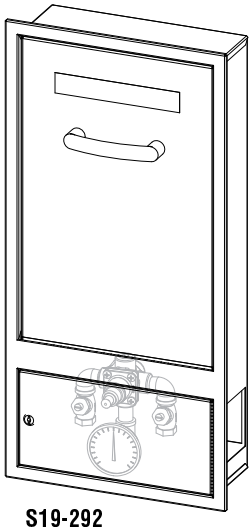
S19-2000



S86-066
(Cabinet Only)



S19-2000EFX



S19-292
(Cabinet Only)

ASSE 1071 & cUPC Certified

Installation

S19-2000, S19-2000EFX Series

Thermostatic Mixing Valve with Optional Cabinet

Robinet thermostatique mélangeur avec cabinet facultatif

Válvula mezcladora termostática con armario opcional

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Dimensiones 17
Instrucciones de instalación 18
Solución de problemas 20

Inlet Connections: 1/2" NPT
Outlet Connection: 1/2" NPT
Temperature Range: 65° – 90° F
Maximum Pressure: 125 PSI
Inlet Temperature Hot: 120° – 180° F
Inlet Temperature Cold: 33° – 80° F
Minimum Temperature Differential (from valve set point): 20° F
Flow at 30 psi: 7.3 gpm
Minimum Cold Water Bypass at 30 psid: 5.6 gpm
Minimum Flow: 1.5 gpm
Maximum Flow with Cold Water Shut-Off: 0.5 gpm

Raccords d'arrivée : 1/2 po NPT
Raccord de sortie : 1/2 po NPT
Plage de température : 65 – 90 °F
Pression maximum : 125 lb/po²
Température d'arrivée, eau chaude : 120 – 180 °F
Température d'arrivée, eau froide : 33 – 80 °F
Différence de température minimum (à partir de valeur de consigne de robinet) : 20 °F
Débit à 30 psi : 7.3 gpm
Dérivation d'eau froide minimum à 30 psid : 5.6 gpm
Débit minimum : 1.5 gpm
Débit maximum avec arrêt d'eau froide : 0.5 gpm

Conexiones de entrada: NPT de 1/2 pulg.
Conexión de salida: NPT de 1/2 pulg.
Rango de temperaturas: 65 – 90 °F
Presión máxima: 125 PSI
Temperatura de entrada, caliente: 120 – 180 °F
Temperatura de entrada, fría: 33 – 80 °F
Diferencial de temperatura mínima (desde el punto de ajuste de la válvula): 20 °F
Flujo a 2,1 bar: 7.3 gpm
Derivación mínima de agua fría a 2,1 bar: 5.6 gpm
Flujo mínimo: 1.5 gpm
Flujo máximo con retención de agua fría: 0.5 gpm

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Phone: 1.800.BRADLEY Fax: 262.253.4161
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IMPORTANT!

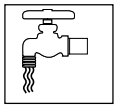


Read this entire installation manual to ensure proper installation. When finished with the installation, file this manual with the owner or maintenance department. Compliance and conformity to local codes and ordinances is the responsibility of the installer.



Separate parts from packaging and make sure all parts are accounted for before discarding packaging material. If any parts are missing, do not begin installation until you obtain the missing parts.

Valve shall be accessible for testing, adjusting and maintenance in the installed position.



Make sure that all water supply lines have been flushed and then completely turned off before beginning installation. Debris in supply lines can cause valves to malfunction.



Product warranties may be found under "Products" on our web site at bradleycorp.com.

Supplies recommended for installation

- Lockable shut-off on the outlet if tempered water is supplied to one or more emergency fixtures
- Lockable shut-off on the inlets/supplies
- (6) 1/4" wall anchors and fasteners for surface-mounted cabinet
- (4) 1/4" fasteners (and wall anchors, if necessary) for recess-mounted cabinet
- Unions on all connections to facilitate removal of valve

Tools required for temperature adjustment

- 5/64" Allen wrench
- Blade screwdriver

1 Install Optional Cabinet (If not installing cabinet, skip to Step 2)

If installing S19-2000EFX into Dropdown Eyewash Cabinet S19-292, please see mounting instructions supplied with cabinet.

Recessed Cabinet:

1. Rough-in wall opening 11-1/2" W x 13" H.

2. Insert the cabinet and secure to wall with four 1/4" fasteners properly anchored (supplied by installer.)

3. Install two anchors and screws through the valve bracket in back of the cabinet into a secure brace (supplied by installer) or into wall. This will support the valve.

4. Install the valve nipples and one-half of the union ball valve using pipe sealant or teflon tape. Install the other half of the union ball valve onto inlet and outlet pipe.

5. Insert the valve into the bracket in the cabinet (right side goes in first). Continue with the valve installation procedure.

6. Position the wall flange tight to the wall and caulk in place.

Surface-Mounted Cabinet:

1. Measure and mark the cabinet mounting hole locations at the dimensions shown on next page. Install six 3/8" wall anchors (supplied by installer).

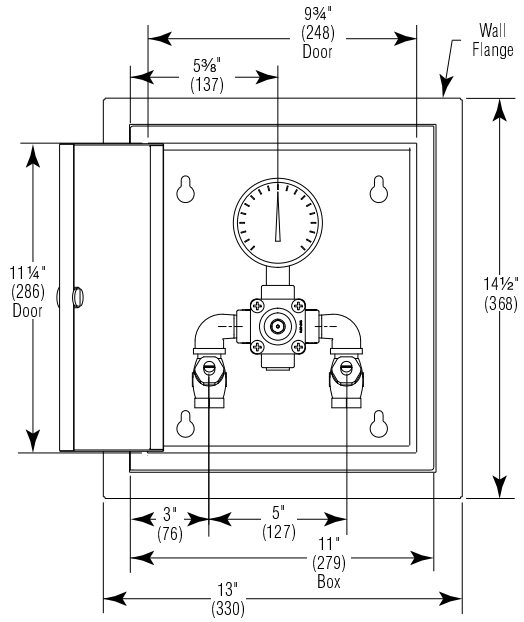
2. Position the cabinet onto the wall and secure into place with six 3/8" wall fasteners (supplied by installer).

3. Install the valve nipples and one-half of the union ball valve using pipe sealant or teflon tape. Then install the other half of the union ball valve onto the inlet and outlet piping.

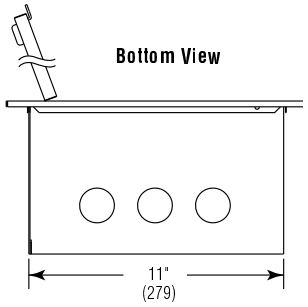
4. Insert the valve into the bracket in the cabinet (right side of the valve goes in first). Continue with the valve installation procedure.

Optional Recessed Cabinet (mm)

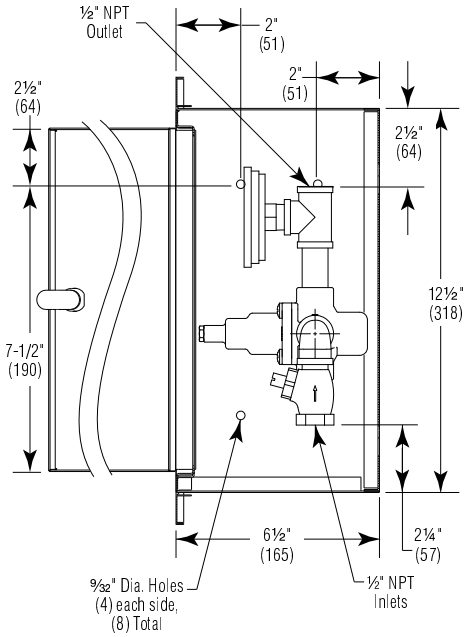
Front View



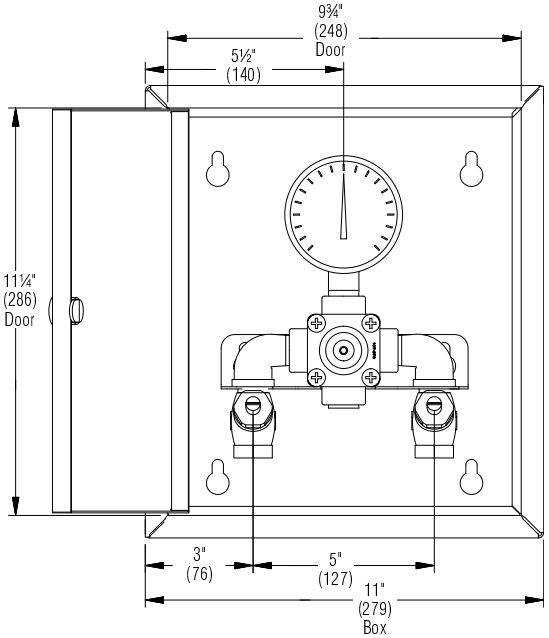
Bottom View

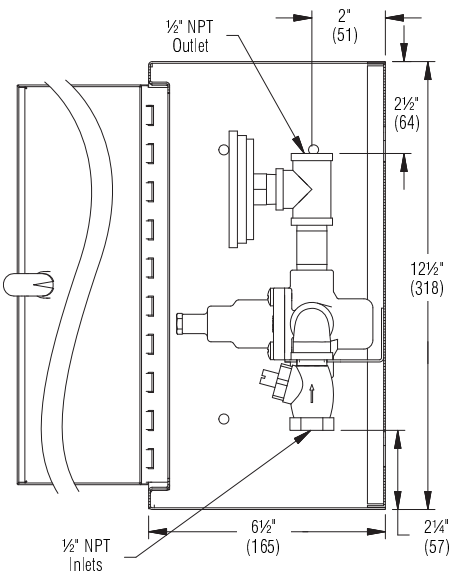


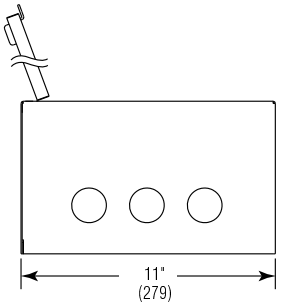
Side View



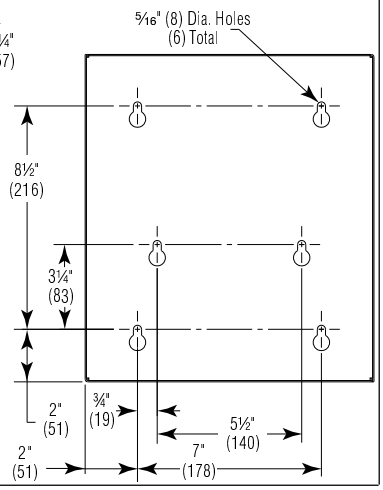
Optional Surface-Mounted Cabinet





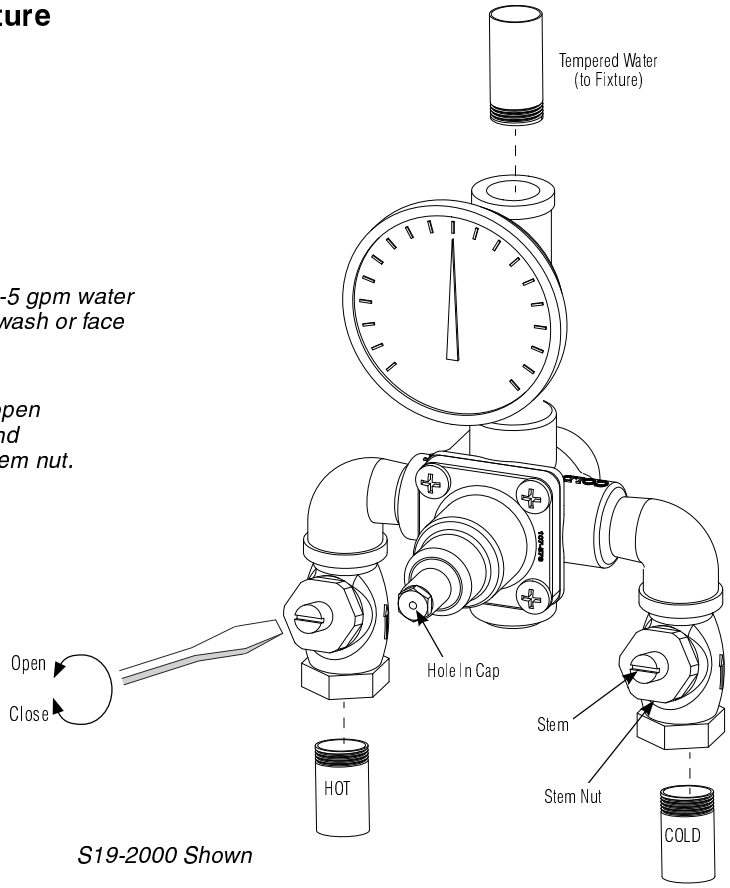


Mounting Hole Locations



2 Connect Supply Lines and Fixture

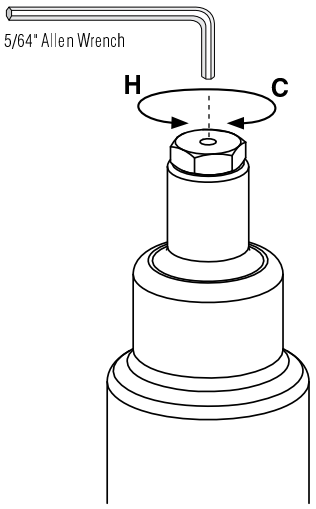
- ☑ *Check for leaks by pressurizing unit SLOWLY.*
- ☑ *Check the temperature when approx. 3-5 gpm water flow is reached (equivalent to one eye wash or face wash) and adjust if necessary.*
- ☑ *When the check stops are in the fully open (operating) position, the stem will extend approximately 1/2" (13mm) from the stem nut.*



S19-2000 Shown

3 Adjust Temperature with Water Running

- ☑ *Check the temperature when approximately 3 – 5 gpm water flow is reached (equivalent to one eye wash).*
- ☑ *No single emergency fixture supplied by this device shall have a minimum flow rate less then 1.5 gpm.*
- ☑ *This device must be checked for final temperature and adjusted as necessary. The standard preset factory temperature setting is 85°F (29°C) [the range of the valve is 65°F–90°F (18°C–32°C)]. Insert Allen Wrench through the hole in the cap and into the set screw to adjust. Consult proper medical and/or safety authorities for the optimum temperature recommended for your particular application.*



4 Test Unit

⚠ **DO NOT SKIP THIS STEP!!!**

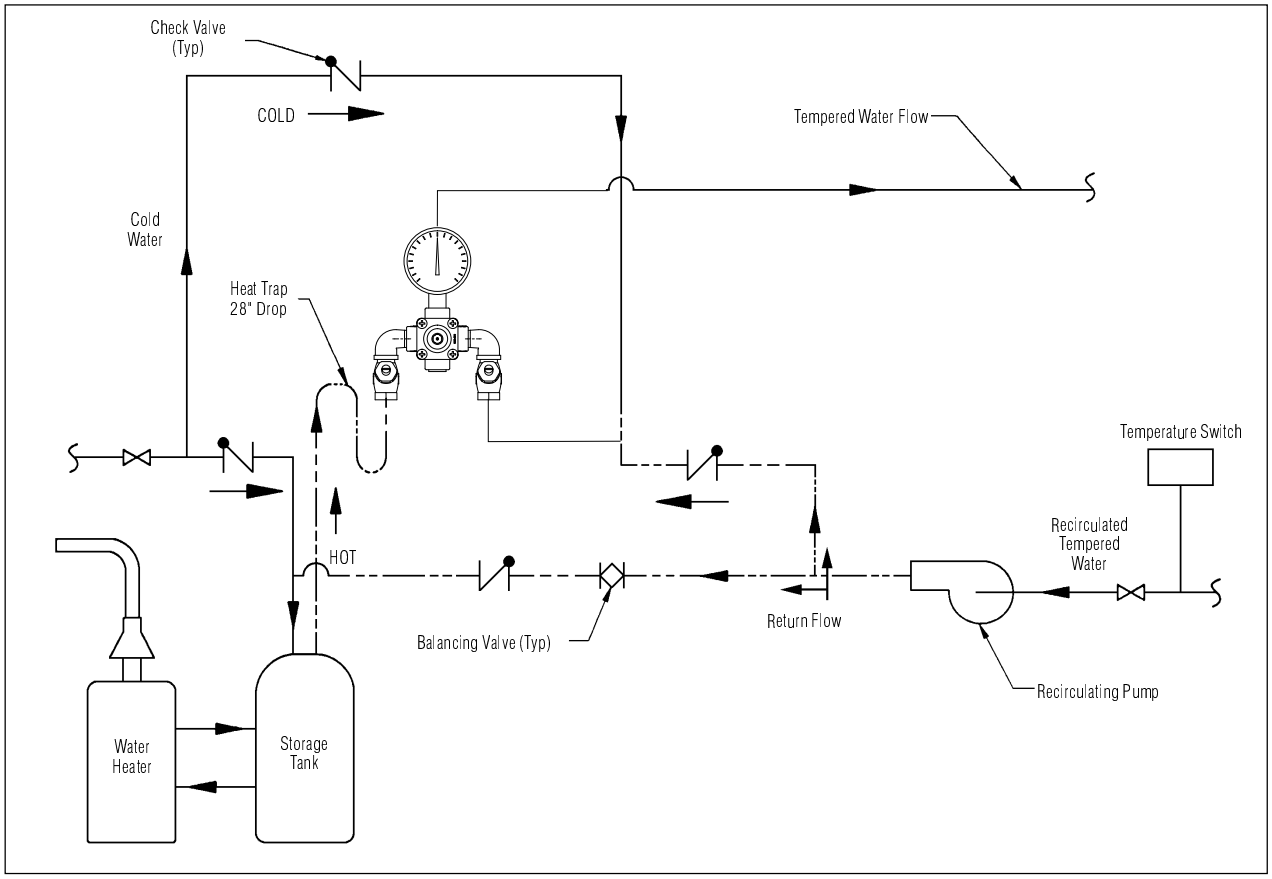
Shut the hot water supply off by closing hot water inlet valve or supply check valve. While the hot water supply is turned off, check to make sure the cold water continues to flow. If the cold water is flowing properly, reopen the hot water supply.

Shut the cold water supply off by closing the cold water inlet valve or supply check valve. While the cold water supply is off, check to make sure that the hot water flow has shut down to less then 0.5 gpm. If hot water is shut down, fully reopen cold water supply.

- ☑ ***Test the system weekly (turn on the water supply and check for constant control of the desired set temperature).***

5 Optional Water Recirculation Setup

Recirculating the water in the system provides constant regulation of the water temperature. Flush the supply lines thoroughly after completing installation. Close off all fixtures and label them as not available for use during the recirculating process.



1. Turn off the recirculating pump and turn on the water supply at emergency fixture (a water flow rate of 3 – 5 gpm is required).

2. Let the water run through the system until a consistent temperature is obtained. If you do not obtain the required temperature, refer to step #3 on previous page for temperature readjustment.

3. As soon as the water reaches the proper temperature, turn on the recirculating pump (make certain the proper system temperature has been achieved before proceeding).

4. Check the water temperature at the return pump. If the temperature exceeds the appropriate level by 2°F, adjust the temperature high-limit switch (this will turn off the pump). Wait until the return water temperature is 5°F below the appropriate level and adjust the low-limit switch (this will turn the pump back on).

5. Open the balancing valve completely.

6. Turn off all fixtures and make sure there is no water running through the system (the cold inlet pipe should feel warm to the touch).

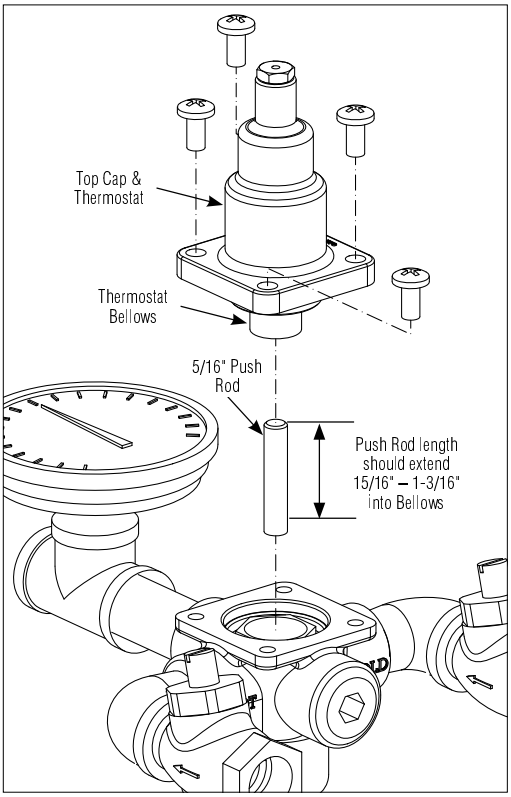
7. Let the system run for 30 minutes or longer without water. If, after thirty minutes, the water temperature increases, you may readjust the temperature by slowly closing the balancing valve until the appropriate temperature is reached.

Troubleshooting Thermostatic Mixing Valve

Before attempting to troubleshoot the valve or disassemble the components, check for the following:

- *Stop/check valves are fully open (the slotted stem extends approximately 1/2" from the stem nut) and that all inlet and outlet shut-off valves are open.*
- *Hot and cold inlet pipes are connected properly, and that there are no cross-connections or leaking stop/check valves.*
- *Water heater output is at least 20° F above the set temperature.*

Be sure to close the appropriate shut-off valves prior to disassembly of the valve and reopen the valves after inspection and repair is complete.

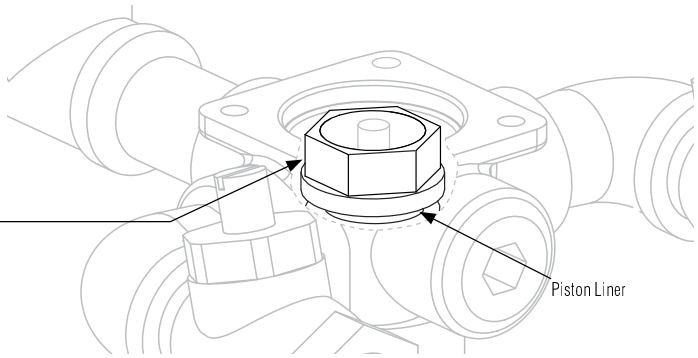


Problem	Cause	Solution
External leaks in the system	Either the NPT joints or the o-rings have been damaged.	Replace the NPT joints and/or o-rings where necessary. For replacement of o-rings, contact your Bradley representative and ask for O-Ring Seal Kit (S65-170).
No hot water flow (cold water flow only)	The thermostat has failed and, subsequently, the safety shut-off has engaged.	**Inspect Thermostat:** 1. Remove the top cap and thermostat. 2. Insert the 5/16" dia. push rod into the thermostat bellows. 3. Mark the length the push rod extends into the bellows (at room temperature, with 10 lb. of force. the length should be approx. 15/16" – 1-3/16"). 4. If the push rod length is not in the proper range, the thermostat must be replaced (it cannot be repaired). Contact your Bradley representative and ask for Thermostat Kit (S65-171).
Limited water flow	The inlet shut-off valve may be partially closed or there has been a significant decrease in water pressure.	
	Dirt and debris have collected on the check screen or seat, limiting the movement of the stop and checks.	**Clean Stop and check Valves:** Remove the stop and checks, clean the seat and reassemble the valve. Do not remove the seat. The components may be brushed with a small wire brush to remove debris. A pair of tweezers works well for pulling debris out from the seat. If the stop and checks need to be replaced, contact your Bradley representative and ask for Check/Stop Kit (S27-102-Rough Brass, or S27-292A-Chrome).
Temperature fluctuation or improper Temperature	The stop and check sections of the valve do not move freely.	Clean Stop and Check Valves as described above.
	Thermostat is slowly failing.	Check Thermostat as described above, or replace.
	Inlet supply line to the mixing valve is being shared by other pieces of equipment that are used only periodically, such as laundry appliances or washdown stations. It may reduce the inlet pressure to the mixing valve to less than 3 PSI. The supply line size may not be large enough to supply both the valve and the other appliances.	Enlarge the supply line size, reconfigure the supply line or regulate the supply usage.
	Recirculation is not balanced.	Review recirculation set up on page 5.
	Piston does not move freely and must be cleaned.	See next page for piston disassembly and cleaning directions.

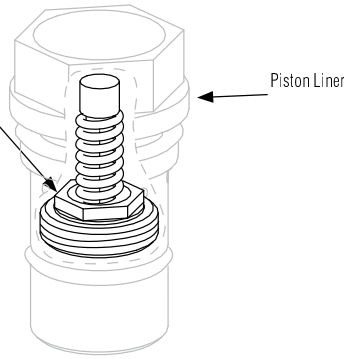
Troubleshooting: Piston Disassembly and Cleaning

A Remove the Top Cap and Thermostat Assembly as shown on Page 6. Set the 5/8" Push Rod aside.

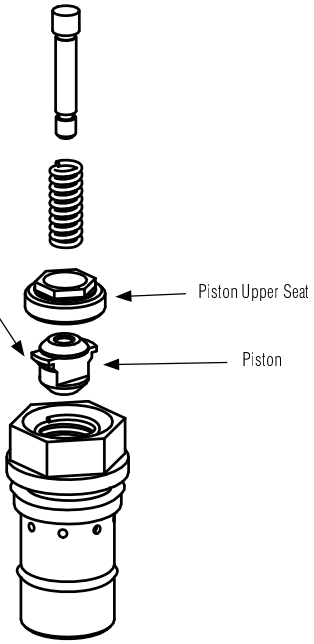
B Using a 15/16" socket wrench, loosen the piston liner from the valve body and lift out with a needle-nose pliers.



C Using a 1/2 deep socket wrench, loosen the piston upper seat from the piston liner and lift out parts with a needle-nose pliers.

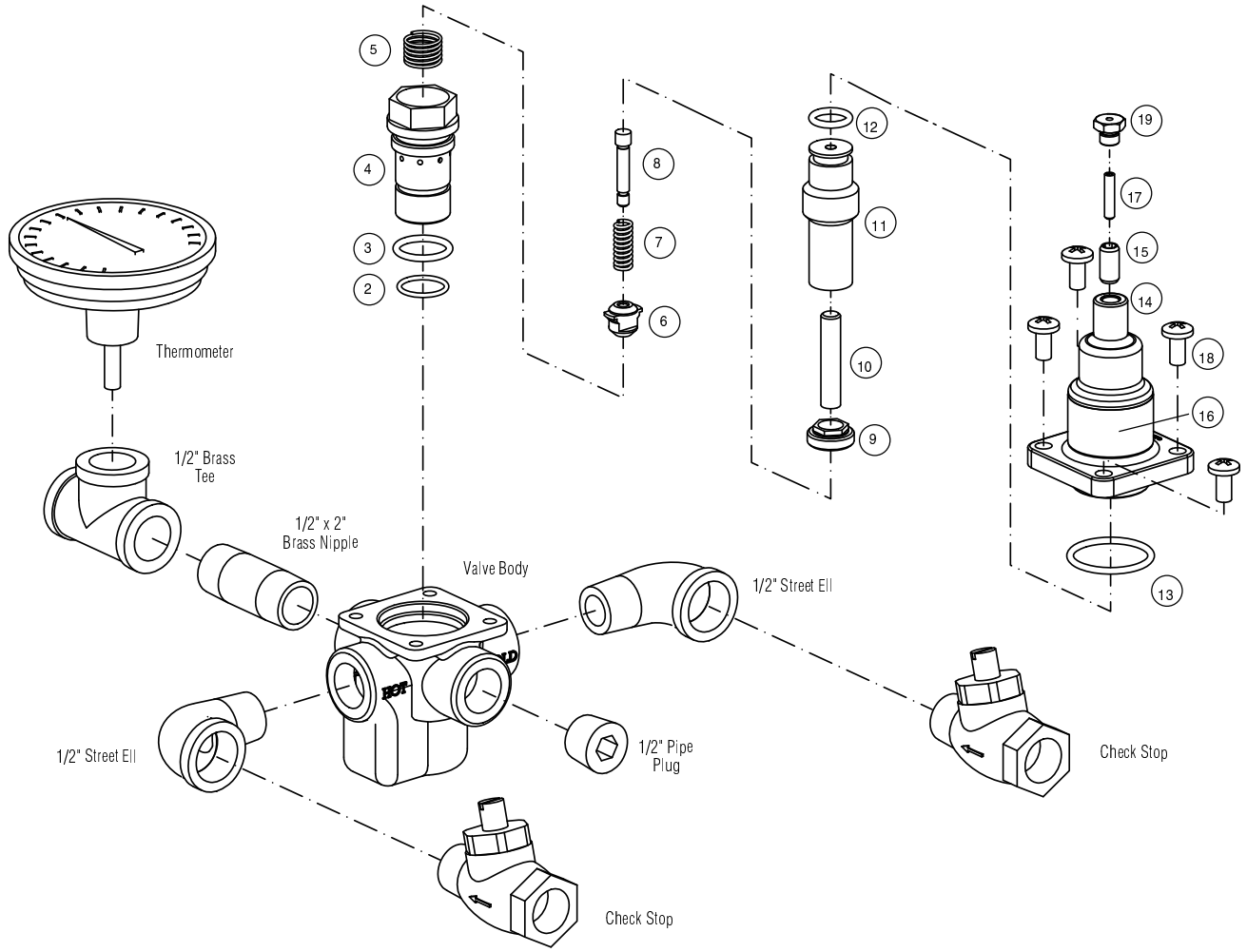


D Dissamble and clean the piston assembly parts with any cleaner suitable for brass and stainless steel. (if necessary, use a 400-grit sandpaper to polish and hone the piston and liner.)



E Re-assemble the piston assembly. Push the mechanism up and down several times to make sure the piston moves smoothly and consistently. If it is not consistent, repeat Procedure D until it moves freely, or replace. Contact your Bradley representative and ask for Piston/Liner Kit (part number S65-172).

Parts Breakdown



Thermostat Kit S65-171

Item	Qty.	Description
11	1	Thermostat
12	1	O-Ring
13	1	O-Ring

Piston & Liner Kit S65-172

Item	Qty.	Description
2	1	O-Ring
3	1	O-Ring
4	1	Liner
5	1	Spring
6	1	Piston
7	1	Spring
8	1	Overheat Screw
9	1	Upper Seat

O-Ring Kit S65-170

Item	Qty.	Description
2	1	O-Ring
3	1	O-Ring
12	1	O-Ring
13	1	O-Ring

Center Section Kit S65-303

Item	Qty.	Description
2	1	O-Ring
3	1	O-Ring
4	1	Liner
5	1	Spring
6	1	Piston
7	1	Spring
8	1	Overheat Screw
9	1	Upper Seat
10	1	Push Rod
11	1	Thermostat
12	1	O-Ring
13	1	O-Ring
14	1	Control Cap
15	1	Set Screw
16	1	Label
17	1	Set Screw
18	4	1/4 Screw
19	1	Cap

Flexible Connection Lines for S19-2000EFX

When used with S19-292, order Part No. 269-653 (3 supplied with unit).

Kit numbers for rough brass finish. Contact Bradley for other configurations.

As of November 2001, the piston (Item 7) has replaced the seal holder and seal as a direct replacement.

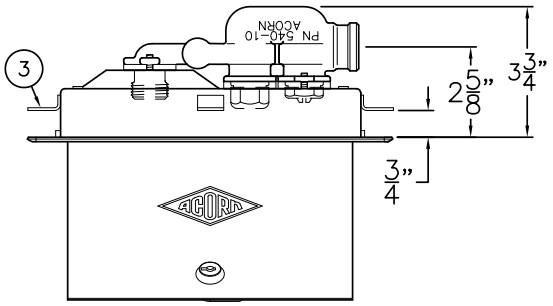
As of June 2008, the brass control cap (item 15) has been replaced by a plastic cap. All internal components are identical.

As of July 2012, the Temperature Adjustment Control (items 15, 17 and 19) have been updated and are compatible with all units using the plastic Control Cap (June 2008 to present).

HS-1 HOSE STATION PER ADDENDUM #2-1

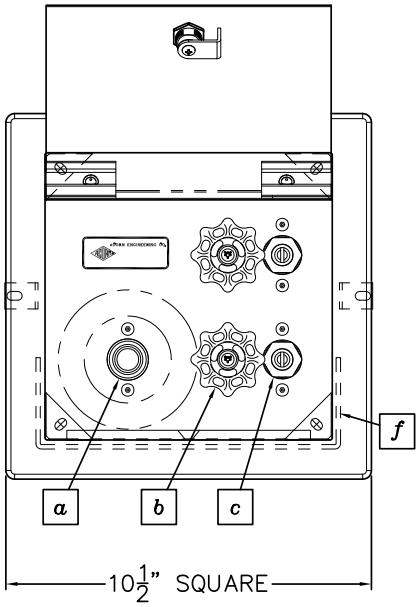
A8156SSLF	ACORN	LFNP *NCSH STAINLESS STEEL HOSE BOX WITH FLANGE DOOR

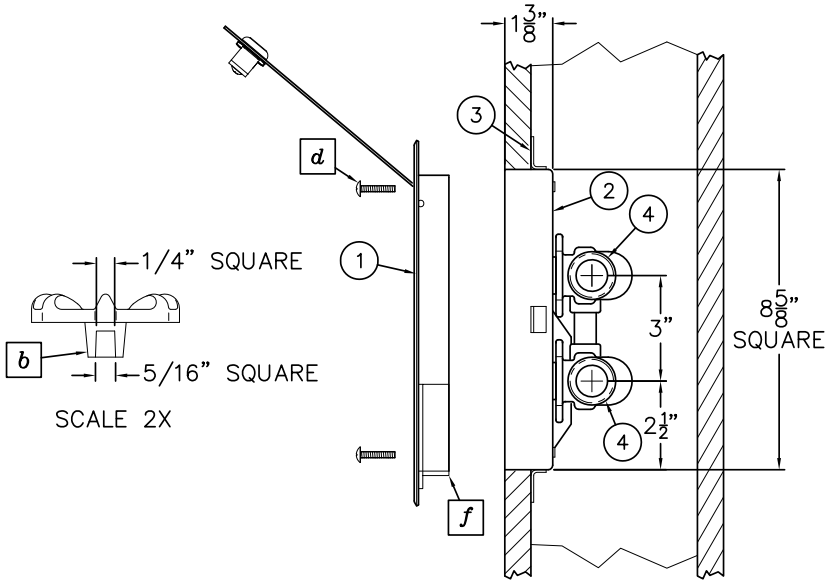
HOSE & SUPPLY BOXES **INSTALLATION INSTRUCTIONS**



REFERENCE DRAWINGS	
REPAIR PARTS	9989-021-002
BITS & DRIVERS	9951-001-002

- a 3/4" MALE HOSE THREAD.
- b REMOVABLE WHEEL LOOSE KEY HANDLE 1/4"-5/16" SQUARE TAPER.
- c LOCKSHIELD SCREWDRIVER STOPS.
- d STAINLESS STEEL #10-32 UNF x 1" LONG WALL FLANGE / DOOR ANCHORING SCREWS.
- e HOSE END VACUUM BREAKER INCLUDED ON MODELS 8146 & 8156.
- f GRAY FOAM WEATHERSTRIPPING TAPE.





WALL FLANGE (MODELS 8145, 8146)
DOOR FRAME SHOWN (MODELS 8155, 8156)

INSTALLATION INSTRUCTIONS:

A- REMOVE THE WALL FLANGE OR DOOR FRAME ① SHOWN FROM THE BOX ②.

B- SELECT RECESSED MOUNTING LOCATION AND BLOCK OUT AND/OR PROVIDE ADEQUATE WALL BACKING OR FRAMING BY OTHERS.

C- USING MOUNTING TABS ③, POSITION AND SECURE THE BOX TO THE STUD FRAMING OR WALL BACKING WITH THE BOX OPENING FLUSH WITH THE FINISHED WALL. PLUMB AND LEVEL AS REQUIRED.

D- MAKE UP SUPPLY CONNECTIONS (HOT AND COLD) TO VALVE INLET ④ 3/4" NPTI AND TEST FIXTURE FOR LEAKS AND OPERATION.

E- INSTALL WALL FLANGE OR DOOR FRAME ① TO THE RECESSED BOX ② TO COMPLETE THE INSTALLATION.

NOTE: THE BOX CAN BE MOUNTED SO THE SUPPLY CONNECTION IS ORIENTATED TO ACCEPT THE INCOMING SUPPLY LINE.

NOTE: MAXIMUM RECOMMENDED WORKING WATER PRESSURE IS 100 PSI; MAXIMUM TEMPERATURE IS 130° F.

WARNING: PRIOR TO MAKING INSTALLATION, SUPPLY LINES MUST BE FLUSHED OF ALL FOREIGN MATERIAL SUCH AS PIPE DOPE, CHIPS, SOLDER, ETC. VALVE MUST BE DRAINED PRIOR TO BEING SUBJECTED TO FREEZING TEMPERATURES.

ACORN ENGINEERING COMPANY
P.O. BOX 3527 Industry, CA 91744
15125 Proctor Ave Industry, CA 91746
(626) 336-4561 FAX (626) 961-2200

TITLE		
8145 SERIES RECESSED HOSE BOX (HOT AND COLD)		
MANUFACTURE DATE	DATE ISSUED	DRAWING NUMBER
SEPTEMBER 1971 TO PRESENT	**03/11/10**	**9901-040-001**
	DATE REVISED **02/17/12**	

3/16

ET-1 **ET-1 EXPANSION TANK**

AST60VC	AMTROL	25 GAL TANK VOL THERM-X-TROL THERMAL EXPANSION TANK ASME CONST

INSTALLATION, OPERATION & SERVICE INSTRUCTIONS

THERM-X-TROL®

THERMAL EXPANSION ABSOBERS (ST-5-C THROUGH ST-210V-C)

1400 Division Road, West Warwick, RI 02893 ▲ T: 401.884.6300 ▲ F: 401.885.2567 ▲ www.amtrol.com

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

WARNING **READ CAREFULLY THE PRODUCT INSTALLATION, OPERATING AND MAINTENANCE MANUAL. FAILURE TO FOLLOW THE INSTRUCTIONS AND WARNINGS IN THE MANUAL MAY RESULT IN SERIOUS OR FATAL INJURY AND/OR PROPERTY DAMAGE, AND WILL VOID THE PRODUCT WARRANTY. THIS PRODUCT MUST BE INSTALLED BY A QUALIFIED PROFESSIONAL. FOLLOW ALL APPLICABLE LOCAL AND STATE CODES AND REGULATIONS, IN THE ABSENCE OF SUCH CODES, FOLLOW THE CURRENT EDITIONS OF THE NATIONAL PLUMBING CODE AND NATIONAL ELECTRIC CODE, AS APPLICABLE.**

WARNING This product must be installed by a qualified professional.

WARNING **EXPLOSION HAZARD.** Failure to follow the instructions in the accompanying product manual can cause a rupture or explosion; possibly causing serious or fatal injury, leaking or flooding and/or property damage.

WARNING Use only with potable water system. Do not operate in a setting with freezing temperatures or where the temperature can exceed 200°F and do not exceed the maximum working pressure specified for this Product in the Manual. Mount vertically only.

WARNING This Product, like most Products under pressure, may over time corrode. weaken and burst or explode, causing serious or fatal injury, leaking or flooding and/or property damage. To minimize risk, a licensed professional must install and periodically inspect and service the Product. A drip pan connected to an adequate drain must be installed if leaking or flooding could cause property damage. Do not locate in an area where leakage of the tank or connections could cause property damage to the area adjacent to the appliance or to lower floors of the structure.

WARNING **Chlorine & Aggressive Water:** The water quality can significantly influence the life of this Product. You should test for corrosive elements, acidity, total solids and other relevant contaminants, including chlorine and treat your water appropriately to insure satisfactory performance and prevent premature failure.

WARNING **CALIFORNIA PROPOSITION 65 WARNING:** This product contains a chemical known by the State of California to cause cancer and to cause birth defects or other reproductive harm. (California Installer/Contractor - California law requires that this notice be given to consumer/end user of this product.) For more information: www.amtrol.com/prop65/htm.

THIS IS THE SAFETY ALERT SYMBOL. IT IS USED TO ALERT YOU TO POTENTIAL PERSONAL INJURY AND OTHER HAZARDS. OBEY ALL SAFETY MESSAGES THAT FOLLOW THIS SYMBOL TO REDUCE THE RISK OF PERSONAL INJURY AS WELL AS PROPERTY DAMAGE.

WARNING **EXPLOSION OR RUPTURE HAZARD** A relief valve must be installed to prevent pressure in excess of local code requirement or maximum working pressure designated in the Product Manual, whichever is less. Do not expose Product to freezing temperatures or temperatures in excess of 200° F. Do not adjust the pre-charge or re-pressure this Product except for any adjustments required at the time of initial installation, especially if Product corroded, damaged or with diminished integrity. Adjustments to pre-charge must be done at ambient temperature only. Failure to properly size the Product or follow these instructions may result in excessive strain on the system and lead to Product failure, serious or fatal personal injury, leakage and/or property damage.

NOTE: Inspect for shipping damage and notify freight carrier or store where purchased immediately if damage is present. To avoid risk of personal injury and property damage, if the product appears to be malfunctioning or shows signs of corrosion, call a qualified professional immediately. Current copies of the Product manual can be viewed at www.amtrol.com. Use proper safety equipment when installing.

WARNING **FAILURE TO PROPERLY SEAL WILL RESULT IN LOSS OF PRECHARGE CAUSING PRODUCT TO FAIL.**

IMPORTANT **GENERAL SAFETY INFORMATION - ADDITIONAL SPECIFIC SAFETY ALERTS APPEAR IN THE FOLLOWING INSTRUCTIONS.**

* All ST-C Series models come with a 1 year warranty. See reverse side for warranty information. **MARK OF THE ORIGINATOR**

Part #: 9017-091 (04/11)

Pre-Installation

1. Visually inspect THERM-X-TROL® for any damage. If damage exists return product for replacement.
2. Adjust pre-charge to equal incoming pressure.

   IMPORTANT **If increasing the pre-charge pressure above 55 psig, the following steps must be followed:**

   a. Tank must be connected to the system with isolation valve open.
   b. System must be pressurized to 55-60 psi or slightly higher than the pre-charge setting of the tank.
   c. Isolation valve then needs to be closed.
   d. The pre-charge pressure of the tank can now be increased to the recommended high pressure setting.
   e. Bring system up to pressure, and then open the isolation valve to the tank.

   Failure to follow these instructions could result in damage to the bladder or diaphragm and void all warranties.
3. Replace and tighten plastic cap on air fitting.

   For commercial water heater installations, contact AMTROL for information.

Installation

1. Install the THERM-X-TROL® on the city supply line to the water heater at a point between the water heater and backflow preventer, check valve or pressure reducing valve (see Figure 1).
2. Once the THERM-X-TROL® is installed, check the city supply line for any leakage. Make repairs if necessary.
3. Before the initial firing of the water heater, open any hot water fixture and draw water until all air is removed from the system. Turn the water heater temperature control to desired ending temperature level, (see water heater instructions).
4. To relieve initial thermal expansion, slightly open a hot water faucet. Continue until water heater aquastat temperature is satisfied. Once heater is at its operating range, no further bleeding of expanded water is required.
5. The system water heater and THERM-X-TROL® will now be operational. The THERM-X-TROL® will control temperature and pressure increases caused by thermal expansion to a level well below the water heater relief valve setting.

Maintenance

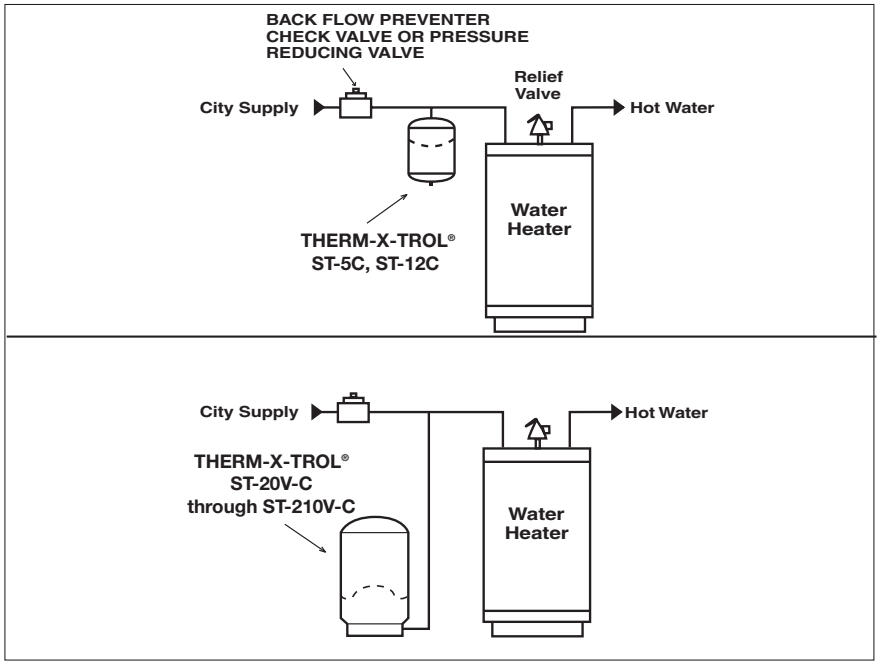
1. A professional plumber should check the complete heating system, including the THERM-X-TROL®, yearly and more frequently as the system ages.

Operation

1. The THERM-X-TROL® is installed in the supply line between the backflow preventer and the water heater. Its sealed-in air pre-charge prevents water from entering it until the system pressure exceeds the pre-charge pressure.
2. As the water temperature rises, expanded water enters the THERM-X-TROL®'s non-corrosive water reservoir. The pre-charged air chamber absorbs the pressure increase, keeping system pressures below the relief valve setting.
3. As hot water is used, the pressure in the air chamber forces water back into the system until the THERM-X-TROL® is empty. At this point, the pressure in the air chamber once again equals the supply pressure.
4. Water treatment is not to exceed 200° F or fall below 35° F.

NOTE: Models are listed (ST-5-C thru ST-210V-C) under ANSI/NSF Std 61 and City of Los Angeles.

Figure 1.



AMTROL INC. LIMITED PRODUCT WARRANTY

Products covered: all Products manufactured by AMTROL Inc. ("AMTROL") .

This warranty cannot be transferred – it is extended only to the original Purchaser or First User of the Product. By accepting and keeping this Product you agree to all of the warranty terms and limitations of liability described below.

IMPORTANT WARNING – READ CAREFULLY THE INSTALLATION, OPERATING AND MAINTENANCE INSTRUCTIONS MANUAL ("MANUAL") to avoid serious personal injury and/or property damage and to ensure safe use and proper care of this product

Who Receives AMTROL's Product Warranty
All purchasers or first users of the new Product. The Warranty is non-transferable.

What is covered by this Warranty
AMTROL warrants to the purchaser or first user of the new Product that at the time of manufacture, the Product is free from defects in material and workmanship. **Any warranty claim must be made within one (1) year unless another time period is set forth in the Manual, measured from the time the Product was purchased.**

What AMTROL Will Do If You Have a Covered Warranty Claim
In the event of a breach of the foregoing warranty, AMTROL will at its option either make repairs to correct any defect in material or workmanship or supply and ship either new or used replacement parts or products. AMTROL will not accept any claims for labor or other costs.

What This Warranty Does Not Cover - Exclusions and Limitations
This Warranty does not cover any failure or problem unless it was caused by a defect in material or workmanship. In addition, this Warranty shall not apply:

- if the Product is not correctly installed, operated, repaired or maintained as described in the Manual provided with the Product;
- to any failure or malfunction resulting from abuse (including freezing); improper or negligent: handling, shipping (by anyone other than AMTROL), storage, use, operation, accident; or alteration, lightning, flood or any other environmental condition;
- to any failure or problem resulting from the use of the Product for any purpose other than those specified in the accompanying Manual or alteration of any part of the product;
- this Warranty does not cover labor costs, shipping charges, service charges, delivery expenses, administrative fees or any costs incurred in removing or reinstalling the Product;
- this Warranty does not cover any claims submitted to AMTROL or an AMTROL-authorized distributor or retailer more than 30 days after expiration of the applicable warranty time period described in this Warranty;
- this Warranty also does not cover repair or replacement costs not authorized in advance by AMTROL.

Additional Warranty Limitations
ALL IMPLIED WARRANTIES, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE SPECIFICALLY DISCLAIMED.

Limitations of Remedies
THE REMEDIES CONTAINED IN THIS WARRANTY ARE THE PURCHASER'S OR FIRST USER'S EXCLUSIVE REMEDIES. IN NO CIRCUMSTANCES WILL AMTROL BE LIABLE FOR MORE THAN, AND PURCHASER-FIRST USER'S REMEDIES SHALL NOT EXCEED, THE PRICE PAID FOR THE PRODUCT. IN NO CASE SHALL AMTROL BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM NON-DELIVERY OR FROM THE USE, MISUSE, OR INABILITY TO USE THE PRODUCT OR FROM DEFECTS IN THE PRODUCT OR FROM AMTROL'S OWN NEGLIGENCE OR OTHER TORT. This exclusion applies regardless of whether such damages are sought for breach of warranty, breach of contract, negligence, strict liability, in tort or under any other legal theory. Such damages include, but are not limited to, inconvenience, loss or damage to property, mold, loss of profits, loss of savings or revenue, loss of use of the Products or any associated equipment, facilities, buildings or services, downtime, and the claims of third parties including customers.

What To Do If You Have a Problem Covered By This Warranty
Any covered Warranty service must be authorized by AMTROL. Contact the person from whom you purchased the Product, who must receive authorization from an AMTROL distributor or AMTROL. If you do not receive a prompt response, call AMTROL directly at 877-517-9673. Notice of a Warranty claim should be submitted by the authorized distributor to AMTROL at the following address:

AMTROL Inc., Warranty Claim Dept.
1400 Division Road, West Warwick, RI 02893

Before AMTROL determines to provide any replacement part or Product, it may as a pre-condition to making such a determination require that the warranty claimant ship the Product, postage prepaid to an authorized AMTROL distributor, or to AMTROL and provide proof of purchase evidenced by the original sales receipt or Product registration.

Replacement Product Warranty
In case of replacement of a Product or any component part, AMTROL reserves the right to make changes in the design, construction, or material of the substitute components or products, which shall be subject to all of the terms and limitations of this Warranty, except that the applicable warranty periods shall be reduced by the amount of time the warranty claimant owned the product prior to submitting notification of the warranty claim.

Revised 01/11

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Part #: 9017-091 (04/11)



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FERGUSON ENTERPRISES, INC.®

HWP-1 HOT WATER CIRCULATING PUMP

B103418LF	B&G	LF 1/25HP BRZ NBF25 CIRC PUMP 115V

Bell & Gossett
a xylem brand

INSTRUCTION MANUAL
P58671H



RED FOX®

BRONZE FOX

c UL us LISTED

NRF/NBF/SSF Circulator

INSTALLER: PLEASE LEAVE THIS MANUAL FOR THE OWNER'S USE.

NOTE: Bell & Gossett recommends Bronze or Stainless Steel Booster Pumps be used for pumping potable water.

This pump is for indoor use only.

SAFETY INSTRUCTIONS

This safety alert symbol will be used in this manual and on the pump Safety Instruction decal to draw attention to safety related instructions. When used, the safety alert symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED! FAILURE TO FOLLOW THE INSTRUCTIONS MAY RESULT IN A SAFETY HAZARD.

Your NRF/NBF/SSF Booster Pump should have the warning/caution label and nonsubmersible warning label displayed to the right (Fig. 1) on the pump conduit box. If this warning and caution label is missing or illegible, contact your local B&G Representative for a replacement.



FIG. 1

DESCRIPTION

The Model NRF/NBF/SSF Circulator Pump features system liquid lubricated bearings, non-overloading permanent split capacitor motor with impedance protection and quiet operation.

PUMP APPLICATION

The Model NRF/NBF/SSF Booster Pump may be used for water circulating applications in hydronic and solar systems. This pump is nonsubmersible, for indoor use only. It has not been investigated for use in swimming pool and marine areas.

OPERATIONAL LIMITS

These pumps are designed to pump liquids compatible with their iron, bronze or stainless steel body constructions.

Maximum Operating Pressure: 150 PSI (10 bars)
Maximum Operating Temperature:
NRF-22 & NRF-9F/LW, 240°F (115° C)
NBF Pumps (except NBF-33), 230°F (110°C)
NRF-33 & NBF-33, 225°F (107°C)
SSF Pumps, 230°F (110°C)

Electrical Rating: 115V, 60Hz, 1Ø; 220V, 60Hz, 1Ø;
220V, 50Hz, 1Ø; 230V, 60Hz, 1Ø

If your NBF pump is equipped with a sweat connected pump body, the maximum operating pressure is limited to 150 PSI (10 bars) or a lower value determined by the type of solder used and pressure/temperature limitations listed below:

Do not exceed these values.
(Solder type limits per ASTM STD. B16.18-1978)

PUMP BODY	TYPE OF SOLDER	MAXIMUM LIMITATIONS	
		PRESSURE PSI	TEMPERATURE °F
SWEAT	95-5 TIN-ANTIMONY	300	200
		250	225
		200	250

WARNING:
Damage to the pump or failure of solder sealing joints may occur if these operational limits are exceeded. This can result in water leakage. Failure to follow this instruction could cause serious personal injury and/or property damage.

SAFETY REQUIREMENTS

MECHANICAL SAFETY

WARNING: EXCESSIVE SYSTEM PRESSURE HAZARD
The maximum working pressure of the pump is listed on the nameplate – DO NOT EXCEED THIS PRESSURE. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

WARNING: EXCESSIVE PRESSURE HAZARD VOLUMETRIC EXPANSION
The heating of water and other fluids causes volumetric expansion. The associated forces may cause failure of system components and the release of high temperature fluids. This can be prevented by installing properly sized and located compression tanks and pressure relief valves. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

THERMAL SAFETY

WARNING: EXTREME TEMPERATURE HAZARD
If the pump, motor or piping are operating at extremely high or low temperature, guarding or insulation is required. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

ELECTRICAL SAFETY

WARNING: ELECTRICAL SHOCK HAZARD
Electrical connections are to be made by a qualified electrician in accordance with all applicable codes, ordinances and good practices. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

WARNING: ELECTRICAL GROUNDING HAZARD
Adequate electrical grounding is required for the safe operation of B&G Pumps. The use of grounded metal conduit assures this requirement. If the means of connection to the supply – connection box (wiring compartment) is other than grounded metal conduit, ground the pump back to the service. Use a copper conductor at least the size of the circuit connectors supplying the pump. Connect the ground wire to the green grounding screw in the wiring compartment. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

WARNING: RISK OF ELECTRIC SHOCK
Do not install this pump in swimming pool or marine areas. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

WARNING:
California Proposition 65 warning! This product contains chemicals known to the state of California to cause cancer and birth defects of other reproductive harm.

REMOVAL OF PUMP FROM EXISTING SYSTEM FOR REPLACEMENT

WARNING: ELECTRICAL SHOCK HAZARD
Disconnect and lockout the power before servicing. Failure to follow these instructions could result in serious personal injury or death.

1. Close the valves on the suction and discharge sides of the pump. (If no valves have been installed, it may be necessary to drain the system.)

WARNING: HOT WATER HAZARD
Before draining the system, allow water to cool to at least 100°F, open the drain valve (take precautions against water damage) and leave the drain valve open until servicing is complete. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

WARNING: ELECTRICAL SHOCK HAZARD
Be certain the electrical power is not present at the motor leads before continuing. Failure to follow these instructions could result in serious personal injury or death

2. Loosen the conduit box cover screw and remove the cover.
3. Disconnect the electrical supply lines to the pump.

WARNING: HIGH PRESSURE HAZARD
Pressure may be present in the pump body. This pressure can be relieved by loosening the flange bolts and shifting the pump assembly slightly to allow the pressurized water to escape. Failure to follow these instructions could result in serious personal injury or death.

4. Remove the flange nuts and bolts or loosen the union ring nuts. Then remove the pump from the piping.

PUMP INSTALLATION

CAUTION: PROPERTY DAMAGE HAZARD
It is not advisable to install circulators in an attic or upper floor over finished living space. If the circulator must be installed over head, or over expensive equipment, provide adequate drainage in the event of leakage. Failure to follow these instructions could result in property damage.

Locate the pump so there is sufficient room for inspection, maintenance and service. Bell & Gossett recommends the installation of service valves on the suction and discharge of all circulators to facilitate servicing or replacement of the circulator without draining the system.

CAUTION: The use of PTFE impregnated pipe compound and PTFE tape on pipe threads provides lubricity which can lead to overtightening and breakage. Do not overtighten. Failure to follow this instruction can result in moderate personal injury from hot water and/or property damage.

Install suction and discharge flanges or union connectors on the pipe ends. The use of PTFE tape sealer or a high quality thread sealant is recommended.

Be sure to minimize any pipe-strain on the pump. Support the suction and discharge piping by the use of pipe hangers near the pump. Line up the vertical and horizontal piping so that the bolt-holes in the pump flanges match the bolt-holes in the pipe flanges. If union connections are used, line up the pump threads with union tail pieces. DO NOT ATTEMPT TO SPRING THE SUCTION OR DISCHARGE LINES IN POSITION. THIS MAY RESULT IN UNWANTED STRESS IN THE PUMP BODY, FLANGE CONNECTIONS AND PIPING. The code for Pressure Piping (ANSI B31.1) lists many types of supports available for various applications.

Bell & Gossett flange/union gaskets must be installed between the NRF/NBF/SSF pump body flanges and the suction and discharge pipe flanges/union tail pieces. Use $^{7}/_{16}$" diameter x $1^{1}/_{2}$" long cap screw and matching nut to connect the pump to the flanges.

WARNING: HOT WATER HAZARD
When disassembling a gasketed joint, always use a new gasket upon reassembly. NEVER RE-USE OLD GASKETS. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

WARNING: HOT WATER HAZARD
Make sure that each flange gasket remains seated in the flange groove during and after installation. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

Apply torque in even increments to both flange bolts until a value of 115 in-lbs. is reached. Both the suction and discharge flange bolts must be torqued in this manner.

If your NBF pump is equipped with a sweat connected pump body, see the following instructions:

1. Use a torch with a sharp pointed flame.
2. Clean tube ends and pump connections thoroughly.
3. Use 95-5 (Tin-Antimony); and a good grade of flux.

CAUTION:
Heat associated with the use of silver solder may damage a pump voiding the warranty. Do not use silver solder. Failure to follow these instructions could result in property damage and/or moderate personal injury.

CAUTION:
Excessive use of solder in a vertical installation may result in damage to the pump impeller. Do not use excessive flux. Failure to follow these instructions could result in property damage and/or moderate personal injury.

4. When sweating the joints, first wrap the pump body with a cool wet rag, then direct the flame with care to avoid subjecting the pump to excessive heat.
5. Check soldered connections for leaks. If resoldering is required, take care to avoid subjecting the pump to excessive heat.

WARNING: WATER LEAKAGE HAZARD
To prevent leakage, make certain that the flange bolts or ring nuts have been adequately tightened and that the solder connections do not leak. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

MODE OF DISCHARGE

The Model NRF/NBF/SSF Circulator can be installed to discharge up or down, horizontally, left or right, but the motor shaft must remain in the horizontal position, the arrow on the body must point in the direction of the flow, the conduit box must be positioned on the top or to the side of the motor housing (see figure 2). If the conduit box position must be changed, it is best to do so before installation. However, if the pump is already installed, see the section titled "REMOVAL OF PUMP FROM EXISTING SYSTEM FOR REPLACEMENT" before proceeding.

CAUTION:
Make sure the power is turned off before placing anything inside the discharge opening to move the impeller.

TO CHANGE THE CONDUIT POSITION

1. Remove the four (4) $^{1}/_{4}$-20 Allen screws ($^{3}/_{16}$ wrench) while supporting the motor assembly.
2. Remove the motor assembly from the pump body and rotate it to the desired position (see figure 2).
3. Replace the Allen screws and tighten evenly in a diagonal method to 60 in-lbs.
4. Check to see that the impeller turns freely. Insert your finger in the discharge port of the pump body (the arrow on the pump body points in the direction of the discharge) until you can feel the impeller and rotate it with your fingertip. If the impeller does not turn easily, repeat the disassembly/reassembly process.

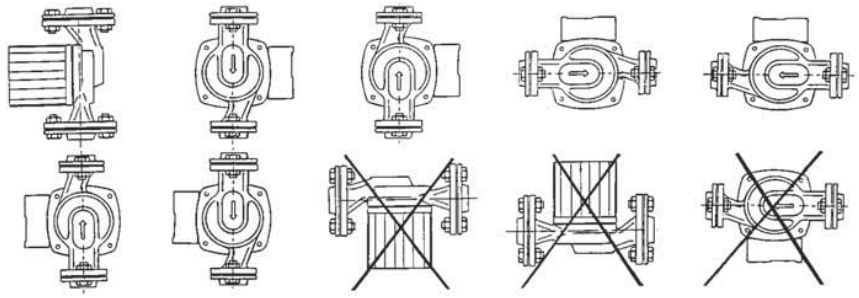


FIG. 2

WARNING: ELECTRICAL SHOCK HAZARD
Disconnect and lock out the power befor e making electrical connections. Failur e to follow these instructions could result in serious personal injury or death.

WARNING: ELECTRICAL SHOCK HAZARD
Be certain that all connections ar e secure and the conduit box cover is closed befor e electrical power is connected. Failure to follow these instructions could r esult in serious personal injury, death and/or property damage.

WIRING INSTRUCTIONS

A. Loosen the scr ew securing the conduit box cover (wiring compartment), and remove the screw & cover.

B. Attach the appropriate size connector to the hole in the side of the conduit box.

C. Using a minimum size of 14 AWG copper electrical wire (refer to your local code for wiring restrictions), wire the motor to a single phase power sour ce that matches the electrical rating on the pump nameplate. See Fig. 3. Use the size of electrical wire as dictated by local code.

D. Connect the gr ound wire to the inside of the conduit box with one of the gr een screws provided inside the box. See Fig. 4.

NOTE: Electrical supply and gr ounding wires must be suitable for at least 90°C (194°F).

NOTE: Model NRF/NBF/SSF Cir culators are impedance protected and do not require external overload protection.

TYPICAL WIRING INSTALLATION SCHEMATIC
1Ø POWER SOURCE

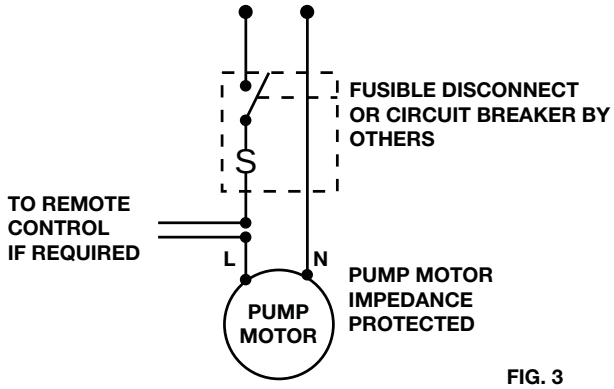


FIG. 3

CONDUIT BOX WIRING DETAIL

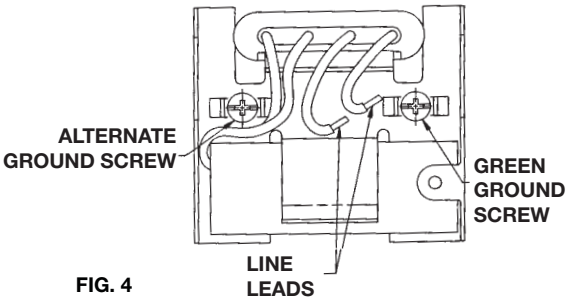


FIG. 4

SYSTEM PREPARATION

Prior to pump start-up, closed heating and cooling systems should be cleaned, drained, and refilled with clean water. The system fluid pH must be maintained between 7 and 9.

START-UP

Do not start pump until the system has been filled and vented. Air should be vented fr om the system by means of an air vent located at a high point in the system. The system must be completely vented prior to pump operation. Do not run NRF/NBF/SSF circulators dry. Pump operation without water cir culation could result in pump and motor damage.

WARNING: HOT WATER LEAKAGE HAZARD
Pressurize the body slowly while checking for leaks at all joints with gaskets or solder connections. Failur e to follow these instructions could r esult in serious personal injury and/or property damage.

PERIODIC INSPECTION

Bell & Gossett NRF/NBF/SSF Cir culators are designed to provide years of trouble free service. It is recommended that periodic inspections be made to check for potential pr oblems with the pump. If any leakage or evidence of leakage is pr esent, repair or replace the unit.

xylem
Let's Solve Water

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Morton Grove, Illinois 60053
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BFP-1		**BFP-1 BACKFLOW PREVENTER PER ADDENDUM #2-1**
W375ASTP	WILKINS	LEAD LAW COMPLIANT 4 STAINLESS STEEL RPP ASSEMBLY STAINLESS STEEL BODY FLGXFLG
WZW209P	WILKINS	LF 4 PRESSURE REDUCING VALVE 150# FXF

Model 375, 375A (R), 375DA & 375ADA (R)

Reduced Pressure Principle Assembly (2 1/2", 3", 4" & 6")
Reduced Pressure Detector Assembly (2 1/2", 3", 4" & 6")

Model 475 & 475V

Reduced Pressure Principle Assembly (2 1/2" & 3")

LEAD-FREE*

ZURN® WILKINS

(Patent No. 5,913,331)

*This product contains a weighted average lead content less than 0.25% for wetted surfaces.

❑ Installation ❑ Testing ❑ Maintenance Instructions

INSTALLATION INSTRUCTIONS

CAUTION: Installation of Backflow Preventers must be performed by qualified, licensed personnel. The installer should be sure the proper device has been selected for the particular installation. Faulty installation could result in an improperly functioning device.

ZURN WILKINS Model 375/475 Series Assemblies are for use on potable water lines where a health hazard exists in the event of a backflow situation.

Damage to the device could result wherever water hammer and/or water thermal expansion could create excessive line pressure. Where this could occur, shock arrestors, check valves and/or pressure relief valves should be installed downstream of the device.

If installation is in a pit or vault, the Backflow Preventer must never be submerged in water because this could cause a cross-connection. Make sure that the pit or vault always remains dry by providing ample drainage. (Consult local codes.)

1. Before installing a Model 375/475 Series Backflow Preventer, flush the line thoroughly to remove all debris, chips and other foreign matter. If required, a strainer should be placed upstream of the Backflow Preventer. **CAUTION**: Do not use a strainer in seldom used emergency waterlines such as fire lines.
2. Provide adequate space around the installed unit so that the test cocks will be accessible for testing and servicing.
3. Install valve at least 12 inches above surrounding flood level.
4. The Model 375 series has been tested and approved in the horizontal position. Contact factory before installing in other orientations.
5. Always consult local codes for installation methods, approvals and guidance.

OUTDOOR INSTALLATION

The Model 375/475 Series Backflow Preventer may be installed outdoors only if the device is protected against freezing conditions. Exposure to freezing conditions will result in improper function or damage to the device. The installation location must be kept above 32°F. All the basic installation instructions apply.

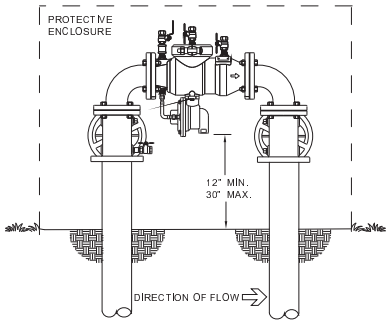
INDOOR INSTALLATION

Indoor installation is preferred in areas that are subject to freezing conditions. All the basic installation instructions apply to such installations. **CAUTION: An adequately sized drain is required to prevent possible water damage due to relief valve discharge.**

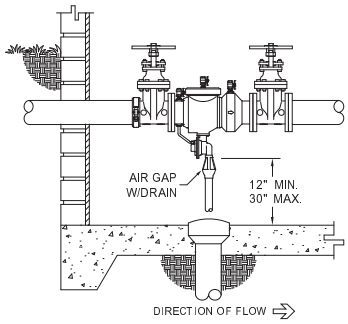
PLACING THE DEVICE IN SERVICE

1. Start with both shut-off valves closed. Slowly open the inlet shut-off valve until the backflow preventer is completely pressurized. A brief discharge from the relief valve may occur while the device is pressurizing. The discharge should cease by the time the shut-off valve is fully open. If the discharge does not stop, refer to "MAINTENANCE INSTRUCTIONS" for repair procedures.
2. After the device has been pressurized, vent all trapped air by slightly opening each of the four test cocks.
3. Slowly open the downstream shut-off valve. The Model 375/475 Series Backflow Preventer is now in service.
4. If spitting or intermittent discharges from the relief valve are noted, it could be a result of pressure fluctuation and/or a water hammer condition in the system. If such conditions exist, install water pressure reducing valves or water hammer shock arrestors in compliance with industry standards as needed.
5. After the Model 375/475 Series has been properly installed, test the device (see "TEST PROCEDURES"). If the device fails the test, remove the first and second check valves and thoroughly flush the device. If the relief valve fails to operate properly, inspect the sensing passage for clogging (see "MAINTENANCE INSTRUCTIONS"). Clean rubber seals of all debris and place unit back in service.

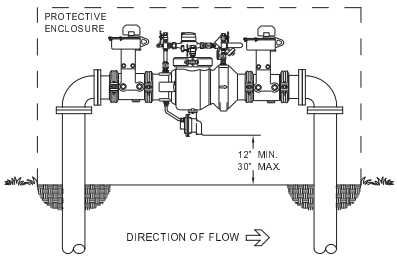
375ASTP ✔



OUTDOOR INSTALLATION
Model 475 (2 1/2" & 3")



INDOOR INSTALLATION
Model 375



OUTDOOR INSTALLATION
Model 375ADABGVIC

Proposition 65 Warning This product contains chemicals known to the State of California to cause cancer or birth defects or other reproductive harm.

Testing Procedures

MODEL 375/475 SERIES ASSEMBLY

Equipment Required: Differential pressure gauge test kit.

TEST NO. 1 - RELIEF VALVE OPENING POINT

REQUIREMENT:

The differential pressure relief valve must operate to maintain the zone between the two check valves at least 2 psi less than the supply pressure.

PROCEDURE:

1. Flush water through test cocks #1, #2 (open #2 slowly), #3 and #4 by opening and closing each test cock one at a time, to eliminate foreign material.
2. Install appropriate fittings to test cocks. Attach hose from the high side of the differential pressure gauge to the #2 test cock then attach hose from the low side of the gauge to the #3 test cock. Open test cock #3 slowly and then bleed all air from the hose and gauge by opening the low side bleed needle valve.
3. Maintain the low side bleed needle valve in the open position while test cock #2 is opened slowly. Open the high side bleed needle valve to bleed all air from the hose and gauge. Close the high side bleed needle valve, then close the low side bleed needle valve after the gauge reading has reached the upper end of the scale.
4. Close the #2 shut-off valve. If the gauge reading drops to the low end of the gauge scale and the differential pressure relief valve discharges continuously, then the #1 check valve is leaking. If this occurs, Tests #1, #2 and #3 cannot be completed (See USC Maintenance Guide). However, should the gauge reading remain above the differential pressure relief valve opening point, then observe the gauge reading. This is the apparent pressure drop across the #1 check valve.
5. Open the high side control needle valve approximately one turn, and then open the low side control needle valve no more than 1/4 turn to by-pass water from the #2 test cock to the #3 test cock. Observe the differential pressure reading as it slowly drops to the relief valve opening point. Record this opening point value when the first discharge of water is detected. Close the low side needle valve.

TEST NO. 2 - TIGHTNESS OF #2 CHECK VALVE

REQUIREMENT:

The #2 check valve shall be tight against backpressure.

PROCEDURE:

1. Maintain the #2 shut-off valve in the closed position (from Test #1). Vent all air through the vent hose by opening the vent needle valve. Close the vent needle valve only (The high side control needle valve is to remain open).
2. Attach the vent hose from the gauge to the #4 test cock, then open the #4 test cock. Bleed water from the zone by opening the low side bleed needle valve on the gauge in order to re-establish the normal reduced pressure within the zone. Once the gauge reading reaches a value above the #1 check valve pressure drop, close the low side bleed needle valve.
3. Open the vent needle valve. If the indicated differential pressure reading remains steady then the #2 check valve is reported as "closed tight." Go to Test #3. If the differential pressure reading falls to the relief valve opening point, bleed water through the low side bleed needle valve until the gauge reading reaches a value above the #1 check valve pressure drop. If the gauge reading settles above the relief valve opening point, record the #2 check valve as "closed tight," and proceed to Test #3. If the differential pressure reading falls to the relief valve opening point again, then the #2 check valve is noted as "leaking," and Test #3 cannot be completed. If the differential pressure reading drops, but stabilizes above the relief valve opening point, the #2 check valve can still be reported as "closed tight."

   Note: Due to disc compression, you may need to bleed off water through low side bleed needle valve several times before the gauge reading will settle above relief valve opening point.

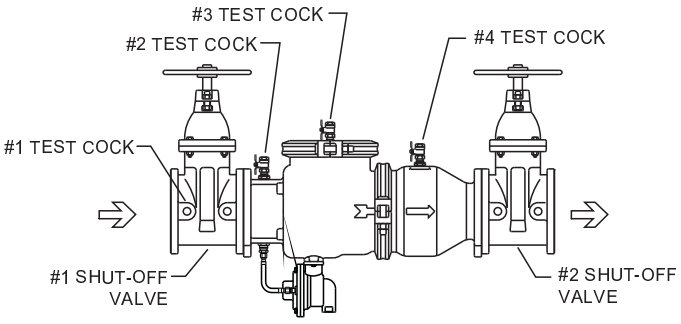
TEST NO.3 - TIGHTNESS OF #1 CHECK VALVE

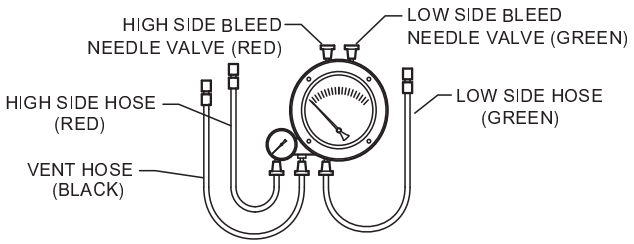
REQUIREMENT:

The static pressure drop across #1 check valve shall be greater than the relief valve opening point (test #1), and at least 5.0 psid.

PROCEDURE:

1. With the vent hose connected to test cock #4 as in step 3 of Test #2, bleed water from the zone through the low side bleed needle valve on the gauge until the reading exceeds the #1 check valve pressure drop. Close the low side bleed needle valve. After the gauge reading settles, the steady state differential pressure reading indicated (reading is not falling on the gauge) is the actual static (i.e., no flow) pressure drop across check valve #1 and is to be recorded as such.
2. Close all test cocks, slowly open shutoff valve #2 and remove equipment.





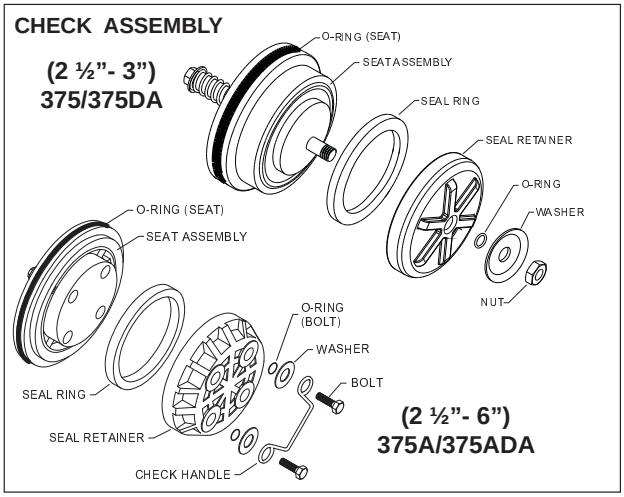
Capacity thru Schedule 40 Pipe				
Pipe size	5 ft/sec	7.5 ft/sec	10 ft/sec	15 ft/sec
2 1/2"	75	112	149	224
3"	115	173	230	346
4"	198	298	397	595
6"	450	675	900	1351
8"	780	1169	1559	2339
10"	1229	1843	2458	3687

SPECIFICATIONS

Maximum working water pressure: 175 PSI
Maximum working water temperature: 140°F
Hydrostatic test pressure: 350 PSI
End connections: Flanged ANSI B16.1 Class 125
Grooved AWWA C606

ZURN WILKINS
*1747 Commerce Way, Paso Robles, CA 93446 Phone:*855-663-9876 *Fax:805-238-5766*
www.zurn.com

Maintenance Instructions



All Model 375/475 Series Backflow Preventers must be inspected and maintained by licensed personnel at least once a year or more frequently as specified by local codes. Replacement of worn or damaged parts must only be made with genuine "ZURN WILKINS" parts.

GENERAL MAINTENANCE

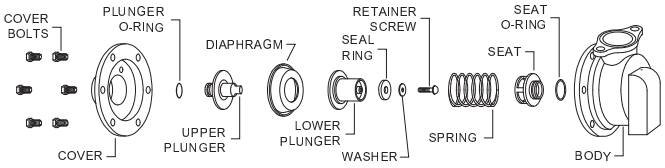
1. Clean all parts thoroughly with water after disassembly.
2. Carefully inspect rubber seal rings and o-rings for damage.
3. Test unit after reassembly for proper operation (refer to "TESTING PROCEDURES").

SERVICING RELIEF VALVE

1. Remove relief valve cover bolts and cover. Gently pull on diaphragm to remove the cartridge assembly.
2. Inspect seal ring for cuts and embedded debris. Turn over or replace if required.
3. Disassemble cartridge by unscrewing relief valve retaining screw.
4. Inspect diaphragm and o-rings for damage. Replace required parts and apply a light coat of lubricant to plunger o-ring.
5. Carefully reassemble cartridge assembly. Tighten retainer screw to 13 -17 in/lbs.
6. Inspect relief valve seat for wear on seating surface. If damaged, replace seat and seat o-ring. Install spring over seat guides.
7. Insert cartridge assembly into relief valve body.
8. Replace relief valve cover and cover bolts.
9. Place the device in service and test per "TESTING PROCEDURES" on page 2.

NOTE: Disassembly of the seat assembly is not recommended. If the seat assembly needs repair, please contact factory.

RELIEF VALVE ASSEMBLY



SERVICING CHECK VALVES

1. Close the outlet and then the inlet shut-off valves.
2. Open No. 2, 3 and 4 test cocks to release internal pressure. Leave them open during check removal and reinstallation.
3. Loosen and remove the two nuts, bolts and seal from the grooved coupling around the access cover.
4. If the valve has a wire retainer on the #1 check assembly, pinch together the exposed ends, pull toward the #2 check and remove from valve.
5. If the valve has a plastic retainer on the #1 check, grasp one of the exposed ends, push down and then pull toward the #2 check. The retainer should "spiral" out of the groove around the check.
6. (2-1/2 – 3" 375/375DA Models) Remove the #2 retainer and check in the same manner as the #1.
7. (4 – 6" 375A/375ADA Models) Remove the #2 check by locating one of the two spring-loaded plate retainers around the face of the check. Pinch the sides of the spring together and rotate the plates out of the body groove one at a time. Remove the 2nd retainer the same way.
8. **Always service the checks one at a time to avoid mixing parts**. Start by removing the hardware and o-rings from the back of the check assembly (See "Check Assembly" illustration). Separate the seal retainer from the assembly to expose the seal ring.
9. Inspect the seal ring for cuts or embedded debris. If the reverse side of the seal is unused, the seal ring can be inverted and used temporarily until a new seal is obtained. Inspect seat o-ring and replace if cut or damaged in any way.
10. Inspect valve cavity and seating areas. Flush with water to remove any debris.
11. (Reassembly, 2-1/2 – 3" 375/375DAModels) Lubricate the #2 check o-ring, install in the body and close the #4 test cock to hold it in place. Install the plastic retainer by inserting one end into the body groove and then sliding your hand around the face of the retainer, pushing it into the groove as you go. The retainer will "snap" into place when fully seated. Install #1 check and retainer in the same way.
12. (Reassembly, 4 – 6" 375A/375ADA Models) Lubricate the #2 check o-ring, install in the body and close the #4 test cock. Install the #2 check retainers into the body groove one plate at a time, squeezing the spring ends together to clear the stops on the face of the seat. Lubricate and install the #1 check, close the #2 test cock and install:
    (A) wire retainer by pinching the ends together, placing the lower edge of the ring into the body groove below the check and rotating the top of the ring into the notch above the check.
    (B) plastic retainer as described above in the 2-1/2 – 3" 375/375DA Models Reassembly section.
13. Lubricate the outside surface of the grooved coupling gasket. Reassemble access cover and grooved coupling, making sure the ends of the coupling touch each other. Close any remaining open test cocks and place valve back in service.

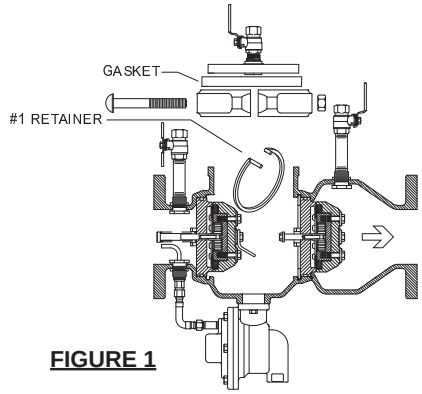


FIGURE 1

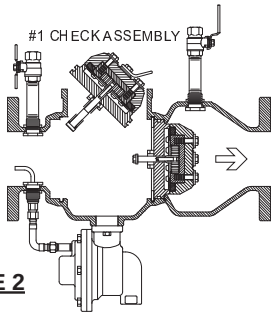


FIGURE 2

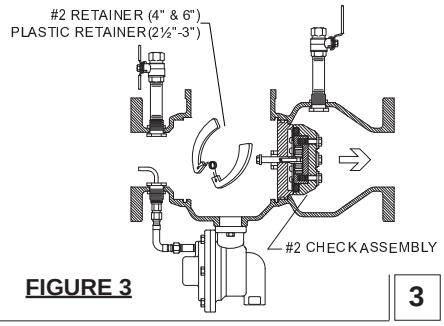


FIGURE 3

Troubleshooting

PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION
1. SUDDEN OR RAPID SPITTING	1. Drop in inlet pressure.	1. Install an in-line spring loaded check valve or pressure reducing valve upstream of Backflow Preventer.
	2. Sudden increase in downstream pressure due to waterhammer from quick closing shut-off valve installed downstream.	2. Install an in-line spring loaded check valve or pressure reducing valve downstream of Backflow Preventer.
2. LIGHT INTERMITTENT DRIP	1. Slightly fouled #1 check.	1. Clean #1 check and/or turn check valve seal ring over or replace.
	2. Slightly fouled relief valve seat.	2. Clean relief valve seat and/or turn relief valve seal ring over or replace.
3. CONTINUOS DISCHARGE	1. Fouled #1 check and/or #2 check.	1. Clean check valves and/or turn check valve seal ring over or replace.
	2. Fouled relief valve seat.	2. Clean relief valve seat and/or turn relief valve seal ring over or replace.

Repair Kits

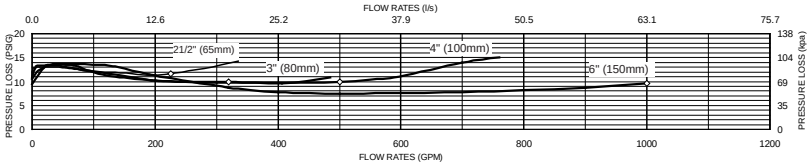
SIZE	MODEL	MODEL 375 RELIEF RUBBER ONLY	MODEL 375 RELIEF COMPLETE	MODEL 375 CHECKS ONLY
2 1/2" - 3"	375/375DA	RK212-375R	RK212-375	RK212-350
4"	375/375DA	RK212-375R	RK212-375	RK4-350
6"	375/375DA	RK212-375R	RK212-375	RK6-350
2 1/2" - 4"	375A/375ADA	RK212-375R	RK212-375	RK4-350
6"	375A/375ADA	RK212-375R	RK212-375	RK6-350

Performance Characteristics

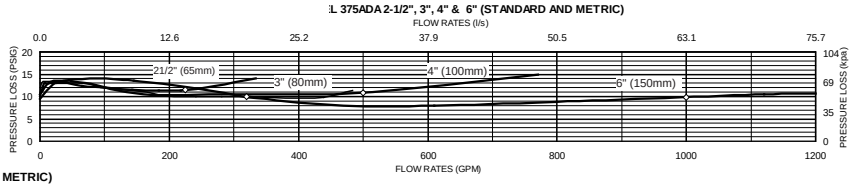
See spec sheet BF-475&V212-3 for flow curves

◇ Rated Flow (Established by approval agencies)

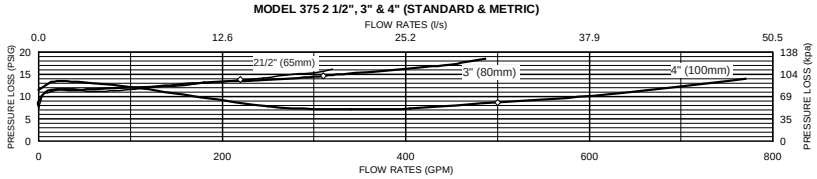
MODEL 375A 2-1/2", 3", 4" & 6" (STANDARD AND METRIC)



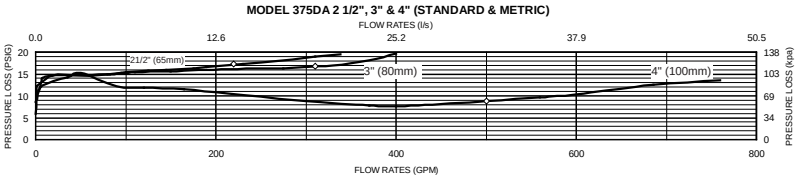
L 375ADA 2-1/2", 3", 4" & 6" (STANDARD AND METRIC)



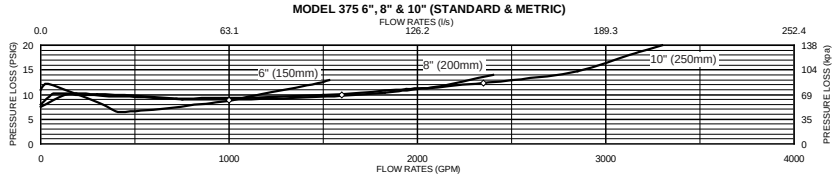
MODEL 375 2 1/2", 3" & 4" (STANDARD & METRIC)



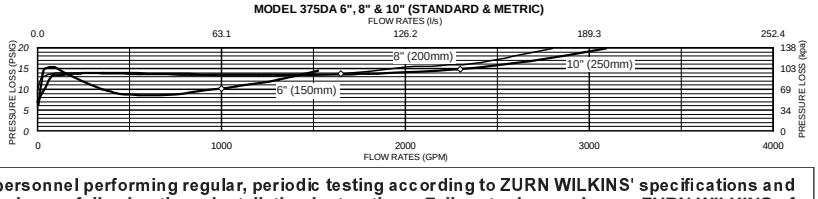
MODEL 375DA 2 1/2", 3" & 4" (STANDARD & METRIC)



MODEL 375 6", 8" & 10" (STANDARD & METRIC)



MODEL 375DA 6", 8" & 10" (STANDARD & METRIC)



Proper performance is dependent upon licensed, qualified personnel performing regular, periodic testing according to ZURN WILKINS' specifications and prevailing governmental & industry standards and codes and upon following these installation instructions. Failure to do so releases ZURN WILKINS of any liability that it might otherwise have with respect to that device. Such failure could also result in an improperly functioning device.

Model ZW209 & ZW209BP LEAD-FREE*

Pressure Reducing Valve Assembly & with Low Flow By-Pass
1 1/4", 1 1/2", 2", 2-1/2", 3", 4", 6", 8" & 10"

ZW209P ✓

*contains a weighted average lead content less than 0.25% for wetted surfaces

ZURN WILKINS

❑ Installation ❑ Troubleshooting ❑ Maintenance Instructions

Installation / Start-up

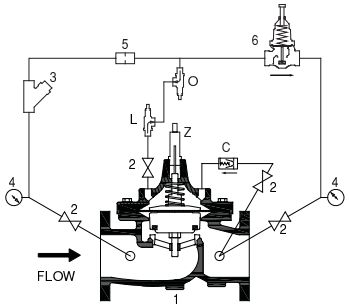
NOTE: Flushing of all pipe lines is to be performed to remove all debris prior to installing valve.

NOTE: If installation is subject to very low flow or potentially static conditions it is recommended a pressure relief valve (1/2" minimum) be installed downstream of the pressure reducing valve for additional system protection.

1. For making adjustments and servicing allow for adequate space around the valve before installing valve.
2. When installing a ZW209 or ZW209BP, gate valves installed on both inlet and outlet are recommended for maintenance allowing for isolation of valve.
3. Position the valve in line matching the direction of flow as indicated on the valve model tag with the proper direction of flow in the system. Once attached to line, double check all fasteners/ bolts in the pilot system and on main valve are tight and there is no damage prior to pressurizing system.

NOTE: Pressure in some applications can be very high so be thorough in checking and inspecting for proper installation and makeup.

4. Zurn Wilkins valves are designed to operate in both the vertical and horizontal positions. However, it is recommended that ZW209 6" and larger, be installation in the horizontal position. The horizontal positioning of the larger valves avoids premature wear due to the mass of plunger assemblies as well as allows for greater accessibility during annual inspections, and maintenance.



ZW209 SCHEMATIC

STANDARD COMPONENTS
1 Main Valve
2 850MXL Isolation Valve
3 SXL Wye Type Strainer
4 Pressure Gauge
5 Restriction Tube Fitting
6 NR3XLHRSC PRV (15-150 psi)

OPTIONAL FEATURES
C 40XL Hydraulic Check w/ Isolation Valve
L SC1 Closing Speed Control
O SC1 Opening Speed Control
Z ZPI Valve Position Indicator
6 PV-PRD (20-200 psi)

START-UP

CAUTION: To prevent personnel injury and damage to equipment check that downstream venting is adequate prior to start-up and test procedures. **All adjustments under pressure should be made slowly while under flowing conditions.** If the main valve closes too fast it may cause surging in upstream piping.

1. Open isolation valves (2) in the pilot system (see ZW209 or ZW209BP schematic).
2. Then slowly open the upstream shutoff valve only enough to fill main valve assembly and pilot system. Prior to pressurizing the valve assembly it is also recommended that a ZPI valve position indicator be installed to aid in verifying proper valve movement.
3. As the valve is filling with water, it is necessary to bleed the main valve and pilot system of air. To vent air, partially open or loosen the highest plugs or fittings in the system. The ZPI valve position indicator is a great location, as it has a test cock at the top to vent air pressure. It may be necessary to bleed system more than once. After removal of air in the system tighten all loose fittings.
4. Before setting valve, if valve is equipped with SC1 Flow controls (O or L on ZW209 schematic) it is necessary to back out the set screw a minimum of 3 turns from initial set point.
5. At this point with the upstream shutoff valve partially open, slowly open the downstream shut off valve. Flow will begin to occur and pressure should build up in valve and eventually stabilize.
6. Next it is advisable to flow water through the valve to ensure all air has been escaped from system. With water flowing through the valve the Zurn Wilkins PRV pilot can be set to the desired pressure. To adjust the pilot, loosen jam nut on adjustment screw and either turn adjustment screw in (to increase pressure) or out (to decrease pressure). Tighten jam nut on pilot when the desired setting has been made. For ZW209BP the low flow by-pass control must be set 5 psi greater than main Pilot PRV.
7. To verify proper operation of ZW209 & ZW209BP close and open downstream shut off valve several times to ensure downstream pressure is stable at set pressure. To verify by-pass operation, close isolation valves on main pilot slowly. Then check the downstream pressure. It should be regulating 5 psi higher than normal Pilot PRV.
8. After pilot system has been adjusted and the valve is properly regulating the main valve opening and closing speed controls (O or L) can be adjusted as needed.
9. When setting speed controls, turning the adjustment screw into the speed control will restrict the amount of flow through the needle valve. Depending on whether the control is for opening or closing (refer to ZW209 schematic) the control will either slow the opening or closing of the main valve when the adjustment screw is turned into the speed control. Adjust as needed and tighten jam nut. In general a closing speed control on a ZW209 and ZW209BP should be at least 3 turns in from the furthest open position to prevent high pressure surges downstream.

Troubleshooting

The following troubleshooting information in Tables 1 & 2 deals strictly with the ZW209 and ZW209BP valve and pilot systems. It is recommended to verify that the pilot system is properly functioning before troubleshooting the main valve. All troubleshooting can be performed without removing the cover. It is also recommended to permanently install a model ZPI valve position indicator and an additional gauge in one of the cover connections.

Troubleshooting

PILOT SYSTEM FUNCTION CHECK

1. To verify if the Pilot PRV is properly regulating pressure, first slowly close the outlet ball valves in the pilot systems. Then allow the cover to fill and the main valve to close. If installed, verify the valve position indicator (model ZPI) is closed.
2. When the main valve is closed, close the cover ball valve to keep the main valve closed.
3. Proceed with venting outlet downstream pressure by opening a source downstream. When opening the downstream source if there is continuous flow, the main valve is not sealing properly. It is recommended that the main valve be disassembled and inspected (Refer to “Disassembly” section).
4. When downstream pressure is relieved, proceed with slowly closing the inlet isolation valve. It may be necessary to reopen the outlet ball valve to relieve pressure on the downstream gauge.
5. With the main valve closed and the system pressure relieved slowly re-open the inlet isolation valve and re-pressurize the pilot system leaving outlet isolation valve open and downstream source open to allow flow. Monitor the inlet and outlet pressures and compare to the desired system settings. If the outlet pressure is the same as the inlet or climbs more than 10 psi above the flowing set point, the Pilot PRV is not properly regulating (refer to the pilot troubleshooting Table 1. Corrective Action section).
6. If the pressure is regulating to the desired system pressures proceed with diagnosis checks for the main valve.

TABLE 1. PILOT SYSTEM TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION
1. Pilot Valve (Pilot PRV) not opening)	1. No spring compression	1. Tighten adjusting screw
	2. Damaged spring	2. Disassemble and replace
	3. Clogged "Wye" Strainer	3. (see plugged “Wye” strainer remedy)
	4. Closed ball valve	4. Open ball valve
2. "Wye" Strainer plugged	1. Clogged with debris or mineral deposits	1. Disassemble and remove obstruction
3. Fails to Regulate	1. Air in main valve cover and/or tubing	1. Loosen top cover plug and fitting and bleed air out of the system
	2. Mechanical obstruction	2. Disassemble and remove obstruction, replace parts as necessary
	3. Worn disc (regulating>10 psi of flow set point)	3. Disassemble and replace disc
4. Pressure gauge fails to operate	1. Damage pressure gauge	1. Replace pressure gauge
	2. Closed ball valve	2. Open ball valve

TABLE 2. MAIN VALVE TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION
1. Main Valve fails to open	1. No pressure at valve Inlet	1. Check Inlet pressure
	2. Main valve diaphragm assembly inoperative	2. Disassemble, clean, and polish stem, replace defective parts
	3. Pilot Valve (Pilot PRV) not opening	
	1) No spring compression	1. Tighten adjusting screw.
	2) Damaged spring	2. Disassemble and replace
2. Main Valve fails to close	1. Foreign matter between disc and seat or worn disc	1. Disassemble the main valve, remove debris, clean parts, and replaced defective parts
	2. Scale on stem or diaphragm ruptured	2. Clean parts, and replace defective parts
	3. "Wye" Strainer plugged	3. Remove, clean, and/or replace
	4. 38-850XL(ball valves) closed	4. Open ball valves
	5. Pilot Valve (Pilot PRV) remains open:	
	1. Spring compressed solid	1. Back off adjusting screw
	2. Mechanical obstruction	2. Disassemble and remove obstruction
	3. Worn seal ring	3. Replace seal ring
3. Fails to Regulate	1. Air in main valve cover and/or tubing	1. Loosen top cover plug and fitting and bleed air out of the system

When performing troubleshooting and diagnosis checks it is recommended that the following steps be performed in sequential order for best results.

DIAGNOSIS CHECKS

CAUTION: Do not service valve while under pressure. When performing diagnosis checks on the ZW209 & ZW209BP when the valve is fully open, high flow rates and high downstream pressures can occur. In order to prevent harm to personnel, equipment, and downstream piping be sure that there are no blocked valves in the system before performing checks.

DIAPHRAGM CHECK

1. Slowly close upstream shut off valve and relieve all pressure downstream.
2. With all pressure relieved in the main valve, close both inlet and outlet isolation valves and remove side plug on cover and leave off.
3. Then open upstream shut off valve partially, allowing water to flow through the valve. While flowing water monitor the opening on the cover. If fluid begins to flow out of the open hole in the cover, then there is most likely damage to the diaphragm or fluid is leaking past the diaphragm assembly due to loose assembly. It is recommended that the valve cover be removed to investigate the leakage (To remove cover see “Maintenance” section for procedures). If no water flows out of cover then the diaphragm is good and you may proceed to the diaphragm movement check.

DIAPHRAGM MOVEMENT CHECK

1. The diaphragm movement check can be determined during the diaphragm check or it can It can also be performed with the use of a valve position indicator model ZPI.
2. Replace cover plug and open pilot ball valves on inlet and cover.
3. Closing the outlet isolation ball valves will direct the flow to the cover causing it to close. **NOTE: Slow or delayed closing of main valve is normal and is due to the time requirements to fill, pressurize cover, and stretch the diaphragm into the closed position. This normal delay is not mechanical binding of the valve assembly.**
4. Using the valve position indicator, make note of the closed position on the indicator. Compare distance of the open mark to the close mark and compare to Table 3.
5. Verify that the main valve is closed, by opening a downstream source (not the outlet isolation ball valve on the main body). If water continuously flows, then the main valve is not sealing properly. Double check the valve movement matches the values in Table 3 and refer to the disassembly procedures section if it does not. This is an indication that the main valve is not sealing due to an obstruction between the seat and the seal or a damaged seal. If water does stop flowing and the measured valve movement does not match Table 3, then there is possible damage under the cover. Remove cover to identify obstruction and replace parts as necessary

TABLE 3. VALVE STEM TRAVEL

VALVE SIZE (in)	VALVE SIZE (mm)	STEM TRAVEL (in)	STEM TRAVEL (mm)
1-1/4" - 1-1/2"	38	0.4	10.2
2"	50	0.7	18.0
2-1/2"	65	0.8	21.3
3"	80	0.9	23.4
4"	100	1.1	28.8
6"	150	1.7	43.4
8"	200	2.4	59.7
10"	250	2.8	71.1

6. For smaller valves (6” and below) diaphragm checks can be performed by hand with the use of a valve stem tool. The valve stem tool can be made using Table 4 to create a “T” bar handle with the appropriate threads on the opposite end of the “T” handle.

TABLE 4. VALVE STEM THREAD SIZE

VALVE SIZE (in)	THREAD SIZE UNF INTERNAL
1-1/4" - 1-1/2"	10-32
2"	10 - 32
2-1/2"	10 - 32
3"	1/4 - 20
4"	1/4 - 20
6"	1/4 - 20
8"	3/8 -16
10"	3/8-16

7. To perform the diaphragm check using the vale stem tool, first remove all pressure in the system and vent the cover. Then remove the center plug on the cover and insert tool into the top of the stem threads. Once the tool is inserted, the valve can be lifted up and the valve movement can be measured by creating marks on the tool in the opened and closed positions. The distance between marks is the valve stem travel. Replace or repair any parts as necessary.

SEAL CHECK

1. To check the seal of the valve disc, an additional pressure gauge will be needed downstream of main valve.
2. With the valve flowing, slowly, close pilot outlet ball valves to apply pressure to cover and allow to close.
3. Open downstream source and monitor the pressure on the inlet and installed outlet gauge, for one min. The pressure on the outlet side should remain zero. If the pressure matches inlet pressure or increases, the main valve is leaking or the outlet ball valve on the pilot system is allowing pressure to creep by. Either way it is recommended that the valve be disassembled and inspected (refer to “Disassembly” section).

Maintenance Instructions

PREVENTATIVE MAINTENANCE

The Zurn Wilkins ZW200 models require minimal maintenance. However, it is highly recommended to schedule annual inspections and to have a repair kit on hand before work begins.

DISASSEMBLY

Warning: Because of the ability to perform inspections and maintenance without removal from the system, it is very important that all shut off valves be closed and all pressure relieved in the valve before beginning disassembly. Failure to do so can result in personnel injury or equipment damage.

1. Verify that all pressure sources are closed up and downstream of valve.
2. Remove pressure in pilot system by loosening the tube fittings to the valve body and cover. When all pressure has been vented, continue to disassemble the pilot control valve and cover tubing. NOTE: Taking a picture before tear down can help with re-assembly of pilot system.
3. Next remove the cover by loosening and removing the cover bolts. If the cover does not come off easily it may be necessary to loosen the cover using a brass chisel and rubber mallet. Apply the chisel under the cover pointing upward away from valve body and tap bottom of cover with the chisel and mallet to loosen the cover. Once the cover is loose, pull cover straight up to avoid damaging the stem and stem bearing in the cover. On larger valves 8” and up, eye bolts and a hoist are recommended due to the weight of these larger covers.
4. With the cover removed the diaphragm assembly can be removed. To avoid damaging the seat bushing, grab the stem and lift straight up. For larger valves 8” and up it is recommended that an eye bolt with the proper stem threads be used with a hoist to lift the assembly out of the valve (see Table 4 for appropriate stem threads).
5. Next it is recommended that the diaphragm assembly be placed in a vise with the bottom hex nut secured. Once secured remove the spring and stem nut. While removing the nut inspect the stem threads. Clean stem with a wire brush if mineral deposits or corrosion are present.
6. After inspecting the stem and removing the nut the diaphragm assembly can be dismantled. If the valve has not been serviced in awhile it is possible that the assembly will require the use of a rubber mallet or pry bars to dismantle the assembly. If this is the case gently tap or pry the components until the components are free to move. When disassembling be sure to clean, inspect, and save all components. Replace any damaged components as necessary.
7. The last component to inspect is the seat which is in the body of the main valve. During inspection of the seat, clean and polish as necessary with fine grit wet/dry sandpaper (400 grit or higher). Typically, if after cleaning there is no visual damage or excessive wear the seat should not require removal. If damage is present or the seat is excessively worn the seat should be replaced.

8. To remove the seat, on valves 6” and smaller the seat is threaded into the body and will require a seat removal tool. Care should be taken when removing the seat to avoid damaging. On 8” and larger valves, the seat is held in place with flat head hex screws. For larger valves a seat puller may be required to remove the seat from the body.

INSPECTION OF COMPONENTS

Cleaning of components is required for proper inspection. Lime deposits are common in systems that use water. To remove deposits, fine grit wet/dry sandpaper (400 grit or higher) can be used. If deposits cannot be removed, off the shelf lime deposit remover can be used. Prepare a solution following the lime deposit remover instructions and soak components (excluding rubber components) until lime deposits are removed.

CAUTION: When handling chemicals (acids) be sure to use proper safety equipment (gloves and eye protection) and practices. After soaking components, be sure to thoroughly rinse all components before handling and re-assembling valve.

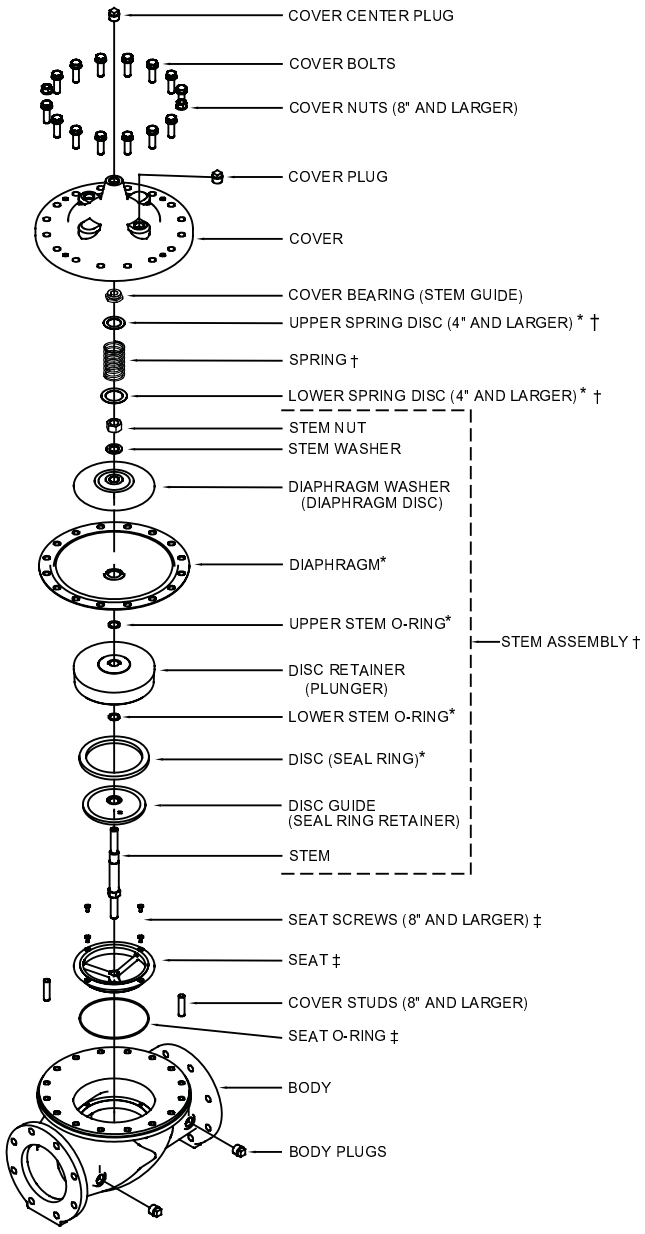
Once all valve components have been cleaned, inspect each component looking for damage, abnormal wear & corrosion, and replace all components that look questionable. Replace all rubber components including the diaphragm, o-rings and disc each time the vale is serviced or inspected (rubber components are standard in ZW200 repair kits.

REASSEMBLY

1. First reinstall seat into body. Be sure to use lube around seat o-ring before tightening. Tighten seat according to torque values in Table 5 using seat tool.
2. Next place valve stem in a vise clamping on the hex portion of the stem. Then assemble the diaphragm assembly as shown in Figure. When assembling be sure that the diaphragm is centered on the raised step of the disc retainer. It is also recommended to apply lube to stem threads and o-rings before tightening. Then tighten the stem nut according to Table 5 for torque values.
3. Lower diaphragm assembly carefully into the seat bushing Be careful not to damage the seat or stem while installing assembly. Rotate the assembly as needed until the bolt holes on the diaphragm line up with the body bolt holes.
4. Place lower spring disc on the diaphragm disc and place spring on top of the assembly. Then install cover, aligning the bolt holes and insuring that the cover is not pinching the diaphragm between the bolt holes. Position cover so plug holes are in original position.
5. Install cover bolts and tighten in a star pattern to the torque values in Table 5.
6. Before installing center cover plug manually check that assembly has full operating travel before installing the pilot assembly (refer to “Diaphragm Movement” in the diagnosis checks section).
7. Once full operation range of the main valve is verified, begin reinstalling pilot system.
8. After installing pilot system double check that all plugs, bolts, and fittings are sealed and tight before applying pressure.
9. Slowly open upstream isolation valve to pressurize the system and check for any leaks.
10. Stop leaks as needed and proceed to “Start-Up” and “Diagnosis Check” sections for returning valve to proper system operations.

TABLE 5. VALVE TORQUE SETTINGS

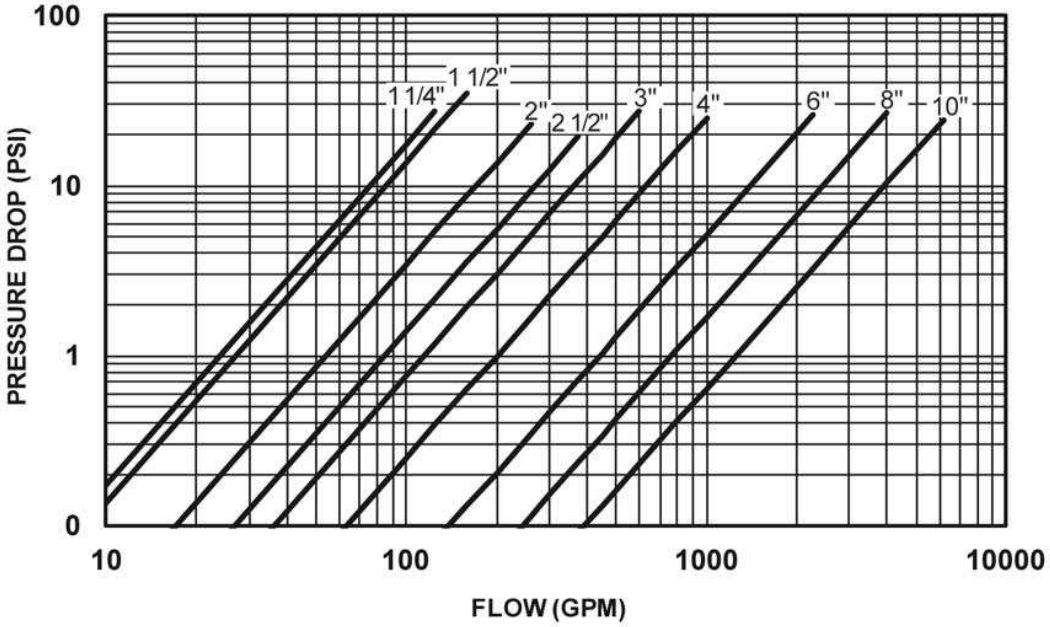
VALVE SIZE (in)	COVER (ft-lbs)	DIAPHRAGM ASSEMBLY (ft-lbs)	THREADED SEAT (ft-lbs)	SEAT BOLTS (ft-lbs)
1-1/4"	3.5	7.5	11	N/A
1-1/2"	3.5	7.5	11	N/A
2"	15	20-25	30	N/A
2-1/2"	25	25-35	60	N/A
3"	25	35-45	70	N/A
4"	55	40-50	85	N/A
6"	110	50-60	95	N/A
8"	120	60-70	N/A	7.4
10"	184	70-75	N/A	7.4



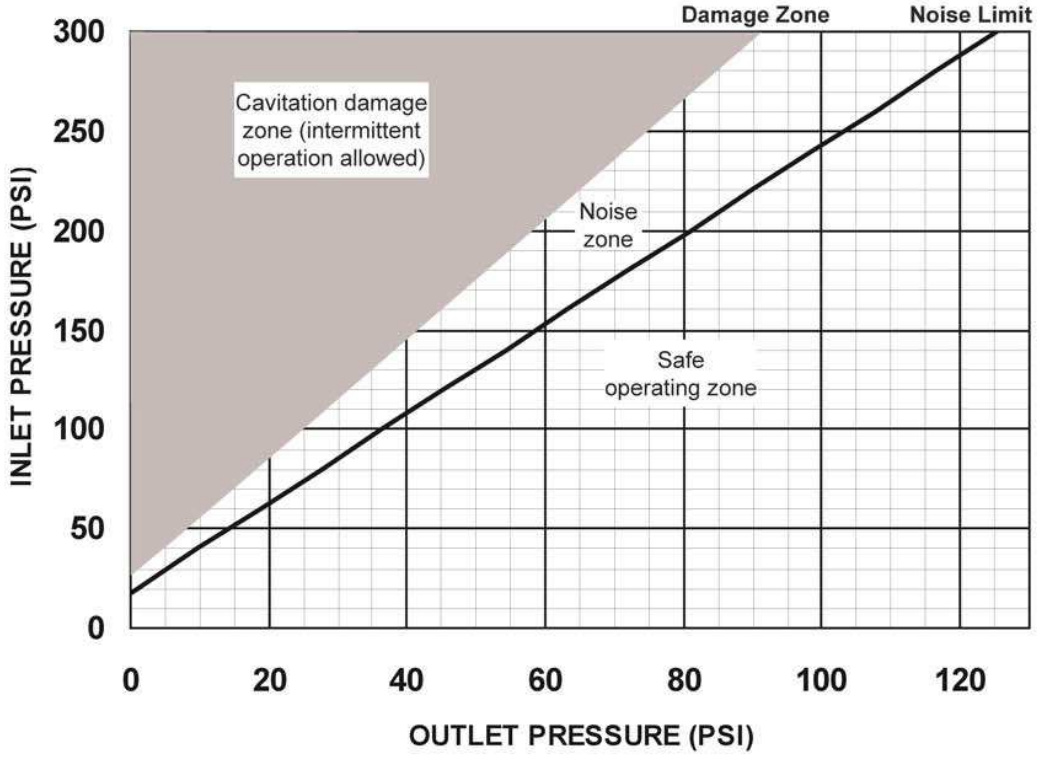
* RUBBER REPAIR KIT ITEMS
† COMPLETE REPAIR KIT ITEMS
‡ SEAT REPAIR KIT

FLOW CHARACTERISTICS

BODY MINIMUM FRICTION LOSS



PRESSURE REDUCTION LIMIT



*** Notes for Body Minimum Friction Loss Chart:**
Minimum inlet pressure is 10 psi higher than set point or the additional body friction loss at intended flow, whichever is higher. (friction loss may be important at flows above 20 ft/s)
Example: A 6" valve intended to flow 2000 GPM at 150 psi has a friction loss of 20 psi at 2000 GPM. The minimum inlet pressure would be 150 + 20 = 170 psi. When inlet pressure is below set point, the outlet pressure will be the pressure at the inlet minus the friction loss.

BFP-2 **BFP-2 BACKFLOW PREVENTER**

W375XLSF	WILKINS	3/4" LF RPP ASSEMBLY COMP VES FNPT STR

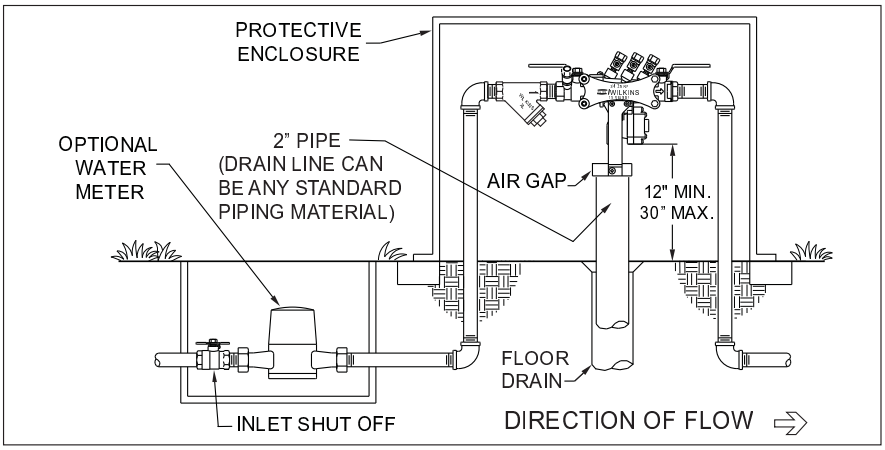
Model 375XL, 375XLB, 375ST LEAD-FREE*

Reduced Pressure Principle Assembly (1/2", 3/4" & 1")

*This product contains a weighted average lead content less than 0.25% for wetted surfaces.

*Certified to NSF/ANSI 61-G

375XLSF ❑ Installation ❑ Testing ❑ Maintenance Instructions



CAUTION: Installation of Backflow Preventers must be performed by qualified, licensed personnel. The installer should be sure the proper device has been selected for the particular installation. Faulty installation could result in an improperly functioning device.

ZURN WILKINS Model 375 Reduced Pressure Principle Backflow Preventers are for use on potable water lines where a health hazard could exist if a backflow situation were to occur.

Proper performance is dependent upon following these installation instructions and prevailing governmental and industry standards and codes. Failure to do so, according to ZURN WILKINS Limited Warranty "... releases ZURN WILKINS of any liability that it might otherwise have with respect to that device." Such failure could also result in an improperly functioning device.

Damage to the device could result wherever water hammer and/or water thermal expansion could create excessive line pressure. Where this could occur, shock arresters and/or pressure relief valves should be installed downstream of the device.

1. Before installing a Model 375 Backflow Preventer, flush the line thoroughly to remove all debris, chips and other foreign matter. If required, a strainer should be placed upstream of the Backflow Preventer.

CAUTION: Do not use a strainer in seldom used emergency waterlines such as fire lines.

2. Provide adequate space around the installed unit so that the test cocks will be accessible for testing and servicing.

3. **WARNING: If installation of a Model 375 is in a building, a suitable drain arrangement MUST be provided to drain off spillage from the relief valve. An air gap at least two times the pipe diameter must be provided between the relief valve and the drain piping to prevent a cross-connection. Air Gap AG-11 not intended to support weight of drain pipe.**

CAUTION: Do not pipe the relief valve solidly to a floor drain, sewer or sump.

CAUTION: An adequately sized drain is required to prevent possible water damage due to relief valve discharge.

4. Install valve at least 12 inches above surrounding flood level.

5. Always consult local codes for installation methods, approvals and guidance.

OUTDOOR INSTALLATION

Model 375 Backflow Preventers may be installed outdoors only if the device is protected against freezing conditions. Exposure to freezing conditions will result in improper function or damage to the device. The installation location must be kept above 32°F. All the basic installation instructions apply.

If installation is in a pit or vault, the Backflow Preventer must never be submerged in water because this will cause a cross-connection. Make sure that the pit or vault always remains dry by providing ample drainage.

INDOOR INSTALLATION

Indoor installation is preferred in areas that are subject to freezing conditions. All the basic installation instructions apply to such installations.

PARALLEL INSTALLATION

Where uninterrupted service from a single meter connection must be maintained, two or more Backflow Preventers may be connected in parallel. All the basic installation instructions apply to parallel installation. Be sure to allow adequate room between the units for testing and repair.

PLACING THE DEVICE IN SERVICE

After the installation of a Model 375 has been completed, place the unit in service as follows:

375 REDUCED PRESSURE PRINCIPLE

1. Start with both shut-off valves closed. Slowly open the inlet shut-off valve until the backflow preventer is completely pressurized. A brief discharge from the relief valve may occur while the device is pressurizing. The discharge should cease by the time the shut-off valve is fully open. Device should function properly. If the discharge does not stop, refer to "MAINTENANCE INSTRUCTIONS" for repair procedures.

2. After the device has been pressurized, vent all trapped air from both check valves by slightly opening each of the four test cocks.

3. Slowly open the downstream shut-off valve. The Model 375 Reduced Pressure Principle Backflow Preventer is now in service.

4. If "spitting" or intermittent discharges from the relief valve are noted, it could be a result of pressure fluctuation and/or a water hammer condition in the system. If such conditions exist, install a ZURN WILKINS water pressure reducing valve, a ZURN WILKINS Model 40XL check valve, or a ZURN WILKINS Model 1250XL water hammer shock arresters in compliance with industry standards as needed.

5. After the Model 375 has been properly installed, test the device (see "TEST PROCEDURES"). If the device fails the test, remove the first and second check valves and thoroughly flush the device. If the relief valve fails to operate properly, inspect the sensing passage for clogging (see "MAINTENANCE INSTRUCTIONS"). Clean rubber seals of all debris and place unit back in service.

Testing Procedures

MODEL 375 REDUCED PRESSURE PRINCIPLE ASSEMBLY

Equipment Required: Differential pressure gauge test kit.

TEST NO. 1
Purpose:
Test #2 check valve for tightness against reverse flow.
Requirement:
The valve must close tight against reverse flow under all pressure differentials.
Procedure:

1. Attach the "HIGH" hose to test cock #2 and the "LOW" hose to test cock #3.
2. Close #2 shut-off valve.
3. Open test cocks #2 and #3.
4. Open by-pass valves "C" and "A" and bleed to atmosphere until all air is expelled.
5. Close by-pass valve "A". Open by-pass valve "B" and bleed to atmosphere until all air is expelled. Close by-pass valves "B" and "C".
6. Attach the "VENT" hose to test cock #4.
7. Slowly open by-pass valves "A" and "C" and keep by-pass valve "B" closed.
8. Open test cock #4.
9. Indicated pressure differential will drop slightly. If pressure differential does not continue to decrease, the #2 check valve is considered tight.

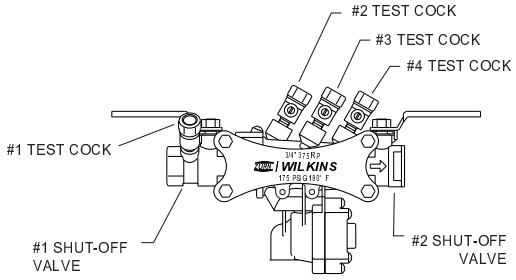
TEST NO. 2
Purpose:
Test #1 check valve for tightness and record pressure drop across #1 check valve.
Requirement:
The static pressure drop across #1 check valve shall be greater than the relief valve opening point (test #3), and at least 5.0 psid.
Procedure:

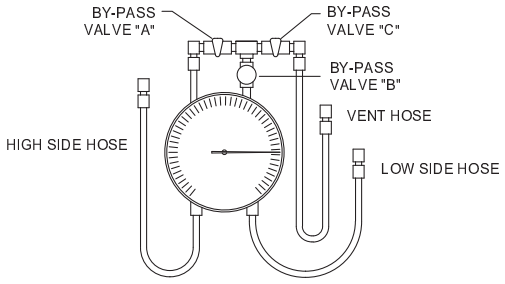
1. Close by-pass valve "A"
2. Close test cock #4, and disconnect "VENT" hose from test cock #4.
3. Open by-pass valves "B" and "C" bleeding to atmosphere, then close by-pass valve "B" restoring the system to normal static condition.
4. Observe the pressure differential gauge and note this as the #1 check valve psid.

TEST NO. 3
Purpose:
To test operation of the differential relief valve.
Requirement:
The pressure differential relief valve must operate to maintain the "ZONE" between the two check valves at least 2 PSID less than the supply pressure.

Procedure:

1. Close by-pass valve "C" and open by-pass valve "A".
2. Open by-pass valve "B" very slowly until differential gauge needle starts to drop. Hold the valve at this position and observe the gauge reading at the moment the first discharge is noted from the relief valve. Record this as the opening differential pressure of the relief valve.





WARRANTY: ZURN WILKINS Valves are guaranteed against defects of material or workmanship when used for the services recommended. If in any recommended service, a defect develops due to material or workmanship, and the device is returned, freight prepaid, to ZURN WILKINS within 12 months from date of purchase, it will be repaired or replaced free of charge. ZURN WILKINS liability shall be limited to our agreement to repair or replace the valve only.

Maintenance Instructions

All Model 375 Reduced Pressure Principle Backflow Preventers must be inspected and maintained by licensed personnel at least once a year or more frequently as specified by local codes. Replacement of worn or damaged parts must only be made with genuine "ZURN WILKINS" parts. The ZURN WILKINS Certificate of Limited Warranty provides that failure to do so "...releases ZURN WILKINS of any liability that it might otherwise have with respect to that device." Such failure could also result in an improperly functioning device.

The Model 375 Reduced Pressure Principle Assemblies should be thoroughly flushed after backflow conditions occur to prevent any type of corrosive deterioration to its components. Failure to do so could result in malfunction of the device.

GENERAL MAINTENANCE

1. Clean all parts thoroughly with water after disassembly.
2. Carefully inspect rubber seal rings, diaphragms and o-rings for damage.
3. Test unit after reassembly for proper operation (see "Testing Procedures").

SERVICING CHECK VALVES

1. Close inlet and outlet shut-off valves.
2. Open No. 2, No. 3 and No. 4 test cocks to release pressure from valve.
3. Unscrew clamp screws, and remove clamp. (inserting screw in center hole can remove stuck clamp). Slide sleeve toward inlet pipe. Slide valve body toward inlet and lift upward.
4. Using finger or blunt object, push in outlet end of body, both checks should slide out the body inlet. (A phillips screw driver will work in a 1/2"-3/4" valve. The closed ball valve handle will work in a 1" valve).

ZURN WILKINS
1747 Commerce Way, Paso Robles, CA 93446 Phone:855-663-9876 Fax:805-238-5766
www.zurn.com

Maintenance Instructions

5. Twist spring retainers counter-clockwise to remove from seat and access poppets.
6. Inspect the rubber seal ring for cuts or embedded debris.

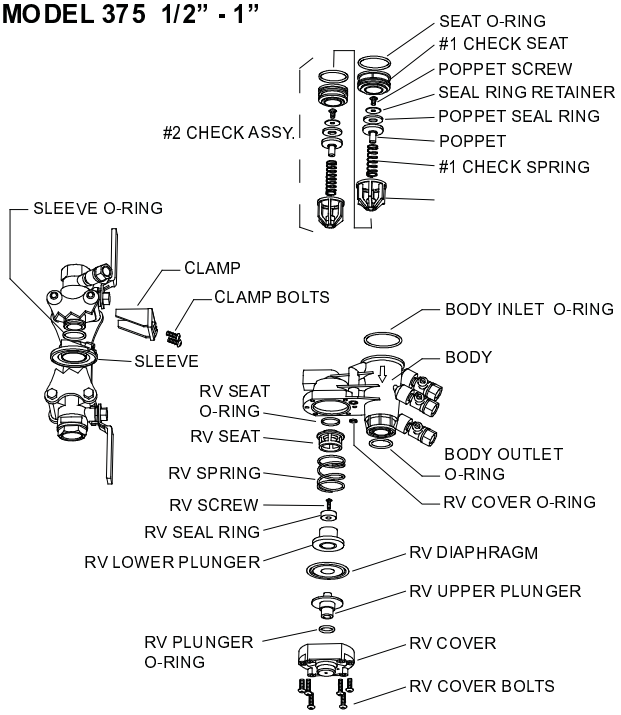
To remove seal ring, remove screw and seal ring retainer. If the reverse side of the seal ring is unused, it is possible to invert the seal ring. This would be considered a temporary solution to fixing a fouled check and should be replaced with a new seal ring as soon as possible.

7. Inspect seat surface for nicks or dings and replace if necessary. Use fingernail to check for dings. Re-grease seat o-rings.
8. Inspect seat o-ring sealing areas in body and wipe clean.
9. Reverse the above procedures to reinstall check valve assembly. (Drop #2 check assembly in body. Then drop #1 check assembly in and turn until #1 spring retainer lines up with #2 seat. Then push both assemblies into body.) Care should be taken to make sure the heavy spring is installed in the No. 1 check valve. **Do not overtighten** clamp screws as this can cause leak at the sleeve o-ring.

SERVICING RELIEF VALVE

1. Remove relief valve cover screws and cover. Gently pull on diaphragm to remove the cartridge assembly.
2. Inspect seal ring for cuts and embedded debris. Turn over or replace if required.
3. Disassemble cartridge by unscrewing relief valve retaining screw.
4. Inspect diaphragm and o-ring for damage. Replace required parts and apply a light coat of grease to plunger o-ring, and place on plunger.
5. Carefully reassemble cartridge assembly.
6. Inspect relief valve seat for wear on seating surface. If damaged, replace seat and seat o-ring. (Twist seat and o-ring while inserting to keep it from popping out.
7. Insert cartridge assembly into relief valve cover.
8. Check cover o-ring in groove on body. Clean or replace as necessary.
9. Replace relief valve cover and cover screws.
10. Place device in service and test per "TESTING PROCEDURES".

MODEL 375 1/2" - 1"



Troubleshooting

When the relief valve discharges intermittently it can be almost always assumed that the device is functioning correctly and that the discharge is caused by systems problem such as inlet pressure fluctuations or water hammer due to quick closing valves.

PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION
1. **SUDDEN OR RAPID SPITTING**	1. Drop in inlet pressure. 2. Sudden increase in downstream pressure due to water hammer from quick closing shut-off valve installed downstream.	A. Install an in-line spring loaded check valve upstream of backflow. (ZURN WILKINS Model 40XL2) B. Install pressure reducing valve upstream of backflow unit. (ZURN WILKINS Model NR3XL) C. Install in-line spring loaded check valve downstream of backflow as close to source as possible, but not closer than 4 feet. (ZURN WILKINS Model 40XL2)
2. LIGHT INTERMITTENT DRIP	1. Slightly fouled #1 check	A. Clean #1 check and turn check valve seal ring over or replace.

Continuous discharge of the relief valve signifies a failure of some part of the device. To help determine the specific area of failure, close the #2 shut-off valve. If the discharge stops, the #2 check requires service. If the discharge continues, the #1 check requires service.

1. CONTINUOUS DISCHARGE	1. Fouled #1 check. 2. Fouled relief valve seat. 3. Fouled #2 check.	A. Clean check valves and turn check valve seal rings over or replace. B. Clean relief valve seat and turn relief valve seal ring over or replace.

In summation, the amount of discharge is proportional to degree of fouling. Most problems occur in the #1 check which is where debris enters the backflow preventer first.

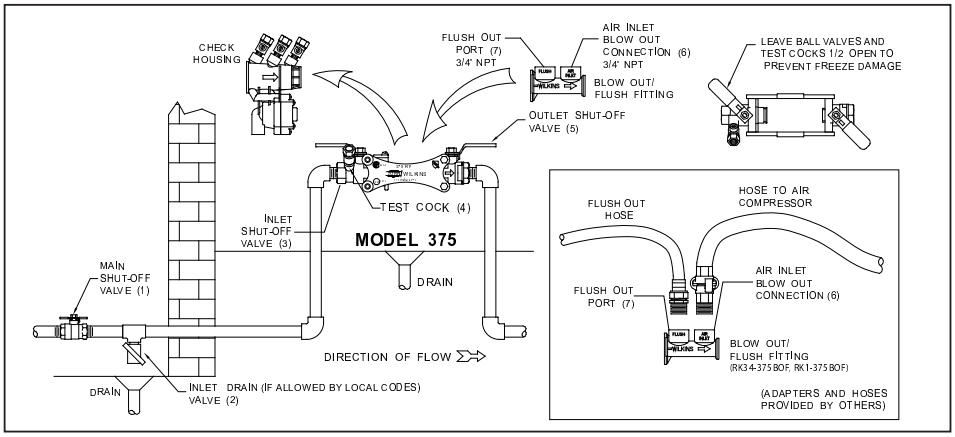
Proper performance is dependent upon licensed, qualified personnel performing regular, periodic testing according to ZURN WILKINS' specifications and prevailing governmental & industry standards and codes and upon following these installation instructions. Failure to do so releases ZURN WILKINS of any liability that it might otherwise have with respect to that device. Such failure could also result in an improperly functioning device.

SPECIFICATIONS

Maximum working water pressure	175 PSI
Maximum working water temp.	180°F
Hydrostatic	350 PSI
End connections	Threaded NPT ANSI B1.20.1

Proposition 65 Warning This product contains chemicals known to the State of California to cause cancer or birth defects or other reproductive harm.

Blow Out / Flush Procedure for Freeze Protection



To Blow Out System for freeze protection, use the following procedure:

1. Turn off main shut-off valve (1) that supplies water to the system.
2. Open inlet drain valve in the system (2). Open inlet and outlet shut-off valves on the backflow preventer (3 & 5) and all of the test cocks (4). Leave all valves and test cocks in the half open/half closed (45°) position to allow full drainage of the ball valves and test cocks.
3. Remove black backflow preventer housing. Replace with orange Blow Out / Flush fitting. Store backflow preventer housing in a safe location for winter. Orange Blow Out / Flush fitting may remain in valve body during winter. Place plugs in ports to keep debris from entering housing.
4. A hose and adapter can be connected to flush out port (7) to drain water to a safe drain.
5. Connect an air hose and adapter to the air inlet connection (6). Inject an adequate volume of air to remove all water from the downstream portion of the system. Do not allow the fitting to overheat.
6. Leave drain valve (2), shut-off valves (3 & 5) and test cocks (4) in the half open/half closed position (45°) for the duration of the winter to prevent freezing.
7. Store valve housing/check assemblies, clamp/sleeve and o-rings in sealed plastic bag during winter to prevent weathering.

To Flush System during installation, use the following procedures:

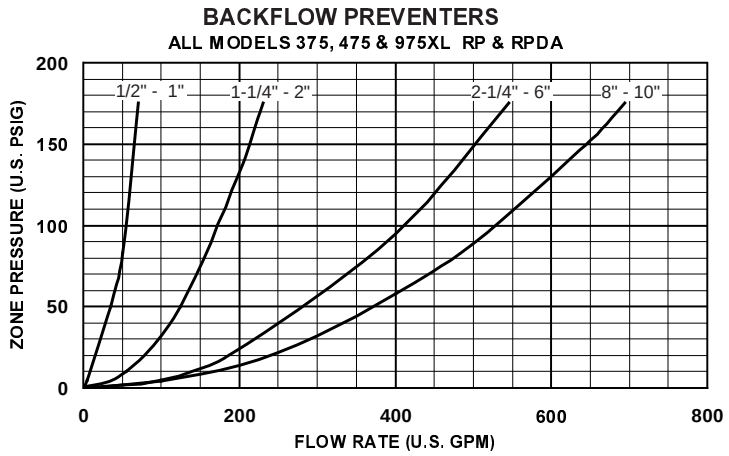
1. Install backflow device in pipe system, leave water off.
2. Remove the black backflow preventer housing from the bronze body.
3. Install the orange Blow Out / Flush fitting into the bronze body.
4. Thread a garden hose adapter into Flush-Out port (7). Connect a hose to the adapter and run to a safe drain. Shut-off valves (3) and (4) should be open.
5. Turn on water supply at main shut-off valve (1) to flush out any debris in the pipe. Turn water off.
6. Remove orange Blow-Out / Flush fitting and replace black check housing back into the line. Close shut-off valves (3) and (4). Turn water on at main shut-off (1).
7. Slowly open shut-off valve (3) to pressurize backflow preventer. Once fully open, pressurize system by slowly opening shut-off valve (4).

CAUTION: For freeze protection be certain that main shut-off valve (1) remains tightly closed to prevent refilling of the system. Also, the main shut-off valve must be resilient seated to insure no leakage of water into the system.

Performance Characteristics

Relief Valve Discharge Rates

(Worst case condition- If 1st check or relief valve is lodged wide open)



Capacity thru Schedule 40 Pipe				
Pipe size	5 ft/sec	7.5 ft/sec	10 ft/sec	15 ft/sec
1/2"	5	7	9	14
3/4"	8	12	17	25
1"	13	20	27	40
1 1/4"	23	35	47	70
1 1/2"	32	48	63	95
2"	52	78	105	167

REPAIR KITS FOR 375's	
BLOW OUT/FLUSH FITTING 1/2" - 3/4" RK34-375BOF 1" RK1-375BOF	VESSEL 1/2" - 3/4" RK34-375V 1" RK1-375V
COMPLETE INTERNALS 1/2" - 3/4" RK34-375 1" RK1-375	WEDGE/CLAMP 1/2" - 3/4" RK34-375W 1" RK1-375W
RUBBER PARTS 1/2" - 3/4" RK34-375R 1" RK1-375R	 BLOW OUT/ FLUSH FITTING

BFP-3 **BFP-3 BACKFLOW PREVENTER PER ADDENDUM #2-1**

W375XLSG WILKINS 1" LF RPP ASSEMBLY COMP VES FNPT STR

Model 375XL, 375XLB, 375ST LEAD-FREE*

Reduced Pressure Principle Assembly (1/2", 3/4" & 1")

*This product contains a weighted average lead content less than 0.25% for wetted surfaces.

*Certified to NSF/ANSI 61-G

❑ Installation ❑ Testing ❑ Maintenance Instructions

CAUTION: Installation of Backflow Preventers must be performed by qualified, licensed personnel. The installer should be sure the proper device has been selected for the particular installation. Faulty installation could result in an improperly functioning device.

ZURN WILKINS Model 375 Reduced Pressure Principle Backflow Preventers are for use on potable water lines where a health hazard could exist if a backflow situation were to occur.

Proper performance is dependent upon following these installation instructions and prevailing governmental and industry standards and codes. Failure to do so, according to ZURN WILKINS Limited Warranty "... releases ZURN WILKINS of any liability that it might otherwise have with respect to that device." Such failure could also result in an improperly functioning device.

Damage to the device could result wherever water hammer and/or water thermal expansion could create excessive line pressure. Where this could occur, shock arresters and/or pressure relief valves should be installed downstream of the device.

1. Before installing a Model 375 Backflow Preventer, flush the line thoroughly to remove all debris, chips and other foreign matter. If required, a strainer should be placed upstream of the Backflow Preventer.

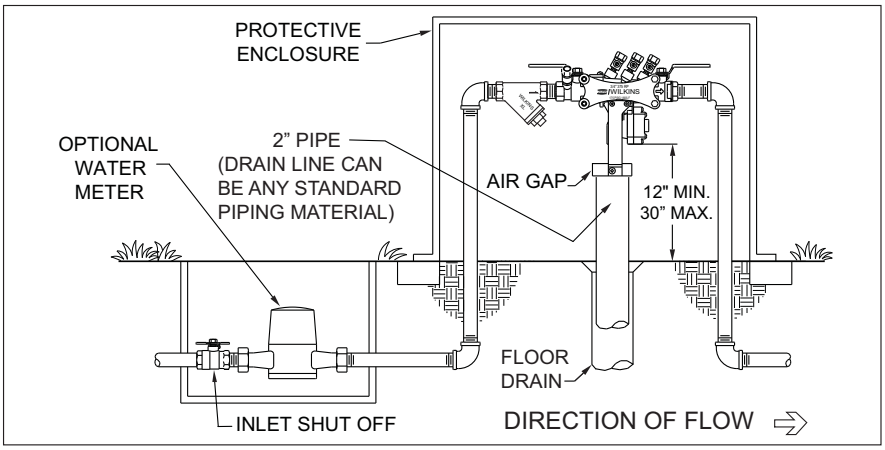
CAUTION: Do not use a strainer in seldom used emergency waterlines such as fire lines.

2. Provide adequate space around the installed unit so that the test cocks will be accessible for testing and servicing.

3. **WARNING: If installation of a Model 375 is in a building, a suitable drain arrangement MUST be provided to drain off spillage from the relief valve. An air gap at least two times the pipe diameter must be provided between the relief valve and the drain piping to prevent a cross-connection. Air Gap AG-11 not intended to support weight of drain pipe.**

CAUTION: Do not pipe the relief valve solidly to a floor drain, sewer or sump.

CAUTION: An adequately sized drain is required to prevent possible water damage due to relief valve discharge.



4. Install valve at least 12 inches above surrounding flood level.

5. Always consult local codes for installation methods, approvals and guidance.

OUTDOOR INSTALLATION

Model 375 Backflow Preventers may be installed outdoors only if the device is protected against freezing conditions. Exposure to freezing conditions will result in improper function or damage to the device. The installation location must be kept above 32°F. All the basic installation instructions apply.

If installation is in a pit or vault, the Backflow Preventer must never be submerged in water because this will cause a cross-connection. Make sure that the pit or vault always remains dry by providing ample drainage.

INDOOR INSTALLATION

Indoor installation is preferred in areas that are subject to freezing conditions. All the basic installation instructions apply to such installations.

PARALLEL INSTALLATION

Where uninterrupted service from a single meter connection must be maintained, two or more Backflow Preventers may be connected in parallel. All the basic installation instructions apply to parallel installation. Be sure to allow adequate room between the units for testing and repair.

PLACING THE DEVICE IN SERVICE

After the installation of a Model 375 has been completed, place the unit in service as follows:

375 REDUCED PRESSURE PRINCIPLE

1. Start with both shut-off valves closed. Slowly open the inlet shut-off valve until the backflow preventer is completely pressurized. A brief discharge from the relief valve may occur while the device is pressurizing. The discharge should cease by the time the shut-off valve is fully open. Device should function properly. If the discharge does not stop, refer to "MAINTENANCE INSTRUCTIONS" for repair procedures.

2. After the device has been pressurized, vent all trapped air from both check valves by slightly opening each of the four test cocks.

3. Slowly open the downstream shut-off valve. The Model 375 Reduced Pressure Principle Backflow Preventer is now in service.

4. If "spitting" or intermittent discharges from the relief valve are noted, it could be a result of pressure fluctuation and/or a water hammer condition in the system. If such conditions exist, install a ZURN WILKINS water pressure reducing valve, a ZURN WILKINS Model 40XL check valve, or a ZURN WILKINS Model 1250XL water hammer shock arresters in compliance with industry standards as needed.

5. After the Model 375 has been properly installed, test the device (see "TEST PROCEDURES"). If the device fails the test, remove the first and second check valves and thoroughly flush the device. If the relief valve fails to operate properly, inspect the sensing passage for clogging (see "MAINTENANCE INSTRUCTIONS"). Clean rubber seals of all debris and place unit back in service.

Testing Procedures

MODEL 375 REDUCED PRESSURE PRINCIPLE ASSEMBLY

Equipment Required: Differential pressure gauge test kit.

TEST NO. 1

Purpose:

Test #2 check valve for tightness against reverse flow.

Requirement:

The valve must close tight against reverse flow under all pressure differentials.

Procedure:

1. Attach the "HIGH" hose to test cock #2 and the "LOW" hose to test cock #3.
2. Close #2 shut-off valve.
3. Open test cocks #2 and #3.
4. Open by-pass valves "C" and "A" and bleed to atmosphere until all air is expelled.
5. Close by-pass valve "A". Open by-pass valve "B" and bleed to atmosphere until all air is expelled. Close by-pass valves "B" and "C".
6. Attach the "VENT" hose to test cock #4.
7. Slowly open by-pass valves "A" and "C" and keep by-pass valve "B" closed.
8. Open test cock #4.
9. Indicated pressure differential will drop slightly. If pressure differential does not continue to decrease, the #2 check valve is considered tight.

TEST NO. 2

Purpose:

Test #1 check valve for tightness and record pressure drop across #1 check valve.

Requirement:

The static pressure drop across #1 check valve shall be greater than the relief valve opening point (test #3), and at least 5.0 psid.

Procedure:

1. Close by-pass valve "A"
2. Close test cock #4, and disconnect "VENT" hose from test cock #4.
3. Open by-pass valves "B" and "C" bleeding to atmosphere, then close by-pass valve "B" restoring the system to normal static condition.
4. Observe the pressure differential gauge and note this as the #1 check valve psid.

TEST NO. 3

Purpose:

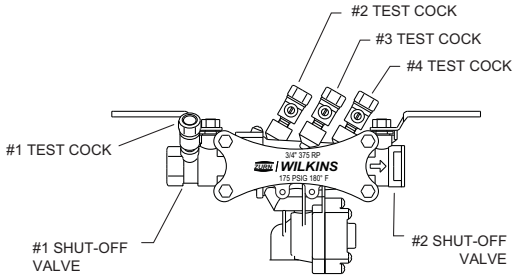
To test operation of the differential relief valve.

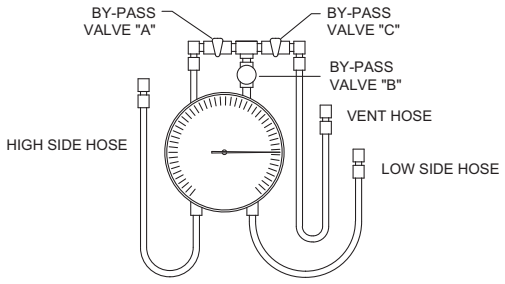
Requirement:

The pressure differential relief valve must operate to maintain the "ZONE" between the two check valves at least 2 PSID less than the supply pressure.

Procedure:

1. Close by-pass valve "C" and open by-pass valve "A".
2. Open by-pass valve "B" very slowly until differential gauge needle starts to drop. Hold the valve at this position and observe the gauge reading at the moment the first discharge is noted from the relief valve. Record this as the opening differential pressure of the relief valve.





WARRANTY: ZURN WILKINS Valves are guaranteed against defects of material or workmanship when used for the services recommended. If in any recommended service, a defect develops due to material or workmanship, and the device is returned, freight prepaid, to ZURN WILKINS within 12 months from date of purchase, it will be repaired or replaced free of charge. ZURN WILKINS liability shall be limited to our agreement to repair or replace the valve only.

Maintenance Instructions

All Model 375 Reduced Pressure Principle Backflow Preventers must be inspected and maintained by licensed personnel at least once a year or more frequently as specified by local codes. Replacement of worn or damaged parts must only be made with genuine "ZURN WILKINS" parts. The ZURN WILKINS Certificate of Limited Warranty provides that failure to do so "...releases ZURN WILKINS of any liability that it might otherwise have with respect to that device." Such failure could also result in an improperly functioning device.

The Model 375 Reduced Pressure Principle Assemblies should be thoroughly flushed after backflow conditions occur to prevent any type of corrosive deterioration to its components. Failure to do so could result in malfunction of the device.

GENERAL MAINTENANCE

1. Clean all parts thoroughly with water after disassembly.
2. Carefully inspect rubber seal rings, diaphragms and o-rings for damage.
3. Test unit after reassembly for proper operation (see "Testing Procedures").

SERVICING CHECK VALVES

1. Close inlet and outlet shut-off valves.
2. Open No. 2, No. 3 and No. 4 test cocks to release pressure from valve.
3. Unscrew clamp screws, and remove clamp. (inserting screw in center hole can remove stuck clamp). Slide sleeve toward inlet pipe. Slide valve body toward inlet and lift upward.
4. Using finger or blunt object, push in outlet end of body, both checks should slide out the body inlet. (A phillips screw driver will work in a 1/2"-3/4" valve. The closed ball valve handle will work in a 1" valve).

Maintenance Instructions

5. Twist spring retainers counter-clockwise to remove from seat and access poppets.
6. Inspect the rubber seal ring for cuts or embedded debris.

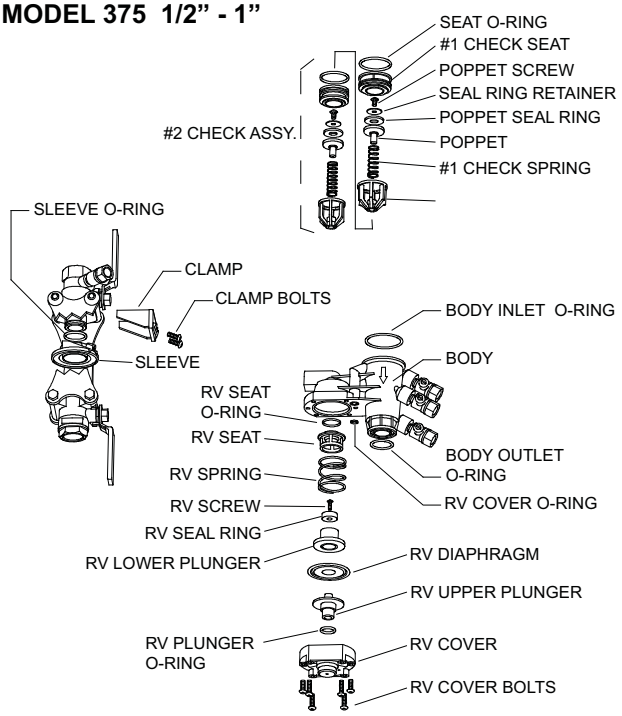
To remove seal ring, remove screw and seal ring retainer. If the reverse side of the seal ring is unused, it is possible to invert the seal ring. This would be considered a temporary solution to fixing a fouled check and should be replaced with a new seal ring as soon as possible.

7. Inspect seat surface for nicks or dings and replace if necessary. Use fingernail to check for dings. Re-grease seat o-rings.
8. Inspect seat o-ring sealing areas in body and wipe clean.
9. Reverse the above procedures to reinstall check valve assembly. (Drop #2 check assembly in body. Then drop #1 check assembly in and turn until #1 spring retainer lines up with #2 seat. Then push both assemblies into body.) Care should be taken to make sure the heavy spring is installed in the No. 1 check valve. **Do not overtighten** clamp screws as this can cause leak at the sleeve o-ring.

SERVICING RELIEF VALVE

1. Remove relief valve cover screws and cover. Gently pull on diaphragm to remove the cartridge assembly.
2. Inspect seal ring for cuts and embedded debris. Turn over or replace if required.
3. Disassemble cartridge by unscrewing relief valve retaining screw.
4. Inspect diaphragm and o-ring for damage. Replace required parts and apply a light coat of grease to plunger o-ring, and place on plunger.
5. Carefully reassemble cartridge assembly.
6. Inspect relief valve seat for wear on seating surface. If damaged, replace seat and seat o-ring. (Twist seat and o-ring while inserting to keep it from popping out.
7. Insert cartridge assembly into relief valve cover.
8. Check cover o-ring in groove on body. Clean or replace as necessary.
9. Replace relief valve cover and cover screws.
10. Place device in service and test per "TESTING PROCEDURES".

MODEL 375 1/2" - 1"



Troubleshooting

When the relief valve discharges intermittently it can be almost always assumed that the device is functioning correctly and that the discharge is caused by systems problem such as inlet pressure fluctuations or water hammer due to quick closing valves.

PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION
1. **SUDDEN OR RAPID SPITTING**	1. Drop in inlet pressure. 2. Sudden increase in downstream pressure due to water hammer from quick closing shut-off valve installed downstream.	A. Install an in-line spring loaded check valve upstream of backflow. (ZURN WILKINS Model 40XL2) B. Install pressure reducing valve upstream of backflow unit. (ZURN WILKINS Model NR3XL) C. Install in-line spring loaded check valve downstream of backflow as close to source as possible, but not closer than 4 feet. (ZURN WILKINS Model 40XL2)
2. LIGHT INTERMITTENT DRIP	1. Slightly fouled #1 check	A. Clean #1 check and turn check valve seal ring over or replace.

Continuous discharge of the relief valve signifies a failure of some part of the device. To help determine the specific area of failure, close the #2 shut-off valve. If the discharge stops, the #2 check requires service. If the discharge continues, the #1 check requires service.

1. CONTINUOUS DISCHARGE	1. Fouled #1 check. 2. Fouled relief valve seat. 3. Fouled #2 check.	A. Clean check valves and turn check valve seal rings over or replace. B. Clean relief valve seat and turn relief valve seal ring over or replace.

In summation, the amount of discharge is proportional to degree of fouling. Most problems occur in the #1 check which is where debris enters the backflow preventer first.

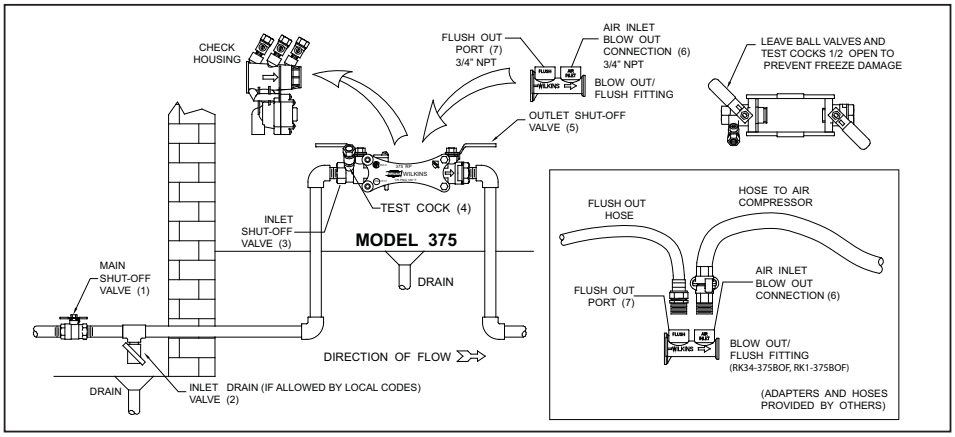
Proper performance is dependent upon licensed, qualified personnel performing regular, periodic testing according to ZURN WILKINS' specifications and prevailing governmental & industry standards and codes and upon following these installation instructions. Failure to do so releases ZURN WILKINS of any liability that it might otherwise have with respect to that device. Such failure could also result in an improperly functioning device.

SPECIFICATIONS

Maximum working water pressure	175 PSI
Maximum working water temp.	180°F
Hydrostatic	350 PSI
End connections	Threaded NPT ANSI B1.20.1

Proposition 65 Warning This product contains chemicals known to the State of California to cause cancer or birth defects or other reproductive harm.

Blow Out / Flush Procedure for Freeze Protection



To Blow Out System for freeze protection, use the following procedure:

1. Turn off main shut-off valve (1) that supplies water to the system.
2. Open inlet drain valve in the system (2). Open inlet and outlet shut-off valves on the backflow preventer (3 & 5) and all of the test cocks (4). Leave all valves and test cocks in the half open/half closed (45°) position to allow full drainage of the ball valves and test cocks.
3. Remove black backflow preventer housing. Replace with orange Blow Out / Flush fitting. Store backflow preventer housing in a safe location for winter. Orange Blow Out / Flush fitting may remain in valve body during winter. Place plugs in ports to keep debris from entering housing.
4. A hose and adapter can be connected to flush out port (7) to drain water to a safe drain.
5. Connect an air hose and adapter to the air inlet connection (6). Inject an adequate volume of air to remove all water from the downstream portion of the system. Do not allow the fitting to overheat.
6. Leave drain valve (2), shut-off valves (3 & 5) and test cocks (4) in the half open/half closed position (45°) for the duration of the winter to prevent freezing.
7. Store valve housing/check assemblies, clamp/sleeve and o-rings in sealed plastic bag during winter to prevent weathering.

To Flush System during installation, use the following procedures:

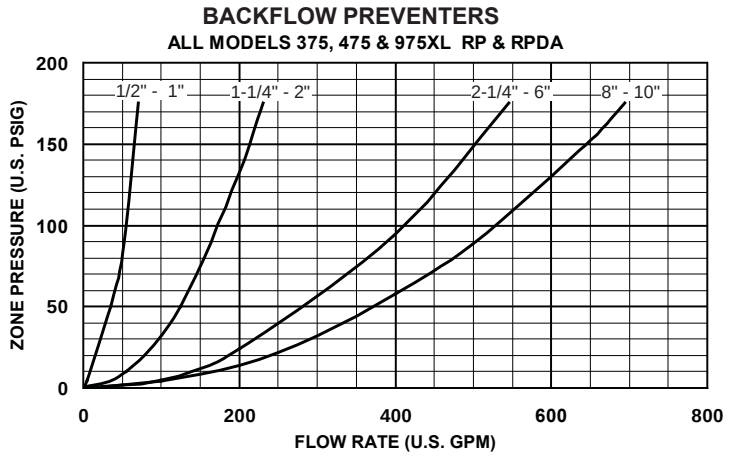
1. Install backflow device in pipe system, leave water off.
2. Remove the black backflow preventer housing from the bronze body.
3. Install the orange Blow Out / Flush fitting into the bronze body.
4. Thread a garden hose adapter into Flush-Out port (7). Connect a hose to the adapter and run to a safe drain. Shut-off valves (3) and (4) should be open.
5. Turn on water supply at main shut-off valve (1) to flush out any debris in the pipe. Turn water off.
6. Remove orange Blow-Out / Flush fitting and replace black check housing back into the line. Close shut-off valves (3) and (4). Turn water on at main shut-off (1).
7. Slowly open shut-off valve (3) to pressurize backflow preventer. Once fully open, pressurize system by slowly opening shut-off valve (4).

CAUTION: For freeze protection be certain that main shut-off valve (1) remains tightly closed to prevent refilling of the system. Also, the main shut-off valve must be resilient seated to insure no leakage of water into the system.

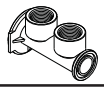
Performance Characteristics

Relief Valve Discharge Rates

(Worst case condition- If 1st check or relief valve is lodged wide open)



Capacity thru Schedule 40 Pipe				
Pipe size	5 ft/sec	7.5 ft/sec	10 ft/sec	15 ft/sec
1/2"	5	7	9	14
3/4"	8	12	17	25
1"	13	20	27	40
1 1/4"	23	35	47	70
1 1/2"	32	48	63	95
2"	52	78	105	167

REPAIR KITS FOR 375's	
BLOW OUT/FLUSH FITTING 1/2" - 3/4" RK34-375BOF 1" RK1-375BOF	VESSEL 1/2" - 3/4" RK34-375V 1" RK1-375V
COMPLETE INTERNALS 1/2" - 3/4" RK34-375 1" RK1-375	WEDGE/CLAMP 1/2" - 3/4" RK34-375W 1" RK1-375W
RUBBER PARTS 1/2" - 3/4" RK34-375R 1" RK1-375R	 BLOW OUT/ FLUSH FITTING

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BFP-4 **BFP-4 BACKFLOW PREVENTER PER ADDENDUM #2-1**

W375XLSH WILKINS 1-1/4" LF RPP ASSEMBLY COMP VES FNPT STR

Model 375XL, 375XLB, 375ST LEAD-FREE*

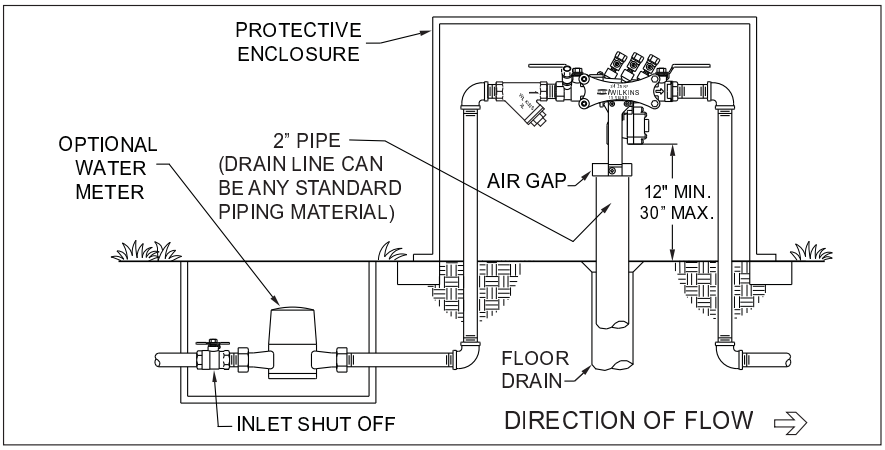
Reduced Pressure Principle Assembly (1/2", 3/4" & 1")

*This product contains a weighted average lead content less than 0.25% for wetted surfaces.

*Certified to NSF/ANSI 61-G

375XLSH

❑ Installation ❑ Testing ❑ Maintenance Instructions



CAUTION: Installation of Backflow Preventers must be performed by qualified, licensed personnel. The installer should be sure the proper device has been selected for the particular installation. Faulty installation could result in an improperly functioning device.

ZURN WILKINS Model 375 Reduced Pressure Principle Backflow Preventers are for use on potable water lines where a health hazard could exist if a backflow situation were to occur.

Proper performance is dependent upon following these installation instructions and prevailing governmental and industry standards and codes. Failure to do so, according to ZURN WILKINS Limited Warranty "... releases ZURN WILKINS of any liability that it might otherwise have with respect to that device." Such failure could also result in an improperly functioning device.

Damage to the device could result wherever water hammer and/or water thermal expansion could create excessive line pressure. Where this could occur, shock arresters and/or pressure relief valves should be installed downstream of the device.

1. Before installing a Model 375 Backflow Preventer, flush the line thoroughly to remove all debris, chips and other foreign matter. If required, a strainer should be placed upstream of the Backflow Preventer.

CAUTION: Do not use a strainer in seldom used emergency waterlines such as fire lines.

2. Provide adequate space around the installed unit so that the test cocks will be accessible for testing and servicing.

3. **WARNING: If installation of a Model 375 is in a building, a suitable drain arrangement MUST be provided to drain off spillage from the relief valve. An air gap at least two times the pipe diameter must be provided between the relief valve and the drain piping to prevent a cross-connection. Air Gap AG-11 not intended to support weight of drain pipe.**

CAUTION: Do not pipe the relief valve solidly to a floor drain, sewer or sump.

CAUTION: An adequately sized drain is required to prevent possible water damage due to relief valve discharge.

4. Install valve at least 12 inches above surrounding flood level.

5. Always consult local codes for installation methods, approvals and guidance.

OUTDOOR INSTALLATION

Model 375 Backflow Preventers may be installed outdoors only if the device is protected against freezing conditions. Exposure to freezing conditions will result in improper function or damage to the device. The installation location must be kept above 32°F. All the basic installation instructions apply.

If installation is in a pit or vault, the Backflow Preventer must never be submerged in water because this will cause a cross-connection. Make sure that the pit or vault always remains dry by providing ample drainage.

INDOOR INSTALLATION

Indoor installation is preferred in areas that are subject to freezing conditions. All the basic installation instructions apply to such installations.

PARALLEL INSTALLATION

Where uninterrupted service from a single meter connection must be maintained, two or more Backflow Preventers may be connected in parallel. All the basic installation instructions apply to parallel installation. Be sure to allow adequate room between the units for testing and repair.

PLACING THE DEVICE IN SERVICE

After the installation of a Model 375 has been completed, place the unit in service as follows:

375 REDUCED PRESSURE PRINCIPLE

1. Start with both shut-off valves closed. Slowly open the inlet shut-off valve until the backflow preventer is completely pressurized. A brief discharge from the relief valve may occur while the device is pressurizing. The discharge should cease by the time the shut-off valve is fully open. Device should function properly. If the discharge does not stop, refer to "MAINTENANCE INSTRUCTIONS" for repair procedures.

2. After the device has been pressurized, vent all trapped air from both check valves by slightly opening each of the four test cocks.

3. Slowly open the downstream shut-off valve. The Model 375 Reduced Pressure Principle Backflow Preventer is now in service.

4. If "spitting" or intermittent discharges from the relief valve are noted, it could be a result of pressure fluctuation and/or a water hammer condition in the system. If such conditions exist, install a ZURN WILKINS water pressure reducing valve, a ZURN WILKINS Model 40XL check valve, or a ZURN WILKINS Model 1250XL water hammer shock arresters in compliance with industry standards as needed.

5. After the Model 375 has been properly installed, test the device (see "TEST PROCEDURES"). If the device fails the test, remove the first and second check valves and thoroughly flush the device. If the relief valve fails to operate properly, inspect the sensing passage for clogging (see "MAINTENANCE INSTRUCTIONS"). Clean rubber seals of all debris and place unit back in service.

Testing Procedures

MODEL 375 REDUCED PRESSURE PRINCIPLE ASSEMBLY

Equipment Required: Differential pressure gauge test kit.

TEST NO. 1
Purpose:
Test #2 check valve for tightness against reverse flow.
Requirement:
The valve must close tight against reverse flow under all pressure differentials.
Procedure:

1. Attach the "HIGH" hose to test cock #2 and the "LOW" hose to test cock #3.
2. Close #2 shut-off valve.
3. Open test cocks #2 and #3.
4. Open by-pass valves "C" and "A" and bleed to atmosphere until all air is expelled.
5. Close by-pass valve "A". Open by-pass valve "B" and bleed to atmosphere until all air is expelled. Close by-pass valves "B" and "C".
6. Attach the "VENT" hose to test cock #4.
7. Slowly open by-pass valves "A" and "C" and keep by-pass valve "B" closed.
8. Open test cock #4.
9. Indicated pressure differential will drop slightly. If pressure differential does not continue to decrease, the #2 check valve is considered tight.

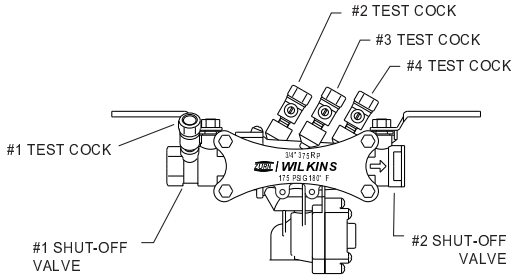
TEST NO. 2
Purpose:
Test #1 check valve for tightness and record pressure drop across #1 check valve.
Requirement:
The static pressure drop across #1 check valve shall be greater than the relief valve opening point (test #3), and at least 5.0 psid.
Procedure:

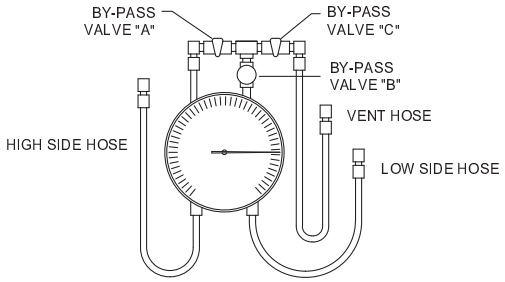
1. Close by-pass valve "A"
2. Close test cock #4, and disconnect "VENT" hose from test cock #4.
3. Open by-pass valves "B" and "C" bleeding to atmosphere, then close by-pass valve "B" restoring the system to normal static condition.
4. Observe the pressure differential gauge and note this as the #1 check valve psid.

TEST NO. 3
Purpose:
To test operation of the differential relief valve.
Requirement:
The pressure differential relief valve must operate to maintain the "ZONE" between the two check valves at least 2 PSID less than the supply pressure.

Procedure:

1. Close by-pass valve "C" and open by-pass valve "A".
2. Open by-pass valve "B" very slowly until differential gauge needle starts to drop. Hold the valve at this position and observe the gauge reading at the moment the first discharge is noted from the relief valve. Record this as the opening differential pressure of the relief valve.





WARRANTY: ZURN WILKINS Valves are guaranteed against defects of material or workmanship when used for the services recommended. If in any recommended service, a defect develops due to material or workmanship, and the device is returned, freight prepaid, to ZURN WILKINS within 12 months from date of purchase, it will be repaired or replaced free of charge. ZURN WILKINS liability shall be limited to our agreement to repair or replace the valve only.

Maintenance Instructions

All Model 375 Reduced Pressure Principle Backflow Preventers must be inspected and maintained by licensed personnel at least once a year or more frequently as specified by local codes. Replacement of worn or damaged parts must only be made with genuine "ZURN WILKINS" parts. The ZURN WILKINS Certificate of Limited Warranty provides that failure to do so "...releases ZURN WILKINS of any liability that it might otherwise have with respect to that device." Such failure could also result in an improperly functioning device.

The Model 375 Reduced Pressure Principle Assemblies should be thoroughly flushed after backflow conditions occur to prevent any type of corrosive deterioration to its components. Failure to do so could result in malfunction of the device.

GENERAL MAINTENANCE

1. Clean all parts thoroughly with water after disassembly.
2. Carefully inspect rubber seal rings, diaphragms and o-rings for damage.
3. Test unit after reassembly for proper operation (see "Testing Procedures").

SERVICING CHECK VALVES

1. Close inlet and outlet shut-off valves.
2. Open No. 2, No. 3 and No. 4 test cocks to release pressure from valve.
3. Unscrew clamp screws, and remove clamp. (inserting screw in center hole can remove stuck clamp). Slide sleeve toward inlet pipe. Slide valve body toward inlet and lift upward.
4. Using finger or blunt object, push in outlet end of body, both checks should slide out the body inlet. (A phillips screw driver will work in a 1/2"-3/4" valve. The closed ball valve handle will work in a 1" valve).

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Maintenance Instructions

5. Twist spring retainers counter-clockwise to remove from seat and access poppets.
6. Inspect the rubber seal ring for cuts or embedded debris.

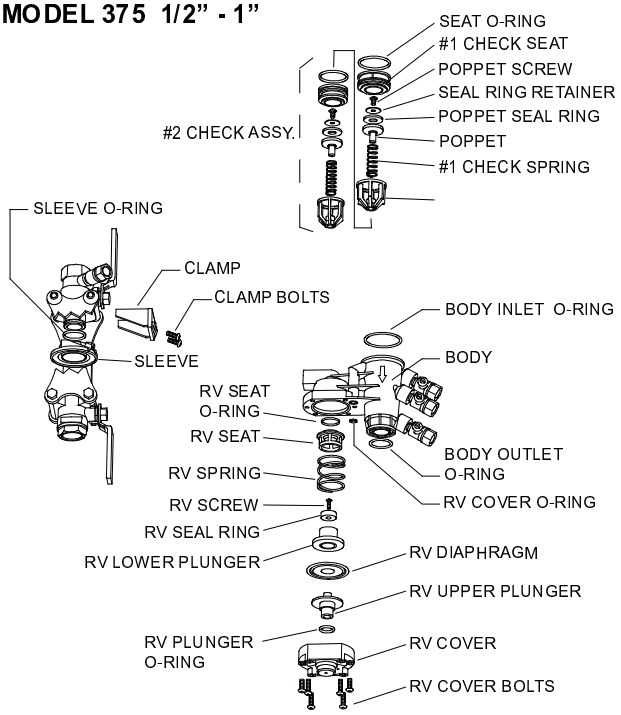
To remove seal ring, remove screw and seal ring retainer. If the reverse side of the seal ring is unused, it is possible to invert the seal ring. This would be considered a temporary solution to fixing a fouled check and should be replaced with a new seal ring as soon as possible.

7. Inspect seat surface for nicks or dings and replace if necessary. Use fingernail to check for dings. Re-grease seat o-rings.
8. Inspect seat o-ring sealing areas in body and wipe clean.
9. Reverse the above procedures to reinstall check valve assembly. (Drop #2 check assembly in body. Then drop #1 check assembly in and turn until #1 spring retainer lines up with #2 seat. Then push both assemblies into body.) Care should be taken to make sure the heavy spring is installed in the No. 1 check valve. **Do not overtighten** clamp screws as this can cause leak at the sleeve o-ring.

SERVICING RELIEF VALVE

1. Remove relief valve cover screws and cover. Gently pull on diaphragm to remove the cartridge assembly.
2. Inspect seal ring for cuts and embedded debris. Turn over or replace if required.
3. Disassemble cartridge by unscrewing relief valve retaining screw.
4. Inspect diaphragm and o-ring for damage. Replace required parts and apply a light coat of grease to plunger o-ring, and place on plunger.
5. Carefully reassemble cartridge assembly.
6. Inspect relief valve seat for wear on seating surface. If damaged, replace seat and seat o-ring. (Twist seat and o-ring while inserting to keep it from popping out.
7. Insert cartridge assembly into relief valve cover.
8. Check cover o-ring in groove on body. Clean or replace as necessary.
9. Replace relief valve cover and cover screws.
10. Place device in service and test per "TESTING PROCEDURES".

MODEL 375 1/2" - 1"



Troubleshooting

When the relief valve discharges intermittently it can be almost always assumed that the device is functioning correctly and that the discharge is caused by systems problem such as inlet pressure fluctuations or water hammer due to quick closing valves.

PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION
1. **SUDDEN OR RAPID SPITTING**	1. Drop in inlet pressure. 2. Sudden increase in downstream pressure due to water hammer from quick closing shut-off valve installed downstream.	A. Install an in-line spring loaded check valve upstream of backflow. (ZURN WILKINS Model 40XL2) B. Install pressure reducing valve upstream of backflow unit. (ZURN WILKINS Model NR3XL) C. Install in-line spring loaded check valve downstream of backflow as close to source as possible, but not closer than 4 feet. (ZURN WILKINS Model 40XL2)
2. LIGHT INTERMITTENT DRIP	1. Slightly fouled #1 check	A. Clean #1 check and turn check valve seal ring over or replace.

Continuous discharge of the relief valve signifies a failure of some part of the device. To help determine the specific area of failure, close the #2 shut-off valve. If the discharge stops, the #2 check requires service. If the discharge continues, the #1 check requires service.

1. CONTINUOUS DISCHARGE	1. Fouled #1 check. 2. Fouled relief valve seat. 3. Fouled #2 check.	A. Clean check valves and turn check valve seal rings over or replace. B. Clean relief valve seat and turn relief valve seal ring over or replace.

In summation, the amount of discharge is proportional to degree of fouling. Most problems occur in the #1 check which is where debris enters the backflow preventer first.

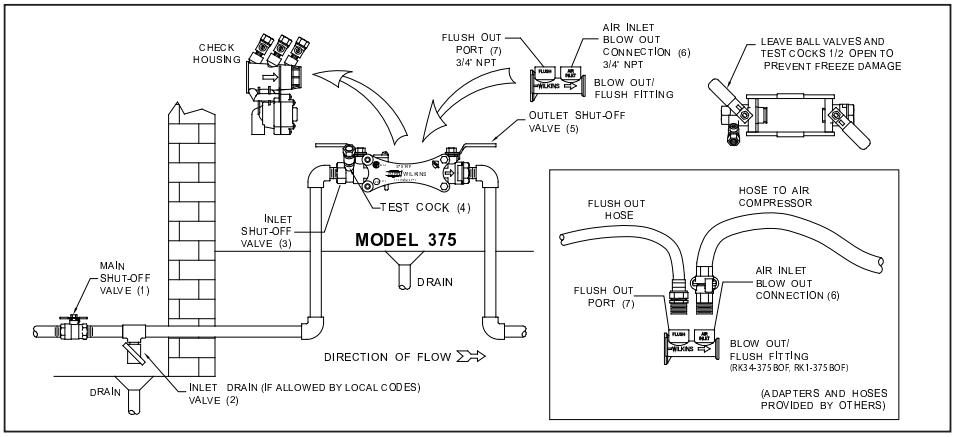
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SPECIFICATIONS

Maximum working water pressure	175 PSI
Maximum working water temp.	180°F
Hydrostatic	350 PSI
End connections	Threaded NPT ANSI B1.20.1

Proposition 65 Warning This product contains chemicals known to the State of California to cause cancer or birth defects or other reproductive harm.

Blow Out / Flush Procedure for Freeze Protection



To Blow Out System for freeze protection, use the following procedure:

1. Turn off main shut-off valve (1) that supplies water to the system.
2. Open inlet drain valve in the system (2). Open inlet and outlet shut-off valves on the backflow preventer (3 & 5) and all of the test cocks (4). Leave all valves and test cocks in the half open/half closed (45°) position to allow full drainage of the ball valves and test cocks.
3. Remove black backflow preventer housing. Replace with orange Blow Out / Flush fitting. Store backflow preventer housing in a safe location for winter. Orange Blow Out / Flush fitting may remain in valve body during winter. Place plugs in ports to keep debris from entering housing.
4. A hose and adapter can be connected to flush out port (7) to drain water to a safe drain.
5. Connect an air hose and adapter to the air inlet connection (6). Inject an adequate volume of air to remove all water from the downstream portion of the system. Do not allow the fitting to overheat.
6. Leave drain valve (2), shut-off valves (3 & 5) and test cocks (4) in the half open/half closed position (45°) for the duration of the winter to prevent freezing.
7. Store valve housing/check assemblies, clamp/sleeve and o-rings in sealed plastic bag during winter to prevent weathering.

To Flush System during installation, use the following procedures:

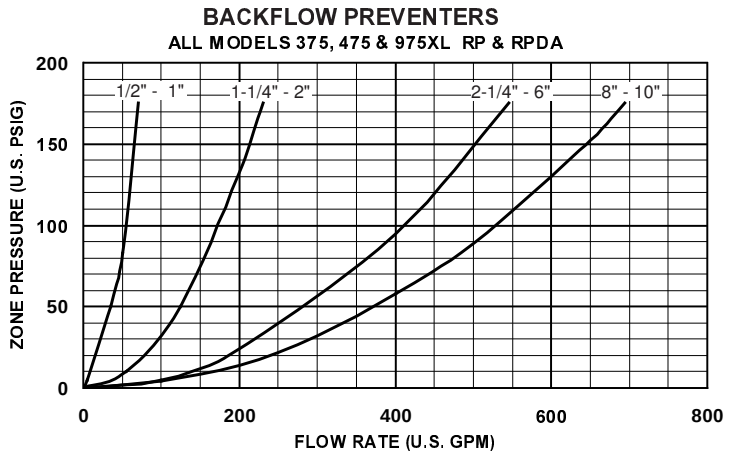
1. Install backflow device in pipe system, leave water off.
2. Remove the black backflow preventer housing from the bronze body.
3. Install the orange Blow Out / Flush fitting into the bronze body.
4. Thread a garden hose adapter into Flush-Out port (7). Connect a hose to the adapter and run to a safe drain. Shut-off valves (3) and (4) should be open.
5. Turn on water supply at main shut-off valve (1) to flush out any debris in the pipe. Turn water off.
6. Remove orange Blow-Out / Flush fitting and replace black check housing back into the line. Close shut-off valves (3) and (4). Turn water on at main shut-off (1).
7. Slowly open shut-off valve (3) to pressurize backflow preventer. Once fully open, pressurize system by slowly opening shut-off valve (4).

CAUTION: For freeze protection be certain that main shut-off valve (1) remains tightly closed to prevent refilling of the system. Also, the main shut-off valve must be resilient seated to insure no leakage of water into the system.

Performance Characteristics

Relief Valve Discharge Rates

(Worst case condition- If 1st check or relief valve is lodged wide open)



Capacity thru Schedule 40 Pipe				
Pipe size	5 ft/sec	7.5 ft/sec	10 ft/sec	15 ft/sec
1/2"	5	7	9	14
3/4"	8	12	17	25
1"	13	20	27	40
1 1/4"	23	35	47	70
1 1/2"	32	48	63	95
2"	52	78	105	167

REPAIR KITS FOR 375's	
BLOW OUT/FLUSH FITTING 1/2" - 3/4" RK34-375BOF 1" RK1-375BOF	VESSEL 1/2" - 3/4" RK34-375V 1" RK1-375V
COMPLETE INTERNALS 1/2" - 3/4" RK34-375 1" RK1-375	WEDGE/CLAMP 1/2" - 3/4" RK34-375W 1" RK1-375W
RUBBER PARTS 1/2" - 3/4" RK34-375R 1" RK1-375R	 BLOW OUT/ FLUSH FITTING

GI-1 **GI-1 GREASE INTERCEPTOR**

W5100NH35418XT WADE GREASE INTERCEPTOR, A.R.C. STEEL - 4" NO HUB, HEAVY DUTY COVER, EXTENSION (UP TO 6")

WH-1 **WH-1 WALL HYDRANT PER ADDENDUM #2-1**

S5518SSBXCL	JR SMITH	5518 HYDRANT W/BOX W/(-SS-CL)SS HYD BOX W/CL LK

SMITH® JAY R. SMITH MFG. CO.®
MEMBER OF MORRIS GROUP INTERNATIONAL
POST OFFICE BOX 3237
MONTGOMERY, ALABAMA 36109-0237 (USA)
TEL: 334-277-8520 FAX: 334-272-7396 www.jrsmith.com
CUSTOMER DRIVEN SINCE 1926
MEMBER OF:

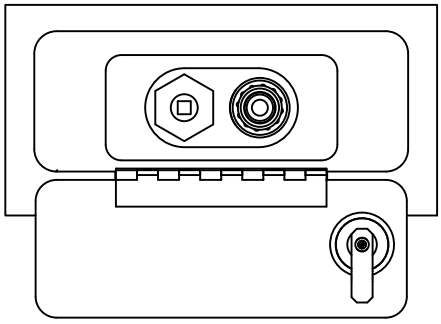
LOCATION

NARROW WALL WARM CLIMATE HYDRANT

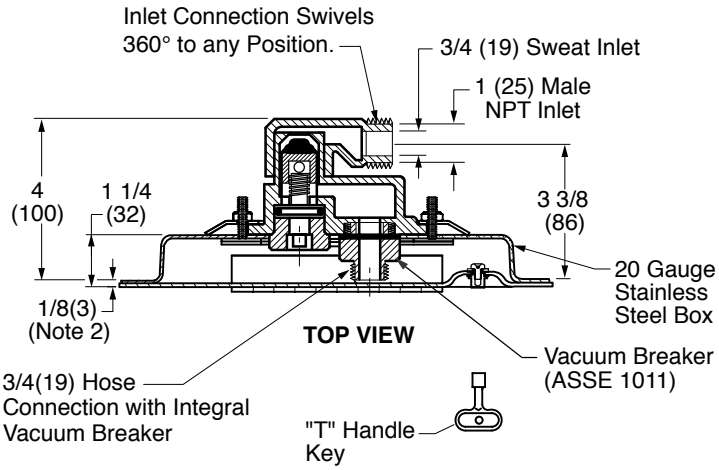
BOX TYPE WITH CONCEALED HOSE CONNECTION

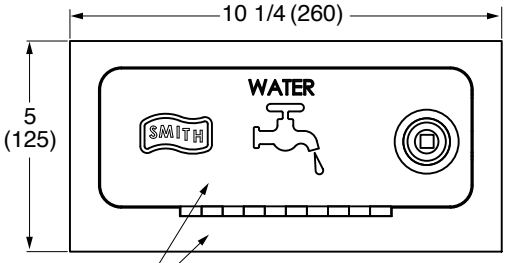
FUNCTION: For installation in interior or exterior wall of building where a concealed hose connection is desired and there is no danger of freezing. Hydrant features an integral type vacuum breaker. The locking cover prevents unauthorized use.

The hydrant contained within the box assembly is the 5618 Warm Climate Hydrant which complies with the Lead Free Plumbing Law. Certified by the IAPMO R & T, File No. 6127 (NSF/ANSI 372)



FRONT VIEW with COVER OPEN





NOTES:
1. Recommended wall opening is 3 3/16 (83) x 8 1/2 (215).
2. Add 3/8 (10) when optional box face material is specified.
3. All Jay R. Smith hydrants are manufactured with "NO LEAD" brazing rings and USDA approved lubricants.
4. Dimensions shown in parentheses are in millimeters.
5. The AB1953, California Lead Law, and NSF/ANSI Standard 61-2008 - Drinking Water System Components are not applicable to Jay R. Smith hydrants as they do not convey/dispense water for human consumption through drinking or cooking.
6. **FOR IRRIGATION PURPOSES ONLY.**

☐ **FIG. 5518**

A small amount of water seepage may occur from the vacuum breaker and operating screw upon initial opening and closing of the hydrant. This is normal operation.

REGULARLY FURNISHED:
All Bronze Warm Climate Hydrant with Chrome Plated Face, Hose Connection having Integral ASSE 1011 Vacuum Breaker, 360 Swivel Inlet Connection, "T" Handle Key and Stainless Steel Box.

VARIATIONS:
☐ Cylinder Lock -CL

OPTIONAL MATERIALS:
☐ Polished Bronze Box Face -PB
☐ Nickel Bronze Box Face -NB
☐ Rough Bronze Box Face -RB
☐ Chrome Plated Box Face -CP

REV.	DATE	DESCRIPTION	BY	CKD. BY
D	6-17-16	Added Note	TBW	TWK
C	1-31-13	Revised Notes	TBW	CL
B	1-7-11	Revised Regularly Furnished	RN	CL
A	10-7-09	Revised Notes	RN	CL

WEIGHT POUNDS | VOLUME CUBIC FEET | FIGURE NUMBER **5518**

FIGURE NUMBER **5518** | DRAWN BY: **RN** | CHECKED BY: **CL** | APPROVED BY: **CL** | DATE: **8-11-09** | SCALE: **NONE** | SIZE **A** | DRAWING NUMBER **s5518** | **D**

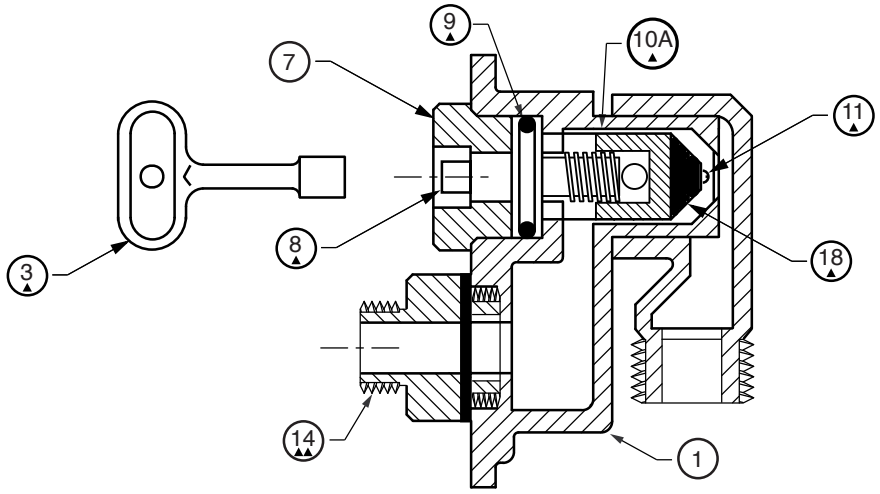
DIMENSIONS ARE SUBJECT TO MANUFACTURERS TOLERANCE AND CHANGE WITHOUT NOTICE
WE CAN ASSUME NO RESPONSIBILITY FOR USE OF SUPERSEDED OR VOID DATA

SMITH® CUSTOMER DRIVEN SINCE 1926
JAY R. SMITH MFG. CO.®
MEMBER OF MORRIS GROUP INTERNATIONAL
POST OFFICE BOX 3237
MONTGOMERY, ALABAMA 36109-0237 (USA)
TEL: 334-277-8520 FAX: 334-272-7396 www.jrsmith.com

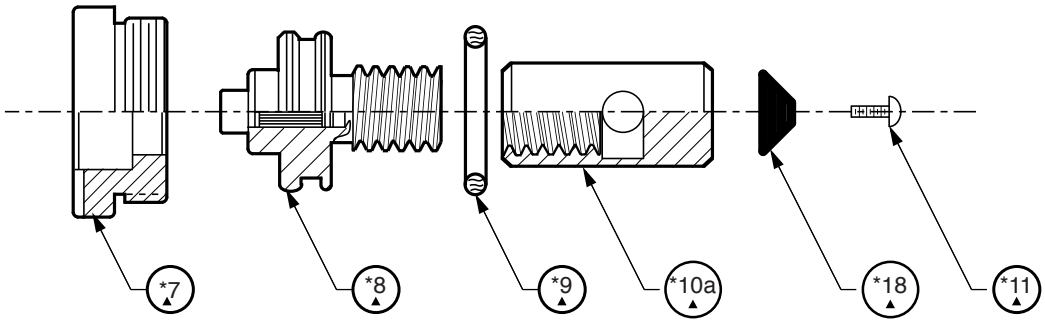
MEMBER OF:

LOCATION

PARTS LIST WITH MAINTENANCE INSTRUCTIONS



▲▲ THESE REPLACEMENT PARTS AVAILABLE IN HPRK-18VB



▲ THESE REPLACEMENT PARTS AVAILABLE IN HPRK-18

MAINTENANCE INSTRUCTIONS:

1. Shut off water supply.
2. Remove face nut.
3. Pull stem out for complete access to all working parts.
4. Check all working parts for replacement.
5. Replace complete stem assembly and face nut.

* These Parts are accessible from face of hydrant by removing face nut.

HYDRANT PARTS LIST			
No.	Description	No.	Description
1	Head/Casing Assembly	10a	Coupling
3	Key	11	Washer Screw
7	Face Nut	14	Vacuum Breaker
8	Operating Screw	18	Plunger Washer
9	Operating Screw “O” Ring		

REV.	DATE	DESCRIPTION	BY	CKD. BY
A	12-3-12	Rev. Replacement Parts	TBW	CL

WEIGHT POUNDS | VOLUME CUBIC FEET | FIGURE NUMBER 5518BS

FIGURE NUMBER 5518BS | DRAWN BY: JJ | CHECKED BY: CL | APPROVED BY: CL | DATE: 08/26/09 | SCALE: NONE | SIZE A | DRAWING NUMBER S5518BS | A

DIMENSIONS ARE SUBJECT TO MANUFACTURERS TOLERANCE AND CHANGE WITHOUT NOTICE

WE CAN ASSUME NO RESPONSIBILITY FOR USE OF SUPERSEDED OR VOID DATA

KS-1 **KS-1 KITCHEN SINK**

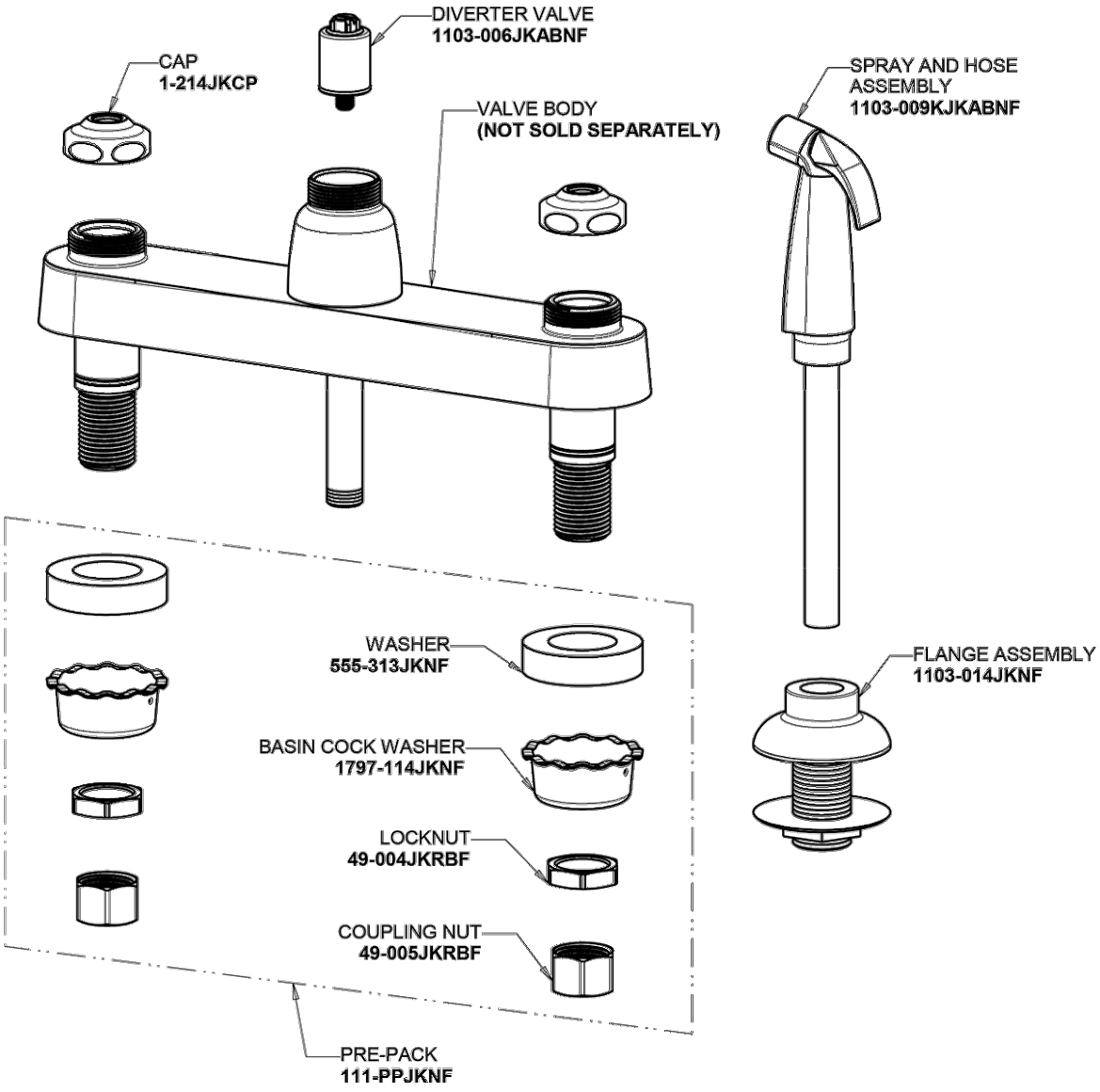
C1102202358AB	CHICAGO	CCN LEAD LAW COMPLIANT 2 HANDLE SINK FAUCET WITH SRPY CHROME 2.2

Repair Parts

1102-ABCP

Hot and Cold Water Sink Faucet with Side Spray

Base Parts:



For Technical Assistance:

Phone: 800-TEC-TRUE (832-8783)

Email: techsupport.us@chicagofaucets.com

2100 South Clearwater Drive
Des Plaines, IL 60018
Phone: 847-803-5000
chicagofaucets.com

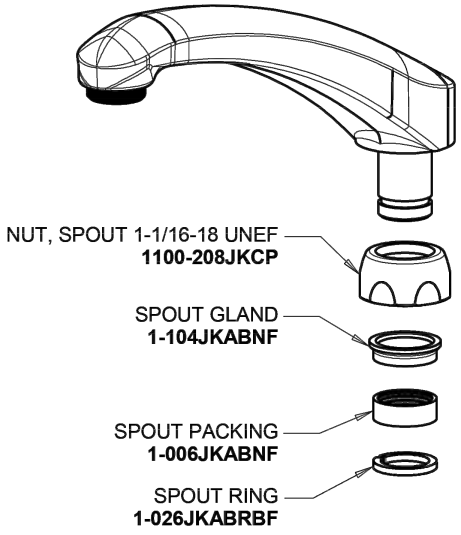
Repair Parts

1102-ABCP

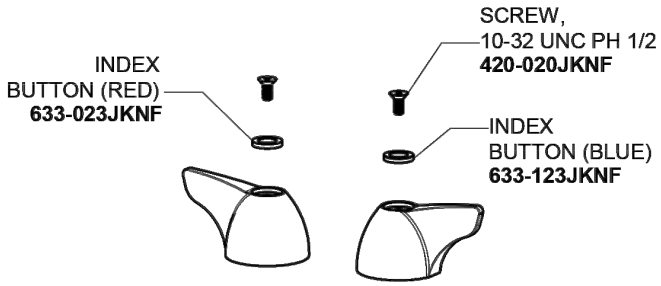
Hot and Cold Water Sink Faucet with Side Spray

CHICAGO FAUCETS
a Geberit company

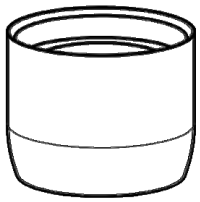
8" L Type Swing Spout
L8LEOJKAB



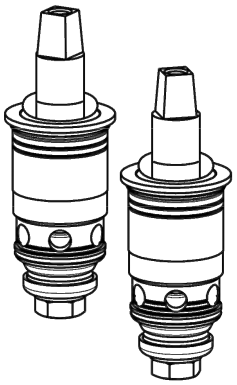
2" Vandal Proof Canopy Single Wing Handle
1000-PRJKCP



2.2 GPM (8.3 L/min) Aerator
E3JKABCP



Quaturn Compression Operating Cartridge (pair)
1-099XTJKABNF (right)
1-100XTJKABNF (left)



For Technical Assistance:

Phone: 800-TEC-TRUE (832-8783)
Email: techsupport.us@chicagofaucets.com

2100 South Clearwater Drive
Des Plaines, IL 60018
Phone: 847-803-5000
chicagofaucets.com

KS-2

C1102GN8AE3317A CHICAGO B

KS-2 KITCHEN SINK PER ADDENDUM #2-1

LF H&C WTR SINK FAUCET 2.2 GPM

Deck Mounted Faucets Installation Instructions

Recommended for base numbers 50, 50T, 51, 51T, 333, 335, 349, 350, 525, 526, 527, 700, 701, 730, 797, 802, 891, 894, 895, 1100, 1102, 1891, 1895 Centerset and Single Basin Fittings, Pop-Up Drain Installation and Rigid/Swing Convertible Spout Installation.

CHICAGO FAUCETS
a Geberit company

1102GN8AE3317AB



Overview

Chicago Faucets deck mounted faucets feature cast brass bodies and precision cartridges for years of reliable operation. Metering models with adjustable cycle time offer true water savings.

Notice to the Installer

- Read this entire instruction sheet before installing to ensure proper installation.
- Installation must comply with local codes and ordinances.

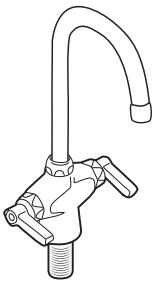
Pressurized plumbing fixtures shall be installed in accordance with manufacturer's recommendations. The supply piping to these devices shall be securely anchored to the building structure to prevent installed device from unnecessary movement when operated by the user. Care shall be exercised when installing the device to prevent marring the exposed surface.

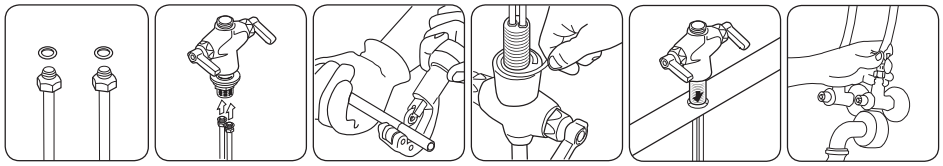
NOTE: The information in this manual is subject to change without notice.

Please leave this manual with the facility manager after completing the faucet installation. This document contains information necessary for routine maintenance and servicing.

NOTE: Before installation, turn off water supplies to existing faucet and remove faucet if replacing. Clean faucet basin and clear away debris. Flush all supply lines before connecting to faucet. Failure to do so can result in debris clogging the inlets and/or cartridges.

Single Hole Mixing Fittings — Base numbers 50, 50T, 51, 51T



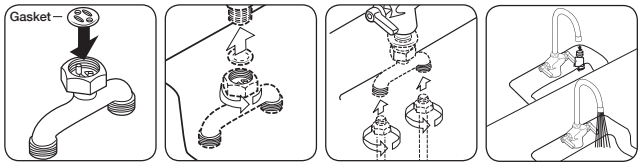


1. Ensure O-Rings are installed on hoses or tubes.
2. Install hoses or tubes.

Copper Tube Installation
2b. Cut tubes to desired length.

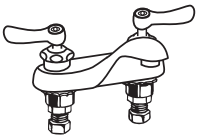
3. Apply putty to underside of faucet body to assure a good seal and level fit.
4. Place shank through hole in sink and assemble mounting hardware.
5. Attach hoses or tubes to supply stops. Make sure gasket is installed.

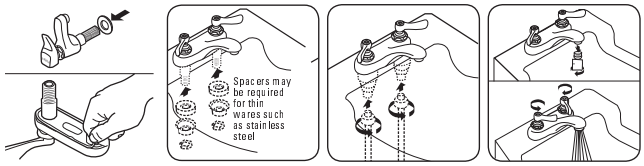
Mixing Tee Installation



1. Install tee gasket over guide pins and secure coupling nut of tee to body shank.
2. Secure coupling nut of tee to body shank. Tighten securely.
3. Attach supply lines with coupling nuts. Tighten securely.
4. Remove outlet and flush lines for about one minute. Replace outlet.

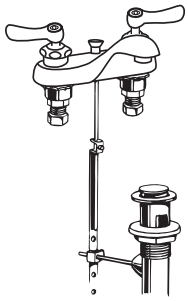
Centerset and Single Basin Fittings — Base numbers 333, 335, 349, 350, 525, 526, 527, 700, 701, 730, 797, 802, 891, 894, 895, 1100, 1102, 1891, 1895

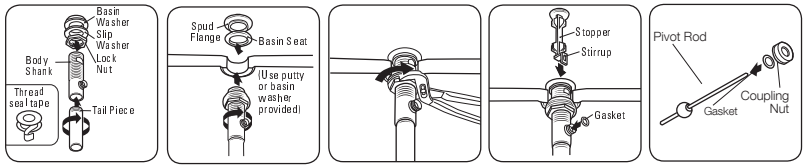




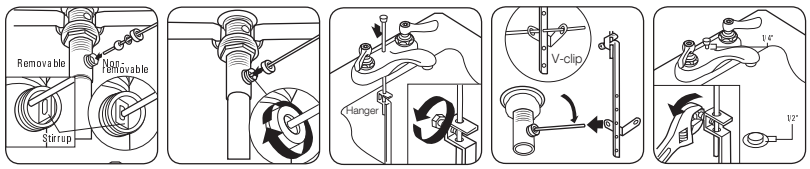
1. Apply putty or rubber washer to underside of faucet body to assure a good seal and level fit.
2. Place shank(s) through holes in sink and assemble mounting hardware. Use spacers if necessary.
3. Attach supply lines with coupling nuts and tighten securely. Attach spout if provided separately.
4. Remove outlet and flush lines for about one minute. Replace outlet.

Pop-Up Drain Installation





1. Assemble tail piece to body shank with thread seal tape. Assemble lock nut, slip washer, and basin washer to body shank.
2. Fully assemble the basin seat and spud flange to body shank assembly.
3. Position body shank toward the lift rod. Tighten lock nut until properly sealed.
4. Place stopper into body shank cavity orienting the stirrup for removable or non-removable stopper as desired. (see #6)
5. Insert pivot ball rod assembly through pivot rod gasket and coupling nut.



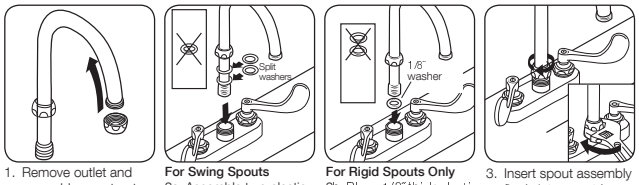
6. Attach pivot rod assembly to body shank.
7. Tighten pivot rod assembly nut as required to seal and provide smooth operation.
8. Insert pop up rod through holes in hanger and hand tighten.
9. Push pivot ball rod to lowest position, squeeze v-clip and slide pivot ball rod through v-clip and appropriate hole in hanger.
10. Test the assembly for proper function and make adjustments as necessary. Once set, tighten securely.

For additional technical assistance, call 800/TEC-TRUE (800-832-8783) or visit our website at chicagofaucets.com.

Deck Mounted Faucets Installation Instructions
(continued)

CHICAGO FAUCETS
a Geberit company

Rigid/Swing Convertible Spout Installation



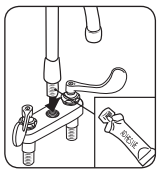
1. Remove outlet and assemble spout nut over outlet end, until it rests on shoulder of spout joint.

For Swing Spouts
2a. Assemble two plastic split washers to spout joint and discard 1/8" thick plastic washer.

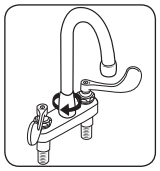
For Rigid Spouts Only
2b. Place 1/8" thick plastic washer into spout base bore and discard plastic split washers.

3. Insert spout assembly firmly into spout base and tighten spout nut.

RGD1 and RGD2 Only Spout Installation



1. Apply supplied adhesive to threads of spout and tighten spout into base. Back off as necessary for centered position.



2. Hand tighten sleeve until flush with body.

Chicago Faucets deck mounted faucets come with cartridges already installed. Instructions for adjusting the timing on metering cartridges are shown below. For complete instructions on servicing and replacing Chicago Faucets cartridges, see our Cartridge Maintenance/Repair Guide, available online at chicagofaucets.com/pdf/CF1081.pdf. You may also order a copy of the Guide by calling 800-832-8783.

Supplemental Bubbler Installation Instructions for 748-665CP, 748-665FHCP, 748-244CP and 748-244FHCP

Installation with Anti-Rotational Pins (Figure A)

1. Choose Two holes in bubbler base that corresponds with the deck/sink drilling and tap each anti-rotational pin with a hammer until seated. There should be approximately 1/8" length of pin exposed when fully seated.
2. Drill 3/16" diameter holes on 1-9/32" centers and 1/4" deep in the deck/sink for anti-rotational pins if mounting holes are not provided.
3. Attach Bubbler to deck using the anti-rotational washer provided.

Flow Adjustments (Figure B)

1. The projection of water flow can be adjusted by using the 1/8" hex wrench provided. Insert hex wrench and rotate control clockwise or counterclockwise until the desired flow is achieved.

Note: Bubblers have been designed to utilize the 722-013K inlet flow control. To insure proper performance, it is imperative that the 722-013K be installed with each bubbler.

Timing Adjustment on an MVP Metering Cartridge

1. With cartridge and handle installed in body and water supply turned on, purge cartridge of air by pushing handle completely down 4-8 times repeatedly, then check timing cycle.
2. To change cycle time, remove index button, then handle using a 3/32" hex wrench. (Figure C)
3. Using your fingers, change height of adjustment nut by 1/4 turn only. Turn adjustment nut clockwise to increase cycle time or counter-clockwise to decrease cycle time. (Figure D)
4. If filter and lower valve cartridge have been removed from fitting, replace them by inserting filter first.
5. If gasket has been removed from the actuator assembly, replace it by inserting into bottom of actuator assembly.
6. Assemble actuator assembly to body and tighten to 12-15 ft-lbs torque.
7. Replace handle and verify desired cycle time. NOTE: TIMING MUST BE CHECKED WITH HANDLE IN PLACE.
8. If additional adjustment is necessary, repeat steps 3 through 7 until desired cycle time is achieved. Note: Some new installations might produce a slight closing noise. This is normally the result of air trapped in the cartridge. The noise will dissipate over time.
9. Attach handle and tighten set screw with a 3/32" hex wrench. If index button is included, snap into handle.

Timing Adjustment on Push-Button (NAIAD) & Tip-Tap Self-Closing Cartridges

1. Turn off water supply.
2. Remove cartridge from valve body with 1-1/4" flat hex wrench. Use care to prevent damage to cap hex nut.
3. Locate timing hex nut on bottom of dashpot. Turn hex nut clockwise to increase cycle time or counter-clockwise to decrease cycle time (Figure E). NOTE: Turn in 90 degree increments for each adjustment cycle. Fill the dashpot with water, slide it over the bottom of the cartridge, and place both back into the faucet body.
4. Place cartridge into faucet body and fully tighten cap nut with wrench to 15-25 ft-lbs torque. Turn on water and verify cycle time by depressing cartridge fully. NOTE: Insure that cap gasket is in place within cap before assembly into valve body.

NOTE: Cartridges with 'SLO' designation include an external timing adjustment via a set screw in the top of the handle. Using a 7/64" hex wrench, turn the set screw clockwise to decrease cycle time or counter-clockwise to increase cycle time. (Figure E)

Timing Adjustment on a Push-Tilt Self-Closing Cartridge

For Push-Tilt cartridges, the timing adjustment procedure is identical to Push-Button Self-Closing Cartridges, except for an external timing adjustment feature that is integral to Push-Tilt handles. This adjustment can be used for minor cycle time changes without the need to remove the cartridge from the body.

For external adjustment, lift handle slightly to expose 1/16" hex socket set screw (Figure F). Turn adjustment set screw clockwise to increase cycle time or counter-clockwise to decrease cycle time. If greater timing adjustment is required, follow the instructions for adjusting the timing on a Push-Button Self-Closing Cartridge.

FIGURE A

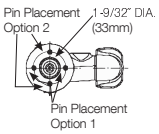


FIGURE B



FIGURE C

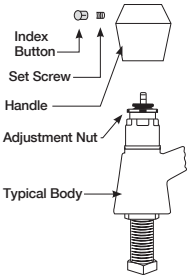


FIGURE D
How To Adjust (Top View)

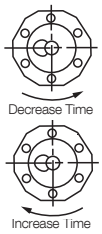


FIGURE E

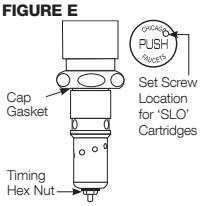
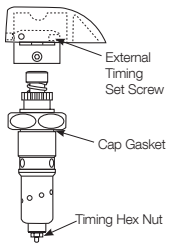


FIGURE F



Care and Maintenance
All Chicago Faucets fittings are designed and engineered to meet or exceed industry performance standards. Care should be taken when cleaning this product. Do not use abrasive cleaners, chemicals or solvents as they can result in surface damage. Use mild soap with warm water for cleaning and protecting the surface of Chicago Faucets fittings.

For additional technical assistance, call 800/TEC-TRUE (800-832-8783) or visit our website at chicagofaucets.com.

CHICAGO FAUCETS LIMITED WARRANTY

TO WHOM DOES THIS WARRANTY APPLY? — The Company extends the following limited warranty to the original user only.

WHAT DOES THIS WARRANTY COVER AND HOW LONG DOES IT LAST?
This warranty covers the following Commercial Products:

LIFETIME FAUCET WARRANTY — The 'Faucet,' defined as any metal cast, forged, stamped or formed portion of the Product, not including electronic or moving parts or other products separately covered by this Limited Warranty or water restricting components or other components, is warranted against material manufacturing defects for the life of the Product.

FIVE YEAR FAUCET WARRANTY — Certain Products and portions of the Product are warranted against material manufacturing defects for a period of five (5) years from the date of Product purchase. Products warranted against material manufacturing defects for a period of five (5) years from the date of Product purchase are referred to by the product numbers 42X, 43X, 15XX and E-Tronic® - 4X, 5X, 6X, 7X, 8X and 9X. All zinc die cast portions of Product are warranted against material manufacturing defects for a period of five (5) years from the date of Product purchase.

THREE YEAR ELECTRONICS WARRANTY — Electronic components, including the solenoid, are warranted for three (3) years from the date of installation.

FIVE YEAR CARTRIDGE WARRANTY — The 'Cartridge', defined as the metal portion of any Product typically referred to by the product numbers containing 1-099, 1-100, 377X, 217X and 274X, excluding any rubber or plastic components, is warranted against material manufacturing defects for a period of five (5) years from the date of Product purchase. All Cartridges included in the Company's Single Control or Shower Products also are warranted against material manufacturing defects for a period of five (5) years from the date of Product purchase.

ONE YEAR FINISH WARRANTY – COMMERCIAL — For Products used in commercial applications, the finish of the Product is warranted against material manufacturing defects for a period of one (1) year from the date of Product purchase.

OTHER WARRANTIES — All other Products not covered above are warranted against material manufacturing defects for a period of one (1) year from the date of Product purchase.

Other restrictions and limitations apply. For complete warranty details, call Chicago Faucets Customer Service at 847-803-5000 or visit chicagofaucets.com.

The Chicago Faucet Company
2100 South Clearwater Drive
Des Plaines, IL 60018
Phone: 847/803-5000
Fax: 847/803-5454
Technical: 800/832-8783
www.chicagofaucets.com

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FERGUSON ENTERPRISES, INC.®

KS-3 KITCHEN SINK

C895317ABCP	CHICAGO	CCN LEAD LAW COMPLIANT 2 HANDLE DECK MOUNT SINK FAUCET CHROME 2.2 GALLONS PER MINUTE

RELEASED DOCUMENT
April 16th 2015
ELECTRONIC FILE
IS MASTER

Deck Mounted Faucets Installation Instructions

Recommended for base numbers 50, 50T, 51, 51T, 333, 335, 349, 350, 525, 526, 527, 700, 701, 730, 797, 802, 891, 894, 895, 1100, 1102, 1891, 1895 Centerset and Single Basin Fittings, Pop-Up Drain Installation and Rigid/Swing Convertible Spout Installation.

CHICAGO FAUCETS
a Geberit company



Overview

Chicago Faucets deck mounted faucets feature cast brass bodies and precision cartridges for years of reliable operation. Metering models with adjustable cycle time offer true water savings.

Notice to the Installer

- Read this entire instruction sheet before installing to ensure proper installation.
- Installation must comply with local codes and ordinances.

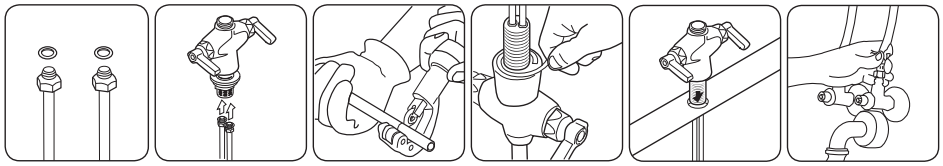
Pressurized plumbing fixtures shall be installed in accordance with manufacturer's recommendations. The supply piping to these devices shall be securely anchored to the building structure to prevent installed device from unnecessary movement when operated by the user. Care shall be exercised when installing the device to prevent marring the exposed surface.

NOTE: The information in this manual is subject to change without notice.

Please leave this manual with the facility manager after completing the faucet installation. This document contains information necessary for routine maintenance and servicing.

NOTE: Before installation, turn off water supplies to existing faucet and remove faucet if replacing. Clean faucet basin and clear away debris. Flush all supply lines before connecting to faucet. Failure to do so can result in debris clogging the inlets and/or cartridges.

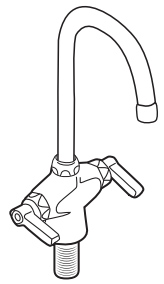
Single Hole Mixing Fittings — Base numbers 50, 50T, 51, 51T



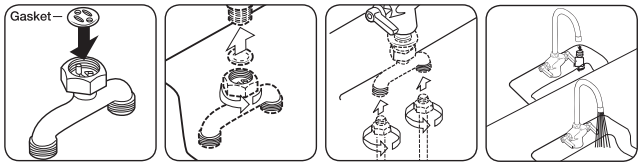
1. Ensure O-Rings are installed on hoses or tubes.
2. Install hoses or tubes.

Copper Tube Installation
2b. Cut tubes to desired length.

3. Apply putty to underside of faucet body to assure a good seal and level fit.
4. Place shank through hole in sink and assemble mounting hardware.
5. Attach hoses or tubes to supply stops. Make sure gasket is installed.

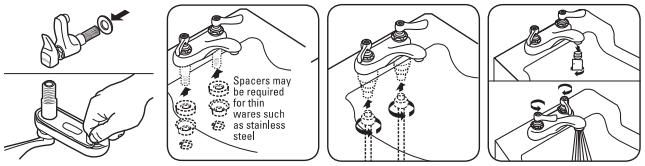


Mixing Tee Installation

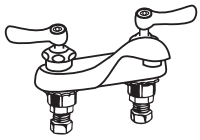


1. Install tee gasket over guide pins and secure coupling nut of tee to body shank.
2. Secure coupling nut of tee to body shank. Tighten securely.
3. Attach supply lines with coupling nuts. Tighten securely.
4. Remove outlet and flush lines for about one minute. Replace outlet.

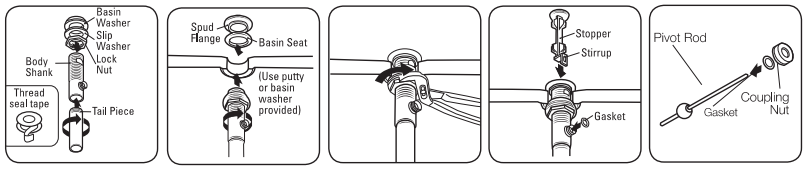
Centerset and Single Basin Fittings — Base numbers 333, 335, 349, 350, 525, 526, 527, 700, 701, 730, 797, 802, 891, 894, 895, 1100, 1102, 1891, 1895



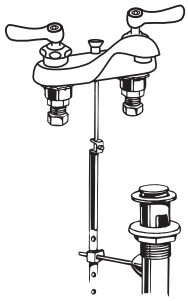
1. Apply putty or rubber washer to underside of faucet body to assure a good seal and level fit.
2. Place shank(s) through holes in sink and assemble mounting hardware. Use spacers if necessary.
3. Attach supply lines with coupling nuts and tighten securely. Attach spout if provided separately.
4. Remove outlet and flush lines for about one minute. Replace outlet.

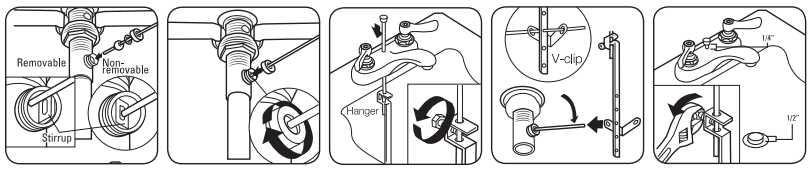


Pop-Up Drain Installation



1. Assemble tail piece to body shank with thread seal tape. Assemble lock nut, slip washer, and basin washer to body shank.
2. Fully assemble the basin seat and spud flange to body shank assembly.
3. Position body shank toward the lift rod. Tighten lock nut until properly sealed.
4. Place stopper into body shank cavity orienting the stirrup for removable or non-removable stopper as desired. (see #6)
5. Insert pivot ball rod assembly through pivot rod gasket and coupling nut.





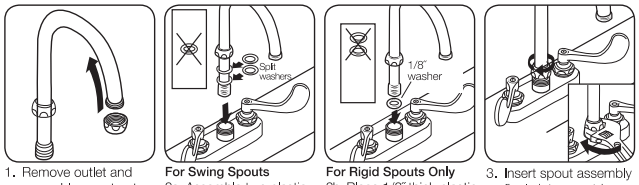
6. Attach pivot rod assembly to body shank.
7. Tighten pivot rod assembly nut as required to seal and provide smooth operation.
8. Insert pop up rod through holes in hanger and hand tighten.
9. Push pivot ball rod to lowest position, squeeze v-clip and slide pivot ball rod through v-clip and appropriate hole in hanger.
10. Test the assembly for proper function and make adjustments as necessary. Once set, tighten securely.

For additional technical assistance, call 800/TEC-TRUE (800-832-8783) or visit our website at chicagofaucets.com.

Deck Mounted Faucets Installation Instructions
(continued)

CHICAGO FAUCETS
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Rigid/Swing Convertible Spout Installation



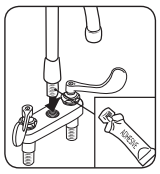
1. Remove outlet and assemble spout nut over outlet end, until it rests on shoulder of spout joint.

For Swing Spouts
2a. Assemble two plastic split washers to spout joint and discard 1/8" thick plastic washer.

For Rigid Spouts Only
2b. Place 1/8" thick plastic washer into spout base bore and discard plastic split washers.

3. Insert spout assembly firmly into spout base and tighten spout nut.

RGD1 and RGD2 Only Spout Installation



1. Apply Permabond HH-040 anaerobic sealant or equivalent NSF 61 approved sealant to threads of spout and tighten spout into base. Back off as necessary for centered position.



2. Hand tighten sleeve until flush with body.

Chicago Faucets deck mounted faucets come with cartridges already installed. Instructions for adjusting the timing on metering cartridges are shown below. For complete instructions on servicing and replacing Chicago Faucets cartridges, see our Cartridge Maintenance/Repair Guide, available online at chicagofaucets.com/pdf/CF1081.pdf. You may also order a copy of the Guide by calling 800-832-8783.

Supplemental Bubbler Installation Instructions for 748-665CP, 748-665FHCP, 748-244CP and 748-244FHCP

Installation with Anti-Rotational Pins (Figure A)

1. Choose Two holes in bubbler base that corresponds with the deck/sink drilling and tap each anti-rotational pin with a hammer until seated. There should be approximately 1/8" length of pin exposed when fully seated.
2. Drill 3/16" diameter holes on 1-9/32" centers and 1/4" deep in the deck/sink for anti-rotational pins if mounting holes are not provided.
3. Attach Bubbler to deck using the anti-rotational washer provided.

Flow Adjustments (Figure B)

1. The projection of water flow can be adjusted by using the 1/8" hex wrench provided. Insert hex wrench and rotate control clockwise or counterclockwise until the desired flow is achieved.

Note: Bubblers have been designed to utilize the 722-013K inlet flow control. To insure proper performance, it is imperative that the 722-013K be installed with each bubbler.

Timing Adjustment on an MVP Metering Cartridge

1. With cartridge and handle installed in body and water supply turned on, purge cartridge of air by pushing handle completely down 4-8 times repeatedly, then check timing cycle.
2. To change cycle time, remove index button, then handle using a 3/32" hex wrench. (Figure C)
3. Using your fingers, change height of adjustment nut by 1/4 turn only. Turn adjustment nut clockwise to increase cycle time or counter-clockwise to decrease cycle time. (Figure D)
4. If filter and lower valve cartridge have been removed from fitting, replace them by inserting filter first.
5. If gasket has been removed from the actuator assembly, replace it by inserting into bottom of actuator assembly.
6. Assemble actuator assembly to body and tighten to 12-15 ft-lbs torque.
7. Replace handle and verify desired cycle time. NOTE: TIMING MUST BE CHECKED WITH HANDLE IN PLACE.
8. If additional adjustment is necessary, repeat steps 3 through 7 until desired cycle time is achieved. Note: Some new installations might produce a slight closing noise. This is normally the result of air trapped in the cartridge. The noise will dissipate over time.
9. Attach handle and tighten set screw with a 3/32" hex wrench. If index button is included, snap into handle.

Timing Adjustment on Push-Button (NAIAD) & Tip-Tap Self-Closing Cartridges

1. Turn off water supply.
2. Remove cartridge from valve body with 1-1/4" flat hex wrench. Use care to prevent damage to cap hex nut.
3. Locate timing hex nut on bottom of dashpot. Turn hex nut clockwise to increase cycle time or counter-clockwise to decrease cycle time (Figure E). NOTE: Turn in 90 degree increments for each adjustment cycle. Fill the dashpot with water, slide it over the bottom of the cartridge, and place both back into the faucet body.
4. Place cartridge into faucet body and fully tighten cap nut with wrench to 15-25 ft-lbs torque. Turn on water and verify cycle time by depressing cartridge fully. NOTE: Insure that cap gasket is in place within cap before assembly into valve body.

NOTE: Cartridges with 'SLO' designation include an external timing adjustment via a set screw in the top of the handle. Using a 7/64" hex wrench, turn the set screw clockwise to decrease cycle time or counter-clockwise to increase cycle time. (Figure E)

Timing Adjustment on a Push-Tilt Self-Closing Cartridge

For Push-Tilt cartridges, the timing adjustment procedure is identical to Push-Button Self-Closing Cartridges, except for an external timing adjustment feature that is integral to Push-Tilt handles. This adjustment can be used for minor cycle time changes without the need to remove the cartridge from the body.

For external adjustment, lift handle slightly to expose 1/16" hex socket set screw (Figure F). Turn adjustment set screw clockwise to increase cycle time or counter-clockwise to decrease cycle time. If greater timing adjustment is required, follow the instructions for adjusting the timing on a Push-Button Self-Closing Cartridge.

FIGURE A

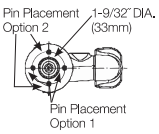


FIGURE B



FIGURE C

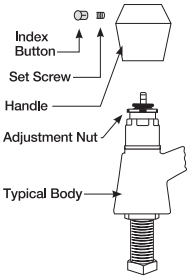


FIGURE D
How To Adjust (Top View)

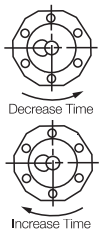


FIGURE E

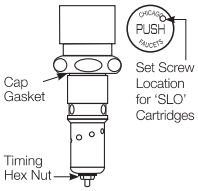
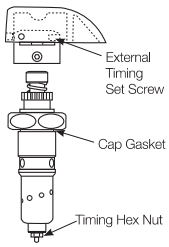


FIGURE F



Care and Maintenance
All Chicago Faucets fittings are designed and engineered to meet or exceed industry performance standards. Care should be taken when cleaning this product. Do not use abrasive cleaners, chemicals or solvents as they can result in surface damage. Use mild soap with warm water for cleaning and protecting the surface of Chicago Faucets fittings.

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GUARANTEE ELECTRICAL CONTRACTORS
JOB: WEBSTER ISB
PO# 505555-11317 PC 13

TYPE	QTY ORDERED	MANUFACTURER	CATALOG NUMBER
BB2	3	TECH	700BCALDY-S-LED830-277
BC15	1	LUMENWERX	LWERX-VIA4WDI-HLO-LED-80-750-750- 30-15'-UNV-D-1-DMB-W-(REMOTE DRIVERS)-WHITE
CA	8	LUMENWERX	LWERX-VIA1.5S-HLO-LED-80-400- 30-4FT-277-D (1%)-1-DRC- W-WHITE
CB	4	METALUX	4VT2-LD4-4-DR-W-UNV-L835-CD1- WL-TH-U
EA	1	IO LTG	06.SSS.2.PMC.NR.ASYM.3K.66.50'
EE	30	LUMENPULSE	LOID-24V-24-30K-DIM-ASL LOIDC00009085
EE	30	LUMENPULSE	PACBOX-210/277-DIRCT WHITE-NO/DIM-24
EE	30	LUMENPULSE	ROB-LOI-24
EE	1	LUMENPULSE	LOILC-UL-10 LEADER CABLE
EE	1	LUMENPULSE	LOI-JB-UL JBOX
EE	27	LUMENPULSE	LOIJC-UL-8FT-SPL009335A 8' JUMPER CABLE
EE	2	LUMENPULSE	LOIJC-UL-12FT-SOL009335B 12' JUMPER CABLE
EG3	4	STERNBERG	STE-1A-1970LED-F-GTSR-SV1- 4ARC35K-T3-F/EZ/62PM-MOD/ 550P-12/CM/DRYLAC 49/66220
EG3	4	STERNBERG	BOLT-ANCHOR SET OF 4
EG5	7	STERNBERG	1A-1970LED-F-GTSR-SV1-4ARC35K-T5-F/EZ/62PM- MOD/550P-12/CM/DRYLAC 49/66220
EG5	7	STERNBERG	BOLT-ANCHOR SET OF 4
EG5R	3	STERNBERG	1A-1970LED-F-GTSR-SV1-4ARC35K-T5-F-/EZ/62PM- MOD/550P-12/1-GFI/LPIUC/CM DRYLAC 49/66220
EG5R	3	STERNBERG	BOLT-ANCHOR SET OF 4
L41	1	STERNBERG	550P5-12-BCC/MOD PLAT/CM
A	1	POULSEN	NYPA/1/50MH/ED-17 MEDIUM/120/208/240/277V/SRA TIGER DRYLAC 29/65650 FINISH PER DWG #131-14870-001
A	1	POULSEN	POSTTOP, SRA-NYPA, 1-90, STD, TIGER DRYLAC 29/65650 FINISH PER DWG # 131-14870-001
A	1	POULSEN	CAP, POLE 4IN O.D. TIGER DRYLAC 29/65650 FINISH PER DWG #131-14870-001
PA4	100	LUMENWERX	LWERX-MP1279VIA4PDI-HLO-LGO-LED- 80-750-500-30-4FT-277-D-1-53WAC36-W -TG9-WHITE
PA6	2	LUMENWERX	LWERX-MP1279VIA4PDI-HLO-LGO-LED-80- 750-500-30-6'-277-D-1-53WAC36-W- TG9-WHITE
PA8	7	LUMENWERX	LWERX-MP1279VIA4PDI-HLO-LGO-LED-80 750-500-30-8'-277-D-1-53WAC36-W-TG9 -WHITE
PA12	3	LUMENWERX	LWERX-MP1279VIA4PDIWS-HLO-LGO-LED- 80-750-500-30-12'-277-D-1-53WAC36-W -TG9-WHITE
PA16-2	1	LUMENWERX	LWERX-MP1279VIA4PDI-HLO-LGO-LED- 80-750-500-30-16'-277-D-2-53WAC36-W -TG9/16-WHITE
PA-16-1	1	LUMENWERX	LWERX-MP1279VIA4PDI-HLO-LGO-LED-80- 750-500-30-16'-277-D-1-53WAC36-W-TG 9-WHITE

VILLA LIGHTING SUPPLY
2929 Chouteau Ave.
St. Louis, MO 63103
Tel: (314) 531-2600
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Toll Free: 1-800-325-0963

GUARANTEE ELECTRICAL CONTRACTORS
JOB: WEBSTER ISB
PO# 505555-11317 PC 13

TYPE	QTY ORDERED	MANUFACTURER	CATALOG NUMBER
PA22	10	LUMENWERX	LWERX-MP1279VIA4PDI-HLO-LGO-LED- 80-750-500-30-22'-277-D-2-53WAC36-W -TG9-WHITE (10FT SEC/12FT SEC SEPERATE CIRCUIT)
PA24	39	LUMENWERX	LWERX-MP1279VIA4PDI-HLO-LGO-LED- 80-750-500-30-24'-277-D-2-53WAC36-W -TG9-WHITE (2-12FT SECTIONS SEPERATE CIRCUIT)
PB26-6	6	FINELITE	FN-HP4D-26'-6"-H-3000K-F-277-FM- SC-C4-1%-DIM-WHITE
PC	109	METALUX	MX-4SNLED-LD4-60SL-UNV-L835-CD1-U 12538813 FOR 4SNLED-LD4-50SL-LW-UNV-L835-CD1-U TYPE PC .
PC	109	METALUX	MX-SNLED-LENS-LW-4FT-U 12351408 LENS ONLY COOPER TYPE PC .
PC	109	METALUX	AYC-CHAIN/SET-U
PD8	4	LUMENWERX	LWERX-MP1331VIA4PDIWS-HLO-LGO-LED- 80-750-1000-30-8'-277-D-1-5WAC36/CU W-WHITE
RA2	13	FINELITE	FN-HP-4R-2'-H-3000K-F-277V-SC-C3F- DIM
RA3	8	FINELITE	FN-HP-4R-3'-H-3000K-F-277V-SC- C3F-DIM
RA4	75	FINELITE	FN-HP-4R-4'-H-3000K-F-277-SC- C3F-DIM
RA6	60	FINELITE	FN-HP-4R-6'-H-3000K-F-277-SC- C3F-DIM
RA8	19	FINELITE	FN-HP-4R-8'-H-3000K-F-277V-SC- C3F-DIM
RA10	1	FINELITE	FN-HP-4R-10'-H-3000K-F-277V-SC- C3F-DIM
RA12	2	FINELITE	FN-HP-4R-12'-H-3000K-F-277V-SC- C3F-DIM
RA16	1	FINELITE	FN-HP-4R-16'-H-3000K-F-277V-SC- C3F-DIM
RA18	1	FINELITE	FN-HP-4R-18'-H-3000K-F-277V-2C- C3F-DIM 12FT ON 1-CIRCUIT/6FT ON SEP CIRCUIT NEED 6FT ON ONE FEED/CIRC AND THE OTHER 12FT ON ANOTHER
RA24	9	FINELITE	FN-HP-4R-68'-H-3000K-F-277V-2C- C2T-DIM ONE LEG OF FOUR ON SEP CIRCUIT ONE 10FT LEG ON A SEPERATE FEED/CIR
RA-24X10	1	FINELITE	FN-HP-4R-68'-H-3000K-F-277V-2C- C2T-DIM ONE LEG OF FOUR ON SEP CIRCUIT ONE 10FT LEG ON A SEPERATE FEED/CIR FINELITE TYPE RA-24X9 . *** Non-Stock ***
RB-6X7	1	FINELITE	FN-HP-4R-13'-H-3000K-F-277V- SC-SF-DIM 6FT X 7FT L C/O: 1 TYPE RB6C 1 TYPE RB7C 1-90 DEGREE CORNER DRYWALL CEILING FINELITES TYPE RB-6X7 . *** Non-Stock ***
RA-24X6	1	FINELITE	FN-HP-4R-62'8"-H-3000K-F-277V- SC-C3F-DIM 24FT 8IN X 6FT 8IN RECTANGLE C/O: 2 TYPE RA24-8C 2-TYPE RA6-8C 4-90 DEGREE CORNERS FINELITE TYPE RA-24X6 . *** Non-Stock ***
RB-9-4X6	1	FINELITE	FN-HP-4R-15'8"-H-3000K-F-277V- SC-SF-DIM 9FT 4IN X 6FT 4IN L C/O: 1 TYPE RB9-4C 1 TYPE RB6-4C 1 90 DREGREE CORNER DRYWALL CEILING EACH LEG ON SEPERATE FEED
RA-12X6	1	FINELITE	FN-HP-4R-18'4"-H-3000K-F-277V-MC- C3F-DIM 12FT 4IN X 6FT L C/O: 1-TYPE RA12-4C 1-TYPE RA6C 1-90 DEGREE CORNER 6FT LEG ON SEPERATE CKT
RB4	9	FINELITE	FN-HP-4R-4'-H-3000K-F-277V-SC-SF- DIM
RB6	8	FINELITE	FN-HP-4R-6'-H-3000K-F-277-SC- SF-DIM
RB8	4	FINELITE	FN-HP-4R-8'-H-3000K-F-277-SC- SF-DIM
RB10	8	FINELITE	FN-HP-4R-10'-H-3000K-F-277V-SC- SF-DIM
RB17	1	FINELITE	FN-HP-4R-17'-H-3000K-F-277V- SC-SF-DIM
RC4-7	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-4'7"-277-D-1-DTL-W

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RC5	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-5'-277-D-1-DTL-W
RC5-6	4	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-5'6"-277-D-1-DTL-W
RC6	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-6'-277-D-1-DTL-W
RC7	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-7'-277-D-1-DTL-W
RC8	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-8'-277-D-1-DTL-W
RC9	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-9'-277-D-1-DTL-W
RC9-.1%	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-9-277-D (0.1% ELDOLEDSOLO)- 1-DTL-W
RC10	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-10'277-D-1-DTL-W
RC10-6	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-10'6"-277-D-1-DTL-W
RC12	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-12'-277-D-1-DTL-W
RC12-6	2	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-12'6"-277-D-1-DTL-W
RC15-6-.1%	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-15'6"-277-D(0.1% ELDOLEDSOLO)- 1-DTL-W
RC18-6	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-18'6"-277-D-1-DTL-W
RC34-3	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-34'3"-277-D-1-DTL-W
RC34-6	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-34'6"-277-D-1-DTL-W
RC43-6	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-43'6"-277-D-1-DTL-W
RC45-8	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-45'8"-277-D-1-DTL-W
RCG6	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-6-277-D-1-ST-W
RCG9-9	2	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-9'9"-277-D-1-ST-W
RCG10	10	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-10'-277-D-1-ST-W
RCG10-6	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-10'6"-277-D-1-ST-W
RCG12	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-12'-277-D-1-ST-W
RCG12-6	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500-30-12FT 6IN-277-D-1-ST-W
RCG15	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-15'-277-D-1-ST-W
RCG16	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500-16FT-27 7-D-1-ST-W
RCG20-6	3	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-20'6"-277-D-1-ST-W
RCG31	1	LUMENWERX	LWERX-V3SKID-GRO-LED-80-500- 30-31'-277-D-1-ST-W
RD	41	PORTFOLIO	LD4B15D010 HOUSING 1500LM

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RD	41	PORTFOLIO	EU4B10208030 LED MODULE
RD	41	PORTFOLIO	4LBM1H TRIM MED
RE	29	USAI	3131-B1-S-10-AL20F- LSTA4-8416-C330KH-25-NC-277-DIML2
RE	29	USAI	USAI-LSTA4-8416-C3-30KH-25-NC-277V-DIML6 HOUSING
RE	29	USAI	USAI-AL20F SIZE F ACCESSORY LENS USAI LIGHTING TYPE RE LENS HOLD
RED	16	USAI	1011-B1-10-LSLD4-9020- M2-30KS-50-NCSM1-277-DIML6A
RED	16	USAI	USAI-LSLD4-9020-M2-30KS-50-NCSM1-277V-DIML6A
RF	30	ELLIPTIPAR	S-222-M007-L(9/16" TEGULAR TILE)-02-M-0-30-ZX
RG	36	KENALL	CSEDI-22-67L35K-DCC-DV-5F- 2H CHANGE TO FIT 9/16 TEG TILE .
RG	72	KENALL	EQ-CLIPS
RH	182	PORTFOLIO	LD4B1020D010 HOUSING
RH	182	PORTFOLIO	EU4B10208030 LED MODULE
RH	182	PORTFOLIO	4LBW1H TRIM WIDE
RHB	10	PORTFOLIO	LD4B20D010 HOUSING NEED TO ACCEPT 2.75" DEEP CEILING .
RHB	10	PORTFOLIO	EU4B10208030 POWER MODULE LED DOWNLIGHT 4" TYPE RHB .
RHB	10	PORTFOLIO	4LBW1H TRIM LED 4" WIDE SF H TYPE RHB .
RJ4	5	CON-TECH	RDA4L230K27D2FX4WHT-P2CW COMPATABLE WITH 1% DIMMING (4) HEAD UNIT ON (2) SEPERATE CIRCUIT, 1% 0-10V DIMMING
RK2	19	METALUX	22GRRA-LD4-32-F1-UNV-L835-HCD1- PAF-U
RK2	76	METALUX	EQ-CLIP-U
RL	8	PORTFOLIO	LDA4A13835D010TE
RL	8	PORTFOLIO	LAR35FL
RL	8	PORTFOLIO	4LA1WWF
RM2 9/16 STD	5	LUMENWERX	LWERX-NOVRS-22-PMO-HLO-LED- 80-3200-30-277-D-1-TB9-W
RM2 9/16 STD	10	LUMENWERX	LWERX-EQ-CLIPS
RM2 9/16 TEG	51	LUMENWERX	LWERX-NOVRS-22-PMO-HLO-LED-80- 3200-30-277-D-1-TG9-W
RM2 9/16 TEG	102	LUMENWERX	LWERX-EQ-CLIPS
RM4	12	LUMENWERX	LWERX-NOVRS-24-PMO-HLO-LED- 80-4000-30-277-D-1-TG9-W
RM4	48	LUMENWERX	LWERX-EQ-CLIPS

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RN	8	FINELITE	FN-HP-4R-4FT-S-3000K-F-277V- SC-VF-WOOD-DIM
RP16	1	FOCAL POINT	FSM4L-SR-875LF-30K-1C-277-LD1-T2-WH-16
RP20	1	FOCAL POINT	FSM4L-SR-875LF-30K-1C-277-LD1-T2-WH-20'
RP24	1	FOCAL POINT	FSM4L-SR-875LF-30K-1C-277-LD1-T2-WH-24'
RP28	1	FOCAL POINT	FSM4L-SR-875LF-30K-1C-277-LD1-T2-WH-28'
RR4X4	1	FINELITE	FN-HP-4R-16'-S-3000K-F-277V- SC-DIM (4X4) -SF DRYWALL CEILING
RR4X6 9/16 TEG	8	FINELITE	FN-HP-4R-20'-S-3000K-F-277V- SC-DIM (4X6)-C2T
RR6X8 DRYWALL	1	FINELITE	FN-HP-4R-28'-S-3000K-F-277V- SC-DIM(6X8)-SF DRYWALL CEILING
RS8	2	FINELITE	FN-HP-4R-8'-H-3000K-F-277V- SC-C3F-DIM-ELDOLED
UA2	20	KENALL	AUCLED-I-MW-11L30K-24"-277V- MS-SW
UA4	55	KENALL	AUCLED-I-MW-20L30K-48" 277V-MS-SW
UB4	36	FINELITE	UC-E-45"-FINISH-PS-60W MAGNETIC MOUNTING INCLUDED
UB4	12	FINELITE	PS-60W WITH L5-15P PLUG
UB4	24	FINELITE	CP-28
WA	2	FINELITE	FN-HP-4R-4'-SO-3000K-277V-SC-SF VERITCAL IN WALL-SECURE LENS
XA	13	SURE-LITES	LPX6
XA	1	SURE-LITES	LPX18PKWH
XB	14	SURE-LITES	EUXRL
XB	14	SURE-LITES	EUX6RH
XC	25	SURE-LITES	EUXRL
XC	25	SURE-LITES	EUX6RH
YA	1	ISOLITE	ELT-FT-AC-G-1C-WH-SW-NA- CW (IN USE)
EB-88'	1	LED LINEAR	VARIOLED HYDRA LD10 W825 IP67 IN 003 W/ 60° LENS AND 45° CLIPS
			1 RUN AT 88'- ACTUAL LENGTH=
			THE 85' RUN WILL BE MADE OF 17 X 4.98' (60") & 1 X 3.34 (40") SEGMENTS
			VARIOLED HYDRA LD10 W825/1519MM IP67 IN 003 W/ 60° CLEAR LENS
			VARIOLED HYDRA LD10 W825/1019MM IP67 IN 003 W/ 60° CLEAR LENS
			CONNECT MAXIMUM 3 X PIECES IN SERIES

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			VARIOCON FEMALE MONO 2 X 0.34 MM2 5 M IP67
			VARIOCON PROTECT SNAP
			VARIOCLIPS 003/006 45 DEG.
			HLG-80H-24A
			80W 24V LED DRIVER 90-305VAC (ON/OFF)
			LINEAR DRIVE DC 211D-LG
			LOGARITHMIC 0-10V MODULE 8 AMPS MAX - FOR STATIC WHITE/COLOUR
			RUN LENGTH BASED OFF DRAWING- MUST BE FIELD VERIFIED BEFORE ORDERING
EB-120'	1	LED LINEAR	VARIOLED HYDRA LD10 W825 IP67 IN 003 W/ 60° LENS AND 45° CLIPS
			1 RUN AT 120'- ACTUAL LENGTH= 120.03' (1440.4 INCHES)
			120 FEET C/O (23)@4.98' (60") + (1)@2.11'(25.4") + (1)@3.3' (35")
			VARIOLED HYDRA LD10 W825/1519MM IP67 IN 003 W/ 60° CLEAR LENS
			VARIOLED HYDRA LD10 W825/644MM IP67 IN 003 W/ 60° CLEAR LENS
			VARIOLED HYDRA LD10 W825/894MM IP67 IN 003 W/ 60° CLEAR LENS
			CONNECT MAXIMUM 3 X 4.98' PIECES IN SERIES
			VARIOCON FEMALE MONO 2 X 0.34 MM2 5 M IP67
			VARIOCON PROTECT SNAP
			VARIOCLIPS 003/006 45 DEG.
			HLG-80H-24A
			80W 24V LED DRIVER 90-305VAC (ON/OFF)
			LINEAR DRIVE DC 211D-LG
			LOGARITHMIC 0-10V MODULE 8 AMPS MAX - FOR STATIC WHITE/COLOUR
			RUN LENGTH BASED OFF DRAWING- MUST BE FIELD VERIFIED BEFORE ORDERING
EC-ALT (ASI 039)	8	VISTA	VA-1043-B-MF-30-C-MV-010-FC LED FLOOD FULL SHIELD INSTALLED
EC-ALT (ASI 039)	8	VISTA	VA-HL-1034 HONEYCOMB LOUVER
EC-ALT (ASI 039)	8	VISTA	VA-MP-150 MOUNTING STAKE
ED	1	LED LINEAR	LEDLIN-VARIO.LED.HYRA.LD5.W825 IP67 IN 003 W 90D DIFFUSE LENS 6 METER OPEN END LEAD ON FIRST FIXTURE IN EACH RUN (3)20'RUNS(19.63FT)=(4) 1519MM FIXTURE PER RUN TYPE ED-20' .
			VERIFY COLOR TEMP BEFORE ORDERING

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			1 RUN AT 25'4"- ACTUAL LENGTH= 24.91'
			THE 25'-4" RUN WILL BE MADE OF 5 X 4.98'RUNS
			VARIOLED HYDRA LD5 W830/1519MM IP67 IN 003 W/ 90° CLEAR LENS
			VARIOCON FEMALE MONO 2 X 0.34 MM2 5 M IP67
			VARIOCON PROTECT SNAP
			VARIOCLIPS 003/006 45 DEG.
			HLG-80H-24A
			80W 24V LED DRIVER 90-305VAC (ON/OFF)
			LINEAR DRIVE DC 211D-LG
			LOGARITHMIC 0-10V MODULE 8 AMPS MAX - FOR STATIC WHITE/COLOUR
			RUN LENGTH BASED OFF DRAWING- MUST BE FIELD VERIFIED BEFORE ORDERING
ED	1	LED LINEAR	LEDLIN-VARIO.LED.HYDRA.LD5.W825 IP67 IN OO3 W 90D DIFFUSE LENS (1) RUN (13.72'FT)/164.6") = (2)1519MM & (1)1144MM *** Non-Stock ***
ED	75	LED LINEAR	LEDLIN-13000006-45 45D MOUNTING CLIPS *** Non-Stock ***
ED	2	LED LINEAR	LEDLIN-HLG-80H-24A LED DRIVER *** Non-Stock ***
ED	1	LED LINEAR	LEDLIN-HLG-40H-24A LED DRIVER *** Non-Stock ***
ED	2	LED LINEAR	LEDLIN-DC211D-LG LINEAR DRIVE LED LIGHTING *** Non-Stock ***
EH	21	PERF IN LIGHT	074684-3000K-IR-17258
EH	1	PERF IN LIGHT	074684-3000K-BK-17258
EH	23	PERF IN LIGHT	ROUGH-IN-ALU-TECH-RO-310409 BACK BOX ONLY
			For full range dimming each driver paired with (1) eldoLED LD DC 211D-LG
			If MeanWell 24"B" drivers with basic 0-10V dimming range allowed- deduct
			ALL LED LINEAR IS TO BE FIELD VERIFIED BEFORE ORDERING
EL	5	BEGA	99856-BLK LED MODULE
EL	5	BEGA	99626-BLK BOLLARD TUBE
EL	5	BEGA	79818 A/B & TEMPLATE
RQ	2	LINEAR LIGHTING	WW4-D-1-ET5-277-NS-R-BW-EM-4'
EF36	9	CREE	PWY-EDG-3M-P3-02-E-UL-BZ-525-40K
EF36	9	CREE	CS047S01

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EF36	27	CREE	CZ076X01RD
EF42	3	CREE	PWY-EDG-3M-P4-02-E-UL-BZ-525-40K
EF42	3	CREE	CREE-CS047S01 TMPLT BXBP PATHWAY TYPE EF 36/42 TEMPLATE .
EF42	9	CREE	CREE-CZ076X01RD ANCH BLT 3/8-16X6+1.25GA TYPE EF36/42 ANCHOR BOLTS .
EK (ASI 039)	3	VISA	VISA-OW2480-L30K-H-MVOLT-GLIM MULLION MOUNT W/ REMOTE POWER SUPPLY
SA	12	LED LINEAR	LEDLIN-XOOLINE-HYD-LD25-830/1880 -DL-C002-IP40 (6.16') LED-LINEAR IN ALUM. PROFILE *** Non-Stock ***
SA	2	LED LINEAR	LEDLIN-CUSTOM-XOOLINE-HYD-LD25- 830/1380-DL-C002-IP40 (4.52') LED-LINEAR IN ALUM. PROFILE *** Non-Stock ***
SA	10	LED LINEAR	LEDLIN-XOOLINE-HYD-LD25-830/0380 -DL-C002-IP40 (1.24')LED-LINEAR IN ALUM. PROFILE *** Non-Stock ***
SA	16	LED LINEAR	LEDLIN-XOOLINE-HYD-LD25-830/1255 -DL-C002-IP40 (4.11')LED-LINEAR IN ALUM. PROFLIE *** Non-Stock ***
SA	68	LED LINEAR	LEDLIN-CUSTOM-XOOLINE-HYD-L25- 830/0880-DL-C002-IP40 (2.88')LED-LINEAR IN ALUMN. PROFILE *** Non-Stock ***
SA	7	LED LINEAR	LEDLIN-XOOLINE-HYD-LD25-830/0630 -DL-C002-IP40 (2.06')LED-LINEAR IN ALUMN. PROFILE *** Non-Stock ***
SA	50	LED LINEAR	LEDLIN-15000142-F-FEED-2METER *** Non-Stock ***
SA	50	LED LINEAR	LEDLIN-15000218 VARIOCON FEMALE MINI PROTECTION CAP MONO IP67 *** Non-Stock ***
SA	1	LED LINEAR	HLG-40-H-24A
SA	14	LED LINEAR	HLG-60-H-24A
SA	32	LED LINEAR	HLG-80H-24A
SA	2	LED LINEAR	HLG-100H-24A
SA	49	LED LINEAR	LINEAR DRIVER CD-211D-LG
SA	115	LED LINEAR	LEDLIN-ADJUSTABLE.MOUNT.BRACKET 002/004(SET OF 2)
SA	15	LED LINEAR	LEDLIN-VARIOCON.EXTENSION.MINI 2X.034MM2 0.1M IP67 *** Non-Stock ***
EB-17	2	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1269MM-IP67-IN-003 W/60DEG DIFFUSE LENS, 500MM BLACK OPEN ON ONE END AND FEMAIL BLACK CONNECT TYPE EB-17 . *** Non-Stock ***
EB-17	2	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1268MM-IP67-IN-003-W/60DEG DIFFUSE LENS, MALE BLACK CONNECT ONLY TYPE EB-17 .
EB-17	16	LED LINEAR	LEDLIN-13000006-45 45D MOUNTING CLIPS TYPE EB-17 .
EB-17	1	LED LINEAR	SSLTG-HLG-60-H-24A 60W 24V LED DRIVER 90-305(ON/OFF) TYPE EB-17 ,
EB-17	1	LED LINEAR	LEDLIN-DC211D-LG LINEAR DRIVE LED LIGHTING TYPE EB-17 .
EB-19-5	1	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1894MM-IP67-IN-003 W/60 DEG DIFFUSE LENS, 500MM BLACK OPEN ON ONE END AND FEMALE BLACK CONNECT TYPE EB-19-5 .
EB-19-5	1	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1894MM-IP67-IN-003 W/60DEG DIFFUSE LENS, MALE BLACK CONNECT ONLY TYPE EB-19-5 .
EB-19-5	1	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1894MM-IP67-IN-003 W/60DEG DIFFUSE LENS, 500MM BLACK OPEN ON ONE END ONLY TYPE EB-19-5 .

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GUARANTEE ELECTRICAL CONTRACTORS
JOB: WEBSTER ISB
PO# 505555-11317 PC 13

TYPE	QTY ORDERED	MANUFACTURER	CATALOG NUMBER
EB-19-5	1	LED LINEAR	LEDLIN-13000006-45 45D MOUNTING CLIPS TYPE EB-19-5 .
EB-19-5	1	LED LINEAR	SSLTG-HLG-80-H-24A 80W 24V LED DRIVER 90-305(ON/OFF) TYPE EB-19-5 .
EB-19-5	1	LED LINEAR	LEDLIN-LINEAR.DRIVE.DC.211D-LG LN211D1-LG TYPE EB-19-5 .
EB-15-9	3	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1519MM-IP67-IN-003 W/60DEG DIFFUSE LENS, 500MM BLACK OPEN ON ONE END AND FEMALE BLACK CONNECT TYPE EB-15-9 .
EB-15-9	3	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1644MM-IP67-IN-003 W/60DEG DIFFUSE LENS TYPE EB-15-9 .
EB-15-9	3	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1519MM-IP67-IN-003 W/60 DEG DIFFUSE LENS, MALE BLACK CONNECT ONLY TYPE EB-15-9 .
EB-15-9	45	LED LINEAR	LEDLIN-13000006-45 45D MOUNTING CLIPS TYPE EB-15-9 .
EB-15-9	3	LED LINEAR	SSLTG-HLG-60-H-24A 60W 24V LED DRIVER 90-305(ON/OFF) TYPE EB-15-9 .
EB-15-9	3	LED LINEAR	LEDLIN-LINEAR.DRIVE.DC.211D-LG LN211D1-LG TYPE EB-15-9 .
EB-13-6	1	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10-W825/139 4MM-IP67-IN-003 W/60DEG DIFFUSE LENS, 500MM BLACK OPEN ON ONE END AND FEMALE BLACK CONNECT TYPE EB-13-6 . *** Non-Stock ***
EB-13-6	1	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10-W825/126 9MM-IP67-IN-003 W/60 DIFUSE LENS TYPE EB-13-6 .
EB-13-6	1	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1394MM-IP67-IN-003 W/60 DEG DIFFUSE LENS TYPE EB-13-6 .
EB-13-6	1	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1394MM-IP67-IN-003 W/ 60 DEG DIFFUSE LENS, MALE BLACK CONNECT ONLY TYPE EB-13-6 .
EB-13-6	12	LED LINEAR	LEDLIN-13000006-45 45D MOUNTING CLIPS TYPE EB-13-6 .
EB-13-6	1	LED LINEAR	SSLTG-HLG-60-H-24A 60W 24V LED DRIVER 90-305(ON/OFF) TYPE EB-13-6 ,
EB-13-6	1	LED LINEAR	LEDLIN-LINEAR.DRIVE.DC.211D-LG LN211D1-LG TYPE EB-13-6 .
EB-11-1	1	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1644MM-IP67-IN-003 W/ 60 DEG DIFFUSE LENS, 500MM BLACK OPEN ON ONE END AND FEMALE BLACK CONNECT TYPE EB-11-1 .
EB-11-1	1	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1644MM-IP67-IN-003 W/ 60 DEG DIFFUSE LENS, MALE BLACK CONNECT ONLY TYPE EB-11-1 .
EB-11-1	10	LED LINEAR	LEDLIN-13000006-45 45D MOUNTING CLIPS TYPE EB-11-1 .
EB-11-1	1	LED LINEAR	SSLTG-HLG-60-H-24A 60W 24V LED DRIVER 90-305(ON/OFF) TYPE EB-11-1 .
EB-11-1	1	LED LINEAR	LEDLIN-LINEAR.DRIVE.DC.211D-LG LN211D1-LG TYPE EB-11-1 .
EB-15-6	1	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1519MM-IP67-IN-003 W/60DEG DIFFUSE LENS, 500MM BLACK OPEN ON ONE END AND FEMALE BLACK CONNECT TYPE EB-15-6 .
EB-15-6	1	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1644MM-IP67-IN-003 W/60DEG DIFFUSE LENS TYPE EB-15-6 .
EB-15-6	1	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1519MM-IP67-IN-003 W/60 DEG DIFFUSE LENS, MALE BLACK CONNECT ONLY TYPE EB-15-6 .
EB-15-6	15	LED LINEAR	LEDLIN-13000006-45 45D MOUNTING CLIPS TYPE EB-15-6 .
EB-15-6	1	LED LINEAR	SSLTG-HLG-60-H-24A 60W 24V LED DRIVER 90-305(ON/OFF) TYPE EB-15-6 .
EB-15-6	1	LED LINEAR	LEDLIN-LINEAR.DRIVE.DC.211D-LG LN211D1-LG TYPE EB-15-6 .
EB-15-10	1	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1644MM-IP67-IN-003 W/ 60 DEG DIFFUSE LENS, 500MM BLACK OPEN ON ONE END AND FEMALE BLACK CONNECT TYPE EB-15-10 .

VILLA LIGHTING SUPPLY
2929 Chouteau Ave.
St. Louis, MO 63103
Tel: (314) 531-2600
Fax: (314) 531-8720
Toll Free: 1-800-325-0963

GUARANTEE ELECTRICAL CONTRACTORS
JOB: WEBSTER ISB
PO# 505555-11317 PC 13

TYPE	QTY ORDERED	MANUFACTURER	CATALOG NUMBER
EB-15-10	1	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10 W825/1519MM-IP67-IN-003 W/ 60DEG DIFFUSE LENS TYPE EB-15-10 .
EB-15-10	1	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1644MM-IP67-IN-003 W/ 60 DEG DIFFUSE LENS, MALE BLACK CONNECT ONLY TYPE EB-15-10 .
EB-15-10	15	LED LINEAR	LEDLIN-13000006-45 45D MOUNTING CLIPS TYPE EB-15-10 .
EB-15-10	1	LED LINEAR	SSLTG-HLG-60-H-24A 60W 24V LED DRIVER 90-305(ON/OFF) TYPE EB-15-10 .
EB-15-10	1	LED LINEAR	LEDLIN-LINEAR.DRIVE.DC.211D-LG LN211D1-LG TYPE EB-15-10 .
EB-15-7	1	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1519MM-IP67-IN-003 W/60DEG DIFFUSE LENS, 500MM BLACK OPEN ON ONE END AND FEMALE BLACK CONNECT TYPE EB-15-7 .
EB-15-7	1	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1644MM-IP67-IN-003 W/60DEG DIFFUSE LENS TYPE EB-15-7 .
EB-15-7	1	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1519MM-IP67-IN-003 W/60 DEG DIFFUSE LENS, MALE BLACK CONNECT ONLY TYPE EB-15-7 .
EB-15-7	15	LED LINEAR	LEDLIN-13000006-45 45D MOUNTING CLIPS TYPE EB-15-7 .
EB-15-7	1	LED LINEAR	SSLTG-HLG-60-H-24A 60W 24V LED DRIVER 90-305(ON/OFF) TYPE EB-15-7 .
EB-15-7	1	LED LINEAR	LEDLIN-LINEAR.DRIVE.DC.211D-LG LN211D1-LG TYPE EB-15-7 .
EB-14-6	2	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10-W825/139 4MM-IP67-IN-003 W/60DEG DIFFUSE LENS, 500MM BLACK OPEN ON ONE END AND FEMALE BLACK CONNECT TYPE EB-14-6 .
EB-14-6	2	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10 W825/1519MM-IP67-IN-003 W/ 60DEG DIFFUSE LENS TYPE EB-14-6 .
EB-14-6	2	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1394MM-IP67-IN-003 W/ 60 DEG DIFFUSE LENS, MALE BLACK CONNECT ONLY TYPE EB-14-6 .
EB-14-6	24	LED LINEAR	LEDLIN-13000006-45 45D MOUNTING CLIPS TYPE EB-14-6 .
EB-14-6	2	LED LINEAR	SSLTG-HLG-60-H-24A 60W 24V LED DRIVER 90-305(ON/OFF) TYPE EB-14-6 .
EB-14-6	2	LED LINEAR	LEDLIN-LINEAR.DRIVE.DC.211D-LG LN211D1-LG TYPE EB-14-6 .
EB-9-8	1	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10-W825/139 4MM-IP67-IN-003 W/60DEG DIFFUSE LENS, 500MM BLACK OPEN ON ONE END AND FEMALE BLACK CONNECT TYPE EB-9-8 .
EB-9-8	1	LED LINEAR	LEDLIN-VARIOLED-HYDRA-LD10- W825/1519MM-IP67-IN-003 W/60 DEG DIFFUSE LENS, MALE BLACK CONNECT ONLY TYPE EB-9-8 .
EB-9-8	8	LED LINEAR	LEDLIN-13000006-45 45D MOUNTING CLIPS TYPE EB-9-8 .
EB-9-8	1	LED LINEAR	SSLTG-HLG-40-H-24A 40W 24V LED DRIVER 90-305VAC(ON/OFF) TYPE EB-9-8 .
EB-9-8	1	LED LINEAR	LEDLIN-LINEAR.DRIVE.DC.211D-LG LN211D1-LG TYPE EB-9-8 .
EB	300	LED LINEAR	LEDLIN-14000030 VARIO CABEL MONO 2X 0.34MM2 IP68 15 X 6M PIECES *** Non-Stock ***
BA-ALT	1	DADO	DADO-H-HL25-2AML3-30-1- W-R-S-240FC-RT90-44FC- WHE-In-CL2P50 / R-X-D010-UNV - HardLine 2.5" with 9.8W/ft 3000K LED (direct view multi-row LED). Stairwell pattern, L shape 240"x44" ft, White finish on entire housing, with (1) Right Turn & 50ft feed cables. Includes 0-10V dimmable remote power supply in NEMA enclosure per Note 1 below. TYPE BA-ALT
BA-ALT	1	DADO	DADO-H-HL25-2AML3-30-1-w- R-S-240FC-RT90-44FC-IC148- 162FC-OC211-24FC-WHE-In-CL2P50 / R-X-D010-UNV - HardLine 2.5" with 9.8W/ft 3000K LED (direct view multi-row LED). Stairwell pattern, (4) Field cuttable sections 39.25 ft total length, White finish on entire housing. with (1) Right Turn, (1) Inside Corner and (1) Outside Corner & 50ft feed cables. Includes 0-10V dimmable remote power supply in NEMA enclosure per
BA-ALT	1	DADO	H-HL25-2AML3-30-1-W-R- S-240FC-RT90-44FC-IC148- 162FC-OC211-24FC-WHE-In-CL2P50 / R-X-D010-UNV - HardLine 2.5" with 9.8W/ft 3000K LED (direct view multi-row LED). Stairwell pattern, (4) Field cuttable sections 39.25 ft total length, White finish on entire housing. with (1) Right Turn, (1) Inside Corner and (1) Outside Corner & 50ft feed cables. Includes 0-10V dimmable remote power supply per Note 1 below. TYPE

6/13/20178:42 AM

Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** 700BCALDY-S-LED830-277 Notes: satin nickel	**Type:** **BB2** LAI16-104794

B A T H C O L L E C T I O N

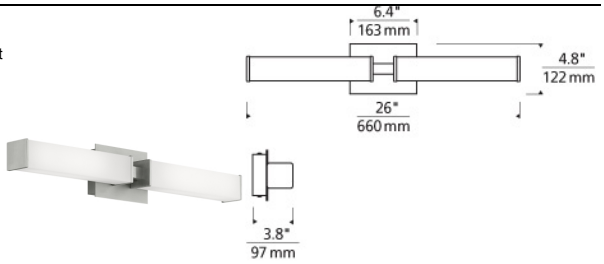
Alden Bath

LED CF ADA

DESCRIPTION
Dual linear acrylic shades providing both task and ambient light are accented by a minimal metal body and sleek metal endcaps in the Alden bath light fixture from Tech Lighting. Includes two GX24Q-2 base 18 watt triple tube compact fluorescent lamps (electronic ballast included) or 20 watt, 1200 net lumen, 3000K LED modules. LED version dimmable with low-voltage electronic dimmer. May be mounted horizontally or vertically. ADA compliant.

INSTALLATION
This product can mount to either a 4" square electrical box with round plaster ring or an octagonal electrical box. May be mounted horizontally or vertically. For wall mount use only.

WEIGHT
4.03lb / 1.83kg ±



acrylic



bronze chrome satin nickel

ORDERING INFORMATION

700BCALD	COLOR	FINISH	LAMP
	Y ACRYLIC	**Z** ANTIQUE BRONZE	**-CF** COMPACT FLUORESCENT 120V
		C CHROME	**-CF277** COMPACT FLUORESCENT 277V
		S SATIN NICKEL	**-LED830** LED 80 CRI 3000K 120V
			-LED830-277 LED 80 CRI 3000K 277V

TECH LIGHTING®
7400 Linder Avenue
Skokie, Illinois 60077
T 847.410.4400
F 847.410.4500

Tech Lighting, L.L.C.

700BCALD ____ ____ ____

FIXTURE TYPE: _____

JOB NAME: _____

NOTES: _____

_____

_____

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Tech Lighting reserves the right to change specifications for product improvements without notification.

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
VIA4WDI-HLO-LED-80-750-750-30-15'-UNV-D-1-DMB-W -(REMOTE DRIVERS)
Notes: REMOTE DRIVER

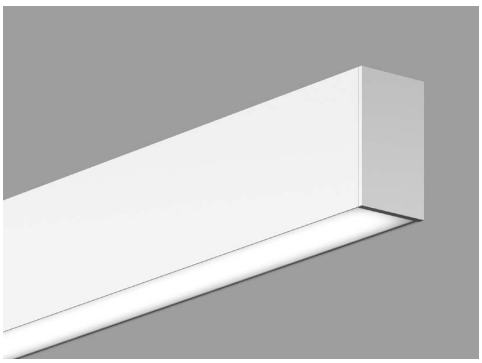
Type:
BC15
LAI16-104794

VIA 4 LED

WALL DIRECT/INDIRECT

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Shown with HLO optics

PROJECT: _____
TYPE: _____
NOTES: _____

DESCRIPTION

Via 4 is the flexible linear LED luminaire system for pendant, surface and recessed or in-wall installation, whether as discrete luminaires, continuous runs or patterns. Via 4 features numerous high-efficiency optical configurations, including separately controlled indirect/direct, wall wash and asymmetric distributions, as well as a wide range of electrical, control and trim options. See separate spec sheets for patterns and other available mountings.

DLC QPL LISTED

LED lighting facts LED Product Partner

up to 118 lm/w performance

ORDER GUIDE

VIA4WDI	HLO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**DIRECT LUMEN PACKAGES**	**INDIRECT LUMEN PACKAGES**
VIA4WDI - via 4" wall direct/indirect	**HLO** - High-Efficiency Lambertian Optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**500** - low output 500lm/ft **750** - med. output 750lm/ft **1000** - high output 1000lm/ft **1200** - ultra high output 1200lm/ft	**500** - low output 500lm/ft **750** - medium output 750lm/ft Lower lumen packages are available, consult factory

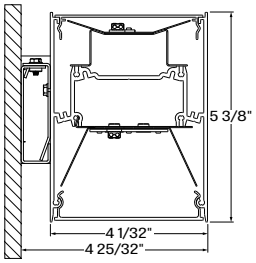
15'

COLOR TEMP.	LUMINAIRE LENGTH	VOLTAGE	DRIVER	ELECTRICAL
30 - 3000k **35** - 3500k **40** - 4000k	Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **2** - 2 circuits **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device

DMB			
MOUNTING	**FINISH**	**CONTROLS**	**OPTIONS**
DMB - drywall mounting bracket	**W** - matte white **AL** - aluminum **B** - matte black **CF#** - custom finish specify RAL#	ONBOARD **OMS** - Motion Sensor & power pack **ODS** - Daylight Sensor & controller WIRELESS **EWC** - EnOcean Wireless Controller **LMC** - Lutron Motion Controller **LDC** - Lutron Daylight Controller	**FU** - fuse **DC** - dust cover **CU** - custom REMOTE DRIVER

See page 2 for ordering code detailed information

CROSS SECTION



VIA4WDI - wall

OPTICS



HLO - High-efficiency Lambertian Optic

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ETL LISTED c US Intertek

VIA 4 LED

WALL DIRECT/INDIRECT

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OPTICS

HIGH EFFICIENCY LAMBERTIAN OPTIC (HLO) - Matte white side reflectors combined with High-Efficiency Lambertian Optic (HLO) shielding of diffusing 0.075" thick acrylic with up to 88% transmission and good source obscuration. Luminaire brightness is controlled by the flux-to-shielding area ratio.

LIGHT SOURCE - LED

Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

PERFORMANCE PER 4' AT 4000K

High Indirect Output (3000 Lumens)

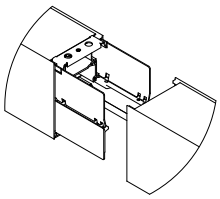
LED output	Color Temp	Watts	Direct Lumens	Indirect Lumens	Total Nominal Delivered Lumens	Efficacy LPW
low output	4000K	42	2000	3000	5000	118
medium output	4000K	53	3000	3000	6000	114
high output	4000K	63	4000	3000	7000	111
ultra high ouput	4000K	72	4800	3000	7800	108

Low Indirect Output (2000 Lumens)

LED output	Color Temp	Watts	Direct Lumens	Indirect Lumens	Total Nominal Delivered Lumens	Efficacy LPW
low output	4000K	34	2000	2000	4000	118
medium output	4000K	44	3000	2000	5000	114
high output	4000K	55	4000	2000	6000	109
ultra high ouput	4000K	64	4800	2000	6800	107

LUMINAIRE LENGTH

Via 4 is made up of standard 2, 3, 4, 5, 8 and 12 foot sections that may be joined together to create longer continuous run lengths. Exact run length must be noted in the product code. The minimum individual section available is 2 foot, and continuous run lengths can be ordered in 2 inch increments.
All individual sections are joined together onsite using the joiner kits provided. LumenWerx offers joiner kits that are extremely simple to work with in the field and result in a fixture that appears virtually seamless with no light leak at any connection.



joining system Via 4 direct/indirect

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

MOUNTING OPTIONS

Fixtures may be horizontally mounted to the wall using a bracket. For long runs, a minimum of 6" from adjacent walls is required.

FINISH

Interior - 95%, reflective matte powder coated white paint
Exterior - matte white, matte black or silver powder coating.
Custom finishes are also available.

CONTROLS

LumenWerx offers several options for integrating motion and daylight controls into Via 4 luminaires. Wireless options incorporate a wireless controller/powerpack into the luminaire, which receives signals from a wireless sensor (by others) installed in the space. The advantages of the wireless option include greater flexibility of control options, sensor coverage and system integration. Onboard options incorporate both the sensor and controller/powerpack. Onboard sensors, while inherently simpler, have limitations of control and coverage.

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VIA 4 LED

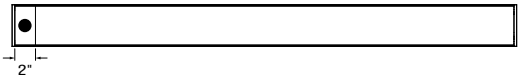
WALL DIRECT/INDIRECT

LUMENWERX
WWW.LUMENWERX.COM

Onboard

Onboard Motion Sensor and **power pack (OMS)** provide automatic on and automatic off control, using PIR detection. Sensor is designed to detect fine-motion when installed within 6' of occupants.

Onboard Daylight Sensor and **controller (ODS)** provide input for 0-10V dimming drivers. Separate switched control of line input is required for on/off control.



Location of an Onboard sensor

Wireless

EnOcean Wireless Controller (EWC) provides both a power pack for presence detection control and a 0-10V interface for daylight harvesting. EnOcean wireless sensors (by others) mounted in the room signal the onboard EWC. This option permits manual on/automatic off (vacancy) control.

Lutron Motion Controller (LMC) and **Lutron Daylight Controller (LDC)** provide inputs to Ecosystem drivers. Compatible Lutron wireless motion and daylight sensors (by others) mounted in the room signal onboard LPC or LDC. This option permits manual on/automatic off (vacancy) control.

CONSTRUCTION

Housing - Extruded Aluminum (0.095" nominal) up to 90% Recycled Content
Interior brackets - Die formed cold rolled sheet steel 18 gauge thick
Joining system - Die cast Zinc (0.95" nominal)
Reflectors - Cold rolled steel 0.024" thick precisely die formed, 95% reflective matte white painted
End caps - Die cast Aluminum (0.95" nominal)

WEIGHT

Via 4 4ft - 13.66lbs - 6.2kg
Via 4 8ft - 27.53lbs - 12.5kg
Via 4 12ft - 41.41lbs - 18.8kg

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
DLC - Testing to DLC requirements, for this product, have been completed by an Accredited Laboratory and certified by DLC.
Lighting facts - testing products and reporting performance results according to industry standards.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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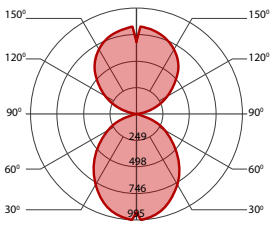
VIA 4 LED

WALL DIRECT/INDIRECT

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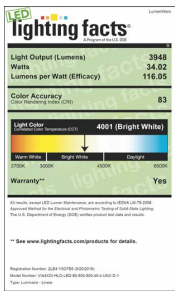
PERFORMANCE AT INDIRECT 500 LUMEN PER FOOT

500 LUMEN AT 80CRI - LOW OUTPUT

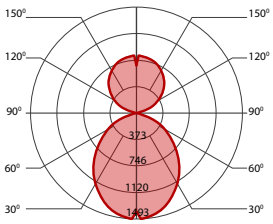


PERFORMANCE PER 4'

LED output	Color Temp	Watts	Direct Lumens	Indirect Lumens	Total Nominal Delivered Lumens	Efficacy LPW
low output	3000K	36	2000	2000	4000	110
low output	3500K	35	2000	2000	4000	114
low output	4000K	34	2000	2000	4000	118



750 LUMEN AT 80CRI - MEDIUM OUTPUT

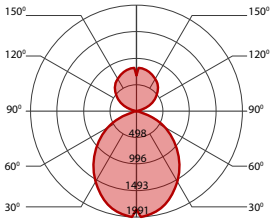


PERFORMANCE PER 4'

LED output	Color Temp	Watts	Direct Lumens	Indirect Lumens	Total Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	47	3000	2000	5000	107
medium output	3500K	45	3000	2000	5000	110
medium output	4000K	44	3000	2000	5000	114



1000 LUMEN AT 80CRI - HIGH OUTPUT

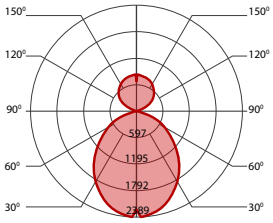


PERFORMANCE PER 4'

LED output	Color Temp	Watts	Direct Lumens	Indirect Lumens	Total Nominal Delivered Lumens	Efficacy LPW
high output	3000K	58	4000	2000	6000	103
high output	3500K	60	4000	2000	6000	106
high output	4000K	55	4000	2000	6000	109

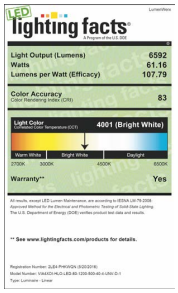


1200 LUMEN AT 80CRI - ULTRA HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Direct Lumens	Indirect Lumens	Total Nominal Delivered Lumens	Efficacy LPW
ultra high ouput	3000K	68	4800	2000	6800	100
ultra high ouput	3500K	65	4800	2000	6800	104
ultra high ouput	4000K	64	4800	2000	6800	107



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Intertek

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
VIA4WDI-HLO-LED-80-750-750-30-15'-UNV-D-1-DMB-W -(REMOTE DRIVERS)
Notes: REMOTE DRIVER

Type:
BC15
LAI16-104794

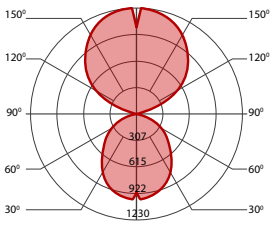
VIA 4 LED

WALL DIRECT/INDIRECT

LUMENWERX
WWW.LUMENWERX.COM

PERFORMANCE AT INDIRECT 750 LUMEN PER FOOT

500 LUMEN AT 80CRI - LOW OUTPUT

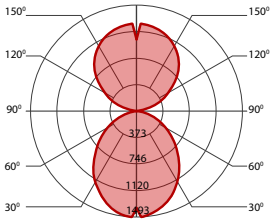


PERFORMANCE PER 4'

LED output	Color Temp	Watts	Direct Lumens	Indirect Lumens	Total Nominal Delivered Lumens	Efficacy LPW
low output	3000K	45	2000	3000	5000	110
low output	3500K	44	2000	3000	5000	114
low output	4000K	42	2000	3000	5000	118



750 LUMEN AT 80CRI - MEDIUM OUTPUT

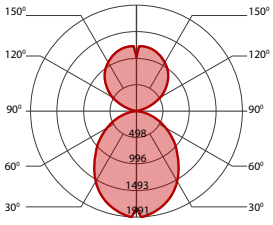


PERFORMANCE PER 4'

LED output	Color Temp	Watts	Direct Lumens	Indirect Lumens	Total Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	28	3000	3000	6000	107
medium output	3500K	54	3000	3000	6000	111
medium output	4000K	53	3000	3000	6000	114



1000 LUMEN AT 80CRI - HIGH OUTPUT

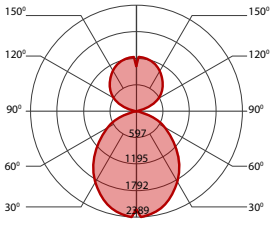


PERFORMANCE PER 4'

LED output	Color Temp	Watts	Direct Lumens	Indirect Lumens	Total Nominal Delivered Lumens	Efficacy LPW
high output	3000K	67	4000	3000	7000	104
high output	3500K	65	4000	3000	7000	107
high output	4000K	63	4000	3000	7000	111



1200 LUMEN AT 80CRI - ULTRA HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Direct Lumens	Indirect Lumens	Total Nominal Delivered Lumens	Efficacy LPW
ultra high ouput	3000K	76	4800	3000	7800	102
ultra high ouput	3500K	74	4800	3000	7800	105
ultra high ouput	4000K	72	4800	3000	7800	108



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Intertek

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
VIA1.5S-HLO-LED-80-400-30-4FT-277-D(1%)-1-DRC-W Notes: Providing equal not specified

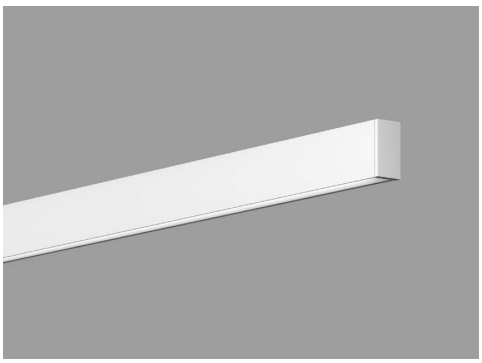
Type:
CA
LAI16-104794

VIA 1.5 LED

SURFACE

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Shown with HLO optics

DESCRIPTION

Via 1.5 is the elegant, ultra-compact and flexible linear LED luminaire system for pendant, surface, and recessed or in-wall installation, whether as discrete luminaires, continuous runs, or patterns.
Via 1.5 features numerous optical configurations, which are difficult to achieve in such a compact luminaire.
See separate spec sheets for patterns and other available mountings.

PROJECT: _____
TYPE: _____
NOTES: _____

LED lighting facts
LED Product Partner

ORDER GUIDE

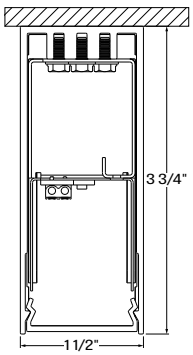
VIA1.5S	HLO	LED		400 - 400 LM/FT	
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
VIA1.5S - via 1.5" surface	**HLO** - High-Efficiency Lambertian Optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med. output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

4'		ELDOLED DRIVER	
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2**- Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires /EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit

MOUNTING	**FINISH**	**CONTROLS**	**OPTIONS**
GRD - grid ceiling **DRC**- drywall ceiling **OHC** - other ceiling (specify)	**W** - matte white **AL** - aluminum **CF#** - custom finish specify RAL#	WIRELESS **EWC** - EnOcean Wireless Controller **LMC** - Lutron Motion Controller **LDC** - Lutron Daylight Controller	**FU** - fuse **TB#** - T-bar caddy clip specify grid size **TG#** - Tegular caddy clip specify grid size **ST** - Screw Slots caddy clip **CU** - custom

See page 2 for ordering code detailed information

CROSS SECTION



VIA1.5S - surface

OPTICS



HLO - High-efficiency Lambertian Optic

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ETL LISTED c US Intertek

VIA 1.5 LED

SURFACE

LUMENWERX
WWW.LUMENWERX.COM

OPTICS

HIGH EFFICIENCY LAMBERTIAN OPTIC (HLO) - matte white side reflectors combined with High-Efficiency Lambertian Optic (HLO) shielding of diffusing 0.075" thick acrylic with up to 88% transmission and good source obscuration. Luminaire brightness is controlled by the flux-to-shielding area ratio.

LIGHT SOURCE - LED

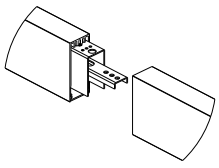
Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

PERFORMANCE PER 4' AT 4000K

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	17	1400	83
medium output	4000K	24	2000	82
high output	4000K	37	3000	81

LUMINAIRE LENGTH

Via 1.5 is made up of standard 2, 3, 4, 5, 8 and 12 foot sections that may be joined together to create longer continuous run lengths. Exact run length must be noted in the product code. The minimum individual section available is 2 foot.
All individual sections are joined together onsite using the joiner kits provided. LumenWerx offers joiner kits that are extremely simple to work with in the field and result in a fixture that appears virtually seamless with no light leak at any connection.



joining system for Via 1.5

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

MOUNTING OPTIONS

Fixtures can be mounted directly to T-Bar, drywall and hard surface ceilings, hardware supplied by others. Long runs require a minimum of 6" distance from the vertical wall.

FINISH

Interior - 95%, reflective matte powder coated white paint
Exterior - matte white or silver powder coating. Custom finishes are also available.

CONTROLS

LumenWerx offers several options for integrating occupancy and daylight controls into Via 1.5 luminaires. Wireless options incorporate a wireless controller/powerpack into the luminaire, which receives signals from a wireless sensor (by others) installed in the space. The advantages of the wireless option include greater flexibility of control options, sensor coverage and system integration.
Wireless
EnOcean Wireless Controller (EWC) provides both a power pack for presence detection control and a 0-10V interface for daylight harvesting. EnOcean wireless sensors (by others) mounted in the room signal the onboard EWC. This option permits manual on/automatic off (vacancy) control.
Lutron Motion Controller (LMC) and **Lutron Daylight Controller (LDC)** provide inputs to Ecosystem drivers. Compatible Lutron wireless motion and daylight sensors (by others) mounted in the room signal onboard LPC or LDC. This option permits manual on/automatic off (vacancy) control.

CONSTRUCTION

Housing - Extruded Aluminum (0.095" nominal) up to 90% Recycled Content
Interior brackets - Die formed cold rolled sheet steel 18 gauge thick
Joining system - Die cast Zinc (0.95" nominal)
Reflectors - Flat rolled Aluminum sheet 0.040" thick precisely die formed, 95% reflective matte white painted
End caps - Die cast Aluminum (0.95" nominal)

WEIGHT

Via 1.5 4ft - 7.16lbs - 3.25kg
Via 1.5 8ft - 14.32lbs - 6.5kg
Via 1.5 12ft - 21.48lbs - 9.75kg

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Intertek

VIA 1.5 LED

SURFACE

LUMENWERX
WWW.LUMENWERX.COM

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
Lighting facts - testing products and reporting performance results according to industry standards.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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Intertek

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
VIA1.5S-HLO-LED-80-400-30-4FT-277-D(1%)-1-DRC-W Notes: Providing equal not specified

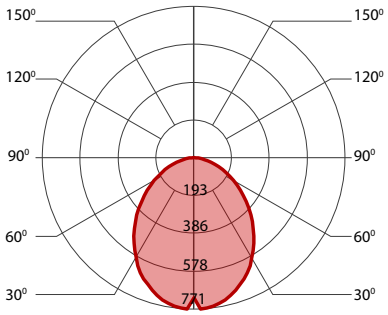
Type:
CA
LAI16-104794

VIA 1.5 LED

SURFACE

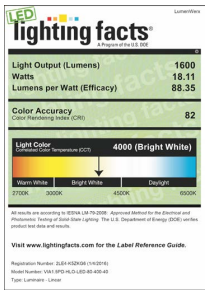
LUMENWERX
WWW.LUMENWERX.COM

350 LUMEN AT 80CRI - LOW OUTPUT

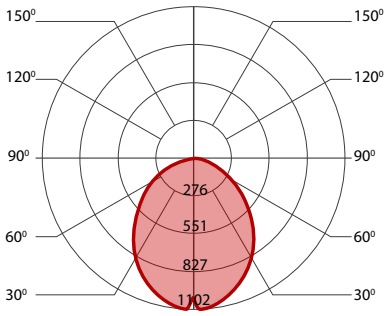


PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	18	1400	78
low output	3500K	17.5	1400	80
low output	4000K	17	1400	83

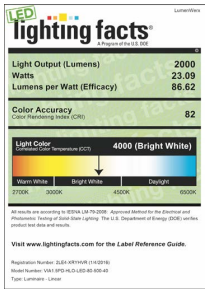


500 LUMEN AT 80CRI - MEDIUM OUTPUT

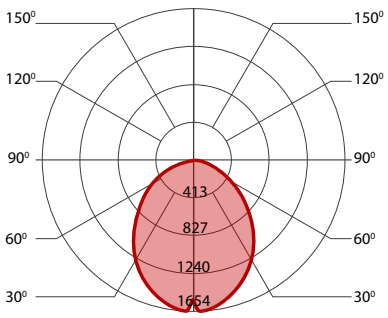


PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	26	2000	77
medium output	3500K	25	2000	79
medium output	4000K	24	2000	82

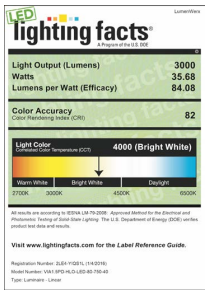


750 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	39	3000	76
high output	3500K	38	3000	78
high output	4000K	37	3000	81



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Intertek

Submitted by LIGHTING ASSOCIATES, INC.		
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** 4VT2-LD4-4-DR-W-UNV-L835-WL-TH-U Notes: Providing equal not specified
		Type: **CB** LAI16-104794

Metalux

DESCRIPTION

The Vaportite LED Series is an energy efficient industrial Vaportite fixture that features rugged and durable construction. The Vaportite LED incorporates a full metal fixture liner inside a reinforced fiberglass housing with a high impact diffuser. This Vaportite series is suitable for interior and exterior applications and can be surface or chain mounted.

The Vaportite LED Series has been designed for maximum operation in commercial institutional and industrial environments and can operate in a wide range of temperatures (-20°C to 25°C) and is ideal for cold storage environments.

Catalog #		**Type**
Project		
Comments		**Date**
Prepared by		



VAPORTITE LED

4' INDUSTRIAL LED LAMP

Vaportite Industrial Refrigerated Case

SPECIFICATION FEATURES

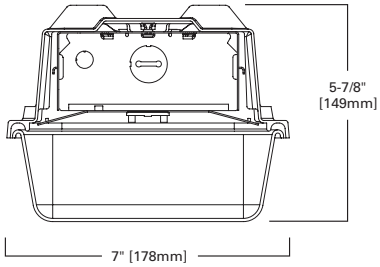
Construction
Fiberglass housing is reinforced polyester and self-extinguishing (ASTM-D635-74) plastic of a permanent pearl gray color. A watertite hub for 1/2" conduit entry is provided at each end of housing (standard) for continuous feed. Polyurethane gasketing is formed in the housing providing a continuous seamless seal for the diffuser. Four sturdy cam latches clamp diffuser tightly for a positive seal between housing, gasketing and diffuser. Electrical components and fixtures are UL/ cUL listed for Wet Locations.

Electrical
Long-Life LED system coupled with electrical driver to deliver optimal performance. LED's available in 3500, 4000 and 5000K with a CRI ≥ 85. Projected life is 60,000 hours at 91% lumen output. cULus listed. Electronic drivers are available for 120-277V applications. A 0-10V dimming control is available (standard). IP65 rated and NSF certified (4' only).

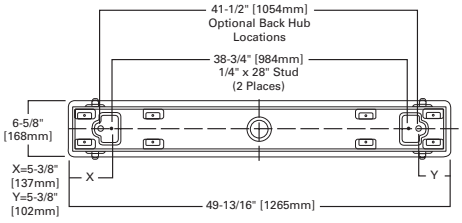
Lens
DR=Internal Prismatic Lens/15% DR High Impact Additive.
DR100=Internal Prismatic Lens/100% DR High Impact Additive.

Warranty
Vaportite LED features a five year limited warranty.

Compliance
DesignLights Consortium™ Qualified and classified for DLC Standard (some models are not DLC qualified), refer to www.designlights.org for details.



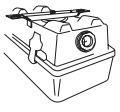
MOUNTING DATA



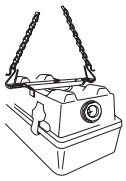
ENERGY DATA

Input Watts:
4VT2-LD4-4 (4,000 lumens)=38W
4VT2-LD4-6 (6,000 lumens)=57.3W
4VT2-LD4-8 (8,000 lumens)=81.1W

INSTALLATION DATA



MOUNTING BRACKETS
Furnished
Two per 2' and 4' Unit
Four per 8' Unit



OPTIONAL CHAN HANGING SET
(VT2-CHAIN/SET-U)
Includes 6 ft. of chain, 4 large S-Hooks and 4 small S-Hooks
Order One (1) Kit for each 2' or 4' Fixture

EATON
Powering Business Worldwide

LINEAR DISCONNECT
Safe and convenient means of disconnecting power

ADF142831
2016-07-13 10:33:33

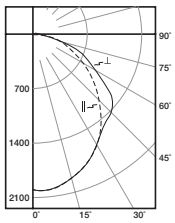
Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
4VT2-LD4-4-DR-W-UNV-L835-WL-TH-U
Notes: Providing equal not specified

Type:
CB
LAI16-104794

PHOTOMETRICS



4VT2-LD4-6-DR-UNV-L835-CD1-U
Electronic Driver
Linear LED 3500K
Spacing criterion: (II) 1.2 x mounting height, (⊥) 1.2 x mounting height
Lumens: 5882
Input Watts: 56W
Efficacy: 104.7 lm/W
Test Report: 4VT2-LD4-6-DR-UNV-L835-CD1-U.IES

Candlepower

Angle	Along II	45°	Across ⊥
0	2000	2000	2000
5	2007	1979	1980
10	1981	1951	1956
15	1930	1900	1903
20	1857	1836	1844
25	1764	1748	1765
30	1645	1646	1660
35	1511	1522	1534
40	1375	1393	1468
45	1221	1271	1438
50	1062	1207	1343
55	903	1175	1148
60	749	1048	933
65	600	1151	771
70	461	591	600
75	332	398	426
80	206	249	255
85	94	137	127
90	34	75	63

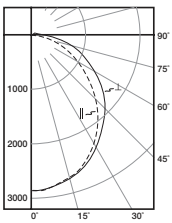
Coefficients of Utilization

Effective floor cavity reflectance 20%

rc	80%				70%				50%			30%			10%			0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	119	119	119	119	116	116	116	116	110	110	110	105	105	105	101	101	101	99
1	108	103	98	94	105	101	96	93	96	93	90	92	89	87	88	86	84	82
2	98	89	82	76	95	87	81	75	84	78	73	80	75	71	77	73	70	67
3	89	78	70	63	86	76	69	62	73	67	61	70	65	60	68	63	59	56
4	81	69	60	53	79	68	59	53	65	58	52	62	56	51	60	55	50	48
5	75	62	52	46	73	60	52	45	58	51	45	56	49	44	54	48	44	41
6	69	55	46	40	67	54	46	40	52	45	39	51	44	39	49	43	38	36
7	64	50	41	35	62	49	41	35	48	40	35	46	39	34	45	38	34	32
8	59	46	37	31	58	45	37	31	44	36	31	42	35	31	41	35	30	28
9	56	42	34	28	54	41	33	28	40	33	28	39	32	28	38	32	27	25
10	52	39	31	25	51	38	31	25	37	30	25	36	30	25	35	29	25	23

Zonal Lumen Summary

Zone	Lumens	% Fixture
0-30	1536	26.1
0-40	2490	42.3
0-60	4463	75.9
0-90	5804	98.7
0-180	5882	100.0



4VT2-LD4-8-FR50-UNV-L835-CD1-WL-U
Electronic Driver
Linear LED 3500K
Spacing criterion: (II) 1.2 x mounting height, (⊥) 1.3 x mounting height
Lumens: 8553
Input Watts: 81W
Efficacy: 105.5 lm/W
Test Report: 4VT2-LD4-8-FR50-UNV-L835-CD1-WL-U.IES

Candlepower

Angle	Along II	45°	Across ⊥
0	2854	2854	2854
5	2857	2829	2842
10	2811	2790	2804
15	2733	2723	2742
20	2626	2629	2658
25	2484	2508	2545
30	2316	2365	2408
35	2120	2195	2253
40	1904	2011	2086
45	1678	1819	1914
50	1451	1622	1736
55	1222	1422	1558
60	1009	1229	1368
65	810	1034	1171
70	622	843	959
75	446	659	748
80	287	487	555
85	148	341	392
90	45	228	271

Coefficients of Utilization

Effective floor cavity reflectance 20%

rc	80%				70%				50%			30%			10%			0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	118	118	118	118	115	115	115	115	109	109	109	104	104	104	99	99	99	96
1	107	102	97	93	104	99	95	91	94	91	87	90	87	84	85	83	81	79
2	97	88	81	75	94	86	79	74	82	76	72	78	73	69	74	71	67	65
3	88	77	69	62	85	75	68	61	72	65	60	69	63	58	66	61	57	54
4	81	68	59	53	78	67	58	52	64	57	51	61	55	50	59	53	49	46
5	74	61	52	45	72	60	51	45	57	50	44	55	48	43	53	47	42	40
6	69	55	46	39	66	54	45	39	52	44	38	50	43	38	48	42	37	35
7	64	50	41	35	62	49	41	35	47	40	34	45	39	34	44	38	33	31
8	59	46	37	31	57	45	37	31	43	36	30	42	35	30	40	34	30	28
9	55	42	34	28	54	41	33	28	40	32	27	38	32	27	37	31	27	25
10	52	39	31	25	50	38	30	25	37	30	25	36	29	25	34	29	24	23

Zonal Lumen Summary

Zone	Lumens	% Fixture
0-30	2200	25.7
0-40	3573	41.8
0-60	6232	96.4
0-90	8248	100.0
0-180	8553	100.0

LUMEN MAINTENANCE

Ambient Temperature	TM-21 Lumen Maintenance (60,000 hours)	Theoretical L70 (Hours)
25°C	> 91%	> 247,000

ORDERING INFORMATION

SAMPLE NUMBER: 4VT2-LD4-4-DR-UNV-L840-CD1-WL-U

Series [2]
4VT2=4' Vaportite

Lamp Type
LD4=LED 4.0

LED Lumens Output
4=4000 Lumens
6=6000 Lumens
8=8000 Lumens

Lens
DR=Internal Prismatic Lens/15% DR High Impact Additive
DR100=Internal Prismatic Lens/100% DR High Impact Additive
FR50=Frosted Lens/15% DR High Impact Additive [1]

Distribution
[Blank]=Medium (Standard)
W=Wide Distribution

Voltage
UNV=Universal Voltage 120-277

Remote Emergency Enclosure
VT-REM-EL=Emergency Installed, 700 lumens [3]

Lamps
L835=3500K, LED
L840=4000K, LED
L850=5000K, LED

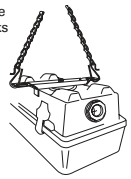
Driver Type
CD1=1 Dimming Driver
5LTD1=Fifth Light DALI

WL=Wet Location Label

Options
SSL=Stainless Steel Latches
TH=(2) Top Watertite Hubs
TEH=(2) Top and (2) End Watertite Hubs (all Watertite Hubs have 1/2" Conduit Entry)

Packaging
U=Unit Pack

Accessories (order separately)
VT2-Chain/Set-U=Chain Hanging Set
Includes 6 ft. of chain, 4 large S-Hooks and 4 small S-Hooks
Order One (1) Kit for each 2' or 4' Fixture
VT2-SS-MBK=Stainless Steel Mounting Bracket



NOTES: [1] Not availablie in wide distribution. [2] DesignLights Consortium™ Qualified and classified for DLC Standard (some models are not DLC qualified), refer to www.designlights.org for details. [3] EL must specify 120 or 277V only.

Specifications & dimensions subject to change without notice. Consult your Eaton Representative for availability and ordering information.

SHIPPING DATA

Catalog No.	Wt.
4VT2-LD4	18 lbs.

Eaton
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.eaton.com/lighting

Specifications and dimensions subject to change without notice.

Sheet No.	Sheet Name
1	COVER PAGE (DFS1)
2	161-0917-01
3	161-0917-02

Revision History		
Rev	Date	Description
1	11/18/2016	Initial Approval Drawings
2	1/16/2017	Customer Revision
3	6/6/2017	Customer Revision

GENERAL NOTES:

Material: 304 Stainless
Finish: #4
Mounting Type: Embed
Epoxy: 1 - 50 mL

Level-offs and Returns are round pipe/tube unless otherwise noted.

Circled Dimensions are Assumed

CRITICAL DIMENSIONS TO BE VERIFIED

___Tread Rise
___Tread Depth
___Tread Quantity (Number of times you lift your foot)
___Nose to Nose
___Ramp Height
___Ramp Length
___Overall Lengths
___Wireway / Feed Locations (If applicable)

CODE APPROVAL:

~~RAILS ARE DESIGNED TO THE REQUIREMENTS OF IBC 2012.~~

VERIFICATION OF LOCAL CODE COMPLIANCE IS THE RESPONSIBILITY OF THE CUSTOMER.

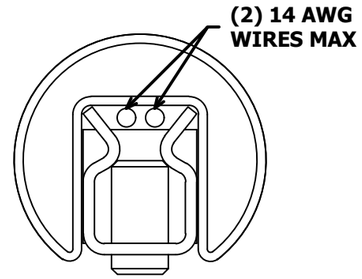
INSTALLATION:

ALL RAILING NEEDS TO BE INSTALLED BY A QUALIFIED HANDRAIL INSTALLER

JOB SPECIFIC NOTE:

RAILS DESIGNED PER CUSTOMER PROVIDED DIMENSIONS. CUSTOMER RESPONSIBLE FOR FIT, CODE COMPLIANCE, AND LOADING DATA.

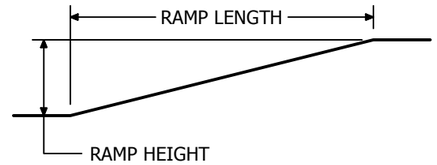
CAPRAIL DETAIL



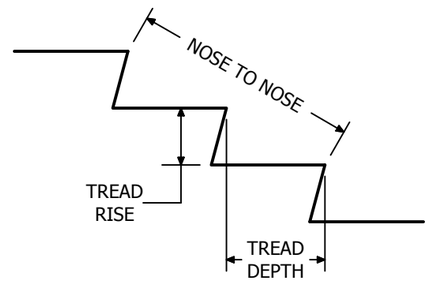
DRIVER REMOTE DISTANCE

7'-0" (2.1m) w/22 AWG
18'-0" (5.5m) w/18 AWG
46'-0" (14.0m) w/14 AWG
71'-0" (21.6m) w/12 AWG

RAMP DIMENSIONS



STAIR DIMENSIONS



FOR APPROVAL

☐ APPROVED AS IS - NO REVISONS
☐ NOT APPROVED - REVISE PER MARKUPS AND RE-SUBMIT

TO EXPEDITE THE REVISION PROCESS PLEASE MARK-UP AND RETURN THESE PRINTS

SIGNATURE: DATE:

MANUFACTURING WILL NOT BEGIN UNTIL SIGNED APPROVAL DRAWINGS ARE RECEIVED FROM CUSTOMER

ARCHITECTURAL REVIEW / DESIGN INTENT ONLY

REVISIONS TO OVERALL DIMENSIONS WILL NOT BE MADE UNTIL FIELD MEASUREMENTS HAVE BEEN RECEIVED

TOLERANCE

FRACTION:
X/XX.....= ± 1/16" over 4ft.
16 FT RAIL EXAMPLE:
16 FT / 4 FT = 4 * 1/16" = 1/4"
16 FT RAIL.....= ± 1/4"

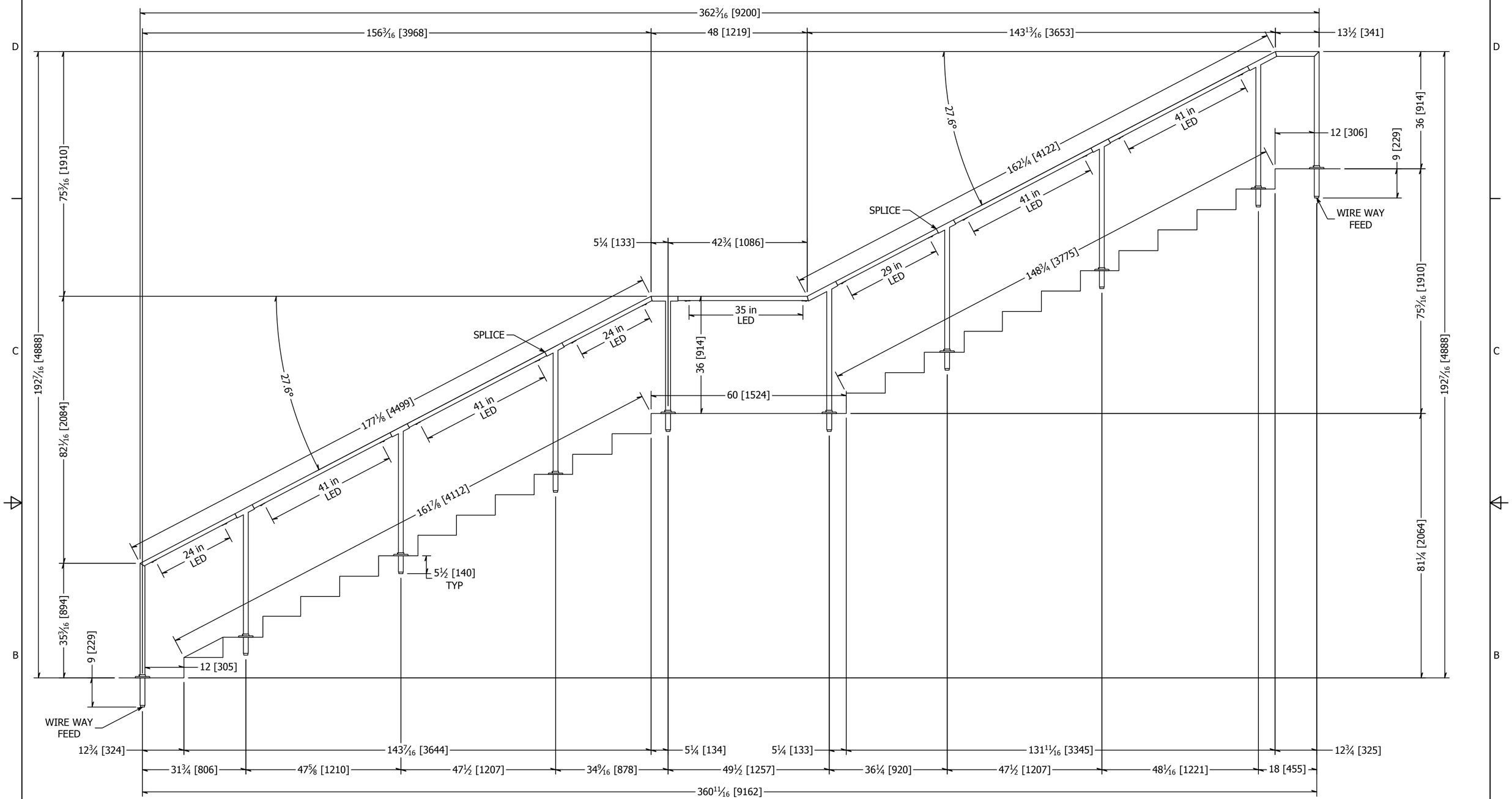
DECIMAL:
X.XX.....= ± .030
X.XXX.....= ± .010

UNLESS OTHERWISE NOTED

FINISH: #4
WEIGHT:
SHEET SIZE: B
DESCRIPTION: WEBSTER UNIVERSITY
MATERIAL: 304 Stainless
PROJECTION:
DATE: 6/7/2017
DRAWN BY: S. Frey

io LED Lighting
Eaton Lighting Solutions
18001 E Colfax Ave
Aurora, CO 80011

JOB NUMBER: QMH72800ILLUM
SHEET: 1 OF 3
PART NUMBER: COVER PAGE (DFS1)
REV: 3



SOUTH COURTYARD STAIR - REF A0507.B

JOB SPECIFIC NOTE:
RAILS DESIGNED PER CUSTOMER PROVIDED DIMENSIONS.
CUSTOMER RESPONSIBLE FOR FIT, CODE COMPLIANCE, AND LOADING DATA.

FOR APPROVAL

- ☐ APPROVED AS IS - NO REVISONS
- ☐ NOT APPROVED - REVISE PER MARKUPS AND RE-SUBMIT

TO EXPEDITE THE REVISION PROCESS PLEASE MARK-UP AND RETURN THESE PRINTS

SIGNATURE: DATE:

MANUFACTURING WILL NOT BEGIN UNTIL SIGNED APPROVAL DRAWINGS ARE RECEIVED FROM CUSTOMER

ARCHITECTURAL REVIEW / DESIGN INTENT ONLY

REVISIONS TO OVERALL DIMENSIONS WILL NOT BE MADE UNTIL FIELD MEASUREMENTS HAVE BEEN RECEIVED

TOLERANCE

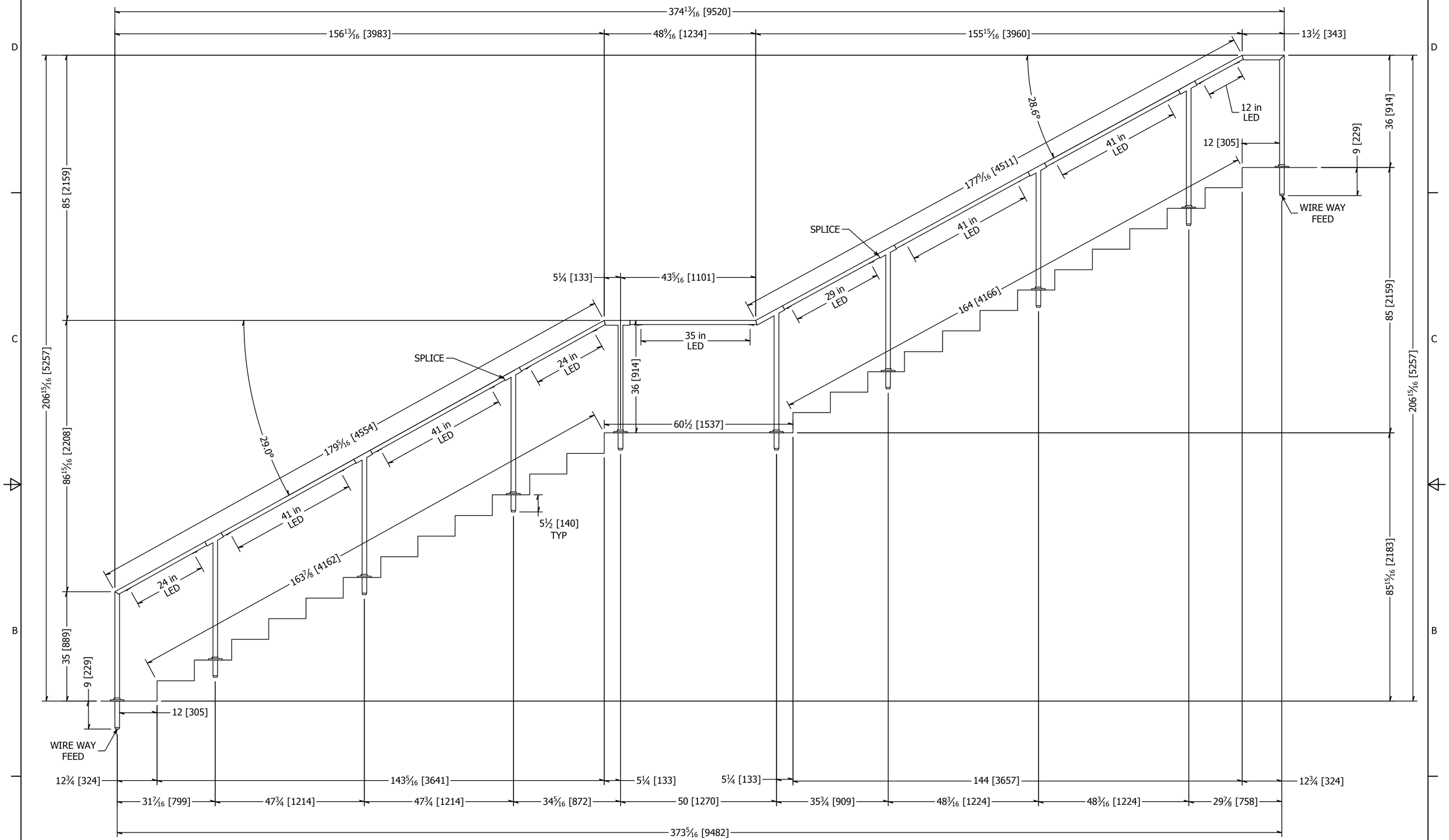
FRACTION:
X/XX.....= ± 1/16" over 4ft.
16 FT RAIL EXAMPLE:
16 FT / 4 FT = 4 * 1/16" = 1/4"
16 FT RAIL.....= ± 1/4"

DECIMAL:
X.XX.....= ± .030
X.XXX.....= ± .010

UNLESS OTHERWISE NOTED

FINISH:	#4
WEIGHT:	N/A
SHEET SIZE:	C
DESCRIPTION:	1.50" O.D. 316SS ILLUMINATED HANDRAIL
MATERIAL:	304 Stainless
PROJECTION:	
DATE:	6/7/2017
DRAWN BY:	S. Frey
JOB NUMBER:	QMH72800ILLUM
SHEET:	2 OF 3
PART NUMBER:	QMH72800ILLUM
REV:	3

io LED Lighting
Eaton Lighting Solutions
18001 E Colfax Ave
Aurora, CO 80011



WEST COURTYARD STAIR - REF A0508.A

JOB SPECIFIC NOTE:
RAILS DESIGNED PER CUSTOMER PROVIDED DIMENSIONS.
CUSTOMER RESPONSIBLE FOR FIT, CODE COMPLIANCE, AND LOADING DATA.

FOR APPROVAL

- ☐ APPROVED AS IS - NO REVISONS
- ☐ NOT APPROVED - REVISE PER MARKUPS AND RE-SUBMIT

TO EXPEDITE THE REVISION PROCESS PLEASE MARK-UP AND RETURN THESE PRINTS

SIGNATURE: DATE:

MANUFACTURING WILL NOT BEGIN UNTIL SIGNED APPROVAL DRAWINGS ARE RECEIVED FROM CUSTOMER

ARCHITECTURAL REVIEW / DESIGN INTENT ONLY

REVISIONS TO OVERALL DIMENSIONS WILL NOT BE MADE UNTIL FIELD MEASUREMENTS HAVE BEEN RECEIVED

TOLERANCE

FRACTION:
X/XX.....= ± 1/16" over 4ft.
16 FT RAIL EXAMPLE:
16 FT / 4 FT = 4 * 1/16" = 1/4"
16 FT RAIL.....= ± 1/4"

DECIMAL:
X.XX.....= ± .030
X.XXX.....= ± .010

UNLESS OTHERWISE NOTED

FINISH:	#4
WEIGHT:	N/A
SHEET SIZE:	C
DESCRIPTION:	1.50" O.D. 316SS ILLUMINATED HANDRAIL
MATERIAL:	304 Stainless
PROJECTION:	
DATE:	6/7/2017
DRAWN BY:	S. Frey
JOB NUMBER:	QMH72800ILLUM
SHEET:	3 OF 3
PART NUMBER:	161-0917-02
REV:	3

io LED Lighting
Eaton Lighting Solutions
18001 E Colfax Ave
Aurora, CO 80011

Submitted by LIGHTING ASSOCIATES, INC.		
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** (30) LOID-100/277-24-30K-DIM-ASL (30) PACBOX-277V-24V-DIM (30) LOI-RBO-24-GRD (1) LOILC-10 (1) LOI-JBOX (29) LOIJC-10FT Notes:
		Type: **EE** LAI16-104794

Specification Sheet

lumenfacade™

INGROUND
DIRECT VIEW
WHITE & STATIC COLORS

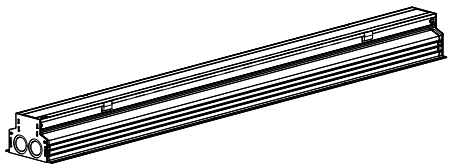
Client _____ **Project name** _____

Order# _____ **Type** _____ **Qty** _____

FEATURES AND BENEFITS

Physical :

- Aluminum optical chamber housing
- Anodized aluminum flush trim
- Polymer recycled PVC blockout housing
- Available in 1', 2', 3' or 4' sections
- Die cast aluminum end caps
- Stainless steel hardware
- Frosted glass lens
- IP68 rated for up to 1' (30cm), not suitable for permanent immersion applications
- IK10 rated
- 1000kg max load, walk over only*



IK10

CERTIFICADO No.05884, 05885
RETILAP

lumentalk

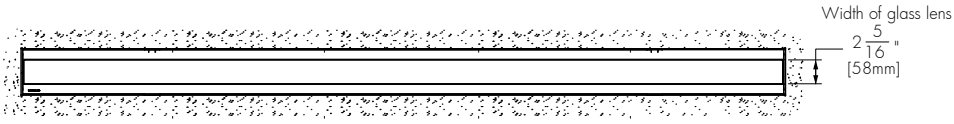
EcoSystem Enabled

Performance :

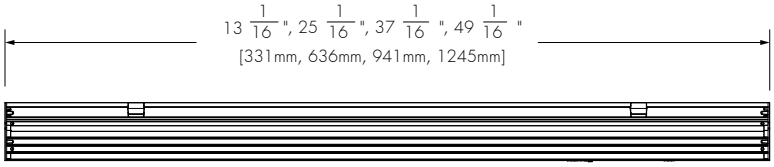
- Lumen maintenance 80,000 hrs [L70 @ 25°C]
- Lumen maintenance 60,000 hrs [L70 @ 50°C]
- Resolution per foot or per fixture
- Operating temperatures: -40° C to 50° C [-40F to 122F]

Electrical :

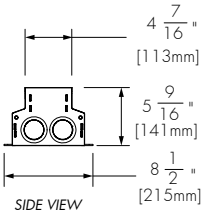
- Line voltage luminaire for 100 to 277V
- Power and data in 1 cable (#16-5)
- IP68 push-lock connectors
- 5W/ft
- Dimming options: 0-10 volt, DMX, DALI, Lumentalk, or Lutron® EcoSystem® enabled



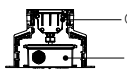
TOP VIEW



FRONT VIEW
*All dimensions are preliminary



SIDE VIEW



SECTION DETAIL

*To meet 1000kg walk over resistance requirements, cement must support 100% of the exterior surfaces of the blockout.

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25/NO/2015
N.Kassabian - Rev.10

1751 Richardson, Suite 1505
Montreal (Quebec) Canada
H3K 1G6

1.877.937.3003
P.514.937.3003
F. 514.937.6289
info@lumenpulse.com
www.lumenpulse.com

5-year limited warranty.

Consult www.lumenpulse.com for our complete Standard Terms and Conditions of Sales.

lumenpulse

Lumenpulse reserves the right to make changes to this product at any time without prior notice and such modification shall be effective immediately.

Specification Sheet

lumenfacade™

INGROUND
DIRECT VIEW
WHITE & STATIC COLORS

ACCESSORIES

Order separately, refer to each item's specification sheet for ordering information

Control Systems:

LTO2 Lumentouch is a wall mount DMX 512 controller keypad.

LCU Lumencue is a USB / mini SD DMX 512 controller.

LID LumenID is a diagnostic and addressing DMX 512 controller.
It must be specified on all DMX applications.
Refer to LID specification sheet for details.

LTN Lumentone is a simple pre-programmed DMX 512 controller with a push button rotary dial and live feedback.

Control Boxes:

CBX DMX/RDM control box.
Up to six power and data outputs to fixtures or fixture runs.
Ethernet enabled option.
Refer to CBX specification sheet for details.

Cables **(required)**:

LOILC Leader Cable for Lumenfacade Inground 10', 25' or 50' [3m, 7.6m or 15.2m] standard lengths

LOIJC Jumper Cable for Lumenfacade Inground; 2', 4' or 10' [0.6m, 1.2m or 3m] standard lengths

Inground Junction Box (optional):

Lumenfacade Inground IP68 sealed junction box starter kit - **LOI-JBOX** order code.
*Use for stand alone fixtures and/or first of run fixtures

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Specification Sheet

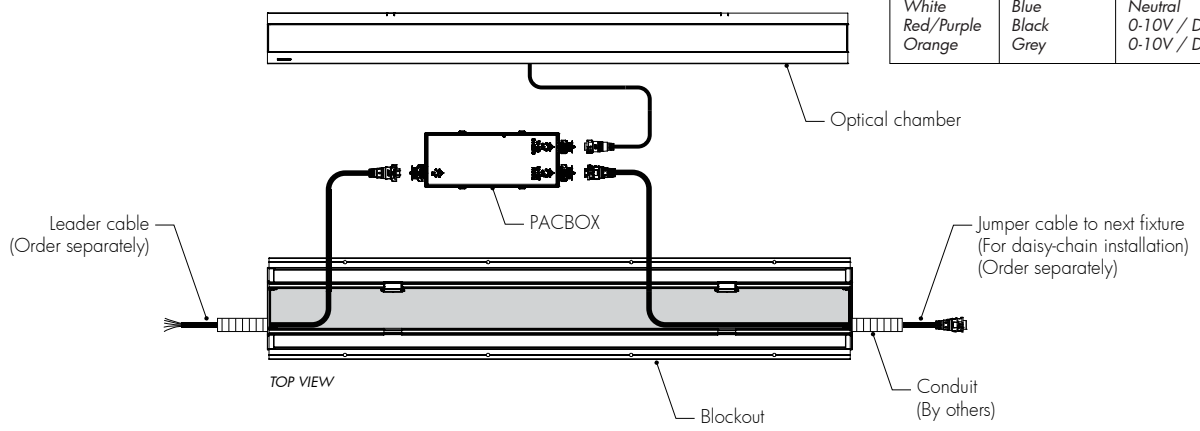
lumenfacade™

INGROUND
DIRECT VIEW
WHITE & STATIC COLORS

TYPICAL WIRING DIAGRAMS

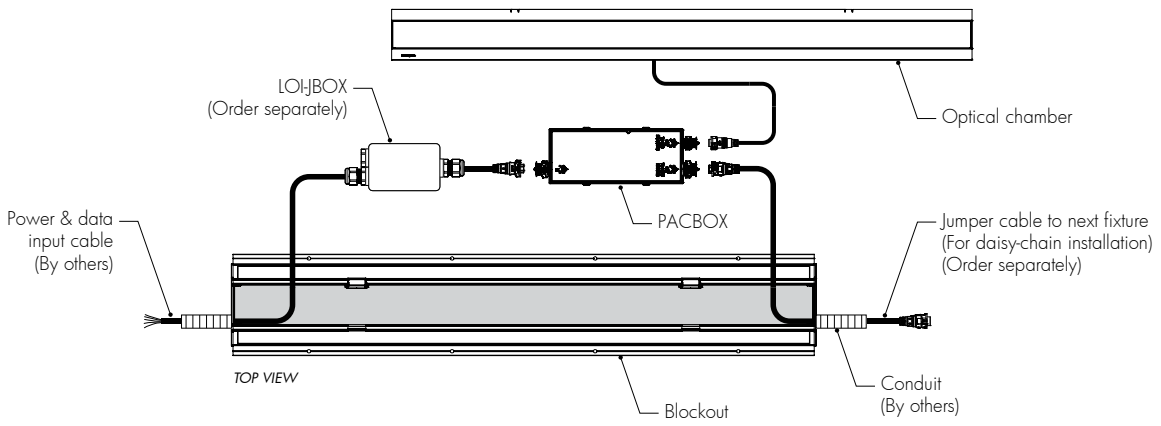
Typical Installation with Leader Cable

American Color Code	CE Color Code	USE
Green	Yellow/Green	Ground
Black	Brown	Live 100-277V
White	Blue	Neutral
Red/Purple	Black	0-10V / Data +
Orange	Grey	0-10V / Data -



Typical Installation with IP68 LOI-JBOX Accessory

Cannot be used with 1ft LOI fixture



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Montreal (Quebec) Canada
H3K 1G6

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www.lumenpulse.com

5-year limited warranty.

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lumenpulse

Lumenpulse reserves the right to make changes to this product at any time without prior notice and such modification shall be effective immediately.

Specification Sheet

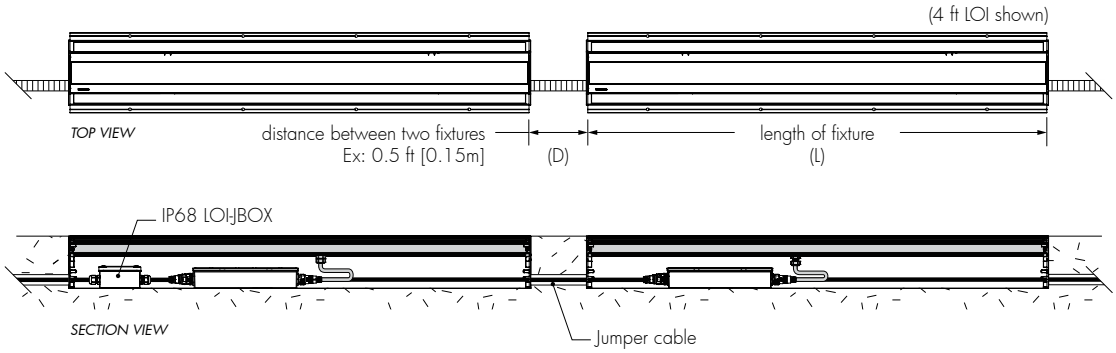
lumenfacade™

INGROUND
DIRECT VIEW
WHITE & STATIC COLORS

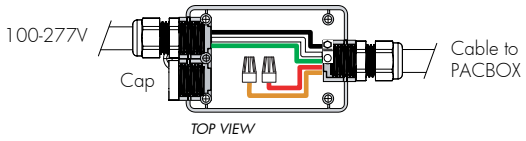
TYPICAL WIRING DIAGRAMS - continued

Non-Dimming or Lumentalk Dimming Version

1% minimum dimming value with Lumentalk dimming



IP68 LOI-JBOX Accessory - Wiring Detail

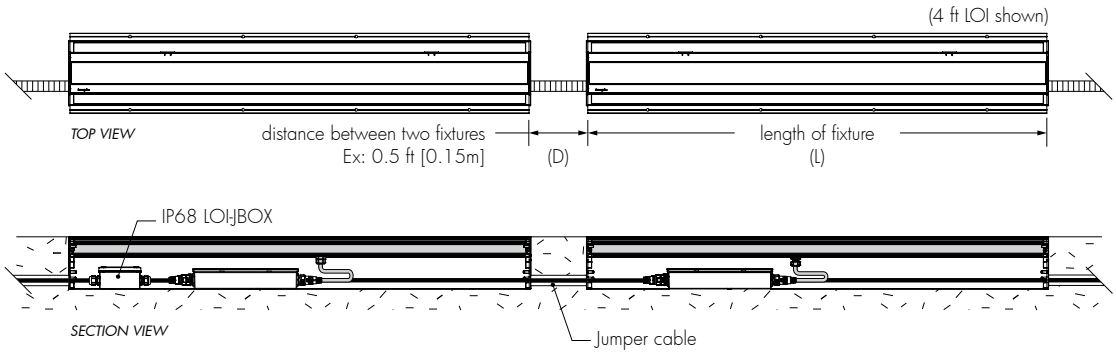


Jumper Cable Length Selection

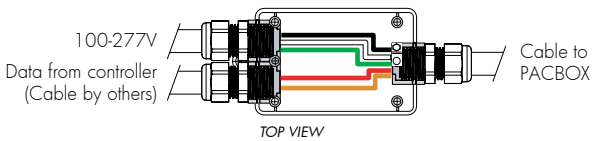
Add the length of one fixture to the distance between two fixtures: L + D.	Ex: L + D = 4.5ft [1.4m]
Order the next longest jumper cable available: **2', 4' or 10' [0.6m, 1.2m or 3m]**	Therefore 10' [3m] jumper cable required

Dimming Version (0-10V, DALI, EcoSystem®*)

10% minimum dimming value for 0-10V, 1% minimum dimming value for DALI, EcoSystem®



IP68 LOI-JBOX Accessory - Wiring Detail



Jumper Cable Length Selection

Add the length of one fixture to the distance between two fixtures: L + D.	Ex: L + D = 4.5ft [1.4m]
Order the next longest jumper cable available: **2', 4' or 10' [0.6m, 1.2m or 3m]**	Therefore 10' [3m] jumper cable required

*Each Lutron® EcoSystem® enabled fixture has its own address; for the example shown above, there are a total of 2 EcoSystem® addresses.

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5-year limited warranty.

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Specification Sheet

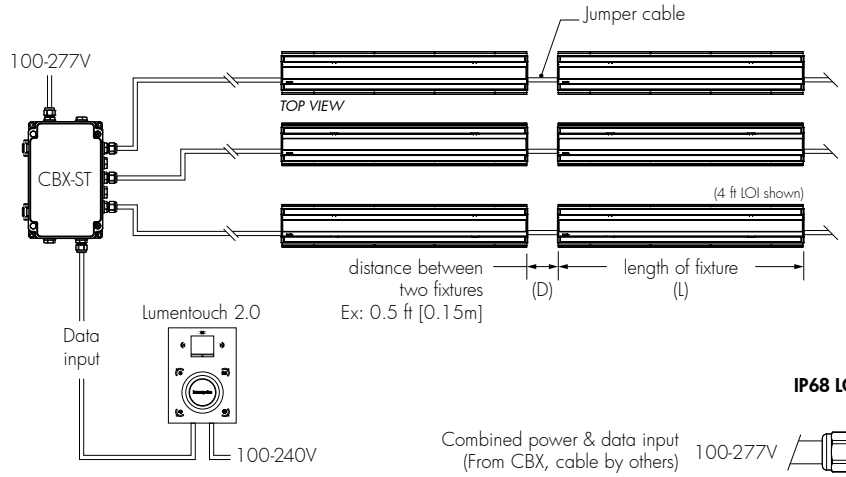
lumenfacade™

INGROUND
DIRECT VIEW
WHITE & STATIC COLORS

TYPICAL WIRING DIAGRAMS - continued

Star Layout (DMX Dimming)

1% minimum dimming value



Jumper Cable Length Selection

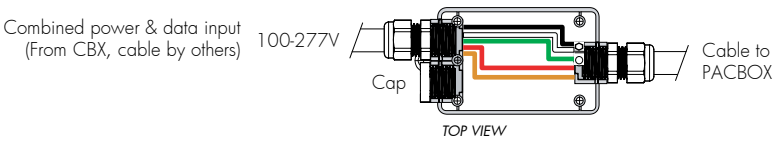
Add the length of one fixture to the distance between two fixtures: L + D.

Order the next longest jumper cable available: **2', 4' or 10' [0.6m, 1.2m or 3m]**

Ex: L + D = 4.5ft [1.4m]

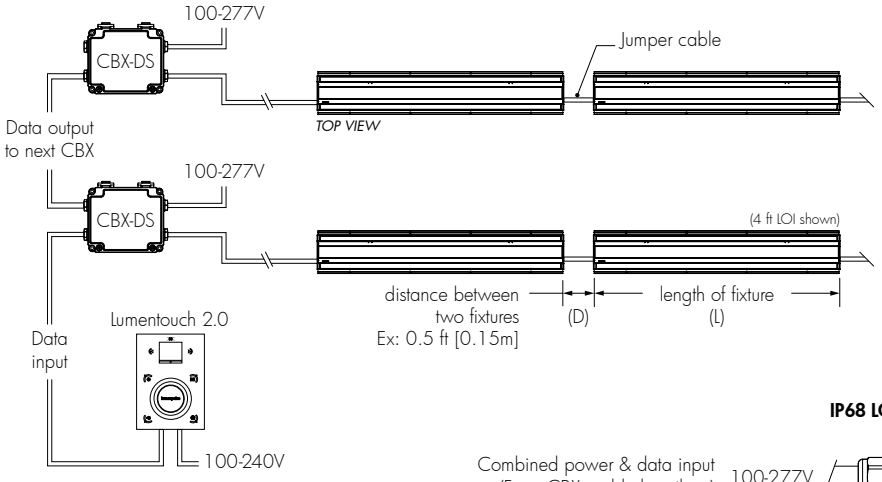
Therefore 10' [3m] jumper cable required

IP68 LOI-JBOX Accessory - Wiring Detail



Daisy Chain Layout (DMX Dimming)

1% minimum dimming value



Jumper Cable Length Selection

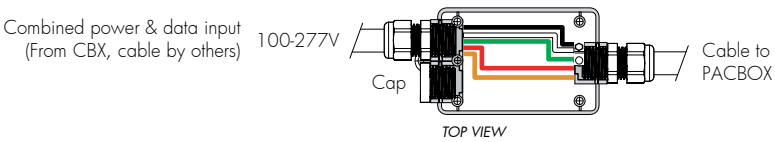
Add the length of one fixture to the distance between two fixtures: L + D.

Order the next longest jumper cable available: **2', 4' or 10' [0.6m, 1.2m or 3m]**

Ex: L + D = 4.5ft [1.4m]

Therefore 10' [3m] jumper cable required

IP68 LOI-JBOX Accessory - Wiring Detail



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5-year limited warranty.

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** (30) LOID-100/277-24-30K-DIM-ASL (30) PACBOX-277V-24V-DIM (30) LOI-RBO-24-GRD (1) LOILC-10 (1) LOI-JBOX (29) LOIJC-10FT Notes:	**Type:** EE LAI16-104794

Specification Sheet

lumenfacade™

INGROUND
DIRECT VIEW
WHITE & STATIC COLORS

HOW TO ORDER

LOID	100/277				
1	2	3	4	5	6

1

Housing:

LOID - Lumenfacade™ Inground Direct View, 5W/ft

A Lumenfacade Inground fixture includes 1x optical chamber (LOIC), 1x power and control box (PACBOX) and 1x recessed blockout (RBO). The LOIC, PACBOX and RBO are provided according to the output/color, length and control configuration.

2

Voltage:

100/277 - 100-277 volts

3

Length:

12 - 13 1/16 inches (331mm)
24 - 25 1/16 inches (636mm)
36 - 37 1/16 inches (941mm)
48 - 49 1/16 inches (1245mm)

4

Colors and Color temperatures:

27K - 2700K
30K - 3000K
35K - 3500K
40K - 4000K
RD - Red (8-10 weeks lead time)
GR - Green (8-10 weeks lead time)
BL - Blue (8-10 weeks lead time)

5

Control:

NO - No Dimming
LT - Lumentalk Dimming[1]
DIM - 0-10V Dimming[2]
DMX 1FT - DMX Dimming, resolution per foot[1]
DMX 1FX - DMX Dimming, resolution per fixture[1]
DALI - DALI Dimming[1]
ES - Lutron® EcoSystem® Enabled Dimming[3]

6

Option:

ASL - Anti-slip lens

PACBOX - POWER AND CONTROL BOX
RBO - INGROUND BLOCKOUT
LOILC-10 - LEADER CABLE 10FT
LOIJC-10 - JUMPER CABLE 10FT
JBOX - FIXTURE JUNCTION BOX - REQUIRED PER FIXTURE

Notes:

[1] 1% minimum dimming value.
[2] 10% minimum dimming value.
[3] One EcoSystem® address per fixture length. 1% minimum dimming value.

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25/NO/2015
N.Kassabian - Rev.10

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
1A-1970LED-F-GTSR-SV1-4ARC35K-T3-F/EZ/62PM-MOD/550P-12/CM/DRYLAC 29/65650

Notes: COLOR TO MATCH OTHER PHASE

Type:
EG3
LAI16-104794



GALLERY 1970LED

The 1970LED Gallery series is large scale, decorative downlight fixture with a spun aluminum shade. The dome is available with two types of shades: straight (S) and flared (F) styles. The luminaire shall measure 24" outside diameter and 16 3/8" overall height. The luminaire shall have a hinged door for tool-less driver and LED access. The luminaire shall be supplied with the line-ground, line neutral and neutral-ground electrical surge protection in accordance with IEEE/ANSE C62.41.2 guidelines. The luminaire shall be U.L. or E.T.L. listed in U.S. and Canada.

SternbergLighting
ESTABLISHED 1923 / EMPLOYEE OWNED

PROJECT:

TYPE:

ORDERING EXAMPLE: 1A-1970LED-FGW-EZ-FG-6ARC35T2-F-MDH03-R-HSS-FHD/UBKT

MOUNT CONFIG.	SERIES Large Scale Downlight		GLOW RINGS[4]	MOUNT OPTIONS	LENS	NO. OF LEDS	COLOR TEMP K	DISTR. TYPE	DISTR. ORIENT.	DRIVER	CONTROLS	HOUSE SIDE SHIELD	DUAL FUSE & HOLDER	OPTIONAL FINIAL[1,2]	COLOR	
1W	1970LED-S BF	1970LED-S GW[3]	BLUE	EZ	FG	10ARC	27(00) K	T2	F	MDL03	OPTIONS				UBKT	BK
1A	1970LED-F BF	1970LED-F GW[3]	GREEN	HS-H	SG	8ARC	35(00) K	T3	R	MDH03	R1[1]	HSS	FHD	B	UBT	WH
2A	1970LED-S BT	1970LED-S HW[3]	RED	HS-C	FSG	6ARC	45(00) K	T3R	L		R1[1]			S	ULBT	PG
2A90	1970LED-F BT	1970LED-F HW[3]	CLEAR	SH-44	SV1*	4ARC		T4	S		PEC				USLT	ABZ
3A	1970LED-S CW[3]	1970LED-S BTSR		CH-44	SV2**			T5							UWHT	DB
3A90	1970LED-F CW[3]	1970LED-F BTSR													UCHS	OI
4A	1970LED-S GR[3]	1970LED-S GTSR[3]													UBK	RT
	1970LED-F GR[3]	1970LED-F GTSR[3]													UB	WBR
															ULB	CD
															USL	WBK
															UWH	TT
															BKT	VG
															WHT	SI
															PGT	OWGT
															ABZT	
															DBT	

[1] Only available with HS-H and HS-C mounting. [2] Not available with Twist-lock photocell. [3] Illuminated LED glow option. [4] Only available with 1970LED-S GR and 1970LED-F GR.

Product Specs

Optical
- IP65 rated. BUG rating of U-0.
- Utilizes high output, high brightness LEDs.
- Operates at -40°C (-40°F) to +50°C (122°F) ambient air temperature range.
- Minimum CRI of 70, CCT 2700, 3500, and 4500K. Call factory for other CCT.
- LM-79 and LM-80 tests in accordance with IESNA standards.
- Lumen depreciation rating L70 > 200,000 hrs. Projected per TM-21 guideline and based on 350mA drive current.
- RoHS Compliant.

Electrical
- 120-277 volt standard and 347-480 volt option available.
- Minimum drivers power factor: >0.9.
- Electrical surge protection in accordance with IEEE/ANSI C62.41.2 guidelines (10kV).
- UL or ETL listed in U.S. and Canada.
- Illuminated LED glow options are provided with 12 LEDs in the upper housing and will increase system wattage 12W.[5]

[5] Will contribute uplight and will be a BUG rating of U-1.

Mechanical
- A large scale decorative downlight fixture. The housing is a spun aluminum bell shade attached to a cast aluminum top.
- The luminaire shall be supplied with an aluminum door frame and lens with tool-less access.
- The fixture is offered with many different hangstraight mounting options to accomodate a variety of installations. See mounting options section.
- Luminaire housing is IP65 rated (BF version only).

Controls
- Optional Twist-lock receptacle only R[1].
- Optional Twist-lock receptacle with photocell R1[1].
- Optional electronic button photocell: PEC (120-277V).[6]

[6] Eliminates IP rating fixture.

Finish
- Durable, color retentive powder coat finish.

Warranty & Standards
LED Systems and Drivers - 7 years. All fixtures shall be free from all defects in materials and workmanship for a period of 7 years from the date of manufacture. The luminaire manufacturer shall warrant the LED boards/system, during the stated warranty period, against failure defined as more than 10 percent of non-operating LEDs.

Drivers (0-10V dimming):
MDL03: 350mA, 120-277V **MDH03:** 350mA, 347-480V

Lens:
FG - Clear Flat Glass Lens
SG - Clear Sag Glass Lens
FSG - Frosted Sag Glass Lens

Soft Vue (coming September 2014)**:**
SV1* - Flat Medium Diffuse Acrylic Lens
SV2** - Flat Heavy Diffuse Acrylic Lens

* Provides moderate reduction in Brightness while only a minimal reduction in lumen output.

**Provides maximum reduction in Brightness while only a nominal reduction in lumen output. Consult photometric files for exact lumen performance.

Colors

Urbanline Finishes
UBKT - Urban Black Textured
UBT - Urban Bronze Textured
ULBT - Urban Light Bronze Textured
USLT - Urban Silver Textured
UWHT - Urban White Textured
UCHS - Urban Champagne Satin Smooth
UBK - Urban Black Matte
UB - Urban Bronze Matte
ULB - Urban Light Bronze Matte
USL - Urban Silver Matte
UWH - Urban White Matte

Standard Finishes
BKT - Black Textured
BK - Black
WHT - White Textured
WH - White
PGT - Park Green Textured
PG - Park Green
ABZT - Architectural Medium Bronze Textured
ABZ - Architectural Medium Bronze
DBT - Dark Bronze Textured
DB - Dark Bronze

Custom Finishes
OI - Old Iron
RT - Rust
WBR - Weathered Brown
CD - Cedar
WBK - Weathered Black
TT - Two Tone

Sternberg Select Finishes
VG - Verde Green
SI - Swedish Iron
OWGT - Old World Gray Textured

Distribution Orientation



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Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
1A-1970LED-F-GTSR-SV1-4ARC35K-T3-F/EZ/62PM-MOD/550P-12/CM/DRYLAC 29/65650

Notes: COLOR TO MATCH OTHER PHASE

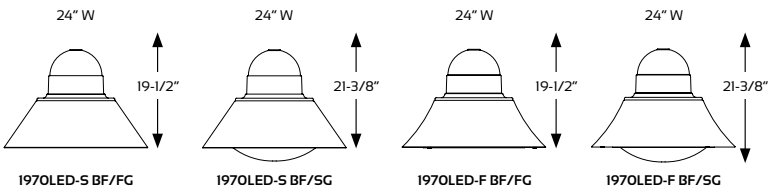
Type:
EG3
LAI16-104794

Product Dimensions and Features

All models available with Straight (S) or Flared (F) shades

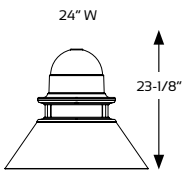
EPA: 0.93 SQUARE FT
WEIGHT: 38 LBS

1970LED GALLERY BF BASE FIXTURE



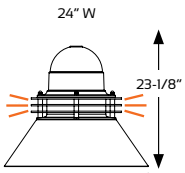
1970LED-S BF/FG | 1970LED-S BF/SG | 1970LED-F BF/FG | 1970LED-F BF/SG

1970LED GALLERY BT BLANK TOP



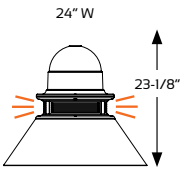
1970LED-S BT/SG

1970LED GALLERY GR GLOW RINGS



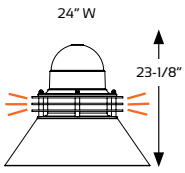
1970LED-S GR/FG

1970LED GALLERY HW HORIZONTAL WINDOW



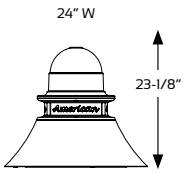
1970LED-S HW/FG

1970LED GALLERY GLOW TOP SOLID RINGS



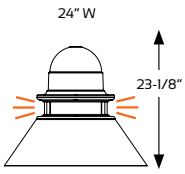
1970LED-S GTSR/FG

1970LED GALLERY CW CUSTOM WINDOW DESIGNS



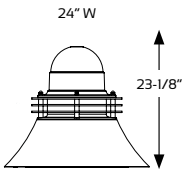
1970LED-F CW/FG

1970LED GALLERY GW GLOW WINDOW



1970LED-S GW/FG

1970LED GALLERY BTSR BLANK TOP SOLID RINGS



1970LED-F BTSR/FG

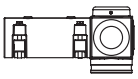
Mounting Options



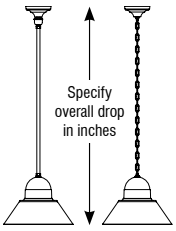
EZ
EZ Hang
Vertical
2-3/4"W x
4"H



HS-H
Horizontal
8-1/4"W x
7-5/8"H



HS-C
Clamp
12-1/2"W x
7-5/8"H



SH44
Stem Hung

CH44
Chain Hung

Optional Finials*



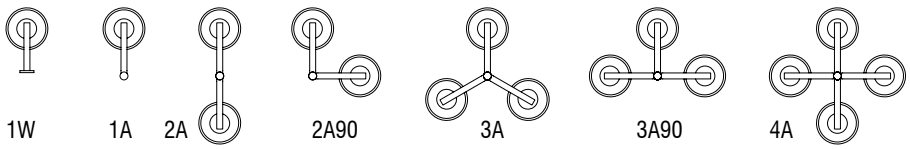
B
Ball Finial
3"W x 4-3/8"H



S
Spiked Finial
2-1/2"W x 6-3/8"H

* Only available with HS-H, HS-C, and SM mounting

Mounting Configurations



1W | 1A | 2A | 2A90 | 3A | 3A90 | 4A

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Job Name:
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Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

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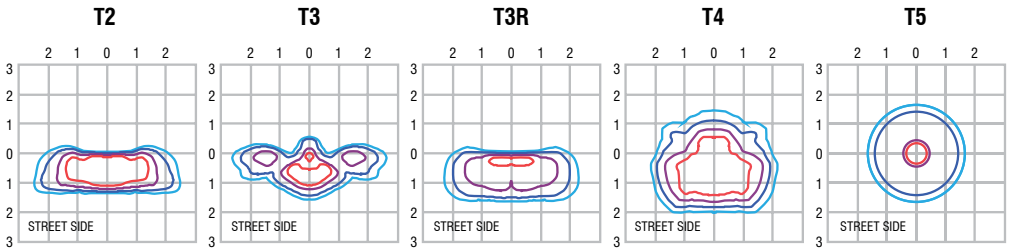
Notes: COLOR TO MATCH OTHER PHASE

Type:
EG3
LAI16-104794

Performance (Based on FG Lens)

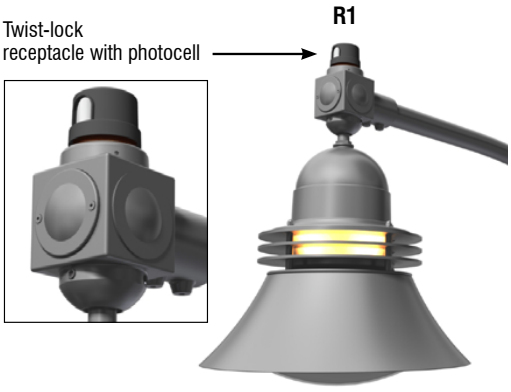
MODEL #	T2 DELIVERED LUMENS	EFFICACY (LPW)	T3 DELIVERED LUMENS	EFFICACY (LPW)	T3R DELIVERED LUMENS	EFFICACY (LPW)	T4 DELIVERED LUMENS	EFFICACY (LPW)	T5 DELIVERED LUMENS	EFFICACY (LPW)	WATT-AGE
4ARC27	4905	74.3	4575	69.3	4940	74.8	4810	72.9	4740	71.8	66
4ARC35	5595	84.8	5220	79.1	5630	85.3	5480	83.0	5405	81.9	66
4ARC45	5965	90.4	5560	84.2	6000	90.9	5840	88.5	5760	87.3	66
6ARC27	7105	73.2	6760	69.7	6895	71.1	6770	69.8	6725	69.3	97
6ARC35	8105	83.6	7705	79.4	7865	81.1	7720	79.6	7670	79.1	97
6ARC45	8635	89.0	8215	84.7	8380	86.4	8230	84.8	8170	84.2	97
8ARC27	9465	74.5	9085	71.5	9230	72.7	9055	71.3	8870	69.8	127
8ARC35	10790	85.0	10360	81.6	10525	82.9	10325	81.3	10115	79.6	127
8ARC45	11500	90.6	11040	86.9	11215	88.3	11000	86.6	10780	84.9	127
10ARC27	11530	72.1	11105	69.4	11330	70.8	11080	69.3	10965	68.5	160
10ARC35	13145	82.2	12665	79.2	12920	80.8	12635	79.0	12505	78.2	160
10ARC45	14010	87.6	13495	84.3	13770	86.1	13465	84.2	13325	83.3	160

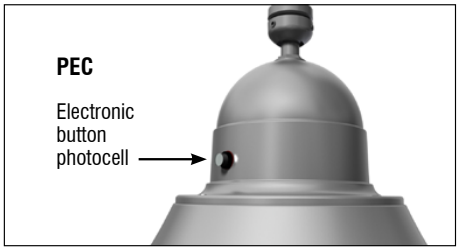
ISO Footcandle Plots



All published luminaire photometric testing performed to IESNA LM-79 standards by NVLAP, certified laboratory. ISO footcandle plots demonstrate the GALLERY 1970LED light patterns only. Not for total fixture output. For complete specifications and IES files, see website.

Other Options





SternbergLighting
ESTABLISHED 1923 / EMPLOYEE OWNED

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info@sternberglighting.com
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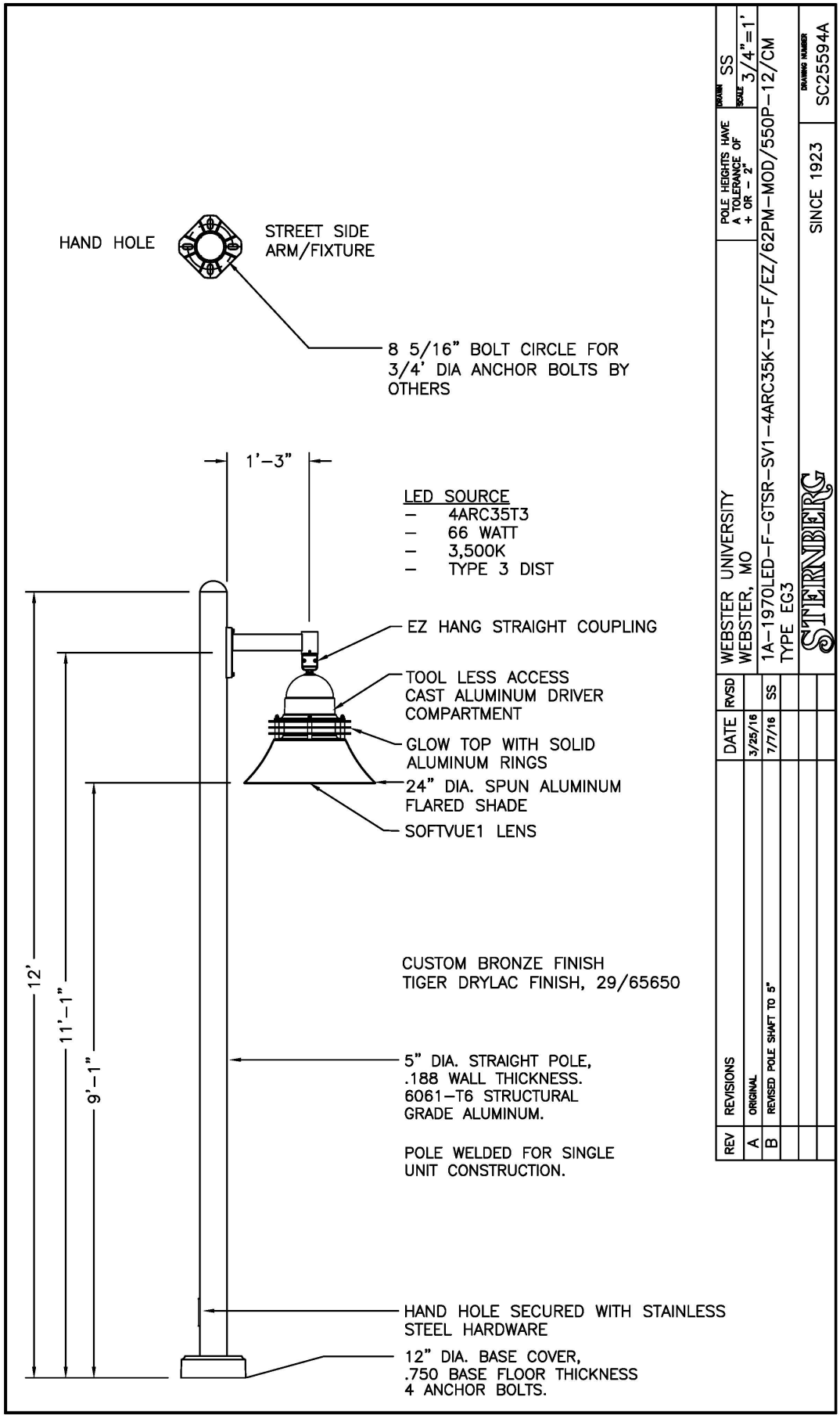
Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
1A-1970LED-F-GTSR-SV1-4ARC35K-T3-F/EZ/62PM-MOD/550P-12/CM/DRYLAC 29/65650

Notes: COLOR TO MATCH OTHER PHASE

Type:
EG3

LAI16-104794



Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
1A-1970LED-F-GTSR-SV1-4ARC35K-T5-F/EZ/62PM-MOD/550P-12/CM/DRYLAC 29/65650

Notes: COLOR TO MATCH OTHER PHASE

Type:
EG5

LAI16-104794



GALLERY 1970LED

The 1970LED Gallery series is large scale, decorative downlight fixture with a spun aluminum shade. The dome is available with two types of shades: straight (S) and flared (F) styles. The luminaire shall measure 24" outside diameter and 16 3/8" overall height. The luminaire shall have a hinged door for tool-less driver and LED access. The luminaire shall be supplied with the line-ground, line neutral and neutral-ground electrical surge protection in accordance with IEEE/ANSE C62.41.2 guidelines. The luminaire shall be U.L. or E.T.L. listed in U.S. and Canada.

SternbergLighting
ESTABLISHED 1923 / EMPLOYEE OWNED

PROJECT:

TYPE:

ORDERING EXAMPLE: 1A-1970LED-FGW-EZ-FG-6ARC35T2-F-MDH03-R-HSS-FHD/UBKT

MOUNT CONFIG.	SERIES Large Scale Downlight		GLOW RINGS[4]	MOUNT OPTIONS	LENS	NO. OF LEDS	COLOR TEMP K	DISTR. TYPE	DISTR. ORIENT.	DRIVER	CONTROLS	HOUSE SIDE SHIELD	DUAL FUSE & HOLDER	OPTIONAL FINIAL[1,2]	COLOR	
1W	1970LED-S BF	1970LED-S GW[3]	BLUE	EZ	FG	10ARC	27(00) K	T2	F	MDL03	OPTIONS				UBKT	BK
1A	1970LED-F BF	1970LED-F GW[3]	GREEN	HS-H	SG	8ARC	35(00) K	T3	R	MDH03	R[1]	HSS	FHD	B	UBT	WH
2A	1970LED-S BT	1970LED-S HW[3]	RED	HS-C	FSG	6ARC	45(00) K	T3R	L		R1[1]			S	ULBT	PG
2A90	1970LED-F BT	1970LED-F HW[3]	CLEAR	SH-44	SV1*	4ARC		T4	S		PEC				USLT	ABZ
3A	1970LED-S CW[3]	1970LED-S BTSR		CH-44	SV2**			T5							UWHT	DB
3A90	1970LED-F CW[3]	1970LED-F BTSR													UCHS	OI
4A	1970LED-S GR[3]	1970LED-S GTSR[3]													UBK	RT
	1970LED-F GR[3]	1970LED-F GTSR[3]													UB	WBR
															ULB	CD
															USL	WBK
															UWH	TT
															BKT	VG
															WHT	SI
															PGT	OWGT
															ABZT	
															DBT	

[1] Only available with HS-H and HS-C mounting. [2] Not available with Twist-lock photocell. [3] Illuminated LED glow option. [4] Only available with 1970LED-S GR and 1970LED-F GR.

Product Specs

Optical
- IP65 rated. BUG rating of U-0.
- Utilizes high output, high brightness LEDs.
- Operates at -40°C (-40°F) to +50°C (122°F) ambient air temperature range.
- Minimum CRI of 70, CCT 2700, 3500, and 4500K. Call factory for other CCT.
- LM-79 and LM-80 tests in accordance with IESNA standards.
- Lumen depreciation rating L70 > 200,000 hrs. Projected per TM-21 guideline and based on 350mA drive current.
- RoHS Compliant.

Electrical
- 120-277 volt standard and 347-480 volt option available.
- Minimum drivers power factor: >0.9.
- Electrical surge protection in accordance with IEEE/ANSI C62.41.2 guidelines (10kV).
- UL or ETL listed in U.S. and Canada.
- Illuminated LED glow options are provided with 12 LEDs in the upper housing and will increase system wattage 12W.[5]

[5] Will contribute uplight and will be a BUG rating of U-1.

Mechanical
- A large scale decorative downlight fixture. The housing is a spun aluminum bell shade attached to a cast aluminum top.
- The luminaire shall be supplied with an aluminum door frame and lens with tool-less access.
- The fixture is offered with many different hangstraight mounting options to accomodate a variety of installations. See mounting options section.
- Luminaire housing is IP65 rated (BF version only).

Controls
- Optional Twist-lock receptacle only R[1].
- Optional Twist-lock receptacle with photocell R1[1].
- Optional electronic button photocell: PEC (120-277V).[6]

[6] Eliminates IP rating fixture.

Finish
- Durable, color retentive powder coat finish.

Warranty & Standards
LED Systems and Drivers - 7 years. All fixtures shall be free from all defects in materials and workmanship for a period of 7 years from the date of manufacture. The luminaire manufacturer shall warrant the LED boards/system, during the stated warranty period, against failure defined as more than 10 percent of non-operating LEDs.

Drivers (0-10V dimming):
MDL03: 350mA, 120-277V **MDH03:** 350mA, 347-480V

Lens:
FG - Clear Flat Glass Lens
SG - Clear Sag Glass Lens
FSG - Frosted Sag Glass Lens

Soft Vue (coming September 2014)**:**
SV1* - Flat Medium Diffuse Acrylic Lens
SV2** - Flat Heavy Diffuse Acrylic Lens

* Provides moderate reduction in Brightness while only a minimal reduction in lumen output.

**Provides maximum reduction in Brightness while only a nominal reduction in lumen output. Consult photometric files for exact lumen performance.

Colors

Urbanline Finishes
UBKT - Urban Black Textured
UBT - Urban Bronze Textured
ULBT - Urban Light Bronze Textured
USLT - Urban Silver Textured
UWHT - Urban White Textured
UCHS - Urban Champagne Satin Smooth
UBK - Urban Black Matte
UB - Urban Bronze Matte
ULB - Urban Light Bronze Matte
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UWH - Urban White Matte

Standard Finishes
BKT - Black Textured
BK - Black
WHT - White Textured
WH - White
PGT - Park Green Textured
PG - Park Green
ABZT - Architectural Medium Bronze Textured
ABZ - Architectural Medium Bronze
DBT - Dark Bronze Textured
DB - Dark Bronze

Custom Finishes
OI - Old Iron
RT - Rust
WBR - Weathered Brown
CD - Cedar
WBK - Weathered Black
TT - Two Tone

Sternberg Select Finishes
VG - Verde Green
SI - Swedish Iron
OWGT - Old World Gray Textured

Distribution Orientation



800-621-3376 | 555 Lawrence Ave., Roselle, IL 60172 | info@sternberglighting.com | www.sternberglighting.com

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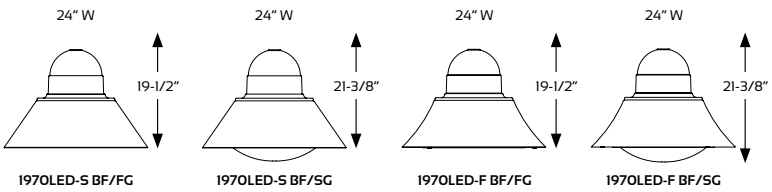
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** 1A-1970LED-F-GTSR-SV1-4ARC35K-T5-F/EZ/62PM-MOD/550P-12/CM/DRYLAC 29/65650 Notes: COLOR TO MATCH OTHER PHASE	**Type:** **EG5** LAI16-104794

Product Dimensions and Features

All models available with Straight (S) or Flared (F) shades

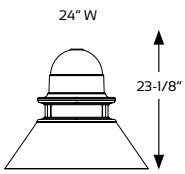
EPA: 0.93 SQUARE FT
WEIGHT: 38 LBS

1970LED GALLERY BF BASE FIXTURE



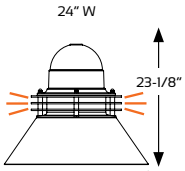
1970LED-S BF/FG | 1970LED-S BF/SG | 1970LED-F BF/FG | 1970LED-F BF/SG

1970LED GALLERY BT BLANK TOP



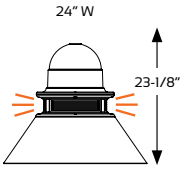
1970LED-S BT/SG

1970LED GALLERY GR GLOW RINGS



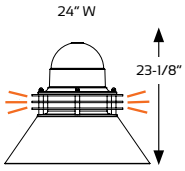
1970LED-S GR/FG

1970LED GALLERY HW HORIZONTAL WINDOW



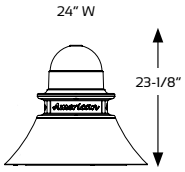
1970LED-S HW/FG

1970LED GALLERY GLOW TOP SOLID RINGS



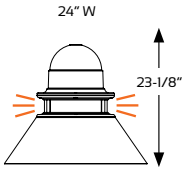
1970LED-S GTSR/FG

1970LED GALLERY CW CUSTOM WINDOW DESIGNS



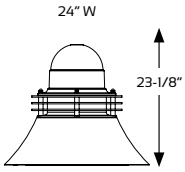
1970LED-F CW/FG

1970LED GALLERY GW GLOW WINDOW



1970LED-S GW/FG

1970LED GALLERY BTSR BLANK TOP SOLID RINGS



1970LED-F BTSR/FG

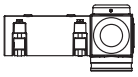
Mounting Options



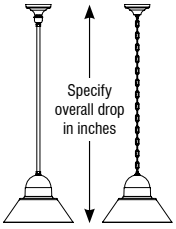
EZ
EZ Hang
Vertical
2-3/4"W x
4"H



HS-H
Horizontal
8-1/4"W x
7-5/8"H



HS-C
Clamp
12-1/2"W x
7-5/8"H



SH44
Stem Hung

CH44
Chain Hung

Optional Finials*



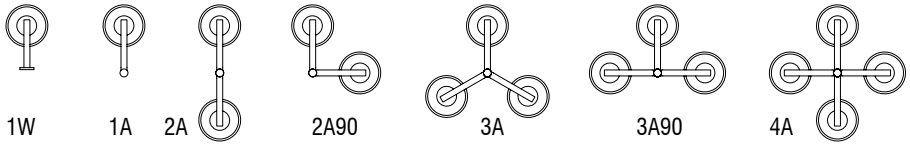
B
Ball Finial
3"W x 4-3/8"H



S
Spiked Finial
2-1/2"W x 6-3/8"H

* Only available with HS-H, HS-C, and SM mounting

Mounting Configurations



1W | 1A | 2A | 2A90 | 3A | 3A90 | 4A

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Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
1A-1970LED-F-GTSR-SV1-4ARC35K-T5-F/EZ/62PM-MOD/550P-12/CM/DRYLAC 29/65650

Notes: COLOR TO MATCH OTHER PHASE

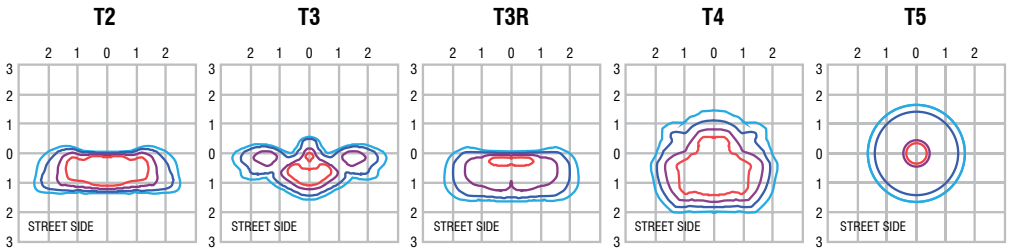
Type:
EG5

LAI16-104794

Performance (Based on FG Lens)

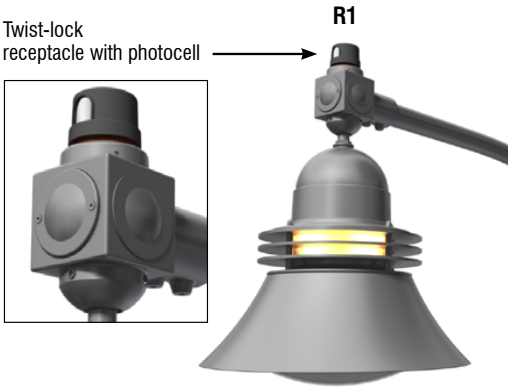
MODEL #	T2 DELIVERED LUMENS	EFFICACY (LPW)	T3 DELIVERED LUMENS	EFFICACY (LPW)	T3R DELIVERED LUMENS	EFFICACY (LPW)	T4 DELIVERED LUMENS	EFFICACY (LPW)	T5 DELIVERED LUMENS	EFFICACY (LPW)	WATT-AGE
4ARC27	4905	74.3	4575	69.3	4940	74.8	4810	72.9	4740	71.8	66
4ARC35	5595	84.8	5220	79.1	5630	85.3	5480	83.0	5405	81.9	66
4ARC45	5965	90.4	5560	84.2	6000	90.9	5840	88.5	5760	87.3	66
6ARC27	7105	73.2	6760	69.7	6895	71.1	6770	69.8	6725	69.3	97
6ARC35	8105	83.6	7705	79.4	7865	81.1	7720	79.6	7670	79.1	97
6ARC45	8635	89.0	8215	84.7	8380	86.4	8230	84.8	8170	84.2	97
8ARC27	9465	74.5	9085	71.5	9230	72.7	9055	71.3	8870	69.8	127
8ARC35	10790	85.0	10360	81.6	10525	82.9	10325	81.3	10115	79.6	127
8ARC45	11500	90.6	11040	86.9	11215	88.3	11000	86.6	10780	84.9	127
10ARC27	11530	72.1	11105	69.4	11330	70.8	11080	69.3	10965	68.5	160
10ARC35	13145	82.2	12665	79.2	12920	80.8	12635	79.0	12505	78.2	160
10ARC45	14010	87.6	13495	84.3	13770	86.1	13465	84.2	13325	83.3	160

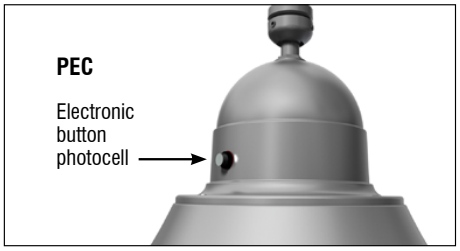
ISO Footcandle Plots



All published luminaire photometric testing performed to IESNA LM-79 standards by NVLAP, certified laboratory. ISO footcandle plots demonstrate the GALLERY 1970LED light patterns only. Not for total fixture output. For complete specifications and IES files, see website.

Other Options





SternbergLighting
ESTABLISHED 1923 / EMPLOYEE OWNED

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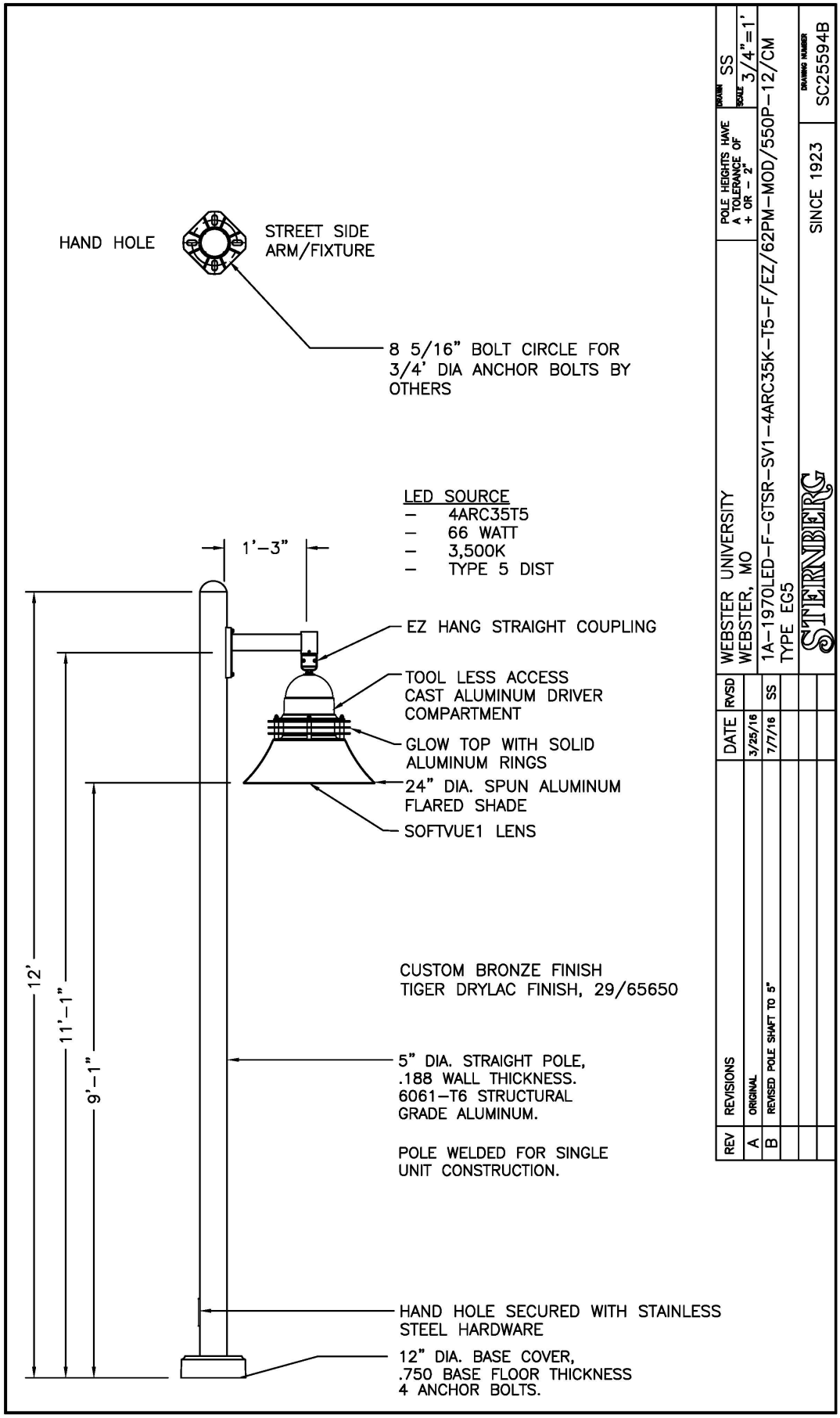
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Notes: COLOR TO MATCH OTHER PHASE

Type:
EG5

LAI16-104794



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Notes: COLOR TO MATCH OTHER PHASE

Type:
EG5R
LAI16-104794



GALLERY 1970LED

The 1970LED Gallery series is large scale, decorative downlight fixture with a spun aluminum shade. The dome is available with two types of shades: straight (S) and flared (F) styles. The luminaire shall measure 24" outside diameter and 16 3/8" overall height. The luminaire shall have a hinged door for tool-less driver and LED access. The luminaire shall be supplied with the line-ground, line neutral and neutral-ground electrical surge protection in accordance with IEEE/ANSE C62.41.2 guidelines. The luminaire shall be U.L. or E.T.L. listed in U.S. and Canada.

SternbergLighting
ESTABLISHED 1923 / EMPLOYEE OWNED

PROJECT:

TYPE:

ORDERING EXAMPLE: 1A-1970LED-FGW-EZ-FG-6ARC35T2-F-MDH03-R-HSS-FHD/UBKT

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2A	1970LED-S BT	1970LED-S HW[3]	RED	HS-C	FSG	6ARC	45(00) K	T3R	L		R1[1]			S	ULBT	PG
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															WHT	SI
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- Minimum CRI of 70, CCT 2700, 3500, and 4500K. Call factory for other CCT.
- LM-79 and LM-80 tests in accordance with IESNA standards.
- Lumen depreciation rating L70 > 200,000 hrs. Projected per TM-21 guideline and based on 350mA drive current.
- RoHS Compliant.

Electrical
- 120-277 volt standard and 347-480 volt option available.
- Minimum drivers power factor: >0.9.
- Electrical surge protection in accordance with IEEE/ANSI C62.41.2 guidelines (10kV).
- UL or ETL listed in U.S. and Canada.
- Illuminated LED glow options are provided with 12 LEDs in the upper housing and will increase system wattage 12W.[5]

[5] Will contribute uplight and will be a BUG rating of U-1.

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- Optional Twist-lock receptacle with photocell R1[1].
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DB - Dark Bronze

Custom Finishes
OI - Old Iron
RT - Rust
WBR - Weathered Brown
CD - Cedar
WBK - Weathered Black
TT - Two Tone

Sternberg Select Finishes
VG - Verde Green
SI - Swedish Iron
OWGT - Old World Gray Textured

Distribution Orientation



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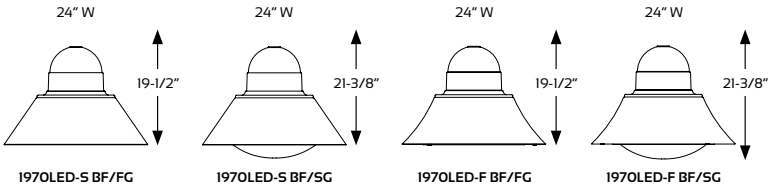
Submitted by LIGHTING ASSOCIATES, INC.	**Catalog Number:**	**Type:**
Job Name: WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	1A-1970LED-F-GTSR-SV1-4ARC35K-T5-F-/EZ/62PM-MOD/550P-12/1-GFI/LPIUC/CM DRYLAC 29/65650 Notes: COLOR TO MATCH OTHER PHASE	**EG5R** LAI16-104794

Product Dimensions and Features

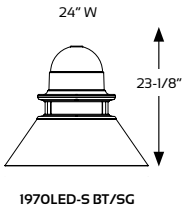
All models available with Straight (S) or Flared (F) shades

EPA: 0.93 SQUARE FT
WEIGHT: 38 LBS

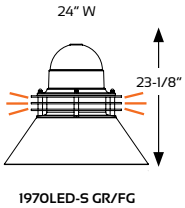
1970LED GALLERY BF BASE FIXTURE



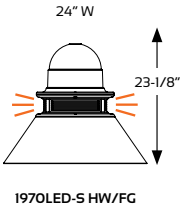
1970LED GALLERY BT BLANK TOP



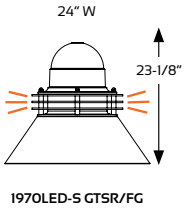
1970LED GALLERY GR GLOW RINGS



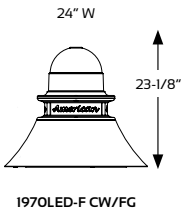
1970LED GALLERY HW HORIZONTAL WINDOW



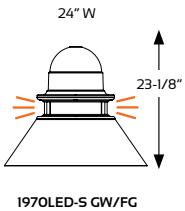
1970LED GALLERY GLOW TOP SOLID RINGS



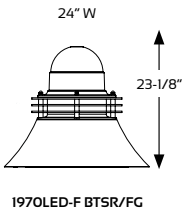
1970LED GALLERY CW CUSTOM WINDOW DESIGNS



1970LED GALLERY GW GLOW WINDOW



1970LED GALLERY BTSR BLANK TOP SOLID RINGS

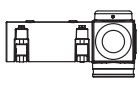


Mounting Options

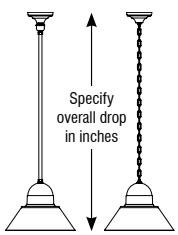


EZ
EZ Hang
Vertical
2-3/4"W x
4"H

HS-H
Horizontal
8-1/4"W x
7-5/8"H



HS-C
Clamp
12-1/2"W x
7-5/8"H



SH44
Stem Hung

CH44
Chain Hung

Optional Finials*



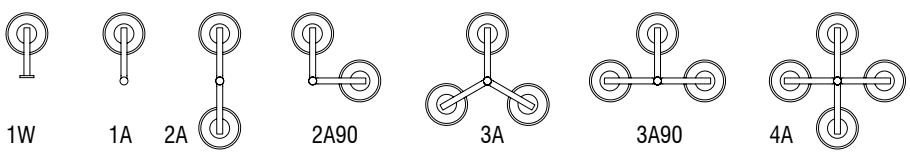
B
Ball Finial
3"W x 4-3/8"H



S
Spiked Finial
2-1/2"W x 6-3/8"H

* Only available with HS-H, HS-C, and SM mounting

Mounting Configurations



800-621-3376 | 555 Lawrence Ave., Roselle, IL 60172 | info@sternberglighting.com | www.sternberglighting.com

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Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
1A-1970LED-F-GTSR-SV1-4ARC35K-T5-F-/EZ/62PM-MOD/550P-12/1-GFI/LPIUC/CM DRYLAC 29/65650

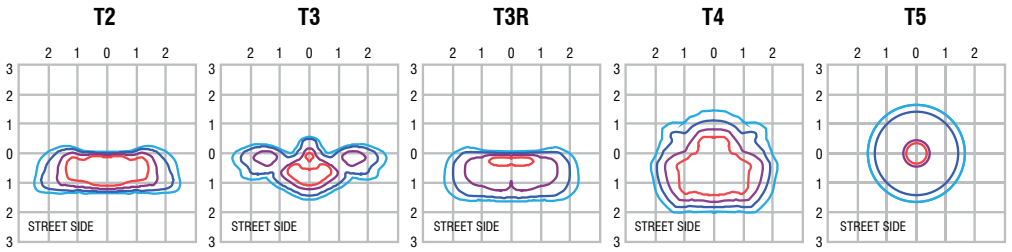
Notes: COLOR TO MATCH OTHER PHASE

Type:
EG5R
LAI16-104794

Performance (Based on FG Lens)

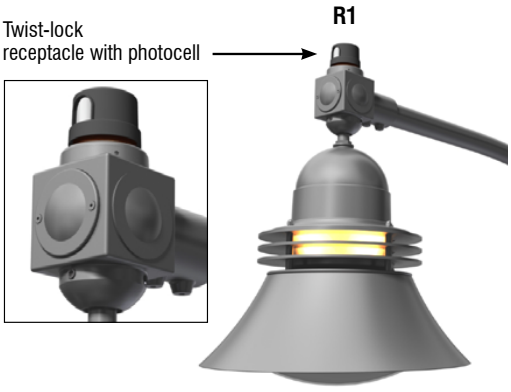
MODEL #	T2 DELIVERED LUMENS	EFFICACY (LPW)	T3 DELIVERED LUMENS	EFFICACY (LPW)	T3R DELIVERED LUMENS	EFFICACY (LPW)	T4 DELIVERED LUMENS	EFFICACY (LPW)	T5 DELIVERED LUMENS	EFFICACY (LPW)	WATT-AGE
4ARC27	4905	74.3	4575	69.3	4940	74.8	4810	72.9	4740	71.8	66
4ARC35	5595	84.8	5220	79.1	5630	85.3	5480	83.0	5405	81.9	66
4ARC45	5965	90.4	5560	84.2	6000	90.9	5840	88.5	5760	87.3	66
6ARC27	7105	73.2	6760	69.7	6895	71.1	6770	69.8	6725	69.3	97
6ARC35	8105	83.6	7705	79.4	7865	81.1	7720	79.6	7670	79.1	97
6ARC45	8635	89.0	8215	84.7	8380	86.4	8230	84.8	8170	84.2	97
8ARC27	9465	74.5	9085	71.5	9230	72.7	9055	71.3	8870	69.8	127
8ARC35	10790	85.0	10360	81.6	10525	82.9	10325	81.3	10115	79.6	127
8ARC45	11500	90.6	11040	86.9	11215	88.3	11000	86.6	10780	84.9	127
10ARC27	11530	72.1	11105	69.4	11330	70.8	11080	69.3	10965	68.5	160
10ARC35	13145	82.2	12665	79.2	12920	80.8	12635	79.0	12505	78.2	160
10ARC45	14010	87.6	13495	84.3	13770	86.1	13465	84.2	13325	83.3	160

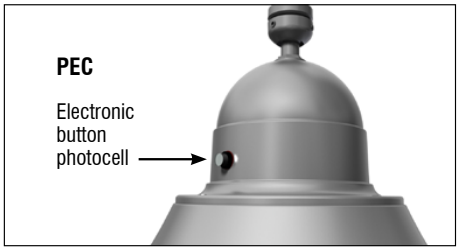
ISO Footcandle Plots



All published luminaire photometric testing performed to IESNA LM-79 standards by NVLAP, certified laboratory. ISO footcandle plots demonstrate the GALLERY 1970LED light patterns only. Not for total fixture output. For complete specifications and IES files, see website.

Other Options





SternbergLighting
ESTABLISHED 1923 / EMPLOYEE OWNED

800-621-3376
555 Lawrence Ave., Roselle, IL 60172
info@sternberglighting.com
www.sternberglighting.com

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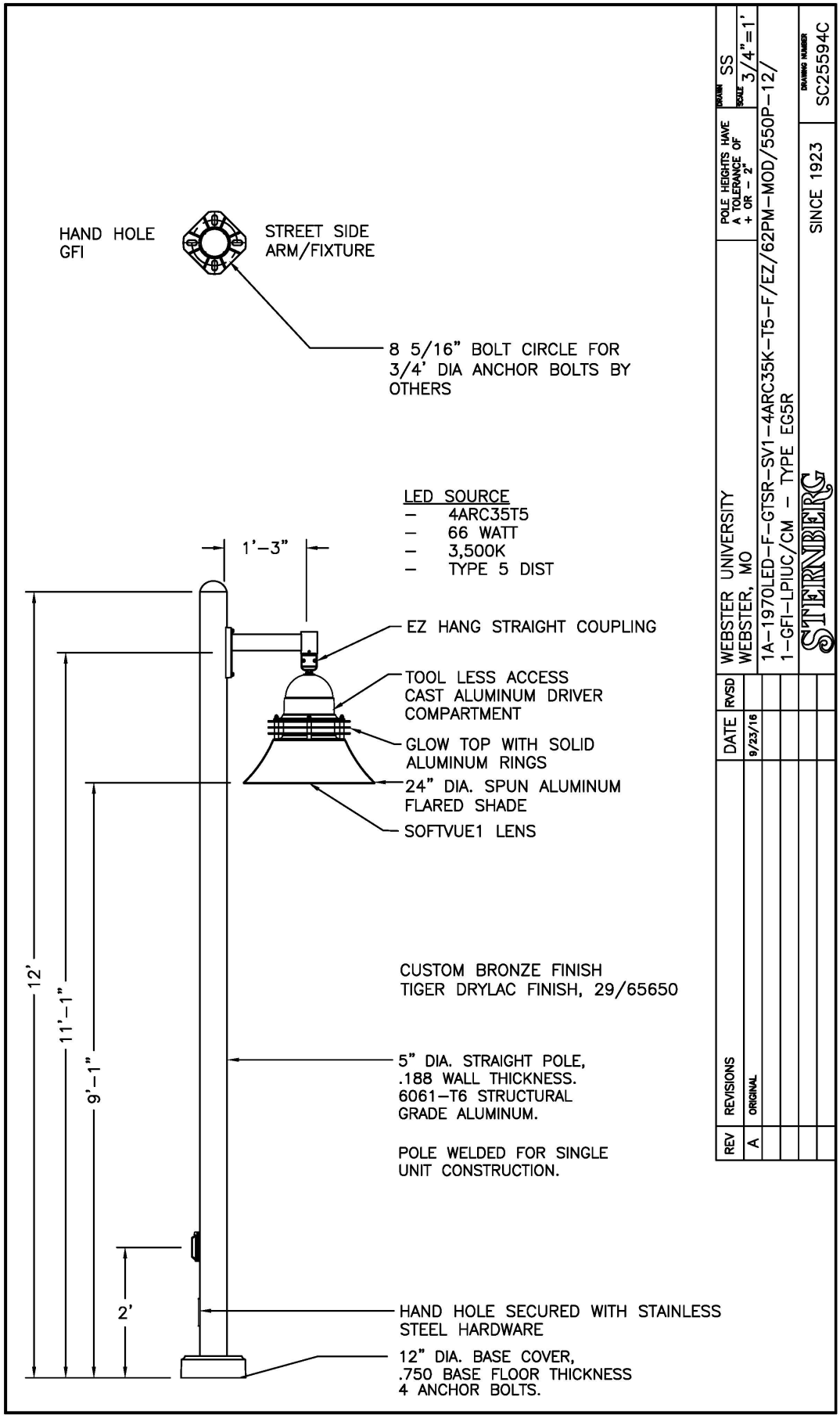
Submitted by LIGHTING ASSOCIATES, INC.

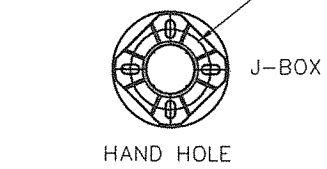
Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

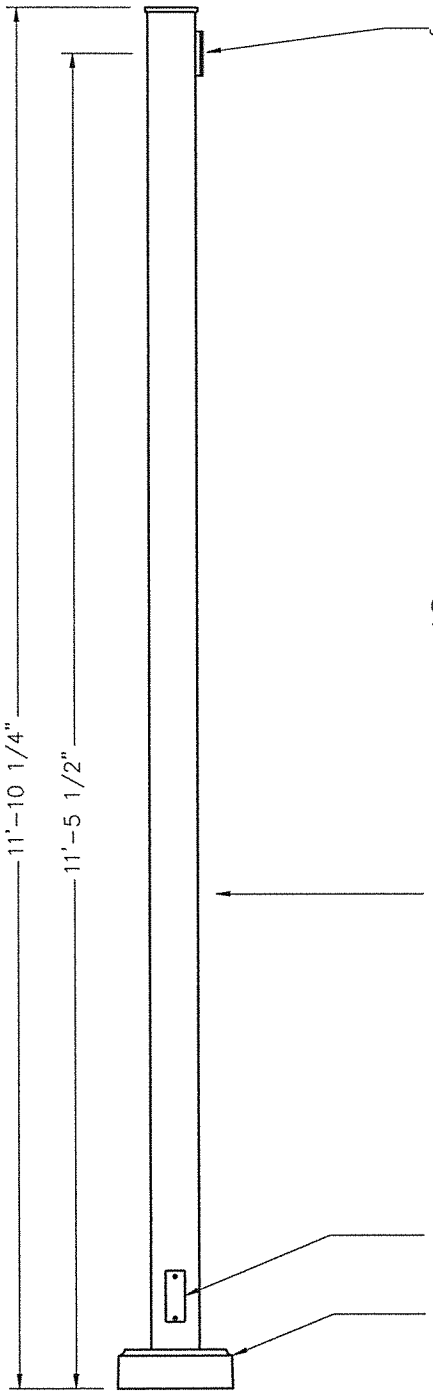
Catalog Number:
1A-1970LED-F-GTSR-SV1-4ARC35K-T5-F-/EZ/62PM-MOD/550P-12/1-GFI/LPIUC/CM DRYLAC 29/65650

Notes: COLOR TO MATCH OTHER PHASE

Type:
EG5R
LAI16-104794







BLACK STD FINISH

CUSTOM BRONZE FINISH
TIGER DRYLAC FINISH, 049/66220

REV	REVISIONS	DATE	RVSD
A	ORIGINAL	1/27/17	
B	CHANGED TO JBOX, REMOVED BCC AND ADD FLAT CAP	2/22/17	JG

DRAWN: JG
SCALE:

WEBSTER UNIVERSITY
ST. LOUIS, MO

550P5-12/PCC/J-BOX/CM
TYPE: L41

SternbergLighting
ESTABLISHED 1923 / EMPLOYEE OWNED

POLE HEIGHTS HAVE A TOLERANCE OF + OR - 2"

DRAWING NUMBER
SC27367

RICK BRANSTETTER
OK
3-22-17 RELEASE

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
MP1279VIA4PDI-HLO-LGO-LED-80-750-500-30-4'-277-D-1-53WAC36-W-TG9

Notes:

Type:
PA4

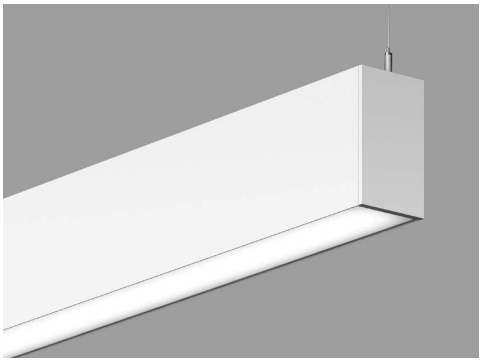
LAI16-104794

MP1279

VIA 4 LED PENDANT DIRECT/INDIRECT

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Shown with HLO optics

DESCRIPTION

Via 4 is the flexible linear LED luminaire system for pendant, surface and recessed or in-wall installation, whether as discrete luminaires, continuous runs or patterns. Via 4 features numerous high-efficiency optical configurations, including separately controlled indirect/direct, wall wash and asymmetric distributions, as well as a wide range of electrical, control and trim options. See separate spec sheets for patterns and other available mountings.

PROJECT: _____

TYPE: _____

NOTES: _____

MANUFACTURER PROVIDED UPDATED PART NUMBER

ORDER GUIDE

MP1279VIA4PDI	HLO	LGO	LED		
LUMINAIRE ID	**DIRECT OPTICS**	**INDIRECT OPTICS**	**LIGHT SOURCE**	**CRI**	**DIRECT LUMEN PACKAGES**
MP1279VIA4PDI - via 4" pendant direct/indirect	**HLO** - High-Efficiency Lambertian Optic	**LGO** - Wide spread Optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**500** - low output 500lm/ft **750** - med. output 750lm/ft **1000** - high output 1000lm/ft **1200** - ultra high output 1200lm/ft

500 LUMEN TYPICAL FOR ALL PA FIXTURES

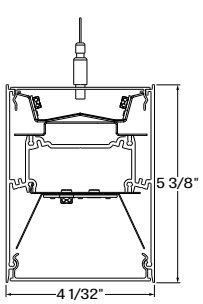
4'

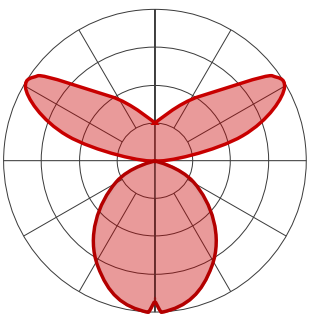
ECT LUMEN PACKAGES	COLOR TEMP.	LUMINAIRE LENGTH	VOLTAGE	DRIVER	ELECTRICAL
500 - low output 500lm/ft **750** - medium output 750lm/ft Lower lumen packages are available, consult factory	**30** - 3000k **35** - 3500k **40** - 4000k	Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires /EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **2** - 2 circuits **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device

9/16

ELECTRICAL	MOUNTING	FINISH	OPTIONS
1 - 1 circuit **2** - 2 circuits **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**53WAC36** - power 5" + non power 3" white canopy (36" air craft cable) **55WSW18** - power 5" + non power 5" white canopy & stem (18" stem) For all other mountings refer to the Pendant Mounting Guide.	**W** - matte white **AL** - aluminum **CF#** - custom finish specify RAL#	**TB#** - T-bar caddy clip specify grid size **TG#** - Tegular caddy clip specify grid size **ST** - Screw Slots caddy clip

CROSS SECTION





MP1279 - air craft cable

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Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
MP1279VIA4PDI-HLO-LGO-LED-80-750-500-30-6'-277-D-1-53WAC36-W-TG9

Notes:

Type:
PA6

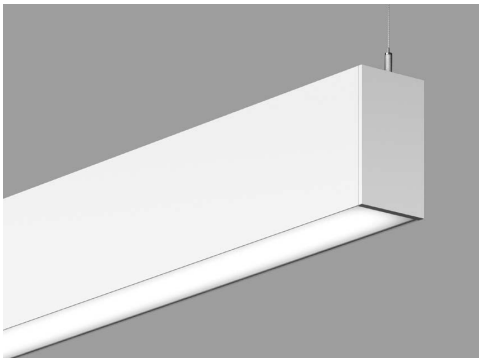
LAI16-104794

MP1279

VIA 4 LED PENDANT DIRECT/INDIRECT

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Shown with HLO optics

DESCRIPTION

Via 4 is the flexible linear LED luminaire system for pendant, surface and recessed or in-wall installation, whether as discrete luminaires, continuous runs or patterns. Via 4 features numerous high-efficiency optical configurations, including separately controlled indirect/direct, wall wash and asymmetric distributions, as well as a wide range of electrical, control and trim options. See separate spec sheets for patterns and other available mountings.

PROJECT: _____

TYPE: _____

NOTES: _____

MANUFACTURER PROVIDED UPDATED PART NUMBER

ORDER GUIDE

MP1279VIA4PDI	HLO	LGO	LED		
LUMINAIRE ID	**DIRECT OPTICS**	**INDIRECT OPTICS**	**LIGHT SOURCE**	**CRI**	**DIRECT LUMEN PACKAGES**
MP1279VIA4PDI - via 4" pendant direct/indirect	**HLO** - High-Efficiency Lambertian Optic	**LGO** - Wide spread Optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**500** - low output 500lm/ft **750** - med. output 750lm/ft **1000** - high output 1000lm/ft **1200** - ultra high output 1200lm/ft

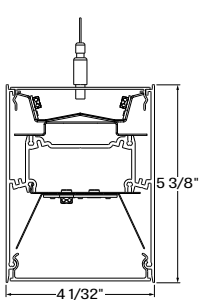
6'

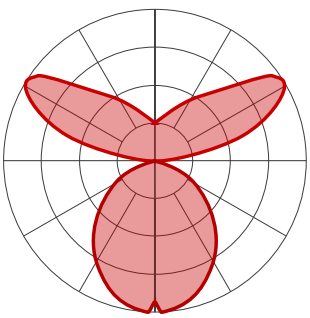
INDIRECT LUMEN PACKAGES	COLOR TEMP.	LUMINAIRE LENGTH	VOLTAGE	DRIVER	ELECTRICAL
500 - low output 500lm/ft **750** - medium output 750lm/ft Lower lumen packages are available, consult factory	**30** - 3000k **35** - 3500k **40** - 4000k	Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires /EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **2** - 2 circuits **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device

9/16

ELECTRICAL	MOUNTING	FINISH	OPTIONS
1 - 1 circuit **2** - 2 circuits **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**53WAC36** - power 5" + non power 3" white canopy (36" air craft cable) **55WSW18** - power 5" + non power 5" white canopy & stem (18" stem) For all other mountings refer to the Pendant Mounting Guide.	**W** - matte white **AL** - aluminum **CF#** - custom finish specify RAL#	**TB#** - T-bar caddy clip specify grid size **TG#** - Tegular caddy clip specify grid size **ST** - Screw Slots caddy clip

CROSS SECTION





MP1279 - air craft cable

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Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
MP1279VIA4PDI-HLO-LGO-LED-80-750-500-30-8'-277-D-1-53WAC36-W-TG9

Notes:

Type:
PA8

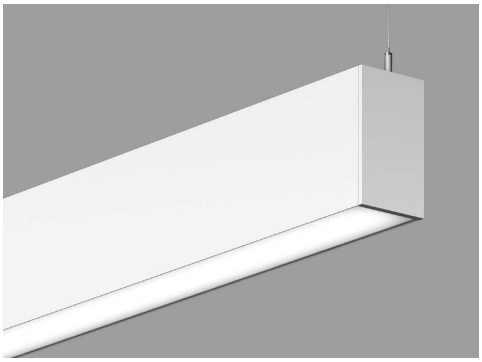
LAI16-104794

MP1279

VIA 4 LED PENDANT DIRECT/INDIRECT

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Shown with HLO optics

DESCRIPTION

Via 4 is the flexible linear LED luminaire system for pendant, surface and recessed or in-wall installation, whether as discrete luminaires, continuous runs or patterns. Via 4 features numerous high-efficiency optical configurations, including separately controlled indirect/direct, wall wash and asymmetric distributions, as well as a wide range of electrical, control and trim options. See separate spec sheets for patterns and other available mountings.

PROJECT: _____

TYPE: _____

NOTES: _____

MANUFACTURER PROVIDED UPDATED PART NUMBER

ORDER GUIDE

MP1279VIA4PDI	HLO	LGO	LED		
LUMINAIRE ID	**DIRECT OPTICS**	**INDIRECT OPTICS**	**LIGHT SOURCE**	**CRI**	**DIRECT LUMEN PACKAGES**
MP1279VIA4PDI - via 4" pendant direct/indirect	**HLO** - High-Efficiency Lambertian Optic	**LGO** - Wide spread Optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**500** - low output 500lm/ft **750** - med. output 750lm/ft **1000** - high output 1000lm/ft **1200** - ultra high output 1200lm/ft

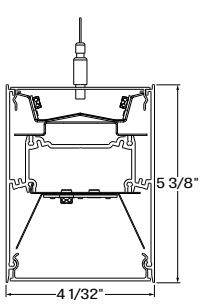
8'

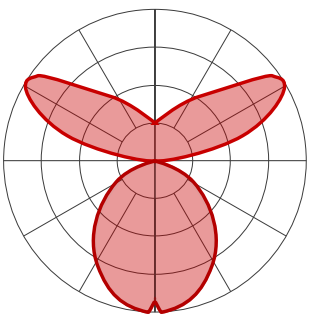
INDIRECT LUMEN PACKAGES	COLOR TEMP.	LUMINAIRE LENGTH	VOLTAGE	DRIVER	ELECTRICAL
500 - low output 500lm/ft **750** - medium output 750lm/ft Lower lumen packages are available, consult factory	**30** - 3000k **35** - 3500k **40** - 4000k	Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires /EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **2** - 2 circuits **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device

9/16

ELECTRICAL	MOUNTING	FINISH	OPTIONS
1 - 1 circuit **2** - 2 circuits **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**53WAC36** - power 5" + non power 3" white canopy (36" air craft cable) **55WSW18** - power 5" + non power 5" white canopy & stem (18" stem) For all other mountings refer to the Pendant Mounting Guide.	**W** - matte white **AL** - aluminum **CF#** - custom finish specify RAL#	**TB#** - T-bar caddy clip specify grid size **TG#** - Tegular caddy clip specify grid size **ST** - Screw Slots caddy clip

CROSS SECTION





MP1279 - air craft cable

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Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
MP1279VIA4PDI-HLO-LGO-LED-80-750-500-30-12'-277-D-1-53WAC36-W-TG9

Notes:

Type:
PA12

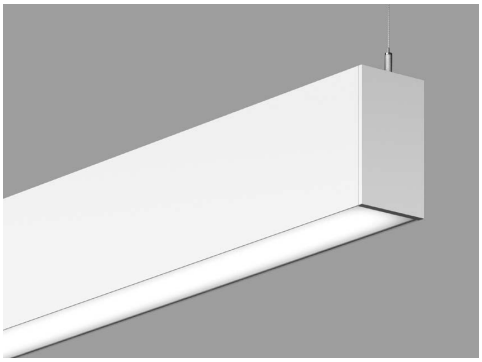
LAI16-104794

MP1279

VIA 4 LED PENDANT DIRECT/INDIRECT

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Shown with HLO optics

DESCRIPTION

Via 4 is the flexible linear LED luminaire system for pendant, surface and recessed or in-wall installation, whether as discrete luminaires, continuous runs or patterns. Via 4 features numerous high-efficiency optical configurations, including separately controlled indirect/direct, wall wash and asymmetric distributions, as well as a wide range of electrical, control and trim options. See separate spec sheets for patterns and other available mountings.

PROJECT: _____

TYPE: _____

NOTES: _____

MANUFACTURER PROVIDED UPDATED PART NUMBER

ORDER GUIDE

MP1279VIA4PDI	HLO	LGO	LED		
LUMINAIRE ID	**DIRECT OPTICS**	**INDIRECT OPTICS**	**LIGHT SOURCE**	**CRI**	**DIRECT LUMEN PACKAGES**
MP1279VIA4PDI - via 4" pendant direct/indirect	**HLO** - High-Efficiency Lambertian Optic	**LGO** - Wide spread Optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**500** - low output 500lm/ft **750** - med. output 750lm/ft **1000** - high output 1000lm/ft **1200** - ultra high output 1200lm/ft

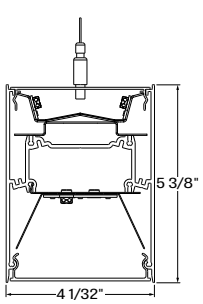
12'

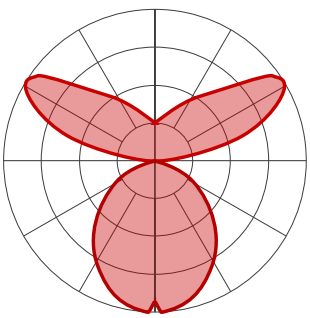
INDIRECT LUMEN PACKAGES	COLOR TEMP.	LUMINAIRE LENGTH	VOLTAGE	DRIVER	ELECTRICAL
500 - low output 500lm/ft **750** - medium output 750lm/ft Lower lumen packages are available, consult factory	**30** - 3000k **35** - 3500k **40** - 4000k	Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires /EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **2** - 2 circuits **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device

9/16

ELECTRICAL	MOUNTING	FINISH	OPTIONS
1 - 1 circuit **2** - 2 circuits **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**53WAC36** - power 5" + non power 3" white canopy (36" air craft cable) **55WSW18** - power 5" + non power 5" white canopy & stem (18" stem) For all other mountings refer to the Pendant Mounting Guide.	**W** - matte white **AL** - aluminum **CF#** - custom finish specify RAL#	**TB#** - T-bar caddy clip specify grid size **TG#** - Tegular caddy clip specify grid size **ST** - Screw Slots caddy clip

CROSS SECTION





MP1279 - air craft cable

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Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
MP1279VIA4PDI-HLO-LGO-LED-80-750-500-30-16'-277-D-2-W-(EACH 8FT ON SEP CIR)-53WAC36-TG9

Notes:

Type:
PA16-2

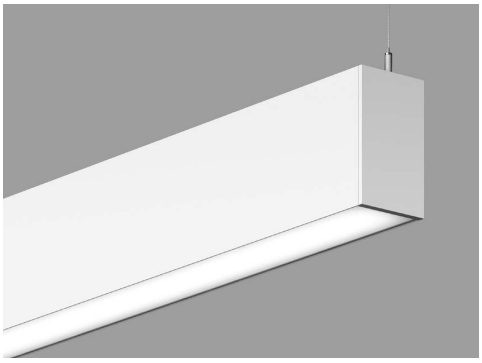
LAI16-104794

MP1279

VIA 4 LED PENDANT DIRECT/INDIRECT

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Shown with HLO optics

DESCRIPTION

Via 4 is the flexible linear LED luminaire system for pendant, surface and recessed or in-wall installation, whether as discrete luminaires, continuous runs or patterns. Via 4 features numerous high-efficiency optical configurations, including separately controlled indirect/direct, wall wash and asymmetric distributions, as well as a wide range of electrical, control and trim options. See separate spec sheets for patterns and other available mountings.

PROJECT: _____

TYPE: _____

NOTES: _____

MANUFACTURER PROVIDED UPDATED PART NUMBER

ORDER GUIDE

MP1279VIA4PDI	HLO	LGO	LED		
LUMINAIRE ID	**DIRECT OPTICS**	**INDIRECT OPTICS**	**LIGHT SOURCE**	**CRI**	**DIRECT LUMEN PACKAGES**
MP1279VIA4PDI - via 4" pendant direct/indirect	**HLO** - High-Efficiency Lambertian Optic	**LGO** - Wide spread Optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**500** - low output 500lm/ft **750** - med. output 750lm/ft **1000** - high output 1000lm/ft **1200** - ultra high output 1200lm/ft

16'

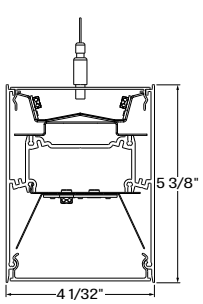
INDIRECT LUMEN PACKAGES	COLOR TEMP.	LUMINAIRE LENGTH	VOLTAGE	DRIVER	ELECTRICAL
500 - low output 500lm/ft **750** - medium output 750lm/ft Lower lumen packages are available, consult factory	**30** - 3000k **35** - 3500k **40** - 4000k	Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires /EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **2** - 2 circuits **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device

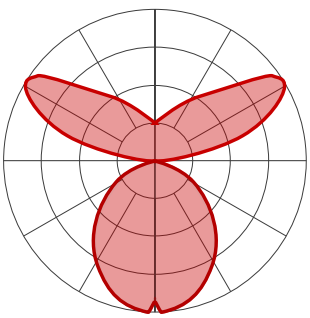
8FT EA ON SEP CKT

9/16

ELECTRICAL	MOUNTING	FINISH	OPTIONS
1 - 1 circuit **2** - 2 circuits **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**53WAC36** - power 5" + non power 3" white canopy (36" air craft cable) **55WSW18** - power 5" + non power 5" white canopy & stem (18" stem) For all other mountings refer to the Pendant Mounting Guide.	**W** - matte white **AL** - aluminum **CF#** - custom finish specify RAL#	**TB#** - T-bar caddy clip specify grid size **TG#** - Tegular caddy clip specify grid size **ST** - Screw Slots caddy clip

CROSS SECTION





MP1279 - air craft cable

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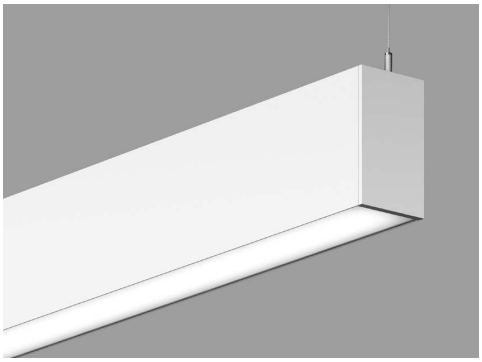
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** MP1279VIA4PDI-HLO-LGO-LED-80-750-500-30-16'-277-D-1-W-53WAC36-TG9 Notes:	**Type:** **PA16-1** LAI16-104794

MP1279

VIA 4 LED PENDANT DIRECT/INDIRECT

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Shown with HLO optics

DESCRIPTION

Via 4 is the flexible linear LED luminaire system for pendant, surface and recessed or in-wall installation, whether as discrete luminaires, continuous runs or patterns. Via 4 features numerous high-efficiency optical configurations, including separately controlled indirect/direct, wall wash and asymmetric distributions, as well as a wide range of electrical, control and trim options. See separate spec sheets for patterns and other available mountings.

PROJECT: _____

TYPE: _____

NOTES: _____

MANUFACTURER PROVIDED UPDATED PART NUMBER

ORDER GUIDE

MP1279VIA4PDI	HLO	LGO	LED		
LUMINAIRE ID	**DIRECT OPTICS**	**INDIRECT OPTICS**	**LIGHT SOURCE**	**CRI**	**DIRECT LUMEN PACKAGES**
MP1279VIA4PDI - via 4" pendant direct/indirect	**HLO** - High-Efficiency Lambertian Optic	**LGO** - Wide spread Optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**500** - low output 500lm/ft **750** - med. output 750lm/ft **1000** - high output 1000lm/ft **1200** - ultra high output 1200lm/ft

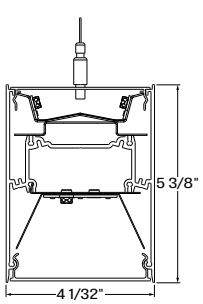
16'

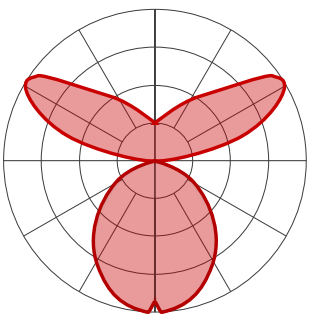
INDIRECT LUMEN PACKAGES	COLOR TEMP.	LUMINAIRE LENGTH	VOLTAGE	DRIVER	ELECTRICAL
500 - low output 500lm/ft **750** - medium output 750lm/ft Lower lumen packages are available, consult factory	**30** - 3000k **35** - 3500k **40** - 4000k	Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires /EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **2** - 2 circuits **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device

9/16

ELECTRICAL	MOUNTING	FINISH	OPTIONS
1 - 1 circuit **2** - 2 circuits **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**53WAC36** - power 5" + non power 3" white canopy (36" air craft cable) **55WSW18** - power 5" + non power 5" white canopy & stem (18" stem) For all other mountings refer to the Pendant Mounting Guide.	**W** - matte white **AL** - aluminum **CF#** - custom finish specify RAL#	**TB#** - T-bar caddy clip specify grid size **TG#** - Tegular caddy clip specify grid size **ST** - Screw Slots caddy clip

CROSS SECTION





MP1279 - air craft cable

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Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
MP1279VIA4PDI-HLO-LGO-LED-80-750-500-30-22'-277-D-2-W- (10FT SECTION/12SECTION SEP CIRC)-53WAC36-TG9
Notes:

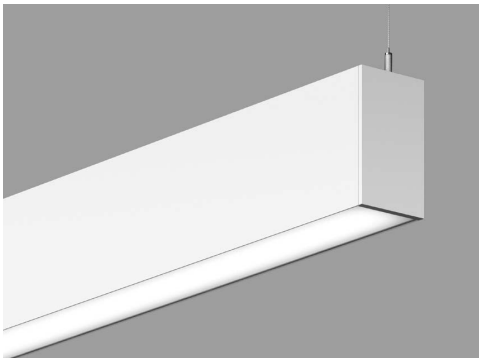
Type:
PA22
LAI16-104794

MP1279

VIA 4 LED PENDANT DIRECT/INDIRECT

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Shown with HLO optics

DESCRIPTION

Via 4 is the flexible linear LED luminaire system for pendant, surface and recessed or in-wall installation, whether as discrete luminaires, continuous runs or patterns. Via 4 features numerous high-efficiency optical configurations, including separately controlled indirect/direct, wall wash and asymmetric distributions, as well as a wide range of electrical, control and trim options. See separate spec sheets for patterns and other available mountings.

PROJECT: _____

TYPE: _____

NOTES: _____

MANUFACTURER PROVIDED UPDATED PART NUMBER

ORDER GUIDE

MP1279VIA4PDI	HLO	LGO	LED		
LUMINAIRE ID	**DIRECT OPTICS**	**INDIRECT OPTICS**	**LIGHT SOURCE**	**CRI**	**DIRECT LUMEN PACKAGES**
MP1279VIA4PDI - via 4" pendant direct/indirect	**HLO** - High-Efficiency Lambertian Optic	**LGO** - Wide spread Optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**500** - low output 500lm/ft **750** - med. output 750lm/ft **1000** - high output 1000lm/ft **1200** - ultra high output 1200lm/ft

16'

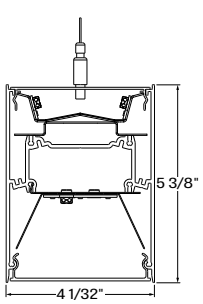
INDIRECT LUMEN PACKAGES	COLOR TEMP.	LUMINAIRE LENGTH	VOLTAGE	DRIVER	ELECTRICAL
500 - low output 500lm/ft **750** - medium output 750lm/ft Lower lumen packages are available, consult factory	**30** - 3000k **35** - 3500k **40** - 4000k	Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires /EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **2** - 2 circuits **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device

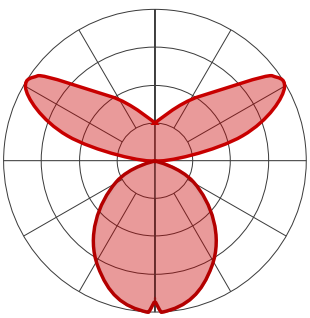
10FT/12FT ON SEP CKT

9/16

ELECTRICAL	MOUNTING	FINISH	OPTIONS
1 - 1 circuit **2** - 2 circuits **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**53WAC36** - power 5" + non power 3" white canopy (36" air craft cable) **55WSW18** - power 5" + non power 5" white canopy & stem (18" stem) For all other mountings refer to the Pendant Mounting Guide.	**W** - matte white **AL** - aluminum **CF#** - custom finish specify RAL#	**TB#** - T-bar caddy clip specify grid size **TG#** - Tegular caddy clip specify grid size **ST** - Screw Slots caddy clip

CROSS SECTION





MP1279 - air craft cable

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Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
MP1279VIA4PDI-HLO-LGO-LED-80-750-500-30-24'-277-D-2-W- (2 12FT SECTION ON SEP CIRCUIT)-53WAC36-TG9
Notes:

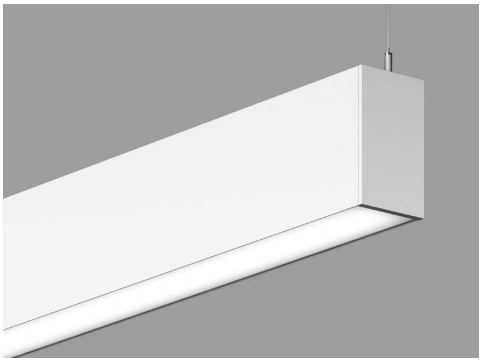
Type:
PA24
LAI16-104794

MP1279

VIA 4 LED PENDANT DIRECT/INDIRECT

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Shown with HLO optics

DESCRIPTION

Via 4 is the flexible linear LED luminaire system for pendant, surface and recessed or in-wall installation, whether as discrete luminaires, continuous runs or patterns. Via 4 features numerous high-efficiency optical configurations, including separately controlled indirect/direct, wall wash and asymmetric distributions, as well as a wide range of electrical, control and trim options. See separate spec sheets for patterns and other available mountings.

PROJECT: _____

TYPE: _____

NOTES: _____

MANUFACTURER PROVIDED UPDATED PART NUMBER

ORDER GUIDE

MP1279VIA4PDI	HLO	LGO	LED		
LUMINAIRE ID	**DIRECT OPTICS**	**INDIRECT OPTICS**	**LIGHT SOURCE**	**CRI**	**DIRECT LUMEN PACKAGES**
MP1279VIA4PDI - via 4" pendant direct/indirect	**HLO** - High-Efficiency Lambertian Optic	**LGO** - Wide spread Optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**500** - low output 500lm/ft **750** - med. output 750lm/ft **1000** - high output 1000lm/ft **1200** - ultra high output 1200lm/ft

24'

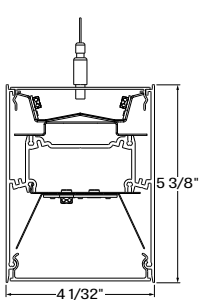
INDIRECT LUMEN PACKAGES	COLOR TEMP.	LUMINAIRE LENGTH	VOLTAGE	DRIVER	ELECTRICAL
500 - low output 500lm/ft **750** - medium output 750lm/ft Lower lumen packages are available, consult factory	**30** - 3000k **35** - 3500k **40** - 4000k	Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires /EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **2** - 2 circuits **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device

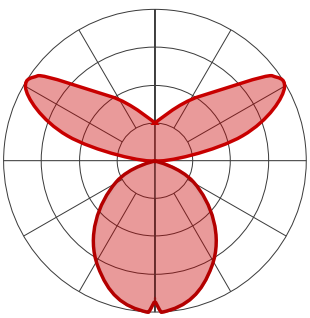
12FT EA ON SEP CKT

9/16

ELECTRICAL	MOUNTING	FINISH	OPTIONS
1 - 1 circuit **2** - 2 circuits **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**53WAC36** - power 5" + non power 3" white canopy (36" air craft cable) **55WSW18** - power 5" + non power 5" white canopy & stem (18" stem) For all other mountings refer to the Pendant Mounting Guide.	**W** - matte white **AL** - aluminum **CF#** - custom finish specify RAL#	**TB#** - T-bar caddy clip specify grid size **TG#** - Tegular caddy clip specify grid size **ST** - Screw Slots caddy clip

CROSS SECTION





MP1279 - air craft cable

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-D-26'-6"-H-3000K-F-277-FM-SC-C4-1%DIM Notes:	**Type:** **PB26-6** LAI16-104794

LED BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Direct

INDUSTRY BEST 10 YEAR LED WARRANTY | 2012 PROGRESS Report SELECTION | LED lighting facts A Program of the U.S. DOE



Date

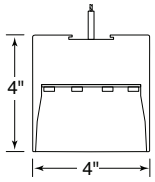
Project

Type

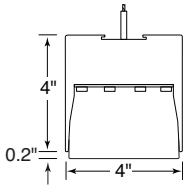
Comments

DESCRIPTION

High Performance 4" Aperture Direct (HP-4 D) is a patented, linear LED luminaire with Flush and Bottom Glow™ options for the downlight. The micro shape delivers excellent performance using an advanced optical design and mid-power LEDs to achieve 90% of initial light output at 100,000+ hours.



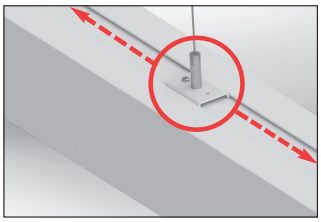
Flush Downlight Diffuser (Standard)



Bottom Glow Diffuser (Optional)

DIMENSIONS & BOTTOM GLOW

The optional Bottom Glow diffuser adds a clean line of light along the downlight element.



FLEXIBLE MOUNTING

The flexible mounting bracket adjusts the suspension points along the length of the luminaire to accommodate existing architecture. Suspension points adjust up to 2' in from the end of 8'or 12' fixture lengths and up to 1' in on shorter lengths.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 D - 32' - S - 8 - 35 - F - 120V - FA - SC - C1 - OBO

26' 6"

HP-4 D

Finelite Series HP-4 D
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard Output , B - Boosted Standard Output, H - High Output , V - Very High Output)
LED CRI (8 - 80 CRI min (standard), 9 - 90 CRI min)
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard) , BG - Bottom)
Voltage (120V, 277V)
Mounting (FA - Fully Adjustable, FM- Flexible Mounting)
Circuiting (SC - Single Circuit)*
Ceiling Type (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - Screw Slot, C4 - Hard Ceiling)
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

1% DIMMING

*Contact factory for switching options.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-D-26'-6"-H-3000K-F-277-FM-SC-C4-1%DIM Notes:	**Type:** **PB26-6** LAI16-104794

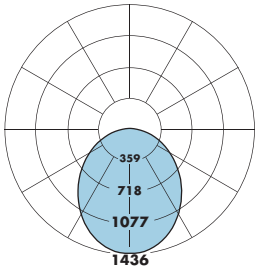
LED BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Direct

PHOTOMETRY

Very High Output - 4' Luminare
Efficacy (Lumen per watt): 100.1
Total luminaire output: 3705 Lumens (926 lumens/foot)
37 Watts (9.3 watts/foot)
Peak Candela Value: 1436 @ 0°
CCT: 3500K
ITL LM79 Report 85124



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1436	1436	1436	1436	1436	
5	1428	1428	1427	1427	1427	135
15	1363	1353	1358	1357	1350	382
25	1236	1221	1226	1219	1212	563
35	1060	1047	1048	1037	1030	653
45	859	849	848	836	831	652
55	647	639	637	628	623	568
65	434	432	431	425	424	425
75	236	236	237	235	236	250
85	67	68	69	70	69	77
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1517	1907	2882	3705

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
379	477	720	926

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
104.7	103.6	101.5	100.1

* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85124
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

High Output (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2882 lm x 0.789 = 2274 lm

Total Light Output per Foot =
720 lm/ft x 0.789 = 568 lm/ft

watts/foot = 7.1 W/ft

$$\textit{Efficacy} = \frac{568\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80\ \text{lm/W}$$

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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LED BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Direct

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard.

ENDCAPS: Flat diecast aluminum endcaps add 0.25" to each end of luminaire.

MITERED CORNER: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors finished in 96LG High Reflectance white power coat paint.

DOWNLIGHT DIFFUSER: 12' maximum lens length. Flush frost white snap-in lens standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Bottom Glow™ frost white snap-in lens option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Factory-choice low-profile backup battery available. 8' minimum fixture length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum fixture length. Backup batteries deliver 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor Occupancy Sensor **INTEGRATED SENSORS:** Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush and Bottom Glow downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: 50" Fully Adjustable (FA) plated steel aircraft cable with safety stop hardware standard. Contact factory for additional lengths up to 150". The Flexible Mounting Bracket (FM) adjusts the suspension points to accommodate existing architecture. Suspension points adjust up to 2' in from the end of 8' or 12' fixture lengths and up to 1' in on shorter lengths.

FINISHES: Finelite Signal White powder coat standard. Optional Adders: 185 Tiger Drylac's non-metallic RAL colors.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when fixture current exceeds 5 amps.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Fixture and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

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Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** 4SNLED-LD4-50SL-LW-UNV-L835-CD1-U AYC-CHAIN/SET-U Notes:	**Type:** **PC** LAI16-104794

Metalux

Catalog #		Type	
Project			
Comments		Date	
Prepared by			

DESCRIPTION

SNLED Lensed is a narrow LED lensed striplight series. This high quality luminaire is dedicated to the latest solid state lighting and electronic driver technology for optimal performance and energy efficiency. This Lensed product is available with three different lens types.

The small size of the SNLED makes it an ideal choice for size restricted architectural applications. The SNLED Series can be the illumination solution in commercial, industrial, retail and residential applications. Fixtures can be used in storage/utility areas, coves, display cases, shops, task and general area lighting.

SPECIFICATION FEATURES

Construction
Channel is die formed cold rolled steel with numerous KOs for ease of installation. Groove for Tong Hanger. End plate quickly converts to snap-in channel connector for continuous row alignment. Channel/wireway cover secured with sheet metal screws.

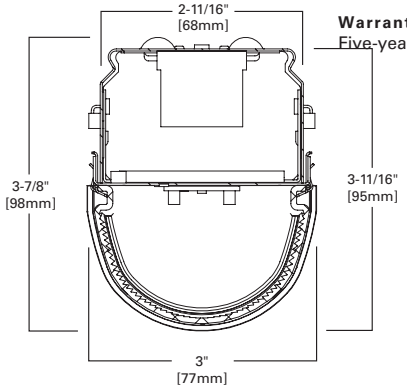
Controls
Equipped standard with a 0-10V continuous dimming driver that works with any standard 0-10V control/dimmer. Dimming range is 10% to 100%; varies by control device. Combine with energy-saving products like occupancy sensors, day lighting controls, and lighting relay panels to maximize energy savings. For motion control, reference options for both end and middle of the row applications.

Electrical
Long-Life LED system coupled with electronic (120-277V) driver to deliver optimal lighting performance. LED's available in 3000K, 3500K, 4000K, or 5000K with a CRI ≥ 85. Other color temperatures are available. Projected life is 60,000 hours at 70% lumen output. This driver is 0-10V dimming standard.

Emergency Battery Pack Option
Optional 120v-277v integral emergency battery pack is available in 7-watts or 14-watts to meet critical life-safety lighting requirements. The 90-minute batteries provide constant power to the LED system, ensuring code-compliance. A test switch/indicator button can be tested safely from the ground using a laser pointer, while the patented EZ Key prevents accidental discharge of the battery during construction. See ordering information for details.

Finish
Multistage iron phosphate pretreatment ensures maximum bonding and rust inhibitor. High reflective paint after fabrication, baked white enamel finish is standard.

Channel/Wireway Cover
Die formed heavy gauge steel. Tight fit for ease of maintenance.



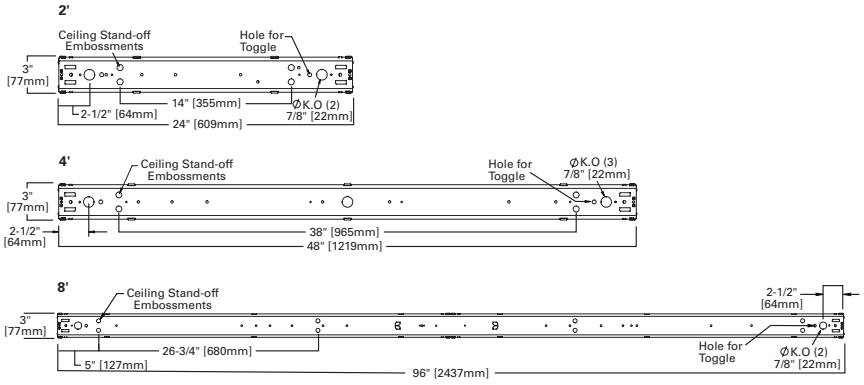
Shielding
Offers three different lensed optical distributions. (LC) Clear with linear optical ribs. (LN) Semi-frost for narrow distribution. (LW) Full frost for wide distribution.

Installation
Fixture may be surface, pendant, or stem mounted. See accessories below in ordering information.

Compliance
Components are UL recognized. Indoor luminaires are cULus listed for 40° C ambient environments, RoHS compliant, damp location listed, and comply with IESNA LM-79. LEDs comply with LM-80 standards. DesignLights Consortium® Qualified. Refer to www.designlights.org Qualified Products List under Family Models for details.

Warranty
Five-year warranty.

MOUNTING DATA





SNLED LENSED
LED

Lensed LED Striplight

powered by fifthlight technology

LINEAR DISCONNECT
Safe and convenient means of disconnecting power

PS519008EN
2016-2-23

EATON
Powering Business Worldwide

WATTAGE

SNLED Type	Stock* / MTO	Lumen Type	Length	Catalog Logic	Nominal Lumens	Wattage	lm/W
Clear Lens (LC)	MTO	Standard	2 ft.	2SNLED-LD4-18SL-LC-UNV-L8XX-CD1-U	1907	17.13	105
Clear Lens (LC)	MTO	Standard	2 ft.	2SNLED-LD4-22SL-LC-UNV-L8XX-CD1-U	2325	21.7	101
Clear Lens (LC)	MTO	Standard	2 ft.	2SNLED-LD4-26SL-LC-UNV-L8XX-CD1-U	2712	23.18	112
Clear Lens (LC)	MTO	Standard	4 ft.	4SNLED-LD4-18SL-LC-UNV-L8XX-CD1-U	2038	16.21	111
Clear Lens (LC)	MTO	Standard	4 ft.	4SNLED-LD4-22SL-LC-UNV-L8XX-CD1-U	2301	18.37	120
Clear Lens (LC)	Stock	Standard	4 ft.	4SNLED-LD4-26SL-LC-UNV-L8XX-CD1-U	2688	21.68	120
Clear Lens (LC)	Stock	Standard	4 ft.	4SNLED-LD4-30SL-LC-UNV-L8XX-CD1-U	3061	25.07	120
Clear Lens (LC)	MTO	Standard	4 ft.	4SNLED-LD4-34SL-LC-UNV-L8XX-CD1-U	3431	28.43	120
Clear Lens (LC)	MTO	Standard	4 ft.	4SNLED-LD4-37SL-LC-UNV-L8XX-CD1-U	3822	32.32	114
Clear Lens (LC)	MTO	Standard	4 ft.	4SNLED-LD4-41SL-LC-UNV-L8XX-CD1-U	4233	36.64	112
Clear Lens (LC)	Stock	Standard	4 ft.	4SNLED-LD4-46SL-LC-UNV-L8XX-CD1-U	4615	41.03	112
Clear Lens (LC)	MTO	Standard	4 ft.	4SNLED-LD4-49SL-LC-UNV-L8XX-CD1-U	4994	45.66	107
Clear Lens (LC)	MTO	Standard	4 ft.	4SNLED-LD4-52SL-LC-UNV-L8XX-CD1-U	5357	50.15	104
Clear Lens (LC)	MTO	Standard	4 ft.	4SNLED-LD4-56SL-LC-UNV-L8XX-CD1-U	5714	56.3	99
Clear Lens (LC)	MTO	High	4 ft.	4SNLED-LD4-60HL-LC-UNV-L8XX-CD1-U	6115	50.71	118
Clear Lens (LC)	MTO	Standard	8 ft.	8TSNLED-LD4-60SL-LC-UNV-L8XX-CD1-U	6122	50.14	120
Clear Lens (LC)	MTO	Standard	8 ft.	8TSNLED-LD4-68SL-LC-UNV-L8XX-CD1-U	6863	56.86	120
Clear Lens (LC)	Stock	Standard	8 ft.	8TSNLED-LD4-75SL-LC-UNV-L8XX-CD1-U	7643	64.64	116
Clear Lens (LC)	Stock	Standard	8 ft.	8TSNLED-LD4-83SL-LC-UNV-L8XX-CD1-U	8466	73.28	113
Clear Lens (LC)	MTO	Standard	8 ft.	8TSNLED-LD4-90SL-LC-UNV-L8XX-CD2-U	9230	82.06	110
Clear Lens (LC)	MTO	Standard	8 ft.	8TSNLED-LD4-98SL-LC-UNV-L8XX-CD2-U	9988	91.32	107
Clear Lens (LC)	MTO	Standard	8 ft.	8TSNLED-LD4-105SL-LC-UNV-L8XX-CD2-U	10714	100.3	105

SNLED Type	Stock* / MTO	Lumen Type	Length	Catalog Logic	Nominal Lumens	Wattage	lm/W
Semi-Frost Lens (LN)	MTO	Standard	2 ft.	2SNLED-LD4-18SL-LN-UNV-L8XX-CD1-U	1901	17	105
Semi-Frost Lens (LN)	MTO	Standard	2 ft.	2SNLED-LD4-22SL-LN-UNV-L8XX-CD1-U	2318	22	101
Semi-Frost Lens (LN)	MTO	Standard	2 ft.	2SNLED-LD4-26SL-LN-UNV-L8XX-CD1-U	2704	23	116
Semi-Frost Lens (LN)	MTO	Standard	4 ft.	4SNLED-LD4-18SL-LN-UNV-L8XX-CD1-U	2032	16	111
Semi-Frost Lens (LN)	MTO	Standard	4 ft.	4SNLED-LD4-22SL-LN-UNV-L8XX-CD1-U	2294	18	120
Semi-Frost Lens (LN)	Stock	Standard	4 ft.	4SNLED-LD4-26SL-LN-UNV-L8XX-CD1-U	2680	22	120
Semi-Frost Lens (LN)	Stock	Standard	4 ft.	4SNLED-LD4-30SL-LN-UNV-L8XX-CD1-U	3052	25	120
Semi-Frost Lens (LN)	MTO	Standard	4 ft.	4SNLED-LD4-34SL-LN-UNV-L8XX-CD1-U	3421	28	120
Semi-Frost Lens (LN)	MTO	Standard	4 ft.	4SNLED-LD4-37SL-LN-UNV-L8XX-CD1-U	3810	32	114
Semi-Frost Lens (LN)	MTO	Standard	4 ft.	4SNLED-LD4-41SL-LN-UNV-L8XX-CD1-U	4220	37	112
Semi-Frost Lens (LN)	Stock	Standard	4 ft.	4SNLED-LD4-46SL-LN-UNV-L8XX-CD1-U	4601	41	112
Semi-Frost Lens (LN)	MTO	Standard	4 ft.	4SNLED-LD4-49SL-LN-UNV-L8XX-CD1-U	4979	46	107
Semi-Frost Lens (LN)	MTO	Standard	4 ft.	4SNLED-LD4-53SL-LN-UNV-L8XX-CD1-U	5341	50	106
Semi-Frost Lens (LN)	MTO	Standard	4 ft.	4SNLED-LD4-56SL-LN-UNV-L8XX-CD1-U	5697	56	99
Semi-Frost Lens (LN)	MTO	High	4 ft.	4SNLED-LD4-60HL-LN-UNV-L8XX-CD1-U	6096	51	118
Semi-Frost Lens (LN)	MTO	Standard	8 ft.	8TSNLED-LD4-60SL-LN-UNV-L8XX-CD1-U	6103	50	120
Semi-Frost Lens (LN)	MTO	Standard	8 ft.	8TSNLED-LD4-68SL-LN-UNV-L8XX-CD1-U	6842	57	120
Semi-Frost Lens (LN)	Stock	Standard	8 ft.	8TSNLED-LD4-75SL-LN-UNV-L8XX-CD1-U	7620	65	116
Semi-Frost Lens (LN)	Stock	Standard	8 ft.	8TSNLED-LD4-83SL-LN-UNV-L8XX-CD1-U	8441	73	113
Semi-Frost Lens (LN)	MTO	Standard	8 ft.	8TSNLED-LD4-91SL-LN-UNV-L8XX-CD2-U	9202	82	111
Semi-Frost Lens (LN)	MTO	Standard	8 ft.	8TSNLED-LD4-98SL-LN-UNV-L8XX-CD2-U	9958	91	107
Semi-Frost Lens (LN)	MTO	Standard	8 ft.	8TSNLED-LD4-106SL-LN-UNV-L8XX-CD2-U	10681	100	106

Submitted by LIGHTING ASSOCIATES, INC.

LIGHTING ASSOCIATES

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
4SNLED-LD4-50SL-LW-UNV-L835-CD1-U AYC-CHAIN/SET-U
Notes:

Type:
PC
LAI16-104794

WATTAGE

SNLED Type	Stock* / MTO	Lumen Type	Length	Catalog Logic	Nominal Lumens	Wattage	lm/W
Full Frost Lens (LW)	MTO	Standard	2 ft.	2SNLED-LD4-16SL-LW-UNV-L8XX-CD1-U	1702	17.13	99
Full Frost Lens (LW)	MTO	Standard	2 ft.	2SNLED-LD4-20SL-LW-UNV-L8XX-CD1-U	2075	21.7	92
Full Frost Lens (LW)	MTO	Standard	2 ft.	2SNLED-LD4-23SL-LW-UNV-L8XX-CD1-U	2421	23.18	104
Full Frost Lens (LW)	MTO	Standard	4 ft.	4SNLED-LD4-16SL-LW-UNV-L8XX-CD1-U	1819	16.21	111
Full Frost Lens (LW)	MTO	Standard	4 ft.	4SNLED-LD4-20SL-LW-UNV-L8XX-CD1-U	2054	18.37	109
Full Frost Lens (LW)	Stock	Standard	4 ft.	4SNLED-LD4-23SL-LW-UNV-L8XX-CD1-U	2399	21.68	111
Full Frost Lens (LW)	Stock	Standard	4 ft.	4SNLED-LD4-27SL-LW-UNV-L8XX-CD1-U	2732	25.07	108
Full Frost Lens (LW)	MTO	Standard	4 ft.	4SNLED-LD4-30SL-LW-UNV-L8XX-CD1-U	3062	28.43	106
Full Frost Lens (LW)	MTO	Standard	4 ft.	4SNLED-LD4-33SL-LW-UNV-L8XX-CD1-U	3411	32.32	105
Full Frost Lens (LW)	MTO	Standard	4 ft.	4SNLED-LD4-37SL-LW-UNV-L8XX-CD1-U	3778	36.64	101
Full Frost Lens (LW)	Stock	Standard	4 ft.	4SNLED-LD4-41SL-LW-UNV-L8XX-CD1-U	4119	41.03	100
Full Frost Lens (LW)	MTO	Standard	4 ft.	4SNLED-LD4-44SL-LW-UNV-L8XX-CD1-U	4457	45.66	96
Full Frost Lens (LW)	MTO	Standard	4 ft.	4SNLED-LD4-47SL-LW-UNV-L8XX-CD1-U	4781	50.15	94
Full Frost Lens (LW)	MTO	Standard	4 ft.	4SNLED-LD4-50SL-LW-UNV-L8XX-CD1-U	5100	56.3	89
Full Frost Lens (LW)	MTO	High	4 ft.	4SNLED-LD4-54HL-LW-UNV-L8XX-CD1-U	5458	50.71	106
Full Frost Lens (LW)	MTO	Standard	8 ft.	8TSNLED-LD4-54SL-LW-UNV-L8XX-CD1-U	5464	50.14	108
Full Frost Lens (LW)	MTO	Standard	8 ft.	8TSNLED-LD4-61SL-LW-UNV-L8XX-CD1-U	6125	56.86	107
Full Frost Lens (LW)	Stock	Standard	8 ft.	8TSNLED-LD4-67SL-LW-UNV-L8XX-CD1-U	6822	64.64	104
Full Frost Lens (LW)	Stock	Standard	8 ft.	8TSNLED-LD4-74SL-LW-UNV-L8XX-CD1-U	7556	73.28	101
Full Frost Lens (LW)	MTO	Standard	8 ft.	8TSNLED-LD4-81SL-LW-UNV-L8XX-CD2-U	8238	82.06	99
Full Frost Lens (LW)	MTO	Standard	8 ft.	8TSNLED-LD4-88SL-LW-UNV-L8XX-CD2-U	8915	91.32	96
Full Frost Lens (LW)	MTO	Standard	8 ft.	8TSNLED-LD4-95SL-LW-UNV-L8XX-CD2-U	9562	100.3	95

* Stocked in either 3500K or 4000K

PHOTOMETRICS

See website for IES/photometric files

LUMEN MAINTENANCE

Ambient Temperature	TM-21 Lumen Maintenance (12,000 hours)	Theoretical L70 (Hours)
25°C	92.55%	303,000

Max Ambient temp in compliance with CSA: 40°C

Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** 4SNLED-LD4-50SL-LW-UNV-L835-CD1-U AYC-CHAIN/SET-U Notes:	**Type:** PC LAI16-104794

ORDERING INFORMATION

SAMPLE NUMBER: 4SNLED-LD4-46SL-LN-UNV-L835-CD1-U

2=2' Length
4=4' Length
8T=8' Length

Series
SNLED=Commercial LED Striplight [10]

Lamp Type
LD4=LED 4.0

LED Lumens Output [2]

Stocked Lumen Packages - LC [9]	Stocked Lumen Packages - LN [9]	Stocked Lumen Packages - LW [9]
26SL=2600 [8]	**26SL**=2600 [8]	**23SL**=2300 [8]
30SL=3000	**30SL**=3000	**27SL**=2700
46SL=4600	**32HL**=3200	**41SL**=4100
75SL=7500	**46SL**=4600	**67SL**=6700
83SL=8300	**75SL**=7500	**74SL**=7400
	83SL=8300	
MTO Lumen Packages - LC	**MTO Lumen Packages - LN**	**MTO Lumen Packages - LW**
18SL=1800 [8]	**18SL**=1800 [8]	**16SL**=1600 [8]
22SL=2200 [8]	**22SL**=2200 [8]	**20SL**=2000 [8]
34SL=3400	**34SL**=3400	**30SL**=3000
37SL=3700	**37SL**=3700	**33SL**=3300
41SL=4100	**41SL**=4100	**37SL**=3700
49SL=4900	**49SL**=4900	**44SL**=4400
52SL=5200	**53SL**=5300	**47SL**=4700
56SL=5600	**56SL**=5600	**50SL**=5000
60SL=6000	**60SL**=6000	**54SL**=5400
60HL=6000 [1]	**60HL**=6000 [1]	**54HL**=5400 [1]
68SL=6800	**68SL**=6800	**61SL**=6100
90SL=9000 [3]	**91SL**=9100 [3]	**81SL**=8100 [3]
98SL=9800 [3]	**98SL**=9800 [3]	**88SL**=8800 [3]
105SL=10,500 [3]	**106SL**=10,600 [3]	**95SL**=9500 [3]
130HL=13,000 [3], [14]		

Optic
LC=Clear Lens
LN=Semi-Frost Lens - Narrow
LW=Full Frost Lens - Wide

Voltage
UNV=Universal Voltage 120-277
347=347V
480=480V [4]

Options
Emergency
EL7W=7-watt, 120V-277V emergency battery pack installed [7], [4]
EL14W=14-watt 120V-277V emergency battery pack installed [7], [4]
GTD2=Bodine Generator Transfer Device [15]
ETS2=IOTA Emergency Transfer Switch [15]

Wiring
PI/CPI=Plug-in Option

Motion Sensors
LB-ERMS360=360° Low Bay Motion Sensor - End of Row
LB-MRMS360=360° Low Bay Motion Sensor - Middle of Row
HB-ERMS360=360° High Bay Motion Sensor - End of Row [5]
HB-MRMS360=360° High Bay Motion Sensor - Middle of Row [5]

CCT
L830=3000K
L835=3500K
L840=4000K
L850=5000K

Driver Type
CD=0-10V Dimming Driver (10% - 100% Dimming)
HCD=0-10V Dimming Driver (1% - 100% Dimming) [13]
SD=Step-dim (Bi Level) [4, 11]
5LTD=Fifth Light (DALI) Driver [4, 6, 11]

Number of Drivers
1=1 Driver
2=2 Drivers

Packaging
U=Unit Pack

ACCESSORIES

(Order Separately)
AYC-Chain/Set=36" Chain Hanger (Use 1 set per fixture)
SCF=Fixed Stem Set (Specify Length)
SCS=Swivel Stem Set (Specify Length)
SCA=Adjustable 48" Stem Set
EYE CHAIN SET/3FT=Eye Bolt Chain (Use 1 set per fixture)
WG/SNF-2FT=2' Wire Guard
WG/SNF-4FT=4' Wire Guard
A1B/Spacer-U=Spacer 1-1/2" to 2-1/2" from ceiling (Use 2 per fixture)
TOGGLE=Single Toggle No. 2 (Specify Length)
Y-TOGGLE=Y Toggle No. 2 (Specify Length)

NOTES: [1] 4 ft. only. [2] Nominal lumen values. [3] Two drivers required. [4] 4 ft. and 8 ft. only. [5] Motion Sensor offers dimmability. [6] For a complete listing of Fifth Light products, visit www.eaton.com/lightingsystems [7] With integral test switch/indicator/laser test. For approximate delivered lumens multiply the lumens per watt of the desired fixture by the wattage of the emergency battery pack (100 lm/W x 7=700 lumens). IES-format photometry for luminaire under emergency operation available. [8] 2 ft. and 4 ft. only. [9] Stocked by mid April 2015. [10] DesignLights Consortium™ Qualified and classified for DLC Standard (all lumen packages), refer to www.designlights.org for details. [11] 3700 lumen and above. [12] Step dimming not available. [13] HCD driver option not available with 6100, 6700, 7400, 7500 and 8300 lumen packages. [14] Not currently listed on DLC QPL. [15] Used to transfer fixture to secondary power source for life-safety operation. When used with a dimming fixture, two devices are required to ensure control is disabled while operating under emergency power.

Specifications & dimensions subject to change without notice. Consult your Eaton Representative for availability and ordering information.

SHIPPING DATA

Length.	Wt.
2 ft.	4.3 lbs.
4 ft.	8.2 lbs.
8 ft.	15.1 lbs.

Powering Business Worldwide

Eaton
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.eaton.com/lighting

Specifications and dimensions subject to change without notice.

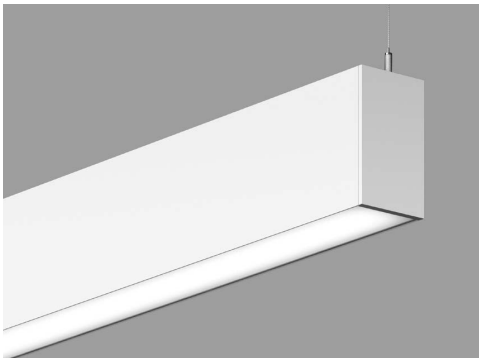
Submitted by LIGHTING ASSOCIATES, INC.		
Job Name: WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** MP1331VIA4PDIWS-HLO-LGO-LED-80-750-1000-30-8'-277-D-1-W-CU Notes:	**Type:** PD8 LAI16-104794

MP1279

VIA 4 LED PENDANT DIRECT/INDIRECT

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Shown with HLO optics

PROJECT: _____

TYPE: _____

NOTES: _____

DESCRIPTION

Via 4 is the flexible linear LED luminaire system for pendant, surface and recessed or in-wall installation, whether as discrete luminaires, continuous runs or patterns. Via 4 features numerous high-efficiency optical configurations, including separately controlled indirect/direct, wall wash and asymmetric distributions, as well as a wide range of electrical, control and trim options. See separate spec sheets for patterns and other available mountings.

ORDER GUIDE

MP1279VIA4PDI	HLO	LGO	LED		
LUMINAIRE ID	**DIRECT OPTICS**	**INDIRECT OPTICS**	**LIGHT SOURCE**	**CRI**	**DIRECT LUMEN PACKAGES**
MP1279VIA4PDI - via 4" pendant direct/indirect	**HLO** - High-Efficiency Lambertian Optic	**LGO** - Wide spread Optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**500** - low output 500lm/ft **750** - med. output 750lm/ft **1000** - high output 1000lm/ft **1200** - ultra high output 1200lm/ft

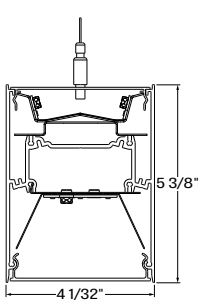
4'

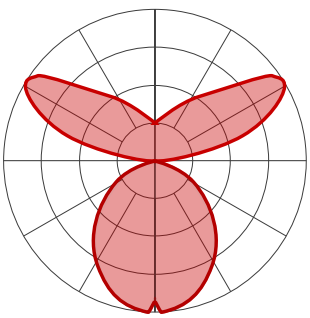
INDIRECT LUMEN PACKAGES	COLOR TEMP.	LUMINAIRE LENGTH	VOLTAGE	DRIVER	ELECTRICAL
500 - low output 500lm/ft **750** - medium output 750lm/ft Lower lumen packages are available, consult factory	**30** - 3000k **35** - 3500k **40** - 4000k	Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires /EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **2** - 2 circuits **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device

9/16

ELECTRICAL	MOUNTING	FINISH	OPTIONS
1 - 1 circuit **2** - 2 circuits **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**53WAC36** - power 5" + non power 3" white canopy (36" air craft cable) **55WSW18** - power 5" + non power 5" white canopy & stem (18" stem) For all other mountings refer to the Pendant Mounting Guide.	**W** - matte white **AL** - aluminum **CF#** - custom finish specify RAL#	**TB#** - T-bar caddy clip specify grid size **TG#** - Tegular caddy clip specify grid size **ST** - Screw Slots caddy clip

CROSS SECTION





MP1279 - air craft cable

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-2'-H-3000K-F-277V-SC-C3F-DIM Notes:	**Type:** **RA2** LAI16-104794

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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

Date

Project

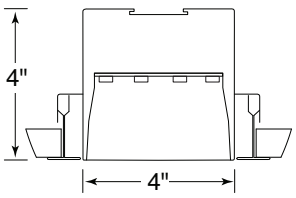
Type

Comments



DESCRIPTION

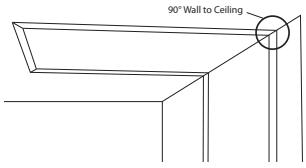
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser (Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

2'

HP-4 R | | | | | | | | | |

Finelite Series HP-4 R
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard, B - Boosted Standard, H - High, V - Very High)
LED CRI (8 - 80 CRI min (standard), 9 - 90 CRI min)
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - screw slot, C3F - flush screw slot, VF - Visible Flange, C2T - 9/16" tegular, C1T - 1" tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - tech zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-2'-H-3000K-F-277V-SC-C3F-DIM Notes:	**Type:** **RA2** LAI16-104794

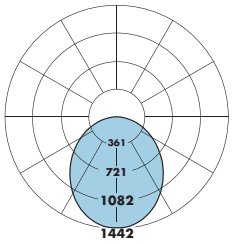
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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

PHOTOMETRY

Very High Output - 4' Luminaire
Efficacy: 101 lumens per watt
Total luminaire output: 3726 Lumens (932 lumens/foot)
37 Watts (9.3 watts/foot)
Peak Candela Value: 1442 @ 0º
CCT: 3500K
ITL LM79 Report 85128



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1442	1442	1442	1442	1442	
5	1434	1434	1433	1433	1434	136
15	1369	1360	1365	1364	1359	384
25	1241	1226	1232	1225	1219	566
35	1064	1053	1055	1043	1037	657
45	864	853	851	840	834	655
55	650	644	640	631	626	571
65	441	436	433	428	425	428
75	238	237	238	237	236	252
85	70	69	70	72	71	78
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1525	1917	2898	3726

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
381	479	725	932

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
105	104	102	101

* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85128
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

Recessed (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2898 lm x 0.789 = 2287 lm

Total Light Output per Foot =
725 lm/ft x 0.789 = 572 lm/ft

watts/foot = 7.1 W/ft

$$Efficacy = \frac{572\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80\ \text{lm/W}$$

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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

HOUSING



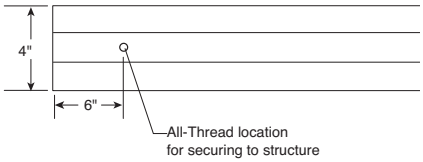
Housing With Extruded Flange (V1)

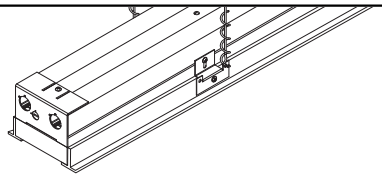
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6





SHEET ROCK INSTALLATION:

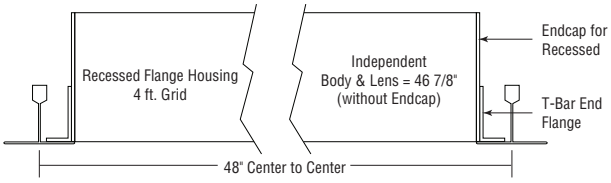
Flex conduit is secured to top of luminaire. Support to structure using All-Thread. All-Thread support holes are located on each end of the luminaire.

T-BAR INSTALLATION:

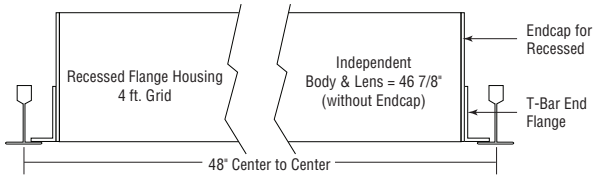
HP-4 R for T-Bar installations comes standard with a splice plate at the end of the luminaire. Mounting brackets (supplied) secure the luminaire to T-Bar and provide support to structure location. All starter/independent luminaires are 1 1/8" shorter than nominal. All joiner/ender luminaire are normal length.

GRID LENGTH DETAIL - 4 ft. example

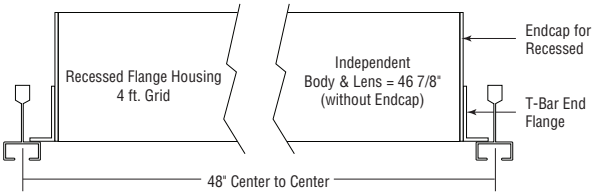
1" T-bar



9/16" T-bar

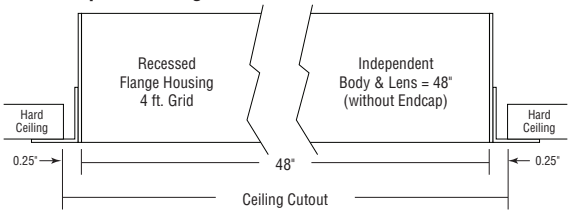


9/16" Screw Slot

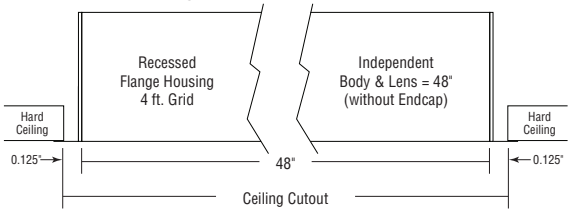


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



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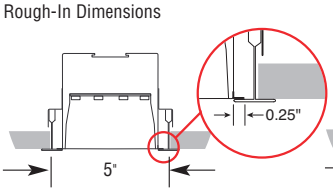
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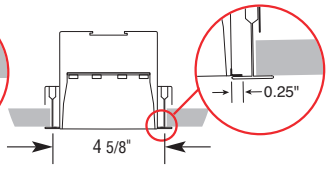
High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR

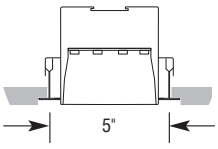
Rough-In Dimensions



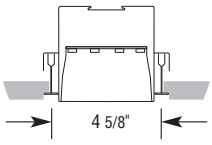
1" T-Bar (C1)



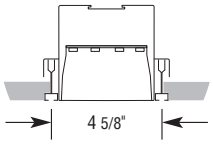
9/16" T-Bar (C2)



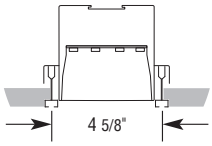
1" Tegular (C1T)



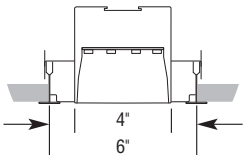
9/16" Tegular (C2T)



Flush Screw Slot (C3F)

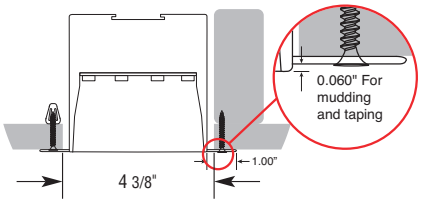


Standard Screw Slot (C3)

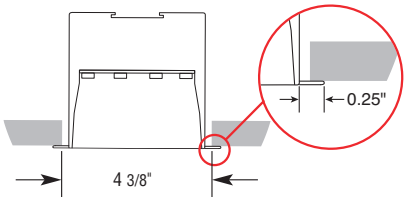


Tech Zone
(TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF)



Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor Occupancy Sensor **INTEGRATED SENSORS:** Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-3'-H-3000K-F-277V-SC-C3F-DIM Notes:	**Type:** **RA3** LAI16-104794

IC - RATED | LED | BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

Date

Project

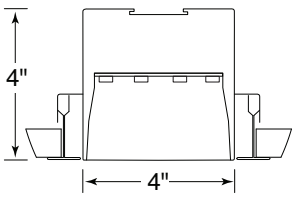
Type

Comments



DESCRIPTION

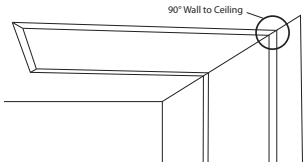
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser (Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

3'

HP-4 R

Finelite Series HP-4 R
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard, B - Boosted Standard, H - High, V - Very High)
LED CRI (8 - 80 CRI min (standard), 9 - 90 CRI min)
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - screw slot, C3F - flush screw slot, VF - Visible Flange, C2T - 9/16" tegular, C1T - 1" tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - tech zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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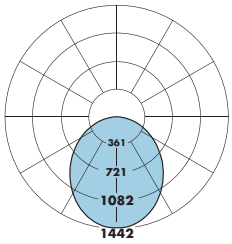
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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

PHOTOMETRY

Very High Output - 4' Luminaire
Efficacy: 101 lumens per watt
Total luminaire output: 3726 Lumens (932 lumens/foot)
37 Watts (9.3 watts/foot)
Peak Candela Value: 1442 @ 0º
CCT: 3500K
ITL LM79 Report 85128



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1442	1442	1442	1442	1442	
5	1434	1434	1433	1433	1434	136
15	1369	1360	1365	1364	1359	384
25	1241	1226	1232	1225	1219	566
35	1064	1053	1055	1043	1037	657
45	864	853	851	840	834	655
55	650	644	640	631	626	571
65	441	436	433	428	425	428
75	238	237	238	237	236	252
85	70	69	70	72	71	78
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1525	1917	2898	3726

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
381	479	725	932

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
105	104	102	101

* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85128
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

Recessed (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2898 lm x 0.789 = 2287 lm

Total Light Output per Foot =
725 lm/ft x 0.789 = 572 lm/ft

watts/foot = 7.1 W/ft

$$Efficacy = \frac{572\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80\ \text{lm/W}$$

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High Performance 4" Aperture (HP-4) - Recessed

HOUSING



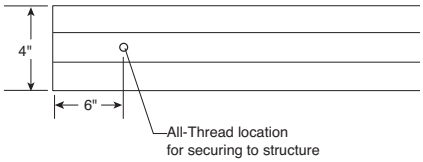
Housing With Extruded Flange (V1)

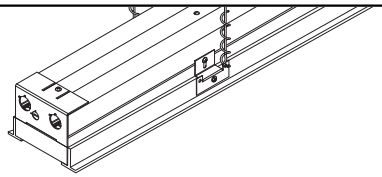
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6





SHEET ROCK INSTALLATION:

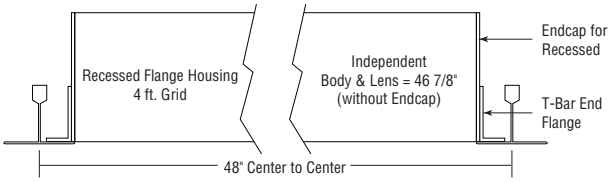
Flex conduit is secured to top of luminaire. Support to structure using All-Thread. All-Thread support holes are located on each end of the luminaire.

T-BAR INSTALLATION:

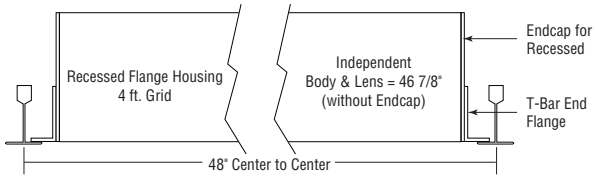
HP-4 R for T-Bar installations comes standard with a splice plate at the end of the luminaire. Mounting brackets (supplied) secure the luminaire to T-Bar and provide support to structure location. All starter/independent luminaires are 1 1/8" shorter than nominal. All joiner/ender luminaire are normal length.

GRID LENGTH DETAIL - 4 ft. example

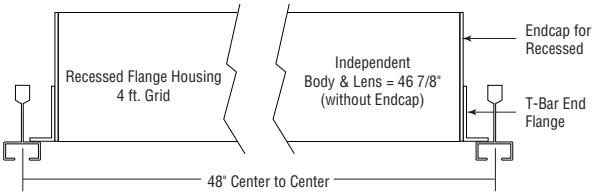
1" T-bar



9/16" T-bar

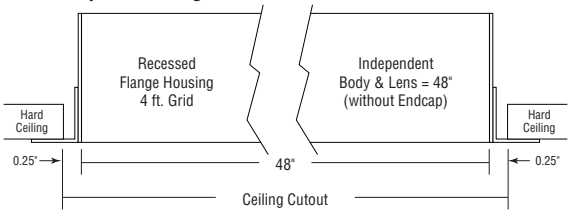


9/16" Screw Slot

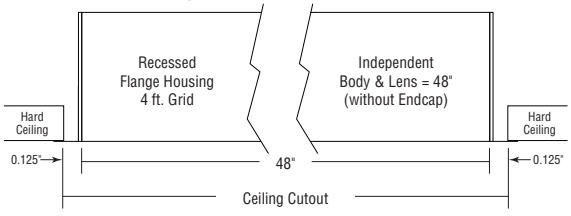


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



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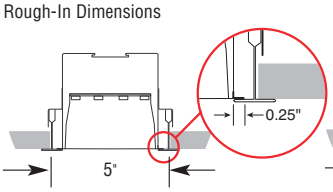
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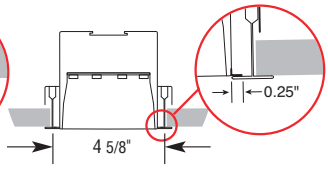
High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR

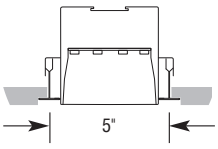
Rough-In Dimensions



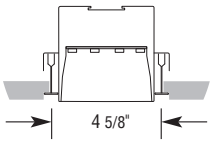
1" T-Bar (C1)



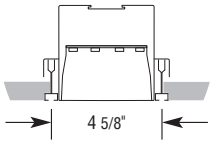
9/16" T-Bar (C2)



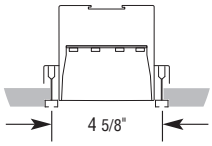
1" Tegular (C1T)



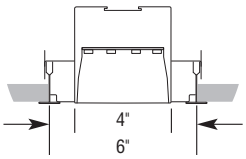
9/16" Tegular (C2T)



Flush Screw Slot (C3F)

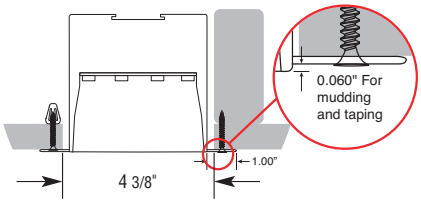


Standard Screw Slot (C3)

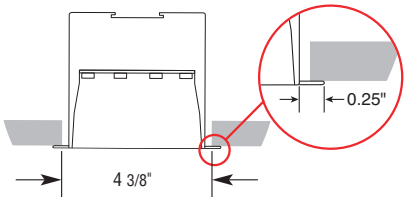


Tech Zone
(TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF)



Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor Occupancy Sensor **INTEGRATED SENSORS:** Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-4'-H-3000K-F-277V-SC-C3F-DIM Notes:	**Type:** **RA4** LAI16-104794

IC - RATED | LED | BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

Date

Project

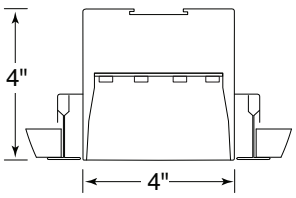
Type

Comments



DESCRIPTION

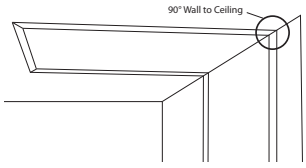
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser (Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

4' | HP-4 R | | | | | | | | | |

Finelite Series HP-4 R
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard, B - Boosted Standard, H - High, V - Very High)
LED CRI (8 - 80 CRI min (standard), 9 - 90 CRI min)
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - screw slot, C3F - flush screw slot, VF - Visible Flange, C2T - 9/16" tegular, C1T - 1" tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - tech zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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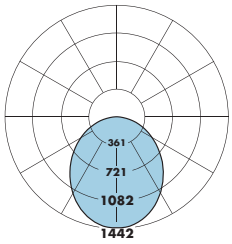
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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

PHOTOMETRY

Very High Output - 4' Luminaire
Efficacy: 101 lumens per watt
Total luminaire output: 3726 Lumens (932 lumens/foot)
37 Watts (9.3 watts/foot)
Peak Candela Value: 1442 @ 0º
CCT: 3500K
ITL LM79 Report 85128



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1442	1442	1442	1442	1442	
5	1434	1434	1433	1433	1434	136
15	1369	1360	1365	1364	1359	384
25	1241	1226	1232	1225	1219	566
35	1064	1053	1055	1043	1037	657
45	864	853	851	840	834	655
55	650	644	640	631	626	571
65	441	436	433	428	425	428
75	238	237	238	237	236	252
85	70	69	70	72	71	78
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1525	1917	2898	3726

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
381	479	725	932

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
105	104	102	101

* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85128
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

Recessed (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2898 lm x 0.789 = 2287 lm

Total Light Output per Foot =
725 lm/ft x 0.789 = 572 lm/ft

watts/foot = 7.1 W/ft

$$\textit{Efficacy} = \frac{572\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80\ \text{lm/W}$$

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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

HOUSING



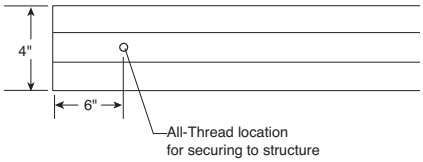
Housing With Extruded Flange (V1)

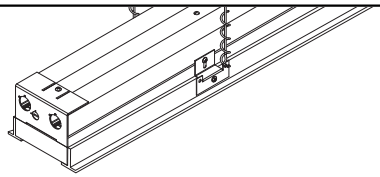
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6





SHEET ROCK INSTALLATION:

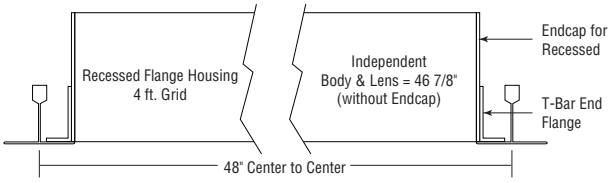
Flex conduit is secured to top of luminaire. Support to structure using All-Thread. All-Thread support holes are located on each end of the luminaire.

T-BAR INSTALLATION:

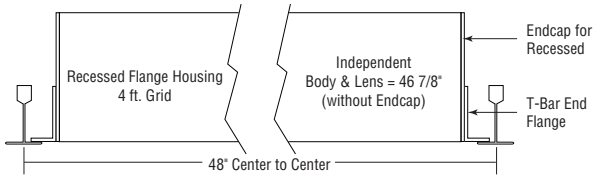
HP-4 R for T-Bar installations comes standard with a splice plate at the end of the luminaire. Mounting brackets (supplied) secure the luminaire to T-Bar and provide support to structure location. All starter/independent luminaires are 1 1/8" shorter than nominal. All joiner/ender luminaire are normal length.

GRID LENGTH DETAIL - 4 ft. example

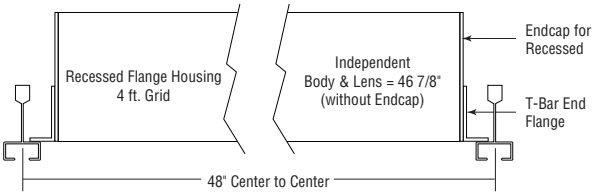
1" T-bar



9/16" T-bar

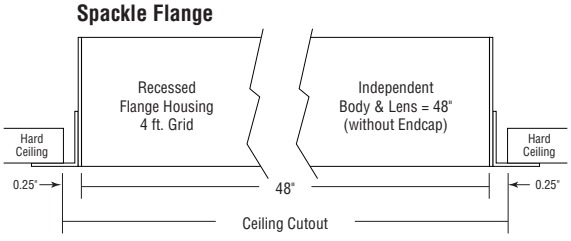


9/16" Screw Slot

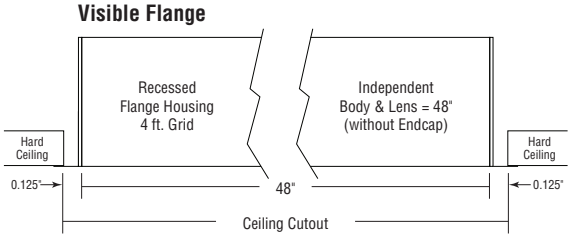


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



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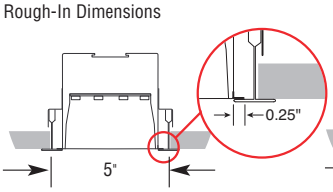
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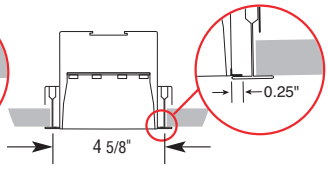
High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR

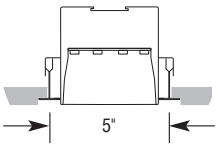
Rough-In Dimensions



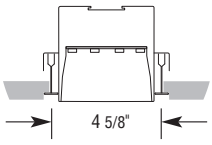
1" T-Bar (C1)



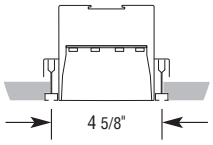
9/16" T-Bar (C2)



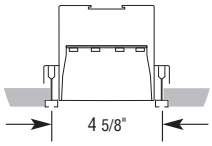
1" Tegular (C1T)



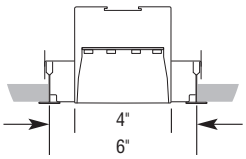
9/16" Tegular (C2T)



Flush Screw Slot (C3F)

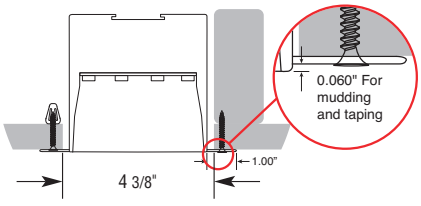


Standard Screw Slot (C3)

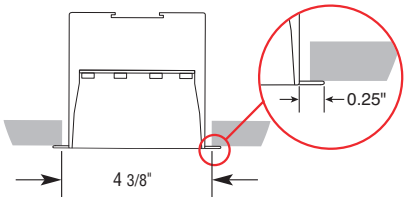


Tech Zone
(TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF)



Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor Occupancy Sensor **INTEGRATED SENSORS:** Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

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High Performance 4" Aperture (HP-4) - Recessed

Date

Project

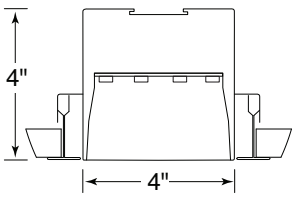
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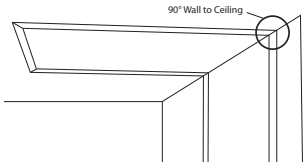
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Flush Diffuser (Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

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6' | HP-4 R | | | | | | | | | |

Finelite Series HP-4 R
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard, B - Boosted Standard, H - High, V - Very High)
LED CRI (8 - 80 CRI min (standard), 9 - 90 CRI min)
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - screw slot, C3F - flush screw slot, VF - Visible Flange, C2T - 9/16" tegular, C1T - 1" tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - tech zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-6'-H-3000K-F-277V-SC-C3F-DIM Notes:	**Type:** **RA6** LAI16-104794

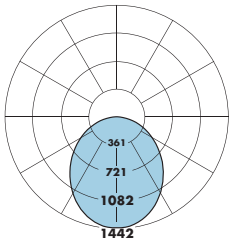
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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

PHOTOMETRY

Very High Output - 4' Luminaire
Efficacy: 101 lumens per watt
Total luminaire output: 3726 Lumens (932 lumens/foot)
37 Watts (9.3 watts/foot)
Peak Candela Value: 1442 @ 0º
CCT: 3500K
ITL LM79 Report 85128



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1442	1442	1442	1442	1442	
5	1434	1434	1433	1433	1434	136
15	1369	1360	1365	1364	1359	384
25	1241	1226	1232	1225	1219	566
35	1064	1053	1055	1043	1037	657
45	864	853	851	840	834	655
55	650	644	640	631	626	571
65	441	436	433	428	425	428
75	238	237	238	237	236	252
85	70	69	70	72	71	78
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1525	1917	2898	3726

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
381	479	725	932

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
105	104	102	101

* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85128
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

Recessed (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2898 lm x 0.789 = 2287 lm

Total Light Output per Foot =
725 lm/ft x 0.789 = 572 lm/ft

watts/foot = 7.1 W/ft

$$Efficacy = \frac{572\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80\ \text{lm/W}$$

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High Performance 4" Aperture (HP-4) - Recessed

HOUSING



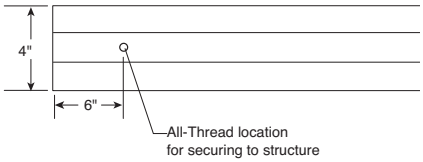
Housing With Extruded Flange (V1)

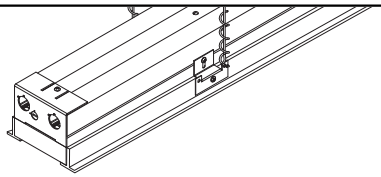
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6





SHEET ROCK INSTALLATION:

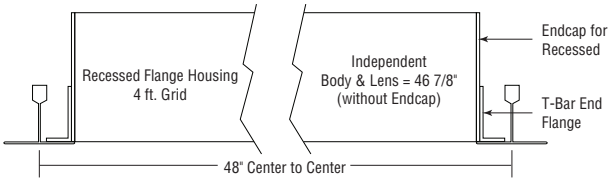
Flex conduit is secured to top of luminaire. Support to structure using All-Thread. All-Thread support holes are located on each end of the luminaire.

T-BAR INSTALLATION:

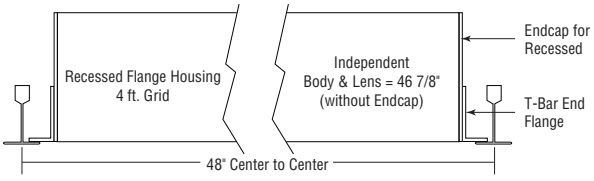
HP-4 R for T-Bar installations comes standard with a splice plate at the end of the luminaire. Mounting brackets (supplied) secure the luminaire to T-Bar and provide support to structure location. All starter/independent luminaires are 1 1/8" shorter than nominal. All joiner/ender luminaire are normal length.

GRID LENGTH DETAIL - 4 ft. example

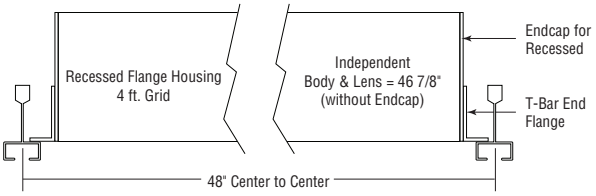
1" T-bar



9/16" T-bar

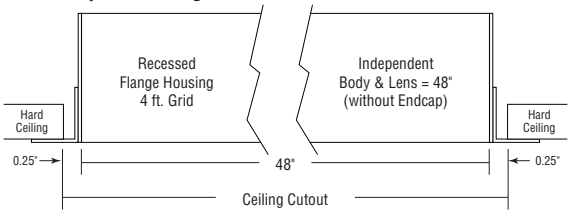


9/16" Screw Slot

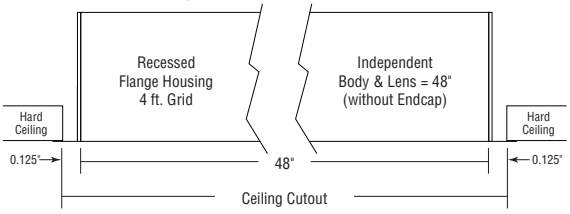


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



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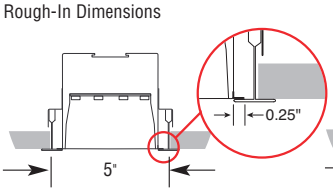
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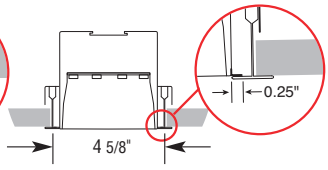
High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR

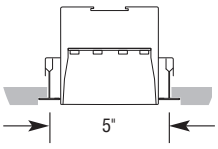
Rough-In Dimensions



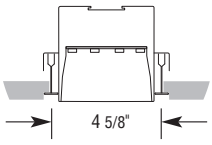
1" T-Bar (C1)



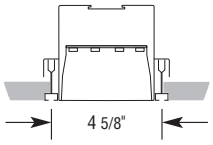
9/16" T-Bar (C2)



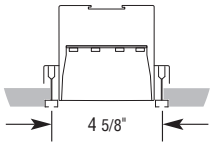
1" Tegular (C1T)



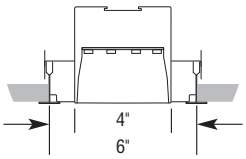
9/16" Tegular (C2T)



Flush Screw Slot (C3F)

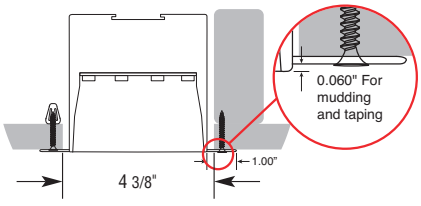


Standard Screw Slot (C3)

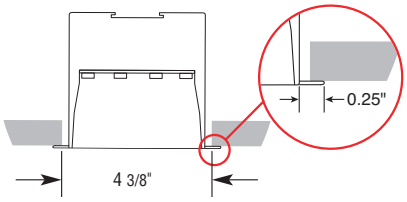


Tech Zone
(TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF)



Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor Occupancy Sensor **INTEGRATED SENSORS:** Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

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High Performance 4" Aperture (HP-4) - Recessed

Date

Project

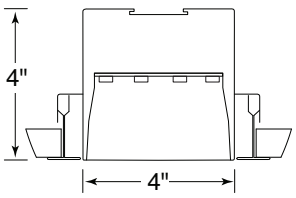
Type

Comments



DESCRIPTION

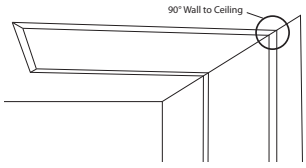
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser (Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

8'

HP-4 R

Finelite Series HP-4 R
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard, B - Boosted Standard, H - High, V - Very High)
LED CRI (8 - 80 CRI min (standard), 9 - 90 CRI min)
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - screw slot, C3F - flush screw slot, VF - Visible Flange, C2T - 9/16" tegular, C1T - 1" tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - tech zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

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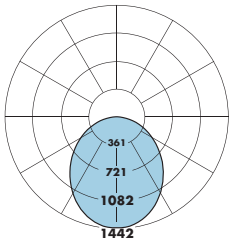
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90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
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High Performance 4" Aperture (HP-4) - Recessed

HOUSING



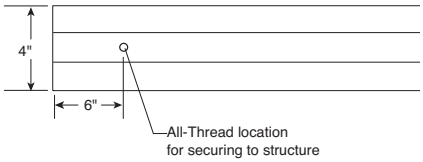
Housing With Extruded Flange (V1)

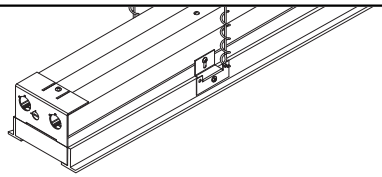
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6





SHEET ROCK INSTALLATION:

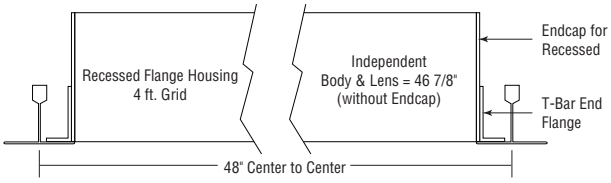
Flex conduit is secured to top of luminaire. Support to structure using All-Thread. All-Thread support holes are located on each end of the luminaire.

T-BAR INSTALLATION:

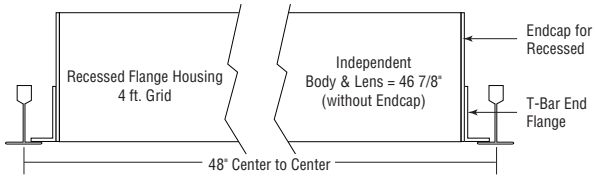
HP-4 R for T-Bar installations comes standard with a splice plate at the end of the luminaire. Mounting brackets (supplied) secure the luminaire to T-Bar and provide support to structure location. All starter/independent luminaires are 1 1/8" shorter than nominal. All joiner/ender luminaire are normal length.

GRID LENGTH DETAIL - 4 ft. example

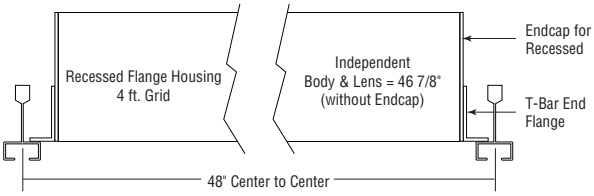
1" T-bar



9/16" T-bar

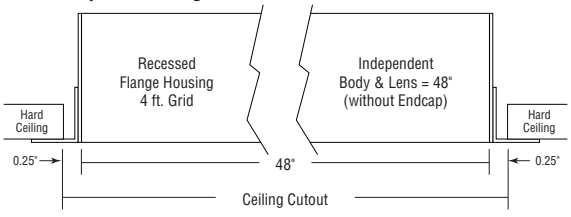


9/16" Screw Slot

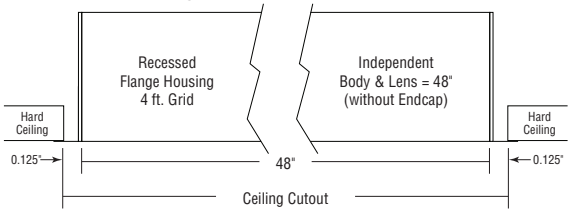


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-8'-H-3000K-F-277V-SC-C3F-DIM Notes:	**Type:** RA8 LAI16-104794

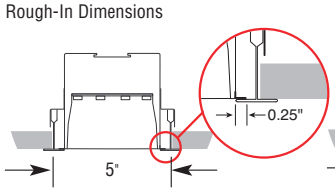
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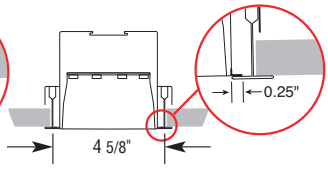
High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR

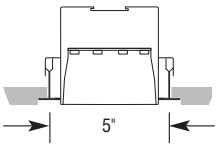
Rough-In Dimensions



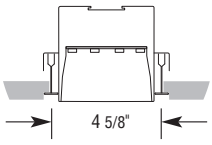
1" T-Bar (C1)



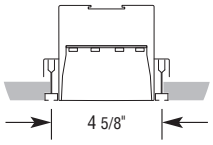
9/16" T-Bar (C2)



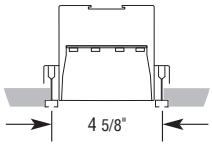
1" Tegular (C1T)



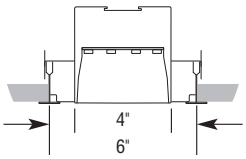
9/16" Tegular (C2T)



Flush Screw Slot (C3F)

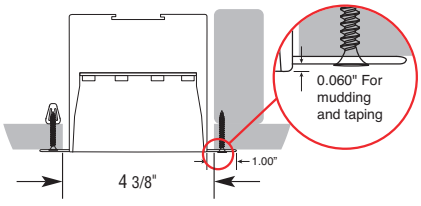


Standard Screw Slot (C3)

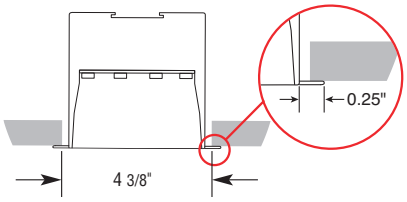


Tech Zone
(TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF)



Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor | Occupancy Sensor

INTEGRATED SENSORS: Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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High Performance 4" Aperture (HP-4) - Recessed

Date

Project

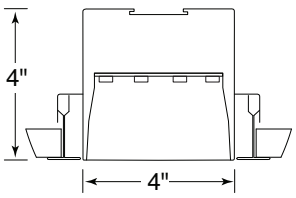
Type

Comments



DESCRIPTION

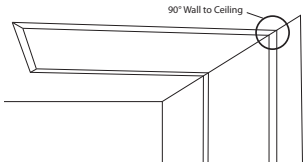
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser (Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

10'

HP-4 R

Finelite Series HP-4 R
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard, B - Boosted Standard, H - High, V - Very High)
LED CRI (8 - 80 CRI min (standard), 9 - 90 CRI min)
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - screw slot, C3F - flush screw slot, VF - Visible Flange, C2T - 9/16" tegular, C1T - 1" tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - tech zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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Type: **RA10**

LAI16-104794

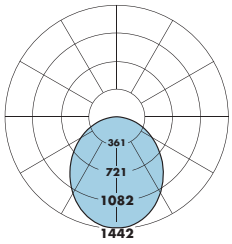
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High Performance 4" Aperture (HP-4) - Recessed

PHOTOMETRY

Very High Output - 4' Luminaire
Efficacy: 101 lumens per watt
Total luminaire output: 3726 Lumens (932 lumens/foot)
37 Watts (9.3 watts/foot)
Peak Candela Value: 1442 @ 0º
CCT: 3500K
ITL LM79 Report 85128



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1442	1442	1442	1442	1442	
5	1434	1434	1433	1433	1434	136
15	1369	1360	1365	1364	1359	384
25	1241	1226	1232	1225	1219	566
35	1064	1053	1055	1043	1037	657
45	864	853	851	840	834	655
55	650	644	640	631	626	571
65	441	436	433	428	425	428
75	238	237	238	237	236	252
85	70	69	70	72	71	78
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1525	1917	2898	3726

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
381	479	725	932

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
105	104	102	101

* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85128
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

Recessed (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2898 lm x 0.789 = 2287 lm

Total Light Output per Foot =
725 lm/ft x 0.789 = 572 lm/ft

watts/foot = 7.1 W/ft

$$\textit{Efficacy} = \frac{572\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80\ \text{lm/W}$$

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HOUSING



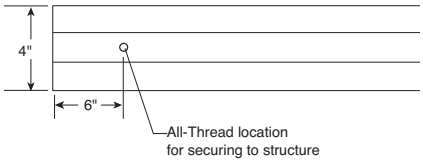
Housing With Extruded Flange (V1)

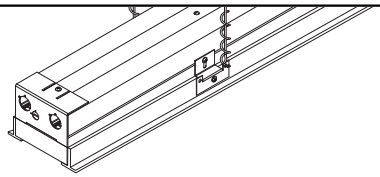
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6





SHEET ROCK INSTALLATION:

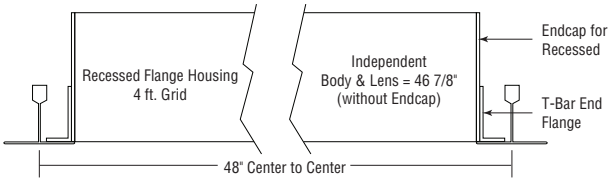
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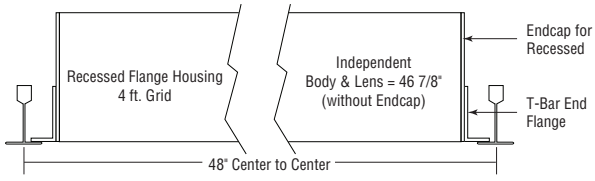
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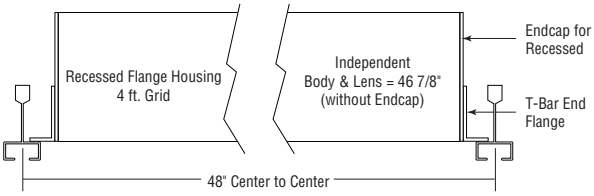
1" T-bar



9/16" T-bar

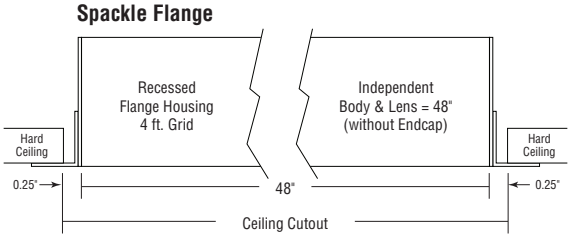


9/16" Screw Slot

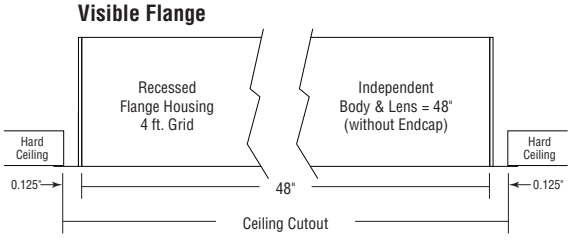


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



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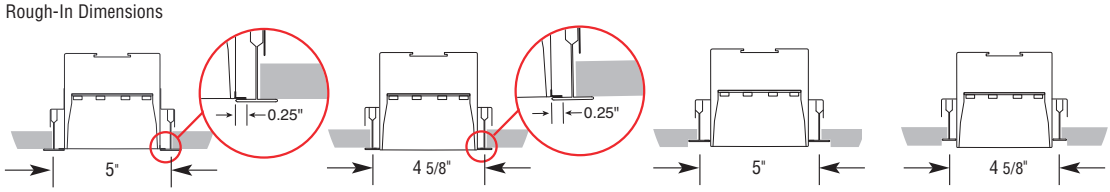
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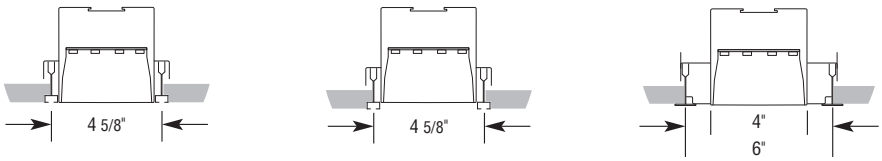
High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR

Rough-In Dimensions

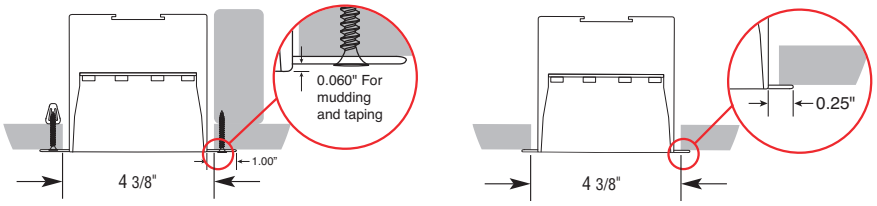


1" T-Bar (C1) | 9/16" T-Bar (C2) | 1" Tegular (C1T) | 9/16" Tegular (C2T)



Flush Screw Slot (C3F) | Standard Screw Slot (C3) | Tech Zone (TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF) | Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor Occupancy Sensor

INTEGRATED SENSORS: Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-12'-H-3000K-F-277V-SC-C3F-DIM Notes:	**Type:** **RA12** LAI16-104794

IC - RATED | LED | BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

Date

Project

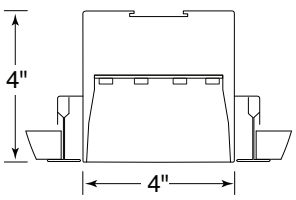
Type

Comments



DESCRIPTION

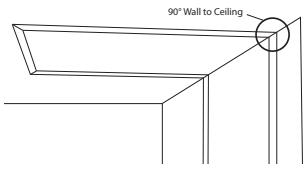
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser (Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

12' | HP-4 R | | | | | | | | | |

Finelite Series HP-4 R
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard, B - Boosted Standard, H - High, V - Very High)
LED CRI (8 - 80 CRI min (standard), 9 - 90 CRI min)
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - screw slot, C3F - flush screw slot, VF - Visible Flange, C2T - 9/16" tegular, C1T - 1" tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - tech zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

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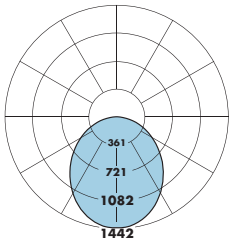
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High Performance 4" Aperture (HP-4) - Recessed

PHOTOMETRY

Very High Output - 4' Luminaire
Efficacy: 101 lumens per watt
Total luminaire output: 3726 Lumens (932 lumens/foot)
37 Watts (9.3 watts/foot)
Peak Candela Value: 1442 @ 0º
CCT: 3500K
ITL LM79 Report 85128



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1442	1442	1442	1442	1442	
5	1434	1434	1433	1433	1434	136
15	1369	1360	1365	1364	1359	384
25	1241	1226	1232	1225	1219	566
35	1064	1053	1055	1043	1037	657
45	864	853	851	840	834	655
55	650	644	640	631	626	571
65	441	436	433	428	425	428
75	238	237	238	237	236	252
85	70	69	70	72	71	78
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1525	1917	2898	3726

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
381	479	725	932

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
105	104	102	101

* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85128
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

Recessed (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2898 lm x 0.789 = 2287 lm

Total Light Output per Foot =
725 lm/ft x 0.789 = 572 lm/ft

watts/foot = 7.1 W/ft

$$\textit{Efficacy} = \frac{572\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80\ \text{lm/W}$$

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High Performance 4" Aperture (HP-4) - Recessed

HOUSING



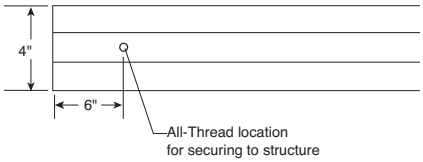
Housing With Extruded Flange (V1)

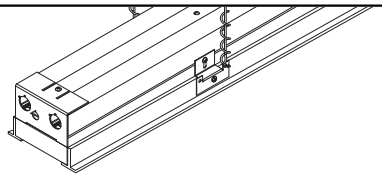
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6



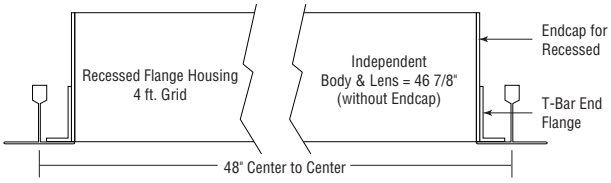


SHEET ROCK INSTALLATION:
Flex conduit is secured to top of luminaire. Support to structure using All-Thread. All-Thread support holes are located on each end of the luminaire.

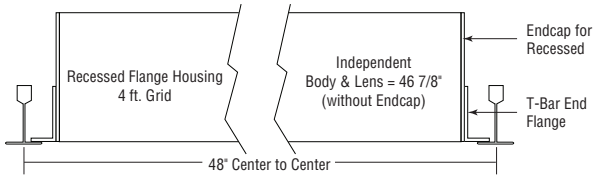
T-BAR INSTALLATION:
HP-4 R for T-Bar installations comes standard with a splice plate at the end of the luminaire. Mounting brackets (supplied) secure the luminaire to T-Bar and provide support to structure location. All starter/independent luminaires are 1 1/8" shorter than nominal. All joiner/ender luminaire are normal length.

GRID LENGTH DETAIL - 4 ft. example

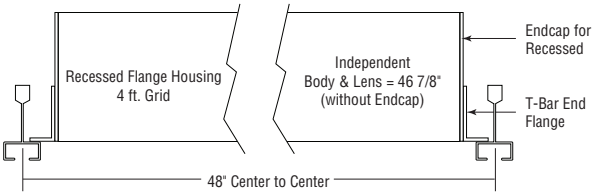
1" T-bar



9/16" T-bar

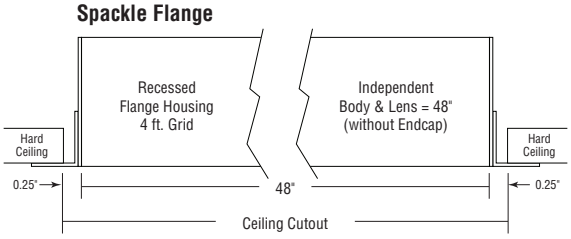


9/16" Screw Slot

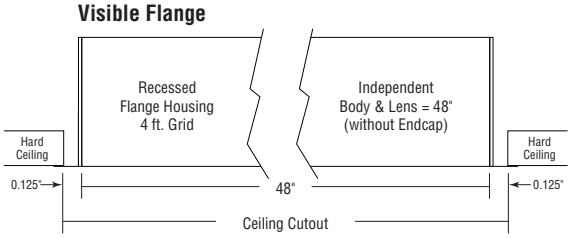


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



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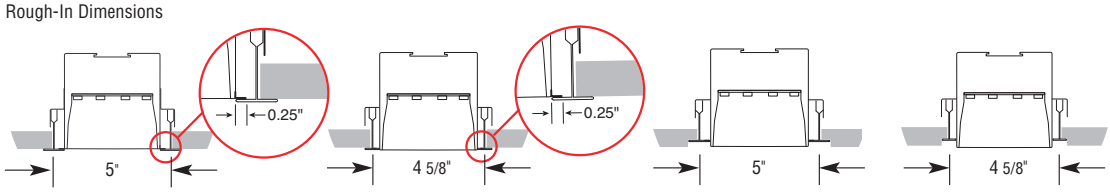
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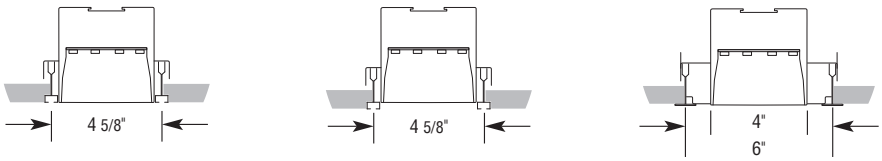
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Rough-In Dimensions

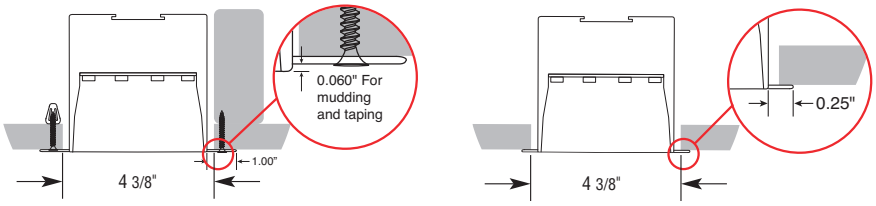


1" T-Bar (C1) | 9/16" T-Bar (C2) | 1" Tegular (C1T) | 9/16" Tegular (C2T)



Flush Screw Slot (C3F) | Standard Screw Slot (C3) | Tech Zone (TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF) | Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

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LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

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INDUSTRY BEST 10 YEAR LED WARRANTY | 2012 PROGRESS Report SELECTION | pia 13 | LED lighting facts® A Program of the U.S. DOE

Date

Project

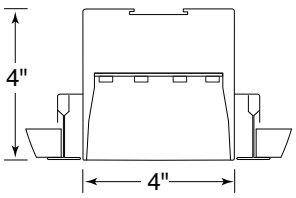
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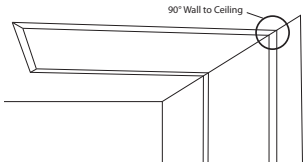
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Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-16'-H-3000K-F-277V-SC-C3F-DIM Notes:	**Type:** **RA16** LAI16-104794

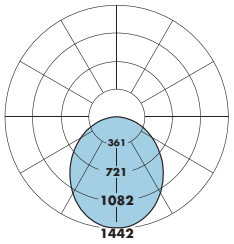
IC - RATED LED BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

PHOTOMETRY

Very High Output - 4' Luminaire
Efficacy: 101 lumens per watt
Total luminaire output: 3726 Lumens (932 lumens/foot)
37 Watts (9.3 watts/foot)
Peak Candela Value: 1442 @ 0º
CCT: 3500K
ITL LM79 Report 85128



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1442	1442	1442	1442	1442	
5	1434	1434	1433	1433	1434	136
15	1369	1360	1365	1364	1359	384
25	1241	1226	1232	1225	1219	566
35	1064	1053	1055	1043	1037	657
45	864	853	851	840	834	655
55	650	644	640	631	626	571
65	441	436	433	428	425	428
75	238	237	238	237	236	252
85	70	69	70	72	71	78
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1525	1917	2898	3726

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
381	479	725	932

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
105	104	102	101

* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85128
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

Recessed (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2898 lm x 0.789 = 2287 lm

Total Light Output per Foot =
725 lm/ft x 0.789 = 572 lm/ft

watts/foot = 7.1 W/ft

$$\textit{Efficacy} = \frac{572\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80\ \text{lm/W}$$

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HOUSING



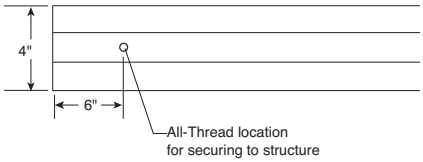
Housing With Extruded Flange (V1)

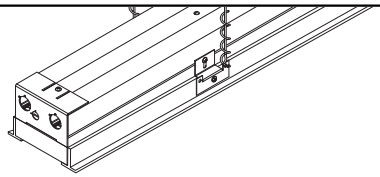
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6



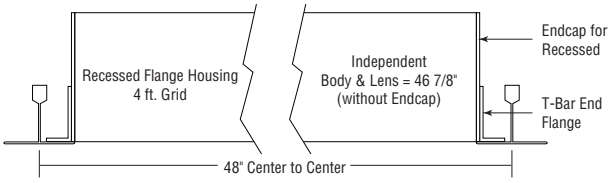


SHEET ROCK INSTALLATION:
Flex conduit is secured to top of luminaire. Support to structure using All-Thread. All-Thread support holes are located on each end of the luminaire.

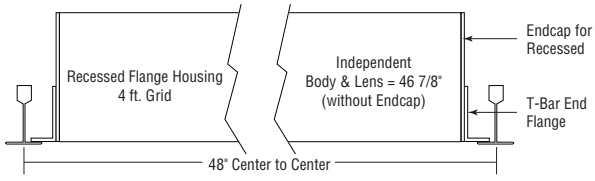
T-BAR INSTALLATION:
HP-4 R for T-Bar installations comes standard with a splice plate at the end of the luminaire. Mounting brackets (supplied) secure the luminaire to T-Bar and provide support to structure location. All starter/independent luminaires are 1 1/8" shorter than nominal. All joiner/ender luminaire are normal length.

GRID LENGTH DETAIL - 4 ft. example

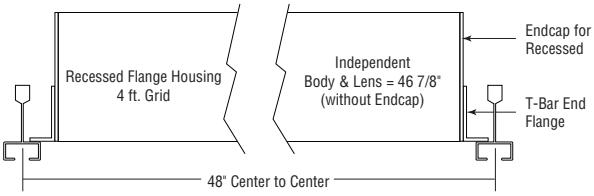
1" T-bar



9/16" T-bar

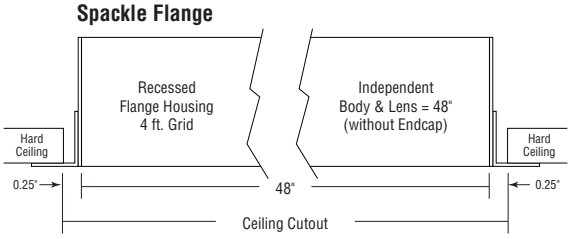


9/16" Screw Slot

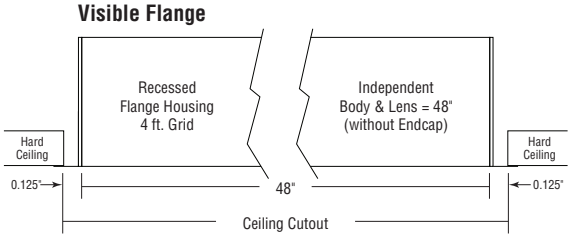


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



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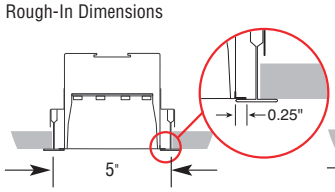
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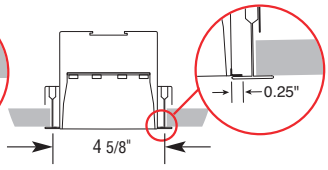
High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR

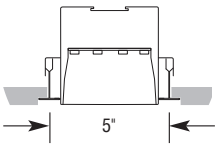
Rough-In Dimensions



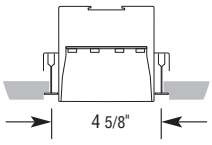
1" T-Bar (C1)



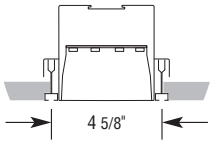
9/16" T-Bar (C2)



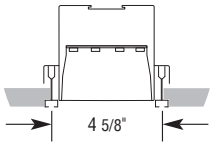
1" Tegular (C1T)



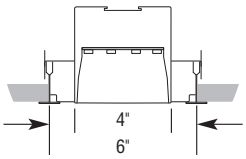
9/16" Tegular (C2T)



Flush Screw Slot (C3F)

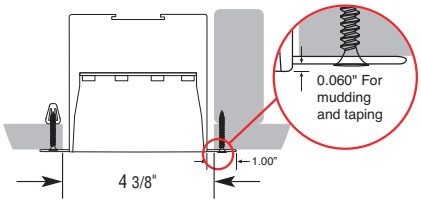


Standard Screw Slot (C3)

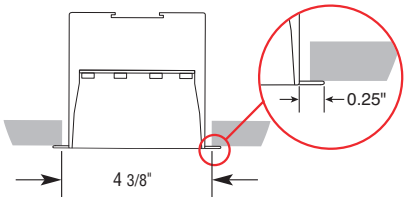


Tech Zone
(TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF)



Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor | Occupancy Sensor

INTEGRATED SENSORS: Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

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Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
FN-HP-4R-18'-H-3000K-F-277V-2C- C3F-DIM 12FT ON 1-CIRCUIT/6FT ON SEP CIRCUIT NEED 6FT ON ONE FEED/CIRC AND THE OTHER 12FT ON ANOTHER

Type:
RA18
LAI16-104794

IC - RATED | LED | BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

Date

Project

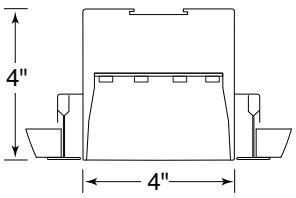
Type

Comments



DESCRIPTION

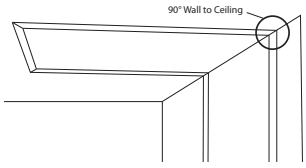
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser (Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

18'

HP-4 R

Finelite Series HP-4 R
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard, B - Boosted Standard, H - High, V - Very High)
LED CRI (8 - 80 CRI min (standard), 9 - 90 CRI min)
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - screw slot, C3F - flush screw slot, VF - Visible Flange, C2T - 9/16" tegular, C1T - 1" tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - tech zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

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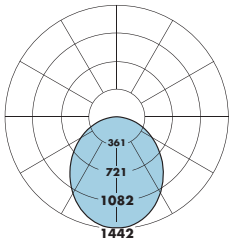
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90	0	0	0	0	0	

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Total Light Output per Foot =
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watts/foot = 7.1 W/ft

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High Performance 4" Aperture (HP-4) - Recessed

HOUSING



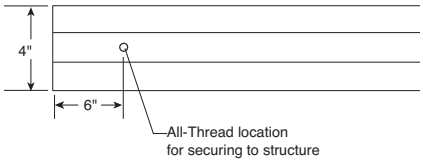
Housing With Extruded Flange (V1)

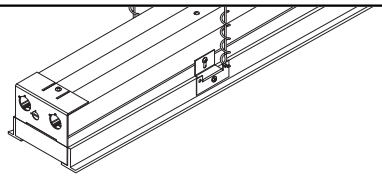
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6





SHEET ROCK INSTALLATION:

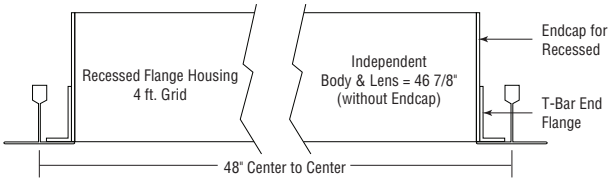
Flex conduit is secured to top of luminaire. Support to structure using All-Thread. All-Thread support holes are located on each end of the luminaire.

T-BAR INSTALLATION:

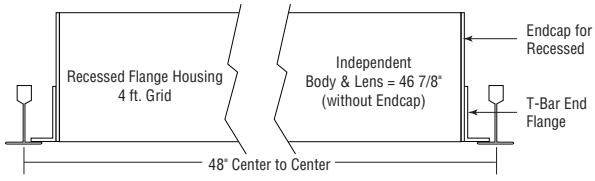
HP-4 R for T-Bar installations comes standard with a splice plate at the end of the luminaire. Mounting brackets (supplied) secure the luminaire to T-Bar and provide support to structure location. All starter/independent luminaires are 1 1/8" shorter than nominal. All joiner/ender luminaire are normal length.

GRID LENGTH DETAIL - 4 ft. example

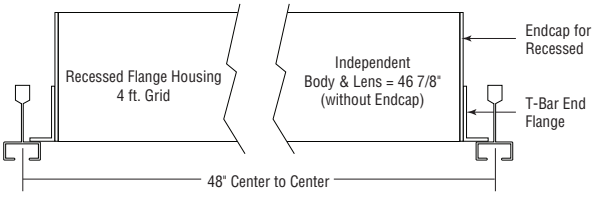
1" T-bar



9/16" T-bar

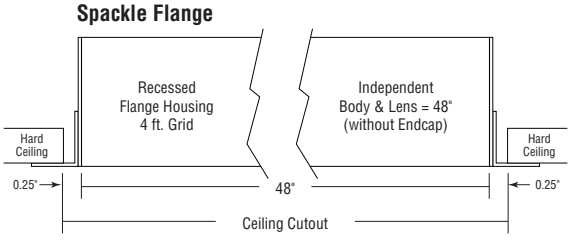


9/16" Screw Slot

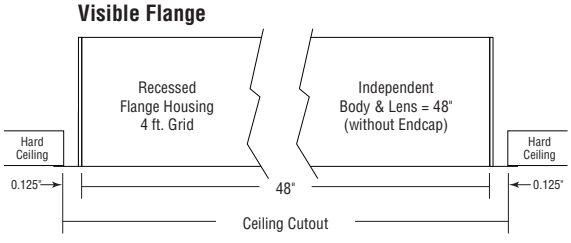


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
FN-HP-4R-18'-H-3000K-F-277V-2C- C3F-DIM 12FT ON 1-CIRCUIT/6FT ON SEP CIRCUIT NEED 6FT ON ONE FEED/CIRC AND THE OTHER 12FT ON ANOTHER

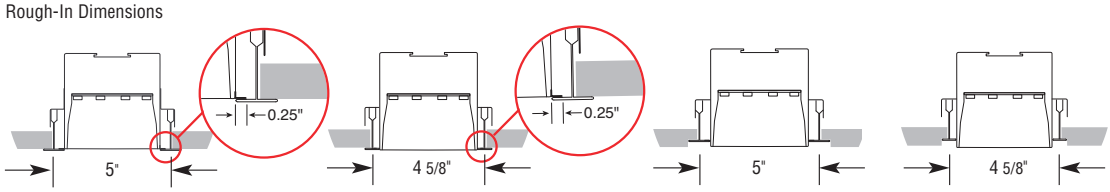
Type:
RA18
LAI16-104794

IC - RATED | LED | BUY AMERICAN ACT OF 2009 COMPLIANT

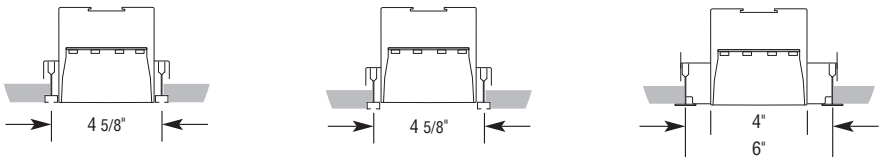
FINELITE

High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR
Rough-In Dimensions

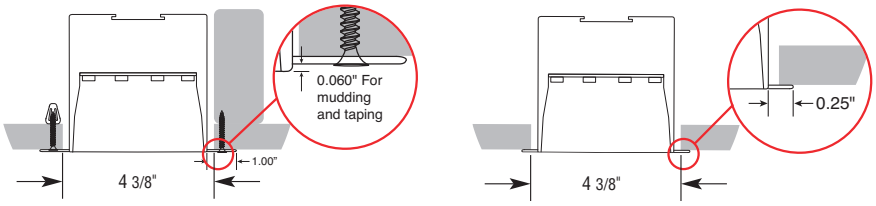


1" T-Bar (C1) | 9/16" T-Bar (C2) | 1" Tegular (C1T) | 9/16" Tegular (C2T)



Flush Screw Slot (C3F) | Standard Screw Slot (C3) | Tech Zone (TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF) | Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor | Occupancy Sensor

INTEGRATED SENSORS: Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
FN-HP-4R-68'-H-3000K-F-277V-2C- C2T-DIM ONE LEG OF FOUR ON SEP CIRCUIT ONE 10FT LEG ON A SEPERATE FEED/CIR

Type:
RA24
LAI16-104794

IC - RATED | LED | BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

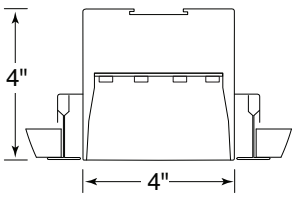
High Performance 4" Aperture (HP-4) - Recessed

Date
Project
Type
Comments



DESCRIPTION

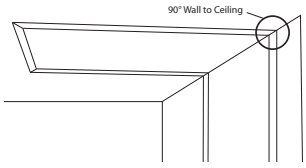
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser (Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

24' | HP-4 R | | | | | | | | | |

Finelite Series HP-4 R
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard, B - Boosted Standard, H - High, V - Very High)
LED CRI (8 - 80 CRI min (standard), 9 - 90 CRI min)
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - screw slot, C3F - flush screw slot, VF - Visible Flange, C2T - 9/16" tegular, C1T - 1" tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - tech zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

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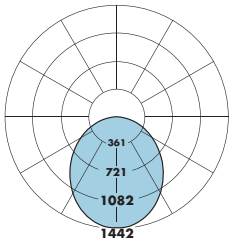
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High Performance 4" Aperture (HP-4) - Recessed

PHOTOMETRY

Very High Output - 4' Luminaire
Efficacy: 101 lumens per watt
Total luminaire output: 3726 Lumens (932 lumens/foot)
37 Watts (9.3 watts/foot)
Peak Candela Value: 1442 @ 0º
CCT: 3500K
ITL LM79 Report 85128



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1442	1442	1442	1442	1442	
5	1434	1434	1433	1433	1434	136
15	1369	1360	1365	1364	1359	384
25	1241	1226	1232	1225	1219	566
35	1064	1053	1055	1043	1037	657
45	864	853	851	840	834	655
55	650	644	640	631	626	571
65	441	436	433	428	425	428
75	238	237	238	237	236	252
85	70	69	70	72	71	78
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1525	1917	2898	3726

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
381	479	725	932

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
105	104	102	101

* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85128
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

Recessed (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2898 lm x 0.789 = 2287 lm

Total Light Output per Foot =
725 lm/ft x 0.789 = 572 lm/ft

watts/foot = 7.1 W/ft

$$Efficacy = \frac{572\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80\ lm/W$$

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Type:
RA24
LAI16-104794

IC - RATED | LED | BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

HOUSING



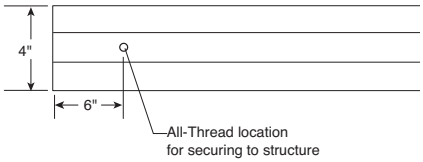
Housing With Extruded Flange (V1)

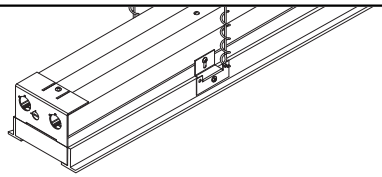
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6





SHEET ROCK INSTALLATION:

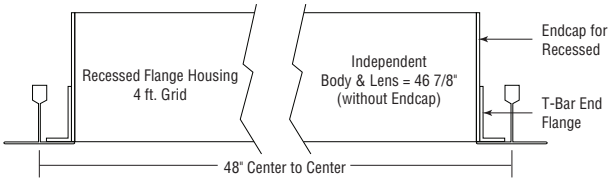
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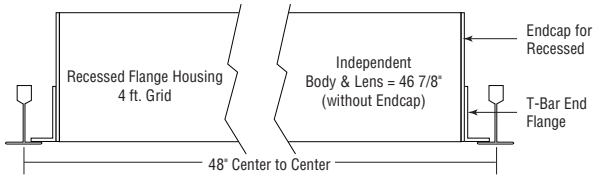
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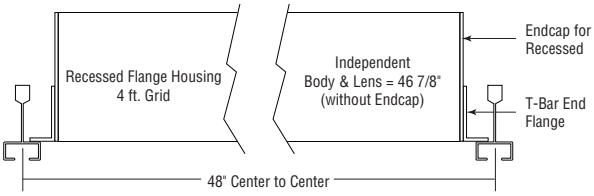
1" T-bar



9/16" T-bar

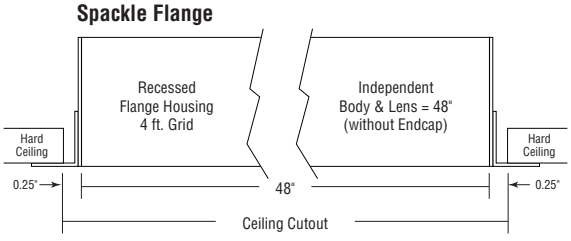


9/16" Screw Slot

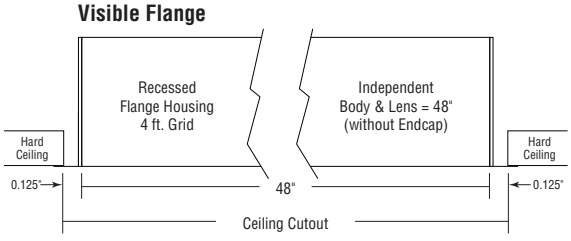


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



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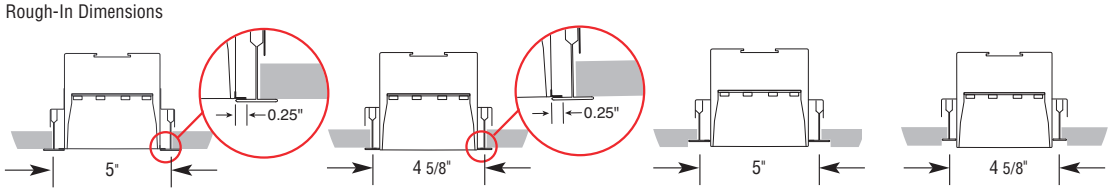
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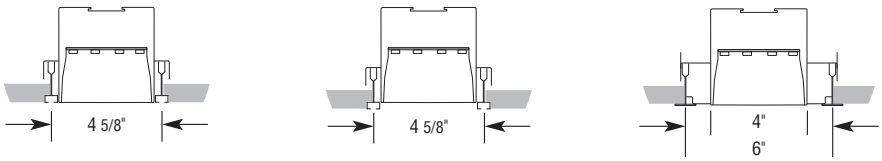
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MOUNTING TYPES: T-BAR

Rough-In Dimensions

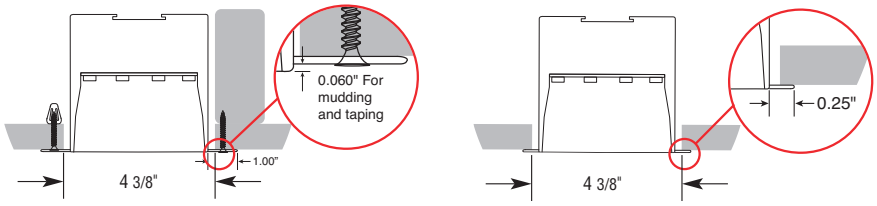


1" T-Bar (C1) | 9/16" T-Bar (C2) | 1" Tegular (C1T) | 9/16" Tegular (C2T)



Flush Screw Slot (C3F) | Standard Screw Slot (C3) | Tech Zone (TZ6- C1, C2. C2T, C3, C3F)

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DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor | Occupancy Sensor

INTEGRATED SENSORS: Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** FN-HP-4R-68'-H-3000K-F-277V-2C- C2T-DIM ONE LEG OF FOUR ON SEP CIRCUIT ONE 10FT LEG ON A SEPERATE FEED/ CIR	**Type:** **RA-24X9** LAI16-104794

IC - RATED | LED | BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

Date

Project

Type

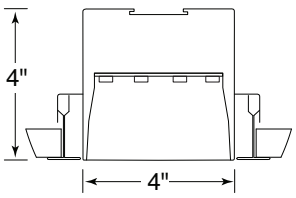
Comments

66' 8" LINEAR LENGTH
24FT X 9FT 4IN RECTANGLE
CONSISTING OF
(2) TYPE RA24C
(2) TYPE RA9-4C
AND (4) 90 DEGREE CORNERS



DESCRIPTION

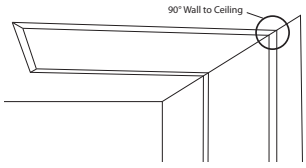
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser (Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

HP-4 R

Finelite Series HP-4 R
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard, B - Boosted Standard, H - High, V - Very High)
LED CRI (8 - 80 CRI min (standard), 9 - 90 CRI min)
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - screw slot, C3F - flush screw slot, VF - Visible Flange, C2T - 9/16" tegular, C1T - 1" tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - tech zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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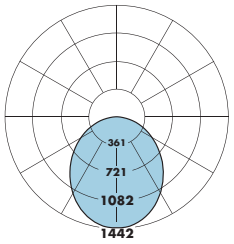
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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

PHOTOMETRY

Very High Output - 4' Luminaire
Efficacy: 101 lumens per watt
Total luminaire output: 3726 Lumens (932 lumens/foot)
37 Watts (9.3 watts/foot)
Peak Candela Value: 1442 @ 0º
CCT: 3500K
ITL LM79 Report 85128



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1442	1442	1442	1442	1442	
5	1434	1434	1433	1433	1434	136
15	1369	1360	1365	1364	1359	384
25	1241	1226	1232	1225	1219	566
35	1064	1053	1055	1043	1037	657
45	864	853	851	840	834	655
55	650	644	640	631	626	571
65	441	436	433	428	425	428
75	238	237	238	237	236	252
85	70	69	70	72	71	78
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1525	1917	2898	3726

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
381	479	725	932

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
105	104	102	101

* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85128
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

Recessed (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2898 lm x 0.789 = 2287 lm

Total Light Output per Foot =
725 lm/ft x 0.789 = 572 lm/ft

watts/foot = 7.1 W/ft

$$Efficacy = \frac{572\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80\ lm/W$$

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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

HOUSING



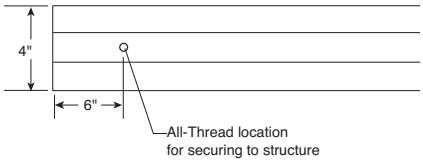
Housing With Extruded Flange (V1)

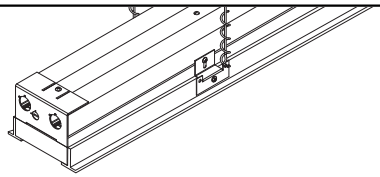
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6



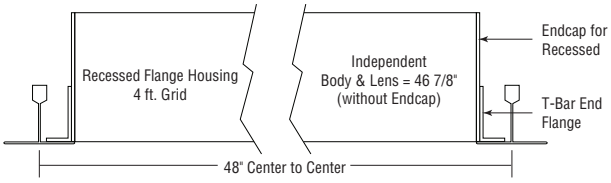


SHEET ROCK INSTALLATION:
Flex conduit is secured to top of luminaire. Support to structure using All-Thread. All-Thread support holes are located on each end of the luminaire.

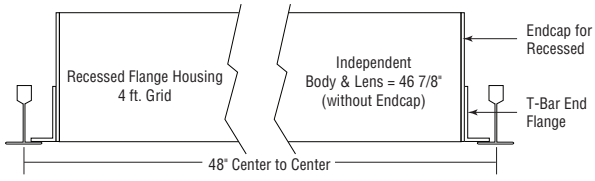
T-BAR INSTALLATION:
HP-4 R for T-Bar installations comes standard with a splice plate at the end of the luminaire. Mounting brackets (supplied) secure the luminaire to T-Bar and provide support to structure location. All starter/independent luminaires are 1 1/8" shorter than nominal. All joiner/ender luminaire are normal length.

GRID LENGTH DETAIL - 4 ft. example

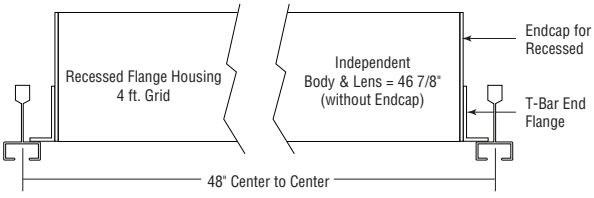
1" T-bar



9/16" T-bar

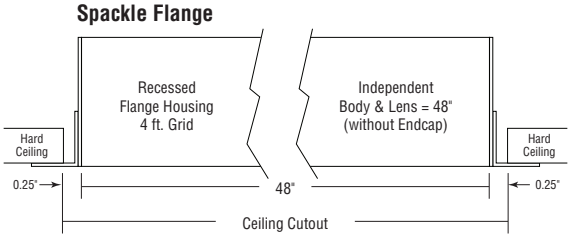


9/16" Screw Slot

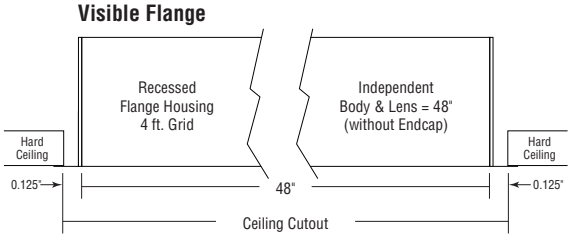


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



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Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
FN-HP-4R-68'-H-3000K-F-277V-2C- C2T-DIM ONE LEG OF FOUR ON SEP CIRCUIT ONE 10FT LEG ON A SEPERATE FEED/ CIR

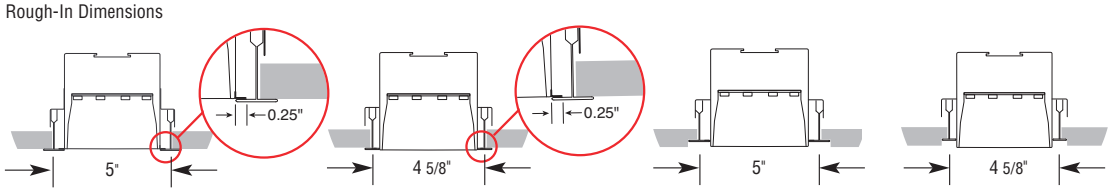
Type:
RA-24X9
LAI16-104794

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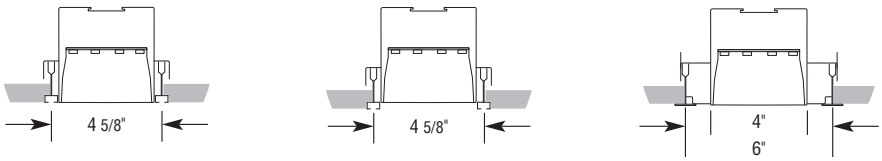
FINELITE

High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR
Rough-In Dimensions

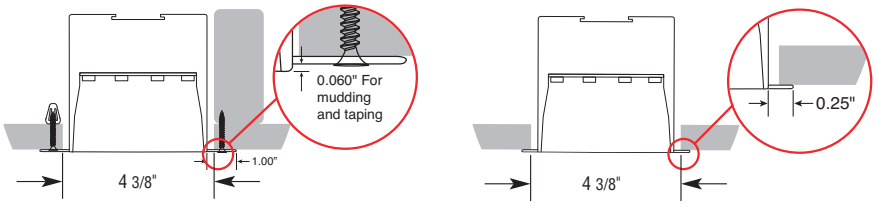


1" T-Bar (C1) | 9/16" T-Bar (C2) | 1" Tegular (C1T) | 9/16" Tegular (C2T)



Flush Screw Slot (C3F) | Standard Screw Slot (C3) | Tech Zone (TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF) | Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor | Occupancy Sensor

INTEGRATED SENSORS: Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

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LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-13'-H-3000K-F-277V-SC-SF-DIM Notes: DRYWALL CEILING	**Type:** **RB-6X7** LAI16-104794

IC - RATED | LED | BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

Date

Project

Type

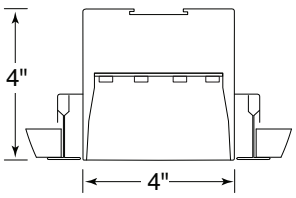
Comments

13' LINEAR LENGTH
6FT X 7FT "L"
CONSISTING OF
(1) TYPE RB6C
(1) TYPE RB7C
AND (1) 90 DEGREE CORNER



DESCRIPTION

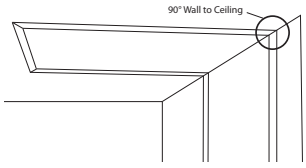
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Flush Diffuser
(Standard)

DIMENSIONS & DIFFUSER

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10 working days

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HP-4 R

Finelite Series HP-4 R
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LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - screw slot, C3F - flush screw slot, VF - Visible Flange, C2T - 9/16" tegular, C1T - 1" tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - tech zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

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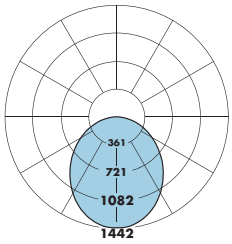
IC - RATED LED BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

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Very High Output - 4' Luminaire
Efficacy: 101 lumens per watt
Total luminaire output: 3726 Lumens (932 lumens/foot)
37 Watts (9.3 watts/foot)
Peak Candela Value: 1442 @ 0º
CCT: 3500K
ITL LM79 Report 85128



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1442	1442	1442	1442	1442	
5	1434	1434	1433	1433	1434	136
15	1369	1360	1365	1364	1359	384
25	1241	1226	1232	1225	1219	566
35	1064	1053	1055	1043	1037	657
45	864	853	851	840	834	655
55	650	644	640	631	626	571
65	441	436	433	428	425	428
75	238	237	238	237	236	252
85	70	69	70	72	71	78
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1525	1917	2898	3726

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
381	479	725	932

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
105	104	102	101

* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85128
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

Recessed (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2898 lm x 0.789 = 2287 lm

Total Light Output per Foot =
725 lm/ft x 0.789 = 572 lm/ft

watts/foot = 7.1 W/ft

$$\textit{Efficacy} = \frac{572\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80\ \text{lm/W}$$

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Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
FN-HP-4R-62'8"-H-3000K-F-277V- SC-C3F-DIM 24FT 8IN X 6FT 8IN RECTANGLE C/O: 2 TYPE RA24-8C 2-TYPE RA6-8C 4-90 DEGREE CORNERS

Type:
RA-24X6
LAI16-104794

IC - RATED | LED | BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

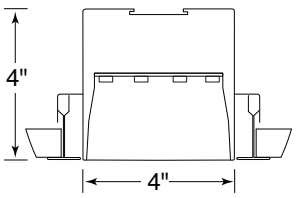
Date
Project
Type
Comments

61' 4" LINEAR LENGTH
24FT X 6FT 8IN RECTANGLE
CONSISTING OF
(2) TYPE RA24C
(2) TYPE RA6-8C
AND (4) 90 DEGREE CORNERS



DESCRIPTION

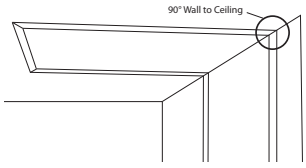
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser (Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

HP-4 R [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]

Finelite Series HP-4 R
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard, B - Boosted Standard, H - High, V - Very High)
LED CRI (8 - 80 CRI min (standard), 9 - 90 CRI min)
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - screw slot, C3F - flush screw slot, VF - Visible Flange, C2T - 9/16" tegular, C1T - 1" tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - tech zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

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Type:
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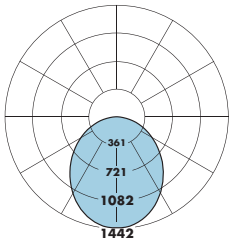
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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

PHOTOMETRY

Very High Output - 4' Luminaire
Efficacy: 101 lumens per watt
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37 Watts (9.3 watts/foot)
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Type:
RA-24X6
LAI16-104794

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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

HOUSING



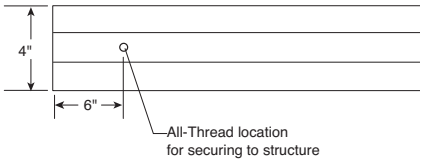
Housing With Extruded Flange (V1)

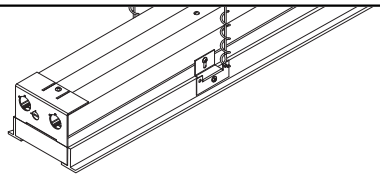
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6





SHEET ROCK INSTALLATION:

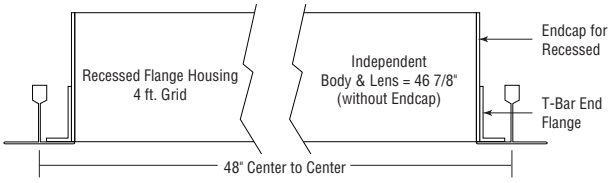
Flex conduit is secured to top of luminaire. Support to structure using All-Thread. All-Thread support holes are located on each end of the luminaire.

T-BAR INSTALLATION:

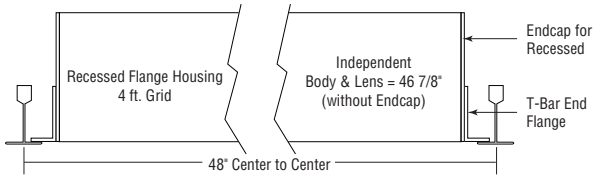
HP-4 R for T-Bar installations comes standard with a splice plate at the end of the luminaire. Mounting brackets (supplied) secure the luminaire to T-Bar and provide support to structure location. All starter/independent luminaires are 1 1/8" shorter than nominal. All joiner/ender luminaire are normal length.

GRID LENGTH DETAIL - 4 ft. example

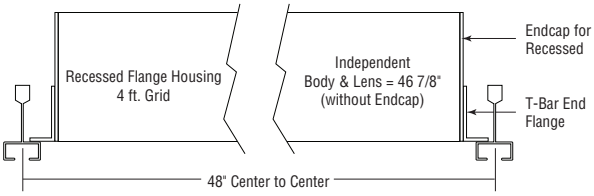
1" T-bar



9/16" T-bar

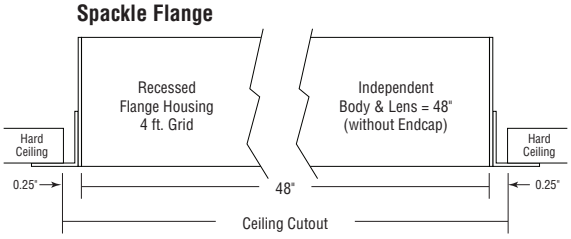


9/16" Screw Slot

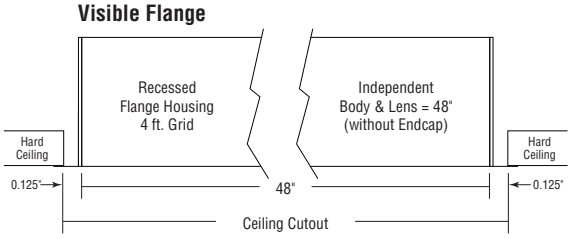


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



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Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
FN-HP-4R-62'8"-H-3000K-F-277V- SC-C3F-DIM 24FT 8IN X 6FT 8IN RECTANGLE C/O: 2 TYPE RA24-8C 2-TYPE RA6-8C 4-90 DEGREE CORNERS

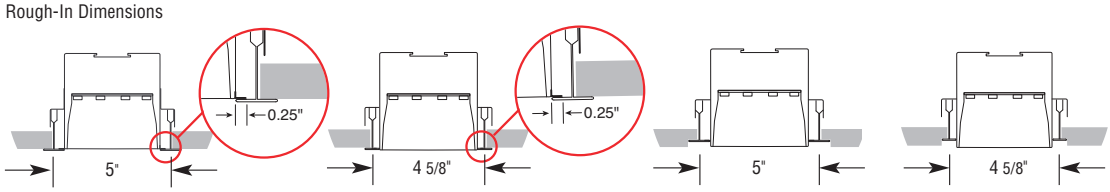
Type:
RA-24X6
LAI16-104794

IC - RATED | LED | BUY AMERICAN ACT OF 2009 COMPLIANT

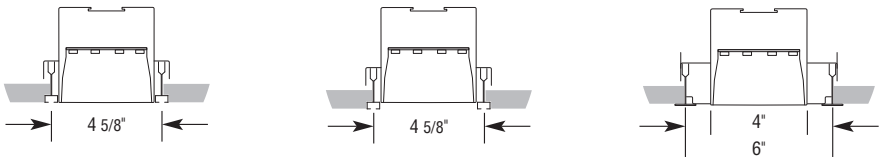
FINELITE

High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR
Rough-In Dimensions

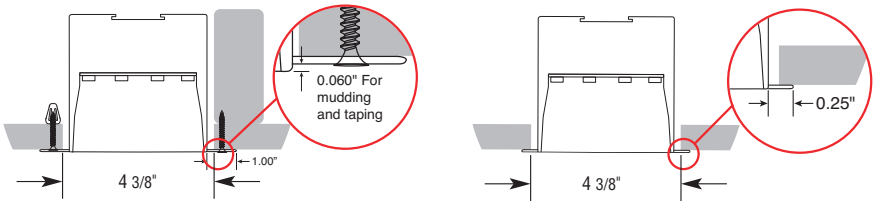


1" T-Bar (C1) | 9/16" T-Bar (C2) | 1" Tegular (C1T) | 9/16" Tegular (C2T)



Flush Screw Slot (C3F) | Standard Screw Slot (C3) | Tech Zone (TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF) | Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor | Occupancy Sensor

INTEGRATED SENSORS: Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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Type:
RB-9-4X6
LAI16-104794

IC - RATED | LED | BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

Date

Project

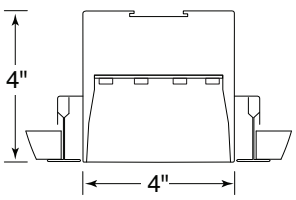
Type

Comments



DESCRIPTION

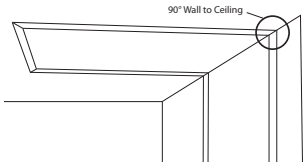
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HP-4 R

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Voltage (120V, 277V)
Circuiting (SC - Single Circuit)
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Type:
RB-9-4X6
LAI16-104794

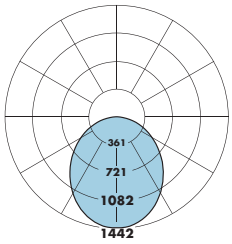
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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

PHOTOMETRY

Very High Output - 4' Luminaire
Efficacy: 101 lumens per watt
Total luminaire output: 3726 Lumens (932 lumens/foot)
37 Watts (9.3 watts/foot)
Peak Candela Value: 1442 @ 0º
CCT: 3500K
ITL LM79 Report 85128



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1442	1442	1442	1442	1442	
5	1434	1434	1433	1433	1434	136
15	1369	1360	1365	1364	1359	384
25	1241	1226	1232	1225	1219	566
35	1064	1053	1055	1043	1037	657
45	864	853	851	840	834	655
55	650	644	640	631	626	571
65	441	436	433	428	425	428
75	238	237	238	237	236	252
85	70	69	70	72	71	78
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1525	1917	2898	3726

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
381	479	725	932

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
105	104	102	101

* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85128
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

Recessed (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2898 lm x 0.789 = 2287 lm

Total Light Output per Foot =
725 lm/ft x 0.789 = 572 lm/ft

watts/foot = 7.1 W/ft

$$\textit{Efficacy} = \frac{572\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80\ \text{lm/W}$$

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Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
FN-HP-4R-15'8"-H-3000K-F-277V- SC-SF-DIM 9FT 4IN X 6FT 4IN L C/O: 1 TYPE RB9-4C 1 TYPE RB6-4C 1 90 DREGREE CORNER DRYWALL CEILING EACH LEG ON SEPERATE FEED

Type:
RB-9-4X6
LAI16-104794

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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

HOUSING



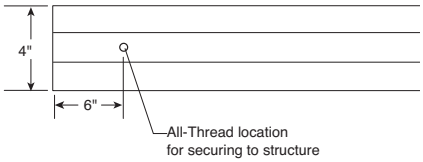
Housing With Extruded Flange (V1)

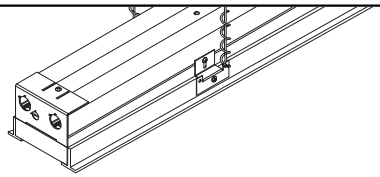
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6





SHEET ROCK INSTALLATION:

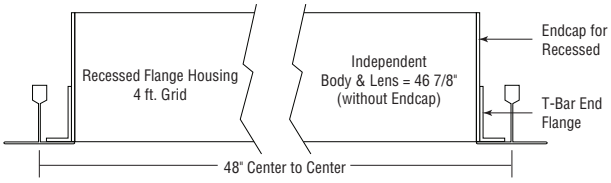
Flex conduit is secured to top of luminaire. Support to structure using All-Thread. All-Thread support holes are located on each end of the luminaire.

T-BAR INSTALLATION:

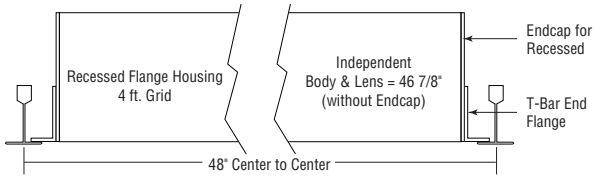
HP-4 R for T-Bar installations comes standard with a splice plate at the end of the luminaire. Mounting brackets (supplied) secure the luminaire to T-Bar and provide support to structure location. All starter/independent luminaires are 1 1/8" shorter than nominal. All joiner/ender luminaire are normal length.

GRID LENGTH DETAIL - 4 ft. example

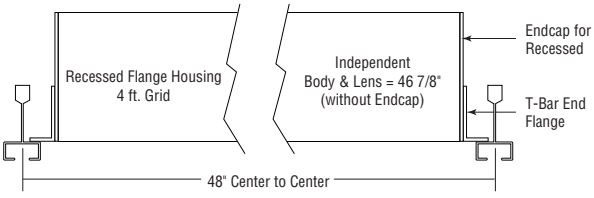
1" T-bar



9/16" T-bar

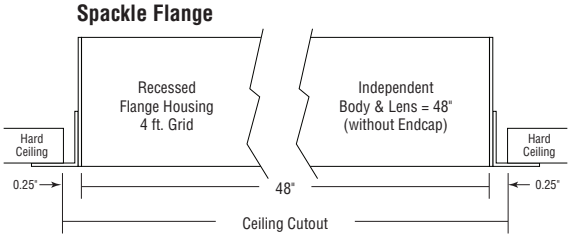


9/16" Screw Slot

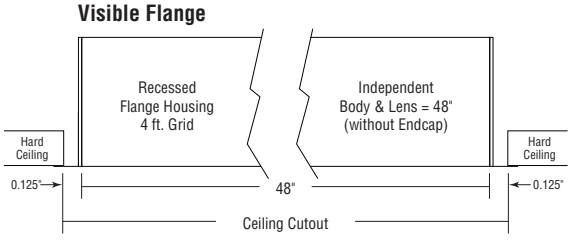


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



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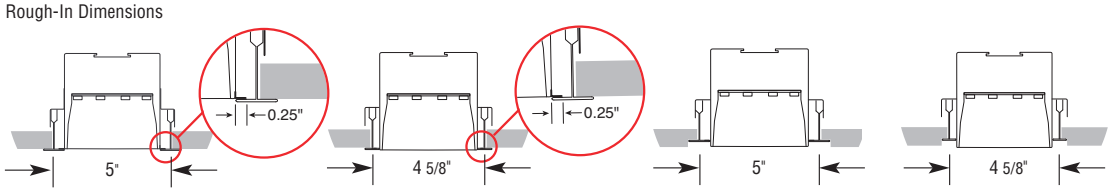
Type:
RB-9-4X6
LAI16-104794

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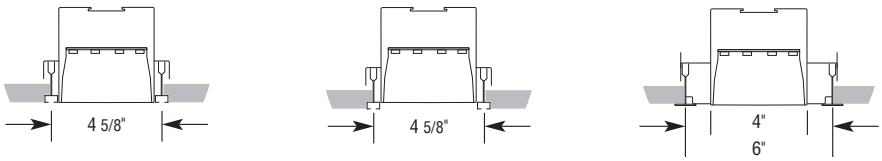
FINELITE

High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR
Rough-In Dimensions

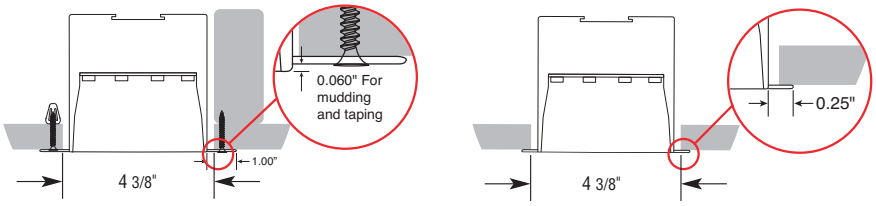


1" T-Bar (C1) | 9/16" T-Bar (C2) | 1" Tegular (C1T) | 9/16" Tegular (C2T)



Flush Screw Slot (C3F) | Standard Screw Slot (C3) | Tech Zone (TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF) | Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor | Occupancy Sensor

INTEGRATED SENSORS: Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** FN-HP-4R-18'4"-H-3000K-F-277V-MC-C3F-DIM 12FT 4IN X 6FT L C/O: 1-TYPE RA12-4C 1-TYPE RA6C 1-90 DEGREE CORNER 6FT LEG ON SEPERATE CKT	**Type:** **RA-12X6** LAI16-104794

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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

Date

Project

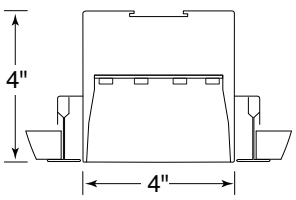
Type

Comments



DESCRIPTION

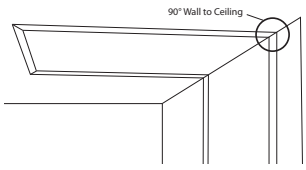
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser (Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

HP-4 R

Finelite Series HP-4 R
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard, B - Boosted Standard, H - High, V - Very High)
LED CRI (8 - 80 CRI min (standard), 9 - 90 CRI min)
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - screw slot, C3F - flush screw slot, VF - Visible Flange, C2T - 9/16" tegular, C1T - 1" tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - tech zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

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Type:
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LAI16-104794

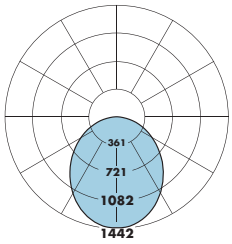
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90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
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watts/foot = 7.1 W/ft

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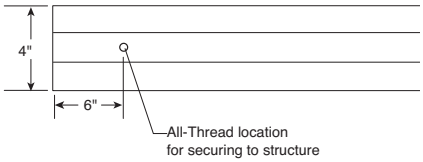
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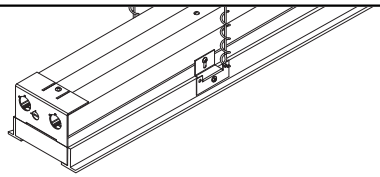
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6





SHEET ROCK INSTALLATION:

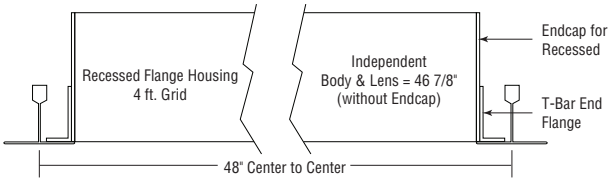
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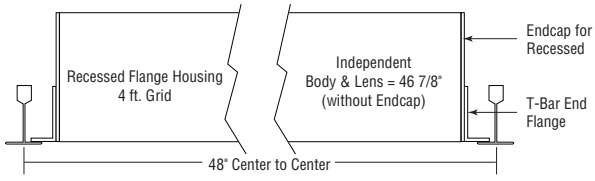
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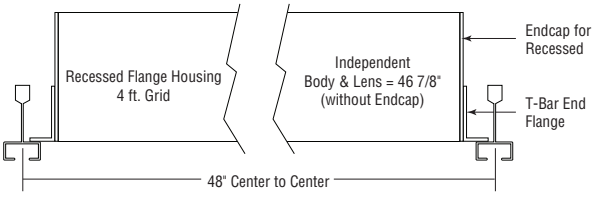
1" T-bar



9/16" T-bar

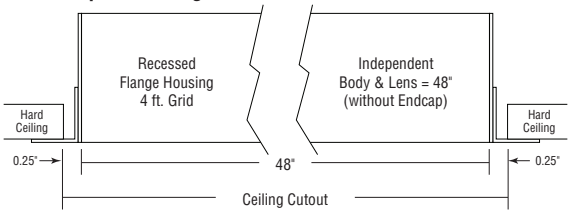


9/16" Screw Slot

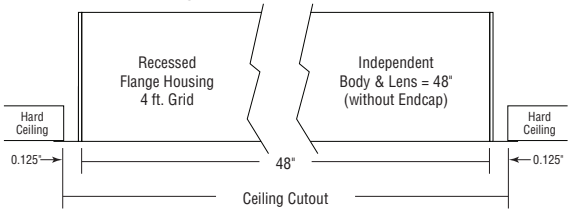


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
FN-HP-4R-18'4"-H-3000K-F-277V-MC-C3F-DIM 12FT 4IN X 6FT L C/O: 1-TYPE RA12-4C 1-TYPE RA6C 1-90 DEGREE CORNER 6FT LEG ON SEPERATE CKT

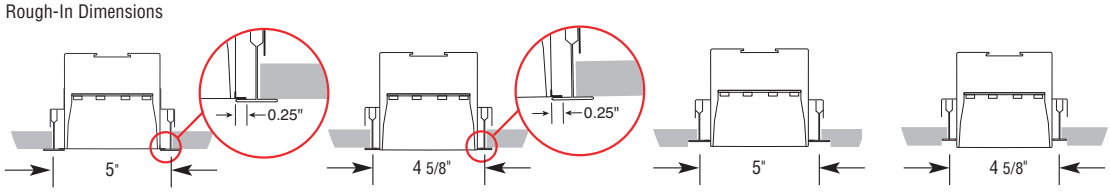
Type:
RA-12X6
LAI16-104794

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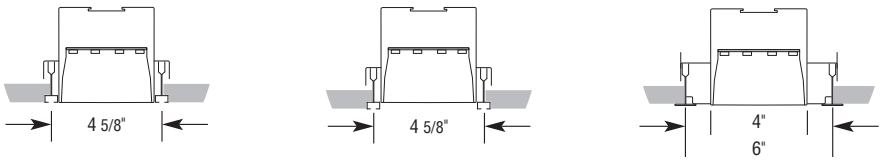
FINELITE

High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR
Rough-In Dimensions

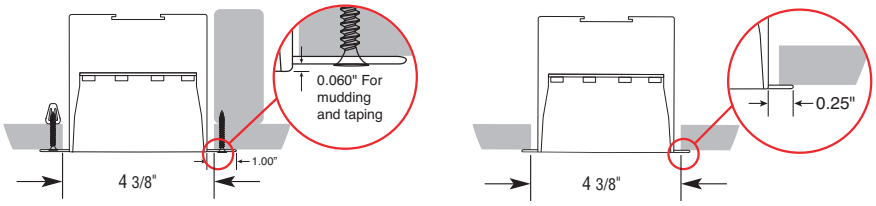


1" T-Bar (C1) | 9/16" T-Bar (C2) | 1" Tegular (C1T) | 9/16" Tegular (C2T)



Flush Screw Slot (C3F) | Standard Screw Slot (C3) | Tech Zone (TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF) | Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor | Occupancy Sensor

INTEGRATED SENSORS: Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-4'-H-3000K-F-277V-SC-SF-DIM Notes:	**Type:** **RB4** LAI16-104794

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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

Date

Project

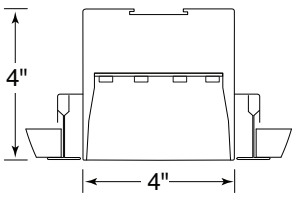
Type

Comments



DESCRIPTION

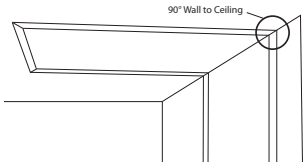
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser (Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

4'

HP-4 R

Finelite Series HP-4 R
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard, B - Boosted Standard, H - High, V - Very High)
LED CRI (8 - 80 CRI min (standard), 9 - 90 CRI min)
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - screw slot, C3F - flush screw slot, VF - Visible Flange, C2T - 9/16" tegular, C1T - 1" tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - tech zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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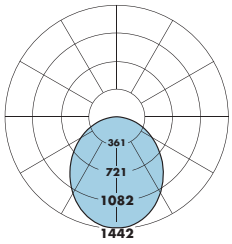
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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

PHOTOMETRY

Very High Output - 4' Luminaire
Efficacy: 101 lumens per watt
Total luminaire output: 3726 Lumens (932 lumens/foot)
37 Watts (9.3 watts/foot)
Peak Candela Value: 1442 @ 0º
CCT: 3500K
ITL LM79 Report 85128



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1442	1442	1442	1442	1442	
5	1434	1434	1433	1433	1434	136
15	1369	1360	1365	1364	1359	384
25	1241	1226	1232	1225	1219	566
35	1064	1053	1055	1043	1037	657
45	864	853	851	840	834	655
55	650	644	640	631	626	571
65	441	436	433	428	425	428
75	238	237	238	237	236	252
85	70	69	70	72	71	78
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1525	1917	2898	3726

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
381	479	725	932

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
105	104	102	101

* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85128
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

Recessed (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2898 lm x 0.789 = 2287 lm

Total Light Output per Foot =
725 lm/ft x 0.789 = 572 lm/ft

watts/foot = 7.1 W/ft

$$\textit{Efficacy} = \frac{572\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80\ \text{lm/W}$$

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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

HOUSING



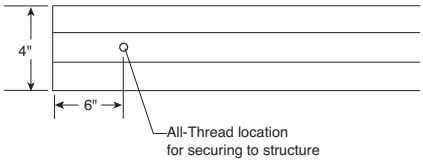
Housing With Extruded Flange (V1)

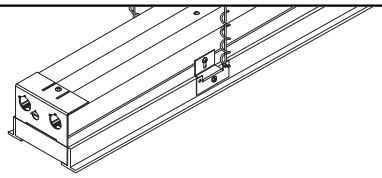
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6





SHEET ROCK INSTALLATION:

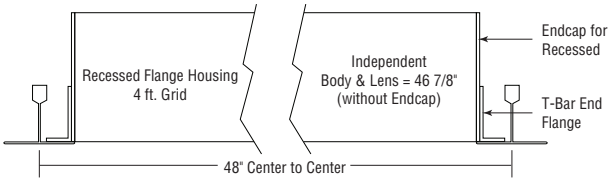
Flex conduit is secured to top of luminaire. Support to structure using All-Thread. All-Thread support holes are located on each end of the luminaire.

T-BAR INSTALLATION:

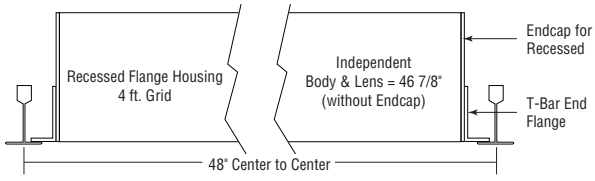
HP-4 R for T-Bar installations comes standard with a splice plate at the end of the luminaire. Mounting brackets (supplied) secure the luminaire to T-Bar and provide support to structure location. All starter/independent luminaires are 1 1/8" shorter than nominal. All joiner/ender luminaire are normal length.

GRID LENGTH DETAIL - 4 ft. example

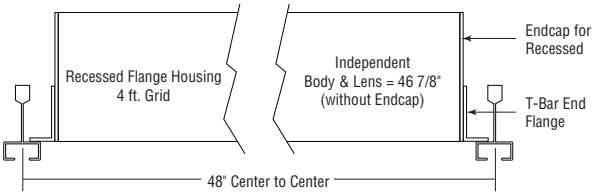
1" T-bar



9/16" T-bar

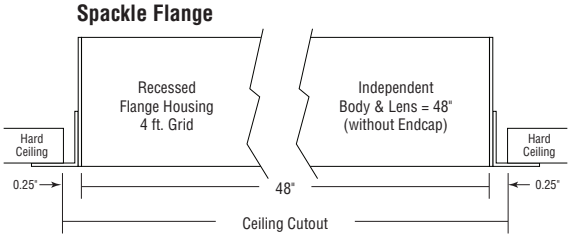


9/16" Screw Slot

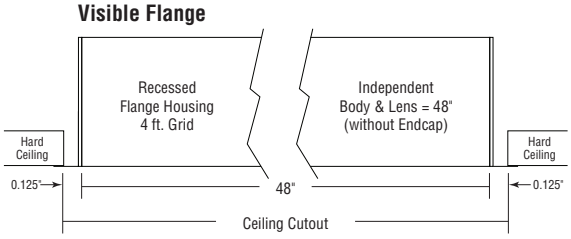


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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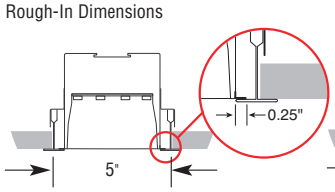
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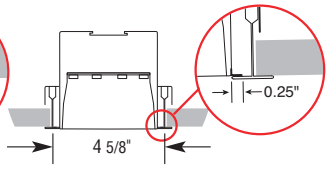
High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR

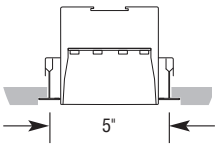
Rough-In Dimensions



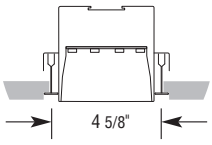
1" T-Bar (C1)



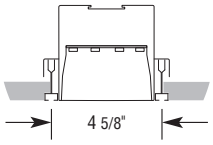
9/16" T-Bar (C2)



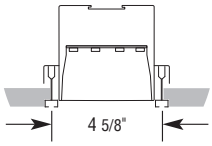
1" Tegular (C1T)



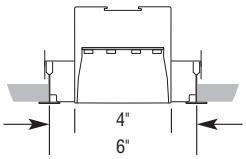
9/16" Tegular (C2T)



Flush Screw Slot (C3F)

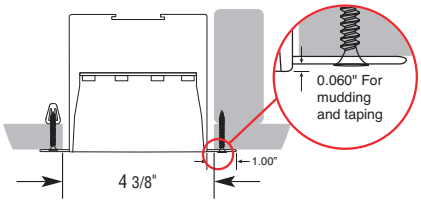


Standard Screw Slot (C3)

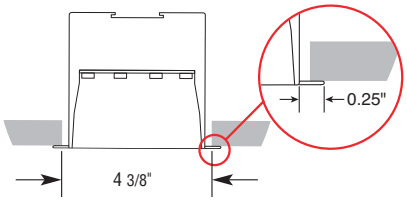


Tech Zone
(TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF)



Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor Occupancy Sensor **INTEGRATED SENSORS:** Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-6'-H-3000K-F-277V-SC-SF-DIM Notes:	**Type:** **RB6** LAI16-104794

IC - RATED | LED | BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

Date

Project

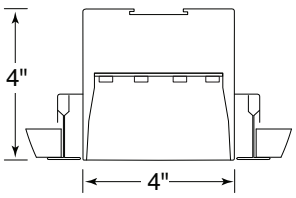
Type

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DESCRIPTION

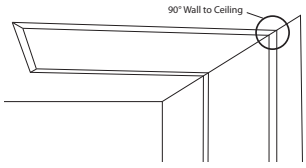
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser (Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

6' | HP-4 R | | | | | | | | | |

Finelite Series HP-4 R
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard, B - Boosted Standard, H - High, V - Very High)
LED CRI (8 - 80 CRI min (standard), 9 - 90 CRI min)
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - screw slot, C3F - flush screw slot, VF - Visible Flange, C2T - 9/16" tegular, C1T - 1" tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - tech zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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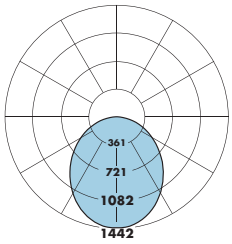
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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

PHOTOMETRY

Very High Output - 4' Luminaire
Efficacy: 101 lumens per watt
Total luminaire output: 3726 Lumens (932 lumens/foot)
37 Watts (9.3 watts/foot)
Peak Candela Value: 1442 @ 0º
CCT: 3500K
ITL LM79 Report 85128



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1442	1442	1442	1442	1442	
5	1434	1434	1433	1433	1434	136
15	1369	1360	1365	1364	1359	384
25	1241	1226	1232	1225	1219	566
35	1064	1053	1055	1043	1037	657
45	864	853	851	840	834	655
55	650	644	640	631	626	571
65	441	436	433	428	425	428
75	238	237	238	237	236	252
85	70	69	70	72	71	78
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1525	1917	2898	3726

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
381	479	725	932

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
105	104	102	101

* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85128
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

Recessed (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2898 lm x 0.789 = 2287 lm

Total Light Output per Foot =
725 lm/ft x 0.789 = 572 lm/ft

watts/foot = 7.1 W/ft

$$Efficacy = \frac{572\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80\ \text{lm/W}$$

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

HOUSING



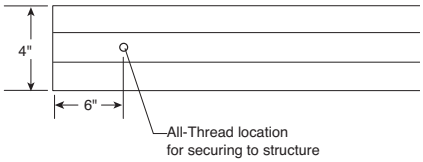
Housing With Extruded Flange (V1)

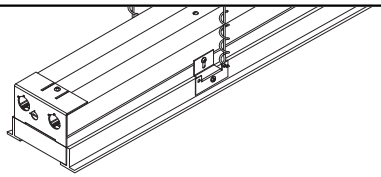
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6





SHEET ROCK INSTALLATION:

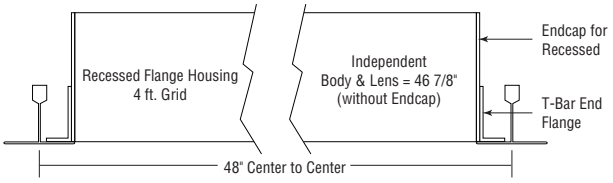
Flex conduit is secured to top of luminaire. Support to structure using All-Thread. All-Thread support holes are located on each end of the luminaire.

T-BAR INSTALLATION:

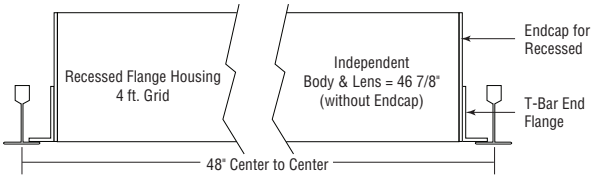
HP-4 R for T-Bar installations comes standard with a splice plate at the end of the luminaire. Mounting brackets (supplied) secure the luminaire to T-Bar and provide support to structure location. All starter/independent luminaires are 1 1/8" shorter than nominal. All joiner/ender luminaire are normal length.

GRID LENGTH DETAIL - 4 ft. example

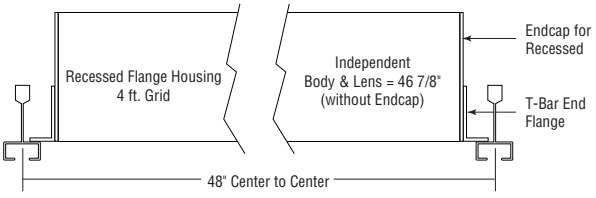
1" T-bar



9/16" T-bar

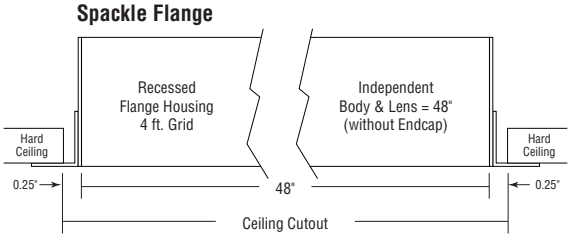


9/16" Screw Slot

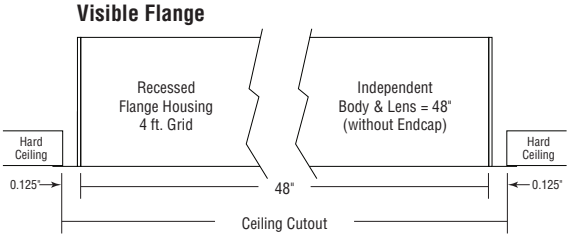


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



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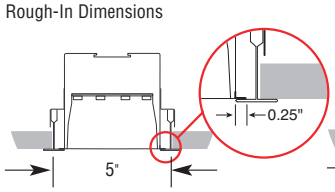
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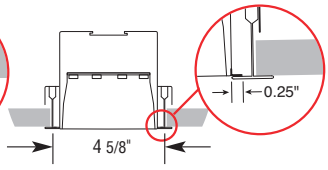
High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR

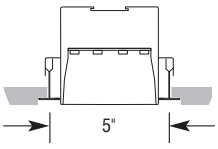
Rough-In Dimensions



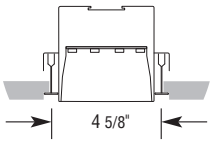
1" T-Bar (C1)



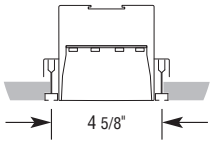
9/16" T-Bar (C2)



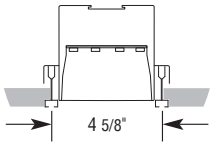
1" Tegular (C1T)



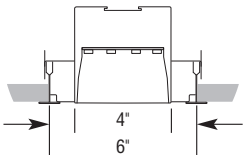
9/16" Tegular (C2T)



Flush Screw Slot (C3F)

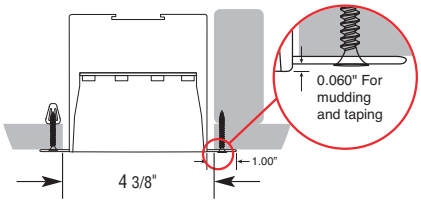


Standard Screw Slot (C3)

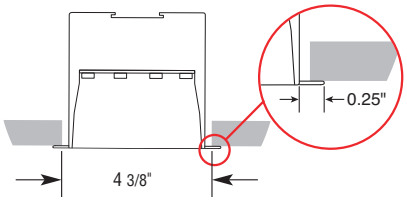


Tech Zone
(TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF)



Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor Occupancy Sensor **INTEGRATED SENSORS:** Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

Date

Project

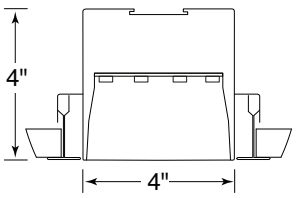
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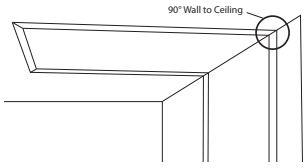
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser (Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

8'

HP-4 R | | | | | | | | | |

Finelite Series HP-4 R
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard, B - Boosted Standard, H - High, V - Very High)
LED CRI (8 - 80 CRI min (standard), 9 - 90 CRI min)
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - screw slot, C3F - flush screw slot, VF - Visible Flange, C2T - 9/16" tegular, C1T - 1" tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - tech zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-8'-H-3000K-F-277V-SC-SF-DIM Notes:	**Type:** **RB8** LAI16-104794

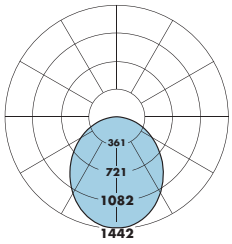
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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

PHOTOMETRY

Very High Output - 4' Luminaire
Efficacy: 101 lumens per watt
Total luminaire output: 3726 Lumens (932 lumens/foot)
37 Watts (9.3 watts/foot)
Peak Candela Value: 1442 @ 0º
CCT: 3500K
ITL LM79 Report 85128



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1442	1442	1442	1442	1442	
5	1434	1434	1433	1433	1434	136
15	1369	1360	1365	1364	1359	384
25	1241	1226	1232	1225	1219	566
35	1064	1053	1055	1043	1037	657
45	864	853	851	840	834	655
55	650	644	640	631	626	571
65	441	436	433	428	425	428
75	238	237	238	237	236	252
85	70	69	70	72	71	78
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1525	1917	2898	3726

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
381	479	725	932

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
105	104	102	101

* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85128
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

Recessed (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2898 lm x 0.789 = 2287 lm

Total Light Output per Foot =
725 lm/ft x 0.789 = 572 lm/ft

watts/foot = 7.1 W/ft

$$Efficacy = \frac{572\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80\ lm/W$$

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HOUSING



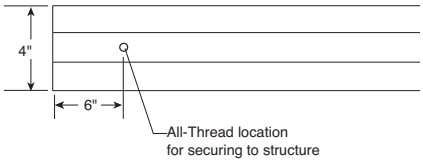
Housing With Extruded Flange (V1)

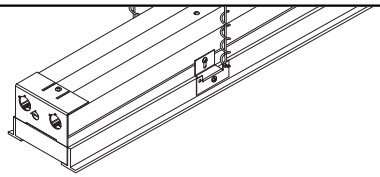
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6





SHEET ROCK INSTALLATION:

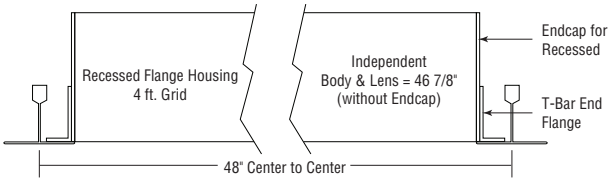
Flex conduit is secured to top of luminaire. Support to structure using All-Thread. All-Thread support holes are located on each end of the luminaire.

T-BAR INSTALLATION:

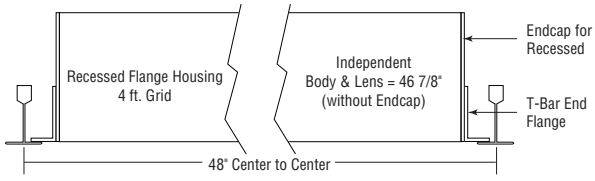
HP-4 R for T-Bar installations comes standard with a splice plate at the end of the luminaire. Mounting brackets (supplied) secure the luminaire to T-Bar and provide support to structure location. All starter/independent luminaires are 1 1/8" shorter than nominal. All joiner/ender luminaire are normal length.

GRID LENGTH DETAIL - 4 ft. example

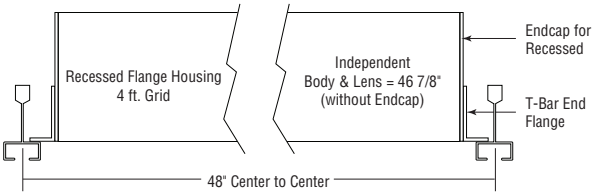
1" T-bar



9/16" T-bar

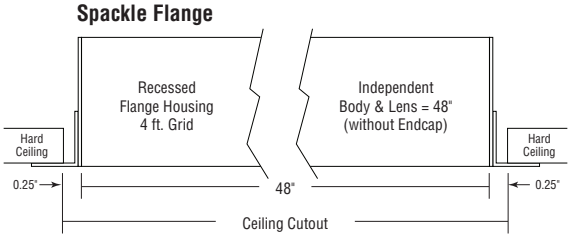


9/16" Screw Slot

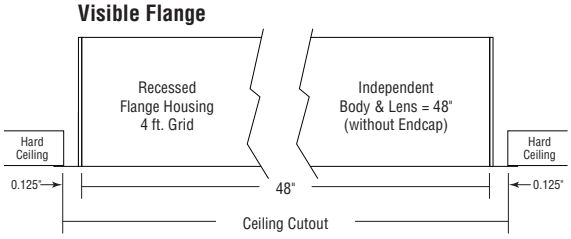


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



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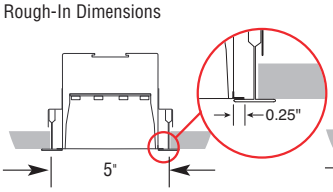
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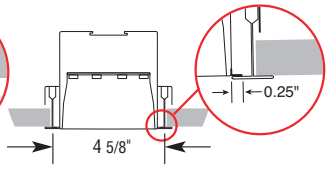
High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR

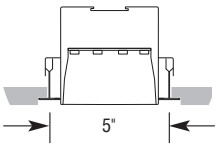
Rough-In Dimensions



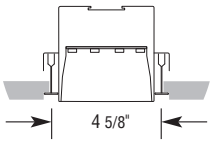
1" T-Bar (C1)



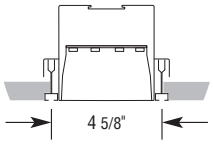
9/16" T-Bar (C2)



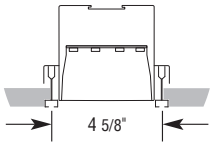
1" Tegular (C1T)



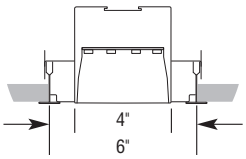
9/16" Tegular (C2T)



Flush Screw Slot (C3F)

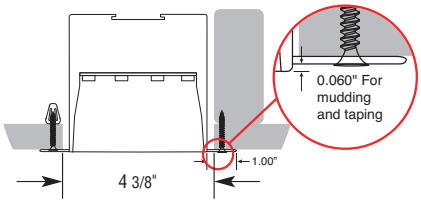


Standard Screw Slot (C3)

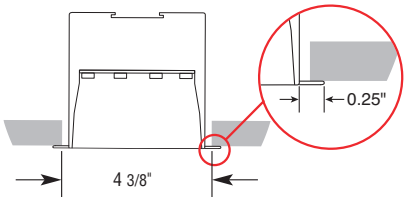


Tech Zone
(TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF)



Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor Occupancy Sensor

INTEGRATED SENSORS: Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

Date

Project

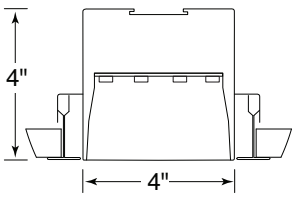
Type

Comments



DESCRIPTION

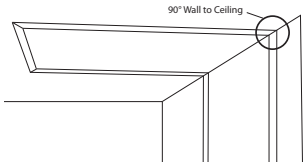
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser (Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

10' | HP-4 R | | | | | | | | | |

Finelite Series HP-4 R
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard, B - Boosted Standard, H - High, V - Very High)
LED CRI (8 - 80 CRI min (standard), 9 - 90 CRI min)
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - screw slot, C3F - flush screw slot, VF - Visible Flange, C2T - 9/16" tegular, C1T - 1" tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - tech zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

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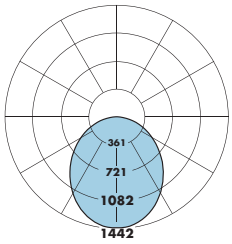
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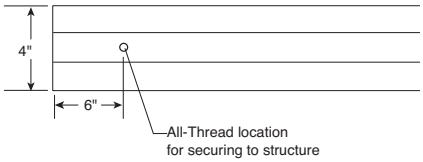
Housing With Extruded Flange (V1)

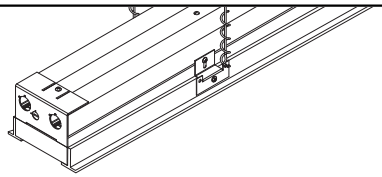
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6





SHEET ROCK INSTALLATION:

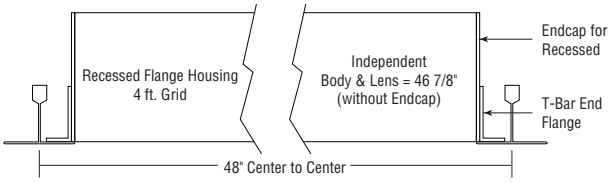
Flex conduit is secured to top of luminaire. Support to structure using All-Thread. All-Thread support holes are located on each end of the luminaire.

T-BAR INSTALLATION:

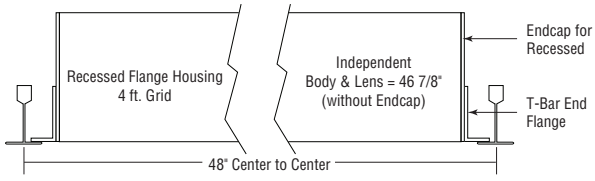
HP-4 R for T-Bar installations comes standard with a splice plate at the end of the luminaire. Mounting brackets (supplied) secure the luminaire to T-Bar and provide support to structure location. All starter/independent luminaires are 1 1/8" shorter than nominal. All joiner/ender luminaire are normal length.

GRID LENGTH DETAIL - 4 ft. example

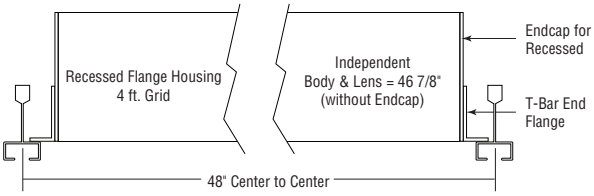
1" T-bar



9/16" T-bar

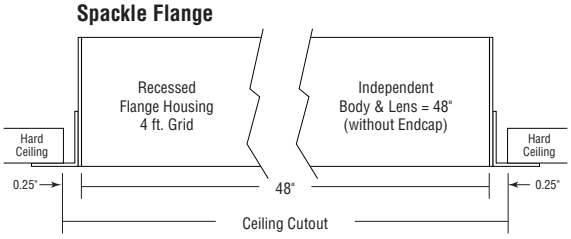


9/16" Screw Slot

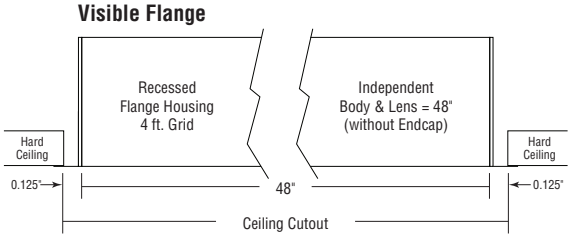


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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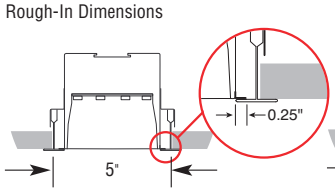
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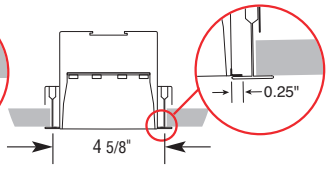
High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR

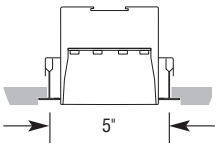
Rough-In Dimensions



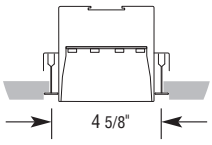
1" T-Bar (C1)



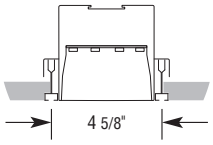
9/16" T-Bar (C2)



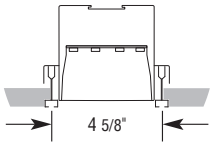
1" Tegular (C1T)



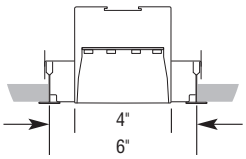
9/16" Tegular (C2T)



Flush Screw Slot (C3F)

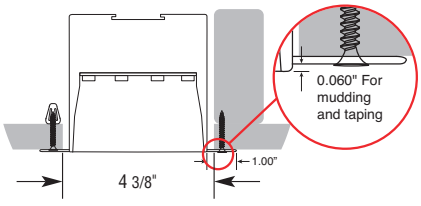


Standard Screw Slot (C3)

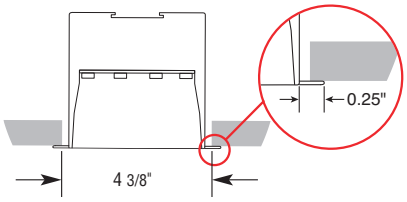


Tech Zone
(TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF)



Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor Occupancy Sensor **INTEGRATED SENSORS:** Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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High Performance 4" Aperture (HP-4) - Recessed

Date

Project

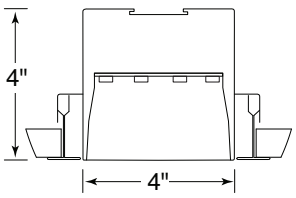
Type

Comments



DESCRIPTION

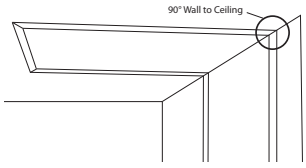
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser (Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

17' 6"

HP-4 R

Finelite Series HP-4 R
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard, B - Boosted Standard, H - High, V - Very High)
LED CRI (8 - 80 CRI min (standard), 9 - 90 CRI min)
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - screw slot, C3F - flush screw slot, VF - Visible Flange, C2T - 9/16" tegular, C1T - 1" tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - tech zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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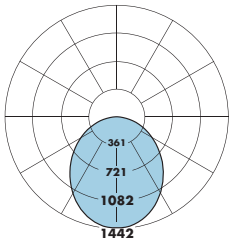
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High Performance 4" Aperture (HP-4) - Recessed

PHOTOMETRY

Very High Output - 4' Luminaire
Efficacy: 101 lumens per watt
Total luminaire output: 3726 Lumens (932 lumens/foot)
37 Watts (9.3 watts/foot)
Peak Candela Value: 1442 @ 0º
CCT: 3500K
ITL LM79 Report 85128



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1442	1442	1442	1442	1442	
5	1434	1434	1433	1433	1434	136
15	1369	1360	1365	1364	1359	384
25	1241	1226	1232	1225	1219	566
35	1064	1053	1055	1043	1037	657
45	864	853	851	840	834	655
55	650	644	640	631	626	571
65	441	436	433	428	425	428
75	238	237	238	237	236	252
85	70	69	70	72	71	78
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1525	1917	2898	3726

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
381	479	725	932

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
105	104	102	101

* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85128
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

Recessed (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2898 lm x 0.789 = 2287 lm

Total Light Output per Foot =
725 lm/ft x 0.789 = 572 lm/ft

watts/foot = 7.1 W/ft

$$Efficacy = \frac{572\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80\ lm/W$$

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High Performance 4" Aperture (HP-4) - Recessed

HOUSING



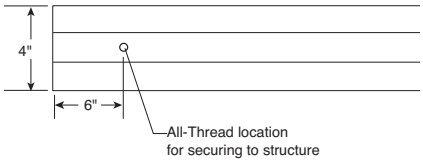
Housing With Extruded Flange (V1)

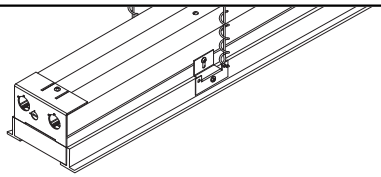
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6





SHEET ROCK INSTALLATION:

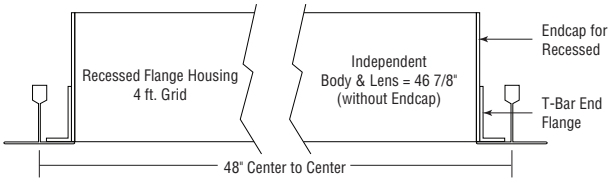
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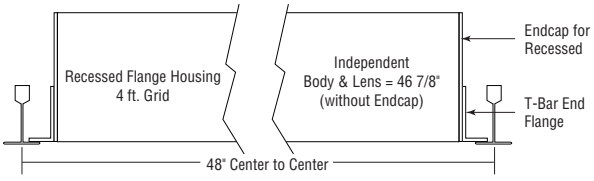
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GRID LENGTH DETAIL - 4 ft. example

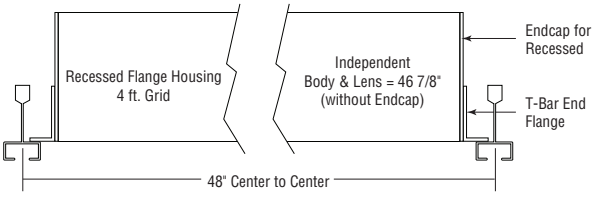
1" T-bar



9/16" T-bar

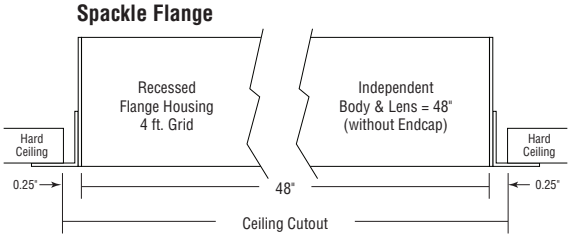


9/16" Screw Slot

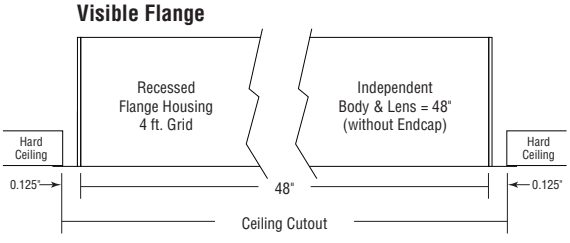


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



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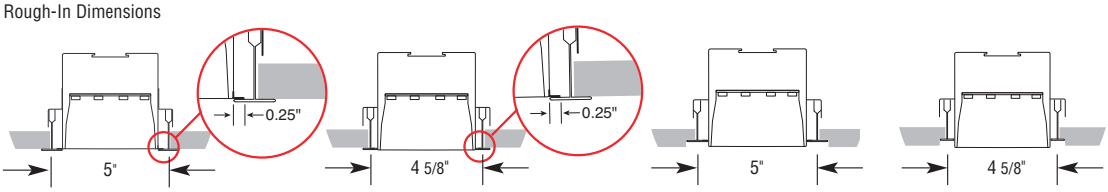
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FINELITE

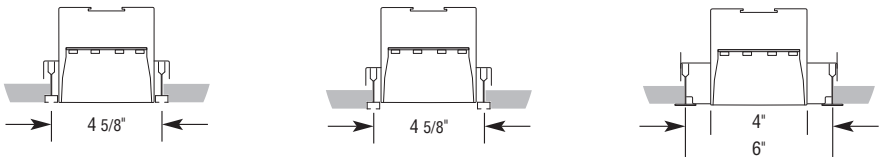
High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR

Rough-In Dimensions

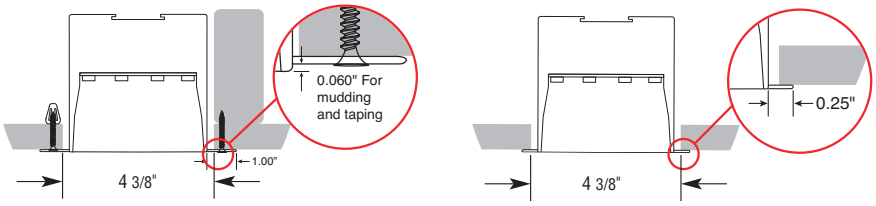


1" T-Bar (C1) | 9/16" T-Bar (C2) | 1" Tegular (C1T) | 9/16" Tegular (C2T)



Flush Screw Slot (C3F) | Standard Screw Slot (C3) | Tech Zone (TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF) | Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor | Occupancy Sensor

INTEGRATED SENSORS: Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

Finelite, Inc. • 30500 Whipple Road • Union City, CA 94587-1530 • 510 / 441-1100 • Fax: 510 / 441-1510 • www.finelite.com

Due to continuing product improvements, Finelite reserves the right to change specifications without notice. Please visit www.finelite.com for most current data.

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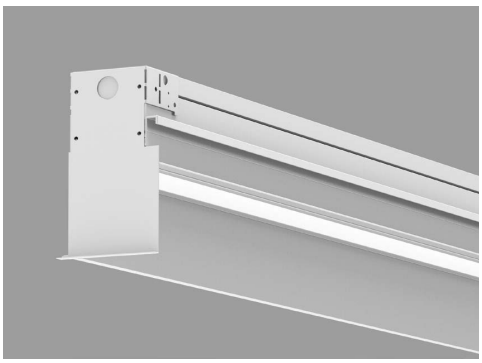
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-4'7"-277-D-1-DTL-W Notes:	**Type:** **RC4-7** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

DESCRIPTION

Via Skim is designed to illuminate textured or polished vertical surfaces with a grazing light from the wall/ceiling intersection. Via Skim provides continuous illumination across the wall surface.
The intense light distribution is achieved with our Grazing Reflector Optic (GRO) oriented to project light with maximum luminous intensity at 5° from nadir.
The Via Skim is available with two depth options: shallow and deep. Total recessed depth ranges from 4¾" to 7".

PROJECT: _____

TYPE: _____

NOTES: _____

ORDER GUIDE

IC RATED

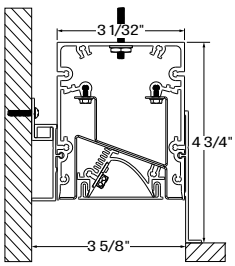
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

4' 7"				
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

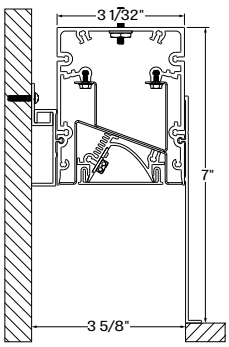
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



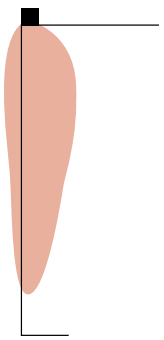
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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c ETL LISTED us Intertek

VIA SKIM 3 LED

RECESSED

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OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

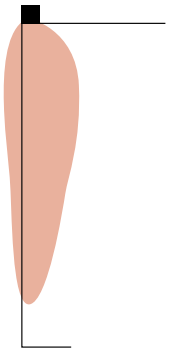
LIGHT SOURCE - LED

Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

PERFORMANCE PER 4' AT 4000K

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	19	1400	75
medium output	4000K	27	2000	74
high output	4000K	42	3000	71

LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

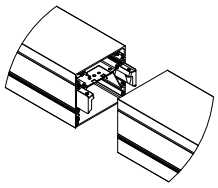
Foot Candles on 20' wide wall, 10' ceiling

128	135	153	144	131	126	134	154	146	136
25.4	24.4	23.5	23.7	23.7	23.8	23.8	23.7	24.8	27.8
12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

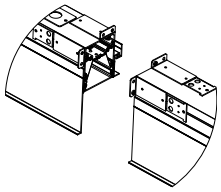
LUMINAIRE LENGTH

All individual sections are joined together onsite using the joiner kits provided. LumenWerx offers joiner kits that are extremely simple to work with in the field and result in a fixture that appears virtually seamless with no light leak at any connection.

Joining system



Drywall joining



Grid joining

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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Intertek

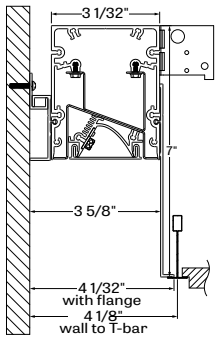
VIA SKIM 3 LED

RECESSED

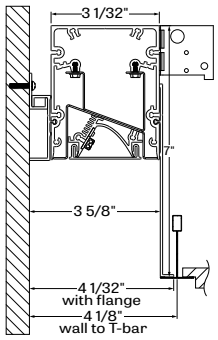
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MOUNTING OPTIONS

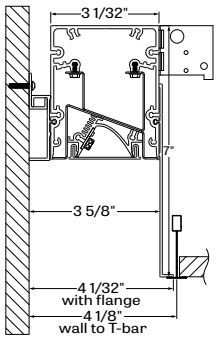
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



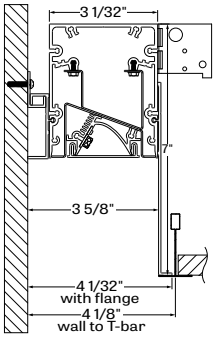
TG9 - tegular 9/16"



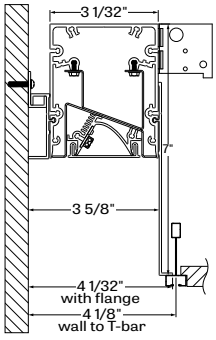
TG15 - tegular 15/16"



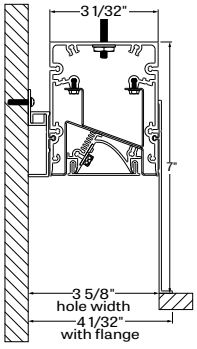
TB9 - t-bar 9/16"



TB15 - t-bar 15/16"



ST - screw slot t-bar



DTL - drywall trimless

FINISH

Interior - 95%, reflective matte powder coated white paint
Exterior - matte white or silver powder coating.
Custom finishes are also available.

CONSTRUCTION

Housing - Extruded Aluminum (0.095" nominal) up to 90% Recycled Content
Interior brackets - Die formed cold rolled sheet steel 18 gauge thick
Joining system - Die cast Zinc (0.95" nominal) and die Formed galvanized sheet 18 gauge
Reflectors - Extruded Aluminum (0.070" nominal) up to 90% Recycled Content.
Recessed flanges - Extruded Aluminum (0.075" nominal) up to 90% Recycled Content
End plate - Die formed cold rolled sheet steel 18 gauge thick

MAINTENANCE

LED boards are housed in a removable cartridge for easy replacement. Driver is accessible from below.

WEIGHT

Via Skim 3 4ft - 11.23lbs - 5.1kg
Via Skim 3 8ft - 22.47lbs - 10.2kg
Via Skim 3 12ft - 33.70lbs - 15.3kg

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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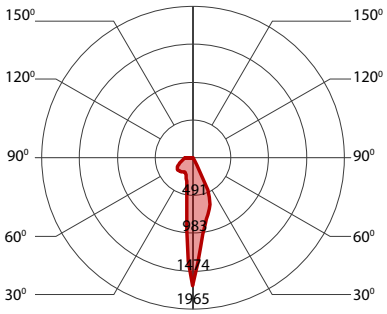
Intertek

VIA SKIM 3 LED

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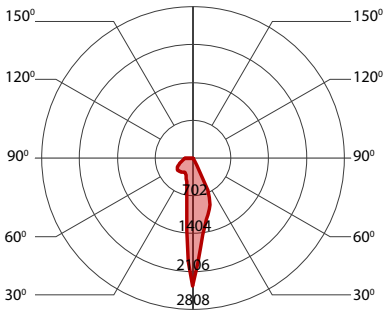
350 LUMEN AT 80CRI - LOW OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	20	1400	71
low output	3500K	19	1400	73
low output	4000K	19	1400	75

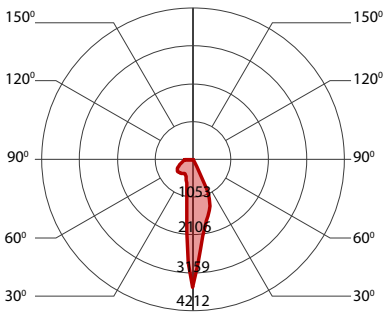
500 LUMEN AT 80CRI - MEDIUM OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	28.5	2000	70
medium output	3500K	28	2000	72
medium output	4000K	27	2000	74

750 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	45	3000	67
high output	3500K	43.5	3000	69
high output	4000K	42	3000	71

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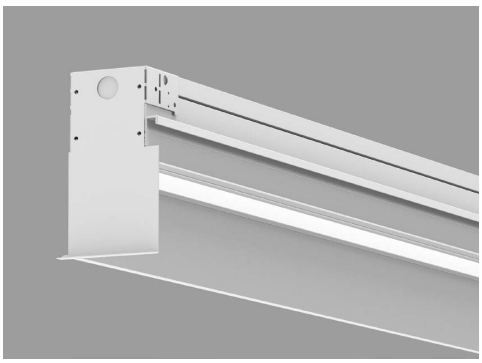
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-5'-277-D-1-DTL-W Notes:	**Type:** **RC5** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

PROJECT: _____

TYPE: _____

NOTES: _____

DESCRIPTION

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ORDER GUIDE

IC **RATED**

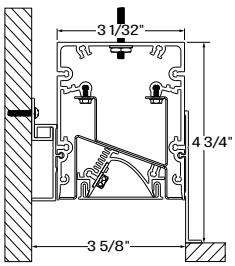
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
~~**V3SKIS**~~- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

5'				
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

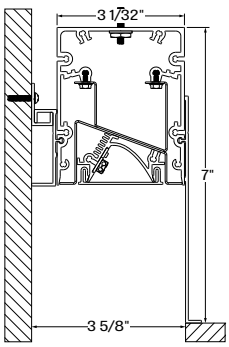
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



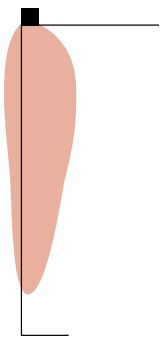
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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C ETL LISTED US Intertek

VIA SKIM 3 LED

RECESSED

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OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

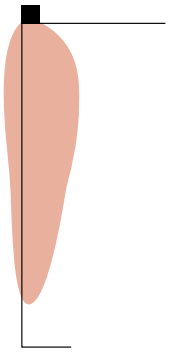
LIGHT SOURCE - LED

Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

PERFORMANCE PER 4' AT 4000K

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	19	1400	75
medium output	4000K	27	2000	74
high output	4000K	42	3000	71

LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

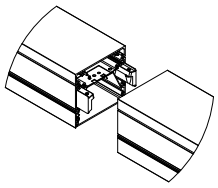
Foot Candles on 20' wide wall, 10' ceiling

128	135	153	144	131	126	134	154	146	136
25.4	24.4	23.5	23.7	23.7	23.8	23.8	23.7	24.8	27.8
12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

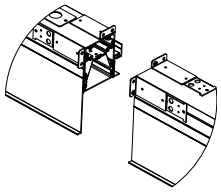
LUMINAIRE LENGTH

All individual sections are joined together onsite using the joiner kits provided. LumenWerx offers joiner kits that are extremely simple to work with in the field and result in a fixture that appears virtually seamless with no light leak at any connection.

Joining system



Drywall joining



Grid joining

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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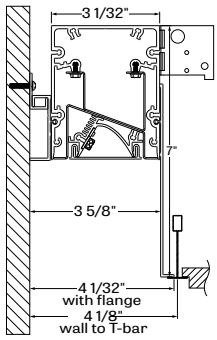
VIA SKIM 3 LED

RECESSED

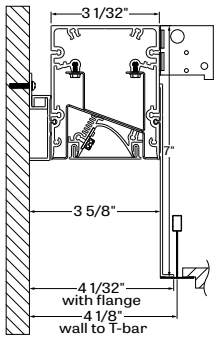
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MOUNTING OPTIONS

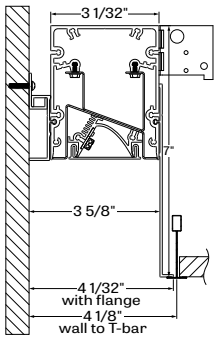
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



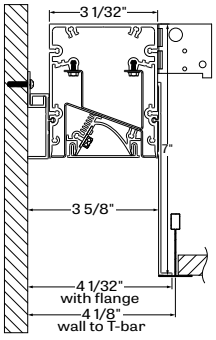
TG9 - tegular 9/16"



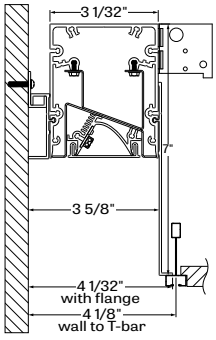
TG15 - tegular 15/16"



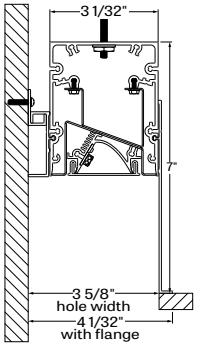
TB9 - t-bar 9/16"



TB15 - t-bar 15/16"



ST - screw slot t-bar



DTL - drywall trimless

FINISH

Interior - 95%, reflective matte powder coated white paint
Exterior - matte white or silver powder coating.
Custom finishes are also available.

CONSTRUCTION

Housing - Extruded Aluminum (0.095" nominal) up to 90% Recycled Content
Interior brackets - Die formed cold rolled sheet steel 18 gauge thick
Joining system - Die cast Zinc (0.95" nominal) and die Formed galvanized sheet 18 gauge
Reflectors - Extruded Aluminum (0.070" nominal) up to 90% Recycled Content.
Recessed flanges - Extruded Aluminum (0.075" nominal) up to 90% Recycled Content
End plate - Die formed cold rolled sheet steel 18 gauge thick

MAINTENANCE

LED boards are housed in a removable cartridge for easy replacement. Driver is accessible from below.

WEIGHT

Via Skim 3 4ft - 11.23lbs - 5.1kg
Via Skim 3 8ft - 22.47lbs - 10.2kg
Via Skim 3 12ft - 33.70lbs - 15.3kg

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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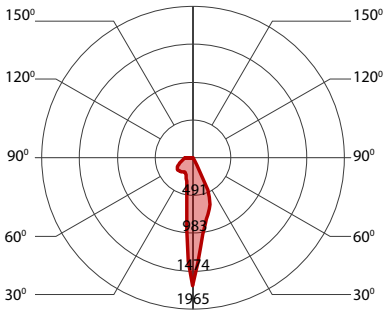
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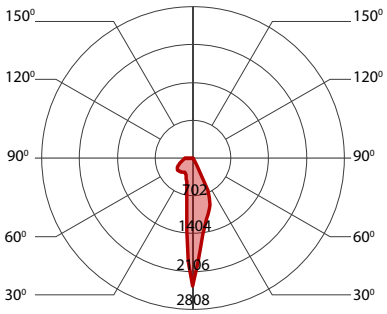
350 LUMEN AT 80CRI - LOW OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	20	1400	71
low output	3500K	19	1400	73
low output	4000K	19	1400	75

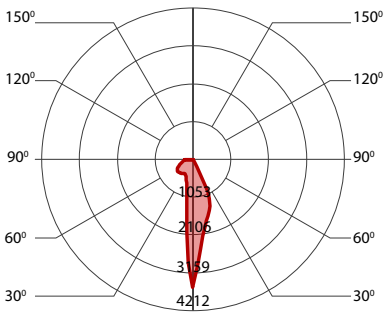
500 LUMEN AT 80CRI - MEDIUM OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	28.5	2000	70
medium output	3500K	28	2000	72
medium output	4000K	27	2000	74

750 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	45	3000	67
high output	3500K	43.5	3000	69
high output	4000K	42	3000	71

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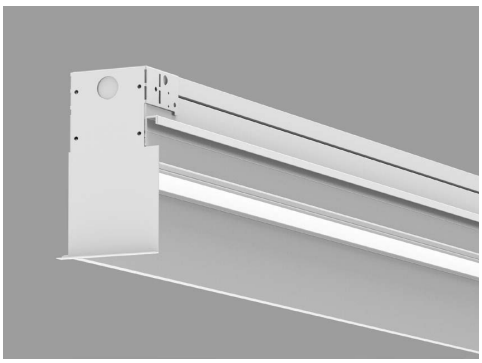
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-5'6"-277-D-1-DTL-W Notes:	**Type:** **RC5-6** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

PROJECT: _____

TYPE: _____

NOTES: _____

DESCRIPTION

Via Skim is designed to illuminate textured or polished vertical surfaces with a grazing light from the wall/ceiling intersection. Via Skim provides continuous illumination across the wall surface.

The intense light distribution is achieved with our Grazing Reflector Optic (GRO) oriented to project light with maximum luminous intensity at 5° from nadir.

The Via Skim is available with two depth options: shallow and deep. Total recessed depth ranges from 4¾" to 7".

ORDER GUIDE

IC RATED

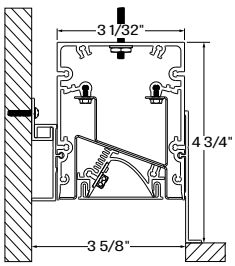
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
~~**V3SKIS**~~- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

5' 6"				
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

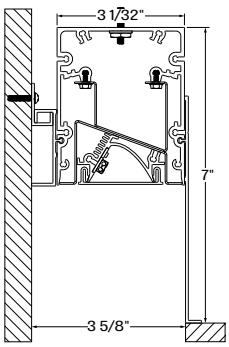
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



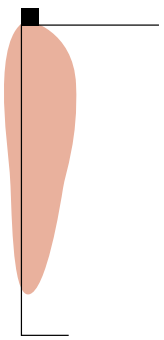
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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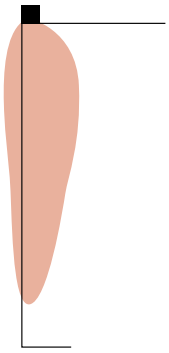
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LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

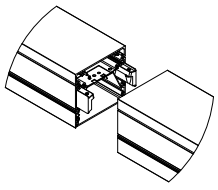
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11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
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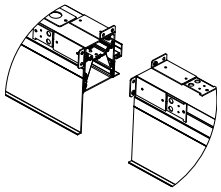
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Drywall joining



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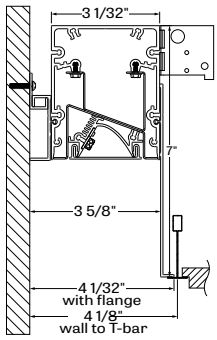
VIA SKIM 3 LED

RECESSED

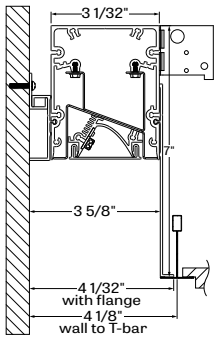
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MOUNTING OPTIONS

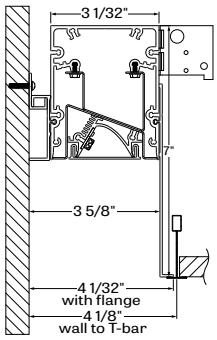
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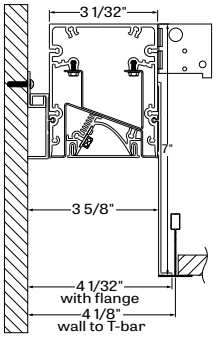
TG9 - tegular 9/16"



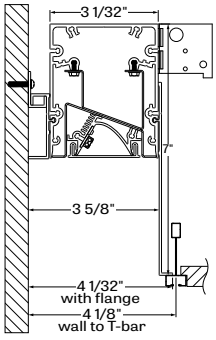
TG15 - tegular 15/16"



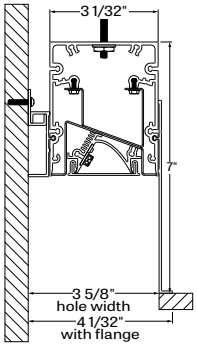
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FINISH

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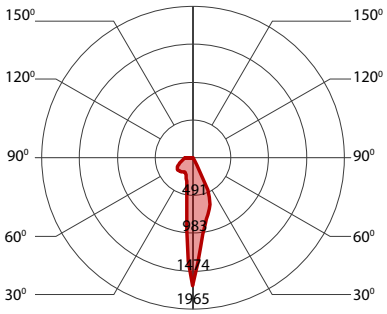
Intertek

VIA SKIM 3 LED

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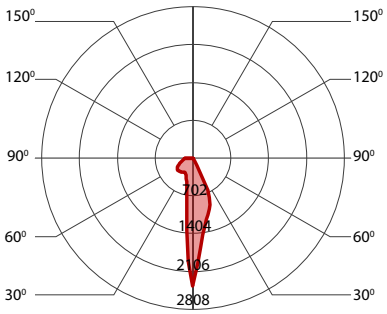
350 LUMEN AT 80CRI - LOW OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	20	1400	71
low output	3500K	19	1400	73
low output	4000K	19	1400	75

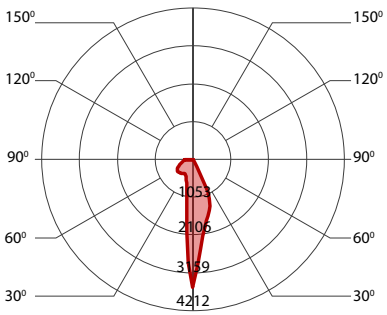
500 LUMEN AT 80CRI - MEDIUM OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	28.5	2000	70
medium output	3500K	28	2000	72
medium output	4000K	27	2000	74

750 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	45	3000	67
high output	3500K	43.5	3000	69
high output	4000K	42	3000	71

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Intertek

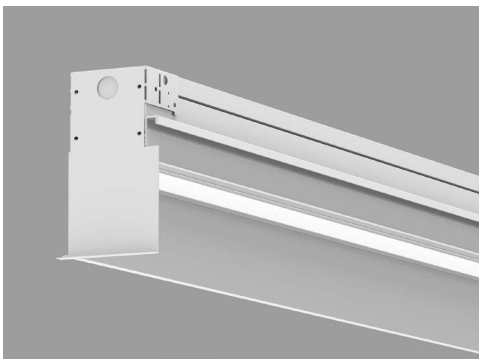
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-6'-277-D-1-DTL-W Notes:	**Type:** **RC6** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

DESCRIPTION

Via Skim is designed to illuminate textured or polished vertical surfaces with a grazing light from the wall/ceiling intersection. Via Skim provides continuous illumination across the wall surface.
The intense light distribution is achieved with our Grazing Reflector Optic (GRO) oriented to project light with maximum luminous intensity at 5° from nadir.
The Via Skim is available with two depth options: shallow and deep. Total recessed depth ranges from 4¾" to 7".

PROJECT: _____

TYPE: _____

NOTES: _____

ORDER GUIDE

IC RATED

	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

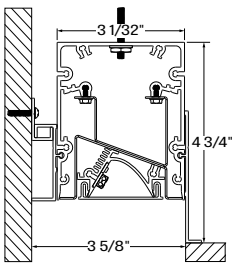
6'

LUMINAIRE LENGTH	VOLTAGE	DRIVER	ELECTRICAL	MOUNTING
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

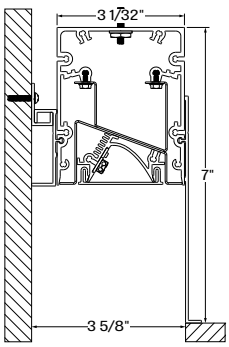
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



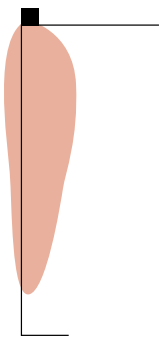
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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VIA SKIM 3 LED

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OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

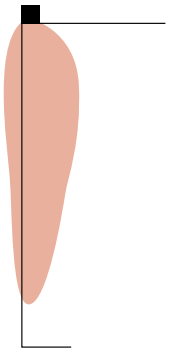
LIGHT SOURCE - LED

Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

PERFORMANCE PER 4' AT 4000K

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	19	1400	75
medium output	4000K	27	2000	74
high output	4000K	42	3000	71

LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

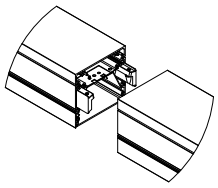
Foot Candles on 20' wide wall, 10' ceiling

128	135	153	144	131	126	134	154	146	136
25.4	24.4	23.5	23.7	23.7	23.8	23.8	23.7	24.8	27.8
12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

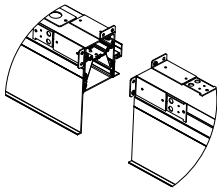
LUMINAIRE LENGTH

All individual sections are joined together onsite using the joiner kits provided. LumenWerx offers joiner kits that are extremely simple to work with in the field and result in a fixture that appears virtually seamless with no light leak at any connection.

Joining system



Drywall joining



Grid joining

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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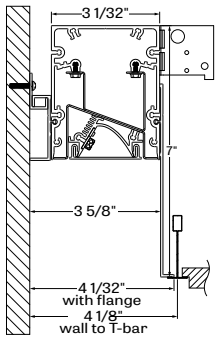
VIA SKIM 3 LED

RECESSED

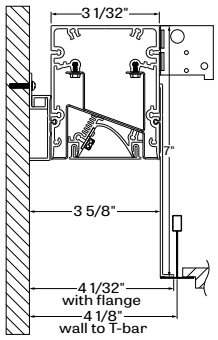
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MOUNTING OPTIONS

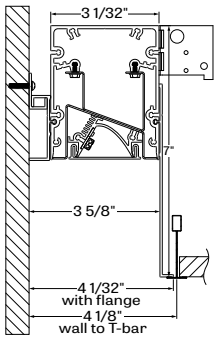
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



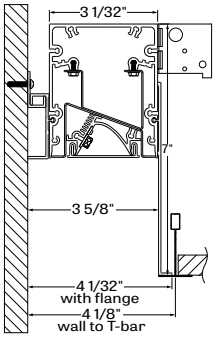
TG9 - tegular 9/16"



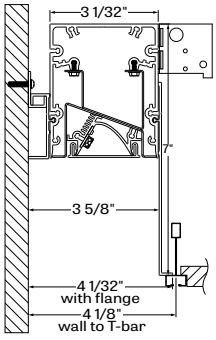
TG15 - tegular 15/16"



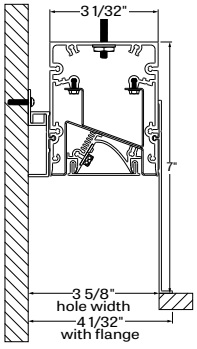
TB9 - t-bar 9/16"



TB15 - t-bar 15/16"



ST - screw slot t-bar



DTL - drywall trimless

FINISH

Interior - 95%, reflective matte powder coated white paint
Exterior - matte white or silver powder coating.
Custom finishes are also available.

CONSTRUCTION

Housing - Extruded Aluminum (0.095" nominal) up to 90% Recycled Content
Interior brackets - Die formed cold rolled sheet steel 18 gauge thick
Joining system - Die cast Zinc (0.95" nominal) and die Formed galvanized sheet 18 gauge
Reflectors - Extruded Aluminum (0.070" nominal) up to 90% Recycled Content.
Recessed flanges - Extruded Aluminum (0.075" nominal) up to 90% Recycled Content
End plate - Die formed cold rolled sheet steel 18 gauge thick

MAINTENANCE

LED boards are housed in a removable cartridge for easy replacement. Driver is accessible from below.

WEIGHT

Via Skim 3 4ft - 11.23lbs - 5.1kg
Via Skim 3 8ft - 22.47lbs - 10.2kg
Via Skim 3 12ft - 33.70lbs - 15.3kg

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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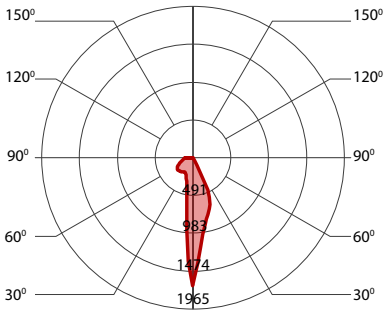
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VIA SKIM 3 LED

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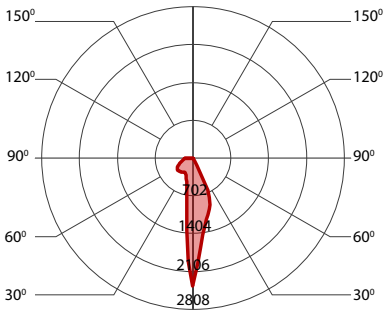
350 LUMEN AT 80CRI - LOW OUTPUT



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LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
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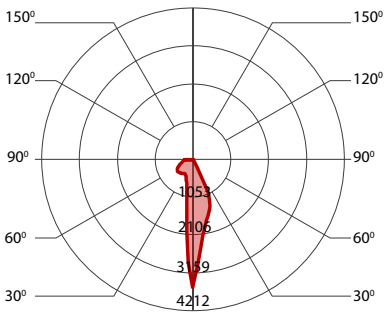
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LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
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LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
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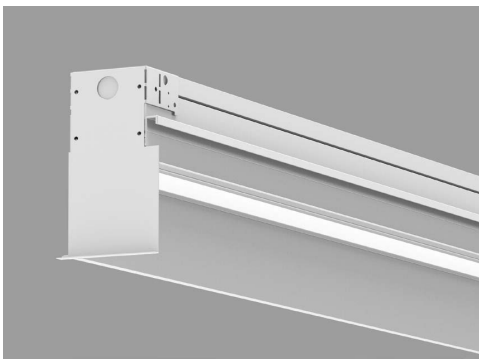
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-7'-277-D-1-DTL-W Notes:	**Type:** RC7 LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

DESCRIPTION

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The intense light distribution is achieved with our Grazing Reflector Optic (GRO) oriented to project light with maximum luminous intensity at 5° from nadir.
The Via Skim is available with two depth options: shallow and deep. Total recessed depth ranges from 4¾" to 7".

PROJECT: _____
TYPE: _____
NOTES: _____

ORDER GUIDE

IC RATED

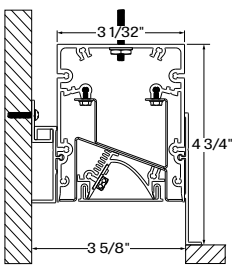
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

7'				
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
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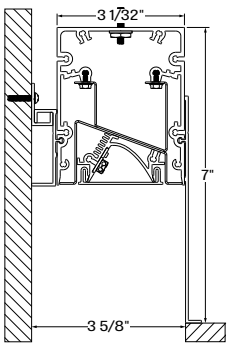
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



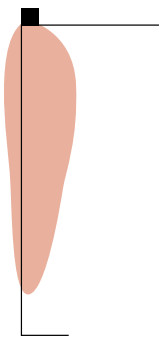
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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VIA SKIM 3 LED

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OPTICS

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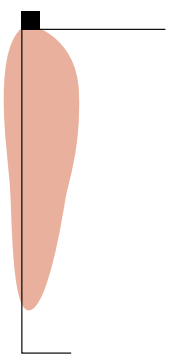
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PERFORMANCE PER 4' AT 4000K

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
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medium output	4000K	27	2000	74
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LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

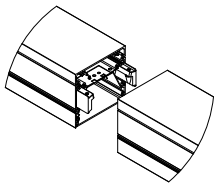
Foot Candles on 20' wide wall, 10' ceiling

128	135	153	144	131	126	134	154	146	136
25.4	24.4	23.5	23.7	23.7	23.8	23.8	23.7	24.8	27.8
12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

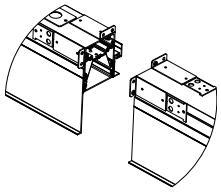
LUMINAIRE LENGTH

All individual sections are joined together onsite using the joiner kits provided. LumenWerx offers joiner kits that are extremely simple to work with in the field and result in a fixture that appears virtually seamless with no light leak at any connection.

Joining system



Drywall joining



Grid joining

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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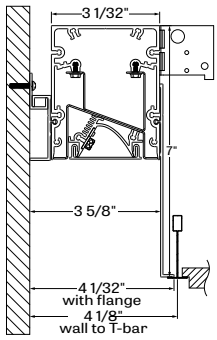
VIA SKIM 3 LED

RECESSED

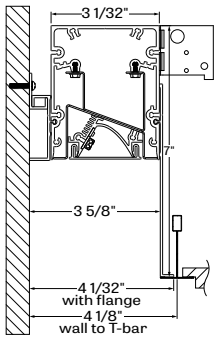
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MOUNTING OPTIONS

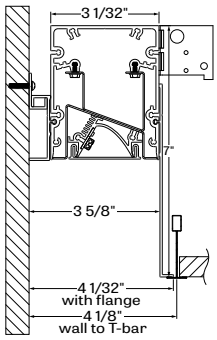
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



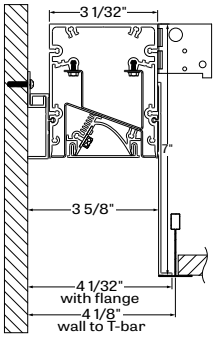
TG9 - tegular 9/16"



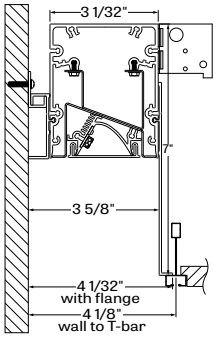
TG15 - tegular 15/16"



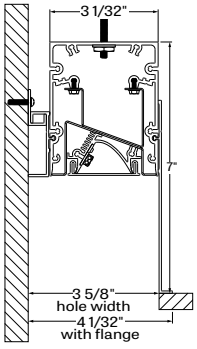
TB9 - t-bar 9/16"



TB15 - t-bar 15/16"



ST - screw slot t-bar



DTL - drywall trimless

FINISH

Interior - 95%, reflective matte powder coated white paint
Exterior - matte white or silver powder coating.
Custom finishes are also available.

CONSTRUCTION

Housing - Extruded Aluminum (0.095" nominal) up to 90% Recycled Content
Interior brackets - Die formed cold rolled sheet steel 18 gauge thick
Joining system - Die cast Zinc (0.95" nominal) and die Formed galvanized sheet 18 gauge
Reflectors - Extruded Aluminum (0.070" nominal) up to 90% Recycled Content.
Recessed flanges - Extruded Aluminum (0.075" nominal) up to 90% Recycled Content
End plate - Die formed cold rolled sheet steel 18 gauge thick

MAINTENANCE

LED boards are housed in a removable cartridge for easy replacement. Driver is accessible from below.

WEIGHT

Via Skim 3 4ft - 11.23lbs - 5.1kg
Via Skim 3 8ft - 22.47lbs - 10.2kg
Via Skim 3 12ft - 33.70lbs - 15.3kg

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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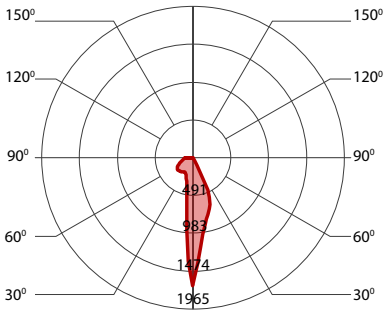
Intertek

VIA SKIM 3 LED

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LUMENWERX
WWW.LUMENWERX.COM

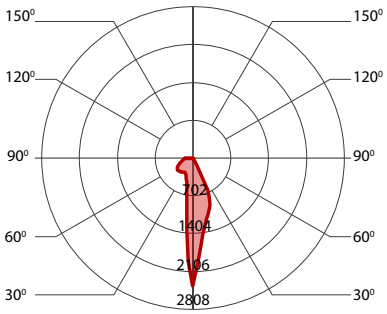
350 LUMEN AT 80CRI - LOW OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	20	1400	71
low output	3500K	19	1400	73
low output	4000K	19	1400	75

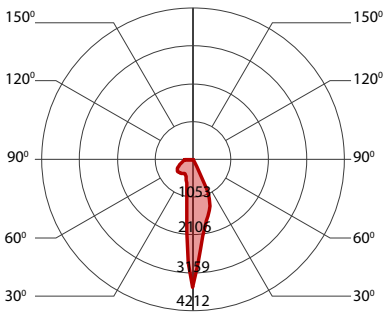
500 LUMEN AT 80CRI - MEDIUM OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	28.5	2000	70
medium output	3500K	28	2000	72
medium output	4000K	27	2000	74

750 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	45	3000	67
high output	3500K	43.5	3000	69
high output	4000K	42	3000	71

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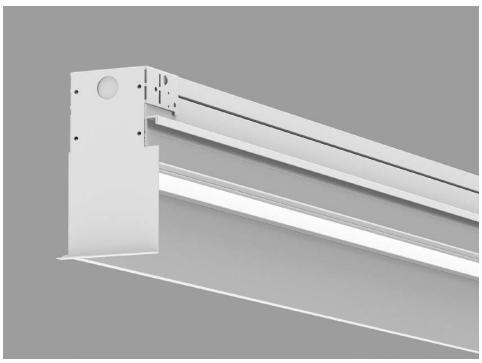
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-8'-277-D-1-DTL-W Notes:	**Type:** **RC8** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

DESCRIPTION

Via Skim is designed to illuminate textured or polished vertical surfaces with a grazing light from the wall/ceiling intersection. Via Skim provides continuous illumination across the wall surface.
The intense light distribution is achieved with our Grazing Reflector Optic (GRO) oriented to project light with maximum luminous intensity at 5° from nadir.
The Via Skim is available with two depth options: shallow and deep. Total recessed depth ranges from 4¾" to 7".

PROJECT: _____
TYPE: _____
NOTES: _____

ORDER GUIDE

IC RATED

	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

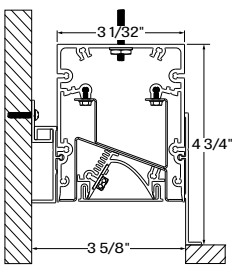
8'

LUMINAIRE LENGTH	VOLTAGE	DRIVER	ELECTRICAL	MOUNTING
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

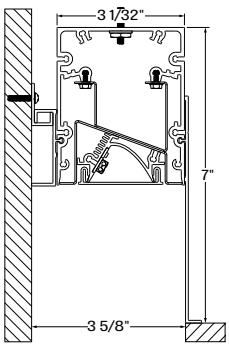
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



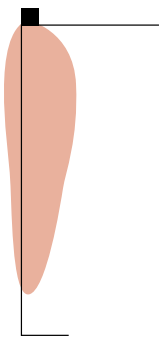
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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VIA SKIM 3 LED

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OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

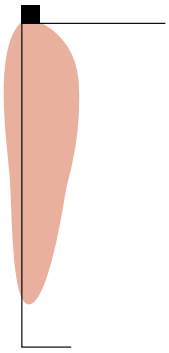
LIGHT SOURCE - LED

Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

PERFORMANCE PER 4' AT 4000K

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	19	1400	75
medium output	4000K	27	2000	74
high output	4000K	42	3000	71

LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

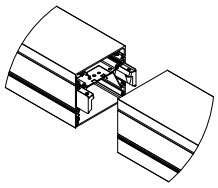
Foot Candles on 20' wide wall, 10' ceiling

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11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

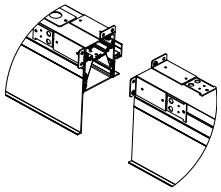
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Joining system



Drywall joining



Grid joining

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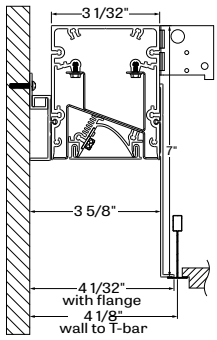
VIA SKIM 3 LED

RECESSED

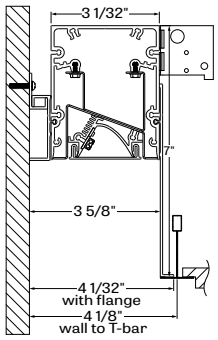
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MOUNTING OPTIONS

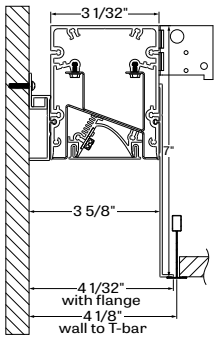
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



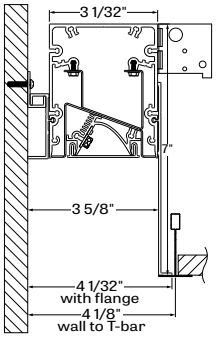
TG9 - tegular 9/16"



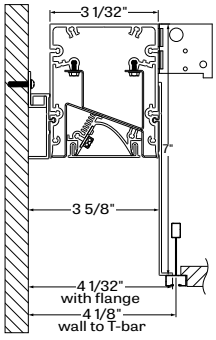
TG15 - tegular 15/16"



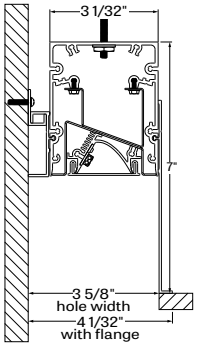
TB9 - t-bar 9/16"



TB15 - t-bar 15/16"



ST - screw slot t-bar



DTL - drywall trimless

FINISH

Interior - 95%, reflective matte powder coated white paint
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Custom finishes are also available.

CONSTRUCTION

Housing - Extruded Aluminum (0.095" nominal) up to 90% Recycled Content
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Via Skim 3 8ft - 22.47lbs - 10.2kg
Via Skim 3 12ft - 33.70lbs - 15.3kg

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ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
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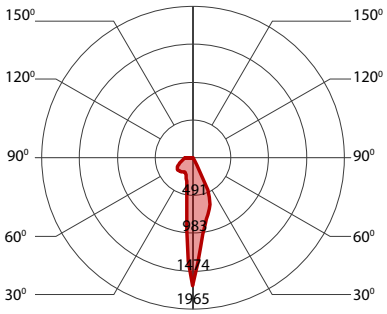
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VIA SKIM 3 LED

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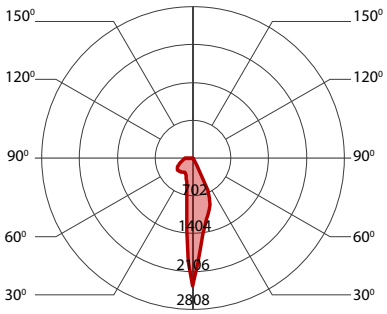
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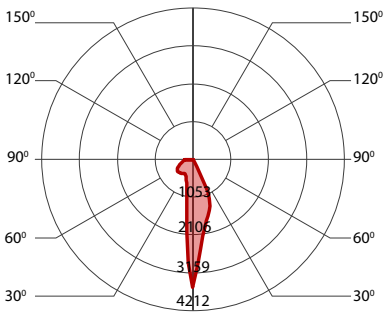
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LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
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medium output	3500K	28	2000	72
medium output	4000K	27	2000	74

750 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	45	3000	67
high output	3500K	43.5	3000	69
high output	4000K	42	3000	71

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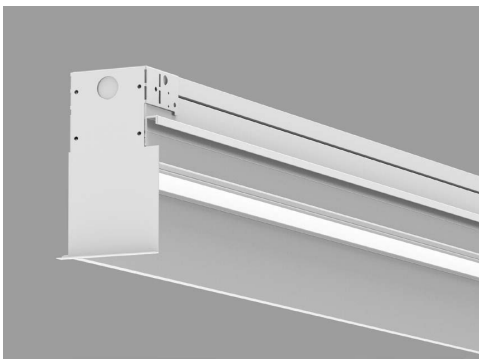
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-9'-277-D-1-DTL-W Notes:	**Type:** **RC9** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

PROJECT: _____

TYPE: _____

NOTES: _____

DESCRIPTION

Via Skim is designed to illuminate textured or polished vertical surfaces with a grazing light from the wall/ceiling intersection. Via Skim provides continuous illumination across the wall surface.

The intense light distribution is achieved with our Grazing Reflector Optic (GRO) oriented to project light with maximum luminous intensity at 5° from nadir.

The Via Skim is available with two depth options: shallow and deep. Total recessed depth ranges from 4¾" to 7".

ORDER GUIDE

IC RATED

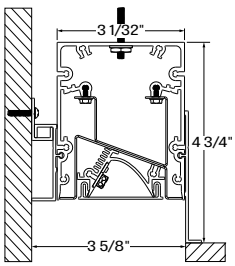
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

9'				
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

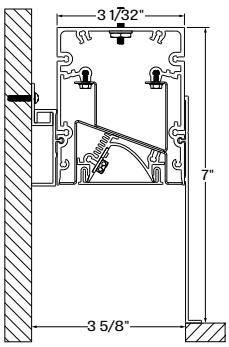
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



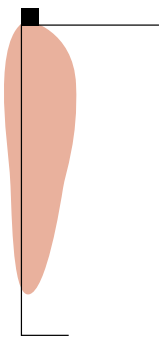
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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Intertek

VIA SKIM 3 LED

RECESSED

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OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

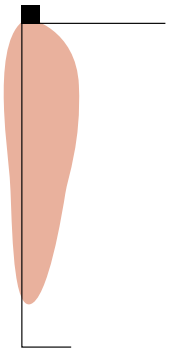
LIGHT SOURCE - LED

Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

PERFORMANCE PER 4' AT 4000K

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	19	1400	75
medium output	4000K	27	2000	74
high output	4000K	42	3000	71

LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

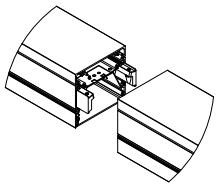
Foot Candles on 20' wide wall, 10' ceiling

128	135	153	144	131	126	134	154	146	136
25.4	24.4	23.5	23.7	23.7	23.8	23.8	23.7	24.8	27.8
12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

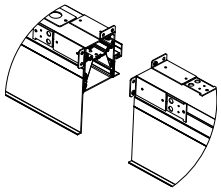
LUMINAIRE LENGTH

All individual sections are joined together onsite using the joiner kits provided. LumenWerx offers joiner kits that are extremely simple to work with in the field and result in a fixture that appears virtually seamless with no light leak at any connection.

Joining system



Drywall joining



Grid joining

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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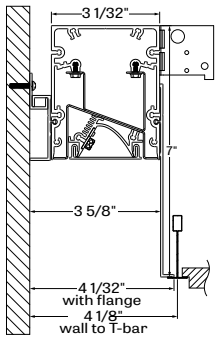
VIA SKIM 3 LED

RECESSED

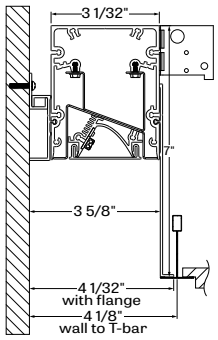
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MOUNTING OPTIONS

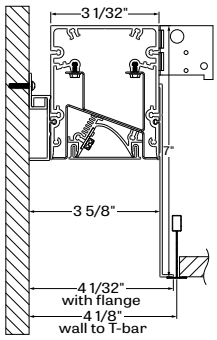
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



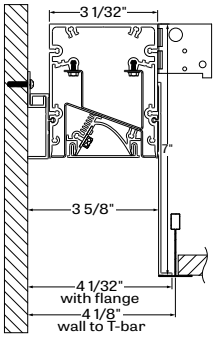
TG9 - tegular 9/16"



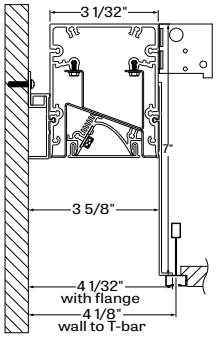
TG15 - tegular 15/16"



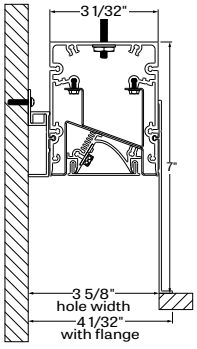
TB9 - t-bar 9/16"



TB15 - t-bar 15/16"



ST - screw slot t-bar



DTL - drywall trimless

FINISH

Interior - 95%, reflective matte powder coated white paint
Exterior - matte white or silver powder coating.
Custom finishes are also available.

CONSTRUCTION

Housing - Extruded Aluminum (0.095" nominal) up to 90% Recycled Content
Interior brackets - Die formed cold rolled sheet steel 18 gauge thick
Joining system - Die cast Zinc (0.95" nominal) and die Formed galvanized sheet 18 gauge
Reflectors - Extruded Aluminum (0.070" nominal) up to 90% Recycled Content.
Recessed flanges - Extruded Aluminum (0.075" nominal) up to 90% Recycled Content
End plate - Die formed cold rolled sheet steel 18 gauge thick

MAINTENANCE

LED boards are housed in a removable cartridge for easy replacement. Driver is accessible from below.

WEIGHT

Via Skim 3 4ft - 11.23lbs - 5.1kg
Via Skim 3 8ft - 22.47lbs - 10.2kg
Via Skim 3 12ft - 33.70lbs - 15.3kg

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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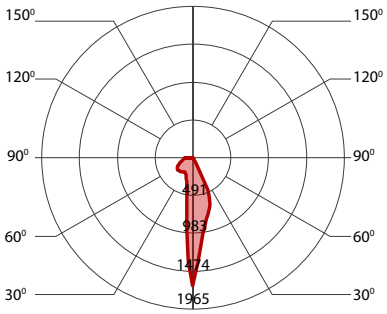
Intertek

VIA SKIM 3 LED

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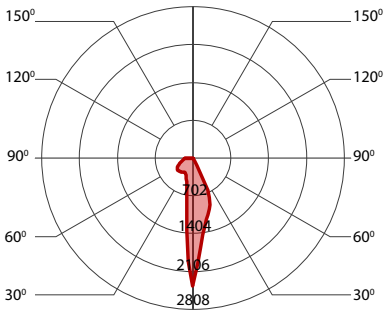
350 LUMEN AT 80CRI - LOW OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	20	1400	71
low output	3500K	19	1400	73
low output	4000K	19	1400	75

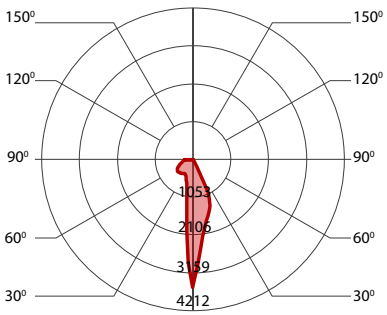
500 LUMEN AT 80CRI - MEDIUM OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	28.5	2000	70
medium output	3500K	28	2000	72
medium output	4000K	27	2000	74

750 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	45	3000	67
high output	3500K	43.5	3000	69
high output	4000K	42	3000	71

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Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
V3SKID-GRO-LED-80-500-30-9'-277-D (0.1% ELDOLEDSOLO)-1-DTL-W

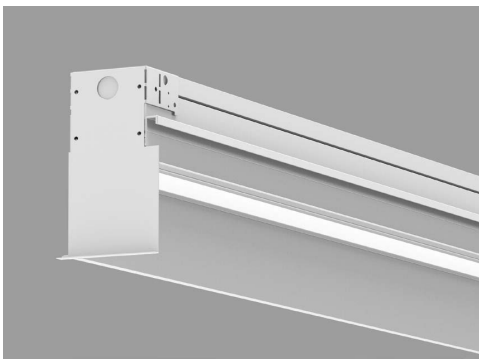
Type:
RC9-.1%
LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

DESCRIPTION

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The intense light distribution is achieved with our Grazing Reflector Optic (GRO) oriented to project light with maximum luminous intensity at 5° from nadir.
The Via Skim is available with two depth options: shallow and deep. Total recessed depth ranges from 4¾" to 7".

PROJECT: _____
TYPE: _____
NOTES: _____

ORDER GUIDE

IC RATED

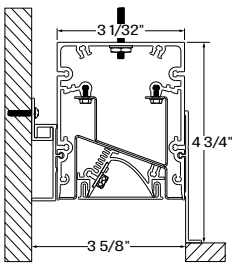
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
~~**V3SKIS**~~- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

9' 6"		.1% DIMMING		
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

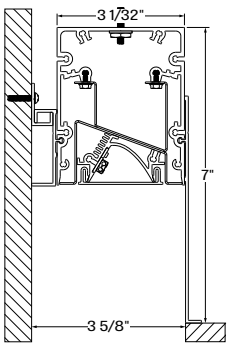
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



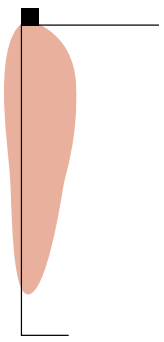
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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VIA SKIM 3 LED

RECESSED

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OPTICS

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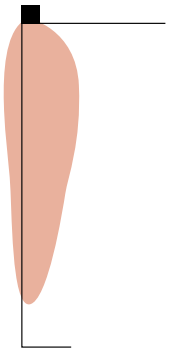
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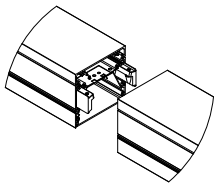
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12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

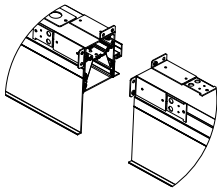
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Drywall joining



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EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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Intertek

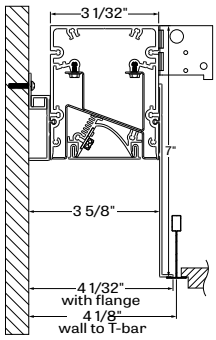
VIA SKIM 3 LED

RECESSED

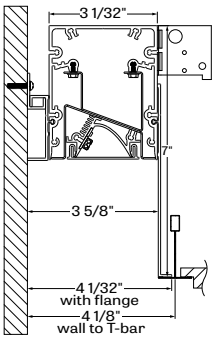
LUMENWERX
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MOUNTING OPTIONS

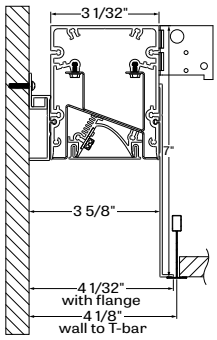
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



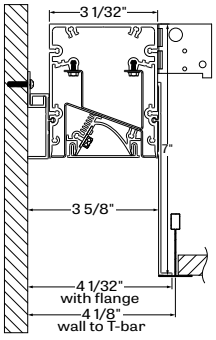
TG9 - tegular 9/16"



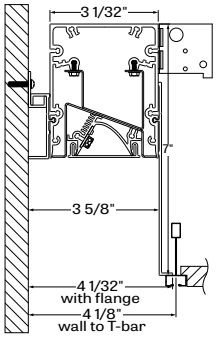
TG15 - tegular 15/16"



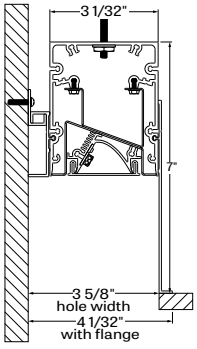
TB9 - t-bar 9/16"



TB15 - t-bar 15/16"



ST - screw slot t-bar



DTL - drywall trimless

FINISH

Interior - 95%, reflective matte powder coated white paint
Exterior - matte white or silver powder coating.
Custom finishes are also available.

CONSTRUCTION

Housing - Extruded Aluminum (0.095" nominal) up to 90% Recycled Content
Interior brackets - Die formed cold rolled sheet steel 18 gauge thick
Joining system - Die cast Zinc (0.95" nominal) and die Formed galvanized sheet 18 gauge
Reflectors - Extruded Aluminum (0.070" nominal) up to 90% Recycled Content.
Recessed flanges - Extruded Aluminum (0.075" nominal) up to 90% Recycled Content
End plate - Die formed cold rolled sheet steel 18 gauge thick

MAINTENANCE

LED boards are housed in a removable cartridge for easy replacement. Driver is accessible from below.

WEIGHT

Via Skim 3 4ft - 11.23lbs - 5.1kg
Via Skim 3 8ft - 22.47lbs - 10.2kg
Via Skim 3 12ft - 33.70lbs - 15.3kg

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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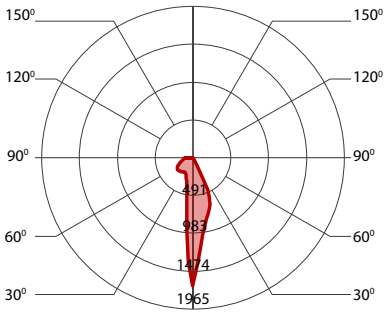
Intertek

VIA SKIM 3 LED

RECESSED

LUMENWERX
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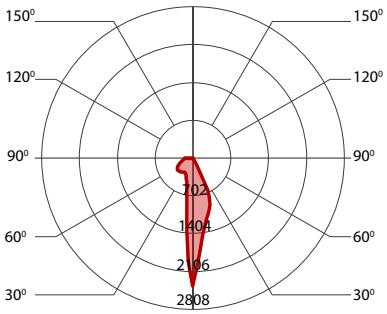
350 LUMEN AT 80CRI - LOW OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	20	1400	71
low output	3500K	19	1400	73
low output	4000K	19	1400	75

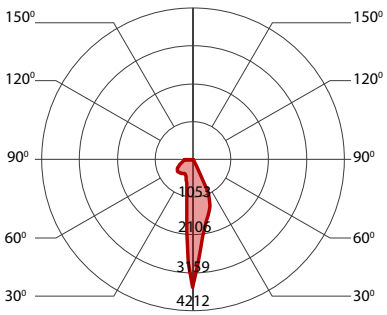
500 LUMEN AT 80CRI - MEDIUM OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	28.5	2000	70
medium output	3500K	28	2000	72
medium output	4000K	27	2000	74

750 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	45	3000	67
high output	3500K	43.5	3000	69
high output	4000K	42	3000	71

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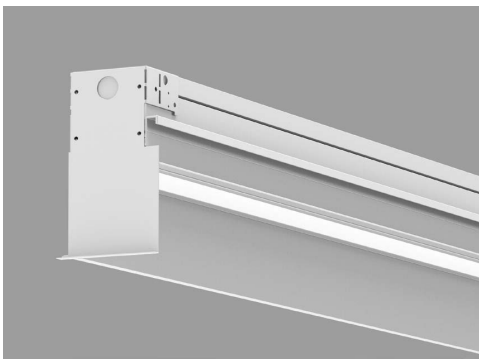
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-10'-277 D-1-DTL-W Notes:	**Type:** **RC10** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

PROJECT: _____

TYPE: _____

NOTES: _____

DESCRIPTION

Via Skim is designed to illuminate textured or polished vertical surfaces with a grazing light from the wall/ceiling intersection. Via Skim provides continuous illumination across the wall surface.

The intense light distribution is achieved with our Grazing Reflector Optic (GRO) oriented to project light with maximum luminous intensity at 5° from nadir.

The Via Skim is available with two depth options: shallow and deep. Total recessed depth ranges from 4¾" to 7".

ORDER GUIDE

IC RATED

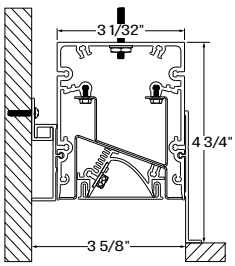
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

10'				
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

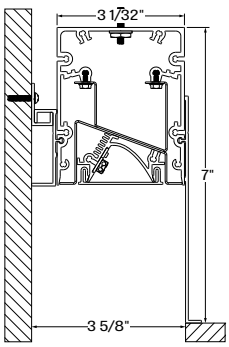
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



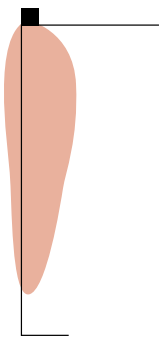
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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VIA SKIM 3 LED

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OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

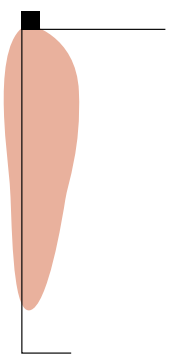
LIGHT SOURCE - LED

Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

PERFORMANCE PER 4' AT 4000K

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	19	1400	75
medium output	4000K	27	2000	74
high output	4000K	42	3000	71

LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

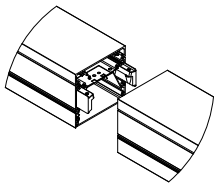
Foot Candles on 20' wide wall, 10' ceiling

128	135	153	144	131	126	134	154	146	136
25.4	24.4	23.5	23.7	23.7	23.8	23.8	23.7	24.8	27.8
12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

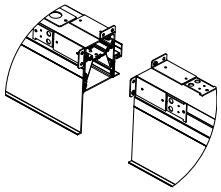
LUMINAIRE LENGTH

All individual sections are joined together onsite using the joiner kits provided. LumenWerx offers joiner kits that are extremely simple to work with in the field and result in a fixture that appears virtually seamless with no light leak at any connection.

Joining system



Drywall joining



Grid joining

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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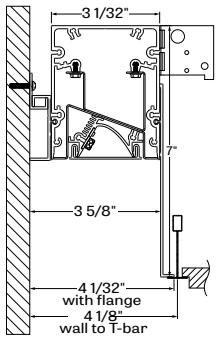
VIA SKIM 3 LED

RECESSED

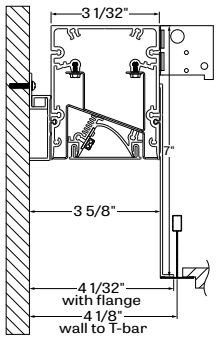
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MOUNTING OPTIONS

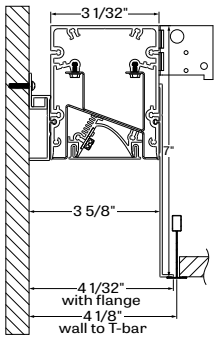
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



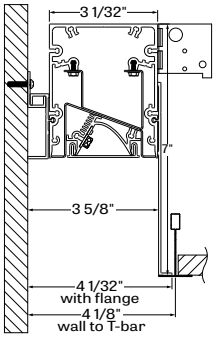
TG9 - tegular 9/16"



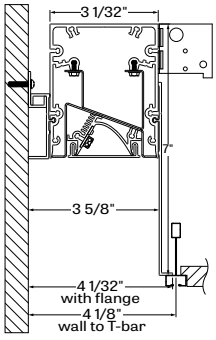
TG15 - tegular 15/16"



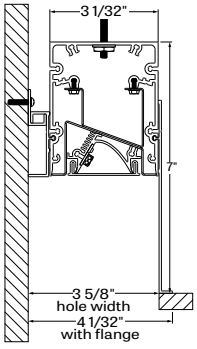
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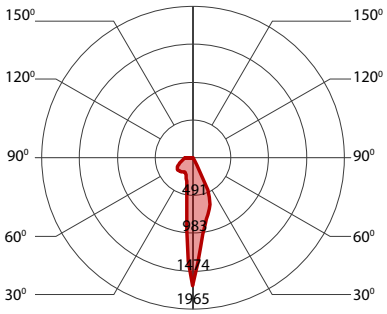
Intertek

VIA SKIM 3 LED

RECESSED

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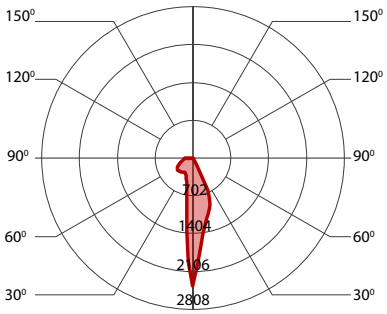
350 LUMEN AT 80CRI - LOW OUTPUT



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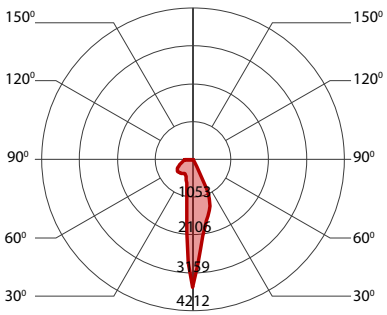
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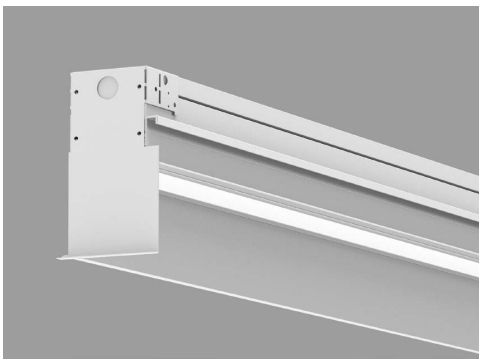
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-10'6"-277-D-1-DTL-W Notes:	**Type:** **RC10-6** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

PROJECT: _____

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ORDER GUIDE

***IC* RATED**

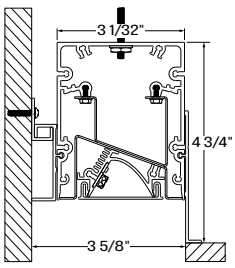
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

10' 6"				
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

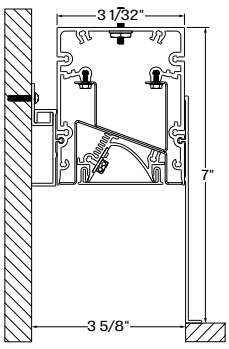
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



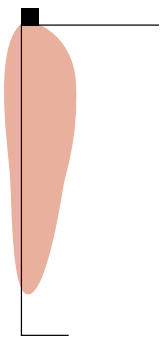
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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Intertek

VIA SKIM 3 LED

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OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

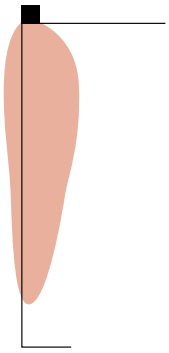
LIGHT SOURCE - LED

Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

PERFORMANCE PER 4' AT 4000K

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	19	1400	75
medium output	4000K	27	2000	74
high output	4000K	42	3000	71

LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

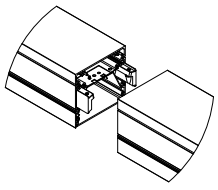
Foot Candles on 20' wide wall, 10' ceiling

128	135	153	144	131	126	134	154	146	136
25.4	24.4	23.5	23.7	23.7	23.8	23.8	23.7	24.8	27.8
12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
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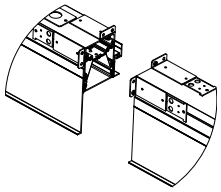
LUMINAIRE LENGTH

All individual sections are joined together onsite using the joiner kits provided. LumenWerx offers joiner kits that are extremely simple to work with in the field and result in a fixture that appears virtually seamless with no light leak at any connection.

Joining system



Drywall joining



Grid joining

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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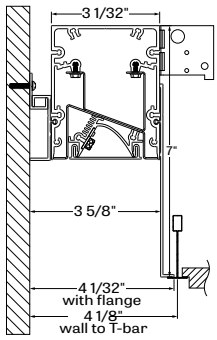
VIA SKIM 3 LED

RECESSED

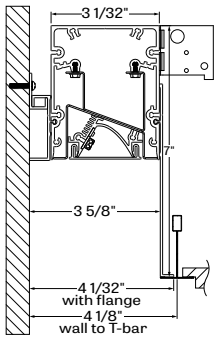
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MOUNTING OPTIONS

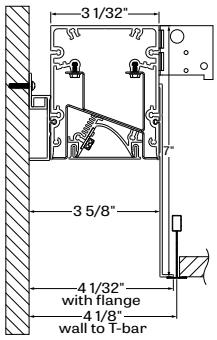
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



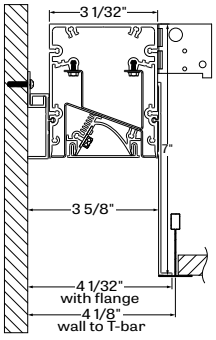
TG9 - tegular 9/16"



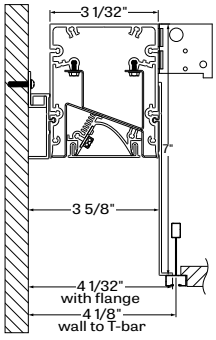
TG15 - tegular 15/16"



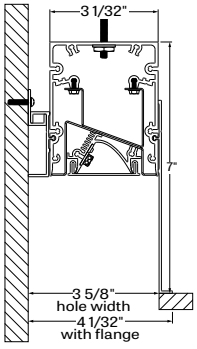
TB9 - t-bar 9/16"



TB15 - t-bar 15/16"



ST - screw slot t-bar



DTL - drywall trimless

FINISH

Interior - 95%, reflective matte powder coated white paint
Exterior - matte white or silver powder coating.
Custom finishes are also available.

CONSTRUCTION

Housing - Extruded Aluminum (0.095" nominal) up to 90% Recycled Content
Interior brackets - Die formed cold rolled sheet steel 18 gauge thick
Joining system - Die cast Zinc (0.95" nominal) and die Formed galvanized sheet 18 gauge
Reflectors - Extruded Aluminum (0.070" nominal) up to 90% Recycled Content.
Recessed flanges - Extruded Aluminum (0.075" nominal) up to 90% Recycled Content
End plate - Die formed cold rolled sheet steel 18 gauge thick

MAINTENANCE

LED boards are housed in a removable cartridge for easy replacement. Driver is accessible from below.

WEIGHT

Via Skim 3 4ft - 11.23lbs - 5.1kg
Via Skim 3 8ft - 22.47lbs - 10.2kg
Via Skim 3 12ft - 33.70lbs - 15.3kg

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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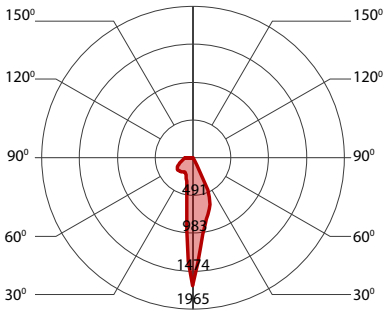
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VIA SKIM 3 LED

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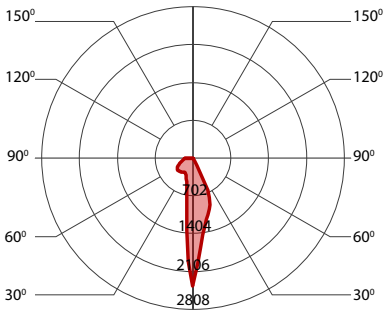
350 LUMEN AT 80CRI - LOW OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	20	1400	71
low output	3500K	19	1400	73
low output	4000K	19	1400	75

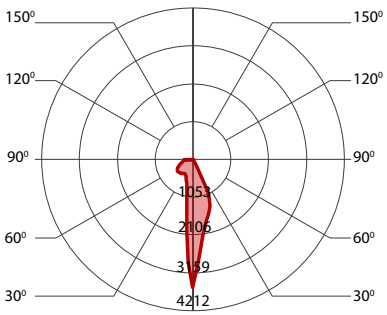
500 LUMEN AT 80CRI - MEDIUM OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	28.5	2000	70
medium output	3500K	28	2000	72
medium output	4000K	27	2000	74

750 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	45	3000	67
high output	3500K	43.5	3000	69
high output	4000K	42	3000	71

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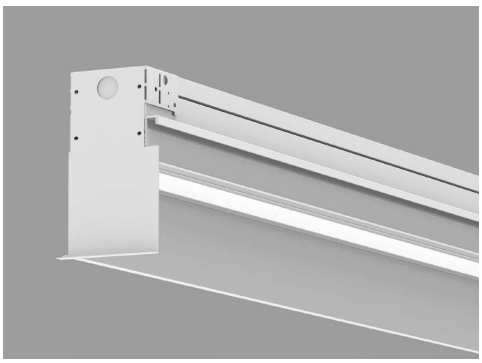
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-12'-277 D-1-DTL-W Notes:	**Type:** **RC12** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

DESCRIPTION

Via Skim is designed to illuminate textured or polished vertical surfaces with a grazing light from the wall/ceiling intersection. Via Skim provides continuous illumination across the wall surface.
The intense light distribution is achieved with our Grazing Reflector Optic (GRO) oriented to project light with maximum luminous intensity at 5° from nadir.
The Via Skim is available with two depth options: shallow and deep. Total recessed depth ranges from 4¾" to 7".

PROJECT: _____

TYPE: _____

NOTES: _____

ORDER GUIDE

IC RATED

	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

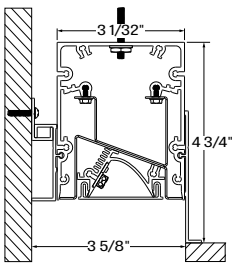
12'

LUMINAIRE LENGTH	VOLTAGE	DRIVER	ELECTRICAL	MOUNTING
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

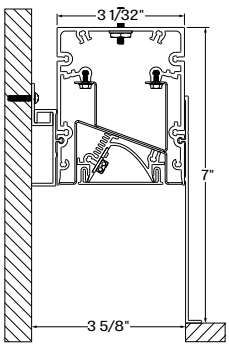
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



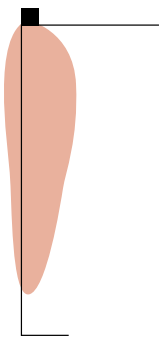
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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VIA SKIM 3 LED

RECESSED

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OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

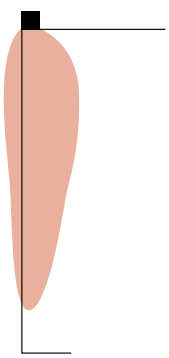
LIGHT SOURCE - LED

Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
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PERFORMANCE PER 4' AT 4000K

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medium output	4000K	27	2000	74
high output	4000K	42	3000	71

LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

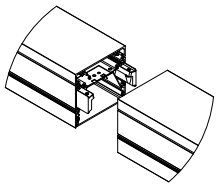
Foot Candles on 20' wide wall, 10' ceiling

128	135	153	144	131	126	134	154	146	136
25.4	24.4	23.5	23.7	23.7	23.8	23.8	23.7	24.8	27.8
12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

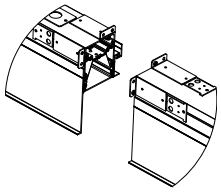
LUMINAIRE LENGTH

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Joining system



Drywall joining



Grid joining

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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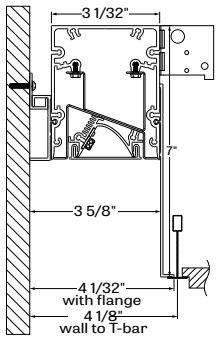
VIA SKIM 3 LED

RECESSED

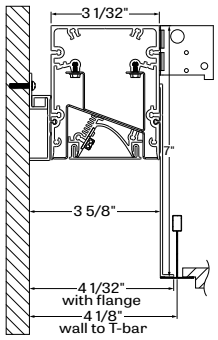
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MOUNTING OPTIONS

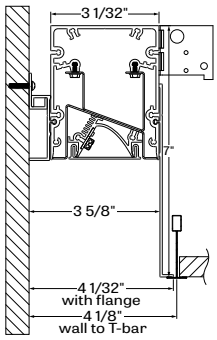
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



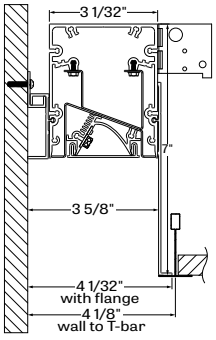
TG9 - tegular 9/16"



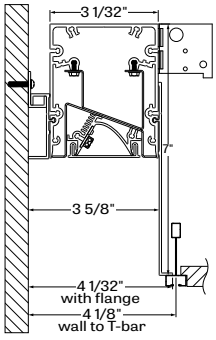
TG15 - tegular 15/16"



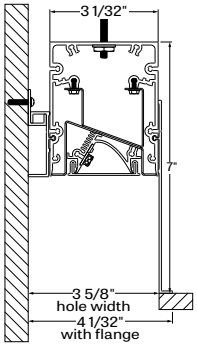
TB9 - t-bar 9/16"



TB15 - t-bar 15/16"



ST - screw slot t-bar



DTL - drywall trimless

FINISH

Interior - 95%, reflective matte powder coated white paint
Exterior - matte white or silver powder coating.
Custom finishes are also available.

CONSTRUCTION

Housing - Extruded Aluminum (0.095" nominal) up to 90% Recycled Content
Interior brackets - Die formed cold rolled sheet steel 18 gauge thick
Joining system - Die cast Zinc (0.95" nominal) and die Formed galvanized sheet 18 gauge
Reflectors - Extruded Aluminum (0.070" nominal) up to 90% Recycled Content.
Recessed flanges - Extruded Aluminum (0.075" nominal) up to 90% Recycled Content
End plate - Die formed cold rolled sheet steel 18 gauge thick

MAINTENANCE

LED boards are housed in a removable cartridge for easy replacement. Driver is accessible from below.

WEIGHT

Via Skim 3 4ft - 11.23lbs - 5.1kg
Via Skim 3 8ft - 22.47lbs - 10.2kg
Via Skim 3 12ft - 33.70lbs - 15.3kg

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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LumenWerx ULC. reserves the right to change or modify product specifications without notification

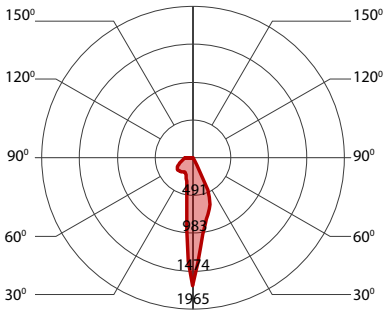
Intertek

VIA SKIM 3 LED

RECESSED

LUMENWERX
WWW.LUMENWERX.COM

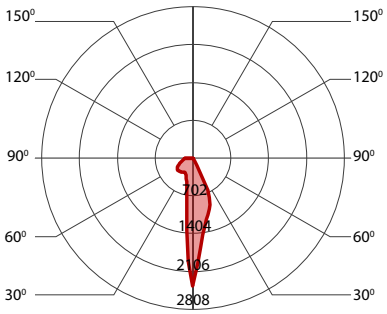
350 LUMEN AT 80CRI - LOW OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	20	1400	71
low output	3500K	19	1400	73
low output	4000K	19	1400	75

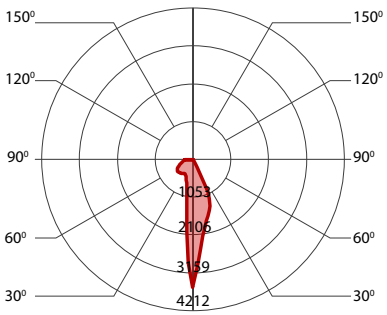
500 LUMEN AT 80CRI - MEDIUM OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	28.5	2000	70
medium output	3500K	28	2000	72
medium output	4000K	27	2000	74

750 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	45	3000	67
high output	3500K	43.5	3000	69
high output	4000K	42	3000	71

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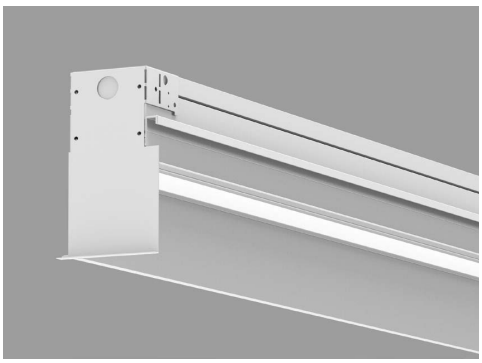
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-12'6"-277-D-1-DTL-W Notes:	**Type:** **RC12-6** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

DESCRIPTION

Via Skim is designed to illuminate textured or polished vertical surfaces with a grazing light from the wall/ceiling intersection. Via Skim provides continuous illumination across the wall surface.
The intense light distribution is achieved with our Grazing Reflector Optic (GRO) oriented to project light with maximum luminous intensity at 5° from nadir.
The Via Skim is available with two depth options: shallow and deep. Total recessed depth ranges from 4¾" to 7".

PROJECT: _____

TYPE: _____

NOTES: _____

ORDER GUIDE

IC RATED

	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

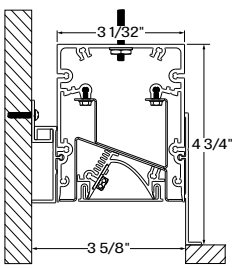
12' 6"

LUMINAIRE LENGTH	VOLTAGE	DRIVER	ELECTRICAL	MOUNTING
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

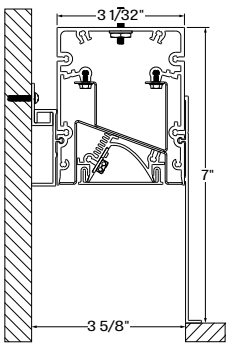
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



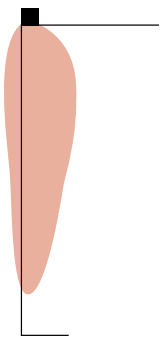
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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Intertek

VIA SKIM 3 LED

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OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

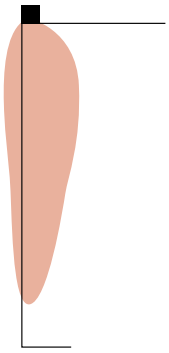
LIGHT SOURCE - LED

Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

PERFORMANCE PER 4' AT 4000K

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	19	1400	75
medium output	4000K	27	2000	74
high output	4000K	42	3000	71

LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

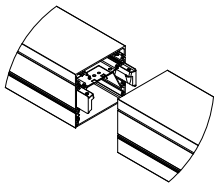
Foot Candles on 20' wide wall, 10' ceiling

128	135	153	144	131	126	134	154	146	136
25.4	24.4	23.5	23.7	23.7	23.8	23.8	23.7	24.8	27.8
12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

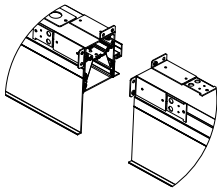
LUMINAIRE LENGTH

All individual sections are joined together onsite using the joiner kits provided. LumenWerx offers joiner kits that are extremely simple to work with in the field and result in a fixture that appears virtually seamless with no light leak at any connection.

Joining system



Drywall joining



Grid joining

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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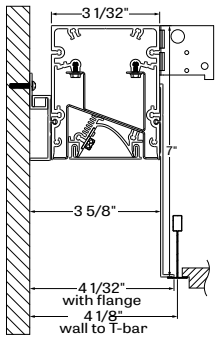
VIA SKIM 3 LED

RECESSED

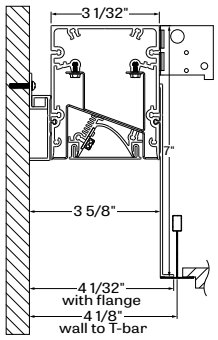
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MOUNTING OPTIONS

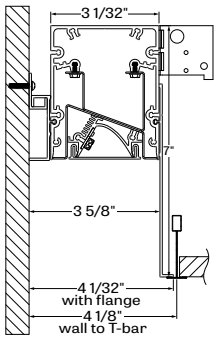
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



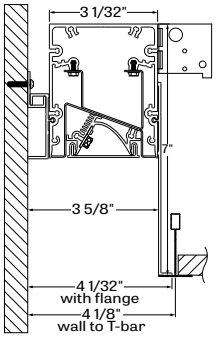
TG9 - tegular 9/16"



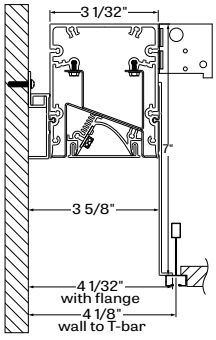
TG15 - tegular 15/16"



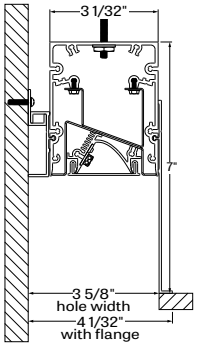
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TB15 - t-bar 15/16"



ST - screw slot t-bar



DTL - drywall trimless

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Exterior - matte white or silver powder coating.
Custom finishes are also available.

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Via Skim 3 8ft - 22.47lbs - 10.2kg
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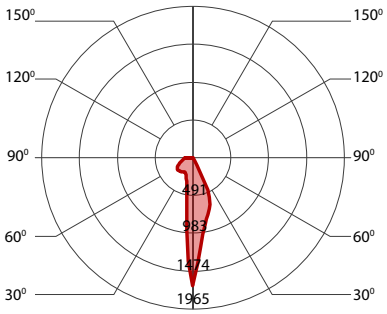
Intertek

VIA SKIM 3 LED

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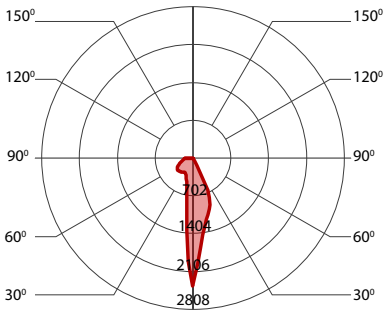
350 LUMEN AT 80CRI - LOW OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
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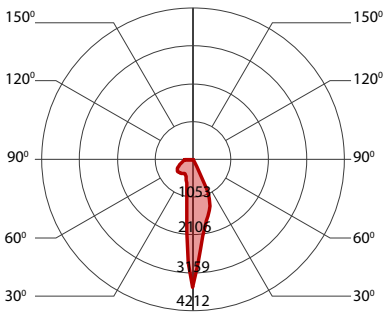
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PERFORMANCE PER 4'

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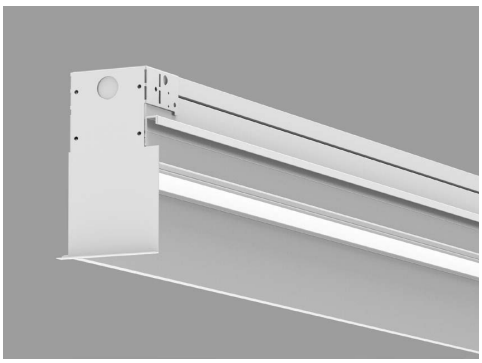
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-15'6"-277-D (.1% ELDO LED)-1-DTL-W Notes:	**Type:** **RC15-6-.1%** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

PROJECT: _____

TYPE: _____

NOTES: _____

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ORDER GUIDE

IC RATED

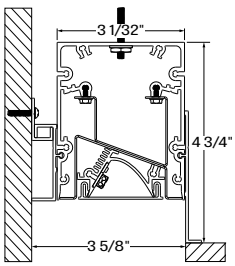
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

15' 8"		.1% DIMMING		
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

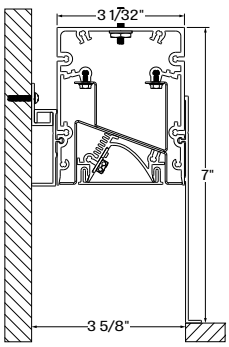
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



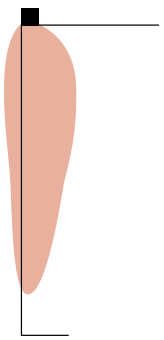
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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VIA SKIM 3 LED

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OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

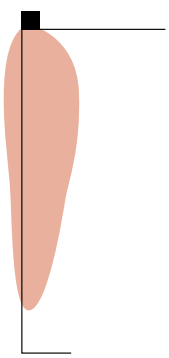
LIGHT SOURCE - LED

Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

PERFORMANCE PER 4' AT 4000K

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	19	1400	75
medium output	4000K	27	2000	74
high output	4000K	42	3000	71

LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

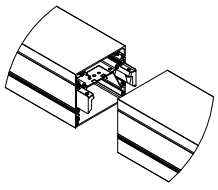
Foot Candles on 20' wide wall, 10' ceiling

128	135	153	144	131	126	134	154	146	136
25.4	24.4	23.5	23.7	23.7	23.8	23.8	23.7	24.8	27.8
12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

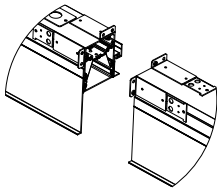
LUMINAIRE LENGTH

All individual sections are joined together onsite using the joiner kits provided. LumenWerx offers joiner kits that are extremely simple to work with in the field and result in a fixture that appears virtually seamless with no light leak at any connection.

Joining system



Drywall joining



Grid joining

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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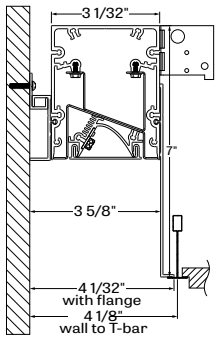
VIA SKIM 3 LED

RECESSED

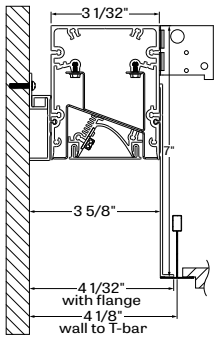
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MOUNTING OPTIONS

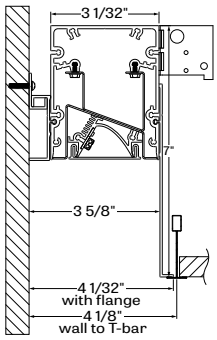
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



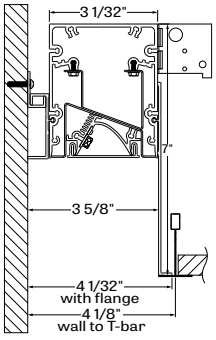
TG9 - tegular 9/16"



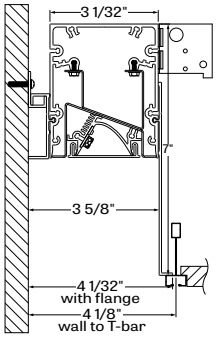
TG15 - tegular 15/16"



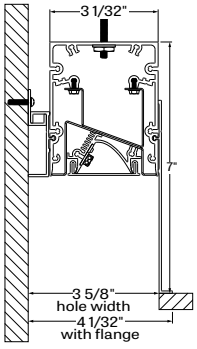
TB9 - t-bar 9/16"



TB15 - t-bar 15/16"



ST - screw slot t-bar



DTL - drywall trimless

FINISH

Interior - 95%, reflective matte powder coated white paint
Exterior - matte white or silver powder coating.
Custom finishes are also available.

CONSTRUCTION

Housing - Extruded Aluminum (0.095" nominal) up to 90% Recycled Content
Interior brackets - Die formed cold rolled sheet steel 18 gauge thick
Joining system - Die cast Zinc (0.95" nominal) and die Formed galvanized sheet 18 gauge
Reflectors - Extruded Aluminum (0.070" nominal) up to 90% Recycled Content.
Recessed flanges - Extruded Aluminum (0.075" nominal) up to 90% Recycled Content
End plate - Die formed cold rolled sheet steel 18 gauge thick

MAINTENANCE

LED boards are housed in a removable cartridge for easy replacement. Driver is accessible from below.

WEIGHT

Via Skim 3 4ft - 11.23lbs - 5.1kg
Via Skim 3 8ft - 22.47lbs - 10.2kg
Via Skim 3 12ft - 33.70lbs - 15.3kg

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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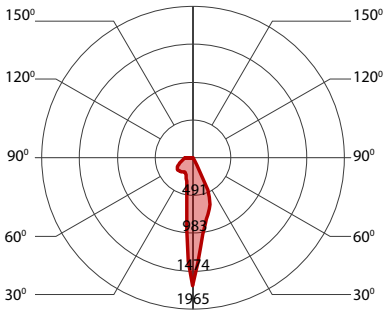
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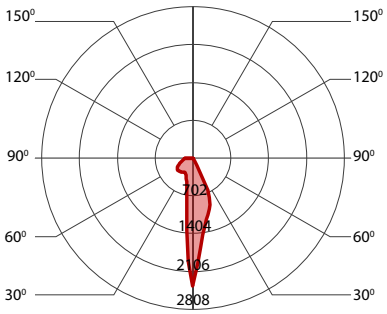
350 LUMEN AT 80CRI - LOW OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	20	1400	71
low output	3500K	19	1400	73
low output	4000K	19	1400	75

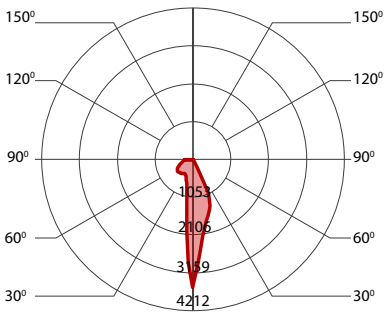
500 LUMEN AT 80CRI - MEDIUM OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	28.5	2000	70
medium output	3500K	28	2000	72
medium output	4000K	27	2000	74

750 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	45	3000	67
high output	3500K	43.5	3000	69
high output	4000K	42	3000	71

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PRESSURE REDUCING VALVES | RD-11, RD-40, RD-50 & HRD-70 | INSTALLATION AND OPERATING INSTRUCTIONS

File No: 11.85
Date: DECEMBER 24, 2015
Supersedes: 11.85
Date: MAY 13, 2008

1.0 INSTALLATION

The pressure reducing valve should be installed with the flow arrow on the body pointing in the direction of the flow. Install the union fittings, supplied with the valve (model RD-11 and C-11), on the inlet side of the valve body, for quick installation and removal if necessary. A shut-off valve should be installed on the city water side of the pressure reducing valve. If the pressure reducing valve is not equipped with a fast fill feature, a by-pass may be used. A three valve by-pass around the pressure reducing valve will also serve as a fast fill option and is recommended for service.

CAUTION

The use of Teflon tape when installing a valve provides lubricity. Care should be taken to avoid over tightening, which may crack the valve body.

2.0 OPERATION

Models RD-11, RD-40 and RD-50 are preset at 12 psi, and the HRD-70 is preset at 45 psi. Open the cold water fill valve and the system will be filled until the boiler gauge indicates the preset valve pressure has been obtained.

Model RD-11 is preset at 12 psi and is equipped with a fast fill feature. When filling the system as noted above, the fast fill thumbscrew should be manually turned in completely. This overrides the pressure regulating function of the valve. The system should be filled until the boiler gauge indicates the preset pressure of the valve and then the fast fill thumbscrew should be backed off completely until it spins freely.

WARNING

The fast fill thumbscrew must never be left in the down position after the system has been filled. The thumbscrew must be placed in the free position to avoid over pressurization and unnecessary relief valve discharge.

3.0 ADJUSTMENT

Allow system water to cool to ambient temperature. If necessary, adjust valve pressure setting as follows: pressure setting can be raised or lowered by loosening the jam nut and turning the slotted adjusting screw clockwise to increase the set pressure or counter-clockwise to lower the set pressure. This should be done slowly until the boiler pressure gauge indicates the required system pressure. A screw driver should be used to hold the adjusting stem stationary while the jam nut is secured.

4.0 SERVICE

If the pressure reducing valve fails to maintain the set cold fill pressure, the sediment strainer may be clogged. To service the strainer, shut off city water supply and the isolation valve on the discharge of the pressure reducing valve. Remove and clean or replace the strainer and replace the strainer gasket and nut. Open both the city water shut-off valve and the isolation valve to resume normal system operation.

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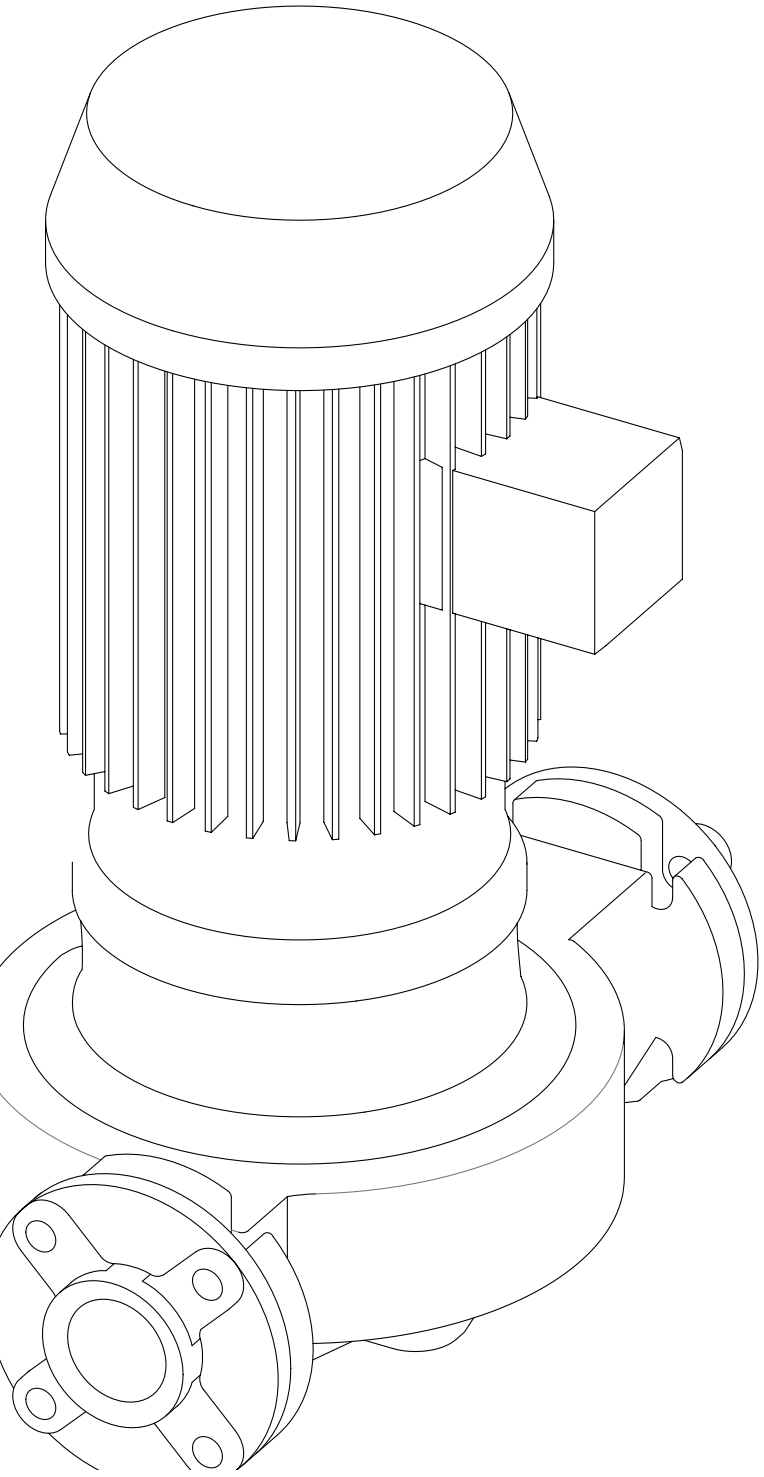
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MAKING ENERGY MAKE SENSE™

ARMSTRONG



Commercial pumps Series 4300, 4360 and 4380

Vertical In-Line pumps

Installation and operating instructions

File No: 43.80
Date: SEPTEMBER 14, 2012
Supersedes: 43.80
Date: SEPTEMBER 15, 2010

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1.3 Noise levels 4
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1.7 Handling large VIL units 5

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2.5 Starting the pump 8
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2.7 Lubrication 9
2.8 System cleanliness 10
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1.0 INTRODUCTION

This document contains specific information regarding the safe installation, operating and maintenance of Vertical In-Line pumps and should be read and understood by installing, operating and maintenance personnel. The equipment supplied has been designed and constructed to be safe and without risk to health and safety when properly installed, operated and maintained. The following instructions must be strictly adhered to. If clarification is needed on any point please contact Armstrong quoting the equipment serial number.

WARNING SYMBOLS


Safety instruction where an electrical hazard is involved.


Safety instruction where non-compliance would affect safety risk.



Safety instruction relating to safe operation of the equipment. (ATTENTION)

1.1 INSTRUCTIONS FOR SAFE USE


No installation of this equipment should take place unless this document has been studied and understood. Handling, transportation and installation of this equipment should only be undertaken by trained personnel with proper use of lifting equipment. See later diagrams for lifting advice. Refer to the pump nameplate for pump speed, pressure and temperature limitations. The limits stated must not be exceeded without written permission from Armstrong.

1.2 TEMPERATURE

Where under normal operating conditions the limit of 68°C/155°F (restricted zone) for normal touch, or 80°C/176°F (unrestricted zone) for unintentional touch, may be experienced, steps should be taken to minimize contact or warn operators/users that normal operating conditions will be exceeded. In certain cases where the temperature of the pumped liquid exceeds the above stated temperature levels, pump casing temperatures may exceed 100°C/212°F and not withstanding pump insulation techniques appropriate measures must be taken to minimize risk for operating personnel.

1.3 NOISE LEVELS

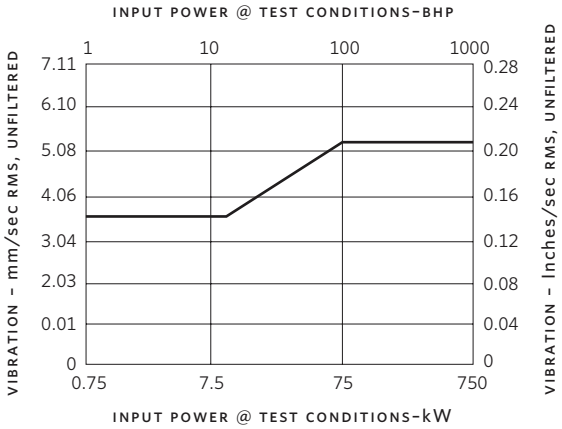
Typical Pumping Unit Sound Pressure Level, Decibels, A-Weighted, at 1 m (3 ft.) from unit.

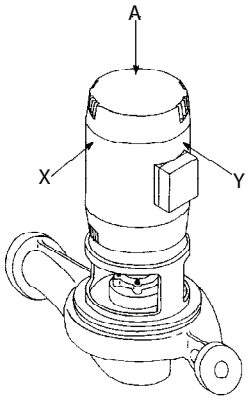
FIG. 1 Noise levels.

	1200 RPM				1800 RPM				3600 RPM			
FRAME DESIGNATION	ODP		TEFC		ODP		TEFC		ODP		TEFC	
	hp	dB-A	hp	dB-A	hp	dB-A	hp	dB-A	hp	dB-A	hp	dB-A
140	0.75 – 1	59	0.75 – 1	58	1 – 3	64	1 – 2	64	1.5 – 3	70	1.5 – 2	79
180	1.5 – 2	61	1.5 – 2	61	3 – 5	66	3 – 5	68	5 – 7.5	74	3 – 5	82
210	3 – 5	66	3 – 5	65	7.5 – 10	70	7.5 – 10	73	10 – 15	76	7.5 – 10	85
250	7.5 – 10	70	7.5 – 10	69	15 – 20	74	15 – 20	78	20 – 25	78	15 – 20	88
280	15 – 20	75	15 – 20	74	25 – 30	74	25 – 30	82	30 – 40	80	25 – 30	89
320	25 – 30	77	25 – 30	77	40 – 50	78	40 – 50	83	50 – 60	83	40 – 50	94
360	40 – 50	80	40 – 50	80	60 – 75	80	60 – 75	89	75 – 100	88	60 – 75	95
400	60 – 75	82	60 – 75	84	100 – 125	83	100	92	125 – 150	92	100	96
440	100 – 125	85	100 – 125	88	150 – 200	87	125 – 150	96	200 – 250	95	125 – 150	98

1.4 VIBRATION LEVELS

Armstrong Vertical In-Line pumps are designed to meet vibration levels set by Hydraulic Institute Standard HI Pump vibration 9.6.4. standard levels are as detailed below:





VERTICAL IN–LINE

1.5 STORAGE

Pumps not immediately placed into service, or removed from service and stored, must be properly prepared to prevent excessive rusting. Pump port protection plates must not be removed until the pump is ready to connect to the piping.

Rotate the shaft periodically (at least monthly) to keep rotating element free and bearings fully functional.

For long term storage (longer than 3 months), the pump must be placed in a vertical position in a dry environment.

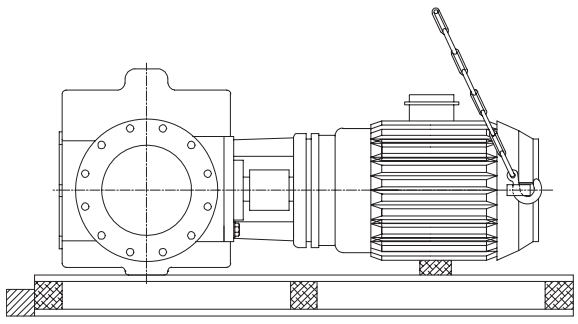
Internal rusting can be prevented by removing the plugs at the top and bottom of the casing and drain or air blow out all water to prevent rust buildup or the possibility of freezing. Be sure to reinstall the plugs when the unit is made operational. Rust-proofing or packing the casing with moisture absorbing material and covering the flanges is acceptable. When returning to service be sure to remove the drying agent from the pump.

1.6 UNCRATING

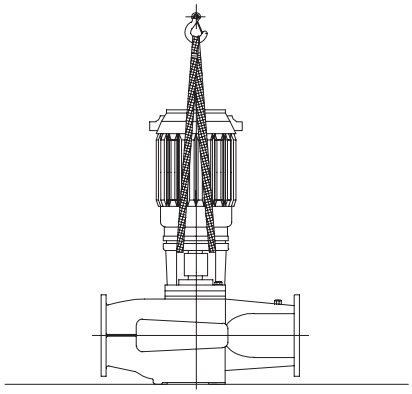
Armstrong Vertical In-Line pumps are thoroughly inspected before shipment to assure they meet with your order requirements. After removing the pump from the crate, make sure the equipment is in good order and that all components are received as called for on the packing list. Any shortages or damage should be reported immediately. Use extreme care in handling the unit, placing slings and hooks carefully so that stress will not be imposed on the pump. **Never place cable slings around the pump shaft.** The eye bolts or lifting lugs on the motor are intended for lifting the motor only and not the complete unit.

1.7 HANDLING LARGE VIL UNITS

One effective way of lifting a large Series 4300 unit from the shipment pallet following uncovering the unit is to place lifting hooks through the motor lifting rings or straps around the upper part of the motor and carefully lift sufficiently to stand the pump vertically. Lift only enough to remove the pallet then lower onto a flat surface. The pump and motor unit will free-stand on the casing ribs. Remove the coupling guard and place (2) lifting straps through the pump/motor pedestal (one on each side of the motor shaft) and secure to the lifting device. With the straps in place, using a spacer bar if necessary to protect the motor fan cover, the whole assembly can now be lifted securely and placed in position in the piping.



Secure pallet and lift pump vertical using motor eye-bolts lift only to clear pallet then sit on the flat surface.



Remove coupling guard and place lifting straps on each side of coupling, use spacer bar if necessary to protect motor fan cover.

IMPORTANT:

Do not run the pump for any length of time under very low flow conditions or with the discharge valve closed. This could cause the water in the casing to reach super heated steam conditions, cause premature failure and cause serious and dramatic damage to the pump and surrounding area.

2.0 INSTALLATION

2.1 LOCATION

In open systems, locate the unit as close as practical to the liquid being pumped, with a short, direct suction pipe. Ensure adequate space is left above and around the unit for operation, maintenance, service and inspection of parts.

In closed systems, where possible, the pumps should be installed immediately downstream of the expansion tank/make-up connection. This is the point of zero pressure change and is necessary for effective pump operation. Do not install more than one expansion tank connection into any closed hydronic system.

Electric motor driven pumps should not be located in damp or dusty locations without special protection.

Airflow into the motor and/or motor fan should not be obstructed.

2.2 INSTALLATION

When installing Vertical In-Line pumps, an important consideration to accrue full added-value from the pump design is to ensure that the pump is pipe-mounted and free to 'float' with any movement, expansion and contraction of the piping. Should any Vertical In-Line pump use supports to the structure it is imperative that no pipe strain is imposed on the pump flanges. Telltale pieces of equipment such as springs or 'waffle' style neoprene isolation pads that distort with pressure to indicate added piping weight, should be used under pump supports should the pump not be truly pipe mounted.

Various installation arrangements are detailed on Pages 6 and 7:

2.2.1
Vertical In-Line pumps may be installed directly in the system piping with no additional support. Pipe hangers are simply sized for the additional weight of the pumping unit. Many pumps are installed in this manner and are mounted at sufficient height to take zero floor space. (Fig. 2.1)

2.2.2
Piping, in many mechanical rooms, is hung close to the ceiling and larger pumps are mounted near ground level for ease of maintenance. Fig 2.2 illustrates such an arrangement with the piping supported at the ceiling and the VIL unit installed with an Armstrong Suction Guide and triple function Flo-Trex valve. Many very large VIL pumps are installed in this manner.

2.2.3
Should additional space saving be required the discharge spool piece and Flo-Trex valve may be replaced by a long-radius elbow and the Flo-Trex valve field converted to a straight-through valve and installed in the vertical discharge pipe. (Fig. 2.3)

2.2.4
Fig 2.4 illustrates a similar arrangement to Fig 2.2 with additional floor mounted pipe-stools isolated from the structure by 'waffle' style neoprene isolation pads under the Armstrong Suction Guide and Flo-Trex valve.

2.2.5
Floor mounted saddle supports (Fig. 2.5) are typical for condenser water pumps where the cooling tower base is near mechanical room elevation.

2.2.6
Where required, additional floor support may be used as shown in Fig. 2.6. Note that the pump should not be rigidly attached to the column. Leave a small gap between pump and column or install a 'waffle' isolation pad under the pump. It is critical that piping be installed in such a manner that the pump does not become a pipe support.

2.2.7
Fig. 2.7 illustrates stanchion plates at the pump inlet and outlet ports that may be supplied for installation convenience. Isolation pads must be used under the legs and monitored as pipe hangers are adjusted to ensure the pump flanges are not supporting the piping. Bolting to the floor or housekeeping pad is not recommended. If the stanchions are bolted down the bolts must be isolated from the stanchion or an inertia base and flexible pipe connectors should be used.

2.2.8
Fig. 2.8 illustrates installations with stanchion plates for seismically active regions. Seismically rated isolation pads or snubbers with bolts isolated from the stanchion plates are installed to restrain the pump during a seismic event. Pipe hangers carry the weight of the equipment as seismic components are designed only to restrain the equipment during a seismic event.

2.2.9
Close coupled in-line units (Series 4360 & 4380) up to 15 hp / 11 kW may be installed with the shaft horizontal. (Fig. 2.9) For horizontal mounting of large units or Series 4300 Split-Coupled style consult the factory. (Fig. 2.9)

2.2.10
Many Vertical In-Line pumps are piped successfully into grooved piping systems. In-line pumps are supported well by grooved piping however flange adapter locking devices or a welded flange at the pump should be used to prevent the possibility of pipe mounted pumps rotating in the piping. Armstrong offers grooved suction guides with cast-in outlet flanges and triple function Flo-Trex valves with inherent locking devices to prevent this possibility. (Fig. 2.10)

2.2.11
Do not support the unit by the motor eye bolts (Fig. 2.11) or by any other part of the motor.

2.2.12
Connecting the pump to a permanent rigid base (Fig. 2.12). is not recommended unless isolated from the piping by flexible connectors and the base isolated from the building structure on an inertia base. (Fig. 2.12 is generally acceptable when using plastic piping).

IMPORTANT:

All Series 4300 pumps contain a tapped hole in the motor bracket above the discharge flange (see Fig. 2.13) for draining the well. Pipe this drain hole to a floor drain to avoid overflow of the cavity caused by collecting chilled water condensate or from seal failure.

2.3 PUMP PIPING – GENERAL

Never connect a pump to piping, unless extra care is taken to measure and align the piping flanges well. Always start piping from pump.

Use as few bends as possible and preferably long radius elbows.

Do not use flexible connectors on the suction or discharge of a Vertical In-Line pump, unless the pump is rigidly mounted to a foundation.

Ensure piping exerts no strain on pump as this could distort the casing causing breakage or early failure due to pump misalignment.

All conecting pipe flanges must be square to the pipework and parallel to the pump flanges.

Suction and discharge pipes may be increased or decreased at pump nozzle to suit pump capacity and particular conditions of installation. Use eccentric reducers on suction connection with flat side uppermost.

Layout the suction line with a continual rise towards the pump without high points, thus eliminating possibility of air pockets that may prevent the pump from operating effectively.

A strainer of three or four times the area of the suction pipe, installed in the suction line, will prevent the entrance of foreign materials into the pump. $^{3}/_{16}$" (5 mm) diameter perforations in the strainer is typical.

In open systems, test suction line for air leaks before starting; this becomes essential with long suction line or static lift. Install, at the pump suction, a straight pipe of a length equivalent to 4 or 6 times its diameter; this becomes essential when handling liquids above 120°F (49°C). Armstrong suction guides may be used in place of the straight pipe run and in-line strainer.

Install an isolation valve in both suction and discharge lines on flooded suction application; these valves are used primarily to isolate the pump for inspection or repair.

Install a non-slam non-return check valve in discharge line between pump and isolation valve to protect pump from excessive back pressure and to prevent water running back through the pump in case of driver failure on open systems. An Armstrong Flo-Trex valve may be used in place of non-return check valve and isolation valve on pump discharge.

CAUTION:

A Only the discharge valve is to be used to throttle pump flow, not the suction valve. Care must be taken in the suction line layout and installation, as it is usually the major source of concern in centrifugal pump applications.

2.4 ALIGNMENT

Alignment is unnecessary on close-coupled pumps, Series 4360 & 4380, as there is no shaft coupling.

Series 4300 units are accurately aligned at the factory prior to being shipped and do not need re-aligning when installed.

Alignment on a Series 4300 unit may be verified by assuring an equal and parallel gap between coupling halves on both sides of the coupling.

OPERATION

2.5 STARTING THE PUMP

Ensure that the pump turns freely by hand, or with some gentle mechanical help such as a strap or Allen key in coupling bolt.

Ensure that all protective guarding is securely fixed in position.

The pump must be fully primed on start up. Fill the pump casing with liquid and rotate the shaft by hand to remove any air trapped in the impeller. On Series 4300 any air trapped in the casing as the system is filled must be removed by the manual air vent in the seal flush line. **Ensure entrained air is removed from series 4300 pumps, prior to starting, through the air vent on the seal flush line. Open vent until clear of air.** Series 4360 & 4380 units are fitted with seal flush/vent lines piped to the pump suction area. When these units operate residual air is drawn out of the pump towards the suction piping.

'Bump' or energize the motor momentarily and check that the rotation corresponds with the directional arrow on the pump casing.

To reverse rotation of a three phase motor, interchange any two power leads.

Start the pump with the discharge valve closed and the suction valve open, then gradually open the discharge valve when the motor is at operating speed. The discharge valve may be open slightly at start up to help eliminate trapped air.

When stopping the pump: Close the discharge valve and de-energize the motor.

Do not run the pump against a closed discharge valve for an extended period of time (a few minutes maximum).

Star-Delta motor starters should be fitted with electronic/mechanical interocks that have a timed period of no more than 40 miliseconds before switching from star (starting) to delta (run) connection yet allow the motor to reach full star (starting) speed before switching to delta (run).

Should the pump be noisy or vibrate on start-up a common reason is overstated system head. Check this by calculating the pump operating head by deducting the suction pressure gauge value from the discharge gauge reading. Convert the result into the units of the pump head as stated on the pump nameplate and compare the values. Should the actual pump operating head be significantly less than the nameplate head value it is typically permissable to throttle the discharge isolation valve until the actual operating head is equal to the nameplate value. Any noise or vibration usually disappears. The system designer or operator should be made aware of this as some adjustment may be required to the pump impeller diameter or drive settings, if applicable, to make the pump suitable for the system as installed.

CAUTION:



Check rotation arrow prior to operating the unit. The rotation of all Armstrong Vertical In-Line units is clockwise when viewed from the drive end. (Looking from on top of/behind the motor).

2.6 GENERAL CARE

Vertical In-Line pumps are built to operate without periodic maintenance, other than motor lubrication on larger units. A systematic inspection made at regular intervals, will ensure years of trouble-free operation, giving special attention to the following:

- Keep unit clean.
- Provide the motor with correctly sized overload protection.
- Keep moisture, refuse, dust or other loose particles away from the pump and ventilating openings of the motor.
- Avoid operating the unit in overheated surroundings (above 100°F/40°C).

WARNING:



Whenever any service work is to be performed on a pumping unit, disconnect the power source from the driver, **lock it off** and tag with the reason. Any possibility of the unit starting while being serviced must be eliminated.

- If mechanical seal environmental accessories are installed, ensure water is flowing through the sight flow indicator and that filter cartridges are replaced as recommended. (See Armstrong files 43.85 & 43.86 for seal environmental instructions).

2.7 LUBRICATION

Pump
Lubrication is not required. There are no bearings in the pump that need external lubrication service.

Large Series 4300 units are installed with a shaft bushing located beneath the impeller that is lubricated from the pump discharge. This bearing is field removable for service on the 20 × 20 × 19 size without disturbing the motor or other major pump components.

Service instructions for the lower bearing is to be found in File no: 43.805.

Motor
Follow the lubrication procedures recommended by the motor manufacturer. Many small and medium sized motors are permanently lubricated and need no added lubrication. Generally if there are grease fittings evident the motor needs periodic lubrication. None if not.

Check the lubrication instructions supplied with the motor for the particular frame size indicated on the motor nameplate.

Mechanical Seal
Mechanical seals require no special attention. The mechanical seal is fitted with a flush line. The seal is flushed from discharge of the pump casing on Series 4300 pumps and is flushed/vented to the suction on close coupled pumps, Series 4360 & 4380.

The Series 4300 pump is flushed from the pump discharge because the mechanical seal chamber is isolated from the liquid in the pump by a throttle bushing. Because the seal chamber is isolated, seal environmental controls such as filters and separators, when installed in the Series 4300 flush line are very effective, as only the seal chamber needs cleansing, and will prolong seal life in HVAC systems.

Do not run the pump unless properly filled with water as the mechanical seals need a film of liquid between the faces for proper operation.

Mechanical seals may 'weep' slightly at start-up. Allow the pump to continue operating for several hours and the mechanical seal to 'seat' properly prior to calling for service personnel.

The following Armstrong files are available for mechanical seal replacement instructions:

- Series 4360 & 4380: File no. 43.81
- Series 4300: P-Base and TCZ Motor Frame – File no. 43.84
  TC Motor Frame – File no. 43.88

2.8 SYSTEM CLEANLINESS

Before starting the pump the system must be thoroughly cleaned, flushed and drained and replenished with clean liquid.

Welding slag and other foreign materials, Stop Leak and cleaning compounds and improper or excessive water treatment are all detrimental to the pump internals and sealing arrangement.

Proper operation cannot be guaranteed if the above conditions are not adhered to.

NOTE:
Particular care must be taken to check the following before the pump is put into operation:

- **A** Pump primed?
- **B** Rotation OK?
- **C** Lubrication OK?
- **D** Pipe work properly supported?
- **E** Voltage supply OK?
- **F** Overload protection OK?
- **G** Is the system clean?
- **H** Is the area around the pump clean?

WARRANTY
Does not cover any damages to the equipment resulting from failure to observe the above precautions. Refer to Armstrong General Terms and Warranty sheet. Contact your local Armstrong representative for full information.

2.9 INSTALLATION LAYOUTS

FIG. 2.1 Hanger supported pipe mounted.

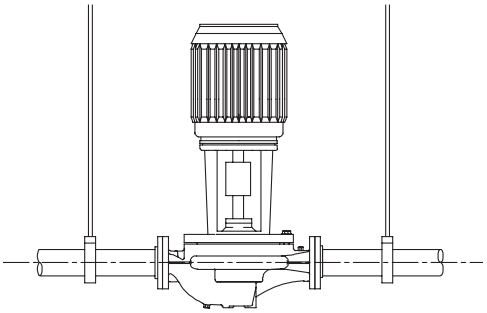


FIG. 2.2 Pipe mounted supported at ceiling.

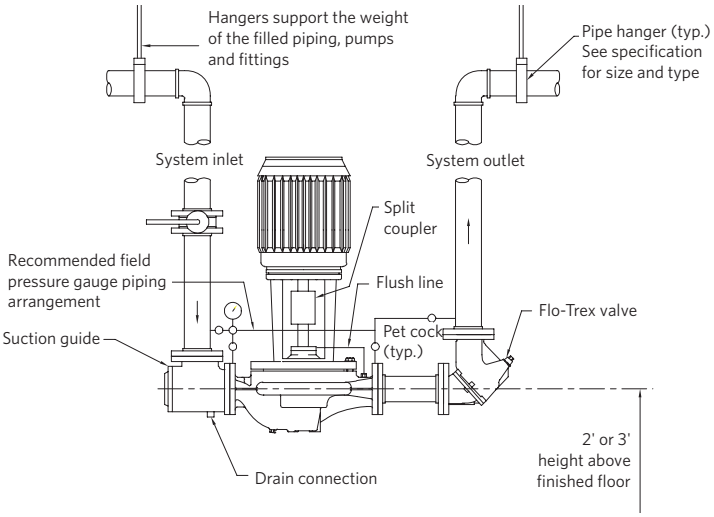


FIG. 2.3 Discharge elbow for minimum footprint.

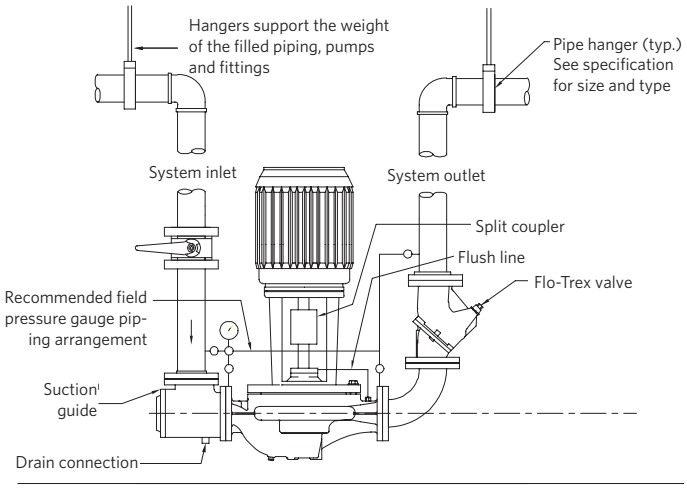


FIG. 2.4 With additional pipe supports.

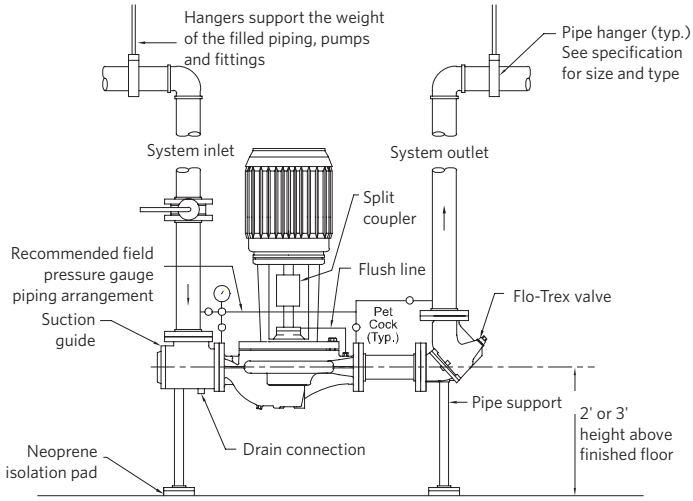


FIG. 2.5 Floor saddle support.

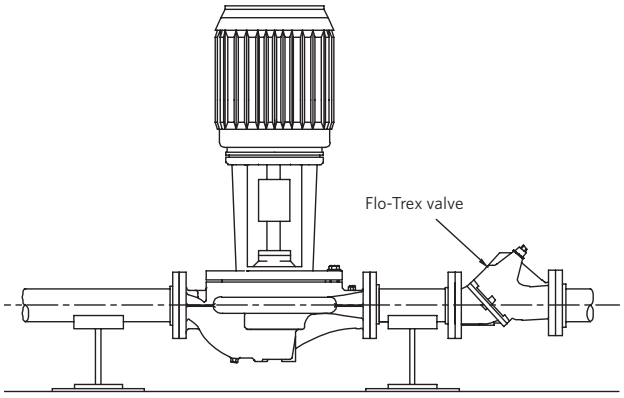


FIG. 2.6 Additional floor support.

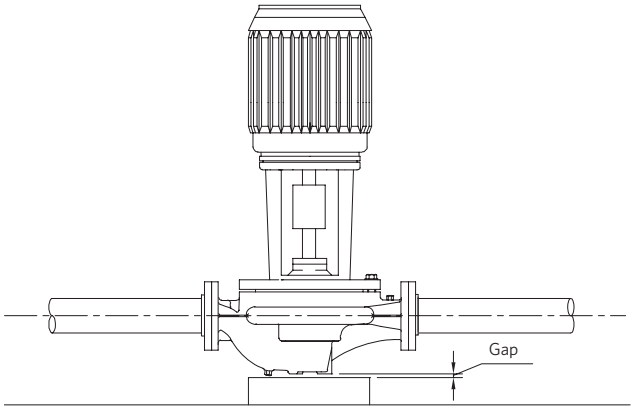


FIG. 2.7 With stanchion plates.

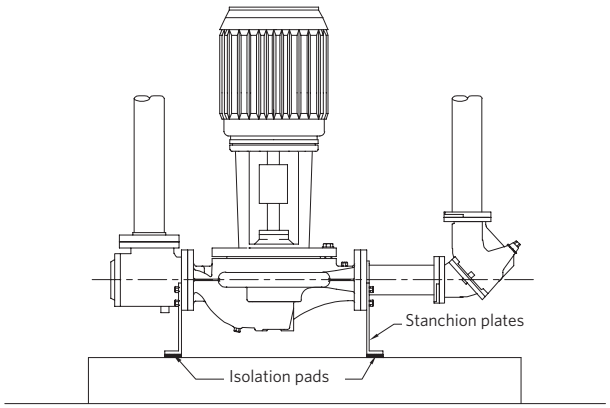


FIG. 2.8 Seismic region installation.

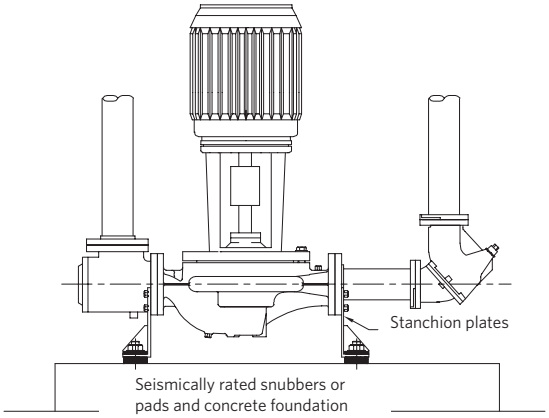


FIG. 2.9 Horizontal mounting – 4360/4380 only to 15 hp (11 kW).

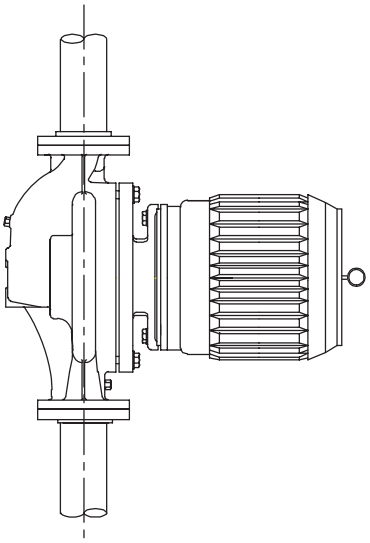


FIG. 2.10 Mounting in grooved pipe systems.

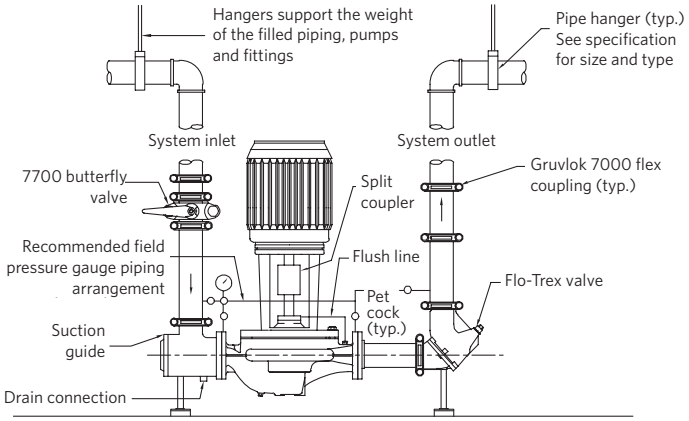


FIG. 2.11 Motor lifting hook supported.

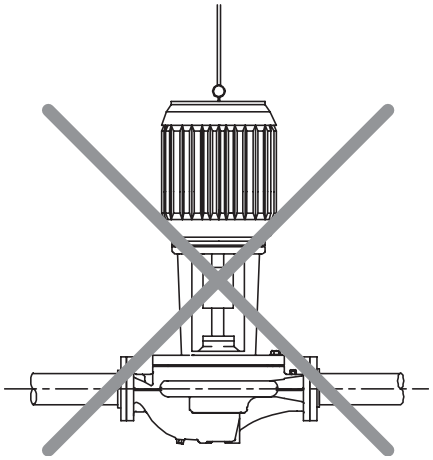


FIG. 2.12 Mounted on rigid base without flexible connectors.

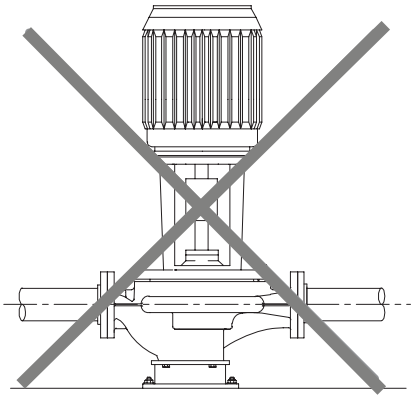
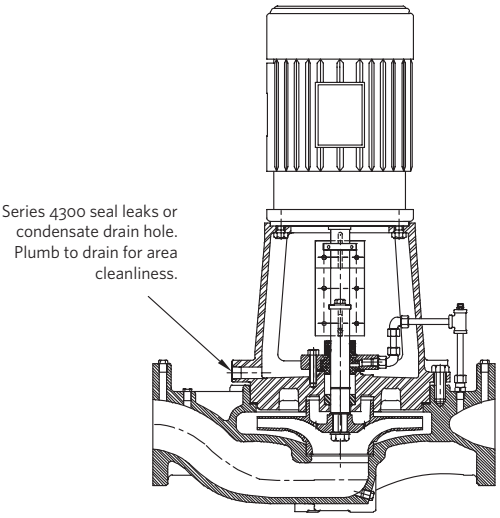


FIG. 2.13 Tapped collection well.



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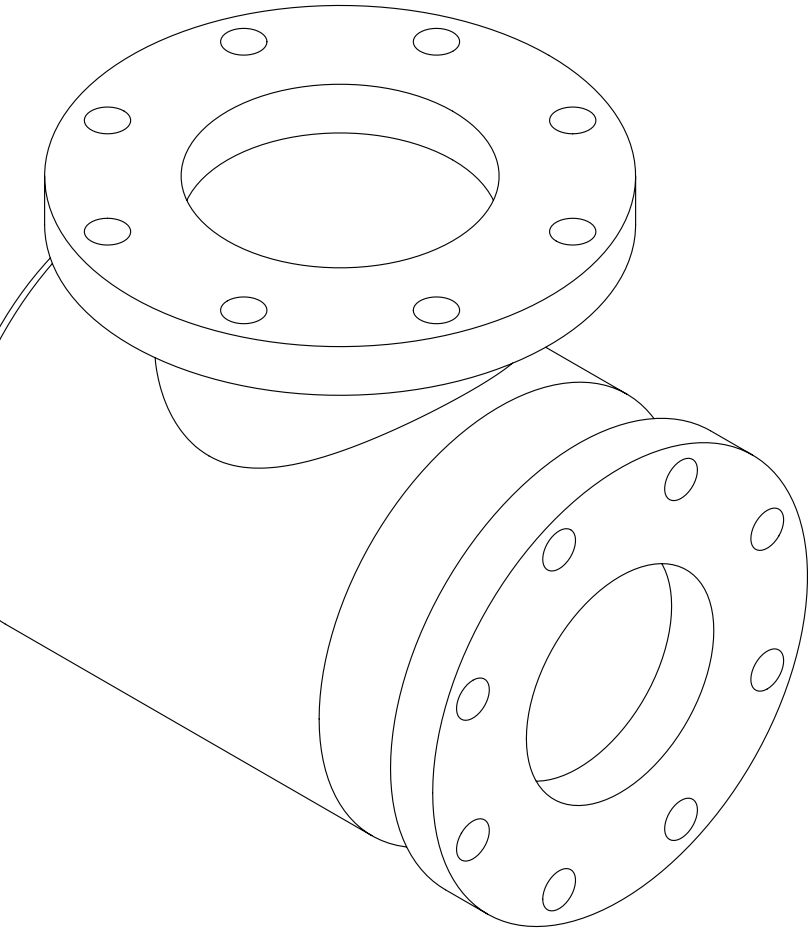
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Suction Guides

Installation and operating instructions

File No: 35.82
Date: OCTOBER 03, 2013
Supersedes: 35.82
Date: AUGUST 16, 2013

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2.0	Operating limits	4
3.0	Inspection	4
4.0	Installation	4
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1.0 INTRODUCTION

Armstrong Suction Guides are designed for bolting directly onto the suction flange of horizontal or vertical shaft centrifugal pumps.

2.0 OPERATING LIMITS

Armstrong Suction Guides are designed in five series:

SERIES DESIGNATION	INLET CONNECTION	PUMP CONNECTION
SG	ANSI 125 / PN16 flange	ANSI 125 / PN16 flange
SG–TF	NPTF / BSPT	ANSI 125 / PN16 flange
SGG	GROOVED*	ANSI 125 / PN16 flange
SGHH	ANSI 250 / PN25 flange	ANSI 250 / PN25 flange
SGH–TF	NPTF / BSPT	ANSI 250 / PN25 flange

*Suitable for straight cut grooved anvil or victaulic fittings.

Each series is designed to be a four-function fitting. Each Suction Guide is a 90º elbow, a pipe strainer and a flow stabilizer. It may also be used as a reducing elbow, should the suction piping be larger than the pump inlet.

3.0 INSPECTION

Armstrong Suction Guides are thoroughly tested and inspected before shipment to assure they meet with your order requirements. All units must be carefully examined upon arrival for possible damage during transit. Any evidence of mishandling should be reported immediately to the carrier and noted on the freight bill.

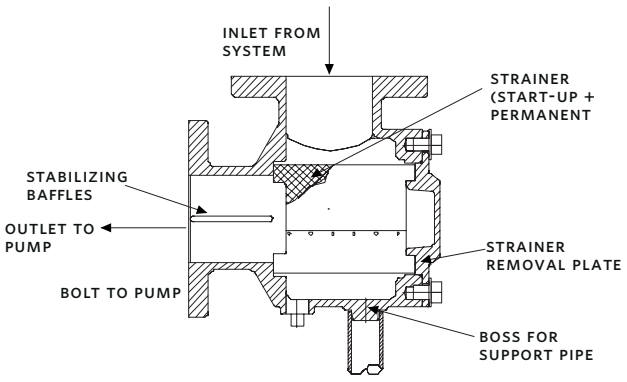


FIG. 1 Armstrong Suction Guide

4.0 INSTALLATION

Install the Suction Guide with the directional arrow, indicated on the body, being aligned with the system flow direction.

Armstrong Suction Guides may be installed in any position, providing the guide vanes are facing the pump inlet flange.

Centrifugal pumps need a minimum of 5 pipe diameters of straight pipe before the pump suction. This length of straight pipe, after the last elbow, tee or fitting, helps to ensure that the flow is stable when entering the pump suction.

Crosspiece guide vanes are fitted into the Armstrong Suction Guide outlet, where it bolts to the pump flange, to stabilize the flow and eliminate the need of long straight suction pipe.

Space must be allowed to remove the end cover and remove the strainer.

A blow–down valve may be installed on the Suction Guide drain connection. Should the Suction Guide be installed with the inlet port facing vertically down: The inlet piping configuration should include a blow–down valve at the lowest point on the down-pipe to exhaust any debris that may fall from the Suction Guide strainer.

The Suction Guide must not be used to support the suction piping. Piping must be supported independently.

On base mounted pumps, a flexible piping connections may allow the Suction Guide to be supported by the pump suction flange. A boss is cast on every SG allowing a supporting pipe-stool to be located under the fitting, thereby removing the weight of the Suction Guide from the pump suction flange.

Suction Guides are supplied with an inlet tapped gauge connection. Monitoring the differential pressure across the fitting, from the suction guide inlet gauge to the pump inlet gauge, will alert the operator should the strainer need to be removed and cleaned.

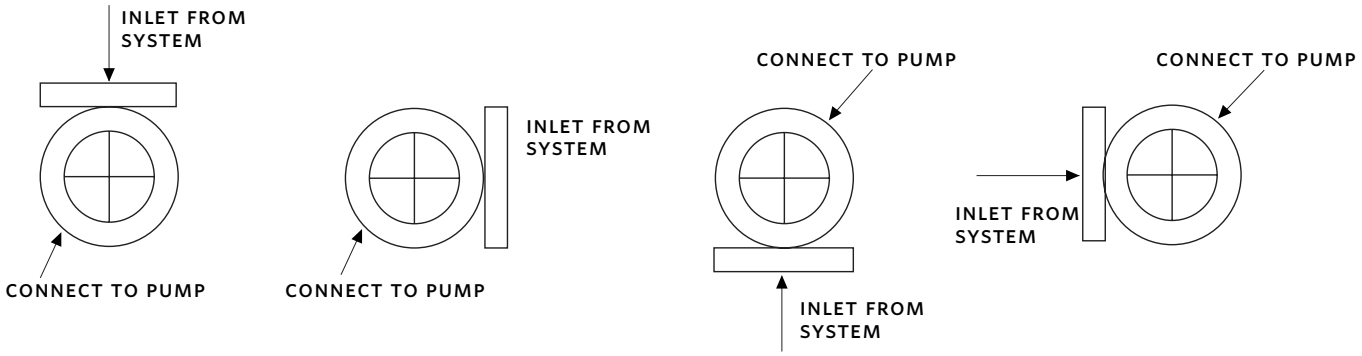


FIG. 2 Armstrong Suction Guide may be installed in any arrangement feasible by pump flange boltholes arrangement.

5.0 OPERATION

No special attention need be paid to the Suction Guide at start-up. The fitting is stationary and will strain the pumped fluid and stabilize the flow into the pump automatically.

Temporary strainer must be removed following system clean up.

After all debris has been removed from the system, or a maximum of 24 running hours, stop the pump and close the pump isolation valves. Drain the Suction Guide by removing the drain plug or opening the blowdown valve, if installed. Remove the Suction Guide cover and remove the strainer assembly from the valve body.

A temporary fine-mesh start-up strainer is tack-welded to the permanent stainless steel strainer. This temporary strainer should now be removed from the permanent strainer. The fine-mesh strainer is designed to remove small particulate from new piping systems and could easily clog with debris if left in place. This will be detrimental to the operation of the pump.

Replace the permanent strainer into the fitting body, once the temporary strainer is removed.

Inspect the cover O-ring and replace if necessary. Replace the cover into the body. Ensuring that the strainer is properly seated, tighten the cover bolts diagonally, evenly and firmly.

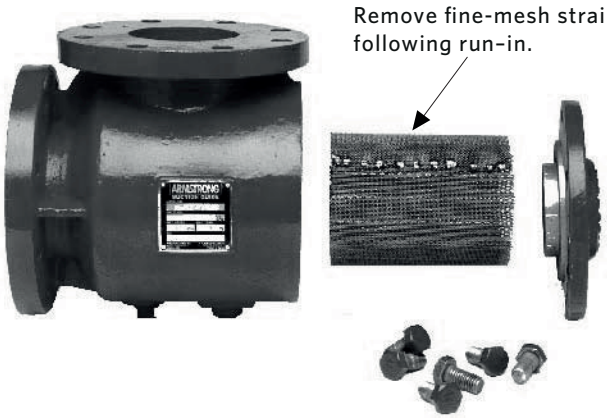


FIG. 3 Remove fine-mesh strainer

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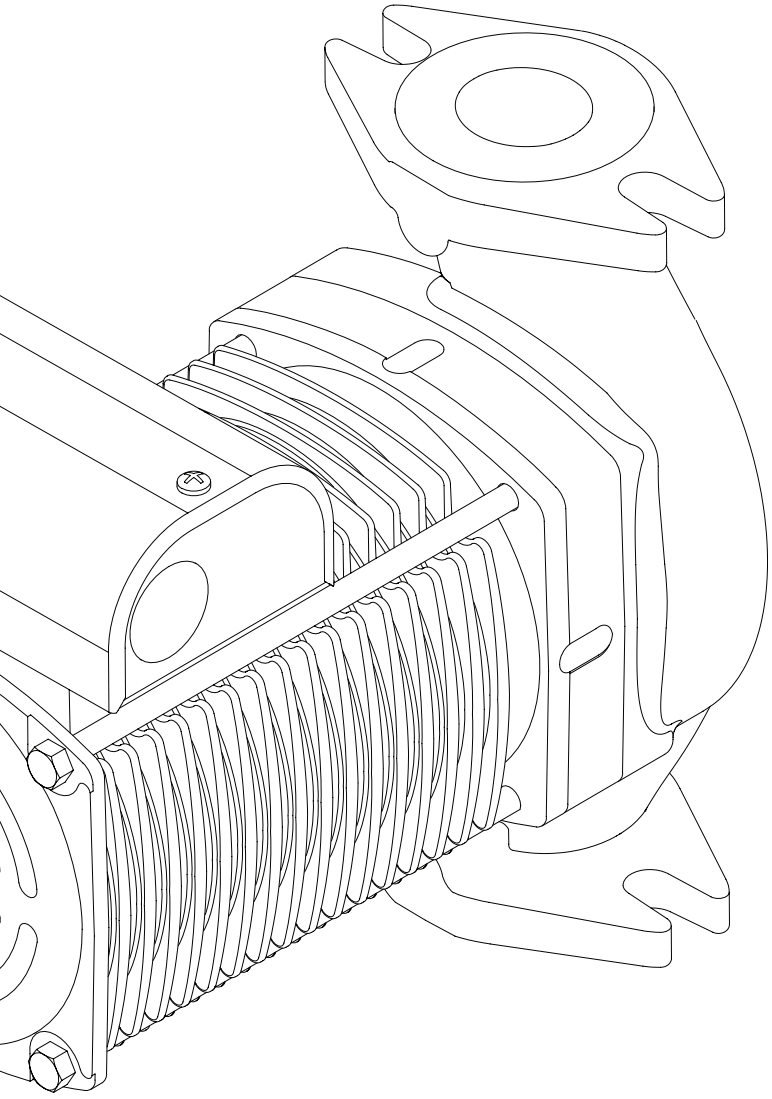
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E.2 Series

High efficiency circulator

Installation and operating instructions

File No: 10.84
Date: JULY 01, 2016
Supersedes: 10.84
Date: JUNE 08, 2016

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6.0 Mechanical seal replacement 6

7.0 E.2 product family specifications 8

READ CAREFULLY BEFORE INSTALLING & OPERATING THE CIRCULATOR

INSTALLER: PLEASE LEAVE THIS MANUAL FOR THE OWNER'S USE

You are about to install an E.2 series circulator – a high-efficiency pump from Armstrong. E.2 series circulators are designed for heating and cooling in hydronic, geothermal or solar systems and circulating water, ethylene or propylene glycol/water solutions. For pumping domestic (potable) water, Armstrong recommends the use of circulators with bronze, or stainless steel body construction.

The E.2 series circulators are extremely efficient and quiet. They utilize a state of the art permanently lubricated bearing system designed for many years of trouble-free operation. They feature a permanent-split capacitor motor with thermal protection.

1.0 OPERATING LIMITS

Maximum operating pressure:
150 psi (1034 kPa)

Maximum operating temperature:
All standard models 230°F (110°C)

Minimum operating temperature:
All standard models 32°F (0°C)

Electrical rating:
For models with ⅙ hp motors (100W): 120 V, 1 phase, 60 Hz or 208/240 V, 1 phase, 60 Hz, or 220-240v, 50Hz

For models with ⅔ hp motors (300W): 120 V, 1 phase, 60 Hz or 208/240/277 V, 1 phase, 60 Hz, or 220-240v, 50Hz

When unpacking the circulator, inspect for any damage that may have occurred during transit. Check for loose, missing or damaged parts.

THIS PUMP IS FOR INDOOR USE ONLY

Before installing the circulator, proper installation practice recommends a thorough flush of the hydronic system, ensuring removal of all foreign materials.

This pump should be installed in a well lit location with good access.

Installation personnel must be qualified for the task.

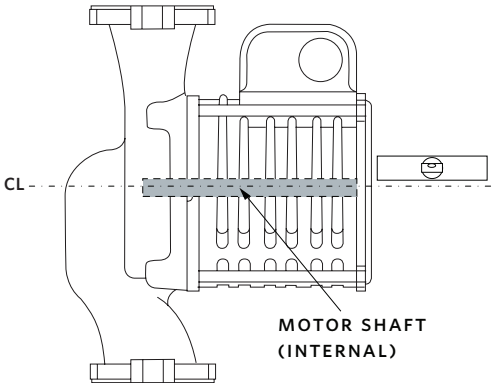
All personnel performing installation must wear appropriate personal protective equipment

WARNING

Mount with motor shaft horizontal and terminal box above centerline (CL) only!

The circulator is supplied for up-discharge.

DIAGRAM 1: Installation Orientation



For alternate discharge orientation:

1. Loosen the four motor mounting bolts
2. Rotate the volute to match piping orientation
3. Observe flow direction arrow on volute
4. Ensure volute gasket is properly seated
5. Retighten mounting bolts evenly to 5 lb/ft (6.7 N/m)
6. Ensure the impeller spins freely

2.0 ELECTRICAL WIRING

The electrical wiring must be installed in strict accordance with the Canadian Electrical Code (Canada) or the U.S. National Electrical Code (USA),or BS7671 (Europe) as well as local codes and regulations.

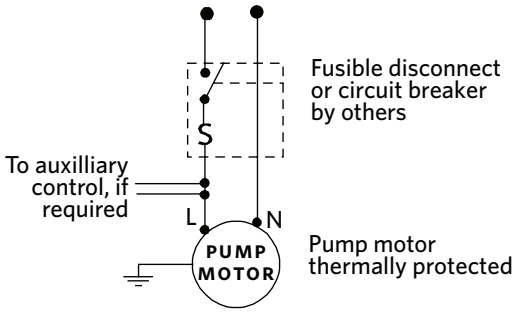
1. Electrical installation should be conducted by a qualified electrician. Installers should be equipped with proper personal protective equipment.
2. The motors of E.2 series circulators are designed for 1 phase, 60 Hz, 120 V 60 Hz, 240 V 60 Hz, 220-240 50 Hz service only. (Please refer to the rating label on the circulator's terminal box to determine the correct voltage.)
3. Always make sure the electric power is disconnected and locked out before wiring the circulator.
4. To wire, loosen the screw from the terminal box cover and remove the screw and cover.
5. Install the appropriate size conduit end to one of the holes on either side of the terminal box.

6 For 120 V models: Referring to **DIAGRAM 2** below, connect the black, hot, (L) and white, neutral, (N) leads of the supply wire to the black and white motor leads respectively inside the terminal box. Connect the ground wire to any one of the four green ground screws inside of the terminal box (use a minimum 18 AWG wire size).

For 208/240/277 V models: Referring to **DIAGRAM 3** below, connect the black (L1) and blue (L2) leads of the supply wire to the black and white motor leads respectively inside the terminal box. Connect the ground wire to any one of the four green ground screws inside of the terminal box (use a minimum 18 AWG wire size).

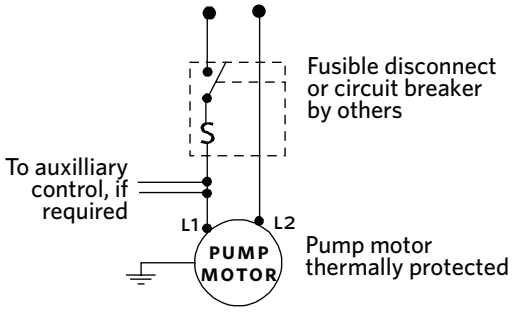
NOTE: For any voltage the brown and yellow wires are hard wired in and should **not** be touched they are for the capacitor only and can stop the motor from running.

DIAGRAM 2 120 V installations



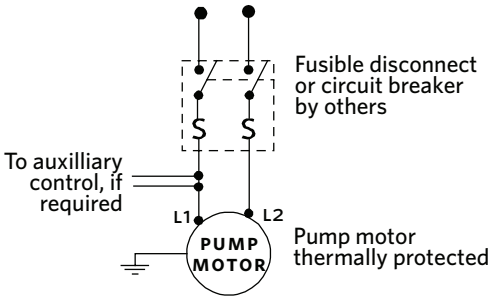
Typical wiring diagram for single phase, 120 V, 60 Hz power source

DIAGRAM 3 208/240/277 V installations



Typical wiring diagram for
A single phase, 240 V, 60 Hz power source
B three phase, 208/277 V, 60 Hz power source

DIAGRAM 4 230 V installations



Typical wiring diagram for single phase, 230 V, 50 Hz power source

7 Replace the terminal box cover.

The motor is thermally protected for your safety so thermal overload protection is not necessary. All that is required is a fused plug or circuit breaker in the power line for short circuit protection.

Electrical information can be found on the nameplate of the motor.

3.0 START UP

1 Before starting up the circulator, proper installation practice recommends a thorough flush and draining of the hydronic system, ensuring removal of all foreign materials. Fill the system with clean water or glycol solution before starting.

2 Air must be completely vented from the system before starting up the circulator. **If the system is not completely vented of air and the circulator is allowed to run dry, the mechanical seal will be damaged.**

3 When the system has been completely filled and vented, only then can the pump be started.

4.0 PREVENTIVE MAINTENANCE – INSPECTION

E.2 series circulators are fitted with permanently lubricated ball bearings and **do not** require lubrication.

Although Armstrong long-life circulators are designed to provide years of worry-free service, it is good maintenance practice to inspect the entire hydronic system periodically – including the E.2 series circulator – for potential problems. If there is any evidence of leakage or damage, repair or replace the pump.

Disconnect and lockout the power before servicing.

5.0 PUMP REPLACEMENT IN AN EXISTING INSTALLATION

5.1 COMPLETE PUMP

1 Ensure that electric power is disconnected and locked out. Loosen the screw from the terminal box cover and remove the cover. Disconnect the supply wires from the circulator only, leaving the capacitor wires connected.



All servicing personnel should be equipped with proper personal protective equipment.

2 If valves have been installed, on the suction and discharge sides of the pump, close them before attempting to remove the circulator from the volute. If no valves have been installed it may be necessary to drain the system.



Allow water to cool to 100°F (40°C) before draining the system. It is best to leave the drain valve open while working on the system.

3 To relieve any residual pressure which may be present in the pump body, loosen the flange bolts and gently move the pump body back and forth to allow the pressurized water to escape.

NOTE: Place a pan under the pump to collect the drain water.

4 If the entire volute is needed to be removed, then remove the flange bolts and nuts. The entire circulator can then be removed from the piping system.

5 Install the E.2 series circulator where there will be sufficient room for inspection and service. It is recommended that isolation valves be installed on both the suction and discharge sides of the circulator for future servicing. This eliminates the need for draining the system when working on the circulator (for example, when replacing the mechanical seal).

6 Install suction and discharge flanges on the pipe ends. The use of Teflon tape sealer or a high quality thread sealant is recommended.

7 Pipe strain can be minimized by the use of pipe hangers near the pump, positioned to support the suction and discharge piping.

To wire the E.2 series circulator, follow steps C through G in the Electrical Wiring section above, noting that electrical supply and grounding wires must be rated for at least 194°F (90°C).

5.2 MOTOR END ONLY

1 Turn off the pump leaving it installed in the line .

2 Ensure electrical power is disconnected and locked out .

3 Close the water supply at the points closest to the pump's inlet and outlet .

4 For safety, allow water to cool to 100°F (40°C) before draining the system. It is best to leave the drain valve open while working on the system.

5 Bleed the water pressure from the pump.

6 Place a pan under the pump to collect the drain water.

7 While holding the motor body, loosen the four bolts that attach the motor to the pump casing (volute). Start with the two bottom bolts first and remove them, then slowly loosen the top two bolts. Allow the water to drain from the bottom of the pump. When the water has finished draining, remove the two top bolts. Remove the motor straight out from the volute being careful of its attached impeller. The motor is heavy, do not drop it.

8 Install new casing gasket .

9 Install new motor end (with impeller and seal kit).

10 Tighten four motor end bolts in a crisscross pattern and tighten evenly to 60 in/lbs.

11 Open isolation flanges or fill the system with water before starting circulator.

12 To wire the E.2 series circulator, follow steps C through G in the Electrical Wiring section above, noting that electrical supply and grounding wires must be rated for at least 194°F (90°C).

6.0 MECHANICAL SEAL REPLACEMENT

1 Follow steps 1 through 4 in section **Existing pump removal from system piping.**

2 While holding the motor body, remove the bottom two bolts that attach the motor to the pump casing (volute), then slowly loosen the top two bolts. Allow the water to drain from the bottom of the pump. When the water has finished draining, remove the two top bolts. Remove the motor straight out from the volute being careful of the attached impeller.



Handle with care
The motor is heavy, and possibly hot,
DO NOT drop it!

3 While holding the rotor very tightly by hand or a gloved hand only, unscrew the impeller nut off the motor shaft by turning it clockwise (i.e. opposite to most bolts and nuts). Place the motor on its back, with the shaft up.

4 Remove the rotary part of the mechanical seal by gently pulling it off the shaft. If it is too tight use two small flat bladed screwdrivers to gently pry it off the shaft by placing the flat side of the blades onto opposite sides of the mechanical seal.

5 Remove the face plate from the motor by gently prying it off of the motor housing extension, and carefully pulling it straight up, avoiding any shaft contact.

6 Remove the stationary part of the seal by gently prying it off the steel faceplate.

7 Remove any corrosion present on the stainless steel motor shaft and face plate (especially the seal seat area) with a non-metallic brush or scrub pad. Do not use a wire brush or steel wool.

8 Remove any dust created during step #7 above and put a few drops of non-petroleum lubricant around the face plate where the stationary seat is to be installed.

9 Install the new stationary seal seat into the faceplate by firmly pressing it down until it bottoms. The disk should be clean. If needed, wipe it with alcohol and a soft lint free cloth.

10 Replace the faceplate on the motor housing extension, being careful to avoid shaft contact. This may need to be gently tapped down until tight to the housing. Be sure to check that the stainless steel plate is flush to the extender plate face.

11 Install the special **installation tool** (item #180212-095) on the top of the shaft making sure it is tight to the flat base of the impeller to protect the seal from sharp edges during seal installation.

12 Apply a liberal amount of non-petroleum based lubricant on the outside of the special plastic **installation tool.**

13 Wipe any excess lubricant off of the stationary silicon carbide seal face with a lint free cloth and alcohol to ensure the surface is clean.

14 Install the new rotating seal element and spring assembly by gently pushing it (graphite ring first) over the **installation tool** and onto the shaft until the graphite ring presses tightly against the stationary seal seat. The seal spring may be compressed slightly.

15 Remove the **installation tool** from the shaft.

16 Install the impeller keeping the inlet end up. Make sure to align the flats to the shaft flats and push the impeller down tightly to the seal.

17 Place 2-3 drops of medium strength thread locker liquid on the nut threads.

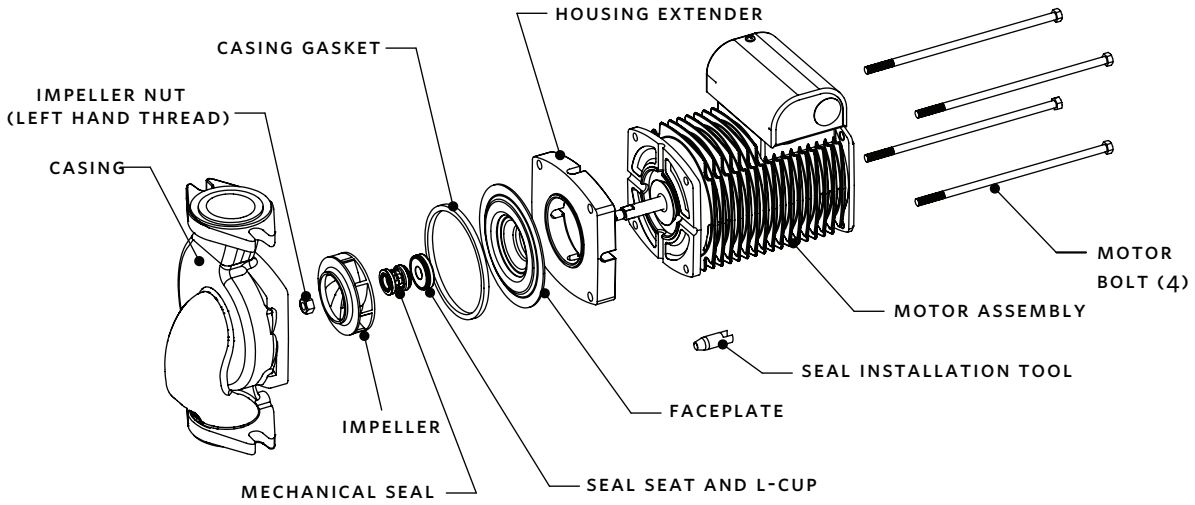
18 Install the special left hand thread nut on the motor shaft. While holding the motor rotor in place as in step 3, thread the impeller nut on to the shaft in a counter-clockwise direction and tighten the nut to approximately 6ft-lbs (8.1Nm).

19 If the impeller will not spin freely contact Armstrong Technical Support at 1-416-755-2291 or email techsupport@armlink.com.

20 Ensure the gasket is properly seated in the pump casing (volute) gasket groove. Holding the motor body, insert the impeller straight into the volute. Verify the gasket was not dislodged during insertion, and is still seated properly. Hold the motor body steady while fastening the four bolts that attach the motor to the pump casing (volute). Tighten evenly and diagonally. There should be a small, even gap of about 0.02" (0.5 mm) between the motor flange and the pump casing (volute).

21 Follow the **START UP** instructions (File no. 10.84) and check for leaks.

DIAGRAM 5 Internal Assembly (Exploded view)



7.0 PRODUCT FAMILY SPECIFICATION

50 HZ E.2 SERIES MODELS

Hydraulic data

MODEL	E7.2/ E7.2B	E9.2/ E9.2B	E12.2/ E12.2B	E14.2/ E14.2B	E22.2/ E22.2B	E33.2/ E33.2B
Nominal Hydr. Power (watts)	105	105	252	252	252	252
Max Flow (L/sec.)	1.9	1.8	2.7	2.8	4.9	7.9
Max Head (m)	5.3	7.7	10.6	11.4	8.7	6.3
Max. Efficiency (BEP%)	22.5	26.4	31.2	32.4	40.7	42.1
Max. Fluid Temperature	110°C (All models)					
Max. Ambient Temperature	50°C (All models)					
Max. Working Pressure	1034 kPa (All models)					

Electrical (motor) data

MODEL	E7.2/E7.2B	E9.2/E9.2B	E12.2/E12.2B	E14.2/E14.2B	E22.2/E22.2B	E33.2/E33.2B
Nominal input voltage range @50 Hz.	220–240VAC	220–240VAC	220–240VAC	220–240VAC	220–240VAC	220–240VAC
Full load current draw @50 Hz.(AC Amperes)	0.80	0.90	1.7	1.8	2.3	2.3
Speed @ max flow (RPM)	2892	2855	2885	2868	2780	2760
Max. Efficiency (BEP%)	22.5	26.4	31.2	32.4	40.7	42.1

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SÃO PAULO
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IN-LINE CIRCULATING PUMPS | MODELS S25 TO S69, H32 TO H68, AND SERIES 1050 & 1060 | INSTALLATION AND OPERATING INSTRUCTIONS

File No: 10.79
Date: SEPTEMBER 06, 2016
Supersedes: 10.79
Date: NOVEMBER 27, 2013

ENGLISH

1.0	Installation	1
2.0	System cleanliness	2
3.0	Starting up	2
4.0	Lubrication	2
5.0	Seal replacement	3

FRANÇAIS

1.0	Installation	4
2.0	Propreté du système	5
3.0	Démarrage	5
4.0	Lubrification	5
5.0	Remplacement des joints d'étanchéité	6

CAUTION

Always disconnect power supply from motor before servicing.

1.0 INSTALLATION

For convenience, Armstrong circulators generally are installed in vertical pipelines, but may be changed easily on the job for horizontal pipelines or for opposite flow directions. To make the change, remove the body capscrews, taking care body gasket is kept in position, and rotate body to desired direction at 90° or 180° from the original position.

With the arrow on the body pointing in direction of the flow, insert body capscrews and tighten evenly. On models S25 to S57, H32 to H54 and series 1050 (1B to 2B), a gap between the bearing bracket and pump body (volute) is normal. Do no over tighten body capscrews! Turn pump shaft manually at coupler to make sure shaft turns freely and impeller does not rub in body. Always install with motor shaft in a horizontal position with pump oil cups or oil well cover on top.

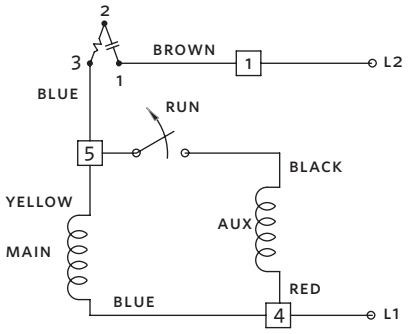
Models S25 to S46 and H32 to H41 are shipped for downward discharge. All other models are shipped for upward discharge as pumps of this size usually are installed in an upward direction on hydronic systems, so the point of zero pressure change - namely, the compression tank connection - can be made easily to the system on the suction side of the circulator.

The pump should be installed in a position to permit proper lubrication and servicing. Motor and bearing brackets are to be kept free of insulation. Pump and motor unit are designed to be supported by the in-line piping only. Do not support in any other manner. A height of approximately four feet above the floor is recommended. When placing the pump between flanges, tighten flange bolts evenly and do not tighten excessively.

Gate valves should be installed on the discharge and suction side of the pump to facilitate service. On larger pump sizes, a check valve should be located on the discharge side of pump between the pump body and the gate valve to prevent damage due to water hammer.

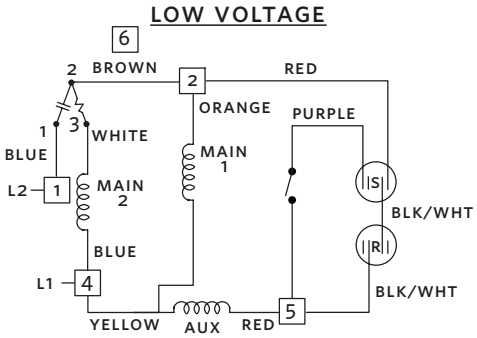
WIRING DIAGRAMS

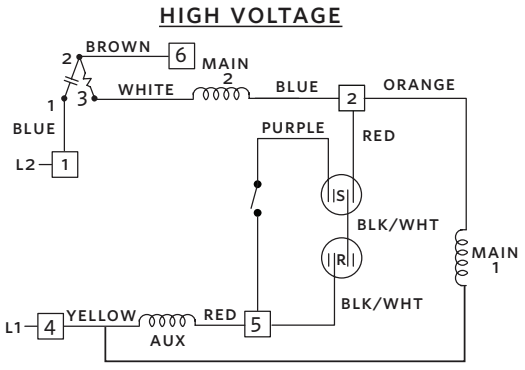
SINGLE PHASE LESS THAN 0.5HP



C.C.W. rotation shown
For C.W. Rotation interchange yellow and blue leads on term 5 & 4

SINGLE PHASE LESS THAN 1HP (with with part number beginning with 811757-...)



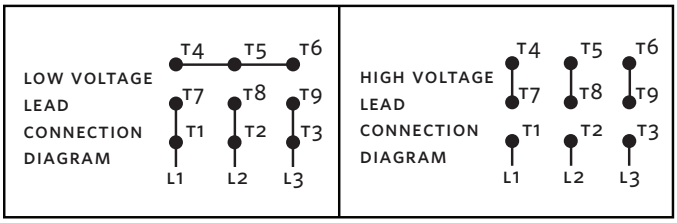


SINGLE PHASE 1HP - 1.5HP (**only** for part number not beginning with 811757-...)

	LINE A	LINE B	JOIN
HIGH STD	1	4,5	2,3,8
HIGH OPP	1	4,8	2,3,5
LOW STD	1,3,8	2,4,5	—
LOW OPP	1,3,5	2,4,8	—

NOTE: Standard rotation is ccw facing end opposite shaft extension

THREE PHASE MOTOR ANY SIZE



Interchange any two lead wires to reverse rotation

2.0 SYSTEM CLEANLINESS

Before starting the pump, the system must be thoroughly cleaned, flushed and drained, then replenished with clean liquid. Welding slag and other foreign materials, 'stopleak' and cleaning compounds, excessive or improper water treatment - all are detrimental to the pump. Warranty will be void if any of these conditions are allowed to exist. (Refer to **File no. 6090.645** design and care of closed hydronic systems.)

3.0 STARTING UP

The pump must be fully primed on start-up. Fill system piping and pump body with liquid and vent complete system, turning pump by hand to dislodge air from body. Make sure fittings and drain valves are airtight, then add any additional fill required.

Check motor against available electric supply, then start pump making sure rotation is correct. When viewed from motor end, rotation is counter-clockwise on models S25 to S46 and H32 to H41. On all other models, rotation is clockwise. If pressure does not develop, stop pump, re-check, vent and fill. Never attempt to fill the system when the pump is running

4.0 LUBRICATION

CAUTION:
Do not put oil in the **maintenance free** circulators. These models contain MF in their item numbers and are labelled: 'THIS BEARING ASSEMBLY CONTAINS PERMANENTLY LUBRICATED BEARINGS AND DOES NOT NEED ANY OILING OR GREASING'.

Stop motor before lubricating, do not over-oil or spill oil on resilient motor rings. Do not force oil into cups, and stop if cup fills before addition of specified amount.

Pump lubrication: Only applicable for pumps those are with sleeve bearing SBA and have oil cup for lubrication.

Immediately after pump is installed and before running, slowly add the oil (SAE 30 non-detergent regular, supplied with pump) to pump oil cup, located on top of bearing bracket:

S25 to S57, H32 to H54 and series 1050 (1B to 2B)	¼ oz.
S69, H63 to H68, series 1060 (1½D to 3D)	2 oz.

At the start of each following heating season, lubricate with SAE 30 oil for models S25 to S57, H32 to H54 and series 1050 (1B to 2B), add approximately ¼ oz. Lubricate every six months for high temperature or constant operation. On models S69, H63 to H68 and series 1060 (1½D to 3D), be sure oil is visible at the top and center of window on side of bracket and maintain this level at all times.

Motor lubrication

CAUTION

Stop motor before lubricating. Do not over-oil or spill oil on resilient motor rings.

This motor has been lubricated properly at the factory. At the start of each following heating season, however, on motors with oil cups, add 15 drops SAE 30 non-detergent oil to each motor cup.

If the motor is fitted with grease fittings, follow the motor manufacturer's recommended procedure. Motors without oil cups or grease fittings are custom-greased for several years operation and require little or no attention.

5.0 SEAL REPLACEMENT

Remove the pump bracket from the body. Remove the impeller, damaged seal assembly, ceramic insert and rubber cup. Clean the recess in bearing bracket coverplate and install a new retainer cup and ceramic insert. Check the condition of the shaft sleeve. If scored, replace the shaft assembly. Otherwise, clean shaft extension and polish sleeve with a fine crocus cloth, using a rotating motion, if required.

Press against the coupler end of the shaft to take up play while pressing new seal firmly against the stationary face. A slight amount of clean vaseline may be put on shaft sleeve to assist installation. Press down firmly and evenly, using two screwdrivers and pushing against the four ears of driving band (the metal ring around rubber bellows), or around top outer edge of driving band on models S25 to S57, H32 to H54 and series 1050 (1B to 2B).

Do not use spring washer on models S25, S35 and H32 current style circulators, where recess to locate spring is provided on impeller hub.

Continue pressing against coupler end of shaft, re-mount impeller and re-assemble the seal bearing assembly into body. If necessary, install a new body gasket and clean gasket surface of both volute and bracket.

CAUTION



Before operating pump, carefully check:

1. Is the pump primed?
2. Is rotation correct?
3. Is pump properly lubricated?
4. Does the power supply agree with data on motor name plate?
5. Is overload protection provided?
6. Is the system clean?

For domestic water systems use bronze body pumps.

ATTENTION

Toujours couper l'alimentation électrique avant de procéder à l'entretien d'un moteur.

1.0 INSTALLATION

Pour des raisons pratiques, les circulateurs Armstrong sont généralement installés sur des conduites verticales, mais peuvent être facilement modifiés sur place pour des conduites horizontales ou pour changer la direction du liquide en circulation. Pour procéder au changement, retirer les boulons de fixation et, en prenant soin de maintenir en place le joint d'étanchéité, tourner le corps suivant l'angle désiré, 90° ou 180°, par rapport à la position originale.

La flèche sur le corps pointant dans la direction de la circulation du liquide, insérer les boulons de fixation et les visser uniformément. Sur les modèles S25 à S57, H32 à H54 et la série 1050 (1B à 2B), il est normal qu'il y ait un espace entre la chaise de palier et le corps de la pompe (volute). Ne pas trop serrer les boulons ! À la jonction, faire tourner l'arbre de la pompe à la main pour vous assurer qu'il tourne librement et que l'impulseur ne frotte pas l'intérieur du corps. Toujours installer de manière à ce que l'arbre du moteur soit en position horizontale, les godets à huile et le couvercle du réservoir d'huile étant placés sur le dessus.

Les modèles S25 à S46 et H32 à H41 sont livrés en prévision d'une évacuation vers le bas. Tous les autres modèles sont livrés en prévision d'une évacuation vers le haut, puisque les pompes de cette taille sont habituellement installées sur les systèmes hydroniques pour pomper vers le haut, de sorte que le point de changement de pression nul, c'est-à-dire la connexion au vase d'expansion, puisse facilement se trouver du côté aspiration du circulateur.

La pompe doit être installée à un endroit qui permet l'entretien et la lubrification. Le moteur et la chaise de palier doivent être exempts d'isolant. La pompe et le moteur sont conçus pour être soutenus uniquement par la tuyauterie en ligne. Ne pas les supporter d'aucune autre façon. Il est recommandé de les placer à environ 4 pi au-dessus du sol. Au moment de fixer la pompe par ses brides, serrer les boulons uniformément et sans excès.

Des robinets-vannes devraient être installés du côté évacuation et du côté aspiration de la pompe pour faciliter l'entretien. Sur les pompes plus grosses, un clapet antiretour devrait être placé du côté évacuation de la pompe, entre cette dernière et le robinet-vanne, pour prévenir les dommages causés par les coups de bélier.

SHÉMAS DE CÂBLAGE

MONOPHASÉ MOINS DE 0.5HP

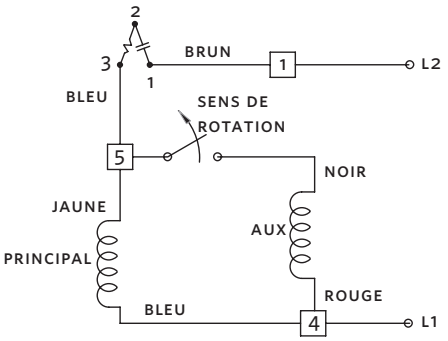
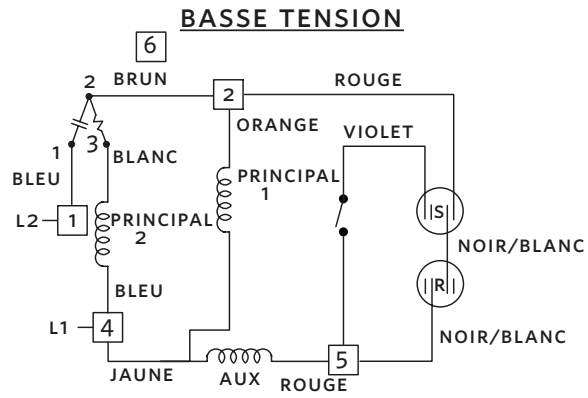
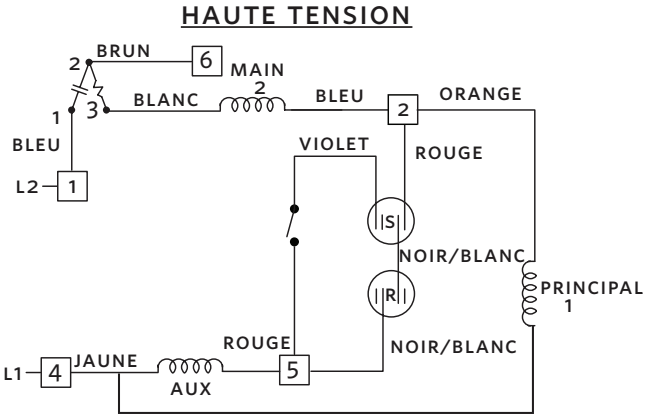


Schéma ci dessus à suivre dans le sens contraire des aiguilles d'une montre.

Pour une rotation dans le sens des aiguilles d'une montre, inverser les fils jaune et bleu des bornes 5 & 4.

MONOPHASÉ MOINS DE 1HP (avec un numéro de référence commençant par 811757-...)



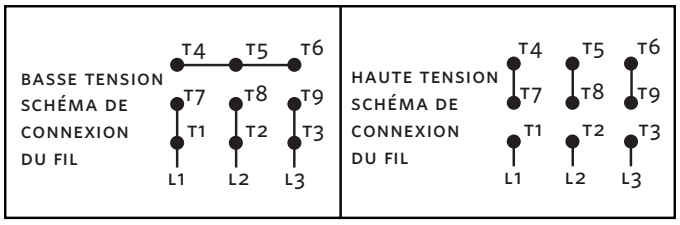


MONOPHASÉ 1HP-1.5HP (seulement pour un numéro de référence ne commençant pas par 811757-...)

	LIGNE A	LIGNE B	JONCTION
HAUTE TENSION ROTATION STD	1	4,5	2,3,8
HAUTE TENSION ROTATION OPP	1	4,8	2,3,5
BASSE TENSION ROTATION STD	1,3,8	2,4,5	—
BASSE TENSION ROTATION OPP	1,3,5	2,4,8	—

NOTE: Le sens de rotation standard est dans le sens contraire des aiguilles d'une montre en faisant face à l'extrémité opposée de l'extension de l'arbre

MOTEUR TRIPHASÉ DE TOUTE TAILLE



Permuter deux des fils de sorties pour inverser le sens de rotation

2.0 PROPRETÉ DU SYSTÈME

Avant de démarrer la pompe, le système doit être entièrement nettoyé, vidangé et rincé, puis rempli de nouveau d'un liquide propre. Les scories de soudage et autres matières étrangères, les composés de colmatage de fuites et de nettoyage, les produits de traitement excessifs ou inappropriés de l'eau, peuvent tous endommager les composantes internes de la pompe. La garantie sera nulle si l'une ou l'autre de ces conditions est permise.(Consulter le **dossier n° 6090.645** conception et entretien des systèmes hydroniques fermés.)

3.0 DÉMARRAGE

La pompe doit être parfaitement amorcée avant le démarrage. Remplir la tuyauterie du système et le corps de la pompe de liquide, ventiler complètement le système, faire tourner la pompe à la main pour déloger les bulles d'air qui y seraient emprisonnées. Vous assurer que les raccords et les robinets de vidange sont étanches et ajouter le liquide qu'il faut pour remplir.

Comparer les exigences électriques aux conditions d'alimentation, puis faire démarrer la pompe et vous assurer qu'elle tourne correctement. Vue de l'extrémité moteur de la pompe, la rotation se fait dans le sens contraire des aiguilles d'une montre sur les modèles S25 à S46 et H32 à H41. Sur tous les autres modèles, la rotation se fait dans le sens des aiguilles d'une montre. Si la pression ne grimpe pas, arrêter la pompe, vérifier de nouveau, ventiler et remplir. Ne jamais essayer de remplir le système lorsque la pompe est en marche.

4.0 LUBRIFICATION

ATTENTION:
NE PAS verser d'huile dans les Circulateurs ne nécessitant aucun entretien. Les modèles mentionnant **MF** dans leur référencesont étiquetés : '**CE SYSTÈME À ROULEMENT EST ÉQUIPÉ DE ROULEMENTS À GRAISSAGE PERMANENT ET NE NÉCESSITE AUCUN AJOUT D'HUILE NI DE GRAISSAGE'.**

Arrêter le moteur avant de lubrifier. Ne pas mettre trop d'huile ni en renverser sur les bagues souples du moteur. Ne pas faire entrer l'huile de force dans les godets et arrêter le remplissage si un godet se remplit avant d'avoir ajouté la quantité spécifiée.

Lubrification de la pompe : Applicable seulement pour les pompes à paliers à douille et ayant un godet pour la lubrification

Immédiatement après l'installation de la pompe et avant de la démarrer, ajouter lentement de l'huile (SAE 30 non détergente régulière, fournie avec la pompe) dans le godet situé sur le dessus de la chaise de palier :

S25 à S57, H32 à H54 et série 1050 (1B à 2B)	¼ oz.
S69, H63 à H68, série 1060 (1½D à 3D)	2 oz.

Par la suite, au début de chaque saison de chauffage, lubrifier la pompe en utilisant de l'huile SAE 30. Pour les modèles S25 à S57, H32 à H54 et la série 1050 (1B à 2B), ajouter environ ½oz. Lubrifier à tous les six mois si la pompe fonctionne tout le temps ou à haute température. Sur les modèles S69, H63 à H68, série 1060 (1½D à 3D), vous assurer que l'huile est visible en haut et au centre de la lunette sur le côté de la chaise de palier et maintenir ce niveau en tout temps.

Lubrification du moteur

ATTENTION

Arrêter le moteur avant de le lubrifier. Ne pas ajouter trop d'huile ni en renverser sur les bagues souples du moteur.

Ce moteur a été lubrifié correctement en usine. Au début de chaque saison de chauffage, toutefois, sur les moteurs munis de godets d'huile, ajouter 15 gouttes d'huile non détergente SAE 30 dans chaque godet.

Si le moteur est équipé d'embouts de graissage, respecter la procédure recommandée par le fabricant. Les moteurs à godets d'huile ou à embouts de graissage sont graissés individuellement en prévision de plusieurs années d'utilisation et exigent peu ou pas d'attention.

5.0 REMPLACEMENT DES JOINTS D'ÉTANCHÉITÉ

Retirer la portion pompe du corps. Retirer l'impulseur, le joint d'étanchéité endommagé, la pièce de céramique et le godet de caoutchouc. Nettoyer le compartiment du joint dans la chaise de palier et installer un nouveau godet et une nouvelle céramique. Vérifier l'état de la chemise de l'arbre. Si elle est marquée, remplacer l'ensemble de l'arbre. Autrement, nettoyer le prolongement de l'arbre et, au besoin, polir la chemise à l'aide d'une toile à polir fine suivant un mouvement rotatif.

Pousser sur l'extrémité accouplement de l'arbre pour réduire le jeu tout en pressant fermement le nouveau joint d'étanchéité sur la face fixe. On peut mettre une petite quantité de vaseline sur la chemise de l'arbre pour aider à l'installation. Pousser fermement et uniformément en utilisant deux tournevis contre les quatre oreillettes du collet (l'anneau de métal autour des soufflets de caoutchouc) ou sur le pourtour extérieur du collet dans le cas des modèles S25 à S57, H32 à H54 et de la série 1050 (1B à 2B).

Ne pas utiliser de rondelle à ressort sur les circulateurs de modèles courants S25, S35 et H32 lorsque la dépression prévue pour le ressort se trouve sur le moyeu de l'impulseur. Continuer d'appuyer sur l'extrémité accouplement de l'arbre. Remonter l'impulseur et l'ensemble porteur du joint d'étanchéité dans le corps. Au besoin, installer un nouveau joint pour le corps et nettoyer la surface du joint de la volute et de la chaise de palier.

ATTENTION

Avant de faire fonctionner la pompe, vous assurer que :

1. La pompe a été amorcée?
2. Le sens de la rotation est le bon?
3. La pompe est correctement lubrifiée?
4. L'alimentation correspond aux données sur la plaque d'identification?
5. La pompe est protégée contre les surcharges?
6. Le système est propre?

Pour les systèmes domestiques de distribution d'eau, utiliser des pompes à corps de bronze.

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ARMSTRONG

FILE NO.:	37.89
DATE:	June 2, 2006
SUPERSEDES:	37.89
DATE:	June 27, 2005

INSTALLATION AND OPERATING INSTRUCTIONS

Series DAS
Dirt & Air Separator

VESSEL DESCRIPTION
Armstrong Series DAS Dirt & Air Separators are designed to eliminate entrained air and separate debris associated with start-up and maintenance of any hydronic system. The design incorporates a removable end cover (optional) for coalescing medium access and an air vent (optional) to automatically release air from the separator. The design and construction conforms to ASME Section VIII, Div. 1 (excluding DAS-Q and DASH-Q models).

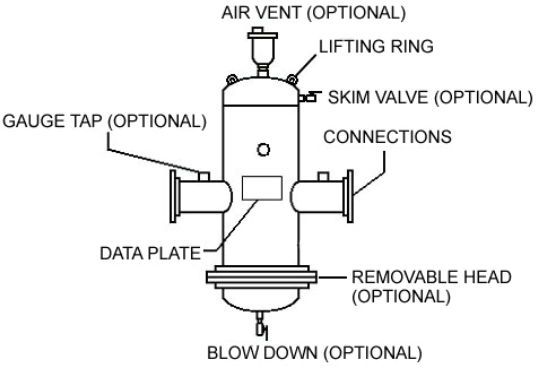


Fig. 1

FACTORY TESTING AND SHIPPING
The Series DAS has been factory tested and inspected prior to shipment. Upon receipt of the unit, carefully inspect the unit for damage that may have occurred during shipment. If the DAS has been damaged, it should be noted on the freight bill and reported to the carrier.

INSTALLATION
Ideally the installation of the DAS is at the point in the system where full water flow is at the lowest pressure and highest temperature. For optimum air elimination, it is at this point where free system air (bubbles) is at its highest concentration. Complete elimination of the free air at this location insures that dissolved air (air in solution) is at its lowest concentration. As the fluid leaves the DAS, and travels throughout the piping system, it will absorb a portion of any free-air that it contacts. This air-saturated water will then circulate back to the DAS where the low pressure/high temperature condition will drive this air back out of solution. This continuous air absorption and subsequent release and elimination by the DAS will ensure an air-free system.

It is recommended that the DAS be installed in the system piping prior to the primary system circulator/pump. For high-rise systems where static pressures are high, placement of the DAS should be as high in the system as practical.

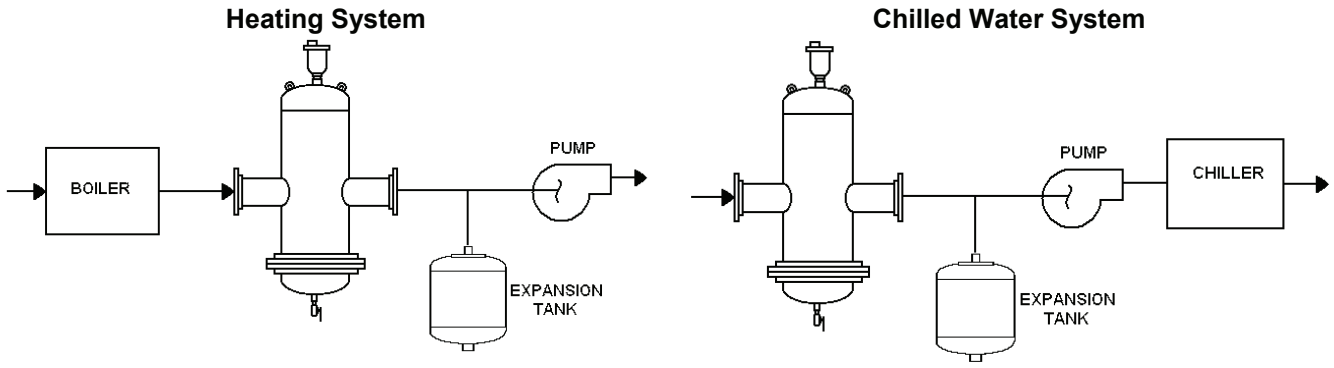


Fig. 2 Recommended Installations

Note: 100% of system flow should pass through the DAS to ensure all particles can be filtered.

OPERATION

All systems contain air in a dissolved state or as free air bubbles. Dirt particles, from multiple sources (piping fabrication, boiler or pump castings, welding beads, rust, etc.) also flow with the system water. As system fluid enters the DAS, air bubbles will rise to the top of the vessel to the vent location. Small, or sometimes referred to as micro-bubbles, will become trapped by the coalescing stainless steel media. With time, these bubbles will combine to form larger bubbles that will, over time as buoyancy overcomes surface tension, float to the top of the vessel to the vent location. Dirt particles are strained out by the enhanced surface stainless screen and collect at the vessel bottom. The debris is then periodically flushed out of the vessel through a blow-down valve. In removable base designs, the coalescing media can be removed and cleaned periodically.

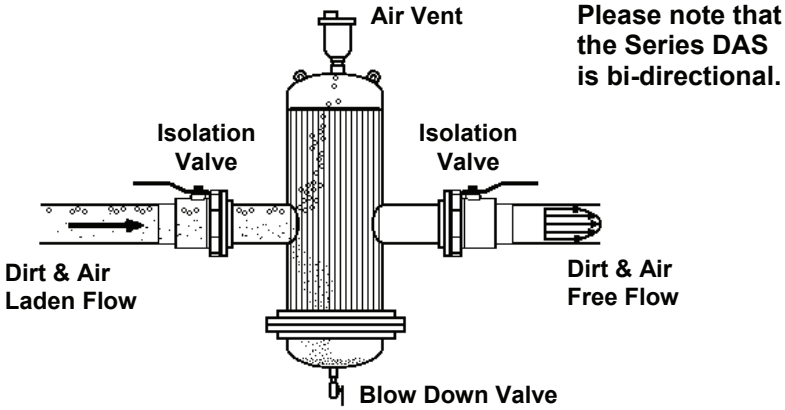


Fig. 3 DAS Working Configuration

MAINTENANCE

Air is eliminated automatically through the float-style vent. The vent should be periodically inspected to ensure optimum performance. If the vent used shows signs of continuous or intermittent leakage, or corrosion, it should be serviced or replaced.

During start up procedures, sediment should be removed frequently. The amount of sediment and the time of each blow-down should be recorded. As the amount of debris from blow-down diminishes, set a routine schedule to periodically blow-down the debris. If sediment builds on the coalescing screen, as evidenced though increased pressure drop, the screen can be removed. Inspect the screen cartridge periodically. Clean or replace if necessary.

WARNING: Standard units are not for use with potable water. Please consult factory for stainless steel option. For support recommendations, please reference local building code requirements

WARNING: The internal coalescing tubes are supported by the removable head. These tubes are not supported when the head bolts are removed.

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ARMSTRONG®

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SUPERSEDES:	New
DATE:	New

INSTALLATION AND OPERATING INSTRUCTIONS

SX Series
Diagphragm Expansion Tanks

SX SERIES Expansion Tanks
This line of expansion tanks is specifically designed for use in hydronic heating systems.

The unique proven design of these tanks incorporates a flexible diaphragm that separates system water from the tank air charge (12 psig) resulting in more positive system protection.

HOW THEY WORK:
Heated water expands, and in a closed hot water heating system, provision must be made for this expansion. The captive air volume separated by the flexible diaphragm in the expansion tank provides for water expansion without permitting absorption of the air cushion by the water.

ATTACHING ACCEPTANCE FITTINGS:
SX tanks are equipped with a convenient bottom outlet elbow for connection to the system. Models SX-30V, SX-40V and SX-60V use a 1" NPTF fitting and models SX-90V, SX-110V and SX-160V use 1¼ " NPTF fitting. The air valve is located on top to provide accessibility no matter how the unit is positioned.

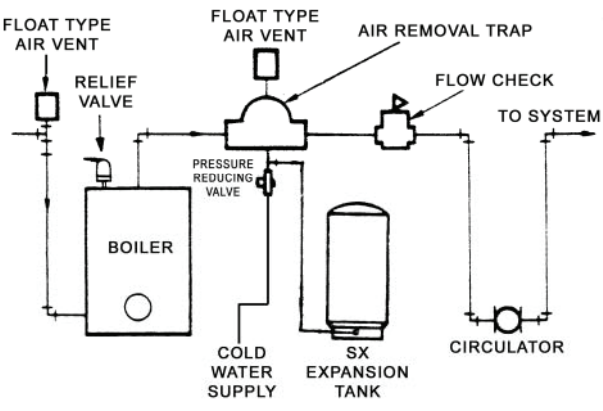
PROPER LOCATION AND INSTALLATION:
The SX Series tank may be located at any convenient point on a hot water heating system on the suction side of the pump. It may be installed into a tee or any other suitable tapping. The preferred installation is to pipe the SX tank into the system piping between the pressure reducing valve (in the water supply line) and the air removal trap / air vent, as shown in Figure 1. Conversely, the SX tank may be piped directly into the Armstrong Air Removal Trap. Regardless of installation, both offer continuous automatic air removal and complete pressure control protection.

ADJUSTING SX EXPANSION TANK PRECHARGE TO SYSTEM REQUIREMENTS:
All SX Series tanks are shipped with a standard precharge of 12 psi. This precharge can be adjusted if necessary. The following steps should be taken:

1. Remove red air charge valve cap and, using a suitable pressure gauge, check precharge pressure.
2. Release or add air as necessary to make precharge pressure equal to the desired fill pressure.
3. Replace protective air valve cap and seal with the air valve label provided. This will enable you to determine if valve has been tampered with on possible future service calls.

SYSTEM CONNECTION:
1. Locate SX Series expansion tank in final desired location.
2. Level as necessary.
3. Connect to heating system.
4. All piping should be in accordance with prevailing local codes and standards.

RECOMMENDED INSTALLATION:



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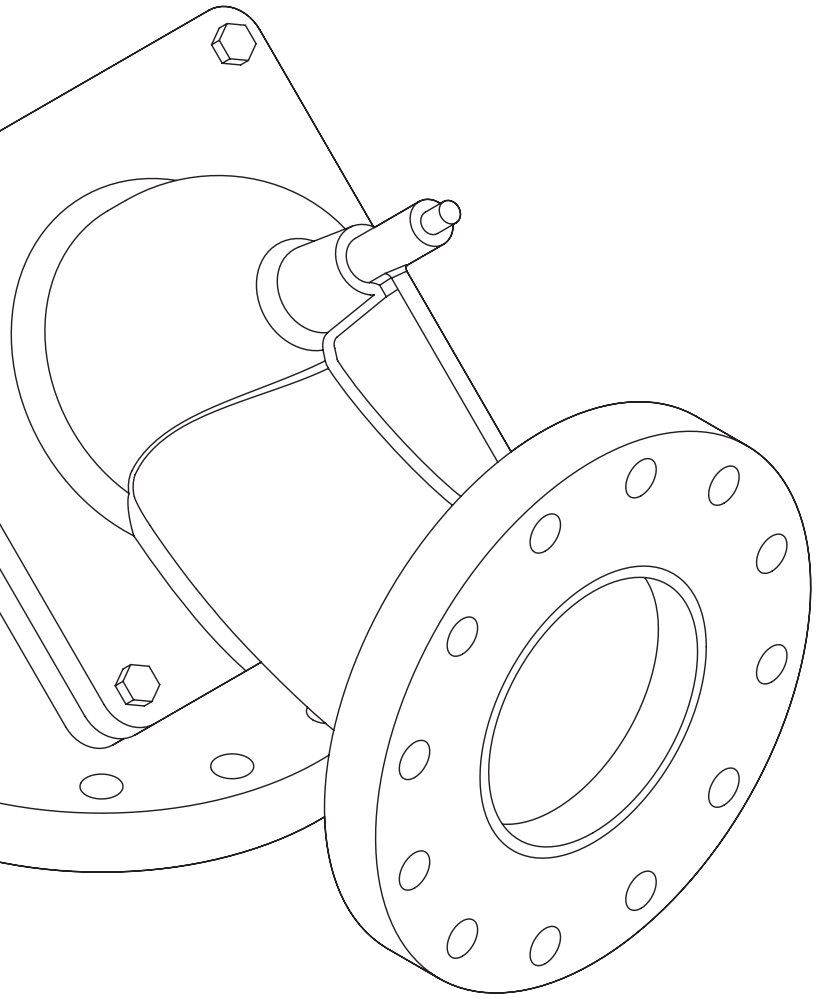
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ARMSTRONG



Armstrong model FTV

Hard flanged Flo-Trex combination valve

Installation and operating instructions

File No: 35.81
Date: SEPTEMBER 18, 2014
Supersedes: 35.81
Date: DECEMBER 02, 2010

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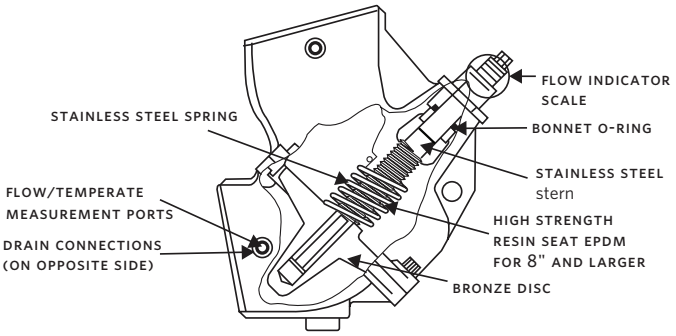
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1.0 INTRODUCTION

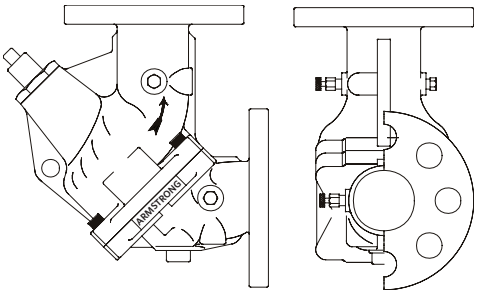
The Armstrong model FTV Flo-Trex combination valves are designed for installation on the discharge side of centrifugal pumps. The Armstrong combination valve incorporates three functions in one valve:

- Drip-tight, shut-off valve
- Spring closure design, non-slam check valve
- Flow throttling valve

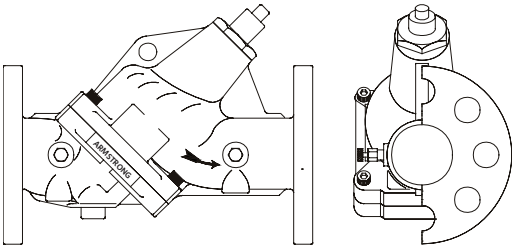
Armstrong model FTV-AF Flo-Trex combination valve



Angle pattern model FTV-AF



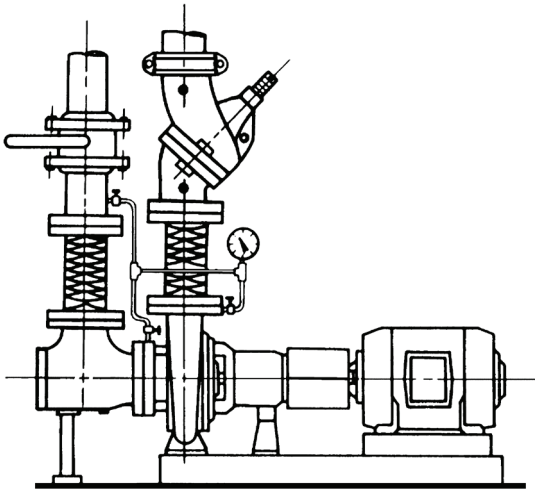
Angle pattern model FTV-SF



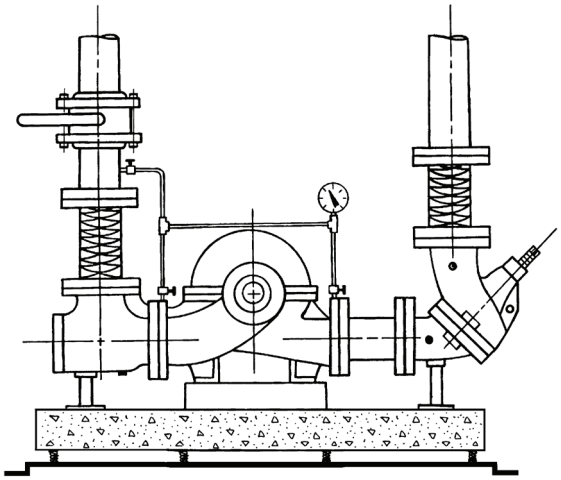
2.0 INSTALLATION

1. The valve should be mounted to a spool piece on the discharge side of the pump. Spool piece required is based on a minimum recommended space of 12" for pump sizes 2 × 2 to 6 × 6 and 24" for pump sizes 8 × 8 to 12 × 12.
2. It is not recommended to mount a valve directly to the pump as this could cause undesirable noise in the system.
3. Sufficient clearance around the valve should be left for valve removal or repair.
4. Install valve in the direction of the flow arrows on the valve body.
5. The valve body has been designed to handle the weight of the pump on vertical in-line installations. The body is not designed to support the piping weight. It is recommended that the piping be supported by hangers. Pipe supports are not required under the valve and strainer bodies but may be used if desired.
6. Ensure that the FTV is installed with the valve stem in the upright position. Valve slam may occur if installed in any other configuration

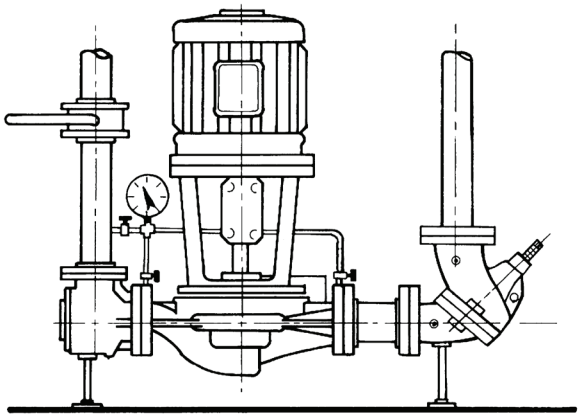
3.0 TYPICAL INSTALLATIONS



Base-mounted single suction



Base-mounted double suction



Vertical in-line

4.0 FLANGE BOLT TIGHTENING

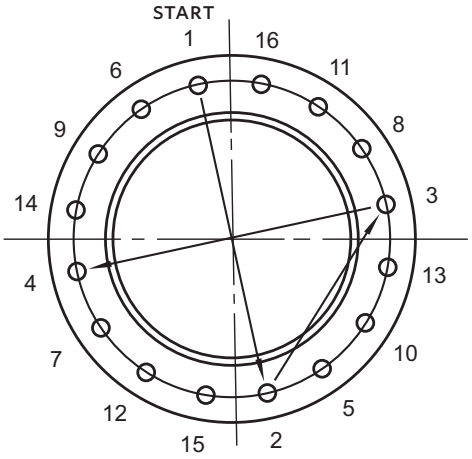


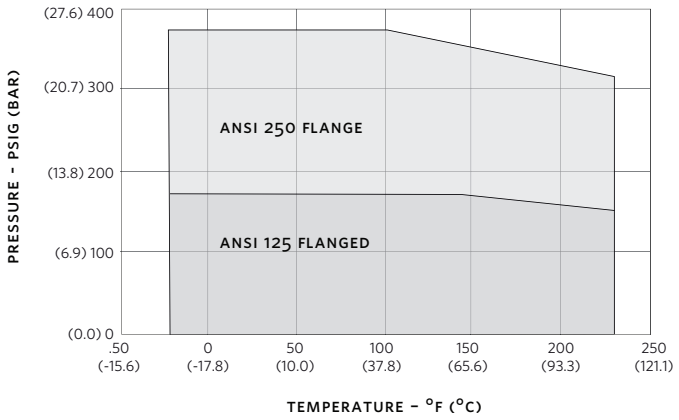
FIG 1: Recommended bolt tightening procedure

VALVE SIZE	125 PSI/150 PSI CAST IRON BOLT	
	BOLT NO.	SIZE
2½	4	⅝
3	4	⅝
4	8	⅝
5	8	¾
6	8	¾

TABLE 1

Tighten nuts evenly, following bolting instructions (**FIG 1**) so that the flange faces remain parallel. Flange bolts should be tightened to 70 ft/lbs. Torque minimum to assure firm metal-to-metal contact. When raised face flanges are used, there will be a gap between the faces of the outer diameter.

5.0 PRESSURE-TEMPERATURE LIMITS



6.0 FIELD CONVERSION (straight to angle pattern valve)

Open valve at least one complete turn.

Remove the body bolts from valve body using allen key.

Rotate one half of the valve body 180° making sure the lower valve seat and o-ring stay in position. Inspect the o-ring for any cuts or nicks and replace if necessary.

Replace body bolts and torque evenly to 70 ft/lbs.

7.0 FLOW MEASUREMENT

Where approximate indication of flow is acceptable the Armstrong Flo-Trex valve can be used.

Measure the flow with valve in fully open position.

1 Measure and record the differential pressure across the valve using an Armstrong CompuFlo with high pressure range transducer, or CBDM- 135/60 meter, or pressure gauges with PMP adapters.

Caution: Safety glasses should be used and the probe should not be left inserted into fittings for prolonged periods of time (overnight, etc), as leakage from the PMP may occur when probe is removed.

2 Refer to Flo-Trex performance curves with valve in full open position (**FIG 2**).

Locate Pressure Differential on left hand side of chart and extend line horizontally across to valve size being used. Drop line vertically down and read flow rate from bottom of chart.

Determining flow rate with valve in throttled position

FLO-TREX PERFORMANCE CURVE WITH VALVE IN FULL OPEN POSITION

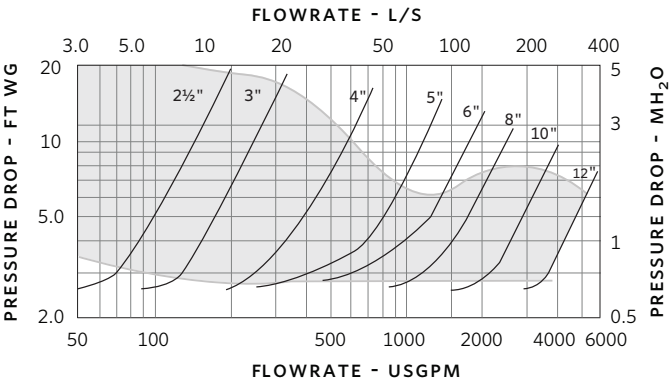


FIG: 5

INHERENT FLOW CHARACTERISTIC CURVE WITH VALVE IN THROTTLED POSITION

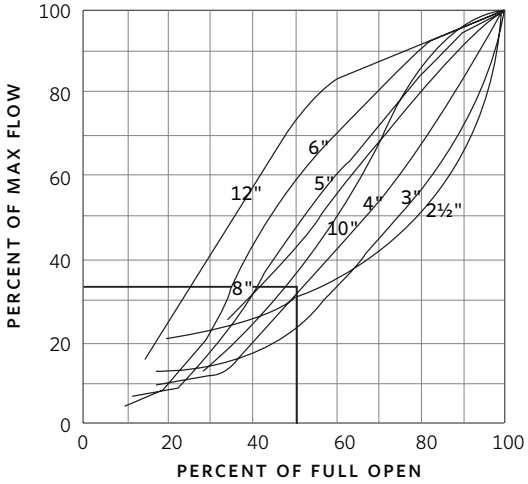


FIG: 6

1 Record the size of valve and stem position using the flow indicator scale (page 7). Calculate percentage of valve opening referring to table below:

VALVE SIZE	NUMBER OF RINGS (VALVE FULL OPEN)
2½	5
3	5
4	6
5	9
6	10
8	12
10	18
12	28

2 Measure and record the differential pressure across the valve in the throttled position.

3 Locate percentage of valve opening on the bottom scale of Flow characteristic curve (**FIG 3**). Project line vertically up to intersect with the valve characteristic curve and from this point project line horizontally across to the left of the chart and record the percentage of maximum flow rate.

4 On the Flo-Trex performance curve (**FIG. 2**) locate the differential pressure obtained in **STEP 2** and project line horizontally across to intercept with valve performance curve. Drop a line vertically down to read the flow rate at the bottom of the chart.

5 To calculate flow rate of valve in the throttled position, multiply the flow rate from **STEP 4** by the percentage flow rate from **STEP 2** divided by 100.

Example: Valve size 4 inch.

Differential Pressure is 5.4 ft. (1.65 m).

Number of rings open = 3. Therefore: 3 rings ÷ 6 rings x 100 = 50% throttled.

From the Flo-Trex Performance Curve (**FIG 2**), a 4 inch, valve with 5.4 ft. pressure drop (1.65 m) represents a flow of 400 USgpm (25.2 L/s).

From Flow Characteristic Curve (**FIG 3**), a 4 inch valve 50% open, represents 34% of maximum flow.

Approximate flow of a 4 inch valve, with a 5.4 ft (1.65 m) pressure drop when 50% throttled is:

$$\frac{400x34}{100} = 136USgpm \left(\frac{25.2x34}{100} = 8.57L/s \right)$$

Note: To prevent premature valve failure it is not recommended that the valve operate in the throttled position with more than 25 ft pressure differential. Instead the pump impeller should be trimmed or valves located elsewhere in the system be used to partially throttle the flow.

FLOW INDICATOR SCALE

The valve stem with its grooved rings and positioning sleeve indicates the throttled position of the valve. The quarter turn graduations on the sleeve, with the scribed line on the stem, provide for approximate flow measurement.



Note: The valve is shipped in the closed position. The indicator on the plastic sleeve is aligned with the vertical scribed line on the stem.

8.0 OPERATION

To assure tight shut off, the valve must be closed using a wrench with 25 to 30 ft/lbs of torque.

To assure trouble-free check valve operation and shut off operation, the valve should be periodically opened and closed to keep valve seat and valve disc guide stem free of build up of system contaminants.

9.0 REPACKING OF FTV VALVE UNDER FULL SYSTEM PRESSURE

1. Should it be necessary, stem o-ring can be changed under full system pressure.
   Caution: Safety glasses should be worn.
2. Record the valve setting.
3. Turn the valve stem counter-clockwise until the valve is fully open and will not turn any further. Torque to a maximum force of 45 ft/lbs. This will ensure good metal-to-metal contact and minimum leakage.
4. The valve bonnet may now be removed. There may be slight leakage, as the metal-to-metal back seating does not provide a drip-tight seal.
5. Clean exposed portion of valve stem (do not scratch).
6. Remove and replace the o-ring and gasket.
7. Install the valve bonnet.
8. Tightening valve bonnet is necessary to stop any leaks.
9. Open valve to balance set point as recorded in **STEP 2**.

10.0 MAXIMUM NUMBER OF TURNS (FULL OPEN VALVE)

Note: On valve sizes 2½" and 3", full open position of valve is 5 turns. However valve will open to 5½ turns which is just back of seating of valve.

11.0 SEAT REPLACEMENT

1. Drain system and remove valve from piping.
2. Remove the body bolts from the body using an allen key.
3. Remove seat and o-ring. O-ring is not used on valves 8" and larger.
4. Inspect and clean o-ring cavity and install new o-ring and seat. Valve disc stem also should be inspected and replaced if worn. Valve stem o-ring should be replaced at this time. Refer to section **8.0**.

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ARMSTRONG®

FILE NO.:	37.83
DATE:	January 20, 2000
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DATE:	NEW

Installation & Operating Instructions
GLA - Glycol Make-up Units

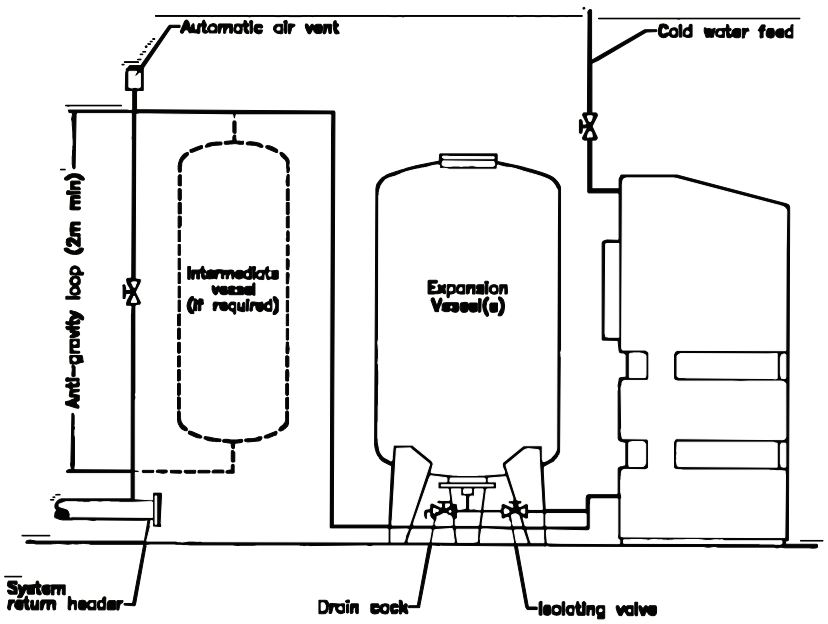
ESSENTIAL SAFETY REQUIREMENTS

1) **Glycol** is toxic and the glycol supplier's safety instructions must be adhered to. In critical areas a retaining wall should be used to contain any spillage or leakage. Overflows should be arranged not to contaminate drainage systems.
2) It is recommended that initial commissioning be carried out with water.
3) The flow rates from the unit are designed for make-up rates. It is therefore suggested that the system is back-filled with due precautions taken to avoid contamination.
4) Glycol is sometimes subject to bacterial attack and can become slimy as a result. We recommend the addition of a suitable biocide. The dosage should be calculated on the amount of water glycol mixture added and not the total tank contents. If bacterial attack occurs on untreated mixtures the unit should be drained, flushed and refilled with fresh mixture and dosed with biocide.
5) Locate units in a well-ventilated environment and ensure that ventilation fans and apertures are not obstructed.
6) Check that the supply voltage and overload protection is correct.
7) A competent electrician should perform the electrical installation.
8) Guards and covers must not be removed during operation.

Expansion Vessel Installation and Commissioning

Refer to separate Armstrong publication for Armstrong vessels.

Install the **GLA** unit as indicated in the diagram below.



NOTES:

1) The pipework from the system to the expansion vessels should not be insulated.
2) For systems operating above 200 degrees F (93 C), an anti-gravity loop with a minimum height of 6 feet, (or an intermediate vessel) should be installed to provide thermal protection to the expansion tanks.
3) For hot water systems, the connections to the intermediate vessel should be reversed, i.e. top to system, and bottom to expansion vessel.
4) The GLA unit is suitable for floor mounting.
5) The ball float valve is fitted with a low-pressure seat; a high-pressure seat is attached to the float valve and should be fitted if required.
6) The pipework to the expansion vessels should be sized according to the size and number of vessels and should be at least the same size as the vessel connection.
7) Where multiple expansion vessels are required it is recommended that each vessel be installed with its own isolating valve and drain cock.

Pressure Switch Adjustment

1) Low system pressure – PS1
2) High system pressure – PS2
3) Duty pump control switch – PS3
4) Standby pump control switch (where fitted) – PS4

For each switch, set the delivery to the required pressure. Then very slowly turn the adjusting screw on the switch until the contacts change.
The high system pressure switch should first be set higher than the required pressure by turning the screw clockwise, and the setting then made by turning the screw anti-clockwise until the switch contacts change-over. The other switches should first be set lower than the required pressure by turning the screw anti-clockwise, and the setting then made by turning the screw clockwise until the switch contacts changeover.
A pipe plug is provided on the outlet to allow connection of a test pump to simulate differing system pressures to check switch settings.
The Ultra versions of the GLA have the capability of controlling duty and standby pumps from a single pressure switch.

GLA Ultra Settings

The extra functionality of Ultra units is integral. The only selectable option is Manual or Automatic reset of alarm conditions. DIP switch 1, on the display board should be set to OFF for auto reset (Factory setting), and ON for manual reset. On alarm conditions, the MUTE switch will mute the buzzer. In manual reset mode this MUTE switch will reset the alarms after the fault condition has been cleared. Other switches change the mode of the printed circuit board for use with other Armstrong products. For GLA application, all switches except 1 and 7 must be set to OFF.

Priming the make-up pumps

1. Close suction isolating valve.
2. Fill the glycol-mixing tank.
3. Remove the upper vent plug from the make-up pump.
4. Open suction isolation valve until water flows out of this tapping.
5. Close valve and replace plug.
6. Repeat for standby pump (where fitted).
7. Close the system-isolating valve.
8. Open suction isolating valve.
9. Switch on unit, initially both pumps will run. As the pressure reaches the pump control switch threshold, the pumps will switch off.
10. Check all piping for leaks following shipping.
11. Crack open system valve. The pressure will fall and the pump will start and maintain pressure.

Powered agitation (Ultra model only)

A solenoid valve is fitted to provide powered agitation of the mixture. Automatically this valve is periodically opened and the duty pump starts creating circulation through the pump and mixing tank. Automatic mixing is inhibited when there is a system demand for make-up.

A switch is provided for manual agitation when adding glycol to the mixing tank.

Topping up with glycol

The mixing tank is calibrated in liters and US gallons. The normal top up level is 53 US gallons (200 liters).

1. Calculate the amount of water needed and add or drain to the correct level.
2. Add the required amount of glycol.
3. Operate the manual-agitating switch.
4. Check the mixture percentage.

The unit is now ready for service.

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IN-LINE CIRCULATING PUMPS | MODELS S25 TO S69, H32 TO H68, AND SERIES 1050 & 1060 | INSTALLATION AND OPERATING INSTRUCTIONS

File No: 10.79
Date: SEPTEMBER 06, 2016
Supersedes: 10.79
Date: NOVEMBER 27, 2013

ENGLISH

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2.0	System cleanliness	2
3.0	Starting up	2
4.0	Lubrication	2
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FRANÇAIS

1.0	Installation	4
2.0	Propreté du système	5
3.0	Démarrage	5
4.0	Lubrification	5
5.0	Remplacement des joints d'étanchéité	6

CAUTION

Always disconnect power supply from motor before servicing.

1.0 INSTALLATION

For convenience, Armstrong circulators generally are installed in vertical pipelines, but may be changed easily on the job for horizontal pipelines or for opposite flow directions. To make the change, remove the body capscrews, taking care body gasket is kept in position, and rotate body to desired direction at 90° or 180° from the original position.

With the arrow on the body pointing in direction of the flow, insert body capscrews and tighten evenly. On models S25 to S57, H32 to H54 and series 1050 (1B to 2B), a gap between the bearing bracket and pump body (volute) is normal. Do no over tighten body capscrews! Turn pump shaft manually at coupler to make sure shaft turns freely and impeller does not rub in body. Always install with motor shaft in a horizontal position with pump oil cups or oil well cover on top.

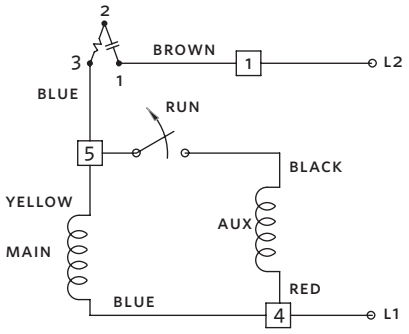
Models S25 to S46 and H32 to H41 are shipped for downward discharge. All other models are shipped for upward discharge as pumps of this size usually are installed in an upward direction on hydronic systems, so the point of zero pressure change - namely, the compression tank connection - can be made easily to the system on the suction side of the circulator.

The pump should be installed in a position to permit proper lubrication and servicing. Motor and bearing brackets are to be kept free of insulation. Pump and motor unit are designed to be supported by the in-line piping only. Do not support in any other manner. A height of approximately four feet above the floor is recommended. When placing the pump between flanges, tighten flange bolts evenly and do not tighten excessively.

Gate valves should be installed on the discharge and suction side of the pump to facilitate service. On larger pump sizes, a check valve should be located on the discharge side of pump between the pump body and the gate valve to prevent damage due to water hammer.

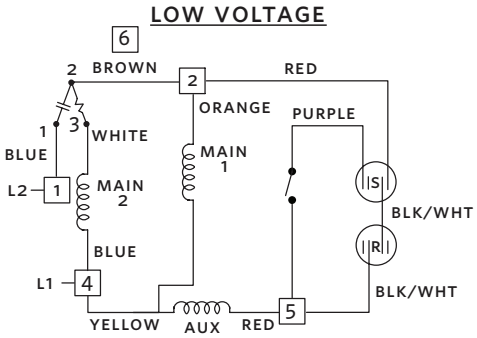
WIRING DIAGRAMS

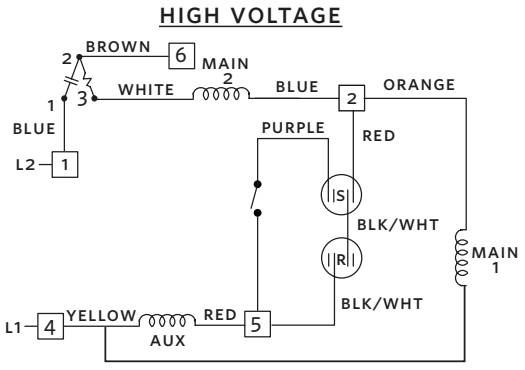
SINGLE PHASE LESS THAN 0.5HP



C.C.W. rotation shown
For C.W. Rotation interchange yellow and blue leads on term 5 & 4

SINGLE PHASE LESS THAN 1HP (with with part number beginning with 811757-...)



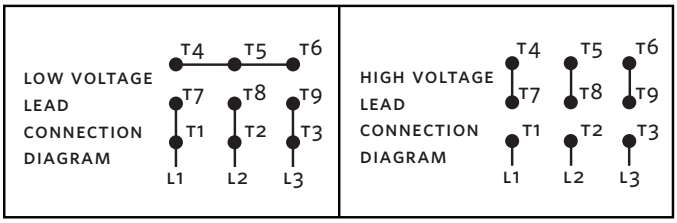


SINGLE PHASE 1HP - 1.5HP (**only** for part number not beginning with 811757-...)

	LINE A	LINE B	JOIN
HIGH STD	1	4,5	2,3,8
HIGH OPP	1	4,8	2,3,5
LOW STD	1,3,8	2,4,5	—
LOW OPP	1,3,5	2,4,8	—

NOTE: Standard rotation is ccw facing end opposite shaft extension

THREE PHASE MOTOR ANY SIZE



Interchange any two lead wires to reverse rotation

2.0 SYSTEM CLEANLINESS

Before starting the pump, the system must be thoroughly cleaned, flushed and drained, then replenished with clean liquid. Welding slag and other foreign materials, 'stopleak' and cleaning compounds, excessive or improper water treatment - all are detrimental to the pump. Warranty will be void if any of these conditions are allowed to exist. (Refer to **File no. 6090.645** design and care of closed hydronic systems.)

3.0 STARTING UP

The pump must be fully primed on start-up. Fill system piping and pump body with liquid and vent complete system, turning pump by hand to dislodge air from body. Make sure fittings and drain valves are airtight, then add any additional fill required.

Check motor against available electric supply, then start pump making sure rotation is correct. When viewed from motor end, rotation is counter-clockwise on models S25 to S46 and H32 to H41. On all other models, rotation is clockwise. If pressure does not develop, stop pump, re-check, vent and fill. Never attempt to fill the system when the pump is running

4.0 LUBRICATION

CAUTION:
Do not put oil in the **maintenance free** circulators. These models contain MF in their item numbers and are labelled: 'THIS BEARING ASSEMBLY CONTAINS PERMANENTLY LUBRICATED BEARINGS AND DOES NOT NEED ANY OILING OR GREASING'.

Stop motor before lubricating, do not over-oil or spill oil on resilient motor rings. Do not force oil into cups, and stop if cup fills before addition of specified amount.

Pump lubrication: Only applicable for pumps those are with sleeve bearing SBA and have oil cup for lubrication.

Immediately after pump is installed and before running, slowly add the oil (SAE 30 non-detergent regular, supplied with pump) to pump oil cup, located on top of bearing bracket:

S25 to S57, H32 to H54 and series 1050 (1B to 2B)	¼ oz.
S69, H63 to H68, series 1060 (1½D to 3D)	2 oz.

At the start of each following heating season, lubricate with SAE 30 oil for models S25 to S57, H32 to H54 and series 1050 (1B to 2B), add approximately ¼ oz. Lubricate every six months for high temperature or constant operation. On models S69, H63 to H68 and series 1060 (1½D to 3D), be sure oil is visible at the top and center of window on side of bracket and maintain this level at all times.

Motor lubrication

CAUTION

Stop motor before lubricating. Do not over-oil or spill oil on resilient motor rings.

This motor has been lubricated properly at the factory. At the start of each following heating season, however, on motors with oil cups, add 15 drops SAE 30 non-detergent oil to each motor cup.

If the motor is fitted with grease fittings, follow the motor manufacturer's recommended procedure. Motors without oil cups or grease fittings are custom-greased for several years operation and require little or no attention.

5.0 SEAL REPLACEMENT

Remove the pump bracket from the body. Remove the impeller, damaged seal assembly, ceramic insert and rubber cup. Clean the recess in bearing bracket coverplate and install a new retainer cup and ceramic insert. Check the condition of the shaft sleeve. If scored, replace the shaft assembly. Otherwise, clean shaft extension and polish sleeve with a fine crocus cloth, using a rotating motion, if required.

Press against the coupler end of the shaft to take up play while pressing new seal firmly against the stationary face. A slight amount of clean vaseline may be put on shaft sleeve to assist installation. Press down firmly and evenly, using two screwdrivers and pushing against the four ears of driving band (the metal ring around rubber bellows), or around top outer edge of driving band on models S25 to S57, H32 to H54 and series 1050 (1B to 2B).

Do not use spring washer on models S25, S35 and H32 current style circulators, where recess to locate spring is provided on impeller hub.

Continue pressing against coupler end of shaft, re-mount impeller and re-assemble the seal bearing assembly into body. If necessary, install a new body gasket and clean gasket surface of both volute and bracket.

CAUTION



Before operating pump, carefully check:

1. Is the pump primed?
2. Is rotation correct?
3. Is pump properly lubricated?
4. Does the power supply agree with data on motor name plate?
5. Is overload protection provided?
6. Is the system clean?

For domestic water systems use bronze body pumps.

ATTENTION

Toujours couper l'alimentation électrique avant de procéder à l'entretien d'un moteur.

1.0 INSTALLATION

Pour des raisons pratiques, les circulateurs Armstrong sont généralement installés sur des conduites verticales, mais peuvent être facilement modifiés sur place pour des conduites horizontales ou pour changer la direction du liquide en circulation. Pour procéder au changement, retirer les boulons de fixation et, en prenant soin de maintenir en place le joint d'étanchéité, tourner le corps suivant l'angle désiré, 90° ou 180°, par rapport à la position originale.

La flèche sur le corps pointant dans la direction de la circulation du liquide, insérer les boulons de fixation et les visser uniformément. Sur les modèles S25 à S57, H32 à H54 et la série 1050 (1B à 2B), il est normal qu'il y ait un espace entre la chaise de palier et le corps de la pompe (volute). Ne pas trop serrer les boulons ! À la jonction, faire tourner l'arbre de la pompe à la main pour vous assurer qu'il tourne librement et que l'impulseur ne frotte pas l'intérieur du corps. Toujours installer de manière à ce que l'arbre du moteur soit en position horizontale, les godets à huile et le couvercle du réservoir d'huile étant placés sur le dessus.

Les modèles S25 à S46 et H32 à H41 sont livrés en prévision d'une évacuation vers le bas. Tous les autres modèles sont livrés en prévision d'une évacuation vers le haut, puisque les pompes de cette taille sont habituellement installées sur les systèmes hydroniques pour pomper vers le haut, de sorte que le point de changement de pression nul, c'est-à-dire la connexion au vase d'expansion, puisse facilement se trouver du côté aspiration du circulateur.

La pompe doit être installée à un endroit qui permet l'entretien et la lubrification. Le moteur et la chaise de palier doivent être exempts d'isolant. La pompe et le moteur sont conçus pour être soutenus uniquement par la tuyauterie en ligne. Ne pas les supporter d'aucune autre façon. Il est recommandé de les placer à environ 4 pi au-dessus du sol. Au moment de fixer la pompe par ses brides, serrer les boulons uniformément et sans excès.

Des robinets-vannes devraient être installés du côté évacuation et du côté aspiration de la pompe pour faciliter l'entretien. Sur les pompes plus grosses, un clapet antiretour devrait être placé du côté évacuation de la pompe, entre cette dernière et le robinet-vanne, pour prévenir les dommages causés par les coups de bélier.

SHÉMAS DE CÂBLAGE

MONOPHASÉ MOINS DE 0.5HP

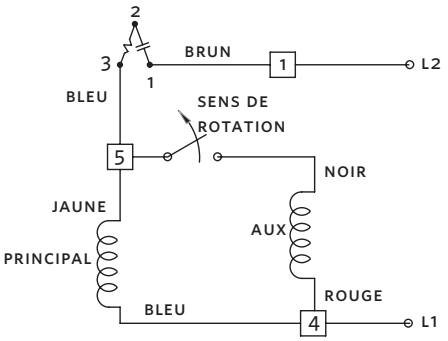
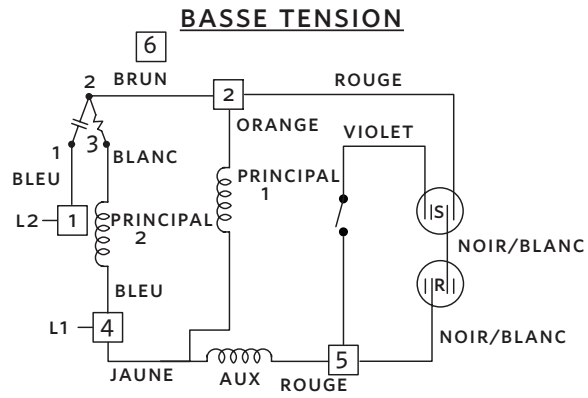
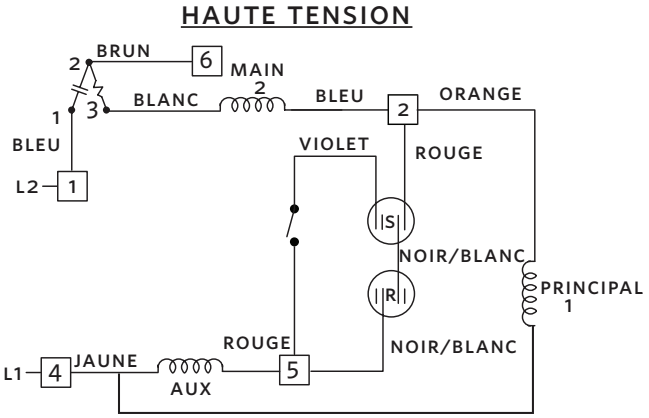


Schéma ci dessus à suivre dans le sens contraire des aiguilles d'une montre.

Pour une rotation dans le sens des aiguilles d'une montre, inverser les fils jaune et bleu des bornes 5 & 4.

MONOPHASÉ MOINS DE 1HP (avec un numéro de référence commençant par 811757-...)



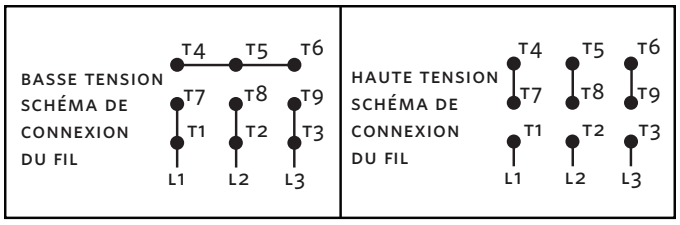


MONOPHASÉ 1HP-1.5HP (seulement pour un numéro de référence ne commençant pas par 811757-...)

	LIGNE A	LIGNE B	JONCTION
HAUTE TENSION ROTATION STD	1	4,5	2,3,8
HAUTE TENSION ROTATION OPP	1	4,8	2,3,5
BASSE TENSION ROTATION STD	1,3,8	2,4,5	—
BASSE TENSION ROTATION OPP	1,3,5	2,4,8	—

NOTE: Le sens de rotation standard est dans le sens contraire des aiguilles d'une montre en faisant face à l'extrémité opposée de l'extension de l'arbre

MOTEUR TRIPHASÉ DE TOUTE TAILLE



Permuter deux des fils de sorties pour inverser le sens de rotation

2.0 PROPRETÉ DU SYSTÈME

Avant de démarrer la pompe, le système doit être entièrement nettoyé, vidangé et rincé, puis rempli de nouveau d'un liquide propre. Les scories de soudage et autres matières étrangères, les composés de colmatage de fuites et de nettoyage, les produits de traitement excessifs ou inappropriés de l'eau, peuvent tous endommager les composantes internes de la pompe. La garantie sera nulle si l'une ou l'autre de ces conditions est permise.(Consulter le **dossier n° 6090.645** conception et entretien des systèmes hydroniques fermés.)

3.0 DÉMARRAGE

La pompe doit être parfaitement amorcée avant le démarrage. Remplir la tuyauterie du système et le corps de la pompe de liquide, ventiler complètement le système, faire tourner la pompe à la main pour déloger les bulles d'air qui y seraient emprisonnées. Vous assurer que les raccords et les robinets de vidange sont étanches et ajouter le liquide qu'il faut pour remplir.

Comparer les exigences électriques aux conditions d'alimentation, puis faire démarrer la pompe et vous assurer qu'elle tourne correctement. Vue de l'extrémité moteur de la pompe, la rotation se fait dans le sens contraire des aiguilles d'une montre sur les modèles S25 à S46 et H32 à H41. Sur tous les autres modèles, la rotation se fait dans le sens des aiguilles d'une montre. Si la pression ne grimpe pas, arrêter la pompe, vérifier de nouveau, ventiler et remplir. Ne jamais essayer de remplir le système lorsque la pompe est en marche.

4.0 LUBRIFICATION

ATTENTION:
NE PAS verser d'huile dans les Circulateurs ne nécessitant aucun entretien. Les modèles mentionnant **MF** dans leur référencesont étiquetés : '**CE SYSTÈME À ROULEMENT EST ÉQUIPÉ DE ROULEMENTS À GRAISSAGE PERMANENT ET NE NÉCESSITE AUCUN AJOUT D'HUILE NI DE GRAISSAGE'.**

Arrêter le moteur avant de lubrifier. Ne pas mettre trop d'huile ni en renverser sur les bagues souples du moteur. Ne pas faire entrer l'huile de force dans les godets et arrêter le remplissage si un godet se remplit avant d'avoir ajouté la quantité spécifiée.

Lubrification de la pompe : Applicable seulement pour les pompes à paliers à douille et ayant un godet pour la lubrification

Immédiatement après l'installation de la pompe et avant de la démarrer, ajouter lentement de l'huile (SAE 30 non détergente régulière, fournie avec la pompe) dans le godet situé sur le dessus de la chaise de palier :

S25 à S57, H32 à H54 et série 1050 (1B à 2B)	¼ oz.
S69, H63 à H68, série 1060 (1½D à 3D)	2 oz.

Par la suite, au début de chaque saison de chauffage, lubrifier la pompe en utilisant de l'huile SAE 30. Pour les modèles S25 à S57, H32 à H54 et la série 1050 (1B à 2B), ajouter environ ½oz. Lubrifier à tous les six mois si la pompe fonctionne tout le temps ou à haute température. Sur les modèles S69, H63 à H68, série 1060 (1½D à 3D), vous assurer que l'huile est visible en haut et au centre de la lunette sur le côté de la chaise de palier et maintenir ce niveau en tout temps.

Lubrification du moteur

ATTENTION

Arrêter le moteur avant de le lubrifier. Ne pas ajouter trop d'huile ni en renverser sur les bagues souples du moteur.

Ce moteur a été lubrifié correctement en usine. Au début de chaque saison de chauffage, toutefois, sur les moteurs munis de godets d'huile, ajouter 15 gouttes d'huile non détergente SAE 30 dans chaque godet.

Si le moteur est équipé d'embouts de graissage, respecter la procédure recommandée par le fabricant. Les moteurs à godets d'huile ou à embouts de graissage sont graissés individuellement en prévision de plusieurs années d'utilisation et exigent peu ou pas d'attention.

5.0 REMPLACEMENT DES JOINTS D'ÉTANCHÉITÉ

Retirer la portion pompe du corps. Retirer l'impulseur, le joint d'étanchéité endommagé, la pièce de céramique et le godet de caoutchouc. Nettoyer le compartiment du joint dans la chaise de palier et installer un nouveau godet et une nouvelle céramique. Vérifier l'état de la chemise de l'arbre. Si elle est marquée, remplacer l'ensemble de l'arbre. Autrement, nettoyer le prolongement de l'arbre et, au besoin, polir la chemise à l'aide d'une toile à polir fine suivant un mouvement rotatif.

Pousser sur l'extrémité accouplement de l'arbre pour réduire le jeu tout en pressant fermement le nouveau joint d'étanchéité sur la face fixe. On peut mettre une petite quantité de vaseline sur la chemise de l'arbre pour aider à l'installation. Pousser fermement et uniformément en utilisant deux tournevis contre les quatre oreillettes du collet (l'anneau de métal autour des soufflets de caoutchouc) ou sur le pourtour extérieur du collet dans le cas des modèles S25 à S57, H32 à H54 et de la série 1050 (1B à 2B).

Ne pas utiliser de rondelle à ressort sur les circulateurs de modèles courants S25, S35 et H32 lorsque la dépression prévue pour le ressort se trouve sur le moyeu de l'impulseur. Continuer d'appuyer sur l'extrémité accouplement de l'arbre. Remonter l'impulseur et l'ensemble porteur du joint d'étanchéité dans le corps. Au besoin, installer un nouveau joint pour le corps et nettoyer la surface du joint de la volute et de la chaise de palier.

ATTENTION

Avant de faire fonctionner la pompe, vous assurer que :

1. La pompe a été amorcée?
2. Le sens de la rotation est le bon?
3. La pompe est correctement lubrifiée?
4. L'alimentation correspond aux données sur la plaque d'identification?
5. La pompe est protégée contre les surcharges?
6. Le système est propre?

Pour les systèmes domestiques de distribution d'eau, utiliser des pompes à corps de bronze.

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INSTALLATION MANUAL

SPLIT SYSTEM Air Conditioners

English

Français

Español

MODELS

RZQ18PVJU (9)
RZQ24PVJU (9)
RZQ30PVJU
RZR18PVJU
RZR24PVJU
RZR30PVJU

Read these instructions carefully before installation.
Keep this manual in a handy place for future reference.
This manual should be left with the equipment owner.

Lire soigneusement ces instructions avant l'installation.
Conserver ce manuel à portée de main pour référence ultérieure.
Ce manuel doit être donné au propriétaire de l'équipement.

Lea cuidadosamente estas instrucciones antes de instalar.
Guarde este manual en un lugar a mano para leer en caso de tener alguna duda.
Este manual debe permanecer con el propietario del equipo.

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1. SAFETY CONSIDERATIONS

Read these "SAFETY CONSIDERATIONS for Installation" carefully before installing air conditioning equipment. After completing the installation, make sure that the unit operates properly during the startup operation.
Instruct the customer on how to operate and maintain the unit. Inform customers that they should store this Installation Manual with the Operation Manual for future reference.
Always use a licensed installer or contractor to install this product. Improper installation can result in water or refrigerant leakage, electrical shock, fire, or explosion.
Meanings of **DANGER**, **WARNING**, **CAUTION**, and **NOTE** Symbols:

⚠ **DANGER**..... Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ **WARNING**..... Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ **CAUTION**..... Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

⚠ **NOTE**..... Indicates situations that may result in equipment or property-damage accidents only.

⚠ DANGER

- **Refrigerant gas is heavier than air and replaces oxygen. A massive leak can lead to oxygen depletion, especially in basements, and an asphyxiation hazard could occur leading to serious injury or death.**
- **Do not ground units to water pipes, gas pipes, telephone wires, or lightning rods as incomplete grounding can cause a severe shock hazard resulting in severe injury or death. Additionally, grounding to gas pipes could cause a gas leak and potential explosion causing severe injury or death.**
- **If refrigerant gas leaks during installation, ventilate the area immediately. Refrigerant gas may produce toxic gas if it comes in contact with fire. Exposure to this gas could cause severe injury or death.**
- **After completing the installation work, check that the refrigerant gas does not leak throughout the system.**
- **Do not install unit in an area where flammable materials are present due to risk of explosions that can cause serious injury or death.**
- **Safely dispose all packing and transportation materials in accordance with federal/state/local laws or ordinances. Packing materials such as nails and other metal or wood parts, including plastic packing materials used for transportation may cause injuries or death by suffocation.**

⚠ WARNING

- **Only qualified personnel must carry out the installation work. Installation must be done in accordance with this installation manual. Improper installation may result in water leakage, electric shock, or fire.**
- **When installing the unit in a small room, take measures to keep the refrigerant concentration from exceeding allowable safety limits. Excessive refrigerant leaks, in the event of an accident in a closed ambient space, can lead to oxygen deficiency.**
- **Use only specified accessories and parts for installation work. Failure to use specified parts may result in water leakage, electric shocks, fire, or the unit falling.**
- **Install the air conditioner on a foundation strong enough that it can withstand the weight of the unit. A foundation of insufficient strength may result in the unit falling and causing injuries.**
- **Take into account strong winds, typhoons, or earthquakes when installing. Improper installation may result in the unit falling and causing accidents.**
- **Make sure that a separate power supply circuit is provided for this unit and that all electrical work is carried out by qualified personnel according to local, state, and national regulations. An insufficient power supply capacity or improper electrical construction may lead to electric shocks or fire.**
- **Make sure that all wiring is secured, that specified wires are used, and that no external forces act on the terminal connections or wires. Improper connections or installation may result in fire.**

- When wiring, position the wires so that the control box cover can be securely fastened. Improper positioning of the control box cover may result in electric shocks, fire, or the terminals overheating.
- Before touching electrical parts, turn off the unit.
- Be sure to install a ground fault circuit interrupter if one is not already available. This helps prevent electrical shocks or fire.
- Securely fasten the outdoor unit terminal cover (panel). If the terminal cover/panel is not installed properly, dust or water may enter the outdoor unit causing fire or electric shock.
- When installing or relocating the system, keep the refrigerant circuit free from substances other than the specified refrigerant (R410A) such as air. Any presence of air or other foreign substance in the refrigerant circuit can cause an abnormal pressure rise or rupture, resulting in injury.
- Do not change the setting of the protection devices. If the pressure switch, thermal switch, or other protection device is shorted and operated forcibly, or parts other than those specified by Daikin are used, fire or explosion may occur.

⚠ CAUTION

- Do not touch the switch with wet fingers. Touching a switch with wet fingers can cause electric shock.
- Do not allow children to play on or around the unit to prevent injury.
- Do not touch the refrigerant pipes during and immediately after operation as the refrigerant pipes may be hot or cold, depending on the condition of the refrigerant flowing through the refrigerant piping, compressor, and other refrigerant cycle parts. Your hands may suffer burns or frostbite if you touch the refrigerant pipes. To avoid injury, give the pipes time to return to normal temperature or, if you must touch them, be sure to wear proper gloves.
- Heat exchanger fins are sharp enough to cut.
  To avoid injury wear glove or cover the fins when working around them.
- Install drain piping to proper drainage. Improper drain piping may result in water leakage and property damage.
- Insulate piping to prevent condensation.
- Be careful when transporting the product.
- Do not turn off the power immediately after stopping operation. Always wait for at least 5 minutes before turning off the power. Otherwise, water leakage may occur.
- Do not use a charging cylinder. Using a charging cylinder may cause the refrigerant to deteriorate.
- Refrigerant R410A in the system must be kept clean, dry, and tight.
  (a) Clean and Dry -- Foreign materials (including mineral oils such as SUNISO oil or moisture) should be prevented from getting into the system.
  (b) Tight -- R410A does not contain any chlorine, does not destroy the ozone layer, and does not reduce the earth's protection again harmful ultraviolet radiation. R410A can contribute to the greenhouse effect if it is released. Therefore take proper measures to check for the tightness of the refrigerant piping installation. Read the chapter Refrigerant Piping Work and follow the procedures.
- Since R410A is a blend, the required additional refrigerant must be charged in its liquid state. If the refrigerant is charged in a state of gas, its composition can change and the system will not work properly.
- The indoor unit is for R410A. See the catalog for indoor models that can be connected. Normal operation is not possible when connected to other units.
- Remote controller (wireless kit) transmitting distance can be shorter than expected in rooms with electronic fluorescent lamps (inverter or rapid start types). Install the indoor unit far away from fluorescent lamps as much as possible.
- Indoor units are for indoor installation only. Outdoor units can be installed either outdoors or indoors.
- Do not install the air conditioner in the following locations:
  (a) Where a mineral oil mist or oil spray or vapor is produced, for example, in a kitchen.
  Plastic parts may deteriorate and fall off or result in water leakage.
  (b) Where corrosive gas, such as sulfurous acid gas, is produced.
  Corroding copper pipes or soldered parts may result in refrigerant leakage.
  (c) Near machinery emitting electromagnetic waves.
  Electromagnetic waves may disturb the operation of the control system and cause the unit to malfunction.
  (d) Where flammable gas may leak, where there is carbon fiber, or ignitable dust suspension in the air, or where volatile flammables such as thinner or gasoline are handled. Operating the unit in such conditions can cause a fire.
- Take adequate measures to prevent the outdoor unit from being used as a shelter by small animals. Small animals making contact with electrical parts can cause malfunctions, smoke, or fire. Instruct the customer to keep the area around the unit clean.

⚠ NOTE

- Install the power supply and control wires for the indoor and outdoor units at least 3.5 feet away from televisions or radios to prevent image interference or noise. Depending on the radio waves, a distance of 3.5 feet may not be sufficient to eliminate the noise.
- Dismantling the unit, treatment of the refrigerant, oil and additional parts must be done in accordance with the relevant local, state, and national regulations.
- Do not use the following tools that are used with conventional refrigerants: gauge manifold, charge hose, gas leak detector, reverse flow check valve, refrigerant charge base, vacuum gauge, or refrigerant recovery equipment.
- If the conventional refrigerant and refrigeration oil are mixed in R410A, the refrigerant may deteriorate.

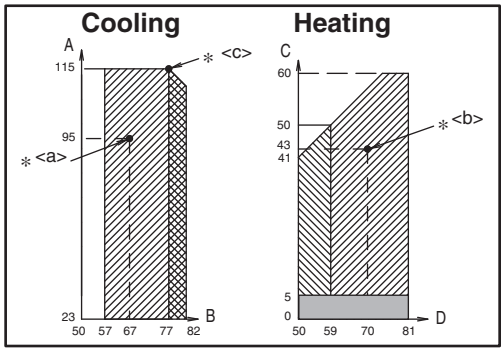
- **This air conditioner is an appliance that should not be accessible to the general public.**
- **The wall thickness of field-installed pipes should be selected in accordance with the relevant local, state, and national regulations.**

〈**Safety Precaution**〉
The PCI Data Station is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

2. INTRODUCTION

2-1 Standard operation limit

The figures below assume following operating conditions for indoor and outdoor units:
Equivalent pipe length.....25 ft.
Level difference.....0 ft.



A Outdoor temperature (°FDB)
B Indoor temperature (°FWB)
C Outdoor temperature (°FWB)
D Indoor temperature (°FDB)
Range for continuous operation
Range for pull down operation
Range for warming up operation
Range for operation

2-2 Technical specifications

(∗<a> and ∗<b> in the table indicate the operating condition (shown in the left figure).)

Model		RZQ18PVJU RZR18PVJU	RZQ24PVJU RZR24PVJU	RZQ30PVJU RZR30PVJU	Precaution
Refrigerant		R410A			
Power		208/230V 60Hz			
[FAQ] Wall mounted					
Cooling (MBh)		18.0	24.0	–	∗<a>
Heating (MBh) (RZQ only)		20.0	26.0	–	∗<b>
[FCQ] Ceiling mounted					
Cooling (MBh)		18.0	24.0	30.0	∗<a>
Heating (MBh) (RZQ only)		20.0	27.0	34.0	∗<b>
[FHQ] Ceiling Suspended					
Cooling (MBh)		18.0	24.0	30.0	∗<a>
Heating (MBh) (RZQ only)		20.0	27.0	34.0	∗<b>
(RZQ only)					
[FTQ] Air Handling Unit					
Cooling (MBh)		18.0	24.0	–	∗<a>
Heating (MBh)		20.0	26.0	–	∗<b>
Dimensions H × W × D	(inch)	30-5/16 × 35 7/16 × 12 5/8			
Weight	(lb.)	150			
Connections					
Gas	(inch)	5/8			
Liquid	(inch)	3/8			

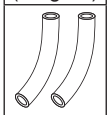
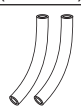
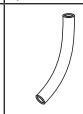
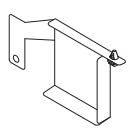
2-3 Electrical specifications

(∗<c> in the table indicate the operating condition (shown in the left figure).)

Model		RZQ18PVJU RZR18PVJU	RZQ24PVJU RZR24PVJU	RZQ30PVJU RZR30PVJU	Precaution
Power					
Phase		~			
Frequency	(Hz)	60			
Voltage	(V)	208/230			
Voltage tolerance	(%)	±10			
Max.Overcurrent Protective device	(A)	20			
Min. Circuit Amps.	(A)	16.5			∗<c>
Compressor					
Phase		3~			
Frequency	(Hz)	60			
Voltage	(V)	208/230			

2-4 Accessories

Confirm that the following accessories are supplied.

Clamp	Insulation tube				Cover (Handle)
	(Large-1)	(Large-2)	(Small-1)	(Small-2)	
					
(1 pc.)	(2 pcs.)	(1 pc.)	(2 pcs.)	(1 pc.)	

Screw	Conduit mounting plate		Others
			• Installation manual
(1 pc.)	(2 pcs.)	(2 pcs.)	

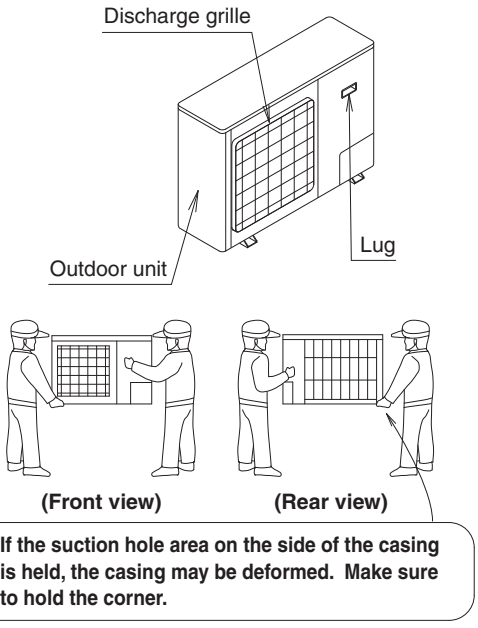
2-5 Main components

For main components and function of the main components, refer to the Engineering Data Book.

3. BEFORE INSTALLATION

〈**Bringing-in**〉

Bring in the outdoor unit slowly by holding the lugs provided on the left and right sides as shown in the figures below.
(Take care so that hands and objects do not touch the fin on the rear.)



If the suction hole area on the side of the casing is held, the casing may be deformed. Make sure to hold the corner.

◎ Make sure to use accessories and specified specification parts in the installation work.

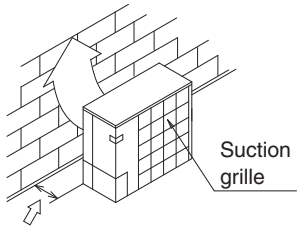
4. SELECTION OF INSTALLATION LOCATION

The refrigerant R410A itself is nontoxic, nonflammable and safe. If the refrigerant should leak however, its concentration may exceed the allowable limit depending on room size. Due to this it could be necessary to take measures against leakage. Refer to the chapter "Caution for refrigerant leaks".

(1) Select a proper location satisfying the following requirements with approval of the customer.
- Sufficient ventilation is secured.
- Adjacent houses are not annoyed.
- The foundation is strong enough to support the weight and withstand vibrations of the outdoor unit, and the location is safe and allows horizontal installation.
- The outdoor unit is exposed to rain as less as possible.
- The space for installation and servicing is secured around the outdoor unit.
- The indoor/outdoor piping length and wiring length are within the allowable range.

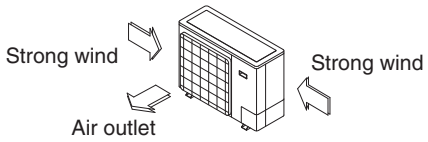
(2) When installing the outdoor unit in a location affected by strong wind, pay special attention to the following items.
- If strong wind whose velocity is 11 mph or more blows to the outdoor unit from the air outlet side, the air flow rate of the outdoor unit is reduced, the outlet air is sucked again (short-circuit), and the following effect may be caused:
  - The capacity is deteriorated.
  - The adhered frost increases during heating operation.
  - The operation is stopped by pressure rise.
- If excessive strong wind continuously blows from the air outlet side of the outdoor unit, the fan may rotate in the reverse direction at high speed, and lead to damage. Install the outdoor unit in reference to the following figures.

• Position the air outlet side toward the building wall, fence or windbreak screen.



(Secure the space for installation and servicing.)

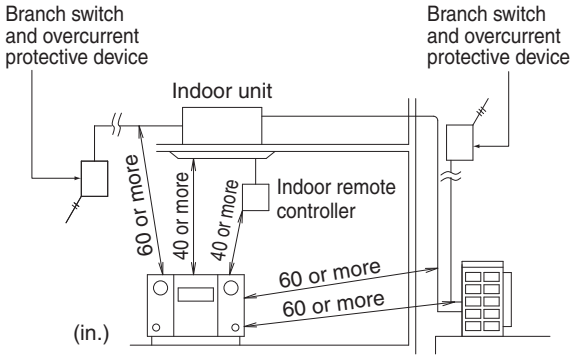
• Let the air outlet direction face be at right angles to the wind direction.



(3) When installing the outdoor unit in a location with heavy snowfall, pay special attention to the following items:
- Prepare strong foundation.
- Attach the snow hood (optional accessory).
- Remove the suction grill on the rear so that snow will not be accumulated in the rear fin.

(4) When there is a possibility of short-circuit depending on the ambient situation, use the wind direction adjusting plate (optional accessory).

(5) The inverter type air conditioner may cause noise in electric products.
When selecting an installation location, keep sufficient distance from the air conditioner units and wiring to radios, personal computers, stereos, etc. as shown in the figure below.
In areas with weak electric waves, keep a distance of 120 in. or more from the indoor remote controller, etc., put the power cables and connection cables in conduit tubes, and ground the conduit tubes.



⚠ DANGER

- Do not install unit in an area where flammable materials are present due to risk of explosion resulting in serious injury or death.
- Refrigerant is heavier than air and replaces oxygen. A massive leak could lead to oxygen depletion , especially in basements, and an asphyxiation hazard could occur leading to serious injury or death.

Installation place (unit: inch)

〈**Cautions on continuous installation**〉

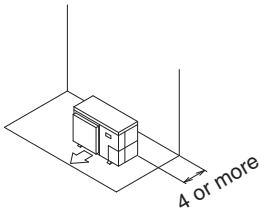
- The connection piping outlet direction in the continuous installation shown in the figures below is frontward or downward.
- When routing the piping rearward, secure space of 10 in. or more on the right side of the outdoor unit. (The unit of numeric values below is “inch”.)
- Make some space for wiring with conduit and servicing between the units.

(A) When an obstruction is present on the air inlet side

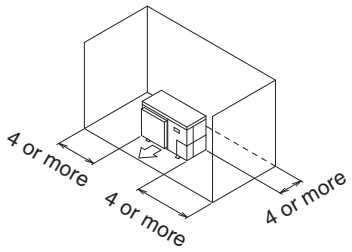
- **When the upward area is open**

(1) When one outdoor unit is installed individually

- When an obstruction is present only on the air inlet side

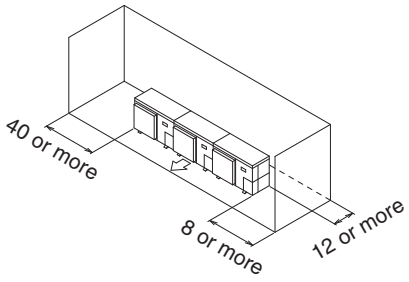


- When an obstruction is present on the both sides



(2) When two or more outdoor units are installed side by side

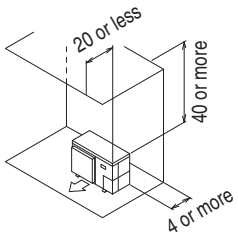
- When an obstruction is present on the both sides



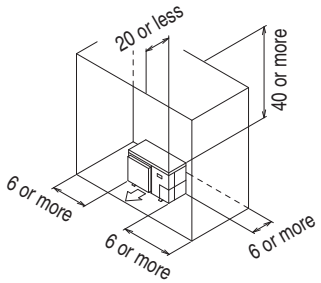
- **When an obstruction is present also in the upward area**

(1) When one outdoor unit is installed individually

- When an obstruction is present also on the air inlet side

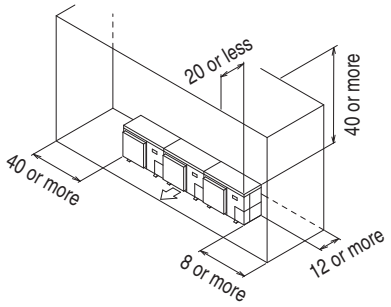


- When an obstruction is present also on the air inlet side and both sides



(2) When two or more outdoor units are installed side by side

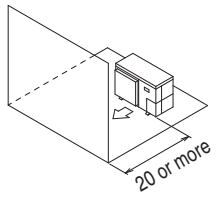
- When an obstruction is present also on the air inlet side and both sides



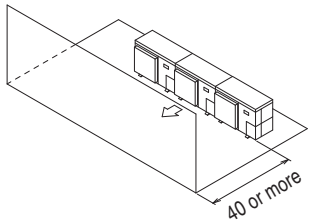
(B) When an obstruction is present on the air outlet side

- **When the upward area is open**

(1) When one outdoor unit is installed individually

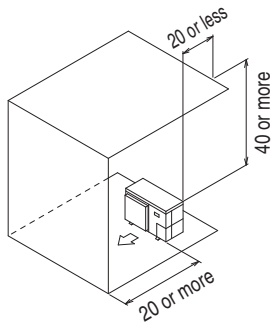


(2) When two or more outdoor units are installed side by side

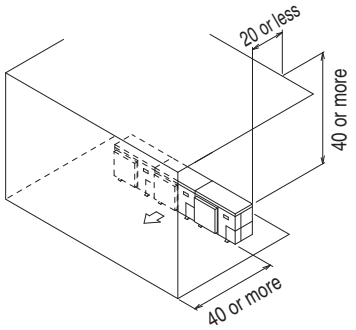


- **When an obstruction is present also in the upward area**

(1) When one outdoor unit is installed individually



(2) When two or more outdoor units are installed side by side



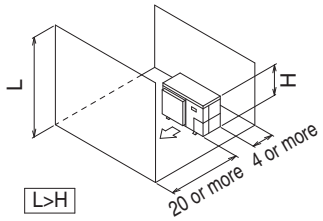
(C) When an obstruction is present on both the air inlet and air outlet sides

<Pattern 1>

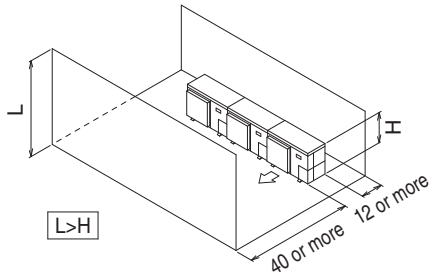
When an obstruction on the air outlet side is higher than the outdoor unit (There is no restriction in the height of obstruction on the air inlet side.)

- **When the upward area is open**

(1) When one outdoor unit is installed individually

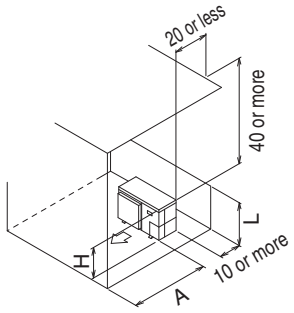


(2) When two or more outdoor units are installed side by side



- **When an obstruction is present also in the upward area**

(1) When one outdoor unit is installed individually



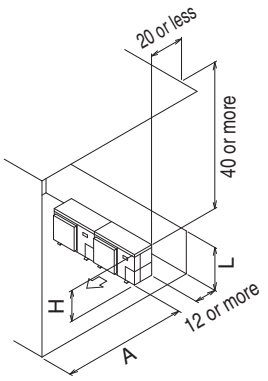
The dimensional relationship between H, L and A is as shown in the table below.

	L	A
L ≤ H	0 < L ≤ 1/2H	30
	1/2H < L ≤ H	40
H < L	**Install the frame to achieve "L ≤ H".**	

⚠ NOTE

- Close the area under the frame so that the outlet air does not bypass there.

(2) When only two outdoor units are installed side by side



The dimensional relationship between H, L and A is as shown in the table below.

	L	A
L ≤ H	0 < L ≤ 1/2H	40
	1/2H < L ≤ H	50
H < L	**Install the frame to achieve "L ≤ H".**	

NOTE

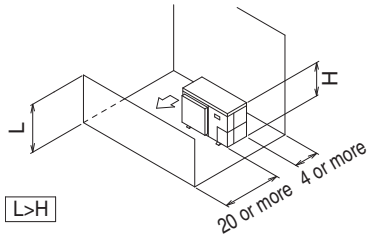
1. Close the area under the frame so that the outlet air does not bypass there.
2. Only two outdoor units can be installed side by side.

<Pattern 2>

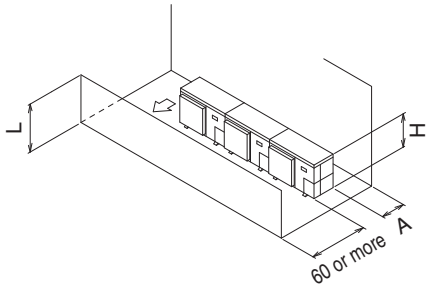
When an obstruction on the air outlet side is lower than the outdoor unit (There is no restriction in the height of obstruction on the air inlet side.)

- **When the upward area is open**

(1) When one outdoor unit is installed individually



(2) When two or more outdoor units are installed side by side

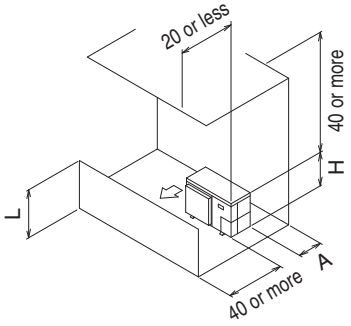


The dimensional relationship between H, L and A is as shown in the table below.

L	A
0 < L ≤ 1/2H	10
1/2H < L ≤ H	12

- **When an obstruction is present also in the upward area**

(1) When one outdoor unit is installed individually



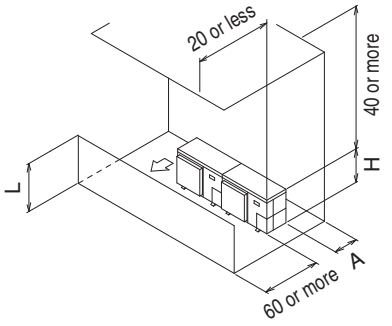
The dimensional relationship between H, L and A is as shown in the table below.

	L	A
L ≤ H	0 < L ≤ 1/2H	4
	1/2H < L ≤ H	8
H < L	**Install the frame to achieve "L ≤ H".**	

NOTE

- Close the area under the frame so that the outlet air does not bypass there.

(2) When only two outdoor units are installed side by side



The dimensional relationship between H, L and A is as shown in the table below.

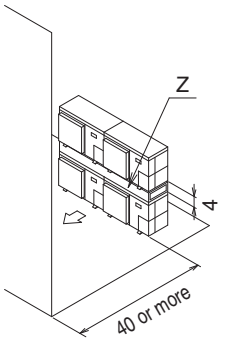
	L	A
L ≤ H	0 < L ≤ 1/2H	10
	1/2H < L ≤ H	12
H < L	**Install the frame to achieve "L ≤ H".**	

NOTE

1. Close the area under the frame so that the outlet air does not bypass there.
2. Only two outdoor units can be installed side by side.

(D) When outdoor units are stacked

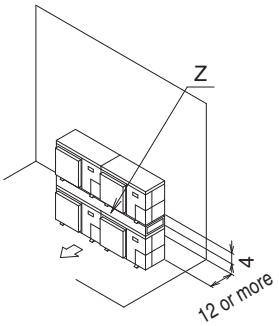
(1) When an obstruction is present on the air outlet side



NOTE

1. Only two outdoor units can be stacked.
2. About 4 in. is required as the drain piping size for the upper outdoor unit.
3. Close the area Z (gap between the upper outdoor unit and the lower outdoor unit) so that the outlet air does not by-pass there.

(2) When an obstruction is present on the air inlet side

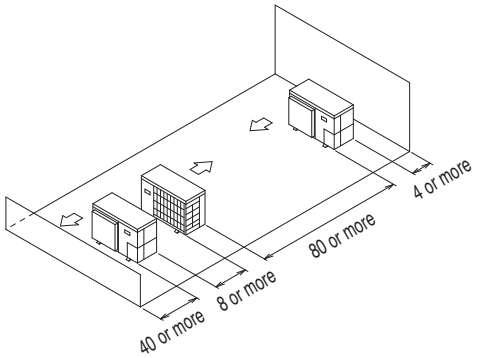


NOTE

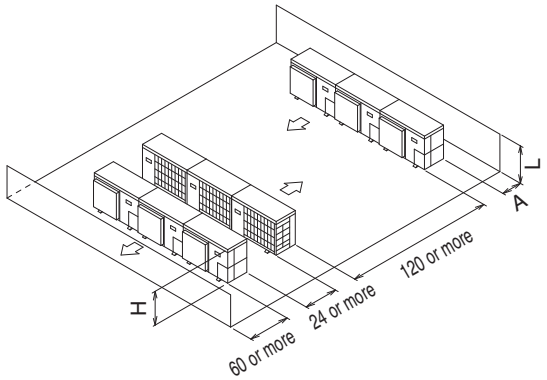
1. Only two outdoor units can be stacked.
2. About 4 in. is required as the drain piping size for the upper outdoor unit.
3. Close the area Z (gap between the upper outdoor unit and the lower outdoor unit) so that the outlet air does not by-pass there.

(E) When outdoor units are installed in rows (on the rooftop, etc.)

(1) When one outdoor unit is installed in each row



(2) When two or more outdoor units are installed side by side

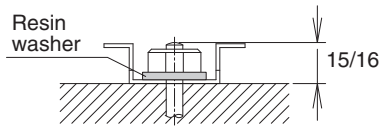


The dimensional relationship between H, L and A is as shown in the table below.

	L	A
L ≤ H	0 < L ≤ 1/2H	10
	1/2H < L ≤ H	12
H < L	**Installation is not allowed.**	

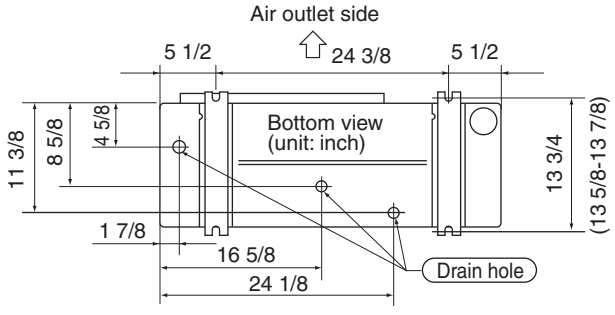
5. CAUTIONS ON INSTALLATION

- Before installation, confirm the strength and levelness of the foundation so that vibrations and noise are not generated.
- Fix the outdoor unit securely on a rigid base with foundation bolts as shown in the foundation drawing below.
  (Prepare 4 sets of commercially available M12-type or equivalent foundation bolts, nuts and washers.)
- Use resin washers to prevent the paint from being scratched off and rusting.
- The foundation bolts should be protruded by 15/16 in.
  (Refer to figure)



〈〈**Drain treatment**〉〉

- In a location where drain from the outdoor unit may cause troubles (for example, where drainage may splash on general passersby), perform the drain piping work using the drain plug (optional).
- For drain treatment, space of at least 4 in. is required under the bottom frame of the outdoor unit.
- In the drain piping work, make sure that drainage is discharged securely.
  (When routing the piping downward, check for water leakage.)



6. REFRIGERANT PIPING WORK

⚠ CAUTION

<To piping technician>

- **Make sure to open the stop valves after finishing the piping work. (Refer to the table shown in " 6-7 Additional refrigerant charge".)**
  (Operating the air conditioner with the stop valve shut may damage the compressor.)
- Use R410A to add refrigerant. (The R410A refrigerant cylinder has a pink stripe painted around it.)
  All field piping must be installed by a licensed refrigeration technician and must comply with relevant local and national regulations.
- **BRAZING REFRIGERANT PIPING**
  Do not use flux when brazing copper-to copper refrigerant piping.
  (Particularly for the HFC refrigerant piping) Therefore, use the phosphor copper brazing filler metal (BCuP) which does not require flux.
  (Flux has an extremely negative effect on refrigerant piping systems. For instance, if chlorine based flux is used, it will cause pipe corrosion. Flux containing fluorine will damage refrigeration oil.)

⚠ NOTE

- Maximum piping length between the outdoor and indoor unit:

Indoor unit	FAQ FCQ FHQ	FTQ
Max. piping length	164 ft.	98 ft.

- Installation tools:
  Make sure to use installation tools (gauge manifold charge hose, etc.) that are exclusively used for R410A installations to withstand the pressure and to prevent foreign materials (e.g. mineral oils such as SUNISO and moisture) from mixing into the system.
  (The screw specifications differ for R410A and R407C.)
  Vacuum pump (use a 2-stage vacuum pump with a non-return valve):
  1. Make sure the pump oil does not flow oppositely into the system while the pump is not working.
  2. Use a vacuum pump which can evacuate to –14.6 psi.

6-1 Selection of piping material

1. Foreign materials inside pipes (including oils for fabrication) must be 0.14gr/10ft. or less.
2. Use the following material specification for refrigerant pipping:
   - Construction material: Phosphoric acid deoxidized seamless copper for refrigerant.
   - Size: liquid pipe: ϕ3/8"
     gas pipe: ϕ5/8"

6-2 Protection of piping

- Protect the piping to prevent moisture and dusts from coming into the piping.
- Especially, pay attention when passing the piping through a hole or connecting the end of piping to the outdoor.

Location	Working period	Protection method
Outdoor	1 month or more	Pinch pipes
	Less than 1 month	Pinch or tape pipes
Indoor	Regardless of period	

6-3 Piping connection

- **For handling of stop valves, refer to "Stop valve operation method" in "6-7 Additional refrigerant charge".**
- **Only use the flare nuts attached to the stop valves. Using different flare nuts may cause the refrigerant to leak.**
- **Be sure to perform a nitrogen blow when brazing.**

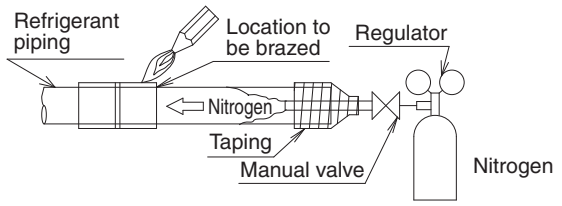
(Brazing without performing nitrogen replacement or releasing nitrogen into the piping will create large quantities of oxidized film inside the pipes, adversely affecting valves and compressor in the refrigerating system and preventing normal operation.)

⚠ DANGER

- Use of oxygen could cause an explosion resulting in severe injury or death. Only use nitrogen gas.
- Refrigerant gas may produce toxic gas if it comes in contact with fire such as from a fan heater, stove or cooking device. Exposure to this gas could cause severe injury or death.

⚠ NOTE

- When brazing with blowing nitrogen, set the nitrogen pressure to 2.9 psi or less by using a pressure reducing valve.



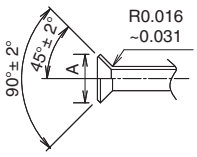
⚠ CAUTION

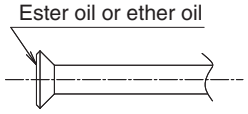
- Do not use anti-oxidants when brazing.
  Residue can clog pipes and break the unit.

◎ Do not let any refrigerant other than the specified refrigerant enter the refrigerant system.
◎ Do not let any gas such as air enter the refrigerant system.

〈**Precautions when connecting the piping**〉

- See the following table for flare dimensions.
- When connecting the flare nuts, apply refrigeration oil to the inside of the flares and turn them three or four times at first. (Use ester oil or ether oil.)
- See the following table for tightening torque. (Applying too much torque may cause the flares to crack.)
- After connecting all the piping perform a gas leak check by using nitrogen.

Pipe size	Tightening torque (ft·lbf)	Flare dimension A (in.)	Flare shape (in.)
ϕ3/8”	24.1 - 29.4	0.504 - 0.520	
ϕ5/8”	45.6 - 55.6	0.760 - 0.776	



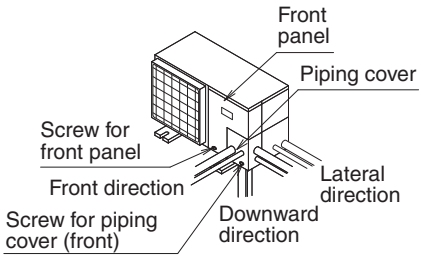
- If you are obliged to install the unit without a torque wrench, you may follow the installation method mentioned below. After the work is finished, make sure to check that there is no gas leak.
- When you keep on tightening the flare nut with a spanner, there is a point where the tightening torque suddenly increases.
  From that position, further tighten the flare nut the angle shown below.

Pipe size	Tightening angle (Guideline)	Recommended arm length of tool (in.)
ϕ3/8”	60°~90°	Approx. 7 7/8
ϕ5/8”	30°~60°	Approx. 11 13/16

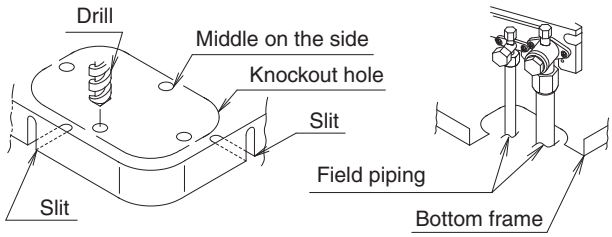
Disposal requirements
Dismantling of the unit, treatment of the refrigerant, oil and eventual other parts should be comply the relevant local and national regulations.

6-4 Refrigerant piping work procedure

◎ The field piping can be connected in three directions.



◎ When connecting the piping downward, remove the knockout hole by making four holes in the middle on the each side of the knockout hole with a drill.



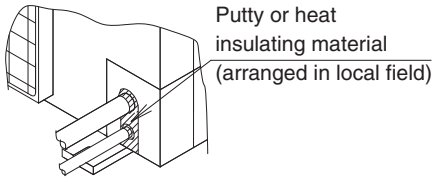
Then cut out the corner of the bottom frame along the slits (in two positions) by using a hacksaw.
◎ After removing the parts, it is recommended to apply repair paint on the edges, to prevent rusting.

Cautions on connecting the connection piping

- When it is expected that water condensed in the stop valve will reach the indoor unit through the gap between the heat insulating material and the piping (for example, when the outdoor unit is installed in a higher position than the indoor unit), take proper action such as caulking the connection area.

[Measures to prevent invasion of small creatures and litter]

- Block all gaps in the piping penetration areas with putty or heat insulating material (arranged in the local field) as shown in the figure below.
  (If small creatures such as insects or litter enter the outdoor unit, a short-circuit may be caused inside the control box.)



6-5 Heat insulation of piping

- Make sure to insulate the field piping (on both the liquid line and gas line) and refrigerant branching kit.
  (If they are not insulated, water leakage may be caused.)

  (The maximum temperature of the piping on the gas line is about 248 °F during heating operation. Use an insulation sufficiently resistant to this temperature.)

- Reinforce the refrigerant piping according to the installation environment. If it is not reinforced, condensate may form on the surface of the insulation.

⚠ WARNING

- Make sure to insulate the field piping up to the piping connection area inside the unit. If the piping is exposed, dew condensation and burn by contact may be caused.

6-6 Airtight test and vacuum drying

The unit has been checked for leaks by the manufacturer. Confirm that the valves are firmly closed before airtight test or vacuumdrying.
To prevent entry of any impurities and insure sufficient pressure resistance, always use the special tools dedicated for R410A.

Perform the following inspections securely after the piping work.

- **Airtight test** - Make sure to use nitrogen gas. (For the service port position, refer to the figure in “**Stop valve operation method**”.)
  [Procedure] Pressurize the air conditioner from the liquid pipe and gas pipe up to 450 psi (Make sure not to exceed 450 psi). When the pressure does not drop for 24 hours, the piping work shall be accepted.
  If the pressure drops, check for leakage positions. (Confirm that there is no leakage, then release nitrogen.)

- **Vacuum drying** - Use a vacuum pump which can evacuate up to –14.6 psi or less.
  [Procedure] Operate the vacuum pump for evacuation for 2 hours or more using both liquid pipe and gas pipe until the vacuum pressure reaches –14.6 psi or less. Leave the air conditioner at –14.6 psi or less for 1 hour or more, and confirm that the vacuum pressure indicated by the vacuum gage does not increase.
  (If the vacuum pressure increases, the system may contain moisture or have leakage.)

If there is a possibility of moisture remaining in the piping (for example, when there is a possibility of dew condensation inside the piping because the piping work was performed in the rainy season or over a long period of time, or when rainwater may have entered the piping during the work)
Perform evacuation described above for 2 hours (vacuum drying), pressurize the air conditioner up to 7 psi (vacuum break) with nitrogen gas, then evacuate the air conditioner using the vacuum pump for 1 hour to achieve –14.6 psi or less (vacuum drying).
(If the vacuum pressure does not reach –14.6 psi or less even after evacuation for 2 hours or more, repeat vacuum break and vacuum drying.) Leave the air conditioner in the vacuum status for 1 hour or more, and confirm that the vacuum pressuree indicated by the vacuum gauge does not increase.

6-7 Additional refrigerant charge

⚠ WARNING

- To avoid injury always use protective gloves and eye protection when charging refrigerant.
- To avoid injury do not charge with unsuitable substances. Use only the appropriate refrigerant.

⚠ NOTE

- Refrigerant cannot be charged until field wiring has been completed.
  Refrigerant may only be charged after performing the airtight test and the vacuum drying (see above).
  When charging refrigerant into the system, take care that its maximum allowable charge is never exceeded, in view of the danger of liquid hammer.
  Refrigerant containers shall be opened slowly.
  To avoid compressor breakdown, do not charge the refrigerant more than the specifed amount to raise the condensing pressure.

- This outdoor unit is factory charged with refrigerant.
- Charge the additional refrigerant calculated by the formula below.

Additional charging amount	=	Liquid piping length × 0.036	+	Additional charging depended on type of indoor unit
(lb.)		(ft.)×0.036		A (lb.)

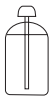
Indoor unit	FAQ FCQ FHQ	FTQ
Additional charging A (lb.)	0	1.54

Record the additional amount to the label stuck on the back of front panel.

- Charge the refrigerant to the liquid pipe in its liquid state. Since R410A is a mixed refrigerant, its composition changes if charged in a state of gas and normal system operation would no longer be assured.
- Before filling, check whether the tank has a siphon attached or not.

How to fill a tank with a siphon attached.

Fill with the tank upright.
(There is a siphon tube inside, so there is no need to turn the tank upside-down.)

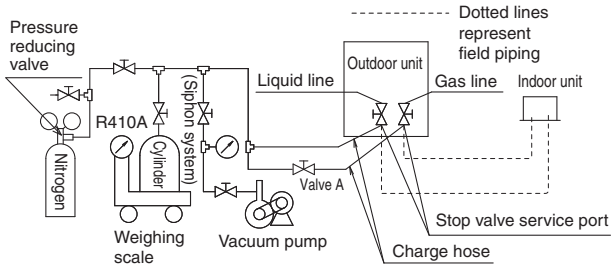


Other ways of filling the tank

Fill with the tank upside-down.



- After the vacuum drying is finished, charge the additional refrigerant in its liquid state through the liquid stop valve service port.
  Taking into account following instructions:
  1. Check that gas and liquid stop valves are closed.
  2. Charge the specified amount of refrigerant.
- If the outdoor unit is not in operation and the total amount cannot be charged, follow the procedures for additional refrigerant charge shown below.
- Make sure to use installation tools you exclusively use on R410A installations to withstand the pressure and to prevent foreign materials from mixing into the system.
- Procedures for charging additional refrigerant.



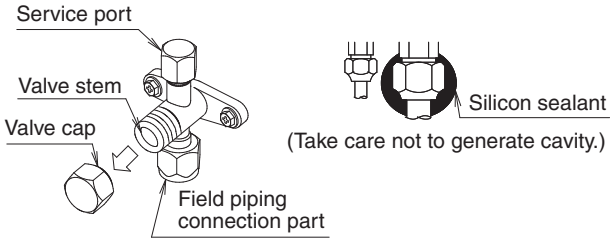
See the “Cautions on service” label on the back of the front panel for the settings for operation after replenishing refrigerant.

1. Open the gas line stop valve (leaving the liquid line stop valve, valve A in the diagram above, close) and perform the operation to add the refrigerant.
2. Once the appropriate amount of refrigerant is in, press the confirmation button (BS3) on the outdoor unit PC board (A2P), and stop operation.
3. Open the stop valves quickly (both liquid and gas line valves).
   (This must be done quickly to avoid the possibility that the pipe might burst.)

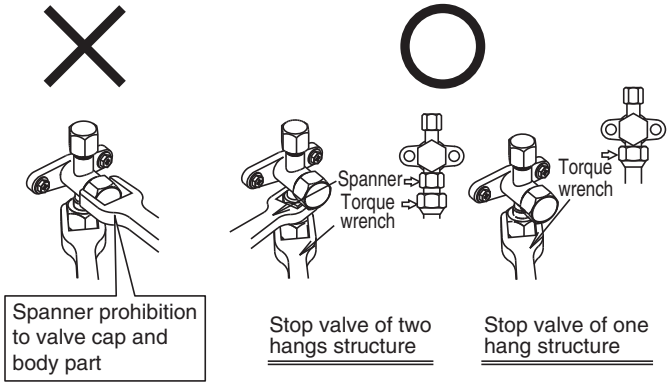
Stop valve operation

Cautions on handling the stop valve

- The figure below shows the name of each part required in handling the stop valve. At the time of shipment, the stop valve is closed.



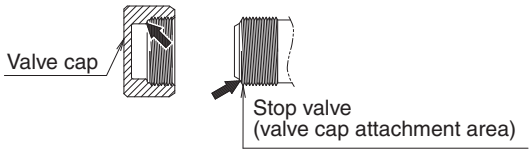
- If only a torque wrench is used to loosen or tighten the flare nut, the side plate may be distorted. Make sure to fix the stop valve with a spanner, then loosen or tighten the flare nut with a torque wrench.



- When it is expected that the operating pressure will be low (for example, when cooling will be performed while the outside air temperature is low), seal sufficiently the flare nut in the stop valve on the gas line with silicon sealant to prevent freezing.

Cautions on handling the valve cap

- The valve is sealed in the arrow area. Take care not to damage the arrow area.



- After handling the valve, make sure to tighten the valve cap securely.

Liquid line	Gas line
10.0~12.2 ft·lbf	16.6~20.3 ft·lbf

Cautions on handling the service port

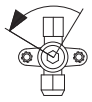
- Use charge hose equipped with push in the work.
- After the work, make sure to tighten the valve cap securely. Tightening torque.....8.5~10.3 ft·lbf

[Stop valve operation method]
Prepare hexagon wrenches (whose size is 4 mm and 6 mm).

How to open the stop valve
1. Insert a hexagon wrench into the valve stem, and turn the valve stem counterclockwise.
2. When the valve stem cannot be turned any more, stop turning. Now, the valve is open.

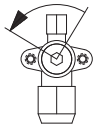
How to close the stop valve
1. Insert a hexagon wrench into the valve stem, and turn the valve stem clockwise.
2. When the valve stem cannot be turned any more, stop turning. Now, the valve is closed.

Opening direction



<Liquid line>

Opening direction



<Gas line>

7. ELECTRIC WIRING WORK

⚠ DANGER

- Do not ground units to water pipes, telephone wires or lightning rods because incomplete grounding could cause a severe shock hazard resulting in severe injury or death, and to gas pipes because a gas leak could result in an explosion which could lead to severe injury or death.

⚠ WARNING

- Disconnect all power to unit to avoid possible electric shock during installation.
- Use only specified wire and connect wires to terminals tightly. Be careful that wires do not place external stress on terminals. Keep wires in neat order so as to not to obstruct other equipment. Incomplete connections could result in overheating, and in worse cases, electric shock or fire. For the details, refer to "**7-3 Power supply wiring connection procedure**".

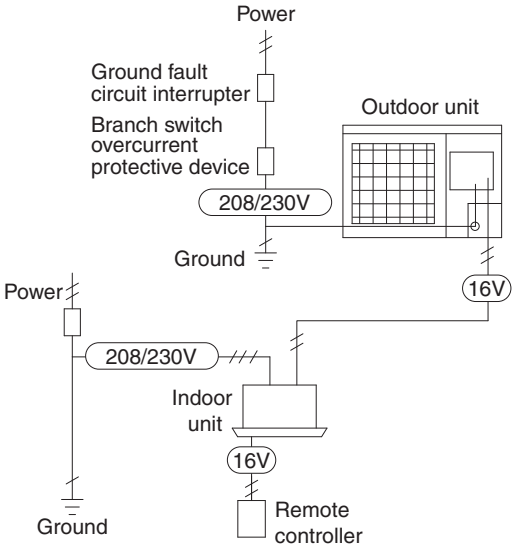
⚠ CAUTION

<To electrician>
- Do not operate the air conditioner until the refrigerant piping work is completed. (Operating the air conditioner before the refrigerant piping work is completed may damage the compressor.)
- Install a ground fault circuit interrupter. (The inverter is provided in the air conditioner. In order to prevent malfunction of the ground fault circuit interrupter itself, use a breaker resistant to higher harmonics.)

- Electricians having sufficient knowledge should perform the electric wiring work. All wiring must comply with local electrical codes and National Electrical Code (NEC).

- Perform the electric wiring work in accordance with the "electric wiring diagram label".
  Make sure to turn OFF the branch switch and overcurrent protective device before starting the work.
- Perform grounding to the indoor unit and outdoor unit.
- Use only copper wires.
- Make sure to turn the power off before starting the electric wiring work.
  Do not turn ON any switch until the work is completed.
- The outdoor unit has an inverter which generates noise and charges the outer casing with the leakage current. The outdoor unit should be grounded so that the effect of the generated noise on other equipment can be reduced, and that the outer casing can be discharged.
- As this unit is equipped with an inverter, installing a phase advancing capacitor will not only reduce the power factor improvement factor, but may also cause the capacitor to overheat due to high-frequency waves. Therefore, never install a phase advancing capacitor.
- Never push excessive electric wires into the units.
- Protect electric wires with conduit tubes or vinyl tubes so that they will not be damaged by edges of knockout holes.
- Fix electric wires with clamps as accessories so that they will not come to contact with pipes and stop valves.
  (Refer to "**7-3 Power supply wiring connection procedure**".)

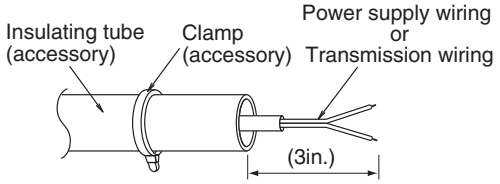
7-1 Connection example of whole system wiring



7-2 Routing power supply wiring and transmission wiring

Let the power supply wiring with a conduit pass through one of the knockout holes on the front or side cover, and let the transmission wiring with a conduit pass through another knockout hole.

- For protection from uninsulated live parts, thread the power supply wiring or the transmission wiring through the included insulating tube and secure it with the included clamp.



〈**Precautions when knocking out knockout holes**〉

- To punch the knockout hole, hit it with a hammer.
- After removing the knockout hole, it is recommended that the edges should be painted to prevent rusting.

⚠ CAUTION

- Use conduit for both the power supply wiring and transmission wiring.
- Outside the unit, make sure to keep the wirings 5 inches away.
  Otherwise, the outdoor unit may be affected by electrical noise (external noise), and malfunction or fail.
- Be sure to connect the power supply wiring to the terminal block and secure it as described in "7-3 Power supply wiring connection procedure".
- Fix the wiring between the units in accordance with "7-4 Transmission wiring connection procedure".
- Secure the wirings with the clamps (accessory) so that do not touch the piping.
- Make sure the wirings will not be pinched by the front panel, and close the panel firmly.
- Route the conduit along the unit by using a elbow socket and so on to prevent it from being stepped on.

7-3 Power supply wiring connection procedure

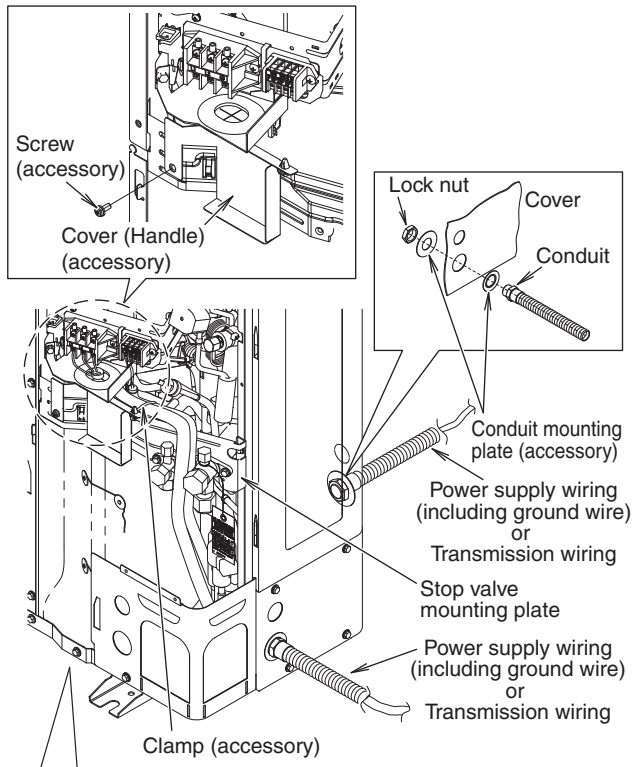
⚠ WARNING

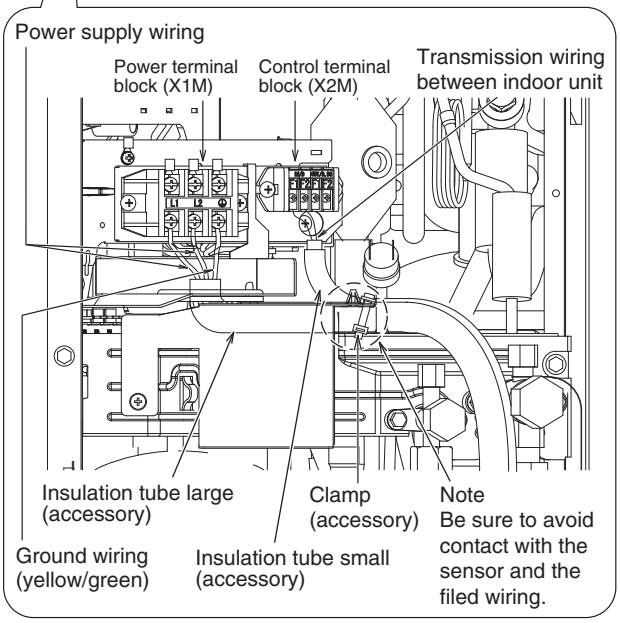
- Never connect power supply wiring to the terminal block for remote controller wiring as this could damage the entire system.

Install a ground fault circuit interrupter.

- It is obliged to install a ground fault circuit interrupter to prevent electric shock and fire accident.

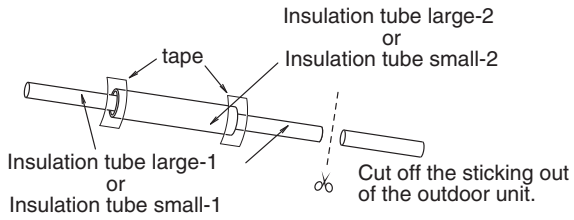
Model	Phase and frequency	Voltage	Max.Overcurrent Protective Device	Min. Circuit Amps.
RZQ18PVJU RZR18PVJU	~ 60Hz	208/230V	20A	16.5A
RZQ24PVJU RZR24PVJU				
RZQ30PVJU RZR30PVJU				





How to Insulation tube.

- Use the insulation tube large to cover the power supply wiring.
  Use the insulation tube small to cover the transmission wiring.
- Joint the insulation tube with the tape and cut off the tube sticking out of the outdoor unit.

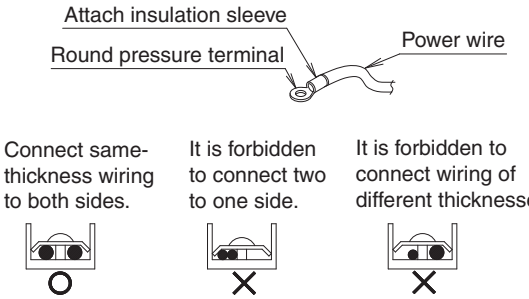


⚠ CAUTION

- After finishing the electric wiring work, confirm that all the wirings are connected securely.

〈〈**Precautions when laying power wiring**〉〉

- Two electric wires of different thickness cannot be connected to the power terminal block.
  (Slack in the electric wires may generate abnormal heat.)
- Use round pressure terminals with insulting sleeve for connection to the power terminal block.
  If such terminals are not available for unavoidable reasons, connect an electric wire of the same thickness to each side as shown in the figure.



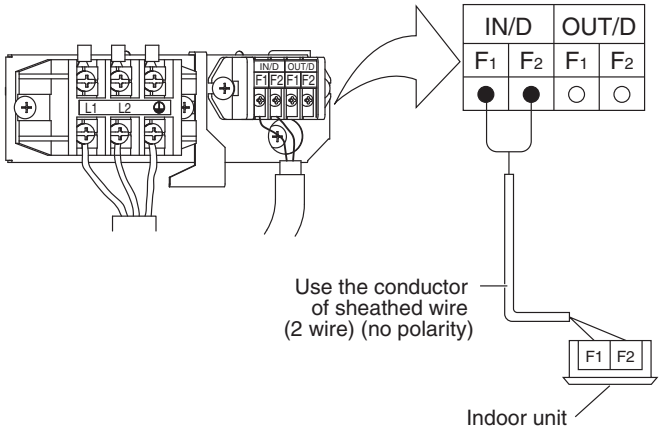
Make sure to observe the following items. If they are not observed, abnormal heat may be generated by slack in electric wires, etc.

- For wiring, use the designated power wire and connect firmly, then secure to prevent outside pressure being exerted on the terminal board.
- Use an appropriate screwdriver for tightening the terminal screws.
  A screwdriver with a small head will strip the head and make proper tightening impossible.
- Over-tightening the terminal screws may break them.
- See the table below for tightening torque for the terminal screws.

Tightening torque (ft·lbf)		
M5	(Power supply and ground terminal block)	1.76 ~ 2.15
M4	(Shielded ground)	0.87 ~ 1.06
M3.5	(Transmission wiring terminal block)	0.58 ~ 0.72

7-4 Transmission wiring connection procedure

- **If an excessive force is applied while connecting a cable to the terminal block on the PC board, the PC board may be damaged.**



⚠ CAUTION

- For low-noise operation, it is necessary to install the optional "External control adaptor for outdoor unit".
  For details, see the installation manual attached to the adaptor.

Caution on the wiring length between units

Make sure to observe the restrictions below. If they are not observed, transmission error may occur.
Maximum wiring length: 3280 ft.

Cautions on the wiring between units

- Never connect 208/230V to the terminal block for the transmission wiring.
  Doing so will break the entire system.
- The transmission wiring from the indoor unit must be connected to the F1/F2 (TO IN/D UNIT) terminals on the PC board in the outdoor unit.

∗ Make sure to use sheathed two-core cables of AWG18-16 in the wiring shown above.

∗ **All cables used in the wiring between the units should be procured on the site.**

8. CHECKS AFTER COMPLETION OF WORK

After completing the work, make sure to confirm the following items:

1. Connection of drain piping and removal of transport fittings:
   Refer to "**5. CAUTIONS ON INSTALLATION**".
2. Connection of power supply wiring and tightening of screws:
   Refer to "**7-3 Power supply wiring connection procedure**".
3. Connection of transmission wiring and tightening of screws:
   Refer to "**7-4 Transmission wiring connection procedure**".
4. Freezing connection of refrigerant piping
   Refer to "**6. REFRIGERANT PIPING WORK**".
5. Piping size and heat insulation:
   Refer to "**6-1 Selection of piping material**", "**6-5 Heat insulation of piping**".
6. Check of stop valve:
   Confirm that the stop valve is open on both the liquid line and gas line.
7. Record of amount of additional refrigerant:
   Record the amount on the label stuck on the back of the front panel.
8. Measurement of insulation in main power circuit:
   - Use the megatester for 500 V.
   - Do not use any megatester for low voltage electric circuits except 230 V.
     (Wiring between the outdoor unit and the indoor unit)

⚠ CAUTION

<To piping technician>

- Make sure to open the stop valve after finishing the piping work.
  (Operating the air conditioner with the stop valve shut may damage the compressor.)

9. TEST RUN PROCEDURE

A crankcase heater is mounted for smooth startup. Make sure to turn on the power 6 hours before starting operation for supplying the power to the crankcase heater.

⚠ WARNING

- Make sure to close the front panel before leaving the outdoor unit in the power ON status.
- To avoid injury, always make sure that the overcurrent protective device on the power supply panel of the installation is switched off before doing any work.

Cautions before turning on the power

- **Put the insulating cover securely onto the control box.**
- **After turning on the power, check the settings and LED indicators on the PC board (A1P) in the outdoor unit through the opening of the insulating cover.**

9-1 Power on and check operation

- Make sure to perform the check operation after installation.
  (If the air conditioner is operated using the indoor remote controller without performing the check operation, the malfunction code "U3" is displayed in the indoor remote controller, and normal operation is disabled.)

- In the check operation, the status of the outdoor unit is checked, and incorrect wiring is checked for.

(1) • Close the front panel of the outdoor unit.
• Turn ON the power to the outdoor unit and indoor unit.

⚠ Caution Make sure to turn on the power 6 hours before starting operation for supplying the power to the crankcase heater.

(2) • Open the front panel of the outdoor unit.
• Check the LED on the PC board (A1P and A2P) in the outdoor unit to see if the data transmission is performed normally.

The power is supplied to the outdoor unit. Take due care during the work to prevent electric shock.

	A1P	A2P						
LED display (Default status before delivery)	SERVICE MONITOR	MODE	TEST/HWL	IND	MASTER	SLAVE	L.N.O.P.	DEMAND
	HAP	**H1P**	**H2P**	**H3P**	**H4P**	**H5P**	**H6P**	**H7P**
Outdoor unit installed	◑	●	●	○	●	●	●	●

LED display: ● OFF ○ ON ◑ Blinking

(3) • When performing the low-noise operation (L.N.O.P.) or demand (DEMAND) operation upon request from the customer, perform the setting using the pushbutton switches (BS1 to BS5) on the PC board (A2P) in the outdoor unit.
• Press each pushbutton switch from the opening of the insulation cover. (Do not remove the insulation cover.)

- The power is supplied to the outdoor unit. Take due care during the work to prevent electric shock.
- Before using the pushbutton switches (BS1 to BS5) for setting, confirm that the microcomputer (SERVICE) monitor is lit.
- For the setting method, refer to the [Cautions on service] label attached on the back of the front panel of the outdoor unit. (Make sure to write the contents of setting on the [Cautions on service] label.)

(4) Confirm that the stop valves are open on both the liquid and gas lines. If they are closed, open them.

⚠ Caution Do not leave any stop valve closed. Otherwise the compressor will fail.

(5) Press and hold the test run button (BS4) for 5 seconds or more to start the check operation. For the details, refer to the **Check operation procedure** on the [Cautions on service] label.

- When leaving the outdoor unit during the check operation for unavoidable reasons, ask another installation worker to watch the outdoor unit, or close the front panel.
- The system operates the check operation for about 15 minutes (30 minutes maximum), then stops automatically. The system can start normal operation about 5 minutes after the check operation if the remote controller does not display any malfunction code.
- During the check operation, the status under execution is indicated on the remote controller.

(6) After the check operation, make sure to close the front panel of the outdoor unit.

<Cautions on check operation>

- If the air conditioner is started within about 12 minutes after the power of the indoor/outdoor unit is turned on, the H2P indicator lights and the compressor does not run. Confirm that the LED status is as shown in the table in (2) in "**9-1 Power on and check operation**" before starting the air conditioner.
- The air conditioner may require about 10 minutes maximum until it can start the compressor after start of operation. This period of time is required to homogenize the refrigerant status, and does not indicate any failure.
- The check operation does not provide any means of checking the indoor unit individually. For that purpose, perform the normal operation using the remote controller after finishing the check operation.
- The check operation is not available in any other mode such as the recovery mode.
- Before running a check on the unit, changing the indoor remote controller settings might cause the error code "UF" to be displayed and prevent a proper check to be run.

9-2 Checks in normal operation

- After finishing the check operation, operate the air conditioner normally. (Heating is not available if the outside air temperature is 75 °F or more. Refer to the operation manual supplied together with the unit.) (Heating is only available for RZQ-P models.)
- Confirm that the indoor and outdoor units are operating normally. (If a knocking sound is heard in the liquid compression of the compressor, stop the air conditioner immediately and energize the crankcase heater for a sufficient period of time, then start the operation again.)
- Check to see if cold (or hot) air is coming out of the indoor unit.
- Press the fan direction button and fan speed control button on the remote controller to see if the fan is operating normally.

<Cautions for normal operation check>

- Once stopped, the compressor will not start for about 5 minutes even if the "**ON/OFF**" button on the remote controller is pressed.
- When the system operation is stopped by the remote control, the outdoor unit may continue to operate for a further 3 minutes.
- If the system has not undergone the check operation by the test run button since it was first installed, a malfunction code "U3" is displayed. In this case, perform the check operation by referring to "**9-1 Power on and check operation**".

When a malfunction code is displayed in the remote controller

(Check a malfunction code in the remote controller connected to the indoor unit.)

Malfunction code	Cause	Solution
E3	The stop valves in the outdoor unit remain closed.	Open the stop valve on both the gas and liquid lines.
	The refrigerant is overcharged.	Calculate again the required amount of refrigerant to be charged based on the piping length, recover the refrigerant using the refrigerant recovery device, then achieve proper amount of refrigerant.
E4 F3	The stop valves in the outdoor unit remain closed.	Open the stop valve on both the gas side and liquid side.
	The operation mode on the remote controller was changed before the check operation.	Set the operation mode on all indoor unit remote controllers to “cooling.”
	The refrigerant is insufficient.	• Check whether additional refrigerant charge has been finished correctly. • Calculate again the required amount of refrigerant to be charged based on the piping length, then charge additionally proper amount of refrigerant.
F6	The refrigerant is overcharged.	Calculate again the required amount of refrigerant to be charged based on the piping length, recover the refrigerant using the refrigerant recovery device, then achieve proper amount of refrigerant.
U3	The check operation has not performed.	Perform the check operation.
U4	The power is not supplied to the outdoor unit.	Connect correctly the power supply wiring of the outdoor unit.
UA	Improper type of indoor unit is connected.	Check the type of indoor unit currently connected. If it is not proper, replace it with proper one.
UF	The stop valves in the outdoor unit remain closed.	Open the stop valve on both the gas and liquid lines.
	The piping and wiring of the indoor unit are not connected correctly to the outdoor unit.	Confirm that the piping and wiring of the indoor unit are connected correctly to the outdoor unit.
	The operation mode on the remote controller was changed before the check operation.	Set the operation mode on indoor unit remote controller to “cooling.”
UH	The transmission wiring is not connected correctly.	Connect correctly the transmission wiring to the F1 and F2 (TO IN/D UNIT) terminals on the PC board (A1P) in the outdoor unit.

When nothing is displayed in the remote controller

- There might be a problem with the connection or transmission between the indoor unit and the remote controller. Check connections, and check for wire breakage.

⚠ CAUTION

<To piping technician>
<To electrician>
- **After finishing the test run and before using the unit by customer, confirm that the front panel and screws are attached securely to the unit.**

10. CAUTION FOR REFRIGERANT LEAKS

⚠ DANGER

- Refrigerant gas is heavier than air and replaces oxygen. A massive leak could lead to oxygen depletion, especially in basements, and an asphyxiation hazard could occur leading to serious injury or death.

(Points to note in connection with refrigerant leaks)

Introduction

The installer and system specialist shall secure safety against leakage according to local regulations or standards. The following standards may be applicable if local regulations are not available.

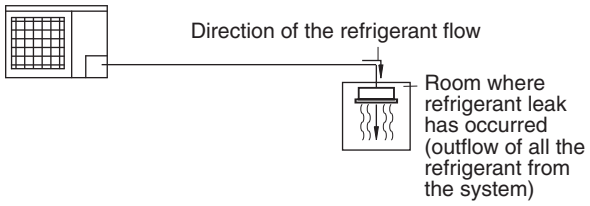
The Split System, like other air conditioning systems, uses R410A as refrigerant. R410A itself is an entirely safe non-toxic, non-combustible refrigerant. Nevertheless care must be taken to ensure that air conditioning facilities are installed in a room which is sufficiently large. This assures that the maximum concentration level of refrigerant gas is not exceeded, in the unlikely event of major leak in the system and this in accordance to the local applicable regulations and standards.

Maximum concentration level

The maximum charge of refrigerant and the calculation of the maximum concentration of refrigerant is directly related to the humanly occupied space in to which it could leak.

The unit of measurement of the concentration is lb./ft³ (the weight in lb. of the refrigerant gas in 1ft³ volume of the occupied space).

Compliance to the local applicable regulations and standards for the maximum allowable concentration level is required.



Pay a special attention to the place, such as a basement, etc. where refrigerant can stay, since refrigerant is heavier than air.

Procedure for checking maximum concentration

Check the maximum concentration level in accordance with steps 1 to 4 below and take whatever action is necessary to comply.

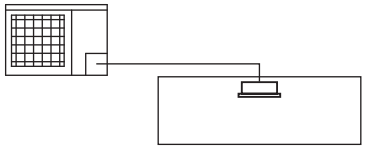
1. Calculate the amount of refrigerant (lb.) charged to each system separately.

amount of refrigerant in the unit (amount of refrigerant with which the system is charged before leaving the factory)	+	additional charging amount (amount of refrigerant added locally in accordance with the length or diameter of the refrigerant piping and type of indoor unit)	=	total amount of refrigerant (lb.) in the system

⚠ NOTE

- Where a single refrigerant facility is divided into 2 entirely independent refrigerant systems then use the amount of refrigerant with which each separate system is charged.

2. Calculate a room volume (ft^3)



3. Calculate the refrigerant concentration by using the results of the calculations in steps 1 and 2 above.

$$\frac{\text{total amount of refrigerant in the system}}{\text{volume } (ft^3) \text{ of the room in which there is an indoor unit installed}} \leq \text{maximum concentration level } (lb./ft^3)$$

4. Deal with the situations where the result exceeds the maximum concentration level.
Where the installation of a facility results in a concentration in excess of the maximum concentration level then it will be necessary to revise the system.
Please consult your dealer.

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3P281953-2A EM08A096D (1102) HT

INSTALLATION MANUAL

SPLIT SYSTEM Air Conditioner

MODELS
Wall-mounted type

FAQ18PVJU
FAQ24PVJU

English

Français

Español

Read these instructions carefully before installation.
Keep this manual in a handy place for future reference.
This manual should be left with the equipment owner.

Lire soigneusement ces instructions avant l'installation.
Concerver ce manuel à portée de main pour référence ultérieure.
Ce manuel doit être donné au propriétaire de l'équipement.

Lea cuidadosamente estas instrucciones antes de instalar.
Guarde este manual en un lugar a mano para leer en caso de tener alguna duda.
Este manual debe permanecer con el propietario del equipo.

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1. SAFETY CONSIDERATIONS

Please read these “SAFETY CONSIDERATIONS” carefully before installing air conditioning equipment and be sure to install it correctly. After completing the installation, make sure that the unit operates properly during the start-up operation.
Please instruct the customer on how to operate the unit and keep it maintained.
Also, inform customers that they should store this installation manual along with the operation manual for future reference.
This air conditioner comes under the term “appliances not accessible to the general public”.
Meaning of danger, warning, caution and note symbols.

DANGER .....Indicates an imminently hazardous situation which,if not avoided, will result in death or serious injury.

WARNING .....Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION .....Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be sued to alert against unsafe practices.

NOTE .....Indicates situation that may result in equipment or property-damage-only accidents.

⚠ DANGER

- **Do not ground the unit to water pipes, telephone wires or lightning rods as incomplete grounding could cause a severe shock hazard resulting in severe injury or death, and to gas pipes because a gas leak could result in an explosion which could lead to severe injury or death.**
- **Do not install unit in an area where flammable materials are present due to risk of explosion resulting in serious injury or death.**
- **Refrigerant gas is heavier than air and displaces oxygen. A massive leak could lead to oxygen depletion, especially in basements, and an asphyxiation hazard could occur leading to serious injury or death.**
- **If the refrigerant gas leaks during installation, ventilate the area immediately.**
  Refrigerant gas may produce toxic gas if it comes in contact with fire such as from a fan, heater, stove or cooking device. Exposure to this gas could result in severe injury or death.
- **After completing the installation work, check that the refrigerant gas does not leak.**
  Refrigerant gas may produce toxic gas if it comes in contact with fire such as from a fan, heater, stove or cooking device. Exposure to this gas could result in severe injury or death.
- **Safely dispose of the packing materials.**
  Packing materials, such as nails and other metal or wooden parts, may cause stabs or other injuries. Tear apart and throw away plastic packaging bags so that children will not play with them. Children playing with plastic bags face the danger of death by suffocation.

⚠ WARNING

- **Ask your dealer or an authorized personnel to carry out installation work. Do not try to install the unit by yourself.**
  Improper installation may result in water leakage, electric shocks or fire.
- **Perform installation work in accordance with this installation manual.**
  Improper installation may result in water leakage, electric shocks or fire.
- **Be sure to use only the specified accessories and parts for installation work.**
  Failure to use the specified parts may result in water leakage, electric shocks, fire or the unit falling.
- **Install the air conditioner on a foundation strong enough to withstand the weight of the unit.**
  A foundation of insufficient strength may result in the equipment falling and causing injuries.
- **Carry out the specified installation work after taking account of strong winds, typhoons or earthquakes.**
  Improper installation work may result in the equipment falling and causing accidents.
- **Make sure that a separate power supply circuit is provided for this unit and that all electrical work is carried out by an authorized personnel according to local laws and regulations and this installation manual.**
  An insufficient power supply capacity or improper electrical construction may lead to electric shocks or fire.
- **Make sure that all wiring is secured, the specified wires are used, and no external forces act on the terminal connections or wires.**
  Improper connections or installation may result in fire.
- **When wiring the power supply and connecting the remote controller wiring and transmission wiring, position the wires so that the electric parts box lid can be securely fastened.**
  Improper positioning of the electric parts box lid may result in electric shocks, fire or the terminals overheating.
- **Before touching electrical parts, turn off the unit.**
- **Do not touch the switch with wet fingers.**
  Touching a switch with wet fingers can cause electric shock.
- **Be sure to install an earth leakage breaker.**
  Failure to install an earth leakage breaker may result in electric shocks, or fire.
- **Do not install the air conditioner in the following locations:**
  (a) where a mineral oil mist or an oil spray or vapor is produced, for example in a kitchen. Plastic parts may deteriorate and fall off or result in water leakage.

(b) where corrosive gas, such as sulfurous acid gas, is produced. Corroding copper pipes or soldered parts may result in refrigerant leakage.
(c) near machinery emitting electromagnetic waves. Electromagnetic waves may disturb the operation of the control system and result in a malfunction of the equipment.
(d) where flammable gases may leak, where there are carbon fiber or ignitable dust suspensions in the air, or where volatile liquids such as thinner or gasoline are handled.
Operating the unit in such conditions may result in fire.

- **Heat exchanger fins are sharp enough to cut.**
  To avoid injury wear gloves to cover the fins when working around them.
- **Refrigerant pipes may be very hot or very cold during or immediately after operation.**
  Touching them could result in burns or frostbite. To avoid injury give the pipes time to return to normal temperature or, if you must touch them, be sure to wear proper gloves.

⚠ CAUTION

- **While following the instructions in this installation manual, insulate piping in order to prevent condensation.**
  Improper piping insulation may result in water leakage and property damage.
- **Be very careful about product transportation.**
  Some products use PP bands for packaging. Do not use any PP bands for a means of transportation. It is dangerous.
- **Do not turn off the power immediately after stopping operation.**
  Always wait at least five minutes before turning off the power. Otherwise, water leakage and trouble may occur.
- **Make sure to provide for adequate measures in order to prevent that the outdoor unit be used as a shelter by small animals.**
  Small animals making contact with electrical parts can cause malfunctions, smoke or fire. Please instruct the customer to keep the area around the unit clean.

⚠ NOTE

- **Install the indoor and outdoor units, power supply wiring and connecting wires at least 3.5ft. away from televisions or radios in order to prevent image interference or noise.**
  (Depending on the radio waves, a distance of 3.5ft. may not be sufficient enough to eliminate the noise.)
- **Remote controller (wireless kit) transmitting distance can result shorter than expected in rooms with electronic fluorescent lamps. (inverter or rapid start types)**
  Install the indoor unit as far away from fluorescent lamps as possible.
- **Dismantling of the unit, treatment of the refrigerant, oil and eventual other parts, should be done in accordance with the relevant local and national regulations.**

2. BEFORE INSTALLATION

- **When moving the unit while removing it from the packing case, be sure to lift it by the four hanger brackets. Aboid putting any pressure on other parts, especially, holizontal flaps, the refrigerant piping, drain piping, and other resin parts.**
- Be sure to remove a cushion (corrugated paper) located between the heat exchanger and the right air filter.
- Be sure to check the type of R410A refrigerant to be used before installing the unit. (Using an incorrect refrigerant will prevent normal operation of the unit.)
- The accessories needed for installation must be retained in your custody until the installation work is completed. Do not discard them!
- Decide upon a line of transport.
- Leave the unit inside its packaging while moving, until reaching the installation site. Where unpacking is unavoidable, use a sling of soft material or protective plates together with a rope when lifting, to avoid damage or scratches to the unit.

- For the installation of an outdoor unit, refer to the installation manual attached to the outdoor unit.
- When using the wireless remote controller, refer to the installation manual attached to the wireless remote controller.
- Do not install or operate the unit in rooms mentioned below.
  - **Laden with mineral oil, or filled with oil vapor or spray like in kitchens. (Plastic parts may deteriorate which could eventually cause the unit to fall out of place, or could lead to leaks.)**
  - **Where corrosive gas like sulfurous gas exists. (Copper tubing and brazed spots may corrode which could eventually lead to refrigerant leaks.)**
  - **Where machines can generate electromagnetic waves. (Control system may malfunction.)**
  - **Where the air contains high levels of salt such as that near the ocean and where voltage fluctuates greatly such as that in factories.**
    Also in vehicles or vessels.
- This unit, both indoor and outdoor, is suitable for installation in a commercial and light industrial environment. If installed as a household appliance it could cause electromagnetic interference.

⚠ WARNING

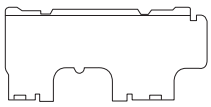
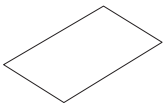
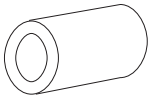
- Entrust installation to the place of purchase or an authorized serviceman. Improper installation could lead to leaks and, in worse cases, electric shock of fire.
- Use of unspecified parts could lead to the unit falling, leaks and, in worse cases, electric shock or fire.

⚠ NOTE

- Be sure to read this manual before installing the indoor unit.

2-1 ACCESSORIES

Check the following accessories are included with your unit.

Name	(1) Installation panel	(2) Attachment screws for the installation panel	(3) Paper pattern for installation	(4) Insulating tape
Quantity	1 set	9 pcs.	1 pc.	1 pc.
Shape		 M4 × 25L		

Name	(5) Clamp	(6) Securing screws	(7) Insulating tube	
Quantity	1 large 4 small	2 pcs.	1 long 1 short	
Shape		 M4 × 12L		(Other) • Operation manual • Installation manual

2-2 OPTIONAL ACCESSORIES

Remote controller type	Model
Wired type	BRC1C71
Wireless type	BRC7E818

FOR THE FOLLOWING ITEMS, TAKE SPECIAL CARE DURING CONSTRUCTION AND CHECK AFTER INSTALLATION IS FINISHED.

1. Items to be checked after completion of work

Items to be checked	If not properly done, what is likely to occur	Check
Are the indoor and outdoor unit fixed firmly?	The units may drop, vibrate or make noise.	
Is the gas leak test finished?	It may result in insufficient cooling.	
Is the unit fully insulated?	Condensate water may drip.	
Does drainage flow smoothly?	Condensate water may drip.	
Does the power supply voltage correspond to that shown on the name plate?	The unit may malfunction or the components burn out.	
Are wiring and piping correct?	The unit may malfunction or the components burn out.	
Is the unit safely grounded?	It may be dangerous at electric leakage.	
Is wiring size according to specifications?	The unit may malfunction or the components burn out.	
Is something blocking the air outlet or inlet of either the indoor or outdoor units?	It may result in insufficient cooling.	
Are refrigerant piping length and additional refrigerant charge noted down?	The refrigerant charge in the system is not clear.	

2. Items to be checked at time of delivery

* Also review the “SAFETY CONSIDERATIONS”

Items to be checked	Check
Did you explain about operations while showing the operation manual to your customer?	
Did you hand the operation manual over to your customer?	

2-3 NOTE TO THE INSTALLER

Be sure to instruct customers how to properly operate the unit (especially cleaning filters, operating different functions, and adjusting the temperature) by having them carry out operations themselves while looking at the manual.

3. SELECTING INSTALLATION SITE

(1) Select an installation site where the following conditions are fulfilled and that meets with your customer's approval.

- In the upper space (including the back of the ceiling) of the indoor unit where there is no possible dripping of water from the refrigerant pipe, drain pipe, water pipe, etc.
- Where the wall is strong enough to bear the indoor unit weight.
- Where sufficient clearance for installation and maintenance can be ensured. **(Refer to Fig. 1 and Fig. 2)**
- Where optimum air distribution can be ensured.
- Where nothing blocks the air passage.
- Where condensate can be properly drained.

- Where the wall is not significantly tilted.
- Where piping between indoor and outdoor units is possible within the allowable limit.
  (Refer to the installation manual of the outdoor unit.)
- Install the indoor and outdoor units, power supply wiring and connecting wires at least 3.5ft. away from televisions or radios in order to prevent image interference or noise.
  (Depending on the radio waves, a distance of 3.5ft. may not be sufficient enough to eliminate the noise.)
- Where the cool (warm) air reaches all across the room.

[Space required for installation (in.)]

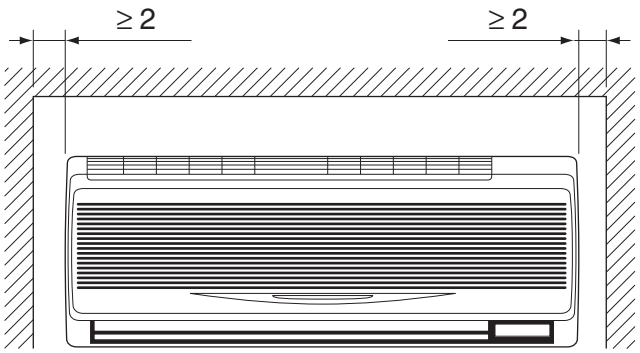


Fig. 1

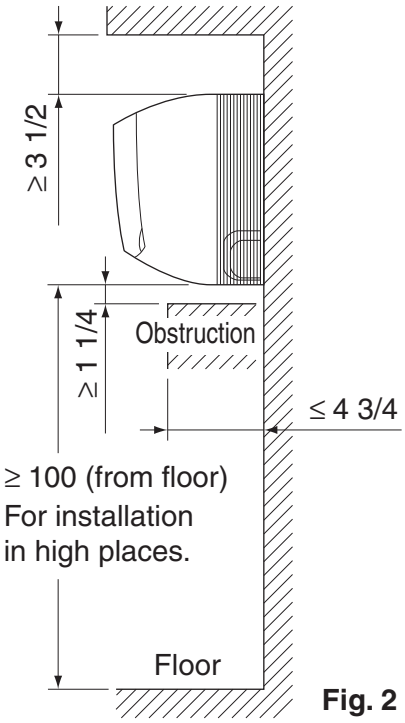


Fig. 2

(2) Consider whether the place where the unit will be installed can support the full weight of the unit, and reinforce it with boards and beams, etc. if needed before proceeding with the installation. Also, reinforce the place to prevent vibration and noise before installing.
(The installation pitch can be found on the paper pattern for installation (3), so refer to it when considering the necessity for reinforcing the location.)

(3) The indoor unit may not be directly installed on the wall. Use the attached installation panel (1) before installing the unit.

⚠ DANGER

- Do not install unit in an area where flammable materials are present due to risk of explosion resulting in serious injury or death.

⚠ WARNING

- If the supporting structural members are not strong enough to take the unit's weight, the unit could fall out of place and cause serious injury.

4. INDOOR UNIT INSTALLATION

• Use only accessories and parts which are of the designated specification when installing.

⚠ CAUTION

• Install so that the unit does not tilt to either side or forward.
• Do not hold the unit by the horizontal flaps when lifting it. (This may damage the horizontal flaps.)

(1) Open the piping through-hole.

• The refrigerant pipe and drain pipe can be passed out in one of 5 directions: left, bottom-left, back-left, bottom-right, and back-right. **(Refer to Fig. 3)**
• Using the paper pattern for installation (3), choose where to pass the piping out and open a through-hole (ϕ3 1/8") in the wall.
Open the hole so that there is a downward slope for the drain piping. (See " 6.DRAIN PIPING WORK ")

(2) Remove the installation panel (1) from the unit and attach to the wall.

(The installation panel is temporarily attached to the unit with a screw. (In case of 12 type))
(Refer to Fig. 3)

(a) Check the location for the hole using the included paper pattern for installation (3).
• Choose a location so that there is at least a 3 1/2" gap between the ceiling and the main unit.

(b) Temporarily attach the installation panel (1) at the temporary-securing position on the paper pattern for installation (3) and use a level to make sure the drain hose is either level or tilted slightly downward.

(c) Secure the installation panel (1) to the wall using either screws or bolts.
• If using the attachment screws for the installation panel (2), attach using at least 4 screws on either side (for a total of 9 screws) of the recommended installation cleat position on the included paper pattern for installation (3).
• If using bolts, attach using a M8 - M10 bolt or equivalent (for a total of 2 bolts) on either side.
• If dealing with concrete, use commercially available foundation bolts (M8 - M10 or equivalent).

(3) If using the left, bottom-left, or bottom-right positions for the piping, cut out the through-hole for the piping in the front grill. (Refer to Fig. 4)

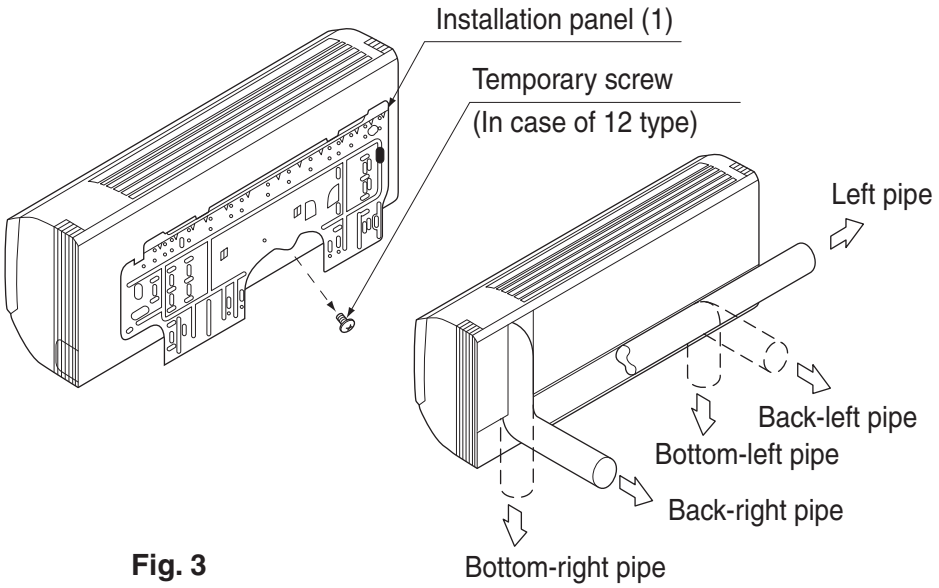


Fig. 3

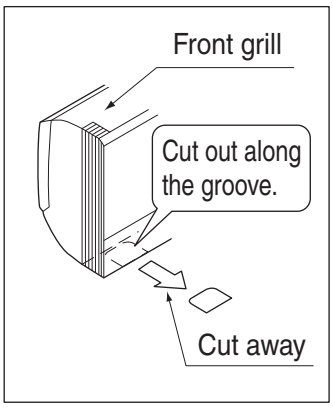


Fig. 4

(4) Remove the front panel and the service lid. (Refer to Fig. 5)

< How to remove the front panel and service lid >

(1) Open the front panel to the point where it stops.

(2) Push the axes on either side of the front panel towards the center of the main unit and remove. (You can also remove it by sliding the front panel either to the left or right and pulling it forward.)

(3) Remove the screw from the service lid and pull the handle forward.

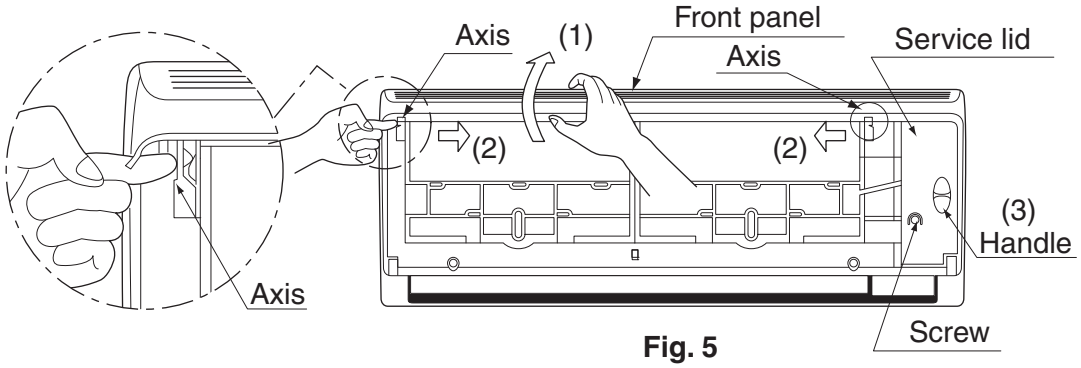


Fig. 5

(5) Point the pipe in the direction it will be passed out.

For bottom-right and back-right piping (Refer to Fig. 6)

• Wrap the drain hose and the refrigerant piping together with the insulating tape (4) so that the drain hose is below the refrigerant piping.

For left, bottom-left, and back-left piping

• Remove the front grill. **(Refer to Fig. 7)**

< How to remove the front grill >

Remove the front grill as described below when securing the indoor unit with screws or when attaching Optional Accessories (wireless remote controller, adapter PC board, etc.).

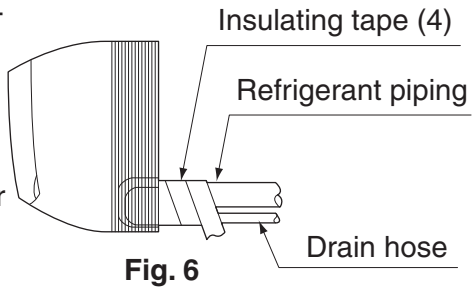


Fig. 6

(1) Remove the front panel.

(2) Remove the screws (3 places) securing the front grill.

(3) Remove the tabs (3 places) securing the front grill by pushing them in the direction of the arrows.

(4) Making sure not to catch the horizontal flaps, remove the front grill by pulling in the direction of the arrow.

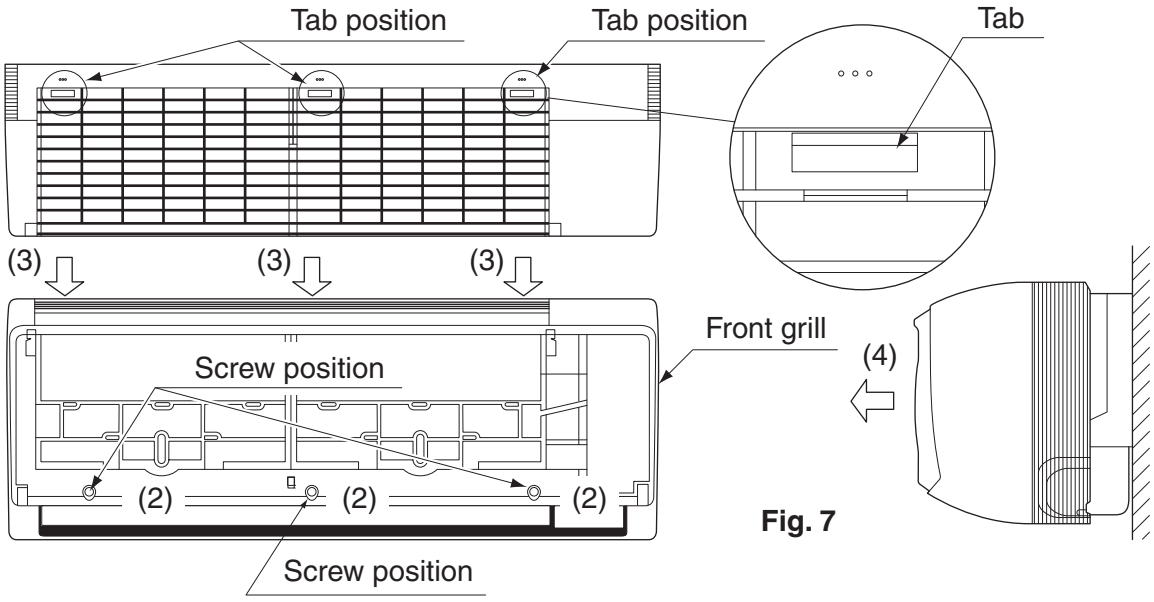


Fig. 7

• Remove the drain plug, the insulation tube, and the drain hose from the drain pan and replace. **(Refer to Fig. 8)**
• Connect the local refrigerant piping ahead of time, matching it to the liquid pipe and gas pipe marks engraved on the installation panel (accessory) (1).

< Replacing the drain hose and drain plug >

(1) Remove the drain plug and insulation tube.
(2) Remove the drain hose and replace onto the left side.
(3) Replace the drain plug and the insulation tube onto the right side.

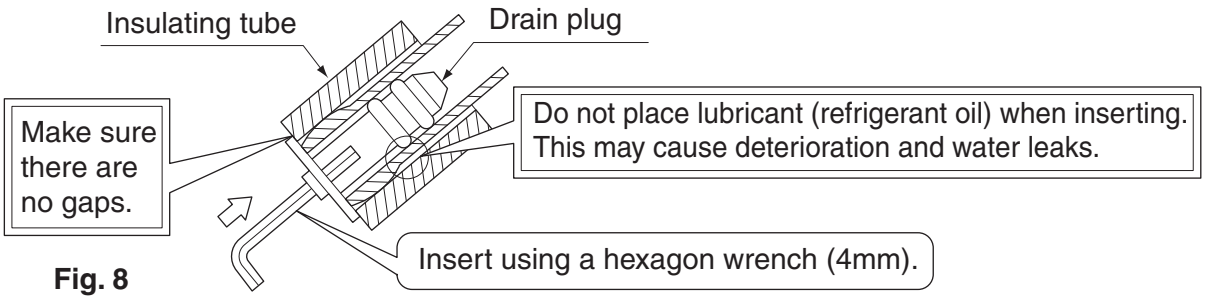


Fig. 8

(6) Hook the indoor unit onto the installation panel. (Refer to Fig. 9)

• Placing buffering material between the wall and the indoor unit at this time will make work easier.

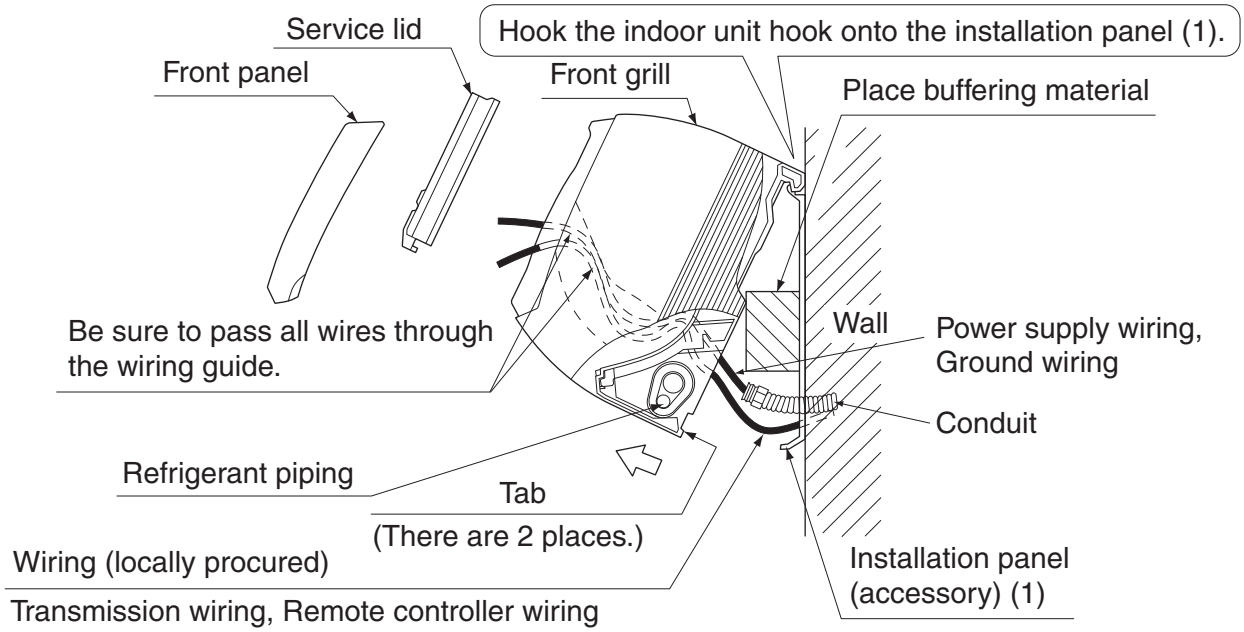


Fig. 9

For bottom-right and back-right piping

• Pass the drain hose and the refrigerant piping to the wall.

(7) Pass power supply wiring and ground wiring threaded through conduit (For connecting the conduit to the unit, see "8-1 HOW TO CONNECT WIRINGS"), and remote controller wiring through the wiring guide in through the back of the indoor unit and to the front.

(8) Connect the piping. (See "5.REFRIGERANT PIPING WORK" and Fig. 10)

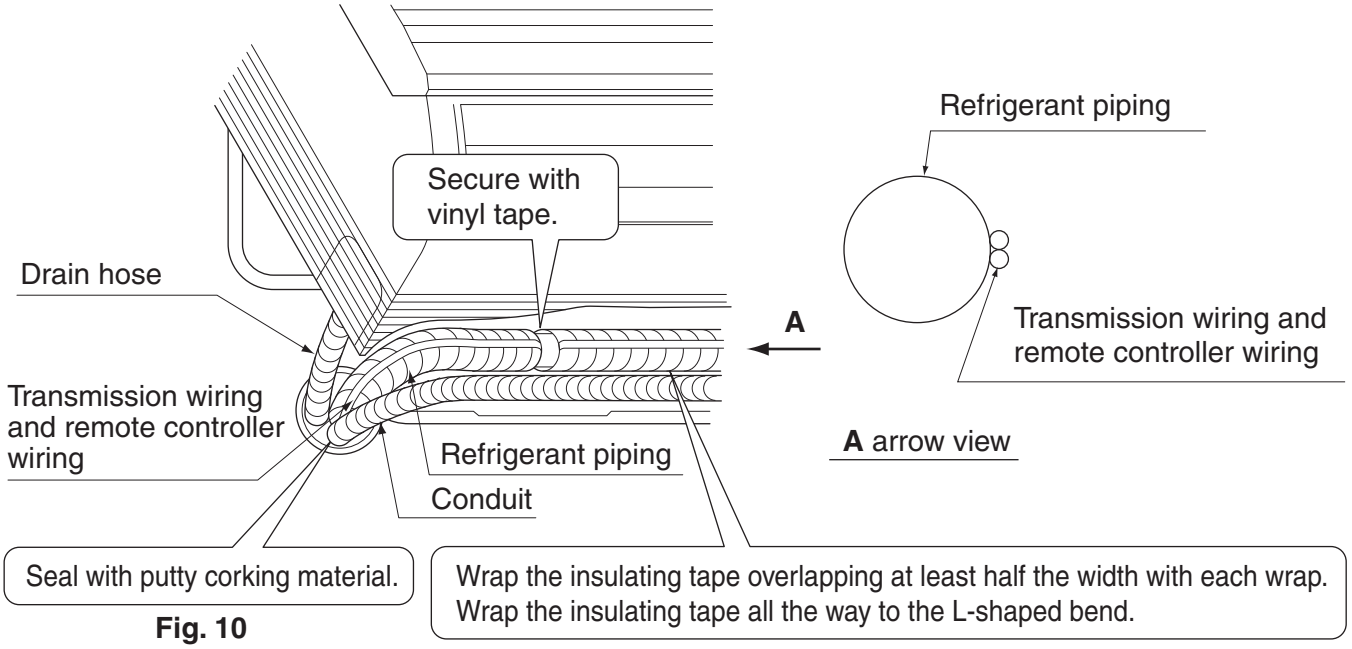


Fig. 10

- Seal the piping through-hole with putty corking material.

(9) Push on both bottom edges of the indoor unit using both hands and hook the tab on the back of the indoor unit onto the installation panel (1). (Refer to Fig. 9)

- At this time remove the buffering material placed in step (6).
- Make sure power supply wiring, transmission wiring, ground wiring and remote controller wiring are not caught inside the indoor unit.

■ **When screwing in the indoor unit**

- Remove the front grill. **(Refer to Fig. 7)**
- Secure the indoor unit to the installation panel (1) with the securing screws (6). **(Refer to Fig. 11)**

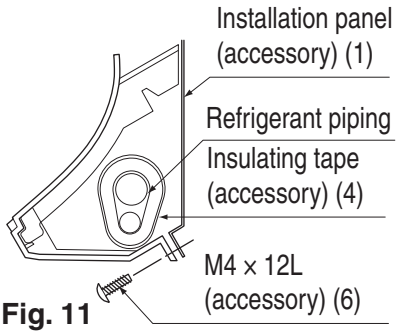


Fig. 11

5. REFRIGERANT PIPING WORK

〈**For refrigerant piping of outdoor units, see the installation manual attached to the outdoor unit.**〉
〈**Execute heat insulation work completely on both sides of the gas piping and the liquid piping. Otherwise, a water leakage can result sometimes.**〉
(When using a heat pump, the temperature of the gas piping can reach up to approximately 250°F, so use insulation which is sufficiently resistant.)
〈**Also, in cases where the temperature and humidity of the refrigerant piping sections might exceed 86ºF or RH80 %, reinforce the refrigerant insulation. (13/16" or thicker) Condensation may form on the surface of the insulating material.**〉
〈**Before refrigerant piping work, check which type of refrigerant is used. Proper operation is not possible if the types of refrigerant are not the same.**〉

⚠ DANGER

- Refrigerant gas may produce toxic gas if it comes in contact with fire such as from a fan, heater, stove or cooking device. Exposure to this gas could result in severe injury or death.

NOTE

- Use a pipe cutter and flare suitable for the type of refrigerant.
- To prevent dust, moisture or other foreign matter from infiltrating the tube, either pinch the end or cover it with tape.
- Do not allow anything other than the designated refrigerant to get mixed into the refrigerant circuit, such as air, etc.
- If any refrigerant gas leaks while working on the unit, ventilate the room thoroughly right away.

- The outdoor unit is charged with refrigerant.
- Use copper alloy seamless pipes.
- Be sure to use both a spanner and torque wrench together, as shown in the drawing, when connecting or disconnecting pipes to/from the unit. **(Refer to Fig. 12)**
- Refer to “Table 1” for the dimensions of flare.
- When connecting the flare nut, coat the flare section with ester oil or ether oil, rotate three or four times first, then screw in. **(Refer to Fig. 13)**

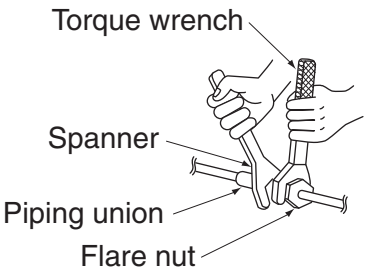


Fig. 12

CAUTION

- Over-tightening may cause the flare nuts to crack or the refrigerant to leak.
- Use the flare nut included with the unit.

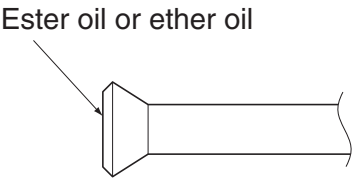
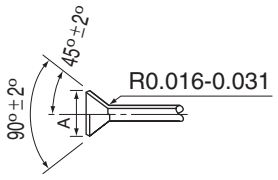


Fig. 13

- Refer to Table 1 for tightening torque.

Table 1

Pipe size	Tightening torque (ft-lbf)	Flare dimensions A (in.)	Flare shape (in.)
ϕ 3/8”	24.1 – 29.4	0.504 – 0.520	
ϕ 5/8”	45.6 – 55.6	0.760 – 0.776	

Not recommended but in case of emergency

You must use a torque wrench but if you are obliged to install the unit without a torque wrench, you may follow the installation method mentioned below.

After the work is finished, make sure to check that there is no gas leak.

When you keep on tightening the flare nut with a spanner, there is a point where the tightening torque suddenly increases. From that position, further tighten the flare nut the angle shown below:

Table 2

Pipe size (in.)	Further tightening angle	Recommended arm length of tool (in.)
ϕ 3/8”	60 to 90 degrees	Approx. 7 7/8”
ϕ 5/8”	30 to 60 degrees	Approx. 11 13/16”

⚠ CAUTION

- CAUTION TO BE TAKEN WHEN BRAZING REFRIGERANT PIPING
  "Do not use flux when brazing refrigerant piping. Therefore, use the phosphor copper brazing filter metal (BCuP) which does not require flux."
  (Flux has an extremely negative effect on refrigerant piping systems. For instance, if chlorine based flux is used, it will cause pipe corrosion. If the flux contains fluorine, it will damage the refrigerant oil.)

- When brazing the refrigerant piping, only begin brazing after having carried out nitrogen substitution (NOTE 1) or while inserting nitrogen into the refrigerant piping (NOTE 2). Once this is done, connect the indoor unit with a flared or a flanged connection.

⚠ DANGER

- Use of oxygen may cause an explosion resulting in serious injury or death. Only use nitrogen gas.

⚠ NOTE

1. Refer to the "Manual for Multi Installation for Buildings" for directions on how to carry out nitrogen substitution. (Inquire with your dealer.)
2. Nitrogen should be set to 2.9 psi with a pressure-reducing valve if brazing while inserting nitrogen into the piping. **(Refer to Fig. 14)**

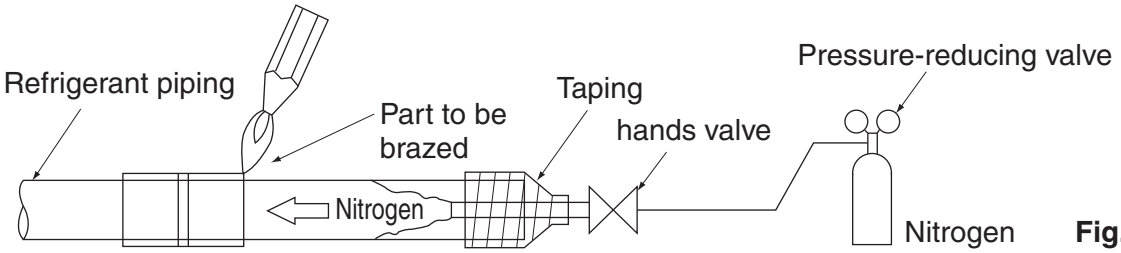


Fig. 14

- After checking for gas leaks, be sure to insulate the pipe connections using the supplementary piping insulation tubing and insulating tape (4). The insulating tape (4) should be wrapped from the L-shaped bend all the way to the end inside the unit. **(Refer to Fig. 15)**

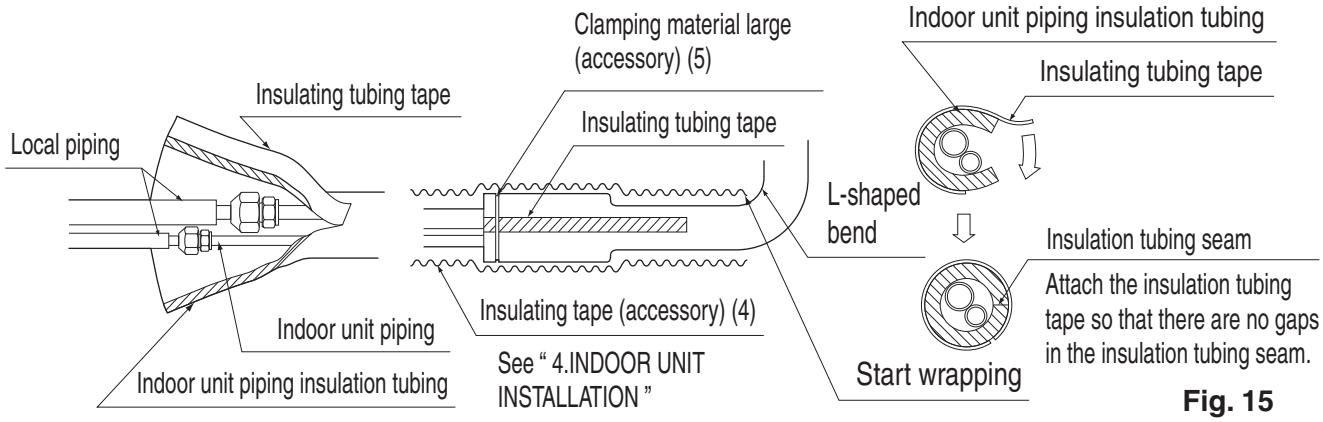


Fig. 15

⚠ CAUTION

- Be sure to insulate any field piping all the way to the piping connection inside the unit. Any exposed piping may cause condensate or burns if touched.

6. DRAIN PIPING WORK

(1) Install the drain piping. (Refer to Fig. 16)

- The drain pipe should be short with a downward slope and should prevent air pockets from forming.
- Watch out for the points in the figure 16 when performing drain work.

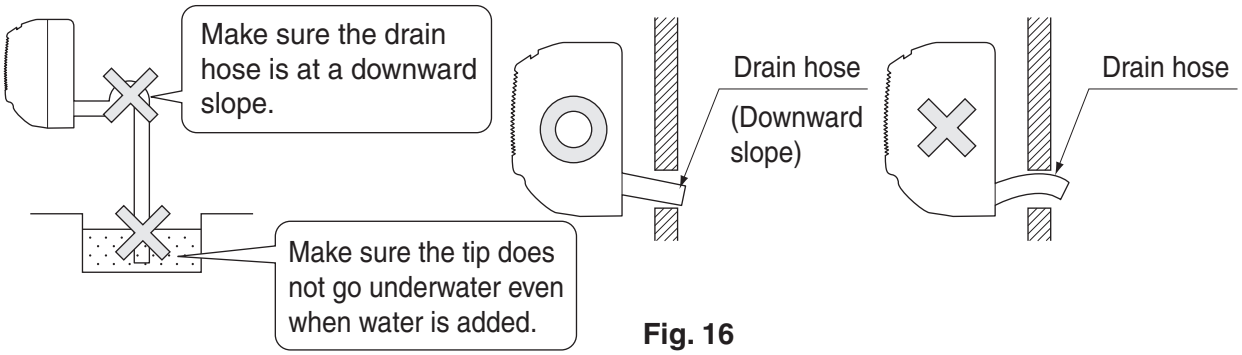


Fig. 16

- When extending the drain hose, use a commercially available drain extension hose, and be sure to insulate the extended section of the drain hose which is indoors. **(Refer to Fig. 17)**

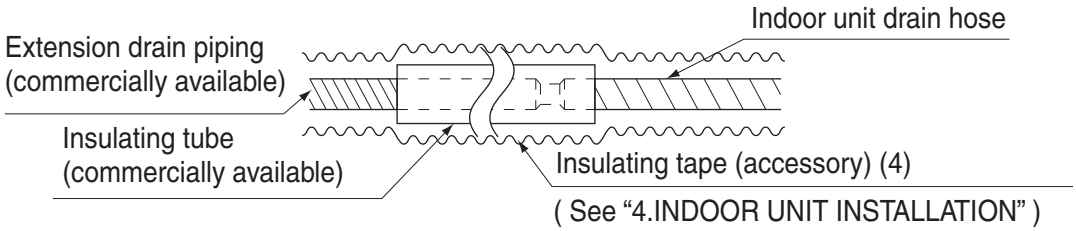


Fig. 17

- Make sure the diameter of the extension drain piping is the same as the indoor unit drain hose (hard vinyl chloride, I.D. 9/16”) or bigger.
- In case of converging multiple drain pipes, install them referring to Fig. 18.
- Select diameter of drain piping which adapts to the capacity of the unit connected.

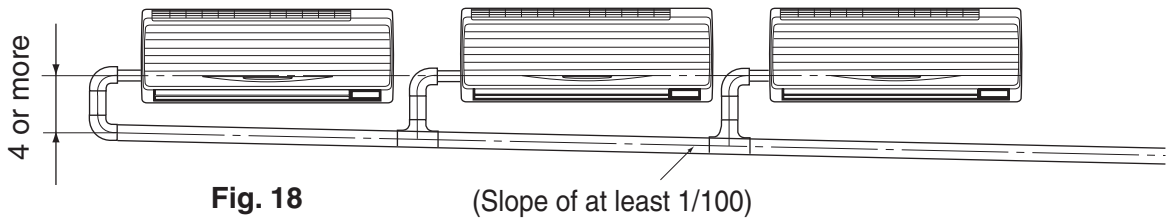


Fig. 18

(2) Make sure the drain works properly.

- After drain work is complete, perform a drain check by opening the front panel, **removing the air filter**, pouring water into the drain pan, and making sure water flows smoothly out of the drain hose. **(Refer to Fig. 19)**

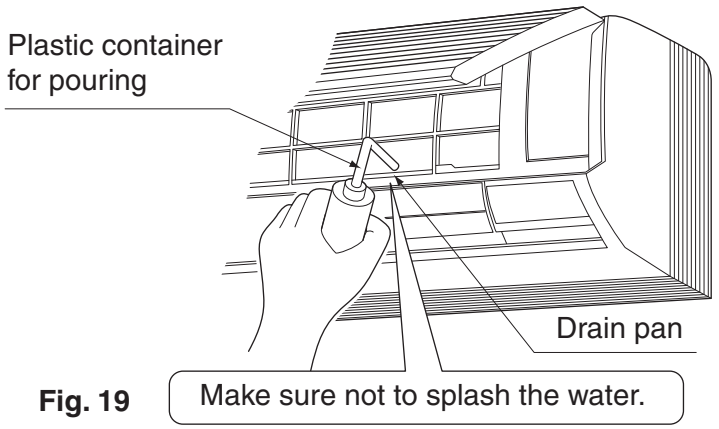


Fig. 19

⚠ CAUTION

- Drain piping connections
  Do not connect the drain piping directly to sewage pipes that smell of ammonia. The ammonia in the sewage might enter the indoor unit through the drain pipes and corrode the heat exchanger.
  Keep in mind that it will become the cause of getting drain pipe blocked if water collects on drain pipe.

7. ELECTRIC WIRING WORK

7-1 GENERAL INSTRUCTIONS

- All field supplied parts and materials and electric works must conform to local codes.
- Use copper wire only.
- For electric wiring work, refer to also “WIRING DIAGRAM” attached to the unit.
- For remote controller wiring details, refer to the installation manual attached to the remote controller.
- All wiring must be performed by an authorized electrician.
- This system consists of multiple indoor units. Mark each indoor unit as unit A, unit B..., and be sure the terminal block wiring to the outdoor unit and BS unit is properly matched. If wiring and piping between the outdoor unit and indoor unit are mismatched, the system may cause a malfunction.
- A circuit breaker capable of shutting down power supply to the entire system must be installed.
- Refer to the installation manual attached to the outdoor unit for the size of power supply wiring connected to the outdoor unit, the capacity of the circuit breaker and switch, and wiring instructions.
- Be sure to ground the air conditioner.

⚠ DANGER

- Do not ground units to water pipes, telephone wires or lightning rods because incomplete grounding could cause a severe shock hazard resulting in severe injury or death, and to gas pipes because a gas leak could result in an explosion which could lead to severe injury or death.

7-2 ELECTRICAL CHARACTERISTICS

Units				Power supply		Fan motor	
Model	Hz	Volts	Voltage range	MCA	MFA	W	FLA
FAQ18PVJU	60	208-230	Max. 253 Min. 187	0.4	15	43	0.3
FAQ24PVJU				0.6	15	43	0.5

MCA: Min. Circuit Amps (A); MFA: Max. Fuse Amps (A)
W: Fan Motor Rated Output (W); FLA: Full Load Amps (A)

7-3 SPECIFICATIONS FOR FIELD SUPPLIED FUSES AND WIRE

Model	Power supply wiring		Remote controller wiring Transmission wiring	
	Field fuses ⊣⊢	Size	Wire	Size
FAQ18PVJU	15A	Size must comply with local codes.	Sheathed wire (2 wire)	AWG18-16
FAQ24PVJU				

- Allowable length of transmission wiring and remote controller wiring are as follows.
  (1) Outdoor unit - Indoor unit:Max.3280ft. (Total wiring length: 6560ft.)
  (2) Indoor unit - Remote controller:Max.1640ft.
- Insulated thickness: 1/16” or more.

8. WIRING EXAMPLE AND HOW TO SET THE REMOTE CONTROLLER

8-1 HOW TO CONNECT WIRINGS

• Conduit for power supply wiring
Unscrew and remove the conduit mounting plate from the electric parts box. **(Refer to Fig. 20)**
Fix a conduit to the plate with a lock nut and reattach them at original position.

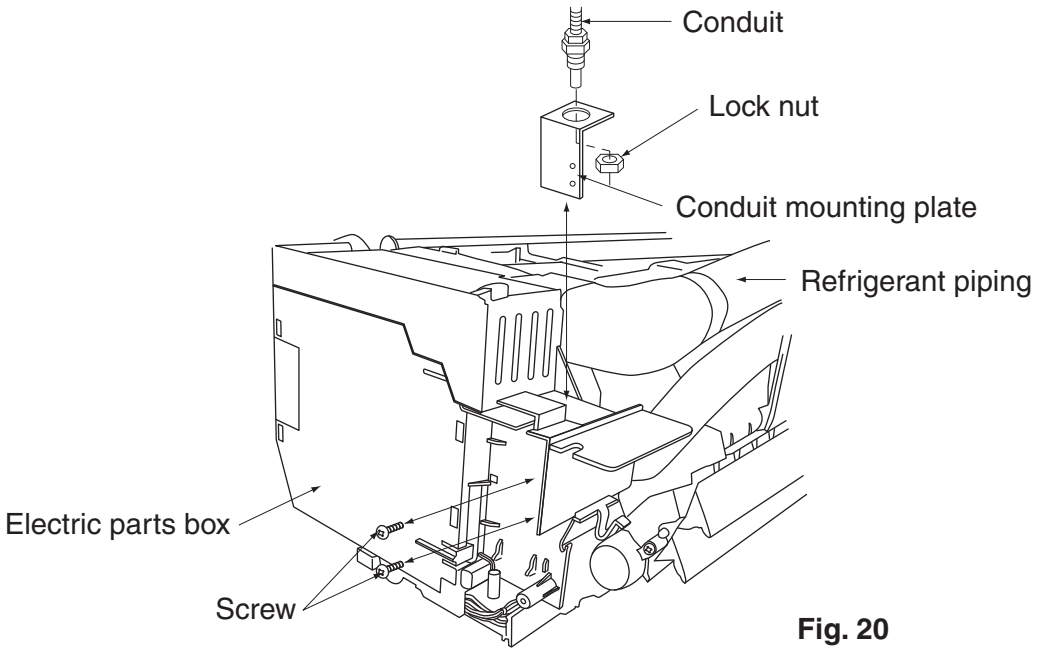


Fig. 20

• Power supply wiring and ground wiring
Unscrew and remove the service lid.
Thread the power supply wiring and ground wiring through the included insulating tube (short) (7) and secure them with the included clamp (small) (5). **(Refer to Fig. 21)**
Connect the power supply wiring and ground wiring to the power supply terminal block (3P).
When doing this, firmly secure using the included clamp (small) (5) according to the figure.
(Refer to Fig. 22)

• Transmission wiring and remote controller wiring
Unscrew and remove the service lid.
Thread the remote controller wiring and transmission wiring through the included insulating tube (long) (7) and secure them with the included clamp (small) (5). **(Refer to Fig. 21)**
Connect the remote controller wiring and the transmission wiring to the terminal block (6P).
When doing this, tie the remote controller wiring and the transmission wiring using the included clamp (small) (5) and then firmly secure using the included clamp (small) (5) according to the figure. **(Refer to Fig. 22)**

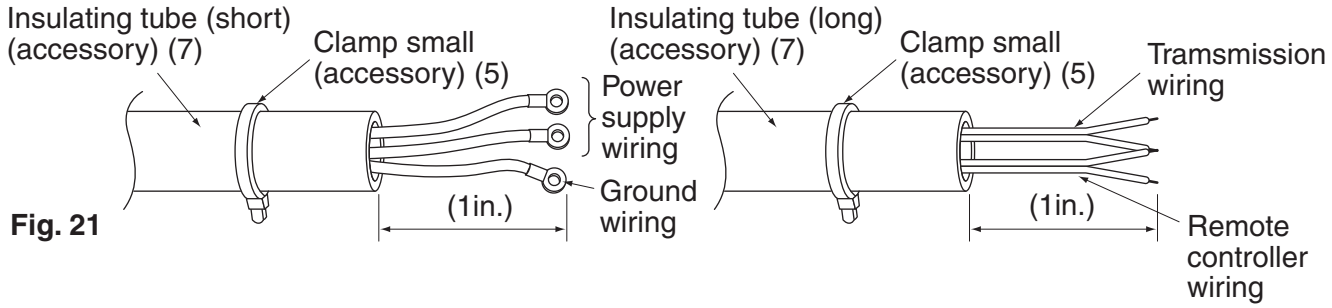


Fig. 21

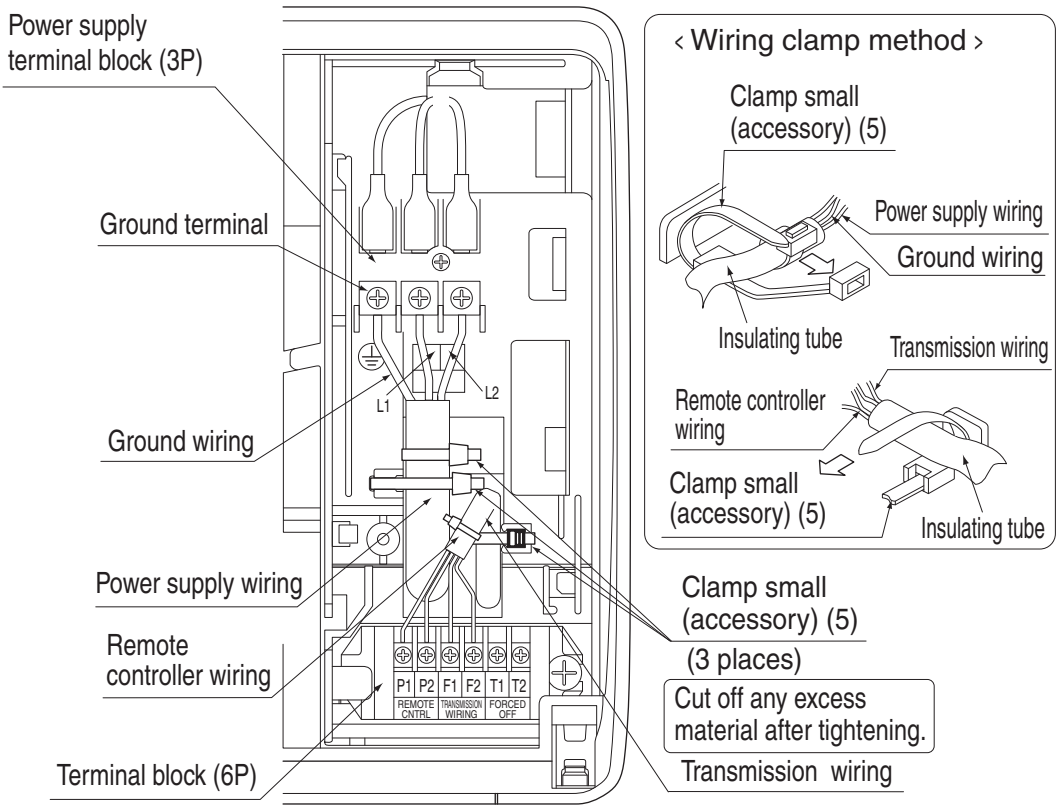


Fig. 22

⚠ WARNING

- Never connect power supply wiring to the terminal block for remote controller wiring as this could damage the entire system.
- Use only specified wire and connect wires to the terminal tightly. Be careful wires do not place external stress on terminals. Keep wires in neat order so as not to obstruct other equipment. Make sure that the electric box lid fits tightly. Incomplete connections could result in overheating and, in worse case, result in electric shock or fire.
- To avoid a short circuit in the electric parts box, be sure to apply sealing material or putty (not included) to the wiring hole to prevent the infiltration of water as well as insects or other small creatures. Otherwise a short-circuit may occur inside the electric parts box.

⚠ CAUTION

- When clamping the wirings, be sure no tension is applied to the wire connections by using the included clamp. Also, when wiring, make sure the lid on the electric parts box fits snugly by arranging the wirings neatly and attaching the service lid firmly. When attaching the service lid, make sure no wirings get caught in the edges. Pass wiring through holes to prevent damage to them.
- Make sure the remote controller wiring and transmission wiring between the units, and other electrical wiring do not pass through the same locations outside the unit, separating them by at least 5”, otherwise electrical noise (external static) could cause incorrect operation or breakage.
  Use only specified wire and tightly connect wires to terminals. Be careful wires do not place external stress on terminals. Keep wiring in neat order and so as not to obstruct other equipment such as popping open the service cover. Make sure the cover closes tight. Incomplete connections could result in overheating, and in worse case, electric shock or fire.

[PRECAUTIONS]

1. Use round crimp-style terminals for connecting wires to the power supply terminal block. **(Refer to Fig. 23)**

   If unavailable, observe the following points when wiring.
   - Do not connect wires of different gauge to the same power supply terminal. (Looseness in the connection may cause overheating.)
   - Use the specified electric wire. Connect the wire securely to the terminal. Lock the wire down without applying excessive force to the terminal. (Tightening torque: 0.97ft.lbf ±10 %)

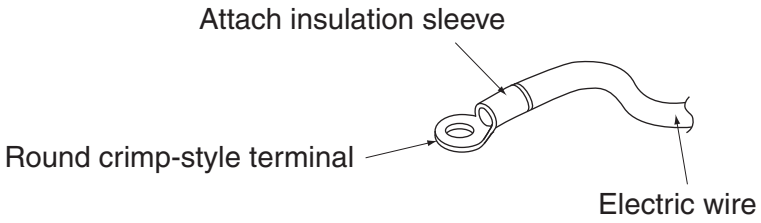


Fig. 23

2. **Tightening torque for the terminal screws.**
   - Use the correct screwdriver for tightening the terminal screws. If the blade of screwdriver is too small, the head of the screw might be damaged, and the screw will not be properly tightened.
   - If the terminal screws are tightened too hard, screws might be damaged.
   - Refer to the table below for the tightening torque of the terminal screws.

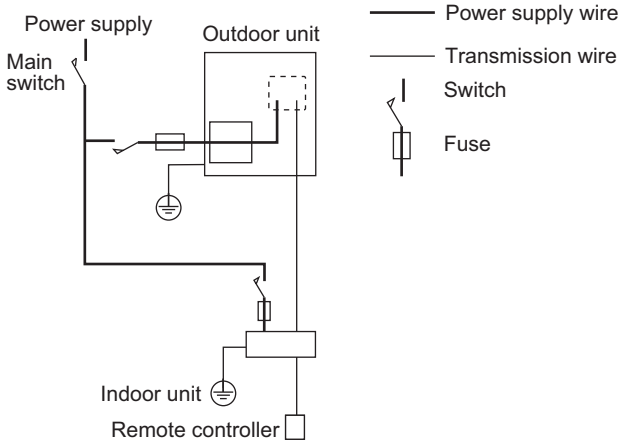
Terminal	Size	Tightening torque (ft-lbf)
Remote controller, Transmission wiring and Forced off terminal block (6P)	M3.5	0.58 – 0.72
Power supply and Ground terminal block (3P)	M4	0.87 – 1.06

3. Do not connect wires of different gauge to the same ground terminal. Looseness in the connection may lessen protection.
4. Keep transmission wiring at least 5” away from power supply wiring. The equipment may malfunction if subjected to electrical (external) noise.
5. For remote controller wiring, refer to the “INSTALLATION MANUAL OF REMOTE CONTROLLER” attached to the remote controller.

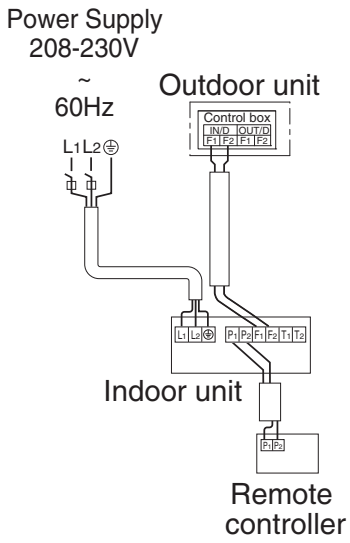
8-2 WIRING EXAMPLE

- Fit the power supply wire of each unit with a switch and fuse as shown in the drawing.

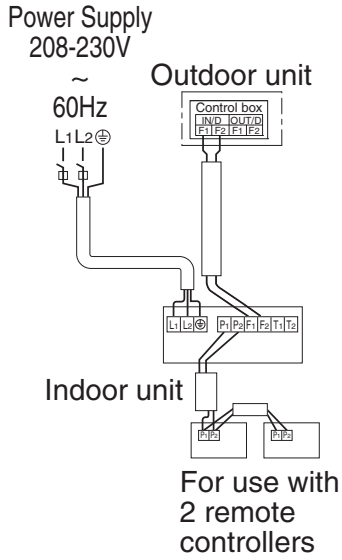
COMPLETE SYSTEM EXAMPLE



1. When using 1 remote controller for 1 indoor unit. (Normal operation)



2. When using 2 remote controllers for 1 indoor unit.



NOTE

1. A single switch can be used to supply power to units on the same system. However, branch switches and branch circuit breakers must be selected carefully.
2. Do not ground the equipment on gas pipes, water pipes or lightning rods, or crossground with telephones. Improper grounding could result in electric shock.

8-3 CONTROL BY 2 REMOTE CONTROLLERS (CONTROLLING 1 INDOOR UNIT BY 2 REMOTE CONTROLLERS)

• When using 2 remote controllers, one must be set to “MAIN” and the other to “SUB”.

MAIN/SUB CHANGEOVER

(1) Insert a ⊖ screwdriver into the recess between the upper and lower part of remote controller, and working from the 2 positions, pry off the upper part. The remote controller PC board is attached to the upper part of the remote controller. **(Refer to Fig. 28)**

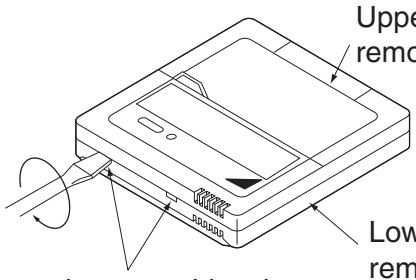


Fig. 28

(2) Turn the **MAIN/SUB changeover** switch on one of the two remote controller PC boards to “S”. (Leave the switch of the other remote controller set to “M”.) **(Refer to Fig. 29)**

Wiring Method (See “7.ELECTRIC WIRING WORK”)

(3) Remove the service lid.

(4) Add remote control 2 (slave) to the terminal block (6P) for remote controller (P1, P2) in the electric parts box.
(There is no polarity.) (Refer to Fig. 26 and section 7-3 for the wiring size.)

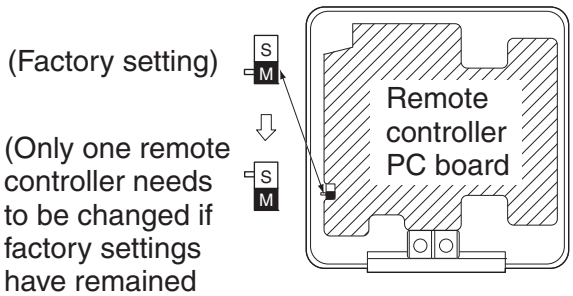


Fig. 29

8-4 COMPUTERISED CONTROL (FORCED OFF AND ON/OFF OPERATION)

(1) Wire specifications and how to perform wiring

• Connect the input from outside to terminals T1 and T2 of the terminal block (6P).

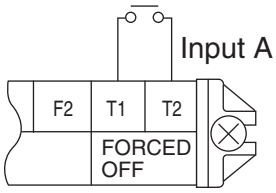


Fig. 30

Wire specification	Sheathed vinyl cord or cable (2 wire)
Gauge	AWG18-16
Length	Max. 328 ft.
External terminal	Contact that can ensure the minimum applicable load of 15V DC, 10 mA.

(2) Actuation

• The following table explains FORCED OFF and ON/OFF OPERATIONS in response to Input A.

FORCED OFF	ON/OFF OPERATION
Input “ON” stops operation (impossible by remote controllers).	Input OFF → ON turns ON unit.
Input OFF enables control by remote controller.	Input ON → OFF turns OFF unit.

(3) How to select FORCED OFF and ON/OFF OPERATION
- Turn the power on and then use the remote controller to select operation.
- Set the remote controller to the field set mode. For details, refer to the “HOW TO SET IN THE FIELD”, in the remote controller manual.
- When in the field set mode, select mode No. 12, then set the first code (switch) No. to “1”. Then set second code (position) No. to “01” for FORCED OFF and “02” for ON/OFF OPERATION.
  (FORCED OFF at factory set) **(Refer to Fig. 31)**

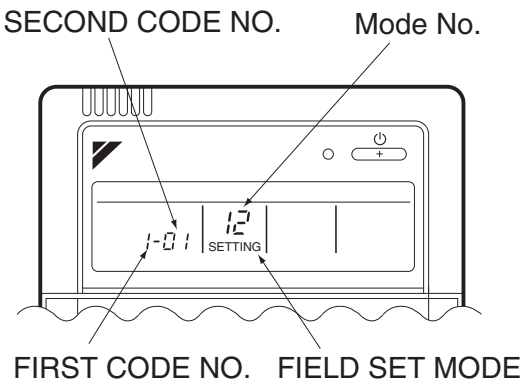


Fig. 31

8-5 CENTRALIZED CONTROL
- For centralized control, it is necessary to designate the group No. For details, refer to the manual of each optional controllers for centralized control.

9. FIELD SETTINGS
(1) Make sure the service lids are closed on the indoor and outdoor units.
(2) Field settings must be made from the remote controller in accordance with installation conditions.
- Settings can be made by changing the “Mode No”, “FIRST CODE NO.” and “SECOND CODE NO.”. Refer to the installation manual attached to the remote controller.
- The “Field Settings” included with the remote controller lists the order of the settings and method of operation.
  *Setting is made in all units in a group. To set for individual indoor units or to check the setting, use the mode Nos. (with “2” in upper digit) in parentheses ( ).

9-1 SETTING AIR FILTER SIGN
- Remote controllers are equiped with liquid crystal display air filter signs to display the time to clean air filters.
- Change the SECOND CODE NO. according to Table 3 depending on the amount of dirt or dust in the room. (SECOND CODE NO. is factory set to “01” for air filter contamination-light)

Table 3

Setting	Spacing time of display air filter sign	Mode No.	FIRST CODE NO.	SECOND CODE NO.
Air filter contamination-light	Approx. 200 hrs	10 (20)	0	01
Air filter contamination-heavy	Approx. 100 hrs			02

9-2 SETTING AIR FLOWRATE INCREASE MODE

- It is possible to raise set air flow (HIGH and LOW) from the field. Change the SECOND CODE NO. as shown in Table 4 to suit your needs.
  (SECOND CODE NO. is factory set to “01” for Standard.)

Table 4

Setting	Mode No.	FIRST CODE NO.	SECOND CODE NO.
Standard	13 (23)	0	01
A little increase			02
Increase			03

〈**When using wireless remote controllers**〉

- When using wireless remote controllers, wireless remote controller address setting is necessary. Refer to the installation manual attached to the wireless remote controller for setting instructions.

10. TEST OPERATION

Make sure the service lids are closed on the indoor and outdoor units.
Refer to the installation manual of the outdoor unit.

- The operation lamp of the remote controller will flash when a malfunction occurs. Check the malfunction code on the liquid crystal display to identify the point of trouble. An explanation of malfunction codes and the corresponding trouble is provided in the installation manual of the outdoor unit.
  If any of the items in Table 5 are displayed, there may be a problem with the wiring or power, so check the wiring again.

  Table 5

Remote controller display	Content
“ ” (under centralized control) is lit up	• There is a short circuit at the FORCED OFF terminals (T1, T2).
“U4” is lit up “UH” is lit up	• The power on the outdoor unit is off. • The outdoor unit has not been wired for power supply. • Incorrect wiring for the transmission wiring and/or FORCED OFF wiring. • The transmission wiring is cut.
No display	• The power on the indoor unit is off. • The indoor unit has not been wired for power supply. • Incorrect wiring for the remote controller wiring, the transmission wiring, and/or the FORCED OFF wiring. • The remote controller wiring is cut.

- If “U3” is lit up, the malfunction code shows the test operation has not been performed yet.

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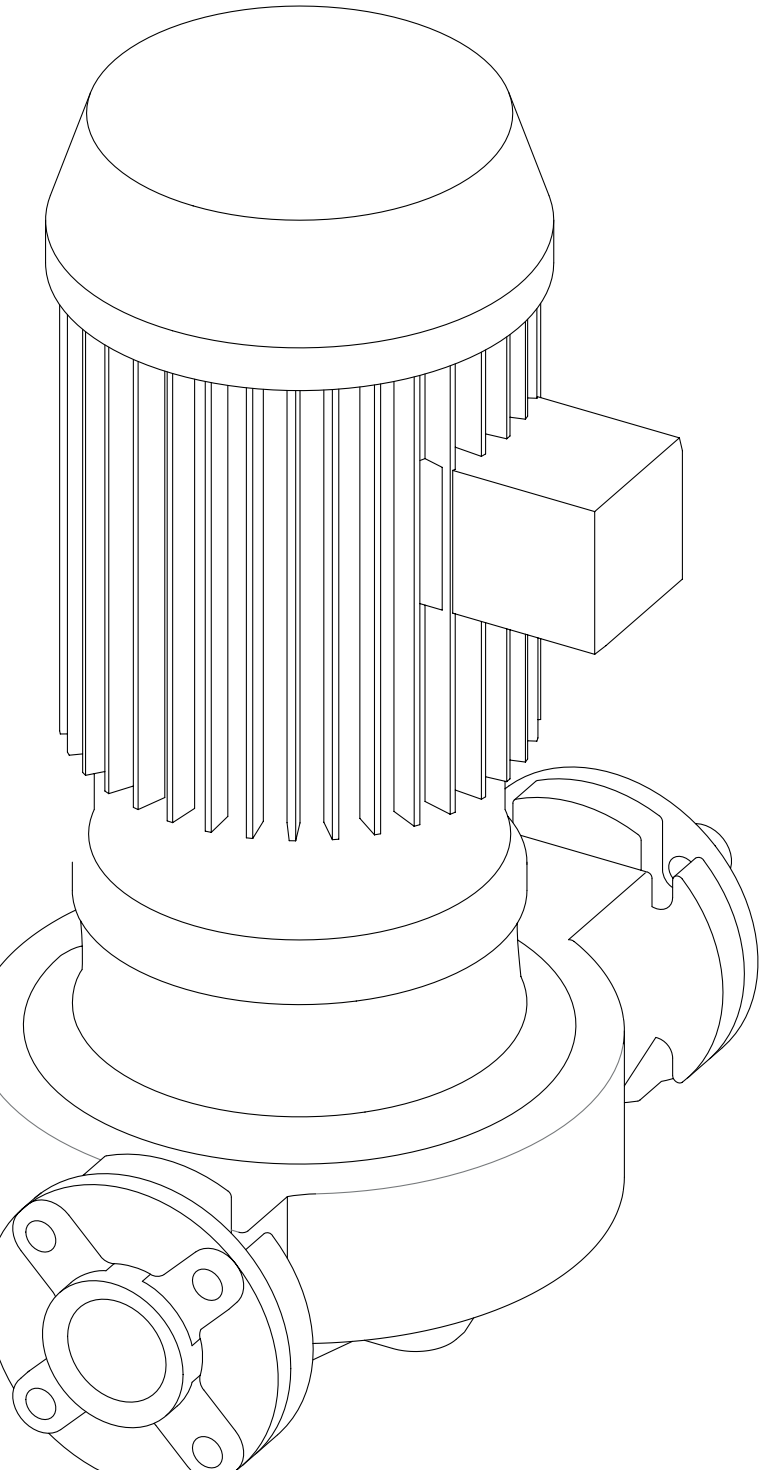
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ARMSTRONG



Commercial pumps Series 4300, 4360 and 4380

Vertical In-Line pumps

Installation and operating instructions

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Date: SEPTEMBER 15, 2010

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1.0 INTRODUCTION

This document contains specific information regarding the safe installation, operating and maintenance of Vertical In-Line pumps and should be read and understood by installing, operating and maintenance personnel. The equipment supplied has been designed and constructed to be safe and without risk to health and safety when properly installed, operated and maintained. The following instructions must be strictly adhered to. If clarification is needed on any point please contact Armstrong quoting the equipment serial number.

WARNING SYMBOLS


Safety instruction where an electrical hazard is involved.


Safety instruction where non-compliance would affect safety risk.



Safety instruction relating to safe operation of the equipment. (ATTENTION)

1.1 INSTRUCTIONS FOR SAFE USE


No installation of this equipment should take place unless this document has been studied and understood. Handling, transportation and installation of this equipment should only be undertaken by trained personnel with proper use of lifting equipment. See later diagrams for lifting advice. Refer to the pump nameplate for pump speed, pressure and temperature limitations. The limits stated must not be exceeded without written permission from Armstrong.

1.2 TEMPERATURE

Where under normal operating conditions the limit of 68°C/155°F (restricted zone) for normal touch, or 80°C/176°F (unrestricted zone) for unintentional touch, may be experienced, steps should be taken to minimize contact or warn operators/users that normal operating conditions will be exceeded. In certain cases where the temperature of the pumped liquid exceeds the above stated temperature levels, pump casing temperatures may exceed 100°C/212°F and not withstanding pump insulation techniques appropriate measures must be taken to minimize risk for operating personnel.

1.3 NOISE LEVELS

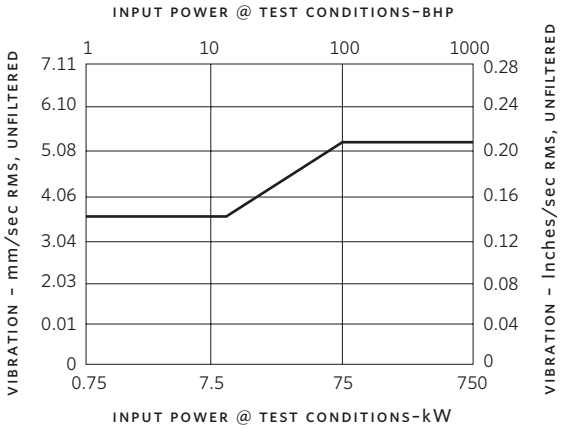
Typical Pumping Unit Sound Pressure Level, Decibels, A-Weighted, at 1 m (3 ft.) from unit.

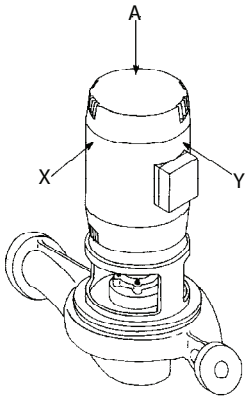
FIG. 1 Noise levels.

	1200 RPM				1800 RPM				3600 RPM			
FRAME DESIGNATION	ODP		TEFC		ODP		TEFC		ODP		TEFC	
	hp	dB-A	hp	dB-A	hp	dB-A	hp	dB-A	hp	dB-A	hp	dB-A
140	0.75 – 1	59	0.75 – 1	58	1 – 3	64	1 – 2	64	1.5 – 3	70	1.5 – 2	79
180	1.5 – 2	61	1.5 – 2	61	3 – 5	66	3 – 5	68	5 – 7.5	74	3 – 5	82
210	3 – 5	66	3 – 5	65	7.5 – 10	70	7.5 – 10	73	10 – 15	76	7.5 – 10	85
250	7.5 – 10	70	7.5 – 10	69	15 – 20	74	15 – 20	78	20 – 25	78	15 – 20	88
280	15 – 20	75	15 – 20	74	25 – 30	74	25 – 30	82	30 – 40	80	25 – 30	89
320	25 – 30	77	25 – 30	77	40 – 50	78	40 – 50	83	50 – 60	83	40 – 50	94
360	40 – 50	80	40 – 50	80	60 – 75	80	60 – 75	89	75 – 100	88	60 – 75	95
400	60 – 75	82	60 – 75	84	100 – 125	83	100	92	125 – 150	92	100	96
440	100 – 125	85	100 – 125	88	150 – 200	87	125 – 150	96	200 – 250	95	125 – 150	98

1.4 VIBRATION LEVELS

Armstrong Vertical In-Line pumps are designed to meet vibration levels set by Hydraulic Institute Standard HI Pump vibration 9.6.4. standard levels are as detailed below:





VERTICAL IN–LINE

1.5 STORAGE

Pumps not immediately placed into service, or removed from service and stored, must be properly prepared to prevent excessive rusting. Pump port protection plates must not be removed until the pump is ready to connect to the piping.

Rotate the shaft periodically (at least monthly) to keep rotating element free and bearings fully functional.

For long term storage (longer than 3 months), the pump must be placed in a vertical position in a dry environment.

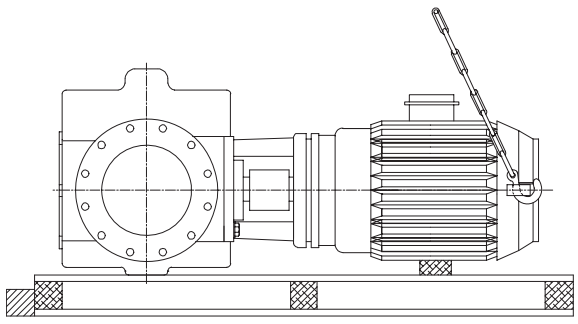
Internal rusting can be prevented by removing the plugs at the top and bottom of the casing and drain or air blow out all water to prevent rust buildup or the possibility of freezing. Be sure to reinstall the plugs when the unit is made operational. Rust-proofing or packing the casing with moisture absorbing material and covering the flanges is acceptable. When returning to service be sure to remove the drying agent from the pump.

1.6 UNCRATING

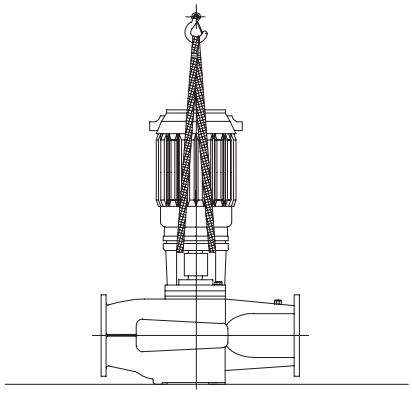
Armstrong Vertical In-Line pumps are thoroughly inspected before shipment to assure they meet with your order requirements. After removing the pump from the crate, make sure the equipment is in good order and that all components are received as called for on the packing list. Any shortages or damage should be reported immediately. Use extreme care in handling the unit, placing slings and hooks carefully so that stress will not be imposed on the pump. **Never place cable slings around the pump shaft.** The eye bolts or lifting lugs on the motor are intended for lifting the motor only and not the complete unit.

1.7 HANDLING LARGE VIL UNITS

One effective way of lifting a large Series 4300 unit from the shipment pallet following uncovering the unit is to place lifting hooks through the motor lifting rings or straps around the upper part of the motor and carefully lift sufficiently to stand the pump vertically. Lift only enough to remove the pallet then lower onto a flat surface. The pump and motor unit will free-stand on the casing ribs. Remove the coupling guard and place (2) lifting straps through the pump/motor pedestal (one on each side of the motor shaft) and secure to the lifting device. With the straps in place, using a spacer bar if necessary to protect the motor fan cover, the whole assembly can now be lifted securely and placed in position in the piping.



Secure pallet and lift pump vertical using motor eye-bolts lift only to clear pallet then sit on the flat surface.



Remove coupling guard and place lifting straps on each side of coupling, use spacer bar if necessary to protect motor fan cover.

IMPORTANT:

Do not run the pump for any length of time under very low flow conditions or with the discharge valve closed. This could cause the water in the casing to reach super heated steam conditions, cause premature failure and cause serious and dramatic damage to the pump and surrounding area.

2.0 INSTALLATION

2.1 LOCATION

In open systems, locate the unit as close as practical to the liquid being pumped, with a short, direct suction pipe. Ensure adequate space is left above and around the unit for operation, maintenance, service and inspection of parts.

In closed systems, where possible, the pumps should be installed immediately downstream of the expansion tank/make-up connection. This is the point of zero pressure change and is necessary for effective pump operation. Do not install more than one expansion tank connection into any closed hydronic system.

Electric motor driven pumps should not be located in damp or dusty locations without special protection.

Airflow into the motor and/or motor fan should not be obstructed.

2.2 INSTALLATION

When installing Vertical In-Line pumps, an important consideration to accrue full added-value from the pump design is to ensure that the pump is pipe-mounted and free to 'float' with any movement, expansion and contraction of the piping. Should any Vertical In-Line pump use supports to the structure it is imperative that no pipe strain is imposed on the pump flanges. Telltale pieces of equipment such as springs or 'waffle' style neoprene isolation pads that distort with pressure to indicate added piping weight, should be used under pump supports should the pump not be truly pipe mounted.

Various installation arrangements are detailed on Pages 6 and 7:

2.2.1
Vertical In-Line pumps may be installed directly in the system piping with no additional support. Pipe hangers are simply sized for the additional weight of the pumping unit. Many pumps are installed in this manner and are mounted at sufficient height to take zero floor space. (Fig. 2.1)

2.2.2
Piping, in many mechanical rooms, is hung close to the ceiling and larger pumps are mounted near ground level for ease of maintenance. Fig 2.2 illustrates such an arrangement with the piping supported at the ceiling and the VIL unit installed with an Armstrong Suction Guide and triple function Flo-Trex valve. Many very large VIL pumps are installed in this manner.

2.2.3
Should additional space saving be required the discharge spool piece and Flo-Trex valve may be replaced by a long-radius elbow and the Flo-Trex valve field converted to a straight-through valve and installed in the vertical discharge pipe. (Fig. 2.3)

2.2.4
Fig 2.4 illustrates a similar arrangement to Fig 2.2 with additional floor mounted pipe-stools isolated from the structure by 'waffle' style neoprene isolation pads under the Armstrong Suction Guide and Flo-Trex valve.

2.2.5
Floor mounted saddle supports (Fig. 2.5) are typical for condenser water pumps where the cooling tower base is near mechanical room elevation.

2.2.6
Where required, additional floor support may be used as shown in Fig. 2.6. Note that the pump should not be rigidly attached to the column. Leave a small gap between pump and column or install a 'waffle' isolation pad under the pump. It is critical that piping be installed in such a manner that the pump does not become a pipe support.

2.2.7
Fig. 2.7 illustrates stanchion plates at the pump inlet and outlet ports that may be supplied for installation convenience. Isolation pads must be used under the legs and monitored as pipe hangers are adjusted to ensure the pump flanges are not supporting the piping. Bolting to the floor or housekeeping pad is not recommended. If the stanchions are bolted down the bolts must be isolated from the stanchion or an inertia base and flexible pipe connectors should be used.

2.2.8
Fig. 2.8 illustrates installations with stanchion plates for seismically active regions. Seismically rated isolation pads or snubbers with bolts isolated from the stanchion plates are installed to restrain the pump during a seismic event. Pipe hangers carry the weight of the equipment as seismic components are designed only to restrain the equipment during a seismic event.

2.2.9
Close coupled in-line units (Series 4360 & 4380) up to 15 hp / 11 kW may be installed with the shaft horizontal. (Fig. 2.9) For horizontal mounting of large units or Series 4300 Split-Coupled style consult the factory. (Fig. 2.9)

2.2.10
Many Vertical In-Line pumps are piped successfully into grooved piping systems. In-line pumps are supported well by grooved piping however flange adapter locking devices or a welded flange at the pump should be used to prevent the possibility of pipe mounted pumps rotating in the piping. Armstrong offers grooved suction guides with cast-in outlet flanges and triple function Flo-Trex valves with inherent locking devices to prevent this possibility. (Fig. 2.10)

2.2.11
Do not support the unit by the motor eye bolts (Fig. 2.11) or by any other part of the motor.

2.2.12
Connecting the pump to a permanent rigid base (Fig. 2.12). is not recommended unless isolated from the piping by flexible connectors and the base isolated from the building structure on an inertia base. (Fig. 2.12 is generally acceptable when using plastic piping).

IMPORTANT:

All Series 4300 pumps contain a tapped hole in the motor bracket above the discharge flange (see Fig. 2.13) for draining the well. Pipe this drain hole to a floor drain to avoid overflow of the cavity caused by collecting chilled water condensate or from seal failure.

2.3 PUMP PIPING – GENERAL

Never connect a pump to piping, unless extra care is taken to measure and align the piping flanges well. Always start piping from pump.

Use as few bends as possible and preferably long radius elbows.

Do not use flexible connectors on the suction or discharge of a Vertical In-Line pump, unless the pump is rigidly mounted to a foundation.

Ensure piping exerts no strain on pump as this could distort the casing causing breakage or early failure due to pump misalignment.

All conecting pipe flanges must be square to the pipework and parallel to the pump flanges.

Suction and discharge pipes may be increased or decreased at pump nozzle to suit pump capacity and particular conditions of installation. Use eccentric reducers on suction connection with flat side uppermost.

Layout the suction line with a continual rise towards the pump without high points, thus eliminating possibility of air pockets that may prevent the pump from operating effectively.

A strainer of three or four times the area of the suction pipe, installed in the suction line, will prevent the entrance of foreign materials into the pump. $^{3}/_{16}$" (5 mm) diameter perforations in the strainer is typical.

In open systems, test suction line for air leaks before starting; this becomes essential with long suction line or static lift. Install, at the pump suction, a straight pipe of a length equivalent to 4 or 6 times its diameter; this becomes essential when handling liquids above 120°F (49°C). Armstrong suction guides may be used in place of the straight pipe run and in-line strainer.

Install an isolation valve in both suction and discharge lines on flooded suction application; these valves are used primarily to isolate the pump for inspection or repair.

Install a non-slam non-return check valve in discharge line between pump and isolation valve to protect pump from excessive back pressure and to prevent water running back through the pump in case of driver failure on open systems. An Armstrong Flo-Trex valve may be used in place of non-return check valve and isolation valve on pump discharge.

CAUTION:

A Only the discharge valve is to be used to throttle pump flow, not the suction valve. Care must be taken in the suction line layout and installation, as it is usually the major source of concern in centrifugal pump applications.

2.4 ALIGNMENT

Alignment is unnecessary on close-coupled pumps, Series 4360 & 4380, as there is no shaft coupling.

Series 4300 units are accurately aligned at the factory prior to being shipped and do not need re-aligning when installed.

Alignment on a Series 4300 unit may be verified by assuring an equal and parallel gap between coupling halves on both sides of the coupling.

OPERATION

2.5 STARTING THE PUMP

Ensure that the pump turns freely by hand, or with some gentle mechanical help such as a strap or Allen key in coupling bolt.

Ensure that all protective guarding is securely fixed in position.

The pump must be fully primed on start up. Fill the pump casing with liquid and rotate the shaft by hand to remove any air trapped in the impeller. On Series 4300 any air trapped in the casing as the system is filled must be removed by the manual air vent in the seal flush line. **Ensure entrained air is removed from series 4300 pumps, prior to starting, through the air vent on the seal flush line. Open vent until clear of air.** Series 4360 & 4380 units are fitted with seal flush/vent lines piped to the pump suction area. When these units operate residual air is drawn out of the pump towards the suction piping.

'Bump' or energize the motor momentarily and check that the rotation corresponds with the directional arrow on the pump casing.

To reverse rotation of a three phase motor, interchange any two power leads.

Start the pump with the discharge valve closed and the suction valve open, then gradually open the discharge valve when the motor is at operating speed. The discharge valve may be open slightly at start up to help eliminate trapped air.

When stopping the pump: Close the discharge valve and de-energize the motor.

Do not run the pump against a closed discharge valve for an extended period of time (a few minutes maximum).

Star-Delta motor starters should be fitted with electronic/mechanical interocks that have a timed period of no more than 40 miliseconds before switching from star (starting) to delta (run) connection yet allow the motor to reach full star (starting) speed before switching to delta (run).

Should the pump be noisy or vibrate on start-up a common reason is overstated system head. Check this by calculating the pump operating head by deducting the suction pressure gauge value from the discharge gauge reading. Convert the result into the units of the pump head as stated on the pump nameplate and compare the values. Should the actual pump operating head be significantly less than the nameplate head value it is typically permissable to throttle the discharge isolation valve until the actual operating head is equal to the nameplate value. Any noise or vibration usually disappears. The system designer or operator should be made aware of this as some adjustment may be required to the pump impeller diameter or drive settings, if applicable, to make the pump suitable for the system as installed.

CAUTION:



Check rotation arrow prior to operating the unit. The rotation of all Armstrong Vertical In-Line units is clockwise when viewed from the drive end. (Looking from on top of/behind the motor).

2.6 GENERAL CARE

Vertical In-Line pumps are built to operate without periodic maintenance, other than motor lubrication on larger units. A systematic inspection made at regular intervals, will ensure years of trouble-free operation, giving special attention to the following:

- Keep unit clean.
- Provide the motor with correctly sized overload protection.
- Keep moisture, refuse, dust or other loose particles away from the pump and ventilating openings of the motor.
- Avoid operating the unit in overheated surroundings (above 100°F/40°C).

WARNING:



Whenever any service work is to be performed on a pumping unit, disconnect the power source from the driver, **lock it off** and tag with the reason. Any possibility of the unit starting while being serviced must be eliminated.

- If mechanical seal environmental accessories are installed, ensure water is flowing through the sight flow indicator and that filter cartridges are replaced as recommended. (See Armstrong files 43.85 & 43.86 for seal environmental instructions).

2.7 LUBRICATION

Pump
Lubrication is not required. There are no bearings in the pump that need external lubrication service.

Large Series 4300 units are installed with a shaft bushing located beneath the impeller that is lubricated from the pump discharge. This bearing is field removable for service on the 20 × 20 × 19 size without disturbing the motor or other major pump components.

Service instructions for the lower bearing is to be found in File no: 43.805.

Motor
Follow the lubrication procedures recommended by the motor manufacturer. Many small and medium sized motors are permanently lubricated and need no added lubrication. Generally if there are grease fittings evident the motor needs periodic lubrication. None if not.

Check the lubrication instructions supplied with the motor for the particular frame size indicated on the motor nameplate.

Mechanical Seal
Mechanical seals require no special attention. The mechanical seal is fitted with a flush line. The seal is flushed from discharge of the pump casing on Series 4300 pumps and is flushed/vented to the suction on close coupled pumps, Series 4360 & 4380.

The Series 4300 pump is flushed from the pump discharge because the mechanical seal chamber is isolated from the liquid in the pump by a throttle bushing. Because the seal chamber is isolated, seal environmental controls such as filters and separators, when installed in the Series 4300 flush line are very effective, as only the seal chamber needs cleansing, and will prolong seal life in HVAC systems.

Do not run the pump unless properly filled with water as the mechanical seals need a film of liquid between the faces for proper operation.

Mechanical seals may 'weep' slightly at start-up. Allow the pump to continue operating for several hours and the mechanical seal to 'seat' properly prior to calling for service personnel.

The following Armstrong files are available for mechanical seal replacement instructions:

- Series 4360 & 4380: File no. 43.81
- Series 4300: P-Base and TCZ Motor Frame – File no. 43.84
  TC Motor Frame – File no. 43.88

2.8 SYSTEM CLEANLINESS

Before starting the pump the system must be thoroughly cleaned, flushed and drained and replenished with clean liquid.

Welding slag and other foreign materials, Stop Leak and cleaning compounds and improper or excessive water treatment are all detrimental to the pump internals and sealing arrangement.

Proper operation cannot be guaranteed if the above conditions are not adhered to.

NOTE:
Particular care must be taken to check the following before the pump is put into operation:

- **A** Pump primed?
- **B** Rotation OK?
- **C** Lubrication OK?
- **D** Pipe work properly supported?
- **E** Voltage supply OK?
- **F** Overload protection OK?
- **G** Is the system clean?
- **H** Is the area around the pump clean?

WARRANTY
Does not cover any damages to the equipment resulting from failure to observe the above precautions. Refer to Armstrong General Terms and Warranty sheet. Contact your local Armstrong representative for full information.

2.9 INSTALLATION LAYOUTS

FIG. 2.1 Hanger supported pipe mounted.

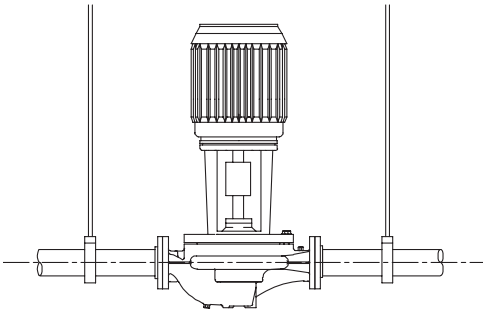


FIG. 2.2 Pipe mounted supported at ceiling.

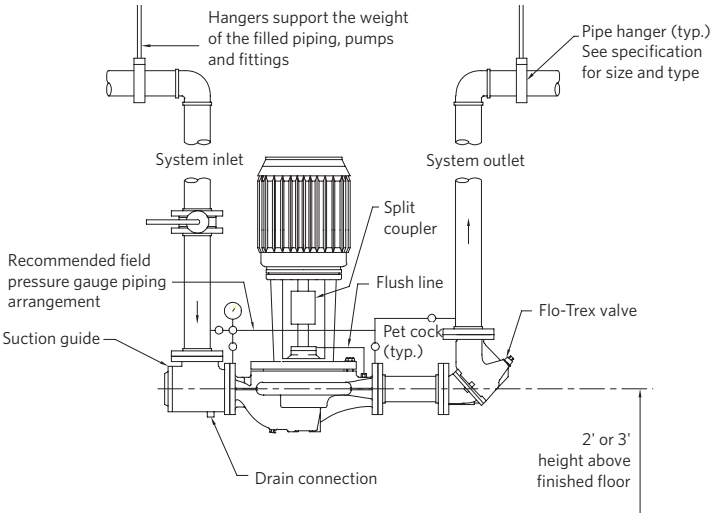


FIG. 2.3 Discharge elbow for minimum footprint.

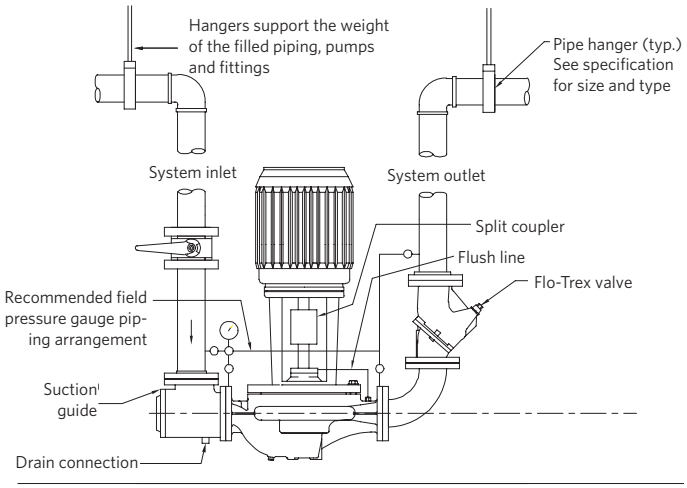


FIG. 2.4 With additional pipe supports.

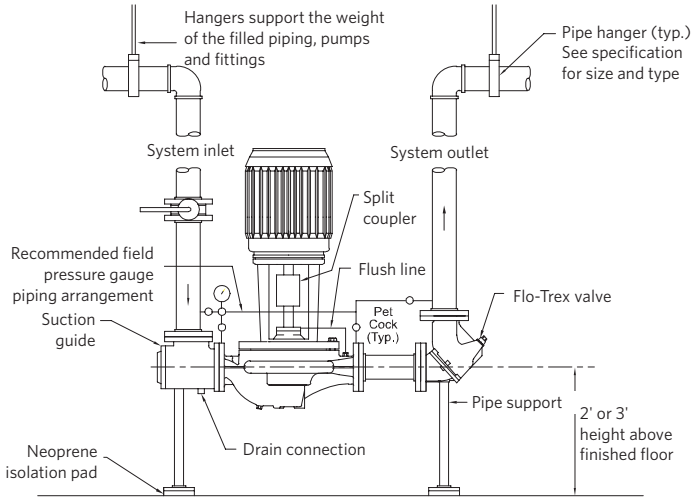


FIG. 2.5 Floor saddle support.

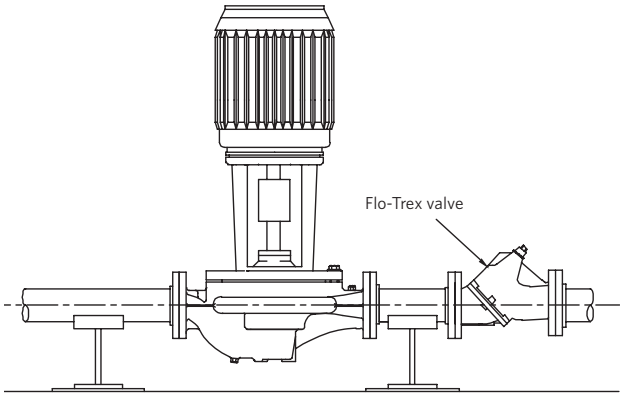


FIG. 2.6 Additional floor support.

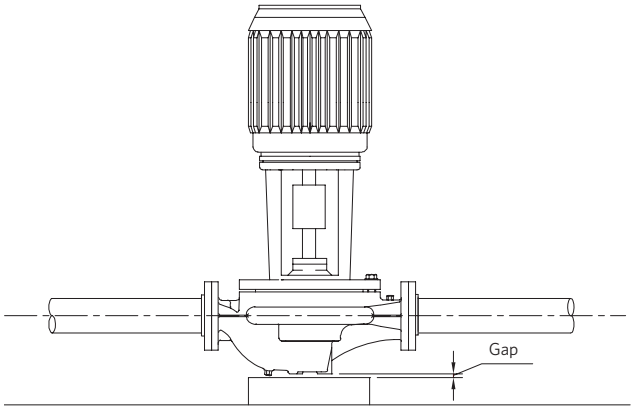


FIG. 2.7 With stanchion plates.

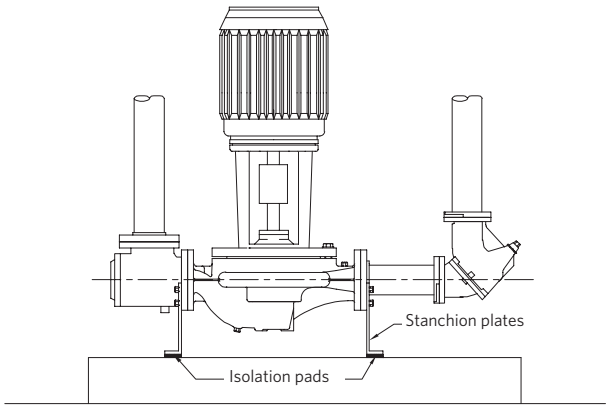


FIG. 2.8 Seismic region installation.

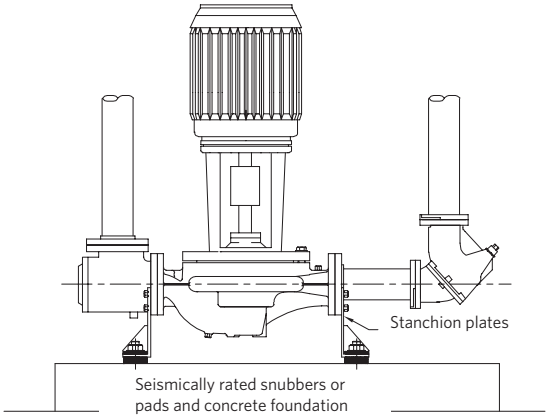


FIG. 2.9 Horizontal mounting – 4360/4380 only to 15 hp (11 kW).

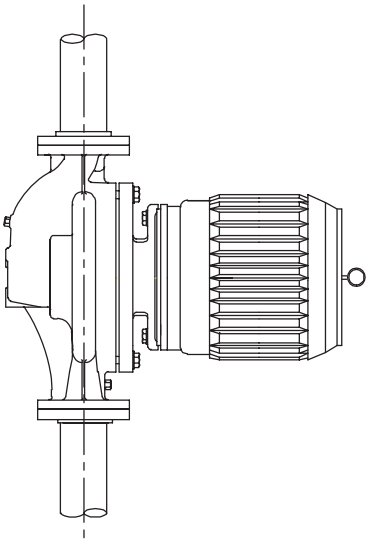


FIG. 2.10 Mounting in grooved pipe systems.

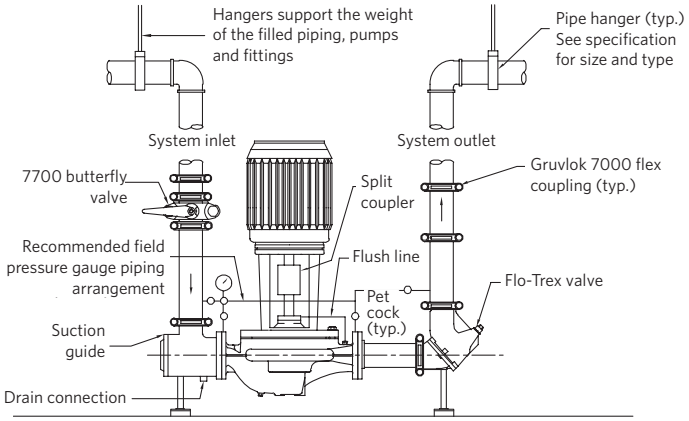


FIG. 2.11 Motor lifting hook supported.

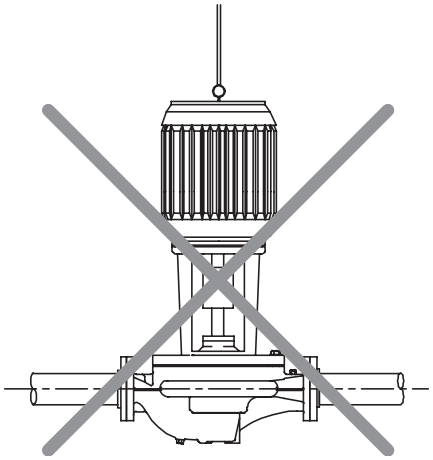


FIG. 2.12 Mounted on rigid base without flexible connectors.

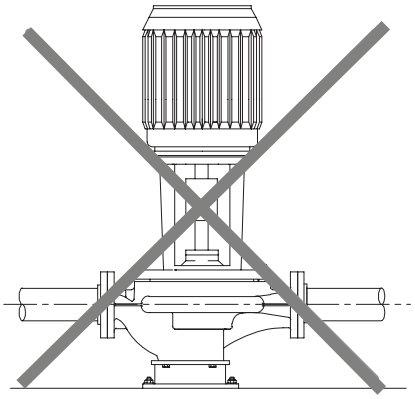
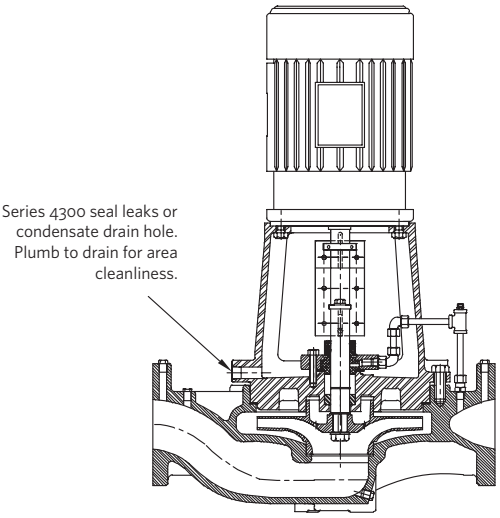


FIG. 2.13 Tapped collection well.



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23 BERTRAND AVENUE
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CANADA
M1L 2P3
+1 416 755 2291

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93 EAST AVENUE
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+1 716 693 8813

BIRMINGHAM

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IN-LINE CIRCULATING PUMPS | MODELS S25 TO S69, H32 TO H68, AND SERIES 1050 & 1060 | INSTALLATION AND OPERATING INSTRUCTIONS

File No: 10.79
Date: SEPTEMBER 06, 2016
Supersedes: 10.79
Date: NOVEMBER 27, 2013

ENGLISH

1.0	Installation	1
2.0	System cleanliness	2
3.0	Starting up	2
4.0	Lubrication	2
5.0	Seal replacement	3

FRANÇAIS

1.0	Installation	4
2.0	Propreté du système	5
3.0	Démarrage	5
4.0	Lubrification	5
5.0	Remplacement des joints d'étanchéité	6

CAUTION

Always disconnect power supply from motor before servicing.

1.0 INSTALLATION

For convenience, Armstrong circulators generally are installed in vertical pipelines, but may be changed easily on the job for horizontal pipelines or for opposite flow directions. To make the change, remove the body capscrews, taking care body gasket is kept in position, and rotate body to desired direction at 90° or 180° from the original position.

With the arrow on the body pointing in direction of the flow, insert body capscrews and tighten evenly. On models S25 to S57, H32 to H54 and series 1050 (1B to 2B), a gap between the bearing bracket and pump body (volute) is normal. Do no over tighten body capscrews! Turn pump shaft manually at coupler to make sure shaft turns freely and impeller does not rub in body. Always install with motor shaft in a horizontal position with pump oil cups or oil well cover on top.

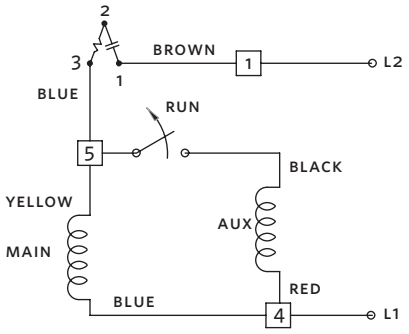
Models S25 to S46 and H32 to H41 are shipped for downward discharge. All other models are shipped for upward discharge as pumps of this size usually are installed in an upward direction on hydronic systems, so the point of zero pressure change - namely, the compression tank connection - can be made easily to the system on the suction side of the circulator.

The pump should be installed in a position to permit proper lubrication and servicing. Motor and bearing brackets are to be kept free of insulation. Pump and motor unit are designed to be supported by the in-line piping only. Do not support in any other manner. A height of approximately four feet above the floor is recommended. When placing the pump between flanges, tighten flange bolts evenly and do not tighten excessively.

Gate valves should be installed on the discharge and suction side of the pump to facilitate service. On larger pump sizes, a check valve should be located on the discharge side of pump between the pump body and the gate valve to prevent damage due to water hammer.

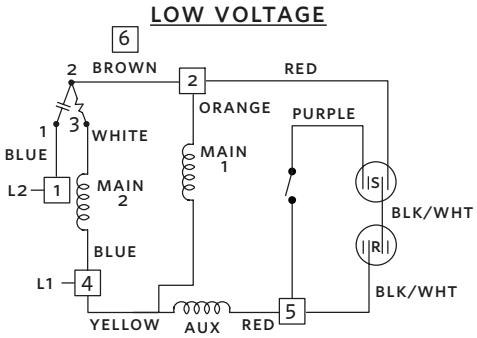
WIRING DIAGRAMS

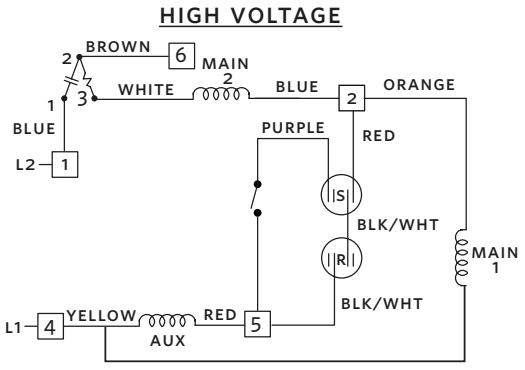
SINGLE PHASE LESS THAN 0.5HP



C.C.W. rotation shown
For C.W. Rotation interchange yellow and blue leads on term 5 & 4

SINGLE PHASE LESS THAN 1HP (with with part number beginning with 811757-...)



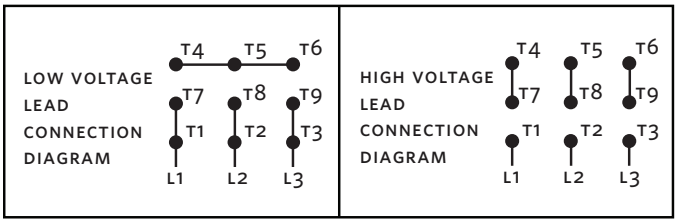


SINGLE PHASE 1HP - 1.5HP (**only** for part number not beginning with 811757-...)

	LINE A	LINE B	JOIN
HIGH STD	1	4,5	2,3,8
HIGH OPP	1	4,8	2,3,5
LOW STD	1,3,8	2,4,5	—
LOW OPP	1,3,5	2,4,8	—

NOTE: Standard rotation is ccw facing end opposite shaft extension

THREE PHASE MOTOR ANY SIZE



Interchange any two lead wires to reverse rotation

2.0 SYSTEM CLEANLINESS

Before starting the pump, the system must be thoroughly cleaned, flushed and drained, then replenished with clean liquid. Welding slag and other foreign materials, 'stopleak' and cleaning compounds, excessive or improper water treatment - all are detrimental to the pump. Warranty will be void if any of these conditions are allowed to exist. (Refer to **File no. 6090.645** design and care of closed hydronic systems.)

3.0 STARTING UP

The pump must be fully primed on start-up. Fill system piping and pump body with liquid and vent complete system, turning pump by hand to dislodge air from body. Make sure fittings and drain valves are airtight, then add any additional fill required.

Check motor against available electric supply, then start pump making sure rotation is correct. When viewed from motor end, rotation is counter-clockwise on models S25 to S46 and H32 to H41. On all other models, rotation is clockwise. If pressure does not develop, stop pump, re-check, vent and fill. Never attempt to fill the system when the pump is running

4.0 LUBRICATION

CAUTION:
Do not put oil in the **maintenance free** circulators. These models contain MF in their item numbers and are labelled: 'THIS BEARING ASSEMBLY CONTAINS PERMANENTLY LUBRICATED BEARINGS AND DOES NOT NEED ANY OILING OR GREASING'.

Stop motor before lubricating, do not over-oil or spill oil on resilient motor rings. Do not force oil into cups, and stop if cup fills before addition of specified amount.

Pump lubrication: Only applicable for pumps those are with sleeve bearing SBA and have oil cup for lubrication.

Immediately after pump is installed and before running, slowly add the oil (SAE 30 non-detergent regular, supplied with pump) to pump oil cup, located on top of bearing bracket:

S25 to S57, H32 to H54 and series 1050 (1B to 2B)	¼ oz.
S69, H63 to H68, series 1060 (1½D to 3D)	2 oz.

At the start of each following heating season, lubricate with SAE 30 oil for models S25 to S57, H32 to H54 and series 1050 (1B to 2B), add approximately ¼ oz. Lubricate every six months for high temperature or constant operation. On models S69, H63 to H68 and series 1060 (1½D to 3D), be sure oil is visible at the top and center of window on side of bracket and maintain this level at all times.

Motor lubrication

CAUTION

Stop motor before lubricating. Do not over-oil or spill oil on resilient motor rings.

This motor has been lubricated properly at the factory. At the start of each following heating season, however, on motors with oil cups, add 15 drops SAE 30 non-detergent oil to each motor cup.

If the motor is fitted with grease fittings, follow the motor manufacturer's recommended procedure. Motors without oil cups or grease fittings are custom-greased for several years operation and require little or no attention.

5.0 SEAL REPLACEMENT

Remove the pump bracket from the body. Remove the impeller, damaged seal assembly, ceramic insert and rubber cup. Clean the recess in bearing bracket coverplate and install a new retainer cup and ceramic insert. Check the condition of the shaft sleeve. If scored, replace the shaft assembly. Otherwise, clean shaft extension and polish sleeve with a fine crocus cloth, using a rotating motion, if required.

Press against the coupler end of the shaft to take up play while pressing new seal firmly against the stationary face. A slight amount of clean vaseline may be put on shaft sleeve to assist installation. Press down firmly and evenly, using two screwdrivers and pushing against the four ears of driving band (the metal ring around rubber bellows), or around top outer edge of driving band on models S25 to S57, H32 to H54 and series 1050 (1B to 2B).

Do not use spring washer on models S25, S35 and H32 current style circulators, where recess to locate spring is provided on impeller hub.

Continue pressing against coupler end of shaft, re-mount impeller and re-assemble the seal bearing assembly into body. If necessary, install a new body gasket and clean gasket surface of both volute and bracket.

CAUTION



Before operating pump, carefully check:

1. Is the pump primed?
2. Is rotation correct?
3. Is pump properly lubricated?
4. Does the power supply agree with data on motor name plate?
5. Is overload protection provided?
6. Is the system clean?

For domestic water systems use bronze body pumps.

ATTENTION

Toujours couper l'alimentation électrique avant de procéder à l'entretien d'un moteur.

1.0 INSTALLATION

Pour des raisons pratiques, les circulateurs Armstrong sont généralement installés sur des conduites verticales, mais peuvent être facilement modifiés sur place pour des conduites horizontales ou pour changer la direction du liquide en circulation. Pour procéder au changement, retirer les boulons de fixation et, en prenant soin de maintenir en place le joint d'étanchéité, tourner le corps suivant l'angle désiré, 90° ou 180°, par rapport à la position originale.

La flèche sur le corps pointant dans la direction de la circulation du liquide, insérer les boulons de fixation et les visser uniformément. Sur les modèles S25 à S57, H32 à H54 et la série 1050 (1B à 2B), il est normal qu'il y ait un espace entre la chaise de palier et le corps de la pompe (volute). Ne pas trop serrer les boulons ! À la jonction, faire tourner l'arbre de la pompe à la main pour vous assurer qu'il tourne librement et que l'impulseur ne frotte pas l'intérieur du corps. Toujours installer de manière à ce que l'arbre du moteur soit en position horizontale, les godets à huile et le couvercle du réservoir d'huile étant placés sur le dessus.

Les modèles S25 à S46 et H32 à H41 sont livrés en prévision d'une évacuation vers le bas. Tous les autres modèles sont livrés en prévision d'une évacuation vers le haut, puisque les pompes de cette taille sont habituellement installées sur les systèmes hydroniques pour pomper vers le haut, de sorte que le point de changement de pression nul, c'est-à-dire la connexion au vase d'expansion, puisse facilement se trouver du côté aspiration du circulateur.

La pompe doit être installée à un endroit qui permet l'entretien et la lubrification. Le moteur et la chaise de palier doivent être exempts d'isolant. La pompe et le moteur sont conçus pour être soutenus uniquement par la tuyauterie en ligne. Ne pas les supporter d'aucune autre façon. Il est recommandé de les placer à environ 4 pi au-dessus du sol. Au moment de fixer la pompe par ses brides, serrer les boulons uniformément et sans excès.

Des robinets-vannes devraient être installés du côté évacuation et du côté aspiration de la pompe pour faciliter l'entretien. Sur les pompes plus grosses, un clapet antiretour devrait être placé du côté évacuation de la pompe, entre cette dernière et le robinet-vanne, pour prévenir les dommages causés par les coups de bélier.

SHÉMAS DE CÂBLAGE

MONOPHASÉ MOINS DE 0.5HP

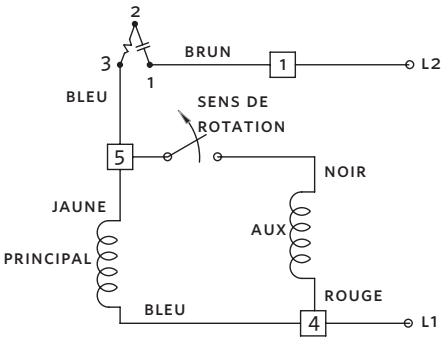
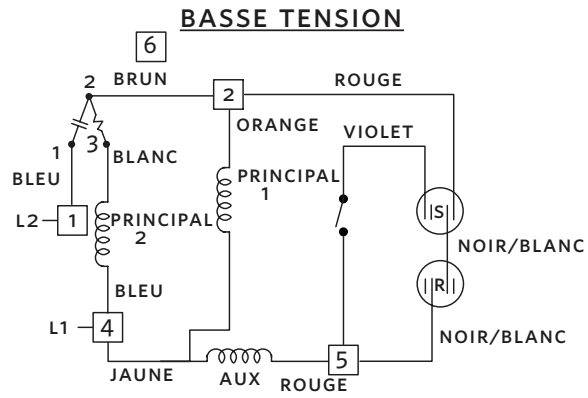
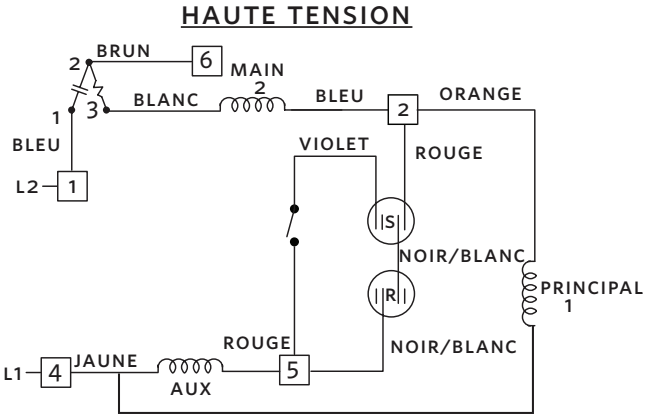


Schéma ci dessus à suivre dans le sens contraire des aiguilles d'une montre.

Pour une rotation dans le sens des aiguilles d'une montre, inverser les fils jaune et bleu des bornes 5 & 4.

MONOPHASÉ MOINS DE 1HP (avec un numéro de référence commençant par 811757-...)



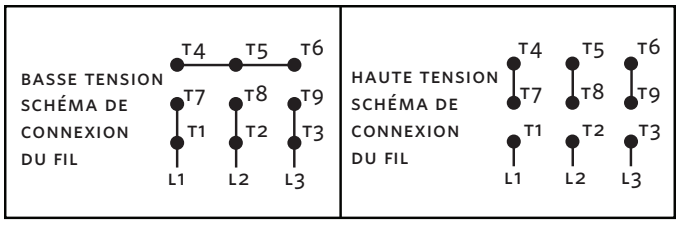


MONOPHASÉ 1HP-1.5HP (seulement pour un numéro de référence ne commençant pas par 811757-...)

	LIGNE A	LIGNE B	JONCTION
HAUTE TENSION ROTATION STD	1	4,5	2,3,8
HAUTE TENSION ROTATION OPP	1	4,8	2,3,5
BASSE TENSION ROTATION STD	1,3,8	2,4,5	—
BASSE TENSION ROTATION OPP	1,3,5	2,4,8	—

NOTE: Le sens de rotation standard est dans le sens contraire des aiguilles d'une montre en faisant face à l'extrémité opposée de l'extension de l'arbre

MOTEUR TRIPHASÉ DE TOUTE TAILLE



Permuter deux des fils de sorties pour inverser le sens de rotation

2.0 PROPRETÉ DU SYSTÈME

Avant de démarrer la pompe, le système doit être entièrement nettoyé, vidangé et rincé, puis rempli de nouveau d'un liquide propre. Les scories de soudage et autres matières étrangères, les composés de colmatage de fuites et de nettoyage, les produits de traitement excessifs ou inappropriés de l'eau, peuvent tous endommager les composantes internes de la pompe. La garantie sera nulle si l'une ou l'autre de ces conditions est permise.(Consulter le **dossier n° 6090.645** conception et entretien des systèmes hydroniques fermés.)

3.0 DÉMARRAGE

La pompe doit être parfaitement amorcée avant le démarrage. Remplir la tuyauterie du système et le corps de la pompe de liquide, ventiler complètement le système, faire tourner la pompe à la main pour déloger les bulles d'air qui y seraient emprisonnées. Vous assurer que les raccords et les robinets de vidange sont étanches et ajouter le liquide qu'il faut pour remplir.

Comparer les exigences électriques aux conditions d'alimentation, puis faire démarrer la pompe et vous assurer qu'elle tourne correctement. Vue de l'extrémité moteur de la pompe, la rotation se fait dans le sens contraire des aiguilles d'une montre sur les modèles S25 à S46 et H32 à H41. Sur tous les autres modèles, la rotation se fait dans le sens des aiguilles d'une montre. Si la pression ne grimpe pas, arrêter la pompe, vérifier de nouveau, ventiler et remplir. Ne jamais essayer de remplir le système lorsque la pompe est en marche.

4.0 LUBRIFICATION

ATTENTION:
NE PAS verser d'huile dans les Circulateurs ne nécessitant aucun entretien. Les modèles mentionnant **MF** dans leur référencesont étiquetés : '**CE SYSTÈME À ROULEMENT EST ÉQUIPÉ DE ROULEMENTS À GRAISSAGE PERMANENT ET NE NÉCESSITE AUCUN AJOUT D'HUILE NI DE GRAISSAGE'.**

Arrêter le moteur avant de lubrifier. Ne pas mettre trop d'huile ni en renverser sur les bagues souples du moteur. Ne pas faire entrer l'huile de force dans les godets et arrêter le remplissage si un godet se remplit avant d'avoir ajouté la quantité spécifiée.

Lubrification de la pompe : Applicable seulement pour les pompes à paliers à douille et ayant un godet pour la lubrification

Immédiatement après l'installation de la pompe et avant de la démarrer, ajouter lentement de l'huile (SAE 30 non détergente régulière, fournie avec la pompe) dans le godet situé sur le dessus de la chaise de palier :

S25 à S57, H32 à H54 et série 1050 (1B à 2B)	¼ oz.
S69, H63 à H68, série 1060 (1½D à 3D)	2 oz.

Par la suite, au début de chaque saison de chauffage, lubrifier la pompe en utilisant de l'huile SAE 30. Pour les modèles S25 à S57, H32 à H54 et la série 1050 (1B à 2B), ajouter environ ½oz. Lubrifier à tous les six mois si la pompe fonctionne tout le temps ou à haute température. Sur les modèles S69, H63 à H68, série 1060 (1½D à 3D), vous assurer que l'huile est visible en haut et au centre de la lunette sur le côté de la chaise de palier et maintenir ce niveau en tout temps.

Lubrification du moteur

ATTENTION

Arrêter le moteur avant de le lubrifier. Ne pas ajouter trop d'huile ni en renverser sur les bagues souples du moteur.

Ce moteur a été lubrifié correctement en usine. Au début de chaque saison de chauffage, toutefois, sur les moteurs munis de godets d'huile, ajouter 15 gouttes d'huile non détergente SAE 30 dans chaque godet.

Si le moteur est équipé d'embouts de graissage, respecter la procédure recommandée par le fabricant. Les moteurs à godets d'huile ou à embouts de graissage sont graissés individuellement en prévision de plusieurs années d'utilisation et exigent peu ou pas d'attention.

5.0 REMPLACEMENT DES JOINTS D'ÉTANCHÉITÉ

Retirer la portion pompe du corps. Retirer l'impulseur, le joint d'étanchéité endommagé, la pièce de céramique et le godet de caoutchouc. Nettoyer le compartiment du joint dans la chaise de palier et installer un nouveau godet et une nouvelle céramique. Vérifier l'état de la chemise de l'arbre. Si elle est marquée, remplacer l'ensemble de l'arbre. Autrement, nettoyer le prolongement de l'arbre et, au besoin, polir la chemise à l'aide d'une toile à polir fine suivant un mouvement rotatif.

Pousser sur l'extrémité accouplement de l'arbre pour réduire le jeu tout en pressant fermement le nouveau joint d'étanchéité sur la face fixe. On peut mettre une petite quantité de vaseline sur la chemise de l'arbre pour aider à l'installation. Pousser fermement et uniformément en utilisant deux tournevis contre les quatre oreillettes du collet (l'anneau de métal autour des soufflets de caoutchouc) ou sur le pourtour extérieur du collet dans le cas des modèles S25 à S57, H32 à H54 et de la série 1050 (1B à 2B).

Ne pas utiliser de rondelle à ressort sur les circulateurs de modèles courants S25, S35 et H32 lorsque la dépression prévue pour le ressort se trouve sur le moyeu de l'impulseur. Continuer d'appuyer sur l'extrémité accouplement de l'arbre. Remonter l'impulseur et l'ensemble porteur du joint d'étanchéité dans le corps. Au besoin, installer un nouveau joint pour le corps et nettoyer la surface du joint de la volute et de la chaise de palier.

ATTENTION

Avant de faire fonctionner la pompe, vous assurer que :

1. La pompe a été amorcée?
2. Le sens de la rotation est le bon?
3. La pompe est correctement lubrifiée?
4. L'alimentation correspond aux données sur la plaque d'identification?
5. La pompe est protégée contre les surcharges?
6. Le système est propre?

Pour les systèmes domestiques de distribution d'eau, utiliser des pompes à corps de bronze.

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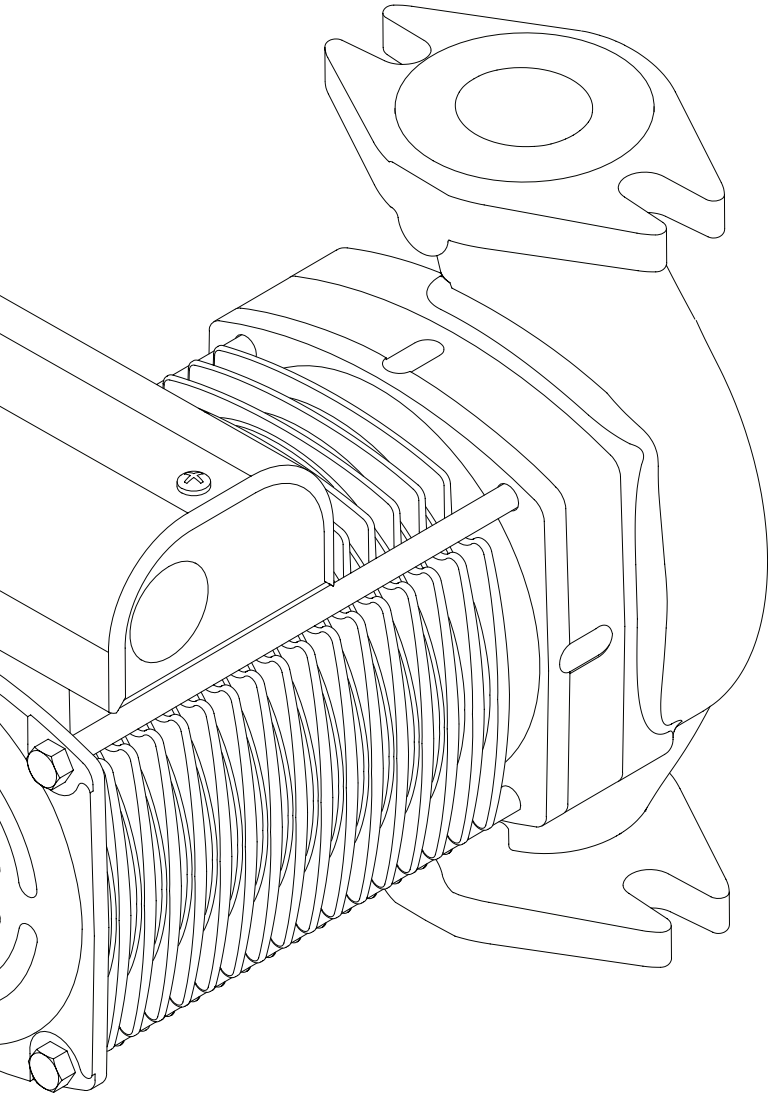
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ARMSTRONG



E.2 Series

High efficiency circulator

Installation and operating instructions

File No: 10.84
Date: JULY 01, 2016
Supersedes: 10.84
Date: JUNE 08, 2016

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2.0 Electrical wiring 4

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READ CAREFULLY BEFORE INSTALLING & OPERATING THE CIRCULATOR

INSTALLER: PLEASE LEAVE THIS MANUAL FOR THE OWNER'S USE

You are about to install an E.2 series circulator – a high-efficiency pump from Armstrong. E.2 series circulators are designed for heating and cooling in hydronic, geothermal or solar systems and circulating water, ethylene or propylene glycol/water solutions. For pumping domestic (potable) water, Armstrong recommends the use of circulators with bronze, or stainless steel body construction.

The E.2 series circulators are extremely efficient and quiet. They utilize a state of the art permanently lubricated bearing system designed for many years of trouble-free operation. They feature a permanent-split capacitor motor with thermal protection.

1.0 OPERATING LIMITS

Maximum operating pressure:
150 psi (1034 kPa)

Maximum operating temperature:
All standard models 230°F (110°C)

Minimum operating temperature:
All standard models 32°F (0°C)

Electrical rating:
For models with ⅙ hp motors (100W): 120 V, 1 phase, 60 Hz or 208/240 V, 1 phase, 60 Hz, or 220-240v, 50Hz

For models with ⅔ hp motors (300W): 120 V, 1 phase, 60 Hz or 208/240/277 V, 1 phase, 60 Hz, or 220-240v, 50Hz

When unpacking the circulator, inspect for any damage that may have occurred during transit. Check for loose, missing or damaged parts.

THIS PUMP IS FOR INDOOR USE ONLY

Before installing the circulator, proper installation practice recommends a thorough flush of the hydronic system, ensuring removal of all foreign materials.

This pump should be installed in a well lit location with good access.

Installation personnel must be qualified for the task.

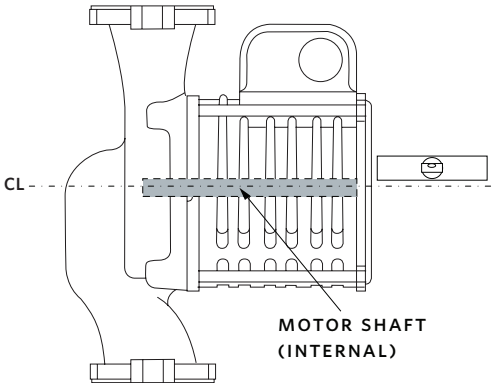
All personnel performing installation must wear appropriate personal protective equipment

WARNING

Mount with motor shaft horizontal and terminal box above centerline (CL) only!

The circulator is supplied for up-discharge.

DIAGRAM 1: Installation Orientation



For alternate discharge orientation:

1. Loosen the four motor mounting bolts
2. Rotate the volute to match piping orientation
3. Observe flow direction arrow on volute
4. Ensure volute gasket is properly seated
5. Retighten mounting bolts evenly to 5 lb/ft (6.7 N/m)
6. Ensure the impeller spins freely

2.0 ELECTRICAL WIRING

The electrical wiring must be installed in strict accordance with the Canadian Electrical Code (Canada) or the U.S. National Electrical Code (USA),or BS7671 (Europe) as well as local codes and regulations.

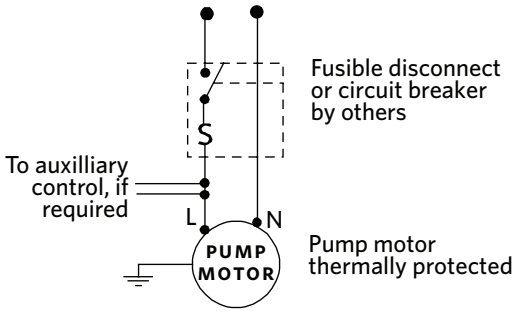
1. Electrical installation should be conducted by a qualified electrician. Installers should be equipped with proper personal protective equipment.
2. The motors of E.2 series circulators are designed for 1 phase, 60 Hz, 120 V 60 Hz, 240 V 60 Hz, 220-240 50 Hz service only. (Please refer to the rating label on the circulator's terminal box to determine the correct voltage.)
3. Always make sure the electric power is disconnected and locked out before wiring the circulator.
4. To wire, loosen the screw from the terminal box cover and remove the screw and cover.
5. Install the appropriate size conduit end to one of the holes on either side of the terminal box.

6 For 120 V models: Referring to **DIAGRAM 2** below, connect the black, hot, (L) and white, neutral, (N) leads of the supply wire to the black and white motor leads respectively inside the terminal box. Connect the ground wire to any one of the four green ground screws inside of the terminal box (use a minimum 18 AWG wire size).

For 208/240/277 V models: Referring to **DIAGRAM 3** below, connect the black (L1) and blue (L2) leads of the supply wire to the black and white motor leads respectively inside the terminal box. Connect the ground wire to any one of the four green ground screws inside of the terminal box (use a minimum 18 AWG wire size).

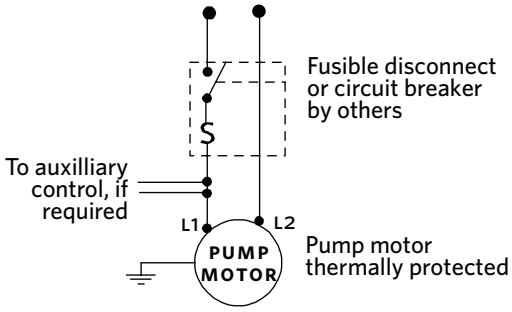
NOTE: For any voltage the brown and yellow wires are hard wired in and should **not** be touched they are for the capacitor only and can stop the motor from running.

DIAGRAM 2 120 V installations



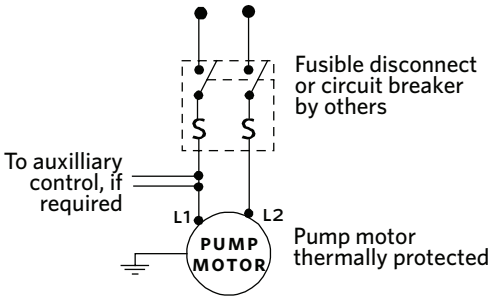
Typical wiring diagram for single phase, 120 V, 60 Hz power source

DIAGRAM 3 208/240/277 V installations



Typical wiring diagram for
A single phase, 240 V, 60 Hz power source
B three phase, 208/277 V, 60 Hz power source

DIAGRAM 4 230 V installations



Typical wiring diagram for single phase, 230 V, 50 Hz power source

7 Replace the terminal box cover.

The motor is thermally protected for your safety so thermal overload protection is not necessary. All that is required is a fused plug or circuit breaker in the power line for short circuit protection.

Electrical information can be found on the nameplate of the motor.

3.0 START UP

1 Before starting up the circulator, proper installation practice recommends a thorough flush and draining of the hydronic system, ensuring removal of all foreign materials. Fill the system with clean water or glycol solution before starting.

2 Air must be completely vented from the system before starting up the circulator. **If the system is not completely vented of air and the circulator is allowed to run dry, the mechanical seal will be damaged.**

3 When the system has been completely filled and vented, only then can the pump be started.

4.0 PREVENTIVE MAINTENANCE – INSPECTION

E.2 series circulators are fitted with permanently lubricated ball bearings and **do not** require lubrication.

Although Armstrong long-life circulators are designed to provide years of worry-free service, it is good maintenance practice to inspect the entire hydronic system periodically – including the E.2 series circulator – for potential problems. If there is any evidence of leakage or damage, repair or replace the pump.

Disconnect and lockout the power before servicing.

5.0 PUMP REPLACEMENT IN AN EXISTING INSTALLATION

5.1 COMPLETE PUMP

1 Ensure that electric power is disconnected and locked out. Loosen the screw from the terminal box cover and remove the cover. Disconnect the supply wires from the circulator only, leaving the capacitor wires connected.



All servicing personnel should be equipped with proper personal protective equipment.

2 If valves have been installed, on the suction and discharge sides of the pump, close them before attempting to remove the circulator from the volute. If no valves have been installed it may be necessary to drain the system.



Allow water to cool to 100°F (40°C) before draining the system. It is best to leave the drain valve open while working on the system.

3 To relieve any residual pressure which may be present in the pump body, loosen the flange bolts and gently move the pump body back and forth to allow the pressurized water to escape.

NOTE: Place a pan under the pump to collect the drain water.

4 If the entire volute is needed to be removed, then remove the flange bolts and nuts. The entire circulator can then be removed from the piping system.

5 Install the E.2 series circulator where there will be sufficient room for inspection and service. It is recommended that isolation valves be installed on both the suction and discharge sides of the circulator for future servicing. This eliminates the need for draining the system when working on the circulator (for example, when replacing the mechanical seal).

6 Install suction and discharge flanges on the pipe ends. The use of Teflon tape sealer or a high quality thread sealant is recommended.

7 Pipe strain can be minimized by the use of pipe hangers near the pump, positioned to support the suction and discharge piping.

To wire the E.2 series circulator, follow steps C through G in the Electrical Wiring section above, noting that electrical supply and grounding wires must be rated for at least 194°F (90°C).

5.2 MOTOR END ONLY

1 Turn off the pump leaving it installed in the line .

2 Ensure electrical power is disconnected and locked out .

3 Close the water supply at the points closest to the pump's inlet and outlet .

4 For safety, allow water to cool to 100°F (40°C) before draining the system. It is best to leave the drain valve open while working on the system.

5 Bleed the water pressure from the pump.

6 Place a pan under the pump to collect the drain water.

7 While holding the motor body, loosen the four bolts that attach the motor to the pump casing (volute). Start with the two bottom bolts first and remove them, then slowly loosen the top two bolts. Allow the water to drain from the bottom of the pump. When the water has finished draining, remove the two top bolts. Remove the motor straight out from the volute being careful of its attached impeller. The motor is heavy, do not drop it.

8 Install new casing gasket .

9 Install new motor end (with impeller and seal kit).

10 Tighten four motor end bolts in a crisscross pattern and tighten evenly to 60 in/lbs.

11 Open isolation flanges or fill the system with water before starting circulator.

12 To wire the E.2 series circulator, follow steps C through G in the Electrical Wiring section above, noting that electrical supply and grounding wires must be rated for at least 194°F (90°C).

6.0 MECHANICAL SEAL REPLACEMENT

1 Follow steps 1 through 4 in section **Existing pump removal from system piping.**

2 While holding the motor body, remove the bottom two bolts that attach the motor to the pump casing (volute), then slowly loosen the top two bolts. Allow the water to drain from the bottom of the pump. When the water has finished draining, remove the two top bolts. Remove the motor straight out from the volute being careful of the attached impeller.



Handle with care
The motor is heavy, and possibly hot,
DO NOT drop it!

3 While holding the rotor very tightly by hand or a gloved hand only, unscrew the impeller nut off the motor shaft by turning it clockwise (i.e. opposite to most bolts and nuts). Place the motor on its back, with the shaft up.

4 Remove the rotary part of the mechanical seal by gently pulling it off the shaft. If it is too tight use two small flat bladed screwdrivers to gently pry it off the shaft by placing the flat side of the blades onto opposite sides of the mechanical seal.

5 Remove the face plate from the motor by gently prying it off of the motor housing extension, and carefully pulling it straight up, avoiding any shaft contact.

6 Remove the stationary part of the seal by gently prying it off the steel faceplate.

7 Remove any corrosion present on the stainless steel motor shaft and face plate (especially the seal seat area) with a non-metallic brush or scrub pad. Do not use a wire brush or steel wool.

8 Remove any dust created during step #7 above and put a few drops of non-petroleum lubricant around the face plate where the stationary seat is to be installed.

9 Install the new stationary seal seat into the faceplate by firmly pressing it down until it bottoms. The disk should be clean. If needed, wipe it with alcohol and a soft lint free cloth.

10 Replace the faceplate on the motor housing extension, being careful to avoid shaft contact. This may need to be gently tapped down until tight to the housing. Be sure to check that the stainless steel plate is flush to the extender plate face.

11 Install the special **installation tool** (item #180212-095) on the top of the shaft making sure it is tight to the flat base of the impeller to protect the seal from sharp edges during seal installation.

12 Apply a liberal amount of non-petroleum based lubricant on the outside of the special plastic **installation tool.**

13 Wipe any excess lubricant off of the stationary silicon carbide seal face with a lint free cloth and alcohol to ensure the surface is clean.

14 Install the new rotating seal element and spring assembly by gently pushing it (graphite ring first) over the **installation tool** and onto the shaft until the graphite ring presses tightly against the stationary seal seat. The seal spring may be compressed slightly.

15 Remove the **installation tool** from the shaft.

16 Install the impeller keeping the inlet end up. Make sure to align the flats to the shaft flats and push the impeller down tightly to the seal.

17 Place 2-3 drops of medium strength thread locker liquid on the nut threads.

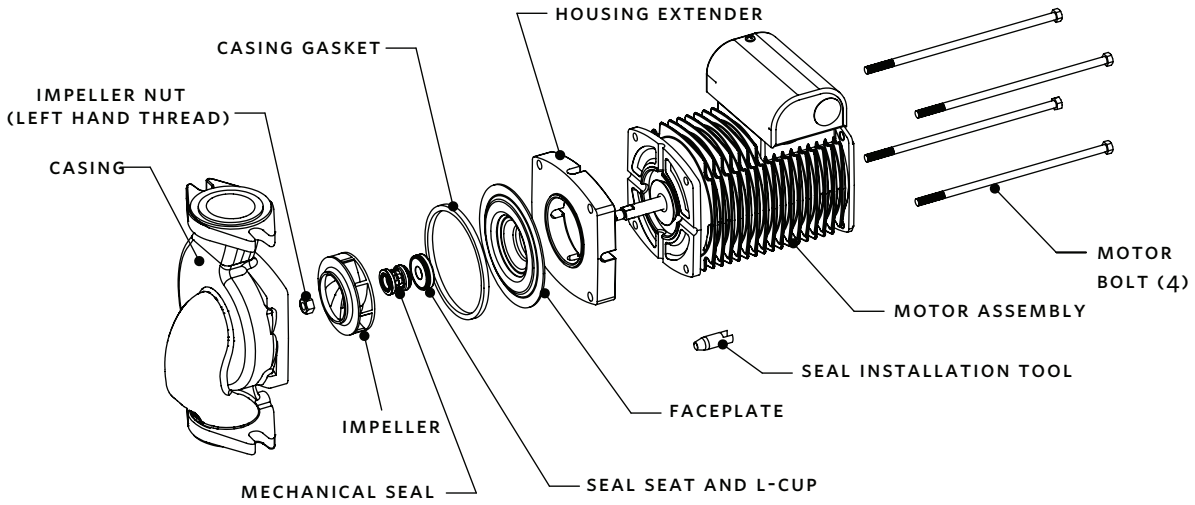
18 Install the special left hand thread nut on the motor shaft. While holding the motor rotor in place as in step 3, thread the impeller nut on to the shaft in a counter-clockwise direction and tighten the nut to approximately 6ft-lbs (8.1Nm).

19 If the impeller will not spin freely contact Armstrong Technical Support at 1-416-755-2291 or email techsupport@armlink.com.

20 Ensure the gasket is properly seated in the pump casing (volute) gasket groove. Holding the motor body, insert the impeller straight into the volute. Verify the gasket was not dislodged during insertion, and is still seated properly. Hold the motor body steady while fastening the four bolts that attach the motor to the pump casing (volute). Tighten evenly and diagonally. There should be a small, even gap of about 0.02" (0.5 mm) between the motor flange and the pump casing (volute).

21 Follow the **START UP** instructions (File no. 10.84) and check for leaks.

DIAGRAM 5 Internal Assembly (Exploded view)



7.0 PRODUCT FAMILY SPECIFICATION

50 HZ E.2 SERIES MODELS

Hydraulic data

MODEL	E7.2/ E7.2B	E9.2/ E9.2B	E12.2/ E12.2B	E14.2/ E14.2B	E22.2/ E22.2B	E33.2/ E33.2B
Nominal Hydr. Power (watts)	105	105	252	252	252	252
Max Flow (L/sec.)	1.9	1.8	2.7	2.8	4.9	7.9
Max Head (m)	5.3	7.7	10.6	11.4	8.7	6.3
Max. Efficiency (BEP%)	22.5	26.4	31.2	32.4	40.7	42.1
Max. Fluid Temperature	110°C (All models)					
Max. Ambient Temperature	50°C (All models)					
Max. Working Pressure	1034 kPa (All models)					

Electrical (motor) data

MODEL	E7.2/E7.2B	E9.2/E9.2B	E12.2/E12.2B	E14.2/E14.2B	E22.2/E22.2B	E33.2/E33.2B
Nominal input voltage range @50 Hz.	220–240VAC	220–240VAC	220–240VAC	220–240VAC	220–240VAC	220–240VAC
Full load current draw @50 Hz.(AC Amperes)	0.80	0.90	1.7	1.8	2.3	2.3
Speed @ max flow (RPM)	2892	2855	2885	2868	2780	2760
Max. Efficiency (BEP%)	22.5	26.4	31.2	32.4	40.7	42.1

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IN-LINE CIRCULATING PUMPS | MODELS S25 TO S69, H32 TO H68, AND SERIES 1050 & 1060 | INSTALLATION AND OPERATING INSTRUCTIONS

File No: 10.79
Date: SEPTEMBER 06, 2016
Supersedes: 10.79
Date: NOVEMBER 27, 2013

ENGLISH

1.0	Installation	1
2.0	System cleanliness	2
3.0	Starting up	2
4.0	Lubrication	2
5.0	Seal replacement	3

FRANÇAIS

1.0	Installation	4
2.0	Propreté du système	5
3.0	Démarrage	5
4.0	Lubrification	5
5.0	Remplacement des joints d'étanchéité	6

CAUTION

Always disconnect power supply from motor before servicing.

1.0 INSTALLATION

For convenience, Armstrong circulators generally are installed in vertical pipelines, but may be changed easily on the job for horizontal pipelines or for opposite flow directions. To make the change, remove the body capscrews, taking care body gasket is kept in position, and rotate body to desired direction at 90° or 180° from the original position.

With the arrow on the body pointing in direction of the flow, insert body capscrews and tighten evenly. On models S25 to S57, H32 to H54 and series 1050 (1B to 2B), a gap between the bearing bracket and pump body (volute) is normal. Do no over tighten body capscrews! Turn pump shaft manually at coupler to make sure shaft turns freely and impeller does not rub in body. Always install with motor shaft in a horizontal position with pump oil cups or oil well cover on top.

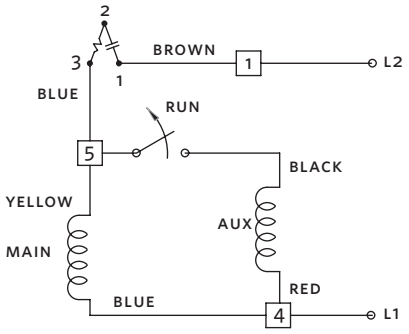
Models S25 to S46 and H32 to H41 are shipped for downward discharge. All other models are shipped for upward discharge as pumps of this size usually are installed in an upward direction on hydronic systems, so the point of zero pressure change - namely, the compression tank connection - can be made easily to the system on the suction side of the circulator.

The pump should be installed in a position to permit proper lubrication and servicing. Motor and bearing brackets are to be kept free of insulation. Pump and motor unit are designed to be supported by the in-line piping only. Do not support in any other manner. A height of approximately four feet above the floor is recommended. When placing the pump between flanges, tighten flange bolts evenly and do not tighten excessively.

Gate valves should be installed on the discharge and suction side of the pump to facilitate service. On larger pump sizes, a check valve should be located on the discharge side of pump between the pump body and the gate valve to prevent damage due to water hammer.

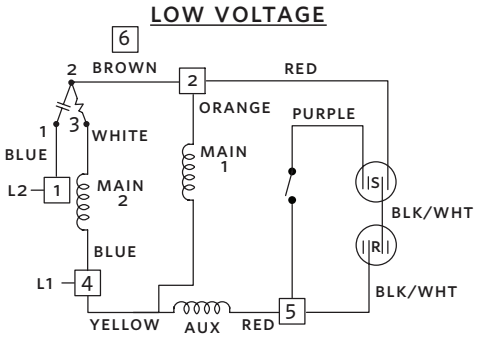
WIRING DIAGRAMS

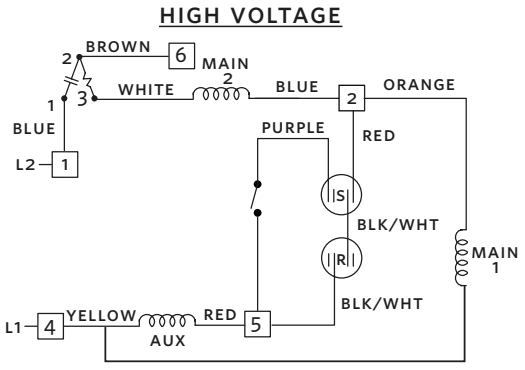
SINGLE PHASE LESS THAN 0.5HP



C.C.W. rotation shown
For C.W. Rotation interchange yellow and blue leads on term 5 & 4

SINGLE PHASE LESS THAN 1HP (with with part number beginning with 811757-...)



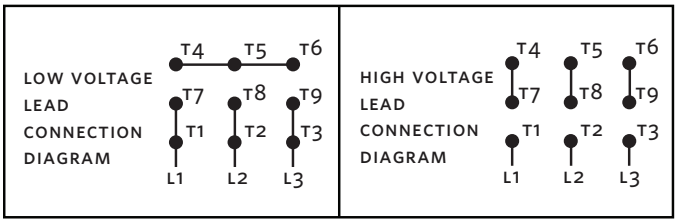


SINGLE PHASE 1HP - 1.5HP (**only** for part number not beginning with 811757-...)

	LINE A	LINE B	JOIN
HIGH STD	1	4,5	2,3,8
HIGH OPP	1	4,8	2,3,5
LOW STD	1,3,8	2,4,5	—
LOW OPP	1,3,5	2,4,8	—

NOTE: Standard rotation is ccw facing end opposite shaft extension

THREE PHASE MOTOR ANY SIZE



Interchange any two lead wires to reverse rotation

2.0 SYSTEM CLEANLINESS

Before starting the pump, the system must be thoroughly cleaned, flushed and drained, then replenished with clean liquid. Welding slag and other foreign materials, 'stopleak' and cleaning compounds, excessive or improper water treatment - all are detrimental to the pump. Warranty will be void if any of these conditions are allowed to exist. (Refer to **File no. 6090.645** design and care of closed hydronic systems.)

3.0 STARTING UP

The pump must be fully primed on start-up. Fill system piping and pump body with liquid and vent complete system, turning pump by hand to dislodge air from body. Make sure fittings and drain valves are airtight, then add any additional fill required.

Check motor against available electric supply, then start pump making sure rotation is correct. When viewed from motor end, rotation is counter-clockwise on models S25 to S46 and H32 to H41. On all other models, rotation is clockwise. If pressure does not develop, stop pump, re-check, vent and fill. Never attempt to fill the system when the pump is running

4.0 LUBRICATION

CAUTION:
Do not put oil in the **maintenance free** circulators. These models contain MF in their item numbers and are labelled: 'THIS BEARING ASSEMBLY CONTAINS PERMANENTLY LUBRICATED BEARINGS AND DOES NOT NEED ANY OILING OR GREASING'.

Stop motor before lubricating, do not over-oil or spill oil on resilient motor rings. Do not force oil into cups, and stop if cup fills before addition of specified amount.

Pump lubrication: Only applicable for pumps those are with sleeve bearing SBA and have oil cup for lubrication.

Immediately after pump is installed and before running, slowly add the oil (SAE 30 non-detergent regular, supplied with pump) to pump oil cup, located on top of bearing bracket:

S25 to S57, H32 to H54 and series 1050 (1B to 2B)	¼ oz.
S69, H63 to H68, series 1060 (1½D to 3D)	2 oz.

At the start of each following heating season, lubricate with SAE 30 oil for models S25 to S57, H32 to H54 and series 1050 (1B to 2B), add approximately ¼ oz. Lubricate every six months for high temperature or constant operation. On models S69, H63 to H68 and series 1060 (1½D to 3D), be sure oil is visible at the top and center of window on side of bracket and maintain this level at all times.

Motor lubrication

CAUTION

Stop motor before lubricating. Do not over-oil or spill oil on resilient motor rings.

This motor has been lubricated properly at the factory. At the start of each following heating season, however, on motors with oil cups, add 15 drops SAE 30 non-detergent oil to each motor cup.

If the motor is fitted with grease fittings, follow the motor manufacturer's recommended procedure. Motors without oil cups or grease fittings are custom-greased for several years operation and require little or no attention.

5.0 SEAL REPLACEMENT

Remove the pump bracket from the body. Remove the impeller, damaged seal assembly, ceramic insert and rubber cup. Clean the recess in bearing bracket coverplate and install a new retainer cup and ceramic insert. Check the condition of the shaft sleeve. If scored, replace the shaft assembly. Otherwise, clean shaft extension and polish sleeve with a fine crocus cloth, using a rotating motion, if required.

Press against the coupler end of the shaft to take up play while pressing new seal firmly against the stationary face. A slight amount of clean vaseline may be put on shaft sleeve to assist installation. Press down firmly and evenly, using two screwdrivers and pushing against the four ears of driving band (the metal ring around rubber bellows), or around top outer edge of driving band on models S25 to S57, H32 to H54 and series 1050 (1B to 2B).

Do not use spring washer on models S25, S35 and H32 current style circulators, where recess to locate spring is provided on impeller hub.

Continue pressing against coupler end of shaft, re-mount impeller and re-assemble the seal bearing assembly into body. If necessary, install a new body gasket and clean gasket surface of both volute and bracket.

CAUTION



Before operating pump, carefully check:

1. Is the pump primed?
2. Is rotation correct?
3. Is pump properly lubricated?
4. Does the power supply agree with data on motor name plate?
5. Is overload protection provided?
6. Is the system clean?

For domestic water systems use bronze body pumps.

ATTENTION

Toujours couper l'alimentation électrique avant de procéder à l'entretien d'un moteur.

1.0 INSTALLATION

Pour des raisons pratiques, les circulateurs Armstrong sont généralement installés sur des conduites verticales, mais peuvent être facilement modifiés sur place pour des conduites horizontales ou pour changer la direction du liquide en circulation. Pour procéder au changement, retirer les boulons de fixation et, en prenant soin de maintenir en place le joint d'étanchéité, tourner le corps suivant l'angle désiré, 90° ou 180°, par rapport à la position originale.

La flèche sur le corps pointant dans la direction de la circulation du liquide, insérer les boulons de fixation et les visser uniformément. Sur les modèles S25 à S57, H32 à H54 et la série 1050 (1B à 2B), il est normal qu'il y ait un espace entre la chaise de palier et le corps de la pompe (volute). Ne pas trop serrer les boulons ! À la jonction, faire tourner l'arbre de la pompe à la main pour vous assurer qu'il tourne librement et que l'impulseur ne frotte pas l'intérieur du corps. Toujours installer de manière à ce que l'arbre du moteur soit en position horizontale, les godets à huile et le couvercle du réservoir d'huile étant placés sur le dessus.

Les modèles S25 à S46 et H32 à H41 sont livrés en prévision d'une évacuation vers le bas. Tous les autres modèles sont livrés en prévision d'une évacuation vers le haut, puisque les pompes de cette taille sont habituellement installées sur les systèmes hydroniques pour pomper vers le haut, de sorte que le point de changement de pression nul, c'est-à-dire la connexion au vase d'expansion, puisse facilement se trouver du côté aspiration du circulateur.

La pompe doit être installée à un endroit qui permet l'entretien et la lubrification. Le moteur et la chaise de palier doivent être exempts d'isolant. La pompe et le moteur sont conçus pour être soutenus uniquement par la tuyauterie en ligne. Ne pas les supporter d'aucune autre façon. Il est recommandé de les placer à environ 4 pi au-dessus du sol. Au moment de fixer la pompe par ses brides, serrer les boulons uniformément et sans excès.

Des robinets-vannes devraient être installés du côté évacuation et du côté aspiration de la pompe pour faciliter l'entretien. Sur les pompes plus grosses, un clapet antiretour devrait être placé du côté évacuation de la pompe, entre cette dernière et le robinet-vanne, pour prévenir les dommages causés par les coups de bélier.

SHÉMAS DE CÂBLAGE

MONOPHASÉ MOINS DE 0.5HP

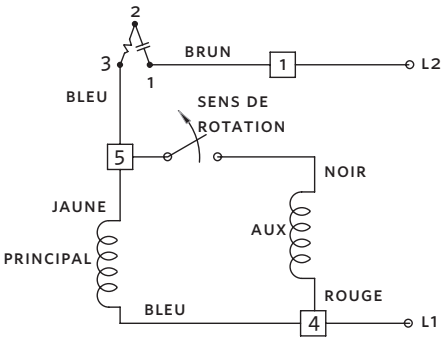
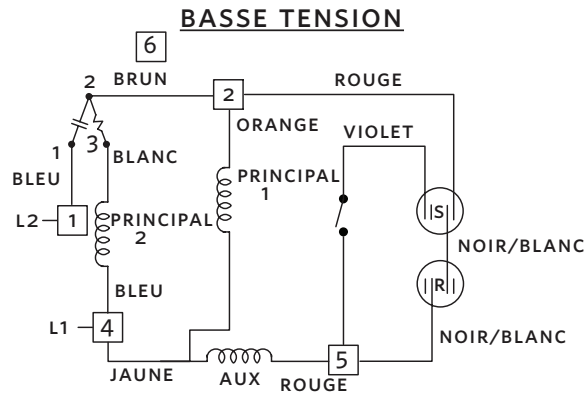
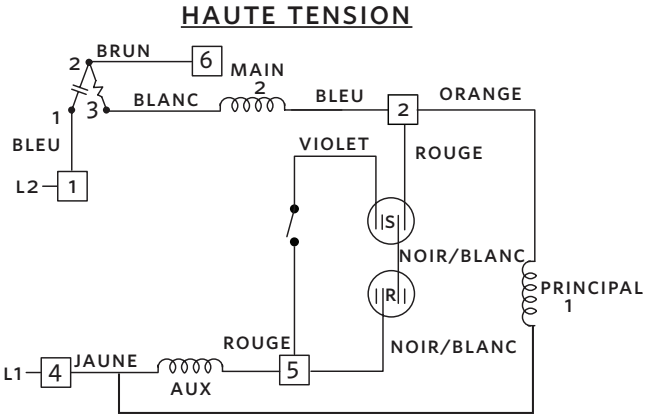


Schéma ci dessus à suivre dans le sens contraire des aiguilles d'une montre.

Pour une rotation dans le sens des aiguilles d'une montre, inverser les fils jaune et bleu des bornes 5 & 4.

MONOPHASÉ MOINS DE 1HP (avec un numéro de référence commençant par 811757-...)



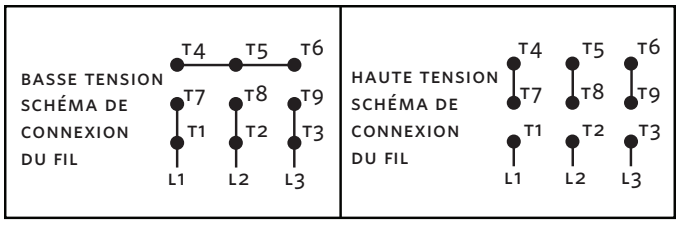


MONOPHASÉ 1HP-1.5HP (seulement pour un numéro de référence ne commençant pas par 811757-...)

	LIGNE A	LIGNE B	JONCTION
HAUTE TENSION ROTATION STD	1	4,5	2,3,8
HAUTE TENSION ROTATION OPP	1	4,8	2,3,5
BASSE TENSION ROTATION STD	1,3,8	2,4,5	—
BASSE TENSION ROTATION OPP	1,3,5	2,4,8	—

NOTE: Le sens de rotation standard est dans le sens contraire des aiguilles d'une montre en faisant face à l'extrémité opposée de l'extension de l'arbre

MOTEUR TRIPHASÉ DE TOUTE TAILLE



Permuter deux des fils de sorties pour inverser le sens de rotation

2.0 PROPRETÉ DU SYSTÈME

Avant de démarrer la pompe, le système doit être entièrement nettoyé, vidangé et rincé, puis rempli de nouveau d'un liquide propre. Les scories de soudage et autres matières étrangères, les composés de colmatage de fuites et de nettoyage, les produits de traitement excessifs ou inappropriés de l'eau, peuvent tous endommager les composantes internes de la pompe. La garantie sera nulle si l'une ou l'autre de ces conditions est permise.(Consulter le **dossier n° 6090.645** conception et entretien des systèmes hydroniques fermés.)

3.0 DÉMARRAGE

La pompe doit être parfaitement amorcée avant le démarrage. Remplir la tuyauterie du système et le corps de la pompe de liquide, ventiler complètement le système, faire tourner la pompe à la main pour déloger les bulles d'air qui y seraient emprisonnées. Vous assurer que les raccords et les robinets de vidange sont étanches et ajouter le liquide qu'il faut pour remplir.

Comparer les exigences électriques aux conditions d'alimentation, puis faire démarrer la pompe et vous assurer qu'elle tourne correctement. Vue de l'extrémité moteur de la pompe, la rotation se fait dans le sens contraire des aiguilles d'une montre sur les modèles S25 à S46 et H32 à H41. Sur tous les autres modèles, la rotation se fait dans le sens des aiguilles d'une montre. Si la pression ne grimpe pas, arrêter la pompe, vérifier de nouveau, ventiler et remplir. Ne jamais essayer de remplir le système lorsque la pompe est en marche.

4.0 LUBRIFICATION

ATTENTION:
NE PAS verser d'huile dans les Circulateurs ne nécessitant aucun entretien. Les modèles mentionnant **MF** dans leur référencesont étiquetés : '**CE SYSTÈME À ROULEMENT EST ÉQUIPÉ DE ROULEMENTS À GRAISSAGE PERMANENT ET NE NÉCESSITE AUCUN AJOUT D'HUILE NI DE GRAISSAGE'.**

Arrêter le moteur avant de lubrifier. Ne pas mettre trop d'huile ni en renverser sur les bagues souples du moteur. Ne pas faire entrer l'huile de force dans les godets et arrêter le remplissage si un godet se remplit avant d'avoir ajouté la quantité spécifiée.

Lubrification de la pompe : Applicable seulement pour les pompes à paliers à douille et ayant un godet pour la lubrification

Immédiatement après l'installation de la pompe et avant de la démarrer, ajouter lentement de l'huile (SAE 30 non détergente régulière, fournie avec la pompe) dans le godet situé sur le dessus de la chaise de palier :

S25 à S57, H32 à H54 et série 1050 (1B à 2B)	¼ oz.
S69, H63 à H68, série 1060 (1½D à 3D)	2 oz.

Par la suite, au début de chaque saison de chauffage, lubrifier la pompe en utilisant de l'huile SAE 30. Pour les modèles S25 à S57, H32 à H54 et la série 1050 (1B à 2B), ajouter environ ½oz. Lubrifier à tous les six mois si la pompe fonctionne tout le temps ou à haute température. Sur les modèles S69, H63 à H68, série 1060 (1½D à 3D), vous assurer que l'huile est visible en haut et au centre de la lunette sur le côté de la chaise de palier et maintenir ce niveau en tout temps.

Lubrification du moteur

ATTENTION

Arrêter le moteur avant de le lubrifier. Ne pas ajouter trop d'huile ni en renverser sur les bagues souples du moteur.

Ce moteur a été lubrifié correctement en usine. Au début de chaque saison de chauffage, toutefois, sur les moteurs munis de godets d'huile, ajouter 15 gouttes d'huile non détergente SAE 30 dans chaque godet.

Si le moteur est équipé d'embouts de graissage, respecter la procédure recommandée par le fabricant. Les moteurs à godets d'huile ou à embouts de graissage sont graissés individuellement en prévision de plusieurs années d'utilisation et exigent peu ou pas d'attention.

5.0 REMPLACEMENT DES JOINTS D'ÉTANCHÉITÉ

Retirer la portion pompe du corps. Retirer l'impulseur, le joint d'étanchéité endommagé, la pièce de céramique et le godet de caoutchouc. Nettoyer le compartiment du joint dans la chaise de palier et installer un nouveau godet et une nouvelle céramique. Vérifier l'état de la chemise de l'arbre. Si elle est marquée, remplacer l'ensemble de l'arbre. Autrement, nettoyer le prolongement de l'arbre et, au besoin, polir la chemise à l'aide d'une toile à polir fine suivant un mouvement rotatif.

Pousser sur l'extrémité accouplement de l'arbre pour réduire le jeu tout en pressant fermement le nouveau joint d'étanchéité sur la face fixe. On peut mettre une petite quantité de vaseline sur la chemise de l'arbre pour aider à l'installation. Pousser fermement et uniformément en utilisant deux tournevis contre les quatre oreillettes du collet (l'anneau de métal autour des soufflets de caoutchouc) ou sur le pourtour extérieur du collet dans le cas des modèles S25 à S57, H32 à H54 et de la série 1050 (1B à 2B).

Ne pas utiliser de rondelle à ressort sur les circulateurs de modèles courants S25, S35 et H32 lorsque la dépression prévue pour le ressort se trouve sur le moyeu de l'impulseur. Continuer d'appuyer sur l'extrémité accouplement de l'arbre. Remonter l'impulseur et l'ensemble porteur du joint d'étanchéité dans le corps. Au besoin, installer un nouveau joint pour le corps et nettoyer la surface du joint de la volute et de la chaise de palier.

ATTENTION

Avant de faire fonctionner la pompe, vous assurer que :

1. La pompe a été amorcée?
2. Le sens de la rotation est le bon?
3. La pompe est correctement lubrifiée?
4. L'alimentation correspond aux données sur la plaque d'identification?
5. La pompe est protégée contre les surcharges?
6. Le système est propre?

Pour les systèmes domestiques de distribution d'eau, utiliser des pompes à corps de bronze.

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ARMSTRONG

FILE NO.:	37.89
DATE:	June 2, 2006
SUPERSEDES:	37.89
DATE:	June 27, 2005

INSTALLATION AND OPERATING INSTRUCTIONS

Series DAS
Dirt & Air Separator

VESSEL DESCRIPTION
Armstrong Series DAS Dirt & Air Separators are designed to eliminate entrained air and separate debris associated with start-up and maintenance of any hydronic system. The design incorporates a removable end cover (optional) for coalescing medium access and an air vent (optional) to automatically release air from the separator. The design and construction conforms to ASME Section VIII, Div. 1 (excluding DAS-Q and DASH-Q models).

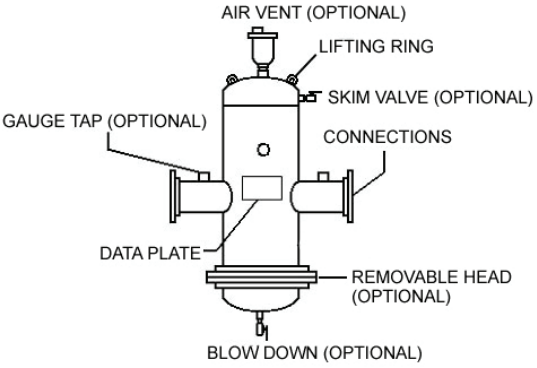


Fig. 1

FACTORY TESTING AND SHIPPING
The Series DAS has been factory tested and inspected prior to shipment. Upon receipt of the unit, carefully inspect the unit for damage that may have occurred during shipment. If the DAS has been damaged, it should be noted on the freight bill and reported to the carrier.

INSTALLATION
Ideally the installation of the DAS is at the point in the system where full water flow is at the lowest pressure and highest temperature. For optimum air elimination, it is at this point where free system air (bubbles) is at its highest concentration. Complete elimination of the free air at this location insures that dissolved air (air in solution) is at its lowest concentration. As the fluid leaves the DAS, and travels throughout the piping system, it will absorb a portion of any free-air that it contacts. This air-saturated water will then circulate back to the DAS where the low pressure/high temperature condition will drive this air back out of solution. This continuous air absorption and subsequent release and elimination by the DAS will ensure an air-free system.

It is recommended that the DAS be installed in the system piping prior to the primary system circulator/pump. For high-rise systems where static pressures are high, placement of the DAS should be as high in the system as practical.

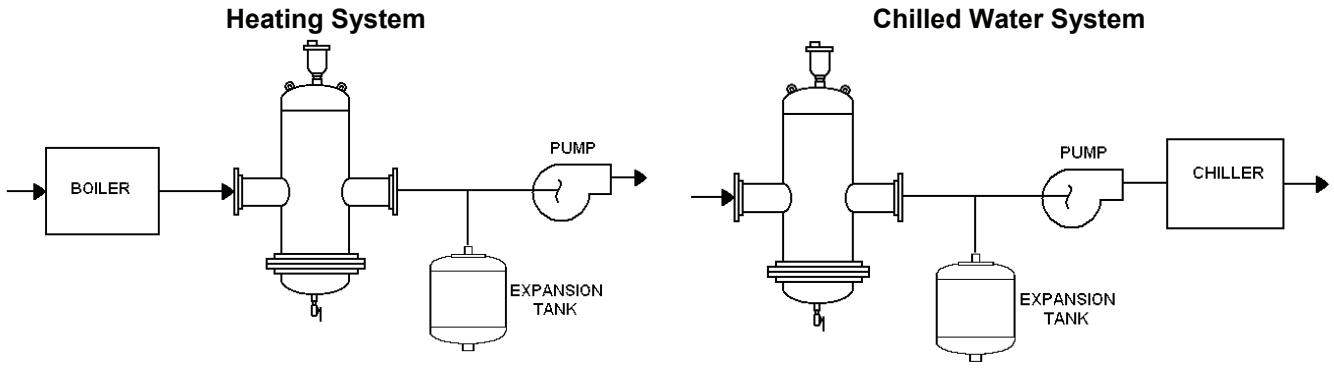


Fig. 2 Recommended Installations

Note: 100% of system flow should pass through the DAS to ensure all particles can be filtered.

OPERATION

All systems contain air in a dissolved state or as free air bubbles. Dirt particles, from multiple sources (piping fabrication, boiler or pump castings, welding beads, rust, etc.) also flow with the system water. As system fluid enters the DAS, air bubbles will rise to the top of the vessel to the vent location. Small, or sometimes referred to as micro-bubbles, will become trapped by the coalescing stainless steel media. With time, these bubbles will combine to form larger bubbles that will, over time as buoyancy overcomes surface tension, float to the top of the vessel to the vent location. Dirt particles are strained out by the enhanced surface stainless screen and collect at the vessel bottom. The debris is then periodically flushed out of the vessel through a blow-down valve. In removable base designs, the coalescing media can be removed and cleaned periodically.

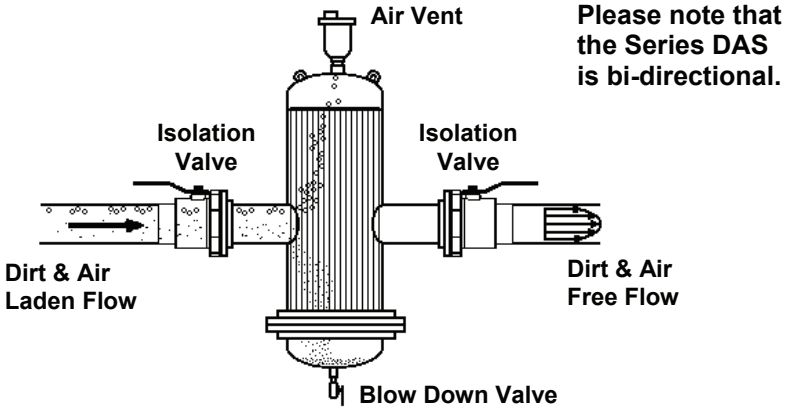


Fig. 3 DAS Working Configuration

MAINTENANCE

Air is eliminated automatically through the float-style vent. The vent should be periodically inspected to ensure optimum performance. If the vent used shows signs of continuous or intermittent leakage, or corrosion, it should be serviced or replaced.

During start up procedures, sediment should be removed frequently. The amount of sediment and the time of each blow-down should be recorded. As the amount of debris from blow-down diminishes, set a routine schedule to periodically blow-down the debris. If sediment builds on the coalescing screen, as evidenced though increased pressure drop, the screen can be removed. Inspect the screen cartridge periodically. Clean or replace if necessary.

WARNING: Standard units are not for use with potable water. Please consult factory for stainless steel option. For support recommendations, please reference local building code requirements

WARNING: The internal coalescing tubes are supported by the removable head. These tubes are not supported when the head bolts are removed.

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ARMSTRONG®

FILE NO.:	37.88
DATE:	Dec. 12, 2003
SUPERSEDES:	New
DATE:	New

INSTALLATION AND OPERATING INSTRUCTIONS

SX Series
Diagphragm Expansion Tanks

SX SERIES Expansion Tanks
This line of expansion tanks is specifically designed for use in hydronic heating systems.

The unique proven design of these tanks incorporates a flexible diaphragm that separates system water from the tank air charge (12 psig) resulting in more positive system protection.

HOW THEY WORK:
Heated water expands, and in a closed hot water heating system, provision must be made for this expansion. The captive air volume separated by the flexible diaphragm in the expansion tank provides for water expansion without permitting absorption of the air cushion by the water.

ATTACHING ACCEPTANCE FITTINGS:
SX tanks are equipped with a convenient bottom outlet elbow for connection to the system. Models SX-30V, SX-40V and SX-60V use a 1" NPTF fitting and models SX-90V, SX-110V and SX-160V use 1¼ " NPTF fitting. The air valve is located on top to provide accessibility no matter how the unit is positioned.

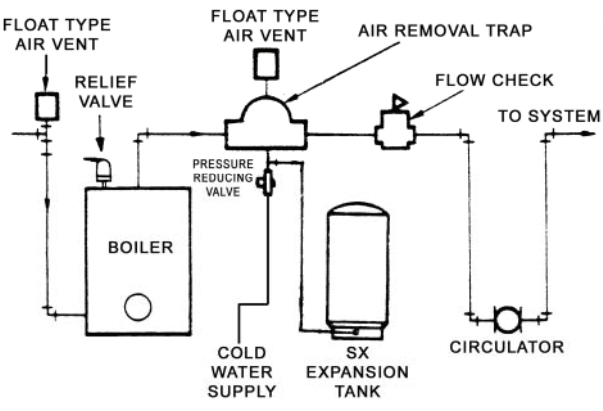
PROPER LOCATION AND INSTALLATION:
The SX Series tank may be located at any convenient point on a hot water heating system on the suction side of the pump. It may be installed into a tee or any other suitable tapping. The preferred installation is to pipe the SX tank into the system piping between the pressure reducing valve (in the water supply line) and the air removal trap / air vent, as shown in Figure 1. Conversely, the SX tank may be piped directly into the Armstrong Air Removal Trap. Regardless of installation, both offer continuous automatic air removal and complete pressure control protection.

ADJUSTING SX EXPANSION TANK PRECHARGE TO SYSTEM REQUIREMENTS:
All SX Series tanks are shipped with a standard precharge of 12 psi. This precharge can be adjusted if necessary. The following steps should be taken:

1. Remove red air charge valve cap and, using a suitable pressure gauge, check precharge pressure.
2. Release or add air as necessary to make precharge pressure equal to the desired fill pressure.
3. Replace protective air valve cap and seal with the air valve label provided. This will enable you to determine if valve has been tampered with on possible future service calls.

SYSTEM CONNECTION:
1. Locate SX Series expansion tank in final desired location.
2. Level as necessary.
3. Connect to heating system.
4. All piping should be in accordance with prevailing local codes and standards.

RECOMMENDED INSTALLATION:



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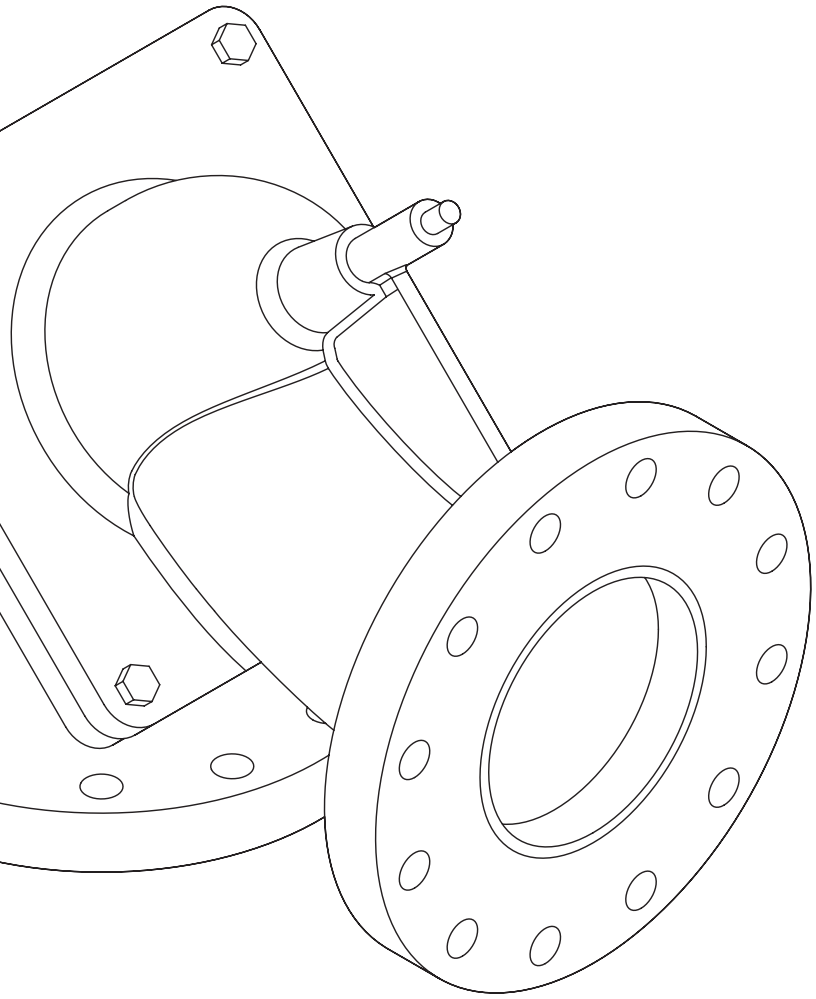
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ARMSTRONG



Armstrong model FTV

Hard flanged Flo-Trex combination valve

Installation and operating instructions

File No: 35.81
Date: SEPTEMBER 18, 2014
Supersedes: 35.81
Date: DECEMBER 02, 2010

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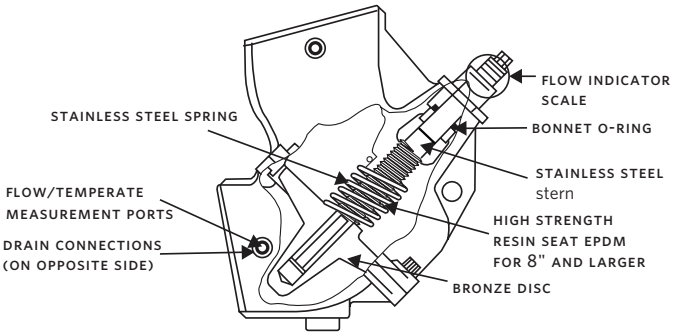
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1.0 INTRODUCTION

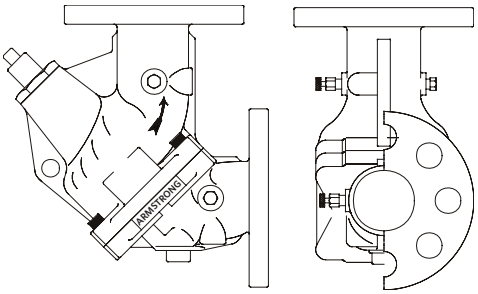
The Armstrong model FTV Flo-Trex combination valves are designed for installation on the discharge side of centrifugal pumps. The Armstrong combination valve incorporates three functions in one valve:

- Drip-tight, shut-off valve
- Spring closure design, non-slam check valve
- Flow throttling valve

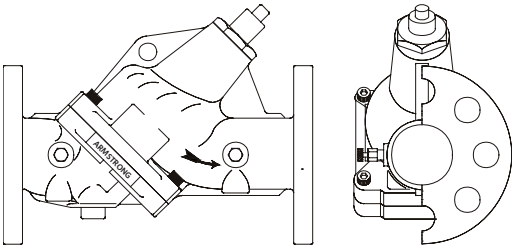
Armstrong model FTV-AF Flo-Trex combination valve



Angle pattern model FTV-AF



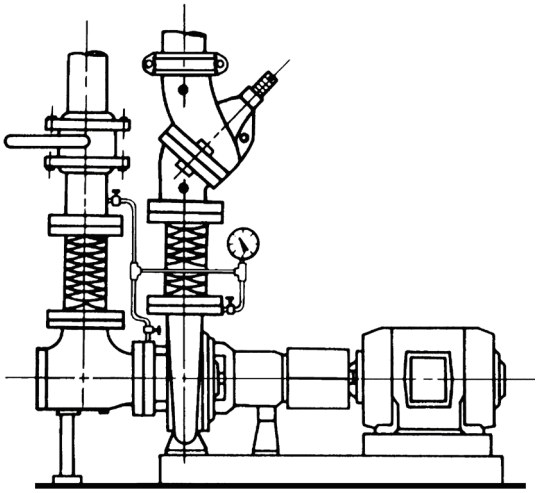
Angle pattern model FTV-SF



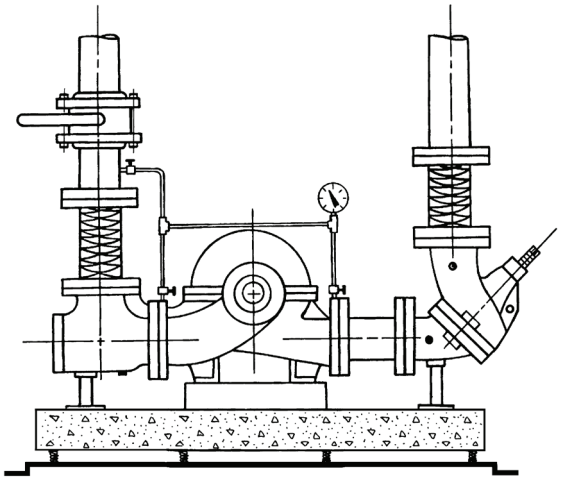
2.0 INSTALLATION

1. The valve should be mounted to a spool piece on the discharge side of the pump. Spool piece required is based on a minimum recommended space of 12" for pump sizes 2 × 2 to 6 × 6 and 24" for pump sizes 8 × 8 to 12 × 12.
2. It is not recommended to mount a valve directly to the pump as this could cause undesirable noise in the system.
3. Sufficient clearance around the valve should be left for valve removal or repair.
4. Install valve in the direction of the flow arrows on the valve body.
5. The valve body has been designed to handle the weight of the pump on vertical in-line installations. The body is not designed to support the piping weight. It is recommended that the piping be supported by hangers. Pipe supports are not required under the valve and strainer bodies but may be used if desired.
6. Ensure that the FTV is installed with the valve stem in the upright position. Valve slam may occur if installed in any other configuration

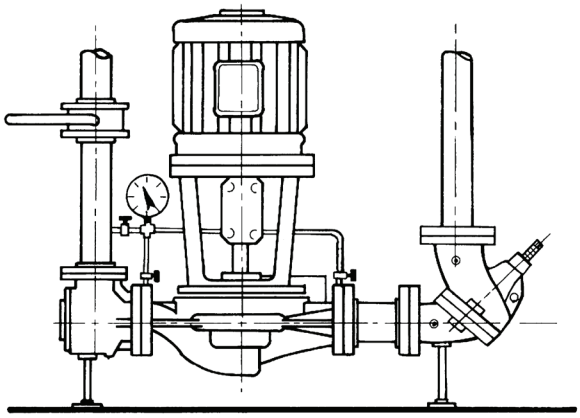
3.0 TYPICAL INSTALLATIONS



Base-mounted single suction



Base-mounted double suction



Vertical in-line

4.0 FLANGE BOLT TIGHTENING

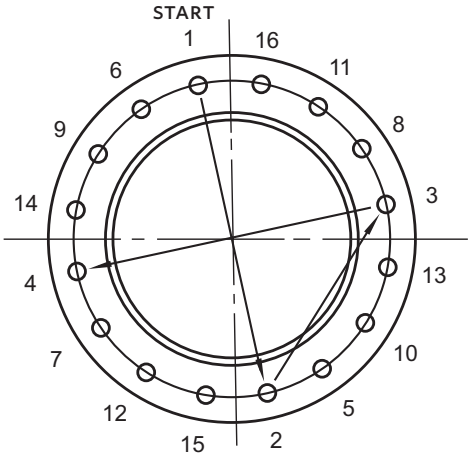


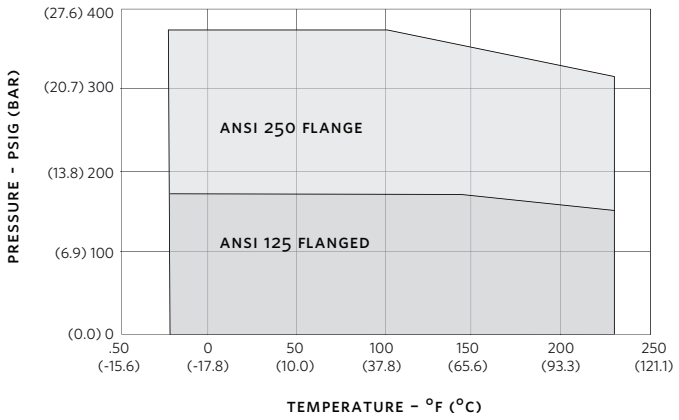
FIG 1: Recommended bolt tightening procedure

VALVE SIZE	125 PSI/150 PSI CAST IRON BOLT	
	BOLT NO.	SIZE
2½	4	⅝
3	4	⅝
4	8	⅝
5	8	¾
6	8	¾

TABLE 1

Tighten nuts evenly, following bolting instructions (**FIG 1**) so that the flange faces remain parallel. Flange bolts should be tightened to 70 ft/lbs. Torque minimum to assure firm metal-to-metal contact. When raised face flanges are used, there will be a gap between the faces of the outer diameter.

5.0 PRESSURE-TEMPERATURE LIMITS



6.0 FIELD CONVERSION (straight to angle pattern valve)

Open valve at least one complete turn.

Remove the body bolts from valve body using allen key.

Rotate one half of the valve body 180° making sure the lower valve seat and o-ring stay in position. Inspect the o-ring for any cuts or nicks and replace if necessary.

Replace body bolts and torque evenly to 70 ft/lbs.

7.0 FLOW MEASUREMENT

Where approximate indication of flow is acceptable the Armstrong Flo-Trex valve can be used.

Measure the flow with valve in fully open position.

1 Measure and record the differential pressure across the valve using an Armstrong CompuFlo with high pressure range transducer, or CBDM- 135/60 meter, or pressure gauges with PMP adapters.

Caution: Safety glasses should be used and the probe should not be left inserted into fittings for prolonged periods of time (overnight, etc), as leakage from the PMP may occur when probe is removed.

2 Refer to Flo-Trex performance curves with valve in full open position (**FIG 2**).

Locate Pressure Differential on left hand side of chart and extend line horizontally across to valve size being used. Drop line vertically down and read flow rate from bottom of chart.

Determining flow rate with valve in throttled position

FLO-TREX PERFORMANCE CURVE WITH VALVE IN FULL OPEN POSITION

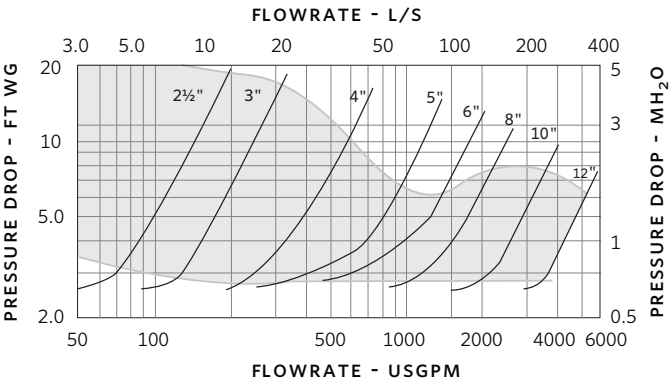


FIG: 5

INHERENT FLOW CHARACTERISTIC CURVE WITH VALVE IN THROTTLED POSITION

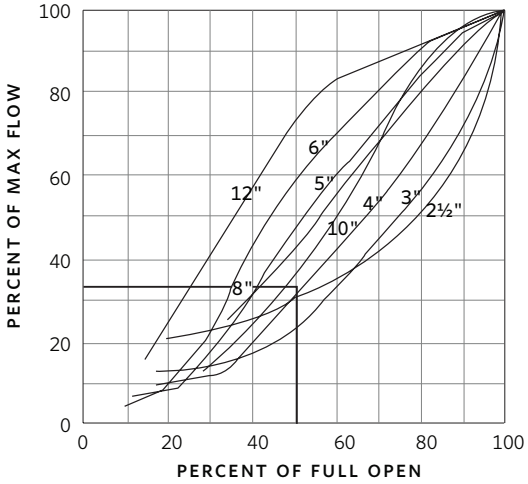


FIG: 6

1 Record the size of valve and stem position using the flow indicator scale (page 7). Calculate percentage of valve opening referring to table below:

VALVE SIZE	NUMBER OF RINGS (VALVE FULL OPEN)
2½	5
3	5
4	6
5	9
6	10
8	12
10	18
12	28

2 Measure and record the differential pressure across the valve in the throttled position.

3 Locate percentage of valve opening on the bottom scale of Flow characteristic curve (**FIG 3**). Project line vertically up to intersect with the valve characteristic curve and from this point project line horizontally across to the left of the chart and record the percentage of maximum flow rate.

4 On the Flo-Trex performance curve (**FIG. 2**) locate the differential pressure obtained in **STEP 2** and project line horizontally across to intercept with valve performance curve. Drop a line vertically down to read the flow rate at the bottom of the chart.

5 To calculate flow rate of valve in the throttled position, multiply the flow rate from **STEP 4** by the percentage flow rate from **STEP 2** divided by 100.

Example: Valve size 4 inch.

Differential Pressure is 5.4 ft. (1.65 m).

Number of rings open = 3. Therefore: 3 rings ÷ 6 rings x 100 = 50% throttled.

From the Flo-Trex Performance Curve (**FIG 2**), a 4 inch, valve with 5.4 ft. pressure drop (1.65 m) represents a flow of 400 USgpm (25.2 L/s).

From Flow Characteristic Curve (**FIG 3**), a 4 inch valve 50% open, represents 34% of maximum flow.

Approximate flow of a 4 inch valve, with a 5.4 ft (1.65 m) pressure drop when 50% throttled is:

$$\frac{400x34}{100} = 136USgpm \left(\frac{25.2x34}{100} = 8.57L/s \right)$$

Note: To prevent premature valve failure it is not recommended that the valve operate in the throttled position with more than 25 ft pressure differential. Instead the pump impeller should be trimmed or valves located elsewhere in the system be used to partially throttle the flow.

FLOW INDICATOR SCALE

The valve stem with its grooved rings and positioning sleeve indicates the throttled position of the valve. The quarter turn graduations on the sleeve, with the scribed line on the stem, provide for approximate flow measurement.



Note: The valve is shipped in the closed position. The indicator on the plastic sleeve is aligned with the vertical scribed line on the stem.

8.0 OPERATION

To assure tight shut off, the valve must be closed using a wrench with 25 to 30 ft/lbs of torque.

To assure trouble-free check valve operation and shut off operation, the valve should be periodically opened and closed to keep valve seat and valve disc guide stem free of build up of system contaminants.

9.0 REPACKING OF FTV VALVE UNDER FULL SYSTEM PRESSURE

1. Should it be necessary, stem o-ring can be changed under full system pressure.
   Caution: Safety glasses should be worn.
2. Record the valve setting.
3. Turn the valve stem counter-clockwise until the valve is fully open and will not turn any further. Torque to a maximum force of 45 ft/lbs. This will ensure good metal-to-metal contact and minimum leakage.
4. The valve bonnet may now be removed. There may be slight leakage, as the metal-to-metal back seating does not provide a drip-tight seal.
5. Clean exposed portion of valve stem (do not scratch).
6. Remove and replace the o-ring and gasket.
7. Install the valve bonnet.
8. Tightening valve bonnet is necessary to stop any leaks.
9. Open valve to balance set point as recorded in **STEP 2**.

10.0 MAXIMUM NUMBER OF TURNS (FULL OPEN VALVE)

Note: On valve sizes 2½" and 3", full open position of valve is 5 turns. However valve will open to 5½ turns which is just back of seating of valve.

11.0 SEAT REPLACEMENT

1. Drain system and remove valve from piping.
2. Remove the body bolts from the body using an allen key.
3. Remove seat and o-ring. O-ring is not used on valves 8" and larger.
4. Inspect and clean o-ring cavity and install new o-ring and seat. Valve disc stem also should be inspected and replaced if worn. Valve stem o-ring should be replaced at this time. Refer to section **8.0**.

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FILE NO.:	37.83
DATE:	January 20, 2000
SUPERSEDES:	NEW
DATE:	NEW

Installation & Operating Instructions
GLA - Glycol Make-up Units

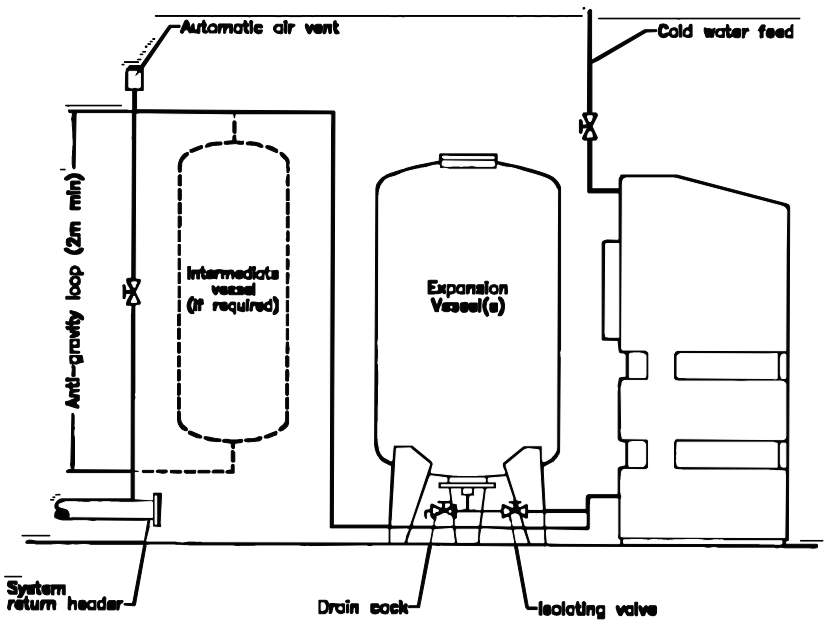
ESSENTIAL SAFETY REQUIREMENTS

1) **Glycol** is toxic and the glycol supplier's safety instructions must be adhered to. In critical areas a retaining wall should be used to contain any spillage or leakage. Overflows should be arranged not to contaminate drainage systems.
2) It is recommended that initial commissioning be carried out with water.
3) The flow rates from the unit are designed for make-up rates. It is therefore suggested that the system is back-filled with due precautions taken to avoid contamination.
4) Glycol is sometimes subject to bacterial attack and can become slimy as a result. We recommend the addition of a suitable biocide. The dosage should be calculated on the amount of water glycol mixture added and not the total tank contents. If bacterial attack occurs on untreated mixtures the unit should be drained, flushed and refilled with fresh mixture and dosed with biocide.
5) Locate units in a well-ventilated environment and ensure that ventilation fans and apertures are not obstructed.
6) Check that the supply voltage and overload protection is correct.
7) A competent electrician should perform the electrical installation.
8) Guards and covers must not be removed during operation.

Expansion Vessel Installation and Commissioning

Refer to separate Armstrong publication for Armstrong vessels.

Install the **GLA** unit as indicated in the diagram below.



NOTES:

1) The pipework from the system to the expansion vessels should not be insulated.
2) For systems operating above 200 degrees F (93 C), an anti-gravity loop with a minimum height of 6 feet, (or an intermediate vessel) should be installed to provide thermal protection to the expansion tanks.
3) For hot water systems, the connections to the intermediate vessel should be reversed, i.e. top to system, and bottom to expansion vessel.
4) The GLA unit is suitable for floor mounting.
5) The ball float valve is fitted with a low-pressure seat; a high-pressure seat is attached to the float valve and should be fitted if required.
6) The pipework to the expansion vessels should be sized according to the size and number of vessels and should be at least the same size as the vessel connection.
7) Where multiple expansion vessels are required it is recommended that each vessel be installed with its own isolating valve and drain cock.

Pressure Switch Adjustment

1) Low system pressure – PS1
2) High system pressure – PS2
3) Duty pump control switch – PS3
4) Standby pump control switch (where fitted) – PS4

For each switch, set the delivery to the required pressure. Then very slowly turn the adjusting screw on the switch until the contacts change.
The high system pressure switch should first be set higher than the required pressure by turning the screw clockwise, and the setting then made by turning the screw anti-clockwise until the switch contacts change-over. The other switches should first be set lower than the required pressure by turning the screw anti-clockwise, and the setting then made by turning the screw clockwise until the switch contacts changeover.
A pipe plug is provided on the outlet to allow connection of a test pump to simulate differing system pressures to check switch settings.
The Ultra versions of the GLA have the capability of controlling duty and standby pumps from a single pressure switch.

GLA Ultra Settings

The extra functionality of Ultra units is integral. The only selectable option is Manual or Automatic reset of alarm conditions. DIP switch 1, on the display board should be set to OFF for auto reset (Factory setting), and ON for manual reset. On alarm conditions, the MUTE switch will mute the buzzer. In manual reset mode this MUTE switch will reset the alarms after the fault condition has been cleared. Other switches change the mode of the printed circuit board for use with other Armstrong products. For GLA application, all switches except 1 and 7 must be set to OFF.

Priming the make-up pumps

1. Close suction isolating valve.
2. Fill the glycol-mixing tank.
3. Remove the upper vent plug from the make-up pump.
4. Open suction isolation valve until water flows out of this tapping.
5. Close valve and replace plug.
6. Repeat for standby pump (where fitted).
7. Close the system-isolating valve.
8. Open suction isolating valve.
9. Switch on unit, initially both pumps will run. As the pressure reaches the pump control switch threshold, the pumps will switch off.
10. Check all piping for leaks following shipping.
11. Crack open system valve. The pressure will fall and the pump will start and maintain pressure.

Powered agitation (Ultra model only)

A solenoid valve is fitted to provide powered agitation of the mixture. Automatically this valve is periodically opened and the duty pump starts creating circulation through the pump and mixing tank. Automatic mixing is inhibited when there is a system demand for make-up.

A switch is provided for manual agitation when adding glycol to the mixing tank.

Topping up with glycol

The mixing tank is calibrated in liters and US gallons. The normal top up level is 53 US gallons (200 liters).

1. Calculate the amount of water needed and add or drain to the correct level.
2. Add the required amount of glycol.
3. Operate the manual-agitating switch.
4. Check the mixture percentage.

The unit is now ready for service.

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PRESSURE REDUCING VALVES | RD-11, RD-40, RD-50 & HRD-70 | INSTALLATION AND OPERATING INSTRUCTIONS

File No: 11.85
Date: DECEMBER 24, 2015
Supersedes: 11.85
Date: MAY 13, 2008

1.0 INSTALLATION

The pressure reducing valve should be installed with the flow arrow on the body pointing in the direction of the flow. Install the union fittings, supplied with the valve (model RD-11 and C-11), on the inlet side of the valve body, for quick installation and removal if necessary. A shut-off valve should be installed on the city water side of the pressure reducing valve. If the pressure reducing valve is not equipped with a fast fill feature, a by-pass may be used. A three valve by-pass around the pressure reducing valve will also serve as a fast fill option and is recommended for service.

CAUTION

The use of Teflon tape when installing a valve provides lubricity. Care should be taken to avoid over tightening, which may crack the valve body.

2.0 OPERATION

Models RD-11, RD-40 and RD-50 are preset at 12 psi, and the HRD-70 is preset at 45 psi. Open the cold water fill valve and the system will be filled until the boiler gauge indicates the preset valve pressure has been obtained.

Model RD-11 is preset at 12 psi and is equipped with a fast fill feature. When filling the system as noted above, the fast fill thumbscrew should be manually turned in completely. This overrides the pressure regulating function of the valve. The system should be filled until the boiler gauge indicates the preset pressure of the valve and then the fast fill thumbscrew should be backed off completely until it spins freely.

WARNING

The fast fill thumbscrew must never be left in the down position after the system has been filled. The thumbscrew must be placed in the free position to avoid over pressurization and unnecessary relief valve discharge.

3.0 ADJUSTMENT

Allow system water to cool to ambient temperature. If necessary, adjust valve pressure setting as follows: pressure setting can be raised or lowered by loosening the jam nut and turning the slotted adjusting screw clockwise to increase the set pressure or counter-clockwise to lower the set pressure. This should be done slowly until the boiler pressure gauge indicates the required system pressure. A screw driver should be used to hold the adjusting stem stationary while the jam nut is secured.

4.0 SERVICE

If the pressure reducing valve fails to maintain the set cold fill pressure, the sediment strainer may be clogged. To service the strainer, shut off city water supply and the isolation valve on the discharge of the pressure reducing valve. Remove and clean or replace the strainer and replace the strainer gasket and nut. Open both the city water shut-off valve and the isolation valve to resume normal system operation.

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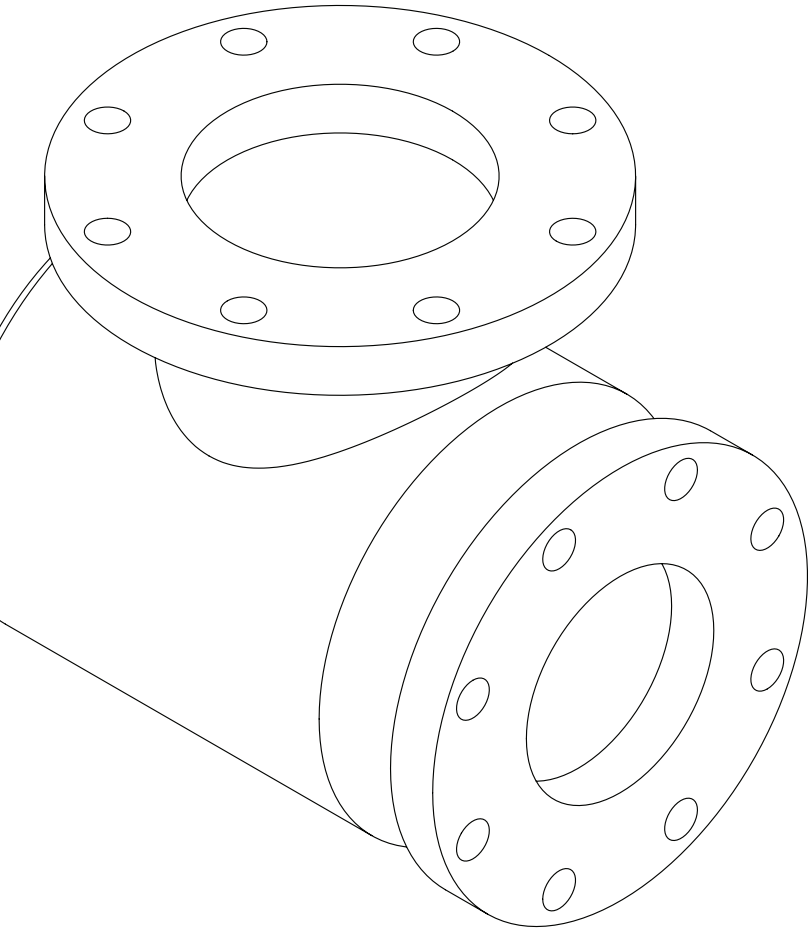
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Suction Guides

Installation and operating instructions

File No: 35.82
Date: OCTOBER 03, 2013
Supersedes: 35.82
Date: AUGUST 16, 2013

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1.0 INTRODUCTION

Armstrong Suction Guides are designed for bolting directly onto the suction flange of horizontal or vertical shaft centrifugal pumps.

2.0 OPERATING LIMITS

Armstrong Suction Guides are designed in five series:

SERIES DESIGNATION	INLET CONNECTION	PUMP CONNECTION
SG	ANSI 125 / PN16 flange	ANSI 125 / PN16 flange
SG–TF	NPTF / BSPT	ANSI 125 / PN16 flange
SGG	GROOVED*	ANSI 125 / PN16 flange
SGHH	ANSI 250 / PN25 flange	ANSI 250 / PN25 flange
SGH–TF	NPTF / BSPT	ANSI 250 / PN25 flange

*Suitable for straight cut grooved anvil or victaulic fittings.

Each series is designed to be a four-function fitting. Each Suction Guide is a 90º elbow, a pipe strainer and a flow stabilizer. It may also be used as a reducing elbow, should the suction piping be larger than the pump inlet.

3.0 INSPECTION

Armstrong Suction Guides are thoroughly tested and inspected before shipment to assure they meet with your order requirements. All units must be carefully examined upon arrival for possible damage during transit. Any evidence of mishandling should be reported immediately to the carrier and noted on the freight bill.

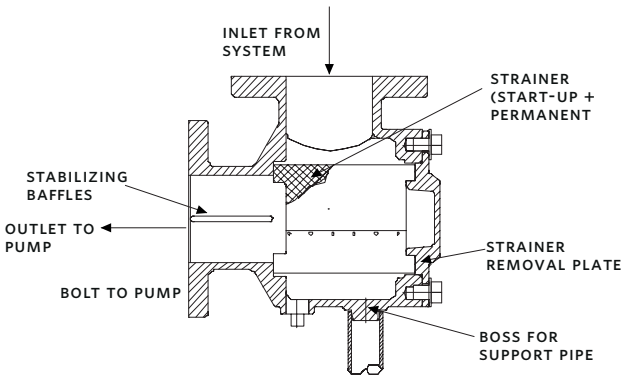


FIG. 1 Armstrong Suction Guide

4.0 INSTALLATION

Install the Suction Guide with the directional arrow, indicated on the body, being aligned with the system flow direction.

Armstrong Suction Guides may be installed in any position, providing the guide vanes are facing the pump inlet flange.

Centrifugal pumps need a minimum of 5 pipe diameters of straight pipe before the pump suction. This length of straight pipe, after the last elbow, tee or fitting, helps to ensure that the flow is stable when entering the pump suction.

Crosspiece guide vanes are fitted into the Armstrong Suction Guide outlet, where it bolts to the pump flange, to stabilize the flow and eliminate the need of long straight suction pipe.

Space must be allowed to remove the end cover and remove the strainer.

A blow–down valve may be installed on the Suction Guide drain connection. Should the Suction Guide be installed with the inlet port facing vertically down: The inlet piping configuration should include a blow–down valve at the lowest point on the down-pipe to exhaust any debris that may fall from the Suction Guide strainer.

The Suction Guide must not be used to support the suction piping. Piping must be supported independently.

On base mounted pumps, a flexible piping connections may allow the Suction Guide to be supported by the pump suction flange. A boss is cast on every SG allowing a supporting pipe-stool to be located under the fitting, thereby removing the weight of the Suction Guide from the pump suction flange.

Suction Guides are supplied with an inlet tapped gauge connection. Monitoring the differential pressure across the fitting, from the suction guide inlet gauge to the pump inlet gauge, will alert the operator should the strainer need to be removed and cleaned.

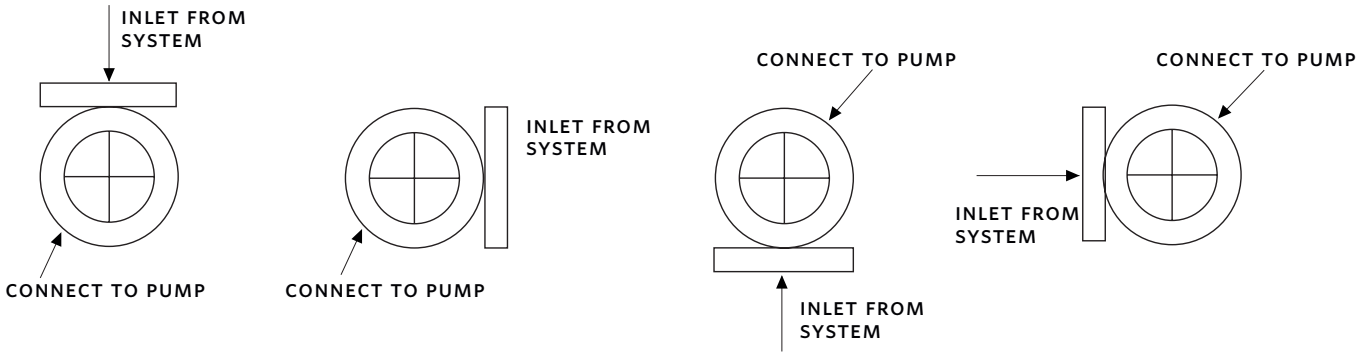


FIG. 2 Armstrong Suction Guide may be installed in any arrangement feasible by pump flange boltholes arrangement.

5.0 OPERATION

No special attention need be paid to the Suction Guide at start-up. The fitting is stationary and will strain the pumped fluid and stabilize the flow into the pump automatically.

Temporary strainer must be removed following system clean up.

After all debris has been removed from the system, or a maximum of 24 running hours, stop the pump and close the pump isolation valves. Drain the Suction Guide by removing the drain plug or opening the blowdown valve, if installed. Remove the Suction Guide cover and remove the strainer assembly from the valve body.

A temporary fine-mesh start-up strainer is tack-welded to the permanent stainless steel strainer. This temporary strainer should now be removed from the permanent strainer. The fine-mesh strainer is designed to remove small particulate from new piping systems and could easily clog with debris if left in place. This will be detrimental to the operation of the pump.

Replace the permanent strainer into the fitting body, once the temporary strainer is removed.

Inspect the cover O-ring and replace if necessary. Replace the cover into the body. Ensuring that the strainer is properly seated, tighten the cover bolts diagonally, evenly and firmly.

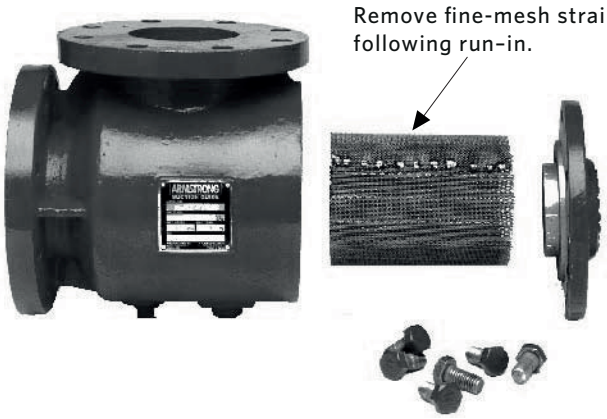


FIG. 3 Remove fine-mesh strainer

TORONTO

23 BERTRAND AVENUE
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M1L 2P3
+1 416 755 2291

BUFFALO

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MARLO INCORPORATED®

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

MATC SERIES

1” TWIN ALTERNATING

COMMERCIAL WATER CONDITIONERS

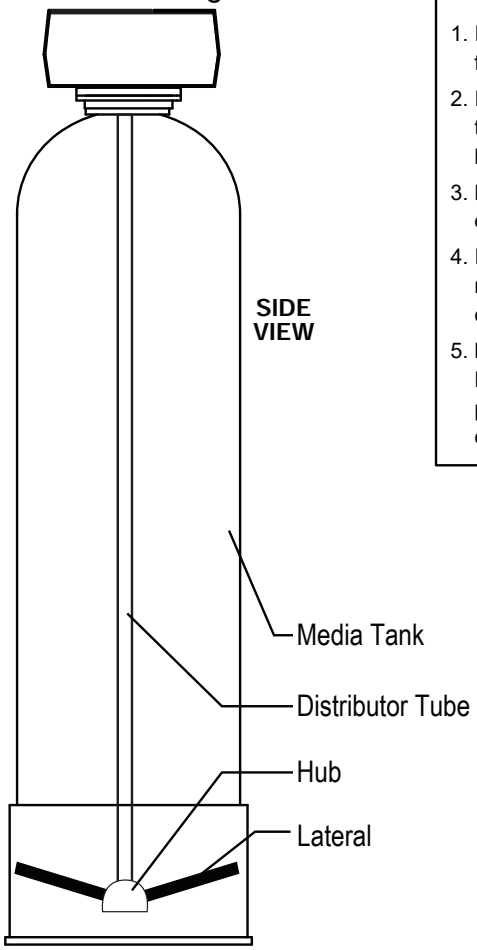
(FOR MODELS BUILT POST-SEPTEMBER 2013)

COMPLETE FOR FUTURE REFERENCE:

MODEL NO:
SERIAL NO:
DATE INSTALLED:
DEALER:

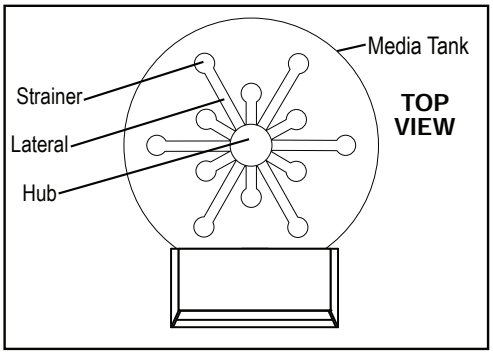
INSTALLATION WARNING

PRIOR TO Media Loading



Inspection Requirement Prior to Loading Media

1. Inspect condition of upper distributor piping. Verify fittings are tight and positioned as shown.
2. Inspect condition of strainers, laterals and hub through top or side access ports. Verify fittings are secured to hub and strainers, if present are secured to laterals.
3. **DO NOT** load media if damaged components are observed. Contact factory.
4. Installer is responsible for media loss into treated water resulting from failure to report and repair damaged components inside media tank prior to media loading.
5. **INSTALLER WARNING:** Refer to installation instructions for media loading procedure. Improper loading of media will damage components inside media tank.



AFTER Media Loading

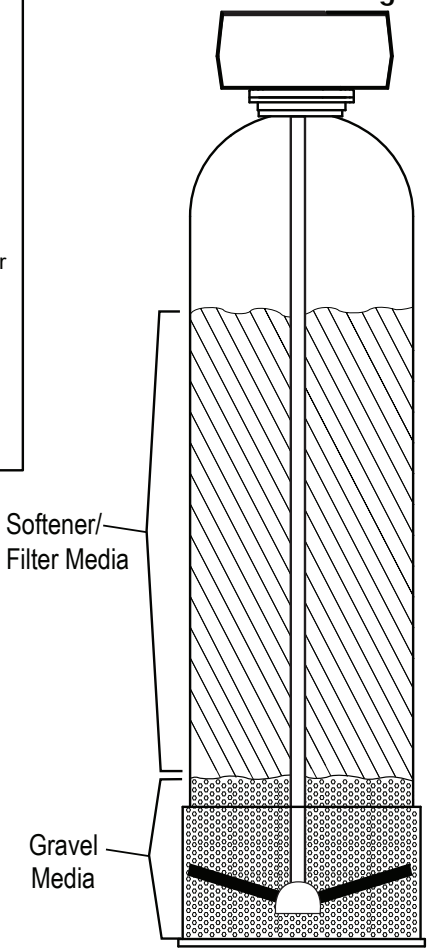


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Ordering:
Orders may be phoned, faxed, or emailed to Marlo Incorporated Purchase orders must include Marlo Incorporated part numbers and pricing. Purchase orders must also state if partial shipments are allowed. If you do not have the correct part numbers, pricing, or case quantities, please contact our customer service department.

Order Confirmations:
All purchase orders will be confirmed by phone, fax, or email. Any discrepancies in part numbers, pricing, descriptions, or case quantities will be listed in the order confirmation. It is the customer's responsibility to review the order confirmations and advise if any changes are to be made. If we do not hear from the customer regarding the confirmation within 24 hours, we will assume everything is correct and will invoice and ship accordingly.

Quotes & Prices:
Quotations are valid for a period of up to 45 days or for the term stated on the quote, whichever term is shortest. We make every effort to notify customers with price change information. However, prices are subject to change or correction without notice. Shipping weights, dimensions and anticipated ship dates are all approximate and subject to change.

Minimum Orders:
Minimum order accepted is $25.00, not including freight or taxes.

Taxes:
Taxes are not included. Quoted prices are exclusive of all taxes. Purchaser shall be responsible for payment of all applicable state/local taxes. Orders shipped within Wisconsin are subject to applicable state tax rates unless a completed resellers card or exempt certificate is on file.

Freight:
All shipments are F.O.B. Marlo Incorporated Racine, Wisconsin, unless otherwise specified.

Shipment:
The shipment method should be specified by the customer on the purchase order; otherwise, Marlo Incorporated will choose the best method of shipment.

Packaging:
Pricing includes packaging that is satisfactory for air, truck, or containerized shipment at no additional cost, unless otherwise stated. Ocean export crating will require an additional charge.

Terms - Domestic Customers:
Terms of payment on open accounts are net 30 days from the date of invoice, unless otherwise stated and mutually agreed upon by both parties. This agreement is subject to credit approval. Terms will only be issued to companies which reside in the United States of America. Orders will not be shipped if any account is past due and/or until payment by check has cleared.

Orders in excess of $60,000 will require partial payments prior to shipment. A specific progress payment schedule will be stated in the quotation. Partial payments may also be required for orders involving special engineering or custom ordered items regardless of order amount.

Interest will be charged on past due accounts. Interest charges will be calculated on the unpaid balance at 1.5% per month. All questions regarding invoices and terms must be addressed with our accounting department before invoices become due.

Unless specifically included as a separate item, prices quoted do not include any city, county, state or federal taxes, or transportation of merchandise.

Terms - International Customers:
All payments due are in U.S. dollars and must be made in advance by check (must clear before shipment), money orders, wire transfer, or credit card. Credit cards that are accepted are Visa, MasterCard, and American Express. Irrevocable Letters of Credit are accepted with a minimum order of $25,000.00 U.S. dollars, per order. Unless specifically included as a separate item, prices quoted do not include any city, county, state or federal taxes, or transportation of merchandise. A deposit may be required for special or custom ordered items.

Freight Claims:
Any damage, discrepancies and/or freight claims must be made immediately and directly, in writing within ten (10) days to Marlo Incorporated. Marlo Incorporated will help as much as possible in settling claims. However, Marlo Incorporated will not be held responsible for breakage or shortage after products are accepted by common carrier. All shipments must be inspected for damages and counted for shortages at the time of delivery.

Order Changes:
Additions to an order may be made at no charge prior to the processing of an order. Processing of an order typically begins within one hour of receipt of a purchase order and is typically accomplished within one working day.

Orders cancelled after the order has been processed and sent to shipping or engineering, will be subject to a minimum 10% cancellation fee, assuming manufacturing has not commenced, and no detailed engineering or special parts have been ordered. Additional fees may be charged depending on the level of completion of detailed engineering, manufacturing, and/or if any special parts have been ordered.

Returns & Restocking:
A Return Goods Authorization (RGA) number must be obtained from Marlo Incorporated before any product returns can be accepted and/or replacements shipped. All returns for warranty consideration are to be shipped prepaid and must be returned within ten (10) business days from the RGA issuance. Returns determined to be in warranty will be replaced or repaired and will be returned to Buyer prepaid. Products returned, other than valid warranty claims, may be subject to a restocking charge of up to 25%. Orders shipped incorrectly by Marlo Incorporated are not subject to restocking charges and correct items will be shipped to Buyer prepaid.

Excusable Delays:
Marlo Incorporated shall not be in default for failure to deliver or delay in delivery arising out of causes beyond its control and without its negligence, including but not limited to Acts of God or the public enemy; acts of the Government in either its sovereign or contractual capacity; fires; floods; epidemics; quarantine restrictions; strikes; shortages of materials or supplies; labor disputes; freight embargoes; delays in transit; consignments lost or damaged by freight agent(s); and unusually severe weather.

Warranty:
Marlo Incorporated warrants its products to be free from defects in design, material, or workmanship for a period of 18 months from shipment date or 12 months from installation, whichever occurs first, when said products are installed and operated in accordance with the written instructions provided. The fiberglass reinforced polyester (FRP) resin/media tanks used in certain products alone have an extended warranty period of five (5) years from the shipment date. If within that period any products shall be proven to Marlo, Inc.'s satisfaction to be defective, those products will be replaced, or the price refunded at Marlo Inc.'s option. Marlo Inc.'s obligations or nonperformance, defective, or any damage caused by its products or their use, and buyer's exclusive remedy therefore, shall be limited to product replacement or refund and shall be conditioned upon Marlo Inc.'s receiving written notice together with a demand for such replacement or refund:

The foregoing warranty is exclusive and in lieu of all other expressed implied warranty (except of title) including but not limited to implied warranty of merchantability and fitness for particular purpose.

Marlo Inc. will not be subject to and disclaims the following:

1. Any other obligations or liabilities arising out of breach of contract or out of warranty.

2. Any obligations whatsoever arising from tort claims (including negligence and strict liability) or arising under other theories of law with respect to products sold or services rendered by Marlo Inc. or any undertakings, acts, or omissions relating thereto.

3. All consequential, incidental, and contingent damages including labor charges, back charges or handling charges are excluded from Marlo Inc.'s warranty provisions.

Policy:
These terms and conditions may be superseded by specific provisions provided by Marlo Incorporated. However, should any of these terms and conditions be contrary to or inconsistent with any terms and conditions contained in any purchase order form or other document between Marlo Incorporated and the buyer, which is prepared by the buyer and whenever executed, the provisions hereof shall be controlling and shall supersede the conflicting terms and conditions which are contained in such other document. No changes shall be made to our terms and conditions unless prior written authorization by Marlo Incorporated

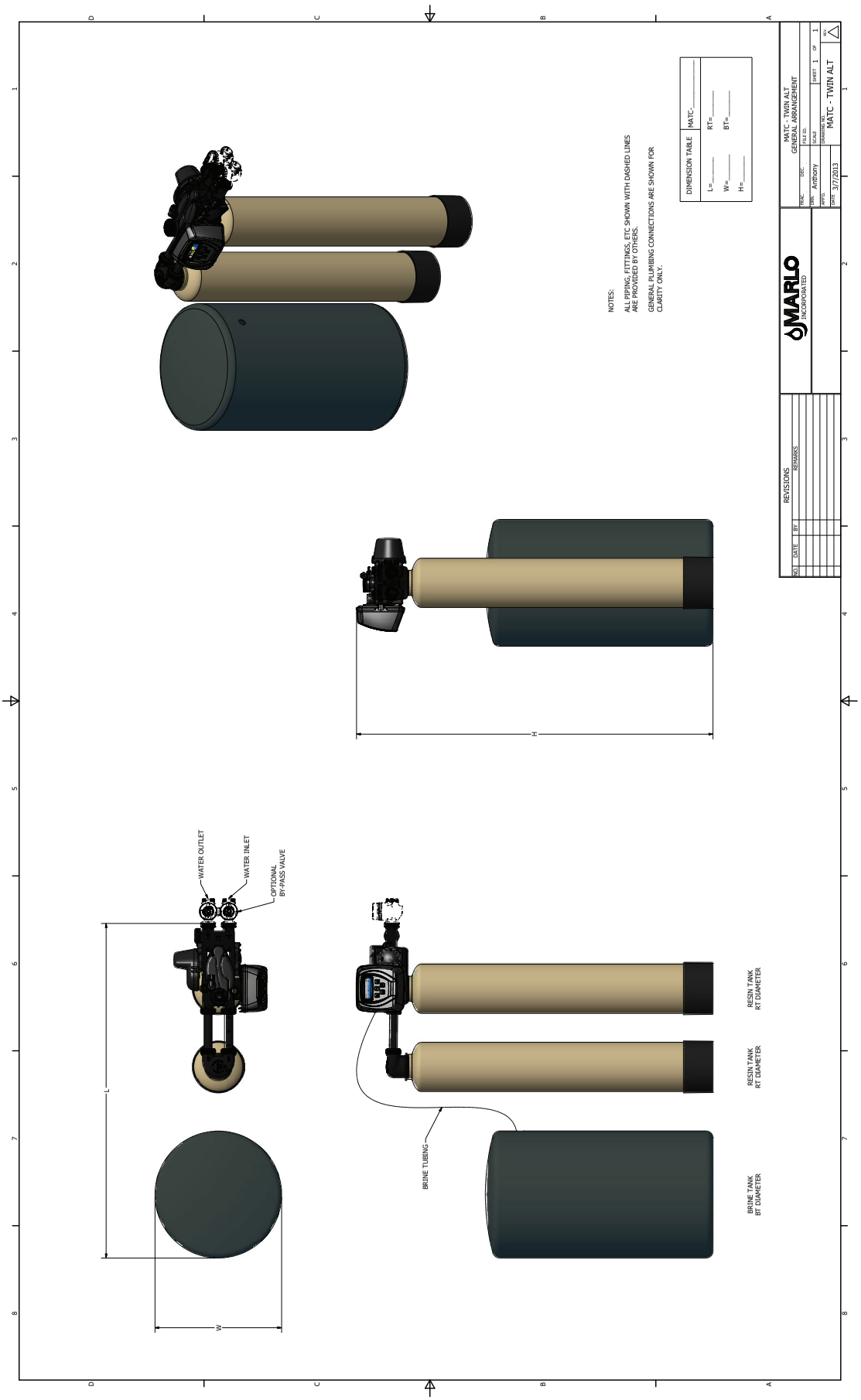
SPECIFICATION CHART

		MODEL MATC -	15	30	45	60	90	120	150
SYSTEM SIZE		Valve Size (In)	1	1	1	1	1	1	1
		Max Capacity (Kilograins)	15	30	45	60	90	120	150
		Min Capacity (Kilograins)	10	20	30	40	60	80	100
		Overall Dimensions (LxWxH) (In.)	50x18x52	51x18x56	51x18x62	54x18x60	57x18x73	66x24x73	69x24x75
FLOWRATE (GPM)		Peak Flowrate (Gpm)	18	20	22	25	26	30	31
		Continuous Flowrate (Gpm)	13	15	17	20	21	23	25
		Backwash & Fast Flush (Gpm)	1.3	2.2	2.7	3.2	4.2	5.3	7.5
		Brine Draw & Rinse (Gpm)	0.2	0.36	0.37	0.52	.79	1.05	1.3
		Brine Tank Refill (Gpm)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
TIMER SETTINGS		Backwash & Fast Flush (Min)	8	8	8	10	10	10	10
		Brine Draw & Rinse (Min)	60	60	60	60	60	60	60
		Fast Flush (Min)	8	8	8	10	10	10	10
		Brine Tank Refill (LBS.)	7.5	15	22.5	30	45	60	75
SOFTENER TANK		Size (In)	7x44	9x48	10x54	12x52	14x65	16x65	18x65
		Gravel (Lbs)	0	0	0	0	30	35	40
		Resin (Ft^3)	0.5	1.0	1.5	2.0	3.0	4.0	5.0
		Freeboard (In.)	8	8	17	16	21	21	24
BRINE SYSTEMS	EQUIPMENT	Tank Size	18x33	18x33	18x40	18x40	18x40	24x41	24x50
		Max Salt Storage (Lbs)	300	300	350	290	290	555	650
		Injector Code	1B	1D	1E	1F	1H	1I	1J
		Injector Color	BROWN	RED	WHITE	BLUE	GREEN	ORANGE	LT BLUE
	MAX	Salt Dosage- Max (Lbs)	7.5	15	22.5	30	45	60	75
		Refill Time - Max (Min)	5	10	15	20	30	40	50
	MIN	Salt Dosage- Min (Lbs)	3	6	9	12	18	24	30
		Refill Time - Min (Min)	2	4	6	8	12	16	20
	REGENERATION WASTE VOLUME (GAL)		35	55	65	80	115	150	200

NOTES:

1. FLOW RATES
   Continuous: pressure loss does not exceed 15 psig.
   Peak: pressure loss does not exceed 25 psig
   Backwash & Flush: maximum flow to drain
   Brine & Rinse: Injector flow to drain @50 psi inlet pressure
   Brine Tank Refill: flow to refill Brine Tank
2. SOFTENER TANK
   Freeboard: distance in inches from surface of resin to top sealing flange of tank
3. SALT DOSAGE
   Maximum 15 lbs./cu.ft. - regeneration efficiency: 2,000 grains/pound of salt (factory setting)
   Maximum 6 lbs./cu.ft. - regeneration efficiency: 3,000 grains/pound of salt
4. REGENERATION WASTE VOLUME - Total gallons water discharged per regeneration
5. DIMENSIONS:
   Leave a minimum 24 inch clearance to the height of the unit for loading media.
   Dimensions are for general arrangement use only.

MATC 1" GENERAL ARRANGEMENT DRAWING



INSTALLATION FITTING ASSEMBLIES

Installation fittings connect to the control valve or the bypass valve (bypass valve is optional) **using nuts that only require hand tightening**. Hand tighten nut connections between control valve and installation fittings, control valve and bypass valve, and bypass valve and installation fittings allow for ease serviceability. Do not use a pipe wrench to tighten nuts on installation fittings. **Hand tighten only.**

Split ring retainer design holds the nut on and allows load to be spread over the entire nut surface area reducing the chance for leakage. The split ring design, incorporated into the installation fittings allows approximately 2 degrees off axis alignment to the plumbing system. The installation fittings are designed to accommodate minor plumbing misalignments but are not designed to support the weight of a system or the plumbing.

When assembling the installation fitting package, connect the fitting to the plumbing system first and then attach the nut, split ring and o-ring. Heat from soldering or solvent cements may damage the nut, split ring or o-ring. Solder joints should be cool and solvent cements should be set before installing the nut, split ring and o-ring. Avoid getting primer and solvent cements on any part of the o-rings or split rings, bypass valve or control valve. Solvent cements and primers should be used in accordance with the manufacturer's instructions.

Slip the nut onto the fitting first, then the split ring second and the o-ring last. hand tighten the nut. If the fitting is leaking, tightening the nut will not stop the leak. Remove the nut, remove the fitting, and check for damage or misalignment of the o-ring.

Do not use the pipe dope or other sealant on threads. Teflon tape must be used on the threads of the 1" NPT elbow and the 1/4" NPT connection and on the threads for the drain line connection. Teflon tape is not necessary on the nut connection or caps because of o-ring seals.

Do not use Vaseline, oils or other unacceptable lubricants on o-rings. A silicon lubricant may be used on black o-rings.

Bypass Valve

The optional bypass valve easily connects to the control valve body using nuts that only require hand tightening. Hand tighten nut connections between control valve and fittings, control valve and bypass valve, and bypass valve and installation fittings allow for easy serviceability. The split ring retainer design holds the nut on and allows load to be spread over the entire nut surface area reducing the chance for leakage. The split ring design, incorporated into the bypass, allows approximately 2 degrees off axis alignment to the plumbing system. The bypass is designed to accommodate minor plumbing misalignments but is not designed to support the weight of a system or the plumbing.

Avoid getting primer and solvent cements on any part of the o-rings or split rings, bypass valve or control valve. Do not use pipe dope or other sealant on threads. Teflon tape is not necessary on the caps because of o-ring seals.

Do not use Vaseline, oil or other unacceptable lubricants on o-rings. A silicon lubricant may be used on black o-rings.

A. GENERAL

1. Shut off all water at main supply valve.
2. Shut off the fuel supply to water heater.
3. Open faucets (hot and cold) nearest pump or water meter to relieve pressure and drain system.
4. Move softener into the installation position. Loosely attach all fittings to measure for bypass valve assembly (if used), or manual bypass valve.
5. Level the unit. Place shims under cabinet or brine tank as needed. (Do Not use metal shims.)
6. Cut the cold water supply line as required.
7. Install the bypass valve assembly if used.

B. PLANNING INSTALLATION

1. All installation procedures must conform to local plumbing, electrical and sanitation codes and ordinances.
2. It is recommended that outside faucets for lawn service be on the hard water line, ahead of the softener, to conserve softened water, save salt and prevent lawn damage.
3. If this isn't practical, use the convenient integral bypass valve assembly during irrigation flows.
   CAUTION: The inlet water temperature MUST NOT exceed 110 F.
4. Do not locate softener where ambient temperature drops below 40 F.
5. Allow space around the softener for ease of servicing.
6. The softener drain lines must never be solidly connected to the sewer line. (Always provide an air gap at the END of the drain line). Valve drain line must not be elevated over 5' from the top of the softener on well systems, and not over 8' on municipal water systems.
7. Move the softener into position. MATC-15, 30, 45 & 60 systems have been pre-loaded at the factory. For systems larger than the MATC-60, complete section C before continuing on to section D.
8. **IMPORTANT:** Be sure that the water inlet line is connected to the "inlet" side of the bypass valve or to the inlet fitting. (Bypass valve both inlet/outlet fittings are marked.) If water lines are reverse, (inlet/outlet) resin may be forced from the water softener into the plumbing system. If this occurs, household plumbing system must be clean.
   NOTE: The twin tanks need to be a specific distance from each other. Refer to the table in paragraph F for the correct center-to-center distance for the tanks.

C. LOADING SOFTENER TANK

1. On Model MATC-15, 30, 45 and 60 the softening media has been pre-loaded at the factory. Skip this section and go to "Connect All Fittings".
2. Fill tank(s) approximately 1/3 full of water using a hose, bucket, etc. Plug the PVC distributor manifold pipe using a plastic cap, cork, rag, etc. NO gravel or resin should go into this distributor manifold pipe.=
3. Verify the distributor manifold is center in the tank with the distributor resting on the bottom of the tank. Verify the riser pipe is still plugged.
   NOTE: Reference the specification table in the front of this manual for the correct quantities of gravel and resin. Note that these quantities are for each tank. Make sure you have the required amounts on site before you begin. Gravel is not required on systems with 12" tanks or smaller.
4. With care not to damage any lateral, pour in the gravel provided for each tank through the top opening in the tank and level out evenly. This will cover the distributor assembly.
   NOTE: Wetting the gravel in the bags before loading will eliminate the normal amount of dust.
5. When gravel is loaded and leveling is completed, proceed as follows:
6. With the distributor riser pipe still plugged, add the proper amount of resin supplied for each tank through the top opening in the tank.
   Caution: The softener resin is very slippery. Take care when stepping on any spilled resin. Remove spilled resin from standing surface immediately.
7. When loading is complete, remove plastic cap, cork, or rag that was used to plug the distributor riser pipe. Be careful not to let any foreign debris fall into the pipe. The result could be damage to system.
8. Repeat instruction steps 1-7 for each softener tank (if applicable).

D. MOUNTING CONTROL VALVE ASSEMBLY

1. Verify that the distributor riser pipe is not plugged.
2. Lubricate the distributor o-ring on the bottom of the control valve with silicone.
3. Screw the control valve into top opening of tank making sure the distributor riser pipe slides easily through the distributor o-ring. Care must be taken not to “nick” this o-ring as hard water leakage could result.
4. Tighten down the control valve to ensure positive o-ring seal at top of tank.
5. Repeat steps 1-4 for the second tank adapter.

E. CONNECT ALL FITTINGS

CAUTION: Care must be used when working with copper tubing. Do not allow the flame from torch to contact any portion of the Valve assembly.

1. Attach 1/2” drain line to drain elbow with insert and nut. Use optional 3/4” drain fittings if drain run exceeds 25 ft.
2. Do not elevate the drain line over 5’ above the top of the valve (8’ on municipal systems) or to exceed 25’ in length at either height.

CAUTION: An air gap must be provided upon sewer entry. (Conform to local plumbing and sanitation codes and ordinances).

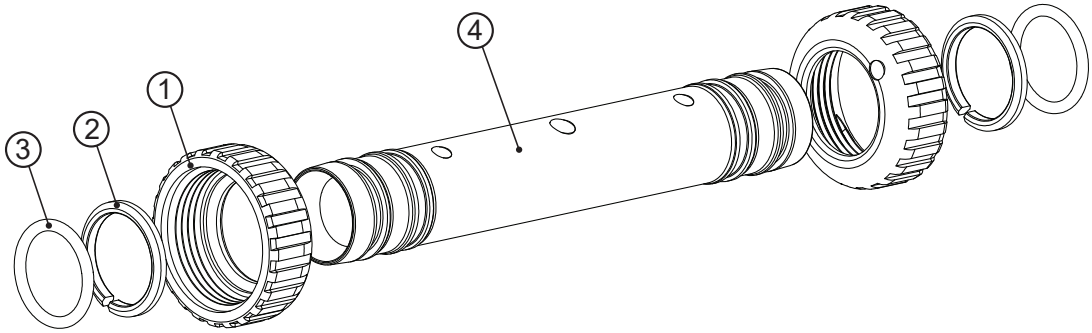
3. The salt storage cabinet or brine tank provides an overflow. Attach 1/2” ID flexible plastic tubing to the overflow fitting and direct it to the drain. DO NOT connect to the main drain line. Use a separate gravity flow line.
4. For pre-loaded systems, connect to bypass assembly (if used). The integral manual bypass option is a connection which eliminates the need for a 3-valve manifold. This makes installation easier and provides a more convenient method of bypassing.

F. TWIN ALTERNATING PLUMBING

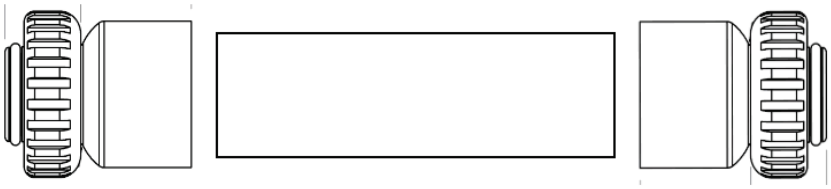
The tanks should have been placed at the distance shown in the chart below. Locate the interconnect pipes (there are two).

Tank Placement based on Diameter	
Tank Diameter (in.)	Center-to-Center Distance (in.)
7”, 8”, 9”, 10”	11.5”
12”	13.5”
14”	15.5”
16”	17.5”
18”	19.5”

For systems with tank diameters from 7” to 10”, place the quick-connect nut (1), o-ring (2) and then split ring (3) on each end of each pipe (4). Insert the pipes between the main valve and the second tank adapter. Secure the pipes on each end using the quick-connect nut. Hand tighten only.



For systems with tanks 12” diameter and larger – additional connectors are needed to adapt the interconnecting pipes to the valve and second tank adapter. Locate the two interconnecting pipes (1-1/4” PVC) and the four (4) connectors and glue one connector to each end of the two interconnecting pipes using PVC glue. Once the glue is set up, insert the interconnecting piping assemblies between the main valve and the second tank adapter. Secure the pipes on each end using the split ring and quick-connect nut. Hand tighten all quick-connect nuts.



The inlet and outlet of the valve can be connected to an optional bypass assembly, or a 3-valve bypass as shown on the layout drawing. The integral manual bypass option is a connection which eliminates the need for a 3-valve manifold. This makes installation easier and provides a more convenient method of bypassing.

The softener system includes a 1” NPT male connector kit. Insert the two connectors into the inlet and outlet (of the valve or optional bypass) and hand tighten the quick-connect nuts. The raw water inlet line and soft water outlet lines are to be attached to the 1” male connectors.

G. PRESSURE TEST THE INSTALLATION

At this point, the water supply is still off and the softener bypass valve is open (inlet and outlet valves are closed). The unit can be plugged in at this time. The plumbing system can now be checked for any possible leaks.

1. Put the unit into fast rinse. To do this, push and hold the REGEN button for 3-5 seconds. When the Valve stops cycling, push the REGEN button again to advance to the next cycle. Continue until FAST RINSE is shown in the display, then unplug the unit. With water supply off, take the softener out of bypass and into the service position.
2. Open water supply line valve very slowly. Water should escape slowly from the drain line. If water enters too quickly, resin may be lost to the drain.
3. When all of the air has been purged from the mineral tank (water flows steadily from the drain) open the main supply valve fully.
4. Allow water to run to drain until clear. CHECK FOR LEAKS!
5. Plug the unit back in.
6. Manually step the unit through the remaining steps, stopping at the fill cycle (to do this, push the REGEN button). Once the piston has stopped moving, push the REGEN button again to the next cycle. Continue until Fill appears on the screen. The unit will now fill the brine tank to the appropriate level. (This sequence is for softeners with post fill brine)
7. Allow control to return to the home position.
8. Check for leaks!
9. Make sure the power cord is plugged into a properly grounded wall receptacle.

H. MANUAL REGENERATION

The user can initiate manual regeneration. The user has the option to request a manual regeneration at the delayed regeneration time or to have the regeneration occur immediately:

1. Pressing and releasing the REGEN button. "Regen Today" will flash on the display and the regeneration will occur at the delayed regeneration time. The user can cancel the request by pressing and releasing the REGEN button. This method of manually initiating regeneration is not allowed when the system is set to immediately regenerate when the gallon capacity reaches zero.
2. Pressing and holding the REGEN button for approximately 3 seconds will immediately start the regeneration The user cannot cancel this request.

NOTE: Program Timer "Lockout" Feature

The Program Timer is initially set to allow access to all Programming, Diagnostic and History screens

The Installer can limit access to (lockout) most screens by activating the Lockout Feature.

Activating "Lockout" allows the user to view and change only Water Hardness, Days Override, Time of Regeneration and Time of day.

Activate "Lockout" Feature: Press DOWN then NEXT then UP then SET CLOCK in sequence. LOCK will briefly appear in the display.

De-activate "Lockout" Feature: Press DOWN then NEXT then UP then SET CLOCK. UNLOCK will briefly appear in the display.

When in operation normal user displays such as time of day, gallons remaining or days remaining before regeneration are shown. When stepping through a procedure if no buttons are pressed within five minutes the display returns to a normal user display. Any changes made prior to the five minute time out are incorporated. The one exception is current flow rate display under the diagnostic procedure. The current flow rate display has a 30 minute time out feature.

CONTROL VALVE FUNCTION AND CYCLES OF OPERATION

This glass filled Noryl™ fully automatic control valve is designed as the primary control center to direct and regulate all cycles of a water softener or filter. When the control valve is set up as a softener, the control valve can be set to perform down flow or up flow regeneration with the proper piston. When the control valve is set up as a filter, the control valve can be set to perform down flow regeneration or simply backwash. The control valve can be set to regenerate on demand (consumption of a predetermined amount of water) and/or as a time clock (passage of a particular number of days). The control valve can be set so that the softener can meet the Water Quality Association (WQA) or NSF International efficiency rating.

The control valve is compatible with a variety of regenerants and resin cleaners. The control valve is capable of routing the flow of water in the necessary paths to regenerate or backwash water treatment systems. The injector regulates the flow of brine or other regenerants. The control valve regulates the flow rates for backwashing, rinsing and the replenishing of treated water into a regenerant tank, when applicable.

The 1” control valve is designed to deliver high service (30 gpm @ 15 psig) and backwash (16 gpm @ 25 psig) flow rates when the bypass has straight fittings and a 1.050” distributor. The control valve uses no traditional fasteners (e.g. screws), instead clips, threaded caps, nuts and snap type latches are used. Caps and nuts only need to be firmly hand tightened because radial seals are used. Tools required to service the valve include one small blade screwdriver, pliers and a pair of hands. Disassembly for servicing takes much less time than comparable products currently on the market. Control valve installation is made easy because the distributor tube can be cut 1/2” above to 1/2” below the top of the tank thread. The distributor tube is held in place by an o-ring seal and the control valve also has a bayonet lock feature for upper distributor baskets.

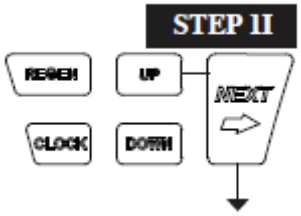
The transformer power pack comes with a 15-foot power cord and is designed for use with the control valve. The transformer power pack is for dry location use only. The control valve remembers all settings for up to 8 hours if the power goes out and the battery is not depleted. After 8 hours, the only item that needs to be reset is the time of day; other values are permanently stored in the nonvolitile memory. If a power loss lasts less than 8 hours and the time flashes on and off, the time of day should be reset and the non rechargeable battery should be replaced. The replacement battery is a commercially available 3 volt Lithium coin cell type 2032.

Table 3 shows the order of the cycles when the valve is set up as a softener.

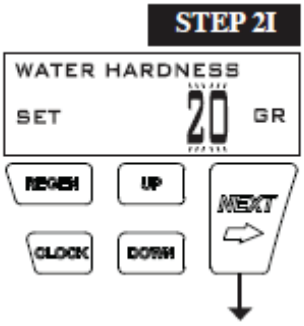
Table 3
Regeneration Cycles Time

		Down Flow Softener
Grains Capacity / LB NaCl		3500 to 2501
Lbs. NaCl/cu ft resin		7.5 to 1.2
Cycle Time In Minutes	**1st Cycle: Backwash Normal**	8-10 minutes
	2nd Cycle: Brine Slowrinse	60 minutes
	3rd Cycle: Rinse	8-10 minutes
	4th Cycle: Fill	minutes will vary depending on softener capacity
	5th Cycle: End	0.011–200

VALVE PROGRAMMING



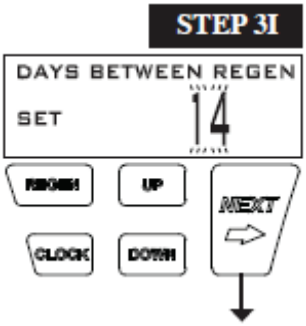
STEP 1I - Press NEXT and UP simultaneously for 3 seconds.



STEP 2I – **Hardness:** The default is 20 with value ranges from 1 to 150 in 1 grain increments. Note: The grains per gallon can be increased if soluble iron needs to be reduced.

Set the amount of hardness in grains of hardness as calcium carbonate per gallon using DOWN or UP.

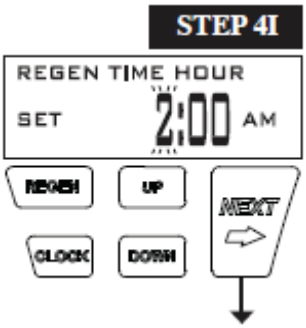
This display will not show if 'AUTO' is not selected in Set Volume Capacity in OEM Softener System Setup. Press NEXT to go to step 3I. Press REGEN to exit Installer Display Settings.



STEP 3I – **Day Override:** Number of days between regeneration (1 to 28); or "OFF".

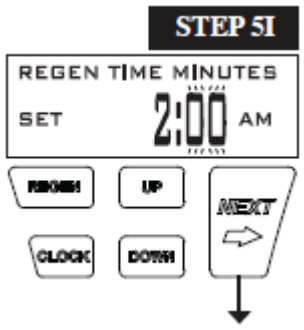
If value set to "OFF", regeneration initiation is based solely on volume used. If value is set as a number (allowable range from 1 to 28) a regeneration initiation will be called for on that day even if sufficient volume of water were not used to call for a regeneration. Set Day Override using DOWN or UP.

When volume capacity is set to "OFF" (time clock), sets the number of days between regenerations. When volume capacity is set to AUTO or to a number (metered), sets the maximum number of days between regenerations. See Setting Options Table 8 for more detail on setup. Press NEXT to go to step 4I. Press REGEN to return to previous step.



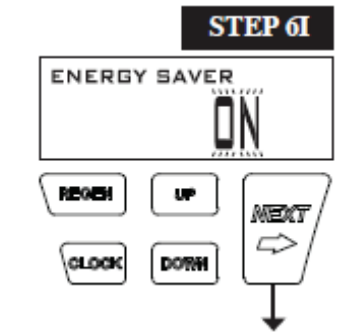
STEP 4I – **Next Regeneration Time (hour):** The default time is 2:00 AM. AM/PM toggles after 12.

Used for DELAY regeneration. Set the "hour" of day for regeneration using DOWN or UP. If "IMMEDIATE" is selected in Set Regeneration Time Option in OEM Softener System Setup, this display will show "REGEN IMMEDIATE ON ZERO GAL". Press NEXT to go to step 5I. Press REGEN to return to previous step.



STEP 5I – **Next Regeneration Time (minutes):**

Used for DELAY regeneration. Set the "minutes" of day for regeneration using DOWN or UP. This display will not be shown if "IMMEDIATE" is selected in Set Regeneration Time Option in OEM Softener System Setup. Press NEXT to go to Step 6I. Press REGEN to return to previous step.

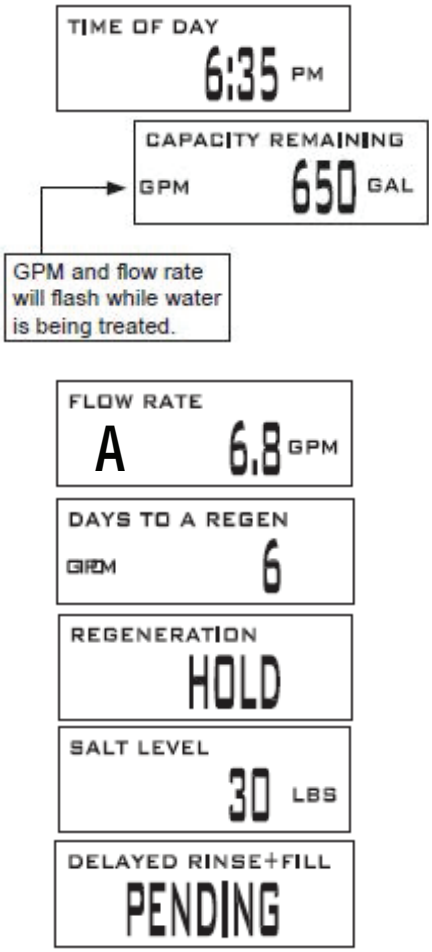


STEP 6I – Energy Saver operation: Set to "OFF" or "ON".

When set to OFF, the display backlight is always on. When set to ON, the display backlight will go off after 5 minutes of no keypad activity.

A valve error or salt level alert will activate the display backlight, and prevent deactivation until the error or alert is reset by the user. Press NEXT to exit Installer Display Settings. Press REGEN to return to the previous step.

User Display Settings



When the system is operating, several displays may be shown. Pressing NEXT will alternate between the displays.

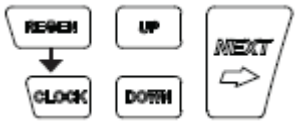
- Current TIME OF DAY.
- CAPACITY REMAINING is the gallons that will be treated before the system goes through a regeneration cycle (Metered units only). Pressing DOWN while in the Capacity Remaining display will decrease the capacity remaining in 10 gallon increments and will also increase the volume used impacting the recorded values in Diagnostics Steps 3D, 4D and 5D and Valve History, Step 4VH.
- If a water meter is installed, GPM flashes (and alternates with the flow rate) on the display when water is being treated (i.e. water is flowing through the system). A tank in service indicator (A or B) will show which tank is in service.
- DAYS TO A REGEN is the number of days left before the system goes through a regeneration cycle. Pressing UP or DOWN while in this screen will temporarily increase or decrease the displayed value by 1 day.
- Contact information will be displayed if it was edited. For concerns with phone number or banner text displays, contact OEM for instructions.
- DP or HOLD if the dP switch is closed.
- REGEN TODAY will alternate with the header on the display if the system has called for a regeneration that will occur at the pre-set time of regeneration.
- If Salt Level Monitor has been set to ON in Step 16S, the SALT LEVEL screen will appear. To adjust the salt level, press CLOCK, and use UP or DOWN to set the current value. The salt level is adjustable from 0 to 500 lbs. in 10 lb. increments
- DELAYED RINSE+FILL PENDING will be displayed whenever a zero-capacity tank has transferred to an off-line state and is currently waiting to initiate the second portion of a regeneration cycle. Viewed only when Delayed Rinse and Fill is set to ON.



Regeneration Mode

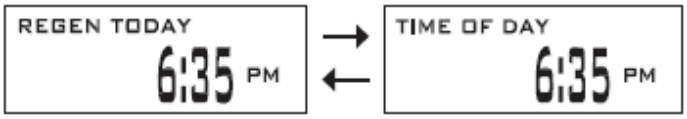
Typically a system is set to regenerate at a time of low water usage. An example of a time with low water usage is when a household is asleep. If there is a demand for water when the system is regenerating, untreated water will be used.

When the system begins to regenerate, the display will change to include information about the step of the regeneration process and the time remaining for that step to be completed. The system runs through the steps automatically and will reset itself to provide treated water when the regeneration has been completed.



Manual Regeneration

Sometimes there is a need to regenerate the system sooner than when the system calls for it, usually referred to as manual regeneration. There may be a period of heavy water usage because of guests or a heavy laundry day. To initiate a manual regeneration at the preset delayed regeneration time, when the regeneration time option is set to “DELAYED REGEN” or “DELAY + IMMEDIATE”, press and release “REGEN”.

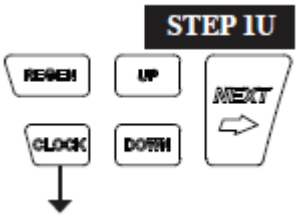


The words “REGEN TODAY” will periodically be shown on the display to indicate that the system will regenerate at the preset delayed regeneration time. If you pressed the “REGEN” button in error, pressing the button again will cancel the request.

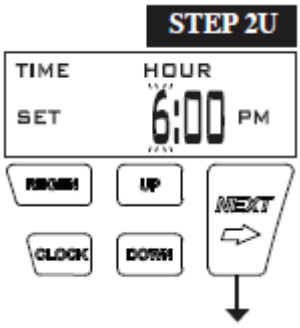
Note: If the regeneration time option is set to “IMMEDIATE” there is no set delayed regeneration time so “REGEN TODAY” will not activate if “REGEN” button is pressed. To initiate a manual regeneration immediately, press and hold the “REGEN” button for three seconds. The system will begin to regenerate immediately. The request cannot be cancelled. Note: For softeners, if brine tank does not contain salt, fill with salt and wait at least two hours before regenerating.

Set Time of Day

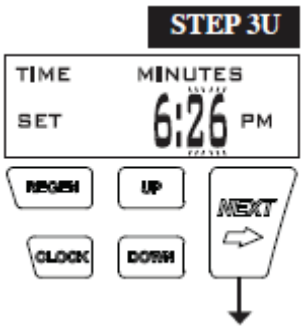
The user can also set the time of day. Time of day should only need to be set if the battery has been depleted because of extended power outages or when daylight saving time begins or ends. If an extended power outage occurs, the time of day will flash on and off which indicates the time of day should be reset. The non rechargeable battery should also be replaced.



STEP 1U – Press CLOCK



STEP 2U - Current Time (hour): Set the hour of the day using DOWN or UP. AM/PM toggles after 12. Press NEXT to go to Step 3U.



RETURN TO NORMAL MODE

STEP 3U - Current Time (minutes): Set the minutes of the day using DOWN or UP. Press NEXT to exit Set Time of Day. Press REGEN to return to previous step.



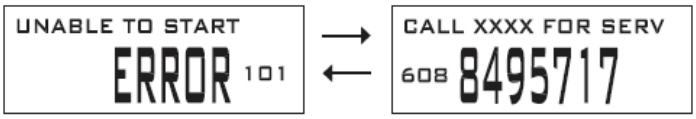
Power Loss

If the power goes out the system will keep time until the battery is depleted. If an extended power outage occurs, the time of day will flash on and off which indicates the time of day should be reset and the non rechargeable battery replaced. The system will remember the rest.

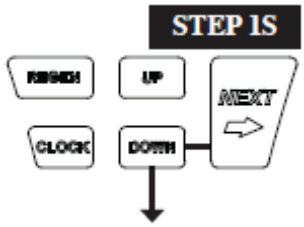


Error Message

If the word “ERROR” and a number are displayed contact the OEM for help. This indicates that the valve was not able to function properly. If the number and banner text in the Contact Screens has been edited, the two displays below will alternate.

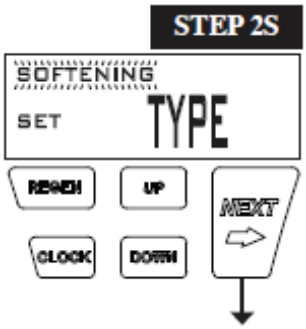


Manufacturers Softener System Setup

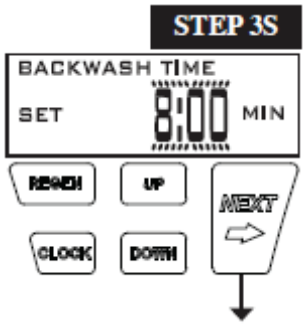


Step 1S – Press NEXT and DOWN simultaneously for 3 seconds and release. If screen in Step 2S does not appear in 5 seconds the lock on the valve is activated. To unlock press DOWN, NEXT, UP, and SET CLOCK in sequence, then press NEXT and DOWN simultaneously for 3 seconds and release.

It is not necessary for the installer or end user to program these screens. All screens have been programmed for your specific equipment.

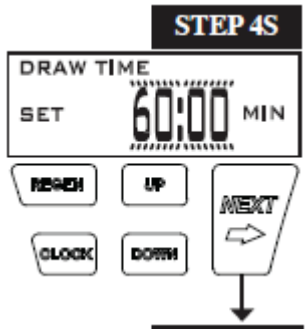


Step 2S – Choose SOFTENING using UP or DOWN. Press NEXT to go to Step 3S. Press REGEN to exit OEM Softener System Setup.



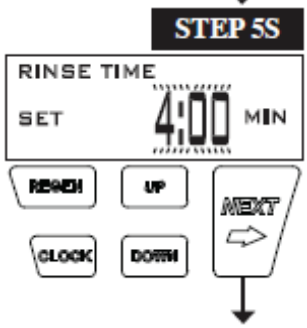
Step 3S – Select the time for the fi rst cycle (which in this example is BACKWASH) using UP or DOWN. Press NEXT to go to Step 4S. Press REGEN to return to previous step.

This is already programmed for your specific unit at Marlo Inc. You do not need to change.



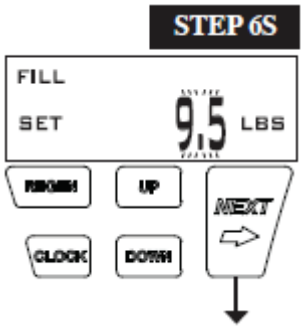
Step 4S – Select the time for the second cycle (which in this example is DRAW) using UP or DOWN. Press NEXT to go to Step 5S. Press REGEN to return to previous step.

This is already programmed for your specific unit at Marlo Inc. You do not need to change.



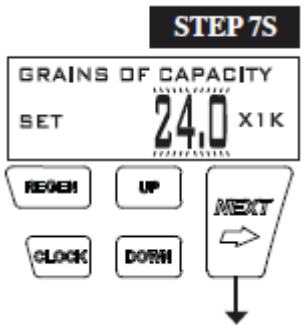
Step 5S – Select the time for the third cycle (which in this example is RINSE) using UP or DOWN. Press NEXT to go to Step 6S. Press REGEN to return to previous step.

This is already programmed for your specific unit at Marlo Inc. You do not need to change.



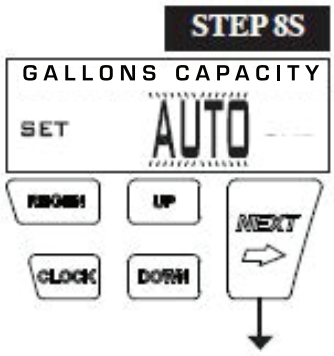
Step 6S – Select the LBS for the fourth cycle (which in this example is FILL) using UP or DOWN. When both 2.0L and 2.0 are options in Step 2CS, and 2.0 is selected, FILL is in minutes. Press NEXT to go to Step 7S. Press REGEN to return to previous step.

This is already programmed for your specific unit at Marlo Inc. You do not need to change.



Step 7S – Set Grains Capacity using UP or DOWN. The ion exchange capacity is in grains of hardness as calcium carbonate for the system based on the pounds of salt that will be used. Calculate the pounds of salt using the fill time previously selected. Grains capacity is affected by the fill time. The grains capacity for the selected fill time should be confirmed by OEM testing. The capacity and hardness levels entered are used to automatically calculate reserve capacity when volume capacity is set to AUTO. Press NEXT to go to Step 8S. Press REGEN to return to previous step.

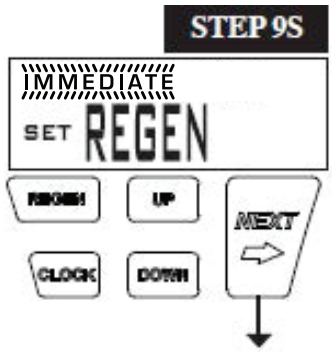
Capacity is already set by Marlo Inc.



Step 8S – Set Gallons Capacity using UP or DOWN. If value is set to:

- "AUTO" capacity will be automatically calculated and reserve capacity will be automatically estimated; **AUTO is the default of all Marlo equipment.**
- "OFF" regeneration will be based solely on the day override set (see Installer Display Settings Step 3I); **"OFF" feature is for Time Clock units only**; or
- "GAL", regeneration initiation will be based off the value specified.

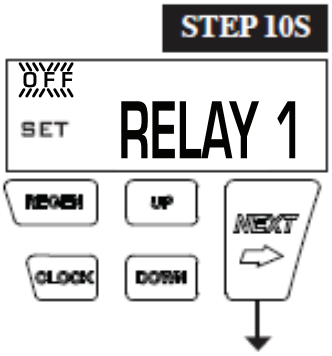
If "OFF" or a number is used, hardness display will not be allowed to be set in Installer Display Settings Step 2I.
If "OFF" is selected, Regeneration Time is automatically "Delayed", so Step 9S will not appear.
See Setting Options Table 8 for more detail. Press NEXT to go to Step 9S. Press REGEN to return to previous step



Step 9S – Set Regeneration Time Options using UP or DOWN. If value is set to:

- "DELAYED" means regeneration will occur at the preset time
- "IMMEDIATE" means regeneration will occur immediately when the volume capacity reaches 0 (zero). "IMMEDIATE" is the default on all Marlo equipment configured as twin alternating

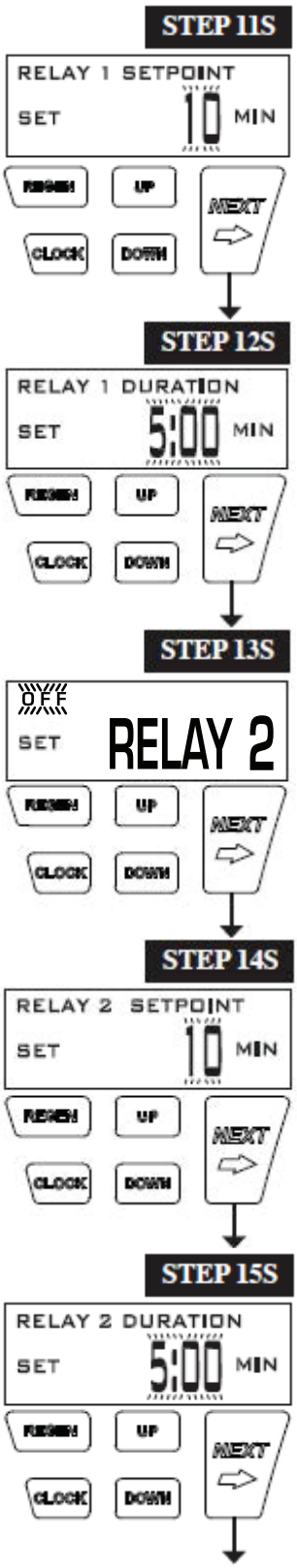
See Setting Options Table 8 for more detail. Press NEXT to go to Step 10S. Press REGEN to return to previous step.



Step 10S: Set Relay 1 operation using UP or DOWN. The choices are:

- Set TIME: Relay activates after a set time at the beginning of a regeneration and then deactivates after a set period of time. The start of regeneration is defined as the first backwash cycle or Regenerant Draw UP (1" only) or DN, which ever comes first. See steps 11S & 12S.
- Set GALLONS: Relay activates after a set number of gallons have been used while in service and then deactivates after a set period of time or after the meter stops registering flow, whichever comes first.
- Set REGEN GAL: Relay activates after a set number of gallons have been used while in service or during regeneration and then deactivates after a set period of time or after the meter stops registering flow, whichever comes first.
- Set OFF: If set to Off, Steps 11S and 12S will not be shown.

Press NEXT to go to Step 11S. Press REGEN to return to previous step.



Step 11S: Set Relay 1 SETPOINT Time or Gallons using UP or DOWN. The choices are:

- Relay Actuation Time: After the start of a regeneration the amount of time that should pass prior to activating the relay. The start of regeneration is defined as the first backwash cycle or Regenerant Draw UP (1" only) or DN, which ever comes first. Ranges from 0 to 500 minutes.
- Relay Actuation Gallons: Relay activates after a set number of gallons have passed. Ranges from 1 to 20,000 gallons.

Press NEXT to go to Step 12S. Press REGEN to return to previous step.

Step 12S: Set Relay DURATION TIME using UP or DOWN.

- If TIME is selected in Step 10S, the relay will deactivate after the time set has expired. Ranges from 0:01 to 500:00 minutes.
- If GALLONS or REGEN GAL is selected in Step 10S, the relay will deactivate after the time set has expired.

Press NEXT to go to Step 13S. Press REGEN to return to previous step.

Step 13S: Set Relay 2 operation using UP or DOWN. The choices are the same as Step 10S.

- If set to Off, Steps 14S and 15S will not be shown.

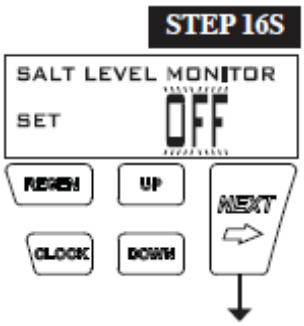
Press NEXT to go to Step 14S. Press REGEN to return to previous step.

Step 14S: Set Relay 2 SETPOINT Time or Gallons using UP or DOWN. The choices are the same as Step 11S. Press NEXT to go to Step 15S. Press REGEN to return to previous step.

Step 15S: Set Relay DURATION TIME using UP or DOWN.

- If TIME is selected in Step 13S the relay will deactivate after the time set has expired.
- If GALLONS or REGEN GAL is selected in Step 13S the relay will deactivate after the time set has expired or after the meter stops registering fl ow, whichever comes first.

Press NEXT to go to Step 16S. Press REGEN to return to previous step



RETURN TO NORMAL MODE

Step 16S: Marlo does not turn this option on. Set Salt Level Monitor. This screen will not appear if Step 2CS is set to 2.0. Press NEXT to exit Softener System Setup. Press REGEN to return to the previous step.

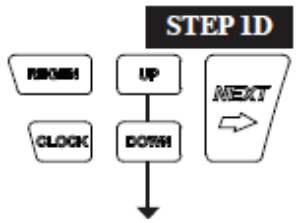
All Marlo equipment has “OFF” as the default.

SETTING OPTIONS TABLE 8

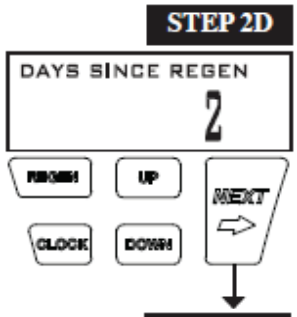
Volume Capacity	Regeneration Time Option	Day Override	Result4
AUTO	DELAYED REGEN	OFF	Reserve capacity automatically estimated. Regeneration occurs when volume capacity falls below the reserve capacity at the next Regen Set Time
AUTO	DELAYED REGEN	Any number	Reserve capacity automatically estimated. Regeneration occurs at the next Regen Set Time when volume capacity falls below the reserve capacity or the specified number of days between regenerations is reached.
Any number	DELAYED REGEN	OFF	Reserve capacity not automatically estimated. Regeneration occurs at the next Regen Set Time when volume capacity reaches 0.
OFF	DELAYED REGEN	Any number	Reserve capacity not automatically estimated. Regeneration occurs at the next Regen Set Time when the specified number of days between regenerations is reached.
Any number	DELAYED REGEN	Any number	Reserve capacity not automatically estimated. Regeneration occurs at the next Regen Set Time when volume capacity reaches 0 or the specified number of days between regenerations is reached.
AUTO	IMMEDIATE	OFF	Reserve capacity not automatically estimated. Regeneration occurs immediately when volume capacity reaches 0. Time of regeneration will not be allowed to be set because regeneration will always occur when volume capacity reaches 0.
Any number	IMMEDIATE	OFF	Reserve capacity not automatically estimated. Regeneration occurs immediately when volume capacity reaches 0. Time of regeneration will not be allowed to be set because regeneration will always occur when volume capacity reaches 0.

4 Reserve capacity estimate is based on history of water usage

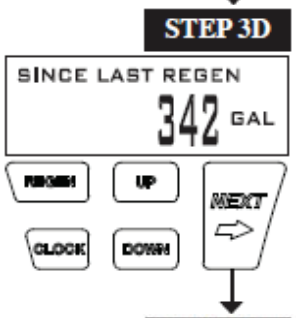
DIAGNOSTICS



STEP 1D – Press UP and DOWN simultaneously for three seconds. If screen in step 2D does not appear in 5 seconds the lock on the valve is activated. To unlock press DOWN, NEXT, UP, and CLOCK in sequence, then press UP and DOWN simultaneously for 3 seconds.



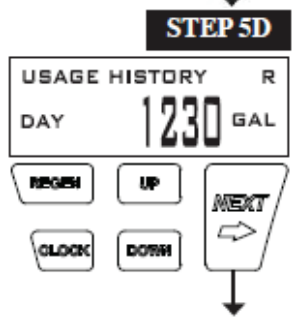
STEP 2D – Days, since last regeneration: This display shows the days since the last regeneration occurred. Press NEXT to go to Step 3D. Press REGEN to exit Diagnostics.



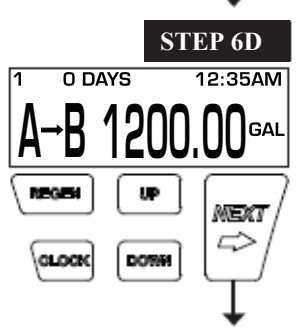
STEP 3D – Volume, since last regeneration: This display shows the volume of water that has been treated since the last regeneration. This display will equal zero if a water meter is not installed. Press NEXT to go to Step 4D. Press REGEN to return to previous step.



STEP 4D – Reserve History Volume used for last 7 days: If the valve is set up as a softener, a meter is installed and Set Volume Capacity is set to "Auto," this display shows 0 day (for today) and the reserve capacity. Pressing UP will show day 1 (which would be yesterday) and the reserve capacity used. Pressing UP again will show day 2 (the day before yesterday) and the reserve capacity. Keep pressing UP to show the capacity for days 3, 4, 5 and 6. DOWN can be pressed to move backwards in the day series. This screen is not displayed if fi lter, time clock, meter immediate, alternator or volume override regeneration is selected. Press NEXT at any time to go to Step 5D. Press REGEN to return to previous step.

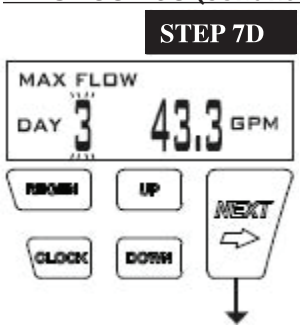


STEP 5D - Volume, 63-day usage history: This display shows day 0 (for today), day 1 (for yesterday), etc., and the volume of water treated that day. Press UP to show the volume of water treated for the last 63 days.
For the 1" twin valve, the usage for tank 1 & tank 2 is combined in this display. If a regeneration occured on the day the letter "R" will also be displayed. This display will show dashes if a water meter is not installed. Press NEXT at any time to go to Step 6D. Press REGEN to return to previous step.



STEP 6D- Tank Transfer History
This display shows data for the last 10 transfers. Flashing number indicates transfer number. A→B or B→A shows which direction transfer occurred. Days shows how many days ago the transfer happened. The number of gallons used at time of transfer is shown. Use UP or DOWN to scroll through each transfer. Press NEXT at any time to go to step 7D. Press REGEN to return to previous step.

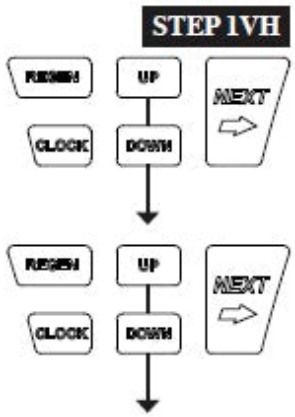
DIAGNOSTICS (continued)



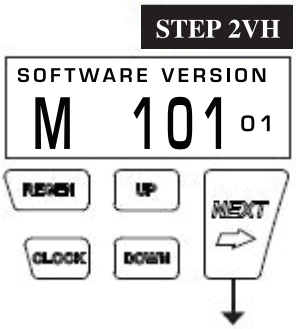
RETURN TO NORMAL MODE

STEP 7D – Flow rate, maximum last seven days: Use UP or DOWN to display the maximum flow rate in gallons per minute that occurred in each of the last seven days. This display will equal zero if a water meter is not installed. Press NEXT to exit Diagnostics. Press REGEN to return to previous step.

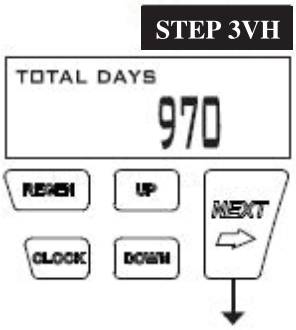
Valve History



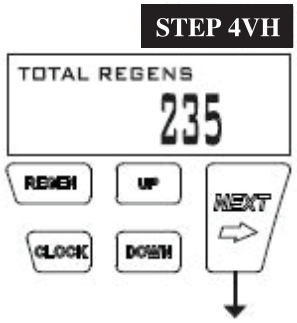
STEP 1VH – Press UP and DOWN simultaneously for three seconds and release. Then press UP and DOWN simultaneously and release. If screen in step 2VH does not appear in 5 seconds the lock on the valve is activated. To unlock press DOWN, NEXT, UP, and CLOCK in sequence, then press UP and DOWN simultaneously for 3 seconds and release. Then press UP and DOWN simultaneously and release.



STEP 2VH – Software Version displays current software version programmed.

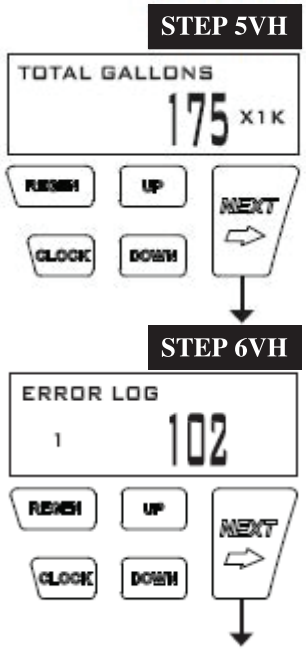


STEP 3VH$_5$ – Days, total since start-up: This display shows the total days since startup. Press NEXT to go to Step 3VH. Press REGEN to return to previous step



STEP 4VH – Regenerations, total number since start-up: This display shows the total number of regenerations that have occurred since startup. Press NEXT to go to Step 4VH. Press REGEN to return to previous step.

DIAGNOSTICS (continued)



STEP 5VH – Volume, total used since start-up: This display shows the total gallons treated since startup. This display will equal zero if a water meter is not installed. Press NEXT to go to Step 5VH. Press REGEN to return to previous step.

STEP 6VH – Error Log: This display shows a history of the last 10 errors generated by the control during operation. Press UP or DOWN to view each error recorded. Press NEXT to exit Valve History. Press REGEN to return to previous step.

RETURN TO NORMAL MODE

5 Values in steps 3VH through 6VH cannot be reset.

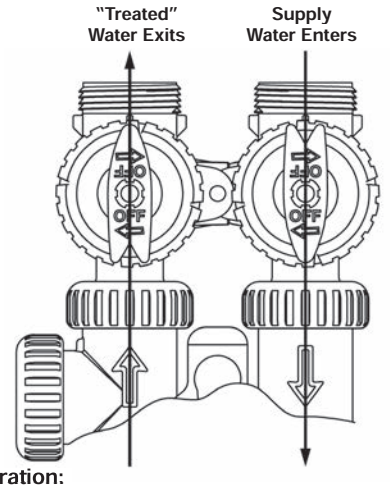
BYPASS VALVE (OPTIONAL)

The bypass valve is typically used to isolate the control valve from the plumbing system's water pressure in order to perform control valve repairs or maintenance. The WS1 bypass valve is particularly unique in the water treatment industry due to its versatility and state of the art design features. The 1" full flow bypass valve incorporates four positions including a diagnostic position that allows service personal to work on a pressurized system while still providing untreated bypass water to the facility or residence. Its completely non-metallic, all plastic, design allows for easy access and serviceability without the need for tools.

The bypass body and rotors are glass filled Noryl and the nuts and caps are glass filled polypropylene. All seals are self-lubricating EPDM to help prevent valve seizing after long periods of non-use. Internal o-rings can easily be replaced if service is required.

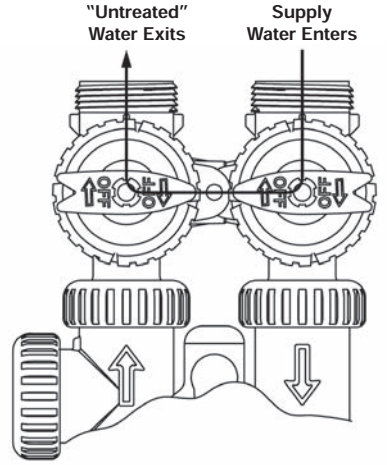
The bypass consists of two interchangeable plug valves that are operated independently by red arrow shaped handles. The handles identify the flow direction of the water. The plug valves enable the bypass valve to operate in four positions.

Figure 1
NORMAL OPERATION



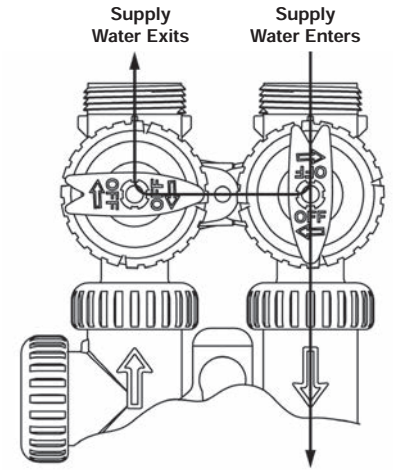
Normal Operation:
The inlet and outlet handles point in the direction of flow indicated by the engraved arrows on the control valve. Water flows through the control valve during normal operation and this position also allows the control valve to isolate the media bed during the regeneration cycle.

Figure 2
BYPASS OPERATION



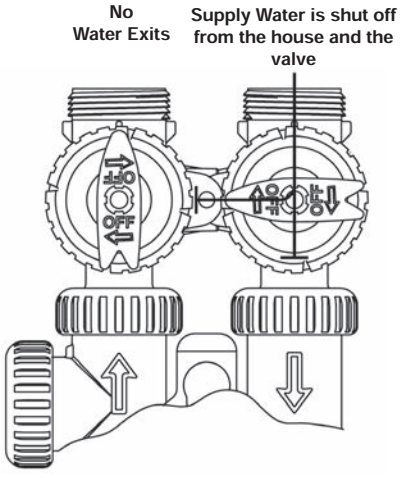
Bypass:
The inlet and outlet handles point to the center of the bypass, the control valve is isolated from the water pressure contained in the plumbing system. Untreated water is supplied to the plumbing system.

Figure 3
DIAGNOSTIC MODE



Diagnostic:
The inlet handle points in the direction of flow and the outlet handle points to the center of bypass valve, system water pressure is allowed to the control valve and the plumbing system while not allowing water to exit from the control valve to the plumbing.

Figure 4
SHUT OFF MODE

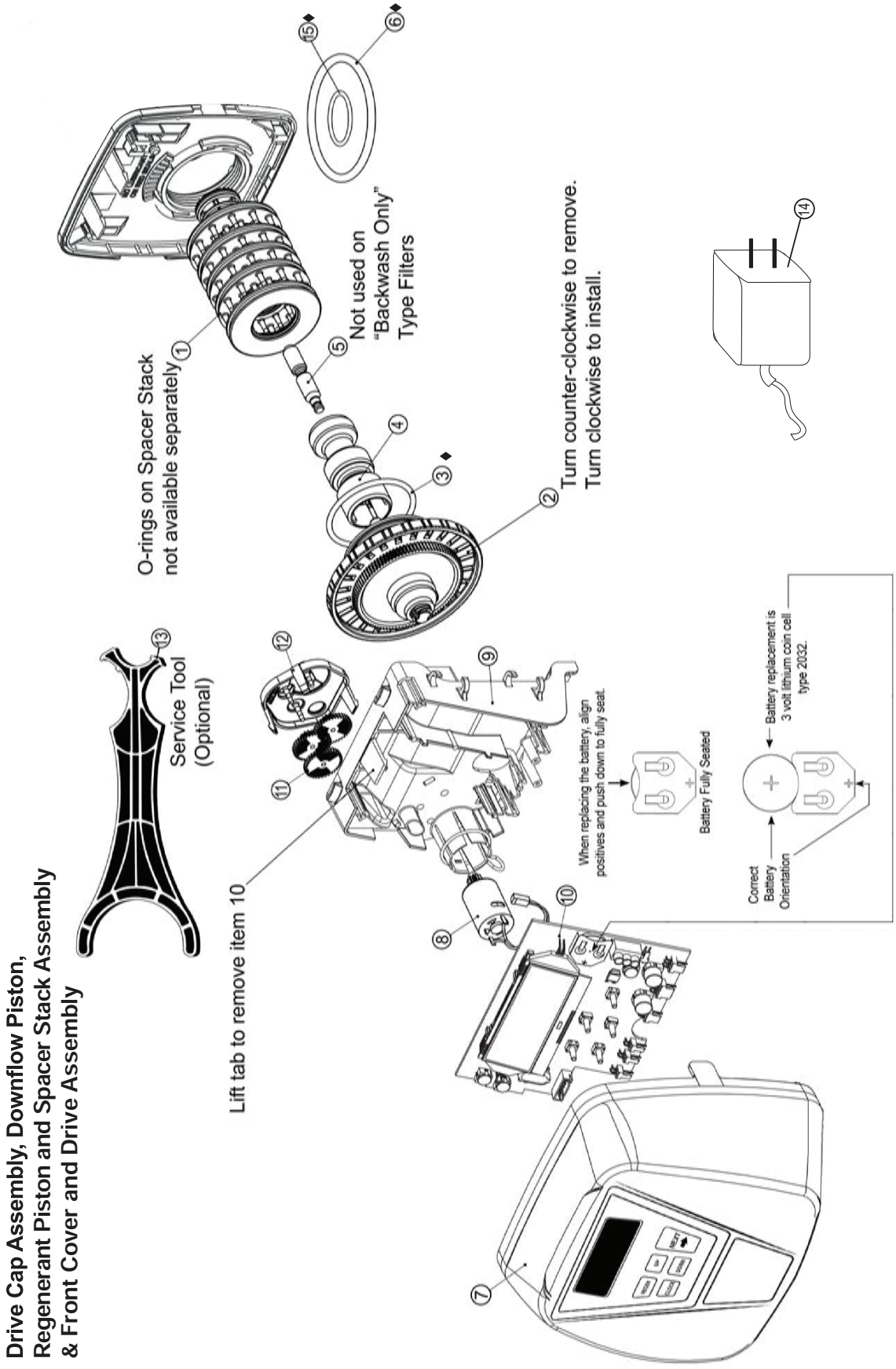


Shut Off:
The inlet handle points to the center of the bypass valve and the outlet handle points in the direction of flow, the water is shut off to the plumbing system. If water is available on the outlet side of the softener it is an indication of water bypass around the system (i.e. a plumbing connection somewhere in the building bypasses the system).

MATC PARTS LISTING

Part Number	No.	Description
B3950550	1	Complete control valve for MATC-15-1 Metered
B3950551	1	Complete control valve for MATC-30-1 Metered
B3950552	1	Complete control valve for MATC-45-1 Metered
B3950553	1	Complete control valve for MATC-60-1 Metered
B3950554	1	Complete control valve for MATC-90-1 Metered
B3950555	1	Complete control valve for MATC-120-1 Metered
B3950556	1	Complete control valve for MATC-150-1 Metered
A2042062	2	Brine Tank Complete for MATC-15, 30
B1300023	2	Brine Tank Complete for MATC-45
A2042064	2	Brine Tank Complete for MATC-60 & MATC-90
B1295015	2	Brine Tank Complete for MATC-120
B1295016	2	Brine Tank Complete for MATC-150
A2071005	3	Brine Well for MATC-15, 30
A2071003	3	Brine Well for MATC-45, 60 & 90
B1015008	3	Brine Well for MATC-120 & MATC-150
A2072003	4	Brine Well Cap for MATC-15, 30, 45 & 90
A2072001	4	Brine Well CAP for MATC-120
A2250003	5	Overflow Elblow 1/2" w/Nut - All
B1180001	6	Brine Valve Assembly MATC-15, 30
B1180004	6	Brine Valve Assembly MATC-45, 60 & 90
B1180014	6	Brine Valve Assembly MATC-120
B1180015	6	Brine Valve Assembly MATC-150
B1020003	7	Brine Line w/Inserts
A2126200	8	Mineral Tank Only MATC-15
A2126203	8	Mineral Tank Only MATC-30
A2126206	8	Mineral Tank Only MATC-45
A2126208	8	Mineral Tank Only MATC-60
A2126105	8	Mineral Tank Only MATC-90
A2126107	8	Mineral Tank Only MATC-120
A2126108	8	Mineral Tank Only MATC-150
A2121047	9	Resin - Please order the quantity indicated next to your unit
A2121047	9	MATC-30 - qty. 0.5 per tank
A2121047	9	MATC-30 - qty. 1 per tank
A2121047	9	MATC-45 - qty. 1.5 per tank
A2121047	9	MATC-60 - qty. 2 per tank
A2121047	9	MATC-90 - qty. 3 per tank
A2121047	9	MATC-120 - qty. 4 per tank
A2121047	9	MATC-150 - qty 5 per tank
A2123001	9	Gravel Subfill - Please order the qty indicated next to your unit - 15, 30, 45 & 60 do not use subfill
A2123001	9	MATC-90 - qty. 30# per tank
A2123001	9	MATC-120 - qty. 35# per tank
A2123001	9	MATC-150 - qty 80# per tank
B1023052	10	Distributor Tube Assembly for MATC-15
B1023054	10	Distributor Tube Assembly for MATC-30
B1023056	10	Distributor Tube Assembly for MATC-45
B1023055	10	Distributor Tube Assembly for MATC-60
B1023057	10	Distributor Tube Assembly for MATC-90
B1201002	10	Distributor Tube Assembly for MATC-120
B1201008	10	Distributor Tube Assembly for MATC-150

MATC CONTROL VALVE PARTS DIAGRAM (see parts listing on next page)



MATC CONTROL VALVE PARTS LISTING (see parts diagram on previous page)

Drive Cap Assembly, Downflow Piston, Upflow Piston, Regenerant Piston and Spacer Stack Assembly

Item No.	Part No.	Description	Quantity
1	A2466034	1” Spacer Stack Assembly w/o o-rings (V3005)	1
2	A2080077	Drive Cap Assembly (V3004)	1
♦3	See Item 51	O-Ring 228 (use Valve O-ring Kit)	1
▲4	A2309040	1” Piston Downflow Assembly (V3011)	1
⊗5	A2498033	Regenerant Piston (V3174)	1
♦6	Use Item 51	O-Ring 337 (use Valve O-ring Kit)	1
15	Use Item 51	O-Ring 215 (use Valve O-ring Kit) 1” Valve	1

▲Item #4 identified with “DN” code.

⊗Item #5 not used with Backwash Only filter applications.

♦ See page 28 For Valve O-Ring Kit

Front Cover and Drive Assembly

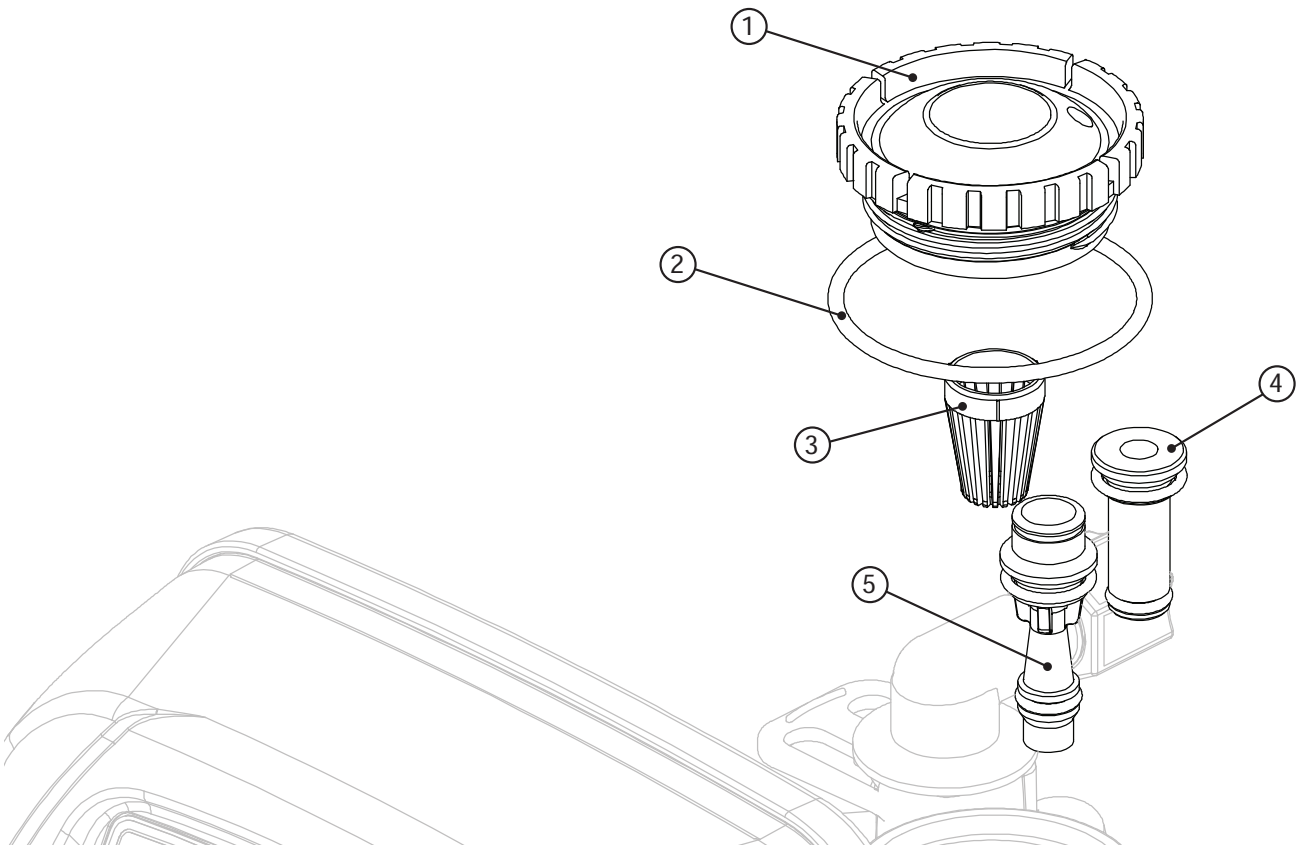
Item No.	Part No.	Description	Quantity
7	A2103160	Front Cover ASSY V3948-01	1
8	A2085050	Motor (V3107-01)	1
9	A2328046	Drive Bracket & Spring Clip (V3106-01)	1
10	A2341033	PC Board V3955MA-BOARD	1
11	A2393046	Drive Gear 12 x 36 (V3110)	3
12	A2103132	Drive Gear Cover (V3109)	1
13	A2491086	Service Tool (V3193-02)	1
14	A2242054	Transformer 110V - 12V (V3186)	1

Injector Cap, Injector Screen, Injector, Plug and O-Ring

Drawing No.	Marlo Part #	Order No.	Description	Quantity
1	A2080079	V3176	INJECTOR CAP	1
2	Use Item 51	V3152	O-RING 135	1
3	A2142016	V3177-01	INJECTOR SCREEN CAGE	1
4	A2079059	V3010-1Z	WS1 INJECTOR ASY Z PLUG	1
5	A2079060	V3010-1A	WS1 INJECTOR ASY A BLACK	1
	A2079048	V3010-1B	WS1 INJECTOR ASY B BROWN	
	A2079046	V3010-1C	WS1 INJECTOR ASY C VIOLET	
	A2079045	V3010-1D	WS1 INJECTOR ASY D RED	
	A2079049	V3010-1E	WS1 INJECTOR ASY E WHITE	
	A2079047	V3010-1F	WS1 INJECTOR ASY F BLUE	
	A2079050	V3010-1G	WS1 INJECTOR ASY G YELLOW	
	A2079055	V3010-1H	WS1 INJECTOR ASY H GREEN	
	A2079062	V3010-1I	WS1 INJECTOR ASY I ORANGE	
	A2079063	V3010-1J	WS1 INJECTOR ASY J LIGHT BLUE	
	A2079064	V3010-1K	WS1 INJECTOR ASY K LIGHT GREEN	
Not Shown	A2077225	V3170	O-RING 011	*
Not Shown	A2077226	V3171	O-RING 013	*

* The injector plug and the injector each contain one 011 (lower) and 013 (upper) o-ring.

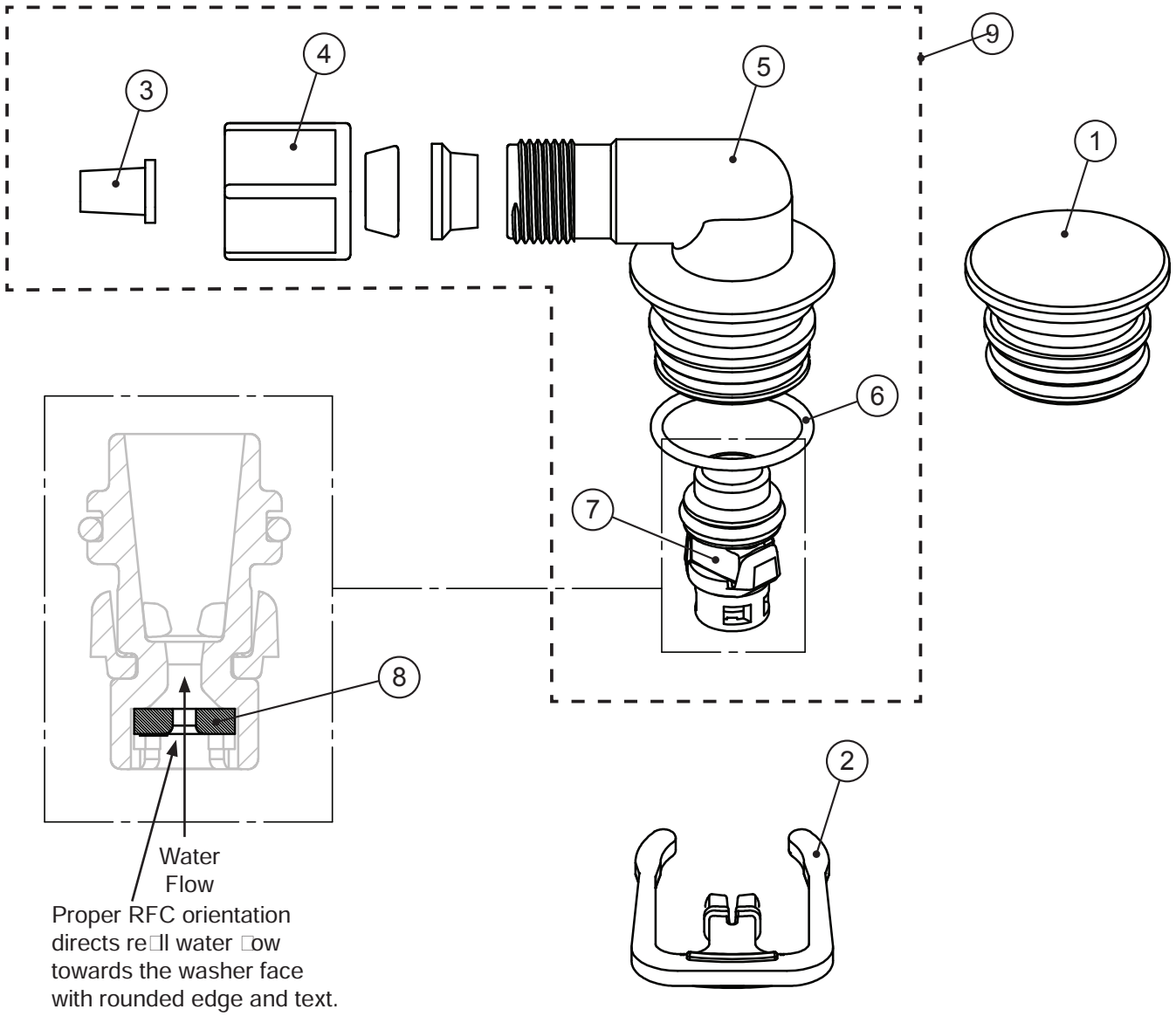
Note: For up□ow position, injector is located in the up hole and injector plug is in the other hole. Up□ow option is not applicable to EA, EE or EI control valves.
For a □lter that only backwashes, injector plugs are located in both holes.



Refi ll Flow Control Assembly and Refi ll Port Plug

Drawing No.	Marlo Part #	Order No.	Description	Quantity
1	A2287059	V3195-01	WS1 Refill Port Plug Asy	This part is required for backwash only systems
2	A2411015	H4615	Elbow Locking Clip	1
3	A2409016	JCP-P-6	Polytube insert 3/8”	1
4	A2095071	JCPG-6PBLK	Nut 3/8”	1
5	A2080078	H4613	Elbow Cap 3/8”	1
6	Use Item 51	V3163	O-ring 019	1
7	A2104033	V3165-01*	WS1 RFC Retainer Asy (0.5 gpm)	1
8	A2253108	V3182	WS1 RFC	1
9	A2078049	V3330-01	WS1 Brine Elbow Asy w/RFC 3/8"	1
Not Shown	NA	V3552	WS1 Brine Elbow Asy w/RFC 1/2"	Option
Not Shown	A2129100	H4650	Elbow ½” with nut and insert	Option

*Assembly includes V3182 WS1 (0.5 gpm) RFC.

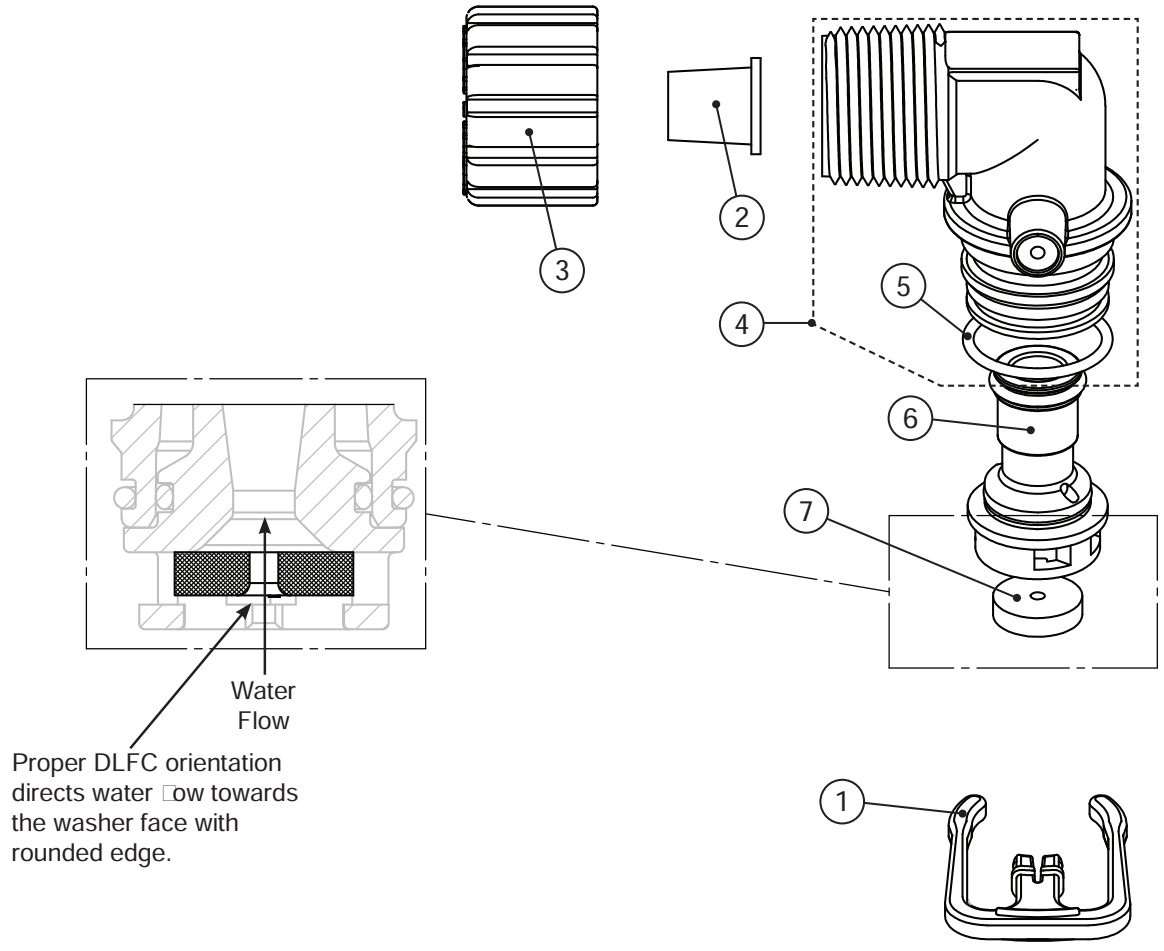


Drain Line – 3/4"

Drawing No.	Marlo Part #	Order No.	Description	Quantity
1	A2411015	H4615	Elbow Locking Clip	1
2	A2409013	PKP10TS8-BULK	Polytube insert 5/8	Option
3	A2095065	V3192	WS1 Nut ¾ Drain Elbow	Option
4*	A2099056	V3158-01	WS1 Drain Elbow ¾ Male	1
5	Use Item 51	V3163	O-ring 019	1
6*	A2104034	V3159-01	WS1 DLFC Retainer ASY	1
7	A2253114	V3162-007	WS1 DLFC 0.7 gpm for ¾	One DLFC must be used if ¾ fitting is used
	A2253099	V3162-010	WS1 DLFC 1.0 gpm for ¾	
	A2253084	V3162-013	WS1 DLFC 1.3 gpm for ¾	
	A2253083	V3162-017	WS1 DLFC 1.7 gpm for ¾	
	A2253081	V3162-022	WS1 DLFC 2.2 gpm for ¾	
	A2253082	V3162-027	WS1 DLFC 2.7 gpm for ¾	
	A2253085	V3162-032	WS1 DLFC 3.2 gpm for ¾	
	A2253086	V3162-042	WS1 DLFC 4.2 gpm for ¾	
	A2253087	V3162-053	WS1 DLFC 5.3 gpm for ¾	
	A2253111	V3162-065	WS1 DLFC 6.5 gpm for ¾	
	A2253112	V3162-075	WS1 DLFC 7.5 gpm for ¾	
	A2253105	V3162-090	WS1 DLFC 9.0 gpm for ¾	
	A2253133	V3162-100	WS1 DLFC 10.0 gpm for ¾	

*4 and 6 can be ordered as a complete assembly - V3331 WS1 Drain Elbow and Retainer Asy

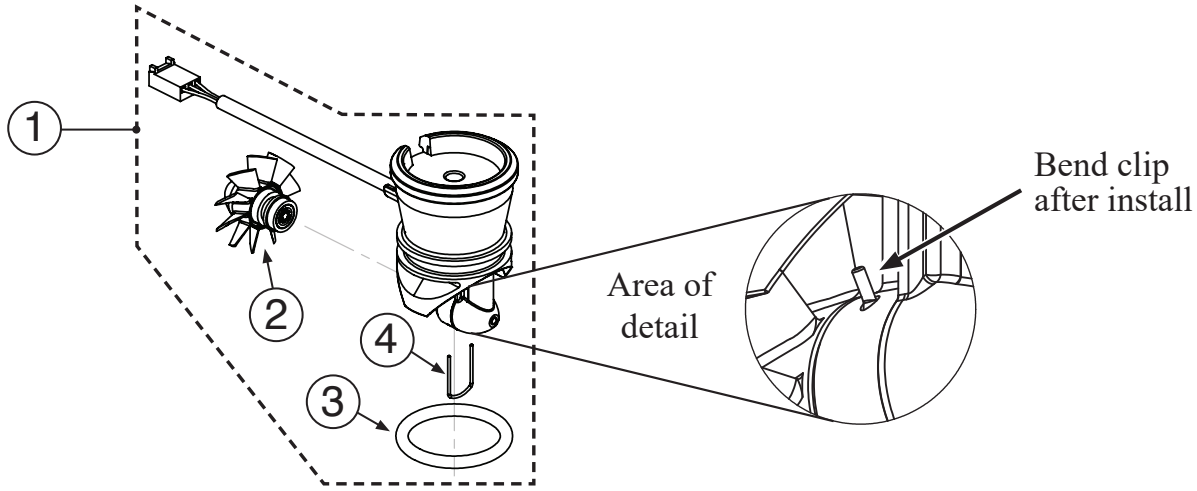
Valves are shipped without drain line flow control (DLFC) - install DLFC before using. Valves are shipped without ¾ nut for drain elbow (polytube installation only) and 5/8" polytube insert (polytube installation only).



Meter Assembly

Service or replace the turbine by:
1. Turn the bypass for the system on and relieve the pressure on the system before removing the meter.
2. Remove the nut and take the meter assembly out of the housing.
3. Remove the bend from the two exposed tips of the retaining clip V3501 and remove clip.
4. Service or replace the V3118-03 WS15/2 Turbine Assembly and place it back on the turbine shaft.
5. Insert the V3501 WS15/2 Turbine Clip and re-bend the exposed ends of the clip. The V3118-03 turbine has a groove to line up with the V3501 WS15/2 Turbine Clip.
6. Insert meter assembly back into the meter housing.
7. Re-install the nut.
8. Open the bypass for the system slowly to bring back into service and check to be sure you have no water leaks.

The V3118-03 has a groove to line up with the V3501 WS1.5/2 Turbine Clip.



Drawing No.	Marlo Part #	Order No.	Description	Quantity
1	A2360075	V3003-02	COMMERCIAL METER ASSEMBLY, 28” CABLE	1
2	A2100029	V3118-03	COMMERCIAL METER TURBINE ASSEMBLY	1
3	B1213022	V3105	O-RING, -215	1
4	NA	V3501	TURBINE CLIP	1
Not Shown	A2095069	V3151	WS1 NUT 1” Q C	1

THIS WATER METER SHOULD NOT BE USED AS THE PRIMARY MONITORING DEVICE FOR CRITICAL OR HEALTH EFFECT APPLICATIONS

BYPASS VALVE PARTS LISTING AND DIAGRAM

Item No.	Part No.	Description	Quantity
41	A2095069	Nut 1” Quick Connect	2
42	A2453012	Split Ring	2
●43	use item 52	O-Ring 215 (Kit available - see Item #10)	2
44	A2607004	Bypass 1” Rotor	2
45	A2080090	Bypass Cap	2
46	A2395009	Bypass Handle	2
47	A2104036	Bypass Rotor Seal Retainer	2
●48	use item 52	O-Ring 135 (use Bypass Valve Kit)	2
●49	use item 52	O-Ring 112 (use Bypass Valve Kit)	2
●50	use item 52	O-Ring 214 (use Bypass Valve Kit)	2

●Part of Kit, O-ring By-Pass(Item 52)

♦Valve O-ring Kit

51	B1213022	KIT O-ring (contains 1 each of 3, 6, 15, 17, 26, & 33)	1 per valve

●Bypass Valve O-ring Kit

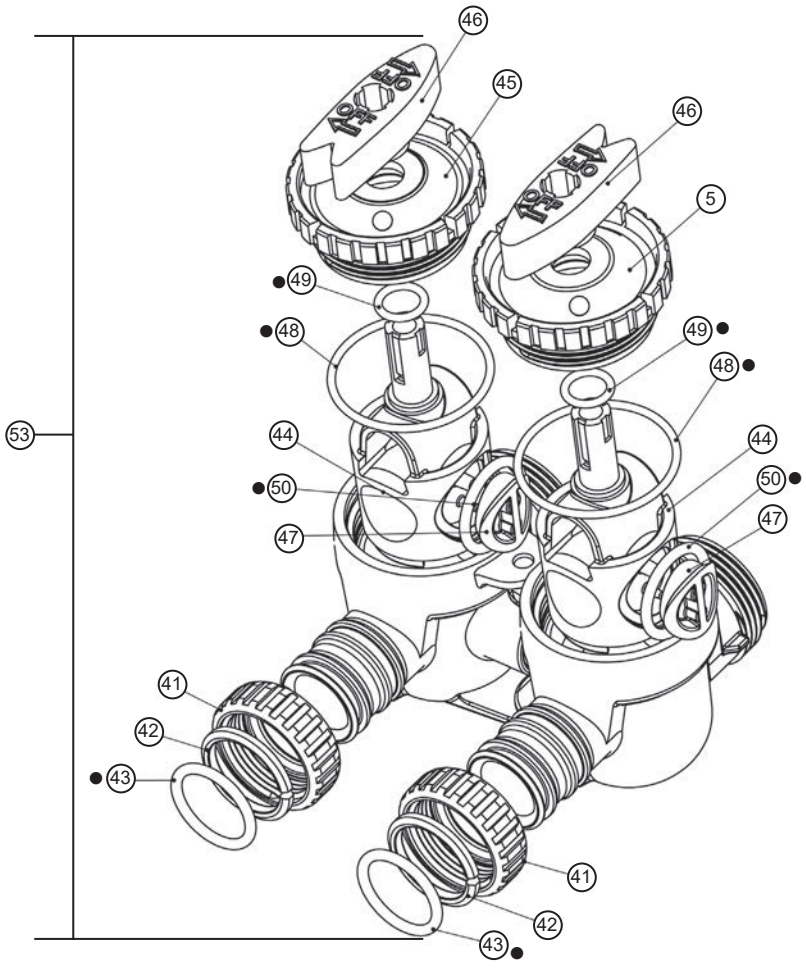
52	B1213021	KIT O-ring Bypass (Incl. 2 ea. of items 43,48,49,& 50)	1 per valve

(Not Shown) Order No. A2412076, Description Bypass Vertical Adapter Assembly

Complete Assembly

53	A2354023	Bypass Valve Complete / Less Connectors	1 per valve

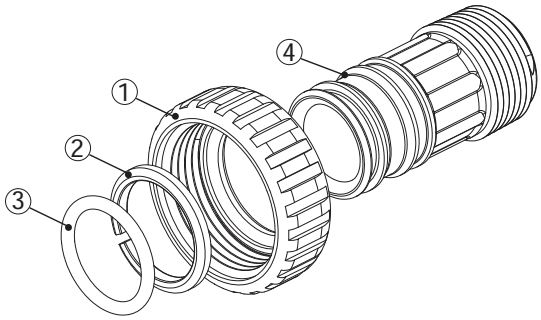
Bypass is optional on 1″ units.



FITTINGS PARTS LISTINGS AND DIAGRAMS

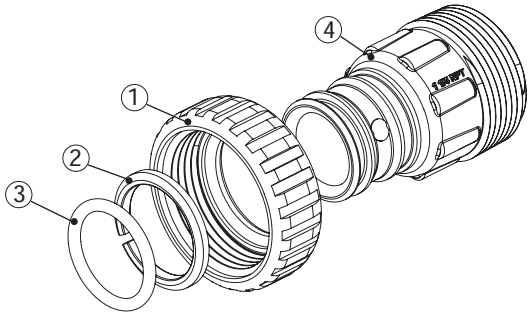
Order No: **A2435081 (std on 1″ units)**
Description: **Fitting 1″ Plastic Male NPT Assembly**

Drawing No.	Order No.	Description	Quantity
1	A2095069	Nut 1” Quick Connect	2
2	A2453012	Split Ring	2
3	A2077178	O-Ring 215	2
4		Fitting 1” Plastic Male NPT	2



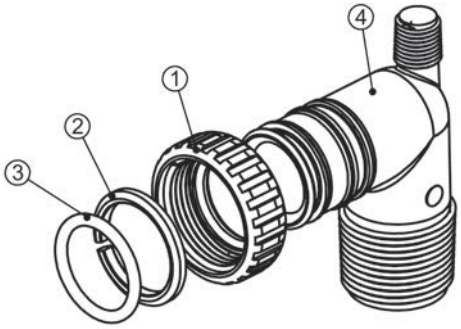
Order No: **A2435080 (std on 1-1/4″ units)**
Description: **Fitting 1-¼″ Plastic Male NPT Assembly**

Drawing No.	Order No.	Description	Quantity
1	A2095069	Nut 1” Quick Connect	2
2	A2453012	Split Ring	2
3	A2077178	O-Ring 215	2
4		Fitting 1-¼” Plastic Male NPT	2



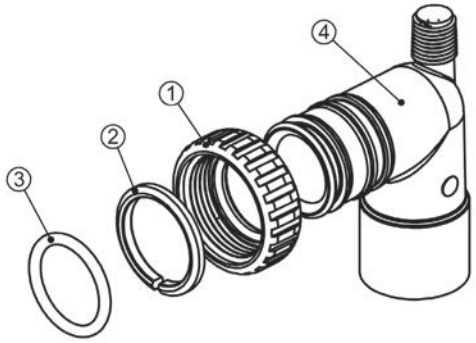
Order No: **A2129080 (Optional)**
Description: **Fitting 1″ PVC Male NPT Elbow Assembly**

Drawing No.	Order No.	Description	Quantity
1	A2095069	Nut 1” Quick Connect	2
2	A2453012	Split Ring	2
3	A2077178	O-Ring 215	2
4	A2129101	Fitting 1”PVCMaleNPT Elbow	2



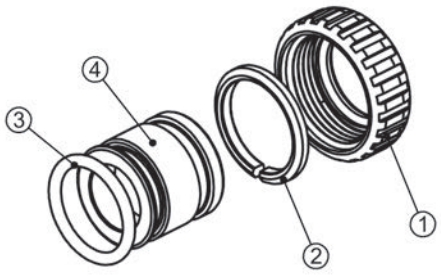
Order No: **A2099054 (Optional)**
Description: **Fitting 3/4″ & 1″ PVC Solvent 90º Asy**

Drawing No.	Order No.	Description	Quantity
1	A2095069	Nut 1” Quick Connect	2
2	A2453012	Split Ring	2
3	A2077178	O-Ring 215	2
4	A2569008	Fitting 3/4&1 PVC Solvent 90	2



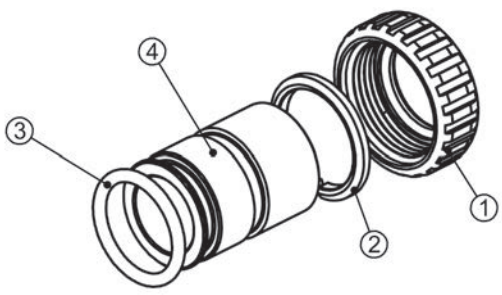
Order No: **A2435068 (Optional)**
Description: **Fitting 1″ Brass Sweat Assembly**

Drawing No.	Order No.	Description	Quantity
1	A2095069	Nut 1” Quick Connect	2
2	A2453012	Split Ring	2
3	A2077178	O-Ring 215	2
4	A2569006	Fitting 1” Brass Sweat	2



Order No: **A2435072 (Optional)**
Description: **Fitting 3/4″ Brass Sweat Assembly**

Drawing No.	Order No.	Description	Quantity
1	A2095069	Nut 1” Quick Connect	2
2	A2453012	Split Ring	2
3	A2077178	O-Ring 215	2
4	A2569007	Fitting 3/4” Brass Sweat	2



Troubleshooting

Problem	Possible Cause	Solution
1. No Display on PC Board	a. No power at electric outlet	a. Repair outlet or use working outlet
	b. Control valve Power Adapter not plugged into outlet or power cord end not connected to PC board connection	b. Plug Power Adapter into outlet or connect power cord end to PC Board connection
	c. Improper power supply	c. Verify proper voltage is being delivered to PC Board
	d. Defective Power Adapter	d. Replace Power Adapter
	e. Defective PC Board	e. Replace PC Board
2. PC Board does not display correct time of day	a. Power Adapter plugged into electric outlet controlled by light switch	a. Use uninterrupted outlet
	b. Tripped breaker switch and/or tripped GFI	b. Reset breaker switch and/ or GFI switch
	c. Power outage	c. Reset time of day. If PC Board has battery back up present the battery may be depleted. See Front Cover and Drive Assembly drawing for instructions.
	d. Defective PC Board	d. Replace PC Board
	a. Meter is not connected to meter connection on PC Board	a. Connect meter to three pin connection labeled METER on PC Board
	b. Restricted/ stalled meter turbine	c. Remove meter and check for rotation or foreign material
	c. Meter wire not installed securely into three pin connector	c. Verify meter cable wires are installed securely into three pin connector labeled METER
	d. Defective meter	d. Replace meter
	e. Defective PC Board	e. Replace PC Board
4. Control valve regenerates at wrong time of day	a. Power outage	a. Reset time of day. If PC Board has battery back up present the battery may be depleted. See Front Cover and Drive Assembly drawing for instructions.
	b. Time of day not set correctly	b. Reset to correct time of day
	c. Time of regeneration set incorrectly	c. Reset regeneration time
	d. Control valve set at “on 0” (immediate regeneration)	d. Check programming setting and reset to NORMAL (for a delayed regen time)
	e. Control valve set at “NORMAL + on 0” (delayed and/ or immediate)	e. Check programming setting and reset to NORMAL (for a delayed regen time)
5. Time of day flashes on and off	a. Power outage	a. Reset time of day. If PC Board has battery back up present the battery may be depleted. See Front Cover and Drive Assembly drawing for instructions.
6. Control valve does not regenerate automatically when the REGEN button is depressed and held.	a. Broken drive gear or drive cap assembly	a. Replace drive gear or drive cap assembly
	b. Broken Piston Rod	b. Replace piston rod
	c. Defective PC Board	c. Defective PC Board
7. Control valve does not regenerate automatically but **does** when the REGEN button is depressed and held.	a. Meter is not connected to meter connection on PC Board	a. Connect meter to three pin connection labeled METER on PC Board
	b. Restricted/ stalled meter turbine	b. Remove meter and check for rotation or foreign material
	c. Incorrect programming	c. Check for programming error
	d. Meter wire not installed securely into three pin connector	d. Verify meter cable wires are installed securely into three pin connector labeled METER
	e. Defective meter	e. Replace meter
	f. Defective PC Board	f. Replace PC Board

Problem	Possible Cause	Solution
8. Hard or untreated water is being delivered	a. Media is exhausted due to high water usage	a. Check program settings or diagnostics for abnormal water usage
	b. Meter not registering	b. Remove meter and check for rotation or foreign material
	c. Water quality fluctuation	c. Test water and adjust program values accordingly
	d. No regenerant or low level of regenerant in regenerant tank	d. Add proper regenerant to tank
	e. Control fails to draw in regenerant	e. Refer to Trouble Shooting Guide number 12
	f. Insufficient regenerant level in regenerant tank	f. Check refill setting in programming. Check refill flow control for restrictions or debris and clean or replace
	g. Damaged seal/stack assembly	g. Replace seal/stack assembly
	h. Control valve body type and piston type mix matched	h. Verify proper control valve body type and piston type match
	i. Fouled media bed	i. Replace media bed
9. Control valve uses too much regenerant	a. Improper refill setting	a. Check refill setting
	b. Improper program settings	b. Check program setting to make sure they are specific to the water quality and application needs
	c. Control valve regenerates frequently	c. Check for leaking fixtures that may be exhausting capacity or system is undersized
10. Residual regenerant being delivered to service	a. Low water pressure	a. Check incoming water pressure – water pressure must remain at minimum of 25 psi
	b. Incorrect injector size	b. Replace injector with correct size for the application
	c. Restricted drain line	c. Check drain line for restrictions or debris and clean
11. Excessive water in regenerant tank	a. Improper program settings	a. Check refill setting
	b. Plugged injector	b. Remove injector and clean or replace
	c. Drive cap assembly not tightened in properly	c. Re-tighten the drive cap assembly
	d. Damaged seal/ stack assembly	d. Replace seal/ stack
	e. Restricted or kinked drain line	e. Check drain line for restrictions or debris and or straighten drain line
	f. Plugged backwash flow controller	f. Remove backwash flow controller and clean or replace
	g. Missing refill flow controller	g. Replace refill flow controller
12. Control valve fails to draw in regenerant	a. Injector is plugged	a. Remove injector and clean or replace
	b. Faulty regenerant piston	b. Replace regenerant piston
	c. Regenerant line connection leak	c. Inspect regenerant line for air leak
	d. Drain line restriction or debris cause excess back pressure	d. Inspect drain line and clean to correct restriction
	e. Drain line too long or too high	e. Shorten length and or height
	f. Low water pressure	f. Check incoming water pressure – water pressure must remain at minimum of 25 psi
13. Water running to drain	a. Power outage during regeneration	a. Upon power being restored control will finish the remaining regeneration time. Reset time of day.
	b. Damaged seal/ stack assembly	b. Replace seal/ stack assembly
	c. Piston assembly failure	c. Replace piston assembly
	d. Drive cap assembly not tightened in properly	d. Re-tighten the drive cap assembly

Problem	Possible Cause	Solution
14. E1, Err – 1001, Err – 101 = Control unable to sense motor movement	a. Motor not inserted full to engage pinion, motor wires broken or disconnected	a. Disconnect power, make sure motor is fully engaged, check for broken wires, make sure two pin connector on motor is connected to the two pin connection on the PC Board labeled MOTOR. Press NEXT and REGEN buttons for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds and then reconnect.
	b. PC Board not properly snapped into drive bracket	b. Properly snap PC Board into drive bracket and then Press NEXT and REGEN buttons for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds and then reconnect.
	c. Missing reduction gears	c. Replace missing gears
15. E2, Err – 1002, Err – 102 = Control valve motor ran too short and was unable to find the next cycle position and stalled	a. Foreign material is lodged in control valve	a. Open up control valve and pull out piston assembly and seal/ stack assembly for inspection. Press NEXT and REGEN buttons for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds and then reconnect.
	b. Mechanical binding	b. Check piston and seal/ stack assembly, check reduction gears, check drive bracket and main drive gear interface. Press NEXT and REGEN buttons for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds and then reconnect.
	c. Main drive gear too tight	c. Loosen main drive gear. Press NEXT and REGEN buttons for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds and then reconnect.
	d. Improper voltage being delivered to PC Board	d. Verify that proper voltage is being supplied. Press NEXT and REGEN buttons for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds and then reconnect.
16. E3, Err – 1003, Err – 103 = Control valve motor ran too long and was unable to find the next cycle position	a. Motor failure during a regeneration	a. Check motor connections then Press NEXT and REGEN buttons for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds and then reconnect.
	b. Foreign matter built up on piston and stack assemblies creating friction and drag enough to time out motor	b. Replace piston and stack assemblies. Press NEXT and REGEN buttons for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds and then reconnect.
	c. Drive bracket not snapped in properly and out enough that reduction gears and drive gear do not interface	c. Snap drive bracket in properly then Press NEXT and REGEN buttons for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds and then reconnect.
17. Err – 1004, Err – 104 = Control valve motor ran too long and timed out trying to reach home position	a. Drive bracket not snapped in properly and out enough that reduction gears and drive gear do not interface	a. Snap drive bracket in properly then Press NEXT and REGEN buttons for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds and then reconnect

Problem	Possible Cause	Solution
18. Err -1006, Err – 106, Err - 116 = MAV/ SEPS/ NHBP/ AUX MAV valve motor ran too long and unable to find the proper park position Motorized Alternating Valve = MAV Separate Source = SEPS No Hard Water Bypass = NHBP Auxiliary MAV = AUX MAV	a. Control valve programmed for ALT A or b, nHbP, SEPS, or AUX MAV with out having a MAV or NHBP valve attached to operate that function	a. Press NEXT and REGEN buttons for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds and then reconnect. Then re-program valve to proper setting
	b. MAV/ NHBP motor wire not connected to PC Board	b. Connect MAV/ NHBP motor to PC Board two pin connection labeled DRIVE. Press NEXT and REGEN buttons for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds and then reconnect.
	c. MAV/ NHBP motor not fully engaged with reduction gears	c. Properly insert motor into casing, do not force into casing Press NEXT and REGEN buttons for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds and then reconnect.
	d. Foreign matter built up on piston and stack assemblies creating friction and drag enough to time out motor	d. Replace piston and stack assemblies. Press NEXT and REGEN buttons for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds and then reconnect.
19. Err – 1007, Err – 107, Err - 117 = MAV/ SEPS/ NHBP/ AUX MAV valve motor ran too short (stalled) while looking for proper park position Motorized Alternating Valve = MAV Separate Source = SEPS No Hard Water Bypass = NHBP Auxiliary MAV = AUX MAV	a. Foreign material is lodged in MAV/ NHBP valve	a. Open up MAV/ NHBP valve and check piston and seal/ stack assembly for foreign material. Press NEXT and REGEN buttons for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds and then reconnect.
	b. Mechanical binding	b. Check piston and seal/ stack assembly, check reduction gears, drive gear interface, and check MAV/ NHBP black drive pinion on motor for being jammed into motor body. Press NEXT and REGEN buttons for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds and then reconnect.

MARLO INCORPORATED ®

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

ACA 10G–18G

1” 2750 TIMECLOCK

COMMERCIAL WATER CONDITIONERS

COMPLETE FOR FUTURE REFERENCE:

MODEL NO:
SERIAL NO:
DATE INSTALLED:
DEALER:

Marlo Incorporated
2227 South Street
P.O. Box 044170
Racine, WI 53404-7003
Ph. (262) 681-1300
Fax (262) 681-1318
Info@Marlo-Inc.com
www.Marlo-Inc.com

Please Circle and/or Fill in the Appropriate Data for Future Reference:

Filter Model:	**ACA/AGA/MID/MGA**
System Size:	**Single/Twin/Triple/Quad**
Configuration:	**Timeclock/Pressure Differential/Metered**
BW/Regen Time:	**_____ AM/PM or OFF**

Additional Notes: _____

_____

_____

_____

IMPORTANT PLEASE READ:

- **Warranty of this product extends to manufacturing defects.**
- **The information, specifications and illustrations in this manual are based on the latest information available at the time of printing. The manufacturer reserves the right to make changes at any time without notice.**
- **This product should be installed by a plumbing professional on potable water systems only.**
- **This product must be installed in compliance with all local and state and municipal plumbing and electrical codes. Permits may be required at the time of installation.**
- **If operating pressure exceeds 100 psi a pressure reducing valve must be installed. If operating pressure drops below 30 psi a booster pump must be installed.**
- **Do not install the unit where temperatures may drop below 32°F or rise above 100°F.**
- **A prefilter should be used on installations in which free solids are present.**
- **A constant voltage of 120V/60Hz (unless otherwise specified) must be supplied to the controller to maintain proper function.**
- **Union or flange fittings are recommended at the control valve’s inlet, outlet, and drain connections**
- **If distance of drain line is over a 10 ft. vertical or 25 ft. horizontal run, increase drain line one pipe size over that provided on the control valve.**
- **Do not make a direct connection to the drain. Provide an air gap of at least four times the diameter of the pipe to conform to sanitation codes and to permit observation of the flow.**

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COMMERCIAL AND INDUSTRIAL PRODUCT WARRANTY

Marlo, Inc. warrants all commercial and industrial water treatment products manufactured and/or distributed by it to be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If within that period any products shall be proven to Marlo, Inc.’s satisfaction to be defective, those products will be replaced or the price refunded at Marlo Inc.’s option.

Marlo Inc.’s obligations or nonperformance, defective, or any damage caused by its products or their use, and buyer’s exclusive remedy therefore, shall be limited to product replacement or refund and shall be conditioned upon Marlo Inc.’s receiving written notice together with a demand for such replacement or refund:

The foregoing warranty is exclusive and in lieu of all other expressed implied warranty (except of title) including but not limited to implied warranty of merchantability and fitness for particular purpose.

Marlo Inc. will not be subject to and disclaims the following:

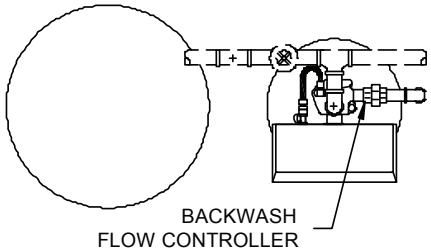
1. Any other obligations or liabilities arising out of breach of contract or out of warranty.
2. Any obligations whatsoever arising from tort claims (including negligence and strict liability) or arising under other theories of law with respect to products sold or services rendered by Marlo Inc. or any undertakings, acts, or omissions relating thereto.
3. All consequential, incidental, and contingent damages. Labor charges, change backs or handling charges are excluded from Marlo Inc.’s warranty provisions.

COMMERCIAL AND INDUSTRIAL WATER CONDITIONER GUARANTEE

Under normal operating conditions:

1. The loss of filter media through attrition during the first three (3) years shall not exceed 3% per year.
2. The filter media shall not be washed out of the system during backwash.
3. The color and turbidity of the softener effluent shall not be greater than the incoming water.

Any mechanical equipment proving defective in workmanship or material within one year after installation or eighteen (18) months after shipment, whichever comes first, shall be replaced FOB factory.

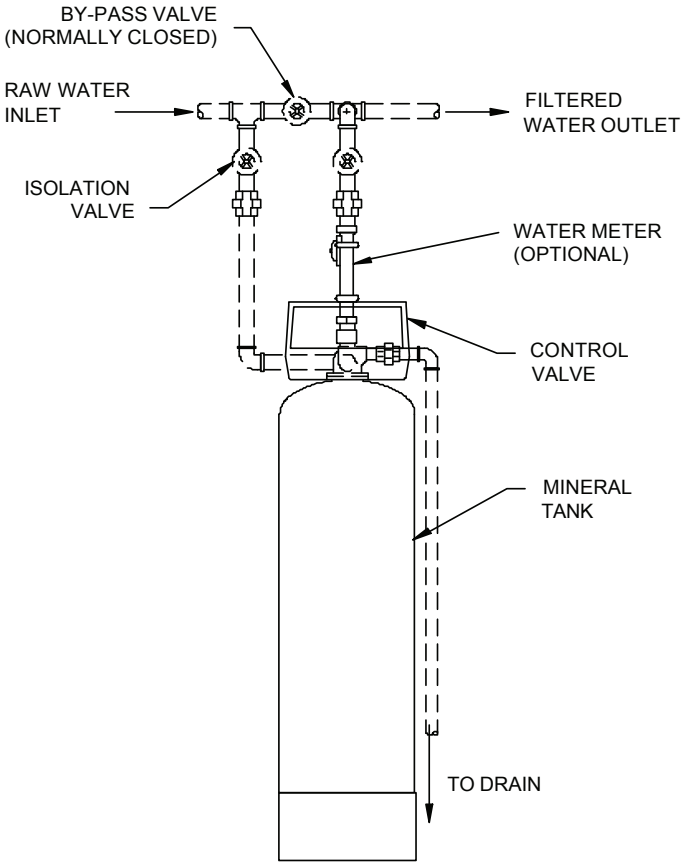


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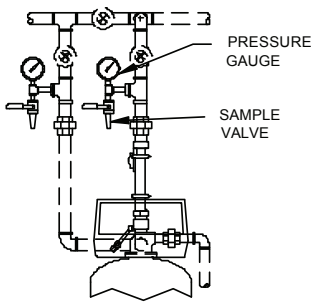
ALL PIPING, FITTINGS, ECT. SHOWN IN DOTTED LINES ARE SUPPLIED BY OTHERS.

GENERAL PLUMBING CONNECTIONS ARE SHOWN FOR CLARITY ONLY.

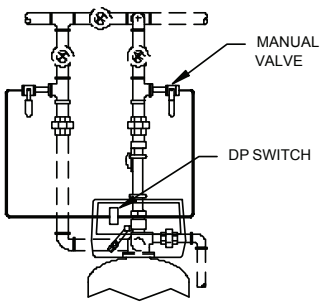
CONSULT I/O MANUAL FOR EXACT PLUMBING CONNECTIONS OF THE CONTROL VALVE.



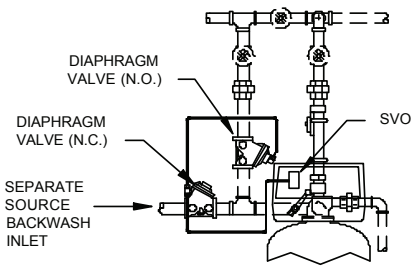
PRESSURE GAUGE &
SAMPLE VALVE OPTION



DIFFERENTIAL PRESSURE
SWITCH INITIATION OPTION



SEPARATE SOURCE
BACKWASH OPTION



MFG 1" (2750) SINGLE FILTER
GENERAL ARRANGEMENT DRAWING

FRAC.±	FILE ID.	MFG 2750 SINGLE	SHEET 1 OF 1	REV. 0
DEC. ±	SCALE	NTS		
DRN. BCD	DRAWING NO.			
APP'D.				
DATE 7-13-94				

CONTROL VALVE FILTER
STANDARD

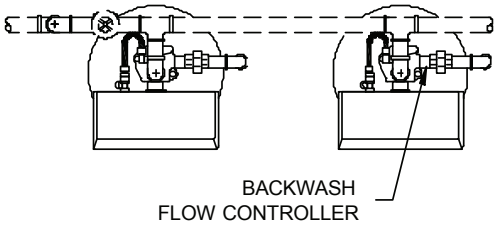
REVISIONS			
NO.	DATE	BY	REMARKS

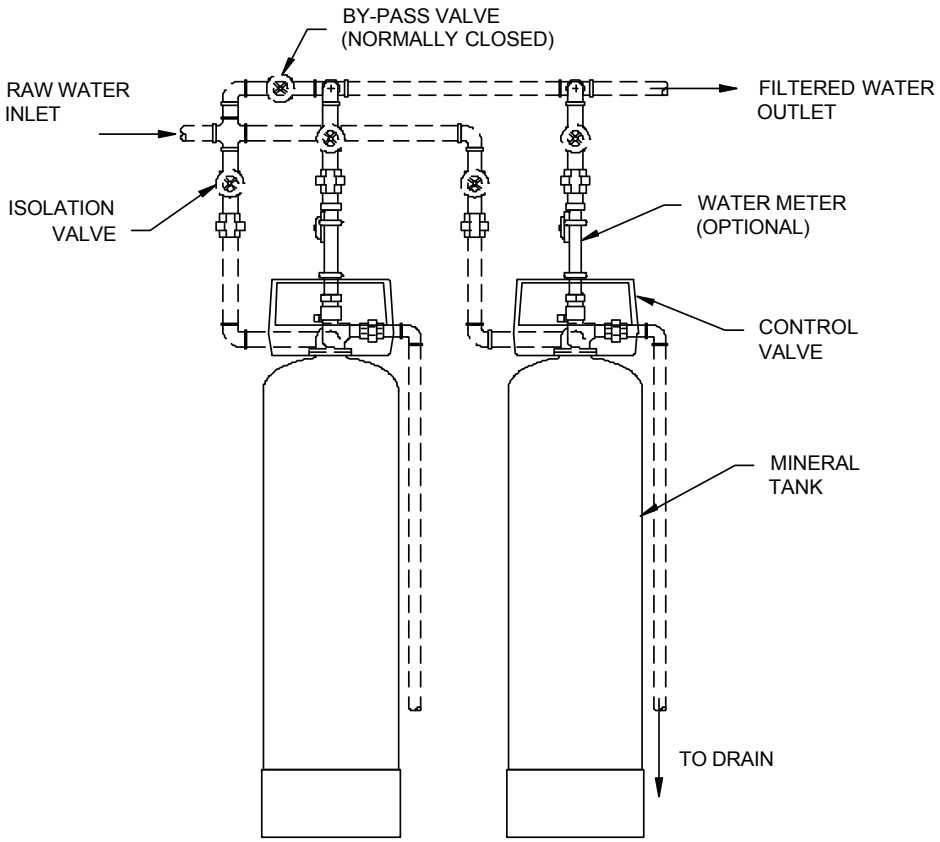
NOTES:

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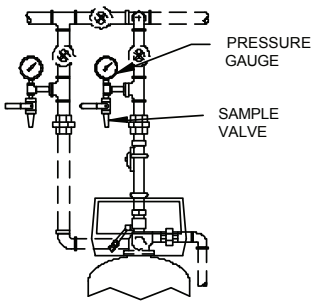
GENERAL PLUMBING CONNECTIONS ARE SHOWN FOR CLARITY ONLY.

CONSULT I/O MANUAL FOR EXACT PLUMBING CONNECTIONS OF THE CONTROL VALVE.

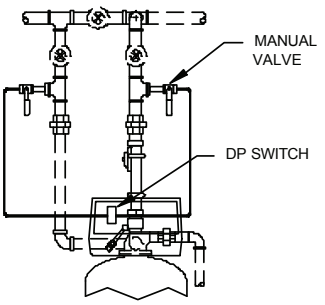




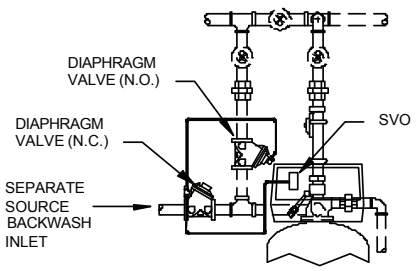
PRESSURE GAUGE & SAMPLE VALVE OPTION



DIFFERENTIAL PRESSURE SWITCH INITIATION OPTION



SEPARATE SOURCE BACKWASH OPTION



MFG 1" (2750) TWIN FILTER
GENERAL ARRANGEMENT DRAWING

FRAC. ±	DEC. ±	FILE ID.	MFG 2750 TWIN	SHEET 1 OF 1	REV. 0
DRN.	BCD	SCALE	NTS		
APP'D.		DRAWING NO.			
DATE	5-9-03				

CONTROL VALVE FILTER
STANDARD

REVISIONS

NO.	DATE	BY	REMARKS

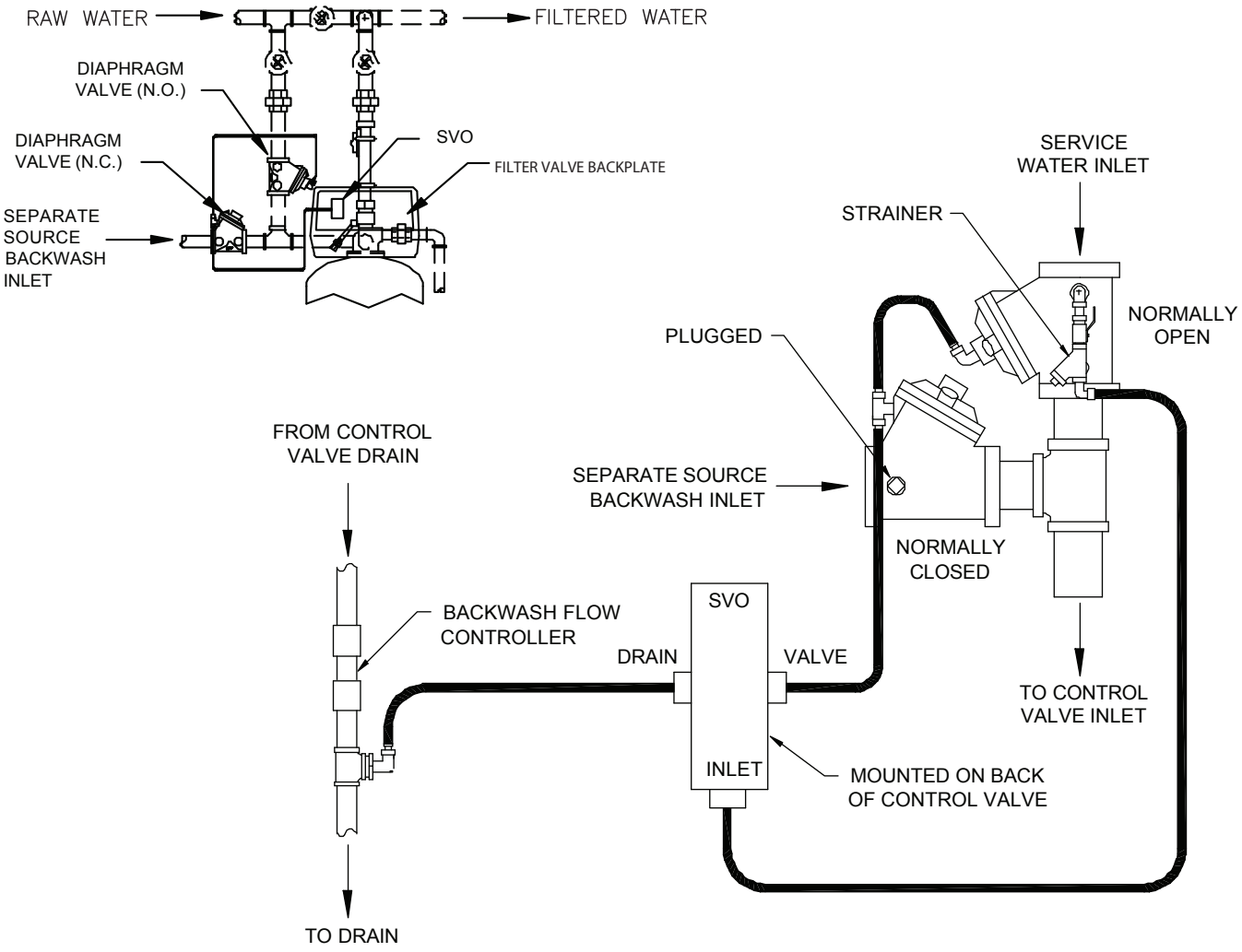
SPECIFICATION CHART

MODEL MID -			10G	12G	14G	16G	18G
SYSTEM SIZE	Service Connection (in)		1	1	1	1	1
	Drain Connection (in)		3/4	3/4	3/4	3/4	3/4
FLOWRATE (GPM)	Service - Normal (gpm)		2	4	5	7	9
	Service - DP (gpm)		2	3	3	4	4
	Service - Peak (gpm)		5	8	10	14	18
	Service - DP (gpm)		4	6	6	9	11
	Backwash & Fast Flush (gpm)		5	8	10	15	17
	Settle (gpm)		5	8	10	15	17
TIMER SETTINGS	Backwash	Pins	8	8	8	8	8
		Minutes	16	16	16	16	16
	Settle	Pins	3	3	3	3	3
		Minutes	6	6	6	6	6
	Fast Flush	Pins	3	3	3	3	3
		Minutes	6	6	6	6	6
	Settle	Pins	2	2	2	2	2
		Minutes	4	4	4	4	4
	Return to Service	Pins	2	2	2	2	2
		Minutes	4	4	4	4	4
TANK	Size - Dia. x Ht. (in)		10x54	12x52	14x65	16x65	18x65
	Gravel Subfill (lbs)		30	40	60	80	80
	Media		1	2	3	4	5

SEPARATE SOURCE BACKWASH (OPTIONAL)

This option allows the filter to use a separate water source for backwashing the system. The separate source uses diaphragm valves to control the flow of the backwash water. The diaphragm valves are controlled by a SVO (Service Valve Operator) that is mounted to the filter valve backplate.

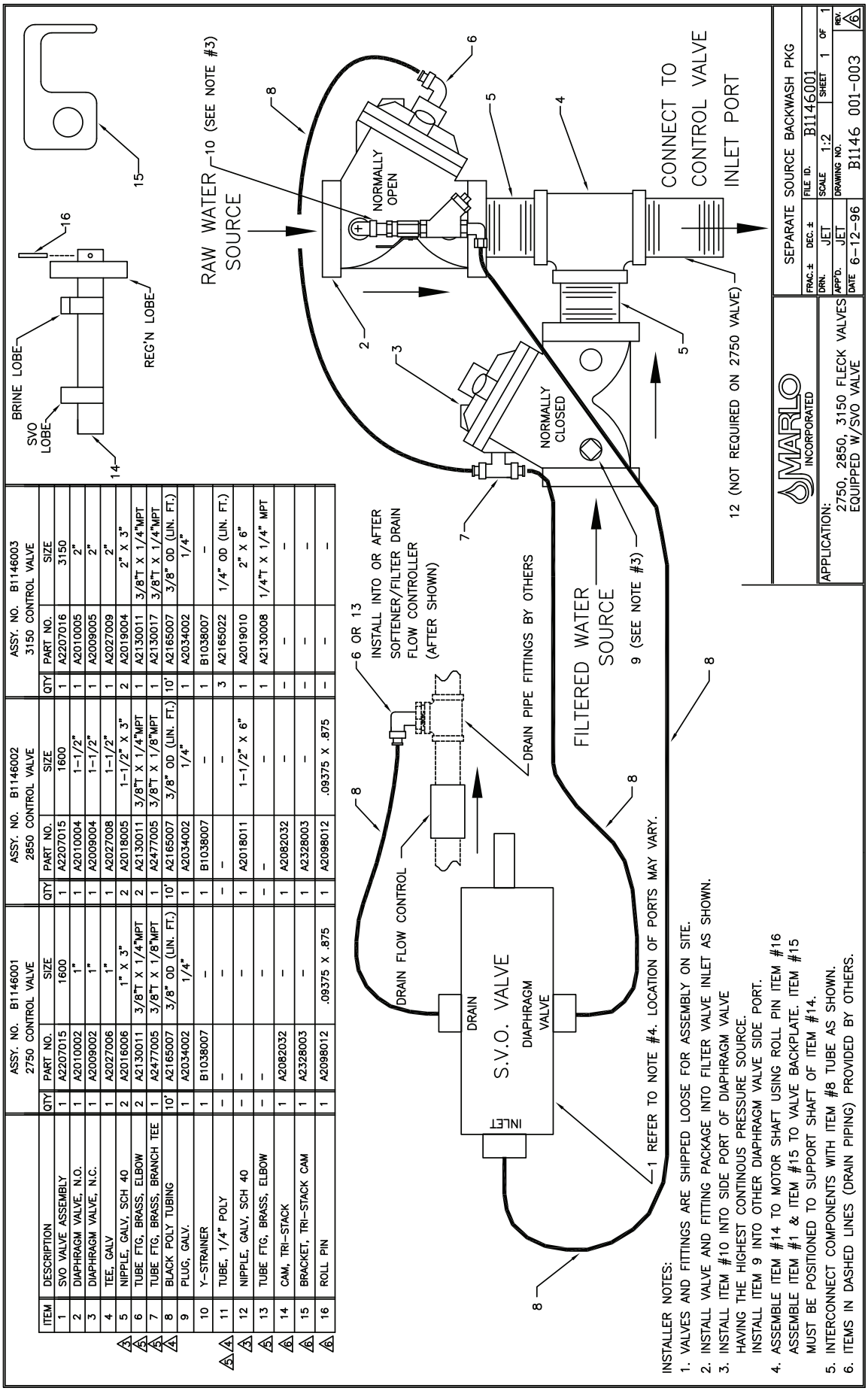
The piston in the SVO Valve is actuated by a cam on the filter valve motor shaft. Extending the piston will allow Raw Water flow. Depressing the piston will allow Separate Source water flow.



ACTUAL SVO PORT LOCATIONS MAY VARY.

DRAWING IS SHOWN FOR CLARITY ONLY.

INSTALL THE STRAINER ASSEMBLY INTO THE INLET BOSS OF THE VALVE WITH THE HIGHEST PRESSURE. PLUG THE OTHER VALVE'S INLET BOSS.



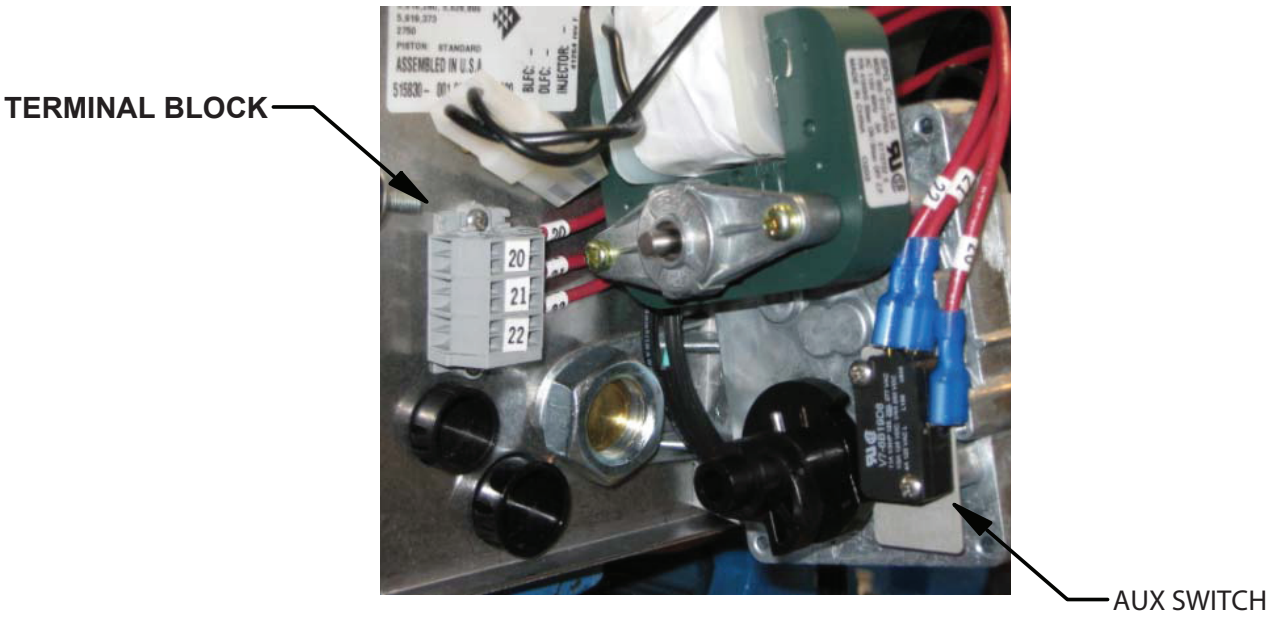
ITEM	DESCRIPTION	ASSY. NO. B1146001 2750 CONTROL VALVE QTY	PART NO.	SIZE	ASSY. NO. B1146002 2850 CONTROL VALVE QTY	PART NO.	SIZE	ASSY. NO. B1146003 3150 CONTROL VALVE QTY	PART NO.	SIZE
1	SVO VALVE ASSEMBLY	1	A2207015	1600	1	A2207015	1600	1	A2207016	3150
2	DIAPHRAGM VALVE, N.O.	1	A2010002	1"	1	A2010004	1-1/2"	1	A2010005	2"
3	DIAPHRAGM VALVE, N.C.	1	A2009002	1"	1	A2009004	1-1/2"	1	A2009005	2"
4	TEE, GALV	1	A2027006	1"	1	A2027008	1-1/2"	1	A2027009	2"
5	NIPPLE, GALV, SCH 40	2	A2016006	1" X 3"	2	A2018005	1-1/2" X 3"	2	A2019004	2" X 3"
6	TUBE FTG, BRASS, ELBOW	2	A2130011	3/8"T X 1/4"MPT	2	A2130011	3/8"T X 1/4"MPT	1	A2130011	3/8"T X 1/4"MPT
7	TUBE FTG, BRASS, BRANCH TEE	1	A2477005	3/8"T X 1/8"MPT	1	A2477005	3/8"T X 1/8"MPT	1	A2130017	3/8"T X 1/4"MPT
8	BLACK POLY TUBING	10'	A2165007	3/8" OD (LIN. FT.)	10'	A2165007	3/8" OD (LIN. FT.)	10'	A2165007	3/8" OD (LIN. FT.)
9	PLUG, GALV.	1	A2034002	1/4"	1	A2034002	1/4"	1	A2034002	1/4"
10	Y-STRAINER	1	B1038007	–	1	B1038007	–	1	B1038007	–
11	TUBE, 1/4" POLY	–	–	–	–	–	–	3	A2165022	1/4" OD (LIN. FT.)
12	NIPPLE, GALV, SCH 40	–	–	–	1	A2018011	1-1/2" X 6"	1	A2019010	2" X 6"
13	TUBE FTG, BRASS, ELBOW	–	–	–	–	–	–	1	A2130008	1/4"T X 1/4" MPT
14	CAM, TRI-STACK	1	A2082032	–	1	A2082032	–	–	–	–
15	BRACKET, TRI-STACK CAM	1	A2328003	–	1	A2328003	–	–	–	–
16	ROLL PIN	1	A2098012	.09375 X .875	1	A2098012	.09375 X .875	–	–	–

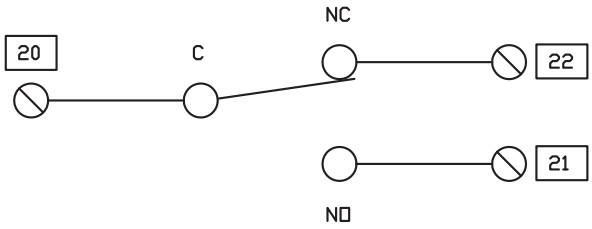
INSTALLER NOTES:
1. VALVES AND FITTINGS ARE SHIPPED LOOSE FOR ASSEMBLY ON SITE.
2. INSTALL VALVE AND FITTING PACKAGE INTO FILTER VALVE INLET AS SHOWN.
3. INSTALL ITEM #10 INTO SIDE PORT OF DIAPHRAGM VALVE HAVING THE HIGHEST CONTINOUS PRESSURE SOURCE. INSTALL ITEM 9 INTO OTHER DIAPHRAGM VALVE SIDE PORT.
4. ASSEMBLE ITEM #14 TO MOTOR SHAFT USING ROLL PIN ITEM #16 ASSEMBLE ITEM #1 & ITEM #15 TO VALVE BACKPLATE. ITEM #15 MUST BE POSITIONED TO SUPPORT SHAFT OF ITEM #14.
5. INTERCONNECT COMPONENTS WITH ITEM #8 TUBE AS SHOWN.
6. ITEMS IN DASHED LINES (DRAIN PIPING) PROVIDED BY OTHERS.

AUX SWITCH (OPTIONAL)

The Aux Switch Option provides an extra switch on the brine valve cam assembly that ties to the terminal strip located on the back-plate of the valve. The switch provides a dry contact circuit that changes status dependent on filter valve’s step. It is most commonly used to lockout an RO activate a pump, or activate separate source inlet valves.

The switch is normally closed during service and normally open during regeneration.





STEP	DRY CONTACT STATUS	
	OPEN	CLOSED
SERVICE	20-21	20-22
BACKWASH/ / REGENERATION	20-22	20-21

Contact Rating: 220 VAC Max. / 2.0 AMP Max.

CONSTRUCTION NOTES:

1. INSTALL MICROSWITCH ASSEMBLY NEXT TO BRINE VALVE CAM ASSEMBLY ON VALVE.
2. INSTALL THE 3 TERMINALS AND LABEL THE TERMINALS NUMBERS 20, 21, 22.
3. WIRE THE MICROSWITCH USING 16 AWG RED WIRE.
4. WIRE AS FOLLOWS:
   COMMON TO 20
   NORMALLY OPEN TO 21
   NORMALLY CLOSED TO 22

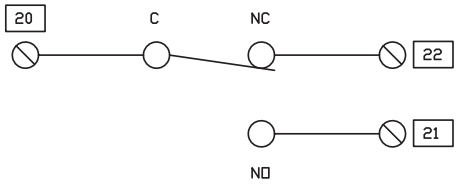
LOCKOUT SWITCH NOTES:

2900 AND 3900 VALVE ALREADY USES THIS SWITCH FOR ITS OPEERATION.
3150 VALVE SYSTEM 4 THIS SWITCH IS ALREADY INSTALLED ON THE VALVE
AND IS AVAILABLE FOR RD LOCKOUT USE.

PN	QTY	DESCRIPTION
MICROSWITCH ASSEMBLY		
A2154001	1	MICROSWITCH VALVE / STAGER RD LOCKOUT
A2083027	2	SCREW 4-40 X 1/2 SELF TAP PHIL MACH
A2490014	1	CAM SHUTOFF VALVE (12777)
A2098012	1	ROLL PIN .09375 X .875 (10338)
A2158001	1	INSULATOR LIMIT SWITCH (10302)
TERMINAL STRIP ASSEMBLY		
A2445043	1	END STOP W / FIXING FLANGE
A2307015	3	TERMINAL BLOCK GRAY 15A 300V
A2457003	2	SCREW 6-32 X 3/8 MACH RD HD SS
A2095048	2	6-32 NUTS SS
A2486021	2	WASHER LOCK #6 SPLIT SS
A2173009	3 FT	WIRE 16 RED

WIRINIG DIAGRAM OF AUXILLIARY SWITCH (5 AMP MAXIMUM)

SWITCH ON NORMALLY CLOSED SIDE DURING SERVICE. NORMALLY OPEN DURING REGENERATION.



REVISIONS			
NO.	DATE	BY	REMARKS

MARLO INCORPORATED

BRINE VALVE CAM SWITCH ADDITION TO TOP MOUNT MULTIPORT VALVE

FRAC.± DEC.±		FILE ID. B1055006	
DRN. JEC	SCALE NTS	SHEET 1 OF 1	
APP'D.	DRAWING NO. B1055006		REV. 0
DATE 2-3-04			

INSTALLATION INSTRUCTIONS

GENERAL INFORMATION

1. Minimum operating pressure is 25 psi. If pressures less then 25 psi are encountered, a pump must be installed.
2. Maximum operating pressure is 120 psi. If pressures greater then 120 psi are encountered, a pressure regulator must be installed.
3. Power requirements are shown on inside cover of the control valve.
4. Standard units are designed to condition unheated water not to exceed 100° F. Special valve assemblies are available to handle heated water supplies exceeding 100°F. Consult factory if applicable.
5. Each mineral tank is shipped with distributor manifold and control valve preassembled. Take care when uncrating and erecting so that no items are damaged.
6. The distributor assembly has been shipped inside the fiberglass mineral tank. Check to make sure that there is no damage to the riser pipe, basket, laterals, or hub.

LOCATE MINERAL TANKS

1. Select a location that is accessible and near a floor drain that has adequate carrying capacity to handle the water conditioner backwash flow. See specification table for the backwash flow rate.
2. Erect the mineral tanks on a concrete or other firm foundation and level.
3. A grounded electric receptacle is required for the control valves.

LOAD FILTER TANKS

1. On sizes 10 and 12 the media has been pre-loaded at the factory. Skip this section and go to “Mount Control Valve Assembly”.
2. Fill tank(s) approximately 1/3 full of water using a hose, bucket, etc. Plug the PVC distributor manifold pipe using a plastic cap, cork, rag, etc. No gravel or resin should go into this distributor manifold pipe.
3. Verify the distributor manifold is center in the tank with the distributor resting on the bottom of the tank. Verify the riser pipe is still plugged.

   Note: Reference the specification table in the front of this manual for the correct quantities of gravel and media. Note that these quantities are for each tank. Make sure you have the required amounts on site before you begin.
4. With care not to damage any lateral, pour in the gravel provided for each tank through the top opening in the tank and level out evenly. This will cover the distributor assembly.

   Note: Wetting the gravel in the bags before loading will eliminate the normal amount of dust.
5. When gravel is loaded and leveling is completed, proceed as follows:
6. Refer to the specification table for the correct amounts and the order of media. Load the bottom layer first and work your way up to the top layer. With the distributor riser pipe still plugged, add the proper amount of media supplied for each tank through the top opening in the tank and then level the media layer.
7. Repeat step 6 for each type of media.
8. When loading is complete, remove plastic cap, cork, or rag that was used to plug the distributor riser pipe. Be careful not to let any foreign debris fall into the pipe. The result could be damage to system.
9. Repeat instruction steps 1-8 for each media tank.

MOUNT CONTROL VALVE ASSEMBLY

1. Verify that the distributor riser pipe is not plugged.
2. Lubricate the distributor O-ring on the bottom of the control valve with silicone.
3. Insert disperser in threaded base of control valve. The threaded base has a groove machined into the inside of the threaded part of the base to allow for the installation of this disperser.
4. Screw control valve into top opening of tank making sure the distributor riser pipe slides easily through the distributor O-ring. Care must be taken not to “nick” this O-ring as hard water leakage could result.
5. Tighten down the control valve to ensure positive O-ring seal at top of tank.
6. Repeat instruction steps 1-5 for each filter tank.

INSTALLATION OF CONNECTION PIPING

Note:

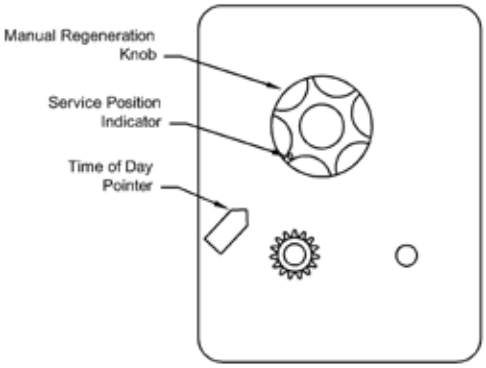
- Use thread sealing tape on all threaded piping connections.
- Install the piping conforming to federal, provincial, and local codes.
- Union or flanges are recommended at the control valve’s inlet, outlet, and drain connections
- To enhance the monitoring of the system’s performance sample valves and pressure gauges can be installed at the inlet and outlet piping to each control valve.
- If distance of drain line is over a 10 ft. vertical or 25 ft. horizontal run, increase drain line one pipe size over that provided on the control valve.
- Do not make a direct connection to the drain. Provide an air gap of at least four times the diameter of the pipe to conform to sanitation codes and to permit observation of the flow.

Caution: All piping must be properly supported. The tank and valve assemblies are not meant to support the connecting piping.

1. Install piping as shown on installation diagram. It is recommended that unions be installed on inlet and outlet connections to facilitate service of unit. Be sure piping is free of thread chips and other foreign matter. The connecting piping should be the same size or larger then the service inlet and outlet of the control valve. On multiple units that are both in service at the same time the common service inlet and outlet headers should be up-sized to accommodate the total flow.
2. Verify that the flow arrow stamped on the brass flow controller is pointing away from the control valve. See installation diagram or valve manual for the location. Install a drain line from backwash control assembly to an appropriate drain using a minimum of elbows. Install a union near the backwash control to facilitate cleaning. Do not install a valve on the drain line.

START-UP

Note: The Activated Carbon needs be allowed to soak for 1 to 2 hours before it can be backwashed. Dry Activated Carbon tends to float in water and will washout to drain.

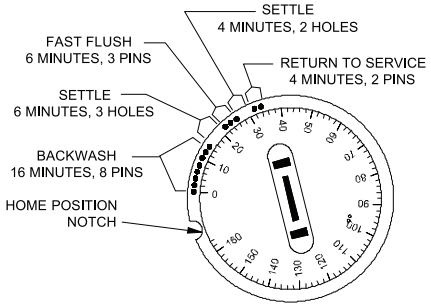


1. Make sure all plumbing is complete and tight including drain line(s). Make all electrical connections per wiring diagrams provided.
2. Make sure inlet and outlet isolation valves are closed, and then turn on power to the system.
3. Remove the black plastic cover from the control valve. The regeneration cycle timer is secured to the backplate of the control valve. The timer is hinged on the right side. Grab the upper left corner of the timer and pull towards you. The timer will swing out to the right. The backside of the timer has a program wheel with holes and pins in it. Each hole or pin represents two (2) minutes.

The holes and pins control the regeneration cycle times as follows:

Step 1 - (Backwash)	First group of pins
Step 2 - (Settle)	First group of holes
Step 3 - (Fast Rinse)	Second group of pins
Step 4 - (Settle)	Second group of holes
Step 5 - (Return to Service)	Third group of pins

PROGRAM WHEEL



4. Locate the manual regeneration knob on the front side of the timer. Slightly turn the knob clockwise. The control valve will advance to backwash position. Be patient this will take several minutes.
5. Remove electrical power from unit, and then slowly open inlet water valve approximately half open. Water will begin to fill through bottom distributor into tank. When tank is full, water will begin to flow out of drain line. Slowly pen the inlet valve until full open. Allow water to flow from drain line for approximately 15 minutes.

   Note: Carbon filters will normally have considerable black fines on the initial backwash and may take 10–15 minutes to run clear. Monitor this drain water flow carefully. There is a problem if you see media in the drain water. Turn off inlet water immediately and then consult factory.
6. Restore electrical power to unit. Advance the control valve to settle position, using the same method as step 5. There should also be to flow at the drain line.
7. Advance the control valve to the fast rinse position. Remove electrical power to the unit. Let water run to drain position for approximately 5 minutes or until water runs clear.
8. Advance control valve to service position.
9. Proceed to start up the next tank (if applicable), by repeating steps 1-8.

SETTING THE TIME / DAY CLOCK

How to set the time of day:

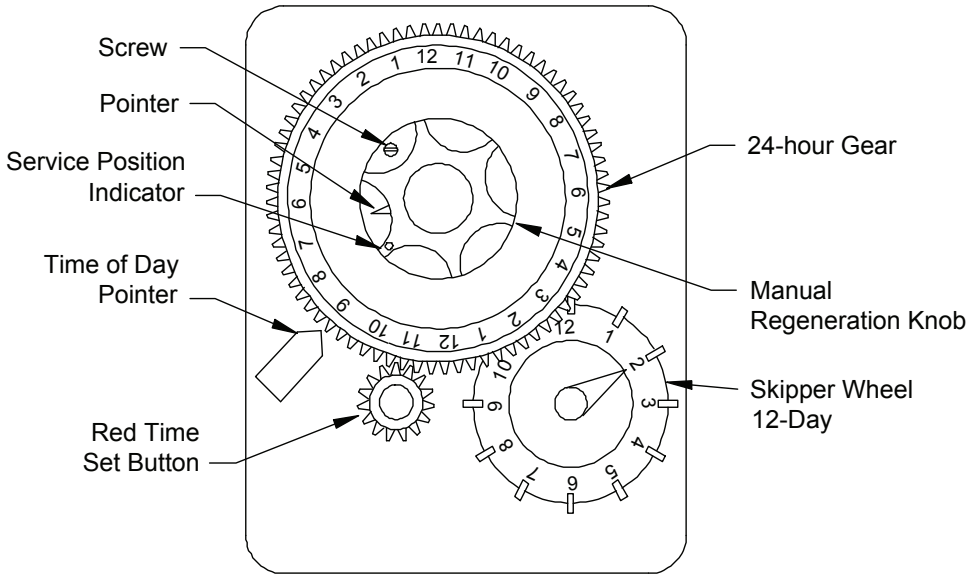
1. Press and hold the red button in to disengage the drive gear.
2. Turn the large gear until the actual time is at the time of day pointer.
3. Release the red button to again engage the drive gear.

How to set days on which the filter is to regenerate:

1. Rotate the skipper wheel until the number “1” is at the red pointer.
2. Set the day that regeneration is to occur by sliding tabs on the skipper wheel outward to expose trip fingers. Each tab is one day. Finger at red pointer is tonight.
3. Moving clockwise from the red pointer, extend or retract fingers to obtain the desired regeneration schedule.

How to manually regenerate your Water Conditioner at any time:

Turn the manual regeneration knob clockwise. This slight movement of the manual regeneration knob engages the program wheel and starts the regeneration program. The manual regeneration knob will make one revolution in approximately three hours and stop in the position shown in the drawing. Even though it takes three hours for this center knob to complete one revolution, the regeneration cycle of your unit might be set only half of this time. In any event, conditioned water may be drawn after rinse water stops flowing from the water conditioner drain line.



How to adjust the time of day regeneration occurs:

1. Disconnect the power source.
2. Locate the three screws behind the manual regeneration knob by pushing the red button in and rotating the 24-hour dial until each screw appears in the cut out portion of the manual regeneration knob.
3. Loosen each screw slightly to release the pressure on the time plate from the 24-hour gear.
4. Locate the regeneration time pointer on the inside of the 24-hour dial in the cutout. The pointer is hard to see.
5. Turn the time plate so the pointer on the desired regeneration time aligns next to the raised arrow.
6. Push the red button in and rotate the 24-hour dial. Tighten each to the three screws.
7. Push the red button and locate the pointer one more time to ensure the desired regeneration time is correct.
8. Reset the time of day and restore power to the unit.

Note: On twin or triple unit filters with time clock controls, each unit should be set to regenerate on different days or different times to avoid simultaneous regenerations.

Note: The screw and pointer are shown for reference only. There is only one cutout in the knob

SETTING THE TIME CLOCK AND GALLONAGE (For filters with the water meter option)

Set the gallons required by lifting the gallon dial and rotating it so that the number of gallons required is aligned with the white dot on the program wheel gear. Release the gallon dial and check for firm engagement with the gear.

Note: To set meter capacity at the initial start-up, either:

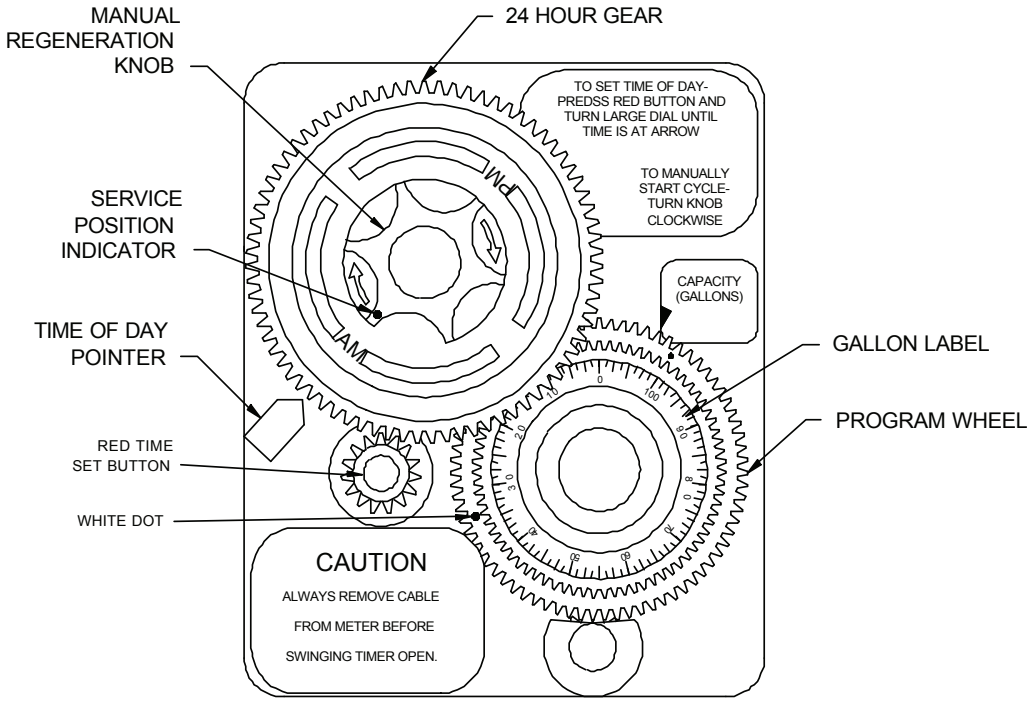
- Rotate the manual regeneration knob one full revolution.
- Rotate the program wheel manually clockwise and align the white dot with the capacity arrow.

How to set the time of day:

1. Press and hold the red button in to disengage the drive gear.
2. Turn the large gear until the actual time is at the time of day pointer.
3. Release the red button to again engage the drive gear.

How to manually regenerate your filter at any time:

Turn the manual regeneration knob clockwise. This slight movement of the manual regeneration knob engages the program wheel and starts the regeneration program. The manual regeneration knob will make one revolution in approximately three hours and stop in the position shown in the drawing. Even though it takes three hours for this center knob to complete one revolution, the regeneration cycle of your unit might be set only half of this time. In any event, conditioned water may be drawn after rinse water stops flowing from the water conditioner drain line.



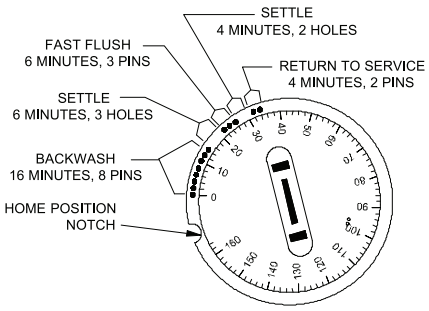
SETTING THE REGENERATION CYCLE PROGRAM TIMER

The regeneration cycle program on your water softener has been factory set. However, portions of the cycle program may be lengthened or shortened in time to suit local conditions. The regeneration cycle timer is secured to the back-plate of the control valve. The timer is hinged on the right side. Grab the upper left corner of the timer and pull towards you. The timer will swing out to the right. The backside of the timer has a program wheel with holes and pins in it.

The holes and pins control the regeneration cycle times as follows:

Step 1 - (Backwash)	First group of pins
Step 2 - (Settle)	First group of holes
Step 3 - (Fast Rinse)	Second group of pins
Step 4 - (Settle)	Second group of holes
Step 5 - (Return to Service)	Third group of pins

PROGRAM WHEEL



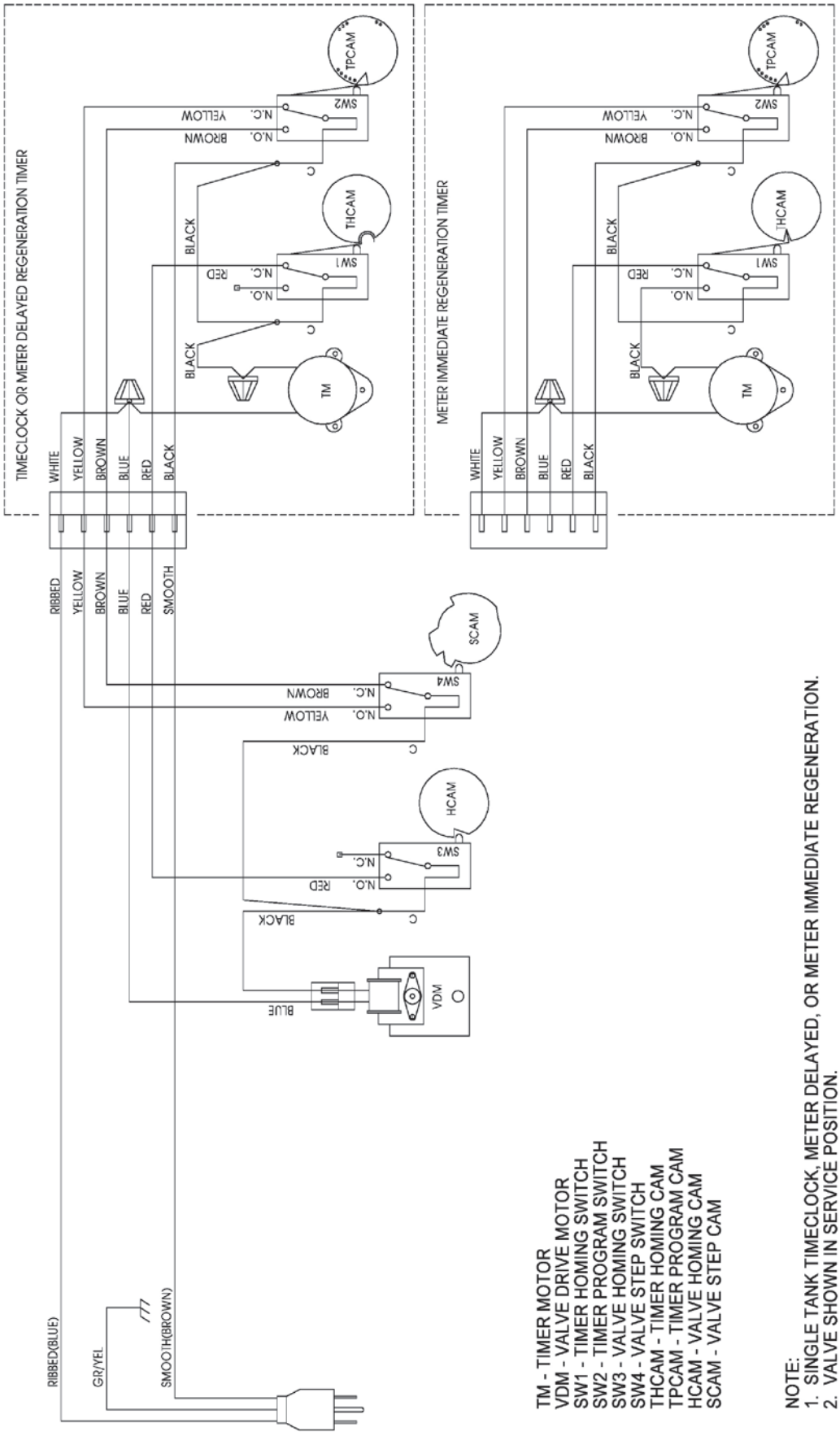
- **Backwash**: The cycle duration is factory set at 16 minutes for clean feed water applications. Increase time if turbidity is present in the feed water.
- **Settle**: The cycle duration is factory set at 6 minutes for clean feed water applications.
- **Fast Flush**: The cycle duration is factory set at 6 minutes.
- **Settle**: The cycle duration is factory set at 4 minutes.
- **Cycle End**: The cycle duration is factory set at 4 minutes. Its purpose is to identify the end of regeneration and advance the filter back to the service cycle.

To adjust the regeneration cycle program it is easier to remove the program wheel by pushing the two black tabs located in the center of the program wheel while pushing up on the program wheel.

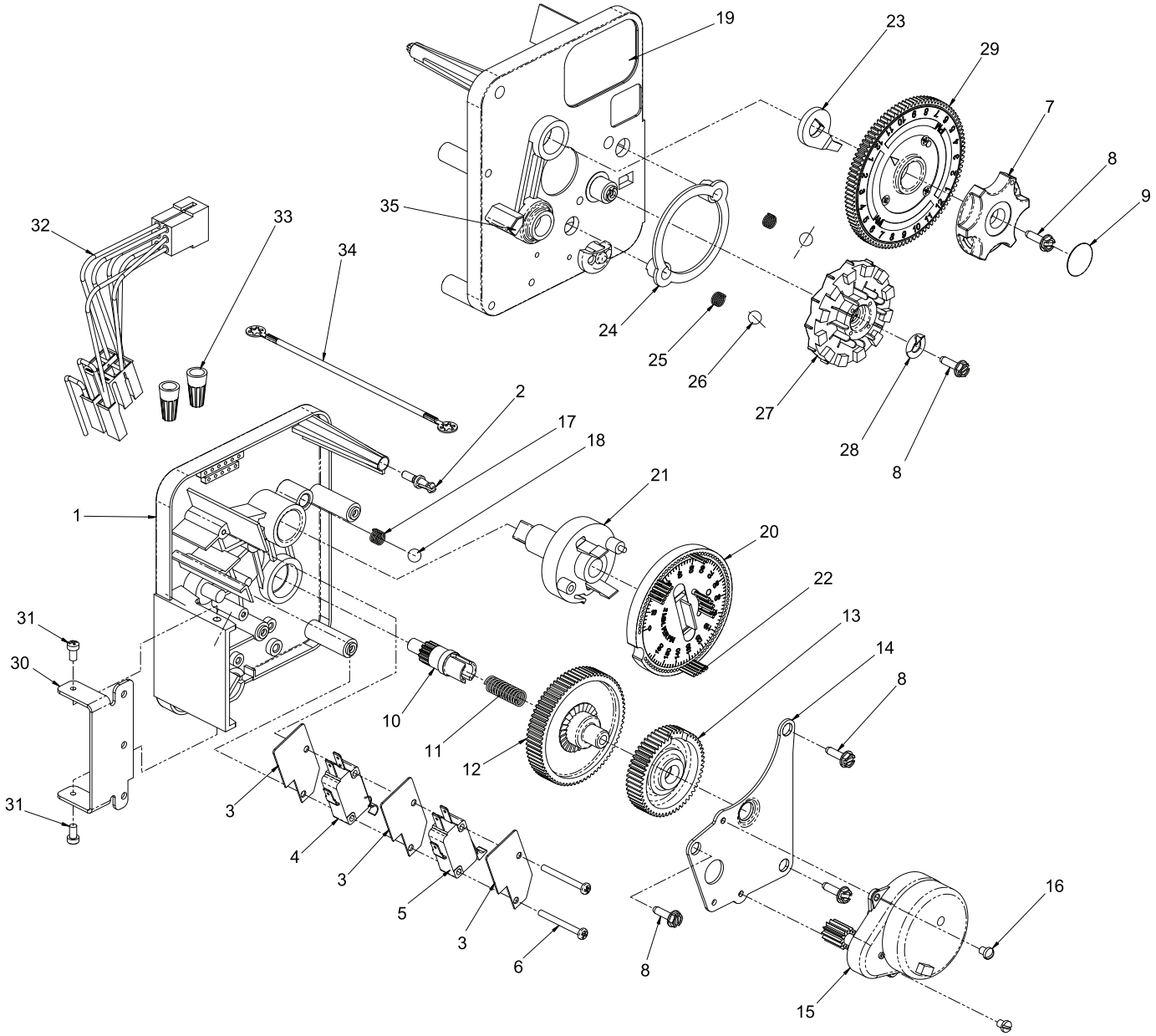
As you look at the number side of the program wheel, starting at zero the number of the group of pins determines the length of time that your unit will be in Backwash. If there are six pins in this section, the time of backwash will be 16 minutes (2 minutes per pin). You must add or remove pins to change the length of this time. All the following groups of holes or pins must be adjusted to maintain their original time.

Important: Changing the time duration in any cycle will require a readjustment of all pins and holes for all the following steps.

2750 WIRING DIAGRAM



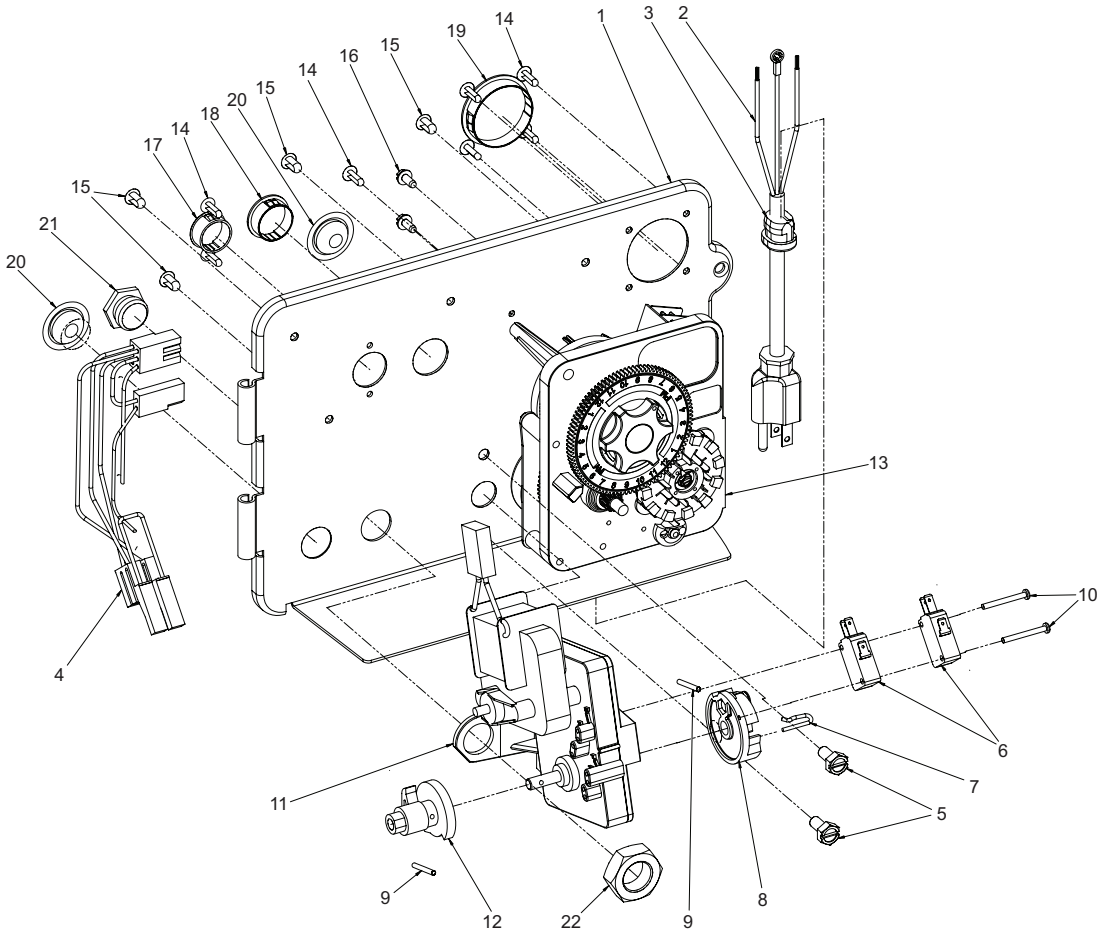
3200 TIMER ASSEMBLY



3200 TIMER ASSEMBLY PARTS LIST

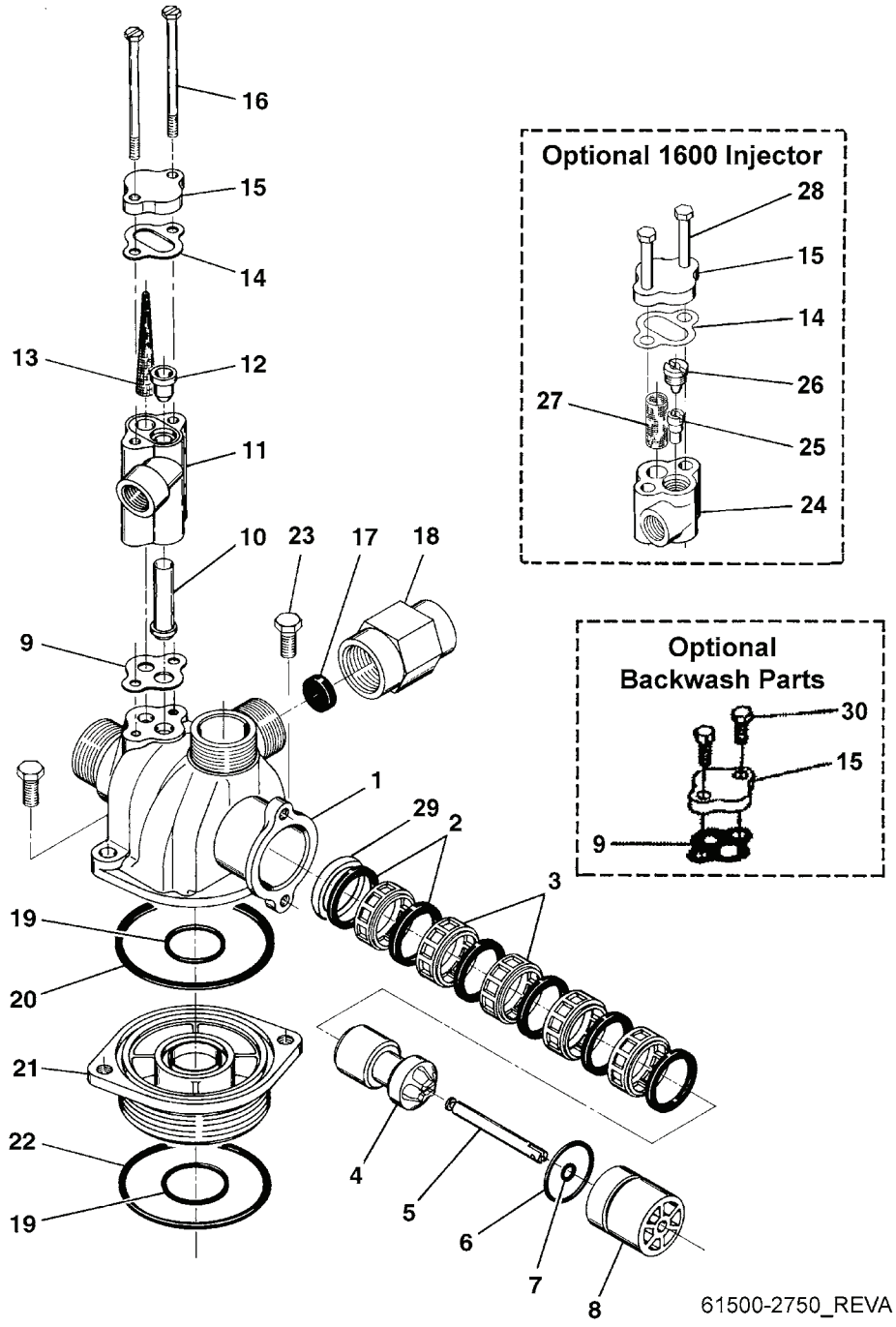
Item No.	Quantity	Part No.	Description
1	1	13870	Housing, Timer, 3200
2	1	14265	Clip, Sping
3	3	14087	Insulator
4	1	10896	Switch, Micro
5	1	15320	Switch, Micro, Timer
6	2	11413	Screw, Pan Hd Mach, 4-40 x 1-1/8
7	1	13886	Knob, 3200
8	5	13296	Screw, Hex Wsh, 6-20 x 1/2
9	1	11999	Label, Button
10	1	13018	Pinion, Idler
11	1	13312	Spring, Idler Shaft
12	1	13017	Gear, Idler
13	1	13164	Gear, Drive
14	1	13887	Plate, Motor Mounting
15	1	18743-1	Motor, 120V, 60Hz, 1/30 RPM, 5600
		19659-1	Motor, 24V, 60Hz, 1/30 RPM
16	2	13278	Screw, Sltd Fillister Hd 6-32 x .156
17	1	15424	Spring, Detent, Timer
18	1	15066	Ball, 1/4”, Delrin
19	1	15465	Label, Caution
20	1	19210	Program Wheel Assy
21	1	13911	Gear, Main Drive, Timer
22	17	41754	Pin, Spring, 1/16 x 5/8 SS, Timer
23	1	13011	Arm, Cycle Actuator
24	1	13864	Ring, Skipper Wheel
25	2	13311	Spring, Detent, Timer
26	2	13300	Ball, 1/4”, SS
27	1	14381	Skipper Wheel Assy, 12 Day
		14860	Skipper Wheel Assy, 7 Day
28	1	13014	Pointer, Regeneration
29	1	40096-24	Dial, 12 AM Regen Assy, Black
		40096-02	Dial, 2 AM Regen Assy, Black
30	1	13881	Bracket, Hinger Timer
31	2	11384	Screw, Phil, 6-32 x 1/4 Zinc
32	1	13902	Harness, 3200
33	2	40422	Nut, Wire, Tan
34	1	15354-01	Wire, Ground, 4”
35	1	14007	Label, Time of Day

2750 POWERHEAD - ENVIRONMENTAL



Item No.	Quantity	Part No.	Description
1	1	18697-13	Backplate, Hinged
2	1	11838	Power Cord, 6’ Fleck
3	1	13547	Strain Relief, Cord
4	1	40400	Harness, Drive, Designer/Enviromental
5	2	10231	Scrw, Slot Hex, 1/4-20 x 1/2
6	2	10218	Switch, Micro
7	1	10909	Pin, Connecting Rod Spring
8	1	60160-15	Drive Cam Assy, STF, Blue, 2900
9	2	10338	Pin, Roll, 3/32 x 7/8
10	2	14923	Screw, Pan HD Mach, 4-40 x 1
11	1	41543	Motor, Drive, 115V/60HZ
12	1	12777	Cam, Shut-off Valve
13	1	61502-3200	Timer Assy, 3200 Clock
14	7	19800	Plug (Hole Size: Dia .140)
15	4	19801	Plug, Dia .190
16	2	10300	Screw, Hx Wash Head, 8 x 3/8
17	1	15806	Hole Plug, Heyco
18	1	16493	Plug, Hole, Heyco, .88 Dia
19	1	40306	Plug, 1.50 Hole, Dome, Heyco
20	2	19691	Plug, .750 Dia. Hole, Flush
21	1	10712	Fitting, Brine Valve
22	1	10269	Nut, Jam, 3/4-16

2750 CONTROL VALVE



2750 CONTROL VALVE

Item No.	Quantity	Part No.	Description
1	1	14749	Valve Body, 2750
2	6	10545	Seal, Piston
3	5	11451	Spacer, 12 Hole
		16589	Spacer, HW
4	1	14451	Piston, 2750
5	1	14452	Rod, Piston
6	1	10234-01	O-Ring, -024, 560CD
7	1	10209	Quad Ring, -010
8	1	10598	End Plug Assembly
		10598-01	End Plug Assembly, Hot Water
9	1	14805	Gasket, Injector Body, 1600/1700
10	1	14802-xxc	Throat, Injector, -xxc is for Injector Size
11	1	17777	Body, Injector, 1700
12	1	14801-xxc	Nozzle, Injector, -xxc is for Injector Size
13	1	14803	Screen, Injector
14	1	10229	Gasket, Injector Cap, 1600
15	1	11893	Cap, Injector, Stainless Steel
		10228	Cap, Injector, Brass
16	2	14804	Screw, Hex Hd Mach, 10-24 x 2-3/4
17	1		Washer - Flow Control (specify size)
18	1	60365-00	Housing, DLFC, 1/2”F x 3/4”F
19	2	11710	O-ring, -215
20	1	11208	O-ring, -232
21	1	12461-01	Adapter Base, 1” 2-1/2” - 8 Quick Connect
22	1	10381	O-ring, -231
23	2	11224	Screw, Hex Hd, 5/16 - 18 x 5/8
24	1	17776	Body, Injector
25	1	10914-xx	Throat, Injector, -xx is for Injector Size
26	1	10913-xx	Nozzle, Injector, -xx is for Injector Size
27	1	10227	Screen, Injector
28	2	10692	Screw, Slot Hex Hd, 10-24 x 18-8 Stainless Steel
29	1	10757	Spacer, End
		10757B	Spacer, End, Brass
30	1	15137	Screw, Hex Wsh Mach, 10-24 x 3/8
Not Shown	1	16221	Disperser, Air, 1600
	1	17996	Disperser, Air, 1700

SERVICE ASSEMBLIES

ADAPTERS - SIDE MOUNT
A2285017 Side mount Adapter Assembly

AUXILIARY MICRO SWITCH
A2203010 3200 Series Timer
A2203108 Lower Drive (2nd Switch)

COVERS
A2103096 Environmental lower cover
A2103095 Environmental
A2103043 Designer 1 piece (only available in black)
A2103047 Designer Lower cover

DRAIN LINE FLOW CONTROLS
60366-_ _ 1” FNPT x ¾” FNPT (specify flow control .6 - 7.0)
60701-_ _ 1” FNPT x 1” FNPT (specify flow control 8.0 - 25.0)
60702-_ _ 1” FNPT x 1” MNPT (specify flow control 8.0 - 25.0)
60708-_ _ 1” FNPT x ¾” FNPT (specify flow control 8.0 - 25.0)
60721-_ _ 1” FNPT x 1” FNPT (specify flow control .6 - 7.0)

CAM ASSEMBLY
A2300002 Separate time fill drive cam (Black)
60160-20 Lower drive (Designer)
A2300013 Lower drive (Environmental)

PISTON ASSEMBLIES
A2309054 Upper Piston
A2309056 Lower piston, Hard Water By-Pass
A2309055 Lower Piston, No By-Pass

SEAL & SPACER KITS
A2435011 Upper kit
A2435026 Lower kit

SERVICE EQUIPMENT
A2475001 Seal & Spacer stuffer tool upper
A2474003 Spacer puller tool lower
A2475003 Seal & Spacer stuffer tool lower
A2474001 Spacer puller tool upper
A2423002 Silicone, 2 oz. Tube
A2164006 Meter Checker Std. Range
A2164005 Meter Checker Ext. Range

SERVICE VALVE OPERATOR ASSEMBLY (SVO)
A2207015 SVO (Old Style)
60150-01 SVO (New Style)

TROUBLESHOOTING 2750 VALVE

Problem	Cause	Correction
1. Water conditioner fails to regenerate.	**A.** Electrical service to unit has been interrupted	**A.** Assure permanent electrical service (check fuse, plug, pull chain, or switch)
	B. Timer is defective.	**B.** Replace timer.
	C. Power failure.	**C.** Reset time of day.
2. Untreated water.	**A.** By-pass valve is open.	**A.** Close by-pass valve
	B. Leak at distributor tube.	**B.** Make sure distributor tube is not cracked. Check O-ring and tube pilot.
	C. Internal valve leak.	**C.** Replace seals and spacers and/or piston.
3. Loss of water pressure.	**A.** Iron buildup in line to water conditioner.	**A.** Clean line to water conditioner.
	B. Iron buildup in water conditioner.	**B.** Clean control and add mineral cleaner to mineral bed. Increase frequency of regeneration.
	C. Inlet of control plugged due to foreign material broken loose from pipes by recent work done on plumbing system.	**C.** Remove piston and clean control.
4. Loss of mineral through drain line.	**A.** Air in water system.	**A.** Assure that well system has proper air eliminator control. Check for dry well condition.
	B. Improperly sized drain line flow control.	**B.** Check for proper drain rate.
5. Iron in conditioned water.	**A.** Fouled mineral bed.	**A.** Check backwash, brine draw, and brine tank fill. Increase frequency of re-generation. Increase backwash time.
6. Control cycles continuously.	**A.** Misadjusted, broken, or shorted switch.	**A.** Determine if switch or timer is faulty and replace it, or replace complete power head.
7. Drain flows continuously.	**A.** Valve is not programming correctly.	**A.** Check timer program and positioning of control. Replace power head assembly if not positioning properly
	B. Foreign material in control.	**B.** Remove power head assembly and inspect bore. Remove foreign material and check control in various regeneration positions.
	C. Internal control leak.	**C.** Replace seals and piston assembly.

Installation, Operation and Maintenance Manuals

Job Title: **ICON - Webster Univ - ISB**

Job Site: Webster University
547 Garden Ave

Saint Louis, MO 63119
United States

Customer PO#: Webster ISB 5768
Contractor: ICON MECHANICAL
Elevation: (ft) 709
Date: 1/25/2017
Submitted By: Mark Haas
Agent Order#: 1610111B

H C SHARP COMPANY INC
8301D CREST INDUSTRIAL DRIVE
SAINT LOUIS, MO 63123
US
Phone: 3143516900
Fax: 13143516901
Email Address: karen@hcsharpco.com

Product IOMs

Mark Name	Model Name
MODs 10-10-2016 Actuator Int., MODs 10-10-2016 Actuator Ext.	VCD-23

GREENHECK
Building Value in Air.

DOCUMENT NUMBER 463384
VCD, FBH & FBV MODELS
Vertical and Horizontal Mount

Installation, Operation, and Maintenance Instructions

This manual is the property of the owner, and is required for future maintenance. Please leave it with the owner when the job is complete.



RECEIVING AND HANDLING

Upon receiving dampers, check for both obvious and hidden damage. If damage is found, record all necessary information on the bill of lading and file a claim with the final carrier. Check to be sure that all parts of the shipment, including accessories, are accounted for.

Dampers must be kept dry and clean. Indoor storage and protection from dirt, dust and the weather is highly recommended. Do not store at temperatures in excess of 100°F (37ºC).

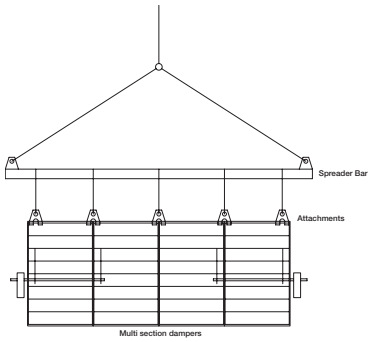
SAFETY WARNING:

Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read the installation, operating, and maintenance instructions thoroughly before installing or servicing this equipment.

PRE-INSTALLATION GUIDELINES

The basic intent of a proper installation is to secure the volume control damper into the opening in such a manner as to prevent distortion and disruption of damper operation. The following items will aid in completing the damper installation in a timely and effective manner.

1) Check the schedules for proper damper locations within the building. Visually inspect the damper for damage.
2) Lift or handle damper using sleeve or frame. Do not lift damper using blades, linkage, actuators, or jackshafting. When handling multiple sections assemblies, use sufficient support to evenly lift at each section mullion (see drawing). Do not drag, step on, apply excessive bending, twisting, or racking.
3) Do not install screws in damper frame that will interfere with unexposed blade linkage and prevent damper blades from opening and/or closing.
4) Damper must be installed into duct or opening square and free of twist or other misalignment. Damper must not be squeezed or stretched into duct or opening. Out of square, racked, twisted or misaligned installations can cause excessive leakage and/or torque requirements to exceed damper/actuator design.



5) Damper and actuator must be kept clean, dry and protected from dirt, dust and other foreign materials prior to and after installation. Examples of such foreign materials include but are not limited to:
    a) Mortar dust
    b) Drywall dust
    c) Firesafing materials
    d) Wall texture
    e) Paint overspray
6) Damper should be sufficiently covered as to prevent overspray if wall texturing or spray painting will be performed within 5 feet (1.50m) of the damper. Excessive dirt or foreign material deposits on damper can cause excessive leakage and/or torque requirements to exceed damper/actuator design.
7) ACCESS: Suitable access (actuators maintenance, etc.) must be provided for damper inspection and servicing. Where it is not possible to achieve sufficient size access, it will be necessary to install a removable section of duct.

ELECTRICAL GUIDELINES

Electrical and/or pneumatic connections to damper actuators should be made in accordance with wiring and piping diagrams developed in compliance with applicable codes, ordinances and regulations.

SAFETY CAUTION!

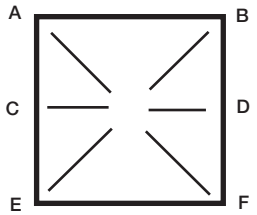
Verify power requirements before wiring actuator. Greenheck is not responsible for any damper to, or failure of the unit caused by incorrect field wiring.

SAFETY DANGER!

Electrical input may be needed for this equipment. This work should be performed by a qualified electrician.

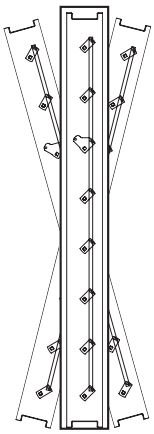
INSTALLATION - FAILURE TO FOLLOW INSTRUCTIONS WILL VOID ALL WARRANTIES

1. Duct opening or opening square should be measured 1/4 inch (6mm) larger than damper dimension and should be straight and level.



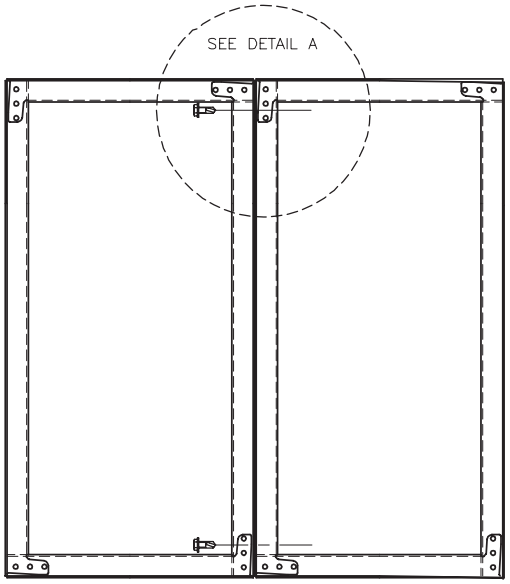
AF=BE
AB=CD

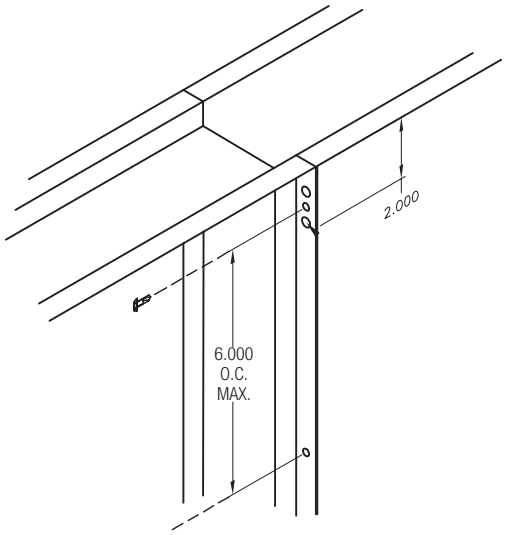
Do not twist or bow. Mount damper plumb in the opening.



INSTALLATION CONTINUED....

2. If more than two sections wide, unit ships as a multiple section assembly and a single section together. The single section is joined to the side of the multiple section where the jackshaft extends past the frame four inches (102mm).



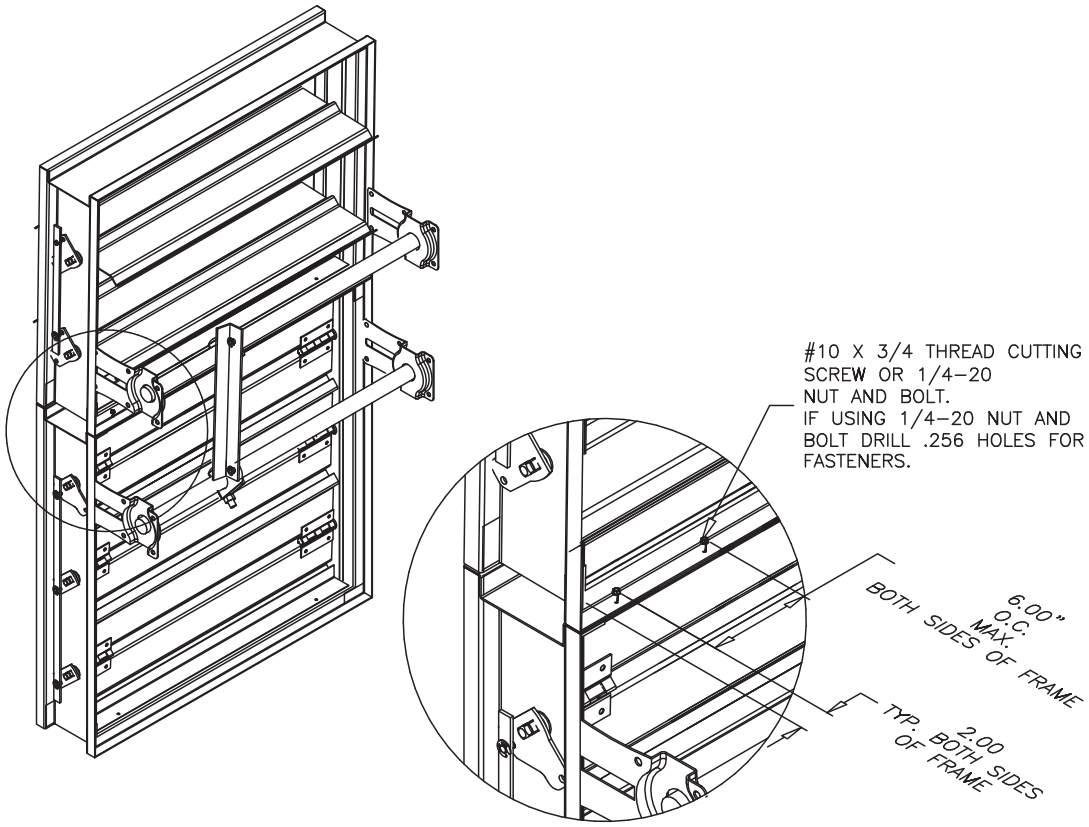


3. A damper assembly is not restricted to a maximum number of sections but, the assembly must not exceed the section sizes and overall sizes (see table below).

Damper Model	Maximum Single Section Size W x H in. (mm)	Maximum Overall Size for Multi-Section Dampers
VCD-20, VCD-23	48 x 74 (1219 x 1880)	Unlimited
VCD-33, VCD-34, VCD-40, VCD-42, VCD-43	60 x 74 (1524 x 1880)	Unlimited
VCD-20V, VCD-23V	74 x 48 (1879 x 1219)	NA
VCD-33V, VCD-42V, VCD-43V	74 x 60 (1879 x 1524)	NA
FBH-33 FBH-43	Face: 60 x 74 (1524 x 1880) Bypass: 60 x 74 (1524 x 1880)	Face: 96 x 74 (2438 x 1880)
FBV-33 FBV-43	Face: 60 x 74 (1524 x 1880) Bypass: 60 x 74 (1524 x 1880)	Face: 96 x 74 (2438 x 1880) Bypass: 96 x 74 (2438 x 1880)
FBH-23	Face: 48 x 74 (1219 x 1880) Bypasss: 48 x 74 (1219 x 1880)	Face: 96 x 74 (2438 x 1880)
FBV-23	Face: 48 x 74 (1219 x 1880) Bypasss: 48 x 74 (1219 x 1880)	Face: 96 x 74 (2438 x 1880) Bypass: 96 x 74 (2438 x 1880)

INSTALLATION (CONTINUED)....

4. The damper sections must be attached together with #10 x 3/4 in. (19mm) max. sheet metal screws, 1/4 in. (6mm) diameter nuts and bolts, tack or spot welds, or 3/16 in. (4mm) diameter steel pop rivets. Attachments must be spaced a maximum of 6 in. (152mm) on centers and a maximum of 2 in. (51mm) from corners. Attachments must be made on front face and back face (air entering and air exiting side) of damper sections.
5. Two section high dampers require reinforcement using a 14 gauge (2mm), 5 in. (127mm) wide mullion or two individually sleeved units stacked vertically. When using two individually sleeved units, the sleeve acts as the mullion, therefore no mullion is required (mullions are not provided by Greenheck).
6. When the height of a face & bypass vertical style (FBV) is greater than 84 in. (2134mm), the damper sections are shipped separate and field assembly is required. Before fastening damper sections together, the non-actuated damper section will need to be flipped upside down so that the linkage is on the same side as the actuated damper. After damper sections are fastened together, attach interconnecting angle as shown.



FRAME FASTENING DETAIL

7. If no holes are present in the frame, drill 1/4 inch (6mm) diameter holes at six inch (52mm) centers and fasten frames together with 1/4 inch (6mm) #20 (.03mm) bolts and nuts (see installation #2).
8. Use shims between damper frame and duct opening or opening space to prevent distortion of frame by fasteners holding it in place. Brace at every horizontal mullion and vertically brace at every eight feet (2.4m) of damper width for strength. Dampers in high velocity (2000 fpm [610mm] per second) may require more bracing.
   Note: Greenheck dampers are specifically designed and engineered for structural integrity based on model and conditions. Attachment, framing, mating flanges, and anchoring of damper assemblies into openings, ductwork, or walls is the responsibility of the installer. Design calculation for these retaining and supporting members should be determined by field engineers for that particular installation.
9. If the damper actuator is to be mounted out of the airstream, the extension pin should extend approximately six inches (152mm) beyond the frame. On jackshafted units, the jackshaft should extend through the jackshaft bearing assembly approximately six inches (152mm) beyond the frame.
10. Individual damper sections, as well as entire multiple section assemblies must be completely square and free from racking, twisting, or bending. Measure diagonally from upper corners to opposite lower corners of each section.
11. Damper blades, axles, and linkage must operate without binding. Before system operation, cycle dampers after installation to assure proper operation. On multiple section assemblies, all sections should open and close simultaneously.

Note: When you have a vertical damper installation, blades must be horizontal. When blades need to be vertical, you need a vertical blade damper (example: VCD-23V). These dampers are built so they don't crush the jamb seal.

DAMPER MAINTENANCE

Greenheck's dampers are designed to be trouble free and hassle free under normal operation. Dampers are to installed square and straight so as to prevent binding during operation. the following annual damper maintenance suggestions will help to insure proper damper operation and increase the life expectancy of the damper.

Foreign Matter Over the course of time, dirt and grime may collect on damper surfaces. The damper surfaces should be cleaned to prevent hindrance to airflow.

Moving Parts Make sure that parts such as linkage, bearings, blades, etc. that are intended to move freely, can do so. Lubricating these components can prevent possible rusting and unnecessary friction increase. Use only a moli-spray oil or similar graphite based oil as regular lubricating oil will attract dirt.

Bearings. Synthetic, oil impregnated, and ball bearings (without grease fittings) do not require lubrication. Ball bearings with grease fittings require only minimal grease.

Closure Remove foreign materials that may be interfering with blade closure or effective sealing of the blades with each other or with the frame.

Operation While operating the damper through its full cycle, check to see that the blades open and close properly. If there is a problem, check for loose linkage, especially at the actuator. Tighten the linkage where required.

DAMPER TROUBLESHOOTING

The following is a cause and correction list for common concerns with the dampers.

Symptom	Possible Cause	Corrective Action
Damper does not fully open and/or fully close	Frame is 'racked' causing blades to bind on jamb seals	Adjust frame such that it is square and plumb
	Actuator linkage loose	Close damper, disconnect power, adjust and tighten linkage
	Defective motor	Replace
	Screws in damper linkage	Locate screws and remove
	Actuator linkage hitting wall or floor	Damper installed too far into wall. Move out to line designated on damper label
	Contaminants on damper	Clean with a non oil-based solvent (see Damper Maintenance)
Actuator runs hot or makes a humming noise	Actuator prohibited from reaching end of stroke	Disconnect linkage from jackshaft, open damper, power actuator to end of spring, tighten linkage. Verify amp draw

Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Specific Greenheck product warranties are located on greenheck.com within the product area tabs and in the Library under Warranties.

GREENHECK
Building Value in Air.

Phone: (715) 359-6171 • Fax: (715) 355-2399 • E-mail: gfcinfo@greenheck.com • Website: www.greenheck.com

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Installation, Operation and Maintenance Manuals

Job Title: **ICON - Webster Univ - ISB**

Job Site: Webster University
547 Garden Ave

Saint Louis, MO 63119
United States

Customer PO#: Webster ISB 5768
Contractor: ICON MECHANICAL
Elevation: (ft) 709
Date: 1/25/2017
Submitted By: Mark Haas
Agent Order#: 1610111B

H C SHARP COMPANY INC
8301D CREST INDUSTRIAL DRIVE
SAINT LOUIS, MO 63123
US
Phone: 3143516900
Fax: 13143516901
Email Address: karen@hcsharpco.com

ICON - Webster Univ - ISB

Product IOMs

Mark Name	Model Name
FD R 11-30-2016, FD 11-30-2016	DFD-150
FSD 11-30-2016	FSD-211
FSD R 11-30-2016	FSDR-511

GREENHECK
Building Value in Air.

Document number 481324
CURTAIN FIRE DAMPERS
DFD, DFD-150X, FD, FD-150X, SSDFD, SSFD, AND KFD Series
1½ and 3 Hour Curtain Fire Dampers

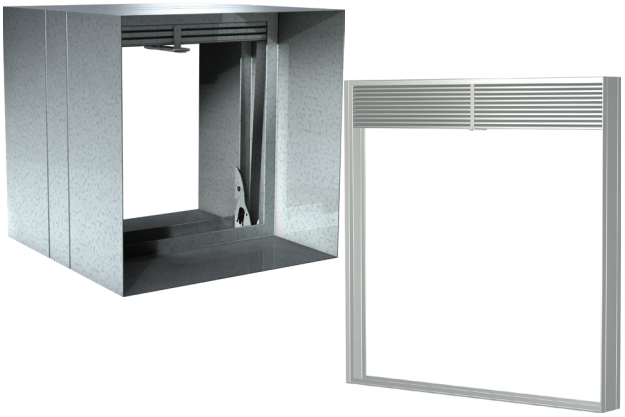
Vertical and Horizontal Mount

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage!

These instructions apply to 1½ and 3 hour rated fire dampers mounted (blades must be horizontal) in: 1) masonry, block, or stud walls and 2) concrete floors. Specific requirements in these instructions are mandatory. Dampers must be installed in accordance with these instructions to meet the requirements of UL 555.

Note: Fire dampers are manufactured and labeled for either vertical or horizontal installation. The dampers must be installed in accordance with labeling.



Receiving and Handling

Upon receiving dampers, check for both obvious and hidden damage. If damage is found, record all necessary information on the bill of lading and file a claim with the final carrier. Check to be sure that all parts of the shipment, including accessories, are accounted for.

Dampers must be kept dry and clean. Indoor storage and protection from dirt, dust and the weather is highly recommended. Do not store at temperatures in excess of 100°F (38°C).

Safety Warning

Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read the installation, operating, and maintenance instructions thoroughly before installing or servicing this equipment.

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This manual is the property of the owner and is required for future maintenance. Please leave it with the owner when the jobs is complete.

"UL CLASSIFIED (see complete marking on product)"
"UL CLASSIFIED to Canadian safety standards (see complete marking on product)"
Standard 555 (Listing #R13317)

Installation Supplements

Refer to the appropriate Greenheck installation supplements for special requirements:

- Closed Indicator Switch
- Concrete Floor with Steel Deck
- Drive Slip Breakaway Connection
- Field Installed Sleeve
- Fire Resistant Ventilated Duct Assembly
- Firestop Material
- Fusible Link Replacement
- Grille Installation
- Metal Stud in Shaftwall Partition
- Non-Concrete Horizontal Mount
- Quick Connect Breakaway Connection
- Sealant Supplement
- Single Side Retaining Angle
- Single 3-Sided Retaining Angle Supplement
- Sleeve Extension
- Support Mullions

Installation supplements available at www.greenheck.com.

Pre-Installation Guidelines

The following items will aid in completing the damper installation in a timely and effective manner.

1) Check the schedules for proper damper locations within the building. Visually inspect the damper for damage and verify that the fusible link is in place and has not activated. Never install a fire damper without the proper UL approved fusible link in place. Visually inspect the link to verify its not damaged. Replace link as necessary.

2) Lift or handle damper using sleeve or frame. Do not lift damper using blades.

3) Dampers have a label indicating the required mounting orientation. Care must be taken to ensure that the indicated orientation is adhered to.

4) Damper must be installed into duct or opening square and free of twist or other misalignment.

5) Damper must be kept clean and protected from dirt, dust and other foreign materials prior to and after installation. Examples of such foreign materials include but are not limited to:

    a) Mortar dust
    b) Drywall dust
    c) Firesafing materials
    d) Wall texture
    e) Paint overspray

6) Damper should be sufficiently covered as to prevent overspray if wall texturing or spray painting will be performed within 5 feet of the damper.

7) Caulking is not necessary, nor is it allowed, between the damper sleeve and the wall or floor opening (annular space). However, caulking may be applied to the retaining angles.

8) ACCESS: Suitable access (such that the fusible link may be removed and the damper's blade stack may be reset, etc.) must be provided for damper inspection and servicing. Where it is not possible to achieve sufficient size access, it will be necessary to install a removable section of duct. (Refer to NFPA 90A).

9) The Code Authority Having Jurisdiction (AHJ) must evaluate and provide approval of final installation where variations to these instructions are necessary.

Preparation of Openings

- Frame wall openings as shown below (**see Figure 1 & 2**).
- Gypsum wall board must be fastened 12 in. (305mm) on center to all stud and runner flanges surrounding opening.
- Prepare opening between studs and sleeve assembly as shown below (**see Figure 3 & 4**).
- All construction and fasteners must meet the requirements of the appropriate wall design (See UL Fire Resistance Directory) and/or local codes.

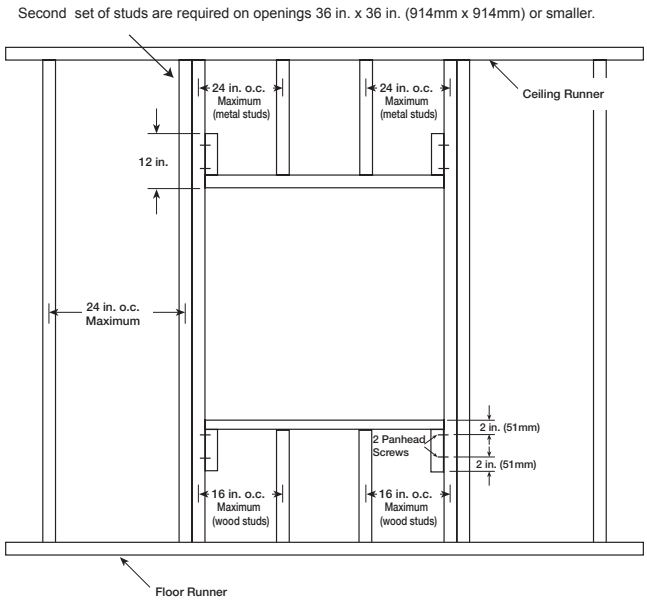


Figure 1

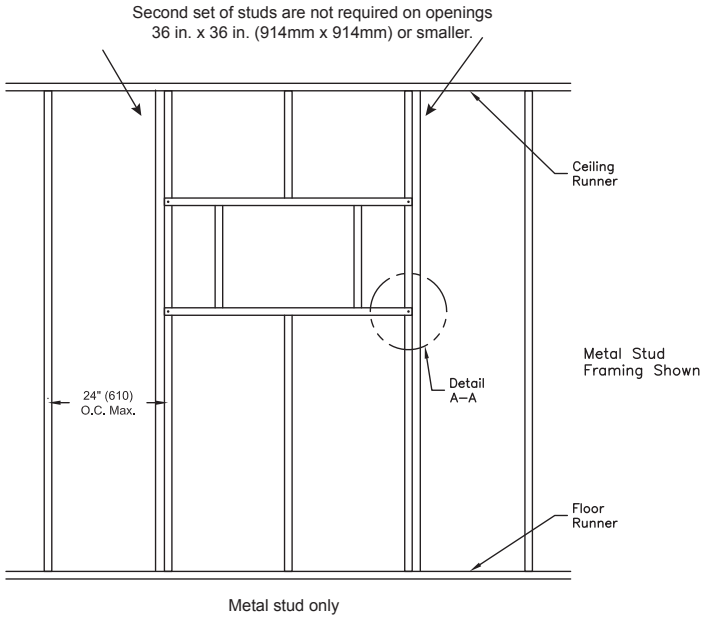
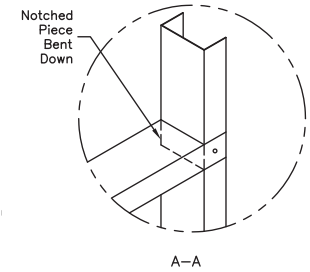


Figure 2



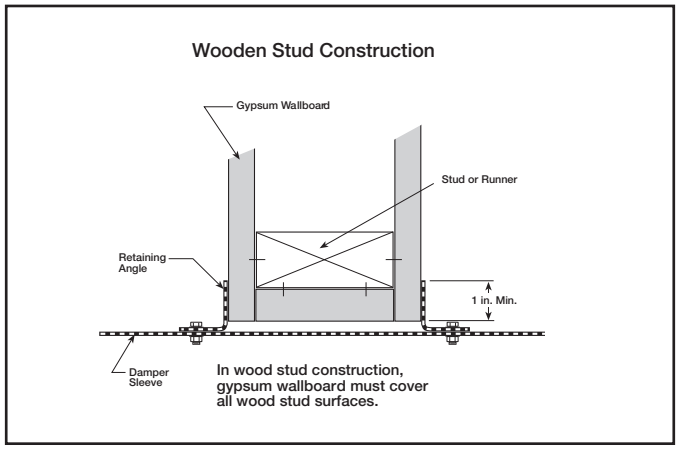


Figure 3 (2 sided angle installation shown)

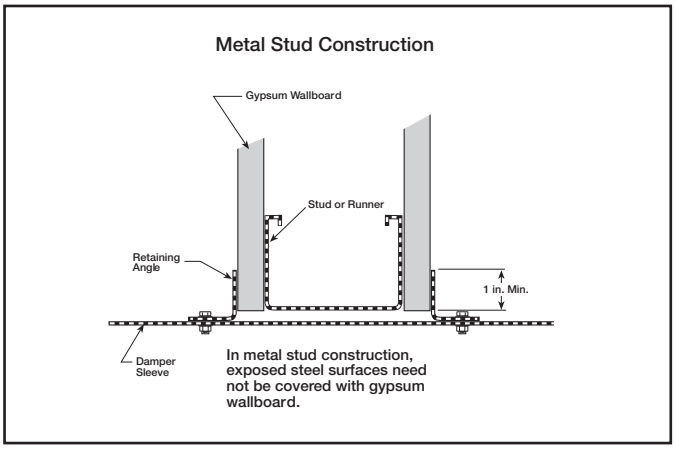


Figure 4 (2 sided angle installation shown)

Clearances Required Between Damper Sleeves & Wall/Floor Openings

Two-sided Angle Installation

Two sided angle installations require clearances for thermal expansion between the damper sleeve and the wall/floor opening. The minimum required clearances are:

- For galvanized steel fire dampers and sleeves: ⅛ in. per foot (3mm per .3 m) of damper width and ⅛ in. per foot (3mm per .3 m) height with a minimum clearance of ¼ in. (6mm), maximum of 1½ in. (38mm).
- For stainless steel fire/smoke dampers and stainless steel or galvanized sleeves: 3⁄16 in. per foot (5mm per .3 m) of damper width and height with a minimum clearance of ¼ in. (6mm), maximum of 2 in. (51mm).

These are total clearances (ignoring fastener heads) and do not need to be equally spaced around the damper.

Example:

A 12 in. x 12 in. (305mm x 305mm) will require a minimum clearance of ¼ in. (6mm) width and ¼ in. (6mm) on height

A 48 in. x 12 in. (1219mm x 305mm) damper will required a minimum clearance of ½ in. (13mm) on width and ¼ in. (13mm) on height.

Although the minimum requirements are listed above, for ease of installation the following are the recommended clearances for galvanized dampers:

- Width/Height of 48 in. (1219 mm) or less - ½ in. (13mm) clearance
- Width/Height between 48.01 in. (1220 mm) and 96 in. (2438 mm): 1 in. (25mm) clearance
- Width/Height greater than 96 in. (2438 mm): 1½ in. (38 mm) clearance

Single Side Angle Installation

On vertical mount single side angle installations there are no minimum clearance requirements between the wall opening and the damper sleeve. However, to facilitate installation, clearances between the wall opening and the damper sleeve are recommended.

On horizontal mount single side angle installations a minimum clearance is required between the outside of the damper sleeve and the floor opening of ⅛ in. per foot (3mm per .3m) of damper width and ⅛ in. per foot (3mm per .3m) height with a minimum clearance of ¼ in. (6mm).

Installing Multiple Section Assemblies

A damper assembly is not restricted to a maximum number of sections, but must not exceed the section sizes and overall sizes shown (see chart below).

The damper sections must be attached together with #10 (¾ in. max. [19mm]) sheet metal screws, ¼ in. (6mm) diameter nuts and bolts, tack or spot welds, or 3⁄16 in. (48mm) diameter steel pop rivets. Attachments must be spaced a maximum of 6 in. (152mm) on centers and a maximum of 2 in. (51mm) from corners. Attachments must be made on front face and back face (air entering and air exiting side) of damper sections.

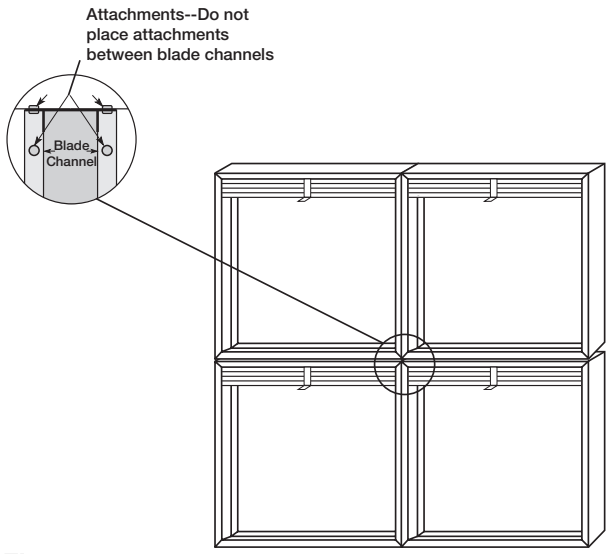


Figure 5

Maximum Assembly Tables

When multiple sections are shipped unassembled, installer shall fasten dampers together. The table shows maximum sizes for multiple section dampers. Dampers that are two or more sections tall must be factory assembled. **Note:** All dimensions are shown in inches (W x H). * Sizes listed is the damper size, not transition size.

Damper Model	Mounting	Maximum Single Section Damper Sizes*	Maximum Multi-Section Damper Sizes*
FD-100 , FD-300, FD-310, SSFD-350	Vertical	48 X 48 (1219mm x 1219mm)	-
FD-150	Vertical or Horizontal	48 X 48 (1219mm x 1219mm)	96 x 48 (2438mm x 1219mm) or 120 x 40 (3048mm x 1016mm)
FD-110	Vertical or Horizontal	48 x 48 (1219mm x 1219mm)	96 x 48 (2438mm x 1219mm)
SSFD-150	Vertical	48 X 48 (1219mm x 1219mm)	96 X 48 (2438mm x 1219mm) or 120 X 40 (3048mm x 1016mm)
	Horizontal	36 x 36 (914mm x 914mm)	-
FD-350	Vertical	48 x 48 (1219mm x 1219mm)	-
	Horizontal	40 x 40 (1016mm x 1016mm)	80 x 40 (2032mm x 1016mm)
KFD-150	Vertical or Horizontal	36 x 16 (914mm x 406mm)	96 x 48 (2438mm x 1219mm) or 120 x 40 (3048mm x 1016mm)
KFD-110	Vertical or Horizontal	36 x 16 (914mm x 406mm)	96 x 48 (2438mm x 1219mm)
SSKFD-150	Vertical	36 x 16 (914mm x 406mm)	96 X 48 (2438mm x 1219mm) or 120 X 40 (3048mm x 1016mm)
KFD-350	Vertical	36 x 16 (914mm x 406mm)	-
	Horizontal	36 x 16 (914mm x 406mm)	80 x 40 (2032mm x 1016mm)
SSKFD-350	Vertical	36 x 16 (914mm x 406mm)	-
DFD-150, DFD-110	Vertical	36 x 36 (914mm x 914mm)	72 x 48 (1828mm x 1219mm) or 60 x 60 (1524mm x 1524mm) or 120 x 30 (3048mm x 762mm)
	Horizontal	24 x 18 (610mm x 457mm)	48 x 36 (1217mm x 914mm)
		30 x 30 (762mm x 762mm)	-
DFD-350	Vertical	36 x 36 (914mm x 914mm)	-
	Horizontal	24 x 18 (610mm x 457mm)	48 x 36 (1217mm x 914mm)
		30 x 30 (762mm x 762mm)	
DFD-310	Vertical	36 x 36 (914mm x 914mm)	-
	Horizontal	30 x 30 (762mm x 762mm)	-
SSDFD-110, SSDFD-150. SSDFD-350	Vertical	30 x 30 (762mm x 762mm)	-
FD-150X	Vertical or Horizontal	48 x 48 (1219mm x 1219mm)	-
DFD-150X	Vertical	36 x 36 (914mm x 914mm)	-
	Horizontal	30 x 30 (762mm x 762mm)	-

Sleeve Requirements

All fire dampers must be installed in a steel sleeve of the required gauge and length. Note that DFD-150X and FD-150X series dampers are provided with an integral sleeve. See **Table on page 10** for required minimum sleeve gauges. Maximum sleeve thickness is 10 gauge (3.5mm). Sleeve inside dimensions must equal damper outside dimensions.

Sleeves shall extend a maximum of 6 in. (152mm) beyond the wall or floor opening on each side. When a factory mounted access door is incorporated as a part of the sleeve the sleeve may extend a maximum of 16 in. (406mm) beyond the wall or floor opening on the access door side.

Fire dampers must be attached to sleeves as shown in **Figure 6**. All four sides of the damper frame must be attached to the sleeve with one row of attachments on each side of the blade channel. Attachments must be spaced a maximum of 6 in. (152mm) on centers and a maximum of 2 in. (51mm) from corners. A minimum of 4 attachments (2 on each side of the blade channel) per side (16 per damper) are required. One of the methods of attachment shown below must be used:

- tack or spot welds
- #10 sheet metal screws
- ¼ in. (6mm) bolts and nuts
- 3⁄16 in. (4.7mm) steel pop rivets

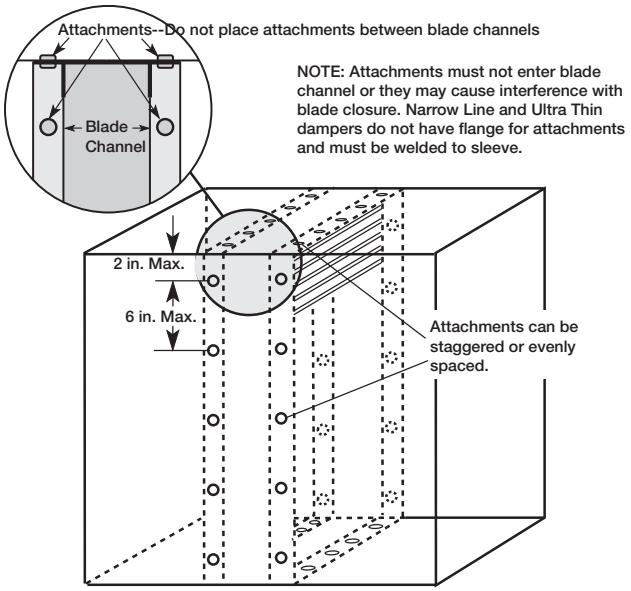


Figure 6: Field attachment of fire dampers to sleeves.

Securing the Damper/Sleeve Assembly to Wall/Floor Openings

All fire dampers may utilize the two sided angle installation method described below. 1½ hour rated fire dampers may use the single sided angle installation method up to the following maximum sizes:

- Vertical mount: 80 in. W x 50. in. H (2032mm W x 1270mm H), 50 in. W x 80 in. H (1270mm W x 2032mm H), or 40 in. W x 100 in. H (1016mm W x 2540mm).
- Horizontal mount: 144 in. W x 96 in. H (3658mm W x 2438mm H)

- **Retaining Angle Gauge**: Retaining angles for 1½ hour rated dampers with a width and height 48 in. (1219mm) or less must be a minimum of 20 ga. (1mm). Retaining angles for all 3 hour rated dampers and all dampers with a width or height greater than 48 in. (1219mm) must be a minimum of 16 gauge (1.5mm).
- **Retaining Angle Size:** The leg of the retaining angle on the damper sleeve shall be a minimum of 1¼ in. (32mm). The leg of the retaining angle on the wall/floor shall be long enough to cover the annular space and overlap the wall/floor by a minimum of 1 in. (25mm).
- **Retaining Angle Attachment to Sleeve:** Retaining angles must be attached to the damper using one or more of the following methods of attachment (refer to label on outside of sleeve for 'No Screw' area):

  - Tack or spot welds
  - #10 (¾ in. [19mm] max.) sheet metal screws
  - ¼ in. (6mm) bolts and nuts
  - 3⁄16 in. (5mm) steel pop rivets

A minimum of two connections per side, top, and bottom, 12 in. (305mm) O.C. maximum for openings of 48 in. W x 36 in. H (1219mm x 914mm) and less. Dampers greater than 48 in. wide (1219mm) or 36 in. high (914mm) require the connections to be no more than 6 in. (152mm) O.C.

The angles must be attached to all 4 sides of the sleeve. Ensure that fasteners do not interfere with the operation of the damper. The angles need not be attached to each other at the corners.

- **Retaining Angle Attachment to Wall/Floor:**

Two sided Angle Method: For two sided angle installations the retaining angles shall not be attached to the wall/floor (**see Figure 7**).

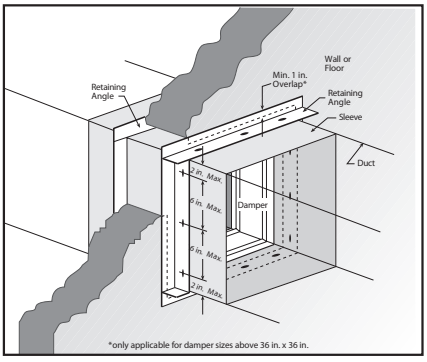


Figure 7: Two Sided Angle Installation

Single Sided Angle Method: For single side installations the retaining angles must be attached to the wall/floor (see **Figures 8-11**). For metal stud partitions only, the single-side mounting angle may be directly attached to the metal stud prior to the installation of the drywall.

- Retaining angles must be attached to the partition using one of the methods shown below:

  - Drywall screws of a length such that the screw engages the steel stud/track by ½ in. (13mm) (steel framing).
  - Drywall screws of a length such that the screw engages the wood stud by 1¾ in. (44mm) (wood framing).
  - Steel anchors or self tapping concrete screws penetrating masonry or block 1¼ in. (31mm).

- A minimum of two connections per side are required. Additional connections made at a maximum of 12 in. (305mm) O.C. maximum for openings of 48 in. W x 36 in. H (1219mm x 914mm) and less. Dampers greater than 48 in. wide (1219mm) or 36 in. high (914mm) require the connections to be no more than 6 in. (152mm) O.C.

Securing the Damper/Sleeve Assembly to Wall/Floor Openings cont.....

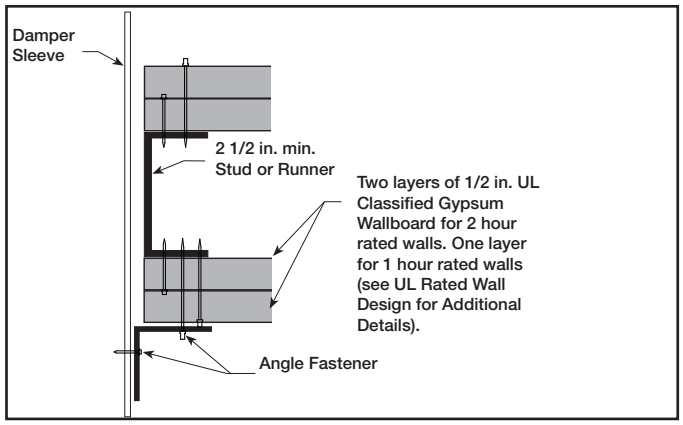


Figure 8: Single Side Angle With Steel Stud Wall - Angle Over Wallboard

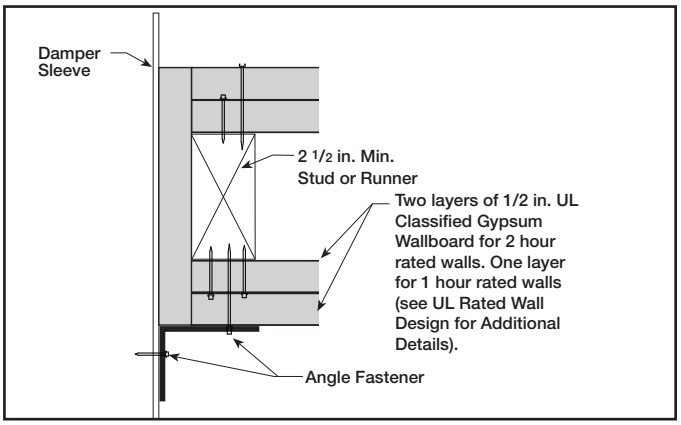


Figure 9: Single Side Angle With Wood Stud Wall

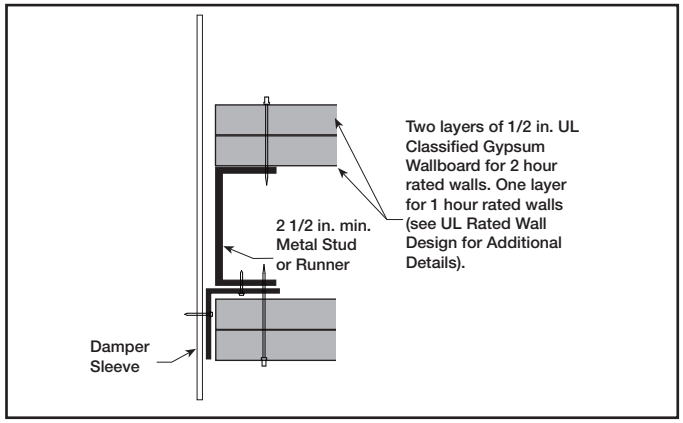


Figure 10: Single Side Angle With Steel Stud Wall - Angle Under Wallboard

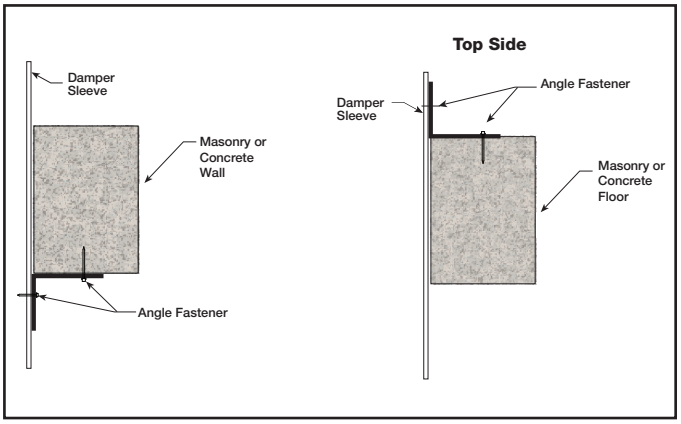


Figure 11: Single Side Angle With Masonry or Concrete Wall and Floor

Grille Installations (Dampers up to 36 in. x 36 in. [914mm x 914mm])

Retaining angles used in conjunction with grille installations must be a minimum of ⅝ in. x 1 in. (15mm x 25mm) 16 gauge (1.5mm) steel. Space screws a maximum of 6 in. (152mm) on center and a maximum of 2 in. (51mm) from the corners (minimum of 2 screws per side). See **Figure 12** and **Figure 13.**

Note: Screws used to attach grille are allowed to penetrate reversed angle leg.

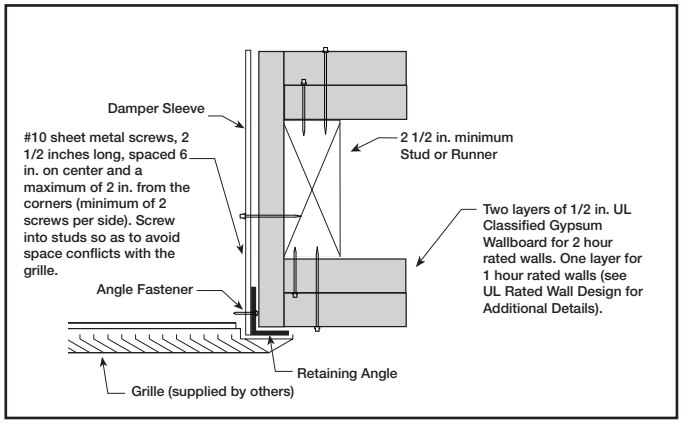


Figure 12: Wood Stud - Grille

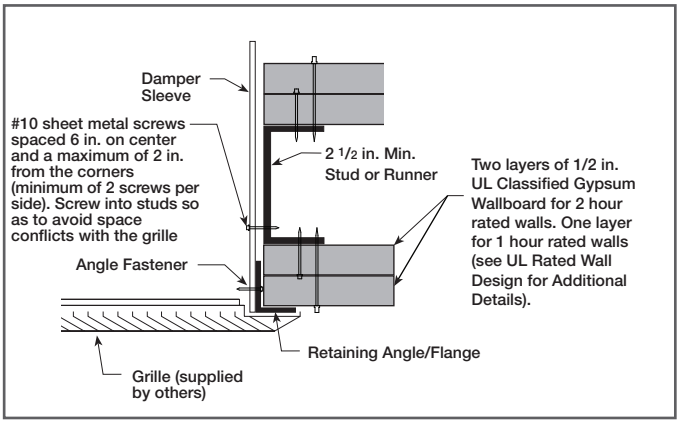
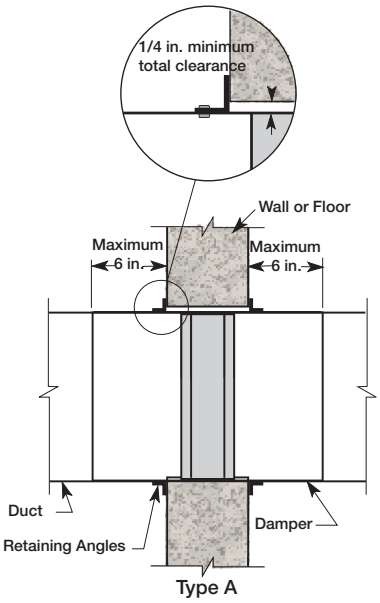
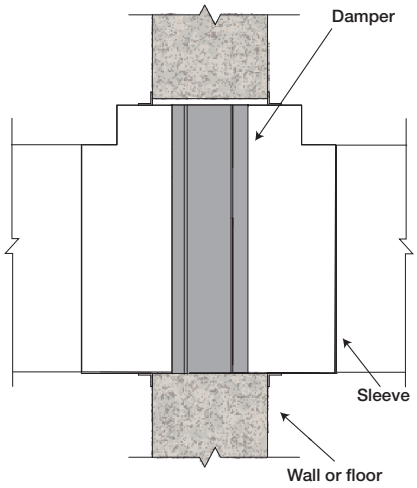


Figure 13: Metal Stud - Grille

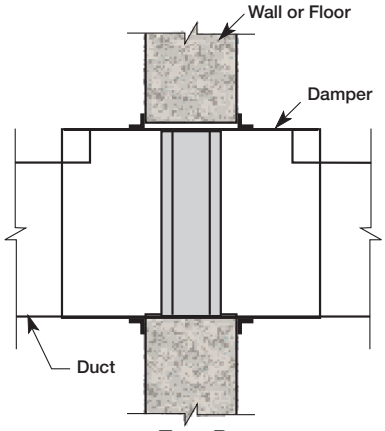


Factory or Field installed Sleeve

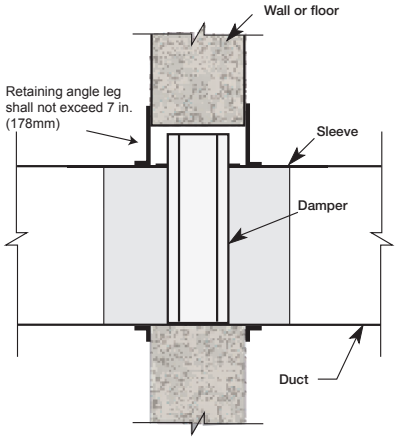


Type B2

Factory Sleeve

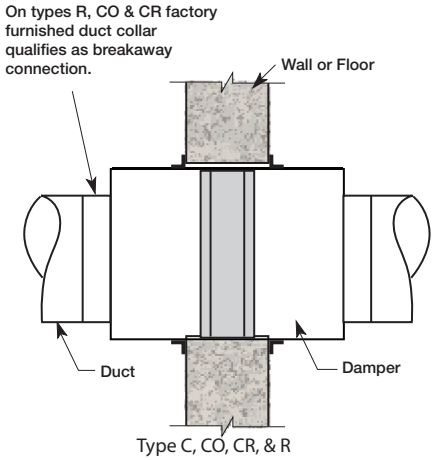


Factory Sleeve

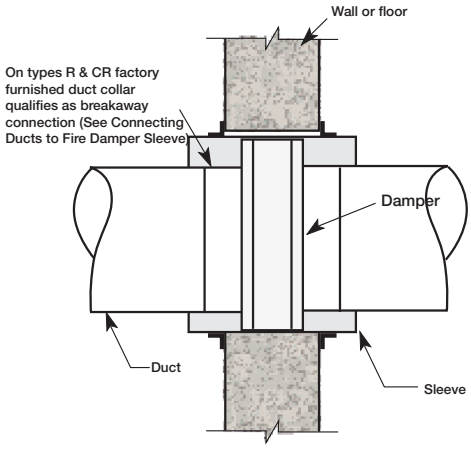


Type B

Field Installed Sleeve



Factory Sleeve



Type C, CO, CR & R

Field installed Sleeve

Figure 14: Damper/Sleeves with Transition

Duct to Sleeve Connection

Sleeve Gauge and Connection Type Requirements

The size of the damper/duct determines the required sleeve gauge and the required duct to sleeve connection (see table to the right). The sleeve thickness must also not be less than the gauge of the connecting duct. Any duct connection other than the breakaway connections described below are considered rigid.

Sleeve Gauge	Duct Dimension	Type of Duct to Sleeve Connection Permitted
14 ga. (0.075 in.) - 10 ga. (0.138 in.) [2mm - 3.5mm]	All duct sizes	Rigid or Breakaway
16 ga. (0.060 in.) [1.5mm]	36 in. (914mm) max. width 24 in. (610mm) max. height 24 in. (610mm) diameter	Rigid or Breakaway
16 ga. (0.060 in.) [1.5mm]	All duct sizes	Breakaway only
18 ga. (0.048 in.) [1.2mm]	85 in. (2159mm) wide and over	
20 ga. (0.036 in.) [0.9mm]	55 in. - 84 in. wide (1397mm - 2134mm)	
22 ga. (.030 in.) [0.76mm]	31 in. - 54 in. wide (787mm - 1372mm)	
24 ga. (0.024) [0.6mm]	13 in. - 30 in. wide (330mm - 762mm)	
26 ga. (0.018 in.) [0.46mm]	12 in. wide and under (305mm)	
See Breakaway Connection section for additional information. UL Standard 555 requires all ducts to terminate at fire damper sleeves.		

Approved Breakaway Connections

All breakaway connections described below may utilize the following duct sealants: PA2084T duct sealant adhesive manufactured by Precision, DP1010 water base duct sealant manufactured by Design Polymetrics, Grey Pookie, Ductmate PROseal®, or CL Ward S Seal in accordance with SMACNA recommendations.

Transverse Joints

The transverse joints shown below are approved as breakaway connections.

- A maximum of two #10 (19mm) sheet metal screws on each side and on the bottom may be used. The screws should be located in the center of the slip pocket and penetrate both sides of the slip pocket.
- Dampers up to 20 inches (508mm) high may use transverse joints on the top and bottom and Drive Slip joints (**see Figure 16**) on the sides.

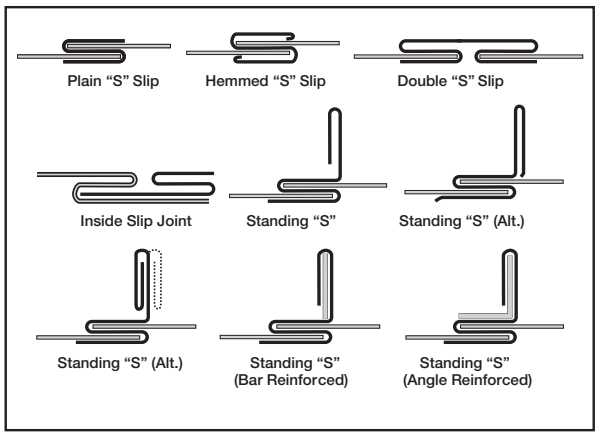


Figure 15 - Transverse Joints



Figure 16

Round and Oval Duct Breakaway Connections

Round or flat oval ducts connected to Type R or O damper collars shall be attached with #10 (19mm) sheet metal screws as follows:

- Ducts up to 22 in. (558mm) wide (or dia.) and less shall have three screws.
- Ducts larger than 22 in. (558mm) wide (or dia.) up to and including 36 in. (914mm) wide (or dia.) shall have five screws.

Factory furnished duct collars, type R and O, are also considered breakaway **(see Figure 17)**.

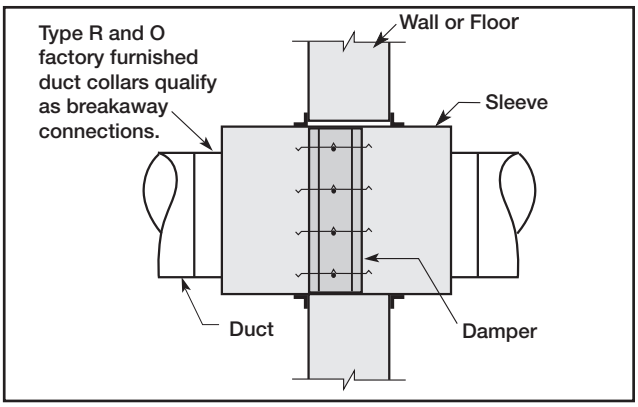


Figure 17: Type R and O Transition

Manufactured Flanged System Breakaway Connections

Flanged connection systems manufactured by Ductmate, Durodyne, Ward, Nexus, Radiant T-35m, and MEZ are approved as breakaway connections when installed as illustrated (**see Figure 18**).

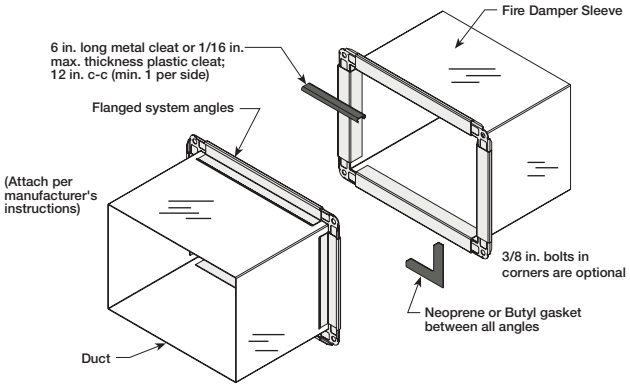


Figure 18

Proprietary Flange System Breakaway Connections

(TDC by Lockformer, TDF by Engle)

TDC and TDF systems are approved as breakaway connections when installed as described in the TDC or TDF addendum to the SMACNA Duct Construction. Standard 6 in. (152mm) metal clip may be used with spacing as shown in diagram (**see Figure 19 & 20**). 3⅜ in. (9.5mm) metal bolts and nuts may be used to fasten together corner pieces (**see Figure 21**).

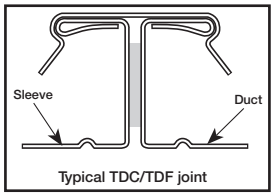


Figure 19

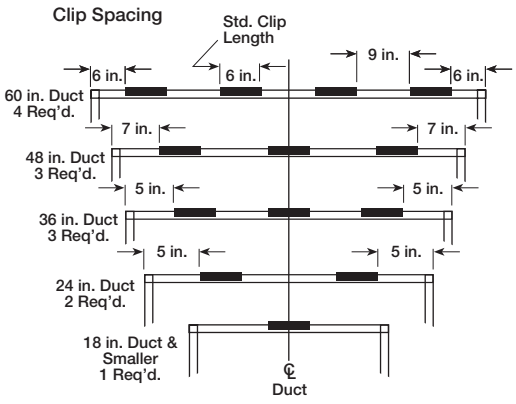


Figure 20

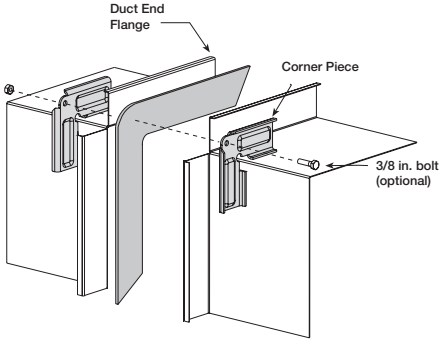


Figure 21

No Connecting Duct or Transfer Opening

Openings where duct does not attach on either side will not require a breakaway connection. Transfer openings are typical of a non-ducted installation (see **Figure 22**).

- Sleeve may end flush with the rated wall/floor on both sides
- Refer to Securing the Damper/Sleeve Assembly to Wall/Floor Openings for securing retaining angles to the sleeve.

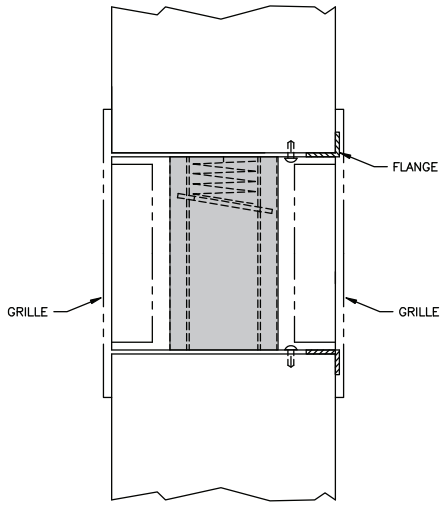


Figure 22: Transfer opening or no connecting duct

Damper Maintenance

Dampers do not typically require maintenance as long as they are kept dry and clean. If cleaning is necessary, use mild detergents or solvents. If lubrication is desired for components such as axle bearings, jackshaft bearings and jamb seals, do not use oil-based lubricants or any other lubricants that attract contaminants such as dust.

Damper Troubleshooting

The following is a possible cause and correction list for common concerns with the dampers.

Symptom	Possible Cause	Corrective Action
Damper does not fully open and/or close	Frame is 'racked' causing blades to bind on jamb seals	Adjust frame such that it is square and plumb
	Screws in damper linkage	Damper installed too far into wall. Move out to line as designated on damper label
	Contaminants on damper	Clean with a non-oil based solvent (see Damper Maintenance)
Link separated	Heat	Replace link

Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.
Specific Greenheck product warrantees can be located on greenheck.com within the product area tabs and listed in the Library under Warrantees.

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Document 481318
MULTI-BLADE FIRE AND COMBINATION FIRE SMOKE DAMPERS

DFD-XXX, DFDAF-XXX, DFDTF-XXX, FSD-XXX, FSD-XXXV, IMO-XXX,SEDFD-XXX, SEFSD-XXX, AND SSFSD-XXX
1½ and 3 Hour Fire & Combination Fire Smoke Dampers
(with factory installed sleeve and actuator)
Vertical and Horizontal Mount

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage!

These instructions apply to 1½ and 3 hour rated fire and combination fire smoke dampers mounted in: 1) masonry, block, or stud walls and 2) concrete floors. Specific requirements in these instructions are mandatory. Dampers must be installed in accordance with these instructions to meet the requirements of UL 555 and/or UL 555S.

Note: Combination fire smoke and fire dampers are manufactured and labeled for either vertical or horizontal installation. The dampers must be installed in accordance with labeling.



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Receiving and Handling

Upon receiving dampers, check for both obvious and hidden damage. If damage is found, record all necessary information on the bill of lading and file a claim with the final carrier. Check to be sure that all parts of the shipment, including accessories, are accounted for.

Dampers must be kept dry and clean. Indoor storage and protection from dirt, dust and the weather is highly recommended. Do not store at temperatures in excess of 100°F (38°C).

Safety Warning

Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read the installation, operating, and maintenance instructions thoroughly before installing or servicing this equipment.

This manual is the property of the owner and is required for future maintenance. Please leave it with the owner when the jobs is complete.

General Information

"UL CLASSIFIED (see complete marking on product)"
"UL CLASSIFIED to Canadian safety standards (see complete marking on product)"
Standard 555 & 555S (Listing #R13317)

Installation Supplements

Refer to the appropriate Greenheck installation supplements for special requirements:

- Concrete Floor with Steel Deck
- Drive Slip Breakaway Connection
- Field Installed Sleeve
- Fire Resistant Ventilated Duct Assembly
- Firestop Material
- Fusible Link Replacement
- Greenheck Test Switch
- Grille Installation
- Metal Stud in Shaftwall Partition
- Non-Concrete Horizontal Mount
- Open or Close Indicator (OCI)
- Quick Connect Breakaway Connection
- Resettable Link (RRL)
- Resettable Link with Blade Indicator (RRL/OCI)
- Sealant Supplement
- Single 3-Sided Retaining Angle Supplement
- Sleeve Extension
- Smoke Detector - Various Types
- Temperature Limited Override (TOR)
- Tunnel Corridor

Installation supplements available at www.greenheck.com.

Electrical Guidelines

Electrical Guidelines

All wiring shall be done in accordance with the National Electrical Code ANSI/NFPA-70 latest edition, any local codes that may apply, and wiring diagrams developed in compliance with the job or project design and specifications.

Important!

Electrical input may be needed for this equipment. This work should be performed by a qualified electrician. Verify power before wiring actuator. Greenheck is not responsible for any damage to, or failure of the unit caused by incorrect field wiring. To avoid causing death or serious bodily harm to building occupants, follow all instructions carefully. Dampers must close completely to preserve the integrity of the fire smoke separation.

Pre-Installation Guidelines

The following items will aid in completing the damper installation in a timely and effective manner.

1) Check the drawings for proper damper locations within the building. Visually inspect the damper for damage and verify that the Reusable Resettable Link (RRL) is in place and has not activated if provided. These electric links have a button for resetting. Visually inspect the link to verify its not missing or broken. Replace link as necessary.
2) Lift or handle damper using sleeve or frame. Do not lift damper using blades or actuators.
3) Damper has label on outside of sleeve indicating a 'No Screw' area. Do not install screws into this area as screws may interfere with unexposed blade linkage and prevent damper blades from opening and/or closing.
4) Damper has label indicating position of damper and sleeve assembly in the wall. Install accordingly to comply with manufacturer's appropriate UL Classification file number.
5) Damper must be installed into duct or opening square and free of twist or other misalignment. Out of square, racked, twisted or misaligned installations can cause excessive leakage and/or torque requirements to exceed damper/actuator design.
6) Damper and actuator must be kept clean and protected from dirt, dust and other foreign materials prior to and after installation. Examples of such foreign materials include but are not limited to:
    a) Mortar dust
    b) Drywall dust
    c) Firesafing materials
    d) Wall texture
    e) Paint overspray
7) Damper should be sufficiently covered as to prevent overspray if wall texturing or spray painting will be performed within 5 feet of the damper. Excessive dirt or foreign material deposits on the damper can cause excessive leakage and/or torque requirements to exceed damper/actuator design.
8) Caulking is not necessary, nor is it allowed, between the damper sleeve and the wall or floor opening (annular space). However, caulking may be applied to the retaining angles.
9) ACCESS: Suitable access (such that RRL's and actuators can be maintained, etc.) must be provided for damper inspection and servicing. Where it is not possible to achieve sufficient size access, it will be necessary to install a removable section of duct. (Refer to NFPA 90A).
10) The Code Authority Having Jurisdiction (AHJ) must evaluate and provide approval of final installation where variations to these instructions are necessary.

Preparation of Openings

- Frame wall openings as shown below (**see Figure 1 & 2**).
- Gypsum wall board must be fastened 12 in. (305mm) on center to all stud and runner flanges surrounding opening.
- Prepare opening between studs and sleeve assembly as shown below (**see Figure 3 & 4**).
- All construction and fasteners must meet the requirements of the appropriate wall design (See UL Fire Resistance Directory) and/or local codes.

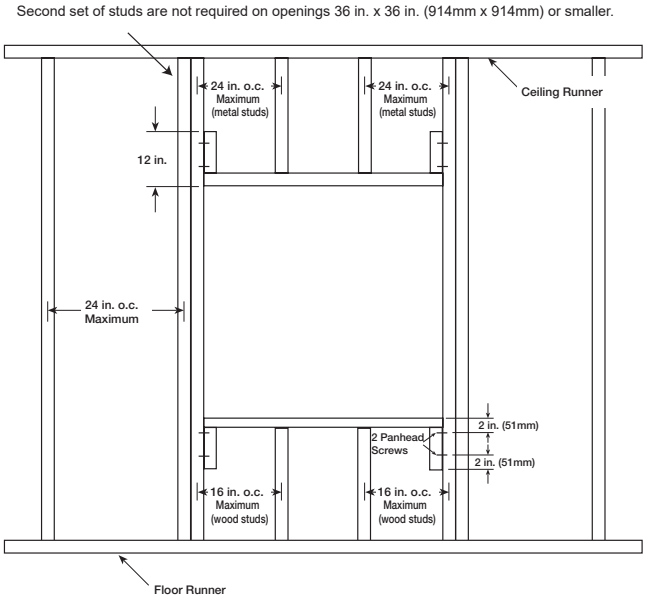


Figure 1

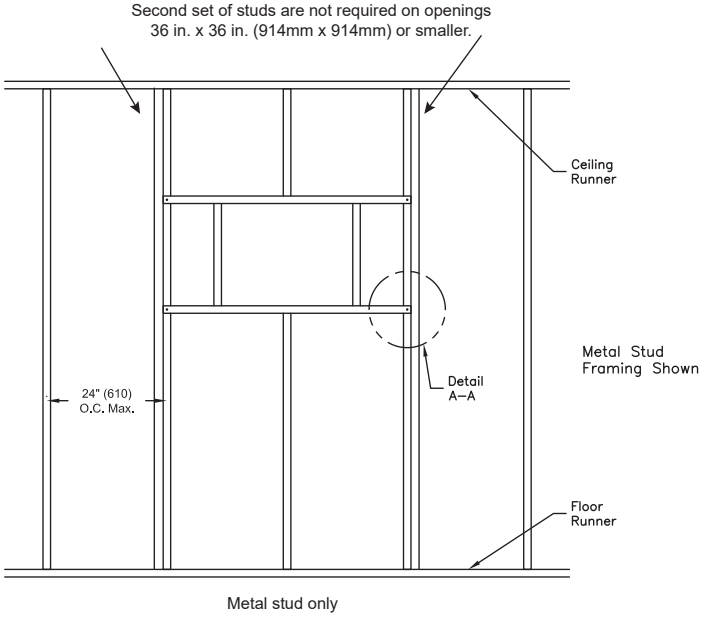
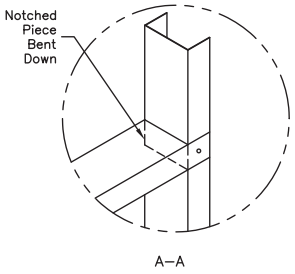


Figure 2



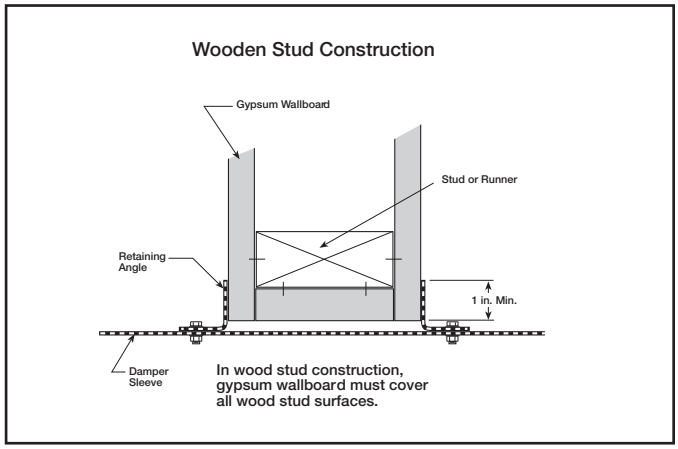


Figure 3 (2 sided angle installation shown)

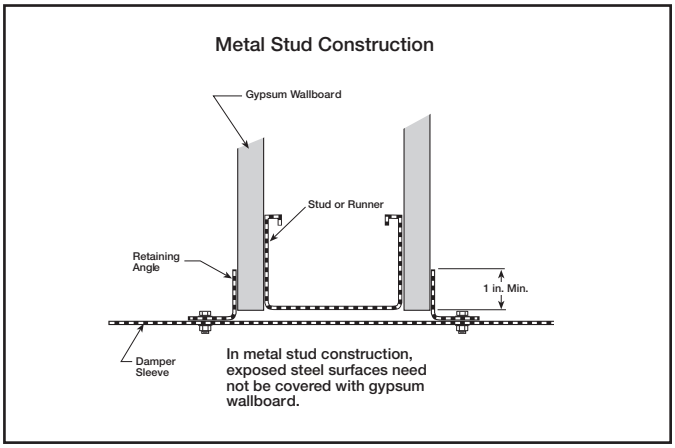


Figure 4 (2 sided angle installation shown)

Clearances Required Between Damper Sleeves & Wall/Floor Openings

Two-sided Angle Installation

Two sided angle installations require clearances for thermal expansion between the damper sleeve and the wall/floor opening. The minimum required clearances are:

- For galvanized steel fire dampers and sleeves: ⅛ in. per foot (3mm per .3 m) of damper width and ⅛ in. per foot (3mm per .3 m) height with a minimum clearance of ¼ in. (6mm), maximum of 1½ in. (38mm).
- For stainless steel fire/smoke dampers and stainless steel or galvanized sleeves: 3⁄16 in. per foot (5mm per .3 m) of damper width and height with a minimum clearance of ¼ in. (6mm), maximum of 2 in. (51mm).

These are total clearances (ignoring fastener heads) and do not need to be equally spaced around the damper.

Example:

A 12 in. x 12 in. (305mm x 305mm) will require a minimum clearance of ¼ in. (6mm) width and ¼ in. (6mm) on height

A 48 in. x 12 in. (1219mm x 305mm) damper will required a minimum clearance of ½ in. (13mm) on width and ¼ in. (13mm) on height.

Although the minimum requirements are listed above, for ease of installation the following are the recommended clearances for galvanized dampers:

- Width/Height of 48 in. (1219 mm) or less - ½ in. (13mm) clearance
- Width/Height between 48.01 in. (1220 mm) and 96 in. (2438 mm): 1 in. (25mm) clearance
- Width/Height greater than 96 in. (2438 mm): 1½ in. (38 mm) clearance

Single Side Angle Installation

On vertical mount single side angle installations there are no minimum clearance requirements between the wall opening and the damper sleeve. However, to facilitate installation, clearances between the wall opening and the damper sleeve are recommended.

On horizontal mount single side angle installations a minimum clearance is required between the outside of the damper sleeve and the floor opening of ⅛ in. per foot (3mm per .3m) of damper width and ⅛ in. per foot (3mm per .3m) height with a minimum clearance of ¼ in. (6mm).

Installing Multiple Section Damper Assemblies

A damper assembly is not restricted to a maximum number of sections, but must not exceed the section sizes and overall sizes shown (see chart below).

Some multiple section high damper assemblies require additional structural support between the damper frames. The following multiple section high damper assemblies require the use of either a support mullion between the damper frames as shown in **Figure 5** or individual sleeves around each row of dampers as shown in **Figure 6**:

- All horizontal mount dampers
- All vertical mount dampers over 72 in. (1829mm) high and greater than 2 sections wide
- All vertical mount dampers rated for more than 4 in. wg (1 kPa)
- All vertical mount dampers that use fusible links as a closure device

The damper sections must be attached together with #10 (¾ in. max. [19mm]) sheet metal screws, ¼ in. (6mm) diameter nuts and bolts, tack or spot welds, or 3⁄16 in. (48mm) diameter steel pop rivets. Attachments must be spaced a maximum of 6 in. (152mm) on centers and a maximum of 2 in. (51mm) from corners. Attachments must be made on front face and back face (air entering and air exiting side) of damper sections.

Note: Dampers ordered for individual installation may not be installed together. The full assembly size must be specified at the time the dampers are ordered.

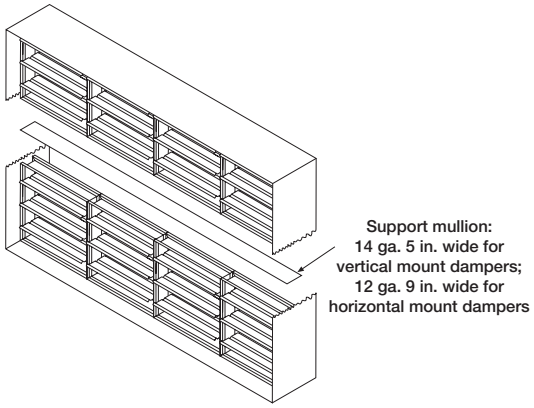


Figure 5: Single sleeve around outside with support mullion

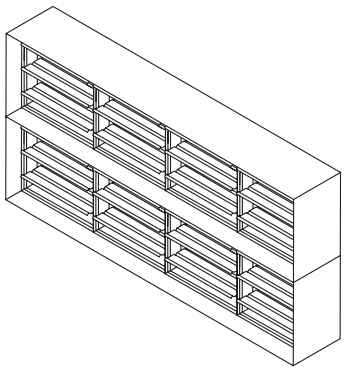


Figure 6: Two individually sleeved units with no mullions

Maximum Assembly Tables

Horizontal Mount

Damper Model	Maximum Single Section Size (inches)	Maximum Overall Size for Multi-Section Dampers (inches)
DFD-210	36 x 36 or 32 x 50	128 x 96
DFD-230	36 x 36 or 32 x 48	72 x 48
DFDAF-310	32 x 50	144 x 96
DFDTF-210	32 x 36	96 x 72
	32 x 48	64 x 48 or 32 x 96
FSD-211, 212, 213	36 x 48 or 32 x 50	144 x 96
FSD-211M, 212M	30 x 36	144 x 72
FSD-231	36 x 36 or 32 x 48	72 x 48
FSD-231M	36 x 36	72 x 48
FSD-311, 312	32 x 50	144 x 96
FSD-311M, 312M	32 x 50	128 x 96
FSD-331, DFDAF-330	30 x 48	144 x 96
IMO-310	32 x 50	NA
IMO-311	32 x 50	NA
SEDFD-210, SEFSD-211	24 x 30	48 x 30
SSFSD-211	24 x 30	48 x 30

Vertical Mount

Damper Model	Maximum Single Section Size (inches)	Maximum Overall Size for Multi-section Dampers (inches)
DFD-210	36 x 36 or 32 x 50	128 x 100
DFD-230	36 x 36 or 32 x 50	72 x 48
DFDAF-310	32 x 50	128 x 100
DFDTF-210	32 x 36	96 x 72
	32 x 50	64 x 50
FSD-211, 212, 213	36 x 48 or 32 x 50	128 x 100
FSD-231	36 x 36 or 32 x 48	72 x 48
FSD-311, 311M, 312, 312M	32 x 50	128 x 100
FSD-311V	50 X 32	100 x 32
FSD-331, DFDAF-330	32 x 36 or 30 x 48	120 x 96
IMO-311	32 x 50	NA
	32 x 50	NA
SEDFD-210, SSDFD-210	24 x 30 or 22 x 36	48 x 30
SEFSD-211 SSFSD-211	24 x 30 or 22 x 36	88 x 72

Note: FSD model dampers fitted with a fusible link closure device are limited to single section sizes.

Inserting Damper into Wall/Floor Openings

Insert the sleeved damper assembly into the prepared opening. Refer to label on outside of sleeve for the recommended location of the damper in the wall or floor (see Dimension A and Detail 1, **Figure 7**).

Special attention must be paid to ensure the following:

1) The ℄ (centerline) of the damper frame remains within the plane of the wall or floor
2) Attachments made through the retaining angle do not penetrate the 'No Screw' area designated on the damper sleeve.
3) The sleeve does not extend more than 16 in. (406mm) beyond the wall or floor on the actuator side of the damper and 6 in. (152mm) on the side opposite the actuator. The sleeve may also extend up to 16 in. (406mm) beyond the wall or floor if the damper has a factory supplied access door.

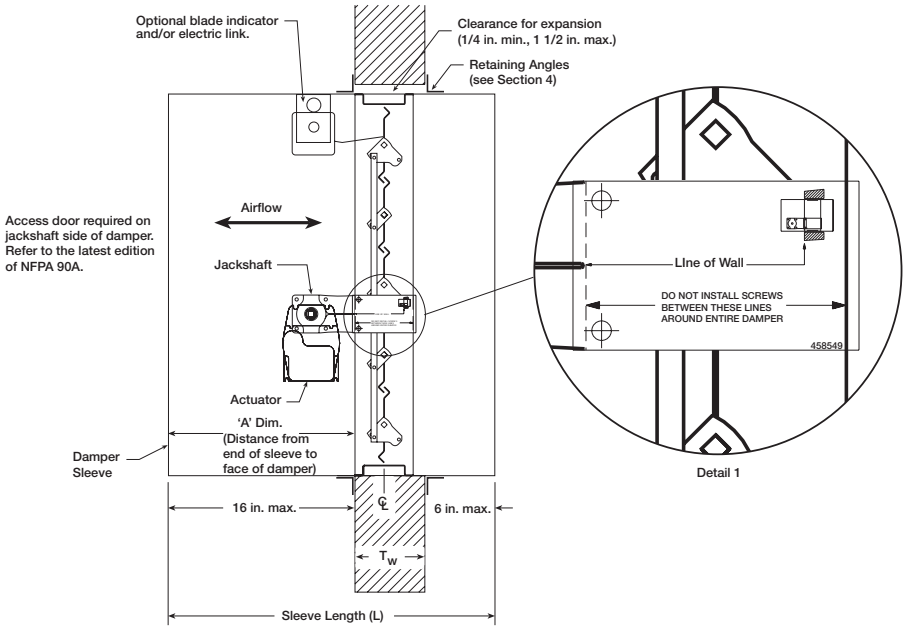


Figure 7: Properly Installed Combination fire smoke damper

Most fire and combination fire smoke dampers come with factory supplied sleeves. For field supplied sleeves, see the Field Supplied Sleeves supplement at www.greenheck.com. The following are recommended sleeve lengths for various wall thicknesses:

Wall Thickness Dimension (T_W)	Recommended Sleeve Length Dimension (L)
4 - 6 in. (102mm - 152mm)	16 in. (406mm)
7 - 10 in. (178mm - 254mm)	21 in. (533mm)
11 - 13 in. (279mm - 330mm)	24 in. (610mm)

Securing the Damper/Sleeve Assembly to Wall/Floor Openings

All fire and combination fire smoke dampers may utilize the two sided angle installation method described below. 1½ hour rated fire and combination fire smoke dampers may use the single sided angle installation method up to the following maximum sizes:

- Vertical mount: 80 in. W x 50. in. H (2032mm W x 1270mm H), 50 in. W x 80 in. H (1270mm W x 2032mm H), or 40 in. W x 100 in. H (1016mm W x 2540mm).
- Horizontal mount: 144 in. W x 96 in. H (3658mm W x 2438mm H)

- **Retaining Angle Gauge**: Retaining angles for 1½ hour rated dampers with a width and height 48 in. (1219mm) or less must be a minimum of 20 ga. (1mm). Retaining angles for all 3 hour rated dampers and all dampers with a width or height greater than 48 in. (1219mm) must be a minimum of 16 gauge (1.5mm).
- **Retaining Angle Size:** The leg of the retaining angle on the damper sleeve shall be a minimum of 1¼ in. (32mm). The leg of the retaining angle on the wall/floor shall be long enough to cover the annular space and overlap the wall/floor by a minimum of 1 in. (25mm).
- **Retaining Angle Attachment to Sleeve:** Retaining angles must be attached to the damper using one or more of the following methods of attachment (refer to label on outside of sleeve for 'No Screw' area):
  - Tack or spot welds
  - #10 (¾ in. [19mm] max.) sheet metal screws
  - ¼ in. (6mm) bolts and nuts
  - 3⁄16 in. (5mm) steel pop rivets

A minimum of two connections per side, top, and bottom, 12 in. (305mm) O.C. maximum for openings of 48 in. W x 36 in. H (1219mm x 914mm) and less. Dampers greater than 48 in. wide (1219mm) or 36 in. high (914mm) require the connections to be no more than 6 in. (152mm) O.C.

The angles must be attached to all 4 sides of the sleeve. Ensure that fasteners do not interfere with the operation of the damper. The angles need not be attached to each other at the corners.

- **Retaining Angle Attachment to Wall/Floor:**

  Two sided Angle Method: For two sided angle installations the retaining angles shall not be attached to the wall/floor (**see Figure 8**).

  Single Sided Angle Method: For single side installations the retaining angles must be attached to the wall/floor (see **Figures 9-12**). For metal stud partitions only, the single-side mounting angle may be directly attached to the metal stud prior to the installation of the drywall.

  - Retaining angles must be attached to the partition using one of the methods shown below:
    - Drywall screws of a length such that the screw engages the steel stud/track by ½ in. (13mm) (steel framing).
    - Drywall screws of a length such that the screw engages the wood stud by 1¾ in. (44mm) (wood framing).
    - Steel anchors or self tapping concrete screws penetrating masonry or block 1¼ in. (31mm).
  - A minimum of two connections per side are required. Additional connections made at a maximum of 12 in. (305mm) O.C. maximum for openings of 48 in. W x 36 in. H (1219mm x 914mm) and less. Dampers greater than 48 in. wide (1219mm) or 36 in. high (914mm) require the connections to be no more than 6 in. (152mm) O.C.

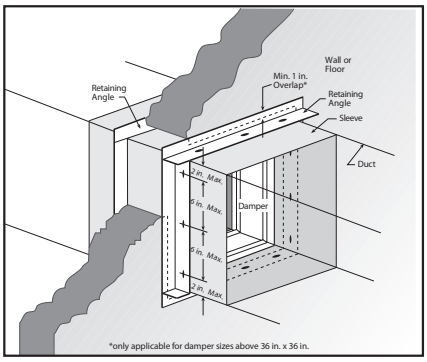


Figure 8: 2 sided angle installation method

Securing the Damper/Sleeve Assembly to Wall/Floor Openings cont.....

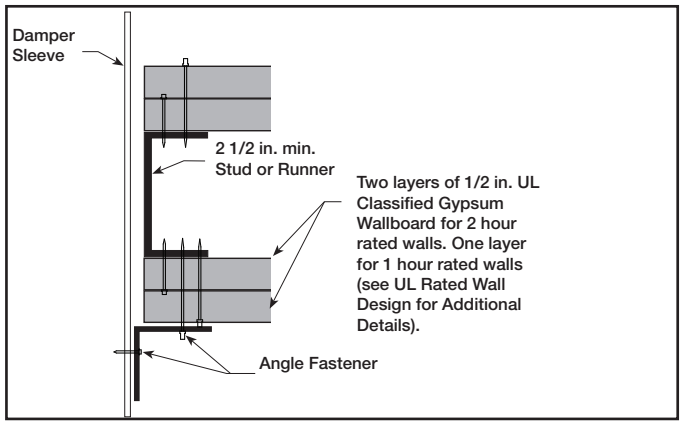


Figure 9: Single Side Angle With Steel Stud Wall - Angle Over Wallboard

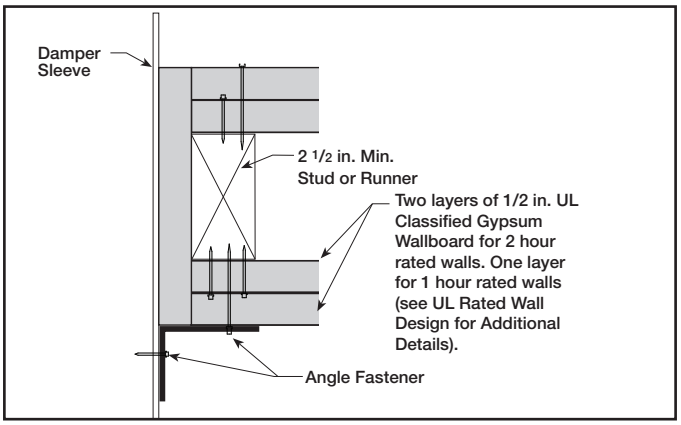


Figure 10: Single Side Angle With Wood Stud Wall

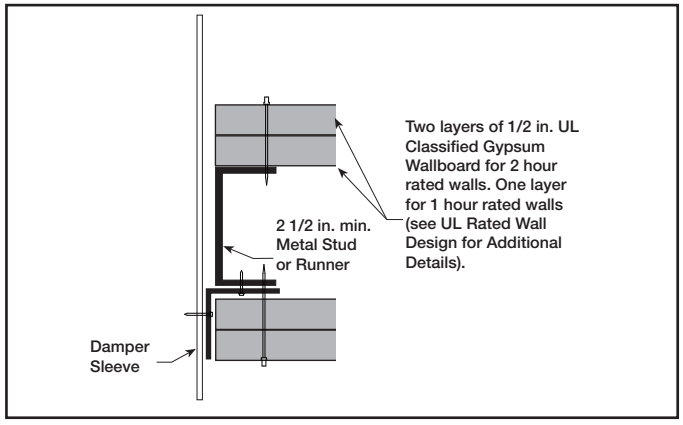


Figure 11: Single Side Angle With Steel Stud Wall - Angle Under Wallboard

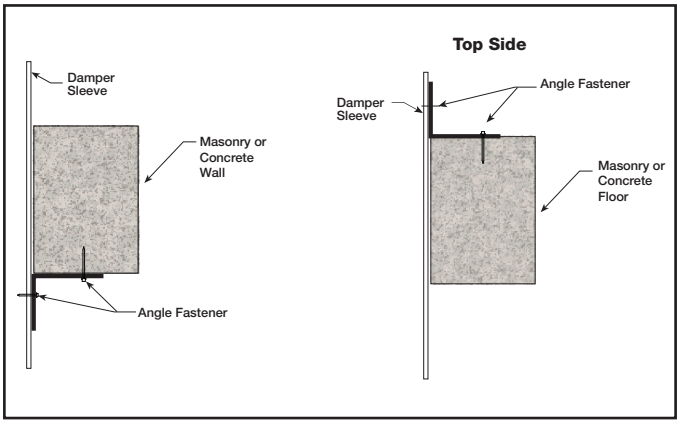


Figure 12: Single Side Angle With Masonry or Concrete Wall and Floor

Grille Installations (Dampers up to 36 in. x 36 in. [914mm x 914mm])

Retaining angles used in conjunction with grille installations must be a minimum of ⅝ in. x 1 in. (15mm x 25mm) 16 gauge (1.5mm) steel. Space screws a maximum of 6 in. (152mm) on center and a maximum of 2 in. (51mm) from the corners (minimum of 2 screws per side). See **Figure 13** and **Figure 14.**

Note: Screws used to attach grille are allowed to penetrate reversed angle leg.

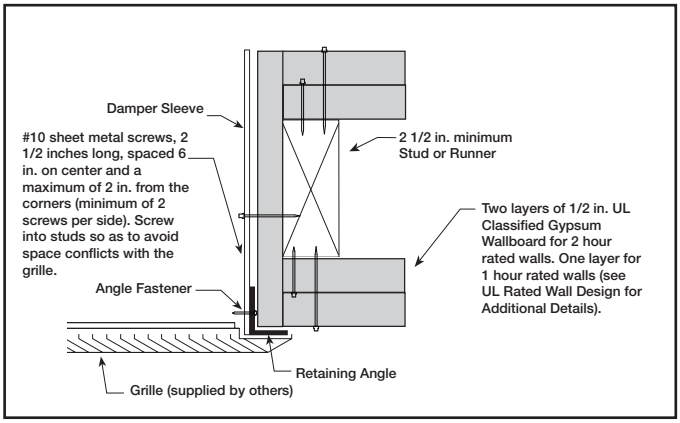


Figure 13: Wood Stud - Grille

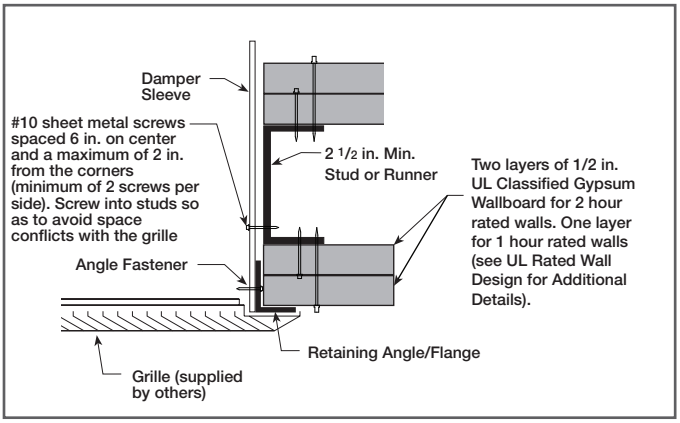


Figure 14: Metal Stud - Grille

Duct to Sleeve Connection

Sleeve Gauge and Connection Type Requirements

The size of the damper/duct determines the required sleeve gauge and the required duct to sleeve connection (see table to the right). The sleeve thickness must also not be less than the gauge of the connecting duct. Any duct connection other than the breakaway connections described below are considered rigid.

Sleeve Gauge	Duct Dimension	Type of Duct to Sleeve Connection Permitted
14 ga. (0.075 in.) - 10 ga. (0.138 in.) [2mm - 3.5mm]	All duct sizes	Rigid or Breakaway
16 ga. (0.060 in.) [1.5mm]	36 in. (914mm) max. width 24 in. (610mm) max. height 24 in. (610mm) diameter	Rigid or Breakaway
16 ga. (0.060 in.) [1.5mm]	All duct sizes	Breakaway only
18 ga. (0.048 in.) [1.2mm]	85 in. (2159mm) wide and over	
20 ga. (0.036 in.) [0.9mm]	55 in. - 84 in. wide (1397mm - 2134mm)	
22 ga. (.030 in.) [0.76mm]	31 in. - 54 in. wide (787mm - 1372mm)	
24 ga. (0.024) [0.6mm]	13 in. - 30 in. wide (330mm - 762mm)	
26 ga. (0.018 in.) [0.46mm]	12 in. wide and under (305mm)	
See Breakaway Connection section for additional information. UL Standard 555 requires all ducts to terminate at fire damper sleeves.		

Approved Breakaway Connections

All breakaway connections described below may utilize the following duct sealants: PA2084T duct sealant adhesive manufactured by Precision, DP1010 water base duct sealant manufactured by Design Polymetrics, Grey Pookie, Ductmate PROseal®, or CL Ward S Seal in accordance with SMACNA recommendations.

Transverse Joints

The transverse joints shown below are approved as breakaway connections.

- A maximum of two #10 (19mm) sheet metal screws on each side and on the bottom may be used. The screws should be located in the center of the slip pocket and penetrate both sides of the slip pocket.
- Dampers up to 20 inches (508mm) high may use transverse joints on the top and bottom and Drive Slip joints (**see Figure 16**) on the sides.

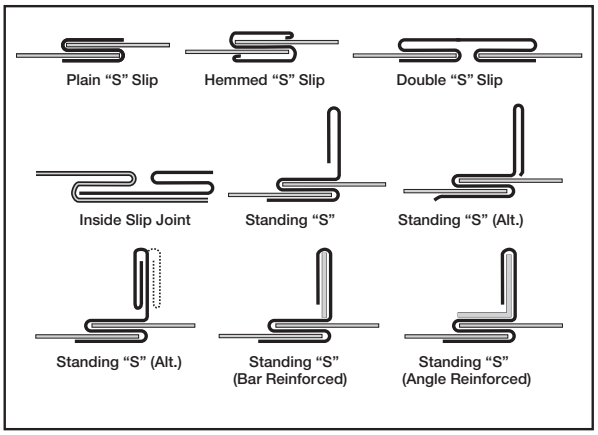


Figure 15 - Transverse Joints



Figure 16

Approved Breakaway Connections....

Round and Oval Duct Breakaway Connections

Factory furnished duct collars, type R and O, are also considered breakaway **(see Figure 17)**.

Round or flat oval ducts connected to Type R or O damper collars shall be attached with #10 (19mm) sheet metal screws as follows:

- Ducts up to 22 in. (558mm) wide (or dia.) and less shall have three screws.
- Ducts larger than 22 in. (558mm) wide (or dia.) up to and including 36 in. (914mm) wide (or dia.) shall have five screws.

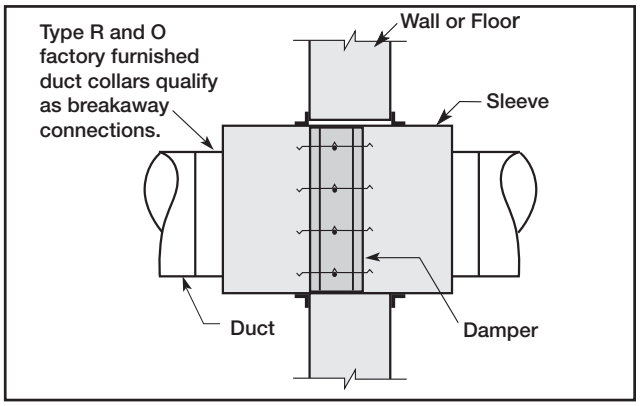


Figure 17: Type R and O Transition

Manufactured Flanged System Breakaway Connections

Flanged connection systems manufactured by Ductmate, Durodyne, Ward, Nexus, Radiant T-35m, and MEZ are approved as breakaway connections when installed as illustrated (**see Figure 18**).

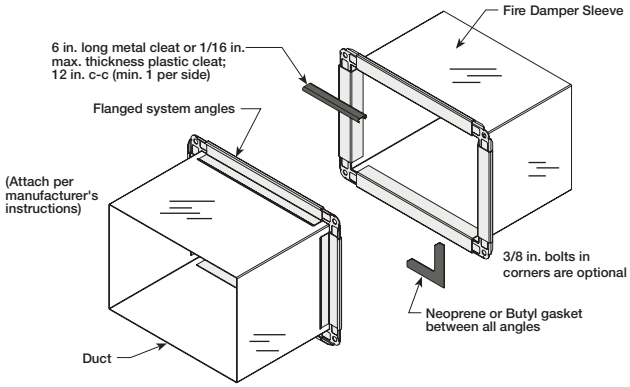


Figure 18

Proprietary Flange System Breakaway Connections

(TDC by Lockformer, TDF by Engle)

TDC and TDF systems are approved as breakaway connections when installed as described in the TDC or TDF addendum to the SMACNA Duct Construction. Standard 6 in. (152mm) metal clip may be used with spacing as shown in diagram (**see Figure 19 & 20**). 3⅜ in. (9.5mm) metal bolts and nuts may be used to fasten together corner pieces (**see Figure 21**).

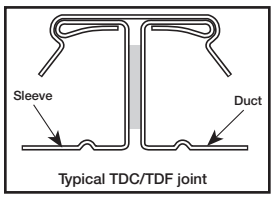


Figure 19

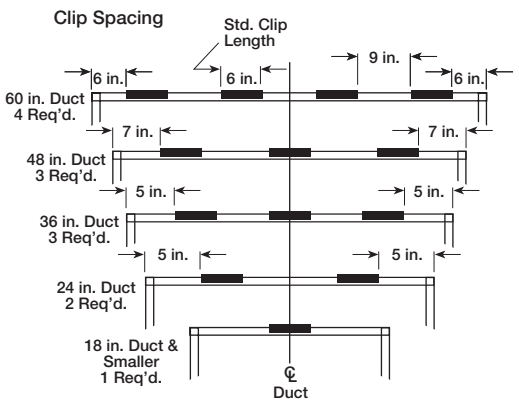


Figure 20

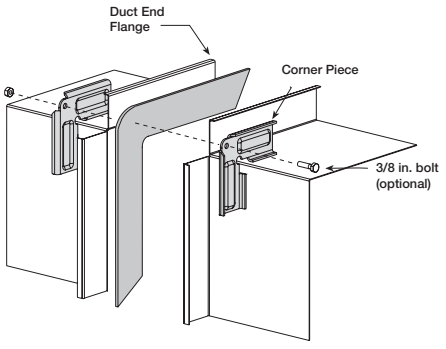


Figure 21

Actuator and Temperature Response Device Connections

Actuator Connections

Electrical and/or pneumatic connections to damper actuators should be made in accordance with wiring and piping diagrams developed in compliance with applicable codes, ordinances and regulations (see **Electrical Guidelines**).

Temperature Response Device Connections

RRL - The RRL (resettable link device) incorporates a single thermostat. When the thermostat temperature is reached the sensor interrupts power to the actuator and the actuator's spring return mechanism causes the damper to close. Refer to **Figure 22** for wiring of the RRL thermostat.

OCI - The OCI (open or closed indicator) option contains two single pole single throw switches used to indicate the damper blade position. The switches provide a positive open and closed signal and can be used in conjunction with remote indicator lights. Refer to **Figure 23** for wiring of the OCI option.

RRL /OCI - The RRL/OCI performs the function of an RRL and OCI (see description above). Refer to **Figure 24** for wiring of the RRL/OCI option.

TOR - The TOR (temperature override device) option incorporates two thermostats with fixed settings (usually 165°F [74°C] and 350°F [177°C]). The primary sensor (the sensor with the lower temperature setting) can be bypassed by an external contact closure allowing the damper to reopen until the secondary temperature is reached (the sensor with the higher temperature setting). See **Figure 25.**

The TOR assembly contains two single pole single throw switches used to indicate damper blade position. The switches provide a positive open and closed signal and can be used in conjunction with remote indicator lights. See **Figure 25** for wiring of the TOR thermostats and indicator switches.

If either the TOR or the RRL is ordered with a pneumatic actuator, an EP switch is required with an appropriate electric power circuit to allow the electric thermostat to control the pneumatic actuator.

Ratings (Figure 22, 23, 24, & 25)

Integral Switch Type: Single Pole, double throw

Electrical Capacity: 10 Amps, 1/3 hp, 120 or 240 Vac
½ Amp, 125 Vdc;
¼ Amp 250 Vdc
5 Amps, 120 Vac “L” (lamp load)
1.0 Amps, 24 Vac
1.5 Amps, 24 Vdc

Temperature Limit: 165° F (standard primary sensor)
212° F (optional primary sensor)
250° F (secondary sensor)*
350° F (secondary sensor)*

* based on actuator temperature rating

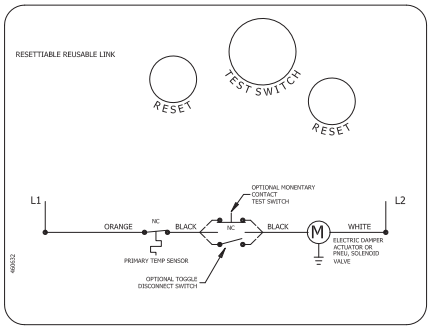


Figure 22: RRL Wiring

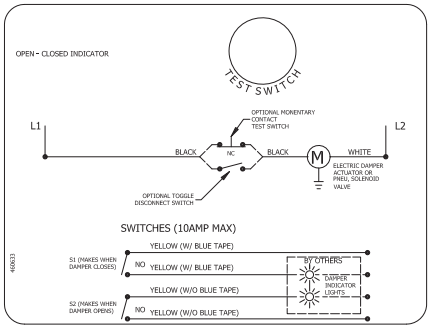


Figure 23: OCI

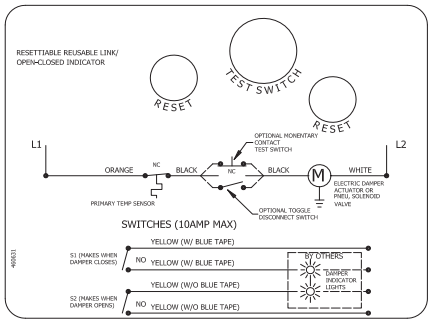


Figure 24: RRL/OCI

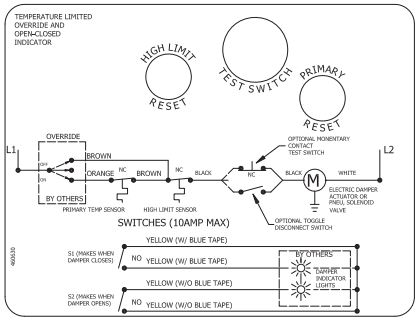


Figure 25: TOR

Damper Maintenance

Dampers do not typically require maintenance as long as they are kept dry and clean. If cleaning is necessary, use mild detergents or solvents. If lubrication is desired for components such as axle bearings, jackshaft bearings and jamb seals, do not use oil-based lubricants or any other lubricants that attract contaminants such as dust.

Dampers and their actuator(s) must be maintained, cycled, and tested a minimum in accordance with:

- The latest editions of NFPA 80, 90A, 92A, 92B, 101, 105, UL864, AMCA 503-03 and local codes.
- Actuator manufacturer recommendations.

Damper Troubleshooting

The following is a possible cause and correction list for common concerns with the dampers.

Symptom	Possible Cause	Corrective Action
Damper does not fully open and/or close	Frame is 'racked' causing blades to bind on jamb seals	Adjust frame such that it is square and plumb
	Actuator linkage loose	Close damper, disconnect power, adjust and tighten linkage
	Defective motor	Replace
	Screws in damper linkage	Damper installed too far into wall. Move out to line as designated on damper label
	Contaminants on damper	Clean with a non-oil based solvent (see Damper Maintenance)
RRL or TOR sensor tripped	Heat	Push reset button located on backside of RRL or TOR
Damper does not operate	No power supplied to the actuator	Add power supply

Our Commitment

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Specific Greenheck product warranties can be located on greenheck.com within the product area tabs and listed in the Library under Warranties.

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Document Number 481319
Fire and Combination Fire Smoke Dampers
DFDR-XXX, FDR-XXX, FSDR-XXX, SEDFDR-XXX, SEFSDR-XXX, SSDFDR-XXX, SSFDR-XXX SSFSDR-XXX Series
1½ Hour
Vertical and Horizontal Mount

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage!

These instructions apply to 1½ hour rated fire and combination fire smoke dampers mounted in: 1) masonry, block, or stud walls and 2) concrete floors or ceilings. Specific requirements in these instructions are mandatory. Dampers must be installed in accordance with these instructions to meet the requirements of UL 555 and/or UL 555S.

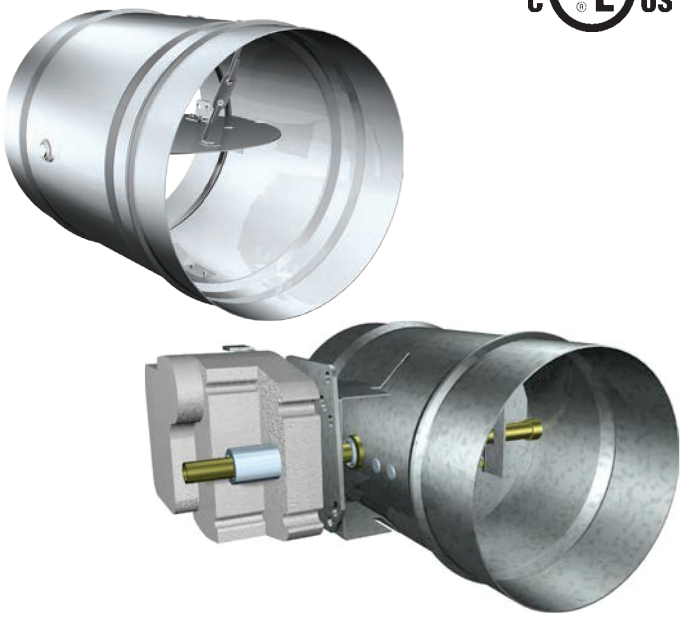


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Receiving and Handling

Upon receiving dampers, check for both obvious and hidden damage. If damage is found, record all necessary information on the bill of lading and file a claim with the final carrier. Check to be sure that all parts of the shipment, including accessories, are accounted for.

Dampers must be kept dry and clean. Indoor storage and protection from dirt, dust and the weather is highly recommended. Do not store at temperatures in excess of 100°F (38°C).

Safety Warning

Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read the installation, operating, and maintenance instructions thoroughly before installing or servicing this equipment.

This manual is the property of the owner and is required for future maintenance. Please leave it with the owner when the jobs is complete.

General Information

"UL CLASSIFIED (see complete marking on product)"
"UL CLASSIFIED to Canadian safety standards (see complete marking on product)"
Standard 555 & 555S (Listing #R13317)

Installation Supplements only available on greenheck.com

- Steel Deck Supplement

Electrical Guidelines

Electrical Guidelines

All wiring shall be done in accordance with the National Electrical Code ANSI/NFPA-70 latest edition, any local codes that may apply, and wiring diagrams developed in compliance with the job or project design and specifications.

Important!

Electrical input may be needed for this equipment. This work should be performed by a qualified electrician. Verify power before wiring actuator. Greenheck is not responsible for any damage to, or failure of the unit caused by incorrect field wiring. To avoid causing death or serious bodily harm to building occupants, follow all instructions carefully. Dampers must close completely to preserve the integrity of the fire smoke separation.

Pre-Installation Guidelines

The following items will aid in completing the damper installation in a timely and effective manner.

1) Check the drawings for proper damper locations within the building. Visually inspect the damper for damage and verify that the Reusable Resettable Link (RRL) is in place and has not activated if provided. These electric links have a button for resetting. Visually inspect the link to verify its not missing or broken. Replace link as necessary.
2) Lift or handle damper using sleeve or frame. Do not lift damper using blades or actuators.
3) Damper has label on outside of sleeve indicating a 'No Screw' area. Do not install screws into this area as screws may interfere with unexposed blade linkage and prevent damper blades from opening and/or closing.
4) Damper has label indicating position of damper and sleeve assembly in the wall. Install accordingly to comply with manufacturer's appropriate UL Classification file number.
5) Damper must be installed into duct or opening square and free of twist or other misalignment. Out of square, racked, twisted or misaligned installations can cause excessive leakage and/or torque requirements to exceed damper/actuator design.
6) Damper and actuator must be kept clean and protected from dirt, dust and other foreign materials prior to and after installation. Examples of such foreign materials include but are not limited to:
    a) Mortar dust
    b) Drywall dust
    c) Firesafing materials
    d) Wall texture
    e) Paint overspray
7) Damper should be sufficiently covered as to prevent overspray if wall texturing or spray painting will be performed within 5 feet of the damper. Excessive dirt or foreign material deposits on the damper can cause excessive leakage and/or torque requirements to exceed damper/actuator design.
8) Caulking is not necessary, nor is it allowed, between the damper sleeve and the wall or floor opening (annular space). However, caulking may be applied to the retaining angles.
9) ACCESS: Suitable access (such that RRL's and actuators can be maintained, etc.) must be provided for damper inspection and servicing. Where it is not possible to achieve sufficient size access, it will be necessary to install a removable section of duct. (Refer to NFPA 90A).
10) The Code Authority Having Jurisdiction (AHJ) must evaluate and provide approval of final installation where variations to these instructions are necessary.

Preparation of Openings

- Frame wall openings as shown below (**see Figure 1 & 2**).
- Gypsum wall board must be fastened 12 in. (305mm) on center to all stud and runner flanges surrounding opening.
- Prepare opening between studs and sleeve assembly as shown below (**see Figure 3**).
- All construction and fasteners must meet the requirements of the appropriate wall design (See UL Fire Resistance Directory) and/or local codes.

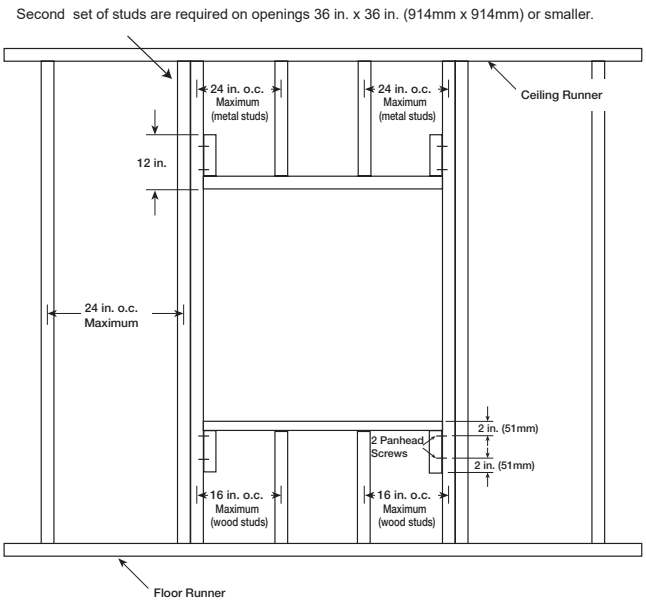


Figure 1

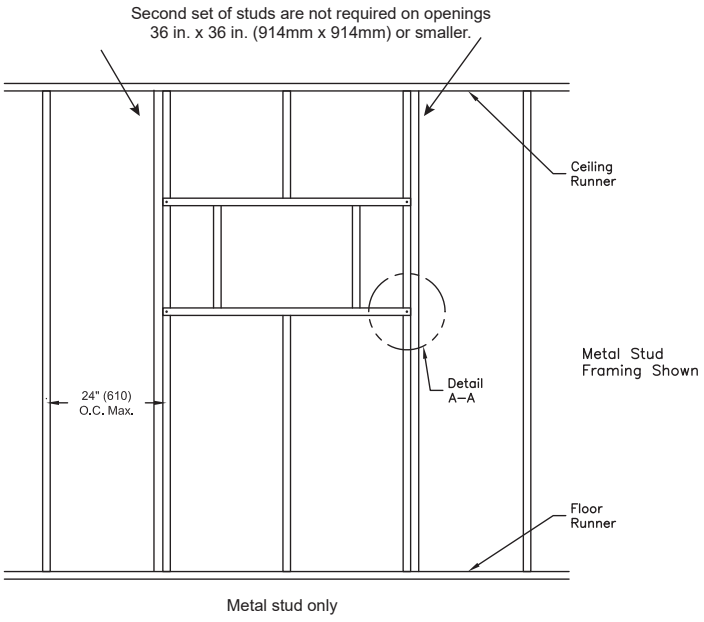
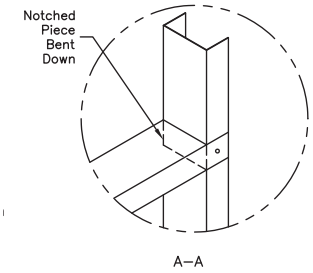


Figure 2



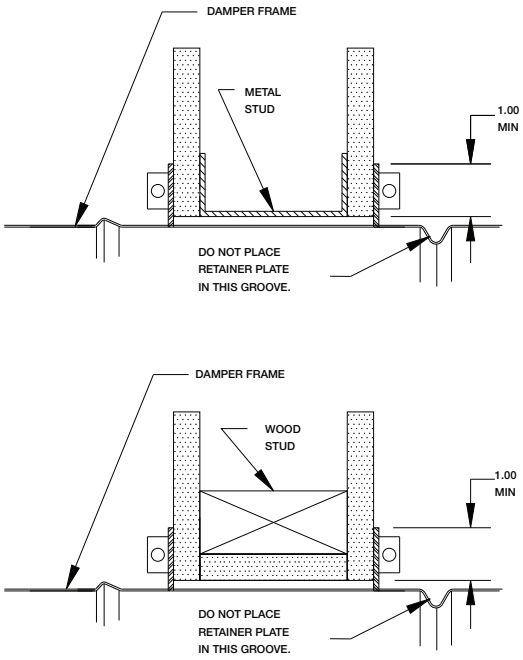


Figure 3

Clearances Required Between Damper Sleeves and Wall/Floor Openings

Fire damper assemblies expand during periods of intense heat. Therefore, it is essential that openings in walls or floors be larger than the fire or combination fire smoke damper assembly to allow for this expansion. The wall/floor opening must be a minimum of ⅞ in. (22mm) larger than the outside diameter of the damper.

Maximum Size Table

Damper Model	Maximum Size
DFDR-510	24 in. (610mm)
FDR-510	
FSDR-511	
FSDR-512	
SEDFDR-510	
SEFSDR-511	
SSDFDR-510	
SSFDR-510	
SSFSDR-511	

Inserting Damper into Wall/Floor Openings

Insert the damper assembly into the prepared opening, to appropriate depth (see **Figure 3 & 4**).

Recommended maximum and minimum insertion depth can be exceeded if:

Special attention must be paid to ensure the following:

1) The ℄ (centerline) of the damper frame remains within the plane of the wall or floor
2) The sleeve does not extend more than 16 in. (406mm) beyond the wall or floor on the actuator side of the damper and 6 in. (152mm) on the side opposite the actuator. The sleeve may also extend up to 16 in. (406mm) beyond the wall or floor if the damper has a factory supplied access door.

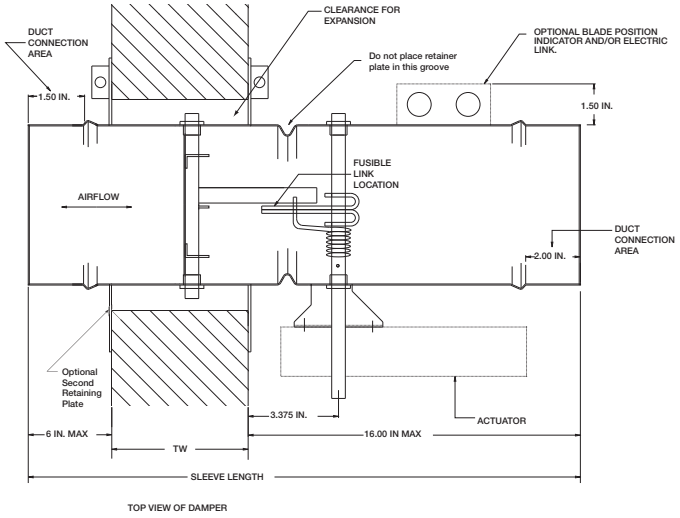


Figure 3: FSDR/SEFSDR/SSFSDR

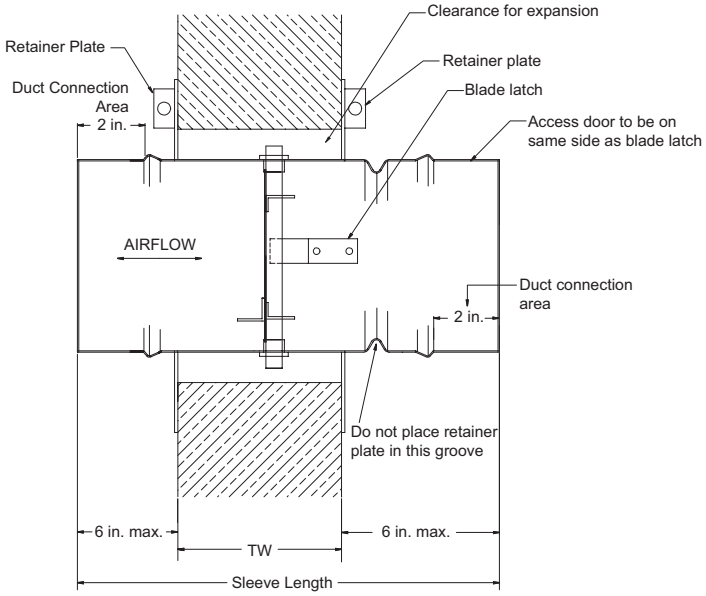


Figure 4: DFDR/FDR/SEDFDR/SSDFDR/SSFDR

Securing the Damper/Sleeve Assembly to Wall and Floor Openings

Damper assemblies must be installed in wall and floor openings using a single retaining plate on either side of the wall/floor or by using a retaining plate on both sides of the wall/floor. The use of a second retaining plate is provided with the dampers. A second retaining plate can be ordered as an option.

- The retaining plate(s) will open up for easy installation when the clamping screw is loosened. If necessary, remove the clamping screw and nut (see **Figure 5**).
- Position the retaining plate between the blade axle and the actuator shaft as shown in **Figure 3 & 4**. Do not place the retaining plate in the groove. IMPORTANT: The clamping mechanism should face away from the wall/floor.
- Place the damper and attached retainer plate into the wall/floor opening.
- If a second retaining plate is being used, secure it on the opposite side of the wall/floor.
- Verify position, blade orientation, and actuator clearance then tighten the retainer plate clamping screws.
- The retainer plate(s) must overlap the wall/floor opening a minimum of 1 inch (25mm).
- Secure the retainer plate(s) to the wall at the four corners of each plate when two retainer plates are used and also within ¾ in. (19mm) of the center of each side when one retainer plate is used. The following fasteners shall be used:
  - #8 or #10 screws of a length such that the screw engages the steel stud/track by ½ in. (13mm)(steel framing).
  - #8 or #10 screws of a length such that screw engages the wood stud by 1¾ in. (44mm) (wood framing)
  - Steel anchors or self tapping concrete screws penetrating masonry or block by 1¼ in. (32mm).

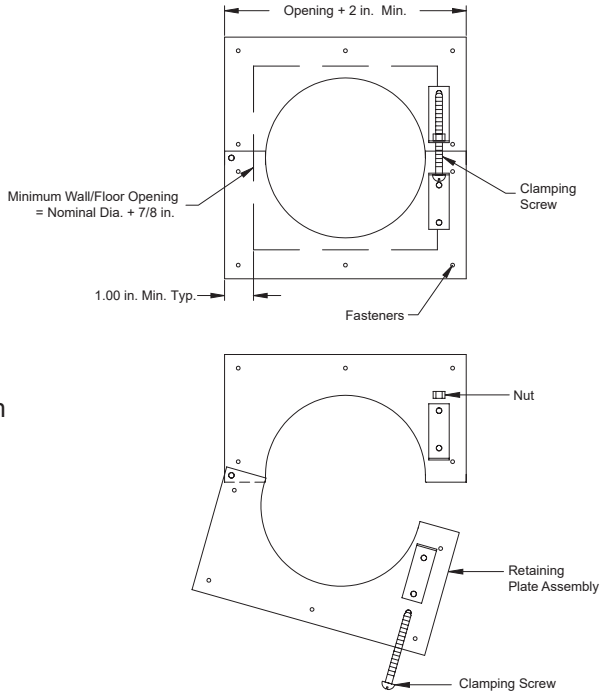


Figure 5: Retaining Plates

Duct to Sleeve Connections

Sleeve Gauge and Connection Type Requirements

Round duct connections to shall be attached with #8 or #10 sheet metal screws as follows:

- Ducts 22 in. (558mm) dia. and smaller shall have three screws.
- Ducts larger than 22 in. (558mm) dia. up to and iincluding 24 in. (610mm) dia. shall have five screws.

Note: All connections described may have duct sealant, PA2084T duct sealant adhesive manufactured by Precision, DP1010 water base duct sealant manufactured by Design Polymetrics, Grey Pookie, Ductmate PROseal®, or CL Ward S Seal applied in accordance with SMACNA recommendations.

Actuator and Temperature Response Device Connections

Actuator Connections

Electrical and/or pneumatic connections to damper actuators should be made in accordance with wiring and piping diagrams developed in compliance with applicable codes, ordinances and regulations (see **Electrical Guidelines**).

Temperature Response Device Connections

RRL - The RRL (resettable link device) incorporates a single thermostat. When the thermostat temperature is reached, the sensor interrupts power to the actuator and the actuator's spring return mechanism causes the damper to close. Refer to **Figure 6** for wiring of the RRL thermostat.

OCI - The OCI (open or closed indicator) option contains two single pole single throw switches used to indicate the damper blade position. The switches provide a positive open and closed signal and can be used in conjunction with remote indicator lights. Refer to **Figure 7** for wiring of the OCI option.

RRL /OCI - The RRL/OCI performs the function of an RRL and OCI (see description above). Refer to **Figure 8** for wiring of the RRL/OCI option.

TOR - The TOR (temperature override device) option incorporates two thermostats with fixed settings (usually 165°F [74°C] and 350°F [177°C]). The primary sensor (the sensor with the lower temperature setting) can be bypassed by an external contact closure allowing the damper to reopen until the secondary temperature is reached (the sensor with the higher temperature setting). See **Figure 9.**

The TOR assembly contains two single pole single throw switches used to indicate damper blade position. The switches provide a positive open and closed signal and can be used in conjunction with remote indicator lights. See **Figure 25** for wiring of the TOR thermostats and indicator switches.

If either the TOR or the RRL is ordered with a pneumatic actuator, an EP switch is required with an appropriate electric power circuit to allow the electric thermostat to control the pneumatic actuator.

Ratings (Figure 6, 7, 8, & 9)

Integral Switch Type: Single Pole, double throw

Electrical Capacity: 10 Amps, 1/3 hp, 120 or 240 Vac
½ Amp, 125 Vdc;
¼ Amp 250 Vdc
5 Amps, 120 Vac “L” (lamp load)
1.0 Amps, 24 Vac
1.5 Amps, 24 Vdc

Temperature Limit: 165° F (standard primary sensor)
212° F (optional primary sensor)
250° F (secondary sensor)*
350º F (secondary sensor)*

* based on actuator temperature rating

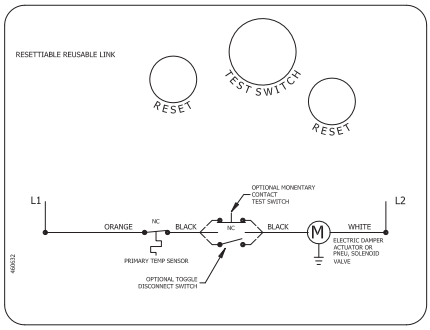


Figure 6: RRL Wiring

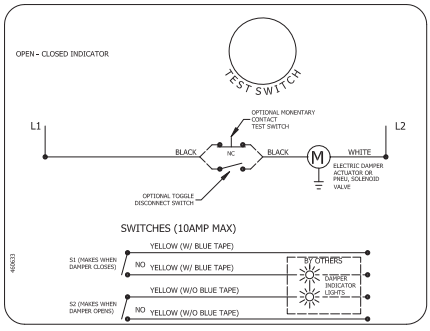


Figure 7: OCI

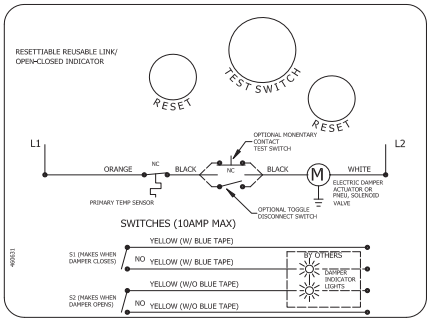


Figure 8: RRL/OCI

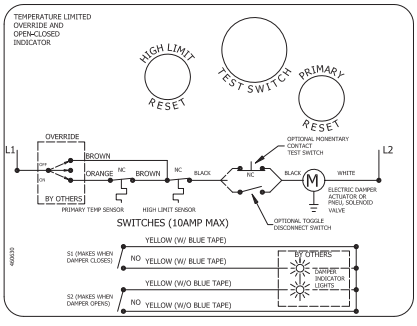
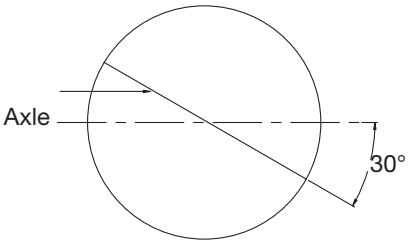
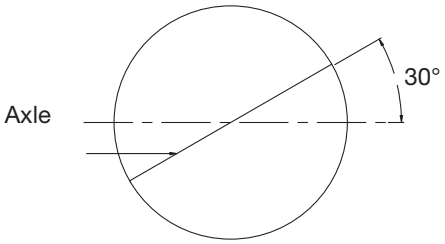


Figure 9: TOR

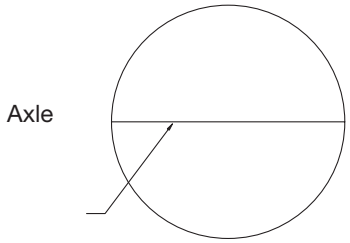
Blade Orientation



30° Off Horizontal (Maximum)



30° Off Horizontal (Maximum)



Normal

Damper Maintenance

Dampers do not typically require maintenance as long as they are kept dry and clean. If cleaning is necessary, use mild detergents or solvents. If lubrication is desired for components such as axle bearings, jackshaft bearings and jamb seals, do not use oil-based lubricants or any other lubricants that attract contaminants such as dust.

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- The latest editions of NFPA 80, 90A, 92A, 92B, 101, 105, UL864, AMCA 503-03 and local codes.
- Actuator manufacturer recommendations.

Damper Troubleshooting

The following is a possible cause and correction list for common concerns with dampers.

Symptom	Possible Cause	Corrective Action
Damper does not fully open and/or close	Frame is 'racked' causing blades to bind on jamb seals	Adjust frame such that it is square and plumb
	Actuator linkage loose	Close damper, disconnect power, adjust and tighten linkage
	Defective motor	Replace
	Screws in damper linkage	Damper installed too far into wall. Move out to line as designated on damper label
	Contaminants on damper	Clean with a non-oil based solvent (see Damper Maintenance)
RRL or TOR sensor tripped	Heat	Push reset button located on backside of RRL or TOR
Damper does not operate	No power supplied to the actuator	Add power supply

Notes

Our Commitment

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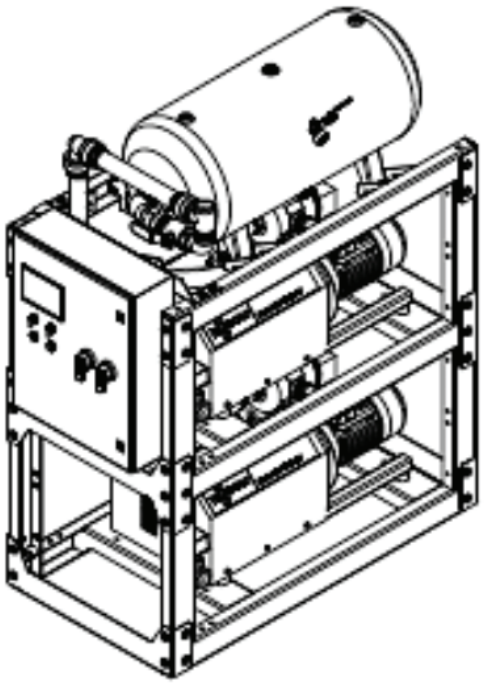
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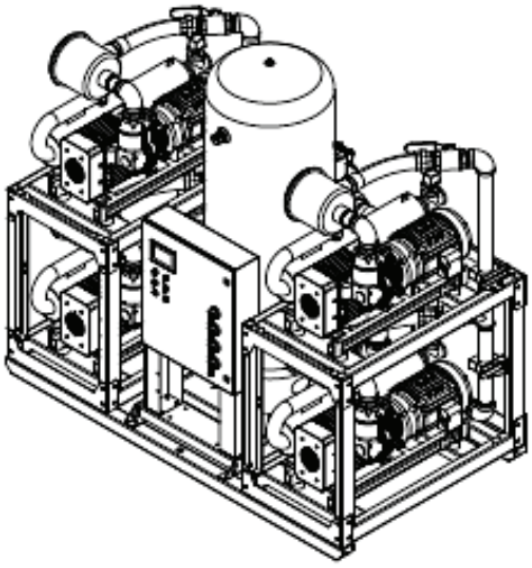
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Patton's Medical

Rotary Claw
Lab Vacuum System





Installation Operation and Maintenance Manual
2 - 15 Hp

Model Number:	
Serial Number:	
Date Purchased:	
Purchased from:	

For further technical assistance, service or replacement parts, please contact:

Patton's Medical
3201 South Boulevard
Charlotte, NC 28209

Customer Service: 1-866-960-0087
Phone: 704-529-5442
FAX: 704-525-5148

www.pattonsmedical.com

Please include the unit serial number located on the control panel with all inquiries.

Patton's Medical reserves the right to make changes and improvements to update products sold previously without notice or obligation.

Issue Date: June 12, 2014

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10.0 Maintenance Record

Safety Precautions

The operator should have carefully read and become familiar with the contents of this manual before installing, wiring, starting, operating, adjusting and maintaining the system. The operator is expected to use common sense safety precautions, good workmanship practices and follow any related local safety precautions.

In addition:

- **Before starting any installation or maintenance procedures, disconnect all power to the package.**
- All electrical procedures must be in compliance with all national, state and local codes and requirements.
- A certified electrician should connect all wiring.
- Refer to the electrical wiring diagram provided with the unit before starting any installation or maintenance work.
- Release all vacuum from the package before removing, loosening, or servicing any covers, guards, fittings, connections, or other devices.
- Notify appropriate personnel if repairs or maintenance will affect available vacuum levels.
- This is a high speed, rotating piece of machinery. Do not attempt to service any part while machine is in operation.
- To prevent automatic starting, disconnect all electrical power before performing any maintenance functions.
- Do not operate unit without guards, shields or screens in place.
- Make sure that all loose articles, packing material, and tools are clear of the package.
- Check all safety devices periodically for proper operation.
- **Do not add lubricating oil of any kind to the pump**.
- The "Hand" mode of operation should only be used for emergencies such as a PLC malfunction and should not be used for normal operation.
- Electrical service must be the same as specified on the control panel nameplate or damage to the equipment may occur.
- Vibration during shipment can loosen electrical terminals, fuse inserts, and mechanical connections. Tighten all electrical connections prior to energizing the control panel.

1.0 General Information

System Configurations
The Claw Lab Vacuum systems are either base mounted or tank mounted units in configurations of duplex, triplex, quadruplex or other multiplexed configurations. The systems are constructed as either single point connection (SPC) or modular packages. The complete package is pre-wired, pre-piped, and assembled either on one common base with single point connections for electrical, intake air, discharge air, and condensation drain or as a modular system with connection points for the above.

Vacuum Module
The vacuum pump is an oil-less rotary claw type direct-driven through a shaft coupling. The design is air-cooled, consisting of two claw-type, non-contacting rotors. Sealing fluid is not required. An oil change is required at approximately 5,000 operating hour intervals in the gearbox only. A built-in anti-suckback valve is mounted at the pump inlet and equipped with an inlet filter for removal of particulates.

Vacuum Drive and Motor
The pump is direct driven through a shaft coupling. The motor is a NEMA rated, C-faced TEFC, with 1.15 service factor suitable for 208 or 230/460V electrical service.

Intake Piping
Each vacuum pump has a piped intake with one "hospital type" inlet air filter. An inlet check valve and isolation valve is piped on each pump. The vacuum pumps are connected to a common manifold and piped to a receiver. A flexible connector is located between each pump and the manifold.

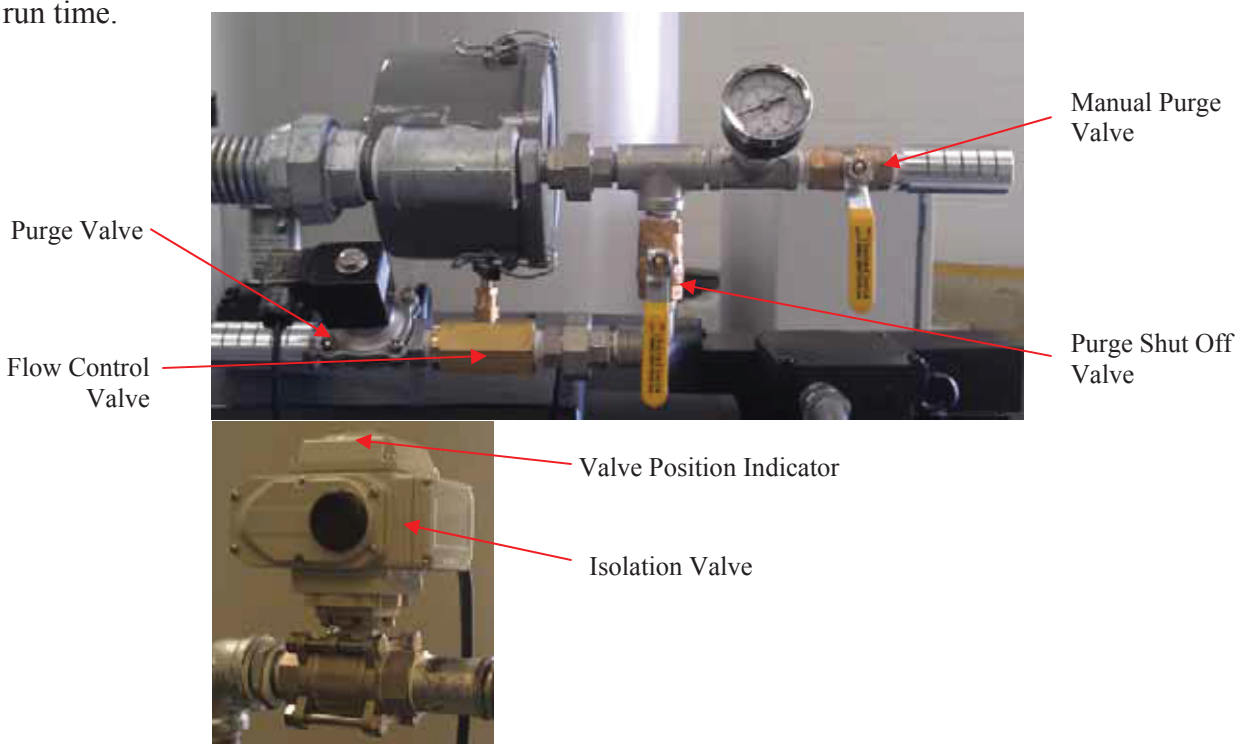
Vacuum Receiver
The vacuum system includes a vacuum receiver vertically or horizontally oriented in the package. The receiver is ASME Code stamped and National Board Certified. The receiver is rated for a minimum 200 psig design pressure and includes an integrally mounted valved bypass, manual drain, and vacuum gauge.

Control System
The mounted and wired control system is NEMA 12 and U.L. labeled. The control system provides automatic lead/lag sequencing with circuit breaker disconnects for each motor. The control panel also includes full voltage motor starter contactors with overload protection, redundant 120V control circuit transformers, visual and audible reserve unit alarm with isolated contacts for remote alarm, hand-off-auto selector switches, a vacuum indicator, and runtime hours indicator. Automatic alternation of vacuum pumps with provisions for simultaneous operation if required, automatic activation of the reserve unit if required. Visual and audible alarms indicators for a high discharge temperature shutdown, with isolated contacts for remote alarm, are included.

1.0 General Information (Continued)

Auto Purge Control (optional)

The Auto purge feature has three operating modes, Manual - Off - Auto Purge. Manual mode puts the selected pump in the purge mode, pump must be turned to the Hand position to operate. The Auto purge mode will purge a pump at the end of it's minimum run time for 15 minutes. The HOA switch need's to be in the Auto mode for the auto purge to operate. The purge feature consists of a purge valve, isolation valve and a manual purge valve. When the auto purge cycle starts the isolation valve will close, 20 seconds later the purge valve will open and flow ambient air at approx 22-23"hg thru pump, after 15 minutes the pump will turn off and wait for it's next run time.



A ***Signal 1*** **System touch screen gateway** is mounted in the control panel door. It includes:

- a vacuum display
- a runtime display
- a vacuum trend display
- a trend display showing number of pumps running
- an alarm history display
- ability to download trending and history files to PC
- a maintenance schedule and history display
- a service indicator
- a replacement parts display
- a battery backup for history data
- a vacuum set point adjustment display
- a system data display

2.0 Installation

2.1 Inspection Upon Receiving

The Claw Lab Vacuum system should be carefully inspected upon delivery. Any damage by the carrier should be noted on the delivery receipt, especially if the system will not be immediately uncrated and installed. The system may remain in its shipping container(s) until ready for installation. If the system is to be stored prior to installation, it must be protected from the elements to prevent rust and deterioration.

DO NOT REMOVE the protective covers from the inlet and discharge connection ports of the unit until they are ready for connecting to the lab's pipeline distribution system.

2.2 Handling

!!WARNING!!
USE APPROPRIATE LOAD RATED LIFTING EQUIPMENT AND OBSERVE SAFE LIFTING PROCEDURES DURING ALL MOVES.

The vacuum package can be moved with either a forklift or dollies. Keep all packing in place during installation to minimize damage. If disassembly of the unit is necessary to access doorways or low ceiling clearances, carefully label all electrical connections that are removed for easier re-assembling at the final destination. Units should be placed to ensure easy access to perform maintenance and high visibility of indicators and gauges.

2.3 Location

The Lab Vacuum system should be installed indoors in a clean, well-ventilated environment. Areas of excessive dust, dirt or other air-borne particulate should be avoided.

Secure the package to a flat, level surface capable of supporting the weight and forces of the unit. Make sure that the main base is not bowed, twisted, or uneven. Because of the internal flexible hose connections and vibration isolators, **no special foundation is required**. However, the unit base must be securely bolted using all mounting holes provided in the base. If a raised concrete pad is used, the base must not overhang the concrete pad. A method to drain away moisture is necessary. If a gravity drain is not available, a connection to a drain is necessary. After securing the unit to the floor, remove all packing material.

The area should have an ambient temperature of between 40^{o}F and 104^{o}F.
(If the maximum ambient exceeds 104°F, contact the factory for special instructions). The system should be located as close as possible to the point of usage to prevent excessive loss of operating vacuum due to pressure drop.

2.0 Installation (Continued)

2.4 Space Requirements

The Lab Vacuum system should be placed to ensure easy access to perform maintenance and high visibility of indicators and gauges. It is recommended that a minimum space of 24” be allowed on all sides of the compressor system for ventilation and maintenance. A minimum space of 36" in front of the control panel is required by NEC code. A vertical distance of 36” is required above the unit for ventilation and maintenance.

2.5 Locations Above Sea Level

All vacuum pumps above sea level have reduced flow and should be de-rated. After determining the correct flow needed for the Lab vacuum system, multiple this number by the adjustment factor in the following chart. After determining the new flow required, use this number to size the Lab vacuum system.

Altitude Adjustment Factor

Altitude (ft)	Normal Barometric Pressure (inches HG)	Multiplier Used for Required SCFM
0	29.92	1.00
500	29.39	1.02
1000	28.86	1.04
1500	28.33	1.06
2000	27.82	1.08
2500	27.32	1.10
3000	26.82	1.12
3500	26.33	1.14
4000	25.84	1.16
>4000	**Do NOT use Oil-less Vacuum Pumps. Contact Factory.**	

2.0 Installation (Continued)

2.6 Wiring

WARNING!
BE SURE TO DISCONNECT ALL ELECTRICAL POWER TO THE VACUUM SYSTEM BEFORE PERFORMING ANY ELECTRICAL PROCEDURES.

Refer to the electrical diagram provided with the unit before starting any installation or maintenance work.

Do not operate the vacuum system on a voltage other than the voltage specified on the system's nameplate.

All customer wiring should be in compliance with the National Electrical Code and any other applicable state or local codes.

Check the control voltage, phase and amp ratings before starting the electrical installation, and make sure the voltage supplied is the same.

The wire size should be able to handle peak motor amp load of all operating units, refer to the full load amperes on the wiring diagram.

Check all electrical connections within the vacuum system that may have loosened during shipment.

Only qualified electricians should make power connections to the control panel and any interconnecting wiring.

Ensure that the emergency generator system's electrical supply is consistent with the vacuum system's requirements.

Three-phase power supplied from the emergency generator(s) must match that of the normal supply to allow for correct direction of the motor rotation at all times.

2.0 Installation (Continued)

2.7 Intake Piping

Before connecting any piping, the plastic thread protector installed in the connection port must be removed. The main vacuum line to the receiver should not be reduced below that provided on the receiver. Long piping runs may need to be increased in size to minimize pressure drop. Improper line sizing may result in a loss of capacity. Ideally, piping should be constructed using long radius elbows and a minimum number of turns. All secondary lines should be taken from the top or side of the main line to prevent any accumulated moisture from draining towards the pumps. All lines should slope away from the pumps. Any low points in the piping should be equipped with pipe drains to remove accumulated moisture. All pipe must be either seamless copper tubing or other corrosion-resistant metallic tubing, such as galvanized steel or stainless steel.

2.0 Installation (Continued)

2.8 Exhaust Piping (Continued)

Minimum Pipe Sizes

Notes: 1. All pipe sizes are based on the following: copper pipe (Type L), 14.7 psia.
2. The minimum pipe size must be maintained for the total length of the exhaust pipe. Use next larger size pipe in the event the minimum size is not available.
3. When determining the total pipe length, add all the straight lengths of pipe together in addition to the number of elbows times the effective pipe length for that pipe size. (See the table and example below.)

Example:
Select the pipe size for a Duplex 6.4 HP with 100 feet of straight pipe and four elbows:
A) Select the pipe size of 4" diameter for 100 feet of straight pipe.
B) Determine the eff. pipe length for an elbow of 4" diameter (EPL = 10.0 ft / elbow).
C) Calculate the SYSTEM PIPE LENGTH {SPL (4.0" D) = 100 + (4 x 10.0) = 140 ft
D) Check this SYSTEM PIPE LENGTH to see if it exceeds the minimum pipe size.

Vacuum System	System Pipe Length (ft) - See Notes											
	25	**50**	**75**	**100**	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**
Duplex 2 HP	1.25	1.25	1.25	1.25	1.50	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Duplex 3 HP	1.50	1.50	1.50	1.50	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Duplex 4 HP	2.00	2.00	2.00	2.00	2.00	2.50	2.50	3.00	3.00	3.00	3.00	3.00
Duplex 5.4 HP	2.00	2.00	2.00	2.00	2.00	2.50	3.00	3.00	3.00	3.00	3.00	3.00
Duplex 6.4 HP	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Duplex 7.5 HP	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Duplex 8.7 HP	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Duplex 10 HP	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00
Duplex 15 HP	3.00	3.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00
Triplex 5.4 HP	2.00	2.00	2.00	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00
Triplex 6.4 HP	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00
Triplex 7.5 HP	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00
Triplex 8.7 HP	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Triplex 10 HP	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Triplex 15 HP	4.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00
Quad 5.4 HP	3.00	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00
Quad 6.4 HP	3.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	5.00
Quad 7.5 HP	3.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	5.00
Quad 8.7 HP	4.00	4.00	4.00	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00
Quad 10 HP	4.00	4.00	4.00	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00
Quad 15 HP	4.00	4.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00

Effective Pipe Length Equivalent of a 90 Degree Elbow									
Pipe Size (in.)	1.50	2.00	2.50	3.00	3.50	4.00	5.00	6.00	8.00
Eff. Pipe Length (ft)	3.6	4.9	6.4	7.9	9.4	10.0	11.9	13.2	14.5

3.0 Control Panel



1. Display Screen – Displays the systems operating screens.
2. LED's –Yellow PWR: Power is correctly supplied
Green CPU: Indicates the Signal 1 is operating correctly
Red COM: Indicates communication with PLC
Not lighted: Power is not supplied
3. HOA selector switch – Compressor control switch, Hand – Off – Auto.
4. Alarm horn – Sounds when an alarm condition occurs.
5. Alarm Reset/Horn Silence – Pushbutton to silence alarm and reset visual alarm on *Signal 1* screen after alarm condition is corrected.
6. Purge selector switch – Selects purge control mode.
7. **Motion sensor** – Turns Signal 1 back light on if movement is present
7. External Operators– Turns Circuit Breakers On - Off

3.0 Control Panel (Continued)

3.1 Signal 1 System touch screen gateway

The Scroll Lab Air system has a touch screen gateway to control and monitor the complete system operation as well as record service and alarm history of the unit and change pressure setting levels.

3.2 *Signal 1* Main Display Screen The main screen for systems will monitor and display the air receiver vacuum level, motor speed, run sequence, individual unit total run hours and run status (HOA switch position). Included on this screen is a service due alarm, transducer fault alarms and lag alarm for the system as well as individual alarms for each compressor unit (motor overload, and high discharge air temperature) . The "MENU" button in the upper right corner will allow the operator to navigate through the screens to view the system alarm history, service schedule and records, and vacuum trends, basic troubleshooting, vacuum settings, and system general information. When the ***Signal 1*** is powered up the main control window will appear on the display screen. This screen displays the systems current vacuum level, total hours run for each module, run sequence, HOA switch setting and status of service schedule and alarm conditions.



Main Screen (Duplex System shown)

3.0 Control Panel (Continued)

3.2 HMI Main Display Screen (Continued)

1. MENU: Displays menu screen which allows the operator to access the systems operating history, service requirements, and vacuum trends, troubleshooting info and main system info.
2. VACUUM (inches Hg): Display's the current vacuum level inside the air receiver.
3. SERVICE DUE: Service intervals and types of service are preprogrammed into the HMI. The button will flash yellow when service is due. Pressing the "service due" button when flashing will display the service schedule screen.
4. TDC FAULT: Indicator will flash red and horn will sound if the transducer fails. Vacuum reading on the display screen will default to "30" hg. Selecting the indicator when flashing red will open a trouble shooting window.
5. LAG ALARM: (Optional) Indicator will flash red and horn will sound when last available vacuum unit comes on. Press the reset button to silence the alarm. If the condition is corrected both the alarm and indicator will turn off. If a lag condition remains the indicating light on the HMI will remain on. Selecting the indicator when flashing red will open a trouble shooting window. Once the lag condition is corrected, press the reset button again to turn off alarm light.
6. UNIT RUN HOURS: Displays total run hours for each vacuum module.
7. HAND-OFF-AUTO: Displays status of each vacuum module. The green "HAND" displays when the vacuum is running and the HOA selector switch is in the HAND setting. The green "AUTO" displays when the vacuum is running in the normal sequencing mode. The "OFF" indicator is displayed when the HOA selector switch is in the "OFF" position for the pump that is not running.
8. MOTOR OVLD: Display will flash red and sound an alarm when overload switch is tripped in the control panel. The vacuum in question will not re-start until the reset button on the starter inside the main control cabinet is reset. Press the reset button on front panel to silence the alarm. Selecting the indicator when flashing red will open a trouble shooting window. The indicator on the HMI will remain on until motor starter is reset.
9. FAILED START: Display will flash red if the vacuum module failed to start/run when signaled to start. This alarm will also activate when a Motor Overload Shutdown occurs. Press the reset button on the front panel to silence the alarm. Selecting the indicator when flashing red will open a trouble shooting window. The indicator light on the HMI will remain on until the problem has been resolved and the reset button pushed again.

3.0 Control Panel (Continued)

3.3 Control Buttons

3.3.1 MENU

The MENU button in the upper right corner on the main screen when selected will display the "MENU" window that will allow the operator to access information shown on screen below. Each button will be explained in detail in this section.

3.3.2 – "MAIN" Button

The main button can be found on many of the screens within the *Signal 1* Controller. At any time when the "MAIN" button is selected, the *Signal 1* display will return to the Main Display Screen.



3.0 Control Panel (Continued)

3.3 Control Buttons (Continued)

3.3.3 – "ALARM HISTORY" Button

The "ALARM HISTORY" button on the "Menu" screen will open a new window listing all the alarm conditions that have occurred as well as routine maintenance alerts. The list will show the date and time of the incident, type of incident and when the condition was cleared/corrected. This creates a permanent record of the history of the unit and cannot be reset.

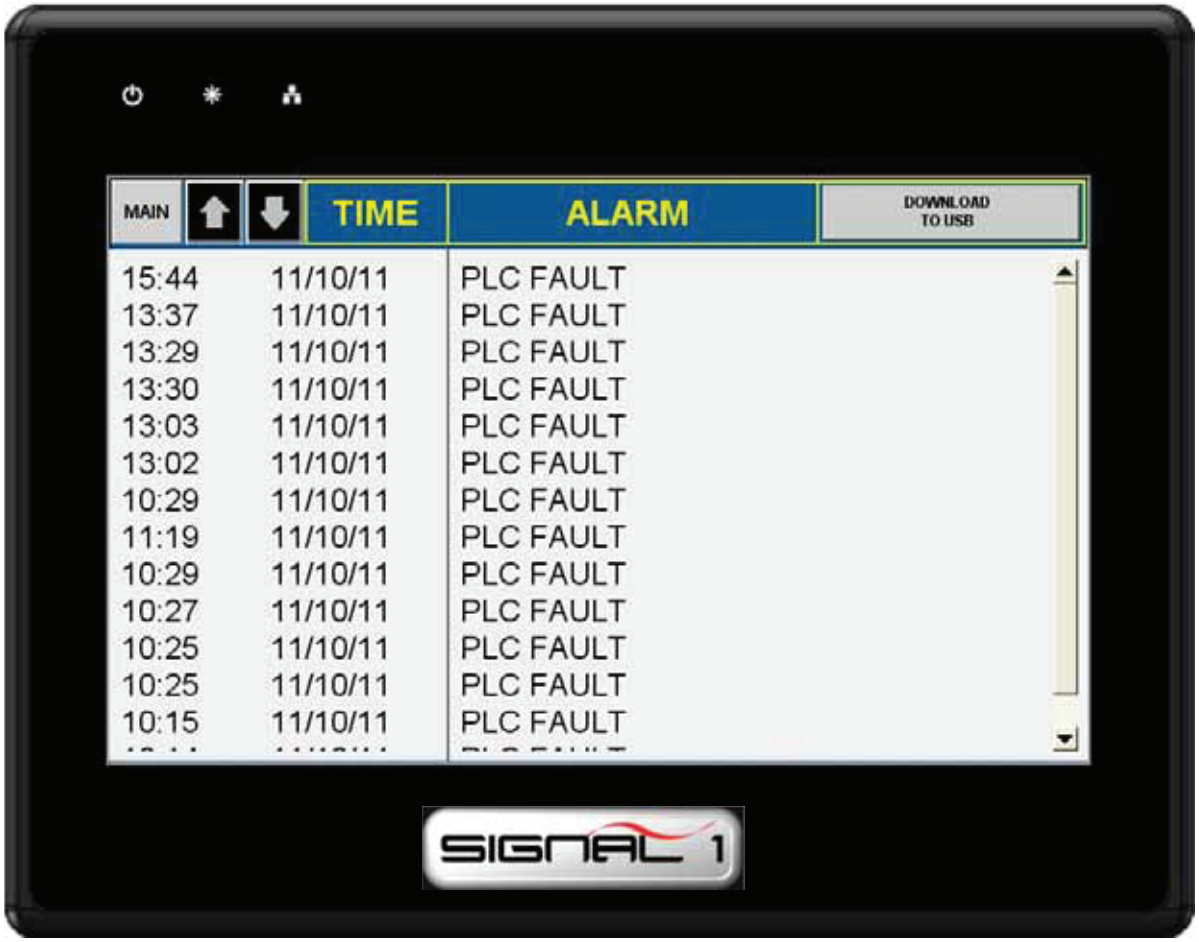
1. "MAIN" button will return you to the main screen.
2. "HISTORY" button will open a new History screen shown on the next page



3.0 Control Panel (Continued)

3.3 Control Buttons (Continued)

3.3.4 – "HISTORY" screen displayed from pressing "History" button on "Alarm History" screen shown below. Pressing the up and down arrows will display alarm/maintenance history one day at a time. History can be down loaded to a USB memory stick by inserting the memory stick into the USB slot on the back of the *Signal 1* and pressing the "Download To USB" button on the screen. Files can be saved to PC and viewed in an excel format.

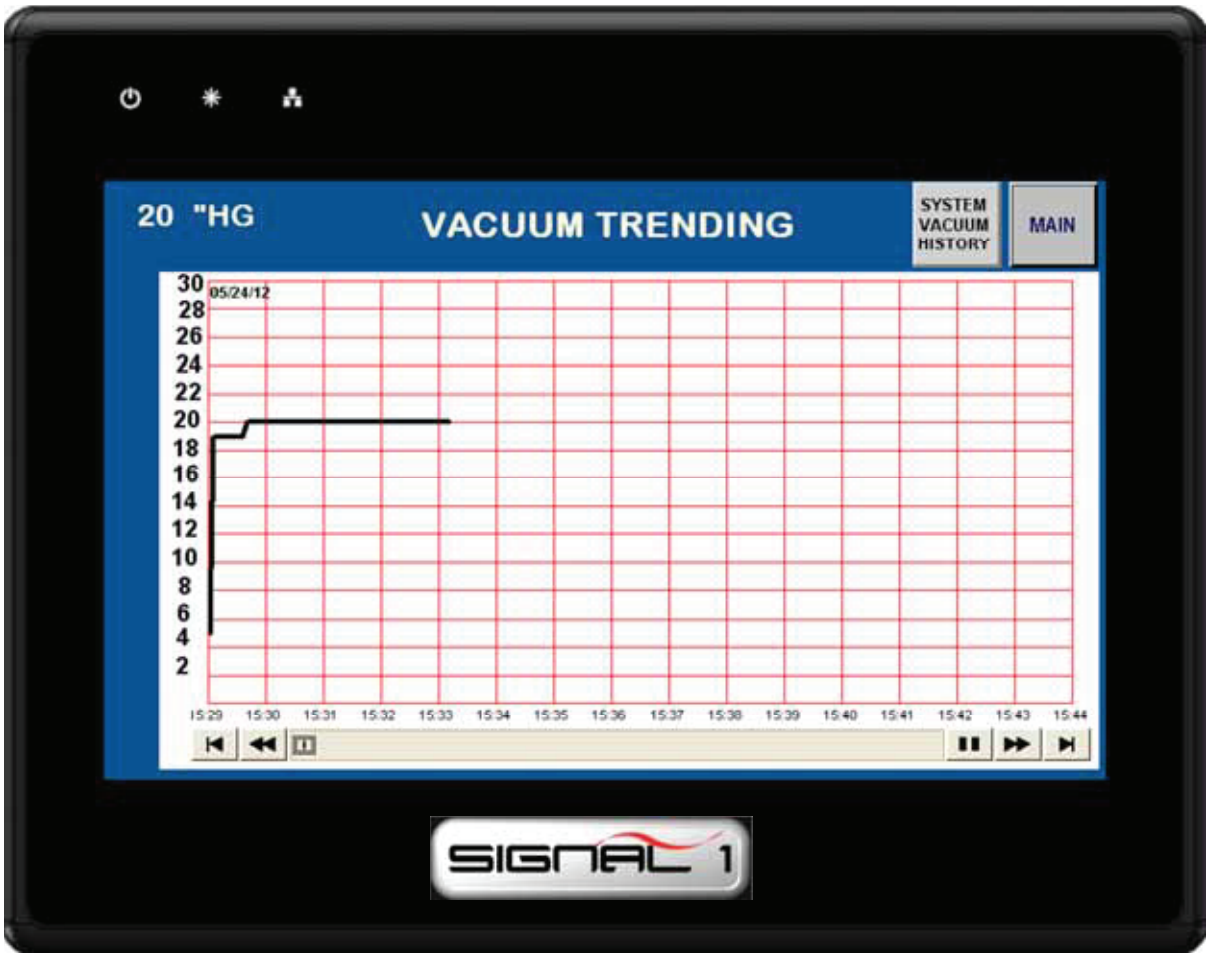




3.0 Control Panel (Continued)

3.3 Control Buttons (Continued)

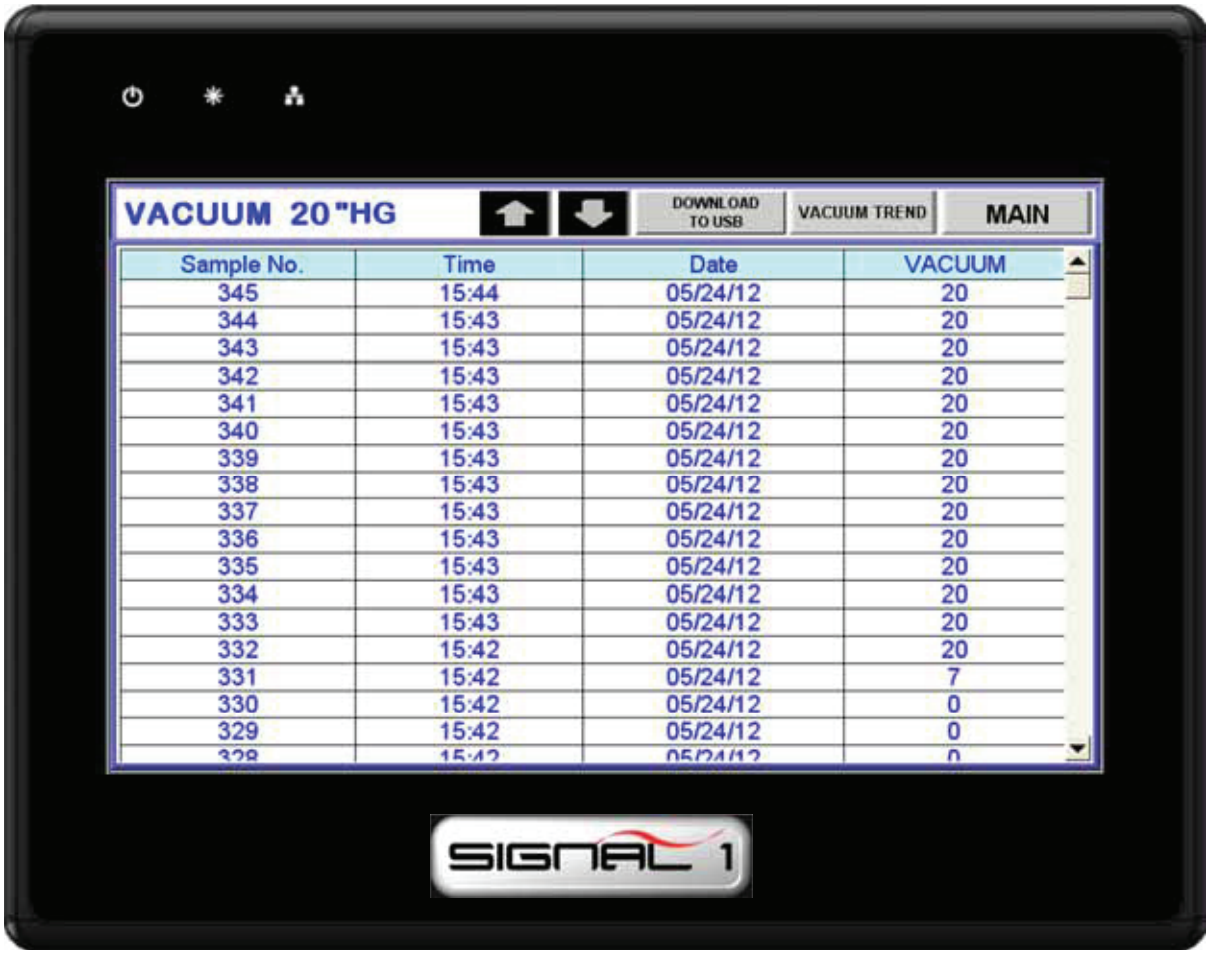
3.3.5 – "VACUUM TREND" Pressing the "Vacuum Trend" button on the "Menu" screen will display the screen below. Screen displays 15 minutes of trending and has a scroll bar on the bottom of screen to scroll to different time frame.
1. "MAIN" button will return you to the main screen.
2. "SYSTEM PRESSURE HISTORY" button will open a new screen shown on the next page



3.0 Control Panel (Continued)

3.3 Control Buttons (Continued)

3.3.6 – "VACUUM TREND HISTORY" screen shown below. Pressing the up and down arrows will display pressure trending history one day at a time. History can be down loaded to a USB memory stick by inserting the memory stick into the USB slot on the back of the *Signal 1* and pressing the "Download To USB" button on the screen. Files can be saved to PC and viewed in an excel format.



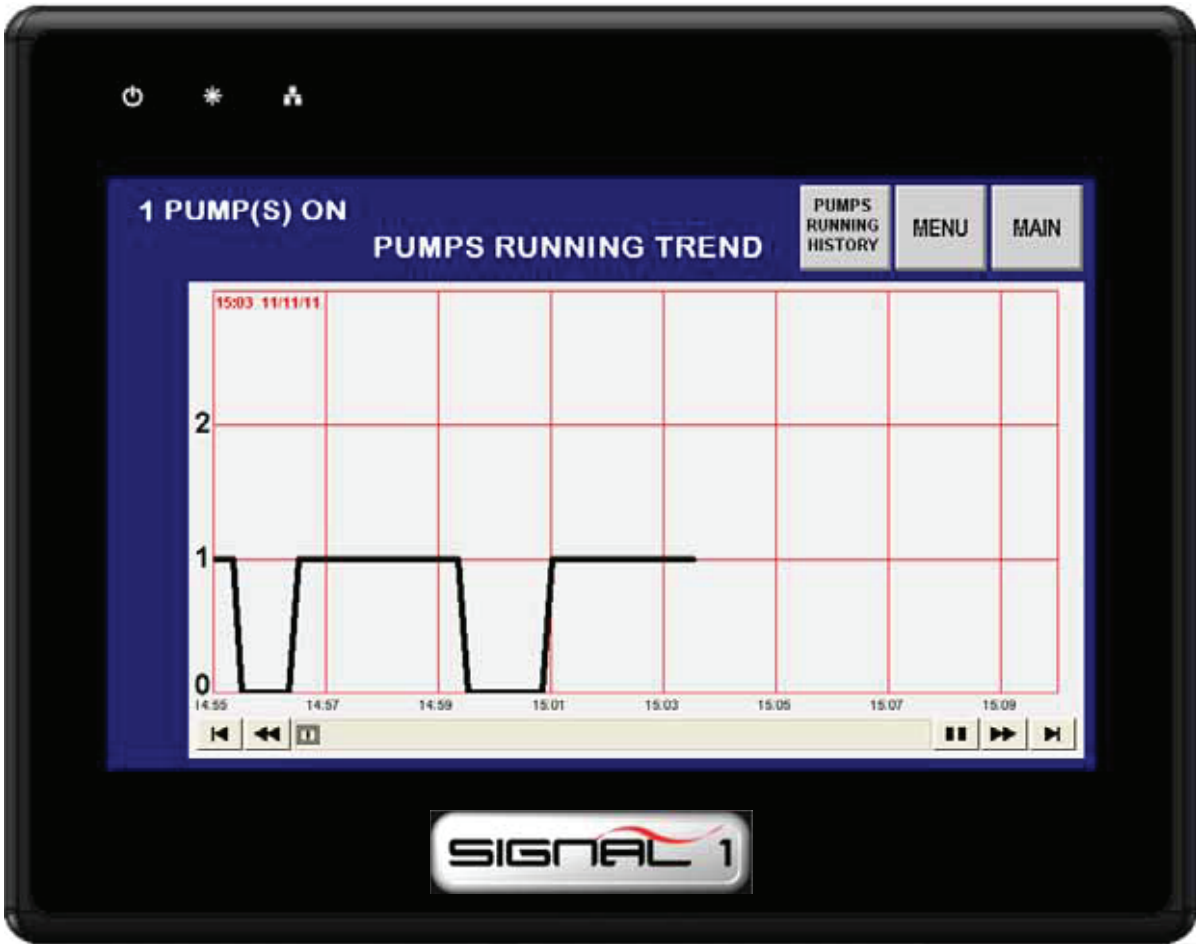


3.0 Control Panel (Continued)

3.3 Control Buttons (Continued)

3.3.7 – "NUMBER PUMPS RUNNING TREND" Pressing the **"**NUMBER PUMPS RUNNING TREND" button on the "Menu" screen will display the screen below. Screen displays 15 minutes of trending and has a scroll bar on the bottom of screen to scroll to different time frames.

1. "MAIN" button will return you to the main screen.
2. "PUMPS RUNNING HISTORY" button will open a new screen shown on the next page



3.0 Control Panel (Continued)

3.3 Control Buttons (Continued)

3.3.8 – "PUMPS RUNNING HISTORY" screen shown below. Pressing the up and down arrows will display number of pumps running trending history one day at a time. History can be down loaded to a USB memory stick by inserting the memory stick into the USB slot on the back of the *Signal 1* and pressing the "Download To USB" button on the screen. Files can be saved to PC and viewed in an excel format.



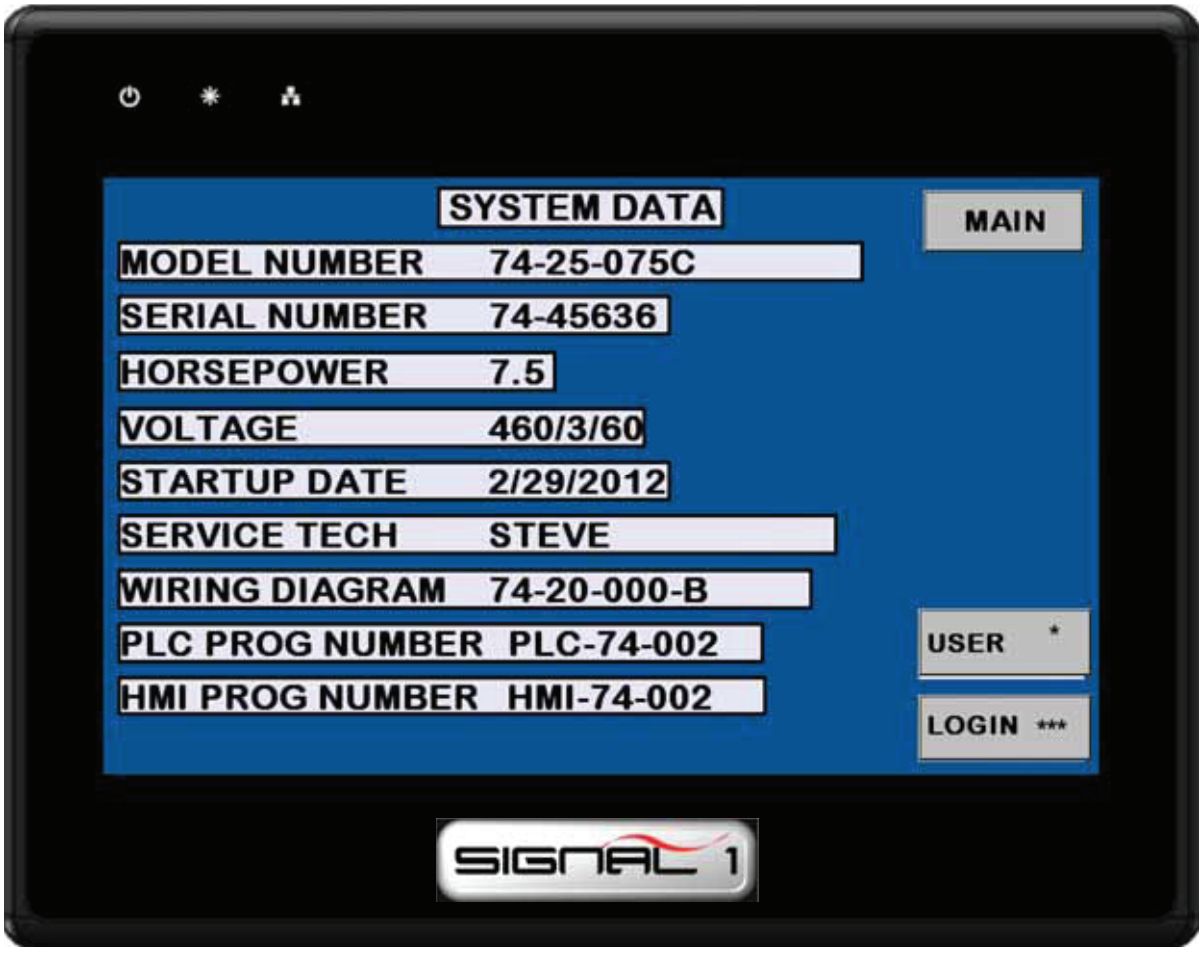


3.0 Control Panel (Continued)

3.3 Control Buttons (Continued)

3.3.9 "SYSTEM DATA" Button

The "System Data" button displays all the system information required when scheduling maintenance or purchasing spare parts from Patton's Medical. The information includes model number, serial number, horsepower, system voltage, and unit start up date. This information will be programmed into the *Signal 1* at startup by a Patton's Medical authorized technician.



3.0 Control Panel (Continued)

3.3 Control Buttons (Continued)

3.3.10 "PARTS MENU" Button

The "Parts Menu" button displays routine maintenance parts required when performing scheduled maintenance.

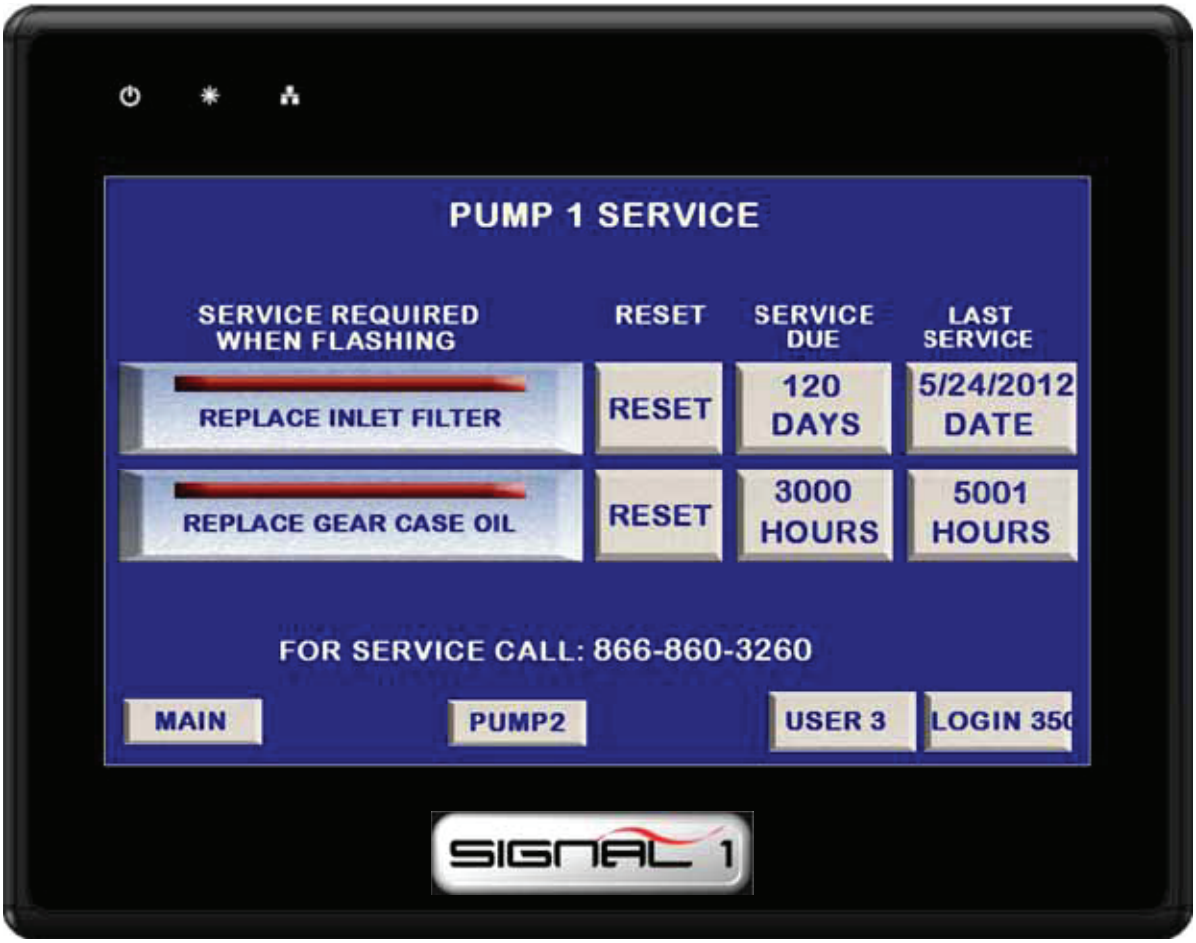


3.0 Control Panel (Continued)

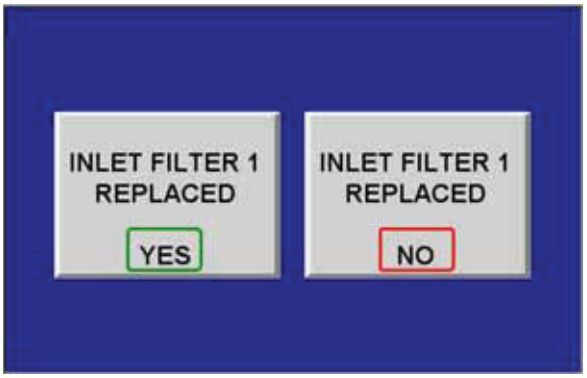
3.3 Control Buttons (Continued)

3.3.11 – "PUMP SERVICE" Buttons

1. Select "**USER #**" button and enter "3" and press "enter".
2. Select "**LOGIN**" button and enter "350" and press "enter".
3. Press "**RESET**" button next to item requiring maintenance red light will be flashing.



4. Screen to right will display press "YES" to reset maintenance performed. Service due date and Last Service date will reset.



3.0 Control Panel (Continued)



3.3 Control Buttons (Continued)

3.3.12 – "VACUUM SETTING" Button

1. Select "**USER #**" button. Enter "2" and select "enter".
2. Select "**LOGIN**" button. Enter "327" and select "enter".
3. Press setting to be changed and screen to right will display. Enter pressure setting desired then "ENT".
4. Pressing "RESTORE DEFAULTS" at anytime will change all settings to original factory settings.



4.0 System Operation

4.1 Pre-start-up

The contractor should notify **Patton's Medical** two weeks prior to start-up date to schedule an appointment for an authorized technician to review the installation prior to start-up.

WARNING:

CAUTION: Failure to install the unit properly and have an authorized technician from **Patton's Medical** start-up the system can void the manufacturer's warranties.

WARNING:

Have more than one person on hand during prestart-up and start-up procedures to ensure safety and to facilitate certain checks.

Prestart-up and start-up procedures should be performed for a new installation or when major maintenance has been performed.

The main power source to the control panel should be OFF for the duration of the visual inspection.

Ensure that the equipment is installed on a solid level surface. Walk around the system to ensure that there is enough clearance on all sides to perform operational checks/actions and maintenance. The temperature of the area containing the modules should be approximately 70°F (21.1°C) with a minimum ambient temperature of 40°F (4.4°C) and a maximum ambient temperature of 104°F (40°C).

Check the inlet piping for proper size and connection to the vacuum system.

Check all piping system joints that might have come loose during shipment and installation to ensure they are tight.

Check the vacuum receiver, controls, and vacuum pumps for damage.

Check the drain valves on the receiver.

4.0 System Operation (Continued)

4.1 Prestart-up (Continued)
Check all valves for full open and full close travel. Ensure that the system's valves are positioned for proper operation. (Refer to indicators on the valve handles.)

Remove all packing material from the unit.

Check the electrical connections to the control cabinet.

Verify electrical service. Before starting the Lab Vacuum system, check to see that voltage, amperage, and wire size are appropriate.

CAUTION: Electrical service must be as specified or damage to equipment may occur.

WARNING:
To prevent electrical shock, ensure that ALL electrical power to the system is OFF, including the disconnect switches and H-O-A switches on the control panel. The facility's supply circuit breaker should also be locked out.

Open the electrical cabinet by loosening the fasteners on the front.

CAUTION: Vibration during shipment and installation can loosen electrical terminals, fuse inserts, and mechanical connections. Tighten as necessary.

Check the electrical cabinet for any broken switches, lights, etc.

Check that all motor starter connections are tight and that there are no loose objects such as terminal lugs, screws, nuts, etc., in the cabinet.

4.0 System Operation (Continued)

4.2 Initial Start-up

CAUTION: Complete the prestart-up procedure before continuing with the initial start-up procedure

WARNING:
To prevent electrical shock, ensure that ALL electrical power to the system is OFF, including the disconnect switches and H-O-A switches on the control panel. The facility's supply circuit breaker should also be locked out.

4.2.1 Lubrication

The pump's synchronizing gears are oil lubricated, but **there is no lubricant or sealing fluid inside the pumping chamber**. All Claw vacuum pumps are shipped with the required amount of oil for start-up already in the pumps. The level should be slightly above the middle of the sight glass.

NOTE: DO NOT ADD OIL TO THE VACUUM PUMP.

WARNING:
Ensure that all loose articles, packing material, and tools are clear of the system.

Set the H-O-A switches are to "O" (OFF).

Check all voltages supplied to the system to ensure they are the required value and phases needed by the control panel.

Open the inlet isolation valve on each vacuum pump.

Open the outlet isolation valve on each vacuum pump.

Open the receiver isolation valves.

Close the receiver bypass valve.

Apply power to the system and turn the disconnect switches to "On".

4.0 System Operation (Continued)

4.2 Initial Start-up (Continued)

4.2.2 Pump Rotation

Prior to actual operation, the pumps must be checked for correct rotation.

Using the Hand-Off-Auto switch on the door of the control panel, jog the motor of the specific pump that is to be checked by momentarily turning the switch to "Hand" and back to "Off". By observing the cooling fan of the motor, you can determine the rotation of the pump. Pump rotation should be counterclockwise when looking at the rear of the motor. Directional arrows are located on each pump.

If the pumps are rotating in the wrong direction, rotation can be reversed by switching any two main power leads to the panel. Correct rotation should be confirmed in the previous manner.

WARNING:
REMOVE POWER BEFORE WORKING ON ANY ELECTRICAL CONNECTIONS.

4.3 Initial Operation

Run the pump for two minutes in the correct rotation. Stop the pump and check for correct oil level in the sight glass. Add oil if necessary. The pump is shipped with oil in the gear case. **DO NOT OPEN THE FILLER PORT WHILE THE PUMP IS RUNNING.**

WARNING!
Pumps that have reached operating temperature may have a high surface temperature on the top of the exhaust muffler.
DO NOT TOUCH!

4.4 General Operation

WARNING!
NEVER RUN THE PUMP WITHOUT LUBRICATING OIL!

4.4.1 Electrical Control Panel

The Lab Vacuum's **multiplex** control panel includes a visual and audible lag pump alarm and a 0-30"Hg vacuum gauge. It also has the following for **each pump**: 120V control transformer with fuses, hour meter, vacuum control switch, high discharge air temperature switch with alarm, high vacuum switch, with alarm, illuminated Hand-Off-Auto switch, motor starter and circuit breaker. All components are enclosed in a NEMA 12 enclosure.

4.4 General Operation (Continued)

4.4.1 Electrical Control Panel (Continued)

During normal operation, all H-O-A switches should be turned to the "Auto" position so that the PLC can effectively control the system. The PLC monitors the condition of the vacuum transducer, starts and stops the pumps depending on changing vacuum level and minimum run time values, and automatically alternates the lead position between units.

In a typical **duplex** system, one pump will be able to handle the system load. The PLC will signal the lead pump to start when system's vacuum level reaches the cut-in set point. If the one pump can carry the load, then the vacuum level will rise to the vacuum set point. At this point, if the minimum run timer for that pump has been satisfied, the PLC will turn off the lead pump. If the minimum run timer for that pump has not been satisfied, the lead pump will continue to run until the timer expires. When the system vacuum drops again, the PLC will automatically sequence the lead role to the other pump and will start it. If the lead pump runs continuously in lead for more than the adjustable minimum run time, the PLC will automatically sequence the pump attempting to evenly distribute the run time among all available pumps. If during operation, the second pump is required to come on in addition to the lead pump, the PLC will turn on the "Lag Alarm" (see section 4.5).

In a **triplex** or **quadruplex** system, the operation is very similar to the duplex operation described above with the following differences. With a triplex or a quadruplex system, the lag unit running alarm may not necessarily correspond to the third or fourth pump coming on. To determine when the PLC turns on the lag alarm, it counts the number of units in the "Auto" position and makes a decision based on the vacuum transducer conditions. For instance, in a quadruplex system with only 2 H-O-A switches in the "Auto" position, the lag alarm will turn on when the second unit is started.

On the **initial** system start-up, when the system vacuum level is below the set points of the vacuum transducer, the first pump will start. After a time delay, the next pump will start if required. The time delay is to prevent high inrush current after a power failure or emergency power switch over. During this initial system start-up, the lag alarm could come on at this point and is normal. It can be reset once the vacuum level has reached the transducer's set point and the lag pump has cut off after it's minimum run time has expired.

In an Auto Purge system, The minimum run time is fixed can be set to run from 1 to 8 hours. At the end of a pumps minimum run time with the pump in auto purge mode the pump will purge for 15 minutes before shutting off.

4.0 System Operation (Continued)

4.4 General Operation (Continued)

4.4.2 Minimum Run Timer(s)

All vacuum systems incorporate minimum run timers to minimize the starts and stops on the vacuum pumps. The timers are adjustable or self adjusting and can be adjusted to suit the load of the facility.

4.5 Tank Drain

The standard tank drain consists of a manually operated ball valve.

To drain the liquid from the tank, open the tank bypass valve and close the tank isolation valves. Then open the drain valve. When draining is complete, close the drain valve first, then open the tank isolation valves and close the tank bypass valve.

4.6 Emergency Shutdown / Alarms

The following conditions may arise during operation.

Motor Overload Shutdown - This will shut down the pump in question and will not re-start until the reset button on the starter inside the main control cabinet is reset. See Section 4 for troubleshooting information.

High Discharge Air Temperature Shutdown - This will shut down the vacuum pump in question and will not restart until the appropriate red push button is pressed on the main control panel. Before allowing the unit to re-start, the condition should be checked. Even after pushing the button, the unit may not re-start, depending on system sequencing and system vacuum.

4.0 System Operation (Continued)

4.6 Emergency Shutdown / Alarms (Continued)

Lag Unit Running Alarm (Optional) - This alarm will activate if the last available vacuum pump comes on. In the case of a duplex system, it will activate when the second pump turns on. In the case of a multiplex system, the lag alarm will activate when the last available unit is required to come on. For example, in a quadruplex system, if all four (4) H-O-A switches are set to "Auto", then the lag alarm will trigger when the fourth unit comes on. If on the same system, three (3) of the four (4) H-O-A switches are set to "Auto" and the other to "Off" or "Hand", then the lag alarm will activate when the third unit comes on. To silence the alarm, press the alarm reset button. In the event the lag alarm is persistent, check to see if any leaks or valves are open downstream or reduce the system load.

4.7 Relief Valve

The pump is built with an integral vacuum relief valve. The purpose of this relief valve is to prevent the pump from operating at a vacuum level that is too high. The maximum operating point varies by model and is factory set before shipping.

The function of the relief is very important to the successful long-term operation of the vacuum system. Since these pumps have no oil or water to carry away the heat of compression, an adequate flow of air *through* the pump, as well as air circulation *around* the pump, is vital.

NEVER SET THE VACUUM RELIEF VALVE AT A POINT THAT EXCEEDS THE FACTORY RECOMMENDED LEVELS!

5.0 Troubleshooting

Problem	Possible Causes	Solution
Failure to start	Main power disconnected	Turn on main power
	Power failure	Restore power
	Main fuse blown	Replace fuse
	Fuse blown in control circuit	Replace fuse
	Overload tripped on starter	Reset & check for system overload
	High temperature switch activated	Allow unit to cool; reset switch & check for over temperature condition
Power failure	Main fuse blown	Replace fuse
	Fuse blown in control circuit	Replace fuse
Unit lacks sufficient vacuum or lag alarm has occurred	Clogged Filters	Clean filters
	Vacuum relief valves need adjusting	Re-calibrate relief valve
	Restrictions in piping	Open pipe connections and examine for internal contamination or buildup
	Leaks in piping	Tighten all piping connections
	Insufficient pump speed (RPM)	Check voltage and amperage to motor
		Inspect motor and coupling halves
		Check that the pump shaft turns freely

5.0 Troubleshooting (Continued)

Problem	Possible Causes	Solution
Unit lacks sufficient vacuum or lag alarm has occurred	Line losses too high	Piping diameter too small replace with larger diameter pipe
	Unit is operating at an elevated altitude	Contact the factory for assistance. Performance may be reduced when operating well above sea level.
Motor breakers trip constantly	Defective motor	Test motor and replace if necessary
	Heaters incorrectly adjusted too small, or defective	Adjust or replace with correctly sized heaters
	Low motor voltage	Check at motor terminals. Contact electric service provider.
	Ambient temperature too high	Reduce ambient temperature
Unit runs rough and cannot be rotated manually	Worn Coupling	Remove motor and inspect coupling element. Replace if necessary.
	Worn bearings	Contact factory for assistance
Pump overheats	Cooling ducts blocked	Clean cooling ducts
	Cooling fan broken	Replace fan
	High ambient temperature	Ventilate or cool room
	Vacuum too high	Adjust vacuum settings or relief valve

5.0 Troubleshooting (Continued)

Problem	Possible Causes	Solution
Pump overheats	Inlet restricted Exhaust restricted The oil tank may be low/empty of oil, has contaminated oil or was filled with an incorrect type of oil	Remove restriction Remove restriction If the oil level is found to be low, immediately shut off the pump, drain the remaining oil form the tank and replenish with fresh oil. If an incorrect oil type or contamination is found, make sure the pump has reached its operating temperature before replacing with fresh oil.
High vacuum level	Vacuum relief valves need adjusting	Re-calibrate relief valve
Excessive noise level	The coupling rubbers may be worn Internal pump damage	See “worn coupling” above Call factory for assistance

For any operational problems not listed here, please contact your local **Patton’s Medical Service** representative.
1-866-960-0087

6.0 Maintenance

6.1 Maintenance Schedule

WARNING:
BEFORE STARTING ANY MAINTENANCE PROCEDURES, DISCONNECT ALL POWER TO THE PACKAGE.

WARNING:
PUMPS THAT HAVE REACHED NORMAL OPERATING TEMPERATURE MAY HAVE A HIGH SURFACE TEMPERATURE OF MORE THAN 70°C (158°F).
DO NOT PERFORM ANY MAINTENANCE UNTIL AFTER A SUFFICIENT COOL DOWN PERIOD.

Never perform any maintenance functions while the unit is in operation.

Maintenance Schedule

Item	Frequency	Action
Exhaust drip leg	Daily	Check for accumulated moisture
Check inlet air filter(s)	Annually	Replace elements
Synchronizing Gear Oil Level	Weekly	Top off when pump is off
Check nuts, bolts, fittings, etc.	Monthly	Inspect and tighten
Synchronizing Gear Oil	Weekly 5,000 hours/Annually	Check oil Change oil
Pump Bearings 2-8.7 hp 15 hp	 Not Required 6 months	 Not required Grease B side bearings
Motor Coupling	Annually	Remove motor to inspect coupling for wear. Replace as needed.

6.0 Maintenance (Continued)

6.2 General Maintenance for All Units

Pumps
Maintain the pump regularly to achieve the best operating results. Maintenance intervals will depend on the pump's use and ambient conditions. Each pump has oil-lubricated synchronizing gears but there is no lubricant in the pumping chamber.

Do not run pumps without synchronizing gear lubricating oil.

Oil Type
The basic specification for the recommended oil is **non-detergent**. The viscosity must correspond to ISO-VG 220.
The recommended oil is Patton's # 43-01-004 for **Standard units**
The recommended oil is Patton's # 43-01-017 for **Oxygen safe units**
Please contact **Patton's Medical** for more information.

Note: If changing brands, it is important to completely drain out all oil from the pump.

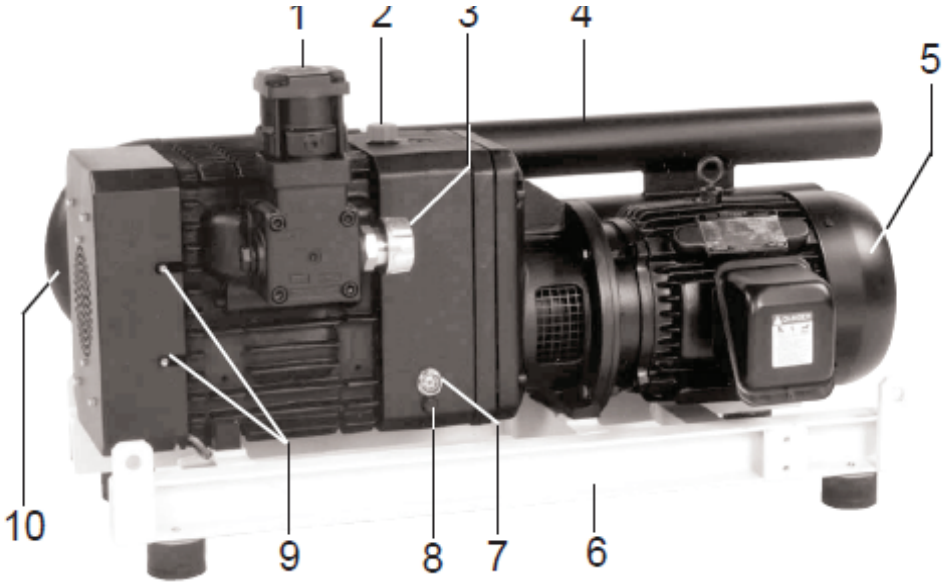
Changing Synchronizing Gear Oil
Check the oil level regularly by observing the built-in sight glass. Each pump requires the proper oil to operate correctly. The oil should be changed every 5,000 hours of operation or more frequently when operating at ambient temperatures of 104°F.

To Change the oil:
1. Make sure the vacuum pump is shut down and locked against inadvertent start up.
2. Prior to draining the oil, always depressurize the gearbox by removing the oil fill plug, located on top of the gear box.
3. Place a drain tray underneath the drain plug and drain the oil.
4. Firmly reinsert the drain plug in the drain valve.
5. Fill with new gear oil until the level is slightly above the middle of the sight glass.
6. Dispose of the used oil in compliance with applicable regulations.

Oil Quantity per Vacuum Pump

System	Oil Quantity (liters)
2 hp	.85
3 hp	.85
4 hp	.85
5.4 hp	.85
6.4 hp	1
7.5 hp	1
8.7 hp	1
10 hp	1
15 hp	.63

6.0 Maintenance (Continued)



6.2

1 Inlet	5 Motor	9 Grease fittings
2 Oil fill	6 Frame	10 Cooling fan
3 Vac. relief valve	7 Oil sight glass	
4 Silencer	8 Oil drain plug	

"B-side" Bearing Lubrication (Standard Claw)
The "B-side" bearings of the Standard 15 HP vacuum unit needs to be greased twice a year with the high melting-point grease, Kluber Asonic HQ 72-102. **Patton's # 43-02-007**
Grease can be added to the bearings by charging the bearings with grease through the grease fittings (9) until grease comes out of the opening.

"B-side" Bearing Lubrication (Oxygen Safe Claw)
The "B-side" bearings of the Oxygen Safe 15 HP vacuum unit needs to be greased twice a year with Oxygen Safe Grease **Patton's # 43-02-014**
Cover plates will need to be removed to add grease to the bearings.

Pump Fan/Motor Fan Openings
Periodically inspect the pump for accumulation of debris and dirt. Keep the ventilation grills of the motor fan and the pump fan clear of excessive debris. Overheating of the pump or motor could result if these openings are blocked.

Inlet Filters

The inlet filter elements should be checked monthly initially. If filter elements are dirty replace with new elements. Elements should be replaced yearly or after 4000 hrs of operation..

Exhaust Drip Leg Valve

Each pump should have a drip leg installed by others at the exhaust port on the pump. This valve should be checked daily at first, then depending on the moisture accumulated could be checked less frequently.

WARNING:
BEFORE STARTING ANY MAINTENANCE PROCEDURES,
DISCONNECT ALL POWER TO THE PACKAGE.

7.0 Inspection/Replacement Procedures

7.1 Air Intake Filter

Never perform any maintenance functions while the unit is in operation.

The air intake filter element should be changed every 4,000 hours of operation or annually under normal operating conditions. To change the filter:

1. Turn off the vacuum pump being serviced and lock open the appropriate disconnect switches.
2. Close intake isolation valve
3. Remove the protective cover by loosening the latches.
4. Remove the element.
5. Clean inside of housing.
6. Insert a new element (note orientation of the element).
7. Replace protective cover and tighten wing nut (if applicable) and latches.
8. Open intake isolation valve
9. Turn on the vacuum pump.

8.0 Replacement Parts

Any information, service or spare parts requests should include the machine serial number and be directed to:

Patton's Medical
3201 South Boulevard
Charlotte, NC 28209

Telephone: 1-866-960-0087
Fax: (704) 525-5148

Medical.service@pattonsmedical.com
www.pattonsmedical.com

Duplex System Parts

Description	2 - 3 HP	Qty per System
Inlet Filter Element	09-11-006	2
Oil "Standard Claw" (1 Quart)	43-01-004	2
Oil "Oxygen Safe Claw" (1 Pint)	43-01-017	4

Description	4 - 5.4 HP	Qty per System
Inlet Filter Element	09-11-006	2
Oil "Standard Claw" (1 Quart)	43-01-004	2
Oil "Oxygen Safe Claw" (1 Pint)	43-01-017	4

Description	6.4 - 10 HP	Qty per System
Inlet Filter Element	09-11-007	2
Oil "Standard Claw" (1 Quart)	43-01-004	2
Oil "Oxygen Safe Claw" (1 Pint)	43-01-017	4

Description	15 HP	Qty per System
Inlet Filter Element	09-11-012	2
Oil "Standard Claw" (1 Quart)	43-01-004	2
Oil "Oxygen Safe Claw" (1 Pint)	43-01-017	4

8.0 Replacement Parts (Continued)

Triplex System Parts

Description	5.4 HP	Qty per System
Inlet Filter Element	09-11-006	3
Oil “Standard Claw” (1 Quart)	43-01-004	3
Oil “Oxygen Safe Claw” (1 Pint)	43-01-017	6
Description	**6.4 - 10 HP**	**Qty per System**
Inlet Filter Element	09-11-007	3
Oil “Standard Claw” (1 Quart)	43-01-004	3
Oil “Oxygen Safe Claw” (1 Pint)	43-01-017	6
Description	**15 HP**	**Qty per System**
Inlet Filter Element	09-11-012	3
Oil “Standard Claw” (1 Quart)	43-01-004	3
Oil “Oxygen Safe Claw” (1 Pint)	43-01-017	6

Quadruplex System Parts

Description	5.4 HP	Qty per System
Inlet Filter Element	09-11-006	4
Oil “Standard Claw” (1 Quart)	43-01-004	4
Oil “Oxygen Safe Claw” (1 Pint)	43-01-017	8
Description	**6.4 - 10 HP**	**Qty per System**
Inlet Filter Element	09-11-007	4
Oil “Standard Claw” (1 Quart)	43-01-004	4
Oil “Oxygen Safe Claw” (1 Pint)	43-01-017	8
Description	**15 HP**	**Qty per System**
Inlet Filter Element	09-11-012	4
Oil “Standard Claw” (1 Quart)	43-01-004	4
Oil “Oxygen Safe Claw” (1 Pint)	43-01-017	8

8.0 Replacement Parts (Continued)

Common Parts

Description	Part Number	Qty. / Pump	Qty. / System
All Systems			
Vacuum Transducer	30-07-025		1
Back up Vacuum Switch	30-07-001		1

9.0 Warranty

Lab Vacuum System Warranty

Patton's Medical warrants the total Lab Vacuum system to be free of defects in material and workmanship under normal use for a period of twenty-four months from start-up, not to exceed thirty months from date of shipment. This warranty covers all necessary parts used in repair as well as all reasonable labor expense. Normal consumable parts required for routine scheduled maintenance (such as filters) are not covered under this warranty.

This warranty does not apply to products that are damaged by external causes, or are improperly warehoused, used, installed, serviced, misapplied or maintained by the customer. The sole liability for **Patton's Medical** under this warranty is limited to repairing, replacing, or crediting, at its election, any such products provided that:

- **Patton's Medical** is notified promptly within the warranty period above of any warranty claim.

- The examination of such items by an authorized representative of **Patton's Medical** will disclose to their reasonable satisfaction that claimed products defect has not been caused by misuse, neglect, improper handling, installation, repair, alteration, or accidents.

- **Patton's Medical** requires that all equipment be commissioned by an authorized **Patton's Medical** distributor and requires a start-up report to be filed within 30 days of equipment start-up. Failure to submit a start-up report to **Patton's Medical** will void the warranty.

- Simplex units 5Hp and below do not include factory assisted start-up in their base price unless specifically noted otherwise. Failure to submit a start-up report to Patton's Medical will void the warranty.

Product modification performed by the customer without prior written approval by **Patton's Medical** will invalidate the above warranty.

This warranty is given in lieu of all other warranties, expressed or implied, including implied warranties of fitness for a particular purpose and merchantability. In no event shall Patton's Medical be liable for damages in excess of the value of the defective product or part, nor shall Patton's Medical be liable for any indirect, special or consequential damages, loss of profits of any kind, or for loss of use of the products.

Patton's Medical shall not be liable to the customer for any claims, loss of damage of any kind whatsoever arising from the nonperformance of **Patton's Medical** of any part of this agreement occasioned by acts of God, fire, war, labor difficulties, governmental regulations, or action of government. **Patton's Medical** shall not be liable to the customer for any other cause, whether of a similar or dissimilar nature beyond its reasonable control.

10.0 Maintenance Record

Model Number

Serial Number

Installation Date

Notes:

Date of Service					
Hours					
Load					
Ambient Temp.					
Inlet Filter					
Misc.					
Serviced By:					

10.0 Maintenance Record

Model Number

Serial Number

Installation Date

Notes:

Date of Service					
Hours					
Load					
Ambient Temp.					
Inlet Filter					
Misc.					
Serviced By:					

10.0 Maintenance Record

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Inlet Filter					
Misc.					
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Charlotte, NC 28209
1-866-960-0087
www.pattonsmedical.com

Patton's Medical Systems Warranty

Patton's Medical warrants that all systems to be free of defects in material and workmanship under normal use for a period of twenty-four months from start-up, not to exceed thirty months from date of shipment. This warranty covers all necessary parts used in repair as well as all reasonable labor expense. Normal consumable parts as well as parts requiring calibration as part of routine scheduled maintenance (such as filters, Dewpoint/CO sensors/monitors) are not covered under this warranty.

This warranty does not apply to products that are damaged by external causes, or are improperly warehoused, used, installed, serviced, misapplied or maintained by the customer. The sole liability for **Patton's Medical** under this warranty is limited to repairing, replacing, or crediting, at its election, any such products provided that:

- **Patton's Medical** is notified promptly within the warranty period above of any warranty claim.
- The examination of such items by an authorized representative of **Patton's Medical** will disclose to their reasonable satisfaction that claimed products defect has not been caused by misuse, neglect, improper handling, installation, repair, alteration, or accidents.
- **Patton's Medical** requires that systems above 5 Hp simplex be commissioned by an authorized **Patton's Medical** distributor and requires a **legible** start-up report **and distributor invoice** to be filed within 30 days of equipment start-up, **late documentation will not be considered**. **Failure to submit a start-up report to Patton's Medical will void the warranty.**
- **Replacement Parts** including pumps and motors carry a limited warranty based upon manufacturer specific terms. Labor for these warranties is not included or implied and is at the sole discretion of Patton's Medical.
- Simplex units 5Hp and below as well as retrofit dryer packages do not include factory assisted start-up in their base price unless specifically noted otherwise.
- **Invoices for work performed, freight, and equipment must be received promptly within 60-days of performance. Invoices received after this date will not be considered.**

Product modification performed by the customer without prior written approval by **Patton's Medical** will invalidate the above warranty.

This warranty is given in lieu of all other warranties, expressed or implied, including implied warranties of fitness for a particular purpose and merchantability. In no event shall Patton's Medical be liable for damages in excess of the value of the defective product or part, nor shall Patton's Medical be liable for any indirect, special or consequential damages, loss of profits of any kind, or for loss of use of the products.

Patton's Medical shall not be liable to the customer for any claims, loss of damage of any kind whatsoever arising from the nonperformance of **Patton's Medical** of any part of this agreement occasioned by acts of God, fire, war, labor difficulties, governmental regulations, or action of government. **Patton's Medical** shall not be liable to the customer for any other cause, whether of a similar or dissimilar nature beyond its reasonable control.

Patton's Medical

Automatic Changeover Medical Manifold



Installation, Operation and Maintenance Manual

Model Number:	
Date Purchased:	
Purchased from:	

For further technical assistance, service or replacement parts, please contact:

Patton's Medical
3201 South Boulevard
Charlotte, NC 28209

Customer Service: 1-866-960-0087
Phone: 704-529-5442
Fax: 704-525-5148

www.pattonsmedical.com

Patton's Medical reserves the right to make changes and improvements to update products sold previously without notice or obligation.

Issue Date: March 24, 2016

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1.0 General Information

The NFPA99 compliant dome biased fully-automatic dual line medical manifold offers continuous, fail-safe pressure and flow control from high pressure medical cylinders. The manifold provides an uninterrupted supply to the facility at a constant pressure. Signal contacts are provided to indicate when the "Secondary" Bank is in use. No manual resetting is required when the Primary Bank is replaced and system pressure level returns to the Primary Bank.

Power Requirements
100-240/1/50-60 VAC
Maximum Inlet Pressure
3,000 PSIG (210 BAR)
Temperature Range
0 to 140°F (-18° to 60°C)
Weight
54 lbs.

Filter
40 micron
Inlet Connection
CGA 1340
Outlet Connection
1/2" NPT for Main Valve (included)
Flow Capacity
1200 SCFH @80psi

Materials:

Bodies
Brass barstock
Seats
Viton®, Neoprene

Seals
PTFE, Neoprene and Viton®
Enclosure
Powder Coated Steel NEMA 1 Enclosure, removable front cover for ease of service.

Features:

- High Flow Regulators
- NEMA 1 enclosure
- Micro-processor control
- Master alarm interface(Secondary in Use)
- Service button allows technician to manually alternate banks
- Simple Installation and set-up
- Pushbutton for transducer calibration
- Pushbutton bleed valves to aide in setting primary regulators
- Primary Source Valve included (1/2" NPT male x brazed in field)
- Separate Wall Mounting bracket included for ease of installation by single technician
- NFPA 99 compliant

Note: A transfer or manifold room shall maintain a temperature not greater than 52°C (125°F) and not less than –7°C. (per NFPA 9.3.6.8)

2.0 Description

Patton's Medical dome loaded manifold is manufactured to supply an uninterrupted source of gas to a medical facility. Manifold will have multiple cylinders divided into two equal banks on the left side and right side. One bank is the primary side the other is the secondary side. One side will be online or "in use" the other will be in secondary or "ready".

Indicator lights will display the status of the gas supply. When the primary bank of cylinders reaches the low setting the red light will display to "Replace" that bank of cylinders. The normally closed alarm contacts will open sending a signal to the remote indicator (Master Alarm - NFPA).

When cylinders are replaced the red light will go out and green light will illuminate automatically. Alarm contacts will close sending remote signal indicating the cylinders have been replaced.

Supply voltage of 100-240 VAC is converted to 12 VDC to power the manifold. Two sets of remote alarm contacts are supplied.

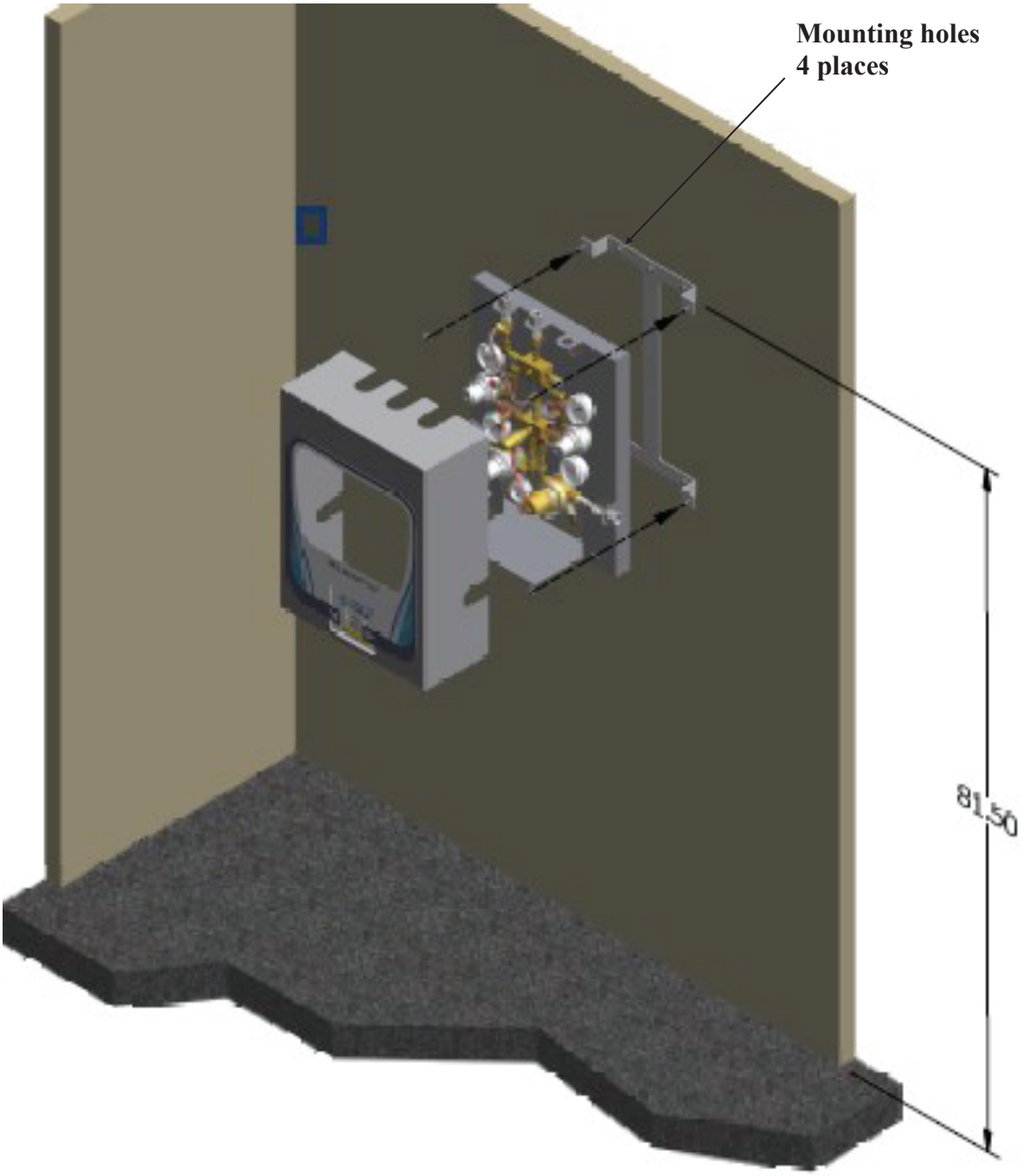
3.0 Shipping Details

The manifold system will be shipped in two or more boxes. The manifold cabinet will be in one box, the wall mounting bracket, CGA fittings, 3/8" washers and nuts for attaching to mounting bracket, 3/4" source valve and Installation and operation manual in another box. Additional boxes may contain appropriate number of header extensions and pigtails. Pigtails for Oxygen and Helium are pre-bent rigid copper. All other gases are use stainless steel flex type. The manifold is made for wall mounting but can be ordered with floor mounting bracket as well.

4.0 Cabinet Mounting Instructions

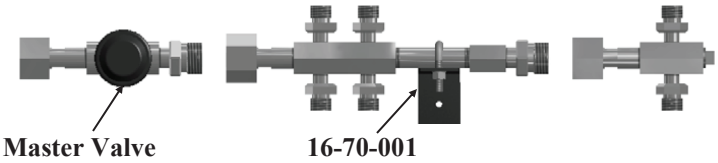
1. Remove manifold from shipping carton and place on cardboard insert face up.
2. Remove manifold cover by removing two screws on sides of the manifold enclosure.
3. Mark top holes in mounting brackets 81.5" from floor. This will allow clearance for "H" size bottles. If taller bottles are used adjust accordingly. Mark all four mounting holes. (See Drawing next page)
4. Drill holes for anchors to mount the bracket (3/8" anchors) supplied by others. Mount bracket to wall.
5. Lift manifold onto four 3/8" studs on mounting bracket. Secure manifold to mounting bracket using four 3/8" washers and nuts.

4.0 Cabinet Mounting Instructions (continued)



5.0 Header Bar Installation

1. Attach the Master Valve assembly to both sides of the manifold (Do not use Thread sealant on connections)
2. Attach the header bar assembly's using the union nuts to the master valve's. If header bar is larger than a 5x5 a wall mounting bracket (part number 16-70-001) is included on each side for each additional 4th or 5th cylinder (see below). Attach wall bracket to wall using 3/8" anchors (supplied by others). Tighten u-bolts to header pipe.



3. Secure cylinders to wall with optional wall mounting brackets and chain. (see be low)





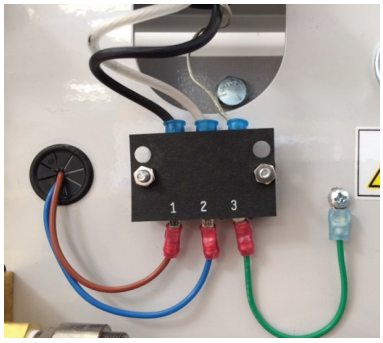
4. Remove plastic caps from header bar and install pigtails to the header bar connections and cylinders.



6.0 Power Supply Connection

1. Supply 100 VAC to 240 VAC 12 to 14 AWG copper wire. Circuit breaker 15 amp max. A 1/2" conduit connection is provided at the top of enclosure. Current draw is .55 amps.



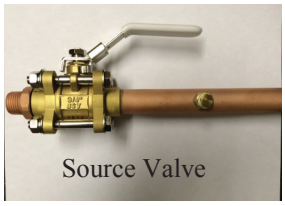


Brown	Hot	1
Blue	Common	2
Green	Ground	3

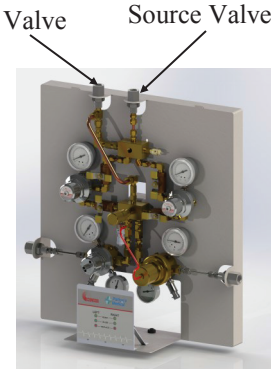
7.0 Master Alarm Contacts (NFPA) " switch-over has occurred"

Two sets of remote alarm contacts are provided for building automation systems. Contacts will open if a switching failure occurs or a loss of power. The alarm contacts are rated for 0.4 amps @ 24VDC. Connection is made through bottom of enclosure.

8.0 Outlet Valve and Relief Valve Connection

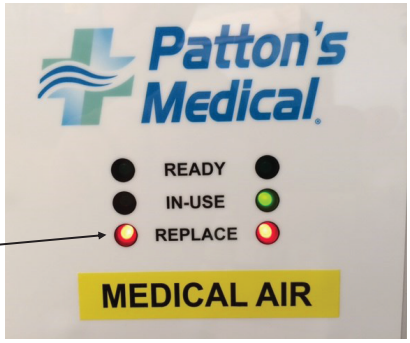


The Source Valve is shipped loose. The source valve is supplied with 1/2" NPT fitting for connection to top of manifold and 3/4" nominal copper for facility connection. A 1/8" plugged port is provided on top of the source valve and can be removed for purging. The relief valve connection is 1/2" NPT located on top of the manifold.



9.0 Initial Start-up

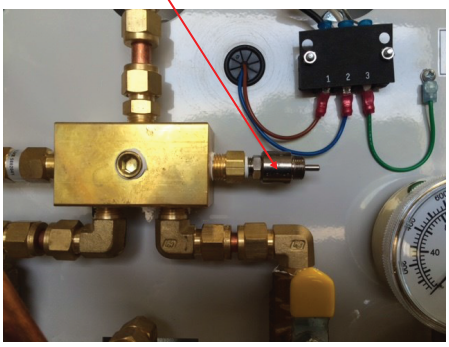
1. Close 3/4" Source Valve.
2. Fully open master valve on both sides of manifold.
3. Open all four regulator isolation valves.
4. Apply power to manifold.
5. "Replace" lights illuminated on both sides.
6. Slowly open one cylinder on right side.



9.0 Initial Start-up (continued)

7. "Ready" and "In use" lights illuminate.
8. Slowly open one cylinder on left side of manifold.
9. "Ready" light illuminates on left side.
10. Slowly close right side cylinder that is open.
11. Press relief valve and drop pressure slowly.







12. When the right side drops below the low limit the red "Replace" light will illuminate, alarm contacts will open and left side "In Use" green light will illuminate. Manifold is now flowing gas from left bank.
13. Slowly reopen one cylinder from right side. Red light turns off and green "Ready" light turns on.
14. Slowly close left side cylinder that is open.
15. Press relief valve and drop pressure slowly.
16. When the left side drops below the low limit the red "Replace" light (local signal) will illuminate, alarm contacts (Remote signal-NFPA to master alarm) will open and right side "In Use" green light will illuminate. Manifold is now flowing gas from the right bank.
17. Reopen one cylinder from left side. Red light goes out and green "Ready" light is illuminated. Alarm contacts should reclose at this time.

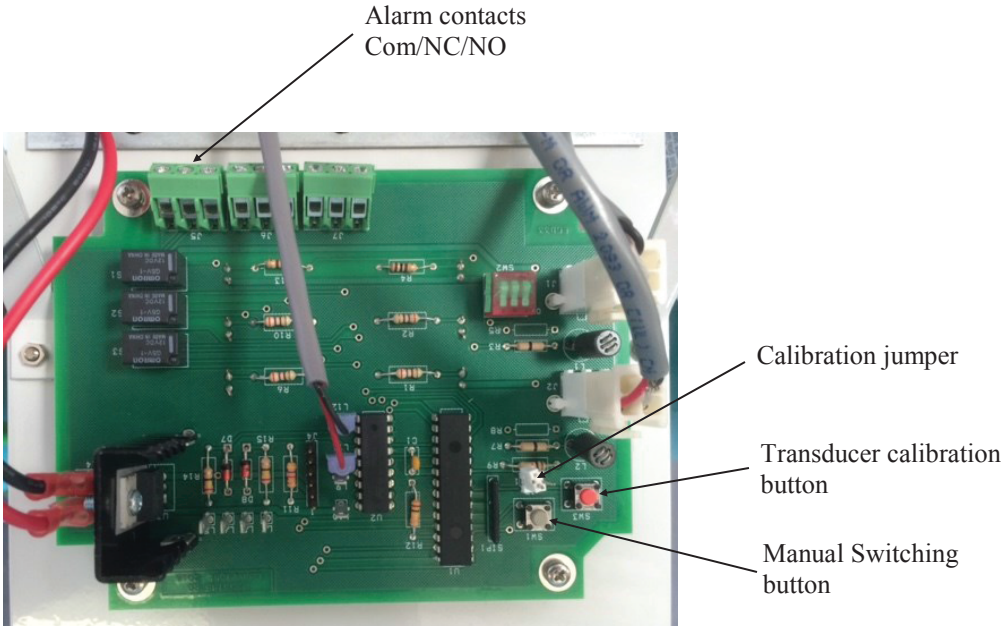
Note:

If a power loss occurs the switching alarm contact will open sending an alarm to master control panel.

The manifold will continue to supply gas until all cylinders are empty.

10.0 Control board

1. Manual switching can be accomplished by pressing gray button on control board.
2. Transducers are calibrated by moving jumper to connect both pins and pressing red calibration button with 0 PSI on transducers. (Required only when replacing trans ducers). Remove jumper from 1 pin after calibration.
3. Three sets of remote alarm contacts are supplied for connection to master alarm panel or other BMS systems. **(Normally open contact will be closed if no alarm condition is present)**



11. Testing for leaks

1. Close 3/4" source shut-off valve.

2. Make sure master valve is open on the right and left side of manifold.

3. Slowly open a cylinder on both sides of the manifold.

4. Check for leaks at all cylinder extension joints using a commercial leak detector which is compatible with oxygen.

5. If leaks are detected close valves on cylinders that were opened. Repair leaks and verify leaks are eliminated.

6. Wipe off excess leak detector after testing. Avoid getting leak detector on electrical components or connections.

12. Specifications

The Patton's Medical Automatic Changeover Manifold is designed in accordance with the latest revision of NFPA 99.
Three types of Patton's Medical manifolds are available depending on the delivery pressure and gas type.

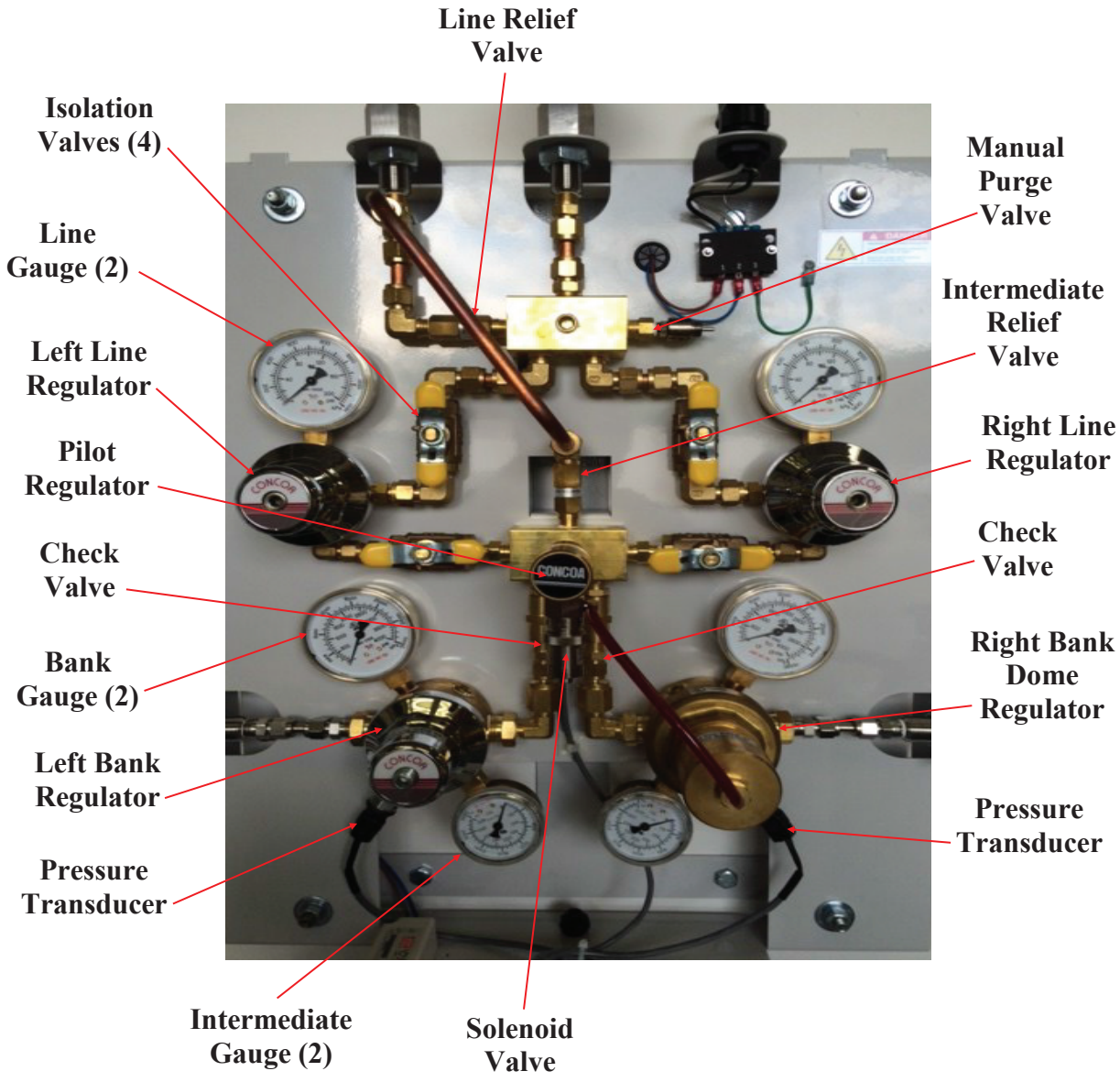
55 PSI Delivery Pressure
- Oxygen, Nitrous Oxide, Medical Air, Carbon Dioxide, Helium, Argon

100 PSI Delivery Pressure
- Medical Air, Oxygen, Carbon Dioxide

180 PSI Delivery Pressure
- Nitrogen, Instrument Air

Delivery Pressure	55	100	180
Intermediate Pressure - Ready Bank	190 PSI	230 PSI	260 PSI
Intermediate Relief Valve	375	375	375
Line Pressure Relief Valve	225 PSI	225 PSI	375 PSI
Maximum Inlet Pressure	3000 PSI	3000 PSI	3000 PSI

13. Manifold Parts Layout

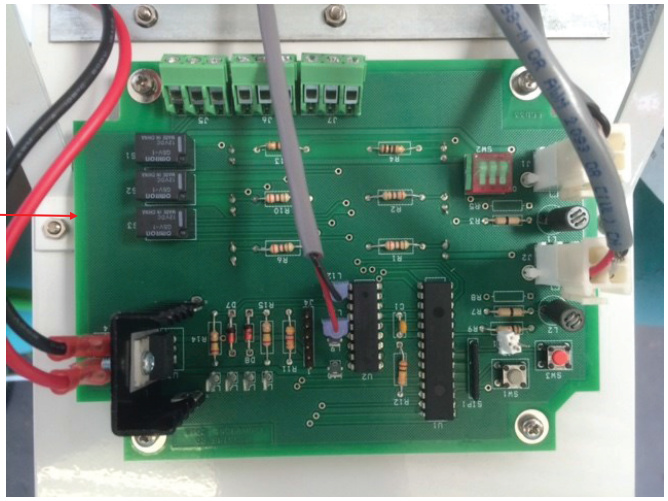


13. Manifold Parts Layout

Power Supply 27-80-066



Control Board 27-80-064



14. Manifold Parts List

Description	Part #
Pilot Regulator	27-80-050
Dome Regulator (not for CO2 or NO2) 55 PSI Delivery	27-80-052
Left Bank Regulator (not for CO2 or NO2) 55 PSI Delivery	27-80-053
Dome Regulator (for CO2 and NO2) 55 PSI Delivery	27-80-057
Left Bank Regulator (for CO2 and NO2) 55 PSI Delivery	27-80-058
Left Line Regulator 55 PSI Delivery	27-80-054L
Right Line Regulator 55 PSI Delivery	27-80-054R
Dome Regulator (not for CO2 or NO2) 100 PSI Delivery	27-80-052
Left Bank Regulator (not for CO2 or NO2) 100 PSI Delivery	27-80-053
Dome Regulator (for CO2 and NO2) 100 PSI Delivery	27-80-057
Left Bank Regulator (for CO2 and NO2) 100 PSI Delivery	27-80-058
Left Line Regulator 100 PSI Delivery	27-80-055L
Right Line Regulator 100 PSI Delivery	27-80-055R
Dome Regulator (not for CO2 or NO2) 170 PSI Delivery	27-80-052
Left Bank Regulator (not for CO2 or NO2) 170 PSI Delivery	27-80-053
Left Line Regulator 170 PSI Delivery	27-80-056L
Right Line Regulator 170 PSI Delivery	27-80-056R
Bank Pressure Gauge	27-80-061
Intermediate Pressure Gauge	27-80-062
Line Pressure Gauge 0-100 PSI	27-80-063
Line Pressure Gauge 0-200 PSI	27-80-068
Pressure Transducer	27-80-059
Solenoid Valve	27-80-065
Power Supply	27-80-066
Front Cover	27-80-067
Intermediate Relief Valve & Line pressure for 170 PSI systems	27-80-070
Line Pressure Relief for 55 & 100 PSI systems	27-80-069
Isolation Valve for manifold	PMIV-M-07



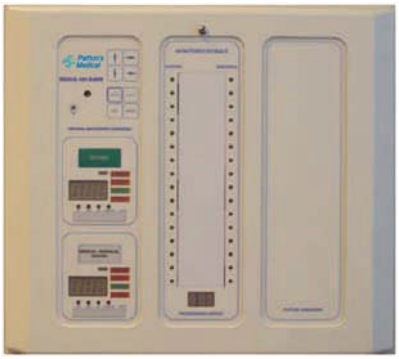
3201 South Boulevard
Charlotte, NC 28209
1-866-960-0087
www.pattonsmedical.com

Patton's Medical

Area, Master & Combination Alarm Systems







Installation and Maintenance Manual

Model Number:	
Date Purchased:	
Purchased from:	

For further technical assistance, service or replacement parts, please contact:

Patton's Medical
3201 South Boulevard
Charlotte, NC 28209

Customer Service: 1-866-960-0087
Phone: 704-529-5442
FAX: 704-525-5148

www.pattonsmedical.com

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INTRODUCTION

The Patton's Medical gas alarm system monitors the status of the medical gas distribution system and provides audible and visual indicators. The master alarm can be furnished with Relay (BIM) building management system. The alarm can be used in conjunction with the Patton's Medical optional Ethernet compatible system to monitor the status of all alarm and manifold systems on a PC. The Patton's Medical alarm system monitors the status of the medical gas sources in accordance with NFPA 99 and CSA Z7396.1.

The Patton's Medical gas alarm system is a two or three section assembly comprised of a rough-in box, a front panel and transducers (only if it is an area alarm or combination alarm).

Rough-in Box

The rough-in box houses the power supply, fuse, on/off switch, and a terminal strip for electrical wiring. An isolated transformer reduces the 110V or 220V AC input to low voltage DC.

Front panel

The front panel includes enclosed printed circuit boards with programming circuitry.

The **Push Button Module** includes a power on indicator, programming buttons and an audible alarm.

The **Remote Signal Module(s)** can monitor up to 16 signals per circuit board. Multiple remote signal modules can be ordered in a single alarm. The signals can be configured to display an abnormal condition on either a normally closed (NC) or a normally open (NO circuit. Each signal may also be turned off it is not being utilized.

The **Remote Signal Module(s) with Relay (BIM module)** are equipped with all of the above described features as standard Remote Signal module(s) described above. In addition, the r emote signal module(s) with Relay (BIM) are equipped with an extra set of remote signal dry contacts to interface with a building management system.

The **Gas (Area) module(s)** on the front panel are identified with gas specific, color coded labels (per NFPA 99 or CSA Z7396.1). The gas displays include LED's which indicate high/normal/ low pipeline pressure. A digital LED display shows the actual gas pressure. The gas pressure may be displayed in PSI and In Hg, or BAR or kPa. The unit is pre-programmed to display PSI / In Hg from the factory, but may be re-programmed in the field to display BAR of kPa. In addition there are LED's which illuminate to indicate System and Program failures. Each module is supplied with dry contacts for remote signaling of high and low pipeline pressure.

Transducers

The transducers converts pressure to an electrical signal and supplies the electrical signal to the alarm circuit board gas module panels. **After the initial 24 hour 150 psi standing pressure test (required per NFPA 99) has been completed** the pressure/vacuum transducers may be connected to the medical gas pipeline. The transducers may be remotely attached to the piping system at distances up to 5,000 feet using standard 18 gauge stranded twisted pair wire. Patton's Medical recommends mounting the transducers in the zone appropriate zone valve box or in the alarm back box. Should a transducer required service or replacement it is considerably more of a safety issue and more time consuming to locate and replace transducers which have been remotely located above the ceiling and eliminates contamination issues - such as having to set up a tent in order to remote ceiling tiles.

Features & Benefits

Microprocessor controlled
State of the art maintenance free electronics provide excellent reliability

Easy to program

One man adjustable digital pressure display
(at the panel, not the transducer)

Remote signal modules
Each circuit board provides monitoring of 16 separate remote devices

Self test program - alarm code display
LED display reveals the nature of the malfunction and reduces maintenance time

Three year PC board warranty
A quality product you can buy with confidence

Independent multiple master alarms
When service is interrupted to one alarm the other(s) continue to operate independently

Transient signal filter
Prevents or reduces nuisance (false) alarms signals (less than 0.7 seconds) created by EMI/RFI interference

Audio & Visual signal indicators
Audible alarm and visual display of both normal and abnormal status of each signal monitored assures prompt and informative indication of a problem

Optional building management interface circuit board(s) - Relay (BIM) boards
Allow communication of remote signals (master alarm points) with building management system

Easy to install and service
Hinged frame with lanyards for easy accessibility

Dry remote signal contacts (high & low) for each gas module
Dry contacts are provided so that both the high & low line pressure alarms may be remotely wired to a remote or master alarm

Programmable remote signals (Master module)
Configure wach remote signal independently (either normally closed, normally open or turn unused signals off).

Digitized transducers
Allow remote locating of transducers up to 5,000 feet away from alarm panel. Extremely resistant to RFI

Programmable gas module high and low set points
Pre-programmed from factory at 60/40 psig for 50 psig delivery pressure gases, 200/140 for N2 and 12 in Hg for Medical Vacuum & WAGD/EVAC. Programmable in 0.5 psig or In Hg increments from 0.5 psig or In Hg up to 30 In Hg or 100 psig or 250 psig (depending on which type of transducer is used).

Compact Unit
Requires minimal wall space. Monitors up to 14 area alarm signals or 64 remote (master) signals in one 5 slot panel.

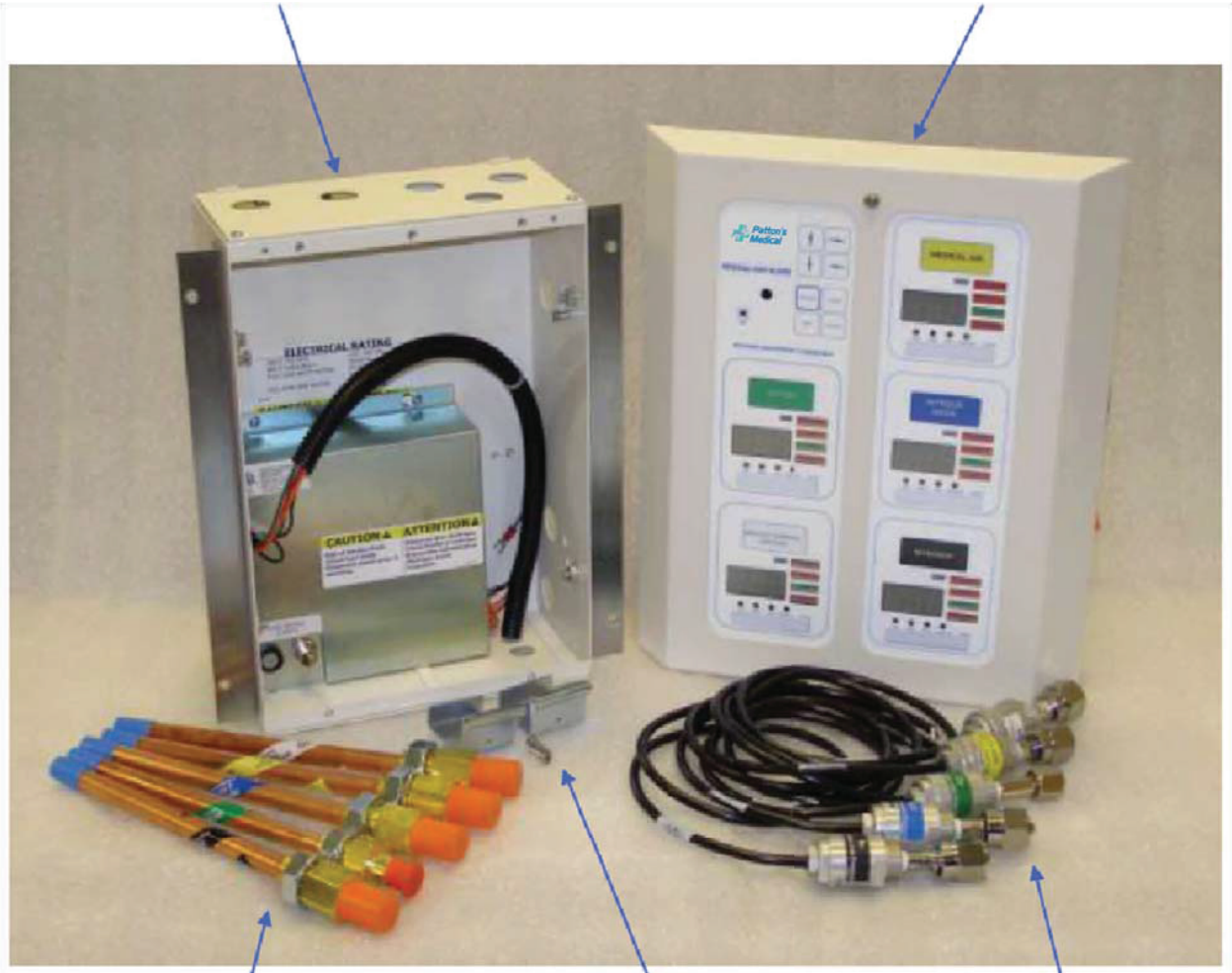
Alarm history recall
Can recall previous alarm signals (both area and master alarms) even after the alarm condition has been corrected and the alarm panel has been cleared

Area Alarm repeat feature
Adjustable from 1 minute to 240 minutes (factory programmed for 10 minutes).

Major Components

Rough-in box or back box

Front panel or front



Riser assemblies (for installing transducers in alarm back box)

Hinges and screws for attaching front panel to back box

Transducer assemblies

Alarm Installation

Installation of the Patton's Medical alarm involves installing the rough-in box, the risers & the transducers (if it is an area alarm or combination alarm) and front panel and making the necessary conduit, plumbing and electrical connections. All installation and testing should be done in accordance with NFPA 99 or CSA Z7396.1.

WARNING: Electrical power intended for the alarm to be installed should be disconnected prior to installation.

WARNING: This device should only be installed by qualified personnel. Installation should not be attempted by anyone not having general experience with the installation of devices of this nature.

Rough-In Box Installation





(Side/end view of rough-in back box)

This is a rough-in box for a combination alarm. Your rough-in box should look the same or similar to this unit. The risers are shipped loose, for protection during shipment, and must be installed. If transducers are to be mounted remotely, it is recommended that they be connected to the DISS demand check valves installed in the corresponding zone valve box.

Refer to the building plans to determine the location of the alarm.

The contractor is to provide rigid mounting that will support the alarm box on both sides. The metal flanges provided on both sides of the rough -in box are to rest against the rigid mounting brackets. Screws (contractor provided) are to be driven thru the holes in the metal flanges into the mounting brackets. Flanges are adjustable to allow for a drywall depth of 1/2" to 1 1/8".

Mount alarm rough-in box so it will be flush or just below the finished wall surface using the adjustment feature on the flanges. Recommended mounting height of alarms is generally 66" (generally accepted) from floor to top of finished alarm unless specifically detailed otherwise.

Alarm Installation

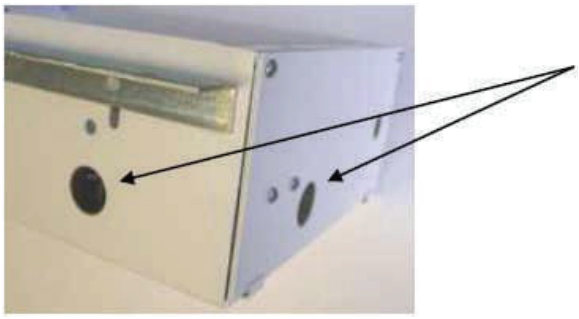


The power supply hole is located in the bottom (left side) of the rough-in box. Remove the plastic cover and panel covering the power supply. Remove the plug from the hole. Make conduit connections for wiring from the facility **emergency power source.**

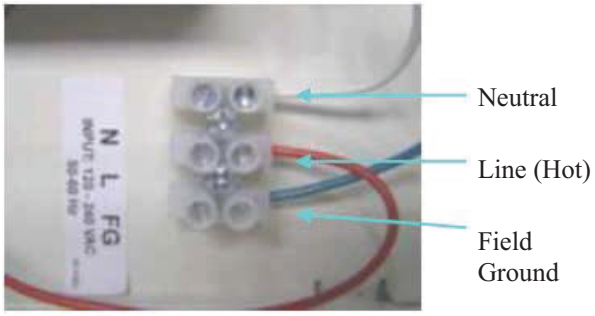


To remove the power supply cover, loosen the two screws at the top of the cover and slide the cover to the right, then lift the cover over the screw heads. Slide the wiring harness strain relief to the left until it is free from the cover.

Wiring

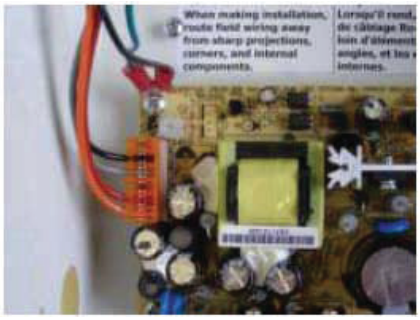


Use either of the two 1/2" conduit knock-outs provided on the lower left side and bottom of the rough-in box to route conduit to supply either 120 or 240 VAC to the power supply. **Note: Separate conduit should be used for low voltage wires (use knock outs provided on the top of the box).**



Route wires through the power supply conduit installed in the bottom and left side of the rough-in box. Connect the 120 or 240 VAC facility **emergency power source** electrical wiring to the terminal strip provided on the lower left side of the box. (N = neutral, L = Line (hot), FG = field ground)

Alarm Installation



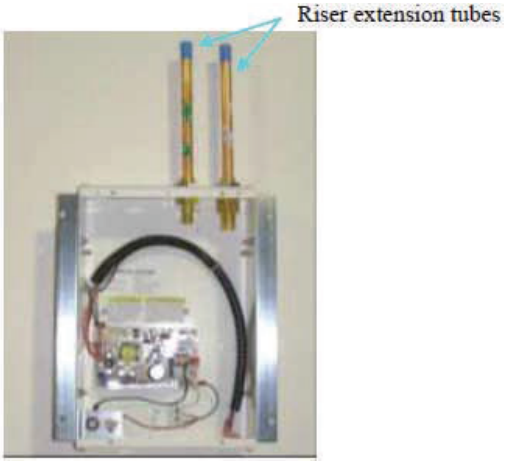


The wiring harness will be provided pre-wired to the power supply. If by chance you are replacing a wiring harness, the single green ground wire should be fastened to the screw on the top left corner of the power supply board. The wiring plug in connector (which should contain the rest of the wires), plugs into the connector terminal on the upper left corner of the power supply board. The black wire will be on the top.

This is how the power supply should look when the wiring is completed.

Replace the power supply cover and plaster cover (to protect the unit while the drywall and wall covering work are being done) after wiring is complete

Plumbing the Riser Extension Tubes



Install the risers in the top of the back box as shown. After removing the protective plastic caps, connect the riser extensions tubes to the gas piping system per NFPA 99. Make sure the drop is for the proper gas service. Using a purge gas to insure cleanliness in the tubes, silver braze the joints. Do not use soft solder. Conduct heat away from the check valves. (A purge kit is required for purge equipment connection to the system). The 150 psi standing pressure test of the piping system must be successfully completed and all pressure removed from the system before connecting the transducers to the system. **Attaching transducers without depleting the 150 psi standing pressure first will result in damage to the transducers.**

Note: It is recommended that gas piping system tubing be connected from the extension tube to the ceiling for a future or blank gas display even though a transducer is not being installed. Cap the unused tube above the ceiling. This will simplify future expansion.

Note: It is possible to install the transducers remotely (not in the alarm box). In this type of installation the risers are connected to the gas piping system up to 5,000 feet away from the alarm panel.

Note: Patton's Medical recommends mounting the transducers either in the zone valve box (remote) in or in the alarm back box - not remotely above the ceiling. Should a transducer require service or replacement it is considerably more time consuming to locate and replace or service transducers remotely located above the ceiling.

Installing the Hinges

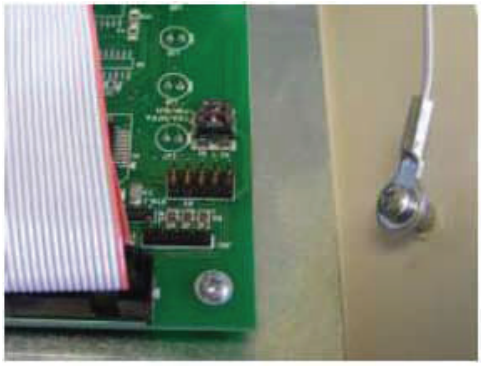


After the walls are finished, the hinges may be installed onto the rough-in box. The two hinges should be fastened to the lower front edge of the rough-in box using the screws provided. The hinge should rest flat against the surface of the drywall.

Installing the Alarm Front Panel

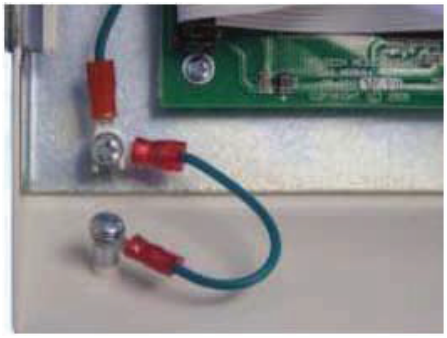


Slide the rectangular holes cut into the bottom edge of the front panel over the front catch of the hinges. Support the front panel in the open position to attach the lanyards.



Attach the two (left & right side) lanyard cables to the alarm front panel using the screws provided.

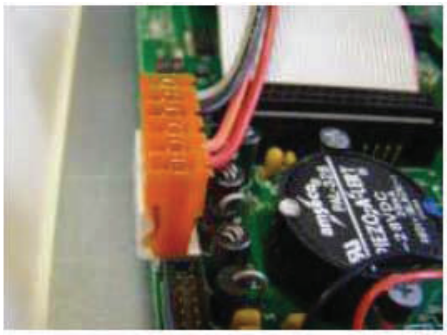
Wiring the Alarm Front Panel to the Power Supply



Attach the green ground wire, which is in the wiring harness, to the ground screw on the left corner of the front panel - just in front of the power supply.



Attach the plug connector at the end of the wiring harness to the appropriate connector located at the top left corner of the button module circuit board. The plug should lock into place. The plug can only be inserted on way.



This is how the wiring harness plug connector should look when properly installed on the back of the button module board.

Installing the Transducers (non remote)



After depressurizing the 150 psig standing pressure from the piping system, install the appropriate transducers to the appropriate riser extension tube connectors inside the rough-in box. Hand tighten then torque lightly with a wrench.

Installing the Transducers (remote)



Transducer assemblies with DISS gas specific fittings have also been provided and, after the 24 hour standing pressure test is completed and normal operating pressure has been restored to the medical gas piping system, they must be connected to the DISS demand valves. Note: maximum mounting distance of each remote transducer is 5,000 feet away from the alarm panel to which it will be wired. Follow the wiring instructions in Appendix F.



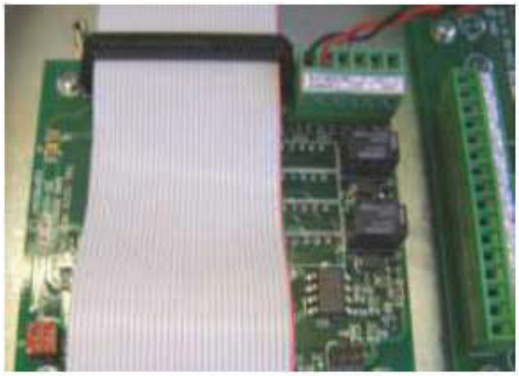
The transducers have been designed so that they may be installed in a standard 4”x 4”x 2 1/8” electrical junction box for added protection.



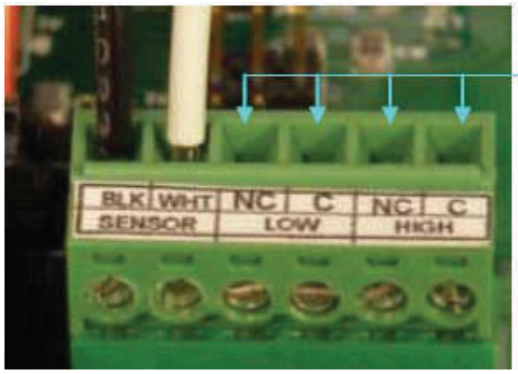


A panel mount feature has been provided to allow mounting of the transducer using standard 1/2” conduit connections and 4”x 4”x 2 1/8” junction boxes. Note: The DISS nut & nipple will need to be removed to allow installation of the conduit nut and the re-installed using oxygen safe Teflon tape.

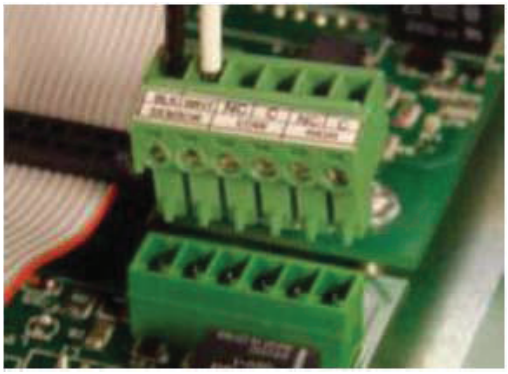
Connecting the Transducer Wiring to the Alarm Front Circuit Board



The wire terminal connector on the gas board has six wire connection slots. The two wires from the transducer should be installed in the BLK & WHT SENSOR slots. These are the two slots closest to the center of the gas board (as shown). It is preferred that the black wire be closest to the center of the gas board.



The other four connection slots are for optional remote signals of the low and high line pressure alarms.

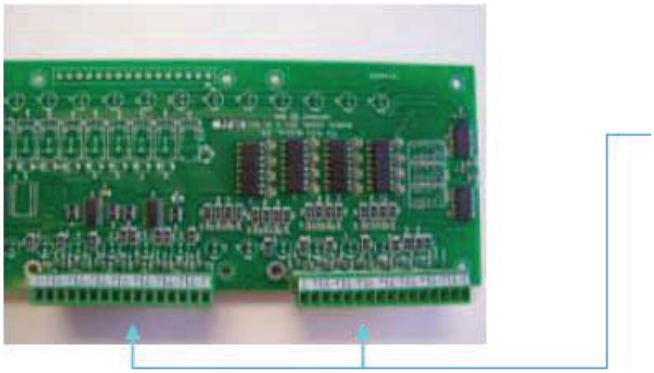


The transducer plug may be removed from the gas module to make it easier to install the wires.

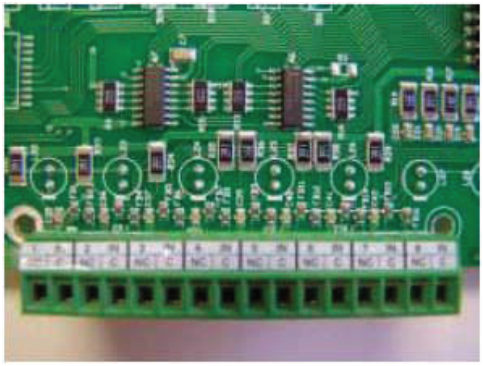


Visually verify that the appropriate transducer wire pair has been attached to the appropriate gas module by looking at the front of the alarm panel. If there is *not* an Error Condition and a System alarm, the proper (matching gas service) transducer has been connected to the gas board.

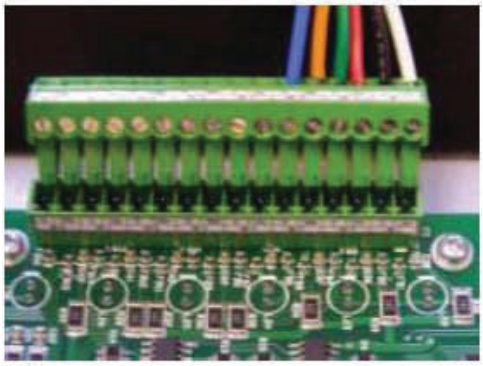
Wiring the Remote Devices to the Remote Signal (Master) Board



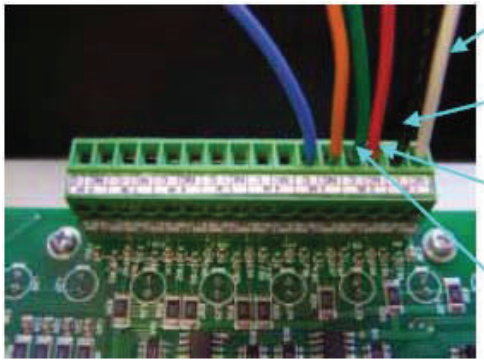
Locate the two banks of 16 terminal connectors on the back of the remote signal (master) board.



There are a total of 32 connection points - two connection points for each remote signal. The pairs are labeled 1 IN thru 16 IN on the circuit board. **The NC (normally closed) labeled terminal of each pair is where the signal wire should be landed.**

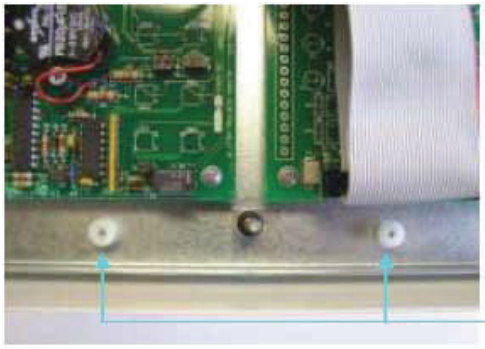


The connector terminal may be unplugged from the circuit board - to simplify installation of the remote signal wires.



Land the corresponding common wire on the C (common) terminal of each pair of terminal connectors.

Labeling the Alarm Front



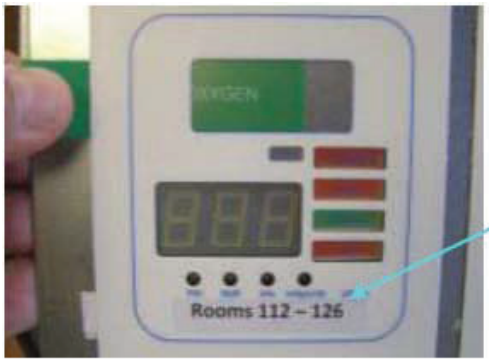
After all remote signal (master) wires have been landed, identified & cataloged (using appendix C in this manual), you are ready to apply the remote signal labels. Remove by unthreading the two nylon nuts shown here from the back of the alarm front panel.



The panel will now lift out of the white frame. Provided in the packaging with the alarm front panel is a long white card and a pre-printed sheet of labels for the remote alarm signals. **Wash your hands before handling these labels and cards!** Apply the labels to the appropriate position on the card using the guide lines on the card. When complete, insert the card into the "Monitored Signals" label pocket of the "Monitored Signals" label.

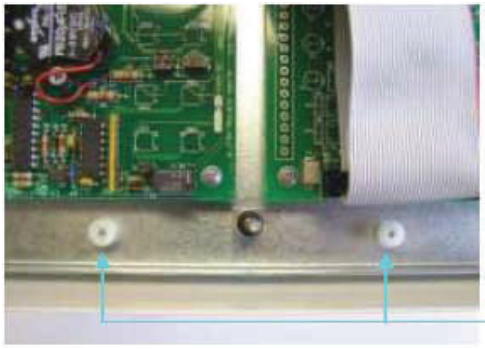


The gas modules are shipped pre-labeled from the factory. If a gas service is changed to a different gas or added to the alarm, it will be necessary to insert the appropriate label in the pocket of the gas module. The new gas label supplied by Patton's Medical will slide into the gas module label pocket of the gas module label.



A blank label has been provided at the bottom of each gas module for room identification. You may type directly onto this label or apply a pre-printed label. The label supplied by Patton's Medical will slide into the gas module label pocket of the gas module label.

Alarm Installation



When the labeling is complete, install the plate into the white frame and re-attach with the two nylon nuts.



You are now ready to supply power to the alarm. Restore power to the circuit feeding this alarm panel. The toggle switch on the front of the power supply should be placed in the ON position.

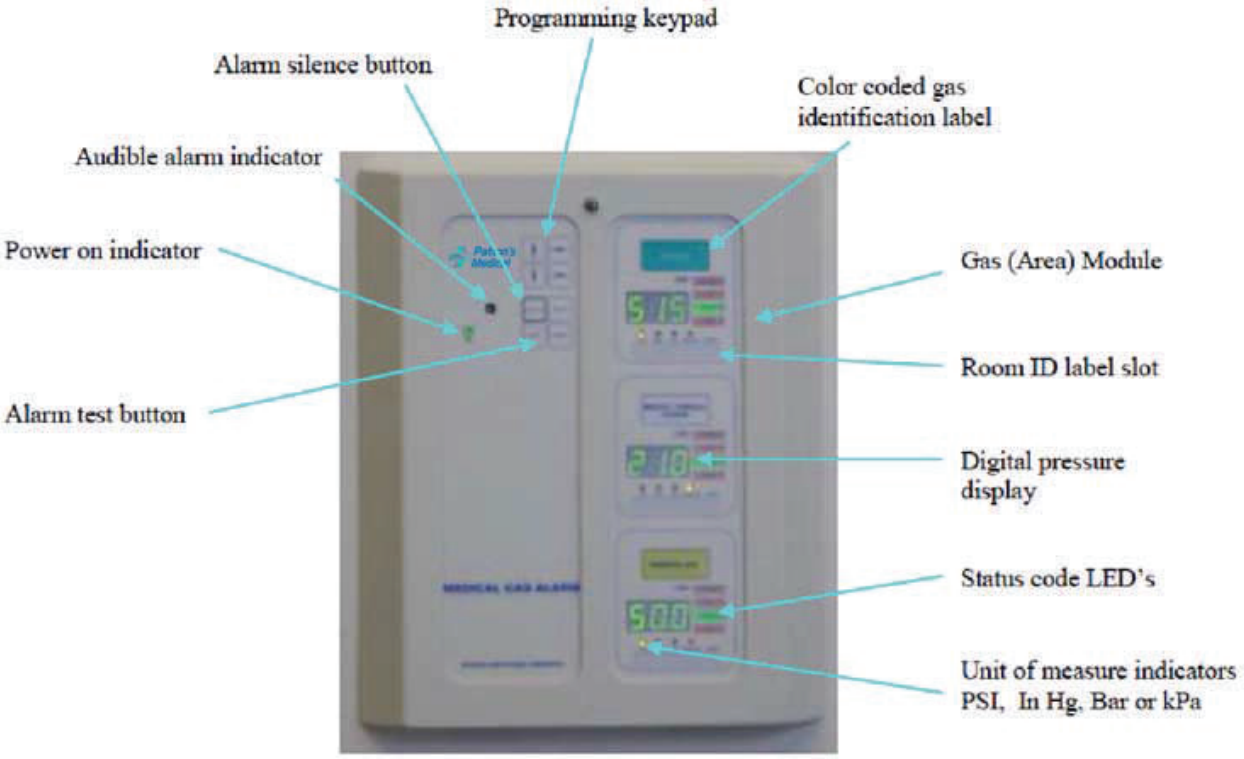


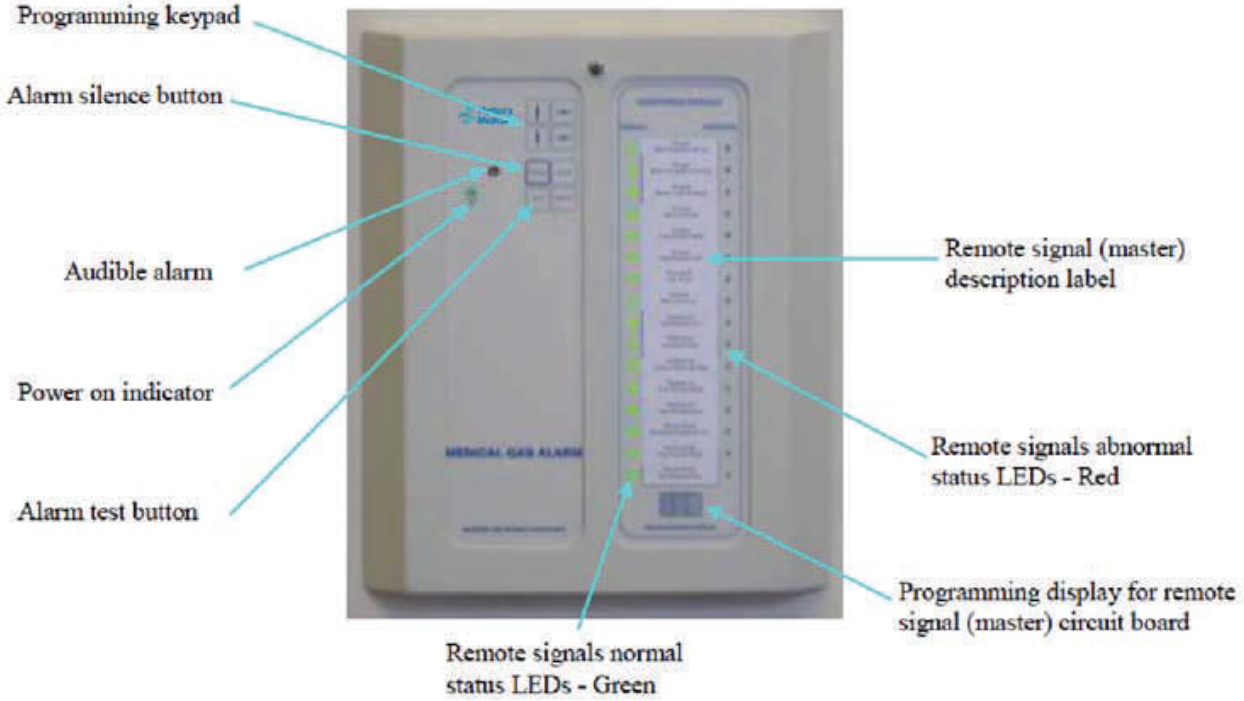
Check the green power LED indicator on the front of the button module. It should be illuminated.



If you haven't already, you are now ready to pressurize the piping system to normal operating pressures. The alarm is shown here with Oxygen & Medical Air at normal operating pressures. All remote signal points (master alarm signals) are shown in normal condition.

Area and Master Alarm Displays & Functions





Alarm Displays & Functions

Button Module

Power on Indicator
The power on indicator (green LED) is illuminated whenever electrical power (120 or 240 VAC) is connected to the alarm and the on/off switch is turned on.

Test Button
When the Test button on the front panel is pressed, the alarm illuminates all segments of all lights and LED's and sounds the buzzer.

Alarm Silence
In the event of an alarm condition an audible alarm sounds. The audible alarm can be silenced by pressing the alarm silence button. The high or low pressure LED or the remote signal LED will remain illuminated until the alarm condition is rectified. If a gas module (area alarm) had alarmed, depressing the silence button will silence the alarm for approximately 10 minutes (factory setting). After approximately 10 minutes, the audible alarm will sound again.

History Button
The History button may be pressed and held at any time to view alarm history. Viewing alarm history is only active while the History button is pressed, releasing the button returns the alarm to normal operation. Pressing the History Button will display the following:
Gas (Area) Module - If there was an alarm condition for any gas (area) module, the High and/or Low Pressure LED's will be illuminated. If both the High and Low Pressure LED's are illuminated, the gas has had both a High and Low alarm.

Remote Signal (Master) Module - If there was an alarm condtion for any Remote Signal the Red LED will be illuminated. All other LED's will be off.

Clear Alarm History - To clear alarm history you simply press the history button, hold it down and simultaneously press the clear button.

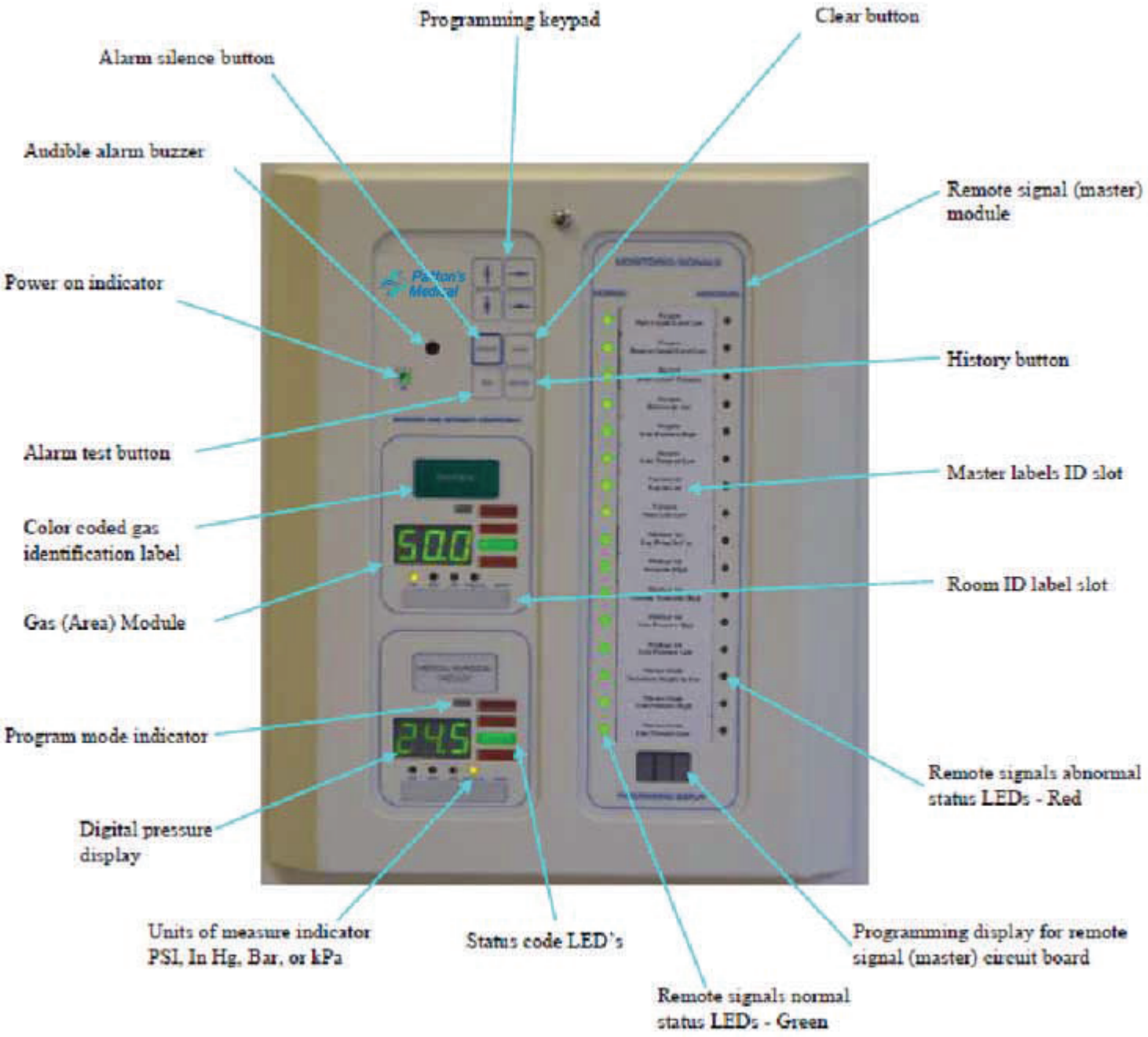
↑ (up arrow)
The up arrow may be pressed & held at any time to display the high line pressure alarm set points of the gas module (area) boards. When in the program mode, the up arrow is used to raise the high line pressure alarm set point on gas module (area) boards and to toggle between your choice of Green condition, Red condition or Disabled condition on remote signal (master) boards.

↓ (down arrow)
The down arrow may be pressed & held at any time to display the low line pressure alarm set points of the gas module (area) boards. When in the program mode, the down arrow is used to lower the low line pressure alarm set point on gas module (area) boards and to toggle between your choice of Green condition, Red condition or Disabled condition on remote signal (master) boards.

→ (right arrow)
The right arrow may be pressed & held at any time to display the gas service for which the gas module (area) board is currently programmed. When in the program mode, the right arrow is used to toggle between the various options of services on the gas module (area) boards and to toggle to the next remote signal point on the remote signal master boards.

← (left arrow)
The left arrow may be pressed & held at any time to display the type of transducer that is connected to each gas module (area) board. The 3 types are 0 - 30 In Hg, 0 - 100 psig and 0 - 250 psig. When the left arrow is pressed "30" will be displayed for a 0 - 30 In Hg transducer, "100" will be displayed for a 0 - 100 psig transducer and "250" will be displayed for a 0 - 250 psig transducer. When in the program mode, the left arrow is used to save the updated programming information. After the changes have been made and the left arrow is pressed three horizontal lines will appear on the digital pressure display of the gas module being programmed or on the programming display for the remote signal (master) board being programmed.

Combination Alarm - Displays & Functions



Alarm Displays & Functions

Gas Module (Area Alarms)

Pressure Reading Display
The LED Digital Pressure Display displays the pressure as indicated by the transducer. The gas pressure may be displayed in PSIG/In Hg, BAR or kPa. PSIG and In Hg is the factory setting.

Note: Vacuum & EVAC/WAGD are actually displayed as inches of Hg in the PSI mode. In kPa mode the Nitrogen gas display indicates one tenth of the actual pressure when the pressure exceeds 999 kPa (i.e. 1100 kPa is displayed as 110 and the kPa and (x 10) LED is lit).

Note: Alarm settings are maintained even if power is interrupted.

Units of Measure Indicator
The Units of Measure Indicator illuminates PSIG/In Hg, BAR or kPa (whichever is selected during programming - PSIG and In Hg is a factory setting) providing the unit of measure displayed on the LED pressure reading. In the kPa model the Nitrogen gas display indicates one tenth of the actual pressure when the pressure exceeds 999 kPa (i.e. 1100 kPa is displayed as 110 and the kPa and (x 10) LED is illuminated).

High / Normal / Low Status Lights
Should the line pressure of a gas exceed the programmed alarm set points for low or high line pressure LED will be illuminated simultaneously with the buzzer sounding to announce an alarm condition has occurred. When the line pressure is neither high nor low it is considered within the normal range and the green Normal LED is illuminated. These indications are relative to the high and low pressure set points which have been programmed into the alarm. These high and low set points should be set in accordance with NFPA 99 and CSA Z7396.1 at ± 20% of the normal operating pressure.

System LED
The System LED illuminates in the event of a system problem or malfunction. The following codes will be displayed when a System Error or Failure is detected, or when the History button is pressed:

Code	Error
0	No error (History only)
1	Flash EE corrupt, defaults
2	Sensor: open or broken line
3	Sensor: com timeout, data not received when expected
4	Sensor: Noise on line, or data errors
5	Sensor: Gas type/range mismatch
Actual low psig	Low pressure (history only)
Actual high psig	High pressure (history only)

Remote Signal Status LED's (Master Module)

Normal Status Light (Green)
The normal green status light when illuminated signifies that the equipment being monitored is not in an alarm condition.

Abnormal Status Light (Red)
The abnormal status light when illuminated signifies that the equipment being monitored is in an alarm condition

Note: If no LED is illuminated the remote signal status LED's have probably been set in the disabled or off position. This can be verified by placing the Remote Signal circuit board in the programming mode and pressing the → to view the status of the remote signal point in question or by simply pressing the Test button to verify that the LED's are functional.

Program Mode
When a circuit board is placed in the program mode (see Programming Modules - page 23) the board may be re-programmed. The brightness level of the circuit boards other than the one in the program mode is decreased. In addition, on Gas Displays (Area Modules) the PGM (Program) LED is illuminated, on Remote Signal Displays (Master Modules) the first Remote Signal point will blink.

Alarm Operation

This section deals with the daily operational aspects of the alarm panel. *The Programming The Alarm* section covers the procedures to follow in order to configure the alarm if the preprogrammed settings are not appropriate, a module is added or deleted or if the alarm is being incorporated into a T-Net system. After installation has been completed and the alarm has been properly configured, it is ready for operation.

Master Alarm Panels

Remote Signal (Master Module)
With electrical power applied to the alarm, it will monitor the status of the medical gas distribution system and the remote equipment connected to it.

The remote signals (master module displays (via LED indicators) the normal/abnormal status of the remote equipment connected to the alarm. All alarm panels are pre-programmed upon leaving the factory to monitor normally closed signals (per NFPA 99). In normal operation all active signals will be green. Whenever an abnormal status signal is detected the corresponding green LED will illuminate. Simultaneously an audible alarm will sound. Pressing the Silence button silences the audible alarm (the Red LED continues to be lit). The appropriate personnel should be notified immediately of the alarm condition. When the alarm condition has been rectified the Red LED is automatically extinguished and the Green LED illuminates. *Note: master alarm signals do not repeat - only area (gas) modules are equipped with the Repeater Delay feature.*

Silencing the Alarm
Press the **Silence** button when the alarm is sounding and the alarm will be silenced.

Testing the Alarm
Pressing and holding the **Test** button initiates a self-test of the alarm. All LED's and seven segment displays will illuminate for as long as the Test button is depressed. In addition the buzzer will sound. If any LED or seven segment display does not illuminate - it is faulty and the circuit board should be replaced. If the buzzer does not sound, it is faulty and the circuit board should be replaced.

Note: The alarms (both Area & Master) are programmed to ignore transient signals that are less than 0.7 seconds in duration.

Area Alarm Panels

Gas Modules
With the electrical power applied to the alarm and the gas systems adequately pressurized, the following indicators are illuminated: 1) the Power On LED, 2) the pressure readings of the gas on each gas display, 3) the Normal LED (green) on each gas display.

If the pressure of one of the gases drops below the programmed low limit setting, the following events take place simultaneously: 1) the Normal LED will be extinguished, 2) the Pressure Low LED (red) will illuminate, 3) an audible alarm will sound.

If the pressure of one of the gases rises above the programmed high limit setting, the following events take place simultaneously: 1) the Normal LED will be extinguished, 2) the Pressure High LED (red) will illuminate, 3) an audible alarm will sound.

Silencing the Alarm
Press the **Silence** button when the alarm is sounding and the alarm will be silenced.

The area alarm is equipped with a **Repeater Delay** feature which monitors only the Gas Module (area) alarms. The Repeater Delay has been factory programmed to make the alarm re-sound every 10 (ten) minutes as long as the alarm condition exists. Note: Remote Signal (master) alarms are **not** monitored by the Repeater Delay.

Alarm Operation







System Alarm

The audible buzzer will sound, the System LED will illuminate and an Error Code "Err" will be displayed on the digital pressure display when a system failure occurs or the history button is depressed. The System LED and "Err" will illuminate and flash on and off and alternate with a number (per table below) being displayed on the digital display.

Note: If "Err" should be displayed on the Gas Pressure Display of any gas module, this indicates a problem. Some possible problems and corrective actions are:
The transducer is not connected to the Gas Module. To correct, check the transducer connection to the back side of the Gas Module.

A transducer for a different gas service has been connected to the Gas Module. To correct, check the transducer and the Gas Module gas identification labels and make sure they match.

If the above corrective actions do not correct the problem, contact the factory for assistance.

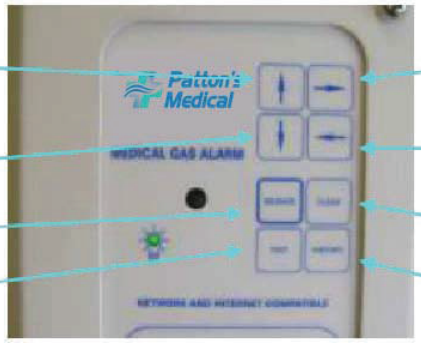
Code	Error
0	No error (History only)
1	Flash EE corrupt,defaults loaded
2	Sensor: open or broken line
3	Sensor: Com timeout, data not received when expected
4	Sensor: Noise on line, or data errors
5	Sensor: Gas type/range mismatch
Actual Low psig	Low pressure (history only)
Actual high psig	High pressure (history only)

PGM Notification

The **PGM** (program mode) LED will flash off & on when a gas module circuit board is manually placed in the program mode. *It is important to note that while a gas module is in the program mode, it is not monitoring the medical gas pipeline.* See the "Programming the Alarm" section of this manual for instructions on programming the gas module.

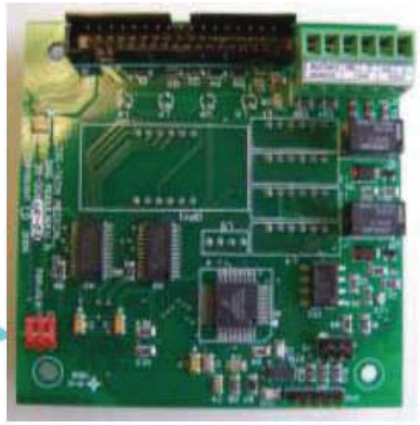
Programming the Alarm

Button Label



Gas Board (back view - showing dip switch)

DIP Switch PGM/RUN
(only outer switch labeled
PGM/RUN should be used)

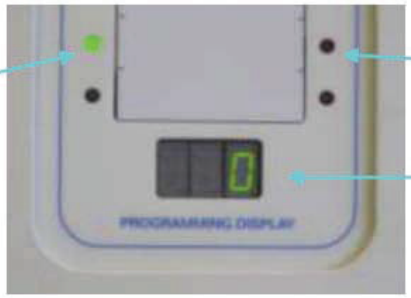


Gas Board



Remote Signal (Master) Board

Green LED Normal Remote
Signal indicators



Programming the Alarm

The alarm has been programmed at the factory prior to shipment. Programming of the alarm may be necessary if:

A) the high or low pressure limits for a gas need to be modified
B) if a future gas module is being put into service for an added gas service
C) if a gas service is being deleted
D) if a gas service is being changed
E) if a remote signal alarm point needs to be re-configured
F) if a remote signal module is being added in the place of a blank module
G) if the alarm identification number needs to be changed
H) you wish to change the repeater delay time
I) you wish to change the units of measure
J) the alarm panel is being set up on the T-NET system

Note: Only authorized personnel should program the alarm! It is important to note that while the alarm is in the program mode, it is **not** monitoring the medical gas system and alarm conditions will **not** trigger an alarm.

Accessing the Alarm Program Mode

To program the alarm, the circuit boards must be placed individually, one at a time in the program mode. To place a circuit board in the programming mode, the dip switch located on the back side of the circuit board to be re-programmed, must be changed from the "run" to the "pgm" position.

After this is done, the gas module (area) board being reprogrammed will be brighter than the rest of the gas module (area) boards (when viewed from the front) and the yellow "PGM" LED indicator will be flashing to indicate that the alarm is in the program mode and the board which is illuminated more brightly and has the flashing "PGM" LED is ready to be reprogrammed.

The remote signal (master) board being reprogrammed will have the top (first) signal point flashing and the programming display LED's (at the bottom of the board) will illuminate displaying either an "O" (open circuit) or a "C" (closed circuit) or a "d" (disabled).

The programming buttons, located on the front of the alarm, upper left corner (see photo on page 22) may now be used to make the needed program changes.

When you have successfully accessed the program mode, it is important to note that some of the buttons revert to their sub-functions:

When programming a gas (area) module:
The UP key ↑ is used to raise the pressure set point and / or to toggle upward thru the list of sub- options.
The DOWN key ↓ is used to lower the pressure set point and / or to toggle downward thru the list of sub-options.
The RIGHT key → is used to toggle (scroll) thru the list of major options.
The LEFT key ← is used to SAVE the new programming options after they are selected.

When programming a remote signal (master) module:
The UP key ↑ is used to toggle between the choices of the green LED or the red LED or both the green & reds illuminated (disabled).
The DOWN key ↓ is used to toggle between the choices of green LED or the red LED or both the green & reds illuminated (disabled).
The RIGHT key → is used to toggle (scroll) down to the next remote signal point.
The LEFT key ← is used to SAVE the new programming options after they are selected.

Note: In order to perform any of the following programming features you must first set the alarm in the program mode.

Programming the High & Low Gas Pressure set points

Immediately upon entering a gas module (area) board in the program mode, the high line pressure set point major option is displayed. If the gas module being programmed is a typical 50 psig delivery pressure gas, the board has been pre-programmed at the factory with the high line pressure set point at 60 psig, so the display should show the number 60. If you wish to raise or lower this setting, simply use the up ↑ or down ↓ keys to adjust the pressure setting.

Programming the Alarm

After the setting has been changed to the new desired setting, press the LEFT key ← (SAVE) to save the new setting. Note: if the SAVE ← LEFT key is not pressed after making the change to the programming and before pressing any other keys, the new setting will not be saved and the alarm will revert to the previously saved setting(s). When the SAVE key ← is depressed, three horizontal dashes will appear in the display.

Press the → key to move on to the low line pressure and repeat the above procedure.

Note: The alarm is designed with a safety feature so that the high and low set points must be at least 0.5 (psig / in Hg), 0.05 (bar) or 5 (kPa) increments apart. The high set point will not be able to be set below the low set point and visa versa.

Programming the Remote Signal (Master) Alarm Points

While in the program mode, the top signal point LED will be blinking. At the bottom of the same remote signal board, the Programming Display LED set will display the contact state for the blinking signal point. "O" = open, "C" = closed and "d" = disabled. The contact point that is flashing is capable of being re-programmed. (Note: in compliance with NFPA 99, all contacts are programmed as closed contact equals a normal condition from the factory). If it is necessary to re-program a signal point; press the → key to view the next Remote Signal Alarm Point, when the desired Remote Signal (Master) point is flashing, use the ↑ or ↓ keys to alter the point to the desired status, after the desired change is achieved, press the ← to save the change.

Note: Any contact point that has been disabled will have both the green (normal) and red (alarm) LED illuminated only when in the programming mode, to make it easy to identify them. In the normal mode of operation, both LED's of a disabled signal point will not illuminate nor will this signal point trigger an alarm.

Note: *When an alarm condition occurs the audible buzzer sound simultaneously with the corresponding red LED illuminating and the green corresponding LED being extinguished. When the silence button is depressed, the audible buzzer is silenced and remains silenced until another alarm condition occurs.*
Master Alarm signals do not repeat.

Programming the Gas Alarm Repeater Delay

After placing a gas board in the program mode, press → until "dLY" is displayed on the digital display of the gas module then let go of the → key. A number will be displayed on the digital display. This number is the setting (in minutes) of the repeater delay. Using the ↑ or ↓ keys, adjust the repeater delay to the desired length of time (0 - 240 minutes). (Note: the repeater delay is preprogrammed from the factory at 10 minutes - per NFPA 99). To save the change and return the alarm to the normal alarm mode, press the ← button, then change the dip switch back to the "run" setting. ***Note: this procedure must be repeated for all gas boards on the alarm panel.***
Note: master alarm signals do not repeat.

Note: If a valve of 0 (zero) is programmed and saved for any board, the repeater is disabled. If left programmed this way after 72 hours, the board(s) will automatically revert back to the preprogrammed factory setting of 10 minutes.

Programming the Units of Measure Displays

While in the program mode, press the → button until "-U-" is displayed on the digital display of the gas module then let go of the → key. The letters "PSI" or "bAŕ" or "PA" will be displayed on the digital display. This is the unit setting that the gas board is set to display. If you wish to alter the unit display, use the ↑ or ↓ keys to select the desired unit display, then press the ← SAVE key.
Note: *this procedure must be repeated for all gas boards on the alarm panel.*

Note: Vacuum & EVAC / WAGD Gas Modules will automatically display in in/Hg when PSI is selected.
Note: The kPa and x10 LED's will both illuminate on all high delivery pressure Gas Modules (i.e. - Nitrogen and Instrument Air) when kPa is selected. Because the Gas Pressure LED Display is only able to display three digits and high delivery pressures viewed in kPa are four digits, the Gas Pressure LED must be read as a four digit number by multiplying the displayed number by ten. I.E. - the Gas Pressure LED Display is displaying 125 in kPa. The pressure should be read as 1,250 kPa (125 x 10).

Programming the Alarm

Adjusting the Digital Line Pressure

The digital line pressure may be adjusted slightly (per the chart below) by following the simple procedure below. This can be done by one person at the alarm panel - no need to open/adjust the transducers!

1. Put the gas module you want to adjust into the PROGRAM MODE.
2. Using the TOGGLE → (right arrow) button go to the CAL mode.
3. Use the UP ↑ ARROW button to increase the pressure reading and the DOWN ↓ ARROW to decrease the pressure reading. The adjusted reading will be displayed as the changes are made.
4. Press the SAVE button ← (left arrow) to save the setting.
5. You can return to the original calibration setting by pressing CLEAR then press the SAVE button ← (left arrow) while at CAL in the PROGRAM MODE. This should be done if a transducer is ever replaced, as the reading offset will be applied to the new transducer readings.

Range of adjustment

VAC or EVAC / WAGD ± 0.5 In Hg
100 psig transducers ± 2.5 psig
250 psig transducers ± 6.0 psig

Programming the Board Identification

Note: This feature is only used when the alarm is used in conjunction with a Patton's Medical T-Net system.

Note: Each gas and master (remote signal) circuit board must have a unique Identification Number - no two can share the same number.

After placing a gas board in the program mode, press → until "Cld" is displayed on the digital display of the gas module then let go of the → key. A number will be displayed on the digital display. This number is the board identification # assigned to the circuit board. Using the ↑ or ↓ keys, select the desired board identification #. Use the ← SAVE button when you are finished.

Note: Each gas and master (remote signal) circuit board must have a unique Identification Number - no two can share the same number.

Note: Valid identification numbers are 1 - 999. The alarm is pre-programmed at the factory with 0 (zero) as the zone identification number.

Adding/Removing Modules or Changing the Gas Service of a Gas Board

To remove either a gas board or a remote signal master board from an alarm - you simply need to turn off the power to the alarm panel (using the switch on the outside of the power supply in the back box), unplug the ribbon cable from the board being removed and then turn the power back on. The alarm will automatically reset itself.

To add a remote signal master board to an alarm - you follow the same instructions above.

Note: The following feature is only used if; an additional gas service is being added to an area alarm, a future gas module is being set up for a new gas service or and existing gas module board is being changed to a different gas service.

The gas boards are pre-programmed for a specific gas service from the factory. After placing a gas board in the program mode, it is possible to change the gas service of the board. The following list cross references the number that is actually displayed on the gas board numeric display with the full names of the gases:

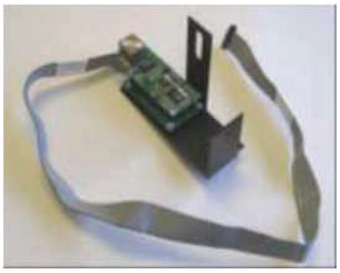
Gas # Displayed	Gas Service	Transducer Type
12	Nitrogen	250
24	Oxygen	100
04	Nitrous Oxide	100
08	CO2 or CO2-O2 mix	100
22	Medical Vacuum	30
32	WAGD / AGSS	30
16	Medical Air	100
06	Helium or Heliox	100
H16	Instrument Air	250
H24	Hyperbaric Oxygen	100
H08	Medium pressure Carbon Dioxide	100
SP	Gas Mixture	100
HSP	High Pressure gas mix	250
3SP	Tri-Gas	100

T-Net ™ Interface, Circuit Board Installation



Patton's Medical A1A/A1M series alarms may be ordered without T-Net Interface Circuit boards. The T-Net Interface Circuit boards may be installed later.

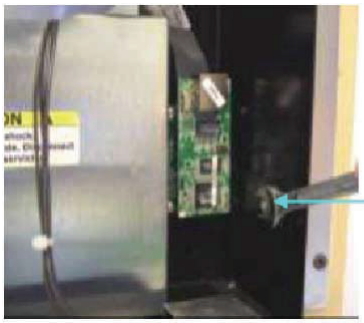
The toggle switch on the front of the power supply should be placed in the OFF position.



You will be installing one of three types of interface circuit boards, bracket and cable connector; RS485, Ethernet or Wireless. The Ethernet Interface board is shown here left and the Wireless board is shown here right.



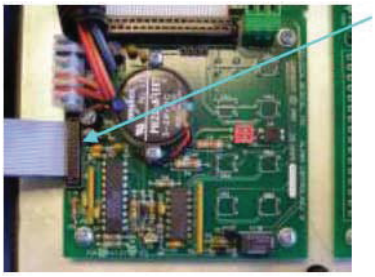
Note: Units incorporating the wireless interface circuit board - contains FCC ID OUR-9XTEND. The enclosed device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device just accept any interference received, including interference that may cause undesired operation.



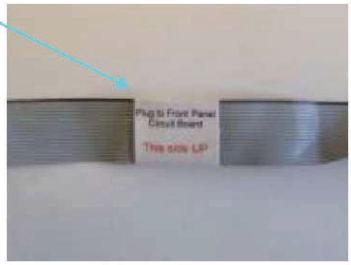
Any of the three types installs into the bottom right corner of the alarm back box. The wireless antenna drops thru a hole in the bottom of the back box.

The bracket mounts to the existing flange nut.

The cable must be installed into the socket on the Button Board properly - per the instructions of the cable.



All of the gas boards and remote signal (master boards) will need to be reprogrammed with a unique identification number and set up in the T-Net software per the T-Net installation instructions provided with the T-Net software.



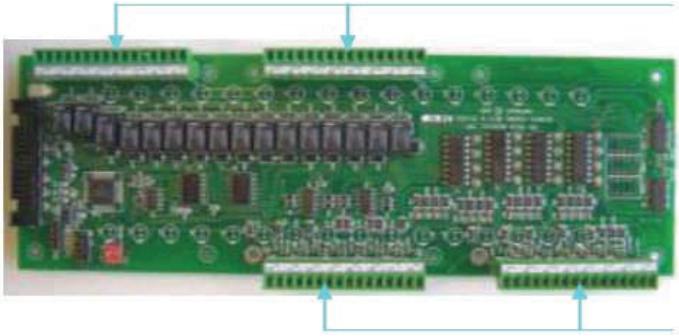
The power may now be restored to the alarm. The alarm is fully functional - even if the T-Net software is not yet installed or is out of service.

Building Management Interface, Relay (BIM) Board Wiring



Patton's Medical A1A/A1M series alarms may be ordered with standard remote signal circuit board(s) or with the building management interface circuit board(s). The building management interface circuit board(s) may be installed later, replacing the standard remote signal circuit board(s). It is only necessary to install building management interface board(s) in one of the master alarm panels.

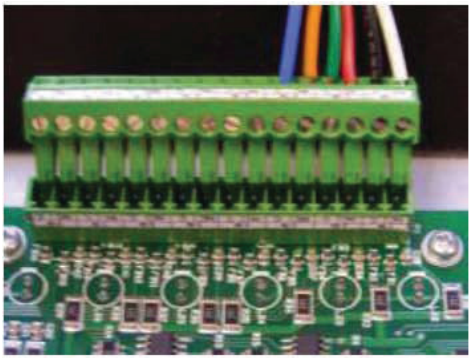
The toggle switch on the front of the power supply should be placed in the OFF position.



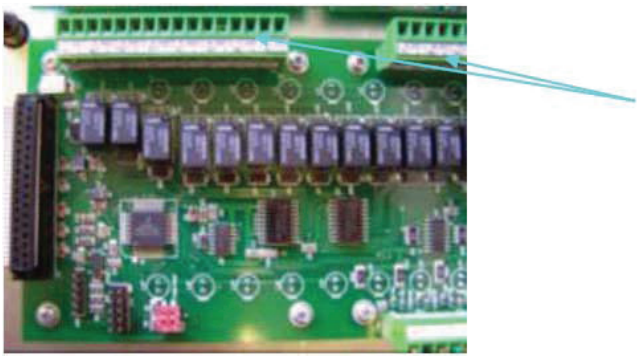
Outlet connections - to building management system

Refer to Wiring Remote Devices to Remote Signal (Master) Board page 13 - the building management interface circuit boards (Relay boards) are wired the same way as the standard remote signal circuit boards. The additional two sets of connection terminal are the connection points for the wires outputting the signal information to the building management system.

Input connections - from remote signal devices



The connector terminals may be un-plugged from the circuit board - to simplify installation of the remote signal wires. There is no need to remove the wires, simply unplug the connectors from the standard remote signal board and plug them back into the new building management interface circuit board. Be certain to match the label on the socket with the label on the plug.



The additional connector terminals are labeled 1 OUT thru 16 OUT are located on the left edge of the new building management interface circuit board. These correspond with the pairs labeled 1 IN thru 16 IN on the right edge of the circuit board. **The NC labeled terminal of each pair is where the signal wire should be landed. The C labeled terminal of each pair is where the common wire should be landed.**

Appendix A

Glossary of Terms

AC ***Alternating Current***
An electric current that reverses direction or polarity at regular intervals.

DC ***Direct Current***
An electric current that flows in one direction. The current can be steady or pulse.

IN Hg ***Inches of Mercury***
A measurement of the force in a gas vacuum system.
1 IN Hg = 3.38 kPa.

kPa ***Kilopascals***
A measurement of the force in a compressed gas system.
1 kPa = .14 PSI

LED ***Light Emitting Diode***
A semiconductor diode that converts applied voltage to light.

NFPA ***National Fire Protection Association***
The National Fire Protection Association is an association engaged in standards development.

NO ***Normally Open***
An electrical circuit in which the switch is normally open. No current flows through the circuit in normal operation. Only when the switch is closed is the flow of current started.

NC ***Normally Closed***
An electrical circuit in which the switch is normally closed. Current flows through the circuit in normal operation. Only when the switch is opened is the flow of current stopped.

PSI ***Pounds per Square Inch***
A measurement of the force in a compressed gas system.
1 PSI = 6.9 kPa

Transducer
A device that converts pressure into an electrical signal.

V ***Voltage***
Voltage is electrical pressure or force. One volt is equal to the difference of electrical potential between two points on a conducting wire carrying a constant current of one ampere when the power dissipated between the points is one watt.

Transient Signal
An intermittent and brief signal that quickly corrects and returns the alarm to a normal operating mode before monitoring personnel can silence the alarm.

Appendix B - Medical Gas Alarm Specifications

Operating Ambient Temperature range: +10C (50F) to +50C (122F)

Storage Temperature: -20C (-4F) to +85C (185F)

AC Input: 120 - 240 volts AC - 50-60 Hz

DC output (to remote signal devices): 5 VDC

Input Fuse: 5 amp input AC line fuse protects the input wiring to power supply

Power Consumption: 45W maximum @ 120 V
50W maximum @ 240 V

Pressure Measurement Accuracy: 0-30 inHg transducer +/-1%
Vacuum, Gas Evacuation

0-100 PSIG transducer +/-1%
Oxygen, Nitrous Oxide, Medical Air, Carbon Dioxide

0-250 PSIG transducer +/-1%
Nitrogen

Dimensions

Rough-in Box - All dimensions are in inches and cover the basic box only (mounting flange excluded)

Two Vertical Slot Panel
8.125W x 11.875H x 4.000D

Three Vertical Slot Panel
13.625W x 11.875H x 4.000D

Five Vertical Slot Panel
19.625W x 11.875H x 4.000D

Front Panel

Two Vertical Slot Panel
8.125W x 11.875H x 4.000D

Three Vertical Slot Panel
13.625W x 11.875H x 4.000D

Five Vertical Slot Panel
19.625W x 11.875H x 4.000D

Transducers: Housing dimensions: 1.990W x 1.990H x 3.625L including inlet fittings

Appendix C - Signal Wire Color Code Log

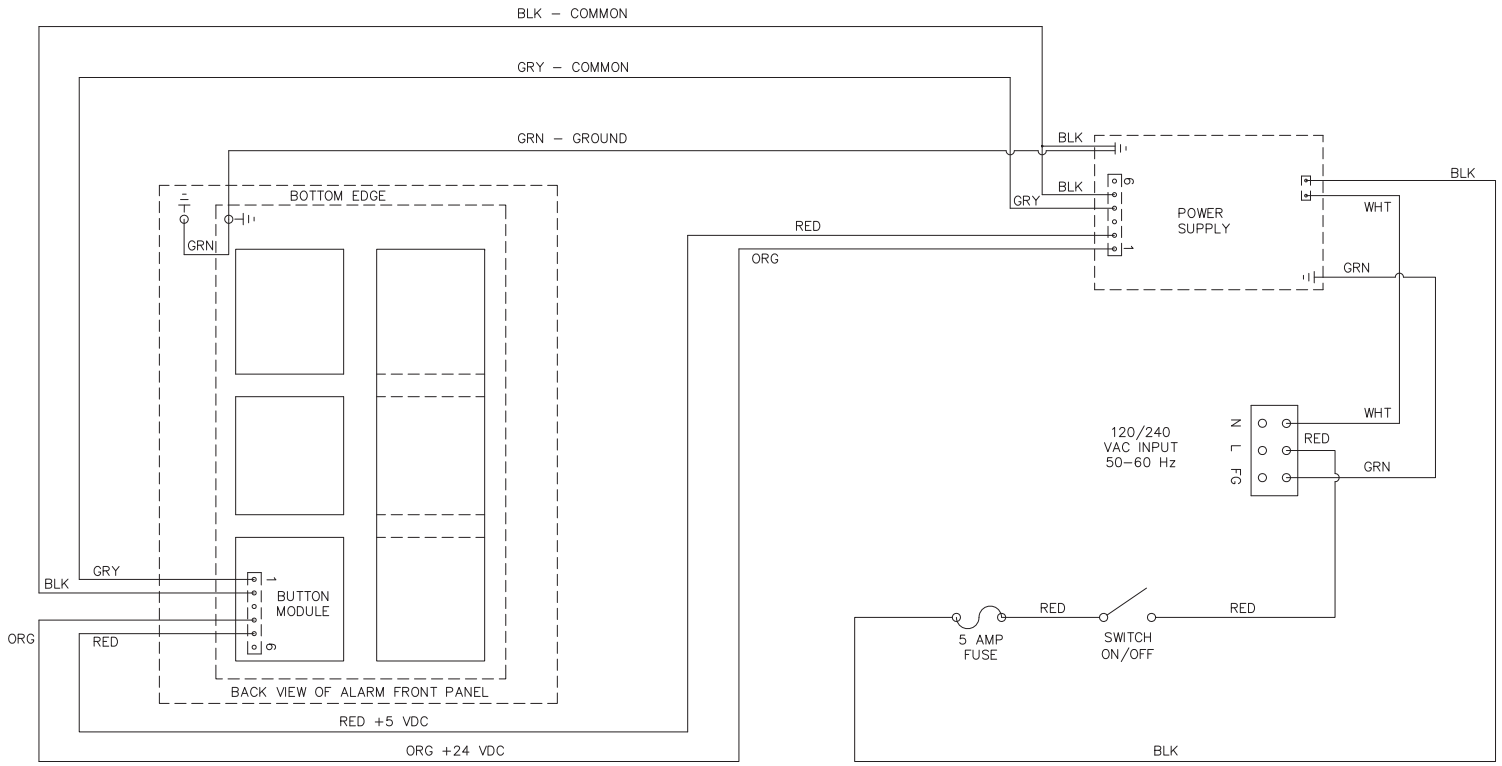
Remote Signals

Signal Position #	Remote Signal Label	Signal Wire Color	Common Wire Color

Remote Signals

Signal Position #	Remote Signal Label	Signal Wire Color	Common Wire Color

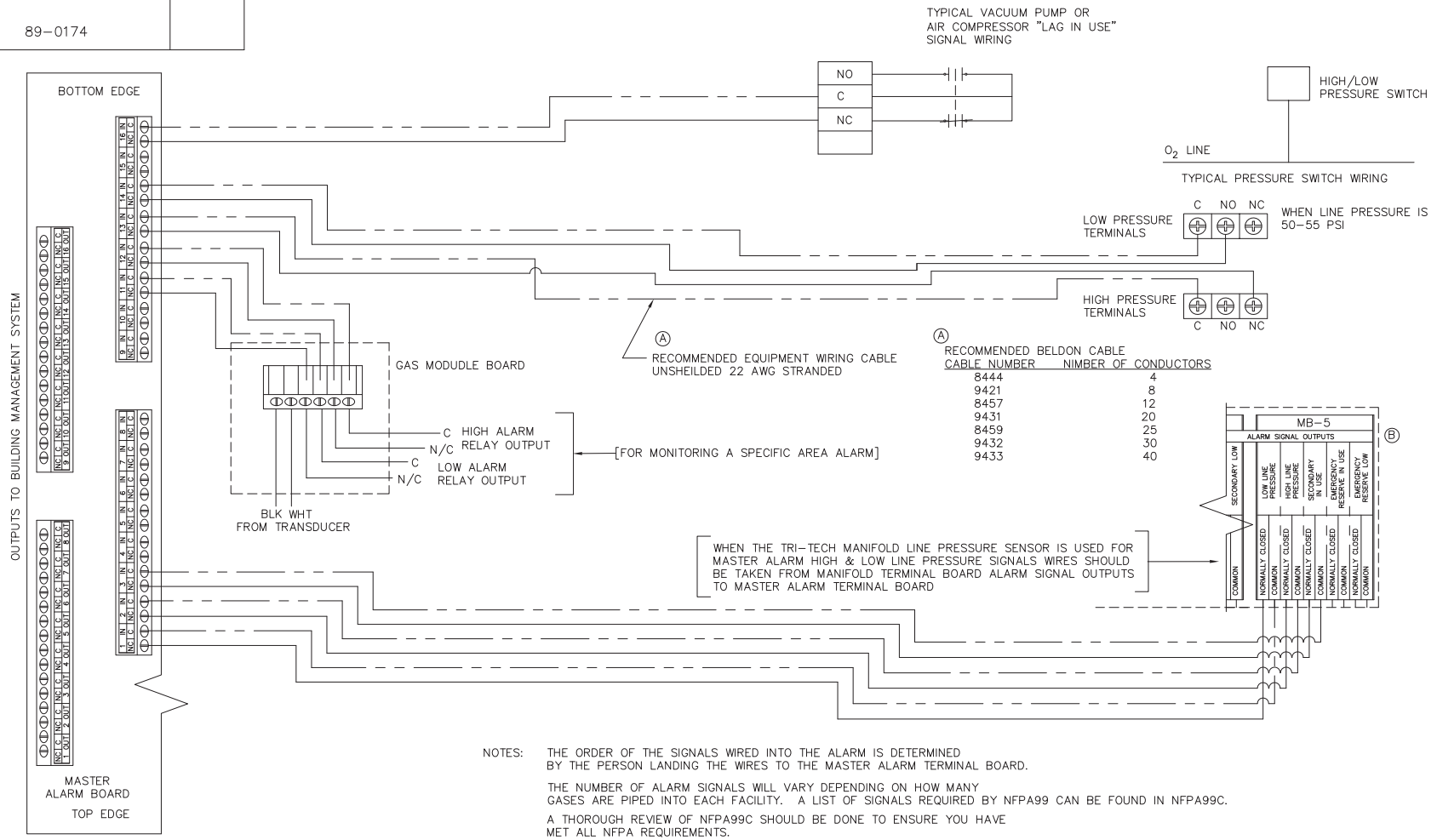
DRAWING NO.	CODE
89–0173	



TOLERANCES UNLESS SPECIFIED	DECIMAL DIAMETERS ± .003 LENGTHS ± .010	CONCENTRICITY WITHIN .010 FIM ANGULAR ± 0°30'	125 √ MAX FINISH ALL SURFACES	SCALE 1=1

Patton's Medical	Drawn by SERRANO	Date 10–07–06	MATERIAL	CODE				DESCRIPTION: DIGITAL AREA OR MASTER ALARM WIRING SCHEMATIC
	Check by	Date						
Note: This drawing is confidential and the sole property of Tri–Tech Medical. It is not to be reproduced or submitted to others without prior approval of Tri–Tech Medical.	Approved by D. SIMO	Date 10–10–06	FINISH					PART NO. 89–0173 / DWG. SIZE C
	Disk No	Release			REV.	ECN	DATE	

DRAWING NO.	CODE
89–0174	



NOTES: THE ORDER OF THE SIGNALS WIRED INTO THE ALARM IS DETERMINED BY THE PERSON LANDING THE WIRES TO THE MASTER ALARM TERMINAL BOARD.

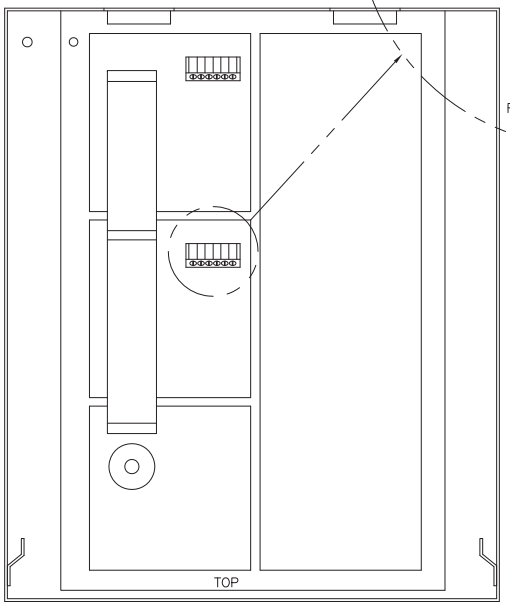
THE NUMBER OF ALARM SIGNALS WILL VARY DEPENDING ON HOW MANY GASES ARE PIPED INTO EACH FACILITY. A LIST OF SIGNALS REQUIRED BY NFPA99 CAN BE FOUND IN NFPA99C.

A THOROUGH REVIEW OF NFPA99C SHOULD BE DONE TO ENSURE YOU HAVE MET ALL NFPA REQUIREMENTS.

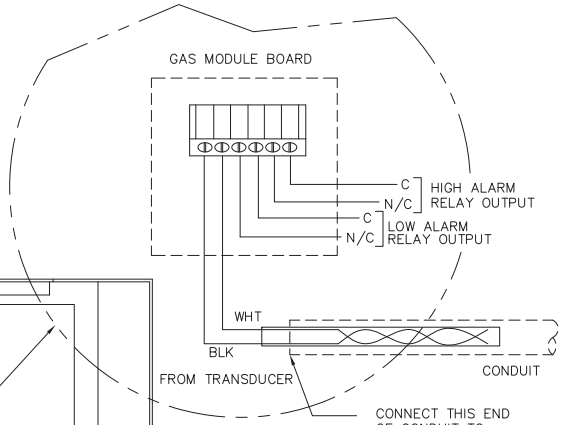
TOLERANCES UNLESS SPECIFIED	DECIMAL DIAMETERS ± .003 LENGTHS ± .010	CONCENTRICITY WITHIN .010 FIM ANGULAR ± 0°30'	125 √ MAX FINISH ALL SURFACES	SCALE 1=1

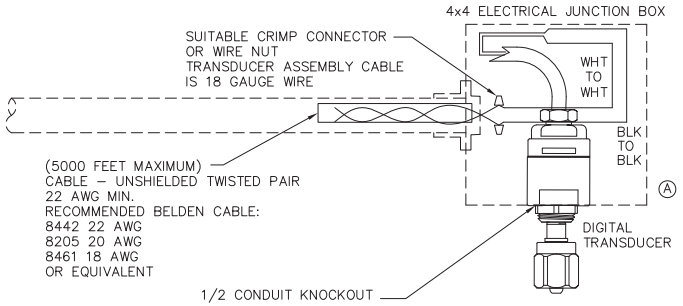
Patton's Medical	Drawn by SERRANO	Date 10–07–06	MATERIAL	CODE			DESCRIPTION WIRING SCHEMATIC EQUIPMENT WIRING TO DIGITAL MASTER ALARM
	Check by	Date					
Note: This drawing is confidential and the sole property of Tri–Tech Medical. It is not to be reproduced or submitted to others without prior approval of Tri–Tech Medical.	Approved by D. SIMO	Date 10–30–06	FINISH	B	5755	09–17–13	PART NO. 89–0174 / DWG. SIZE C
	Disk No	Release		A	4918	02–13–09	
				REV.	ECN	DATE	

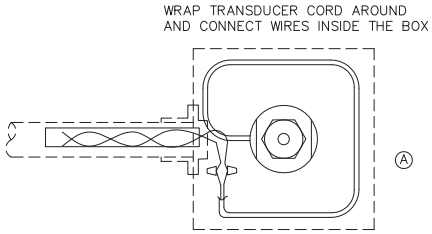
DRAWING NO.	CODE
89–0175	



INSIDE ALARM FRONT PANEL







NOTE: REMOTELY MOUNTING THE TRANSDUCER AND CABLE IN AN ELECTRICAL JUNCTION BOX AND CONDUIT IS NOT REQUIRED. IT DOES HOWEVER PROVIDE MAXIMUM PROTECTION FROM UN–INTENTIONAL DAMAGE BY PERSONNEL WORKING AROUND THIS EQUIPMENT AFTER IT IS INSTALLED. THE TRANSDUCER NUT AND NIPPLE MUST BE REMOVED FROM THE BRASS CONNECTOR TO INSTALL IT IN THE JUNCTION BOX. USE ONE OF THE 1/2 CONDUIT KNOCKOUTS FOR MOUNTING. REINSTALL THE PROPER GAS SPECIFIC NUT AND NIPPLE BACK INTO THE ORIGINAL TRANSDUCER BRASS CONNECTOR USING TEFLON TAPE THREAD SEALANT AND WRENCH TIGHTEN. LEAK TEST THIS JOINT AFTER FINAL INSTALLATION.

TOLERANCES UNLESS SPECIFIED	DECIMAL DIAMETERS ± .003 LENGTHS ± .010	CONCENTRICITY WITHIN .010 FIM ANGULAR ± 0°30'	125 √ MAX FINISH ALL SURFACES	SCALE 1=1

Patton's Medical	Drawn by SERRANO	Date 10–07–06	MATERIAL	CODE			DESCRIPTION REMOTE MOUNTING OF DIGITAL ALARM TRANSDUCERS
	Check by	Date					
Note: This drawing is confidential and the sole property of Tri–Tech Medical. It is not to be reproduced or submitted to others without prior approval of Tri–Tech Medical.	Approved by D. SIMO	Date 10–13–06	FINISH				PART NO. 89–0175 / DWG. SIZE C
	Disk No	Release		A	5755	09–17–13	
				REV.	ECN	DATE	

NOTES:



3201 South Boulevard
Charlotte, NC 28209
1-866-960-0087
www.pattonsmedical.com

Patton's Medical

Zone Valve Box





Installation Operation and Maintenance Manual

Model Number:	
Date Purchased:	
Purchased from:	

For further technical assistance, service or replacement parts, please contact:

Patton's Medical
3201 South Boulevard
Charlotte, NC 28209

Customer Service: 1-866-960-0087
Phone: 704-529-5442
FAX: 704-525-5148

www.pattonsmedical.com

Patton's Medical reserves the right to make changes and improvements to update products sold previously without notice or obligation.

Issue Date: January 7, 2015

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Safety Precautions

1.0 General Information

2.0 Installation

3.0 Brazing

4.0 Gas Identification

5.0 Pressure Test

6.0 Gauge Installation

7.0 Install Aluminum Frame

Safety Precautions

Pressurized air from the system may cause personnel injury or property damage if the unit is improperly operated or maintained. The operator should have carefully read and become familiar with the contents of this manual before installing, operating, and maintaining the product. The operator is expected to use common sense safety precautions, good workmanship practices and follow any related local safety precautions.

Patton's Medical explicitly excludes all responsibility and liability for damage and/or injury caused by failure to follow the instructions described in this manual, or by failing to pay necessary attention when operating handling or servicing this product, even if not specifically stated in individual cases.

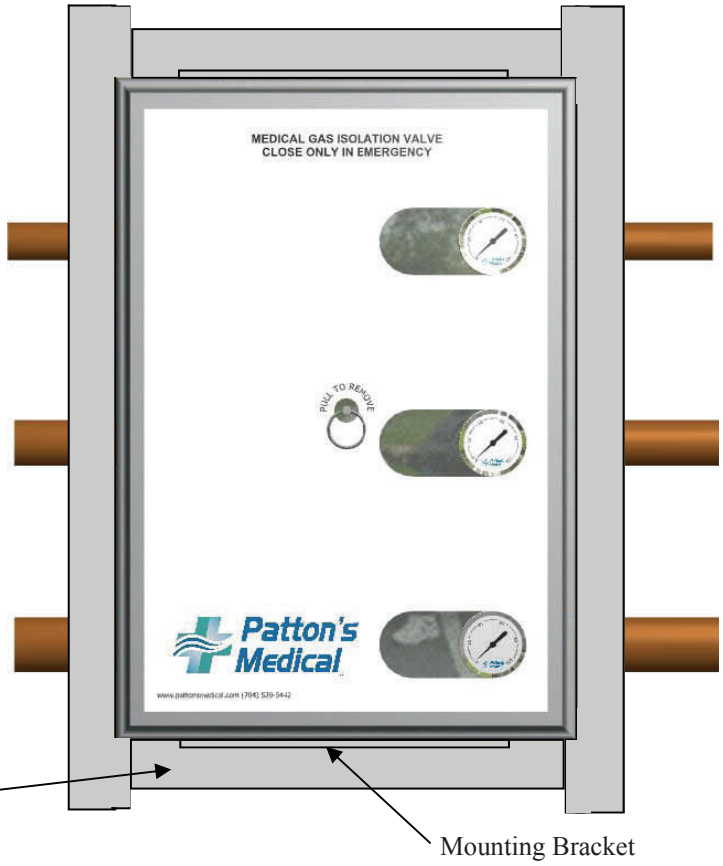
1.0 General Information

Zone valve box assemblies are assembled in single and multiple configurations. Assemblies should be installed in specified locations per NFPA 99 or CSA Z7396.1. All Valves Supplied are cleaned for oxygen. Care should be taken during installation to keep debris from entering valves and pipeline assemblies.

2.0 Installation

Allow sufficient space to accommodate the zone valve box. The rough-in of the zone valve box comes with a cardboard shield covering it's front. The cardboard shield will need to be remove to install the box but needs to be replaced before the walls are finished. Anchor the valve box to the structural frame supports so that the front edge will be flush or slightly recessed with the finished wall. Box mounting height is suggested at 66" from floor to top of finished box. Box should be level and installed a specified height and location on wall.

Note: The valve handles should point downstream for pressurized gases.

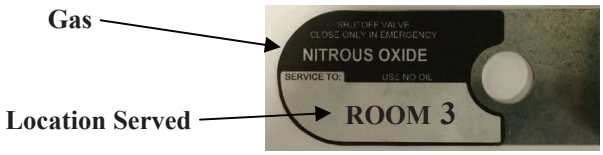


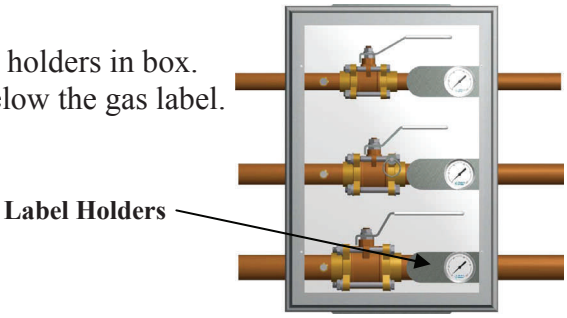
3.0 Brazing

Braze tube extensions to piping per NFPA 99. Use heat sink techniques appropriate to protect the valve seals and sealing material in gauge port plug. Purge with oil-free dry nitrogen while brazing.

4.0 Gas Identification

Install the correct gas identification label to the label holders in box. Mark location serviced by each valve in the space below the gas label.



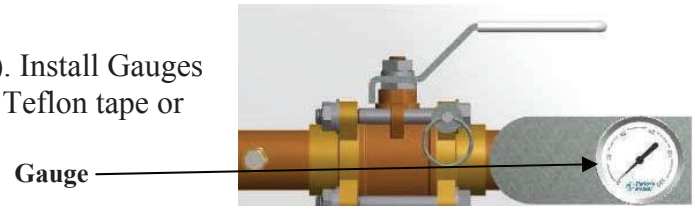


5.0 Pressure Test

Test each system per NFPA. After pressure test is finished replace cardboard shield until wall is finished to keep dust and debris out of box.

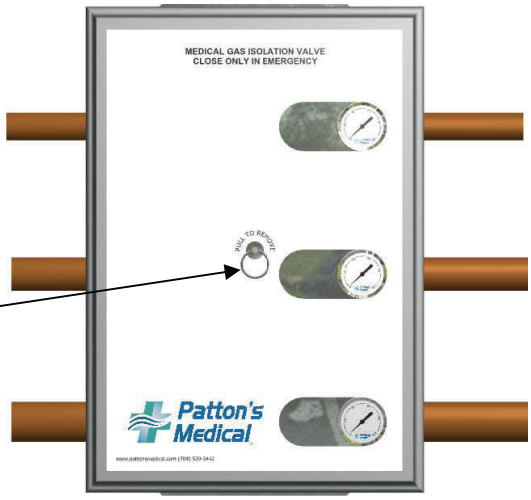
6.0 Gauge Installation

Remove cardboard shield (keep screws). Install Gauges (if required) after wall is finished using Teflon tape or oxygen compatible pipe sealant.



7.0 Install Aluminum Frame

Pull ring to remove window from frame. Secure aluminum frame to box using screws from cardboard shield. Replace window into frame. Clean Window with soap and water, do not use strong solvents that will damage the window.



NOTES:



3201 South Boulevard
Charlotte, NC 28209
1-866-960-0087

Patton's Medical

Medical Gas Outlets







Installation and Maintenance Manual

Model Number:	
Date Purchased:	
Purchased from:	

For further technical assistance, service or replacement parts, please contact:

Patton's Medical
3201 South Boulevard
Charlotte, NC 28209

Customer Service: 1-866-960-0087
Phone: 704-529-5442
FAX: 704-525-5148

www.pattonsmedical.com

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Issue Date: December 11, 2014

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INTRODUCTION

Patton's Inc., now owned and operated by ELGi USA, began selling custom medical air packages to hospitals in 1980. For years we sold Quincy compressors to the local medical market. Knowing we had to expand our product line, we became a distributor for Powerex in 2003. For the next five years, we were one of their leading distributors for medical gas equipment. In 2012 ELGi USA purchased Patton's Inc. and Patton's Medical as an entre into the US marketplace for their industrial products as well diversification into the medical equipment business.

Deciding to sell and service our own medical gas equipment nationwide, we created Patton's Medical in 2008. This does not mean Patton's Medical is the "new kid on the block."We hired some of the best in the medical gas business with extensive backgrounds in sales, marketing, manufacturing and engineering. Within a short period of time, we were able to create a company and product line that is second to none in the industry. Although the influx of this new talent brought new ideas, products and direction to the company, our "old fashion" commitment to customer service is steadfast.

In order to provide the best equipment for the expanding medical market, we acquired collaborative developmental rights to sell Hitachi Bebicon and Scroll compressors. We knew these compressors had been used for over twenty years in the medical market and had proven to be extremely reliable. With this came the ability to sell parts and service for existing equipment that utilize the Hitachi pumps.

In addition to medical air compressors, we knew we had to offer medical vacuum. After extensive research of vacuum companies and vacuum pumps we chose Busch Vacuum pumps for their excellent reputation in the medical arena. We build multiplex vacuum packages utilizing oil-less rotary vane, lubricated rotary vane and oil-less rotary claw pumps.

Today, a premier offering of medical air and vacuum equipment is manufactured in our Charlotte facility. Additionally, we have embarked on a complete Medical Gas pipeline offering as Patton's Medical. Our products meet or exceed NFPA 99 and CSA standards in addition to being U.L. listed. If our standard products do not exactly fit your requirements, we will work with you to develop special packages to comply with your particular specifications or applications.
Our mission is to be the leading innovator, deliverer, and manufacturer in the world of Medical Gas products. We strive to do this through constant examination of our processes and service to our customers.

We are committed to quality and innovation; we look forward to working with you and your needs to be your preferred partner for Medical Gas Equipment.

While we strive to grow our business, we know the importance of customer relationships, business relationships and providing the best equipment to meet the customer's needs. Our focus will continue to be on our customers. Lead by our product knowledge, experience and dedication to you, we will strive to provide the right equipment for any medical gas application that is specified by you.

Product Description

A complete Patton's Medical Outlet is made up to two separate components, the "Back-Body Assembly" and the "Latch-Valve Mechanism". The "Back-Body Assembly" is designed to be unique to each specific gas but is interchangeable within all "same-gas" outlet types (D.I.S.S, Ohmeda, Puritan-Bennett or Chemetron compatibles).

The gas specific "Back-Body Assembly" includes a check valve that permits removal of the "Latch-Valve Mechanism" for service without requiring the pipeline to be shut down.

A 6" long, 3/8" nom. dia. Medical gas copper tube, per NFPA specifications, is brazed into the body for external pipeline connections. The "Back-Body Assembly" is marked with color-coded labeling on the front plate and on the copper pipe so that the installer can easily identify the correct gas when making the installation. The Patton's Medical gas outlet is designed with a gas specific dual pin indexing arrangement to prevent an incorrect gas "Latch-Valve Mechanism: from being installed into a "Back-Body Assembly".

Patton's Medical Gas Outlets (wall and ceiling styles only may be ganged together in 5" [127mm] center to center assemblies providing one attractive module of all medical gases without the additional expense of a headwall or console.

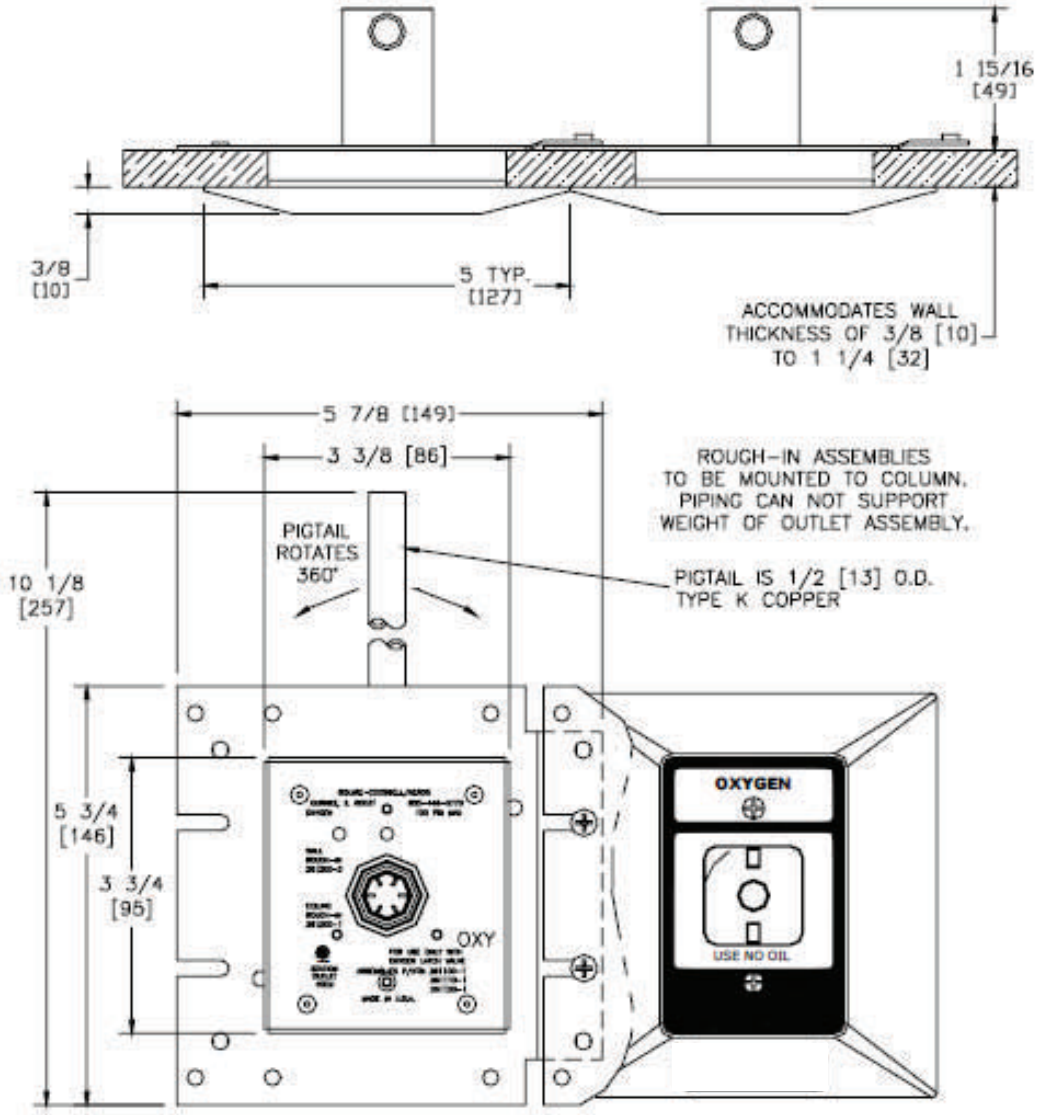
It is the "Latch-Valve Mechanism" which determines which type of adapter that the completed outlet assembly will accept. The "Latch-Valve Mechanism" is available in four different offerings; D.I.S.S. Type, Quick-Connect Ohmeda Compatible, Puritan-Bennett Compatible and Quick Connect Chemetron Compatible. The "Latch-Valve Mechanism" consists of a connector with an internal check valve, an indexing assembly and a color-coded gas specific front plate. A trim plate is also included for wall and ceiling outlets. The "Latch-Valve Mechanism" is designed and manufactured so that its gas specific characteristics cannot be altered during normal use, service or maintenance. The "Latch-Valve Mechanism" is inserted into the "Back-Body Assembly" and secured with plated steel screws to complete the outlet assembly.

The Quick-Connect models are compatible with Ohmeda Diamond, Puritan-Bennett or Chemetron Quick-Connect adapters and only the correct corresponding gas type of adapters can be used with the Quick-Connect outlets.

Since the "Back-Body Assembly" is the same for all types of "Latch-Valve Mechanisms" of the same gas, the Patton's Medical Gas Outlets can easily be converted from one adapter type to another by simply replacing the "Latch-Valve Mechanism".

WALL OUTLETS

D.I.S.S TYPE, OHMEDA COMPATIBLE, PURITAN-BENNETT COMPATIBLE AND CHEMETRON COMPATIBLE

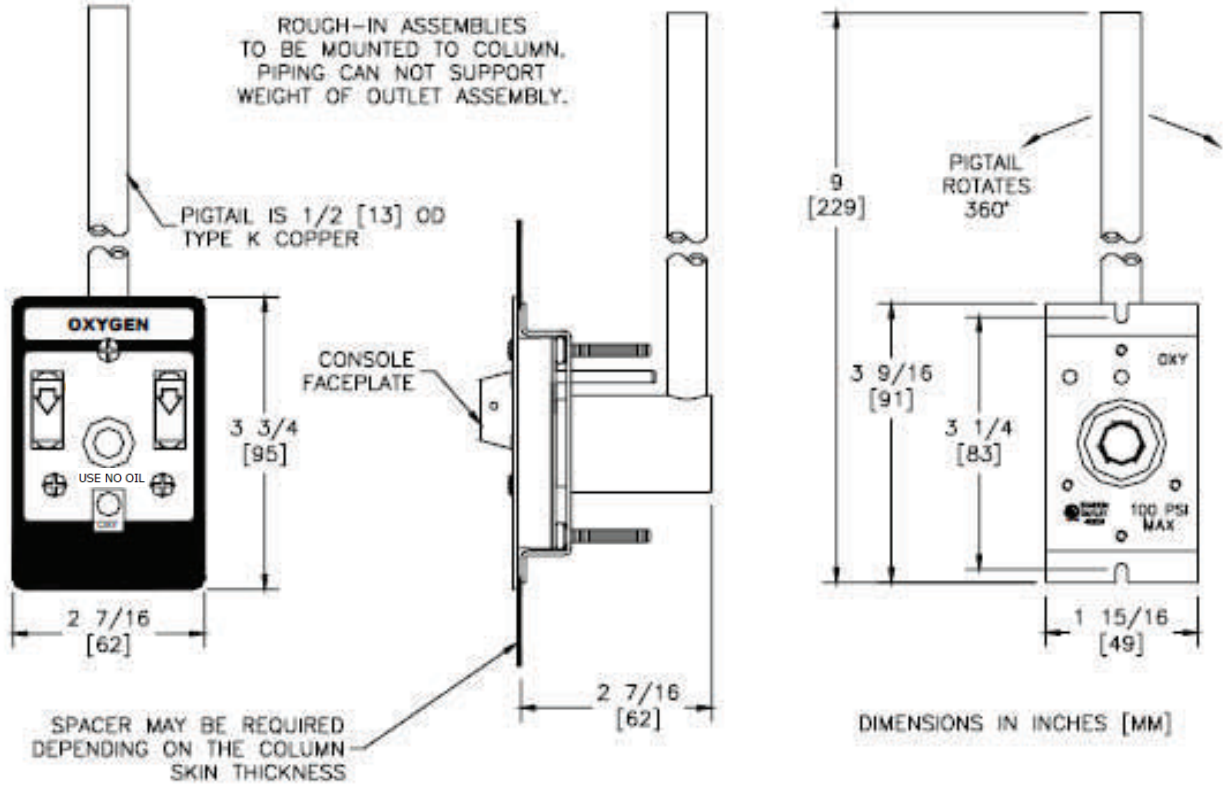


NOTES:

1. Do not cover over the Back-Body Assembly during the drywall and plaster application. Ensure that the clear plastic cover over the Back-Body Assembly is securely in place until the " Latch-Valve Mechanism" can be installed.
2. For W.A.G.D. (Evacuation) and vacuum gases, a round tubing plug and a plug retainer plate are in stalled on the Back-Body Assembly since a secondary check valve does not exist for these gases. Do not remove these components until the latch valve mechanism is to be installed.

CONSOLE OUTLETS

D.I.S.S TYPE, OHMEDA COMPATIBLE, PURITAN-BENNETT COMPATIBLE AND CHEMETRON COMPATIBLE

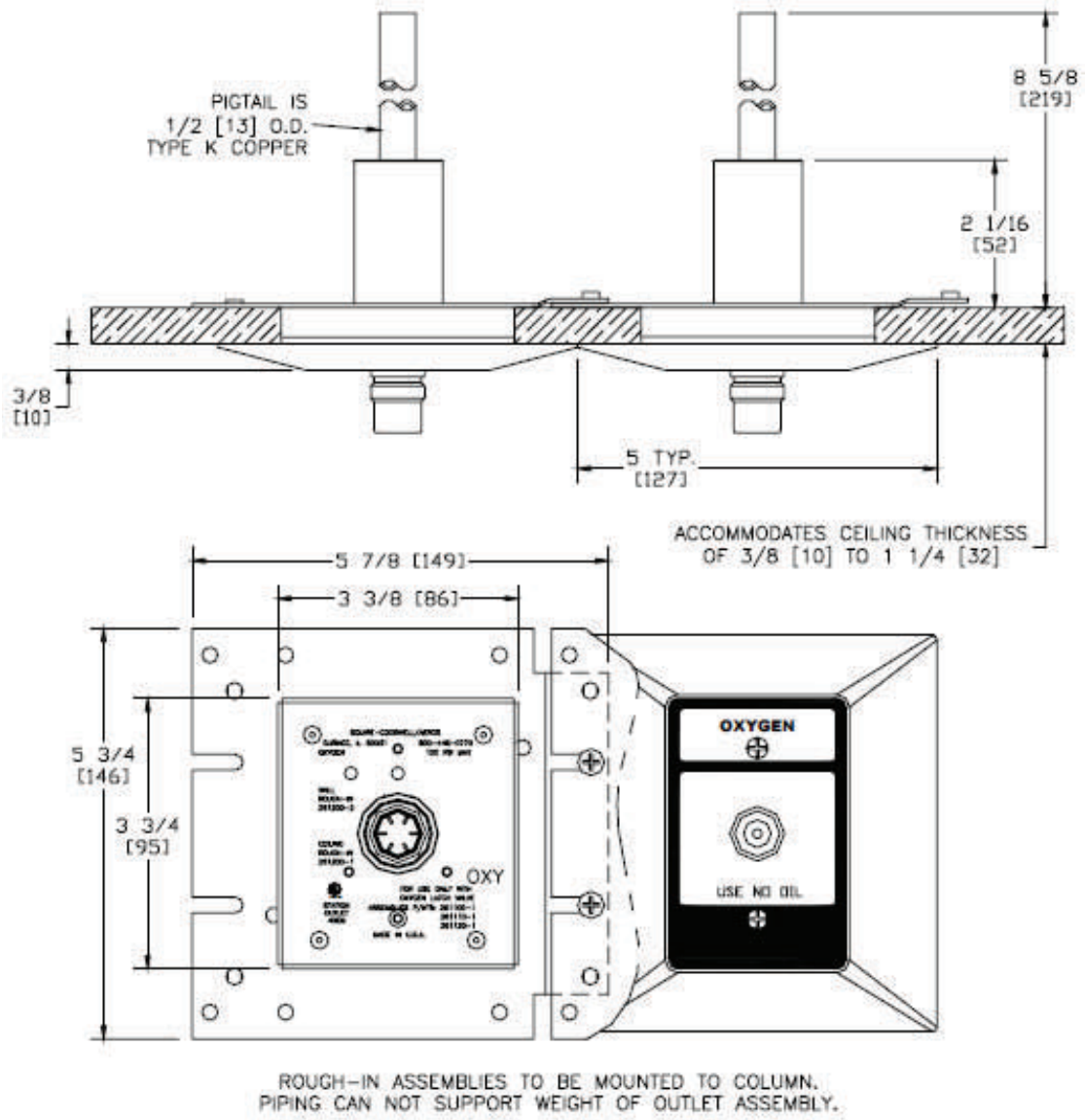


NOTES:

1. For W.A.G.D. (Evacuation) and vacuum gases, a round tubing plug and a plug retainer plate are in stalled on the Back-Body Assembly since a secondary check valve does not exist for these gases. Do not remove these components until the latch valve mechanism is to be installed.

CEILING OUTLETS

D.I.S.S TYPE



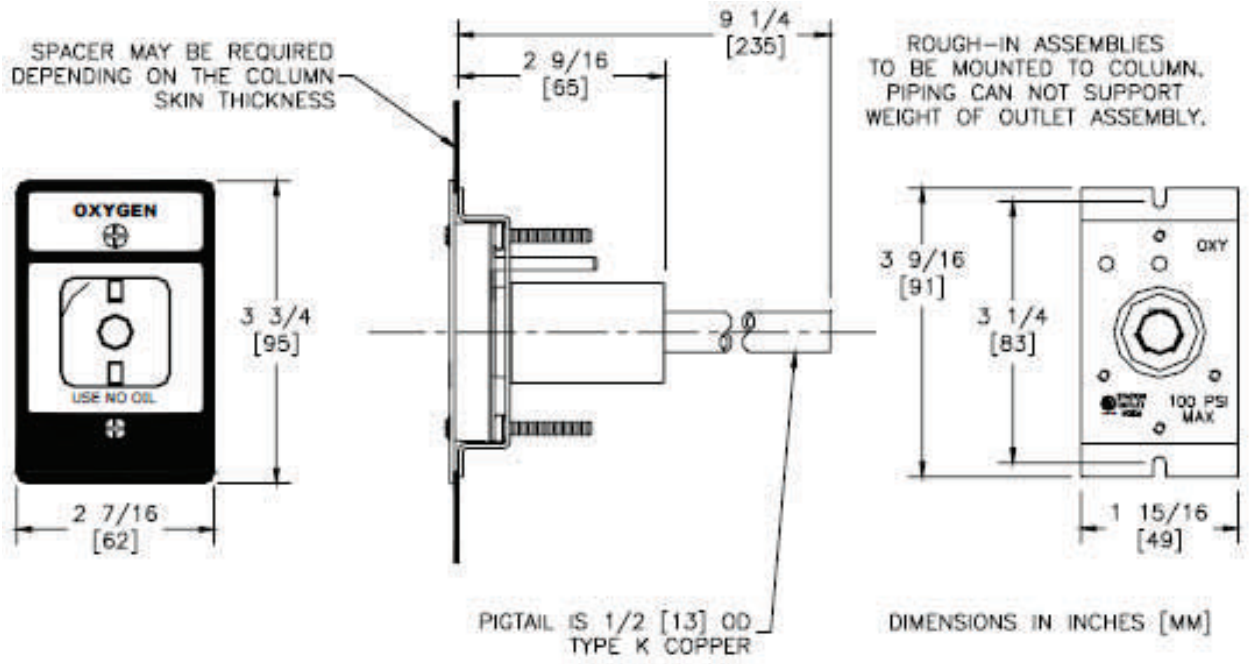
ROUGH-IN ASSEMBLIES TO BE MOUNTED TO COLUMN.
PIPING CAN NOT SUPPORT WEIGHT OF OUTLET ASSEMBLY.

NOTES:

1. Do not cover over the Back-Body Assembly during the drywall and plaster application. Ensure that the clear plastic cover over the Back-Body Assembly is securely in place until the " Latch-Valve Mechanism" can be installed.
2. For W.A.G.D. (Evacuation) and vacuum gases, a round tubing plug and a plug retainer plate are in stalled on the Back-Body Assembly since a secondary check valve does not exist for these gases. Do not remove these components until the latch valve mechanism is to be installed.

CEILING COLUMN OUTLETS

D.I.S.S TYPE, OHMEDA COMPATIBLE, PURITAN-BENNETT COMPATIBLE AND CHEMETRON COMPATIBLE



NOTES:

1. For W.A.G.D. (Evacuation) and vacuum gases, a round tubing plug and a plug retainer plate are in stalled on the Back-Body Assembly since a secondary check valve does not exist for these gases. Do not remove these components until the latch valve mechanism is to be installed.

MEDICAL GAS OUTLETS
COMPLETE ASSEMBLY PART NUMBERS

OHMEDA Compatible Outlet Assemblies

	WALL	CONSOLE	CEILING COLUMN
OXYGEN	O1-QDWAL-OXY	O1-QDCON-OXY	O1-QDCOL-OXY
VACUUM	O1-QDWAL-VAC	O1-QDCON-VAC	O1-QDCOL-VAC
MEDICAL AIR	O1-QDWAL-AIR	O1-QDCON-AIR	O1-QDCOL-AIR
N2O	O1-QDWAL-N2O	O1-QDCON-N2O	O1-QDCOL-N2O
WAGD	O1-QDWAL-WAG	O1-QDCON-WAG	O1-QDCOL-WAG
NITROGEN	O1-QDWAL-NIT	O1-QDCON-NIT	O1-QDCOL-NIT
CARBON DIOXIDE	O1-QDWAL-CO2	O1-QDCON-CO2	O1-QDCOL-CO2
INSTRUMENT AIR	O1-QDWAL-IA	O1-QDCON-IA	O1-QDCOL-IA

CHEMETRON Compatible Outlet Assemblies

	WALL	CONSOLE	CEILING COLUMN
OXYGEN	O1-CHWAL-OXY	O1-CHCON-OXY	O1-CHCOL-OXY
VACUUM	O1-CHWAL-VAC	O1-CHCON-VAC	O1-CHCOL-VAC
MEDICAL AIR	O1-CHWAL-AIR	O1-CHCON-AIR	O1-CHCOL-AIR
N2O	O1-CHWAL-N2O	O1-CHCON-N2O	O1-CHCOL-N2O
WAGD	O1-CHWAL-WAG	O1-CHCON-WAG	O1-CHCOL-WAG
NITROGEN	O1-CHWAL-NIT	O1-CHCON-NIT	O1-CHCOL-NIT
CARBON DIOXIDE	O1-CHWAL-CO2	O1-CHCON-CO2	O1-CHCOL-CO2
INSTRUMENT AIR	O1-CHWAL-IA	O1-CHCON-IA	O1-CHCOL-IA

PURITAN BENNETT Compatible Outlet Assemblies

	WALL	CONSOLE	CEILING COLUMN
OXYGEN	O1-PBWAL-OXY	O1-PBCON-OXY	O1-PBCOL-OXY
VACUUM	O1-PBWAL-VAC	O1-PBCON-VAC	O1-PBCOL-VAC
MEDICAL AIR	O1-PBWAL-AIR	O1-PBCON-AIR	O1-PBCOL-AIR
N2O	O1-PBWAL-N2O	O1-PBCON-N2O	O1-PBCOL-N2O
WAGD	O1-PBWAL-WAG	O1-PBCON-WAG	O1-PBCOL-WAG
NITROGEN	O1-PBWAL-NIT	O1-PBCON-NIT	O1-PBCOL-NIT
CARBON DIOXIDE	O1-PBWAL-CO2	O1-PBCON-CO2	O1-PBCOL-CO2
INSTRUMENT AIR	O1-PBWAL-IA	O1-PBCON-IA	O1-PBCOL-IA

D.I.S.S. Compatible Outlet Assemblies

	WALL	CONSOLE	CEILING	CEILING COLUMN
OXYGEN	O1-DIWAL-OXY	O1-DICON-OXY	O1-DICEI-OXY	O1-PBCOL-OXY
VACUUM	O1-DIWAL-VAC	O1-DICON-VAC	O1-DICEI-VAC	O1-PBCOL-VAC
MEDICAL AIR	O1-DIWAL-AIR	O1-DICON-AIR	O1-PDICEI-AIR	O1-PBCOL-AIR
N2O	O1-DIWAL-N2O	O1-DICON-N2O	O1-DICEI-N2O	O1-PBCOL-N2O
WAGD	O1-DIWAL-WAG	O1-DICON-WAG	O1-DICEI-WAG	O1-PBCOL-WAG
NITROGEN	O1-DIWAL-NIT	O1-DICON-NIT	O1-DICEI-NIT	O1-PBCOL-NIT
CARBON DIOXIDE	O1-DIWAL-CO2	O1-DICON-CO2	O1-DICEI-CO2	O1-PBCOL-CO2
INSTRUMENT AIR	O1-DIWAL-IA	O1-DICON-IA	O1-DICEI-IA	O1-PBCOL-IA

LATCH-VALVE MECHANISM & BACK-BODY ASSEMBLY PART NUMBERS

"LATCH-VALVE MECHANISM" Part Numbers

	D.I.S.S.	OHMEDA COMPATIBLE	CHEMETRON COMPATIBLE	PURITAN-BENNETT COMPATIBLE
OXYGEN	O1-FBDI-OXY	O1-FBQD-OXY	O1-FBCH-OXY	O1-FBPB-OXY
VACUUM	O1-FBDI-VAC	O1-FBQD-VAC	O1-FBCH-VAC	O1-FBPB-VAC
MEDICAL AIR	O1-FBDI-AIR	O1-FBQD-AIR	O1-FBCH-AIR	O1-FBPB-AIR
N2O	O1-FBDI-N2O	O1-FBQD-N2O	O1-FBCH-N2O	O1-FBPB-N2O
WAGD	O1-FBDI-WAG	O1-FBQD-WAG	O1-FBCH-WAG	O1-FBPB-WAG
NITROGEN	O1-FBDI-NIT	O1-FBQD-NIT	O1-FBCH-NIT	O1-FBPB-NIT
CARBON DIOXIDE	O1-FBDI-CO2	O1-FBQD-CO2	O1-FBCH-CO2	O1-FBPB-CO2
INSTRUMENT AIR	O1-FBDI-IA	O1-FBQD-IA	O1-FBCH-IA	O1-FBPB-IA

"BACK-BODY ASSEMBLY" Part Numbers

	WALL	CONSOLE	CEILING	CEILING COLUMN
OXYGEN	O1-BAKWAL-OXY	O1-BAKCON-OXY	O1-BAKCEI-OXY	O1-BAKCOL-OXY
VACUUM	O1-BAKWAL-VAC	O1-BAKCON-VAC	O1-BAKCEI-VAC	O1-BAKCOL-VAC
MEDICAL AIR	O1-BAKWAL-AIR	O1-BAKCON-AIR	O1-BAKCEI-AIR	O1-BAKCOL-AIR
N2O	O1-BAKWAL-N2O	O1-BAKCON-N2O	O1-BAKCEI-N2O	O1-BAKCOL-N2O
WAGD	O1-BAKWAL-WAG	O1-BAKCON-WAG	O1-BAKCEI-WAG	O1-BAKCOL-WAG
NITROGEN	O1-BAKWAL-NIT	O1-BAKCON-NIT	O1-BAKCEI-NIT	O1-BAKCOL-NIT
CARBON DIOXIDE	O1-BAKWAL-CO2	O1-BAKCON-CO2	O1-BAKCEI-CO2	O1-BAKCOL-CO2
INSTRUMENT AIR	O1-BAKWAL-IA	O1-BAKCON-IA	O1-BAKCEI-IA	O1-BAKCOL-IA

INSTALLATION NOTES

- On all wall and console outlets the connecting pipe can be rotated a full 360 degrees for ease of connection to the facility gas piping.

- Excessive heat during soldering may damage the secondary check valve; when soldering the pipe connection take extreme care not to apply heat to the check unit body.

- When installing wall outlets, it is very important to keep the plastic protective cover on the "Back-Body Assembly" in place during construction, to protect the outlet from drywall compound or other contaminants.

- For W.A.G.D. (Evacuation) and vacuum gases, a round tubing plug and a plug retainer plate are installed on the Back-Body Assembly since a secondary check valve does not exist for these gases. Do not remove these components until the latch valve mechanism is to be installed.

- When installing the "Latch-Valve Mechanism", remove the protective cover from the "Back-Body Assembly" and inspect for dirt or debris in the outlet body. Carefully clean out any contaminants necessary.

- The "Latch-Valve Mechanism" should slide smoothly into the "Back-Body Assembly". If it does not, inspect to verify that there has been no damage to the indexing pins. If the indexing pins are bent or damaged the gas specific characteristics of the outlet may be compromised. In this instance the entire "Latch-Valve Mechanism" should be replaced.\

- All "Latch-Valve Mechanisms" with the exception of Nitrogen D.I.S.S. have a maximum pressure rating of 100 PSI [690 kPa]. The Nitrogen D.I.S.S. Latch-Valve Mechanism has a maximum pressure rating of 200 PSI [1,380 kPa].

- After the installation medical gas pipeline systems should be tested in accordance with the NFPA recommendations and/or in compliance with local requirements.

- The "Back-Body Assemblies" may be pressure tested up to a maximum of 200 PSI [1,380 kPa] without the "Latch-Valve Mechanism" installed. DO NOT PRESSURE TEST THE PIPELINE OVER 100 PSI [690 kPa] IF THE "LATCH VALVE MECAHNISM" HAS BEEN INSTALLED.

SERVICING CAUTIONS

Before performing any service or maintenance on any outlet, the appropriate hospital maintenance or engineering personnel should be notified.

The "Latch-Valve Mechanism" can be removed without interrupting service to other outlets on the same pipeline for all gases other than vacuum, however when servicing the "Back-Body Assembly" the supply pressure must be shut off to the entire zone.

SERVICING INSTRUCTIONS
D.I.S.S. TYPE "LATCH-VALVE MECHANISM"

1. Unscrew the two retaining screws **(I)** until the "Latch-Valve Mechanism" can be re moved from the outlet.

2. Remove the Adapter O-Ring seal **(A, B or C)** from the front and replace (NOTE: There is no O-Ring for Oxygen or Evac).

3. Remove the retaining ring **(E)** using the appropriate internal snap ring pliers.

4. Remove the valve stem **(G)**, Primary Check O-Ring **(H)**, primary check valve **(D)** and check valve spring **(F)**. Inspect the items for wear or damage and replace if needed. Re place the O-Ring.

5. Reinstall all internal components and lock in place with the retaining ring.

6. Reinstall the "Latch-Valve Mechanism" into the outlet. Coat the valve body, with a thin coat of oxygen compatible silicone lubricant to aid insertion. Tighten down the retaining screws, **DO NOT OVER TIGHTEN**, as this could damage the Latch-Valve.

7. Connect the proper gas specific adapter to the outlet. The connection should be smooth and hand tightening of the nut should be sufficient to allow the gas to flow without leak age.

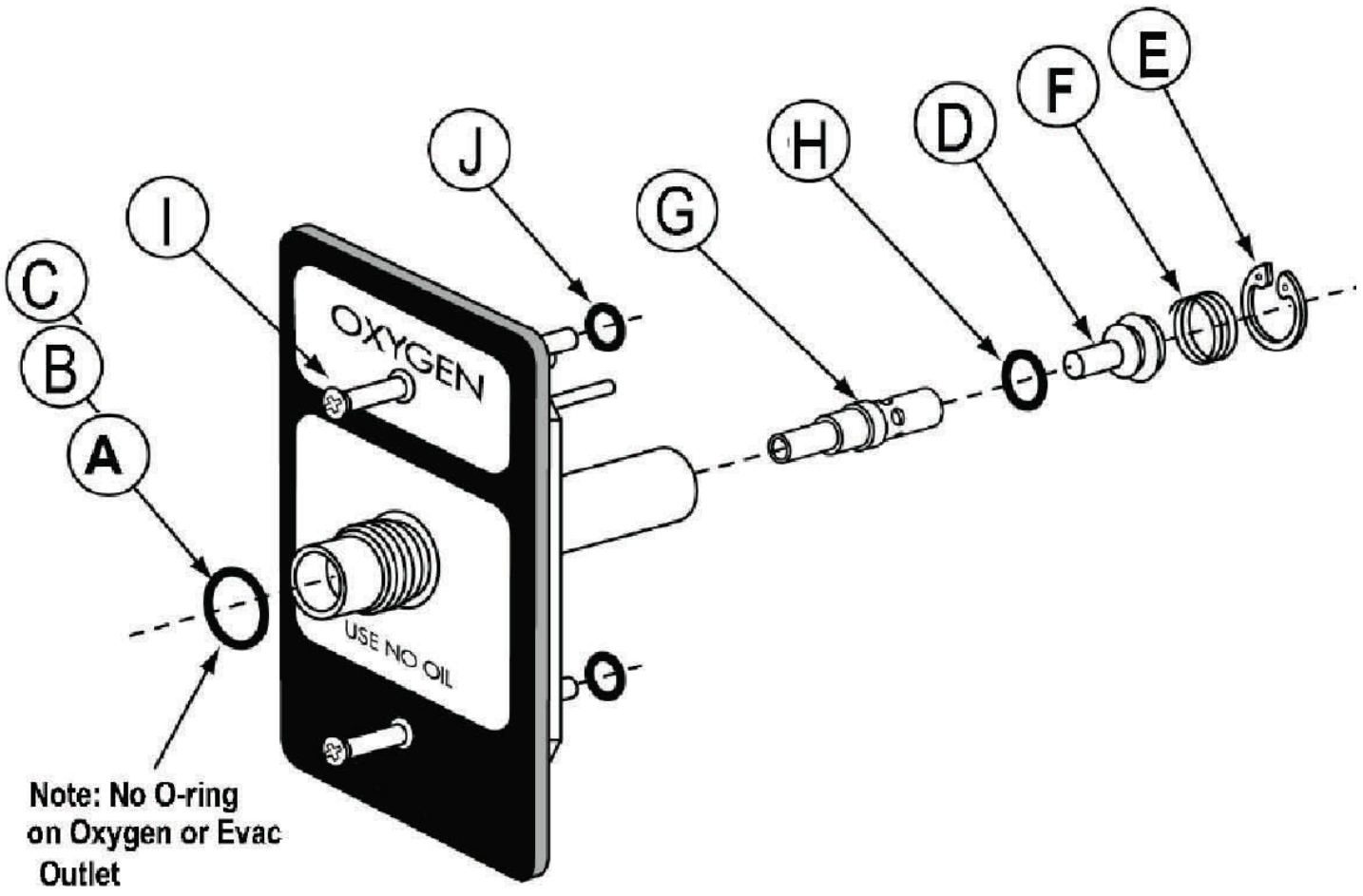
CAUTION: Use caution relative to the type and pressure of the gas so as not to cause injury.

8. If the assembly does not perform correctly with the adapter installed, replace the entire "Latch-Valve Mechanism".

REPLACEMENT PARTS

LATCH-VALVE MECHANISMS – D.I.S.S. TYPE OUTLETS

ITEM	DESCRIPTION	PART NUMBER
A	Adapter O-Ring - Vac	O1-DIARINGV
B	Adapter O-Ring - N2O	O1-CVORING
C	Adapter O-Ring - Air/N2, CO2	O1-DIAORINGANC
D	Primary Check Valve	O1-PCV
E	Retaining Ring	O1-RETRING
F	Check Valve Spring	O1-CVS
G	Valve Stem (Oxygen)	O1-DIVSO
(not shown)	Valve Stem (Vac, EVAC)	O1-DIVSVE
(not shown)	Valve Stem (Air, N2O, N2, CO2)	O1-DIVSA2NC
H	Primary Check Valve O-Ring	O1-CVORING
I	Retaining Screw (2 Req'd)	O1-SCREW
J	Screw Retaining O-Ring (2 Req'd)	O1-SRORING



SERVICING INSTRUCTIONS
OHMEDA COMPATIBLE "LATCH-VALVE MECHANISM"

1. Unscrew the two retaining screws **(L)** until the entire "Latch-Valve Mechanism" can be removed from the outlet.

2. Remove the four screws **(O)** holding the connector retaining plate **(A)** in place. Remove the plate.

3. Remove the valve body **(B)** from the valve assembly.

4. Remove the U-spring **(N)**, inspect for wear or damage, reinstall or replace the U-spring as necessary.

5. Remove the flat washer **(I)** and valve body O-Ring **(J)** from the front of the valve body. Inspect the items for wear or damage and replace the O-Ring seal **(J)**.

6. Remove the retaining ring **(F)** using appropriate snap ring pliers. Remove the primary cap **(K)**, primary cap spring **(C)**, primary check valve O-Ring **(D)**, primary check valve **(E)** and spring **(H)**. Inspect all items for wear or damage and replace as necessary. Re place the O-Ring **(D)**.

7. Reinstall all internal components and lock in place with retaining ring **(F)**. Insert the valve body **(B)** into the latch valve body. Check that the U-Spring **(N)**, flat washer **(I)** and valve body O-Ring **(J)** are in place. Reinstall the retaining plate **(A)** and secure with four screws **(O)**, do not over tighten.

8. Reinstall the "Latch-Valve Mechanism" into the outlet. Coat the valve body **(B)**, with a thin coat of oxygen compatible silicone lubricant to aid insertion. Tighten down the retaining screws **(L)**, **DO NOT OVER TIGHTEN**, as this could damage the Latch-Valve.

9. Connect the proper gas specific adapter into the outlet. The connection should be smooth and the adapter should lock and remain in place allowing gas to flow.

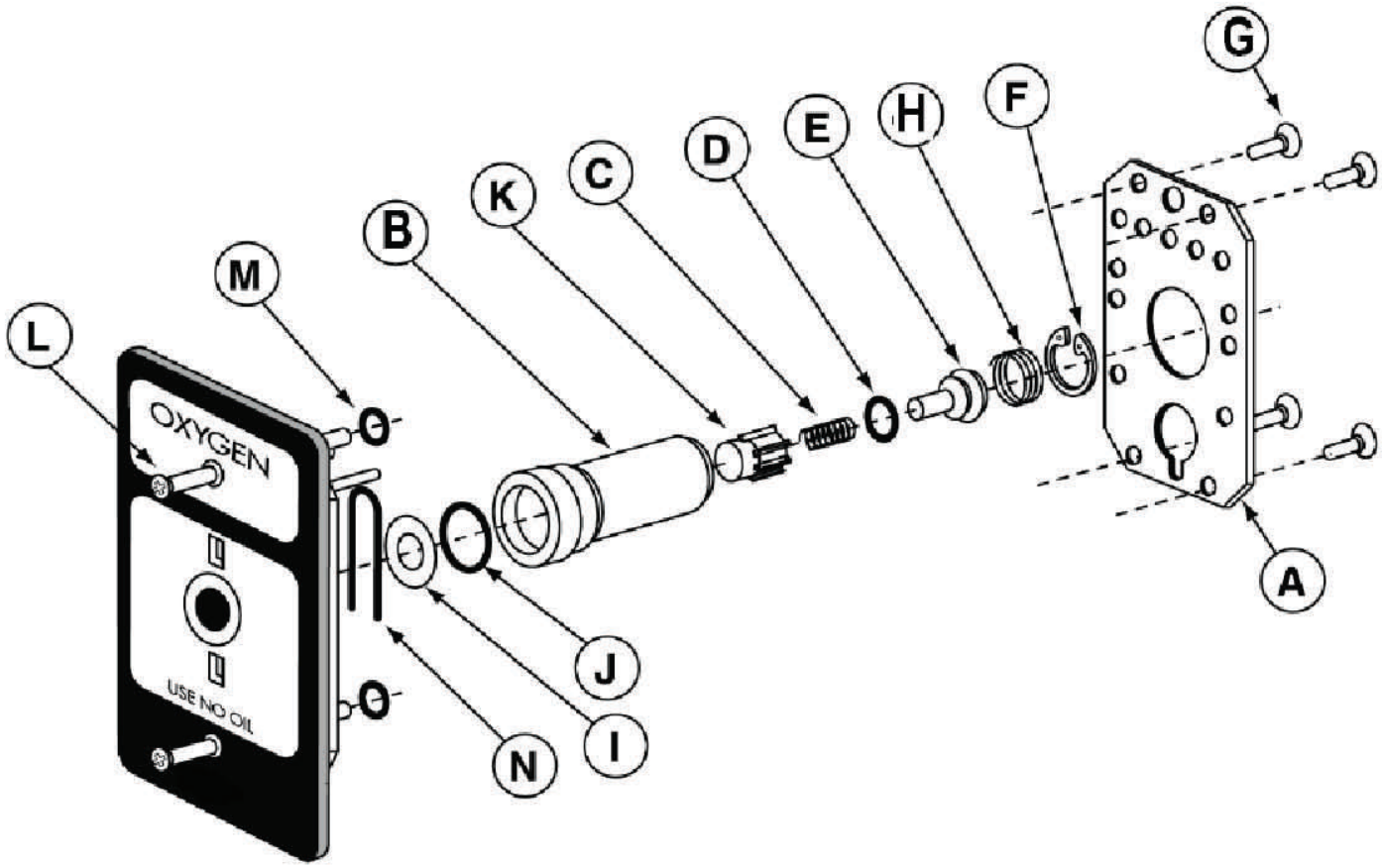
CAUTION: Use caution relative to the type and pressure of the gas so as not to cause injury.

10. If the assembly does not perform correctly with the adapter installed, replace the entire "Latch-Valve Mechanism".

REPLACEMENT PARTS

LATCH-VALVE MECHANISMS - OHMEDA COMPATIBLE OUTLETS

ITEM	DESCRIPTION	PART NUMBER
A	Plate	O1-PLATE
B	Valve Body	O1-VALVEBODY
C	Primary Cap Spring	O1-PCS
D	Check Valve O-Ring	O1-CVORING
E	Primary Check Valve	O1-PCV
F	Retaining Ring	O1-RETRING
G	Screw (4 Req'd)	O1-SCREW1
H	Check Valve Spring	O1-CVS
I	Flat Washer	O1-FLATWASH
J	Valve Body O-Ring	O1-VBORING
K	Primary Cap	O1-PRICAP
L	Screw (2 Req'd)	O1-SCREW
M	Screw Retaining	O1-SRORING
N	U-Spring	O1-QDUSPRING



SERVICING INSTRUCTIONS
PURITAN-BENNETT COMPATIBLE "LATCH-VALVE MECHANISM"

1. Unscrew the two mounting screws **(9)** until the entire "Latch-Valve Mechanism" can be removed from the outlet.

2. Remove the two screws **(8)** holding the retaining ring **(7)** in place. Remove the retaining ring.

3. Remove the connector **(6)** from the valve assembly.

4. Remove the seal ring **(3)**, check valve **(4)**, and valve spring **(5)** from connector **(6)**. Inspect all items for wear or damage and replace.

5. Reinstall all internal components and lock in place with seal ring **(3)**. Insert the connector body **(6)** onto the latch valve body **(1)**. Reinstall retaining ring **(7)** and secure with two screws **(8)**.

6. Reinstall the "Latch-Valve Mechanism" into the outlet. Coat the connector **(6)**, with a thin coat of oxygen compatible silicone lubricant to aid insertion. Tighten down the mounting screws **(9)**, **DO NOT OVER TIGHTEN**, as this could damage the Latch-Valve.

7. Connect the proper gas specific adapter into the outlet. The connection should be smooth and the adapter should lock and remain in place allowing gas to flow..

CAUTION: Use caution relative to the type and pressure of the gas so as not to cause injury.

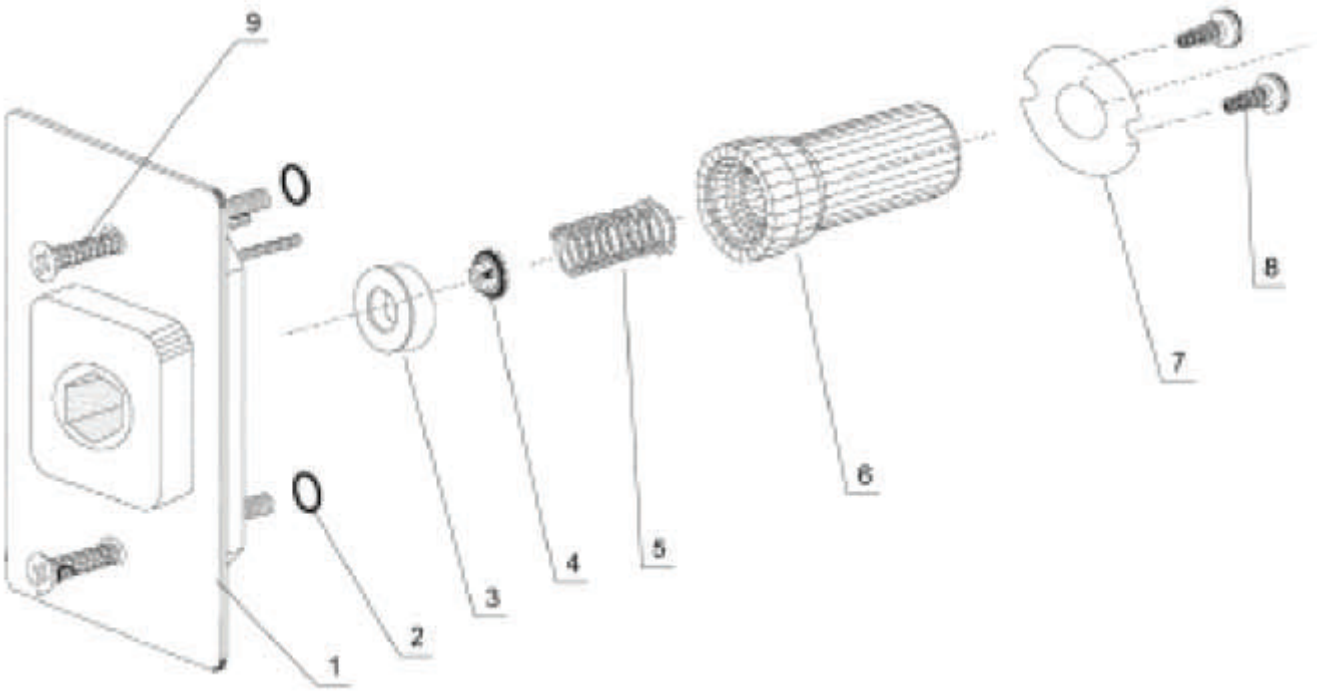
8. If the assembly does not perform correctly with the adapter installed, replace the entire "Latch-Valve Mechanism".

REPLACEMENT PARTS

LATCH-VALVE MECHANISMS - PURITAN BENNETT COMPATIBLE OUTLETS

ITEM	DESCRIPTION	PART NUMBER
3	Seal Ring	
4	Check Valve	
5	Valve Spring	
6	Connector	
7	Retaining Ring	
8	Screws	
9	Mounting Screw	
2	Mounting Screw O-Ring	
1	Panel Assembly, Oxygen	
1	Panel Assembly, Vacuum	
1	Panel Assembly, Medical Air	
1	Panel Assembly, N2O	
1	Panel Assembly, WAGD	

Seal Ring (#3)
Check Valve (#4)
Valve Spring (#5)



SERVICING INSTRUCTIONS
CHEMETRON COMPATIBLE "LATCH-VALVE MECHANISM"

1. Unscrew the three retaining screws **(M)** until the entire "Latch-Valve Mechanism" can be removed from the outlet.

2. Remove the four screws **(N)** holding the connector retaining plate **(A or B)** in place. Remove the plate.

3. Remove the valve body **(G)** from the valve assembly.

4. Remove the flat washer **(I)** and valve body O-Ring **(J)** from the front of the valve body. Inspect the items for wear or damage and replace the O-Ring seal **(J)**.

5. Remove the retaining ring **(F)** using appropriate snap ring pliers. Remove the primary cap **(K)**, primary cap spring **(C)**, O-Ring seal **(D)**, primary check valve **(E)** and spring **(H)**. Inspect all items for wear or damage and replace as necessary. Replace the O-Ring **(D)**.

6. Reinstall all internal components and lock in place with retaining ring **(F)**. Insert the valve body **(B)** into the latch valve body. Check that the flat washer **(I)** and O-Ring **(J)** are in place. Reinstall the connector retaining plate **(A or B)** and secure with four screws **(N)**, do not over tighten.

7. Reinstall the "Latch-Valve Mechanism" into the outlet. Coat the valve body **(B)**, with a thin coat of oxygen compatible silicone lubricant to aid insertion. Tighten down the retaining screws **(M)**, **DO NOT OVER TIGHTEN**, as this could damage the Latch-Valve.

8. Connect the proper gas specific adapter into the outlet. The connection should be smooth and the adapter should lock and remain in place allowing gas to flow.

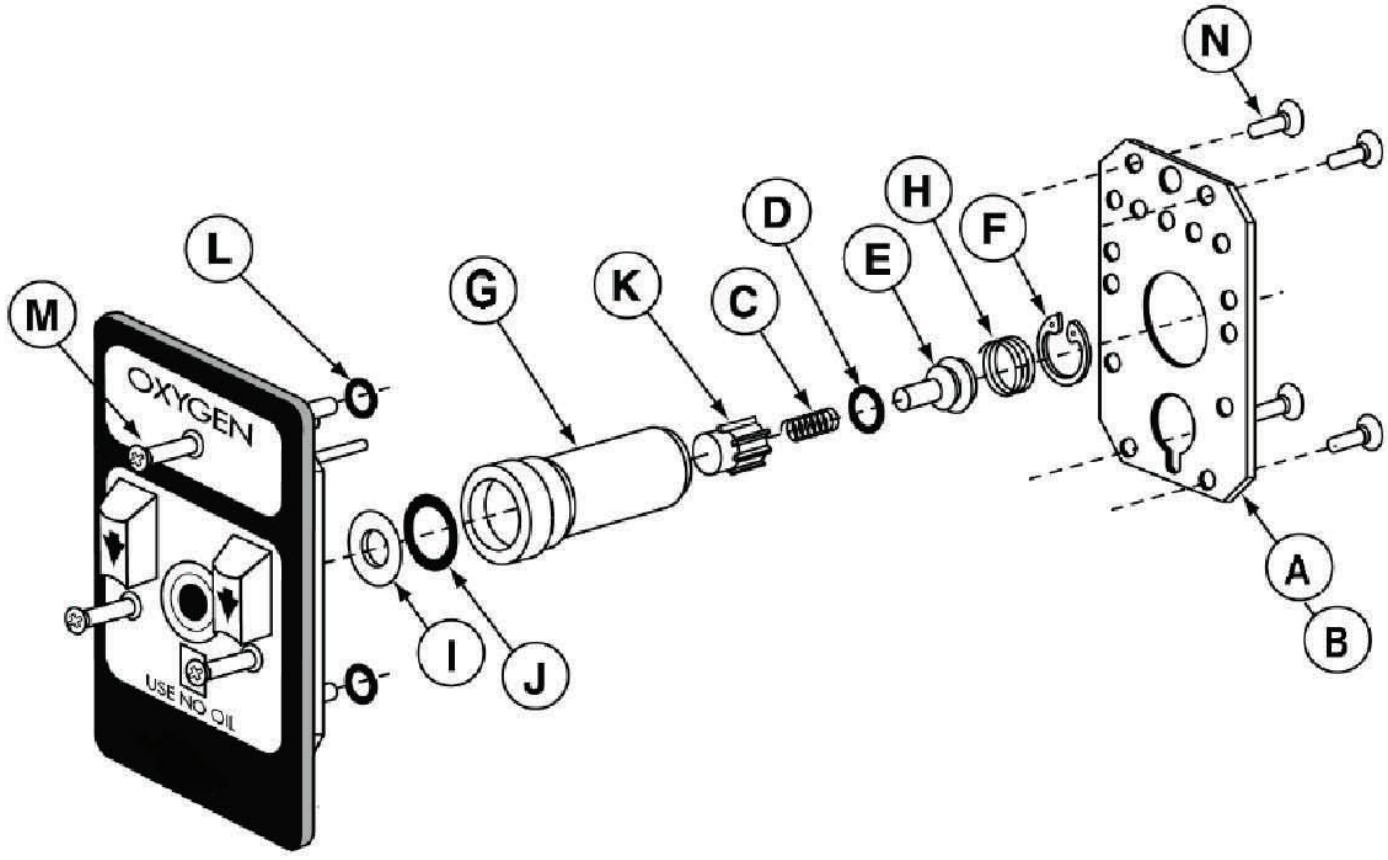
CAUTION: Use caution relative to the type and pressure of the gas so as not to cause injury.

9. If the assembly does not perform correctly with the adapter installed, replace the entire "Latch-Valve Mechanism".

REPLACEMENT PARTS

LATCH-VALVE MECHANISMS - CHEMETRON COMPATIBLE OUTLETS

ITEM	DESCRIPTION	PART NUMBER
A	Plate- All Gases Except Evac	O1-PLATE
B	Plate—Evac	O1-CHPLATEEVAC
C	Primary Cap Spring	O1-PCS
D	Check Valve O-Ring	O1-CVORING
E	Primary Check Valve	O1-PCV
F	Retaining Ring	O1-RETRING
G	Valve Body	O1-VALVEBODY
H	Check Valve Spring	O1-CVS
I	Flat Washer	O1-FLATWASH
J	Valve Body O-Ring	O1-VBORING
K	Primary Cap	O1-PRICAP
L	Screw Retaining O-Ring	O1-SRORING
M	Screw (3 Req'd)	O1-SCREW
N	Screw (4 Req'd)	O1-SCREW1



SERVICING INSTRUCTIONS
"BACK-BODY ASSEMBLY" - ALL OUTLETS

Inside the "Back-Body Assembly" is a secondary check valve that performs the function of shutting off the gas flow for all pressurized gases when the "Latch-Valve Mechanism" is removed. This seat/seal also prevents leaks around the latch-valve connector.

Back-Body Assemblies for vacuum and evacuation gases do not contain a secondary check valve. If it becomes necessary to remove the Latch Valve mechanism from these outlets for service, the Back-Body Assembly must be plugged with a 3/4" round tubing plug (or equivalent) to prevent excessive draw on the vacuum pump.

The secondary seal will rarely need replacement. However, if the seat/seal does need replacement follow the following procedure:

CAUTION: Ensure that the supply pressure is shut off before performing maintenance on the "Back-Body Assembly".

1. **Ensure that no pressure exists in the assembly or pipeline by depressing the secondary check valve (C) until all gas pressure has been relieved from isolated piping zone. Nitrous Oxide and Carbon Dioxide must not be vented near staff or patients.**

2. Remove the retaining ring **(D)** from the inside of the outlet body.

3. Remove the washer **(E)**, seat/seal **(F)**, secondary check valve ***(C)** and secondary check valve spring ***(B)**. Inspect all items for wear or damage and replace the seat/seal **(F)**; replace other components as necessary.

4. Reinstall the spring ***(B)**, secondary check valve ***(C)**, seat/seal **(F)** and the washer **(E)**. Insert the retaining ring **(D)** into the slot and ensure that the ring is seated properly.

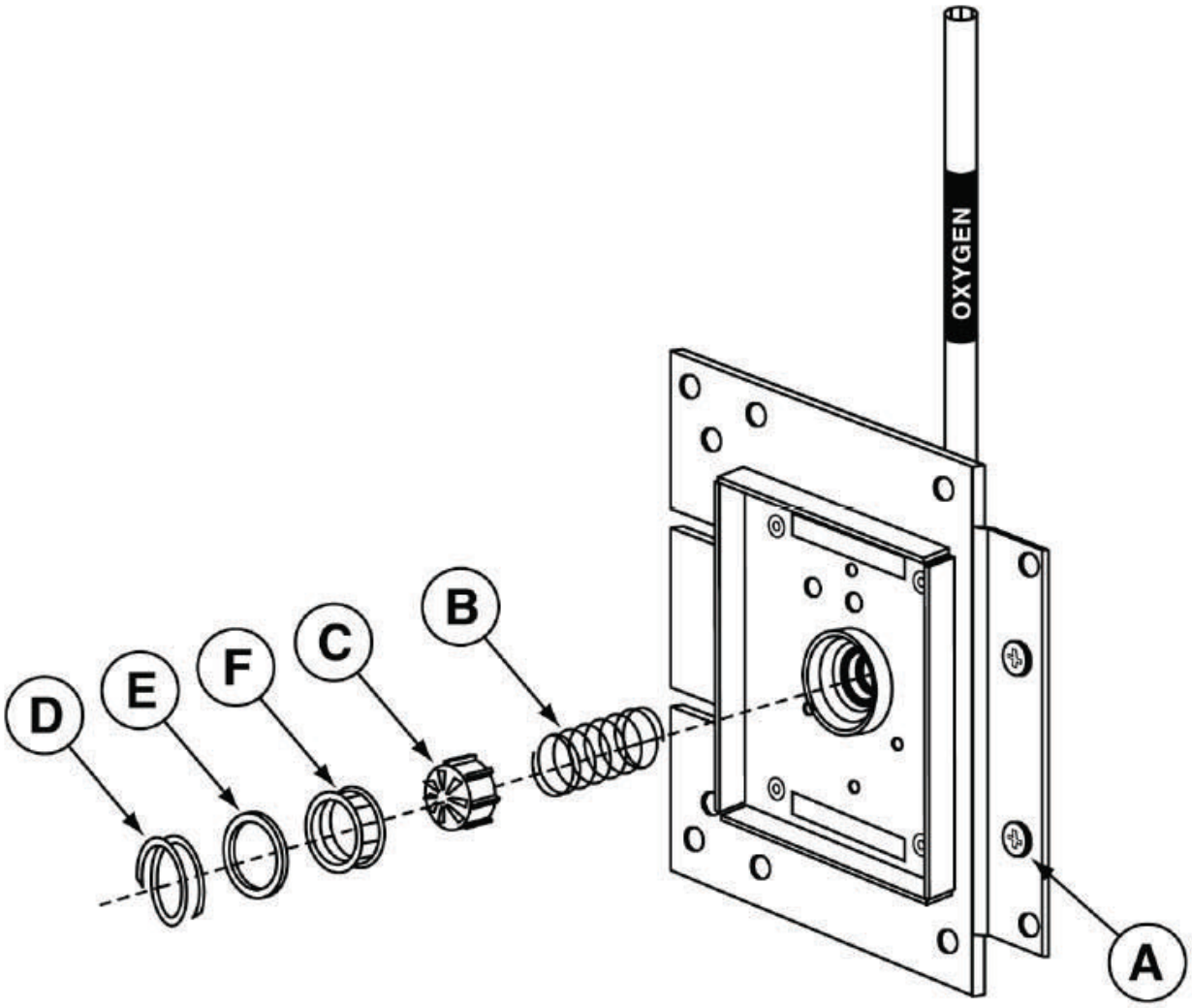
5. Carefully restore pressure to the pipeline and check for leaks.

9. Reinstall the "Latch-Valve Mechanism" and perform appropriate inspection and testing as recommended by NFPA and local requirements.

REPLACEMENT PARTS

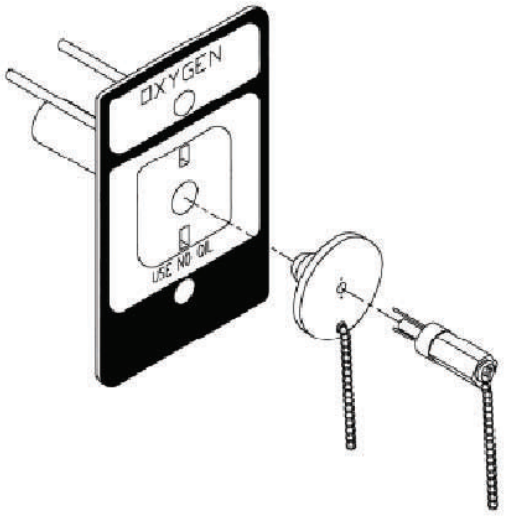
BACK-BODY ASSEMBLY - ALL OUTLETS

ITEM	DESCRIPTION	PART NUMBER
A	Screw-Wall Outlet (2)	O1-SCREWWALL
B	Secondary Check Valve Spring	O1-SCVS
C	Secondary Check Valve	O1-SCV
D	Retaining Ring	O1-BBRETRING
E	Washer	O1-WASHER
F	Seat/Seal	O1-SEATSEAL



OPTIONAL EQUIPMENT:

Ohmeda Locking Device



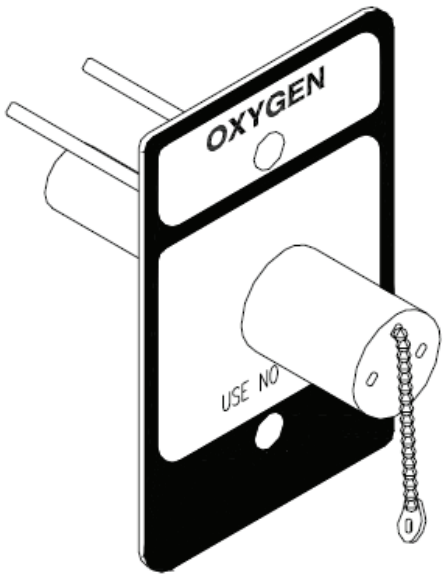
The Locking Kit shall prevent tampering of the internal primary check valve, located in the latch valve assembly.

The locking kit consists of a chrome plated locking cap which plugs into the Ohmeda outlet. Inserting and turning the key will pop off the lock and allow flow of the gas.

Part Numbers:

O1-LOCK-QD	Ohmeda Locking Kit (all gases)
O1-LOCK-QD-KEY	Key for Ohmeda Locking Kit

D.I.S.S. Locking Device



The Locking Kit shall prevent tampering of the internal primary check valve, located in the latch valve assembly.

The locking kit consists of a chrome plated threaded cap which screws into the DISS outlet. Inserting and turning the key will pop off the lock and allow flow of the gas.

Part Numbers:

O1-LOCK-DISS	DISS Locking Kit (all gases except Oxygen and Evac)
O1-LOCK-DISS-OXY	DISS Locking Kit for Oxygen
O1-LOCK-DISS-KEY	Key

NOTES:

NOTES:



3201 South Boulevard
Charlotte, NC 28209
1-866-960-0087
www.pattonsmedical.com

Patton's Medical Pipeline Equipment Warranty

Patton's Medical warrants the Medical Gas Pipeline Equipment to be free of defects in material and workmanship under normal use for a period of twenty-four months from date of shipment or twelve months from the date of start-up, whichever occurs first. Patton's Medical will repair replace any part or component, at their sole discretion, which is proven to be defective in either material or workmanship.

This warranty does not apply to products that are damaged by external causes, or are improperly warehoused, used, installed, serviced, misapplied or maintained by the customer. Installation of user replaceable items will be the user's responsibility. The sole liability for **Patton's Medical** under this warranty is limited to repairing, replacing, or crediting, at its election, any such products provided that:

- **Patton's Medical** is notified promptly within the warranty period above of any warranty claim.
- The examination of such items by an authorized representative of **Patton's Medical** will disclose to their reasonable satisfaction that claimed products defect has not been caused by misuse, neglect, improper handling, installation, repair, alteration, or accidents. .
- The user will be required to issue a purchase order for replacement items. Upon receipt and inspection of defective items, **Patton's Medical** will determine if a credit is due and if so determined will issue credit in the amount equal to the replacement parts.

Product modification performed by the customer without prior written approval by **Patton's Medical** will invalidate the above warranty.

This warranty is given in lieu of all other warranties, expressed or implied, including implied warranties of fitness for a particular purpose and merchantability. In no event shall Patton's Medical be liable for damages in excess of the value of the defective product or part, nor shall Patton's Medical be liable for any indirect, special or consequential damages, loss of profits of any kind, or for loss of use of the products.

Patton's Medical shall not be liable to the customer for any claims, loss of damage of any kind whatsoever arising from the nonperformance of **Patton's Medical** of any part of this agreement occasioned by acts of God, fire, war, labor difficulties, governmental regulations, or action of government. **Patton's Medical** shall not be liable to the customer for any other cause, whether of a similar or dissimilar nature beyond its reasonable control.

Installation, Operation and Maintenance Manuals

Job Title: **ICON - Webster Univ - ISB**

Job Site: Webster University
547 Garden Ave

Saint Louis, MO 63119
United States

Customer PO#: Webster ISB 5768
Contractor: ICON MECHANICAL
Elevation: (ft) 709
Date: 1/25/2017
Submitted By: Mark Haas
Agent Order#: 1610111B

H C SHARP COMPANY INC
8301D CREST INDUSTRIAL DRIVE
SAINT LOUIS, MO 63123
US
Phone: 3143516900
Fax: 13143516901
Email Address: karen@hcsharpco.com

Product IOMs

Mark Name	Model Name
HEF-1 11-16-2016 rev COIL 12-5	VEKTOR-MH

GREENHECK
Building Value in Air.

Document 464652
Model Vektor®-MH, Vektor®-MD and Vektor®-MS Laboratory Exhaust System

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage!

Vektor-MH, Vektor-MD, and Vektor-MS

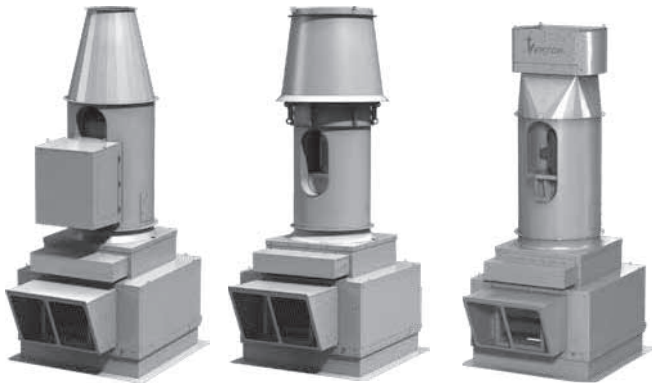


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General Safety Information

Only qualified personnel should install this fan system. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards. Other considerations may be required if high winds or seismic activity are present. If more information is needed, contact a licensed professional engineer before moving forward.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC), the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electrical Code (CEC) in Canada.
2. The rotation of the wheel is critical. It must be free to rotate without striking or rubbing any stationary objects.
3. Motor must be securely and adequately grounded.
4. Do not spin fan wheel faster than maximum cataloged fan rpm. Adjustments to fan speed significantly effects motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.
5. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces or chemicals. Replace cord immediately if damaged.
6. Verify that the power source is compatible with the equipment.
7. Never open access doors to a duct while the fan is running.

DANGER
Always disconnect power before working on or near a fan. Lock and tag the disconnect switch or breaker to prevent accidental power up.
CAUTION
When servicing the fan, motor may be hot enough to cause pain or injury. Allow motor to cool before servicing.
CAUTION
Precaution should be taken in explosive atmospheres.

Receiving

Greenheck model Vektor-MH, Vektor-MD and Vektor-MS fans are thoroughly inspected, test run at the factory, and shipped on a skid or packaged to minimize damage during shipment. Warranty period begins at the time of shipment. The transportation carrier has the responsibility of delivering all items in their original condition as received from Greenheck. The individual receiving the equipment is responsible for inspecting the unit for obvious or hidden damage and recording any damage on the bill of lading before acceptance of the equipment. All claims (if necessary) shall be filed with the final carrier.

Unpacking

Verify that all required parts and the correct quantity of each item have been received, including accessory kit containing gasketing, etc. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the bill of lading.

Handling

The Vektor-MH, Vektor-MD and Vektor-MS laboratory exhaust system is shipped in subassembly sections for easy rigging and installation. Depending on the fan size, the sections can include: Blower Assembly, Stack Extension, Discharge Nozzle, and Bypass Air Plenum.

The Vektor-MH, Vektor-MD and Vektor-MS are designed to be self-supporting and standing (without the use of guy wires) when assembled per the instructions provided within this manual. If additional components are supplied, contact factory or reference submittal if additional supports or guy wires are required. All subassembly sections have lifting lugs as shown.

Storage

Fans are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the fan and accessories while in storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

INDOOR - The ideal environment for the storage of fans and accessories is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Temperatures should be evenly maintained between 30° and 110°F. (*-1°C and 43°C*). Wide temperature swings may cause condensation and “sweating” of metal parts. All accessories must be stored indoors in a clean, dry atmosphere.

Remove any accumulations of dirt, water, ice or snow and wipe dry before moving to indoor storage. To avoid “sweating” of metal parts allow cold parts to reach room temperature. To dry parts and packages use a portable electric heater to get rid of any moisture build up. Leave coverings loose to permit air circulation and to allow for periodic inspection.

The unit should be stored at least 3½ in. (*89 mm*) off the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Aisles between parts and along all walls should be provided to permit air circulation and space for inspection.

OUTDOOR - Fans designed for outdoor applications may be stored outdoors, if absolutely necessary. Roads or aisles for portable cranes and hauling equipment are needed.

The fan should be placed on a level surface to prevent water from leaking into the fan. The fan should be elevated on an adequate number of wooden blocks so that it is above water and snow levels and has enough blocking to prevent it from settling into soft ground. Locate parts far enough apart to permit air circulation, sunlight, and space for periodic inspection. To minimize water accumulation, place all fan parts on blocking supports so that rain water will run off.

Do not cover parts with plastic film or tarps as these cause condensation of moisture from the air passing through heating and cooling cycles.

Fan wheels should be blocked to prevent spinning caused by strong winds.

Inspection and Maintenance during Storage

While in storage, inspect fans once per month. Keep a record of inspection and maintenance performed. **Failure to inspect and maintain during storage may void the warranty.**

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. At each inspection, **rotate the wheel by hand ten to fifteen revolutions** to distribute lubricant on motor and fan bearings. **Bearings should be lubricated at three month intervals. The quantity of grease should be per the lubrication label.**

If paint deterioration begins, the affected areas should be touched-up and repainted. Fans with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive coating should be restored to good condition promptly if signs of rust occur. Immediately remove the original rust preventive coating with petroleum solvent and clean with lint-free cloths. Polish any remaining rust from surface with crocus cloth or fine emery paper and oil. Do not destroy the continuity of the surfaces. Wipe clean thoroughly with Tectyl® 506 (Ashland Inc.) or the equivalent. For hard to reach internal surfaces or for occasional use, consider using Tectyl® 511M Rust Preventive or WD-40® or the equivalent.

REMOVING FROM STORAGE

As fans are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion, until the fan equipment goes into operation.

Prior to assembly and installation of the Vektor fan and system components, inspect the fan assembly to make sure it is in working order.

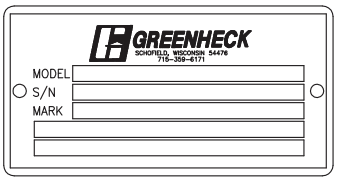
1. Check all fasteners, set screws on the fan, wheel, bearings, drive, motor base and accessories for tightness.
2. Rotate the fan wheel(s) by hand and assure no parts are rubbing. Access to the wheel is obtained through a bolted panel located on the side of the fan housing.
3. Ensure proper wheel settings for radial gap and alignment (see page 18).

General Information

To ensure a successful installation, the instructions in this manual should be read and adhered to. **Failure to comply with proper installation procedures may void the warranty.**

Unit and System Identification Tags

Each fan has a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number.



The tag shown is an example of an identification nameplate on the fan. The information provides general details about the fan, as well as containing specific information unique to the unit. When contacting your Greenheck representative with future needs or questions, please have the information on this label available. Tags are mounted in an area which is clearly visible, usually on the side of the fan cabinet.

Vektor fan systems may arrive in component pieces due to shipping restrictions. Individual components of a system have matching identification tags which should be used to identify and assemble the complete system. Assembling systems with different identification tags can cause reductions in the fan(s) performance.

Prior to fully assembling and installing the Vektor-MH, Vektor-MD or Vektor-MS fans, inspect bypass air plenums and the fan assembly to make sure they are in working order.

Pre-Installation Information

Before installation, it is important to be certain the mounting surface will bear the operating weight of the unit. Structural soundness may impact fan performance. For proper unit operation, it is also important that it be operated in a completely level position.

For further details on safety practices involving industrial and commercial fans, please refer to AMCA Publication 410.

Electrical Disconnects

All fan motors should have disconnects located in close visual proximity to turn off electrical service. Service disconnects shall be locked-out when maintenance is being performed.

Moving Parts

All moving parts must have guards to protect personnel. Refer to local codes for requirements as to the number, type and design. Fully secure fan wheel before performing any maintenance. The fan wheel may start "free wheeling" even if all electrical power has been disconnected. Before the initial start-up or any restart, check the following items to make sure that they are installed and secure.

- Do not spin fan wheel faster than the maximum cataloged fan rpm.
- Adjustments to fan speed significantly affects motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.

Guards (Motor Cover, Weatherhoods, Actuator Cover)

Do not operate fans without proper protective devices in place. Failure to do so may result in serious bodily injury and property damage. Check local codes to ensure compliance for all protective devices.

Plenum Access Doors

Before opening access doors, ensure the fan wheel has stopped moving and that the wheel has been secured from being able to rotate. Do not operate fan without access door in its fully closed position.

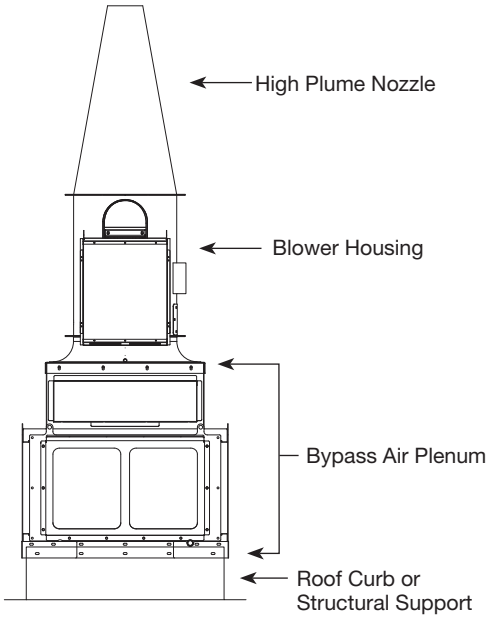
Air Pressure and Suction

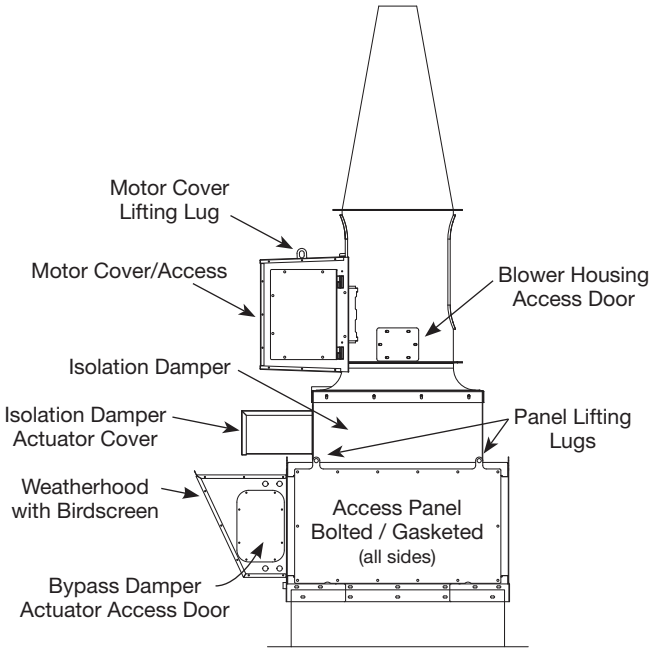
In addition to the usual hazards associated with rotating machinery, fans also create a dangerous suction at the inlet. Special caution needs to be used when moving around a fan, whether it is in operation or not. Before start-up, make sure the inlet area is clear of personnel and loose objects.

System Components

Vektor-MH Assembly View - Belt Drive

Belt and direct drive units share similar system components and assembly configuration.



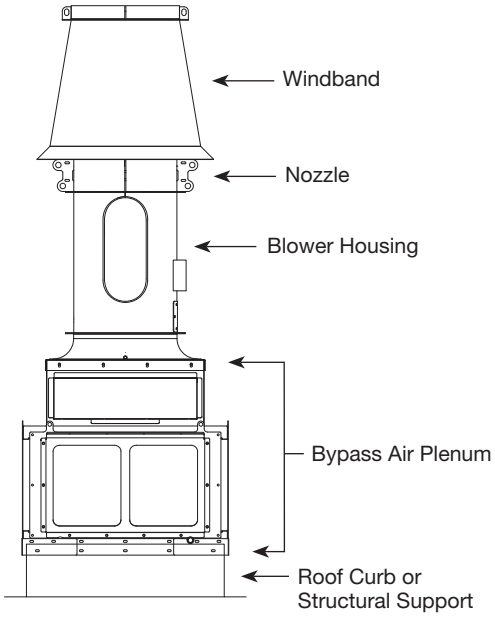


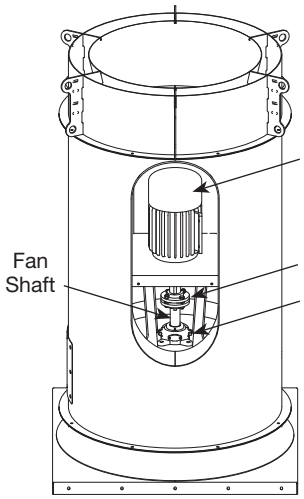
NOTE

Actual component pieces may vary from these images. Refer to your project submittal drawing.

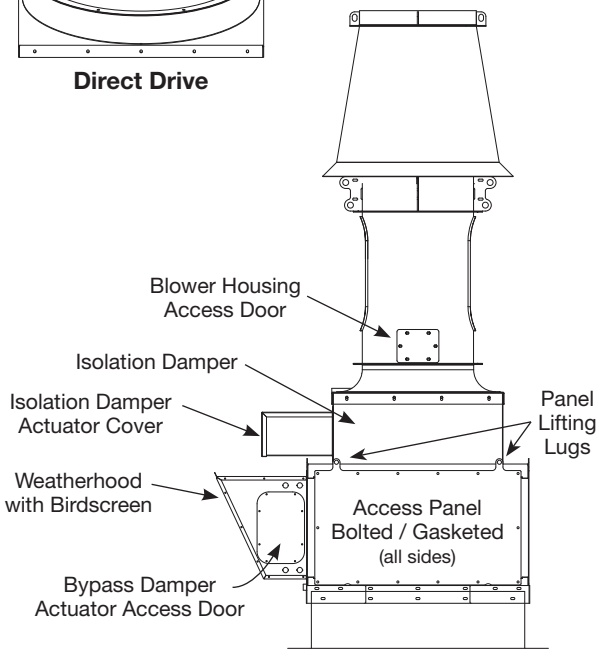
Vektor-MD Assembly View - Direct Drive

Belt and direct drive units share similar system components and assembly configuration.



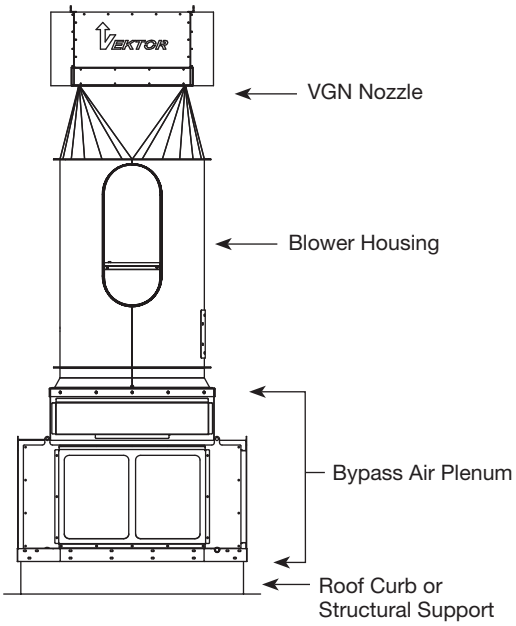


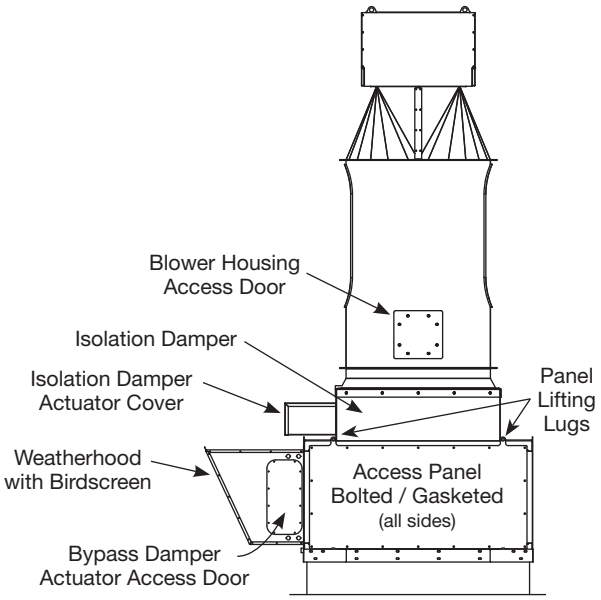
Direct Drive



Vektor-MS Assembly View - Direct Drive

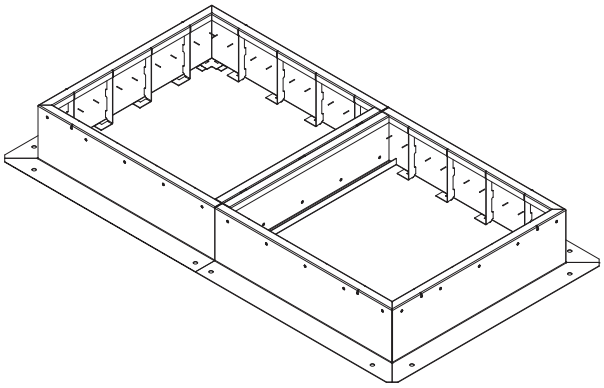
Belt and direct drive units share similar system components and assembly configuration.





Roof Curb and Mounting Details

Refer to VKCURB Assembly Instructions for additional details. Document 475588.



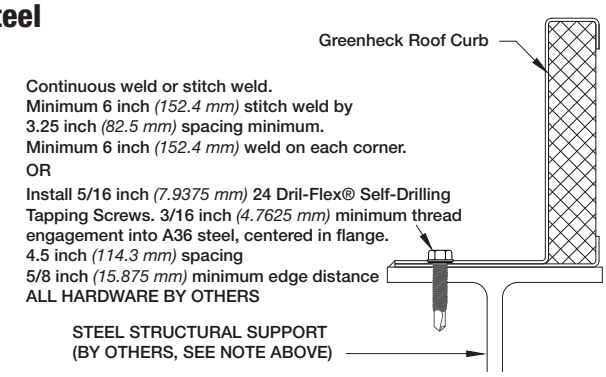
NOTE

Steel, concrete or wood roof support is per structural engineer and in accordance with load requirements and applicable building codes.

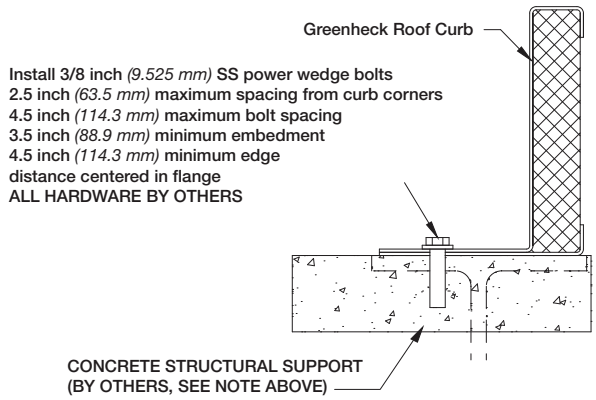
Refer to stand-alone Vektor Roof Curb Assembly Instruction found on greenheck.com within the Laboratory Exhaust section. Chose applicable product model.

The figures illustrates three common methods used to install Vektor systems. Methods used to attach a Vektor unit are dependent on local codes, roof construction design and roof construction materials. Consult an architect or structural engineer for proper means of attachment.

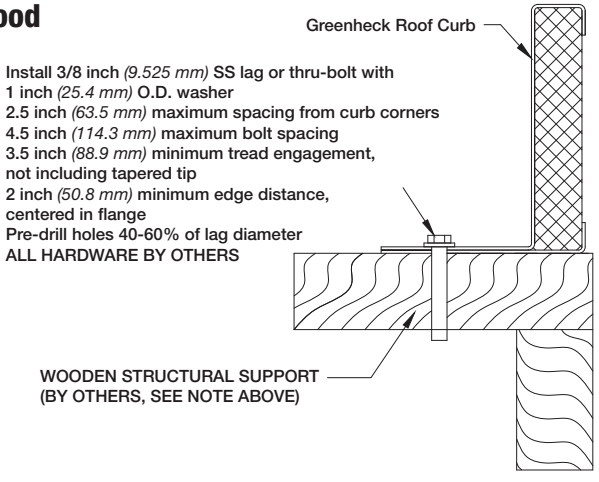
Steel



Concrete



Wood



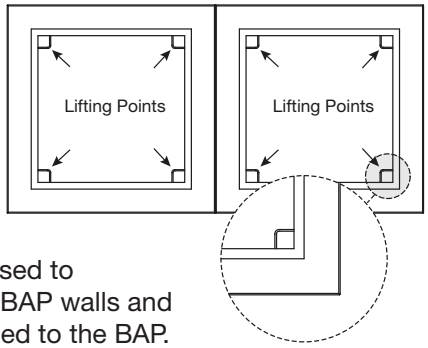
Bypass Air Plenum - Rigging, Lifting and Installation

Prior to lifting any components, verify the weights on the project submittal drawings for each component or contact factory. Do not lift weights beyond the capacities of the on-site lifting equipment. Proper handling of the equipment is critical to avoid damage to the unit.

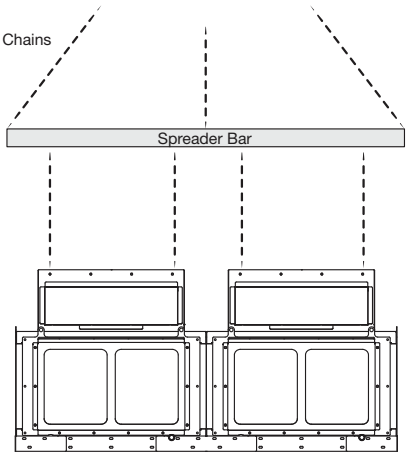
Prior to setting the bypass air plenum (BAP), secure 1/4-inch thick by 3/4-inch wide EPDM gasket (provided) around the perimeter of the roof curb top edge, if mounting on a roof curb.

Bypass Air Plenum - Rigging and Lifting

Each section will have four (4) lifting points. All lifting points must be used when lifting. Spreader bars of sufficient length need to be used to prevent damage to BAP walls and components mounted to the BAP.



1. **Always use all lifting lugs provided by manufacturer. Failure to do so may result in dropping the BAP and voiding the warranty.** Lifting lugs are located around the perimeter of each section.
2. A spreader bar must be used when lifting each section to distribute the weight evenly and to prevent the unit from being over-torqued. Avoid unnecessary jarring or rough handling.
3. Care must be taken to keep the unit in the upright position during rigging.



Two fan bypass air plenum shown. Plenums may be single sections or up to six in length

4. Care must be taken to not damage the watertight seams in the unit casing.
5. Avoid damage to the curb and curb gasketing when rigging onto a curb.
6. Only use trained professional riggers when moving equipment.

Bypass Air Plenum Installation

Bypass air plenums (BAP) are delivered fully assembled unless shipping restrictions require multiple sections. If delivered in sections, all materials required to join plenum sections together are provided.

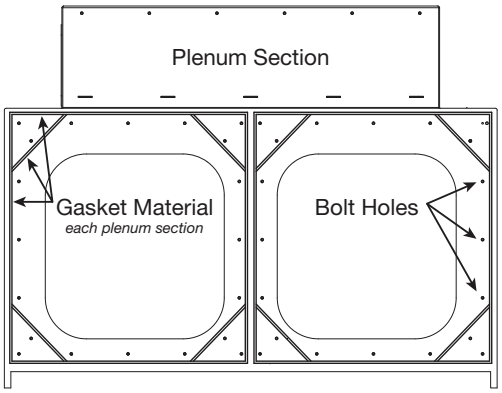
Bypass air plenums are modular in construction and can be disassembled to provide allowances for lower on-site lifting capacities. Plenum sections are joined using stainless steel fasteners. These are removed to separate sections for lifting purposes. Save hardware as these will be required to join the BAP sections together again.

If moving separate sections onto a roof curb or support structure, each section should be joined to its mating section after moving into position and before lifting any additional section(s) into position.

Steps for joining multiple BAP sections together:

1. Lift / place first BAP section making sure that mounting holes are positioned with curb mounting holes or to structure BAP will be secured.
2. Attached provided gasket to plenum section using the pattern shown in the image.
3. Ensure bolts are removed from both mating sections to being joined together. Plenum will ship with hardware in one section's bolt holes or were removed to disassemble BAP to reduce lifting load.
4. Lift / place next section into position using similar lifting procedure.
5. Align holes between two mating sections.
6. Use fasteners (provided) to join the two sections together, this will involve utilizing the nutserts in each section on the inside perimeter. The fasteners are tightened until the sections are pulled together and the gasket material is compressed.
7. Caulk joint (provided) on the top and two sides between sections for enhanced water protection.
8. Repeat steps 1 – 7 until all plenum sections are lifted and joined together.

Any side panels removed to gain access to the interior of the plenum should be reattached.



NOTE

Components that are shipped separately should be lifted separately due to weight and dimensions.

Securing the Bypass Air Plenum

After bypass air plenum (BAP) has been lifted into position, plenum should be secured to roof curb, structural steel or concrete pad. Bottom of the BAP has a removable skirt section with pre-punched holes. These holes will align with holes and nutserts in the roof curb if the roof curb was provided by Greenheck. If the roof curb is from another supplier use the holes in the skirt as a template.

Allow gasketing to compress before securing. When securing BAP to curb install using moly-coated 316 stainless steel screws (provided) in all holes.

If BAP is not being mounted on a roof curb, it can be secured to either structural steel or concrete pad. Full perimeter and cross support under the BAP is required. Method used to secure the BAP to either structural support(s) or concrete pad is determined by site or structural engineer. If BAP is welded to support structure, repair the area where coating was burnt off. See coatings repair section of this manual for details involving touch-up of damaged surfaces.

Mounting the BAP to roof curbs from manufacturers other than Greenheck Fan Corporation or not following proper mounting instructions may impact fan performance and void warranty.

Fans – Rigging, Lifting and Installation

CAUTION

Fans should never be lifted by the shaft, motor, motor cover or accessories.

Prior to setting fan(s) on plenum, place 1/4-inch thick x 3/4-inch wide EPDM gasket around the perimeter of top edge of BAP where fans mount, adhesive side down (gasket provided).

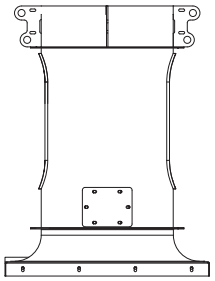
Fans - Rigging and Lifting

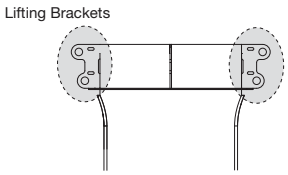
Fans are to be rigged and moved by the lifting brackets provided or by the skid when a forklift is used. Location of brackets varies by model and size. Handle in such a manner as to keep from scratching or chipping the coating. Damaged finish may reduce ability of fan to resist corrosion. See coating repair section of this manual for details involving touch-up of damaged surfaces. Scratches and chipped paint are not covered by warranty.

Vektor-MD fans size 40 and larger and all MH and MS fans are shipped with the nozzle separate from the main housing. For these sizes the nozzle should be lifted separate from the fan. For MD models with the nozzle attached the main fan housing can be lifted using the brackets on the nozzle.

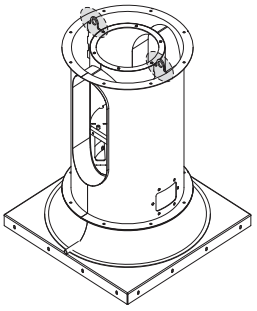
- Use standard lifting and rigging practices.
- **ALL** lifting lugs (brackets) on each component must be utilized at the same time.
- Fan to be kept level during lifting and installation.

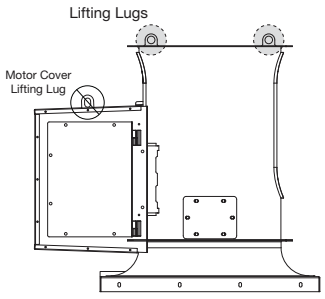
Vektor MD - sizes 36 and smaller





Vektor MD - sizes 40 and greater
Vektor MH and MS - all sizes



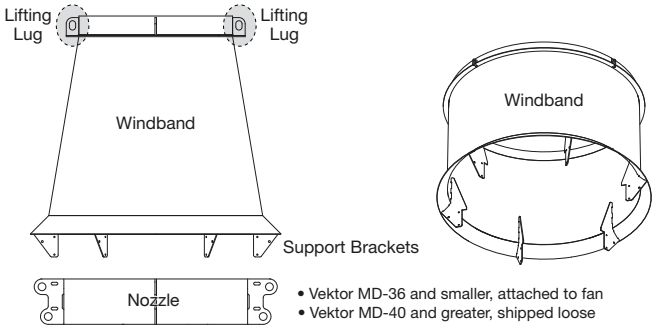


Fan Housing Installation

Lower Vektor fan housing into place. Allow gasket to become compressed before securing to plenum.

Install moly-coated 316 stainless steel screws (provided) in all holes in plenum cap.

Nozzle and Windband Lifting and Installation for Vektor-MD

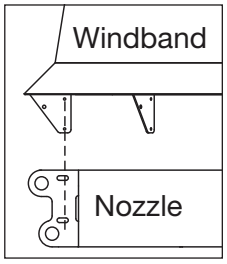


Vektor MD - sizes 36 and smaller, nozzle is attached to the fan housing

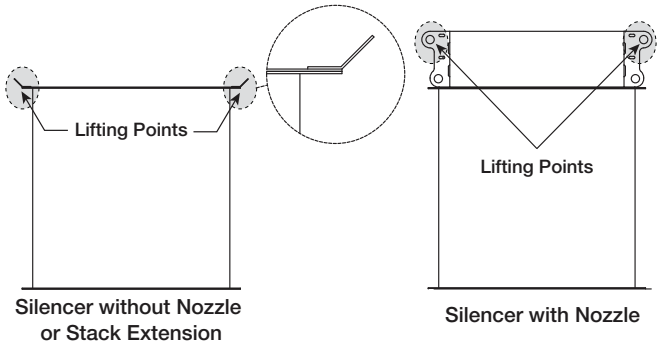
Using the windband lifting lugs, lift and place over the nozzle attached to the fan housing discharge. The windband has support brackets welded around the interior perimeter. Align the windband support bracket bolt holes with the bolt holes in the nozzle. Using the provided moly-coated 316 stainless steel bolts and nuts, securely attach these pieces together.

Vektor MD - sizes 40 and greater, windband and nozzle ship as individual pieces

Using the nozzle lifting brackets, lift and place over the fan discharge. Secure nozzle using moly-coated stainless steel hardware (provided). Align support bracket holes with bolt holes in the nozzle. Attach windband using the provided moly-coated 316 stainless steel bolts through the support brackets welded to the inside of the windband.



Silencer and Stack Extension Lifting and Installation for Vektor-MH / Vektor-MD

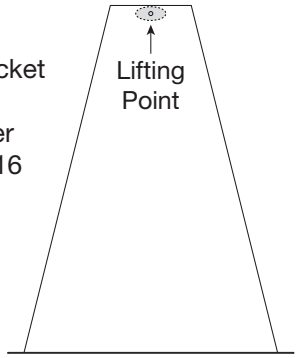


Systems supplied with inline discharge silencers always have the nozzle section ship separate. The silencer is installed between the fan housing and nozzle.

Lift the silencer with provided lifting points. When systems are supplied with silencers, guy wires or independent supports are recommended (by others). Refer to project specific submittal drawings for details.

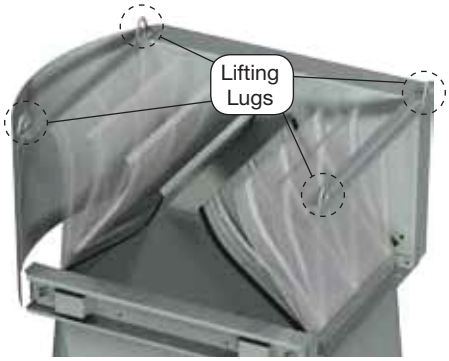
Nozzle Lifting and Installation for Vektor-MH

Using the nozzle lifting points, place nozzle over blower discharge, aligning support bracket holes with bolt holes in blower housing. Attach nozzle to blower discharge using moly-coated 316 stainless steel bolts and nuts provided through the flange.



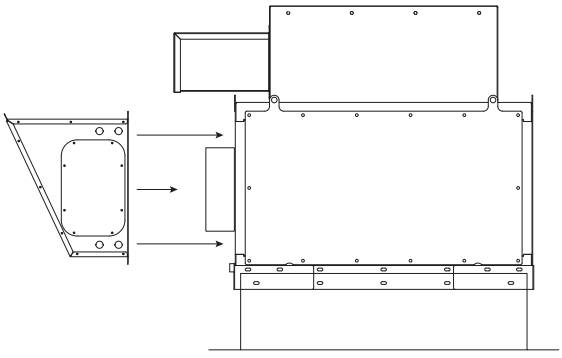
Nozzle Lifting and Installation for Vektor-MS

Using the nozzle lifting lugs, place nozzle over blower discharge, aligning support bracket holes with bolt holes in blower housing. Attach nozzle to blower discharge using moly-coated 316 stainless steel bolts and nuts provided through the flange.



Weatherhood Installation

Shipping constraints may require weatherhoods to be delivered separate from the BAP. The weatherhood bolt hole pattern matches the side panel bolt pattern. Use supplied hardware to secure the weatherhood to the BAP over the bypass air damper.



Duct Connections to the Bypass Air Plenum (BAP)

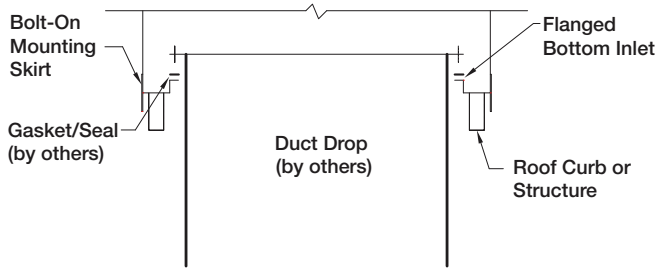
Connecting primary inlet exhaust air ducts is allowed through the roof curb or through one or more of the side access panels. To reduce the potential for system effects in the plenum, the duct connection should be sized to have no more than a maximum air velocity of 1500 fpm when entering. Higher velocities may impact fan performance and void warranty. When attaching ductwork to the plenum, care should be taken to ensure a tight fit and proper seal to prevent leakage from the contaminated airstream.

Side Inlet Duct Connections

Ductwork that has a different size than the removable access panel(s) can either have a transition to the plenum's opening size or the access panel can be field modified by cutting an opening to the size of the ductwork.

Bottom Inlet Duct Connections

Bottom inlet duct connects should be made by attaching the duct to the inside panel edge of the plenum. Ducting to multiple fan plenums may either be split below the roof level and connected to duct drops from the inside the plenum or having the ducting notched for fitting around roof curb and plenum cross support members.



Plenum bottom section view for single fan system. Repeated for multiple fan plenums.

Duct connections are to be sealed from air leakage and water penetration.

Plenum Drainage Piping / Trap Detail (By Others)



Fan Drain Connection



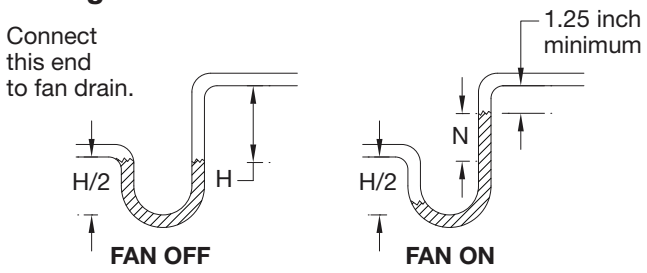
Plenum Drain Connection

There is a location for a pipe connection on each tubular fan housing and bypass air plenum. Each drain may need to be connected to a drainage system to ensure proper disposal of any water or condensate that may occur.

- Drain connections are 0.5 inch FNPT and 1.0 inch MNPT
- Installed piping to have a downward angle to allow for drainage
- Fill traps to recommended level before start-up

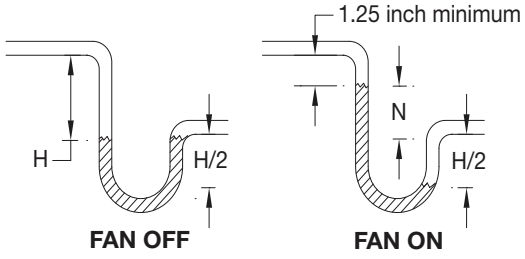
Note: A conservative method of trap design is to set N = total static pressure.

Positive Pressure Trap on Tubular Fan Housing



N = Negative fan pressure (inches W.C.)
H = N - 0.5 inches minimum)

Negative Pressure Trap on Bypass Air Plenum



N = Negative fan pressure (inches W.C.)
H = N - 0.5 inches minimum

Check local codes for proper disposal of drain water which has been in contact with the exhaust air.

Bypass Air Plenum (BAP) and Isolation Damper Access and Actuator Mounting

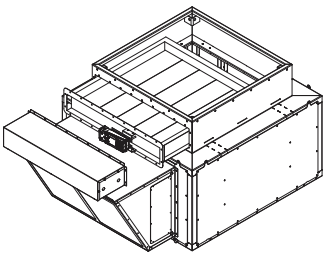
Bypass Air Plenum

Depending on the configuration and intended operation of the system supplied, a Vektor plenum section may not have a weatherhood and bypass damper. If the unit is intended to run at all times, in rare cases the fan may not include an isolation damper. Typically, systems that include a fan which is on standby will have one less weatherhood and BAP damper assembly than plenum sections. Refer to submittal drawings for additional information.

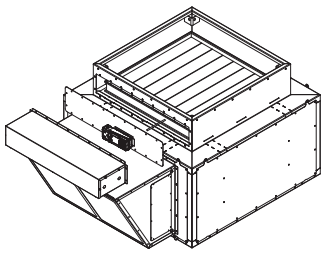
Isolation Damper Access and Actuator Mounting

For all Vektor-M Series units with a Bypass Air Plenum and Isolation damper, access to the isolation damper, actuator(s) (optional from factory) and voltage transformer (optional from factory) can be achieved through the removal of the front panel of the isolation damper cover. The cover is located on the side of the top plenum section. The entire isolation damper assembly can be slid out through the opening.

All Vektor-M systems are available with HCD isolation dampers to be utilized for low to high pressures. Vektor-M, sizes 15 – 33, offer an additional option, the VCD dampers as an option for lower pressure systems. To remove the VCD damper, the actuator must first be removed from the front plate. The HCD damper can be pulled out without removing the actuator.



HCD Isolation Damper



VCD Isolation Damper

Bypass Damper Access and Actuator Mounting

For Vektor fans with bypass air, access to the bypass air damper and actuator (optional from factory) is gained through the removal of the weatherhood or bypass damper actuator access door on the side of the weatherhood.

NOTE

If the Vektor units were not supplied with optional actuators, the dampers have an extended jackshaft for field mounting a customer supplied actuator.

Field Coating Touch-Up Procedure for Scratched Areas

Standard coating and color for the Vektor laboratory exhaust system is Greenheck's LabCoat™. The procedure below details the correct method for repairing minor scratches in the coating.

Failure to perform touch-ups may result in rust or corrosion and accelerate the fade in color and is not covered under warranty.

TOUCH-UP PAINT REPAIR KIT CONTENTS

- One pint of Kem Kromik primer
  - including a technical data sheet
- One pint of industrial enamel
  - RAL7023 Concrete Grey
  - includes a technical data sheet
- Four disposable foam brushes
- One sheet sandpaper
- Repair procedure details

1. Scuff affected area to be repaired using medium sandpaper (provided) or medium scotch brite pad. Feather the edges.
2. Clean affected area to be touched up using an alkaline based cleaner and rinse.
3. Apply Kem Kromik primer using 1 inch foam brush (provided). Follow technical data sheet instructions.
4. Allow primer to dry a minimum of 2 1/2 hours before top coating.
5. Apply topcoat with industrial enamel using 1 inch foam brush (provided). Follow technical data sheets instructions. Allow painted units to air-dry and cure before putting into service. See enclosed Technical Data sheets for detailed drying and cure schedules at different temperatures.

To order additional coating repair kits, please reference Greenheck's part number HAZ2597 RAL7023 CONCRETE GRAY FIELD REPAIR kit. Please contact factory with your fan's serial number for colors other than our standard concrete gray RAL7023.

Electrical Connections

Before electrical connections are made, the supply voltage, phase and ampere capacity must be checked for compatibility with the fan motor. In addition, the supply wiring must be properly fused and conform to local and national electrical codes. If the unit is supplied with a safety disconnect switch, ensure proper wiring to the fan motor. Be sure the disconnect is switched to the “OFF” position before connecting supply wires. If no disconnect is supplied, ensure the supply wire is not live before connection. Supply wires are then connected to the optional safety disconnect switch (if supplied) or motor.

Vektor-MH and Vektor-MD Motor Disconnect and Isolation Damper Wiring Diagram

Disconnect is mounted to fan housing. Transformers are mounted to bypass air plenum with damper actuator motors. For systems that ship unassembled because of physical size, this connection at disconnect from transformers must be field-installed. Wires with conduit and fittings are provided pre-connected to transformers.

Vektor-MH and Vektor-MD Applications with Variable Frequency Drives (VFD)

For Vektor systems with single-point, three-phase wiring per blower, the isolation damper actuator will be powered via a step-down transformer, which is wired to the fan disconnect, as shown in the appropriate diagram.

If fan flow (motor speed) is to be controlled using a variable frequency drive with this wiring, the reduced voltage and frequency supplied to the fan will cause control problems with the isolation damper actuator.

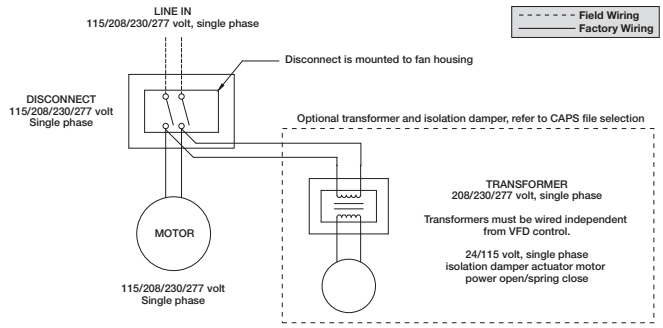
When a project’s Vektor control sequence requires the use of a VFD, it is suggested that the control contractor supply the isolation damper actuator voltage — independent of the power supplied to the Vektor fan motor.

NOTE

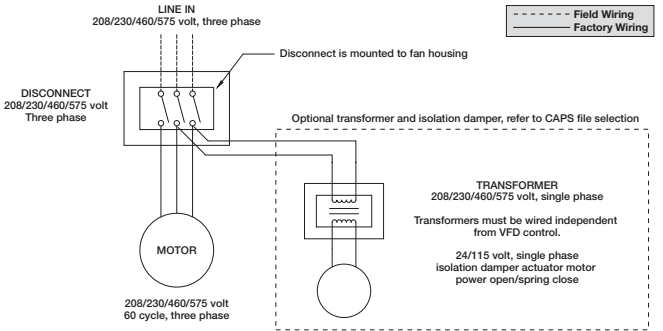
For Vektor-MS fans refer to the Vektor VGN controls Installation, Operation and Maintenance Manual for electrical wiring and connection information.

Improper wiring may damage electrical components and void the warranty.

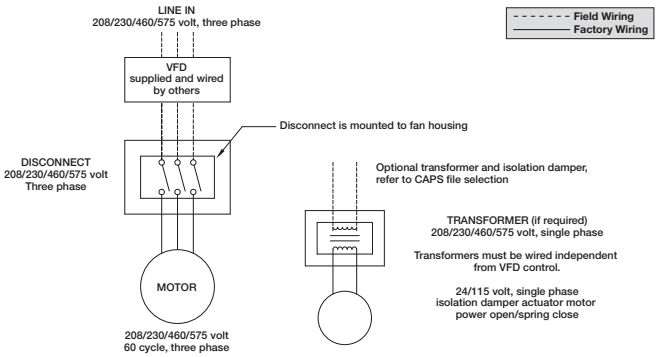
Single Phase Layout



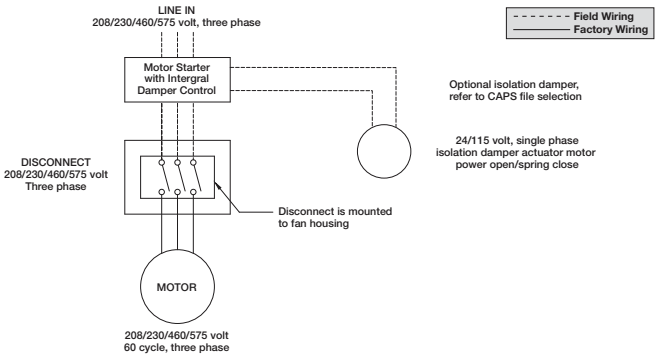
Three Phase Layout



Three Phase with Variable Frequency Drives Layout



Three Phase Motor Starter with Integral Damper Control Layout



Start-Up

WARNING

Disconnect and secure to the **OFF** position all electrical power to the fan prior to inspection or servicing. Failure to comply with this safety precaution could result in serious injury or death.

Visual Inspection of Equipment

The equipment type and arrangement should be verified as ordered at once when it arrives at the jobsite. When a discrepancy is found, the local Greenheck Fan Corporation Sales Representative must be notified immediately so that corrective action may be investigated, also verify electrical conformance to specifications. Unauthorized alterations and unauthorized backcharges will not be recognized by Greenheck Fan Corporation.

After the unit has been assembled, installed and all utilities have been hooked up, the unit is now ready for operation.

Check

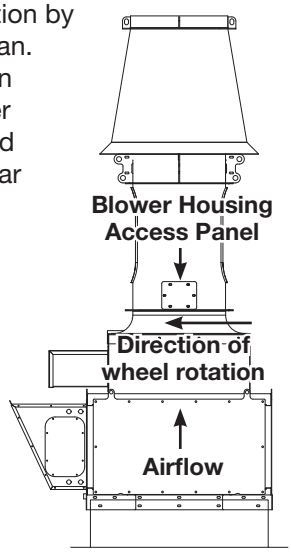
Before starting the unit, check the following:

1. Confirm that building supply voltage matches the voltage for which the unit is wired.
2. Check all piping and wiring penetrations made by contractors for water tightness. All penetrations must be made watertight to prevent water damage to the unit and building.
3. Rotate the fan wheel manually to be sure that it is free to operate. Remove any dirt or debris that may have accumulated during installation.
4. Check the fan bearing setscrews for tightness.
5. Check alignment of sheaves and V-Belts (See maintenance section).
6. Inspect all fasteners to ensure that none have loosened during shipment.
7. Check flex coupling for proper alignment and connect between motor shaft and fan shaft (direct drive).
8. Check all guarding to ensure that it is securely attached and not interfering with rotating parts.
9. Check operation of isolation and bypass dampers (if supplied) for freedom of movement.
10. Check all electrical connections for proper attachment.
11. Check housing and ductwork, if accessible, for obstructions and foreign material that may damage the fan wheel.
12. Fill drainage piping trap.

Additional steps for initial start-up

1. Check for proper wheel rotation by momentarily energizing the fan. Access to view the wheel can be gained through the blower housing access panel located on the side of the fan's tubular housing.





One of the most frequently encountered problems are motors that are wired to rotate the wheel in the wrong direction. This is especially true with 3-phase installations where the motor will run in either direction, depending on how it has been wired. To reverse rotation of a 3-phase motor, interchange any two of the three electrical leads. Single phase motors can be reversed by changing internal connections as described on the motor label or wiring diagram.

2. Fans with multi-speed motors should be checked on low speed during initial start-up.
3. Check for unusual noise, vibration or overheating of bearings. Refer to the "Troubleshooting" section of this manual if a problem develops.
4. Grease may be forced out of the bearing seals during initial start-up. This is a normal self-purging feature for the type of bearing used on this product.

Vibration

On start-up and during operation, the unit should operate smoothly with minimal vibration. It is possible that a higher degree of vibration may be experienced. **Excessive vibration if left unchecked, can cause a multitude of problems, including structural and/or component failure.** The most common sources of vibration are listed.

1. Wheel Unbalance
2. Drive Pulley Misalignment
3. Foundation Stiffness
4. Poor Inlet/Outlet Conditions
5. Incorrect Belt Tension
6. Bearing Misalignment
7. Mechanical Looseness
8. Drive Component Unbalance
9. Faulty Belts

Many of these conditions can be discovered by careful observation. Refer to the troubleshooting section of this manual for corrective actions. If observation cannot locate the source of vibration, a qualified technician using vibration analysis equipment should be consulted. If the problem is wheel unbalance, in-place balancing can be done through the access panel located on the side of each fan's tubular housing. Any correction weights added to the wheel should be welded to either the wheel back or to the wheel back and wheel cone.

Routine Maintenance and Operation

CAUTION

When performing any service to the fan, disconnect the electrical supply and secure fan impeller.

Once the unit has been put into operation, a routine maintenance schedule should be set up to accomplish the following:

1. Lubrication of bearings and motor.
2. Bypass air dampers should be checked for freedom of operation and wear.
3. Wheel, housing, bolts and set screws on the entire fan should be checked for tightness.
4. Any dirt accumulation on the wheel or in the housing should be removed to prevent unbalance and possible damage.
5. Inspect fan impeller and housing looking for fatigue, corrosion, or wear.
6. Examine unit for areas needing paint touch-up.

Fan Operation

Each fan should be run every thirty (30) days as this causes all electrical and mechanical components to get up to temperature, displacing any formed condensation, redistributes load on bearings, and redistributes grease in the bearings (motor and shaft bearings).

CAUTION

When operating conditions of the fan are to be changed (speed, pressure, temperature, etc.), consult manufacturer or your local representative to determine if the unit can operate safely at the new condition.

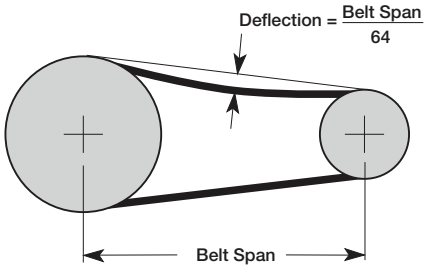
V-Belt Drive

V-belt drives must be checked on a regular basis for wear, tension, alignment and dirt accumulation. Premature or frequent belt failures can be caused by improper belt tension (either too loose or too tight) or misaligned sheaves. **Abnormally high belt tension or drive misalignment will cause excessive bearing loads and may result in failure of the fan and/or motor bearings.** Conversely, loose belts will cause squealing on start-up, excessive belt flutter, slippage and overheated sheaves. Either excessively loose or tight belts may cause fan vibration.

When replacing V-belts on multiple groove drives all belts should be changed to provide uniform drive loading. Use a set of matched belts whenever possible. Do not pry belts on or off the sheave. Loosen belt tension until belts can be removed by simply lifting the belts off the sheaves. After replacing belts, ensure that slack in each belt is on the same side of the drive. Belt dressing should never be used.

Do not install new belts on worn sheaves. If the sheaves have grooves worn in them, they must be replaced before new belts are installed.

The proper tension for operating a V-belt drive is the lowest tension at which the belts will not slip at peak load conditions. Belts are adjusted by swinging out the motor pivot plate. For initial tensioning, the proper belt deflection halfway between sheave centers is 1/64 inch for each inch of belt span. For example, if the belt span is 64 inches, the belt deflection should be 1 inch using moderate thumb pressure at mid-point of the drive.



Check belt tension two times during the first 24 hours of operation and periodically thereafter.

Motors

Motor maintenance is generally limited to cleaning and lubrication. Cleaning should be limited to exterior surfaces only. Removing dust and grease buildup on the motor housing assists proper motor cooling. Never wash-down motor with high pressure spray.

Greasing of motors is only intended when fittings are provided. Motors supplied with grease fittings should be greased in accordance with the manufacturer's recommendations. When motor temperature does not exceed 104ºF (40ºC), the grease should be replaced after 2000 hours of running time.

Direct drive systems have extended grease lines to lubricate the motor without removal of any guarding.

Bearings

The bearings for Greenheck fans are carefully selected to match the operating conditions of the specific class, arrangement, and fan size. The instructions provided in this manual and those provided by the bearing manufacturer will minimize any bearing problems. Bearings are the most critical moving part of the fan, therefore, special care is required when mounting them on the unit and maintaining them.

Refer to the chart on page 15 and the manufacturer's instructions for grease types and intervals for various operating conditions. Never mix greases made with different bases. This will cause a breakdown of the grease and possible failure of the bearing.

Failure to follow recommendations may result in premature bearing failure and is not covered under warranty.

Recommended Bearing Lubrication Schedule Relubrication Schedule in Months* Synthetic Grease								
Fan RPM	Bearing Bore (inches)							
	½ - 1	1⅛ - 1½	1⅝ - 1⅞	1 15/16 - 2 3/16	2 7/16 - 3	3 3/16 - 3½	3 15/16 - 4½	4 15/16 - 5½
To 250	12	12	12	12	12	12	12	12
500	12	12	12	12	12	12	12	12
750	12	12	12	12	12	12	10	7
1000	12	12	12	12	12	9	6	4
1250	12	12	12	12	9	6	4	2
1500	12	12	12	10	7	4	2	
2000	12	10	8	6	3	1.5	.5	
2500	12	7	5	4	1	.5		
3000	12	5	3	2	.5			
3500	12	3	2	.75				
4000	12	2	.5					
5000	12	1						
Number of shots**	4	8	8	10	16	25	41	57

* Lubrication interval is based on 12 hour day operation and maximum 160°F housing temperature. For 24 hour per day operation, the interval should be cut in half.

** Lubricant should be added with the shaft rotating and until clean grease is seen purging from the bearing. The lubrication interval may be modified based on the condition of the purged grease. If bearing is not visible to observe purged grease, lubricate with number of shots indicated for bore size.

- For conditions including high temperatures, moisture, dirt or excessive vibration, consult the factory for a specific lubrication interval for your application.
- Lubricant should be a high quality lithium complex synthetic grease conforming to NLGI Grade 2. Factory recommends synthetic Mobilith SHC100.
- The use of non-synthetic lubricants will decrease lubrication intervals by approximately three times.
- Storage periods of three months or longer require monthly rotation of the shaft and purging grease prior to storage and start-up.

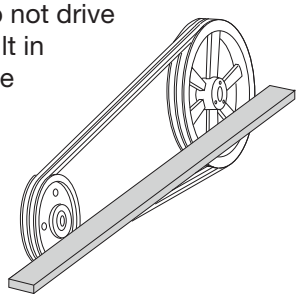
Vektor-MS Nozzle Bearings

The bearings for the MS nozzle assembly are permanently lubricated and do not require additional grease.

V-Belt Drive Installation

Belt Drive

1. Remove the protective coating from the end of the fan shaft using mineral spirits or another similar solvent. Check to ensure that the shaft is free of nicks and burrs.
2. Slide sheaves on shafts - do not drive sheaves on as this may result in bearing damage and void the warranty.
3. Align fan and motor sheaves with a straight-edge or string and tighten.
4. Place belts over sheaves. Do not pry or force belts, as this could result in damage to the cords in the belts.



Aligning Sheaves with a Straight Edge

5. Adjust the tension until the belts appear snug. Run the unit for a few minutes and allow the belts to “Set” properly.
6. With the fan off and disconnect locked out, adjust the belt tension by moving the motor pivot plate. When in operation, the tight side of the belts should be in a straight line from sheave to sheave with a slight bow on the slack side.

Bearing Replacement

The intent of this Vektor fan design with its large side access openings is to allow a field service technician to replace bearings with the fan remaining in place in its intended application. All work can be conducted by accessing the bearings through the blower housing side access openings. This procedure assumes power source has been locked out prior to removing guards and covers, belts and pulleys have been loosened and removed properly and extended lubrication lines have been disconnected at the bearing. In some cases it may be necessary to remove the motor and mounting plate.

Belt Drive

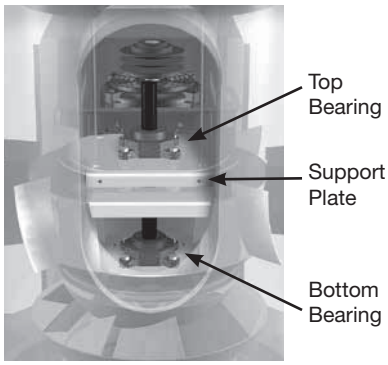
This procedure assumes proper safety measures have been taken and the driven sheaves and belts have already been removed. Shaft black coating can be removed with a solvent similar to brake cleaner. Read through these directions completely prior to starting this procedure.

1. Scribe line at the top of both the top and bottom bearings. These marks are used to locate the proper mounting position for the new bearings
2. Loosen and remove top bearing from fan shaft. Use spanner wrench or blunt punch to loosen bearing.

EQUIPMENT REQUIRED
• Four shaft collars • Emery cloth • Caulk • Replacement bearings • Spanner wrench and sockets

Follow bearing manufacturer's instructions on removal. An emery cloth may be required to clean and remove burrs off shaft. Finish removing top bearing.

3. Install two shaft collars flush with the top support plate to hold and support the shaft when removing bottom bearing.



4. Loosen bottom bearing. Caulk seal may need to be broken around perimeter of flange housing and bottom support plate. Use emery cloth to clean shaft and remove any burrs.
5. Install second set of shaft collars flush with top of bottom support plate.
6. Remove shaft collars on top support plate and finish removing bottom bearing.
7. Install new bottom bearing in reverse of this procedure. Remember to re-install top set of shaft collars prior to removing lower shaft collars.
8. Align the top of the bearing with the scribed mark indicating the correct mounting location. Secure lower bearing to bottom support plate. Do not secure the bearing to the fan shaft.
9. Turn the wheel approximately 20 – 30 rotations to allow the shaft to properly set in the bottom bearing.
10. Finish installing bearing on fan shaft according to bearing manufacturer's installation procedure. Rotate the wheel again for 20 rotations. If resistance is felt the bearing did not set properly. Reset the shaft in the bearing.
11. Remove top set of shaft collars and install top bearing according to bearing manufacturer's instructions making sure the top of the bearing lines up with scribed mark indicating the correct mounting location.
12. Connect extended lube lines to new bearings. Zerk fittings from old bearings may need to be installed in replacement bearings
13. Reinstall drive sheave and belts. Check for alignment.
14. Caulk around bottom bearing flange for an improved water tight seal.

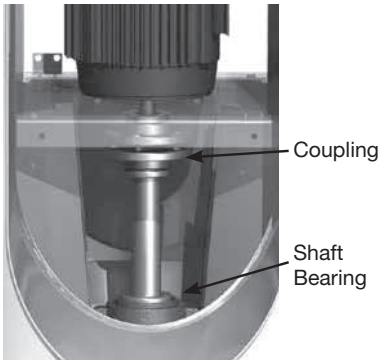
Direct Drive

This procedure assumes proper safety measures have been taken and power locked out prior working on fan shaft / motor assembly. Shaft black coating can be removed with a solvent similar to brake cleaner. Read through these directions completely prior to starting this procedure.

EQUIPMENT REQUIRED
• Blocking materials • Emery cloth • Caulk • Replacement bearing • Spanner wrench and sockets

1. Scribe line at the top of the shaft bearing and also under the lower coupling halve on the fan shaft. These marks are used to locate the proper mounting positions when reassembling the fan.
2. Open side access panel and place blocking materials under wheel to prevent it from shifting down during bearing replacement.

3. Remove coupling assembly from fan shaft. Upper coupling bushing may need to be removed and / or motor might also need to be tilted to remove old bearing and install new bearing. Coupling mounting locations should be scribed on any component loosened or removed.



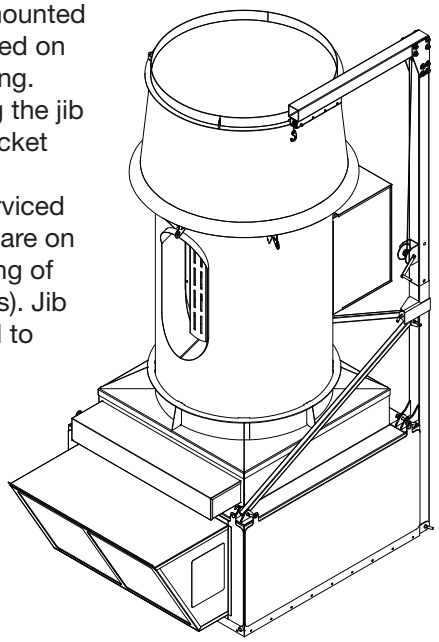
4. Loosen and remove bearing from fan shaft. Follow bearing manufacturer's instructions on removal. Caulk seal may need to be broken around perimeter of flange housing and bottom support plate. Use an emery cloth to clean and remove any burrs on fan shaft.
5. Slide new bearing onto fan shaft, but do not tighten to fan shaft
6. Reinstall coupling bushings and flex pack to fan shaft and motor shaft. This should be done according to manufacturer's instructions making sure the components line up with scribed mark(s) indicating the correct mounting location.
7. Remove blocking from under fan wheel.
8. Turn the wheel approximately 20 – 30 rotations to allow the shaft to properly set in the bearing and alignment between motor shaft and fan shaft.
9. Finish installing bearing on fan shaft according to bearing manufacturer's installation procedure. Rotate the wheel again for 20 rotations. If resistance is felt the bearing did not set properly. Reset the shaft in the bearing.
10. Connect extended lube lines to new bearings. Zerk fittings from old bearings may need to be installed in replacement bearings. Purge non-synthetic grease from new bearing.
11. Caulk around bottom bearing flange for an improved water tight seal.

Jib Crane Assembly (Optional Accessory)

NOTE

Complete assembly instructions for the jib crane are documented in Assembly Instruction #472081, Jib Crane for Vektor. Instructions are shipped with the jib crane or can be found on greenheck.com

The jib crane is mounted to sockets provided on the plenum housing. When assembling the jib crane, use the socket closest to the fan which is to be serviced (multiple sockets are on plenums consisting of three or more fans). Jib crane is designed to lift windband and motor only. Any other use may result in serious injury. Jib crane must not be used to lift the fan from the plenum.



Motor Change-Out Procedure

Direct Drive

To remove the motor:

1. Install jib crane* in plenum mounting socket using Greenheck supplied hardware.
2. Position jib crane boom above windband.
3. Utilizing windband lifting lugs, rig windband to jib crane cable.
4. Remove all bolts used to secure windband to nozzle.
5. Lift off windband and lower to rooftop.
6. Reposition jib crane boom above fan.
7. Lower jib crane cable through center of fan until it reaches the motor.
8. Remove bolts securing the motor to its horizontal mounting plate.
9. Decouple motor shaft from wheel shaft by disassembling coupling.
10. Rig motor to jib crane cable.
11. Lift motor out of fan body and lower to rooftop.

To install the new motor:

1. Rig new motor to jib crane cable.
2. Attach coupling half to motor shaft. Make sure coupling hub is flush with the end of the motor shaft.
3. Position motor above fan body and carefully lower to its intended mounting position.
4. Ensure motor is positioned correctly so mounting bolts can be re-installed.
5. Install all coupling bolts to attach the motor shaft to the fan wheel shaft.
6. Install all bolts to attach motor to fan body mounting plate.

The Vektor fan was designed to ensure that when the new motor is installed, the relative angular alignment of the motor shaft to fan wheel shaft will be within +/-1 degree.

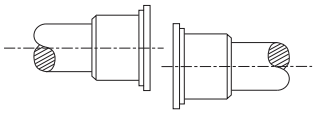
*If jib crane was not supplied with the Vektor system, a portable crane or hoist can be used.

High Strength Metal Disc Coupling Installation and Alignment

Direct Drive

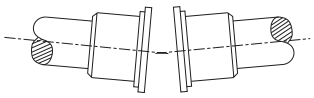
Check for misalignment between the two coupling hubs. The three types of misalignment (parallel, angular, and separation gap) are illustrated below. To minimize misalignment between the hubs, a straight edge can be used as a quick guide in aligning the shafts.

The Vektor direct drive single shaft bearing permits the shaft to swivel and essentially eliminates parallel misalignment.

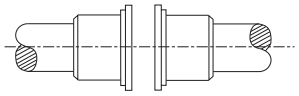


Parallel

But an excessive angle in the fan shaft will cause a higher degree of angular misalignment. It is best to have the motor shaft and fan shaft as close to parallel as possible. The coupling provided allows up to one degree of angular misalignment between the two joining hubs. No lubrication of the coupling is required.



Angular

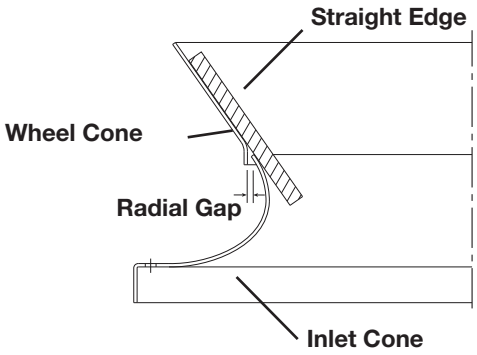


Separation

Refer to the coupling manufacturer's information / installation instruction sheet provided with the fan for additional details. Coupling should not be installed to support the weight of the fan shaft and wheel.

Radial Gap and Alignment

Efficient fan performance can be maintained by having the correct radial gap and alignment. These items should be checked before start-up when the unit has been disassembled.



Radial Gap: Adjust inlet cone position such that the radial gap between the wheel cone and inlet cone is evenly distributed around the wheel.

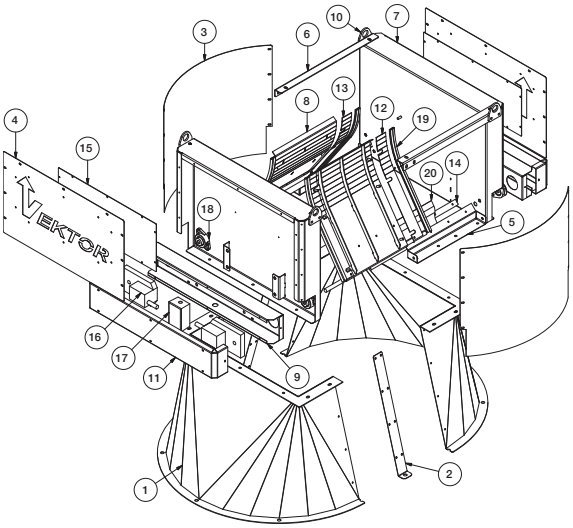
Alignment: If necessary, adjust wheel position by loosening the wheel hub from the fan shaft so that a straight edge held tight to the wheel cone just touches the inlet cone.

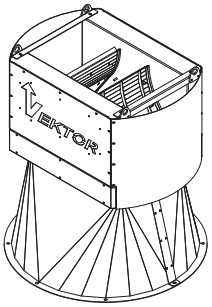
Troubleshooting

Problem	Cause	Corrective Action
Excessive Noise	Wheel Rubbing Inlet	Adjust wheel and/or inlet cone. Tighten wheel hub or bearing collars on shaft.
	V-Belt Drive	Tighten sheaves on motor/fan shaft. Adjust belt tension. Align sheaves properly (see procedure). Replace worn belts or sheaves.
	Bearings	Replace defective bearing(s). Lubricate bearings. Tighten collars and fasteners.
	Wheel Unbalance	Clean all dirt off wheel. Check wheel balance.
Low CFM	Fan	Check wheel for correct rotation. Check blade position of BAP damper, increase fan speed.*
	Duct System	Higher pressure than design. Filters need replacement.
High CFM	Fan	Decrease fan speed.
	Duct System	Increase BAP damper blade open position. Resize ductwork. Access door, filters, dampers not installed.
Static Pressure Wrong	Duct system has more or less restriction than anticipated	Remove obstructions in system. Use correction factor to adjust for temperature/altitude. Adjust set point used to control BAP damper modulation. Resize ductwork. Clean filters/coils. Change fan speed.*
High Motor Amp Draw	Fan	Check rotation of wheel. Reduce fan speed.
	Duct System	Resize ductwork. Check proper operation of isolation and bypass dampers. Check filters and access doors.
Fan Doesn't Operate	Electrical Supply	Check fuses/circuit breakers. Check for switches turned off or disconnected. Check for correct supply voltage.
	Drive	Check for broken belts. Tighten loose pulleys.
	Motor	Assure motor is correct horsepower and not tripping overload protector.
Overheated Bearing	Lubrication	Check for excessive or insufficient grease in the bearing.
	Mechanical	Replace damaged bearing. Relieve excessive belt tension. Align bearings. Check for bent shaft.
Excessive Vibration	Belts	Adjust tightness of belts. Replacement belts should be a matched set.
	System Unbalance	Check alignment of shaft, motor and pulleys. Check wheel balance, rebalance if necessary.
	Weak Roof Structure	Consult Structural Engineer to develop a plan to reinforce building structure.

*Always check motor amps and compare to nameplate rating. Excessive fan speed may overload the motor and result in motor failure. Do not exceed the maximum cataloged rpm of the fan.

Vektor-MS Nozzle Parts and Assembly





Item	Quantity	Description
1	2	Transition Weld
2	2	Transition side cover
3	2	Wind wrap round
4	2	Wind wrap flat
5	2	Frame bottom bar
6	2	Frame top bar
7	2	Frame weld
8	2	Blade weld
9	2 or 4*	Actuator mount
10	4	Lifting lug
11	2 or 4*	Actuator cover
12	2	Blade seal, right
13	6	Blade seal, left
14	4	Flex backing
15	2	Vektor backing
16	2 or 4*	Actuator
17	1	Electrical box
18	4	Bearing
19	4	Blade seal
20	2	Flex seal

*Quantity 2 for sizes 15 thru 24
Quantity 4 for sizes 27 thru 40

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As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Specific Greenheck product warranties are located on greenheck.com within the product area tabs and in the Library under Warranties.

Greenheck Vektor MD and MH catalog provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

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Programming Sure-Aire™

Greenheck's Sure-Aire™ Differential Pressure Controller provides either a 2-10 Vdc or 4-20 mA electrical output signal. The output signal is linearly proportional to the pressure range of differential pressure controller. The ranges for Greenheck's Sure-Aire controllers are listed in the table.

Greenheck Part Number		Controller ΔP Range (inches W.C.)	P_{max} (inches W.C.)
100-240 VAC	24 VAC / VDC		
384799	384986	0-8.30	8.30
384800	384987	0-22.14	22.14
384801	384988	0-41.52	41.52
384802	384989	0-83.04	83.04
384803	384990	0-138.40	138.40

Calculating Flow from Differential Pressure

The volumetric flow through the fan (cfm) can be calculated from the equation:

$$CFM = K\sqrt{\frac{\Delta P}{\rho}}$$

where K is the K-factor for the specific fan model and size, ΔP is the measured differential pressure across the inlet cone (inches W.C.), and ρ is the air density (lb/ft^3). K-factors for Greenheck models are found on the back of this document.

Calculating Flow from Voltage Signal

If using a 2-10 Vdc output signal from a differential pressure controller, this equation can be used to calculate the flow:

$$CFM = K\sqrt{\frac{(V - 2)\ P_{max}}{8\rho}}$$

where V is the output voltage of a 2-10 Vdc transmitter and P_{max} is the maximum pressure range of the controller being used (inches W.C.).

Calculating Flow from Current Signal

If using a 4-20 mA output signal from a differential pressure controller, this equation can be used to calculate the flow:

$$CFM = K\sqrt{\frac{(mA - 4)\ P_{max}}{16\rho}}$$

where mA is the output current of a 4-20 mA transmitter and P_{max} is the maximum pressure range of the controller being used (inches W.C.).

Density Corrections

Air density, ρ, is affected by elevation and temperature. The Greenheck Sure-Aire Differential Pressure Controllers allow the user to input the elevation for the application. This elevation input automatically updates the density used for the flow calculation.

The Remote Temperature Sensor will adjust the air density value in the controller based on the sensor measurement when Temperature Compensation is set to 'Yes'. This density compensation will affect the flow rate displayed on the controller. If Temperature Compensation is set to 'No', the air density value will be a function of standard air (70°F/21°C).

The density being used by the Sure-Aire controller can be viewed on the main menu by scrolling up or down through the settings.

K-Factors

Size	AFSW / BISW VK-H / VK-HS VK-CD / VK-CH / VK-CS CSW USF-400	AFDW / BIDW	QEI / QEID	QEM / QEP HPA APH / APM	VK-MD VK-MH VK-MS
7	259	not applicable	not applicable	not applicable	not applicable
8	252	not applicable	not applicable	not applicable	not applicable
9	248	not applicable	408	not applicable	not applicable
10	202	not applicable	not applicable	not applicable	not applicable
12	296	592	408	355	not applicable
13	351	701	not applicable	not applicable	not applicable
15	431	861	603	355	526
16	531	1062	724	421	634
18	542	1083	897	517	787
20	650	1301	1088	617	955
22	805	1610	1321	759	1161
24	982	1964	1631	913	1436
27	1184	2369	1962	1105	1729
30	1464	2928	2400	1355	2116
33	1770	3540	2923	1625	2581
36	2168	4336	3576	1967	3154
40	2630	5259	4331	2361	3825
44	3220	6440	5318	2854	4698
49	3904	7808	6525	3411	5766
54	4785	9571	7891	4121	6975
60	5854	11707	9648	4972	not applicable
66	7083	14166	not applicable	5960	not applicable
73	8665	17330	not applicable	7276	not applicable

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Greenheck's Sure-Aire™ Flow Monitoring Systems catalogs provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

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Document 475588
VKCURB Curb
for Vektor®-M Series

Assembly Instructions

READ THROUGH THESE INSTRUCTIONS PRIOR TO STARTING ASSEMBLY.

Roof curbs are modular in construction and require field assembly.

Roof Curb Assembly Kit

Each roof curb will arrive in sections along with an assembly kit for field installation. Verify all roof curb sections and assembly kit(s) have arrived for each fan mark and are in good condition prior to signing the shipping receipt.

ROOF CURB ASSEMBLY KIT	
Fan Size	Kit Number
15, 18, 20, 22	866271
24, 27, 30, 33	866272
36, 40, 44, 49, 54	866273

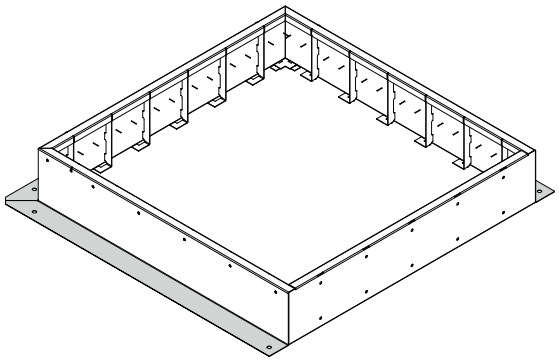
ASSEMBLY KIT CONTENTS	
Part Name	Part Description
Hex Head Cap Screw	316 SS, 3/8 x 1-1/4 inch
Hex Nut	316 SS, 3/8 inch
Flat Washer	316 SS, 3/8 inch
Lock Washer	316 SS, 3/8 inch
Gasketing	1/4 x 3/8 inch EPDM Tape with sticky back
Caulk*	Clear Seam Sealer

*One tube of caulk is supplied per **system**.

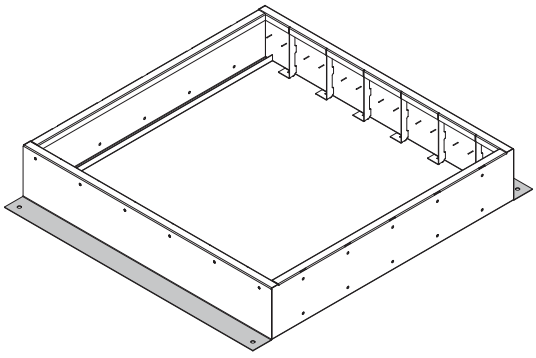
ROOF CURB SECTIONS			
Fan Quantity	End Section(s)	Center Section(s)	Quantity of Roof Curb Assembly Kit(s)
2	2	0	1
3	2	1	2
4	2	2	3
5	2	3	4
6	2	4	5

TOOLS REQUIRED

- Utility knife
- Caulk gun
- Box end wrench with 9/16 inch socket for 3/8 inch bolt with 9/16 inch head



End Section
Flashing on three sides



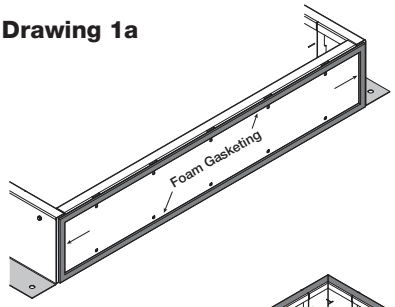
Center Section
Flashing on two sides

Assembly

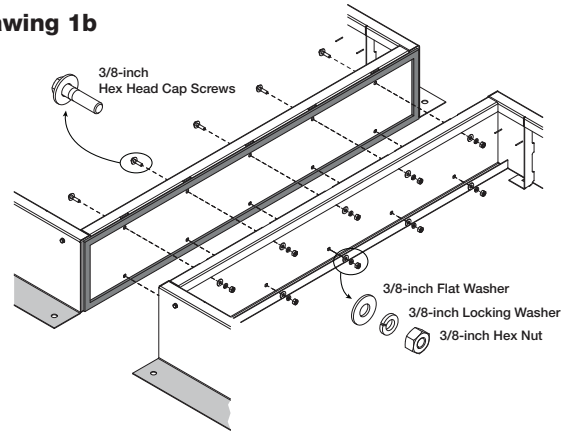
Use one Roof Curb Assembly Kit with gasketing and hardware for each section to be joined. Attach self-adhering foam gasketing (supplied) to one side of either joining section (see Drawing 1a). Gasketing should be placed to form a continuous seal. Corner locations may need second strip to cover seam joints. Supplied hardware should then be used to secure the two sections together as shown (see Drawing 1b). Hold nut with wrench while bolt is tightened.

Drawing 1c shows two end panels and single center section. All sections and configurations are assembled in a similar manor.

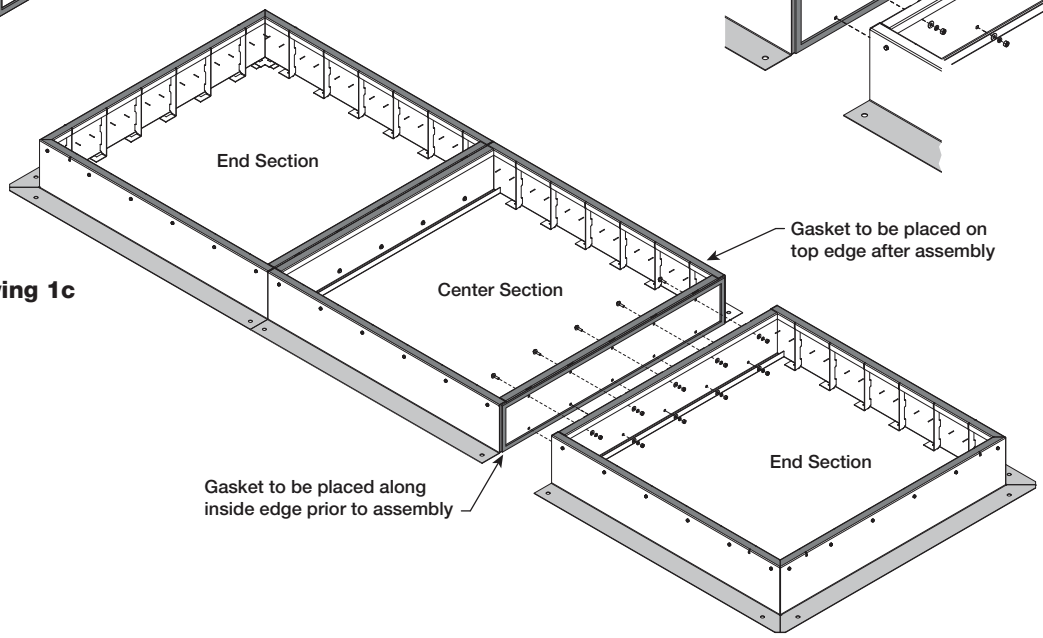
Drawing 1a



Drawing 1b

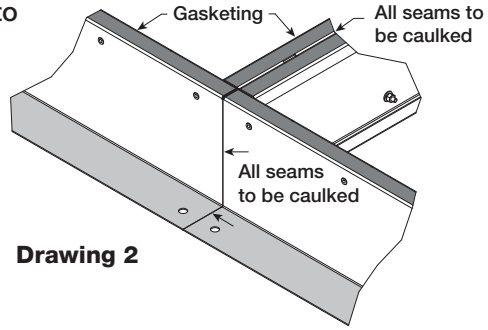


Drawing 1c



Sealing

After all sections have been assembled, caulk (supplied) all seam joints to provide final sealing of roof curb sections. Drawing 2 shows seams to be caulked. Follow caulk manufacturers recommendations for proper application.



Drawing 2

Lifting

Roof curb can be assembled at installation location on the roof deck or at ground level and lifted into position. To lift from ground to roof deck, use spreader bar and support both end and center sections when lifting assembled curb.

Mounting

Attach curb to roof deck or support structure as specified by structural engineer.

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Instruction Manual

Alfa Laval Brazed Plate Heat Exchangers

www.alfalaval.com

Part number 3450021401
2016-04

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Figure 1



Figure 2

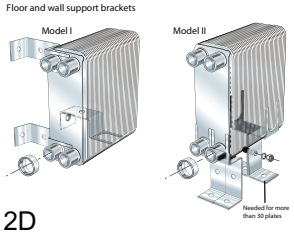
2A



2B



2C



2D

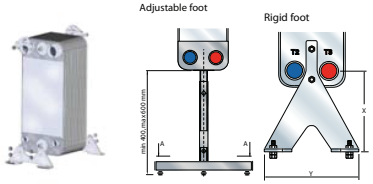
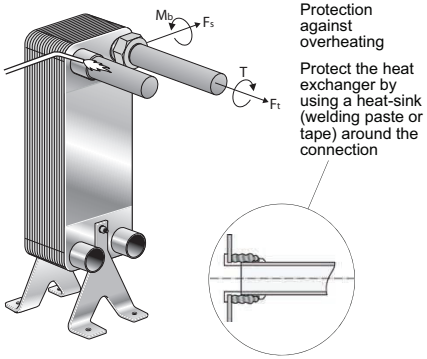
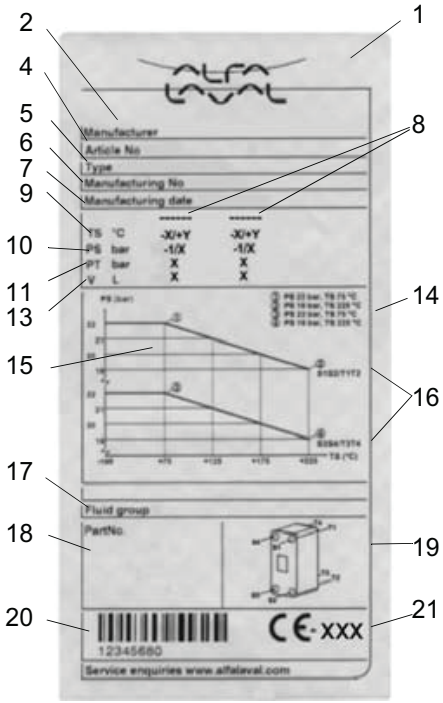


Figure 3



Limits for Connection loads during installation				
Outside diameter mm (inches)	**Tension force F_t (kN)**	**Shear force F_s (kN)**	**Bending moments M_b (Nm**	**Torque T (Nm)**
15 - 25 (0.6 - 1,0'')	2,4	0,7	14	50
26 - 35 (1,0 - 1,4'')	5,4	1,6	20	120
36 - 45 (1,4 - 1,8'')	8,0	2,6	110	240
46 - 55 (1,8 - 2,2'')	9,5	4,8	140	440
56 - 70 (2.2 - 2,8'')	12,0	6,3	300	600
71 - 99 (2,8 - 3.9'')	13,0	6,5	310	1200
100 - (3.9'' -)	60,0	17,0	800	3000

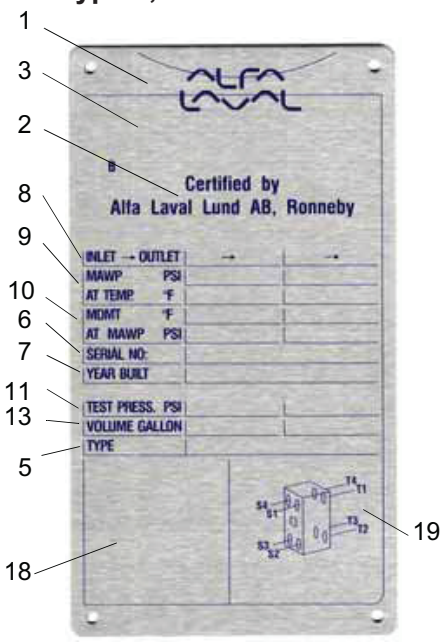
Name plate type 1, PED standard



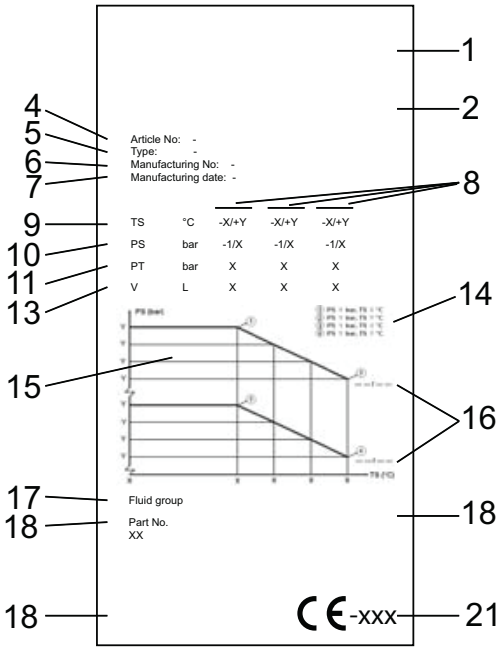
Name plate type 2, PED stainless steel, optional



Name plate type 3, ASME



Name plate type 4, PED Customer designed, optional



Intended use

The brazed heat exchangers (BHE) have been designed to perform heat transfer to meet the requirements of a wide range of applications such as refrigeration, comfort heating, industrial heating and cooling and the process industry.

Definitions

Warning: *Type of hazard*

⚠ *WARNING indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.*

Caution: *Type of hazard*

⚠ *CAUTION indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury.*

Note:

NOTE indicates a potentially hazardous situation that, if not avoided, may result in property damage.

Nameplates

There are different types of nameplates depending on the type of pressure vessel approval.

Note:

- *Other types of nameplates may be used. For detailed information contact an Alfa Laval representative.*
- *Some specifications are not used for all types of nameplates*

Nameplate shows:

1. Space for logotype.
2. Manufacturer's name.
3. Space for National Board stamp and serial number.
4. Article number.
5. Type.
6. Manufacturing or serial number.
7. Year or date of manufacture.
8. Locations of connections for each fluid.
9. Max. permissible operating temperatures.
10. Max. permissible operating pressures.
11. Test pressure.
12. Date of test pressure.
13. Volume of each space.
14. Permissible operating temperatures and pressures.
15. Operating area.
16. Description of each space.
17. Fluid group.
18. Information unique to the customer.
19. Possible locations of connections.
20. Bar code information.
21. Space for mark of approval. (CE marks below are not valid for nameplate type 3)
    – CE-0409 BHE Manufacturing, Ronneby, Sweden
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Jiangyin City, PRC
    – CE-0948 Alfa Laval S.p.A. Alonte, Italy.

Original instruction

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Requirements

Warning: *The heat exchanger must be installed and operated in such a manner that no risk of injury to personnel and damage to property will be incurred.*

Note: *Unless otherwise specified, product data for normal refrigerants, i.e. HFC and HCFC, are applicable to refrigeration applications. Before the heat exchanger is used for flammable, toxic or dangerous liquids (e.g. hydrocarbons) the relevant safety rules for handling such liquids must be used. For further information, please refer to the Internet site of the supplier.*

Installation

The installation must be provided with equipment that protects the heat exchanger against pressures and temperatures outside the approved minimum and maximum values shown on the nameplate.

Caution: *To avoid hand injuries from sharp edges, protective gloves should always be worn when handling the brazed heat exchangers.*

For best possible heat transfer performance, the heat exchanger should be connected so that the media flow through the heat exchanger in opposite directions (in counter-flow).

Note: *Before connecting any piping, make sure all foreign objects have been flushed out of the system.*

Caution: *Take into account the risk of fire during the installation work, i.e. bear in mind the distance to flammable substances.*

Caution: *Never lift by the connections. Straps should be used when lifting. Place the straps according to figure 1.*

Note: *In evaporator applications and in applications in which a phase change of the media occurs, the heat exchanger must be installed vertically with a straight pipe (at least 150-200 mm in length) between the expansion valve and refrigerant inlet.*

Mounting

In a rigid pipe system, small heat exchangers (weighting 1–6 kg) can be suspended directly in the pipework (Figure 2A). Larger heat exchangers should be secured with support mountings (Figure 2D) intended for a specific heat exchanger (accessory), or be secured with straps (Figure 2C) or by means of mounting bolts (Figure 2B). For special orders, mounting bolts can be welded to the front or rear. The tightening torque for M6 bolts is 3.8 Nm, M8 bolts is 9.5 Nm, and for M10 bolts 19.0 Nm.

Note: *If there is risk of vibrations, use anti-vibration mountings as shown in Figure 2A.*

Note: *Heat exchangers with refrigerant distributors should be mounted with the distributor at the bottom.*

Note: *During installation the connection loads must not exceed values according to the table “Limits for Connection loads during installation” on the inside of the cover page.*

Note: *The pipework should be well-anchored and done in a way that no loads are transferred to the plate heat exchanger during operation.*

Connections (Figure 3)

Threaded connections – Use a torque wrench when connecting the pipe and observe the specified limits. Some models are supplied with connections type Victaulic.

Brazed connections – Clean by rubbing down and degreasing the various surfaces. Use a brazing metal grade that is suitable for the materials being brazed, and use the correct brazing temperature. For detailed information refer to the document “Brazing tubes for brazed heat exchanger” or contact an Alfa Laval representative.

Welded connections – TIG or MIG welding. Grind inside and outside of the pipe and, if bevelled, also the bevelled edge at least 25 mm from the pipe edge and inward. This should be done to avoid contamination of copper in the welded area, which might cause the weld to crack.

Note: *Protect the heat exchanger against overheating by wrapping a piece of wet cloth around the connection whenever any brazing or welding is being done. Excessive heating could melt the internal brazing metal inside the heat exchanger. Refer to figure 3.*

⚠ ***Caution:*** *When disconnecting the heat exchanger from the piping system use proper protective equipment, such as safety boots, safety gloves and eye protection, depending on the type of media in the heat exchanger.*

Risk of freezing

⚠ ***Caution:*** *Bear in mind the risk of freezing at low temperatures to avoid damage to the Heat exchanger. Heat exchangers that are not in operation should be emptied and blown dry whenever there is a risk of freezing.*

Note: *To avoid damage due to freezing, the medium used must include an anti-freeze agent at operating conditions below its freezing point.*

Note: *When used as an evaporator*

- *Use a flow switch and a low-pressure switch.*
- *Use an anti-freeze thermostat and flow monitor to ensure a constant water flow before, during and after the compressor has been running.*
- *Avoid "pump-down", i.e. emptying the evaporator by running the compressor after shutdown until a preset refrigerant pressure is reached. The temperature could then drop below the brine freezing point, which could damage the evaporator.*

Protection against clogging

Use a filter as protection against the possible occurrence of foreign particles. If you have any doubt concerning the maximum particle size, consult your nearest representative of the supplier or look under Product information on the supplier’s Internet site.

Control and operation

⚠ ***Caution:*** *Do not use the heat exchanger for media (e.g. de-ionized water)/installations (e.g. galvanized pipes) that (chemically/electrochemically) could affect or be affected by the plates (Stainless steel) and the brazing material (Copper).*

Note: *Copper may generate corrosion in installation with mixed materials*

Protection against thermal or/and pressure fatigue
Sudden temperature and pressure changes could cause fatigue damage to the heat exchanger. Therefore, the following must be taken into consideration to ensure that the heat exchangers operate without swinging pressures/temperatures.

- Locate the temperature sensor as close as possible to the outlet from the heat exchanger.
- Choose valves and regulation equipment which give stable temperatures/pressures for the heat exchanger.
- To avoid water hammer, quick-closing valves must not be used, e.g. on/off valves.
- In automated installations, the stopping and starting of pumps and actuation of valves should be programmed so that the resulting amplitude and frequency of the pressure variation will be as low as possible.

Insulation
Heating and cooling insulations are available as accessories.

Note: *Be aware that temperature limits of insulation and the heat exchanger can be different.*

Troubleshooting
To ensure the correct performance of the heat exchanger, check that:

- the piping system has been connected to the heat exchanger according to the instructions in this manual
- the heat exchanger is perfectly clean and free from deposits.

Note: *Particles and fibers could clog the heat exchanger. An increase in pressure drop or a drop in thermal efficiency indicates that the heat exchanger is fouled.*

- the control circuit is correctly preset and no freezing occurs.

Cleaning
The equipment is suitable for cleaning in place. For advice on suitable cleaning processes, consult the representative of the supplier or visit the Internet site of the supplier. The person responsible for operation should ensure that the correct cleaning method is used and should decide on suitable cleaning intervals.

Note: *The plate package is not meant to be opened.*

Einsatzbereich

Die gelöteten Wärmeübertrager (BHE) wurden dazu konzipiert, die Wärmeübertragung in Hinblick auf unterschiedliche Anwendungen zu gewährleisten, beispielsweise in den Bereichen Kühlung, Heizanwendungen, industrielle Heiz- und Kühltechnik und Prozessindustrie.

Definitionen

Vorsicht: *Gefahrenart*

⚠ *VORSICHT weist auf eine möglicherweise gefährliche Situation hin. Wird sie nicht vermieden, können tödliche oder schwere Verletzungen die Folge sein.*

Achtung: *Gefahrenart*

⚠ *ACHTUNG weist auf eine möglicherweise gefährliche Situation hin. Wird sie nicht vermieden, können leichte oder mittelschwere Verletzungen die Folge sein.*

Hinweis:

HINWEIS weist auf eine möglicherweise gefährliche Situation hin. Wird sie nicht vermieden, können Sachschäden die Folge sein.

Namensschilder

Es gibt verschiedene Typen von Namensschildern, die von der Art der Genehmigung für Druckbehälter abhängig sind.

Hinweis:

- *Andere Arten von Namensschildern können verwendet werden. Für detaillierte Informationen wenden Sie sich bitte an einen Alfa Laval Vertreter.*
- *Einige Spezifikationen werden nicht für alle Arten von Namensschildern verwendet*

Namensschild zeigt:

1. Raum für Firmenschriftzug.
2. Herstellername.
3. Raum für Stempel der nationalen Behörde und Seriennummer.
4. Artikelnummer.
5. Typ.
6. Herstellungs- oder Seriennummer.
7. Herstellungsjahr- oder datum.
8. Positionen der Anschlüsse für jede Flüssigkeit.
9. Max. zulässige Betriebstemperaturen.
10. Max. zulässige Betriebsdrücke.
11. Testdruck.
12. Datum des Testdrucks.
13. Volumina der Bereiche.
14. Zulässige Betriebstemperaturen und -drücke.
15. Betriebsbereich.
16. Beschreibung der Bereiche.
17. Fluidgruppe.
18. Eindeutige Kundeninformationen.
19. Mögliche Anschlusspositionen.
20. Strichcodeinformationen.
21. Raum für Zulassungsmarke.
    (CE-Kennzeichnungen unten gelten nicht für Namensschild Typ 3)
    – CE-0409 BHE Manufacturing, Ronneby, Sweden
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Jiangyin City, PRC
    – CE-0948 Alfa Laval S.p.A. Alonte, Italy.

Originalanleitung

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Anforderungen

Vorsicht: *Der Wärmeübertrager ist so zu installieren und zu betreiben, dass kein Risiko für Verletzungen oder Sachschäden entsteht.*

Hinweis: *Wenn nicht anders angegeben, gelten Produktdaten für normale Kältemittel, d.h. H-FKW und H-FCKW, für Kälteanwendungen. Bevor der Wärmeübertrager für brennbare, toxische oder gefährliche Flüssigkeiten (z.B. Kohlenwasserstoffe) verwendet wird, müssen die relevanten Sicherheitsvorschriften in Bezug auf den Umgang mit solchen Flüssigkeiten beachtet werden. Weitere Informationen erhalten Sie auf der Internetseite des Lieferanten.*

Einbau

Beim Einbau muss die Ausrüstung angebracht werden, die den Wärmeübertrager vor Drücken und Temperaturen außerhalb der zulässigen Mindest- und Höchstwerte, die auf dem Namensschild angegeben sind, schützt.

Achtung: *Zur Vermeidung von Verletzungen an der Hand durch scharfe Kanten sollten bei der Handhabung der gelöteten Wärmeübertrager stets Schutzhandschuhe getragen werden.*

Zur bestmöglichen Wärmeübertragung muss der Wärmeübertrager so angeschlossen sein, dass die Medien gegeneinander (in entgegengesetzte Richtungen) fließen können.

Hinweis: *Vor dem Anschluss von Leitungen kontrollieren, dass die Anlage durchgespült wurde, um Fremdkörper zu beseitigen.*

Achtung: *Während der Installationsarbeiten ist die Brandgefahr zu berücksichtigen, d.h. zu brennbaren Stoffen ist ein ausreichender Abstand einzuhalten.*

Achtung: *Niemals an den Anschlüssen anheben. Beim Heben sollten Hebeseile verwendet werden. Seile gemäß Abbildung 1 anbringen.*

Hinweis: *Bei Verdampferanwendungen und Anwendungen, bei denen eine Phasenänderung der Medien stattfindet, muss der Wärmeübertrager vertikal mit einem geraden Rohr installiert werden (Mindestlänge von 150-200 mm), das zwischen dem Expansionsventil und dem Kältemittelzulauf verläuft.*

Montage

In einem starren Rohrsystem können kleine Wärmeübertrager (Gewicht von 1–6 kg) direkt an den Rohrleitungen aufgehängt werden (Abbildung 2A). Größere Wärmeübertrager sollten mit Stützhalterungen (Abbildung 2D) abgesichert werden, die für einen spezifischen Wärmeübertrager vorgesehen sind (Zubehör), oder mit Gurten (Abbildung 2C) oder mit Hilfe von Montagebolzen (Abbildung 2B) abgesichert werden. Auf Wunsch können Montageschrauben an die Vorder- oder Rückseite geschweißt werden. Das Anzugsmoment für M6-Schrauben beträgt 3,8 Nm, für M8-Schrauben 9,5 Nm und für M10-Schrauben 19,0 Nm.

Hinweis: *Falls das Risiko von Vibrationen besteht, verwenden Sie Anti-Vibrationsbefestigungen wie in Abbildung 2A gezeigt.*

Hinweis: *Wärmeübertrager mit Kältemittelverteilern sollten mit dem Verteiler an der Unterseite montiert werden.*

Hinweis: *Während der Installation dürfen die Anschlusslasten die Werte laut der Tabelle “Grenzwerte für Anschlusslasten während der Installation” auf der Innenseite des Deckblattes nicht überschreiten.*

Hinweis: *Die Rohrleitungen sollten gut verankert und so ausgeführt sein, dass keine Lasten zum Plattenwärmeübertrager hin auftreten, während er in Betrieb ist.*

Verbindungen (Abbildung3)
Gewindeverbindungen – Verwenden Sie einen Drehmomentschlüssel, wenn Sie die Rohre anschließen und beachten Sie die vorgegebenen Grenzwerte. Einige Modelle verfügen über Verbindungen vom Typ Victaulic.
Gelötete Verbindungen – Reinigung durch Abreiben und Entfetten der verschiedenen Oberflächen. Verwenden Sie eine Lötmetallsorte, die für die zu lötenden Werkstoffe geeignet ist, und halten Sie die korrekte Löttemperatur ein. Detaillierte Informationen finden Sie in dem Dokument "Lötrohre für gelötete Wärmeübertrager" oder Sie kontaktieren einen Alfa Laval Vertreter.
Geschweißte Verbindungen – TIG- oder MIG-Schweißen. Innen- und Außenflächen des Rohrs müssen abgeschliffen werden. Falls der Rand abgeschrägt ist, muss auch er mindestens 25 mm vom Rohrrand und innen abgeschliffen werden. Dies erfolgt, um Kupferkontaminationen im geschweißten Bereich zu verhindern, die zum Platzen der Schweißnaht führen könnten.

Hinweis: *Der Wärmeübertrager muss bei allen Löt- oder Schweißarbeiten durch ein nasses Tuch, das um die Verbindung gewickelt wird, vor Überhitzung geschützt werden. Übermäßige Erwärmung kann das innere Lötmetall im Wärmeübertrager schmelzen lassen. Siehe Abbildung 3.*

⚠ ***Achtung:*** *Beim Trennen des Wärmeübertragers vom Rohrsystem muss die für die Art des Mediums im Wärmeübertrager geeignete Schutzausrüstung verwendet werden, beispielsweise Sicherheitsstiefel und -handschuhe sowie ein Augenschutz.*

Risiko des Gefrierens

⚠ ***Achtung:*** *Berücksichtigen Sie das Risiko des Gefrierens bei niedrigen Temperaturen, um Schäden am Wärmeübertrager zu vermeiden. Wärmeübertrager, die nicht in Betrieb sind, sollten immer entleert und trockengeblasen werden, wenn das Risiko des Gefrierens besteht.*

Hinweis: *Um Schäden aufgrund von Gefrieren zu vermeiden, muss das verwendete Medium mit einem Frostschutzmittel versehen werden, das für Betriebsbedingungen unterhalb des Gefrierpunkts geeignet ist.*

Hinweis: *Einsatz als Verdampfer*
- *Verwenden Sie einen Strömungswächter und einen Niederdruckschalter.*
- *Verwenden Sie ein Frostschutzthermostat und einen Strömungsmonitor, um einen konstanten Wasserstrom vor, während und nach dem Betrieb des Kompressors zu gewährleisten.*
- *Vermeiden Sie ein "Leerpumpen", d.h. das Leeren des Verdampfers durch Einsatz des Kompressors nach dem Abschalten, bis ein voreingestellter Kältemitteldruck erreicht ist. Die Temperatur kann dann unterhalb des Gefrierpunkts der Sole fallen, wodurch der Verdampfer beschädigt wird.*

Schutz vor Verstopfung
Zum Schutz vor möglicherweise auftretenden Fremdpartikeln sollte ein Filter verwendet werden. Wenn Sie Zweifel bezüglich der maximalen Partikelgröße haben, wenden Sie sich an den Vertreter Ihres Lieferanten oder informieren Sie sich in den Produktinformationen auf der Internetseite des Lieferanten.

Regelung und Betrieb

> ***Achtung:*** *Der Wärmeübertrager darf nicht mit Medien (z.B. entionisiertes Wasser)/Installationen (z.B. galvanisierte Rohre) verwendet werden, die sich (chemisch/elektrochemisch) auf die Platten (Edelstahl) und das Lötmaterial (Kupfer) auswirken können oder durch diese beeinträchtigt werden können.*

> ***Hinweis:*** *Kupfer kann in Installationen mit gemischten Werkstoffen zu Korrosion führen*

Schutz vor thermischer Belastung oder/und Druckermüdung

Plötzliche Temperatur- und Druckänderungen können am Wärmeübertrager Beschädigungen durch Ermüdung verursachen. Daher muss Folgendes in Betracht gezogen werden, um sicherzustellen, dass die Wärmeübertrager ohne wechselnde Drücke/ Temperaturen betrieben werden.

- Positionieren Sie den Temperatursensor so nah wie möglich am Auslauf vom Wärmeübertrager.
- Wählen Sie Ventile und Regulierungselemente, die für stabile Temperaturen/Drücke für den Wärmeübertrager sorgen.
- Um Wasserschläge zu vermeiden, keine Schnellschluss-Ventile, z.B. Ein-/Aus-Ventile, verwenden.
- In automatisierten Anlagen sollte das Stoppen und Starten von Pumpen und das Betätigen von Ventilen so programmiert sein, dass die daraus resultierende Amplitude und Frequenz der Druckunterschiede so gering wie möglich sind.

Isolierung

Wärmeisolierung und Kälteisolierung sind als Zubehör erhältlich.

> ***Hinweis:*** *Beachten Sie, dass die Temperaturgrenzen der Isolierung und des Wärmeübertragers unterschiedlich sein können.*

Fehlersuche

Um die korrekte Leistung des Wärmeübertragers sicherzustellen, überprüfen Sie Folgendes:

- Das Rohrsystem wurde gemäß den Anweisungen in diesem Handbuch an den Wärmeübertrager angeschlossen
- Der Wärmeübertrager ist völlig sauber und frei von Ablagerungen.

> ***Hinweis:*** *Partikel und Fasern können den Wärmeübertrager verstopfen. Ein stärkerer Druckabfall oder ein Abfall der thermischen Effizienz weist darauf hin, dass der Wärmeübertrager verschmutzt ist.*

- Der Steuerkreis ist korrekt voreingestellt und es ist nichts gefroren.

Reinigung

Die Ausrüstung ist für das Reinigen vor Ort (CIP-Reinigung) geeignet. Informationen über geeignete Reinigungsverfahren erhalten Sie vom Vertreter des Lieferanten oder auf der Internetseite des Lieferanten. Die für den Betrieb verantwortliche Person muss sicherstellen, dass die korrekte Reinigungsmethode verwendet wird, und sie muss über angemessene Reinigungsintervalle entscheiden.

> ***Hinweis:*** *Das Plattenpaket darf nicht geöffnet werden.*

Usage prévu
Les échangeurs thermiques brasés (BHE) ont été conçus pour assurer un échange thermique correspondant aux besoins d'une large gamme d'applications comme la réfrigération, le chauffage domestique, le chauffage et le refroidissement industriel et l'industrie de transformation.

Définitions

Mise en garde:*Type de risque*
MISE EN GARDE indique une situation potentiellement dangereuse qui peut entraîner la mort ou une blessure grave.

Attention:*Type de risque*
ATTENTION indique une situation potentiellement dangereuse qui peut entraîner la une blessure mineure ou de gravité moyenne.

Remarque :
REMARQUE indique une situation potentiellement dangereuse qui peut entraîner des dommages matériels.

Plaques signalétiques
Il existe différents types de plaques signalétiques, selon le type d'agrément du récipient sous pression.

Remarque :
- *Il est possible d'utiliser d'autres types de plaques signalétiques. Pour en savoir plus, contactez un représentant Alfa Laval.*
- *Certaines spécifications ne servent pas à tous les types de plaques signalétiques.*

La plaque signalétique présente :
1. un espace pour le logotype
2. le nom du constructeur
3. l'espace pour le tampon du bureau national et le numéro de série
4. la référence
5. le type
6. le numéro de fabrication ou de série
7. l'année ou la date de fabrication
8. les emplacements des raccords pour chaque liquide
9. les températures de fonctionnement maximum autorisées
10. les pressions de fonctionnement maximum autorisées
11. la pression d'essai
12. la date de la pression d'essai
13. le volume de chaque espace
14. les températures et pressions de fonctionnement autorisées
15. la zone de fonctionnement
16. la description de chaque espace
17. le groupe de liquide
18. les informations spécifiques à chaque client
19. les emplacements possibles des raccords
20. le code barre
21. l'espace pour le tampon d'agrément (les marquages CE ci-dessous ne conviennent pas aux plaques signalétiques de type 3)
    – CE-0409 BHE Manufacturing, Ronneby, Sweden
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Jiangyin City, PRC
    – CE-0948 Alfa Laval S.p.A. Alonte, Italy.

Instructions originales
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Conditions requises

> ⚠ ***Mise en garde:*** *L'échangeur thermique doit être installé et utilisé de manière à ne présenter aucun risque pour le personnel ni dommage matériel.*

> ***Remarque:*** *Sauf mention contraire, les informations relatives aux réfrigérants normaux (HFC et HCFC) s'appliquent aux utilisations de réfrigération. Avant d'utiliser l'échangeur thermique pour des liquides inflammables, toxiques ou dangereux, (comme des hydrocarbures), il convient de respecter les règles de sécurité en vigueur pour la manipulation de tels liquides. Pour de plus amples informations, veuillez consulter le site Internet du fournisseur.*

Installation

L'installation doit être effectuée à l'aide d'un équipement susceptible de protéger l'échangeur thermique contre les pressions et les températures hors des valeurs maximales et minimales indiquées sur la plaque signalétique.

> ⚠ ***Attention:*** *Pour éviter de se blesser les mains sur des rebords tranchants, il convient de porter des gants lors de la manipulation des échangeurs thermiques brasés.*

Pour les meilleures performances possibles en matière d'échange thermique, l'échangeur doit être connecté de manière à ce que les liquides y coulent dans des sens opposés (à contre-courant).

> ***Remarque :****Avant tout raccordement de tuyauterie, vérifiez que le système a été rincé pour éliminer tout objet étranger.*

> ⚠ ***Attention:*** *Prenez en compte le risque d'incendie pendant le travail d'installation : n'oubliez pas la distance entre les substances inflammables*

> ⚠ ***Attention:*** *Ne soulevez jamais par les raccords. Utilisez des sangles de levage. Placez les sangles conformément à la figure 1.*

> ***Remarque:*** *Dans les applications d'évaporateur et dans les applications où se passe un changement de phase du produit, l'échangeur thermique doit être installé verticalement, avec un tuyau droit (d'au moins 150 à 200 mm de long) entre la vanne de détente et l'entrée du réfrigérant.*

Montage

Dans un système à tuyau rigide, il est possible de monter les petits échangeurs thermiques (de 1 à 6 kg) directement dans la tuyauterie (Figure 2A). Les échangeurs thermiques plus gros doivent être attachés avec des supports (Figure 2D) conçus spécifiquement pour chaque échangeur thermique (accessoire), ou avec des sangles (Figure 2C) ou à l'aide de boulons de montage (Figure 2B). Pour les commandes spéciales, les boulons de montage peuvent être soudés à l'avant ou à l'arrière. Le couple de serrage des boulons M6 est de 3,8 Nm, de 9,5 Nm pour les boulons M8 et de 19,0 Nm pour les boulons M10.

> ***Remarque :*** *S'il y a un risque de vibrations, servez-vous de supports anti-vibrations, comme indiqué à la figure 2A.*

> ***Remarque :*** *Les échangeurs thermiques comportant des distributeurs de réfrigérant doivent être montés avec le distributeur vers le bas.*

> ***Remarque :*** *pendant l'installation, les charges de connexion ne doivent pas dépasser les valeurs indiquées dans le tableau « Limites des charges de connexion pendant l'installation » à l'intérieur de la page de couverture.*

> ***Remarque :*** *la tuyauterie doit être solidement ancrée et exécutée de façon à ce qu'aucune charge ne puisse être transférée vers l'échangeur de chaleur à plaques pendant le fonctionnement.*

Raccords (Figure 3)
Raccords filetés - Quand vous effectuez le raccord du tuyau, servez-vous d'une clé dynamométrique et respectez les limites indiquées. Certains modèles disposent de raccords type Victaulic.
Raccords brasés - Nettoyez les surfaces en les frottant et en les dégraissant. Utilisez un matériau de brasage métal adapté aux matériaux brasés et respectez la bonne température de brasage. Pour en savoir plus, veuillez consulter le document "Brasage des tuyaux pour les échangeurs thermiques brasés" ou contactez un représentant Alfa Laval.
Raccords soudés - soudage TIG ou MIG. Polissez l'intérieur et l'extérieur du tuyau, et si ce dernier est conique, polissez également le bord conique sur 25mm en partant du bord du tuyau vers l'intérieur. Cette opération permet d'éviter une contamination par le cuivre dans la zone de soudure, évitant ainsi à la soudure de se fissurer.

Remarque: *Protégez l'échangeur thermique contre la surchauffe en enveloppant le raccord d'un bout de tissu humide, quand vous effectuez un brasage ou une soudure. Toute chaleur excessive pourrait faire fondre le métal de brasage interne à l'intérieur de l'échangeur thermique. Veuillez vous reporter à la figure 3.*

⚠ ***Attention:*** *Quand vous déconnectez l'échangeur thermique du système de tuyauterie, portez un équipement de protection adéquat, comme des bottes de sécurité, des gants de sécurité, des protections pour les yeux, selon le type de produit dans l'échangeur thermique.*

Risque de gel

⚠ ***Attention:*** *N'oubliez pas les risques de gel à basses températures, pour éviter tout dommage à l'échangeur thermique. Les échangeurs thermiques qui ne sont pas en fonction doivent être vidés et séchés à l'air pulsé en cas de risque de gel.*

Remarque: *Pour éviter tout dommage dû au gel, le produit utilisé doit comporter un agent antigel adapté aux conditions de fonctionnement sous son point de congélation.*

Remarque: *Quand vous l'utilisez comme évaporateur*
- *Utilisez un contacteur à débit et un interrupteur basse-pression.*
- *Utilisez un thermostat antigel et un détecteur de débit pour assurer un débit d'eau constant avant, pendant et après le fonctionnement du compresseur.*
- *Évitez d'effectuer une aspiration, c'est à dire vider l'évaporateur en lançant le compresseur après extinction, jusqu'à atteindre la pression prescrite pour le réfrigérant. La température pourrait chuter sous le point de congélation, ce qui pourrait endommager l'évaporateur.*

Protection contre les obstructions
Utilisez un filtre pour protéger l'appareil contre d'éventuels particules étrangères. Si vous avez un doute concernant la taille maximale des particules, consultez votre représentant du fournisseur le plus proche ou regardez sous les informations produit sur le site Internet du fournisseur.

Contrôle et utilisation

> ***Attention:*** *N'utilisez pas l'échangeur thermique pour des produits (comme de l'eau désionisée) ou des installations (comme des tuyaux galvanisés) qui (chimiquement ou électrochimiquement) pourraient affecter ou être affectés par les plaques (en acier inoxydable) et le matériau de brasage (en cuivre).*

> ***Remarque:*** *Le cuivre peut entraîner une corrosion des installations faites de matériaux composites.*

Protection contre la fatigue thermique et / ou de pression

Des modifications soudaines de température et de pression pourraient entraîner une fatigue de l'échangeur thermique. En conséquence, il convient de prendre en compte les éléments suivants pour s'assurer que l'échangeur thermique fonctionne sans que la température ou la pression change soudainement.

- Placez le capteur de température au plus proche de la sortie de l'échangeur thermique.
- Choisissez des vannes et un équipement de régulation qui assurent à l'échangeur thermique les températures et les pressions les plus stables possibles.
- Pour éviter les coups de bélier, vous ne devez pas utiliser de vannes à fermeture rapide, comme les vannes on/off.
- Dans les installations automatisées, l'arrêt et le démarrage des pompes et l'actionnement des vannes doivent être programmés de manière à ce que l'amplitude et la fréquence résultantes des variations de pression soient les plus faibles possibles.

Isolation

Des isolations thermiques de chauffage et de refroidissement sont disponibles en tant qu'accessoires.

> ***Remarque:*** *N'oubliez pas que les limites de température de l'isolant et de l'échangeur thermique peuvent être différentes.*

Dépannage

Pour s'assurer d'une bonne performance de l'échangeur thermique, vérifiez :

- que le système de tuyauterie a été connecté à l'échangeur thermique selon les instructions du présent manuel
- que l'échangeur thermique est parfaitement propre et sans dépôts.

> ***Remarque:*** *Des particules et des fibres peuvent obstruer l'échangeur thermique. Une augmentation de la chute de pression ou une chute de l'efficacité thermique indiquent que l'échangeur thermique est encrassé.*

- le circuit de contrôle correctement réglé et qu'il n'y a pas de gel.

Nettoyage

L'équipement est prévu pour être nettoyé sur place. Pour en savoir plus sur les processus de nettoyage qui conviennent, consultez le représentant du fournisseur ou visitez le site Internet du fournisseur. La personne responsable de cette opération doit s'assurer que l'appareil sera nettoyé selon la méthode qui convient et doit décider des intervalles de nettoyage à respecter.

> ***Remarque:*** *Le jeu de plaque n'est pas prévu pour être ouvert.*

Uso que corresponde
Los intercambiadores de calor soldados (BHE) se han diseñado para que la transferencia de calor cumpla los requisitos de una gran variedad de aplicaciones como la refrigeración, la calefacción, el calentamiento y la refrigeración industrial y la industria de transformación.

Definiciones

Advertencia: *Tipo de riesgo*
ADVERTENCIA indica una situación potencialmente peligrosa que, si no se evita, puede producir la muerte o lesiones graves.

Precaución: *Tipo de riesgo*
PRECAUCIÓN indica una situación potencialmente peligrosa que, si no se evita, puede producir lesiones leves o moderadas.

Aviso:
AVISO indica una situación potencialmente peligrosa que, si no se evita, puede producir daños en el equipo.

Placas de identificación
Hay tipos diferentes de placas de identificación en función del tipo de aprobación del recipiente de presión.

Aviso:
- *Se pueden utilizar otros tipos de placas de identificación. Para obtener información detallada póngase en contacto con un representante de Alfa Laval.*
- *Algunas especificaciones no se utilizan para todos los tipos de placas de identificación*

En la placa de identificación se muestra lo siguiente:
1. Espacio para el logotipo.
2. Nombre del fabricante.
3. Espacio para el sello de National Board y el número de serie.
4. N.º de artículo.
5. Tipo.
6. Número de fabricación o de serie.
7. Año o fecha de fabricación.
8. Ubicación de las conexiones para cada fluido.
9. Temperatura de funcionamiento máx. permitida.
10. Presiones de funcionamiento máx. permitidas.
11. Presión de prueba.
12. Fecha de la presión de prueba.
13. Volumen de cada espacio.
14. Temperaturas y presiones de funcionamiento permitidas.
15. Área de funcionamiento.
16. Descripción de cada espacio.
17. Grupo de fluidos.
18. Información exclusiva para el cliente.
19. Ubicaciones posibles de las conexiones.
20. Información de código de barras.
21. Espacio para marcar la aprobación (las marcas CE siguientes no son válidas para la placa de identificación de tipo 3)
    – CE-0409 BHE Manufacturing, Ronneby, Suecia
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Jiangyin City, PRC
    – CE-0948 Alfa Laval S.p.A. Alonte, Italia.

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Condiciones requeridas

⚠ ***Advertencia:*** *El intercambiador de calor se debe instalar y poner en funcionamiento de forma tal que no existan riesgos de lesiones personales y de daños a la propiedad.*

Nota: *A menos que se especifique lo contrario, los datos del producto para los refrigerantes comunes (es decir, HFC y HCFC) corresponden a las aplicaciones de refrigeración. Antes de utilizar el intercambiador de calor para líquidos inflamables, tóxicos o peligrosos (por ejemplo, hidrocarburos) se deben utilizar las reglas de seguridad correspondientes para la manipulación de este tipo de líquidos. Para más información, consulte el sitio de Internet del proveedor.*

Instalación

Durante la instalación, se deben proporcionar equipos para proteger el intercambiador de calor contra presiones y temperaturas que estén fuera de los valores mínimos y máximos aprobados que se muestran en la placa de identificación.

⚠ ***Precaución:*** *Para evitar que los bordes cortantes le provoquen heridas en las manos, lleve siempre guantes cuando manipule los intercambiadores de calor soldados.*

Para obtener el mejor rendimiento posible en la transferencia de calor, el intercambiador de calor se debe conectar de forma tal que el flujo de medios que atraviesa el intercambiador de calor lo haga en direcciones opuestas (a contraflujo).

Aviso: *Antes de conectar cualquier tubería, asegúrese de que se hayan eliminado mediante lavado a presión todos los objetos extraños del sistema.*

⚠ ***Precaución:*** *Tenga en cuenta el riesgo de incendio durante el trabajo de instalación; es decir, considere la distancia respecto de sustancias inflamables.*

⚠ ***Precaución:*** *Nunca levante el equipo por las conexiones. Utilice correas cuando proceda a izar el equipo. Coloque las correas según la figura 1.*

Nota: *En aplicaciones con el evaporador y en aplicaciones en las que se produzca un cambio de fase en los medios, el intercambiador de calor se debe instalar verticalmente con una tubería recta (de al menos 150-200 mm de longitud) entre la válvula de expansión y la entrada de refrigerante.*

Montaje

En un sistema de tuberías rígidas, los intercambiadores de calor pequeños (que pesen de 1 a 6 kg) se pueden colgar directamente en las tuberías (Figura 2A). Los intercambiadores de calor más grandes se deben fijar con montajes de soporte (Figura 2D) diseñados para el intercambiador de calor específico (accesorio), con correas (Figura 2C) o mediante tornillos de montaje (Figura 2B). Para pedidos especiales, los tornillos de montaje se pueden soldar en la parte delantera o en la trasera. El par de apriete para los tornillos M6 es de 3,8 Nm, para los tornillos M8 es de 9,5 Nm, y para los tornillos M10, de 19,0 Nm.

Nota: *Si existe riesgo de vibraciones, utilice montajes antivibración como se muestra en la Figura 2A.*

Nota: *Los intercambiadores de calor con distribuidores de refrigerante deben montarse con el distribuidor en la parte inferior.*

Nota: *Durante la instalación, las potencias de conexión no deben exceder los valores de acuerdo a la tabla "Límites de potencias de conexión durante la instalación" que aparece en el dorso de la portada.*

Nota: *Durante el funcionamiento, las tuberías deben estar totalmente ancladas y se deben utilizar de manera que no llegue ninguna potencia al intercambiador de calor de placas.*

Conexiones (Figura 3)
Conexiones con rosca – Utilice una llave dinamométrica cuando conecte la tubería y respete los límites especificados. Algunos modelos se suministran con conexiones de tipo Victaulic.
Conexiones con soldado fuerte – Limpie frotando y desengrasando las diversas superficies. Utilice una calidad de metal de soldadura adecuada para los materiales que se vayan a someter a la soldadura fuerte, y utilice la temperatura de soldadura correcta. Para obtener información detallada consulte el documento “Tubos de soldadura para intercambiador de calor soldado” o póngase en contacto con un representante de Alfa Laval.
Conexiones soldadas – soldadura TIG o MIG. Rectifique el interior y el exterior del tubo y, si está achaflanado, rectifique también el perfil achaflanado como mínimo unos 25 mm desde el perfil del tubo y hacia dentro. Esta medida es necesaria para evitar una contaminación de cobre en el área soldada, que podría producir la rotura de la soldadura.

Nota: *Proteja el intercambiador de calor del recalentamiento envolviendo un trozo de tela húmedo alrededor de la conexión cuando se realiza una soldadura o soldadura fuerte. El calor excesivo puede fundir el metal de soldadura interno dentro del intercambiador de calor. Consulte la figura 3.*

⚠ ***Precaución:*** *Al desconectar el intercambiador de calor del sistema de tuberías, use equipos de protección como, por ejemplo, botas de seguridad, guantes de seguridad y protección ocular, dependiendo del tipo de medio que haya en el intercambiador de calor.*

Riesgo de congelación

⚠ ***Precaución:*** *Tenga en cuenta el riesgo de congelación a bajas temperaturas para evitar daños en el intercambiador de calor. Los intercambiadores de calor que no estén en funcionamiento se deben vaciar y secar con aire cuando exista riesgo de congelación.*

Nota: *Para evitar que se produzcan daños por congelación, el medio utilizado debe incluir un agente anticongelante cuando se utilice el equipo en condiciones de funcionamiento debajo del punto de congelación del medio.*

Nota: *Cuando se utiliza como evaporador*
- *Utilice un interruptor de flujo y uno de presión baja.*
- *Utilice un termostato anticongelante y un monitor de flujo para garantizar un flujo de agua constante antes de que se ponga en funcionamiento el compresor, durante el funcionamiento y después del funcionamiento de este.*
- *Evite la “evacuación mediante bombeo” (es decir, el vaciado) del evaporador haciendo funcionar el compresor después del apagado hasta que se alcance una presión de refrigerante preestablecida. La temperatura puede disminuir hasta alcanzar un valor inferior al punto de congelación del agua salada, y esto puede producir daños en el evaporador.*

Protección contra obstrucciones
Utilice un filtro como protección contra la posible presencia de partículas extrañas. Si tiene alguna duda respecto del tamaño máximo de las partículas, consulte a su representante más cercano del proveedor o consulte la información del producto en el sitio de Internet del proveedor.

Control y funcionamiento

> ***Precaución:*** *No utilice el intercambiador de calor para medios (por ejemplo, agua desionizada)/instalaciones (por ejemplo, tuberías galvanizadas) que (químicamente/electroquímicamente) puedan afectar las placas o verse afectador por ellas (acero inoxidable) y el material de soldadura (cobre).*

> ***Nota:*** *El cobre puede generar corrosión en una instalación con materiales mixtos*

Protección contra la fatiga térmica o de presión
Los cambios repentinos de temperatura o de presión pueden producir daños por fatiga en el intercambiador de calor. Por lo tanto, se debe tener en cuenta lo siguiente para garantizar que los intercambiadores de calor funcionen sin oscilaciones de presión/temperatura.

- Ubique el sensor de temperatura tan cerca como sea posible de la salida del intercambiador de calor.
- Seleccione válvulas y equipos de regulación que proporcionen temperaturas/presiones estables para el intercambiador de calor.
- Para evitar golpes de ariete, no se deben utilizar válvulas de cierre rápido (por ej., válvulas de encendido/apagado).
- En instalaciones automatizadas, la detención y el encendido de bombas, y la activación de válvulas se debe programar de modo que la amplitud y la frecuencia resultantes de la variación de presión sean lo más bajas posible.

Aislamiento
Se encuentran disponibles aislamientos de calefacción y enfriamiento como accesorios.

> ***Nota:*** *Tenga en cuenta que los límites de temperatura del aislamiento y del intercambiador de calor pueden ser diferentes.*

Solución de problemas
Para garantizar el rendimiento correcto del intercambiador de calor, compruebe que:

- el sistema de tuberías se haya conectado al intercambiador de calor según las instrucciones de este manual
- el intercambiador de calor esté perfectamente limpio y que no tenga depósitos.

> ***Nota:*** *Las partículas y las fibras pueden obstruir el intercambiador de calor. Un aumento de la caída de presión o una caída de la eficacia térmica indica que el intercambiador de calor está sucio.*

- el circuito de control se haya preestablecido correctamente y que no haya congelación.

Limpieza
El equipo se puede limpiar sin desmontarlo. Para obtener asesoramiento sobre los procesos de limpieza adecuados, consulte con el representante del proveedor o visite el sitio de Internet del proveedor. La persona responsable del funcionamiento debe garantizar que se utilice el método de limpieza correcto y debe decidir los intervalos de limpieza más adecuados.

> ***Nota:*** *El paquete de placas no debe abrirse.*

Impiego previsto
Gli scambiatori di calore brasati (BHE) sono stati progettati per eseguire un trasferimento di calore che soddisfi i requisiti di un'ampia gamma di applicazioni quali la refrigerazione, il riscaldamento di confort, il riscaldamento e il raffreddamento industriali e le applicazioni dell'industria di processo.

Definizioni

Avvertenza *Tipo di pericolo*
AVVERTENZA - indica una situazione potenzialmente pericolosa che, se non evitata, può causare lesioni gravi o addirittura letali.

Attenzione: *Tipo di pericolo*
ATTENZIONE - indica una situazione potenzialmente pericolosa che, se non evitata, può causare lesioni leggere o moderate.

Nota
NOTA - indica una situazione potenzialmente pericolosa che, se non evitata, può causare danni alle cose.

Piastrine identificative
Vi sono diversi tipi di piastrine identificative, a seconda del tipo di approvazione del contenitore a pressione.

Nota
- *Possono essere utilizzati altri tipi di piastrine identificative. Per informazioni dettagliate, entrare in contatto con un rappresentante Alfa Laval.*
- *Alcuni dati tecnici non vengono utilizzati in tutti i tipi di piastrine identificative.*

La piastrina identificativa reca:
1. spazio per il logotipo;
2. nome del produttore;
3. spazio per il timbro dell'ente nazionale preposto e il numero di serie;
4. codice articolo;
5. tipo;
6. numero di produzione o di serie;
7. anno o data di produzione;
8. posizioni delle connessioni per ciascun fluido;
9. temperature massime operative consentite;
10. pressioni massime operative consentite;
11. pressione di prova;
12. data della prova di pressione;
13. volume di ogni spazio;
14. temperature e pressioni operative consentite;
15. area operativa;
16. descrizione di ogni spazio;
17. gruppo di fluidi;
18. informazioni specifiche al cliente;
19. posizioni possibili per le connessioni;
20. dati del codice a barre;
21. spazio per il contrassegno d'approvazione
    (i contrassegni CE sottostanti non sono validi per la piastrina identificativa di tipo 3)
    – CE-0409 BHE Manufacturing, Ronneby, Svezia
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Jiangyin City, Repubblica Popolare Cinese
    – CE-0948 Alfa Laval S.p.A. Alonte, Italia.

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Requisiti

> ***Avvertenza*** *Lo scambiatore di calore deve essere installato e utilizzato in modo tale da prevenire qualsivoglia rischio di lesioni al personale e danni alle proprietà.*

> ***Nota:*** *se non diversamente specificato, i dati dei prodotti per refrigeranti normali, ad es. HFC e HCFC, sono applicabili ad applicazioni di refrigerazione. Prima che lo scambiatore di calore venga utilizzato per liquidi infiammabili, tossici o pericolosi (come ad esempio idrocarburi), si devono osservare le pertinenti regole di sicurezza per la manipolazione di tali liquidi. Per ulteriori informazioni, consultare il sito Internet del fornitore.*

Installazione

L'installazione deve essere eseguita con apparecchiature che proteggano lo scambiatore di calore da pressioni e temperature non conformi all'intervallo fra i valori massimo e minimo approvati, indicati sulla piastrina.

> ***Attenzione:*** *Per evitare lesioni dovute ai bordi appuntiti, indossare sempre guanti protettivi in caso di manipolazione degli scambiatori di calore brasati.*

Per un trasferimento termico ottimale, lo scambiatore di calore deve essere collegato in modo tale che il flusso dei fluidi nel nucleo avvenga in direzioni opposte (controflusso).

> ***Nota*** *Prima di collegare qualsiasi tubazione, accertarsi che non siano rimasti corpi estranei nell'impianto.*

> ***Attenzione:*** *Tenere in considerazione il rischio di incendio durante le operazioni di installazione (ad esempio, non dimenticare di mantenere a distanza le sostanze infiammabili).*

> ***Attenzione:*** *non sollevare mai tramite le connessioni. Per il sollevamento, avvalersi di imbracature. Sistemare le imbracature secondo quanto illustrato in Figura 1.*

> ***Nota:*** *nel caso delle applicazioni di evaporazione ed in quelle in cui avviene un cambiamento di fase del fluido utilizzato, lo scambiatore di calore deve essere installato in posizione verticale, con un tubo diritto (di lunghezza di almeno 150-200 mm) tra la valvola d'espansione e la bocchetta di immissione del refrigerante.*

Montaggio

Nel caso di un impianto a tubo rigido, gli scambiatori di calore di dimensioni ridotte (dal peso compreso tra 1 e 6 kg) possono essere sospesi direttamente alle tubazioni (Figura 2A). Gli scambiatori di dimensioni maggiori devono essere fissati mediante staffe di supporto (Figura 2D) previste per un tipo specifico di scambiatore (come accessorio) o assicurati per mezzo di bande (Figura 2C) o fissati da bulloni di montaggio (Figura 2B). Nel caso di ordini speciali, i bulloni di montaggio possono essere saldati alla parte anteriore o posteriore. La coppia di serraggio per i bulloni M6 deve essere di 3,8 Nm, per quelli M8 di 9,5 Nm ed ancora per i bulloni M10 di 19,0 Nm.

> ***Nota*** *nel caso di rischio di vibrazioni, utilizzare montaggi anti-vibrazioni come illustrato dalla Figura 2A.*

> ***Nota*** *gli scambiatori di calore con distributori di refrigerante devono essere montati con il distributore sul fondo.*

> ***Nota:*** *Durante l'installazione i carichi di collegamento non devono superare i valori riportati nella tabella "Limiti per i carichi di collegamento durante l'installazione" nella parte interna della prima pagina.*

> ***Nota:*** *Le tubazioni devono essere fissate in modo corretto ed eseguite in modo tale che nessun carico sia trasferito allo scambiatore di calore a piastre durante il funzionamento.*

Connessioni (Figura 3)
Connessioni filettate – Utilizzare una chiave dinamometrica per la connessione del tubo, rispettando i limiti specificati. Alcuni modelli vengono forniti con connessioni di tipo Victaulic.
Connessioni brasate – Pulire strofinando e sgrassando le varie superfici. Utilizzare una qualità di metallo per la brasatura che sia adatto per i materiali da brasare, mantenendosi alla corretta temperatura di brasatura. Per informazioni dettagliate, consultare il documento “Brasatura dei tubi per scambiatori di calore brasati” oppure mettersi in contatto con il rappresentante Alfa Laval.
Connessioni saldate – Saldatura TIG o MIG. Smerigliare internamente ed esternamente il tubo e, in caso di presenza di smussatura, anche il bordo smussato, per almeno 25 mm dal bordo del tubo e verso l'interno. Questo, per evitare la contaminazione di rame nell'area saldata, che potrebbe causare fessurazioni alla saldatura stessa.

Nota: *proteggere lo scambiatore di calore dal surriscaldamento avviluppando un panno umido attorno alla connessione, ogni volta che viene attuata una brasatura o una saldatura.Un riscaldamento eccessivo può provocare la fusione del metallo della brasatura all'interno dello scambiatore di calore. Consultare la Figura 3.*

⚠ ***Attenzione:*** *quando si sconnette lo scambiatore di calore dalle tubazioni, utilizzare un insieme di protezione adatto, composto da stivali di sicurezza, guanti ed occhiali protettivi, a seconda del tipo di prodotto che fluisce attraverso lo scambiatore di calore.*

Rischio di congelamento

⚠ ***Attenzione:*** *tenere in considerazione il rischio di congelamento alle basse temperature, per evitare danni allo scambiatore di calore. Qualora sia presente un rischio di congelamento, gli scambiatori di calore non operativi devono essere svuotati e asciugati mediante un flusso d'aria.*

Nota: *per evitare danni dovuti al congelamento, il fluido utilizzato deve comprendere un antigelo in condizioni operative inferiori al suo punto di congelamento.*

Nota: *se utilizzato come evaporatore*
- *Utilizzare un interruttore di flusso e un interruttore di bassa pressione.*
- *Utilizzare un termostato antigelo e un monitor di flusso, per garantire un flusso d’acqua costante prima, durante e dopo l’avvio del compressore.*
- *Evitare uno "spompaggio", come ad esempio nel caso dello svuotamento dell'evaporatore, facendo funzionare il compressore dopo l'arresto, fino al raggiungimento di una pressione del refrigerante preimpostata. La temperatura potrebbe scendere al di sotto del punto di congelamento della brina, danneggiando l’evaporatore.*

Protezione contro le ostruzioni
Utilizzare un filtro come protezione contro l’eventuale presenza di particelle estranee. In caso di dubbi riguardanti le dimensioni massime delle particelle, consultare il rappresentante di zona del fornitore oppure consultare le informazioni del prodotto sul sito Internet del fornitore.

Controllo ed operatività

> ***Attenzione:*** *non utilizzare lo scambiatore di calore per fluidi (ad esempio, acqua deionizzata)/installazioni (ad esempio, tubi galvanizzati) che potrebbero influire o subire un influsso (chimicamente/elettrochimicamente) da parte delle piastre (acciaio inossidabile) e del materiale di brasatura (rame).*

> ***Nota:*** *Il rame può provocare corrosione in installazioni dove coesistono materiali misti.*

Protezione contro la fatica da pressione e/o termica
Cambiamenti di pressione e temperatura improvvisi possono causare danni allo scambiatore di calore. Quindi, le indicazioni seguenti devono essere tenute in considerazione per garantire che lo scambiatore di calore operi senza cambiamenti di pressioni/temperature.

- Posizionare il sensore di temperatura il più vicino possibile all'uscita dallo scambiatore di calore.
- Utilizzare valore e apparecchiature di regolazione che consentano temperature/pressioni stabili nello scambiatore di calore.
- Per evitare il colpo d'ariete, non devono essere utilizzate valvole a chiusura rapida, ad esempio valvole on/off.
- In installazioni automatizzate, l'arresto e l'avvio delle pompe e l'attuazione delle valvole devono essere programmati in modo tale che l'ampiezza e la frequenza risultanti della variazione di pressione siano quanto minori possibili.

Isolamento
Isolamenti per riscaldamento e raffreddamento sono disponibili come accessori.

> ***Nota:*** *Tenere in considerazione che i limiti di temperatura dell'isolazione e dello scambiatore di calore possono essere differenti.*

Ricerca delle anomalie
Per assicurare la corretta operatività dello scambiatore di calore, verificare che:

- le tubazioni siano state connesse allo scambiatore di calore rispettando le istruzioni di questo manuale;
- lo scambiatore di calore sia perfettamente pulito ed esente da depositi.

> ***Nota:*** *particelle e fibre possono occludere lo scambiatore di calore. Un aumento della caduta di pressione o del decremento dell'efficienza termica indicano un'occlusione dello scambiatore di calore.*

- Verificare che il circuito di controllo sia predefinito correttamente e che non sia in atto alcun congelamento.

Pulizia e lavaggio
L'attrezzatura deve essere adatta per una pulizia in loco. Per consigli sui processi di pulizia adatti, consultare il rappresentante o il sito Internet del fornitore. La persona responsabile del funzionamento deve assicurare che venga impiegato un corretto metodo di pulizia e deve stabilire le frequenze di lavaggio adatte.

> ***Nota:*** *il gruppo piastre non deve essere aperto.*

Bestemd gebruik
De gesoldeerde warmtewisselaars zijn ontworpen om warmteoverdracht te verzorgen die voldoet aan de eisen van een groot aantal toepassingen zoals koelen, comfortverwarming, industriële verwarming en afkoeling en de procesindustrie.

Definities

Waarschuwing: *Soort gevaar*
WAARSCHUWING verwijst naar een mogelijk gevaarlijke situatie die indien niet vermeden de dood of ernstige verwondingen tot gevolg kan hebben.

Pas op: *Soort gevaar*
VOORZICHTIG verwijst naar een mogelijk gevaarlijke situatie die indien niet vermeden kleine of matige verwondingen tot gevolg kan hebben.

Opmerking:
NB verwijst naar een mogelijk gevaarlijke situatie die indien niet vermeden, schade aan eigendommen tot gevolg kan hebben.

Naamplaten
Afhankelijk van het goedkeuringstype voor het drukvat zijn er verschillende soorten naamplaten.

Opmerking:
- *Mogelijk worden andere soorten naamplaten gebruikt. Voor meer informatie kunt u contact opnemen met een Alfa Laval-vestiging.*
- *Sommige specificaties worden niet voor alle soorten naamplaten gebruikt*

De naamplaat toont:
1. Ruimte voor logo.
2. Naam van fabrikant.
3. Ruimte voor stempel nationale instantie en serienummer.
4. Artikelnummer.
5. Type.
6. Fabricage- of serienummer.
7. Fabricagejaar of -datum.
8. Locaties van aansluitingen voor elke vloeistof.
9. Max. toegestane bedrijfstemperaturen.
10. Max. toegestane bedrijfsdruk.
11. Testdruk.
12. Datum van testdruk.
13. Volume van elke ruimte.
14. Toegestane werktemperaturen en -druk.
15. Werkomgeving.
16. Beschrijving van elke ruimte.
17. Vloeistofgroep.
18. Informatie uniek voor de klant.
19. Mogelijke locaties van aansluitingen.
20. Barcode-informatie.
21. Ruimte voor keurmerk. (CE-markeringen hieronder zijn niet geldig voor naamplaat type 3)
    – CE-0409 BHE Manufacturing, Ronneby, Zweden
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Jiangyin City, PRC
    – CE-0948 Alfa Laval S.p.A. Alonte, Italië.

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Vereisten

> ***Waarschuwing:*** *De warmtewisselaar moet zodanig worden geïnstalleerd, bediend en gebruikt dat er geen risico op letsel bij personeel en schade aan eigendommen bestaat.*

> ***Opmerking :*** *Tenzij anders is aangegeven, gelden de productgegevens voor normale koelmiddelen, d.w.z. HFC en HCFC, voor koeltoepassingen. Voordat de warmtewisselaar gebruikt wordt voor brandbare, giftige of gevaarlijke vloeistoffen (zoals koolwaterstoffen) moeten de relevante beveiligingsregels voor het verwerken van zulke vloeistoffen worden toegepast. Zie voor meer informatie de website van de leverancier.*

Installatie

De installatie moet zijn uitgerust met apparatuur die de warmtewisselaar beschermt tegen drukken en temperaturen buiten de goedgekeurde minimum- en maximumwaarden die zijn aangegeven op het typeplaatje.

> ***Pas op:*** *Ter voorkoming van verwondingen veroorzaakt door scherpe randen, dient men altijd handschoenen te dragen tijdens werkzaamheden aan de gesoldeerde warmtewisselaars.*

Voor optimale warmteoverdracht dient de warmtewisselaar zo te worden aangesloten dat de vloeistofstroom in tegenovergestelde richtingen (tegenstrooms) door de warmtewisselaar beweegt.

> ***Opmerking:*** *Zorg ervoor dat alle vreemde voorwerpen uit het systeem zijn gespoeld voordat buizen worden aangesloten.*

> ***Pas op:*** *Houd rekening met het risico van brand tijdens de installatiewerkzaamheden, d.w.z. let op de afstand tot ontvlambare stoffen.*

> ***Pas op:*** *Nooit aan de aansluitingen optillen. Voor het hijsen moeten hijsbanden worden gebruikt. Plaats de hijsbanden zoals in afbeelding 1.*

> ***Opmerking :*** *In verdampertoepassingen en in toepassingen waarin een faseverandering van de media plaatsvindt, moet de warmtewisselaar verticaal worden geplaatst met een rechte leiding (ten minste150-200 mm lang) tussen de expansieklep en de koelinlaat.*

Montage

In een systeem met starre leidingen kunnen kleine warmtewisselaars (met een gewicht van 1 tot 6 kg) rechtstreeks aan de leidingen worden opgehangen (afbeelding 2A). Grotere warmtewisselaars moeten met steunen worden vastgezet (afbeelding 2D) die voor een specifieke warmtewisselaar bedoeld zijn (toebehoren), of worden vastgezet met riemen (afbeelding 2C) of montagebouten (afbeelding 2B). Voor speciale opdrachten kunnen montagebouten aan de voor- of achterkant worden gelast. Het aandraaimoment voor M6 bouten is 3,8 Nm, M8 bouten 9,5 Nm, en voor M10 bouten 19,0 Nm.

> ***Opmerking:*** *Als er kans op trillingen bestaat, anti-trilsteunen monteren als in afbeelding 2A.*

> ***Opmerking:*** *Warmtewisselaars met koelmiddelverdeelkop met de verdeelkop aan de onderkant monteren.*

> ***Opmerking:*** *Tijdens de installatie mogen de aansluitbelastingen niet de waarden overschrijden zoals vermeld in de tabel “Limieten voor aansluitbelastingen tijdens de installatie” aan de binnenkant van de voorpagina.*

> ***Opmerking:*** *Het leidingwerk moet goed verankerd en uitgevoerd zijn zodat er tijdens de werking geen belasting wordt overgedragen op de platenwarmtewisselaar.*

Aansluitingen (afbeelding 3)
Aansluitingen met schroefdraad: gebruik een momentsleutel bij het aansluiten van de leiding en let op de opgegeven limieten. Sommige modellen zijn voorzien van aansluitingen van het type Victaulic.
Gesoldeerde aansluitingen: schoonmaken door de verschillende oppervlakken te schuren en ontvetten. Gebruik soldeer dat geschikt is voor de te solderen materialen en gebruik de juiste soldeertemperatuur. Zie voor meer informatie het document "Leidingen voor gesoldeerde warmtewisselaar solderen" of neem contact op met een vertegenwoordiger van Alfa Laval.
Gelaste verbindingen: TIG of MIG lassen. Slijp binnenkant en buitenkant van leiding en (indien afgeschuind) ook de schuine rand ten minste 25 mm van de leidingrand en naar binnen. Dit moet gebeuren om koperverontreiniging in het lasoppervlak te voorkomen, die ertoe kan leiden dat de las scheurt.

Opmerking : *Bescherm de warmtewisselaar tegen oververhitting door een natte lap om de aansluiting te wikkelen bij soldeer- of laswerkzaamheden. Teveel warmte kan de interne soldeer binnen de warmtewisselaar doen smelten. Raadpleeg afbeelding 3.*

⚠ ***Pas op:*** *Gebruik de juiste beschermende uitrusting bij het losmaken van de warmtewisselaar van de leidingen, zoals veiligheidsschoenen, veiligheidshandschoenen en oogbeschermers, afhankelijk van het type medium in de warmtewisselaar.*

Kans op bevriezen

⚠ ***Pas op:*** *Houd rekening met de kans op bevriezen bij lage temperaturen om schade aan de warmtewisselaar te voorkomen. Warmtewisselaars die niet in bedrijf zijn, dienen te worden geleegd en drooggeblazen wanneer er kans op bevriezing bestaat.*

Opmerking : *Om schade door bevriezing te voorkomen, moet het gebruikte medium bij bedrijfscondities onder het vriespunt van het medium een antivriesmiddel bevatten.*

Opmerking : *Indien gebruikt als verdamper*
- *Gebruik een stromingsschakelaar en een lagedrukschakelaar.*
- *Gebruik een antivriesthermostaat en stromingsmeter om voor, tijdens en na het draaien van de compressor een constante waterstroom te garanderen.*
- *Vermijd 'pump-down', d.w.z. het legen van de verdamper door de compressor na uitschakeling te laten draaien totdat een vooraf ingestelde koelmiddeldruk is bereikt. De temperatuur kan dan dalen tot onder het vriespunt voor koudedragers, waardoor de verdamper beschadigd kan raken.*

Bescherming tegen verstopping
Gebruik een filter als bescherming tegen eventuele vreemde deeltjes. Als u twijfels hebt over de maximale deeltjesgrootte, neem dan contact op met de dichtstbijzijnde vestiging van de leverancier of kijk onder Productinformatie op de website van de leverancier.

Bediening en gebruik

⚠ ***Let op :*** *Gebruik de warmtewisselaar niet voor media (zoals gedeïoniseerd water)/installaties (zoals gegalvaniseerde leidingen) die (chemisch of elektrochemisch) de platen (roestvrijstaal) en het soldeermateriaal (koper) kunnen beïnvloeden of daardoor beïnvloed kunnen worden.*

Opmerking : *Koper kan corrosie veroorzaken in installaties met gemengde materialen*

Bescherming tegen thermische vermoeidheid en drukvermoeidheid
Plotselinge temperatuur- en drukveranderingen kunnen vermoeidheidsschade aan de warmtewisselaar veroorzaken. Daarom moet op het volgende worden gelet om ervoor te zorgen dat de warmtewisselaars werken zonder sterk wisselende druk of temperaturen.

- Plaats de temperatuursensor zo dicht mogelijk bij de uitlaat van de warmtewisselaar.
- Kies kleppen en regelapparatuur die de temperaturen/drukken van de warmtewisselaar stabiel houden.
- Om waterslag te voorkomen mogen geen snelsluitende kleppen (zoals AAN/UIT-kleppen) worden gebruikt.
- Bij geautomatiseerde installaties dienen uit- en inschakeling van pompen en bediening van kleppen zodanig te worden geprogrammeerd dat de resulterende amplitude en frequentie van de drukschommeling zo laag mogelijk is.

Isolatie
Verwarmings- en koelingsisolatie is als toebehoren verkrijgbaar.

Opmerking : *Houd er rekening mee dat temperatuurlimieten van isolatie en de warmtewisselaar kunnen verschillen.*

Problemen oplossen
Controleer voor een goede werking van de warmtewisselaar:

- of het leidingsysteem volgens de aanwijzingen in deze handleiding op de warmtewisselaar is aangesloten
- of de warmtewisselaar perfect schoon en vrij van neerslag is.

Opmerking : *Deeltjes en vezels kunnen de warmtewisselaar verstoppen. Een toename in de drukval of een vermindering in de thermische efficiëntie geeft aan dat de warmtewisselaar vervuild is.*

- het bedieningscircuit correct is ingesteld en geen bevriezing plaatsvindt.

Reinigen
De uitrusting is geschikt voor schoonmaken ter plaatse. Neem voor advies over de geschikte manier van schoonmaken contact op met de vertegenwoordiger van de leverancier of bezoek de internetsite van de leverancier. Degene die voor de bediening verantwoordelijk is, moet er voor zorgen dat de juiste schoonmaakmethode wordt toegepast en moet de juiste schoonfrequentie bepalen.

Opmerking : *Het platenpakket mag niet worden geopend.*

Utilização prevista
Os permutadores de placas soldadas (PPS) foram concebidos para realizar a transferência de calor, cumprindo os requisitos de uma vasta gama de aplicações como, por exemplo, refrigeração, aquecimento de conforto, aquecimento e arrefecimento industriais e indústria transformadora.

Definições

Aviso:*Tipo de perigo*
⚠ *AVISO indica uma situação de perigo potencial que, se não for evitada, poderá resultar em morte ou ferimentos graves.*

Cuidado:*Tipo de perigo*
⚠ *CUIDADO indica uma situação de perigo potencial que, se não for evitada, poderá resultar em ferimentos leves ou médios.*

Nota:
NOTA indica uma situação de perigo potencial que, se não for evitada, poderá resultar em danos materiais.

Placas de identificação
Existem diferentes tipos de placas de identificação em função do tipo de aprovação de recipientes sob pressão.

Nota:
- *Poderão ser utilizados outros tipos de placas de identificação. Para obter informações detalhadas, contacte um representante da Alfa Laval.*
- *Nem todas as especificações são utilizadas para todos os tipos de placas de identificação*

A placa de identificação apresenta:
1. Espaço para o logótipo.
2. Nome do fabricante.
3. Espaço para a marca e o número de série do Instituto Nacional.
4. Número de artigo
5. Tipo.
6. Número de série ou de fabrico.
7. Ano ou data de fabrico.
8. Localizações das ligações para cada fluido.
9. Temperaturas de funcionamento máximas admissíveis.
10. Pressões de funcionamento máximas admissíveis.
11. Pressão de teste.
12. Data da pressão de teste.
13. Volume de cada espaço.
14. Pressões e temperaturas de funcionamento admissíveis.
15. Zona de funcionamento.
16. Descrição de cada espaço.
17. Grupo de fluidos.
18. Informações exclusivas para o cliente.
19. Localizações possíveis das ligações.
20. Informações de código de barras.
21. Espaço para a marca de aprovação. (As seguintes marcas CE não são válidas para o tipo de placa de identificação 3)
    – CE-0409 BHE Manufacturing, Ronneby, Suécia
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Cidade de Jiangyin, RPC
    – CE-0948 Alfa Laval S.p.A. Alonte, Itália.

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Requisitos

Aviso: *O permutador de placas tem de ser instalado e operado de forma a evitar o risco de danos físicos e materiais.*

Nota: *Salvo especificação em contrário, os dados de produto para refrigerantes normais, ou seja, HFC e HCFC, são aplicáveis a aplicações de refrigeração. Antes da utilização do permutador de placas para líquidos inflamáveis, tóxicos ou perigosos (por exemplo, hidrocarbonetos), têm de ser utilizadas as regras de segurança relevantes para o processamento desses líquidos. Para obter mais informações, consulte o site da Internet do fornecedor.*

Instalação

A instalação tem de possuir equipamento de protecção do permutador de placas contra temperaturas e pressões que excedam os valores mínimos e máximos aprovados indicados na placa de identificação.

Cuidado: *Utilize sempre luvas de protecção ao manusear os permutadores de placas soldadas para não ferir as mãos em arestas vivas.*

Para obter o melhor desempenho de transferência de calor possível, o permutador de placas deve estar ligado de modo a que os agentes fluam através do permutador de placas em sentidos opostos (em contracorrente).

Nota:*Antes de ligar qualquer tubagem, verifique se foram lavados do sistema todos os corpos estranhos.*

Cuidado: *Tenha em atenção o risco de incêndio durante o processo de instalação, ou seja, a distância relativamente a substâncias inflamáveis.*

Cuidado: *Nunca ice pelas ligações. Devem ser usadas cintas para içar. Coloque as cintas de acordo com a figura 1.*

Nota: *Em aplicações de evaporadores e em aplicações nas quais ocorre uma mudança de fase dos agentes, o permutador de placas tem de ser instalado na vertical com um tubo direito (de, pelo menos, 150 a 200 mm de comprimento) entre a válvula de expansão e a entrada do refrigerante.*

Montagem

Num sistema de tubagem rígida, é possível suspender permutadores de placas pequenos (1 a 6 kg de peso) directamente nas tubagens (Figura 2A). Os permutadores de placas maiores devem ser fixados com suportes (Figura 2D) destinados a um permutador de placas específico (acessório), fixados com cintas (Figura 2C) ou através de parafusos de fixação (Figura 2B). No caso de encomendas especiais, é possível soldar parafusos de fixação às partes posterior ou frontal. O binário de aperto para parafusos M6 é de 3,8 Nm, para parafusos M8 de 9,5 Nm e para parafusos M10 de 19,0 Nm.

Nota: *Se existir risco de vibrações, utilize suportes antivibração, conforme indicado na Figura 2A.*

Nota: *Os permutadores de placas com distribuidores de refrigerante devem ser instalados com o distribuidor na parte inferior.*

Nota: *Durante a instalação, as cargas de ligação não devem exceder os valores de acordo com a tabela "Limites das cargas de ligação durante a instalação" no interior da página de capa.*

Nota: *A canalização devem ser bem fixada e executada de modo a não serem transferidas cargas para o permutador de calor do prato durante o funcionamento.*

Ligações (Figura 3)
Ligações roscadas – Utilize uma chave dinamométrica ao ligar o tubo e respeite os limites especificados. Alguns modelos são fornecidos com ligações de tipo Victaulic.
Ligações soldadas – Limpe, esfregando e desengordurando as diversas superfícies. Utilize um tipo de metal de soldadura adequado para os materiais a soldar e utilize a temperatura de soldadura correcta. Para obter informações detalhadas, consulte o documento “Soldar tubos para permutadores placas soldadas” ou contacte um representante da Alfa Laval.
Ligações soldadas – Soldadura TIG ou MIG. Lixe o interior e o exterior do tubo e, se for o caso, também o rebordo biselado a, pelo menos, 25 mm da extremidade e do centro do tubo. Este procedimento deve ser realizado para evitar a contaminação do cobre na zona soldada, que poderá causar fissuras na soldadura.

Nota: *Proteja o permutador de placas do sobreaquecimento colocando um pano húmido em redor da ligação sempre que efectuar qualquer soldadura. O aquecimento excessivo poderá derreter o metal de soldadura no interior do permutador de placas. Consulte a figura 3.*

⚠ ***Cuidado:*** *Ao desligar o permutador de placas do sistema de tubagem, utilize equipamento de protecção adequado como, por exemplo, botas de protecção, luvas de protecção e protecção ocular, em função do tipo de agentes presentes no permutador de placas.*

Risco de congelação

⚠ ***Cuidado:*** *Tenha em atenção o risco de congelação a temperaturas baixas, de forma a evitar danos no permutador de placas. Os permutadores de placas que não estejam a funcionar devem ser esvaziados e secados sempre que existir risco de congelação.*

Nota: *De forma a evitar danos resultantes de congelação, o agente utilizado tem de incluir um anticongelante em condições de funcionamento abaixo do respectivo ponto de congelação.*

Nota: *Quando utilizado como evaporador*
- *Utilize um interruptor de fluxo e um interruptor de pressão baixa.*
- *Utilize um termóstato e um controlador de fluxo anticongelante para garantir um fluxo de água constante antes, durante e após o funcionamento do compressor.*
- *Evite a "bombagem", ou seja, o esvaziamento do evaporador através da activação do compressor após a paragem até que se obtenha uma pressão de refrigerante predefinida. A temperatura poderá, em seguida, descer abaixo do ponto de congelação do anticongelante, o que poderá danificar o evaporador.*

Protecção contra entupimentos
Utilize um filtro como protecção contra a possível presença de partículas estranhas. Se tiver dúvidas relativamente ao tamanho máximo das partículas, consulte o representante do fornecedor mais próximo ou as informações do produto no site da Internet do fornecedor.
Controlo e funcionamento

⚠ ***Cuidado:*** *Não utilize o permutador de placas para agentes (por exemplo, água desionizada)/instalações (por exemplo, tubos galvanizados) que possam afectar ou ser afectados (quimicamente/electroquimicamente) pelas placas (aço inoxidável) e pelo material de soldadura (cobre).*

Nota: *O cobre poderá criar corrosão em instalações com materiais mistos*

Protecção contra fadiga térmica e/ou de pressão
Alterações bruscas de temperatura e pressão poderão causar danos por fadiga no permutador de placas. Assim sendo, tenha em atenção o seguinte para garantir que os permutadores de placas funcionam sem oscilações de pressão/temperatura.

- Instale o sensor de temperatura tão perto quanto possível da saída do permutador de placas.
- Opte por válvulas e equipamento de regulação que forneçam temperaturas/pressões estáveis ao permutador de placas.
- De forma a evitar o golpe de aríete, não devem ser utilizadas válvulas de fecho rápido como, por exemplo, válvulas de abertura/fecho.
- Em instalações automatizadas, a paragem e o arranque de bombas e o funcionamento de válvulas devem ser programados de forma a que a amplitude e frequência resultantes da variação de pressão sejam o mais baixas possíveis.

Isolamento
Os isolamentos de aquecimento e arrefecimento estão disponíveis como acessórios.

Nota: *Tenha em atenção que os limites de temperatura do isolamento e do permutador de placas poderão ser diferentes.*

Resolução de problemas
De forma a garantir o desempenho correcto do permutador placas, verifique se:

- o sistema de tubagem foi ligado ao permutador de placas de acordo com as instruções contidas neste manual
- o permutador de placas está completamente limpo e livre de depósitos.

Nota: *Partículas e fibras poderão entupir o permutador de placas. Um aumento da queda de pressão ou uma redução na eficiência térmica indicam que o permutador de placas está entupido.*

- o circuito de controlo está correctamente predefinido e não ocorre congelação.

Limpeza
O equipamento está preparado para limpeza no local. Para obter informações sobre processos de limpeza adequados, consulte o representante do fornecedor ou visite o site da Internet do fornecedor. A pessoa responsável pelo funcionamento deve garantir a utilização do método de limpeza correcto e definir intervalos de limpeza adequados.

Nota: *A pilha de placas não deve ser aberta.*

Avsedd användning
De lödda värmeväxlarna (BHE) är utformade för värmeöverföring som uppfyller kraven i ett stort antal tillämpningar som kylning, komfortvärme, industriell uppvärmning och kylning samt processindustri.

Definitioner

Varning! *Typ av risk*
VARNING anger en potentiellt farlig situation som, om den inte undviks, kan leda till dödsfall eller allvarliga skador.

Varsamhet: *Typ av risk*
VARSAMHET anger en potentiellt farlig situation som, om den inte undviks, kan leda till lindriga eller medelsvåra skador.

Obs!
OBS! anger en potentiellt farlig situation som, om den inte undviks, kan leda till egendomsskador.

Märkskyltar
Det finns olika typer av namnplattor som beror på typen av tryckkärlsgodkännande.

Obs!
- *Andra typer av märkskyltar kan användas. För detaljerad information, kontakta en Alfa Laval-representant.*
- *Vissa specifikationer används inte för alla typer av märkskyltar*

På märkskylten finns:
1. Plats för logotyp.
2. Tillverkarens namn.
3. Plats för myndighetsstämpel och serienummer.
4. Artikelnummer.
5. Typ.
6. Tillverknings- eller serienummer.
7. Tillverkningsår eller tillverkningsdatum.
8. Placering av anslutningarna för varje vätska.
9. Max. tillåtna drifttemperaturer.
10. Max. tillåtna drifttryck.
11. Provtryck.
12. Provtrycksdatum.
13. Volym hos varje utrymme.
14. Tillåtna drifttemperaturer och tryck.
15. Driftområde.
16. Beskrivning av varje utrymme.
17. Vätskegrupp.
18. Unik information för kunden.
19. Möjliga anslutningsplatser.
20. Streckkodsinformation.
21. Utrymme för godkännandesymbol. (CE-märkningarna nedan är inte giltiga för märkskyltstyp 3)
    – CE-0409 BHE Manufacturing, Ronneby, Sverige
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co.,
      Ltd, Jiangyin City, PRC
    – CE-0948 Alfa Laval S.p.A. Alonte, Italy.

Originalanvisningar
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Krav

Varning! *Värmeväxlaren måste installeras och användas så att det inte finns någon risk för att det uppstår person- eller egendomsskador.*

OBS! *Om inget annat anges gäller produktdata för normala köldmedel, dvs. HFC och HCFC, i kylsystem. Innan värmeväxlaren används med lättantändliga, giftiga eller farliga vätskor (t.ex. kolväten) måste säkerhetsanvisningarna för hantering av sådana vätskor följas. För ytterligare information, se leverantörens webbplats.*

Installation

Installationen måste förses med utrustning som skyddat värmeväxlaren mot tryck och temperaturer utanför de godkända min- och maxvärdena på märkskylten.

Varsamhet: *Skyddshandskar ska alltid användas vid hantering av lödda värmeväxlare för att undvika att skarpa kanter orsakar skador.*

För bästa möjliga värmeöverföringskapacitet ska värmeväxlaren anslutas så att medierna flyter genom värmeväxlaren i motsatta riktningar (i motflöde)..

Obs! *Kontrollera att alla främmande föremål spolats ut ur systemet innan rören kopplas in.*

Varsamhet: *Tänk på brandrisken under installationsarbetet, dvs. tänk på avståndet till lättantändliga ämnen.*

Varsamhet: *Lyft aldrig anslutningarna. Använd istället lämpliga remmar vid lyft. Placera remmarna enligt bild 1.*

OBS! *I förångartillämpningar och i tillämpningar där en fasändring sker hos medierna måste värmeväxlaren installeras vertikalt med ett rakt rör (minst 150-200 mm långt) mellan expansionsventilen och köldmedieinloppet.*

Montering

I ett styvt rörsystem kan små värmeväxlare (med vikt på 1–6 kg) hängas upp direkt i rören (Bild 2A). Större värmeväxlare ska fästas med stödfästen (Bild 2D) som är avsedda för en specifik värmeväxlare (tillbehör) eller hållas fast med remmar (Bild 2C) eller med fästbultar (Bild 2B). Vid specialbeställningar kan fästbultar svetsas fast fram eller bak. Åtdragningsmomentet för M6-bultar är 3,8 Nm, för M8-bultar är det 9,5 Nm och för M10-bultar 19,0 Nm.

Obs! *Om det finns risk för vibrationer ska vibrationshämmande fästen användas enligt Bild 2A.*

Obs! *Värmeväxlare med köldmediefördelare ska monteras med fördelaren nederst.*

Obs! *Under installationen får inte anslutningslasterna överstiga värdena i tabellen ”Limits for Connection Loads during Installation” på omslagets insida.*

Obs! *Rörledningarna måste vara väl förankrade och rördragningen måste vara utförd så att inga laster överförs till plattvärmeväxlaren under driften.*

Anslutningar (Bild 3)
Gängade anslutningar – Använd en momentnyckel när du ansluter röret och följ de angivna gränserna. Vissa modeller är försedda med Victaulic-anslutningar.
Lödda anslutningar – Rengör genom att torka av och avfetta de olika ytorna. Använd en lödmetallkvalitet som är lämplig för de material som ska lödas och använd rätt lödningstemperatur. För detaljerad information, se dokumentet ”Lödrör för lödda värmeväxlare” eller kontakta en Alfa Laval-representant.
Svetsade anslutningar – TIG- eller MIG-svetsning. Slipa inuti och utanpå röret samt, om det är avfasat, även den fasade kanten minst 25mm från rörets kant och inåt. Detta ska göras för att undvika kopparrester i det svetsade området, som annars skulle kunna få svetsfogen att spricka.

***OBS!** Skydda värmeväxlaren mot överhettning genom att linda en våt duk runt anslutningen när lödning eller svetsning utförs. Kraftig upphettning kan smälta den interna lödmetallen i värmeväxlaren. Se bild 3.*

⚠ ***Varsamhet:** När värmeväxlaren kopplas från rörsystemet måste lämplig skyddsutrustning, som skyddskängor, skyddshandskar och skyddsglasögon användas, beroende på typen av media i värmeväxlaren.*

Frysrisk

⚠ ***Varsamhet:** Tänk på frysrisken vid låga temperaturer för att undvika skador på värmeväxlaren. Värmeväxlare som inte är i bruk ska tömmas och blåsas torra när det finns risk för minusgrader.*

***OBS!** För att undvika frysskador måste det använda mediet innehålla frysskyddsmedel vid användning under dess fryspunkt.*

***OBS!** Vid användning som förångare*
- *Använd en flödesomkopplare och en lågtrycksströmställare.*
- *Använd en frysskyddstermostat och flödesövervakare för att kontrollera att det finns konstant vattenflöde före, under och efter att kompressorn har körts.*
- *Undvik att tömma förångaren genom att köra kompressorn efter avstängning tills ett förinställt köldmedietryck uppnås. Temperaturen kan då sjunka under köldbärarens fryspunkt, vilket kan skada förångaren.*

Skydd mot igensättning
Använd ett filter som skydd mot eventuella främmande partiklar. Om du tvekar på den maximala partikelstorleken, kontakta leverantörens närmaste representant eller se Produktinformation på leverantörens webbplats.

Kontroll och drift

⚠ ***Försiktigt!** Använd inte värmeväxlaren för medier (t.ex. avjoniserat vatten)/installationer (t.ex. galvaniserade rör) som (kemiskt/elektrokemiskt) kan påverka eller påverkas av plattorna (rostfritt stål) och lodet (koppar).*

***OBS!** Koppar kan skapa korrosion i anläggningar med blandade material*

Skydd mot temperatur- och/eller tryckutmattning
Plötsliga temperatur- och tryckförändringar kaj leda till utmattningsskador på värmeväxlaren. Därför måste man ta hänsyn till följande för att se till att värmeväxlarna fungerar utan svängande tryck/ temperaturer.

- Placera temperaturgivaren så nära värmeväxlarens utlopp som möjligt.
- Välj ventiler och reglerutrustning som ger stabila temperaturer/tryck för värmeväxlaren.
- För att undvika tryckstötar får snabbstängande ventiler inte användas, t.ex. på/av-ventiler.
- I automatiserade installationer ska stopp och start av pumpar och aktivering av ventiler programmeras för att ge så låg amplitud och frekvens hos tryckvariationen som möjligt.

Isolering
Värme- och kylisolering finns som tillbehör.

OBS! *Tänk på att isoleringen och värmeväxlaren kan ha olika temperaturgränser.*

Felsökning
För att värmeväxlaren ska ha rätt prestanda, kontrollera att:

- rörsystemet har anslutits till värmeväxlaren enligt anvisningarna i den här handboken
- värmeväxlaren är ren och fri från avlagringar.

OBS! *Partiklar och fibrer kan sätta igen värmeväxlaren. Ökat tryckfall eller minskad termisk effektivitet tyder på att värmeväxlaren är förorenad.*

- reglerkretsen är korrekt inställd och att ingen frysning uppstår.

Rengöring
Utrustningen är lämplig för rengöring på plats. För råd om lämpliga rengöringsprocesser, kontakta leverantörens representant eller besök leverantörens webbplats. Den driftansvarige ansvarar för att rätt rengöringsmetod används och ska besluta om lämpliga rengöringsintervaller.

OBS! *Plattpaketet ska inte öppnas.*

Käyttötarkoitus
Kovajuotetut lämmönvaihtimet (BHE) on suunniteltu täyttämään monenlaisten sovellusten, kuten jäähdytyksen, lämmityksen, teollisen lämmityksen ja jäähdytyksen sekä prosessiteollisuuden lämmönsiirtotarpeet.

Määritelmät

Varoitus: *Vaaran tyyppi*
⚠ *VAROITUS tarkoittaa mahdollisesti vaarallista tilannetta,joka - jos tilannetta ei korjata - voi aiheuttaa kuoleman tai vakavan vamman.*

Huomautus: *Vaaran tyyppi*
⚠ *HUOMAUTUS tarkoittaa mahdollisesti vaarallista tilannetta, joka - jos tilannetta ei korjata - voi aiheuttaa pienen tai lievän vamman.*

Huom:
HUOM tarkoittaa mahdollisesti vaarallista tilannetta, joka – jos tilannetta ei korjata – voi aiheuttaa omaisuusvahingon.

Tyyppikilvet
Tyyppikilpiä on olemassa erilaisia paineastian hyväksyntätyyppien mukaan.

Huom:
- *Muun tyyppisiä tyyppikilpiä voidaan käyttää. Lisätietoja saat Alfa Lavalin edustajalta.*
- *Tiettyjä erittelyitä ei käytetä kaikissa tyyppikilvissä.*

Tyyppikilven sisältämät tiedot:
1. Logolle varattu tila
2. Valmistajan nimi
3. Keskuslautakunnan leimalle ja sarjanumerolle varattu tila
4. Tuotenumero
5. Tyyppi
6. Valmistus- tai sarjanumero
7. Valmistusvuosi tai -päivämäärä
8. Eri nesteiden yhteiden sijainti
9. Korkeimmat sallitut käyttölämpötilat
10. Korkeimmat sallitut käyttöpaineet
11. Koepaine
12. Koepaineen päivämäärä
13. Kunkin tilan tilavuus
14. Sallitut käyttölämpötilat ja -paineet
15. Käyttöalue
16. Kunkin tilan kuvaus
17. Nesteryhmä
18. Asiakaskohtaiset tiedot
19. Yhteiden mahdolliset sijainnit
20. Viivakooditiedot
21. Hyväksyntämerkille varattu tila (alla olevat CE-merkinnät eivät koske tyypin 3 tyyppikilpeä)
    – CE-0409 BHE Manufacturing, Ronneby, Sweden
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Jiangyin City, PRC
    – CE-0948 Alfa Laval S.p.A. Alonte, Italy.

Alkuperäisten ohjeiden käännös
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Vaatimukset

Varoitus:*Lämmönvaihtimen asennuksessa ja käytössä on huolehdittava siitä, ettei henkilöille tai omaisuudelle aiheudu vahinkoja.*

Huom! *Ellei muuta mainita, tavallisten jäähdytysaineiden, esimerkiksi HFC :n ja HCFC:n, tuotetietoja voidaan soveltaa jäähdytyssovelluksissa. Kun lämmönvaihdinta käytetään syttyvien, myrkyllisten tai vaarallisten nesteiden (esimerkiksi hiilivetyjen) kanssa, kyseisten nesteiden käsittelyä koskevia turvaohjeita on noudatettava. Lisätietoja saat toimittajan Internet-sivustosta.*

Asennus

Asennusta varten on toimitettava varusteet, jotka suojaavat lämmönvaihdinta tyyppikilvessä määritetyt vähimmäis- ja enimmäispaineet ja -lämpötilat ylittäviltä arvoilta.

Huomautus:*Käytä aina suojakäsineitä kun käsittelet kovajuotettuja lämmönvaihtimia terävien reunojen aiheuttamien vammojen estämiseksi.*

Parhaan mahdollisen lämmönsiirtotehon takaamiseksi lämmönvaihdin on kytkettävä siten, että aine virtaa lämmönvaihtimen läpi vastakkaiseen suuntaan (vastavirtaan).

Huom: *Varmista ennen putkien liittämistä, että kaikki vieraat esineet on huuhdottu pois järjestelmästä.*

Huomautus: *Ota asennustyön aikana huomioon tulipalon vaara. Muista esimerkiksi huomioida riittävä etäisyys herkästi syttyviin aineisiin.*

Huomautus:*Älä koskaan nosta laitetta yhteistä. Nostamiseen on käytettävä hihnoja. Aseta hihnat kuvan 1 mukaisesti.*

Huom! *Höyrystinsovelluksissa ja sovelluksissa, joissa aineen vaihetta muutetaan, lämmönvaihdin on asennettava pystysuoraan (vähintään 150-200 mm:n pituinen) suora putki paisuntaventtiilin ja kylmäaineen tulon välille.*

Asennus

Jäykässä putkijärjestelmässä pienet (1-6 kg:n painoiset) lämmönvaihtimet voidaan ripustaa suoraan putkistoon (kuva 2A). Suuret lämmönvaihtimet on kiinnitettävä kyseiselle lämmönvaihtimelle tarkoitetuilla tukikiinnikkeillä (kuva 2D) (lisävaruste), hihnoilla (kuva 2C) tai kiinnityspulteilla (kuva 2B). Erikoistilauksesta kiinnityspultit voidaan hitsata laitteen etu- tai takaosaan. Kiristysmomentti M6-pulteille on 3,8 Nm, M8-pulteille 9,5 Nm ja M10-pulteille 19,0 Nm.

Huom:*Jos olemassa on tärinän vaara, käytä tärinää sietäviä kiinnikkeitä kuvassa 2A esitetyllä tavalla.*

Huom:*Kylmäaineen jakelulaitteilla varustetut lämmönvaihtimet on asennettava siten, että jakelulaite on yksikön alaosassa.*

Huom: *Asennuksen aikana liitäntäkuormat eivät saa ylittää kansilehden sisäpuolella olevan taulukon “Liitäntäkuormien rajat asennuksen aikana” arvoja.*

Huom: *Putkiston tulee olla hyvin ankkuroitu ja toteutettu niin, ettei kuormituksia välity levylämmönvaihtimeen käytön aikana.*

Yhteet (kuva 3)
Kierreyhteet – käytä momenttiavainta putken kytkemisessä ja noudata määritettyjä raja-arvoja. Tietyt mallit toimitetaan varustettuina Victaulic-tyyppisillä yhteillä.
Kovajuotetut yhteet – puhdista hiomalla ja poistamalla rasva eri pinnoilta. Käytä juotettaville materiaaleille sopivaa juottometallia ja asianmukaista juottolämpötilaa. Lisätietoa saat asiakirjasta “Brazing tubes for brazed heat exchanger” tai ottamalla yhteyttä Alfa Lavalin edustajaan.
Hitsausyhteet – TIG- tai MIG-hitsaus. Hio putkea sisä- ja ulkopuolelta ja, mikäli putki on viistetty, myös viisto kulma vähintään 23 mm:n matkalta putken reunasta sisäänpäin. Hiomisella vältetään hitsattavan alueen kuparijäämät, jotka voivat aiheuttaa hitsin vaurioitumisen.

***Huom!** Suojaa lämmönvaihdinta ylikuumenemiselta juottamisen tai hitsauksen aikana kietomalla märkä kangas yhteen ympärille. Liiallinen kuumuus voi sulattaa lämmönvaihtimen sisällä käytetyn juottometallin. Katso kuva 3.*

⚠ ***Huomautus:**Kun irrotat lämmönvaihtimen putkistosta käytä lämmönvaihtimessa käytetyn aineen edellyttämää suojavarustusta, kuten turvasaappaita, suojakäsineitä ja suojalaseja.*

Jäätymisriski

⚠ ***Huomautus:**Lämmönvaihtimen vaurioitumisen välttämiseksi on muistettava, että alhaisessä lämpötilassa on olemassa jäätymisriski. Kun lämmönvaihdinta ei käytetä ja olemassa on jäätymisriski, laite on tyhjennettävä ja puhallettava kuivaksi.*

***Huom!** Jäätymisen aiheuttamien vahinkojen välttämiseksi laitteessa käytetyssä aineessa on oltava jäätymisenestoainetta, kun ainetta käytetään sen jäätymispisteen alittavissa lämpötiloissa.*

***Huom!** Käyttö höyrystimenä*
- *Käytä virtauskytkintä ja matalapainekytkintä.*
- *Varmista veden tasainen virtaaminen ennen kompressorin käyttöä, sen aikana ja sen jälkeen käyttämällä jäätymisen estävää termostaattia ja virtausmonitoria.*
- *Vältä höyrystimen tyhjentämistä siten, että kompressoria käytetään virran katkaisun jälkeen, kunnes ennalta määritetty kylmäaineen paine on saavutettu. Tällöin lämpötila voi laskea jäähdytysliuoksen jäätymispisteen alapuolelle, mikä voi vaurioittaa höyrystintä.*

Tukkeumien ehkäiseminen
Käytä suodatinta suojaamaan laitetta mahdollisilta vierailta hiukkasilta. Jos sinulla on kysyttävää suurimmasta mahdollisesta hiukkaskoosta, ota yhteyttä lähimpään myyntiedustajaan tai toimittajaan, tai katso lisätietoja toimittajan Internet-sivujen tuotetiedoista.

Tarkastus ja käyttö

⚠ ***Varoitus:** Älä käytä lämmönvaihdinta sellaisten aineiden (esim. ionivaihdettu vesi) / asennusten (esim. galvanoidut putket) kohdalla, joihin levyt (ruostumaton teräs) ja juottomateriaali (kupari) voivat vaikuttaa (kemiallisesti/sähkökemiallisesti).*

***Huom!** Kupari voi aiheuttaa korroosiota eri materiaaleja sisältävissä asennuksissa.*

Lämpötilaan ja/tai paineeseen liittyvän väsymisen ehkäiseminen
Äkilliset lämpötilan ja paineen muutokset voivat aiheuttaa lämmönvaihtimelle väsymisvaurioita. Seuraavat asiat on siis otettava huomioon, jotta lämmönvaihdin toimisi ilman paineen/lämpötilan vaihteluita.

- Sijoita lämpötila-anturi mahdollisimman lähelle lämmönvaihtimen poistoaukkoa.
- Valitse sellaiset venttiilit ja säätölaitteet, joilla lämmönvaihtimen lämpötila/paine pysyy tasaisena.
- Paineiskujen välttämiseksi pikaventtiileitä, kuten kaksiasentoisia venttiilejä, ei pidä käyttää.
- Automatisoiduissa asennuksissa pumppujen pysäytys ja käynnistys ja venttiilien toiminta on ohjelmoitu siten, että paineenvaihteluiden amplitudi ja taajuus on mahdollisimman pieni.

Eristeet
Lämmitys- ja jäähdytyseristeitä on saatavana lisävarusteena.

Huom! *Huomaa, että eristeen ja lämmönvaihtimen lämpötilarajoitukset voivat erota toisistaan.*

Vianmääritys
Jotta lämmönvaihdin toimisi oikein, tarkista seuraavat asiat:

- Putkisto on kytketty lämmönvaihtimeen tämän oppaan ohjeiden mukaisesti.
- Lämmönvaihdin on täysin puhdas, eikä siinä ole saostumia.

Huom! *Hiukkaset ja kuidut voivat tukkia lämmönvaihtimen. Painehäviön nousu tai lämpöhyötysuhteen lasku osoittaa, että lämmönvaihdin on tukkeutunut.*

- Säätöpiiri on ajastettu oikein, eikä laite ole jäätynyt.

Puhdistus
Laite sopii kiertopesuun. Ohjeita sopivan puhdistusprosessin valintaan saat toimittajan edustajalta tai Internet-sivustosta. Laitteen käytöstä vastaavan henkilön on varmistettava, että käytössä on asianmukainen ja sopivin väliajoin toistettava puhdistusmenetelmä.

Huom! *Levyn pakkausta ei ole tarkoitettu avattavaksi.*

Tilsigtet brug

De loddede varmevekslere er beregnet til at udveksle varme for at opfylde kravene i et stort udsnit af anvendelser, for eksempel nedkøling, komfortopvarmning, industriopvarmning og -afkøling samt i procesindustrien.

Definitioner

Advarsel! *Risikotype*

⚠ *ADVARSEL indikerer en potentielt farlig situation, som, hvis den ikke undgås, kan medføre dødsfald eller alvorlig personskade.*

Forsigtig! *Risikotype*

⚠ *FORSIGTIG indikerer en potentielt farlig situation, som, hvis den ikke undgås, kan medføre mindre eller moderat personskade.*

Bemærk!

BEMÆRK indikerer en potentielt farlig situation, der, hvis den ikke undgås, kan medføre tingskade.

Navneplader

Der er forskellige typer af navneplader, afhængigt af typen af trykbeholdergodkendelse.

Bemærk!

- *Der kan benyttes andre typer af navneplader. Kontakt en Alfa Laval-repræsentant for at få detaljerede oplysninger.*
- *Nogle specifikationer benyttes ikke til alle typer navneplader*

Navnepladen viser:

1. Plads til logotype.
2. Navn på producenten.
3. Plads til den nationale myndigheds stempel og serienummer.
4. Varenummer.
5. Type.
6. Produktions- eller serienummer.
7. År og dato for fremstillingen.
8. Placeringer af tilslutninger for hver væske.
9. Maks. tilladte driftstemperaturer.
10. Maks. tilladte driftstryk.
11. Testtryk.
12. Dato for testtryk.
13. Indhold af hvert rum.
14. Tilladte driftstemperaturer og -tryk.
15. Driftsområde.
16. Beskrivelse af hvert rum.
17. Væskegruppe.
18. Entydige oplysninger om kunden.
19. Mulige placeringer af tilslutninger.
20. Stregkodeoplysninger.
21. Plads til godkendelsesmærke. (CE-mærkerne nedenfor er ikke gyldige for navneplader af type 3)
    – CE-0409 BHE Manufacturing, Ronneby, Sverige
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Jiangyin By, Kina
    – CE-0948 Alfa Laval S.p.A. Alonte, Italien.

Oversættelse af original instruktion

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Krav

Advarsel! *Varmeveksleren skal installeres og betjenes således, at der ikke opstår nogen risiko for personskade og tingskade.*

Bemærk: *Medmindre andet er angivet, gælder produktdata for normale kølemidler, dvs. HFC og HCFC, for kølingsanvendelser. Før varmeveksleren benyttes til brandbare, giftige eller farlige væsker (f.eks. kulbrinter), skal de relevante sikkerhedsforskrifter for håndtering af sådanne væsker træffes. For yderligere oplysninger henvises til leverandørens hjemmeside på internettet.*

Installation

Installationen skal udføres med udstyr, der beskytter varmeveksleren mod tryk og temperaturer uden for de godkendte minimum- og maksimumværdier, der er angivet på navnepladen.

Forsigtig! *Der skal altid bæres beskyttelseshandsker ved håndtering af loddede varmevekslere for at undgå skader på hænderne fra de skarpe kanter.*

For at opnå den bedst mulige varmeoverførsel skal varmeveksleren tilsluttes, så mediet strømmer gennem varmeveksleren i modsatte retninger (modstrøm).

Bemærk! *Inden der tilsluttes rør, skal du kontrollere, at alle fremmedlegemer er skyllet ud af systemet.*

Forsigtig! *Tag højde for risikoen for brand under installationen, dvs. vær opmærksom på brandbare stoffer.*

Forsigtig! *Løft aldrig i forbindelserne. Der skal anvendes stropper, når varmeveksleren løftes. Placer stropperne i henhold til figur 1.*

Bemærk: *Ved fordampningsanvendelser og ved anvendelser, hvor mediet undergår et faseskift, skal varmeveksleren installeres lodret med et lige rør (mindst 150-200 mm længde) mellem reduktionsventilen og kølemiddelindgangen.*

Montering

I et stift rørsystem kan mindre varmevekslere (vægt 1–6 kg) ophænges direkte i rørsystemet (figur 2A). Større varmevekslere skal sikres med støttemonteringer (figur 2D), der er beregnet til en bestemt varmeveksler (tilbehør), eller de skal sikres med stropper (figur 2C) eller ved hjælp af monteringsbolte (figur 2B). Ved særbestillinger kan monteringsbolte svejses på forsiden eller bagsiden. Tilspændingsmomentet for M6-bolte er 3,8 Nm, for M8-bolte er det 9,5 Nm, og for M10-bolte er det 19,0 Nm.

Bemærk! *Hvis der er risiko for vibrationer, skal du benytte antivibrationsmontering som vist i figur 2A.*

Bemærk! *Varmevekslere med kølemiddelfordelere skal monteres med fordeleren nederst.*

Bemærk: *Under installationen må belastningerne på forbindelserne ikke overskride værdierne i tabellen "Grænser for forbindelsesbelastninger under installation" på indersiden af forsiden.*

Bemærk! *Rørledningerne skal være solidt forankrede og ført således, at der ikke overføres belastninger til pladevarmeveksleren under drift.*

Forbindelser (figur 3)

Gevindforbindelser – Brug en skruenøgle ved tilslutningen af røret, og overhold de angivne grænseværdier. Nogle modeller leveres med Victaulic-tilslutningstypen.

Loddede forbindelser – Rengør ved at aftørre og affedte de forskellige flader. Brug en loddemetaltype, som er passende til de materialer, der loddes, og brug den rigtige loddetemperatur. For detaljerede oplysninger henvises til dokumentet “Brazing tubes for brazed heat exchanger”, eller kontakt en Alfa Laval-repræsentant.

Svejsede forbindelser – TIG- eller MIG-svejsning. Slib indersiden og ydersiden af røret samt, hvis røret er affaset, også den affasede kant mindst 25 mm fra rørets kant og indad. Dette bør gøres for at undgå kontaminering af kobber i det svejsede område, som kan forårsage sprækker i svejsningen.

Bemærk: *Beskyt varmeveksleren mod overopvarmning ved at lægge et stykke vådt stof om forbindelsen, hver gang der udføres lodde- eller svejsearbejde. For kraftig varme kan smelte det indvendige loddemetal inde i varmeveksleren. Se figur 3.*

⚠ ***Forsigtig!*** *Benyt korrekt beskyttelsesudstyr, når varmeveksleren fjernes fra rørføringssystemet, for eksempel sikkerhedsstøvler, beskyttelseshandsker og øjenbeskyttelse, afhængigt af typen af mediet inde i varmeveksleren.*

Risiko for frysning

⚠ ***Forsigtig!*** *Vær opmærksom på frysning ved lave temperaturer for at undgå beskadigelse af varmeveksleren. Varmevekslere, der ikke er i drift, skal tømmes og blæses tørre, når der er risiko for frysning.*

Bemærk: *For at undgå beskadigelse på grund af frysning skal det anvendte medie indeholde en antifrostvæske ved driftsforhold under frysepunktet for mediet.*

Bemærk: *Ved brug som fordamper*

- *Brug en gennemstrømningsafbryder og en lavtryksafbryder.*
- *Brug en antifrosttermostat og overvågning af gennemstrømningen for at sikre konstant vandgennemstrømning, før, under og efter at kompressoren har kørt.*
- *Undgå "lukning af pumpen", dvs. tømning af fordamperen ved at køre kompressoren efter lukning, før der er nået et forudindstillet kølemiddeltryk. Temperaturen kan i så fald falde til under frysepunktet for kuldebæreren, hvilket kan beskadige fordamperen.*

Beskyttelse mod tilstopning

Brug et filter som beskyttelse mod mulig tilstedeværelse af fremmedlegemer. Hvis du er i tvivl om den maksimale partikelstørrelse, skal du kontakte leverandørens nærmeste repræsentant eller se under Produktoplysninger på leverandørens hjemmeside på internettet.

Kontrol og betjening

⚠ ***Forsigtig!*** *Anvend ikke varmeveksleren til medier (f.eks. afioniseret vand)/installationer (f.eks. galvaniserede rør), der (kemisk/elektrokemisk) kan påvirke eller påvirkes af pladerne (rustfrit stål) og loddematerialet (kobber).*

Bemærk: *Kobber kan medføre korrosion i installationer med forskellige materialer*

Beskyttelse mod termisk materialetræthed og/eller tryktræthed

Pludselige temperatur- og trykændringer kan medføre metaltræthedsskader på varmeveksleren. Overvej derfor følgende for at sikre dig, at varmevekslere arbejder i et miljø uden varierende tryk/temperaturer.

- Placer temperatursensoren så tæt som muligt på varmevekslerens afgang.
- Vælg ventiler og reguleringsudstyr, der sørger for stabile temperaturer/tryk for varmeveksleren.
- For at undgå trykstød må der ikke benyttes hurtigt lukkende ventiler, f.eks. on/off-ventiler.
- I automatiske installationer skal standsning og start af pumper og aktivering af ventiler programmeres, så den resulterende amplitude og frekvens af trykvariationen er så lille som muligt.

Isolering

Varme- og kuldeisolering er tilgængelig som tilbehør.

Bemærk: *Vær opmærksom på, at temperaturgrænserne kan være forskellige for isoleringen og varmeveksleren.*

Fejlfinding

For at sikre, at varmeveksleren fungerer korrekt, skal du kontrollere, at:

- rørsystemet er tilsluttet til varmeveksleren i overensstemmelse med instruktionerne i denne manual
- varmeveksleren er helt ren og fri for aflejringer.

Bemærk: *Partikler og fibre kan tilstoppe varmeveksleren. En forøgelse i trykfaldet eller et fald i den termiske effektivitet tyder på, at varmeveksleren er snavset.*

- kontrolkredsløbet er forudindstillet korrekt, og der sker ikke frysning.

Rengøring

Udstyret er egnet til rengøring på stedet. For råd vedrørende passende rensningsprocedurer henvises til leverandørens repræsentant, eller besøg leverandørens hjemmeside på internettet. Den person, der er ansvarlig for driften, skal sikre sig, at der benyttes den rigtige metode til rengøring, og skal fastlægge passende rengøringsintervaller.

Bemærk: *Pladepakken er ikke beregnet til at blive åbnet.*

Tilsiktet bruk

De loddede varmevekslerne (BHE) er utformet for å tilfredsstille kravene på en rekke bruksområder slik som kjøling, komfortvarme, industrioppvarming og -kjøling og foredlingsindustrien.

Definisjoner

Advarsel! *Faretype*

ADVARSEL angir en potensielt farlig situasjon som, hvis den ikke unngås, kan sette liv og helse i fare.

Forsiktig! *Faretype*

FORSIKTIG angir en potensielt farlig situasjon som, hvis den ikke unngås, kan føre til mindre eller moderate skader.

Merk:

MERK angir en potensielt farlig situasjon som, hvis den ikke unngås, kan føre til skader på eiendom.

Typeskilt

Det er forskjellige typeskilt alt etter type trykktankgodkjenning.

Merk:

- *Det kan brukes andre typer typeskilt. Ta kontakt med en Alfa Laval-representant for mer informasjon.*
- *Noen spesifikasjoner brukes ikke for alle typer typeskilt*

Typeskiltet viser:

1. Plass til logo.
2. Produsentens navn.
3. Plass til nasjonalt godkjenningsstempel og serienummer.
4. Artikkelnummer.
5. Type.
6. Produksjons- eller serienummer.
7. Produksjonsdato eller -år.
8. Plassering av koblinger for hver væske.
9. Maks. tillatte driftstemperaturer.
10. Maks. tillatte driftstrykk.
11. Testtrykk.
12. Dato for trykktest.
13. Volum i hvert rom.
14. Tillatte driftstemperaturer og -trykk.
15. Driftsområde.
16. Beskrivelse av hvert rom.
17. Væskegruppe.
18. Kundespesifikk informasjon.
19. Mulige plasseringer av koblinger.
20. Strekkodeinformasjon.
21. Plass for godkjenningsmerke. (CE-merkene nedenfor gjelder ikke for typeskilt av type 3)
    – CE-0409 BHE Manufacturing, Ronneby, Sweden
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co.,Ltd, Jiangyin City, PRC
    – CE-0948 Alfa Laval S.p.A. Alonte, Italy.

Original-instruksjon

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Krav

Advarsel! *Varmeveksleren må installeres og betjenes på en slik måte at verken personell eller utstyr kan utsettes for skade.*

Merk: *Med mindre annet er angitt gjelder produktdataene for vanlige kjølemidler, dvs. HFC og HCFC, til kjøleformål. Før varmeveksleren brukes for brennbare, giftige eller skadelige væsker (f.eks. hydrokarboner), må man ta hensyn til sikkerhetsreglene for håndtering av slike væsker. Se leverandørens webside for ytterligere informasjon.*

Installasjon

Installasjonen skal ha utstyr som beskytter varmeveksleren mot trykk og temperaturer utenfor de godkjente minimums- og maksimumsverdiene som er angitt på typeskiltet.

Forsiktig! *Unngå håndskader fra skarpe kanter ved alltid å bruke beskyttelseshansker når du skal håndtere loddede varmevekslere.*

For best mulig varmeoverføringsytelse bør varmeveksleren kobles til slik at mediet går gjennom varmeveksleren i motsatte retninger (motstrømsflyt).

Merk: *Før du kobler til rør må du påse at alle fremmedlegemer er spylt ut av systemet.*

Forsiktig! *Ta hensyn til brannfaren under installasjonen, dvs. sørg for sikker avstand til brannfarlige stoffer.*

Forsiktig! *Enheten må aldri løftes etter koblingene. Det må brukes stropper ved løfting. Legg stroppene som vist i figur 1.*

Merk: *Når det brukes fordamper og faseendring av mediet, må varmeveksleren installeres vertikalt med rett rør (lengde på minst 150-200 mm) mellom ekspansjonsventilen og kjølemiddelinnløpet.*

Montering

I et fastrørsystem kan små varmevekslere (vekt på 1–6 kg) henges opp direkte i rørsystemet (figur 2A). Større varmevekslere bør festes med støttefester (figur 2D) beregnet for en bestemt varmeveksler (tilbehør) eller sikres med stropper (figur 2C) eller festebolter (figur 2B). For spesialordrer kan festeboltene sveises til fronten eller baksiden. Tiltrekkingsmomentet for M6-bolter er 3,8 Nm, M8-bolter 9,5 Nm og M10-bolter 19,0 Nm.

Merk: *Ved fare for vibrasjoner må det brukes antivibrasjonsfester, som vist i figur 2A.*

Merk: *Varmevekslere med kjølemiddelfordelere bør monteres med fordeleren nederst.*

Merk: *Under installasjonen må ikke tilkoblingsbelastningen overstige verdiene i tabellen "Grenser for tilkoblingsbelastning under installasjon" på innsiden av omslagssiden.*

Merk: *Røropplegget skal være godt forankret og utført slik at ingen belastninger overføres til platevarmeveksleren under drift.*

Tilkoblinger (figur 3)

Gjengede tilkoblinger – Bruk en momentnøkkel når du skal koble røret, og kontroller de angitte grensene. Noen modeller leveres med tilkoblinger av typen Victaulic.

Loddede tilkoblinger – Rengjør ved å gni og fjerne fettet på de ulike flatene. Bruk en loddemetallkvalitet som egner seg for materialene som loddes, og bruk riktig loddetemperatur. Hvis du ønsker mer informasjon, kan du se dokumentet “Lodde rør for loddet varmeveksler” eller kontakte en Alfa Laval-representant.

Sveisede tilkoblinger – TIG- eller MIG-sveising. Slip innsiden og utsiden av røret, og hvis den er skråskåret, også den skrå kanten minst 25 mm fra rørkanten og innover. Dette bør gjøres for å unngå forurensninger av kobber i sveiseområdet, noe som kan føre til sprekker i sveisen.

Merk: *Beskytt varmeveksleren mot overoppheting ved å legge en våt klut rundt koblingen etter loddingen eller sveisingen er utført. For stor varme kan smelte det innvendige loddemetallet i varmeveksleren. Se figur 3.*

⚠ ***Forsiktig!*** *Når du skal koble varmeveksleren fra rørsystemet, må du bruke riktig beskyttelsesutstyr, slik som vernesko, beskyttelseshansker og øyebeskyttelse, avhengig av medietypen i varmeveksleren.*

Fare for frysing

⚠ ***Forsiktig!*** *Vær klar over faren for frysing ved lave temperaturer for å unngå å skade varmeveksleren. Varmevekslere som ikke er i bruk, bør tømmes og tørrblåses når det er fare for frysing.*

Merk: *For å unngå skader grunnet frysing må mediet inneholde frostvæske når enheten brukes under frysepunktet.*

Merk: *Når den brukes som fordamper*

- *Bruk en strømningsbryter og en lavtrykksbryter.*
- *Bruk en frostsikker termostat og strømningsovervåker for å sikre konstand vannstrøm før, under og etter at kompressoren har vært i drift.*
- *Unngå "nedpumping", dvs. å tømme fordamperen ved å kjøre kompressoren etter avstenging før et forhåndsinnstilt kjølemiddeltrykk er nådd. Temperaturen kan da falle under saltvannsfrysepunktet, som kan skade fordamperen.*

Beskyttelse mot tilstopping

Bruk et filter som beskyttelse mot eventuelle fremmedlegemer. Hvis du er i tvil om den maksimale partikkelstørrelsen, kan du konsultere leverandøren eller produktinformasjonen på leverandørens webside.

Kontroll og drift

⚠ ***Forsiktig!*** *Bruk ikke varmeveksleren til medier (f.eks. avionisert vann)/installasjoner (f.eks. galvaniserte rør) som (kjemisk/elektrokjemisk) kan påvirke eller bli påvirket av platene (rustfritt stål) og loddematerialet (kobber).*

Merk: *Kobber kan generere korrosjon i installasjoner med forskjellige materialer*

Beskyttelse mot termisk og/eller trykktretthet
Brå temperatur- og trykkendringer kan gi varmeveksleren tretthetsskader. Følgende må derfor tas i betraktning for å sikre at varmevekslerne fungerer med varierende trykk/temperaturer.

- Plasser temperaturføleren så nær utløpet fra varmeveksleren som mulig.
- Velg ventiler og reguleringsutstyr som gir stabile temperaturer/trykk for varmeveksleren.
- For å unngå vannslag må det ikke brukes hurtigstengende ventiler, f.eks. koblingsventiler.
- I automatiserte installasjoner bør start og stans av pumper og betjening av ventiler programmeres slik at resulterende omfang og hyppighet i trykkvariasjonen holdes så lav som mulig.

Isolasjon
Varme- og kjøleisolasjon fås som tilbehør.

Merk: *Vær klar over at temperaturgrensene for isolasjonen og varmeveksleren kan være ulike.*

Feilsøking
For å sikre riktig ytelse fra varmeveksleren må du kontrollere at:

- rørsystemet er koblet til varmeveksleren iht. instruksjonene i denne håndboken
- varmeveksleren er helt ren og fri for avleiringer.

Merk: *Partikler og fibre kan tette igjen varmeveksleren. En økning i trykkfallet eller en reduksjon i den varmeeffektiviteten indikerer at varmeveksleren er tilsmusset.*

- kontrollkretsen er riktig innstilt og at frysing ikke forekommer.

Rengjøring
Utstyret kan rengjøres på stedet. Hvis du ønsker råd om engede rengjøringsprosesser, kan du kontakte leverandøren eller websiden til leverandøren. Den driftsansvarlige skal sørge for riktige rengjøringsmetoder og -intervaller.

Merk: *Platepakken skal ikke åpnes.*

Ενδεικνυόμενη χρήση
Οι εναλλάκτες θερμότητας με συγκόλληση (BHE) έχουν σχεδιαστεί για τη μετάδοση θερμότητας ώστε να ανταπεξέρχονται στις ανάγκες μιας μεγάλης ποικιλίας εφαρμογών όπως, ψύξη, θέρμανση, βιομηχανική θέρμανση και ψύξη και τις υπόλοιπες βιομηχανικές διαδικασίες.

Ορισμοί

Προειδοποίηση: *Τύπος κινδύνου*
Η ΠΡΟΕΙΔΟΠΟΙΗΣΗ υποδεικνύει μια ενδεχομένως επικίνδυνη κατάσταση η οποία, αν δεν αποφευχθεί, θα μπορούσε να προκαλέσει θάνατο ή σοβαρό τραυματισμό.

Προσοχή: *Τύπος κινδύνου*
Η ΠΡΟΣΟΧΗ υποδεικνύει μια ενδεχομένως επικίνδυνη κατάσταση η οποία, αν δεν αποφευχθεί, θα μπορούσε να προκαλέσει μικρό ή μέτριο τραυματισμό.

Σημείωση:
Η ΣΗΜΕΙΩΣΗ υποδεικνύει μια ενδεχομένως επικίνδυνη κατάσταση, η οποία, αν δεν αποφευχθεί, ενδέχεται να προκαλέσει υλική ζημιά.

Πινακίδες τεχνικών χαρακτηριστικών
Υπάρχουν διάφοροι τύποι πινακίδων τεχνικών χαρακτηριστικών ανάλογα με τον τύπο έγκρισης του δοχείου υπό πίεση.

Σημείωση:
- *Είναι δυνατή η χρήση διαφορετικών τύπων πινακίδων τεχνικών χαρακτηριστικών. Για αναλυτικές πληροφορίες, επικοινωνήστε με κάποιον αντιπρόσωπο της Alfa Laval.*
- *Ορισμένες προδιαγραφές δεν χρησιμοποιούνται σε όλους τους τύπους πινακίδων τεχνικών χαρακτηριστικών*

Στις πινακίδες τεχνικών χαρακτηριστικών εμφανίζεται:
1. Ο χώρος για το λογότυπο.
2. Το όνομα του κατασκευαστή.
3. Ο χώρος για τη σφραγίδα του Εθνικού συμβουλίου και το σειριακό αριθμό.
4. Ο αριθμός προϊόντος.
5. Ο τύπος.
6. Ο αριθμός κατασκευής ή σειράς.
7. Το έτος ή η ημερομηνία κατασκευής.
8. Οι θέσεις σύνδεσης για κάθε υγρό.
9. Οι μέγιστες επιτρεπόμενες θερμοκρασίες λειτουργίας.
10. Οι μέγιστες επιτρεπόμενες τιμές πίεσης λειτουργίας.
11. Η πίεση δοκιμής.
12. Η ημερομηνία της δοκιμαστικής πίεσης.
13. Ο όγκος κάθε χώρου.
14. Οι επιτρεπόμενες τιμές πίεσης και θερμοκρασίας λειτουργίας.
15. Η περιοχή λειτουργίας.
16. Η περιγραφή κάθε χώρου.
17. Η ομάδα υγρού.
18. Οι πληροφορίες που είναι μοναδικές για κάθε πελάτη.
19. Οι πιθανές θέσεις συνδέσεων.
20. Οι πληροφορίες γραμμωτού κώδικα.
21. Ο χώρος για τη σήμανση έγκρισης. (Η σήμανση CE που εμφανίζεται παρακάτω δεν είναι έγκυρη για την πινακίδα τεχνικών χαρακτηριστικών τύπου 3)
    – CE-0409 BHE Manufacturing, Ronneby, Σουηδία
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Jiangyin City, PRC
    – CE-0948 Alfa Laval S.p.A. Alonte, Ιταλία.

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Απαιτήσεις

Προειδοποίηση: *Η εγκατάσταση και ο χειρισμός του εναλλάκτη θερμότητας θα πρέπει να γίνεται με τρόπο που δεν θα προκαλέσει κίνδυνο τραυματισμού του προσωπικού ή υλικής ζημιάς.*

Σημείωση: *Αν δεν παρέχονται διαφορετικές οδηγίες, τα δεδομένα προϊόντος για τυπικά ψυκτικά μέσα, π.χ. HFC και HCFC, ισχύουν για τις εφαρμογές ψύξης. Πριν από τη χρήση του εναλλάκτη θερμότητας για εύφλεκτα, τοξικά ή επικίνδυνα υγρά (π.χ. υδρογονάνθρακες) θα πρέπει να εφαρμοστούν οι σχετικοί κανόνες ασφάλειας για το χειρισμό τέτοιου είδους υγρών. Για περαιτέρω πληροφορίες, ανατρέξτε στην τοποθεσία του προμηθευτή στο Internet.*

Εγκατάσταση

Η εγκατάσταση θα πρέπει να παρέχεται μαζί με τον εξοπλισμό που προστατεύει τον εναλλάκτη θερμότητας από τιμές πίεσης και θερμοκρασίας εκτός των εγκεκριμένων ελάχιστων και μέγιστων τιμών που εμφανίζονται στην πινακίδα τεχνικών χαρακτηριστικών.

Προσοχή: *Για την αποφυγή τραυματισμών στα χέρια από τις κοφτερές ακμές, φοράτε πάντοτε προστατευτικά γάντια όταν χειρίζεστε τους εναλλάκτες θερμότητας με συγκόλληση.*

Για τη βέλτιστη απόδοση μετάδοσης θερμότητας, ο εναλλάκτης θερμότητας θα πρέπει να συνδέεται με τρόπο ώστε το μέσα να ρέουν μέσω του εναλλάκτη θερμότητας προς αντίθετες κατευθύνσεις (αντίστροφη ροή).

Σημείωση: *Πριν συνδέσετε τους αγωγούς, βεβαιωθείτε ότι το σύστημα έχει εκπλυθεί καλά ώστε να απομακρυνθούν όλα τα ξένα σώματα.*

Προσοχή: *Λάβετε υπόψη σας τον κίνδυνο πυρκαγιάς κατά την εργασία εγκατάστασης, π.χ. υπολογίστε την απόσταση από τυχόν εύφλεκτες ουσίες.*

Προσοχή: *Μην ανυψώνεται ποτέ τη μονάδα από τις συνδέσεις. Για την ανύψωση της μονάδας πρέπει να χρησιμοποιείτε ιμάντες. Τοποθετήστε τους ιμάντες σύμφωνα με την εικόνα 1.*

Σημείωση: *Σε εφαρμογές εξατμιστών και σε εφαρμογές στις οποίες προκύπτει αλλαγή φάσης των μέσων, ο εναλλάκτης θερμότητας θα πρέπει να εγκατασταθεί κάθετα με σωλήνα σε ευθεία (μήκους τουλάχιστον 150-200 mm) μεταξύ της βαλβίδας επέκτασης και της αναρρόφησης ψυκτικού μέσου.*

Τοποθέτηση

Σε σταθερό σύστημα σωλήνων, είναι δυνατή η ανάρτηση μικρών εναλλακτών θερμότητας (με βάρος 1–6 kg) απευθείας στους αγωγούς (Εικόνα 2A). Οι μεγαλύτεροι εναλλάκτες θερμότητας θα πρέπει να ασφαλίζονται με την τοποθέτηση εξαρτημάτων υποστήριξης (Εικόνα 2D) που ενδείκνυνται για το συγκεκριμένο εναλλάκτη θερμότητας (εξάρτημα) ή να ασφαλίζονται με ιμάντες (Εικόνα 2C) ή με μπουλόνια σταθεροποίησης (Εικόνα 2B). Για ειδικές παραγγελίες, τα μπουλόνια σταθεροποίησης μπορούν να συγκολληθούν στην μπροστινή ή την πίσω πλευρά. Η ροπή σύσφιξης για μπουλόνια M6 είναι 3,8 Nm, για μπουλόνια M8 είναι 9,5 Nm και για μπουλόνια M10 19 Nm.

Σημείωση: *Εάν υπάρχει κίνδυνος δονήσεων, χρησιμοποιήστε εξαρτήματα προστασίας από τις δονήσεις με τον τρόπο που υποδεικνύεται στην εικόνα 2A.*

Σημείωση: *Οι εναλλάκτες θερμότητας με διανομείς ψυκτικού μέσου θα πρέπει να τοποθετούνται με τον διανομέα στο κάτω μέρος.*

Σημείωση: *Κατά την εγκατάσταση, τα φορτία της σύνδεσης δεν πρέπει να υπερβαίνουν τις τιμές που αναφέρονται στον πίνακα "Όρια φορτίων σύνδεσης κατά την εγκατάσταση" στο εσωτερικό του εξωφύλλου.*

Σημείωση: *Ο αγωγός πρέπει να είναι καλά στερεωμένος και τοποθετημένος, ώστε να μην μεταφέρονται φορτία στον πλακοειδή εναλλάκτη θερμότητας κατά τη διάρκεια της λειτουργίας.*

Συνδέσεις (Εικόνα 3)

Σπειροειδείς συνδέσεις – Χρησιμοποιήστε δυναμόκλειδο για τη σύνδεση του σωλήνα και παρατηρήστε τα καθοριζόμενα όρια. Ορισμένα μοντέλα παρέχονται με συνδέσεις τύπου Victaulic.

Συνδέσεις θερμοσυγκόλλησης – Καθαρίστε αφαιρώντας υπολείμματα και γράσα από τις διάφορες επιφάνειες. Χρησιμοποιήστε βαθμό συγκόλλησης μετάλλου που είναι κατάλληλος για τα υλικά που πρόκειται να συγκολλήσετε και την κατάλληλη θερμοκρασία συγκόλλησης. Για αναλυτικές πληροφορίες ανατρέξτε στο έγγραφο “Συγκόλληση αγωγών για εναλλάκτη θερμότητας με συγκόλληση” ή επικοινωνήστε με κάποιον αντιπρόσωπο της Alfa Laval.

Συνδέσεις συγκόλλησης – Συγκόλληση TIG ή MIG. Εφαρμόστε άλεση στο εσωτερικό και το εξωτερικό του σωλήνα και τα άκρα λοξοτομής, εάν υπάρχουν, τουλάχιστον κατά 25 mm από το άκρο του σωλήνα και προς το εσωτερικό. Αυτή η ενέργεια θα πρέπει να εφαρμοστεί ώστε να αποφευχθεί η μεταφορά χαλκού στην περιοχή συγκόλλησης, που θα μπορούσε να προκαλέσει το σπάσιμο της ένωσης συγκόλλησης.

Σημείωση: *Προστατεύστε τον εναλλάκτη θερμότητας από την υπερθέρμανση, τυλίγοντας ένα κομμάτι υγρού πανιού γύρω από τη σύνδεση όταν εκτελείτε εργασίες συγκόλλησης. Η υπερβολική θέρμανση θα μπορούσε να λιώσει το εσωτερικό μέταλλο του εναλλάκτη θερμότητας. Ανατρέξτε στην εικόνα 3.*

⚠ ***Προσοχή:*** *Κατά την αποσύνδεση του εναλλάκτη θερμότητας από το σύστημα σωληνώσεων, χρησιμοποιήστε κατάλληλο προστατευτικό εξοπλισμό, όπως μπότες προστασίας, προστατευτικά γάντια και προστατευτικά για τα μάτια, ανάλογα με τον τύπο των μέσων μεταφοράς θερμότητας που χρησιμοποιούνται στον εναλλάκτη θερμότητας.*

Κίνδυνος ψύξης

⚠ ***Προσοχή:*** *Λάβετε υπόψη σας τον κίνδυνο ψύξης σε χαμηλές θερμοκρασίες, ώστε να αποφευχθεί η ζημιά στον εναλλάκτη θερμότητας. Οι εναλλάκτες θερμότητας που δεν χρησιμοποιούνται θα πρέπει να αδειάζονται και να στεγνώνονται όταν υπάρχει ο κίνδυνος ψύξης.*

Σημείωση: *Για να αποφύγετε τις βλάβες εξαιτίας της ψύξης, το μέσο που χρησιμοποιείτε θα πρέπει να περιλαμβάνει αντιψυκτική ουσία, για συνθήκες χειρισμού κάτω από το αντίστοιχο σημείο ψύξης.*

Σημείωση: *Όταν χρησιμοποιείται ως εξατμιστής*

- *Χρησιμοποιήστε ένα διακόπτη ροής και ένα διακόπτη χαμηλής πίεσης.*
- *Χρησιμοποιήστε αντιψυκτικό θερμοστάτη και μια μονάδα παρακολούθησης ροής για να εξασφαλίσετε τη συνεχή ροή νερού πριν, κατά τη διάρκεια και μετά από την εκτέλεση του συμπιεστή.*
- *Αποφύγετε την "εκκένωση", δηλαδή το άδειασμα του εξατμιστή με χρήση του συμπιεστή μετά τον τερματισμό έως ότου επιτευχθεί η προκαθορισμένη πίεση του ψυκτικού μέσου. Με αυτήν την ενέργεια η θερμοκρασία θα μπορούσε να πέσει κάτω από το σημείο ψύξης της άλμης, καταστρέφοντας τον εξατμιστή.*

Προστασία από έμφραξη

Χρησιμοποιήστε φίλτρα για την προστασία από την ενδεχόμενη παρουσία ξένων σωματιδίων. Εάν έχετε απορίες σχετικά με το μέγιστο μέγεθος σωματιδίων, συμβουλευθείτε τον πιο κοντινό σας αντιπρόσωπο του προμηθευτή ή ανατρέξτε στις πληροφορίες προϊόντος στην τοποθεσία του προμηθευτή στο Internet.

Έλεγχος και λειτουργία

Προσοχή: *Μην χρησιμοποιείτε τον εναλλάκτη θερμότητας για μέσα (π.χ. απιονισμένο νερό)/ εγκαταστάσεις (π.χ. γαλβανισμένους σωλήνες) που θα μπορούσαν να επηρεάσουν (χημικά/ηλεκτροχημικά) ή να επηρεαστούν από τις πλακέτες (ανοξείδωτο ατσάλι) και το υλικό συγκόλλησης (χαλκός).*

Σημείωση: *Ο χαλκός ενδέχεται να διαβρώσει την εγκατάσταση με μεικτά υλικά*

Προστασία από την θερμική καταπόνηση ή/και την καταπόνηση από πίεση

Οι απότομες αλλαγές θερμοκρασίας και πίεσης θα μπορούσαν να προκαλέσουν βλάβες καταπόνησης στον εναλλάκτη θερμότητας. Επομένως, θα πρέπει να λαμβάνετε υπόψη σας τα ακόλουθα για να εξασφαλίσετε ότι οι εναλλάκτες θερμότητας λειτουργούν χωρίς εναλλαγές πίεσης/θερμοκρασίας.

- Τοποθετήστε τον αισθητήρα θερμοκρασίας όσο το δυνατόν πιο κοντά στην έξοδο του εναλλάκτη θερμότητας.
- Επιλέξτε βαλβίδες και ρυθμιστικό εξοπλισμό που θα παρέχει σταθερή θερμοκρασία/πίεση στον εναλλάκτη θερμότητας.
- Για να αποφύγετε το υδραυλικό πλήγμα, μην χρησιμοποιείτε βαλβίδες γρήγορου κλεισίματος, π.χ. βαλβίδες ενεργ./απενεργ.
- Σε αυτοματοποιημένες εγκαταστάσεις, η έναρξη και ο τερματισμός των αντλιών και η ενεργοποίηση των βαλβίδων θα πρέπει να προγραμματίζονται ώστε το εύρος και η συχνότητα των μεταβολών της πίεσης που προκύπτουν να είναι όσο το δυνατόν χαμηλότερες.

Μόνωση

Οι μονώσεις θερμότητας και ψύξης είναι διαθέσιμες ως εξαρτήματα.

Σημείωση: *Λάβετε υπόψη σας ότι τα όρια θερμοκρασίας της μόνωσης και του εναλλάκτη θερμότητας ενδέχεται να διαφέρουν.*

Αντιμετώπιση προβλημάτων

Για να εξασφαλίσετε τη σωστή απόδοση του εναλλάκτη θερμότητας, βεβαιωθείτε ότι:

- το σύστημα σωληνώσεων έχει συνδεθεί στον εναλλάκτη θερμότητας σύμφωνα με τις οδηγίες σε αυτό το εγχειρίδιο
- ο εναλλάκτης θερμότητας είναι απόλυτα καθαρός και απαλλαγμένος από υπολείμματα.

Σημείωση: *Σωματίδια και ίνες θα μπορούσαν να φράξουν τον εναλλάκτη θερμότητας. Τυχόν αύξηση της πτώσης πίεσης ή πτώση της θερμικής απόδοσης αποτελεί ένδειξη ότι υπάρχει βλάβη στον εναλλάκτη θερμότητας.*

- το κύκλωμα ελέγχου είναι σωστά προρυθμισμένο και δεν προκύπτει ψύξη.

Καθαρισμός

Ο εξοπλισμός είναι κατάλληλος για επιτόπιο καθαρισμό. Για συμβουλές σχετικά με τις κατάλληλες διαδικασίες καθαρισμού, συμβουλευθείτε κάποιον αντιπρόσωπο του προμηθευτή ή επισκεφθείτε την τοποθεσία του προμηθευτή στο Internet. Ο υπεύθυνος για το χειρισμό θα πρέπει να εξασφαλίσει ότι χρησιμοποιείται η σωστή μέθοδος καθαρισμού και να αποφασίσει τα κατάλληλα χρονικά διαστήματα καθαρισμού.

Σημείωση: *Το σετ πλακών δεν θα πρέπει να ανοιχθεί.*

Использование по назначению
Паяные теплообменники (BHE) предназначены для выполнения теплопередачи согласно требованиям широкого спектра областей применений, включая охлаждение, комфортный обогрев, промышленный обогрев и охлаждения, а также обрабатывающая промышленность.

Определения

***Предупреждение!** Вид опасности*
ПРЕДУПРЕЖДЕНИЕ указывает на потенциально опасную ситуацию, которая, если ее не избежать, может привести к смерти или серьезной тяжести.

***Осторожно!** Вид опасности*
ВНИМАНИЕ! указывает на потенциально опасную ситуацию, которая, если ее не избежать, может привести к легкой травме или травме средней тяжести.

Примечание.
ПРИМЕЧАНИЕ указывает на потенциально опасную ситуацию, которая, если ее не избежать, может привести к повреждению оборудования.

Приборные щитки
Существуют различные типы приборных щитков в зависимости от типа разрешения на использование резервуара высокого давления.

Примечание.
- *Могут применяться другие типы приборных щитков. Для получения дополнительных сведений обратитесь к представителю Alfa Laval.*
- *Некоторые спецификации не используются для всех типов приборных щитков*

Приборный щиток содержит следующие сведения
1. Место для логотипа.
2. Наименование производителя.
3. Место для штампа национального совета и серийного номера.
4. Номер изделия.
5. Тип.
6. Заводской или серийный номер.
7. Год или дата производства.
8. Расположение подключений для каждой жидкости.
9. Макс. допустимые значения рабочей температуры.
10. Макс. допустимые значения рабочего давления.
11. Испытательное давление.
12. Дата испытания под давлением.
13. Объем каждого пространства.
14. Допустимые значения рабочей температуры и давления.
15. Рабочая зона.
16. Описание каждого пространства.
17. Группа жидкостей.
18. Уникальная информация для заказчика.
19. Возможные расположения подключений.
20. Данные штрих-кода.
21. Место для отметки об утверждении. (Приведенные ниже отметки CE недействительны для приборного щитка типа 3)
    – CE-0409 BHE Manufacturing, Ronneby, Sweden
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Jiangyin City, PRC
    – CE-0948 Alfa Laval S.p.A. Alonte, Italy.

Оригинальная инструкция
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Требования

Предупреждение! *Теплообменник должен устанавливаться и эксплуатироваться таким образом, чтобы устранить опасность травмирования персонала и повреждения имущества.*

Примечание. *Если не указано иначе, данные о продукте, касающиеся обычных хладагентов, т. е. HFC и HCFC, применимы к холодильным системам. Прежде, чем использовать теплообменник для легковоспламеняющихся, токсичных и опасных жидкостей (например, углеводородов), необходимо выполнить соответствующие правила безопасности для обращения с такими жидкостями. Для получения дополнительных сведений см. веб-сайт поставщика.*

Установка

При установке должно применяться оборудование, защищающее теплообменник от давления и температуры, выходящих за утвержденные минимальные и максимальные величины, указанные на приборном щитке.

Осторожно! *Для того, чтобы предотвратить травмирование рук об острые края, при обращении с паяными теплообменниками следует всегда надевать защитные перчатки.*

Для достижения оптимальной эффективности теплопередачи теплообменник необходимо подключать таким образом, чтобы поток носителя проходил через теплообменник в противоположных направлениях (противотоком).

Примечание. *Перед подсоединением трубопроводов убедитесь в том, что из системы путем промывания были удалены все посторонние предметы.*

Осторожно! *Во время работ по установке необходимо учитывать опасность возгорания, т. е. следить за расстоянием до легковоспламеняющихся веществ.*

Осторожно! *Никогда не поднимайте агрегат за места соединений. Для подъема следует использовать стропы. Располагайте стропы согласно рисунку 1.*

Примечание. *В установках в качестве испарителя и в установках с фазовым переходом носителя теплообменник следует устанавливать вертикально с прямой трубой (длиной не менее 150—200 мм) между регулирующим вентилем и входом хладагента.*

Монтаж

В жесткой системе трубопроводов небольшие теплообменники (весом 1—6 кг) можно подвешивать непосредственно к трубопроводу (Рис. 2A). Более крупные теплообменники необходимо закреплять при помощи опор (Рис. 2D), предназначенных для конкретного теплообменника (принадлежность), или при помощи строп (Рис. 2C) или монтажных болтов (Рис. 2B). Для специальных заказов монтажные болты можно приваривать к передней или задней части. Момент затяжки болтов M6 составляет 3,8 Нм, болтов M8 — 9,5 Нм, а болтов M10 — 19,0 Нм.

Примечание. *При наличии риска вибрации используйте антивибрационные опоры, как показано на Рисунке 2A.*

Примечание. *Теплообменники с распределителями хладагента необходимо монтировать таким образом, чтобы распределитель находился внизу.*

Примечание: *Во время монтажа нагрузки на соединения не должны превышать значений, указанных в таблице "Ограничения нагрузок на соединения во время монтажа" на обложке.*

Примечание: *Трубопроводы должны быть надежно закреплены и эксплуатироваться таким образом, чтобы во время работы не передавались нагрузки на пластинчатый теплообменник.*

Соединения (Рис. 3)

Резьбовые соединения – Для соединения трубы используйте динамометрический ключ и соблюдайте указанные ограничения. Некоторые модели поставляются с соединениями типа виктолик.

Паяные соединения – Очистите поверхности, зачистив их шкуркой и обезжирив. Используйте твердый припой, подходящий для спаиваемых материалов, и соблюдайте надлежащую температуру пайки. Для получения дополнительных сведений см. документ «Пайка труб для паяного теплообменника» или обратитесь к представителю Alfa Laval.

Сварные соединения – Сварка ВИА или МИА. Отшлифуйте внутреннюю и наружную поверхности трубы и (при необходимости) скошенную кромку на участке не менее 25 мм от края трубы и внутрь. Это необходимо для того, чтобы предотвратить загрязнение меди в зоне сварки, что может привести к возникновению трещин в сварном шве.

Примечание. *Чтобы защитить теплообменник от перегрева, при проведении любых работ по сварке или пайке наматывайте лоскут влажной ткани вокруг соединения. Чрезмерное нагревание может вызвать плавление твердого припоя внутри теплообменника. См. Рис. 3.*

⚠ ***Осторожно!*** *При отсоединении теплообменника от системы трубопроводов используйте соответствующие средства индивидуальной защиты, такие как защитная обувь, защитные перчатки и защитные очки, в зависимости от типа теплоносителя в теплообменнике.*

Опасность замерзания

⚠ ***Осторожно!*** *Чтобы предотвратить повреждения теплообменника, помните об опасности замерзания при низких температурах. Теплообменники, не находящиеся в эксплуатации, необходимо опорожнить и осушить, поскольку существует риск замерзания.*

Примечание. *Во избежание повреждения из-за замораживания используемый носитель должен включать антифриз для условий эксплуатации ниже его точки замерзания.*

Примечание. *При использовании в качестве испарителя*

- *Используйте реле расхода и реле низкого давления.*
- *Для обеспечения постоянного потока воды до, во время и после работы компрессора следует использовать термостат антифриза и расходомер.*
- *Избегайте «откачки», т. е. опорожнения испарителя вследствие работы компрессора после остановки до достижения заданного давления хладагента. Из-за этого температура может упасть ниже точки рассольного замораживания, что приведет к повреждению испарителя.*

Защита от засорения

В качестве защиты от возможного появления посторонних частиц используйте фильтр. При возникновении сомнений относительно максимального размера частиц обратитесь к ближайшему представителю поставщика либо посмотрите раздел

«Информация о продукции» на Интернет-сайте поставщика.

Управление и эксплуатация

> ⚠ ***Осторожно!*** *Не используйте теплообменник с носителями (например, деионизированной водой) или в установках (например, с оцинкованными трубами), которые могут иметь химическое или электрохимическое воздействие на пластины (нержавеющая сталь) и твердый припой (медь) или подвергаться влиянию с их стороны.*

> ***Примечание.*** *Медь может вызывать коррозию в установке, в которой используются различные материалы.*

Защита от усталости вследствие температуры и/или давления

Внезапные изменения температуры и давления могут вызвать усталостное повреждение теплообменника. Поэтому для обеспечения работы теплообменников без колебаний давления и температуры необходимо принимать во внимание следующее.

- Расположите датчик температуры как можно ближе к выпуску теплообменника.
- Выбирайте клапаны и регулировочное оборудование, обеспечивающие в теплообменнике стабильные температуру и давление.
- Во избежание гидравлического удара не допускается использование быстрозакрывающихся клапанов, например двухпозиционных.
- В автоматизированных системах остановка и пуск насосов и приведение в действие клапанов необходимо запрограммировать так, чтобы амплитуда и частота изменений давления в итоге происходили как можно реже.

Изоляция

Тепловая и холодильная изоляция поставляются дополнительно.

> ***Примечание.*** *Учитывайте, что изоляция и теплообменник могут иметь различные ограничения температуры.*

Поиск неисправностей

Для обеспечения правильной работы теплообменника, убедитесь в следующем:

- система трубопроводов была подсоединена к теплообменнику в соответствии с инструкциями, содержащимися в руководстве по эксплуатации теплообменника;
- теплообменник идеально чист и не содержит отложений;

> ***Примечание.*** *Частицы и волокна могут засорять теплообменник. Увеличение снижения давления или снижение теплового коэффициента полезного действия свидетельствуют о засорении теплообменника.*

- контур управления настроен правильно, и не происходит замораживание.

Очистка

Оборудование пригодно для проведения очистки на месте. Для получения рекомендаций о подходящих процессах очистки обратитесь к представителю поставщика или посетите веб-сайт поставщика. Лицо, ответственное за эксплуатацию, должно обеспечивать использование надлежащего способа очистки и принимать решения в отношении подходящих интервалов очистки.

> ***Примечание.*** *Блок пластин не следует открывать.*

Przeznaczenie
Lutowane wymienniki ciepła spełniają wymogi wymiany ciepła w różnorodnych zastosowaniach, takich jak chłodzenie, ciepłownictwo, ciepłownictwo i chłodnictwo przemysłowe oraz przemysł przetwórczy.

Definicje

Zagrożenie: *Typ niebezpieczeństwa*
OSTRZEŻENIE informuje o sytuacji potencjalnie niebezpiecznej której, jeżeli nie da uniknąć, doprowadzi do poważnych obrażeń lub śmierci.

Ostrzeżenie: *Typ niebezpieczeństwa*
OSTRZEŻENIE informuje o sytuacji potencjalnie niebezpiecznej której, jeżeli nie da uniknąć, doprowadzi do drobnych lub umiarkowanych obrażeń ciała.

Uwaga:
UWAGA informuje o potencjalnie niebezpiecznej sytuacji której, jeżeli nie da się uniknąć, doprowadzi do zniszczenia własności.

Tabliczki znamionowe
Zależnie od atestu zbiornika ciśnieniowego stosowane są różne rodzaje tabliczek znamionowych.

Uwaga:
- *W konkretnym przypadku mogą być stosowane inne typy tabliczek znamionowych. Szczegółowe informacje można uzyskać u przedstawiciela Alfa Laval.*
- *Nie wszystkie specyfikacje są stosowane we wszystkich typach tabliczek znamionowych*

Tabliczka znamionowa:
1. Miejsce na logotyp.
2. Nazwa producenta.
3. Miejsce na pieczęć i numer seryjny Rady Krajowej.
4. Numer produktu.
5. Typ.
6. Numer fabryczny lub seryjny.
7. Rok lub data produkcji.
8. Miejsce podłączenia każdego obiegu cieczy.
9. Maks. dopuszczalne temperatury robocze.
10. Maks. dopuszczalne ciśnienia robocze.
11. Próba ciśnieniowa.
12. Data próby ciśnieniowej.
13. Objętość każdego obiegu.
14. Dopuszczalne temperatury i ciśnienia robocze.
15. Obszar roboczy.
16. Opis każdego obiegu.
17. Grupa czynników.
18. Szczególne informacje klienta.
19. Możliwe miejsca podłączeń.
20. Kod paskowy.
21. Miejsce na oznaczenie atestowe. (podane poniżej znaki CE nie są stosowane w tabliczkach znamionowych typu 3)
    – CE-0409 BHE Manufacturing, Ronneby, Sweden
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Jiangyin City, PRC
    – CE-0948 Alfa Laval S.p.A. Alonte, Italy.

Tłumaczenie oryginalnej instrukcji
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Wymagania

Zagrożenie: *Wymiennik ciepła należy zamontować i używać w sposób gwarantujący bezpieczeństwo personelowi i pozwalający na uniknięcie uszkodzenia mienia.*

Uwaga: *Jeśli określono inaczej, dane produktu dotyczące normalnych czynników chłodniczych, np. HFC i HCFC są odpowiednie do aplikacji chłodzenia. W przypadku użycia wymiennika ciepła z łatwopalnymi, toksycznymi lub niebezpiecznymi czynnikami (np. węglowodorami) należy przestrzegać odpowiednich zasad bezpiecznego postępowania z takimi substancjami. Więcej informacji można znaleźć na stronie internetowej dostawcy.*

Montaż

Montaż należy przeprowadzić korzystając z narzędzi, które zabezpieczą wymiennik ciepła na wypadek ciśnień i temperatur przekraczających zatwierdzone minimalne i maksymalne wartości przedstawione na tabliczce znamionowej.

Ostrzeżenie: *W celu uniknięcia ryzyka obrażeń ostrymi krawędziami, przed rozpoczęciem pracy przy lutowanych wymiennikach ciepła należy założyć rękawice ochronne.*

W celu uzyskania najlepszej wydajności wymiany ciepła, wymiennik ciepła należy podłączyć w taki sposób, aby czynniki przepływały przez wymiennik w kierunkach przeciwnych (w przeciwprądzie)..

Uwaga: *Przed podłączeniem instalacji rurowej, należy upewnić się, że z systemu wypłukano wszystkie ciała obce.*

Ostrzeżenie: *Podczas prac montażowych, należy wziąć pod uwagę niebezpieczeństwo związane z pożarem, np. pamiętać o odległościach od substancji łatwopalnych.*

Ostrzeżenie: *W żadnym wypadku nie wolno podnosić urządzenia za przyłącza. Do podnoszenia należy używać taśm. Taśmy należy rozmieścić tak, jak pokazano na ilustracji 1.*

Uwaga: *Do zastosowania wymiennika w charakterze parownika oraz w zastosowaniach, w których występuje zmiana fazy czynnika, wymiennik ciepła należy zamontować pionowo z rurą prostą (co najmniej 150-200 mm długości) między zaworem rozprężnym a wlotem chłodziwa.*

Mocowanie

W układzie sztywnym, małe wymienniki ciepła (o masie 1-6 kg) można podwiesić bezpośrednio w instalacji rurowej (Il. 2A). Większe wymienniki ciepła należy zabezpieczyć wspornikami (Il. 2D) przeznaczonymi dla danego wymiennika ciepła (akcesoria) lub zabezpieczyć taśmami (Il. 2C) albo śrubami montażowymi (Il. 2B). W przypadku zamówień specjalnych śruby montażowe można przyspawać z przodu lub z tyłu. Moment dokręcający dla śrub M6 wynosi 3,8 Nm, dla śrub M8 - 9,5 Nm oraz dla śrub M10 - 19,0 Nm.

Uwaga: *Jeśli istnieje ryzyko drgań, należy użyć wsporników przeciwdrganiowych - patrz ilustracja 2A.*

Uwaga: *Wymienniki ciepła z dystrybutorami czynnika chłodzącego, należy montować tak, by dystrybutor znajdował się u dołu.*

Uwaga: *W trakcie montażu obciążenia działające na połączenia nie mogą wykraczać poza wartości określone w tabeli „Limity obciążeń działających na połączenia podczas montażu”, zamieszczonej po wewnętrznej stronie strony tytułowej.*

Uwaga: *Instalację rurową należy prawidłowo zakotwić i wykonać tak, aby podczas montażu na płytowy wymiennik ciepła nie były przenoszone żadne obciążenia.*

Połączenia (Ilustracja 3)
Połączenia gwintowane – Do podłączenia rury należy użyć klucza dynamometrycznego i przestrzegać podanych limitów. Niektóre modele posiadają połączenia typu rurowego.
Połączenia lutowane – Czyścić poprzez odtłuszczenie i zeszlifowanie różnych powierzchni. Używać klasy lutu dostosowanej do lutowanych materiałów; lutować w odpowiedniej temperaturze. Szczegółowe informacje można znaleźć w dokumencie "Rury lutowane do lutowanego wymiennika ciepła" lub od przedstawiciela firma Alfa Laval.
Połączenia spawane – spawanie TIG lub MIG. Przeszlifować wewnętrzną i zewnętrzną powierzchnię rury, a w przypadku rur fazowanych także co najmniej 25 mm krawędzi rury do środka. Podczas tej czynności należy uważać, aby nie doszło do zanieczyszczenia miedzią spawanej powierzchni, gdyż mogłoby to spowodować pękanie spawu.

Uwaga: *Należy zabezpieczyć wymiennik ciepła przed przegrzaniem, osłaniając mokrą tkaniną połączenie podczas spawania lub lutowania. Nadmierne temperatury mogą spowodować stopienie wewnętrznego lutowania w wymienniku. Patrz il. 3.*

⚠ ***Ostrzeżenie:*** *Podczas odłączania wymiennika z instalacji rurowej należy stosować środki ochrony osobistej, takie jak buty ochronne, rękawice i gogle dostosowane do rodzaju czynnika stosowanego w wymienniku.*

Ryzyko zamarznięcia

⚠ ***Ostrzeżenie:*** *Należy pamiętać, że w niskich temperaturach istnieje ryzyko zamarznięcia wymiennika ciepła. Wymienniki ciepła, które nie są używane należy opróżnić i osuszyć z powodu ryzyka związanego z zamarzaniem.*

Uwaga: *Aby uniknąć uszkodzeń spowodowanych zamarzaniem, używany czynnik musi zawierać środek zabezpieczający przed zamarzaniem w warunkach roboczych poniżej jego temperatury zamarzania.*

Uwaga: *Jeśli wymiennik jest stosowany jako parownik*
- *Użyć przełącznika natężenia przepływu i przełącznika niskociśnieniowego.*
- *Aby zapewnić stały przepływ cieczy przed, podczas i po uruchomieniu sprężarki, należy użyć termostatu zapobiegającego przed zamarzaniem i urządzenia do monitorowania przepływu.*
- *Unikać „przestojów pompy”, np. opróżniania parownika poprzez włączenie sprężarki po wyłączeniu do momentu osiągnięcia ustalonego ciśnienia czynnika chłodniczego. Temperatura może spaść poniżej temperatury krzepnięcia, co może doprowadzić do uszkodzenia parownika.*

Zabezpieczenie na wypadek zablokowania
Jako zabezpieczenia na wypadek pojawienia się ciał obcych należy używać filtra. W razie wątpliwości dotyczących maksymalnej wielkości cząsteczek, należy skontaktować się z najbliższym przedstawicielem dostawcy lub zapoznać się z informacjami na temat produktu na stronie internetowej dostawcy.

Sterowanie i obsługa

Przestroga: *Nie wolno stosować wymiennika ciepła w przypadku czynników (np. woda demineralizowana)/ instalacji (np. rur galwanizowanych), które mogą mieć lub odczuwać wpływ (chemiczny/elektrochemiczny) płyt (ze stali nierdzewnej) oraz lutu (miedź).*

Uwaga: *Miedź może powodować korozję instalacji wykonanej z różnych materiałów*

Zabezpieczenie na wypadek zmęczenia termicznego i/ lub ciśnieniowego

Nagłe zmiany temperatury i ciśnienia mogą doprowadzić do uszkodzenia wymiennika ciepła. Z tego względu, należy sprawdzić, czy wymiennik ciepła pracuje w sposób prawidłowy, bez wahań ciśnienia i temperatury, biorąc pod uwagę poniższe zalecenia.

- Umieścić czujnik temperatury tak blisko jak to możliwe wylotu z wymiennika ciepła.
- Wybrać zawory i sprzęt regulacyjny, który stabilizuje temperatury/ciśnienia wymiennika ciepła.
- Aby uniknąć uderzenia wody, nie należy używać szybko zamykających się zaworów, np. zaworów włączania/wyłączania.
- W zautomatyzowanych instalacjach, zatrzymanie i uruchomienie pompy i uruchomienie zaworów należy zaprogramować tak, aby powstałe amplituda i częstotliwość wahań ciśnienia były jak najmniejsze.

Izolacja

Izolacje grzewcze i chłodzące są dostępne jako akcesoria.

Uwaga: *Należy mieć na uwadze, że izolacja i wymiennik ciepła mogą mieć różne limity temperatur.*

Rozwiązywanie problemów

Aby zapewnić prawidłowe działanie wymiennika, należy sprawdzić, czy:

- instalacja rurowa jest podłączona do wymiennika ciepła zgodnie z instrukcją obsługi
- wymiennik ciepła jest idealnie czysty i wolny od osadów.

Uwaga: *Drobne cząstki i włókna mogą zatkać wymiennik ciepła. Wzrost spadku ciśnienia lub spadek sprawności cieplnej wskazuje na zanieczyszczenie wymiennika.*

- obwód sterowania jest właściwie zaprogramowany i nie zamarza.

Czyszczenie

Urządzenie można czyścić w miejscu instalacji. Informacji na temat właściwych procedur czyszczących udziela przedstawiciel dostawcy, można je także znaleźć na stronie internetowej dostawcy. Za wybór właściwej metody czyszczenia i określenie częstotliwości czyszczenia urządzenia odpowiada jego operator.

Uwaga: *Nie należy otwierać pakietu płyt.*

Kavandatud kasutus
Joodetud soojusvahetid (BHE) on ette nähtud soojusülekandeks vastavalt paljude rakenduste nõuetele, nagu näiteks jahutamine, mugav küte, tööstuslik küte ja jahutus ning keemiatööstus.

Määratlused

Hoiatus! *Ohu tüüp*
HOIATUS tähistab potentsiaalselt ohtlikku olukorda, mille eiramine võib põhjustada tõsise või isegi eluohtliku vigastuse.

Ettevaatust! *Ohu tüüp*
ETTEVAATUST tähistab potentsiaalselt ohtlikku olukorda, mille eiramine võib põhjustada kergema või mõõduka vigastuse.

Tähelepanu!
TÄHELEPANU tähistab potentsiaalselt ohtlikku olukorda, mille eiramine võib põhjustada varalist kahju.

Nimesildid
Toodetel võite leida erinevaid nimesilte olenevalt surveanuma tüübikinnitusest.

Tähelepanu!
- *Kasutusel võivad olla ka muud tüüpi nimesildid. Üksikasjaliku teabe saamiseks võtke ühendust Alfa Lavali esindajaga.*
- *Mõnda spetsifikatsiooni kõigil nimesiltidel ei kasutata.*

Nimesildil on kujutatud järgmist.
1. Koht logotüübi jaoks.
2. Valmistaja nimi.
3. Koht tehnilise järelevalve inspektsiooni templi ja seerianumbri jaoks.
4. Tootetähis.
5. Tüüp.
6. Toote- või seerianumber.
7. Valmistamise aasta või kuupäev.
8. Ühenduskohad iga vedeliku jaoks.
9. Maksimaalne lubatud töötemperatuur.
10. Maksimaalne lubatud töörõhk.
11. Proovirõhk.
12. Surveproovi kuupäev.
13. Iga ruumi maht.
14. Lubatud töötemperatuur ja -rõhk.
15. Kasutuspiirkond.
16. Iga ruumi kirjeldus.
17. Vedeliku rühm.
18. Kliendipõhine teave.
19. Võimalikud ühenduskohad
20. Vöötkooditeave.
21. Vastavusmärgise koht (alltoodud CE-märgised ei kehti nimesildi tüübi 3 puhul).
    – CE-0409 BHE Manufacturing, Ronneby, Rootsi
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Jiangyin City, PRC
    – CE-0948 Alfa Laval S.p.A. Alonte, Itaalia.

Originaaljuhendi tõlge
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Nõuded

Hoiatus! *Soojusvaheti tuleb paigaldada ja kasutusele võtta nii, et sellega ei kaasne töötajate kehavigastuse ega varalise kahju ohtu.*

Tähelepanu! *Kui ei ole määratletud teisiti, kehtivad külmutusrakenduste puhul tavaliste külmutusagensite (s.t HFC ja HCFC) tooteandmed. Enne soojusvaheti kasutamist koos tuleohtlike, mürgiste või ohtlike vedelikega (nt süsivesinikega) tuleb sätestada niisuguste vedelike käitlemiseks ettenähtud ohutuseeskirjad. Lisateavet leiate tarnija veebisaidilt.*

Paigaldamine

Paigaldis tuleb varustada seadmetega, mis kaitsevad soojusvahetit nimesildil toodud miinimum- ja maksimumväärtust ületava rõhu ja temperatuuri eest.

Ettevaatust! *Teravatest servadest põhjustatud käevigastuste vältimiseks kandke joodetud soojusvaheti käsitsemisel alati kaitsekindaid.*

Parima võimaliku jõudluse tagamiseks tuleb soojusvaheti ühendada nii, et keskkonnad voolaksid läbi soojusvaheti vastupidises suunas (vastuvoolu).

Tähelepanu! *Enne torude ühendamist veenduge, et kõik võõrkehad on süsteemist välja loputatud.*

Ettevaatust! *Võtke paigaldustöödel arvesse tuleohtu, s.t hoidke tuleohtlikud ained piisaval kaugusel.*

Ettevaatust! *Ärge mingil juhul tõstke seadet ühendustest kinni võttes. Kasutage tõstmiseks tõsterihmu. Paigutage rihmad vastavalt joonisele 1.*

Tähelepanu! *Aurustites ja keskkonna faasimuutusega rakendustes tuleb soojusvaheti paigaldada vertikaalselt, nii et sirgtoru (vähemalt 150–200 mm pikkune) paikneb paisumisklapi ja külmutusagensi sisselaske vahel.*

Paigaldamine

Jäigas torusüsteemis võib väikese soojusvaheti (kaaluga 1–6 kg) riputada vahetult torustiku külge (joonis 2A). Suuremad soojusvahetid tuleb kinnitada konkreetse soojusvaheti (lisaseadme) jaoks ettenähtud tugiarmatuuri abil (joonis 2D), rihmadega (joonis 2C) või paigalduspoltidega (joonis 2B). Eritellimusel võib paigalduspoldid keevitada seadme esi- või tagaossa. Pingutusmoment on poltidel M6 3,8 Nm, poltidel M8 9,5 Nm ja poltidel M10 19,0 Nm.

Märkus. *Vibratsiooniohu korral kasutage vibratsioonikindlat armatuuri, nagu näha joonisel 2A.*

Märkus. *Külmutusagensi jaoturiga varustatud soojusvaheti tuleb paigaldada nii, et jaotur jääb allossa.*

Märkus. *Paigaldamise ajal ei tohi ühenduskoormused ületada tiitellehe siseküljel asuvas tabelis „Ühenduskoormuste piirnormid paigaldamise ajal" esitatud väärtuseid.*

Märkus. *Torustik peab olema hästi kinnitatud ja teostatud, et käitamise ajal ei kanduks mingisugune koormus üle plaatsoojusvahetile.*

Ühendused (joonis 3)

Keermesühendused – kasutage toru ühendamisel momendimõõtevõtit ning jälgige ettenähtud piire. Mõni mudel on varustatud Victaulic-tüüpi ühendustega.

Jooteühendused – puhastage hoolikalt, siludes ja rasvatustades ühenduspindu. Kasutage joodetavate materjalide jaoks sobivat joodisemarki ja õiget jootetemperatuuri. Üksikasjalikumat teavet leiate dokumendist „Torude jootmine joodetud soojusvaheti jaoks" või võtke ühendust Alfa Lavali esindajaga.

Keevisühendused – TIG-keevitus (sulamatu elektroodiga kaarkeevitus inertgaasis) või MIG-keevitus (sulavelektroodiga kaarkeevitus inertgaasis). Lihvige toru seest- ja väljastpoolt; kaldserva puhul ka kaldserva vähemalt 25 mm toru otsast sissepoole. See on vajalik vasesaaste vältimiseks keevise piirkonnas, mis võib põhjustada keevisliite pragunemise.

Tähelepanu! *Kaitske soojusvahetit ülekuumenemise eest, mähkides joote- või keevitustööde tegemisel ühenduskoha ümber märja riidetüki. Liigkuumus võib sulatada sisemise joodise soojusvaheti sisemusse. Lisateavet leiate jooniselt 3.*

⚠ ***Ettevaatust!*** *Soojusvaheti lahutamisel torusüsteemist kasutage sobivat kaitsevarustust olenevalt soojusvaheti keskkonna tüübist – näiteks kaitsejalatseid, kaitsekindaid ja kaitseprille.*

Külmumisoht

⚠ ***Ettevaatust!*** *Soojusvaheti kahjustuste vältimiseks arvestage külmumisohuga madalal temperatuuril. Külmumisohu korral tühjendage parajasti mittekasutatavad soojusvahetid ja kuivatage läbipuhumise abil.*

Tähelepanu! *Kui töökoha temperatuur langeb alla kasutatava keskkonna külmumistemperatuuri, tuleb külmakahjustuste vältimiseks keskkonnale lisada antifriisi.*

Tähelepanu! *Aurustina kasutamine*

- *Kasutage voolülitit ja madalrõhulülitit.*
- *Kasutage külmumistermostaati ja voolukulu seireseadet püsiva veevoolu tagamiseks enne kompressori käivitamist, kompressori töö ajal ja pärast väljalülitamist.*
- *Vältige „tühjakspumpamist", s.t aurusti tühjendamist kompressori käitamisega pärast väljalülitamist kuni külmutusagensi rõhu eelsätte saavutamiseni. Selle tagajärjel võib temperatuur langeda alla soolalahuse külmumistemperatuuri ja aurustit kahjustada.*

Kaitse ummistuste vastu

Kasutage filtrit, mis kaitseb kõrvaliste osakeste võimaliku juurdepääsu eest. Kui teil on kahtlusi osakeste maksimaalse suuruse suhtes, pidage nõu tarnija lähima esindajaga või uurige tooteteavet tarnija veebisaidil.

Kasutamine ja järelevalve

⚠ ***Ettevaatust!*** *Ärge kasutage soojusvahetit keskkonna (nt deioniseeritud vesi) või paigaldiste (nt tsingitud torud) puhul, mis võivad keemiliselt või elektrokeemiliselt mõjutada plaate (roostevaba teras) ja jootematerjali (vask) või nendega mitte ühilduda.*

Tähelepanu! *Vask võib tekitada segamaterjalist valmistatud paigaldises korrosiooni.*

Kaitse termilise ja/või rõhust tingitud väsimuse eest

Temperatuuri ja rõhu äkilised muudatused võivad põhjustada soojusvahetis väsimuskahjustusi. Seetõttu tuleb kindlustada soojusvaheti töö rõhu ja temperatuuri oluliste kõikumisteta, võttes arvesse järgmist:

- paigutage temperatuuriandur soojusvaheti väljalaskele võimalikult lähedale;
- valige klapid ja regulaatorid, mis tagavad soojusvahetis stabiilse temperatuuri ja rõhu;
- hoiduge hüdrauliliste löökide vältimiseks kiirsulgeklappide, näiteks sulgearmatuuri kasutamisest;
- automaatsüsteemi paigaldamisel tuleb pumpade seiskamine ja käivitamine ning klappide juhtimine programmeerida nii, et tulemuseks olevate rõhumuutuste amplituud ja sagedus jääksid võimalikult väikseks.

Isoleerimine

Soojus- ja jahutusisolatsioon on saadaval lisavarustusena.

Tähelepanu! *Võtke arvesse, et isolatsiooni ja soojusvaheti temperatuuripiirid võivad olla erinevad.*

Rikkeotsing

Soojusvaheti õige jõudluse tagamiseks kontrollige järgmist:

- torusüsteem on soojusvahetiga ühendatud käesoleva kasutusjuhendi kohaselt;
- soojusvaheti on täiesti puhas ja settevaba;

Tähelepanu! *Osakesed ja kiud võivad soojusvaheti ummistada. Rõhulangu kasv või soojusliku kasuteguri langus näitavad, et soojusvaheti ei ole töökorras.*

- juhtimisahel on õigesti häälestatud ja külmumist ei esine.

Puhastamine

Seadet saab puhastada kohapeal. Lisateabe saamiseks sobivate puhastustoimingute kohta võtke ühendust tarnija esindajaga või külastage tarnija veebisaiti. Soojusvaheti kasutamise eest vastutav isik peab tagama õige puhastusmeetodi rakendamise ja määrama sobiva puhastusvälba.

Tähelepanu! *Plaadipakett ei ole mõeldud avamiseks.*

Paskirtis

Lituotieji šilumokaičiai (LŠM) yra skirti šilumai perduoti ir naudojami įvairiems poreikiams tenkinti, pvz., šaldymo, patalpų šildymo, pramoninio šildymo ir aušinimo bei perdirbimo pramonės poreikiams.

Apibrėžtys

Įspėjimas: *Pavojaus tipas*

ĮSPĖJIMAS žymi potencialiai pavojingą situaciją, kuri gali sukelti mirtį ar sunkią traumą.

Perspėjimas: *Pavojaus tipas*

PERSPĖJIMAS žymi potencialiai pavojingą situaciją, kuri gali sukelti nesunkią arba vidutinio sunkumo traumą.

Pastaba:

PASTABA žymi potencialiai pavojingą situaciją, kuri gali padaryti žalos turtui.

Gamyklinė lentelė

Priklausomai nuo slėginio indo tipo patvirtinimo, naudojamos skirtingos gamyklinės lentelės.

Pastaba:

- *Gali būti naudojamos kitų tipų gamyklinės lentelės. Dėl išsamios informacijos kreipkitės į „Alfa Laval“ atstovą.*
- *Kai kurie techniniai duomenys nurodomi ne visų tipų gamyklinėse lentelėse.*

Gamyklinėje lentelėje būna nurodyta:

1. Vieta logotipui.
2. Gamintojo pavadinimas.
3. Vieta nacionalinės tarybos spaudui ir serijos numeriui.
4. Gaminio numeris.
5. Tipas.
6. Gamybinis arba serijos numeris.
7. Pagaminimo metai arba data.
8. Kiekvieno skysčio jungčių išdėstymas.
9. Didžiausiosios leidžiamosios darbinės temperatūros vertės.
10. Didžiausiojo leidžiamojo darbinio slėgio vertės.
11. Bandymo slėgis.
12. Slėginio bandymo data.
13. Kiekvienos ertmės tūris.
14. Leidžiamosios darbinės temperatūros ir slėgio vertės.
15. Įrangos zona.
16. Kiekvienos ertmės aprašas.
17. Skysčių grupė.
18. Paties užsakovo informacija.
19. Galimas jungčių išdėstymas.
20. Brūkšninio kodo informacija.
21. Vieta patvirtinimo ženklui. (Toliau pateikti CE ženklai negalioja 3 tipo gamyklinei lentelei)
    – CE-0409 „BHE Manufacturing“, Ronneby, Švedija
    – CE-0036 „Alfa Laval (Jiangyin) Manufacturing Co. Ltd“, Jiangyin City, Kinijos LR
    – CE-0948 „Alfa Laval S.p.A.“, Alonte, Italija.

Pradinės instrukcijos vertimas

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Reikalavimai

> ⚠ ***Įspėjimas:*** *šilumokaitis turi būti įrengtas ir eksploatuojamas taip, kad nekeltų darbuotojų traumos ir žalos turtui pavojaus.*

> ***Pastaba:*** *jei nenurodyta kitaip, naudojant prietaisą šaldymui taikomi įprastų šaldalų, t. y. HFC ir HCFC, duomenys. Prieš naudojant šilumokaitį degiesiems, nuodingiesiems ar pavojingiesiems skysčiams (pvz., angliavandeniams), būtina atsižvelgti į tokių skysčių tvarkymui taikomas saugos taisykles. Išsamesnės informacijos prašome ieškoti tiekėjo interneto svetainėje.*

Įrengimas

Įrengiant šilumokaitį, būtina sumontuoti įrangą, kuri apsaugotų jį nuo slėgio ir temperatūros, neatitinkančių gamyklinėje lentelėje nurodytų patvirtintų mažiausiųjų ir didžiausiųjų verčių.

> ⚠ ***Perspėjimas:*** *dirbdami su lituotaisiais šilumokaičiais, visada mūvėkite apsaugines pirštines, kad nesusižeistumėte rankų į aštrias briaunas.*

Kiek galima geresnio šilumos perdavimo sumetimais šilumokaitį visada reikia prijungti taip, kad terpės tekėtų per šilumokaitį priešingomis kryptimis (priešpriešiniu srautu).

> ***Pastaba:*** *prieš prijungdami bet kokius vamzdžius, sistemą būtinai praplaukite ir pašalinkite visus teršalus.*

> ⚠ ***Perspėjimas:*** *įrengdami šilumokaitį, atsižvelkite į gaisro pavojų, t. y. turėkite omenyje atstumą iki degiųjų medžiagų.*

> ⚠ ***Perspėjimas:*** *niekada nekelkite šilumokaičio paėmę už jungčių. Keliant reikia naudoti diržus. Šilumokaitį apjuoskite diržais taip, kaip pavaizduota 1 paveiksle.*

> ***Pastaba:*** *naudojant šilumokaitį garintuve ir kitais atvejais, kai keičiasi terpių būvis, šilumokaitį reikia montuoti vertikaliai, o tarp plėtimosi vožtuvo ir šaldalo įvado turi būti sumontuotas tiesus vamzdis (ne trumpesnis kaip 150–200 mm).*

Tvirtinimas

Standžiojoje vamzdžių sistemoje nedideli šilumokaičiai (sveriantys 1–6 kg) gali būti tvirtinami tiesiogiai prie vamzdyno (2A pav.). Didesnius šilumokaičius reikia pritvirtinti atraminiais laikikliais (2D pav.), skirtais konkrečiam šilumokaičiui (priedais), diržais (2C pav.) arba tvirtinimo varžtais (2B pav.). Pagal specialų užsakymą tvirtinimo varžtai gali būti privirinti prie priekinės arba užpakalinės pusės. M6 varžtų užveržimo sūkio momentas yra 3,8 Nm, M8 varžtų – 9,5 Nm, o M10 varžtų – 19,0 Nm.

> ***Pastaba:*** *jei egzistuoja vibracijos pavojus, naudokite antivibracinius laikiklius, kaip pavaizduota 2A paveiksle.*

> ***Pastaba:*** *šilumokaičius su šaldalo skirstytuvais reikia montuoti taip, kad skirstytuvas būtų apačioje.*

> ***Pastaba:*** *montavimo metu jungties apkrovos negali viršyti verčių, nurodytų jungčių apkrovų montavimo metu ribinių verčių lentelėje, pateiktoje vidinėje viršelio pusėje.*

> ***Pastaba:*** *vamzdžiai turi būti gerai pritvirtinti ir sujungiami taip, kad naudojimo metu šilumokaičio plokštė nebūtų veikiama apkrovos.*

Jungtys (3 pav.)

Srieginės jungtys – vamzdžiui prijungti naudokite dinamometrinį raktą ir laikykitės nustatytų apribojimų. Kai kurie modeliai tiekiami su „Victaulic“ tipo jungtimis.

Lituotosios jungtys – įvairius paviršius nuvalykite nušveisdami ir pašalindami riebalus. Naudokite tokios rūšies lydmetalį, kuris tinka lituojamoms medžiagoms, ir lituokite tinkamoje temperatūroje. Išsamios informacijos ieškokite dokumente „Lituotajam šilumokaičiui skirtų vamzdžių litavimas“ arba kreipkitės į „Alfa Laval“ atstovą.

Suvirintosios jungtys – suvirinimas volframo (TIG) arba lydžiuoju (MIG) elektrodu inertinėse dujose. Nušlifuokite vamzdžio vidų ir išorę, o jei vamzdis yra su nuosklemba, nušlifuokite ir nusklembtąjį kraštą ne mažiau kaip 25 mm nuo vamzdžio krašto į vidaus pusę. Tai būtina norint išvengti vario užteršimo suvirintoje srityje, dėl kurio suvirinimo siūlė gali įtrūkti.

Pastaba: *atlikdami litavimo ar suvirinimo darbus, šilumokaitį apsaugokite nuo perkaitimo apvyniodami aplink jungtį šlapią skudurą. Per didelis karštis gali išlydyti šilumokaičio viduje esantį lydmetalį. Žr. 3 paveikslą.*

Perspėjimas: *atjungdami šilumokaitį nuo vamzdyno sistemos naudokite tinkamas apsaugos priemones, pvz., apsauginius batus, apsaugines pirštines ir akių apsaugos priemonę, priklausomai nuo to, kokios rūšies terpės naudojamos šilumokaityje.*

Užšalimo pavojus

Perspėjimas: *siekdami išvengti šilumokaičio sugadinimo, turėkite omenyje užšalimo pavojų esant žemai temperatūrai. Visais atvejais, kai egzistuoja užšalimo pavojus, iš nenaudojamų šilumokaičių reikia išleisti skystį ir prapučiant išdžiovinti.*

Pastaba: *siekiant išvengti sugadinimo dėl užšalimo, į naudojamą terpę reikia įpilti antifrizo, jei įrenginys eksploatuojamas esant temperatūrai, žemesnei už terpės užšalimo temperatūrą.*

Pastaba: *kai įrenginys naudojamas kaip garintuvas*

- *Naudokite srauto jungiklį ir mažo slėgio jungiklį.*
- *Naudokite antifrizo temperatūros relę ir srauto kontrolės prietaisą, kad užtikrintumėte nepertraukiamą vandens srautą prieš įjungiant kompresorių, jam veikiant ir jį išjungus.*
- *Stenkitės „neišpumpuoti“, t. y. neištuštinti garintuvo palikdami kompresorių įjungtą po šilumokaičio išjungimo, kol bus pasiektas iš anksto nustatytas šaldalo slėgis. Tokiu atveju temperatūra gali nukristi žemiau sūrymo užšalimo temperatūros ir dėl to garintuvas gali sugesti.*

Apsauga nuo užsikimšimo

Kaip apsaugos nuo galimų pašalinių dalelių priemonę naudokite filtrą. Jei tiksliai nežinote didžiausiojo dalelių skersmens, kreipkitės į artimiausią tiekėjo atstovą arba paieškokite informacijos tiekėjo interneto svetainės skyriuje „Informacija apie gaminius“.

Valdymas ir eksploatavimas

Perspėjimas: *nenaudokite šio šilumokaičio su terpėmis (pvz., dejonizuotu vandeniu) ir įrenginiais (pvz., cinkuotojo plieno vamzdžiais), kurie (chemiškai ir (arba) elektrochemiškai) gali paveikti arba kuriuos gali paveikti plokštelės (iš nerūdijančiojo plieno) ir lydmetalis (varis).*

Pastaba: *įrenginyje, kuriame naudojamos mišrios medžiagos, varis gali sukelti koroziją.*

Apsauga nuo šiluminio ir (arba) slėginio nuovargio
Staigūs temperatūros ir slėgio pokyčiai gali sukelti šilumokaičio gedimą dėl nuovargio. Dėl šios priežasties būtina atsižvelgti į toliau pateiktus nurodymus, siekiant, kad eksploatuojami šilumokaičiai nepatirtų slėgio ir temperatūros svyravimų poveikio.

- Temperatūros jutiklį įtaisykite kiek galima arčiau šilumokaičio išleidimo angos.
- Parinkite vožtuvus ir reguliavimo prietaisus, kurie užtikrintų šilumokaičio eksploatavimą pastovios temperatūros ir slėgio sąlygomis.
- Siekiant išvengti hidraulinių smūgių, negalima naudoti greitaveikių uždarymo vožtuvų, pvz., įjungimo ir išjungimo vožtuvų.
- Automatinių įrenginių siurblių išjungimą ir įjungimą bei vožtuvų įjungimą reikia užprogramuoti taip, kad susidaranti slėgio svyravimo amplitudė ir dažnis būtų kiek galima žemesni.

Izoliacija
Šildymo izoliacija ir aušinimo izoliacija tiekiamos kaip priedai.

Pastaba: *turėkite omenyje, kad izoliacijos ir šilumokaičio temperatūros ribinės vertės gali būti skirtingos.*

Gedimų paieška ir šalinimas
Siekdami užtikrinti nepriekaištingą šilumokaičio veikimą, patikrinkite, ar:

- vamzdyno sistema yra prijungta prie šilumokaičio pagal šiame vadove pateiktus nurodymus;
- šilumokaitis yra idealiai švarus ir jame nėra nuosėdų;

Pastaba: *dalelės ir plaušeliai gali užkimšti šilumokaitį. Per didelis slėgio kritimas arba šiluminio efektyvumo sumažėjimas yra šilumokaičio užsikimšimo požymiai.*

- valdymo grandinė yra tinkamai nustatyta ir įrenginys neužšąla.

Valymas
Šią įrangą galima valyti eksploatavimo vietoje. Dėl tinkamų valymo procedūrų pasitarkite su tiekėjo atstovu arba apsilankykite tiekėjo interneto svetainėje. Už eksploatavimą atsakingas asmuo turi užtikrinti, kad būtų taikomas tinkamas valymo būdas, ir nustatyti tinkamus valymo intervalus.

Pastaba: *plokštelių paketo negalima ardyti.*

Paredzētais lietojums

Lodētie siltummaiņi (BHE) ir izstrādāti, lai veiktu siltuma pārnesi atbilstoši plaša lietojuma prasībām, piemēram, saldēšanai, komforta apsildei, industriālai apsildei un atdzesēšanai, kā arī apstrādes rūpniecībā.

Formulējumi

Brīdinājums! *Bīstamības veids*

BRĪDINĀJUMS norāda potenciāli bīstamu situāciju, kas var izraisīt nāvi vai smagus ievainojumus, ja šī situācija netiek novērsta.

Uzmanību! *Bīstamības veids*

UZMANĪBU norāda potenciāli bīstamu situāciju, kas var izraisīt nelielus vai vidēji smagus ievainojumus.

Piezīme.

PIEZĪME norāda potenciāli bīstamu situāciju, kas var izraisīt īpašuma bojājumus, ja šī situācija netiek novērsta.

Nosaukuma plāksnes

Atkarībā no apstiprinātā spiediena rezervuāra ir dažādi nosaukuma plākšņu tipi.

Piezīme.

- *Var tikt izmantoti citi nosaukuma plākšņu tipi. Lai iegūtu detalizētu informāciju, sazinieties ar Alfa Laval pārstāvi.*
- *Dažas specifikācijas netiek izmantotas visiem nosaukuma plākšņu tipiem*

Nosaukuma plāksnē ir šāda informācija:

1. Vieta logotipam.
2. Ražotāja nosaukums.
3. Vieta Nacionālās padomes zīmogam un sērijas numuram.
4. Artikula numurs.
5. Tips.
6. Ražošanas vai sērijas numurs.
7. Ražošanas gads vai datums.
8. Savienojuma vietas katram šķidrumam.
9. Maks. pieļaujamās darba temperatūras.
10. Maks. pieļaujamais darba spiediens.
11. Spiediena pārbaude.
12. Spiediena pārbaudes datums.
13. Katras vietas apjoms.
14. Pieļaujamās darba temperatūras un spiedieni.
15. Darbības zona.
16. Katras vietas apraksts.
17. Šķidruma grupa.
18. Unikāla informācija klientam.
19. Iespējamās pieslēgvietas.
20. Svītrkoda informācija.
21. Vieta, kas paredzēta apstiprināšanas marķējumam. (Tālāk norādītais CE marķējums nav derīgs nosaukuma plāksnes 3. tipam.)
    – CE-0409 BHE Manufacturing, Ronneby, Sweden
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Jiangyin City, PRC
    – CE-0948 Alfa Laval S.p.A. Alonte, Italy.

Oriģinālā rokasgrāmata

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Prasības

Brīdinājums! *Siltummainis jāuzstāda un jādarbina tā, lai nerastos ievainojumu risks personālam un īpašuma bojājumu risks.*

Piezīme. *Parasto aukstumaģentu, piem., HFC un HCFC, produktu dati attiecas uz lietojumu saldēšanā, ja vien nav norādīts citādi. Pirms siltummainis tiek izmantots ar viegli uzliesmojošiem, toksiskiem vai bīstamiem šķidrumiem (piemēram, ogļūdeņradi), jāievēro atbilstošie drošības noteikumi darbībai ar šādiem šķidrumiem. Papildinformāciju, lūdzu, skatiet piegādātāja interneta vietnē.*

Uzstādīšana

Uzstādīšana jāveic ar aprīkojumu, kas aizsargā siltummaini pret spiedienu un temperatūrām ārpus nosaukuma plāksnē norādītajām apstiprinātajām minimālajām un maksimālajām vērtībām.

Uzmanību! *Lai izvairītos no asu stūru radītiem roku ievainojumiem, vienmēr jāvalkā aizsargcimdi, kad strādājat ar lodētiem siltummaiņiem.*

Lai iegūtu labāko iespējamo siltuma pārnesi, siltummainis jāpievieno tā, lai šķidrums plūstu caur siltummaini pretējos virzienos (pretplūsmā).

Piezīme. *Pirms cauruļu savienošanas pārliecinieties, ka visi svešķermeņi ir izskaloti no sistēmas.*

Uzmanību! *Ņemiet vērā, ka uzstādīšanas laikā pastāv ugunsgrēka risks, proti — ievērojiet attālumu līdz uzliesmojošām vielām.*

Uzmanību! *Nekad neceliet aiz savienojumiem. Siksnas jāizmanto tad, kad paredzēts pacelt. Uzlieciet siksnas atbilstoši 1. attēlam.*

Piezīme. *Iztvaikotājos un iekārtās, kur notiek šķidruma fāzes maiņa, siltummainis jāuzstāda vertikāli ar taisnu cauruli (vismaz 150-200 mm garumā) starp izplešanās vārstu un aukstumaģenta ieplūdi.*

Montāža

Stingru cauruļu sistēmā nelielus siltummaiņus (svars 1–6 kg) var nostiprināt tieši uz caurulēm (2A attēls). Lielākus siltummaiņus jānostiprina ar atbalsta stiprinājumiem (2D attēls), kas paredzēti konkrētajam siltummainim (piederums), vai jānostiprina ar siksnām (2C attēls) vai montāžas skrūvēm (2B attēls).
Pēc īpaša pasūtījuma montāžas skrūves var tikt piemetinātas priekšpusē vai aizmugurē. Pievilkšanas moments M6 skrūvēm ir 3,8 Nm, M8 skrūvēm — 9,5 Nm, bet M10 skrūvēm — 19,0 Nm.

Piezīme. *Ja pastāv vibrācijas risks, izmantojiet pretvibrācijas stiprinājumus, kā norādīts 2A attēlā.*

Piezīme. *Siltummaiņus ar aukstumaģenta sadalītāju jāmontē tā, lai sadalītājs atrastos apakšā.*

Piezīme. *Uzstādīšanas laikā savienojumu noslodze nedrīkst pārsniegt vērtības, kas norādītas tabulā vāka iekšpusē "Savienojumu noslodzes robežvērtības uzstādīšanas laikā".*

Piezīme. *Cauruļvadu sistēmai jābūt labi nostiprinātai un ierīkotai tā, lai ekspluatācijas laikā plākšņu siltummainis netiktu noslogots.*

Savienojumi (3. attēls)
Vītņsavienojumi — izmantojiet uzgriežņu atslēgu, kad pievienojat cauruli, un ievērojiet norādītos ierobežojumus. Daži modeļi tiek piegādāti ar Victaulic tipa savienojumiem.
Lodēti savienojumi — veiciet tīrīšanu, noberžot dažādās virsmas un notīrot no tām smērvielas. Izmantojiet lodējamajiem materiāliem atbilstošos lodēšanas metālus un pareizo lodēšanas temperatūru. Lai iegūtu detalizētu informāciju, skatiet dokumentu "Cauruļu lodēšana lodētajam siltummainim" vai sazinieties ar Alfa Laval pārstāvi.
Metināti savienojumi — TIG vai MIG metināšana. Režģis caurules iekšpusē un ārpusē, kā arī, ja pastāv slīpums, slīpā mala vismaz 25 mm no caurules malas un uz iekšpusi. Šie stiprinājumi jāpiemetina, lai novērstu vara piesārņojumu metināšanas zonā, jo tas var izraisīt metinājuma lūzumu.

Piezīme. *Aizsargājiet siltummaini pret pārkaršanu, aptinot mitru drānu ap savienojuma vietu, kad tiek veikti lodēšanas vai metināšanas darbi. Pārāk liels karstums var izkausēt iekšējo lodēšanas metālu siltummaiņa iekšpusē. Skatiet 3. attēlu.*

⚠ ***Uzmanību!*** *Atvienojot siltummaini no cauruļu sistēmas, izmantojiet piemērotu aizsargaprīkojumu, piemēram, aizsargzābakus, aizsargcimdus un acu aizsargu, atkarībā no siltummainī esošā šķidruma veida.*

Sasalšanas risks

⚠ ***Uzmanību!*** *Ievērojiet, ka pie zemām temperatūrām pastāv sasalšanas risks, lai novērstu siltummaiņa bojājumus. Siltummaiņus, kas netiek izmantoti, ir jāiztukšo un jāizžāvē, kad pastāv sasalšanas risks.*

Piezīme. *Lai novērstu sasalšanas radītus bojājumus, izmantotajam šķidrumam jāsatur antifrīzs, kad darba apstākļi ir zem šķidruma sasalšanas punkta.*

Piezīme. *Kad tiek izmantots kā iztvaikotājs*
- *Izmantojiet plūsmas slēdzi un zema spiediena slēdzi.*
- *Izmantojiet antifrīza termostatu un plūsmas kontrolierīci, lai nodrošinātu nemainīgu ūdens plūsmu pirms un pēc kompresora palaišanas, kā arī tā darbības laikā.*
- *Izvairieties no "izsūknēšanas", t.i., no iztvaikotāja iztukšošanas, darbinot kompresoru pēc izslēgšanas, līdz ir sasniegts iepriekšnoteikts aukstumaģenta spiediens. Temperatūra var samazināties zem sālsūdens sasalšanas punkta, kas var izraisīt iztvaikotāja bojājumus.*

Aizsardzība pret aizsprostošanos
Izmantojiet filtru kā aizsardzību pret iespējamu svešķermeņu daļiņu iekļūšanu. Ja radušās šaubas saistībā ar maksimālo daļiņu lielumu, sazinieties ar tuvāko piegādātāja pārstāvi vai skatiet sadaļu par produkta informāciju piegādātāja interneta vietnē.

Kontrole un darbība

⚠ ***Uzmanību!*** *Neizmantojiet siltummaini ar šķidrumiem (piemēram, dejonizētu ūdeni) vai instalācijās (piemēram, galvanizētās caurulēs), kas (ķīmiski/elektroķīmiski) var ietekmēt vai ko var ietekmēt plāksnes (nerūsējošais tērauds) un lodēšanas materiāls (varš).*

Piezīme. *Varš var izraisīt koroziju instalācijai ar sajauktiem materiāliem*

Aizsardzība pret termisku vai/un spiediena izraisītu nogurumu

Pēkšņas temperatūras un spiediena izmaiņas var izraisīt noguruma radītus siltummaiņa bojājumus. Tādēļ, lai nodrošinātu, ka siltummaiņi darbojas bez straujām spiediena/temperatūras izmaiņām, jāņem vērā šādi nosacījumi.

- Novietojiet temperatūras sensoru maksimāli tuvu siltummaiņa izplūdei.
- Izvēlieties vārstus un regulēšanas aprīkojumu, kas siltummainim nodrošina stabilu temperatūru/ spiedienu.
- Lai izvairītos no hidrauliskā trieciena, nedrīkst izmantot ātri noslēdzamos vārstus, piem., divpozīciju vārstus.
- Automatizētās instalācijās sūkņu ieslēgšanai un izslēgšanai un vārstu aktivizēšanai jābūt programmētai tā, lai spiediena amplitūda un frekvence būtu iespējami zema.

Izolācija

Siltumizolācija un aukstumizolācija ir pieejama kā piederums.

Piezīme. *Ņemiet vērā, ka izolācijas un siltummaiņa temperatūras ierobežojumi var atšķirties.*

Problēmu novēršana

Lai nodrošinātu siltummaiņa pareizu darbību, pārbaudiet, vai:

- cauruļu sistēma ir savienota ar siltummaini atbilstoši šajā rokasgrāmatā minētajām instrukcijām;
- siltummainis ir pilnībā tīrs un tajā nav nosēdumu;

Piezīme. *Daļiņas un šķiedras var aizsprostot siltummaini. Straujš spiediena kritums vai termiskās efektivitātes kritums norāda, ka siltummainis ir bojāts.*

- kontroles kontūrs ir pareizi iestatīts un nepastāv sasalšanas risks.

Tīrīšana

Šis aprīkojums ir piemērots tīrīšanai lietojuma vietā. Lai iegūtu ieteikumus par piemērotām tīrīšanas procedūrām, sazinieties ar piegādātāja pārstāvi vai apmeklējiet piegādātāja interneta vietni. Personai, kas atbildīga par darbību, jānodrošina, lai tiktu izmantota pareizā tīrīšanas metode, un jāievieš piemēroti tīrīšanas intervāli.

Piezīme. *Plākšņu iepakojums nav paredzēts atvēršanai.*

Namenjena uporaba
Lamelasti toplotni izmenjevalniki (BHE) so zasnovani za prenos toplote, ki bo ustrezala zahtevam širše uporabe, kot so zamrzovanje, ogrevanje bivalnih prostorov, ogrevanje in hlajenje industrijskih prostorov in v obdelovalni industriji.

Definicija pojmov

Opozorilo: *Vrsta nevarnosti*

OPOZORILO opozarja na možno nevarnost, ki lahko, če je ne odpravite, povzroči smrt ali resno telesno poškodbo.

Svarilo: *Vrsta nevarnosti*

SVARILO opozarja na možno nevarnost, ki lahko, če je ne odpravite, povzroči majhno ali zmerno telesno poškodbo.

Upoštevaj:
UPOŠTEVAJ opozarja na možno nevarnost, ki lahko, če je ne odpravite, poškoduje lastnino.

Plošče z oznakami
Obstajajo različni tipi plošč z oznakami, odvisno od vrste dovoljenja za tlačno posodo.

Upoštevaj:
- *Uporabljajo se lahko drugi tipi plošč z oznakami. Za podrobne informacije se obrnite na predstavnika podjetja Alfa Laval.*
- *Nekateri tehnični podatki niso namenjeni za vse tipe plošč z oznakami*

Plošča z oznakami vsebuje:
1. Logotip.
2. Ime proizvajalca.
3. Oznaka nacionalne uprave in serijska številka.
4. Številka člena.
5. Tip prenosnika.
6. Proizvodna ali serijska številka.
7. Leto ali datum proizvodnje.
8. Mesta priključkov glede na vrsto tekočine.
9. Maksimalne dovoljene obratovalne temperature.
10. Maksimalni dovoljeni obratovalni tlaki.
11. Preizkusni tlak.
12. Datum tlačnega preizkusa.
13. Prostornina vsakega prostora.
14. Dovoljene obratovalne temperature in tlaki.
15. Delovno območje.
16. Opis vsakega prostora.
17. Skupina tekočine.
18. Informacije o kupcu.
19. Možna mesta priključkov.
20. Črtna koda.
21. Znak odobritvenega organa. (spodnje oznake CE ne veljajo za ploščo z oznakami tip 3)
    – CE-0409 BHE Manufacturing, Ronneby, Švedska
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Jiangyin City, PRC
    – CE-0948 Alfa Laval S.p.A. Alonte, Italija.

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Zahteve

Opozorilo: *Toplotni izmenjevalnik mora obratovati in biti nameščen tako, da preprečuje tveganja telesnih poškodb ali poškodbe lastnine.*

Upoštevajte: *Če ni drugače navedeno, za hlajenje veljajo podatki o izdelku za običajne hladilne tekočine, npr. HFC in HCFC. Pred uporabo toplotnega izmenjevalnika z vnetljivimi, strupenimi ali nevarnimi tekočinami (npr. ogljikovodiki) morate upoštevati ustrezne varnostne predpise za ravnanje s takšnimi tekočinami. Za več informacij obiščite spletno mesto dobavitelja.*

Montaža

Montaža mora biti opravljena z opremo, ki ščiti toplotni izmenjevalnik pred tlaki in temperaturi, ki niso v skladu z odobrenimi minimalnimi in maksimalnimi vrednostmi navedenimi na plošči z oznakami.

Svarilo: *Da si na ostrih robovih ne poškodujete rok, morate pri rokovanju lamelastega toplotnega izmenjevalnika vedno uporabljati zaščitne rokavice.*

Za najboljšo prevajanje toplote mora biti toplotni izmenjevalnik priključen tako, da bo omogočal pretok medija skozi toplotni izmenjevalnik v nasprotni smeri (proti toku).

Upoštevaj: *Pred nameščanjem cevi se prepričajte, da v prenosniku ni tujkov.*

Svarilo: *Med montažo upoštevajte nevarnost požara, tj. pazite na razdaljo do vnetljivih snovi.*

Svarilo: *Nikoli ne dvigujte za priključke. Za dviganje uporabljajte jermena. Jermene namestite kot prikazuje shema 1.*

Upoštevajte: *Pri izparevanju in pri uporabi, kjer se pojavi fazna sprememba medija, morate toplotni izmenjevalnik namestiti navpično z ravno cevjo (z dolžino vsaj 150-200 mm) med razširitvenim ventilom in vhodno odprtino za hladilno tekočino.*

Vgradnja

V togem sistemu cevi lahko majhne toplotne izmenjevalnike (s težo od 1 do 6 kg) obesite neposredno na cevi (Shema 2A). Večje toplotne izmenjevalnike morate zavarovati s podporniki (Shema 2D), namenjenimi za določen toplotni izmenjevalnik (dodatek), z jermeni (Shema 2C) ali s pritrditvenimi vijaki (Shema 2B). Pri posebnih naročilih so pritrditveni vijaki lahko privarjeni na sprednjo ali zadnjo stran. Moment privijanja za vijake M6 znaša 3,8 Nm, vijake M8 znaša 9,5 Nm in za vijake M10 znaša 19,0 Nm.

Upoštevaj: *V primeru vibracij uporabite proti vibracijske nosilce, kot to prikazuje shema 2A.*

Upoštevaj: *Toplotne izmenjevalnike, ki imajo distribucijski sistem za hladilno tekočino, morate namestiti tako, da bo sistem na dnu.*

Upoštevaj: *Med vgrajevanjem obremenitve priključkov ne smejo presegati vrednosti iz preglednice „Omejitve obremenitev priključkov med vgrajevanjem“ na notranji strani platnice.*

Upoštevaj: *Cevna napeljava mora biti dobro pritrjena in izvedena tako, da se med delovanjem z nje na ploščni izmenjevalnik toplote ne prenašajo nikakršne obremenitve.*

Priključki (Shema 3)
Priključi z navoji – Uporabite momentni ključ za pritrditev cevi in pazite na določene mejne vrednosti. Nekaterim modelom so priloženi priključki tipa Victaulic.
Spajkalni priključki – Očistite z drgnjenjem in razmaščevanjem različnih površin. Uporabite kovino za spajkanje, ki je primerna za materiale, ki jih spajkate, ter pri tem pazite na ustrezno temperaturo za spajkanje. Za več informacij glejte dokument "Spajkanje cevi za lamelasti toplotni izmenjevalnik" ali se obrnite na predstavnika Alfa Laval.
Varjeni priključki – Varjeni deli TIG ali MIG. Zbrusite notranji in zunanji del cevi in, če je prirezana, prirezan konec vsaj 25 mm stran od roba cevi proti notranjosti. S tem boste preprečili kontaminacijo z bakrom na zvarjenem mestu, ki lahko povzroči, da le-to poči.

Upoštevajte: *V primeru spajkanja in varjenja lahko toplotni izmenjevalnik zaščitite pred prekomernim segrevanjem, če okoli priključka ovijete mokro krpo. Prekomerno segrevanje lahko stopi notranji spajkani material znotraj toplotnega izmenjevalnika. Glejte shemo 3.*

⚠ ***Svarilo:*** *Ko odklapljate toplotni izmenjevalnik s cevi, uporabite ustrezno zaščitno opremo, kot so zaščitni škornji, zaščitne rokavice in zaščito za oči, odvisno od medija v toplotnem izmenjevalniku.*

Nevarnost zamrzovanja

⚠ ***Svarilo:*** *Upoštevajte nevarnost zamrzovanja pri nizkih temperaturah, da s tem preprečite okvaro toplotnega izmenjevalnika. Toplotne izmenjevalnike, ki ne obratujejo, morate sprazniti in osušiti, če je prisotna nevarnost zamrzovanja.*

Upoštevajte: *Če želite preprečiti škodo zaradi zamrzovanja, morate uporabljenemu mediju primešati sredstvo proti zamrzovanju pri delovnih pogojih pod njegovim lediščem.*

Upoštevajte: *Če ga uporabljate ko izparilnik*
- *Uporabite tokovno stikalo ali nizko tlačno stikalo.*
- *Uporabite termostat proti zamrzovanju in tokovni upravljalnik, da s tem zagotovite konstantni pretok vode pred, med in po delovanju kompresorja.*
- *Izogibajte se tako imenovanem "pump-down" delovanju, tj. praznjenje izparilnika z zagonom kompresorja po izklopu vse dokler ni dosežen prednastavljen tlak hladilnega sredstva. Temperatura lahko pri tem pade pod ledišče slanice, kar lahko poškoduje izparilnik.*

Zaščita pred zamašitvijo
Za zaščito pred možno prisotnostjo tujkov uporabite filter. Če ste negotovi glede največje velikosti delcev, se posvetujte z dobaviteljem ali poiščite informacije o izdelku na spletnem mestu dobavitelja.

Krmiljenje in obratovanje

⚠ ***Svarilo:*** *Toplotnega izmenjevalnika ne uporabljajte za medije (npr. deionizirana voda)/instalacij (npr. pocinkane cevi), ki bi lahko (kemično/elektrokemično) vplivale na plošče (nerjavno jeklo) in material za varjenje (baker).*

Upoštevaj: *Baker lahko povzroči korozijo v instalacijah iz različnih materialov*

Zaščita pred toplotno in/ali tlačno utrujenostjo
Nenadne spremembe v temperaturi in tlaku lahko povzročijo poškodbo toplotnega izmenjevalnika zaradi utrujenosti materiala. Zaradi tega morate upoštevati naslednje, da s tem zagotovite obratovanje toplotnega izmenjevalnika brez nihanja vrednosti tlaka/ temperature.

- Namestite temperaturni senzor čim bližje izhodni odprtini toplotnega izmenjevalnika.
- Izberite ventile in opremo za reguliranje, ki omogočajo stabilno temperaturo/tlak v toplotnem izmenjevalniku.
- Preprečite vodni kamen z uporabo ventilov za hitro zapiranje, npr. zapiralni ventili.
- Pri avtomatiziranih instalacijah je potrebno vklop in izklop črpalk ter delovanje ventilov programirati tako, da sta amplituda in frekvenca tlačnih sprememb čim manjši.

Izolacija
Toplotni in hladilni izolaciji sta na voljo posebej.

Upoštevaj: *Upoštevajte, da se lahko mejne temperaturne vrednosti izolacije in toplotnega izmenjevalnika razlikujejo.*

Odpravljanje težav
Za pravilno delovanje toplotnega izmenjevalnika preverite ali:

- so cevi priključene na toplotni izmenjevalnik v skladu z navodili v tem priročniku.
- je toplotni izmenjevalnik povsem čist in brez usedlin.

Upoštevaj: *Delci in tkanine lahko zamašijo toplotni izmenjevalnik. Visok padec tlaka ali znižan toplotni izkoristek pomeni, da je toplotni izmenjevalnik umazan.*

- krmilno vezje je pravilno prednastavljeno in ni zamrzovanja.

Čiščenje
Oprema omogoča čiščenje na mestu. Za nasvet o primernem procesu čiščenja, se posvetujte z dobaviteljem ali obiščite spletno mesto dobavitelja. Oseba, ki je odgovorna za obratovanje, mora zagotoviti, da se uporablja pravilna metoda čiščenja in hkrati mora določiti ustrezne intervale čiščenja.

Upoštevaj: *Embalažo plošče ne smete odpreti.*

Javasolt felhasználás
A keményforrasztott hőcserélők (BHE) kialakítása széles körű felhasználást tesz lehetővé, a hőcserélő készülékek alkalmazhatók fagyasztó és központi fűtési berendezésekben, ipari fűtési és hűtési, illetve feldolgozóipari rendszereknél.

Meghatározások

Figyelmeztetés: *A veszély típusa*
FIGYELMEZTETÉS: olyan potenciálisan veszélyes helyzetet jelez, amely, ha bekövetkezik, halált vagy súlyos sérülést okozhat.

Vigyázat: *A veszély típusa*
VIGYÁZAT: olyan potenciálisan veszélyes helyzetet jelez, amely, ha bekövetkezik, enyhe vagy közepes sérülést okozhat.

Megjegyzés:
MEGJEGYZÉS: olyan potenciálisan veszélyes helyzetet jelez, amely, ha bekövetkezik, anyagi kárt okozhat.

Adattáblák
Az adattáblák különböző típusúak lehetnek a nyomástartó edény jóváhagyásának típusától függően.

Megjegyzés:
- *Előfordulhat, hogy más típusú adattáblákat használnak. Bővebb tájékoztatásért forduljon az Alfa Laval képviselőjéhez.*
- *Néhány műszaki adat nem alkalmazható minden adattáblatípus esetén.*

Az adattáblán látható:
1. Az embléma számára fenntartott hely.
2. A gyártó neve.
3. A nemzeti hatóság bélyegzője számára fenntartott hely és a gyártási szám.
4. Cikkszám.
5. Típus.
6. Gyári szám vagy sorozatszám.
7. A gyártás éve vagy dátuma.
8. Az egyes folyadékok csatlakozásának helyei.
9. Megengedett legnagyobb üzemi hőmérsékletek.
10. Megengedett legnagyobb üzemi nyomások.
11. Próbanyomás.
12. A próbanyomás dátuma.
13. Az egyes terek térfogata.
14. Megengedett üzemi hőmérsékletek és nyomások.
15. Üzemi terület.
16. Az egyes terek leírása.
17. Folyadékcsoport.
18. Az ügyfél számára fontos információk.
19. A csatlakozások lehetséges helyei.
20. Vonalkód-információ.
21. A jóváhagyási jel számára fenntartott hely. (Az alábbi CE jelölések a 3-as típusú adattáblára nem érvényesek.)
    – CE-0409 BHE Manufacturing, Ronneby, Svédország
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Jiangyin City, Kína
    – CE-0948 Alfa Laval S.p.A. Alonte, Olaszország.

Eredeti utasítások
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Követelmények

Figyelmeztetés: *A hőcserélő beszerelése és működtetése során ki kell küszöbölni a személyi sérülés és az anyagi kár lehetőségét.*

Megjegyzés: *Amennyiben nincs más rendelkezés, a szokványos hűtőközegek, például a HFC és a HCFC termékadatai alkalmazhatók a hűtési alkalmazásokra. A hőcserélő gyúlékony, mérgező vagy veszélyes folyadékokkal (pl. szénhidrogénekkel) történő használata előtt kötelező az ezen folyadékok kezelésére vonatkozó biztonsági szabályok betartása. További információért keresse fel a szállító honlapját.*

Beszerelés

A beszerelést olyan felszereléssel kell biztosítani, amely megvédi a hőcserélőt az adattáblán található minimális és maximális hőmérsékleti és nyomási értékeken kívüli hatásoktól.

Vigyázat: *Az éles szélek okozta kézsérülések elkerülése érdekében mindig védőkesztyűt kell viselni a keményforrasztott hőcserélők kezelésekor.*

A lehető legjobb hőcserélő teljesítmény érdekében úgy kell csatlakoztatni a hőcserélőt, hogy a folyadék ellenáramban haladjon rajta keresztül..

Megjegyzés: *Az összes csővezeték csatlakoztatása előtt ellenőrizze, hogy minden idegen tárgy ki lett-e öblítve a rendszerből.*

Vigyázat: *A beszerelés során vegye számításba a tűzveszélyt, például ügyeljen a környezetében található gyúlékony anyagokra.*

Vigyázat: *Soha ne a csatlakozásoknál végezze az emelést. Emeléskor hevedereket kell használni. A hevedereket az 1. ábrának megfelelően kell elhelyezni.*

Megjegyzés: *Párologtató berendezéseknél és olyan eszközök esetében, amelyeknél a folyadék fázisának megváltozásával kell számolni, a hőcserélőt függőlegesen kell beszerelni, és egy egyenes (legalább 150-200 mm hosszúságú) csövet kell elhelyezni a tágulási szelep és a hűtőközeg bemenete között.*

Felszerelés

Merev csőrendszer esetén a kis (1–6 kg tömegű) hőcserélőket közvetlenül a csőhálózatba lehet függeszteni (2A ábra). A nagyobb hőcserélőket támasztó szerelékekkel kell ellátni (2D ábra), amely az adott hőcserélőhöz tartozik (tartozékként), vagy hevedereket (2C ábra), illetve rögzítőcsavarokat kell használni (2B ábra). Speciális megrendelés esetén a rögzítőcsavarok a készülék elejére vagy hátuljára hegeszthetők. Az M6 csavarok meghúzási nyomatéka 3,8 Nm, az M8 csavaroké 9,5 Nm, az M10 csavaroké pedig 19,0 Nm.

Megjegyzés: *Ha fennáll a vibráció kockázata, használjon vibrációcsökkentő rögzítőberendezéseket, amint az a 2A ábrán látható.*

Megjegyzés: *A hűtőközeg-elosztóval rendelkező hőcserélőket úgy kell felszerelni, hogy az elosztó legyen alul.*

Megjegyzés: *A telepítés során a csatlakozási terhelések nem haladhatják meg a borító belső oldalán felüntetett "Csatlakozási terhelés határai telepítés során" c. táblázat értékeit.*

Megjegyzés: *A csővezetékeknek megfelelően horgonyzottnak és kivitelezettnek kell lenniük, úgy, hogy semmilyen terhelés ne kerüljön át a lap hőcserélőjére működés közben.*

Csatlakozások (3. ábra)
Menetes csatlakozások – Használjon nyomatékkulcsot a cső csatlakoztatásakor, és vegye figyelembe a megadott határértékeket. Egyes modellek Victaulic típusú csatlakozással rendelkeznek.
Forrasztott csatlakozások – Dörzsöléssel és zsírmentesítéssel tisztítsa meg a különböző felületeket. Használja a forrasztandó anyagoknak megfelelő forraszanyagot és a megfelelő forrasztási hőmérsékletet. Bővebb tájékoztatásért tanulmányozza a „Brazing tubes for brazed heat exchanger” (Keményforrasztott hőcserélők csöveinek forrasztása) című dokumentumot vagy forduljon az Alfa Laval képviselőjéhez.
Hegesztett csatlakozások – TIG vagy MIG hegesztés. Csiszolja le a cső belsejét és külsejét – leélezett csővég esetén a csővéget is – a cső szélétől legalább 25 mm hosszúságú részen befelé. Ezzel megakadályozható, hogy a hegesztési terület rézzel szennyeződjön, ami a hegesztés törését okozhatná.

Megjegyzés: *Óvja a hőcserélőt a túlmelegedéstől, és tekerjen egy darab nedves ruhát a csatlakozás köré a forrasztás vagy hegesztés környékén. Az erős hőhatás megolvaszthatja a hőcserélő belsejében a forraszanyagot. Lásd a 3. ábrát.*

⚠ ***Vigyázat:*** *A hőcserélő csővezetékről történő leválasztásakor a hőcserélőben található folyadéktól függően használjon megfelelő védőfelszerelést, például védőcipőt, védőkesztyűt és védőszemüveget.*

Fagyásveszély

⚠ ***Vigyázat:*** *A hőcserélő károsodásának elkerülése érdekében tartsa szem előtt az alacsony hőmérsékleten fellépő fagyásveszélyt. Ha fennáll a fagyásveszély, az üzemen kívül helyezett hőcserélőket ki kell üríteni és levegőbefúvással ki kell szárítani.*

Megjegyzés: *A fagyáskárok elkerülése érdekében a fagyáspontja alatt alkalmazott folyadéknak tartalmazni kell fagyálló összetevőt.*

Megjegyzés: *Párologtatóként történő alkalmazás esetén*
- *Alkalmazzon áramláskapcsolót és alacsonynyomás-kapcsolót.*
- *Használjon fagyvédelmi termosztátot és áramlásmérőt, hogy a kompresszor működése előtt, alatt és után biztosított legyen a folyamatos vízáramlás.*
- *Kerülje el a „kiszivattyúzást”, vagyis ne ürítse ki a párologtatót úgy, hogy a leállás után a kompresszort a hűtőközeg előre beállított nyomásának eléréséig működteti. A hőmérséklet így a sós víz fagypontja alá eshet, ami károsíthatja a párologtatót.*

Dugulás elleni védelem
Az esetlegesen előforduló idegen anyagok ellen használjon szűrőt. Ha bármilyen kétsége merül fel a maximális szemcseméretttel kapcsolatban, forduljon a szállító legközelebbi képviseletéhez vagy tájékozódjon a szállító honlapjának Termékinformáció részében.

Vezérlés és üzemeltetés

⚠ ***Vigyázat:*** *Ne használja a hőcserélőt olyan közeg (pl. ionmentesített víz)/szerelvények (pl. galvanizált csövek) esetén, amelyek (kémiai vagy elektrokémiai módon) reakcióba léphetnek a lemezekkel (rozsdamentes acél) vagy a forraszanyaggal (réz).*

Megjegyzés: *A réz korróziót idézhet elő a különböző anyagokkal történő alkalmazás esetén*

Védelem a hő és/vagy nyomás következtében fellépő anyagfáradás ellen
A hirtelen hőmérséklet- vagy nyomásváltozások a hőcserélő anyagfáradásból következő károsodását okozhatják. Ezért az alábbiakat kell figyelembe venni annak érdekében, hogy a hőcserélők hő/nyomásingadozás nélkül működjenek.

- A hőérzékelőt a lehető legközelebb helyezze a hőcserélő kimenetéhez.
- Válasszon olyan szelepeket és szabályozó berendezéseket, amelyek stabil hőmérsékletet/nyomást biztosítanak a hőcserélő számára.
- A vízlökés elkerülése érdekében ne használjon gyorsan záró, például be/ki szelepeket.
- Automatizált telepítés esetén a szivattyúk elindulását és leállását, illetve a szelepek működését úgy kell programozni, hogy a nyomásváltozás amplitúdója és frekvenciája a lehető legkisebb legyen.

Szigetelés
A fűtő és hűtő szigetelések tartozékként érhetők el.

Megjegyzés: *Ne feledje, hogy a szigetelés és a hőcserélő hőmérsékleti korlátai eltérőek lehetnek.*

Hibaelhárítás
A hőcserélő megfelelő teljesítményének elérése érdekében ellenőrizze a következőket:

- a csővezeték az ebben a kézikönyvben leírt utasításoknak megfelelően csatlakozik a hőcserélőhöz
- a hőcserélő tökéletesen tiszta, és nincs benne lerakódás.

Megjegyzés: *A részecskék és szálak eltömíthetik a hőcserélőt. A nyomás fokozatos csökkenése, illetve a hőhatásfok csökkenése a hőcserélő dugulását jelzi.*

- a vezérlőkör előzetes beállítása megfelelő, és nem jelentkezik fagyás.

Tisztítás
A berendezés helyben tisztítható. A megfelelő tisztítási eljárásról érdeklődjön a szállító képviselőjénél, vagy tájékozódjon a szállító honlapján. Az üzemeltetésért felelős személy feladata biztosítani a helyes tisztítási eljárás alkalmazását, illetve neki kell megállapítania a tisztítási időközöket.

Megjegyzés: *A lemezcsomagot nem szabad kinyitni.*

Určené použití

Pájené výměníky tepla (Brazed Heat Exchangers – BHE) jsou určeny k zajištění potřebného přenosu tepla v celé řadě aplikací, jako je zchlazování, komfortní vytápění, průmyslové vytápění a chlazení a zpracovatelské odvětví.

Definice

Výstraha: *Typ nebezpečí*

⚠ *VÝSTRAHA označuje potenciálně nebezpečnou situaci, která, není-li jejímu vzniku zabráněno, může mít za následek usmrcení nebo vážné zranění.*

Varování: *Typ nebezpečí*

⚠ *VAROVÁNÍ označuje potenciálně nebezpečnou situaci, která, není-li jejímu vzniku zabráněno, může mít za následek lehké nebo střední zranění.*

Upozornění:
UPOZORNĚNÍ označuje potenciálně nebezpečnou situaci, která, není-li jejímu vzniku zabráněno, může mít za následek škodu na majetku.

Typové štítky

Existují různé varianty typového štítku v závislosti na druhu atestu tlakové nádoby.

Poznámka:
- *Mohou být použity i jiné varianty typového štítku. Podrobné informace vám sdělí zástupce společnosti Alfa Laval.*
- *Některé specifikace nejsou používány pro všechny varianty typového štítku.*

Typový štítek obsahuje:

1. Místo pro logo
2. Název výrobce
3. Místo pro razítko státního orgánu a sériové číslo
4. Číslo výrobku
5. Typ
6. Výrobní nebo sériové číslo
7. Rok nebo datum výroby
8. Umístění přípojek pro jednotlivé kapaliny
9. Maximální dovolené provozní teploty
10. Maximální dovolené provozní tlaky
11. Zkušební tlak
12. Datum tlakové zkoušky
13. Objem každého prostoru
14. Dovolené provozní teploty a tlaky
15. Pracovní oblast
16. Popis každého prostoru
17. Skupina kapalin
18. Informace týkající se výhradně zákazníka
19. Možné umístění přípojek
20. Čárový kód
21. Prostor pro schvalovací značku (Dále uvedené značky CE nejsou platné pro typový štítek 3.)
    – CE-0409 BHE Manufacturing, Ronneby, Švédsko
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Jiangyin City, Čína
    – CE-0948 Alfa Laval S.p.A. Alonte, Itálie

Originální návod
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Požadavky

> ⚠ ***Výstraha:*** *Výměník tepla musí být instalován a obsluhován takovým způsobem, aby nehrozilo žádné riziko zranění osob nebo škody na majetku.*

> ***Poznámka:*** *Není-li stanoveno jinak, výrobkové specifikace pro běžná chladiva, tj. HFC a HCFC, lze použít pro aplikace zchlazování. Před použitím výměníku tepla pro hořlavé, jedovaté nebo nebezpečné kapaliny (např. uhlovodíky) musí být dodrženy příslušné bezpečnostní předpisy pro zacházení s těmito kapalinami. Další informace najdete na internetových stránkách dodavatele.*

Instalace

Zařízení musí být vybaveno prostředky, které chrání výměník tepla před tlaky a teplotami mimo schválené minimální a maximální hodnoty uvedené na typovém štítku.

> ⚠ ***Varování:*** *Aby nedošlo k poranění rukou ostrými hranami, při práci s pájenými výměníky tepla vždy používejte ochranné rukavice.*

Aby přenos tepla byl co nejlepší, musí být výměník tepla připojen tak, aby jím média proudila v opačném směru (protiproud).

> ***Poznámka:****Před připojením jakéhokoliv potrubí se ujistěte, že ze systému byly odstraněny veškeré cizí předměty.*

> ⚠ ***Varování:*** *Během montážních prací počítejte s rizikem vzniku požáru, tj. udržujte dostatečnou vzdálenost od hořlavin.*

> ⚠ ***Varování:*** *Zařízení nikdy nezvedejte za přípojky. Při zvedání použijte popruhy. Popruhy umístěte podle obr. 1.*

> ***Poznámka:*** *V případě aplikací s odpařováním a se změnou skupenství média musí být výměník tepla instalován ve svislé poloze s rovnou délkou trubky (min. 150–200mm) mezi expanzním ventilem a vstupem chladiva.*

Montáž

V pevném potrubním rozvodu mohou být malé výměníky tepla (hmotnost 1–6kg) zavěšeny přímo v potrubí (obr. 2A). Větší výměníky tepla musí být zabezpečeny montážními podpěrami (obr. 2D), které jsou určeny pro specifický výměník (příslušenství), třmeny (obr. 2C) nebo montážními šrouby (obr. 2B). Ve zvláštních případech mohou být montážní šrouby přivařeny vpředu, nebo vzadu. Utahovací moment je 3,8Nm pro šrouby M6, 9,5Nm pro šrouby M8 a 19,0Nm pro šrouby M10.

> ***Poznámka:*** *Jestliže existuje nebezpečí vibrací, použijte antivibrační uchycení podle obr. 2A.*

> ***Poznámka:*** *Výměníky tepla s distributorem chladiva musí být namontovány s distributorem v dolní poloze.*

> ***Poznámka:*** *Během instalace nesmí namáhání spojů překročit hodnoty podle tabulky „Limity pro namáhání spojů během instalace“ na vnitřní straně obálky.*

> ***Poznámka:*** *Potrubní systém by měl být řádně zakotven a proveden tak, aby se během provozu nepřenášely žádné zátěže na deskový výměník tepla.*

Přípojky (obr. 3)
Závitové přípojky – Během připojování trubky použijte momentový klíč a dodržte stanovené mezní hodnoty. Některé modely jsou dodávány s přípojkami typu Victaulic.
Pájené přípojky – Různé povrchy očistěte obroušením a odmaštěním. Použijte jakost tvrdé pájky, která je vhodná pro pájené materiály, a použijte správnou pájecí teplotu. Podrobné informace najdete v dokumentu „Pájení trubek pro pájené výměníky tepla“ nebo se obrat’te na zástupce společnosti Alfa Laval.
Svařované přípojky – Svařování metodami TIG nebo MIG. Obruste vnitřní a vnější povrch trubky, a je-li trubka zkosená, obruste rovněž zkosenou hranu do vzdálenosti alespoň 25mm od hrany a uvnitř. Tím se zamezí znečištění oblasti svaru mědí, která by mohla způsobit svarové trhliny.

Poznámka: *Chraňte výměník tepla před přehřátím tím, že během pájení nebo svařování obalíte přípojku kusem mokré látky. Nadměrné zahřátí by mohlo roztavit tvrdou pájku uvnitř výměníku. Viz obrázek 3.*

⚠ ***Varování:*** *Během odpojování výměníku tepla od potrubí používejte v závislosti na druhu média ve výměníku vhodné ochranné prostředky jako ochrannou obuv, ochranné rukavice a ochranu zraku.*

Nebezpečí zamrznutí

⚠ ***Varování:*** *Pamatujte na nebezpečí zamrznutí při nízkých teplotách, aby nedošlo k poškození výměníku tepla. Jestliže existuje nebezpečí zamrznutí, výměníky tepla mimo provoz musí být vyprázdněny a vysušeny proudem vzduchu.*

Poznámka: *Aby nedošlo k poškození v důsledku zamrznutí, musí použité médium při provozních podmínkách pod jeho bodem tuhnutí obsahovat nemrznoucí prostředek.*

Poznámka: *Je-li výměník použit jako výparník*
- *Použijte průtokový spínač a nízkotlaký spínač.*
- *Použijte termostat proti zamrznutí a hlídač průtoku k zajištění konstantního průtoku vody před, během a po uvedení kompresoru do provozu.*
- *Vyvarujte se „vyčerpání“, tj. vyprázdnění výparníku v důsledku spuštění kompresoru po přerušení provozu bez dosažení předem nastaveného tlaku chladiva. Mohlo by dojít k poklesu teploty pod teplotu tuhnutí solanky a k následnému poškození výparníku.*

Ochrana proti ucpání
Jako ochranu před možným výskytem cizích částic použijte filtr. Máte-li pochybnosti týkající se maximální velikosti částic, poraďte se s nejbližším zástupcem dodavatele nebo údaje vyhledejte na internetových stránkách dodavatele v sekci informací o výrobcích.

Řízení a provoz

⚠ ***Varování:*** *Výměník tepla nepoužívejte pro média (např. deionizovanou vodu) a instalace (např. pozinkované trubky), které by mohly (chemicky nebo elektrochemicky) ovlivňovat nebo být ovlivněny deskami (nerezová ocel) a tvrdou pájkou (měď).*

Poznámka: *Měď může vyvolat korozi v zařízeních složených z různých materiálů.*

Ochrana proti tepelné a/nebo tlakové únavě
Náhlé změny teploty a tlaku mohou být příčinou únavového poškození výměníku tepla. Proto je nutné provést následující opatření, která zajistí provoz výměníku bez teplotních a tlakových změn.

- Umístěte snímač teploty co nejblíže k výstupu z výměníku tepla.
- Volte ventily a regulační zařízení, která pro výměník tepla zajistí stabilní tlaky a teploty.
- Pro vyloučení vodního rázu nesmějí být použity rychlouzavírací ventily, např. ventily otevřeno/zavřeno.
- Vautomatizovaných instalacích je třeba naprogramovat spouštění a zastavování čerpadel a pohony ventilů tak, aby byly výsledné amplitudy a frekvence změn tlaku co nejnižší.

Izolace
Tepelná a chladová izolace je dodávána jako příslušenství.

Poznámka: *Nezapomeňte, že mezní teploty izolace a výměníku tepla se mohou lišit.*

Odstraňování problémů
Chcete-li zajistit správnou funkci výměníku tepla:

- Zkontrolujte, zda je potrubní systém připojený k výměníku tepla v souladu s pokyny uvedenými v tomto návodu.
- Zkontrolujte, zda je výměník tepla dokonale čistý a bez usazenin.

Poznámka: *Částice a vlákna mohou výměník tepla ucpat. Zvýšení tlakové ztráty nebo snížení tepelné účinnosti signalizuje, že výměník tepla je zanesený.*

- Zkontrolujte, zda je regulační okruh správně přednastavený a nedochází k zamrznutí.

Čištění
Zařízení je vhodné pro metodu čištění na místě.
Použití vhodných metod čištění konzultujte se zástupcem dodavatele nebo navštivte jeho internetové stránky.
Osoba odpovědná za provoz musí zajistit, aby byla použita správná metoda čištění, a musí stanovit vhodné intervaly čištění.

Poznámka: *Otevření svazku desek se neuvažuje.*

Účel použitia
Spájkované výmenníky tepla (BHE) sú navrhnuté tak, aby uskutočňovali výmenu tepla a spĺňali požiadavky pri mnohých aplikáciách, napríklad chladení, pohodlnom vykurovaní, priemyselnom vykurovaní a chladení a v spracovateľskom priemysle.

Definície

Varovanie: *typ nebezpečenstva*

Slovo VAROVANIE signalizuje potenciálne nebezpečnú situáciu, ktorá, ak jej nezabránite, môže spôsobiť usmrtenie alebo vážne poranenie.

Upozornenie: *typ nebezpečenstva*

Slovo UPOZORNENIE signalizuje potenciálne nebezpečnú situáciu, ktorá, ak jej nezabránite, môže spôsobiť mierne alebo stredne ťažké poranenie.

Poznámka:
Slovo POZNÁMKA signalizuje potenciálne nebezpečnú situáciu, ktorá, ak jej nezabránite, môže spôsobiť poškodenie majetku.

Typové štítky
Existujú rôzne typy typových štítkov v závislosti od typu schválenia tlakovej nádoby.

Poznámka:
- *Môžu byť použité iné typy typových štítkov. Podrobnejšie informácie vám poskytne zástupca spoločnosti Alfa Laval.*
- *Niektoré špecifikácie sa nepoužívajú na všetkých typoch typových štítkov*

Na typovom štítku sa nachádza:
1. Priestor pre logo.
2. Názov výrobcu.
3. Priestor pre pečiatku výboru National Board a sériové číslo.
4. Číslo výrobku.
5. Typ:
6. Výrobné alebo sériové číslo.
7. Rok alebo dátum výroby.
8. Umiestnenie spojov pre jednotlivé kvapaliny.
9. Maximálna dovolená prevádzková teplota.
10. Maximálny dovolený prevádzkový tlak.
11. Skúšobný tlak.
12. Dátum tlakového testu.
13. Objem každého priestoru.
14. Dovolená prevádzková teplota a tlak.
15. Prevádzková oblasť.
16. Popis každého priestoru.
17. Skupina kvapalín.
18. Jedinečné informácie pre zákazníka.
19. Možné umiestnenie spojov.
20. Informácie o čiarovom kóde.
21. Priestor pre značku schválenia. (značky CE nižšie nie sú platné pre typový štítok typu 3)
    – CE-0409 BHE Manufacturing, Ronneby, Švédsko
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Jiangyin City, Čína
    – CE-0948 Alfa Laval S.p.A. Alonte, Taliansko.

Pôvodné pokyny
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Požiadavky

> ***Varovanie:*** *Výmenník tepla musí byť nainštalovaný a obsluhovaný spôsobom, ktorý nebude mať za následok riziko poranenia pracovníkov a poškodenia majetku.*

> ***Poznámka:*** *Ak nie je uvedené inak, produktové údaje pre bežné chladiace zmesi, napr. HFC a HCFC, platia pre aplikácie chladenia. Pred použitím výmenníka tepla s horľavými, toxickými alebo nebezpečnými kvapalinami (napr. uhľovodíkmi) sa musia uplatniť príslušné bezpečnostné opatrenia pre manipuláciu s týmito kvapalinami. Ďalšie informácie nájdete na internetovej lokalite dodávateľa.*

Inštalácia

Inštalácia sa musí uskutočniť so zariadením, ktoré bude výmenník tepla chrániť pred tlakom a teplotou mimo schválených minimálnych a maximálnych hodnôt uvedených na typovom štítku.

> ***Upozornenie:*** *Aby nedošlo kporaneniu rúk ostrými hranami, pri práci sospájkovanými výmenníkmi tepla vždy používajte ochranné rukavice.*

Na dosiahnutie maximálneho možného výkonu pri výmene tepla by mal byť výmenník tepla pripojený tak, aby médiá pretekali výmenníkom tepla opačnými smermi (v protiprúde).

> ***Poznámka:*** *Pred pripojením akéhokoľvek potrubia sa uistite, že boli zo systému odstránené všetky cudzie predmety.*

> ***Upozornenie:*** *Počas inštalačných prác berte do úvahy riziko požiaru, t.j. vzdialenosť horľavých látok.*

> ***Upozornenie:*** *Nikdy nedvíhajte výmenník za spoje. Pri zdvíhaní použite popruhy. Popruhy umiestnite podľa obrázka 1.*

> ***Poznámka:*** *V aplikáciách vyparovania a v aplikáciách, v ktorých dochádza k zmene fázy médií, musí byť výmenník tepla nainštalovaný zvisle s priamym potrubím (s dĺžkou minimálne 150-200 mm) medzi expanzným ventilom a vstupom chladiacej zmesi.*

Montáž

V pevnom systéme potrubia sa môžu malé výmenníky tepla (s hmotnosťou 1–6 kg) uložiť priamo v potrubí (obrázok 2A). Väčšie výmenníky tepla by mali byť zabezpečené prostredníctvom podpornej armatúry (obrázok 2D) určenej pre konkrétny výmenník tepla (príslušenstvo) alebo prostredníctvom popruhov (obrázok 2C) alebo montážnych skrutiek (obrázok 2B). Pri špeciálnych objednávkach môžu byť montážne skrutky privarené k prednej alebo zadnej časti. Uťahovací moment pre skrutky M6 je 3,8 Nm, pre skrutky M8 9,5 Nm a pre skrutky M10 19,0 Nm.

> ***Poznámka:*** *Ak existuje riziko vibrácií, použite tlmiacu podložku tak, ako je znázornené na obrázku 2A.*

> ***Poznámka:*** *Výmenníky tepla s rozvádzačom chladiacej zmesi by sa mali montovať tak, aby sa rozvádzač nachádzal v spodnej časti.*

> ***Poznámka:*** *Počas inštalácie nesmie namáhanie spojov prekročiť hodnoty podľa tabuľky „Limity pre namáhanie spojov počas inštalácie“ na vnútornej strane obálky.*

> ***Poznámka:*** *Potrubný systém by mal byť riadne zakotvený a vyhotovený tak, aby sa počas prevádzky neprenášali žiadne zát'aže na doskový výmenník tepla.*

Pripojenia (obrázok 3)
Pripojenia so závitom – pri pripojení potrubia použite momentový kľúč a dodržujte uvedené limity. Niektoré modely sa dodávajú s pripojeniami typu Victaulic.
Spájkované pripojenia – obrúsením a odmastením vyčistite jednotlivé povrchy. Pri spájkovaní použite triedu kovu vhodnú pre spájkované materiály a správnu teplotu spájkovania. Podrobnejšie informácie nájdete v dokumente „Spájkovanie potrubia pre spájkovaný výmenník tepla“ alebo kontaktujte zástupcu spoločnosti Alfa Laval.
Zvárané pripojenia – zváranie TIG alebo MIG. Obrúste vnútornú a vonkajšiu stranu potrubia. Ak je potrubie naklonené, obrúste tiež fazetu v dĺžke aspoň 25 mm od okraja potrubia smerom dovnútra. Tým sa zabráni kontaminácii medi v zváranej oblasti, čo by mohlo spôsobiť prasknutie zvaru.

Poznámka: *Pri každom spájkovaní alebo zváraní chráňte výmenník tepla pred prehriatím tak, že okolo pripojenia omotáte kus mokrej látky. Nadmerné teplo môže roztopiť vnútorný spájkovací kov vo výmenníku tepla. Pozrite si obrázok 3.*

⚠ ***Upozornenie:*** *Pri odpájaní výmenníka tepla od systému potrubia použite vhodné ochranné pomôcky, napríklad bezpečnostnú obuv, bezpečnostné rukavice a prostriedky na ochranu zraku, v závislosti od typu média vo výmenníku tepla.*

Riziko zamrznutia

⚠ ***Upozornenie:*** *Berte do úvahy riziko zamrznutia pri nízkych teplotách, aby sa zabránilo poškodeniu výmenníka tepla. Výmenníky tepla, ktoré sú mimo prevádzky, by mali byť vyprázdnené a vysušené vždy, keď existuje riziko zamrznutia.*

Poznámka: *Ak chcete zabrániť poškodeniu z dôvodu zamrznutia, použité médium musí pri prevádzkových podmienkach pod bodom mrazu obsahovať nemrznúce činidlo.*

Poznámka: *Pri použití výparníka*
- *Použite prietokový a nízkotlakový spínač.*
- *Použite termostat, ktorý zabráni zamrznutiu, a monitor prietoku, aby sa zabezpečil rovnaký prietok vody pred, počas a po skončení prevádzky kompresora.*
- *Zabráňte „vyčerpaniu“, t.j. vyprázdneniu výparníka prevádzkou kompresora po vypnutí, kým sa nedosiahne stanovený tlak chladiacej zmesi. Teplota by mohla klesnúť pod bod mrazu kvapaliny, čo by mohlo poškodiť výparník.*

Ochrana pred upchaním
Použite ochranný filter, ktorý zabráni možnému výskytu cudzích častíc. Ak máte akékoľvek pochybnosti týkajúce sa maximálnej veľkosti častíc, požiadajte o radu miestneho zástupcu dodávateľa alebo si prečítajte časť Informácie o produkte na internetovej lokalite dodávateľa.

Ovládanie a prevádzka

⚠ ***Upozornenie:*** *Nepoužívajte výmenník tepla s médiami (napr. deionizovanou vodou)/inštaláciami (napr. pozinkovaným potrubím), ktoré môžu (chemicky/elektrochemicky) ovplyvniť alebo byť ovplyvnené doskami (nehrdzavejúca oceľ) a spájkovacím materiálom (meď).*

Poznámka: *V inštalácii so zmiešanými materiálmi môže meď spôsobiť koróziu*

Ochrana pred tepelnou alebo tlakovou únavou materiálu

Náhle zmeny teploty a tlaku môžu spôsobiť únavové poškodenie výmenníka tepla. Preto je nutné vziať do úvahy nasledujúce opatrenia, aby sa zabezpečila prevádzka výmenníkov tepla bez kolísania tlaku/teploty.

- Umiestnite teplotný snímač čo najbližšie k výstupu z výmenníka tepla.
- Použite ventily a regulačné zariadenia, ktoré zabezpečujú nemennú teplotu/tlak vo výmenníku tepla.
- Ak chcete zabrániť vodnému rázu, nesmú sa rýchlo uzatvárať ventily, napr. otváracie/uzatváracie ventily.
- Vautomatizovaných inštaláciách je potrebné naprogramovať spustenie a zastavovanie čerpadiel a pohony ventilov tak, aby boli výsledné amplitúdy a frekvencie zmien tlaku čo najnižšie.

Izolácia

Tepelná izolácia a izolácia chladenia je k dispozícii ako príslušenstvo.

Poznámka: *Teplotný rozsah izolácie a výmenníka tepla sa môže líšiť.*

Riešenie problémov

Ak chcete zabezpečiť správnu prevádzku výmenníka tepla, uistite sa, že:

- systém potrubia je pripojený k výmenníku tepla podľa pokynov v tomto návode
- výmenník tepla je úplne čistý a neobsahuje usadeniny.

Poznámka: *Častice a vlákna môžu výmenník tepla upchať. Vyšší pokles tlaku alebo pokles tepelnej účinnosti indikuje, že výmenník tepla je znečistený.*

- regulačný obvod je nastavený správne a nedochádza k mrznutiu.

Čistenie

Zariadenie je vhodné na čistenie na mieste. Ak potrebujete informácie o vhodných čistiacich postupoch, požiadajte o radu zástupcu dodávateľa alebo navštívte internetovú lokalitu dodávateľa. Osoba zodpovedná za prevádzku by mala zabezpečit', aby sa použil správny čistiaci postup, a určiť vhodný interval čistenia.

Poznámka: *Súprava dosiek nie je určená na otváranie.*

Tujuan penggunaan
Penukar haba terpateri (BHE) telah direka untuk menjalankan pemindahan haba untuk memenuhi keperluan rangkaian aplikasi yang luas seperti penyejukan, pemanasan selesa, pemanasan dan penyejukan industri serta industri proses.

Definisi

Amaran: *Jenis bahaya*
AMARAN menunjukkan situasi yang berpotensi berbahaya yang, jika tidak dielakkan, boleh menyebabkan kematian atau kecederaan serius.

Awas: *Jenis bahaya*
AWAS menunjukkan situasi yang berpotensi berbahaya yang, jika tidak dielakkan, boleh menyebabkan kecederaan kecil atau sederhana.

Nota:
NOTA menunjukkan situasi yang berpotensi berbahaya yang, jika tidak dielakkan, boleh menyebabkan kerosakan harta-benda.

Plat nama
Terdapat jenis plat nama yang berbeza bergantung kepada jenis kelulusan bekas tekanan.

Nota:
- *Jenis plat nama lain mungkin digunakan. Untuk maklumat terperinci hubungi wakil Alfa Laval.*
- *Beberapa spesifikasi tidak digunakan untuk semua jenis plat nama*

Plat nama menunjukkan:
1. Ruang untuk jenis logo.
2. Nama pengeluar.
3. Ruang untuk cap Lembaga Kebangsaan dan nombor siri.
4. Nombor artikel.
5. Jenis.
6. Nombor pengeluaran atau siri.
7. Tahun atau tarikh dikeluarkan.
8. Lokasi sambungan untuk setiap bendalir.
9. Suhu pengendalian dibenarkan maks.
10. Tekanan pengendalian dibenarkan maks.
11. Tekanan ujian.
12. Tarikh tekanan ujian.
13. Isipadu bagi setiap ruang.
14. Suhu dan tekanan pengendalian dibenarkan.
15. Kawasan pengendalian.
16. Penerangan bagi setiap ruang.
17. Kumpulan bendalir.
18. Maklumat unik kepada pelanggan.
19. Kemungkinan lokasi bagi sambungan.
20. Maklumat kod bar.
21. Ruang untuk tanda kelulusan. (Tanda CE di bawah tidak sah untuk plat nama jenis 3)
    – CE-0409 BHE Manufacturing, Ronneby, Sweden
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Jiangyin City, PRC
    – CE-0948 Alfa Laval S.p.A. Alonte, Italy.

Arahan asal
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Keperluan

> ***Amaran:*** *Penukar haba mesti dipasang dan dikendalikan dengan cara supaya tiada risiko kecederaan kepada kakitangan dan kerosakan kepada harta-benda akan berlaku.*

> ***Nota:*** *Kecuali dinyatakan sebaliknya, data produk untuk bahan penyejuk biasa, iaitu HFC dan HCFC adalah berkaitan kepada aplikasi penyejukan. Sebelum penukar haba digunakan untuk cecair mudah bakar, toksik atau merbahaya (cth. hidrokarbon) peraturan keselamatan yang relevan untuk mengendalikan cecair seumpamanya mesti digunakan. Untuk maklumat lanjut, sila rujuk laman Internet pembekal.*

Pemasangan

Pemasangan mesti disediakan bersama peralatan yang melindungi penukar haba terhadap tekanan dan suhu di luar nilai minimum dan maksimum yang diluluskan yang ditunjukkan pada plat nama.

> ***Awas:*** *Untuk mengelakkan kecederaan tangan akibat terkena bahagian tepi yang tajam, sarung tangan pelindung perlu sentiasa dipakai semasa mengendalikan penukar haba terpateri.*

Untuk prestasi pemindahan haba yang terbaik, penukar haba perlu disambungkan supaya aliran media melalui penukar haba adalah dalam arah bertentangan (dalam aliran lawan).

> ***Nota:*** *Sebelum menyambungkan sebarang perpaipan, pastikan semua objek asing telah dikeluarkan daripada sistem.*

> ***Awas:*** *Ambil kira risiko kebakaran semasa kerja pemasangan, iaitu berhati-hati mengenai jarak ke bahan mudah bakar.*

> ***Awas:*** *Jangan sekali-kali mengangkat pada sambungan. Tali pengikat perlu digunakan semasa mengangkat. Letakkan tali pengikat mengikut rajah 1.*

> ***Nota:*** *Di dalam aplikasi penyejat dan di dalam aplikasi di mana perubahan fasa media berlaku, penukar haba mesti dipasang secara menegak menggunakan paip lurus (sekurang-kurangnya 150-200 mm panjang) di antara injap pengembangan dan salur masuk bahan penyejuk.*

Cagakan

Dalam sistem paip yang tegar, penukar haba kecil (berat 1–6 kg) boleh diampai terus di dalam kerja paip (Rajah 2A). Penukar haba yang lebih besar perlu diperkemaskan menggunakan cagakan sokongan (Rajah 2D) yang disediakan untuk penukar haba khusus (aksesori), atau diperkemaskan menggunakan tali pengikat (Rajah 2C) atau dengan menggunakan bolt cagakan (Rajah 2B). Untuk pesanan khas, bolt cagakan boleh dikimpal ke depan atau belakang. Kilas pengikat untuk bolt M6 adalah 3.8 Nm, bolt M8 adalah 9,5Nm dan untuk bolt M10 19.0 Nm.

> ***Nota:*** *Jika terdapat risiko getaran, gunakan cagakan anti getaran seperti ditunjukkan dalam Rajah 2A.*

> ***Nota:*** *Penukar haba yang mempunyai pengagih bahan penyejuk perlu dicagak supaya pengagih berada di bawah.*

> ***Nota:*** *Semasa pemasangan beban sambungan mesti tidak melebihi nilai yang dinyatakan menurut jadual "Had bagi Beban Sambungan semasa Pemasangan" pada bahagian dalam halaman depan.*

> ***Nota:*** *Kerja paip perlu terpasang kukuh dan sempurna supaya tiada beban dipindahkan ke penukar haba plat semasa operasi.*

Sambungan (Rajah 3)

Sambungan terulir – Gunakan sepana kilas semasa menyambungkan paip dan patuhi had yang dinyatakan. Beberapa model dibekalkan bersama jenis sambungan Victaulic.

Sambungan terpateri – Bersihkan dengan menggosok dan menyahgris kesemua permukaan yang berbeza. Gunakan gred logam pateri yang sesuai untuk bahan yang dipateri, dan gunakan suhu pematerian yang betul. Untuk maklumat terperinci rujuk dokumen "Tiub pematerian untuk penukar haba terpateri" atau hubungi wakil Alfa Laval.

Sambungan terkimpal – Kimpalan TIG atau MIG. Kisar di dalam dan di luar paip dan, jika serong, hujung serong sekurang-kurangnya 25 mm daripada hujung paip dan ke arah dalam. Ini perlu dilakukan untuk mengelakkan pencemaran tembaga di dalam kawasan yang dikimpal, yang boleh menyebabkan kimpalan retak.

Nota: *Lindungi penukar haba daripada pemanasan berlebihan dengan membalutkan sehelai kain basah di keliling sambungan setiap kali sebarang pematerian atau kimpalan dilakukan. Pemanasan berlebihan boleh mencairkan logam pematerian dalaman di dalam penukar haba. Rujuk rajah 3.*

⚠ ***Awas:*** *Semasa menanggalkan penukar haba daripada sistem perpaipan gunakan peralatan perlindungan yang sesuai, seperti kasut keselamatan, sarung tangan keselamatan dan perlindungan mata, bergantung pada jenis media di dalam penukar haba.*

Risiko penyejukbekuan

⚠ ***Awas:*** *Berhati-hati mengenai risiko penyejukbekuan pada suhu rendah untuk mengelakkan kerosakan kepada penukar Haba. Penukar haba yang tidak digunakan perlu dikosongkan dan disembur kering setiap kali terdapat risiko penyejukbekuan.*

Nota: *Untuk mengelakkan kerosakan akibat penyejukbekuan, medium yang digunakan mesti termasuk ejen anti beku pada keadaan pengendalian di bawah takat penyejukbekuannya.*

Nota: *Apabila digunakan sebagai penyejat*

- *Gunakan suis aliran dan suis tekanan rendah.*
- *Gunakan termostat anti beku dan pemantau aliran untuk memastikan aliran air yang malar sebelum, semasa dan selepas pemampat telah berjalan.*
- *Elakkan "pam turun", iaitu mengosongkan penyejat dengan menjalankan pemampat selepas penutupan sehingga tekanan bahan penyejuk yang dipraset dicapai. Suhu kemudiannya boleh jatuh di bawah titik penyejukbekuan garam, yang boleh merosakkan penyejat.*

Perlindungan daripada tersumbat

Gunakan penapis sebagai perlindungan daripada kemungkinan berlakunya partikel asing. Jika anda mempunyai sebarang keraguan mengenai saiz partikel maksimum, rujuk wakil pembekal terdekat anda atau cari di bawah maklumat Produk di laman Internet pembekal.

Kawalan dan operasi

⚠ ***Awas:*** *Jangan gunakan penukar haba untuk media (cth. air ternyahion)/pemasangan (cth. paip tergalvani) yang (secara kimia/elektrokimia) boleh memberi kesan atau menerima kesan oleh plat (Keluli tahan karat) dan bahan pematerian (Tembaga).*

Nota: *Tembaga boleh menghasilkan pengakisan di dalam pemasangan yang mempunyai bahan bercampur*

Perlindungan terhadap lesu terma atau/dan tekanan

Perubahan suhu dan tekanan yang tiba-tiba boleh menyebabkan kerosakan lesu kepada penukar haba. Oleh itu, yang berikut perlu diambil kira untuk memastikan penukar haba beroperasi tanpa tekanan/ suhu yang tidak menentu.

- Letakkan penderia suhu seberapa hampir yang boleh dengan salur keluar daripada penukar haba.
- Pilih injap dan peralatan pengatur yang memberikan suhu/tekanan yang stabil untuk penukar haba.
- Untuk mengelakkan tukul air, injap yang ditutup cepat tidak boleh digunakan, cth. injap buka/tutup.
- Di dalam pemasangan automatik, pemberhentian dan permulaan pam dan penggerakan injap perlu diprogramkan supaya amplitud yang dihasilkan dan kekerapan variasi tekanan akan seberapa rendah yang boleh.

Penebatan

Penebatan pemanasan dan penyejukan tersedia sebagai aksesori.

Nota: *Sila ketahui bahawa had suhu bagi penebatan dan penukar haba boleh berbeza.*

Menyelesaikan masalah.

Untuk memastikan prestasi penukar haba yang betul, pastikan bahawa:

- sistem perpaipan telah disambungkan ke penukar haba menurut arahan di dalam manual ini
- penukar haba bersih sepenuhnya dan bebas daripada endapan.

Nota: *Partikel dan fiber boleh menyumbat penukar haba. Peningkatan dalam jatuhan tekanan atau jatuhan dalam kecekapan terma menunjukkan bahawa penukar haba rosak.*

- litar kawalan dipraset dengan betul dan tiada penyejukbekuan berlaku.

Pembersihan

Peralatan ini sesuai untuk dibersihkan di tempatnya. Untuk mendapatkan nasihat mengenai proses pembersihan, rujuk wakil pembekal atau lawati laman Internet pembekal. Orang yang bertanggungjawab untuk operasi perlu memastikan bahawa kaedah pembersihan yang betul digunakan dan perlu memutuskan mengenai selang pembersihan yang sesuai.

Nota: *Pakej plat bukan untuk dibuka.*

Utilizarea conform destinaţiei
Schimbătoarele de căldură brazate (BHE) au fost destinate transferului de căldură pentru a întruni cerinţele unei game vaste de aplicaţii precum refrigerare, încălzire confortabilă, încălzire şi răcire industrială şi industria prelucrătoare.

Definiţii

Avertisment: *Tipul de pericol*
AVERTISMENTUL indică o situaţie potenţial periculoasă care, dacă nu este evitată, poate cauza moartea sau rănirea gravă.

Atenţie: *Tipul de pericol*
ATENŢIE indică o situaţie potenţial periculoasă care, dacă nu este evitată, poate cauza rănire minoră sau gravă.

Notă:
NOTĂ indică o situaţie potenţial periculoasă care, dacă nu este evitată poate cauza daune materiale.

Plăcuţe de fabricaţie
Există diferite tipuri de plăcuţe de fabricaţie în funcţie de autorizaţia vasului sub presiune.

Notă:
- *Pot fi utilizate alte tipuri de plăcuţe de fabricaţie. Pentru informaţii detaliate contactaţi reprezentantul Alfa Laval.*
- *Unele specificaţii nu sunt utilizate pentru toate tipurile de plăcuţe de fabricaţie*

Plăcuţa de fabricaţie indică:
1. Spaţiu pentru tipul logoului.
2. Numele producătorului.
3. Spaţiu pentru ştampila Consiliului Naţional şi numărul de serie.
4. Numărul articolului.
5. Tipul.
6. Numărul de fabricaţie sau de serie.
7. Anul sau data de fabricaţie.
8. Locaţiile racordurilor pentru fiecare lichid.
9. Temperaturi de funcţionare max. admise.
10. Presiuni de funcţionare max. admise.
11. Presiunea de probă.
12. Data presiunii de probă.
13. Capacitatea pentru fiecare spaţiu.
14. Temperaturi şi presiuni de funcţionare admise.
15. Zona de operare.
16. Descrierea fiecărui spaţiu.
17. Grupul de lichide.
18. Informaţii unice pentru client.
19. Posibile locaţii ale racordurilor.
20. Informaţii cod de bară.
21. Spaţiu pentru marcajul autorizaţiei. (Marcajele CE de mai jos nu sunt valabile pentru plăcuţa de fabricaţie tip 3)
    – CE-0409 BHE Manufacturing, Ronneby, Suedia
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Jiangyin City, PRC
    – CE-0948 Alfa Laval S.p.A. Alonte, Italia.

Instrucţiuni originale
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Cerinţe

Avertisment: *Schimbătorul de căldură trebuie montat şi utilizat astfel încât să nu apară riscul de vătămări de persoane sau de daune materiale.*

Notă: *Dacă nu s-a specificat altceva, datele de produs pentru agenţi frigorifici normali, de ex. HFC şi HCFC, sunt destinate aplicaţiilor de refrigerare. Înainte ca schimbătorul de căldură să fie utilizat pentru lichide inflamabile, toxice sau periculoase (de ex. hidrocarburi), trebuie utilizate regulile relevante de siguranţă pentru manevrarea unor astfel de lichide. Pentru informaţii suplimentare, vă rugăm să consultaţi pagina de internet a furnizorului.*

Instalarea

Instalarea trebuie asigurată cu echipament care protejează schimbătorul de căldură împotriva presiunilor şi temperaturilor din afara valorilor minime şi maxime aprobate indicate pe plăcuţa de fabricaţie.

Atenţie: *Pentru a evita vătămarea mâinilor din cauza muchiilor ascuţite, se vor purta întotdeauna mănuşi de protecţie în timpul manipulării schimbătoarelor de căldură brazate.*

Pentru cea mai bună performanţă posibilă de transfer al căldurii, schimbătorul de căldură trebuie conectat astfel încât mediile să curgă prin schimbătorul de căldură în direcţii opuse (în contra-flux).

Notă: *Înainte de conectarea tubulaturii, asiguraţi-vă că toate obiectele străine au fost evacuate din sistem.*

Atenţie: *Luaţi în considerare riscul de incendiu în timpul lucrării de instalare, de ex. aveţi în vedere distanţa faţă de substanţele inflamabile.*

Atenţie: *Nu ridicaţi niciodată de racorduri. Pentru ridicare, trebuie folosite chingi. Aşezaţi chingile conform figurii 1.*

Notă: *În aplicaţiile de evaporator şi în aplicaţiile în care apare o modificare de fază a mediilor, schimbătorul de căldură trebuie instalat vertical cu o ţeavă dreaptă (cel puţin 150-200 mm în lungime) între supapa de expansiune şi admisia agentului frigorific.*

Montarea

Într-un sistem de ţevi rigide, schimbătoarele de căldură mici (cu o greutate de 1-6 kg) pot fi suspendate direct în conductele îngropate (figura 2A). Schimbătoarele de căldură mai mari trebuie asigurate cu cadre de susţinere (figura 2D) destinate pentru un schimbător de căldură specific (accesoriu) sau trebuie asigurate cu chingi (figura 2C) sau cu ajutorul bolţurilor de montare (figura 2B). Pentru comenzi speciale, bolţurile de montare pot fi sudate la partea din faţă sau din spate. Cuplul de strângere pentru bolţurile M6 este de 3,8 Nm, bolţurile M8 este de 9,5 Nm şi pentru bolţurile M10 este de 19,0 Nm.

Notă: *Dacă există risc de vibraţii, utilizaţi suporturi anti-vibraţii, aşa cum este indicat în figura 2A.*

Notă: *Schimbătoarele de căldură cu distribuitoare de agent frigorific trebuie montate cu distribuitorul la partea inferioară.*

Notă: *În timpul instalării, sarcinile de racordare nu trebuie să depăşească valorile specificate în tabelul din interiorul paginii de copertă "Valorile limită pentru sarcinile de racordare în timpul instalării".*

Notă: *Conducta trebuie să fie bine ancorată şi bine îmbinată astfel încât, în timpul operaţiunii, să nu existe transferuri de sarcină către schimbătorul de căldură cu plăci.*

Racorduri (figura 3)
Racordurile filetate - Utilizaţi o cheie dinamometrică atunci când conectaţi ţeava şi respectaţi limitele specificate. Unele modele sunt echipate cu racorduri tip Victaulic.
Racorduri brazate – Curăţaţi prin frecarea şi degresarea diferitelor suprafeţe. Utilizaţi un tip de metal brazat care este adecvat pentru materialele care sunt brazate şi utilizaţi temperatura corectă de brazare. Pentru informaţii detaliate consultaţi documentul "Tuburi de brazare pentru schimbător de căldură brazat" sau contactaţi reprezentantul Alfa Laval.
Racorduri sudate – Sudură TIG sau MIG. Şlefuiţi interiorul şi exteriorul ţevii şi, dacă este oblic, şlefuiţi şi marginea oblică la cel puţin 25 mm faţă de muchia ţevii şi faţă de interior. Acest lucru trebuie realizat pentru a evita contaminarea cuprului din zona sudată, care poate cauza fisurarea sudurii.

Notă: *Protejaţi schimbătorul de căldură împotriva supraîncălzirii, înfăşurând o bucată de lavetă umedă în jurul racordului, de fiecare dată când se execută o brazare sau o sudare. Încălzirea excesivă poate topi metalul interior de brazare din interiorul schimbătorului de căldură. Consultaţi figura 3.*

⚠ ***Atenţie:*** *Atunci când deconectaţi schimbătorul de căldură de la sistemul de ţevi, utilizaţi echipament adecvat de protecţie, precum încălţăminte de protecţie, mănuşi de siguranţă şi protecţie a ochilor, în funcţie de tipul mediilor din schimbătorul de căldură.*

Risc de îngheţ

⚠ ***Atenţie:*** *Aveţi în vedere riscul îngheţului la temperaturi joase pentru a evita deteriorarea schimbătorului de căldură. Schimbătoarele de căldură care nu se află în funcţiune trebuie golite şi uscate prin purjare, de fiecare dată când există risc de îngheţare.*

Notă: *Pentru a evita daunele cauzate de îngheţ, mediile utilizate trebuie să includă agent anti-îngheţ în condiţii de funcţionare sub punctul de îngheţ.*

Notă: *Atunci când este utilizat ca evaporator*
- *Utilizaţi un comutator de flux şi un comutator de joasă presiune.*
- *Utilizaţi un termostat anti-îngheţ şi un dispozitiv de monitorizare a fluxului pentru a asigura un flux de apă constant, în timpul funcţionării şi după ce compresorul a funcţionat.*
- *Evitaţi "pomparea în jos", de ex. golind evaporatorul prin funcţionarea compresorului după oprire, până când se obţine o presiune presetată a agentului frigorific. Temperatura poate scădea sub punctul de îngheţare al saramurii, care poate deteriora evaporatorul.*

Protecţia împotriva colmatării
Utilizaţi un filtru ca protecţie împotriva posibilei apariţii a particulelor străine. Dacă aveţi dubii referitoare la dimensiunea maximă a particulelor, consultaţi reprezentantul dvs. al furnizorului sau Informaţiile despre produs de pe pagina de internet a furnizorului.

Control şi operare

⚠ ***Atenţie:*** *Nu utilizaţi schimbătorul de căldură pentru medii (de ex. apă de-ionizată)/instalaţii (de ex. ţevi galvanizate) care pot afecta sau pot fi afectate (chimic/electrochimic) de plăci (oţel inoxidabil) şi material de brazare (cupru).*

Notă: *Cuprul poate cauza coroziunea în instalaţiile cu materiale mixte*

Protecţie împotriva oboselii termice şi/sau cauzate de presiune.
Temperatura bruscă sau modificările de temperatură pot duce la deteriorarea schimbătorului de căldură cauzată de oboseală. Prin urmare, trebuie luate în considerare următoarele pentru a asigura că schimbătoarele de căldură funcţionează fără presiuni/ temperaturi de oscilare.

- Localizaţi senzorul de temperatură cât de aproape posibil faţă de evacuarea schimbătorului de căldură.
- Alegeţi supape şi echipament de reglare care oferă temperaturi/presiuni stabile pentru schimbătorul de căldură.
- Pentru a evita lovitura de berbec, nu trebuie utilizate supape cu închidere rapidă, de ex. supape deschis/închis.
- În instalaţiile automate, oprirea şi pornirea pompelor şi acţionarea supapelor trebuie programate, astfel încât amplitudinea rezultată şi frecvenţa variaţiei de presiune vor fi cât de joase posibil.

Izolarea
Izolările de încălzire şi de răcire sunt disponibile ca accesorii.

Notă: *Aveţi în vedere că limitele de temperatură ale izolării şi schimbătorului de căldură pot fi diferite.*

Disfuncţionalităţi
Pentru a asigura o performanţă corectă a schimbătorului de căldură, verificaţi dacă:

- sistemul de ţevi a fost conectat la schimbătorul de căldură conform instrucţiunilor din acest manual
- schimbătorul de căldură este perfect curat şi nu prezintă depuneri.

Notă: *Particulele şi fibrele pot colmata schimbătorul de căldură. O creştere în scăderea presiunii sau o scădere a eficienţei termice indică faptul că schimbătorul de căldură este înfundat.*

- circuitul de control este presetat corect şi nu apare îngheţarea.

Curăţarea
Echipamentul este adecvat pentru curăţarea pe loc. Pentru sfaturi privind procesele adecvate de curăţare, consultaţi reprezentatul furnizorului sau vizitaţi pagina de internet a acestuia. Persoana responsabilă cu operarea trebuie să se asigure că este utilizată metoda corectă de curăţare şi trebuie să se decidă referitor la intervalele adecvate de curăţare.

Notă: *Ambalajul plăcuţei nu trebuie desfăcut.*

Предназначение
Запоените пластинчати топлообменници са предназначени за извършване на топлообмен и отговарят на изискванията в широка гама от приложения като хладилна техника, домашно отопление, промишлено отопление и охлаждане, както и на преработващата промишленост.

Определения

Предупреждение: *Тип на опасността ПРЕДУПРЕЖДЕНИЕТО означава потенциално опасна ситуация, която, ако не бъде избегната, може да доведе до смърт или сериозно нараняване.*

Внимание: *Тип на опасността ВНИМАНИЕТО означава потенциално опасна ситуация, която, ако не бъде избегната, може да доведе до леко или средно нараняване.*

Забележка:
ЗАБЕЛЕЖКАТА означава потенциално опасна ситуация, която ако не бъде избегната, може до доведе до имуществени щети.

Фирмени табелки
Съществуват различни видове фирмени табелки в зависимост от вида на одобрението на съда под налягане.

Забележка:
- *Може да се използват и други видове фирмени табелки. Свържете се с представител на Alfa Laval за по-подробна информация.*
- *Някои спецификации не се използват при всички видове фирмени табелки*

Фирмената табелка показва:
1. Място за логотип.
2. Име на производителя.
3. Място за печат на Националния борд и сериен номер.
4. Номер на артикул.
5. Тип.
6. Производствен или сериен номер.
7. Година или дата на производство.
8. Местоположение на връзките за всеки флуид.
9. Максимално допустима работна температура.
10. Максимално допустимо работно налягане.
11. Пробно налягане.
12. Дата на пробно налягане.
13. Обем на всяко пространство.
14. Допустими работни температури и налягане.
15. Работна област.
16. Описание на всяко пространство.
17. Група флуид.
18. Информация, специфична за клиента.
19. Възможни местоположения на връзките.
20. Информация за бар кода.
21. Място за марка за одобрение. (CE марките по-долу не са валидни за фирмена табелка тип 3)
    – CE-0409 BHE Manufacturing, Ronneby, Sweden
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Jiangyin City, PRC
    – CE-0948 Alfa Laval S.p.A. Alonte, Italy.

Оригинални инструкции
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Изисквания

Предупреждение: *Топлообменникът трябва да е инсталиран и работещ по начин, който не създава риск от нараняване на персонала или вреда на имуществото.*

Забележка: *Продуктовите данни за нормалните охладители, т.е. хидро-флуоро-въглеродни и хидро-флуоро-хлоро-въглеродни агенти, са приложими при охладителните системи, освен ако не е упоменато друго. Преди да използвате топлообменника за запалими, токсични или опасни течности (напр. въглеводород) трябва да вземете необходимите мерки за безопасност при работа с такива течности. Моля, погледнете интернет сайта на доставчика за повече информация.*

Монтаж

Монтажът трябва да бъде извършен с оборудване, което защитава топлообменника от налягане и температура извън одобрените минимални и максимални стойности, показани на фирмената табелка.

Внимание: *За да избегнете нараняването на ръцете от остри ръбове, винаги носете предпазни ръкавици, когато работите със запоените пластинчати топлообменници.*

За да осигурите най-добрия топлообмен, топлообменникът трябва да бъде свързан така, че флуидите да протичат през топлообменника в противоположни посоки (в противоток).

Забележка: *Преди да свържете каквито и да е тръби към топлообменника, се уверете, че всички чужди тела са били изхвърлени от системата.*

Внимание: *Вземете под внимание риска от пожар по време на монтаж, т.е. спазвайте необходимото разстояние до запалимите вещества.*

Внимание: *Никога не повдигайте топлообменника за връзките. При повдигане на топлообменника трябва да се използват примки от метално въже. Поставете примките в съответствие с фигура 1.*

Забележка: *В изпарителните системи и в приложенията, при които настъпва фазово превръщане на флуида, топлообменниците трябва да бъдат монтирани вертикално с права тръба (с дължина поне 150-200 мм) между разширителния шибър и входа на охлаждащото вещество.*

Монтиране

В системите с твърди тръби малките топлообменници (с тегло 1-6 кг) могат да бъдат окачени директно в системата от тръбопроводи (Фигура 2A): По-големите топлообменници трябва да бъдат закрепени здраво с крепежни елементи (Фигура 2D), предназначени за определени топлообменници (допълнителни принадлежности) или да бъдат закрепени с примки от метално въже (Фигура 2C) или чрез монтажни болтове (Фигура 2B). При специални поръчки монтажните болтове може да бъдат заварени към предната или задната част. Въртящият момент на затягането за M6 болтове е 3,8 Nm, за M8 болтове е 9,5 Nm, а за M10 болтове е 19,0 Nm.

Забележка: *Ако съществува риск от вибрации използвайте противовибрационни стойки за закрепване, както е показано на Фигура 2A.*

Забележка: *Топлообменниците с разпределители на охладителните вещества трябва да бъдат монтирани с разпределителя в долната част.*

Забележка: *По време на монтажа включеното натоварване не трябва да надвишава стойностите според таблицата „Ограничения за включено натоварване по време на монтаж“ от вътрешната страна на корицата.*

Забележка: *Тръбопроводната система трябва да е добре закрепена и изпълнена така, че натоварванията да се прехвърлят към топлообменника по време на работа.*

Връзки (Фигура 3)
Резбови съединения – Използвайте динамометричен гаечен ключ при свързване на тръбата и спазвайте определените ограничения. Някои модели са снабдени с виктоличен тип съединение.
Споени съединения – Почистете чрез търкане и обезмасляване на различните повърхности. Използвайте степен на запояване на метала, която е подходяща за материалите, които се запояват. Използвайте и правилната температура на спояване. За подробности вижте документа "Спояване на тръби за споени топлообменници" или се свържете с представител на Alfa Laval.
Заваръчни съединения – заваряване по метода ВИГ или МИГ. Шлифовайте вътрешната и външната страна на тръбата, а ако е скосена - и скосения край, на поне 25 мм от края на тръбата и навътре. Това трябва да бъде извършено с цел да се избегне заразяването на медта в областта на заваряване, което може да предизвика пропукване на заварката.

Забележка: *Защитете топлообменника от пренагряване чрез обвиване на парче влажна кърпа около връзката при всеки случай на спояване или заваряване. Прекомерното нагряване може да разтопи метала за спояване във вътрешността на топлообменника. Вижте фигура 3.*

⚠ ***Внимание:*** *При изключване на топлообменника от тръбопроводната система използвайте подходяща защитна екипировка, като например ботуши, предпазни ръкавици и очила в зависимост от вида на флуида в топлообменника.*

Риск от замръзване

⚠ ***Внимание:*** *Вземете под внимание риска от замръзване при ниски температури, за да избегнете повредата на топлообменника. Топлообменниците, които не се използват, трябва да бъдат изпразнени и изсушени, когато има риск от замръзване.*

Забележка: *За да избегнете повредата вследствие на замръзване, използваният флуид трябва да включва добавка, предпазваща от замръзване, при работни условия под неговата точка на замръзване.*

Забележка: *Когато се използва като изпарител*
- *Използвайте реле за поток и превключвател за ниско налягане.*
- *Използвайте термостат, защитаващ от замръзване и монитор за поток, за да осигурите постоянно снабдяване с вода преди, по време на и след работа на компресора.*
- *Избягвайте "евакуацията", т.е. изпразването на изпарителя чрез работа на компресора след изключване, до достигане на предварително зададеното налягане на охладителя. При това положение температурата може да спадне под точката на замръзване на соления разтвор, което може да повреди изпарителя.*

Защита от запушване
Използвайте филтър като защита срещу евентуално попадане на чужди частици. Ако имате съмнения относно максималния размер на частиците, консултирайте се с най-близкия представител на доставчика или погледнете в раздел Информация за продукта на уеб страницата на доставчика.
Контрол и работа

⚠ ***Внимание:*** *Не използвайте топлообменника за флуиди (напр. дейонизирана вода)/монтаж (напр. галванизирани тръби), които могат (по химичен или по електро-химичен път) да засегнат или да бъдат засегнати от пластините (неръждаема стомана) и материала за спояване (мед).*

Забележка: *Медта може да генерира корозия в монтаж със смесени материали*

Защита от топлинна умора или/и умора от налягане
Внезапните промени в температурата и налягането може да предизвикат повреда вследствие на умора на топлообменника. По тази причина трябва да вземете под внимание следното, за да осигурите работата на топлообменниците без промяна на налягането/ температурата.

- Поставете температурния датчик възможно най-близо до изхода от топлообменника.
- Подберете клапани и регулиращо оборудване, което осигурява стабилна температура/налягане за топлообменника.
- За да избегнете хидравлически удар не трябва да използвате бързо-затварящи се клапани, като например двупозиционни клапани.
- При автоматизираните инсталации спирането и пускането на помпите и задействането на клапаните трябва да бъде програмирано така, че получената амплитуда и честота на вариациите в налягането да бъдат възможно най-ниски.

Изолация
Отоплителните и охладителни изолации са налични като допълнителни принадлежности.

Забележка: *Вземете под внимание, че температурните ограничения на изолацията и топлообменника може да са различни.*

Отстраняване на неизправности
За да осигурите правилната работа на топлообменника, проверете дали:

- тръбопроводната система е свързана към топлообменника според инструкциите в това ръководство
- топлообменникът е напълно чист и освободен от отлагания.

Забележка: *Частиците и влакната може да запушат топлообменника. Увеличението на спада на налягането или спадът в топлинната ефективност указват, че топлообменникът е замърсен.*

- контролната верига е с правилни предварително зададени настройки и не се получава замръзване.

Почистване
Оборудването може да бъде почистено на място. Свържете се с представителя на доставчика или посетете интернет страницата на доставчика за съвет относно подходящи процедури за почистване. Човекът, отговорен за работата на топлообменника, трябва да осигури използването на подходящия метод на почистване и да установи подходящи интервали на почистване.

Забележка: *Пакетът пластини не трябва да бъде отварян.*

使用目的

本ブレージング熱交換器 (BHE) は、冷凍、空調、業務用冷却 / 加熱、プロセス産業といった多様な用途の要件に対応する熱交換用に設計されています。

定義

警告： *危険の種類*

警告は、放置すると死亡または重傷事故が発生する可能性がある、潜在的に危険な状況を示します。

注意： *危険の種類*

注意は、放置すると軽傷事故が発生する可能性がある、潜在的に危険な状況を示します。

注意：

注意は、放置すると物的損害が発生する可能性がある潜在的に危険な状況を示します。

ネームプレート

圧力容器承認の種類に応じて、様々な種類のネームプレートがあります。

注意：

- *他の種類のネームプレートが使用される場合もあります。詳しくは、アルファ・ラバルの担当者にお問い合わせください。*
- *一部の仕様は、すべてのネームプレートでは使用できません*

ネームプレートには以下の情報が表示されています：

1. ロゴタイプ用のスペース。
2. メーカー名。
3. 委員会のスタンプおよびシリアル番号用の余白。
4. 品番。
5. 型式。
6. 製造番号またはシリアル番号。
7. 製造年または日付。
8. 流体別の接続場所。
9. 最大許容使用温度。
10. 最大許容使用圧力。
11. テスト圧力。
12. テスト圧力の日付。
13. 各スペースの容積。
14. 許容使用温度および圧力。
15. 使用エリア。
16. 各スペースの説明。
17. 流体グループ。
18. お客様固有の情報。
19. 可能な接続場所。
20. バーコード情報。
21. 承認マーク用の余白。(下の CE マークは、ネームプレートタイプ 3 には無効です)
    – CE-0409 BHE Manufacturing, Ronneby, Sweden
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, Jiangyin City, PRC
    – CE-0948 Alfa Laval S.p.A. Alonte, Italy.

オリジナル取扱説明書

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要件

警告： *熱交換器の設置および操作は、負傷や物的損害が発生しないように行ってください。*

注意： *他に指示のない限り、通常の冷却材 (HFC および HCFC) の製品データは冷却用途に適用されます。熱交換器で可燃性液体、有毒液体または危険な液体 (炭化水素など) を扱う前に、当該の液体に関する安全規則に従ってください。詳しくは、サプライヤのウェブサイトを参照してください。*

設置

設置は、ネームプレートに記載されている承認済みの最小値 / 最大値を逸脱する圧力や温度から熱交換器を保護する機器を使用して行ってください。

注意： *鋭利なエッジによる手の負傷を防ぐために、ブレージング熱交換器を取り扱う際は必ず保護グローブを着用してください。*

熱交換器のパフォーマンスを最大限に高めるためには、熱交換器内で流体の流れが対向するように熱交換器を接続してください。

注意： *配管を行う前に、システム内のすべての異物を流して除去してください。*

注意： *設置作業中は引火リスクに配慮してください。つまり、引火性物質と十分な距離をとってください。*

注意： *接続部で吊り上げないでください。吊り上げにはストラップを使用する必要があります。ストラップは図 1 に従って配置します。*

注意： *蒸発器の用途や、媒体の相変化が発生する用途では、拡張バルブと冷媒入り口の間にストレートパイプ (長さ 150 ～ 200 mm 以上) を使用して熱交換器を垂直に設置する必要があります。*

取り付け

硬質管システムでは、小型の熱交換器 (重量が 1 ～ 6 kg) は配管に直接吊り下げることができます (図 2A)。大型の熱交換器は、特定の熱交換器 (付属品) 専用の支持取付部 (図 2D) を使用して固定するか、ストラップ (図 2C) を使用して固定するか、取付ボルト (図 2B) を使用します。特注の場合、取付ボルトを全部または後部に溶接できます。M6 ボルトの締め付けトルクは 3.8 Nm、M8 ボルトの締め付けトルクは 9.5 Nm、M10 ボルトの締め付けトルクは 19.0 Nm です。

注意： *振動リスクがある場合、図 2A を参照して防振取付部を使用してください。*

注意： *冷媒の分散装置が搭載されている熱交換器は、分散装置を底部に配置して取り付ける必要があります。*

注記： *設置中には、負荷接続か表紙の内側に記載されている「設置中の負荷接続の限界」表に従って、限界値を超えないようにしなければなりません。*

注記： *設置中には、負荷接続か表紙の内側に記載されている「設置中の負荷接続の限界」表に従って、限界値を超えないようにしなければなりません。*

接続 (図 3)

ネジ接続 - パイプの接続時にはトルクレンチを使用して、規定の上限を超えないよう注意してください。一部のモデルは接続タイプがビクトリック形です。

ろう付け接続 - 様々な表面をこすり、グリースを除去してクリーニングします。ろう付け対象物に適したろう付け金属グレードを使用し、正しいろう付け温度を使用してください。詳しくは『ブレージング熱交換器用ブレージングチューブ (Brazing tubes for brazed heat exchanger)』マニュアルを参照するか、アルファ・ラバルの担当者にお問い合わせください。

溶接接続 - TIG または MIG 溶接。パイプの内側と外側を研磨します。傾斜している場合は、パイプの端から少なくとも 25 mm、内側に向かって斜端も研磨してください。研磨の際は、溶接部に銅が混入しないようにしてください。混入すると、溶接がひび割れる可能性があります。

***注意**: ろう付けまたは溶接を行うときは、濡れた布切れを接続部に巻くことにより、熱交換器の過熱を防いでください。過熱により、熱交換器内部のろう付け金属が溶解する場合があります。図 3 を参照してください。*

⚠ ***注意**: 配管システムから熱交換器を外すときは、熱交換器内の流体のタイプに応じて、安全ブーツ、安全グローブ、眼球保護装置など適切な保護用具を使用してください。*

凍結リスク

⚠ ***注意**: 低温時は凍結リスクに注意し、熱交換器が破損しないようにしてください。熱交換器を使用しない場合、凍結リスクがあるときは、熱交換器を空にして吹き付け乾燥してください。*

***注意**: 凍結による破損を防ぐために、凍結温度を下回る運転状況では、使用する流体に不凍液を加える必要があります。*

***注意**: 蒸発器として使用する場合*

- *フロースイッチと低圧スイッチを使用してください。*
- *圧縮室の使用前、使用中、使用後に水の流量を一定に保つために、不凍サーモスタットと流量モニターを使用してください。*
- *「ポンプダウン」を回避してください。シャットダウン後、規定の冷媒圧力に達するまで圧縮室を稼働することにより、蒸発器を空にします。塩水の凍結温度を下回り、蒸発器が破損する可能性があります。*

詰まり保護

異物の混入を防ぐためにフィルターを使用してください。粒子の最大サイズについて疑問がある場合、お近くのサプライヤ代理店にご相談いただくか、サプライヤのウェブサイトで製品情報を参照してください。

制御と操作

⚠ ***注意**: プレート (ステンレス鋼) とろう付け材料 (銅) に化学的 / 電気化学的な影響を与える (または受ける) 可能性がある流体 (イオン除去水など)/ 設置 (めっきパイプなど) に熱交換器を使用しないでください。*

***注意**: 銅は、混合材料の設置で腐食を発生させる可能性があります*

熱や圧力による披露からの保護
温度や圧力が急激に変化すると、熱交換器が疲労損傷を受ける可能性があります。そのため、圧力 / 温度の変動なく熱交換器を運転するためには、次の事項に従う必要があります。

- 温度センサーは、熱交換器の出口にできるだけ近い位置に設置してください。
- 熱交換器に安定した温度 / 圧力を提供できるバルブと制御装置を選択してください。
- ウォーターハンマーを防止するために、急速閉止バルブ (オン / オフバルブなど) は使用しないでください。
- 自動設置では、圧力変動の振れ幅と頻度が可能なかぎり低くなるようにポンプの開始 / 停止とバルブの作動をプログラムする必要があります。

絶縁材
冷却および加熱の断熱材は付属品として提供されています。

注意: *温度の限度は、断熱材と熱交換器で異なる可能性があります。*

トラブルシューティング
熱交換器のパフォーマンスを最適化するためには、以下を確認してください :

- 本書の指示に従って配管システムを熱交換器に接続している
- 熱交換器が完全にクリーンで、沈殿物がない。

注意: *粒子や繊維で熱交換器が詰まる可能性があります。圧力低下の増加または熱効率の低下は、熱交換器で障害が発生している可能性を示唆しています。*

- 制御回路が正しくプリセットされており、凍結が発生していない。

洗浄
本機は、設置したままでの洗浄に最適です。適切な洗浄プロセスについて詳しくは、サプライヤの担当者にお問い合わせいただくか、サプライヤのウェブサイトを参照してください。操作担当者は、正しい洗浄方法を使用していることを確認し、適切な洗浄間隔を決める必要があります。

注意: *プレートパッケージは開封には適していません。*

预期用途

本钎焊换热器（BHE）设计用于热传递，以满足诸如冷藏、供暖、工业加热与冷却以及加工行业等广泛应用领域的要求。

定义

警告： *危险类型*

“警告”表示有潜在危险的情况，如果未加以避免，可能导致死亡或重伤。

小心： *危险类型*

“小心”表示有潜在危险的情况，如果未加以避免，可能导致轻微或中等程度的伤害。

注意：

“注意”表示有潜在危险的情况，如果未加以避免，可能导致财产损坏。

铭牌

铭牌的类型因压力容器许可类型的不同而异。

注意：

？有可能使用其他类型的铭牌。有关详细信息，请联系阿法拉伐代表。

？某些规格并不用于所有类型的铭牌

铭牌上包含：

1. 商标。
2. 制造商名称。
3. 国家委员会戳记和序列号。
4. 项目编号。
5. 类型。
6. 制造编号或序列号。
7. 制造年份或日期。
8. 每种液体的接头位置。
9. 允许的最高操作温度。
10. 允许的最大操作压力。
11. 测试压力。
12. 测试压力的日期。
13. 各空间的容量。
14. 允许的操作温度和压力。
15. 操作区域。
16. 各空间的描述。
17. 液体组。
18. 客户独有的信息。
19. 可能的接头位置。
20. 条形码信息。
21. 认证标记的位置。（下面的 CE 标记对于铭牌类型 3 无效）
    - CE-0409 BHE Manufacturing, Ronneby, Sweden
    - CE-0036 阿法拉伐（江阴）设备制造有限公司，中华人民共和国江阴市
    - CE-0948 Alfa Laval S.p.A. Alonte, Italy.

原厂说明

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要求

警告： *安装和操作本换热器时不得造成任何人身伤害或财产损坏的风险。*

注意： *除非另有说明，否则针对普通制冷剂（即 HFC 和 HCFC）的产品数据适用于制冷应用领域。在将换热器用于易燃、有毒或危险液体（例如碳氢化合物）之前，必须按照处理此类液体的相关安全规则操作。有关更多信息，请参阅供应商的网站。*

安装

进行安装时必须使用相应的保护设备，避免换热器承受超出铭牌标注的最低和最高认可值的压力和温度。

小心： *为避免尖锐边缘割伤手部，搬动钎焊换热器时应始终佩戴防护手套。*

为了达到可能的最佳热传递性能，连接换热器时应能够使介质经过换热器流向相反方向（逆向流动）。

注意： *在连接任何管路之前，应确保系统中的所有异物均已排净。*

小心： *安装施工期间要注意防火，牢记远离易燃物品。*

小心： *切勿拉住接头提升装置。提升时应使用皮带。请将皮带置于图 1 所示的位置。*

注意： *在蒸发器应用领域和发生介质相变的应用领域中，换热器必须垂直安装，并在膨胀阀与制冷剂注入口之间安装直管（长度至少 150-200 毫米）。*

固定

在刚性管道系统中，小型换热器（重量在 1 - 6 千克）可以直接悬吊在管道中（图 2A）。较大型的换热器应使用适用于特定换热器的支撑固定架（配件）进行固定（图 2D），或使用皮带（图 2C）或固定螺栓（图 2B）进行固定。对于专门定制产品，可以将固定螺栓焊接在前部或后部。M6 螺栓的拧紧扭矩为 3.8 Nm，M8 螺栓的拧紧扭矩为 9.5 Nm，M10 螺栓的拧紧扭矩为 19.0 Nm。

注意： *如果存在振动风险，请使用图 2A 中所示的防振动固定架。*

注意： *固定带有制冷剂分配器的换热器时，应将分配器置于底部。*

注意： *安装期间，连接负载不得超过封面内页上表“安装期间连接负载的限值”中的规定值。*

注意： *管道应固定可靠，其设置应保证在运转过程中负载不会传导到板式换热器上。*

接头 （图 3）

螺纹接头 – 连接管路时使用扭矩扳手并遵守规定的限度。某些型号提供维克托利克型接头。

钎焊接头 – 打磨各表面并去除油污，以清洁接头。采用适合要钎焊之材料的钎焊金属级品位，并采用正确的钎焊温度。有关详细信息，请参阅 “ 为钎焊换热器钎焊管道 ” 文档，或联系阿法拉伐代表。

焊接接头 – TIG 或 MIG 焊接方法。打磨管道内部和外部，如果有斜坡口，在管道边沿向内至少 25 毫米处打磨斜坡边缘。应采取这种做法，以避免焊接区域出现铜沾污，如果出现沾污，可能导致开焊。

注意： *钎焊或焊接完成时，应在接头处包裹湿布，保护换热器不会过热。过度加热可能导致换热器内部的钎焊金属融化。请参阅图 3。*

⚠ ***小心：*** *在断开换热器与管道系统的连接时，请穿戴适当的保护设备 （如安全靴、安全手套和护目用具），具体取决于换热器内的介质。*

结冰风险

⚠ ***小心：*** *切记低温条件下存在结冰风险，避免换热器因结冰而损坏。当存在结冰风险时，不工作的换热器应排空并进行风干。*

注意： *为避免结冰造成设备损坏，所用介质必须加入防冻剂，在其冰点以下的操作条件下使用。*

注意： *当用作蒸发器时*

- *使用流量开关和低压开关。*
- *使用防冻恒温器和流量监视器，确保压缩机运行之前、期间及之后保持恒定水流。*
- *避免 “ 抽气 ”，即通过关机后运行压缩机，直至达到预设的制冷压力，而使蒸发器排空。一旦如此，温度可能跌落至盐水冰点以下，从而可能损坏蒸发器。*

阻塞防护措施

使用过滤器作为防护措施，防止可能出现的异物颗粒。如果对最大颗粒尺寸有任何疑问，请就近咨询供应商代表或查询供应商网站上的产品信息。

控制和操作

⚠ ***小心：*** *请勿将换热器用于可能对板片 （不锈钢）和钎焊材料 （铜）造成化学／电化学影响或受这两者影响 （化学／电化学）的介质 （例如去离子水）／安装 （例如镀锌管）。*

注意： *铜在使用混合材料安装时可能产生腐蚀。*

热疲劳和 / 或压力疲劳的防护措施
温度和压力的骤然变化可能对换热器造成疲劳损坏。因此，必须注意以下事项，确保换热器在运转时不会出现压力 / 温度摆动。

? 将温度传感器尽可能靠近换热器的出口。
? 选择可以为换热器提供稳定温度 / 压力的阀门和调节设备。
? 为避免水锤现象，不要使用快关阀，例如开关阀。
? 在自动安装时，应对泵的停止和启动以及阀门的启动进行编程，以便使得到的压力变化的振幅和频率尽可能地低。

保温
加热和冷却保温装置作为配件提供。

注意：*保温装置和换热器的温度限制可能各有不同。*

故障排除
为了确保换热器发挥应有的性能，请检查：

? 管道系统已经按照本手册的说明连接到换热器
? 换热器经过彻底清洁并且无积淀物。

注意：*颗粒和纤维可能会阻塞换热器。压降升高或热效率下降表明换热器发生堵塞。*

? 控制回路已经过正确预设，并且未发生结冰现象。

清洗
本设备适合原位清洗。有关合适的清洗过程的建议，请咨询供应商的代表或访问供应商的网站。负责操作设备的人员应当确保采用正确的清洗方法，并确定合适的清洗间隔。

注意：*不应打开板片组。*

Pravilna uporaba

Lemljeni izmjenjivači topline (BHE) projektirani su tako da se ispune zahtjevi za izmjenu topline u širokom području primjene kao što je hlađenje, grijanje stambenog prostora, industrijsko grijanje i hlađenje te izmjena topline u procesnoj industriji.

Definicija

Upozorenje: *Vrsta opasnosti*

UPOZORENJE označava potencijalno opasnu situaciju koja bi, ako se ne izbjegne, mogla imati za posljedicu smrtni slučaj ili ozbiljnu ozljedu.

Oprez: *Vrsta opasnosti*

OPREZ označava potencijalno opasnu situaciju koja, ako se ne izbjegne, može imati za posljedicu manje ili umjerene povrede.

Napomena:

NAPOMENA označava potencijalno opasnu situaciju koja, ako se ne izbjegne, može imati za posljedicu oštećenje imovine.

Označna pločica

Postoje različite vrste pločica ovisno o vrsti odobrenja tlačnog spremnika.

Napomena:

- *U uporabi mogu biti različite nazivne pločice. Za više informacija kontaktirajte s predstavnikom tvrtke Olympus.*
- *Neke specifikacije nisu navedene na svim vrstama pločica.*

Na natpisnoj pločici nalazi se sljedeće:

1. Mjesto za logotip.
2. Naziv proizvođača.
3. Mjesto za oznaku Državnog odbora i serijski broj.
4. Kataloški broj.
5. Tip.
6. Proizvodni ili serijski broj.
7. Godina ili datum proizvodnje.
8. Mjesto priključaka za pojedini fluid.
9. Maks. dopuštene radne temperature.
10. Maks. dopušteni radni tlakovi.
11. Ispitni tlak.
12. Datum ispitivanja tlaka.
13. Volumen pojedinog prostora.
14. Dopuštene radne temperature i tlakovi.
15. Raspon primjene.
16. Opis pojedinog prostora.
17. Grupa fluida.
18. Informacije prema traženju kupca.
19. Mogući položaji priključaka.
20. Bar kod informacije Crtični kod.
21. Mjesto za oznaku certifikata. (Dolje navedene CE-oznake ne vrijede za natpisnu pločicu tipa 3)
    - CE-0409 BHE Proizvodnja, Ronneby, Švedska
    - CE-0036 Alfa Laval (Jiangyin) Manufacturing Co, Ltd, Jiangyin City, NR Kina
    - CE-0948 Alfa Laval S.p.A. Alonte, Italija.

Prijevod originalnih uputa

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Zahtjevi

Upozorenje: *Izmjenjivač topline mora biti instaliran i njime treba rukovati na način da se izbjegnu opasnosti od ozljede osoblja i oštećenja imovine.*

Napomena: *Ako nije drugačije navedeno, u rashladnim primjenama upotrebljavaju se proizvodni podaci za standardne rashladne tvari, kao što su kloro-fluoro-ugljikovodici. Prije nego što se izmjenjivač topline počne koristi za zapaljive, otrovne ili opasne kapljevine (npr. ugljikovodici), moraju se primijeniti odgovarajuća sigurnosna pravila za rukovanje takvim kapljevinama. Sve dodatne informacije potražite na internetskim stranicama dobavljača.*

Instalacija

Postrojenje mora imati opremu koja ga štiti od tlaka i temperature izvan odobrenih minimalnih i maksimalnih vrijednosti navedenih na nazivnoj pločici.

Oprez: *Pri rukovanju lemljenim izmjenjivačem topline uvijek trebate nositi zaštitne rukavice kako biste izbjegli ozljede ruku na oštrim bridovima.*

Za najbolji mogući učinak prijenosa topline izmjenjivač treba biti spojen tako da mediji kroz izmjenjivač teku u suprotnom smjeru (protustrujno).

Napomena: *Prije spajanja cjevovoda, pobrinite se da svi strani predmeti budu isprani iz sustava.*

Oprez: *Uzmite u obzir opasnost od požara tijekom ugradnje, odnosno imajte na umu udaljenost od zapaljivih tvari.*

Oprez: *Nikada ne podižite izmjenjivač hvatajući za priključke. Prilikom podizanja koristite trake. Postavite trake kao na slici 1.*

Napomena: *U primjenama za isparavanje i onima u kojima dolazi do promjene agregatnog stanja fluida izmjenjivač topline mora biti ugrađen okomito. Ulazni priključak s ravnom cijevi (uz minimalnu duljinu od 150 do 200 mm) između ulaza i ekspanzijskog ventila rashladnog sredstva.*

Ugradnja

U sustavu s krutim cijevima manji izmjenjivači topline (težine od 1 do 6 kg) mogu se montirati izravno u cjevovod (slika 2A). Veći izmjenjivači topline trebaju se dodatno pričvrstiti (slika 2D) nosačima namijenjenima za pojedini izmjenjivač topline (pribor), trakom (slika 2C) ili pričvrsnim vijcima (slika 2B). Za posebne narudžbe pričvrsni vijci mogu se zavariti s prednje i stražnje strane. Moment zatezanja vijka M6 je 3,8 Nm, za M8 je 9,5 Nm, a za M10 je 19,0 Nm.

Napomena: *Ako postoji opasnost od vibracija, upotrijebite protuvibracijske nosače, kao što je prikazano na slici 2A.*

Napomena: *Izmjenjivači topline s razdjelnikom rashladnog sredstva trebaju biti ugrađeni s razdjelnikom pri dnu.*

Napomena: *Tijekom instalacije opterećenje priključaka ne smije prijeći vrijednosti navedene u tablici "Granice za opterećenje priključaka tijekom instalacije" na unutarnjoj naslovnoj stranici.*

Napomena: *Cjevovod treba biti dobro pričvršćen i montiran na način da tijekom rada ne opterećuje pločasti izmjenjivač topline.*

Priključci (slika 3)
Navojni priključci – Prilikom spajanja cijevi upotrijebite momenti ključ i poštujte zadane granice. Neki su modeli opremljeni priključcima tipa Victaulic.
Lemljeni priključci – Dobro očistite i odmastite sve površine. Koristite gradaciju materijala za lemljenje koja je pogodna za materijal koji se lemi i lemite pri ispravnoj temperaturi lemljenja. Detaljne informacije možete pronaći u dokumentu "Lemljenje cijevi za lemljene izmjenjivače topline" ili se obratite predstavniku tvrtke Alfa Laval.
Zavareni priključci – TIG i MIG zavarivanje. Izbrusite cijev iznutra i izvana i, ako je ukošena, učinite isto s nakošenim rubom najmanje 25 mm od ruba cijevi i prema unutra. Ovo je potrebno kako bi se izbjegla kontaminacija bakrom u zavarenom području, što bi moglo dovesti do loma zavara.

Napomena: *Zaštitite izmjenjivač topline od pregrijavanja omatanjem komada mokre tkanine oko mjesta lemljenja ili zavara. Pretjerano zagrijavanje može rastopiti lemljeni metal unutar izmjenjivača topline. Pogledajte na slici 3.*

⚠ ***Oprez:*** *Kad odvajate izmjenjivač topline iz sustava cjevovoda, upotrijebite odgovarajuću zaštitnu opremu kao što su sigurnosne čizme, zaštitne rukavice i zaštitne naočale (ovisno o vrsti medija koji se nalazi u izmjenjivaču topline).*

Opasnost od zaleđivanja

⚠ ***Oprez:*** *Imajte na umu da na niskim temperaturama postoji opasnost od zaleđivanja i izbjegnite oštećenje izmjenjivača topline. Izmjenjivače topline koji nisu u funkciji treba isprazniti i osušiti kad god postoji opasnost od smrzavanja.*

Napomena: *U radnim uvjetima ispod ledišta sredstvo koje se koristi mora sadržavati dodatak protiv zaleđivanja kako biste izbjegli oštećenja uslijed zaleđivanja.*

Napomena: *Korištenje u svojstvu isparivača*
- *Koristite sklopku protoka i niskotlačnu sklopku.*
- *Koristite termostat za zaštitu od zaleđivanja i protokomjer kako biste osigurali stalan protok vode prije, tijekom i nakon rada kompresora.*
- *Izbjegavajte ispumpavanje, primjerice, pražnjenje isparivača pokretanjem kompresora nakon isključivanja dok se ne postigne predviđeni tlak hladnjaka. U takvom bi slučaju temperatura mogla opasti ispod ledišta otopine, što može oštetiti isparivač.*

Zaštita od začepljenja
Koristite filtar kao zaštitu od nakupljanja stranih čestica. Ako imate bilo kakve dvojbe u vezi s maksimalnom veličinom čestica, obratite se najbližem predstavniku dobavljača filtera ili pogledajte odjeljak Informacije o proizvodu na internetskim stranicama dobavljača.

Upravljanje i rad

⚠ ***Oprez:*** *Nemojte koristiti izmjenjivač topline s medijima (primjerice, deionizirana vodu) ili s opremom (primjerice, pocinčane cijevi) koja bi mogla kemijski ili elektrokemijski reagirati s pločama (nehrđajući čelik) ili lemljenim materijalima (bakar).*

Napomena: *Bakar može izazvati koroziju ako je ugrađen u instalaciju s miješanim materijalima.*

Zaštita od toplinskog i tlačnog zamora materijala
Nagle promjene temperature i tlaka mogu uzrokovati oštećenja na izmjenjivaču topline uslijed zamora materijala. Kako biste osigurali da izmjenjivači topline rade bez promjena tlaka ili temperature, postupite prema sljedećim uputama.

- Postavite temperaturni senzor što je moguće bliže izlazu izmjenjivača topline.
- Odaberite ventile i opremu za reguliranje koja osigurava stabilnu temperaturu i tlak u izmjenjivaču topline.
- Kako biste izbjegli vodni udar, ne upotrebljavajte ventile s brzim zatvaranjem (primjerice, ventile za otvoren/zatvoren funkcijom).
- Kod automatiziranih postrojenja, zaustavljanje i pokretanje pumpi i aktiviranje ventila treba biti programirano tako da nastala amplituda i frekvencija promjene tlaka budu što manji.

Izolacija
Izolacije od visoke i niske temperature dostupne su kao dodatna oprema.

Napomena: *Imajte na umu da temperaturna ograničenja izolacije i izmjenjivača topline mogu biti različiti.*

Otklanjanje poteškoća
Kako biste osigurali ispravan rad izmjenjivača topline, provjerite sljedeće:

- je li cjevovod spojen na izmjenjivač topline prema uputama ovog priručnika
- je li izmjenjivač topline potpuno čist i bez naslaga.

Napomena: *Čestice i vlakna mogu začepiti izmjenjivač topline. Povećanje pada tlaka ili smanjenje toplinskog učina ukazuje na to da je izmjenjivač neispravan.*

- je li upravljački sklop postavljen i dolazi li do zaleđivanja.

Pranje
Proizvod se može čistiti na mjestu ugradnje. Za savjet o odgovarajućim postupcima čišćenja obratite se predstavniku dobavljača ili posjetite internetske stranice dobavljača. Osoba odgovorna za rad treba osigurati da se primjenjuje ispravna metoda čišćenja i treba odlučiti o odgovarajućim intervalima čišćenja.

Napomena: *Paket ploča nije predviđen za otvaranje.*

용도

브레이징 열교환기 (BHE) 는 냉장 , 난방 , 산업용 가열 및 냉각 , 가공 산업 등과 같은 다양한 용도에 대한 요구 사항을 충족하는 열전달을 수행하도록 설계되었습니다.

정의

경고 : *위험 유형*

경고는 방지하지 않을 경우 사망이나 심각한 부상을 초래할 수 있는 잠재적으로 위험한 상황을 나타냅니다 .

주의 : *위험 유형*

주의는 방지하지 않을 경우 경미하거나 심하지 않은 부상을 초래할 수 있는 잠재적으로 위험한 상황을 나타냅니다 .

참고 :

참고는 방지하지 않을 경우 재산상의 손해를 초래할 수 있는 잠재적으로 위험한 상황을 나타냅니다 .

명판

압력 용기 인증 유형에 따라 명판 유형이 다릅니다 .

참고 :

- *다른 유형의 명판을 사용할 수 있습니다 . 자세한 내용은 Alfa Laval 담당자에게 문의하십시오 .*
- *명판 유형에 따라서는 일부 사양이 사용되지 않습니다 .*

명판에 표시되는 사항 :

1. 로고가 들어가는 자리
2. 제조업체 이름
3. 국가위원회 소인 및 일련번호가 들어가는 자리
4. 물품 번호
5. 유형
6. 제조 또는 일련번호
7. 제조 연도 또는 날짜
8. 각 유체의 연결 위치
9. 허용 가능한 최대 운전 온도
10. 허용 가능한 최대 운전 압력
11. 테스트 압력
12. 테스트 압력 날짜
13. 각 공간의 부피
14. 허용 가능한 작동 온도 및 압력
15. 작동 영역
16. 각 공간에 대한 설명
17. 유체 그룹
18. 고객 고유의 정보
19. 가능한 연결 위치
20. 바코드 정보
21. 인증 마크가 들어가는 자리 (아래 CE 마크는 명판 유형 3 에 사용할 수 없음)
    – CE-0409 BHE Manufacturing, 론네뷔 , 스웨덴
    – CE-0036 Alfa Laval (Jiangyin) Manufacturing Co., Ltd, 장인시 , 중국
    – CE-0948 Alfa Laval S.p.A. 알롱테 , 이탈리아

기존 지침

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요구 사항

경고 : *열교환기는 인적 피해 및 재산 손실이 발생할 위험이 없는 방식으로 설치 및 작동해야 합니다 .*

참고: *달리 명시하지 않은 경우 일반 냉매(예: HFC 및 HCFC)에 대한 제품 데이터는 냉장 용도에 적용 가능합니다 . 열교환기를 가연성 또는 유독성의 위험 액체 (예 : 탄화수소) 에 사용하려면 먼저 이러한 액체 취급과 관련된 안전 규칙을 따라야 합니다 . 자세한 내용은 공급업체의 인터넷 사이트를 참조하십시오 .*

설치

설치할 때는 압력 및 온도가 명판에 표시된 승인된 최소 및 최댓값을 벗어나는 경우에 열교환기를 보호하는 장비를 함께 제공해야 합니다 .

주의 : *날카로운 모서리에 손을 다치지 않도록 브레이징 열교환기를 취급할 때는 항상 보호용 장갑을 착용하십시오 .*

최상의 열전달 성능을 얻으려면 열교환기를 통과하는 유체가 서로 반대 방향 (대향류) 으로 흐르도록 열교환기를 연결해야 합니다 .

참고 : *파이프를 연결하기 전에 시스템에서 이물질을 모두 씻어냈는지 확인하십시오 .*

주의 : *설치 작업 중 화재 위험을 고려하십시오 . 즉 , 가연성 물질과의 거리에 유념하십시오 .*

주의 : *배관 연결부를 잡고 들어 올리지 마십시오 . 들어 올릴 때는 끈을 사용해야 합니다 . 그림 1 에 따라 끈을 배치하십시오 .*

참고 : *증발기 용도에서와 유체의 상변화가 발생하는 용도에서는 , 팽창 밸브와 냉매 유입부 사이를 연결하는 직선 파이프 (길이 150-200mm 이상) 를 사용하여 열교환기를 수직으로 설치해야 합니다 .*

설치

견고한 파이프 시스템에서는 소형 열교환기 (무게 1–6kg)를 파이프에 직접 매달 수 있습니다(그림 2A). 대형 열교환기는 특정 열교환기용 지지 받침대(부속품)(그림 2D) 를 사용하여 고정하거나 끈 (그림 2C) 또는 장착용 볼트 (그림 2B) 를 사용하여 고정해야 합니다 . 특별 주문하면 장착용 볼트를 전면 또는 후면에 용접할 수 있습니다. M6 볼트용 체결 토크는 3.8Nm, M8 볼트용은 9.5Nm, M10 볼트용은 19.0Nm 입니다 .

참고 : *진동이 발생할 위험이 있는 경우 그림 2A 에 나온 진동 방지 받침대를 사용하십시오 .*

참고: *냉매 분배기가 있는 열교환기의 경우 분배기가 맨 아래에 오도록 하여 장착해야 합니다 .*

참고: *설치 중 연결부 부하가 표지 안쪽에 있는 " 설치 중 연결부 부하에 대한 제한 " 표에 나온 값을 초과하면 안 됩니다 .*

참고: *파이프를 제대로 고정해 작동 중 부하가 판형 열교환기로 전달되지 않도록 해야 합니다 .*

연결부 (그림 3)

나사 연결부 – 파이프를 연결할 때 토크 렌치를 사용하고 지정된 제한을 준수하십시오 . 일부 모델에는 빅톨릭 (Victualic) 유형의 연결부가 제공됩니다 .

브레이징 연결부 – 다양한 표면을 반질반질하게 문지르거나 기름기를 제거하여 깨끗하게 하십시오 . 소재에 적합한 브레이징 금속 등급을 사용하고 올바른 브레이징 온도를 사용하십시오 . 자세한 내용은 " 브레이징 열교환기용 튜브 브레이징 " 문서를 참조하거나 Alfa Laval 담당자에게 문의하십시오 .

용접 연결부 – TIG 또는 MIG 용접 . 파이프의 내부와 외부 및 (비스듬한 경우) 경사진 모서리를 파이프 모서리에서 25mm 이상 안쪽으로 연마하십시오. 이렇게 해야만 용접 부위의 구리 오염으로 인해 용접에 균열이 생기는 문제를 방지할 수 있습니다 .

참고 : *브레이징이나 용접을 수행하는 중에는 항상 젖은 천 조각으로 연결부를 둘러싸서 열교환기가 과열되지 않게 하십시오 . 지나치게 가열되면 열교환기 안쪽의 내부 브레이징 금속이 녹을 수 있습니다 . 그림 3 을 참조하십시오 .*

주의 : *열교환기와 파이프 시스템을 분리할 때는 열교환기의 유체 유형에 따라 안전화 , 안전 장갑 , 보호 안경 등과 같은 적절한 보호 장비를 사용하십시오 .*

동결 위험

주의 : *저온에서 열교환기 손상을 피하기 위해서는 동결 위험에 유념하십시오 . 동결 위험이 있을 때마다 작동 중이지 않은 열교환기를 비우고 헤어 드라이기로 말려야 합니다 .*

참고 : *동결로 인한 손상을 방지하려면 빙점 이하의 운전 조건에는 부동액을 유체에 넣어야 합니다 .*

참고 : *증발기로 사용하는 경우*

- *흐름 스위치와 저압 스위치를 사용하십시오 .*
- *동결방지 서모스탯과 흐름 모니터를 사용하여 컴프레서 가동 중과 전후에 일정한 수류를 유지하십시오 .*
- *" 펌프다운 " 을 방지하십시오 . 즉 , 가동 중단 후 미리 설정된 냉매 압력에 도달할 때까지 컴프레서를 가동하여 증발기를 비우십시오 . 온도가 브라인의 빙점 아래로 떨어지면 증발기가 손상될 수 있습니다 .*

막힘 방지

필터를 사용하여 발생 가능한 외부 입자를 방지하십시오. 최대 입자 크기에 관해 궁금한 사항이 있는 경우 가까운 공급업체 담당자에게 문의하거나 공급업체 인터넷 사이트에서 제품 정보를 알아보십시오 .

제어 및 작동

주의: *플레이트(스테인리스강) 및 브레이징 소재(구리)와 전기 / 화학적으로 영향을 주고받을 수 있는 유체 (예 : 탈이온수) / 설치 (예 : 아연도금 파이프) 에는 열교환기를 사용하지 마십시오 .*

참고 : *구리는 혼합 소재가 사용된 설치에 부식을 일으킬 수 있습니다 .*

열 및 / 또는 압력 피로 방지
갑작스러운 온도 및 압력 변화로 인해 열교환기에 피로 손상이 발생할 수 있습니다 . 따라서 열교환기가 급격한 압력 / 온도 변화 없이 작동하도록 다음 사항을 고려해야 합니다 .

- 온도 센서를 열교환기 배출부에 최대한 가깝게 배치하십시오 .
- 열교환기에 안정적인 온도 / 압력을 제공하는 밸브 및 조정 장비를 선택하십시오 .
- 수격을 방지하려면 온 / 오프 밸브와 같이 급속 폐쇄 밸브를 사용하면 안 됩니다 .
- 자동 설치에서는 펌프의 정지와 시작 및 밸브 작동을 프로그래밍하여 이런 작동에 따른 압력 변화의 진폭과 빈도를 최대한 낮춰야 합니다 .

보온
가열 및 냉각 보온재는 부속품으로 제공됩니다 .

참고 : *보온재와 열교환기의 온도 한계는 다를 수 있습니다 .*

보수
열교환기의 올바른 성능을 보장하려면 다음을 확인하십시오 .

- 이 설명서의 지침에 따라 파이프 시스템을 열교환기에 연결했습니다 .
- 열교환기가 완전히 깨끗하고 축적물이 없습니다 .

참고: *입자와 섬유로 열교환기가 막힐 수 있습니다. 압력 손실이 증가하거나 열 효율이 감소하면 열교환기가 오염되어졌음을 나타냅니다 .*

- 제어 회로가 올바르게 미리 설정되어 있고 동결이 발생하지 않습니다 .

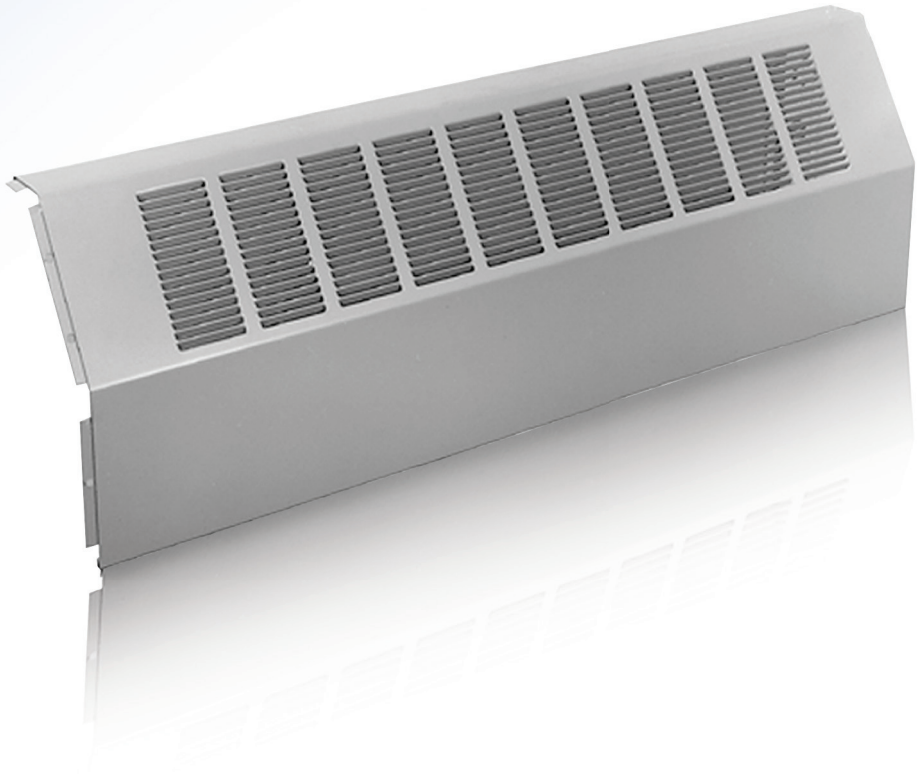
세정
이 장비는 제자리 세정 (Cleaning In Place) 에 적합합니다 . 적합한 세정 프로세스에 대한 조언을 얻으려면 공급업체 담당자에게 문의하거나 공급업체 인터넷 사이트를 참조하십시오 . 작동 담당자는 올바른 세정 방법을 사용하도록 확인하고 적합한 세정 간격을 결정해야 합니다 .

참고 : *플레이트 패키지는 열지 마십시오 .*

2nd Floor Fin Tube

AIREDALE

Commercial Fin Tube Radiation



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MODINE

AIR12-135.4 • July, 2014

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BREEZE™ AccuSpec

The Modine Breeze® AccuSpec is the fastest way to generate performance data based on actual job conditions. The Breeze® AccuSpec program is a web-based sizing and selection program. The program provides a series of step-by-step questions that allow for the easy configuration of Modine products. After a model has been configured, the program can generate Submittal Schedules, Submittal Data (including performance and dimensional drawings), and Specifications.

Enclosure Nomenclature

1,2,3	4,5,6	7,8	9	10,11,12
ET	EH	MG	DMP	EL

1,2,3 - Enclosure Type (ET)
S - Slope Top
SP - TrimFin Slope Top
R - Front and Top Outlet
F - Front Outlet
T - Top Outlet
TA - Top Outlet, Architectural Grille
SF - Slope Top Floor Mount
RF - Front and Top Outlet Floor Mount
P - Pedestal Mount
PA - Pedestal with Architectural Grille
PS - Slope Top Security
EM - Expanded Metal Element Cover
FT - Flat Top Element Cover
BIP - Bottom Inlet Panel

4,5,6 - Enclosure Height (EH)
001 - 1 Row Wide Pedestal
002 - 2 Row Wide Pedestal
003 - TrimFin Bottom Inlet Panel
004 - 4" High Enclosure
005 - Std Bottom Inlet Panel
008 - 8" High Enclosure
010 - 10" High Enclosure
012 - 12" High Enclosure
014 - 14" High Enclosure
018 - 18" High Enclosure
024 - 24" High Enclosure

7,8 - Material Gauge (MG)
14 - 14 Gauge
16 - 16 Gauge
18 - 18 Gauge
20 - 20 Gauge

9 - Damper (DMP)
N - No Damper
K - Knob Damper
S - Security Damper

10,11,12 - Enclosure Length (EL)
020 - 2' 0" Length
025 - 2' 6" Length
030 - 3' 0" Length
035 - 3' 6" Length
040 - 4' 0" Length
045 - 4' 6" Length
050 - 5' 0" Length
055 - 5' 6" Length
060 - 6' 0" Length
065 - 6' 6" Length
070 - 7' 0" Length
075 - 7' 6" Length
080 - 8' 0" Length

Element Nomenclature

1,2,3	4,5,6	7,8	9	10,11,12
TM	TD	FSP	FSZ	EL

1,2,3 - Tube Material (TM)
CP - Copper

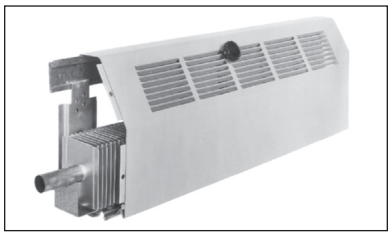
4,5,6 - Tube Diameter (TD)
075 - 0.75"
100 - 1.00"
125 - 1.25"

7,8 - Fin Spacing (FSP)
34 - 34 fins/ft.
42 - 42 fins/ft.
50 - 50 fins/ft.

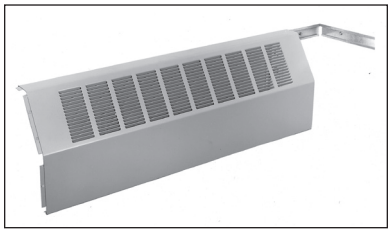
9 - Fin Size (FSZ)
A - 2.75" x 4.25" Fin
B - 2.75" x 3.25" Fin
C - 4.25" x 4.25" Fin

10,11,12 - Element Length (EL)
020 - 2' 0" Length
025 - 2' 6" Length
030 - 3' 0" Length
035 - 3' 6" Length
040 - 4' 0" Length
045 - 4' 6" Length
050 - 5' 0" Length
055 - 5' 6" Length
060 - 6' 0" Length
065 - 6' 6" Length
070 - 7' 0" Length
075 - 7' 6" Length
080 - 8' 0" Length
085 - 8' 6" Length
090 - 9' 0" Length
095 - 9' 6" Length
100 - 10' 0" Length
105 - 10' 6" Length
110 - 11' 0" Length
115 - 11' 6" Length
120 - 12' 0" Length

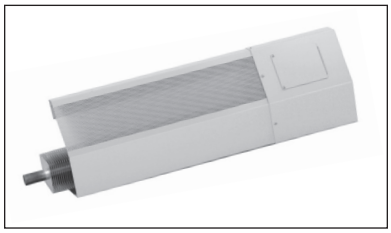
COMMERCIAL FIN TUBE RADIATION



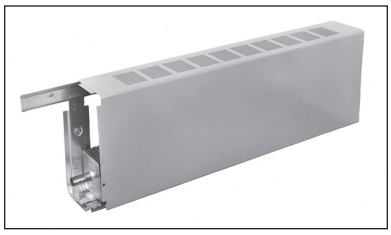
Model SP
Slope Top - Trimfin™
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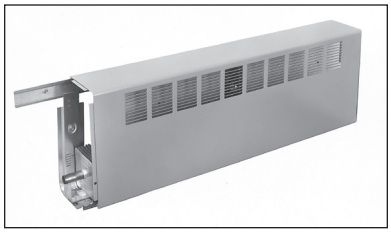
Model S Slope Top
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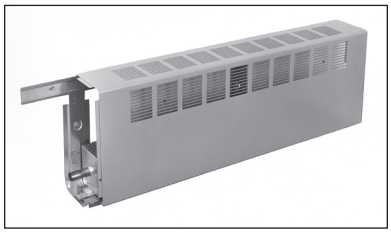
Model PS Security
Slope Top
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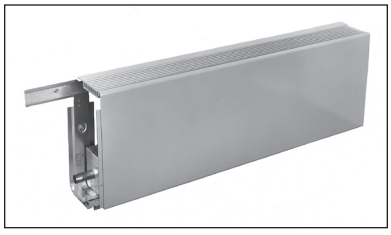
Model T Top Outlet
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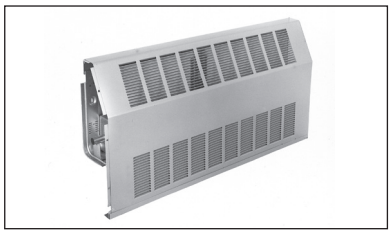
Model F Front Outlet
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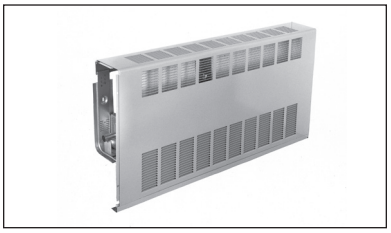
Model R Front and
Top Outlet
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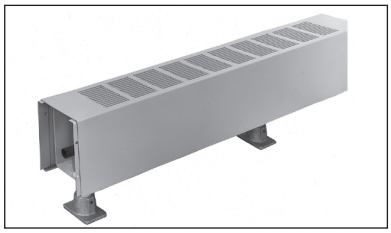
Model TA
Architectural
Top Outlet
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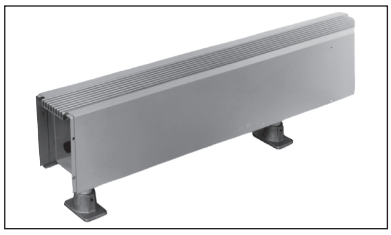
Model SF Slope Top,
Floor Mounted
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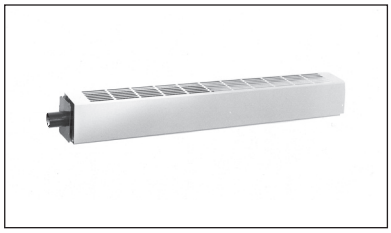
Model RF Front and
Top Outlet,
Floor Mounted
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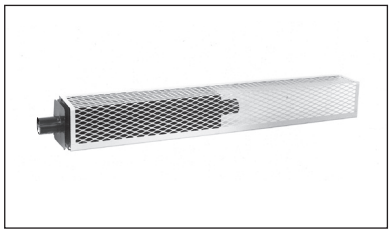
Model P
Pedestal Style
Page 35



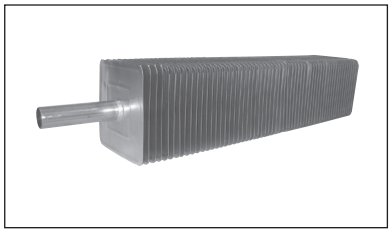
Model PA Architectural
Pedestal Style
Page 37



Model FT Flat Top
Element Cover
Page 40



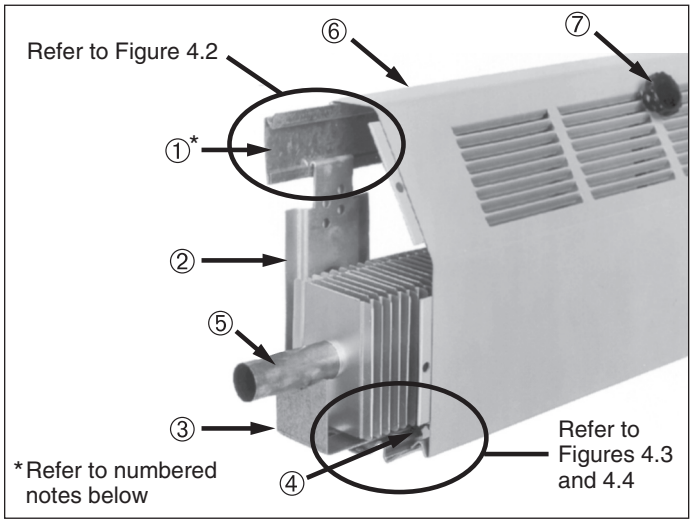
Model EM Expanded
Metal Element Cover
Page 42



Model CP Bare
Heating Element
Page 44

DESIGN FEATURES - SYSTEM COMPONENTS/ACCESSORIES

Figure 4.1 - Typical System Components



1. Hanger strip provides an easy and sturdy method to properly align all components. Enclosure rests in the top V-bend of the hanger strip and positions the enclosure 1/16" from the wall and 3/16" above the top of the hanger strip so it is not visible, creating a clean, one piece appearance (see Figure 4.2). Standard hanger strip is 20 gauge aluminized steel in 4 and 8 foot lengths. Also available with full back panel.
2. Enclosure/element support brackets with heating element cradle are suspended from the bottom V-bend of the hanger strip (see Figure 4.2). Infinite side to side location of brackets allows installation at strongest support points, such as wall studs. The hanger strip bears most of the weight, so only one wall fastener is required for each bracket. Holes are provided near the top of the bracket for installation of return pipe hanger (not available if using a damper in Note 7).
3. All element cradles rest on a full bearing nylon washer. There is no metal to metal contact and no noise from element expansion. Cradle and washer are fastened to bracket with a nylon rivet (see Figure 4.3).
4. The double V-bend of the enclosure rests in the bottom V-bend of the enclosure support bracket (see Figure 4.4). A quarter turn latch (shown in locked position) allows insertion of the enclosure and securely holds it to the bracket. Latch is rotated by using a socket wrench on the Hex head bolt underneath.
5. Copper tube/aluminum fin heating element is available in 3 tube diameters, 2 fin sizes, and 3 fin spacings.
6. Enclosure sections are joined together utilizing a slip joint connection. Viewed from the interior of the enclosure, the slip joint is comprised of left and right hand spot welded clips (see Figure 4.5). Slip joint connections produce a barely noticeable joint on the exterior of the enclosure. Certain accessory parts, such as end caps, are also assembled with slip joint connections.
7. Optional dampers are available with either exposed knob type damper operator or tamper-proof operator to prevent unauthorized damper operation or adjustment (see Figure 5.1). Damper blades are painted to match the enclosure. The damper blades are adjustable to any position between open and closed using a screw type operator. The damper blade assembly is factory installed and permanently attached to the enclosure. The damper operator mechanism is field installed.

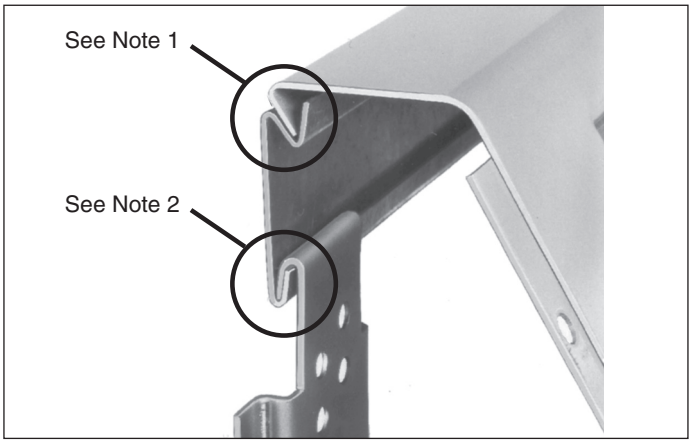


Figure 4.3 - Element/Enclosure Support Assemblies

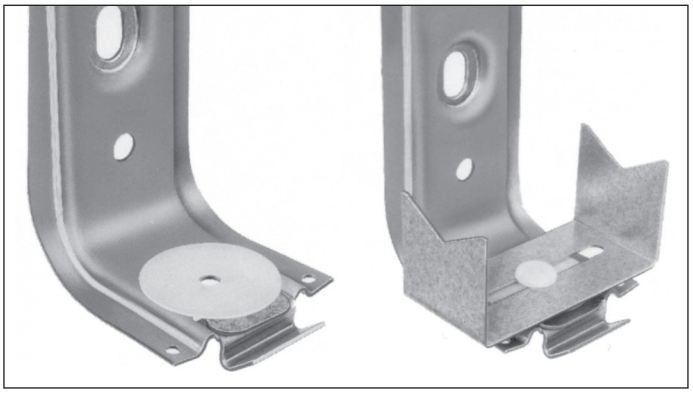


Figure 4.4 - Bottom Enclosure Support

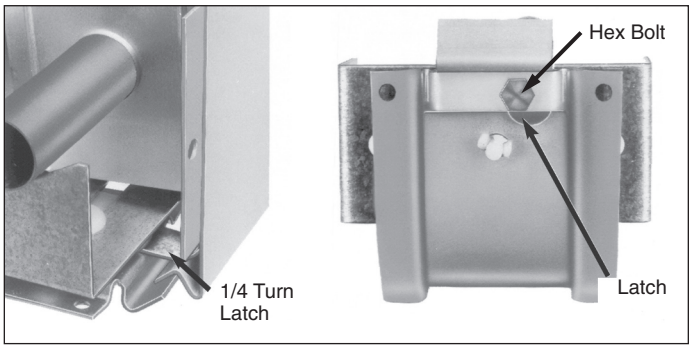
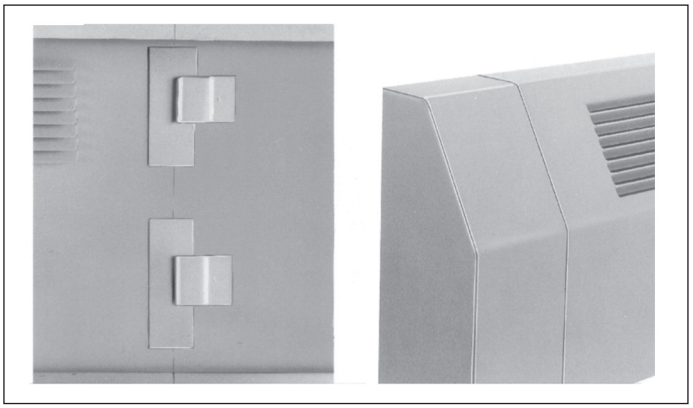
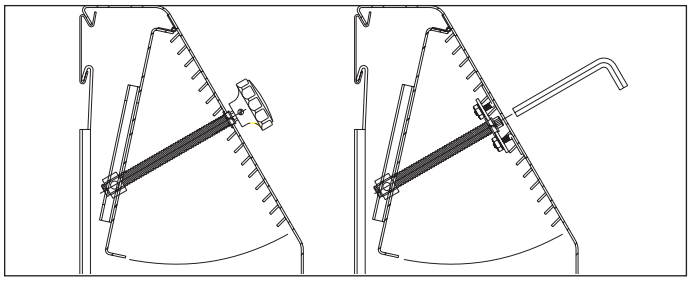


Figure 4.5 - Enclosure Slip Fit Connections



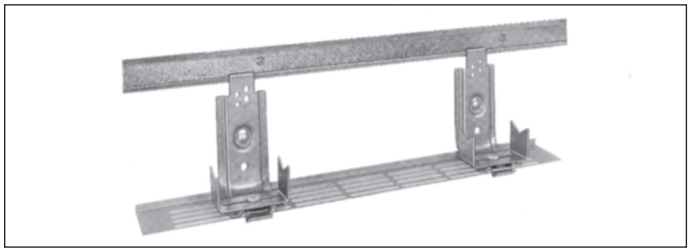
DESIGN FEATURES - SYSTEM COMPONENTS/ACCESSORIES

Figure 5.1 - Damper Operators



8. The bottom inlet panel is available to provide security cover to the open inlet at the bottom of the enclosure. It is fastened to the enclosure support brackets with a plastic expansion dart. See Figure 5.2

Figure 5.2 - Bottom Inlet Panel



9. A wall support is used to support overlapping enclosure extensions at a wall. A 5" wide enclosure extension completes the gap between the enclosure and the wall. Fold over tabs at the bottom hold the extension firmly in place. Some accessory items, 12" wide extensions, 12" wide end enclosures are available with access doors. See Figure 5.3.

Figure 5.3 - Enclosure Accessories

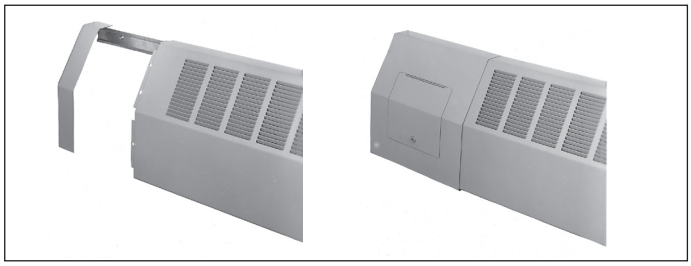
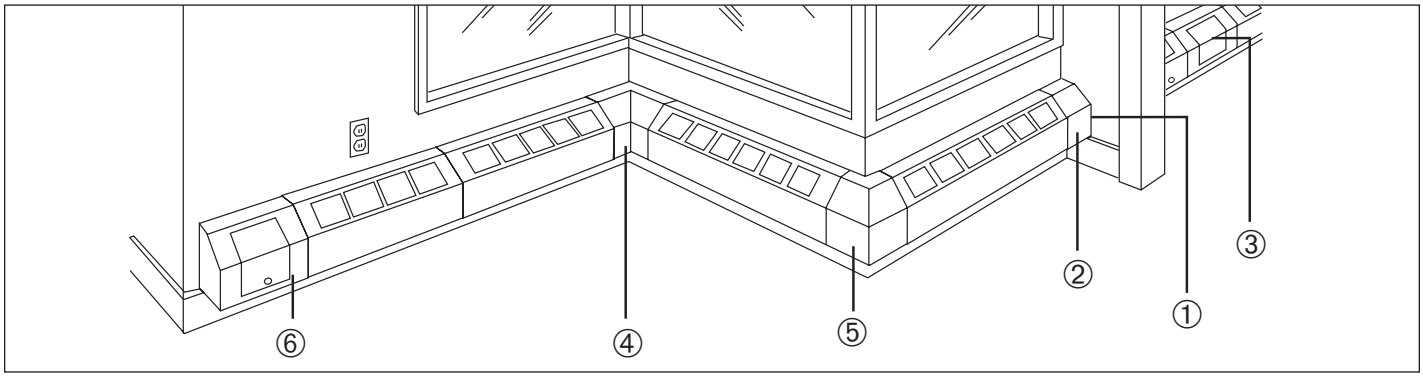
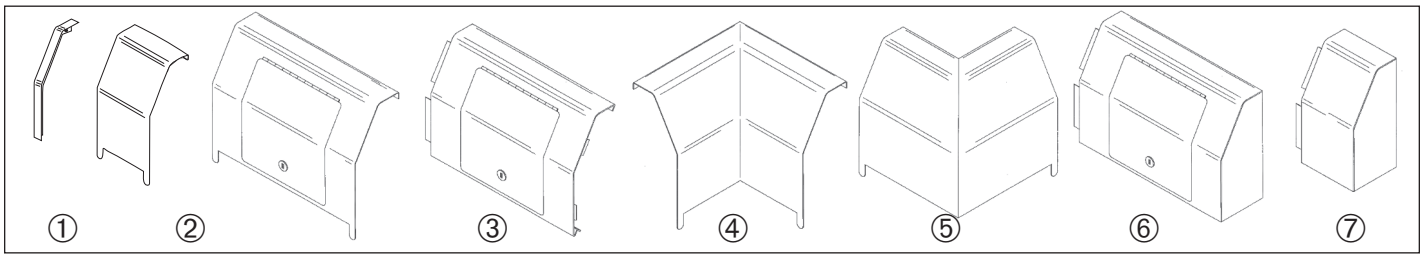
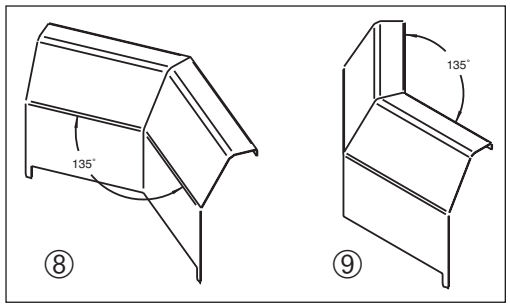


Figure 5.4 - Typical Enclosure Layout







Ref. No.	Accessory Description ① ②	Fit Type ③
1	Wall Support	(R or L)
2	5" or 12" Wide Enclosure Extension	(O)
2	12" Wide Enclosure Extension with Access Door	(O)
3	12" or 18" Wide Valve Compartment	(S)
4	90° Inside Corner	(O)
5	90° Outside Corner	(O)
6	12" Wide End Enclosure	(S) (R or L)
6	12" Wide End Enclosure with Access Door	(S) (R or L)
7	End Cap	(S) (R or L)
8	135° Inside Corner	(O)
9	135° Outside Corner	(O)

① Accessories constructed of 20 gauge CRS
② See Page 39 for Pedestal support and accessories
③ (O)=Overlapping, (S)=Slip, (R or L)=Right or Left Hand Configurations

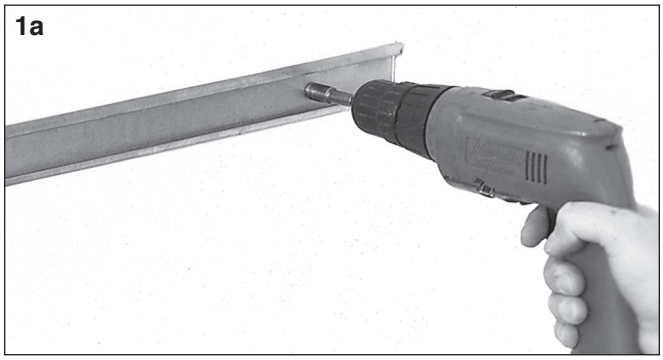
INSTALLATION

1. Create a level line at the required mounting height (recommended 4" clearance below element support bracket). Fasten the hanger strip or hanger strip with full back panel at the desired height.

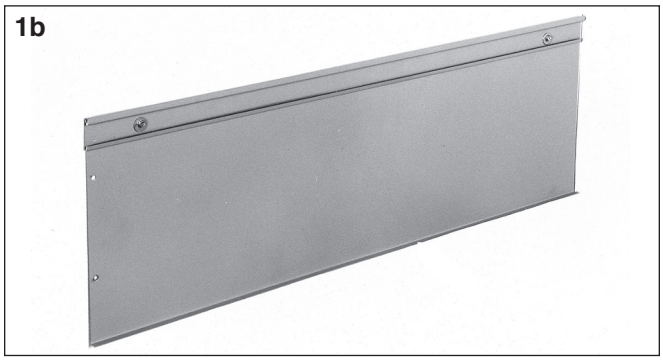
   For styles SF or RF, a second line may be set on the floor to locate the floor angle location.

   For style P, attach pedestal base to floor. Insert pedestal assembly and adjust height.

1a

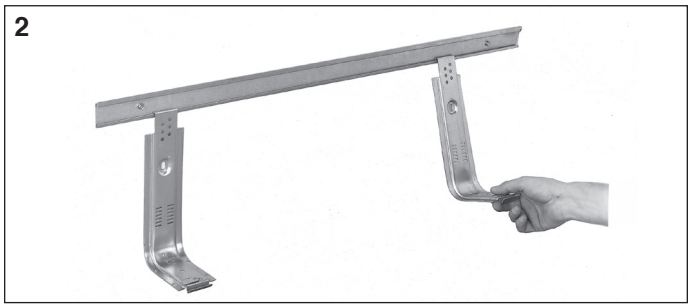


1b



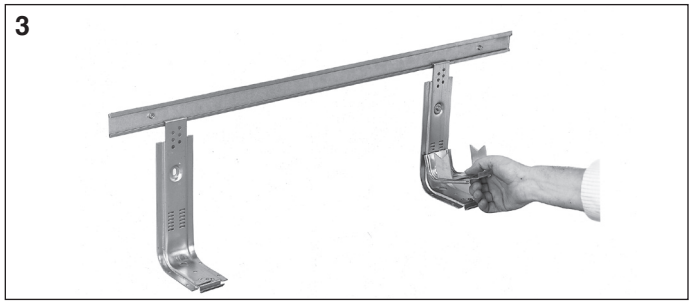
2. Place the Enclosure Wall Support (EWS) on the hanger strip. Position the EWS to assure location directly over wall supports. Fasten each EWS with one fastener to a wall support. EWS placement is recommended every 3 feet. All EWS are equipped with a concealed enclosure lock. If the EWS has been ordered with integral element cradles, skip step 3.

2



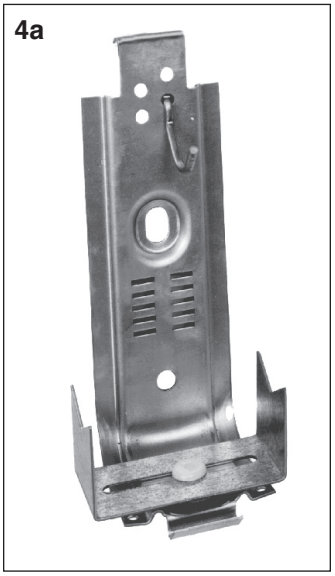
3. When element pitch or other adjustment is required, a separate Element Support Assembly (ESA) is used. The ESA hooks into slots on the EWS. For 12" high style S enclosure, the ESA must be located in the lowest slot to avoid element contact with the enclosure.

3



4. Return Pipe hangers (RPH) are attached into holes on the upper portion of the EWS to accommodate return piping. RPH is not to be used in combination with a damper for styles S or SF enclosures.

4a



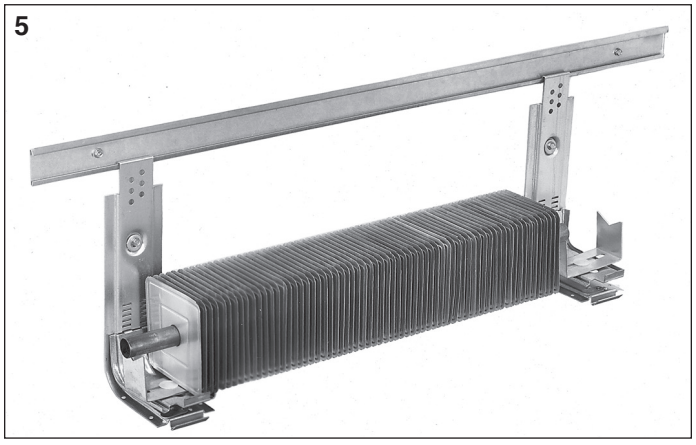
4b



If dampers are included, the operator must be pre-assembled prior to enclosure installation.

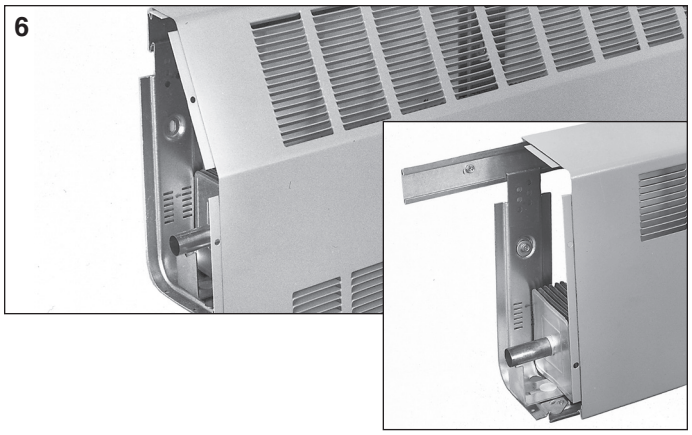
5. In the fin-tube element placement, position the cradle on the EWS to allow for expansion of the element.

5

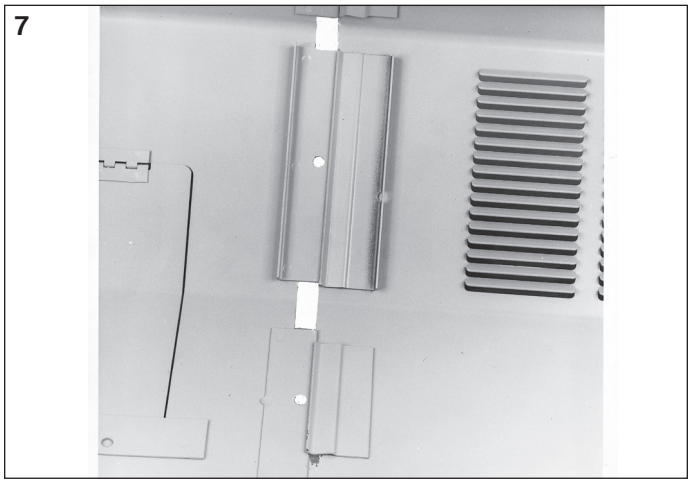


INSTALLATION

6. The first enclosure section should be set in place as noted by the Room Schedule (style S is shown at right). Engage the enclosure into the hanger strip, then into the bottom bend of the Enclosure Wall Support (EWS). Once in place, secure the enclosure to the bracket with a quarter turn of the hex headed enclosure latch.



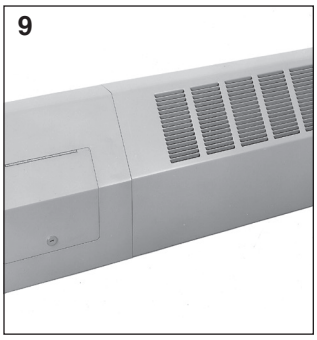
7. Adjoining sections of enclosure can be added to the first by means of interlocking slip-joints. The male strip always faces to the left, the concealed female clip always right. Start enclosure slip-joints from the top before engaging the hanger strip and EWS. Enclosures may be tapped together to protect the edge of the adjoining enclosure. As with the first enclosure, all other enclosures should be secured to the EWS by a quarter-turn of the built-in enclosure latch.



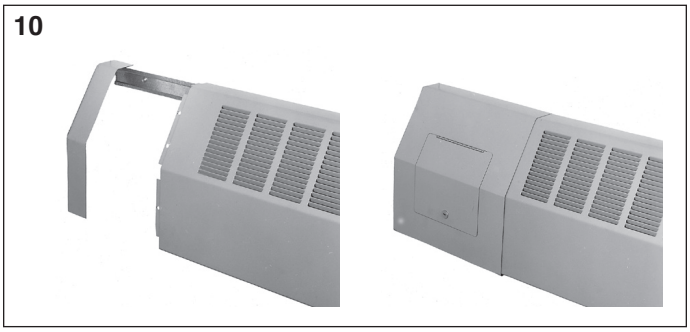
8. Enclosure End Caps terminate enclosure when not running wall-to-wall and join to enclosures with concealed slip-joints. Each end cap adds to the overall length of fin-tube enclosures. End Caps with access door are also available. For fin-tube covers, EM and FT end caps overlap.



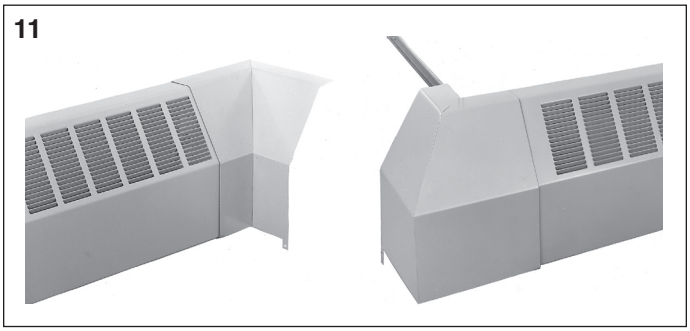
9. Valve Compartments have concealed interlocking slip-joints to mate up with enclosures to provide valve access within an enclosure run. Locate as directed on Room Schedule.



10. Enclosure extensions overlap enclosures and make up length differences when running to a wall. Place extension over enclosure, then bend tabs to secure the extension to the bottom of the enclosure.



11. Inside or Outside corners allow an enclosure run to continue around a corner. Corners overlap enclosures to make up length difference between walls. Corners have fold-over tabs. Place corner over enclosure, then bend tabs to secure the corner to the bottom of the enclosure.



SAMPLE SIZING CALCULATIONS

Example 1 - Hot Water At Decreased Flow

Determine fin tube length required:

Conditions:

Standard air temperature = 65°F
Average water temperature = 200°F
Water velocity = 1.0 ft/sec
Calculated heat loss of room = 20,000 Btu/hr.

Water Velocity Correction:

A water velocity correction factor must be used if the water velocity is other than the 3.0 ft/sec.

$$\frac{\text{Heat Loss}}{\text{Correction Factor}} = \text{Btu/hr if the water velocity is 3.0 ft/sec}$$

Water velocity correction factor for 1.0 ft/sec = .957 (Refer to Table 9.2 on page 9)

$$\frac{20{,}000 \text{ Btu/hr}}{0.957} = \text{20,899 Btu/hr if the water velocity is 3.0 ft/sec}$$

Selection of Unit:

A model 'S' Slope Top with an enclosure height of 12" and one row of 3/4" copper tube with aluminum fin size of 4-1/4" X 4-1/4" is desired.

Determine hot water ratings for desired tube and fin size (Refer to Table 15.1 on page 15):

34 fins/ft = 1160 Btu/hr/ft $\frac{20{,}899 \text{ Btu/hr}}{1160 \text{ Btu/hr/ft}}$ = 18.0 linear ft.

42 fins/ft = 1380 Btu/hr/ft $\frac{20{,}899 \text{ Btu/hr}}{1380 \text{ Btu/hr/ft}}$ = 15.1 linear ft.

50 fins/ft = 1390 Btu/hr/ft $\frac{20{,}899 \text{ Btu/hr}}{1390 \text{ Btu/hr/ft}}$ = 15.0 linear ft.

Example 2 - Hot Water, Air And Water Temperature Other Than Standard

Determine fin tube length required:

Conditions:

Air temperature = 55°F
Average water temperature = 210°F
Water velocity = 3.0 ft/sec (standard)
Calculated heat loss of room = 20,000 Btu/hr.

Air And Water Temperature Correction:

A correction factor must be used if the air and/or water temperatures other than standard conditions

$$\frac{\text{Heat Loss}}{\text{Correction Factor}} = \text{Btu/hr if the air and/or water temperature are not standard}$$

Air and water correction factor = 1.05 (Refer to Table 10.2 on page 10)

$$\frac{20{,}000 \text{ Btu/hr}}{1.05} = \text{19,048 Btu/hr if standard conditions}$$

Selection of Unit:

A model 'S' Slope Top with an enclosure height of 18" and two rows of 3/4" copper tube with aluminum fin size of 4-1/4" X 4-1/4" is desired.

Determine hot water ratings for desired tube and fin size (Refer to Table 15.1 on page 15):

34 fins/ft = 2130 Btu/hr/ft $\frac{19{,}048 \text{ Btu/hr}}{2130 \text{ Btu/hr/ft}}$ = 8.9 linear ft., two rows

42 fins/ft = 2340 Btu/hr/ft $\frac{19{,}048 \text{ Btu/hr}}{2340 \text{ Btu/hr/ft}}$ = 8.1 linear ft., two rows

50 fins/ft = 2560 Btu/hr/ft $\frac{19{,}048 \text{ Btu/hr}}{2560 \text{ Btu/hr/ft}}$ = 7.4 linear ft., two rows

SAMPLE SIZING CALCULATIONS

Example 3 - Steam Systems At Non-Standard Air Temperature And Steam Pressure

Determine fin tube length required:

Conditions:

Air temperature = 55°F
Steam pressure = 25 psi
Calculated heat loss of room = 25,000 Btu/hr.

Air Temperature And Steam Pressure Correction:

A model 'S' Slope Top with an enclosure height of 24" and three rows of 3/4" copper tube with aluminum fin size of 4-1/4" X 4-1/4" is desired.

A correction factor must be used for steam systems.

Standard Output X Correction Factor = Output at Conditions

34 fins/ft: 2630 Btu/hr/ft X 1.59 = 4182 Btu/hr/ft

42 fins/ft: 2910 Btu/hr/ft X 1.59 = 4627 Btu/hr/ft

50 fins/ft: 3160 Btu/hr/ft X 1.59 = 5024 Btu/hr/ft

Refer to Table 15.1 on page 15 for ratings
Refer to Table 10.3 on page 10 for correction factors

Selection of Unit:

Determine fin tube length required:

34 fins/ft = 4182 Btu/hr/ft $\frac{25{,}000 \text{ Btu/hr}}{4182 \text{ Btu/hr/ft}}$ = 6.0 linear ft., three rows

42 fins/ft = 4627 Btu/hr/ft $\frac{25{,}000 \text{ Btu/hr}}{4627 \text{ Btu/hr/ft}}$ = 5.4 linear ft., three rows

50 fins/ft = 5024 Btu/hr/ft $\frac{25{,}000 \text{ Btu/hr}}{5024 \text{ Btu/hr/ft}}$ = 5.0 linear ft., three rows

Example 4 - Ethylene Glycol Solution Correction

Determine fin tube length required:

Conditions:

Standard air temperature = 65°F
Average solution temperature = 150°F
Percent Ethylene Glycol = 50%
Calculated heat loss of room = 20,000 Btu/hr.

Ethylene Glycol Correction:

A model 'S' Slope Top with an enclosure height of 24" and one row of 3/4" copper tube with aluminum fin size of 4-1/4" X 4-1/4" is desired.

A correction factor must be used if an ethylene glycol solution is used.

Standard Output X Correction Factor = Output with 50% Glycol

34 fins/ft: 790 Btu/hr/ft X 0.90 = 711 Btu/hr/ft

42 fins/ft: 860 Btu/hr/ft X 0.90 = 774 Btu/hr/ft

50 fins/ft: 940 Btu/hr/ft X 0.90 = 846 Btu/hr/ft

Refer to Table 15.1 on page 15 for ratings
Refer to Table 10.1 on page 10 for correction factors

Selection of Unit:

Determine fin tube length required:

34 fins/ft = 711 Btu/hr/ft $\frac{20{,}000 \text{ Btu/hr}}{711 \text{ Btu/hr/ft}}$ = 28.1 linear ft.

42 fins/ft = 774 Btu/hr/ft $\frac{20{,}000 \text{ Btu/hr}}{774 \text{ Btu/hr/ft}}$ = 25.8 linear ft.

50 fins/ft = 846 Btu/hr/ft $\frac{20{,}000 \text{ Btu/hr}}{846 \text{ Btu/hr/ft}}$ = 23.6 linear ft.

CORRECTION FACTORS

Figure 10.1 - Expansion in Copper Tubing

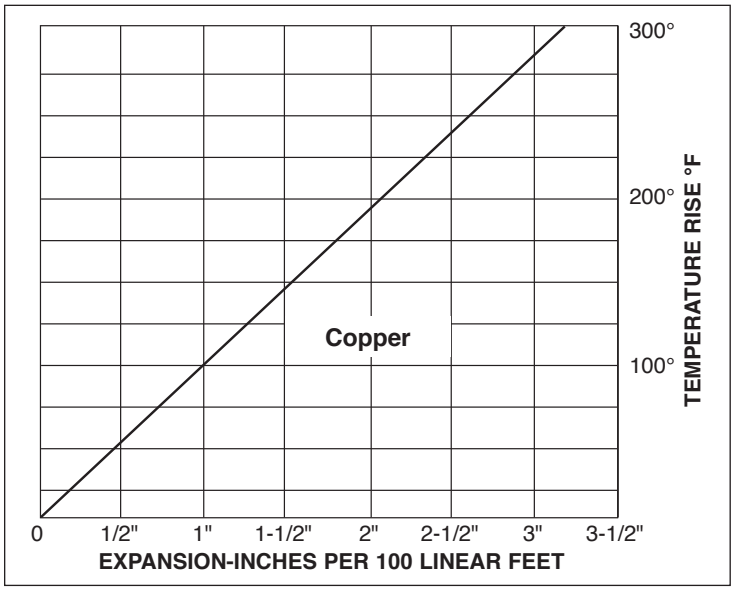


Table 10.1 - Converting AHRI Steam Ratings to Hot Water Ratings at Indicated Temperature ①

Average Water Temperature	Factor	Average Water Temperature	Factor
100	0.15	185	0.73
110	0.20	190	0.78
120	0.26	195	0.82
130	0.33	200	0.86
140	0.40	205	0.91
150	0.45	210	0.95
155	0.49	215	1.00
160	0.53	220	1.05
165	0.57	225	1.09
170	0.61	230	1.14
175	0.65	235	1.20
180	0.69	240	1.25

① Multiply correction factor x 1 PSI steam rating to determine Btu at actual water temperature rating.

Table 10.2 - Factors for Non-Standard Water Temperature and Air Temperature ②

Average Water Temp. °F	Entering Air Temperature °F									
	45	55	Std. 65	70	75	80	85	90	95	100
100	0.25	0.19	0.13	0.11	0.08	0.06				
110	0.31	0.25	0.19	0.16	0.13	0.11	0.08	0.06		
120	0.38	0.31	0.25	0.22	0.19	0.16	0.13	0.11	0.08	0.06
130	0.45	0.38	0.31	0.28	0.25	0.22	0.19	0.16	0.13	0.11
140	0.53	0.45	0.38	0.34	0.31	0.28	0.25	0.22	0.19	0.16
150	0.61	0.53	0.45	0.42	0.38	0.34	0.31	0.28	0.25	0.22
160	0.69	0.61	0.53	0.49	0.45	0.42	0.38	0.34	0.31	0.28
170	0.78	0.69	0.61	0.57	0.53	0.49	0.45	0.42	0.38	0.34
180	0.86	0.78	0.69	0.65	0.61	0.57	0.53	0.49	0.45	0.42
190	0.95	0.86	0.78	0.73	0.69	0.65	0.61	0.57	0.53	0.49
200	1.05	0.95	0.86	0.82	0.78	0.73	0.69	0.65	0.61	0.57
210	1.14	1.05	0.95	0.91	0.86	0.82	0.78	0.73	0.69	0.65

② Multiply correction factor x 1 PSI steam rating to determine Btu at non-standard water and air temperature.

Table 10.3 - Factors for Non-Standard Steam Pressure and Air Temperature ③

Steam Pressure psi	Entering Air Temperature °F									
	45	55	65	70	75	80	85	90	100	110
0.899	1.22	1.11	1.00	0.95	0.90	0.84	0.80	0.75	0.65	0.57
5	1.34	1.22	1.11	1.05	1.00	0.95	0.90	0.81	0.75	0.66
10	1.45	1.33	1.22	1.17	1.11	1.05	1.00	0.91	0.85	0.75
15	1.55	1.43	1.31	1.26	1.20	1.14	1.09	1.00	0.94	0.84
20	1.63	1.52	1.40	1.33	1.28	1.23	1.17	1.07	1.02	0.92
25	1.71	1.59	1.47	1.41	1.36	1.30	1.25	1.15	1.09	0.98
30	1.78	1.66	1.54	1.48	1.42	1.37	1.31	1.21	1.15	1.05
40	1.91	1.79	1.66	1.61	1.54	1.49	1.43	1.32	1.27	1.16
50	2.02	1.90	1.77	1.71	1.65	1.60	1.54	1.42	1.37	1.26
60	2.10	2.00	1.87	1.81	1.75	1.69	1.63	1.51	1.47	1.35
70	2.20	2.09	1.95	1.89	1.83	1.77	1.71	1.59	1.55	1.44
80	2.27	2.17	2.03	1.97	1.91	1.85	1.80	1.69	1.63	1.52
90	2.36	2.24	2.11	2.05	1.98	1.93	1.87	1.74	1.70	1.59
100	2.43	2.31	2.18	2.11	2.05	2.00	1.94	1.81	1.77	1.65
125	2.59	2.47	2.33	2.27	2.21	2.16	2.10	1.96	1.92	1.80
150	2.73	2.62	2.47	2.43	2.35	2.29	2.23	2.08	2.05	1.94
175	2.86	2.74	2.60	2.54	2.47	2.41	2.35	2.21	2.17	2.05
200	2.95	2.85	2.71	2.63	2.58	2.52	2.47	2.31	2.29	2.17

③ Multiply correction factor x 1 PSI steam rating to determine Btu at non-standard steam pressure and air temperature.

CORRECTION FACTORS

Table 11.1 - Ethylene Glycol Correction Factors ①

Solution Temperature (°F)	Ethylene Glycol Solution %						
	20%	30%	40%	50%	60%	70%	80%
100	0.99	0.96	0.93	0.89	0.85	0.81	0.76
150	0.99	0.96	0.94	0.90	0.87	0.83	0.78
200	0.99	0.97	0.94	0.92	0.88	0.85	0.81
250	0.98	0.96	0.94	0.92	0.89	0.86	0.82

① For Propylene Glycol solution correction factor, multiply Ethylene Glycol correction factor by 0.95.

Table 11.2 - Factors for Reduced G.P.M. and Velocity ①

Ft./Sec. Velocity	Gallons Per Minute Copper			
	3/4" Dia.	1" Dia.	1-1/4" Dia.	Correction Factor
3.0	5.0	8.5	12.9	1.000
2.5	4.2	7.1	10.7	0.992
2.0	3.3	5.7	8.6	0.984
1.5	2.5	4.2	6.4	0.973
1.0	1.7	2.8	4.3	0.957
0.5	0.8	1.4	2.1	0.931
0.25	0.4	0.7	1.1	0.905

① The factors in this table may be used only when the water flow rate through the finned tube unit is known and where the flow rate is less than three feet per second. To determine the output at less than three feet per second, multiply the AHRI Water Rating by the factor in this table which applies to the known flow rate.

Table 11.3 - Factor for Enclosure Mounted Lower Than Recommended 4" Inlet Height ①

Enclosure	Inlet Height						
	4"	3"	2"	1-1/2"	1"	3/4"	1/2"
All Styles	1.00	1.00	0.99	0.97	0.85	0.63	0.40

① When inlet height is less than 4", use these Correction Factors to determine BTU at actual mounting height.

Table 11.4 - Factors for Enclosure Mounted Higher Than Recommended 4" Inlet Height ①

Enclosure	Total Height															
	18" or less	19"	20"	21"	22"	23"	24"	25"	26"	27"	28"	29"	30"	32"	34"	36" or more
S	1.10	1.09	1.09	1.08	1.07	1.07	1.06	1.05	1.05	1.04	1.03	1.03	1.02	1.01	1.01	1.00
R, F, FT, EM	1.15	1.14	1.13	1.12	1.11	1.10	1.09	1.08	1.07	1.06	1.05	1.04	1.03	1.02	1.01	1.00

① When enclosures are mounted more than 4" above floor, use the following formula to determine BTU at actual mounting height.

If the unit is to be installed at a different height than recommended, the AHRI Rating shall be adjusted as follows:

$$\frac{\text{Actual Mounting Height Factor}}{\text{Recommended Mounting Height Factor}} = \text{CORRECTION FACTOR}$$

EXAMPLE - S12

12 inch enclosure height + 4 inch inlet height = 16 inch recommended Mounting Height.
Change to 12 inch enclosure height + 12 inch inlet height = 24 inch actual Mounting Height.

Factors from Table 11.4:
At 16 inches, factor = 1.10 At 24 inches, factor = 1.06
Apply to formula: $\frac{1.06}{1.10}$ = CORRECTION FACTOR

Correction Factor X Catalog Rating (BTU) = BTU at Actual Mounting Height.

MODEL SP SLOPE TOP TRIMFIN™ FEATURES

- Enclosure ② engages with concealed Hanger Strip ③.
- Enclosure Wall Support (EWS) ④ hangs from Hanger Strip at any location and attaches to wall with one fastener.
- EWS ④ supports Heating Element ①, second and third row Element Support Assembly (ESA) ⑤ and Return Pipe Hanger ⑥ without fasteners.
- EWS ④ supports have integral enclosure lock.

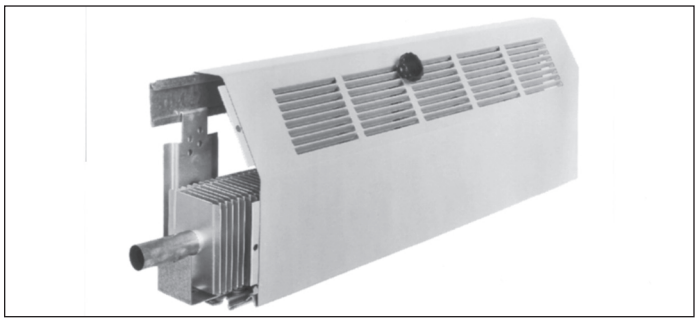
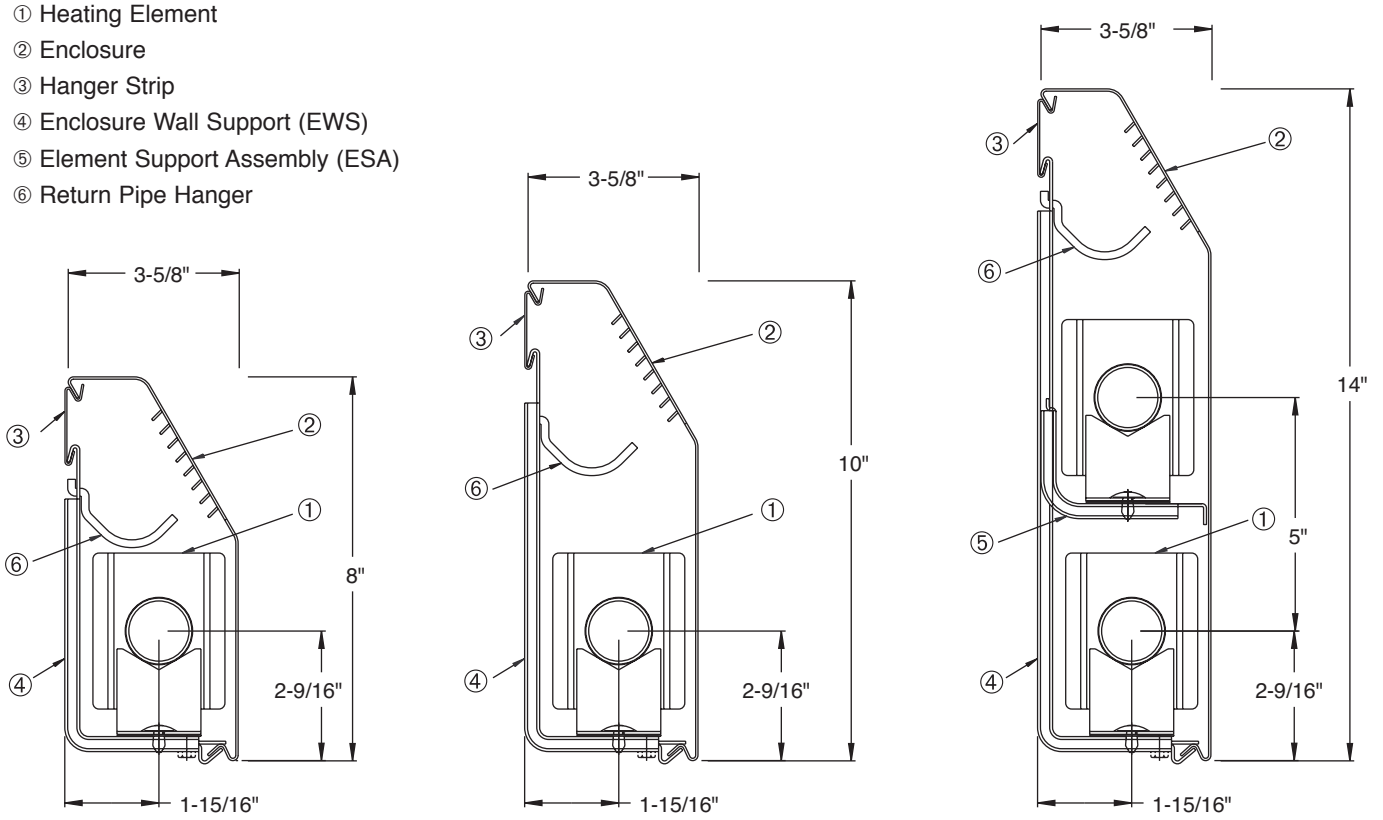


Figure 12.1 - System Components

① Heating Element
② Enclosure
③ Hanger Strip
④ Enclosure Wall Support (EWS)
⑤ Element Support Assembly (ESA)
⑥ Return Pipe Hanger



Standard Features

- Hanger strip - 20 gauge aluminized steel.
- Enclosure, 18 gauge in lengths of 2 feet through 8 feet in 6 inch increments.
- Heights of 8, 10, and 14 inches.
- Enclosure sections are joined using concealed slip joints.
- Baked on polyester powdercoat paint finish, tan color.

Accessories

- Accessories, 18 gauge, include all items for a complete installation.
- End caps, end enclosures and valve compartments use slip joints to attach to enclosure.
- Inside, outside corners and enclosure extensions overlap enclosure sections.
- Return pipe hanger. Note: return pipe hanger cannot be used with damper option.

Options

- Enclosures available in 14 or 16 gauge steel.
- Baked on polyester powdercoat paint finish available in colors selected from color guide (75-403).
- Bottom inlet grille conceals open air inlet for installations above eye level.
- Hanger strip with full back panel.
- Knob operated or tamperproof (key) damper.

MODEL SP PERFORMANCE

Table 13.1 - Steam and Hot Water Ratings - Fin Size - 3-1/4" x 2-3/4"

FIN SIZE - 3-1/4" X 2-3/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
3/4" Copper 34 Fins/ft.	8	1	***840***	***800***	***720***	***660***	***580***	***510***	***450***	***380***	***340***
	10	1	***860***	***820***	***740***	***670***	***590***	***520***	***460***	***390***	***340***
	14	1	***910***	***860***	***780***	***710***	***630***	***560***	***480***	***410***	***360***
	14	2 @ 5"	***1420***	***1350***	***1220***	***1110***	***980***	***870***	***750***	***640***	***570***
3/4" Copper 42 Fins/ft.	8	1	***910***	***860***	***780***	***710***	***630***	***560***	***480***	***410***	***360***
	10	1	***950***	***900***	***820***	***740***	***660***	***580***	***500***	***430***	***380***
	14	1	***1040***	***990***	***890***	***810***	***720***	***630***	***550***	***470***	***420***
	14	2 @ 5"	***1480***	***1410***	***1270***	***1150***	***1020***	***900***	***780***	***670***	***590***
3/4" Copper 50 Fins/ft.	8	1	***980***	***930***	***840***	***760***	***680***	***600***	***520***	***440***	***390***
	10	1	***1040***	***990***	***890***	***810***	***720***	***630***	***550***	***470***	***420***
	14	1	***1160***	***1100***	***1000***	***900***	***800***	***710***	***610***	***520***	***460***
	14	2 @ 5"	***1540***	***1460***	***1320***	***1200***	***1060***	***940***	***820***	***690***	***620***
1" Copper 34 Fins/ft.	8	1	***820***	***780***	***710***	***640***	***570***	***500***	***430***	***370***	***330***
	10	1	***850***	***810***	***730***	***660***	***590***	***520***	***450***	***380***	***340***
	14	1	***900***	***860***	***770***	***700***	***620***	***550***	***480***	***410***	***360***
	14	2 @ 5"	***1370***	***1300***	***1180***	***1070***	***950***	***840***	***730***	***620***	***550***
1" Copper 42 Fins/ft.	8	1	***880***	***840***	***760***	***690***	***610***	***540***	***470***	***400***	***350***
	10	1	***930***	***880***	***800***	***730***	***640***	***570***	***490***	***420***	***370***
	14	1	***1020***	***970***	***880***	***800***	***700***	***620***	***540***	***460***	***410***
	14	2 @ 5"	***1410***	***1340***	***1210***	***1100***	***970***	***860***	***750***	***630***	***560***
1" Copper 50 Fins/ft.	8	1	***940***	***890***	***810***	***730***	***650***	***570***	***500***	***420***	***380***
	10	1	***1010***	***960***	***870***	***790***	***700***	***620***	***540***	***450***	***400***
	14	1	***1130***	***1070***	***970***	***880***	***780***	***690***	***600***	***510***	***450***
	14	2 @ 5"	***1450***	***1380***	***1250***	***1130***	***1000***	***880***	***770***	***650***	***580***
1-1/4" Copper 34 Fins/ft.	8	1	***810***	***770***	***700***	***630***	***560***	***490***	***430***	***360***	***320***
	10	1	***840***	***800***	***720***	***660***	***580***	***510***	***450***	***380***	***340***
	14	1	***890***	***850***	***770***	***690***	***610***	***540***	***470***	***400***	***360***
	14	2 @ 5"	***1310***	***1240***	***1130***	***1020***	***900***	***800***	***690***	***590***	***520***
1-1/4" Copper 42 Fins/ft.	8	1	***860***	***820***	***740***	***670***	***590***	***520***	***460***	***390***	***340***
	10	1	***910***	***860***	***780***	***710***	***630***	***560***	***480***	***410***	***360***
	14	1	***1000***	***950***	***860***	***780***	***690***	***610***	***530***	***450***	***400***
	14	2 @ 5"	***1340***	***1270***	***1150***	***1050***	***920***	***820***	***710***	***600***	***540***
1-1/4" Copper 50 Fins/ft.	8	1	***910***	***860***	***780***	***710***	***630***	***560***	***480***	***410***	***360***
	10	1	***980***	***930***	***840***	***760***	***680***	***600***	***520***	***440***	***390***
	14	1	***1110***	***1050***	***950***	***870***	***770***	***680***	***590***	***500***	***440***
	14	2 @ 5"	***1360***	***1290***	***1170***	***1060***	***940***	***830***	***720***	***610***	***540***

Table 13.2 - Steam and Hot Water Ratings - Fin Size - 4-1/4" x 2-3/4"

FIN SIZE - 4-1/4" X 2-3/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
3/4" Copper 34 Fins/ft.	10	1	***960***	***910***	***830***	***750***	***660***	***590***	***510***	***430***	***380***
	14	1	***1030***	***980***	***890***	***800***	***710***	***630***	***550***	***460***	***410***
3/4" Copper 42 Fins/ft.	10	1	***1040***	***990***	***890***	***810***	***720***	***630***	***550***	***470***	***420***
	14	1	***1110***	***1050***	***950***	***870***	***770***	***680***	***590***	***500***	***440***
3/4" Copper 50 Fins/ft.	10	1	***1130***	***1070***	***970***	***880***	***780***	***690***	***600***	***510***	***450***
	14	1	***1170***	***1110***	***1010***	***910***	***810***	***710***	***620***	***530***	***470***
1" Copper 34 Fins/ft.	10	1	***950***	***900***	***820***	***740***	***660***	***580***	***500***	***430***	***380***
	14	1	***1010***	***960***	***870***	***790***	***700***	***620***	***540***	***450***	***400***
1" Copper 42 Fins/ft.	10	1	***1030***	***980***	***890***	***800***	***710***	***630***	***550***	***460***	***410***
	14	1	***1080***	***1030***	***930***	***840***	***750***	***660***	***570***	***490***	***430***
1" Copper 50 Fins/ft.	10	1	***1110***	***1050***	***950***	***870***	***770***	***680***	***590***	***500***	***440***
	14	1	***1160***	***1100***	***1000***	***900***	***800***	***710***	***610***	***520***	***460***
1-1/4" Copper 34 Fins/ft.	10	1	***940***	***890***	***810***	***730***	***650***	***570***	***500***	***420***	***380***
	14	1	***980***	***930***	***840***	***760***	***680***	***600***	***520***	***440***	***390***
1-1/4" Copper 42 Fins/ft.	10	1	***1020***	***970***	***880***	***800***	***700***	***620***	***540***	***460***	***410***
	14	1	***1060***	***1010***	***910***	***830***	***730***	***650***	***560***	***480***	***420***
1-1/4" Copper 50 Fins/ft.	10	1	***1100***	***1050***	***950***	***860***	***760***	***670***	***580***	***500***	***440***
	14	1	***1140***	***1080***	***980***	***890***	***790***	***700***	***600***	***510***	***460***

- Bottom of enclosure mounted 2 inches above floor. Refer to page 11 for correction factors for other mounting heights.
- Ratings are based on finned length with 65°F entering air, 1 PSI steam or average water temperature (215°F) at 3 ft/sec. water velocity. These water ratings, applicable to water flow rates of three or more feet per second, have been determined by applying the factors listed on page 11 to the AHRI Steam Ratings, which have been approved by AHRI.
- Finned length is the specified element length - 6" (3" plain end each side).

▶ Bold, italicized units are AHRI CERTIFIED® ◀

MODEL S SLOPE TOP FEATURES

- Enclosure ② engages concealed Hanger Strip ③.
- Enclosure Wall Support (EWS) ④ hangs from Hanger Strip at any location and attaches to wall with one fastener.
- EWS ④ supports Heating Element ①, second and third row Element Support Assembly (ESA) ⑤ and Return Pipe Hanger ⑥ without fasteners.
- EWS ④ supports have integral enclosure lock.

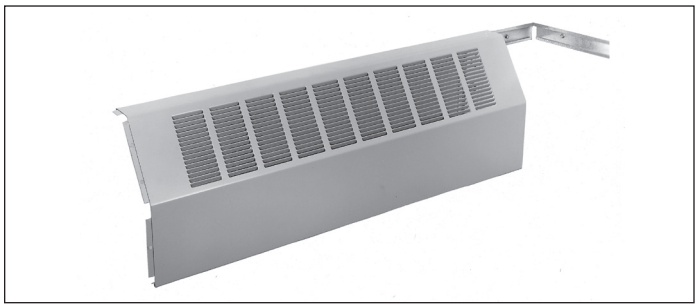
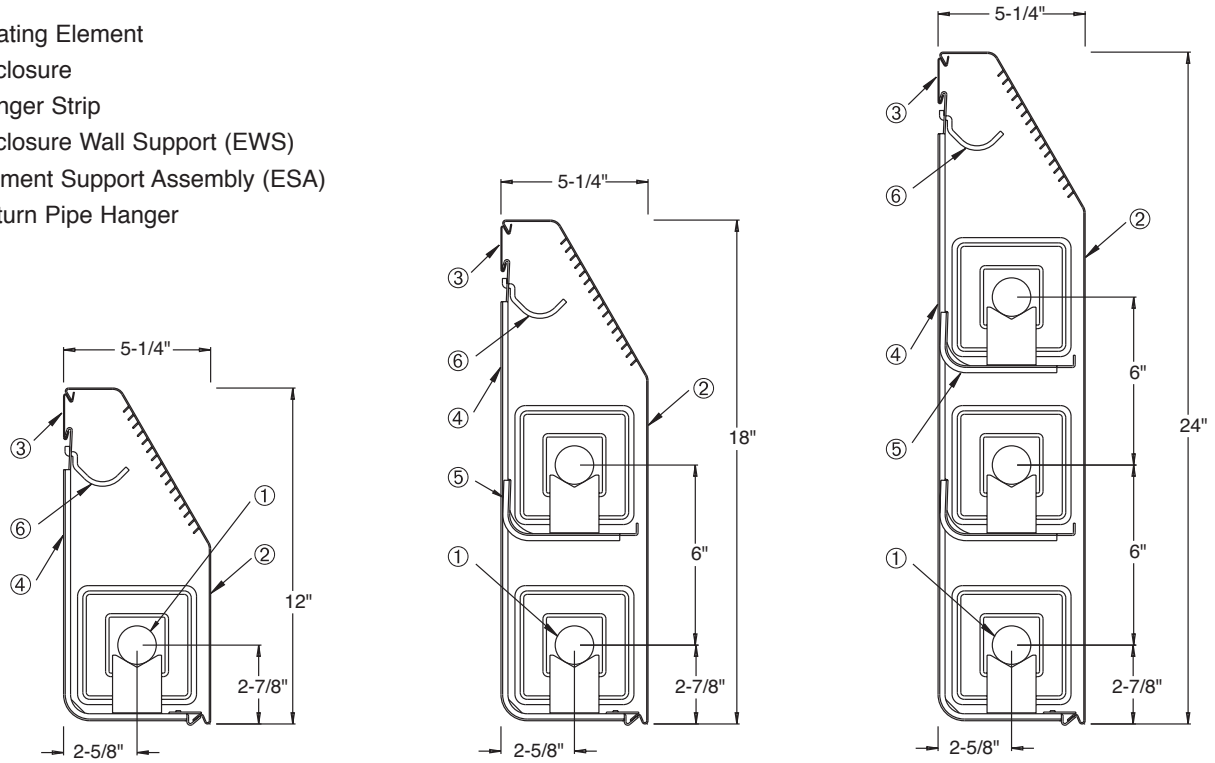


Figure 14.1 - System Components

① Heating Element
② Enclosure
③ Hanger Strip
④ Enclosure Wall Support (EWS)
⑤ Element Support Assembly (ESA)
⑥ Return Pipe Hanger



Standard Features

- Hanger strip - 20 gauge aluminized steel.
- Enclosure, 18 gauge in lengths of 2 feet through 8 feet in 6 inch increments.
- Heights of 12, 18 and 24 inches.
- Enclosure sections are joined using concealed slip joints.
- Baked on polyester powdercoat paint finish, tan color.

Accessories

- Accessories, 20 gauge, include all items for a complete installation.
- End caps, end enclosures and valve compartments use slip joints to attach to enclosure.
- Inside, outside corners and enclosure extensions overlap enclosure sections.
- Return pipe hanger. Note: return pipe hanger cannot be used with damper option.

Options

- Enclosures available in 14 or 16 gauge steel.
- Baked on polyester powdercoat paint finish available in colors selected from color guide (75-403).
- Bottom inlet grille conceals open air inlet for installations above eye level.
- Hanger strip with full back panel.
- Knob operated or tamperproof (key) damper.
- Column enclosure conceals piping around columns.

MODEL S PERFORMANCE

Table 15.1 - Steam and Hot Water Ratings - Fin Size - 4-1/4" x 4-1/4"

FIN SIZE - 4-1/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
	12	1	1350	1280	1160	1050	930	820	720	610	540
	18	1	1660	1580	1430	1290	1150	1010	880	750	660
3/4" Copper	24	1	1750	1660	1510	1370	1210	1070	930	790	700
	18	2 @ 6"	2130	2020	1830	1660	1470	1300	1130	960	850
34 Fins/ft.	24	2 @ 6"	2250	2140	1940	1760	1550	1370	1190	1010	900
	24	2 @ 12"	2330	2210	2000	1820	1610	1420	1230	1050	930
	24	3 @ 6"	2630	2500	2260	2050	1810	1600	1390	1180	1050
	▶ 12	1	***1610***	***1530***	***1380***	***1260***	***1110***	***980***	***850***	***720***	***640*** ◀
	18	1	1820	1730	1570	1420	1260	1110	960	820	730
3/4" Copper	24	1	1920	1820	1650	1500	1320	1170	1020	860	770
	18	2 @ 6"	2340	2220	2010	1830	1610	1430	1240	1050	940
42 Fins/ft.	24	2 @ 6"	2480	2360	2130	1930	1710	1510	1310	1120	990
	24	2 @ 12"	2570	2440	2210	2000	1770	1570	1360	1160	1030
	24	3 @ 6"	2910	2760	2500	2270	2010	1780	1540	1310	1160
	▶ 12	1	***1620***	***1540***	***1390***	***1260***	***1120***	***990***	***860***	***730***	***650*** ◀
	18	1	1980	1880	1700	1540	1370	1210	1050	890	790
3/4" Copper	24	1	2090	1990	1800	1630	1440	1270	1110	940	840
	18	2 @ 6"	2560	2430	2200	2000	1770	1560	1360	1150	1020
50 Fins/ft.	24	2 @ 6"	2700	2570	2320	2110	1860	1650	1430	1220	1080
	24	2 @ 12"	2800	2660	2410	2180	1930	1710	1480	1260	1120
	24	3 @ 6"	3160	3000	2720	2460	2180	1930	1670	1420	1260
	12	1	1430	1360	1230	1120	990	870	760	640	570
	18	1	1740	1650	1500	1360	1200	1060	920	780	700
1" Copper	24	1	1850	1760	1590	1440	1280	1130	980	830	740
	18	2 @ 6"	2250	2140	1940	1760	1550	1370	1190	1010	900
34 Fins/ft.	24	2 @ 6"	2380	2260	2050	1860	1640	1450	1260	1070	950
	24	2 @ 12"	2460	2340	2120	1920	1700	1500	1300	1110	980
	24	3 @ 6"	2760	2620	2370	2150	1900	1680	1460	1240	1100
	▶ 12	1	***1610***	***1530***	***1380***	***1260***	***1110***	***980***	***850***	***720***	***640*** ◀
	18	1	1910	1810	1640	1490	1320	1170	1010	860	760
1" Copper	24	1	2020	1920	1740	1580	1390	1230	1070	910	810
	18	2 @ 6"	2460	2340	2120	1920	1700	1500	1300	1110	980
42 Fins/ft.	24	2 @ 6"	2600	2470	2240	2030	1790	1590	1380	1170	1040
	24	2 @ 12"	2700	2570	2320	2110	1860	1650	1430	1220	1080
	24	3 @ 6"	3050	2900	2620	2380	2100	1860	1620	1370	1220
	▶ 12	1	***1680***	***1600***	***1440***	***1310***	***1160***	***1020***	***890***	***760***	***670*** ◀
	18	1	2050	1950	1760	1600	1410	1250	1090	920	820
1" Copper	24	1	2160	2050	1860	1680	1490	1320	1140	970	860
	18	2 @ 6"	2650	2520	2280	2070	1830	1620	1400	1190	1060
50 Fins/ft.	24	2 @ 6"	2800	2660	2410	2180	1930	1710	1480	1260	1120
	24	2 @ 12"	2900	2760	2490	2260	2000	1770	1540	1310	1160
	24	3 @ 6"	3280	3120	2820	2560	2260	2000	1740	1480	1310
	12	1	1500	1430	1290	1170	1040	920	800	680	600
	18	1	1830	1740	1570	1430	1260	1120	970	820	730
1-1/4" Copper	24	1	1940	1840	1670	1510	1340	1180	1030	870	780
	18	2 @ 6"	2370	2250	2040	1850	1640	1450	1260	1070	950
34 Fins/ft.	24	2 @ 6"	2510	2380	2160	1960	1730	1530	1330	1130	1000
	24	2 @ 12"	2600	2470	2240	2030	1790	1590	1380	1170	1040
	24	3 @ 6"	2930	2780	2520	2290	2020	1790	1550	1320	1170
	▶ 12	1	***1610***	***1530***	***1380***	***1260***	***1110***	***980***	***850***	***720***	***640*** ◀
	18	1	2000	1900	1720	1560	1380	1220	1060	900	800
1-1/4" Copper	24	1	2120	2010	1820	1650	1460	1290	1120	950	850
	18	2 @ 6"	2590	2460	2230	2020	1790	1580	1370	1170	1040
42 Fins/ft.	24	2 @ 6"	2740	2600	2360	2140	1890	1670	1450	1230	1100
	24	2 @ 12"	2840	2700	2440	2220	1960	1730	1510	1280	1140
	24	3 @ 6"	3200	3040	2750	2500	2210	1950	1700	1440	1280
	▶ 12	1	***1730***	***1640***	***1490***	***1350***	***1190***	***1060***	***920***	***780***	***690*** ◀
	▶ 18	1	***2120***	***2010***	***1820***	***1650***	***1460***	***1290***	***1120***	***950***	***850*** ◀
1-1/4" Copper	▶ 24	1	***2240***	***2130***	***1930***	***1750***	***1550***	***1370***	***1190***	***1010***	***900*** ◀
	18	2 @ 6"	2740	2600	2360	2140	1890	1670	1450	1230	1100
50 Fins/ft.	▶ 24	2 @ 6"	***2890***	***2750***	***2490***	***2250***	***1990***	***1760***	***1530***	***1300***	***1160*** ◀
	▶ 24	2 @ 12"	***3000***	***2850***	***2580***	***2340***	***2070***	***1830***	***1590***	***1350***	***1200*** ◀
	24	3 @ 6"	3380	3210	2910	2640	2330	2060	1790	1520	1350

• Bottom of enclosure mounted 2 inches above floor. Refer to page 11 for correction factors for other mounting heights.
• Ratings are based on finned length with 65°F entering air, 1 PSI steam or average water temperature (215°F) at 3 ft/sec. water velocity. These water ratings, applicable to water flow rates of three or more feet per second, have been determined by applying the factors listed on page 11 to the AHRI Steam Ratings, which have been approved by AHRI.
• Finned length is the specified element length - 6" (3" plain end each side).

▶ Bold, italicized units are AHRI CERTIFIED ◀

MODEL S PERFORMANCE

Table 16.1 - Steam and Hot Water Ratings - Fin Size - 2-3/4" x 4-1/4"

FIN SIZE - 2-3/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
3/4" Copper 34 Fins/ft.	12	1	***1230***	***1170***	***1060***	***960***	***850***	***750***	***650***	***550***	***490***
	18	1	1500	1430	1290	1170	1040	920	800	680	600
	24	1	1590	1510	1370	1240	1100	970	840	720	640
	18	2 @ 6"	1880	1790	1620	1470	1300	1150	1000	850	750
	24	2 @ 6"	1990	1890	1710	1550	1370	1210	1050	900	800
	24	2 @ 12"	2060	1960	1770	1610	1420	1260	1090	930	820
	24	3 @ 6"	2250	2140	1940	1760	1550	1370	1190	1010	900
3/4" Copper 42 Fins/ft.	12	1	***1400***	***1330***	***1200***	***1090***	***970***	***850***	***740***	***630***	***560***
	18	1	1710	1620	1470	1330	1180	1040	910	770	680
	24	1	1810	1720	1560	1410	1250	1100	960	810	720
	18	2 @ 6"	2140	2030	1840	1670	1480	1310	1130	960	860
	24	2 @ 6"	2260	2150	1940	1760	1560	1380	1200	1020	900
	24	2 @ 12"	2340	2220	2010	1830	1610	1430	1240	1050	940
	24	3 @ 6"	2560	2430	2200	2000	1770	1560	1360	1150	1020
3/4" Copper 50 Fins/ft.	12	1	***1580***	***1500***	***1360***	***1230***	***1090***	***960***	***840***	***710***	***630***
	18	1	1930	1830	1660	1510	1330	1180	1020	870	770
	24	1	2040	1940	1750	1590	1410	1240	1080	920	820
	18	2 @ 6"	2410	2290	2070	1880	1660	1470	1280	1080	960
	24	2 @ 6"	2550	2420	2190	1990	1760	1560	1350	1150	1020
	24	2 @ 12"	2640	2510	2270	2060	1820	1610	1400	1190	1060
	24	3 @ 6"	2880	2740	2480	2250	1990	1760	1530	1300	1150
1" Copper 34 Fins/ft.	12	1	***1220***	***1160***	***1050***	***950***	***840***	***740***	***650***	***550***	***490***
	18	1	1480	1410	1270	1150	1020	900	780	670	590
	24	1	1560	1480	1340	1220	1080	950	830	700	620
	18	2 @ 6"	1850	1760	1590	1440	1280	1130	980	830	740
	24	2 @ 6"	1960	1860	1690	1530	1350	1200	1040	880	780
	24	2 @ 12"	2030	1930	1750	1580	1400	1240	1080	910	810
	24	3 @ 6"	2200	2090	1890	1720	1520	1340	1170	990	880
1" Copper 42 Fins/ft.	12	1	***1390***	***1320***	***1200***	***1080***	***960***	***850***	***740***	***630***	***560***
	18	1	1650	1570	1420	1290	1140	1010	870	740	660
	24	1	1740	1650	1500	1360	1200	1060	920	780	700
	18	2 @ 6"	2060	1960	1770	1610	1420	1260	1090	930	820
	24	2 @ 6"	2180	2070	1870	1700	1500	1330	1160	980	870
	24	2@ 12"	2260	2150	1940	1760	1560	1380	1200	1020	900
	24	3 @ 6"	2460	2340	2120	1920	1700	1500	1300	1110	980
1" Copper 50 Fins/ft.	12	1	***1560***	***1480***	***1340***	***1220***	***1080***	***950***	***830***	***700***	***620***
	18	1	1820	1730	1570	1420	1260	1110	960	820	730
	24	1	1930	1830	1660	1510	1330	1180	1020	870	770
	18	2 @ 6"	2280	2170	1960	1780	1570	1390	1210	1030	910
	24	2 @ 6"	2410	2290	2070	1880	1660	1470	1280	1080	960
	24	2 @ 12"	2500	2380	2150	1950	1730	1530	1330	1130	1000
	24	3 @ 6"	2730	2590	2350	2130	1880	1670	1450	1230	1090
1-1/4" Copper 34 Fins/ft.	12	1	***1200***	***1140***	***1030***	***940***	***830***	***730***	***640***	***540***	***480***
	18	1	1410	1340	1210	1100	970	860	750	630	560
	24	1	1490	1420	1280	1160	1030	910	790	670	600
	18	2 @ 6"	1770	1680	1520	1380	1220	1080	940	800	710
	24	2 @ 6"	1880	1790	1620	1470	1300	1150	1000	850	750
	24	2 @ 12"	1940	1840	1670	1510	1340	1180	1030	870	780
	24	3 @ 6"	2120	2010	1820	1650	1460	1290	1120	950	850
1-1/4" Copper 42 Fins/ft.	12	1	***1370***	***1300***	***1180***	***1070***	***950***	***840***	***730***	***620***	***550***
	18	1	1560	1480	1340	1220	1080	950	830	700	620
	24	1	1650	1570	1420	1290	1140	1010	870	740	660
	18	2 @ 6"	1960	1860	1690	1530	1350	1200	1040	880	780
	24	2 @ 6"	2070	1970	1780	1610	1430	1260	1100	930	830
	24	2 @ 12"	2140	2030	1840	1670	1480	1310	1130	960	860
	24	3 @ 6"	2330	2210	2000	1820	1610	1420	1230	1050	930
1-1/4" Copper 50 Fins/ft.	12	1	***1540***	***1460***	***1320***	***1200***	***1060***	***940***	***820***	***690***	***620***
	18	1	1720	1630	1480	1340	1190	1050	910	770	690
	24	1	1820	1730	1570	1420	1260	1110	960	820	730
	18	2 @ 6"	2150	2040	1850	1680	1480	1310	1140	970	860
	24	2 @ 6"	2270	2160	1950	1770	1570	1380	1200	1020	910
	24	2 @ 12"	2360	2240	2030	1840	1630	1440	1250	1060	940
	24	3 @ 6"	2560	2430	2200	2000	1770	1560	1360	1150	1020

- Bottom of enclosure mounted 4 inches above floor. Refer to page 11 for correction factors for other mounting heights.
- Ratings are based on finned length with 65°F entering air, 1 PSI steam or average water temperature (215°F) at 3 ft/sec. water velocity. These water ratings, applicable to water flow rates of three or more feet per second, have been determined by applying the factors listed on page 11 to the AHRI Steam Ratings, which have been approved by AHRI.
- Finned length is the specified element length - 6" (3" plain end each side).

▶ Bold, italicized units are AHRI CERTIFIED ◀

PS SECURITY SLOPE TOP FEATURES

- Enclosure ② engages concealed Hanger Strip ③.
- Heating Elements are supported by Inverted Element Bracket (IEB) ④.

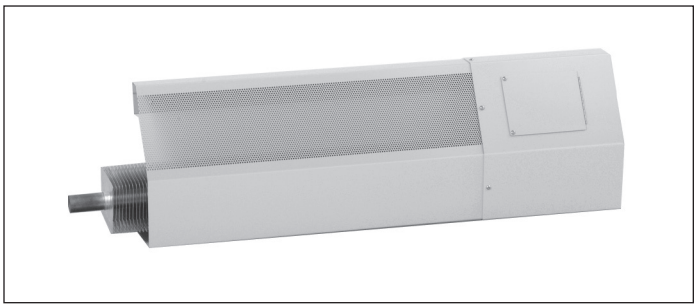
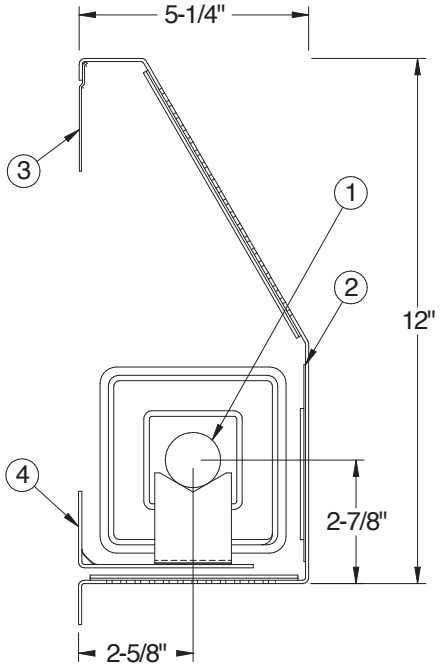


Figure 17.1 - System Components

① Heating Element
② Enclosure
③ Hanger Strip
④ Inverted Element Support Bracket (IEB)



PS 012

Standard Features

- Hanger strip - 16 gauge aluminized steel.
- Enclosure, 14 gauge in lengths of 2 feet through 8 feet in 6 inch increments.
- Height of 12 inches.
- Enclosure sections are joined using concealed slip joints.
- Baked on polyester powdercoat paint finish, tan color.

Accessories

- Accessories, 14 gauge, include all items for a complete installation.
- End caps, end enclosures and valve compartments use slip joints to attach to enclosure.
- Inside, outside corners and enclosure extensions overlap enclosure sections.

Options

- Baked on polyester powdercoat paint finish available in colors selected from color guide (75-403).
- Hanger strip with full back panel.
- Tamperproof (key) damper.
- Column enclosure conceals piping around columns.

MODEL PS PERFORMANCE

Table 18.1 - Steam and Hot Water Ratings - Fin Size - 4-1/4" x 4-1/4"

FIN SIZE - 4-1/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
3/4" Copper 34 Fins/ft.	12	1	960	910	830	750	660	590	510	430	380
3/4" Copper 42 Fins/ft.	12	1	1150	1090	990	900	790	700	610	520	460
3/4" Copper 50 Fins/ft.	12	1	1160	1100	1000	900	800	710	610	520	460
1" Copper 34 Fins/ft.	12	1	1020	970	880	800	700	620	540	460	410
1" Copper 42 Fins/ft.	12	1	1140	1080	980	890	790	700	600	510	460
1" Copper 50 Fins/ft.	12	1	1200	1140	1030	940	830	730	640	540	480
1-1/4" Copper 34 Fins/ft.	12	1	1070	1020	920	830	740	650	570	480	430
1-1/4" Copper 42 Fins/ft.	12	1	1150	1090	990	900	790	700	610	520	460
1-1/4" Copper 50 Fins/ft.	12	1	1130	1070	970	880	780	690	600	510	450

Table 18.1 - Steam and Hot Water Ratings - Fin Size - 2-3/4" x 4-1/4"

FIN SIZE - 2-3/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
3/4" Copper 34 Fins/ft.	12	1	880	840	760	690	610	540	470	400	350
3/4" Copper 42 Fins/ft.	12	1	1000	950	860	780	690	610	530	450	400
3/4" Copper 50 Fins/ft.	12	1	1090	1040	940	850	750	660	580	490	440
1" Copper 34 Fins/ft.	12	1	870	830	750	680	600	530	460	390	350
1" Copper 42 Fins/ft.	12	1	990	940	850	770	680	600	520	450	400
1" Copper 50 Fins/ft.	12	1	1120	1060	960	870	770	680	590	500	450
1-1/4" Copper 34 Fins/ft.	12	1	860	820	740	670	590	520	460	390	340
1-1/4" Copper 42 Fins/ft.	12	1	980	930	840	760	680	600	520	440	390
1-1/4" Copper 50 Fins/ft.	12	1	1100	1050	950	860	760	670	580	500	440

- Bottom of enclosure mounted 4 inches above floor. Refer to page 11 for correction factors for other mounting heights.
- Ratings are based on finned length with 65°F entering air, 1 PSI steam or average water temperature (215°F) at 3 ft/sec. water velocity. These water ratings, applicable to water flow rates of three or more feet per second, have been determined by applying the factors listed on page 11 to the AHRI Steam Ratings, which have been approved by AHRI.
- Finned length is the specified element length - 6" (3" plain end each side).

MODEL T TOP OUTLET FEATURES

- Enclosure ② engages concealed Hanger Strip ③.
- Enclosure Wall Support (EWS) ④ hangs from Hanger Strip at any location and attaches to wall with one fastener.
- EWS ④ supports Heating Element ①, second and third row Element Support Assembly (ESA) ⑤ and Return Pipe Hanger ⑥ without fasteners.
- EWS ④ supports have integral enclosure lock.

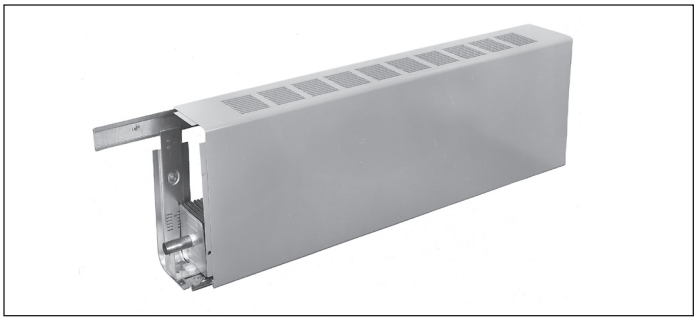
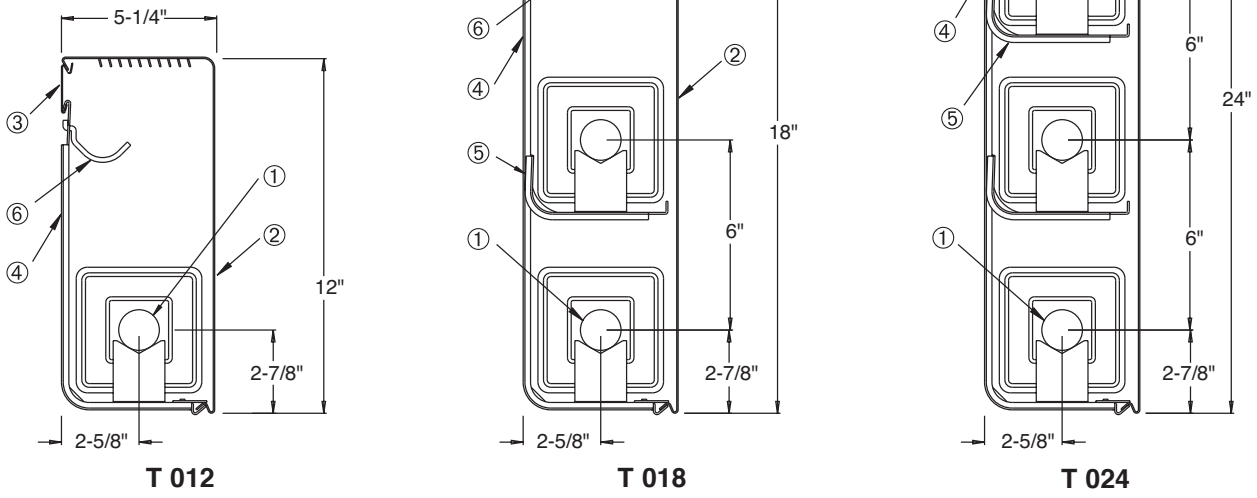


Figure 19.1 - System Components

① Heating Element
② Enclosure
③ Hanger Strip
④ Enclosure Wall Support (EWS)
⑤ Element Support Assembly (ESA)
⑥ Return Pipe Hanger



Standard Features

- Hanger strip - 20 gauge aluminized steel.
- Enclosure, 18 gauge in lengths of 2 feet through 8 feet in 6 inch increments.
- Heights of 12, 18 and 24 inches.
- Enclosure sections are joined using concealed slip joints.
- Baked on polyester powdercoat paint finish, tan color.

Accessories

- Accessories, 20 gauge, include all items for a complete installation.
- End caps, end enclosures and valve compartments use slip joints to attach to enclosure.
- Inside, outside corners and enclosure extensions overlap enclosure sections.
- Return pipe hanger. Note: return pipe hanger cannot be used with damper option.

Options

- Enclosures available in 14 or 16 gauge steel.
- Baked on polyester powdercoat paint finish available in colors selected from color guide (75-403).
- Bottom inlet grille conceals open air inlet for installations above eye level.
- Hanger strip with full back panel.
- Knob operated or tamperproof (key) damper.
- Column enclosure conceals piping around columns.

MODEL T PERFORMANCE

Table 20.1 - Steam and Hot Water Ratings - Fin Size - 4-1/4" x 4-1/4"

FIN SIZE - 4-1/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
	12	1	1240	1180	1070	970	860	760	660	560	500
	18	1	1480	1410	1270	1150	1020	900	780	670	590
3/4" Copper	24	1	1520	1440	1310	1190	1050	930	810	680	610
	18	2 @ 6"	1900	1810	1630	1480	1310	1160	1010	860	760
34 Fins/ft.	24	2 @ 6"	1950	1850	1680	1520	1350	1190	1030	880	780
	24	2 @ 12"	2020	1920	1740	1580	1390	1230	1070	910	810
	24	3 @ 6"	2280	2170	1960	1780	1570	1390	1210	1030	910
	12	1	1370	1300	1180	1070	950	840	730	620	550
	18	1	1620	1540	1390	1260	1120	990	860	730	650
3/4" Copper	24	1	1660	1580	1430	1290	1150	1010	880	750	660
	18	2 @ 6"	2090	1990	1800	1630	1440	1270	1110	940	840
42 Fins/ft.	24	2 @ 6"	2140	2030	1840	1670	1480	1310	1130	960	860
	24	2 @ 12"	2220	2110	1910	1730	1530	1350	1180	1000	890
	24	3 @ 6"	2520	2390	2170	1970	1740	1540	1340	1130	1010
	▶ 12	1	***1490***	***1420***	***1280***	***1160***	***1030***	***910***	***790***	***670***	***600*** ◀
	▶ 18	1	***1760***	***1670***	***1510***	***1370***	***1210***	***1070***	***930***	***790***	***700*** ◀
3/4" Copper	▶ 24	1	***1810***	***1720***	***1560***	***1410***	***1250***	***1100***	***960***	***810***	***720*** ◀
	18	2 @ 6"	2280	2170	1960	1780	1570	1390	1210	1030	910
50 Fins/ft.	24	2 @ 6"	2340	2220	2010	1830	1610	1430	1240	1050	940
	24	2 @ 12"	2430	2310	2090	1900	1680	1480	1290	1090	970
	24	3 @ 6"	2740	2600	2360	2140	1890	1670	1450	1230	1100
	12	1	1310	1240	1130	1020	900	800	690	590	520
	18	1	1610	1530	1380	1260	1110	980	850	720	640
1" Copper	24	1	1770	1680	1520	1380	1220	1080	940	800	710
	18	2 @ 6"	2080	1980	1790	1620	1440	1270	1100	940	830
34 Fins/ft.	24	2 @ 6"	2280	2170	1960	1780	1570	1390	1210	1030	910
	24	2 @ 12"	2370	2250	2040	1850	1640	1450	1260	1070	950
	24	3 @ 6"	2650	2520	2280	2070	1830	1620	1400	1190	1060
	12	1	1430	1360	1230	1120	990	870	760	640	570
	18	1	1760	1670	1510	1370	1210	1070	930	790	700
1" Copper	24	1	1940	1840	1670	1510	1340	1180	1030	870	780
	18	2 @ 6"	2280	2170	1960	1780	1570	1390	1210	1030	910
42 Fins/ft.	24	2 @ 6"	2500	2380	2150	1950	1730	1530	1330	1130	1000
	24	2 @ 12"	2590	2460	2230	2020	1790	1580	1370	1170	1040
	24	3 @ 6"	2930	2780	2520	2290	2020	1790	1550	1320	1170
	12	1	1540	1460	1320	1200	1060	940	820	690	620
	18	1	1890	1800	1630	1470	1300	1150	1000	850	760
1" Copper	24	1	2080	1980	1790	1620	1440	1270	1100	940	830
	18	2 @ 6"	2450	2330	2110	1910	1690	1490	1300	1100	980
50 Fins/ft.	24	2 @ 6"	2690	2560	2310	2100	1860	1640	1430	1210	1080
	24	2 @ 12"	2780	2640	2390	2170	1920	1700	1470	1250	1110
	24	3 @ 6"	3150	2990	2710	2460	2170	1920	1670	1420	1260
	12	1	1380	1310	1190	1080	950	840	730	620	550
	18	1	1700	1620	1460	1330	1170	1040	900	770	680
1-1/4" Copper	24	1	1860	1770	1600	1450	1280	1130	990	840	740
	18	2 @ 6"	2190	2080	1880	1710	1510	1340	1160	990	880
34 Fins/ft.	24	2 @ 6"	2410	2290	2070	1880	1660	1470	1280	1080	960
	24	2 @ 12"	2490	2370	2140	1940	1720	1520	1320	1120	1000
	24	3 @ 6"	2810	2670	2420	2190	1940	1710	1490	1260	1120
	12	1	1500	1430	1290	1170	1040	920	800	680	600
	18	1	1850	1760	1590	1440	1280	1130	980	830	740
1-1/4" Copper	24	1	2030	1930	1750	1580	1400	1240	1080	910	810
	18	2 @ 6"	2390	2270	2060	1860	1650	1460	1270	1080	960
42 Fins/ft.	24	2 @ 6"	2630	2500	2260	2050	1810	1600	1390	1180	1050
	24	2 @ 12"	2720	2580	2340	2120	1880	1660	1440	1220	1090
	24	3 @ 6"	3070	2920	2640	2390	2120	1870	1630	1380	1230
	12	1	1590	1510	1370	1240	1100	970	840	720	640
	18	1	1960	1860	1690	1530	1350	1200	1040	880	780
1-1/4" Copper	24	1	2150	2040	1850	1680	1480	1310	1140	970	860
	18	2 @ 6"	2530	2400	2180	1970	1750	1540	1340	1140	1010
50 Fins/ft.	24	2 @ 6"	2780	2640	2390	2170	1920	1700	1470	1250	1110
	24	2 @ 12"	2880	2740	2480	2250	1990	1760	1530	1300	1150
	24	3 @ 6"	3250	3090	2800	2540	2240	1980	1720	1460	1300

• Bottom of enclosure mounted 4 inches above floor. Refer to page 11 for correction factors for other mounting heights.
• Ratings are based on finned length with 65°F entering air, 1 PSI steam or average water temperature (215°F) at 3 ft/sec. water velocity. These water ratings, applicable to water flow rates of three or more feet per second, have been determined by applying the factors listed on page 11 to the AHRI Steam Ratings, which have been approved by AHRI.
• Finned length is the specified element length - 6" (3" plain end each side).

▶ Bold, italicized units are AHRI CERTIFIED ◀

MODEL T PERFORMANCE

Table 21.1 - Steam and Hot Water Ratings - Fin Size - 2-3/4" x 4-1/4"

FIN SIZE - 2-3/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
	12	1	1130	1070	970	880	780	690	600	510	450
	18	1	1340	1270	1150	1050	920	820	710	600	540
3/4" Copper	24	1	1380	1310	1190	1080	950	840	730	620	550
	18	2 @ 6"	1680	1600	1440	1310	1160	1020	890	760	670
34 Fins/ft.	24	2 @ 6"	1720	1630	1480	1340	1190	1050	910	770	690
	24	2 @ 12"	1790	1700	1540	1400	1240	1090	950	810	720
	24	3 @ 6"	1950	1850	1680	1520	1350	1190	1030	880	780
	12	1	1310	1240	1130	1020	900	800	690	590	520
	18	1	1500	1430	1290	1170	1040	920	800	680	600
3/4" Copper	24	1	1570	1490	1350	1220	1080	960	830	710	630
	18	2 @ 6"	1910	1810	1640	1490	1320	1170	1010	860	760
42 Fins/ft.	24	2 @ 6"	1960	1860	1690	1530	1350	1200	1040	880	780
	24	2 @ 12"	2030	1930	1750	1580	1400	1240	1080	910	810
	24	3 @ 6"	2220	2110	1910	1730	1530	1350	1180	1000	890
	12	1	1450	1380	1250	1130	1000	880	770	650	580
	18	1	1720	1630	1480	1340	1190	1050	910	770	690
3/4" Copper	24	1	1770	1680	1520	1380	1220	1080	940	800	710
	18	2 @ 6"	2150	2040	1850	1680	1480	1310	1140	970	860
50 Fins/ft.	24	2 @ 6"	2210	2100	1900	1720	1520	1350	1170	990	880
	24	2 @ 12"	2290	2180	1970	1790	1580	1400	1210	1030	920
	24	3 @ 6"	2490	2370	2140	1940	1720	1520	1320	1120	1000
	12	1	1110	1050	950	870	770	680	590	500	440
	18	1	1370	1300	1180	1070	950	840	730	620	550
1" Copper	24	1	1500	1430	1290	1170	1040	920	800	680	600
	18	2 @ 6"	1710	1620	1470	1330	1180	1040	910	770	680
34 Fins/ft.	24	2 @ 6"	1880	1790	1620	1470	1300	1150	1000	850	750
	24	2 @ 12"	1950	1850	1680	1520	1350	1190	1030	880	780
	24	3 @ 6"	2110	2000	1810	1650	1460	1290	1120	950	840
	12	1	1240	1180	1070	970	860	760	660	560	500
	18	1	1530	1450	1320	1190	1060	930	810	690	610
1" Copper	24	1	1670	1590	1440	1300	1150	1020	890	750	670
	18	2 @ 6"	1910	1810	1640	1490	1320	1170	1010	860	760
42 Fins/ft.	24	2 @ 6"	2090	1990	1800	1630	1440	1270	1110	940	840
	24	2 @ 12"	2170	2060	1870	1690	1500	1320	1150	980	870
	24	3 @ 6"	2360	2240	2030	1840	1630	1440	1250	1060	940
	12	1	1370	1300	1180	1070	950	840	730	620	550
	18	1	1690	1610	1450	1320	1170	1030	900	760	680
1" Copper	24	1	1850	1760	1590	1440	1280	1130	980	830	740
	18	2 @ 6"	2110	2000	1810	1650	1460	1290	1120	950	840
50 Fins/ft.	24	2 @ 6"	2310	2190	1990	1800	1590	1410	1220	1040	920
	24	2 @ 12"	2400	2280	2060	1870	1660	1460	1270	1080	960
	24	3 @ 6"	2620	2490	2250	2040	1810	1600	1390	1180	1050
	12	1	1060	1010	910	830	730	650	560	480	420
	18	1	1300	1240	1120	1010	900	790	690	590	520
1-1/4" Copper	24	1	1430	1360	1230	1120	990	870	760	640	570
	18	2 @ 6"	1640	1560	1410	1280	1130	1000	870	740	660
34 Fins/ft.	24	2 @ 6"	1800	1710	1550	1400	1240	1100	950	810	720
	24	2 @ 12"	1870	1780	1610	1460	1290	1140	990	840	750
	24	3 @ 6"	2040	1940	1750	1590	1410	1240	1080	920	820
	12	1	1180	1120	1010	920	810	720	630	530	470
	18	1	1450	1380	1250	1130	1000	880	770	650	580
1-1/4" Copper	24	1	1590	1510	1370	1240	1100	970	840	720	640
	18	2 @ 6"	1810	1720	1560	1410	1250	1100	960	810	720
42 Fins/ft.	24	2 @ 6"	1990	1890	1710	1550	1370	1210	1050	900	800
	24	2 @ 12"	2060	1960	1770	1610	1420	1260	1090	930	820
	24	3 @ 6"	2240	2130	1930	1750	1550	1370	1190	1010	900
	12	1	1290	1230	1110	1010	890	790	680	580	520
	18	1	1590	1510	1370	1240	1100	970	840	720	640
1-1/4" Copper	24	1	1740	1650	1500	1360	1200	1060	920	780	700
	18	2 @ 6"	1990	1890	1710	1550	1370	1210	1050	900	800
50 Fins/ft.	24	2 @ 6"	2180	2070	1870	1700	1500	1330	1160	980	870
	24	2 @ 12"	2260	2150	1940	1760	1560	1380	1200	1020	900
	24	3 @ 6"	2460	2340	2120	1920	1700	1500	1300	1110	980

- Bottom of enclosure mounted 4 inches above floor. Refer to page 11 for correction factors for other mounting heights.
- Ratings are based on finned length with 65°F entering air, 1 PSI steam or average water temperature (215°F) at 3 ft/sec. water velocity. These water ratings, applicable to water flow rates of three or more feet per second, have been determined by applying the factors listed on page 11 to the AHRI Steam Ratings, which have been approved by AHRI.
- Finned length is the specified element length - 6" (3" plain end each side).

MODEL F FRONT OUTLET FEATURES

- Enclosure ② engages concealed Hanger Strip ③.
- Enclosure Wall Support (EWS) ④ hangs from Hanger Strip at any location and attaches to wall with one fastener.
- EWS ④ supports Heating Element ①, second and third row Element Support Assembly (ESA) ⑤ and Return Pipe Hanger ⑥ without fasteners.
- EWS ④ supports have integral enclosure lock.

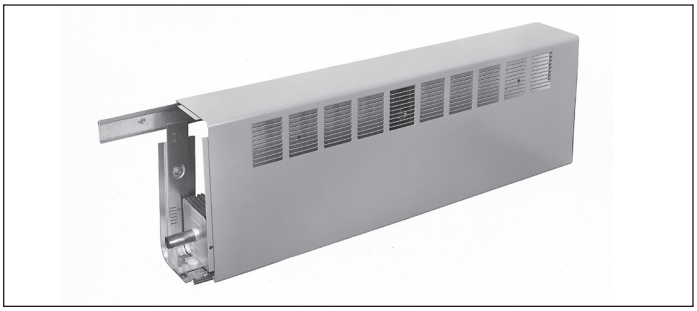
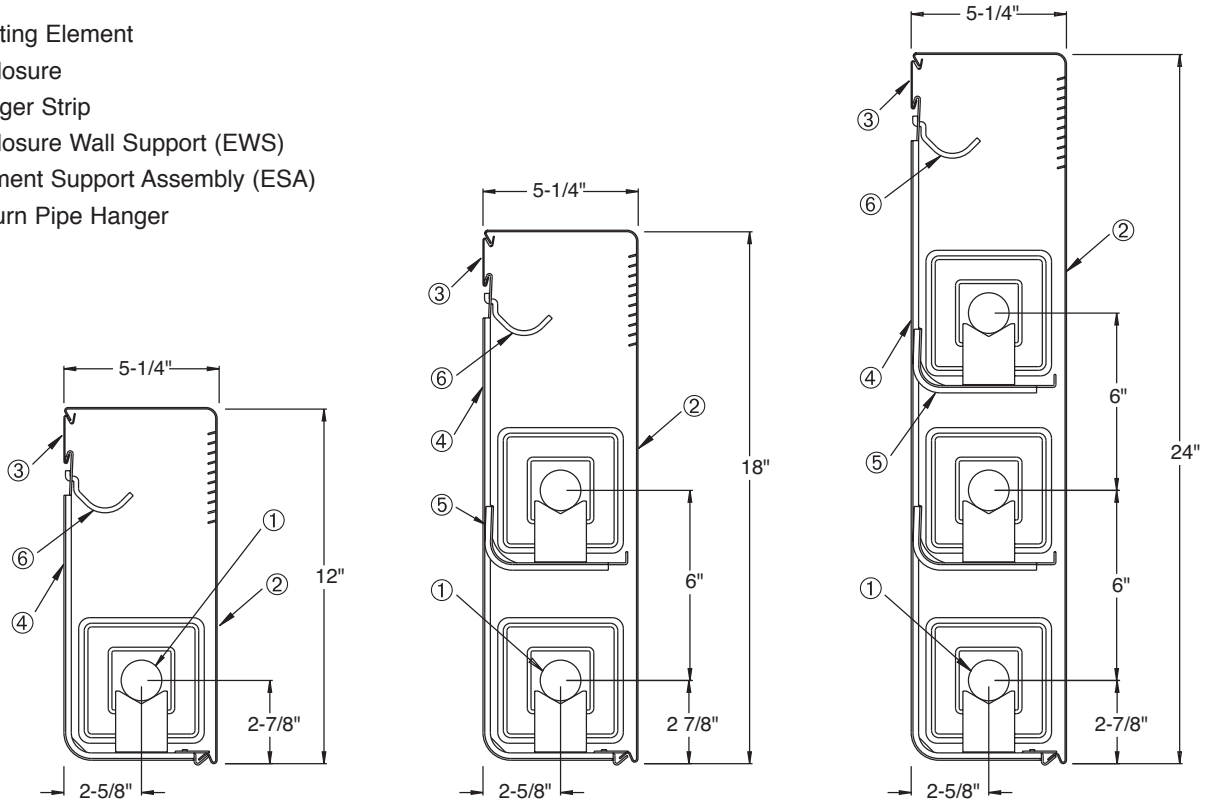


Figure 22.1 - System Components

① Heating Element
② Enclosure
③ Hanger Strip
④ Enclosure Wall Support (EWS)
⑤ Element Support Assembly (ESA)
⑥ Return Pipe Hanger



Standard Features

- Hanger strip - 20 gauge aluminized steel.
- Enclosure, 18 gauge in lengths of 2 feet through 8 feet in 6 inch increments.
- Heights of 12, 18 and 24 inches.
- Enclosure sections are joined using concealed slip joints.
- Baked on polyester powdercoat paint finish, tan color.

Accessories

- Accessories, 20 gauge, include all items for a complete installation.
- End caps, end enclosures and valve compartments use slip joints to attach to enclosure.
- Inside, outside corners and enclosure extensions overlap enclosure sections.
- Return pipe hanger. Note: return pipe hanger cannot be used with damper option.

Options

- Enclosures available in 14 or 16 gauge steel.
- Baked on polyester powdercoat paint finish available in colors selected from color guide (75-403).
- Bottom inlet grille conceals open air inlet for installations above eye level.
- Hanger strip with full back panel.
- Knob operated or tamperproof (key) damper.
- Column enclosure conceals piping around columns.

MODEL F PERFORMANCE

Table 23.1 - Steam and Hot Water Ratings - Fin Size - 4-1/4" x 4-1/4"

FIN SIZE - 4-1/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
	12	1	1350	1280	1160	1050	930	820	720	610	540
	18	1	1620	1540	1390	1260	1120	990	860	730	650
3/4" Copper	24	1	1680	1600	1440	1310	1160	1020	890	760	670
	18	2 @ 6"	2080	1980	1790	1620	1440	1270	1100	940	830
34 Fins/ft.	24	2 @ 6"	2160	2050	1860	1680	1490	1320	1140	970	860
	24	2 @ 12"	2240	2130	1930	1750	1550	1370	1190	1010	900
	24	3 @ 6"	2520	2390	2170	1970	1740	1540	1340	1130	1010
	12	1	1480	1410	1270	1150	1020	900	780	670	590
	18	1	1780	1690	1530	1390	1230	1090	940	800	710
3/4" Copper	24	1	1840	1750	1580	1440	1270	1120	980	830	740
	18	2 @ 6"	2290	2180	1970	1790	1580	1400	1210	1030	920
42 Fins/ft.	24	2 @ 6"	2380	2260	2050	1860	1640	1450	1260	1070	950
	24	2 @ 12"	2460	2340	2120	1920	1700	1500	1300	1110	980
	24	3 @ 6"	2800	2660	2410	2180	1930	1710	1480	1260	1120
	12	1	***1610***	***1530***	***1380***	***1260***	***1110***	***980***	***850***	***720***	***640***
	18	1	1930	1830	1660	1510	1330	1180	1020	870	770
3/4" Copper	24	1	2010	1910	1730	1570	1390	1230	1070	900	800
	18	2 @ 6"	2500	2380	2150	1950	1730	1530	1330	1130	1000
50 Fins/ft.	24	2 @ 6"	2590	2460	2230	2020	1790	1580	1370	1170	1040
	24	2 @ 12"	2690	2560	2310	2100	1860	1640	1430	1210	1080
	24	3 @ 6"	3040	2890	2610	2370	2100	1850	1610	1370	1220
	12	1	1420	1350	1220	1110	980	870	750	640	570
	18	1	1700	1620	1460	1330	1170	1040	900	770	680
1" Copper	24	1	1770	1680	1520	1380	1220	1080	940	800	710
	18	2 @ 6"	2200	2090	1890	1720	1520	1340	1170	990	880
34 Fins/ft.	24	2 @ 6"	2280	2170	1960	1780	1570	1390	1210	1030	910
	24	2 @ 12"	2360	2240	2030	1840	1630	1440	1250	1060	940
	24	3 @ 6"	2650	2520	2280	2070	1830	1620	1400	1190	1060
	12	1	1550	1470	1330	1210	1070	950	820	700	620
	18	1	1860	1770	1600	1450	1280	1130	990	840	740
1" Copper	24	1	1940	1840	1670	1510	1340	1180	1030	870	780
	18	2 @ 6"	2410	2290	2070	1880	1660	1470	1280	1080	960
42 Fins/ft.	24	2 @ 6"	2500	2380	2150	1950	1730	1530	1330	1130	1000
	24	2 @ 12"	2590	2460	2230	2020	1790	1580	1370	1170	1040
	24	3 @ 6"	2930	2780	2520	2290	2020	1790	1550	1320	1170
	12	1	1670	1590	1440	1300	1150	1020	890	750	670
	18	1	2000	1900	1720	1560	1380	1220	1060	900	800
1" Copper	24	1	2080	1980	1790	1620	1440	1270	1100	940	830
	18	2 @ 6"	2580	2450	2220	2010	1780	1570	1370	1160	1030
50 Fins/ft.	24	2 @ 6"	2680	2550	2300	2090	1850	1630	1420	1210	1070
	24	2 @ 12"	2780	2640	2390	2170	1920	1700	1470	1250	1110
	24	3 @ 6"	3150	2990	2710	2460	2170	1920	1670	1420	1260
	12	1	1490	1420	1280	1160	1030	910	790	670	600
	18	1	1790	1700	1540	1400	1240	1090	950	810	720
1-1/4" Copper	24	1	1860	1770	1600	1450	1280	1130	990	840	740
	18	2 @ 6"	2320	2200	2000	1810	1600	1420	1230	1040	930
34 Fins/ft.	24	2 @ 6"	2410	2290	2070	1880	1660	1470	1280	1080	960
	24	2 @ 12"	2490	2370	2140	1940	1720	1520	1320	1120	1000
	24	3 @ 6"	2810	2670	2420	2190	1940	1710	1490	1260	1120
	12	1	1630	1550	1400	1270	1120	990	860	730	650
	18	1	1950	1850	1680	1520	1350	1190	1030	880	780
1-1/4" Copper	24	1	2030	1930	1750	1580	1400	1240	1080	910	810
	18	2 @ 6"	2530	2400	2180	1970	1750	1540	1340	1140	1010
42 Fins/ft.	24	2 @ 6"	2620	2490	2250	2040	1810	1600	1390	1180	1050
	24	2 @ 12"	2720	2580	2340	2120	1880	1660	1440	1220	1090
	24	3 @ 6"	3070	2920	2640	2390	2120	1870	1630	1380	1230
	12	1	1720	1630	1480	1340	1190	1050	910	770	690
	18	1	2070	1970	1780	1610	1430	1260	1100	930	830
1-1/4" Copper	24	1	2150	2040	1850	1680	1480	1310	1140	970	860
	18	2 @ 6"	2670	2540	2300	2080	1840	1630	1420	1200	1070
50 Fins/ft.	24	2 @ 6"	2780	2640	2390	2170	1920	1700	1470	1250	1110
	24	2 @ 12"	2880	2740	2480	2250	1990	1760	1530	1300	1150
	24	3 @ 6"	3240	3080	2790	2530	2240	1980	1720	1460	1300

- Bottom of enclosure mounted 4 inches above floor. Refer to page 11 for correction factors for other mounting heights.
- Ratings are based on finned length with 65°F entering air, 1 PSI steam or average water temperature (215°F) at 3 ft/sec. water velocity. These water ratings, applicable to water flow rates of three or more feet per second, have been determined by applying the factors listed on page 11 to the AHRI Steam Ratings, which have been approved by AHRI.
- Finned length is the specified element length - 6" (3" plain end each side).

▶ Bold, italicized units are AHRI CERTIFIED ◀

MODEL F PERFORMANCE

Table 24.1 - Steam and Hot Water Ratings - Fin Size - 2-3/4" x 4-1/4"

FIN SIZE - 2-3/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
	12	1	1230	1170	1060	960	850	750	650	550	490
	18	1	1470	1400	1260	1150	1010	900	780	660	590
3/4" Copper	24	1	1530	1450	1320	1190	1060	930	810	690	610
	18	2 @ 6"	1840	1750	1580	1440	1270	1120	980	830	740
34 Fins/ft.	24	2 @ 6"	1910	1810	1640	1490	1320	1170	1010	860	760
	24	2 @ 12"	1980	1880	1700	1540	1370	1210	1050	890	790
	24	3 @ 6"	2160	2050	1860	1680	1490	1320	1140	970	860
	12	1	1400	1330	1200	1090	970	850	740	630	560
	18	1	1670	1590	1440	1300	1150	1020	890	750	670
3/4" Copper	24	1	1740	1650	1500	1360	1200	1060	920	780	700
	18	2 @ 6"	2090	1990	1800	1630	1440	1270	1110	940	840
42 Fins/ft.	24	2 @ 6"	2170	2060	1870	1690	1500	1320	1150	980	870
	24	2 @ 12"	2250	2140	1940	1760	1550	1370	1190	1010	900
	24	3 @ 6"	2460	2340	2120	1920	1700	1500	1300	1110	980
	12	1	1570	1490	1350	1220	1080	960	830	710	630
	18	1	1880	1790	1620	1470	1300	1150	1000	850	750
3/4" Copper	24	1	1960	1860	1690	1530	1350	1200	1040	880	780
	18	2 @ 6"	2360	2240	2030	1840	1630	1440	1250	1060	940
50 Fins/ft.	24	2 @ 6"	2450	2330	2110	1910	1690	1490	1300	1100	980
	24	2 @ 12"	2540	2410	2180	1980	1750	1550	1350	1140	1020
	24	3 @ 6"	2760	2620	2370	2150	1900	1680	1460	1240	1100
	12	1	1200	1140	1030	940	830	730	640	540	480
	18	1	1440	1370	1240	1120	990	880	760	650	580
1" Copper	24	1	1500	1430	1290	1170	1040	920	800	680	600
	18	2 @ 6"	1810	1720	1560	1410	1250	1100	960	810	720
34 Fins/ft.	24	2 @ 6"	1880	1790	1620	1470	1300	1150	1000	850	750
	24	2 @ 12"	1950	1850	1680	1520	1350	1190	1030	880	780
	24	3 @ 6"	2110	2000	1810	1650	1460	1290	1120	950	840
	12	1	1340	1270	1150	1050	920	820	710	600	540
	18	1	1610	1530	1380	1260	1110	980	850	720	640
1" Copper	24	1	1670	1590	1440	1300	1150	1020	890	750	670
	18	2 @ 6"	2010	1910	1730	1570	1390	1230	1070	900	800
42 Fins/ft.	24	2 @ 6"	2090	1990	1800	1630	1440	1270	1110	940	840
	24	2 @ 12"	2170	2060	1870	1690	1500	1320	1150	980	870
	24	3 @ 6"	2360	2240	2030	1840	1630	1440	1250	1060	940
	12	1	1490	1420	1280	1160	1030	910	790	670	600
	18	1	1780	1690	1530	1390	1230	1090	940	800	710
1" Copper	24	1	1850	1760	1590	1440	1280	1130	980	830	740
	18	2 @ 6"	2230	2120	1920	1740	1540	1360	1180	1000	890
50 Fins/ft.	24	2 @ 6"	2310	2190	1990	1800	1590	1410	1220	1040	920
	24	2 @ 12"	2400	2280	2060	1870	1660	1460	1270	1080	960
	24	3 @ 6"	2620	2490	2250	2040	1810	1600	1390	1180	1050
	12	1	1150	1090	990	900	790	700	610	520	460
	18	1	1380	1310	1190	1080	950	840	730	620	550
1-1/4" Copper	24	1	1430	1360	1230	1120	990	870	760	640	570
	18	2 @ 6"	1730	1640	1490	1350	1190	1060	920	780	690
34 Fins/ft.	24	2 @ 6"	1800	1710	1550	1400	1240	1100	950	810	720
	24	2 @ 12"	1860	1770	1600	1450	1280	1130	990	840	740
	24	3 @ 6"	2040	1940	1750	1590	1410	1240	1080	920	820
	12	1	1280	1220	1100	1000	880	780	680	580	510
	18	1	1530	1450	1320	1190	1060	930	810	690	610
1-1/4" Copper	24	1	1590	1510	1370	1240	1100	970	840	720	640
	18	2 @ 6"	1910	1810	1640	1490	1320	1170	1010	860	760
42 Fins/ft.	24	2 @ 6"	1990	1890	1710	1550	1370	1210	1050	900	800
	24	2 @ 12"	2060	1960	1770	1610	1420	1260	1090	930	820
	24	3 @ 6"	2230	2120	1920	1740	1540	1360	1180	1000	890
	12	1	1400	1330	1200	1090	970	850	740	630	560
	18	1	1680	1600	1440	1310	1160	1020	890	760	670
1-1/4" Copper	24	1	1740	1650	1500	1360	1200	1060	920	780	700
	18	2 @ 6"	2100	2000	1810	1640	1450	1280	1110	950	840
50 Fins/ft.	24	2 @ 6"	2180	2070	1870	1700	1500	1330	1160	980	870
	24	2 @ 12"	2260	2150	1940	1760	1560	1380	1200	1020	900
	24	3 @ 6"	2460	2340	2120	1920	1700	1500	1300	1110	980

- Bottom of enclosure mounted 4 inches above floor. Refer to page 11 for correction factors for other mounting heights.
- Ratings are based on finned length with 65°F entering air, 1 PSI steam or average water temperature (215°F) at 3 ft/sec. water velocity. These water ratings, applicable to water flow rates of three or more feet per second, have been determined by applying the factors listed on page 11 to the AHRI Steam Ratings, which have been approved by AHRI.
- Finned length is the specified element length - 6" (3" plain end each side).

MODEL R FRONT AND TOP OUTLET FEATURES

- Enclosure (2) engages concealed Hanger Strip ③.
- Enclosure Wall Support (EWS) ④ hangs from Hanger Strip at any location and attaches to wall with one fastener.
- EWS (4) supports Heating Element ①, second and third row Element Support Assembly (ESA) ⑤ and Return Pipe Hanger ⑥ without fasteners.
- EWS ④ supports have integral enclosure lock.

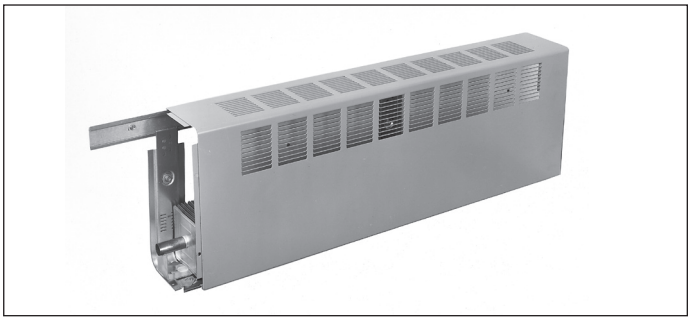
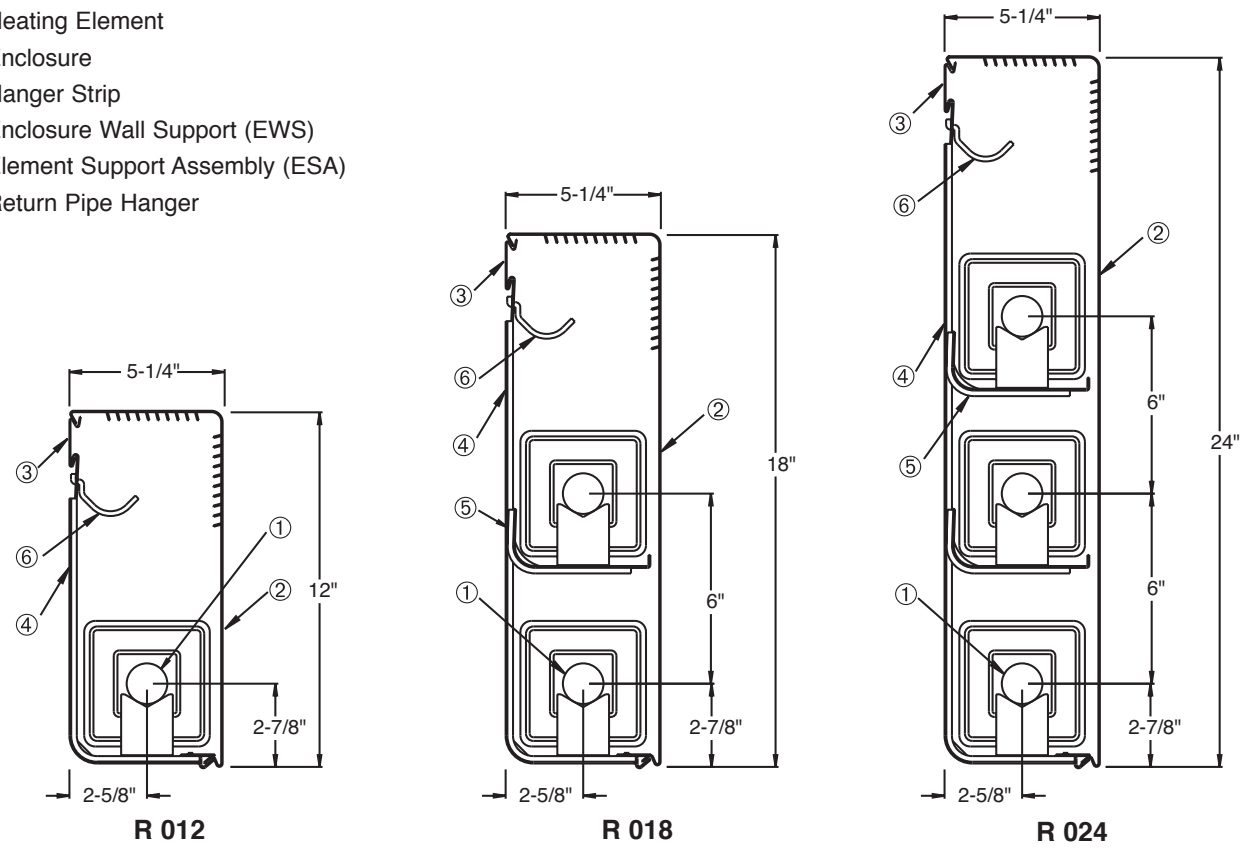


Figure 25.1 - System Components

① Heating Element
② Enclosure
③ Hanger Strip
④ Enclosure Wall Support (EWS)
⑤ Element Support Assembly (ESA)
⑥ Return Pipe Hanger



Standard Features

- Hanger strip - 20 gauge aluminized steel.
- Enclosure, 18 gauge in lengths of 2 feet through 8 feet in 6 inch increments.
- Heights of 12, 18 and 24 inches.
- Enclosure sections are joined using concealed slip joints.
- Baked on polyester powdercoat paint finish, tan color.

Accessories

- Accessories, 20 gauge, include all items for a complete installation.
- End caps, end enclosures and valve compartments use slip joints to attach to enclosure.
- Inside, outside corners and enclosure extensions overlap enclosure sections.
- Return pipe hanger. Note: return pipe hanger cannot be used with damper option.

Options

- Enclosures available in 14 or 16 gauge steel.
- Baked on polyester powdercoat paint finish available in colors selected from color guide (75-403).
- Bottom inlet grille conceals open air inlet for installations above eye level.
- Hanger strip with full back panel.
- Knob operated or tamperproof (key) damper.
- Column enclosure conceals piping around columns.

MODEL R PERFORMANCE

Table 26.1 - Steam and Hot Water Ratings - Fin Size - 4-1/4" x 4-1/4"

FIN SIZE - 4-1/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
	12	1	1400	1330	1200	1090	970	850	740	630	560
	18	1	1710	1620	1470	1330	1180	1040	910	770	680
3/4" Copper	24	1	1830	1740	1570	1430	1260	1120	970	820	730
	18	2 @ 6"	2200	2090	1890	1720	1520	1340	1170	990	880
34 Fins/ft.	24	2 @ 6"	2350	2230	2020	1830	1620	1430	1250	1060	940
	24	2 @ 12"	2430	2310	2090	1900	1680	1480	1290	1090	970
	24	3 @ 6"	2740	2600	2360	2140	1890	1670	1450	1230	1100
	12	1	1540	1460	1320	1200	1060	940	820	690	620
	18	1	1880	1790	1620	1470	1300	1150	1000	850	750
3/4" Copper	24	1	2000	1900	1720	1560	1380	1220	1060	900	800
	18	2 @ 6"	2420	2300	2080	1890	1670	1480	1280	1090	970
42 Fins/ft.	24	2 @ 6"	2580	2450	2220	2010	1780	1570	1370	1160	1030
	24	2 @ 12"	2680	2550	2300	2090	1850	1630	1420	1210	1070
	24	3 @ 6"	3040	2890	2610	2370	2100	1850	1610	1370	1220
	▶ 12	1	***1670***	***1590***	***1440***	***1300***	***1150***	***1020***	***890***	***750***	***670*** ◀
	18	1	2040	1940	1750	1590	1410	1240	1080	920	820
3/4" Copper	24	1	2180	2070	1870	1700	1500	1330	1160	980	870
	18	2 @ 6"	2640	2510	2270	2060	1820	1610	1400	1190	1060
50 Fins/ft.	24	2 @ 6"	2820	2680	2430	2200	1950	1720	1490	1270	1130
	24	2 @ 12"	2920	2770	2510	2280	2010	1780	1550	1310	1170
	24	3 @ 6"	3300	3140	2840	2570	2280	2010	1750	1490	1320
	12	1	1470	1400	1260	1150	1010	900	780	660	590
	18	1	1800	1710	1550	1400	1240	1100	950	810	720
1" Copper	24	1	1920	1820	1650	1500	1320	1170	1020	860	770
	18	2 @ 6"	2320	2200	2000	1810	1600	1420	1230	1040	930
34 Fins/ft.	24	2 @ 6"	2480	2360	2130	1930	1710	1510	1310	1120	990
	24	2 @ 12"	2570	2440	2210	2000	1770	1570	1360	1160	1030
	24	3 @ 6"	2880	2740	2480	2250	1990	1760	1530	1300	1150
	12	1	1610	1530	1380	1260	1110	980	850	720	640
	18	1	1970	1870	1690	1540	1360	1200	1040	890	790
1" Copper	24	1	2100	2000	1810	1640	1450	1280	1110	950	840
	18	2 @ 6"	2540	2410	2180	1980	1750	1550	1350	1140	1020
42 Fins/ft.	24	2 @ 6"	2710	2570	2330	2110	1870	1650	1440	1220	1080
	24	2 @ 12"	2810	2670	2420	2190	1940	1710	1490	1260	1120
	24	3 @ 6"	3180	3020	2730	2480	2190	1940	1690	1430	1270
	12	1	1730	1640	1490	1350	1190	1060	920	780	690
	18	1	2110	2000	1810	1650	1460	1290	1120	950	840
1" Copper	24	1	2250	2140	1940	1760	1550	1370	1190	1010	900
	18	2 @ 6"	2730	2590	2350	2130	1880	1670	1450	1230	1090
50 Fins/ft.	24	2 @ 6"	2910	2760	2500	2270	2010	1780	1540	1310	1160
	24	2 @ 12"	3020	2870	2600	2360	2080	1840	1600	1360	1210
	24	3 @ 6"	3420	3250	2940	2670	2360	2090	1810	1540	1370
	12	1	1550	1470	1330	1210	1070	950	820	700	620
	18	1	1890	1800	1630	1470	1300	1150	1000	850	760
1-1/4" Copper	24	1	2020	1920	1740	1580	1390	1230	1070	910	810
	18	2 @ 6"	2450	2330	2110	1910	1690	1490	1300	1100	980
34 Fins/ft.	24	2 @ 6"	2610	2480	2240	2040	1800	1590	1380	1170	1040
	24	2 @ 12"	2710	2570	2330	2110	1870	1650	1440	1220	1080
	24	3 @ 6"	3050	2900	2620	2380	2100	1860	1620	1370	1220
	12	1	1690	1610	1450	1320	1170	1030	900	760	680
	18	1	2070	1970	1780	1610	1430	1260	1100	930	830
1-1/4" Copper	24	1	2200	2090	1890	1720	1520	1340	1170	990	880
	18	2 @ 6"	2670	2540	2300	2080	1840	1630	1420	1200	1070
42 Fins/ft.	24	2 @ 6"	2850	2710	2450	2220	1970	1740	1510	1280	1140
	24	2 @ 12"	2950	2800	2540	2300	2040	1800	1560	1330	1180
	24	3 @ 6"	3330	3160	2860	2600	2300	2030	1760	1500	1330
	12	1	1790	1700	1540	1400	1240	1090	950	810	720
	18	1	2190	2080	1880	1710	1510	1340	1160	990	880
1-1/4" Copper	24	1	2330	2210	2000	1820	1610	1420	1230	1050	930
	18	2 @ 6"	2830	2690	2430	2210	1950	1730	1500	1270	1130
50 Fins/ft.	24	2 @ 6"	3010	2860	2590	2350	2080	1840	1600	1350	1200
	24	2 @ 12"	3120	2960	2680	2430	2150	1900	1650	1400	1250
	24	3 @ 6"	3520	3340	3030	2750	2430	2150	1870	1580	1410

• Bottom of enclosure mounted 4 inches above floor. Refer to page 11 for correction factors for other mounting heights.
• Ratings are based on finned length with 65°F entering air, 1 PSI steam or average water temperature (215°F) at 3 ft/sec. water velocity. These water ratings, applicable to water flow rates of three or more feet per second, have been determined by applying the factors listed on page 11 to the AHRI Steam Ratings, which have been approved by AHRI.
• Finned length is the specified element length - 6" (3" plain end each side).

▶ Bold, italicized units are AHRI CERTIFIED ◀

MODEL R PERFORMANCE

Table 27.1 - Steam and Hot Water Ratings - Fin Size - 2-3/4" x 4-1/4"

FIN SIZE - 2-3/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
	12	1	1270	1210	1090	990	880	770	670	570	510
	18	1	1550	1470	1330	1210	1070	950	820	700	620
3/4" Copper	24	1	1660	1580	1430	1290	1150	1010	880	750	660
	18	2 @ 6"	1940	1840	1670	1510	1340	1180	1030	870	780
34 Fins/ft.	24	2 @ 6"	2070	1970	1780	1610	1430	1260	1100	930	830
	24	2 @ 12"	2150	2040	1850	1680	1480	1310	1140	970	860
	24	3 @ 6"	2340	2220	2010	1830	1610	1430	1240	1050	940
	12	1	1450	1380	1250	1130	1000	880	770	650	580
	18	1	1770	1680	1520	1380	1220	1080	940	800	710
3/4" Copper	24	1	1890	1800	1630	1470	1300	1150	1000	850	760
	18	2 @ 6"	2210	2100	1900	1720	1520	1350	1170	990	880
42 Fins/ft.	24	2 @ 6"	2360	2240	2030	1840	1630	1440	1250	1060	940
	24	2 @ 12"	2440	2320	2100	1900	1680	1490	1290	1100	980
	24	3 @ 6"	2670	2540	2300	2080	1840	1630	1420	1200	1070
	12	1	1630	1550	1400	1270	1120	990	860	730	650
	18	1	1990	1890	1710	1550	1370	1210	1050	900	800
3/4" Copper	24	1	2120	2010	1820	1650	1460	1290	1120	950	850
	18	2 @ 6"	2490	2370	2140	1940	1720	1520	1320	1120	1000
50 Fins/ft.	24	2 @ 6"	2660	2530	2290	2070	1840	1620	1410	1200	1060
	24	2 @ 12"	2760	2620	2370	2150	1900	1680	1460	1240	1100
	24	3 @ 6"	3000	2850	2580	2340	2070	1830	1590	1350	1200
	12	1	1250	1190	1080	980	860	760	660	560	500
	18	1	1520	1440	1310	1190	1050	930	810	680	610
1" Copper	24	1	1630	1550	1400	1270	1120	990	860	730	650
	18	2 @ 6"	1910	1810	1640	1490	1320	1170	1010	860	760
34 Fins/ft.	24	2 @ 6"	2040	1940	1750	1590	1410	1240	1080	920	820
	24	2 @ 12"	2110	2000	1810	1650	1460	1290	1120	950	840
	24	3 @ 6"	2300	2190	1980	1790	1590	1400	1220	1040	920
	12	1	1390	1320	1200	1080	960	850	740	630	560
	18	1	1700	1620	1460	1330	1170	1040	900	770	680
1" Copper	24	1	1820	1730	1570	1420	1260	1110	960	820	730
	18	2 @ 6"	2130	2020	1830	1660	1470	1300	1130	960	850
42 Fins/ft.	24	2 @ 6"	2270	2160	1950	1770	1570	1380	1200	1020	910
	24	2 @ 12"	2350	2230	2020	1830	1620	1430	1250	1060	940
	24	3 @ 6"	2560	2430	2200	2000	1770	1560	1360	1150	1020
	12	1	1540	1460	1320	1200	1060	940	820	690	620
	18	1	1880	1790	1620	1470	1300	1150	1000	850	750
1" Copper	24	1	2010	1910	1730	1570	1390	1230	1070	900	800
	18	2 @ 6"	2360	2240	2030	1840	1630	1440	1250	1060	940
50 Fins/ft.	24	2 @ 6"	2510	2380	2160	1960	1730	1530	1330	1130	1000
	24	2 @ 12"	2600	2470	2240	2030	1790	1590	1380	1170	1040
	24	3 @ 6"	2840	2700	2440	2220	1960	1730	1510	1280	1140
	12	1	1190	1130	1020	930	820	730	630	540	480
	18	1	1460	1390	1260	1140	1010	890	770	660	580
1-1/4" Copper	24	1	1550	1470	1330	1210	1070	950	820	700	620
	18	2 @ 6"	1830	1740	1570	1430	1260	1120	970	820	730
34 Fins/ft.	24	2 @ 6"	1950	1850	1680	1520	1350	1190	1030	880	780
	24	2 @ 12"	2020	1920	1740	1580	1390	1230	1070	910	810
	24	3 @ 6"	2210	2100	1900	1720	1520	1350	1170	990	880
	12	1	1320	1250	1140	1030	910	810	700	590	530
	18	1	1620	1540	1390	1260	1120	990	860	730	650
1-1/4" Copper	24	1	1720	1630	1480	1340	1190	1050	910	770	690
	18	2 @ 6"	2020	1920	1740	1580	1390	1230	1070	910	810
42 Fins/ft.	24	2 @ 6"	2160	2050	1860	1680	1490	1320	1140	970	860
	24	2 @ 12"	2230	2120	1920	1740	1540	1360	1180	1000	890
	24	3 @ 6"	2430	2310	2090	1900	1680	1480	1290	1090	970
	12	1	1550	1470	1330	1210	1070	950	820	700	620
	18	1	1780	1690	1530	1390	1230	1090	940	800	710
1-1/4" Copper	24	1	1890	1800	1630	1470	1300	1150	1000	850	760
	18	2 @ 6"	2220	2110	1910	1730	1530	1350	1180	1000	890
50 Fins/ft.	24	2 @ 6"	2370	2250	2040	1850	1640	1450	1260	1070	950
	24	2 @ 12"	2460	2340	2120	1920	1700	1500	1300	1110	980
	24	3 @ 6"	2670	2540	2300	2080	1840	1630	1420	1200	1070

- Bottom of enclosure mounted 4 inches above floor. Refer to page 11 for correction factors for other mounting heights.
- Ratings are based on finned length with 65°F entering air, 1 PSI steam or average water temperature (215°F) at 3 ft/sec. water velocity. These water ratings, applicable to water flow rates of three or more feet per second, have been determined by applying the factors listed on page 11 to the AHRI Steam Ratings, which have been approved by AHRI
- Finned length is the specified element length - 6" (3" plain end each side).

MODEL TA ARCHITECTURAL TOP OUTLET FEATURES

- Enclosure ② engages concealed Hanger Strip ③.
- Enclosure Wall Support (EWS) ④ hangs from Hanger Strip at any location and attaches to wall with one fastener.
- EWS ④ supports Heating Element ①, second and third row Element Support Assembly (ESA) ⑤ and Return Pipe Hanger ⑥ without fasteners.
- EWS ④ supports have integral enclosure lock.

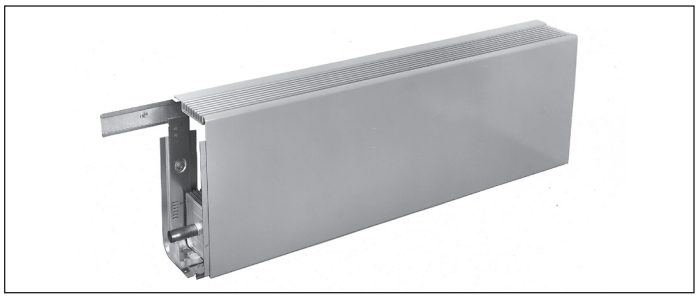
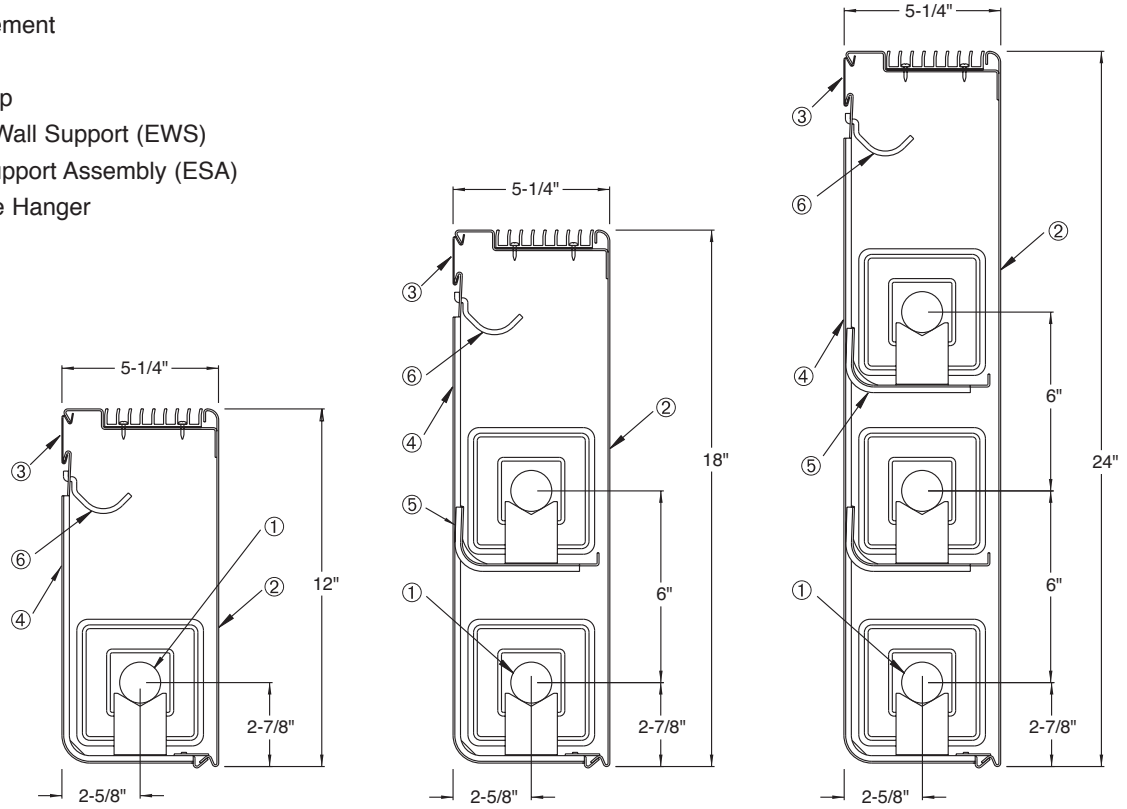


Figure 28.1 - System Components

① Heating Element
② Enclosure
③ Hanger Strip
④ Enclosure Wall Support (EWS)
⑤ Element Support Assembly (ESA)
⑥ Return Pipe Hanger



Standard Features

- Hanger strip - 20 gauge aluminized steel.
- Enclosure, 16 gauge in lengths of 2 feet through 8 feet in 6 inch increments.
- Heights of 12, 18 and 24 inches.
- Enclosure sections are joined using concealed slip joints.
- Aluminum bar grille at top outlet.
- Baked on polyester powdercoat paint finish, tan color.

Accessories

- Accessories, 20 gauge, include all items for a complete installation.
- End caps, end enclosures and valve compartments use slip joints to attach to enclosure.
- Inside, outside corners and enclosure extensions overlap enclosure sections.
- Return pipe hanger. Note: return pipe hanger cannot be used with damper option.

Options

- Enclosures available in 14 gauge steel.
- Baked on polyester powdercoat paint finish available in colors selected from color guide (75-403).
- Bottom inlet grille conceals open air inlet for installations above eye level.
- Hanger strip with full back panel.
- Knob operated or tamperproof (key) damper.
- Column enclosure conceals piping around columns.

MODEL TA PERFORMANCE

Table 29.1 - Steam and Hot Water Ratings - Fin Size - 4-1/4" x 4-1/4"

FIN SIZE - 4-1/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
	12	1	1390	1320	1200	1080	960	850	740	630	560
	18	1	1710	1620	1470	1330	1180	1040	910	770	680
3/4" Copper	24	1	1880	1790	1620	1470	1300	1150	1000	850	750
	18	2 @ 6"	2200	2090	1890	1720	1520	1340	1170	990	880
34 Fins/ft.	24	2 @ 6"	2420	2300	2080	1890	1670	1480	1280	1090	970
	24	2 @ 12"	2500	2380	2150	1950	1730	1530	1330	1130	1000
	24	3 @ 6"	2820	2680	2430	2200	1950	1720	1490	1270	1130
	12	1	1530	1450	1320	1190	1060	930	810	690	610
	18	1	1880	1790	1620	1470	1300	1150	1000	850	750
3/4" Copper	24	1	2060	1960	1770	1610	1420	1260	1090	930	820
	18	2 @ 6"	2420	2300	2080	1890	1670	1480	1280	1090	970
42 Fins/ft.	24	2 @ 6"	2660	2530	2290	2070	1840	1620	1410	1200	1060
	24	2 @ 12"	2760	2620	2370	2150	1900	1680	1460	1240	1100
	24	3 @ 6"	3130	2970	2690	2440	2160	1910	1660	1410	1250
	▶ 12	1	***1600***	***1520***	***1380***	***1250***	***1100***	***980***	***850***	***720***	***610*** ◀
	18	1	2040	1940	1750	1590	1410	1240	1080	920	820
3/4" Copper	24	1	2240	2130	1930	1750	1550	1370	1190	1010	900
	18	2 @ 6"	2640	2510	2270	2060	1820	1610	1400	1190	1060
50 Fins/ft.	24	2 @ 6"	2900	2760	2490	2260	2000	1770	1540	1310	1160
	24	2 @ 12"	3010	2860	2590	2350	2080	1840	1600	1350	1200
	24	3 @ 6"	3390	3220	2920	2640	2340	2070	1800	1530	1360
	12	1	1470	1400	1260	1150	1010	900	780	660	590
	18	1	1800	1710	1550	1400	1240	1100	950	810	720
1" Copper	24	1	1980	1880	1700	1540	1370	1210	1050	890	790
	18	2 @ 6"	2320	2200	2000	1810	1600	1420	1230	1040	930
34 Fins/ft.	24	2 @ 6"	2550	2420	2190	1990	1760	1560	1350	1150	1020
	24	2 @ 12"	2640	2510	2270	2060	1820	1610	1400	1190	1060
	24	3 @ 6"	2960	2810	2550	2310	2040	1810	1570	1330	1180
	12	1	1600	1520	1380	1250	1100	980	850	720	640
	18	1	1970	1870	1690	1540	1360	1200	1040	890	790
1" Copper	24	1	2170	2060	1870	1690	1500	1320	1150	980	870
	18	2 @ 6"	2550	2420	2190	1990	1760	1560	1350	1150	1020
42 Fins/ft.	24	2 @ 6"	2800	2660	2410	2180	1930	1710	1480	1260	1120
	24	2 @ 12"	2900	2760	2490	2260	2000	1770	1540	1310	1160
	24	3 @ 6"	3280	3120	2820	2560	2260	2000	1740	1480	1310
	12	1	1720	1630	1480	1340	1190	1050	910	770	690
	18	1	2120	2010	1820	1650	1460	1290	1120	950	850
1" Copper	24	1	2320	2200	2000	1810	1600	1420	1230	1040	930
	18	2 @ 6"	2730	2590	2350	2130	1880	1670	1450	1230	1090
50 Fins/ft.	24	2 @ 6"	3000	2850	2580	2340	2070	1830	1590	1350	1200
	24	2 @ 12"	3110	2950	2670	2430	2150	1900	1650	1400	1240
	24	3 @ 6"	3520	3340	3030	2750	2430	2150	1870	1580	1410
	12	1	1540	1460	1320	1200	1060	940	820	690	620
	18	1	1900	1810	1630	1480	1310	1160	1010	860	760
1-1/4" Copper	24	1	2080	1980	1790	1620	1440	1270	1100	940	830
	18	2 @ 6"	2450	2330	2110	1910	1690	1490	1300	1100	980
34 Fins/ft.	24	2 @ 6"	2690	2560	2310	2100	1860	1640	1430	1210	1080
	24	2 @ 12"	2790	2650	2400	2180	1930	1700	1480	1260	1120
	24	3 @ 6"	3140	2980	2700	2450	2170	1920	1660	1410	1260
	12	1	1680	1600	1440	1310	1160	1020	890	760	670
	18	1	2070	1970	1780	1610	1430	1260	1100	930	830
1-1/4" Copper	24	1	2270	2160	1950	1770	1570	1380	1200	1020	910
	18	2 @ 6"	2670	2540	2300	2080	1840	1630	1420	1200	1070
42 Fins/ft.	24	2 @ 6"	2940	2790	2530	2290	2030	1790	1560	1320	1180
	24	2 @ 12"	3040	2890	2610	2370	2100	1850	1610	1370	1220
	24	3 @ 6"	3430	3260	2950	2680	2370	2090	1820	1540	1370
	12	1	1780	1690	1530	1390	1230	1090	940	800	710
	18	1	2190	2080	1880	1710	1510	1340	1160	990	880
1-1/4" Copper	24	1	2400	2280	2060	1870	1660	1460	1270	1080	960
	18	2 @ 6"	2830	2690	2430	2210	1950	1730	1500	1270	1130
50 Fins/ft.	24	2 @ 6"	3100	2950	2670	2420	2140	1890	1640	1400	1240
	24	2 @ 12"	3220	3060	2770	2510	2220	1960	1710	1450	1290
	24	3 @ 6"	3630	3450	3120	2830	2500	2210	1920	1630	1450

• Bottom of enclosure mounted 4 inches above floor. Refer to page 11 for correction factors for other mounting heights.
• Ratings are based on finned length with 65°F entering air, 1 PSI steam or average water temperature (215°F) at 3 ft/sec. water velocity. These water ratings, applicable to water flow rates of three or more feet per second, have been determined by applying the factors listed on page 11 to the AHRI Steam Ratings, which have been approved by AHRI.
• Finned length is the specified element length - 6" (3" plain end each side).

▶ Bold, italicized units are AHRI CERTIFIED ◀

MODEL TA PERFORMANCE

Table 30.1 - Steam and Hot Water Ratings - Fin Size - 2-3/4" x 4-1/4"

FIN SIZE - 2-3/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
	12	1	1270	1210	1090	990	880	770	670	570	510
	18	1	1560	1480	1340	1220	1080	950	830	700	620
3/4" Copper	24	1	1710	1620	1470	1330	1180	1040	910	770	680
	18	2 @ 6"	1940	1840	1670	1510	1340	1180	1030	870	780
34 Fins/ft.	24	2 @ 6"	2130	2020	1830	1660	1470	1300	1130	960	850
	24	2 @ 12"	2210	2100	1900	1720	1520	1350	1170	990	880
	24	3 @ 6"	2410	2290	2070	1880	1660	1470	1280	1080	960
	12	1	1440	1370	1240	1120	990	880	760	650	580
	18	1	1770	1680	1520	1380	1220	1080	940	800	710
3/4" Copper	24	1	1950	1850	1680	1520	1350	1190	1030	880	780
	18	2 @ 6"	2210	2100	1900	1720	1520	1350	1170	990	880
42 Fins/ft.	24	2 @ 6"	2430	2310	2090	1900	1680	1480	1290	1090	970
	24	2 @ 12"	2520	2390	2170	1970	1740	1540	1340	1130	1010
	24	3 @ 6"	2750	2610	2370	2150	1900	1680	1460	1240	1100
	12	1	1620	1540	1390	1260	1120	990	860	730	650
	18	1	1990	1890	1710	1550	1370	1210	1050	900	800
3/4" Copper	24	1	2190	2080	1880	1710	1510	1340	1160	990	880
	18	2 @ 6"	2490	2370	2140	1940	1720	1520	1320	1120	1000
50 Fins/ft.	24	2 @ 6"	2740	2600	2360	2140	1890	1670	1450	1230	1100
	24	2 @ 12"	2840	2700	2440	2220	1960	1730	1510	1280	1140
	24	3 @ 6"	3090	2940	2660	2410	2130	1880	1640	1390	1240
	12	1	1240	1180	1070	970	860	760	660	560	500
	18	1	1530	1450	1320	1190	1060	930	810	690	610
1" Copper	24	1	1680	1600	1440	1310	1160	1020	890	760	670
	18	2 @ 6"	1910	1810	1640	1490	1320	1170	1010	860	760
34 Fins/ft.	24	2 @ 6"	2100	2000	1810	1640	1450	1280	1110	950	840
	24	2 @ 12"	2180	2070	1870	1700	1500	1330	1160	980	870
	24	3 @ 6"	2360	2240	2030	1840	1630	1440	1250	1060	940
	12	1	1390	1320	1200	1080	960	850	740	630	560
	18	1	1710	1620	1470	1330	1180	1040	910	770	680
1" Copper	24	1	1870	1780	1610	1460	1290	1140	990	840	750
	18	2 @ 6"	2130	2020	1830	1660	1470	1300	1130	960	850
42 Fins/ft.	24	2 @ 6"	2340	2220	2010	1830	1610	1430	1240	1050	940
	24	2 @ 12"	2420	2300	2080	1890	1670	1480	1280	1090	970
	24	3 @ 6"	2640	2510	2270	2060	1820	1610	1400	1190	1060
	12	1	1530	1450	1320	1190	1060	930	810	690	610
	18	1	1880	1790	1620	1470	1300	1150	1000	850	750
1" Copper	24	1	2070	1970	1780	1610	1430	1260	1100	930	830
	18	2 @ 6"	2360	2240	2030	1840	1630	1440	1250	1060	940
50 Fins/ft.	24	2 @ 6"	2590	2460	2230	2020	1790	1580	1370	1170	1040
	24	2 @ 12"	2680	2550	2300	2090	1850	1630	1420	1210	1070
	24	3 @ 6"	2930	2780	2520	2290	2020	1790	1550	1320	1170
	12	1	1190	1130	1020	930	820	730	630	540	480
	18	1	1460	1390	1260	1140	1010	890	770	660	580
1-1/4" Copper	24	1	1600	1520	1380	1250	1100	980	850	720	640
	18	2 @ 6"	1830	1740	1570	1430	1260	1120	970	820	730
34 Fins/ft.	24	2 @ 6"	2010	1910	1730	1570	1390	1230	1070	900	800
	24	2 @ 12"	2090	1990	1800	1630	1440	1270	1110	940	840
	24	3 @ 6"	2280	2170	1960	1780	1570	1390	1210	1030	910
	12	1	1320	1250	1140	1030	910	810	700	590	530
	18	1	1620	1540	1390	1260	1120	990	860	730	650
1-1/4" Copper	24	1	1780	1690	1530	1390	1230	1090	940	800	710
	18	2 @ 6"	2020	1920	1740	1580	1390	1230	1070	910	810
42 Fins/ft.	24	2 @ 6"	2220	2110	1910	1730	1530	1350	1180	1000	890
	24	2 @ 12"	2300	2190	1980	1790	1590	1400	1220	1040	920
	24	3 @ 6"	2500	2380	2150	1950	1730	1530	1330	1130	1000
	12	1	1440	1370	1240	1120	990	880	760	650	580
	18	1	1780	1690	1530	1390	1230	1090	940	800	710
1-1/4" Copper	24	1	1950	1850	1680	1520	1350	1190	1030	880	780
	18	2 @ 6"	2220	2110	1910	1730	1530	1350	1180	1000	890
50 Fins/ft.	24	2 @ 6"	2440	2320	2100	1900	1680	1490	1290	1100	980
	24	2 @ 12"	2530	2400	2180	1970	1750	1540	1340	1140	1010
	24	3 @ 6"	2750	2610	2370	2150	1900	1680	1460	1240	1100

- Bottom of enclosure mounted 4 inches above floor. Refer to page 11 for correction factors for other mounting heights.
- Ratings are based on finned length with 65°F entering air, 1 PSI steam or average water temperature (215°F) at 3 ft/sec. water velocity. These water ratings, applicable to water flow rates of three or more feet per second, have been determined by applying the factors listed on page 11 to the AHRI Steam Ratings, which have been approved by AHRI
- Finned length is the specified element length - 6" (3" plain end each side).

MODEL SF SLOPE TOP, FLOOR MOUNTED FEATURES

- Enclosure ② engages concealed Hanger Strip ③.
- Enclosure Wall Support (EWS) ④ hangs from Hanger Strip at any location and attaches to wall with one fastener.
- EWS ④ supports Heating Element ①, first and/or second row Element Support Assembly (ESA) ⑤ and Return Pipe Hanger ⑥ without fasteners.
- Single or double Floor Angle ⑦ anchors enclosure to floor.

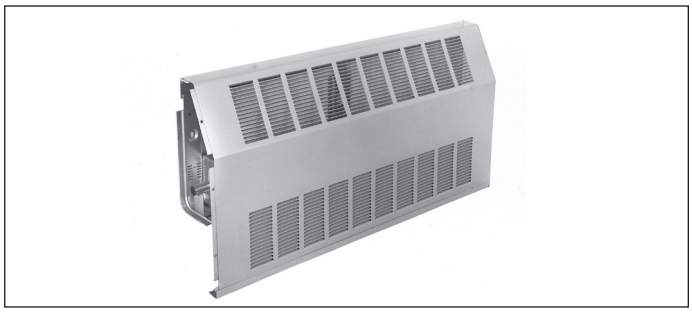
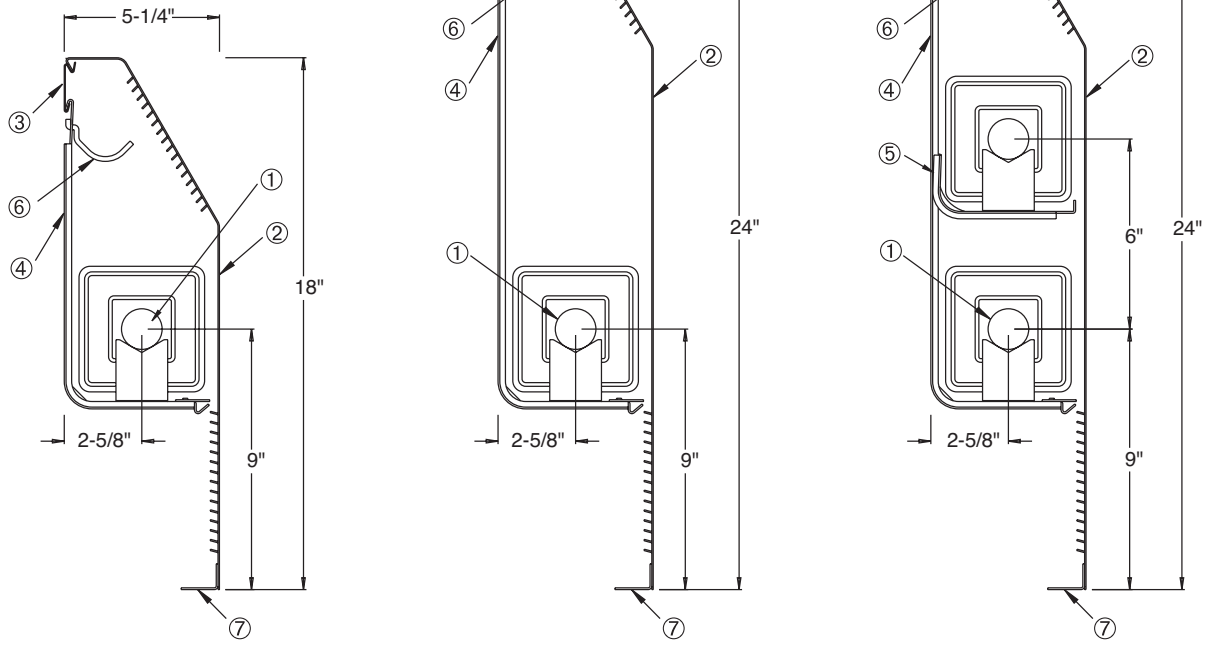


Figure 31.1 - System Components

① Heating Element
② Enclosure
③ Hanger Strip
④ Enclosure Wall Support (EWS)
⑤ Element Support Assembly (ESA)
⑥ Return Pipe Hanger
⑦ Single or Double Floor Angle



Standard Features

- Hanger strip - 20 gauge aluminized steel.
- Enclosure, 18 gauge in lengths of 2 feet through 8 feet in 6 inch increments.
- Heights of 18 and 24 inches.
- Enclosure sections are joined using concealed slip joints.
- Baked on polyester powdercoat paint finish, tan color.

Accessories

- Accessories, 20 gauge, include all items for a complete installation.
- End caps, end enclosures and valve compartments use slip joints to attach to enclosure.
- Inside, outside corners and enclosure extensions overlap enclosure sections.
- Return pipe hanger. Note: return pipe hanger cannot be used with damper option.

Options

- Enclosures available in 14 or 16 gauge steel.
- Baked on polyester powdercoat paint finish available in colors selected from color guide (75-403).
- Single floor angle using screws or double floor angle without screws to anchor enclosure to floor.
- Hanger strip with full back panel.
- Knob operated or tamperproof (key) damper.
- Column enclosure conceals piping around columns.

MODEL SF PERFORMANCE

Table 32.1 - Steam and Hot Water Ratings - Fin Size - 4-1/4" x 4-1/4"

FIN SIZE - 4-1/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
3/4" Copper 34 Fins/ft.	18	1	1570	1490	1350	1220	1080	960	830	710	630
	24	1	1660	1580	1430	1290	1150	1010	880	750	660
	24	2 @ 6"	2130	2020	1830	1660	1470	1300	1130	960	850
3/4" Copper 42 Fins/ft.	18	1	1720	1630	1480	1340	1190	1050	910	770	690
	24	1	1820	1730	1570	1420	1260	1110	960	820	730
	24	2 @ 6"	2340	2220	2010	1830	1610	1430	1240	1050	940
3/4" Copper 50 Fins/ft.	18	1	1870	1780	1610	1460	1290	1140	990	840	750
	24	1	1980	1880	1700	1540	1370	1210	1050	890	790
	24	2 @ 6"	2560	2430	2200	2000	1770	1560	1360	1150	1020
1" Copper 34 Fins/ft.	18	1	1650	1570	1420	1290	1140	1010	870	740	660
	24	1	1750	1660	1510	1370	1210	1070	930	790	700
	24	2 @ 6"	2250	2140	1940	1760	1550	1370	1190	1010	900
1" Copper 42 Fins/ft.	18	1	1810	1720	1560	1410	1250	1100	960	810	720
	24	1	1910	1810	1640	1490	1320	1170	1010	860	760
	24	2 @ 6"	2460	2340	2120	1920	1700	1500	1300	1110	980
1" Copper 50 Fins/ft.	18	1	1940	1840	1670	1510	1340	1180	1030	870	780
	24	1	2050	1950	1760	1600	1410	1250	1090	920	820
	24	2 @ 6"	2650	2520	2280	2070	1830	1620	1400	1190	1060
1-1/4" Copper 34 Fins/ft.	18	1	1730	1640	1490	1350	1190	1060	920	780	690
	24	1	1830	1740	1570	1430	1260	1120	970	820	730
	24	2 @ 6"	2370	2250	2040	1850	1640	1450	1260	1070	950
1-1/4" Copper 42 Fins/ft.	18	1	1890	1800	1630	1470	1300	1150	1000	850	760
	24	1	2000	1900	1720	1560	1380	1220	1060	900	800
	24	2 @ 6"	2590	2460	2230	2020	1790	1580	1370	1170	1040
1-1/4" Copper 50 Fins/ft.	18	1	2000	1900	1720	1560	1380	1220	1060	900	800
	24	1	2120	2010	1820	1650	1460	1290	1120	950	850
	24	2 @ 6"	2740	2600	2360	2140	1890	1670	1450	1230	1100

Table 32.2 - Steam and Hot Water Ratings - Fin Size - 2-3/4" x 4-1/4"

FIN SIZE - 2-3/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
3/4" Copper 34 Fins/ft.	18	1	1420	1350	1220	1110	980	870	750	640	570
	24	1	1510	1430	1300	1180	1040	920	800	680	600
	24	2 @ 6"	1880	1790	1620	1470	1300	1150	1000	850	750
3/4" Copper 42 Fins/ft.	18	1	1620	1540	1390	1260	1120	990	860	730	650
	24	1	1710	1620	1470	1330	1180	1040	910	770	680
	24	2 @ 6"	2140	2030	1840	1670	1480	1310	1130	960	860
3/4" Copper 50 Fins/ft.	18	1	1820	1730	1570	1420	1260	1110	960	820	730
	24	1	1930	1830	1660	1510	1330	1180	1020	870	770
	24	2 @ 6"	2410	2290	2070	1880	1660	1470	1280	1080	960
1" Copper 34 Fins/ft.	18	1	1400	1330	1200	1090	970	850	740	630	560
	24	1	1480	1410	1270	1150	1020	900	780	670	590
	24	2 @ 6"	1850	1760	1590	1440	1280	1130	980	830	740
1" Copper 42 Fins/ft.	18	1	1560	1480	1340	1220	1080	950	830	700	620
	24	1	1650	1570	1420	1290	1140	1010	870	740	660
	24	2 @ 6"	2060	1960	1770	1610	1420	1260	1090	930	820
1" Copper 50 Fins/ft.	18	1	1720	1630	1480	1340	1190	1050	910	770	690
	24	1	1820	1730	1570	1420	1260	1110	960	820	730
	24	2 @ 6"	2280	2170	1960	1780	1570	1390	1210	1030	910
1-1/4" Copper 34 Fins/ft.	18	1	1330	1260	1140	1040	920	810	700	600	530
	24	1	1410	1340	1210	1100	970	860	750	630	560
	24	2 @ 6"	1770	1680	1520	1380	1220	1080	940	800	710
1-1/4" Copper 42 Fins/ft.	18	1	1480	1410	1270	1150	1020	900	780	670	590
	24	1	1560	1480	1340	1220	1080	950	830	700	620
	24	2 @ 6"	1960	1860	1690	1530	1350	1200	1040	880	780
1-1/4" Copper 50 Fins/ft.	18	1	1630	1550	1400	1270	1120	990	860	730	650
	24	1	1720	1630	1480	1340	1190	1050	910	770	690
	24	2 @ 6"	2150	2040	1850	1680	1480	1310	1140	970	860

- Ratings are based on finned length with 65°F entering air, 1 PSI steam or average water temperature (215°F) at 3 ft/sec. water velocity. These water ratings, applicable to water flow rates of three or more feet per second, have been determined by applying the factors listed on page 11 to the AHRI Steam Ratings, which have been approved by AHRI.
- Finned length is the specified element length - 6" (3" plain end each side).

MODEL RF FRONT/TOP OUTLET, FLOOR MOUNTED FEATURES

- Enclosure ② engages concealed Hanger Strip ③.
- Enclosure Wall Support (EWS) ④ hangs from Hanger Strip at any location and attaches to wall with one fastener.
- EWS ④ supports Heating Element ①, first and/or second row Element Support Assembly (ESA) ⑤ and Return Pipe Hanger ⑥ without fasteners.
- Single or double Floor Angle ⑦ anchors enclosure to floor.

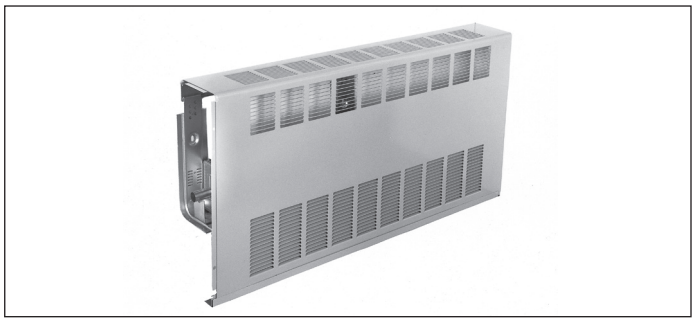
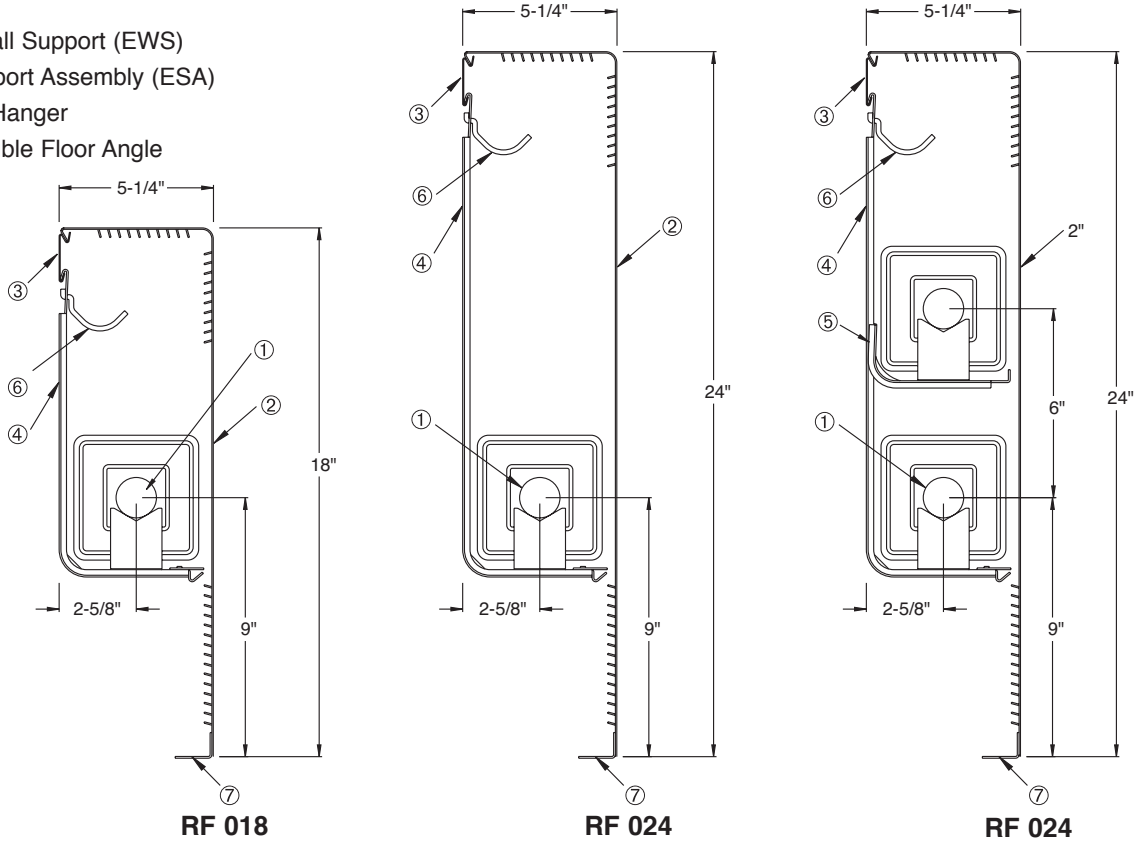


Figure 33.1 - System Components

① Heating Element
② Enclosure
③ Hanger Strip
④ Enclosure Wall Support (EWS)
⑤ Element Support Assembly (ESA)
⑥ Return Pipe Hanger
⑦ Single or Double Floor Angle



Standard Features

- Hanger strip - 20 gauge aluminized steel.
- Enclosure, 18 gauge in lengths of 2 feet through 8 feet in 6 inch increments.
- Heights of 18 and 24 inches.
- Enclosure sections are joined using concealed slip joints.
- Baked on polyester powdercoat paint finish, tan color.

Accessories

- Accessories, 20 gauge, include all items for a complete installation.
- End caps, end enclosures and valve compartments use slip joints to attach to enclosure.
- Inside, outside corners and enclosure extensions overlap enclosure sections.
- Return pipe hanger. Note: return pipe hanger cannot be used with damper option.

Options

- Enclosures available in 14 or 16 gauge steel.
- Baked on polyester powdercoat paint finish available in colors selected from color guide (75-403).
- Single floor angle using screws or double floor angle without screws to anchor enclosure to floor.
- Hanger strip with full back panel.
- Knob operated or tamperproof (key) damper.
- Column enclosure conceals piping around columns.

MODEL RF PERFORMANCE

Table 34.1 - Steam and Hot Water Ratings - Fin Size - 4-1/4" x 4-1/4"

FIN SIZE - 4-1/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
3/4" Copper 34 Fins/ft.	18	1	1620	1540	1390	1260	1120	990	860	730	650
	24	1	1730	1640	1490	1350	1190	1060	920	780	690
	24	2 @ 6"	2220	2110	1910	1730	1530	1350	1180	1000	890
3/4" Copper 42 Fins/ft.	18	1	1780	1690	1530	1390	1230	1090	940	800	710
	24	1	1890	1800	1630	1470	1300	1150	1000	850	760
	24	2 @ 6"	2440	2320	2100	1900	1680	1490	1290	1100	980
3/4" Copper 50 Fins/ft.	18	1	1930	1830	1660	1510	1330	1180	1020	870	770
	24	1	2060	1960	1770	1610	1420	1260	1090	930	820
	24	2 @ 6"	2660	2530	2290	2070	1840	1620	1410	1200	1060
1" Copper 34 Fins/ft.	18	1	1700	1620	1460	1330	1170	1040	900	770	680
	24	1	1820	1730	1570	1420	1260	1110	960	820	730
	24	2 @ 6"	2340	2220	2010	1830	1610	1430	1240	1050	940
1" Copper 42 Fins/ft.	18	1	1860	1770	1600	1450	1280	1130	990	840	740
	24	1	1990	1890	1710	1550	1370	1210	1050	900	800
	24	2 @ 6"	2570	2440	2210	2000	1770	1570	1360	1160	1030
1" Copper 50 Fins/ft.	18	1	2000	1900	1720	1560	1380	1220	1060	900	800
	24	1	2130	2020	1830	1660	1470	1300	1130	960	850
	24	2 @ 6"	2760	2620	2370	2150	1900	1680	1460	1240	1100
1-1/4" Copper 34 Fins/ft.	18	1	1790	1700	1540	1400	1240	1090	950	810	720
	24	1	1910	1810	1640	1490	1320	1170	1010	860	760
	24	2 @ 6"	2470	2350	2120	1930	1700	1510	1310	1110	990
1-1/4" Copper 42 Fins/ft.	18	1	1960	1860	1690	1530	1350	1200	1040	880	780
	24	1	2090	1990	1800	1630	1440	1270	1110	940	840
	24	2 @ 6"	2700	2570	2320	2110	1860	1650	1430	1220	1080
1-1/4" Copper 50 Fins/ft.	18	1	2070	1970	1780	1610	1430	1260	1100	930	830
	24	1	2210	2100	1900	1720	1520	1350	1170	990	880
	24	2 @ 6"	2850	2710	2450	2220	1970	1740	1510	1280	1140

Table 34.2 - Steam and Hot Water Ratings - Fin Size - 2-3/4" x 4-1/4"

FIN SIZE - 2-3/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
3/4" Copper 34 Fins/ft.	18	1	1470	1400	1260	1150	1010	900	780	660	590
	24	1	1570	1490	1350	1220	1080	960	830	710	630
	24	2 @ 6"	1960	1860	1690	1530	1350	1200	1040	880	780
3/4" Copper 42 Fins/ft.	18	1	1630	1550	1400	1270	1120	990	860	730	650
	24	1	1790	1700	1540	1400	1240	1090	950	810	720
	24	2 @ 6"	2230	2120	1920	1740	1540	1360	1180	1000	890
3/4" Copper 50 Fins/ft.	18	1	1880	1790	1620	1470	1300	1150	1000	850	750
	24	1	2010	1910	1730	1570	1390	1230	1070	900	800
	24	2 @ 6"	2510	2380	2160	1960	1730	1530	1330	1130	1000
1" Copper 34 Fins/ft.	18	1	1440	1370	1240	1120	990	880	760	650	580
	24	1	1540	1460	1320	1200	1060	940	820	690	620
	24	2 @ 6"	1930	1830	1660	1510	1330	1180	1020	870	770
1" Copper 42 Fins/ft.	18	1	1610	1530	1380	1260	1110	980	850	720	640
	24	1	1720	1630	1480	1340	1190	1050	910	770	690
	24	2 @ 6"	2150	2040	1850	1680	1480	1310	1140	970	860
1" Copper 50 Fins/ft.	18	1	1780	1690	1530	1390	1230	1090	940	800	710
	24	1	1900	1810	1630	1480	1310	1160	1010	860	760
	24	2 @ 6"	2380	2260	2050	1860	1640	1450	1260	1070	950
1-1/4" Copper 34 Fins/ft.	18	1	1380	1310	1190	1080	950	840	730	620	550
	24	1	1470	1400	1260	1150	1010	900	780	660	590
	24	2 @ 6"	1850	1760	1590	1440	1280	1130	980	830	740
1-1/4" Copper 42 Fins/ft.	18	1	1530	1450	1320	1190	1060	930	810	690	610
	24	1	1630	1550	1400	1270	1120	990	860	730	650
	24	2 @ 6"	2040	1940	1750	1590	1410	1240	1080	920	820
1-1/4" Copper 50 Fins/ft.	18	1	1680	1600	1440	1310	1160	1020	890	760	670
	24	1	1790	1700	1540	1400	1240	1090	950	810	720
	24	2 @ 6"	2240	2130	1930	1750	1550	1370	1190	1010	900

• Ratings are based on finned length with 65°F entering air, 1 PSI steam or average water temperature (215°F) at 3 ft/sec. water velocity. These water ratings, applicable to water flow rates of three or more feet per second, have been determined by applying the factors listed on page 11 to the AHRI Steam Ratings, which have been approved by AHRI.

• Finned length is the specified element length - 6" (3" plain end each side).

MODEL P PEDESTAL STYLE FEATURES

- Enclosure ② attaches to height adjustable floor mounted pedestal Assembly ③.
- Heating Element ① supported by cradle on each Pedestal ③, two rows wide has 2 cradles.
- Pedestal ③ base anchored to the floor with one fastener.

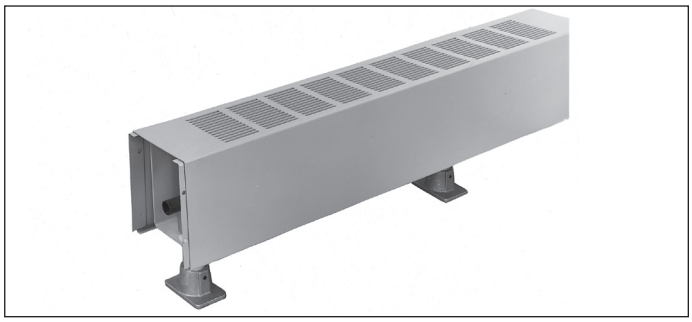
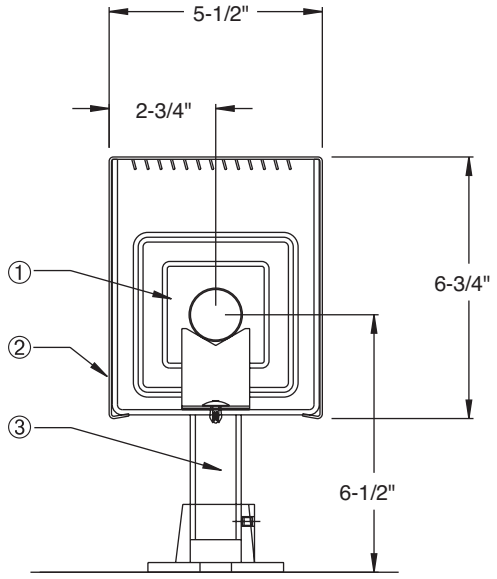
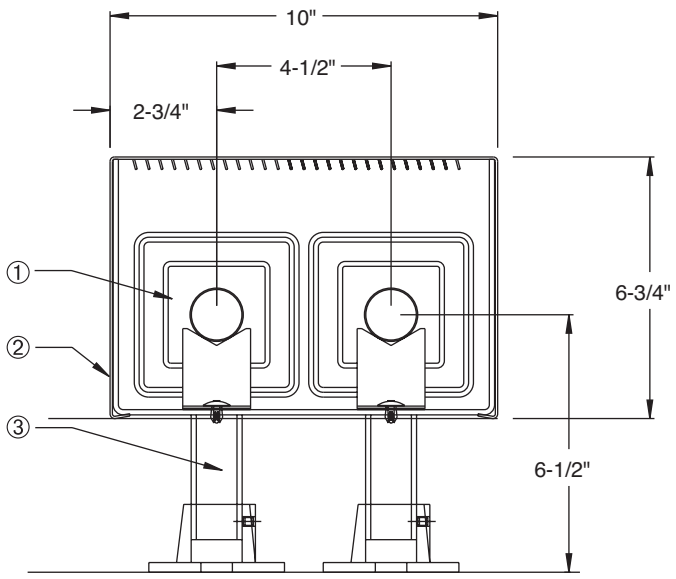


Figure 35.1 - System Components

① Heating Element
② Enclosure
③ Pedestal Assembly



P 001



P 002

Standard Features

- Enclosure, 16 gauge in lengths of 2 feet through 8 feet in 6 inch increments.
- Enclosure and Heating Element in one or two rows wide.
- Enclosure sections are joined using concealed slip joints.
- Baked on polyester powdercoat paint finish, tan color.

Accessories

- Accessories, 20 gauge, include all items for a complete installation.
- End caps and end enclosures use slip joints to attach to enclosure.
- Inside, outside corners and enclosure extensions overlap enclosure sections.

Options

- Enclosures available in 14 gauge steel.
- Baked on polyester powdercoat paint finish available in colors selected from color guide (75-403).
- Column enclosure conceals piping around columns.

MODEL P PERFORMANCE

Table 36.1 - Steam and Hot Water Ratings - Fin Size - 4-1/4" x 4-1/4"

FIN SIZE - 4-1/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Type	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
3/4" Copper	P 001	1	1170	1110	1010	910	810	710	620	530	470
34 Fins/ft.	P 002	2	2330	2210	2000	1820	1610	1420	1230	1050	930
3/4" Copper	P 001	1	1280	1220	1100	1000	880	780	680	580	510
42 Fins/ft.	P 002	2	2560	2430	2200	2000	1770	1560	1360	1150	1020
3/4" Copper	P 001	1	***1390***	***1320***	***1200***	***1080***	***960***	***850***	***740***	***630***	***560***
50 Fins/ft.	P 002	2	2780	2640	2390	2170	1920	1700	1470	1250	1110
1" Copper	P 001	1	1210	1150	1040	940	830	740	640	540	480
34 Fins/ft.	P 002	2	2420	2300	2080	1890	1670	1480	1280	1090	970
1" Copper	P 001	1	1320	1250	1140	1030	910	810	700	590	530
42 Fins/ft.	P 002	2	2650	2520	2280	2070	1830	1620	1400	1190	1060
1" Copper	P 001	1	1420	1350	1220	1110	980	870	750	640	570
50 Fins/ft.	P 002	2	2840	2700	2440	2220	1960	1730	1510	1280	1140
1-1/4" Copper	P 001	1	1260	1200	1080	980	870	770	670	570	500
34 Fins/ft.	P 002	2	2510	2380	2160	1960	1730	1530	1330	1130	1000
1-1/4" Copper	P 001	1	1370	1300	1180	1070	950	840	730	620	550
42 Fins/ft.	P 002	2	2740	2600	2360	2140	1890	1670	1450	1230	1100
1-1/4" Copper	P 001	1	1450	1380	1250	1130	1000	880	770	650	580
50 Fins/ft.	P 002	2	2900	2760	2490	2260	2000	1770	1540	1310	1160

Table 36.2 - Steam and Hot Water Ratings - Fin Size - 2-3/4" x 4-1/4"

FIN SIZE - 2-3/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Type	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
3/4" Copper	P 001	1	970	920	830	760	670	590	510	440	390
34 Fins/ft.	P 002	2	1930	1830	1660	1510	1330	1180	1020	870	770
3/4" Copper	P 001	1	1090	1040	940	850	750	660	580	490	440
42 Fins/ft.	P 002	2	2170	2060	1870	1690	1500	1320	1150	980	870
3/4" Copper	P 001	1	1210	1150	1040	940	830	740	640	540	480
50 Fins/ft.	P 002	2	2410	2290	2070	1880	1660	1470	1280	1080	960
1" Copper	P 001	1	960	910	830	750	660	590	510	430	380
34 Fins/ft.	P 002	2	1930	1830	1660	1510	1330	1180	1020	870	770
1" Copper	P 001	1	1080	1030	930	840	750	660	570	490	430
42 Fins/ft.	P 002	2	2150	2040	1850	1680	1480	1310	1140	970	860
1" Copper	P 001	1	1190	1130	1020	930	820	730	630	540	480
50 Fins/ft.	P 002	2	2380	2260	2050	1860	1640	1450	1260	1070	950
1-1/4" Copper	P 001	1	960	910	830	750	660	590	510	430	380
34 Fins/ft.	P 002	2	1920	1820	1650	1500	1320	1170	1020	860	770
1-1/4" Copper	P 001	1	1070	1020	920	830	740	650	570	480	430
42 Fins/ft.	P 002	2	2130	2020	1830	1660	1470	1300	1130	960	850
1-1/4" Copper	P 001	1	1170	1110	1010	910	810	710	620	530	470
50 Fins/ft.	P 002	2	2340	2220	2010	1830	1610	1430	1240	1050	940

• Ratings are based on finned length with 65°F entering air, 1 PSI steam or average water temperature (215°F) at 3 ft/sec. water velocity. These water ratings, applicable to water flow rates of three or more feet per second, have been determined by applying the factors listed on page 11 to the AHRI Steam Ratings, which have been approved by AHRI.
• Finned length is the specified element length - 6" (3" plain end each side).

▶ Bold, italicized units are AHRI CERTIFIED ◀

MODEL PA ARCHITECTURAL PEDESTAL STYLE FEATURES

- Enclosure ② attaches to height adjustable floor mounted pedestal Assembly ③.
- Heating Element ① supported by cradle on each Pedestal ③, two rows wide has 2 cradles.
- Pedestal ③ base anchored to the floor with one fastener.

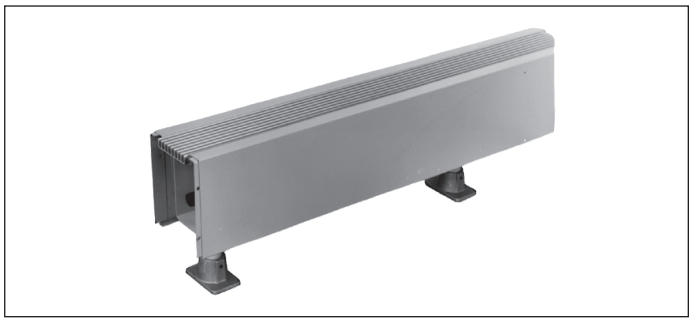
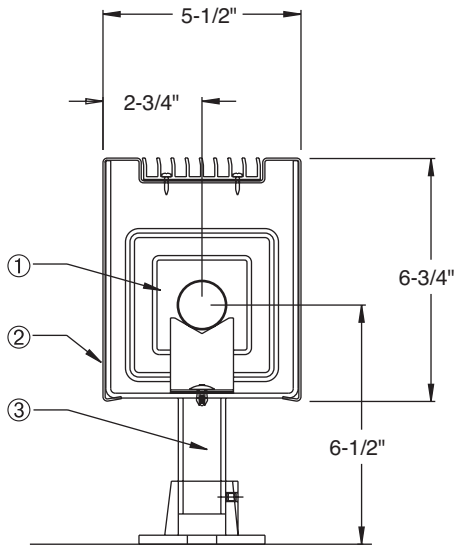
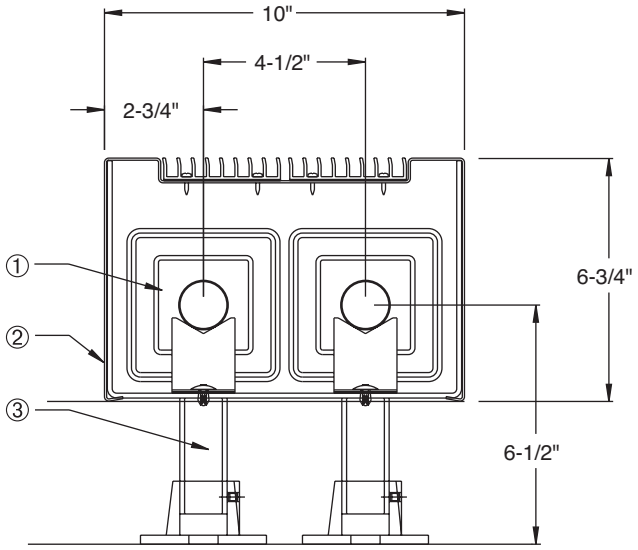


Figure 37.1 - System Components

① Heating Element
② Enclosure
③ Pedestal Assembly



PA 001



PA 002

Standard Features

- Enclosure, 16 gauge in lengths of 2 feet through 8 feet in 6 inch increments.
- Enclosure and Heating Element in one or two rows wide.
- Enclosure sections are joined using concealed slip joints.
- Aluminum bar grille at top outlet.
- Baked on polyester powdercoat paint finish, tan color.

Accessories

- Accessories, 20 gauge, include all items for a complete installation.
- End caps and end enclosures use slip joints to attach to enclosure.
- Inside, outside corners and enclosure extensions overlap enclosure sections.

Options

- Enclosures available in 14 gauge steel.
- Baked on polyester powdercoat paint finish available in colors selected from color guide (75-403).
- Column enclosure conceals piping around columns.

MODEL PA PERFORMANCE

Table 38.1 - Steam and Hot Water Ratings - Fin Size - 4-1/4" x 4-1/4"

FIN SIZE - 4-1/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Type	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
3/4" Copper	PA 001	1	1090	1040	940	850	750	660	580	490	440
34 Fins/ft.	PA 002	2	2190	2080	1880	1710	1510	1340	1160	990	880
3/4" Copper	PA 001	1	1200	1140	1030	940	830	730	640	540	480
42 Fins/ft.	PA 002	2	2400	2280	2060	1870	1660	1460	1270	1080	960
3/4" Copper	PA 001	1	***1310***	***1240***	***1130***	***1020***	***900***	***800***	***690***	***590***	***520***
50 Fins/ft.	PA 002	2	2610	2480	2240	2040	1800	1590	1380	1170	1040
1" Copper	PA 001	1	1140	1080	980	890	790	700	600	510	460
34 Fins/ft.	PA 002	2	2270	2160	1950	1770	1570	1380	1200	1020	910
1" Copper	PA 001	1	1240	1180	1070	970	860	760	660	560	500
42 Fins/ft.	PA 002	2	2490	2370	2140	1940	1720	1520	1320	1120	1000
1" Copper	PA 001	1	1330	1260	1140	1040	920	810	700	600	530
50 Fins/ft.	PA 002	2	2670	2540	2300	2080	1840	1630	1420	1200	1070
1-1/4" Copper	PA 001	1	1180	1120	1010	920	810	720	630	530	470
34 Fins/ft.	PA 002	2	2360	2240	2030	1840	1630	1440	1250	1060	940
1-1/4" Copper	PA 001	1	1290	1230	1110	1010	890	790	680	580	520
42 Fins/ft.	PA 002	2	2570	2440	2210	2000	1770	1570	1360	1160	1030
1-1/4" Copper	PA 001	1	1360	1290	1170	1060	940	830	720	610	540
50 Fins/ft.	PA 002	2	2720	2580	2340	2120	1880	1660	1440	1220	1090

Table 38.2 - Steam and Hot Water Ratings - Fin Size - 2-3/4" x 4-1/4"

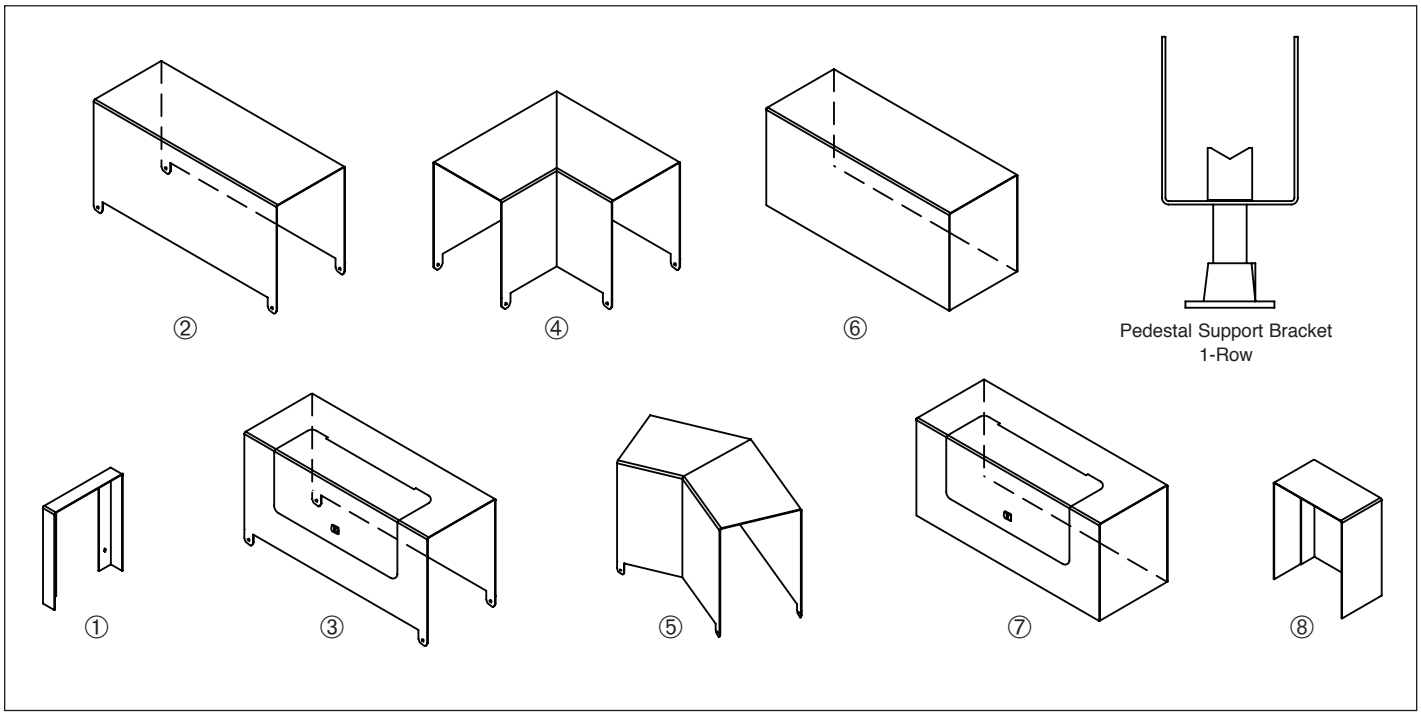
FIN SIZE - 2-3/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Type	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
3/4" Copper	PA 001	1	910	860	780	710	630	560	480	410	360
34 Fins/ft.	PA 002	2	1810	1720	1560	1410	1250	1100	960	810	720
3/4" Copper	PA 001	1	1020	970	880	800	700	620	540	460	410
42 Fins/ft.	PA 002	2	2040	1940	1750	1590	1410	1240	1080	920	820
3/4" Copper	PA 001	1	1130	1070	970	880	780	690	600	510	450
50 Fins/ft.	PA 002	2	2270	2160	1950	1770	1570	1380	1200	1020	910
1" Copper	PA 001	1	900	860	770	700	620	550	480	410	360
34 Fins/ft.	PA 002	2	1810	1720	1560	1410	1250	1100	960	810	720
1" Copper	PA 001	1	1010	960	870	790	700	620	540	450	400
42 Fins/ft.	PA 002	2	2020	1920	1740	1580	1390	1230	1070	910	810
1" Copper	PA 001	1	1120	1060	960	870	770	680	590	500	450
50 Fins/ft.	PA 002	2	2230	2120	1920	1740	1540	1360	1180	1000	890
1-1/4" Copper	PA 001	1	900	860	770	700	620	550	480	410	360
34 Fins/ft.	PA 002	2	1800	1710	1550	1400	1240	1100	950	810	720
1-1/4" Copper	PA 001	1	1000	950	860	780	690	610	530	450	400
42 Fins/ft.	PA 002	2	2000	1900	1720	1560	1380	1220	1060	900	800
1-1/4" Copper	PA 001	1	1100	1050	950	860	760	670	580	500	440
50 Fins/ft.	PA 002	2	2200	2090	1890	1720	1520	1340	1170	990	880

- Ratings are based on finned length with 65°F entering air, 1 PSI steam or average water temperature (215°F) at 3 ft/sec. water velocity. These water ratings, applicable to water flow rates of three or more feet per second, have been determined by applying the factors listed on page 11 to the AHRI Steam Ratings, which have been approved by AHRI.
- Finned length is the specified element length - 6" (3" plain end each side).

▶ Bold, italicized units are AHRI CERTIFIED ◀

MODEL P AND PA ACCESSORIES

Figure 39.1 - Model P and PA Enclosure Accessories



Ref. No.	Accessory Description ① ②	Fit Type ③
1	Wall Support	(R or L)
2	5" or 12" Wide Enclosure Extension	(O)
3	12" Wide Enclosure Extension with Access Door	(O)
4	90° Inside/Outside Corner	(O)
5	135° Inside/Outside Corner	(O)
6	12" Wide End Enclosure	(S) (R or L)
7	12" Wide End Enclosure with Access Door	(S) (R or L)
8	End Cap	(S) (R or L)

① At least two pedestals are required for each enclosure section. Allow a pedestal every 3'.
② Accessories constructed of 20 gauge CRS
③ (O)=Overlapping, (S)=Slip, (R or L)=Right or Left Hand Configurations

MODEL FT FLAT TOP ELEMENT COVER FEATURES

- Cover ② attaches directly to Heating Element ① fins.
- Heating Element ① and Cover ② can be installed in one, two or three rows.
- Heating Elements are supported by Fixed Brackets (FB) ④ or Expansion Brackets (EB) ③.
- Cover has overlapping joints.
- Enclosure Strap ⑤ provides a means to secure Cover to Heating Elements in multiple row installations.

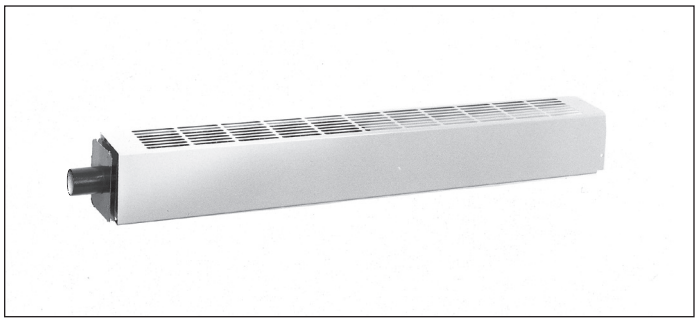
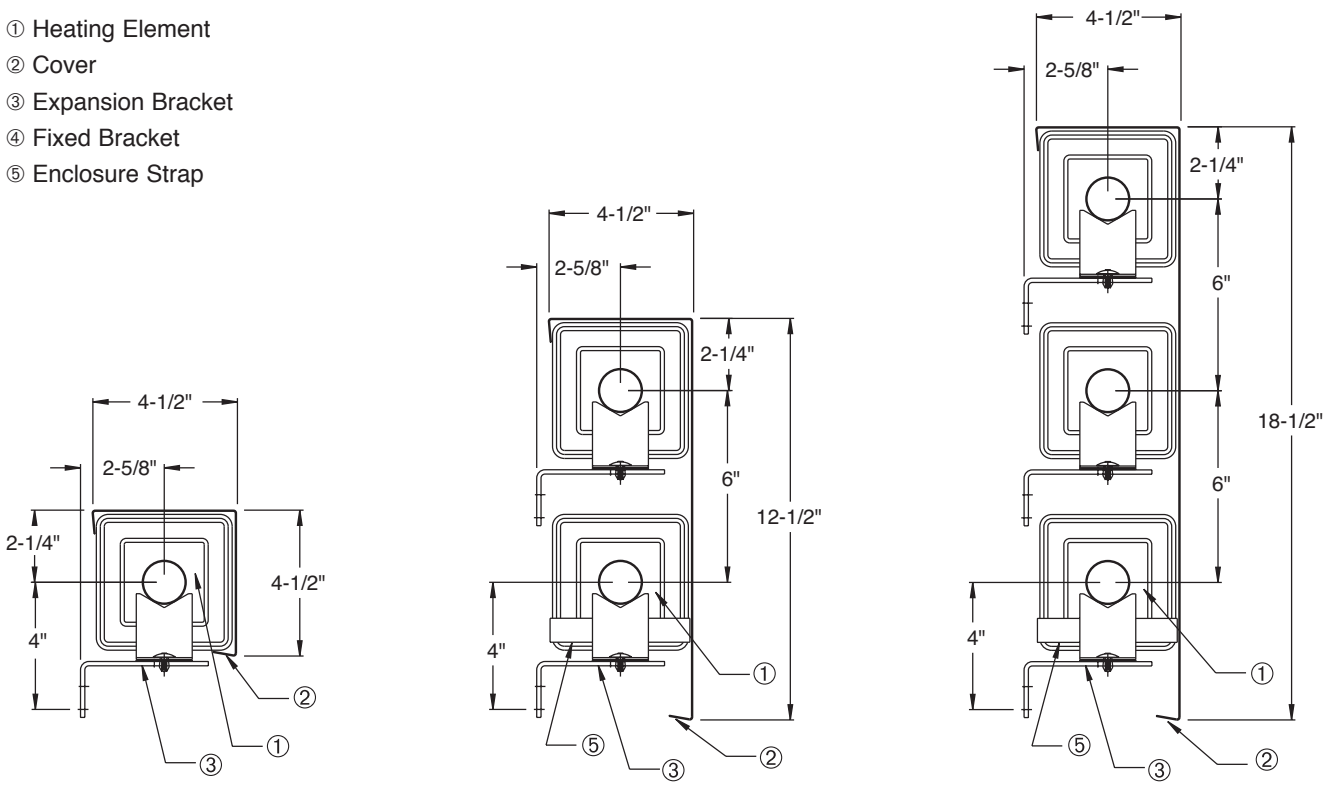


Figure 40.1 - System Components

① Heating Element
② Cover
③ Expansion Bracket
④ Fixed Bracket
⑤ Enclosure Strap



FT 004 **FT 012** **FT 018**

Standard Features

- Cover, 18 gauge in lengths of 2 feet through 8 feet in 6 inch increments.
- Cover heights of 4.5, 12.5 and 18.5 inches.
- Cover sections are joined using overlapping joints secured with screws.
- Baked on polyester powdercoat paint finish, tan color.

Accessories

- Accessories, 20 gauge, include all items for a complete installation.
- End caps and end enclosures overlap cover and attach with screws.
- Inside, outside corners and enclosure extensions overlap cover sections and attach with screws.

Options

- Baked on polyester powdercoat paint finish available in colors selected from color guide (75-403).

MODEL FT PERFORMANCE

Table 41.1 - Steam and Hot Water Ratings - Fin Size - 4-1/4" x 4-1/4"

FIN SIZE - 4-1/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
3/4" Copper 34 Fins/ft.	4.5	1	1210	1150	1040	940	830	740	640	540	480
	12.5	2 @ 6"	2110	2000	1810	1650	1460	1290	1120	950	840
	18.5	3 @ 6"	2860	2720	2460	2230	1970	1740	1520	1290	1140
3/4" Copper 42 Fins/ft.	4.5	1	1330	1260	1140	1040	920	810	700	600	530
	12.5	2 @ 6"	2320	2200	2000	1810	1600	1420	1230	1040	930
	18.5	3 @ 6"	3170	3010	2730	2470	2190	1930	1680	1430	1270
3/4" Copper 50 Fins/ft.	4.5	1	1450	1380	1250	1130	1000	880	770	650	580
	12.5	2 @ 6"	2530	2400	2180	1970	1750	1540	1340	1140	1010
	18.5	3 @ 6"	3440	3270	2960	2680	2370	2100	1820	1550	1380
1" Copper 34 Fins/ft.	4.5	1	1260	1200	1080	980	870	770	670	570	500
	12.5	2 @ 6"	2200	2090	1890	1720	1520	1340	1170	990	880
	18.5	3 @ 6"	2970	2820	2550	2320	2050	1810	1570	1340	1190
1" Copper 42 Fins/ft.	4.5	1	1380	1310	1190	1080	950	840	730	620	550
	12.5	2 @ 6"	2410	2290	2070	1880	1660	1470	1280	1080	960
	18.5	3 @ 6"	3280	3120	2820	2560	2260	2000	1740	1480	1310
1" Copper 50 Fins/ft.	4.5	1	1480	1410	1270	1150	1020	900	780	670	590
	12.5	2 @ 6"	2590	2460	2230	2020	1790	1580	1370	1170	1040
	18.5	3 @ 6"	3520	3340	3030	2750	2430	2150	1870	1580	1410
1-1/4" Copper 34 Fins/ft.	4.5	1	1310	1240	1130	1020	900	800	690	590	520
	12.5	2 @ 6"	2290	2180	1970	1790	1580	1400	1210	1030	920
	18.5	3 @ 6"	3110	2950	2670	2430	2150	1900	1650	1400	1240
1-1/4" Copper 42 Fins/ft.	4.5	1	1420	1350	1220	1110	980	870	750	640	570
	12.5	2 @ 6"	2500	2380	2150	1950	1730	1530	1330	1130	1000
	18.5	3 @ 6"	3390	3220	2920	2640	2340	2070	1800	1530	1360
1-1/4" Copper 50 Fins/ft.	4.5	1	1510	1430	1300	1180	1040	920	800	680	600
	12.5	2 @ 6"	2640	2510	2270	2060	1820	1610	1400	1190	1060
	18.5	3 @ 6"	3580	3400	3080	2790	2470	2180	1900	1610	1430

- Bottom of enclosure mounted 4 inches above floor. Refer to page 11 for correction factors for other mounting heights.
- Ratings are based on finned length with 65°F entering air, 1 PSI steam or average water temperature (215°F) at 3 ft/sec. water velocity. These water ratings, applicable to water flow rates of three or more feet per second, have been determined by applying the factors listed on page 11 to the AHRI Steam Ratings, which have been approved by AHRI.
- Finned length is the specified element length - 6" (3" plain end each side).

MODEL EM EXPANDED METAL ELEMENT COVER FEATURES

- Cover ② attaches directly to Heating Element ① fins.
- Heating Element ① and Cover ② can be installed in one, two or three rows.
- Heating Elements are supported by Fixed Brackets (FB) ④ or Expansion Brackets (EB) ③.
- Cover has butting joints.
- Enclosure Strap ⑤ provides a means to secure Cover to Heating Elements in multiple row installations.

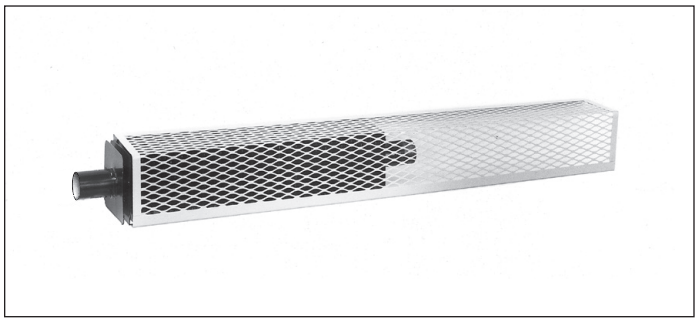
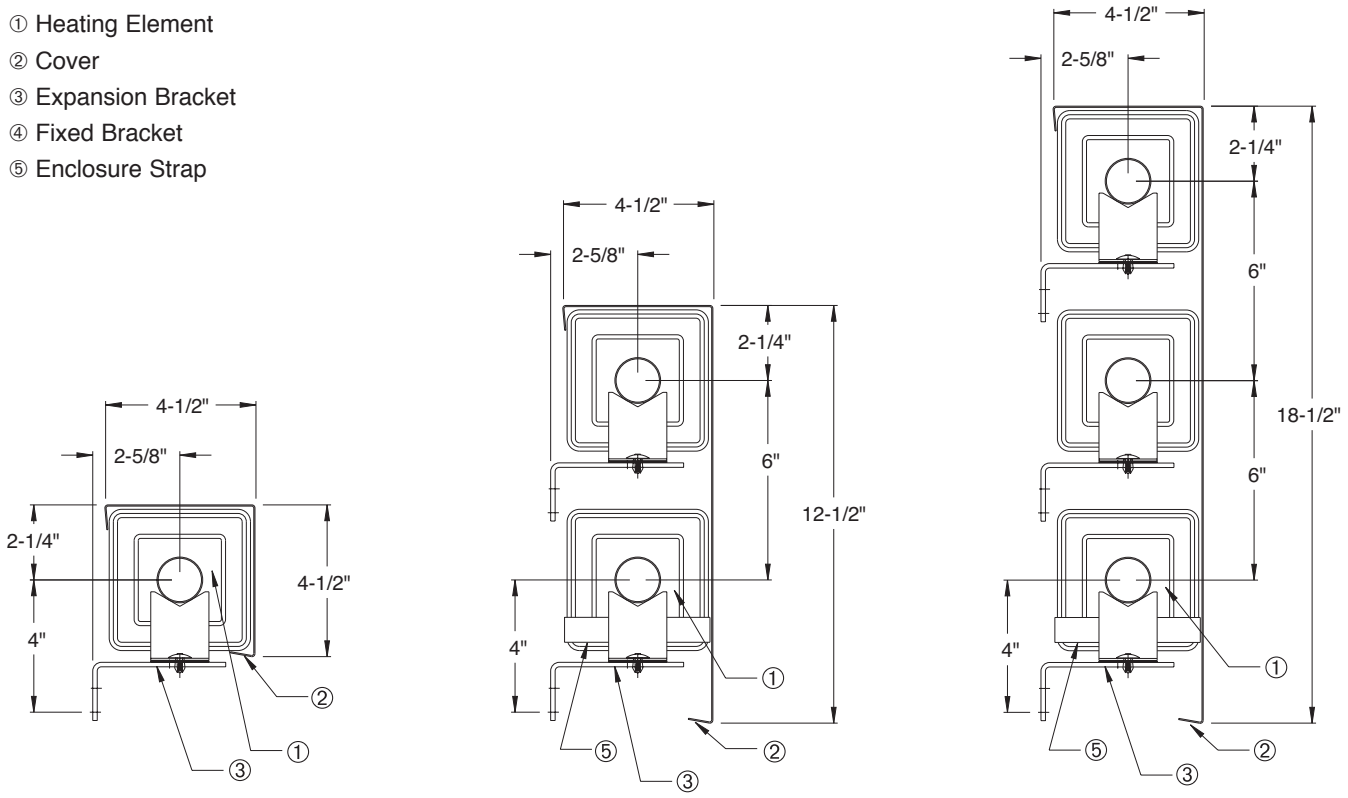


Figure 42.1 - System Components

① Heating Element
② Cover
③ Expansion Bracket
④ Fixed Bracket
⑤ Enclosure Strap



EM 004 **EM 012** **EM 018**

Standard Features

- Cover, 18 gauge in lengths of 2 feet through 8 feet in 6 inch increments.
- Cover heights of 4.5, 12.5 and 18.5 inches.
- Cover sections are joined using butt joints.
- Baked on polyester powdercoat paint finish, tan color.

Accessories

- Accessories, 20 gauge, include all items for a complete installation.
- End caps and end enclosures overlap cover and attach with screws.
- Inside, outside corners and enclosure extensions overlap cover sections and attach with screws.

Options

- Baked on polyester powdercoat paint finish available in colors selected from color guide (75-403).

MODEL EM PERFORMANCE

Table 43.1 - Steam and Hot Water Ratings - Fin Size - 4-1/4" x 4-1/4"

FIN SIZE - 4-1/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Enclosure Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
3/4" Copper 34 Fins/ft.	4.5	1	1310	1240	1130	1020	900	800	690	590	520
	12.5	2 @ 6"	2280	2170	1960	1780	1570	1390	1210	1030	910
	18.5	3 @ 6"	3080	2930	2650	2400	2130	1880	1630	1390	1230
3/4" Copper 42 Fins/ft.	4.5	1	1430	1360	1230	1120	990	870	760	640	570
	12.5	2 @ 6"	2500	2380	2150	1950	1730	1530	1330	1130	1000
	18.5	3 @ 6"	3420	3250	2940	2670	2360	2090	1810	1540	1370
3/4" Copper 50 Fins/ft.	4.5	1	1560	1480	1340	1220	1080	950	830	700	620
	12.5	2 @ 6"	2730	2590	2350	2130	1880	1670	1450	1230	1090
	18.5	3 @ 6"	3710	3520	3190	2890	2560	2260	1970	1670	1480
1" Copper 34 Fins/ft.	4.5	1	1360	1290	1170	1060	940	830	720	610	540
	12.5	2 @ 6"	2370	2250	2040	1850	1640	1450	1260	1070	950
	18.5	3 @ 6"	3200	3040	2750	2500	2210	1950	1700	1440	1280
1" Copper 42 Fins/ft.	4.5	1	1480	1410	1270	1150	1020	900	780	670	590
	12.5	2 @ 6"	2600	2470	2240	2030	1790	1590	1380	1170	1040
	18.5	3 @ 6"	3520	3340	3030	2750	2430	2150	1870	1580	1410
1" Copper 50 Fins/ft.	4.5	1	1590	1510	1370	1240	1100	970	840	720	640
	12.5	2 @ 6"	2790	2650	2400	2180	1930	1700	1480	1260	1120
	18.5	3 @ 6"	3800	3610	3270	2960	2620	2320	2010	1710	1520
1-1/4" Copper 34 Fins/ft.	4.5	1	1410	1340	1210	1100	970	860	750	630	560
	12.5	2 @ 6"	2470	2350	2120	1930	1700	1510	1310	1110	990
	18.5	3 @ 6"	3350	3180	2880	2610	2310	2040	1780	1510	1340
1-1/4" Copper 42 Fins/ft.	4.5	1	1530	1450	1320	1190	1060	930	810	690	610
	12.5	2 @ 6"	2690	2560	2310	2100	1860	1640	1430	1210	1080
	18.5	3 @ 6"	3650	3470	3140	2850	2520	2230	1930	1640	1460
1-1/4" Copper 50 Fins/ft.	4.5	1	1620	1540	1390	1260	1120	990	860	730	650
	12.5	2 @ 6"	2850	2710	2450	2220	1970	1740	1510	1280	1140
	18.5	3 @ 6"	3860	3670	3320	3010	2660	2350	2050	1740	1540

- Bottom of enclosure mounted 4 inches above floor. Refer to page 11 for correction factors for other mounting heights.
- Ratings are based on finned length with 65°F entering air, 1 PSI steam or average water temperature (215°F) at 3 ft/sec. water velocity. These water ratings, applicable to water flow rates of three or more feet per second, have been determined by applying the factors listed on page 11 to the AHRI Steam Ratings, which have been approved by AHRI.
- Finned length is the specified element length - 6" (3" plain end each side).

MODEL CP BARE HEATING ELEMENT FEATURES

- Copper Tube/Aluminum Fin.
- Heating Element ① can be installed in one, two or three rows.
- Heating Elements are supported by Fixed Brackets (FB) ③ or Expansion Brackets (EB) ②.

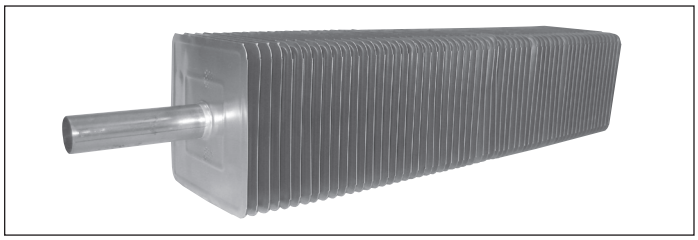
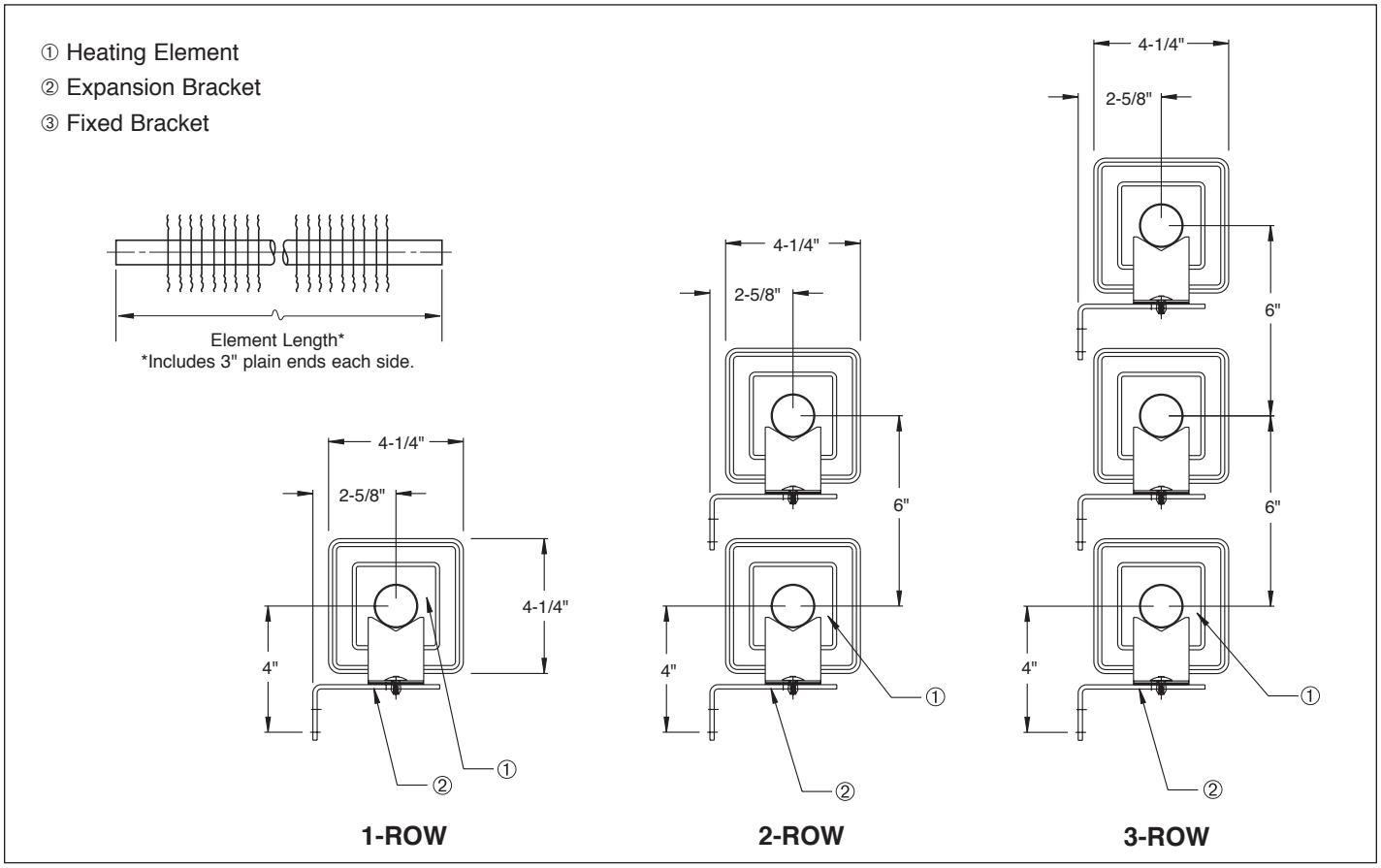


Figure 44.1 - System Components



Copper Tube/Aluminum Fin

- Lengths of 2 feet through 12 feet in 6 inch increments for 1-1/4" diameter. Lengths are 2 feet through 8 feet in 6 inch increments for 3/4" and 1" diameter.
- Aluminum fins are 4-1/4" x 4-1/4" x 0.018" thick or 2-3/4" x 4-1/4" x 0.018" thick.
- Fins/foot are 34, 42 or 50.

MODEL CP PERORMANCE

Table 45.1 - Steam and Hot Water Ratings - Fin Size - 4-1/4" x 4-1/4"

FIN SIZE - 4-1/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Mounting Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
3/4" Copper 34 Fins/ft.	9-1/4	1	***1350***	***1280***	***1160***	***1050***	***930***	***820***	***720***	***610***	***540***
	15-1/4	2 @ 6"	2350	2230	2020	1830	1620	1430	1250	1060	940
	21-1/4	3 @ 6"	3040	2890	2610	2370	2100	1850	1610	1370	1220
3/4" Copper 42 Fins/ft.	9-1/4	1	***1480***	***1410***	***1270***	***1150***	***1020***	***900***	***780***	***670***	***590***
	15-1/4	2 @ 6"	***2840***	***2700***	***2440***	***2220***	***1960***	***1730***	***1510***	***1280***	***1140***
	21-1/4	3 @ 6"	***3720***	***3530***	***3200***	***2900***	***2570***	***2270***	***1970***	***1670***	***1490***
3/4" Copper 50 Fins/ft.	9-1/4	1	***1610***	***1530***	***1380***	***1260***	***1110***	***980***	***850***	***720***	***640***
	15-1/4	2 @ 6"	2820	2680	2430	2200	1950	1720	1490	1270	1130
	21-1/4	3 @ 6"	3660	3480	3150	2850	2530	2230	1940	1650	1460
1" Copper 34 Fins/ft.	9-1/4	1	***1400***	***1330***	***1200***	***1090***	***970***	***850***	***740***	***630***	***560***
	15-1/4	2 @ 6"	2440	2320	2100	1900	1680	1490	1290	1100	980
	21-1/4	3 @ 6"	3150	2990	2710	2460	2170	1920	1670	1420	1260
1" Copper 42 Fins/ft.	9-1/4	1	***1530***	***1450***	***1320***	***1190***	***1060***	***930***	***810***	***690***	***610***
	15-1/4	2 @ 6"	***2770***	***2630***	***2380***	***2160***	***1910***	***1690***	***1470***	***1250***	***1110***
	21-1/4	3 @ 6"	***3630***	***3450***	***3120***	***2830***	***2500***	***2210***	***1920***	***1630***	***1450***
1" Copper 50 Fins/ft.	9-1/4	1	***1640***	***1560***	***1410***	***1280***	***1130***	***1000***	***870***	***740***	***660***
	15-1/4	2 @ 6"	2880	2740	2480	2250	1990	1760	1530	1300	1150
	21-1/4	3 @ 6"	3740	3550	3220	2920	2580	2280	1980	1680	1500
1-1/4" Copper 34 Fins/ft.	9-1/4	1	***1450***	***1380***	***1250***	***1130***	***1000***	***880***	***770***	***650***	***580***
	15-1/4	2 @ 6"	2540	2410	2180	1980	1750	1550	1350	1140	1020
	21-1/4	3 @ 6"	3330	3160	2860	2600	2300	2030	1760	1500	1330
1-1/4" Copper 42 Fins/ft.	9-1/4	1	***1580***	***1500***	***1360***	***1230***	***1090***	***960***	***840***	***710***	***630***
	15-1/4	2 @ 6"	***2690***	***2560***	***2310***	***2100***	***1860***	***1640***	***1430***	***1210***	***1080***
	21-1/4	3 @ 6"	***3520***	***3340***	***3030***	***2750***	***2430***	***2150***	***1870***	***1580***	***1410***
1-1/4" Copper 50 Fins/ft.	9-1/4	1	***1670***	***1590***	***1440***	***1300***	***1150***	***1020***	***890***	***750***	***670***
	15-1/4	2 @ 6"	***2670***	***2540***	***2300***	***2080***	***1840***	***1630***	***1420***	***1200***	***1070***
	21-1/4	3 @ 6"	***3480***	***3310***	***2990***	***2710***	***2400***	***2120***	***1840***	***1570***	***1390***

Table 45.2 - Steam and Hot Water Ratings - Fin Size - 2-3/4" x 4-1/4"

FIN SIZE - 2-3/4" X 4-1/4" ALUMINUM											
Heating Element Fin Spacing	Mounting Height (Inches)	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
				210	200	190	180	170	160	150	140
3/4" Copper 34 Fins/ft.	6-3/4	1	***1110***	***1050***	***950***	***870***	***770***	***680***	***590***	***500***	***440***
	12-3/4	2 @ 6"	***1890***	***1800***	***1630***	***1470***	***1300***	***1150***	***1000***	***850***	***760***
	18-3/4	3 @ 6"	***2480***	***2360***	***2130***	***1930***	***1710***	***1510***	***1310***	***1120***	***990***
3/4" Copper 42 Fins/ft.	6-3/4	1	***1250***	***1190***	***1080***	***980***	***860***	***760***	***660***	***560***	***500***
	12-3/4	2 @ 6"	***2120***	***2010***	***1820***	***1650***	***1460***	***1290***	***1120***	***950***	***850***
	18-3/4	3 @ 6"	***2790***	***2650***	***2400***	***2180***	***1930***	***1700***	***1480***	***1260***	***1120***
3/4" Copper 50 Fins/ft.	6-3/4	1	***1390***	***1320***	***1200***	***1080***	***960***	***850***	***740***	***630***	***560***
	12-3/4	2 @ 6"	***2360***	***2240***	***2030***	***1840***	***1630***	***1440***	***1250***	***1060***	***940***
	18-3/4	3 @ 6"	***3090***	***2940***	***2660***	***2410***	***2130***	***1880***	***1640***	***1390***	***1240***
1" Copper 34 Fins/ft.	6-3/4	1	***1110***	***1050***	***950***	***870***	***770***	***680***	***590***	***500***	***440***
	12-3/4	2 @ 6"	***1880***	***1790***	***1620***	***1470***	***1300***	***1150***	***1000***	***850***	***750***
	18-3/4	3 @ 6"	***2470***	***2350***	***2120***	***1930***	***1700***	***1510***	***1310***	***1110***	***990***
1" Copper 42 Fins/ft.	6-3/4	1	***1240***	***1180***	***1070***	***970***	***860***	***760***	***660***	***560***	***500***
	12-3/4	2 @ 6"	***2100***	***2000***	***1810***	***1640***	***1450***	***1280***	***1110***	***950***	***840***
	18-3/4	3 @ 6"	***2760***	***2620***	***2370***	***2150***	***1900***	***1680***	***1460***	***1240***	***1100***
1" Copper 50 Fins/ft.	6-3/4	1	***1370***	***1300***	***1180***	***1070***	***950***	***840***	***730***	***620***	***550***
	12-3/4	2 @ 6"	***2330***	***2210***	***2000***	***1820***	***1610***	***1420***	***1230***	***1050***	***930***
	18-3/4	3 @ 6"	***3060***	***2910***	***2630***	***2390***	***2110***	***1870***	***1620***	***1380***	***1220***
1-1/4" Copper 34 Fins/ft.	6-3/4	1	***1110***	***1050***	***950***	***870***	***770***	***680***	***590***	***500***	***440***
	12-3/4	2 @ 6"	***1890***	***1800***	***1630***	***1470***	***1300***	***1150***	***1000***	***850***	***760***
	18-3/4	3 @ 6"	***2480***	***2360***	***2130***	***1930***	***1710***	***1510***	***1310***	***1120***	***990***
1-1/4" Copper 42 Fins/ft.	6-3/4	1	***1230***	***1170***	***1060***	***960***	***850***	***750***	***650***	***550***	***490***
	12-3/4	2 @ 6"	***2100***	***2000***	***1810***	***1640***	***1450***	***1280***	***1110***	***950***	***840***
	18-3/4	3 @ 6"	***2740***	***2600***	***2360***	***2140***	***1890***	***1670***	***1450***	***1230***	***1100***
1-1/4" Copper 50 Fins/ft.	6-3/4	1	***1350***	***1280***	***1160***	***1050***	***930***	***820***	***720***	***610***	***540***
	12-3/4	2 @ 6"	***2300***	***2190***	***1980***	***1790***	***1590***	***1400***	***1220***	***1040***	***920***
	18-3/4	3 @ 6"	***3010***	***2860***	***2590***	***2350***	***2080***	***1840***	***1600***	***1350***	***1200***

- Refer to page 11 for correction factors for other mounting heights.
- Ratings are based on finned length with 65°F entering air, 1 PSI steam or average water temperature (215°F) at 3 ft/sec. water velocity These water ratings, applicable to water flow rates of three or more feet per second, have been determined by applying the factors listed on page 11 to the AHRI Steam Ratings, which have been approved by AHRI.
- Finned length is the specified element length - 6" (3" plain end each side).

▶ Bold, italicized units are AHRI CERTIFIED ◀

MODEL CP PERFORMANCE

Table 46.1 - Steam and Hot Water Ratings - Fin Size - 3-1/4" x 2-3/4"

FIN SIZE - 3-1/4" X 2-3/4" ALUMINUM										
Heating Element Fin Spacing	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
			210	200	190	180	170	160	150	140
3/4" Copper 34 Fins/ft.	1	880	840	760	690	610	540	470	400	350
3/4" Copper 42 Fins/ft.	1	970	920	830	760	670	590	510	440	390
3/4" Copper 50 Fins/ft.	1	1050	1000	900	820	720	640	560	470	420
1" Copper 34 Fins/ft.	1	870	830	750	680	600	530	460	390	350
1" Copper 42 Fins/ft.	1	940	890	810	730	650	570	500	420	380
1" Copper 50 Fins/ft.	1	1020	970	880	800	700	620	540	460	410
1-1/4" Copper 34 Fins/ft.	1	850	810	730	660	590	520	450	380	340
1-1/4" Copper 42 Fins/ft.	1	920	870	790	720	630	560	490	410	370
1-1/4" Copper 50 Fins/ft.	1	990	940	850	770	680	600	520	450	400

Table 46.2 - Steam and Hot Water Ratings - Fin Size - 4-1/4" x 2-3/4"

FIN SIZE - 4-1/4" X 2-3/4" ALUMINUM										
Heating Element Fin Spacing	Rows of Element	1 PSI Steam	Hot Water Ratings - BTU/HR/FT - AWT °F							
			210	200	190	180	170	160	150	140
3/4" Copper 34 Fins/ft.	1	1000	950	860	780	690	610	530	450	400
3/4" Copper 42 Fins/ft.	1	1140	1080	980	890	790	700	600	510	460
3/4" Copper 50 Fins/ft.	1	1280	1220	1100	1000	880	780	680	580	510
1" Copper 34 Fins/ft.	1	990	940	850	770	680	600	520	450	400
1" Copper 42 Fins/ft.	1	1120	1060	960	870	770	680	590	500	450
1" Copper 50 Fins/ft.	1	1250	1190	1080	980	860	760	660	560	500
1-1/4" Copper 34 Fins/ft.	1	960	910	830	750	660	590	510	430	380
1-1/4" Copper 42 Fins/ft.	1	1080	1030	930	840	750	660	570	490	430
1-1/4" Copper 50 Fins/ft.	1	1200	1140	1030	940	830	730	640	540	480

- Refer to page 11 for correction factors for other mounting heights.
- Ratings are based on finned length with 65°F entering air, 1 PSI steam or average water temperature (215°F) at 3 ft/sec. water velocity. These water ratings, applicable to water flow rates of three or more feet per second, have been determined by applying the factors listed on page 11 to the AHRI Steam Ratings, which have been approved by AHRI.
- Finned length is the specified element length - 6" (3" plain end each side).

SPECIFICATIONS

Heating Elements

Copper tube/Aluminum fin elements are available in 3/4, 1, and 1-1/4 inch outer diameter seamless copper tubing. Fins are either 2-3/4 x 3-1/4, 2-3/4 x 4-1/4, or 4-1/4 x 4-1/4 inches with 34, 42, or 50 fins/ft., and are unpainted and bonded to the tube by mechanical expansion of the tube. Maximum element length is 8 feet for 3/4 and 1 inch diameter tubes and 12 feet for 1-1/4 inch diameter tubes. Maximum working pressure at 300° F is 250 psi for 3/4 inch tubes, 185 psi for 1 inch tube and 190 psi for 1-1/4 inch tubes.

Hangers and Supports

Enclosure wall supports attach to the 20 gauge aluminized steel hanger strip. Enclosure wall supports may be placed at any location along the hanger strip allowing installation directly over wall supports.

One fastener is required for each enclosure wall support in order to properly secure it.

Enclosure wall supports have a V-bend at the bottom which fully engages the enclosure and supports its weight.

Element support assembly and return pipe hangers hook into the wall support “pegboard style”.

Enclosure and element supports are die-formed in 16 gauge galvanized steel with integral stiffening ribs. All return pipe hangers are wire formed for ease of adjustment. No fasteners or sub-assembly are required for any element or return pipe support.

Element support cradles give two-point support to the element and allow over 2-1/2 inches of lateral movement. Cradles slide on full bearing polymeric discs and are held in place with a polymeric rivet.

Fin Tube Enclosures

All standard Commercial enclosures are manufactured in 18 gauge (14 gauge for model PS) cold-rolled steel. Enclosure lengths range from 2 feet to 8 feet in 6 inch increments.

Air discharge louver banks are 3 inches on center and have a “pencil proof” design.

All standard enclosures have a tan color, baked-on polyester powdercoat paint finish, which may be used as a final coat or repainted.

All enclosure styles include interlocking slip-joints for smooth hairline joints, with no fasteners required. All friction clips and back-up strips include stiffening angles for added reinforcement at all enclosure joints.

Fin Tube Element Covers

Types FT and EM element covers overlap and clip over the fin area of the element. No hanger strip is required. The element must be supported by either a fixed bracket (FB) or expansion bracket (EB).

All covers are made of 18 gauge steel and are finished in tan baked on polyester powdercoat paint finish. Type EM covers butt together. Type FT covers overlap one another. Cover straps are available for use with multiple rows of element, to secure the cover to the lower row of element.

Accessories

Accessories are manufactured in either 14, 18, or 20 gauge cold-rolled steel, depending on the piece. Accessories are cleaned, phosphatized, and finished with a baked on polyester powdercoat paint finish to match enclosures. Valve compartments, end caps, and end enclosures have slip joints to attach to the end of the enclosure. Corners and extensions are telescoping and overlap adjacent corners. They incorporate fold-over tabs to secure the accessory to the enclosure without fasteners, except for model PS accessories which attach to the enclosure with tamperproof fasteners.

AIREDALE

Products from Modine are designed to provide indoor air-comfort and ventilation solutions for residential, commercial, institutional and industrial applications. Whatever your heating, ventilating and air conditioning requirements, Modine has the product to satisfy your needs, including:

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Specific catalogs are available for each product. Catalogs 75-136 and 75-137 provide details on all Modine HVAC equipment.

MODINE

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3rd Floor Fin Tube

Radiator Installation Instructions

Horizontal Radiators

1. Radiators are boxed together in as few crates as possible. A box of brackets is included as a separate piece, and it is marked to denote brackets. Inside the crates, each panel is wrapped in foam sheeting. Saving this foam to re-wrap the panel once it is wall mounted will protect it from construction site damage.
2. Each radiator is tagged with a label that indicates the project name, model type, color, connection code, bracket type & quantity and tag number. The tag number will usually designate a floor level and room number for easier placement on the job. Locate each radiator as required.
3. Carefully place each radiator face down on a smooth level surface (e.g. floor or table). Distribute the K12 wall brackets for each radiator. The tag on the radiator indicates the quantity of brackets. Mount the brackets securely on wall studs, spacing them as evenly as possible at 2 to 4 feet apart, with a bracket at least 12 inches from each end of the panel. Allow a minimum of 3 inches below each panel radiator to facilitate cleaning and to assure proper output. For baseboard models, 2 inches or even 1 inch above the floor is permissible with little loss of heat output.

4A. **RADIATORS WITH FINS (BACK SIDE OF PANEL)**
With the radiator face down, attach each K12 clip to the fins at the stud location. With the radiator still face down, thread the K45 offset bolts (5/16” carriage bolts) into the bottom threaded positions with a crescent wrench. Once the bolts have cleared the paint away, they should turn easily by hand. Attach the K12 bracket to the wall stud with 2 lag bolts. Hang the panel onto the brackets to determine if the K45 offset bolts are properly adjusted. Check that the panel is level.

4B. **RADIATORS (NO FINS ON BACK SIDE OF PANEL)**
With the radiator face down, attach each K12 clip to the radiator’s perforated steel mounting channel at the K12 stud locations. With the radiator still face down, thread the K45 offset bolts (5/16” carriage bolts) into the bottom threaded positions with a crescent wrench. Once the bolts have cleared the paint away, they should turn easily by hand. Hang the panel onto the brackets to determine if the K45 offset bolts are properly adjusted. Check that the panel is level.

5. Remove the radiator from the wall, and thread the supply and return fittings into the connections on the panel. The sealing tape or pipe dope used is the installer’s choice – make sure the connections are leak tight. One quarter of a turn past hand tight is usually sufficient. Use the foam wrap as a pad for the face of the panel while tightening up the fittings. Each radiator needs to be fitted with a 1/8” air vent prior to startup.
6. **FLOOR POST & PEDESTAL MOUNTED RADIATORS**
When using floor posts, each post must line up with a corresponding K45 offset bolt attached to the back side of the radiator. Using this spacing as a guide, securely fasten each floor post to the floor, using appropriate fasteners. The K12 wall bracket is attached to the floor post, and the K12 clip to the radiator, as described in step #4. The nut and bolt used to attach the K12 bracket to the floor post is to be supplied by others.
For pedestal mounting, the pedestals should be arranged so that the end pedestals sit within 12 inches of each end of the radiator, with the remainder spaced evenly along the radiator’s length. Each pedestal should be securely fastened to the floor using appropriate fasteners.
Radiators sit on the pedestals, with the “fingers” of the pedestals sticking up between the fins to provide stability.
7. . Radiators expand a maximum of 0.016 inch per linear foot of length if heated to 215°F. Piping attached to the radiator must provide the necessary expansion compensation.
8. Once the radiators are installed, the system can be tested to 50 psi. **DO NOT OVER-PRESSURIZE THE RADIATORS** as permanent damage may be done.

Standard Pressure Panels
Maximum 56 psi

Medium Pressure Panels
Maximum 85 psi

High Pressure Panels
Maximum 128 psi

When the system has been shown to hold 50 psi maximum air, the piping and radiators can be filled with water. As water fills the system and radiators, air is forced to the vent fittings. Vent as much air as possible before turning on the circulating pump(s).

9. When the system is filled, operate the circulator(s) to force the remaining air to the high points of the system. With the system pressurized, turn off the circulator(s) to vent the panels. Each radiator should be individually bled of air. Once cold venting has been completed, heat the system to design temperature and repeat the venting procedure as many times as necessary to remove all air from the system.

Installation Manual	IM 962-2
	Group: **Applied Air Systems**
	Part Number: **IM 962-2**
	Date: **August 2013**

Air-Cooled Split System Condensing Units

Models RCS 06F – 20F
6.5 to 20 Tons
R-410A Refrigerant



6.5 – 7.5 Tons



10.0 – 12.0 Tons



15.0 – 20.0 Tons

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DAIKIN McQUAY®

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Hazard Identification Information

⚠ DANGER

The use of unauthorized components, accessories or devices may adversely affect the operation of the condensing unit and may also endanger life and property.

The manufacturer disclaims any responsibility for such loss or injury and the manufacturer's warranty does not cover any damage or defect to the air conditioner caused by the attachment or use of any components, accessories or devices (other than those authorized by the manufacturer) into, onto or in conjunction with the condensing unit.

⚠ DANGER

Dangers indicate a hazardous situation which will result in death or serious injury if not avoided.

⚠ WARNING

Warnings indicate potentially hazardous situations, which canresult in property damage, severe personal injury, or death ifnot avoided.

⚠ CAUTION

Cautions indicate potentially hazardous situations, which can result in personal injury or equipment damage if not avoided.

This manual contains the installation and operating instructions for your split condensing unit. There are a few precautions that should be taken to derive maximum satisfaction from it. Improper installation can result in unsatisfactory operation or dangerous conditions.

Read this manual and any instructions packaged with separate equipment required to make up the system prior to installation. Give this manual to the owner and explain its provisions. The owner should retain this manual for future reference.

Checking Product Received

Upon receiving the unit, inspect it for any damage from shipment. Claims for damage, either shipping or concealed, should be filed immediately with the shipping company. Check the unit model number, electrical characteristics, and accessories to determine if they are correct.

Nomenclature

R C S – 06 – F – 078 – C

Rooftop Condensing System

Nominal capacity (tons)
06 = 6.5
07 = 7.5
10 = 10 (single compressor)
11 = 10 (tandem compressors)
12 = 12
15 = 15
20 = 20

Refrigerant
F = R-410A

Voltage
C = 208/230 - 3 - 60
D = 460 - 3 - 60
Y = 575 - 3 - 60

Compressor
078 = 6.5 ton, single
090 = 7.5 ton, single
120 = 10 ton, single
125 = 10 ton, tandem
150 = 12.5 ton, tandem
180 = 15 ton, tandem
240 = 20 ton, tandem

NOTE: For larger size units (greater than 20 ton), refer to Catalog 222.

Standard Unit Features

Cabinet — Galvanized steel with a durable powder paint finish. Stamped louvered panels offer 100% protection for the condenser coil.

Compressor — Hermetically sealed scroll compressors. Compressors are mounted on rubber-in-shear pads to reduce vibration and noise.

Condenser Coil — Constructed with copper tubes and aluminum fins mechanically bonded to the tubes for maximum heat transfer capabilities. All coil assemblies are leak tested at 450 psig internal pressure.

Refrigerant Connections — Field piping connections are made through a fixed panel. This allows complete access or removal of access panels after piping connections have been made.

Crankcase Heater — Standard, all models.

Low Ambient Control — A pressure sensitive fan cycling control to allow unit operation to 0°F is standard.

Service Valves — Standard on liquid lines and vapor lines.

Service Access — The control box, as well as the compressor and other refrigerant controls, is accessible through access panels. It may be opened without affecting the normal operation of the unit. Condenser fan motors are accessible by removing wire grilles.

Filter Drier — Field supplied.

Sight Glass — Optional, field supplied.

Transformer — Step down type, line to 24 volts.

Contactor — The contactor is an electrical switch which operates the compressor and condenser fans.

High Pressure Control — Opens the contactor circuit on high refrigerant pressure; manual reset.

Low Pressure Control — Stops compressor operation in the event of loss of refrigerant.

Condenser Fan Motor (Direct Drive) — Ball bearing 1075 RPM motors are mounted to minimize vibration and noise problems.These are permanent split capacitor types and require the same capacitance for both run and start.
Testing — All units are run tested at the factory prior to shipment. Units are shipped with a holding pressure of nitrogen.

Figure 1: RCS 06F & 07F Ton Features

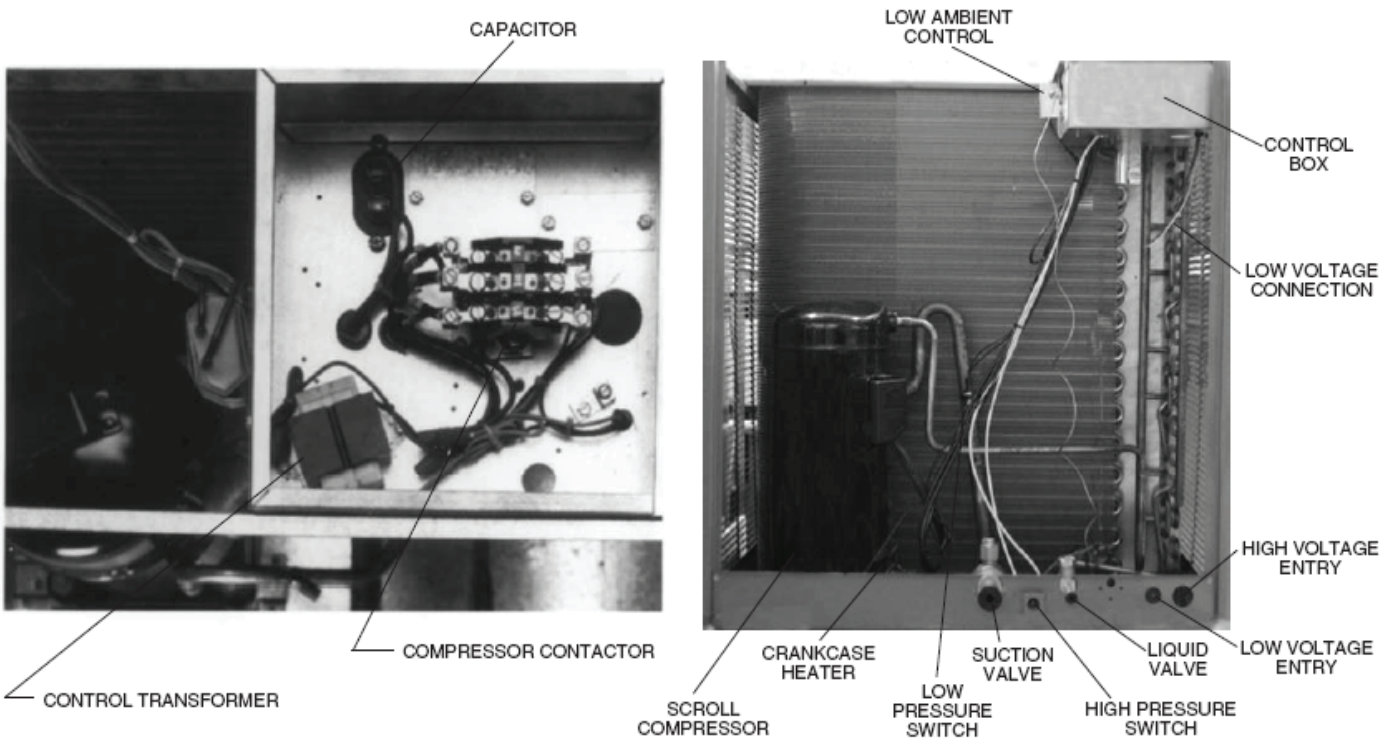
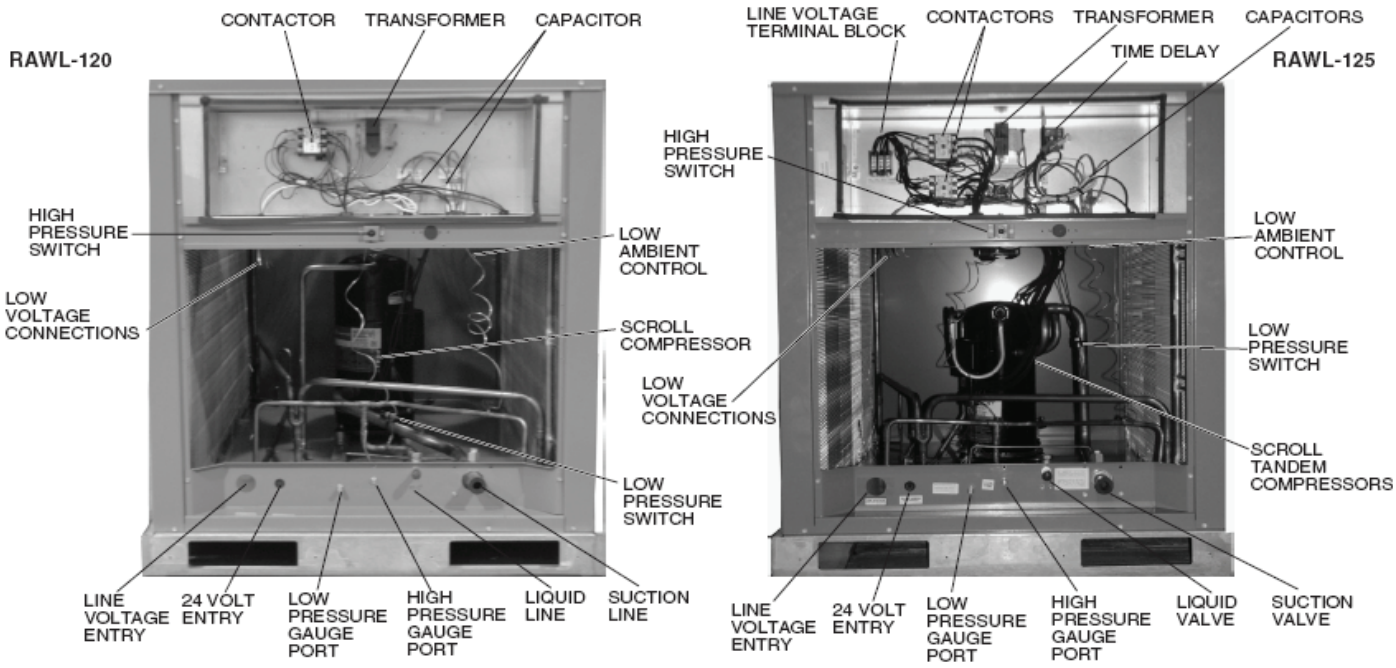


Figure 2: RCS 10F – 20F Ton Features



Dimensional and Weight Data

Figure 3: RCS 06F and 07F Dimensions and Weights

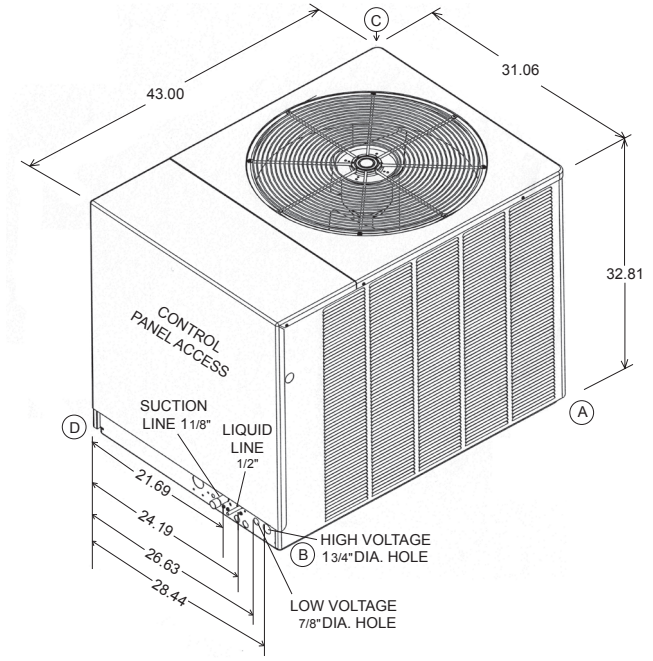
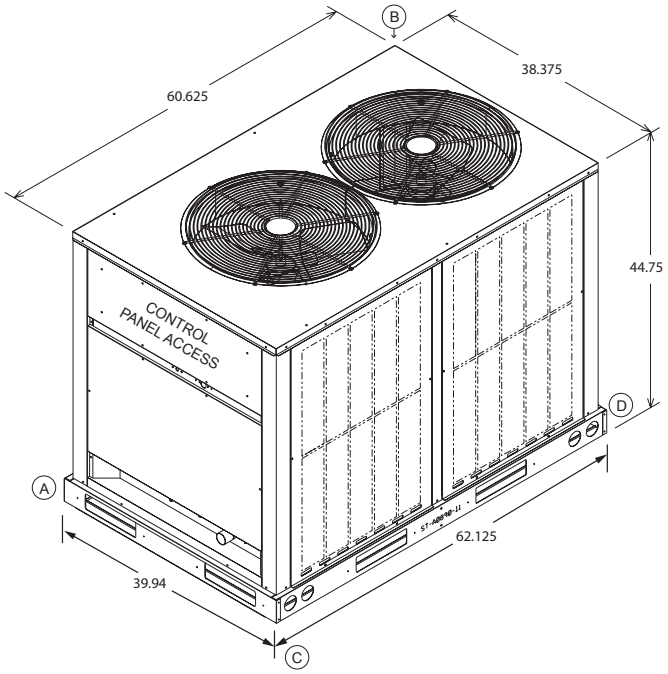


Table 1: RCS 06F and 07F Operating Weights

RCS model	Total weight lbs. [kg]	Corner weight lbs. [kg]			
		A	B	C	D
06F	291 [132]	50 [22.7]	73 [33.1]	69 [31.3]	99 [44.9]
07F	318 [144]	53 [24.0]	84 [38.1]	71 [32.2]	110 [49.9]

Figure 4: RCS 10F and 11F Dimensions and Weights



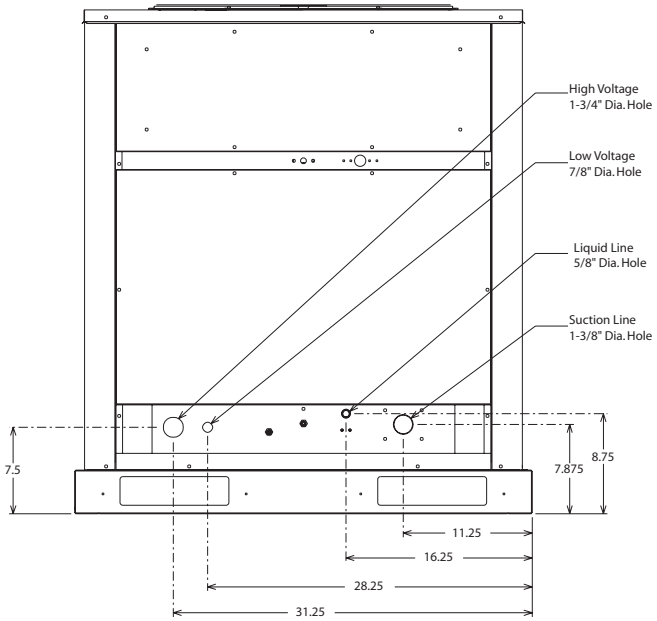
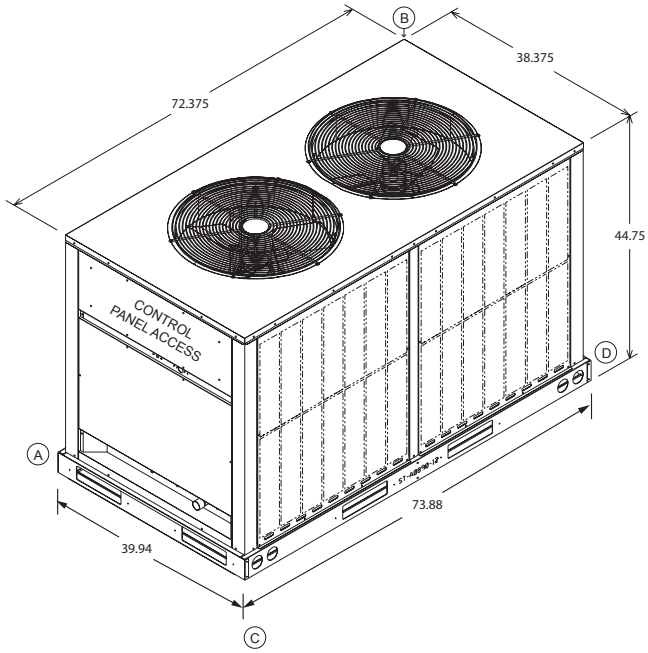


Table 2: RCS 10F and 11F Operating Weights

RCS model	Total weight lbs. [kg]	Corner weight lbs. [kg]			
		A	B	C	D
10F (Single)	501 [228]	123 [53.9]	132 [60.0]	119 [54.1]	127 [58.0]
11F (Tandem)	586 [266]	144 [65.3]	154 [69.9]	139 [63.2]	149 [67.6]

Figure 5: RCS 12F Dimensions and Weights



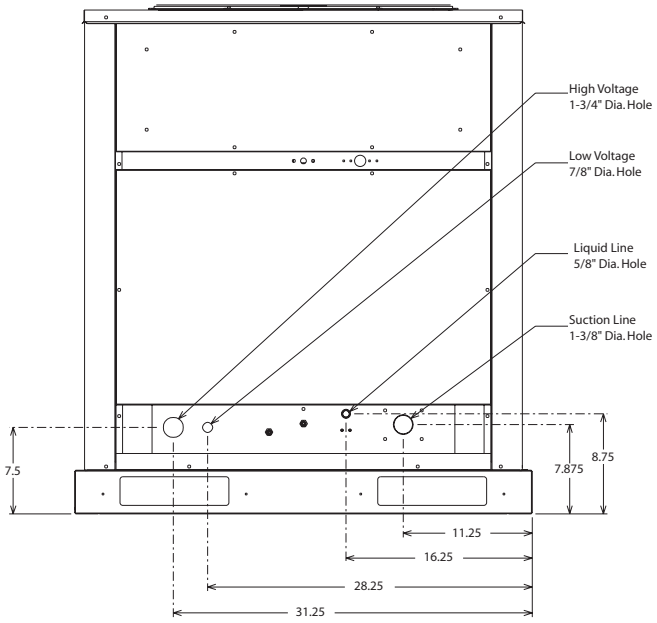
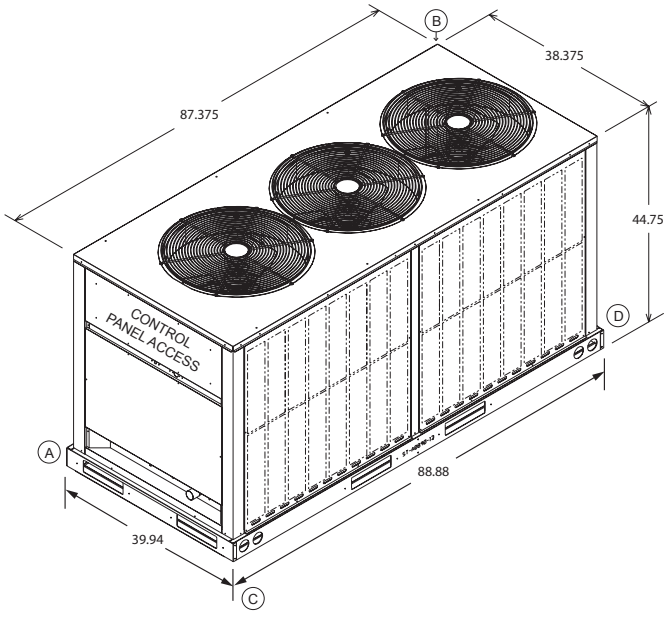


Table 3: RCS 12F Operating Weights

RCS model	Total weight lbs. [kg]	Corner weight lbs. [kg			
		A	B	C	D
12F	650 [293]	160 [72.0]	171 [78.0]	154 [70.0]	165 [75.0]

Figure 6: RCS 15F – 20F Dimensions and Weights



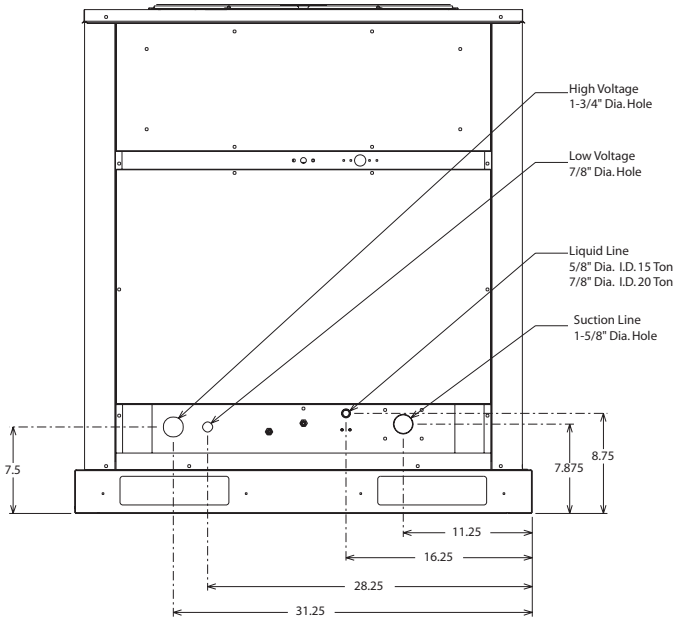


Table 4: RCS 15F and 20F Operating Weights

RCS model	Total weight lbs. [kg]	Corner weight lbs. [kg]			
		A	B	C	D
15F	746 [338.0]	183 [83.0]	196 [89.0]	177 [80.0]	189 [86.0]
20F	952 [432.0]	234 [106.0]	251 [114.0]	226 [103.0]	241 [110.0]

Unit Capacity and Physical Data

Table 5: RCS 06F – 20F Physical Data

Model	RCS						
	06F Single	**07F Single**	**10F Single**	**11F Tandem**	**12F Tandem**	**15F Tandem**	**20F Tandem**
Capacity and Weight							
Capacity (tons) [kW]	6.5 [22.9]	7.5 [26.4]	10 [35.2]	10 [35.2]	12 [42.2]	15 [52.8]	20 [70.3]
Number of circuits	1						
Operating weight (lbs) [Kg]	291 [132]	318 [144]	501 [227.3]	586 [265.8]	650 [294.8]	746 [338.4]	952 [431.8]
Shipping weight (lbs) [Kg]	314 [142.5]	341 [154.7]	541 [245.4]	626 [284.0]	690 [313.0]	786 [356.5]	992 [450.0]
Compressor							
Quantity	1			2			
Type	Scroll						
RPM	3500						
Refrigerant charge R410A oz. [g]	178 [5046]	242 [6861]	339 [9661]	300 [8505]	378 [10,716]	506 [14,345]	655 [18,569]
Condenser Fans							
Quantity	1		2			3	
CFM [L/s]	4700 [2218]	4700 [2218]	8100 [3822]	8100 [3822]	8100 [3882]	12,000 [5663]	12,000 [5663]
Diameter (in.) [mm	24 [610]	24 [610]	24 [610]	24 [610]	24 [610]	24 [610]	24 [610]
Drive	Direct						
Motor horsepower each [W]	1/3 [249]	1/3 [249]	1/3 [249]	1/3 [249]	1/3 [249]	1/3 [249]	1/3 [249]
Type	PSC						
RPM	1075						
Condenser Coil							
Quantity	1		2				
Rows	1-1/2	2					3
Fins per inch	20	22	18	22	22	22	22
Sq. ft. [m^2]	23.0 [2.14]	23.0 [2.14]	27.0 [2.51]	27.0 [2.51]	33.9 [3.05]	40.38 [3.75]	40.38 [3.75]
Fins/tubes	Aluminum/Copper						
Cabinet							
Finish	Powder Coat						
Sheet metal	Galvanized						
Gauge (nominal) top	20						
Sides	20						
Base rails	14						
Refrigerant Connection							
Vapor sweat (in.) [mm]	1-1/8 [29]	1-1/8 [29]	1-3/8 [35]	1-3/8 [35]	1-3/8 [35]	1-5/8 [41.3]	1-5/8 [41.3]
Liquid sweat (in.) [mm]	1/2 [13]	1/2 [13]	5/8 [16]	5/8 [16]	5/8 [16]	5/8 [16]	7/8 [22]

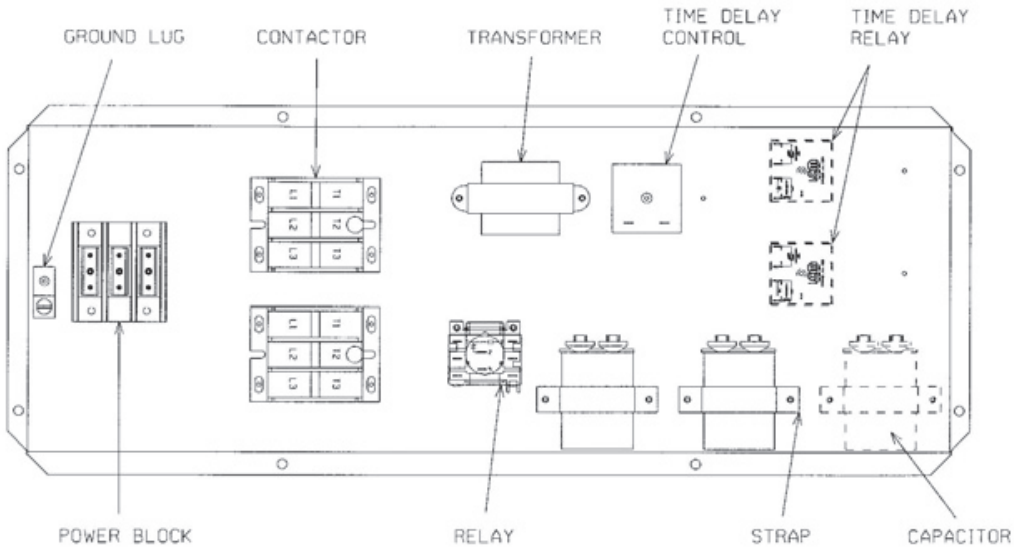
Power Wiring

Table 6: RCS 06F – 20F Electrical Data

Model	RCS																				
	06F			07F			10F			11F			12F			15F			20F		
Compressor Motor																					
Voltage	208/230	460-	575	208/230	460	575	208/230	460	575	208/230	460	575	208/230	460	575	208/230	460	575	208/230	460	575
Phase and hertz	3 – 60																				
Number of compressors	Single									Tandem											
Operating Current																					
Rated load amps (each)[1]	22.4	10.6	7.7	25.0	12.2	9.0	30.1	16.7	12.2	17.6	9.6	6.1	22.4	10.6	7.7	25.0	12.2	9.0	33.3	17.9	12.8
Locked rotor amps (each)[1]	149	75	54	164	100	78	225	114	80	123	64	40	14	75	54	164	100	78	239	125	80
Condenser Fan Motors																					
Voltage	208/230	460	575	208/230	460	575	208/230	460	575	208/230	460	575	208/230	460	575	208/230	460	575	208/230	460	575
Phase	Single																				
Full load amps (each)	2.2	1.3	1.0	2.2	1.3	1.0	2.4	1.4	1.0	2.4	1.4	1.0	2.4	1.4	1.0	2.4	1.4	1.0	2.4	1.1	0.8
System characteristics																					
Unit full load amps[2]	24.6	11.9	8.7	27.2	13.5	10.0	34.9	19.5	14.2	40.0	22.0	14.2	49.6	24.0	17.4	57.2	28.6	21.0	73.8	39.1	28.0
Minimum circuit ampacity	31.0	15.0	11.0	34.0	17.0	13.0	43.0	24.0	18.0	45.0	25.0	16.0	56.0	27.0	20.0	64.0	32.0	24.0	83.0	44.0	32.0
Maximum fuse size (amps) or HACR circuit breaker ampacity[3]	50	25	15	50	25	20	60	40	25	60	30	20	70	35	25	80	40	30	110	60	40
Disconnect size	60	30	30	60	30	30	60	40	25	60	30	30	60	30	30	100	60	60	200	60	60

Note:
1 Each compressor
2 Conditions at 45° suction and 95° ambient
3 Local codes take precedent over recommended fuse size

Figure 7: Control Box Example – RCS 10F Through 20F



Order Parts

When reporting shortages or damaged parts, or when ordering repair parts, give the complete unit model and serial numbers which are stamped on the unit rating plate.

Standard Items

The condensing unit consists of a completely assembled package which includes a compressor pack, condenser coils, fans, fan motors, outdoor control box, factory wiring, factory tubing and fittings.

Crankcase Heaters

These units are equipped with a crankcase heater that is factory wired to operate whenever the main power supply to the unit is “ON” and compressors are “OFF.” Before starting the equipment after prolonged shutdown or at the time of initial spring startup, be sure that the circuits to the condensing units are closed for at least 24 hours.

Corrosive Environment

The metal parts of this unit may be subject to rust or deterioration if exposed to a corrosive environment. This oxidation could shorten the equipment’s useful life. Corrosive elements include salt spray, fog or mist in seacoast areas, sulphur or chlorine from lawn watering systems, and various chemical contaminants from industries such as paper mills and petroleum refineries.

If the unit is to be installed in an area where contaminants are likely to be a problem, special attention should be given to the equipment location and exposure.

- Avoid having lawn sprinkler heads spray directly on the unit cabinet
- In coastal areas, locate the unit on the side of the building away from the waterfront.
- Shielding provided by a protection, based on clearances

⚠ DANGER

Disconnect all power to unit before starting maintenance. Failure to do so can cause electrical shock resulting in severe personal injury or death.

Regular maintenance will reduce the buildup of contaminants and help to protect the unit’s finish.

- Frequent washing of the cabinet, fan blade and coil with fresh water will remove most of the salt or other contaminants that build up on the unit.
- Regular cleaning and waxing of the cabinet with a good automobile polish will provide some protection.
- A good liquid cleaner may be used several times a year to remove matter that will not wash off with water.

Several different types of protective coatings are offered in some areas. These coatings may provide some benefit, but the effectiveness of such coating materials cannot be verified by the equipment manufacturer.

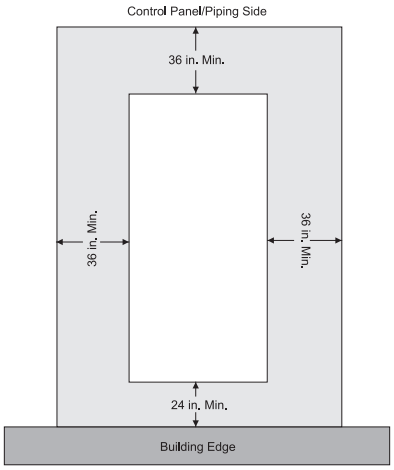
Installation General

The condensing unit should be installed outdoors. It should be located as near as possible to the evaporator section to keep connecting refrigerant tubing lengths to a minimum. The unit must be installed to allow a free air flow to the condenser coils

If several units are installed adjacent to each other, take care to avoid recirculation of air from one condenser to another. In all installations, adequate space must be provided for installation and servicing.

The unit must not be connected to any duct work. Do not locate unit under a roof drip; if necessary, install gutters, etc., to prevent water runoff onto the unit. To prevent air recirculation, it is recommended that the unit not be installed under an overhang. However, if this is necessary, allow a minimum of 60" above the unit for air discharge

Figure 8: Clearances RCS 06F – 20F Service Clearances



Rooftop Installation

If rooftop installation is required, make certain that the building construction is adequate for the weight of the unit. (Table 5) Before placing the unit on the roof, make certain that the nylon rigging slings are of sufficient length to maintain equilibrium of the unit when lifting. Under no circumstances should the unit be lifted by only one corner for rooftop installation.

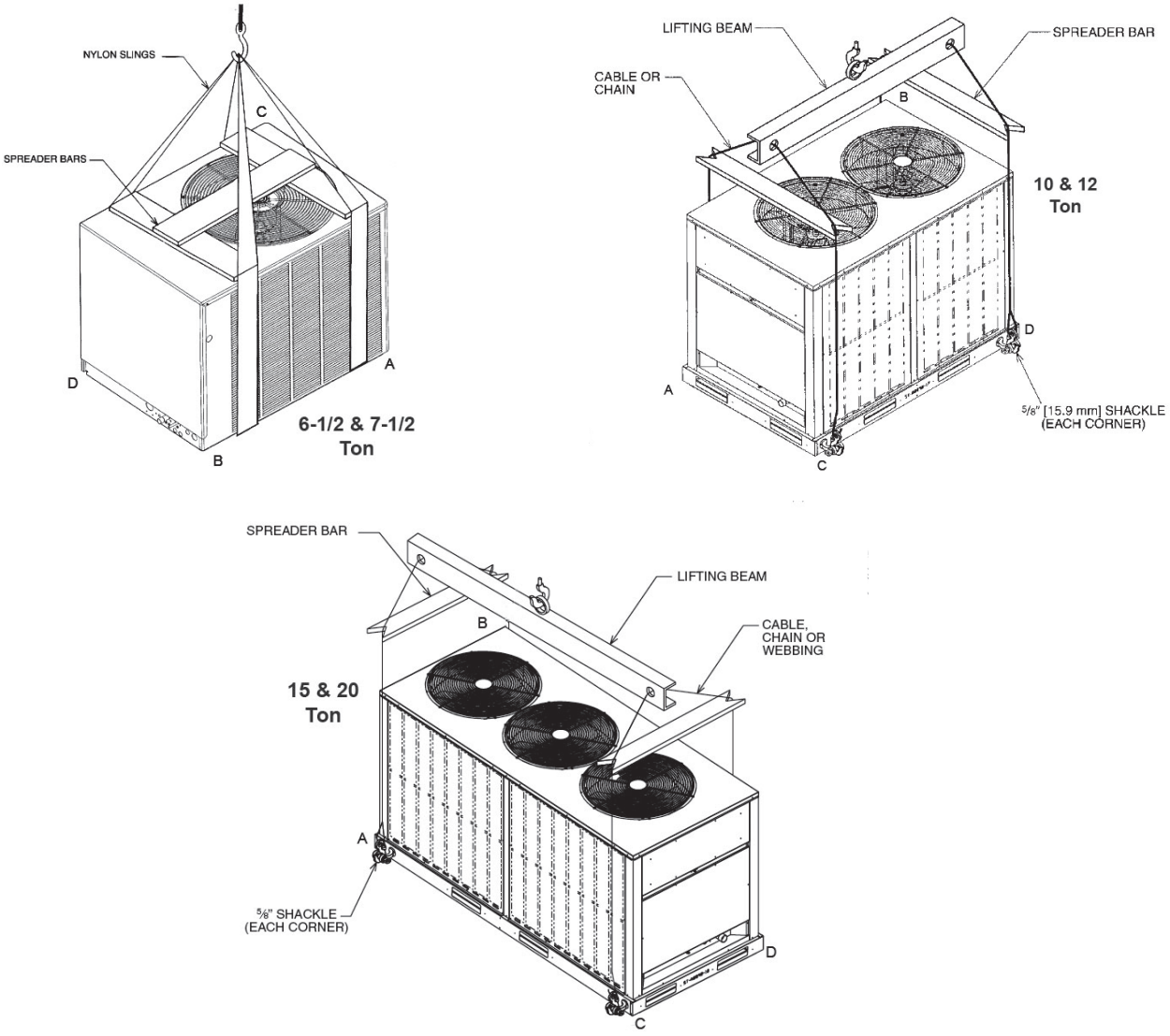
Slab Installation

Condensing units should be set on a solid level foundation. When installed at ground level, the unit should be placed on a 6" cement slab. If the pad is formed at the installation site, do not pour the pad tight against the structure, otherwise vibration will be transmitted from the unit through the pad.

Table 7: RCS 06F and 07F Operating Weights

RCS model	Total weight lbs. [kg]	Corner weight lbs. [kg]			
		A	B	C	D
06F	291 [132]	50 [22.7]	73 [33.1]	69 [31.3]	99 [44.9]
07F	318 [144]	53 [24.0]	84 [38.1]	71 [32.2]	110 [49.9]
10F (Single)	501 [228]	123 [53.9]	132 [60.0]	119 [54.1]	127 [58.0]
11F (Tandem)	586 [266]	144 [65.3]	154 [69.9]	139 [63.2]	149 [67.6]
12F	650 [293]	160 [72.0]	171 [78.0]	154 [70.0]	165 [75.0]
15F	746 [338.0]	183 [83.0]	196 [89.0]	177 [80.0]	189 [86.0]
20F	952 [432.0]	234 [106.0]	251 [114.0]	226 [103.0]	241 [110.0]

Figure 9: Rigging



Installation of Piping

⚠ WARNING

Do not use oxygen to purge lines or pressure system for leak test. Oxygen reacts violently with oil, which can cause an explosion resulting in severe personal injury or death.

NOTE: The condensing unit is shipped with a holding charge of dry nitrogen which must be purged from the unit before evacuation.

Once located, the condensing unit is ready to be interconnected with the evaporator using ONLY refrigeration grade dehydrated tubing.The following should be considered when connecting the tubing.

1. Pitch vapor line toward the compressor approximately 1/2" every 10 feet to facilitate oil return.
2. It is recommended that the sight glass, filter drier and liquid line solenoid valve be installed in the liquid line just prior to the evaporator.
3. Silver solder (such as silfos, Easy Flow, etc.) should be used for all refrigerant joints.
4. Thoroughly clean all joints before fluxing. DO NOT USE ACID FLUX.
5. When fluxing, limit the application of paste to the minimum and always apply flux to the male portion of the connection.
6. Vapor lines should be insulated to prevent condensate drip. Use insulation of at least 3/8" wall thickness. The insulation should be installed on the tubing prior to making the sweat connections.
7. Insulate the liquid line whenever the heat pickup or transfer can affect the subcooling.
8. Care should be taken to avoid transmission of noise or vibration to building structure.

Table 8: Refrigerant Piping Data

Equivalent Length, ft. [m] of Straight Type "L" Tubing for Nonferrous Valves/Fittings (Brazed)						
Tube Size, O.D.	**Solenoid Valve**	**Angle Valve**	**Short Radius Ell**	**Long Radius Ell**	**Tee Line Flow**	**Tee Branch Flow**
1/2	70 [21.3]	8.3 [2.5]	1.6 [0.5]	1.0 [0.3]	1.0 [0.3]	3.1 [0.9]
5/8	72 [21.9]	10.4 [3.2]	1.9 [0.6]	1.2 [0.4]	1.2 [0.4]	3.6 [1.1]
3/4	75 [22.9]	12.5 [3.8]	2.1 [0.7]	1.4 [0.4]	1.4 [0.4]	4.2 [1.3]
7/8	78 [23.8]	14.6 [4.4]	2.4 [0.7]	1.6 [0.5]	1.6 [0.5]	4.8 [1.5]
1-1/8	—	18.8 [5.7]	3.0 [0.9]	2.0 [0.6]	2.0 [0.6]	6.0 [1.8]
1-3/8	—	22.9 [7.0]	3.6 [1.1]	2.4 [0.7]	2.4 [0.7]	7.2 [2.2]
1-5/8	—	27.1 [8.3]	4.2 [1.3]	2.8 [0.8]	2.8 [0.8]	8.4 [2.6]
2-1/8	—	35.4 [10.8]	5.3 [1.6]	3.5 [1.1]	10.7 [3.3]	10.7 [3.3]

Typical Piping Recommendations

The following will be of help in accomplishing a successful

1. Size liquid line for no more than 10°F loss which corresponds to approximately 3 psig pressure drop.
2. Size vapor lines for no more than 2°F loss which corresponds to approximately 3 psig pressure drop.
3. Install sight glass, filter drier and solenoid valve in liquid line adjacent to evaporator. Filter drier should be between the condensing unit and sight glass.
4. Pitch all horizontal vapor lines downward in the direction of flow (1/2" to 10 ft. run).
5. When making up refrigerant piping, take every precaution to prevent dirt and moisture from entering the piping.
6. Locate the condensing unit and evaporator(s) as close together as possible to minimize piping runs.
7. Liquid or vapor lifts not to exceed 60 ft.
8. To prevent suction line breakage due to vibration and to prevent tubing noise transmission into the conditioned space, the suction clamp must be installed after tubing is brazed as illustrated in Figure 10.

Figure 10: Suction Clamp

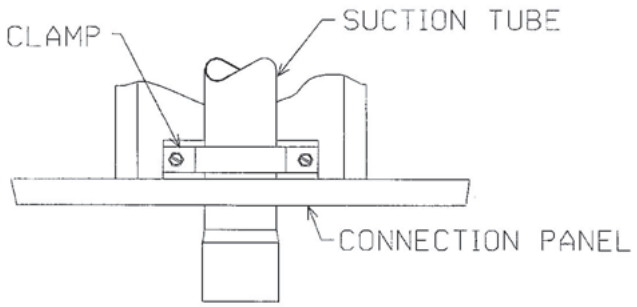
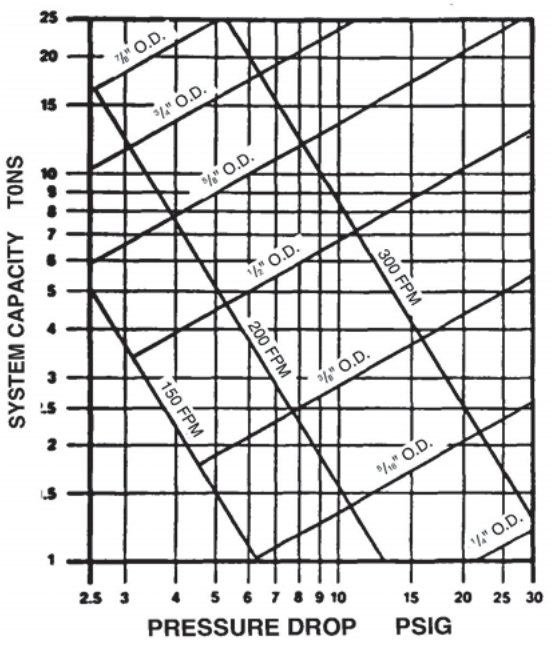


Table 9: Recommended Vapor and Liquid Line Sizes for Various Lengths of Run

Recommended Vapor and Liquid Line Sizes for Various Lengths of Run														
Equivalent Length to Evaporator (ft)	Cooling Model													
	Liquid Line O.D. Sizes (in)							Vapor Line O.D. Sizes (in)						
	6	7	10	11	12	15	20	6	7	10	11	12	15	20
0 to 15	1/2	1/2	5/8	5/8	5/8	5/8	7/8	1-1/8	1-1/8	1-3/8	1-3/8	1-3/8	1-5/8	1-5/8
16 to 50	1/2	1/2	5/8	5/8	5/8	5/8	7/8	1-1/8	1-1/8	1-3/8	1-3/8	1-5/8	1-5/8	1-5/8
51 to 100	1/2	1/2	5/8	5/8	5/8	3/4	7/8	1-1/8	1-3/8	1-3/8	1-3/8	1-5/8	1-5/8	2-1/8
101 to 150	1/2	1/2	5/8	5/8	5/8	3/4	7/8	1-3/8	1-3/8	1-5/8	1-5/8	2-1/8	2-1/8	2-1/8

NOTE: Line length between condenser and evaporator (suction and liquid) not to exceed 150' equivalent length.

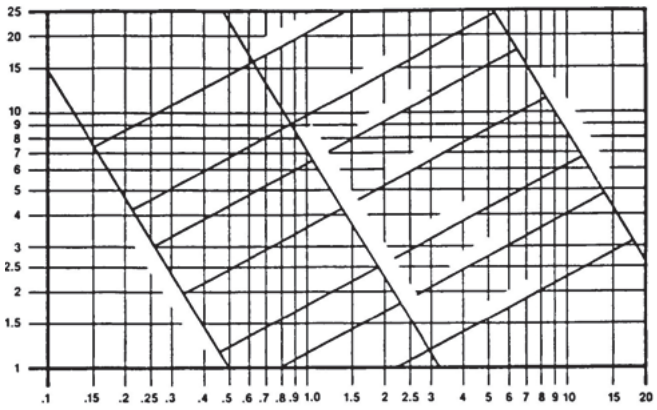
Figure 11: Liquid Line Pressure Drop Per 100 Feet Equivalent Length (Type L Copper Tubing)



Note:

1. When evaporator coil is above condenser, the pressure drop due to vertical lift (0.5 PSIG per foot of lift) must be added to the pressure drop derived from this curve.
2. Size liquid line for no more than 10°F loss (approximately 30 PSIG total pressure drop).
3. Do not oversize liquid line. Oversized liquid lines add significantly to the amount of refrigerant required to charge the system.
4. The maximum recommended velocity with solenoid valves or other quick closing devices in the liquid line is 300 FPM.

Figure 12: Suction Line System Capacity Loss In Percent Per 100 Feet Equivalent Length (Type L Copper Tubing)



Note:

1. The minimum velocity line (700 fpm) is recommended for cooling only units with vertical or horizontal run refrigerant lines.
2. For suction pressure drop (PSIG), multiply percent (%) loss by 1.18.

Figure 13: Typical Drain Piping

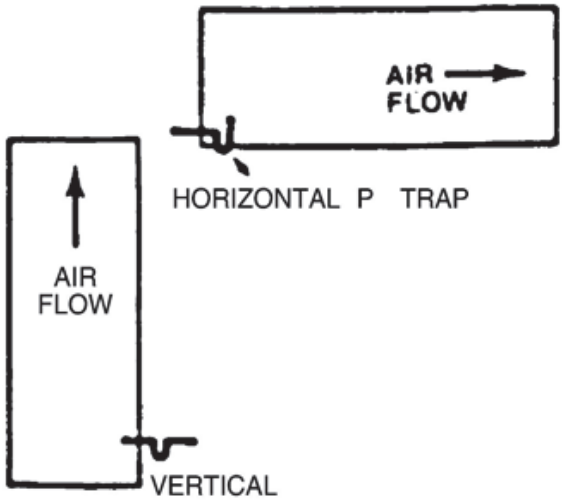


Figure 14: Coil Above Condensing Unit

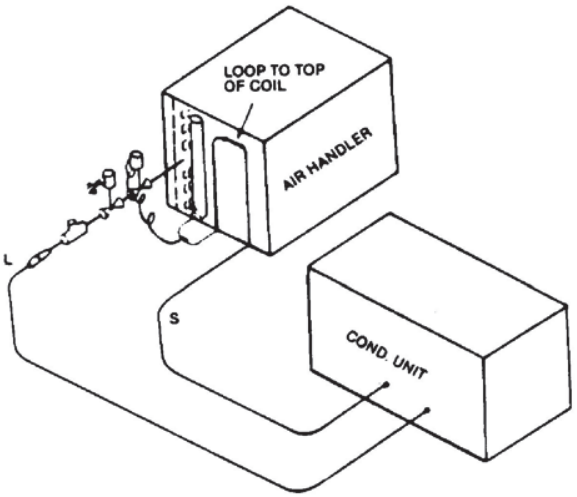
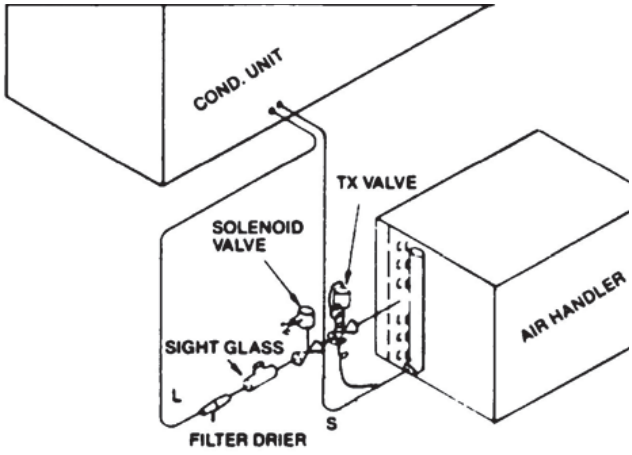


Figure 15: Coil Below Condensing Unit



NOTE: PIPING ACCESSORIES SHOWN SHOULD BE MOUNTED AS CLOSE TO AIR HANDLER AS POSSIBLE.

Electrical Wiring

NOTE: Field wiring must comply with the National Electric Code (CEC in Canada) and any local ordinance that may apply.

Electrical Power

It is important that proper electrical power is available at the unit. Voltage must not vary more than 10% from that stamped on the rating plate. (See Table 6 on page 9 for minimum and maximum voltage.) Interphase voltage variation on three-phase units must not be more than 3%. Contact local power company for correction of improper voltage or phase unbalance.

Important: Models equipped with scroll compressors must be phased correctly for proper compressor rotation. If the compressor is noisy or if suction and discharge pressures do not appear normal, reverse any two power leads to the unit. Extended run time in reverse rotation will damage the compressor and lead to premature failure.

Power Wiring

Power wiring should be run in grounded rain-tight conduit. See Table 6 for wire ampacity and proper wire size.

Wire Routing

POWER WIRING MUST BE RUN IN CONDUIT. Conduit must be run through the connector panel below the service cover and attached to the bottom of the control box.

If low (extra-low in Canada) voltage control wire is run in conduit with power supply, Class I insulation is required. If run separate, Class II is required. Low voltage wiring may be run through the insulated bushing provided in the 7/8" hole in the connector panel, then route to the control box.

⚠ WARNING

After completing wiring, check all electrical connections, including factory wiring within the unit. Make sure all connections are tight. eplace and secure all electrical box covers and access doors before leaving the unit or turning on power to the unit. Failure to do so can cause a fire or electrical shock resulting in property damage, personal injury or death.

Table 10: Field Wire Size for 24 Volt Thermostat

Thermostat Load Amps	Solid Copper Wire –AWG				
3.0	16	12	10	10	10
2.5	16	12	12	10	10
2.0	18	14	12	12	10
Length of Run, ft(1)	50	150	200	250	300

(1) Wire length equals twice the run distance.

Grounding

A grounding lug is provided in control box for a ground wire. Grounding also may be accomplished by grounding the power line conduit to the unit.

⚠ WARNING

This unit must be permanently grounded. A ground lug is provided near the contactor for a ground wire. Failure to do so can cause a fire or electrical shock resulting in property damage, severe personal injury or death.

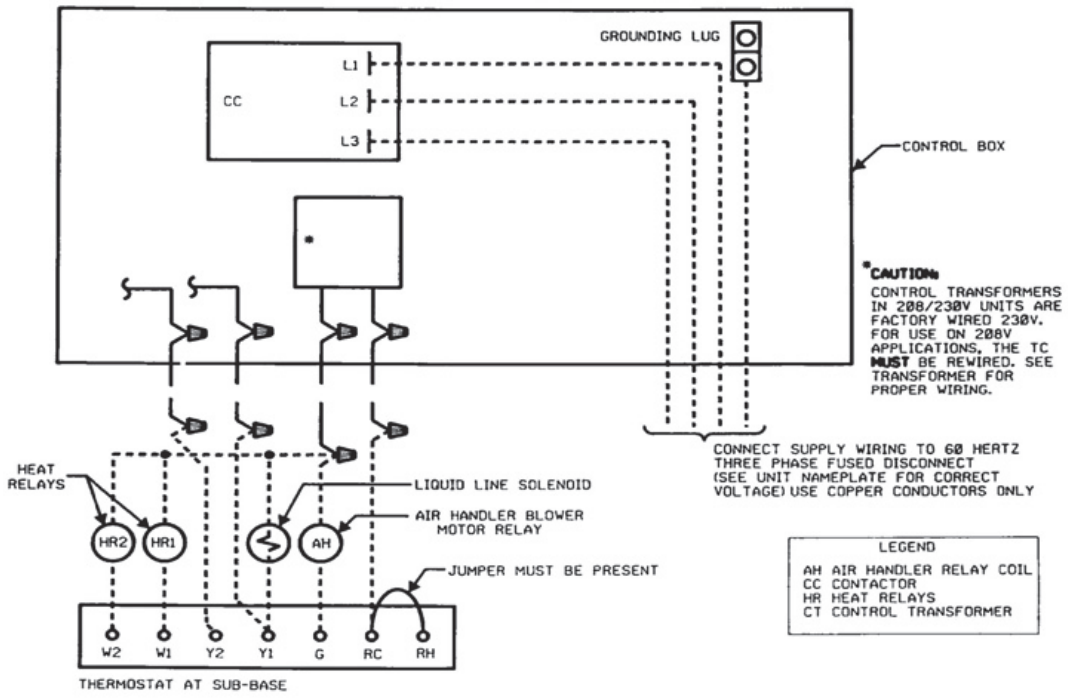
Thermostat

An appropriate thermostat should be mounted on an inside wall in a location where it will not be affected by the sun or drafts, from open doors or other sources. Install, level, and after installation check the thermostat calibration and recalibrate if necessary. Refer to thermostat manufacturer's information for additional installation, checkout and operation instructions.

Table 11: Copper Wire Size (1% Voltage Drop)

Circuit Ampacity	Copper Wire Gauge (75°C Insulation)				
	Distance In Feet				
	100	150	200	250	300
40	6	4	3	2	1
45	4	3	2	1	1/0
50	4	3	2	1	1/0
60	4	2	1	1/0	2/0
70	3	2	1/0	2/0	3/0
80	3	1	1/0	2/0	3/0
90	2	1/0	2/0	3/0	4/0
100	2	1/0	2/0	3/0	4/0
110	1	2/0	3/0	4/0	250
125	1	2/0	3/0	4/0	250

Figure 16: Typical Field Wiring Connections



Refrigerant Charge

Leak Testing

Pressurize line set and coil through service fittings with dry nitrogen to 150 psig maximum. Leak test all joints using liquid detergent. If a leak is found, recover pressure and repair.

⚠ WARNING

Do not use oxygen to purge lines or pressure system for leak test. Oxygen reacts violently with oil, which can cause an explosion resulting in severe personal injury or death.

Table 12: Basic System Charge*

Unit	Charge oz [g]
06F	178 [5046]
07F	242 [6861]
10F	339 [9661]
11F	300 [8505]
12F	378 [10,716]
15F	506 [14,345]
20F	655 [18,569]

Note: *System with 0 Feet of Tubing

Table 13: Required Ounces of R410A Charge per Foot of Tubing

Tube Size O.D., in [mm]	Liquid Tube, oz [g]	Vapor, oz [g]
1/2 [12.7]	1.06 [30.0]	0.04 [1.13]
5/8 [15.88]	1.65 [46.7]	0.07 [1.98]
3/4 [19.05]	2.46 [69.7]	0.10 [2.83]
7/8 [22.23]	3.28 [92.9]	0.13 [3.68]
1-1/8 [28.58]	—	0.22 [6.23]
1-3/8 [34.93]	—	0.34 [9.63]
1-5/8 [41.28]	—	0.48 [13.60]
2-1/8 [53.98]	—	0.84 [23.81]

Note: Quantities based on 110°F liquid and 45°F vapor

Tools Required for Installing and Servicing R410A Models

Manifold Sets:

- Up to 800 PSIG High side
- Up to 250 PSIG Low Side
- 550 PSIG Low Side Retard

Manifold Hoses:

- Service Pressure Rating of 800 PSIG

Recovery Cylinders:

- 400 PSIG Pressure Rating
- Dept. of Transportation 4BA400 or BW400

⚠ CAUTION

R410A systems operate at higher pressures than R22 systems. Do not use R22 service equipment or components on R410A equipment

Specification of R410A

Application: R410A is not a drop-in replacement for R22; equipment designs must accommodate its higher pressures. It cannot be retrofitted into R22 condensing units.

Physical Properties: R410A has an atmospheric boiling point of 62.9°F and its saturation pressure at 77°F is 224.5 psig.

Composition: R410A is an azeotropic mixture of 50% by weight difluoromethane (HFC32) and 50% by weight pentafluoroethane (HFC125).

Pressure: The pressure of R410A is approximately 60% (1.6 times) greater than R22. Recovery and recycle equipment, pumps, hoses and the like need to have design pressure ratings appropriate for R410A. Manifold sets need to range up to 800 psig high-side and 250 psig low-side with a 550 psig low-side retard. Hoses need to have a service pressure rating of 800 psig. Recovery cylinders need to have a 400 psig service pressure rating. DOT 4BA400 or BW400.

Combustibility: At pressures above 1 atmosphere, mixture of R410A and air can become combustible. R410A and air should never be mixed in tanks or supply lines, or be allowed to accumulate in storage tanks. Leak checking should never be done with a mixture of R410A and air. Leak checking can be performed safely with nitrogen or a mixture of FR410A and nitrogen.

Quick Reference Guide for R410A

- R410A refrigerant operates at approximately 60% higher pressure (1.6 times) than R22. Ensure that servicing equipment is designed to operate with R410A.
- R410A refrigerant cycles are pink in color.
- R410A, as with other HFC's is only compatible with POE oils.
- Vacuum pumps will not remove moisture from oil.
- R410A systems are to be charged with liquid refrigerants. Prior to March 1999, R410A refrigerant cylinders had a dip tube. These cylinders should be kept upright for equipment charging. Post March 1999 cylinders do not have a dip tube and should be inverted to ensure liquid charging of the equipment.
- Do not install a suction line filter drier in the liquid line.
- A liquid line filter drier is standard on every unit. Only manufacturer approved liquid line filter driers can be used. These filter driers are rated for minimum working pressure of 600 psig.
- Desiccant (drying agent) must be compatible for POE oils and R410A.

Replacement Units

To prevent failure of a new condensing unit, the existing evaporator tubing system must be correctly sized and cleaned or replaced. Care must be exercised that the expansion device is not plugged. For new and replacement units, a liquid line filter drier should be installed and refrigerant tubing should be properly sized. Test the oil for acid. If positive, a suction line filter drier is mandatory.

Important: When replacing an R22 unit with an R410A unit, either replace the line set or ensure that the existing line set is thoroughly cleaned of any old oil or debris.

Evaporator Coil

Refer to evaporator coil manufacturer's installation instructions.

Important: The manufacturer is not responsible for the performance and operation of a mismatched system, or for a match listed with another manufacturer's coil.

⚠ CAUTION

Only use evaporators approved for use on R410A systems. Use of existing R22 evaporators can introduce mineral oil to the R410A refrigerant forming two different liquids and decreasing oil return to the compressor. This can result in compressor failure.

Evacuation and Charging

The evacuation of any system component that has been exposed to atmosphere or lost its charge is essential before charging. Never attempt to operate a system while it is under a vacuum.

NOTE: The condensing unit is shipped with a holding charge of dry nitrogen which must be purged from the unit before evacuation.

1. Since the condensing unit itself must be evacuated, open the vapor, discharge and liquid shut-off valves.
2. Use a refrigeration type vacuum pump capable of evacuation in the 500 micron range.
3. Connect the vacuum pump to the service manifold assembly with a pressure gauge that will read 30 inches vacuum. Connect the service manifold to the vapor line service port. ("Low" shown on label.)
4. With an accurate scale, 1/2 oz., set refrigerant tank up so its weight can be measured while in a position to charge liquid. (Unit must be OFF.) Energize liquid line solenoid valve by wiring valve to 24V power supply (or open by manual stem if applicable).
5. Connect to the liquid line service port. ("High" shown on label.) Shut off tank and evacuate the system. The pressure gauge should read at least 29.5" of vacuum.
6. Triple evacuate the system.
7. The refrigerant system will now be free of noncondensables.
8. Remove vacuum pump from 3-way valve.
9. Install refrigerant tank (liquid charging) to liquid line service valve.
10. Before tightening, purge tank and service valve hose.
11. Note weight of refrigerant tank.
12. De-energize liquid line solenoid valve. Open refrigerant tank valve. Allow pressure in tank and unit to equalize.
13. Close off service valve to liquid line service port and note weight of refrigerant tank.
14. Position tank for gas charging.
15. Rewire liquid line solenoid to thermostat control. Close main disconnect switch and turn thermostat to lowest setting.
16. Charge unit per Table 12 and Table 13.

17. Adjust refrigerant charge to obtain pressures indicated in the temperature/pressure Charging Charts starting on page 21.
18. Note weight of refrigerant tank.
19. When system has stabilized, check superheat at the suction line service valve. The actual line temperature should be 8° to 20°F higher than the saturation temperature corresponding to the vapor pressure. If superheat is measured at evaporator, the actual line temperature should be 6° to 10° higher than the saturation temperature corresponding to the vapor pressure.
20. Close service ports on vapor and liquid valves. Remove service gauges.
21. Replace service port caps and valve stem caps. These caps must be replaced to prevent leaks.
22. Record total charge quantity on rating plate.

Final Leak Testing

After the unit has been properly evacuated and charged, a halogen leak detector should be used to detect leaks in the system. All piping within the condensing unit, evaporator, and interconnecting tubing should be checked for leaks. If a leak is detected, the refrigerant should be recovered before repairing a the leak. The Clean Air Act prohibits releasing refrigerant into the atmosphere.

Table 14: Charging Hints

Symptom	Possible Cause	Remedy
High head pressure	Air flow to/from condenser restricted or dirty condenser	Remove obstruction, relocate condensing unit, if necessary clean condenser
	Faulty condenser fan or motor	Replace
	Overcharge of refrigerant	Reduce charge
	Air in system	Evacuate and recharge
Low head pressure	Short of refrigerant	Check for leak, add charge
	Low evaporator air flow	Increase blower speed, check filters
Low vapor & hot compressor	Short of refrigerant	Check for leak—add refrigerant
Excessive sweating	Low indoor airflow	Increase speed of air handler blower or reduce restriction, replace air filter
	Excess refrigerant	Slowly reduce charge

Table 15: Pre-Start Check

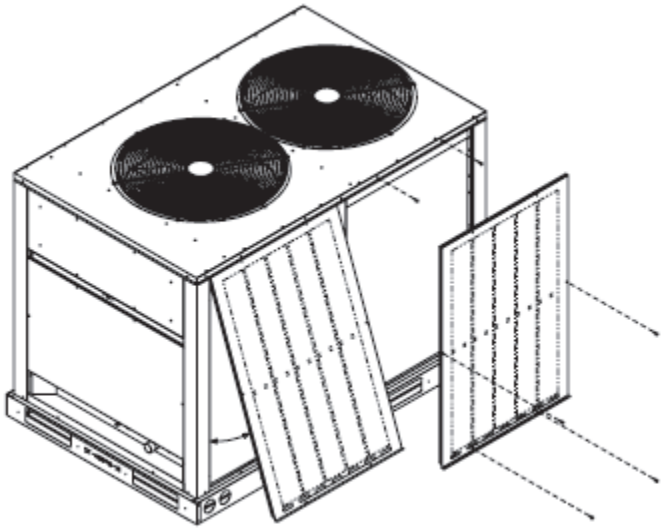
1	Is the condensing unit properly located and level?	☐ Yes	☐ No
2	Is there free air movement to and from the condensing unit?	☐ Yes	☐ No
3	Is the wiring connected according to the unit wiring diagram?	☐ Yes	☐ No
4	Are the wiring connections tight (including those in the unit and compressor electrical box)?	☐ Yes	☐ No
5	Is the unit properly grounded?	☐ Yes	☐ No
6	Is the circulating air blower correctly wired?	☐ Yes	☐ No
7	Is the condensing unit properly fused?	☐ Yes	☐ No
8	Is the thermostat level, correctly wired and in a good location?	☐ Yes	☐ No
9	Is the ductwork correctly sized, run, taped and insulated?	☐ Yes	☐ No
10	Is the refrigerant tubing neatly run and the vapor line thoroughly insulated?	☐ Yes	☐ No
11	Is the condensate drain properly sized, run, trapped and pitched?	☐ Yes	☐ No
12	Are the refrigerant connections tight and leak tested?	☐ Yes	☐ No
13	Are the filters clean and in place?	☐ Yes	☐ No
14	Does the condenser fan turn freely without rubbing?	☐ Yes	☐ No
15	Is the fan blade tight on the fan shaft?	☐ Yes	☐ No
16	Areall covers and access panels in place to prevent air loss?	☐ Yes	☐ No

Accessory Installation

Louvered Panels

1. Remove two screws from top panel where louver will install.
2. Slide top of louver panel under lip of the top panel and slide into place.
3. Attach with four screws provided.

Figure 17: Louver Removal



Optional Service Valve

1. Remove clamp securing suction line ext. tube (if applicable).
2. Remove connector panel “A”.
3. Remove suction line ext. tube by sweating at reducer/ suction line “B” (reducer required on some models and remains on suction line). Remove excess braze material from surface.
4. Slide service valve “C” onto reducer/suction line “B” (DO NOT braze at this time).
5. Install connector panel “A”.
6. Install bracket “D”.
7. Braze valve.

⚠ IMPORTANT

Refrigerant Piping: A qualified Architect or Systems HVAC Design Engineer familiar with refrigerant piping design, as well as local codes and regulations, must provide refrigerant piping design. The following manufacturer recommendations serve as a general guide and should not replace a qualified professional's refrigerant piping system design.

⚠ IMPORTANT

Chilled Water Piping: A qualified Architect or Systems HVAC Design Engineer familiar with piping design, local codes and regulations, must provide piping design. The following manufacturer recommendations serve as a general guide and should not replace a qualified professional's piping system design.

- All access panels must be in place when unit is in operation.
- For maximum efficiency, the condenser coil must be kept clean. Periodic inspections, depending on local conditions are recommended. If it is necessary to clean the condenser coil, use a common garden hose.
- Never operate the unit without filters installed in the air handler.

Crankcase Heaters

All units are equipped with crankcase heaters that are factory wired to operate whenever the main power supply to the unit is "ON" and compressors are "OFF". Before starting the equipment after prolonged shutdown or at the time of initial start-up, be sure that the circuits to the condensing units are closed for at least 24 hours.

Contactor

The contactor is an electrical switch which operates the compressor and condenser fans. Relay activates contactor when safety circuit is made.

High Pressure Switch (HPC)

Opens the contactor circuit on high refrigerant pressure - Manual Reset - check for cause of tripping before putting unit back in service.

⚠ WARNING

Do not wire around the high pressure switch. 15 ton unit compressors are not provided with internal pressure relief means. Failure to follow this warning can cause an explosion resulting in personal injury or death.

Low Pressure Switch (LPC)

Acts as safety against loss of refrigerant.

Relay (R)

Energizes the compressor contactor when safety circuit is made.

Replacement Parts

To find your local Daikin McQuay Certified Parts Distributor, go to www.DaikinMcQuay.com and select Parts Locator.

Charge Information

Refer to the appropriate Charging Charts starting on page 21.

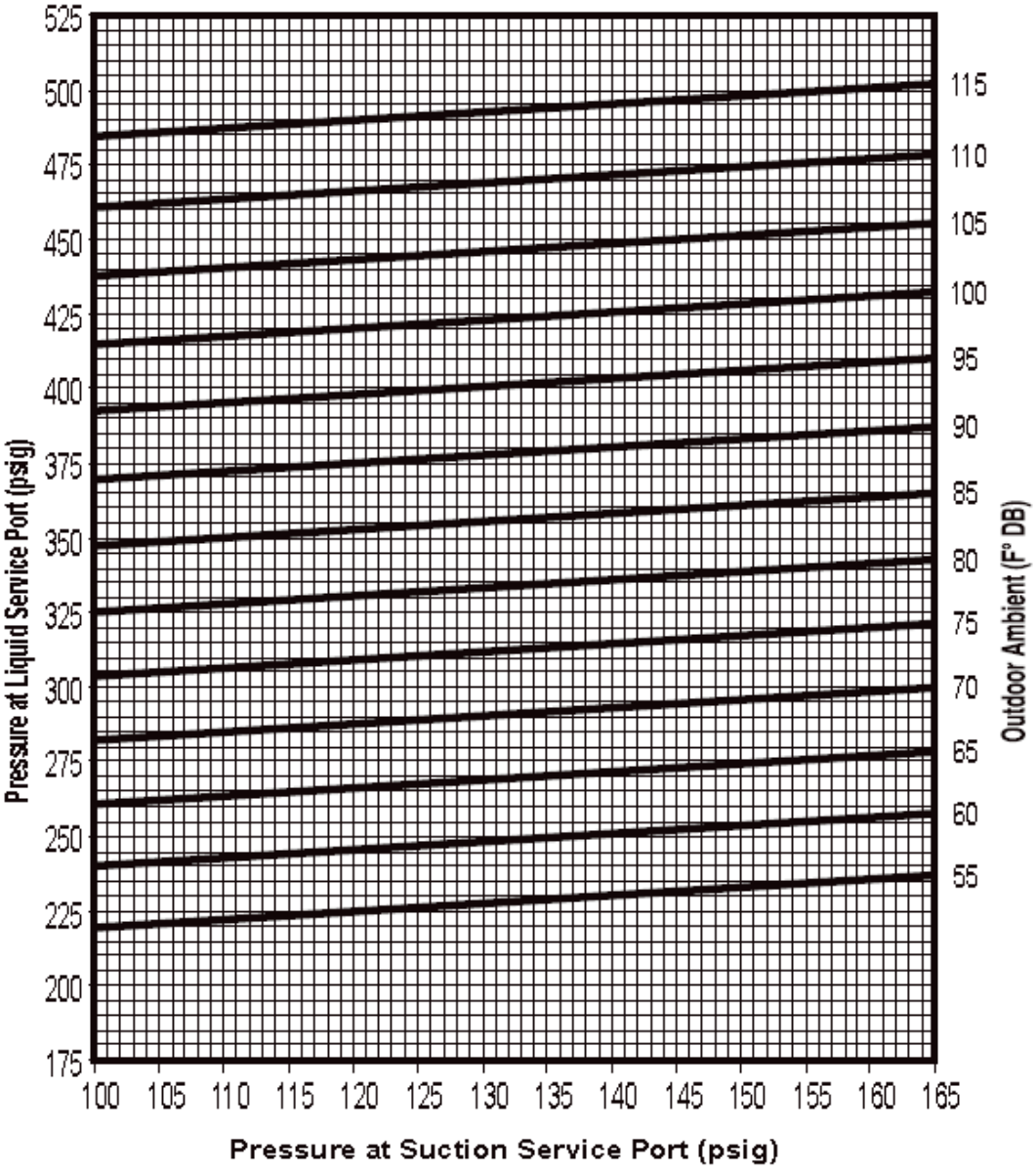
Wiring Diagrams

Refer to the appropriate Wiring Diagrams starting on page 27.

Troubleshooting

Refer to the troubleshooting chart Table 15 on page 18.

Figure 18: 6-1/2 Ton Charging Charts



REQUIRED OUNCES R-410A CHARGE PER FOOT OF TUBING		
TUBE SIZE O.D. IN.	LIQUID LINE	VAPOR LINE
1/2	1.06	
5/8	1.65	
1-1/8		.22
1-3/8		.34

REFRIGERANT REQUIRED: 178 OZ. WITH 0 FT. OF SUCTION AND LIQUID LINE.

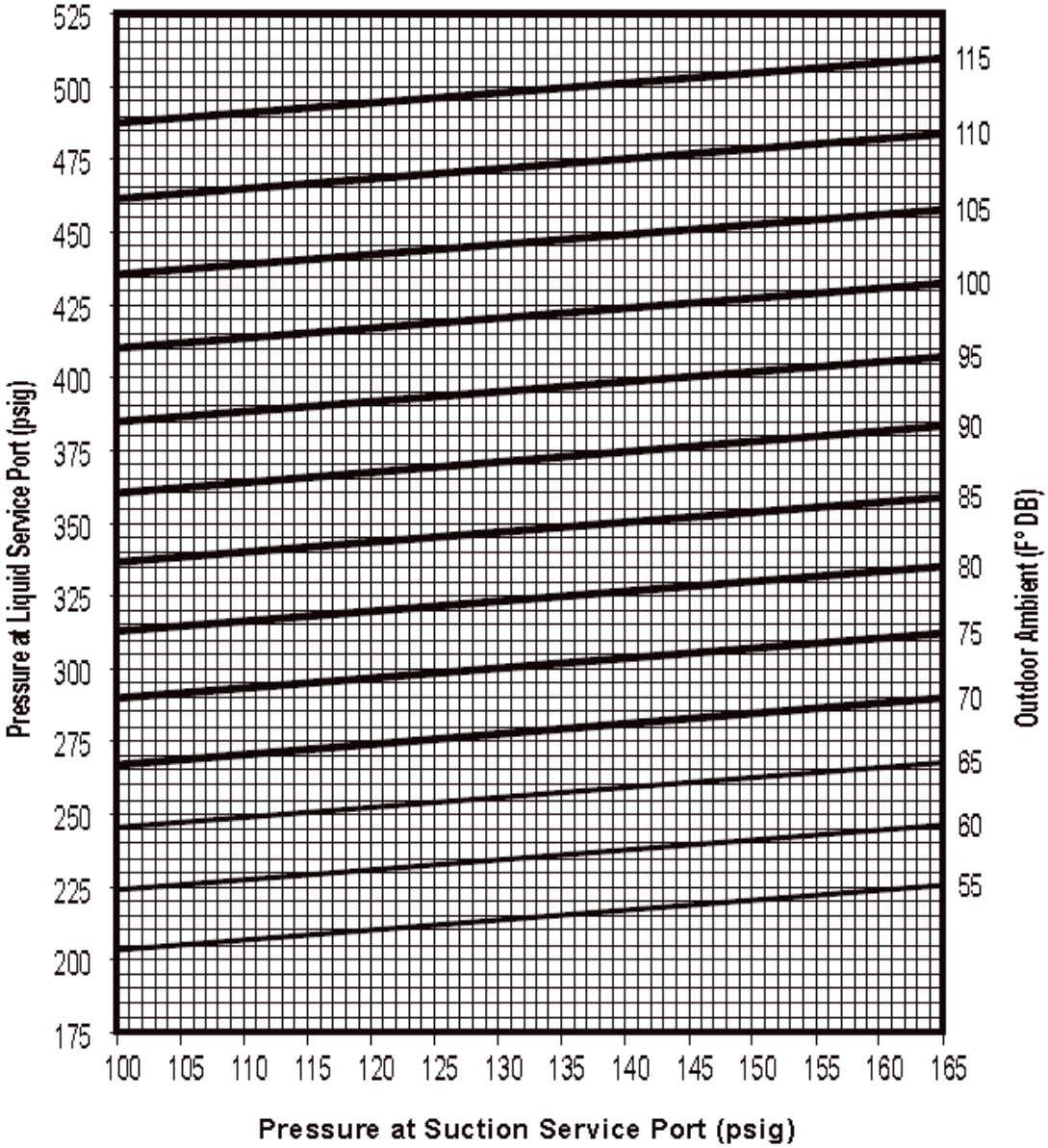
CAUTION: BEFORE FINAL REFRIGERANT CHECK, INDOOR AIR TEMPERATURE SHOULD BE AT COMFORT CONDITIONS FOR MOST ACCURATE RESULTS.

INSTRUCTIONS:

1. CONNECT PRESSURE GUAGES TO SUCTION AND LIQUID PORTS ON UNIT.
2. MEASURE AIR TEMPERATURE TO OUTDOOR COIL.
3. PLACE AN "X" ON THE APPROPRIATE CHART WHERE THE SUCTION AND LIQUID PRESSURES CROSS.
4. IF "X" IS BELOW AMBIENT TEMPERATURE LINE, ADD CHARGE AND REPEAT STEP 3.
5. IF "X" IS ABOVE AMBIENT TEMPERATURE LINE, RECOVER EXCESS CHARGE AND REPEAT STEP 3.
6. IF CONDENSER FANS ARE NOT RUNNING, THE HEAD PRESSURE CONTROL MAY REQUIRE JUMPERING.

Charging Charts

Figure 19: 7-1/2 Ton Charging Chart



REQUIRED OUNCES R-410A CHARGE PER FOOT OF TUBING		
TUBE SIZE O.D. IN.	LIQUID LINE	VAPOR LINE
1/2	1.06	
5/8	1.65	
1-1/8		.22
1-3/8		.34

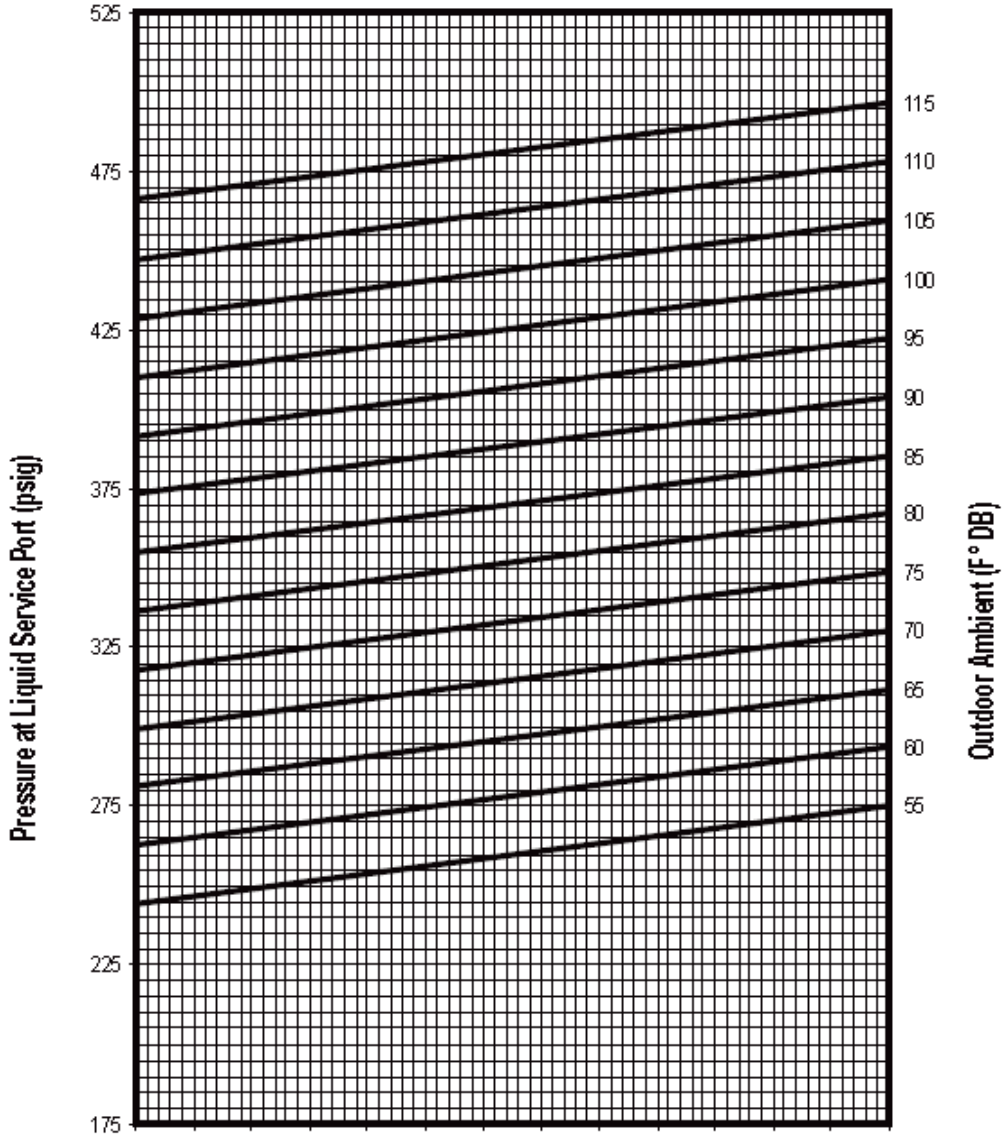
REFRIGERANT REQUIRED: 239 OZ. WITH 0 FT. OF SUCTION AND LIQUID LINE

CAUTION: BEFORE FINAL REFRIGERANT CHECK, INDOOR AIR TEMPERATURE SHOULD BE AT COMFORT CONDITIONS FOR MOST ACCURATE RESULTS.

INSTRUCTIONS:

1. CONNECT PRESSURE GUAGES TO SUCTION AND LIQUID PORTS ON UNIT.
2. MEASURE AIR TEMPERATURE TO OUTDOOR COIL.
3. PLACE AN "X" ON THE APPROPRIATE CHART WHERE THE SUCTION AND LIQUID PRESSURES CROSS.
4. IF "X" IS BELOW AMBIENT TEMPERATURE LINE, ADD CHARGE AND REPEAT STEP 3.
5. IF "X" IS ABOVE AMBIENT TEMPERATURE LINE, RECOVER EXCESS CHARGE AND REPEAT STEP 3.
6. IF CONDENSER FANS ARE NOT RUNNING, THE HEAD PRESSURE CONTROL MAY REQUIRE JUMPERING.

Figure 20: 10 Ton Charging Chart



REQUIRED OUNCES R-410A CHARGE PER FOOT OF TUBING		
TUBE SIZE O.D.IN.	LIQUID LINE	VAPOR LINE
1/2	1.06	
5/8	1.65	
1-1/8		.22
1-3/8		.34

REFRIGERANT REQUIRED: 300 OZ. WITH 0 FT. OF SUCTION AND LIQUID LINE.

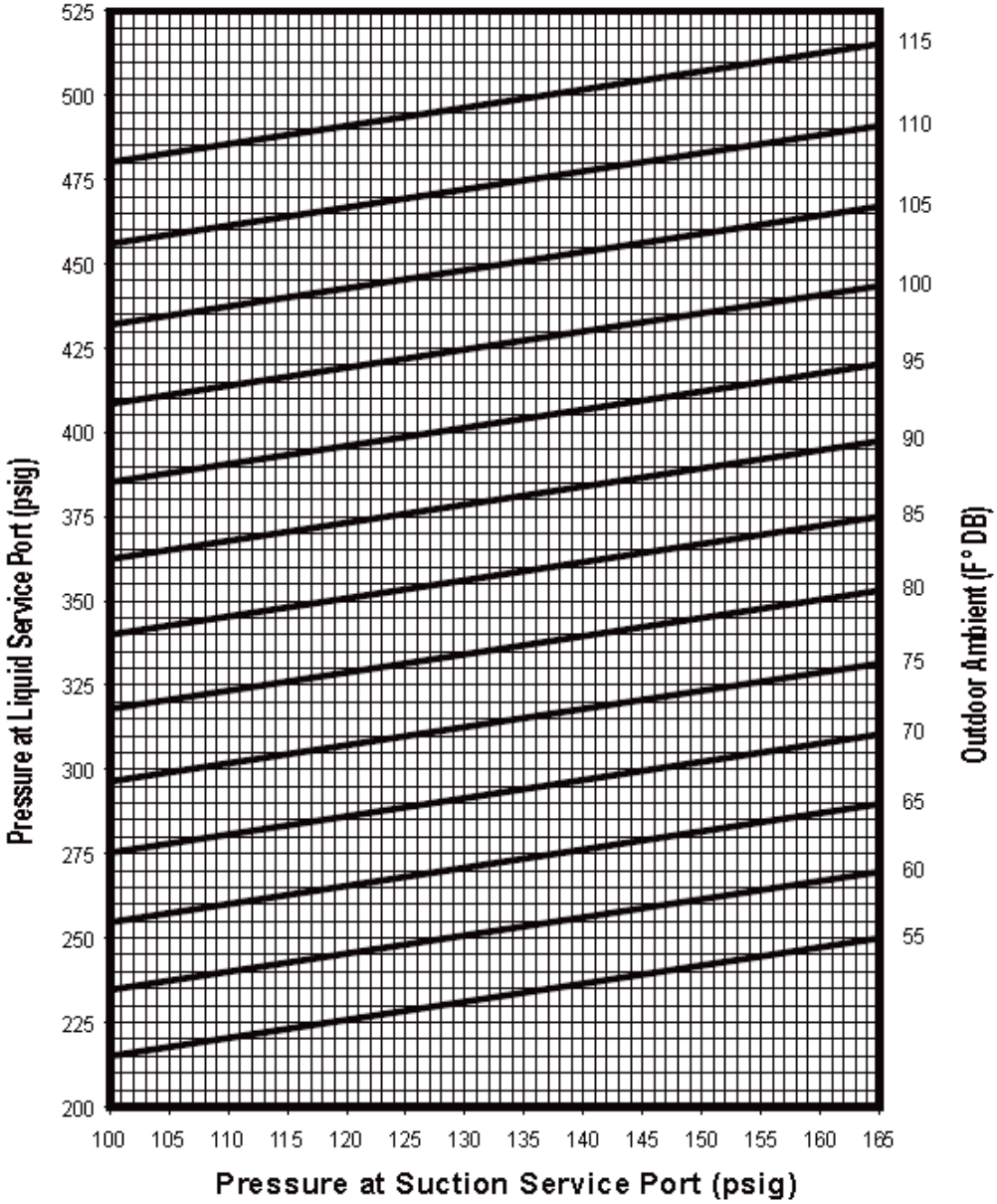
CAUTION: BEFORE FINAL REFRIGERANT CHECK, INDOOR AIR TEMPERATURE SHOULD BE AT COMFORT CONDITIONS FOR MOST ACCURATE RESULTS.

INSTRUCTIONS:

1. CONNECT PRESSURE GUAGES TO SUCTION AND LIQUID PORTS ON UNIT.
2. MEASURE AIR TEMPERATURE TO OUTDOOR COIL.
3. PLACE AN "X" ON THE APPROPRIATE CHART WHERE THE SUCTION AND LIQUID PRESSURES CROSS.
4. IF "X" IS BELOW AMBIENT TEMPERATURE LINE, ADD CHARGE AND REPEAT STEP 3.
5. IF "X" IS ABOVE AMBIENT TEMPERATURE LINE, RECOVER EXCESS CHARGE AND REPEAT STEP 3.
6. IF CONDENSER FANS ARE NOT RUNNING, THE HEAD PRESSURE CONTROL MAY REQUIRE JUMPERING.

Charging Charts

Figure 21: 12 Ton Charging Chart



REQUIRED OUNCES R-410A CHARGE PER FOOT OF TUBING		
TUBE SIZE O.D.IN.	LIQUID LINE	VAPOR LINE
1/2	1.06	
5/8	1.65	
1-1/8		.22
1-3/8		.34

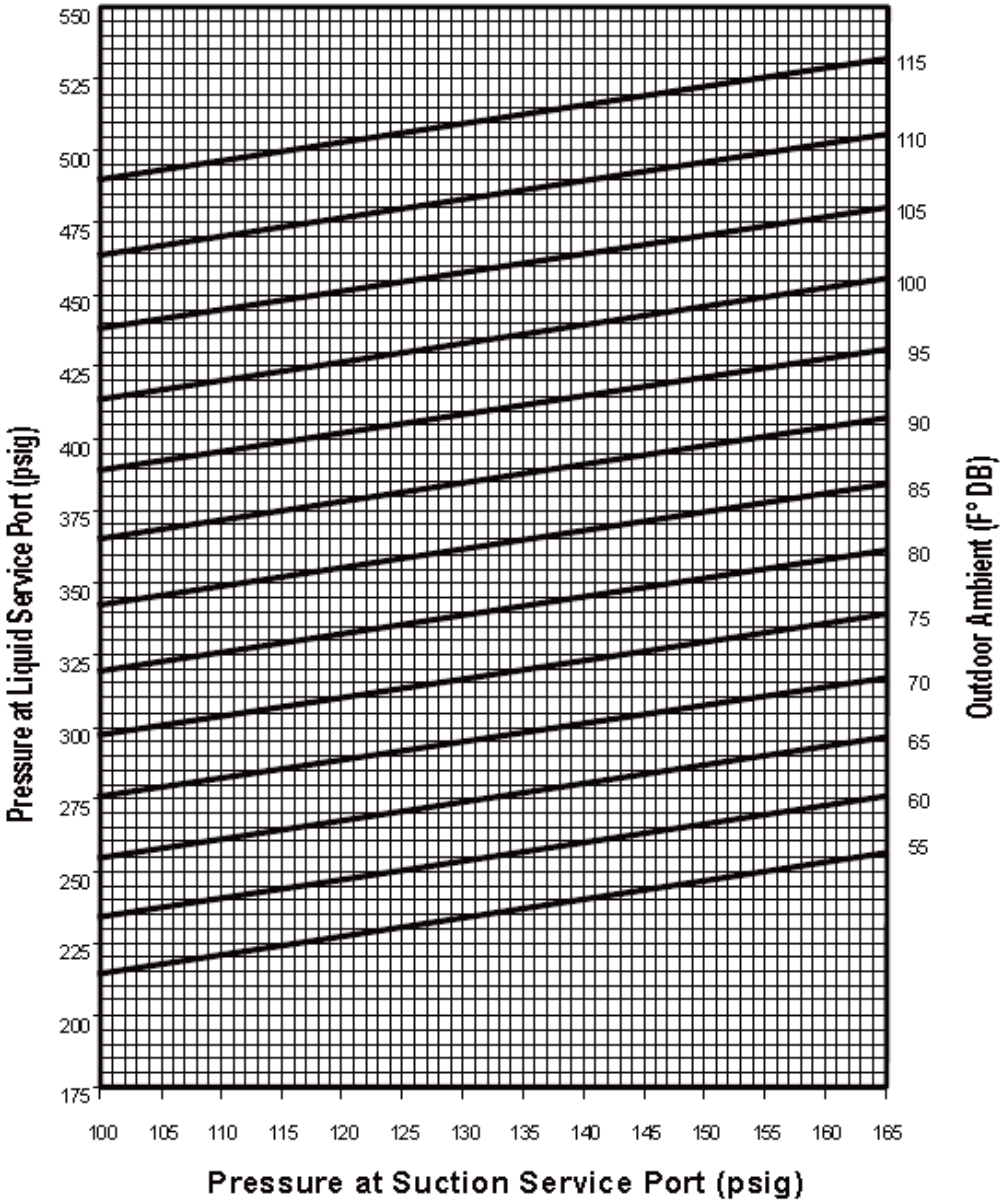
REFRIGERANT REQUIRED: 378 OZ. WITH 0 FT. OF SUCTION AND LIQUID LINE.

CAUTION: BEFORE FINAL REFRIGERANT CHECK, INDOOR AIR TEMPERATURE SHOULD BE AT COMFORT CONDITIONS FOR MOST ACCURATE RESULTS.

INSTRUCTIONS:

1. CONNECT PRESSURE GUAGES TO SUCTION AND LIQUID PORTS ON UNIT.
2. MEASURE AIR TEMPERATURE TO OUTDOOR COIL.
3. PLACE AN "X" ON THE APPROPRIATE CHART WHERE THE SUCTION AND LIQUID PRESSURES CROSS.
4. IF "X" IS BELOW AMBIENT TEMPERATURE LINE, ADD CHARGE AND REPEAT STEP 3.
5. IF "X" IS ABOVE AMBIENT TEMPERATURE LINE, RECOVER EXCESS CHARGE AND REPEAT STEP 3.
6. IF CONDENSER FANS ARE NOT RUNNING, THE HEAD PRESSURE CONTROL MAY REQUIRE JUMPERING.

Figure 22: 15 Ton Charging Chart



REQUIRED OUNCES R-410A CHARGE PER FOOT OF TUBING		
TUBE SIZE O.D. IN.	LIQUID LINE	VAPOR LINE
1/2	1.06	
5/8	1.65	
1-1/8		.22
1-3/8		.34

REFRIGERANT REQUIRED: 506 OZ. WITH 0 F.T. OF SUCTION AND LIQUID LINE.

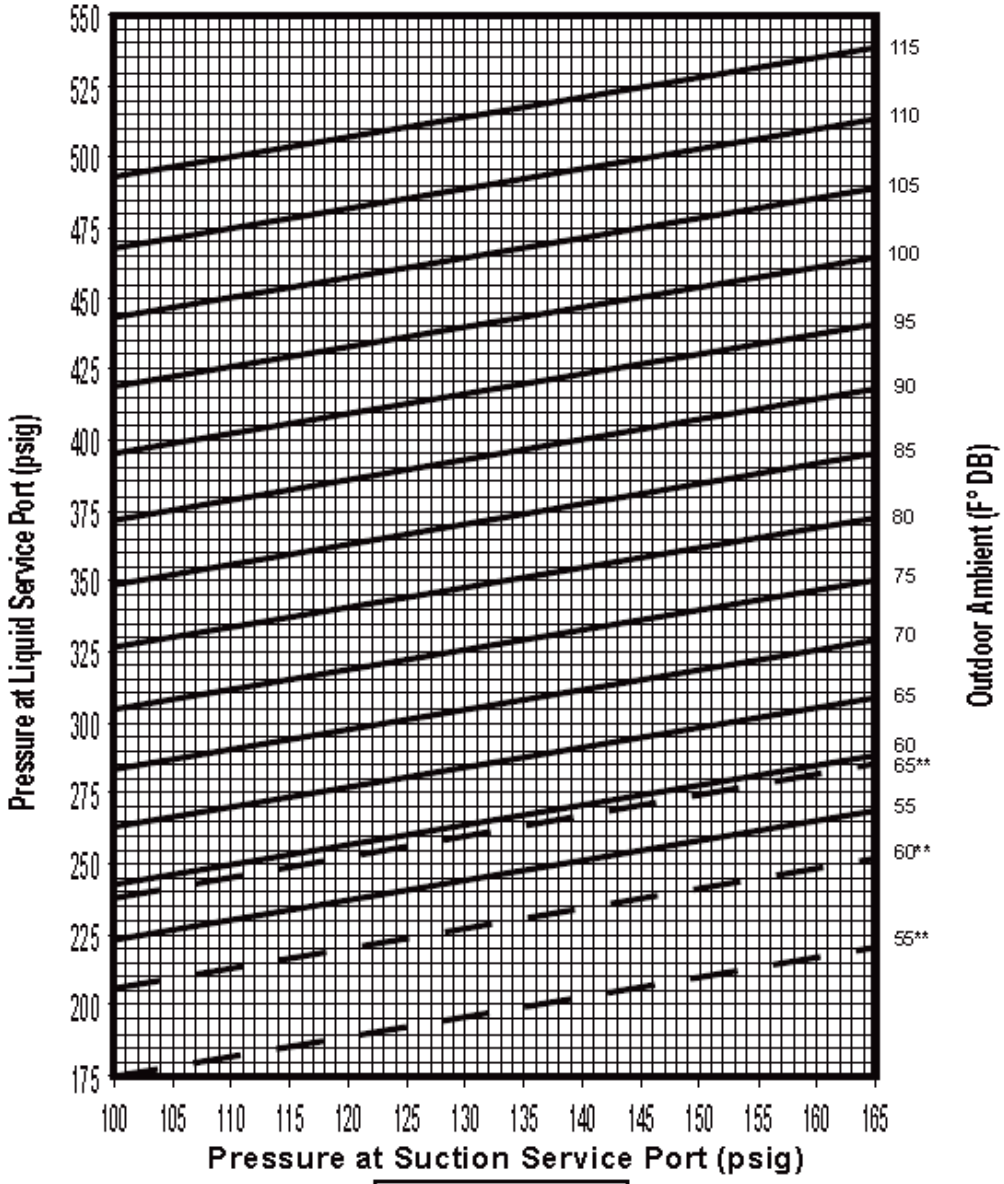
CAUTION: BEFORE FINAL REFRIGERANT CHECK, INDOOR AIR TEMPERATURE SHOULD BE AT COMFORT CONDITIONS FOR MOST ACCURATE RESULTS.

INSTRUCTIONS:

1. CONNECT PRESSURE GUAGES TO SUCTION AND LIQUID PORTS ON UNIT.
2. MEASURE AIR TEMPERATURE TO OUTDOOR COIL.
3. PLACE AN "X" ON THE APPROPRIATE CHART WHERE THE SUCTION AND LIQUID PRESSURES CROSS.
4. IF "X" IS BELOW AMBIENT TEMPERATURE LINE, ADD CHARGE AND REPEAT STEP 3.
5. IF "X" IS ABOVE AMBIENT TEMPERATURE LINE, RECOVER EXCESS CHARGE AND REPEAT STEP 3.
6. IF CONDENSER FANS ARE NOT RUNNING, THE HEAD PRESSURE CONTROL MAY REQUIRE JUMPERING.

Charging Charts

Figure 23: 20 Ton Charging Chart



REQUIRED OUNCES R-410A CHARGE PER FOOT OF TUBING		
TUBE SIZE O.D. IN.	LIQUID LINE	VAPOR LINE
1/2	1.06	
5/8	1.65	
1-1/8		.22
1-3/8		.34

REFRIGERANT REQUIRED: 655 OZ. WITH 0 FT. OF SUCTION AND LIQUID LINE.

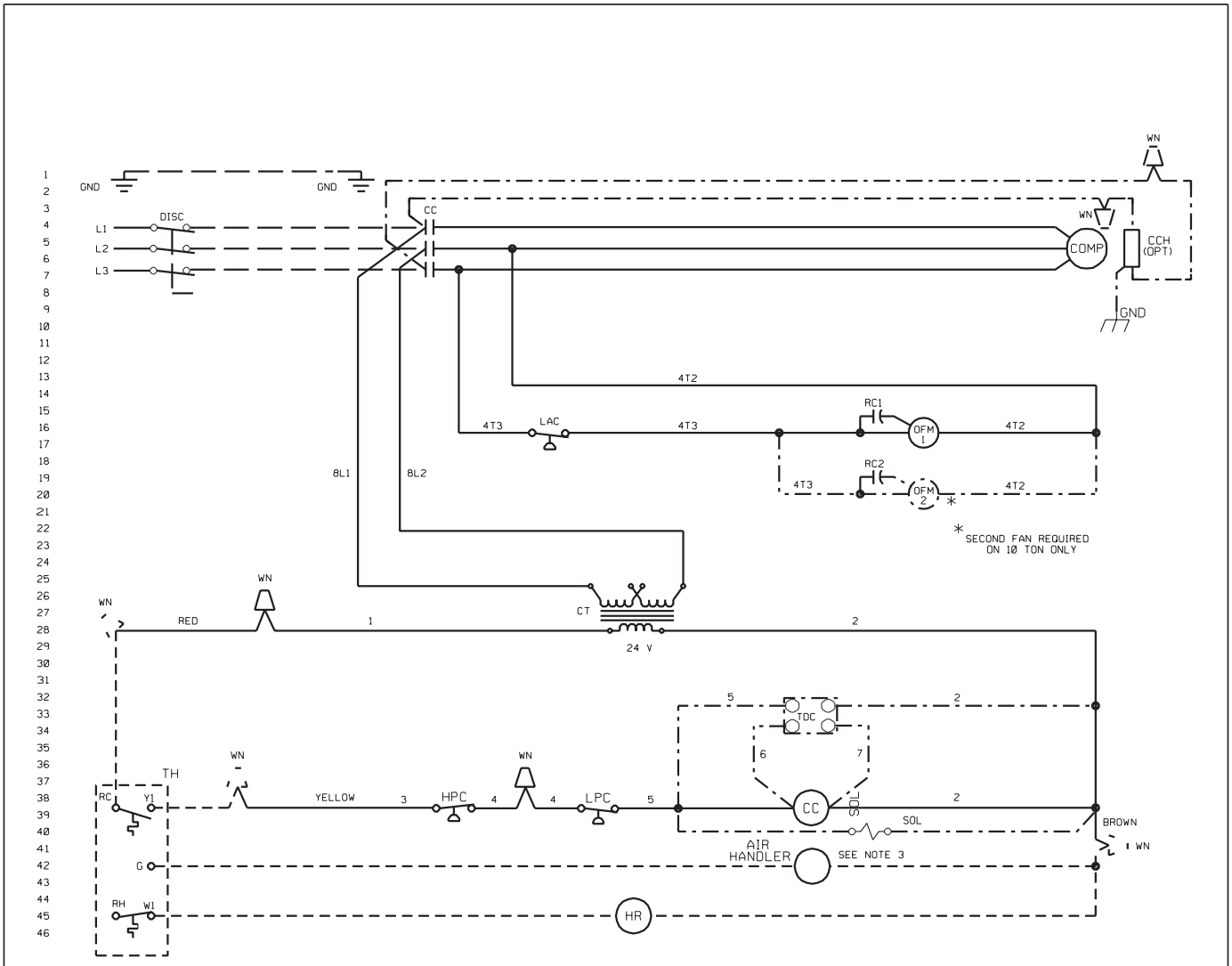
CAUTION: BEFORE FINAL REFRIGERANT CHECK, INDOOR AIR TEMPERATURE SHOULD BE AT COMFORT CONDITIONS FOR MOST ACCURATE RESULTS.

INSTRUCTIONS:

1. CONNECT PRESSURE GUAGES TO SUCTION AND LIQUID PORTS ON UNIT.
2. MEASURE AIR TEMPERATURE TO OUTDOOR COIL.
3. PLACE AN "X" ON THE APPROPRIATE CHART WHERE THE SUCTION AND LIQUID PRESSURES CROSS.
4. IF "X" IS BELOW AMBIENT TEMPERATURE LINE, ADD CHARGE AND REPEAT STEP 3.
5. IF "X" IS ABOVE AMBIENT TEMPERATURE LINE, RECOVER EXCESS CHARGE AND REPEAT STEP 3.
6. IF CONDENSER FANS ARE NOT RUNNING, THE HEAD PRESSURE CONTROL MAY REQUIRE JUMPERING.

** DOTTED LINES INDICATE ONLY 1 COMPRESSOR OPERATING.

Figure 24: Typical Wiring Schematic - RCS 06F-10F



DWG. NO. 90-42456-02 REV 14

COMPONENT CODE

CC	COMPRESSOR CONTACTOR
CCH	CRANKCASE HEATER
COMP	COMPRESSOR
CT	CONTROL TRANSFORMER
HPC	HIGH PRESSURE CONTROL
HR	HEATER RELAY
LAC	LOW AMBIENT CONTROL
LPC	LOW PRESSURE CONTROL
OFM	OUTDOOR FAN MOTOR
RC	RUN CAPACITOR
TH	THERMOSTAT (H/C)
TDC	TIME DELAY CONTROL
WN	WIRE NUT

NOTES:

1. REPLACEMENT WIRE & FUSES MUST BE SAME TYPE & SIZE AS ORIGINAL.
2. UNIT MUST BE PERMANENTLY GROUNDED & CONFORM TO N.E.C. & LOCAL CODES.
3. MAXIMUM IN RUSH VA NOT TO EXCEED 92 VA.
4. MINIMUM WIRE SIZE BASED ON 75 DEGREES C INSULATION COPPER WIRE.

WIRING INFORMATION

LINE VOLTAGE
- -FACTORY STANDARD
- -FACTORY OPTION
- -FIELD INSTALLED

LOW VOLTAGE
- -FACTORY STANDARD
- -FACTORY OPTION
- -FIELD INSTALLED

REPLACEMENT WIRE
- -MUST BE THE SAME SIZE AND TYPE OF INSULATION AS ORIGINAL (105° C MIN.)

WARNING
- -CABINET MUST BE PERMANENTLY GROUNDED AND CONFORM TO I.E.C., N.E.C., C.E.C., NATIONAL WIRING REGULATIONS, AND LOCAL CODES AS APPLICABLE.

WIRE COLOR CODE

BK__BLACK	O___ORANGE
BR__BROWN	PR__PURPLE
BL__BLUE	R___RED
G___GREEN	W___WHITE
GY__GRAY	Y___YELLOW

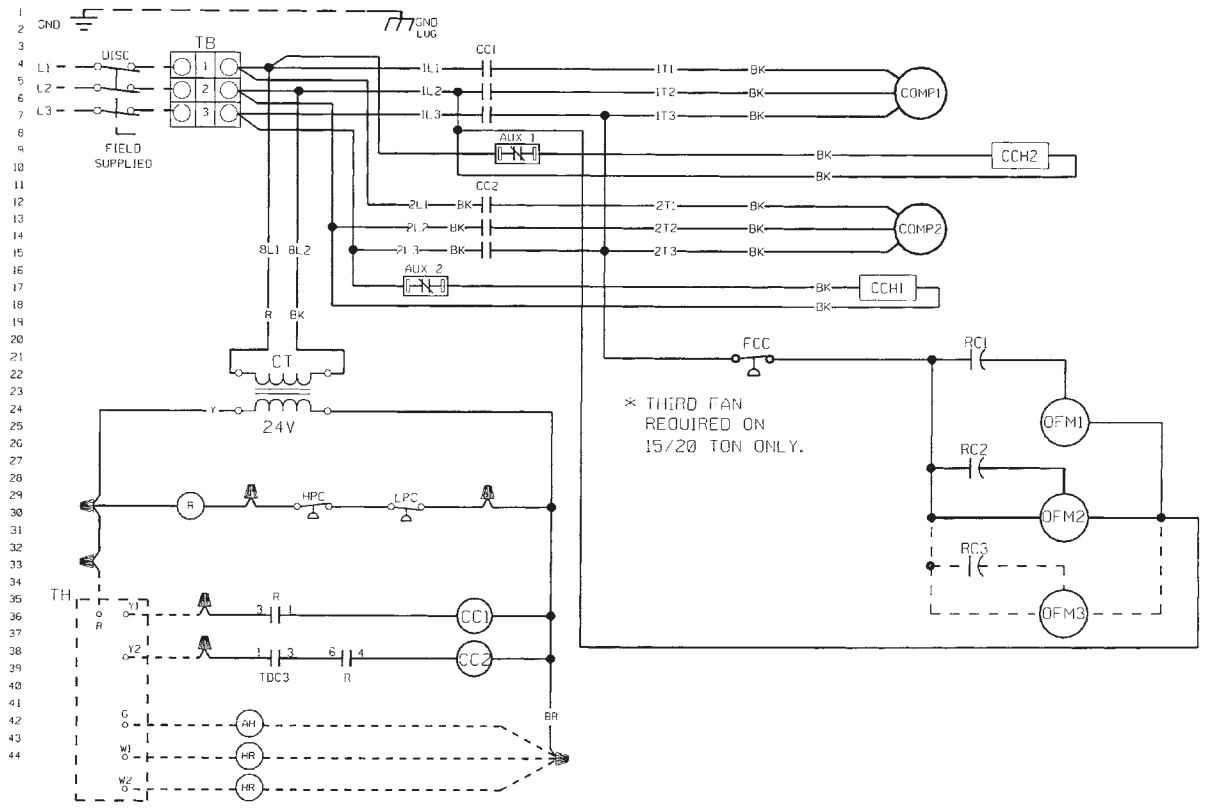
WIRING SCHEMATIC
CONDENSING UNIT

208/230, 380, 460 3PH 60Hz &
200/220, 380/415 3PH 50Hz &
6½& 7½TON - 575 3PH 60Hz

DR. BY	APP. BY	DATE	DWG. NO.	REV
MCB		8-29-90	90-42456-02	14

Wiring Diagrams

Figure 25: Typical Wiring Schematic - RCS 11F-20F



COMPONENT CODE

AH	SUPPLY FAN
CC	COMPRESSOR CONTACTOR
CCH	CRANKCASE HEATER
COMP	COMPRESSOR
CT	CONTROL TRANSFORMER
DISC	DISCONNECT SWITCH
FC	FAN MOTOR CONTACTOR
FCC	FAN CYCLE CONTROL
GND	GROUND
HR	HEATER RELAY AS NEEDED
HPC	HIGH PRESSURE CONTROL
LPC	LOW PRESSURE CONTROL
MS	METAL STRIP
OFM	OUTDOOR FAN MOTOR
RC	RUN CAPACITOR
R	RELAY
TB	TERMINAL BLOCK
TH	THERMOSTAT HEATING
TDC	TIME DELAY CONTROL
THM	MOTOR SAFETY THERMOSTAT
TOR	THERMAL OVERLOAD RELAY
	WIRE NUT

NOTES:

1. REPLACEMENT WIRE & FUSES MUST BE SAME TYPE & SIZE AS ORIGINAL.
2. UNIT MUST BE PERMANENTLY GROUNDED AND CONFORM TO N.E.C. AND LOCAL CODES.
3. MAXIMUM IN RUSH VA NOT TO EXCEED 92 VA.
4. MINIMUM WIRE SIZE BASED ON 75 DEGREES C INSULATION COPPER WIRE.

WIRING INFORMATION

1. LINE VOLTAGE
   FACTORY STANDARD
   FACTORY OPTION
   FIELD INSTALLED
2. LOW VOLTAGE
   FACTORY STANDARD
   FACTORY OPTION
   FIELD INSTALLED
3. REPLACEMENT WIRE MUST BE THE SAME SIZE AND TYPE OF INSULATION AS ORIGINAL (105°C MIN.)

WARNING
CABINET MUST BE PERMANENTLY GROUNDED AND CONFORM TO I.E.C., N.E.C. (C.E.C.-CANADA) AND LOCAL CODES AS APPLICABLE.

WIRE COLOR CODE

BK — BLACK	O — ORANGE
BR — BROWN	PR — PURPLE
BL — BLUE	R — RED
G — GREEN	W — WHITE
GY — GRAY	Y — YELLOW

WIRING SCHEMATIC
CONDENSING UNIT

208-230,
460, 575, 3 PH, 50 & 60 Hz
380, 3 PH, 60 Hz

90-42663-08-03

Replacement Parts

When contacting Daikin McQuay for service or replacement parts, provide the model number, serial number, and unit part number of the unit as stamped on the serial plate attached to the unit. For questions regarding wiring diagrams, provide the number on the specific diagram. If replacement parts are required, include the date of unit installation, the date of failure, an explanation of the malfunction, and a description of the replacement parts required.

Scroll Compressor

All Daikin McQuay Rooftop products include a first-year parts only warranty. The warranty period extends 12 months from startup or 18 months from date of shipment, whichever comes first. Labor to install these parts is not included with this warranty. Compressors are considered a part and are included in this standard warranty.

All Compressors

Replacement compressors for Daikin McQuay Rooftop Units can be obtained from the Daikin McQuay Service Parts department.

1. Contact the Daikin McQuay Parts Department for compressor availability.
2. Send a completed parts order form to the Daikin McQuay Parts Department.
3. The Parts Department processes the order and the compressors are shipped from our Dayton, OH warehouse via ground transportation. If next-day air is required, indicate this on the parts order form and a freight charge will be billed to your account. Air freight costs are not covered under the Daikin McQuay warranty.
4. After the failed compressor is replaced, return it to Daikin McQuay with a Return Goods Tag attached, which you will receive in the mail. It must be attached to the compressor. The Return Goods Tag has instructions on where to send the compressor. If the compressor is not returned, you will be billed for the replacement compressor.
5. Consideration may be given at this time to a compressor teardown analysis, depending on the history of failures.

In-Warranty Return Material Procedure

Material other than compressors may not be returned except by permission of authorized factory service personnel of Daikin McQuay at Minneapolis, Minnesota.

A “return goods” tag will be sent to be included with the returned material. Enter the information as called for on the tag in order to expedite handling at out factories and issuance of credits. All parts shall be returned to the factory designated on the return goods tag, transportation charges prepaid.

The return of the part does not constitute an order for replacement. A purchase order for the replacement part must be entered through your nearest Daikin McQuay representative. The order should include the component’s part number and description and the model and serial numbers of the unit involved.

If it is determined that the failure of the returned part is due to faulty material or workmanship within the standard warranty period, credit will be issued on the customer’s purchase order.

Warranty Registration Form

DAIKIN McQUAY®

To comply with the terms of Daikin McQuay Warranty, complete and return this Equipment Warranty Registration Form within 10 days to Daikin McQuay, Warranty Department.

Check, test, and start procedure for RoofPak roof mounted air conditioners with or without heat recovery and roof mounted air handlers.

Job Name:_____ **McQuay G.O. No.:** _____

Installation address: _____

City: _____ **State:** _____

Purchasing contractor:_____

City: _____ **State:** _____

Name of Person doing start-up (print)_____

Company name _____

Address _____

City/State/Zip_____

Unit model number: _____ **Unit serial number:** _____

Compressor #1 model number: _____ **Serial number:** _____

Compressor #2 model number: _____ **Serial number:** _____

Circle Yes or No. If not applicable to the type of unit, circle N/A.

I. INITIAL CHECK

A. Is any shipping damage visible?	Yes	No	N/A
B. Tightened all setscrews?	Yes	No	N/A
C. Have the shipping spacers been removed from the compressor springs and have the neoprene spacers been installed on each compressor mounting bolt? (Only applies to 115C-135C units with compressor spring isolators.)?	Yes	No	N/A
D. Electrical service corresponds to unit nameplate?	Yes	No	N/A
Volts _____ Hertz _____ Phase _____			
E. Is the main disconnect adequately fused and are fuses installed?	Yes	No	N/A
F. Are crankcase heaters operating, and have they been operating 24 hours prior to start-up?	Yes	No	N/A
G. Are all electrical power connections tight (Check compressor electrical box.)	Yes	No	N/A
H. Has the field piping been piped per ASHRAE recommendations?	Yes	No	N/A

II. START-UP COMPRESSOR OPERATION

A. Has each circuit been field leak tested?	Yes	No	N/A
B. Circuit 1	Yes	No	N/A
C. Circuit 2	Yes	No	N/A
D. Refrigerant charge per circuit: Circuit 1 _____ Circuit 2 _____			
E. Do condenser fans rotate in the right direction?	Yes	No	N/A
F. Are compressors rotating in the right direction?	Yes	No	N/A
G. Ambient temperature: _____°F			
H. Compressor lockout timers function?	Yes	No	N/A
I. Does unit start up and perform per sequence of operation?	Yes	No	N/A

III. PERFORMANCE DATA

A. Compressor voltage across each phase:	L1-2_____ V	L2-3 _____ V	L1-3 _____ V	
B. Compressor amperage of fully loaded compressor:				
Compressor #1:	Phase 1 _____	Phase 2 _____	Phase 3 _____	
Compressor #2:	Phase 1 _____	Phase 2 _____	Phase 3 _____	
C. Low pressure cut-out:	Circuit 1	psig	Circuit 2	psig
Low pressure cut-in:	Circuit 1	psig	Circuit 2	psig
D. High pressure cut-out:	Circuit 1	psig	Circuit 2	psig
E. Discharge pressure, one compressor:	Circuit 1	psig	Circuit 2	psig
F. Discharge pressure, fully loaded:	Circuit 1	psig	Circuit 2	psig
G. Suction pressure, one compressor:	Circuit 1	psig	Circuit 2	psig
Suction pressure, fully loaded:	Circuit 1	psig	Circuit 2	psig
Liquid press, fully loaded (at liquid line shut-off valve):	Circuit 1	psig	Circuit 2	psig
Liquid temperature, fully loaded:	Circuit 1	psig	Circuit 2	psig
	Circuit 1		Circuit 2	

H.	Suction Line temperature: _____	°F	°F		
I.	Superheat: _____	°F	°F		
J.	Supercooling: _____	°F	°F		
K.	Is the liquid in the liquid line sightglass clear and dry?		Yes	No	N/A
L.	At what suction pressure does the hot gas bypass valve open? Circuit 1_____ psig	Circuit 1_____ psig			
M.	Record discharge air temperature at discharge of the air handler:	°F			
N.	Are all control lines secure to prevent excessive vibration and wear?		Yes	No	N/A
O.	Are all gauges shut off and valve caps and packings tight after start-up?		Yes	No	N/A

Signature: _____ Start-up date:_____

Please see the following page "Quality Assurance Survey Report" and list any additional comments that could affect the operation of this unit; e.g., shipping damage, failed components, adverse installation applications, etc. If additional comment space is needed, write the comment(s) on a separate sheet, attach it to the Survey Report and return it to the Warranty Department with the above completed Warranty Registration form.

RETURN COMPLETED EQUIPMENT WARRANTY REGISTRATION FORM TO:
Daikin McQuay Warranty Department, 13600 Industrial Park Boulevard, Minneapolis, MN 55441

DAIKIN McQUAY®

Quality Assurance Survey Report

To whom it may concern:
Please review the items below upon receiving and installing our product. Mark N/A on any item that does not apply to the product.

Job Name: _____ **McQuay G.O. No.** _____

Installation address:_____

City: _____ State: _____

Purchasing contractor:_____

City: _____ State: _____

Name of person doing start-up (print): _____

Company name:_____

Address:_____

City/State/Zip: _____

1. Is there any shipping damage visible? . . . . . Yes No N/A

   Location on unit _____

2. How would you rate the overall appearance of the product; i.e., paint, fin damage, etc.?

   Excellent Good Fair Poor

3. Did all sections of the unit fit together properly? . . . . . Yes No N/A
4. Did the cabinet have any air leakage? . . . . . Yes No N/A

   Location on unit _____

5. Were there any refrigerant leaks? . . . . . Yes No N/A

   From where did it occur? . . . . . Shipping Workmanship Design

6. Does the refrigerant piping have excessive vibration? . . . . . Yes No N/A

   Location on unit _____

7. Did all of the electrical controls function at start-up? . . . . . Yes No N/A

   Comments _____

8. Did the labeling and schematics provide adequate information? . . . . . Yes No N/A
9. How would you rate the serviceability of the product?

   Excellent Good Fair Poor

10. How would you rate the overall quality of the product?

    Excellent Good Fair Poor

11. How does the quality of McQuay products rank in relation to competitive products?

    Excellent Good Fair Poor

    Comments _____

Please list any additional comments which could affect the operation of this unit; i.e., shipping damage, failed components, adverse installation applications, etc. If additional comment space is needed, write the comment(s) on a separate sheet, attach the sheet to this completed Quality Assurance Survey Report, and return it to the Warranty Department with the completed preceding “Equipment Warranty Registration Form”.

Daikin McQuay Training and Development

Now that you have made an investment in modern, efficient Daikin McQuay equipment, its care should be a high priority. For training information on all Daikin McQuay HVAC products, please visit us at www.DaikinMcQuay.com and click on training, or call 540-248-9646 and ask for the Training Department.

Warranty

All Daikin McQuay equipment is sold pursuant to its standard terms and conditions of sale, including Limited Product Warranty. Consult your local Daikin McQuay Representative for warranty details. Refer to Form 933-430285Y. To find your local Daikin McQuay Representative, go to www.DaikinMcQuay.com.

Aftermarket Services

To find your local parts office, visit www.DaikinMcQuay.com or call 800-37PARTS (800-377-2787). To find your local service office, visit www.DaikinMcQuay.com or call 800-432-1342.

This document contains the most current product information as of this printing. For the most up-to-date product information, please go to www.DaikinMcQuay.com.

Products manufactured in an ISO Certified Facility.

DAIKIN McQUAY®

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Installation and Maintenance Manual	IM 900
	Group: **Applied Air**
	Part Number: **IM 900**
	Date: **February 2008**

McQuay Water Cooling, Heating, and High Capacity Booster Coils

Types HI-F5, E-F5



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McQuay® Air Conditioning

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General Information

These are general guidelines for the installation, operation and maintenance of McQuay water heating and high capacity booster coils. They may have to be tailored to meet the specific requirements of any one job. An experienced installation company or fully trained personnel should perform the installation and maintenance of any coil.

Hazard Identification Information

⚠ DANGER

Dangers indicate a hazardous situation which will result in death or serious injury if not avoided.

⚠ WARNING

Warnings indicate potentially hazardous situations, which can result in property damage, severe personal injury, or death if not avoided.

⚠ CAUTION

Cautions indicate potentially hazardous situations, which can result in personal injury or equipment damage if not avoided.

Receiving Instructions

1. All McQuay fluid coils are factory tested at 315 psig minimum air pressure while submersed in water, inspected, and carefully packaged.
2. Damage to the coils can occur after they have left the factory. Therefore, the coils should be inspected for shipping damage upon receipt. The freight bill should also be checked against items received for complete delivery.
3. Damaged and/or missing items should be noted on the carrier's freight bill and signed by the driver.
4. For additional assistance, contact your local McQuay sales representative.

Coil Types

Standard Fluid Coils

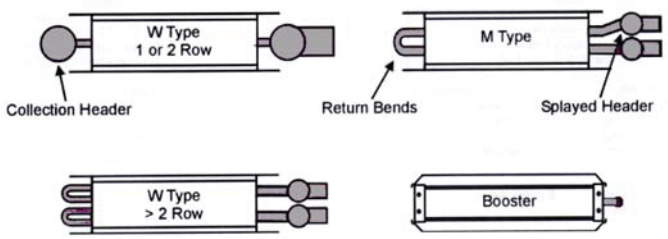
McQuay fluid coils are specifically designed for your particular application. Flexibility is built into our manufacturing processes, offering variations in fin type, fin density, circuitry arrangement, coil casing, and materials of construction.

Standard fluid type "W" coils utilize a collection header for one and two row applications and return bends for applications that require three or more rows.

Type "M" coils are used for one and two row applications that require same end connections. For type "M" coils, the supply and return headers are offset or "splayed." This orientation allows for the supply and return headers to be placed side by side.

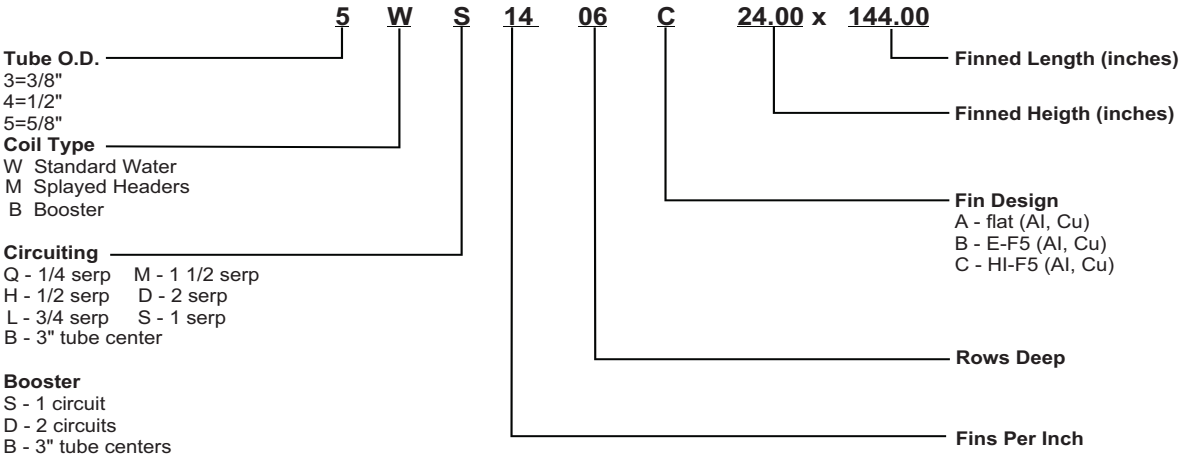
Booster coils, type "B," are also available for one and two row applications.

Figure 1: Coil Types



Introduction

Nomenclature

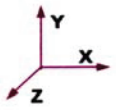


Mounting

All McQuay water and glycol coils are designed to be fully drainable when properly mounted. Vertical air-flow is not recommended for dehumidifying coils.

Figure 2: Coil Mounts

	Horizontal Air Flow Horizontal Tubes	Level with the y-axis and x-axis.
	Vertical Air Flow[2] Horizontal Tubes	Level with the z-axis and x-axis.
	Horizontal Air Flow Vertical Tubes	Level with the y-axis and x-axis.



Installation

⚠ CAUTION

Sharp edges on sheet metal and fasteners can cause personal injury. This equipment must be installed, operated, and serviced only by an experienced installation company and fully trained personnel.
Protective equipment such as safety glasses, steel toe boots and gloves are recommended during the installation and routine maintenance of the coil.

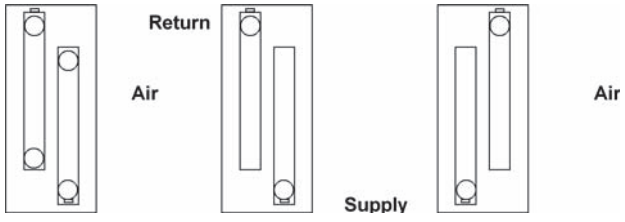
⚠ CAUTION

Failure to properly install the coil can result in irreparable damage to the coil as well as other components in the system.

If you are unsure about any portion of the installation, contact your local steam specialist for assistance.

1. Carefully remove the coil from the shipping package to avoid damage to the finned surface area. Damaged fins can be straightened using an appropriate fin comb.
2. McQuay recommends cleaning the coil with a commercially available coil cleaner prior to installation. Refer to "Maintenance" on page 5 for cleaning recommendations.
3. Check the coil hand designation to insure that it matches the system. Water and glycol coils are generally plumbed with the supply connection located on the bottom of the leaving air-side of the coil and the return connection at the top of the entering air-side of the coil. This arrangement (Figure 2) provides counter flow heat exchange and positive coil drainage. If a universal coil is supplied, cap off the two unused connections.

Figure 3: Supply and Return Locations



4. Standard coils must be mounted level to insure proper drainage. Refer to "Mounting" on page 4 for leveling requirements.
5. Proper clearance should be maintained between the coil and other structures such as the fan, filter racks, transition areas, etc.
6. Once installed, the coil should be pressurized to 100 psig with dry nitrogen or other suitable gas. The coil should be left pressurized for a minimum of 10 minutes. If the coil holds the pressure, the hook-up can be considered leak free. If the pressure drops by 5 psig or less, re-pressurize the coil and wait another 10 minutes. If the pressure drops again, there is more than likely one or more small leaks which should be located and repaired. Pressure losses greater than 5 psig would indicate a larger leak that should be isolated and repaired. If the coil itself is found to be leaking, contact your local McQuay sales representative.

   Note: Unauthorized repair to the coil may void the coil's warranty (see McQuay's warranty policy on back cover).
7. All field brazing and welding should be performed using high quality materials and an inert gas purge (like nitrogen) to reduce oxidation of the internal surface of the coil.
8. All field piping must be self-supporting. System piping should be flexible enough to allow for thermal expansion and contraction of the coil. Typical piping diagrams are represented in Figure 4 and Figure 5.

Figure 4: Horizontal Air Flow

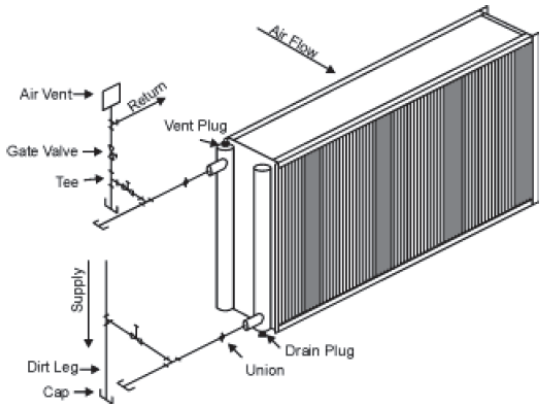
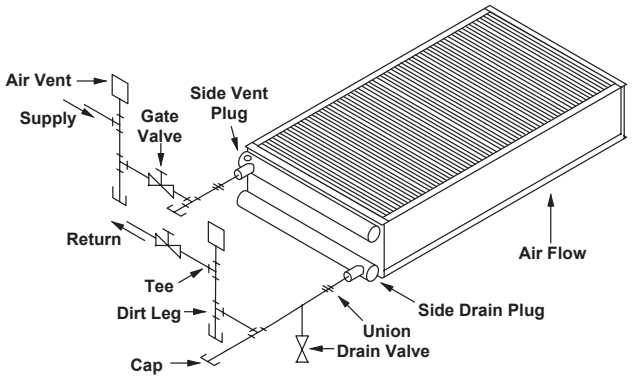


Figure 5: Vertical Air Flow



Operation

Initial Start-Up

1. Open all air vents to eliminate air in the coil circuitry and headers.
2. Verify that all vents and drains are unobstructed and can discharge a stream of water.
3. Fill the coil with water an then close all vents.
4. Perform an initial hydrostatic leak test of all brazed, threaded or flanged joints, valves, and interconnecting piping. Recheck the coil level and correct if necessary. When the setup is found to be leak free, discharge and discard initial water charge. It is important that all grease, oil, flux and sealing compounds found present during installation be removed.

General

1. Proper air distribution is vital to coil performance. Airflow anywhere on the coil face should not vary by more than 20%.
2. The drain pan and associated piping (drain line and trap) should be installed so that there is no standing water in the drain pan and that no blow-through occurs.
3. Working pressure rating is 250 psig @ 300°F (standard)
4. Fluid and air velocities should be maintained within McQuay's recommended values and for ARI certification.

Table 1: Fluid Velocities

Fluid Velocity	
Water	1 to 8 fps
Glycol	1 to 6 fps

Maintenance

⚠ DANGER

Follow the manufacturer's guidelines for lockout/tagout and disconnect all power to the unit before performing maintenance. Contact with high voltage power will cause electrical shock, resulting in severe personal injury or death.

⚠ WARNING

Moving parts, high pressure, and/or high temperature fluids can cause serious personal injury.

General

1. Filters should be inspected on a regular basis and changed as needed. Maintaining clean filters is a cost effective way to help maintain maximum coil performance and service life.
2. Periodic inspection of the coil for signs of corrosion and/or leaks is recommended. Repair and replacement of the coil and the connecting piping, valves, etc., should be performed as needed by a qualified individual.
3. Should the coil surface need cleaning, caution should be exercised in selecting the cleaning solution as well as the cleaning equipment. Improper selection can result in damage to the coil and/or health hazards.
4. Suggested cleaning instructions:
   - **a** When handling strong chemicals, be sure to wear chemical impervious gloves, apron and splash goggles.
   - **b** Acti-Brite (AB-1) is the recommended cleaning solution. For more information, contact your local McQuay Parts Distributor.
   - **c** Determine required dilution for the specific application. It is recommended to start with a dilution ratio of 10:1 and increase concentration until the desired results are achieved.
   - **d** As with mixing all acids, place the desired amount of water into the tank and then add the chemicals.
   - **e** Turn off fans and allow hot coils to cool before applying.
   - **f** Using plain water, wet both the coil as well as the area surrounding the equipment. Wetting the coil with water aids in product penetration and performance.

⚠ CAUTION

Carefully read and follow the manufacturer's recommendations before using any cleaning fluid.

   - **g** Apply properly diluted product to coil surface. Whenever possible, apply solution from the outlet side of the coil. Allow solution to remain on surface, normally 5-10 minutes. Do not allow solution to dry on the coil.

   Note: In extreme cases, application may have to be repeated to achieve desired results.

   - **h** If foaming does not occur, check for extreme grease buildup which will slow the cleaning process. Foaming may not occur if coil is coated or painted.
   - **i** Rinse coils, tools, and surrounding area thoroughly after the coil cleaning.
5. Clean the coil from the leaving airside so that foreign material will be washed out of the coil rather than pushed further in.
6. Maintain the circulated fluid free of sediment, corrosive products, and biological contaminants. Periodic testing of the fluid followed by any necessary corrective measures, along with maintaining adequate fluid velocities and proper filtering of the fluid, will help to satisfy this goal.
7. If automatic air vents are not utilized, periodic venting of the coil is recommended to remove accumulated air.

Blowing-Out Coils

1. Isolate the coil from the rest of the system by closing the valves on both the supply and return lines (see gate valves in Figure 5 and Figure 6).
2. Drain the coil by opening all drain valves and/or the drain plug. Remove the vent plug to aid the draining process.
3. Once the coil has been fully drained, the blower compressed air can be hooked-up. Caps installed in the piping on straight runs going to the supply and return connections are ideal points to hook-up the blower. The air vent and drain plug are not suitable locations for hooking up the blower.

⚠ DANGER

The blower operator must take precautions to insure that water does not come into contact with any of the electrical components of the blower. Failure to do so will result in damage to the equipment and serious injury.

4. Close the vent or drain plug on the header that the blower is connected and open the drain valve or cap on the other header.
5. Operate the blower for 45 minutes and then check the coil to see if it is dry. A mirror placed in the discharge will become fogged if moisture is present. Repeat this procedure until the coil is dry.
6. Let the coil stand for several minutes then blow it out again. If water comes out, repeat the blowout operation.
7. Leave all plugs out and drains open until the threat of freezing has passed.

Figure 6: Horizontal Air Flow

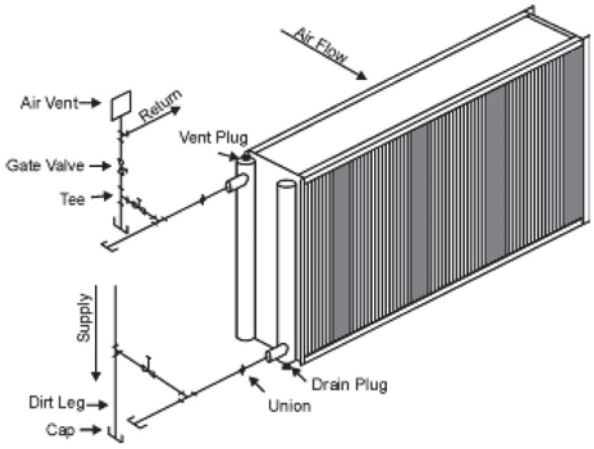
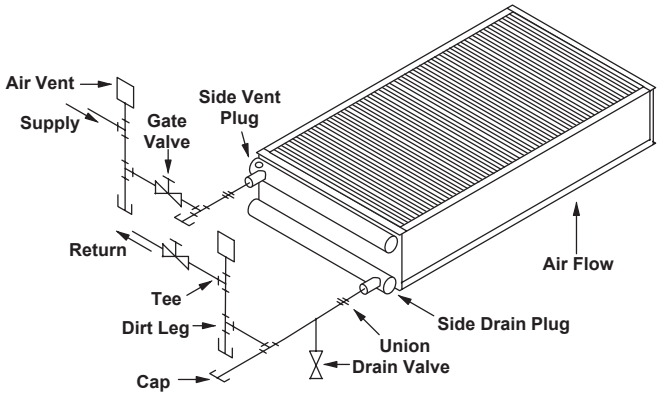


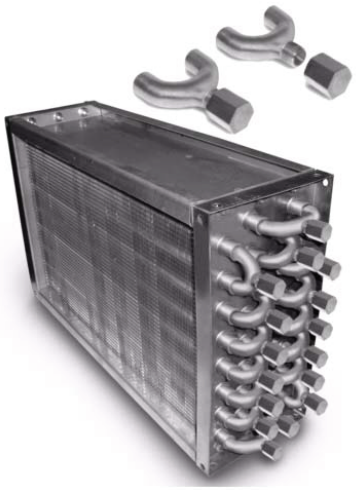
Figure 7: Vertical Air Flow



Freeze Protection Fittings

During the winter, chilled water coils need to be protected against freezing. Factory installed and tested freeze protection fittings are brazed onto water and steam coil headers, return bends and tube stubs (as necessary) as part of the factory assembly process. Freeze relief caps are then screwed onto each fitting. All coils are leak tested at 315 psi air pressure before shipping. The relief caps are designed to burst at 650 psig, relieving pressure before coil damage occurs. When freeze damage occurs, simply unscrew the ruptured relief caps and screw in replacement caps.

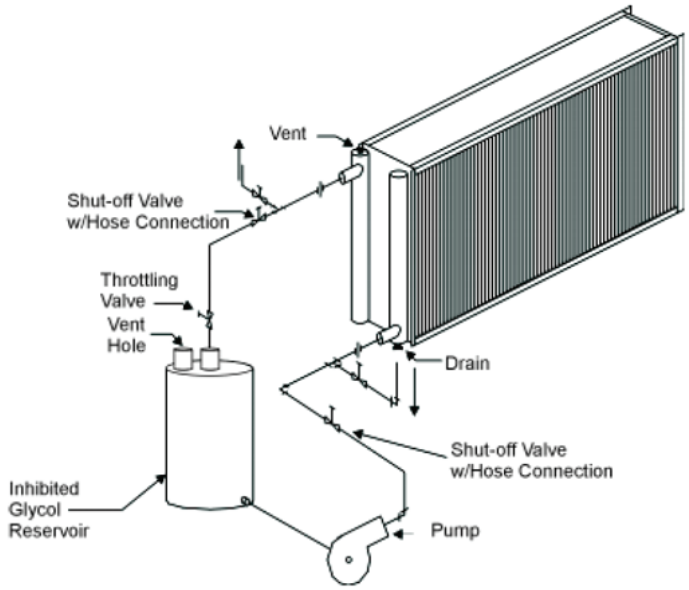
Figure 8: Freeze Protection Fittings



Flushing Coils

1. McQuay recommends the use of inhibited glycol designed for HVAC applications for corrosion protection. The use of uninhibited glycol has produced formicary corrosion in copper tubing. The complete filling of water coils with an inhibited glycol solution for freeze protection can be expensive. In some instances, it is more cost effective to flush the coils with an appropriate concentration of inhibited glycol solution. Residual fluid can be left in the coil without the threat of freeze damage provided the correct concentration of inhibited glycol was used. The recovered fluid can then be used to flush other coils. Select an inhibited glycol solution that will protect the coil from the lowest possible temperatures that can occur at the particular coil's locality.
2. Estimate the volume of the coil in gallons. For 5/8" tubes (1.5" face tube spacing) (finned height in inches) x (finned length in inches) x (# of rows) x 0.0011 = gallons.
3. Isolate the coil from the rest of the system by closing the valves on both the supply and return lines (gate valves in Figure 5 and Figure 6).
4. Drain the coil by opening all drain valves and/or the drain plug. Remove the vent plug to aid the draining process.

Figure 9: Flushing System



5. Close the drain valve(s) and drain plug.
6. Connect the flushing system to the coil. A typical system is shown in Figure 9.
7. With the throttling valve closed, start the pump and operate until the air is vented from the coil. After venting, close the air vent.
8. Open the throttling valve about halfway and circulate the fluid through the coil for 15 minutes. Check the strength of the fluid. A hydrometer or test kit from the fluid manufacturer is suitable for this application.
9. Adjust the solution strength as needed and circulate the fluid for another 15 minutes.
10. Repeat steps 8 and 9 until the desired concentration is reached.
11. Shut the pump down and drain the inhibited glycol from the coil.
12. The recaptured fluid can be used to flush other coils.

Note: Follow the manufactures' recommendations before utilizing any glycol based antifreeze solution. Additional fluid will be required for the pump, connected piping, and fluid reservoir. Formulae are for estimation purposes only.

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Installation and Maintenance Manual IM 1152-3

Group: **Fan Coil**
Part Number: **910175957**
Date: **May 2016**

ThinLine Horizontal Fan Coils and Cabinet Unit Heaters

Type FC and FH



Exposed Horizontal Cabinet Fan Coil



Recessed Horizontal Cabinet Fan Coil



Concealed Horizontal Unit Heater



Concealed Horizontal Fan Coil

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Daikin Thinline Horizontal Fan Coils are intended for use in single zone applications. They are available in sizes from 200 to 1200 cfm. Figure 2 describes the main features of these units and can be referred to for component placement. These units are available in two-pipe configurations with one hydronic coil, with or without electric heat.

They are also available in four-pipe configurations with a primary coil and a secondary reheat or preheat coil. A variety of factory-built piping packages are available, either factory or field-installed. Units are available with a variety of thermostat and fan speed control options, including the MicroTech® III controller board.

Figure 1: Nomenclature (see Table 3 page 49 through page 53 for complete model number description)

FC H C – 2 02 A

Unit Type
FC = Fan Coil
FH = Cabinet Unit Heater

Unit Configuration
H= Horizontal

Cabinet Type
C = Cabinet
R = Recessed
H = Hideaway

Voltage
A = 115/60/1
E = 208-230/60/1
J = 277-265/60/1

Unit Size
02 = 200 CFM
03 = 300 CFM
04 = 400 CFM
06 = 600 CFM
08 = 800 CFM
10 = 1000 CFM
12 = 1200 CFM

Design Series

Figure 2: Model FCHH with Return Plenum



Safety

Follow all safety codes. Wear safety glasses and work gloves. Use a quenching cloth for brazing operations. Have a fire extinguisher available. Follow all warnings and cautions in these instructions and attached to the unit. Consult applicable local building codes and National Electrical Codes (NEC) for special requirements.

Recognize safety information. When you see a safety symbol on the unit or in these instructions, be alert to the potential for personal injury. Understand the meanings of the words DANGER, WARNING, and CAUTION.

- **DANGER** identifies the most serious hazards that will result in death or severe personal injury;
- **WARNING** means the hazards can result in death or severe personal injury;
- **CAUTION** identifies unsafe practices that can result in personal injury or product and property damage.

Improper installation, adjustment, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may result in personal injury or property damage.

This product must be installed only by personnel with the training, experience, skills, and applicable licensing that makes him/her “a qualified professional HVACR installer.”

Operating Limits

This equipment is designed for indoor installation only. Sheltered locations such as attics, garages, etc., generally will not provide sufficient protection against extremes in temperature and/or humidity, and equipment performance, reliability, and service life may be adversely affected.

⚠ DANGER

Disconnect all electrical power before servicing unit. Electrical shock will cause severe injury or death.

⚠ WARNING

Hazardous Voltage!

Use copper conductors only. Unit terminals are not designed to accept other types of conductors. Failure to do so may cause damage to the equipment.

⚠ WARNING

Personal injury hazard. Wear protective gloves to avoid possible cuts and abrasions from exposed edges. Avoid contact with sharp edges

⚠ CAUTION

Cleaning agents may cause serious damage to internal components, such as aluminum coils and electronic controls, etc. Do not operate fan coil while building maintenance cleaning agents are in use.

⚠ CAUTION

Sharp edges and coil surfaces are injury hazards. Avoid contact with them.

⚠ CAUTION

Moving machinery and electrical power hazards may cause severe personal injury or death. Disconnect and lock off power before servicing equipment.

⚠ NOTICE

Installation and maintenance are to be performed only by qualified personnel who are familiar with and in compliance with state, local and national codes and regulations, and experienced with this type of equipment.

Receiving and Storage

Upon receipt of the equipment, check carton for visible damage. Make a notation on the shipper's delivery ticket before signing. If there is any evidence of rough handling, immediately open the cartons to check for concealed damage. If any damage is found, notify the carrier within 48 hours to establish your claim and request their inspection and a report. The Warranty Claims Department should then be contacted.

Do not stand or transport the machines on end. For storing, each carton is marked with "up" arrows.

Temporary storage at the job site must be indoors, completely sheltered from rain, snow, etc. High or low temperatures naturally associated with weather patterns will not harm the units. Excessively high temperatures, 140°F (60°C) and higher, may deteriorate certain plastic materials and cause permanent damage.

⚠ IMPORTANT

This product was carefully packed and thoroughly inspected before leaving the factory. Responsibility for its safe delivery was assumed by the carrier upon acceptance of the shipment. Claims for loss or damage sustained in transit must therefore be made upon the carrier as follows:

VISIBLE LOSS OR DAMAGE
Any external evidence of loss or damage must be noted on the freight bill or carrier's receipt, and signed by the carrier's agent. Failure to adequately describe such external evidence of loss or damage may result in the carrier's refusal to honor a damage claim. The form required to file such a claim will be supplied by the carrier.

CONCEALED LOSS OR DAMAGE
Concealed loss or damage means loss or damage which does not become apparent until the product has been unpacked. The contents may be damaged in transit due to rough handling even though the carton may not show external damages. When the damage is discovered upon unpacking, make a written request for inspection by the carrier's agent within fifteen (15) days of the delivery date and file a claim with the carrier

Pre-Installation Notes

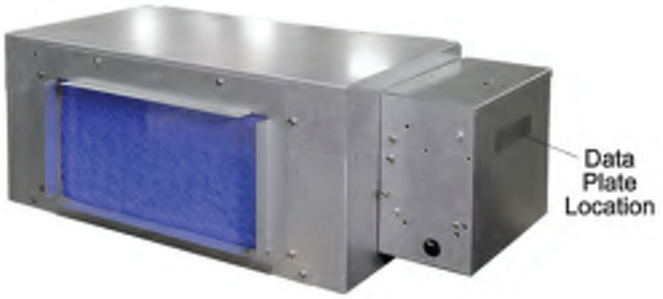
Installation and maintenance are to be performed only by qualified personnel who are familiar with and in compliance with state, local and national codes and regulations, and experienced with this type of equipment. Before beginning installation, please read this publication in its entirety. Directions given in this bulletin for right and left sides or coil hand assume a position facing the front (discharge) of the unit.

1. To prevent damage, do not operate this equipment for supplementary heating and cooling during the construction period. Doing so will void the warranty.
2. Inspect the carton for any specific tagging numbers indicated by the factory per a request from the installing contractor. At this time the voltage, phase and capacity should be checked against the plans.
3. Check the packing list and unit identification/tagging numbers against the plans to verify that the unit is being installed in the correct location. The unit data plate is attached to the front of the control box (see Figure 3). Remove the bottom panel on cabinet units to access it. The panel contains specific information on standard components as listed in Figure 1 on page 3 and starting in Table 3 on page 49.
4. Before installation, check the available dimensions of the space where the unit is to be installed against the dimensions of the unit.
5. Note the location and routing of water piping, condensate drain piping, and electrical wiring. The locations of these items should be clearly marked on submittal drawings.
6. An installing contractor may find it beneficial to confer with piping, sheet metal, and electrical foremen before installing any unit.

NOTE: Check the unit data plate for correct voltage with the plans before installing the equipment. Also, make sure all electrical ground connections are made in accordance with local code.

7. After installation, cover the unit with the shipping carton or other appropriate material for protection during finishing of the building. This is critical while spraying fireproofing material on ceiling beams, bar joists, sandblasting, spray painting and plastering. Damage to the unit due to a failure to protect it during finishing of the building is not covered by the warranty.
8. Maximum entering water temperature is 200°F (93°C).

Figure 3: Data Plate Location



9. Air ducts, when used with hideaway units, should be installed in accordance with local and national codes, including National Fire Protection Association standards for the Installation of Air Conditioning and Ventilating Systems and the National Fire Protection Association standards for the Installation of Air Conditioning and Ventilation Systems other than Residence Type.
10. Completed installation of hideaway units without return plenum must comply with the requirements of NFPA90B with regard to the use of concealed ceiling spaces as return air plenums.
11. When a return air duct is not provided, applicable codes may limit installation to single story buildings.
12. A one-inch duct collar is provided on units with a ducted return and/or discharge to attach ductwork. Daikin recommends using galvanized sheet metal ductwork. Slide the sheetmetal duct over the duct collar flange of the unit, seal the joint and fasten with sheetmetal screws.
13. Vibration isolators are generally not needed, if required by local codes, they must be provided by the installing contractor.
14. Valve and Piping Packages supplied with the unit should be supported during the installation process. It is advisable to keep the support in place after the unit has been installed and started.

Uncrating and Inspecting the Unit

⚠ WARNING

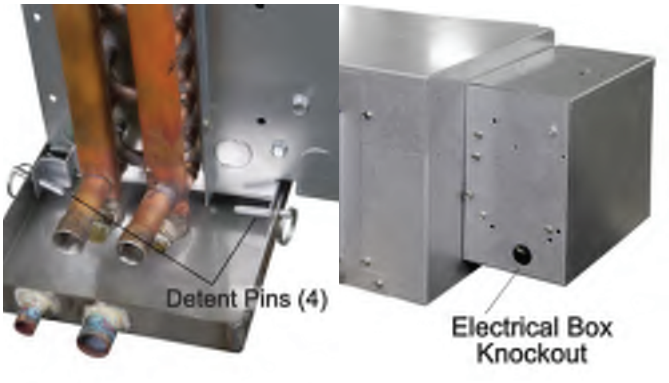
Plastic packaging is a suffocation hazard, dispose of properly. Keep away from children.

1. Carefully remove the packaging, remaining alert to any signs of shipping damage. Be careful not to discard components that may be included with the packaging.
2. If the unit is damaged, file a claim with the carrier. Notify the local Daikin representative immediately.
3. You may want to retain some or all of the packaging to provide jobsite unit location information and temporary protection for the fan coil after installation. Be sure to dispose of plastic packaging and protective cardboard properly, in accordance with local recycling rules and guidelines.
4. Touch up painted panels if necessary. If panels need paint, sanding is not necessary. However, clean the surface of any oil, grease, or dirt residue so the paint will adhere. Purchase factory approved touch up paint from your Daikin representative or Daikin Service.

Installation

1. Consult job blueprints for unit location.
2. Clean area where unit is to be installed, removing all construction dirt and debris.
3. Remove the unit from the shipping carton and plastic covering. Save the carton and plastic to use as a protective cover after the installation is complete.
4. Rotate fan wheels by hand to make sure the wheels rotate freely.
5. Unit is ready for installation. See Duct Connections for more detail.
6. Secure unit in proper position. The top of the unit must be level. If hanger rods are used, “back-up” nuts should be put on the rods to prevent the mounting nuts from loosening. The drain pan is designed to have a little gradient to ensure proper drainage and operation. Do not level Drain Pan.
7. Water and drain connections can now be made to the unit. Piping must be installed in accordance with local codes and regulations. See Piping Connection Recommendations for more detail.
8. Vent the coils.
9. All water and drain lines should be well insulated to prevent sweating and heat loss. See External Insulating Requirements for more detail Electrical connections can now be made to the electrical panel or chase, in case the panel is not provided. Unless it is a special-order unit, all electrical connections are made in the main electrical control panel located on the opposite side of the primary panel connections. Electrical power wiring goes through the chase located between the drain pan and coil section. If needed the power connections may be done through knockouts located on both sides of the unit. See Figure 4.

Figure 4: Electrical Knockouts (Typical)



10. The installer shall provide wiring to the unit. Branch circuit overcurrent protection and disconnect should conform to the applicable electrical codes. The motor provided is “thermally protected.” See Electrical Connections on page 13.
11. All panels and doors should be in place and closed before starting up the unit.
12. During summer construction, there is an unusually high amount of moisture in the air; therefore, the initial pulldown should be very gradual (high speed for maximum airflow with reduced GPM and elevated chilled water temperature for reduced capacity). This procedure will reduce the possibility of the unit sweating.

Recommended Maintenance Clearance

Cabinet units have removable bottom and side panels for easy access to components for service and maintenance. The fan assembly and main drain pan are easily removable from the bottom for cleaning. See Accessing/Removing the Main Fan Deck and Motor Assembly on page 20 for more information.

Figure 5 shows recommended maintenance clearances for hideaway units. For exposed units use: 24 inches [61 cm] on either side (A and B) and 18 inches [46 cm] (C) below for bottom panel removal. Units are referred to as either right-hand or left-hand depending upon the piping connection. Hand is designated by facing the front of the unit (airflow discharges from the front or bottom).

Duct Connections

Air ducts, when used with hideaway units, should be installed in accordance with local and national codes, including National Fire Protection Association standards for the Installation of Air Conditioning and Ventilating Systems and the National Fire Protection Association standards for the Installation of Air Conditioning and Ventilation Systems other than Residence Type.

A one-inch duct collar is provided on units with a ducted return and/or discharge to attach ductwork. Daikin recommends using galvanized sheet metal ductwork. Slide the sheetmetal duct over the duct collar flange of the unit, seal the joint and fasten with sheetmetal screws.

Ductwork Recommendations

Follow the general recommendations listed below when installing the ductwork for the unit.

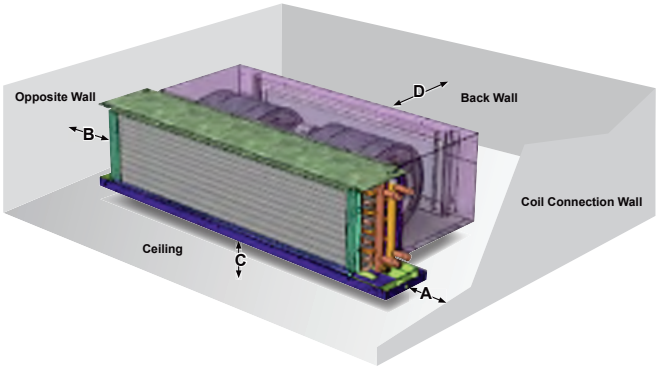
1. Air ducts should be made of galvanized steel and connected to the flange of the unit with a canvas connector. Insert the duct into the flange and fix with screws. Duct connections must be installed in accordance with national and local codes.
2. Discharge ductwork should run in a straight line, unchanged in size or direction, for a minimum distance of three fan diameters from the unit (approximately 20 inches).
3. Avoid making sharp turns when making duct turns and transitions. Use proportional splits, turning vanes, and air scoops when necessary.
4. When possible, construct and orient supply ductwork turns in the same direction as the fan rotation.

External Insulating Requirements

Insulate and vapor-seal surfaces that are colder than the surrounding air dew point to prevent unplanned condensation. Daikin recommends field-insulation in the following areas to prevent potential condensate problems:

- Supply and return water piping connections
- Condensate drain lines and connections
- Fresh air intake duct connections
- Discharge duct connections
- Wall boxes

Figure 5: Concealed Hideaway Unit Clearance



A = 8" (same side connection) or 24" (opposite side)
B = 24"
C = 3"
D = 18" for Hideaway units without plenum

Piping Connection Recommendations

General Guidelines

IMPORTANT

Venting is required on the return piping for secondary preheat or reheat coils. It is included on factory-built piping packages, but must be added by the installing contractor for field-installed piping. See Figure 7

WARNING

Avoid overheating when soldering field connections to the coil to prevent leakage, overheating of the copper tubes, and melting of valves, factory-soldered joints or component gasketing. A quenching cloth is recommended. See Figure 6.

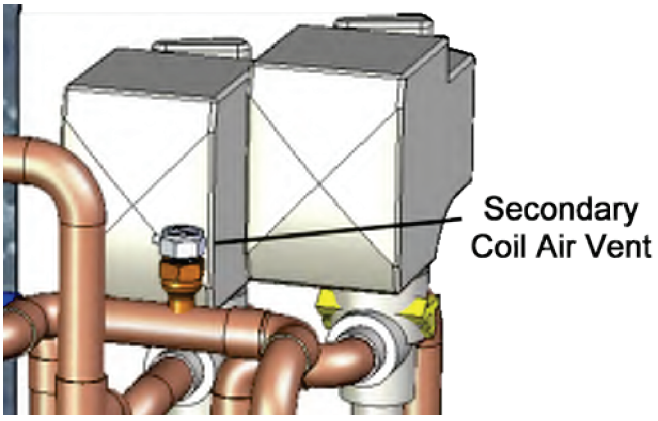
- Piping can be steel, copper or PVC, but must comply with local codes.
- Proper ventilation is required for soldering. When soldering, use a quenching cloth to protect fan coil components from overheating damage—melting insulation, also damage to valves, wiring, electronics, sensors, etc. See Figure 6. When Daikin provides valve packages with unions, o-rings are included. When soldering near unions, remove the o-rings before heating.

Figure 6: Protect Components from Overheating



- If sealant compound is not provided for flexible hose fittings, apply Teflon tape to the connections to help prevent leaks.
- Ensure proper insulation of supply and return piping. Proper insulation prevents loss of fan coil capacity, overheating of end compartments, and/or moisture dripping.
- The piping to and from the unit must be protected from outside air and freeze conditions. It must be suitably insulated for condensation and for heat loss or gain. Penetrations entering the unit end compartments must be fitted/sealed for unit integrity.
- Exterior condensate may be an issue if field piping does not have a control valve. Review the supply and return header locations in the dimensions drawings. If using a field-assembled piping package, allow sufficient room to install the secondary drain pan. Uninsulated piping for chilled water should not extend over the edges of the secondary condensate drain pan.
- Supply and return shutoff valves are recommended at each unit. The return valve is used for balancing and should have a “memory stop” so that it can always be closed off, but can only be re-opened to the proper position for the flow required.
- Primary coils are factory-equipped with vents for venting the system, but secondary coils (preheat or reheat) are not. If the unit is not equipped with factory-built piping packages which includes a secondary coil air vent, then vents must be added. See Figure 7.
- Be sure to install control valves on the correct fan coil. Indiscriminate mixing of valves in the field can result in valves improperly sized for the desired flow rate, which can result in poor operation and coil freezes.
- Install control valves so there is at least 2" (51mm) minimum clearance to remove the actuator from the valve body.

Figure 7: Secondary Coil Air Vent



- Do not connect a unit to the supply and return piping until the water system has been cleaned and flushed completely. After this is done, the initial connection should have all valves wide open in preparation for water system flushing.
- Automatic flow control devices must not be installed prior to system cleaning and flushing.
- Check local code for any requirement for electrical fittings.

Drain Piping

- Condensate piping can be steel, copper, or PVC. A means of disconnection must be furnished to facilitate fan deck removal.
- No point of the drain system may be above the drain pan of any unit.
- Pipe insulation is recommended to avoid condensation.
- Suggested slope of the drain pipe is at least 1/8" per foot to facilitate adequate condensate drainage but local code requirement should prevail.
- Slide the pipe over the drain pan nipple and tighten the collar on the pipe with a hose clamp (supplied by installer).
- The drain line should be supported to prevent undue stress on the secondary drain pan. Make sure the drain line is free of kinks.
- Trap drain line according to local codes.
  NOTE: Traps for exposed units may be located outside the cabinet as there is insufficient space inside the unit.
- Cap overflow drain connection or connect it with clear piping to the point where it can be used as an indicator for a clogged main drain connection.

Chilled Water Pipe Connections

No Valve Package

- Connect chilled water pipes to the unit. The water supply is on the bottom and water return is on top of the coil header.

Connecting to a Factory-Installed Valve & Piping Package

To view connection locations for factory-installed valve & piping packages, see Valve and Piping Packages on page 39.
Before installing supply and return lines to a factory piping package, review the following items.

- All piping connections are 5/8" O.D.S. (1/2" nominal) female copper connections.
- Supply and return piping should not interfere with the secondary drain pan or condensate line. The installer must provide adequate piping system filtration and water treatment. Daikin Deluxe and Enhanced piping packages include a strainer which prevents debris from entering the coil. Clean the strainer regularly.
- The fan coil ships with brackets and special shipping packaging to adequately support the piping package during shipment. Remove the packaging before connecting to the water piping but leave the support brackets in place during and after the installation.
- Set ALL valves to the fully open position to prevent damage to the valve seat during brazing. Use a quenching cloth as protection.
- Remove the secondary drain pan, if in place, to prevent exposure to dripping solder or excessive temperatures.
- Solder water piping connections to supply and return end connections. Avoid overheating factory soldered joints to prevent the possibility of leakage.
- Insulate fan coil piping to secondary drain pan connections and any piping that is not above the secondary drain pan.

Field-Installed Valve & Piping

Review General Guidelines on page 9 before beginning. Then carry out the following steps to install valves and piping.

- For units equipped with a secondary coil make sure that an air vent is included in the return line piping. Primary coils are factory-equipped with vents, secondary coils are not. See Figure 7. Valve Package support brackets are included with the secondary coil kits.
- Remove the secondary drain pan, if in place, to prevent exposure to dripping solder or excessive temperatures.

NOTE: Field-installed valve and piping packages provided by Daikin include the secondary drain pan. If valve packages by the field, secondary drain pans should be provided by others.

- Slide ½" copper tubing or connection couplings (provided by installer) onto the coil connections. Solder the joint using a good-quality, lead-free solder to provide a watertight connection.
- After connections are complete, insulate all piping to the coil connections as necessary to prevent condensate from dripping outside of the secondary drain pan.
- Install the optional secondary drain pan.

Shutoff/Balancing Valve

Each fan coil should be at least be equipped with shutoff valves on both the supply and return lines for easy serviceability and removal if it becomes necessary. We suggest using our combination shutoff/balancing valves between the main supply line and the fan coil unit. These are furnished as part of a field-installed valve & piping package. The balancing valve installed on the return line is used to adjust the water flow to provide the best performance.

Automatic Changeover Sensor

Two-pipe changeover units require an automatic changeover switch or pipe sensor that determines heating or cooling mode based on the supply water temperature. On units with a factory-installed valve & piping package, the factory straps the changeover switch or sensor to the piping supply water pipe. See Figure 8. For field-installed Valve Packages, the ACO must be ordered separately.

For a two-pipe system with intermediate supplemental electric heat, a second set is required including a changeover switch. See Two-Pipe Systems with Electric Heat on page 12 section for more details.

NOTE: The bypass bleed line is used on 2-pipe Fan Coils with 2-way control valves to prevent stagnation of water near the aqua-stat or pipe sensor. The bleed line allows 3 – 4 gpm of flow to bypass the coil which is necessary for the proper function of the automatic changeover system. All 2-pipe valve packages with 2-way control valves automatically include the bypass bleed line. If the bleed line is unwanted, it may be crimped by the installing contractor to prevent bypass flow.

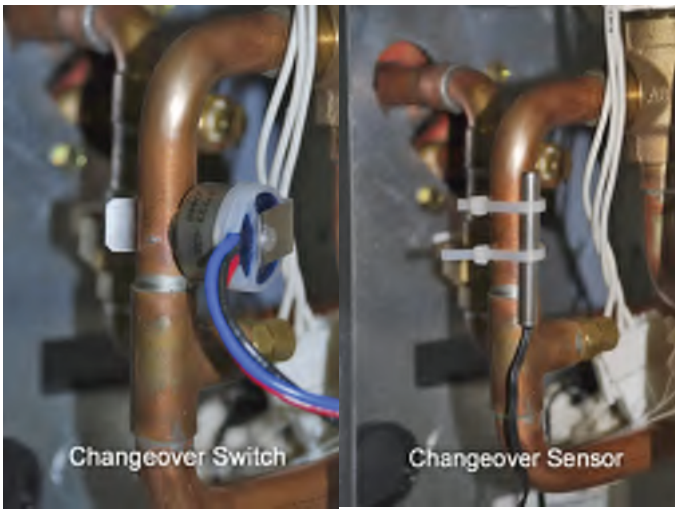
If the unit does not have a factory-installed valve & piping package, the changeover switch or sensor can be ordered for field installation. The installer should attach the sensor or auto changeover switch parallel to and in direct contact with the supply water pipe.

NOTE: The installer is responsible to ensure the changeover sensor is installed in a location that can sense active water temperature. Otherwise, the unit may fail to sense the correct operating mode and disable temperature control.

When using field-supplied 3-way control valves, install the changeover sensor upstream of the valve and the bypass on the supply water pipe. When using field-supplied two-way control valves install the changeover sensor in a location that will detect active water temperature. The unit must always be able to sense the correct system water temperature, regardless of the control valve position.

NOTE: The maximum length of the automatic changeover wire cannot exceed 10 feet from the control panel to the sensor. If the wire extends beyond the unit chassis, use shielded conductors to eliminate radio frequency interference (RFI).

Figure 8: Automatic Changeover Switch and Sensor



Steam Piping Connections

⚠ CAUTION

Coil Damage!

In all steam coil installations, the condensate return connections must be at the low point of the coil to ensure condensate flows freely from the coil at all times. Failure to do so may cause physical coil damage from water hammer, unequal thermal stresses, freeze-up and/or corrosion

Make piping connections to the steam coil per job requirements. (Daikin does not supply steam piping connections.) Install a 1/2", 15-degree swing check vacuum breaker in the unused condensate return trapping as close as possible to the coil. The following procedures are recommended:

- Vent the vacuum breaker line to atmosphere or connect it into the return main at the discharge side of the steam trap.
- Pitch all steam supply and return mains down a minimum of one inch per ten feet in the direction of flow.
- Do not drain the steam mains or takeoff through the coils. Drain the mains ahead of the coils through a steam trap to the return line.
- Overhead returns require one psig of pressure at the steam trap discharge for each two-feet elevation to ensure continuous condensate removal.
- Proper steam trap selection and installation is necessary for satisfactory coil performance and service life. For installation, use the following steps:
  - Position the steam trap discharge at least 12 inches below the condensate return connection. This provides sufficient hydrostatic head pressure to overcome trap losses and ensure complete condensate removal.
  - Daikin recommends using float and thermostatic traps because of gravity drain and continuous discharge operation.
  - Use float and thermostatic traps with atmospheric pressure gravity condensate return, with automatic controls or where the possibility of low pressure supply steam exists.
  - Always install strainers as close as possible to the trap inlet side.

Two-Pipe Systems with Electric Heat

⚠ IMPORTANT

Daikin recommends operating the electric heater at the High motor speed setting.

The electric heating coil is designed to be the total source of heat for the unit. If used for auxiliary intermediate season heating, additional control is required. A second changeover switch is required. For units ordered with intermediate electric heat, the second changeover switch is factory installed.

To protect the electric heat elements, an automatic and manual electric heat switch disengages the electric heat to prevent overheating. For information on resetting the manual switch, see Electric Heat Over-Temp Reset Button on page 15. For a typical wiring diagram, see Figure 53.

Electrical Connections

⚠ WARNING

A means for disconnect from electrical supply shall be provided according to NEC or local codes. Confirm that the power has been switched OFF before installing or servicing the unit.

Installation and maintenance must be performed only by qualified personnel who are familiar with local codes and regulations, and are experienced with this type of equipment. Wiring connection must be completed according to the wiring diagram on the unit. The unit must be GROUNDED. Installation of all field wiring must comply with NEC and local codes.

Line and voltage wiring must be done in accordance with local codes or the National Electrical Code, whichever is applicable.

Apply correct line voltage to the unit. Power to the unit must be sized correctly. Branch circuit overcurrent protection must be provided per local codes. See the data plate for correct ratings.

Standard Electrical Connection

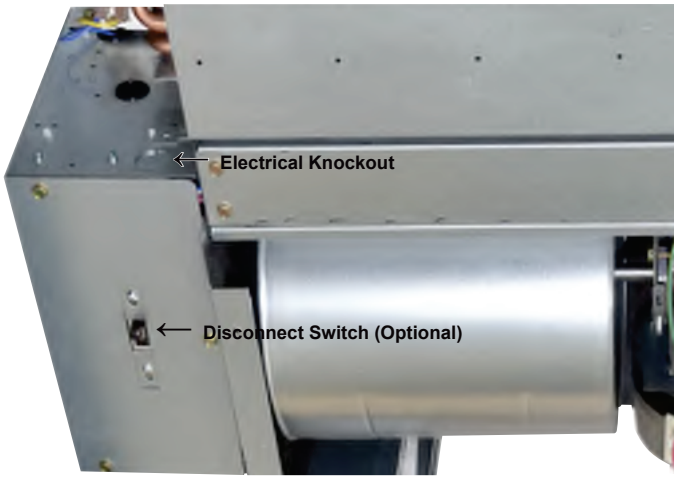
Field electrical power connections are made in the electrical control box, which is mounted to the side of the chassis opposite the primary coil piping connections. See Figure 9. An optional disconnect switch is located in this box.

Units with an electric heat option that have the same voltage as the unit have single-point power connections and bring the power conductors into this same connection box through one of the knockouts. Units with electric heat that has a different voltage should bring the electric heat into one of the knockouts on the chase. See Figure 9.

If provided by the field, low voltage wires should be brought into a knockout located next to the electrical control box. See Figure 4.

Install a strain relief and pass the wires through the strain relief into the control box. Make the connections and reinstall the control box cover.

Figure 9: Electrical Power Connections



Bottom View

Electrical Data

The wiring diagram for the unit is attached to the exterior of the blower housing. See Figure 10. Be sure the available power is the same voltage and phase as that shown on the unit data plate. See Figure 3, for the location of the data plate. See page 44 through page 46 for typical wiring diagrams.

Figure 10: Location of the Wiring Diagram.



Operating Voltages

Operating voltages are as follows (+/– 10%).

- 115/60/1
- 208-230/60/1
- 265-277/60/1

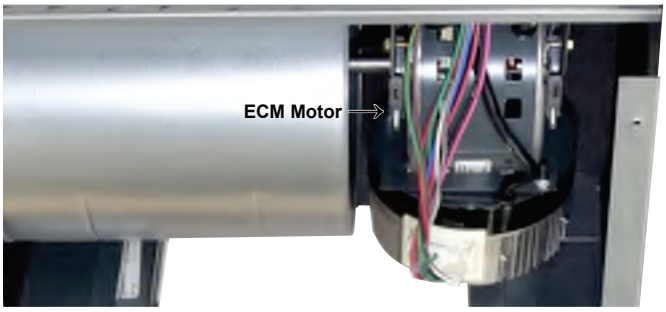
NOTE: Voltages listed are to show voltage range. However, units operating with overvoltage and undervoltage for extended periods of time will experience premature component failure.

ECM Blower

If the unit is equipped with an ECM blower, additional steps may be required during the air balancing process. The ECM blower is controlled by a control board. Three-speed taps are provided with an ECM blower: high, medium and low.

The unit has been factory configured to produce PSC equivalent airflow on high speed, with medium speed at 80% and low speed at 60% of full volume. If these settings are acceptable, then no further configuring is necessary. If different speeds are required select a field adjustment ECM.

Figure 11: ECM Blower



EC Motor Pin Out Locations

Figure 13 and Figure 14 show the pin locations for both connectors.

Figure 12: Connectors

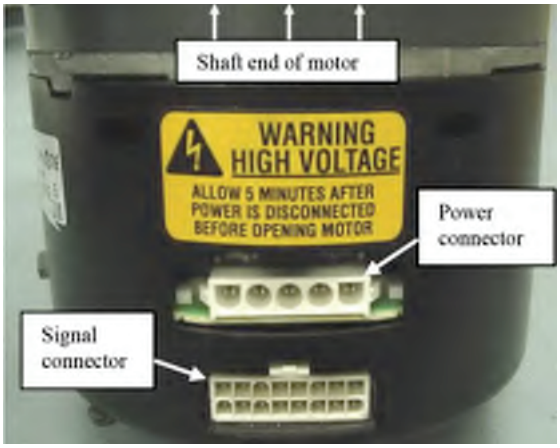
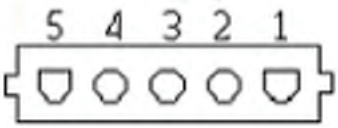
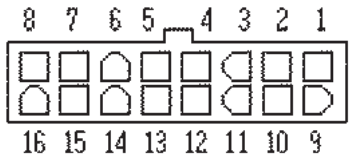


Figure 13: Power Connector

Power Connector	

Pin	Description
1	JUMPER PIN 1 TO PIN 2 FOR
2	120 VAC LINE INPUT ONLY
3	CHASSIS GROUND
4	AC LINE
5	AC LINE

Figure 14: Signal Connector

Signal Connector	

Pin	Description	Pin	Description
1	C1 - Common	9	O
2	W/W1 – High Speed	10	BK/PWM
3	C2 - Common	11	HEAT
4	DELAY	12	R- 24V
5	COOL	13	EM/W2- Super High
6	Y1 – Low Speed	14	Y/Y2 – Super Low
7	ADJUST	15	G – Medium Speed
8	OUT-	16	OUT+

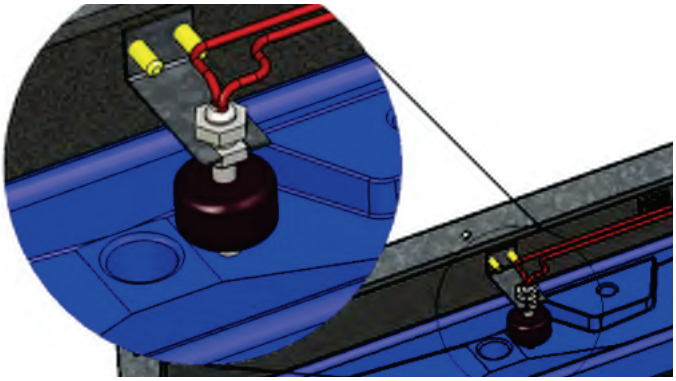
Condensate Overflow Detection Device

The condensate overflow detection device is a factory-installed option on fan coils. This device has a condensate overflow switch with dry contacts and is connected to the LV board or MicroTech board. See Figure 15.

If you suspect it is not working properly, check to be sure that the float is installed straight up with the proper elevation. See Accessing/Removing the Main Fan Deck and Motor Assembly on page 20 for instructions on removing the main drain pan to access the device.

The condensate overflow switch needs to be wired to the proper controller (MicroTech for example) to shut off the fan if excessive water is present in the drain pan.

Figure 15: Condensate Overflow Switch Installation

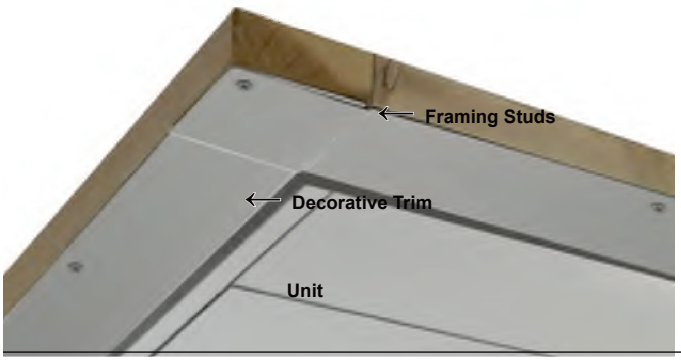


Decorative Trim Flange for Partially-Recessed Units

A fixed trim flange is used for partially-recessed fan coils (with height restrictions of 14.5 inches or below). Trim Flanges are also used with fan coils featuring a bottom discharge configuration.

The sheetrock location for the unit should be cut to the appropriate size, then framed with steel or wooden studs before the decorative trim flange is installed. See Figure 42 on page 38 for a sample illustration and recommended gaps.

DO NOT secure the Trim Flange without a stud frame to the drywall.



Electric Heat Over-Temp Reset Button

⚠ DANGER

PERSONAL INJURY HAZARD.

Power supply can cause electrical shock. Always disconnect power to unit before servicing.

The electric heat options comes with two over-temperature switches. The first resets automatically when the over-temperature condition no longer exists. The second, backup high limit switch must be reset manually.

NOTE: The need to reset the manual switch may indicate that there are improperly functioning system components. If the switch trips again, contact Daikin Service for help in diagnosing the cause.

To reset the manual switch, carry out the following steps:

1. Disconnect all power to the unit. Verify the power has been disconnected.
2. Remove the raceway access covers (see Accessing/Removing the Main Fan Deck and Motor Assembly on page 20).
3. Access and push in the red reset button in the raceway of the heater assembly. See Figure 17.
4. Reinstall the access cover.
5. Reconnect the power.

Figure 17: Electric Heat Over-Temp Reset Button Location



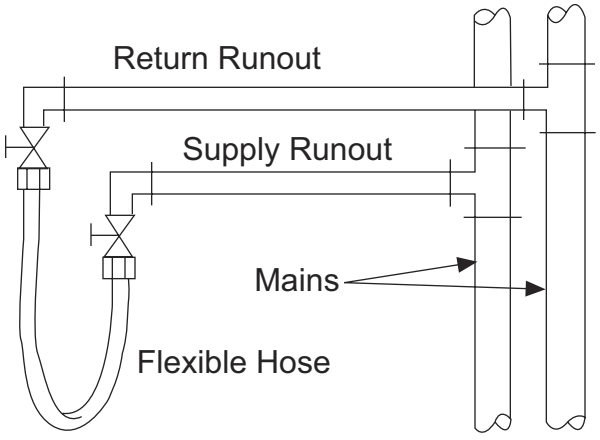
Cleaning & Flushing the Water System

⚠ CAUTION

Units must be checked for water leaks upon initial water system startup. Water leaks may be a result of mishandling or damage during shipping. Failure by the installing contractor to check for leaks upon start-up of the water system could result in property damage

- Prior to first operation of any unit, clean and flush the water circulating system of all construction dirt and debris.
- If units are equipped with water shutoff valves, either electric or pressure operated, connect the supply and return runouts together at each unit location. This will prevent the introduction of dirt into the unit. See Figure 18.
- Fill the system at the water makeup connection with all air vents open. After filling, close all air vents.
- Start the main circulator with the pressure reducing valve open.
- Check vents in sequence to bleed off any trapped air, ensuring circulation through all components of the system.
- While circulating water, check for any leaks in the unit and surrounding piping and repair as neccessary.
- Drains at the lowest point(s) in the system should be opened for initial flush and blow-down, making sure city water fill valves are set to make up water at the same rate.
- Check the pressure gauge at pump suction and manually adjust the makeup to hold the same positive steady pressure both before and after opening the drain valves.

Figure 18: Connections for flushing system piping



- *Flush should continue for at least two hours or longer until the drain water is clean and clear.
- Shut off the circulator pump and open all drains and vents to completely drain down the system.
- Short-circuited supply and return run outs should now be connected to the unit supply and return connections. Do not use sealers at the swivel flare connections of hoses.
- Refill the system with clean water.Test the water using litmus paper for acidity, and treat as required to leave the water slightly alkaline (pH 7.5 to 8.5).
- Antifreeze may also be added at this time. Use commercial grade antifreeze designed for HVAC systems only. Do not use automotive grade antifreeze. Antifreeze will have an effect on the performance of the unit.
- Once the system has been filled with clean water and antifreeze (if used), precautions should be taken to protect the system from contamination.

Venting Hydronic Coils

⚠ IMPORTANT

It is not Daikin's policy to make recommendations on what brand or type of water treatment is to be installed and used. It is the responsibility of the general contractor/owner to verify that the water supply to the units is free from contaminates, corrosive agents, chemicals and/or minerals. The general contractor/owner should contact a local water treatment company regarding water quality issues and treatment. A fouled water system will lead to premature component failure.

Hydronic coils require a vent, either manual or automatic, to release air from the unit. Primary coils on all ThinLine fan coils come standard with a coil air vent. It is located on the piping side of the unit, above the coil connections.

Secondary coils on ThinLine units are not equipped with an air vent, but one is included on all factory-supplied valve and piping packages. It is located on the pipe closest to the outlet coil connection. See Figure 18.

Perform the following steps to vent both primary and secondary coils after installing the unit:

- Pressurize the building piping system with water and vent any trapped air at system vents.
- For units with manual air vents, back the set screw out to expel air from the unit and then re-tighten the set screw.
- Automatic air vents should require no adjustment for the coil to vent. However, if the coil does not vent immediately, unscrew the outer portion of the fitting to expel air from the port. If debris has become trapped in the vent, completely remove the outer portion of the fitting and clean.

Equipment Start Up Check List

⚠ IMPORTANT

Fan coils must be filled with water before operating a circulating pump. Filling the system properly will result in immediate lubrication of the bearings. The pump bearings should not be allowed to operate dry.

Receiving and Inspection

☐ Unit received undamaged
☐ Unit received complete as ordered
☐ Parts for field installation received as ordered
☐ Unit arrangement/hand correct
☐ Unit structural support complete and correct

Handling and Installation

☐ Mounting grommets/isolators used
☐ Unit mounted level and square
☐ Proper access provided for unit and accessories
☐ Proper electrical service provided
☐ Proper overcurrent protection provided
☐ Proper service switch/disconnect provided
☐ Proper chilled water line size to unit
☐ Proper hot water line size to unit
☐ All services to unit in code compliance
☐ All shipping screws and braces removed
☐ Unit protected from dirt and foreign matter
☐ Install & connect parts for field installation

Cooling/Heating Connections

☐ Protect field-provided valve package components from heat
☐ Mount field-provided valve packages
☐ Connect field piping to unit
☐ Pressure test all piping for leaks
☐ Install drain line and traps, as required
☐ Insulate all piping, as required
☐ Install secondary drain pan under piping, as required

Ductwork Connections

☐ Install ductwork, fittings and grilles, as required
☐ Flexible duct connections at unit
☐ Proper supply and return grille type and size
☐ Control outside air for freeze protection
☐ Insulate all ductwork, as required

Electrical/Controls Connection

☐ Refer to unit wiring diagram
☐ Connect incoming power service or services
☐ Install and connect parts for field installation

Unit Start-up

☐ General visual unit and system inspection
☐ Check for proper fan rotation
☐ Record electrical supply voltage
☐ Check all wiring for secure connections
☐ Close all unit isolation valves
☐ Flush water systems
☐ Fill systems with water
☐ Vent water systems, as required
☐ All ductwork and grilles in place
☐ All unit panels and filters in place
☐ Start fans, pumps, chillers, etc.
☐ Check for overload conditions of all units
☐ Check all ductwork and units for air leaks
☐ Balance water systems, as required
☐ Balance air systems, as required
☐ Record all final settings for future use
☐ Check piping and ductwork for vibration
☐ Check all dampers for proper operation
☐ Verify proper cooling operation
☐ Verify proper heating operation
☐ Reinstall all covers and access panels
☐ Verify proper condensate drainage

General Maintenance

Normal maintenance on all units is generally limited to filter changes and cleaning the condensate drain pans. Units are provided with permanently lubricated motors and require no oiling.

Record performance measurements of volts, amps, and water temperature differences (both heating and cooling). A comparison of logged data with start-up and other annual data is useful as an indicator of general equipment condition.

Filter Changes

Filter changes are required at regular intervals. The time period between changes will depend upon the project requirements. Some applications, such as motels, produce a lot of lint from carpeting and linen changes, and will require more frequent filter changes. Units equipped with a MicroTech III board may have Change Filter indicator lights set to be activated at certain time intervals (60, 90 or 120 days). For units which were not provided with MicroTech board check filters at 60-day intervals for the first year until experience is acquired. If light cannot be seen through the filter when held up to sunlight or a bright light, it should be changed. A more critical standard may be desirable.

Filters can be removed without removing any panels. See Figure 19 or Figure 20. Cabinet units are equipped with large bottom access doors allowing easy access to the filter media from any direction.

A. **To remove the filter**

Bottom return:

1. Turn the tabs on the side of the filter frame.
2. Slide your fingers along the bottom of the filter until they reach the rear paperboard edge.
3. Pull the filter out of the unit.

Back return:

1. Turn the tabs on the bottom of the filter frame. Open the frame.
2. Feel for the paperboard edge of the filter. Slide the filter down and remove it.

C. **To install a new filter**

1. Bottom: Slide the filter in. Turn the tabs into place.
2. Back: Push the filter up until it clears the front lip on the filter housing, then turn the tabs into place.
3. Close the tabs of the filter frame.

Figure 19: Filter Removal for Units with Bottom Returns

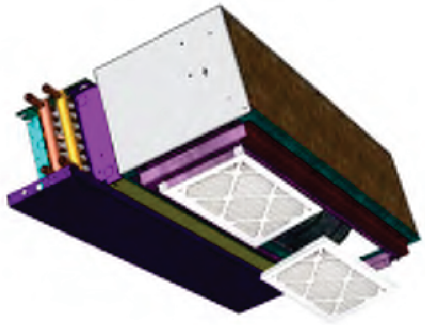
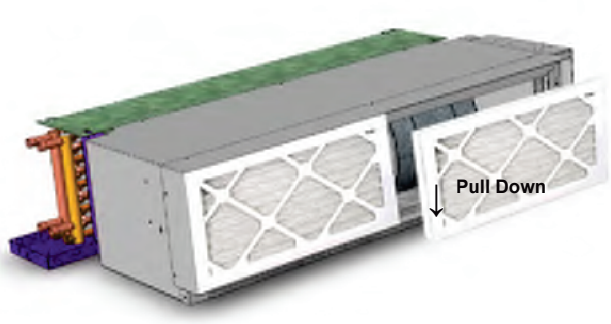


Figure 20: Filter Removal for Units with Rear Returns



Coils

Units provided with the proper type of air filters, even when replaced regularly,may require periodic coil cleaning. Coils may be cleaned in-place by removing the motor/blower assemblies and brushing the entering air face with a soft brush in a parallel motion with the fins. Do not brush perpendicular to the fin orientation, damage may occur. Brushing should be followed by blowing air through the fins with a vacuum cleaner from the leaving air side then removing all debris with the vacuum.

Electric Resistance Heater Assembly

Electric resistance heaters typically require no periodic maintenance when the unit's air filters are changed properly. Other conditions and equipment in the system may affect the operation and service life of the heaters. The most important operating conditions for an electric heater is airflow and supply voltage. As a rule, Daikin recommends operating the electric heater on the High speed, never on Low. Restricted or insufficient airflow over the elements and/or high supply voltage to the elements will result in the unit overheating. This condition may result in the heater cycling on the high limit thermal cutout and premature failure of the heater.

Open-wire type heaters provided with ThinLine fan coils (see Figure 21) have an automatic reset switch with a back up high limit thermal switch. Automatic reset switches reset after the heater has cooled. High limit thermal switches must be manually reset. The high limit thermal cutout switch and automatic reset switch are only safety devices, not intended for continuous operation. With proper unit application and normal operation, the high limit thermal devices will not trip.

The need to reset the manual switches indicates there is a problem. Any conditions that causes high limit cutout MUST be corrected immediately. High supply voltage causes excessive amperage draw and may result in tripping the circuit breaker or blowing fuses on the incoming power supply.

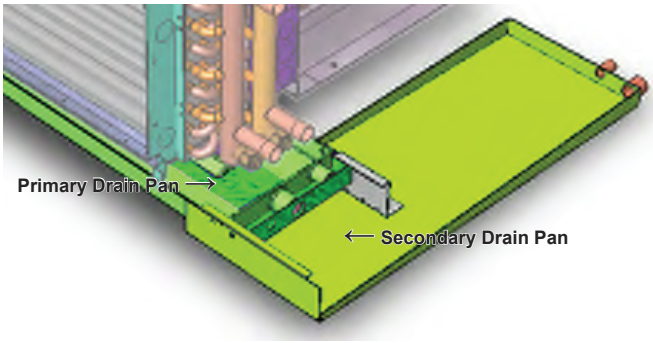
Figure 21: Exposed Electric Heater Assembly



Condensate Drain Pans

The main and secondary condensate drain pans should be checked annually and cleaned and flushed as required. See Figure 22.

Figure 22: Primary and Secondary Drain Pans



Accessing the Secondary Drain Pan

DANGER

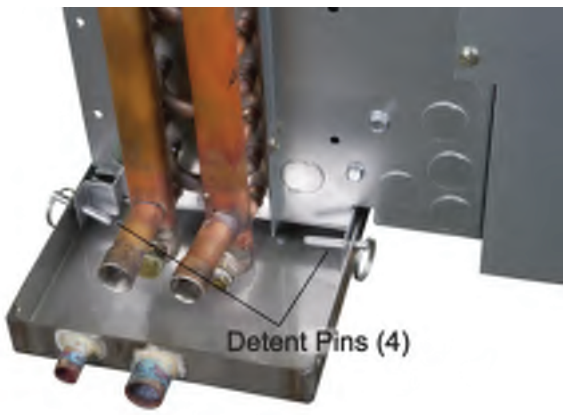
Water coils exposed to freezing temperatures should be drained or anti-freeze should be added to the water circuit to avoid freezing.

To access the secondary drain pan (cabinet units), remove the side panel from the side of the unit where the main piping connections are made (this is opposite the control panel side).

Drain Pan

1. Remove the 4 detent pins from the drain pan and move the pan to a location for inspection and cleaning.
2. After inspection and cleaning, reinstall the drain pans by reversing the procedure in Step 1.

Figure 23: Drain Pan Attachment to Coil Section



Blower

Dirt and dust should not be allowed to accumulate on the blower wheels or housing (see typical, Figure 24). Excessive debris can result in an unbalanced blower wheel condition which can damage the wheel and/or motor. The wheel and housing should be cleaned periodically using a brush and vacuum cleaner. Care must be taken to not dislodge the factory balancing weights on the blower blades.

Accessing/Removing the Main Fan Deck and Motor Assembly

Both the fan deck and the main condensate drain pan are easily removed for access and cleaning as follows.

Fan Deck:

1. Disconnect electrical power to the unit.
2. Remove the two screws that attach the fan deck to the chassis, see Figure 25 (on sizes 10 and 12 units, there are 4 screws to be removed).
3. Firmly grasp the fan deck and lift upward and off the unit. See Figure 26.
4. Disconnect the fan motor wiring harness by removing the plug where it attaches to the connector on the side of the chassis. See Figure 26.
5. To reinstall, follow these steps in reverse order.

NOTE: Push the tabs inward on the sides of the plug to free it from the connector base.

Monthly Intervals

- Inspect and clean the condensate drain pan to help avoid clogging of drainage by dirt, dust, etc. Inspect drainage piping for proper condensate flow.
- Check and clean the coil. Clean the coil with a low pressure water jet or low pressure air.
- Clean and tighten all the wiring connections.

Figure 24: Fan Housing

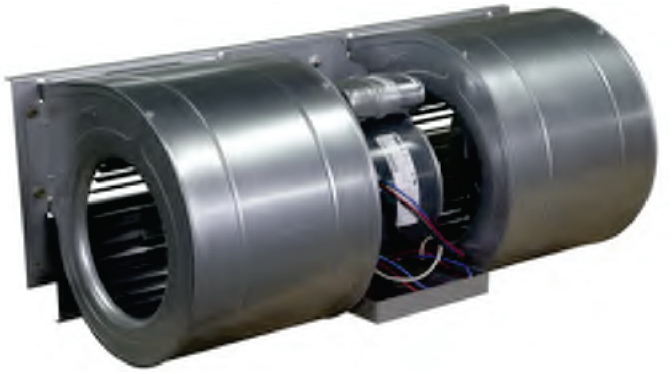


Figure 25: Removing Fan Deck Assembly

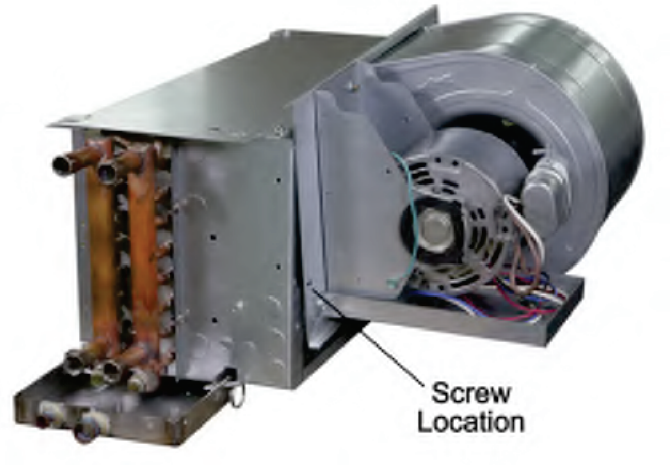


Figure 26: Unit Wiring Harness



Replacement Parts

Factory replacement parts should be used wherever possible to maintain the unit's performance, service life, operating characteristics and testing agency listings. Replacement parts may be purchased through a local Daikin sales representative.

Contact your local Daikin sales representative or Daikin Parts before attempting any unit modifications. Any modifications not authorized by Daikin could void all factory warranties and result in personal injury and/or unit damage.

When ordering replacement parts the following information must be supplied to ensure proper item identification:

1. Unit model number
2. Unit serial number
3. Unit orientation, hand connection (right or left hand when facing into the airstream)
4. Complete part description including any numbers

See replacement parts list for descriptions and part numbers. Contact Daikin for authorization of any returned parts, such as defective parts covered under warranty.

Controls

A wide variety of control options are available for Daikin ThinLine Horizontal Fan Coils, both unit-mounted and remote-mounted. This section provides a brief overview of these options and their operation. For more complete information, contact your Daikin representative.

3-Position Fan Switch with Manual ON-OFF

This three-speed fan switch (High, Med, Low) with ON-OFF option, shown at the right, is available as unit- or remote-mounted. It operates on low-voltage or line-voltage power and can be provided with a factory-mounted low-voltage interface board, which contains three-24 volt relays with line voltage contactors and terminal connections. The transformer is factory-installed and wired.



Sequence of operation

- *OFF:* Fan is turned OFF. The motorized fresh-air damper, when supplied, is closed .
- *High, Medium, Low:* Fan runs continuously at the selected speed. The two-position, motorized fresh-air damper, when supplied, is opened.

Low-Voltage (LV) Interface Board

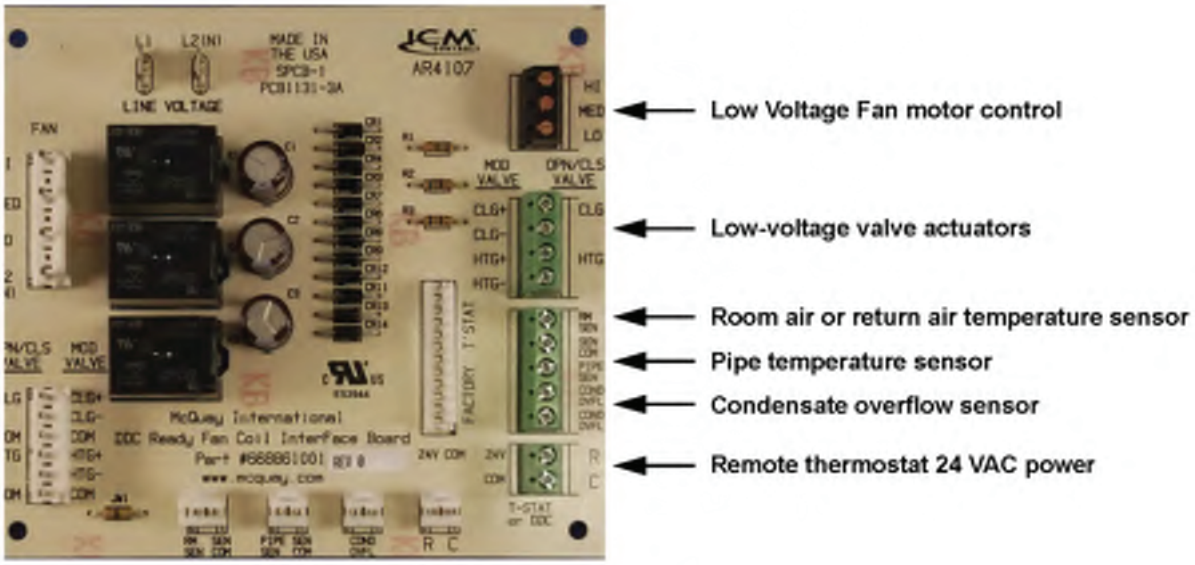
The low-voltage interface board is used with any remote (wall mounted) Daikin thermostat or control. It can also be used in conjunction with a field-supplied controller of a building automation system (BAS) control where low voltage is needed to operate the fan coil. It is located in the control box for the unit (see Figure 27).

The LV interface board includes:

- Three 24-volt relays with line-voltage contactors to operate the fan motor speeds.
- Terminal connections for interfacing to:
  - An optional remote-mounted thermostat.
  - Low-voltage actuators for heating and cooling valves.
  - A return air sensor.
  - A pipe temperature sensor for changeover from heating to cooling on two-pipe systems.
- A factory-wired and installed transformer.

See Figure 27 for a list of connecting points to the board. For additional wiring information, see the typical wiring diagram Figure 52 on page 44 or the unit's wiring diagram, which is attached to the fan coil exterior. (see Figure 10 on page 13).

Figure 27: LV Interface Board 24 VAC connections



MT155 Thermostat

For more details refer to Addendum IM 1014 — MT155 on page 55. The MT155 series thermostat provides ON-OFF control for low-voltage or line-voltage valves and fan motors. This thermostat is designed as a remote-mount with connection to the LV interface board mounted on the fan coil unit. Options include manual or automatic changeover and three-speed fan control for continuous or cycling fan operation.

Figure 28: MT155 Thermostats



Two standard control options are available:

- *Continuous fan and ON-OFF* valve cycle operation: The thermostat cycles the valves on and OFF. The fan runs continuously at the manually selected fan speed.
- *ON-OFF fan and ON-OFF valve cycle operation:* The thermostat cycles the fan from the manually selected fan speed to OFF and it cycles the valves ON and OFF.

When the system switch is in the OFF position, the fan coil system including the fan is shut OFF.

TA155: A HEAT-OFF-COOL system switch manually selects heating or cooling mode (Addendum IM 1089 — MT155 A/B on page 59). In the HEAT position, only the heat output cycles with demand. In the COOL position, only the cool output cycles with demand. In the OFF position, heating and cooling outputs are off. Units with a two position system switch or without a system switch must use a load transfer switch when both heating and cooling outputs are used. This prevents control failure and equipment damage caused by direct cycling between loads.

TB155: An ON-OFF system switch enables auto-changeover of heating and cooling modes (Addendum IM 1089 — MT155 A/B on page 59). In the ON position the thermostat activates heating or cooling outputs dependant upon the relationship between set point and ambient temperature. Heat on to cool on dead band is 4°F. In the OFF position, heating and cooling outputs are OFF. Units without a system switch cycle between heating and cooling with a 4°F dead band.

FAN: Some units have a switch for manual selection of fan speed. On these units fan operation is either internally wired for fan continuous operation or is dependant upon connection to the fan supply input . When internally wired for fan continuous operation, the fan will be OFF when the system switch is OFF. When dependant upon external connections the fan may not be OFF with the system switch in the OFF position. The fan supply input is switched to fan speed outputs (HI-MED-LO).

Digital Thermostats

Daikin offers a broad range of remote, wall-mounted digital thermostats with the capability to control ON-OFF, 3-wire and proportional modulating valves and Normally-Closed or Normally-Open actuator valves. For more information, refer to Daikin publications ED 18513 and ED 18527.



MT158 and MT168 Thermostat-Controllers with Digital Display

For more details refer to Addendum IM 1089 — MT155 A/B on page 59, Addendum IM 1016 — MT158 B on page 67 and Addendum IM 1017 — MT168 on page 71. Series MT158 and MT168 microprocessor-based thermostat-controllers combine a proportional integral control algorithm with adaptive logic. They are remote-wall mounted.

Figure 29: MT158 and MT168 Thermostats



Heating and cooling outputs for the MT158 are individually configurable for three-wire floating control valves or ON/OFF valves in the Normally Open or Normally Closed modes.

Heating and cooling outputs for the MT168 provide 0-10 Vdc or 4-20 mA for proportional modulating valve control. The integrated, three-speed fan control switch is line voltage to allow direct connection to the fan motors. Manual or automatic changeover is provided with remote setback capability from a time clock or facility management system. Features include a Fahrenheit or Celsius digital display and a built-in purge cycle which assists the controller to determine if the system is supplying hot water or cooling.

Two standard control options are available:

- *Continuous fan and modulating (or ON-OFF) valve operation:* The fan runs continuously at the manually selected fan speed (high, medium or low). The controller modulates the valves or, on the MT158, dip-switches can be set to cycle the valves ON and OFF.
- *ON-OFF fan cycle operation and modulating (or ON-OFF) valve operation:* The controller cycles the fan from the manually selected fan speed to OFF. The controller modulates the valves or, on the MT158, dip-switches can be set to cycle the valves ON and OFF.

T170 Thermostat with Digital Display

Two thermostats are offered for remote installation only: TA170 for three-speed fan control and TB170 for staged fan operation. Both thermostats are used for ON-OFF control of low- or line-voltage valves with auto changeover. Detailed installation instructions and modes of operation can be found in Addendum IM 846 — MT170 on page 75.

Figure 30: T170 Thermostat with Digital Display



T180 Programmable Thermostat

Daikin offers two different 7-Day Programmable Digital Heating/Cooling Thermostat with constant fan or Fan cycled, ON/OFF Valve Control depending on the fan speed control. The thermostat interface contains buttons for use in navigation to accompanying menus/screens and for performing specific operations. Detailed installation instructions and modes of operation can be found in Addendum IM 1019 — MT180 on page 85.

Figure 31: T180 Thermostat with Digital Display



MicroTech III Controller

⚠ IMPORTANT

Units equipped with MicroTech III controllers should be used in conjunction with wall-mounted sensors only. Thermostats should not be used with MicroTech controllers.



ThinLine fan coils can be provided with unit-mounted MicroTech controllers and multiple unit- or room-mounted sensors.

MicroTech is a unit-mounted controller able to operate in either a stand-alone non-communicating environment or a communicating environment. To operate in a communicating environment, a board named *communication module*, is installed on the unit controller. There are two types of communication modules available with MicroTech controllers: LONWORKS and BACnet MSTP.

Unit controllers and/or I-O expansion boards have inputs for room or return temperatures, temperature setpoint adjustments, fan speed switches, entering water temperatures, discharge air temperatures, changeover auto switches, low temperature detection, emergency shutdown detection, condensate overflow detection, dirty air filter detection and occupancy. All sensors are software selectable and the controller is configured based on the selection.

For units with factory installed MicroTech III controllers, please see OM 1111 for details.

Sensors

Room Temperature Sensor with Setpoint Adjustable Module and Fan Speed Control



The Digitally Adjustable sensor provides the ultimate of temperature control and display, simple user interface, alarm annunciation, and alarm reset. The easy to ready LCD clearly identifies the system operating mode including occupied/unoccupied mode, fan operation and control, unit status, timed override status, alarm annunciation, and energy savings mode through a series of recognizable icons. Tactile response buttons initiate adjustments for temperature set points, system mode, fan mode, occupancy, tenant override and fault reset functions. The large numeric LCD will display space temperature (°F or °C) with the corresponding setpoint conditions. This sensor is designed for use with BACnet or LONWORKS applications. However, it can also be installed as a standalone sensor using factory default set points.

For detailed installation instructions and modes of operation see Addendum IM 1171 — Digitally Adjustable Display Sensor on page 92.

MicroTech III Wall-Mounted Room Temperature Sensor with Timed Override



MicroTech III Wall Mounted Room Temperature Sensors provide electronic sensing of room temperatures at wall locations. The sensor features a thermistor (10kO), a green LED for unit status and tenant override button.

Sensor Specifications

- Thermistor resistance (10kΩ) (Conforms to Advance Thermal Products curve 2)
- Ambient Temperature Limits:
  - — Shipping and Storage: 40°F to 160°F (–40°C to 71°C)
  - — Operating: 40°F to 140°F (4°C to 60°C)
- Locations: NEMA Type 1, Indoor only
- Connections: Color Coded Leads

Wiring

3-lead NEC Class II low voltage wiring.

NOTE:

1. Do not install the wire cables in the same conduit with power wiring.
2. Never apply external voltage of any type to any terminal or damage will result.
3. Do not exceed ratings of the device. This is a low voltage device:
4. Always use 22-gauge wire and never locate the room temperature sensor more than 250′ from the unit:

Wiring must be installed in accordance with the National Electrical Code and all local codes and ordinances, which can require the use of plenum rated cable or conduit.

Mounting Location

Locate the sensor on a wall where exposure to unrestricted air circulation represents the average temperature of the space. A common mistake is to mount the sensor too close to the supply air diffuser in a room. This causes short cycling of the air conditioning unit and large room temperature swings.

Installation

⚠ DANGER

THIS EQUIPMENT PRESENTS HAZARDS OF ELECTRICITY.

Failure to read and follow these instructions can result in property damage, severe personal injury or death.

⚠ CAUTION

Be certain that exposed portions of wires do not come in contact with each other.

1. Turn off power at the main service panel by removing the fuse or switching the appropriate circuit breaker to the OFF position.
2. To remove the cover on sensor 669529001, loosen two allen-wrench set screws located on the underside of the cover.
3. Place the wall sensor mounting base against the wall where the sensor where be located. Using the base as a template trace the mounting holes onto the wall.
4. Drill a 3/16" hole at each mounting hole mark.
5. Insert wall anchors into mounting holes and tap in to the wall surface.
6. Feed wires through the back of the sensor mounting base and align sensor mounting holes with wall anchors.
7. Use supplied screws to secure sensor base to wall.
8. Connect stripped, labeled wires to matching terminals on the temperature sensor. Refer to Figure 32 for wiring details.
9. Tighten screws on terminal connections. Gently tug wire to check for secure connections. Confirm that each wire is connected to the proper terminal.
10. Seal the hole where the wire enters through the wall behind the temperature sensor, with non-flammable insulation or putty.
11. Replace cover on wall temperature sensor by snapping it in place.
12. Turn on power to the system at the main service panel.
13. Test wall temperature sensor operation as described in “Testing”.

NOTE: Mount the sensor five feet above the floor. Do not mount the sensor on an outside wall, in direct sunlight, behind a door, or in an area affected by a vent or duct.

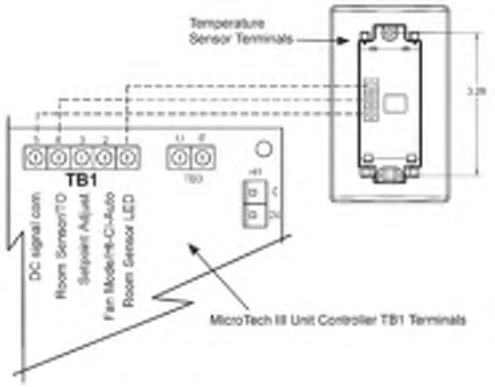
Utility Box Mounting of Sensor 669529001

1. Feed the cable from the utility box.
2. Strip 1/4–inch of insulation from the end of the wires.
3. Connect stripped, labeled wires to matching terminals on the temperature sensor base. See Figure 32.
4. Tighten screws on terminal connections. Gently tug wire to check for secure connections. Confirm that each wire is connected to the proper terminal.
5. Neatly store excess wire back inside the utility box.
6. Mount the sensor base to the utility box using two 6-32 × 5/8–inch flat head sheet metal screws provided with the sensor.
7. Replace cover on wall temperature sensor by attaching the catches at the top of the cover to the top tabs on the sensor base. Secure the cover to the base by tightening the two allen wrench set-screws on the bottom of the sensor cover. Do not overtighten.

NOTE: Sensor 669529001 has two allen wrench set-screws on the underside of the sensor cover to secure it in place. Do not overtighten.

Wiring

Figure 32: Temperature Sensor Wiring to MicroTech III Unit Controller



Cool Test

1. Using the building automation system (BMS), adjust room cooling setpoint to 5 degrees below room temperature.
2. Air conditioning should come on within five (5) minutes. Status indicator may come on.
3. Using the BMS, adjust the set temperature 2 degrees above the room temperature and the A/C should turn off. There may be a fan delay on your system.

Heat Test

1. Using the building automation system (BMS), adjust room heating setpoint to 5 degrees above room temperature.
2. Heating should come on within five (5) minutes. Status indicator may come on.
3. Using the BMS, adjust the set temperature 2 degrees above the room temperature and the A/C should turn off. There may be a fan delay on your system.

Timed Override

Press Override button for more than 3 but less than 10 seconds and Unit will return to Occupied operation until the override time expires (as programmed in BMS).

Figure 33: MicroTech III Room Temperature Wall Sensor with Timed Override



Troubleshooting

Symptom	Remedy
No LED illuminated	Check for 5 VDC at sensor, LED is dark when 5 VDC is not present
Unit turns on and off too frequently	Sensor must be located as described in " Mounting Location".

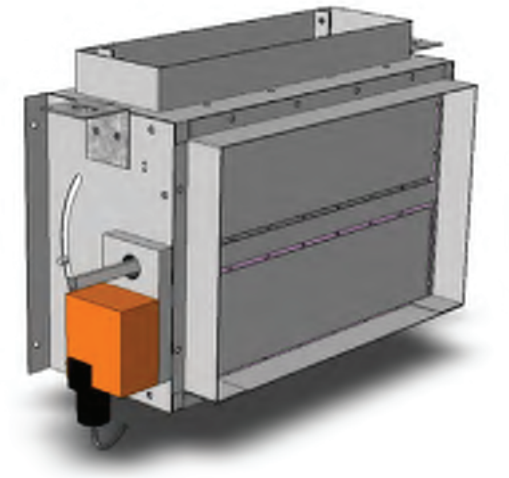
The fresh air damper module with top or rear fresh air inlets is available for concealed, recessed or exposed units. Fresh Air Damper control can be automated or manual. Automatic options include a 2-position control or a full economizer option (MicroTech controller only).

Manual Damper – The manual damper is field-adjustable to allow a zero to 25 percent fresh air position.

Auto Two-Position Damper – The auto two-position damper is factory set at 25 percent when open. The damper can be set in the field to allow a zero to 50 percent fresh air position.

Economizer Damper – The economizer damper is accompanied by a factory-installed and wired modulating actuator. The damper is factory set at 25 percent default minimum and 100 percent maximum opening. The damper is field adjustable using MicroTech III to allow a zero to 100 percent fresh air.

Figure 34: Factory Installed Dampers



Unit Data

Table 1: Physical Data: Coils, Fans, Motors and Filters

	Size 02	Size 03	Size 04	Size 06	Size 08	Size 10	Size 12
Primary Coil Data							
Face Area, ft^2 (cm^2)	1.08 (1004)	1.08 (1004)	1.43(1323)	2.11(1962)	2.46(2281)	3.14(2917)	3.83(3559)
Fins/inch (cm)	12 (4.7)	12 (4.7)	12 (4.7)	12 (4.7)	12 (4.7)	12 (4.7)	12 (4.7)
Connection Size	1/2" Nominal Copper (5/8" OD)						
Coil Dimensions							
2-Row L × D × H, in (cm)	17.3 × 1.7 × 9 (43.9 × 4.4 × 22.9)	17.3 × 1.7 × 9 (43.9 × 4.4 × 22.9)	22.8 × 1.7 × 9 (57.9 × 4.4 × 22.9)	33.8 × 1.7 × 9 (85.9 × 4.4 × 22.9)	39.3 × 1.7 × 9 (99.8 × 4.4 × 22.9)	50.2 × 1.7 × 9 (127.6 × 4.4 × 22.9)	61.3 × 1.7 × 9 (155.7 × 4.4 × 22.9)
3-Row L × D × H, in (cm)	17.3 × 2.6 × 9 (43.9 × 6.6 × 22.9)	17.3 × 2.6 × 9 (43.9 × 6.6 × 22.9)	22.8 × 2.6 × 9 (57.9 × 6.6 × 22.9)	33.8 × 2.6 × 9 (85.9 × 6.6 × 22.9)	39.3 × 2.6 × 9 (99.8 × 6.6 × 22.9)	50.2 × 2.6 × 9 (127.6 × 6.6 × 22.9)	61.3 × 2.6 × 9 (155.7 × 6.6 × 22.9)
4-Row L × D × H, in (cm)	17.3 × 1.7 × 9 (43.9 × 8.8 × 22.9)	17.3 × 3.5 × 9 (43.9 × 8.8 × 22.9)	22.8 × 3.5 × 9 (57.9 × 8.8 × 22.9)	33.8 × 3.5 × 9 (85.9 × 8.8 × 22.9)	39.3 × 3.5 × 9 (99.8 × 8.8 × 22.9)	50.2 × 3.5 × 9 (127.6 × 8.8 × 22.9)	61.3 × 3.5 × 9 (155.7 × 8.8 × 22.9)
Coil Volume, Gal (Liters)							
2-Row	0.19 (0.7)	0.19 (0.7)	0.24(.9)	0.32(1.2)	0.37(1.4)	0.46(1.7)	0.55(2.1)
3-Row	0.26 (1.0)	0.26 (1.0)	0.32(1.2)	0.45(1.7)	0.52(2.0)	0.64(2.4)	0.77(2.9)
4-Row	0.34 (1.3)	0.34 (1.3)	0.43(1.6	0.61(2.3)	0.70(2.6)	0.87(3.3)	1.05(4.0)
Secondary Coil Data: 1-Row Standard Capacity, Hot Water or Steam							
Face Area, ft^2 (cm^2)	0.61(567)	0.61(567)	0.84(780.1)	1.3(1208)	1.5(1421)	1.99(1845)	2.44(2267)
Fins/inch (cm)	12 (4.7)	12 (4.7)	12 (4.7)	12 (4.7)	12 (4.7)	12 (4.7)	12 (4.7)
L × D × H, in (cm)	14.7 × .86 × 6 (37.3 × 2.2 × 15.2)	14.7 × .86 × 6 (37.3 × 2.2 × 15.2)	20.2 × .86 × 6 (51.3 × 2.2 × 22.9)	31.2 × .86 × 6 (79.2 × 2.2 × 22.9)	36.7 × .86 × 6 (93.2 × 2.2 × 22.9)	47.7 × .86 × 6 (121.1 × 2.2 × 22.9)	58.7 × .86 × 6 (149.0 × 2.2 × 22.9)
Coil Volume, Gal (Liters)	0.06 (0.23)	0.06 (0.23)	0.08 (0.30)	0.11 (0.42)	0.12 (0.45)	0.15 (0.57)	0.18 (0.70)
Secondary Coil Data: 1-Row High Capacity, Hot Water or Steam							
Face Area, ft^2 (cm^2)	0.82 (762)	0.82 (762)	1.26 (1171)	1.73 (1607)	2.04 (1895)	2.65 (2460)	3.26 (3029)
Fins/inch (cm)	12 (4.7)	12 (4.7)	12 (4.7)	12 (4.7)	12 (4.7)	12 (4.7)	12 (4.7)
L × D × H, in (cm)	14.7 × .86 × 8 (37.3 × 2.2 × 20.3)	14.7 × .86 × 8 (37.3 × 2.2 × 20.3)	20.2 × .86 × 8 (51.3 × 2.2 × 22.9)	31.2 × .86 × 8 (79.2 × 2.2 × 22.9)	36.7 × .86 × 8 (93.2 × 2.2 × 22.9)	47.7 × .86 × 8 (121.1 × 2.2 × 22.9)	58.7 × .86 × 8 (149.0 × 2.2 × 22.9)
Coil Volume, Gal (Liters)	0.08 (0.30)	0.08 (0.30)	0.11 (0.42)	0.14 (0.53)	0.16 (0.61)	0.20 (0.76)	0.24 (0.92)
Fan/Motor Data							
Fan Quantity	1	1	2	2	2	4	4
Motor Quantity	1	1	1	1	1	2	2
Filter Data							
1" (25.4 cm) Media	Throwaway (MERV 4), MERV 7*, MERV 13* and Aluminum Washable						
Quantity	1	1	1	1	1	2	2
Hideaway cm L × D × H, in. ()	10.50 × 1.00 × 8.75 (26.6 × 2.5 × 22.2)	10.50 × 1.00 × 8.75 (26.6 × × 2.5 × 22.2)	16.00 × 1.00 × 8.75 (40.6 × 2.5 × 22.2)	27.21 × 1.00 × 8.75 (69.1 × 2.5 × 22.2)	32.71 × 1.00 × 8.75 (83.1 × 2.5 × 22.2)	21.81 × 1.00 × 8.75 (55.4 × 2.5 × 22.2)	27.31 × 1.00 × 8.75 (69.3 × 2.5 × 22.2)
Cabinet L × D × H, in. (cm)	15.63 × 1.00 × 10.89 (39.7 × 2.5 × 27.6)	15.63 × 1.00 × 10.89 (39.7 × 2.5 × 27.6)	21.00 × 1.00 × 10.89 (53.3 × 2.5 × 27.6)	32.13 × 1.00 × 10.89 (81.6 × 2.5 × 27.6)	39.25 × 1.00 × 10.89 (81.7 × 2.5 × 27.6)	24.38 × 1.00 × 10.89 (61.9 × 2.5 × 27.6)	30.00 × 1.00 × 10.89 (76.2 × 2.5 × 27.6)

* For use with ECM only

Shipping Weights

Table 2: Approximate Shipping Weights - lbs (kg)*

Unit Type	Unit Size						
	S02	S03	S04	S06	S08	S10	S12
FCHC/FCHR	108 (49)	110 (50)	124 (56)	139 (63)	151 (69)	184 (84)	196 (89)
FCHH	30 (14)	33 (15)	35 (16)	45 (20)	55 (25)	62 (28)	65 (30)

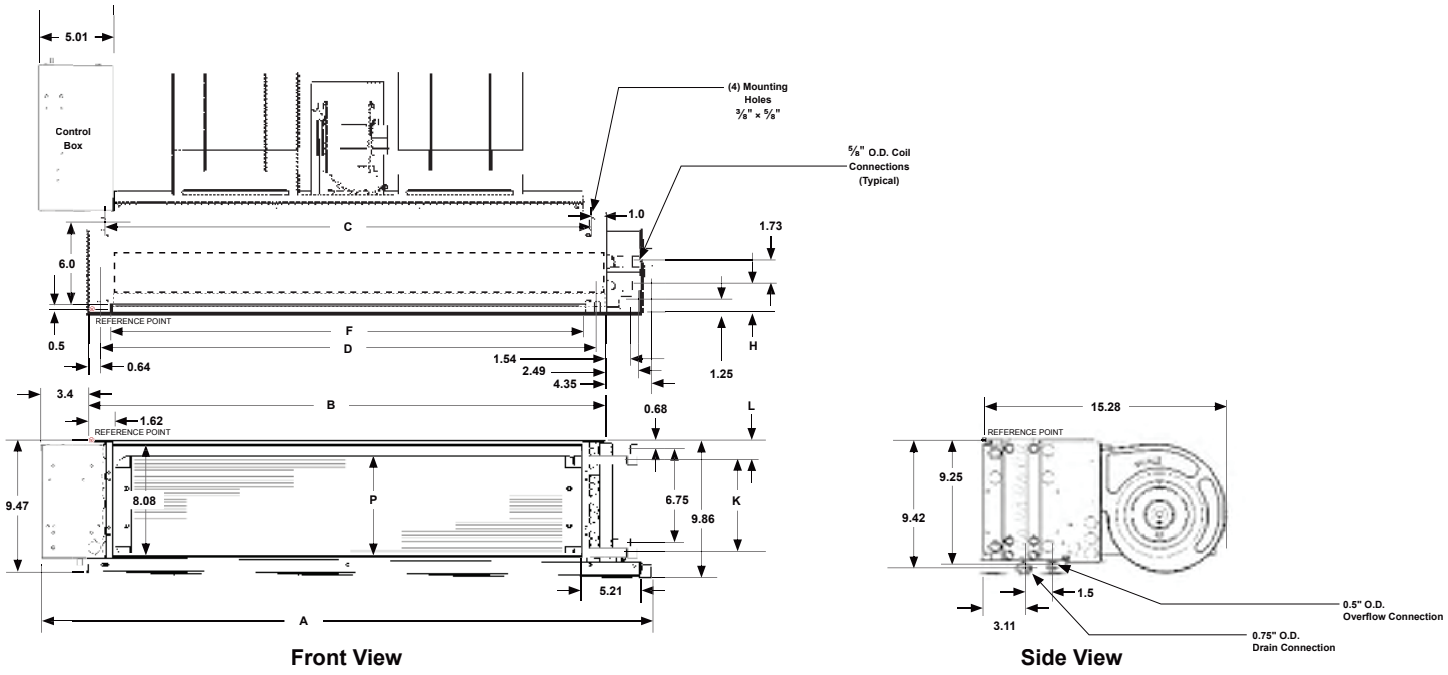
Note: *Approximate dry weights do not include plenums, valve packages, hot water coils, electric heaters or other options.

Unit Dimensions

Figure 35: Dimensions – Hideaway Fan Coil, Front Discharge – Free Return

Reheat coil shown

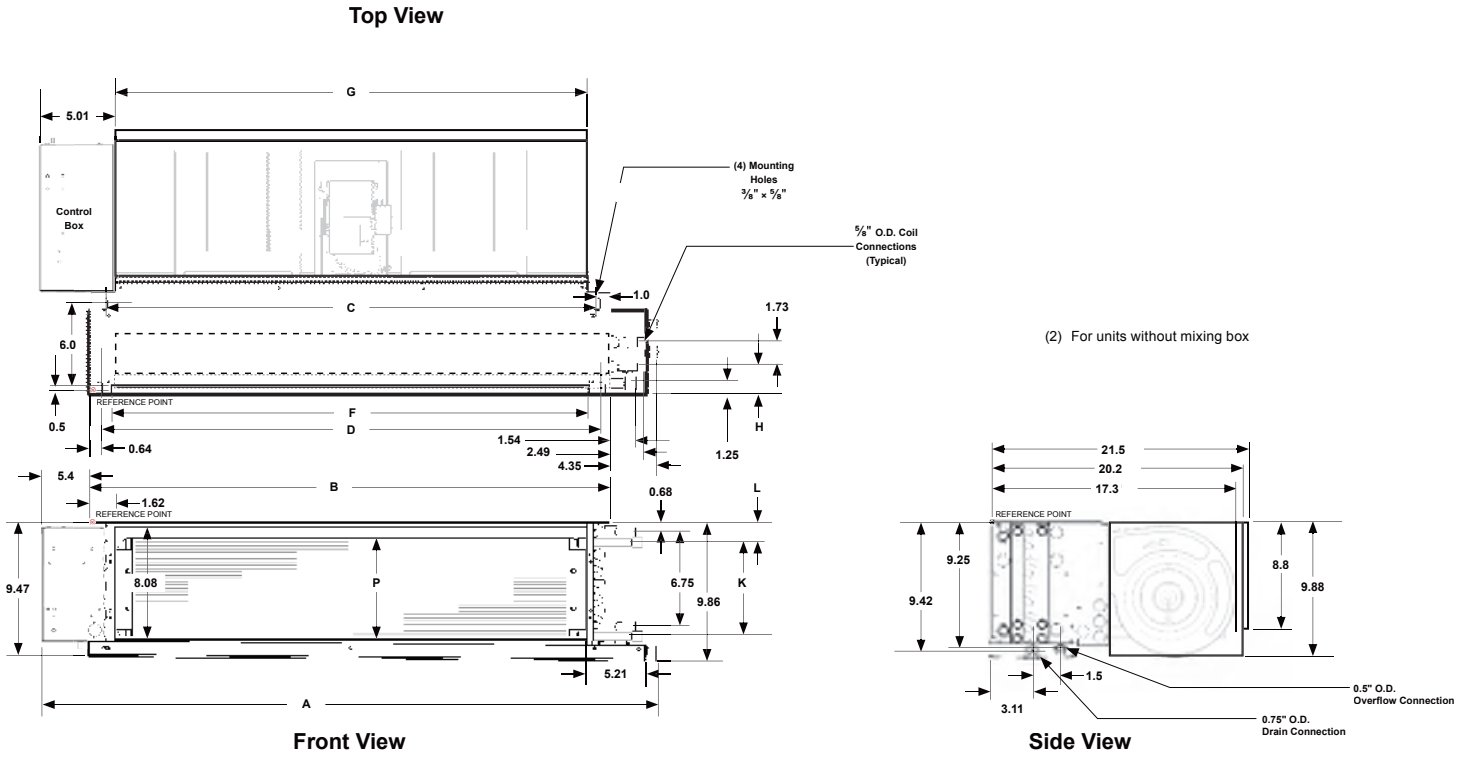
Top View



Front View **Side View**

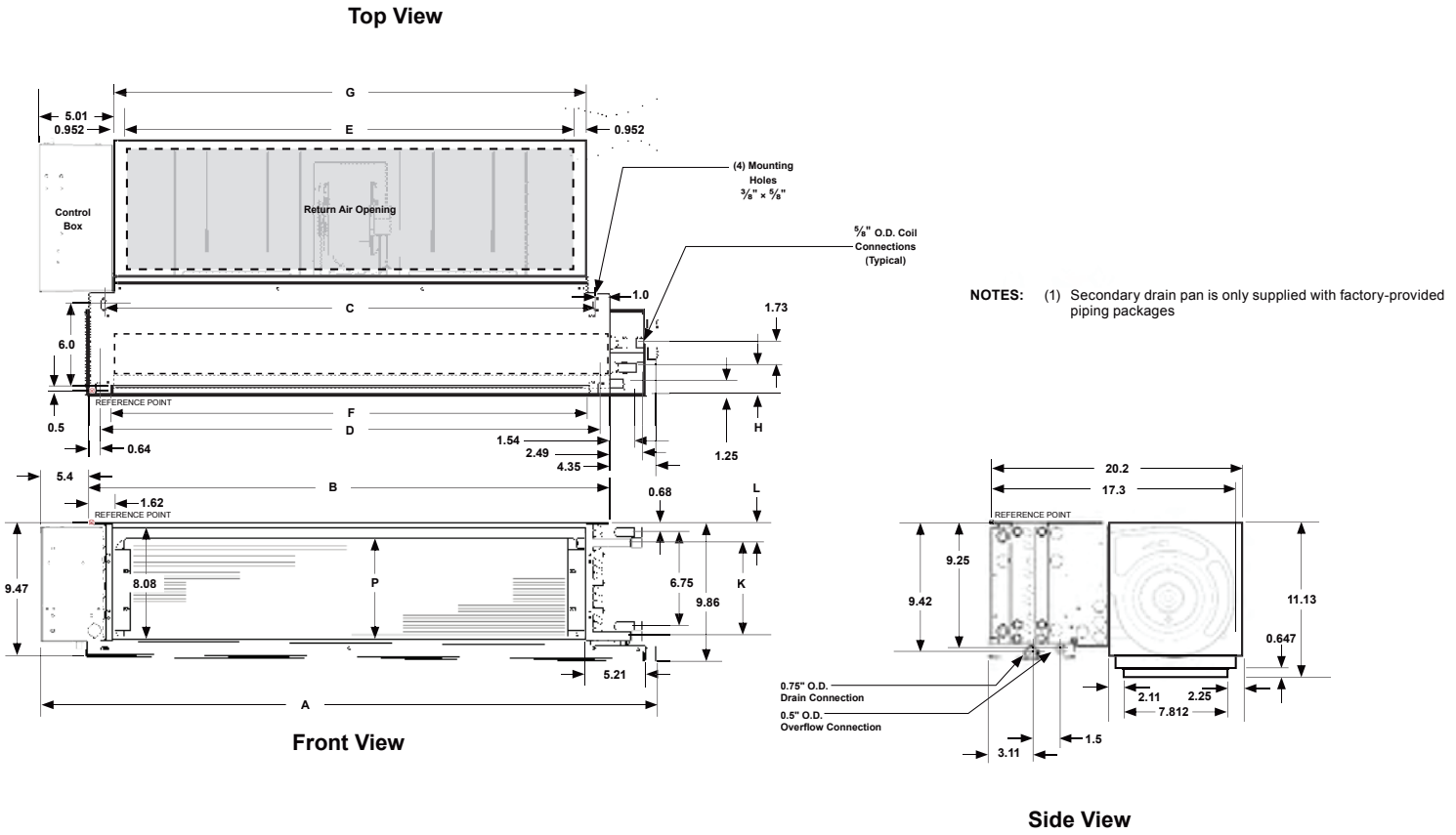
Dimension		S02	S03	S04	S06	S08	S10	S12
		inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)
Overall Unit Width	A	28.48 (723)	28.48 (723)	33.98 (863)	44.98 (1142)	50.48 (12.82)	61.48 (1562)	72.48 (1841)
Chassis Width	B	20.63 (524)	20.63 (524)	26.13 (664)	37.13 (943)	42.63 (1083)	53.63 (1362)	64.63 (1641)
Mounting Hole Distance (Rear)	C	18.64 (473)	18.64 (473)	24.14 (613)	35.14 (892)	40.64 (1032)	51.64 (1312)	62.44 (1702)
Mounting Slot Location (Front)	D	19.35 (491)	19.35 (491)	24.85 (631)	35.85 (911)	41.35 (1050)	52.35 (1330)	63.35 (1609)
Discharge Opening - Width	F	17.39 (442)	17.39 (442)	22.84 (581)	33.89 (867)	39.39 (1000)	50.39 (1280)	61.39 (1559)
Primary Coil Location	H	1.81 (46) for 2- or 3-row primary coil; 2.81 (71) for 4-row primary coil						
Secondary Coil - Standard Capacity	L	2.86 (73)						
Secondary Coil - High Capacity		0.86 (22)						
Secondary Coil - Standard Capacity	K	5.0 (127)						
Secondary Coil - High Capacity		7.0 (178)						

Figure 36: Dimensions – Hideaway Fan Coil With Plenum, Front Discharge – Rear Return



Dimension		S02	S03	S04	S06	S08	S10	S12
		inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)
Overall Unit Width	A	30.48 (771)	30.48 (771)	35.98 (944)	46.98 (1193)	52.48 (1333)	63.48 (1612)	74.48 (1892)
Chassis Width	B	20.63 (524)	20.63 (524)	26.13 (664)	37.13 (943)	42.63 (1083)	53.63 (1362)	64.63 (1641)
Mounting Hole Distance (Rear)	C	18.64 (473)	18.64 (473)	24.14 (613)	35.14 (892)	40.64 (1032)	51.64 (1312)	62.44 (1702)
Mounting Slot Location (Front)	D	19.35 (491)	19.35 (491)	24.85 (631)	35.85 (911)	41.35 (1050)	52.35 (1330)	63.35 (1609)
Discharge Opening - Width	F	17.39 (442)	17.39 (442)	22.84 (581)	33.89 (867)	39.39 (1000)	50.39 (1280)	61.39 (1559)
Plenum/Return Air Opening - Width	G	21.5 (546)	21.5 (546)	27.0 (686)	38.0 (965)	43.5 (1105)	54.5 (1384)	65.5 (1664)
Primary Coil Location	H	1.81 (46) for 2- or 3-row primary coil; 2.81 (71) for 4-row primary coil						
Secondary Coil - Standard Capacity	L	2.86 (73)						
Secondary Coil - High Capacity		0.86 (22)						
Secondary Coil - Standard Capacity	K	5.0 (127)						
Secondary Coil - High Capacity		7.0 (178)						

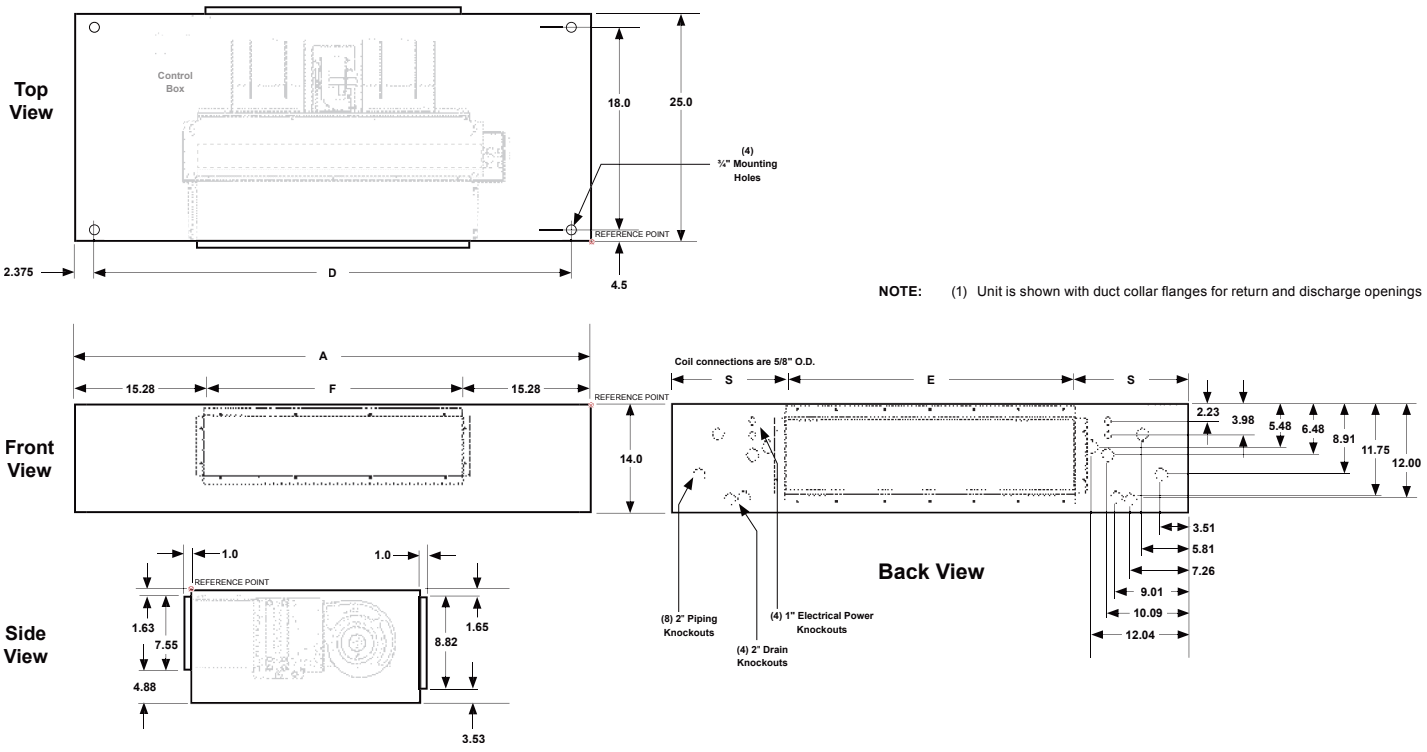
Figure 37: Dimensions – Hideaway Fan Coil With Plenum, Front Discharge – Bottom Return



NOTES: (1) Secondary drain pan is only supplied with factory-provided piping packages

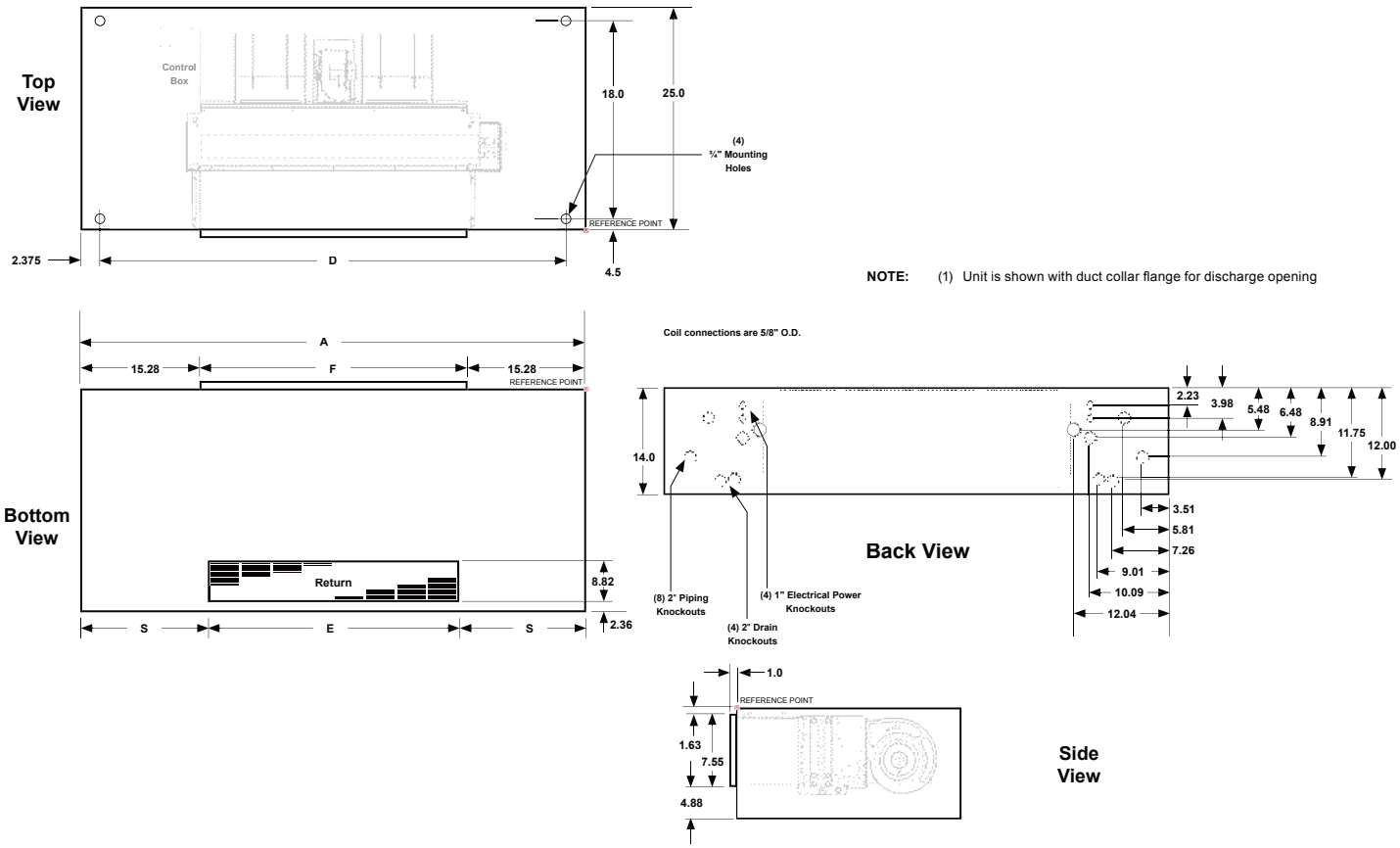
Dimension		S02	S03	S04	S06	S08	S10	S12
		inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)
Overall Unit Width	A	30.48 (771)	30.48 (771)	35.98 (944)	46.98 (1193)	52.48 (1333)	63.48 (1612)	74.48 (1892)
Chassis Width	B	20.63 (524)	20.63 (524)	26.13 (664)	37.13 (943)	42.63 (1083)	53.63 (1362)	64.63 (1641)
Mounting Hole Distance (Rear)	C	18.64 (473)	18.64 (473)	24.14 (613)	35.14 (892)	40.64 (1032)	51.64 (1312)	62.44 (1702)
Mounting Slot Location (Front)	D	19.35 (491)	19.35 (491)	24.85 (631)	35.85 (911)	41.35 (1050)	52.35 (1330)	63.35 (1609)
Return Air Opening - Width	E	17.7 (450)	17.7 (450)	23.2 (589)	34.2 (869)	39.7 (1008)	50.7 (1288)	61.7 (1567)
Discharge Opening - Width	F	17.39 (442)	17.39 (442)	22.84 (581)	33.89 (867)	39.39 (1000)	50.39 (1280)	61.39 (1559)
Plenum Width	G	21.5 (546)	21.5 (546)	27.0 (686)	38.0 (965)	43.5 (1105)	54.5 (1384)	65.5 (1664)
Primary Coil Location	H	1.81 (46) for 2- or 3-row primary coil; 2.81 (71) for 4-row primary coil						
Secondary Coil - Standard Capacity	L	2.86 (73)						
Secondary Coil - High Capacity		0.86 (22)						
Secondary Coil - Standard Capacity	K	5.0 (127)						
Secondary Coil - High Capacity		7.0 (178)						

Figure 38: Dimensions – Cabinet Fan Coil, Front Discharge – Rear Return



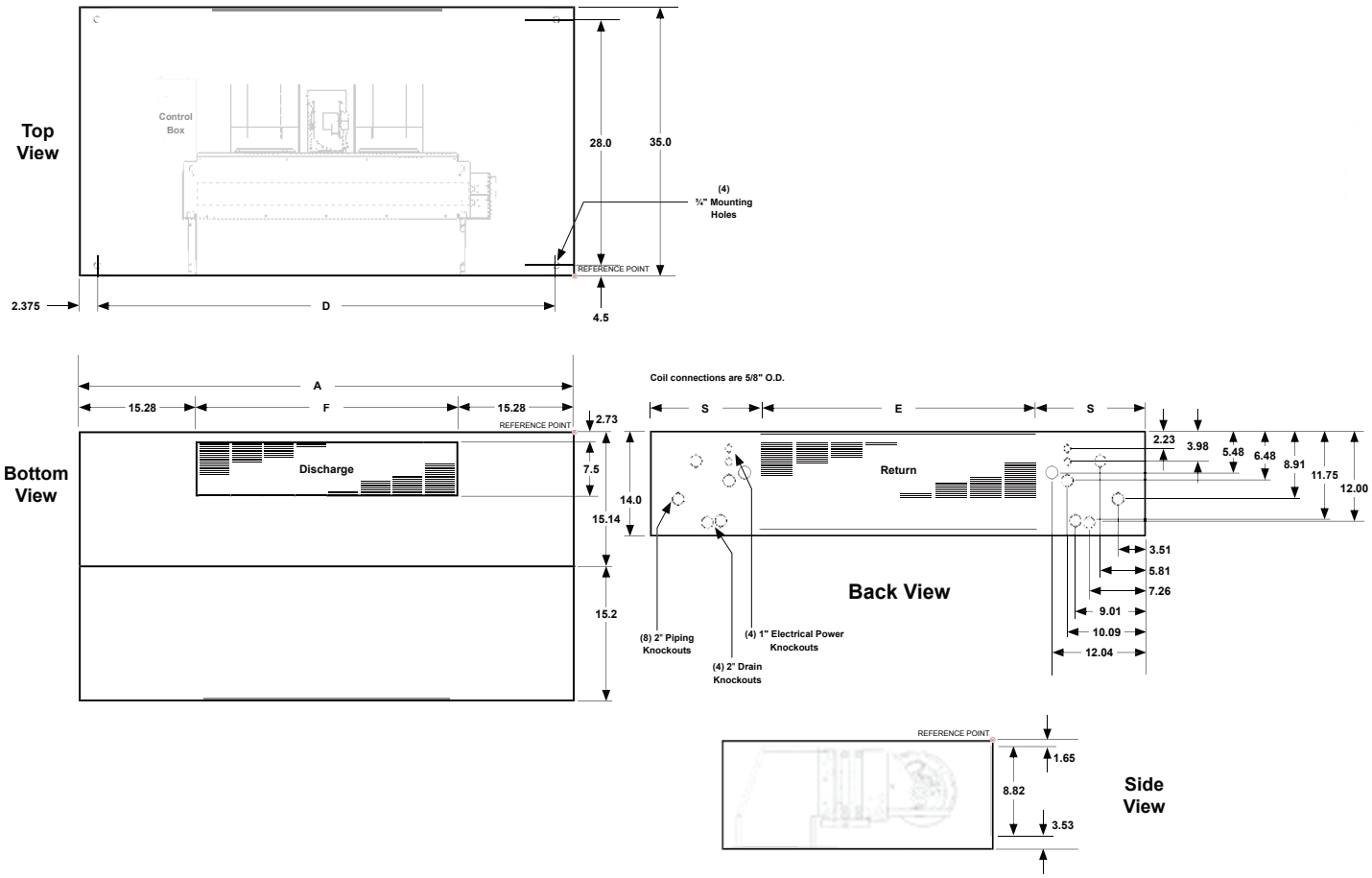
Dimension		S02	S03	S04	S06	S08	S10	S12
		inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)
Overall Unit Width	A	47.64 (1210)	47.64 (1210)	53.14 (1350)	64.14 (1629)	69.64 (1769)	80.63 (2048)	91.64 (2328)
Mounting Hole Distance	D	40.64 (1032)	40.64 (1032)	46.14 (1172)	57.14 (1451)	62.64 (1591)	73.64 (1870)	84.64 (2150)
Return Air Opening - Width	E	19.0 (483)	19.0 (483)	22.9 (581)	34.5 (876)	38.4 (975)	50.0 (1270)	61.6 (1565)
Discharge Opening - Width	F	17.09 (434)	17.09 (434)	22.59 (574)	33.59 (853)	39.09 (993)	50.09 (1272)	61.09 (1552)
Return Air Opening Location	S	14.32 (364)	14.32 (364)	15.13 (384)	14.82 (376)	15.63 (397)	15.32 (389)	15.01 (381)

Figure 39: Dimensions – Cabinet Fan Coil, Front Discharge – Bottom Return



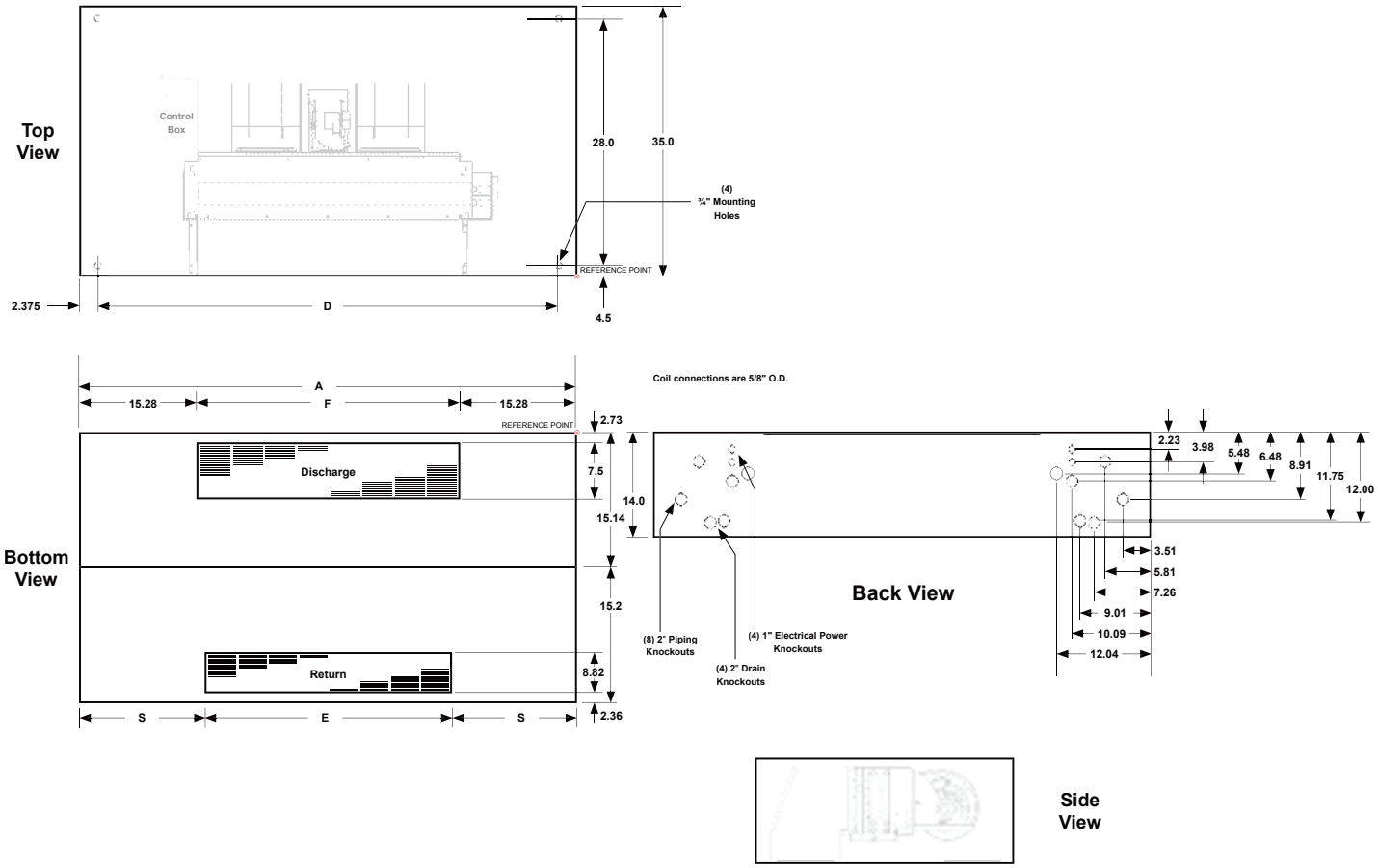
Dimension		S02	S03	S04	S06	S08	S10	S12
		inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)
Overall Unit Width	A	47.64 (1210)	47.64 (1210)	53.14 (1350)	64.14 (1629)	69.64 (1769)	80.63 (2048)	91.64 (2328)
Mounting Hole Distance	D	40.64 (1032)	40.64 (1032)	46.14 (1172)	57.14 (1451)	62.64 (1591)	73.64 (1870)	84.64 (2150)
Return Air Opening - Width	E	18.5 (470)	18.5 (470)	22.88 (581)	34.5 (876)	38.38 (975)	50.0 (1270)	61.63 (1565)
Discharge Opening - Width	F	17.4 (442)	17.4 (442)	22.98 (588)	33.59 (853)	39.39 (1001)	50.39 (1280)	61.09 (1552)
Return Air Opening Location	S	14.57 (370)	14.57 (370)	15.13 (384)	14.82 (376)	15.63 (397)	15.32 (389)	15.01 (381)

Figure 40: Dimensions – Cabinet Fan Coil, Bottom Discharge – Rear Return



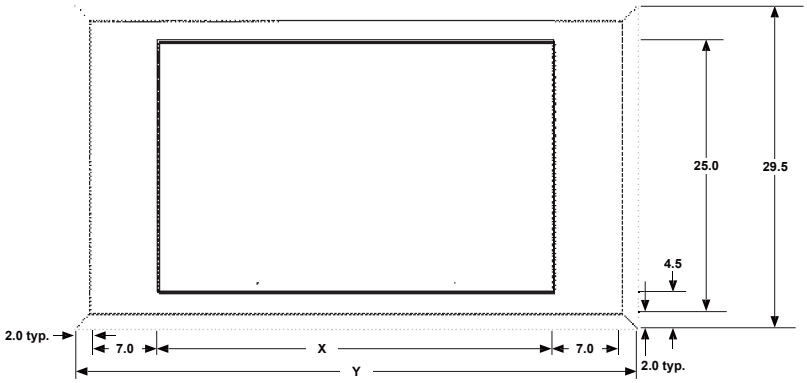
Dimension		S02	S03	S04	S06	S08	S10	S12
		inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)
Overall Unit Width	A	47.64 (1210)	47.64 (1210)	53.14 (1350)	64.14 (1629)	69.64 (1769)	80.63 (2048)	91.64 (2328)
Mounting Hole Distance	D	40.64 (1032)	40.64 (1032)	46.14 (1172)	57.14 (1451)	62.64 (1591)	73.64 (1870)	84.64 (2150)
Return Air Opening - Width	E	16.22 (412)	16.22 (412)	21.7 (552)	32.72 (831)	38.22 (971)	49.22 (1250)	60.22 (1530)
Discharge Opening - Width	F	17.09 (434)	17.09 (434)	22.59 (574)	33.59 (853)	39.09 (993)	50.09 (1272)	61.09 (1552)
Return Air Opening Location	S	14.32 (364)	14.32 (364)	15.13 (384)	14.82 (376)	15.63 (397)	15.32 (389)	15.01 (381)

Figure 41: Dimensions – Cabinet Fan Coil, Bottom Discharge – Bottom Return



Dimension		S02	S03	S04	S06	S08	S10	S12
		inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)	inch (mm)
Overall Unit Width	A	47.64 (1210)	47.64 (1210)	53.14 (1350)	64.14 (1629)	69.64 (1769)	80.63 (2048)	91.64 (2328)
Mounting Hole Distance	D	40.64 (1032)	40.64 (1032)	46.14 (1172)	57.14 (1451)	62.64 (1591)	73.64 (1870)	84.64 (2150)
Return Air Opening - Width	E	16.22 (412)	16.22 (412)	21.7 (552)	32.72 (831)	38.22 (971)	49.22 (1250)	60.22 (1530)
Discharge Opening - Width	F	17.09 (434)	17.09 (434)	22.59 (574)	33.59 (853)	39.09 (993)	50.09 (1272)	61.09 (1552)
Return Air Opening Location	S	14.32 (364)	14.32 (364)	15.13 (384)	14.82 (376)	15.63 (397)	15.32 (389)	15.01 (381)

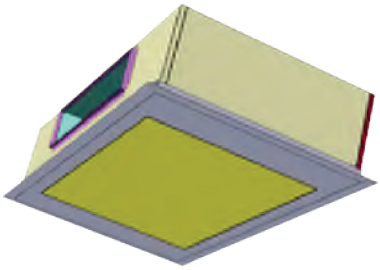
Figure 42: Dimensions – Recessed Cabinet Fan Coil with Ceiling Plate

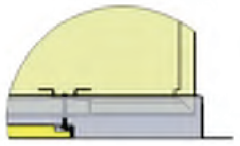


Bottom View



Side View

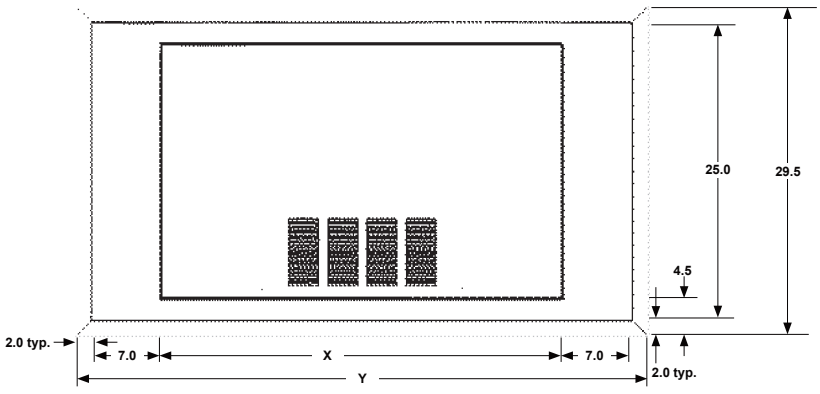




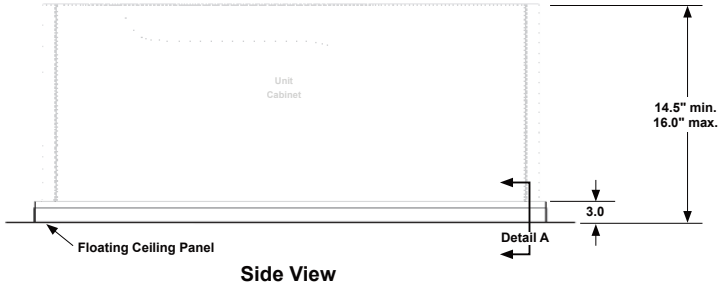
Detail A

Plate to cabinet connection for fully recessed units

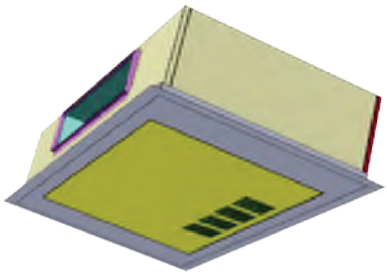
Figure 43: Dimensions – Trim Flange Mount

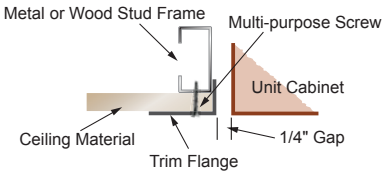


Bottom View



Side View





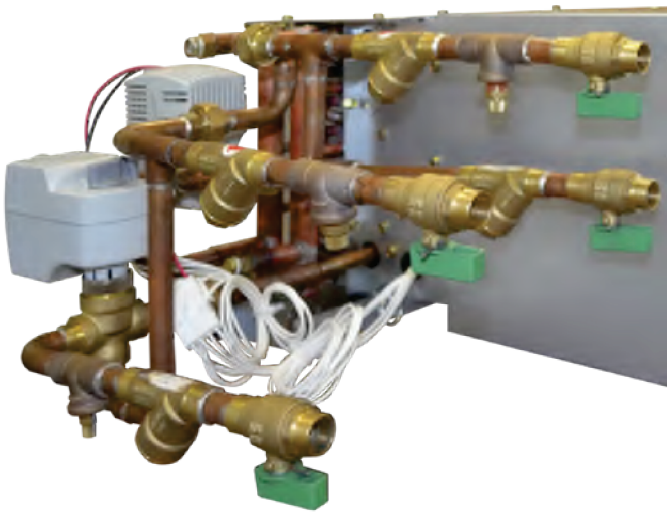
Trim Flange Securing Detail

Factory-Installed Valve and Piping Packages

Factory valve and piping packages are available for both two-pipe and four-pipe systems with either right or left hand connections. Four-pipe systems can be configured with the heating and cooling connections on the same or opposite sides of the unit. Packages can be either factory-installed or factory-assembled and shipped loose with the unit. All factory-assembled packages are fully leak tested. Units are also available without valve and piping packages in either a right-hand or left-hand configurations.

Factory-installed packages are soldered to the coil and wired to the unit control box, MicroTech controller or LV Interface Board. For field-installed packages, chilled and hot water pipes are the only field connections required. Piping is 1/2" nominal copper (5/8" OD).

Figure 44: Four-Pipe Deluxe Valve and Piping Package



Pre-determined field connection points are located for easy access. The installing contractor can pre-pipe the building water connections before the units arrive on the jobsite. A label clearly identifies chilled and hot water connection points on every unit.

All chilled water piping and components are located to allow condensate to drain into the secondary drain pan supplied with the valve package. Insulation of the factory piping package is not required.

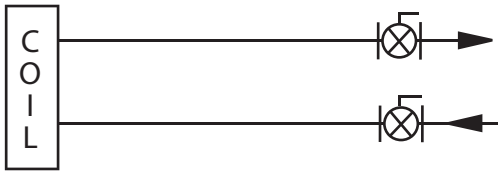
Available Packages

All factory-installed valve packages are flexible, configurable and fully software-selectable in our Daikin Tools™ selection program. Custom valve packages are available also. Numerous piping packages are available to match design configurations. Additional components can be added to meet exact requirements, including P/T ports, unions, and flexible stainless steel hoses.

Shut-Off Only Packages

Shut-Off Only piping packages provide interconnecting copper piping and shut-off ball valves for ease in connecting supply and return lines to the unit. Four-pipe packages include a venting valve for the preheat or reheat coil. Primary coils on all units have an integral venting valve.

Figure 45: Shut-Off Only Package

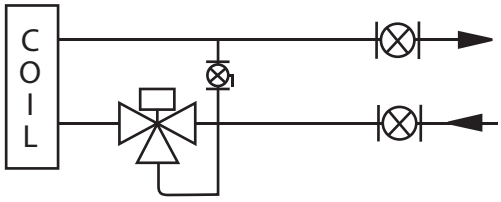


(See Figure 50 for components key)

Basic Packages

Basic valve and piping packages add control valves to the Shut-Off Only package. All Daikin control valves are factory-mounted in the supply water pipe. See Control Valve Options on page 41 for more information on the variety of control valves available.

Figure 46: Basic Package

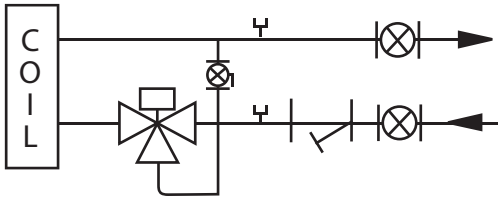


(See Figure 50 for components key)

Enhanced Packages

Enhanced valve and piping packages add a strainer to the Basic package supply water pipe. The strainer body is cast brass construction with a stainless steel mesh that is easy to remove for cleaning.

Figure 47: Enhanced Package



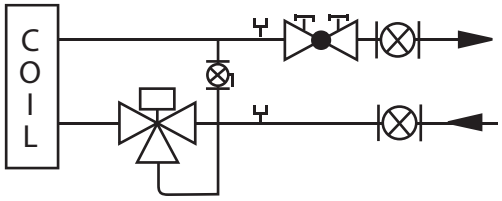
(See Figure 50 for components key)

Premium Packages

Premium valve and piping packages replace the Basic package a ball valve in the return line with a manual or automatic circuit setter. The manual circuit setter is also known as a manual flow control valve. The auto circuit setter acts as both a flow setting device and a shut-off valve. It allows water flow through the fan coil to be set quickly and accurately. The circuit setter includes a cartridge within the valve body that is sized to allow a specific flow rate through the coil without any action required by a system piping balancer.

P/T ports are included, which are used to measure the temperature or pressure drop across the valve. This pressure drop can be compared to factory supplied tables that relate the pressure drop to a specific flow rate. The manual circuit setter valve also has a memory stop so that the correct setting can be found quickly.

Figure 48: Premium Package

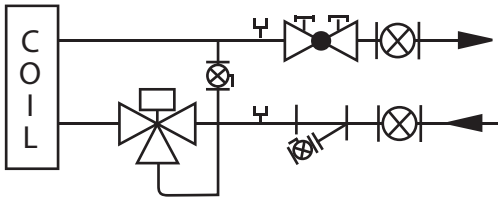


(See Figure 50 for components key)

Deluxe Packages

Deluxe valve and piping packages add a strainer to the Premium package. The strainer is available with or without an optional draining (blow-off) valve.

Figure 49: Deluxe Package



(See Figure 50 for components key)

Figure 50: Components Key for Schematics

		**Manual Shutoff Ball Valve:** Water shut-off. Handle rotates 90 degrees.
		**Manual Shutoff Ball Valve with Memory Stop:** Used on return line for limiting water flow.
		**2-Way, N.C., On/Off Valve, Spring Return:** Turn On or Off water flow to the coil in response to 24V or line voltage signal
		**3-Way, N.C., On/Off Valve, Spring Return:** Bypass water flow away from coil in response to 24V or line voltage signal. Includes fixed orifice for balancing.
		**2-Way Modulating Valve (3-wire or proportional):** Modulates water flow in response to 24V signal.
		**3-Way Modulating Valve (3-wire or proportional):** Modulates or bypass water flow in response to 24V signal. Includes fixed orifice for balancing.
		**PT Port:** For connecting a pressure or temperature gauge.
		**Y-Strainer:** Removable screen filters out small particles from supply line during normal system operation.
		**Manually Adjustable Circuit Setter with Shutoff:** Pressure-dependent, ball-type, manual flow control.
		**Cartridge-Type, Auto-Fixed Circuit Setter:** Pressure-compensated, automatic fixed-flow control.
		**Union:** For easy removal of piping from coil.
		**Bypass Balancing Valve:** Adjustable balancing of water flow through the bypass circuit on a 3-way control valve.

Note: Daikin 3-way valves are equipped with a fixed balance orifice in the bypass line, eliminating the need for a separate balancing valve

Control Valve Options

Except for Shut-off Only packages, all valve and piping packages include control valves for controlling water flow. All Daikin control valves are factory assembled and mounted in the supply water pipe downstream of the coil. Several options are available:

Two-Way Two-Position Valves

These valves will be either Fully-Open or Fully-Closed in response to a line voltage (115, 208-230 or 265-277 VAC) or 24 VAC signal from the Daikin thermostat or MicroTech controller. Some means of relieving pump head pressure should be applied when two-way valves are selected. Normally-Open or Normally-Closed valves are available, both spring-return type.

Three-Way Two-Position Valves

These valves either allow full water flow through the coil or divert the flow through a bypass line. The valves respond to a line voltage (115, 203-230 or 265-277 VAC) or to 24 VAC signal from the Daikin thermostat or MicroTech controller. All standard three-way valves come with a fixed-balance orifice in a bypass line to compensate for flow balancing in the bypass position, eliminating the need for an additional balancing valve. Normally-Open or Normally-Closed valves are available.

Two-Way Modulating Valves

These valves modulate the water flow through the coil in response to a signal from the Daikin thermostat or controller. Standard Daikin modulating valves are three-wire floating point valves. Zero to 10 VDC equal percentage proportional valves are also available. The modulating valves are factory mounted in the supply water pipe upstream of the coil. Daikin modulating valves are failed-in-place type.

Three-Way Modulating Valves

These valves modulate water flow through a coil in response to a signal from a Daikin thermostat or controller. Three-way valves allow water that is directed through the coil to mix with water that is directed through the bypass line. This mixture exits through the leaving water pipe. Modulating valves are three-wire, floating-point valves or 0-10 VDC equal percentage proportional. The modulating valves are factory mounted in the supply water pipe upstream of the coil. Daikin modulating valves are failed-in-place type.

Selecting Correct Size Modulating Valves

Daikin Tools software automatically selects the best modulating valve size for the unit and coil being considered. By combining the ARI performance data, the coil flow rate and the DP across the water coil, the water coil Cv is calculated and the best matching modulating port size is selected. Valve and piping packages can easily be configured and automatically selected using Daikin Tools.

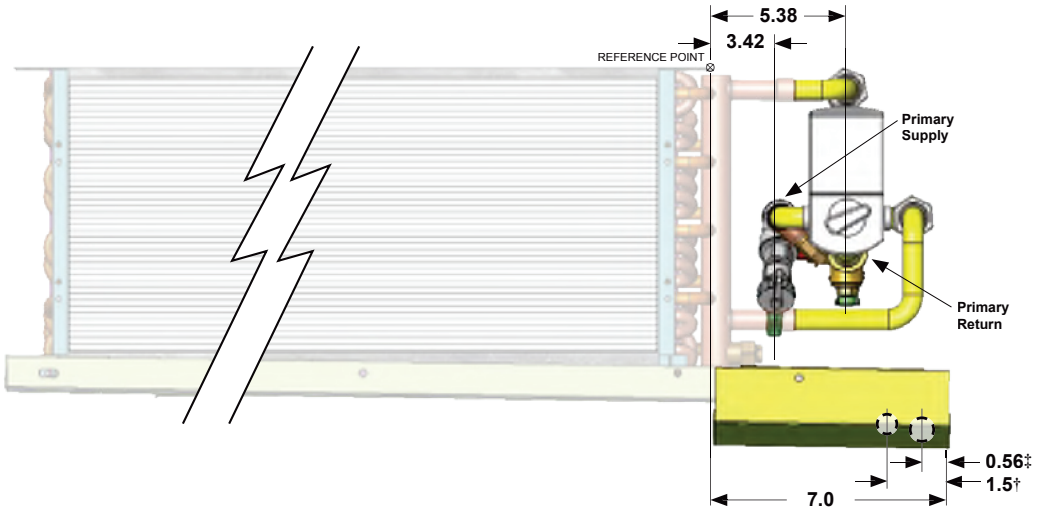
NOTE: MicroTech controllers do not currently support 0-10 VDC Proportional valves.

Figure 51: Factory-installed Valve & Piping Packages (right-hand shown)

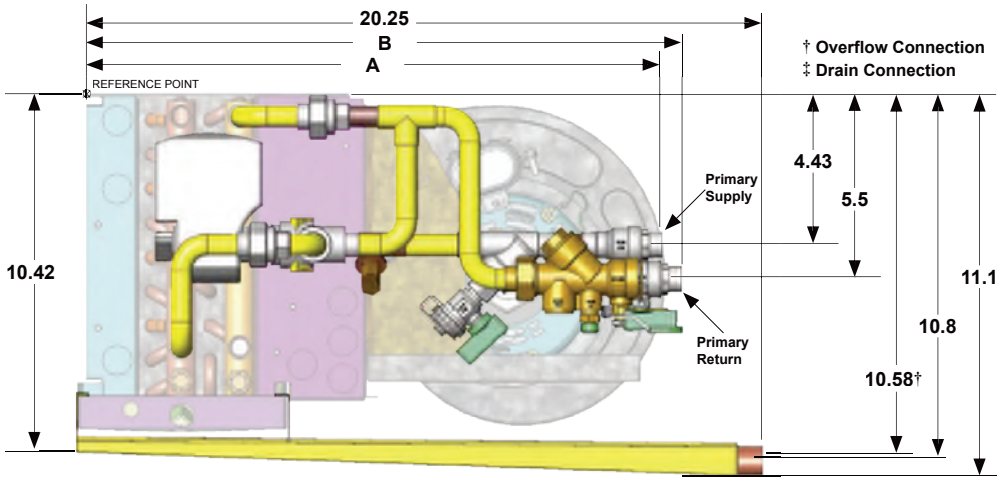
Connecting Pipe Locations: 2-Pipe Cooling or Heating

Deluxe Package shown

Front View



End View



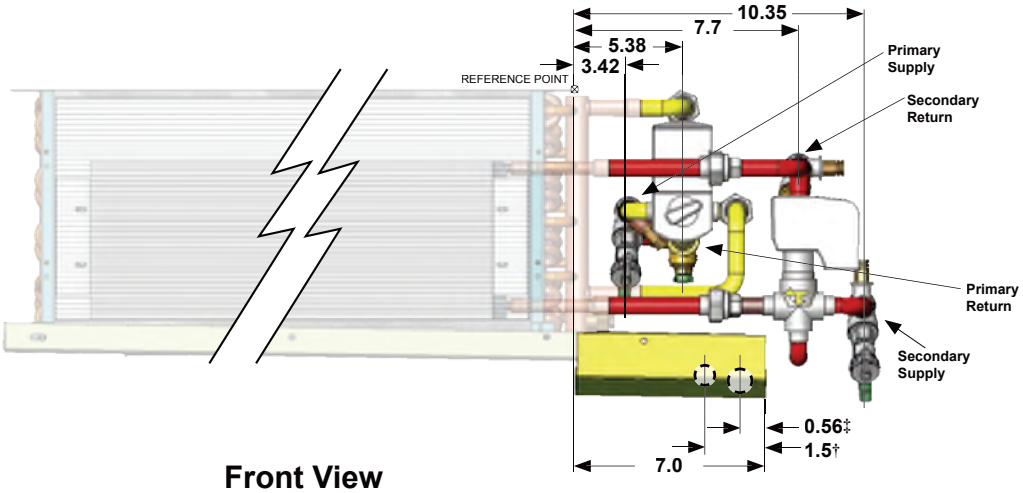
Name	Component Description	Primary Package Connections from Reference Point (2- & 3-row Coil)	
		Supply (A)*	Return (B)*
Basic 2W	2Way control valve, shut-off valves	12.2	16.2
Basic 3W	3Way control valve, shut-off valves	12.2	17.0
Enhanced 2W	2Way control valve, shut-off valves, strainer	15.8	16.3
Enhanced 3W	3Way control valve, shut-off valves, strainer	15.8	17.0
Premium 2W, auto flow	2Way control valve, shut-off valves, auto flow-setter	12.3	15.8
Premium 2W, manual flow	2Way control valve, shut-off valves, manual flow-setter	12.3	16.6
Premium 3W, auto flow	3Way control valve, shut-off valves, auto flow-setter	12.2	14.8
Premium 3W, manual flow	3Way control valve, shut-off valves, manual flow-setter	12.2	15.6
Deluxe 2W, auto flow	2Way control valve, shut-off valves, strainer, auto flow-setter	15.8	15.8
Deluxe 2W, manual flow	2Way control valve, shut-off valves, strainer, manual flow-setter	15.8	16.6
Deluxe 3W, auto flow	3Way control valve, shut-off valves, strainer, auto flow-setter	12.2	14.8
Deluxe 3W, manual flow	3Way control valve, shut-off valves, strainer, manual flow-setter	12.2	15.6

NOTE: For 4-row Primary Coils add 1" to the dimensions A and B shown

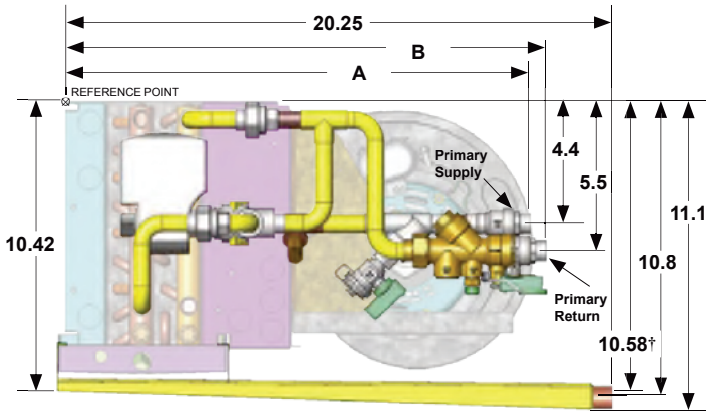
Figure 51 continued: Factory-installed Valve & Piping Packages (right-hand shown)

Connecting Pipe Locations: 4-Pipe Cooling and Heating, Same-side

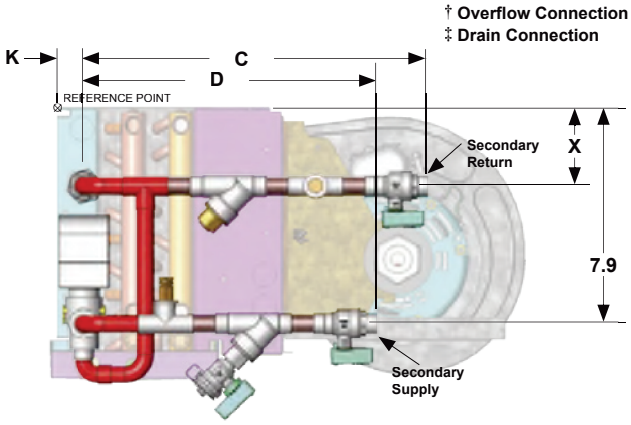
Deluxe Package shown



Front View



Primary Piping End View



Secondary Piping End View

Name	Component Description	Primary Package Connections from Reference Point (2- & 3-row Coil)		Secondary Package Length		Secondary Coil Connection from Reference Point			
		Supply (A)*	Return (B)*	Return (C)	Supply (D)	Preheat (K)	Reheat (K)	High Capacity (X)	Standard Capacity (X)
Basic 2W	2Way control valve, shut-off valves	12.2	16.2	6.5	7.1	4.53	1.03	0.8	2.8
Basic 3W	3Way control valve, shut-off valves	12.2	17.0	9.0	7.1				
Enhanced 2W	2Way control valve, shut-off valves, strainer	15.8	16.3	6.5	10.7				
Enhanced 3W	3Way control valve, shut-off valves, strainer	15.8	17.0	9.0	10.7				
Premium 2W, auto flow	2Way control valve, shut-off valves, auto flow-setter	12.3	15.8	6.1	7.1				
Premium 2W, manual flow	2Way control valve, shut-off valves, manual flow-setter	12.3	16.6	10.6	7.1				
Premium 3W, auto flow	3Way control valve, shut-off valves, auto flow-setter	12.2	14.8	5.1	7.1				
Premium 3W, manual flow	3Way control valve, shut-off valves, manual flow-setter	12.2	15.6	9.6	7.1				
Deluxe 2W, auto flow	2Way control valve, shut-off valves, strainer, auto flow-setter	15.8	15.8	6.1	10.7				
Deluxe 2W, manual flow	2Way control valve, shut-off valves, strainer, manual flow-setter	15.8	16.6	10.6	10.7				
Deluxe 3W, auto flow	3Way control valve, shut-off valves, strainer, auto flow-setter	12.2	14.8	5.1	10.7				
Deluxe 3W, manual flow	3Way control valve, shut-off valves, strainer, manual flow-setter	12.2	15.6	9.6	10.7				

NOTE: For 4-row Primary Coils add 1" to the dimensions A and B shown

Figure 52: Fan Coil Wiring Diagram – Typical Low Voltage Interface Board and ECM, Intermediate Electric Heat, F/A Damper, 3-Speed Switch–Unit Mounted

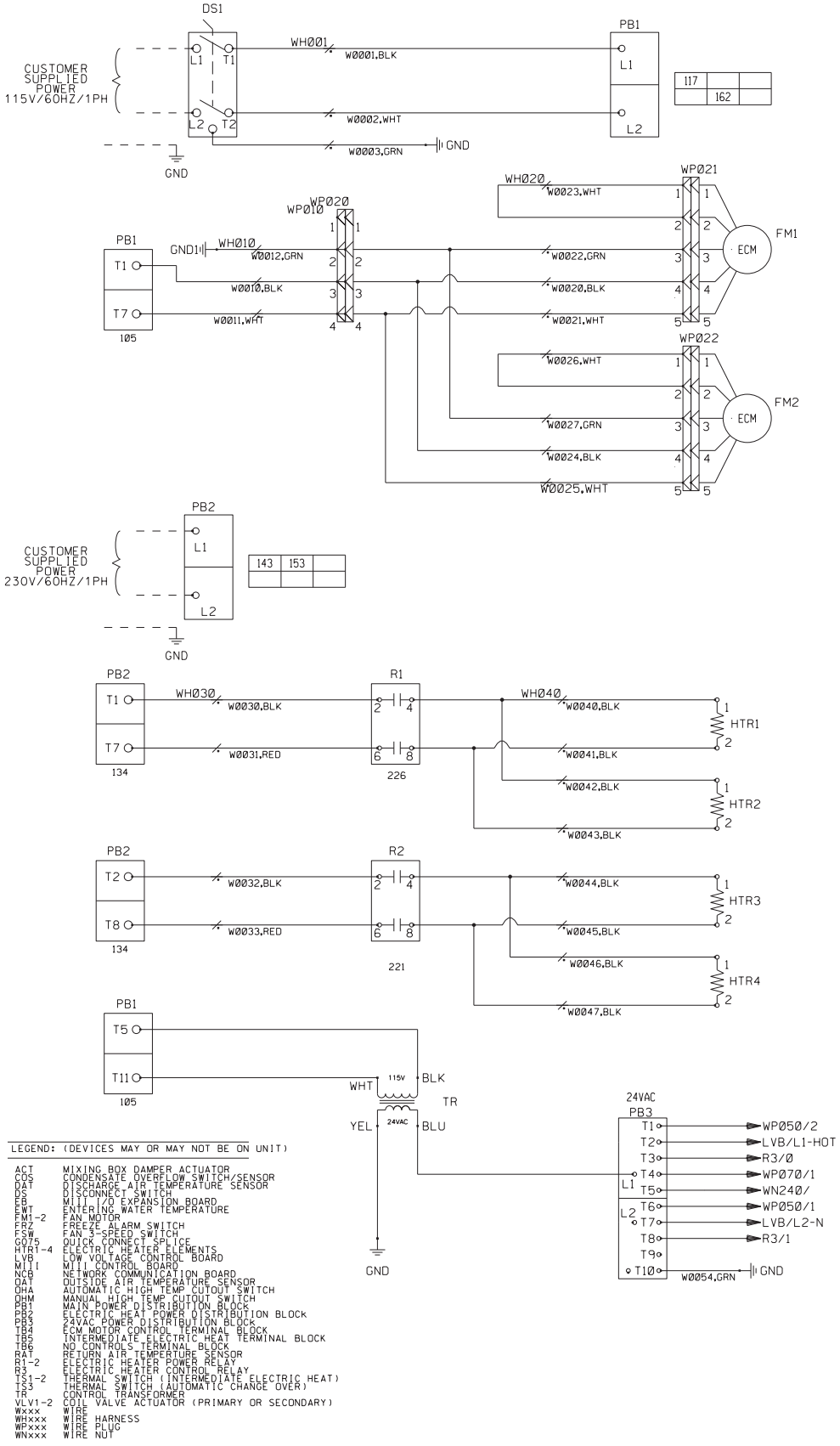


Figure 52 continued: Fan Coil Wiring Diagram – Typical Low Voltage Interface Board and ECM, Intermediate Electric Heat, F/A Damper, 3-Speed Switch–Unit Mounted

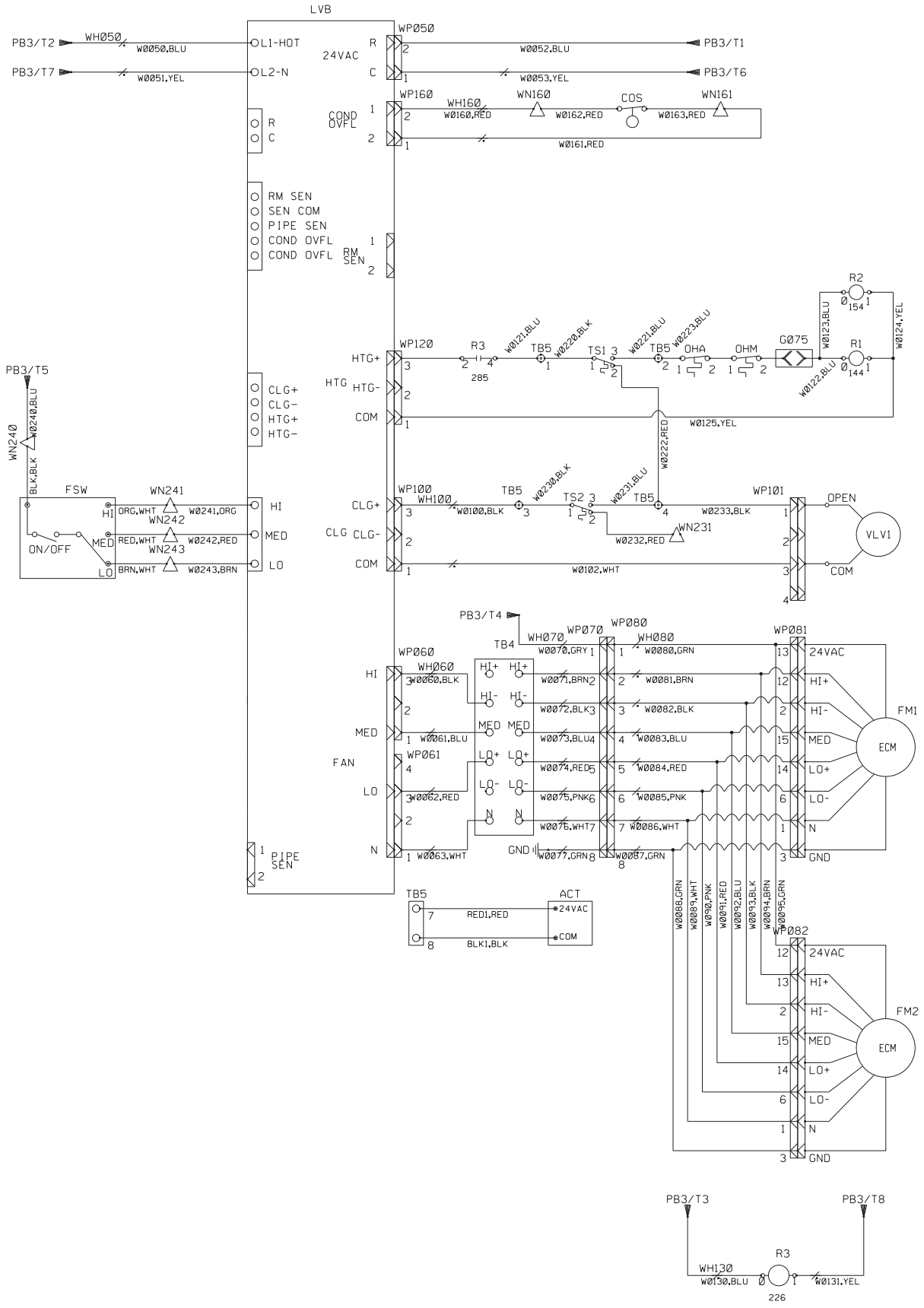
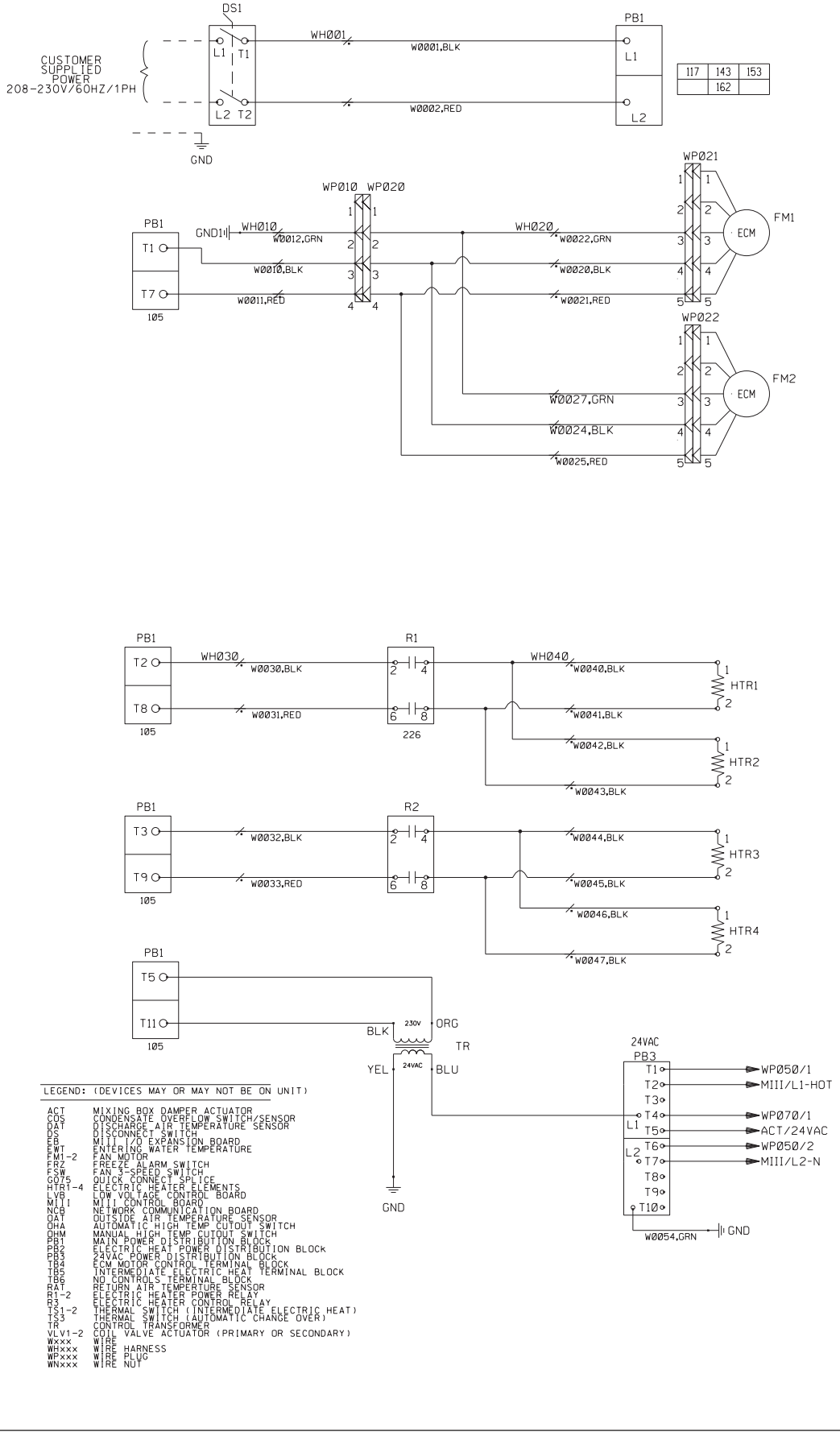


Figure 53: Fan Coil Wiring Diagram – Typical MicroTech Controller with ECM and Economizer, Intermediate Electric Heat



LEGEND: (DEVICES MAY OR MAY NOT BE ON UNIT)

ACT	MIXING BOX DAMPER ACTUATOR
COS	CONDENSATE OVERFLOW SWITCH/SENSOR
DAT	DISCHARGE AIR TEMPERATURE SENSOR
DS	DISCONNECT SWITCH
EB	MIII I/O EXPANSION BOARD
EWT	ENTERING WATER TEMPERATURE
FM1-2	FAN MOTOR
FRZ	FREEZE ALARM SWITCH
FSW	FAN 3-SPEED SWITCH
GQTS	QUICK CONNECT SPLICE
HTR1-4	ELECTRIC HEATER ELEMENTS
LVB	LOW VOLTAGE CONTROL BOARD
MIII	MIII CONTROL BOARD
NCB	NETWORK COMMUNICATION BOARD
OAT	OUTSIDE AIR TEMPERATURE SENSOR
OHA	AUTOMATIC HIGH TEMP CUTOUT SWITCH
OHM	MANUAL HIGH TEMP CUTOUT SWITCH
PB1	MAIN POWER DISTRIBUTION BLOCK
PB2	ELECTRIC HEAT POWER DISTRIBUTION BLOCK
PB3	24VAC POWER DISTRIBUTION BLOCK
TB4	ECM MOTOR CONTROL TERMINAL BLOCK
TB5	INTERMEDIATE ELECTRIC HEAT TERMINAL BLOCK
TB6	NO CONTROLS TERMINAL BLOCK
RAT	RETURN AIR TEMPERATURE SENSOR
R1-2	ELECTRIC HEATER POWER RELAY
R3	ELECTRIC HEATER CONTROL RELAY
TS1-2	THERMAL SWITCH (INTERMEDIATE ELECTRIC HEAT)
TS3	THERMAL SWITCH (AUTOMATIC CHANGE OVER)
TR	CONTROL TRANSFORMER
VLV1-2	COIL VALVE ACTUATOR (PRIMARY OR SECONDARY)
Wxxx	WIRE
WHxxx	WIRE HARNESS
WPxxx	WIRE PLUG
WNxxx	WIRE NUT

Figure 53 continued: Fan Coil Wiring Diagram – Typical MicroTech Controller with ECM and Economizer, Intermediate Electric Heat

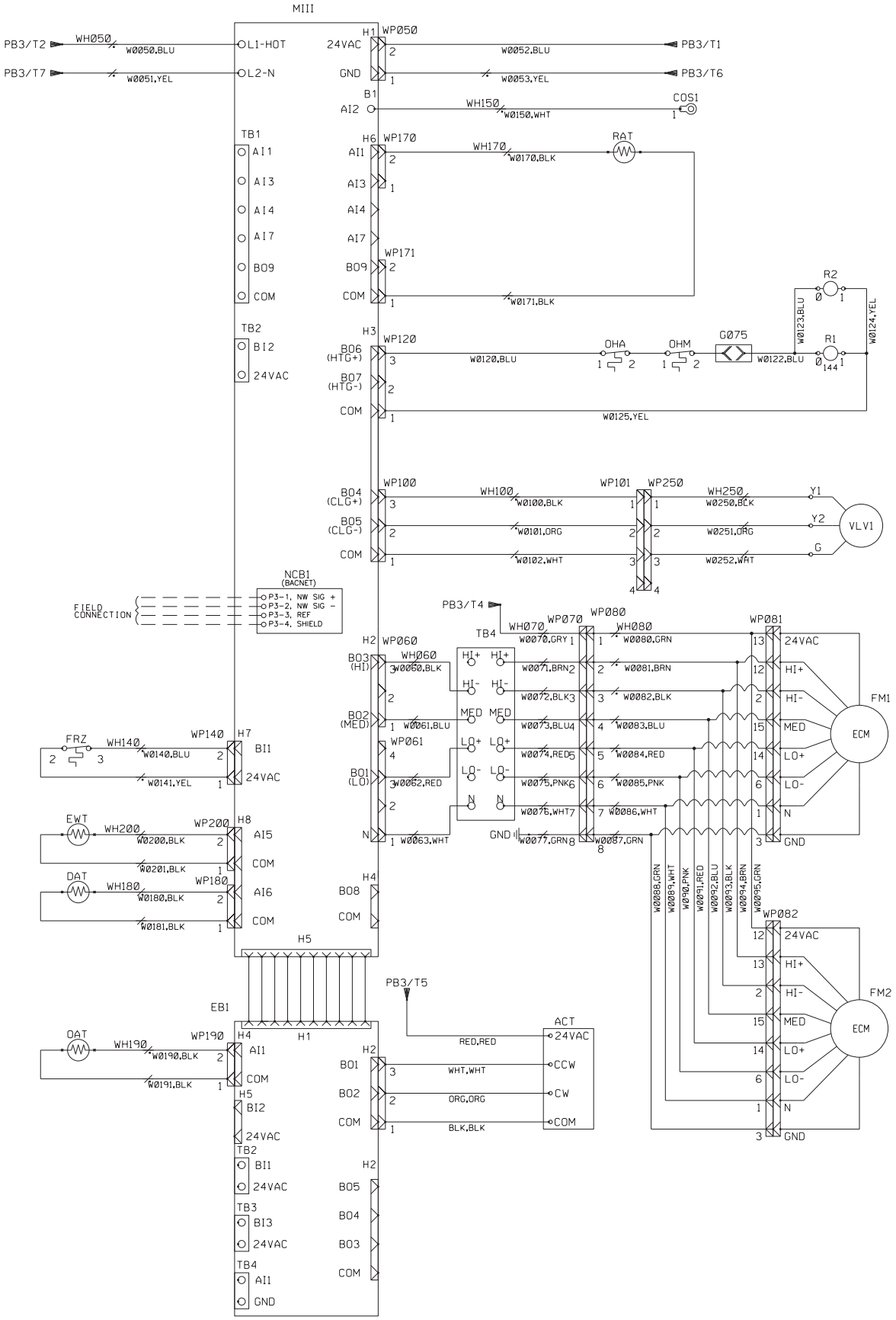


Figure 54: Fan Coil Wiring Diagram – Unit Mounted 3 Speed Switch, Low Voltage Valves

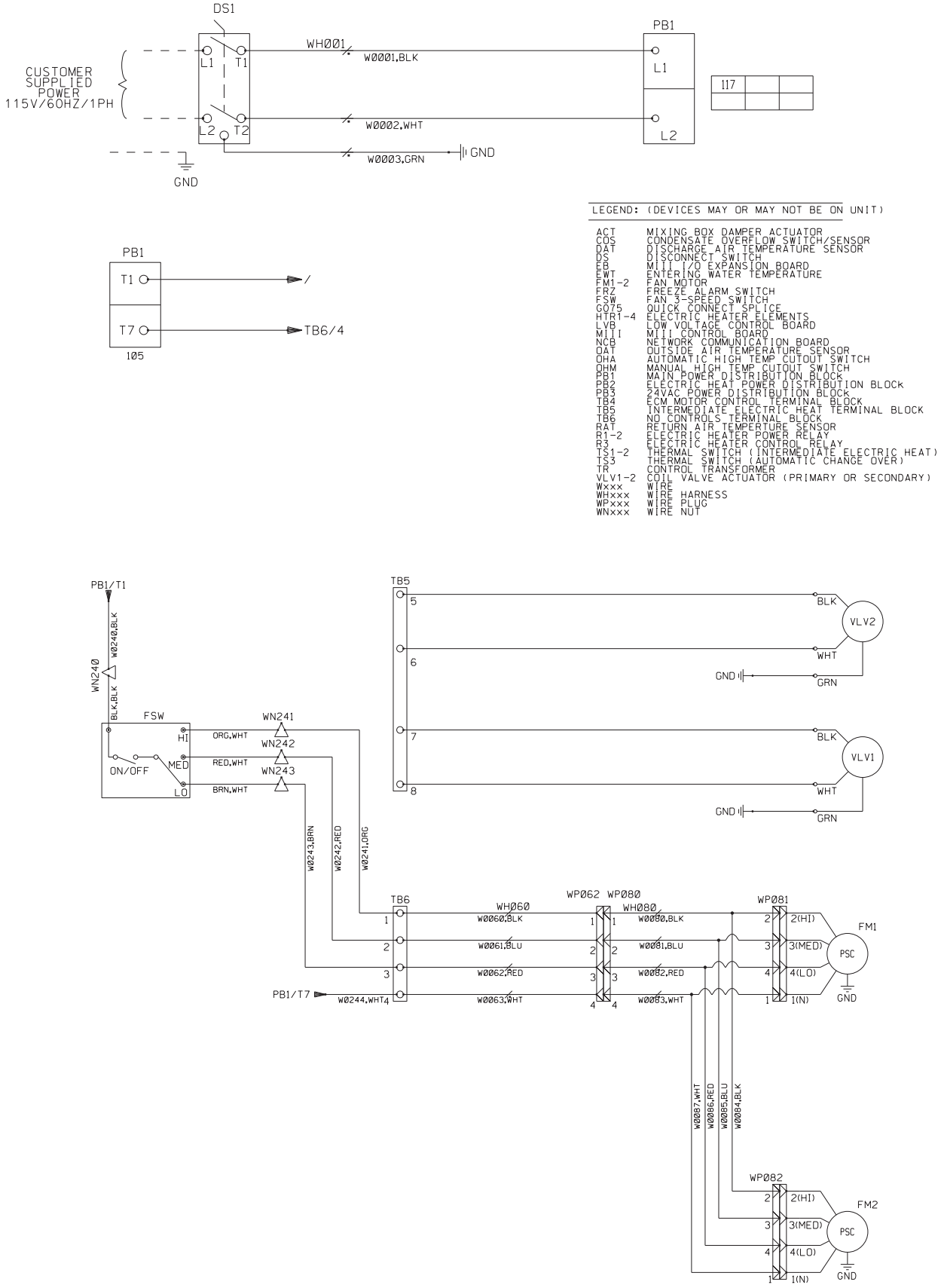


Table 3: Model Number Description: Fields 1—21

Field	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Code	FC	HC	1	02	A	A	G	M	Y	YY	W	3	12	R	F	T	YY	12	Y	Y	N

1. Unit Type
    - FC = fan coil
    - FH = cabinet unit heater
2. Product Identifier
    - HC = horizontal, exposed
    - HH = horizontal, concealed
3. Design Series
    - 1 = Design 1
4. Unit Size - nominal capacity
    - 02 = 200 cfm
    - 03 = 300 cfm
    - 04 = 400 cfm
    - 06 = 600 cfm
    - 08 = 800 cfm
    - 10 = 1000 cfm
    - 12 = 1200 cfm
    - 14 = 1400 cfm
5. Volts/Hertz/Phase
    - A = 115/60/1
    - E = 208-230/60/1
    - J = 265-277/60/1
6. Coil fin type
    - A = aluminum
7. Coil casing material
    - G = galvanized
8. Coil air vent
    - M = manual
    - A = auto
9. Coil coating
    - Y = none
10. Not currently used
    - YY = none
11. Primary Coil Type
    - C = chilled water only
    - W = CW/HW 2-pipe
    - H = hot water only
    - S = steam
12. Primary Coil Rows
    - 2 = 2 row
    - 3 = 3 row
    - 4 = 4 row
13. Primary Coil Fins Per Inch
    - 12 = 12 fins per inch
14. Primary Coil Connection Hand
    - L = left hand
    - R = right hand
15. Primary Coil Piping Package
    - F = factor installed
    - L = shipped loose
    - Y = none
16. Primary Coil Connection Type
    - S = sweated
    - T = threaded
    - N = none
17. Preheat Coil Type
    - E1 = electric single stage
    - M1 = intermediate electric single-stage
    - W1 = water standard capacity
    - W2 = water high capacity
    - S1 = standard capacity
    - S2 = high capacity
    - YY = none
18. Preheat Coil Fins Per Inch
    - 12 = 12 fins per inch
19. Preheat Coil Connection Hand
    - L = left hand
    - R = right hand
    - Y = none
20. Preheat Coil Piping Package
    - F = factor installed
    - L = shipped loose
    - Y = none
21. Preheat Coil Connection Type
    - S = sweated
    - T = threaded
    - N = none

Table 3 continued: Model Number Description: Fields 22—41

Field	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
Code	YY	W1	12	R	F	T	Y	000	Y	P	PSC	S	3	Q	Y	MR	Y	D	Y	R

22. Not currently used
    - YY = none
23. Reheat Coil Type
    - W1 = water standard capacity
    - W2 = water high capacity
    - S1 = standard capacity
    - S2 = high capacity
    - YY = none
24. Reheat Coil Fins Per Inch
    - 12 = 12 fins per inch
25. Reheat Coil Connection Hand
    - L = left hand
    - R = right hand
    - Y = none
26. Reheat Coil Piping Package
    - F = factor installed
    - L = shipped loose
    - Y = none
27. Reheat Coil Connection Type
    - S = sweated
    - T = threaded
    - N = none
28. Electric Heat Power Supply
    - A = 115-60-1
    - E = 208-230/60/1
    - J = 277-265/60/1
    - Y = None
29. Electric Heat Wattage
    - 005 = 0.5 kW electric heat
    - 010 = 1.0 kW electric heat
    - 015 = 1.5 kW electric heat
    - 020 = 2.0 kW electric heat
    - 025 = 2.5 kW electric heat
    - 030 = 3.0 kW electric heat
    - 040 = 4.0 kW electric heat
    - 050 = 5.0 kW electric heat
    - 060 = 6.0 kW electric heat
    - 080 = 8.0 kW electric heat
    - 100 = 10.0 kW electric heat
    - 000 = None
30. Not currently used
    - YY = none
31. Drain Pan Material
    - G = galvanized
    - S = stainless steel
32. Blower Motor Type
    - PSC = PSC motor
    - ECM = ECM motor
    - XXX = special
33. Discharge Conditions
    - S = standard static
    - H = high static
34. Motor Speed
    - 3 = 3 speed
35. Motor Connections
    - Q = quick connect
36. Not currently used
    - YY = none
37. Fresh Air Damper
    - MR = manual rear
    - 2R = automatic, 2-position, rear
    - ER = automatic, economizer
    - XX = special
    - YY = none
38. Not currently used
    - YYY = none
39. Unit Disconnect Switch
    - D = toggle disconnect switch
    - X = special
    - Y = none
40. Site Control Voltage
    - L = 24V (low) voltage
    - H = line voltage
41. Control Type
    - A = analog
    - D = digital
    - M = MicroTech III
    - R = low voltage interface board
    - S = 3-speed switch
    - X = Special
    - Y = None

Table 3 continued: Model Number Description: Fields 42—56

Field	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
Code	Y	Y	Y	RL	MOR	Y	3MOU	YYYY	3MOU	Y	Y	C	Y	Y	Y

42. Network Communication Card
    - Y = none
43. Changeover Type
    - Y = none
    - A = auto
    - M = manual
    - U = user selectable
44. Programmability
    - Y = none
45. Setpoint Adjustment
    - YY = none
    - UL = unit-mounted, +/- 3 degrees
    - UF = unit-mounted, full range
    - RL = remote-mounted, +/- 3 degrees
    - RF = remote-mounted, full range
46. Fan Speed Control
    - YYY = None
    - MBU = manual, off/low/med/high, unit-mounted
    - MBR = manual, off/low/med/high, remote-mounted
47. Timed Override
    - Y = none
48. Valve - Primary Coil
    - See Table 4
49. Valve - Preheat Coil
    - See Table 4
50. Valve - Reheat Coil
    - See Table 4
51. Future Control Function
    - Y = None
52. Low Temperature Protection
    - A = auto
    - Y = None
    - X = special
53. Condensate Overflow Protection
    - C = condensate overflow protection
    - Y = None
    - X = special
54. Discharge Air Thermistor
    - Y = None
    - X = special
55. Smoke Input Sensor
    - Y =none
    - X = special
56. Occ / Vacant Control Input
    - Y = none
    - X = special

Table 3 continued: Model Number Description: Fields 57—72

Field	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
Code	Y	Y	Y	Y	S	18	P	I	00	S	00	00	30F	TA	FR	1

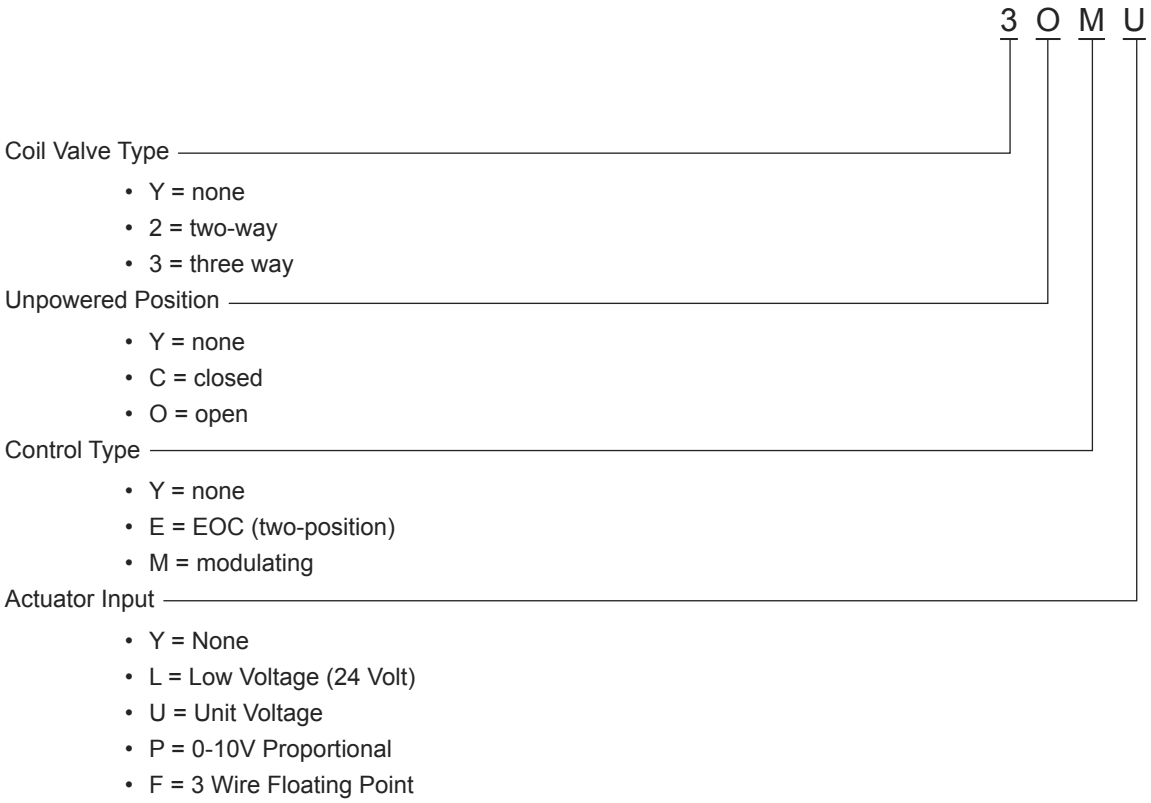
57. Filter Status Sensor
    - Y = none
    - X = special
58. Fan Status Sensor
    - Y = none
    - X = special
59. Future Control Function
    - Y = none
60. Future Control Function
    - Y = none
61. Cabinet Style
    - S = standard
    - T = tamperproof
    - Y = none
62. Cabinet Gauge
    - 16 = 16 gauge
    - 18 = 18 gauge
    - YY = none
    - XX = special
63. Cabinet Coating Type
    - B = powder coat
    - Y = none
64. Color- Cabinet
    - I = antiqueivory
    - W = off white
    - G = soft gray
    - C = cupola white
    - P = putty beige
    - Y = none
    - X = special
65. Cabinet Depth Extension
    - 00 = none
66. Unit Lineup Position
    - S = standalone
67. Left Hand End Pocket Extension
    - 00 = none
    - 04 = 4 inch extended length
68. Right Hand End Pocket Extension
    - 00 = none
    - 04 = 4 inch extended length
69. Subbase (not applicable)
70. Discharge Air - Outlet
    - BA = bottom discharge with double deflection grille
    - BD = bottom discharge with duct collar
    - BP = open bottom discharge
    - BS = bottom discharge with stamped louver grille
    - FA = front discharge with double deflection grille
    - FD = front discharge with duct collar
    - FP = open front discharge
    - FS = front discharge with stamped louver grille
    - XX = special
71. Return Air Inlet
    - BS = bottom inlet with stamped louver
    - BD = bottom inlet with duct collar (plenum)
    - RD = rear inlet with duct collar (plenum)
    - RS = rear inlet with stamped louver
    - XX = special
    - YY = no plenum (open return)
72. Filter
    - 1 = 1 inch Throwaway Filter
    - 3 = 1 inch Throwaway + (1) Extra

Table 3 continued: Model Number Description: Fields 73—78

Field	73	74	75	76	77	78
Code	YYY	Y	A	S	Y	1

73. Special Options
    - YYY = none
74. Reserved for future use
    - Y = none
75. Agency Listing
    - A = ETL, CETL, ARI
    - R = ETL, CSA
    - X = special
    - Y = none
76. Packaging
    - S = Standard
    - T = palletized based on tagging and by floor
77. Extended Warranty
    - Y = none (standard warranty)
    - 1 = 1 year Extended component warranty (30 month from shipment or 24 month from installation)
    - 2 = 2 year Extended component warranty (42 month from shipment or 36 month from installation)
    - 3 = 3 year Extended component warranty (54 month from shipment or 48 month from installation)
    - 4 = 4 year Extended component warranty (66 month from shipment or 60 month from installation)
    - X = special
78. Product Style
    - 1 = Style 1

Figure 55: Model Number Detail — Valve Package Fields 48—50



Addendum Material

DAIKIN

Installation and Maintenance Manual IM 1014

Group: **Applied Air Systems**
Part Number: **910102989**
Date: **October 2013**

MT 155 Thermostat

Installation

⚠ DANGER

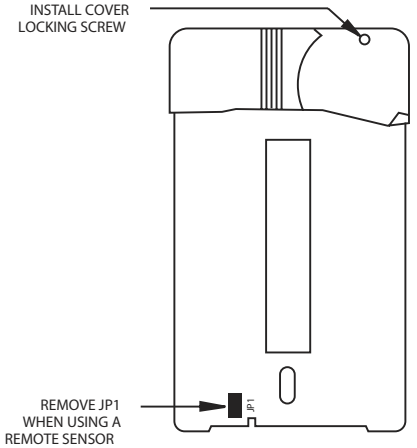
READ THESE INSTRUCTIONS CAREFULLY BEFORE ATTEMPTING TO INSTALL, OPERATE OR SERVICE THIS THERMOSTAT.

Failure to observe safety information and comply with instructions could result in PERSONAL INJURY, DEATH AND/ OR PROPERTY DAMAGE.

To avoid electrical shock or damage to equipment, disconnect power before installing or servicing. Use only wiring with insulation rated for full thermostat operating voltage. Use copper wire only. Insulate or wirenut all unused leads. Any wiring, including the remote probe,may carry the full operating voltage of the thermostat.

To avoid potential fire and/ or explosion do not use in potentially flammable or explosive atmospheres. Retain these instructions for future reference. You must review your application and national and local codes to ensure that your installation will be functional and safe.

Figure 1: Removing Jumper JP-1



1. Install the thermostat with the two furnished mounting screws to a standard 2" × 4" electrical box, 4-11/16" × 21/8" square device box with a 2" x 4" adapter ring or to a 4" × 4" box with accessory adapter plate.
2. For wall installations, mount the thermostat on an inside wall approximately 5 feet above the floor. The location should provide circulation at average room temperature. Avoid direct sunlight or sources of hot or cold air in the room or wall.
3. Remove the knob and then the cover. Mount thermostat base assembly to the outlet box using the screws provided, tighten the screws evenly but do not over tighten. Make wiring connections as noted.
4. To use a remote sensor, remove jumper JP-1 to disable local sensing. See Figure 1. Failure to remove JP-1 when using a remote sensor will cause improper operation of the thermostat. Some units do not have remote sensing capability. See Application Notes.
5. Reinstall the cover assembly. Install cover locking screw provided. Reinstall the knob.
6. Checkout: After wiring and installation are complete, energize the system and check the operation. Adjust the thermostat as necessary to complete at least one cycle. Be sure the thermostat and all other equipment are functioning correctly.

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Thermostat Operation

Temperature Range: 50°F - 90°F (10°C - 32°C)

TA155: A HEAT-OFF-COOL system switch manually selects heating or cooling mode. In the HEAT position, only the heat output cycles with demand. In the COOL position, only the cool output cycles with demand. In the OFF position, heating and cooling outputs are off. Units with a two position system switch or without a system switch must use a load transfer switch when both heating and cooling outputs are used. This prevents control failure and equipment damage caused by direct cycling between loads.

TB155: An ON-OFF system switch enables auto-changeover of heating and cooling modes. In the ON position the thermostat activates heating or cooling outputs dependant upon the relationship between set point and ambient temperature. Heat on to cool on dead band is 4°F. In the OFF position, heating and cooling outputs are off. Units without a system switch cycle between heating and cooling with a 4°F dead band.

FAN: Some units have a switch for manual selection of fan speed. On these units fan operation is either internally wired for fan continuous operation or is dependant upon connection to the fan supply input . When internally wired for fan continuous operation, the fan will be off when the system switch is off. When dependant upon external connections the fan may not be off with the system switch in the off position. The fan supply input is switched to fan speed outputs (HI - MED - LO).

SWITCHED POWER: L1 power is switched to this output any time the system switch is out of the OFF position.

Ratings

Table 1: Fan and system switches

Voltage Rating	Inductive		Resistive Amps	Pilot Duty	Thermostatic Switching
	FLA	LRA			
24 VAC	N.A.	N.A.	N.A.	24 VA	10 VA
120	5.8	34.8	6.0	125 VA	20 VA
240	2.9	17.4	5.0	125 VA	20 VA
277	2.4	14.4	4.2	125 VA	20 VA

Table 2: Wire Lead Colors (if applicable)

Wire Color	Purpose
White with Orange Stripe	Fan High
White with Red Stripe	Fan Med.
White with Brown Stripe	Fan Low
Red	Heat
Blue	Cool
Black	L1
Yellow	L2 or Neutral
Orange	Switched Power
Violet	Fan Supply
Brown	Remote Probe
Brown	Remote Probe

Application Notes

1. To use a remote sensor, remove jumper JP-1 to disable local sensing. See Figure 1. Failure to remove JP-1 when using a remote sensor will cause improper operation of the thermostat. Some units do not have remote sensing capability.
2. Units with remote sensing capability have a four-position terminal block at TB1. If TB1 is two position the unit is local sensing only.
3. Remote probe wiring should be located away from any electrical motors or power wiring
4. Some units are internally wired for permanent fan continuous operation.
5. On units with a Fan Supply input, the operation of the fan is determined by wiring connection. For fan continuous, jumper the Fan Supply input (TB2-5) to the Switched Power output (TB3-3).
6. For fan cycling operation with a call for heat or cool, a fan relay must be used.
7. Observe electrical ratings. Thermostatic outputs are pilot duty only.

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Wiring Diagrams

Figure 2: Units with remote sensing capability

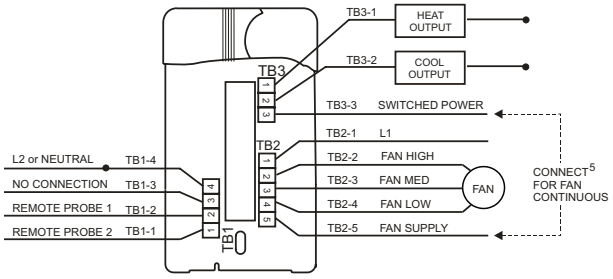


Figure 3: Units with switches used for local sensing only

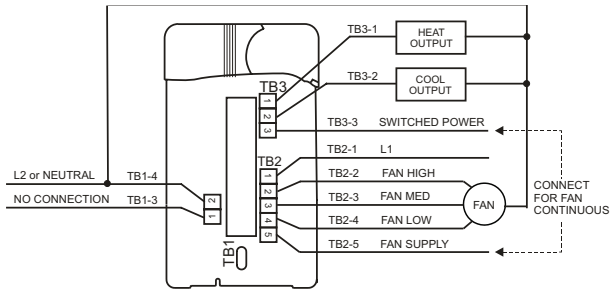


Figure 4: Units with no switches with local/remote sensing capability

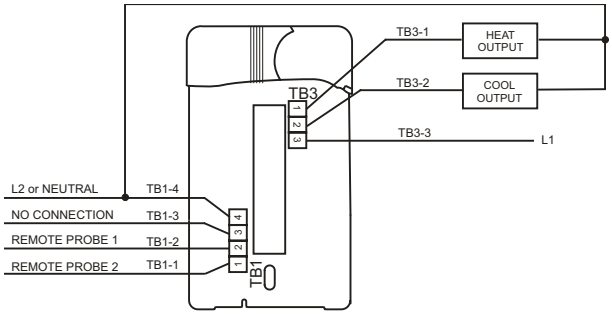
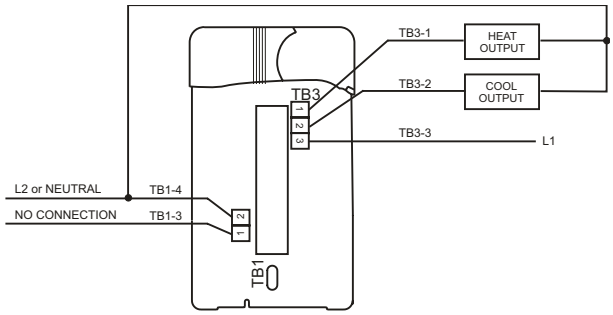


Figure 5: Units with no switches used for local sensing only



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Addendum Material

DAIKIN

Installation and Maintenance Manual IM 1089

Group: **Applied Air Systems**
Part Number: **IM 1089**
Date: **October 2013**

MT 155 A/B Thermostat Field Installation

24V Valve Packages on ThinLine™ Vertical Fan Coil Units with Factory-Installed Low Voltage Interface Board

General

⚠ DANGER

READ THESE INSTRUCTIONS CAREFULLY BEFORE ATTEMPTING TO INSTALL, OPERATE OR SERVICE THIS THERMOSTAT.

Failure to observe safety information and comply with instructions could result in PERSONAL INJURY, DEATH AND/ OR PROPERTY DAMAGE.

To avoid electrical shock or damage to equipment, disconnect power before installing or servicing. Use only wiring with insulation rated for full thermostat operating voltage. Use copper wire only. Insulate or wire-nut all unused leads. Any wiring, including the remote probe, may carry the full operating voltage of the thermostat. To avoid potential fire and/ or explosion do not use in potentially flammable or explosive atmospheres. Retain these instructions for future reference. You must review your application and national and local codes to ensure that your installation will be functional and safe.

⚠ CAUTION

Care should be used to avoid electrostatic discharge to the microprocessor.

This unit has configuration dip switches and jumpers. You may need to reconfigure the thermostat for your application.

Installation

Two-pipe system (Cooling or Heating)

To field wire a T*155 thermostat (either as wall-mounted or unit-mounted) and field-install valve package for a 2-pipe system the following accessories are required:

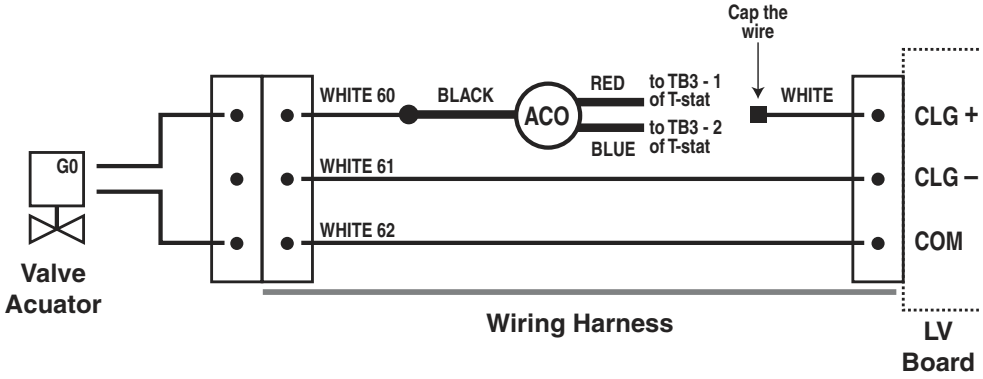
- Single-Pole Double-Throw Automatic Changeover Switch (SPDT ACO Kit P/N 039398600)
- Thermostat TA155 (kit) – PN 107345302 or Thermostat TB155 (kit) – PN 107345304
- 10K Return Air Sensor - PN 107345501

Step 1: Installing NC (Normally Closed) valve packages

- Solder the appropriate inlet and outlet pipe connections from the valve package to the coil connections. Refer to Figures 1, 2, 3 and 4.
- Snap-on the SPDT ACO Switch on the supply side of the valve package (SPDT ACO Kit P/N 039398600 to be ordered as field-installed option)
- Cut white wire 60 of the wiring harness leading from the Low Voltage Interface Board terminal connection (see Fig. 1) prior to attaching the quick-connect connector of the On-Off valve actuator to the interface board (Fig. 3). The white wire lead going to the actuator will be connected to terminal No. 1 of the ACO switch (see Fig. 5):
  - Terminal No. 1: black wire - to be connected to the valve side (G terminal) with white wire of the terminal strip
  - Terminal No. 2: red wire – to be connected to the red wire (TB3-1) of the thermostat
  - Terminal No. 3: blue wire – to be connected to the blue wire (TB3-2) of the thermostat

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Figure 1: Automatic changeover connection between the valve actuator and the interface board



Step 2: Provide power to thermostat

- Connect a wire from thermostat terminal TB1- 4 (L2 Neutral) to the common terminal on Low Voltage Interface Board (terminal C) Refer to Figures 2 and 4.
- Connect a wire from thermostat terminal TB2- 1 (24VAC) to the 24 V terminal connection R.
- Connect fan speed wires from the thermostat to appropriate Low Voltage Interface Board terminals:
- Connect a wire from thermostat terminal TB2- 2 (High fan speed) to the HI terminal
- Connect a wire from thermostat terminal TB2- 3 (Med fan speed) to the Med terminal
- Connect a wire from thermostat terminal TB2- 24 (Low fan speed) to the Low terminal
- Remove Jumper JP1 to allow the remote mounted 10K Return Air Sensor to operate.
- Mount the 10K Return Air Sensor (PN 107345501) above the filter through the knockout provided Note: (1) If a fan coil unit is to be used for heating or cooling only, the SPDT ACO Switch (SPDT ACO Kit P/N 039398600) is not required. For such applications just follow Step 2.

Figure 2: Low Voltage Interface Board shown with all additional support options

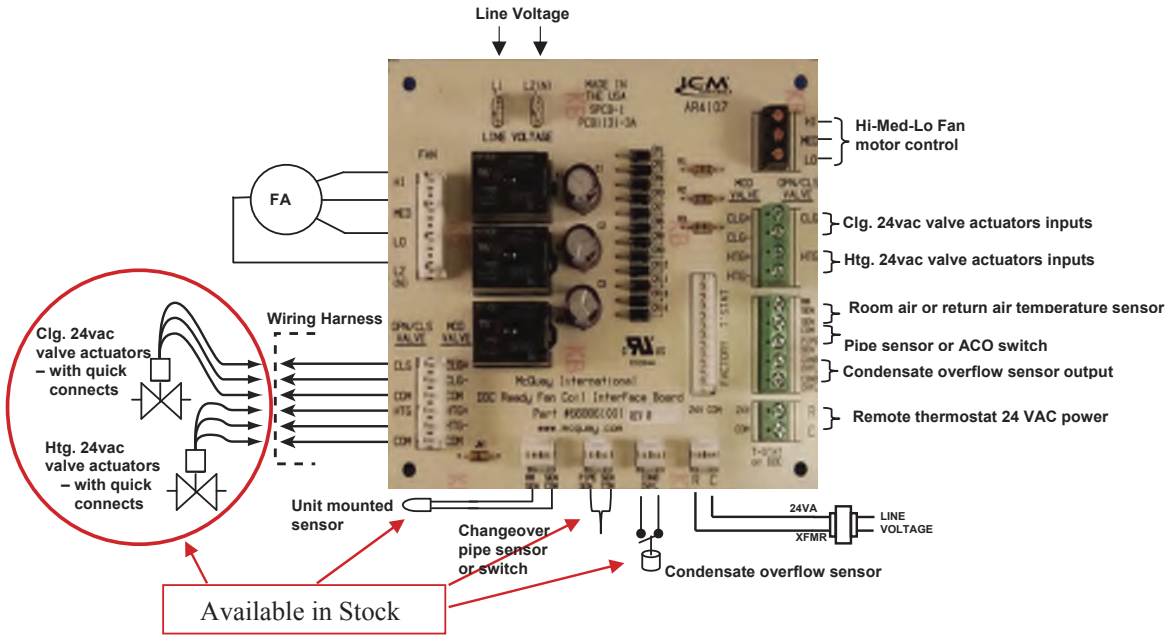


Figure 3: Factory-installed and wired Low Voltage Interface Board (Wiring Diagram)

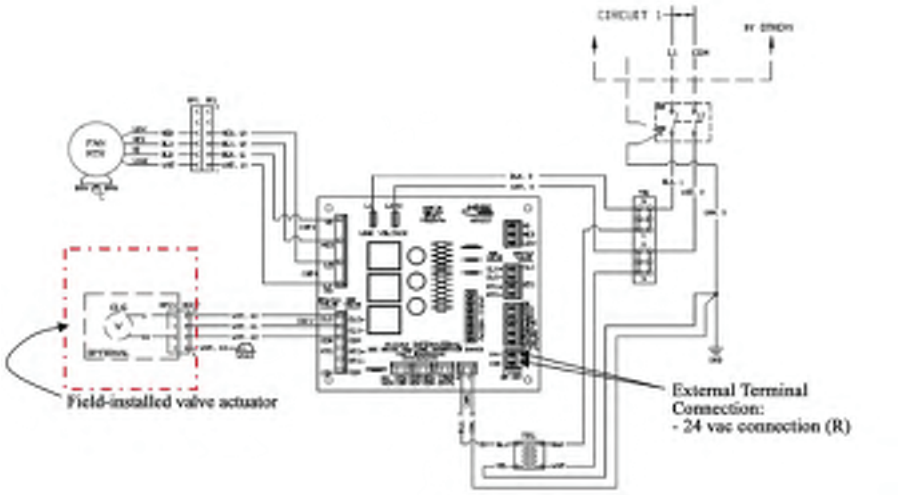


Figure 4: Thermostat TB155 autochangeover to be used with ON-OFF 24V valve packages, SPDT ACO and unit-mounted Low Voltage Interface Board

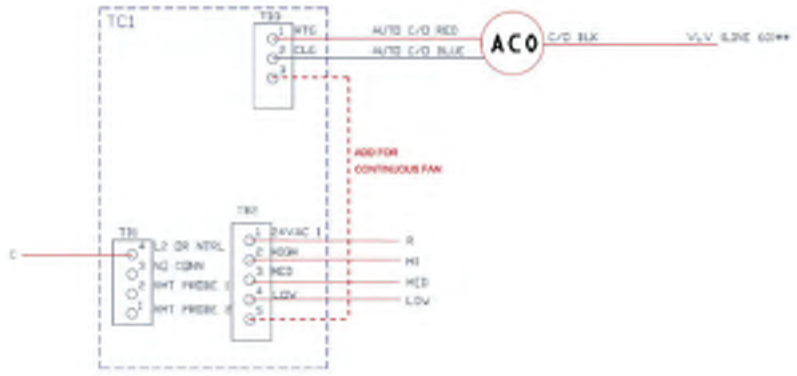
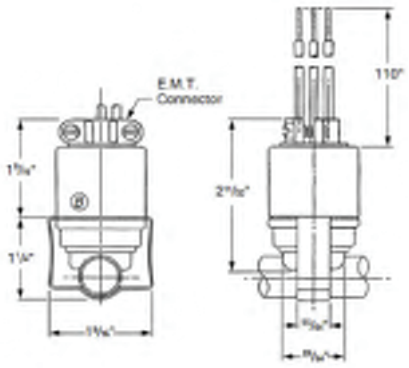


Figure 5: Automatic changeover switch (SPDT ACO Kit P/N 039398600)



Four-pipe system (Cooling and Heating)

Two piping packages will be required for CW and HW coils. The following accessories needed for field-installed thermostat model T*155 (unit-mounted or wall-mounted):

- Thermostat TA155 (kit) – PN 107345302 or Thermostat TB155 (kit) – PN 107345304
- 10K Return Air Sensor - PN 107345501 for unit-mounted applications only (for wall-mounted applications the sensor is imbedded with the thermostat)

Step 1: Installing valve packages

- Solder the appropriate inlet and outlet CW pipe connections from the valve package to the coil connections.
- Solder the appropriate inlet and outlet HW pipe connections from the valve package to the coil connections.
- Snap-on the Quick-connects of the valve actuators to the appropriate terminals of the Low Voltage Interface Board as per Fig. 2.

Step 2: Provide power to thermostat

- Connect a wire from thermostat terminal TB1- 4 (L2 Neutral)to the common terminal on the interface board (terminal C) Refer to Figure 2 and 4.
- Connect a wire from thermostat terminal TB2- 1 (24VAC) tothe 24 V terminal connection R.
- Connect fan speed wires from the thermostat to the appropriate Low Voltage Interface Board terminals:
- Connect a wire from thermostat terminal TB2- 2 (High fan speed) to the HI terminal
- Connect a wire from thermostat terminal TB2- 3 (Med fan speed) to the Med terminal
- Connect a wire from thermostat terminal TB2- 24 (Low fan speed) to the Low terminal
- Remove Jumper JP1 to allow the remote mounted the 10K Return Air Sensor to operate.
- Mount the 10K Return Air Sensor (PN 107345501) above the filter through the knockout provided

NOTE: (2) For thermostats supplied by others refer to the manufacturer's installation literature and use this manual as a guideline only.

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Installation and Maintenance Manual IM 1015

Group: **Applied Air Systems**
Part Number: **910102990**
Date: **October 2013**

MTA 158 Microprocessor Thermostat

ON/OFF Controller

Installation

⚠ DANGER

READ THESE INSTRUCTIONS CAREFULLY BEFORE ATTEMPTING TO INSTALL, OPERATE OR SERVICE THIS THERMOSTAT.

Failure to observe safety information and comply with instructions could result in PERSONAL INJURY, DEATH AND/ OR PROPERTY DAMAGE.

To avoid electrical shock or damage to equipment, disconnect power before installing or servicing. Use only wiring with insulation rated for full thermostat operating voltage. Use copper wire only. Insulate or wirenut all unused leads. Any wiring, including the remote probe,may carry the full operating voltage of the thermostat.

To avoid potential fire and/ or explosion do not use in potentially flammable or explosive atmospheres.

Retain these instructions for future reference. You must review your application and national and local codes to ensure that your installation will be functional and safe.

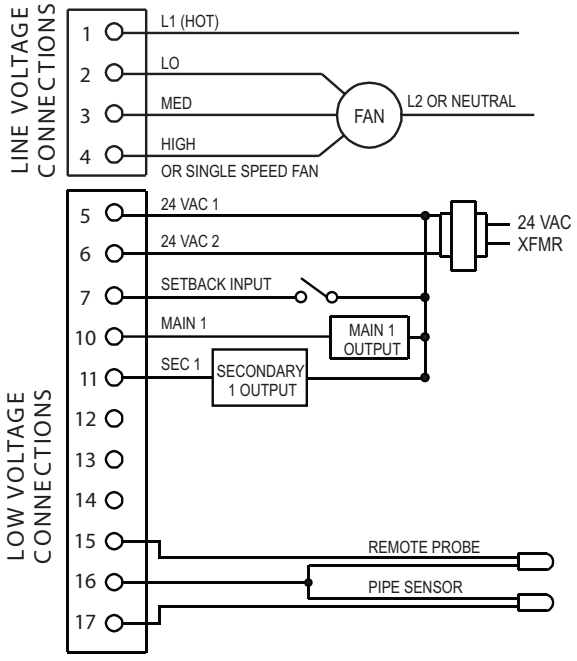
⚠ CAUTION

Care should be used to avoid electrostatic discharge to the microprocessor.

This unit has configuration jumpers. You may need to reconfigure this thermostat for your application.

1. Install the thermostat with the two furnished mounting screws to a standard 4-11/16" × 2-1/8" square device box with a 2" × 4" adapter ring.
2. For wall installations, mount the thermostat on an inside wall approximately 5 feet above the floor. The location should provide circulation at average room temperature. Avoid direct sunlight or sources of hot or cold air in the room or wall.
3. Remove the cover. Mount thermostat base assembly to the outlet box using the screws provided, tighten the screws evenly but do not over tighten. Connect wires as shown in the appropriate wiring diagram for your thermostat style.
4. To use a remote sensor on units with local sensing capability, remove jumper JP-1 to disable local sensing. Failure to remove JP-1 will cause improper operation of the thermostat.

Figure 1: Wiring Diagram for ON/OFF Output Configuration



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*Table 1: MTA 158 Operation**

Output	OFF with Demand	ON with Demand
Main 1 (Terminal 10)	ON at temperature demand	ON at temperature demand
Main 2 (Terminal 12)	NA	NA
Secondary (Terminal 11)	Summer: OFF with heat demand Winter: Disabled	Summer: ON with heat demand Summer: Disabled
Secondary 2 (Terminal 13)	NA	NA

Note: * Operation determined by configuration. See Dip Switch Configuration Table.

5. Remove the LCD plastic protective film. Reinstall the cover assembly. Install the cover locking screw provided in the hole at the left side of the control enclosure to complete the installation.
6. Checkout: After wiring and installation are complete, energize the system and check the operation. Adjust the thermostat as necessary to complete at least one cycle. Be sure the thermostat and all other equipment are functioning correctly.

Thermostat Operation

These thermostats are designed to control ON-OFF, N.O. and N.C. valves, relays and Erie® three wire floating valves. These units may include a fan switch with one or more fan speed selections.

Mode Button Operation

OFF: All thermostat outputs are off, fan is still operational if connected to manual fan speed switch.

AUTO: The thermostat automatically selects heating or cooling mode depending on the set point and room temperature. The appropriate HEAT or COOL indicator is enabled in addition to AUTO. A 3°F dead-band is provided to prevent short cycling between heating and cooling modes. After change-over the control points automatically shift so that the heating off-point or the cooling off-point equals the setpoint temperature.

COOL: The thermostat operates as a cooling-only thermostat. by pressing the UP and DOWN arrows simultaneously. The heating outputs are disabled.

HEAT: The thermostat operates as a heating-only thermostat. The cooling outputs are disabled.

If constructed without a mode button, the thermostat operates in Auto mode, subject to configuration of the 2/4 pipe jumper and pipe sensor input.

Fan Speed Switch Operation

Fan speed is determined by manual selection from fan switch OFF to HIGH, MEDIUM and/ or LOW. In units with the Cycling Fan Option (demand output), the Fan operation (CYCLING vs. CONTINUOUS) is determined by application connections. In OFF position all outputs are off and display blank.

Up/ Down Arrow Operation

A first touch of either arrow will display the set point (a single set point is employed for both heating and cooling). Continued pressure on either arrow will scroll the set point to new values. After three seconds with no pressure on either arrow, the selected set point becomes effective and the display of the room temperature resumes.

Setback Operation

Connection of the Setback Input to 24 VAC 1 will force the control into unoccupied mode (see wiring diagram). Pressing an arrow key or the mode button on the thermostat cover will disable the setback input for one hour.

Pipe Sensor Operation

If cold water is detected, the system will operate in summer mode and the Main output will be cooling. If hot water is detected, the system will operate in winter mode, the Main output will be heating and First Stage Secondary Output will be disabled. In the case of an ambiguous reading, neither hot nor cold, the thermostat will initiate a purge cycle.

Ratings

Table 2: Fan and system switches

Voltage Rating	Inductive		Resistive Amps	Pilot Duty	Thermostatic Switching
	FLA	LRA			
24 VAC	N.A.	N.A.	N.A.	24 VA	10 VA
120 VAC	5.8	34.8	6.0	125 VA	NA
240 VAC	2.9	17.4	5.0	125 VA	NA
277 VAC	2.4	14.4	4.2	125 VA	NA

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Service Menu

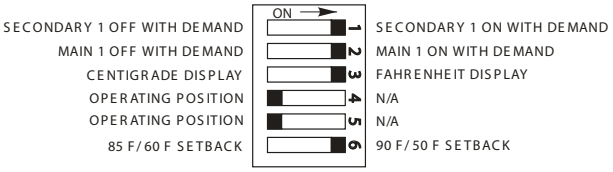
Access: Press UP▲ and DOWN▼ arrows for 5 seconds.

Menu Selection: Select 1 to 5 by pressing the mode button or by pressing the UP▲ and DOWN▼ arrows simultaneously.

Adjust Value: Use UP▲ or DOWN▼ arrow.

Item #	Function	Range	Default
1	Zone Temp Offset	-5.1°F to 5.1°F	0°F
2	Valve Stroke Time	30 sec. to 5 min.	120 sec.
3	Fan Delay to OFF	0 to 10 minutes	0 sec.
4	Compressor Minimum OFF Time	30 sec. to 10 min.	120 sec.
5	Purge Cycle	0 = Time Based 1 = Temperature Based	1

Figure 2: Dipswitch Configuration



Example: This dip switch is configured for on with demand, °F Display, ON-OFF Operation And 90/50°F Setback.

NOTE: Thermostat power must be cycled for changes in dip switch configuration to take effect.

Figure 3: Circuit Board Jumpers

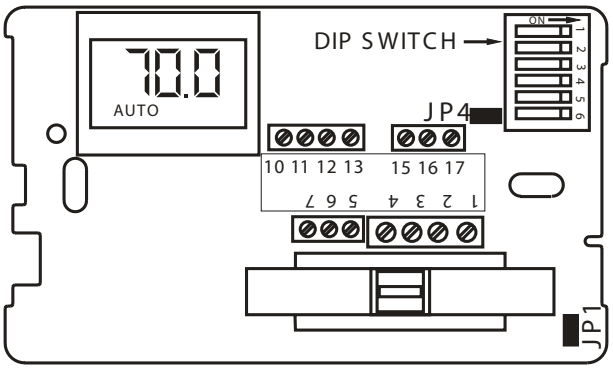


Table 3: Circuit Board Jumper Configuration

Jumper Designation	Jumper Installed ON	Jumper Removed
JP1	Local Sensing	Remote Sensing
JP4	2 Pipe System*	4 Pipe System

Application Notes

1. When no pipe sensor is used the main output controls cooling and the secondary output controls heating.
2. The pipe sensor should be mounted on the main coil input for water system operation and in the main duct system for forced air operation.
3. The set point and operating mode will be retained on a loss of power.
4. When using either a remote probe or pipe sensor, run wiring away from any electrical motors or power wiring.

Power-Up Operating Sequence

Upon application of power, an MTA158 will go directly to normal operation.

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Addendum Material

DAIKIN

Installation and Maintenance Manual IM 1016-1

Group: **Applied Air Systems**
Part Number: **910102991**
Date: **October 2013**

MTB 158 Microprocessor Thermostat

ON/OFF and 3-Wire Controller

⚠ DANGER

READ THESE INSTRUCTIONS CAREFULLY BEFORE ATTEMPTING TO INSTALL, OPERATE OR SERVICE THIS THERMOSTAT.

Failure to observe safety information and comply with instructions could result in PERSONAL INJURY, DEATH AND/ OR PROPERTY DAMAGE.

To avoid electrical shock or damage to equipment, disconnect power before installing or servicing. Use only wiring with insulation rated for full thermostat operating voltage. Use copper wire only. Insulate or wirenut all unused leads. Any wiring, including the remote probe,may carry the full operating voltage of the thermostat.

To avoid potential fire and/ or explosion do not use in potentially flammable or explosive atmospheres.

Retain these instructions for future reference. You must review your application and national and local codes to ensure that your installation will be functional and safe.

⚠ CAUTION

Care should be used to avoid electrostatic discharge to the microprocessor.

This unit has configuration jumpers. You may need to reconfigure this thermostat for your application.

Installation

1. Install the thermostat with the two furnished mounting screws to a standard 4-11/16" × 2-1/8" square device box with a 2" × 4" adapter ring.
2. For wall installations, mount the thermostat on an inside wall approximately 5 feet above the floor. The location should provide circulation at average room temperature. Avoid direct sunlight or sources of hot or cold air in the room or wall.
3. Remove the cover. Mount thermostat base assembly to the outlet box using the screws provided, tighten the screws evenly but do not over tighten. Connect wires as shown in the appropriate wiring diagram for your thermostat style.
4. To use a remote sensor on units with local sensing capability, remove jumper JP-1 to disable local sensing. Failure to remove JP-1 will cause improper operation of the thermostat.
5. Remove the LCD plastic protective film. Reinstall the cover assembly. Install the cover locking screw provided in the hole at the left side of the control enclosure to complete the installation.
6. Checkout: After wiring and installation are complete, energize the system and check the operation. Adjust the thermostat as necessary to complete at least one cycle. Be sure the thermostat and all other equipment are functioning correctly.

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Figure 1: Wiring Diagram for 3-Wire Valve Configuration

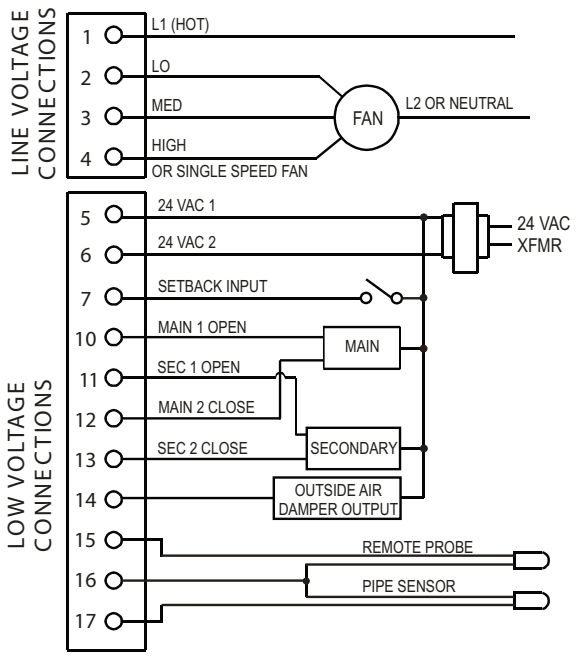


Figure 2: Wiring Diagram for ON/OFF Ouput Configuration

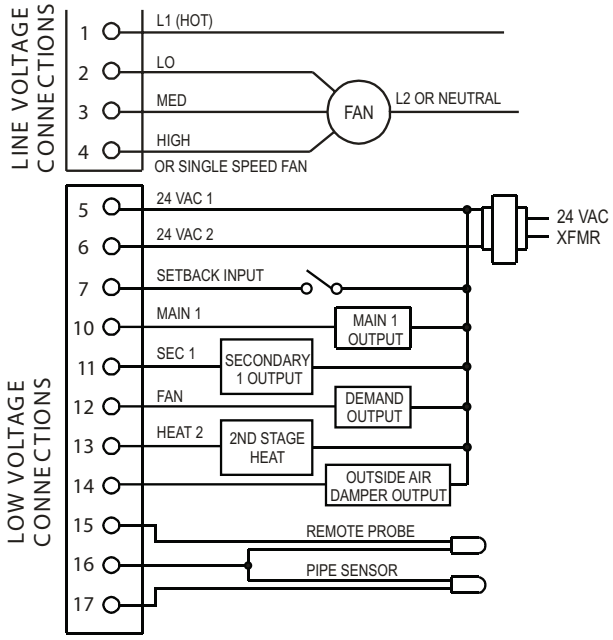


Table 1: Ratings

Voltage Rating	Fan and system switches				Thermostatic Switching (Pilot Duty)
	Inductive		Resistive Amps	Pilot Duty	
	FLA	LRA			
24 VAC	N.A.	N.A.	N.A.	24 VA	10 VA
120 VAC	5.8	34.8	6.0	125 VA	NA
240 VAC	2.9	17.4	5.0	125 VA	NA
277 VAC	2.4	14.4	4.2	125 VA	NA

Thermostat Operation

These thermostats are designed to control ON-OFF, N.O. and N.C. valves, relays and three-wire floating valves. These units may include a fan switch with one or more fan speed selections.

*Table 2: Main and Secondary Output Operation**

Output	3-Wire Floating	OFF with Demand	ON with Demand
Main 1 (Terminal 10)	Powers main valve open	ON at temp demand	ON at temp demand
Main 2 (Terminal 12)	Powers main valve closed	Cycles ON with demand	Cycles ON with demand
Secondary (Terminal 11)	Powers secondary valve open	Summer: OFF with heat demand Winter: Disabled	Summer: ON with heat demand Winter: Disabled
Secondary 2 (Terminal 13)	Powers secondary valve closed	ON at second stage heating demand	ON at second stage heating demand

Note: * Operation determined by configuration. See Dip Switch Configuration Table.

Mode Button Operation

OFF: All thermostat outputs are off, fan is still operational if connected to manual fan speed switch.

AUTO: The thermostat automatically selects heating or cooling mode depending on the set point and room temperature. The appropriate HEAT or COOL indicator is enabled in addition to AUTO. A 3°F dead-band is provided to prevent short cycling between heating and cooling modes.

After change-over the control points automatically shift so that the heating OFF-point or the cooling OFF-point equals the set point temperature.

COOL: The thermostat operates as a cooling-only thermostat. The heating outputs are disabled.

HEAT: The thermostat operates as a heating-only thermostat. The cooling outputs are disabled.

If constructed without a mode button, the thermostat operates in Auto mode, subject to configuration of the 2/4 pipe jumper and pipe sensor input.

Fan Speed Switch Operation

Fan speed is determined by manual selection from fan switch OFF to HIGH, MEDIUM and/ or LOW. In units with the Cycling Fan Option (demand output), the Fan operation (CYCLING vs. CONTINUOUS) is determined by application connections. In OFF position all outputs are off and display blank.

Up/ Down Arrow Operation

A first touch of either arrow will display the set point (a single set point is employed for both heating and cooling). Continued pressure on either arrow will scroll the set point to new values. After three seconds with no pressure on either arrow, the selected set point becomes effective and the display of the room temperature resumes.

Setback Operation

Connection of the Setback Input to 24 VAC 1 will force the control into unoccupied mode (see wiring diagram). Pressing an arrow key or the mode button on the thermostat cover will disable the setback input for one hour.

Pipe Sensor Operation

If cold water is detected, the system will operate in summer mode and the Main output will be cooling. If hot water is detected, the system will operate in winter mode, the Main output will be heating and First Stage Secondary Output will be disabled. In the case of an ambiguous reading, neither hot nor cold, the thermostat will initiate a purge cycle.

Three Wire Floating Valve Operation

Open and Close outputs are used to position the valve. Stroke time is factory set at two minutes. Outputs are off after reaching full on or off position. Valves are periodically reset for accuracy.

Outside Air Damper Operation

This output is ON any time the control is turned ON.

Application Notes

1. When no pipe sensor is used the main output controls cooling and the secondary output controls heating.
2. The pipe sensor should be mounted on the main coil input for water system operation and in the main duct system for forced air operation.
3. The set point and operating mode will be retained on a loss of power.
4. When using either a remote probe or pipe sensor, run wiring away from any electrical motors or power wiring.

Service Menu

Access: Press UP▲ and DOWN▼ arrows for 5 seconds.

Menu Selection: Select 1 to 5 by pressing the mode button or by pressing the UP▲ and DOWN▼ arrows simultaneously.

Adjust Value: Use UP▲ or DOWN▼ arrow.

Table 3: Service Menu Functions

Item #	Function	Range	Default
1	Zone Temp Offset	-5.1°F to 5.1°F	0°F
2	Valve Stroke Time	30 sec. to 5 min.	120 sec.
3	Fan Delay to OFF	0 to 10 min.	0 sec.
4	Compressor Minimum OFF Time	30 sec. to 10 min.	120 Sec.
5	Purge Cycle	0 = Time Based 1 = Temperature Based	1

Figure 3: Circuit Board Jumpers

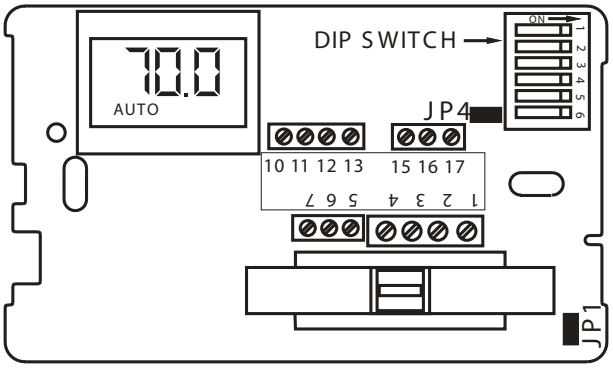


Table 4: Circuit Board Jumper Configuration

Jumper Designation	Jumper Installed ON	Jumper Removed
JP1	Local Sensing	Remote Sensing
JP4	2 Pipe System*	4 Pipe System

Power-Up Operating Sequence

Upon application of power, an MTA158 will go directly to normal operation.

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Addendum Material

DAIKIN

Installation and Maintenance Manual IM 1017

Group: **Applied Air Systems**
Part Number: **910102992**
Date: **October 2013**

MT 168 0-10 VDC/4-20mA Thermostat

Installation

⚠ DANGER

READ THESE INSTRUCTIONS CAREFULLY BEFORE ATTEMPTING TO INSTALL, OPERATE OR SERVICE THIS THERMOSTAT.

Failure to observe safety information and comply with instructions could result in PERSONAL INJURY, DEATH AND/ OR PROPERTY DAMAGE.

To avoid electrical shock or damage to equipment, disconnect power before installing or servicing. Use only wiring with insulation rated for full thermostat operating voltage. Use copper wire only. Insulate or wire-nut all unused leads. Any wiring, including the remote probe, may carry the full operating voltage of the thermostat.

To avoid potential fire and/ or explosion do not use in potentially flammable or explosive atmospheres.

Retain these instructions for future reference. You must review your application and national and local codes to ensure that your installation will be functional and safe.

⚠ CAUTION

Care should be used to avoid electrostatic discharge to the microprocessor.

This unit has configuration dip switches and jumpers. You may need to reconfigure the thermostat for your application.

1. Install the thermostat with the two furnished mounting screws to a standard 4-1/16" × 2-1/8" square device box with a 2" × 4" adapter ring.
2. For wall installations, mount the thermostat on an inside wall approximately 5 feet above the floor. The location should provide circulation at average room temperature. Avoid direct sunlight or sources of hot or cold air in the room or wall.
3. Remove the cover. Mount thermostat base assembly to the outlet box using screws provided. Tighten the screws evenly but do not overtighten. Connect wires per wiring diagram.
4. To use a remote sensor on units with local sensing capability, remove jumper JP-1 to disable local sensing. Failure to remove JP-1 will cause improper operation of thermostat.
5. Connecting a jumper between terminals 16 and 17 will disable the secondary output and change the main output to heat mode.
6. Connection of a 24 VAC set-back signal will force the control into unoccupied mode (see diagram). Pressing an arrow key or the mode buttons on the thermostat cover will disable the setback input for one hour.
7. Remove the LCD plastic protective film to complete the installation. Reinstall the cover assembly. Install cover locking screw provided.
8. Checkout: After wiring and installation are complete, energize the system and check the operation. Adjust the thermostat as necessary to complete at least one cycle. Be sure the thermostat and all other equipment are functioning correctly.

People and ideas you can trust.™

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Figure 1: Mounting

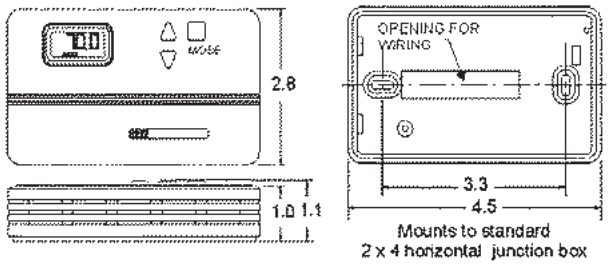
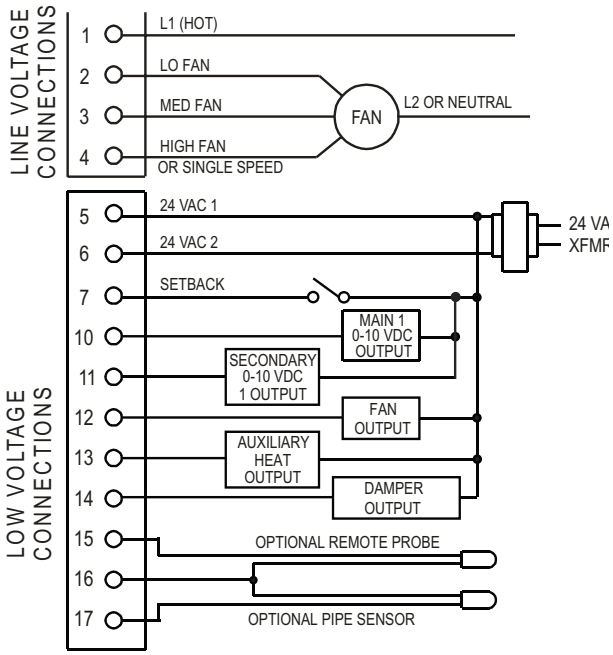


*Figure 2: Typical Wiring**



NOTE: Note: * Specific models may have fewer connections.

Electrical Ratings

Table 1: Fan switch (terminals 1-4) line voltage connections

Voltage Rating	Inductive		Resistive Amps	Pilot Duty	Thermostatic Switching
	FLA	LRA			
24 VAC	N.A.	N.A.	N.A.	24 VA	10 VA
120 VAC	5.8	34.8	6.0	125 VA	NA
240 VAC	2.9	17.4	5.0	125 VA	NA
277 VAC	2.4	14.4	4.2	125 VA	NA

Application Notes

1. When no changeover pipe sensor is used, the main output controls cooling and the secondary output controls heating.
2. The fan output, terminal 12, is energized whenever there is a demand for heating or cooling. This output can be connected to a relay that can be used to provide fan cycling to terminal 1.
3. The changeover pipe sensor should be mounted on the main coil input for water system operation and in the main duct system for forced air operation.
4. The set point and operating mode will be retained on a loss of power.
5. When using either a remote probe or pipe sensor, run wiring away from any electrical motors or power wiring.
6. The auxiliary heat output supplies a 24 VAC signal with call for heat. This output is shipped configured for staged heat.
7. The thermostat is shipped with all dip switches in the “ON” (closed) position.
8. The damper output is ON when mode is AUTO, HEAT or COOL. Damper is OFF in set back.

Thermostat Operation

These thermostats are designed to control 0-10 VDC/4-0 mA valves. These units may include a fan switch with one or more fan speed selections.

Mode Button Operation

OFF: All thermostat outputs are off, fan is still operational if connected to a manual fan switch.

AUTO: The thermostat automatically selects heating or cooling mode depending upon the relationship of the setpoint and the room temperature. The appropriate HEAT or COOL indicator is enabled in addition to AUTO. A 3°F dead band is provided to prevent short cycling between heating and cooling modes. After changeover, the control points automatically shift so that the heating OFF-point equals the set point temperature or the cooling OFF-point equals the set point temperature.

COOL: The thermostat operates as a cooling only thermostat. The heating outputs are disabled.

HEAT: The thermostat operates as a heating-only thermostat. The cooling outputs are disabled.

Fan Speed Switch Operation

Fan speed is determined by manual selection from fan switch OFF to HIGH, MEDIUM and/or LOW. In the OFF position, all outputs are off and the display is blank.

Up/Down Arrow Operation

A first touch of either arrow will display the setpoint (a single set point is employed for both heating and cooling). Continued pressure on either arrow will scroll the setpoint to new values. After three consecutive seconds on either arrow, the selected setpoint becomes effective and the display of the room temperature resumes.

Configuration

Table 2: Circuit Board Jumper Configuration

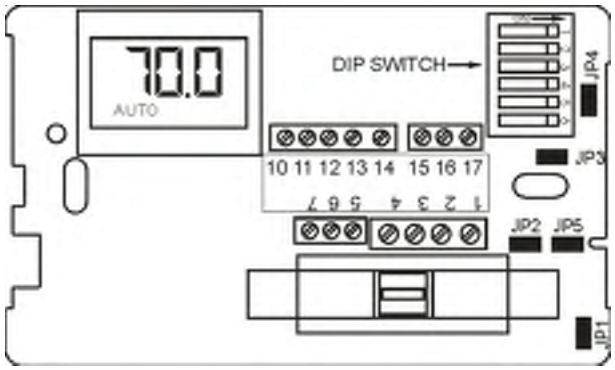
Jumper	Closed ON*	Open OFF
JP1	Local Sensing	Remote Sensing
JP2	2 Pipe System	4 Pipe System
JP3	Factory Use Only	
JP4	0-10 VOC Main Output	4-20 mA Main Output
JP5	0-10 VOC Secondary Output	4-20 mA Secondary Output

Table 3: Dip Switch Configuration

Switch	Closed ON*	Open OFF
1	Not Use	Not Used
2	Staged Heat 3°F Diff. (Term. 13)	Aux. Heat No Diff. (Term. 13)
3	°F Display	°C Display
4	Main & Sec. Outputs 0-10 VOC (Term. 10 & 11) requires JP4 & JP5	Main & Sec. Outputs 4-20 mA (Term. 10 & 11) Remove JP4 & JP5
5	Operating Position	Not Used
6	Setback= 90°F & 50°F	Setback = 85°F & 60°F

Note: * On is with the dip switch handle to the right. See diagram.

Figure 3: Circuit Board



Service Menu:

Access: Press UP▲ and DOWN▼ arrows for 5 seconds.

Menu Selection: Select 1 to 5 by pressing the mode button or by pressing the UP▲ and DOWN▼ arrows simultaneously.

Adjust Value: Use UP▲ or DOWN▼ arrow.

Table 4: Service Functions

Item #	Function	Range	Default
1	Zone Temp Offset	-5.1 °F to 5.1 °F	°0 F
2	Valve Stroke Time	30 sec. to 5 min.	120 sec.
3	Fan Delay to OFF	2 to 10 min.	120 sec.
4	Compressor Minimum OFF Time	30 sec. to 10 min.	120 sec.
5	Purge Cycle	0 = time based 1 = temperature based	1

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Addendum Material

Installation and Maintenance Manual IM 846

Group: **Applied Air Systems**
Part Number: **910102993**
Date: **October 2013**

T170 Thermostat

24 VAC/120–277 VAC

3-Speed Fan Control (Continuous or Cycling) or Staged Fan Control



⚠ WARNING

BEFORE ATTEMPTING TO INSTALL, OPERATE, OR SERVICE THIS THERMOSTAT, CAREFULLY READ THESE INSTRUCTIONS.

Failure to observe safety information and comply with instructions could result in PERSONAL INJURY, DEATH, AND/OR PROPERTY DAMAGE.

To avoid potential fire and/or explosion, do not use in potentially flammable or explosive atmospheres.

Retain these instructions for future reference. This product, when installed, is part of an engineered system whose specifications and performance characteristics are not designed or controlled by Daikin. You must review your application and national and local codes to assure that your installation is functional and safe.

⚠ DANGER

Hazardous voltage. To avoid electrical shock or damage to equipment, disconnect power before installing or servicing.

Failure to follow these instructions will result in death or serious injury.

DAIKIN

Installation

Thermostat Model and Part Number

Daikin offers two different thermostats depending on the fan speed control used (Table 1).

Table 1: Thermostat model and part numbers

Model Number	Part Number	Fan Speed Control
TA170-001	107345335	3-Speed Fan Control
TB170-001	107345336	Staged Fan

Note – For a list of thermostat features, refer to ED 3611.

Optional Occupancy Detection Sensors/ Kits

In addition to the T170 thermostat, Daikin offers optional occupancy detection sensors that can be ordered and used in conjunction with the thermostat. When ordering, use the associated kit number(s)

Table 2: Occupancy sensor model and kit numbers

Model Number	Kit Number
SA200-001	6677877211
SB200-001	6677877311
SD200-001	6677877411
SB200-002	6677877511

Mounting and Wiring the Thermostat

⚠ CAUTION

Before applying power, the voltage selection switch must be in the appropriate position. Failure to select the correct voltage can cause thermostat malfunction or permanently damage the thermostat.

⚠ CAUTION

To use a remote sensor on units with local sensing capability, remove jumper JP1 to disable local sensing. Failure to remove JP1 can cause improper operation of the thermostat with a remote probe installed.

⚠ CAUTION

Use copper wire only. Insulate or wire nut all unused leads. Avoid electrostatic discharge to the thermostat. Failure to do so can cause thermostat malfunction or permanently damage the thermostat.

⚠ DANGER

Hazardous voltage. Combined load current is not to exceed 20 amps. Mount only to a grounded metallic box. Low voltage wiring is Class 2. To avoid electrical shock or damage to equipment, disconnect power before installing or servicing. Failure to follow these instructions will result in death or serious injury.

The thermostat base mounts to a field provided 4" × 4" outlet box with a 2" × 4" mud ring (Figure 1). The thermostat cover assembly mounts to the thermostat base.

1. Disconnect power before installing or servicing.
2. Run line voltage wiring (and low voltage wiring if applicable) into the field provided outlet box and mud ring (Figure 1).
3. Locate all connections within the mud ring/connection box and wire nut all unused wires.
4. Remove the thermostat cover assembly from its base to gain access to the circuit board (Figure 2).
5. On the circuit board, set the voltage selection switch (Figure 2) to the appropriate voltage for the application
   - 24 V = 24 VAC
   - 110–277 V = 120, 240, or 277 VAC.

NOTE: The circuit board is shipped with the voltage selection switch in the 110-227 V position. For 24 VAC use, the switch must be in the 24 V position.

6. The circuit board is also equipped with configuration jumpers (JP1, JP3, and JP4 in Figure 2). Depending on the application, it may be necessary to reconfigure the following jumpers:
   - **JP4:** 2/4 Pipe Sensor Jumper - This jumper selects between 2-pipe (jumper ON) and 4-pipe (jumper OFF) operation (Fan Operation).
   - **JP3:** Door/Window Switch Jumper - This jumper is shipped normally open. Placement of a jumper allows for occupancy detection and door/window switch only operation (Optional Occupancy Detection Equipment Operation).
   - **JP1:** Removal of this jumper allows the sensor to be located in a remote location.
7. Connect the color coded thermostat wires (Figure 3) to the line voltage wires located in the mud ring/connection box and secure the connections with wire nuts.
8. Install the thermostat base to the mud ring/outlet box using two furnished mounting screws. Tighten the screws evenly but do not over tighten.

NOTE: An output ratings chart (Table 3) is located on the inside of the base.

9. With the base now secured, verify that the circuit board is firmly snapped into the cover and is not dislodged.
10. Install the cover assembly to the base, pressing firmly to engage the cover locking snaps.

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Figure 1: Mounting the thermostat

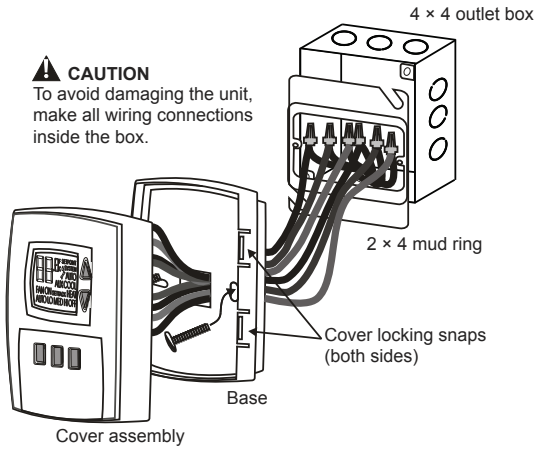


Figure 2: Circuit board

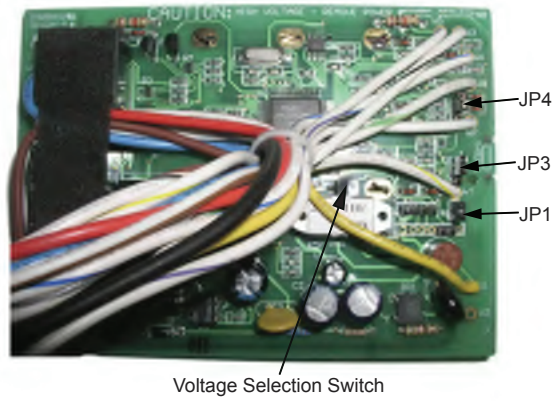


Figure 3: Wiring diagram

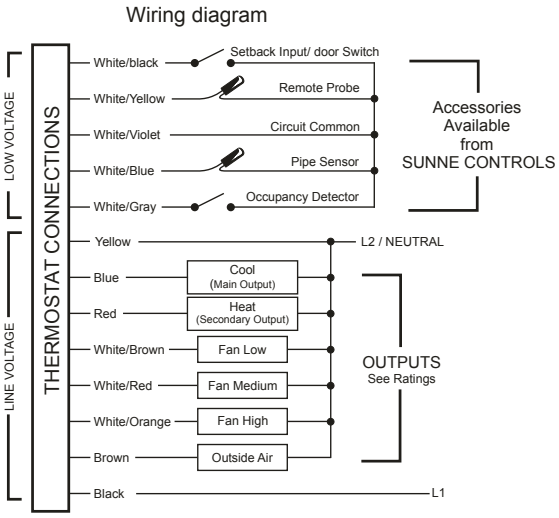


Table 3: Output ratings

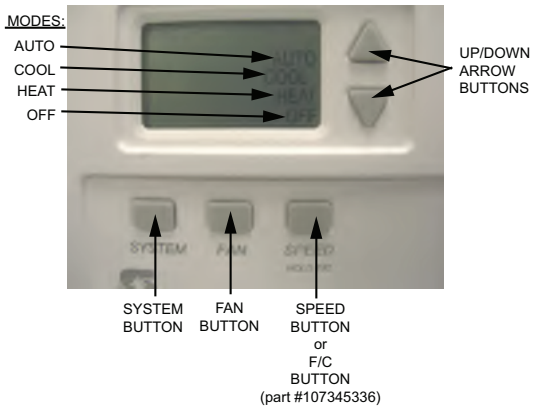
Voltage	Inductive		Resistive Amps	Pilot Duty	HP
	FLA	LRA			
24 VAC	NA	NA	NA	24 VA	NA
120 VAC	5.8	34.8	6.0	125 VA	1/4
240 VAC	2.9	17.4	5.0	125 VA	1/4
277 VAC	2.4	14.4	4.2	125 VA	1/4

Operation

Thermostat Button Operation

The thermostat interface (Figure 4) contains buttons for use in navigating to accompanying menus/screens and for performing specific operations. These buttons and operations are described below.

Figure 4: Thermostat interface (model #TA170-001 shown)



System Button Operation

The System button (Figure 4) contains and displays the following modes of operation:

OFF—All thermostat outputs are off. The fan is still operational if FAN ON is selected.

AUTO—The thermostat automatically selects heating or cooling mode depending on the set point and room temperature. If demand exists, the appropriate HEAT or COOL icon illuminates. A 3°F dead band is provided to prevent short cycling between heating and cooling modes. After changeover, the control point automatically shifts so that the control OFF point equals the set point temperature.

COOL—The thermostat operates as a cooling only thermostat.

HEAT—The thermostat operates as a heating only thermostat.

Up/Down Arrow Button Operation

4. Use the Up▲ and Down▼ arrow buttons (Figure 4) to increase or decrease the temperature.

Fan Button Operation

Use the Fan button (Figure 4) to control operation of the fan. In the ON position, the fan output operates continuously. In the AUTO position, the output cycles with demand. In the OFF position, all outputs are off.

NOTE: Model #TB170-001 (part #107345336) has staged fan control.

Speed Button Operation (TA170-001)

The fan Speed button (Figure 4) for model #TA170-001 (part #107345335) is determined by manually selecting HI, MED, or LO. Press and hold the Speed button for five seconds to toggle the displayed temperature from Fahrenheit to Celsius.

F/C Button Operation (TB170-001)

Model #TB170-001 (part #107345336) is configured for staged fan control and therefore utilizes a F/C button (Figure 4) instead of a Speed button. When pressed, the F/C button toggles between Fahrenheit and Celsius.

Verifying Thermostat Operation

To verify thermostat operation after mounting and wiring it, perform the following:

1. Energize the system.
2. Set the fan to ON.
3. Select each fan speed, if available, to verify operation.
4. Set the system button to AUTO or other available selection.
5. Using the UP▲ arrow, adjust the temperature to more than 5°F above ambient temperature to cycle on heating.
6. Using the DOWN▼ arrow, adjust the temperature to more than 5°F below ambient temperature to cycle on cooling.

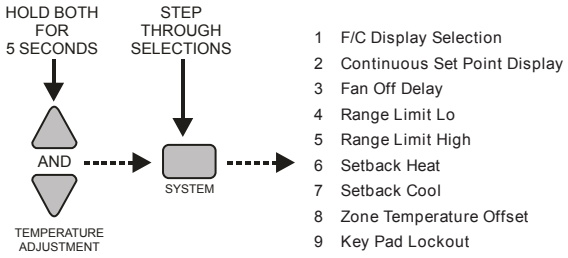
Thermostat Menu Functions

The thermostat menu contains nine functions which can be accessed using controls on the thermostat. Accessing the menu functions and details of each function are described below.

Menu Function Access

1. Press and hold the UP and DOWN arrow buttons (Figure 5) for five seconds.
2. The current display clears and the number “1” appears.
3. 3 Press the SYSTEM button to scroll to the next item number.
4. Use the UP and DOWN buttons to make changes within the selected number.

Figure 5: Thermostat menu



1. **F/C (Fahrenheit/Celsius) display selection:** When this function is selected, the F and C icons appear and the selected icon flashes. To toggle between F or C, press the up or down arrow button.
2. **Continuous set point display:** When this function is selected, the F or C icon, current digits, and the set point icon appear. If the Continuous set point display is enabled, the set point icon flashes. To toggle between continuous display of set point and display of zone temperature, press the up or down arrow button.
3. **FAN OFF delay:** When this function is selected, the FAN, OFF, and digits appear. The digits represent the number of seconds the fan stays on after the heating and cooling outputs are turned off. To increase or decrease the value from 0–255 seconds, press the up or down arrow button.
4. **Range limit low:** When this function is selected, the current minimum range setting, the SET POINT icon and the LO icon appear. To increase or decrease the value, press the up or down arrow button.
5. **Range limit high:** When this function is selected, the current maximum temperature range adjustment, SET POINT icon, and LO icon appear. To increase or decrease the value, press the up or down arrow button.

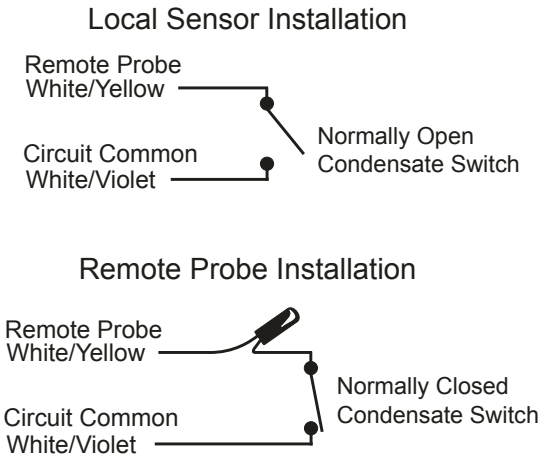
6. **Set back heat:** When this function is selected, the current temperature range adjustment, the SET BACK icon, and the HEAT icon appear. To increase or decrease the value, press the up or down arrow button.
7. **Set back cool:** When this function is selected, the current Cool setback value, the SET BACK icon, and the COOL icon appear. To increase or decrease the value, press the up or down arrow button.
8. **Zone temperature offset:** When this function is selected, the numeric ones and tenths (0.0) appear with a leading minus sign. To increase or decrease the value +/– 9°F, press the up or down arrow button. Increments are made in 1°F and 0.5°C.
9. **Keypad lockout:** When this function is selected, the ON and OFF icons appear. The enabled icon flashes. OFF is the default. ON disables the keypad except for entry into the service menu. To increase or decrease the value, press the up or down arrow button.

NOTE: In the event of a power failure, these values are stored and can be recalled.

Condensate Overflow Interrupt

The remote probe input can be used with a condensate overflow switch (CO), either in conjunction with a remote probe (normally closed CO switch, Figure 6), or with local sensing (normally open CO switch, Figure 6). When the condensate switch activates, the thermostat displays a service wrench icon and disables all outputs.

Figure 6: Local and remote probe installation



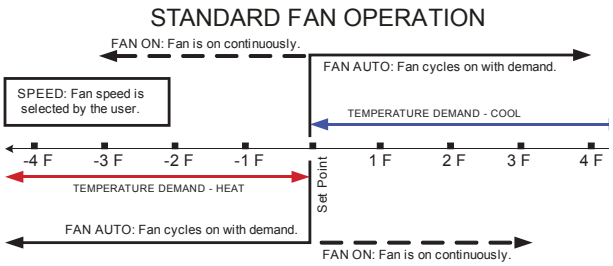
Fan Operation

The thermostat may be factory configured for standard or staged fan operation.

Standard Fan Configuration (TA170-001)

Units with standard fan operation (Figure 7) have a selectable fan Speed button.

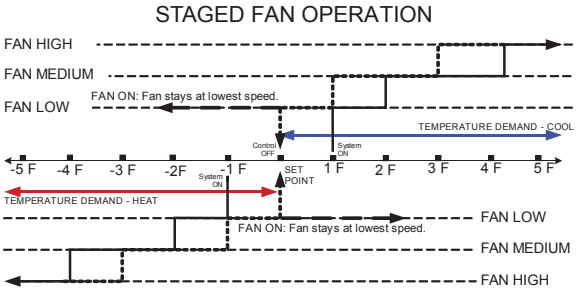
Figure 7: Standard fan operation



Staged Fan Configuration (TB170-001)

Factory configuration is available for staged fan operation (Figure 8) to provide occupant comfort while using the most effective fan speed.

Figure 8: Staged fan operation



Controlled Off Factory Configuration

A factory configuration may be provided for minimum heating and cooling requirements. Using this configuration, the HEAT and COOL outputs are automatically cycled on at the heat setback limit. Your thermostat may not have this feature.

Fan Coil Operation

Fan Coil operation is either a 2-pipe or 4-pipe configuration which is determined by jumper selection JP4 (Mounting and Wiring the Thermostat).

2-Pipe Operation

In this configuration, the thermostat permanently disables the secondary output and disables the fan from cycling in an invalid mode. The main output configuration is dependent on the pipe sensor input. With a pipe sensor connected, the thermostat automatically selects heating or cooling depending on the sensed water temperature. If the pipe sensor input is open (unconnected), the main output only cools. If the pipe sensor input is shorted, the main output only heats. Normal thermostat default is for 4-pipe operation. For 2-pipe operation, install a jumper on JP4.

4-Pipe Operation

In this configuration, both the main output (COOL) and the secondary output (HEAT) are available. These both cycle ON depending on the mode of the thermostat. With a pipe sensor connected, the thermostat automatically changes the main output to heat and disables the secondary output if the main coil water is hot. For 4-pipe operation, the JP4 jumper is removed.

Pipe Sensor Operation

A pipe sensor can be connected when the thermostat is configured for either 2-pipe or 4-pipe configuration. The pipe sensor is used to determine the water temperature in the main coil, which should be connected to the primary output.

Pipe sensor input—use a 10K Remote Probe or a standard ON-OFF Aquastat for summer/winter changeover.

Purge Cycle

With a pipe sensor connected, the thermostat initiates a purge cycle if the sensed water temperature is ambiguous (not adequately hot or cold). The sequence for purge cycle operation is as follows:

1. The thermostat has a call for heat or cooling.

NOTE: If at any time the call goes away, the thermostat stops the purge cycle.

2. The thermostat checks the pipe sensor to verify water temperature.
3. If the water temperature is beyond 15°F of the set point, normal HVAC control occurs.
4. If the water temperature is not beyond 15°F of the set point, the thermostat checks to see if the water temperature is above 80°F or below 60°F.

   If yes, normal HVAC control occurs.

   If no, the thermostat opens the main output (COOL) for three minutes.

5. After the three minute purge cycle occurs, the thermostat checks to see if the water temperature is more than 15°F from the set point, or above 80°F, or below 60°F.

   If yes, normal HVAC operation occurs.

   If no, the valve is left open and the thermostat continues to search for a valid reading.

NOTE: If at any time the demand goes away, the thermostat will stop the purge cycle.

Table 4 shows output operation, depending on the sensed water temperature.

Table 4: Output operation

2-Pipe/4-Pipe Selection	Water Temperature	Output Operation	
		Main Output	Secondary Output
2-pipe JP4 ON	Cold	Cooling only The fan does not cycle ON with a heat demand.	Disabled
	Hot	Heating only The fan does not cycle ON with a cool demand.	Disabled
4-pipe JP4 OFF	Cold	Cooling	Heating
	Hot	Heating only The fan does not cycle ON with a cool demand.	Disabled

Setback Operation

In this configuration, the low level switch input normally is open. To enable setback operation, the JP3 jumper is removed (Mounting and Wiring the Thermostat). The input will close and the thermostat heating and cooling setback limits can then be used as temperature control points. Fan operation in setback is cycled with demand. Press any thermostat key to override setback for one hour. Setback overrides any user setting except if the control is turned to OFF.

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Optional Occupancy Detection Equipment Operation

The T170 thermostat can be used with optional S200 series occupancy detection equipment. Purchasing and installing this equipment to compliment the thermostat adds energy savings by setting back HVAC operation during occupied and unoccupied times. Optional detection equipment configurations and operation are described below.

SB200-001 Occupancy Sensor

The SB200-001 occupancy sensor (Figure 9) serves as an occupancy sensor for automatic control of a guest room HVAC system. It incorporates an innovative dual delay processor which allows the sensor to verify the nature of occupancies, and is capable of eliminating unnecessary actuations of the HVAC device due to unintentional passages or short time occupancies. The sensor may also serve as a slave sensor (Figure 11).

The sensor switch is open in occupied mode and closed in unoccupied mode. An optional door and/or window switch (Figure 9) is open when the door/window is open and is closed when the door/window is closed.

NOTE: To use this configuration, a jumper must be installed to JP3 to allow occupancy input.

An optional door and/or window switch (Figure 9) can be added for use with the SB200-001 sensor.

Operation

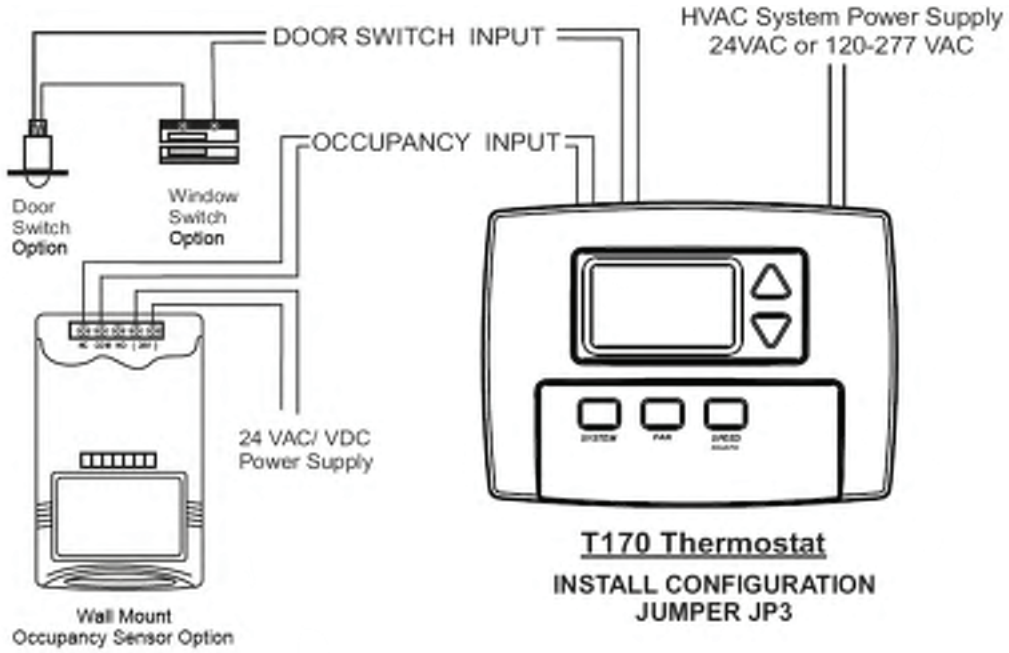
In an occupied mode, the thermostat operates normally and looks for a door open signal. When the door opens, the thermostat waits for a door close signal. If the door is open for more than two minutes, the thermostat turns the HVAC system outputs to OFF. During this two minute period, if any button is pressed on the keypad, the time delay is extended to ten minutes. The time delay can only be extended once. Once the HVAC outputs transition to OFF, a door closure is required to re-enable the outputs. When the door closes, the thermostat starts a two minute timer and tries to detect occupancy. If the timer expires and no occupancy is detected, the thermostat transitions to an unoccupied state. If occupancy is detected while the timer is running, the thermostat will remain in the occupied mode.

In an unoccupied mode, the thermostat sets heating and cooling set points to setback values as determined by factory or user settings. The fan is automatically set to cycle with demand. The thermostat continually monitors the occupancy sensor and will enter into occupied mode if occupancy is detected.

If the installation is only using a door/window switch, the thermostat will disable the HVAC outputs if this output is open for longer than two minutes.

To enable door/window switch only operation, install a jumper to JP3 (Mounting and Wiring the Thermostat) and the occupancy input must be shorted to circuit common.

Figure 9: Optional equipment configuration #1



SD200-001 Occupancy Sensor

The SD200-001 occupancy sensor (Figure 10) serves as a master sensor for a guest room HVAC management system. The sensor provides HVAC operation according to occupancy status, as well as door/window switch monitoring, selectable high/low temperature setback, form-C output, slave sensor connectivity, and a five minute door open HVAC shut-off.

NOTE: To use this configuration, the jumper to JP3 is removed to allow setback input.

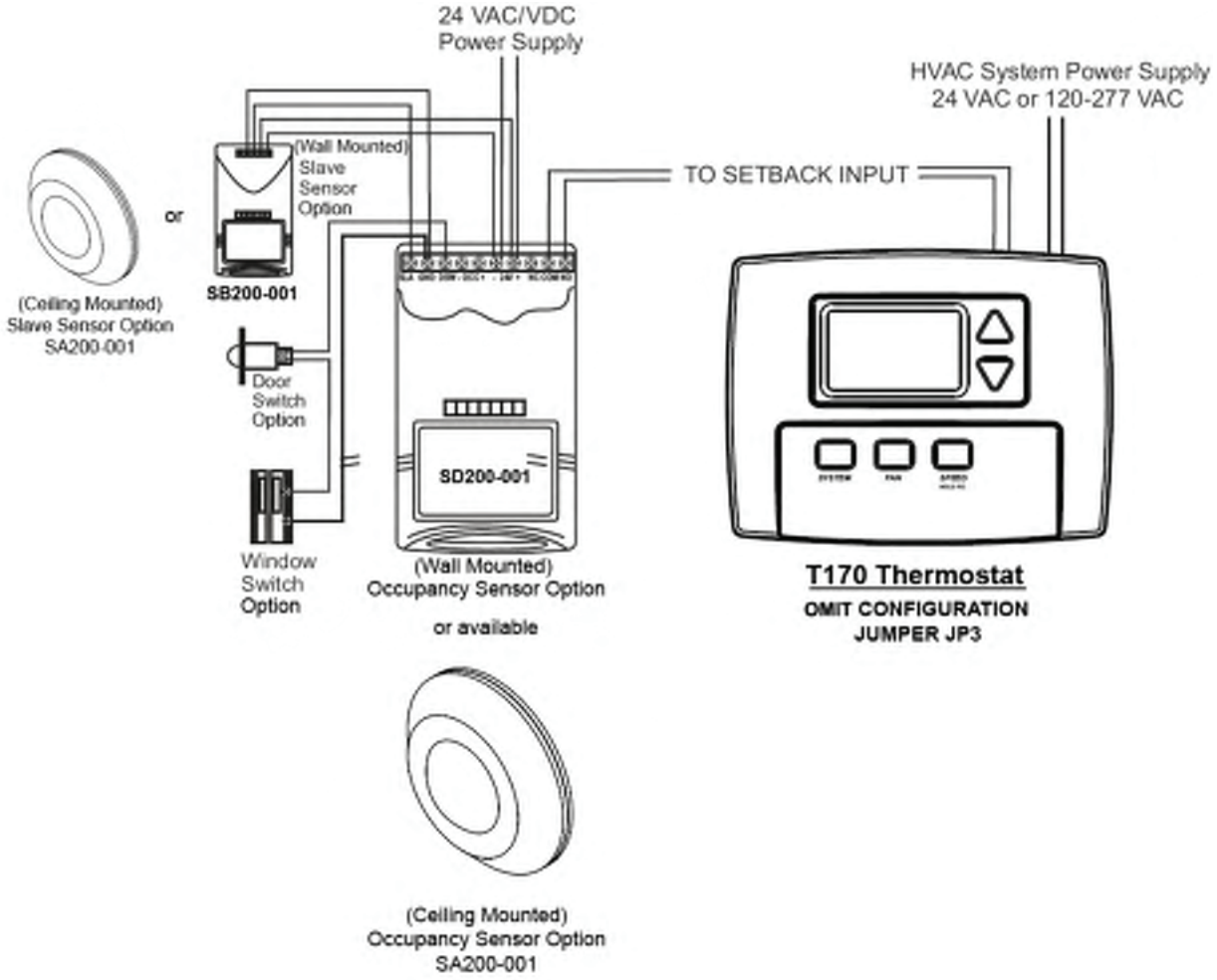
An optional door and/or window switch (Figure 10) and slave sensor can be added for use with the SD200-001 sensor.

Operation

In an occupied mode, the SD200-001 occupancy sensor (Figure 10) and door switch use advanced microprocessor logic to determine occupancy. A door open signal will initiate occupancy status detection. If the sensor determines that a room is occupied, it will allow normal HVAC control. The sensor will wait for another door open signal before determining occupancy again.

In an unoccupied mode, the sensor continually monitors the room. Any occupancy detection will set the operation to occupied mode.

Figure 10: Optional equipment configuration #2



SD200-002 Occupancy Sensor

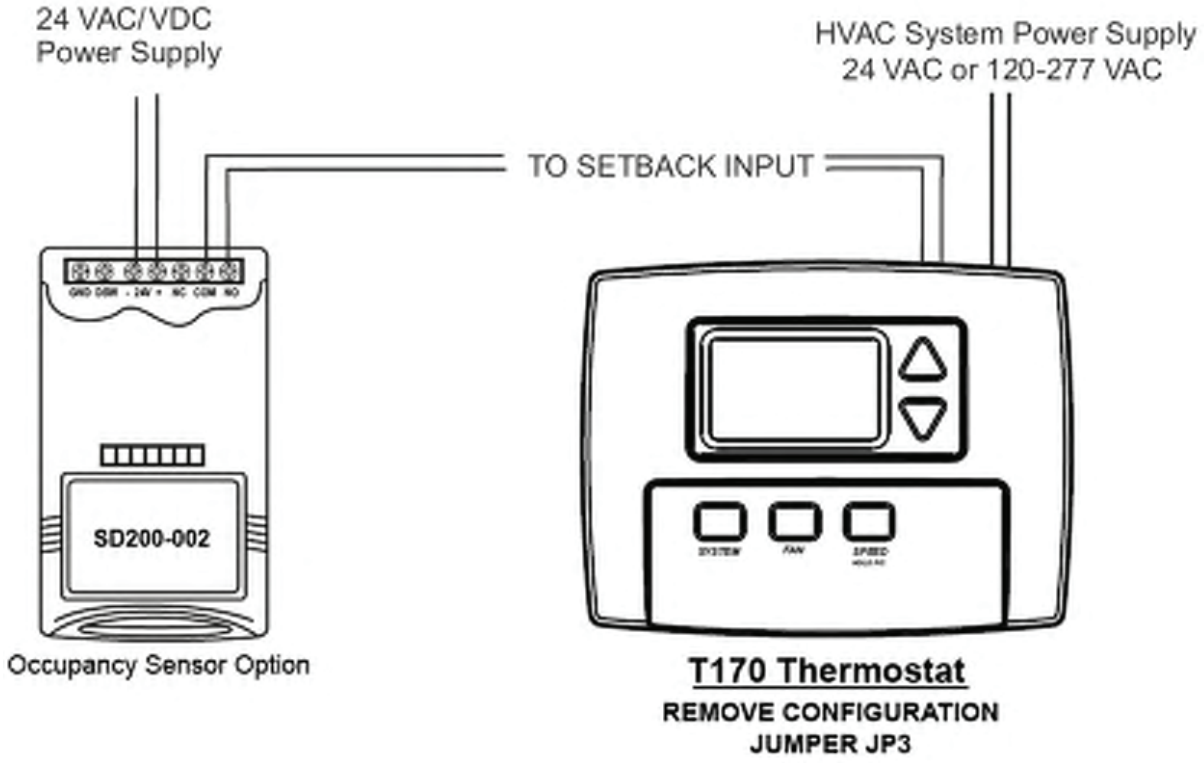
The SD200-002 occupancy sensor serves as a stand alone master sensor for a guest room HVAC management system. The sensor provides HVAC operation according to occupancy status, as well as selectable high/low temperature setback, form-C output, and a five minute door open HVAC shut-off. This system provides basic room setback and is ideal for control of HVAC in commercial spaces.

NOTE: To use this configuration, the jumper to JP3 is removed to allow setback input.

Operation

With each occupancy detection, an OFF delay is started and can be set to delay for up to 30 minutes.

Figure 11: Optional equipment configuration #3



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Addendum Material

Installation and Maintenance Manual IM 1019

Group: **Fan Coil**
Part Number: **IM 1019**
Date: **October 2011**

MT 180 Programmable Thermostat



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⚠ WARNING

READ THESE INSTRUCTIONS CAREFULLY BEFORE ATTEMPTING TO INSTALL, OPERATE OR SERVICE THIS THERMOSTAT.

Failure to observe safety information and comply with instructions could result in PERSONAL INJURY, DEATH AND/OR PROPERTY DAMAGE.

To avoid electrical shock or damage to equipment, disconnect power before installing or servicing and use only wiring with insulation rated for full thermostat operating voltage.

Before installing this control, the Voltage Selection Switch must be placed in the correct position. See instructions. To avoid potential fire and/or explosion do not use in potentially flammable or explosive atmospheres.

Retain these instructions for future reference. This product, when installed, will be part of an engineered system whose specifications and performance characteristics are not designed or controlled by PECO. You must review your application and national and local codes to assure that your installation will be functional and safe.

⚠ CAUTION

- Use copper wire only, insulate or wire nut all unused leads.
- Care should be used to avoid electrostatic discharge to the T180 thermostat.
- This unit has configuration jumpers. You may need to reconfigure this thermostat for your application

Applications and Features

For 2 or 4 Pipe Fan Coil and ON/OFF Control Applications

- 7 Day, 4 Event Programmability
- System Selection: OFF-Heat-Cool-Auto-Setback
- 6 Outputs: 1H, 1C, Up to 3 Fan, OA Damper
- Fan Control: 1-3 Speeds
  - — Cycling (Auto) or Continuous (ON)
  - — Automatic Fan Speed Staging (TB180 models only)

Connections for:

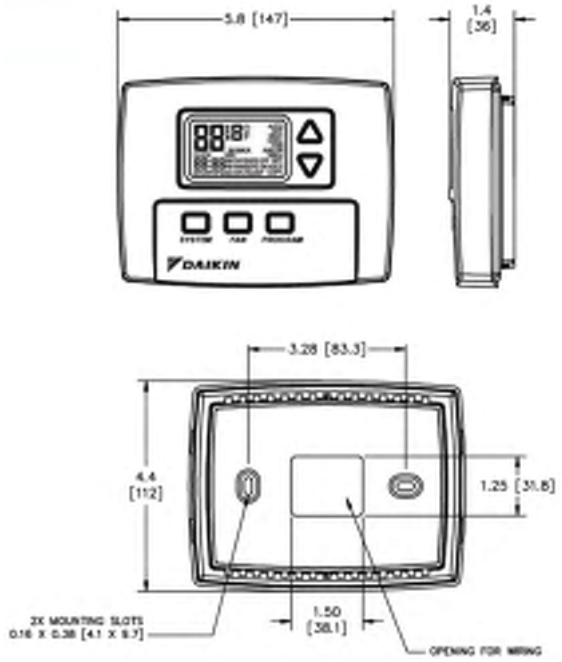
- Fan Coil Pipe Sensor
- Remote Temperature Probe
- Occupancy Control
- Door Switch or Setback
- Condensate Overflow

Specifications

Table 1: MT180 Programmable Thermostat Specifications

Temperature Set Point Range	50 to 90°F / 10 to 32°C
Differential	1°
Memory – Back-Up	EEPROM, No batteries required, Stores settings for unlimited time
Mounting	Installs on standard 4" × 4" device box with a 2" × 4" horizontal mud ring
Physical Dimensions	4.4"(h) × 5.8"(w) × 1.1"(d)
Agency Approvals	UL, UL Canada
Electrical Ratings	(see Ratings table)

Figure 1: MT180 Programmable Thermostat Dimensions



Thermostat Model and Part Number

Daikin offers two different 7-Day Programmable Digital Heating/Cooling Thermostat with constant fan or Fan cycled, On/Off Valve Control depending on the fan speed control used (See Table 2).

Table 2: Thermostat Model and Part Number

Model Number	Part Number	Fan Speed Control
TA180-001	910119110	3-speed fan control
TB180-001	910119111	Staged fan control

Optional Sensors/Kits

In addition to the T180 thermostat, Daikin offers optional sensors for occupancy detection (page 14 and page 15) and 10K pipe sensor page 12) that can be ordered and used in conjunction with the thermostat. Use the associated kit number(s) provided in Table 3 when ordering.

Table 3: Sensor Model and Kit Numbers

Sensor Model Number		Daikin Part Number
Occupancy Detection Sensor	SB200-001	6677877311
	SD200-001	6677877411
	SD200-002	6677877511
10K Pipe Sensor		107201601

Installing, Mounting and Wiring the Thermostat

⚠ CAUTION

Before applying power, the voltage selection switch must be in the appropriate position. Failure to select the correct voltage can cause thermostat malfunction or permanently damage the thermostat.

⚠ CAUTION

To use a remote sensor on units with local sensing capability, remove jumper JP1 to disable local sensing. Failure to remove JP1 can cause improper operation of the thermostat with a remote probe installed.

⚠ CAUTION

- Use copper wire only. Insulate or wire nut all unused leads.
- Avoid electrostatic discharge to the thermostat.
- Failure to do so can cause thermostat malfunction or permanently damage the thermostat.

⚠ DANGER

Hazardous voltage. Combined load current is not to exceed 20 amps. Mount only to a grounded metallic box. Low voltage wiring is Class 2. To avoid electrical shock or Damage to equipment, disconnect power before installing or servicing. Failure to follow these instructions will result in death or serious injury

Figure 2: Mounting the Thermostat

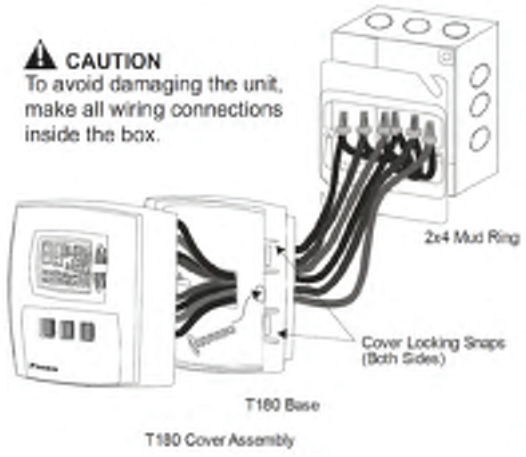
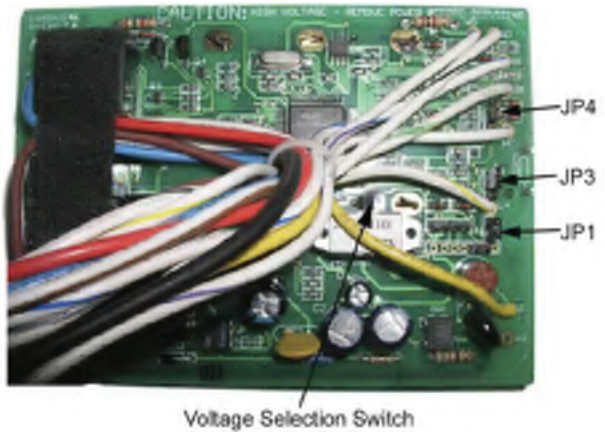


Figure 3: Circuit Board



The thermostat should be used indoors only. It should be mounted on an inner wall in a location with freely circulating air, and where it will be responsive to changes in room temperature. Avoid mounting near heat generating appliances (i.e. TV, heater, refrigerator), or in direct sunlight.

The thermostat base mounts to a field provided 4” × 4” outlet box with a 2” × 4” horizontal mud ring. The thermostat cover assembly mounts to the thermostat base.

1. Disconnect power before installing or servicing.
2. Run line voltage wiring (and low voltage wiring if applicable) into the field provided outlet box and mud ring (Figure 2).
3. Locate all connections within the mud ring/connection box and wire nut all unused wires.
4. Remove the thermostat cover assembly from its base to gain access to the circuit board (Figure 3).
5. On the circuit board, set the voltage selection switch (Figure 3) to the appropriate position prior to application of power.
   - 24V = 24 VAC
   - 110-277 V = 120, 240 or 277 VAC

NOTE: The circuit board is shipped with the voltage selection switch in the 110-227 V position. For 24 VAC use, the switch must be in the 24 V position

6. The circuit board is also equipped with configuration jumpers (JP1, JP3, and JP4 in Figure 3). Depending on the application, it may be necessary to reconfigure the following jumpers:

   JP1 Jumper Selection – Remote Temperature Sensor

   Local Sensing – Install JP1

   Remote Sensing – Remove JP1 – Accessory sensors are available in standard 60" lengths but can be extended to meet application requirements.

   JP3 Jumper Selection – HVAC Setback Systems

   The JP3 jumper allows the T180 to be configured for Setback, Occupancy Detection or Door Switch Only Occupancy Operations. For further descriptions of these conditions please see the Technical and Application Notes, page 12.

   - Setback Operation - Remove JP3
   - Occupancy Detection - Install JP3
   - Door Switch Only - Install JP3

   JP4 Jumper Selection – 2 or 4 Pipe Operation

   Connection of a pipe sensor will change the operation of the outputs as shown in Table 4. (See Technical Notes for further information on Pipe Sensor Operation, page 12)

   - 2-Pipe Operation - Install JP4 - The thermostat will permanently disable the Secondary Output and disables system and fan invalid modes.
   - 4-Pipe Operation - Remove JP4 - Both the Main Output (COOL) and Secondary Output (HEAT) will be available.

7. Connect the color coded thermostat wires (Figure 4) to the line voltage wires located in the mud ring/connection box and secure the connections with wire nuts.
8. Install the thermostat base to the mud ring/outlet box using two furnished mounting screws. Tighten the screws evenly but do not over tighten.

NOTE: Note: An output ratings chart (Table 5) is located on the inside of the base.

9. With the base now secured, verify that the circuit board is firmly snapped into the cover and is not dislodged.
10. Install the cover assembly to the base, pressing firmly to engage the cover locking snaps.

Figure 4: Wiring Diagram

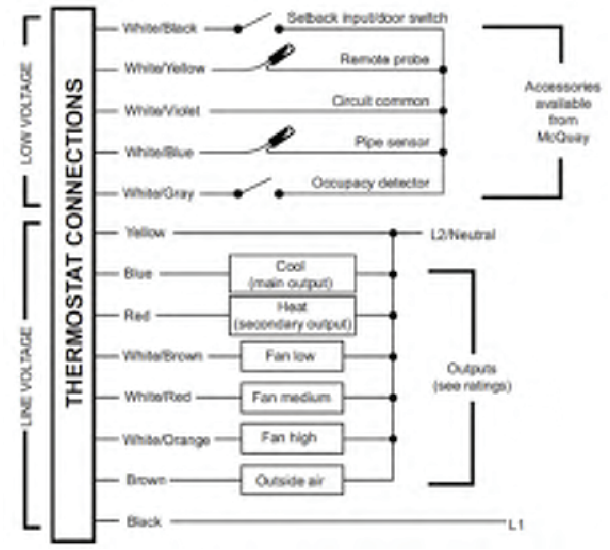


Table 4: Jumper Activation

JP4 Section	Pipe Sensor Water Temp	Aqua Stat	Main Output (Blue Wire)	Secondary Output (Red wire)
2-Pipe	Cold	Open	Cooling Only	Disabled
JP4-ON	Hot	Closed	Heating Only	Disabled
2-Pipe	Cold	Open	Cooling	Heating
JP4-OFF	Hot	Closed	Heating Only	Disabled

NOTE: *Fan will not cycle on for disabled modes.

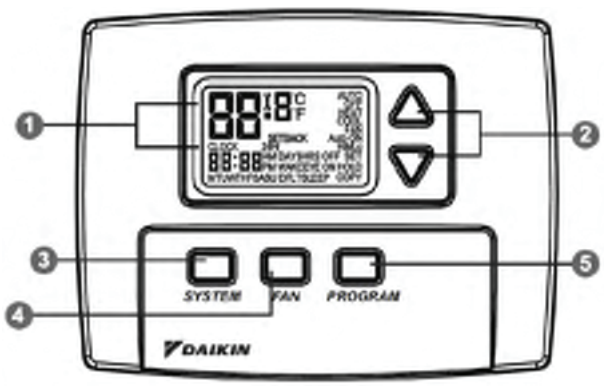
Table 5: Output Ratings

Voltage	FLA	LRA	RES Amps	Pilot Duty	HP
24 VAC	NA	NA	NA	24 VA	NA
120 VAC	5.8	34.8	6.0	125 VA	¼
240 VAC	2.9	17.4	5.0	125 VA	¼
277 VAC	2.4	14.4	4.2	125 VA	¼

Combined Load Current Not to Exceed 20 Amps

Front Panel Reference

Figure 5: MT180 Programmable Thermostat Interface

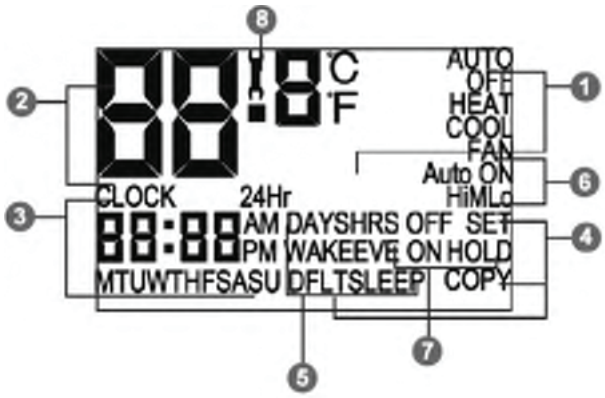


The thermostat interface (Figure 5) contains buttons for use in navigating to accompanying menus/screens and for performing specific operations. These buttons and operations are described below.

1. Liquid Crystal Display with a blue backlight
2. UP .and DOWN .Buttons
3. SYSTEM Button
4. FAN Button
5. PROGRAM Button.

Display Reference

Figure 6: MT180 Programmable Thermostat Display



1. System Mode Display (See Table 6)
2. Temperature Display (See Table 7)
3. Time and Day Display (See Table 8)
4. Programming Commands (See Table 9)
5. Time Period Indicators

   WAKE, DAY, EVE, and SLEEP are the names given to the four time periods per day. Each time period has its own unique setpoint temperatures as shown in Table 15.
6. Fan Operation Indicators (See Table 10)
7. Program Override Commands (See Table 11)
8. Service Indicator

   The wrench symbol is displayed when there is a temperature sensor error or condensate overflow error. It indicates there is an open or a short connection to the sensor switch. When this occurs, the thermostat will disable all outputs and illuminate the wrench symbol. A service technician should be called to determine the cause of the error.

Table 6: System Mode Display Overview

Menu	Description
HEAT	Indicates the system is in heating mode
COOL	Indicates the system is in cooling mode
AUTO	Indicates the system will automatically changeover between heating and cooling modes as the room temperature varies
OFF	Turns OFF the entire system
SETBACK	Indicates the heating or cooling system is operating in setback mode. Setback mode is an energy saving feature that can be either manually activated by the thermostat's user, or automatically activated by an occupancy sensor or door switch

Table 7: Temperature Display Overview

Menu	Description
Default Display	Digits display the current room temperature
During Programming	Digits are used to set the desired temperatures

Table 8: Time and Day Display Overview

Menu	Description
Default Display	Digits indicate the current time, and day abbreviations indicate the current day
During Programming	Digits and days are used to program time periods
CLOCK	Lights up during programming when the clock is being set
24Hr	Lights up during programming to indicate time will be displayed in 24-hour clock format
AM/PM	Indicates 12-hour clock format

Table 9: Programming Commands Overview

Menu	Description
SET	Enters thermostat into custom program mode which allows you to specify a unique times and temperatures for a particular day or group of days
COPY	Simplifies programming by allowing you to copy all of an individual day's settings to another day or group of day
DFLT	Restores the thermostat to the factory program

Table 10: Fan Operation Indicators Overview

Menu	Description
FAN	"FAN" will be always be lit in conjunction with "ON" or "AUTO"
ON	Indicates constant, continuous fan operation
AUTO	Indicates fan is only on with heating or cooling demand
HI	Indicates high speed fan; always lit in conjunction with "ON" or "AUTO"
M	Indicates medium speed fan; always lit in conjunction with "ON" or "AUTO"
LO	Indicates low speed fan; always lit in conjunction with "ON" or "AUTO"

Table 11: Program Override Commands Overview

Menu	Description
HOLD	Indicates thermostat is in manual operation. (Programmed settings are OFF, but not lost)
HOLD HRS	During programming, lights up in conjunction with clock digits; allows program to be put on hold for up to 24 hours
HOLD DAYS	During programming, lights up in conjunction with the clock digits; allows program to be put on hold for up to 99 days
HOLD ON	Indicates thermostat is in permanent manual operation
OFF	Turns OFF the hold and resumes programmed settings

Saving Changes

As you navigate your thermostat, be aware of the thermostat's save and exit protocol:

- The thermostat automatically saves all the changes you make, as you make them.
- When you are in the SYSTEM or FAN menus:
  - — If you push a button that is not applicable to the current menu, all changes are saved and the thermostat goes to the menu associated with the button that was pushed.
  - — If the thermostat is idle for five seconds, the thermostat times out, saves all changes, and returns to the thermostat's default display.
- When you are in the PROGRAM menu:
  - — If you push a button that is not applicable to the current menu, nothing happens (your programming is not interrupted).
  - — If the thermostat is idle for fifteen seconds, the thermostat times out, saves all changes, and returns to the thermostat's default display.

Up/Down Arrow Button Operation

The ▲ and ▼ buttons function in two ways:

- When you are in the default display, you can press ▲ to increase, or ▼ to decrease, the current temperature set-point. This will override programmed temperature settings until the next programmed time period (Wake, Day, Evening, or Sleep).
- When you are in the PROGRAM menu, you can press ▲ to scroll up, or ▼ to scroll down, through the menu, time, and temperature options.

System Button Operation

Pressing SYSTEM will light up the five system mode options described below. Press SYSTEM to scroll through the options. As you scroll, the current option will be blinking. To select the blinking option, wait for the five-second timeout, which saves your option and returns you to the thermostat's default display.

Table 12: System Button Operation Overview

Menu	Description
HEAT	The thermostat operates as a Heating Only thermostat
COOL	The thermostat operates as a Cooling Only thermostat
AUTO	The thermostat automatically selects the appropriate Heat or Cool mode depending upon the setpoint (desired temperature) and zone temperature (actual temperature)
OFF	Turns the system OFF by disabling all thermostat outputs
SET BACK	Setback mode is an energy saving feature that minimizes the heating and cooling when the room is not occupied. Setback mode overrides the programmed time and temperature settings by telling the thermostat to instead use the setback setpoint for heating and cooling. The setback setpoint temperatures are factory default or installer-selected during installation. During setback mode, when a demand for heating or cooling exists, the fan will run at the lowest speed. • Automatic setback mode: If your thermostat is connected to an occupancy sensor or door switch, setback mode is automatically turned on and off by the sensor or door switch. • Manual setback mode: Select SETBACK in the SYSTEM menu. Setback temperature settings will remain in effect until you manually turn off setback mode. Selecting HEAT, COOL, or AUTO in the SYSTEM menu will turn off setback and resume your programmed time and temperature settings. **NOTE:** SETBACK appears on your menu only if the thermostat's installer enabled this feature.

Fan Button Operation

Pressing FAN will light up the six fan mode options described below. Press FAN to scroll through the options. As you scroll, the current option will be blinking. To select the blinking option, wait for the five-second timeout, which saves your option and returns you to the thermostat's default display.

Table 13: Fan Button Operation Overview

Menu	Description
ON HI	High speed fan is on continuously, even if no demand for heating or cooling exists
ON M	Medium speed fan is on continuously, even if no demand for heating or cooling exists
ON LO	Low speed fan is on continuously, even if no demand for heating or cooling exists
AUTO HI	High speed fan cycles with active demand for heating and cooling
AUTO M	Medium speed fan cycles with active demand for heating and cooling
AUTO LO	Low speed fan cycles with active demand for heating and cooling

Program Button Operation

Function Overview

Pressing PROGRAM lights up five program mode options, described below. Press ▲ or ▼ buttons to scroll through the options. As you scroll, the current option will be blinking. To select the blinking option, press PROGRAM again and you will be taken to the menu associated with that option.

Table 14: Program Button Operation Overview

Menu	Description
CLOCK	Sets the current time and day.
°F / °C	Use this option to change the temperature display to Fahrenheit or Celsius. Your thermostat's default temperature display setting is Fahrenheit.
SET	Use to specify the time and temperature programming for a particular day or group of days. Also allows you to reset the thermostat to the factory default ENERGY STAR program.
COPY	Simplifies programming by allowing you to copy a particular day's program to another day or group of days.
HOLD	Puts the thermostat in manual operation for a permanent or temporary time period. Overrides your programmed settings, but does not lose them.

Setting the Clock & Day

1. Press PROGRAM once.
2. Press ▲ or ▼ to scroll until “CLOCK” is blinking. To select, press PROGRAM once.
3. Press ▲ or ▼ to scroll through “24Hr”, “AM”, “PM” options. “24Hr” sets your thermostat to a 24-hour clock. “AM” and “PM” sets your thermostat to a 12-hour clock. To select your preference, press PROGRAM once.
4. Press▲ or▼ to scroll to the current hour. To select, press PROGRAM once.
5. Press ▲ or ▼ to scroll to the current minute. To select, press PROGRAM once.
6. Press ▲ or ▼ to scroll to the current day. To select, press PROGRAM once.

Your selections have been saved and you have exited program mode. Your thermostat is ready to function with the factory preprogrammed ENERGY STAR® program. If you want to change the program for your particular needs, follow the instructions in the “Programming Your Thermostat” section.

Setting the Temperature Display

1. Press PROGRAM once.
2. Press ▲ or ▼ to scroll until “°F °C” is blinking. To select, press PROGRAM once.
3. Both “°F” and “°C” will be lit, but only one will be blinking. Press .or .to scroll so that the preferred option is blinking. To select, press PROGRAM once.

Your selection has been saved and you have exited program mode.

Copy Feature

1. Press PROGRAM once.
2. Press ▲ or ▼to scroll until “COPY” is blinking. To select, press PROGRAM once.
3. Press ▲ or ▼ to scroll to the individual day you want to copy from. “DFLT” (the default Factory Program) is also a copy option. To select your preference, press PROGRAM once.
4. Press ▲ or ▼to scroll to the day or group of days you want to copy to. To select, press PROGRAM once.

Your selection has been saved and you have exited program mode.

Thermostat Configuration/ Service Menu

To enter the Service Menu press the UP and DOWN arrows simultaneously for five (5) seconds. The current display icon will be turned off.

Service menu number 1 will appear. Push the SYSTEM button to move to the next Service Menu number. The UP and DOWN arrow keys will scroll through your range of options for each feature. All changes to the Service Menu are automatically saved when the system times out. Please refer to the service menu table (Annex II, page 17).

Programming Time & Temperature Settings

Your thermostat’s programming feature allows you to divide up a 24-hour day into four time periods (referred to as “Wake”, “Day”, “Evening”, and “Sleep”), and give each time period its own setpoint temperatures. Your “Heat Setpoint temperature” tells your heating system the room temperature to maintain during cold weather. The “Cool Setpoint Temperature” tells your cooling system the room temperature to maintain during hot weather.

Factory Program: Your thermostat comes from the factory preprogrammed with all seven days of the week set to the times and temperatures shown in Table 15.

Table 15: Factory Set-Up of Time & Temperature Settings

Time Period	Start Time	Heat Setpoint Temperature	Cool Setpoint Temperature
Wake	6:00 am	70° F (21.0° C)	78° F (25.5° C)
Day	8:00 am	62° F (16.5° C)	85° F (29.5° C)
Evening	6:00 pm	70° F (21.0° C)	78° F (25.5° C)
Sleep	10:00 pm	62° F (16.5° C)	72° F (22.0° C)

If the factory program meets your needs, simply follow the “Setting the Clock & Day” instructions and you’re done.
If you want to change the preprogrammed times and/or temperatures, follow the instructions under “Custom Program”.

Custom Program

Begin by planning your program. Use the “Custom Program Worksheet” to plan your program time periods and temperatures you want during each period. You must program four periods for each day. Fill in the complete table, as it will serve as a record of your programs, then follow this procedure:

1. Press PROGRAM once.
2. Press ▲ or ▼ to scroll until “SET” is blinking. To select, press PROGRAM once.
3. Press ▲ or ▼ to scroll to the day or group of days you want to program. To select your preference, press PROGRAM once.

   Day / Group of Days options are:

   - To program each day individually, the abbreviations are: “M” is Monday, “TU” is Tuesday, “W” is Wednesday, “TH” is Thursday, “F” is Friday, “SA” is Saturday, and “SU” is Sunday.
   - “MTUWTHFSASU” allows you to give all 7 days of the week the identical heating & cooling program.
   - “MTUWTHF” allows you to give all 5 weekdays the identical heating & cooling program.
   - “SASU” allows you to give both weekend days the identical heating & cooling program.
   - “DFLT” restores all seven days of the week to the original factory preprogrammed ENERGY STAR program.
4. Press ▲ or ▼ to scroll through the four time periods. To select your preference, press PROGRAM once.
5. Press ▲ or ▼ to scroll to the desired starting hour. To select, press PROGRAM once.
6. Press ▲ or ▼ to scroll to the desired starting minute. To select, press PROGRAM once.
7. Press ▲ or ▼ to scroll to the desired HEAT setpoint temperature. To select, press PROGRAM once.
8. Press ▲ or ▼ to scroll to the desired COOL setpoint temperature. To select, press PROGRAM once.

Time & Temperature Programming Example

In this example, the thermostat user wants to program the weekend with a different schedule from the Factory Program. The user wants the Saturday and Sunday program to be identical.

1. Press PROGRAM once.
2. Press ▲ or ▼ to scroll until “SET” is blinking. To select, press PROGRAM once.
3. Press ▲ or ▼ to scroll until “SASU” is blinking. To select, press PROGRAM once.
4. Press ▲ or ▼ to scroll until “WAKE” is blinking. To select, press PROGRAM once.
5. Press ▲ or ▼ .to scroll hours to “8:”. To select, press PROGRAM once.
6. Press ▲ or ▼ to scroll minutes to “:30”. To select, press PROGRAM once.
7. User wants to keep same HEAT setpoint temperature. To keep unchanged, press PROGRAM once.
8. User wants to keep same COOL setpoint temperature. To keep unchanged, press PROGRAM once.

Now you’re done setting up the Wake period, and ready to set up the other three time periods for Saturday and Sunday:

- Program the Day period for SASU by repeating steps 1 through 8, but in Step 4, select “DAY”.
- Program the Evening period for SASU by repeating steps 1 through 8, but in Step 4, select “EVE”.
- Program the Sleep period for SASU by repeating steps 1 through 8, but in Step 4, select “SLEEP”.

Now you’re done setting up all four time periods for SASU.

Overriding the Program

Your thermostat's HOLD feature allows you to put the thermostat in manual operation for either a specified or indefinite length of time. HOLD will override your programmed settings, but does not lose them.

Setting up a Temporary Hold

You may set up a temporary hold by hours and/or days.

1. Press PROGRAM once.
2. Press ▲ or ▼ to scroll until "HOLD" is blinking. To select, press PROGRAM once.
3. Press ▲ or ▼ to scroll through options. "DAYS" allows you to specify 0-99 days hold; "HRS" allows you to specify 0-24 hours hold. To select your preference, press PROGRAM once.
4. Press ▲ or ▼ to scroll to the desired length of time. To select, press PROGRAM once.

The thermostat is now on hold for the time period you selected, unless you decide to turn it OFF earlier. (See Turning OFF a Hold.)

Setting up a Permanent Hold

1. Press PROGRAM once.
2. Press ▲ or ▼ to scroll until "HOLD" is blinking. To select, press PROGRAM once.
3. Press ▲ or ▼ to scroll to "ON". To select, press PROGRAM once.

The thermostat is now on hold until you manually turn OFF the hold. (See Turning OFF a Hold.)

Turning OFF a Hold

1. Press PROGRAM once.
2. Press ▲ or ▼ to scroll until "HOLD" is blinking. To select, press PROGRAM once.
3. Press ▲ or ▼ to scroll to "OFF". To select, press PROGRAM once.

The thermostat will now resume your programmed time and temperature settings.

For an easy planning refer to the Custom Program Worksheet (Annex I, page 16).

System Check-out

To verify thermostat operation after mounting and wiring it, perform the following:

1. Energize the system.
2. Set fan to ON. Select each fan speed (TA180 Models) to verify operation.
3. Set the System button to AUTO, or available selection.
4. Using the UP arrow, adjust temperature more than 5°F above the room temperature to cycle on heating.
5. Using the DOWN arrow adjust the temperature to 5°F below room temperature to cycle on cooling.

NOTE: If the thermostat is set to utilize a time-based purge cycle (Service menu 16), the thermostat will conduct a 3-min purge on initial start-up if a pipe sensor is connected.

Condensate Overflow Interrupt

The remote probe input can be used with a condensate overflow interrupt switch (CO), either in conjunction with a remote probe (normally closed CO switch) or with local sensing (normally open CO switch). When the condensate switch activates, the T180 will display the service wrench and disable all outputs.

Figure 7: Remote Probe Installation

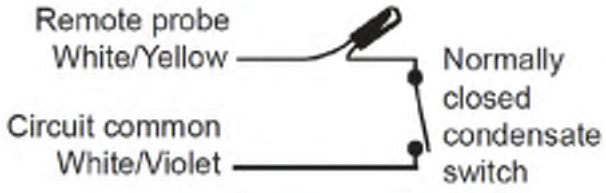
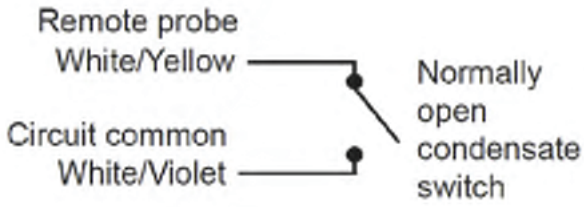


Figure 8: Local sensor installation



Fan Operation

The thermostat may be factory configured for standard or staged fan operation.

Standard Fan Operation

Single setpoint represented in Figure 9. Programming mode includes multiple setpoints.

Figure 9: Standard Fan Operation

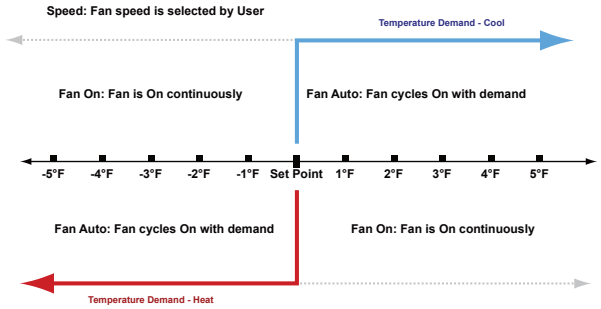


Table 16: Standard Fan Operation Overview

Menu	Description
FAN ON	Fan is on continuously and is not dependant on a heat or cool demand
FAN AUTO	Fan cycles on with a heat or cool temperature demand and cycles off with the heat or cool output
FAN SPEED	High, medium, or low is selected by the user

Staged Fan Operation with Temperature Demand

Single setpoint represented in Figure 10. Programming mode includes multiple setpoints.

Figure 10: Staged Fan Operation

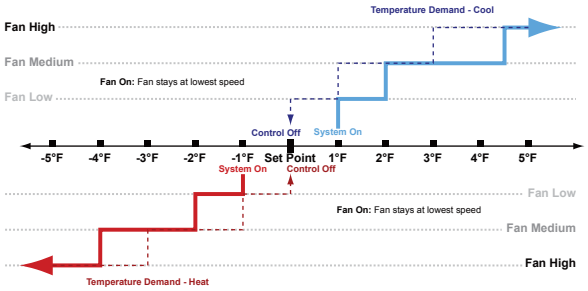


Table 17: Staged Fan Operation with Temperature Demand Overview

Menu	Description
FAN ON	Fan stages from high to medium to low and stays continuously on in the lowest available speed
FAN AUTO	Fan stages from high to medium to low and cycles off at set point
FAN SPEED	selected by the thermostat program

Fancoil Operation

Fancoil operation is either a 2-pipe or 4-pipe configuration which is determined by jumper selection JP4 (see Installing, Mounting and Wiring the Thermostat, page 4).

Pipe Sensor Operation

A pipe sensor can be connected when the thermostat is configured for either 2-pipe or 4-pipe fan coil operation (see JP4 jumper configuration). The Pipe sensor is used to determine the water temperature in the Main Coil. The Pipe Sensor should be mounted on the Main Coil supply and wrapped with insulating material.

Pipe Sensor Input: 10K Remote Probe or a standard On-Off Aqua-stat can be used for summer/winter changeover. ON (closed) is winter heating mode and OFF (open) is summer cooling mode.

Purge Cycle Operation

With a pipe sensor connected, this thermostat will initiate a purge cycle if the sensed water temperature is ambiguous (not adequately hot or cold). The purge cycle algorithm can be either temperature or time based, depending on the configuration of Service Menu 16.

Temperature-Based Purge

- When an Ambiguous mode is detected and a demand exists, a 3 minute purge timer begins and the Main Output is opened.
- After the 3 minute purge cycle, the thermostat checks again to see if the water temperature is more than 15°F from set point, or above 80°F or below 60°F.
- If Winter or Summer mode is determined, normal HVAC operation occurs. If still ambiguous, the thermostat checks to see if the COIL temperature is below 60°F or above 80°.
  - Coil < 60°F = Summer Mode.
  - Coil > 80°F = Winter mode.
- Purge Cycle is repeated until a non-ambiguous condition is sensed.

NOTE: If at any time the demand goes away, the thermostat will abort the purge cycle.

Time-Based Purge (Default)

1. The time-based purge cycle will start a 3-min purge cycle and enable the Main Output if any of the following conditions occur: transition from OFF to AUTO mode, Reset event, power cycle, and/or 1-hour timer expires.
2. After the 3 min purge cycle, a pipe sensor reading says: Pipe is 15°F+ below the zone temp = Summer mode Pipe is 15°F+ above the zone temp = Winter mode Pipe is within 15°F of zone temp = still Ambiguous
3. If a Winter or Summer mode is determined, the appropriate heating/cooling occurs. The thermostat will purge and check pipe temperatures again after 1-hour.
   - If step 2 is still ambiguous, all thermostat outputs are disabled for 1 hour.
   - After 1 hour, the purge cycle resumes at step 1.

HVAC Setback Systems

Setback Operation - Remove JP3

This is a low level input that is normally open. When switch is closed, the T180 heating and cooling setback limits are used as temperature control points. Fan operation in setback is cycled with demand. Pressing any button will override setback for 1 hour. Setback will override any user setting unless control is turned to OFF.

Intelligent Occupancy Sensors like the SD200-001 and SD200-002 can be used with this input to set the HVAC system to control at setback limits.

Door Switch Only Operation - Install JP3

A stand alone door or window switch can be connected to the T180 to disable the HVAC system (outputs) if a door or window is left open for more than 2 minutes. A one-time ten minute override can be initiated by pressing any thermostat key pad.

The T180 thermostat can be used with optional S200 series occupancy detection equipment. Purchasing and installing this equipment to compliment the thermostat adds energy savings by setting back HVAC operation during occupied and unoccupied times.

Occupancy Operation (Install JP3)

The T180 can be used with PECO S200 series occupancy detection equipment. The occupancy and switch inputs are designed to connect to the SB200 slave sensor and SE200 door switch.

The Occupancy Sensor is a low-level switch that is open when there is occupancy and closed when unoccupied.

The Door Switch is a low-level switch that is open when the door is open and closed when the door is closed. This system requires both an Occupancy Sensor and a Door Switch.

Operation from an Occupied Mode

The T180 operates normally and looks for a door close. A door close signal initiates occupancy status detection.

If occupancy is detected, the T180 will maintain normal HVAC control. It then waits for a door open signal before determining occupancy again.

If no occupancy signal is detected within 2 minutes, the T180 changes to unoccupied mode and controls at setback temperature values.

Operation from an Unoccupied Mode

In an Unoccupied State, the T180 sets heating and cooling set points to setback values, as determined in the service menu. In this mode, the fan is automatically set to cycle with demand.

The T180 will continually monitor the room for occupancy.

Any occupancy detection, including door open, will set the operation to occupied mode.

In either mode, if the door is left open for more than 2 minutes the T180 will disable the HVAC system. A one-time ten minutes override can be initiated by pressing any thermostat keypad.

Optional detection equipment configurations and operation are described below.

SB200-001 Occupancy Sensor

The SB200-001 occupancy sensor (Figure 11) serves as an occupancy sensor for automatic control of a guest room HVAC system. It incorporates an innovative dual delay processor which allows the sensor to verify the nature of occupancies, and is capable of eliminating unnecessary actuations of the HVAC device due to unintentional passages or short time occupancies. The sensor may also serve as a slave sensor (Figure 12, page 15).

The sensor switch is open in occupied mode and closed in unoccupied mode. An optional door and/or window switch (Figure 11) is open when the door/window is open and is closed when the door/window is closed.

NOTE: To use this configuration, a jumper must be installed to JP3 to allow occupancy input.

An optional door and/or window switch (Figure 11) can be added for use with the SB200-001 sensor.

Operation

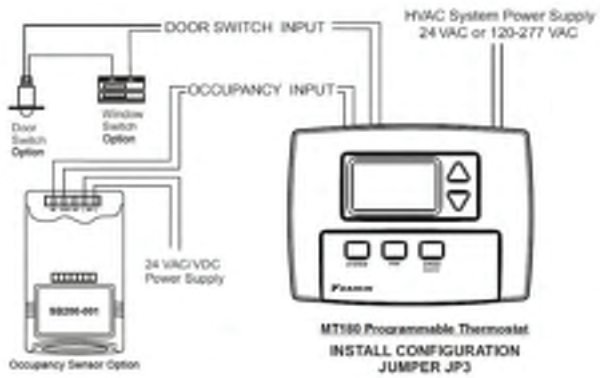
In an occupied mode, the thermostat operates normally and looks for a door open signal. When the door opens, the thermostat waits for a door close signal. If the door is open for more than two minutes, the thermostat turns the HVAC system outputs to OFF. During this two minute period, if any button is pressed on the keypad, the time delay is extended to ten minutes. The time delay can only be extended once. Once the HVAC outputs transition to OFF, a door closure is required to re-enable the outputs. When the door closes, the thermostat starts a two minute timer and tries to detect occupancy. If the timer expires and no occupancy is detected, the thermostat transitions to an unoccupied state. If occupancy is detected while the timer is running, the thermostat will remain in the occupied mode.

In an unoccupied mode, the thermostat sets heating and cooling set points to setback values as determined by factory or user settings. The fan is automatically set to cycle with demand. The thermostat continually monitors the occupancy sensor and will enter into occupied mode if occupancy is detected.

If the installation is only using a door/window switch, the thermostat will disable the HVAC outputs if this output is open for longer than two minutes.

To enable door/window switch only operation, install a jumper to JP3 (see Installing, Mounting and Wiring the Thermostat, page 4) and the occupancy input must be shorted to circuit common.

Figure 11: Optional Equipment Configuration #1



SD200-001 Occupancy Sensor

The SD200-001 occupancy sensor (Figure 12) serves as a master sensor for a guest room HVAC management system. The sensor provides HVAC operation according to occupancy status, as well as door/window switch monitoring, selectable high/low temperature setback, form-C output, slave sensor connectivity, and a five minute door open HVAC shut-off.

NOTE: To use this configuration, the jumper to JP3 is removed to allow setback input.

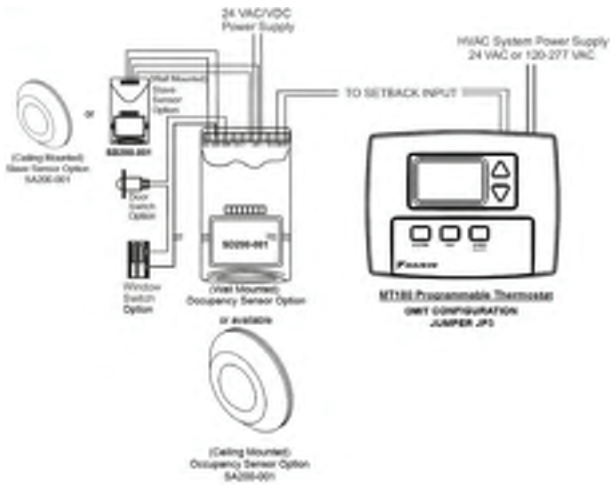
An optional door and/or window switch (Figure 12) and slave sensor can be added for use with the SD200-001 sensor.

Operation

In an occupied mode, the SD200-001 occupancy sensor (Figure 12) and door switch use advanced microprocessor logic to determine occupancy. A door open signal will initiate occupancy status detection. If the sensor determines that a room is occupied, it will allow normal HVAC control. The sensor will wait for another door open signal before determining occupancy again.

In an unoccupied mode, the sensor continually monitors the room. Any occupancy detection will set the operation to occupied mode.

Figure 12: Optional Equipment Configuration #2



SD200-002 Occupancy Sensor

The SD200-002 occupancy sensor serves as a stand alone master sensor for a guest room HVAC management system.

The sensor provides HVAC operation according to occupancy status, as well as selectable high/low temperature setback, form-C output, and a five minute door open HVAC shut-off.

This system provides basic room setback and is ideal for control of HVAC in commercial spaces.

NOTE: To use this configuration, the jumper to JP3 is removed to allow setback input.

Operation

With each occupancy detection, an OFF delay is started and can be set to delay for up to 30 minutes (Figure 13).

Figure 13: Optional Equipment Configuration #3

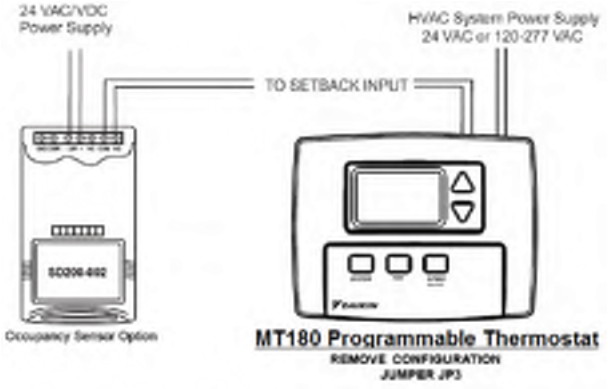


Table 18: Custom Program Worksheet

Day	Time Period	Start Time	Heat Setpoint Temperature	Cool Setpoint Temperature
Monday	Wake			
	Day			
	Evening			
	Sleep			
Tuesday	Wake			
	Day			
	Evening			
	Sleep			
Wednesday	Wake			
	Day			
	Evening			
	Sleep			
Thursday	Wake			
	Day			
	Evening			
	Sleep			
Friday	Wake			
	Day			
	Evening			
	Sleep			
Saturday	Wake			
	Day			
	Evening			
	Sleep			
Sunday	Wake			
	Day			
	Evening			
	Sleep			

Table 19: Service Menu Table

Menu	Feature	Range	Description/Comments
1	F° or C°	0-Celsius 1-Fahrenheit (Default)	Determines temperature displays in Fahrenheit or Celsius
3	Fan OFF Delay	0–99 Seconds (0-Default)	The amount of time (in seconds) the lowest available fan speed will run after the thermostat outputs are disabled.
4	Range Low	50–90°F, 10–32°C (50°F- Default)	The lowest selectable temperature setpoint value.
5	Range High	50–90°F, 10–32°C (90°F- Default)	The highest selectable temperature setpoint value.
6	Setback Low	0-OFF 50–82°F, 11–27°C (55°F- Default)	The temperature setpoint value you want the thermostat to Heat to when the T180 is in the Setback mode.
7	Setback High	0-OFF 50–90°F, 11–32°C (90°F- Default)	The temperature setpoint value you want the thermostat to Cool to when the T180 is in the Setback mode.
8	Zone Temp Offset	+/- 9°F or +/- 4.5°C (0°F-Default)	Zone Temperature offset adjusts the sensed Zone Temperature displayed, allowing calibration in the field.
9	Keypad Lockout	0-No keypad lockout (Default) 1-Disables System/Fan/Program 2-Disables all buttons	This function blocks access to certain features of the device. The Service Menu is still available if the keypad lockout is enabled.
10	Fan Mode	1-ON 2-Auto 3-ON or Auto (Default)	ON-Fan is always on, regardless of demand. Auto-Fan is only ON with heating or cooling demand. ON or Auto-User can choose either selection.
11	Fan Speeds	1-High 2-Low, High 3-Low, Med, High (Default)	Speeds which are selectable by the user.
12	System Mode	OFF, Auto OFF, Heat, Cool, Auto (Default) OFF, Heat, Cool Heat, Cool, Auto	Sets the system modes the occupant is able to select.
13	Controlled OFF or OFF Override	0-Disable (Default) 1-Enable	When enabled, the unit will control to the Setback setpoints. This function will also override the user mode setting of OFF if the room temperature is equal to or above the Cool Setback setpoint or equal to or below the Heat Setback setpoint.
14	Front Panel Setback Control	0-Disable (Default) 1-Enable	When enabled, Setback is shown as an available system mode selection. If Setback mode is selected, the thermostat will control to the current Setback Heat and Setback Cool setpoints.
15	Cycled Outside Air Damper	0-Cycles (Default) 1-Continuous	The Outside Air output will cycle with heat or cool demand if Cycles mode is chosen. The Outside Air output is active anytime the thermostat is out of the OFF mode when Continuous mode is chosen. When in Setback the Outside Air output will turn OFF.
16	Temperature Based Purge Cycle	0-Time Based (Default) 1-Temperature Based	Determines if the Purge Cycle will be Temperature or Time Based.
17	Minimum Dead Band Adjustment	3°F (Default) 3–10°F, 1.5–5°C	A changeover deadband value prevents short cycling between Heating and Cooling modes. The value is adjustable to meet various HVAC system requirements.
18	Factory Default Reset	0-Disable (Default) 1-Enable	Toggles between OFF and DFLT. When factory default is desired, select DFLT.
25	Pre-Occupancy Purge	0 Hours (Default) 0–3 Hours	Energizes Fan Low for selected number of hours (0-3) prior to events Wake (Occupied 1) and Day (Occupied 2)
30	Cycles Per Hour (CPH) Cooling	3 CPH (Default) 0–6 CPH	Defines the number of cycles per hour for cooling. A selection of 0 disables cycling.
32	Cycles Per Hour (CPH) Heating	5 CPH (Default) 0–12 CPH	Defines the number of cycles per hour for heating. A selection of 0 disables cycling.
35	Heat Recovery Rate	5°F/Hr (Default) 0–18°F/Hr 0–10°C/Hr	Defines the rate in which the device achieves the comfort setpoint. 0 disables ramp recovery.
36	Cool Recovery Rate	5°F/Hr (Default) 0–18°F/Hr 0–10°C/Hr	Defines the rate in which the device achieves the comfort setpoint. 0 disables ramp recovery.
40	Minimum OFF Time	4 Minutes (Default) 1–10 Minutes	Sets the minimum OFF time for both heat and cool output
45	Intermittent Fan	0-Disable (Default) 1-Enable	If enable is selected, the intermittent fan will operate during setback operation. (Default values will be used unless menu 46 and 47 are adjusted.)
46	Intermittent Fan-ON Time	5 Minutes (Default) 1–60 Minutes	Defines the duration in which fan low will be ON. Fan ON will be activated after Fan OFF time has passed.
47	Intermittent Fan-OFF Time	25 Minutes (Default) 0–60 Minutes	Defines the duration in which fan low will be OFF. Fan OFF will be activated after Fan ON time has passed. A selection of 0 will result in continuous Fan.
71	Revision	—	Upon menu selection, the firmware and configuration revision will be displayed.
80	System Test Main Output (Cool)	0-Disable (Default) 1-Enable	If enable is selected, it will activate the main output (cool output) for 10 minutes. Fan High will automatically turn ON. If a different menu is selected the output will be disabled.
81	System Test Main Output (Heat)	0-Disable (Default) 1-Enable	If enable is selected, it will activate the secondary output (heat output) for 10 minutes. Fan High will automatically turn ON. If a different menu is selected the output will be disabled.
82	System Test Fan Output	0-Disable (Default) 1-Enable Fan Low Output 2-Enable Fan Medium Output 3-Enable Fan High Output	If enable is selected, it will activate the fan output for 10 minutes. If a different menu or a different fan speed is selected the output will be disabled.

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Installation and Maintenance Manual IM 1171-7

Group: **WSHP/FCU**
Part Number: **910166919**
Date: **April 2015**

Digitally Adjustable Display Sensor



Used with:

Water Source Heat Pumps (WSHP) - Sensor Part No. 910121754
SmartSource™ Units - Models GS & GT
Enfinity™ Units with MicroTech® III Controls - Models CCH, CCW; VFC, VFW; LVC, LVW; MHC, MHW & VHC, VHF
Fan Coil Units (FCU) - Sensor Part No. 910113679, 910152148
Models With MicroTech III Controls - 910113575

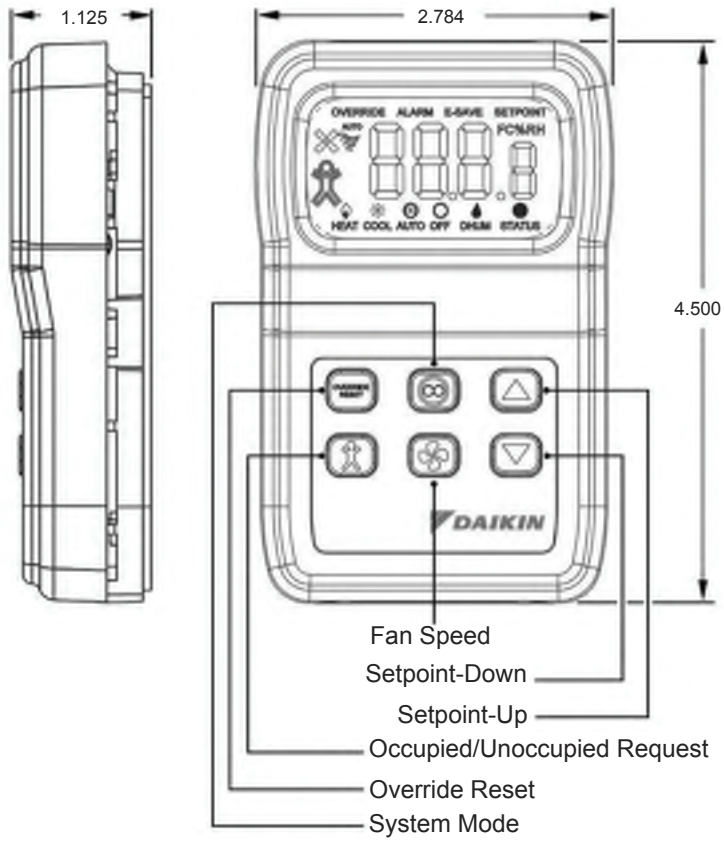
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The display sensor is used in conjunction with the MicroTech III equipped units as described in the Application Section below. The same sensor is used for Water Source Heat Pump (WSHP) and for Fan Coil Units (FCU) with just a hardware jumper and menu change during configuration. The sensor has a digital display for Temperature, Humidity, Occupancy, Fan Speed, System Mode, Alarm, Setpoint and Status indication. Controls include six buttons for Setpoint, System Mode, Fan Speed, Occupied/Unoccupied Request, and Override Reset. (Figure 1).

Sensor buttons & dimensions

Figure 1: Digital display sensor - Water Source Heat Pump P/N 910121754, Fan Coil P/N 910113679, 910113575, 910152148



The display sensor can be used on the products shown in Table 1.

Table 1: Product usage guide

Units	Product		Models	Controls	Used with Digitally Adjustable Sensor with Temperature and Humidity Display
Water Source Heat Pumps	Horizontal	Enfinity™	W.CCH, CCW	MicroTech III Unit Controller	Yes
	Vertical		W.VFC, VFW		
	Vertical Stacked		W.VHC		
	Console		W.MHC, MHW		
	Horizontal & Vertical	SmartSource 1-Stage	W.GSH, GSV	MicroTech III SmartSource Unit Controller	
		SmartSource 2-Stage	W. GTH, GTV		
	Vertical	SmartSource Inverter	W.DFW	Daikin Inverter Controller	No
Fan Coils	Horizontal	ThinLine™	FC.H, FH.H	MicroTech III Unit Controller	Yes
	Vertical		FC.V, FH.V		

The display sensor for water source heat pump applications is shown in Table 2.

Table 2: Water source heat pump application guide

Units	Product		Models	Applications									
				Cooling	Heating	Dehumidification					Electric Heat			Water-side Economizer
				Stages		Smart Dehumidification	Hot Gas Reheat	Simplified	Humidistat Controlled	Dehumidification Only	Boilerless	Supplemental	Primary	3-Way Valve Control
Water Source Heat Pumps	Horizontal	Enfinity	W.CCH, W.CCW	1	1	No	No	No	No	No	No	No	No	No
	Vertical		W.VFC, W.VFW	1	1	No	Yes	No	No	No	Yes[1]	Yes[1]	No	No
	Vertical Stacked		W.VHC	1	1	No	No	No	No	No	No	No	No	No
	Console		W.MHC, W.MHW	1	1	No	No	No	No	No	Yes[1]	Yes[1]	No	No
	Horizontal & Vertical	SmartSource 1-Stage	W.GSH, W.GSV	3	4	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Horizontal & Vertical	SmartSource 2-Stage	W.GTH, W.GTV	3	4	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Vertical	SmartSource Inverter	W.DFW	NA	NA	No	No	No	No	No	No	No	No	No

Note: *[1]With optional Boilerless controls*

Sensor functions

910152148, 910113575, 910113679, Fan-coil unit model:

- Display sensor to show room Temperature, fan speed (AUTO/HIGH/MEDIUM/LOW), system mode (HEAT/COOL/AUTO/OFF), ALARM, Override and occupancy.

Note: *910113575 will not display a temperature value as this is measured using a unit-mounted return air sensor.*

910121754, Water source heat pump model:

- Display sensor to show room Temperature, room humidity, fan speed (AUTO/ON), system mode (HEAT/COOL/AUTO/OFF/DHUM), ALARM, Override and occupancy.
- De-humidification output contact has an adjustable setpoint and configurable deadband. This output operates automatically using the RH setpoint and deadband in the system “AUTO” mode or in the “DHUM” mode.

Mounting

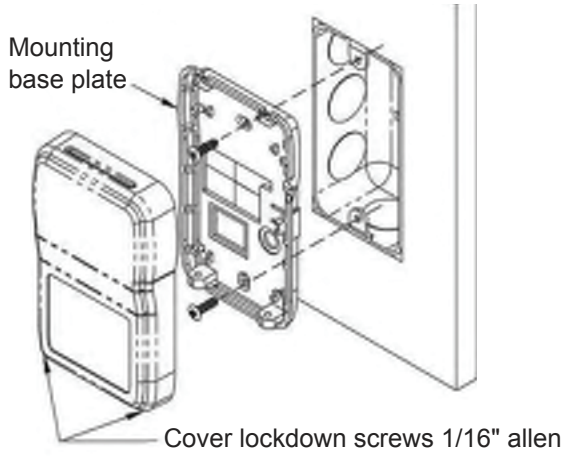
Location

Avoid mounting on outside walls or in direct sunlight.

Junction Box, (J-Box)

1. Pull the wire through the wall and out of the junction box, leaving about six inches free.
2. Pull the wire through the hole in the base plate.
3. Secure the back plate to the box using the #6-32 × 1/2 inch mounting screws provided.
4. Screw the plate firmly to the wall so the foam plate backing is compressed about 50%.
5. Terminate the unit according to the guidelines in the Termination section.
6. Attach Cover by latching it to the top of the base, rotating it down and snapping into place.
7. Secure the cover by backing out the lock-down screws using a 1/16" Allen wrench until it is flush with the bottom of the cover.

Figure 2: Junction box mounting (hardware is provided for both junction box and drywall installation.)



Drywall mounting

1. Place the base plate against the wall where you want to mount the sensor.
2. Mark out the two mounting holes where the unit will be attached to the wall. Drill a 3/16" hole in the center of each mounting hole and insert a drywall anchor into the holes.
3. Drill one 1/2" hole in the middle of the marked wiring through hole area.
4. Pull the wire through the wall and out the 1/2" hole, leaving about six inches free.
5. Pull the wire through the hole in the base plate.
6. Secure the base to the drywall anchors using the #6 × 1" mounting screws provided.
7. Screw the plate firmly to the wall so the foam plate backing is compressed about 50%.
8. Terminate the unit according to the guidelines in the Termination section.
9. Attach cover by latching it to the top of the base, rotating it down and snapping it into place.
10. Secure the cover by backing out the lock-down screws using a 1/16" Allen wrench until it is flush with the sides of the cover

Note: *in any wall-mount application, the wall temperature and the temperature of the air within the wall cavity can cause erroneous readings.*

The mixing of room air and air from within the wall cavity can lead to condensation, erroneous readings and sensor failure. To prevent these conditions, Daikin recommends sealing the conduit leading to the junction box with fiberglass.

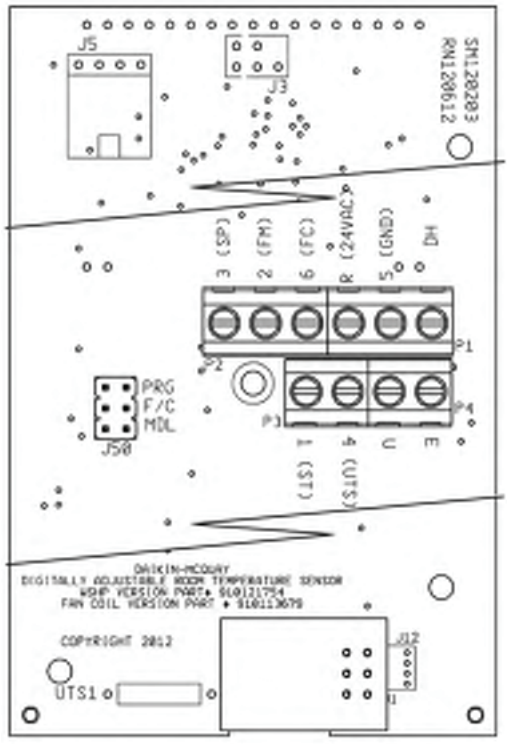
Maintenance

Wipe the display as needed with a damp water only cotton cloth. Do not use any type of cleaner as it may damage the buttons or scratch the display. Do not paint.

Terminations

Daikin recommends using a twisted shielded pair of at least 22AWG for the power wire connections. The shield should be earth grounded only at the power source. Larger gauge wire may be required for long runs.

Figure 3: Sensor Circuit Board



⚠ CAUTION

Combination of power wiring (R, 5, DH) and analog (1, 2, 3, 4, and 6 to ground) wiring in a common cable may cause signal interference and must be avoided.

All wiring must comply with the National Electric Code (NEC) and local codes. Do NOT run any of this device's wiring in the same conduit as other AC power wiring. Tests show that fluctuating and inaccurate signal levels are possible when AC power wiring is present in the same conduit as the signal lines. If you are experiencing any of these difficulties, please contact your Daikin representative.

Figure 4: SmartSource MicroTech III board to digital room temperature sensor wiring

SmartSource Board	MicroTech III Board								I/O Expansion Module
	Base Board								
Terminal Block Label	TB2-1	TB1-1	TB1-2	TB1-3	TB1-4	TB1-5	TB3-1	TB3-2	TB1-1
Description	24VAC	Unit Status Output	Fan & Unit Mode	Setpoint Adjust	Room Temp Sensor & Tenant Override	DC Signal Common	Emergency Shutdown Input	Unoccupied Input	Dehumidification Input
Terminal Label	R	1	2	3	4	5	E	U	1
Typical Wiring	↕	↕	↕	↕	↕	↕	↕	↕	↕
Terminal Label	R (24VAC)	1 (ST)	2 (FM)	3 (SP)	4 (UTS)	5 (GND)	6 (FC)	E	U	DH
Description	24VAC	Unit Status Output	Fan & Unit Mode	Setpoint Adjust	Room Temp Sensor & Tenant Override	DC Signal Common	Fan Speed Select - Fan Coil Version Only	Emergency Shutdown	Unoccupied	Dehumidification
Sensor	Digitally Adjustable Room Temperature Sensor (Part No. 910121754)									

Figure 5: Fan-Coil MicroTech III board to digital room temperature sensor wiring

SmartSource Board	MicroTech III Board							
	Base Board							
Terminal Block Label	TB2-2	TB1-5	TB1-4	TB1-3	TB1-2	TB1-1	TB1-6	TB2-1
Description	24VAC	Unit Status Output	Unit Mode	Fan Mode	Setpoint Adjust	Room Temp Sensor & Tenant Override	DC Signal Common	Unoccupied
Terminal Label	24 VAC	BO9	AI7	AI4	AI3	AI1	COM	BI2
Typical Wiring	↕	↕	↕	↕	↕	↕	↕	↕
Terminal Label	R (24VAC)	1 (ST)	2 (FM)	6 (FC)	3 (SP)	4 (UTS)	5 (GND)	U
Description	24VAC	Unit Status Output	Fan & Unit Mode	Fan Speed Select - Fan Coil Version Only	Setpoint Adjust	Room Temp Sensor & Tenant Override	DC Signal Common	Unoccupied
Sensor	Digitally Adjustable Room Temperature Sensor (Part No. 910113679) / 910152148, 910113575							

Terminal descriptions

Note: *Refer to "Figure 3: Sensor Circuit Board" on page 4 for terminal locations*

R.....15 to 28VAC* (AC requires separate shielded wire) (Shield terminated at power source only)

DH .....Dehumidification Contact (Triac from R to DH @170mA, WSHP Only).

U.....Unoccupied Contact. (Terminal grounded when in Unoccupied, VDC only).

E.....System "Off" Indication. (Terminal grounded when in System "Off" mode, VDC only).

1.....Status Indicator Input from the MicoTech III Unit Controller. (5VDC).

2.....Output Signal, and Fan Mode System (0 to 5VDC). Output Signal, System Mode Select for FCU only, (0 to 5VDC).

3.....Output Signal, Setpoint Adjust from 55º to 95˚F (default) or ±5º Configurable. (0 to 5VDC) See Setpoint Analog Range Tolerances. See Table 3.

4.....Output Signal, Room Temp Thermistor Sensor. (10K ATP Z curve, 10K-2). 910113575 tenant override only

5.....Ground or Neutral* (AC requires separate shielded wire). Common Reference for All Signal Terminals.

6.....Output Signal, Fan Speed Select for FCU only. (0 to 5VDC). Terminal 6 not used for WSHP units.

Note: ** The AC power wiring at terminals [R] & [5] should be run in a separate twisted shielded pair to avoid possible fluctuating and inaccurate signal levels induced into the other sensor signal wires.*

This sensor AC power can be run in the same conduit with the sensor signal wire as long as it's run in twisted, shielded pair and terminated properly.

Setpoint analog range tolerance

Table 3: Setpoint analog range tolerance

Setpoint Analog Tolerance			
55˚ to 95˚F Scale	**-3˚ to +3˚F Scale**	**-5˚ to +5˚F Scale**	**Terminal 3 Analog Output**
@ 55˚F (min.)	@-3˚F (min.)	@ -5˚F (min.)	0.0 to 0.10 vdc
@65˚F	@-1.5˚F	@-2.5˚F	1.3 to 1.42 vdc
@75˚F	@0˚F	@0˚F	2.12 to 2.2 vdc
@85˚F	@+1.5˚F	@+2.5˚F	2.58 to 2.63 vdc
@95˚F (max.)	@+3˚F (max.)	@+5˚F (max.)	3.0 to 4.0 vdc

Initial start-up occupied sequence

On initial installation power-up, the sensor is in "Occupied" mode with a solid occupied icon and DC voltage at terminal "U". If the "STATUS/Dot" input on Terminal 1 from the controller indicates occupied ("ON" continuous), then the unit continues to stay "Occupied". If the "STATUS/Dot" input on Terminal 1 from the controller indicates unoccupied (5 seconds "ON" then 5.5 seconds "OFF"), then the occupied icon will flash the desired occupancy state every 8 seconds, indicating to the user a mismatch of the desired occupied status and system occupied status at the controller

Power fail start-up occupied sequence

On a power failure, the sensor retains its last known desired occupancy status in non-volatile memory. On restoration of power, the sensor restores its last known desired occupancy state from memory. The occupied icon will reflect this with a solid (occupied) or hollow (unoccupied) indication and terminal "U" will have voltage applied (occupied) or grounded (unoccupied). If the "STATUS/Dot" input on Terminal 1 from the controller matches this occupancy state then the occupied status icon will continue to be solid or hollow depending on the last known state. If the "STATUS/Dot" input on Terminal 1 from the controller is different from the sensor occupied state, then the occupied icon will flash the desired occupancy state every 8 seconds indicating to the user a mismatch of the desired occupied status and system occupied status at the controller.

Display descriptions

Numerical display

The factory setting default numerical display (Figure 6) shows current temperature (°F or °C) and toggles to humidity and setpoint display every 5 seconds.

Figure 6: Sensor numerical display



Adjusting the setpoint

(Temperature or humidity)

Whichever is displayed at the time, temperature or humidity:

- Push the ▲ or ▼ button, the displayed setpoint can be adjusted up or down.
- After an adjustment, the setpoint is displayed for 5 seconds.

During the setpoint display push (System Mode Button) to switch between the temperature display or the humidity display.

- Push the ▲ or ▼ button, the displayed setpoint can be adjusted up or down. (See "Front Panel Button Operation" on page 7 for details.)

The unit can also be programmed in the field to "Setpoint Only" display or Setpoint Lockout. See the "Optional Technician Adjustments" on page 9.

Occupied icon indicator

The Occupied Icon on the left side of the display indicates whether the room sensor is in the Occupied or Unoccupied Mode, (Figure 7).

Figure 7: Occupied & unoccupied icons

 = "Occupied"  = "Unoccupied"

Solid is Occupied and Hollow is Unoccupied.

- A blinking icon every 8 seconds indicates an override request that has not been fulfilled.

"OVERRIDE" on the display

The **"OVERRIDE"** word indicator in the top left corner illuminates when the sensor is signalled by the "Status" input (Terminal 1).

This is initiated from the Override/Reset Button at first and then confirmed from the "Status" input code which keeps the "OVERRIDE" indicator on.

Fan status & speed indicators

 **"Fan & No Wavy Lines"** indicate the fan is Off.

 **"Fan & 2 Wavy Lines"** indicate Low.

 **"Fan & 3 Wavy Lines"** indicate Medium.



"Fan & 4 Wavy Lines" indicate High, **and the word "AUTO"** indicate fan Auto mode.

System mode "HEAT/COOL/AUTO/OFF/DHUM" indicators

The **"HEAT/COOL/AUTO/OFF/DHUM"** Mode Indicators on the bottom of the display describe each of the sensor's modes. The mode is changed by pushing the System Mode button on the sensor. (Dhum is only used on WSHP units.)

"ALARM" on the display

The **"ALARM"** word indicator on top illuminates when the sensor interprets the "Status" input code from the controller as an alarm. See Table 4 on page 7.

"E-SAVE" word on the display

The **"E-SAVE"** word indicator on top illuminates when the sensor interprets the "Status" input code from the controller as Standby Mode (See Table 4 on page 7).

"SETPOINT" word on the display

The **"Setpoint"** word on top illuminates when the sensor is displaying the setpoint on the numerical display (Temperature or Humidity). When this "Setpoint" indicator is off, the numerical display shows the actual room temperature or humidity.

"STATUS" word & dot on the display



The Status "Dot" on the display indicates the unit status or alarm condition. It is turned "On" and "Off" by interpreting the status input from the controller on terminal 1.

Table 4 shows the alternating conditions and sensor status.

Table 4: WSHP unit status input timing definition

Status Dot "ON" (+ 5 vdc) time	Status Dot "OFF" (0 vdc) Time	WSHP Availability	Display Indication
0.5 seconds	0.5 seconds	Controller Off (or Network "Wink" operation active)	"ALARM" On
0.0 seconds	Continuous	Unit running in Night Setback Override Mode or no power to the unit	"OVERRIDE" On
0.5 seconds	5.5 seconds	Unoccupied Mode	Hollow Occupied Icon
5.5 seconds	0.5 seconds	Standby Mode	"E-SAVE" On
Continuous	0.0 seconds	Occupied Mode	Solid Occupied Icon

Table 5: Fan Coil (FCU) unit status input timing definition

Status Dot "ON" (+ 5 vdc) time	Status Dot "OFF" (0 vdc) Time	Fan Coil Availability	Display Indication
0.3 seconds	0.3 seconds	Alarm Active	"ALARM" On
0.0 seconds	Continuous	Unit running in Night Setback Override Mode or no power to the unit	"OVERRIDE" On
0.5 seconds	5.5 seconds	Unoccupied Mode	Hollow Occupied Icon
5.5 seconds	0.5 seconds	Standby Mode	"E-SAVE" On
Continuous	0.0 seconds	Occupied Mode	Solid Occupied Icon
3.0 seconds	3.0 seconds	Calibration Mode/ Network Wink	No Change

Front panel button operation

System mode indication (FCU only)

"HEAT/COOL/AUTO/OFF"

The "HEAT/COOL/AUTO/OFF" Mode Indicators on the bottom of the display show the mode status of the sensor and are changed by pushing the System Mode button.

- **"HEAT"** on the display means the unit will only provide heating.
- **"COOL"** on the display means the unit will only provide cooling.
- **"AUTO"** on the display means the unit switches automatically to provide cooling or heating.
- **"Off"** on the display means the unit will not provide cooling, heating or fan operation.

There should always be one indicator “ON” unless the sensor has no power or has a problem. The System Mode Analog Output voltage on Term. 2 will change based on the system mode.

Fan speed indication (FCU only)

“AUTO/HIGH/MEDIUM/LOW”

The Fan Speed Indicators on the display show the fan speed status (AUTO/HIGH/MEDIUM/LOW) and are changed by pushing the Fan Mode button.



“Fan & 4 Wavy Lines & AUTO” - the fan stages up or down automatically depending on the demand for HEAT/COOL.



“Fan & 4 Wavy Lines” - the fan runs continuously at high speed regardless of the system mode setting of HEAT/COOL/AUTO.



“Fan & 3 Wavy Lines” - the fan runs continuously at medium speed regardless of the system mode setting of HEAT/COOL/AUTO.



“Fan & 2 Wavy Lines” - the fan runs continuously at low speed regardless of the system mode setting of HEAT/COOL/AUTO.



“Fan & No Wavy Lines” - Indicates the fan is Off.

There should always be one indicator “On” unless the sensor has no power or has a problem. The Fan Speed Analog Output voltage on Terminal 6 will change based on the fan speed selection.

System mode indication (WSHP only)

“HEAT/COOL/AUTO/OFF/DHUM”

The “HEAT/COOL/AUTO/OFF/DHUM” Mode Indicators on the display show the mode status of the sensor and are changed by pushing the System Mode button.

- **“HEAT”** on the display means the unit will only provide heating.
- **“COOL”** on the display means unit will only provide cooling.
- **“AUTO”** on the display means the unit can switch automatically to provide cooling or heating or dehumidification.
- **“OFF”** on the display means the unit will not provide cooling, heating, dehumidification or fan operation (“E” terminal goes Low).
- **“DHUM”** on the display means that only dehumidification will operate.

There should always be one indicator “On” unless the sensor has no power or has a problem. The System Mode Analog Output voltage on Terminal 2 will change based on the system mode selection.

Fan indication (WSHP only)

“AUTO/ON”

The Fan Indicators on the left side of the display show the fan status (AUTO/ON) of the sensor and are changed by pushing the Fan Mode button.



“Fan & 4 Wavy Lines & AUTO” - the fan runs on a call for HEAT/COOL/DHUM. Otherwise the fan is off.



“Fan & 4 Wavy Lines” - the fan runs continuously regardless of the system mode setting of HEAT/COOL/AUTO/DHUM.



“Fan & No Wavy Lines” - the fan is Off when the system mode is “Off”.



Override/Reset button (timed override & alarm reset)

When the “Override/Reset” Button is pressed, the thermistor sensor is shorted. If held for more than 3 seconds but less than 11 seconds, it puts the controller into a timed Occupied Override (the time is set by the controller). If the unit is in alarm, then holding the “Override/Reset” Button for more than 11 seconds will clear all alarms in the controller but only if the cause of the alarm has already returned to its non-alarm condition. Some alarms will not reset from the digital room sensor.

In this case, power to the unit must be cycled off for 5 seconds to clear the alarm. Continuously resetting alarms from the room sensor could damage the controller. Please call a service technician when repeated alarm resets are required to keep the unit operational.



Occupied button (occupied/ unoccupied request)

Note: *Terminal “U” opens HI to source power on power-up “Occcupied”*

When the “Occupancy” Button is pushed, the current “Occupied” or “Unoccupied” status of the sensor will be toggled to the opposite condition for 20 seconds. Both the display and “U” terminal output reflect the new status during the 20 seconds. If a confirmation signal is received from the controller into the Status Input terminal “1” within 20 seconds, then the new occupancy condition remains; otherwise the “U” terminal will return to the original state and the “Occupied” Icon will flash the desired occupancy state every 8 seconds.



Up & down setpoint buttons temp or humidity)

Press the Setpoint “Up/Down” Buttons once to enter the Setpoint Adjustment Mode. View the display to see whether the unit is in Temperature or Humidity Setpoint mode. If needed, press the “System Mode” Button once to toggle to the desired Setpoint. The current setpoint value will display for 5 seconds. When the “Up/Down” Buttons are pressed in this mode, the temperature or humidity setpoint will change in one degree or percent (%) increments. It will only change within the temperature setpoint range that was ordered (or the setpoint range that was set via the Program Mode).

The humidity setpoint is always between 40% to 90%. After 5 seconds of no buttons being pushed, the sensor will go into the standard display mode.

System mode button (FCU has HEAT/COOL/AUTO/OFF) or (WSHP has HEAT/COOL/AUTO/OFF/DHUM)

When the “System” Button is pushed, the unit switches between system modes.

Fan mode button (FCU has AUTO/ HIGH/MEDIUM/LOW/OFF) (WSHP has AUTO/ON)

When the “Fan” Button is pushed, the fan speed changes in order from one speed to another.

Optional technician adjustments

Note: *The sensor setup is factory set per your order. Setup adjustments are not required*

The unit is shipped ready to install per the order and does not require any special setup or programming. The following Program Menu Changes are available if the installer decides to change the factory settings. The Setpoint Up/Down Buttons and Occupancy Button are used in the Programming Mode to make Menu changes and selection.

Set-up jumper (J50) configuration

(Factory set per order)

⚠ CAUTION

Turn off power to the unit before reconfiguring the F/C or MDL jumper settings.Damage to the sensor board can occur if jumpers are moved while there is power to the unit and sensor.

Figure 8: J50 Jumper



Label description setting

PRG	Program Mode or Run Mode Menu below).	Program Mode = Jumper installed for Program Mode (See Program Run Mode = Jumper removed for Run Mode (Place jumper on one pin only).
F/C	ºC Indication or ºF Indication	ºC = Jumper installed for ºC . ºF = Jumper removed for ºF Indication (Place jumper on one pin only). 910152148, 910113575
MDL	Sets the Model FCU or WSHP	910113679 = Jumper removed for FCU (Default for units ordered as FCU). 910121754 = Jumper installed for WSHP (Default for units ordered as WSHP).

Program mode menu pages:

(Display required)

Note: *Both J50 “F/C” and J50 “MDL” jumpers must be configured first before entering the program “PRG” mode.*

Entering program mode and making changes

1. Install the J50 “PRG” jumper onto both pins with power turned on to enter Program Mode.
2. Press the Up/Down Buttons to advance to the desired program parameter from P1 through P14 (Parameters described below).
3. Press the Occupancy Button to select the specific program parameter to change.
4. Change the parameter value as described in the Mode Menus section below. (Usually with the Up/Down Button)
5. Press the Occupancy Button again to set the selected parameter.
6. Press the Up/Down Buttons to proceed to the next parameter (as in Step 2 above).
7. When done making changes, remove the J50 “PRG” jumper (and place over one pin). This action will end the Programming Mode and store all the values. The sensor is now in the Run Mode.

Program mode menu pages

P1 **Setpoint Mode** (Factory set to temperature value “S1”. J50 ºF/ºC must be set before entering the program “PRG” mode).

- **S1** – “UP/DOWN” to select setpoint to absolute temperature setpoint value. Actual setpoint value set in P4 and P5. **Example:** 55ºF (13º C) to 95ºF (35º C).
- **S2** – “UP/DOWN” to select setpoint to relative temperature setpoint value of ±5.0ºF (±2.8ºC).
- **S3** – “UP/DOWN” to select setpoint to relative temperature setpoint value of ±3.0ºF (±1.67ºC) for Enfinity systems.

P2 **Temperature Offset** (Factory set to zero).

- “UP” to increase offset up to +2.
- “DOWN” to decrease offset down to -2.

P3 **Humidity Offset** (Factory set to zero).

- “UP” to increase offset up to +5
- “DOWN” to decrease offset down to -5.

P4 **Setpoint Low Range** (Factory set to 55°F or 13°C depending on J50 °F/°C setting).

P1 in S1 Mode: Adjustment range 55 to 65°F or 13 to 18°C.

- “UP” to increase the low setpoint range up to 65°F or 18°C.
- “DOWN” to decrease the low setpoint range down to 55°F or 13°C.

P1 in S2 Mode: No adjustment. Factory set to -5°F (-2.8°C).

P1 in S3 Mode: No adjustment. Factory set to -3°F (-1.6°C) for Enfinity systems.

P5 **Setpoint High Range** (Factory set to 95°F or 35°C depending on J50-°F/°C setting).

P1 in S1 Mode: Adjustment range 85 to 95°F or 29 to 35°C.

- "UP" to increase the high setpoint range up to 95°F or 35°C.
- "DOWN" to decrease the high setpoint range down to 85°F or 29°C.

P1 in S2 Mode: No adjustment. Factory set to 5°F (2.8°C).

P1 in S3 Mode: No adjustment. Factory set to 3°F (1.6°C) for Enfinity systems.

P6 **Fan Lock Mode** (Factory set to Unlocked "Unl")

- "UP/DOWN" to set Fan Lock mode. Choose from list below:

All Models	**Unl**	Enables fan to be controlled by the Sensor Fan button
All Models	**FA**	Locks fan to the Fan Auto position (No Sensor Fan button control)
WSHP Models	**FO**	Locks fan to the Fan On position (No Sensor Fan button control)
FCU Models	**FH**	Locks fan to the Fan High speed position (No Sensor Fan button control)
FCU Models	**Fd**	Locks fan to the Fan Medium speed position (No Sensor Fan button control)
FCU Models	**FL**	Locks fan to the Fan Low speed position (No Sensor Fan button control)
FCU Models	**Fo**	Locks fan to the Fan Off position (No Sensor Fan button control)

P7 **System Lock Mode** (Factory set to Unlocked "Unl")

- "UP/DOWN" to set System Lock mode. Choose from list below:

Unl	Enables System to be controlled by the Sensor System Mode button.
UH	Locks System to the Heat mode (No Sensor System button control).
UC	Locks System to the Cool mode (No Sensor System button control).
UA	Locks System to the Auto mode (No Sensor System button control).
UO	Locks System to the Off mode (No Sensor System button control).
Ud	Locks System to the Dhum mode (No Sensor System button control).

P8 **Display Resolution** (Factory set to ±0.5 resolution, "0.5").

- **0.1** "UP/DOWN" to set resolution to ±0.1, (Rounds up at .05).
- **0.5** "UP/DOWN" to set resolution to ±0.5, (Rounds up at .08).
- **1** "UP/DOWN" to set resolution to ±1.0, (Rounds up at .5).

P9 **Dehumidification Dead band (DB)** (Factory set to 2%), (WSHP Only).

- **2** "UP/DOWN" to set Dead band at 2% (On at setpoint SP, Off at SP-DB).
- **3** "UP/DOWN" to set Dead band at 3% (On at setpoint SP, Off at SP-DB).
- **4** "UP/DOWN" to set Dead band at 4% (On at setpoint SP, Off at SP-DB).
- **5** "UP/DOWN" to set Dead band at 5% (On at setpoint SP, Off at SP-DB).

P10 **Display Mode** (Factory set to #16 for WSHP units, factory set to #4 or #3 for FCU Units).

- "UP/DOWN" to set display mode.
- Choose from numbered list below. Choices 5-16 will not be shown if P12 = nOH.

1 = No value on the main display (Blank).
2 = Temperature Value (TV).
3 = Temperature Setpoint (TSP) (FCU Default 910113575).
4 = Temperature Value & Temperature Setpoint (FCU Default 910152148, 910113679).
5 = Humidity Value (HV).
6 = Temperature Value & Humidity Value.
7 = Humidity Value & Temperature Setpoint.
8 = Temperature Value, Temp Setpoint & Humidity Value.
9 = Humidity Setpoint (HSP).
10 = Temperature Value & Humidity Setpoint.
11 = Temperature Setpoint & Humidity Setpoint.
12 = Temperature Value & Temp Setpoint & Humidity Setpoint.
13 = Humidity Value & Humidity Setpoint.
14 = Temperature Value, & Humidity Value & Humidity Setpoint.
15 = Humidity Value & Temperature Setpoint & Humidity Setpoint.
16 = Temperature Value & Temperature Setpoint & Humidity Value & Humidity Setpoint (WSHP Default).

P11 **Setpoint Button Lockout** (Factory set to "0": Temp. & Humidity Setpoint Enabled.

Note: *1. Selections in P11 will impact Menu P10).*

2. After changing P11 option, remove PRG jumper on J50 to exit programming mode and refresh options. In order to make additional programming changes, PRG Jumper must be reinstalled to enter programming mode.

0 Both Temperature & Humidity Setpoints are enabled (No Setpoint lockout, WSHP Units Only).

1 Humidity Setpoint Only is Enabled (Temperature setpoint is locked out, WSHP Units Only).

2 Temperature Setpoint Only is Enabled (Humidity setpoint is locked out).

3 Both Temperature & Humidity Setpoints are Disabled (Full Setpoint lockout).

P12 Dehumidification Enable/Disable

nOH Dehumidification is Disabled (Factory default for FCU Units).

HuA Dehumidification is Enabled (Factory default for WSHP Units).

P13 Occupancy Button Enable/Disable (Factory set to enabled "ObE").

ObE Occupancy Button Enabled (Factory default)

Obd Occupancy Button Disabled

P14 Firmware Version - XXX.X

P15 For Units with a BACnet or LONWORKS Communications Module

Setpoint Calibration Offset (Factory set to "0".)

- "UP" to increase offset up to +100 will raise the MicroTech III perceived set point from the sensor.
- "DOWN" to decrease offset down to -100. This will lower the MicroTech III perceived set point from the sensor.

Calibrate the displayed set point to the set point value sent to the MicroTech III as follows:

1. Set the digital room sensor displayed set point to 90° F.
2. Observe the local set point via the BAS/EMS connected by the BACnet or LonWorks Communications Module.
3. Adjust the Configuration Menu P15 on the sensor until the local set point and the displayed set point are equal.

P15 For Units without a BACnet or LONWORKS Communications Module

Setpoint Calibration Offset (Factory set to "0".)

- "UP" to increase offset up to +100 will raise the MicroTech III perceived set point from the sensor.
- "DOWN" to decrease offset down to -100. This will lower the MicroTech III perceived set point from the sensor.

The Setpoint Calibration Offset can be calculated using the following formula:

ROUND [(Controller Vdd / Sensor Vdd)*1000]-1000

Example:

Given: Controller Vdd = 5.15VDC

Sensor Vdd = 4.95 VDC

The programmed Calibration Offset would be

[(5.15/4.95)*1000] -1000 = 40

Diagnostics

Problem & possible solution

No display

- Check the power connections and power voltage level
- Replace unit if power is okay.

No temperature signal

- Be sure the termination and wiring is correct and the controller is set up properly. Make sure the "Override/ Reset" button is not stuck down.
- Replace unit if all checks are okay.

Override/Reset not working

- Measure the resistance to ground at the sensor output terminal (Term. 4). When pushing the Override Button, it should show a short. If not, replace the sensor.

No fan voltage signal

- Be sure the termination and wiring is correct and the controller is set up properly.
- Replace unit if all checks are okay.

No system voltage signal

- Be sure the termination and wiring is correct and the controller is set up properly.
- Replace unit if all checks are okay.

De-humidification not working

- Adjust the System Mode to DHUM and check terminal DH for voltage.
- Change the RH setpoint above and below the ambient RH to prove the output contact.
- Replace unit if it still doesn't work.

Occupied not working

- Verify that this terminal is in a powered circuit. Measure the voltage to ground at the occupied terminal (U). When pushing the Occupied Button (<2 secs), it should read close to 0 volts. When you lift the button it should read high volts.
- Replace unit if it still doesn't work.

"Err" shown on the screen

- This indicates that the temperature and humidity sensing element has failed.

FAN key does not change fan mode

- Check to verify FAN is not locked out in Programming Mode Menu Page P6.

MODE key does not change system mode

- Check to verify Mode is not locked out in Programming Mode Menu Page P7.

Up or Down key does not change setpoints

- Check to verify Set points are not locked out in Programming Mode Menu Page P11.

Solid Man goes away after 20 seconds

- Occupancy Request was not acknowledged by Main controller, check wiring of Status Signal from controller.

Supply voltage

AC Hot.....(R) 7 to 28VAC, 24VAC nominal, 0.17VA

GND/Neutral.....(5) Sensor common reference ground.

Sensor

Temperature .....10K-2 Thermistor, ±0.36ºF (±0.2ºC)

Humidity.....2% Accuracy from 20 to 80%, Capacitive.

Outputs

Unoccupied.....(U), Unoccupied = Digital low to ground (Same ground as power source), 100mA @5VDC max.

Dehumidify.....(DH), = Dehumidify = Voltage output (same as supply voltage), 170mA max.

System Off.....(E), System Off = Digital low to ground (Same ground as power source), 100mA @5VDC max.

Fan Speed.....(2 or 6), Analog, 0 to 5 VDC.

System Mode.....(2), Analog, 0 to 5 VDC.

Setpoint .....(3), Analog, 0 to 5 VDC.

Temperature .....(4), Analog thermistor resistance.

Sensor controls

Setpoint .....2 Up/Down buttons

System.....1 button to cycle between Heat/Cool Auto/Off/Dhum/Off

Fan .....1 button to cycle between Auto/High/On.

Occupied .....1 button to check and request change in Occupancy Status.

Override/Reset .....1 button to request timed occupancy override and reset alarms.

Inputs:.....(1), Controller alarm & system status, 5VDC max.

Termination:.....10 Terminals, 16 to 22 AWG.

Mounting:.....Standard 2" × 4" J-Box or Drywall

Field setup jumper J50

PRG ..... Program Mode, On = Program, Off = Run.

F/C.....Display Units, On = ºC, Off = ºF.

MDL.....MODEL, On = WSHP. Off = FCU.

Display

LCD

Overall size.....2.04"W × 1.33"H.

Main Digits.....±999.9 Digits @0.6"H

Resolution.....0.5 displayed value, 0.1 for offset adjust

Main Value.....Temp, Humidity & Setpoint, toggling every 5 sec.

Eng. Units .....ºF, ºC, %RH.

System.....Heat/Cool/Auto/Off/Dhum.

Fan .....Auto/High/Medium/Low.

Occupied Icon .....Hollow = Unoccupied, Solid = Occupied.

Function.....Override, Alarm, E-Save, Setpoint

Field configuration menu

(Requires J50 PRG jumper to be "On")

Offset .....Temp or Humidity display, ±2ºF (±1.0ºC) and ±5% RH.

Setpoint range .....Default 55º to 95ºF (13º to 35ºC), ±3ºF (±1.6ºC) or ±5ºF (±3ºC). Adjustable between 55º to 95ºF, ±3ºF (±1.6ºC) or ±5.0ºF (±2.8ºC).

Fan Lock-in.....Any fan speed or off can be locked in System Lock-in. Any system mode can be locked in

Resolution.....Main display can be default .5, or .1 or 1.0 (ºF, ºC or %).

Display Mode.....Temp only, RH only, Setpoint only or any combination.

Dhum DB ..... Dehumidify Dead Band adjust, 2% default.

Enclosure material

ABS Plastic, UL94V-0.

Ambient

32º to 122ºF (0º to 50ºC), 0 to 95%RH, Non-condensing.

Agency

Restriction of the use of certain Hazardous Substances (RoHS).

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Installation and Maintenance Manual IM 831

Group: **Applied Air Systems**
Part Number: **667757200**
Date: **October 2013**

Fan Coil Thermostat Conversion Kit

to Eliminate 3-speed Switch Capability

Safety Information

The installation of this equipment shall be in accordance the regulations of authorities having jurisdiction and all applicable codes. It is the responsibility of the installer to determine and follow the applicable codes. This equipment is to be installed only by an experienced installation company which employs trained personnel.

⚠ WARNING

Rigorously adhere to field wiring procedures regarding proper lockout and tagout of components.

⚠ WARNING

To avoid electrical shock, personal injury or death:

1. Installer must be qualified, experienced technician.
2. Disconnect power supply before installation to prevent electrical shock and damage to equipment.

Introduction

This thermostat conversion **kit number 107345245** converts a fan coil unit thermostat to a thermostat without a 3-speed switch. The thermostat kit includes a cover that does NOT have an opening for the 3-speed control switch. The following is the proper procedure to convert the thermostat.

Procedure

⚠ CAUTION

If the FAN Switch remains in the left-most (Off) position the thermostat will NOT function properly.

1. Carry out this procedure before mounting the thermostat or applying power to it. If the thermostat is already mounted, turn off all power to it before proceeding.
2. Slide the FAN switch on the front of the thermostat to the setting at which you want the motor to run all the time.
3. Remove the cover from the thermostat by gently prying with behind the left hand edge of the cover with a small screwdriver, then pulling it off as shown in Figures 1 and 2.

NOTE: Once you exchange thermostat covers, the user can no longer change this setting.

4. Adjust the dip switch and jumpers to your desired configuration (see thermostat installation manual).
5. Pull off the fan slide switch cap (Figure 3). Note: Be careful not to change the position of the switch you set in Step 2.
6. Place the new thermostat cover that does not have the 3-speed switch opening on the thermostat (Figure 4).

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Figure 1: Opening the Thermostat Cover

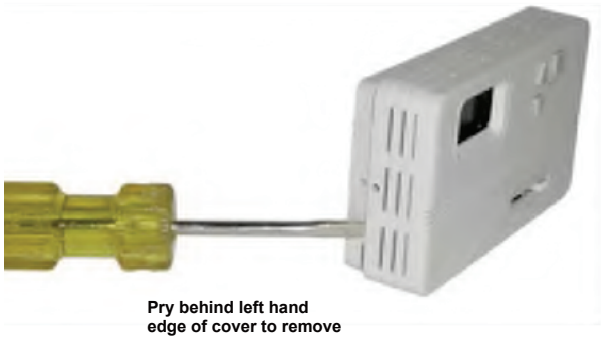


Figure 2: Accessing The Components



Figure 3: Remove Plastic Fan Slide Switch Cap

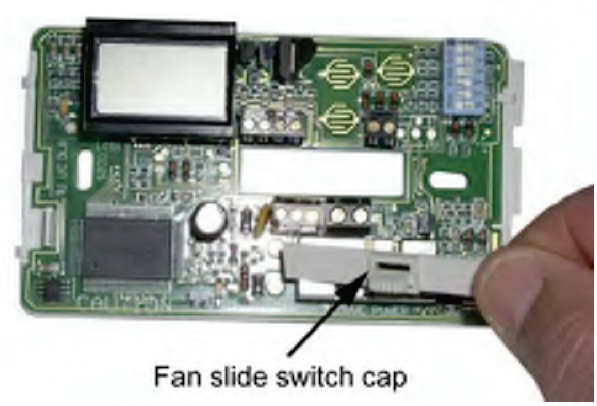
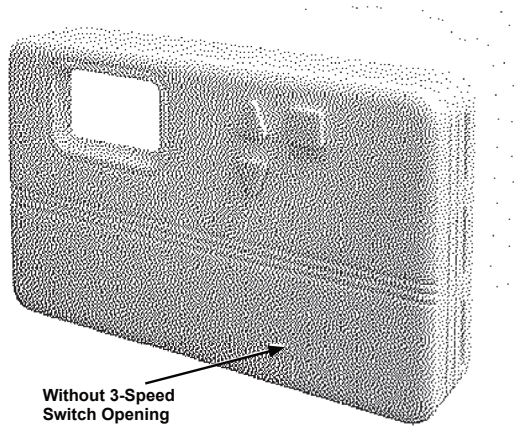


Figure 4: New Thermostat Cover



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Installation and Maintenance Manual IM 763

Group: **Applied Air Systems**
Part Number: **106333101**
Date: **October 2013**

Automatic Changeover Switch

for Automatic Seasonal Changeover on Two-pipe Systems

⚠ WARNING

Installation and maintenance are to be performed only by qualified personnel who are familiar with and in compliance with state, local and national codes and regulations, and experienced with this type of equipment.

⚠ CAUTION

Sharp edges and coil surfaces are a potential injury hazards. Avoid contact with them

These line voltage changeover switches are designed to switch a thermostat from heating to cooling based on a change in supply water temperature. The switches can be mounted on 5/8" or 7/8" O.D. copper tube or iron pipe.

Both models are easily mounted to the supply piping with a simple spring clip included with the thermostat.

Models

The 039398600 model (Fig. 1) has 110 in. leads and is the standard changeover switch. The 06361801 model (Fig. 2) has the same operating characteristics and includes 18 in. conduit and connector.

Both models are snap acting, SPDT switches.

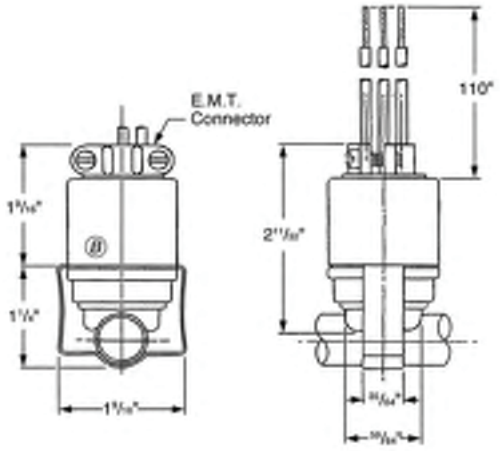
Terminal No. 1 has a black wire and is the common (C) connected to valve (valve cycle) or to the yellow wire of the speed switch (fan cycle).

Terminal No. 2 has a red wire and is normally open (N.O.). Connected to the heating (red) wire of the thermostat.

Terminal No. 3 has a blue wire and is normally closed (N.C.). Connected to the cooling (blue) wire of the thermostat.

At approximately 65°F, plus or minus 6°F, terminals 1 and 3 are closed and terminals 1 and 2 are open. At 95°F, plus or minus 6°F, terminals 1 and 2 are closed and terminals 1 and 3 are open.

Figure 1: Automatic Changeover Switch (Kit P/N 039398600)



Terminal No. 1 *Black 60455 (Common)*
Terminal No. 2 *Red 60456 (N.O.) – Heating*
Terminal No. 3 *Blue 60457 (N.C.) – Cooling*

Type 14TC33
Open Temp Term. 1 and 3, 95°F ± 6°
Close Temp Term. 1 and 3, 65°F ± 6°

U.L. File – E29653
U.L. Guide – SDFY2
Volts – 120
Amps – 25

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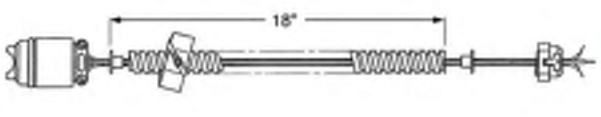
Specifications

Table 26: Electrical Rating

Model	Voltage	FLA	LRA	Restive
039398600 061361801	24 – 240	15 – 5	90 – 30	25
Changeover Range:	65°F to 95°F (18°C to 35°C)			
Maximum Operating Temperature Limits	220°F Fluid Temperature @ 125°F Ambient (104°C Fluid Temperature @ 52°C Ambient)			
Agency Approval	UL Listed, CSA Approved			

The specifications above are nominal and conform to generally acceptable industry standards. Daikin is not responsible for damages resulting from misapplication or misuse of its products.

Figure 2: Automatic Changeover Switch (Kit P/N 061361801)



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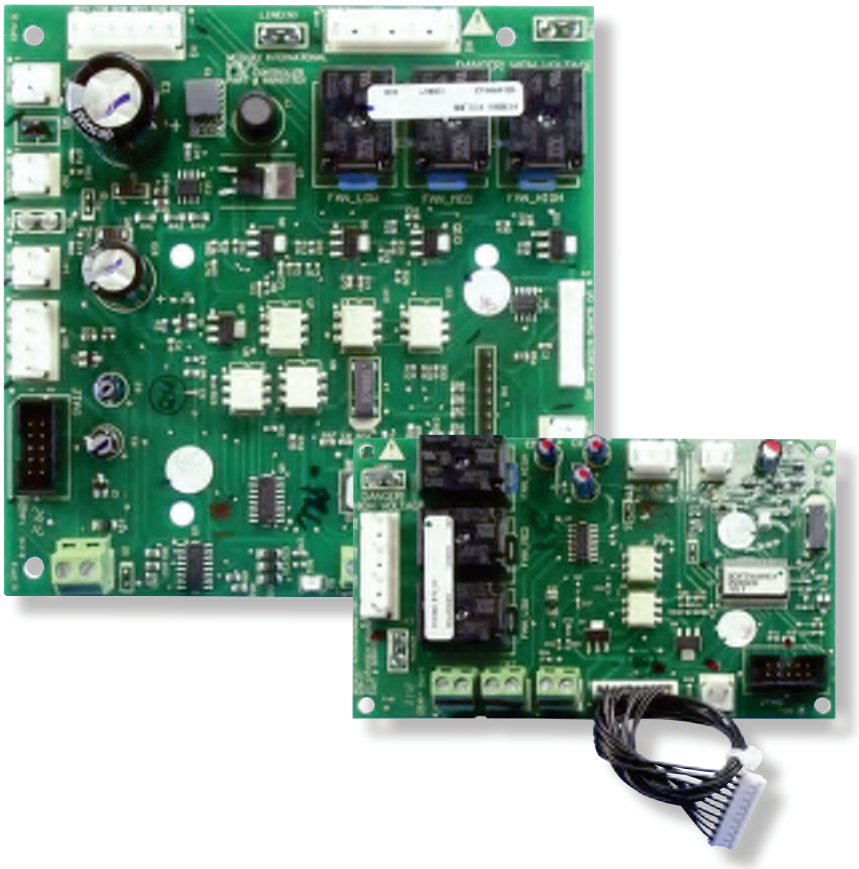
Operation and Maintenance Manual

OM 1111-2

Group: **Applied Air Systems**
Part Number: **OM 1111**
Date: **October 2015**

MicroTech® Unit Controller with I/O Expansion Module for Fan Coils

Models FCHH / FCHC / FCHR and Cabinet Unit Heaters, Models FHHH / FHHC / FHHR



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This Operation Manual covers the MicroTech® Unit Controller for the Daikin ThinLine Fan Coils. For information on LONWORKS® or BACnet® communication modules and other ancillary components, see:

- IM 1012 — MicroTech III Fan Coil LONWORKS Communication Module.
- IM 1013 — MicroTech III Fan Coil Unit Controller BACnet MS/TP Communication Module.
- IM 933 — LONWORKS Plug-In Software for use with MicroTech III Unit Controller - LONWORKS Communication Module.
- IM 1171 — Digitally Adjustable Display Sensor Installation and Maintenance Manual
- OM 1095 — MicroTech III The Downloading And Configuration Procedure
- ED 15135 — MicroTech III Fan Coil Unit Controller Protocol Information

For information on ThinLine Fan Coils and Cabinet Unit Heaters see

- Catalog 724 — ThinLine Horizontal Fan Coils (Type FCHC, FCHH, and FCHR)
- Catalog 725 — ThinLine Horizontal Cabinet Unit Heaters (Type FHHC, FHHH, and FHHR)
- IM 1152 — Installation Manual Daikin ThinLine Horizontal Fan Coils and Cabinet Unit Heaters (Type FC and FH Horizontal Design).

General Use and Information

The MicroTech unit controller is a fan coil/cabinet unit heater control platform used to control the fan coil/unit heater in all modes of operation, including economizers, control valves, and all components used to control conditioned space temperature. By adding a communication module, (LONWORKS or BACnet) network integration is possible. The controller can be used with wall sensor control only.

No outside power sources may be used to operate MicroTech controller. All units must be properly grounded per local code requirements. See the Installation Manual IM 1152 for specific power requirements.

Control Inputs

The baseboard accepts the following analog and binary control inputs:

1. Room Temp and Tenant Override . . . . . Analog
2. Local Setpoint Adjust . . . . . Analog
3. Fan Mode/Speed Switch . . . . . Analog
4. Entering Water Temperature (EWT) . . . . . Analog
5. Discharge Air Temperature (DAT) . . . . . Analog
6. Heat/Cool/Auto Mode Switch . . . . . Analog
7. Freeze Fault Detection. . . . . Binary
8. Occupancy Sensor . . . . . Binary
9. Condensate Overflow . . . . . Binary

Input Description

Room or Return Air Temp & Tenant Override

Analog input may be used to measure Room or Return Air temperature using a 10k NTC thermistor. The same analog input is used to sense the position of the timed override switch when a room sensor is applied. This sensor is mandatory in the Fan Coil/Cabinet Unit Heater units unless the input value is provided through network communications.

Condensate Overflow

Analog input may be used to detect the presence of water in condensate pan. While the input is analog (microOhms), the result of the algorithm is binary (dry or wet). If the value is below 2.5 microOhms, the pan is dry. If the value is above 2.5 microOhms, the pan is wet. Ultimately the pan is considered dry for analog inputs above 1.8 VDC.

Local Setpoint Adjust

Analog input may be used to determine hardwired setpoint position based on a 1.5K Ω potentiometer that is mounted on the room temperature sensor. Setpoint is at its minimum value at 0 Ohms (0.0 VDC), maximum value at 1.5K Ohms (3.0 VDC). Range of input is determined by the setting of an equipment configuration bit. Long range input is limited by Max and Min clamp settings. Either “Short” or “Long” range is selected during the unit order and preset at the Daikin factory. See “nciSoftJumpers” in Table 18 for specification details.

- If “Short Range” is selected, the nvoSetptShift variables are used.
- If “Long Range” is selected, the nvoSetpoint variable is used.

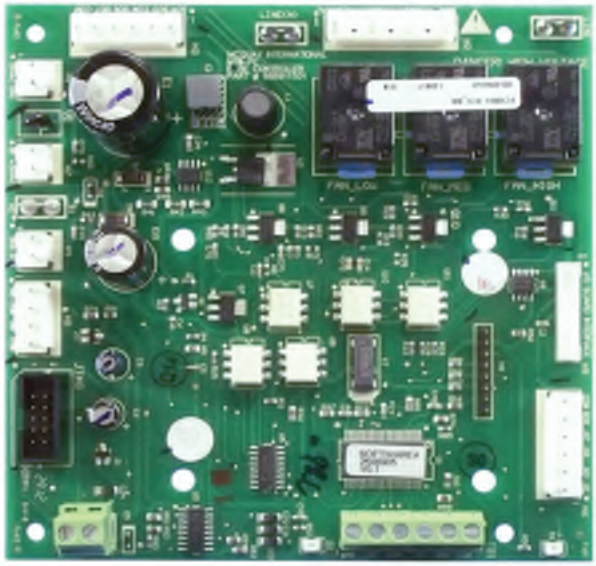
Fan Mode/Speed Switch

Analog input may be used to determine the position of the fan mode and speed switch. Input DC voltages are defined as follows: 0.0v = Auto, 1.0v = High, 2.0v = Medium, 3.0v = Low, 4.0v = Off, 5.0v = Switch is not present.

Entering Water Temperature (EWT)

Analog input may be used to measure temperature of water entering the hydronic coil using a 10k NTC thermistor. The sensor is only required in 2-Pipe Cooling/Heating systems or Heating-only with Supplemental Electric Heat, and is optional elsewhere.

Figure 1: MicroTech Baseboard



Discharge Air Temperature (DAT)

Analog input may be used to measure discharge air temperature sensor using a 10k NTC thermistor.

Heat/Cool/Auto Mode Switch

Analog input may be used to determine the position of the heat/cool/auto mode switch. Input DC voltages are defined as follows: 0.0v = Cool, 1.0v = Auto, 2.5v = Heat, 5.0v = Switch is not present.

Freeze Fault Detection

Binary input may be used to detect the position of a low discharge air temperature freeze fault detection switch. The sensor part of the switch is installed in the air stream. If the contact on the switch is open, the temperature in the air stream is below freezing (alarm active). If the contact on the

switch is closed, the temperature in the air stream is above freezing (alarm inactive). Must use “nciSoftJumpers” to enable or disable this input. See Table 18. Input span is 0.0 to 3.6 VDC, with a threshold of 1.5 VDC.

NOTE: Freezestat sensor should be provided from the factory or field-supplied

Occupancy Sensor

Binary input may be used to detect the position of an occupancy sensor. This could be a motion detector or a time clock. Open sensor contact represents occupied, closed sensor contact represents unoccupied. Network-effective occupancy has priority over position of this input. Input span is 0.7 (unoccupied) to 5.0 VDC (occupied), with a threshold of 2.85 VDC.

NOTE: Note: Occupancy sensor is field-supplied

Control Outputs

The MicroTech baseboard provides the following Binary Outputs:

1. Fan Low Speed
2. Fan Medium Speed
3. Fan High Speed
4. Valve Output #1
5. Valve Output #2
6. Valve Output #3/Electric Heat S1
7. Valve Output #4
8. Fresh (Outside) Air Damper – 2-Position only.
9. Room Sensor Status Output

Output Description

Each binary output is either a relay with normally-open contacts or a triac. A triac is treated like a relay with normally-open contacts. In other words, energizing the triac is like closing a normally-open contact.

Fan Speed Outputs

There are three fan speed outputs on baseboard, and three fan speed outputs on I/O expansion board. The two separate fans operate in unison. In other words – if the low speed output on baseboard is energized, the low speed output on I/O expansion board is also energized, etc. If all three outputs are de-energized, the fan motor is off. Only a single type (low, medium, high) of speed output shall be turned on when fan operation is required.

- **Low Speed:**

  This binary output is used to operate the fan at low speed. If this output is energized, the fan operates at low speed.

- **Medium Speed:**

  This binary output is used to operate the fan at medium speed. If this output is energized, the fan operates at medium speed.

- **High Speed:**

  This binary output is used to operate the fan at high speed. If this output is energized, the fan operates at high speed.

Two-Position Damper Output

Binary output may be used to open a fresh air ventilation damper. If the output is de-energized, the damper is closed. If the output is energized, the damper is open.

Room Sensor Status Output

Binary output may be used to energize and de-energize an indicator located on the room sensor. See Room Sensor Status Output Annunciation Table below.

Status Annunciation Tables

Table 1: Room Sensor Status Output Annunciation Table

Condition *	Indicator On Time (Sec)	Indicator Off Time (Sec)
Alarm Active: Specific Alarm Determines Number of Flashes (See Alarms section)	0.3	0.3 (1.3 Between Cycles)
Calibration or Network Wink Active	3.0	3.0
Service Test Mode	0.0	Continually
Unoccupied Mode	0.5	5.5
Standby Mode	5.5	0.5
Occupied, Bypass Mode	Continually	0.0

* Annunciation conditions are listed in order of priority.

Table 2: Baseboard Diagnostic LED Annunciation Table

Diagnostic LED State	Condition
LED #1: On Steady	Normal I/O Expansion Board SPI Communications
LED #1: Flashing	Failed I/O Expansion Board SPI Communications
LED #2: On Steady	Normal Comm Module SPI Communications
LED #2: Flashing	Failed Comm Module SPI Communications

The I/O Expansion Module is an extension of the main board and provides extra functionality to the MicroTech control system. The MicroTech unit controller in combination with the I/O Expansion Module will be the standard control system for ThinLine Fan Coils and Cabinet Unit Heaters. See Figure 2.

Adding an I/O Expansion Module (with an interconnect cable) to the main controller allows:

- Economizer Control
- Second Fan Motor Control
- Additional control inputs

I/O Expansion Board Inputs & Outputs

I/O expansion Board accepts the following inputs:

1. Outdoor Air Temperature (OAT) – analog
2. Dirty Air Filter – binary[1]
3. Emergency Shutdown Detection – binary [Future option]
4. Humidistat – binary [Future option]

[1] Currently Dirty Filter indication uses timer only

Input Description

Outdoor(Fresh) Air Temperature (OAT)

Analog input may be used to measure outdoor air temperature using a 10k NTC thermistor.

Dirty Air Filter

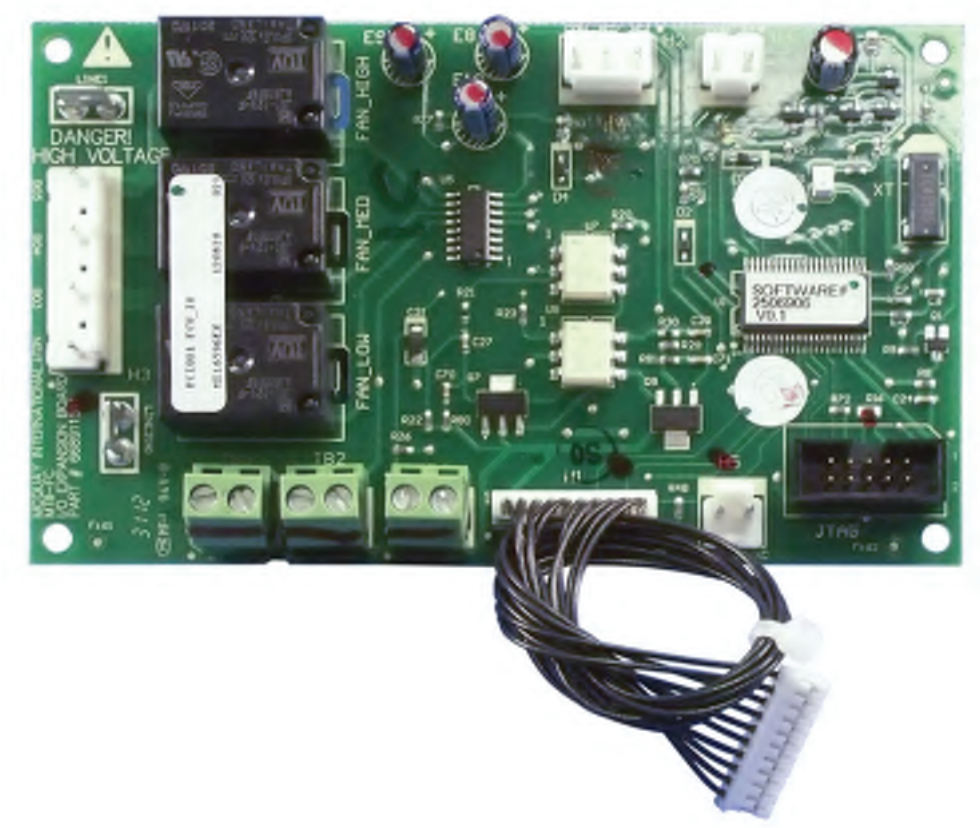
Binary input may be used to detect Dirty Filter[2] condition. Dirty air filter alarm is active when the input contact opens. Must use “nciSoftJumpers” to enable or disable this input. See Table 18 for details. Input span is 0.0 to 3.6 VDC, with a threshold of 1.5 VDC.

[2] Currently Dirty Filter input uses timer signal only.

Humidistat [future option]

Binary input may be used to detect humidistat position. Contact closes when dehumidification is required. This feature is only allowed for 4-Pipe Heating & Cooling systems with modulating valves and 2-Pipe Cooling-only systems. Input span is 0.0 to 3.6 VDC, with a threshold of 1.5 VDC.

Figure 2: MicroTech I/O Expansion Module



Output Description

I/O Expansion Board provides the following binary Outputs:

1. Economizer Open
2. Economizer Closed
3. Fan Low Speed
4. Fan Medium Speed
5. Fan High Speed

Economizer Control Outputs

I/O expansion board binary outputs 1 and 2 are may be used for economizer control. Output #1 drives the economizer toward the open position. Output #2 drives the economizer toward the closed position.

Emergency Shutdown [future option]

Binary input may be used to detect an emergency shutdown condition. Shutdown occurs when the input contact opens. Must use “nciSoftJumpers” to enable or disable this input. See Table 18 for details. Input span is 0.0 to 3.6 VDC, with a threshold of 1.5 VDC.

Second Fan Motor Speed Outputs

There are three fan speed outputs on baseboard, and three fan speed outputs on I/O expansion board. The two separate fans operate in unison. In other words – if the low speed output on baseboard is energized, the low speed output on I/O expansion board is also energized, etc. If all three outputs are de-energized, the fan motor is off. Only a single type (low, medium, high) of speed output shall be turned on when fan operation is required.

- **Low Speed:**

  This binary output is used to operate the fan at low speed. If this output is energized, the fan operates at low speed.

- **Medium Speed:**

  This binary output is used to operate the fan at medium speed. If this output is energized, the fan operates at medium speed.

- **High Speed:**

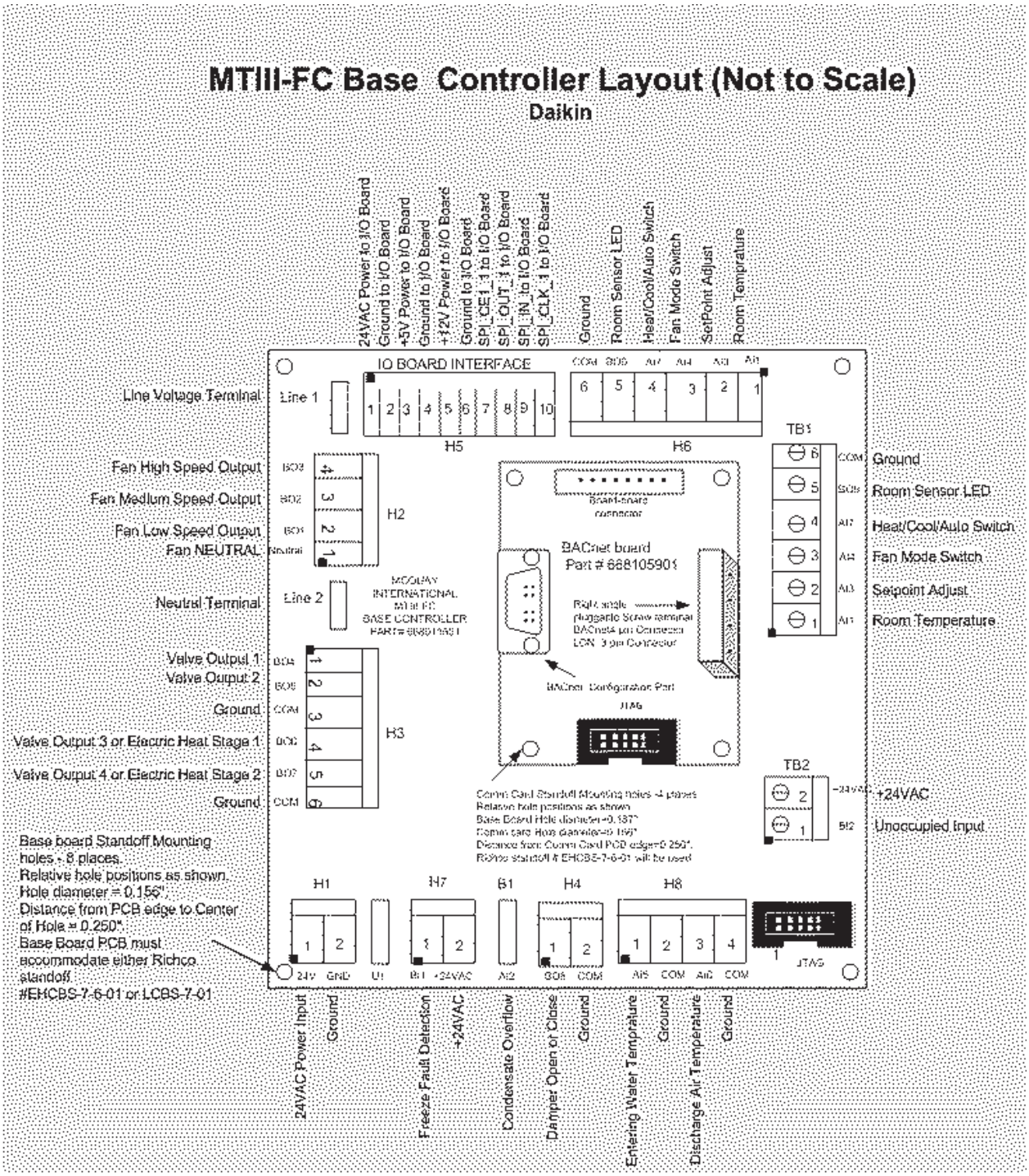
  This binary output is used to operate the fan at high speed. If this output is energized, the fan operates at high speed.

Table 3: I/O Expansion Board Diagnostic LED Annunciation Table

Condition *	LED On Time (Sec)	LED Off Time (Sec)
SPI Communications Receive (RX) Fail	0.5	0.5
SPI Communications Transmit (TX) Fail (From Baseboard)	2.5	2.5
Normal SPI Communications	Continually	0.0

* Annunciation conditions are listed in order of priority.

Figure 3: MicroTech Unit Controller & I/O Expansion Module Connectors Descriptions

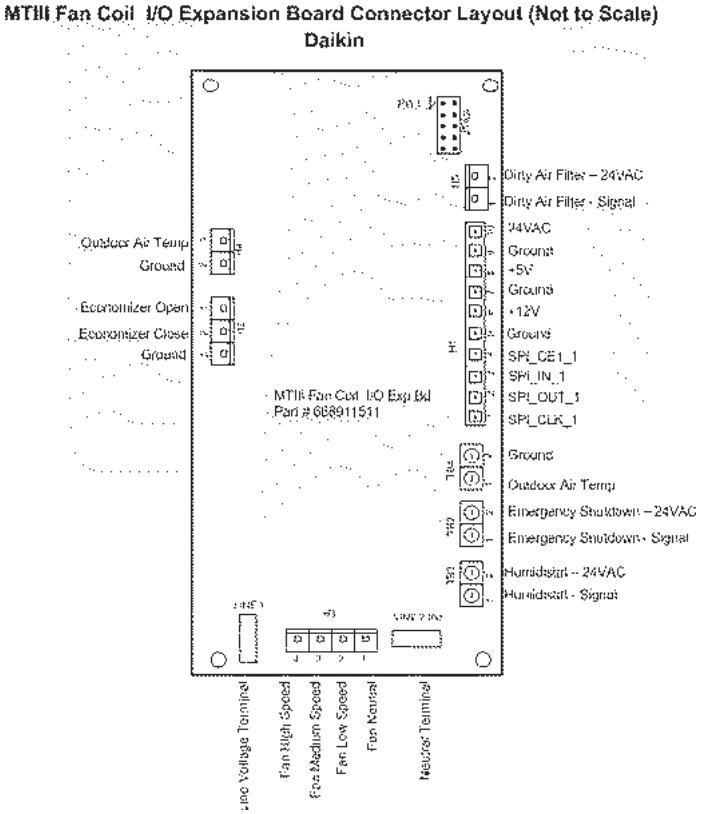


MicroTech Unit Controller

Table 4: MicroTech Unit Controller Terminals & Descriptions

Baseboard Connector – Terminal #	Silk Screen Label	Description
H1-1	24VAC	24VAC Power Input
H1-2	GND	Ground
H2-4	BO3	Fan High Speed Output
H2-3	BO2	Fan Medium Speed Output
H2-2	BO1	Fan Low Speed Output
H2-1	NEUTRAL	Fan Neutral
H3-1	BO4	Valve Output 1
H3-2	BO5	Valve Output 2
H3-3	COM	Ground
H3-4	BO6	Valve Output 3 or Electric Heat Stage 1
H3-5	BO7	Valve Output 4
H3-6	COM	Ground
H4-1	BO8	Damper Open
H4-2	COM	Ground
H5-1	I/O BOARD INTERFACE	24VAC Power to I/O Board
H5-2		Ground to I/O Board
H5-3		+5V Power to I/O Board
H5-4		Ground to I/O Board
H5-5		+12V Power to I/O Board
H5-6		Ground to I/O Board
H5-7		SPI_CE1_1 to I/O Board
H5-8		SPI_OUT_1 to I/O Board
H5-9		SPI_IN_1 to I/O Board
H5-10		SPI_CLK_1 to I/O Board
H6-1	AI1	Room Temperature
H6-2	AI3	SetPoint Adjust
H6-3	AI4	Fan Mode Switch
H6-4	AI7	Heat/Cool/Auto Switch
H6-5	BO9	Room Sensor LED
H6-6	COM	Ground
H7-1	BI1	Freeze Fault Detection
H7-2	24VAC	24VAC
H8-1	AI5	Entering Water Temperature
H8-2	COM	Ground
H8-3	AI6	Discharge Air Temperature
H8-4	COM	Ground
B1	AI2	Condensate Overflow
TB1-1	AI1	Room Temperature
TB1-2	AI3	SetPoint Adjust
TB1-3	A14	Fan Mode Switch
TB1-4	AI7	Heat/Cool/Auto Switch
TB1-5	BO9	Room Sensor LED
TB1-6	COM	Ground
TB2-1	BI2	Unoccupied input
TB2-2	24VAC	24VAC
LINE1	LINE1	Line Voltage/ECM Terminal
LINE2(N)	LINE2(N)	Neutral Terminal

Figure 4: MicroTech III Fan Coil I/O Expansion Board Connector Layout (not to scale)

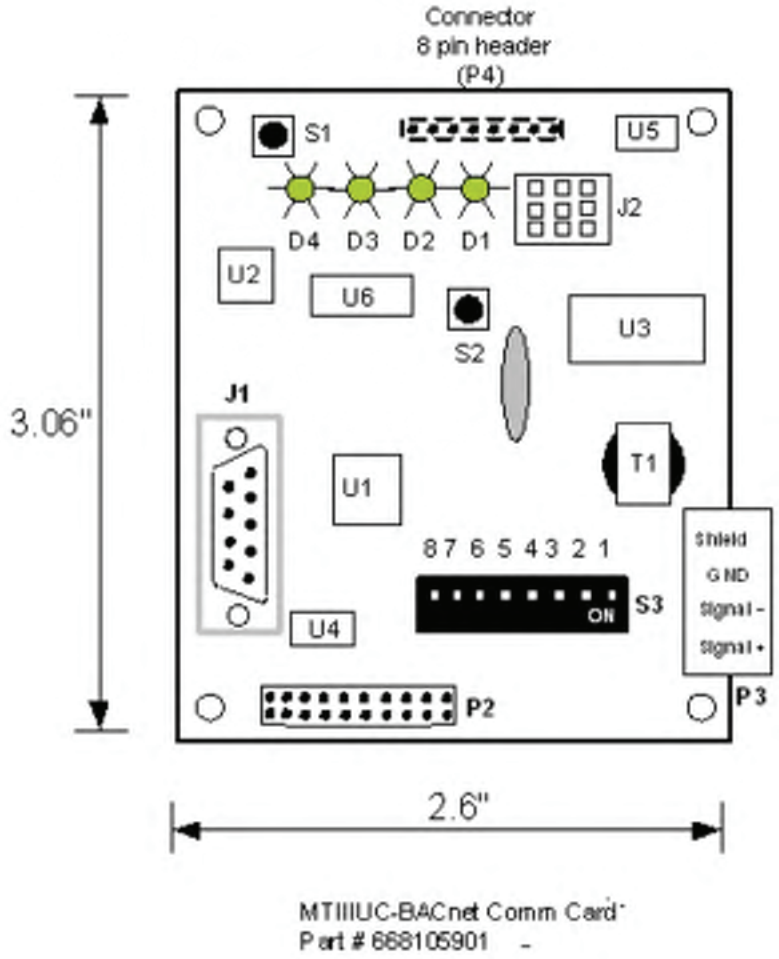


I/O Expansion Module

Table 5: I/O Expansion Module Connectors/Terminals

IO Exp. Module Connector – Terminal #	Silk Screen Label	Description
H1-1	UNIT CONTROLLER INTERFACE	SPI_CLK_1 to I/O Board
H1-2		SPI_OUT_1 to I/O Board
H1-3		SPI_IN_1 to I/O Board
H1-4		SPI_CE1_1 to I/O Board
H1-5		Ground to I/O Board
H1-6		+12V Power to I/O Board
H1-7		Ground to I/O Board
H1-8		+5V Power to I/O Board
H1-9		Ground to I/O Board
H1-10		24VAC Power to I/O Board
H2-1	BO1	Economizer Open output
H2-2	BO2	Economizer Closed output
H2-3	COM	Ground
H3-4	BO5	Fan High Speed
H3-3	BO4	Fan Medium Speed
H3-2	BO3	Fan Low Speed
H3-1	NEUTRAL	Fan Neutral
H4-1, TB4-1	AI1	Outdoor Air Temp
H4-2, TB4-2	COM	Ground
TB2-1	BI1	Emergency Shutdown signal
TB2-2	24VAC	Emergency Shutdown 24VAC
TB3-1	BI3	Humidistat signal
TB3-2	24VAC	Humidistat 24VAC
H5-1	BI2	Dirty Air filter signal
H5-2	24VAC	Dirty Air Filter 24VAC

Figure 5: BACnet Communication Module

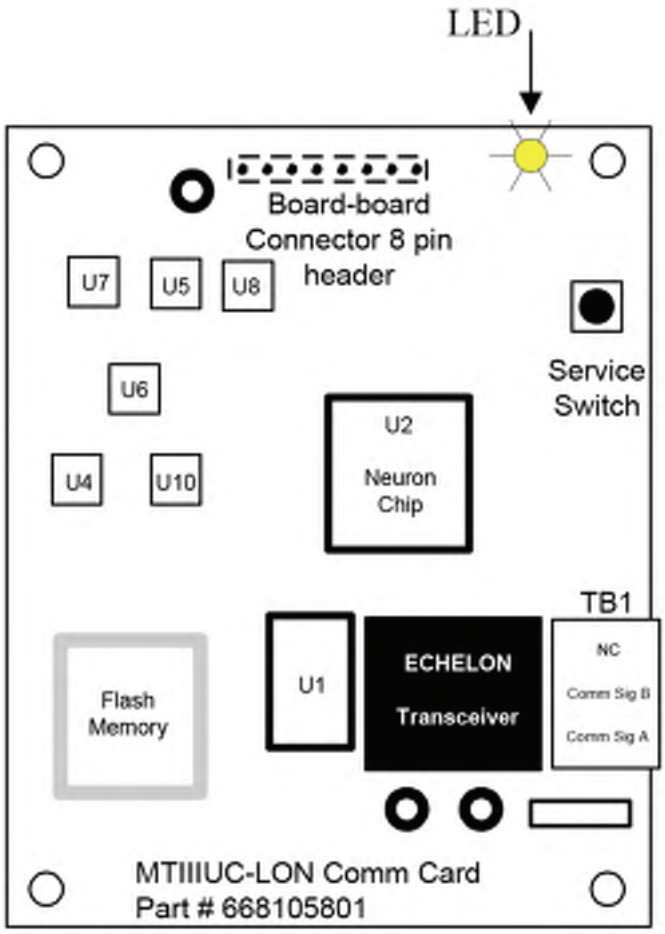


BACnet Communication Module

Table 6: BACnet Communication Module Connectors/Terminals

BACnet Module Connector – Terminal #	Silk Screen Label	Description
P3 – 1	P3	Network Signal +
P3 – 2		Network Signal –
P3 – 3		REF
P3 – 4		Shield

FIGURE 6: LONWORKS Communication Module



LONWORKS Communication Module

Table 7: LON Communication Module Connectors/Terminals

LONWORKS Module Connector – Terminal #	Silk Screen Label	Description
TB1 – 1	TB1	Network Signal A
TB1 – 2		Network Signal B
TB1 – 3		No Connection

The FCU primary operation depends on eight unit states of operation. When power is applied or controller is reset, the unit controller will go through a boot-up sequence, then go to the “Off” unit state. Refer to Table 8 and Table 9 for the state of every fan coil component in the Occupied and Unoccupied (Standby) Modes.

Possible FCU Machine States include:

- Off Alarm
- Off
- Start (Actuator calibration occurs if applicable)
- Fan Only (Fan is enabled, however may not be on)
- Heating
- Economizer
- Cooling (fan coils only)
- Dehumid [future option for Fan coils only: 2-Pipe in Cooling mode or 4-Pipe Modulating Heat & Cool Systems]

Fan Coil/Cabinet Unit Heater Control Output Tables

Table 8: UNOCCUPIED or STANDBY

(Economizer State & Dehumid State [future option] not allowed)

	Off Alarm	Off	Start	Fan Only	Heating	Economizer	Cooling	Dehumid [future option]
Fan	Off	Off	Off	Off	Highest	N/A	Highest	N/A
Cooling Valve	Note[1]	Closed[2]	Closed	Closed	Closed	N/A	Open	N/A
Heating Valve	Note [1]	Closed[2]	Closed	Closed	Open	N/A	Closed	N/A
Electric Heat	Off	Off	Off	Off	On	N/A	Off	N/A
Damper	Closed	Closed	Closed	Closed	Closed	N/A	Closed	N/A
Economizer	Closed	Unchanged	Closed	Closed	Closed	N/A	Closed	N/A

Table 9: OCCUPIED or BYPASS

(Economizer State allowed if enabled by Equipment Configuration)

	Off Alarm	Off	Start	Fan Only	Heating	Economizer	Cooling	Dehumid [future option]
Fan	Off	Off	Off	Controlled	Controlled	Controlled	Controlled	Controlled
Cooling Valve	Note[1]	Closed[2]	Closed	Closed	Closed	Closed	Controlled	Open
Heating Valve	Note[1]	Closed[2]	Closed	Closed	Controlled	Closed	Closed	Controlled
Electric Heat	Off	Off	Off	Off	On	Off	Off	Off
Damper	Closed	Closed	Closed	Controlled[3]	Open	Open	Open	Open
Economizer	Closed	Unchanged	Closed	Closed, Minimum[4]	Minimum	Controlled Min to Open	Open, Minimum[5]	Open, Minimum[5]

[1] Dependant on specific alarm, see “Alarm: Control & Reset Table”.
[2] Two position valves closed, modulating valves are unchanged.
[3] Damper open if fan is on, closed if fan is off
[4] Economizer closed if fan is off, otherwise at minimum position per fan speed
[5] Economizer open if available to cool, otherwise at min position per fan speed

Table 10: Fixed Timing Parameters Default Values

Fixed Timing Parameter	Normal
Condensate Overflow Alarm Activation Delay	60 sec
Dehumidification Minimum Off Timer	180 sec
Fan Runtime After Electric Heat Turnoff	30 sec
Fan Speed Change Timer	0.2 sec
Room Temperature Sensor Failure Delay When Analog Input Is Shorted	4 min
Valve & Economizer Calibration Interval	24 hrs

Table 11: Configuration Property Default Values

Configuration Property	Usable Range	Default Value	Description
nciBypassTime	0, 30 to 120 Min	120 m	Amount of time controller operates is in the bypass occupancy mode when the user activates the timed override function.
nciSetpoints:Occ_cool	50 to 95 °F	75 °F	Occupied operating mode cooling setpoint.
nciSetpoints:Stby_cool	50 to 95 °F	77 °F	Standby operating mode cooling setpoint.
nciSetpoints:Unoc_cool	50 to 95 °F	85 °F	Unoccupied operating mode cooling setpoint.
nciSetpoints:Occ_heat	50 to 95 °F	70 °F	Occupied operating mode heating setpoint.
nciSetpoints:Stby_heat	50 to 95 °F	66 °F	Standby operating mode heating setpoint.
nciSetpoints:Unoc_heat	50 to 95 °F	60 °F	Unoccupied operating mode heating setpoint.
nciOccDiff	1 to 5 °F	1 °F	Differential between the effective on and off setpoints when operating in the occupied mode.
nciUnoccDiff	2 to 10 °F	2 °F	Differential between the effective on and off setpoints when operating in the unoccupied mode.
nciEwtFlowTimer	60 to 600 Sec	120 s	Length of time flow is allowed after opening a hydronic valve before sampling the EWT.
nciEwtSampleTmr	0, 20 to 120 Min	120 m	Length of time between EWT sampling processes.
nciFanMinOffTmr	120 to 1200 Sec	180 s	Minimum length of time the fan must remain off after it initially turns off.
nciFanMinOnTmr	120 to 1200 Sec	180 s	Minimum length of time the fan must remain running after it initially turns on.
nciFltrChangeHrs	0, 360 to 4320 Hr	1440 hr	Length of time the fan operates before a dirty air filter alarm is generated.
nciLocSptEnable	Disable, Enable	Enable	Variable to enable or disable the use of the local setpoint adjustment input from the room sensor.
nciSptAdjMax	55 to 95 °F	95 °F	Long range setpoint adjust input maximum value.
nciSptAdjMin	55 to 95 °F	55 °F	Long range setpoint adjust input minimum value.
Hydronic Heating Control			
nciHeatEnDiff	2 to 10 °F	5 °F	EWT must be warmer than the room temperature at least by this amount for hydronic heating to be allowed in two pipe systems.
nciHeatIntStgTmr	120 to 1200 Sec	300 s	Inter stage time used between automatic heating capacity fan speed changes.
nciHeatKp	5 to 160 %	25 %	Hydronic heating valve PI control loop proportional gain setting.
nciHeatKi	0 to 1200 Sec	20 s	Hydronic heating valve PI control loop integral setting.
nciHeatDB	3 to 100 %	3 %	Hydronic heating valve actuator positioning deadband.
nciHeatVlvStroke	15 to 600 Sec	180 s	Hydronic heating valve actuator full travel time.
Hydronic Cooling Control			
nciCoolEnDiff	2 to 10 °F	5 °F	EWT must be colder than the room temperature at least by this amount for hydronic cooling to be allowed in two pipe systems.
nciCoolIntStgTmr	120 to 1200 Sec	300 s	Inter stage time used between automatic cooling capacity fan speed changes.
nciCoolKp	5 to 160 %	40 %	Hydronic cooling valve PI control loop proportional gain setting.
nciCoolKi	0 to 1200 Sec	30 s	Hydronic cooling valve PI control loop integral setting.
nciCoolDB	3 to 100 %	3 %	Hydronic cooling valve actuator positioning deadband.
nciCoolVlvStroke	15 to 600 Sec	180 s	Hydronic cooling valve actuator full travel time.
Economizer Cooling Control			
nciDaSptKp	5 to 160 %	40 %	Discharge air temperature setpoint PI control loop proportional gain setting.
nciDaSptKi	0 to 1200 Sec	20 s	Discharge air temperature setpoint PI control loop integral setting.
nciMaxDaSpt	50 to 80 °F	75 °F	Economizer PI control block setpoint maximum value when the discharge air PI control loop output is at 0%.
nciMinDaSpt	50 to 80 °F	55 °F	Economizer PI control block setpoint minimum value when the discharge air PI control loop output is at 100%.
nciEconOaEnDiff	1 to 12 °F	2 °F	Outdoor air temperature must be colder than the room temperature at least by this amount for Economizer cooling to be allowed.
nciEconOaEnSpt	40 to 80 °F	50 °F	Outdoor air temperature must be above this setpoint to allow Economizer cooling.
nciEconKp	5 to 160 %	90 %	Economizer positioning PI control loop proportional gain setting.
nciEconKi	0 to 1200 Sec	10 s	Economizer positioning PI control loop integral setting.
nciEconDB	3 to 100 %	3 %	Economizer actuator positioning deadband setting.
nciEconStroke	15 to 600 Sec	66 s	Economizer actuator full travel time.
nciEconLowMin	0 to 100 %	10 %	Economizer minimum position when the fan is operating at low speed.
nciEconMedMin	0 to 100 %	10 %	Economizer minimum position when the fan is operating at medium speed.
nciEconHighMin	0 to 100 %	10 %	Economizer minimum position when the fan is operating at high speed.

Note: Reference the ED15135 protocol information document for more details on configuration properties and other network variables.

Operating Modes

Start-up

The unit will not operate until all the inputs and safety controls are checked for normal conditions.

General Sequences of Operation

Fan Operation

The Table 12 describes fan operation in the various controller modes. Fan operation depends on the occupied/unoccupied status of the controller, the position of the room sensor mounted (or unit mounted) fan speed switch, and the capacity requested from the control algorithm.

Table 12: Fan Mode

Fan Mode	Occupied	Unoccupied
Off	Off	Off
Low	Low speed, continuous operation	Fan runs on low speed when heating or cooling capacity is required. Fan is off otherwise.
Medium	Medium speed, continuous operation	Fan runs on medium speed when heating or cooling capacity is required. Fan is off otherwise.
High	High speed, continuous operation	Fan runs on high speed when heating or cooling capacity is required. Fan is off otherwise.
Auto – Continuous	Fan runs continuously on low, medium or high depending on capacity required.	Fan runs on high speed when heating or cooling capacity is required. Fan is off otherwise.
Auto – Cycling	When no capacity is required, fan is off and damper is closed. When capacity is required, fan runs on low, medium or high depending on capacity required.	Fan runs on high speed when heating or cooling capacity is required. Fan is off otherwise.

Occupied/Unoccupied Operation

The occupied/unoccupied operation of the unit is either controlled from the occupied/unoccupied binary input or over the communications network. When in the occupied mode, the controller will control to the occupied heating and cooling setpoints. In the unoccupied mode, unoccupied heating and cooling setpoints will be used. Fan operation is as described above. Heating and cooling operation will not be enabled until the fan is running. When the occupied/unoccupied state of the controller is being controlled over the communications interface, the local binary input will be ignored.

Occupied Capacity Control

Occupied Operation

The board will be in Occupied mode if the unoccupied terminal (BI2) is not shorted to ground. Heating and cooling will not operate until the fan is running.

Cooling

If the room temperature is above the Occupied Cooling On Setpoint in the fan Auto Cycling mode, the fan will start before the cooling state is entered. After the fan is on, the cooling valve will open (two position valves) or a proportional-integral control algorithm will modulate the cooling valve open in an attempt to maintain the room temperature.

If the temperature remains above the Occupied Cooling On Setpoint for longer than a cooling stage time when the cooling valve is full open and the fan is on Low speed (auto fan mode), the fan will stage to Medium speed in an attempt to satisfy the load. If the temperature remains above the Occupied Cooling On Setpoint for longer than a cooling stage time when the cooling valve is full open and the fan is on Medium speed (auto fan mode), the fan will stage to High speed in an attempt to satisfy the load.

If the temperature is below the Cooling On Setpoint and the cooling Interstage timer has expired, the fan will stage from High to Medium speed. If the temperature is below the Cooling On Setpoint and the cooling Interstage timer has expired, the fan will stage from Medium to Low speed. If the temperature remains below the Cooling Off Setpoint for longer than the cooling stage time and the fan is at its lowest fan speed , cooling valve will close and the unit will enter the “Fan Only” state. When the Fan Minimum On timer has expired, the fan will turn off if fan cycling is enabled.

Heating

If the room temperature is below the Occupied Heating On Setpoint in the fan auto cycling mode, the fan will start before the heating state is entered. After the fan is on, the heating valve will open (two position valves), the electric heat will be enabled, or a proportional-integral control algorithm will modulate the heating valve open in an attempt to maintain the room temperature.

If the temperature remains below the Occupied Heating On Setpoint for longer than a heating stage time when the heating valve is full open and the fan is on Low speed (auto fan mode), the fan will stage to Medium speed in an attempt to satisfy the load. If the temperature remains below the Occupied Heating On Setpoint for longer than a heating stage time when the heating valve is full open and the fan is on Medium speed (auto fan mode), the fan will stage to High speed in an attempt to satisfy the load.

If the temperature is above the Heating On Setpoint and the heating Interstage timer has expired, the fan will stage from High to Medium speed. If the temperature is above the Heating On setpoint and the heating Interstage timer has expired, the fan will stage from Medium to Low speed. If the temperature remains above the Heating Off Setpoint for longer than the heating stage time and the fan is at its lowest fan speed the heating valve will close, electric heat will shut off, and the unit will enter the Fan Only state. When the Fan Minimum On and the Fan On After Electric Heat timers have expired, the fan will turn off if fan cycling is enabled.

Unoccupied Capacity Control

Cooling

When the room temperature rises above the Unoccupied Cooling On Setpoint, the fan will start in High speed and the cooling valve will fully open in an attempt to maintain room temperature. When the temperature is satisfied (temperature drops below the Unoccupied Cooling On Setpoint minus the unoccupied differential) and the cooling Interstage timer has expired, the valve will first close and then the fan will shut off.

Heating

When the room temperature falls below the Unoccupied Heating On Setpoint, the fan will start in High speed and the heating valve will fully open (or the electric heat will be enabled) in an attempt to maintain room temperature. When the temperature is satisfied (temperature rises above the Unoccupied Heating On Setpoint plus the unoccupied differential) and the heating Interstage timer has expired, the valve will first close, electric heat will shut off and then the fan will shut off.

Dehumidification Operation [future option]

This fan coil state is allowed for: 2-Pipe in Cooling only or 4-Pipe Modulating Heating & Cooling systems; and controller must be in the occupied or bypass mode. Modulating Cooling valve is fully open. Electric heat is off. Fresh Air Damper (if available) is open. Economizer, if available, will be fully open, otherwise at minimum position based on fan speed.

2-Pipe Cooling Only System:

- Fan is on at lowest available speed.
- Heating valve is non-existent.
- Dehumidification is only allowed when the effective space temperature is greater than the effective heating on setpoint, and becomes disabled when space temperature drops below the effective heating on setpoint minus a 2°F fixed differential.

4-Pipe Modulating Heating & Cooling System:

- Fan is on at speed determined by capacity and effective fan mode/speed.
- Heating valve is controlled.

General Operation

Unit status will change to the “Fan Only” state if all of the following conditions exist:

- Dehumidification isn’t required or is not available, heating or cooling capacity becomes required.
- The cooling valve has been driven closed.
- The 4-pipe system heating valve has been driven closed.
- Fan is running at the lowest possible speed based on: selected occupancy and fan mode/speed switch setting.

Dehumid State Notes

- For dehumidification availability definition, see “Miscellaneous Control Definitions section”.
- When leaving “Dehumid” state, the 180 second fixed “dehumidification minimum off” timer will be started. This prevents returning back to the “Dehumid” state too soon.

Total Electric Heat mode (2-pipe Cooling systems only)

On an initial call for heating:

1. The fan will start at Low speed in “Fan Only” state
2. Unit enters Heating state, electric heat is energized, and heating Interstage timer is started
3. If Heating Interstage Countdown Timer has expired and room temperature is below the Heating On Setpoint, fan speed will be changed from Low to Medium, and Heating Interstage Countdown Timer is started again.
4. If Heating Interstage Countdown Timer has expired and room temperature is below the Heating On Setpoint, fan speed will be changed from Medium to High, and Heating Interstage Countdown Timer is started again.

Once room temperature reaches the Heating On Setpoint the fan will be run at Medium and Low speed with Interstage Countdown Timer started each time the fan speed is changed. When the room setpoint conditions are satisfied, electric heat will be de-energized and the fan will continue to operate at its “fan only” setting when enabled, for continuous fan operation. If fan cycling is enabled, the fan will turn off after 30 seconds once room setpoint conditions are satisfied.

Supplemental (Intermediate) Electric Heat mode [for 2-pipe Cooling/Heating systems only]

On an initial call for heating, the controller will open the water valve for Flow Timer" to check for appropriate entering water temperature. Once the water valve is 100% open, a 120-second (default setting) flow timer will start and flow allowed. When timer has expired and if water temperature is colder than required for hydronic heating the control valve will fully closed, fan started and electric heater energized. The rest of the operation will run as described in paragraph Total Electric heat above exclusively using electric heat (EWT is not sampled for systems with Total Electric Heat).

Proportional–Integral Control Parameters

Associated with each Proportional-Integral (PI) control loop are three adjustable parameters: Proportional Gain (Kp), Integral Time (Ki), and Deadband (DB). When the fan coil unit (FCU) is properly sized for the space, the factory settings for these parameters will provide the best control action for all the various operating scenarios.

PI Control Algorithm

The PI control algorithm calculates the desired actuator output, and ranges from 0 to 100%.

Definitions:

- Error: Value is calculated one of two ways depending on the PI blocks fixed action type.

  Direct Acting Block: Error = (PV – SP)

  Reverse Acting Block: Error = (SP – PV)
- Process Variable (PV): Measured analog input reading.
- Sample Time: Scan rate of the PI control blocks, which is an internal fixed value of 10 seconds.
- Sum of Errors: Summation, or total, of all past errors.

Output Formula:

PI Output = (Kp × Error) + ((Sample Time × Sum of Past Errors) / Ki)

If field problems arise, first ensure these parameters are set back to the factory default settings. If adjustment is required, only make small adjustments to one parameter at a time. After each adjustment, induce an instantaneous error into the PI algorithm and allow enough time for the system to stabilize before making any further modifications. If you do not have the means to graph the process variable performance, record the actual measured value and set point for the duration of the test and then plot the results using a spreadsheet to determine the correct action to take.

⚠ CAUTION

Adjusting PI parameters can cause erratic unit operation, and potentially damage the equipment.

PI control parameters must only be adjusted by trained personnel having a complete understanding of how these parameters affect system operation. Generally these parameters do not need to be adjusted from the factory settings.

Proportional Gain

The proportional gain, or proportional action, causes the controlled output to change in proportion to the magnitude of the present error amount. Error is the difference between the sensors present value and the set point. When the Kp setting is too low, the process variable (PV) response will change too slowly. When the Kp setting is too high, the process variable response will excessively overshoot and possibly oscillate around the setpoint (SP). If faster system response is desired increase the proportional gain (Kp) setting. Use caution not to become too aggressive with the proportional gain setting to avoid causing system instability.

Integral Time

The integral time, or integral action, accumulates the error amounts and causes the controlled output to approach the set point over time in an attempt to eliminate any system offset. The smaller the integral (Ki) setting, the more the integral will affect the process under control. When the Ki setting is too low, the process variable (PV) will oscillate around the setpoint. When the Ki setting is too high, the process variable will never reach the setpoint.

Deadband

The deadband parameter serves two main purposes. First deadband prevents the actuator from constantly hunting or overcorrecting, and secondly ensures the actuator physically moves every time a new positioning command is given. Deadband will prevent small output changes from modifying the actuator position. When the deadband configuration property is set to 3%, the PI control output adjustment must exceed plus or minus 1.5%, or the actuator position will not be changed.

PI Control Blocks

The fan coil unit contains four PI control loop blocks. The PI control blocks are defined as follows:

1. Modulating Hydronic Heating Valve
2. Modulating Hydronic Cooling Valve
3. Economizer Discharge Air Temperature (DAT) Setpoint
4. Economizer Position

The following is a brief summary of the fan coil PI control blocks and their associated support functions. Applicable LonWorks network variables are listed first, along with their BACnet equivalent objects. Refer to the ED15135 protocol information document for more details pertaining to the fan coil network variables.

Table 13: PI Control Block #1 – Modulating Hydronic Heating Valve Control

Inputs / Outputs	Interpretation
Polarity Type: Reverse Acting (Not Adjustable)	Error is defined as: (Effective Heat SP minus Room Temp)
SP: Effective Heating Setpoint	The desired heating setpoint input.
PV: nvoSpaceTemp (AV-22)	Room temperature is used as the process variable input.
KP: nciHeatKp (Loop1:Proportional_ Constant)	Proportional gain used in the PI control algorithm.
KI: nciHeatKi (Loop1:Integral_ Constant)	Integral time used in the PI control algorithm.
Output: nvoHeatVlvOut (Loop1:Present_Value)	Heating valve position output command.
DB: nciHeatDB (AV-29)	Deadband used to determine if the PI output is applied to the heating valve positioning control.

Table 14: PI Control Block #2 – Modulating Hydronic Cooling Valve Control

Inputs / Outputs	Interpretation
Polarity Type: Direct Acting (Not Adjustable)	Error is defined as: (Room Temp minus Effective Cool SP)
SP: Effective Cooling Setpoint	The desired cooling setpoint input.
PV: nvoSpaceTemp (AV-22)	Room temperature is used as the process variable input.
KP: nciCoolKp (Loop2:Proportional_ Constant)	Proportional gain used in the PI control algorithm.
KI: nciCoolKi (Loop2:Integral_ Constant)	Integral time used in the PI control algorithm.
Output: nvoCoolVlvOut (Loop2:Present_Value)	Cooling valve position output command.
DB: nciCoolDB (AV-9)	Deadband used to determine if the PI output is applied to the cooling valve positioning control.

Table 15: PI Control Block #3 – Economizer Discharge Air Setpoint Control

Inputs / Outputs	Interpretation
Polarity Type: Direct Acting (Not Adjustable)	Error is defined as: (Room Temp minus Effective Cool SP)
SP: Effective Cooling Setpoint	The desired cooling setpoint input.
PV: nvoSpaceTemp (AV-22)	Room temperature is used as the process variable input.
KP: nciDASptKp (Loop3:Proportional_ Constant)	Proportional gain used in the PI control algorithm.
KI: nciDASptKi (Loop3:Integral_ Constant)	Integral time used in the PI control algorithm.
Output: nvoDASptOut (Loop3:Present_Value)	Economizer position output command.
Translator: nciMaxDaSpt (AV-11)	Translated DA temperature SP that is sent to PI block #4 when the PI output is at 0%.
Translator: nciMinDaSpt (AV-12)	Translated DA temperature SP that is sent to PI block #4 when the PI output is at 100%.

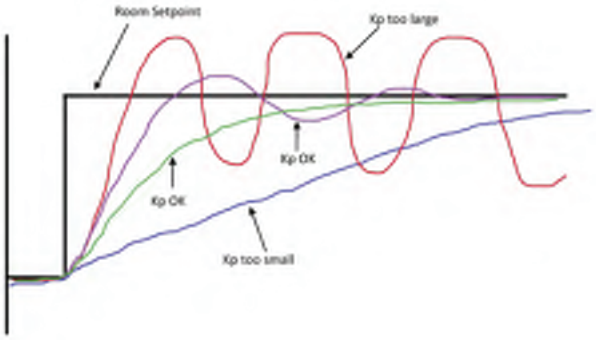
Table 16: PI Control Block #4 – Economizer Position Control

Inputs / Outputs	Interpretation
Polarity Type: Direct Acting (Not Adjustable)	Error is defined as: (DAT minus Discharge Air SP)
SP: Discharge Air SP from PI Control Block #3 Output	The desired DAT setpoint input. The PI block #3 output is translated into a discharge air temperature SP value.
PV: nvoDischAirTemp (AI-4)	Discharge air temperature is used as the process variable input.
KP: nciDASptKp (Loop4:Proportional_ Constant)	Proportional gain used in the PI control algorithm.
KI: nciDASptKi (Loop4:Integral_ Constant)	Integral time used in the PI control algorithm.
Output: nvoEconOut (Loop4:Present_ Value)	Economizer position output command.
DB: nciEconDB (AV-18)	Deadband used to determine if the PI output is applied to the Economizer positioning control.

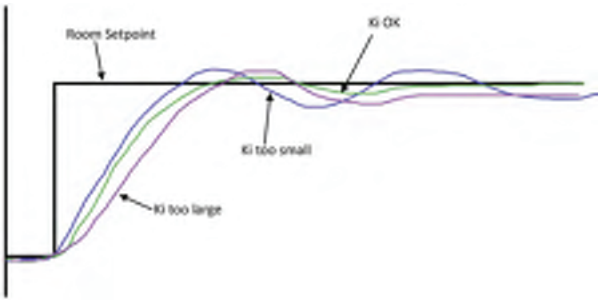
Tuning the PI Blocks

If the temperature control behavior of the FCU is poor, it may be necessary to tune the PI control blocks of the cooling valve, heating valve, or economizer position. When tuning the control blocks, it is highly recommended that you follow the below procedure. Failure to do so may result in increased tuning time, and sub-par performance.

1. Zero out the Ki setting.
2. Choose a starting point for Kp
3. Introduce a step change to the room setpoint.
4. Observe FCU performance and temperature control
5. Adjust Kp based on the following graph:



6. Repeat steps 3-5 until the temperature control matches the acceptable Kp behavior in the above graph. Behavior should be somewhere between the two “Kp OK” system responses detailed above. Please note that there may be an offset error after the Kp value is tuned. This is OK, as the Ki variable will eliminate the offset error.
7. While keeping Kp constant, choose a starting value for Ki
8. Introduce a step change to the room setpoint.
9. Observe FCU performance and temperature control
10. Adjust Ki based on the following graph::



11. Repeat steps 8-10 until the FCU temperature control is acceptable. There should be no offset error and no temperature oscillations when the loops are fully and correctly tuned.

NOTE: The PI blocks controlling the economizer behavior (PI Control Block #3 & PI Control Block #4) are used in a ‘cascade’ arrangement, meaning the output of block #3 directly affects the behavior and output of block #4. If changes to the behavior of these blocks are needed, then both blocks should be tuned, to avoid negatively affecting the performance by just changing one of the control blocks. Block # 4 should be tuned first, followed by block #3. In addition, the PI control for the economizer behavior may be affected by the minimum damper position, or the minimum or maximum setpoint outputs (nciMaxDaSpt (AV-11) and nciMinDaSpt (AV-12)). If erratic temperature control behavior is exhibited, it should be investigated whether the PI block or these other settings are negatively affecting the performance.

Alarm Control Modes

- **Display Only:** Full control is maintained, alarm is for display purposes only.
- **Modified:** Normal unit control is slightly modified by this type of alarm.
- **Shutdown #1:** Fan & electric heat immediately turned off; damper & economizer closed; valves are unchanged.
- **Shutdown #2:** Fan & electric heat immediately turned off; damper & economizer closed; all valve types closed.
- **Shutdown #3:** Fan & electric heat immediately turned off; damper & economizer closed; previous control mode valve type is opened.

Table 17: Alarm Control & Reset Table

Room Sensor LED Pulses	Alarm Definition	Control Type	Auto Recover	Tenant Override Button Reset	Remote Clear Alarm
2	Invalid Equipment Configuration	Shutdown #1	No	No	No
3	Emergency Shutdown	Shutdown #2	Yes	No	No
4	Freeze Fault Detection	Shutdown #3	No	Yes	Yes
5	Entering Water Temp Sensor Fail (EWT Sampling Systems)	Shutdown #2	No	No	Yes
6	Room Temp Sensor Fail	Shutdown #2	No	No	Yes
7	IO Expansion Communications Fail (IO Exp Board Selected)	Shutdown #2	Yes	No	No
8	Condensate Overflow (Econ, Cool, & Dehumid Modes Only) (Fixed 60s Delay)	Shutdown #2	Yes[1]	No	Yes
9	Outdoor Air Temp Sensor Fail (Economizer Selected)	Modified: Disable Economizer	No	No	Yes
10	Discharge Air Temp Sensor Fail (Economizer Selected)	Modified: Disable Economizer	No	No	Yes
11	Dirty Air Filter (currently based on settable timer)[2]	Display Only	No	Yes	Yes
12	Serial EEPROM Corrupted	Display Only	No	No	No

1) Auto recover is subject to intelligent alarm reset

2) Timer is user-adjustable through network. Setting timer to 0 (zero) disables the alarm. Refer to ED 15135 for more details Alarm conditions are listed in order of priority.

Heating Capacity Required

Heating capacity is considered “required” when Effective Space Temperature (nvoSpaceTemp) goes below calculated effective heating on setpoint; then becomes “not required” when the temperature goes above calculated effective heating off setpoint.

Cooling Capacity Required

Cooling capacity is considered “required” when Effective Space Temperature (nvoSpaceTemp) goes above calculated effective cooling on setpoint; then becomes “not required” when the temperature goes below calculated effective cooling off setpoint. Economizer state, if available, has priority over cooling state.

Dehumidification Required

Dehumidification is considered “required” when the humidistat binary input is active, and no heating or cooling capacities are required. Also in 2-Pipe cooling only systems, the effective space temperature (nvoSpaceTemp) must be greater than the effective heating on setpoint for dehumidification to be allowed

Fan Availability

Fan is considered available if all of the following conditions exist:

- Equipment configuration software jumper (nciSoftJumpers) has selected a valid fan speed type.
- Remote application mode (nviApplicMode) is not set to “Off”.
- Local hardwired fan mode/speed switch (nvoFanModeSpdSw) is not set to “Off”.
- The “fan minimum off” timer has expired.

Dehumidification Availability

Dehumidification is considered available if all of the following conditions exist:

- Equipment configuration software jumper (nciSoftJumpers) states that a 2-Pipe hydronic cooling only without electric heat; or 4-Pipe hydronic modulating heating and cooling system is selected in the fan coil unit.
- For 2-Pipe Cooling only systems the Effective Space Temperature (nvoSpaceTemp) must be above the Effective Heating On setpoint.
- Remote application mode (nviApplicMode) is set to “Auto”, “Dehumid”, or “Null”.
- Local Heat/Cool/Auto mode switch (nvoHeatCoolAuto) is set to “Auto” or “Cool”.
- I/O expansion board communications is not failed.
- Effective occupancy (nvoEffectOccup) is occupied or bypass mode.
- The fixed “dehumidification minimum off” timer has expired.
- Condensate overflow alarm is not active.

Economizer Availability

Economizer is considered available if all of the following conditions exist:

- Equipment configuration software jumper (nciSoftJumpers) states economizer is present in the fan coil unit.
- Remote application mode (nviApplicMode) is set to “Auto”, “Economy”, or “Null”.
- Local Heat/Cool/Auto mode switch (nvoHeatCoolAuto) is set to “Auto” or “Cool”.
- Effective occupancy (nvoEffectOccup) is occupied or bypass mode.
- Difference between indoor and outdoor air temperature is greater than economizer indoor to outdoor air control enable differential (nciEconIOAEnDiff) setting for ability to cool. Prevents using outdoor air that’s too hot.
- Outdoor air temperature is greater than economizer outdoor air temperature control enable (nciEconOAEn) setting. Prevents using outdoor air that’s too cold.
- I/O expansion board communications failure alarm is not active.
- Condensate overflow alarm is not active.
- Outdoor air temperature sensor failure alarm is not active.
- Discharge air temperature sensor failure alarm is not active.

Electric Heating Availability

Electric heating is considered available if all of the following conditions exist:

- Equipment configuration software jumper (nciSoftJumpers) states electric heating is selected in the fan coil unit.
- Remote application mode (nviApplicMode) is set to “Auto”, “Heat”, or “Null”.
- Local Heat/Cool/Auto mode switch (nvoHeatCoolAuto) is set to “Auto” or “Heat”.

Hydronic Heating Availability

Hydronic heating is considered available if all of the following conditions exist:

- Equipment configuration software jumper (nciSoftJumpers) states hydronic heating is selected in the fan coil unit.
- Remote application mode (nviApplicMode) is set to “Auto”, “Heat”, or “Null”.
- Local Heat/Cool/Auto mode switch (nvoHeatCoolAuto) is set to “Auto” or “Heat”.

Hydronic Cooling Availability

Hydronic cooling is considered available if all of the following conditions exist:

- Equipment configuration software jumper (nciSoftJumpers) states hydronic cooling is selected in the fan coil unit.
- Remote application mode (nviApplicMode) is set to “Auto”, “Cool”, or “Null”.
- Local Heat/Cool/Auto mode switch (nvoHeatCoolAuto) is set to “Auto” or “Cool”.
- Condensate overflow alarm is not active.

Replacing a MicroTech Circuit Board

⚠ WARNING

The MicroTech circuit board incorporates static sensitive de-vices. A static charge from touching the device can damage the electronic components. To help prevent damage during service, use static discharge wrist straps. Static discharge wrist straps are grounded to the fan coil chassis through a 1 MOhm resistor.

Replacement part is shipped from Daikin with correct configuration preset at the factory.

1. Connect grounding wrist strap to unit.
2. Remove faulty board and place on static protected surface.
3. Remove replacement board from static protected bag.

Do not touch circuit board; hold by edges.

4. Holding board in grounded hand, install board in unit.
5. Insert faulty board in empty static bag for return.

NOTE: The new board needs to have correct equipment configuration performed at the factory otherwise it will not operate properly. Contact Daikin factory representative for directions.

Equipment Configuration Settings

Configuration property variable are used to determine the equipment configuration; which are read from the serial EEPROM when the controller initially boots. The FCU control option bits are then initialized based on the “nciSoftJumpers” values read from the serial EEPROM. The controller must be rebooted after modifying the software configuration settings before they will be used in controlling the FCU. Setting is considered: open when bit is zero, and closed when bit is one.

Table 18: Equipment Configuration Setting Options

Function	Bit/Binary Setting	Model/Feature
Service Test Mode	Byte 1: b0	0 = Normal Operation 1 = Service Test Mode
Continuous/Cycling Fan	Byte 1: b1	0 = Continuous Fan 1 = Cycling Fan
Setpoint Adjust – Temperature Range	Byte 1: b2	0 = Short Range (-5 to +5 °F) 1 = Long Range (55 to 95 °F)
IO Expansion Board Selection	Byte 1: b3	0 = No IO Expansion Board Present 1 = Enable IO Expansion Board
Economizer Selection	Byte 1: b4	0 = No Economizer Present 1 = Enable Economizer Use
N.O./N.C. Two Position Heating Valve	Byte 1: b5	0 = Normally Open Heating Valve 1 = Normally Closed Heating Valve
N.O./N.C. Two Position Cooling Valve	Byte 1: b6	0 = Normally Open Cooling Valve 1 = Normally Closed Cooling Valve
Two Position/Modulating Valves	Byte 1: b7	0 = Two position Hydronic Valves 1 = Modulating Hydronic Valves
Electric Heat Selection	Byte 2: b1=0, b0=0 Byte 2: b1=0, b0=1 Byte 2: b1=1, b0=0	00 = No Electric Heating 01 = One Stage Electric Heat 10 = Two Stage Electric Heat (Future) 11 = Not Valid
Hydronic Valves Selection	Byte 2: b4=0, b3=0, b2=0 Byte 2: b4=0, b3=0, b2=1 Byte 2: b4=0, b3=1, b2=0 Byte 2: b4=0, b3=1, b2=1 Byte 2: b4=1, b3=0, b2=0	000 = No Hydronic Valves 001 = 2-Pipe Heating Only 010 = 2-Pipe Cooling Only 011 = 2-Pipe Heat & Cool Changeover 100 = 4-Pipe Hydronic Heat & Cool
Fan Speed Selection	Byte 2: b6=0, b5=0 Byte 2: b6=0, b5=1 Byte 2: b6=1, b5=0	00 = 1Speed (Uses: High) 01 = 2Speed (Uses: Low, High) 10 = 3Speed (Uses: Low, Med, High)
Freeze Fault Detect Binary Input Selection	Byte 2: b7	0 = Disable Binary Input 1 = Enable Binary Input
Emergency Shutdown Binary Input Selection	Byte 3: b0	0 = Disable Binary Input 1 = Enable Binary Input
Dirty Air Filter* Binary Input Selection	Byte 3: b1	0 = Disable Binary Input 1 = Enable Binary Input
*Currently functions based on user-adjustable timer		

MicroTech Unit Controller with an optional LONWORKS® Communication Module

For installation and operation information on LONWORKS Communication Module and other ancillary control components, see:

- IM 1012 — MicroTech III Fan Coil LONWORKS Communication Module.
- IM 933 — LONMAKER Integration Plug-in Tool: For use with the MicroTech III Unit Controller.
- IM 1171 — Digitally Adjustable Display Sensor Installation and Maintenance Manual

Each Daikin ThinLine fan coil can be equipped with a LONWORKS communication module that is LONMARK 3.4 certified to meet the LONMARK Space Comfort Control (SCC) profile for fan coils. The controller is microprocessor-based and is designed to communicate over a LONWORKS network with the optional factory or field-installed communication module.

The unit controller is programmed and tested with all the logic required to monitor and control the unit. An optional wall sensor may be used with the communication module to provide limited local control of the Fan Coil or Cabinet Unit Heater unit. The unit controller monitors water and air temperatures and passes information to the communication module. The module communicates with the BAS to provide network control of the Fan Coil or Cabinet Unit Heater unit.

Figure 7: LONWORKS Communication Module



The MicroTech unit controller with communication module includes a unit-mounted discharge air and entering water temperature sensors. Entering air temperature can be monitored either by selecting either unit-mounted return air temperature or wall- mounted room temperature sensors. Room sensor options includes one with a setpoint adjustment, unit mode, fan speed, and tenant override. See actual sensor to make sure these options are present.

MicroTech Unit Controller with LONWORKS Communication Module orchestrates the following unit operations:

- Enable heating and cooling to maintain setpoint based on a room sensor
- Monitors all equipment protection controls
- Monitors room and discharge air temperatures
- Monitors outside air temperature for units with economizer option
- Relays status of all vital unit functions

The MicroTech unit controller with an optional communication module should include:

- Return Air Temperature sensor (RAT) (factory- or field-mounted)
- Discharge Air Temperature sensor (DAT) (factory- or field-mounted)
- Entering Water Temperature sensor (EWT) (factory- or field-mounted)

NOTE: Refer to IM 956 for details to install (RAT) & (DAT)

⚠ WARNING

When an optional wall-mounted room temperature sensor is connected to the unit controller, the Return Air Temperature (RAT) sensor must not be installed. A wall-mounted room temperature sensor and the return air temperature sensor must not be connected simultaneously or the unit will not operate properly.

The communication module provides access to setpoints for operational control

Available wall sensors include:

- Room sensor with LED status and tenant override button
- Room sensor with LCD display, fan speed selection switch, tenant override button, and ±5°F setpoint adjustment
- Room sensor with LCD display, fan speed selection switch, tenant override button, 55° to 95°F setpoint adjustment

MicroTech Unit Controller with an optional BACnet® Communication Module

For installation and operation information on MicroTech unit controller and other ancillary components, see:

- IM 1013 — MicroTech Fan Coil BACnet Communication Module
- IM 1171 — Digitally Adjustable Display Sensor Installation and Maintenance Manual

Daikin ThinLine fan coils and cabinet unit heaters are available with an optional BACnet MS/TP communication module that is designed to communicate over a BACnet MS/TP communications network to a building automation system (BAS). It can be factory or field-installed.

The module makes operational data and commands available on a communications network using BACnet objects and properties:

- The network cable is a shielded twisted-pair cable
- Network communications run up to 76.8 Kbps
- DIP switches on the controller enable the MS/TP MAC address to be set in the range 0-127
- Four green status LEDs on the communication module indicate communication activity on the MS/TP communication network and with the unit controller

Figure 8: MicroTech BACnet MS/TP Snap-in Communication Module



The unit controller is programmed and tested with all the logic required to monitor and control the unit. An optional wall sensor may be used with the communication module to provide limited local control of the fan coils and cabinet unit heater unit. Room sensor options include one with a setpoint adjustment, unit mode, fan speed, and tenant override. See actual sensor to make sure these options are present.

The unit controller monitors water and air temperatures and passes information to the communication module. The module communicates with the BAS, to provide network control of the fan coils and cabinet unit heater unit.

MicroTech Unit Controller with BACnet MS/TP Communication Module orchestrates the following unit operations:

- Enable heating and cooling to maintain setpoint based on a room sensor
- Monitors all equipment protection controls
- Monitors room and discharge air temperatures
- Monitors outside air temperature for units with economizer option
- Relays status of all vital unit functions

The MicroTech unit controller with an optional communication module should include:

- Return Air Temperature sensor (RAT) (factory- or field-mounted)
- Discharge Air Temperature sensor (DAT) (factory- or field-mounted)
- Entering Water Temperature sensor (EWT) (factory- or field-mounted)

NOTE: Refer to IM 956 for details to install (RAT) & (DAT)

⚠ WARNING

When an optional wall-mounted room temperature sensor is connected to the unit controller, the Return Air Temperature (RAT) sensor must not be installed. A wall-mounted room temperature sensor and the return air temperature sensor must not be connected simultaneously or the unit will not operate properly.

The communication module provides access to setpoints for operational control

Available wall sensors include:

- Room sensor with LED status and tenant override button
- Room sensor with LCD display, fan speed selection switch, tenant override button, and ±5°F setpoint adjustment
- Roomsensor with LCD display, fan speed selection switch, tenant override button, 55° to 95°F setpoint adjustment

Typical Wiring Diagrams

Figure 9: 1 PSC Motor, No Electric Heat, 2 Position Actuators, 2 Position Valves – Page 1

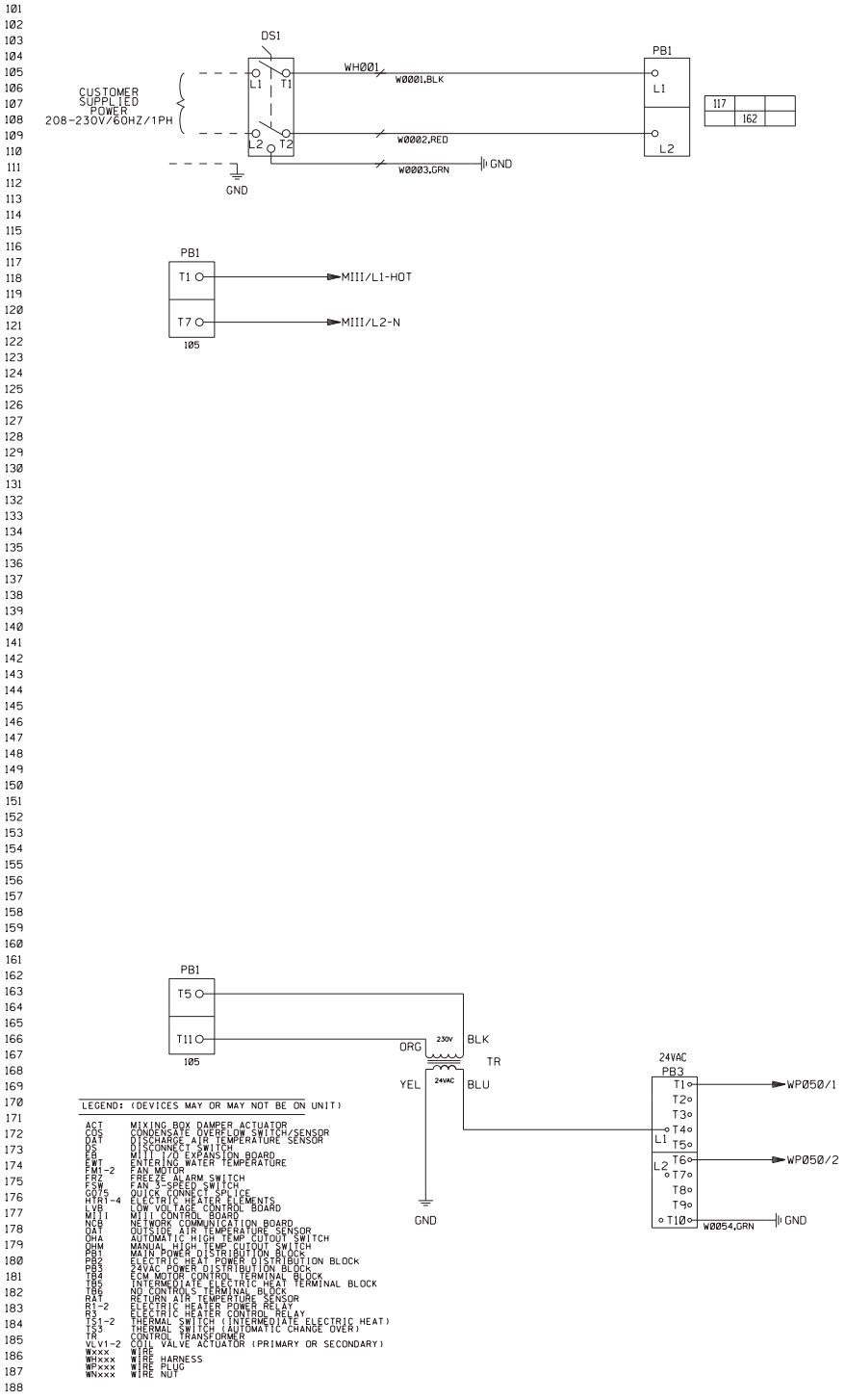


Figure 10: 1 PSC Motor, No Electric Heat, 2 Position Actuators, 2 Position Valves – Page 2

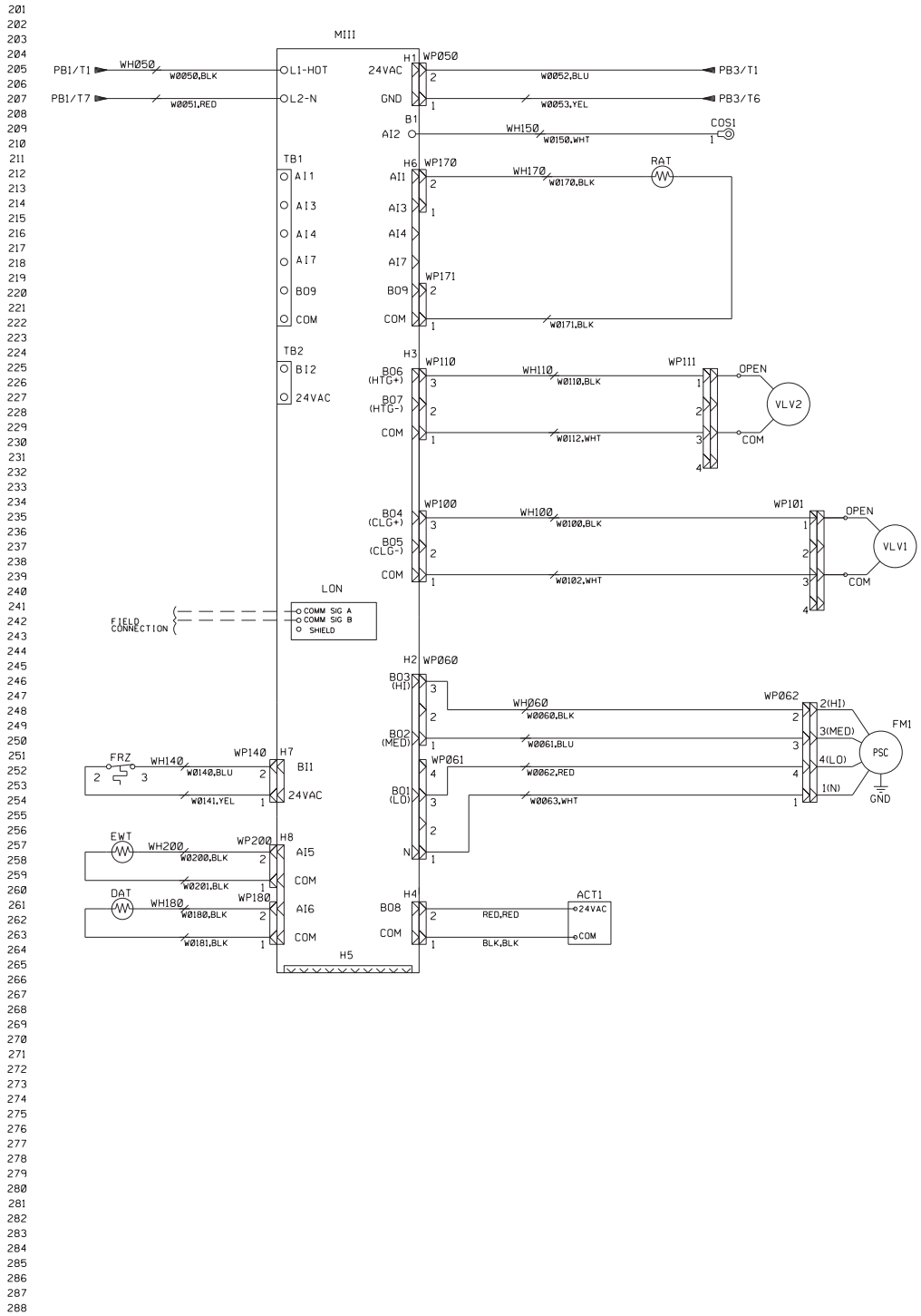


Figure 11: 1 PSC Motor, No Electric Heat, Valve1 FLT, No Return Air Temperature – Page 1

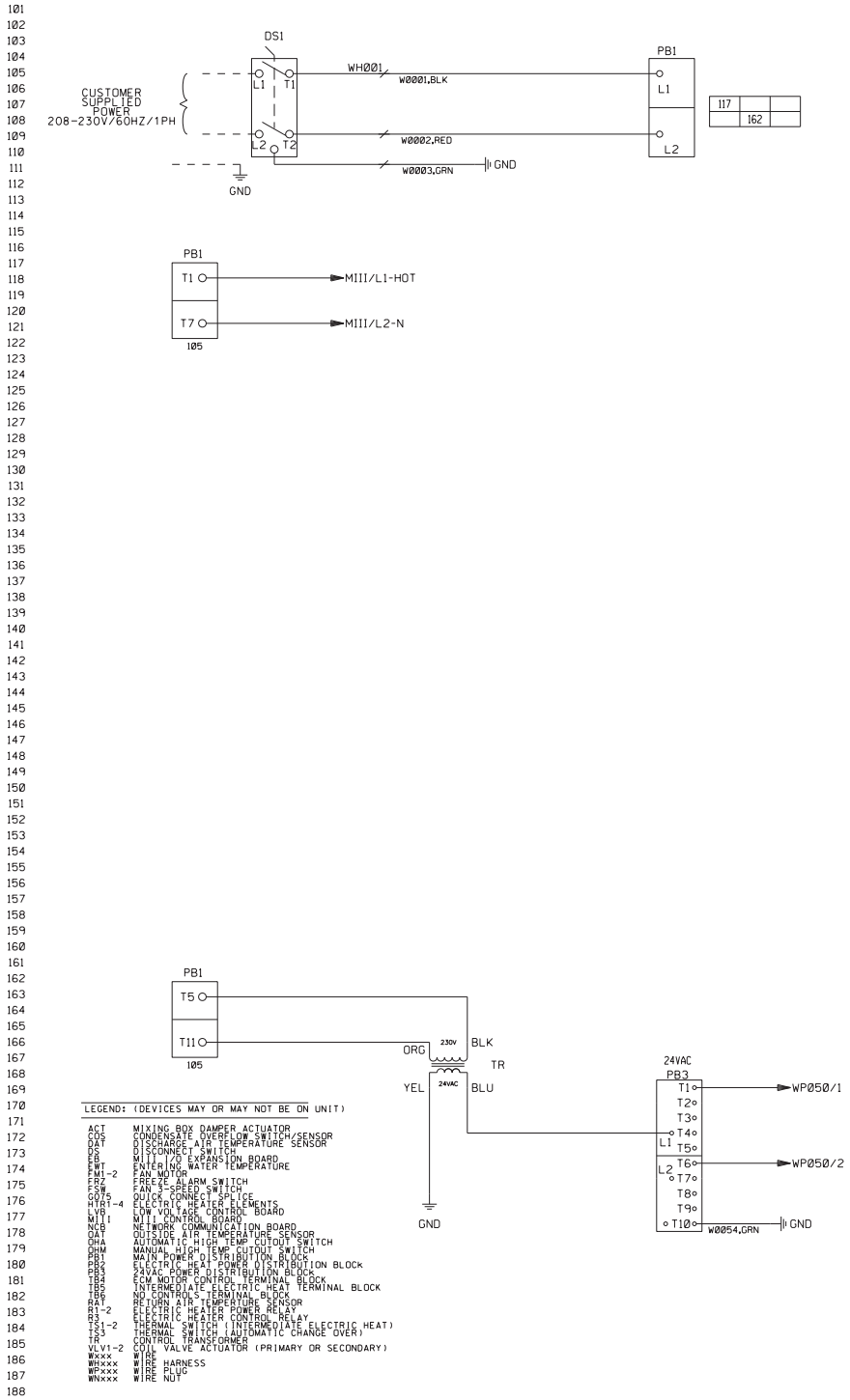


Figure 12: 1 PSC Motor, No Electric Heat, Valve1 FLT, No Return Air Temperature – Page 2

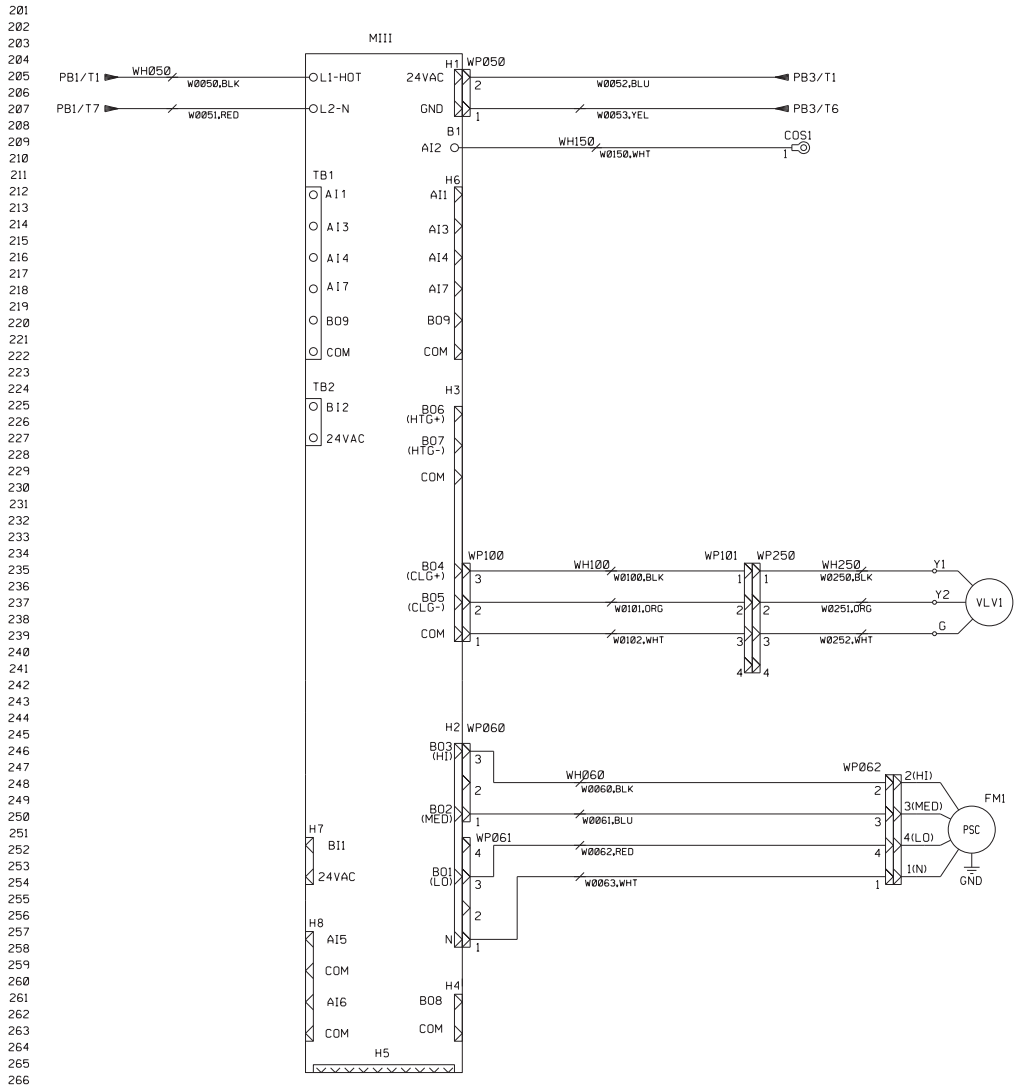


Figure 13: ECM Motor, Electric Heat, 230V, Economizer – Page 1

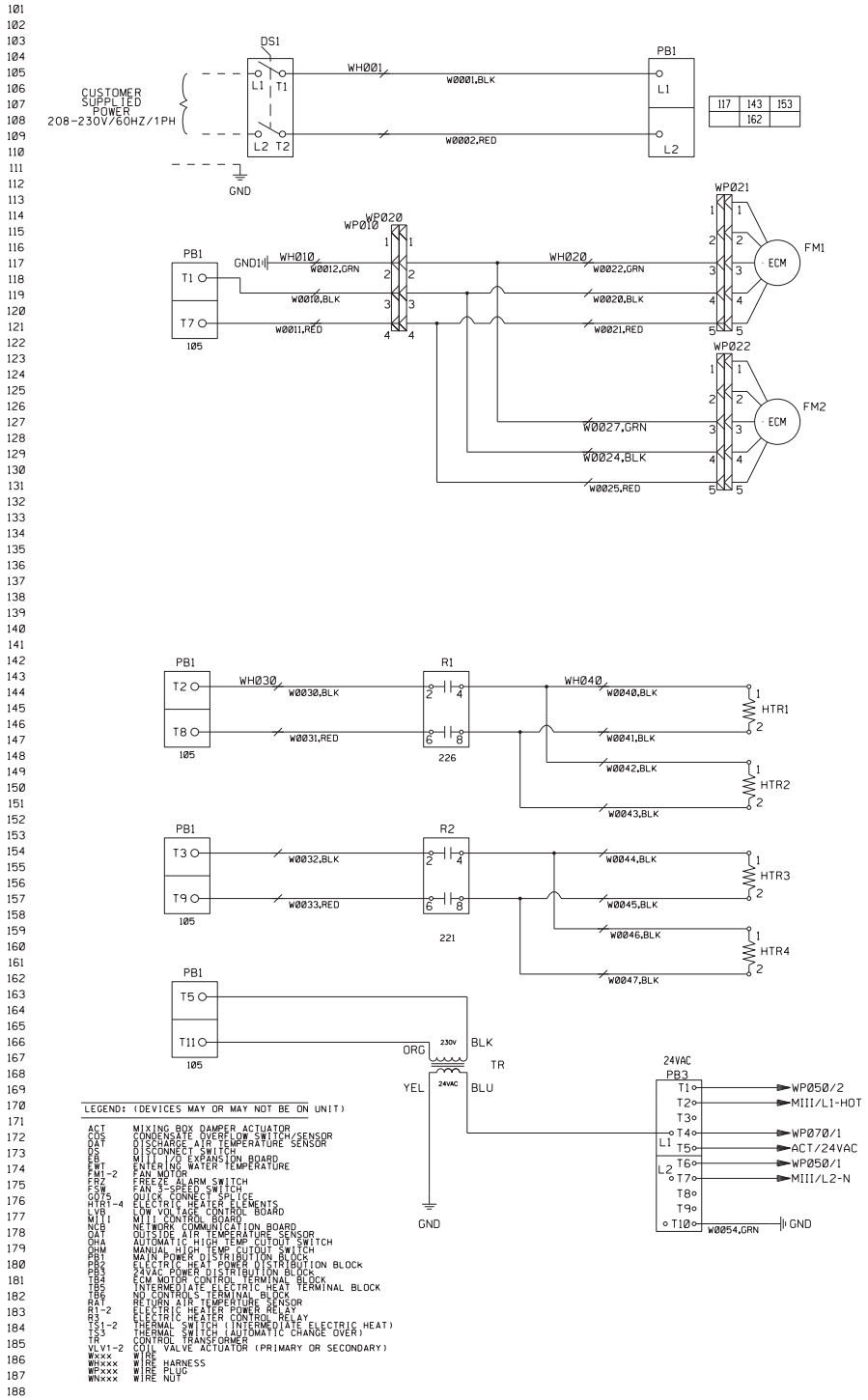
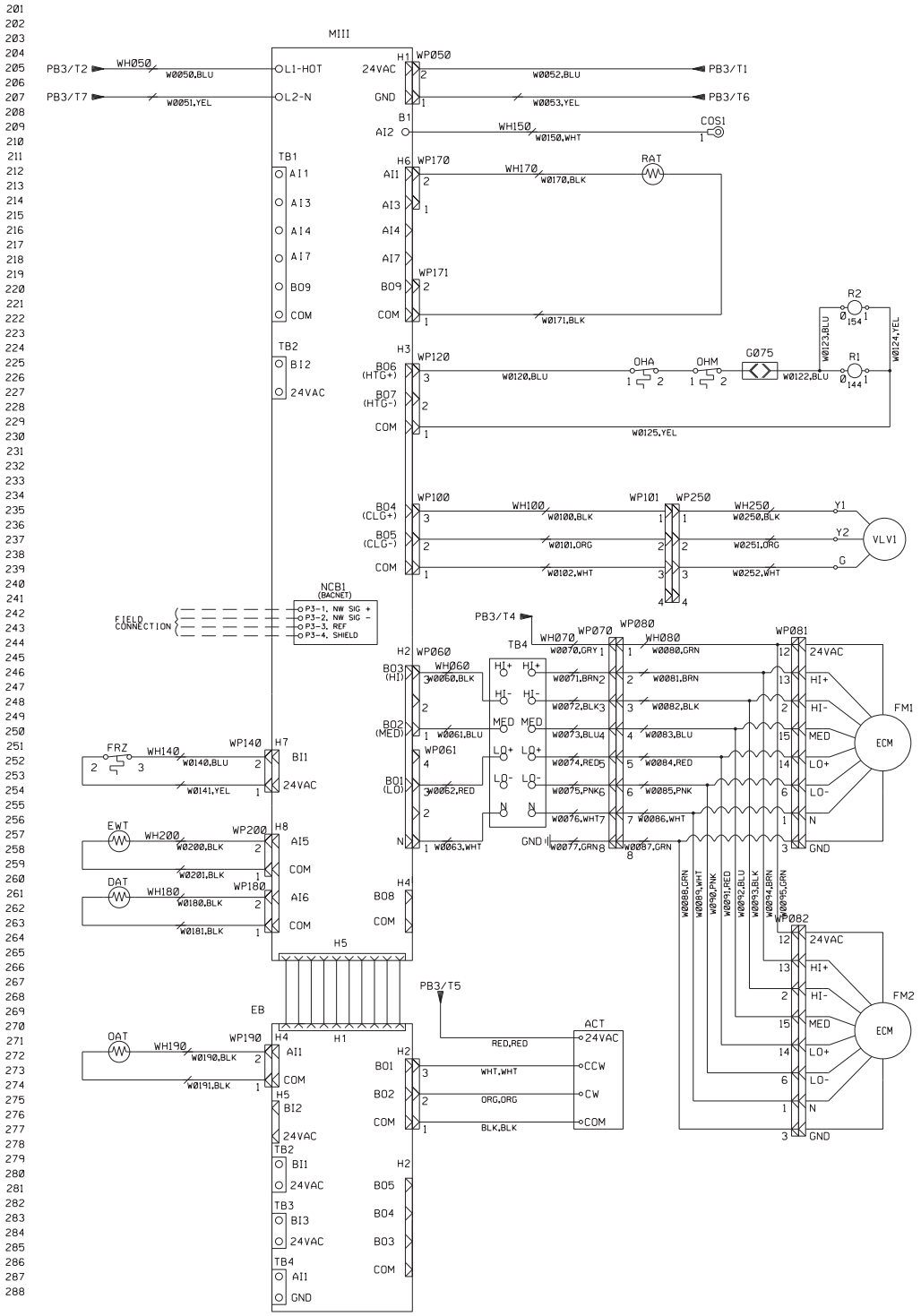


Figure 14: ECM Motor, Electric Heat, 230V, Economizer – Page 2



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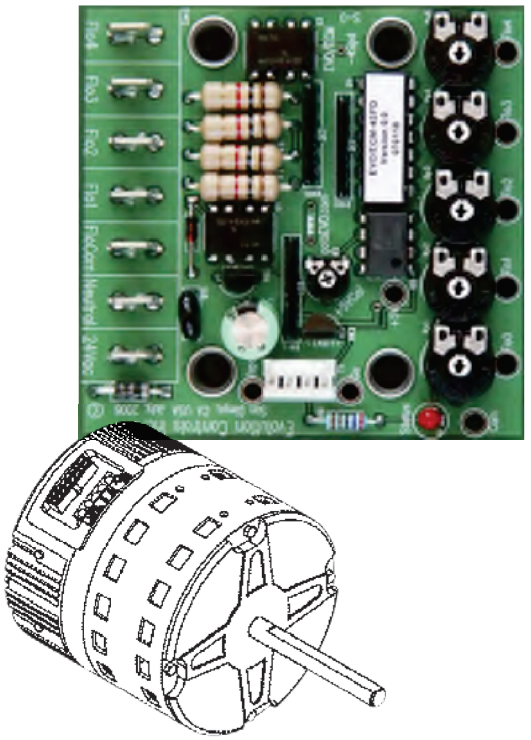
Sales and Engineering Data

ED 19059-2

Group: **Applied Air Systems**
Part Number: **ED 19059**
Date: **October 2015**

ThinLine and Large Cap Fan Coils

ECM Speed Adjustment Board (EVO Board)



Overview

The constant CFM ECM when wired to with the ECM speed adjustment board (EVO Board) allows the user the manually adjust the airflow for each of the three fan speeds by turning a dial. Each speed may be adjusted across the full RPM range of the motor and once set the new flow rate will then be maintained by the motor despite changes to the system static pressure. The CFM for each speed setting may be determined by measuring the airflow in the system or by measuring the DC voltage between the adjusted terminal and the reference point on the board. If desired, the motor may be used without speed adjustment by replacing the wire harness from the EVO board with the standard wire harness. In this case the motor will run at the factory programmed flow rates.

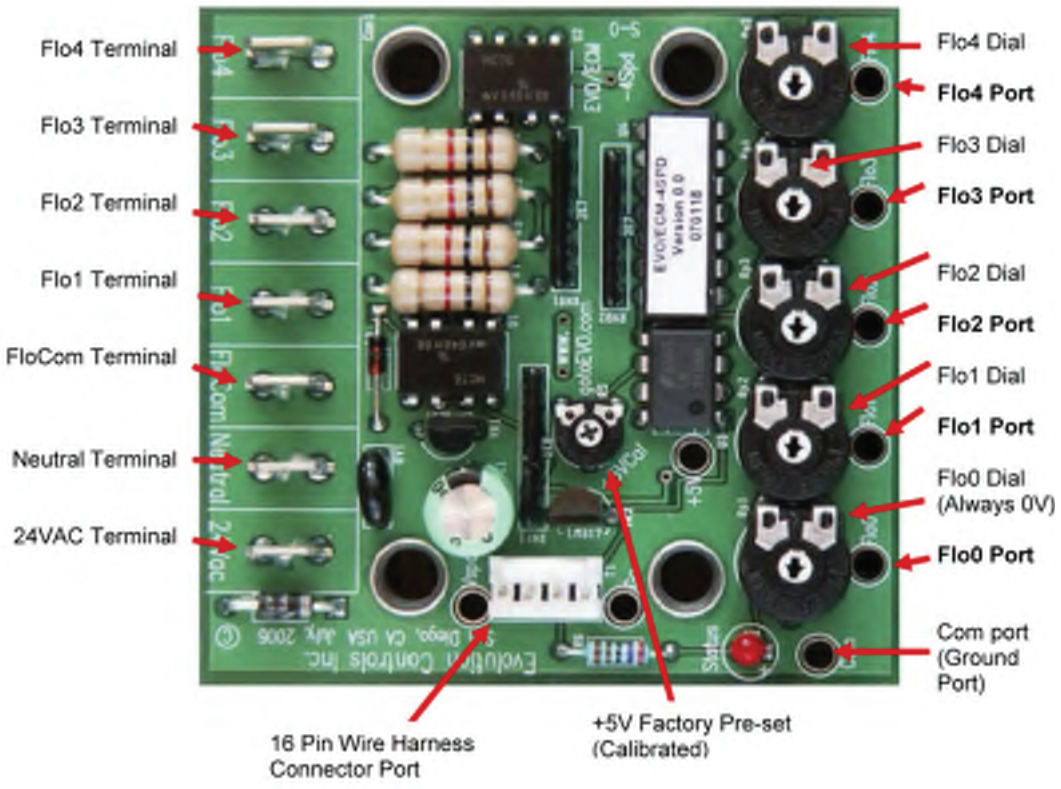
Connecting the Unit to Field Power

Line voltage power wires L1 and Com are connected to S2 as shown. A factory provided step down transformer provides 24VAC power for the ECM control and the EVO board and the factory provided 16 pin wire harness connects the EVO board to the ECM (Figure 7 and Figure 8).

Connecting the Unit to a 24V Thermostat or Controller

The factory provided 24VAC transformer should be used to provide power for the field mounted t-stat by connecting the 24V input to TB2 terminal B and the common to TB2 terminal E. The three t-stat fan speed outputs are connected to the EVO board spade terminals labeled Flo1, Flo2 and Flo3 (Figure 1). When a t-stat fan speed output is energized, the fan will run at the speed set at the corresponding flow dial until the speed output is de-energized.

Figure 1: EVO Board Key Components and Locations



Adjusting Fan Speed

The fan will run at the factory set flow rates when the unit is installed. If different flow rate is required, turn the flow dial (Figure 1) corresponding to the Flo terminal until the desired CFM is achieved or the measured DC reference voltage between the com port and corresponding flo port equals the correct value from Table 2 through Table 13 on page 8.

For example, if terminal Flo1 is on and the Flo1 dial is turned until the Flo1 reference voltage = 2.5, then the motor will run at the CFM that corresponds to 2.5V.

NOTE: The Flo0 dial should always be set at 0V to prevent the fan from running when all speed outputs are OFF.

Bypassing the EVO board

If the EVO board should fail or if it is not needed, the EVO board may be bypassed allowing the ECM to operate at the factory programmed fixed flow rates. To bypass the EVO board unplug the 16 pin EVO board wire harness (Figure 3) from the ECM and the board and remove it from the unit. Locate the standard 16 pin wire harness (included in the unit paper work packet) and plug it into the motor. The individual wires on the other end of the harness connect wire 78 (blue) to terminal C on terminal block TB2 and wire 73 (green) to terminal D on terminal block TB2. Connect the five fan speed wires, 77, 74, 75, 76, and 80 to terminals HI+, HI-, MED, LO+ and LO- respectively on terminal block TB4. Connect the field mounted t-stat 24V+ and common to terminals B and E, respectively, on terminal block TB2. Apply 24V to any of the five speed inputs on TB4 to run motor at that speed

Figure 2: Typical EVO Board Wiring for a Single Motor Large Cap Unit

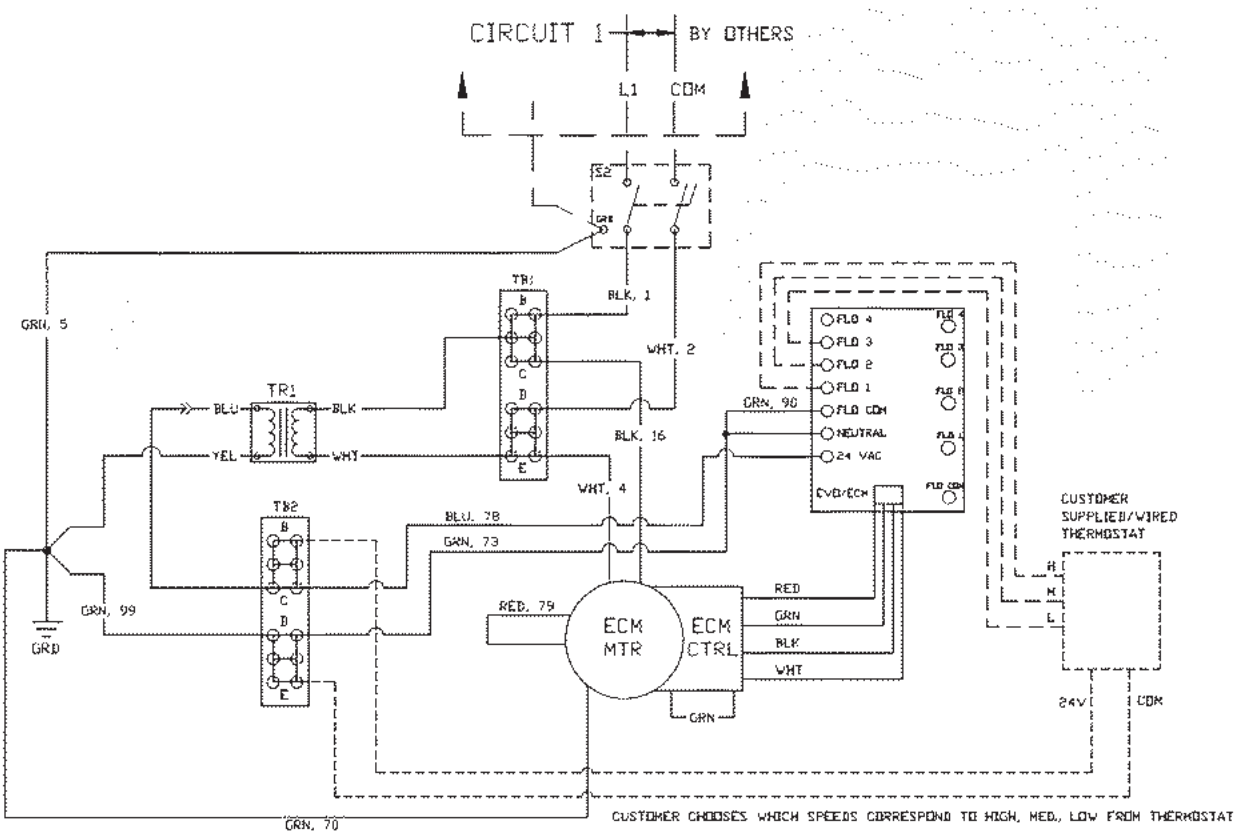


Figure 3: Single Motor EVO Board Bypass Wiring Detail for Large Cap Unit

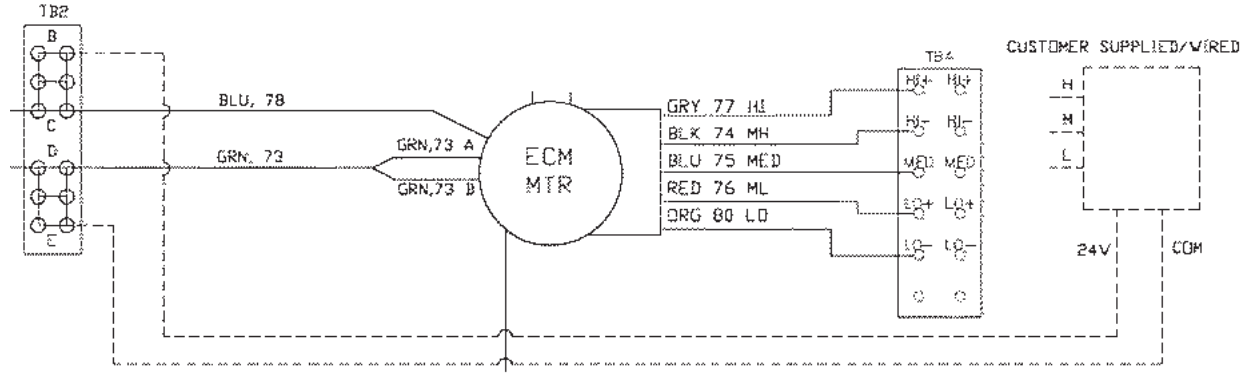


Figure 4: Two Motor EVO Board Bypass Wiring Detail for Large Cap Unit

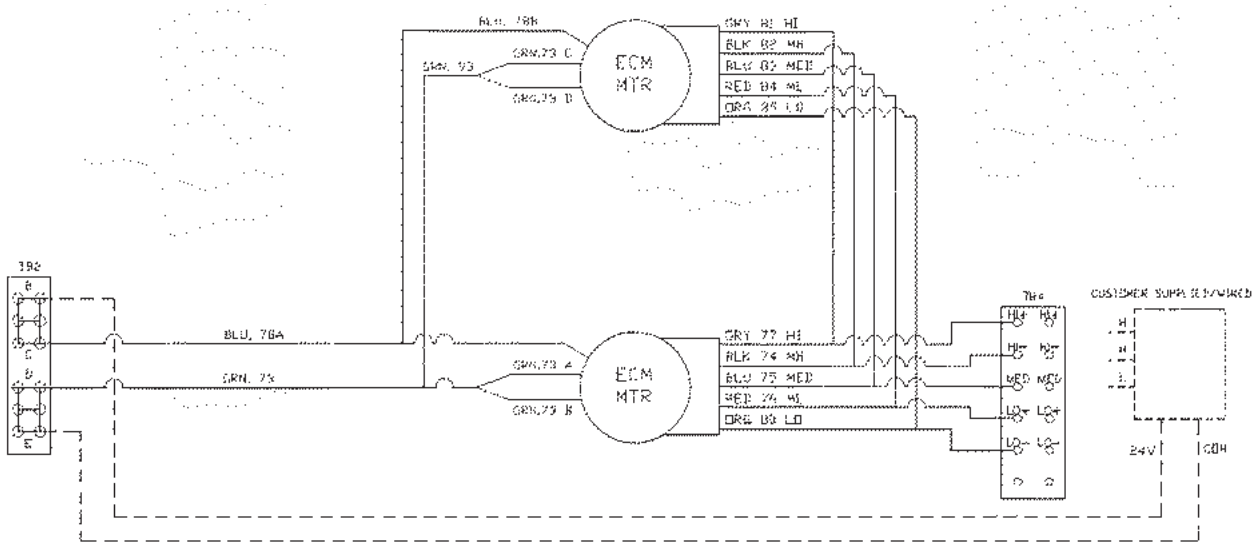


Table 1: Large Cap Wiring Schematics

Drawing Number	Description
910116769	ECM with 3 speed control, 115V, 1 Motor
910167425	ECM with 3 speed control, 115V, 2 Motors
910167454	ECM with 3 speed control, 208-230V, 1 Motor
910167432	ECM with 3 speed control, 208-230V, 2 Motors
910167455	ECM with 3 speed control, 265-277V, 1 Motor
910167433	ECM with 3 speed control, 265-277V, 2 Motors
910165943	ECM with EVO Board, 115V, 1 Motor
910166611	ECM with EVO Board, 115V, 2 Motors
910165944	ECM with EVO Board, 208-230V, 1 Motor
910166613	ECM with EVO Board, 208-230V, 2 Motors
910165945	ECM with EVO Board, 265-277V, 2 Motors

Figure 5: Single Motor EVO Board Bypass Wiring Detail for ThinLine Unit

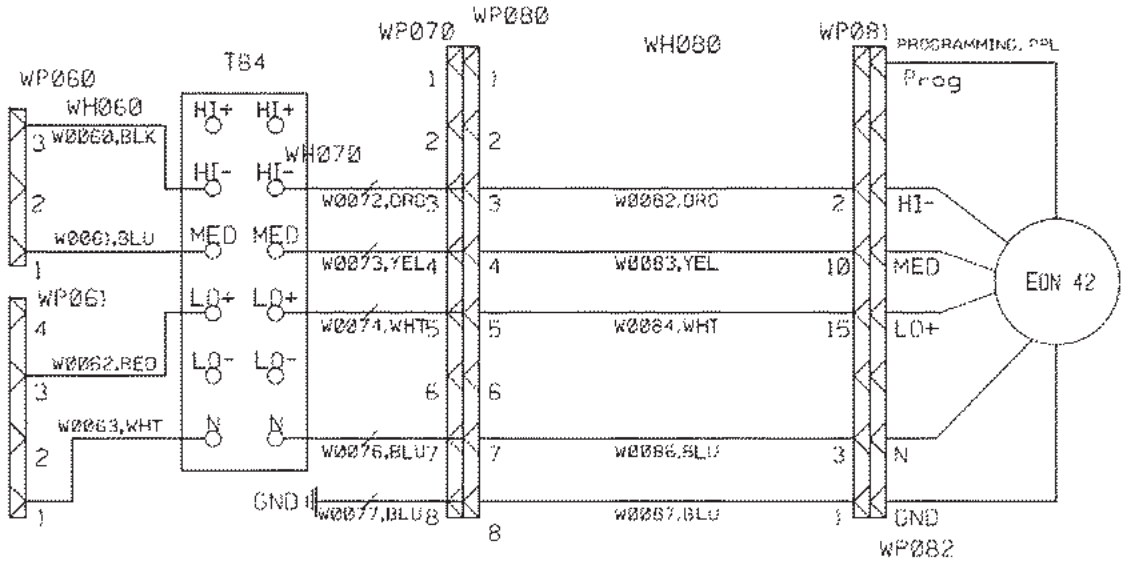


Figure 6: Two Motor EVO Board Bypass Wiring Detail for ThinLine Unit

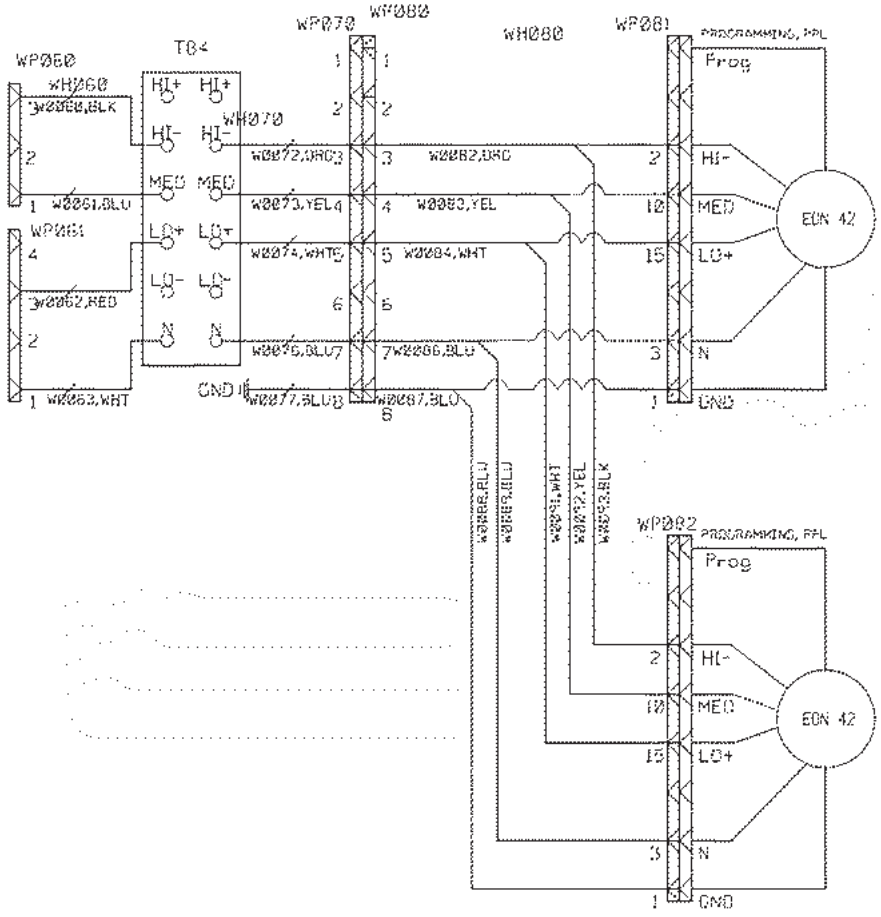


Figure 7: Standard 16 pin Wire Harness Detail

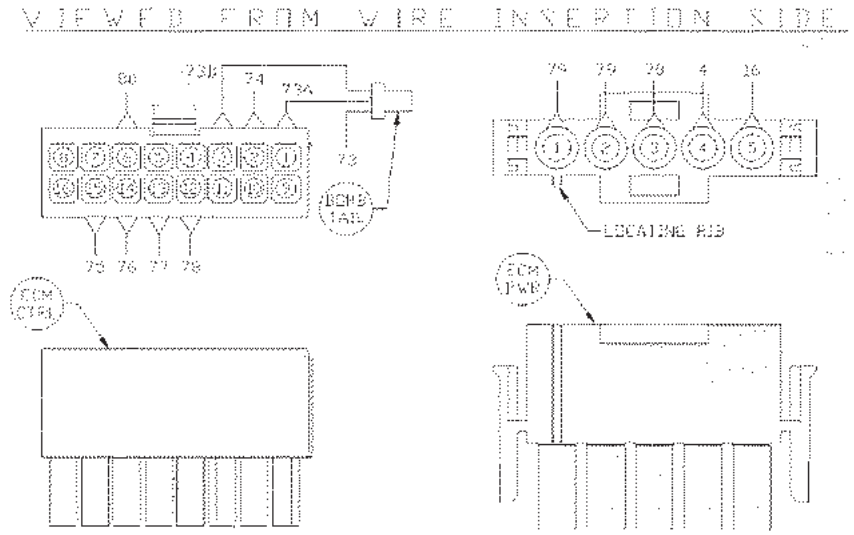


Figure 8: EVO Board 16 Pin Wire Harness Detail

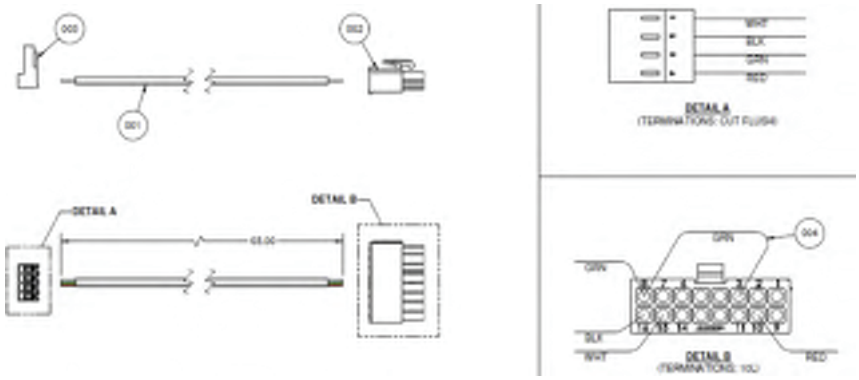


Table 2: Size 6 Voltage Table–Large Cap

Coil Configuration	Speed	Set Voltage* (VDC)	RPM*	CFM*
3	High	3.6	1033	591
	Medium	2.2	916	462
	Low	0.7	806	305
3 + 2	High	3.8	1184	596
	Medium	2.25	1040	470
	Low	0.75	881	293
6	High	3.75	1236	598
	Medium	2.2	1058	450
	Low	0.7	885	306
6 + 2	High	3.75	1369	590
	Medium	2.2	1158	447
	Low	0.7	946	312

* These values are all approximates and not exact

Table 3: Size 8 Voltage Table–Large Cap

Coil Configuration	Speed	Set Voltage* (VDC)	RPM*	CFM*
3	High	3.6	1068	797
	Medium	2.2	943	623
	Low	0.7	813	446
3 + 2	High	3.65	1206	799
	Medium	2.2	1050	625
	Low	0.75	888	447
6	High	3.65	1304	796
	Medium	2.2	1113	626
	Low	0.75	933	453
6 + 2	High	3.7	1400	798
	Medium	2.25	1202	626
	Low	0.8	988	440

* These values are all approximates and not exact

Table 4: Size 12 Voltage Table–Large Cap

Coil Configuration	Speed	Set Voltage* (VDC)	RPM*	CFM*
3	High	3.55	1160	1084
	Medium	1.94	993	800
	Low	0.37	909	503
3 + 2	High	3.71	1282	1082
	Medium	2.0	1105	799
	Low	0.41	996	501
6	High	3.55	1406	1078
	Medium	1.975	1164	802
	Low	0.37	1037	500
6 + 2	High	3.95	1512	1074
	Medium	2.03	1240	801
	Low	0.4	1104	498

* These values are all approximates and not exact

Table 5: Size 16 Voltage Table–Large Cap

Coil Configuration	Speed	Set Voltage* (VDC)	RPM*	CFM*
3	High	3.6	1076	1595
	Medium	2.1	921	1192
	Low	0.575	788	727
3 + 2	High	3.6	1231	1591
	Medium	2.1	1047	1195
	Low	0.575	851	715
6	High	3.42	1333	1593
	Medium	2.1	1108	1209
	Low	0.575	893	728
6 + 2	High	3.42	1473	1594
	Medium	2.1	1227	1202
	Low	0.575	956	727

* These values are all approximates and not exact

Table 6: Size 20 Voltage Table–Large Cap

Coil Configuration	Speed	Set Voltage* (VDC)	RPM*	CFM*
3	High	3.7	1114	1790
	Medium	2.65	1011	1488
	Low	0.7	923	800
3 + 2	High	3.6	1226	1814
	Medium	2.6	1148	1499
	Low	0.73	974	794
6	High	4.4	1370	1810
	Medium	3.35	1220	1502
	Low	0.3	1066	805
6 + 2	High	MAX VDC**	1423	1620
	Medium	3.4	1292	1492
	Low	0.55	1108	806

* These values are all approximates and not exact
** MAX VDC is referring to the dial being turned to its MAXIMUM voltage output

Table 7: Size 2 Voltage Table–ThinLine

Speed	Voltage*	CFM*
LOW	1.31 VDC	158 @ 0" WC
MED	1.95 VDC	228 @ 0" WC
HIGH	2.16 VDC	308 @ 0" WC

Table 8: Size 3 Voltage Table–ThinLine

Speed	Voltage*	CFM*
LOW	1.53 VDC	177 @ 0" WC
MED	2.11 VDC	265 @ 0" WC
HIGH	2.77 VDC	352 @ 0" WC

Table 9: Size 4 Voltage Table–ThinLine

Speed	Voltage*	CFM*
LOW	1.74 VDC	228 @ 0.05" WC
MED	2.46 VDC	337 @ 0.05" WC
HIGH	3.20 VDC	452 @ 0.05" WC

Table 10: Size 6 Voltage Table–ThinLine

Speed	Voltage*	CFM*
LOW	1.40 VDC	340 @ 0.1" WC
MED	2.1 VDC	522 @ 0.1" WC
HIGH	2.75 VDC	711 @ 0.1" WC

Table 11: Size 8 Voltage Table–ThinLine

Speed	Voltage*	CFM*
LOW	0.89 VDC	410 @ 0" WC
MED	2.77 VDC	627 @ 0" WC
HIGH	4.95 VDC	825 @ 0" WC

Table 12: Size 10 Voltage Table–ThinLine

Speed	Voltage*	CFM*
LOW	0.50 VDC	551 @ 0.05" WC
MED	2.55 VDC	825 @ 0" WC
HIGH	4.40 VDC	1105 @ 0" WC

Table 13: Size 12 Voltage Table–ThinLine

Speed	Voltage*	CFM*
LOW	0.47 VDC	719 @ 0" WC
MED	2.50 VDC	1010 @ 0" WC
HIGH	4.60 VDC	1344 @ 0" WC

* These values are all approximates and based on testing with the 3 row coil.

** MAX VDC is referring to the dial being turned to its MAXIMUM voltage output.

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Installation and Maintenance	IM 1027

ThinLine™ 3G Vertical Unit Heaters

Type FHVC, FHVH, FHVS, FHWC Vertical Design

200 to 1200 cfm

Group: **Applied Systems**
Part Number: 910102986
Date: **October 2013**



Model FHVC

Model FHVS

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Thinline 3G vertical unit heaters are intended for use in single zone applications. They are available in sizes from 200 to 1200 cfm. Figure 2 describes the main features of these units and can be referred to for component placement. A variety of factory-built piping packages are available, either factory or field-installed.

Units are available with a variety of thermostat and fan speed control options, which can be mounted on the unit or shipped loose for mounting in the controlled space.

Options include:

- Four-position fan switch (Off/Lo/Med/Hi).
- Manual thermostat with on/off valve control.
- Digital thermostat with a variety of control options, including fan control and on/off or modulating valve control.
- DDC interface board for connecting the unit to controls provided by others. The controls interface option includes a 24 volt AC transformer and an interface terminal board.
- No controls, with pigtail connections to the unit's fan motor wiring harness.

Figure 1: Nomenclature (see Table 4, page 24 for complete model number description)

FH V S - 1 02 A

Unit Type
FH = Cabinet Unit Heater

Unit Configuration
V= Vertical
W = Wall Hung
I = Inverted Wall Hung

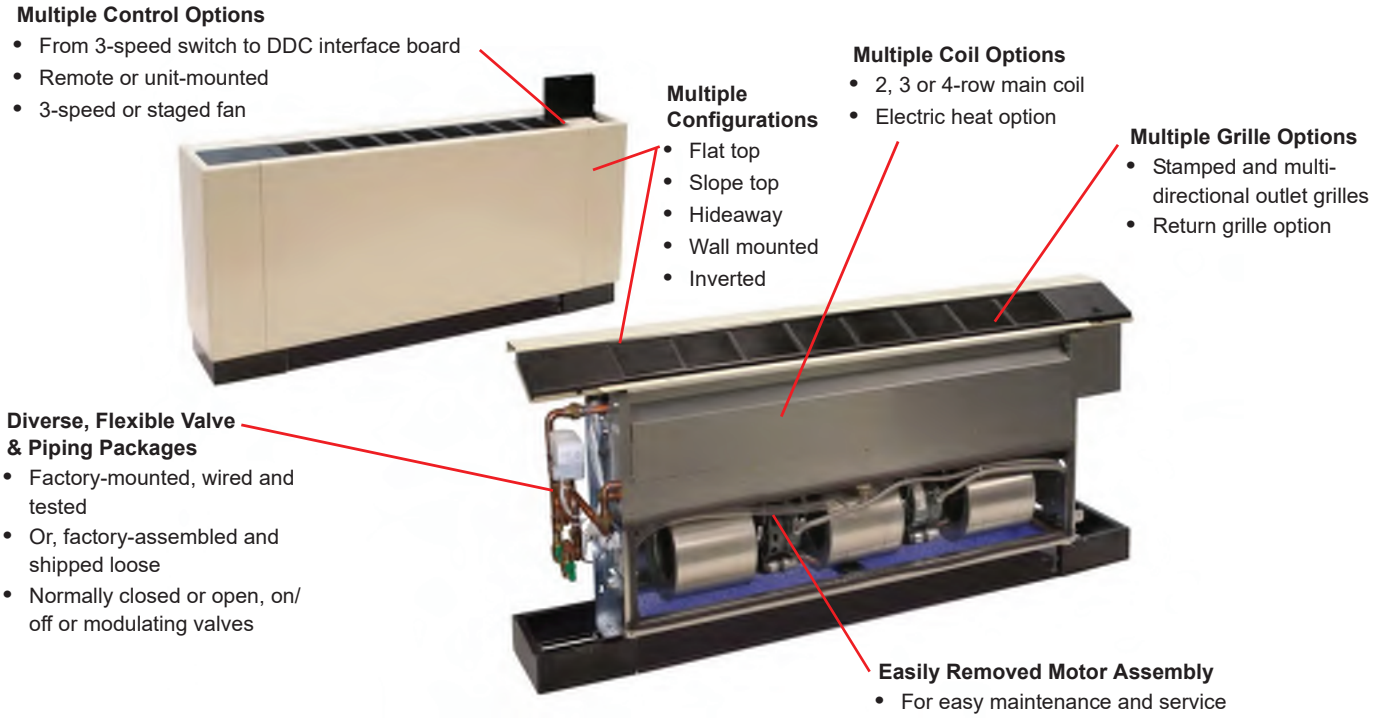
Cabinet Type
C = Cabinet (Flat Top)
S = Slope Top
H = Hideaway

Voltage
A = 115/60/1
E = 208-230/60/1
J = 265-277/60/1

Unit Size
02 = 200 CFM
03 = 300 CFM
04 = 400 CFM
06 = 600 CFM
08 = 800 CFM
10 = 1000 CFM
12 = 1200 CFM

Design Series

Figure 2: Unit Features



Receiving and Storage

Upon receipt of the equipment, check carton for visible damage. Make a notation on the shipper's delivery ticket before signing. If there is any evidence of rough handling, immediately open the cartons to check for concealed damage. If any damage is found, notify the carrier within 48 hours to establish your claim and request their inspection and a report. The Warranty Claims Department should then be contacted.

Do not stand or transport the machines on end. For storing, each carton is marked with "up" arrows.

Temporary storage at the job site must be indoor, completely sheltered from rain, snow, etc. High or low temperatures naturally associated with weather patterns will not harm the units. Excessively high temperatures, 140°F (60°C) and higher, may deteriorate certain plastic materials and cause permanent damage.

⚠ IMPORTANT

This product was carefully packed and thoroughly inspected before leaving the factory. Responsibility for its safe delivery was assumed by the carrier upon acceptance of the shipment. Claims for loss or damage sustained in transit must therefore be made upon the carrier as follows:

VISIBLE LOSS OR DAMAGE

Any external evidence of loss or damage must be noted on the freight bill or carrier's receipt, and signed by the carrier's agent. Failure to adequately describe such external evidence of loss or damage may result in the carrier's refusal to honor a damage claim. The form required to file such a claim will be supplied by the carrier.

CONCEALED LOSS OR DAMAGE

Concealed loss or damage means loss or damage which does not become apparent until the product has been unpacked. The contents may be damaged in transit due to rough handling even though the carton may not show external damages. When the damage is discovered upon unpacking, make a written request for inspection by the carrier's agent within fifteen (15) days of the delivery date and file a claim with the carrier.

Pre-Installation

Before beginning installation, please read this publication in its entirety. Directions given in this bulletin for right and left sides or coil hand assume a position facing the front of the unit.

1. To prevent damage, do not operate this equipment for supplementary heating during the construction period. Doing so will void the warranty.
2. Inspect the carton for any specific tagging numbers indicated by the factory per a request from the installing contractor. At this time the voltage, phase and capacity should be checked against the plans.
3. Check the packing list and unit identification/tagging numbers against the plans to verify that the unit is being installed in the correct location. The unit data plate is attached to the deck plate on the front of the unit heater (see Figure 3). Remove the front panel on cabinet units to access it. The panel contains specific information on standard components as listed in Figure 1, page 3 and in Table 7, page 26.

Figure 3: Data Plate Location



4. Before installation, check the available dimensions where the unit is to be installed versus the dimensions of the unit.
5. Note the location and routing of water piping, condensate drain piping, and electrical wiring. The locations of these items are clearly marked on submittal drawings.
6. The installing contractor will find it beneficial to confer with piping, sheet metal, and electrical foremen before installing any unit.

Note: Check the unit data plate for correct voltage with the plans before installing the equipment. Also, make sure all electrical ground connections are made in accordance with local code.

7. The unit is not designed to be free-standing. Install it against a wall or other flat surface that meets fire and electrical codes requirements for heating and cooling devices.
8. After installation, cover the unit with the shipping carton or other appropriate material for protection during finishing of the building. This is critical while spraying fireproofing material on bar joists, sandblasting, spray painting and plastering. Damage to the unit due to a failure to protect it during finishing of the building is not covered by the warranty.

Fresh Air Box Openings

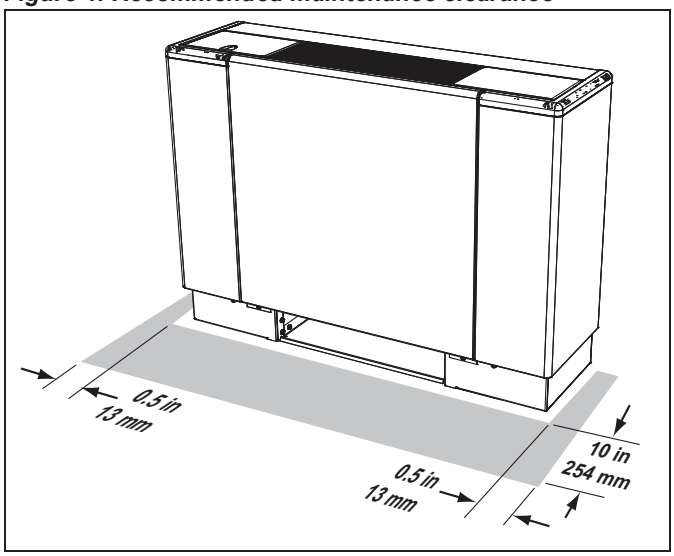
Thinline vertical unit heaters can be installed with an optional fresh air box that is designed to let in outside air while preventing water (such as rain) from getting into the unit itself. If used, prior to unit installation, be sure that the exterior wall opening and the wall box are ready and installed in accordance with the job plans.

Recommended Maintenance Clearance

Cabinet units have removable front and side panels for easy access to components for service and maintenance. The fan assembly is easily removed from the front for cleaning. See General Maintenance, page 15 for more information.

Figure 4 shows recommended maintenance clearances: 0.5 inches (13 mm) on either side and 10 inches (254 mm) in front. Units are referred to as either right-hand or left-hand depending upon the piping connection. Hand is designated by facing the front of the unit (airflow discharges from the front or top). Unless it is a special-order unit, the control panel is always on the end opposite the coil pipe connections.

Figure 4: Recommended maintenance clearance



Duct Connections

Air ducts, when used with hideaway units, should be installed in accordance with local and national codes, including National Fire Protection Association standards for the Installation of Air Conditioning and Ventilating Systems and the National Fire Protection Association standards for the Installation of Air Conditioning and Ventilation Systems other than Residence Type.

A one-inch duct collar is provided on units with a ducted return and/or discharge to attach ductwork. Daikin recommends using galvanized sheet metal ductwork. Slide the sheet metal duct over the duct collar flange of the unit, seal the joint and fasten with sheet metal screws.

Note: Do not run screws through the removable front panel on hideaway units.

Ductwork Recommendations

Follow the general recommendations listed below when installing the ductwork for the unit.

1 Discharge ductwork should run in a straight line, unchanged in size or direction, for a minimum distance of three fan diameters from the unit (approximately 20 inches).

2 Avoid making sharp turns when making duct turns and transitions. Use proportional splits, turning vanes, and air scoops when necessary.

3 When possible, construct and orient supply ductwork turns in the same direction as the fan rotation.

Safety

Follow all safety codes. Wear safety glasses and work gloves. Use a quenching cloth for brazing operations. Have a fire extinguisher available. Follow all warnings and cautions in these instructions and attached to the unit. Consult applicable local building codes and National Electrical Codes (NEC) for special requirements.

Recognize safety information. When you see a safety symbol on the unit or in these instructions, be alert to the potential for personal injury. Understand the meanings of the words DANGER, WARNING, and CAUTION. DANGER identifies the most serious hazards that will result in death or severe personal injury; WARNING means the hazards can result in death or severe personal injury; CAUTION identifies unsafe practices that can result in personal injury or product and property damage. Improper installation, adjustment, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may result in personal injury or property damage. This product must be installed only by personnel with the training, experience, skills, and applicable licensing that makes him/her “a qualified professional HVACR installer.”

⚠ DANGER

Disconnect all electrical power before servicing unit. Electrical shock will cause severe injury or death.

⚠ WARNING

Hazardous Voltage!
Use copper conductors only. Unit terminals are not designed to accept other types of conductors. Failure to do so may cause damage to the equipment.

⚠ WARNING

Personal injury hazard. Wear protective gloves to avoid possible cuts and abrasions from exposed edges. Avoid contact with sharp edges.

⚠ CAUTION

Cleaning agents may cause serious damage to internal components, such as aluminum coils and electronic controls, etc. Do not operate unit heater while building maintenance cleaning agents are in use.

Uncrating and Inspecting the Unit

1. Carefully remove the packaging, remaining alert to any signs of shipping damage. Be careful not to discard components that may be included with the packaging.
2. If the unit is damaged, file a claim with the carrier. Notify the local Daikin representative immediately.
3. You may want to retain some or all of the packaging to provide jobsite unit location information and temporary protection for the unit heater after installation. Be sure to dispose of plastic packaging and protective cardboard properly, in accordance with local recycling rules and guidelines.

⚠ WARNING

Plastic packaging is a suffocation hazard, dispose of properly. Keep away from children.

4. Touch up painted panels if necessary. If panels need paint, sanding is not necessary. However, clean the surface of any oil, grease, or dirt residue so the paint will adhere. Purchase factory approved touch up paint from your Daikin representative or Daikin Factory Service.

Mounting Unit to Wall

⚠ WARNING

Installation and maintenance are to be performed by qualified personnel who are familiar with local codes and Regulations, and experienced with this type of equipment.

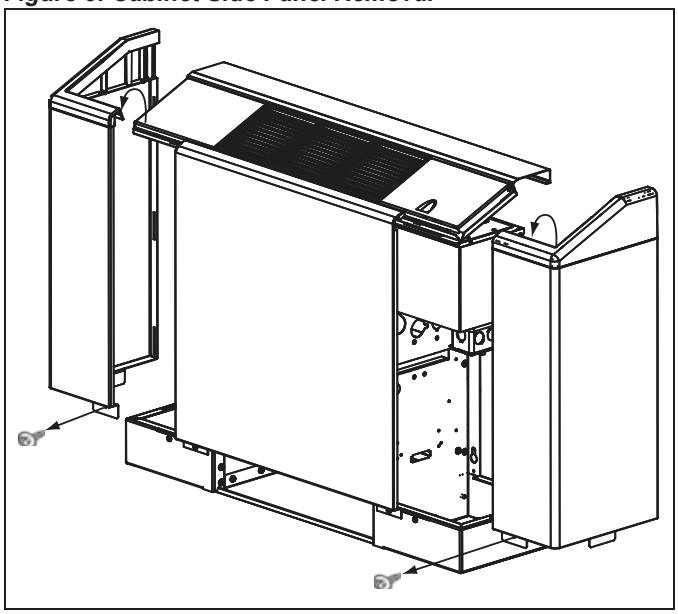
⚠ CAUTION

Personal injury hazard. Wear protective gloves to avoid possible cuts and abrasions from exposed edges. Avoid contact with sharp edges.

1. Consult job blueprints for unit location.
2. Clean area where unit is to be installed, removing all construction dirt and debris. Remove any mouldings at the floor or wall.
3. Remove the unit from the shipping carton and plastic covering. Save the carton and plastic to use as a protective cover after the installation is complete.
4. On cabinet units, remove the screws shown in Figure 5 that secure the right and left cabinet corner panels to the subbase. For ease of installation, you may also remove the center panel. Lift the panels up and out.

Note: Set the unit panels aside where they will not be damaged. Take care not to bend the mounting tabs on the bottom of the panels.

Figure 5: Cabinet Side Panel Removal



5. STOP! If an outside air damper kit is to be installed, install it now. See Figure 17, page 14 and the IM included with the damper for more information.
6. Position the chassis/subbase against the wall where the unit is to be installed. Make sure that the area under the unit is free of combustible materials such as carpet. For cabinet units, the wall must act to close off the back of the unit.
7. For hideaway units, if you are using McQuay's decorative wall plate, use blocks or other suitable material to raise the unit off the floor a minimum of 1.5 inches (38 mm).
8. Make sure electrical and piping connections are in the proper location within the end compartments. The control box is in the end compartment opposite the main coil piping connections. Power to the unit is hooked up through the junction box/disconnect box located under the control box. See Figure 23, page 18 through Figure 26, page 21 for location information.
9. Use a level to check that the unit is level both front to back and side to side (see Figure 6). Adjust the unit as needed using the optional leveling legs or shims.
10. The chassis has a series of slots on the back flange to mount the assembly to the wall. Transfer a mark with a marker or pencil to the wall at the mounting hole locations.
11. Insert fasteners through the mounting holes in the chassis and secure the unit to the wall. Do not over-tighten fasteners. It is the installing contractor's responsibility to select the correct fasteners for each unit to meet local codes. At location(s) where no stud is present, secure with a Toggle bolt or equivalent.

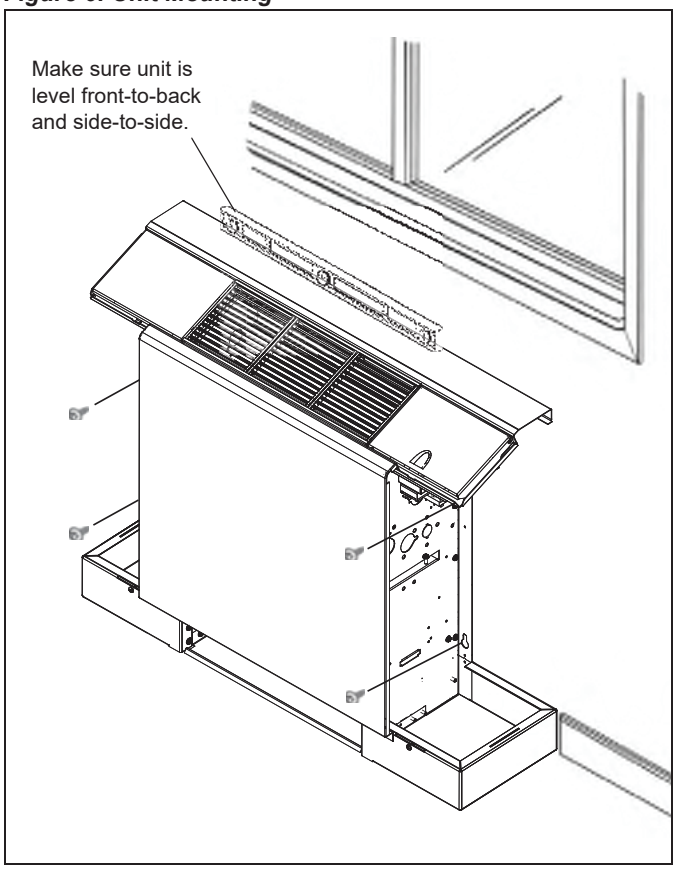
Note: Use a minimum of two fasteners on each side to secure the unit (field supplied).

12 On cabinet units, reinstall the side/quarter panels in reverse order as performed in step 4.

13 If you raised the unit off the floor in step 7, remove the block or other material supporting the bottom of the unit. Make sure the unit is securely fastened to and supported by the wall mounts.

14 Cut out one side and the bottom of the shipping carton, leaving the top and three sides to place over the unit for protection during construction.

Figure 6: Unit Mounting



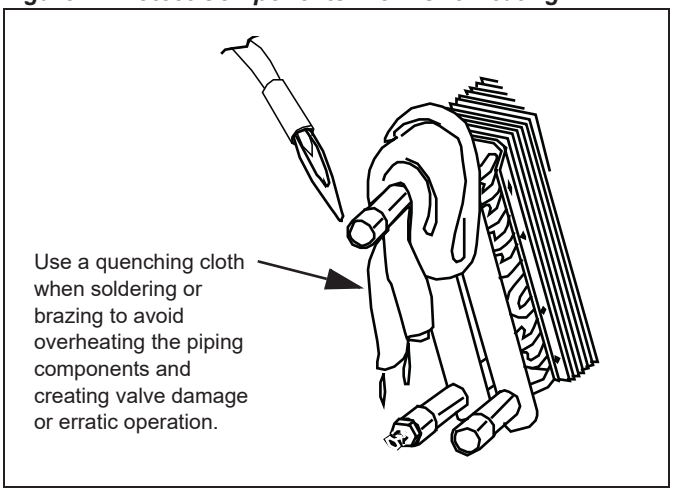
Water Piping Connections

General Guidelines

1 Piping can be steel, copper or PVC, but must comply with local codes.

2 Proper ventilation is required for soldering. When soldering, use a quenching cloth to protect unit heater components from overheating damage—melting insulation, also damage to valves, wiring, electronics, sensors, etc. See Figure 7. When Daikin provides valve packages with unions, o-rings are included. When soldering near unions, remove the o-rings before heating.

Figure 7: Protect Components From Overheating



3 If sealant compound is not provided for flexible hose fittings, apply Teflon tape to the connections to help prevent leaks.

4 Ensure proper insulation of supply and return piping. Proper insulation prevents loss of unit heater capacity and overheating of end compartments.

5 The piping to and from the unit must be protected from outside air and freeze conditions. It must be suitably insulated for condensation and for heat loss or gain. Penetrations entering the unit end compartments must be fitted/sealed for unit integrity.

6 Supply and return shutoff valves are recommended at each unit. The return valve is used for balancing and should have a “memory stop” so that it can always be closed off, but can only be re-opened to the proper position for the flow required.

7 Be sure to install control valves on the correct unit heater. Indiscriminate mixing of valves in the field can result in valves improperly sized for the desired flow rate, which can result in poor operation.

8 Install control valves so there is at least 2" (51mm) minimum clearance to remove the actuator from the valve body.

9 Do not connect a unit to the supply and return piping until the water system has been cleaned and flushed completely. After this is done, the initial connection should have all valves wide open in preparation for water system flushing.

10 Automatic flow control devices must not be installed prior to system cleaning and flushing.

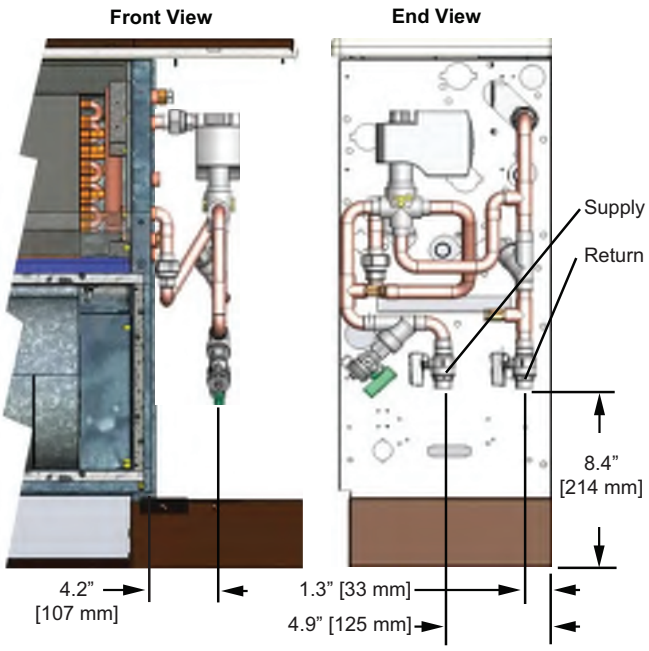
11 Check local code for any requirement for electrical fittings.

Connecting to a Factory-Installed Valve & Piping Package

To view connection locations for factory-installed valve & piping packages, see Figure 8. Before installing supply and return lines to a factory piping package, review the following items.

- All piping connections are 5/8" O.D.S. (1/2" nominal) female copper connections.
- The installer must provide adequate piping system filtration and water treatment.
- Daikin deluxe and premium piping packages include a strainer which prevents debris from entering the coil. Clean the strainer regularly.
- The unit heater ships with brackets to adequately support the piping package during shipment. Remove these brackets before connecting water piping to the unit.
- Set end valves to the fully open position to prevent damage to the valve seat during brazing.
- Solder water piping connections to supply and return end connections. Avoid overheating factory soldered joints to prevent the possibility of leakage.

Figure 8: Hook Up Locations: Factory-installed Packages



Note: RIght-hand connections shown. Left-hand connection distances are the same.

Distances to connections from chassis are from unit mounting holes. Distances may vary slightly from given values.

Field-Installed Valve & Piping

Review General Guidelines, page 7 before beginning. Slide ½" copper tubing or connection couplings (installer provided) onto the coil connections. Solder the joint using a good-quality, lead-free solder to provide a watertight connection.

⚠ WARNING

Avoid overheating when soldering field connections to the coil to prevent leakage, overheating of the copper tubes, and melting of valves, factory-soldered joints or component gasketing. A quenching cloth is recommended. See Figure 7.

Shutoff/Balancing Valve

Each unit heater should be at least equipped with shutoff valves on both the supply and return lines for easy serviceability and removal if it becomes necessary. We suggest using our combination shutoff/balancing valves between the main supply line and the unit heater unit. These can be furnished as part of a factory-installed valve and piping package or they can be installed in the field. The balancing valve installed on the return line is used to adjust the water flow to provide the best performance.

Systems with electric heat

The electric heating coil is designed to be used only when the hot water heat is turned off for the season. To protect the electric heat elements, an automatic and manual electric heat switch disengages the electric heat to prevent overheating. For information on resetting the manual switch, see Electric Heat Over-Temp Reset Button, page 15.

Electrical Connections

Installation and maintenance must be performed only by qualified personnel who are familiar with local codes and regulations, and are experienced with this type of equipment.

⚠ DANGER

Hazardous Voltage!

The installer must determine and follow all applicable codes and regulations. This equipment presents hazards of electricity, rotating parts, sharp edges, heat and weight. Failure to read and follow instructions can result in property damage, severe personal injury or death.

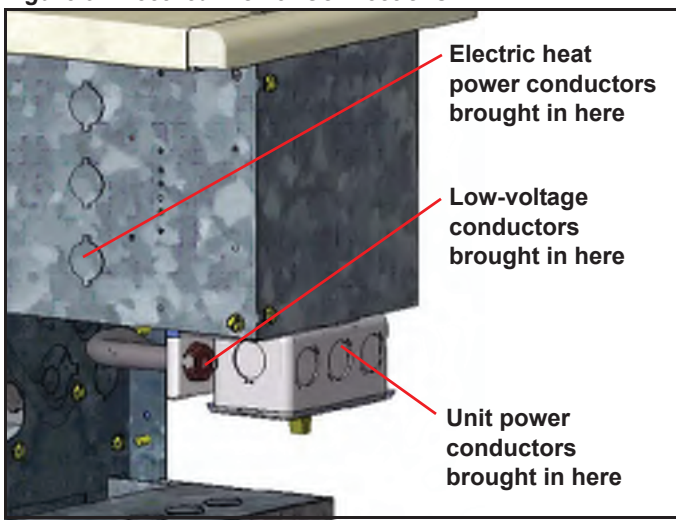
Standard Electrical Connection

Field electrical power connections are made in the electrical junction box, which is mounted to the control box on the side of the chassis opposite the coil piping connections. See Figure 9. If the unit is equipped with an optional disconnect switch, it is located in this junction box.

Units with an electric heat option that has the same voltage as the unit can bring the power conductors into this same junction box. Units with electric heat that has a different voltage should bring the electric heat into one of the knockouts on the control box. See Figure 9.

Low voltage wires should be brought into the conduit located next to the field electrical power junction box. See Figure 9.

Figure 9: Electrical Power Connections



If electrical wiring or conduit comes through the floor, all wires or conduit should be sealed at this point.

Note: Wiring coming through the wall should be sealed to stop cold air infiltration through the wall cavity, which could affect unit thermostat operation. Wiring coming through the floor should be sealed to prevent water leakage from reaching live wires.

Install a strain relief and pass the wires through the strain relief into the junction box. Make the connections and reinstall the junction box cover.

Electrical Data

The wiring diagram for the unit is attached to the inside of the corner panel on cabinet units. It is attached to the front cover of the unit on hideaway units. See Figure 9. Be sure the available power is the same voltage and phase as that shown on the unit serial plate. See Figure 3, page 4 for the location of the serial plate.

Line and voltage wiring must be done in accordance with local codes or the National Electrical Code, whichever is applicable.

Apply correct line voltage to the unit. Power to the unit must be sized correctly. Branch circuit overcurrent protection must be provided per local codes. See the nameplate for correct ratings.

All 208-230V single-phase units are factory wired for 230 volt operation. For 208 V operation the L1 wire connection to the unit transformer (found in the main control box) must be changed. The L1 wire must be disconnected from the 230 V (orange) wire and connected to the 208 V (red) wire. The 230 V wire must then be capped off via a wire nut or male terminal as appropriate. Please refer to the unit wiring diagram.

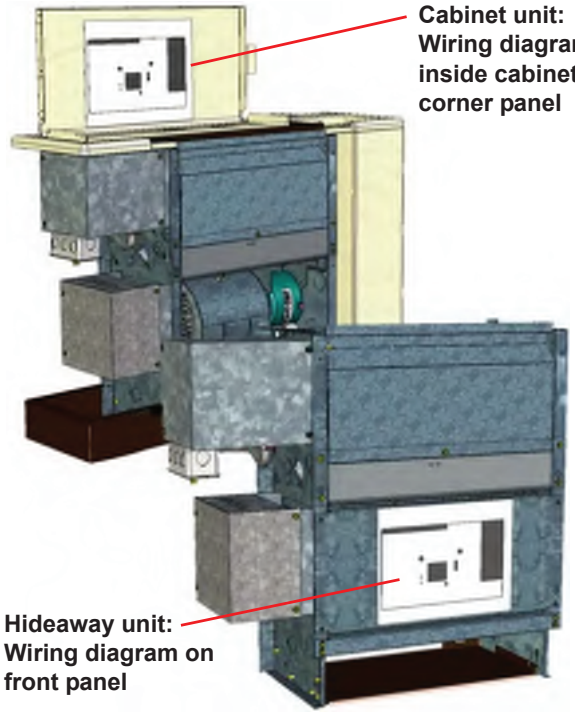
Operating Voltages

Operating voltages are as follows, plus or minus 10%.

- 115/60/1
- 208-230/60/1
- 265-277/60/1

Note: Voltages listed are to show voltage range. However, units operating with overvoltage and undervoltage for extended periods of time will experience premature component failure.

Figure 10: Wiring Diagram Locations



Thermostat and Controls

⚠ DANGER

READ THE INSTRUCTIONS INCLUDED WITH THE THERMOSTAT/CONTROL CAREFULLY BEFORE ATTEMPTING TO INSTALL, OPERATE OR SERVICE IT.

Failure to observe safety information and comply with instructions could result in PERSONAL INJURY, DEATH AND/ OR PROPERTY DAMAGE.

To avoid electrical shock or damage to equipment, disconnect power before installing or servicing. Use only wiring with insulation rated for full thermostat operating voltage. Use copper wire only. Insulate or wirenut all un-used leads. Any wiring, including the remote probe,may carry the full operating voltage of the thermostat.

To avoid potential fire and/ or explosion do not use in potentially flammable or explosive atmospheres.

Retain the installation instructions for future reference. You must review your application and national and local codes to ensure that your installation will be functional and safe.

After wiring and installation are complete, energize the system and check the operation. Adjust the thermostat as necessary to complete at least one cycle. Be sure the thermostat and all other equipment are functioning correctly.

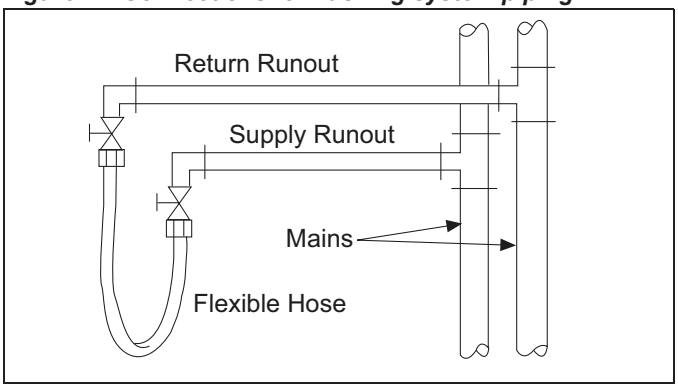
Initial Startup

Cleaning & Flushing the Water System

1 Prior to first operation of any unit, clean and flush the water circulating system of all construction dirt and debris.

2 If units are equipped with water shutoff valves, either electric or pressure operated, connect the supply and return runouts together at each unit location. This will prevent the introduction of dirt into the unit. See Figure 11.

Figure 11: Connections for flushing system piping



3 Fill the system at the city water makeup connection with all air vents open. After filling, close all air vents.

4 Start the main circulator with the pressure reducing valve open.

5 Check vents in sequence to bleed off any trapped air, ensuring circulation through all components of the system.

6 While circulating water, check and repair any leaks in the unit and surrounding piping.

⚠ CAUTION

Units must be checked for water leaks upon initial water system startup. Water leaks may be a result of mishandling or damage during shipping. Failure by the installing contractor to check for leaks upon start-up of the water system could result in property damage

7 Drains at the lowest point(s) in the system should be opened for initial flush and blow-down, making sure city water fill valves are set to make up water at the same rate.

8 Check the pressure gauge at pump suction and manually adjust the makeup to hold the same positive steady pressure both before and after opening the drain valves.

9 Flush should continue for at least two hours or longer until the drain water is clean and clear.

10 Shut off the circulator pump and open all drains and vents to completely drain down the system.

11 Short-circuited supply and return run outs should now be connected to the unit supply and return connections. Do not use sealers at the swivel flare connections of hoses.

12 Refill the system with clean water.

13 Test the water using litmus paper for acidity, and treat as required to leave the water slightly alkaline (pH 7.5 to 8.5).

14 Antifreeze may also be added at this time. Use commercial grade antifreeze designed for HVAC systems only. Do not use automotive grade antifreeze. Antifreeze will have an effect on the performance of the unit.

15 Once the system has been filled with clean water and antifreeze (if used), precautions should be taken to protect the system from dirty water conditions.

⚠ IMPORTANT

It is McQuay's policy not to make recommendations on water treatment. It is the responsibility of the user to check that the water supply to the units is free of contaminants or corrosive agents, chemicals or minerals. The general contractor or owner should contact a local water treatment company regarding water treatment. A fouled water system will lead to premature component failure.

Operating Limits

This equipment is designed for indoor installation only. Sheltered locations such as attics, garages, etc., generally will not provide sufficient protection against extremes in temperature and/or humidity, and equipment performance, reliability, and service life may be adversely affected.

Venting Hydronic Coils

Hydronic coils require a vent, either manual or automatic, to release air from the unit. Coils on all Thinline unit heaters come standard with a coil air vent. It is located on the piping side of the unit, above the coil connections.

Perform the following steps to vent both primary and secondary coils after installing the unit.

1. Pressurize the building piping system with water and vent any trapped air at system vents.
2. For units with manual air vents, back the set screw out to expel air from the unit and then re-tighten the set screw.
3. Automatic air vents should require no adjustment for the coil to vent. However, if the coil does not vent immediately, unscrew the outer portion of the fitting to expel air from the port. If debris has become trapped in the vent, completely remove the outer portion of the fitting and clean.

Controls

A wide variety of control options are available for Thinline 3G unit heaters, both unit-mounted and remote-mounted. This section provides a brief overview of these options and their operation. For more complete information, contact your Daikin representative or the installation manual that came with the control.

Manual 4-Position Fan Switch

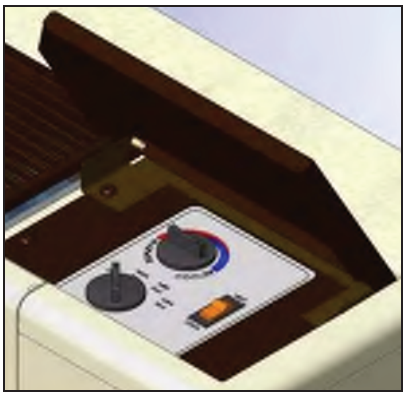


This four-position fan switch (Off, High, Med, Low) option is available unit or remote-mounted (wall-mounted version picture to right). The unit-mounted option operates on line voltage. The remote-mounted option operates on low-voltage power and may have been provided with a factory-mounted, low-voltage interface board, which contains 3-24 volt relays with line voltage contactors and terminal connections. The transformer is factory-installed and wired.

Sequence of operation

- *Off:* Fan is turned off. The motorized fresh-air damper, when supplied, is closed (see Fresh Air Damper, page 14).
- *High, Medium, Low:* Fan runs continuously at the selected speed. The two-position, motorized fresh-air damper, when supplied, is opened.

Unit-Mounted, Mechanical Thermostat With 4-Position Fan Switch



This unit-mounted option combines the four-position fan switch described above with a mechanical thermostat. Sequence of operation

- Fan Switch
  - *Off:* Fan is turned off. The two-position, motorized fresh-air damper, when supplied, is closed (see Fresh Air Damper, page 14).
  - *High, Medium, Low:* Fan runs continuously at the selected speed. The two-position, motorized fresh-air damper, when supplied, is opened.
- Thermostat
  - Cycles the valve(s) open or closed on demand based on occupant-desired level.

Digital Thermostats



Daikin offers a broad range of unit-mounted and remote, wall-mounted digital thermostats with the capability to control on-off, 3-wire and proportional modulating valves, and normally closed or normally open actuator valves. For more information, refer to the Daikin publication ED 18513.

MT155 Thermostat

The MT155 series thermostat provides on-off control for low-voltage or line-voltage valves and fan motors. This unit is designed for remote-mounting with connection to the DDC interface board which is mounted on the unit. Options three-speed fan control for continuous or cycling fan operation.

Figure 12: MT155 Thermostats



Three standard control options are available:

- *On-off fan cycle operation:* The thermostat cycles the fan from the manually selected fan speed (high, medium or low) to off.
- *Continuous fan and on-off valve cycle operation:* The thermostat cycles the valves on and off. The fan runs continuously at the manually selected fan speed.
- *On-off fan and on-off valve cycle operation:* The thermostat cycles the fan from the manually selected fan speed to off and it cycles the valves on and off.

When the system switch is in the off position, the unit heater system including the fan is shut off.

MT158 and MT168 Thermostat-Controllers with Digital Display

Series MT158 and MT168 microprocessor-based thermostat-controllers combine a proportional integral control algorithm with adaptive logic. They may be unit-mounted or remote-wall mounted.

Figure 13: MT158 and MT168 Thermostats



Heating outputs for the MT158 are individually configurable for three-wire floating control valves or on/off valves in the normally open or normally closed modes.

Heating outputs for the MT168 provide 0-10 Vdc or 4-20 mA The integrated, three-speed fan control switch is line voltage to allow direct connection to the fan motors. Manual or automatic changeover is provided with remote setback capability from a time clock or facility management system. Features include a Fahrenheit or Celsius digital display.

Two standard control options are available:

- *Continuous fan and modulating (or on-off) valve operation:* The fan runs continuously at the manually selected fan speed (high, medium or low). The controller modulates the valves or, on the MT158, dip-switches can be set to cycle the valves on and off.
- *On-off fan cycle operation and modulating (or on-off) valve operation:* The controller cycles the fan from the manually selected fan speed to off. The controller modulates the valves or, on the MT158, dip-switches can be set to cycle the valves on and off.

DDC Interface Board

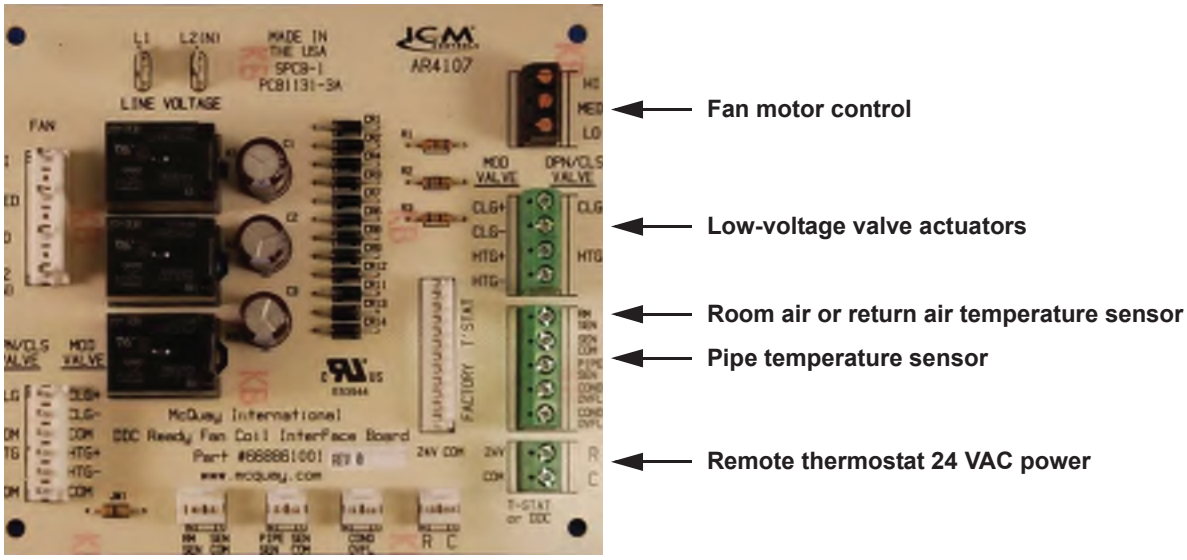
The low-voltage, DDC interface board is used with any remote (wall mounted) Daikin thermostat or control. It can also be used with a building automation system (BAS) control where low voltage is needed to operate the unit heater. It is located in the control box for the unit (see Figure 9, page 9).

The DDC interface board includes:

- Three 24-volt relays with line-voltage contactors to operate the fan motor speeds.
- Terminal connections for interfacing to:
  - An optional remote-mounted thermostat.
  - Low-voltage, on-off valve actuators.
  - A return air sensor.
- A factory-wired and installed transformer.

See Figure 14 for a list of connecting points to the board. For additional wiring information, see the typical wiring diagram Figure 28 or the unit's wiring diagram, which is attached to the corner panel on cabinet units and to the chassis front cover on hideaway units. (see Figure 10, page 9).

Figure 14: DDC Interface Board 24 VAC connections



Accessories

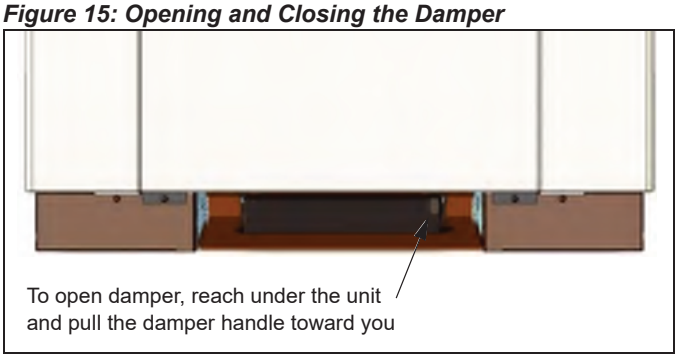
Fresh Air Damper

The fresh air damper kit provides up to 25% outside air to the fan coil. It consists of an intake with damper blade and insect screen. The damper may be manually controlled through the return air opening or with an optional field-installed damper motor. For installation information, see Daikin installation manual IM 1023 which is supplied with the damper kit.

Operation

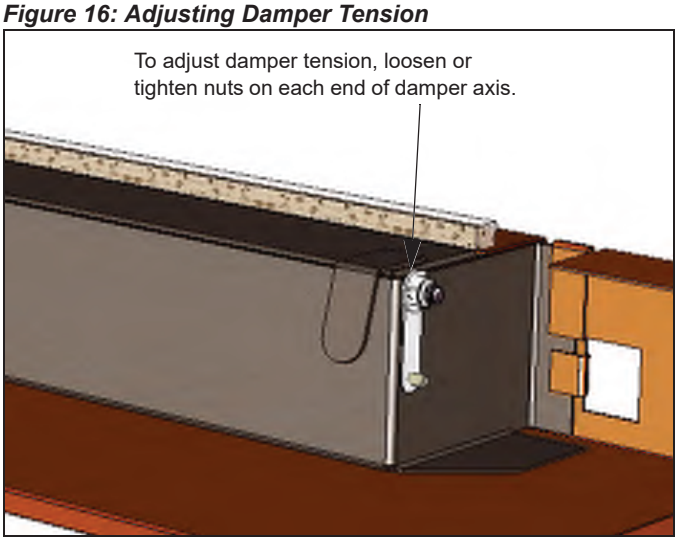
To open the damper, reach under the unit and pull the damper handle toward you. To close, push the damper away from you. See Figure 15.

Figure 15: Opening and Closing the Damper



If the damper is difficult to open or moves too freely, you can adjust the tension by tightening or loosening the nuts on its pivot axis. See Figure 16.

Figure 16: Adjusting Damper Tension



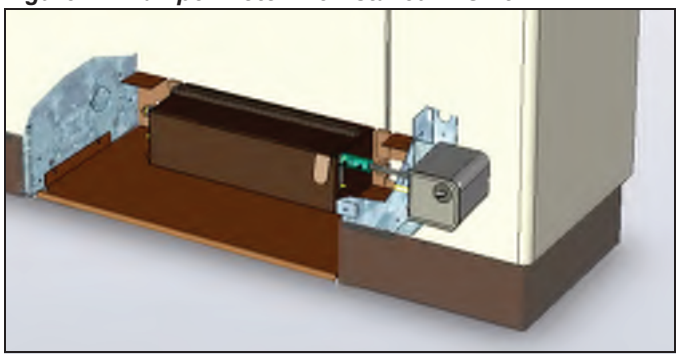
Cold Weather Operation

Fan coils may experience erratic operation during cold ambient conditions with the outside air damper in the open position.

Fresh Air Damper Motor Kit

This damper motor kit is for field installation with the fresh air damper kit. The damper kit must be ordered separately. For installation information, see Daikin installation manual IM 1028, which is supplied with the damper motor kit. Under most control schemes, the damper motor is set up to open the damper automatically whenever the unit fan is in operation.

Figure 17: Damper Motor Kit Installed in Unit



Leveling Legs Option

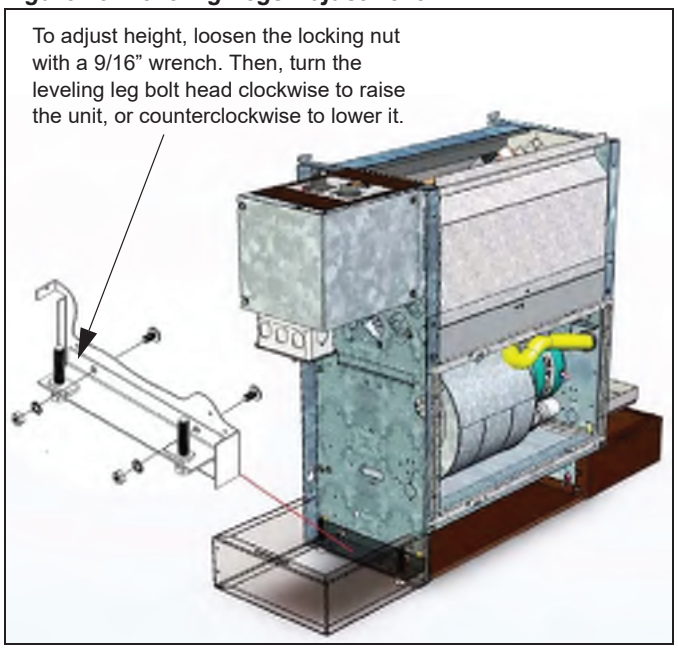
Field or factory-installed kits are available with 0” to 1" adjustment for positive leveling of floor-mounted units.

Height Adjustment

To adjust the height of a leveling leg:

1. Loosen the locking nut on the leveling leg bolt with a 9/16-inch wrench.
2. Turn the leveling leg bolt clockwise to lower the unit or counterclockwise to raise it.
3. When you are finished adjusting the height, hold the leveling leg bolt in place and draw the locking nut up tight against the mounting bracket.

Figure 18: Leveling Legs Adjustment



Electric Heat Over-Temp Reset Button

The electric heat options comes with two over-temperature switches. The first resets automatically when the over-temperature condition no longer exists. The second, backup switch must be reset manually.

Note: The need to reset the manual switch may indicate that there are improperly functioning system components. If the switch trips again, contact Daikin Factory Service for help in diagnosing the cause.

To reset the manual switch, carry out the following steps:

1 Disconnect all power to the unit. Verify the power has been disconnected.

⚠ DANGER

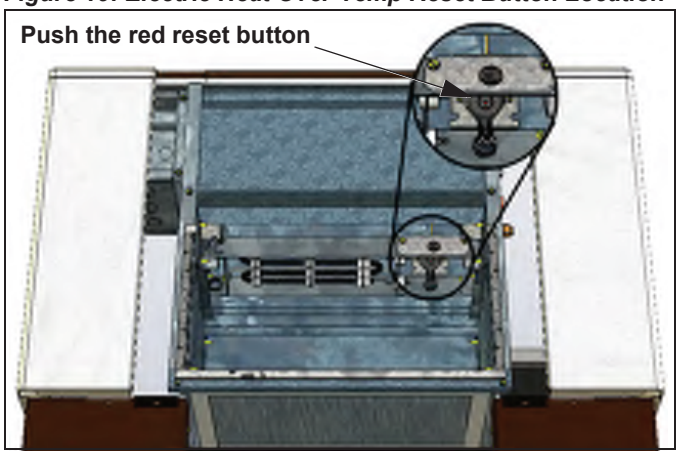
Personal Injury Hazard.

Power supply can cause electrical shock. Always disconnect power to unit before servicing.

2 Remove the main drain pan and motor assembly from the unit (see Removing the fan & motor assembly, page 15).

3 Access and push in the red reset button. See Figure 19.

Figure 19: Electric Heat Over-Temp Reset Button Location



4 Reinstall the drain pan and motor assembly.

5 Reconnect the power.

General Maintenance

Normal maintenance on all units is generally limited to filter changes and cleaning the condensate drain pans. Units are provided with permanently lubricated motors and require no oiling even though oil caps may be provided.

Record performance measurements of volts, amps, and water temperature differences (both heating and cooling). A comparison of logged data with start-up and other annual data is useful as an indicator of general equipment condition.

Filter Changes

Filter changes are required at regular intervals. The time period between changes will depend upon the project requirements. Some applications, such as motels, produce a lot of lint from carpeting and linen changes, and will require more frequent filter changes. Check filters at 60-day intervals for the first year until experience is acquired. If light cannot be seen through the filter when held up to sunlight or a bright light, it should be changed. A more critical standard may be desirable.

Filters can be removed without removing any panels. However, if the unit is equipped with a return air grille, this must first be removed to access the filter. To remove the filter:

1 Slide your hands under the front opening on the bottom of the unit and feel for the filter above.

2 Slide your fingers along the bottom of the filter until they reach the rear paperboard edge.

3 Push the paperboard edge back about a half-inch until the front edge of the filter drops down.

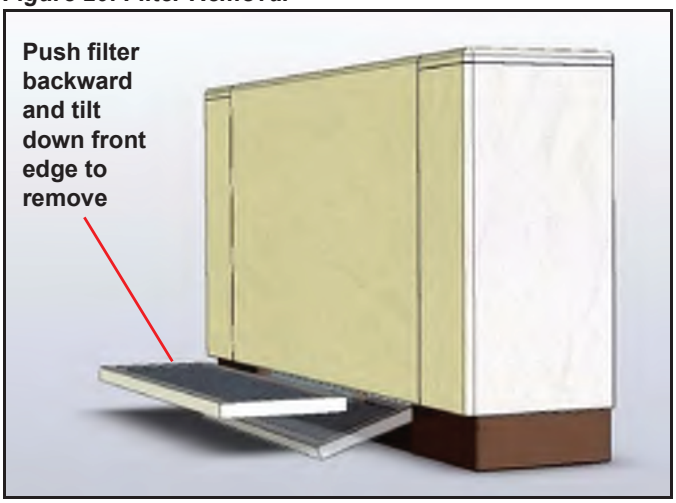
4 Remove the filter from under the unit.

To install a new filter:

1 Slide the filter under the unit and tilt its rear edge upward and into the pocket at the rear of the filter housing.

2 Push the front edge of the filter back until it clears the front lip on the filter housing, then push it up and into place.

Figure 20: Filter Removal



Removing the fan & motor assembly

The fan and motor assembly is housed in the top of the unit's fan deck. It is easily removed for access and cleaning as follows.

1 Disconnect electrical power to the unit.

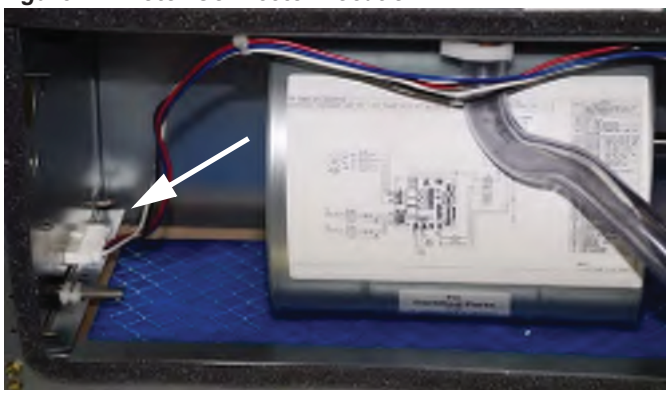
2 Remove the two screws that attach the center panel of the unit to the base (see Figure 5, page 6).

3 Lift the center panel upward and off the unit.

4 Disconnect the fan motor wiring harness by removing the plug where it attaches to the connector on the side of the chassis. See Figure 21.

Note: Push the tabs inward on the sides of the plug to free it from the connector base.

Figure 21: Motor Connector Location

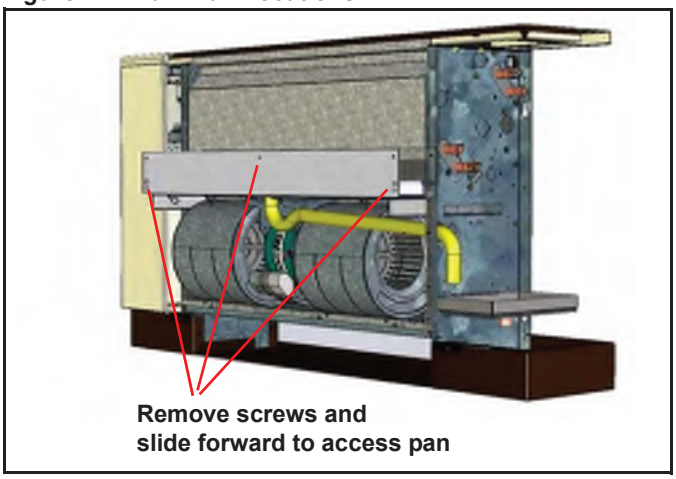


5 Remove the five screws shown in Figure 22 that attach the fan deck to the unit chassis.

6 Firmly grasp the fan deck, then slide it towards you and out of the unit.

7 To reinstall, follow these steps in reverse order.

Figure 22: Drain Pan Locations



Unit Data

Table 1: Unit Data

	02	03	04	06	08	10	12
Coil Data							
Face Area, ft^2 (cm^2)	0.74 (685)	1.08 (1004)	1.43 (1323)	2.11 (1962)	2.46 (2281)	3.14 (2917)	3.83 (3559)
Fins/inch (cm)	12 [4.7]	12 [4.7]	12 [4.7]	12 [4.7]	12 [4.7]	12 [4.7]	12 [4.7]
Coil Dimensions							
2-Row L x D x H, in (cm	11.8 x 1.7 x 9 (30.0x4.4x22.9)	17.3 x 1.7 x 9 (43.9x4.4x22.9)	22.8 x 1.7 x 9 (57.9x4.4x22.9)	33.8 x 1.7 x 9 (85.9x4.4x22.9)	39.3x 1.7 x 9 (99.8x4.4x22.9)	50.2 x 1.7 x 9 (127.6x4.4x22.9)	61.3 x 1.7 x 9 (155.7x4.4x22.9)
3-Row L x D x H, in (cm	11.8 x 2.6 x 9 (30x6.6x22.9)	17.3 x 2.6 x 9 (43.9x6.6x22.9)	22.8 x 2.6 x 9 (57.9x6.6x22.9)	33.8 x 2.6 x 9 (85.9x6.6x22.9)	39.3 x 2.6 x 9 (99.8x6.6x22.9)	50.2 x 2.6 x 9 (127.6x6.6x22.9)	61.3 x 2.6 x 9 (155.7x6.6x22.9)
4-Row L x D x H, in (cm	11.8 x 3.5 x 9 (30.0x8.8x22.9)	17.3 x 3.5 x 9 (43.9x8.8x22.9)	22.8 x 3.5 x 9 (57.9x8.8x22.9)	33.8 x 3.5 x 9 (85.9x8.8x22.9)	39.3 x 3.5 x 9 (99.8x8.8x22.9)	50.2 x 3.5 x 9 (127.6x8.8x22.9)	61.3 x 3.5 x 9 (155.7x8.8x22.9)
Volume, Gal (Liters)							
2-Row	0.15 (0.6)	0.19 (0.7)	0.24 (0.9)	0.32 (1.2)	0.37 (1.4)	0.46 (1.7)	0.55 (2.1)
3-Row	0.20 (0.7)	0.26 (1.0)	0.32 (1.2)	0.45 (1.7)	0.52 (2.0)	0.64 (2.4)	0.77 (2.9)
4-Row	0.26 (1.0)	0.34 (1.3)	0.43 (1.6)	0.61 (2.3)	0.70 (2.6)	0.87 (3.3)	1.05 (4.0)
Fan/Motor Data							
Fan Quantity	1	1	2	2	3	4	4
Size, Dia" x W" (cm)	6.26 x 6.3 (15.9 x 16)	7.95 x 6.3 (20 x 16)	6.26 x 6.3 (15.9 x 16)	7.95 x 6.3 (20 x 16)	6.26 x 6.3 (15.9 x 16)	6.26 x 6.3 (15.9 x 16)	7.95 x 6.3 (20 x 16)
Motor Quantity	1	1	1	1	2	2	2
Filter Data							
Part Number	668332901	668332902	668332903	668332907	668332905	668332906	668332904
1" (25.4 cm) Media	Throw-away	Throw-away	Throw-away	Throw-away	Throw-away	Throw-away	Throw-away
Quantity	1	1	1	1	2	2	2
L x D x H, in. (cm)	16 x 8.75 x 1 (40.6 x 22 x 2.5)	21.5 x 8.75 x 1 (54.6 x 22 x 2.5)	27 x 8.75 x 1 68.5 x 22 x 2.5	38 x 8.75 x 1 (96.5 x 22 x 2.5)	21.7 x 8.75 x 1 (56.1 x 22 x 2.5)	27.2 x 8.75 x 1 (69.0 x 22 x 2.5)	32.7 x 8.75 x 1 (83.1 x 22 x 2.5)

Table 2:

Table 3: Approximate Shipping Weights - lbs (kg)*

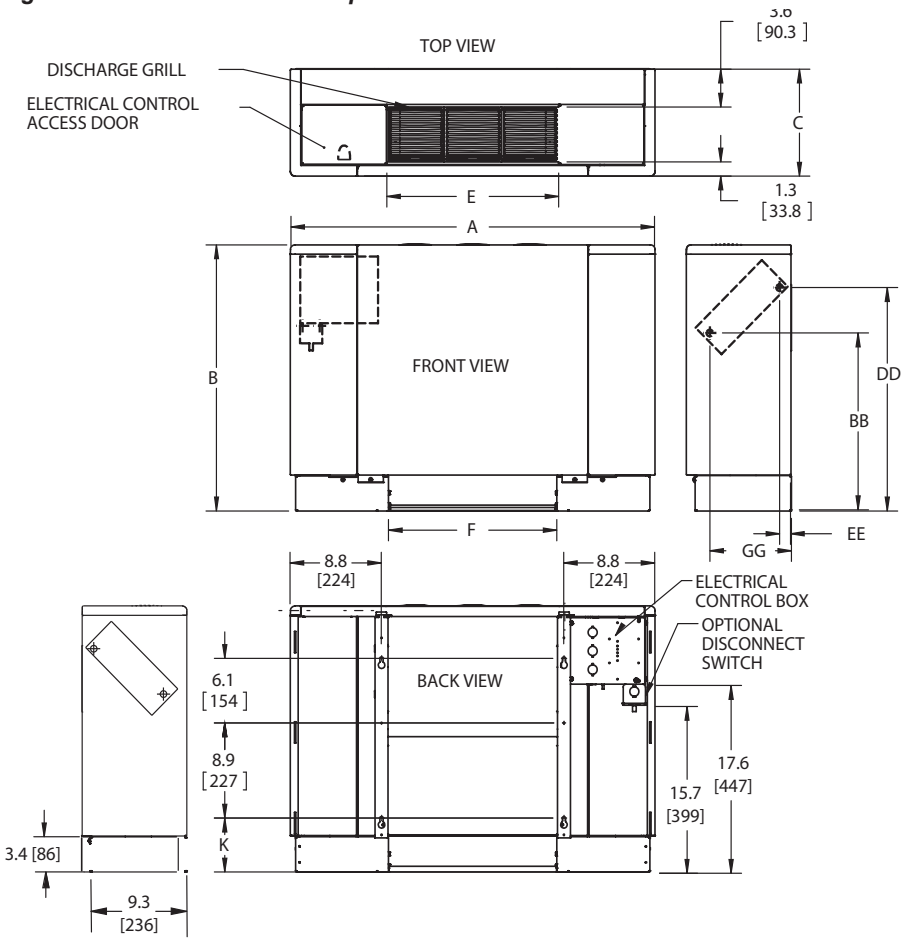
Unit Type	Unit Size						
	S02	S03	S04	S06	S08	S10	S12
FHVC,FHVS	84 (38)	95 (43)	108 (49)	131 (60)	152 (69)	177 (80)	202 (92)
FHVH, FHVI	55 (25)	63 (29)	74 (34)	91 (41)	110 (50)	129 (59)	149 (68)

Note: *Approximate shipping weights do not include valve packages or other options.

Physical Data

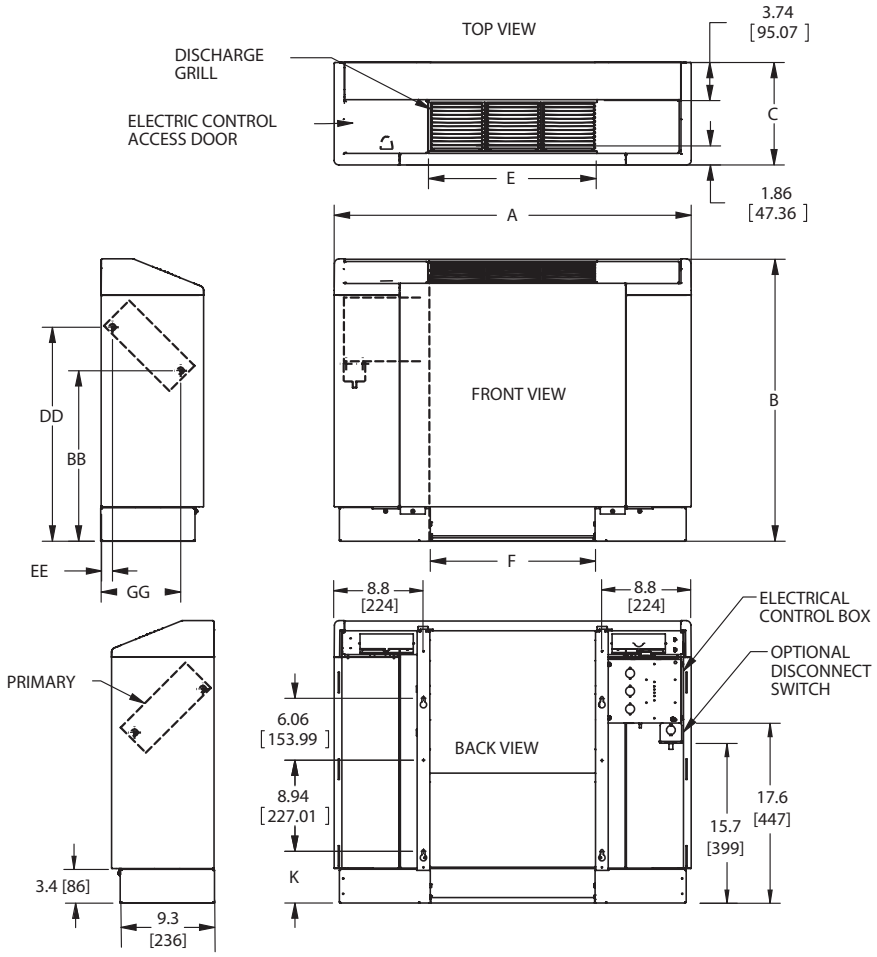
Unit Dimensions

Figure 23: Dimensions: Flat Top unit heaters



Dimension		S02		S03		S04		S06		S08		S10		S12	
		inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
Unit Width	A	35.0	889	40.5	1029	46.0	1168	57.0	1448	62.5	1588	73.5	1867	84.5	2146
Unit Height	B	25.0	635	25.0	635	25.0	635	25.0	635	25.0	635	25.0	635	25.0	635
Unit Depth	C	10.0	254	10.0	254	10.0	254	10.0	254	10.0	254	10.0	254	10.0	254
Discharge Grille - Width	E	16.3	414	21.8	554	27.3	693	38.3	973	43.8	1113	54.8	1392	65.8	1671
Return Air Opening - Width	F	16.2	411	21.7	551	27.2	691	38.2	970	43.7	1110	54.7	1389	65.7	1669
Floor to Bottom Mtg Hole	K	5	127	5	127	5	127	5	127	5	127	5	127	5	127
Water Supply	BB	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424
	GG	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198
Water Return	DD	21	533	21	533	21	533	21	533	21	533	21	533	21	533
	EE	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28

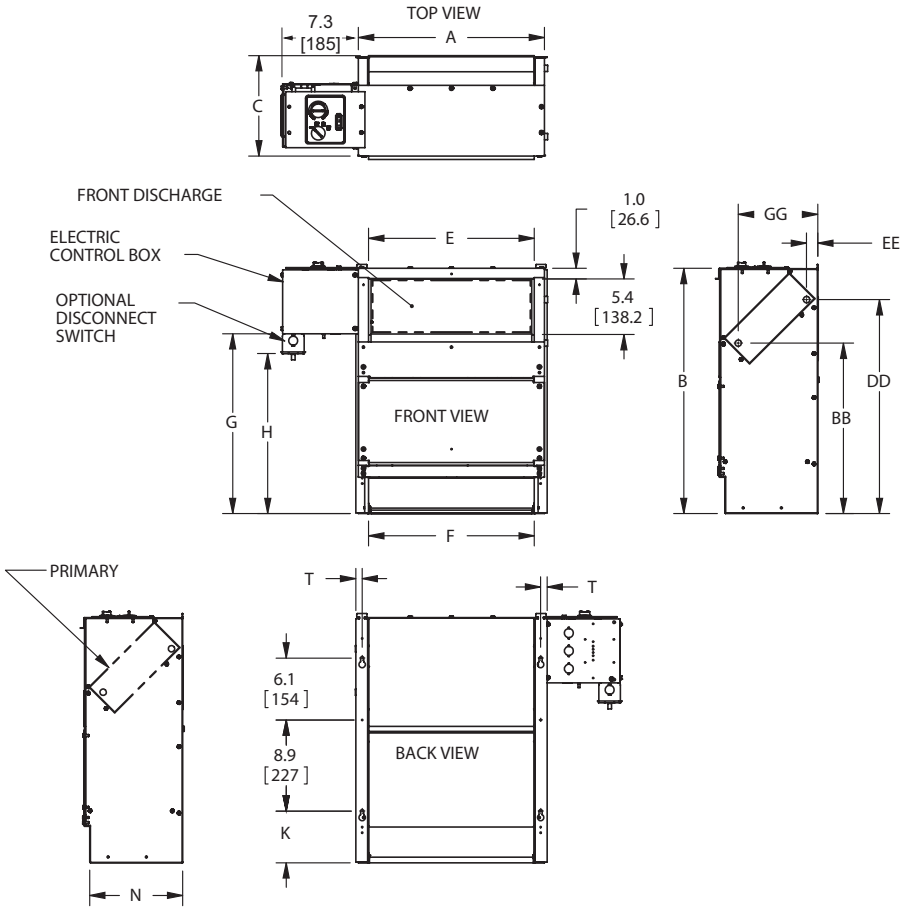
Figure 24: Dimensions: Slope Top unit heaters



Dimension		S02		S03		S04		S06		S08		S10		S12	
		inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
Unit Width	A	35.0	889	40.5	1029	46.0	1168	57.0	1448	62.5	1588	73.5	1867	84.5	2146
Unit Height	B	27.6	701	27.6	701	27.6	701	27.6	701	27.6	701	27.6	701	27.6	701
Unit Depth	C	10.0	254	10.0	254	10.0	254	10.0	254	10.0	254	10.0	254	10.0	254
Discharge Grille - Width	E	16.3	414	21.8	554	27.3	693	38.3	973	43.8	1113	54.8	1392	65.8	1671
Return Air Opening - Width	F	16.2	411	21.7	551	27.2	691	38.2	970	43.7	1110	54.7	1389	65.7	1669
Floor to Bottom Mtg Hole	K	5	127	5	127	5	127	5	127	5	127	5	127	5	127
Water Supply	BB	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424
	GG	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198
Water Return	DD	21	533	21	533	21	533	21	533	21	533	21	533	21	533
	EE	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28

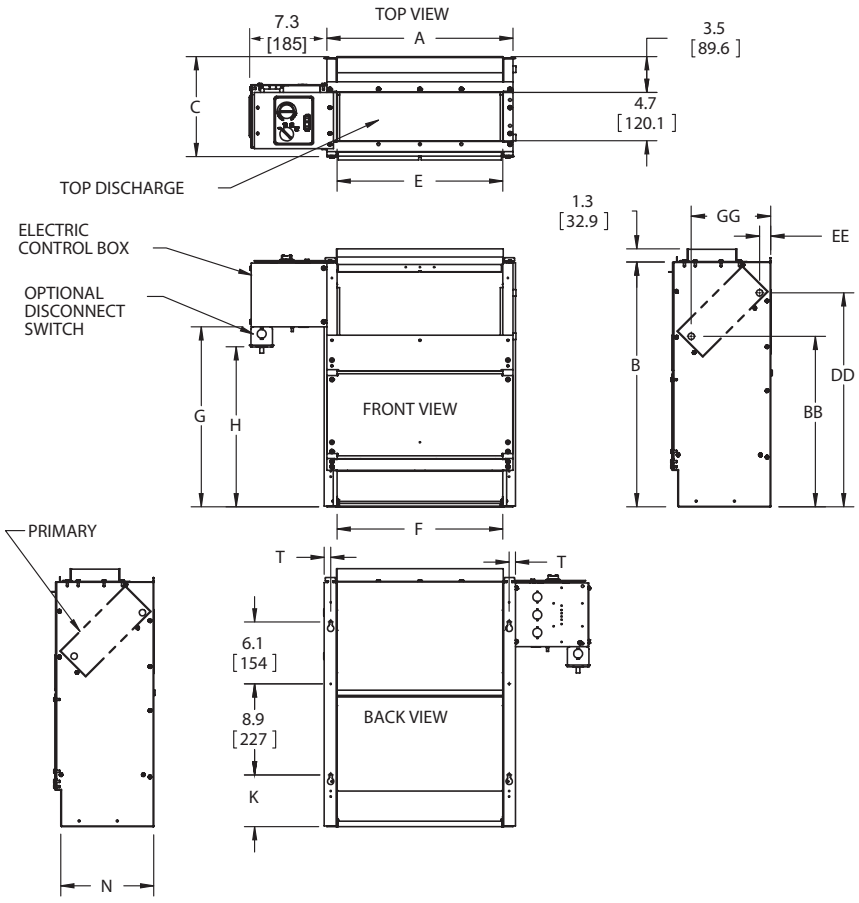
Physical Data

Figure 25: Dimensions: Hideaway, Front-Discharge unit heaters



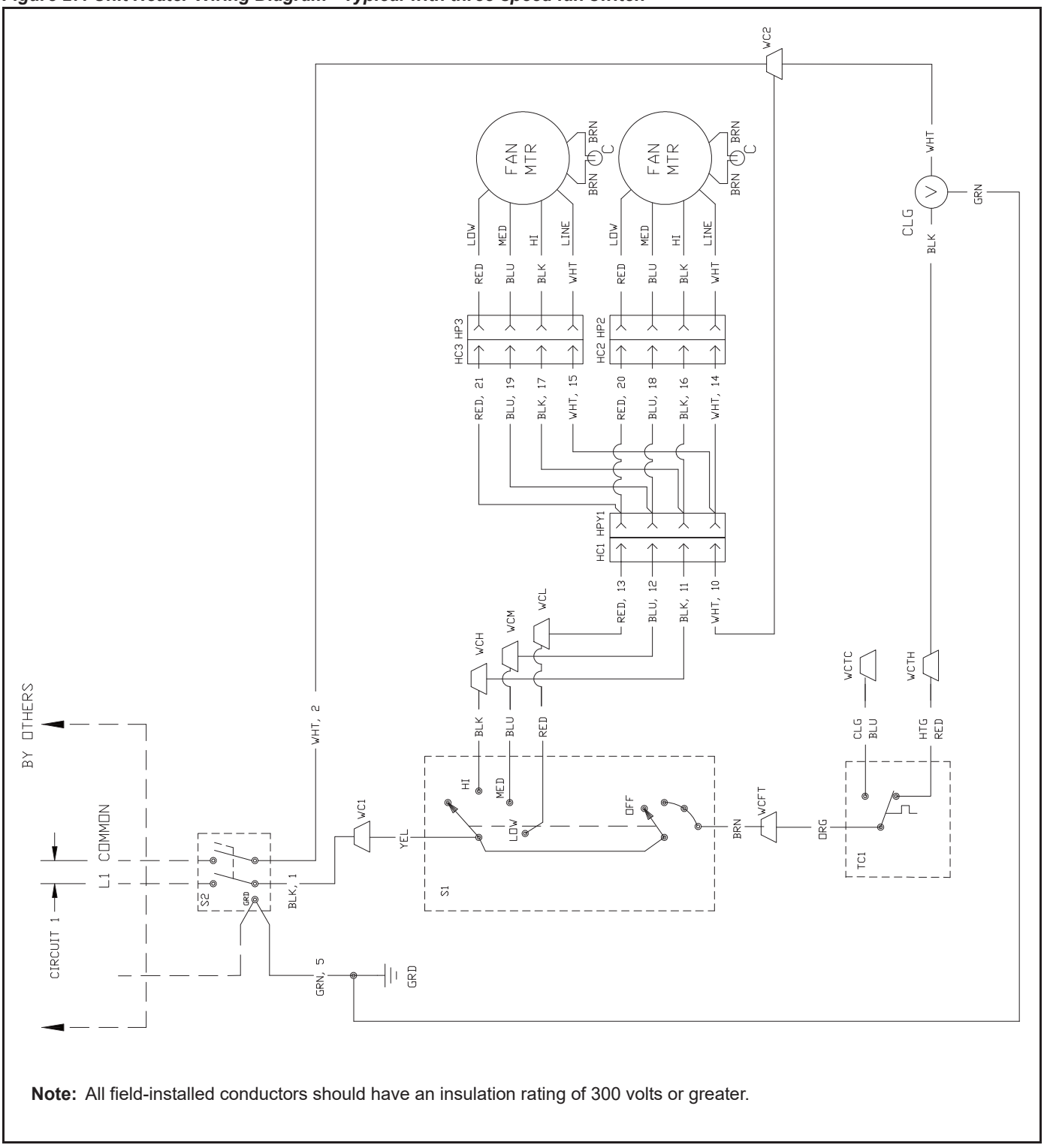
Dimension		S02		S03		S04		S06		S08		S10		S12	
		inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
Unit Width	A	18.8	475	24.3	617	29.8	757	40.8	1036	46.3	1176	57.3	1455	68.3	1735
Unit Height	B	24.0	610	24.0	610	24.0	610	24.0	610	24.0	610	24.0	610	24.0	610
Unit Depth	C	9.6	243	9.6	243	9.6	243	9.6	243	9.6	243	9.6	243	9.6	243
Discharge Grille - Width	E	16.3	414	21.8	554	27.3	693	38.3	973	43.8	1113	54.8	1392	65.8	1671
Return Air Opening - Width	F	16.2	411	21.7	551	27.2	691	38.2	970	43.7	1110	54.7	1389	65.7	1669
Floor to Bottom Mtg Hole	K	5	127	5	127	5	127	5	127	5	127	5	127	5	127
Water Supply	BB	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424
	GG	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198
Water Return	DD	21	533	21	533	21	533	21	533	21	533	21	533	21	533
	EE	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28

Figure 26: Dimensions: Hideaway, Top-Discharge unit heaters



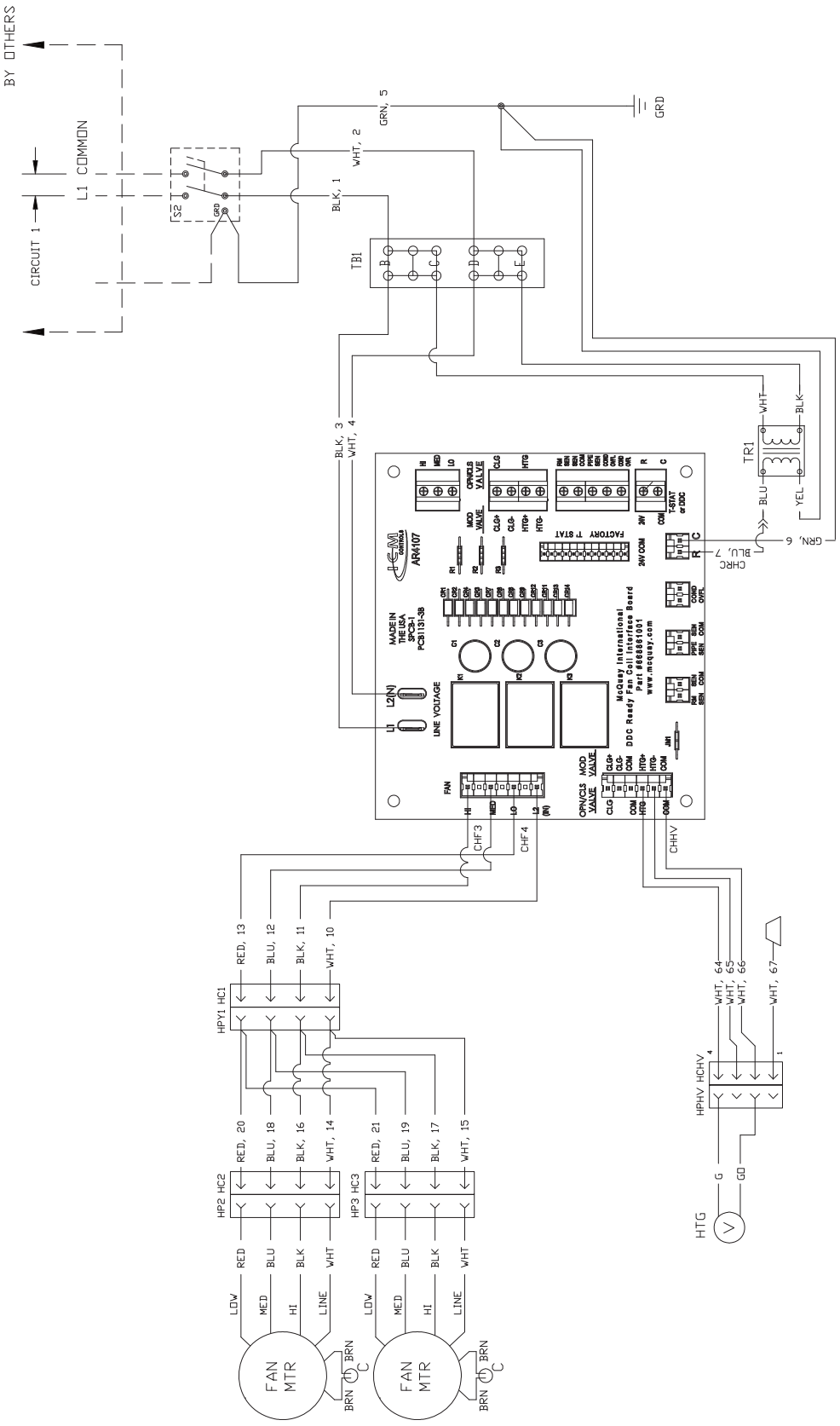
Dimension		S02		S03		S04		S06		S08		S10		S12	
		inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
Unit Width	A	18.8	475	24.3	617	29.8	757	40.8	1036	46.3	1176	57.3	1455	68.3	1735
Unit Height	B	24.0	610	24.0	610	24.0	610	24.0	610	24.0	610	24.0	610	24.0	610
Unit Depth	C	9.6	243	9.6	243	9.6	243	9.6	243	9.6	243	9.6	243	9.6	243
Discharge Grille - Width	E	16.3	414	21.8	554	27.3	693	38.3	973	43.8	1113	54.8	1392	65.8	1671
Return Air Opening - Width	F	16.2	411	21.7	551	27.2	691	38.2	970	43.7	1110	54.7	1389	65.7	1669
Floor to Bottom Mtg Hole	K	5	127	5	127	5	127	5	127	5	127	5	127	5	127
Water Supply	BB	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424
	GG	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198
Water Return	DD	21	533	21	533	21	533	21	533	21	533	21	533	21	533
	EE	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28

Figure 27: Unit Heater Wiring Diagram - Typical with three-speed fan switch



Note: All field-installed conductors should have an insulation rating of 300 volts or greater.

Figure 28: Unit Heater Wiring Diagram - Typical with DDC board



Note: All field installed conductors should have an insulation rating of 300 volts or greater.

Model Number Description

Table 4: Model Number Description: Fields 1 - 21

Field	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Code	FC	VC	1	02	A	A	G	M	Y	YY	W	3	12	R	F	T	YY	12	Y	Y	N

1 Unit Type
- FC = fan coil
- FH = cabinet unit heater

2 Product Identifier
- IC = inverted wall hung cabinet
- VC = vertical cabinet, flat top
- VH = vertical hideaway
- VS = vertical cabinet, slope top
- WC = wall-hung cabinet

3 Design Series
- 1 = Design 1

4 Unit Size - nominal capacity
- 02 = 200 cfm
- 03 = 300 cfm
- 04 = 400 cfm
- 06 = 600 cfm
- 08 = 800 cfm
- 10 = 1000 cfm
- 12 = 1200 cfm
- 14 = 1400 cfm

5 Volts/Hertz/Phase
- A = 115/60/1
- E = 208-230/60/1
- J = 265-277/60/1

6 Coil fin type
- A = aluminum

7 Coil casing material
- G = galvanized

8 Coil air vent
- M = manual
- A = auto

9 Coil coating
- Y = none

10 Not currently used
- YY = none

11 Primary Coil Type
- C = chilled water only
- W = CW/HW 2-pipe
- H = hot water only
- S = steam

12 Primary Coil Rows
- 2 = 2 row
- 3 = 3 row
- 4 = 4 row

13 Primary Coil Fins Per Inch
- 12 = 12 fins per inch

14 Primary Coil Connection Hand
- L = left hand
- R = right hand

15 Primary Coil Piping Package
- F = factor installed
- L = shipped loose
- Y = none

16 Primary Coil Connection Type
- S = sweated
- T = threaded
- N = none

17 Preheat Coil Type
- E1 = electric single stage
- W1 = 1-row water
- W2 = 2-row water
- S1 = 1-row steam
- S2 = 2-row steam
- YY = none

18 Preheat Coil Fins Per Inch
- 12 = 12 fins per inch

19 Preheat Coil Connection Hand
- L = left hand
- R = right hand
- Y = none

20 Preheat Coil Piping Package
- F = factor installed
- L = shipped loose
- Y = none

21 Preheat Coil Connection Type
- S = sweated
- T = threaded
- N = none

Table 5: Model Number Description: Fields 21 - 41

Field	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
Code	YY	W1	12	R	F	T	Y	000	Y	P	PSC	S	3	Q	Y	MR	Y	D	Y	R

22 Not currently used
- YY = none

23 Reheat Coil Type
- W1 = 1-row water
- S1 = 1-row steam
- YY = none

24 Reheat Coil Fins Per Inch
- 12 = 12 fins per inch

25 Reheat Coil Connection Hand
- L = left hand
- R = right hand
- Y = none

26 Reheat Coil Piping Package
- F = factor installed
- L = shipped loose
- Y = none

27 Reheat Coil Connection Type
- S = sweated
- T = threaded
- N = none

28 Electric Heat Power Supply
- A = 115-60-1
- E = 208-230/60/1
- J = 277-265/60/1
- Y = None

29 Electric Heat Wattage
- 005 = 0.5 kW Electric Heat
- 010 = 1.0 kW Electric Heat
- 015 = 1.5 kW Electric Heat
- 020 = 2.0 kW Electric Heat
- 025 = 2.5 kW Electric Heat
- 030 = 3.0 kW Electric Heat
- 040 = 4.0 kW Electric Heat
- 050 = 5.0 kW Electric Heat
- 060 = 6.0 kW Electric Heat
- 000 = None

30 Not currently used
- YY = none

31 Drain Pan Material
- P = plastic, non-corrosive
- S = stainless steel

32 Blower Motor Type
- PSC = PSC motor
- XXX = special

33 Discharge Conditions
- S = standard static

34 Motor Speed
- 3 = 3 speed

35 Motor Connections
- Q = quick connect

36 Not currently used
- YY = none

37 Fresh Air Damper
- MR = manual rear
- 2R = automatic, 2-position, rear
- ER = automatic, economizer
- XX = special
- YY = none

38 Not currently used
- YYY = none

39 Unit Disconnect Switch
- D = toggle disconnect switch
- X = special
- Y = none

40 Future Control Function
- Y = none

41 Control Type
- A = analog
- D = digital
- R = DDC Ready
- X = Special
- Y = None

Model Number Description

Table 6: Model Number Description: Fields 43-59

Field	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
Code	Y	Y	Y	RL	MOR	Y	3MOU	YYYY	3MOU	Y	Y	C	Y	Y	Y

42 Network Communication Card
- Y = none

43 Changeover Type
- Y = none
- A = auto
- M = manual
- U = user selectable

44 Programmability
- Y = none

45 Setpoint Adjustment
- YY = none
- UL = unit-mounted, +/- 3 degrees
- UF = unit-mounted, full range
- RL = remote-mounted, +/- 3 degrees
- RF = remote-mounted, full range

46 Fan Speed Control
- YYY = None
- MOU = manual, on/off, unit-mounted
- MOR = manual, on/off, remote-mounted
- MAU = manual, low/med/high, unit-mounted
- MAR = manual, low/med/high, remote-mounted
- MPU = manual, off/proportional, unit-mounted
- MPR = manual, off/proportional, remote-mounted
- SOU = SCR, on/off, unit-mounted
- SOR = SCR, on/off, remote-mounted
- SAU = SCR, low/med/high, unit-mounted
- SAR = SCR, low/med/high, remote-mounted
- SPU = SCR, off/proportional, unit-mounted
- SPR = SCR, off/proportional, remote-mounted

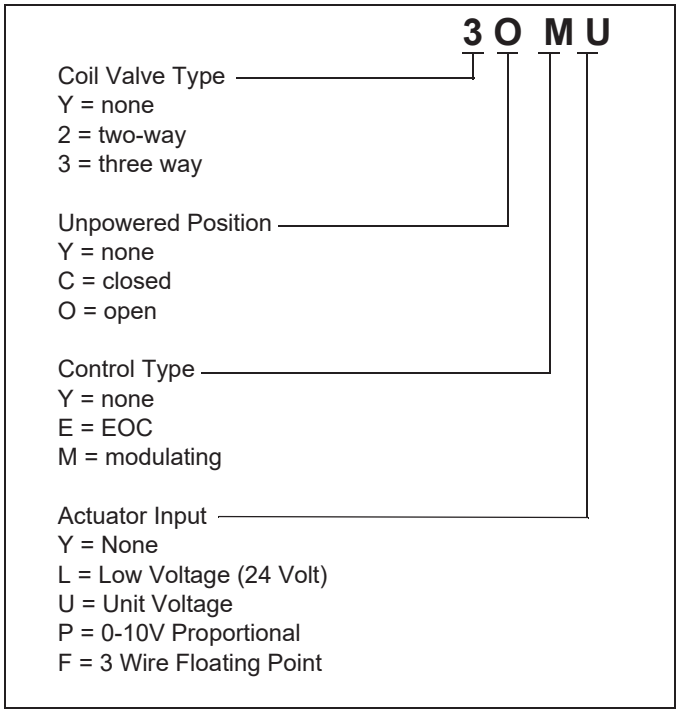
47 Timed Override
- Y = none

48 Valve - Primary Coil
- See Table 7

49 Valve - Preheat Coil
- See Table 7

50 Valve - Reheat Coil
- See Table 7

Table 7: Model Number Detail: Coil Valve Fields 49, 50, 51



51 Future Control Function
- Y = None

52 Low Temperature Protection
- Y = None
- X = special

53 Condensate Overflow Protection
- C = condensate overflow protection
- Y = None
- X = special

54 Discharge Air Thermistor
- Y = None
- X = special

55 Smoke Input Sensor
- Y = None
- X = special

56 Occ / Vacant Control Input
- Y = None
- X = special

Table 8: Model Number Description: Fields 57 - 72

Field	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
Code	Y	Y	Y	Y	S	18	P	I	00	S	00	00	30F	TA	FR	1

57 Filter Status Sensor
- Y = None
- X = special

58 Fan Status Sensor
- Y = None
- X = special

59 Future Control Function
- Y = None

60 Future Control Function
- Y = None

61 Cabinet Style
- S = Standard
- T = Tamperproof
- Y = None

62 Cabinet Gauge
- 16 = 16 Gauge
- 18 = 18 Gauge
- YY = None
- XX = Special

63 Cabinet Coating Type
- B = Powder Coat
- Y = None

64 Color- Cabinet
- I = Antique Ivory
- W = Off White
- G = Soft Gray
- C = Cupola White
- P = putty Beige
- Y = None
- X = Special

65 Cabinet Depth Extension
- 00 = None
- 04 = 4 Inch Extended Depth
- 08 = 08 inch Extended Depth

66 Unit Lineup Position
- S = Standalone

67 Left Hand End Pocket Extension
- 00 = None
- 04 = 4 Inch Extended Length
- 08 = 8 inch Extended Length

68 Right Hand End Pocket Extension
- 00 = None
- 04 = 4 Inch Extended Length
- 08 = 8 inch Extended Length

69 Subbase
- 30F = 3" subbase with leveling feet
- 30Y = 3" subbase without leveling feet
- XXF = special with leveling feet
- XXY = special without leveling feet
- YYY = none

70 Discharge Air - Outlet
- TA = top discharge with stamped louver grille
- TB = top discharge with multi-directional grille
- TY = top discharge with no grille
- TD: top discharge with duct collar
- FD = front discharge with duct collar
- FY = front discharge with no duct collar
- BD = bottom discharge with duct collar
- BY = bottom discharge with no duct collar
- XX = special

71 Return Air Inlet
- FR = front inlet with open return
- FS = front inlet with stamped louver
- FT = front inlet with toe space
- TR = top inlet with open return
- TS = top inlet with stamped louver
- BR = bottom inlet with open return
- BS = bottom inlet with stamped louver
- BT = bottom inlet with toe space
- XX = special

72 Filter
- 1 = 1” Throwaway Filter
- 3 = 1” Throwaway + (1) Extra

Model Number Description

Table 9: Model Number Description: Fields 73 - 78

Field	73	74	75	76	77	78
Code	YYY	Y	A	S	Y	1

73 Special Options

- YYY = none

74 Reserved for future use

- Y = none

75 Agency Listing

- A = ETL, CETL, ARI
- R = ETL, CSA
- X = special
- Y = none

76 Packaging

- S = Standard
- T = palletized based on tagging and by floor

77 Extended Warranty

- Y = none (standard warranty)
- 1 = 1 year Extended component warranty (30 month from shipment or 24 month from installation)
- 2 = 2 year Extended component warranty (42 month from shipment or 36 month from installation)
- 3 = 3 year Extended component warranty (54 month from shipment or 48 month from installation)
- 4 = 4 year Extended component warranty (66 month from shipment or 60 month from installation)
- X = special

78 Product Style

- 1 = Style 1
-

Daikin Training and Development

Now that you have made an investment in modern, efficient Daikin equipment, its care should be a high priority. For training information on all Daikin HVAC products, please visit us at www.DaikinApplied.com and click on training, or call 540-248-9646 and ask for the Training Department.

Warranty

All Daikin equipment is sold pursuant to its standard terms and conditions of sale, including Limited Product Warranty. Consult your local Daikin representative for warranty details. Refer to Form 933-430285Y. To find your local Daikin representative, go to www.DaikinApplied.com.

This document contains the most current product information as of this printing. For the most up-to-date product information, please go to www.DaikinApplied.com.

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INSTALLATION OPERATION AND SERVICE MANUAL

ADVANTUS™ SERIES

GAS FIRED FIRE TUBE COMMERCIAL CONDENSING STAINLESS STEEL BOILERS

HYDRONIC HEATING

Models; AVH 500, 600, 800, 1000, 1200, 1400, 1600, 1800, 2000, 2500, 3000, 3500, 4000

HOT WATER HEATER

Models; AVW 500, 600, 800, 1000, 1200, 1400, 1600, 1800, 2000, 2500, 3000, 3500, 4000

H HLW

WARNING:
If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

WHAT TO DO IF YOU SMELL GAS:

- Do not try to light any appliance,
- Do not touch any electrical switch; do not use any phone in your building,
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions,
- If you cannot reach your gas supplier, call the fire department.

Qualified installer, service agency or the gas supplier must perform installation and service.

To the Installer: After installation, these instructions must be given to the end user or left on or near the appliance.

To the End User: This booklet contains important information about this appliance. Retain for future reference.



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PART 1 GENERAL INFORMATION

1.1 INTRODUCTION

The Advantus™ is a condensing, fan assisted, fire tube appliance based on a push through design which offers several venting options. Heat output is controlled by air/gas ratio control gas valves which provide seamless modulation. The Advantus™ provides central heating or domestic hot water at working pressures up to 160 PSI. It is designed for use with a pumped and pressurized system. The boiler/water heater will automatically modulate to provide heat outputs between 100% and down to 10% for models AV500 & AV600 and down to 4.5% for models AV800 to AV1800 and 4.0% for models AV2000 to AV4000. The Advantus™ models 500 & 600 use a single automatic gas valve and operate on the principle of negative pressure. As the fan varies in speed it generates a varying negative pressure at the fan suction which draws in a corresponding amount of gas.

The Advantus™ models 800-4000 use two automatic gas valves - one at the low end and one at the high end. The high end gas valve works on the principle of differential pressure. Operation of the fan generates a differential air pressure, which the air/gas ratio control gas valve matches on the gas side. The steady state efficiency is maintained across the entire range of modulation. Air and gas are metered in precise proportion (1:1 Ratio) to modulation signal, allowing combustion characteristics which determine efficiency to remain the same over the entire operating range. The low end the gas valve works on the principle of negative pressure.

Figure 1: Advantus™



1.2 SPECIAL INSTRUCTIONS TO OWNER

This manual supplies information for the installation, operation and servicing of the appliance. It is strongly recommended that this manual be reviewed completely before proceeding with an installation.

CAUTION

It is important that all gas appliances are installed by a qualified installer/technician that is trained by Camus Hydronics Limited. It is in your own interest and that of safety to ensure that all local codes, and all the following “NOTES” and “WARNINGS” are complied with. Installing, servicing or adjusting this appliance should be performed only by a qualified installer/technician that is trained by Camus Hydronics Limited. The serviceman must utilize a combustion analyzer with CO_2, CO, and draft gauge to set the appliance according to Camus Hydronics Limited’s recommendations, prior to commissioning.

NOTE

RETAIN THIS MANUAL FOR FUTURE REFERENCE

1.3 CHECKING EQUIPMENT

Check for signs of shipping damage upon receiving equipment. Pay particular attention to parts accompanying the boiler, which may show signs of being hit or otherwise being mishandled. Verify total number of pieces shown on packing slip with those actually received. In case there is damage or a shortage, immediately notify carrier.

Figure 2: Checking the Advantus™



Do not attempt to pry any panel off. To begin disassembly, you must first remove the two top panels (which can be lifted off without the use of tools). Only then will you be able to remove the front and two side panels.

Once you have removed the two top panels, carefully check and confirm that all ¼" copper tubing connections are intact and have not broken or loosened in shipment. Leaks at any connections on these lines will result in erratic appliance operation.

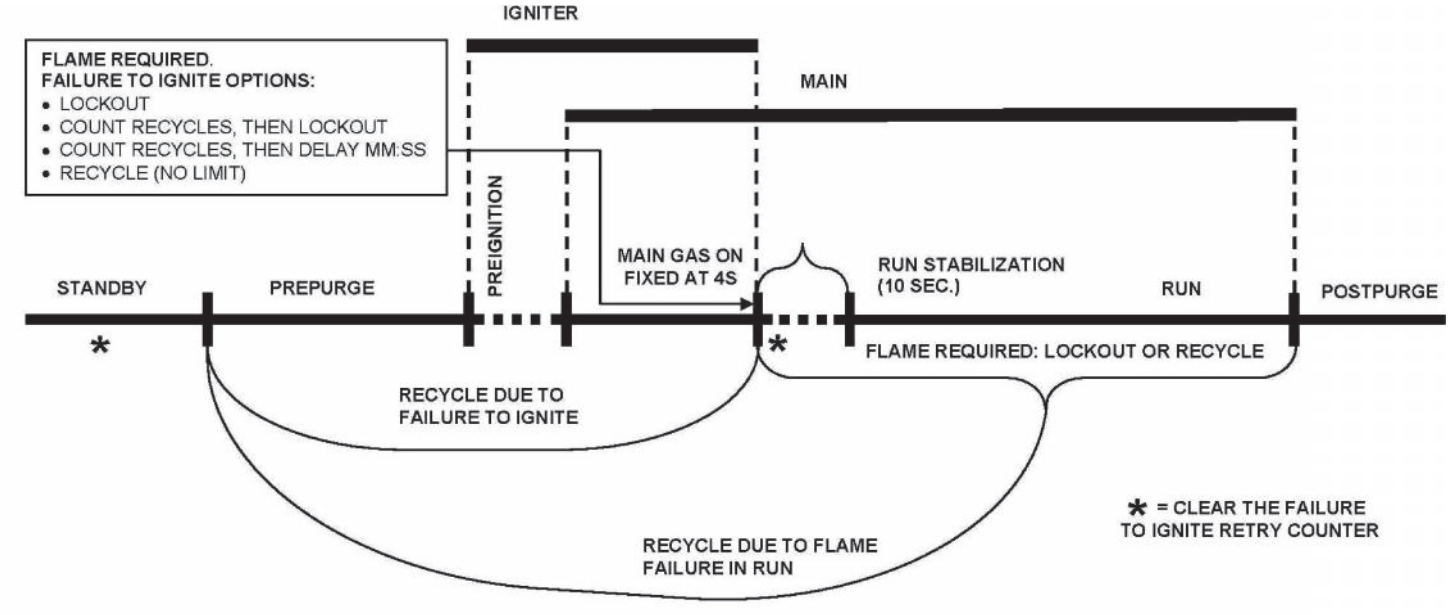
1.4 HOW IT OPERATES (SEQUENCE OF OPERATION)

1. Supply power connection as per table 9.
2. The power switch is placed in the "ON" position.
3. 120 VAC power is supplied to the control transformer.
4. 24 VAC is supplied to the ignition module and low voltage controls for all models.
5. After the appliance water pump starts, flow is proven by the flow switch and water pressure switch. The water pressure switch is set to close at 30 PSI and is installed in the unit. The flow switch is mounted at the outlet of the appliance. If installing a flow switch, take care to properly trim the flow switch paddles so as not to jam the switch in the tee. The normally open dry contacts in the low water cutoff (LWCO) are to be wired in series with the normally open contacts of the flow switch. Locate the probe type LWCO in the piping above the boiler inlet/outlet connection. In all cases, check with local codes.
6. The Advantus™ controller receives a call for heat via the remote operator contacts and the Demand parameter reads Central Heating, DHW, or Lead Lag Slave.
7. **a) AV500-AV600**: The Advantus™ controller energizes the pump contacts and starts to ramp up the voltage to the EC DC motor of the combustion fan after internal safety checks are satisfied.
   b) AV800-AV4000: The Advantus™ controller closes the pump contacts to start the pump which then causes the flow switch to close once minimum flow is reached. If all limit controls are made including temperature, water pressure and water flow, the controller closes the blower contacts to initiate the VFD and allows 60 seconds for the variable frequency drive (VFD) to ramp up the frequency to the 3 phase motor of the combustion fan using the modulating signal provided by the on board modulating control or the remote operating system. If the low air switch contacts are made within the 60 seconds, the VFD will run at pre-purge speed until the pre-purge timer is satisfied.
8. Once the pre-purge timer is satisfied, the Advantus™ controller will target the ignition fan speed.
9. **a) AV500-AV600 (Direct Ignition)**: The hot surface igniter will be energized for 22 seconds followed by opening of the gas valve. A signal of 0.8 Vdc minimum must be recognized by the controller at the UV scanner to keep the gas valve in an open position. The fan is kept at ignition speed as long as it receives a minimum modulation signal. As demand increases the modulation signal increases until full fire is reached. As target temperature is approached, the demand signal is reduced and the gas valve modulates downwards.
   b) AV800 – AV2500 (Direct Ignition): The Advantus™ controller will activate the hot surface igniter for 22 seconds followed by energizing the low end gas valve. A signal of 0.8Vdc minimum must be recognized by the controller at the UV scanner to keep the low end gas valve in the open position. The fan is kept at ignition speed until the flame is stabilized. As demand increases the modulation signal causes the low end gas valve to draw more gas. If the low-end gas valve cannot satisfy demand, at a preset point the staging relay opens the fan inlet damper and directs power to the high end gas valve while shutting off the low end gas valve. As target temperature is approached the demand signal is reduced and at a pre-set point the high end gas valve shuts off and the boiler proceeds to post purge.
   c) AV3000 - AV4000 (Proven Pilot): The Advantus™ controller will activate the hot surface igniter for 22 seconds followed by energizing the pilot valve for 10 seconds, whereupon a signal of 0.8Vdc must be recognized by the controller at the UV scanner to keep the pilot valve in an open position. The fan is kept at ignition speed until the stabilization timer is satisfied. After the stabilization timer expires the low end gas valve is opened and the pilot valve is deactivated. As demand increases, the modulation signal causes the low end valve to draw more gas and the sequence as detailed in (b) above is followed.
10. If the flame signal is not reached, the module will stop the ignition sequence after the" main gas on" period & recycle.
11. The fan speed will slowly decrease as the temperature nears the target. The modulation rate is controlled via a 4-20mA signal. If the heat demand is sustained without change, the boiler firing rate will reach a point of steady-state and the fan will rotate at constant speed.
12. When the heat demand is satisfied or the remote enable is removed, the burner will shut off and the fan speed will ramp up to the preset Post-Purge speed until the Post-Purge timer is satisfied.
13. The pump continues to circulate until the post-purge time is satisfied.
14. The boiler will then go into Standby as it waits for the next heat demand or remote enable.

NOTE

The igniter is energized with 115Vac when control is switching from the high end gas valve to the low end gas valve. To avoid shock do not contact bare igniter wires at this time

Figure 3: Advantus™ Ignition Cycle



NOTE:

1. If a flame signal is detected at the end of the pre-purge period, an error will occur.
2. If at the end of the safety period (4 sec) no flame is detected, the control will go to post-purge to remove the unburned gas. After this, a re-ignition attempt is started following the same cycle. The number of re-ignition attempts is limited to 2 after which a lockout occurs.
3. The burner can only be on continuously for a period of 24 hours. After this, the burner is switched off and a restart sequence follows.
4. The hot surface ignition is de-energized at the end of the ignition period to allow for ionization detection.

1.4.1 HEAT TRANSFER PROCESS

1. Burner input rate continues to increase until water temperature reaches the set point temperature.
2. Burner input rate may stabilize at a fixed rate when demand equals input.
3. Burner input rate will decrease when water temperate approaches temperature set point.

1.4.2 END OF SEQUENCE

1. Set point temperature is reached.
2. Power to the gas valve is turned off.
3. Combustion air fan ramps to a stop over the factory pre-programmed time period.
4. Thermostat is now in a standby mode waiting for the next “Call for Heat”.

WARNING
To minimize the possibility of serious personal injury, fire or damage to your appliance, never violate the following safety rules.

WARNING
IMPROPER INSTALLATION, ADJUSTMENT, ALTERATION, SERVICE OR MAINTENANCE can cause injury or property damage. Refer to this manual. For additional information, consult a qualified installer, service agency or gas supplier.

DO NOT
Do not use this appliance if any part of it has been **under water**. The possible damage to a flooded appliance can be extensive and present numerous safety hazards. Any appliance that has been **under water** must be replaced.

WHAT TO DO IF YOU SMELL GAS
Do not try to light any appliance. Do not touch any electric switch. Do not use any phone in your building. Immediately call your gas supplier from a neighbor’s phone. Follow the gas supplier’s instructions. If you cannot reach your gas supplier, call the fire department.

IMPORTANT
Consult and follow local Building and Fire Regulations and other Safety Codes that apply to this installation. Contact the local gas utility

company to authorize and inspect all gas and flue connections.

Installation and service must be performed by Camus Hydronics Limited qualified factory trained service technicians.

WARNING

Should overheating occur or the gas supply fails to shut off, **DO NOT** turn off or disconnect the electrical supply to the pump. Shut off the gas supply at a location external to the appliance.

Boilers and water heaters are heat producing appliances. To avoid damage or injury, do not store materials against the appliance or the vent-air intake system. Use proper care to avoid unnecessary contact (especially children) with the appliance and vent-air intake components.

- Never cover your appliance, lean anything against it, store trash or debris near it, stand on it or in any way block the flow of fresh air to your appliance.
- **UNDER NO CIRCUMSTANCES** may flammable materials such as gasoline or paint thinner be used or stored in the vicinity of this appliance, vent-air intake system or any location from which fumes could reach the appliance or vent-air intake system.
- A gas appliance that draws combustion air from the equipment room where it is installed must have an adequate supply of fresh air circulating around it during burner operation for proper gas combustion and proper venting.

1.5 CODES

The equipment shall be installed in accordance with those installation regulations enforced in the local area where the installation is to be made. These shall be carefully followed in all cases. Authorities having jurisdiction shall be consulted before installations are made. In the absence of such requirements, the installation shall conform to the latest edition of the National Fuel Gas Code, ANSI Z223.1 and/or CAN/CGAB149 Installation Code. All electrical wiring must be done in accordance with the requirements of the authority having jurisdiction or, in the absence of such requirements, with National Electrical Code, ANSI/NFPA70 and/or the Canadian Electrical Code part 1 CSA C22.1. Where required by the authority having jurisdiction, the installation must conform to the American Society of Mechanical Engineers Safety Code for Controls and Safety Devices for Automatically Fired Boiler, ASME CSD-1. All boilers conform to the latest edition of the ASME Boiler and Pressure Vessel Code, Section II & IV. Where required by the authority having jurisdiction, the installation must comply with the CSA International, CAN/CGA-B149 and/or local codes. This appliance meets the safe lighting performance criteria with the gas manifold and control assembly provided, as specified in the ANSI standards for gas-fired units, ANSI Z21.13 & ANSI Z21.10

1.6 WARRANTY

- Factory warranty (shipped with unit) does not apply to units improperly installed or improperly operated.
- Factory warranty shall apply only when the appliance is installed in accordance with local plumbing and building codes, ordinances and regulations, the printed instructions provided with it and good industry practices.
- Excessive **water hardness** causing a lime build-up on the stainless steel tubes is not a fault of the appliance and is not covered by warranty. Consult the factory for recommendations for use in hard water areas (See Water Treatment and Water Chemistry).
- Using or storing **corrosive chemicals** in the vicinity of this appliance can rapidly attack the stainless steel tubes and voids warranty.
- Damage caused by **freezing or dry firing** voids warranty.
- This appliance is not to be used for **temporary heating** of buildings under construction.
- The manufacturer shall **NOT** be held liable for any personal injury or property damage due to ice formation or the dislodging of ice from the vent system or the vent termination.

1.7 REMOVAL OF EXISTING APPLIANCE

When an existing appliance is removed from a common venting system, the common venting system is likely to be too large for proper venting of the appliances remaining connected to it. At the time of removal of an existing appliance, the following steps must be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

- Seal any unused opening in the common venting system.
- Visually inspect the venting system for proper size and horizontal pitch and determine that there is no blockage, restriction, leakage, corrosion or other deficiency, which could cause an unsafe condition.
- Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. If applicable, turn on the clothes dryers and any appliances not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
- Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so that the appliance operates continuously.

- If provided, test for spillage at the draft control device relief opening after 5 minutes of main burner operation. Use a cold mirror, the flame of a match, or candle or smoke from a cigarette.
- After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous condition of use.
- Any improper operation of the common venting system should be corrected so that the installation conforms to the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or the Natural Gas and Propane Installation Code, CAN/CGA B149.1, Installation Codes. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Chapter 13 of the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or the Natural Gas and Propane Installation Code, CAN/CGA B149.1, Installation Codes.

Heat exchanger surfaces and vent piping should be checked every six months for deterioration and carbon deposits. Remove all soot or other obstructions from chimney and flue, which might impede draft action. Replace any damaged or deteriorated parts of the venting system.

A qualified service technician should follow this procedure when inspecting and cleaning the heat exchanger and vent pipe.

1. Turn off electrical power and main gas shut-off and allow appliance to cool down.
2. Remove the vent pipe running to the chimney and check heat exchanger, vent and chimney for obstruction and clean as necessary.
3. Remove burner from appliance and carefully clean as required. Never brush or wipe the knitted metal fiber surface – use a garden hose and wash instead. **Caution: Never use a pressure washer to clean the burner.**
4. Use a pressure washer to clean heat exchanger if necessary.
5. Reinstall parts removed in steps 2 and 3. Be sure that vent pipe has proper pitch and is properly sealed. Replace any damaged gasket. Note that the burner is supplied with two gaskets; a high temperature graphite coated ceramic paper gasket under the burner flange, and a stamped silicon gasket between the burner flange and fan flange. Tighten fan flange mounting nuts to 20 ft-lb (Models 500 & 600), 25 ft-lb (Models 800-4000).
6. Restore electrical power and gas supply to appliance.
7. Place appliance in operation using lighting instructions provided.
8. Confirm proper operation of all safety devices.
9. Check for gas leaks and proper vent operation.

NOTE
Experience has shown that improper installation or system design, rather than faulty equipment, is the cause of most operating problems.

1.8 BOILER ROOM OPERATING CONDITION

- Due to low jacket losses from the appliance, temperatures in a typical boiler room may drop significantly; supplemental heat is required to maintain ambient temperature at acceptable levels.
- Camus Advantus™ boilers and water heaters are approved at 95% efficiency and are required to be vented as a Category II or IV condensing appliance.

1.9 CLEARANCE FROM COMBUSTIBLE MATERIAL

This appliance is suitable for alcove (a closet without a door) installation with minimum clearances to combustibles as follows:

Table 1: Clearance from combustibles

Clearance from Combustibles			
TOP	12”	REAR	12”
SIDES	12”	VENT	1”

Figure 4: Clearance from Combustibles



When placing the appliance, be aware that a minimum clearance of 24" (60cm) must be provided at the front to allow easy access to the heat exchanger.

When installed directly on carpeting, the appliance shall be installed on a metal or wood panel extending beyond the full width and depth of the appliance by at least 3 inches (76.2mm) in any direction, or if the appliance is installed in an alcove or closet, the entire floor shall be covered by the panel. The panel must be strong enough to carry the weight of the heater when full of water.

Note: Clearances from combustible construction are noted on the appliance rating plate. Maintain minimum specified clearances for adequate operation. All installations must allow sufficient space for servicing the vent connections, water pipe connections, circulating pump, bypass piping and other auxiliary equipment, as well as the appliance.

Table 2: Servicing Clearances

Service Clearances					
Model	Service Clearance, Inches (cm)				
	Top	Right Side	Left Side	Back	Front
500	24"	12"	12"	24"	24"
600	24"	12"	12"	24"	24"
800	24"	12"	12"	24"	24"
1000	24"	12"	12"	24"	24"
1200	24"	12"	12"	24"	24"
1400	24"	12"	12"	24"	24"
1600	24"	12"	12"	24"	24"
1800	24"	12"	12"	24"	24"
2000	24"	12"	12"	24"	24"
2500	24"	12"	12"	24"	24"
3000	24"	12"	12"	24"	24"
3500	24"	12"	12"	24"	24"
4000	24"	12"	12"	24"	24"

1.10 INSTALLATION PROCEDURE AND LOCATION OF UNIT

Install this appliance in a clean, dry location with adequate air supply.

- Do not locate this appliance in an area where it will be subject to freezing unless precautions are taken. Radiant losses from the Advantus™ are minimal and should not be relied on to keep the appliance room warm.
- The appliance should be located close to a floor drain in an area where leakage from the appliance or connections will not result in damage to the adjacent area or to lower floors in the structure. It is recommended that a suitable drain pan, adequately drained, be installed under the unit. Under no circumstances is the manufacturer to be held responsible for water damage in connection with this unit, or any of its components.
- If the appliance is installed above the level of the buildings radiation system, a low water cut-off device must be installed above the heat exchanger inlet/outlet connections. Some local codes require the installation of a low water cut-off on all systems.
- When placing the appliance be aware that a minimum clearance of 24" must be provided at the front to allow easy access to the heat exchanger.
- The appliance must be installed so that the ignition system components are protected from water (dripping, spraying, etc.) during appliance operation and service (circulator replacement, control replacement, etc.)
- Appliances located in a residential garage and in adjacent spaces that open to the garage and are not part of the living space of a dwelling unit, must be installed so that all burners and burner ignition devices have a minimum clearance of not less than 18" (46cm) above the floor. The appliance must be located or protected so that it is not subject to physical damage by a moving vehicle.
- DO NOT install this appliance in any location where gasoline or flammable vapors are likely to be present.
- Appliance must be installed on a level floor. Maintain required clearances from combustible surfaces.
- The appliance designed for indoor installation (Indoor Models) must be installed indoors where it is protected from exposure to wind, rain and weather.
- The appliance designed for outdoor installation (Outdoor Models) must be installed outdoors. For outdoor installations, always consider the use of a shelter such as a garden shed in lieu of direct exposure of the appliance to the elements. The additional protection afforded by the shelter will help to minimize nuisance problems with electrical connections and will allow easier servicing of the appliance under severe weather conditions.

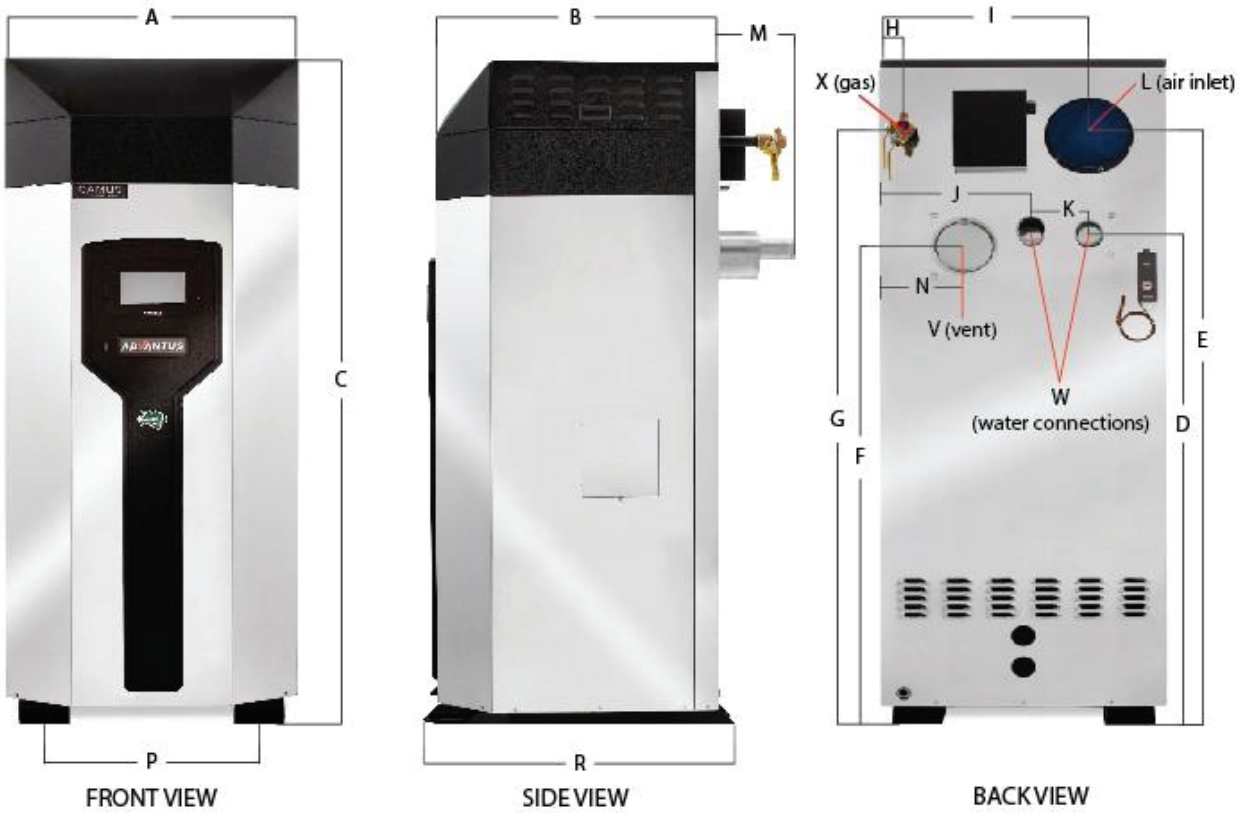


Table 3: Appliance Dimensions and Specifications

Model	"A" [in.]	"B" [in.]	"C" [in.]	"D" [in.)	"E" [in.]	"F" [in.]	"G" [in.]	"H" [in.]	"I" [in.]	"J" [in.]	"K" [in.]	"L" [in.]	"M" [in.]	"N" [in.]	"P" [in.]	"R" [in.]	"W" [Øin.] Water	"X" [Ø in.] Gas	Weight [lbs.]
500	29½	34	60	39½	50	37	50	4	21½	15	6	6	19 1/8	9	22	37½	2	1	830
600	29½	34	60	39½	50	37	50	4	21½	15	6	8	19 1/8	9	22	37½	2	1	860*
800	30	34	83	61	74	59½	68½	4	21½	15½	6	8	19	9	22	37½	2	1	1000*
1000	30	34	83	61	74	59½	68½	4	21½	15½	6	8	19	9	22	37½	2	1	1100
1200	30	42	83	59	75	57	67	4	21½	15½	6	10	19	7½	22	37½	2½	1	1200*
1400	30	42	83	59	75	57	67	4	21½	15½	6	10	19	7½	22	37½	2½	1¼	1630
1600	30	42	83	54 ½	75	51	63	4	21½	16 ½	6	10	23	7½	22	37½	3	1¼	1840
1800	30	42	83	54 ½	75	51	63	4	21½	16 ½	6	10	23	7½	22	37½	3	1¼	1900*
2000	30	42	93	63 ½	80	60	72	4	22	16 ½	6	12	23	7½	22	37½	3	1¼	2160
2500	30	42	93	63 ½	80	60	72	4	22	16 ½	6	12	23	7½	22	37½	3	1½	2200*
3000	35	47	101	66	90	62	78	5 ½	26	17 ½	6	12	23	17½	27½	50	3	1½	2400*
3500	35	47	101	66	90	62	78	5 ½	26	17 ½	24	12	23	17½	27½	50	4	2	2700*
4000 (Natural Gas)	35	47	101	66	90	62	78	5 ½	26	17 ½	24	12	23	17½	27 ½	50	4	2½	3000
4000 (Propane)	35	47	101	66	90	62	78	5 ½	26	17 ½	24	12	23	17½	27 ½	50	4	2	3000

*Preliminary estimates

Model	Air Inlet up to 100 ft. Equiv. Length	Ø Dim. "V" (in.) Vent - As Shipped	CAT IV up to 100ft Equiv. Length	Ø Dim. "V" (in.) Vent CAT. II
500	5	5	5	6
600	5	5	5	6
800	6	6	6	6
1000	6	6	6	7
1200	6	7	7	8
1400	6	7	7	8
1600	8	8	7	9
1800	8	8	8	10
2000	8	8	8	10
2500	8	8	9	10
3000	10	10	10	10
3500	10	10	10	12
4000 (Natural Gas)	10	10	10	12
4000 (Propane)	10	10	10	14

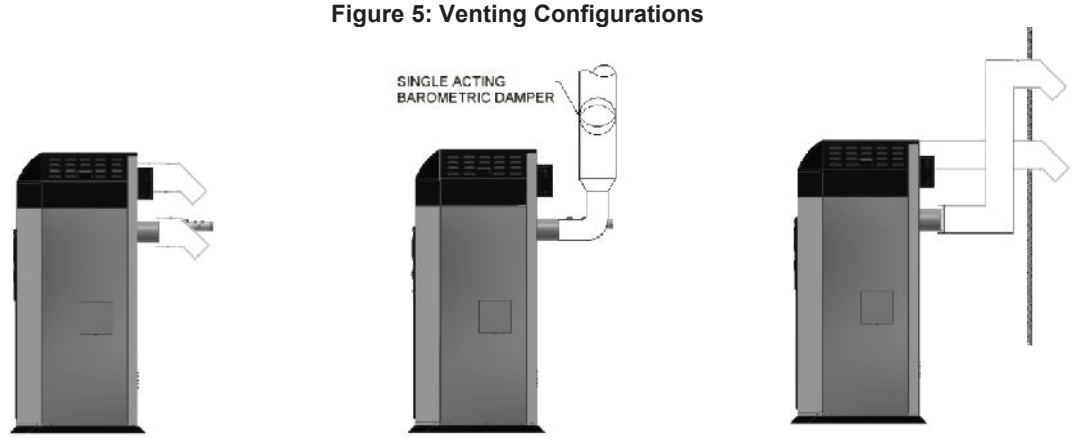
PART 2 VENTING & AIR SUPPLY

DANGER
It is extremely important to follow these venting instructions carefully. Failure to do so can cause severe personal injury, death or substantial property damage.

DANGER
Use of cellular core PVC (ASTM F891), cellular core CPVC or Radel® (polyphenosulfone) in venting systems is prohibited

2.1 GENERAL VENTING GUIDE

Figure 5: Venting Configurations



OUTDOOR VENTING | **STANDARD VENTING** | **SIDEWALL VENTING AND COMBUSTION AIR INLET**

The Advantus™ is a category II condensing appliance, up to 99% efficient unit.

- The Advantus™ may be vented with manufactured prefabricated UL/ULC listed vents of AL29-4C or 316L stainless steel or with plastic vent certified to UL/ULC S636, such as, IPEX System 636 CPVC or IPEX System 636 PP as permitted by local jurisdictions.
- The Advantus™ boiler must be vented and supplied with combustion and ventilation air as described in this section. Ensure that the venting and combustion air supply complies with these instructions regarding the vent system, air system, and combustion air quality.
- Vent installations for connection to gas vents or chimneys must be in accordance with Part 7, “Venting of Equipment” of the latest edition of the National Fuel Gas Code, ANSI Z223.1, in Canada, the latest edition of CAN/CGA Standard B149 Installation Codes for Gas Burning Appliances and Equipment or applicable provisions of the local building codes.
- The distance of the vent terminal from adjacent building, windows that open and building openings MUST comply with the latest edition of the National Fuel Gas Code, ANSI Z223.1, in Canada, the latest edition of CAN/CGA Standard B149 Installation Codes for Gas Burning Appliances and Equipment.
- Vent connection is made directly to the flue outlet opening on the back of the unit.
- For indoor installations, venting must be in accordance with Part 7, Venting of Equipment, of the National Fuel Gas Code, ANSI Z223.1, or Section 7, Venting of Equipment and Air Supply for Appliances, of the CAN/CGA B149, Installation Codes, or applicable provisions of the local building codes.
- Horizontal runs of vent pipe shall be securely supported (approximately every 4 feet) to prevent sagging and maintain a minimum upward slope of ¼” per foot from the appliance to the vent terminal.
- The weight of the venting system must not rest on the unit. Adequate support of the venting system must be provided in compliance with local codes and other applicable codes.
- All connections should be secured and sealed per the vent manufacturer’s specifications. When a positive vent system is disconnected for any reason, the flue must be reassembled and resealed according to the vent manufacturer’s instructions.
- Do not use an existing chimney as a raceway if another appliance or fireplace is vented though the chimney.

2.1.1 CATEGORY II AND CATEGORY IV VENTING

A Category II venting system operates with a negative pressure in the vent.

A Category IV venting system operates with positive pressure generated by the internal combustion air fan which operates the combustion process and also exhausts the flue products from the building.

- The Category II flues from multiple appliances can be combined into a common vent. This special venting system must be engineered by venting manufacturer and to be approved by local authority.
- The Category IV flues from multiple appliances **CAN NOT** be combined into a common vent.
- The Category IV flue must be a dedicated stack.

- The Category IV flue appliance must have all vent joints and seams sealed gas tight.
- The flue products in the vent system will be cooled below their dew point and will form condensate in the flue. Flue construction must be of AL29-4C, 316L Stainless, S636 CPVC, S636 PPE.
- The flue from a Category II and IV vent system must have a condensate drain with provisions to properly collect, neutralize and dispose of any condensate that may occur.

2.1.2 VENTING GUIDELINES FOR CATEGORY II AND/OR IV VENTING

- This installed length of the positive pressure flue from the appliance to the point of termination, outside of the building, must not exceed a maximum of 100 equivalent feet (30.5M) in length. Depending on diameter and centerline radius subtract from 7 to 19 feet per 90° elbow using published data. Subtract half this value for each 45° elbow.
- The flue may terminate either vertically at the roof top or horizontally on a SIDEWALL. See the information about the specific vent termination location for recommended location and clearances.
- For direct vent applications, the maximum wall thickness must be between 0.5" – 12" (1.2 cm to 30cm).

2.1.3 APPROVED VENTING MATERIALS

Exhaust Vent for Use for Advantus™ Category II or IV

Installations

1. Manufactured prefabricated UL/ULC listed vent of AL29-4C or equivalent, Single or Double wall.
2. 316L Stainless Steel is limited to use in applications where there is no possibility of contaminants in the air such as refrigerants, chlorine etc.
3. "BH" type
4. CPVC Schedule 40 or 80 approved to ULC S636
5. CPVC Schedule 40 approved to comply with ANSI/ASTM F441. (US Jurisdictions ONLY when permitted)
6. Polypropylene approved to comply with ULC S636 up to 12" diameter.

NOTE
1) Use of cellular core PVC (ASTM F891), cellular core CPVC or Radel® (polyphenosulfone) in venting systems is prohibited. 2) Covering non-metallic vent pipe and fittings with thermal insulation is prohibited.

Table 4: Maximum Flue Temperatures for Various Vent Materials

Vent Material	Maximum Flue Temperature (°F)
CPVC	194
Polypropylene	230
AL29-4C	300+, limited only by rating of seals
316L Stainless Steel	300+, limited only by rating of seals

Stack temperature is generally 10-25°F above boiler inlet temperature when operating at steady state at full fire.

Vent Material Selection

When selecting vent material, take into consideration that appliances installed near a corrosive or potentially corrosive air supply must be isolated from it or they will suffer damage to the appliance and the venting system.

The corrosion resistance of AL29-4C is typically higher than that of 316L. Always choose the venting system which best satisfies the requirements of the application.

This recommendation does not supersede local codes or the provision of the B149 in Canada or the National Fuel Gas Code in the United States.

Intake Air (Supply Air, or Fresh Air) Piping

NOTE
Air Intake material must be of a type listed by a nationally recognized testing agency

1. **PVC** Non Foam Core Pipe.
2. **CPVC** Non Foam Core Pipe.
3. **Polypropylene**
4. **ABS** (Acrylonitrile-Butadiene-Styrene)

Single Wall air intake pipes are to be insulated 5 feet from wall toward the interior of the building to minimize external sweating.

2.1.4 VENT TERMINATION CLEARANCES

- Do not terminate the vent in a window well, stairwell, alcove, courtyard or other recessed area. The vent cannot terminate below grade. The bottom of the vent terminal shall be located at least 12 inches (30cm) above grade and above normal snow levels. In all cases, the appliance shall be installed in accordance with local codes.
- The vent outlet MUST NOT terminate below a forced air inlet at any distance.
- The vent cannot terminate below grade. Position the vent termination where vapors will not damage walls or plants or may otherwise be objectionable.
- The vent terminal shall not be installed closer than 3 feet (1m) from an inside corner of an L-shaped structure, window well, stairwell, alcove, courtyard or other recessed area as wind eddies could affect boiler performance or cause recirculation.
- DO NOT terminate closer than 4 feet (1.25m) horizontally and vertically from any electric meter, gas meter, regulator, relief valve, or other equipment. In all cases, local codes take precedence.
- Position terminations so they are not likely to be damaged by foreign objects, or exposed to a build-up of debris.
- The vent piping must terminate in an elbow pointed outward or away from the air inlet.
- To avoid a blocked flue condition, keep the vent cap/terminal clear of snow, ice, leaves, debris etc.
- Flue gases from this appliance may contain large amounts of water vapor that will form a white plume in winter. Plume could obstruct a window view.
- Flue gas condensate can freeze on exterior walls or on the vent cap. Frozen condensate on the vent cap can result in a blocked flue condition. Some discoloration to exterior building surfaces can be expected. Adjacent brick or masonry surfaces should be protected with a rust resistant sheet metal plate.

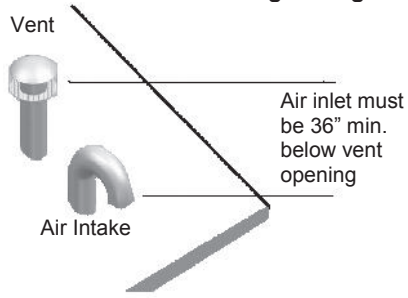
2.1.5 INLET CAP FOR ROOFTOP TERMINATION

The air inlet cap consists of two 90° elbows installed at the point of termination for the air inlet pipe. The first 90° elbow is installed on the rooftop at the highest vertical point of the air inlet pipe and turned horizontal; the second 90° elbow is screened and is installed on the horizontal outlet of the first elbow and turned down. A 90° elbow and a 90° street elbow may be used to make this assembly. If a straight piece of pipe is used between the two elbows, it should not exceed 6" (150mm) in length.

2.1.6 LOCATION OF A ROOFTOP AIR INLET AND VENT CAPS

- The point of termination for the combustion air inlet cap MUST be at least 3 feet (0.91m) below the point of flue gas termination (vent cap) if it is located within a 5 foot (1.5m) radius of the flue outlet. Use care to ensure that the 90° elbow assembly is properly installed on the air inlet pipe.
- The termination point of the combustion air inlet cap must be installed at least 3 feet (0.91m) above the rooftop and above normal snow levels.
- The vent cap assembly MUST be listed by nationally recognized agencies.
- The combustion air cap and vent cap MUST be located on the same roof top surface and in the same pressure zone.
- Combustion air supplied from outdoors must be free of contaminants. To prevent recirculation of flue products in to the combustion air inlet, follow all instructions in this section.
- Incorrect installation and/or location of the air inlet cap can allow flue products to be drawn back into the appliance. This can result in incomplete combustion and potentially hazardous levels of carbon monoxide in the flue products. This will cause operational problems with the appliance and if left uncorrected, will lead to conditions that can cause personal injury or death.

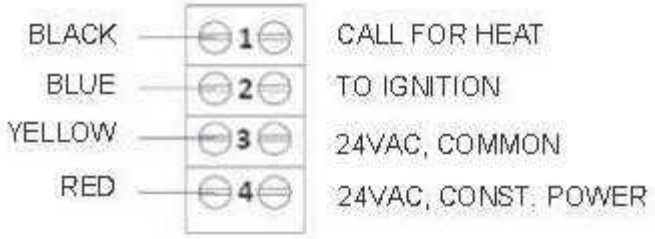
Figure 6: Vertical Direct Venting Configuration



2.1.7 AIR INLET DAMPER

In cold climates, it is essential to provide a motorized air inlet damper to control the supply of combustion air and prevent nuisance condensation. Each air inlet damper is designed to serve only one appliance and it must be electrically wired to the Air Inlet Damper Connection inside the junction box. All electrical wiring must be done in accordance with the requirements of the authority having jurisdiction or, in the absence of such requirements, with National Electrical Code, ANSI/NFPA70 and/or the Canadian Electrical Code part 1 CSA C22.1. A minimum clearance of not less than 6" (152mm) between the air inlet damper and combustible construction must be maintained for service of the vent damper device.

Figure 7: Air Inlet Damper Connection inside J-Box



NOTE
Damper must be in open position when appliance main burner is operating.

2.1.8 MASONARY CHIMNEY INSULATIONS

Always follow local codes when venting this appliance into a masonry chimney. A standard masonry chimney must NOT be used to vent the products of combustion from the flue of a condensing, positive or negative pressure appliance (Category II or IV). If a masonry chimney is to be used, the chimney MUST use a sealed, corrosion resistant liner system to vent flue products from this high efficiency appliance. Sealed, metallic, corrosion resistant liner systems (AL29-4C or equivalent, single wall or double wall, or flexible or rigid metallic liners) must be rated for use with a high efficiency condensing, positive pressure vent system. Corrosion resistant chimney liner systems are typically made from a high grade of corrosion resistant stainless steel such as AL29-4C or equivalent. The corrosion resistant liner must be properly sized and fully sealed throughout the entire length. If the flue is contained within the masonry chimney, both the top and the bottom of the masonry chimney must be capped and sealed to provide a dead air space around the sealed corrosion resistant liner.

Consult with local code officials to determine code requirements or the advisability of using a masonry chimney with a sealed corrosion resistant liner system.

2.1.9 VERTICAL VENTING TERMINATION

- Follow Category II or IV vent termination and all General Instructions.
- The vent terminal should be vertical and exhaust outside the building at least 2 feet (0.61m) above the highest point of the roof within a 10 foot (3.05m) radius of the termination.
- The vertical termination must be a minimum of 3 feet (0.91m) above the point of exit.
- A vertical termination less than 10 feet (3.05m) from a parapet wall must be a minimum of 2 feet (0.61m) higher than the parapet wall.

2.1.10 COMBINED COMBUSTION AIR INLET

The air inlet pipes from multiple appliances can be combined to a single common connection if the common air inlet pipe has a cross sectional area equal to or larger than the total area of all air inlet pipes connected to the common air inlet pipe.

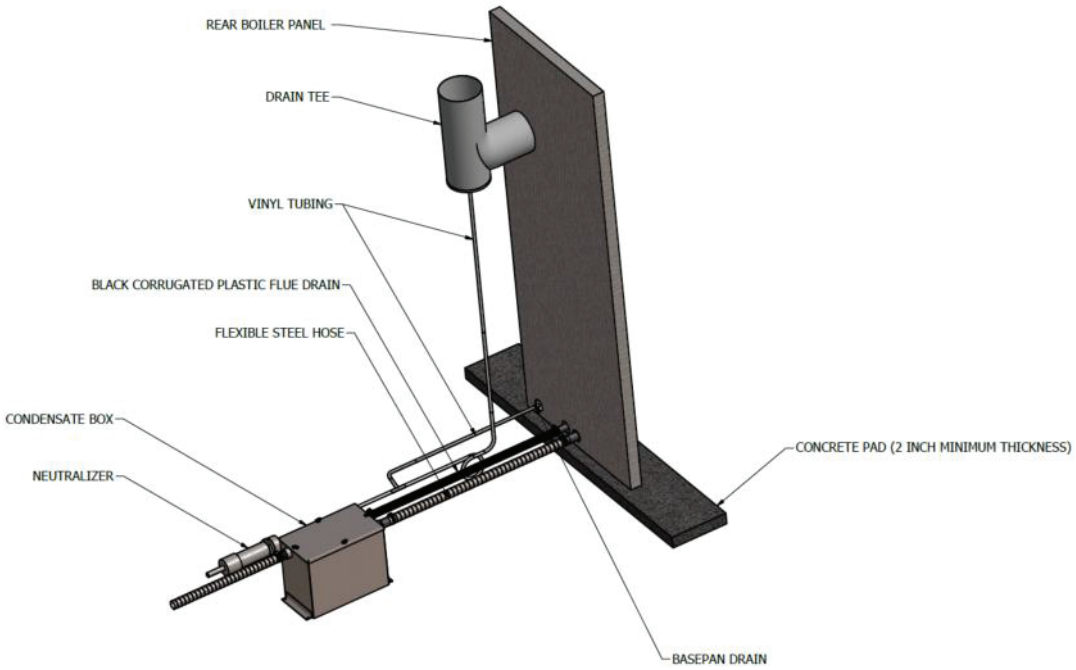
Equivalent pipe diameter = Sq Root $[(d_1)^2 + (d_2)^2 + (d_3)^2 + (d_4)^2 + ... + (d_n)^2]$, d, pipe diameter

- Example: What is equivalent pipe diameter of three air inlet pipes, 8" (20.3cm), 10" (25.4cm) and 12" (30.5cm)
    - Equivalent pipe diameter = Sq Root $[(8)^2 + (10)^2 + (12)^2]$ = Sq Root (308) = 17.5", Select 18" (82.8cm) diameter pipe or larger.

The air inlet point for multiple boiler air inlets must be provided with an exterior opening which has a free area equal to or greater than the total area of all air inlet pipes connected to the common air inlet. This exterior opening for combustion air must connect directly to the outdoors. The total length of the combined air inlet pipe must not exceed a maximum of 100 equivalent feet (30.5m). You must deduct the restriction in area provided by any screens, grills or louvers installed in the common air inlet point. Screens, grills or louvers installed in the common air inlet can reduce the free area of the opening from 25% to 75% based on the materials used. Calculate and compensate accordingly for the restriction.

2.1.11 DRAIN TEE

Figure 8: Drain "T" and Neutralizer Cartridge Installation



A drain line must be connected to the boiler condensate drain and to a tee installed in the vent pipe to collect and dispose of any condensate that may occur in the boiler and vent system. The drain tee should be installed at the point where the flue turns vertical for a roof top termination or as one of the first fittings in a horizontal flue that will terminate on a SIDEWALL. Ensure that horizontal portions of the vent are properly sloped away from the appliance to allow condensate to be evacuated at the drain tee. Plastic drain tubing, sized per the vent manufacturer's instructions, shall be provided as a drain line from the tee and from the boiler condensate line. The drain tubing from the tee must have a trap provided by a 4" (10cm) diameter circular trap loop in the drain tubing and the boiler drain shall be normal with no loop and tied into the tee drain tubing with a tee at a point after the 4" loop and before the neutralizer. Prime the trap loop by pouring a small quantity of water into the drain hose before assembly to the vent. Secure the trap loop in position with nylon ties. Use caution not to collapse or restrict the condensate drain line with the nylon wire ties. The common condensate drain must be routed to the condensate neutralization system or a suitable drain for the disposal of condensate that occurs in both the boiler and in the vent system. Ensure that the drain from the condensate tee is not exposed to freezing temperature.

2.2 CONVENTIONAL VENTING (INDOOR) INSTALLATIONS

- The Advantus™ is a category II appliance and is approved for venting into a common chimney. On single appliance installations with dedicated chimney, if drafts are excessive (above negative 0.15 inches W.C.), we recommend a single acting barometric damper.
- A qualified professional using a proven vent-sizing program with input of accurate operating parameters must properly determine sizing of the venting system. In applications where flue gas temperatures are lower than can support a Category II with conventional negative draft, it will be determined at the venting design stage that a positive pressure will be developed in the vent. It will then be necessary to either provide separate vents as for Category IV, pressurize the room or to provide an extractor at the chimney outlet interlocked with the appliance operating circuit in order to maintain a negative draft in the chimney and allow common venting.
- Approval of the installation will be at the discretion of authorities having jurisdiction.

IN GENERAL

- The operation of exhaust fans, compressors, air handling units etc. can rob air from the room, creating a negative pressure condition leading to reversal of the natural draft action of the venting system. Under these circumstances, an engineered air supply is necessary.
- If the appliance is to be installed near a corrosive or potentially corrosive air supply, the appliance must be isolated from it and outside air should be supplied as per code.
- Potentially corrosive atmospheres will result from exposure to permanent wave solution, chlorinated waxes and cleaners, chlorine, water softening chemicals, carbon tetrachloride, halogen based refrigerants, Freon cleaning solvents, hydrochloric acid, cements and glues, masonry washing materials, antistatic fabric softeners, dry cleaning solvents, degreasing liquids, printing inks, paint removers, etc.
- The equipment room MUST be provided with properly sized openings to assure adequate combustion air and proper ventilation when the unit is installed with a proper venting system.

2.2.1 AIR REQUIRED FOR COMBUSTION AND VENTILATION

If air is taken directly from outside the building with no duct, provide two permanent openings:

a) Net free area for combustion air opening shall be in accordance with all applicable codes. In the absence of such codes, provide combustion air opening with a minimum free area of one square inch per 7000 Btuh input (5.5cm per kW) up to 1,000,000 Btuh and one square inch per 14,000 Btuh in excess of 1,000,000 Btuh. This opening must be ducted no higher than 18" nor less than 6" above the floor. Provide a ventilation air opening located as high as practical in the room sized no less than 10% of the air supply opening.

b) Provision for combustion and ventilation must be in accordance with:
   - Applicable sections of The National Fuel Gas Code ANSI Z223.1
   - Applicable sections of CAN/CGA B149 installation codes
   - Applicable provisions of the local building codes

NOTE
Outside air openings shall directly communicate with the outdoors

CAUTION
Under no circumstances should the mechanical room ever be under a negative pressure. Particular care should be taken where exhaust fan, attic fans, clothes dryers, compressors, air handling units, etc., may take away air from the unit.

2.2.2 EXHAUST FANS

Any fan or equipment which exhausts air from the equipment room may deplete the combustion air supply and/or cause a downdraft in the venting system through a barometric damper if installed. Spillage of flue products from the venting system into an occupied living space can cause a very hazardous condition that must be immediately corrected.

2.3 OUTDOOR VENTING

The Advantus^{TM} windproof cabinet protects the unit from weather, when fitted with the factory supplied air intake and UL approved vent cap (93.0298), it will be self-venting and suitable for outdoor installation.

1. Outdoor models must be installed outdoors and must use the air intake and vent cap supplied by Camus Hydronics.
2. Periodically check to ensure that air intake and vent cap are not obstructed.
3. Locate appliance at least 3 feet away from any overhang.
4. Locate appliance at least 10 feet away from building air intake.
5. Avoid installation in areas where runoff from adjacent building can spill onto appliance.

For outdoor installations, always consider the use of shelter such as a garden shed in lieu of direct exposure of the appliance to the elements. The additional protection afforded by the shelter will help to minimize nuisance problems with electrical connections and will allow easier servicing of the appliance under severe weather conditions.

2.4 SIDEWALL VENTING

When fitted with the factory supplied vent terminal, the Advantus^{TM} can vent up to 100 equivalent feet. Elbows can range from 7 to 19 feet in equivalent length depending on centerline radius. Refer to table 3 for vent sizes.

Appliances may be installed with either a horizontal sidewall vent or vertical roof top vent. Terminals differ with each application. Use approved single wall or double wall vent.

Periodically check to ensure that the vent terminal is unobstructed.

This venting system uses the appliance's internal combustion air fan to force the flue products out horizontally.

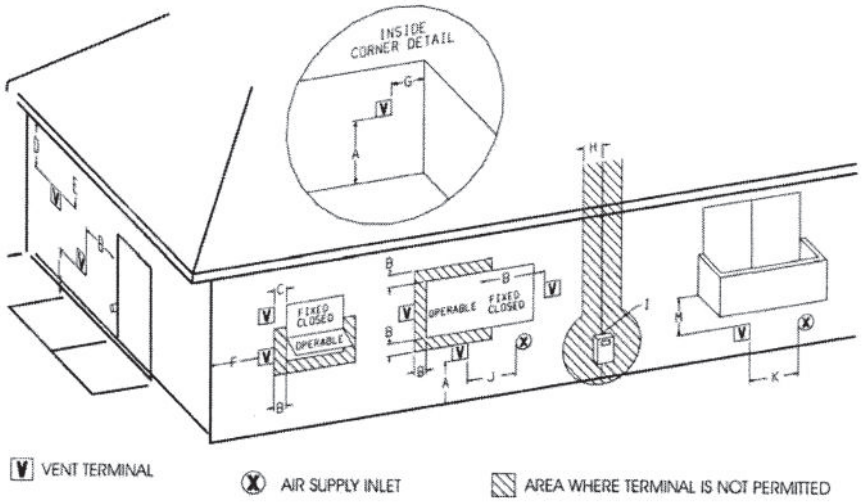
The Advantus^{TM} fan generates a positive pressure in the flue. Combustion air is drawn from the equipment room. Sidewall terminations are available from the factory. Refer to local codes for proper installation and location of vent terminals.

2.4.1 SIDEWALL VENT TERMINAL & SIDEWALL INTAKE AIR TERMINAL

- The sidewall vent terminal kit includes the wall penetration assembly and the discharge screen assembly.
- The opening through the wall for installation of the sidewall vent terminal must provide an air space clearance of 1 inch (2.5cm) to combustible material around the flue pipe. The diameter of the opening for the air inlet will be the same as the nominal size of the pipe.
- Install the proper vent pipe to the vent terminal provided by Camus Hydronics.
- Follow all requirements in the General Venting sections for venting flue products to the outdoors.

2.4.2 LOCATION OF A SIDEWALL VENT TERMINATION

- The vent terminal shall terminate at least 3 feet (1m) above any forced air inlet within 10 feet (3m) horizontally.
- The vent terminal MUST NOT terminate below a forced air intake at any distance.
- Do not terminate the vent in a window well, stairwell, alcove, courtyard or other recessed area. The vent cannot terminate below grade.
- Do not terminate the vent near soffit vents or crawl space vents or other areas where condensate or vapour could create a nuisance or hazard of cause property damage.
- Do not terminate the vent where condensate or vapour could cause damage or could be detrimental to the operation of regulators, relief valves or other equipment.
- The vent shall not terminate less than 7 feet above a public walkway due to the normal formation of water vapor in the combustion process.
- The vent system shall terminate at least 3 feet (1m) above normal snow levels and least 7 feet (2.15m) above grade when located adjacent to public walkways.
- The vent terminal shall not be installed closer than 3 feet (1m) from an inside corner of an L-shaped structure.
- The vent terminal should have a minimum clearance of 4 feet (1.25m) horizontally from and in no case above or below, unless a 4 foot (1.25m) horizontal distance is maintained from electric meters, gas meters, regulators and relief equipment. In all cases, local codes take precedence.
- Flue gas condensate can freeze on exterior walls or on the vent terminal. Frozen condensate on the vent cap can result in a blocked flue condition. Some discoloration to exterior building surfaces can be expected. Adjacent brick or masonry surfaces should be protected with a rust resistant sheet metal plate.



Direct Vent Terminal Clearances		Canadian Installations[1]	US Installations[2]
A	Clearance above grade, veranda, porch, deck, or balcony	12” (30 cm)	12 in (30 cm)
B	Clearance to window or door that may be opened	36” (91 cm)	12” (30 cm)
C	Clearance to window or door that may be opened	*	*
D	Clearance to permanently closed window	*	*
E	Clearance to unventilated soffit	*	*
F	Clearance to outside corner	*	*
G	Clearance to inside corner	*	*
H	Clearance to each side of center line extended above meter/ regulator assembly	3 feet (91 cm) within a height of 15’ (4.5 m) above the meter/ regulator assembly	*
I	Clearance to service regulator vent outlet	36” (91 cm)	*
J	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	36” (91cm)	12” (30 cm)
K	Clearance to a mechanical air supply inlet	6’ (1.83 m)	3’ (91 cm) above if within 10’ (3 m) horizontally
L	Clearance above paved sidewalk or paved driveway located on public property	7’ (2.13 m)[α]	*
M	Clearance under veranda, porch deck, or balcony	12” (30 cm)[β]	*

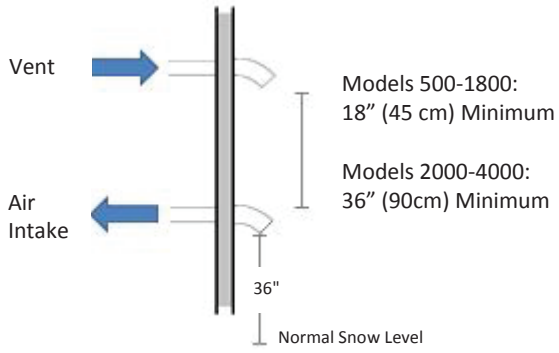
[1] In accordance with the current CSA B149.1 Natural Gas and Propane Installation Code
[2] In accordance with ANSI Z223.1/ NFPA 54 National Fuel Gas Code
[α] A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings
[β] Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.
* For clearances not specified in ANSI Z223.1/ NFPA 54 or CSA-B149.1. Clearance in accordance with local installation codes and the requirements of the gas supplier

Room Air, Vent Terminal Clearances		Canadian Installations[1]	US Installations[2]
A	Clearance above grade, veranda, porch, deck, or balcony	12" (30 cm)	12 in (30 cm)
B	Clearance to window or door that may be opened	36" (91 cm)	4' (1.2 m) below or to side of opening; 1' (30 cm) above opening
C	Clearance to window or door that may be opened	*	*
D	Clearance to permanently closed window	*	*
E	Clearance to unventilated soffit	*	*
F	Clearance to outside corner	*	*
G	Clearance to inside corner	*	*
H	Clearance to each side of center line extended above meter/ regulator assembly	36" (91 cm) within a height of 15' (4.5 m) above the meter/ regulator assembly	*
I	Clearance to service regulator vent outlet	36" (91 cm)	*
J	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	36" (91cm)	4' (1.2 m) below or to side of opening; 1' (30 cm) above opening
K	Clearance to a mechanical air supply inlet	6' (1.83 m)	3' (91 cm) above if within 10' (3 m) horizontally
L	Clearance above paved sidewalk or paved driveway located on public property	7' (2.13 m)[α]	*
M	Clearance under veranda, porch deck, or balcony	12" (30 cm)[β]	*

[1] In accordance with the current CSA B149.1 Natural Gas and Propane Installation Code
[2] In accordance with ANSI Z223.1/ NFPA 54 National Fuel Gas Code
[α] A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings
[β] Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.
* For clearances not specified in ANSI Z223.1/ NFPA 54 or CSA-B149.1. Clearance in accordance with local installation codes and the requirements of the gas supplier

2.4.3 LOCATION OF A SIDEWALL AIR INLET TERMINAL

- The termination point of the sidewall air inlet must be installed a minimum of 3 feet above normal levels of snow accumulation.
- **Models 500 – 1800:** The point of termination for the sidewall combustion air inlet terminal MUST be located a minimum 18 inches (0.45m) below the point of flue gas termination (vent cap).
- **Models 2000 – 4000:** The point of termination for the sidewall combustion air inlet terminal MUST be located a minimum of 3 feet (1m) below the point of flue gas termination (vent cap).
- The sidewall vent and air termination must be purchased with the boiler to ensure reliable boiler operation.



2.4.4 LENGTH OF AIR INLET PIPE

The maximum total length of the sidewall or vertical roof top combustion air inlet pipe as installed from the appliance to the air inlet terminal must not exceed 100 equivalent feet (30.5m) in length. Subtract 7 (2.13m) to 19 feet (5.8m) of equivalent length depending on centerline radius for each 90° elbow installed in the air inlet pipe system. Pressure drop in 45° elbow will be half as much.

PART 3 GAS CONNECTIONS

Verify that the appliance is supplied with the type of gas specified on the rating plate. Consult factory for installations at high altitude.

3.1 GAS CONNECTION

- Safe operation of unit requires properly sized gas supply piping. See gas line sizing data.
- Gas pipe size may be larger than appliance connection.
- Installation of a union at the appliance gas line connection is required for ease of service and removal of the gas train.
- Install a manual main gas shutoff valve, outside of the appliance gas connection as required by local codes.
- A trap (drip leg) MUST be provided in the inlet gas connection to the appliance.
- Optional gas controls may require routing of bleeds and vents to the atmosphere, outside the building when required by local codes.
- Larger models of this appliance may be supplied with a gas pressure relief valve. This valve is designed to relieve lockup pressure in excess of the high gas pressure switch setting. It must be piped to discharge excess gas pressure through the valve to a safe location in accordance with local codes. Follow table 5 for sizing the vent line.

Table 5: Gas Pressure Relief Valve – Vent Manifold Sizing Chart

Size of Combined Vent Line (Sch. 40 pipe)*		
Qty of Pressure Relief Valves being combined	Pressure Relief Valve Size – ¾" NPT	Pressure Relief Valve Size - 1" NPT
1	¾"	1"
2	1"	1 ¼"
3	1 ¼"	1 ½"
4	1 ¼"	2"
5	1 ½"	2"
6	1 ½"	2"
7	2"	2 ½"
8	2"	2 ½"

*Up to 50 feet. Increase by one pipe size for every 50 feet or part thereof that the vent line extends beyond the initial 50 feet. The increase is to be made at the connection to the relief valve.

Table 6: Recommended Gas Pipe Size

Single Appliance Installation (For distance from natural gas meter or propane second stage regulator)

Input	0-100 feet		101-200 feet		201-300 feet	
Btu/Hr x 1000	NAT.	L.P.	NAT.	L.P.	NAT.	L.P.
450	1 ½"	1 ¼"	2"	1 ½"	2"	1 ½"
600	1 ½"	1 ¼"	2"	1 ½"	2"	1 ½"
800	2 "	1 ½"	2"	1 ½"	2 ½"	2"
1000	2 "	1 ½"	2"	1 ½"	2 ½"	2"
1200	2"	1 ½"	2 ½"	2"	2 ½"	2"
1400	2 ½"	2"	2 ½"	2"	3"	2 ½"
1600	2 ½"	2"	3"	2 ½"	3"	2 ½"
1800	2 ½"	2"	3"	2 ½"	3"	2 ½"
2000	2 ½"	2"	3"	2 ½"	3"	2 ½"
2500	3"	2 ½"	3"	2 ½"	3 ½"	3"
3000	3"	2 ½"	3"	2 ½"	3 ½"	3"
3500	3"	2 ½"	3 ½"	3"	4"	3 ½"
4000	3 ½"	3"	4"	3 ½"	4"	3 ½"

3.2 GAS PIPING

All gas connections must be made with pipe joint compound resistant to the action of liquefied petroleum and natural gas. All piping must comply with local codes and ordinances.

3.3 INSTALL PIPING

- The gas line should be sufficient to handle the total installed capacity. Verify pipe size with gas supplier.
- Use new, properly threaded black iron pipe free from burrs. Avoid flexible gas connections. Internal diameter of flexible gas lines may not provide appliance with proper volume of gas.
- Install a manual main gas shutoff valve at the appliance gas inlet, outside of the appliance and before the gas valve. Install a joint union at the appliance gas line connection for ease of service and removal of the gas train.
- Run gas pipe to appliance gas inlet.
- Install a sediment trap in the supply line to the appliance gas inlet.
- Apply a moderate amount of good quality pipe compound.
- For LP gas, consult your LP gas supplier for expert installation.

The appliance and its individual gas shutoff valve must be disconnected from the supply piping when pressure testing the gas supply piping at pressures above ½ PSI.

Table 7: Gas Pressures at Inlet to Appliance

	PROPANE	NATURAL GAS
Minimum (inches W.C.)	11	4
Maximum (inches W.C.)	11	14

The gas supply line must be of adequate size to prevent undue pressure drop and must never be smaller than the size of the connection on the appliance. Sizing based on Table 6 is recommended.

Before operating the appliance, the complete gas train and all connections must be tested using soap solution.

Verify that the appliance is supplied with the type of gas specified on the rating plate. Heating values of local natural gas are to be between 950 and 1010 Btu/ft^3. Consult factory if heating values are outside this range or if a gas with a mixture of constituents is being used.

3.4 AIR/GAS RATIO VALVE

Models 500 & 600 utilize a dual seat negative pressure air/gas ratio control valve. Operation of the gas valve in combination with the combustion air fan allows the burner input rate to vary from 10% to 100% based on temperature demand.

Models 800-4000 utilize a dual seat negative pressure air/gas ratio control valve at the low end and an air/gas ratio control valve at the high end. This combination allows the low end valve to fire down to 4.5% for AV800 to AV1800 and 4.0% for AV2000 and above of full input to achieve a 22:1 and 25:1 turndown, respectively. At a pre-determined point control is passed from the low end valve to the high end valve and at the same time the fan air inlet damper is opened. The high end valve controls the pressure difference across a flow orifice in the manifold supply line as a function of the pressure difference across the combustion air supply to the burner. The high end valve actuator maintains a matching 1:1 air to gas ratio as the volume of air changes based on the operation of the combustion air fan.

The air/gas ratio of both low and high end valves is preset at the factory and adjustment is not usually required if gas supply pressure is maintained within the specified range.

There are no serviceable parts on the dual seat negative pressure low end air/gas ratio control valve.

A reduction of up to 30% is permitted in the inlet gas pressure between light off and full fire conditions.

If the manifold differential pressure is to be measured, refer to section 3.8 Checking Differential Air and Gas Pressures for Proper Measurement.

Figure 9: AV500 – 600 1:1 Negative Pressure Air Gas Ratio Control Valve

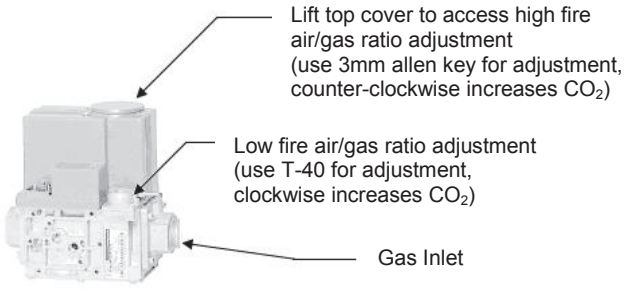
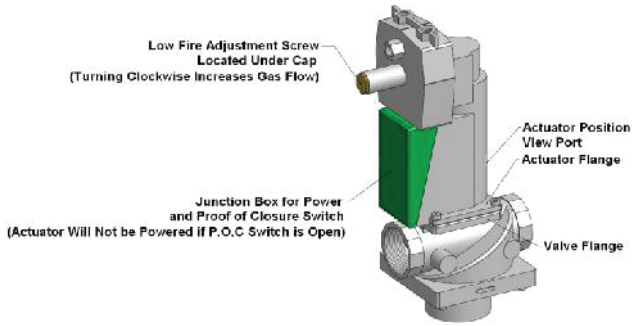


Figure 10: AV800 – 4000: 1:1 Air/Gas Ratio Control Valve



3.5 OPERATION OF NEGATIVE PRESSURE AND DIFFERENTIAL PRESSURE VALVES

- The Advantus™ Models 500 & 600 both operate on the principle of negative pressure. As the fan varies in speed it generates a varying negative pressure at the fan suction which draws in a corresponding amount of gas.
- The Advantus™ Models 800-4000 utilize both a negative pressure gas valve and a 1:1 air/gas ratio control valve. At the low end these models operate on the principle of negative pressure and at the high end they operate on the principle of differential pressure.
- The differential air pressure measurement is made between the high and low pressure taps across the fan discharge and the fan static discharge. There are two pressure taps at the fan discharge and care must be taken to tee into the correct line. The correct line may be identified by tracing it back to the ratio control valve where the identification of the tapping is stamped into the die cast actuator.
- The differential gas pressure measurement is made between the high and low pressure taps across the inline metering gas orifice. Check this value to confirm that it matches the differential air pressure while the appliance is firing.
- The controls on this appliance may fire the burner from 4.0% up to 100% of rated input.
- Differential manifold gas pressure will be reduced as burner input is reduced.
- All reference gas pressure measurements must be made at 100% of rated burner input.
- The differential gas manifold pressure is preset at the factory through the ratio gas valve. Adjustment of manifold pressure is not normally required for proper operation. It may be necessary to adjust the low fire adjustment screw located on the ratio control valve actuator in order to achieve acceptable light off under field conditions.
- **Always check settings posted on boiler test label.**

3.6 GAS MANIFOLD DIFFERENTIAL PRESSURE ADJUSTMENT (AV800-AV4000)

Tampering with gas valve adjustments after startup and commissioning will void the warranty on the gas valve assembly and the burner.

The appliance's manifold gas pressure **IS NOT** field adjustable after startup and commissioning. The gas valve pressure ratios have been factory set with an internal bias adjustment to ensure a 1:1 air/gas ratio on operation. Tampering with this adjustment will void the warranty on the gas valve assembly and the burner. An appliance supplied with a properly sized gas line, properly sized meter and a minimum gas supply pressure (see table 7 for minimum allowable inlet gas supply pressure) while firing at full rate will ensure full burner input. The manifold pressure supplied to the burner is a differential pressure. This pressure is the result of the difference in two gas pressure measurements. A differential manifold gas pressure measurement should not be made until you have measured the gas supply pressure. Gas supply pressure must be at least at minimum allowed with all appliances on the gas line firing at full rate before a manifold pressure measurement is made. Use the following procedure to check gas supply pressure with a manometer connected to the inlet pressure tap on the gas line connection at the rear of the appliance.

3.7 CHECKING GAS SUPPLY PRESSURE

- Turn the main power to the "OFF" position.
- Shut off gas supply at the manual gas cock in the gas piping to the appliance. If fuel supply is LP gas, shut off gas supply at the tank.
- The boiler and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of ½ psi (3.5 kPa).
- The boiler must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressure equal to or less than ½ psi (3.5 kPa).
- Remove the 1/8" hex plug from the gas pressure test port located on the inlet gas supply connection at the rear of the appliance. Install a fitting in the inlet pressure tapping suitable to connect to a manometer or magnahelic gauge. Range of scale should be 0 to 14 inch W.C. or greater to check inlet pressure.
- Turn on gas supply at the field installed manual gas cock; turn on LP gas at tank if required.
- Turn the power switch to the "ON" position.
- Adjust the thermostat set point to call for heat.
- Observe the gas supply pressure as the burner fires at 100% of rated input.

- Ensure inlet pressure is within specified range. Minimum and maximum gas supply pressures are specified in Table 7.
- If gas pressure is out of range, contact the gas utility, gas supplier, qualified installer or service agency to determine necessary steps to provide proper gas pressure to the control.
- If gas supply pressure is within normal range, proceed to remove gas manometer and replace pressure tap fittings in the gas piping to the appliance.
- Turn on gas supply at the manual valve; turn on LP gas at tank if required.
- Turn the power switch to the "ON" position.
- Adjust the thermostat temperature set point to the desired water temperature so that the appliance will call for heat.
- Check appliance performance by cycling the system while you observe burner response. The burner should ignite promptly. Flame patterns should be stable, see "Maintenance-Normal Flame Pattern". Turn system off and allow burner to cool, then cycle burner again to ensure proper ignition and flame characteristics.

IMPORTANT

Upon completion of any testing on the gas system, leak test all gas connections with a soap solution while the main burner is firing. Immediately repair any leak found in the gas train or related components. DO NOT operate an appliance with a leak in the gas train, valves, or related gas piping.

3.7.1 REGULATED GAS SUPPLY PRESSURES FOR ADVANTUS™ BOILERS & WATER HEATERS

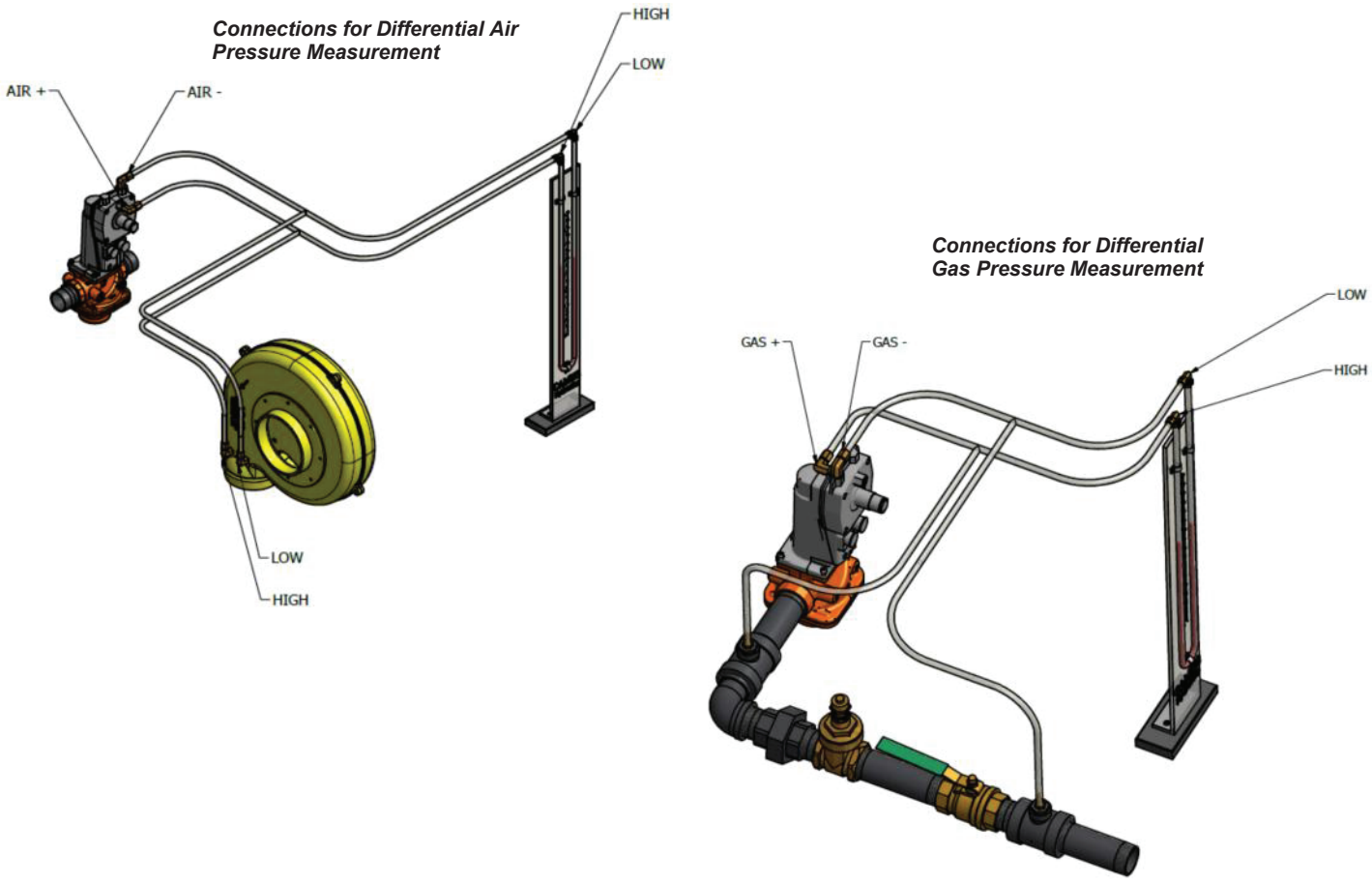
A stable gas supply pressure is important to avoid rough starts with machines like the Advantus™ which use a 1:1 ratio control valve for internal gas pressure regulation. Camus requires that all Advantus™ models be supplied with no more than 14" w.c.supply pressure. This means that lockup pressure must not exceed 14" w.c.

It is paramount that maximum lockup pressure be confirmed before any attempt is made to start up the appliance.

Operating the Advantus™ at lockup pressures exceeding 14" w.c. is not recommended and could lead to delayed ignitions and damage to the appliance.

3.8 CHECKING DIFFERENTIAL AIR AND GAS PRESSURES (AV800-AV4000)

Figure 11: Checking Differential Air and Gas Pressures (AV800 – AV4000)



The 1:1 air/gas ratio control actuator has embossed markings identifying + air, - air, + gas & - gas connections. Using a test hose assembly fitted with tees, connections can be made from the manometer to the appropriate ports on the actuator.

- Using tees connect a hose from the positive air and the negative air to each of the two sides of a monometer. This will allow the two pressure points to be measured while at the same time the actuator still receives the proper operating signal.
- If a second manometer is available, it can be connected to the appropriate gas ports. Typically, the gas signal will closely follow the air signal on all models. If the incoming gas pressure reduces significantly as the VFD accelerates to maximum speed, the gas signal may lag behind the air signal by up to 15%. This will occur once the actuator has driven downwards as far as it can go. The amount that the actuator has opened is registered by an indicator arm which is visible through the view window.
- As the appliance comes on and fires, record the maximum inches of water column which is achieved at maximum speed on the VFD using startup report form (93-0332). To adjust this differential pressure when commissioning the appliance, use the adjusting screw on the air shutter to the fan. In all cases, the final adjustment is to be made using a combustion analyzer. Depending on field conditions differential pressures will have to be adjusted accordingly. Typically with long lateral runs, the differential signal as read will be reduced from the value shown on the rating plate. The opposite will occur with tall stacks where drafts exceed negative 0.15" W.C.
- If the appliance will not light off it will be necessary to adjust the low fire as explained in the detailed startup procedure.

3.9 GAS TRAIN AND CONTROLS

Figure 12: Typical Gas Train (models AV500 & AV600)

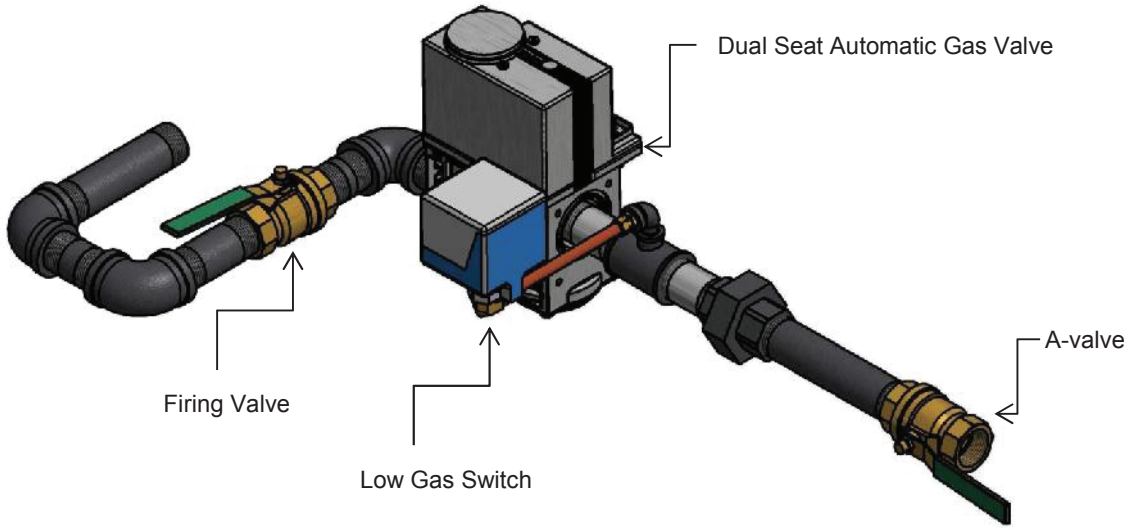


Figure 13: Typical Gas Train (Models AV800 -2000)

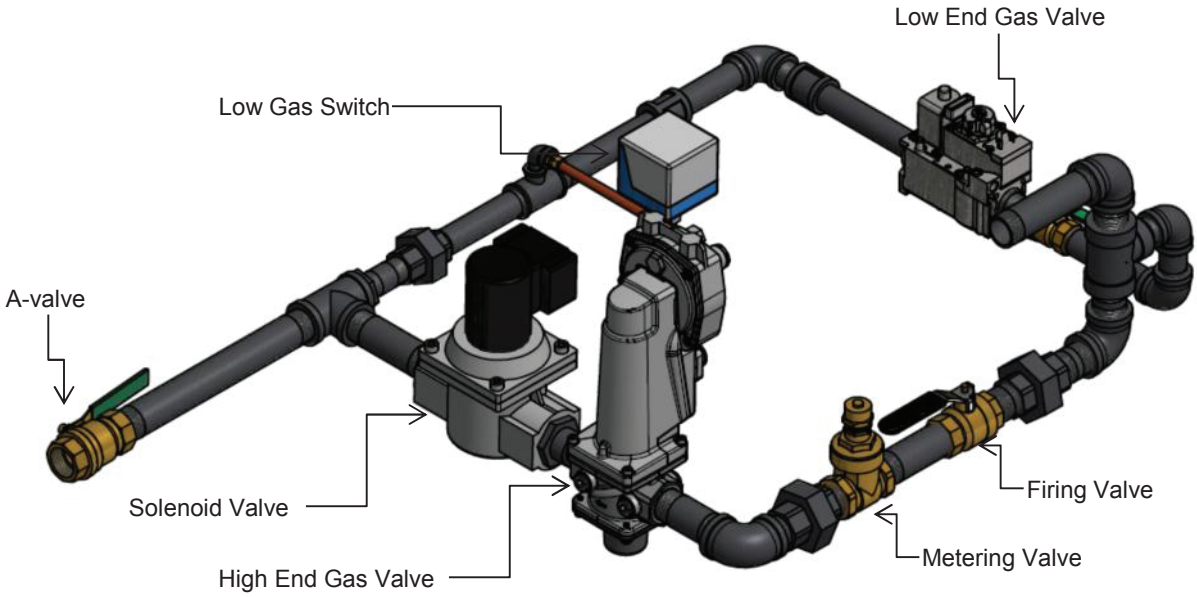


Figure 14: Typical Gas Train (Models AV2500-3000)

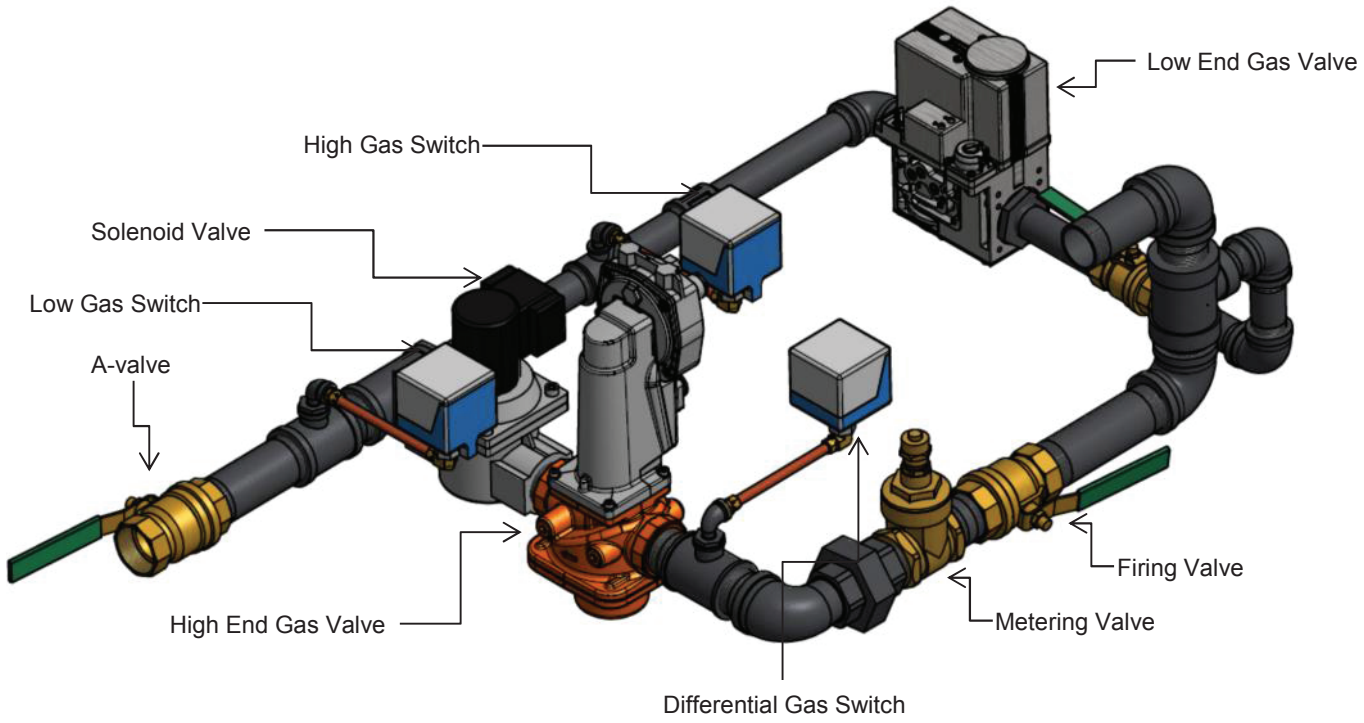
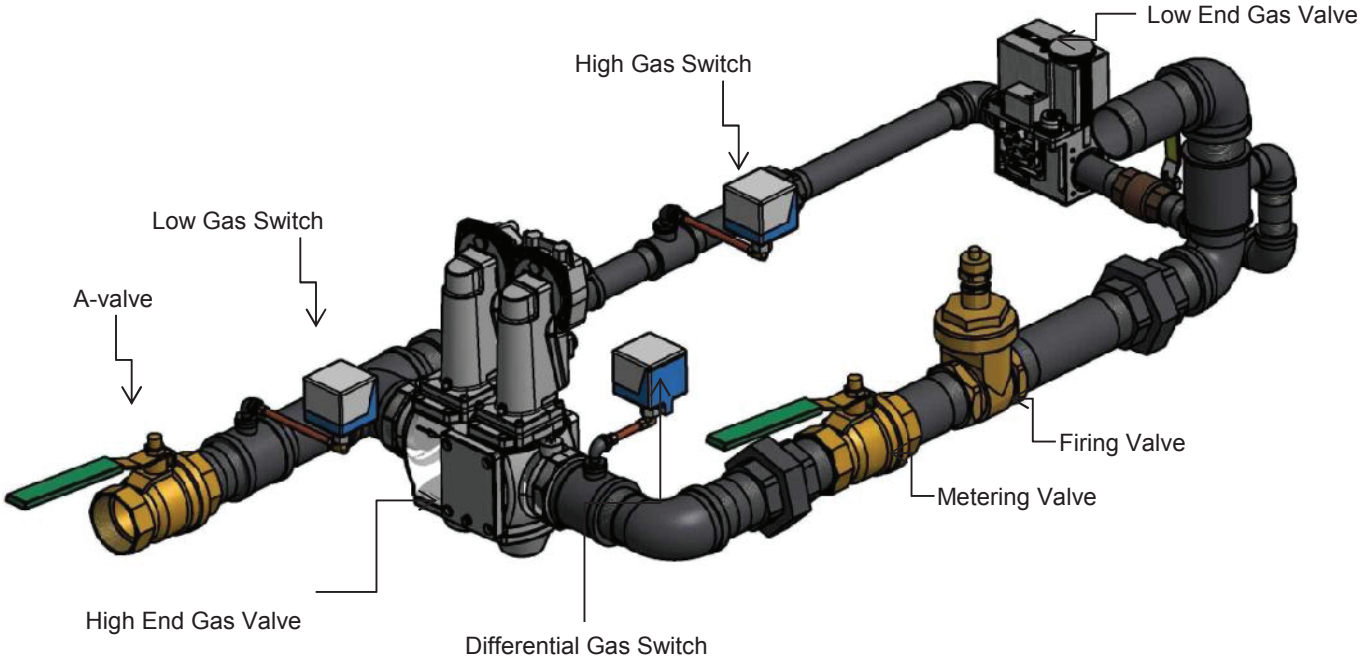


Figure 15: Typical Gas Train (Models AV3500-4000)

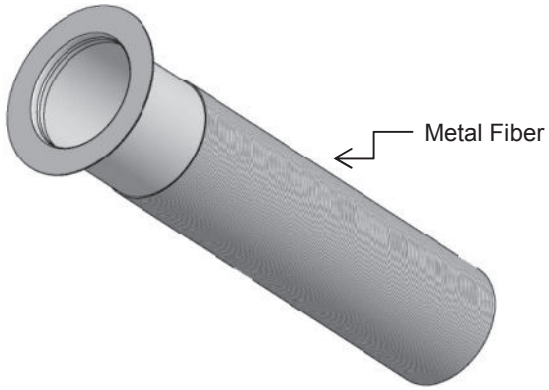


3.10 VENTING OF GAS VALVES AND PRESSURE SWITCHES

The optional gas pressure switches may be provided with threaded termination points to be vented to the atmosphere, outside the building. The gas pressure regulation function is provided by the ratio gas valve which does not require installation of a vent line. The optional gas pressure switches are installed in the upper chamber of the appliance. Threaded vent line connections from components requiring an external vent line are provided on the component. These vent line connection points may be accessed by removing the top of the appliance. Local codes may require the routing of these bleeds and vents to the atmosphere, outside the building. Proper routing of vent lines to the atmosphere from the factory supplied termination points is the responsibility of the installing contractor.

3.11 BURNER

Figure 16: Burner



This appliance uses a single cylindrical burner installed vertically into the cavity located in the center of the heat exchanger.

The burner consists of a round mounting flange welded to a mixing tube. The top side of the mixing tube provides the transition which mounts the discharge from the combustion air fan into the burner. The bottom side of the mixing tube is attached to a stainless steel perforated sleeve. This stainless steel sleeve is covered with a metal fiber alloy material that forms the burner port surface. The burner port material is a metal fiber material which is a unique alloy of iron, chrome, aluminum and several rare earth metals. This alloy is designed to operate stress free as a burner port surface. The burner port surface can sustain operation from a blue flame down to infrared conditions as the burner input varies. Infrared operation will occur only as turndown is increased.

Model 500-2500: Direct ignition is standard. The burner mounting flange provides a flame view port and the mounting point for the hot surface igniter and the UV Scanner.

Model 3000-4000: Proven pilot ignition is standard. The burner mounting flange provides a flame view port, the mounting point for the hot surface igniter, a connection to the pilot tube and the UV Scanner.

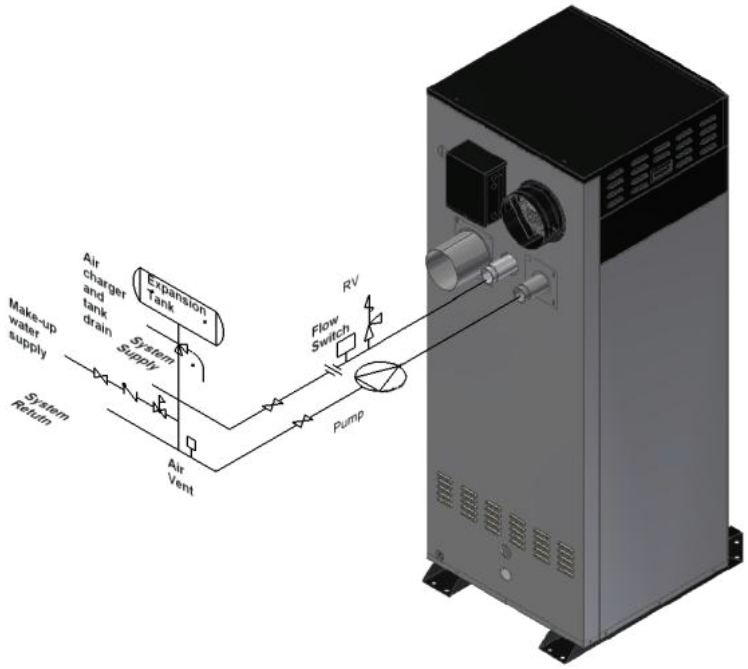
The hot surface igniter and UV Scanner are removable from the burner mounting flange without removing the burner assembly from the heat exchanger.

Never use an open flame (match, lighter, etc.) to check gas connections, use a soap solution instead.

PART 4 WATER CONNECTION

- Check all applicable local heating, plumbing and building safety codes before proceeding.
- If the appliance is installed above radiation level, it must be provided with a low water cut-off device at the time of appliance installation (available from factory). Some local codes require the installation of a low water cut off on all systems.
- **A pressure relief valve is supplied with each Advantus™. The relief valve must be mounted in a vertical position and piped to the floor in a manner acceptable to the enforcing authority.**
- **Minimum water operating system pressure should not drop below 30 PSIG. A minimum water pressure relief valve setting of 50 PSIG is recommended.**
- Be sure to provide unions and gate valves at inlet and outlet to the appliance so that it can be easily isolated for service. The provision of a flow setter valve at the appliance outlet will facilitate setting of the proper flow at the desired temperature rise at high fire.
- Special attention to minimum water flow rates will ensure that temperature rise is not excessive. See Table 8.
- To eliminate trapped air, install venting devices at high points in the system as well as in the piping on the suction of the pump and in the piping on the discharge of the appliance.
- Use suitable pipe hangers or floor stands to support the weight of all water and gas piping.
- Always pump toward the heat exchanger inlet. Never pump away from the exchanger since this will result in a low-pressure zone, which will allow localized boiling and result in heat exchanger damage.
- The Advantus™ must be installed so that the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during appliance operation and service (circulator replacement, control replacement, etc.)

Figure 17: Typical Space Heating System



4.1 FREEZE PROTECTION

- Appliance installations are not recommended outdoors in areas where danger of freezing exists unless precautions are taken. Maintaining a mixture of 50% water and 50% propylene glycol is the preferred method of freeze protection in hydronic systems. This mixture will protect the appliance to approximately -35ºF (-37ºC). To maintain the same temperature rise across the appliance increase the GPM flow by 15% and the head loss by 20%.

The following example demonstrates the procedure to follow for calculating the revised head for the heat exchanger when using a water/glycol mixture.

- Given that Camus is showing a heat exchanger flow and head loss of 100 gpm @ 10 feet
- Increasing the flow by 15% now results in a head loss of 13 feet at 115 gpm (from B&G system syzer). At this increased flow Camus now recommends to increase the head loss by 20%.
- The requirement for the heat exchanger with water / glycol mixture will now be 115 gpm @ 15.6 feet. (ie. 1.2 x 13ft. = 15.6 ft.)
- A similar procedure must be followed to calculate the additional head loss in pipe and fittings in order to arrive at the proper pump selection.

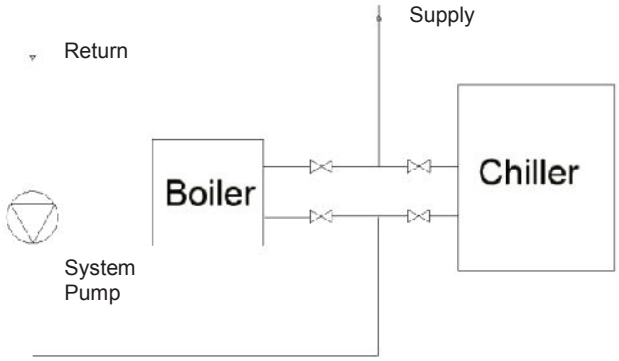
For outdoor installations in colder climates a snow screen should be installed to prevent snow and ice accumulation on and around the appliance. Regular inspections should be made to ensure that air intake and vent are free of snow and ice. Always consider the use of a shelter such as a garden shed in lieu of direct exposure of the appliance to the elements. The additional protection afforded by the shelter will help to minimize nuisance problems with electrical connections and will allow easier servicing of the appliance under severe weather conditions.

4.2 WARNING REGARDING CHILLED WATER AND HEATING COIL SYSTEMS

When an appliance is connected to a refrigeration system where the same water is used for heating and cooling, the chiller must be piped in parallel with the appliance. Appropriate flow control valves; manual or motorized must be provided to prevent the chilled water from entering the appliance.

The appliance piping system of a hot water boiler connected to heating coils located in air handling units where they may be exposed to refrigerated air circulation must be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle.

Figure 18: Chilled Water System



4.3 INLET AND OUTLET CONNECTIONS

- All water connections are groove-lock fittings.
- For ease of service, install unions on inlet and outlet of the appliance. The connection to the appliance marked “Inlet” on the header should be used for return from the system. The connection on the header marked “Outlet” is to be connected to the supply side of the system.

4.4 MINIMUM PIPE SIZE REQUIREMENTS

The equivalent number of straight feet of pipe for each valve and fitting in the connecting piping must be considered to properly arrive at the total equivalent feet of straight pipe in the field installed piping to the appliance. See the piping requirements in Part 11 - Installation section of this manual. Consult factory if longer piping distances are required for a specific application.

4.5 HEAT EXCHANGER

The heat exchanger is of fully welded construction, and is cylindrical in appearance. The heat exchanger is a vertical, two-pass, counter-flow, fire-tube design and consists of an integral combustion chamber with an inner tube bundle for primary heat transfer and an outer tube bundle to extract latent heat from flue gases. This heat exchanger is designed to withstand 160 PSIG working pressure.

A factory recommended circulating pump ensures proper water flow during burner operation so as not to exceed maximum recommended temperature rise. Scale formation in the heat exchanger is controlled by proper water treatment.

4.6 LOW WATER TEMPERATURE SYSTEMS

In applications where the heating system requires supply water temperatures below 110°F, connections may be made directly to the Advantus™. At incoming temperatures of 120°F or lower the Advantus™ achieves maximum efficiency. Inlet temperatures must not drop below 40°F to prevent freezing.

4.7 INSTANTANEOUS WATER HEATER

An instantaneous water heater is designed to deliver hot water without the use of a storage tank. It is suitable for applications with variable load such as restaurants, condominiums, apartments and motels and typically used in conjunction with tempering valves to achieve temperature control. In some applications it may be appropriate to provide a flow through tank to act as a buffer. Consult factory for recommendations. (See Figure 19)

Figure 19: Typical Instantaneous Water Heating System

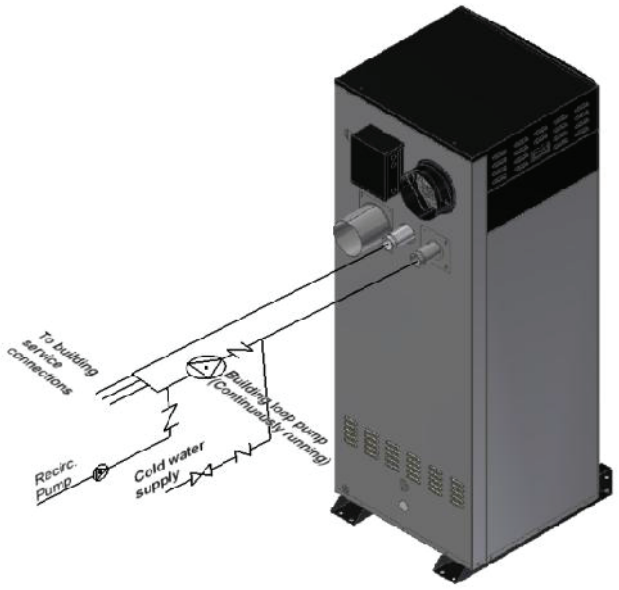


Table 8: Flow and Pressure Drop at a Given Temperature Rise (AV500-4000)

Model	Absolute Minimum Flow (10°F ΔT at 1/23rd input)	Pressure Drop ΔP	Flow at 20°F ΔT (Maximum Input)	Pressure Drop ΔP	Flow at 40°F ΔT (Maximum Input)	Pressure Drop ΔP	Flow at 60°F (Maximum Input)	Pressure Drop ΔP
500	n/a	n/a	47.2	1.8	23.6	0.5	15.7	0.2
600	n/a	n/a	56.6	2.6	28.3	0.6	18.9	0.3
800	6.6	0.03	74.8	4.5	37.4	1.1	24.9	0.5
1000	8.2	0.05	93.4	7.0	46.7	1.8	31.2	0.8
1200	9.9	0.02	112.2	2.0	56.1	0.5	37.4	0.2
1400	11.5	0.02	130.8	2.7	65.4	0.7	43.6	0.3
1600	13.2	0.03	149.6	3.9	74.8	0.8	49.9	0.4
1800	14.8	0.04	168.2	4.4	84.1	1.2	56.1	0.5
2000	16.5	0.05	189.8	5.6	94.9	1.4	63.2	0.6
2500	20.6	0.07	237.2	8.8	118.6	2.2	79.1	1.0
3000	24.7	0.01	284.6	1.6	142.3	0.4	95.0	0.2
3500	28.9	0.02	332.0	2.2	166.0	0.6	110.7	0.3
4000	33.0	0.02	379.4	2.9	189.7	0.7	126.5	0.3

4.8 WATER HEATER THERMOSTAT SETTING

1. This appliance is provided with an electronic temperature controller as detailed in Section 6.
2. The maximum setting for this water heater is 140°F.
3. There is a hot water scald potential if the temperature controller is set too high.

4.9 WATER FLOW SWITCH (shipped loose)

A water flow switch is to be installed in the outlet piping on all heating boilers and hot water supply boilers. The flow switch is wired in series with the 24VAC safety control circuit.

4.10 LOW WATER CUTOFF (If Equipped)

If this boiler is installed above radiation level, a low water cut-off device must be installed at the time of boiler installation. Some local codes require the installation of a low water cut-off on all systems. Electronic low water cut-offs are available as a factory supplied option on all models. Low water cut-offs should be tested every six months, including flushing of float types. The normally open switch contact of the low water cutoff is to be wired in series with the flow switch. A *Hold* condition message will be indicated on the control display on a low flow condition.

Caution
Remove jumper when connecting to 24 VAC circuit.

Figure 20: Low Water Cut Off Electrical Connections (Watts)

Connection detail for placing L.W.C.O in 24V circuit

WARNING: Be sure to remove the jumper between H and P1

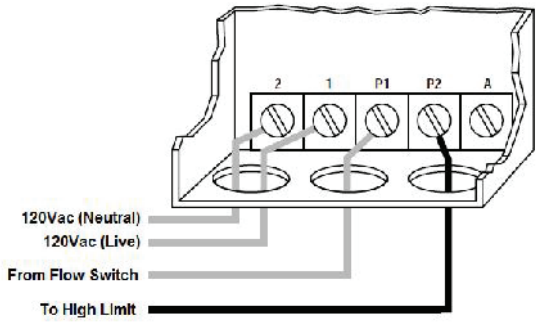
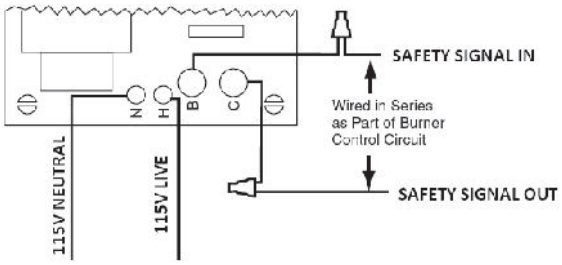


Figure 21: Low Water Cut Off Electrical Connections (ITT)



4.11 RELIEF VALVE

This appliance is supplied with a relief valve sized in accordance with ASME Boiler and Pressure Vessel Code, Section IV ("Heating Boilers"). The relief valve is to be installed in the vertical position and mounted in the hot water outlet. No valve is to be placed between the relief valve, and the appliance. To prevent water damage, the discharge from the relief valve shall be piped to a suitable floor drain for disposal when relief occurs. No reducing couplings or other restrictions shall be installed in the discharge line. The discharge line shall allow complete drainage of the valve and line. Relief valves should be manually operated at least once a year. If a relief valve discharges periodically, this may be due to thermal expansion in a closed water supply system. Contact the water supplier or local plumbing inspector on how to correct this situation. Do not plug the relief valve.

CAUTION
Avoid contact with hot discharge water

4.12 CIRCULATING PUMP SELECTION

The appliance has a stainless steel heat exchanger for fast response and high heat absorption. Selecting the proper pump will ensure that temperature rise does not exceed the maximum recommended for the application.

4.12.1 CIRCULATING PUMP OPERATION OF HEAT EXCHANGER

MOST IMPORTANT
This appliance is designed for continuous pump operation when the burner is firing. The pump control option allows the appliance circulating pump to be cycled “ON” prior to the burner firing and cycled “OFF” sometime after the set point is satisfied.

The operation of the circulating pump is controlled by the Advantus™ temperature control (SOLA). When the appliance is activated by a remote operating signal the pump will start and run for the operating cycle and for a post purge period based on temperature difference between inlet and outlet connections to the appliance. The SOLA can directly operate pumps up to 1/6 HP. Larger pumps will require a separate relay or contactor.

To select the proper pump it is strongly recommended to consider the following:

- Need to know the required flow (GPM) and pressure drop for your appliance (see Table 8)
- Type of application: hydronic heating or domestic hot water (DHW).
- For hydronic heating and DHW applications with normal water hardness choose a pump which will result in a temperature rise across the main heat exchanger of 20ºF to 40ºF (11.1ºC - 22.2ºC) depending on the size of the heater. If necessary use a flow setter valve to achieve the desired temperature rise.
- For DHW applications with other than normal water hardness consult the factory for recommendations.

NOTE
The use of a system sensor is required in lead lag operation 1. When variable speed main circulators ARE NOT used the system sensor is to be placed into the return system piping. 2. When variable speed main circulators are used the system sensor is to be placed into the supply system piping.

4.13 ΔT HEAT EXCHANGER ALGORITHM

The Advantus™ is constantly monitoring the inlet and outlet water temperatures when the ΔT approaches 60°F the burner will modulate down to prevent tripping of the high limit.

PART 5 ELECTRICAL & CONTROLS

DANGER
IT IS EXTREMELY IMPORTANT THAT THIS UNIT BE PROPERLY GROUNDED!

5.1 ELECTRICAL CONNECTIONS

Table 9: Minimum Power Requirements

Model	Voltage Requirement	Maximum Over Current Protection	Full Load Amps
		[Amperes]	[Amperes]
500 – 1600	115VAC, 60Hz	15	8.0
800 – 1600 $^{\Delta}$	208/230VAC, 60Hz, 1 Phase*	10	4.0
1800 – 3500	208/230VAC, 60Hz, 1 Phase*	30	20
1800 - 3500 $^{\Delta}$	208/230VAC, 60Hz, 3 Phase**	20	12.0
4000	208/230VAC, 60Hz, 3 Phase**	30	18.0

*This is a 4-wire power supply requiring two (2) lives, a neutral and a ground
**This is a 5-wire power supply requiring three (3) lives, a neutral and a ground
$^{\Delta}$ Optional power supply

Advantus^{TM} boilers supplied at 460/3/60 voltage, differ from the standard unit per the following:

CAUTION
While working with 460V circuits, it is imperative that extra precautions be taken • Ensure that lock-out/tag-out procedures are strictly enforced • Only properly trained and authorized personnel should be permitted to work on live electrical circuits • All electrical workers should be trained in electrical rescue techniques and CPR.

Each unit has a back mounted 500VA transformer to supply the single leg 115V necessary for the ignition circuit, which is factory mounted. The boiler itself is a single point power connection. A 460V/3/60 variable frequency drive replaces the standard VFD, and the combustion blower fan has been configured to operate at 460/3/60V (using the standard fan). Part numbers as well as FLA and MOCP information is below.

500VA transformer: DC0500UH

VFD:	**Model Range**:
n/a	AV500 – AV600
ESV371N04TXB	AV800 (0.5hp)
ESV751N04TXB	AV1000 – AV1600 (1hp)
ESV152N02YXB	AV1800 – AV2000 (2hp)
ESV222N02YXB	AV2500 – AV3500 (3hp)
ESV402N02TXB	AV4000 (5hp)

Advantus^{TM} Model	Voltage Requirement	Maximum Over Current Protection	Full Load Amps
		(Amperes)	(Amperes)
800 – 1000	460VAC, 60Hz, 3 Phase	10	n/a
1200 – 1800			1.4
2000			2.1
2500			3.3
3000			6.0
3500 – 4000			9.0

The combustion air fan motor operates on 230 VAC, 3 phase, 60Hz on models AV800-4000. Three phase voltage is generated by the VFD and supplied directly to the fan motor on models 800-4000. Refer to Table 9 for appropriate supply voltage to the appliance. The appliance, when installed, must be electrically grounded in accordance with the requirements of the authority having jurisdiction or in the absence of such requirements, with the latest edition of the National Electrical Code ANSI/NFPA No. 70. When the unit is installed in Canada, it must conform to the Canadian Electrical Code, C22.1, Part 1 and/or local Electrical Codes.

- All wiring between the appliance and field installed devices shall be made with wire having minimum 220°F (105°C) rating.
- Line voltage wire external to the appliance must be enclosed in approved conduit or approved metal clad cable.
- The pump must run continuously when appliance is firing.
- To avoid serious damage, **DO NOT ENERGIZE** the appliance until the system is full of water. Ensure that all air is removed from the heat exchanger pump housing and piping before beginning initial operation. Serious damage may result if the appliance is operated prior to purging of all air.
- Provide the appliance with proper overload protection.

5.2 VARIABLE FREQUENCY DRIVE (AV800-4000)

This appliance uses a VFD which provides power to the combustion fan. The fan motor operates on 230VAC 3 phase power. This three phase voltage is generated by the VFD and supplied directly to the fan motor. The VFD receives a 4-20mA modulating signal from the SOLA to vary the frequency of the voltage supplied to the fan motor. This varies the output of the combustion air fan from 4% up to 100% of capacity corresponding to the same variation in burner input. Once the self-checks are completed by the SOLA, the VFD is provided with a signal to operate at soft start level for initial burner ignition. After main burner ignition is established, the modulating signal is generated by the VFD to vary fan speed based on desired water temperature set point.

CAUTION
The voltage output from the variable frequency drive to the combustion air fan is 230VAC, 3 Phase. **AVOID** contact with high voltage wiring.

5.3 LOW AIR DIFFERENTIAL PRESSURE SWITCH

Models 500 & 600 use a normally open differential air pressure switch to prove air flow. A pressure transducer coupled with an electronic controller is used to prove operation of the combustion air fan on the AV800-4000. The pressure switch sensing points are installed at the fan outlet housing for models 500 & 600 and they are installed at the fan intake for models 800 - 4000. One point measures total pressure (+air) and is connected to a pitot tube facing the flow. The other point measures static pressure. Differential pressure at the switch will be affected by blockages in the intake pipe or at the flue discharge. A minimum differential pressure across the sensing points of the pressure switch proves operation of the combustion air fan. The diagnostics display will exhibit a status of an open Interrupted Air Switch (ILK Open) when the differential pressure switch detects a sustained low air condition. This condition could be caused by a number of factors including:

- Sensing line broken or loose fitting
- Dirty filter or blocked vent
- Steady high wind condition
- Incorrectly set switch

Figure 22: Low Air Proving Switch (Models 500 & 600)



5.4 BLOCKED FLUE SWITCH

All models use a normally closed automatic reset blocked flue switch to shut down the appliance under the following conditions:

1. Air intake 50% blocked
2. Vent outlet 80% blocked

When the blocked flue switch has tripped check the venting and/or air intake piping for obstructions before placing the unit into operation. Power must be shut off to the boiler and gas supply to the appliance must be closed before attempting to investigate reason for blocked flue condition. If the boiler cannot be restored to normal operating condition after removal of obstruction, please contact a qualified service agency.

Figure 23: Blocked Flue Switch



5.5 HIGH AND LOW GAS PRESSURE SWITCHES

A manual reset high gas pressure switch is standard on AV3000-4000 models and available as an option on AV500-2500 models. If gas pressure exceeds the maximum setting of the pressure switch, the appliance will shut down and an open gas pressure switch will be shown on the display. A low gas pressure switch is standard and monitors the minimum incoming gas supply pressure supplied to the gas train. If gas pressure falls below the minimum setting of the pressure switch, the appliance will shut down and an open gas pressure switch will be shown on the display.

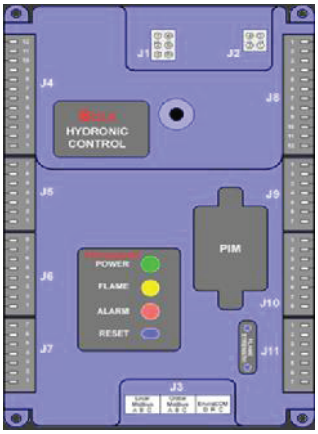
5.6 HIGH LIMIT

A high limit aquastat control is located at the back of the appliance and the control bulb is installed in a dry well in the heat exchanger header outlet. The setting of this control limits maximum discharge water temperature. A manual reset high limit will have a red reset button which must be pushed whenever water temperature has exceeded the set point of the manual reset limit. The temperature of the water in the heat exchanger must drop a minimum of 15°F (8.3°C) below the setting of the high limit control before the reset function can be activated. Whenever an appliance is supplied with both an auto reset and manual reset high limit, always set the auto reset limit 10°F (5.5°C) below the manual reset limit to prevent nuisance tripping.

5.7 Advantus™ SOLA

AV500-AV2500 models utilize a hot surface ignition system. AV3000-AV4000 models utilize a proven pilot. The ignition control proves the presence of the flame using a flame rectification voltage (0.8Vdc), energizes the main gas valve, proves the presence of main burner flame, and provides for lockouts. The alarm light will be lit on the ignition control module in the event of a fault.

Figure 24: Ignition Module



5.7.1 SERVICE PARTS

The electronic ignition module is not repairable. Any modification or repairs will invalidate the warranty and may create hazardous conditions that result in property damage, personal injury, fire, explosion and/or toxic gases. A faulty hot surface igniter or ignition module MUST BE replaced with a new factory approved unit only. A factory approved igniter, ignition control module and UV Scanner for this specific unit is available from your local distributor. DO NOT use general purpose field replacement ignition modules, igniters or UV Scanners. Each appliance has one ignition module, one hot surface igniter and one UV Scanner.

5.7.2 IGNITION MODULE LOCKOUT FUNCTIONS

The ignition module may lockout in either a hard lockout condition requiring pushing of the reset button to recycle the control for a CSD-1 requirement or a soft lockout condition which may be reset automatically once the error clears. A typical hard lockout fault can occur with a single trial for ignition CSD-1 module. Pushing the reset button on the ignition control is the only way to reset an ignition module that is in a hard lockout condition. The reset button is located on the ignition module. Turning the main power “OFF” and the “ON” or cycling the thermostat will not reset a hard lockout condition. Wait until the display shows the temperatures on screen before pushing the reset button when the ignition module is in a hard lockout.

5.8 Advantus™ CONTROLLER

Table 10: Connector Description

Connector	Connector Description
J1	UV Scanner, Ground Rod
J2	Fan Modulation (AV500 & 600)
J3	Display, Lead Lag, Modbus Communication
J4	24VAC Power, Pump, VFD
J5	Gas Valve, Safety Interlock String
J6	Safety Annunciation, Remote Operator
J8	24 VAC Power, Inlet, Outlet Sensor
J9	DHW, Stack Sensor

5.9 ERROR TABLE

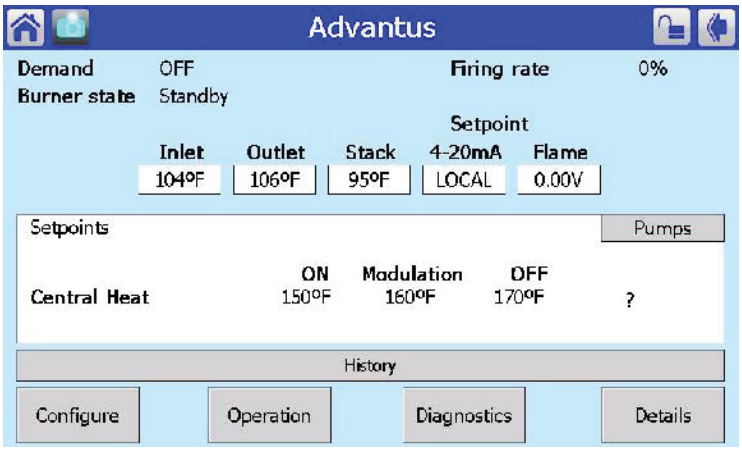
The following tables provide a description of all the possible errors with the Advantus™ appliance. Errors can be divided into two groups. Alert errors (will disappear when error is gone) and lockout errors (can only be reset by the RESET button).

When the control is in error, the pump will be running. This is done to prevent the freezing of the central heating circuit when the boiler is in error during the winter period. For some non-volatile lockouts, the pump will not be running. See table below for more details.

Table 11: Lockout Codes

#	Description
1	Unconfigured safety data
2	Waiting for safety data verification
3-46	Internal Fault. Replace SOLA Controller
47	Flame rod to ground leakage
48	Static Flame
49	24VAC low/high
50	Modulation Fault
64	Fan speed not proved, ignition failure
67	Interlock Off, safety circuit is open
79	Heater Outlet high limit tripped
81	Delta T Limit
82	Stack limit tripped (PVC: 149°F, CPVC: 194°F, 250°F)
91	Inlet sensor fault
92	Outlet sensor fault
93	DHW sensor fault
94	Header sensor fault
95	Stack sensor fault
96	Outdoor sensor fault
105	Flame detected out of sequence
106	Flame lost if Main Flame Establishing Period (MFEP)
107	Flame lost early in run
108	Flame lost in run
109, 110	Ignition failed
112	Pilot test flame timeout
113	Flame circuit timeout
149	Flame detected

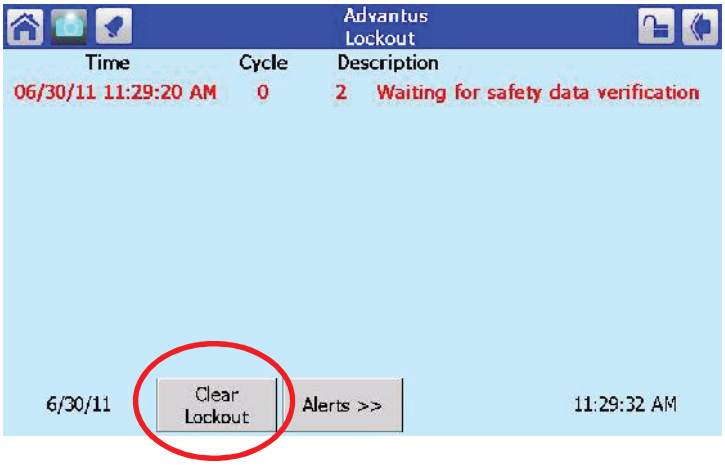
Figure 25: Lockout Condition



To eliminate the lockout error,

1. Press the red bar, as circled below
2. Press the [Lockouts] button

Figure 26: Lockout History



3. Press [Clear Lockout]

Table 12: Alert Codes

#	Description
29	Burner switch turned OFF
30	Burner switch turned ON
47	Invalid subsystem reset request occurred
50	Modulation Fault (DR300 – 1000 ONLY)
61	Anti-short Cycle
62	Fan speed not proved
63	LCI off, safety circuit is open
68	Setpoint was overridden due to sensor fault
69	Modulation was overridden due to sensor fault
123	Modulation rate was limited due to outlet limit
124	Modulation rate was limited due to Delta-T limit
215	No Lead Lag slaves available to service demand
219	Using backup Lead Lag header sensor due to sensor failure
229	Lead lag slave communication timeout.
275-281	LCI off, safety circuit is open
283	Demand off during measured purge time
291	Abnormal Recycle: Flame was not on at end of Ignition period
292	Abnormal Recycle: Flame was lost during Main Flame Establishing Period
293	Abnormal Recycle: Flame was lost early in Run
294	Abnormal Recycle: Flame was lost during Run
303-310+	Interlock Off, safety circuit is open
324, 374-379	Hardware flame bias. Flame sensor wire needs to be re-routed.
352+	Stack sensor fault
355+	Outlet sensor fault
357+	DHW sensor fault
359+	Inlet sensor fault
460	LCI lost in run
550	Delta T inlet/outlet limit was exceeded

*If an internal hardware fault is detected, contact Camus Technical Support for troubleshooting procedure.

PART 6 CONTROL PANEL

6.1 APPLIANCE TEMPERATURE CONTROLLER

The appliance is provided with a control panel at the front. Operating controls are installed inside the control box and are accessible by undoing the (2) slotted screws and swinging the door open. The diagnostic information center as well as the on/off switch and the appliance temperature controls reside on the control box door. The ignition module, VFD, transformer and relays are mounted on the internal panel.

Figure 27: Control Panel Front



The SOLA icons will appear in one of four colors indicating the boiler status:

Blue: Normal operation
Red: Lockout Condition
Yellow: Holding Mode
Grey: Communication Error

The Boiler Temperature Controller for this appliance is the Honeywell SOLA. It initiates the local call for heat and sets the target return (appliance inlet) water temperature. This controller offers a range of operation modes which provides set point as well as modulating control. It provides the following:

- Readings of inlet and outlet water temperatures as well as flame signal.
- Operation as an auto reset limit
- Operation as a control for inlet water temperature, outlet temperature, system temperature.
- 60°F ΔT heat exchanger protection algorithm
- Available storage tank mounted sensor used in conjunction with inlet sensor.
- Adjustable: target temp, inter-stage differential, on delay between stages, minimum on time per stage, minimum off time per stage.
- Display of run hours for maintenance purposes. Counter wraps around at 10000 hours.
- Flame failure signal
- JST and Molex connectors for ease of service.
- Error message display in text.
- Manual override of boiler input rate for combustion.
- Pump exercising feature runs pump 10 seconds every three days in the event of no pump operation.

Levels of access

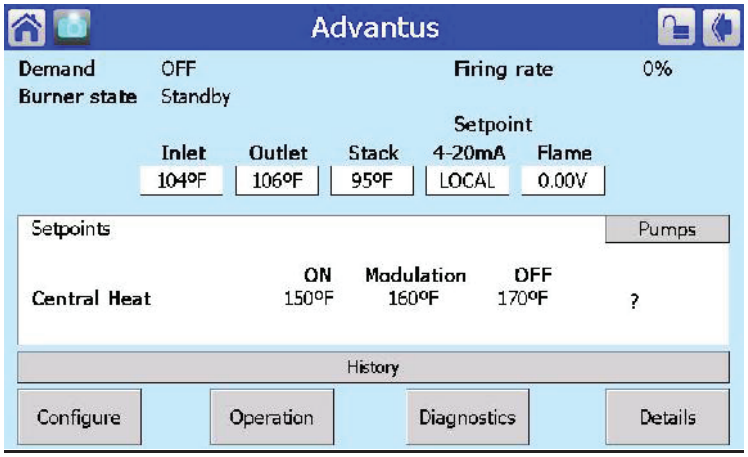
Two levels of access to simplify the use of the boiler.

User: Access to general boiler and display settings and adjustments to the central heating, domestic hot water, and lead lag setpoint.

Installer: Access to all user parameters and allows for changes to additional boiler parameters to allow for ease of startup and serviceability.

NOTE
Due to the sensitivity of the touchscreen controller, using the backend of a pen/pencil is recommended for accuracy

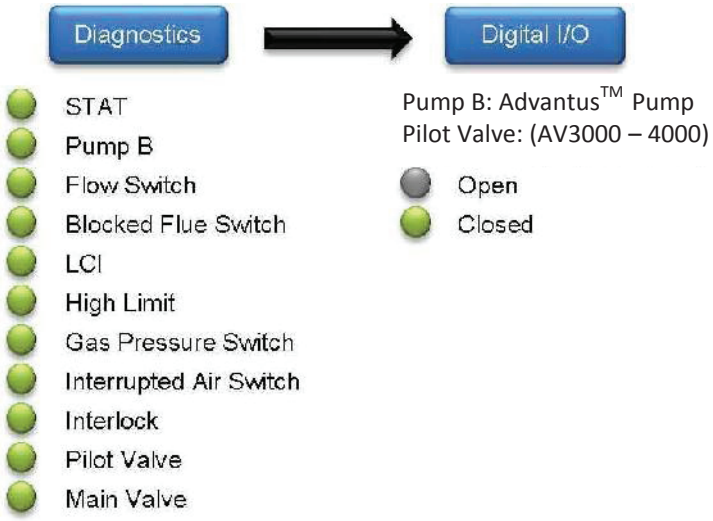
Figure 28: Home Screen



Parameter	Description
Demand	Central Heating (AVH)
	Domestic Hot Water (AVW)
	Lead Lag
Burner State	Current Status of Advantus™
Firing Rate	Target Firing Rate (AV800-4000)
Fan Speed	Actual Firing Rate (AV500-600)
Inlet	Inlet Water Temperature [°F]
Outlet	Outlet Water Temperature [°F]
Stack	Stack Temperature [°F]
DHW	DHW Temperature [°F] if equipped
Header	Header Temperature [°F] if equipped
Outdoor	Outdoor Temperature [°F] if equipped

Button	Description
Configure	Access Advantus™ parameters (CH Parameters, DHW Parameters, Outdoor Reset, Pump Configuration etc.)
Operation	Details of boiler operation (Set point, Firing Rate, Pump Status, Safety Circuit)
Diagnostics	Manual firing rate, Analog/Digital Status
Details	History, Pump Status, Outlet Temperature

Sequence of Operation



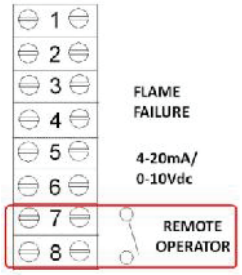
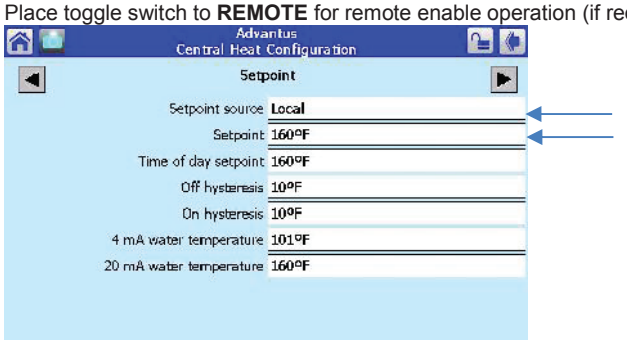
Flow Switch = Flow Switch, Water Pressure Switch (30 PSIG), Low Water Cut Off (if equipped)

Gas Pressure Switch = Low Gas Pressure Switch (4.5" w.c., N/O), High Gas Pressure Switch (14" w.c., N/C)

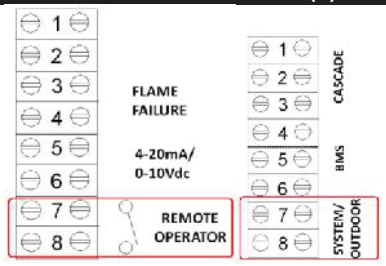
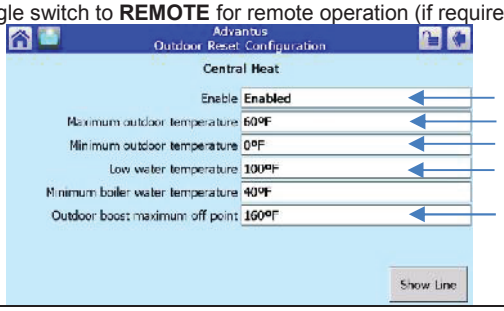
Interrupted Air Switch = Air Proving Switch (N/O)

Hydronic Heating

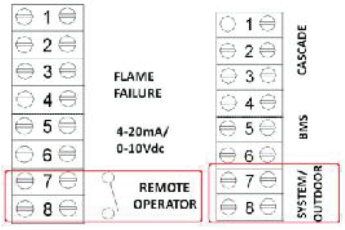
Modulation: Boiler Inlet, Boiler Fixed Setpoint Operation (Standalone)

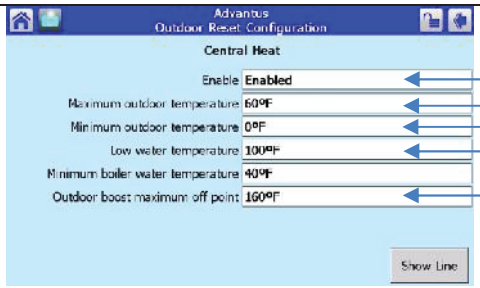
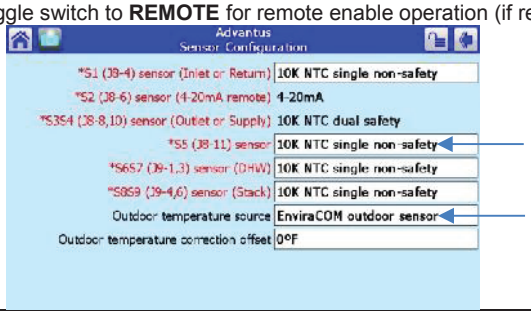
Description	Electrical Connection(s)	Programming Instructions
• Boiler operates at a fixed CH setpoint • Modulates on boiler inlet sensor (default) • Heat demand is generated when inlet temperature drops below setpoint minus on hysteresis • If set to local enable constant pumping is required • For remote enable intermittent pumping is allowed.		1) Place toggle switch to **LOCAL** 2) Press Configure and Login 3) Press **[CH – Central Heat Configuration]** 4) Press the ❯ to arrive at **Setpoint** 5) Select **Setpoint source: Local** 6) Enter desired **Setpoint** 7) Place toggle switch to **REMOTE** for remote enable operation (if required) 

Modulation: Boiler Inlet, Outdoor Reset Operation (Standalone)

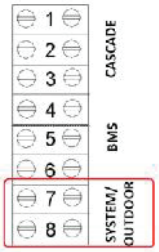
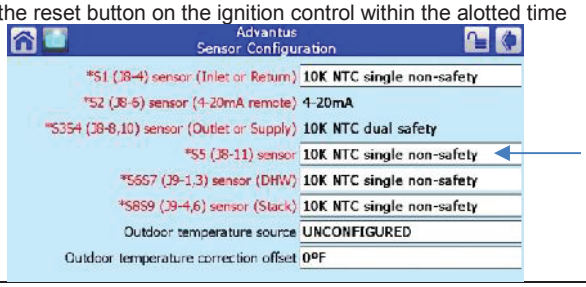
Description	Electrical Connection(s)	Programming Instructions
• Boiler operates with variable setpoint determined by outdoor reset curve • Modulates on inlet sensor (default) • Heat demand is generated when inlet temperature drops below setpoint minus on hysteresis		1) Connect outdoor sensor to System/Outdoor contacts 2) Place toggle switch to **LOCAL** 3) Press Configure and Login 4) Press **Outdoor Reset Configuration** 5) Press the ❯ to arrive at **Central Heat** 6) Select **Enable: Enable** 7) Select **Maximum outdoor temperature** (WWSD) 8) Select **Minimum outdoor temperature** (Outdoor Design) 9) Select **Low Water Temperature** (Min. Water Temp.) 10) Select **Outdoor boost maximum off point** (Design Max.) 11) Press **[CH – Central Heat Configuration]** 12) Select **Outdoor Reset = Enabled** 13) Set **CH Setpoint = Maximum off point** 14) Press **Sensor Configuration** 15) Select **Outdoor temperature source = S5 (J8-11) sensor** 16) Place toggle switch to **REMOTE** for remote operation (if required) 

Modulation: System Sensor, Outdoor Reset Operation (Standalone) NOTE: Outdoor Reset Module required (PN: W8735S1000)

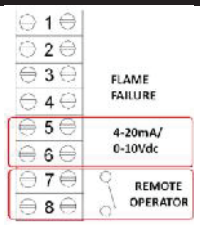
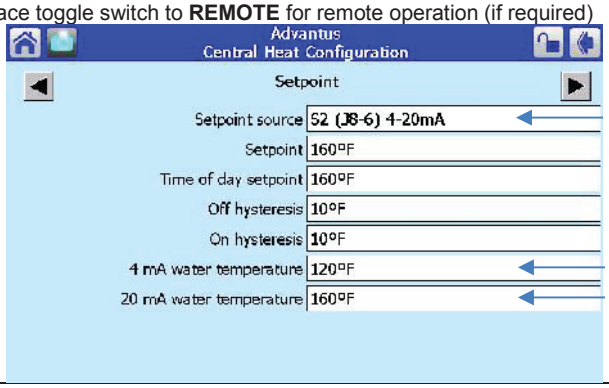
Description	Electrical Connection(s)	Programming Instructions
• Boiler operates with variable setpoint determined by outdoor reset curve • Modulates on system sensor • Heat demand is generated when system temperature drops below setpoint minus on hysteresis		1) Connect Remote Operator 2) Connect System sensor to System/Outdoor contacts 3) Connect Outdoor Sensor to J3 ECOM connector 4) Place toggle switch in **LOCAL** 5) Press Configure and Login 6) Press **Outdoor Reset Configuration** 7) Press the ❯ to arrive at **Central Heat** 8) Select **Enable: Enable** 9) Select **Maximum outdoor temperature** (WWSD) 10) Select **Minimum outdoor temperature** (Outdoor Design) 11) Select **Low Water Temperature** (Min. Water Temp.) 12) Select **Outdoor boost maximum off point** (Design Max.)

		 13) Press **[Show Line]** to confirm reset curve 14) Press **Sensor Configuration** 15) Selet **S5 (J8-11) sensor: 10K NTC single non-safety** 16) Select **Outdoor temperature source = EnviraCOM outdoor sensor** 17) Place toggle switch to **REMOTE** for remote enable operation (if required) 

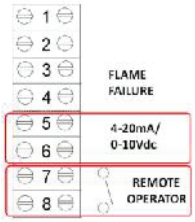
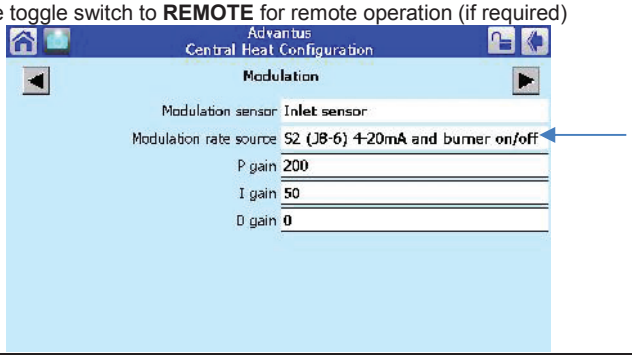
System Sensor Enable (Standalone)

Description	Electrical Connection(s)	Programming Instructions
• Method to enable system sensor for Standalone applications		1) Press Configure and Login 2) Press **[Sensor Configuration]** 3) Select **S5 (J8-11) Sensor**: **10K NTC Single Non-Safety** 4) The control will proceed into a Lockout 2 condition 5) Press **[Verify]** > **[Begin]** > **[Yes]** 6) Press the reset button on the ignition control within the alotted time 

4-20mA/ 0-10Vdc Setpoint Operation (Standalone)

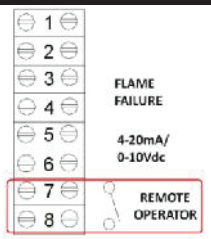
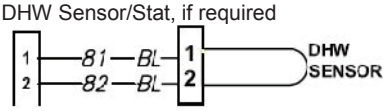
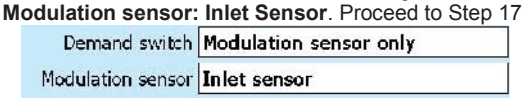
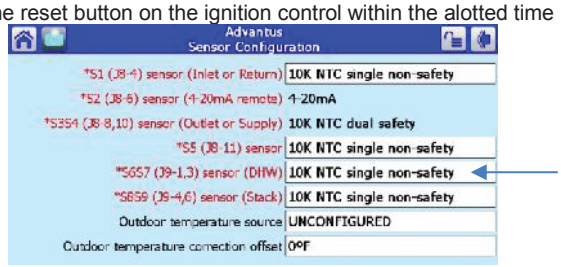
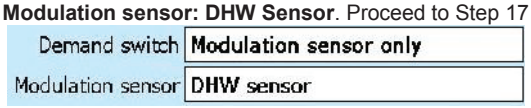
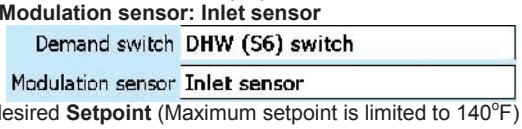
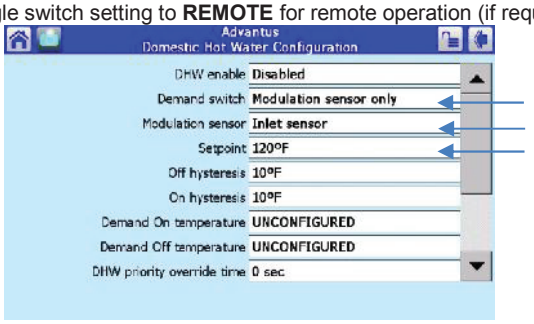
Description	Electrical Connection(s)	Programming Instructions
• Boiler operates with variable setpoint determined by 4-20mA incoming signal • Modulates on boiler inlet sensor (default) • Heat demand is generated when inlet temperature drops below setpoint minus on hysteresis and 4-20mA or 0-10Vdc signal is present. • If set to local enable constant pumping is required • For remote enable intermittent pumping is allowed.		1) Place both toggle switches in **LOCAL** 2) Press Configure and Login 3) Press **[CH – Central Heat Configuration]** 4) Press the ▶ to arrive at **Setpoint** 5) Select **Setpoint Source = S2 (J8-6) 4-20mA** 6) Select **4mA water temperature** 7) Select **20mA water temperature** 8) Place toggle switch to **REMOTE** for remote operation (if required) 

4-20mA/ 0-10Vdc Firing Rate Operation (Standalone)

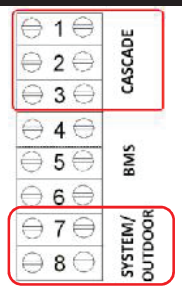
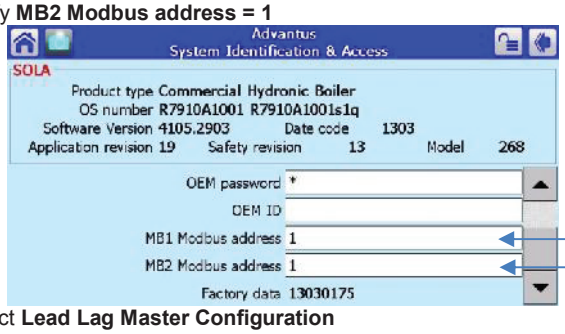
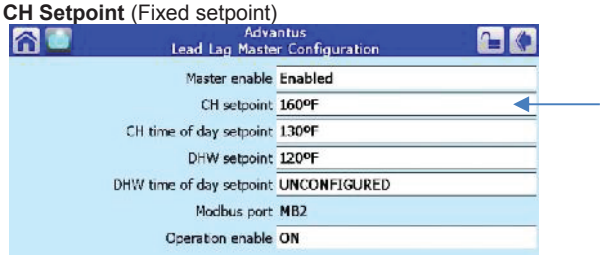
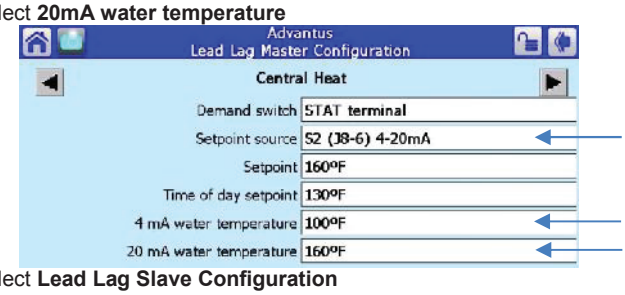
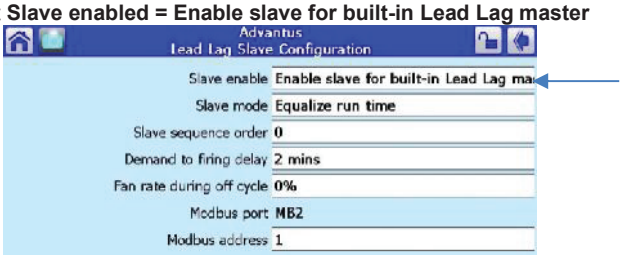
Description	Electrical Connection(s)	Programming Instructions
• Boiler operates with variable firing rate determined by 4-20mA incoming signal • Modulates on boiler inlet sensor (default) • Heat demand is generated when inlet temperature drops below setpoint minus on hysteresis and 4-20mA or 0-10Vdc signal is present. • If set to local enable constant pumping is required • For remote enable intermittent pumping is allowed.		1) Place both toggle switches in **LOCAL** 2) Press Configure and Login 3) Press **[Lead Lag Master Configuration]** 4) Press **[Advanced Settings >]** 5) Press the ▶ to arrive at **Central Heat** 6) Select **Modulation Rate Source = S2 (J8-6) 4-20mA and burner on/off** 7) Place toggle switch to **REMOTE** for remote operation (if required) 

DHW

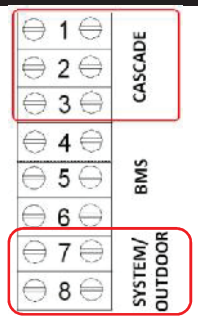
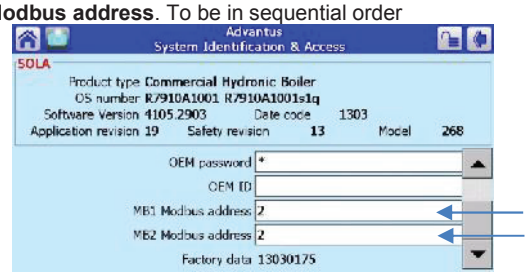
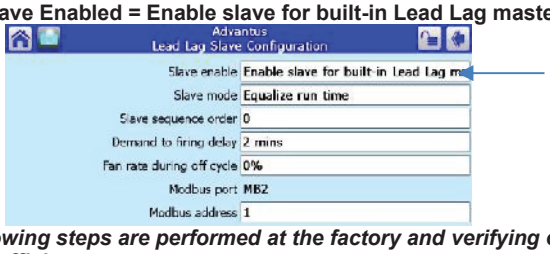
Modulation: Boiler Inlet, Fixed Setpoint Operation (Standalone)

Description	Electrical Connection(s)	Programming Instructions
• Boiler operates at a fixed DHW setpoint • Modulates on boiler inlet sensor (default) • Heat demand is generated when inlet temperature drops below setpoint minus on hysteresis. • For inlet sensor operation constant pumping is required • For DHW sensor/aquastat operation intermittent pumping is allowed	 DHW Sensor/Stat, if required 	1) Place both toggle switches to **LOCAL** ***2)*** Press Configure and Login ***Inlet Sensor operation*** 3) Press **[DHW – Domestic Hot Water Configuration]** 4) Select **Demand Switch: Modulation sensor only** 5) Select **Modulation sensor: Inlet Sensor**. Proceed to Step 17  ***DHW Sensor/Stat operation*** 6) Press **[Sensor Configuration]** 7) Select **S6S7 (J9-1,3) Sensor (DHW)**: **10K NTC Single Non-Safety** 8) The control will proceed into a Lockout 2 condition 9) Press **[Verify]** > **[Begin]** > **[Yes]** 10) Press the reset button on the ignition control within the alotted time  ***DHW Sensor operation*** 11) Press **[DHW – Domestic Hot Water Configuration]** 12) Select **Demand Switch: Modulation sensor only** 13) Select **Modulation sensor: DHW Sensor**. Proceed to Step 17  ***DHW Stat operation*** 14) Press **[DHW – Domestic Hot Water Configuration]** 15) Select **Demand Switch: DHW (S6) switch** 16) Select **Modulation sensor: Inlet sensor**  17) Enter desired **Setpoint** (Maximum setpoint is limited to 140°F) 18) Place toggle switch setting to **REMOTE** for remote operation (if required) 

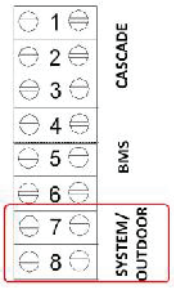
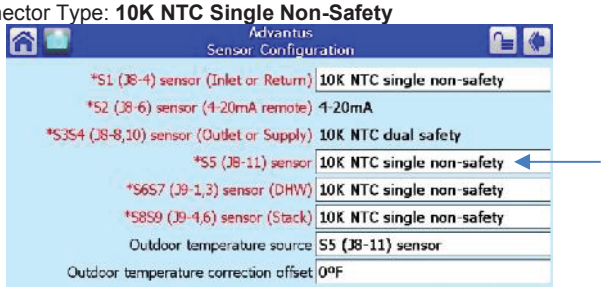
AV(H,W) Lead lag Operation
Master Boiler

Description	Electrical Connection(s)	Programming Instructions
• Master boiler lead lag setup • Modulates on system sensor connected to master boiler • System temperature sensor must be connected to boiler #1. • Outdoor temperature sensor must be connected to boiler #2.		1) Place both toggle switches to **LOCAL** 2) Press Configure and Login 3) Select **System Identification & Access** 4) Verify **MB1 Modbus address = 1** 5) Verify **MB2 Modbus address = 1**  6) Select **Lead Lag Master Configuration** 7) Select **Master Enabled = Enabled** <u>Fixed Setpoint operation</u> 8) Enter **CH Setpoint** (Fixed setpoint)  <u>4-20mA/ 0-10Vdc setpoint operation</u> 9) Select **[Advanced Settings >]** 10) Press the ▶ to arrive at **Central Heat** 11) Select **Setpoint Source = S2 (J8-6) 4-20mA** 12) Select **4mA water temperature** 13) Select **20mA water temperature**  14) Select **Lead Lag Slave Configuration** 15) Select **Slave enabled = Enable slave for built-in Lead Lag master**  The following steps are performed at the factory and verifying on site will be sufficient: 16) Select **Pump Configuration** 17) Press **[Advanced Options >>]** 18) Press the ▶ to arrive at **Central Heat Pump** or **DHW Pump** 19) On Options: ☑ Local burner demand 20) On Options: Local Lead Lag ☑ Service Active 21) Force On: ☑ Outlet high limit

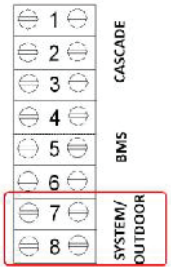
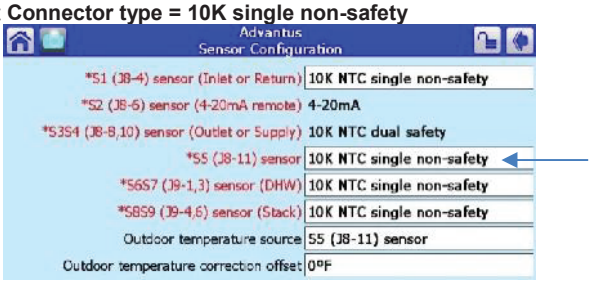
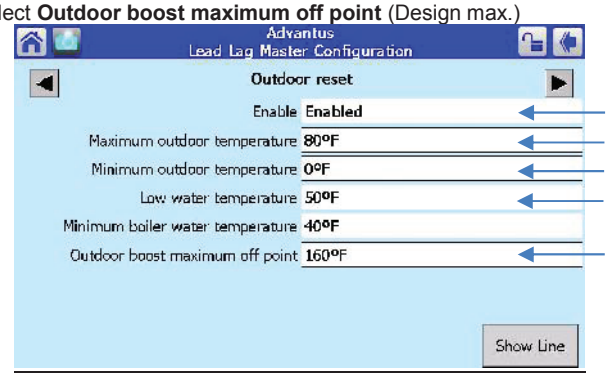
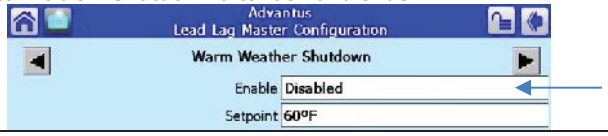
Slave Boiler

Description	Electrical Connection(s)	Programming Instructions
• Slave boiler lead lag setup • System temperature sensor must be connected to boiler #1. • Outdoor temperature sensor must be connected to boiler #2.		1) Place both toggle switches to **LOCALL** 2) Press Configure and Login 3) Select **System Identification & Access** 4) Verify **Modbus address**. To be in sequential order  5) Select **Lead Lag Slave Configuration** 6) Select **Slave Enabled = Enable slave for built-in Lead Lag master**  ***The following steps are performed at the factory and verifying on site will be sufficient:*** 7) Select **Pump Configuration** 8) Press **[Advanced Options >>]** 9) Press the ▶ to arrive at **Central Heat Pump** or **DHW Pump** 10) On Options: ☑ Local burner demand 11) On Options: Local Lead Lag ☑ Service Active 12) Force On: ☑ Outlet high limit

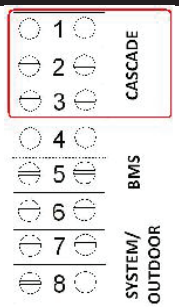
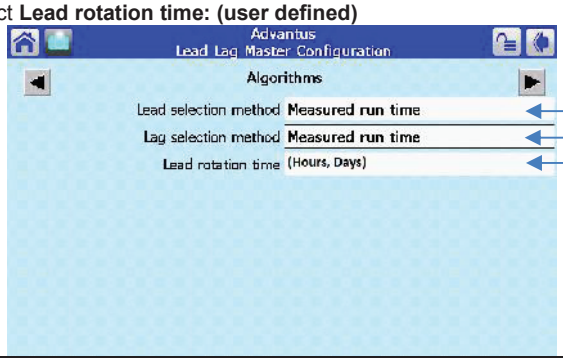
Master Boiler, System Sensor (Connected to Master Boiler #1)

Description	Electrical Connection(s)	Programming Instructions
• Master boiler system sensor configuration • System temperature sensor must be connected to boiler #1. • Outdoor temperature sensor must be connected to boiler #2.		1) Press Configure and Login 2) Press **[Sensor Configuration]** 3) Select **S5 (J8-11) Sensor** 4) Connector Type: **10K NTC Single Non-Safety**  5) The control will proceed into a Lockout 2 condition 6) Press **[Verify]** > **[Begin]** > **[Yes]** 7) Press the reset button on the ignition control within the alotted time

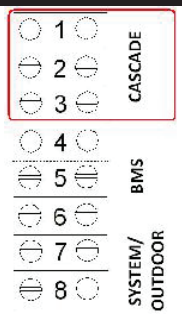
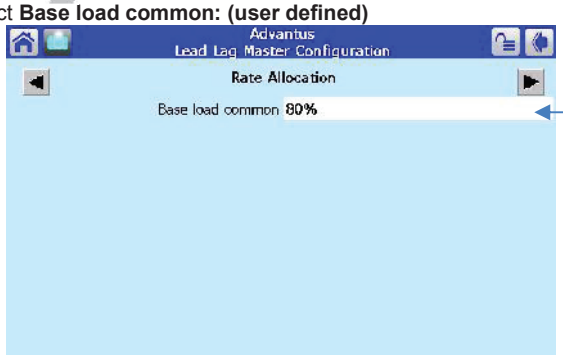
Outdoor Sensor connected to Slave boiler 2 (AVH ONLY)

Description	Electrical Connection(s)	Programming Instructions
• Slave boiler outdoor sensor configuration • Outdoor temperature sensor must be connected to boiler #2. • When done correctly, the outdoor temperature will be shown on the Master boiler		***Slave Boiler*** 1) Press Configure and Login 2) Press **Sensor Configuration** 3) Select **S5 (J8-11) Sensor** 4) Select **Connector type = 10K single non-safety**  5) The control will proceed into a Lockout 2 condition 6) Press **[Verify]** > **[Begin]** > **[Yes]** 7) Press the reset button on the ignition control within the alotted time ***Master Boiler*** 8) Press Configure and Login 9) Press **[Lead Lag Master Configuration]** 10) Press **[Advanced Settings >]** 11) Press the ▶ to arrive at **Outdoor Reset** 12) Select **Enable: Enabled** 13) Select **Maximum outdoor temperature** (WWSD) 14) Select **Minimum outdoor temperature** (Outdoor design) 15) Select **Low Water Temperature** (Min. water temp) 16) Select **Outdoor boost maximum off point** (Design max.)  17) Press **[Show Line]** to confirm reset curve 18) Press the ▶ to arrive at **Warm Weather Shutdown** 19) Select **Enable = Shutdown after demand ends** 

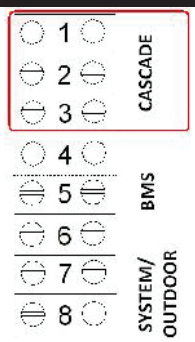
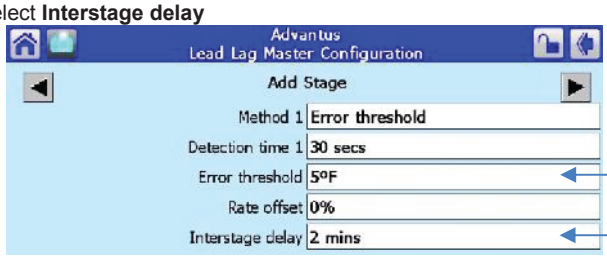
Rotation schedule adjustment

Description	Electrical Connection(s)	Programming Instructions
• Standard rotation schedule is based on equalizing run time on a 1-hour schedule • To vary the rotation to a fixed schedule based on (hours, days)		1) Press Configure and Login 2) Press **[Lead Lag Master Configuration]** 3) Press **[Advanced Settings >]** 4) Press the ▶ to arrive at **Algorithms** 5) Select **Lead selection method: Sequence order** 6) Select **Lag selection method: Sequence order** 7) Select **Lead rotation time: (user defined)** 

Base load rate adjustment

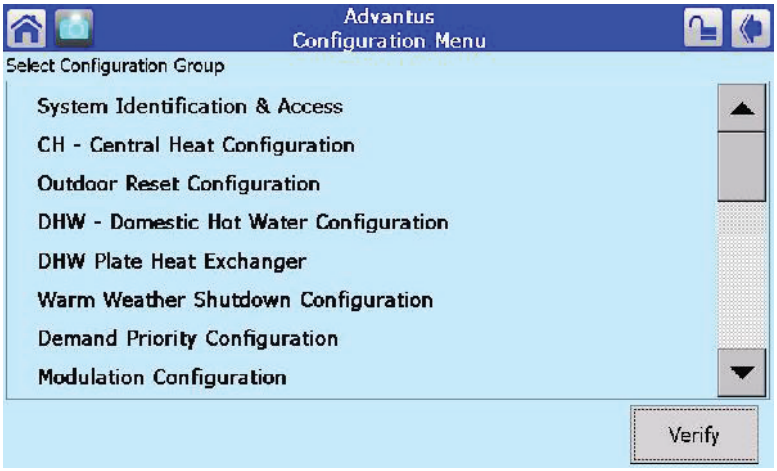
Description	Electrical Connection(s)	Programming Instructions
• Upon a call for heat the lead boiler will fire up to the specified base load rate (80%). If the temperature is not within Error threshold (5°F) of setpoint after Interstage delay (2 minutes) a lag boiler will be brought online and will also fire up to the base load rate specified. • Modulation of boilers will only occur after all boilers in the Lead Lag system are firing up to the specified base load rate (80%).		1) Press Configure and Login 2) Press **[Lead Lag Master Configuration]** 3) Press **[Advanced Settings >]** 4) Press the ▶ to arrive at **Rate Allocation** 5) Select **Base load common: (user defined)** 

Adjust staging of boilers

Description	Electrical Connection(s)	Programming Instructions
• Upon a call for heat the lead boiler will fire up to the specified base load rate (80%). If the temperature is not within Error threshold (5°F) of setpoint after Interstage delay (2 minutes) a lag boiler will be brought online and will also fire up to the base load rate specified. • This method will then be repeated for the next lag boiler, if available.		1) Press Configure and Login 2) Press **[Lead Lag Master Configuration]** 3) Press **[Advanced Settings >]** 4) Press the ▶ to arrive at **Add Stage** 5) Select **Error threshold** 6) Select **Interstage delay** 

6.2 CONFIGURE MENU

Figure 29: Configure Menu



6.2.1 SYSTEM IDENTIFICATION & ACCESS

Menu Group Selection	Parameter	Description
System Identification & Access	Product Type	Commercial Hydronic Boiler
	OS number	Part Number of SOLA Controller
	Software Version	Software version
	Date Code:	Release date of software
	Boiler Name	Advantus™ Model Number
	Installation	Type of application

6.2.2 PUMP CONFIGURATION

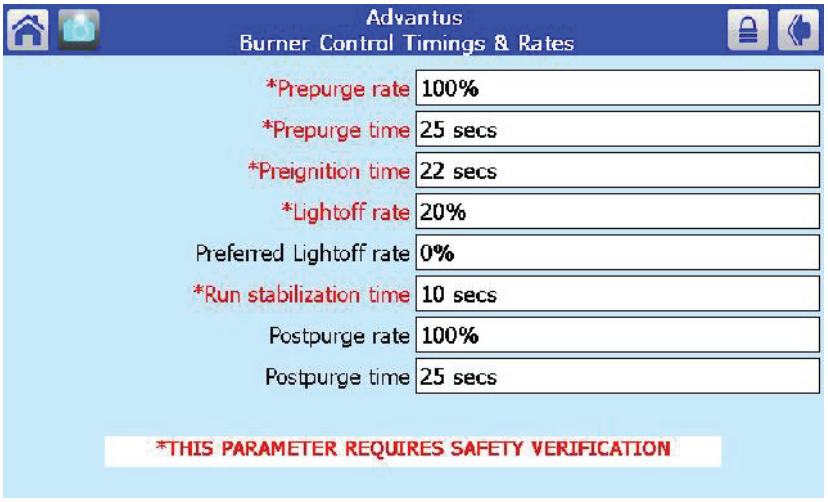
Menu Group Selection	Sub-Menu Group Selection	Parameter	Selection	Description
Pump Configuration	Central Heat Pump	Pump Control	Auto	Assigns the method for SOLA to control a Central Heating pump (Default: Auto, Pump is activated whenever a call for heat is present)
			ON	ON: Pump is constantly powered
		Pump Output	Pump B	Specify pump contact
		Over run time	1..5 min	Post pump time (Default: 1 min)
		Use for local (Stand-alone) demands	✓	
		Use for Lead Lag Master demands	✓	
	Boiler Pump	Pump Control	Auto	Refer to above (Default)
			ON	Refer to above
		Pump Output	Pump A	Specify pump contact
		Over run time	1..5 min	Post pump time (Default: 1 min)
		Use for local (Stand-alone) demands	✓	
		Use for Lead Lag Master demands	✓	
Pump Configuration	DHW Pump	Pump Control	Auto	Refer to above (Default)
			ON	ON: Pump is constantly powered
		Pump Output	Pump B	Specify pump contact
		Over run time	1..5 min	Post pump time (Default: 1 min)
	System Pump	Pump Control	Auto	Refer to above (Default)
			ON	ON: Pump is constantly powered
		Pump Output	None	Specify pump contact
		Over run time	1..5 min	Post pump time (Default: 1 min)

6.2.3 STATISTICS CONFIGURATION

Menu Group Selection	Sub-Menu Group Selection	Parameter	Selection	Description
Statistics Configuration		Boiler pump cycles		Displays the number of cycles the boiler pump has been activated
		Burner cycles		Displays the number of cycles the burner has been activated
		Burner run time		Displays burner run time in hours
		CH pump cycles		Displays the number of cycles the CH pump has been activated
		DHW pump cycles		Displays the number of cycles the DHW pump has been activated
		System pump cycles		Displays the number of cycles the system pump has been activated

6.2.4 BURNER CONTROL TIMING AND RATES

Figure 30: Burner Control Timing and Rates



Menu Group Selection	Sub-Menu Group Selection	Parameter	Selection	Description
Burner Control Timing and Rates		Prepurge rate	3000 RPM	Prepurge fan speed (Default: AV500-600: 3000 RPM, AV800-4000: 100.0%)
		Prepurge time	25 sec.. 5 mins	Prepurge time (Default: 25 sec)
		Run Stabilization Time	10 sec	Main flame establishing period
		Postpurge rate	3000 RPM	Postpurge fan speed (Default: AV500-600: 3000 RPM, AV800-4000: 100.0%)
		Postpurge time	25 sec.. 5 mins	Postpurge time (Default 25 sec)

6.2.5 BURNER CONTROL IGNITION

Menu Group Selection	Sub-Menu Group Selection	Parameter	Selection	Description
Burner Control Ignition		Lightoff rate	AV500-600: 3000 RPM AV800-4000: Consult factory test sticker	Ignition Fan speed

6.2.6 SENSOR CONFIGURATION

Menu Group Selection	Sub-Menu Group Selection	Parameter	Selection	Description
Sensor Configuration		S1 (J8-4) sensor	10K NTC single non-safety	Inlet Sensor
		S2 (J8-6) sensor	4-20mA	4-20mA Input Signal
		S3S4 (J8-8, 10) sensor	10K NTC dual safety	Outlet Sensor
		S5 (J8-11) sensor	10K NTC single non-safety	Outdoor Sensor: Standalone boiler or Slave boiler Header sensor: Master boiler
		S6S7 (J9-1,3) sensor	10K NTC single non-safety	DHW Sensor (AVW Only)
		S8S9 (J9-4,6) sensor	10K NTC single non-safety	Stack Sensor

6.3 LEAD LAG SETUP

All SOLA controllers are programmed with a default adress of 1. The address of the slave controllers in the system must have a unique address (1..8).

Sequence of Operation:

When a boiler is set as Lead Lag Master = Enabled and Modbus address =1, the controller of this boiler will drive the lead lag operation.

The outdoor temperature sensor connected to the slave boiler 2 (ie. B-2) will be the outdoor sensor for the lead lag system.

- The system temperature sensor connected to boiler 1 (the master) in terminals labeled “Outdr/Sys” in the junction box will be the control sensor for lead lag operaiton.
- The start/stop signal connected to boiler 1 (the master) at terminals labeled “Remote Operator” will be the enable signal for lead lag operation.

When the enable signal is present and there is a heat demand, the lead boiler will start and uses the lead lag parameters for boiler modulation. After a period of “Interstage delay” the master boiler compares the lead lag temperature with the lead lag set point and will check if:

1. **An additional boiler is needed**: Lead lag temperature < Lead lag setpoint – Add stage Error Threshold
2. **Number of boilers remain the same**: Lead lag temperature > Lead lag setpoint – Add Stage Error Threshold **AND** Lead lag < Lead lag setpoint + Drop Stage Error Threshold
3. **A boiler should stop**: Lead lag temperature > Lead lag setpoint + Drop Stage Error Threshold
4. **All boilers off:** Lead lag temperautre > Lead lag setpoint + Off Hysteresis

If the lead lag master system is interrupted, the remaining boilers will operate as standalone boilers based on the Central Heat or DHW parameters when set to “Enabled”.

Rotation
Rotation time is configurable based on equalized run time (default) or a fixed rotation schedule.

Interstage Delay
The length of time to wait between requesting a slave SOLA to fire. (Default: 2 minutes)

Base load rate
When a call for heat is initiated the lead boiler runs up to the desired base load rate (default: 80%) and continues to operate in this fashion based on the above 4 scenarios. If the lead lag temperature is not satisfied a second boiler is fired and they would both operate up to 80% fire rate.

Slave State

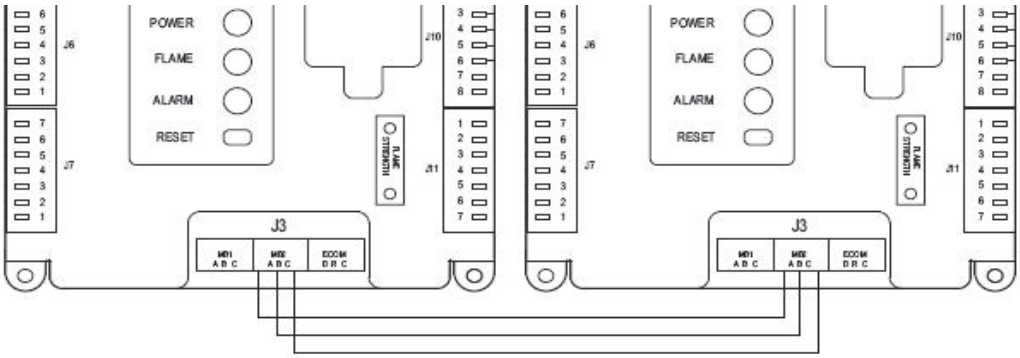
Slave Status Manager	
Unknown	Table entry is unused or empty
Available	Slave is operational and ready to use
Add Stage	Stage is getting ready to fire
Suspend Stage	Stage was getting ready but is not needed
Disabled	Slave is locked out or disabled
Recovering	Slave is in time delay to verify that it is operational before considered to be available

Wiring the Lead Lag Setup

Use Cascade terminals in the juntion box to wire lead lag appliances

	Master	Slave 2	..	Slave 7
J3, MB2	A	A	..	A
	B	B	..	B
	C	C	..	C

Figure 31: Lead Lag Wiring Setup (Left: Master, Right: Slave)



NOTE
Recycle power on all boilers after programming is complete if lag boilers are not discovered automatically

NOTE
CH Setpoint or DHW Setpoint must match Setpoint located in Lead Lag Master Configuration in order for the system to operate correctly.

NOTE
The Local/Remote switch (explained below) must be set in the “Local” position on ALL lag boilers.

6.4 LOCAL/REMOTE SWITCH

The local remote switch mounted inside the control box is designed to deliver an enable signal either relying on an external contact closure (*Remote*) or enabling the boiler locally (*local*). When *Remote* is selected via the DPDT switch, the Remote Operator contacts must close to deliver an enable signal. When *Local* is selected via the DPDT switch, a constant enable signal is present. When troubleshooting the Advantus™, it is recommended to switch to *Local* mode.

6.5 MODBUS, BACNET IP, BACNET MSTP, LONWORKS, METASYSN2 INTEGRATION

For more instructions on interfacing with Modbus/Bacnet/LonWorks/MetasysN2 Network:

http://www.camus-hydronics.com/media/1296/93_0238_dynaflame_dynaforce_dynamaxhs_advantus_protocol_setup.pdf

6.6 VARIABLE FREQUENCY DRIVE (AV800-4000)

The VFD has 50 parameters, which can be adjusted. At present, only the following are pertinent:

Table 13: Variable Frequency Drive Parameters

Parameter #	Function	Settings
100	Sets terminal strip as start/stop control	01
101	Sets 4-20mA as standard reference source	02
102	Min Freq.	Refer to factory test sticker
103	Max Freq.	Refer to factory test sticker
104	Acceleration time	220
105	Deceleration time	140
111	Stop method - will use value in Parameter #105	02
150	Follows 0-10VDC output freq.	01
160	Speed at minimum signal	Refer to factory test sticker
161	Speed at maximum signal	Refer to factory test sticker

1) To enter/exit parameter menu use 

2) Use  and  to arrive desired parameter and adjust value

2) If stop activated in run condition, must reset power to clear stop

6.7 FROST PROTECTION

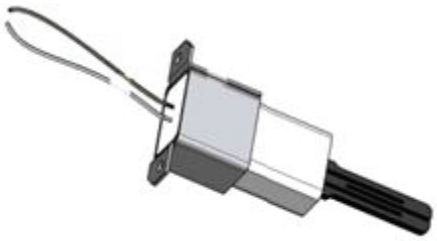
The Advantus™ is equipped with a heat exchanger frost protection algorithm where if the boiler inlet or outlet temperature sensors drop below 41°F (5°C) the boiler pump is enabled. If the temperature continues to drop to 38°F (3.3°C) the burner will be fired to bring the inlet and outlet temperatures to 50°F (10°C) to prevent freezing of the heat exchanger.

PART 7 COMPONENTS

7.1 HOT SURFACE IGNITER (GLOW BAR)

The silicon carbide igniter is inserted directly through the fan flange and held in place by two screws. A hold down bracket as well as sealing gasket above and below the igniter assures a good seal. Care must be taken when removing and/or installing the igniter since the silicon carbide element is brittle. Always remove the igniter prior to removing the fan assembly for inspection of the burner and heat exchanger. A properly prepared igniter will have a bead of silicone sealing the end mounting bracket to the ceramic shaft. Ceramic gaskets above and below the metal flange prevent the escape of hot combustion products.

Figure 32: Hot Surface Igniter



During trial for ignition a properly operating igniter will generate 3.2+/-0.2A which is above the current required for reliable ignition. It is recommended that the hot surface igniter be replaced every 4,000 hours of appliance operation to maintain peak ignition efficiency.

7.2 UV SCANNER

The UV Scanner is screwed on a ½" NPT pipe nipple and is screwed into the fan flange. Care must be taken when installing the UV Scanner, to align it parallel to the ½" NPT pipe nipple and not to over tighten. Always remove the UV Scanner prior to removing the fan assembly for inspection of the burner and heat exchanger.

Figure 33: UV Scanner



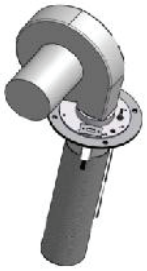
The ignition module relies on the UV Scanner to provide a flame rectification signal. Oxide deposits, improper placement or damaged ceramic insulator will result in insufficient signal leading to ignition module lock out. For proper operation minimum 0.8 Vdc must be fed back to the module. Oxide deposit on the detector window must be removed with a soft, clean cloth. The inside of the sight pipe must be cleaned before re-installing the UV Scanner. The UV Scanner has a life expectancy of 40,000 hours.

7.3 COMBUSTION AIR FAN

AV500-600

Uses a modulating air fan to provide combustible air/gas mix to the burner and push the products of combustion through the heat exchanger and venting system. The fan assembly consists of a sealed housing and fan wheel constructed from spark resistant cast aluminum. The fan is operated by a fully enclosed 120 VAC, Single Phase EC/DC electric motor. The fan housing and motor assembly is fully sealed and SHOULD NOT be field serviced. The power draw of the motor is proportional to the modulated gas input rate of the appliance.

Figure 34: Fan, Burner, Hot Surface Igniter and UV Scanner Arrangement (AV800 – 4000)



Uses a sealed air fan to provide combustible air/gas mix to the burner and push the products of combustion through the heat exchanger and venting system. The fan assembly consists of a sealed housing and fan wheel constructed from spark resistant cast aluminum. The fan is operated by a fully enclosed 230 VAC, 3-phase electric motor. The fan housing and motor assembly is fully sealed and SHOULD NOT be field serviced. The power draw of the motor is proportional to the modulated gas input rate of the appliance.

7.4 OUTER JACKET

The outer jacket assembly is constructed from mirror finish stainless steel. This ensures a long life for the jacket assembly, with full integrity.

7.5 VENTING TRANSITION

All appliances are shipped with a male vent outlet pipe. Depending on the appliance category, an increaser will be required for the proper vent configuration. Please refer to Table 3 dimensions and specifications.

7.6 CONDENSATION COLLECTION

Depending on water temperatures and firing rate there may be large volumes of condensate generated. At high fire with condensing inlet water temperatures less than 130^{o}F, condensate will be ejected from the vent outlet pipe and into the vent. It is recommended that provisions be made for collection and disposal of condensate from the vent. At low fire with condensing inlet water temperature condensate will be generated within the secondary pass of the heat exchanger and will fall into the bottom collection pan. This condensate will be collected in the condensate box provided with the Advantus^{TM}. The condensate box provided with the Advantus^{TM} has two connections. One connection (flex metal) removes condensate from the bottom pan and the other connection (flexible plastic) removes condensate from the vent outlet pipe.

PART 8 FIELD STARTUP PROCEDURES

8.1 CHECKING THE INSTALLATION

- Inspect the connections for water, gas and electricity.
- Confirm that water is being pumped toward the heat exchanger inlet. Never pump away from the exchanger since this will result in a low-pressure zone, which will allow localized boiling and result in heat exchanger damage.
- Power to the boiler and pump must be from the same circuit to prevent the boiler firing in case the pump is inadvertently shut off.
- Vent all air from the heat exchanger prior to firing using the two air vents provided on the heat exchanger. Both air vents can be accessed by removing the top cover and they are located on top of the Advantus™ heat exchanger.
- Inlet gas pressure must be a minimum of 4.0" W.C. for natural gas and 11" W.C. for propane.
- With the boiler off, open the main gas supply valve and vent the trapped air from the piping leading to the boiler. Confirm that all gas connections to the heater are tight and that there are no missing test plugs.
- **AV800-4000**: Connect a manometer to obtain the differential air pressure between negative and positive ports, See Figure 11.
- The air/gas ratio controller automatically adjusts to match the air signal on the gas side. In this way true mass flow control of air/gas mix is achieved. All boilers are test fired and factory set. A test sticker with actual reading is affixed to the unit.

8.2 CHECKING THE CONSTRUCTION

- Check the boiler wiring to see that it agrees with the wiring diagram supplied.
- Confirm that all terminal strips and field connections are identified.
- Confirm that the Advantus™ controller is set in the proper mode. Auto reset limits are fixed in all modes.
- With the low end firing valve in the off position, switch on power to the boiler. The fan motor will accelerate until the Interrupted Air Switch icon becomes green.
- Once all lights past the STAT are green, the SOLA will try for ignition. When the igniter is hot enough, the gas valve actuator is energized and if ignition is accomplished the Burner State will show "Run". If ignition is not accomplished, the Burner State will show "Safe Startup". It is normal during initial startup, when air is being purged from the piping, to require two to three tries before successful ignition.
- With the boiler running, check for flue gas leaks around the flue outlet. Some minor leakage is acceptable.
- Repair any major leaks prior to the next step.
- At the factory adjustments were made to achieve proper input and acceptable burner performance at full input and at minimum input.

8.3 GAS VALVE ADJUSTMENT PROCEDURE

Table 14: Combustion Values

Advantus™ Combustion Values				
	Natural Gas		Propane	
	CO_2	CO	CO_2	CO
Max Fire	9.0% - 9.5%	<100 PPM	10.5% - 11.5%	<100 PPM
Min Fire	8.0% - 8.5%	<100 PPM	10.0% - 10.5%	<100 PPM

If adjustment of the gas valve is required, use the following procedure.

It is imperative that the coldest system water temperature possible is used when setting up low fire combustion. These cold system temperatures create large amounts of flue condensate resulting in large amounts of condensate build up on the stainless steel heat transfer tubes. These conditions create the highest back pressure through the boiler and makes for the most critical combustion set up point when running 10% input on models 500-600 and 4.0% input on models 800-4000. This set up must be achieved quickly to ensure low system temperatures are maintained throughout the setup of single or multiple boiler installations.

Models 500 – 600
Light off the boiler and make the initial adjustment to the low fire bias to obtain the specified CO_2, CO, at minimum gas input.

Allow the boiler to run for 5 minutes at 10% and then make the final low fire adjustment according to the combustion values above. Allow the boiler to run up to high fire and set the combustion according to the combustion values above.

Models 800 – 4000
Light off the boiler and adjust the low end valve as described above for models 500 – 600.

Once the interface relay has switched to the high end valve, while maintaining the lowest possible water temperature, observe the differential gas pressure when running with the high end valve. The differential gas pressure must not drop below a minimum of 0.25" W.C. Once the boiler has run for at least 5 minutes with dead cold water, there should be a maximum amount of condensate in the lower heat exchanger. At this point adjust the combustion for CO_2.

The boiler must continue to run with stable combustion without making any howling noise which usually happens from an overly rich mixture. Once settings are complete at low fire, continue to run the machine for at least 5 more minutes and record the final low fire input and the combustion data.

To ensure the coldest possible water temperatures for set up on multiple boiler systems, the low fire combustion should be established on all boilers before setting any boiler high fire combustion rates.

In order to perform adjustments to the gas valve, the Advantus™ must be firing before proceeding.

Figure 35: AV800 – 1200 Low End Gas Valve

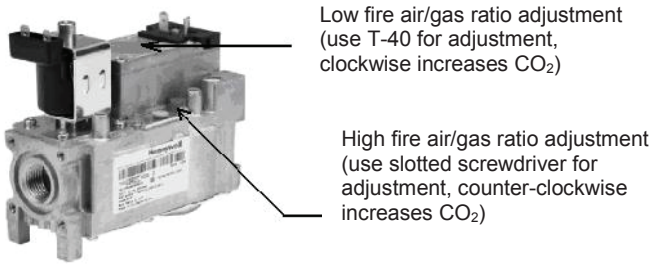
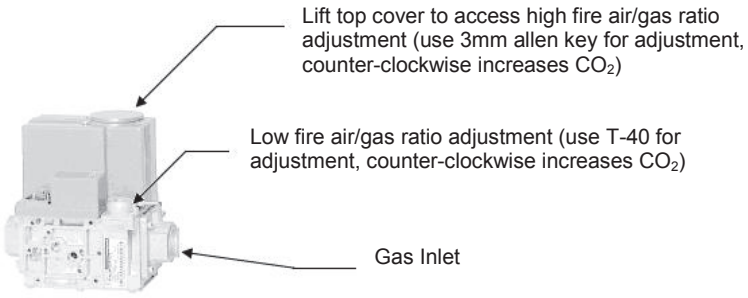


Figure 36: AV 500 – 600 Gas Valve, AV1400 – 4000 Low End Gas Valve



<u>To adjust the low fire setting (AV500-600)</u>

Use the Advantus™ Control Panel:

1. Press **[DIAGNOSTICS]** button
2. Press **[Diagnostic Tests]** button
3. Press **[Minimum Modulation]** button
4. Press **[start test]** to operate the boiler at minimum fire for 5 minutes

The Advantus™ should respond immediately and fire at 1075 RPM. When this is achieved, locate the low fire adjustment screw.

	Increase CO2	Decrease CO2
Low Fire Adjustment	↻	↺
	Clockwise	Counter-Clock Wise

When the correct combustion values are achieved replace the screw cap back on to the gas valve.

- This boiler is designed for low fire soft start. At the start of trial for ignition the fan will decelerate to minimum fire and will light off at soft start speed before ramping up towards full input through the PWM signal from the controller.
- Shut power off to the heater and open the firing valve. Switch power back on and allow the burner to fire. Ignition should be smooth. Always make adjustments to meet the recommended CO_2 levels. Adjust low fire first followed by high fire adjustment.

<u>To adjust the high-fire setting (AV500-600)</u>

After the low fire settings are stable, ramp the boiler firing rate to 100% using the boiler control and bring the system temperatures up to 130°F or to highest system design temperatures to minimize or eliminate condensate.

Use the Advantus™ Control Panel:

1) Press **[DIAGNOSTICS]** button
2) Press **[Diagnostic Tests]** button
3) Press **[Maximum Modulation]** button
4) Press **[Start Test]** to operate the boiler at max fire for 5 minutes.

Locate the input adjustment screw on the top side of the gas valve.

	Increase CO2	Decrease CO2
High Fire Adjustment		
	Counter-Clock Wise	Clockwise

After adjusting the screw wait a moment for the combustion levels to stabilize before attempting to make any further adjustments. Continue this procedure until combustion levels are satisfied.

To adjust the low fire setting of the low end valve (AV800 – 4000)

Use the Advantus™ Control Panel

1. Press **[DIAGNOSTICS]** button
2. Press **[Diagnostic Tests]** button
3. Press **[Minimum Modulation]** button
4. Press **[Start Test]** to operate the boiler at this firing rate for 5 minutes.

	Increase CO2	Decrease CO2
Low Fire Adjustment		
	Clockwise	Counter-Clock Wise

When the correct combustion values are achieved replace the screw cap back on to the gas valve.
After adjusting the screw wait a moment for the combustion levels to stabilize before attempting to make any further adjustments. Continue this procedure until combustion levels are satisfied.

To adjust the high fire setting of the low end valve (AV800 – 4000)

The high fire setting of the low end gas valve must be set at a point just before the Siemens gas valve is activated. This will vary from model to model and the installer will need to monitor at which point on the VFD that the transition occurs. It is advised to set the high end gas valve at 2 Hz below where the transition occurs. This transition has been set and tested at the factory and should normally not require adjustment

Use the Advantus™ Control Panel

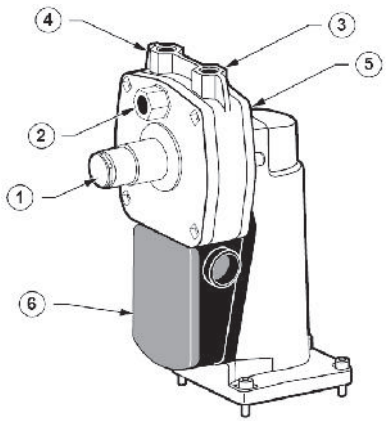
1. Press **[DIAGNOSTICS]** button
2. Press **[Diagnostic Tests]** button
3. Move the firing rate slider to a point where the VFD is 2 Hz before the transition point.
4. Press **[Start Test]** to operate the boiler at this firing rate for 5 minutes.

	Increase CO2	Decrease CO2
High Fire Adjustment		
	Counter- Clockwise	Clock Wise

When the correct combustion values are achieved replace the screw cap back on to the gas valve.
After adjusting the screw wait a moment for the combustion levels to stabilize before attempting to make any further adjustments. Continue this procedure until combustion levels are satisfied.

To adjust the low-fire setting of the high end valve (AV800-4000)

Figure 37: SKP55 Gas Valve



1. Adjustment of low fire bias
2. Connection for air pressure (+) sensing line
3. Connection for the air pressure (-) sensing line
4. Connection for the gas pressure (-) sensing line
5. Connection for the gas pressure (+) sensing line
6. Position indicator

All these connections are stamped on the die casting

Use the Advantus™ Control Panel

1) Press **[DIAGNOSTICS]** button
2) Press **[Diagnostic Tests]** button
3) Move the firing rate slider to 30.0%
4) Press **[Start Test]** to operate the boiler at max fire for 5 minutes.

	Increase CO2	Decrease CO2
Low Fire Adjustment	↻	↺
	Clockwise	Counter-Clock Wise

When the correct combustion values are achieved replace the screw cap back on to the gas valve.

To adjust the high-fire setting of the high end valve (AV800-4000)

Two manometers should be connected to the Advantus™ before proceeding to the next step to simultaneously monitor the air and gas signal. Refer to Section 3.8 of this manual for details on connecting manometers.

After the low fire settings are stable, ramp the boiler firing rate to 100% using the boiler control and bring the system temperatures up to 130°F or to highest system design temperatures to minimize or eliminate condensate.

Use the Advantus™ Control Panel:

1) Press **[DIAGNOSTICS]** button
2) Press **[Diagnostic Tests]** button
3) Press **[Maximum Modulation]** button
4) Press **[Start Test]** to operate the boiler at max fire for 5 minutes.

Figure 38: Typical Gas Train (Models AV800 -2000)

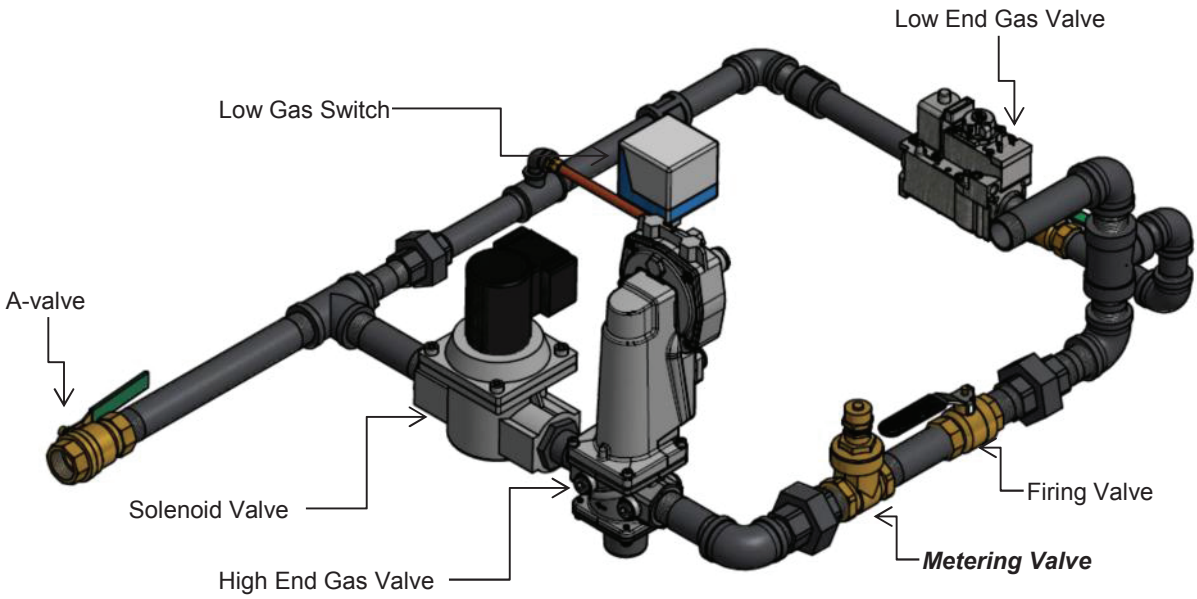


Figure 39: Typical Gas Train (Models AV2500-3000)

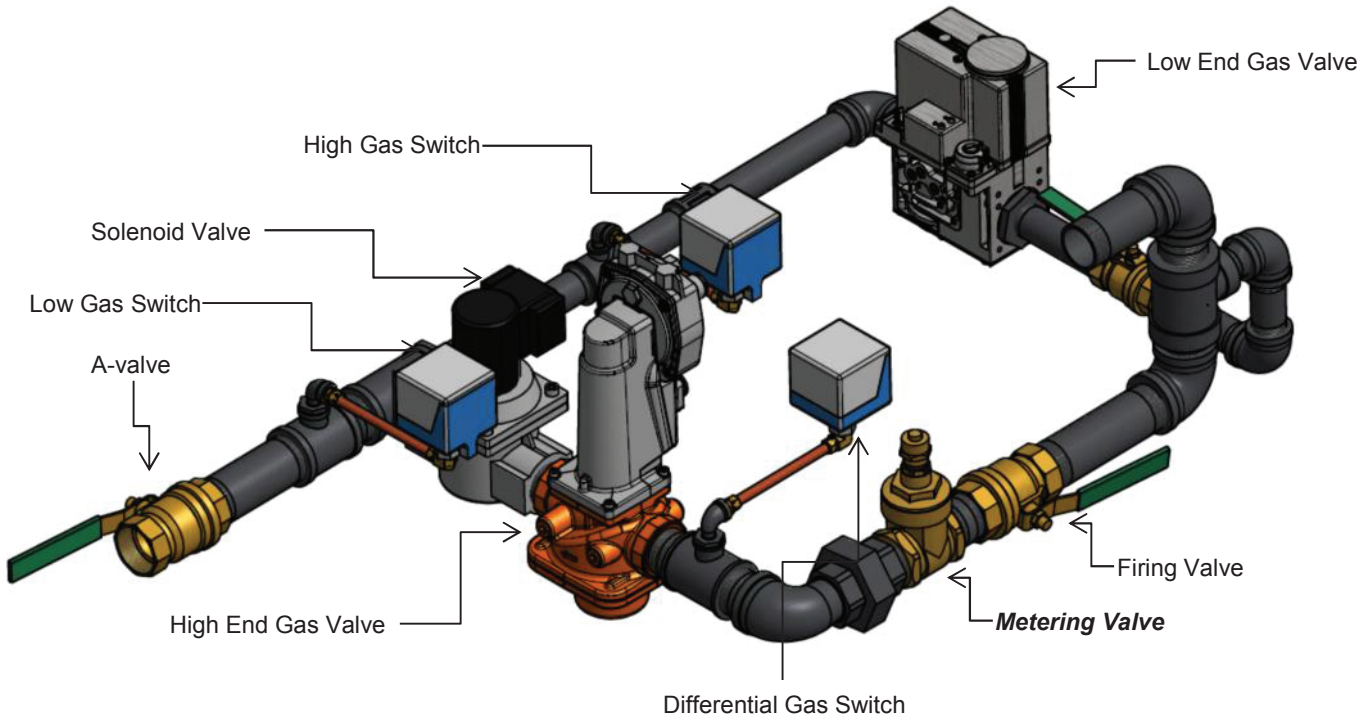
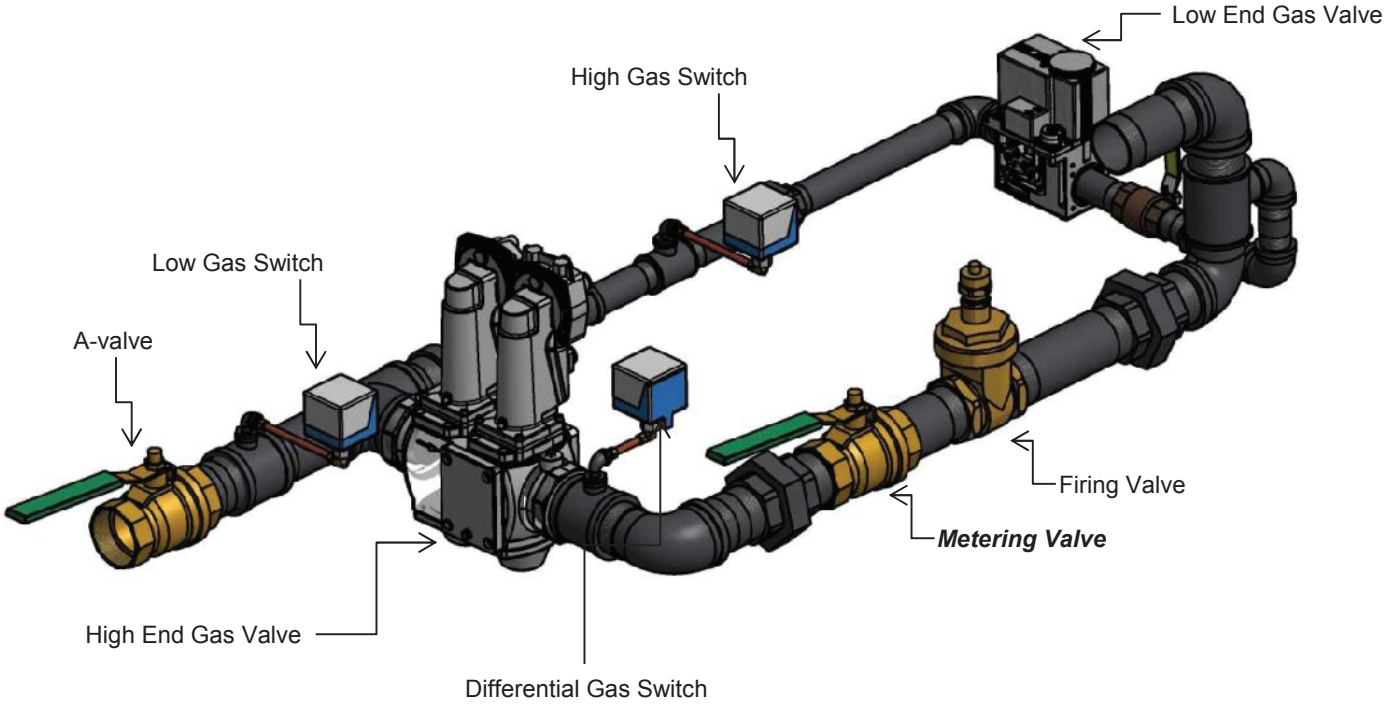


Figure 40: Typical Gas Train (Models AV3500-4000)



	Increase CO2	Decrease CO2
High Fire Adjustment	↺	↻
	Counter-Clock Wise	Clockwise

Turn the metering valve 1/8 turn in either way for each adjustment to keep track of the adjustments. After adjusting the valve wait a moment for the combustion levels to stabilize before attempting to make any further adjustments. Continue this procedure until combustion levels are satisfied.

To reset the metering valve to factory settings refer to the chart below and the step-by-step instructions that follow.

Table 15: Inline metering valve setting*

Model	LP Gas (Propane)	Natural Gas
	# of Turns Clockwise	# of Turns Clockwise
800	3	1 ½
1000	3	1 ½
1200	3	1 ½
1400	4	3
1600	4	3
1800	4	3
2000	3 ¾	2 ½
2500	3 5/8	2 7/8
3000	4	3
3500	5 ¾	4
4000	5 7/8	5

Step 1: Fully open inline metering valve (counter-clockwise)
Step 2: Close inline metering valve to preset level
Step 3: Above table shows initial settings only, fine-tuning will be required with the use of an analyzer.
***NOTE:** Metering valve is factory set and should not normally require adjustment

- This boiler is designed for low fire soft start. At the start of trial for ignition the fan will decelerate to minimum fire and will light off at soft start speed before ramping up towards full input through the 4-20mA from the controller.
- Shut power off to the heater and open the firing valve. Switch power back on and allow the burner to fire. Ignition should be smooth. Normally the differential gas pressure will be identical to the differential air pressure. Actual differential pressure may vary from the numbers on the test label due to the field conditions and sample variations. Always make adjustments to meet the recommended CO_2 levels. Adjust high fire first followed by low fire adjustment.
- Allow the water temperature to rise so that the heater cycles on the operator.
- Check the temperature rise across the heat exchanger. This will be indicated by taking a difference between the inlet and outlet temperatures on the Advantus™ control.
- Allow the unit to cycle on the limit. This can be done by gradually restricting outlet water flow to raise outlet temperature and then slowly rotating the limit dial. The auto reset limits are set at 200ºF for domestic hot water and hydronic heating.
- At full fire, block 50% of the fan inlet opening. The display should show 'LCI not closed'. If it does not, slowly turn the adjustment on the normally closed blocked flue switch counter clockwise until the blocked flue switch light goes out.
- Check the air proving switch. Remove the restriction from the fan inlet and reset the power on the control panel. A properly set air proving switch will permit the boiler to continue running when it is running at minimum fire or 10% for models 500 – 600 and 4% for models 800 – 4000.
- Check the ignition retries circuit.
- Shut the main gas off to the unit and allow it to try for ignition. Trial for ignition should commence within 30 seconds.

8.4 COMISSIONING APPLIANCE

- Remove manometers and replace inlet gas pressure test plug.
- Fill out start up report for each heater. Be sure to record all settings and readings. Retain a copy of report for future reference.
- Startup is now complete and heater may be placed into service.

PART 9 TROUBLESHOOTING

COMPONENT	FAILURE MODE	ANALYSIS
Incoming Power	• Two wires interchanged	• No effect on safety • Live and Neutral wires are interchanged.
Transformer Tripped	• The 24Volts and 120 Volts wired are interchanged • Alert: 49 • Lockout: 53	• Breaker on transformer trips
Relief Valve	• System pressure exceeds relief valve setting	• Replace the standard relief valve with a higher rated valve up to the maximum pressure of the heat exchanger. • Improperly sized expansion tank.
Flow Switch	• Flow Switch contacts are open • Alert: 63, 275-281, 460 • LCI OFF	• Verify that pump is operating • Verify for closed valves or obstructions in boiler piping • Verify that all air has been purged from the system • Verify that wiring is correct
Water Pressure Switch	• Pressure Switch contacts are open • Alert: 63, 275-281, 460 • LCI OFF	• Verify that minimum water pressure exceeds 30 PSI • Verify that pump is operating • Verify for closed valves or obstructions in boiler piping • Verify that all air has been purged from the system • Verify that wiring is correct
Flame Failure	• The boiler has failed to ignite the burner • Alert: 110, 291-294	• To reset the module refer to section 5.7.2 • Verify that all air has been purged from gas line • Inspect hot surface igniter and related wiring for damage and connection errors • AV500-2500: Verify igniter is glowing • AV3000-4000: Verify pilot is lit • Inspect UV Scanner and associated wiring. Replace if necessary • Remove the detector and clean the viewing window with a soft, clean cloth • Clean the inside of the sight pipe before re-installing the detector • Verify that boiler is properly grounded • Verify incoming gas supply pressure and that it coincides with Table 7. • Verify that the vent/ air inlet piping (if equipped) are correctly installed and obstructions are not present. • Verify 24 VAC is being supplied to the low end gas valve relay from the Advantus™ Controller during ignition. Check wiring from Advantus™ Controller and Gas Valve Relay. If a signal cannot be detected, the Advantus™ Controller needs to be replaced • If 24 VAC is present, check the outlet of the valve to ensure that gas is flowing. When the valve is energized a change in pressure should occur, if no change is detected the gas valve has failed to open or it is passing insufficient amount of gas. If this is an initial startup increase the low fire gas setting by ¼ turn clockwise. • Inspect the burner. Refer to Burner Maintenance in section 10.5 • Replace the Advantus™ Controller, if necessary
Flame Disappears During a Run Cycle	• The Advantus™ boiler was running and flame signal suddenly disappeared. • Lockout: 106, 107, 108, 109	• Verify that all air has been purged from gas line • Verify that boiler is properly grounded • Inspect UV Scanner and associated wiring. Replace if necessary • Remove the detector and clean the viewing window with a soft, clean cloth • Clean the inside of the sight pipe before re-installing the detector • Adjust the air proving switch. Turn counter-clockwise to reduce sensitivity • Adjust the blocked flue switch. Turn clockwise to reduce sensitivity • Verify incoming gas supply pressure and that it coincides with Table 7. • Verify that the gas line connections to the boiler are adequate. Refer to Table 6. • Verify that the vent/ air inlet piping (if equipped) are correctly installed and obstructions are not present • Verify that 24 VAC is being supplied to the low end gas valve during operation. If a signal cannot be detected, the transformer needs to be replaced • Verify that 115 VAC is being supplied to the high end gas valve during operation • Inspect the burner. Refer to Burner Maintenance in section 10.5 • Replace the Advantus™ Controller if necessary

COMPONENT	FAILURE MODE	ANALYSIS
Noisy Operation	• Supply Gas Issue	• Refer to Part 3 Gas Connection in this manual. • Natural Gas Pressure reads between 4” w.c. and 14” w.c. • L.P. Gas Pressure should be at 11” w.c.
	• Air/Gas Mixture Issue	• Refer to Section 8.3 Gas Valve Adjustment Procedure for proper combustion setting.
	• Air Inlet and/or Vent configuration	• Refer to Part 2 Venting and Air Supply
	• Dirty/ Damaged Burner	• Refer to Burner Maintenance in section 10.5 of this manual for the burner removal and inspection procedure. Clean or replace the burner, if required.
	• Air in the piping system	• Purge all air from the piping system
Auto Reset High Limit Trips	• The outlet temperature has exceeded the set point temperature specified. • Alert: 67, 79, 137, 303-310 • ILK OFF	• Verify that the system is full of water and that all air has been properly purged from the system. • Verify that ΔT does not exceed 60°F across the heat exchanger • Verify that the boiler is piped properly. • Verify that 120 VAC is being supplied to the boiler pump on a call for heat. If voltage cannot be detected check wiring. • Verify that the pump is circulating when 120VAC is detected. If not, pump impeller may be stuck. • If 120 VAC is present during a call for heat, but the pump still does not circulate, replace the pump. • Check outlet sensor for proper functionality. At 77°F (25°C) the sensor will show 10kΩ of resistance.

SYMPTOM	FAILURE MODE	ANALYSIS
Manual Reset High Limit Trips (if equipped)	• Manual Reset Safety High Limit tripped, outlet temperature in excess of 210°F • Alert: 63, 67, 79, 137, 276-281, 303-309 • LCI OFF	• Verify that the system is full of water and that all air has been properly purged from the system. • Verify that the boiler is piped properly. • Verify that 120 VAC is being supplied to the boiler pump on a call for heat. If voltage cannot be detected check wiring. • Verify that the pump is circulating when 120 VAC is supplied. If so, pump impeller may be stuck. Use a flat head screwdriver on face of pump to turn impeller manually. • If 120 VAC is present during a call for heat, but the pump still does not circulate, replace pump.
Delta-T Limit Tripped	• Inlet and Outlet temperature has exceeded 60°F • Alert: 124	• Verify that the system is full of water and that all air has been properly purged from the system. • Verify that the boiler is piped properly. • Verify that 120VAC is being supplied to the boiler pump on a call for heat. If voltage cannot be detected check wiring. • Verify that the pump is circulating when 120VAC is detected. If not, pump impeller may be stuck. • If 120VAC is present during a call for heat, but the pump still does not circulate, replace the pump. • Purge all air from the piping • Verify boiler water pressure exceeds 30 PSI
Temperature Overshoot	• Stack temperature has exceeded the limit temperature. • Alert: 125	• The stack temperature has exceeded the maximum temperature allowed. • CPVC: 194°F • PPE: 230°F • AL29-4C, Stainless Steel: 300°F+ • Measure the resistance of the flue sensor at room temperature, it should be approximately 10kΩ.
	• Outlet temperature has exceeded target temperature. • Alert: 63, 67, 79, 137, 276-281, 303-309 • LCI OFF	• Check outlet sensor. It should be firmly inserted in well • Water flow may be too low and allows burner to run longer than required creating a reservoir of hot water in the center of the heat exchanger. Check Central Heat and/or DHW PID parameters P=20, I = 10, D=0 provides quickest response. • Lower target to modulate burner off sooner • If modulating pump is supplied, increase the pump speed to prevent outlet temperature overshoot.
Sensor Not Connected	• Inlet sensor, Alert: 91 • Outlet sensor, Alert: 92 • DHW sensor, Alert: 93 • Flue sensor, Alert: 95 • Outdoor sensor, Alert: 96	• Verify sensors are connected • Verify wiring. • Measure resistance of sensors at room temperature, 10kΩ sensors. • Replace sensor if necessary
Fan Not Turning	• Fan refuses to rotate • Alert 122, 123, 128, 129, 130, 131, 132	• Check fan power wires • Fan signal wires are interchanged • Minimum fan speed must be greater than 800 RPM
Air Proving Switch	• Interrupted Air Switch error • Alert: 67, 137, 303-310 • ILK OFF	• Air Switch wire(s) is/are loose • Air Switch is set too tight • Models 500 – 600: Reduce sensitivity by turning screw ¼ turn counter-clockwise. • Models 800 – 1400: An electronic air switch is used.
Blocked Flue Switch opens at full speed	• LCI error • Alert: 63, 137, 276-281 • LCI OFF	• Check for blockage in the vent and/or air intake, if applicable. • Remove restriction from vent and /or air intake. • Blocked Flue Switch wire(s) is/are loose • Blocked Flue Switch is set too light, reduce sensitivity by turning screw ¼ turn clockwise.
Flame Detection is out of Sync	• Flame detection is present when no visible signs of a flame exist • Lockout: 105, 158	• Verify supply voltage for proper polarity. • Check external wiring for voltage feedback • Check internal wiring for proper connections • Check the UV Scanner and verify that viewing window is clean and scanner is not flashing • Replace scanner
Blank Display Screen	• Blank display screen	• Check wire connections from Advantus™ Controller to touchscreen display
Internal Fault	• Lockout: 3-46, 58-60, 97-99, 143-148	• Reset SOLA, • If fault persists, replace SOLA

Table 16: Lockout Codes

#	Description
1	Unconfigured safety data
2	Waiting for safety data verification
3-46	Internal Fault. Replace SOLA Controller
47	Flame rod to ground leakage
48	Static Flame
49	24VAC low/high
50	Modulation Fault
64	Fan speed not proved, ignition failure
67	Interlock Off, safety circuit is open
79	Heater Outlet high limit tripped
81	Delta T Limit
82	Stack limit tripped (PVC: 149°F, CPVC: 194°F, 250°F)
91	Inlet sensor fault
92	Outlet sensor fault
93	DHW sensor fault
94	Header sensor fault
95	Stack sensor fault
96	Outdoor sensor fault
105	Flame detected out of sequence
106	Flame lost if Main Flame Establishing Period (MFEP)
107	Flame lost early in run
108	Flame lost in run
109, 110	Ignition failed
112	Pilot test flame timeout
113	Flame circuit timeout
149	Flame detected

* If an internal hardware error is detected contact Camus technical support for troubleshooting procedure.

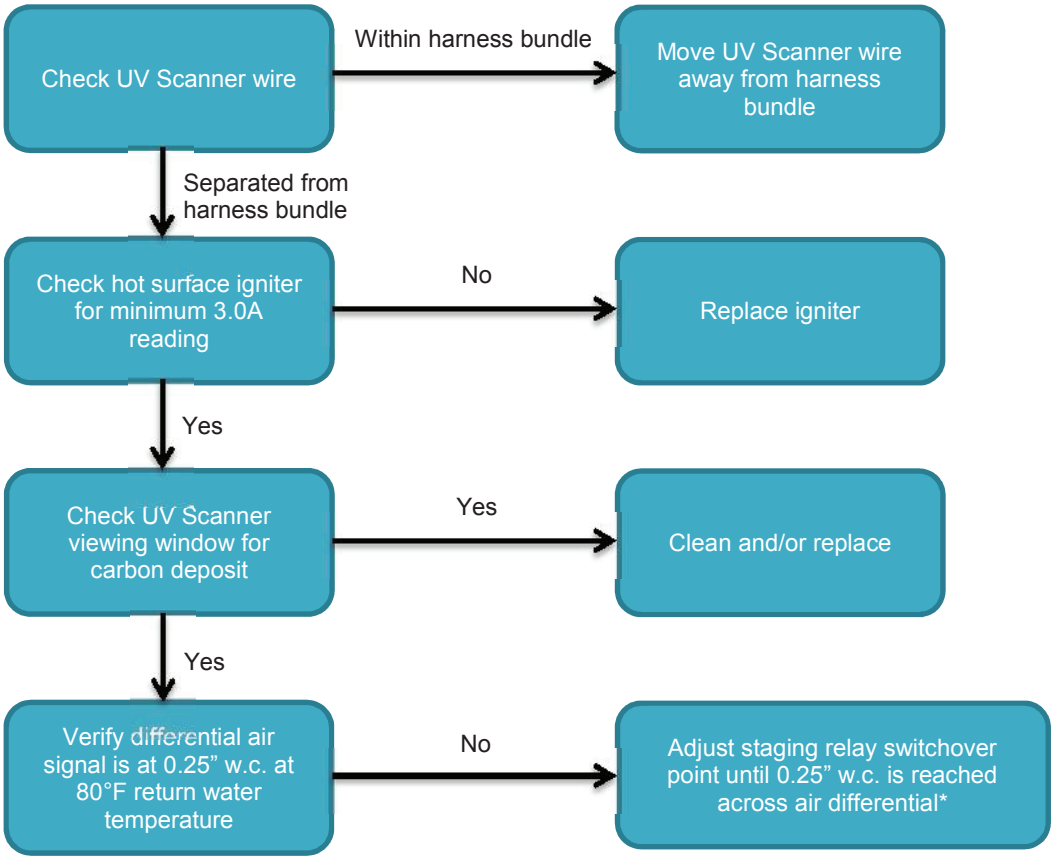
Table 17: Alert Codes

#	Description
29	Burner switch turned OFF
30	Burner switch turned ON
47	Invalid subsystem reset request occurred
50	Modulation Fault (DR300 – 1000 ONLY)
61	Anti-short Cycle
62	Fan speed not proved
63	LCI off, safety circuit is open
68	Setpoint was overridden due to sensor fault
69	Modulation was overridden due to sensor fault
123	Modulation rate was limited due to outlet limit
124	Modulation rate was limited due to Delta-T limit
215	No Lead Lag slaves available to service demand
219	Using backup Lead Lag header sensor due to sensor failure
229	Lead lag slave communication timeout.
275-281	LCI off, safety circuit is open
283	Demand off during measured purge time
291	Abnormal Recycle: Flame was not on at end of Ignition period
292	Abnormal Recycle: Flame was lost during Main Flame Establishing Period
293	Abnormal Recycle: Flame was lost early in Run
294	Abnormal Recycle: Flame was lost during Run
303-310+	Interlock Off, safety circuit is open
324, 374-379	Hardware flame bias. Flame sensor wire needs to be re-routed.
352+	Stack sensor fault
355+	Outlet sensor fault
357+	DHW sensor fault
359+	Inlet sensor fault
460	LCI lost in run
550	Delta T inlet/outlet limit was exceeded

+ The alarm LED and alarm contacts are closed and will remain closed until the ‘RESET’ button is pressed.

Alert 291: Abnormal Recycle: Flame was not on at end of ignition
Alert 294: Abnormal Recycle: Flame was lost during Run
Alert 324: Abnormal Recycle: Hardware flame bias
Alert 377: Abnormal Recycle: Hardware flame bias delta

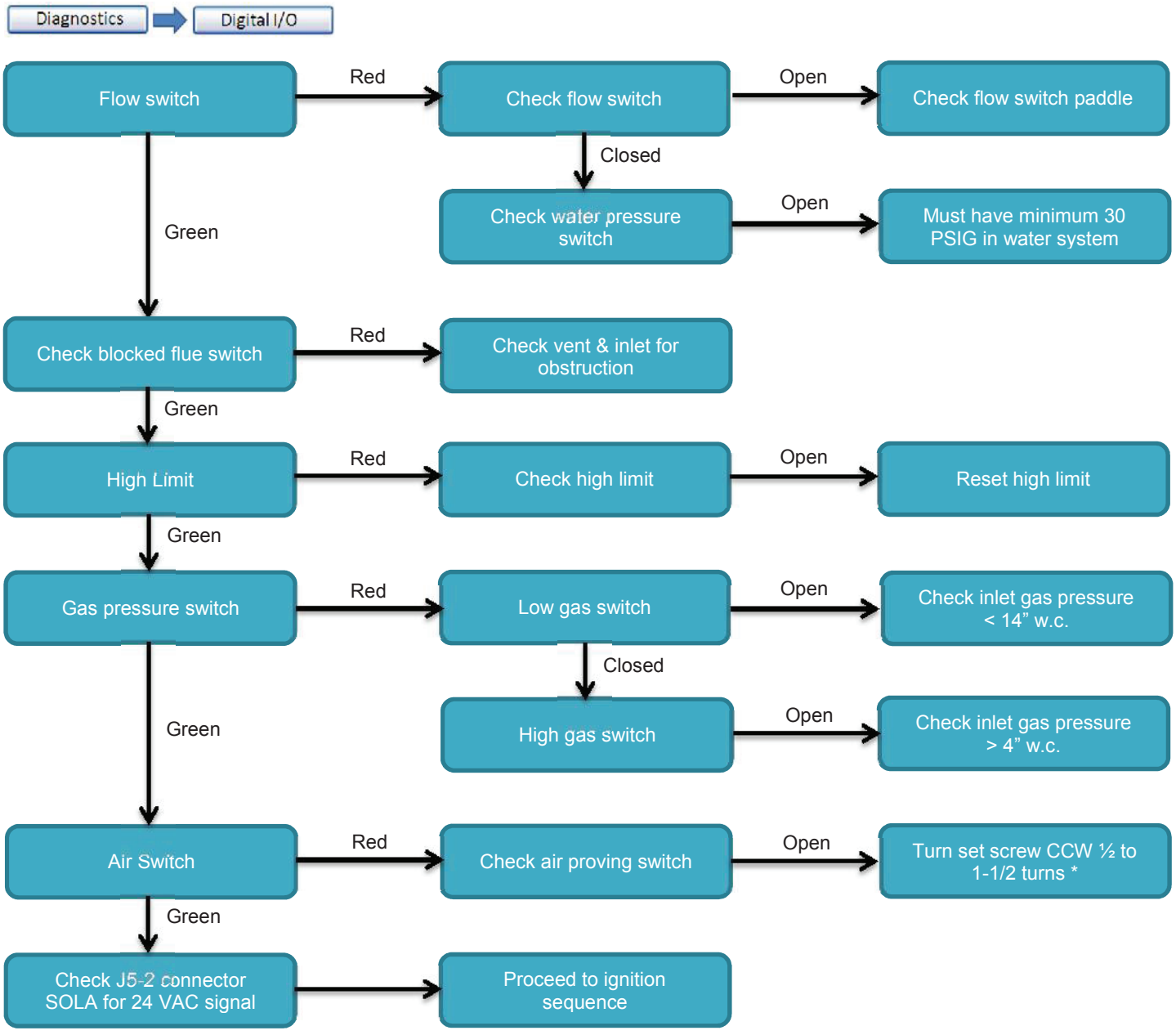
This error occurs when a flame signal is not detected by the UV Scanner. A minimum signal of 0.8Vdc must be detected by the UV Scanner to prove the flame.



* Models 800 – 4000: For high end valve. Staging relay switch over is factory set and normally does not require field adjustment.

Hold 63: LCI OFF (Load Control Input)
Hold 67: ILK OFF (High Limit, Gas Pressure Switch, and Interrupted Air Switch)
Alert 303-310: Abnormal Recycle: ILK off
Alert 460: LCI lost in run

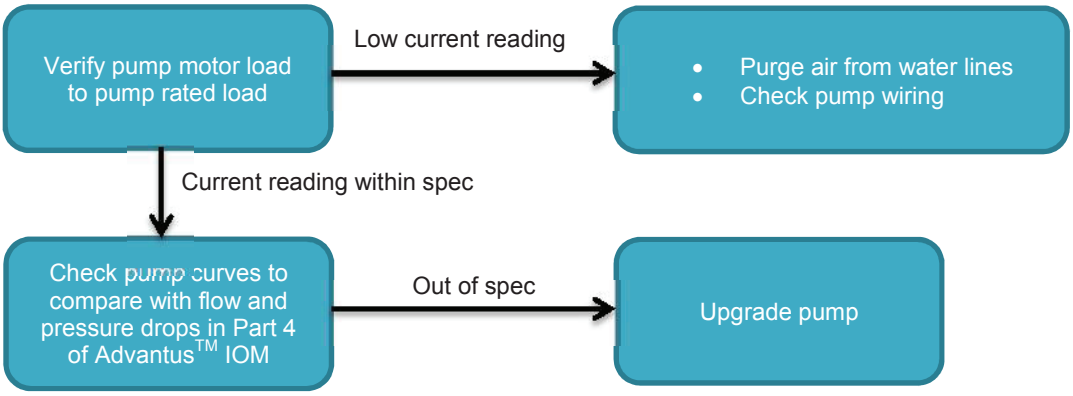
This error occurs when one of more of the boiler safety switches are in an open condition when it is to be in a closed condition before the ignition sequence is allowed to proceed.



* Models 500 and 600 only.
* Models 800 – 4000 are equipped with an electronic air switch

Alert 354: Abnormal Recycle Delta-T limit

This safety was breached as the inlet and outlet temperature difference exceeded 60°F. This is done to prevent damage to the heat exchanger. Before this error appears, the combustion air blower would have slowed down in an effort to prevent such an error from occurring.



PART 10 MAINTENANCE

CAUTION

It is important that all gas appliances to be serviced by a Camus trained service technician. It is in your own interest and that of safety to ensure that all local codes, and all the "NOTES" and "WARNINGS" in this manual are complied with. To service or adjust this appliance, it is imperative that the Camus trained service technician utilize a combustion analyzer to read CO_2, CO and flue pressure according to Camus Hydronics recommendation.

CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation, verify proper operation after servicing.

Listed below are items that must be checked to ensure safe reliable operations. Verify proper operation after servicing.

10.1 EXAMINE THE VENTING SYSTEM

Examine the venting system at least once a year. Check more often in the first year to determine inspection interval. Check all joints and pipe connections for tightness, corrosion or deterioration. Flush the condensate drain hose with water to clean. Clean screens in the venting air intake system as required. Have the entire system, including the venting system, periodically inspected by a qualified service agency.

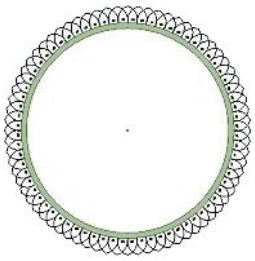
10.2 VISUALLY CHECK MAIN BURNER FLAMES

At each start up after long shutdown periods or at least every six months. A burner view port is located on the burner mounting flange.

CAUTION

The area around the burner view port is hot and direct contact could result in burns.

Figure 39: Normal Burner Flame Profile (short dense and blue at full fire, infrared at low fire)



- Normal Flame: A normal flame at 100% of burner input is blue, with slight yellow tips and a well-defined flame, no flame lifting
- Yellow Tip: Yellow tipping can be caused by blockage or partial obstruction of air flow to the burner.
- Yellow Flames: Yellow flames can be caused by blockage of primary air flow to the burner or excessive gas input. This condition **MUST** be corrected immediately
- Lifting Flames: Lifting flames can be caused by over firing the burner, excessive primary air or high draft in excess of negative 0.15" w.c.

If improper flame is observed, examine the venting system; ensure proper gas supply and adequate supply of combustion and ventilation air. Periodic visual check of pilot and burner flame is recommended to ensure trouble-free operation.

10.3 FLUE GAS PASSAGEWAYS CLEANING PROCEDURES

Any sign of soot around the flue pipe connections, burner or in the combustion chamber indicates a need for cleaning. The following cleaning procedure must only be performed by a Camus trained service technician. Proper service is required to maintain safe operation. Properly installed and adjusted units seldom need flue cleaning.

NOTE

All gaskets/sealant on disassembled components or jacket panels must be replaced with new gaskets/sealant on re-assembly. Gasket and sealant kits are available from the factory.

CAUTION

When the vent system is disconnected for any reason it must be reassembled and resealed according to vent manufacturer's instruction.

10.4 CONDENSATION TREATMENT

This high efficiency appliance may operate as a condensing appliance for extended periods of time based on return water temperatures. Condensate occurs when the products of combustion are cooled below their dew point in the heat transfer process. The liquid condensate formed from this high efficiency heat transfer process is mildly acidic. The condensate will typically have a pH ranging from 4.0 to 5.0 as it is discharged from the condensate drain at the rear of the appliance. The neutralizer/condensate box where condensate is collected is constructed from a corrosion resistant stainless steel it contains neutralizer medium that must be replaced periodically. All materials external to the appliance in contact with the condensate must be corrosion resistant. This is typically accomplished by using PVC or CPVC plastic pipe and synthetic tubing. Condensate must be able to flow freely from the appliance. All condensate flow is accomplished by gravity requiring a minimum downward slope of ¼" per foot (21mm/m) to ensure proper flow to the condensate management system and/or a suitable drain. The neutralizer condensate box **MUST** always be mounted lower than the bottom of the appliance cabinet. All condensate piping and connections must be easily accessible for routine maintenance and inspection.

10.4.1 CONDENSATE VOLUME

There are several factors affecting the amount of condensation created by the appliance however for rough approximation use. Condensation Volume, US Gallon/Hr = Input, MBH/1000 x 5.0.

Many codes will require the acidic condensate to be neutralized before it can be placed in a drain system. An additional supplementary neutralizer to control the pH of the liquid discharged to a drain system is recommended with every appliance. The neutralizer consists of an industrial grade, non-corrosive reservoir for additional treatment of the condensate. As the reservoir fills, it provides an extended residency time to neutralize the condensate. The neutralized condensate exits from the reservoir outlet. The neutralizer/ condensate box supplied with the Advantus™ provides a 'P' trap to prevent flue gas escape as well as initial neutralization of the condensate.

When the condensate level in the reservoir rises to the drain, it spills out into the condensate bin and from there exits to the external neutralizer. As the pH number increases in numerical value, the relative acidity of the discharge decreases. The neutralized condensate may then be discharged into a suitable drain system without fear of damage to the drain system. Always check with local codes for specific pH requirements. Neutralizers may be used in series to raise pH.

10.5 BURNER MAINTENANCE

The burner should be removed for inspection and cleaning on an annual basis. An appliance installed in a dust or dirt contaminated environment will require inspection and cleaning on a more frequent schedule. The fan assisted combustion process may force airborne dust and dirt contaminants, contained in the combustion air, into the burner. With sustained operation, non-combustible contaminants may reduce burner port area, reduce burner input or cause non-warrantable damage to the burner.

Airborne contaminants such as dust, dirt, concrete dust or dry wall dust can be drawn into the burner with the combustion air and block the burner port area. An external combustion air filter is provided with the appliance and may be washed in the sink under the tap. This filter should be checked and cleaned at the time of appliance commissioning and on a six month interval or more often in a contaminated environment.

10.5.1 BURNER REMOVAL

Access to the burner will require the following steps:

- Turn off main electrical power to the appliance.
- Turn off main manual gas shutoff to the appliance
- Remove the top cover.
- Disconnect the gas supply connection to the fan inlet.
- Disconnect the fan motor power wires at the harness.
- Remove the hot surface igniter and the UV Scanner.
- Remove the sensing tubes from the air ratio gas valve to the combustion air fan.
- Remove the nuts holding the fan assembly to the heat exchanger and remove the fan assembly. On occasion the red silicone gasket may adhere to the underside of the fan's flange. Carefully pry the flange away from the gasket prior to removing the fan assembly.
- The burner can now be lifted vertically out of the heat exchanger cavity. A graphite backed ceramic paper gasket is located directly under the burner flange. This gasket must be replaced if it is damaged. A solid black graphite gasket sits directly on the heat exchanger top plate.
- Use care to prevent damage to the knitted metal fiber of the burner surface.
- Check all gaskets and replace as necessary. Gaskets affected by heat will not reseal properly and must be replaced.
- Replace the burner in the reverse order that it was removed. Insert the igniter and UV scanner before doing the final tightening on the fan mounting nuts. Evenly tighten the nuts to 20 ft-lbs (models 500-600) and 30 ft-lbs (models 800-4000)

NOTE

When the combustion air fan is removed for any reason, the inlet to the burner must be covered to prevent further foreign objects from falling into the burner. Always look inside the burner to check for dents. Do not place a burner back into operation if the inner distribution screen has been dented during the service operation, call the factory for recommendations. Use care when removing and handling the burner, Sharp objects or impact may damage or tear the metal fiber surface rendering the burner unfit for service.

10.5.2 BURNER CLEANING PROCEDURE

Remove any visible dust or dirt blockage from the surface of the burner using water from a garden house. Wash the burner with low pressure water. Never wipe or brush the surface of the burner nor use high pressure water or air.
The burner may best be cleaned by immersing the burner port area in a solution of dishwashing detergent and hot water. Allow the burner to remain in the solution for a short period of time to remove dust, dirt and oil or grease laden contaminants. Rinse the burner thoroughly with clean water to remove any residue from the detergent cleaner. The burner should be air dried after removal from the cleaning solution and rinsing. **DO NOT** use chlorine based solvents or cleaning agents on the burner.

10.6 CHANGING THE HOT SURFACE IGNITER

- The hot surface igniter is to be checked at least after every 4000 hours of operation and more frequently under high cycling conditions. This will maintain peak ignition efficiency.
- Turn off main electrical power to the appliance.
- Turn off main manual gas shutoff to the appliance.
- Locate the hot surface igniter.
- Disconnect the two power leads to the hot surface igniter.
- Loosen and remove the two screws that hold the igniter.
- Lift the igniter vertically out of the burner mounting flange. Use care, do not hit or break the silicon carbide igniter. **DO NOT** pull out by leads.
- Ensure that the ceramic paper gaskets used to seal the base and top of the igniter are reinstalled on the new igniter.

10.6.1 RE-INSTALLING THE IGNITER

- Confirm that the end of the replacement igniter has a bead of silicone sealing the gap between the metal mounting flange and the ceramic shaft of the igniter.
- Carefully insert the igniter into the mounting point on the burner flange and push into position on top of the fan's flange
- Reinstall the two mounting head screws and tighten by hand only.
- Ensure that the igniter ceramic paper gaskets are properly installed and seal the point of contact between the igniter and fan mounting flange.
- Reconnect the power leads to the igniter.
- Turn on main gas supply.
- Turn on main power.
- Test fire the appliance to ensure proper operation.
- The igniter must generate minimum 3A to reliably light the main burner (Models 500 – 2500) or pilot (Models 3000 – 4000).

10.7 HEAT EXCHANGER INSPECTION

- The heat exchanger should be inspected at the time of burner maintenance.
- Turn off all power to the appliance.
- Turn off main gas to the appliance.
- Remove top cover.
- Remove fan assembly and burner as detailed in the Burner and Cleaning section.
- Check the heat exchanger tubes and combustion chamber. If soot is present, heat exchanger must be cleaned
- Remove the front outer jacket door.
- Use detergent water pressure wash to remove soot from heat exchanger tubes and combustion chamber.
- Disconnect condensate/ neutralizer box and allow dirty wash water to drain away
- Reinstall the burner and fan assembly.
- Reassemble all gas piping. Test for gas leaks.
- Reassemble outer jacket panels. Keep top cover off.
- Cycle unit and check for proper operation.
- Once proper operation is confirmed replace the top cover.

10.8 RE-INSTALL HEAT EXCHANGER

- Carefully reinstall the heat exchanger if removed from the appliance
- Cycle unit and check for proper operation
- Replace the top cover

10.9 COMBUSTION AIR FAN

Combustion air fan should be checked every 6 months. Clean the inlet screen and damper plate as required when installed in a dust or dirt contaminated location. The motor and bearings on the combustion air fan are sealed and permanently lubricated requiring no addition of oil or lubricants.

10.10 COMBUSTION AND VENTILATION AIR

Check frequently to be sure that the flow of combustion and ventilation air to the appliance is not obstructed. Combustion and ventilation air must be provided to the mechanical room with openings sized per the requirements of the B149 or National Fuel Gas Code. The optional outdoor air kit brings combustion air from the outdoors directly to the appliance.

10.11 CONTROL CIRCUIT VOLTAGE

This appliance uses a transformer to supply a low voltage control circuit. The voltage on the secondary side should be 24 to 28VAC when measured with a voltmeter. A secondary voltage of 21VAC or less supplied to 24VAC components may cause operational problems. A 4A circuit breaker is provided on the secondary side of the transformer. A tripped circuit breaker indicates a short in the 24VAC controls and must be corrected.

10.12 COMBUSTIBLE MATERIALS

CAUTION
Keep appliance clear from combustible materials; do not store **GASOLINE** and other flammable vapors and liquids in the proximity of the appliance.

10.13 FREEZE PROTECTION

Installations are not recommended in areas where the danger of freezing exists. Proper freeze protection must be provided for appliances installed outdoors, in unheated mechanical rooms or where temperatures may drop to the freezing point or lower. If freeze protection is not provided for the system, a low ambient temperature alarm is recommended for the mechanical room. Damage to the appliance by freezing is non-warrantable.

- **Location** - Heating boilers, hot water supply boilers or water heaters must be located in a room having a temperature of at least 50ºF (10ºC)
- **Caution** - A mechanical room operating under a negative pressure may experience a downdraft in the flue of an appliance that is not firing. The cold outside air may be pulled down the flue and freeze a heat exchanger. This condition must be corrected to provide adequate freeze protection.
- Freeze protection for the appliance using an indirect coil can be provided by using hydronic system antifreeze. Follow the manufacturer's instructions. **DO NOT** use undiluted or automotive type antifreeze.
- **Shut-down and draining** - If for any reason, the unit is to be shut off where danger of freezing exists, the following precautionary measures must be taken:
    - Shut off gas supply
    - Shut off water supply
    - Shut off electrical supply
    - Drain the heat exchanger completely
    - Ensure the pump and connecting piping are fully drained

10.14 FREEZE PROTECTION FOR A HEATING BOILER SYSTEM (Optional)

- Use only properly diluted inhibited glycol antifreeze designed for hydronic systems.
- Follow the instructions from the antifreeze manufacturer. Quantity of antifreeze required is based on total system volume including expansion tank volume.
- Antifreeze is denser than water and changes the viscosity of the system. The addition of antifreeze will decrease heat transfer and increase frictional loss in the boiler and related piping. Where antifreeze has been used, to maintain the temperature rise across the appliance confirm that the recommended GPM for pure water has been increased by 15% and the head loss by 20%.
- Local codes may require a back flow preventer or actual disconnect from city water supply when antifreeze is added to the system.
- When filling or topping-up the system with water mixed with the antifreeze always used distilled or RO (reverse osmosis) water. This will prevent the reaction of the water with antifreeze which can create sludge.

PART 11 INSTALLATIONS

WARNING

Before starting the boiler smell near the floor, the interior of the boiler and around the boiler for any gas odors or any unusual odor. If there is any sign of a gas leak, do not proceed with startup. Repair all the leaks before attempting to start the boiler

WARNING

Propane boilers **ONLY** – Your local propane supplier adds an odorant to the propane gas to allow for propane gas leak detection. In some cases, the added odorant can fade and the gas may not give off any noticeable odor. Before startup have the local propane supplier check for the correct odorant level in the gas.

11.1 CHECKING THE INSTALLATION

- Inspect the connections for water, gas and electricity.
- Inlet gas pressure should be 7" W.C. for natural gas and 11" W.C. for propane.
- With the boiler off, open the main gas supply valve and vent the trapped air from the piping leading to the boiler. Confirm that all gas connections to the heater are tight and that there are no missing test plugs.
- Refer to Section 8.3 Gas Valve Adjustment Procedure of the manual for recommendations on setting combustion characteristics

11.2 CHECKING THE INSTALLTION

- Check the boiler wiring to see that it agrees with the wiring diagram supplied.
- Confirm that all terminal strips and field connections are identified.
- With the boiler running, check for flue gas leaks around the flue outlet.
- Repair any leaks prior to proceeding to the next step.
- At the factory, adjustments were made to achieve proper input and acceptable burner performance at full input and at minimum input.

11.3 INSPECT & RECHARGE CONDENSATE COLLECTION & NEUTRALIZING RESERVOIR

1. Inspect the connections to the neutralizer/ condensate box.
2. Remove screws holding lid on to condensate collection box. Remove lid from the condensate collection box.
3. Fill with fresh water until the water begins to flow out of drain. Recharge with neutralizer medium as required.
4. Re-install the lid and hold-down screw on the neutralizer condensate collection box.
5. Inspect the condensate neutralizer supplied on site and confirm that it contains sufficient calcium carbonate to operate effectively to neutralize condensate to required level.
6. Check pH level of condensate.

WARNING

The neutralizer condensate collection box must be filled with water to prevent flue gas emissions from escaping during boiler operation.

CAUTION

A leak in a boiler heating "System" will cause the fill system to introduce fresh water constantly, which may cause the tubes to accumulate a lime/scale build up. Lime/scale buildup leading to heat exchanger failure is **NOT** covered by warranty.

11.4 HEATING BOILER INSTALLATIONS

It is recommended that this appliance be installed in a primary/secondary reverse return piping system for proper operation. Before beginning the installation, consult local codes for specific plumbing requirements. The installation should provide unions and valves at the inlet and outlet of the appliance so it can be isolated for service. An air separation device must be supplied in the installation piping to eliminate trapped air in the system. Locate a system air vent at the highest point in the system. The system must also have a properly sized expansion tank installed. Typically, an air charged diaphragm-type expansion tank is used. The expansion tank must be installed close to the boiler and on the suction side of the system pump (appliance Inlet) to ensure proper operation. **Caution: This appliance should not be operated at less than 30 PSIG**. Water piping must be supported by suitable hangers or floor stands, **NOT** by the appliance. Pipe systems will be subject to considerable expansion and contraction. Pipe supports could allow the pipe to slide resulting in noise transmitted into the system. Padding is recommended. The boiler pressure relief valve must be piped to a suitable floor drain. See Part 4.

11.5 WATER CONNECTIONS

All models have groove locked inlet and outlet stainless steel connections. Pipe size must be in accordance with Table 3 and, between supply and return lines, must not exceed 80 feet of equivalent length. Any reduction in recommended pipe size may decrease flow resulting in high water temperatures, boiler noise, flashing to steam and non-warrantable heat exchanger damage.

11.6 PIPING LENGTHS

The appliance circulator provides the water flow from the system piping, through the boiler and back to the system. Pipe diameter and length are critical to ensure proper flow through the boiler.
The secondary loop piping to and from the appliance must have a fully ported ball valve installed in both the inlet and outlet side piping and will be used for isolation only. *The ball valves must be the same diameter as the installed piping*. If flow control is required, other means of flow control such as globe valve or flow setter should be used.

11.7 INTERMITTENT PUMP OPERATION

An intermittent pump operation signal is standard and can be used to operate a separate pump contactor. A 1/6 hp pump delay relay is standard, and a 1 hp pump delay relay is available. When utilizing this feature, the boiler's integral circulating pump will cycle on each call for heat, before the burner fires. The pump will continue to operate while the burner is firing. The pump will run for a post-pump period after the temperature set point is satisfied. This will remove any residual heat from the combustion chamber before turning the pump off. See wiring diagram shipped with the unit.

11.8 SUMMARY

a) Typical Boiler Installations

General Plumbing Rules

1. Check all local codes.
2. For serviceability of boiler, always install unions.
3. Always pipe pressure relief valve to an open drain.
4. Locate system air vents at highest point of system.
5. Expansion tank must be installed near the boiler and on the suction side of the system pump.
6. Support all water piping.

b) Placing the Boiler in Operation

Pre-Start Check List

1. Review the location of the boiler, clearances from combustible surfaces and available service clearances.
2. Review Part 2 Venting and Air Supply. Ensure that all vent components are fabricated from the correct category of materials with adequate clearance from combustibles.
3. Ensure that the boiler condensate drain and all vent system condensate drains are properly routed to an acceptable floor drain or neutralization system.
4. Review the vent termination point for proper location and clearances.
5. Ensure that proper volumes of combustion and ventilation air are provided to the mechanical room. If a separate combustion air pipe is used, ensure that it is properly sized, sealed and terminated.
6. Review the water piping from the boiler to the system. The boiler must be installed in a primary/ secondary piping system. Review the diameter and equivalent length of the installed piping to and from the boiler for proper flow.
7. Ensure that a properly sized primary system pump is installed with an expansion tank.
8. Check system pressure. Ensure a minimum of 30 PSIG with the system hot and not more than 90% of the rated pressure of the relief valve.
9. Review the installed gas piping from the meter to the boiler. Ensure that the gas pipe, meter and any regulators are adequately sized.
10. Review the field wiring and electrical service for both the boiler controls and pump. Ensure that the electrical service(s) is adequately sized.

Boiler Set-Up

1. Ensure that the boiler and piping system are full of water. Bleed all air from the pump housing and secondary loop.
2. Check system for any water leaks.
3. Check system for installation of glycol or water treatment where required. Where glycol has been used to maintain the temperature rise across the appliance confirm that the recommended flow for pure water has been increased by 15% and the head loss by 20%.
4. Turn on power to the primary system pump and the appliance secondary pump and verify operation.

Boiler Operational Checks

1. Turn the boiler main power switch to the “ON” position.
2. Program the adjustable points.
3. Turn the switch to the “ON” position to start boiler operation.
4. Push the resets for low water level, high water temperature and alarm.
5. Install a manometer on the gas supply to the boiler and verify minimum gas supply pressure as the burner fires at 100% of rated input.
6. Verify operation of safeties as necessary (low water cut-off, high limit, gas pressure, blocked flue switch, etc).
7. With the firing valve closed allow the boiler to proceed through 3 ignition attempts. After the third failed ignition attempt the boiler will proceed to an Ignition Error fault. After this has been verified, recycle power on the boiler and open the firing valve.
8. Once the boiler is running and the flame has stabilized, open the UV Scanner wires at an interconnection point in the harness. Main flame must extinguish within 4 sec. If flame does not extinguish replace the ignition control.

Boiler Operation

1. Appliance should begin the start-up process for the sequence of operation.
2. The boiler will fire down to approximately 20% on initial start-up and adjust input as required to meet system demand.
3. Based on system demand, the appliance will modulate accordingly.
4. As system demand is satisfied, the burner will cycle off and the combustion air fan will decelerate at a pre-programmed rate before the appliance shuts down.

AV500 – AV2500

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS

- DO NOT TRY TO LIGHT ANY APPLIANCE.
- DO NOT TOUCH ANY ELECTRIC SWITCH.
- DO NOT USE ANY PHONE IN YOUR BUILDING.
- IMMEDIATELY CALL YOUR GAS SUPPLIER FROM A NEIGHBOUR'S PHONE. FOLLOW THE GAS SUPPLIER'S INSTRUCTIONS.
- IF YOU CANNOT REACH YOUR GAS SUPPLIER, CALL THE FIRE DEPARTMENT.

C. Use only your hand to turn the Manual Gas Cock control handle. Never use tools. If the handle will not turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

E. Do not operate appliance unless unit is filled with water and inlet valves are fully open.

MANUAL GAS COCK

“OFF” POSITION

FIGURE “A”



“ON” POSITION

FIGURE “B”



OPERATING INSTRUCTIONS

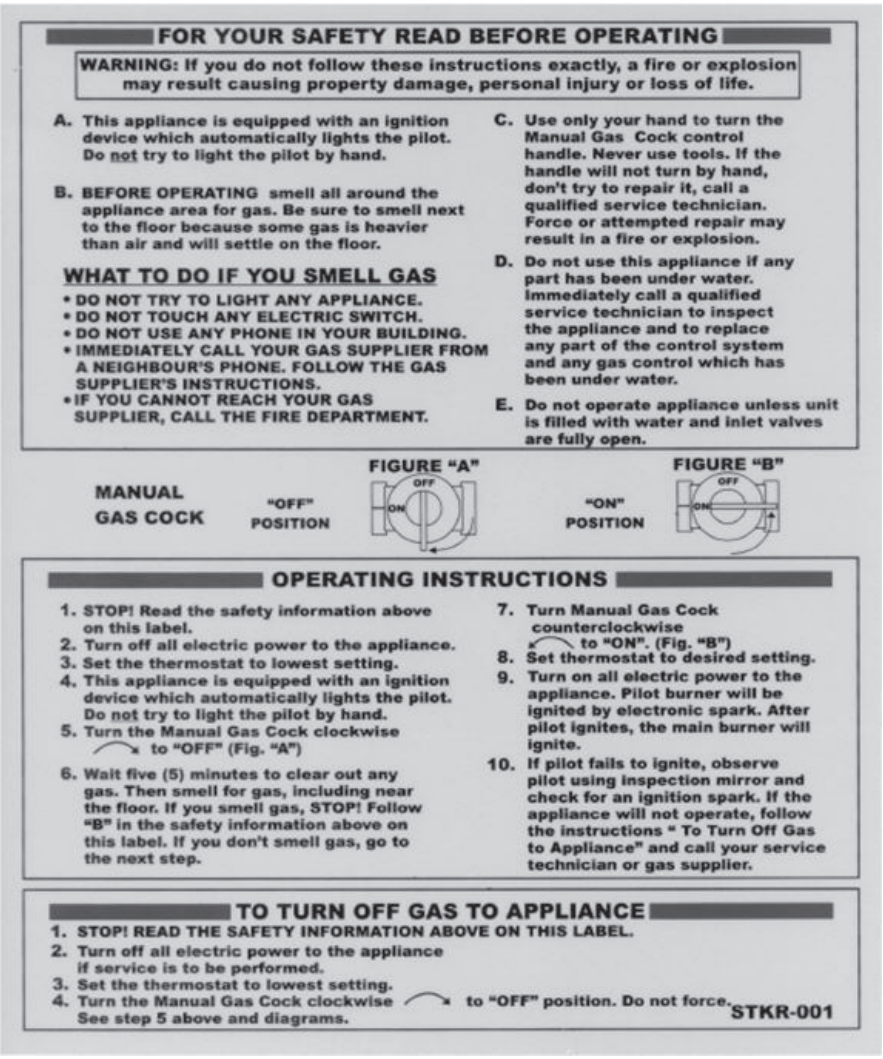
1. STOP! Read the safety information above on this label.
2. Turn off all electric power to the appliance.
3. Set the thermostat to lowest setting.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Turn the Manual Gas Cock clockwise to “OFF” (Fig. “A”)
6. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow “B” in the safety information above on this label. If you don't smell gas, go to the next step.
7. Turn Manual Gas Cock counterclockwise to “ON”. (Fig. “B”)
8. Set thermostat to desired setting.
9. Turn on all electric power to the appliance. The main burner will be light directly.
10. If the main burner fails to ignite, follow the instructions “ To Turn Off Gas to Appliance” and Call your service technician or gas supplier.

TO TURN OFF GAS TO APPLIANCE

1. STOP! READ THE SAFETY INFORMATION ABOVE ON THIS LABEL.
2. Turn off all electric power to the appliance if service is to be performed.
3. Set the thermostat to lowest setting.
4. Turn the Manual Gas Cock clockwise to “OFF” position. Do not force. See step 5 above and diagrams.

STKR-001-A

AV3000 – AV4000



FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

A. This appliance is equipped with an ignition device which automatically lights the pilot. Do not try to light the pilot by hand.

B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS

- DO NOT TRY TO LIGHT ANY APPLIANCE.
- DO NOT TOUCH ANY ELECTRIC SWITCH.
- DO NOT USE ANY PHONE IN YOUR BUILDING.
- IMMEDIATELY CALL YOUR GAS SUPPLIER FROM A NEIGHBOUR'S PHONE. FOLLOW THE GAS SUPPLIER'S INSTRUCTIONS.
- IF YOU CANNOT REACH YOUR GAS SUPPLIER, CALL THE FIRE DEPARTMENT.

C. Use only your hand to turn the Manual Gas Cock control handle. Never use tools. If the handle will not turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

E. Do not operate appliance unless unit is filled with water and inlet valves are fully open.

MANUAL GAS COCK

"OFF" POSITION

FIGURE "A"

"ON" POSITION

FIGURE "B"

OPERATING INSTRUCTIONS

1. STOP! Read the safety information above on this label.
2. Turn off all electric power to the appliance.
3. Set the thermostat to lowest setting.
4. This appliance is equipped with an ignition device which automatically lights the pilot. Do not try to light the pilot by hand.
5. Turn the Manual Gas Cock clockwise to "OFF" (Fig. "A")
6. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas, go to the next step.
7. Turn Manual Gas Cock counterclockwise to "ON". (Fig. "B")
8. Set thermostat to desired setting.
9. Turn on all electric power to the appliance. Pilot burner will be ignited by electronic spark. After pilot ignites, the main burner will ignite.
10. If pilot fails to ignite, observe pilot using inspection mirror and check for an ignition spark. If the appliance will not operate, follow the instructions " To Turn Off Gas to Appliance" and call your service technician or gas supplier.

TO TURN OFF GAS TO APPLIANCE

1. STOP! READ THE SAFETY INFORMATION ABOVE ON THIS LABEL.
2. Turn off all electric power to the appliance if service is to be performed.
3. Set the thermostat to lowest setting.
4. Turn the Manual Gas Cock clockwise to "OFF" position. Do not force. See step 5 above and diagrams.

STKR-001

11.9 DOMESTIC HOT WATER HEATER

Hot water heaters are designed for installation with a storage tank. The operation of the properly sized circulating pump, the piping between the tank and heater and the control of water velocity, as explained below, are important for correct operation of your hot water heater.

11.10 WATER THERMOSTAT SETTING

1. This appliance is provided with an electronic temperature controller as detailed in Section 6.
2. The maximum setting for this water heater is 140°F.
3. There is a hot water scald potential if the temperature controller is set too high.

11.11 WATER FLOW CONTROL

To ensure proper water flow through the heat exchanger, it is necessary to select the proper pump. Temperature rise at full fire will be an indication of flow. This must be done on initial installation and periodically rechecked.

Excessive lime/scale build-up in the heat exchanger is a result of improper water treatment or improper pump operation. Care should be taken to maintain proper water treatment and proper pump operation:

11.12 TEMPERATURE RISE AT FULL FIRING RATE

1. The pump must run continuously when the burner is firing.
2. With the pump running and the burner in the appliance in the off cycle, the inlet temperature and outlet temperature readings on the display should read approximately the same temperatures.
3. Turn the hot water heater on and allow time for the temperature to stabilize. Check the temperature rise when the burner is firing at 100% of rated input.
4. Compare the temperature rise on the Advantus™ display with the expected temperature rise.

If the temperature rise is too high, adjust as follows:

1. Check for flow restrictions. Check for debris in strainers
2. Check diameter and equivalent length of the piping between the storage tank and hot water heater.
3. Be sure all valves are open between the hot water heater and the storage tank. Ensure that all ball valves are fully ported.
4. Check the pump to be sure it is running properly and that the pump motor is running in the proper direction.
5. Be sure the pipes between the hot water heater and storage tank are not more than a total of 80 equivalent feet between inlet and outlet lines. If maximum equivalent length for the specified pipe diameter is exceeded, larger diameter pipe may have to be installed to achieve correct flow and temperature rise.
6. Common manifold piping for multiple unit installations will require larger minimum pipe sizes and tank circulating tapping to ensure proper flow.
7. Check PID settings and on/off hysteresis.

If the temperature rise is too low, adjust as follows:

1. Temperature rise can be increased by slowly closing the flow control valve (globe valve or flow setter) in the outlet piping from the hot water heater to the storage tank to achieve the proper temperature rise.

The required temperature rise and the recommended pump size are based on the heating of potable water with normal hardness. Consult the factory when heating potable water exceeding these specifications. For DHW applications with other than normal hardness, choose a pump for the local water hardness conditions. Alternatively, soften the water to normal levels. Damage to the heat exchanger as a result of scaling or corrosive water conditions in non-warrantable.

CAUTION
Temperature rise cannot be adjusted when the burner is firing at less than 100% of input rate.

11.13 WATER HEATERS

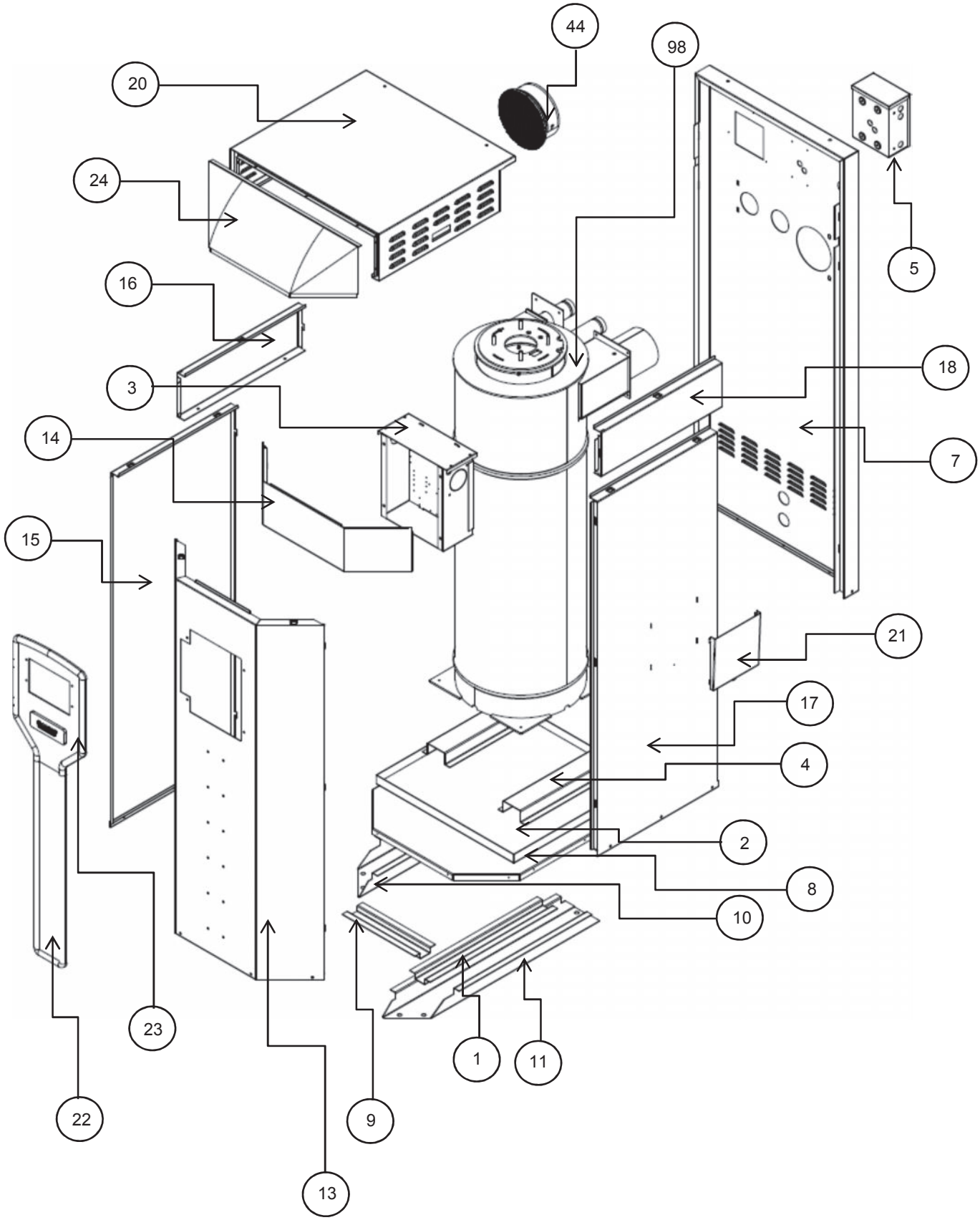
The manufacturer recommends the use of a properly sized thermostatic mixing valve to supply domestic hot water at temperatures less than 140°F (60°C). Storing the water at a higher temperature and thermostatically mixing the water will decrease the size of the storage tank and increase the available quantity of mixed hot water.

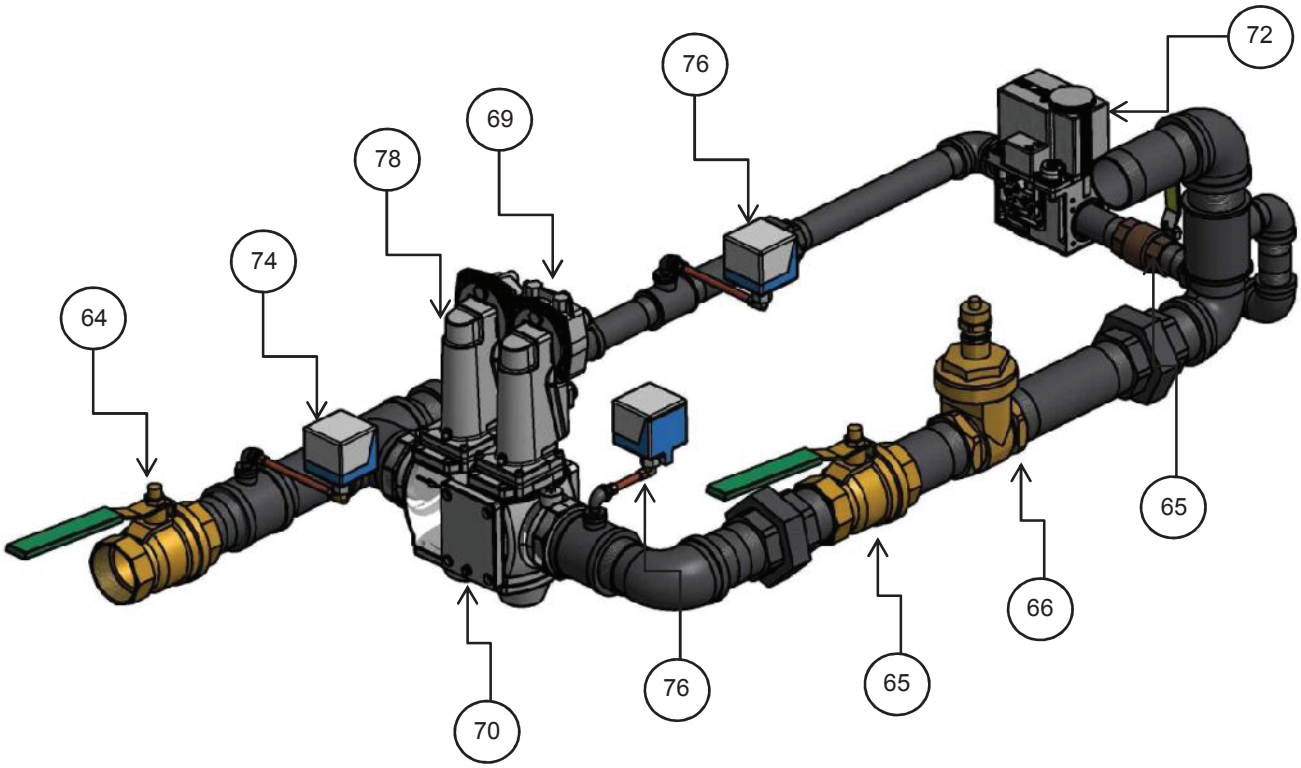
- Piping components connected to the water heater for a space heating application shall be suitable for use with potable water.
- Toxic chemicals, used for boiler treatment, shall not be introduced into the potable water used for space heating
- A water heater which will be used to supply potable water shall not be connected to any heating system or component(s) previously used with a non-potable water heating appliance
- When a system requires water for space heating at temperatures higher than required for other uses, a means such as a mixing valve shall be installed to temper the water for those uses in order to reduce scald hazard potential.

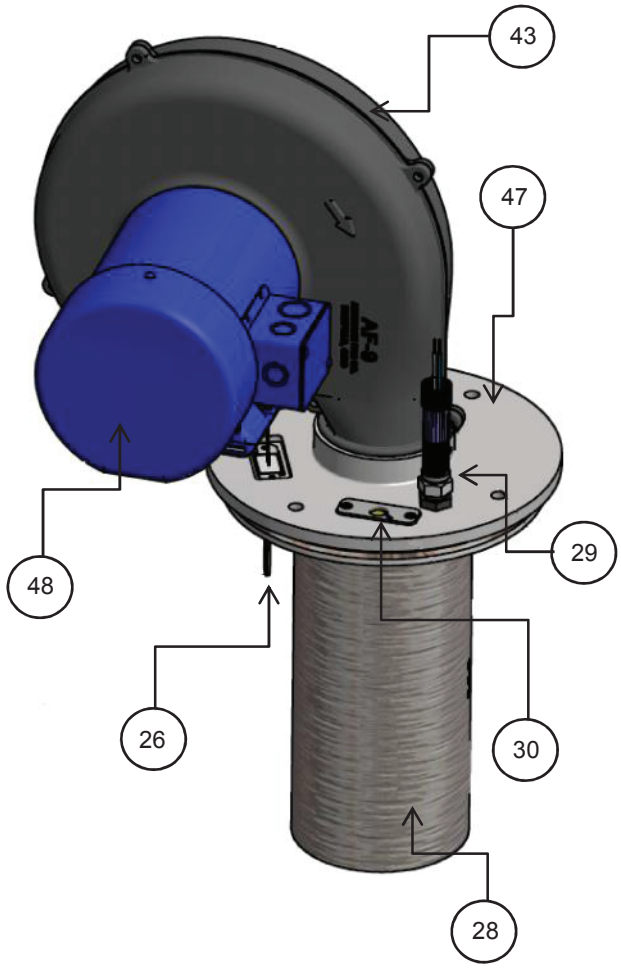
CAUTION
Adequate care **MUST** be taken to prevent potential scald injury when storing water at 140°F (60°C) and hotter.

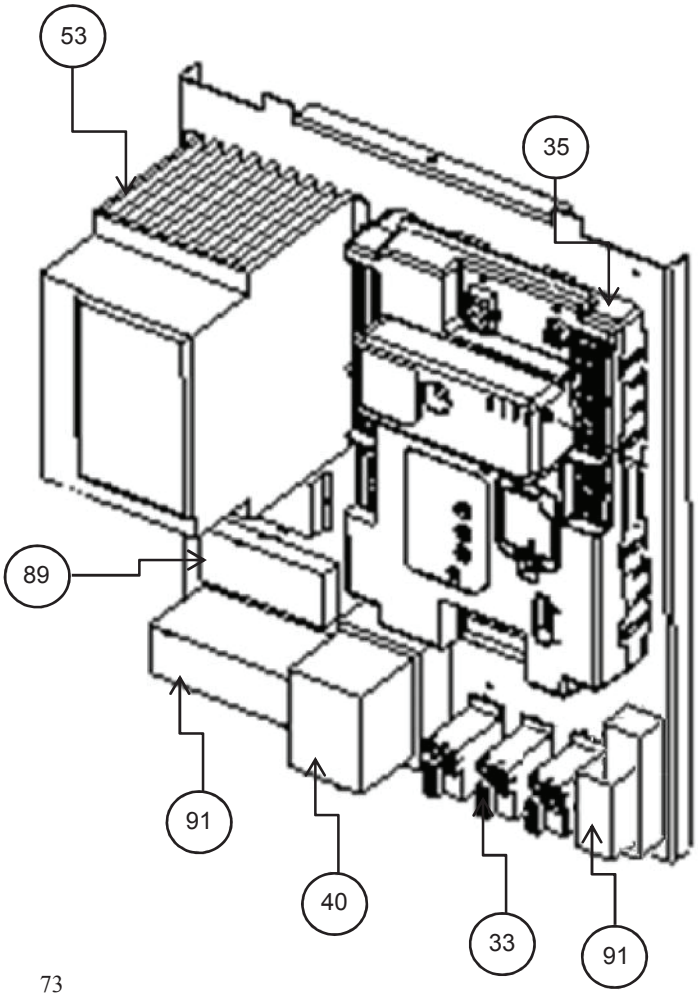
WARNING
Should overheating occur or the gas supply fail to shut off, do not turn off or disconnect the electrical supply to the pump, instead, shut off the gas supply at a location external to the appliance.

PART 12 EXPLODED VIEW

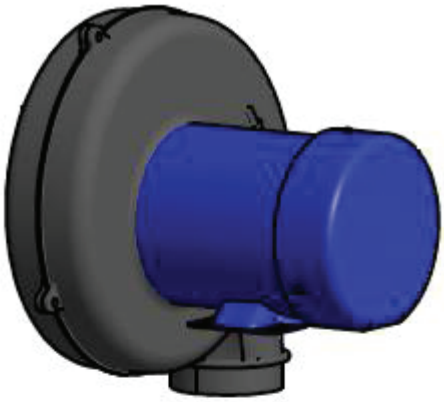



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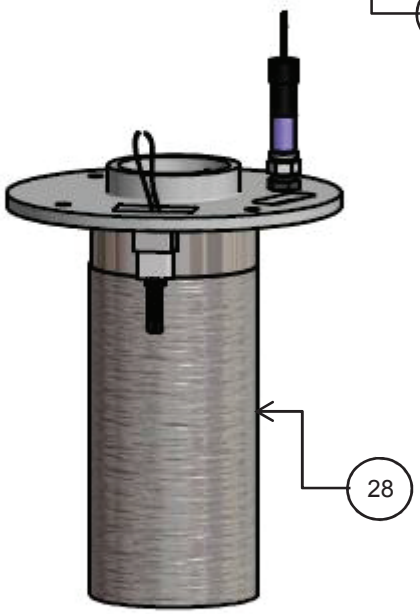

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Blower



Red Silicone Gasket





Burner

White Ceramic Gasket



Graphite Gasket



White Ceramic Gasket (only required if heat exchanger surface is rough or uneven)



Ref#	Part Description	Part Number	Advantus™ Models													
			All	500	600	800	1000	1200	1400	1600	1800	2000	2500	3000	3500	4000
1	Base Stiffener	109105		x	x	x	x	x	x	x	x	x	x			
		109301												x	x	x
2	Condensate Tray Assembly	109099		x	x	x	x									
		109350						x	x	x	x	x	x			
		109295												x	x	x
3	Electrical Box Assembly	DR-14-1030		x	x	x	x	x	x	x						
		DR-14-1005									x	x	x	x	x	x
4	Heat Exchanger Riser	109114		x	x	x	x									
		109360						x	x	x	x	x	x			
		109306												x	x	x
5	Junction Box Assembly	DF-14-5240A	x													
6	Mixing Chamber Assembly (Transition Arm)	109266		x	x											
7	Outer Jacket Back Panel	109102		x	x											
		109339				x	x									
		109353						x	x							
		109368								x	x					
		109372										x	x			
		109298												x		
		109314													x	x
8	Outer Jacket Base	109104		x	x	x	x									
		109355						x	x	x	x	x	x			
		109300												x	x	x
9	Outer Jacket Base Stiffener (Long)	109324		x	x	x	x	x	x	x	x	x	x			
		109327												x	x	x
10	Outer Jacket Base Support (Left)	109106		x	x	x	x									
		109356						x	x	x	x	x	x			
		109302												x	x	x
11	Outer Jacket Base Support (Right)	109107		x	x	x	x									
		109357						x	x	x	x	x	x			
		109303												x	x	x
12	Outer Jacket Base Support (Center)	109657														x
13	Outer Jacket Front Panel (Bottom)	109100		x	x											
		109342				x	x	x	x			x	x			
		109595								x	x					
		109296												x		
		109312													x	x
14	Outer Jacket Front Panel (Top)	109697		x	x	x	x	x	x	x	x	x	X			
		109746												x	x	x
15	Outer Jacket Left Panel (Bottom)	109101		x	x											
		109345				x	x									
		109352						x	x			x	x			
		109367								x	x					
		109297												x		
		109313													x	x
16	Outer Jacket Left Panel (Top)	109695		x	x	x	x									
		109732						x	x	x	x					

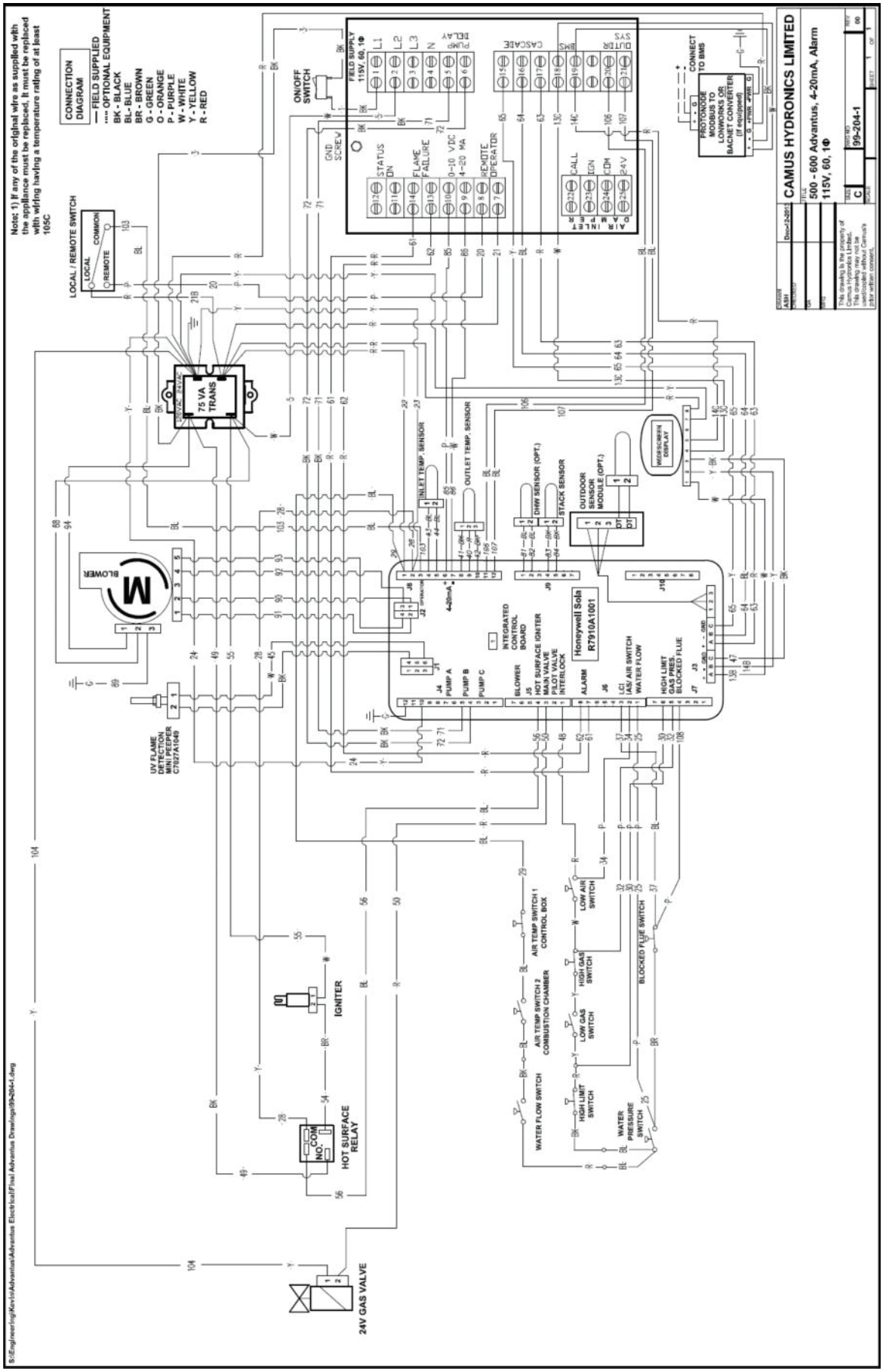
Ref#	Part Description	Part Number	Advantus™ Models													
			All	500	600	800	1000	1200	1400	1600	1800	2000	2500	3000	3500	4000
16	Outer Jacket Left Panel (Top)	109743										x	x			
		109745												x		
		109748													x	x
17	Outer Jacket Right Panel (Bottom)	109103		x	x											
		109344				x	x									
		109354						x	x			x	x			
		109369								x	x					
		109299												x		
		109315													x	x
18	Outer Jacket Right Panel (Top)	109696		x	x	x	x									
		109733						x	x	x	x					
		109744										x	x			
		109747												x		
		109749													x	x
19	Sight Glass Holder	13-5334	x													
20	Top Cover	109108		x	x	x	x									
		109358						x	x	x	x	x	x			
		109304												x	x	x
21	Literature Pocket	DR-14-0150	x													
22	Bezel (Bottom)	DR-90-10020		x	x											
		DR-90-10006				x	x	x	x	x	x					
		DR-90-10005										x	x	x		
		DR-90-10007													x	x
23	Bezel (Top)	DR-90-10004	x													
24	Top Cover Front (Plastic)	109279		x	x	x	x	x	x	x	x	x	x			
		109326												x	x	x
25	Burner Flange	109708, (4”)		x	x	x	x									
		109728, (6”)						x	x							
		109541, (8”)								x	x	x	x			
		109602, (10”)												x	x	x
26	Hot Surface Igniter	271R-225	x													
27	Hot Surface Igniter Mounting Flange	13-5335	x													
28	Primary Burner	109739		x	x											
		109740				x	x									
		109741						x	x							
		109742								x	x					
		109743										x	x			
		109744												x		
		109745													x	x
29	UV Scanner	C7027A1049/U	x													
30	View Port Glass	TG-94010-040	x													
31	2-10Vdc Converter	ETISO-V	x													
32	On/Off Switch (with rainproof cover)	C6000ALBB/G74/W46	x													
33	Pump Delay Relay (up to 1hp)	AMP1649341-8	x													
34	Snap-Action Thermostat	EKA-114-58	x													
35	Sola Controller	R7910A1001	x													

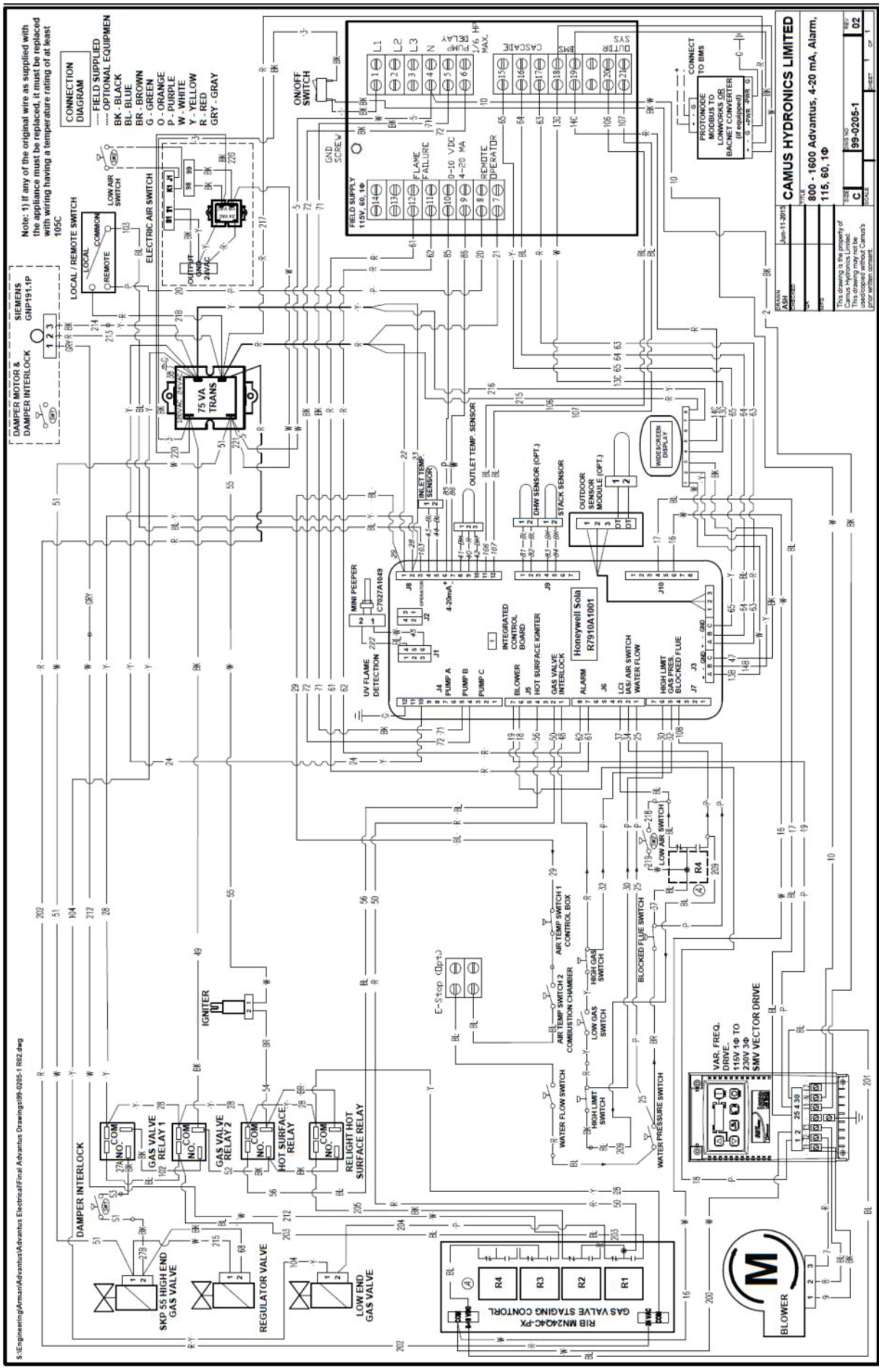
Ref#	Part Description	Part Number	Advantus™ Models													
			All	500	600	800	1000	1200	1400	1600	1800	2000	2500	3000	3500	4000
36	Sola Display	S7999D1006	x													
37	Terminal Block - 4 Pole	TB200-4	x													
38	Terminal Block - 6 Pole	TB200-6	x													
39	Terminal Block - 8 Pole	TB200-8	x													
40	Transformer (75VA)	HCT-01J2BB07	x													
41	Wiring Harness	77-0038	x													
	Advantus Kit Harness	77-0048				x	x	x	x	x	x	x	x	x	x	X
42	Air Inlet Damper Assembly (Includes Siemens Electronic Damper Actuator)	110008				x	x	x	x	x						
		110014									x	x	x	x	x	x
43	AF Fan Kit	AF09 FAN KIT				x	x	x	x	x						
		AF10 FAN KIT									x	x	x	x		
		AF12 FAN KIT													x	
		AF15 FAN KIT														x
44	Air Inlet Filter Assembly	DM-14-0117		x	x											
		DM-14-0118				x	x									
		DF-14-0119						x	x							
		DF-14-0120								x	x	x	x	x	x	x
45	Air Inlet to Fan Adapter (1)	DR-16-0015		x												
46	Air Inlet to Fan Adapter (2)	DR-16-0016		x												
47	Aluminum Fan Flange	109717				x	x									
		109736						x	x	x						
		109750 (AF10)									x	x	x	x		
		109751 (AF12)													x	
		109752 (AF15)														x
48	Blower	150930-03		x												
		150232			x											
		D391				x										
		D393					x	x	x	x						
		D394									x	x				
		D395											x			
		D396												x	x	
		C204B														x
49	Fan Gasket	33-0037		x												
50	Fan Flange Gasket	33-0058		x												
51	Gasket for Mixing Chamber End	33-0057		x	x											
53	VFD	ESV371N01SXB				x										
		ESV751N01SXB					x	x	x	x						
		ESV152N02XYB									x	x				
		ESV222N02YXB											x	x	x	
		ESV402N02TXB														x
54	Pilot Tubing	11-0115-10”												x	x	x
55	Plastic Coupling	1056-32		x												
		1056-44			x											

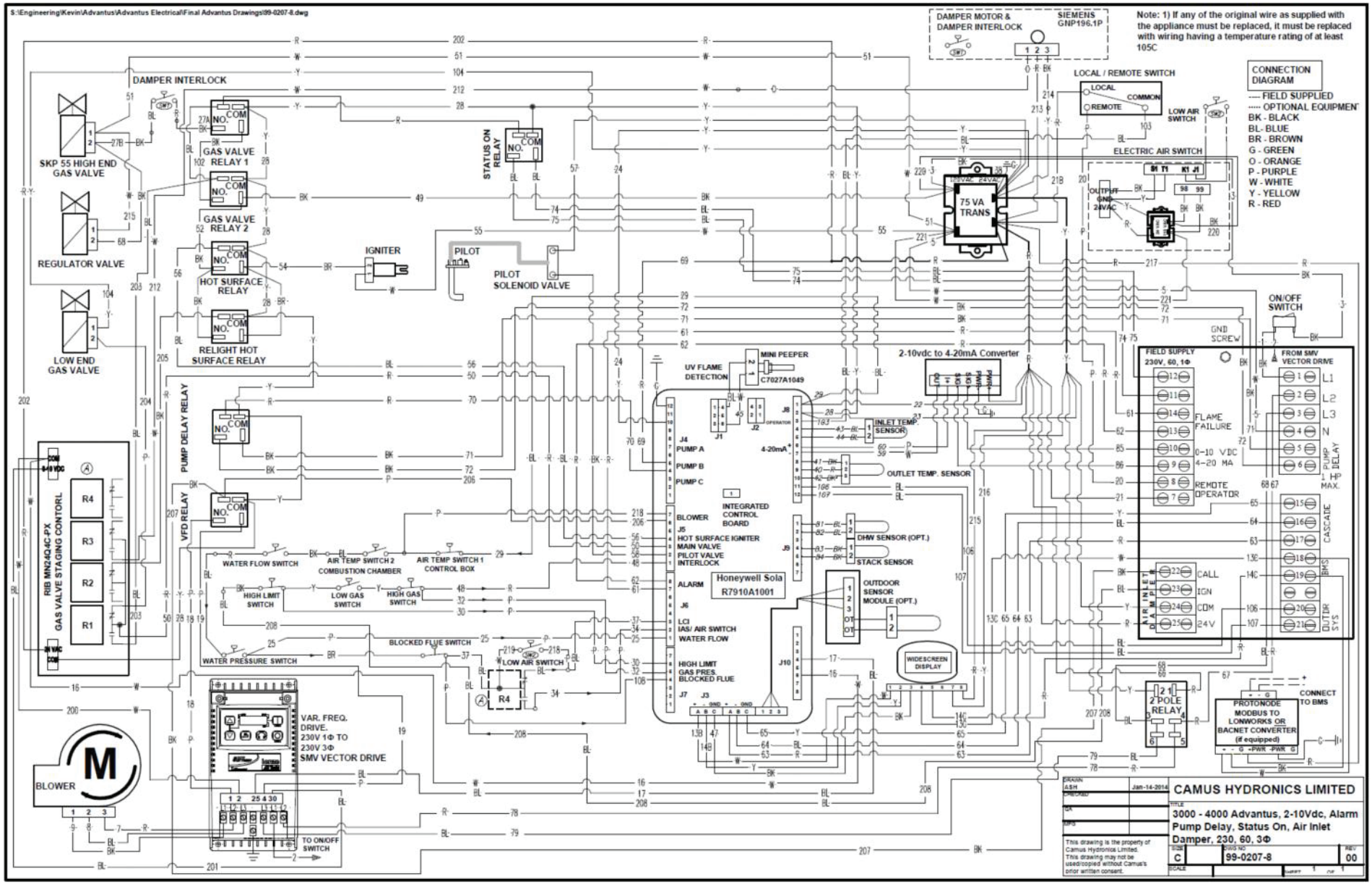
Ref#	Part Description	Part Number	Advantus™ Models													
			All	500	600	800	1000	1200	1400	1600	1800	2000	2500	3000	3500	4000
56	Relief Valve	10-614-09		x	x	x	x	x								
		10-615-15							x	x	x	x	x			
		10-616-15												x	x	x
57	Victaulic Coupling	VIC107-2		x	x	x	x									
		VIC107-3						x	x	x	x	x	x	x	x	x
58	Victaulic Stainless Steel Nipple (Inlet)	2” x ...		x	x	x	x									
		3” x ...						x	x	x	x	x	x	x	x	x
59	Victaulic Stainless Steel Nipple (Outlet)	2” x ...		x	x	x	x									
		3” x ...						x	x	x	x	x	x	x	x	x
60	Air/Gas Mixing Tube	13-0026/16-0033				x	x	x	x	x	x	x				
		13-0027/16-0036												x	x	x
		66-5005											x			
61	A-Valve	50-GB5-01A		x	x	x	x									
		50-GB6-01A						x	x	x	x	x				
		50-GB7-01A											x	x		
		50-GB8-01A													x	x
62	Ball Valve	USA0759101		x	x											
		USA1009101				x	x	x	x							
		USA1259101								x	x	x				
		USA1509101											x	x		
		USA2009101													x	x
63	Brass Gate Valve	14107				x	x	x	x	x	x	x				
		14108											x	x		
		14109													x	x
64	Dual Gas Valve	V8730C1007		x												
		V8730C1023			x											
65	High End Gas Valve	SKP55.011U1				x	x	x	x	x	x	x	x	x	x	x
66	High End Gas Valve Body	VGG10.254U				x	x	x								
		VGG10.404U							x	x	x	x	x	x		
		VGD40.065U													x	x
67	Low End Gas Valve	VR8615VB1044B				x	x	x	x							
		V8730C1007								x						
68	Low End Gas Valve	V8730C1015									x					
		V8730C1023										x	x	x		
		V8730C1031													x	x
69	Low End Gas Valve Flange	32006652-003									x	x	x	x	x	
		32006652-004														x
70	Low Gas Pressure Switch	C6097A1012	x													
71	Differential High Gas Pressure Switch	HGP-A												x	x	x
72	High Gas Pressure Switch	C6097B1028												x	x	x
73	Mixing Tube Ring	13-0028/16-0039				x	x	x	x	x	x	x	x	x	x	x
74	Motorized Safety Shut Off Valve	SKP25.011U1													x	x
75	Pilot Regulator (Combination Control)	CV100B6N-22-0001												x	x	x
76	Solenoid Valve	V4295A1031				x	x	x								
		V4295A1049							x	x						
		V4295A1056									x	x	x	x		

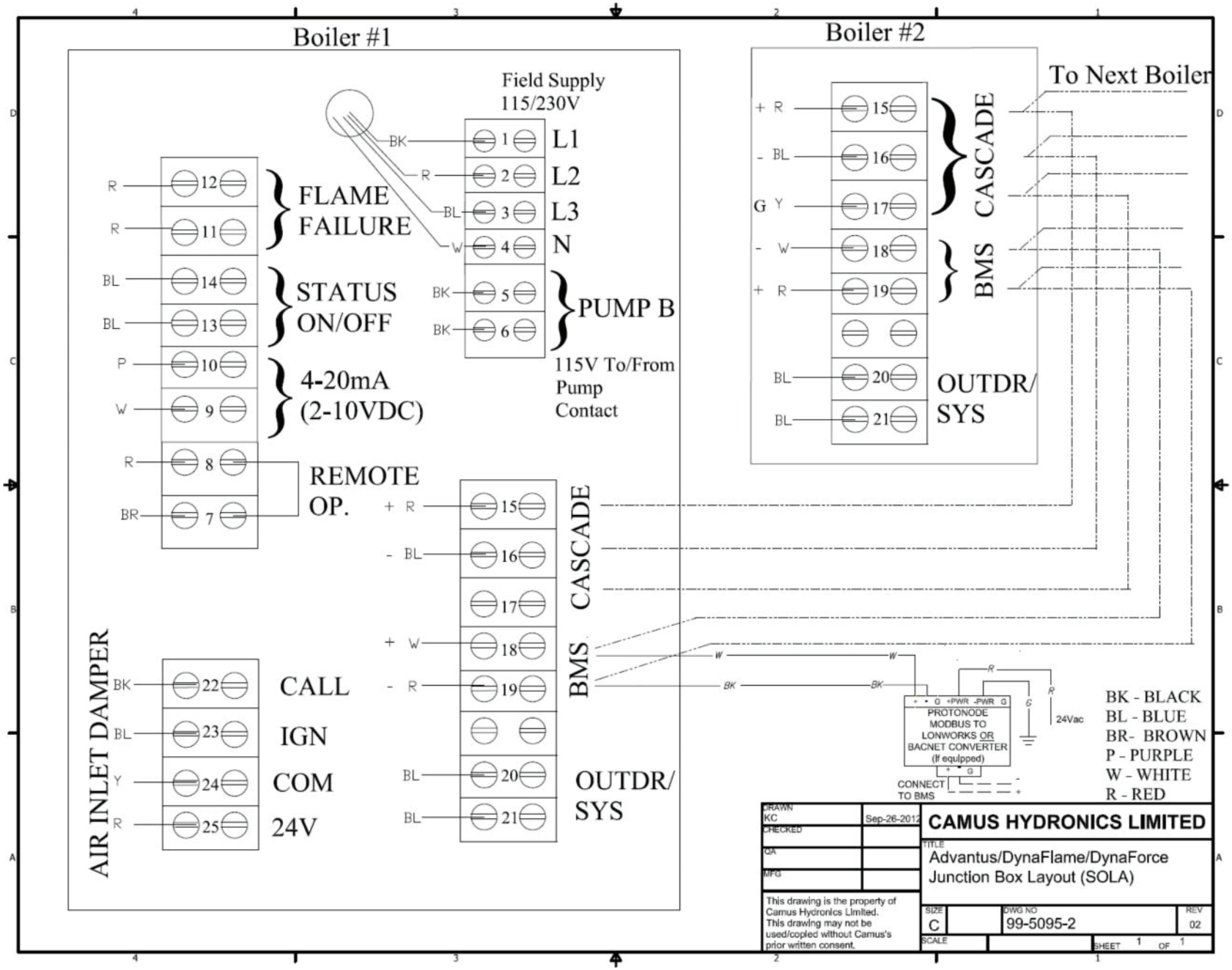
Ref#	Part Description	Part Number	Advantus™ Models													
			All	500	600	800	1000	1200	1400	1600	1800	2000	2500	3000	3500	4000
77	Gas Valve Regulator	SKP25													x	x
78	Venturi	45900450-030B		x												
		VMU300A1046			x	x										
79	Graphite Gasket	109064		x	x	x	x									
		109730						x	x							
		109542								x	x	x	x			
		109600												x	x	x
80	Red Silicone Gasket	109691		x	x	x	x									
		109728						x	x							
		109544								x	x	x	x			
		109599												x	x	x
81	White Ceramic Gasket with Graphite Facing	109692		x	x	x	x									
		109729						x	x							
		109543						x	x	x	X	x	x			
		109601												x	x	x
82	Air Vent (inlet)	FV-4M1	x													
83	Air Vent (Outlet)	590173	x													
84	Aquastat (Breaks on rise)	L4008E1313	x													
85	Aquastat (on/off)	L6008A1242	x													
86	Contactor Relay	T92P7A22-24									x	x	x	x	x	x
87	Differential Pressure Switch	SML1210034		x	x											
		ACI/DP2-6-20-AC PM3C1EA-AAAAAA				x	x	x	x	x	x	x	x	x	x	x
88	Gas Valve Staging Control	RIBMN24Q4C-PX				x	x	x	x	x	x	x	x	x	x	x
89	Indoor Flow Switch	F61KB-11C	x													
90	Inlet Sensor	198799Z/U	x													
91	Outlet Dual Sensor	50001464-005/B	x													
92	Blocked Flue Switch	8021205256	x													
93	Stack Sensor	NTC-SENSOR-003	x													
94	Water Pressure Switch	HB26A218L	x													
95	Primary Heat Exchanger	109238		x	x											
		109240				x	x									
		109241						x	x							
		109243								x	x					
		109244										x	x			
		109245												x		
		109246													x	x

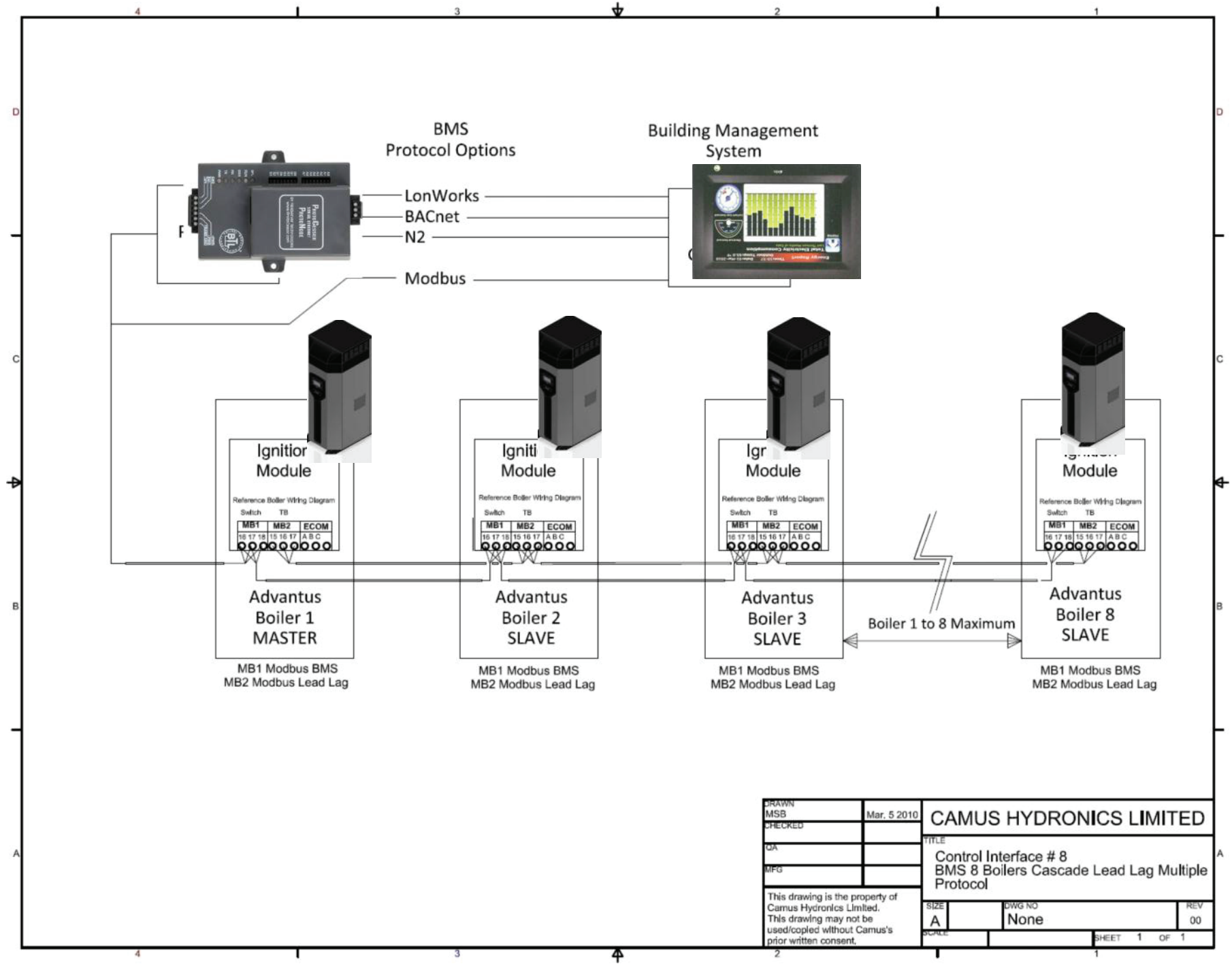
PART 13 ELECTRICAL DIAGRAMS



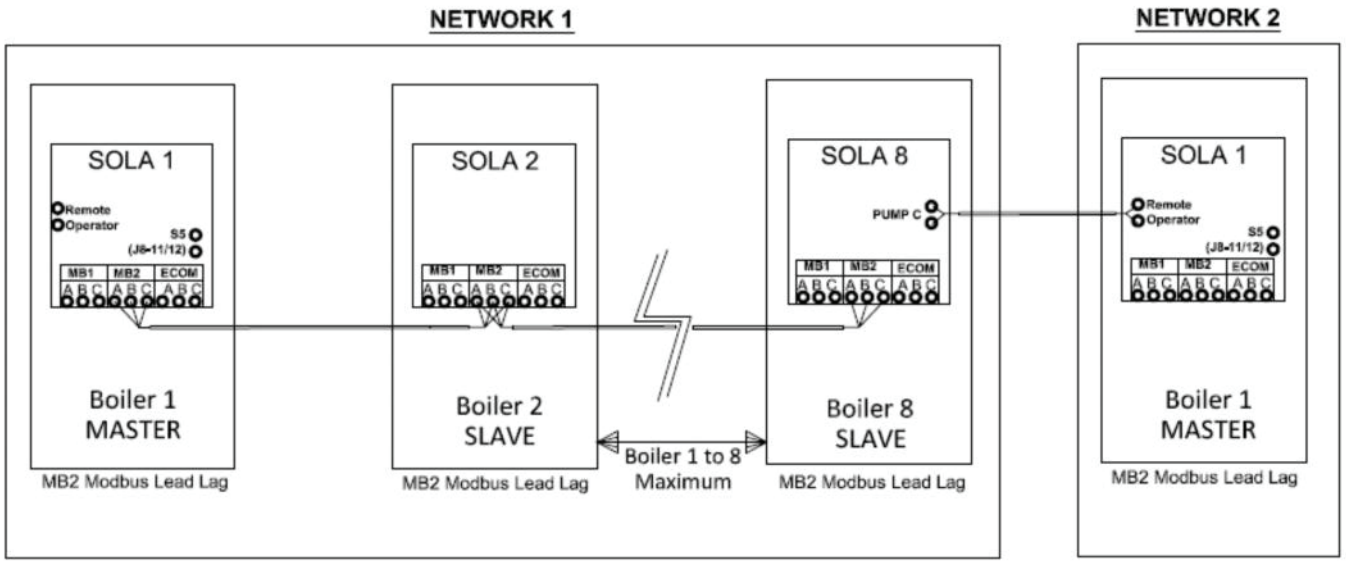

CONNECTION DIAGRAM
--- FIELD SUPPLIED
---- OPTIONAL EQUIPMEN
BK - BLACK
BL- BLUE
BR - BROWN
G - GREEN
O - ORANGE
P - PURPLE
W - WHITE
Y - YELLOW
R - RED
GRY - GRAY
Note: 1) If any of the original wire as supplied with the appliance must be replaced, it must be replaced with wiring having a temperature rating of at least 105C
CAMUS HYDRONICS LIMITED
800 - 1600 Advantus, 4-20 mA, Alarm, 115, 60, 1Φ
99-0205-1
DAMPER MOTOR & DAMPER INTERLOCK
SIEMENS GNP191.1P
LOCAL / REMOTE SWITCH
LOW AIR SWITCH
ELECTRIC AIR SWITCH
75 VA TRANS
ON/OFF SWITCH
FIELD SUPPLY 115V, 60, 1Φ
FLAME FAILURE
0-10 VDC 4-20 MA
REMOTE OPERATOR
CASCADE
SYS
OUTDR
PROTONODE ADDRESS TO LONWORKS OR BACNET CONVERTER (if equipped)
CONNECT TO BMS
WIDESCREEN DISPLAY
OUTDOOR SENSOR MODULE (OPT.)
DHW SENSOR (OPT.)
STACK SENSOR
OUTLET TEMP. SENSOR
INLET TEMP SENSOR
MINI PEEPER
C7027A1049
UV FLAME DETECTION
INTEGRATED CONTROL BOARD
Honeywell Sola R7910A1001
BLOWER
HOT SURFACE IGNITER
GAS VALVE INTERLOCK
ALARM
LG1
AIR SWITCH WATER FLOW
HIGH LIMIT SWITCH BLOCKED FLUE
PUMP A
PUMP B
PUMP C
4-20mA
DAMPER INTERLOCK
GAS VALVE RELAY 1
GAS VALVE RELAY 2
HOT SURFACE RELAY
RELIGHT HOT SURFACE RELAY
IGNITER
E-Stop (Opt.)
AIR TEMP SWITCH 1 CONTROL BOX
AIR TEMP SWITCH 2 COMBUSTION CHAMBER
HIGH GAS SWITCH
LOW GAS SWITCH
BLOCKED FLUE SWITCH
LOW AIR SWITCH
WATER FLOW SWITCH
HIGH LIMIT SWITCH
WATER PRESSURE SWITCH
VAR. FREQ. DRIVE. 115V 1Φ TO 230V 3Φ SMV VECTOR DRIVE
SKP 55 HIGH END GAS VALVE
REGULATOR VALVE
LOW END GAS VALVE
RIB MN24024C-PX GAS VALVE STAGING CONTROL
R1
R2
R3
R4
BLOWER


S:\Engineering\Kevin\Advantus\Advantus Electrical\Final Advantus Drawings\99-0207-8.dwg
DAMPER MOTOR & DAMPER INTERLOCK
SIEMENS GNP196.1P
Note: 1) If any of the original wire as supplied with the appliance must be replaced, it must be replaced with wiring having a temperature rating of at least 105C
CONNECTION DIAGRAM
---- FIELD SUPPLIED
----- OPTIONAL EQUIPMENT
BK - BLACK
BL - BLUE
BR - BROWN
G - GREEN
O - ORANGE
P - PURPLE
W - WHITE
Y - YELLOW
R - RED
DAMPER INTERLOCK
LOCAL / REMOTE SWITCH
LOCAL
COMMON
REMOTE
LOW AIR SWITCH
ELECTRIC AIR SWITCH
SKP 55 HIGH END GAS VALVE
GAS VALVE RELAY 1
GAS VALVE RELAY 2
STATUS ON RELAY
REGULATOR VALVE
HOT SURFACE RELAY
IGNITER
PILOT
PILOT SOLENOID VALVE
75 VA TRANS
LOW END GAS VALVE
RELIGHT HOT SURFACE RELAY
ON/OFF SWITCH
GND SCREW
PUMP DELAY RELAY
VFD RELAY
UV FLAME DETECTION
MINI PEEPER
C7027A1049
2-10vdc to 4-20mA Converter
FIELD SUPPLY 230V, 60, 1Φ
FROM SMV VECTOR DRIVE
L1
L2
L3
N
PUMP DELAY
HP MAX.
FLAME FAILURE
0-10 VDC
4-20 MA
REMOTE OPERATOR
CASCADE
BMS
OUTDR STS
CALL
IGN
COM
24V
FIRE INLET
RIB MN24Q4C-PX
GAS VALVE STAGING CONTORL
R4
R3
R2
R1
INTEGRATED CONTROL BOARD
PUMP A
PUMP B
PUMP C
BLOWER
HOT SURFACE IGNITER
MAIN VALVE
PILOT VALVE
INTERLOCK
ALARM
LCI
IAS/ AIR SWITCH
WATER FLOW
HIGH LIMIT
GAS PRES.
BLOCKED FLUE
Honeywell Sola
R7910A1001
INLET TEMP. SENSOR
OUTLET TEMP. SENSOR
DHW SENSOR (OPT.)
STACK SENSOR
OUTDOOR SENSOR MODULE (OPT.)
WIDESCREEN DISPLAY
WATER FLOW SWITCH
AIR TEMP SWITCH 2 COMBUSTION CHAMBER
AIR TEMP SWITCH 1 CONTROL BOX
HIGH LIMIT SWITCH
LOW GAS SWITCH
HIGH GAS SWITCH
BLOCKED FLUE SWITCH
WATER PRESSURE SWITCH
LOW AIR SWITCH
2 POLE RELAY
PROTONODE MODBUS TO LONWORKS OR BACNET CONVERTER (if equipped)
CONNECT TO BMS
VAR. FREQ. DRIVE. 230V 1Φ TO 230V 3Φ SMV VECTOR DRIVE
BLOWER
TO ON/OFF SWITCH
CAMUS HYDRONICS LIMITED
3000 - 4000 Advantus, 2-10Vdc, Alarm Pump Delay, Status On, Air Inlet Damper, 230, 60, 3Φ
DRAWN ASH Jan-14-2014
DRAWING NO 99-0207-8
REV 00
SIZE C
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Boiler #1
Field Supply
115/230V
BK
R
BL
W
1
2
3
4
L1
L2
L3
N
FLAME FAILURE
12
11
R
R
STATUS ON/OFF
14
13
BL
BL
PUMP B
5
6
BK
BK
115V To/From Pump Contact
4-20mA (2-10VDC)
10
9
P
W
REMOTE OP.
8
7
R
BR
CASCADE
BMS
15
16
17
18
19
+ R
- BL
+ W
- R
OUTDR/ SYS
20
21
BL
BL
AIR INLET DAMPER
CALL
IGN
COM
24V
22
23
24
25
BK
BL
Y
R
Boiler #2
To Next Boiler
+ R
- BL
G Y
- W
+ R
BL
BL
PROTONODE MODBUS TO LONWORKS OR BACNET CONVERTER (If equipped)
CONNECT TO BMS
24Vac
BK - BLACK
BL - BLUE
BR- BROWN
P - PURPLE
W - WHITE
R - RED
DRAWN KC
Sep-26-2012
CHECKED
QA
MFG
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CAMUS HYDRONICS LIMITED
TITLE
Advantus/DynaFlame/DynaForce Junction Box Layout (SOLA)
SIZE C
DWG NO 99-5095-2
REV 02
SCALE
SHEET 1 OF 1


BMS
Protocol Options
Building Management
System
LonWorks
BACnet
N2
Modbus
Ignitior
Module
Igniti
Module
Igr
Module
Module
Reference Boiler Wiring Diagram
Switch
TB
MB1
MB2
ECOM
16 17 18 15 16 17 A B C
Advantus
Boiler 1
MASTER
Advantus
Boiler 2
SLAVE
Advantus
Boiler 3
SLAVE
Boiler 1 to 8 Maximum
Advantus
Boiler 8
SLAVE
MB1 Modbus BMS
MB2 Modbus Lead Lag
MB1 Modbus BMS
MB2 Modbus Lead Lag
MB1 Modbus BMS
MB2 Modbus Lead Lag
MB1 Modbus BMS
MB2 Modbus Lead Lag
DRAWN
MSB
Mar. 5 2010
CHECKED
QA
MFG
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CAMUS HYDRONICS LIMITED
TITLE
Control Interface # 8
BMS 8 Boilers Cascade Lead Lag Multiple Protocol
SIZE
A
DWG NO
None
REV
00
SCALE
SHEET 1 OF 1

HONEYWELL SOLA LEAD LAG OPERATION UP TO 9 BOILERS



Sensor Wiring:

Each Network must have independent S5 (Lead Lag) sensors and they must be positioned closely together in building piping and wired to respective SOLA 1.
Network 1 Outdoor sensor is to be wired to S5 (J8-11/12), if applicable.
Network 2 Outdoor sensor is to be wired to ECOM using Outdoor Reset Module (W8735S1000), if applicable.

Operation:

Network 1 supports up to 8 boilers operating in lead lag with SOLA 1 acting as the master. Based on Lead Lag sensor this will govern if additional boilers in Network 1 is required. Refer to I&O Manual for additional details on lead lag operation within a single network.
Network 2 supports up to a maximum of 4 boilers operating in lead lag.
Network 1 SOLA 8 Pump C contacts are wired to Network 2 SOLA 1 Remote Operator Contacts
Network 1 SOLA 8 activates Network 2 SOLA 1 through the use of Pump C contact on R7910A1001. Pump C is activated on a time delay algorithm, where the timer is initiated when SOLA 8 begins ignition sequence.
Pump C Time Delay (Register #293) = Interstage Delay (Default: 2 mins) x Number of Boilers
Network 2 operates independently of Network 1.

Note:

Due to rotation of leaders in Network 1; SOLA 8 may become lead boiler. Operation is not impacted regardless of lead boiler in Network 1 as all boilers in Network 1 will attempt to start before Network 2 boilers are activated.
Lead lag setpoint: Network 2 < Network 1 (Default: 2 deg F lower)

WARNING:
This drawing shows suggested control and interface configuration.

DRAWN KC	May 26 2014	CAMUS HYDRONICS LIMITED
CHECKED		TITLE: Honeywell SOLA Lead Lag Operation Up to 9 Boilers
QA		
MFG		

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S:\Engineering\Kevin\DynaFlow Electrical\99-0220 R00.dwg

SIZE	DWG NO	REV
A	99-0220	00

SCALE | SHEET 1 OF 1

CONDENSING BOILER LIMITED WARRANTY

GENERAL
Camus Hydronics Limited ("Camus") extends the following LIMITED WARRANTY to the owner of this appliance, provided that the product has been installed and operated in accordance with the Installation Manual provided with the equipment. Camus will furnish a replacement for, or at Camus option repair, any part that within the period specified below, shall fail in normal use and service at its original installation location due to any defect in workmanship, material or design. The repaired or replacement part will be warranted for only the unexpired portion of the original warranty. This limited warranty does not cover failures or malfunctions resulting from: (1) Failure to properly install, operate or maintain the equipment in accordance with Camus' manual; (2) Abuse, alteration, accident, fire, flood, foundation problems and the like; (3) Sediment or lime build-up, freezing, or other conditions causing inadequate water circulation; (4) Pitting and erosion caused by high water velocity; (5) Failure of connected systems devices, such as pump or controller; (6) Use of non-factory authorized accessories or other components in conjunction with the system; (7) failing to eliminate air from, or replenish water in, the connected water system; (8) Chemical contamination of combustion air or use of chemical additives to water; (9) Production of noise, odors, discoloration or rusty water; (10) Damage to surrounds or property caused by leakage or malfunction; (11) All labor costs associated with the replacement and/or repair of the unit; (12) Any failed component of the hydronic system not manufactured as part of the boiler.

HEAT EXCHANGER
Within 10 years of the appliance having declared FOB from Camus®, a heat exchanger shall prove upon examination by Camus® to be defective in material or workmanship, Camus® will exchange or repair such part or portion if deemed warranty based on the number of years the appliance has been in service.

Years In Service	Advantus™	Years In Service	Advantus™
1	*100%*	*6*	*100%*
2	*100%*	*7*	*100%*
3	*100%*	*8*	*100%*
4	*100%*	*9*	*100%*
5	*100%*	*10*	*100%*

The exchanged or repaired heat exchanger will carry the balance of the remaining original warranty provided with the appliance based on the FOB date. In the event a replacement heat exchanger is delivered and if the defective heat exchanger is deemed to be repairable by Camus® the repaired heat exchanger will be returned to the customer and a credit will not be issued. Heat Exchanger shall be warranted for (20) years of the appliance having declared FOB from Camus® against "Thermal Shock" (excluded, however, if caused by appliance operation at large changes exceeding 150ºF between the water temperature at inlet and appliance temperature or operating at temperatures exceeding 210°F (AVH & AVW).

BURNER
If within FIVE years of the appliance having declared FOB from Camus® to be defective in material or workmanship, Camus® will exchange or repair such part or portion.

ANY OTHER PART
If any other part fails within one (1) year after installation, or eighteen (18) months of the appliance having declared FOB from Camus® whichever comes first Camus® will furnish a replacement or repair that part. Replacement parts will be shipped FOB our factory.

DURATION OF LIMITED WARRANTY
Any limited warranty, including the warranty of merchantability imposed on the sale of the boiler under the laws of the state or province of sale are limited in duration to one year from date of original installation.

STATE LAW & LIMITED WARRANTY
Some states or provinces do not allow:
a) Limitations on how long an implied warranty lasts
b) Limitations on incidental or consequential damages.

The listed limitations may or may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state and province to province.

CONDITIONS
We will not:
a) Repair or replace any boiler, or part, subject to conditions outlined in 'This Limited Warranty Does Not Cover'
b) Reimburse any costs associated with repair and/or replacement
c) Replace and/or repair any boiler without complete model number/serial number
d) Replace any boiler without prior receipt of actual rating plate from the appliance.

HOW TO MAKE A CLAIM
Any claim under this warranty shall be made directly to Camus Hydronics Limited Canadian Head Office

SERVICE LABOR RESPONSIBILITY
Camus shall not be responsible for any labor expenses to service, repair or replace the components supplied. Such costs are the responsibility of the owner.

DISCLAIMERS
Camus shall not be responsible for any water damage. Provisions should be made that in the event of a water/appliance or fitting leak, the resulting flow of water will not cause damage to its surroundings.

Name of Owner:

Name of Dealer:

Address:

Model Number:

Serial Number:

Date of Installation:

Date of Initial Operation:

Camus Hydronics Ltd., 6226 Netherhart Road, Mississauga, Ontario, L5T 1B7, CANADA

CAMUS CERTIFIED!

CAMUS Hydronics is a manufacturer of replacement parts for most copper finned and stainless steel water heaters and heating boilers as well as a supplier of specialty HVAC products. Our service line is open 24 hours, 7 days a week! The CAMUS CERTIFIED! Seal assures you that Reliability, Efficiency & Serviceability are built into every single unit! For more information on our innovative products from CAMUS Hydronics Limited, call 905-696-7800 today!



CAMUS®
Hydronics Ltd.

Installation and Maintenance Manual IM 672-10

Group: **Applied Air Systems**
Part Number: **IM 672**
Date: **March 2014**

Vision™ Air Handler

Models CAC/CAH 003—090 C



People and ideas you can trust.™

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General Information

Vision® indoor air handlers are not designed to be weather resistant. Do not install them outdoors.

The system design and installation must follow accepted industry practice as described in the ASHRAE Handbook, the National Electric Code, and other applicable standards. This equipment must be installed in accordance with regulations of authorities having jurisdiction and all applicable codes.

Installation and maintenance must be performed by qualified personnel familiar with applicable codes and regulations and experienced with this type of equipment. Sheet metal parts, self-tapping screws, clips, and such items inherently have sharp edges; the installer should exercise caution.

⚠ CAUTION

Sharp edges and coil surfaces are a potential injury hazard. Avoid contact with them.

Receiving and Handling

1. Carefully check items against the bills of lading to verify all crates and cartons have been received. Carefully inspect all units for shipping damage. Report damage immediately to the carrier and file a claim.
2. Vision air handler units are constructed of galvanized or painted steel and are inspected thoroughly before leaving the factory. Take care during installation to prevent damage to units.
3. Take special care when handling the blower section. All fans are dynamically balanced before leaving the factory. Rough handling can cause misalignment or a damaged bearings or shaft. Carefully inspect fans and shaft before unit installation to verify this has not happened.
4. Handle the zone damper of the multi-zone units with special care. Zone dampers are set and inspected before leaving the factory, but should be checked on arrival to the job to verify the bell arm and connecting rod set screws did not become loose in shipment.

Nomenclature

CAH 003 G D A C

Model
CAH = Custom modular air handler
CAC = Custom modular component

Nominal unit size
(cataloged size—nominal square foot of coil)
003, 004, 006, 008, 010, 012, 014, 017, 021, 025, 030, 035, 040, 050, 065, 080, 085, 090

Vintage

Unit cross section
C = Standard unit cross section
M = Custom size cross section

Motor location
A = Motor along side of fan housing
D = Motor down stream of belt-drive plenum fan
F = Motor on inline fan
G = Motor downstream of direct-drive plenum fan
H = Motor downstream of fan array
T = Motor behind twin fan housing

Unit type/coil position
B = Blow-through cooling coil location
D = Draw-through cooling coil location
H = Heating only
V = Vent only
M = Multizone

Unit Storage

- Store on a level surface in a clean, dry location where temperature can be controlled if possible.
- Pack fan and motor bearings (unless motor bearings are sealed) with compatible grease with the shaft stationary. After grease has been installed, rotate shaft about 10 rotations.
- Isolate unit from shock and vibration.
- Once a month, rotate shaft a minimum of 10 revolutions. Insure the stopped position is different than the original position.
- Coat shafts with lubricant as needed to prevent corrosion.
- A descant bag may be hung in the interior of the unit to minimize corrosion in humid storage environments. Do not clean galvanized steel surfaces with oil dissolving chemicals. This may remove the protective coating and accelerate corrosion.
- Do not allow coverings to trap moisture on galvanized surfaces.

Belt-Driven fans

- Reduce belt tension by at least 50% or remove the belts. Remove belts if they will be subjected to temperatures exceeding 85° F to avoid deterioration.
- Remove belt guard when adjusting belts
- Reduce belt tension prior to removing or installing belts.
- Removing or installing tensioned belts may cause personal injury and damage to the sheaves, belts, bearings or shafts.
- Adjustable sheaves should be opened as wide as possible and the adjustment threads lubricated so they do not corrode. Be careful not to put lubricant on the belt running surface

Prior to start up

- Set screws on bearings, fan wheels, and sheaves need to be checked for proper torque. Also check bolt torque for any taper lock hubs either on the wheel or sheaves.
- Check sheaves for corrosion. Significant corrosion can cause belt or sheave failure.
- Purge old grease from fan bearings while rotating the shaft to distribute the new grease evenly and prevent bearing seal failure.
- Correctly align and tension belts. See General Rules of Tensioning on page 42.

Service Clearances

In addition to providing adequate space around the unit for piping coils and drains, access to at least one side of the unit is always required to allow for regular service and routine maintenance, which includes filter replacement, drain pan inspection and cleaning, fan bearing lubrication, and belt adjustment. Provide sufficient space—at least equal to the length of the coil—on the side of the unit for shaft removal and coil removal. Space, at least equal to the length of the side coil, is required for coil removal. Space, at least equal to the fin height, is required for top coil removal. See Figure 1 for servicing space requirements.

For routine maintenance purposes, access normally is obtained through the access doors or by removing panels. Fan and filter sections are always provided with a service door on one side of the unit. If requested, doors can be provided on both sides of the unit. Optional service doors are available for most section types and are provided based on customer request.

If component replacement is required, the top panel also can be removed. If necessary, the unit can be disassembled. Maintain at least 54" of clearance in front of electrical power devices (starters, VFDs, disconnect switches and combination devices). Electrical power devices that are mounted on the side of the unit typically are up to 12" deep (Figure 2). Fan sections with multiple fans have motor control boxes up to 16" deep when supplied with VFDs.

Figure 1: Servicing Space Requirements

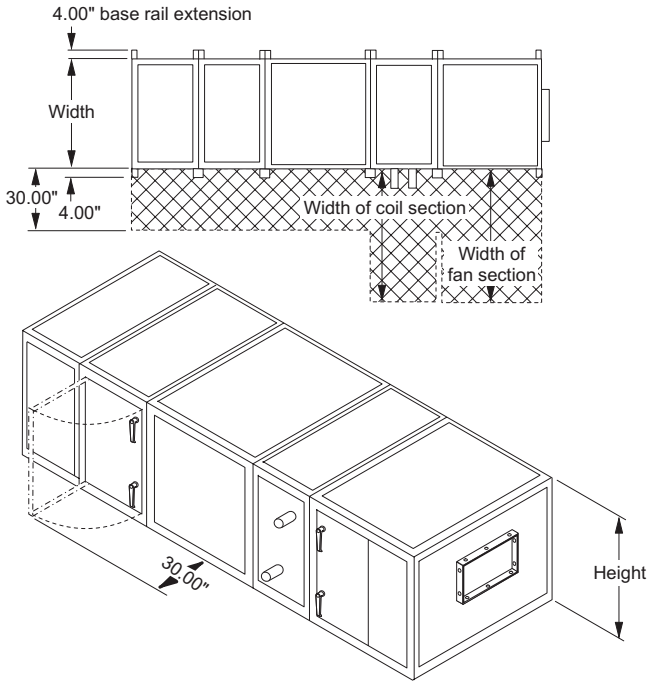
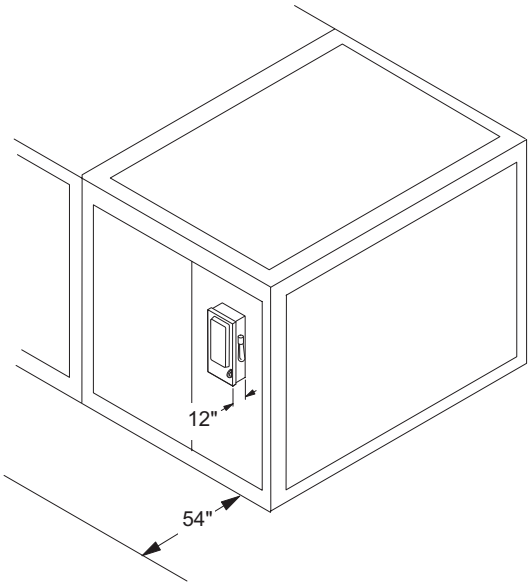


Figure 2: Service Clearance for Electrical Power Devices



Rigging

⚠ WARNING

Use all lifting points. Improper lifting can cause severe personal injury and property damage.

⚠ CAUTION

Lifting points may not be symmetrical to the center of gravity of the unit. Ballast or unequal cable lengths maybe required.

⚠ DANGER

DO NOT LIFT FROM 2" HOLES AT ENDS OF UNIT. Failure to comply may result in personal injury or death.

Vision air handlers ship as separate sections, completely assembled, or in modules of assembled sections. The unit must be rigged as it ships from the factory. Do not rig units after assembly. When a unit is provided with a factory-installed base rail, it can be lifted using the 2" diameter lifting holes located in the corners of each shipping section (Figure 3). If a unit does not have a base rail, rig it using straps or a sling. Fasten the strapping under the skid that ships with the section (Figure 4).

To prevent damage to the unit cabinetry, use spreader bars. Position spreader bars to prevent cables from rubbing the frame or panels. Before hoisting into position, test lift for stability and balance. Avoid twisting or uneven lifting of the unit.

A fan array or coil section might have a tall, thin aspect ratio. The center of balance on these sections can be high and make the section prone to tipping during the lift. Care should be taken when lifting units with a tall, thin aspect ratio.

Figure 3: Units on Base Rails

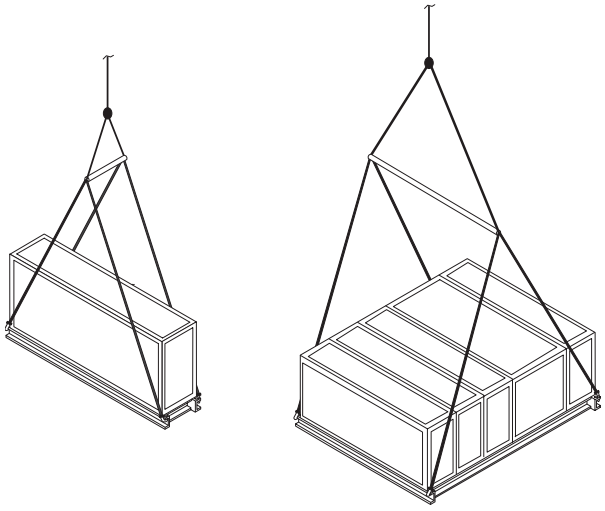
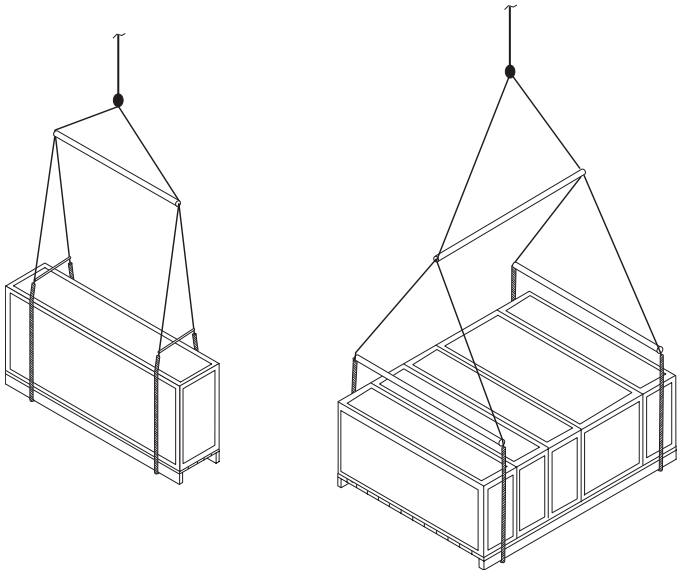
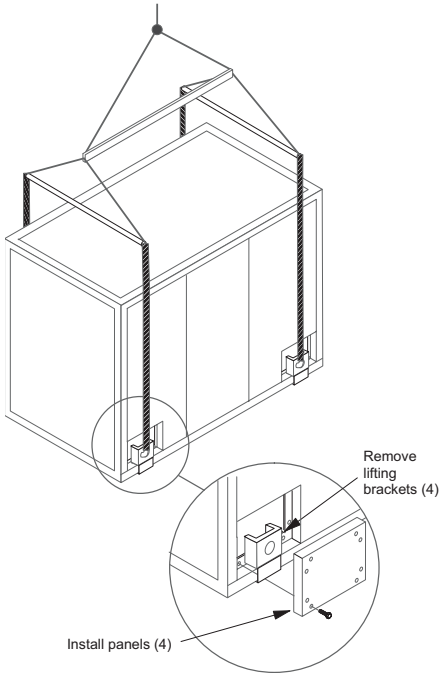


Figure 4: Units on Skids



Fan sections greater than 108" wide that are stacked on another section that are not Class II plenum fans are constructed with internal fan support frames that have integral lifting brackets (Figure 5). After the fan section is placed in position, remove and discard the lifting brackets. Install the small panels provided to complete the unit cabinet areas where the lifting brackets were located.

Figure 5: Large Fan Sections Stacked on Top of a Lower Section



Class II plenum fans that are stacked on another section may be lifted using the methods shown in the following figures. The shipping brackets must remain in place and be tight in order to lift using this method. Figure 6 shows a belt-drive fan with field supplied eye bolts that are screwed into factory installed hex AVK fasteners in the main channels supporting the fan. Figure 7 shows a direct-drive fan with field supplied eye bolts on the motor end and straps around the spring bracket on the inlet end. When factory installed hex AVK fasteners are installed, they should be used for lifting. When they are not installed, it is acceptable to lift from the shipping brackets on the fan. Figure 8 shows dual fans being lifted in a similar manner as the single direct-drive fan. An eight point lift must be used for dual fans to make sure both fans are supported properly and the cabinet structure does not become overloaded along the center.

If the fan section is connected to another section such as a plenum or access section, then DO NOT attempt to lift both sections using just the fan section. The other section(s) must be supported separately using straps.

Figure 6: Belt-Drive Class II Plenum Fan Stacked Unit

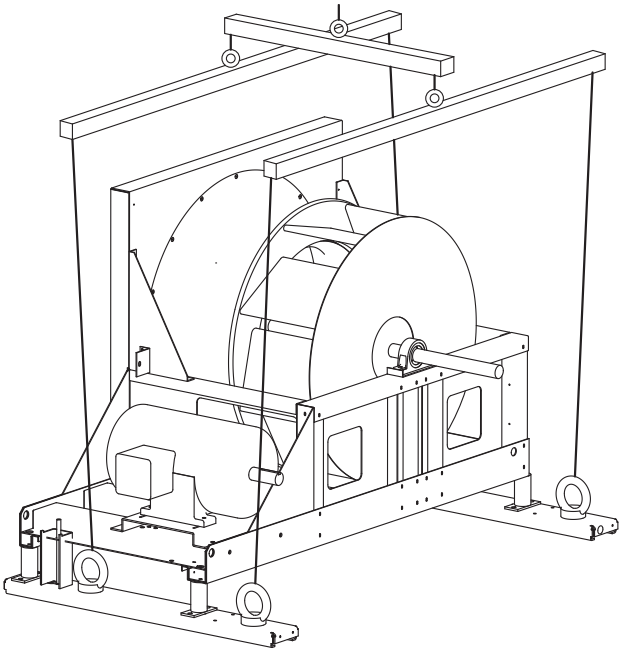


Figure 7: Direct-Drive Class II Plenum Fan Stacked Unit

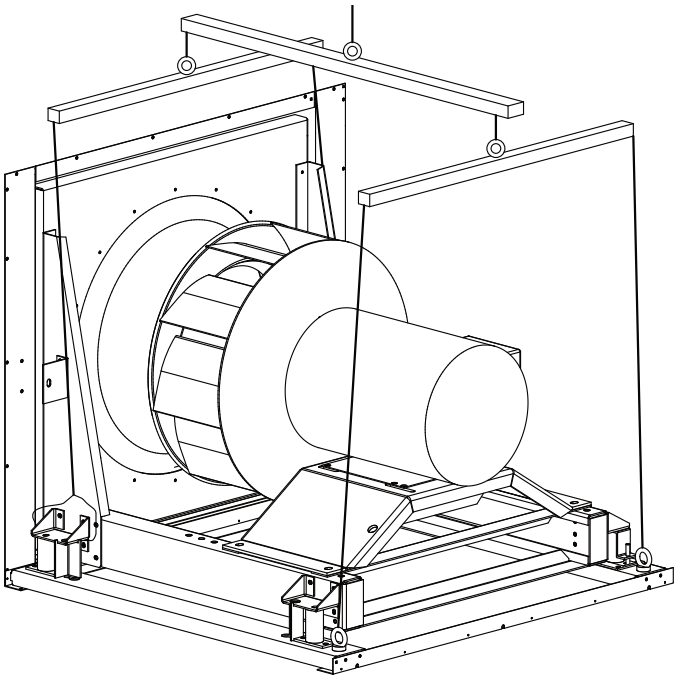
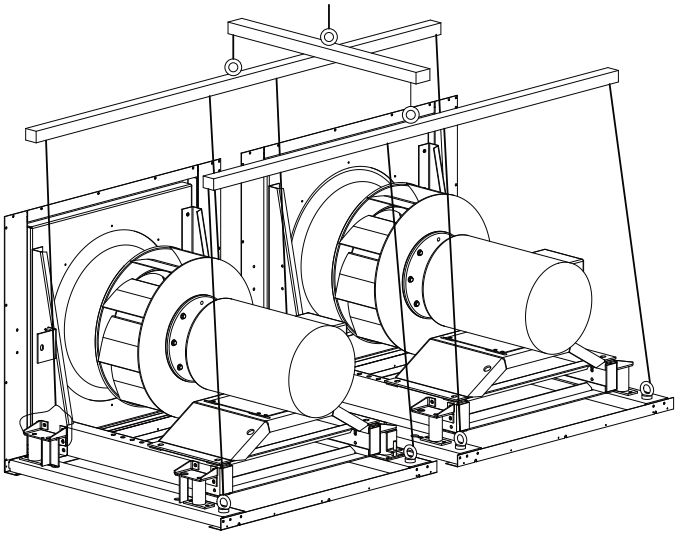


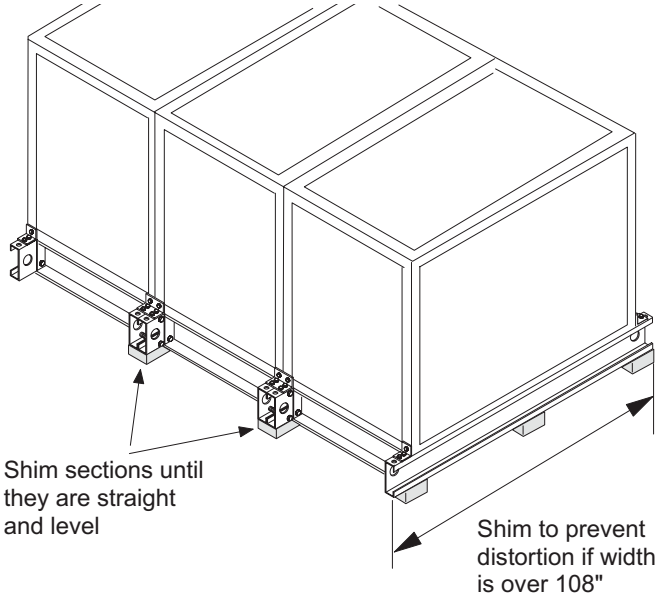
Figure 8: Direct-Drive Class II Dual Plenum Fan Stacked Unit



Unit Leveling

Place the equipment on a flat and level surface. Where the surface irregularities could cause the equipment to distort, use a shim so the base of the unit is a straight line. Uneven or distorted sections cause misfit or binding of the doors and panels and improper draining of drain pans. Units that are over 108" wide must rest on a flat surface for the entire width of the base rails or must be shimmed at one or more points along the length of the rails to prevent distortion or sagging of the support rails (Figure 9).

Figure 9: Leveling the Unit



Assembling Sections

External Section-to-Section Mounting

Vision air handling units can ship fully assembled or as separate shipping sections. Rig units that require field assembly of shipping sections into position first. Shipping sections are provided with a connection splice joint attached on the leaving air side of the shipping section. The splice joint is insulated and provides an air-tight seal between two sections once they are assembled together. If the splice joint was bent during shipping or rigging, restore it to its original position. (Figure 19 on page 12).

Horizontal Airflow Section Mounting

1. Rig the unit into position and lineup shipping sections in the direction of air flow. Pull sections together to fasten. Use a furniture clamp or straps and a ratchet to help pull the sections together securely (Figure 10).
2. If the unit has a factory-installed base rail, first fasten base rails together using the 3/8"-16 × 5" bolts located in the splice kit provided with the unit.
    a. To fasten two shipping sections together, four bolts are needed (two on each side of the unit). The bolts are run from one base rail into the other and fastened with a nut. Complete each section bottom and top before attaching additional sections.
3. If no base rail is provided, fasten the unit in the same manner on the bottom and top frame channels.
4. Once the sections are positioned together, remove the fastener in each of the channel corners (on the mating edges in the channel piece).
5. Place a flat section joining plate (found in the splice kit) over the two coned holes in the channels, so that the plate spans the two sections.
6. Replace the fasteners in their original position, through the joining plate.
7. For certain Custom Air Handler units, use the provided section joining plates to fasten sections together. Space them as shown in Figure 11. Using the provided ¼"-14 x 1" self tapping screws, drill screw the joining plates into the frame channel on each section, keeping unit sections tight together. Follow instruction drawing included in the assembly kit.

Figure 10: Horizontal Joining Sections

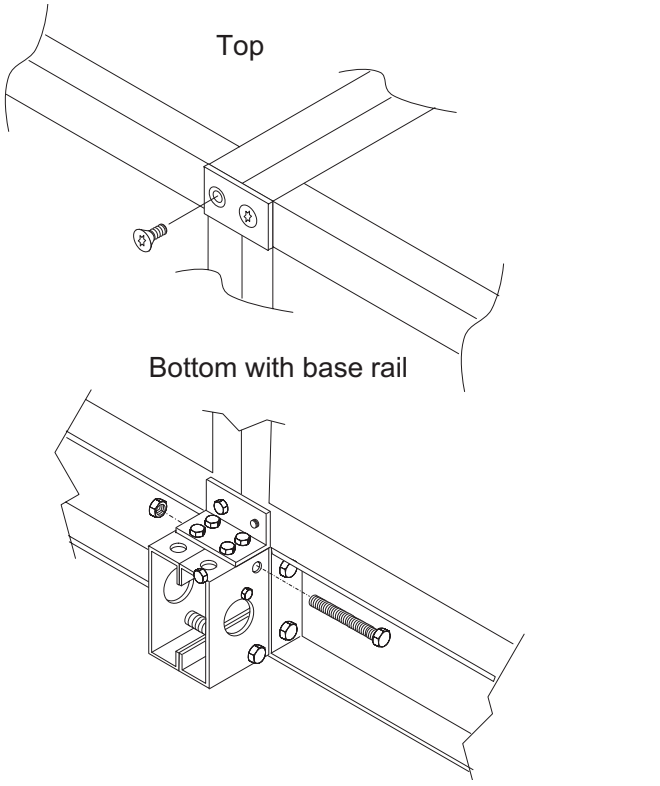
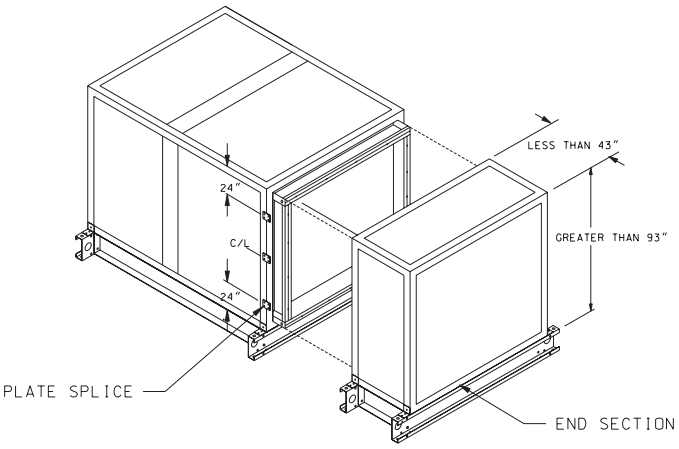


Figure 11: Frame Channel Stiffener Plates (Custom Air Handler Units Only)



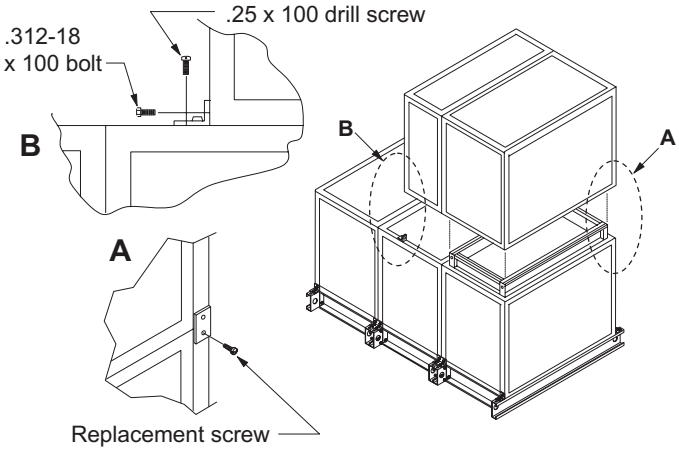
Vertical Inverted Airflow Section Mounting

For vertical or inverted arrangements, before lifting any top mounting sections into place, rig into place and fasten together the bottom tier of sections. Once bottom level sections are in place and secured, lift stacked components and fasten using the following procedure:

NOTE: See Face and Bypass Section Mounting on page 14 for the exception to this procedure.

1. The vertical/inverted section has a splice joint extending out the top of the bottom joining section. Lower the section that is to be positioned over the opening over the splice joint to seal the connection between the two sections.
2. The two sections are fastened together at the four bottom corners of the mating edge. To fasten the corners located on the end of the unit (where bottom section and top section walls are flush with each other), remove the flat head fasteners in the corners of both sections.
3. Cover the coned holes with a flat joining plate and replace the flat head fasteners in the holes to secure the joining plate to both sections (Figure 12).
4. When one section is deeper than the other, secure the two sections using an L-shaped joining plate. To secure the L-shaped bracket, remove the flat head fastener from the corner, position the bracket over the hole, and replace the flathead fastener with a 5/16"-18 × 1" bolt. Once the bolt is in place, secure the bracket to the adjoining section with a 1/4" × 1" drill screw. Repeat the same procedure on both corners of the unit (Figure 12).

Figure 12: Vertical/Inverted Joining Sections

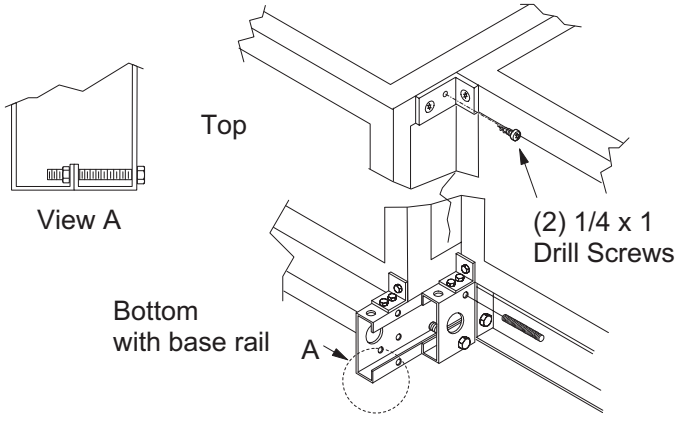


Extended Coil Section Mounting

The extended coil section is 6" wider than all other sections of the same unit size. The extension is always located on the coil connection side of the unit. Because the extended coil section is wider than other sections, it always ships as a separate shipping section, and must be joined to other sections in the field. To join an extended coil section to other components, first follow the Horizontal Airflow Section Mounting, page 7 steps to secure the opposite connection side. To fasten the connection side, use the following procedure:

1. If the unit has a factory-installed base rail, the extended coil section base rail is also 6" wider than the adjoining base rail. Extended coil section base rails on the connection side are fastened together using the 3/8"-16 by 3" bolts located in splice kit provided with the unit (Figure 13).
2. If no base rail is provided, the section is fastened in the same manner on the bottom and top. Once the sections are positioned together, remove the fastener in the corner of the channel piece of the section mating to the extended coil section (Figure 13).
3. Place an L-shaped section joining plate (located in the splice kit) over the coned hole in the channel.
4. Replace the flat head fastener originally used in the corner with a 5/16"-18 1" bolt and fasten it through the L-shaped joining plate.
5. Position the L-shaped joining plate so it butts up against the extended coil section frame channel. To secure the plate to the extended coil section, run two 1/4" × 1" drill screws through the joining plate and into the frame channel.

Figure 13: Extended Coil Section Joining

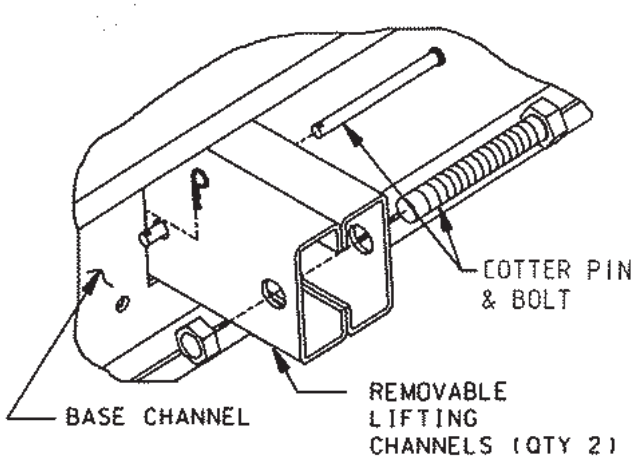


Side-by-Side Heatwheel Section Joining

The side-by-side heatwheel will have two individual sections parallel in the direction of airflow to be attached to either side. Each section will attach to the heatwheel section and then to the other parallel section.

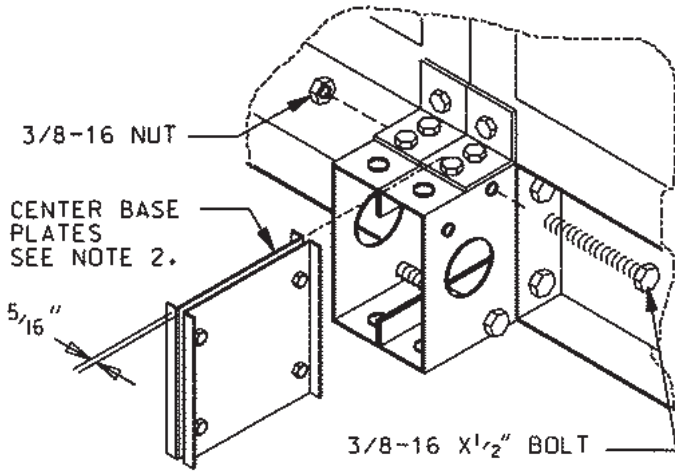
1. Rig the unit into position and line shipping sections up in direction of air flow. Sections must be pulled together to fasten using a furniture clamp or straps.
    a. If the heatwheel section width is greater than 143", then rig the section into position using the two removable lifting channels. After section is properly placed, remove cotter pin and bolts from lifting channel and discard as seen in Figure 14

Figure 14: Cotter Pin and Bolt Detail



2. If included, remove center base plates that are attached to the base channels and save for Step 4.
3. If the unit has a factory installed base rail, fasten the base rails together using the 3/8"-16 × 5" bolts located in the splice kit provided with the unit.
    a. To fasten two shipping sections together, two bolts are required on the one side. The bolts are run from one base rail into the other and fastened with a nut. Complete each section bottom and top before attaching additional sections.
4. Assemble the center base plates as show in Figure 15, leaving a 5/16" space between each plate to slide onto section base channels to center point of section width.
5. Once the sections are positioned together, remove the fastener in each of the channel corners (on the mating edges in the channel piece).
6. Place a flat section joining plate (found in the splice kit) over the two coned holes in the channels, so the plate spans the two sections.

Figure 15: Base Plate Detail



7. Replace the fasteners in their original position, through the joining plate.
8. Assemble the next section parallel to the assembled section by following Steps 1 – 7 above.
9. Using the 3/8"-16 × 1" bolts provided, fasten the two parallel sections' bases together as seen in Figure 16.
10. Using appropriate safety equipment if necessary, remove the fastener in each of the channel corners on the top between the two parallel sections and discard.
11. Use the 2 × 2 holed splice plate with 2 × 5/16"-18 × 1" screws and 2 × ¼" drill screws. The 2 × 5/16"-18 × 1" screws will go into the frame channel holes and the 2 × ¼" drill screws will go into the heatwheel frame channel as show in Figure 17.

Figure 16: Base Section Detail

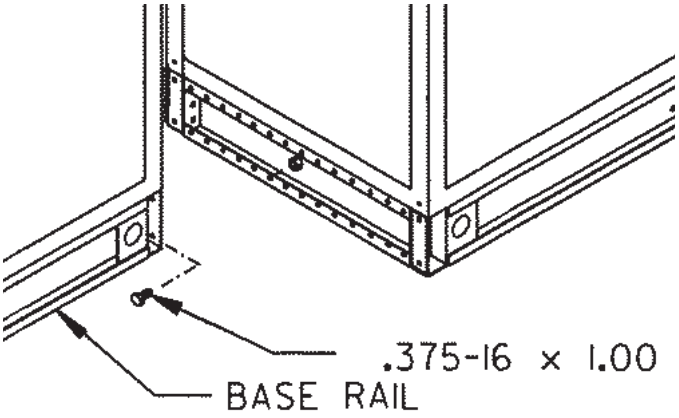
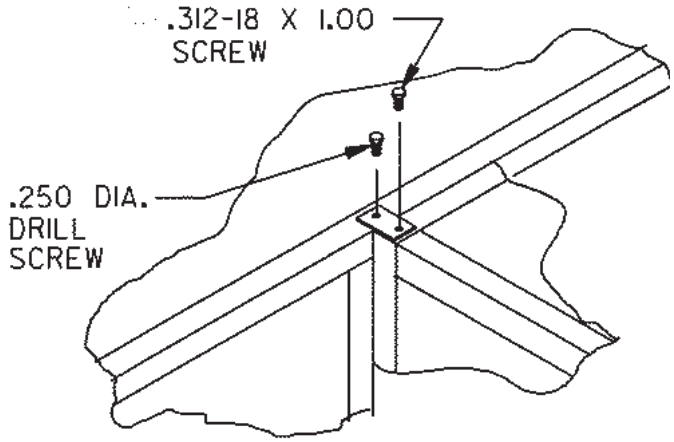


Figure 17: Frame Channel Detail



Internal Section-to-Section Mounting

If desired, shipping sections can be fastened together internally. To fasten internally, run field-provided #10 sheet metal screws or drill screws (4" long maximum) through the interior frame channel of one unit into the splice joint of the neighboring section.

The section-to-section splice joint is always provided on the leaving air side of a shipping section and seals against the frame channel on the entering-air side of the adjoining section. Align the splice joint to seat into the mating gasket to provide an air seal. If the splice joint was bent during shipping or rigging, restore it to its original position (Figure 19).

For Custom Air Handler units, ensure that the D-gasket is attached to the entering air side frame channel (Figure 18). If it has dislodged during shipping, restore to original location.

Figure 18: D-Gasket Placement Detail (Custom Air Handler Units only)

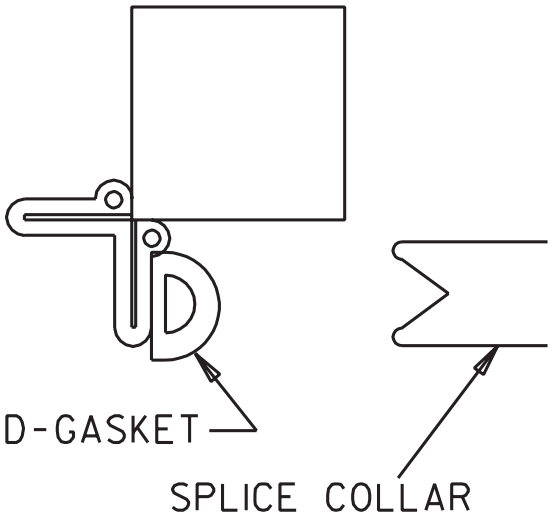
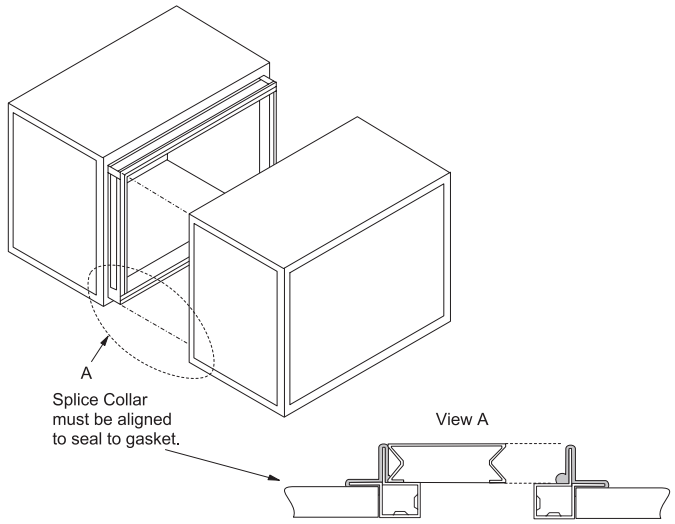


Figure 19: Internal Fastening



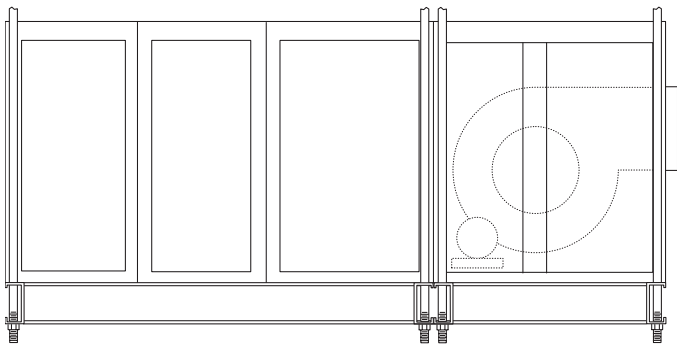
Ceiling Hung

When a unit is ceiling hung, support it with a base rail, angle iron, or channel. The Vision air handler is not designed to be suspended from the top of the unit. Before hanging, rig and completely assemble the unit. See Assembling Sections on page 8.

Ceiling Hung Using Base Rail

The optional base rail provided by the factory has 5/8" diameter holes in each corner to run hanger rods through. To properly support the unit and maintain unit integrity, support each shipping section with hanger rods in each corner (Figure 20).

Figure 20: Ceiling Suspended with Base Rail



Ceiling Hung Using Angle Iron Channel

Install field-provided angle iron or channels per SMACNA guidelines. When a unit is unitized (ships in one piece), channel support each component under the unit width (Figure 21).

NOTE: The supporting angle iron must fully support the 2" frame channel at each section joint.

When a unit is sectionalized (ships in multiple sections), channel support each component under the unit width and provide support under the full length of the unit base (Figure 22). Locate hanger rods so they do not interfere with access into the unit.

Ceiling suspension using the unit base rails is limited to unit cabinet widths less than 108". Support units with cabinets 108" wide and greater with structural members designed to support the unit at the ends and at intermediate points along the base rails.

Figure 21: Ceiling Suspended w/o Base Rail—Unitized Construction

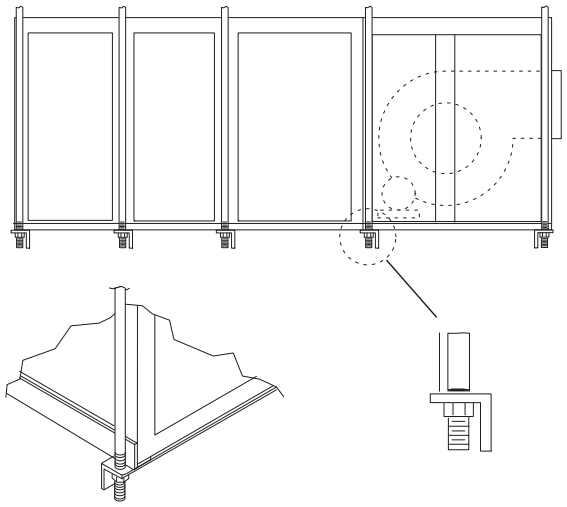
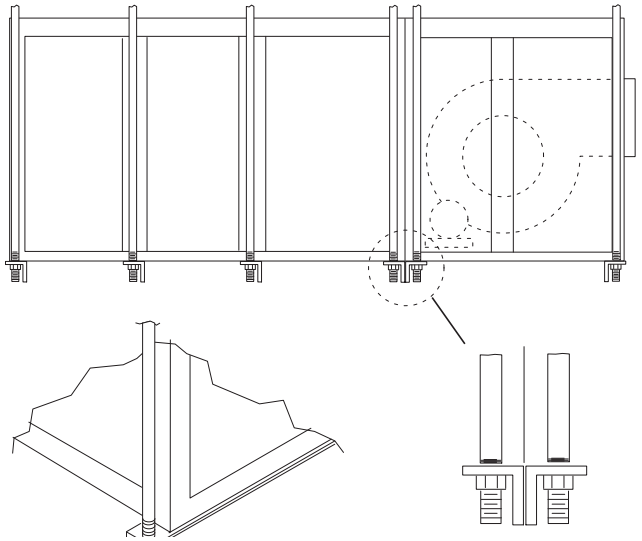


Figure 22: Ceiling Suspended w/o Base Rail—Modular Construction



Panels, Frame Channels, and Doors

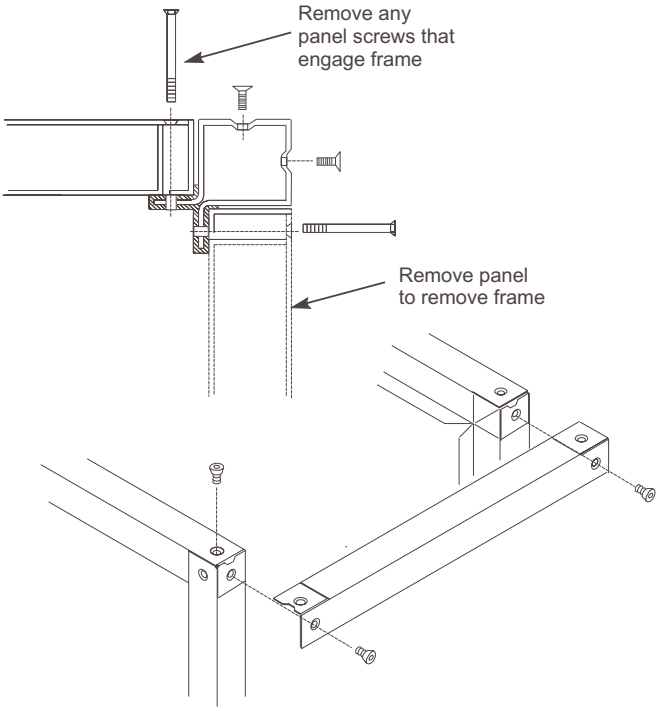
Panel Removal

To remove a side or top panel, remove the flat head Torx 30 fasteners along the sides of the panel. Lift off the panel after removing all fasteners.

Frame Channel Removal

Frame channels that run the length of the unit along the top can be removed to allow access to both the side and top of the unit. To remove the frame channel, first remove the side panel(s). Once the side panel is off, remove the flat head Torx 30 fasteners in the corner of the frame channels. Then pull the frame channel out the side. Remove any panel screws that are within one inch of the of the frame since they are engaged into the gasketed flange of the frame (Figure 23).

Figure 23: Removing Panel Screws



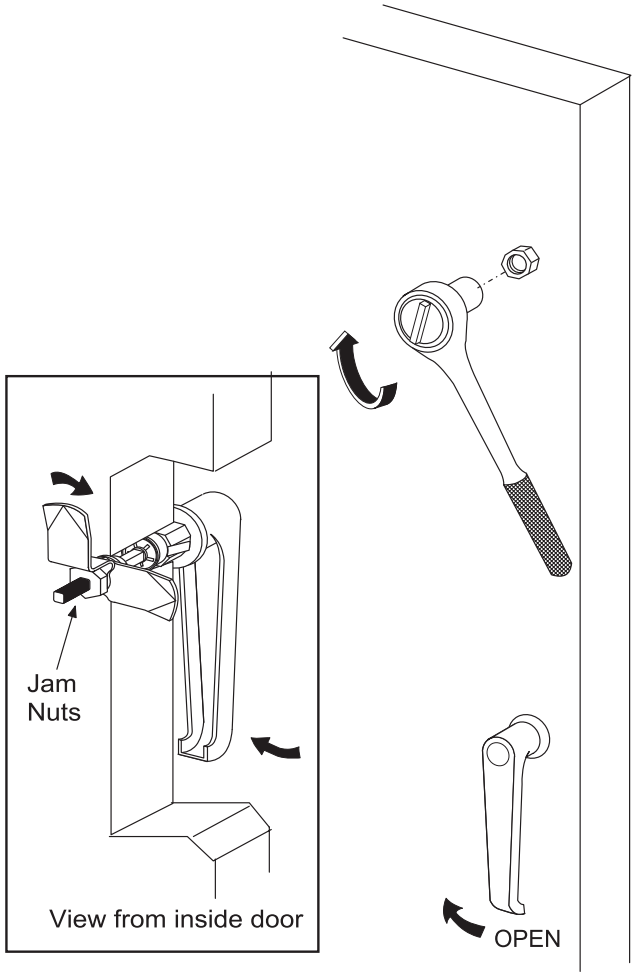
Fan Section Doors

⚠ CAUTION

Sharp edges and coil surfaces are a potential injury hazard. Avoid contact with them.

NOTE: Opening fan section doors requires using a 1/2" socket wrench (Figure 24), which satisfies ANSI standards and other codes that require the “use of tools” to access compartments containing moving parts or electrical wiring.

Figure 24: Opening Fan Section Door



Injected-Foam Insulated Panels

Vision air handlers are furnished with double-wall, injected-foam insulated panels. Foam panels are stronger, more rigid, and lighter than panels with fiberglass insulation. The insulation R-value is improved to 13. However, foam insulation can burn when exposed to flame or other ignition sources and release toxic fumes. Take care in cutting and sealing all field-cut openings in these panels.

Panel Cutting Procedure

⚠ WARNING

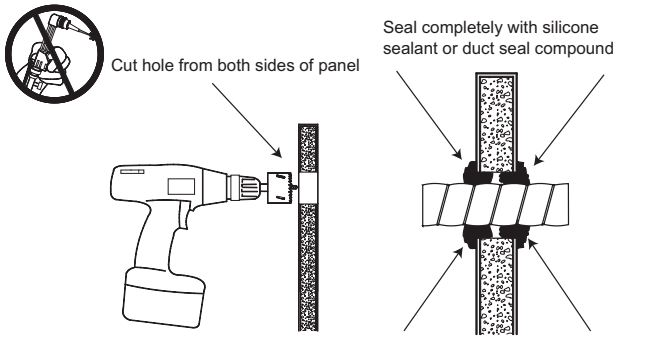


Flame and smoke can cause equipment damage, severe personal injury, or death.

Before operating unit, seal all piping and wiring holes on both inner and outer panels with an industrial grade silicone sealant or duct seal compound. **Do not use a cutting torch or expose panel to fire.** Panel damage can occur.

1. Determine the number and location of holes required for electrical conduit, piping, and control wiring as follows (also refer to Figure 25):
   a. Check that adequate space is available inside the unit for conduit or pipe routing.
   b. Do not locate holes in a panel that provides access to key maintenance components such as filters and fan assemblies.
   c. Do not locate where the conduit or piping blocks airflow or obstructs hinged access doors.
2. Once a proper location is determined, drill a small pilot hole completely through the panel. Then use a sharp hole saw or a saber saw and cut from each side of the panel.
3. Seal the double-wall panel on each side with an industrial/ commercial grade silicone sealant or duct seal compound. It is extremely important to seal each panel hole or penetration securely so that it is airtight, watertight, and that there is no exposed foam insulation.

Figure 25: Cutting/Sealing Injected-Foam Insulated panels



Prop 65—Substances in fuel or from fuel combustion can cause personal injury or death, and are known to the State of California to cause cancer, birth defects or other reproductive harm.

Field Mounting Junction Boxes and Other Components

For field mounting 4" × 4" or smaller junction boxes to the standard panel exterior, use a minimum quantity of four, 3/16" diameter pop rivets. DO NOT use self-tapping drill screws. They will not tighten nor secure properly and panel damage can occur.

If larger, heavier components require mounting on unit panels, use through-bolts with flat washers through both outer and inner panels. To maintain panel integrity, seal both ends with an industrial/commercial grade silicone sealant or duct seal compound.

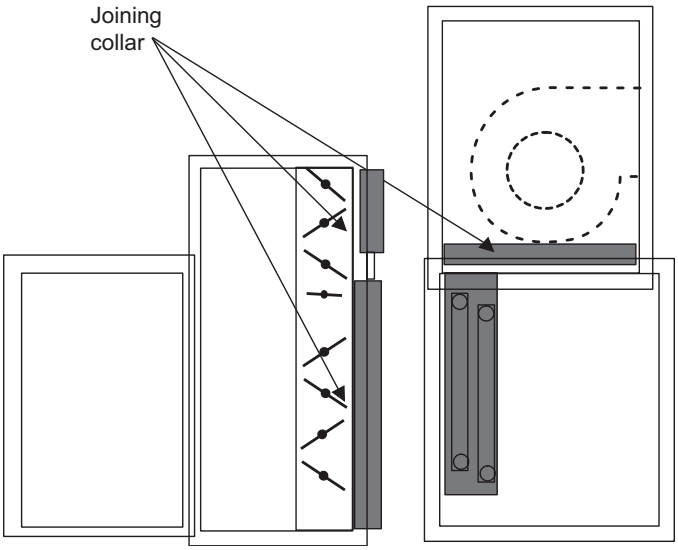
The unit frame channel is another excellent location for securing heavier components; self-tapping screws are not acceptable. Ensure that the location permits the full operation of all access doors and panels and does not interfere with other vital components.

Face and Bypass Section Mounting

Internal face and bypass, and external face and bypass for sizes 003 to 035 are mounted together using the instructions for horizontal components and do not require additional instruction.

For all size units that bypass directly into a vertical fan section and for sizes 040 to 090 with external face and bypass, use the following instructions.

Figure 26: Assembly of Fan Coil Sections



Bypass Into a Vertical Fan Section

Vertical coil sections and the top mounted fan section always ship separately and must be mounted together at the job site. The vertical coil section and the bypass duct each has a joining collar mounted on the leaving air side of the section and duct, respectively (Figure 26). The mounting collar fits into the side (bypass) and bottom (vertical coil section) openings in the fan section. To correctly position the collars in the fan openings, assemble the fan and coil section first. Use the steps below for assembly.

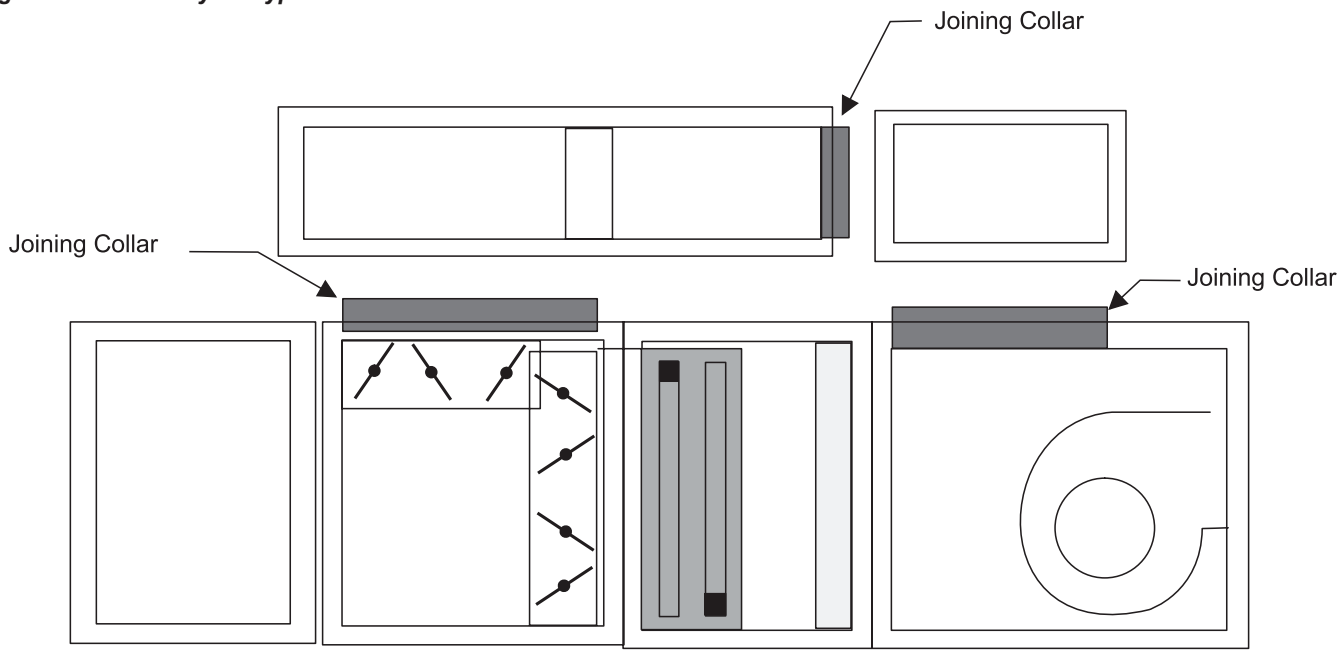
1. Place the vertical coil section in position. If an access section is positioned downstream from the coil section and not already assembled to the coil section, secure the two sections together.
2. Lift the fan section on top of the vertical coil section, taking care to line up the joining collar in the bottom of the fan section.
3. For sizes 003 to 035, the bypass duct is integral to the unit construction and does not require attachment to the bypass section. For sizes 040 to 090, position and assemble the bypass duct to the bypass section before joining to the fan.
4. Once the fan is positioned on top of the vertical coil section and the bypass duct and bypass section are assembled, position the two assemblies and line up the joining collars with the openings in the fan and vertical coil section.
5. Once the sections are lined up and in position, secure the unit together by fastening joining plates to the unit.

External Face and Bypass Duct Assembly (Sizes 040 to 090)

When unit sizes 040 to 090 are ordered with external face and bypass, the bypass duct ships separately and must be attached to the unit in the field. The joining of the bypass duct to the unit must be done after the unit is assembled. Also, if the bypass duct is over 90" long, the duct does not ship in one piece and must be field assembled. The field assembly of the bypass duct to the unit requires the following steps (also refer to Figure 27).

1. Position the unit shipping sections together and assemble in the equipment room.
2. After the unit is assembled, lift the duct into position over the unit. Joining collars are shipped factory assembled to the unit and duct. There is a joining collar located in the top of the bypass opening and in the leaving air side of the bypass duct. These joining collars are used to provide air seals. Line up the duct with the top openings in the unit.
3. If the bypass duct is longer than 90", the duct ships in more than one piece and must be field assembled. Place the piece of duct that has the joining collar on the bottom on top of the unit first. Once it is in place, position the other piece of duct. Take care to fit the splice collar into the first piece of duct and then lower the other end into the bypass opening.
4. Once the duct is positioned correctly, fasten the duct pieces together with the joining plate provided. To do this, remove the fasteners in the corners of the duct assemblies, place the plate over the holes in the corners, and then replace the fasteners (Figure 10 on page 9).

Figure 27: Assembly of Bypass Duct to Unit



Multizone Assembly

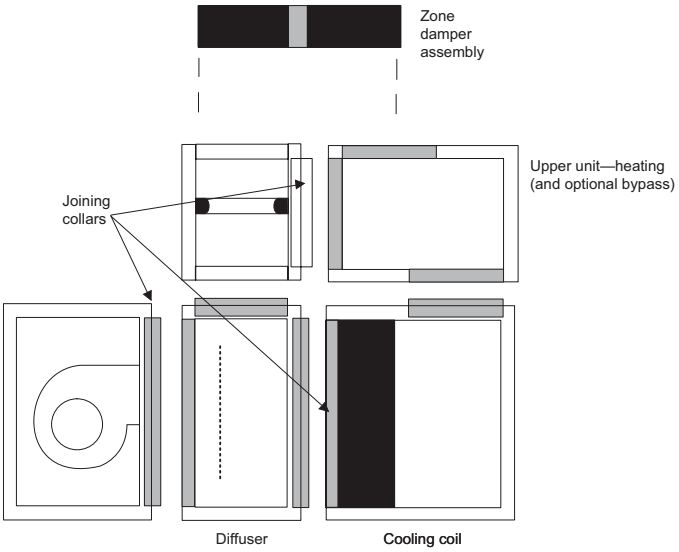
The multizone section may ship completely assembled or it may ship in numerous pieces. Whether the section ships in a single piece or multiple pieces depends on customer requirements and the unit size. When a multizone section is over 90" high or 90" wide, split it into sections for shipping.

The unit may ship in 1, 2, 3, 4, or 5 separate pieces, see Figure 29. Typically, the multizone damper assembly ships separately (see Multizone Damper Assembly and Figure 29) and must be attached at the job site. Attach the damper after the other components are assembled. Use the instructions below for assembling the multizone section (also refer to Figure 29).

1. If the diffuser and the cold deck section ship separately, join them together first. The joining collar mounted in the diffuser fits into the entering air side of the coil section. Line up the two sections and fasten together.
2. Once the diffuser and cold deck sections are joined, lift the hot deck and bypass sections in place on top of the diffuser/ cold deck section. If possible, assemble the hot deck and bypass section (if there is one) together before lifting on top. There always is a joining collar in the diffuser. The joining collar provides the seal between the sections joints. It is important to line up and fit the collar in the hot deck and bypass section. For vertical applications, the cold deck also has a joining collar in the discharge opening. This collar fits in the bottom of the vertical bypass section.
3. After the components in the multizone are fitted together, fasten the joining plates to the corners in the unit exterior.
4. If a damper was ordered, assemble it to the section (see Multizone Damper Assembly and Figure 29).

NOTE: Verify that the joining collars are aligned to seat into the gasket. Straighten any collars distorted from shipping or from rigging.

Figure 28: Multizone Sections Assembly



Multizone Damper Assembly

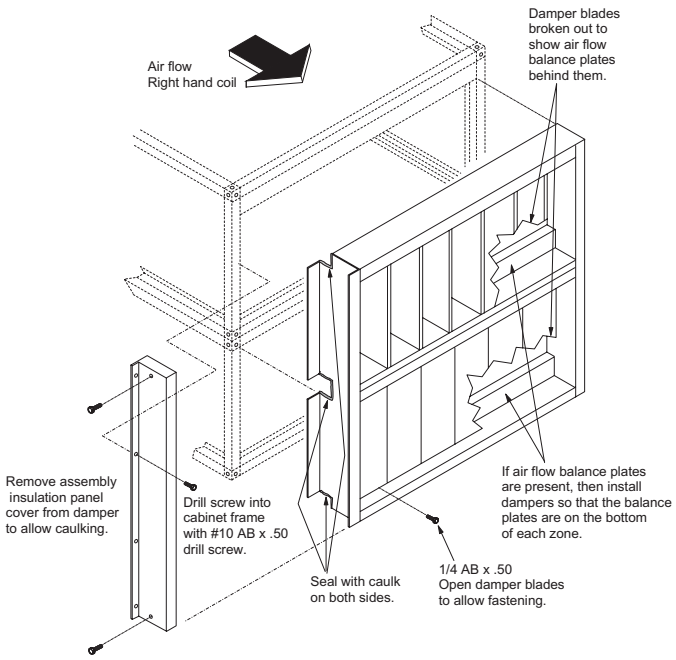
When a multizone unit is ordered with dampers, depending on the multizone configuration and size, the damper assembly may ship separately (all horizontal and units with a total height over 90").

When the dampers are not factory assembled to the unit, they ship to the job site on a skid. An assembly kit with screws and an instruction drawing are included with the damper for field assembly to the unit.

To assemble:

1. First remove the side plate that encloses insulation from both sides of the damper assembly.
2. Lift the damper assembly into position (Figure 29).
3. Fasten the assembly to the frame channels within the multizone openings.
4. Use caulking to seal up the areas around the unit frame channel to prevent any air leakage.
5. After caulking, put the side plates back in place and secure. Damper shaft extensions are provided on both ends of the damper assembly for actuation. The dampers are linked together by a linkage bar on both ends of the damper. The linkage bar is cut at the time of installation to divide the damper into the required number of zones (refer to Multizone Damper Adjustment on page 17).

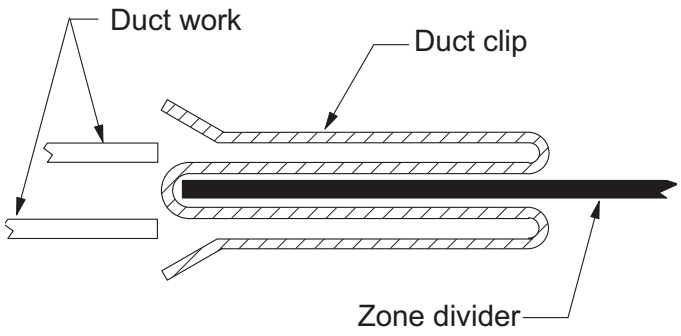
Figure 29: Multizone Damper Assembly



Duct Connections

Use flexible connectors on the outlet and inlet duct connections of all units. Each zone divider has a W-shaped duct clip. Insert ductwork into this clip (Figure 30).

Figure 30: Duct Connectors



NOTE: Before connecting to ductwork, refer to Multizone Damper Adjustment below.

Multizone Damper Adjustment

The installer must clear the damper assemblies of construction dirt and debris. These materials result in higher torque requirements and may bend or damage damper components.

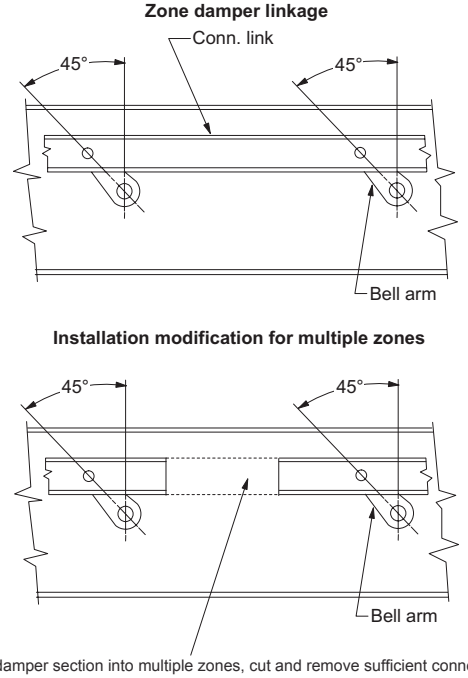
Before you begin:

1. Verify that dampers are square and operating smoothly before ducting.
2. Install duct access panels on the downstream damper for inspection and maintenance.

If multizone dampers do not close properly, adjust the blades as follows:

1. Loosen set screws in bell arms for all zones.
2. Close all cold deck dampers tightly.
3. Move bell arms so they are at a 45° angle to the vertical center when viewing the zone dampers from the cold deck end of the damper section (Figure 31).
    a. Two-deck zone dampers—The cold deck closes when the bell arms are 45° from the vertical center. The hot deck closes when the bell arms are 45° clockwise from the vertical center.
    b. Three-deck zone dampers—The cold deck closes when the bell arms are 45° clockwise from the vertical center. The hot deck closes when the bell arms are 45° counterclockwise from the vertical center.
4. Tighten set screws on bell arms while holding the dampers closed.
5. All zone damper blades should close properly. If one or a few zones do not close completely, repeat the procedure for these zones.

Figure 31: Bell Arms at 45° Angle to Vertical Center



To divide the damper section into multiple zones, cut and remove sufficient connecting link to allow adjacent zones to operate independently.

NOTE: The damper blades on two-deck dampers seal through several degreesof shaft rotation.The damper blades can rotate 360° and do not engage a stop.The hot deck blades are mounted at a 90° to the cold deck blades. Beforeinstalling the zone duct, set up linkages and dampers and adjust. If adjustmentis required and access to the blades is restricted, observe the cold deck bladeposition by removing the cabinet panel on the coil section.

Multizone, Mixing Box and Economizer Damper Torque Requirements

On multizone units, the actuator must drive the connection link for proper damper actuation. Do not activate multiple dampers must from the shaft extension opposite the connection link.

Mounting Actuators

⚠ CAUTION

Maximum damper rotation is 70°. Maximum shaft torque is 205 inches/pound. Greater rotation or torque can cause equipment damage.

The installing contractor is responsible for the mounting of all field-installed actuators. No provisions are made for the location of these actuators due to the number of options and arrangements available and the variety of specific applications. Typically, actuators are mounted inside the cabinet. Provide proper support for the actuator to avoid excessive stress in the cabinet, linkage, or damper shafts.

Fresh air and return air dampers can be linked together and driven from the same actuator if the dampers are the same size. If the dampers are different sizes, they must be driven by separate actuators and controlled appropriately. Exhaust dampers are always driven by a separate actuator.

A typical rotary electric actuator can handle up to 40 sq. ft. of damper. For pneumatic actuators, allow 5 in-lb per square foot of damper area.

Face Bypass Damper Torque Requirements

Face and bypass dampers may or may not be linked together. When dampers are placed before a single bank of coils, they always are linked together and require a single actuator. When dampers bypass a stacked or staggered coil, the dampers are not linked and require multiple actuators. Unit sizes 040 to 090 provided with external face and bypass require three actuators. Other arrangements with stacked or staggered coils require two actuators. A damper shaft extension is provided. Normally, the shaft extension is located on the drive side of the unit, but it can be moved to the other side.

Face and bypass dampers have a torque requirement of 10 in-lbs per square foot of damper face area.

Isolation Dampers for Multiple Fans

Optional isolation dampers can be provided on multiple fans to prevent backflow through a fan that is turned off for service. These isolation dampers are not intended to be used to control flow through the fan. The isolation damper for a fan that is going to be started must be positioned in the full open position before the fan is started. Do not start a fan with the damper located at the inlet with the damper fully or partially closed. This can cause airflow, vibration, and sound problems that can lead to failure.

Isolation dampers can be provided with actuators that are mounted in the airstream. Actuator sizing for the isolation dampers should be based on 9 in-lb per square foot of damper.

Piping and Coils

When designing and installing piping:

- Follow applicable piping design, sizing, and installation information in ASHRAE handbooks.
- Observe all local codes and industry standards.
- Do not apply undue stress at the connection to coil headers; **always use a backup pipe wrench.**
- Support pipework independently of the coils.

Water Cooling Coils

- Water supply, water return, drain, and vent connections extend through the end panel of the coil section. All connections are labeled on the end panel.
- Water supply and water return connections are typically male NPT iron pipe.
- When installing couplings, do not apply undue stress to the connection extending through unit panel. **Use a backup pipe wrench to avoid breaking the weld between coil connection and header.**
- Follow recommendations of the control manufacturer regarding types, sizing, and installation of controls.

Direct Expansion Coils

- The coil distributor and suction connection extend through the end panel of the coil section.
- Check nozzle in distributor for proper tonnage.
- When a field supplied thermostatic expansion valve is used, it is located outside the unit and connected directly to the distributor. Do not apply heat to the body of the expansion valve.
- The thermostatic expansion valve must be of the external equalizer tube type. Connect the 1/4" diameter external equalizer tube provided on the coil to connection on expansion valve.
- Use care when piping the system to see that all joints are tight and all lines are dry and free of foreign material. For typical refrigerant piping, see condensing unit product manual.

Steam Coils

Piping (see Figure 32)

- All steam coils in units are pitched toward return connection.
- Steam supply and steam return connections typically are male NPT iron pipe and are labeled on the end panel of coil section. Connections extend through the coil section end panel.
- When installing couplings, do not apply undue stress to the connection extending through unit panel. **Use a backup pipe wrench to avoid breaking the weld between coil connection and header.**
- Support piping independently of coils and provide adequate piping flexibility. Stresses resulting from expansion of closely coupled piping can cause serious damage.
- Do not reduce pipe size at the coil return connection. Carry return connection size through the dirt pocket, making the reduction at the branch leading to the trap.

Coils

- Install vacuum breakers on all application to prevent retaining condensate in the coil. Generally, the vacuum breaker is connected between the coil inlet and the return main. The vacuum breaker should be open to the atmosphere, and the trap design should allow venting of large quantities of air.
- Do not drip supply mains through the coil.
- Do not attempt to lift condensate when using modulating or on/off control.

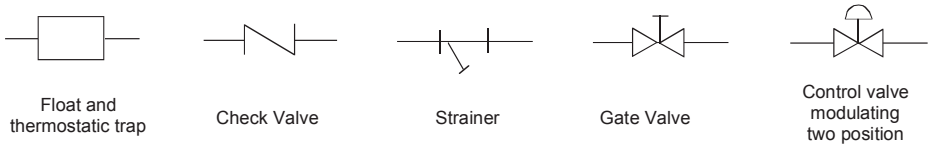
Traps

- Size traps in accordance with the manufacturers' recommendations. Make sure that the required pressure differential is always available. Do not undersize.
- Use float and thermostatic or bucket traps for low pressure steam. On high pressure steam, use bucket traps. Use thermostatic traps only for air venting.
- Use bucket traps for on/off control only.
- Locate traps at least 12 inches below the coil return connection.
- Multiple coil installation
- Individually trap each coil or group of coils that is controlled individually trapped.
- Coils in series—use separate traps for each coil, or bank of coils.
- Coils in parallel—a single trap can be used, but an individual trap for each coil is preferred.
- Do not attempt to lift condensate when using modulating or on/off control.
- With coils arranged for series airflow, use a separate control on each bank or coil in the direction of airflow.

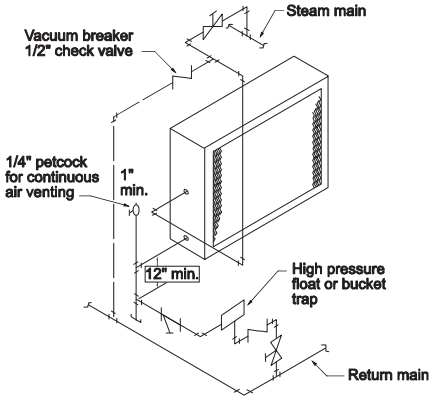
Valves

- Do not use modulating steam valves on high pressure systems.
- Properly size modulating valves. **Do not undersize.**
- Freezing conditions (entering air temperatures below 35°F).
- Daikin strongly recommends 5JA, 8JA, 5RA and 8RA coils.
- Supply 5 psi steam to coils at all times.
- Do not use modulating valves. Provide control by face and bypass dampers.
- Consider using two or three coils in series with two position steam control valves on the coil or coils that handle 35°F or colder air. Use a modulating valve on the downstream coil to provide the desired degree of control.
- Thoroughly mix fresh air and return air before it enters the coil. Also, to obtain true air mixture temperatures, properly locate temperature control elements.
- As additional protection against freeze-up, install the trap sufficiently below the coil to provide an adequate hydrostatic head to remove condensate during an interruption in the steam pressure. Estimate three feet for each 1 psi of trap differential required.
- On startup, admit steam to coil ten minutes before admitting outdoor air.
- Close fresh air dampers if steam supply pressure falls below the minimum specified.

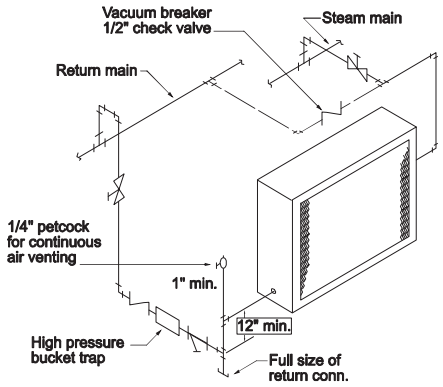
Figure 32: Piping Arrangements



High Pressure (over 25 psi)

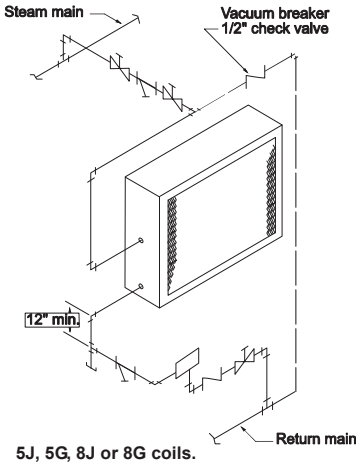


5GA or 8GA coils. Note that the addition of a vacuum breaker to permit the coil to drain during shutdown.

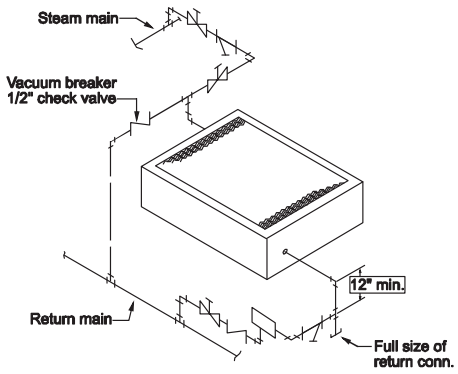


5TA, 8TA, or 5HA coils. Condensate is lifted to overhead return main

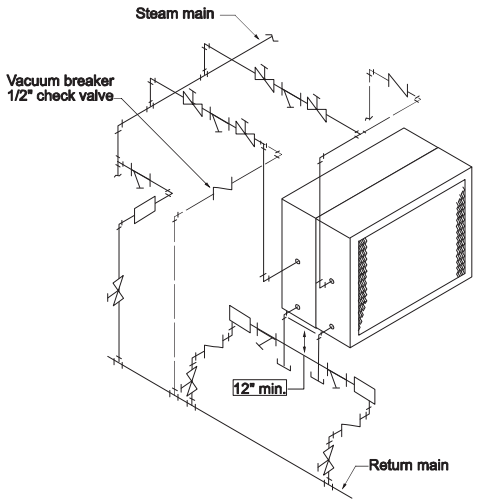
Low Pressure (to 25 psi)



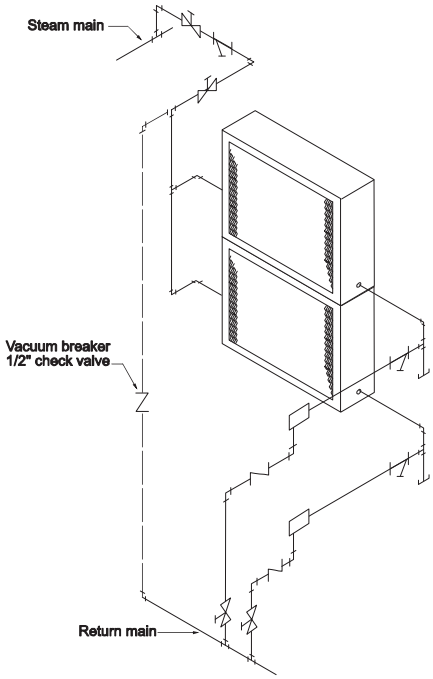
5J, 5G, 8J or 8G coils.



5RA, 8RA, or 5SA coils. Installed



5JA or 8JA coil. Installed in series. Note that each coil must have a separate control valve and trap.



5RA, 8RA, or 5SA coils. Banked two high, individual trapping of each coil as shown is preferred.

Water Heating Coils

⚠ CAUTION

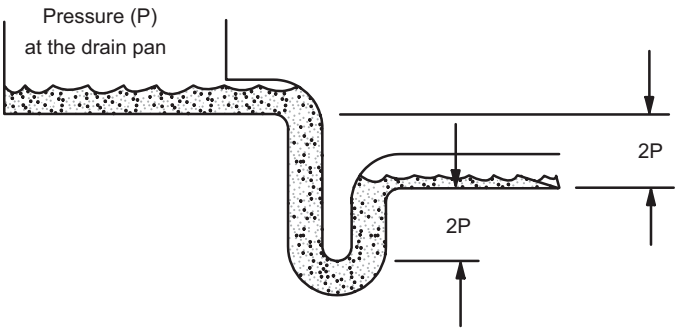
Improper installation, use, or maintenance of water heating coils can cause equipment damage. Read and follow instructions carefully.

- Water supply and water return connections extend through the end panel of the coil section. All connections are labeled on the end panel.
- Water supply and water return connections are male NPT iron pipe.
- When installing couplings, do not apply undue stress to the connection extending through unit panel. Use a backup pipe wrench to avoid breaking the weld between the coil connection and header.
- Follow recommendations of the control manufacturer regarding types, sizes, and installation of controls.
- Do not use hot water coils with entering air below 40°F.
- If fresh air and return air are to be heated by a hot water coil, carefully design the system to provide thorough mixing before air enters the coil.
- To prepare coils for winter operation, see Winterizing Water Coils on page 44.

Drain Pan Traps

Run drain lines and traps full size from the drain pan connection. Install drain pan trap to allow condensate to drain freely. On both blow-through and draw-through units, the trap depth and the distance between the trap outlet and the drain pan outlet must be twice the static pressure in the drain pan section under normal operation so the trap remains sealed (Figure 33).

Figure 33: Allow Adequate Distance Between Trap Outlet and Drain Pan Outlet



Internal Isolation Assembly Adjustment

On units with internally isolated fan and motor assemblies, the assemblies are secured for shipment.

Before Operating the Unit

Remove the shipping brackets and tie-down bolts (refer to Figure 35, Figure 36 and) and discard. The shipping brackets located on the opposite drive side of the unit are difficult to access from the drive side of the unit. Either remove them before the unit is assembled, or remove the panel on the opposite drive side to gain access.

The spring isolators under the four corners of the fan and motor assembly are factory adjusted while the fan was not running. With the unit operating at normal cfm and static pressure, all the isolators should be at the same height opening (Table 1 through Table 5). If adjustments are required, loosen the 1/2" cap screw on top of the isolator and turn the adjusting bolt to lower or raise the fan and motor base. Retighten the cap screw when adjustments are completed.

Table 1: Motor Beside Fan Spring Mount Adjustments

Spring Mount Adjustment at Rest			
Isolator Position	**Top or Bottom Horizontal H**	**Downblast H**	**Upblast H**
Unit Sizes 003 – 035			
1	3.75	3.75	4.25
2	4.25	3.75	4.25
3	4.25	3.75	4.25
4	3.75	3.75	4.25
Unit Sizes 040 – 090			
1	6.00	6.00	6.50
2	6.50	6.00	6.50
3	6.50	6.00	6.50
4	6.00	6.00	6.50

Table 2: Motor Behind Fan Spring Mount Adjustments

Spring Mount Adjustment at Rest			
Isolator Position	**Top or Bottom Horizontal H**	**Downblast H**	**Upblast H**
Unit Sizes 003 – 035			
1	6.75	6.75	6.75
2	6.75	6.75	6.75
3	6.75	6.75	6.75
4	6.75	6.75	6.75
Unit Sizes 040 – 090			
1	6.75	6.75	6.75
2	6.75	6.75	6.75
3	6.75	6.75	6.75
4	6.75	6.75	6.75

For models 040 through 090 with housed fans, the isolators should be at equal height (6") during fan operation. Center the fan outlet in the outlet panel opening. If adjustment is required, loosen the bolt on top of the isolator assembly (. Turn the adjustment nut below the fan frame to lower or raise the fan motor and frame assembly. Retighten the bolt on top of the isolator assembly.

Table 3: Class II Belt-Drive Plenum Fan Spring Height

Fan Size	Isolator Type	Operating Height (in.)
13–16	Standard 2" Deflection	4.5
18–36	Standard 2" Deflection	4.0
13–36	Seismic	4.0
40–60	All	6.75

Table 4: Class III Plenum Fan Spring Height

Cabinet Width (in.)	Isolator Type	Operating Height (in.)
Width < 108	All	4.0
Width ≥ 108	All	6.75

Table 5: Class II Direct-Drive Plenum Fan Spring Height

Fan Size	Isolator Type	Operating Height (in.)
11–36	All	4.0
40–44	All	6.75

Figure 34: Adjusting Large Spring Mount Assembly

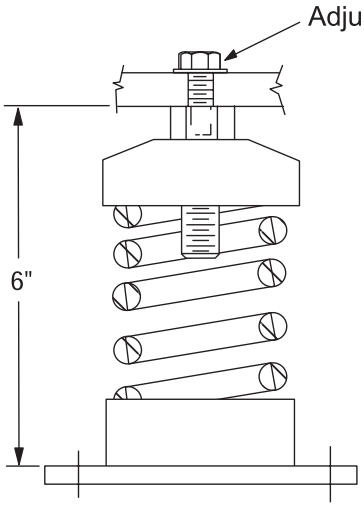


Figure 35: Removing "Motor Behind" Shipping Brackets

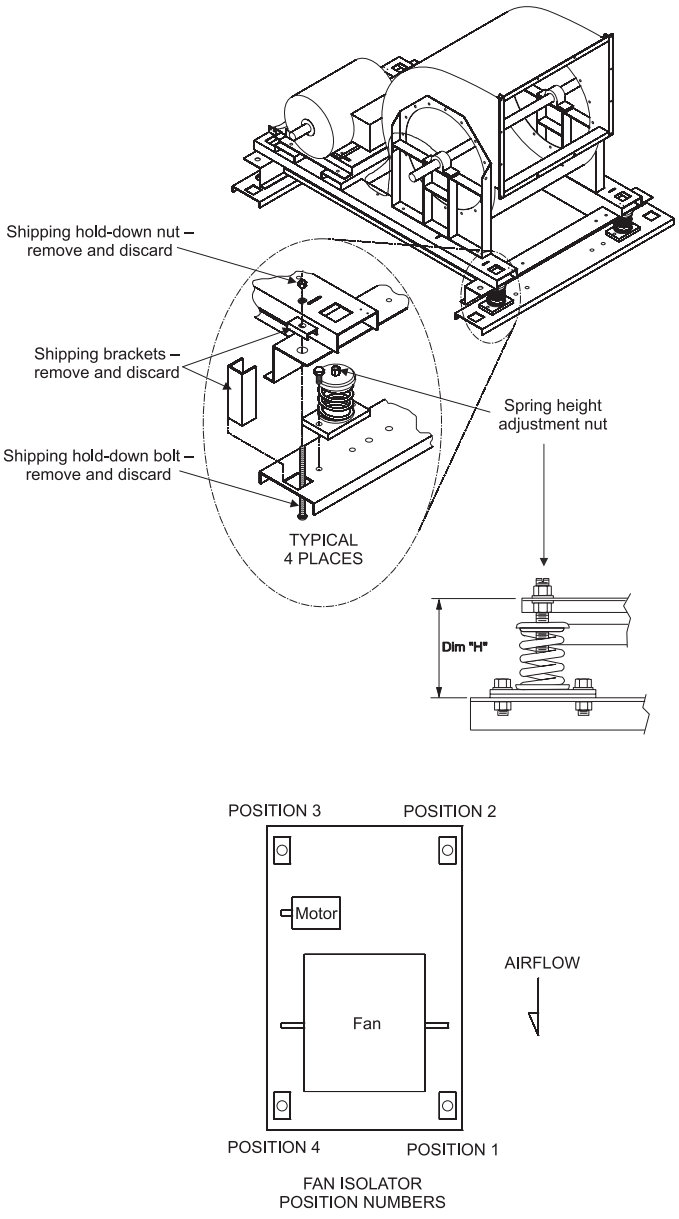


Figure 36: Removing "Motor Beside" Shipping Brackets

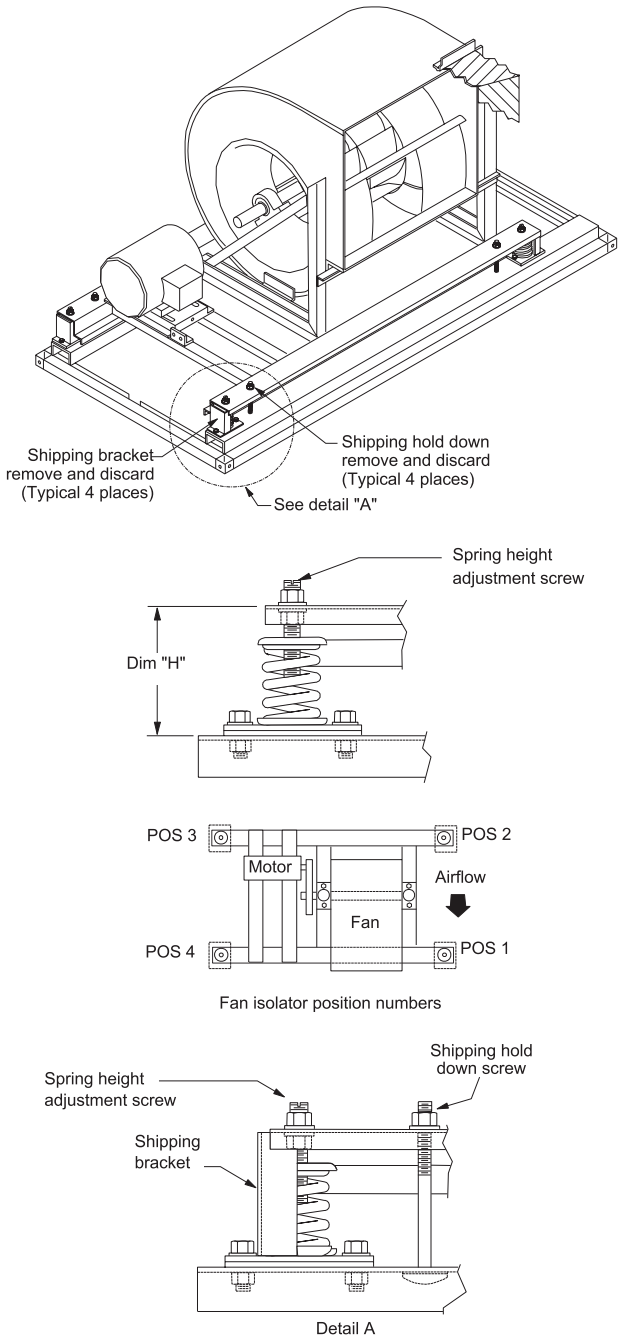
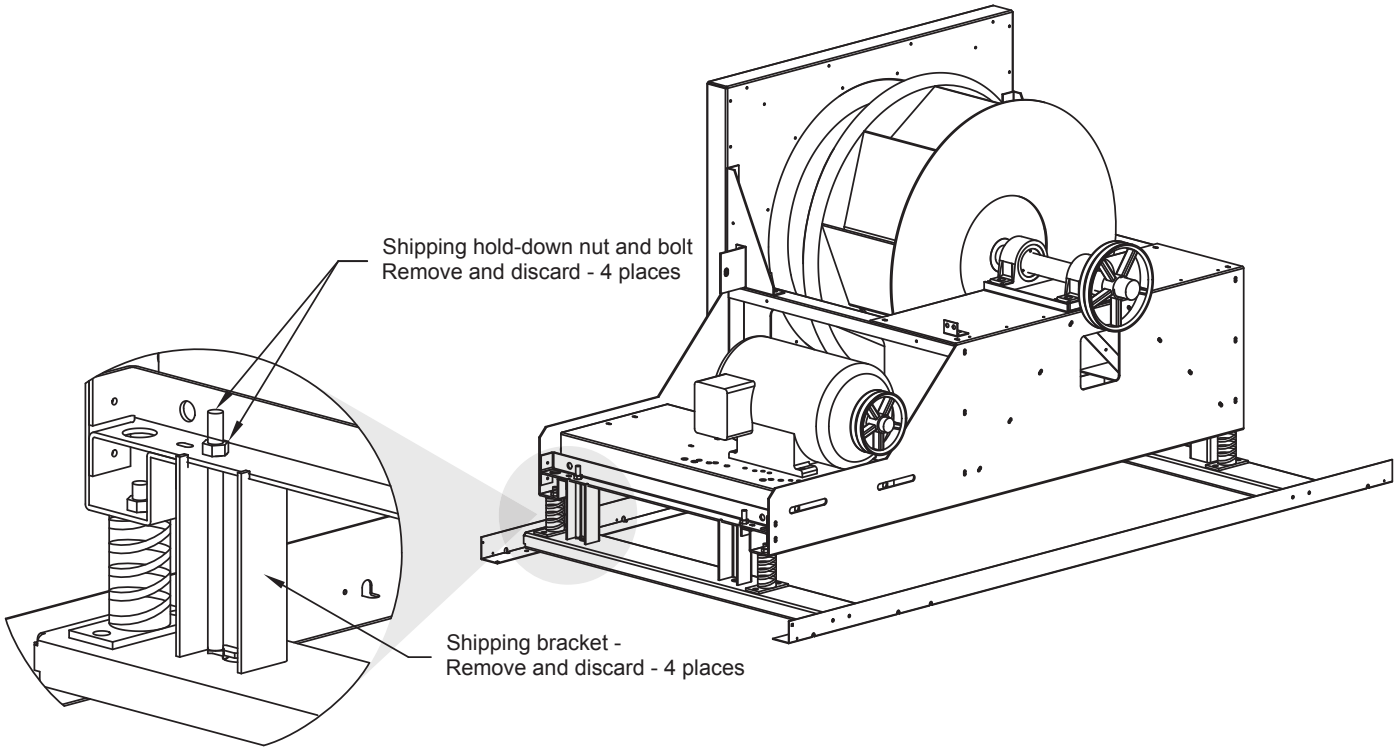


Figure 37: Plenum Fan Typical Shipping Brackets



OSHPD Seismic Anchoring/Mounting

For seismic stability of the unit, additional anchoring and mounting procedures are required. The anchoring options and corresponding spectral response acceleration are given in Table 6. Holes in the Vision/Skyline base frame are to be field drilled. Any mounting hardware is to be field supplied.

Table 6: OSHPD Mounting

Attachment Method	SDS	Attachment System (by Others)	
		Spacing	System
Bolted attachment to steel (Figure 38)	1.93	48	5/8" DIA SAE Grade 5
Welded attachment to steel (Figure 39)	1.84	48	3/16" Weld Leg and 4" welded length
Bolted attachment to Concrete (Figure 40)	1.68	24	Hilti HAD-P M16 × 190/40 with 4-3/4" embedment

Figure 38: Unit with Base Frame Mounted on Steel

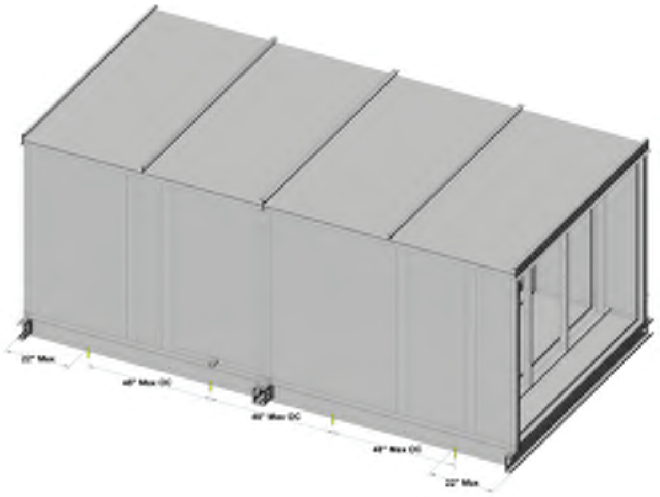


Figure 39: Unit with Base Frame Welded

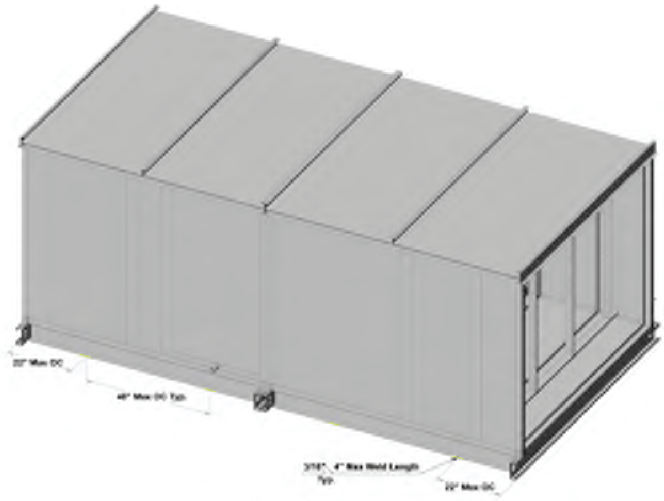


Figure 40: Unit with Base Frame Mounted on Concrete



Wiring

⚠ DANGER

Capacitor Hazardous Voltage! Failure to disconnect power and discharge capacitors before servicing will result in serious injury or death.

Disconnect all electric power (including remote disconnects) before servicing. Perform lockout/tagout procedures to ensure that power can not be energized. For variable frequency drives,or other energy storing components that have been furnished and mounted by either Daikin, or by others, refer to the specific manufacturer's literature for allowable waiting periods For discharge of capacitors. Verify capacitors have been discharged using an appropriate voltmeter.

⚠ CAUTION

Use copper conductors only! Failure to use copper conductors can result equipment damage.

- Electrical service to each fan must correspond to the rated voltage on the motor or electrical panel nameplate and conform to the National Electric Code and local restrictions.
- Connect each fan section metal frame to the building electrical ground.
- A door electrical interlock is not provided as standard.
- Thermal motor protection is external to the unit. Unless the unit is provided with a variable frequency drive (VFD) or a unit mounted starter, thermal protection and a disconnect switch provision per electric codes are provided by others.
- When the unit is factory provided with a disconnect switch, starter or a variable frequency drive (VFD), the components are mounted on the outside of the unit cabinet. Factory wiring is provided from the device to the unit internal motor.
- All electrical components must be grounded to the building central ground. Suitable ground wires and/or (bonding) lugs are provided for all motors, disconnect switches, starters, and variable frequency drives. Provide dedicated ground (bonding) copper conductors in accordance with local and national codes.
- For units provided with a motor only or with an external junction box, wire connections are made with suitable wire nuts or connectors for the gauge wires provided.
- For units provided with a disconnect switch or starter, field wiring will be terminated to lugs. Wire size and lug torque requirements are shown on the unit electrical schematic provided in the component print pocket. All power supply wire connections must be torqued as shown.
- When the unit is provided with a VFD only, refer to the VFD manual for wire size and torque requirements. For instances where multiple motors are being driven by a single VFD, be sure to set up the VFD and size the wiring according to the power requirements of all motors that are being driven by that VFD.
- When not being serviced, close and secure electrical panel doors to prevent ingress of moisture and airborne contaminants.

Control Wiring

- Access to the VFD is through the fan cabinet access door for single fans. Provide shielded cable only as described in the provided VFD manual. Route wire through the panel so that it does not interfere with an other components or access doors. Do not drill through drip pans or drain pans. Refer to the provided VFD installation manual for detailed control wiring instructions.
- For multiple fans in parallel, the VFD(s) are mounted inside of the electrical enclosure, which is mounted on the exterior of the fan section. When multiple fan sections are provided with multiple VFDs, they must be set up so that the fans always start simultaneously and are set to ramp up and down together. Do not attempt to run fans in parallel at different speeds as this can result in uneven airflow that can cause performance, sound, and vibration problems that can lead to failure. Provided that the fan is capable of running fast enough and the motor is sized appropriately, VFDs may be operated up to a maximum recommended frequency of 90 Hertz for 1800 RPM and slower motors. Motors that are 3600 RPM may be operated up to a maximum speed of 4000 RPM or 66.7 Hertz provided the fan is rated that high. Operation above 4000 RPM can damage motor bearings and is not recommended.

Startup Checks

When performing startup and service, always take thorough safety precautions. Only trained, experienced personnel should perform these functions.

⚠ WARNING

ROTATING FAN

Can cause severe injury or death. Before servicing fans,lockout and tag out power.

⚠ WARNING

FIRE/ELECTRIC SHOCK HAZARD

Can cause property damage, personal injury or death. Wire fan power supply and ground motor frame in accordance with local electric codes.

⚠ WARNING

Fan motor requires overload protection.

Failure to provide motor overload protection can result in fire,property damage, electric shock, personal injury, or death. Connect motor to an overload protective device rated incompliance with local electric codes.

⚠ CAUTION

DO NOT OVERHEAT FAN MOTOR

High air temperatures in the fan section can cause the fan motor to burnout. On draw-through air handlers or air handlers with the fan section down the air stream from the heating section, the discharge air temperature of the heating section must not exceed 104°F (40°C).

Before Starting the Unit

⚠ CAUTION

Equipment damage due to loose fasteners represents improper start-up and equipment abuse. It is not covered by the warranty.

Before entering fan section, make sure that fan electrical power source is disconnected and locked in the OFF position.

1. Check that the unit is completely and properly installed with ductwork connected.
2. Check that all constru tion debris is removed and filters are clean.
3. Check that all electrical work is complete and properly terminated.
4. Check that all electrical connections are tight and that the proper voltage is connected. Phase imbalance must not exceed 2%.
5. Do not grease ball bearings on the fan shaft and motor before startup. They are prelubricated.
6. Check tightness of crews in bearings and fan wheel(s). If retightening is needed, position the fan wheel(s) per Table 7, page 29 through Table 9, page 30 and Table 10 through Table 12, page 31. Torque set screws per Table 13 and , page 31.
7. Check alignment of fan and motor sheaves and belt tension. Adjust if necessary. Check tightness of sheave setscrews and/or capscrews (refer to , page 31).
8. Leak test the thermal system to verify that connections are tight.
9. Check that the condensate drain is trapped.
10. Rotate the shaft by hand to be sure it is free.
11. If multiple fans are supplied with a block off plate and it is installed on one of the fans, make sure to only start the fans without the block off plate. Do not start any fan that has the block off plate installed on it.
12. If multiple fans are supplied with isolation dampers, make sure the isolation dampers are fully open before starting the fans.

VFD Setup

Fans ordered with VFDs that were factory installed are setup and tested prior to shipment. Prior to starting the fan(s), double check the VFD settings according to the recommendations in the VFD manual.

Once the correct VFD settings are verified, the fans should be run through a sweep of the full range of operating speeds that are expected to check for any vibration issues. If any areas of concern are located, it is recommended to lock out those frequencies using the VFD (see lock out frequencies or skip frequencies in the VFD manual). This will ensure that the fans will never operate continuously at those points, but will rather pass through them to get to the desired points of operation.

Fan Startup

Start and run fan. See on page 30 for proper fan rotation. Observe the rotation. If the fan operates backward, reverse two legs of the three-phase supply power.

NOTE: Variable pitch fan drives usually are provided for operation in the mid-speed adjustment range. However, the drives usually ship with the adjustment opened up for minimum fan speed. Adjust the drives for the proper airflow. See Fan Drive Adjustments on page 38.

After 48 Hours of Operation

⚠ WARNING

ROTATING FAN

Can cause severe injury or death. Before servicing fans,lockout and tag out power.

1. Disconnect and lock electrical power source.
2. Check tightness of all bearing, wheel, and sheave setscrews (or capscrews). Refer to Table 13.
3. Recheck belt tension and adjust if necessary. Belts tensioned sufficiently to slip one to two seconds at startup will perform satisfactorily, extending life and reducing

Fan Wheel Alignment

Figure 41: Wheel-to-Inlet Funnel Relationship—Fan Wheels (Housed)

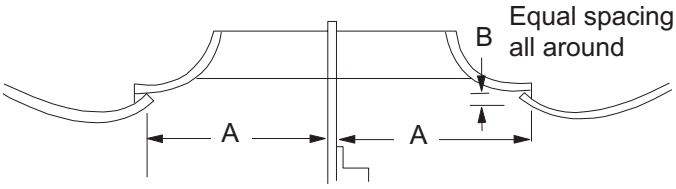


Table 7: Wheel-to-Inlet Funnel Relationship—Fan Wheels(Housed)

Airfoil[1] (in.)					
Unit sizes 003 to 035			Unit sizes 040 to 090		
Diameter	A[2] (mm)	B[3] (mm)	Diameter	A[2] (mm)	B[3] (mm)
13.22	4.56 (116)	0.21 (5.33)	20.00	7.19 (183)	0.31 (7.87)
14.56	5.06 (129)	0.21 (5.33)	22.25	7.69 (195)	0.33 (8.38)
16.18	5.62 (143)	0.21 (5.33)	24.50	8.56 (217)	0.31 (7.87)
17.69	6.90 (175)	0.22 (5.59)	27.00	9.47 (241)	0.63 (16.00)
21.56	7.59 (193)	0.24 (6.10)	30.00	10.47 (266)	0.39 (9.91)
24.00	8.45 (215)	0.23 (5.84)	33.00	11.75 (298)	0.38 (9.65)
—	—	—	36.50	325 (12.78)	0.38 (9.65)
—	—	—	40.25	363 (14.31)	0.50 (12.70)

Note:

[1]To obtain rated air performance, dimensional relationship must be held.

[2]To obtain dimension A, loosen setscrews in wheel hub(s), shiftingwheel(s) axial as needed, retightening setscrews.

[3]To obtain dimension B, loosen screw and washer fasteners around periphery of funnel(s), shifting funnel radially as required, re-torquing fasteners.

Figure 42: Wheel-to-Inlet Funnel Relationship—Forward Curved Fan Wheels

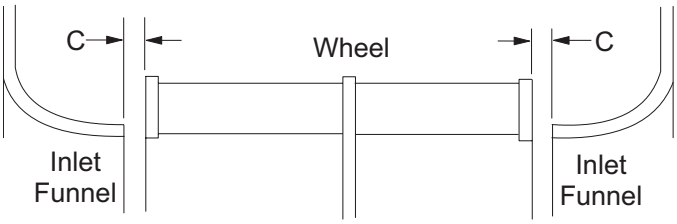


Figure 43: Wheel-to-Inlet Funnel Relationship—Forward Curved Fan Wheels

Forward Curved[1] (in.)			
Unit sizes 003 to 035		Unit sizes 040 to 090	
Diameter	C[2] (mm)	Diameter C[2] (mm)	
9×4	0.25 (6.35)	20 (Class 1 & 2)	0.24 (6.10)
9×7	0.13 (3.30)	22.38 (Class 1 & 2)	0.41 (10.41)
9×9	0.25 (6.35)	25 (Class 1 & 2)	0.47 (11.94)
10	0.22 (5.59)	27.62 (Class 1 & 2)	0.47 (11.94)
12	0.35 (8.89)	30 (Class 1 & 2)	0.47 (11.94)
15	0.44 (11.18)	33 (Class 1 & 2)	0.50 (12.70)
18	0.25 (6.35)	36 (Class 1 & 2)	0.75 (19.05)
20 (Class 1 & 2)	0.73 (8.54)	—	—
22½ (Class 1 & 2)	0.59 (14.99)	—	—
24½ (Class 1 & 2)	0.56 (14.22)	—	—

Note:
[1]To obtain rated air performance, dimensional relationship must be vibration. If retensioning is necessary, be certain to retain held.
[2]Adjust dimension C by loosening wheel hub setscrews, shifting sheave alignment wheel(s) axial as needed, and retightening setscrews.

Figure 44: Wheel-to-Inlet Funnel Relationship— 13 to 36 Belt-Drive Plenum Fans

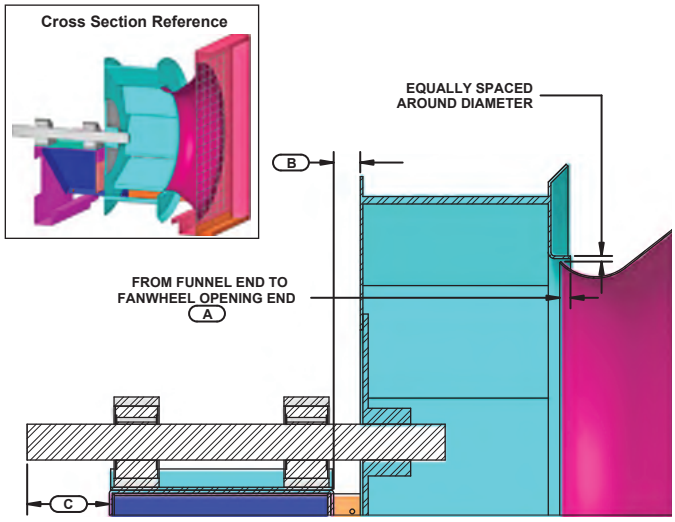


Table 8: Wheel-to-Inlet Funnel Relationship— 13 to 36 Belt-Drive Plenum Fan

Wheel-Funnel Parameters			
Size	**A**	**B**	**C**
13	0.25	0.91	3.50
15	0.25	0.91	3.50
16	0.25	0.91	3.50
18	0.38	0.86	3.88
20	0.42	1.11	3.88
22	0.45	1.11	3.88
24	0.51	1.11	3.88
27	0.55	1.36	4.50
30	0.62	1.36	4.50
33	0.55	1.50	5.00
36	0.63	1.50	5.00

Figure 45: Wheel-to-Inlet Funnel Relationship— 40 to 60 Belt-Drive Plenum Fans

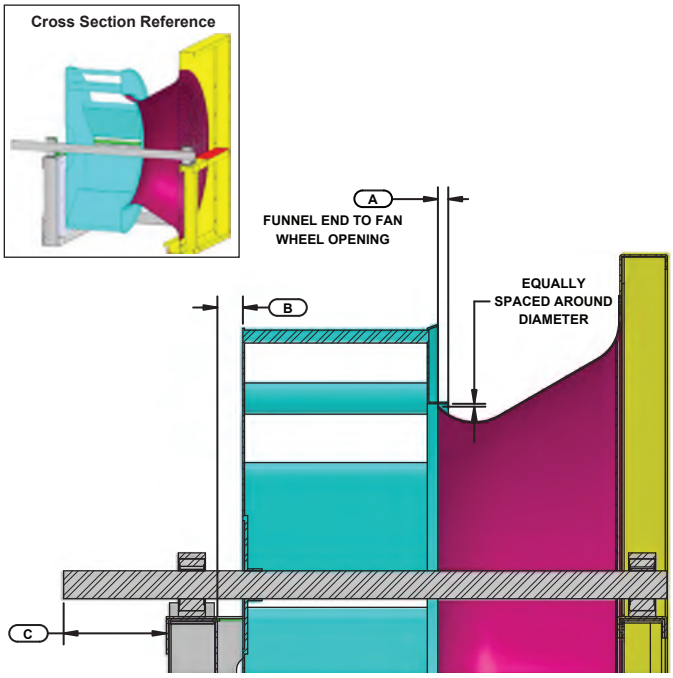


Table 9: Wheel-to-Inlet Funnel Relationship— 40 to 60 Belt-Drive Plenum Fan

Wheel-Funnel Parameters			
Size	**A**	**B**	**C**
40	0.82	2.00	4.88
44	0.91	2.25	5.50
49	1.00	2.50	5.50
54	1.10	2.50	5.50
60	1.23	3.00	5.50

Setscrews on MPQ fan wheels must be installed using a calibrated torque wrench to the value listed below, ±5%.The fasteners must be periodically checked to satisfy agency requirements for components on rotating machinery.

Figure 46: Fan Wheel Rotation

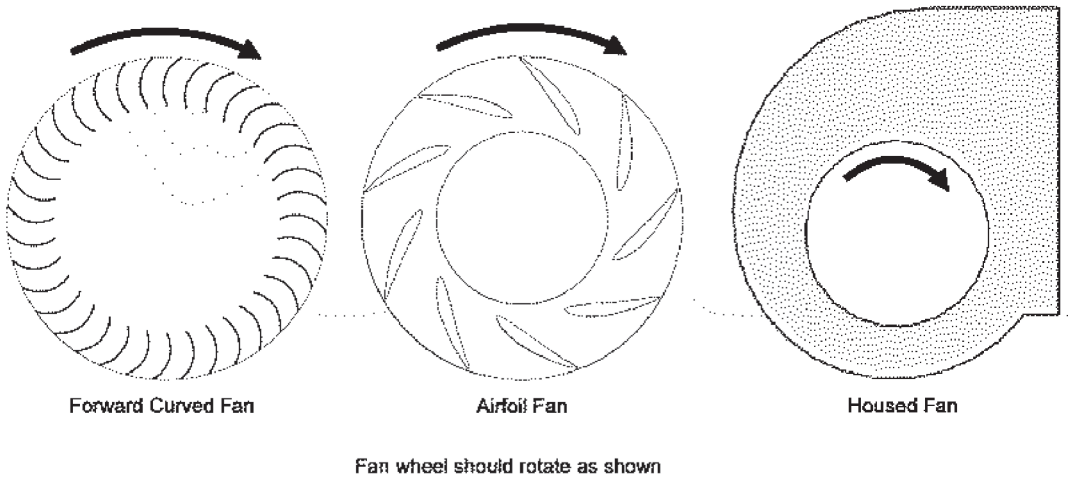


Figure 47: Wheel-to-Inlet Funnel Relationship—Inline Fans Overlap

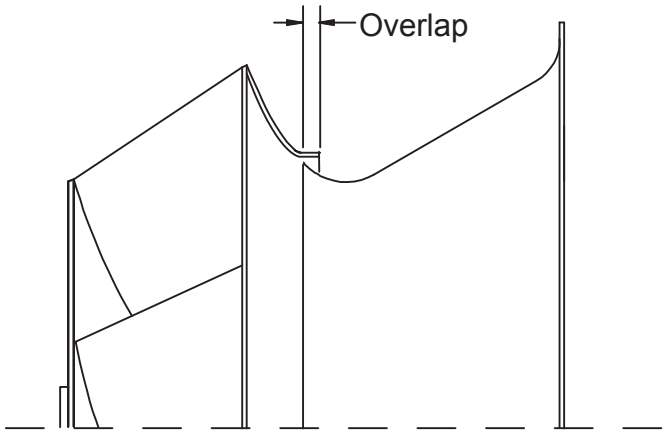


Table 10: Wheel-to-Inlet Funnel Relationship—Inline Fans

Wheel—Funnel Overlap	
Size	**Overlap**
150	.375
165	.438
182	.562
200	.625
222	.688
245	.750
270	.812
300	.875
330	1.000
365	1.125
402	1.250
445	1.375

Table 11: Wheel-to-Inlet Funnel Relationship—Direct-Drive Fans Only Class II fans

Fan Size	Overlap (in.)
11	0.25
12	0.25
15	0.25
16	0.38
18	0.38
20	0.41
22	0.45
24	0.50
27	0.55
30	0.61
33	0.67
36	0.75
40	0.82
44	0.91

Table 12: Wheel-to-Inlet Funnel Relationship—Direct-Drive Class III fans

Fan Size	Overlap (in.)
13	0.12
15	0.19
16	0.25
18	0.31
20	0.38
22	0.44
24	0.50
27	0.56
30	0.62
33	0.75
36	0.81
40	0.88
44	0.94
49	1.0
54	1.06
60	1.12

Table 13: Setscrew Torque Specifications—Class II Plenum

Fan Size	Setscrew Size	Torque (ft.-lb)	
		Aluminum	Steel
11/12/13	3/8	19.2	N/A
15	3/8	19.2	N/A
16	3/8	19.2	N/A
18	3/8	19.2	N/A
20	3/8	19.2	N/A
22	3/8	19.2	N/A
24	3/8	19.2	N/A
27	3/8	19.2	22
30	1/2	41.7	55
33	1/2	41.7	55
36	1/2	41.7	55
40	1/2	41.7	55
44	1/2	41.7	55
49	1/2	41.7	55
54	1/2	41.7	55
60	3/4	115	150

Table 14: Bearing Collar and Wheel Hub Set Screw Torque (All Fans Except Class II Plenum Fans)

Set Screw Diameter (in)	Minimum torque ft/lbs (kg/m)
1/4	5.5 (0.76)
1/16	10.5 (1.45)
3/8	19.0 (2.63)
7/16	29.0 (4.01)
1/2	42.0 (5.81)
5/8	92.0 (12.72)

Fan Array

The Daikin Fan Array is available with optional, factory mounted VFDs. See OM manuals OM 1190 and 1191 for details on the Daikin supplied VFD.

Care should be taken when programing and synchronizing the drives in the Daikin Fan Array such that all fans turn at the same speed. Fans running at unequal speeds can produce vibration and could stall a fan. Definition of fan numbering is given in Figure 48.

The Daikin Fan Array is standard with a manual block off plate. The unit will ship with one block off plate that will come installed on fan 1A. This block off plate is to be removed before unit operation and stored outside of the air tunnel. In the event of a lost fan motor, the block off plate is installed on the non-functional fan to prevent air re-circulation. This is designed to be a temporary measure unit this fan and/or motor is replaced. After fan and/or motor replacement the block off plate is to be removed and stored outside of the air tunnel.

The Daikin Fan Array has an optional gravity actuated block off damper. These dampers are equipped with counter weights.

The Daikin Fan Array has an optional actuated block off damper. These dampers are designed to prevent air recirculation in the event of a lost fan. Care should be taken that the damper actuator only be given a close signal if the fan is not operational (motor burnout for example).

The Daikin Fan Array can be equipped with a fan blank off plate. See Figure 49 with a block off plate mounted to fan 3C. If the unit is ordered with the manual block off plate, it will be installed to fan 1A. This plate has to be removed before start up.

⚠ WARNING

Closing the damper on an operational fan could send the fan into surge that could produce fans stall, excessive vibration, unit damage, or personnel injury.

Figure 48: Daikin Fan Array Configuration

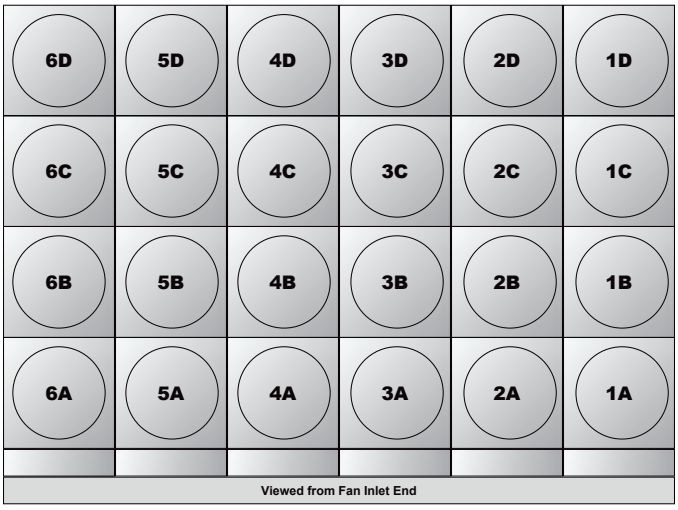
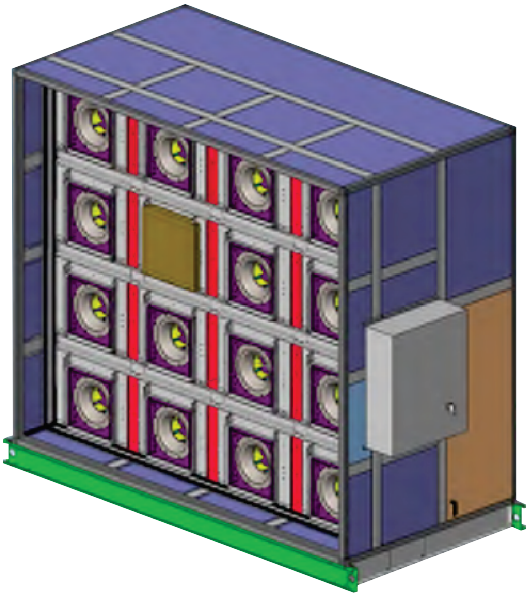


Figure 49: Fan Array with Block Off Plate



Optional Piezometer Ring Airflow Measurement Device

Piezometer rings are available as an option on direct drive plenum fans to measure airflow though the fan. The device consists of a piezometer ring mounted in the throat of the funnel and a static pressure tap mounted near the inlet of the funnel. The pressure drop is measured from the tap located near the inlet of the funnel to the piezometer ring in the throat. The inlet tap is connected to the high-pressure side of the transducer and the piezometer ring is connected to the low-pressure side.

Below are the equations and factors required to calculate flow using the piezometer ring:

Non-Standard Density Method

The following equation is used to measure the flow for non-standard density:

ACFM = C1 × A × √(ΔP/ρ)

where: A = Inlet funnel throat area (square feet) - from Table 2

ΔP = The differential in static pressure from the piezometer ring and the inlet pressure tap (inches w.g.)

ρ = Air density (pounds mass/cubic foot)

C1 = Value from Table 1 below

Standard Density Method

The equation can be simplified by assuming standard density and assuming funnel dimensions match the drawing dimensions. Table 16 shows the factor (F) for each fan size and type. The equation then becomes the following:

For standard air (ρ = 0.075 lb/ft3):

ACFM = F × √ (ΔP)

where: F = factor from Table 2

ΔP = The differential in static pressure from the piezometer ring and the front pressure tap (inches w.g.)

Table 15: DDPL Factors For Free and Ducted Inlet—Non Standard Density Method

Product	C1 Free Inlet	C1 Ducted Inlet
DDPL Size 11-16	753.06	794.06
DDPL Size 18-44	692.03	740.14

Table 16: DDPL Factors For Free and Ducted Inlet—Standard Density Method

DDPL Size	Free Inlet F	Ducted Inlet F	Area A
11 and 12	944.92	996.36	0.344
15	1206.40	1272.08	0.439
16	1518.58	1601.26	0.552
18	1821.92	1948.58	0.721
20	2185.80	2337.76	0.865
22	2713.93	2902.60	1.074
24	3285.02	3513.39	1.300
27	3997.61	4275.53	1.582
30	4945.21	5289.01	1.957
33	5968.62	6383.56	2.362
36	7290.21	7797.03	2.885
40	8869.55	9486.16	3.510
44	10827.92	11580.68	4.285

Optional Transducer for Piezometer Rings

A transducer is available for Piezometer rings. Factory mounting locations for the fan transducer is shown in Figure 50 for direct-drive plenum fans. Figure 51 shows the installation for fan array. Wiring for the transducer is field-supplied and installed.

Figure 50: Direct-drive Plenum Fan Installation

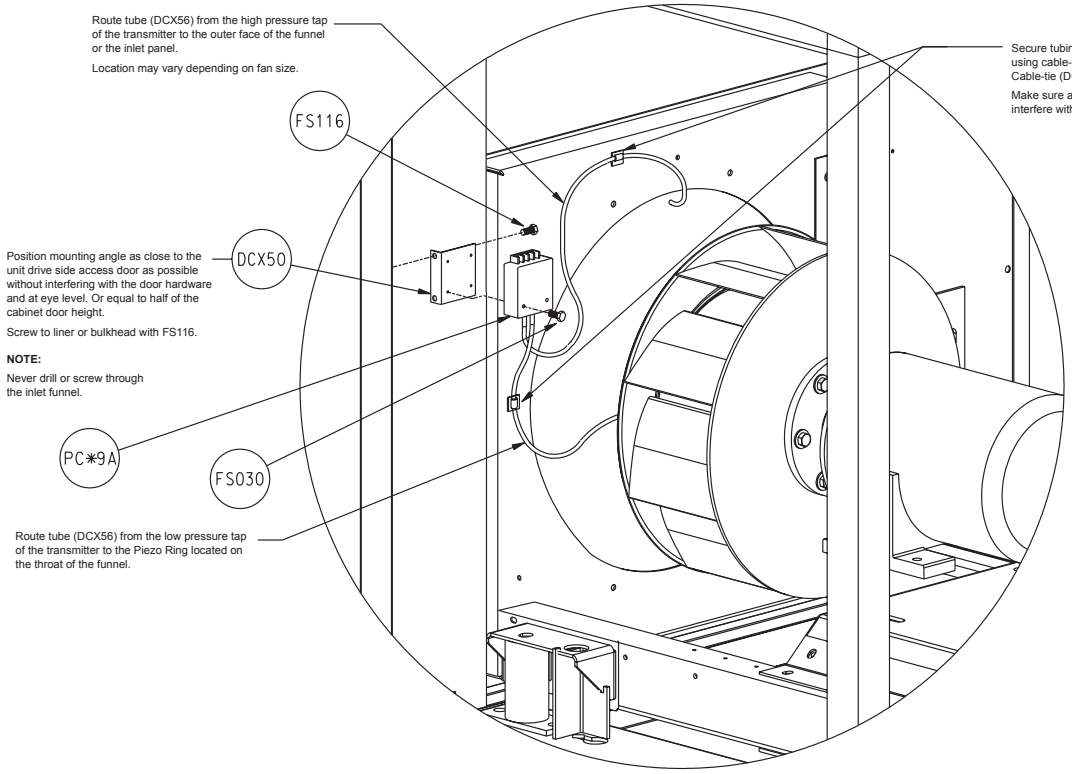
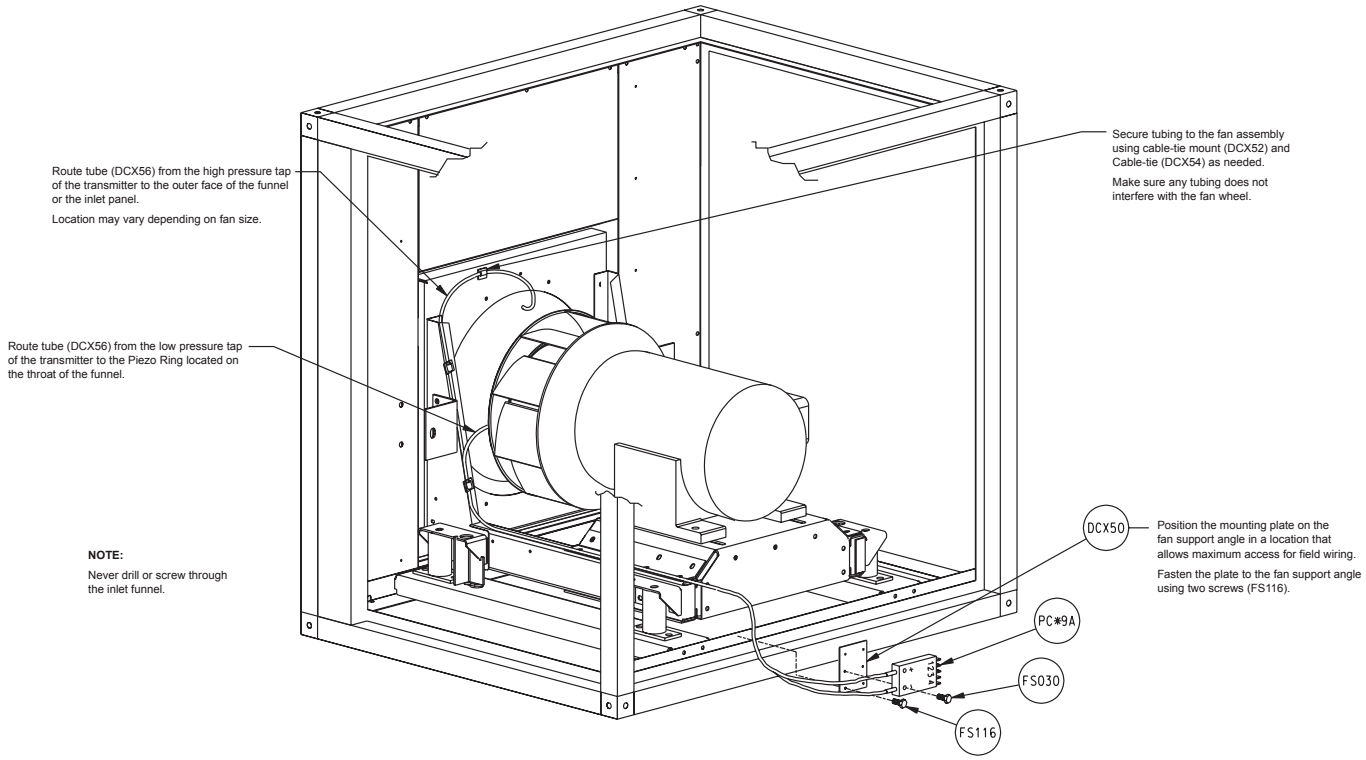


Figure 51: Fan Array Installation



Operating Limits

Do not exceed the operating limits in Table 17 through Table 21. A fan wheel operated beyond the rpm and temperature limits shown can suffer permanent distortion or fracture. The resulting unbalance can cause severe unit vibration.

Table 17: Fan Operating Limits—Unit Sizes 003 to 035

Forward Curved—Housed										
Diameter	9×4	9×7	9×9	10.62	12.62	15	18	20	22.25	24.50
Max. RPM Class I	N/A	2189	2223	1934	1614	1328	1155	1050	944	858
Max. RPM Class II	2244	2854	2896	2518	2091	1725	1450	1200	1030	910

Airfoil—Housed					
13.22	14.56	16.19	19.69	21.56	24.00
3000	3000	2300	2000	1700	1500
4335	3918	3457	2858	2427	2255

Table 18: Fan Operating Limits—Unit Sizes 040–090

Forward Curved—Housed							
Diameter	20	22.38	25	27.62	30.25	33	36
Max. RPM Class I	1010	930	790	690	650	600	560
Max. RPM Class II	1281	1178	1011	910	835	763	715

Airfoil—Housed						
20	22.25	24.5	27	30	33	36.5
2077	1875	1691	1479	1328	1209	1073
2703	2413	2199	1928	1730	1579	1401

Table 19: Fan Operating Limits—Belt-Drive Plenum Fans

Belt-Drive Plenum fans																
Size	13	15	16	18	20	22	24	27	30	33	36	40	44	49	54	60
Max. RPM Class II	3909	3468	2820	2930	2674	2403	2183	1860	1783	1620	1465	1329	1202	1091	986	891
Max. RPM Class III	4000	4000	3887	3735	3409	3065	2780	2423	2182	1984	1759	1598	1447	1314	1178	1071

Table 20: Fan Operating Limits—Direct-Drive Plenum Fans

Direct-Drive Plenum Fans																		
Size	11	12	13	15	16	18	20	22	24	27	30	33	36	40	44	49	54	60
Max. RPM Class II	4000	4000	—	3909	3650	3650	2674	2403	2183	1981	1783	1620	1465	1329	1202	—	—	—
Max. RPM Class III	—	—	4000	4000	3887	3735	3409	3065	2780	2423	2182	1984	1759	1598	1447	1314	1178	1071

Table 21: Fan Operating Limits—Inline Fans, Twin Fans

Inline Fans/Twin Fans												
Diameter	18.25	20	22.25	24.5	27	30	33	36.5	40.25	44.50	49	54.25
Max. RPM Class I	2727	2488	2236	2041	1835	1665	1476	1330	1208	1072	973	880
Max. RPM Class II	3409	3111	2796	2551	2294	2082	1846	1662	1510	1340	1216	1100

Twin Fans						
Diameter	9×9	10.62	12.62	15	18.12	20
Max. RPM	2575	2400	2000	1700	1400	1200
Max. HP	10	15	15	30	40	40

Fan Vibration Levels

Each unit as shipped is trim balanced to operate smoothly. To provide satisfactory operation after shipping and installation, use the accepted industry guidelines for field balancing fans. See Table 22.

Table 22: Vibration Levels

Fan Speed (RPM)	Vibration
800 or less	5 mils maximum displacement
801 or greater	0.20 in/sec. maximum velocity

Note:
Excessive vibration from any cause contributes to premature fan and motor bearing failure. Monitor overall vibration levels every six months of operation. An increase in levels is an indication of potential trouble.

Vibration Causes

1. Wheel imbalance.
   a. Dirt or debris on wheel blades.
   b. Loose set screws in wheel hub or bearing-to-shaft.
   c. Wheel distorted from overspeed.
2. Bent shaft.
3. Drive faulty.
   a. Variable pitch sheaves—axial and radial runout of flanges; uneven groove spacing; out of balance. Also similar faults in driven sheave.
   b. Bad V-belts; lumpy, or mismatched; belt tension too tight or too loose.
4. Bad bearings, loose bearing hold-down bolts.
5. Motor imbalance.
6. Fan section not supported evenly on foundation.

Periodic Maintenance

1. Check all moving parts for wear every six months.
2. Check bearing collar, sheave, and wheel hub setscrews, sheave capscrews, and bearing hold-down bolts for tightness every six months.
3. Annually check and snug all electrical connections. Inspect for signs of water damage such as corrosion and repair if necessary. Check ground conductor and connection integrity and correct if needed.

Ball Bearing Lubrication

⚠ CAUTION

Bearing overheating potential. Can damage the equipment. Do not over lubricate bearings. Use only a high grade mineral grease with a 200°F safe operating temperature. See below for specific recommended lubricants.

Motor Bearings

Supply and return fans—Supply and return fan motors should have grease added after every 2000 hours of operation. Using the following procedure, re-lubricate the bearings while the motor is warm, but not running. Use one of the greases shown in Table 23.

1. Remove and clean upper and lower grease plugs.
2. Insert a grease fitting into the upper hole and add clean grease (Table 23) with a low pressure gun.
3. Run the motor for five minutes before replacing the plugs.

NOTE: Direct-Drive Class II fans that are supplied with TECO motors have double shielded bearings on frame sizes 140T-280T. These bearings are pre-packed with a long life grease and are not regreaseable. Larger frame size TECO motors are regreaseable and follow the same lubrication recommendations as all other motors.

Table 23: Recommended Lubricants and Amounts for Fan Motor Bearings

Manufacturers' Grease	NEMA Size	Amount to Add (oz.)
Texaco, Polystar or Polyrex EM (Exxon Mobile) or Rykon Premium #2 or Penzoil Pen 2 Lube	56 to 140	0.08
	140	0.15
	180	0.19
	210	0.30
	250	0.47
	280	0.61
	320	0.76
	360	0.81
	400	1.25
	440	2.12

NOTE: Specific greasing instructions are located on a tag attached to the motor. If special lubrication instructions are on the motor, they supersede all other instructions.

Fan Shaft Bearings

⚠ CAUTION

For safety, stop rotating quipment. Add one half of the recommended amount shown in Figure 24. Start bearing, and run for a few minu Stop bearing and add the second half of the recommended amount. A temperature rise, sometimes 30°F (1°C after lubrication is normal. Bearing should operate at tempe ature less than 200°F (94°C) and should not exceed 225 (107°C) for intermittent operation. For a lubrication schedule, see Table 22. For applications that are not in the range of the table, contact Daikin.

⚠ CAUTION

Table 24, Table 25 and Table 26 state general lubrication recommendations based on our experience and are intended as suggested or starting points only. For best results, specific applications should be monitored regularly and lubrication intervals and amounts adjusted accordingly.

Any good quality lithium or lithium complex base grease, using mineral oil, conforming to NLGI grade 2 consistency, and an oil viscosity of 455-1135 SUS at 100°F (100-200 cSt at 40°C) may be used for re-lubrication.

Compatibility of grease is critical. Lubricatable bearings are supplied with grease fittings or zerks for ease of lubrication with hand or automatic grease guns. Always wipe the fitting and grease nozzle clean.

Table 24: Lubrication Intervals

Speed	Bearing Temperature	Cleanliness	Lubrication Intervals
(Use NLGI #2 Lithium or Lithium Complex Grease)			
100 RPM	Up to 120°F (50°C)	Clean	6 to 12 months
500 RPM	Up to 150°F (65°C)	Clean	2 to 6 months
1000 RPM	Up to 210°F (100°C)	Clean	2 weeks to 2 months
1500 RPM	Over 210°F (100°C) to 250°F (120°C)	Clean	Weekly
Above 1500 RPM	Up to 150°F (65°C)	Dirty/Wet	1 week to 1 month
Max Catalog Rating	Over 150°F (65°C) to 250°F (120°C)	Dirty/Wet	Daily to 2 weeks
	Above 250°F (120°C)		Contact Browning

Table 25: Recommended Lubricants for Fan Shaft Ball Bearings

Name	Temperature	Base	Thickener	NLGI Grade
Texaco, Premium RB	30° to 350°F (34° to 177°C)	Parafinic Mineral Oil	Lithium	2
Mobil, AW2	40° to 437°F (40° to 175°C)	Mineral Oil	Lithium	2
Mobil, SHC 100	68° to 356°F (50° to 180°C)	Synthetic	Lithium	2
Chevron, Altiplex Synthetic	60° to 450°F (51° to 232°C)	Synthetic	Lithium	2
Exxon, Ronex MP	40° to 300°F (40° to 149°C)	Mineral Oil	Lithium	2

Note:
Temperature ranges over 225°F are shown for lubricants only. High temperature applications are not suitable for standard air handler components.

Table 26: Recommended Fan Lubrication Grease Charge

Shaft Size in Inches (mm)	Weight in Ounces (grams)
1/2 to 3/4 (20)	0.03 (0.85)
7/8 to 1-3/16 (25-30)	0.10 (2.84)
1-1/4 to 1-1/2 (35-40)	0.15 (4.25)
1-11/16 to 1-15/16 (45-50)	0.20 (5.67)
2 to 2-7/16 (55-60)	0.30 (8.51)
2-1/2 to 2-15/16 (65-70)	0.50 (15.59)
3 to 3-7/16 (75-80)	0.85 (24.10)
3-1/2 to 4 (85-105)	1.50 (42.53)

Fan Drive Adjustments

⚠ WARNING

Before servicing fans, lock out and tag out all power to the unit. Fans or belts can cause severe personal injury or death.

⚠ WARNING

Do not open the hinged access door and screw-fastenerd access panels while the unit is operating. Moving parts and strong suction forces can cause severe personal injury or death.

Upon completion of the air balance, replace the variable pitched motor sheave with a properly sized, fixed sheave. A matching fixed sheave provides longer belt and bearing life and minimizes vibration. Initially, it is best to have a variable pitched motor sheave for the purpose of air balancing. Once the balance is achieved, fixed sheaves maintain balancing and alignment more effectively. Replace the adjustable sheaves with fixed sheaves.

With the electrical power disconnected, locked and tagged out, measure the diameter of the V-belt outer surface where it passes around the sheave (pitch diameter). Calculate fan speed from the motor nameplate rpm.

$$\text{Fan RPM} = \text{motor RPM} \times \frac{\text{Measured diameter at motor sheave}}{\text{Measured diameter at fan sheave}}$$

VM/VP Variable Pitch Key Type Sheaves

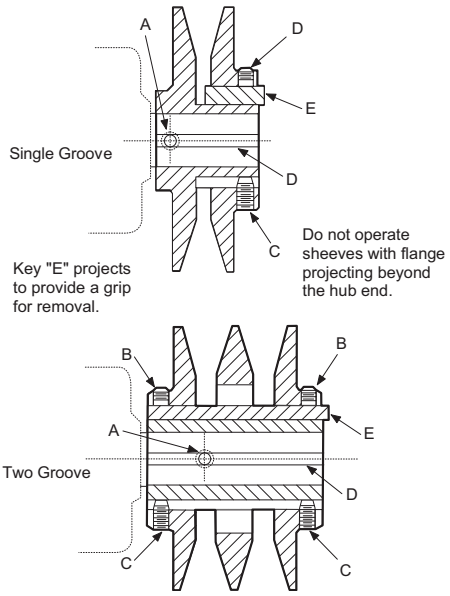
Mounting:

1. Mount all sheaves on the motor or driving shaft with the setscrews **A** toward the motor.
2. Verify that both driving and driven sheaves are in alignment and that shafts are parallel.
3. Fit internal key **D** between sheave and shaft and lock setscrew **A** securely in place.

Adjusting:

1. Loosen setscrews **B** and **C** in moving parts of sheave and pull out external key **E**. (This key projects a small amount to provide a grip for removing.)
2. To adjust sheave pitch diameter for desired speed, open moving parts by half or full turns from closed position. **Do not open more than five full turns for A belts or six full turns for B belts.**
3. Replace external key **E** and securely tighten setscrews **B** over key and setscrews **C** into keyway in fixed half of the sheave.
4. Put on belts and adjust tension. **Do not force belts over grooves.** See Fan Drive Belt on page 42.
5. Make future adjustments by loosening the belt tension and increasing or decreasing the pitch diameter of the sheave by half or full turns as required. Readjust belt tension before starting drive.
6. To provide the same pitch diameter, adjust both halves of the two-groove sheaves by the same number of turns from closed position.
7. Verify that all keys are in place and that all se screws are tight before starting drive. Check setscrews and belt tension after 24 hours service.

Figure 52: VP Type Sheave Adjustment



LVP Variable Speed Sheaves

Mounting:

1. Slide sheave on motor shaft so that the side of the sheave with setscrew **A** is next to the motor when setscrew **A** is in the hub or barrel of the sheave.
2. When setscrew **A** is at an angle in the center flange **B**, mount it away from the motor so that the outer locking ring and flange can be removed to get to the setscrew.
3. To remove the flange and locking ring:
   a. Loosen setscrews **D**.
   b. Loosen but do not remove capscrews **E**.
   c. Remove key **F**.

NOTE: This key projects a small amount to provide a grip for removing.

   d. Rotate the flange counterclockwise until it disengages the threads on the sheave barrel.
4. Verify that the driving and driven sheaves are in alignment and the shafts are parallel. When aligning two-groove sheaves, allow room between the sheave and motor to access capscrews **E**.
5. Insert key **C** between the sheave and the shaft and tighten setscrew **A** securely.
6. If flange and locking ring have been removed, when replacing them make sure that the inner and outer flanges are open from the closed position by the same amount as the other flange. Determine this by accurately measuring the top width of the grooves.
7. Insert key **F**.
8. Tighten setscrews **D** and capscrews **E**.
9. Put on belts and adjust belt tension. Do not force belts over grooves. See Fan Drive Belt.
10. Before starting the drive, ensure that all keys are in place and all setscrews and all capscrews are tight. Check and retighten all screws and retension belts after approximately 24 hours of service.

Adjusting:

1. Slack off belt tension if belts have been installed.
2. Loosen setscrews **D**.
3. Loosen but do not remove capscrews **E**.
4. Remove key **F**.

NOTE: This key projects a small amount providing a grip for removing.

5. Adjust pitch diameter by opening or closing the movable flanges by half or full turns.

NOTE: Two-groove sheaves are supplied with both grooves set at the same pitch diameter. To provide the same pitch diameter for satisfactory operation, move both movable flanges the same number of turns. Do not open sheaves more than five turns for A belts or six turns for B belts.

6. Replace key **F**.
7. Tighten setscrews **D** and capscrews **E**
8. If belts have been installed, readjust belt tension. If belts have not been installed, install them and adjust belt tension. **Do not force belts over grooves.** See Fan Drive Belt on page 42.
9. Before starting the drive, ensure that all keys are in place and all setscrews and all capscrews are tight. Check and retighten all screws and retension belts after approximately 24 hours of operation.
10. Replace variable speed sheaves for 15 hp motors and greater with a fixed pitch sheave after air balancing to maintain fan balance integrity. Fixed sheaves furnished by others.

MVP Variable Speed Sheaves

Mounting:

1. Verify both driving and driven sheaves are in alignment and the shafts are parallel. The centerline of the driving sheave must be in line with the centerline of the driven sheave (Figure 54).
2. Verify that all setscrews are torqued to the values shown in Table 27 before starting drive. Check setscrew torque and belt tension after 24 hours of service.

Adjusting:

1. Adjust motor base forward to release belt tension. Remove the belts for easier adjustment.
2. Loosen, but do not remove both of the locking setscrews **A** in the outer locking ring by using a hex key or torque wrench with a hex bit.
3. Adjust sheave to desired pitch diameter by turning the outer locking ring, using a spanner wrench or drift inserted into the three holes that are located 120° apart on the ring.
4. Any pitch diameter can be obtained within the sheave range. One complete turn of the outer locking ring changes the pitch diameter 0.233".
5. Do not open sheaves more than the following
   a. Do not open **B** sheaves more than 4-3/4 turns for the **A** belts or 6 turns for the **B** belts.
   b. Do not open **C** sheaves more than 9-1/2 turns.
   c. Do not open **5V** sheaves more than 6 turns.
   d. Do not open **8V** sheaves more than 8 turns.
6. Tighten BOTH locking screws **A** in the outer locking ring before operating the drive. Use a torque wrench and tighten to the value shown in Table 27.
7. Replace belts and adjust the motor base to tension the belts properly. See Fan Drive Belt on page 42.
8. Do not loosen any screws other than the two locking screws **A** in the outer locking ring when adjusting the sheave pitch. Do not operate the drive until the locking screws have been set to the torque specifications.

Figure 53: LVP Type Sheave Adjustment

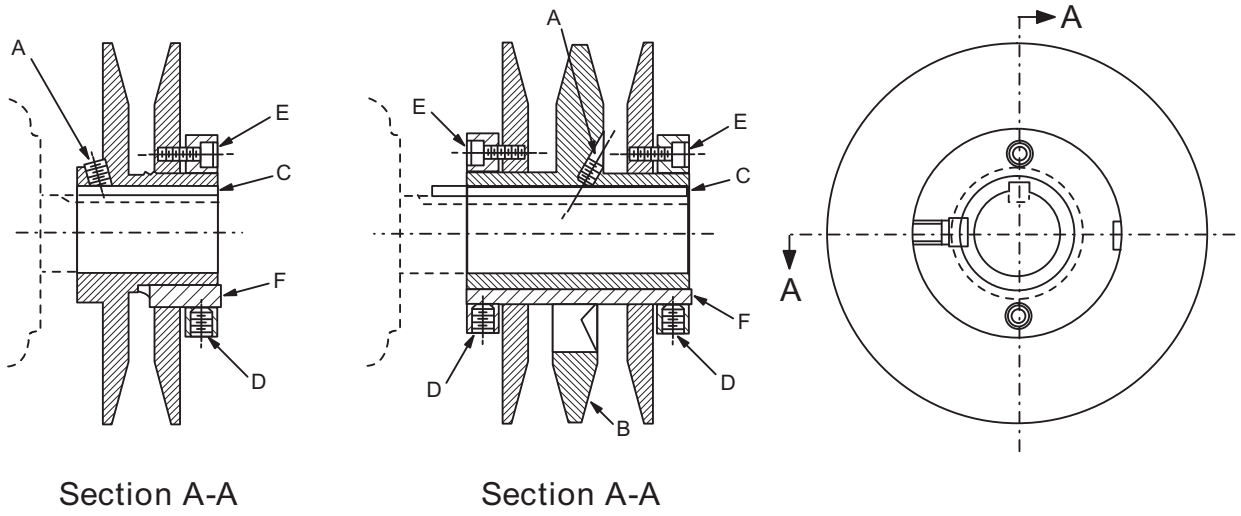
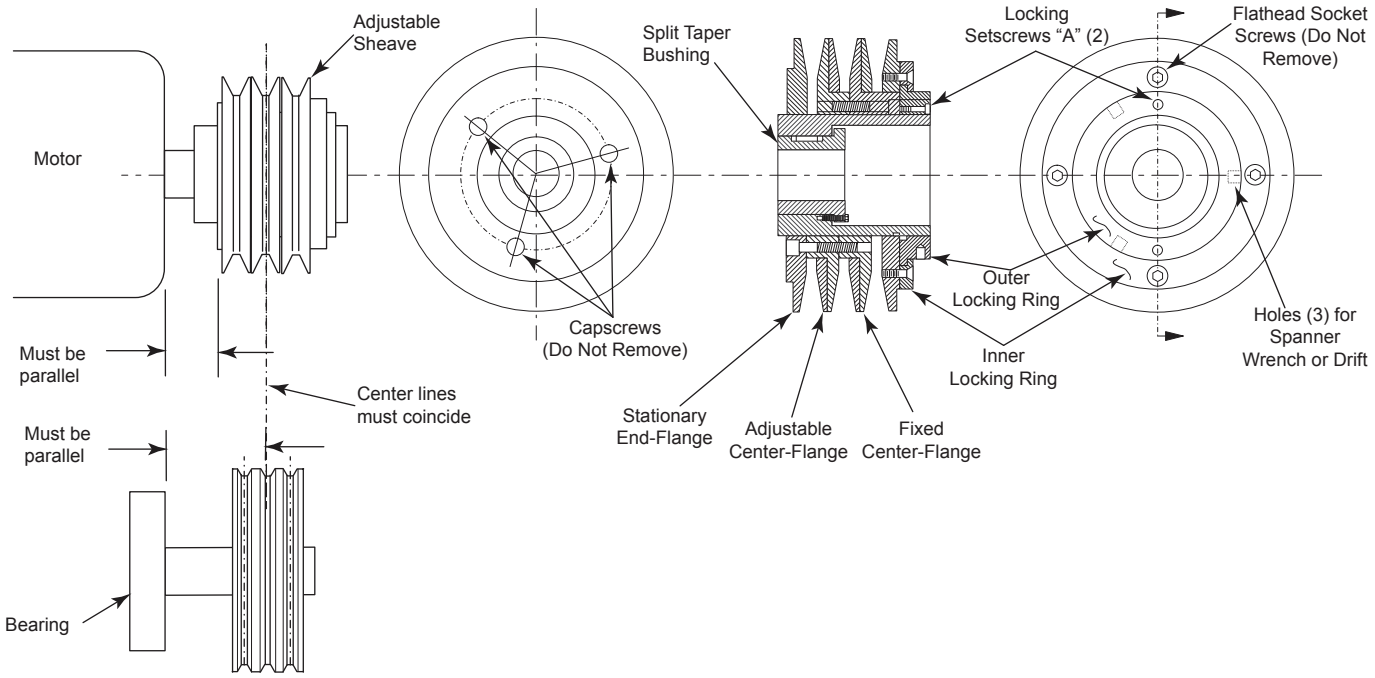


Table 27: Screw Torque Values

Nominal Screw Size (dia–thds/in)	Socket Head Cap Screws		Flat Head Socket Screws	Hollow Head Set Screws Only			
	Seating Torque		Seating Torque	Lengths Equal or Greater Than Dia.		For Lengths (L) Less Than Dia.	
				Seating Torque	Seating Torque	Length (L)	Seating Torque
	(in–lbs)	(in–lbs)	(in–lbs)	(in–lbs)	(in–lbs)	(in)	(in–lbs)
1/4–20NC	150	12.5	100	87	7.3	3/16	50
5/16–11NC	305	25.4	200	165	13.8	1/4	90
3/8–16NC	545	45.4	350	290	24.2	1/4, 5/16	150, 250
1/2–13NC	1300	108.3	N/A	620	51.7	N/A	N/A
5/8–11NC	N/A	N/A	N/A	1225	102.1	N/A	N/A

Figure 54: MVP Sheave Adjustment



Fan Drive Belt

General Rules of Tensioning

1. The ideal tension is the lowest tension at which the belt does not slip under peak load conditions.
2. Check tension frequently during the first 24 to 48 hours of operation.
3. Over tensioning shortens belt and bearing life.
4. Keep belts free from foreign material that can cause slippage.
5. Inspect V-drive on a periodic basis. Adjust tension if the belt is slipping. Do not apply belt dressing. This can damage the belt and cause early failure.

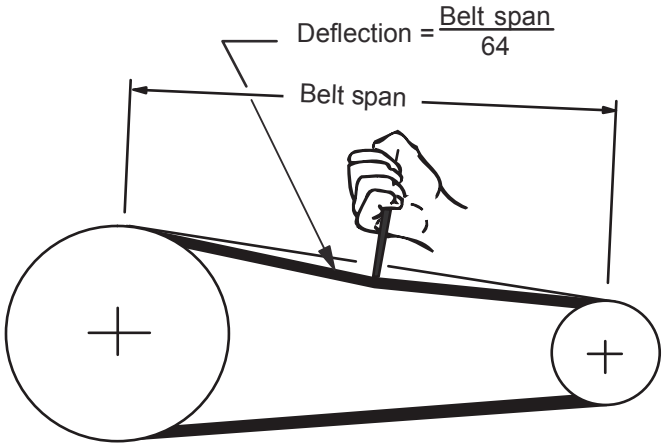
Tension Measurement Procedure

1. Measure the belt span (Figure 55).
2. Place belt tension checker squarely on one belt at the center of the belt span. Apply force to the checker, perpendicular to the belt span, until the belt deflection equals belt span distance divided by 64. Determine the force applied while in this position.
3. Compare this force to the values in Table 28.

Table 28: Belt Deflection Force (per Browning Specifications)

Cross Section	Small Sheave Diameter (in)	Number of Belts (Deflection Force lbs)					
		1		2		3 +	
		Min	Max	Min	Max	Min	Max
A, AX	0.0 to 3.5	3.0	5.0	2.5	4.0	2.0	3.5
	3.6 to 4.4	3.5	5.0	3.0	4.5	2.0	4.0
	4.5 +	4.0	5.5	3.0	5.0	2.5	4.5
B, BX	0.0 to 5.4	5.5	8.0	4.5	7.0	3.5	5.5
	5.5 to 7.6	5.5	8.5	4.5	7.5	3.5	5.5
	7.7 +	6.5	9.0	5.0	8.0	4.0	6.5
5V, 5VX	0.0 to 8.5	7.0	11.0	5.5	9.0	4.0	7.0
	8.6 to 12.0	8.5	13.0	6.5	10.5	5.0	8.0
	12.1 +	10.0	15.0	7.5	11.5	5.5	9.0

Figure 55: Drive Belt Adjustment



⚠ WARNING

Moving belt and fan can cause severe personal injury or death.

During installation and filter maintenance:

- Verify that the belt and fan guards on plenum fan units are always in place.
- Lock and tag out fans to prevent accidental start up.
- Do not enter the filter compartment until the fan is completely stopped.
- Use approved equipment for reaching filters located above normal reach. Do not step on filter frames or unit components.
- Floor surfaces must be dry and free of oil or grease.

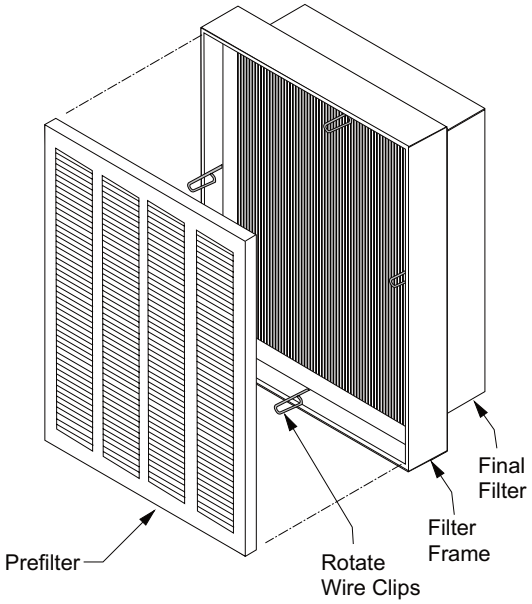
Filters

Front Load Filter Option

Front loaded filter options require that the filters be removed and replaced from inside the unit.

To remove filters, rotate the wire clips. This releases both the prefilter and the final filter. When installing clean filters, check to verify the filters are fully seated in the frame (Figure 56).

Figure 56: Frame and Filters with Holding Clips



Filter Gauges

Filter gauges indicate pressure drop for installed filters. If prefilters are present, the gauge will indicate the pressure drop for both pre- and final filters.

Table 29 shows the typical filter pressure drop for clean filters at rated air flow. The tables also show a final pressure drop for front loaded filters.

Where a single filter gauge is used, the prefilters can be removed to check the pressure drop of the final filters.

Figure 57: Filter Gauge



Table 29: Filter Pressure Drops

Bag filters—DriPak 2000				
Efficiency	45%	65%	85%	95%
Rated velocity (FPM)	625	500	500	500
Initial pressure drop	0.20–0.26	0.21–0.30	0.34–0.48	0.50–0.70
Initial pressure drop	1.0	1.0	1.0	1.0
Cartridge filters—Varicel II MH, 4.25" deep				
Efficiency	65%	85%	95%	
Rated velocity (FPM)	500	500	500	
Initial pressure drop	0.43	0.61	0.70	
Final pressure drop	1.5	1.5	1.5	
Cartridge filters—Varicel SH, 12" deep				
Efficiency	70%			
Rated velocity (FPM)	500			
Initial pressure drop	0.39			
Final pressure drop	1.2			
Pleated panel filters				
Type	Perfect pleat	AMAir 1300 4"		
Efficiency	30%	30%		
Rated Velocity (FPM)	500	625		
Initial Pressure Drop	0.36	0.36		
Final Pressure Drop	1.0	1.0		
5700 filters				
Efficiency	N/A			
Rated velocity (FPM)	500			
Initial pressure drop	0.25			
Final pressure drop	1.0			
Pleated 62 Plus filters				
Size	2"	4"		
Efficiency	70%	70%		
Initial pressure drop	0.42	0.37		
Final pressure drop	1.0	1.0		

Coils

⚠ CAUTION

Sharp fin edges are a potential injury hazard. Avoid contact with them.

1. To obtain maximum performance, the coil must be clean. Check once a year under normal operating conditions and, if dirty, brush or vacuum clean. Use a chemical coil cleaner on multiple row coils. Read and follow the chemical cleaner's instructions as some cleaners may contain harsh chemicals. Take care not to damage fins while cleaning. **CAUTION—Fin edges are sharp.**
2. Drain pans in any air conditioning unit may have some moisture. Algae, etc., can grow due to airborne spores and bacteria. Periodic cleaning is necessary to prevent this buildup from plugging the drain and causing the drain pan to overflow. Also, keep the drain pans clean to prevent the spread of disease. Cleaning should be performed by qualified personnel.
3. Dirt and lint can clog the condensate drain, especially with dirty filters. Inspect twice a year to help avoid overflow.

Winterizing Water Coils

⚠ WARNING

Mold can cause personal injury. Clean drain pan regularly so mold does not develop.

Coils can freeze due to air stratification or failure of outdoor air dampers and/or preheat controls. Drain all coils as thoroughly as possible and then treat in the following manner.

- Fill each coil independently with an antifreeze solution using a small circulating pump and again thoroughly drain.
- Check freezing point of antifreeze before proceeding to next coil. Due to a small amount of water always remaining in each coil, there is a diluting effect. The small amount of antifreeze solution remaining in the coil must always be sufficient enough to prevent freeze-up.

NOTE: Carefully read instructions for mixing antifreeze solution used. Some products have a higher freezing point in their natural state when mixed with water. Daikin is not responsible for the freezing of coils.

Removing and Replacing Components

⚠ WARNING

Before removing any component, lock out and tag out all power to the unit. Fans and belts can cause severe personal injury or death.

Removing a Side or Top Panel

1. Remove the flat head fasteners located along the sides of the panel.
2. Once all fasteners are removed, lift off the panel.

Removing a Frame Channel

Frame channels that run the length of the unit along the top can be removed to allow access to both the side and top of the unit.

1. First remove any adjoining side and top panel(s).
2. Once the side panel is off, remove the flat head fasteners in the corner of the frame channels.
3. Pull the frame channel out the side.
4. If any top panel fastens into the frame channel (when the frame channel is 24" or wider in direction of air flow), remove the fasteners in the top panel before pulling out the channel.

Removing the Fan Section

The fan shaft, motor, and any drive components can be removed and replaced through the access door opening. If required, the side panel can be removed for additional access.

If fan replacement is required, the entire fan assembly can be pulled out the side of the cabinet for housed fan assemblies. The fan assembly includes the fan housing, the bearing support, and the fan base.

1. Remove the side panels and any intermediate supports (follow instructions for side panel removal).
2. Once the panels and any intermediate supports are removed, disconnect the neoprene bulk head seal that is attached to the fan discharge.
3. Remove the four discharge angles that hold the neoprene canvas in place around the discharge opening.
4. Disconnect the fan sled from each of the corner mounts and pull the entire assembly out the side of the unit.
5. After the fan sled is out, loosen the fan bearings and pull out the shaft.
6. Disconnect the fan housing from the fan sled, and bearing support by removing the attaching bolts.
7. Replace the new fan, reconnect the shaft and bearings and put the fan assembly in the cabinet.
8. Replace panels and fasteners.

For plenum fan assemblies, the entire fan cabinet may need to be removed to replace the entire fan assembly depending on the length of the fan section. In some cases, the fan section is not long enough for the assembly to fit out the side of the cabinet. For those cases where it will fit, follow the above steps except the neoprene seal is a D-gasket on the inlet side that needs to be removed for plenum fans. Otherwise, the entire fan cabinet must be removed from the other sections and then the fan assembly can be removed out the discharge side of the cabinet.

Removing and Replacing the Coil

The coil can be removed by the side, top, or a combination of both. The size and configuration of the coil affects how the coil can be removed. Single banks of coil are fastened only on the connection side of the unit. Stacked and staggered coils are fastened on both ends of the coil. See the instructions below for details to remove each coil type.

Before removing the coil, disconnect all piping. The instructions below assume the coil is mounted in a sectionalized coil section where the frame channel can be removed without affecting other components. If the coil section is unitized with other components, removing the top frame channel requires removing additional panels.

Removing Single Coils

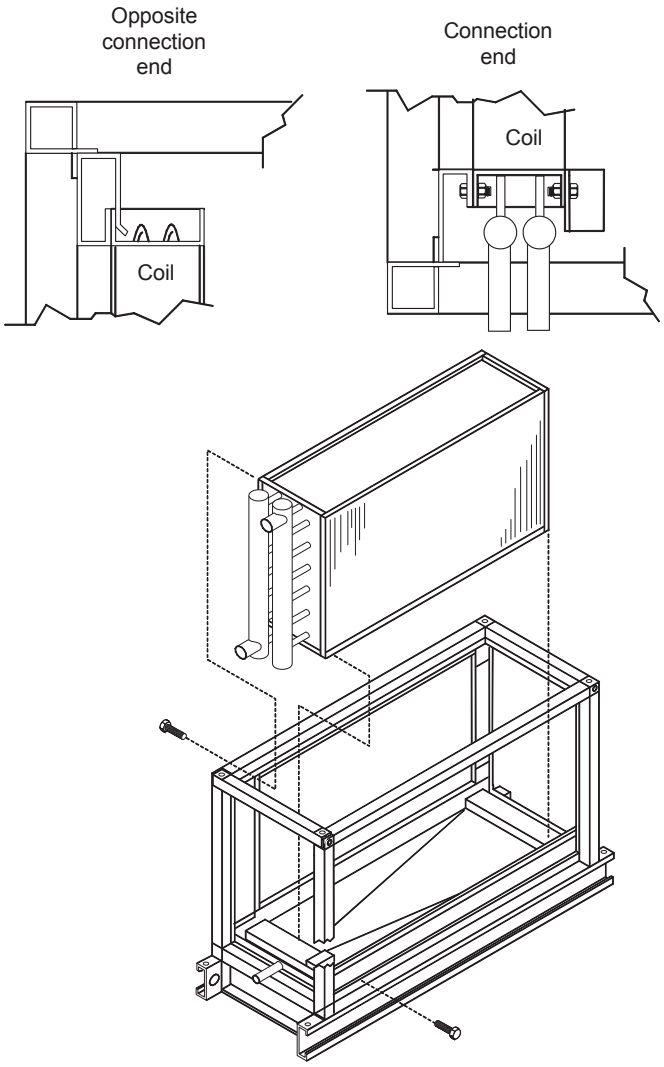
NOTE: Single coils are bolted to the unit on the connection end.The connection end is held in place with a clamp.

1. Disconnect all piping and remove the brass plugs for the vents and drains located in the connections.
2. Remove all screws and remove the access panel.
3. Remove the screws holding the coil in place.
4. Lift and pull the coil out the side.

Installing Single Coils

1. Slide the coil through the opening in the coil section onto the bottom coil rests.
2. To prevent any air bypass around the coil, place coils up against the coil bulkheads (refer to Figure 58).
3. Once the coil is in place, fasten the coil to the section.
4. Caulk the seams between the coil casings and bulkheads (refer to Figure 58).
5. If this is an additional coil being installed and not a replacement, locate the coil supply and return connections dimensionally. Carefully drill holes in the end panels of the unit.
6. Remove the brass plugs for the vents and drains on the connections.
7. Slip the panel over the connections.
8. Replace the brass plugs and panel fasteners.

Figure 58: Single Coil Removal



Removing Stacked Coils

NOTE: Top and bottom stacked coils are held together with steel plate and screws on one side and drain trough and screws on the other side. Remove the plate and trough before removing the coils. The coils cannot be removed attached together.

1. Disconnect all piping and remove the brass plugs for the vents and drains located in the connections.
2. Remove all screws and remove the access panel.
3. Remove the bolts holding the coil in place and then lift and pull out the coil from the side.
4. Remove the steel plate and the drain trough that hold the coils together.
5. Remove the bolts on both ends of the top coil holding it in place and then lift and slide the coil out.
6. Remove the bolts on both ends of the bottom coil holding it in place and then lift and slide the coil out.

Installing Stacked Coils

1. Slide the bottom coil through the opening in the coil section onto the bottom coil rests.
2. Place the coil up against the coil bulkheads to prevent any air bypass around the coil.
3. Once the coil is in place, bolt the coil to the section.
4. Caulk the mounting surface of the steel plate and install the plate on the coils.
5. Caulk the mounting surface of the drain trough and install the drain trough on the coils.
6. Caulk the seams between the coil casings and blockoffs.
7. Connect all piping and install the brass plugs for the vents and drains located in the connections.
8. Install the access panel.

Removing and Installing Staggered Coils

Staggered coils have two banks of coils positioned a few inches apart in the direction of airflow. Both coils are secured to the unit on the connection and opposite connection end of the unit.

1. Disconnect all piping and remove the brass plugs for the vents and drains located in the connections.
2. To access bolts holding the coils in place, remove the panels on both the connection and opposite connection end of the coil section.
3. Each coil is held in place with bolts located in the corners of the coil side plates. Remove the bolts and then lift and pull the coil out the side.
4. The bottom coil is fastened to the air block off plate. Remove the screws attaching this plate to the coil.
5. Once the fasteners holding the coil in place are removed, pull out the coil from either side of the unit.
6. Install the coils in reverse order of removal.

Replacement Parts

When writing to Daikin for service or replacement parts, refer to the model number and serial number of the unit stamped on the serial plate attached to the unit. If replacement parts are required, mention the date of installation of the unit and date of failure, along with an explanation of the malfunctions and a description of the replacement parts required.

Warranty

Consult your local Daikin Representative for warranty details. Refer to Form 933-430285Y. To find your local Daikin Representative, go to www.DaikinApplied.com.

Warranty Return Material Procedure

Defective material may not be returned without permission of authorized factory service personnel of Daikin in Minneapolis, Minnesota, (763) 553-5330. A “Return Goods” tag must be included with the returned material. Enter the required information to expedite handling and prompt issuance of credits. All parts must be returned to the appropriate Daikin facility, designated on the “Return Goods” tag. Transportation charges must be prepaid.

The return of the part does not constitute an order for replacement. Therefore, a purchase order must be entered through the nearest Daikin representative. The order should include part number, model number, and serial number of the unit involved.

Credit will be issued on customer’s purchase order following an inspection of the return part and upon determination that the failure is due to faulty material or workmanship during the warranty period.

Air Handling Equipment Warranty Registration Form

To comply with the terms of Daikin Applied Warranty, complete and return this form within 10 days to Daikin Applied, Warranty Department

Check, test, and start procedure for air handling units with or without heat recovery.

Job Name: _____ **Daikin Applied S.O. No.:** _____

Daikin Applied G.O. No.: _____

Installation address: _____

City: _____ **State:** _____

Purchasing contractor: _____

City: _____ **State:** _____

Name of person doing start-up (print): _____

Company name: _____

Address: _____

City/State/Zip: _____

Unit model number: _____ **Unit serial number:** _____

SF VFD model number: _____ **Serial number:** _____

RF VFD model number: _____ **Serial number:** _____

Circle Yes or No. If not applicable to the type of unit, circle N/A.

I. INITIAL CHECK

A. Is any shipping damage visible?	Yes	No	N/A
B. Are fan drives properly aligned and belts properly adjusted?	Yes	No	N/A
C. Tightened all setscrews on pulleys, bearings and fans?	Yes	No	N/A
D. Have the hold-down bolts been backed off on spring mounted fan isolators?	Yes	No	N/A
E. With the power off, do fans turn freely by hand?	Yes	No	N/A
F. Electrical service corresponds to unit nameplate?	Yes	No	N/A

Volts _____ Hertz _____ Phase _____

G. Is the main disconnect adequately fused and are fuses installed?	Yes	No	N/A
H. Are all electrical power connections tight? (Check compressor, electrical box.)	Yes	No	N/A
I. Is the condensate drain trapped?	Yes	No	N/A
J. Fill the drain pan. Does water drain freely?	Yes	No	N/A
K. Is the unit mounted level?	Yes	No	N/A

II. FAN DATA

A. Check rotation of supply fan?	Yes	No	N/A

B. Voltage at supply fan motor: 1–2_____ V 2–3 _____ V 1–3 _____ V

C. Supply fan motor amp draw per phase: L1 _____ L2 _____ L3 _____

D. Overload amp setting: _____

E. What is the supply fan rpm? _____

F. Check rotation of return fan?	Yes	No	N/A

G. Voltage at return fan motor: 1–2_____ V 2–3 _____ V 1–3 _____ V

H. Return fan motor amp draw per phase: L1 _____ L2 _____ L3 _____

I. Overload amp setting: _____

J. What is the return fan rpm? _____

K. Record supply static pressure at unit: _____ inches of H_20

L. Record return static pressure at unit (with outside air dampers closed) _____ inches of H_20

1

Air Handling Equipment Warranty Registration Form (continued)

III. DAMPERS

A. Are blades and seals present? . . . . . Yes No N/A
B. Do damper open smoothly and shut tight? . . . . . Yes No N/A

IV. ELECTRIC HEAT

A. Electrical heat service corresponds to unit nameplate? . . . . . Yes No N/A

Volts _____ Hertz _____ Phase _____

B. Are there any signs of physical damage to the electric heat coils? . . . . . Yes No N/A
C. Have all electrical terminals been tightened? . . . . . Yes No N/A
D. Does sequence controller stage contactors properly? . . . . . Yes No N/A
E. Electric heater voltage across each phase: _____ L1 _____ L2 _____ L3
F. Amp draw across each phase at each heating stage:

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Phase L1:	_____	_____	_____	_____	_____	_____
Phase L2:	_____	_____	_____	_____	_____	_____
Phase L3	_____	_____	_____	_____	_____	_____

G. FLA: L1 _____ L2_____ L3 _____
H. Operate electric heat with fans off. Electric heat must cycle on high limit control . . . . . Yes No N/A

V. CHILLED WATER

A. Pressure test OK? . . . . . Yes No N/A
B. Drain pan draining OK? Yes No N/A

VI. HOT WATER COIL

A. Pressure test OK? . . . . . Yes No N/A

VI. HEAT RECOVERY

A. Heat wheel rotates freely? . . . . . Yes No N/A
B. Heat wheel VFD operates properly? . . . . . Yes No N/A
C. Heat wheel VFD: Model # _____ Serial # _____
D. Check for air bypass around heat wheel. . . . . Yes No N/A

Comments:

Performed by: _____ **Title:** _____

Signature: _____ **Date of start-up:** _____

Return completed form by mail to:

Daikin Applied Warranty Department
13600 Industrial Park Boulevard
Minneapolis, MN 55441

or by email to:

AAH.Wty_WAR_forms@DaikinApplied.com

Please list any additional comments that could affect the operation of this unit; e.g., shipping damage, failed components, adverse installation applications, etc., on a separate sheet and attach to this form or within the email message.

2

Quality Assurance Survey Report

To whom it may concern:
Please review the items below upon receiving and installing our product. Mark N/A on any item that does not apply to the product.

Job Name: _____ **Daikin Applied G.O. No.** _____

Installation address:_____

City: _____ State: _____

Purchasing contractor:_____

City: _____ State: _____

Name of person doing start-up (print): _____

Company name:_____

Address:_____

City/State/Zip: _____

1. Is there any shipping damage visible? . . . . . Yes No N/A

   Location on unit _____

2. How would you rate the overall appearance of the product; i.e., paint, fin damage, etc.?

   Excellent Good Fair Poor

3. Did all sections of the unit fit together properly? . . . . . Yes No N/A
4. Did the cabinet have any air leakage? . . . . . Yes No N/A

   Location on unit _____

5. Were there any refrigerant leaks? . . . . . Yes No N/A

   From where did it occur? . . . . . Shipping Workmanship Design

6. Does the refrigerant piping have excessive vibration? . . . . . Yes No N/A

   Location on unit _____

7. Did all of the electrical controls function at start-up? . . . . . Yes No N/A

   Comments _____

8. Did the labeling and schematics provide adequate information? . . . . . Yes No N/A
9. How would you rate the serviceability of the product?

   Excellent Good Fair Poor

10. How would you rate the overall quality of the product?

    Excellent Good Fair Poor

11. How does the quality of Daikin Applied products rank in relation to competitive products?

    Excellent Good Fair Poor

    Comments _____

Please list any additional comments which could affect the operation of this unit; i.e., shipping damage, failed components, adverse installation applications, etc. If additional comment space is needed, write the comment(s) on a separate sheet, attach the sheet to this completed Quality Assurance Survey Report, and return it to the Warranty Department with the completed preceding “Equipment Warranty Registration Form”.

People and ideas you can trust.™

Daikin Applied Training and Development

Now that you have made an investment in modern, efficient Daikin equipment, its care should be a high priority. For training information on all Daikin HVAC products, please visit us at www.DaikinApplied.com and click on Training, or call 540-248-9646 and ask for the Training Department.

Warranty

All Daikin equipment is sold pursuant to its standard terms and conditions of sale, including Limited Product Warranty. Consult your local Daikin Applied representative for warranty details. To find your local Daikin Applied representative, go to www.DaikinApplied.com.

Aftermarket Services

To find your local parts office, visit www.DaikinApplied.com or call 800-37PARTS (800-377-2787). To find your local service office, visit www.DaikinApplied.com or call 800-432-1342.

This document contains the most current product information as of this printing. For the most up-to-date product information, please go to www.DaikinApplied.com.

Products manufactured in an ISO Certified Facility.

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Installation and Maintenance Manual IM 672-10

Group: **Applied Air Systems**
Part Number: **IM 672**
Date: **March 2014**

Vision™ Air Handler

Models CAC/CAH 003—090 C



People and ideas you can trust.™

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General Information

Vision® indoor air handlers are not designed to be weather resistant. Do not install them outdoors.

The system design and installation must follow accepted industry practice as described in the ASHRAE Handbook, the National Electric Code, and other applicable standards. This equipment must be installed in accordance with regulations of authorities having jurisdiction and all applicable codes.

Installation and maintenance must be performed by qualified personnel familiar with applicable codes and regulations and experienced with this type of equipment. Sheet metal parts, self-tapping screws, clips, and such items inherently have sharp edges; the installer should exercise caution.

⚠ CAUTION

Sharp edges and coil surfaces are a potential injury hazard. Avoid contact with them.

Receiving and Handling

1. Carefully check items against the bills of lading to verify all crates and cartons have been received. Carefully inspect all units for shipping damage. Report damage immediately to the carrier and file a claim.
2. Vision air handler units are constructed of galvanized or painted steel and are inspected thoroughly before leaving the factory. Take care during installation to prevent damage to units.
3. Take special care when handling the blower section. All fans are dynamically balanced before leaving the factory. Rough handling can cause misalignment or a damaged bearings or shaft. Carefully inspect fans and shaft before unit installation to verify this has not happened.
4. Handle the zone damper of the multi-zone units with special care. Zone dampers are set and inspected before leaving the factory, but should be checked on arrival to the job to verify the bell arm and connecting rod set screws did not become loose in shipment.

Nomenclature

CAH 003 G D A C

Model
CAH = Custom modular air handler
CAC = Custom modular component

Nominal unit size
(cataloged size—nominal square foot of coil)
003, 004, 006, 008, 010, 012, 014, 017, 021, 025, 030, 035, 040, 050, 065, 080, 085, 090

Vintage

Unit cross section
C = Standard unit cross section
M = Custom size cross section

Motor location
A = Motor along side of fan housing
D = Motor down stream of belt-drive plenum fan
F = Motor on inline fan
G = Motor downstream of direct-drive plenum fan
H = Motor downstream of fan array
T = Motor behind twin fan housing

Unit type/coil position
B = Blow-through cooling coil location
D = Draw-through cooling coil location
H = Heating only
V = Vent only
M = Multizone

Unit Storage

- Store on a level surface in a clean, dry location where temperature can be controlled if possible.
- Pack fan and motor bearings (unless motor bearings are sealed) with compatible grease with the shaft stationary. After grease has been installed, rotate shaft about 10 rotations.
- Isolate unit from shock and vibration.
- Once a month, rotate shaft a minimum of 10 revolutions. Insure the stopped position is different than the original position.
- Coat shafts with lubricant as needed to prevent corrosion.
- A descant bag may be hung in the interior of the unit to minimize corrosion in humid storage environments. Do not clean galvanized steel surfaces with oil dissolving chemicals. This may remove the protective coating and accelerate corrosion.
- Do not allow coverings to trap moisture on galvanized surfaces.

Belt-Driven fans

- Reduce belt tension by at least 50% or remove the belts. Remove belts if they will be subjected to temperatures exceeding 85° F to avoid deterioration.
- Remove belt guard when adjusting belts
- Reduce belt tension prior to removing or installing belts.
- Removing or installing tensioned belts may cause personal injury and damage to the sheaves, belts, bearings or shafts.
- Adjustable sheaves should be opened as wide as possible and the adjustment threads lubricated so they do not corrode. Be careful not to put lubricant on the belt running surface

Prior to start up

- Set screws on bearings, fan wheels, and sheaves need to be checked for proper torque. Also check bolt torque for any taper lock hubs either on the wheel or sheaves.
- Check sheaves for corrosion. Significant corrosion can cause belt or sheave failure.
- Purge old grease from fan bearings while rotating the shaft to distribute the new grease evenly and prevent bearing seal failure.
- Correctly align and tension belts. See General Rules of Tensioning on page 42.

Service Clearances

In addition to providing adequate space around the unit for piping coils and drains, access to at least one side of the unit is always required to allow for regular service and routine maintenance, which includes filter replacement, drain pan inspection and cleaning, fan bearing lubrication, and belt adjustment. Provide sufficient space—at least equal to the length of the coil—on the side of the unit for shaft removal and coil removal. Space, at least equal to the length of the side coil, is required for coil removal. Space, at least equal to the fin height, is required for top coil removal. See Figure 1 for servicing space requirements.

For routine maintenance purposes, access normally is obtained through the access doors or by removing panels. Fan and filter sections are always provided with a service door on one side of the unit. If requested, doors can be provided on both sides of the unit. Optional service doors are available for most section types and are provided based on customer request.

If component replacement is required, the top panel also can be removed. If necessary, the unit can be disassembled. Maintain at least 54" of clearance in front of electrical power devices (starters, VFDs, disconnect switches and combination devices). Electrical power devices that are mounted on the side of the unit typically are up to 12" deep (Figure 2). Fan sections with multiple fans have motor control boxes up to 16" deep when supplied with VFDs.

Figure 1: Servicing Space Requirements

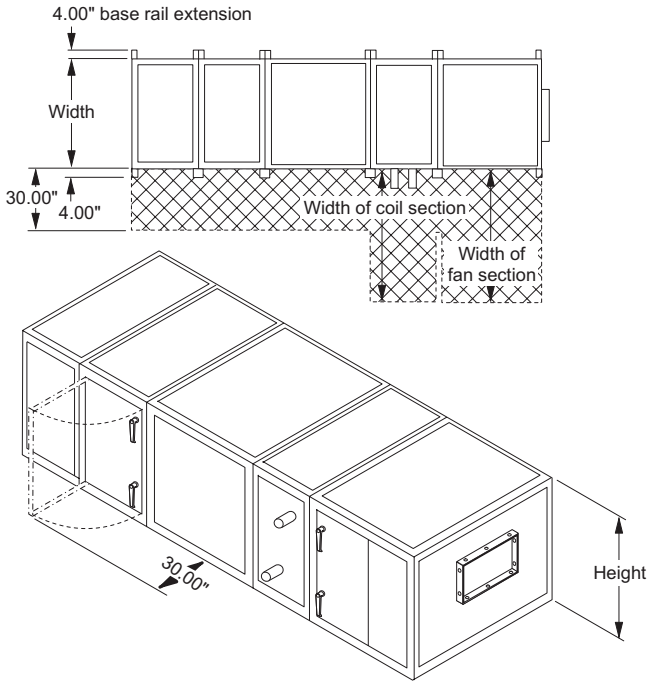
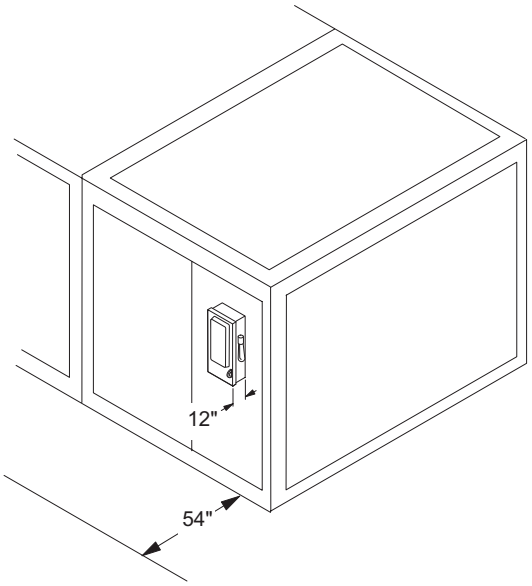


Figure 2: Service Clearance for Electrical Power Devices



Rigging

⚠ WARNING

Use all lifting points. Improper lifting can cause severe personal injury and property damage.

⚠ CAUTION

Lifting points may not be symmetrical to the center of gravity of the unit. Ballast or unequal cable lengths maybe required.

⚠ DANGER

DO NOT LIFT FROM 2" HOLES AT ENDS OF UNIT. Failure to comply may result in personal injury or death.

Vision air handlers ship as separate sections, completely assembled, or in modules of assembled sections. The unit must be rigged as it ships from the factory. Do not rig units after assembly. When a unit is provided with a factory-installed base rail, it can be lifted using the 2" diameter lifting holes located in the corners of each shipping section (Figure 3). If a unit does not have a base rail, rig it using straps or a sling. Fasten the strapping under the skid that ships with the section (Figure 4).

To prevent damage to the unit cabinetry, use spreader bars. Position spreader bars to prevent cables from rubbing the frame or panels. Before hoisting into position, test lift for stability and balance. Avoid twisting or uneven lifting of the unit.

A fan array or coil section might have a tall, thin aspect ratio. The center of balance on these sections can be high and make the section prone to tipping during the lift. Care should be taken when lifting units with a tall, thin aspect ratio.

Figure 3: Units on Base Rails

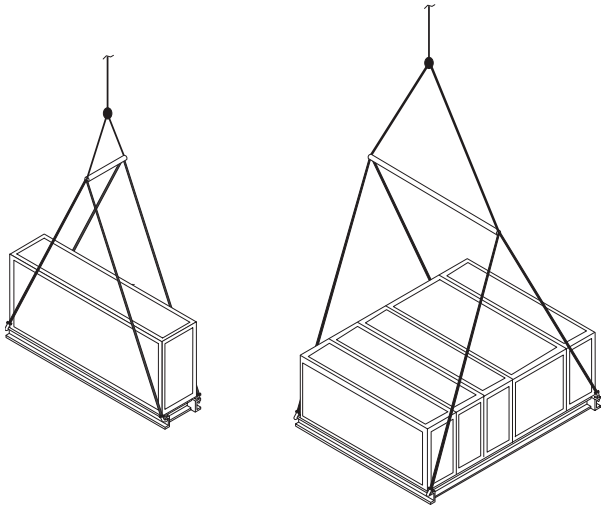
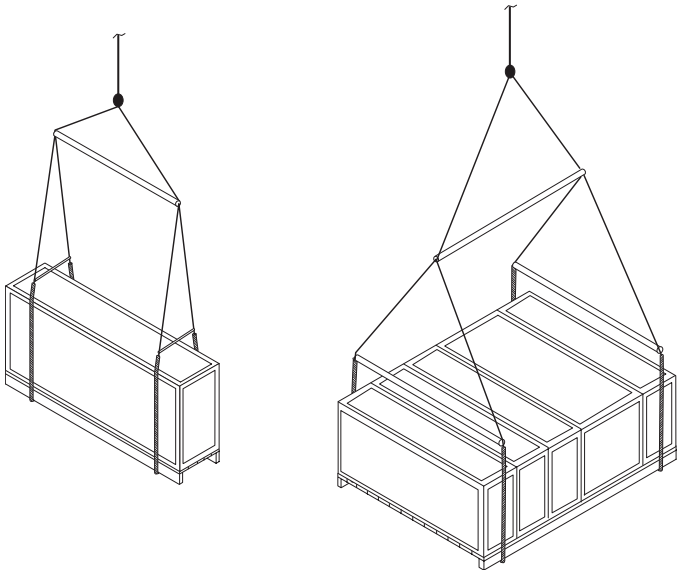
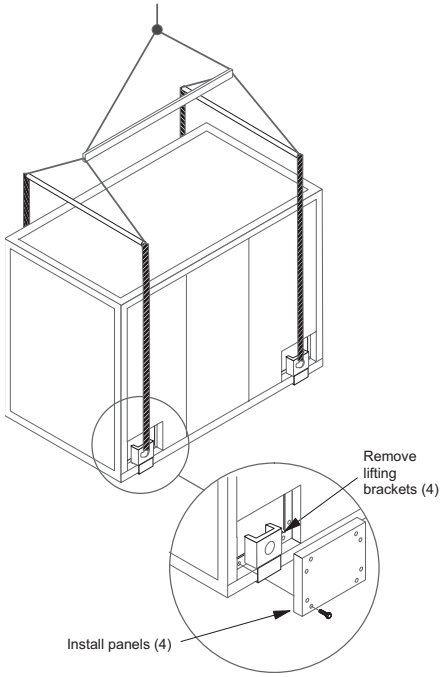


Figure 4: Units on Skids



Fan sections greater than 108" wide that are stacked on another section that are not Class II plenum fans are constructed with internal fan support frames that have integral lifting brackets (Figure 5). After the fan section is placed in position, remove and discard the lifting brackets. Install the small panels provided to complete the unit cabinet areas where the lifting brackets were located.

Figure 5: Large Fan Sections Stacked on Top of a Lower Section



Class II plenum fans that are stacked on another section may be lifted using the methods shown in the following figures. The shipping brackets must remain in place and be tight in order to lift using this method. Figure 6 shows a belt-drive fan with field supplied eye bolts that are screwed into factory installed hex AVK fasteners in the main channels supporting the fan. Figure 7 shows a direct-drive fan with field supplied eye bolts on the motor end and straps around the spring bracket on the inlet end. When factory installed hex AVK fasteners are installed, they should be used for lifting. When they are not installed, it is acceptable to lift from the shipping brackets on the fan. Figure 8 shows dual fans being lifted in a similar manner as the single direct-drive fan. An eight point lift must be used for dual fans to make sure both fans are supported properly and the cabinet structure does not become overloaded along the center.

If the fan section is connected to another section such as a plenum or access section, then DO NOT attempt to lift both sections using just the fan section. The other section(s) must be supported separately using straps.

Figure 6: Belt-Drive Class II Plenum Fan Stacked Unit

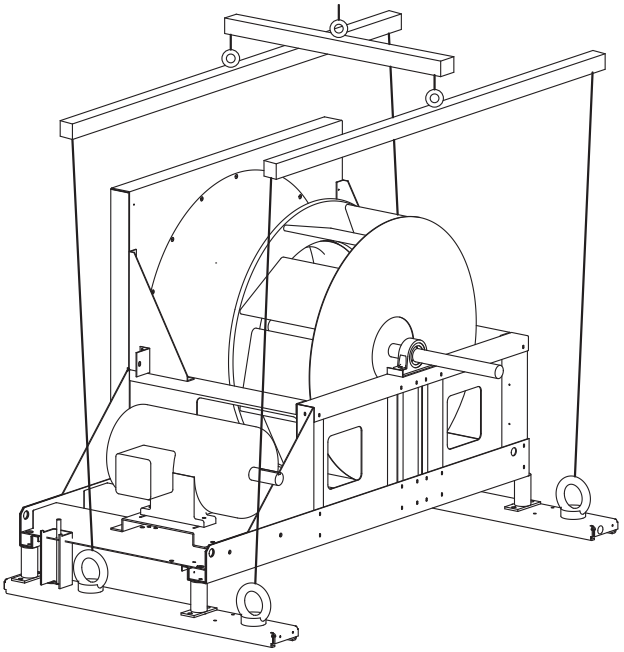


Figure 7: Direct-Drive Class II Plenum Fan Stacked Unit

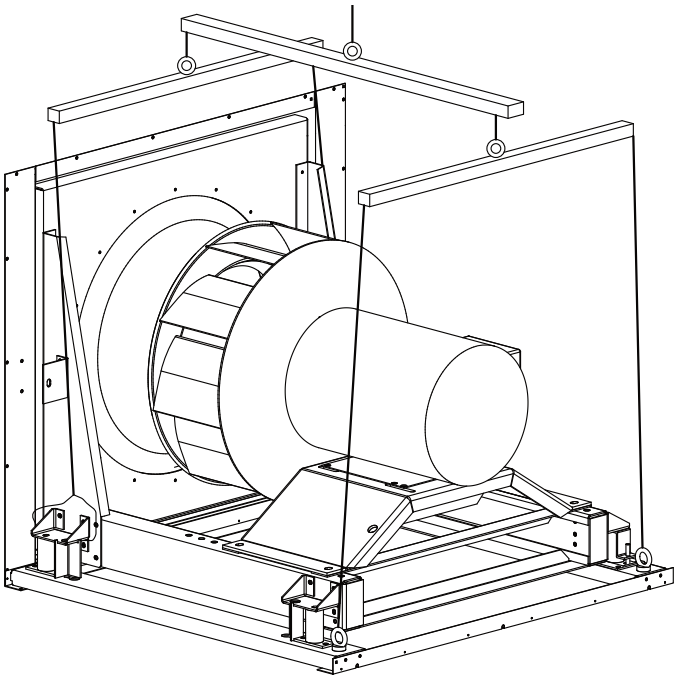
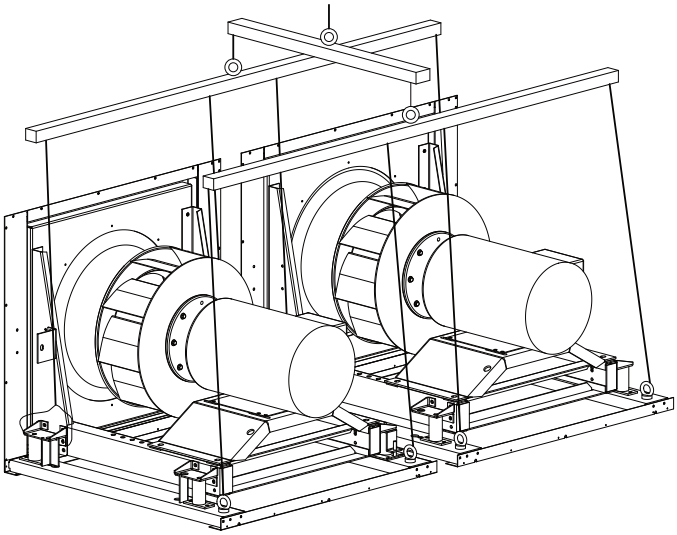


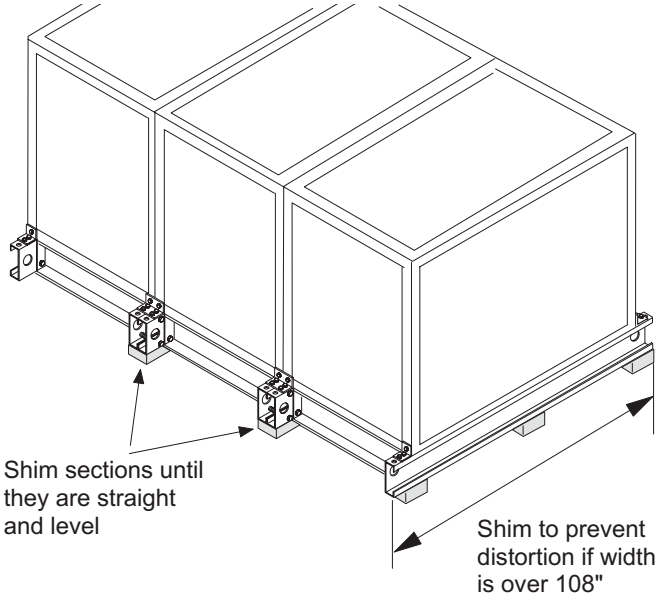
Figure 8: Direct-Drive Class II Dual Plenum Fan Stacked Unit



Unit Leveling

Place the equipment on a flat and level surface. Where the surface irregularities could cause the equipment to distort, use a shim so the base of the unit is a straight line. Uneven or distorted sections cause misfit or binding of the doors and panels and improper draining of drain pans. Units that are over 108" wide must rest on a flat surface for the entire width of the base rails or must be shimmed at one or more points along the length of the rails to prevent distortion or sagging of the support rails (Figure 9).

Figure 9: Leveling the Unit



Assembling Sections

External Section-to-Section Mounting

Vision air handling units can ship fully assembled or as separate shipping sections. Rig units that require field assembly of shipping sections into position first. Shipping sections are provided with a connection splice joint attached on the leaving air side of the shipping section. The splice joint is insulated and provides an air-tight seal between two sections once they are assembled together. If the splice joint was bent during shipping or rigging, restore it to its original position. (Figure 19 on page 12).

Horizontal Airflow Section Mounting

1. Rig the unit into position and lineup shipping sections in the direction of air flow. Pull sections together to fasten. Use a furniture clamp or straps and a ratchet to help pull the sections together securely (Figure 10).
2. If the unit has a factory-installed base rail, first fasten base rails together using the 3/8"-16 × 5" bolts located in the splice kit provided with the unit.
    a. To fasten two shipping sections together, four bolts are needed (two on each side of the unit). The bolts are run from one base rail into the other and fastened with a nut. Complete each section bottom and top before attaching additional sections.
3. If no base rail is provided, fasten the unit in the same manner on the bottom and top frame channels.
4. Once the sections are positioned together, remove the fastener in each of the channel corners (on the mating edges in the channel piece).
5. Place a flat section joining plate (found in the splice kit) over the two coned holes in the channels, so that the plate spans the two sections.
6. Replace the fasteners in their original position, through the joining plate.
7. For certain Custom Air Handler units, use the provided section joining plates to fasten sections together. Space them as shown in Figure 11. Using the provided ¼"-14 x 1" self tapping screws, drill screw the joining plates into the frame channel on each section, keeping unit sections tight together. Follow instruction drawing included in the assembly kit.

Figure 10: Horizontal Joining Sections

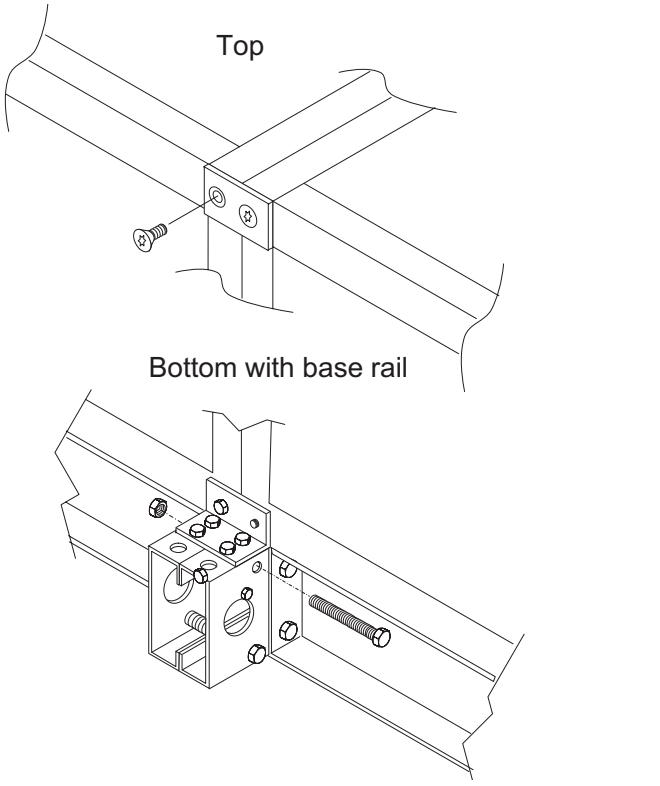
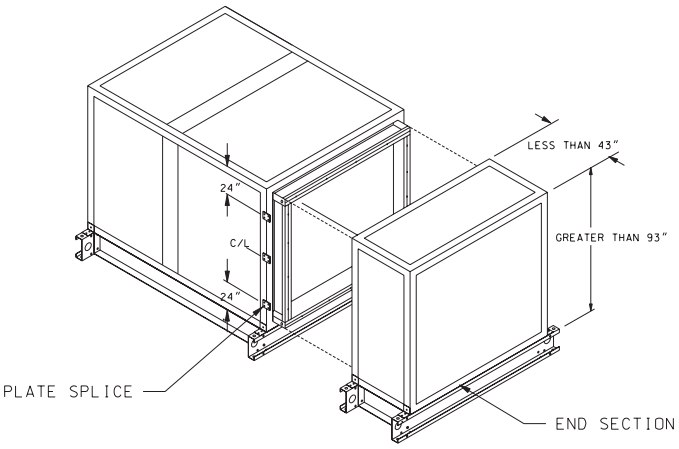


Figure 11: Frame Channel Stiffener Plates (Custom Air Handler Units Only)



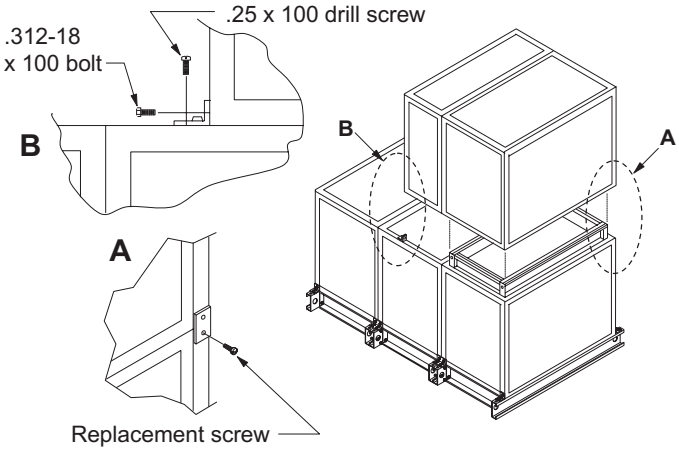
Vertical Inverted Airflow Section Mounting

For vertical or inverted arrangements, before lifting any top mounting sections into place, rig into place and fasten together the bottom tier of sections. Once bottom level sections are in place and secured, lift stacked components and fasten using the following procedure:

NOTE: See Face and Bypass Section Mounting on page 14 for the exception to this procedure.

1. The vertical/inverted section has a splice joint extending out the top of the bottom joining section. Lower the section that is to be positioned over the opening over the splice joint to seal the connection between the two sections.
2. The two sections are fastened together at the four bottom corners of the mating edge. To fasten the corners located on the end of the unit (where bottom section and top section walls are flush with each other), remove the flat head fasteners in the corners of both sections.
3. Cover the coned holes with a flat joining plate and replace the flat head fasteners in the holes to secure the joining plate to both sections (Figure 12).
4. When one section is deeper than the other, secure the two sections using an L-shaped joining plate. To secure the L-shaped bracket, remove the flat head fastener from the corner, position the bracket over the hole, and replace the flathead fastener with a 5/16"-18 × 1" bolt. Once the bolt is in place, secure the bracket to the adjoining section with a 1/4" × 1" drill screw. Repeat the same procedure on both corners of the unit (Figure 12).

Figure 12: Vertical/Inverted Joining Sections

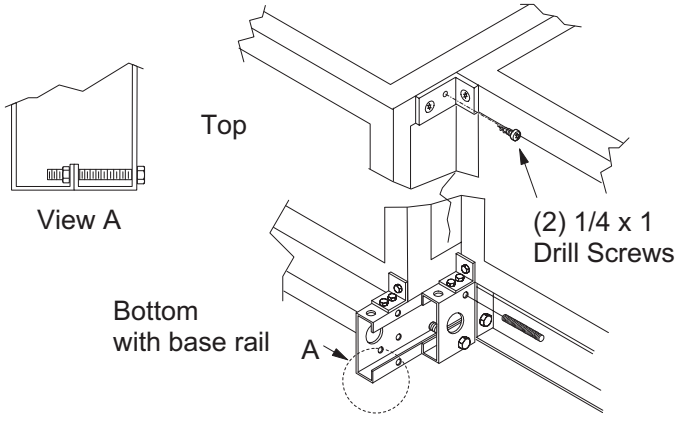


Extended Coil Section Mounting

The extended coil section is 6" wider than all other sections of the same unit size. The extension is always located on the coil connection side of the unit. Because the extended coil section is wider than other sections, it always ships as a separate shipping section, and must be joined to other sections in the field. To join an extended coil section to other components, first follow the Horizontal Airflow Section Mounting, page 7 steps to secure the opposite connection side. To fasten the connection side, use the following procedure:

1. If the unit has a factory-installed base rail, the extended coil section base rail is also 6" wider than the adjoining base rail. Extended coil section base rails on the connection side are fastened together using the 3/8"-16 by 3" bolts located in splice kit provided with the unit (Figure 13).
2. If no base rail is provided, the section is fastened in the same manner on the bottom and top. Once the sections are positioned together, remove the fastener in the corner of the channel piece of the section mating to the extended coil section (Figure 13).
3. Place an L-shaped section joining plate (located in the splice kit) over the coned hole in the channel.
4. Replace the flat head fastener originally used in the corner with a 5/16"-18 1" bolt and fasten it through the L-shaped joining plate.
5. Position the L-shaped joining plate so it butts up against the extended coil section frame channel. To secure the plate to the extended coil section, run two 1/4" × 1" drill screws through the joining plate and into the frame channel.

Figure 13: Extended Coil Section Joining

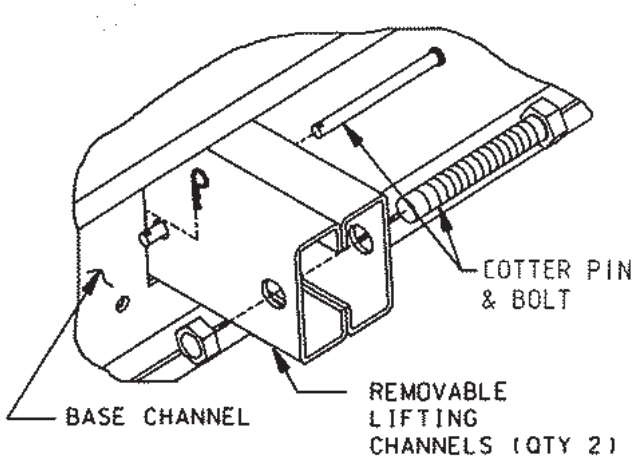


Side-by-Side Heatwheel Section Joining

The side-by-side heatwheel will have two individual sections parallel in the direction of airflow to be attached to either side. Each section will attach to the heatwheel section and then to the other parallel section.

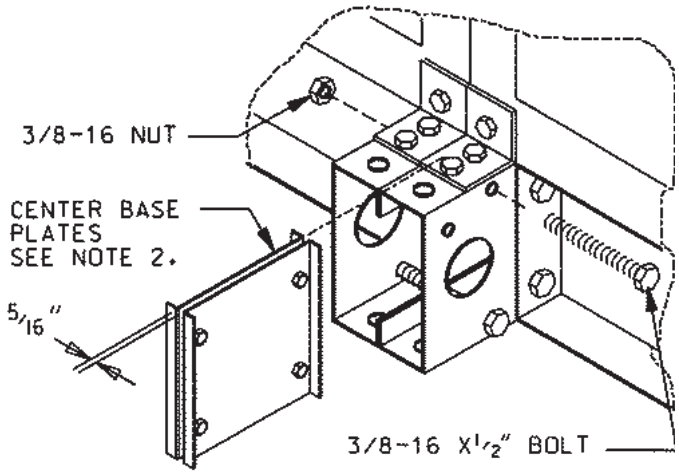
1. Rig the unit into position and line shipping sections up in direction of air flow. Sections must be pulled together to fasten using a furniture clamp or straps.
    a. If the heatwheel section width is greater than 143", then rig the section into position using the two removable lifting channels. After section is properly placed, remove cotter pin and bolts from lifting channel and discard as seen in Figure 14

Figure 14: Cotter Pin and Bolt Detail



2. If included, remove center base plates that are attached to the base channels and save for Step 4.
3. If the unit has a factory installed base rail, fasten the base rails together using the 3/8"-16 × 5" bolts located in the splice kit provided with the unit.
    a. To fasten two shipping sections together, two bolts are required on the one side. The bolts are run from one base rail into the other and fastened with a nut. Complete each section bottom and top before attaching additional sections.
4. Assemble the center base plates as show in Figure 15, leaving a 5/16" space between each plate to slide onto section base channels to center point of section width.
5. Once the sections are positioned together, remove the fastener in each of the channel corners (on the mating edges in the channel piece).
6. Place a flat section joining plate (found in the splice kit) over the two coned holes in the channels, so the plate spans the two sections.

Figure 15: Base Plate Detail



7. Replace the fasteners in their original position, through the joining plate.
8. Assemble the next section parallel to the assembled section by following Steps 1 – 7 above.
9. Using the 3/8"-16 × 1" bolts provided, fasten the two parallel sections' bases together as seen in Figure 16.
10. Using appropriate safety equipment if necessary, remove the fastener in each of the channel corners on the top between the two parallel sections and discard.
11. Use the 2 × 2 holed splice plate with 2 × 5/16"-18 × 1" screws and 2 × ¼" drill screws. The 2 × 5/16"-18 × 1" screws will go into the frame channel holes and the 2 × ¼" drill screws will go into the heatwheel frame channel as show in Figure 17.

Figure 16: Base Section Detail

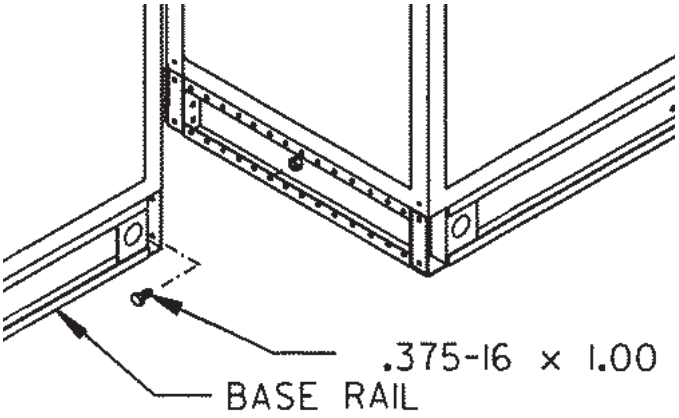
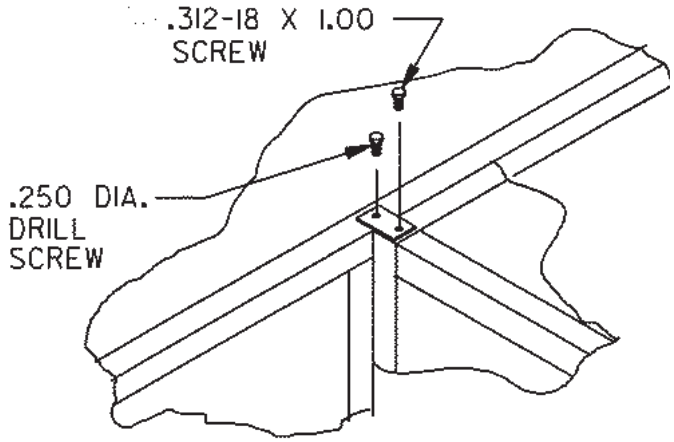


Figure 17: Frame Channel Detail



Internal Section-to-Section Mounting

If desired, shipping sections can be fastened together internally. To fasten internally, run field-provided #10 sheet metal screws or drill screws (4" long maximum) through the interior frame channel of one unit into the splice joint of the neighboring section.

The section-to-section splice joint is always provided on the leaving air side of a shipping section and seals against the frame channel on the entering-air side of the adjoining section. Align the splice joint to seat into the mating gasket to provide an air seal. If the splice joint was bent during shipping or rigging, restore it to its original position (Figure 19).

For Custom Air Handler units, ensure that the D-gasket is attached to the entering air side frame channel (Figure 18). If it has dislodged during shipping, restore to original location.

Figure 18: D-Gasket Placement Detail (Custom Air Handler Units only)

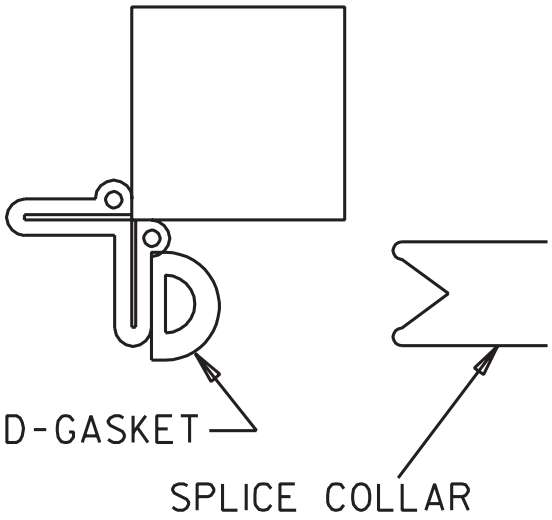
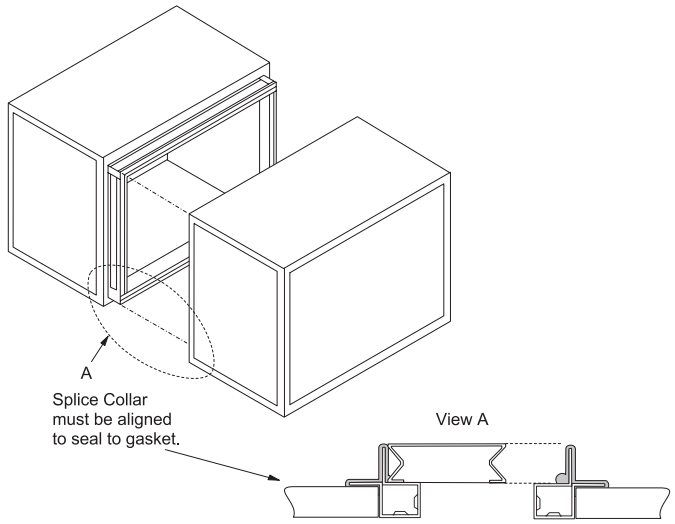


Figure 19: Internal Fastening



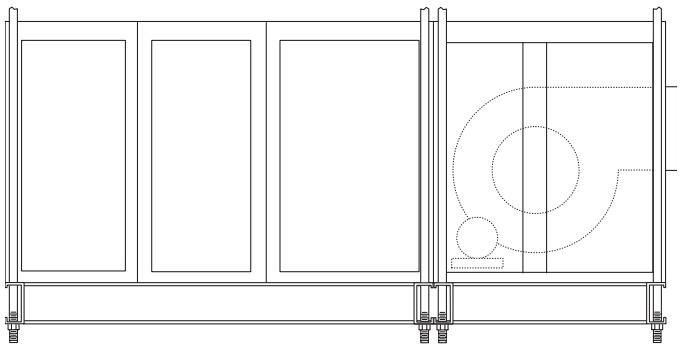
Ceiling Hung

When a unit is ceiling hung, support it with a base rail, angle iron, or channel. The Vision air handler is not designed to be suspended from the top of the unit. Before hanging, rig and completely assemble the unit. See Assembling Sections on page 8.

Ceiling Hung Using Base Rail

The optional base rail provided by the factory has 5/8" diameter holes in each corner to run hanger rods through. To properly support the unit and maintain unit integrity, support each shipping section with hanger rods in each corner (Figure 20).

Figure 20: Ceiling Suspended with Base Rail



Ceiling Hung Using Angle Iron Channel

Install field-provided angle iron or channels per SMACNA guidelines. When a unit is unitized (ships in one piece), channel support each component under the unit width (Figure 21).

NOTE: The supporting angle iron must fully support the 2" frame channel at each section joint.

When a unit is sectionalized (ships in multiple sections), channel support each component under the unit width and provide support under the full length of the unit base (Figure 22). Locate hanger rods so they do not interfere with access into the unit.

Ceiling suspension using the unit base rails is limited to unit cabinet widths less than 108". Support units with cabinets 108" wide and greater with structural members designed to support the unit at the ends and at intermediate points along the base rails.

Figure 21: Ceiling Suspended w/o Base Rail—Unitized Construction

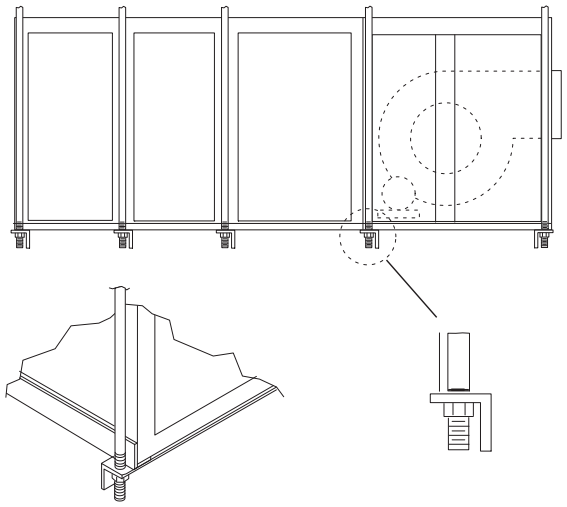
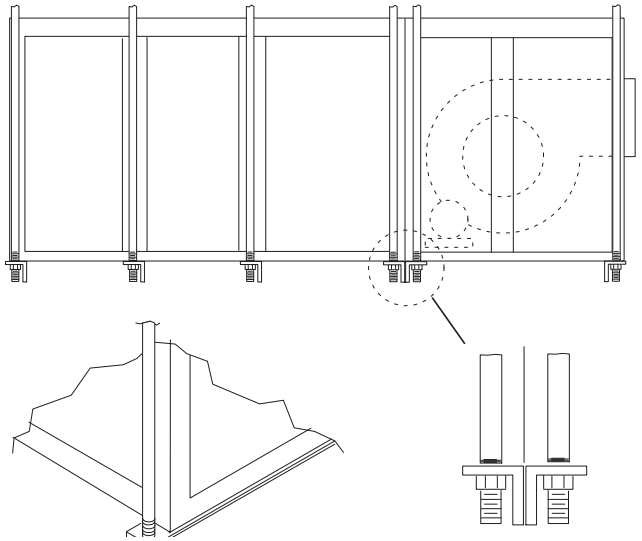


Figure 22: Ceiling Suspended w/o Base Rail—Modular Construction



Panels, Frame Channels, and Doors

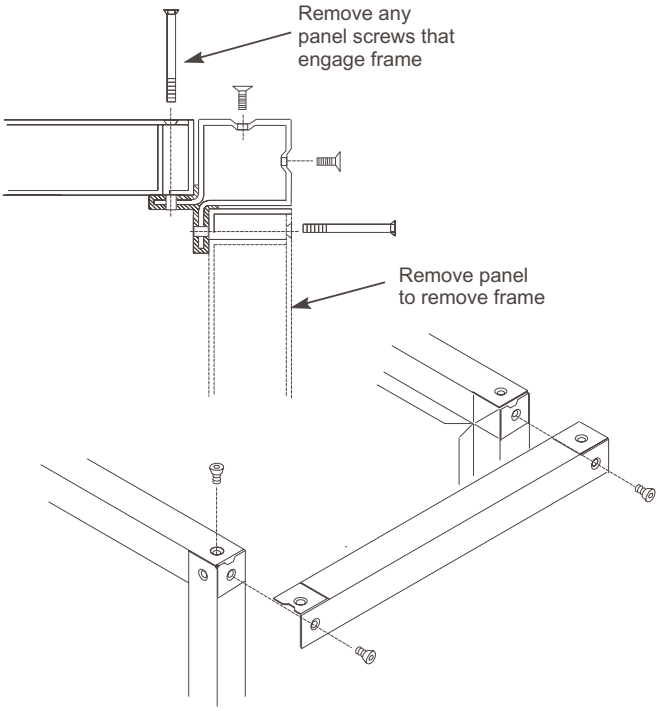
Panel Removal

To remove a side or top panel, remove the flat head Torx 30 fasteners along the sides of the panel. Lift off the panel after removing all fasteners.

Frame Channel Removal

Frame channels that run the length of the unit along the top can be removed to allow access to both the side and top of the unit. To remove the frame channel, first remove the side panel(s). Once the side panel is off, remove the flat head Torx 30 fasteners in the corner of the frame channels. Then pull the frame channel out the side. Remove any panel screws that are within one inch of the of the frame since they are engaged into the gasketed flange of the frame (Figure 23).

Figure 23: Removing Panel Screws



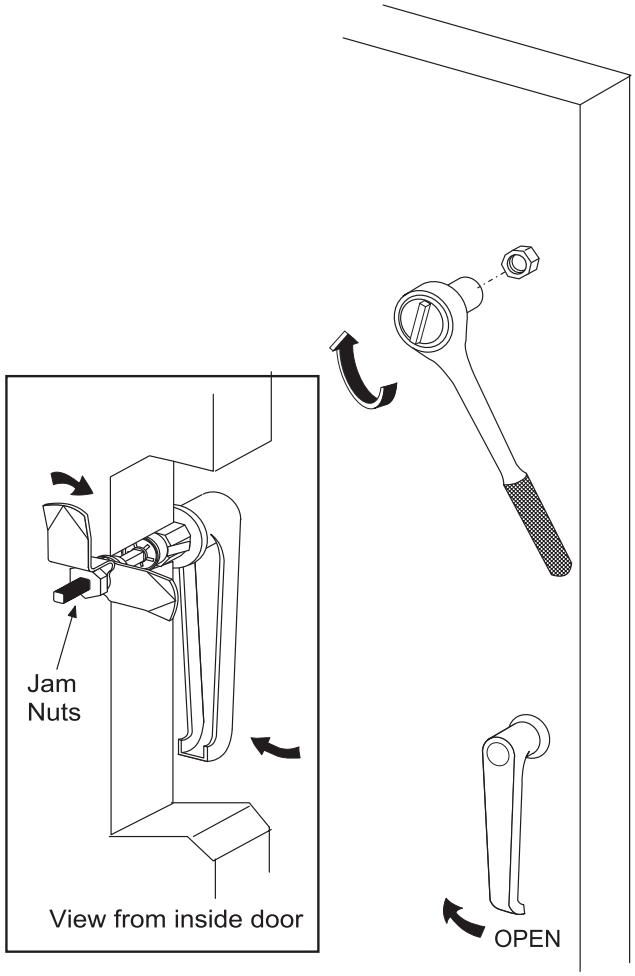
Fan Section Doors

⚠ CAUTION

Sharp edges and coil surfaces are a potential injury hazard. Avoid contact with them.

NOTE: Opening fan section doors requires using a 1/2" socket wrench (Figure 24), which satisfies ANSI standards and other codes that require the “use of tools” to access compartments containing moving parts or electrical wiring.

Figure 24: Opening Fan Section Door



Injected-Foam Insulated Panels

Vision air handlers are furnished with double-wall, injected-foam insulated panels. Foam panels are stronger, more rigid, and lighter than panels with fiberglass insulation. The insulation R-value is improved to 13. However, foam insulation can burn when exposed to flame or other ignition sources and release toxic fumes. Take care in cutting and sealing all field-cut openings in these panels.

Panel Cutting Procedure

⚠ WARNING

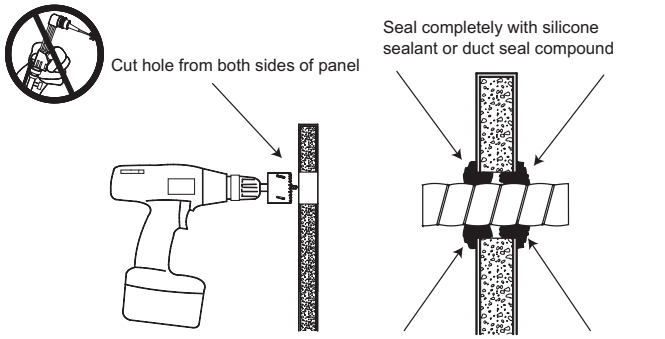


Flame and smoke can cause equipment damage, severe personal injury, or death.

Before operating unit, seal all piping and wiring holes on both inner and outer panels with an industrial grade silicone sealant or duct seal compound. **Do not use a cutting torch or expose panel to fire.** Panel damage can occur.

1. Determine the number and location of holes required for electrical conduit, piping, and control wiring as follows (also refer to Figure 25):
   a. Check that adequate space is available inside the unit for conduit or pipe routing.
   b. Do not locate holes in a panel that provides access to key maintenance components such as filters and fan assemblies.
   c. Do not locate where the conduit or piping blocks airflow or obstructs hinged access doors.
2. Once a proper location is determined, drill a small pilot hole completely through the panel. Then use a sharp hole saw or a saber saw and cut from each side of the panel.
3. Seal the double-wall panel on each side with an industrial/ commercial grade silicone sealant or duct seal compound. It is extremely important to seal each panel hole or penetration securely so that it is airtight, watertight, and that there is no exposed foam insulation.

Figure 25: Cutting/Sealing Injected-Foam Insulated panels



Prop 65—Substances in fuel or from fuel combustion can cause personal injury or death, and are known to the State of California to cause cancer, birth defects or other reproductive harm.

Field Mounting Junction Boxes and Other Components

For field mounting 4" × 4" or smaller junction boxes to the standard panel exterior, use a minimum quantity of four, 3/16" diameter pop rivets. DO NOT use self-tapping drill screws. They will not tighten nor secure properly and panel damage can occur.

If larger, heavier components require mounting on unit panels, use through-bolts with flat washers through both outer and inner panels. To maintain panel integrity, seal both ends with an industrial/commercial grade silicone sealant or duct seal compound.

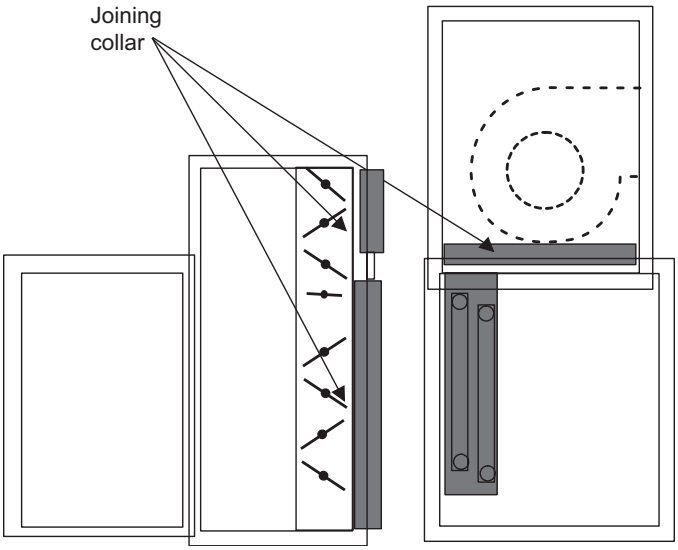
The unit frame channel is another excellent location for securing heavier components; self-tapping screws are not acceptable. Ensure that the location permits the full operation of all access doors and panels and does not interfere with other vital components.

Face and Bypass Section Mounting

Internal face and bypass, and external face and bypass for sizes 003 to 035 are mounted together using the instructions for horizontal components and do not require additional instruction.

For all size units that bypass directly into a vertical fan section and for sizes 040 to 090 with external face and bypass, use the following instructions.

Figure 26: Assembly of Fan Coil Sections



Bypass Into a Vertical Fan Section

Vertical coil sections and the top mounted fan section always ship separately and must be mounted together at the job site. The vertical coil section and the bypass duct each has a joining collar mounted on the leaving air side of the section and duct, respectively (Figure 26). The mounting collar fits into the side (bypass) and bottom (vertical coil section) openings in the fan section. To correctly position the collars in the fan openings, assemble the fan and coil section first. Use the steps below for assembly.

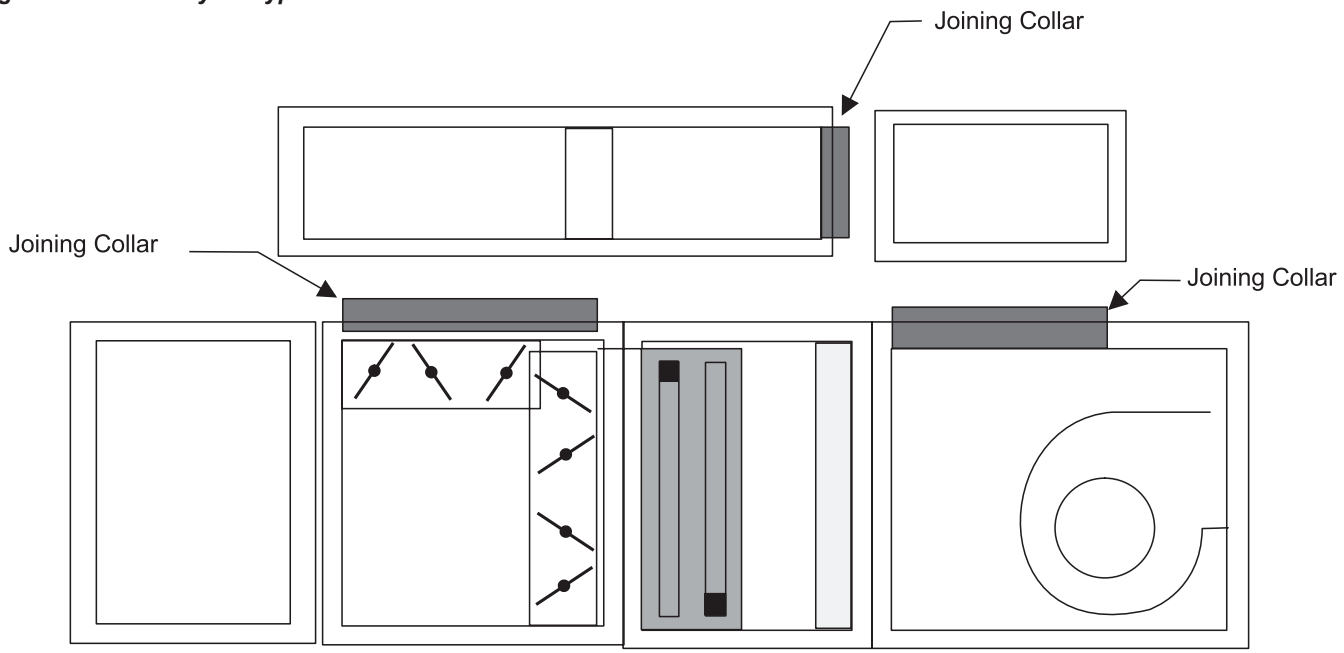
1. Place the vertical coil section in position. If an access section is positioned downstream from the coil section and not already assembled to the coil section, secure the two sections together.
2. Lift the fan section on top of the vertical coil section, taking care to line up the joining collar in the bottom of the fan section.
3. For sizes 003 to 035, the bypass duct is integral to the unit construction and does not require attachment to the bypass section. For sizes 040 to 090, position and assemble the bypass duct to the bypass section before joining to the fan.
4. Once the fan is positioned on top of the vertical coil section and the bypass duct and bypass section are assembled, position the two assemblies and line up the joining collars with the openings in the fan and vertical coil section.
5. Once the sections are lined up and in position, secure the unit together by fastening joining plates to the unit.

External Face and Bypass Duct Assembly (Sizes 040 to 090)

When unit sizes 040 to 090 are ordered with external face and bypass, the bypass duct ships separately and must be attached to the unit in the field. The joining of the bypass duct to the unit must be done after the unit is assembled. Also, if the bypass duct is over 90" long, the duct does not ship in one piece and must be field assembled. The field assembly of the bypass duct to the unit requires the following steps (also refer to Figure 27).

1. Position the unit shipping sections together and assemble in the equipment room.
2. After the unit is assembled, lift the duct into position over the unit. Joining collars are shipped factory assembled to the unit and duct. There is a joining collar located in the top of the bypass opening and in the leaving air side of the bypass duct. These joining collars are used to provide air seals. Line up the duct with the top openings in the unit.
3. If the bypass duct is longer than 90", the duct ships in more than one piece and must be field assembled. Place the piece of duct that has the joining collar on the bottom on top of the unit first. Once it is in place, position the other piece of duct. Take care to fit the splice collar into the first piece of duct and then lower the other end into the bypass opening.
4. Once the duct is positioned correctly, fasten the duct pieces together with the joining plate provided. To do this, remove the fasteners in the corners of the duct assemblies, place the plate over the holes in the corners, and then replace the fasteners (Figure 10 on page 9).

Figure 27: Assembly of Bypass Duct to Unit



Multizone Assembly

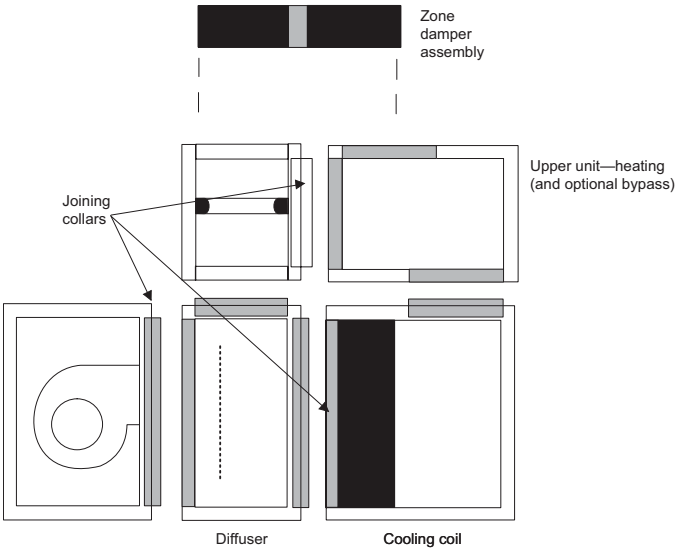
The multizone section may ship completely assembled or it may ship in numerous pieces. Whether the section ships in a single piece or multiple pieces depends on customer requirements and the unit size. When a multizone section is over 90" high or 90" wide, split it into sections for shipping.

The unit may ship in 1, 2, 3, 4, or 5 separate pieces, see Figure 29. Typically, the multizone damper assembly ships separately (see Multizone Damper Assembly and Figure 29) and must be attached at the job site. Attach the damper after the other components are assembled. Use the instructions below for assembling the multizone section (also refer to Figure 29).

1. If the diffuser and the cold deck section ship separately, join them together first. The joining collar mounted in the diffuser fits into the entering air side of the coil section. Line up the two sections and fasten together.
2. Once the diffuser and cold deck sections are joined, lift the hot deck and bypass sections in place on top of the diffuser/ cold deck section. If possible, assemble the hot deck and bypass section (if there is one) together before lifting on top. There always is a joining collar in the diffuser. The joining collar provides the seal between the sections joints. It is important to line up and fit the collar in the hot deck and bypass section. For vertical applications, the cold deck also has a joining collar in the discharge opening. This collar fits in the bottom of the vertical bypass section.
3. After the components in the multizone are fitted together, fasten the joining plates to the corners in the unit exterior.
4. If a damper was ordered, assemble it to the section (see Multizone Damper Assembly and Figure 29).

NOTE: Verify that the joining collars are aligned to seat into the gasket. Straighten any collars distorted from shipping or from rigging.

Figure 28: Multizone Sections Assembly



Multizone Damper Assembly

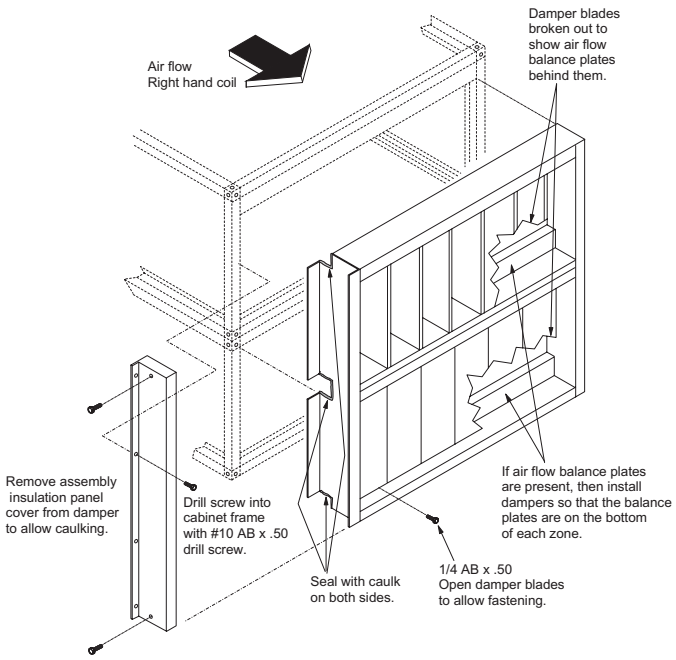
When a multizone unit is ordered with dampers, depending on the multizone configuration and size, the damper assembly may ship separately (all horizontal and units with a total height over 90").

When the dampers are not factory assembled to the unit, they ship to the job site on a skid. An assembly kit with screws and an instruction drawing are included with the damper for field assembly to the unit.

To assemble:

1. First remove the side plate that encloses insulation from both sides of the damper assembly.
2. Lift the damper assembly into position (Figure 29).
3. Fasten the assembly to the frame channels within the multizone openings.
4. Use caulking to seal up the areas around the unit frame channel to prevent any air leakage.
5. After caulking, put the side plates back in place and secure. Damper shaft extensions are provided on both ends of the damper assembly for actuation. The dampers are linked together by a linkage bar on both ends of the damper. The linkage bar is cut at the time of installation to divide the damper into the required number of zones (refer to Multizone Damper Adjustment on page 17).

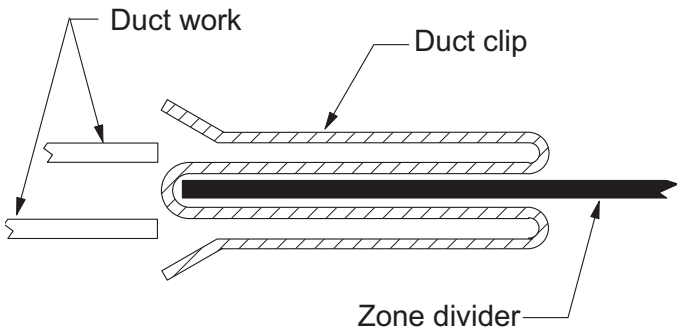
Figure 29: Multizone Damper Assembly



Duct Connections

Use flexible connectors on the outlet and inlet duct connections of all units. Each zone divider has a W-shaped duct clip. Insert ductwork into this clip (Figure 30).

Figure 30: Duct Connectors



NOTE: Before connecting to ductwork, refer to Multizone Damper Adjustment below.

Multizone Damper Adjustment

The installer must clear the damper assemblies of construction dirt and debris. These materials result in higher torque requirements and may bend or damage damper components.

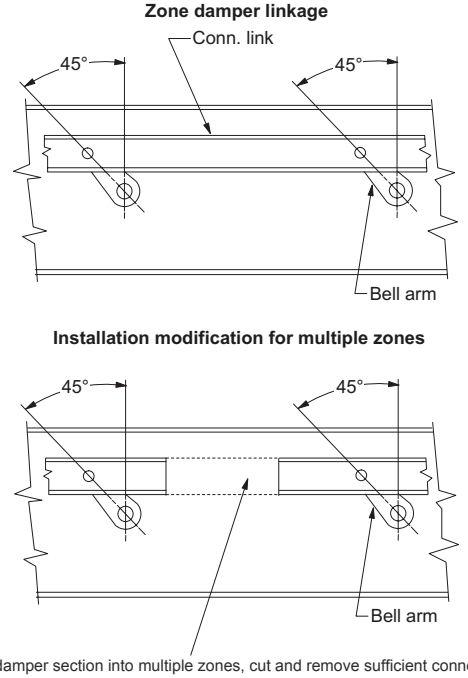
Before you begin:

1. Verify that dampers are square and operating smoothly before ducting.
2. Install duct access panels on the downstream damper for inspection and maintenance.

If multizone dampers do not close properly, adjust the blades as follows:

1. Loosen set screws in bell arms for all zones.
2. Close all cold deck dampers tightly.
3. Move bell arms so they are at a 45° angle to the vertical center when viewing the zone dampers from the cold deck end of the damper section (Figure 31).
    a. Two-deck zone dampers—The cold deck closes when the bell arms are 45° from the vertical center. The hot deck closes when the bell arms are 45° clockwise from the vertical center.
    b. Three-deck zone dampers—The cold deck closes when the bell arms are 45° clockwise from the vertical center. The hot deck closes when the bell arms are 45° counterclockwise from the vertical center.
4. Tighten set screws on bell arms while holding the dampers closed.
5. All zone damper blades should close properly. If one or a few zones do not close completely, repeat the procedure for these zones.

Figure 31: Bell Arms at 45° Angle to Vertical Center



To divide the damper section into multiple zones, cut and remove sufficient connecting link to allow adjacent zones to operate independently.

NOTE: The damper blades on two-deck dampers seal through several degreesof shaft rotation.The damper blades can rotate 360° and do not engage a stop.The hot deck blades are mounted at a 90° to the cold deck blades. Beforeinstalling the zone duct, set up linkages and dampers and adjust. If adjustmentis required and access to the blades is restricted, observe the cold deck bladeposition by removing the cabinet panel on the coil section.

Multizone, Mixing Box and Economizer Damper Torque Requirements

On multizone units, the actuator must drive the connection link for proper damper actuation. Do not activate multiple dampers must from the shaft extension opposite the connection link.

Mounting Actuators

⚠ CAUTION

Maximum damper rotation is 70°. Maximum shaft torque is 205 inches/pound. Greater rotation or torque can cause equipment damage.

The installing contractor is responsible for the mounting of all field-installed actuators. No provisions are made for the location of these actuators due to the number of options and arrangements available and the variety of specific applications. Typically, actuators are mounted inside the cabinet. Provide proper support for the actuator to avoid excessive stress in the cabinet, linkage, or damper shafts.

Fresh air and return air dampers can be linked together and driven from the same actuator if the dampers are the same size. If the dampers are different sizes, they must be driven by separate actuators and controlled appropriately. Exhaust dampers are always driven by a separate actuator.

A typical rotary electric actuator can handle up to 40 sq. ft. of damper. For pneumatic actuators, allow 5 in-lb per square foot of damper area.

Face Bypass Damper Torque Requirements

Face and bypass dampers may or may not be linked together. When dampers are placed before a single bank of coils, they always are linked together and require a single actuator. When dampers bypass a stacked or staggered coil, the dampers are not linked and require multiple actuators. Unit sizes 040 to 090 provided with external face and bypass require three actuators. Other arrangements with stacked or staggered coils require two actuators. A damper shaft extension is provided. Normally, the shaft extension is located on the drive side of the unit, but it can be moved to the other side.

Face and bypass dampers have a torque requirement of 10 in-lbs per square foot of damper face area.

Isolation Dampers for Multiple Fans

Optional isolation dampers can be provided on multiple fans to prevent backflow through a fan that is turned off for service. These isolation dampers are not intended to be used to control flow through the fan. The isolation damper for a fan that is going to be started must be positioned in the full open position before the fan is started. Do not start a fan with the damper located at the inlet with the damper fully or partially closed. This can cause airflow, vibration, and sound problems that can lead to failure.

Isolation dampers can be provided with actuators that are mounted in the airstream. Actuator sizing for the isolation dampers should be based on 9 in-lb per square foot of damper.

Piping and Coils

When designing and installing piping:

- Follow applicable piping design, sizing, and installation information in ASHRAE handbooks.
- Observe all local codes and industry standards.
- Do not apply undue stress at the connection to coil headers; **always use a backup pipe wrench.**
- Support pipework independently of the coils.

Water Cooling Coils

- Water supply, water return, drain, and vent connections extend through the end panel of the coil section. All connections are labeled on the end panel.
- Water supply and water return connections are typically male NPT iron pipe.
- When installing couplings, do not apply undue stress to the connection extending through unit panel. **Use a backup pipe wrench to avoid breaking the weld between coil connection and header.**
- Follow recommendations of the control manufacturer regarding types, sizing, and installation of controls.

Direct Expansion Coils

- The coil distributor and suction connection extend through the end panel of the coil section.
- Check nozzle in distributor for proper tonnage.
- When a field supplied thermostatic expansion valve is used, it is located outside the unit and connected directly to the distributor. Do not apply heat to the body of the expansion valve.
- The thermostatic expansion valve must be of the external equalizer tube type. Connect the 1/4" diameter external equalizer tube provided on the coil to connection on expansion valve.
- Use care when piping the system to see that all joints are tight and all lines are dry and free of foreign material. For typical refrigerant piping, see condensing unit product manual.

Steam Coils

Piping (see Figure 32)

- All steam coils in units are pitched toward return connection.
- Steam supply and steam return connections typically are male NPT iron pipe and are labeled on the end panel of coil section. Connections extend through the coil section end panel.
- When installing couplings, do not apply undue stress to the connection extending through unit panel. **Use a backup pipe wrench to avoid breaking the weld between coil connection and header.**
- Support piping independently of coils and provide adequate piping flexibility. Stresses resulting from expansion of closely coupled piping can cause serious damage.
- Do not reduce pipe size at the coil return connection. Carry return connection size through the dirt pocket, making the reduction at the branch leading to the trap.

Coils

- Install vacuum breakers on all application to prevent retaining condensate in the coil. Generally, the vacuum breaker is connected between the coil inlet and the return main. The vacuum breaker should be open to the atmosphere, and the trap design should allow venting of large quantities of air.
- Do not drip supply mains through the coil.
- Do not attempt to lift condensate when using modulating or on/off control.

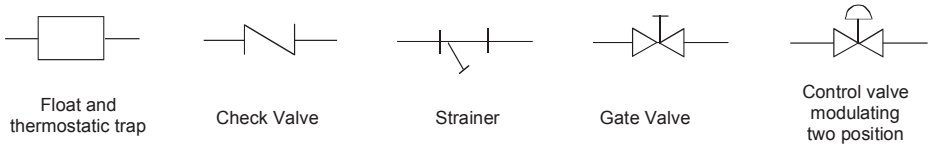
Traps

- Size traps in accordance with the manufacturers' recommendations. Make sure that the required pressure differential is always available. Do not undersize.
- Use float and thermostatic or bucket traps for low pressure steam. On high pressure steam, use bucket traps. Use thermostatic traps only for air venting.
- Use bucket traps for on/off control only.
- Locate traps at least 12 inches below the coil return connection.
- Multiple coil installation
- Individually trap each coil or group of coils that is controlled individually trapped.
- Coils in series—use separate traps for each coil, or bank of coils.
- Coils in parallel—a single trap can be used, but an individual trap for each coil is preferred.
- Do not attempt to lift condensate when using modulating or on/off control.
- With coils arranged for series airflow, use a separate control on each bank or coil in the direction of airflow.

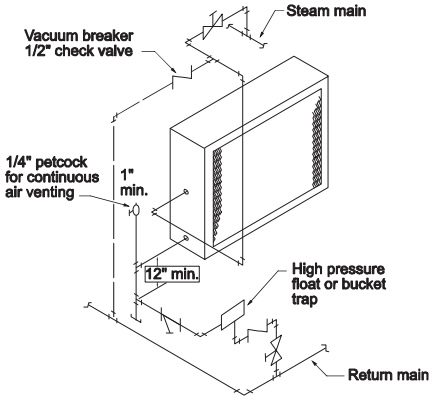
Valves

- Do not use modulating steam valves on high pressure systems.
- Properly size modulating valves. **Do not undersize.**
- Freezing conditions (entering air temperatures below 35°F).
- Daikin strongly recommends 5JA, 8JA, 5RA and 8RA coils.
- Supply 5 psi steam to coils at all times.
- Do not use modulating valves. Provide control by face and bypass dampers.
- Consider using two or three coils in series with two position steam control valves on the coil or coils that handle 35°F or colder air. Use a modulating valve on the downstream coil to provide the desired degree of control.
- Thoroughly mix fresh air and return air before it enters the coil. Also, to obtain true air mixture temperatures, properly locate temperature control elements.
- As additional protection against freeze-up, install the trap sufficiently below the coil to provide an adequate hydrostatic head to remove condensate during an interruption in the steam pressure. Estimate three feet for each 1 psi of trap differential required.
- On startup, admit steam to coil ten minutes before admitting outdoor air.
- Close fresh air dampers if steam supply pressure falls below the minimum specified.

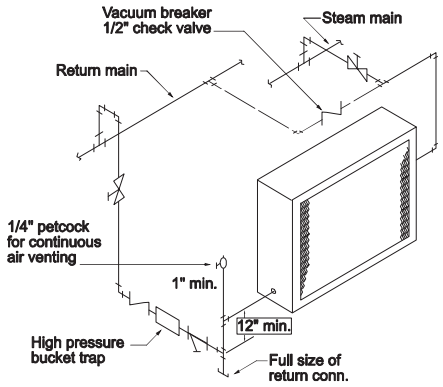
Figure 32: Piping Arrangements



High Pressure (over 25 psi)

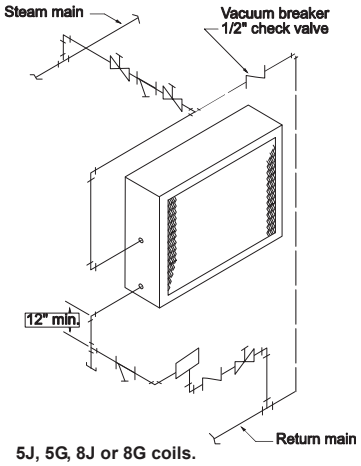


5GA or 8GA coils. Note that the addition of a vacuum breaker to permit the coil to drain during shutdown.

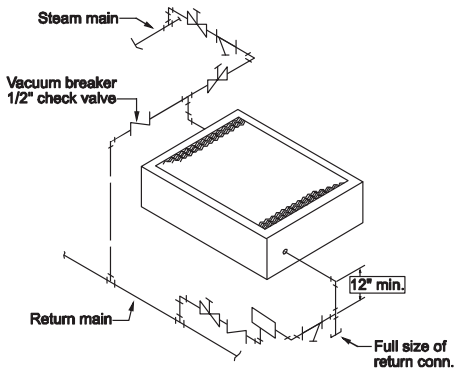


5TA, 8TA, or 5HA coils. Condensate is lifted to overhead return main

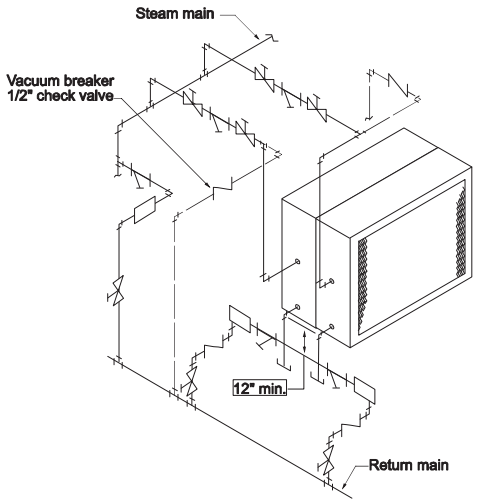
Low Pressure (to 25 psi)



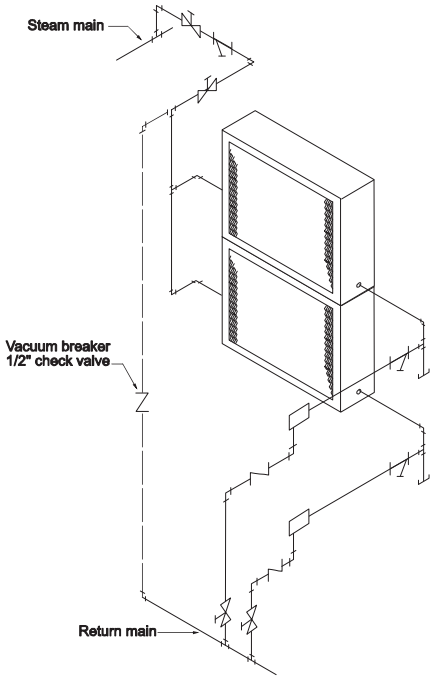
5J, 5G, 8J or 8G coils.



5RA, 8RA, or 5SA coils. Installed



5JA or 8JA coil. Installed in series. Note that each coil must have a separate control valve and trap.



5RA, 8RA, or 5SA coils. Banked two high, individual trapping of each coil as shown is preferred.

Water Heating Coils

⚠ CAUTION

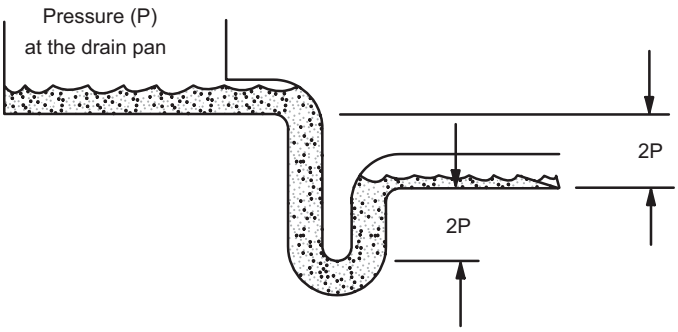
Improper installation, use, or maintenance of water heating coils can cause equipment damage. Read and follow instructions carefully.

- Water supply and water return connections extend through the end panel of the coil section. All connections are labeled on the end panel.
- Water supply and water return connections are male NPT iron pipe.
- When installing couplings, do not apply undue stress to the connection extending through unit panel. Use a backup pipe wrench to avoid breaking the weld between the coil connection and header.
- Follow recommendations of the control manufacturer regarding types, sizes, and installation of controls.
- Do not use hot water coils with entering air below 40°F.
- If fresh air and return air are to be heated by a hot water coil, carefully design the system to provide thorough mixing before air enters the coil.
- To prepare coils for winter operation, see Winterizing Water Coils on page 44.

Drain Pan Traps

Run drain lines and traps full size from the drain pan connection. Install drain pan trap to allow condensate to drain freely. On both blow-through and draw-through units, the trap depth and the distance between the trap outlet and the drain pan outlet must be twice the static pressure in the drain pan section under normal operation so the trap remains sealed (Figure 33).

Figure 33: Allow Adequate Distance Between Trap Outlet and Drain Pan Outlet



Internal Isolation Assembly Adjustment

On units with internally isolated fan and motor assemblies, the assemblies are secured for shipment.

Before Operating the Unit

Remove the shipping brackets and tie-down bolts (refer to Figure 35, Figure 36 and) and discard. The shipping brackets located on the opposite drive side of the unit are difficult to access from the drive side of the unit. Either remove them before the unit is assembled, or remove the panel on the opposite drive side to gain access.

The spring isolators under the four corners of the fan and motor assembly are factory adjusted while the fan was not running. With the unit operating at normal cfm and static pressure, all the isolators should be at the same height opening (Table 1 through Table 5). If adjustments are required, loosen the 1/2" cap screw on top of the isolator and turn the adjusting bolt to lower or raise the fan and motor base. Retighten the cap screw when adjustments are completed.

Table 1: Motor Beside Fan Spring Mount Adjustments

Spring Mount Adjustment at Rest			
Isolator Position	**Top or Bottom Horizontal H**	**Downblast H**	**Upblast H**
Unit Sizes 003 – 035			
1	3.75	3.75	4.25
2	4.25	3.75	4.25
3	4.25	3.75	4.25
4	3.75	3.75	4.25
Unit Sizes 040 – 090			
1	6.00	6.00	6.50
2	6.50	6.00	6.50
3	6.50	6.00	6.50
4	6.00	6.00	6.50

Table 2: Motor Behind Fan Spring Mount Adjustments

Spring Mount Adjustment at Rest			
Isolator Position	**Top or Bottom Horizontal H**	**Downblast H**	**Upblast H**
Unit Sizes 003 – 035			
1	6.75	6.75	6.75
2	6.75	6.75	6.75
3	6.75	6.75	6.75
4	6.75	6.75	6.75
Unit Sizes 040 – 090			
1	6.75	6.75	6.75
2	6.75	6.75	6.75
3	6.75	6.75	6.75
4	6.75	6.75	6.75

For models 040 through 090 with housed fans, the isolators should be at equal height (6") during fan operation. Center the fan outlet in the outlet panel opening. If adjustment is required, loosen the bolt on top of the isolator assembly (. Turn the adjustment nut below the fan frame to lower or raise the fan motor and frame assembly. Retighten the bolt on top of the isolator assembly.

Table 3: Class II Belt-Drive Plenum Fan Spring Height

Fan Size	Isolator Type	Operating Height (in.)
13–16	Standard 2" Deflection	4.5
18–36	Standard 2" Deflection	4.0
13–36	Seismic	4.0
40–60	All	6.75

Table 4: Class III Plenum Fan Spring Height

Cabinet Width (in.)	Isolator Type	Operating Height (in.)
Width < 108	All	4.0
Width ≥ 108	All	6.75

Table 5: Class II Direct-Drive Plenum Fan Spring Height

Fan Size	Isolator Type	Operating Height (in.)
11–36	All	4.0
40–44	All	6.75

Figure 34: Adjusting Large Spring Mount Assembly

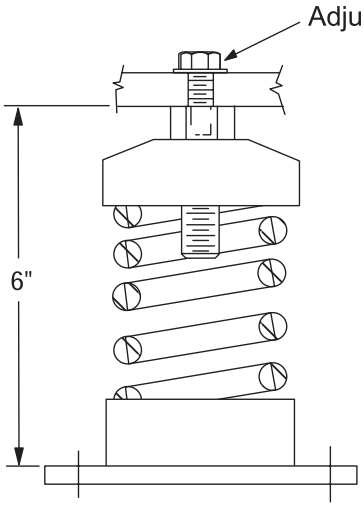


Figure 35: Removing "Motor Behind" Shipping Brackets

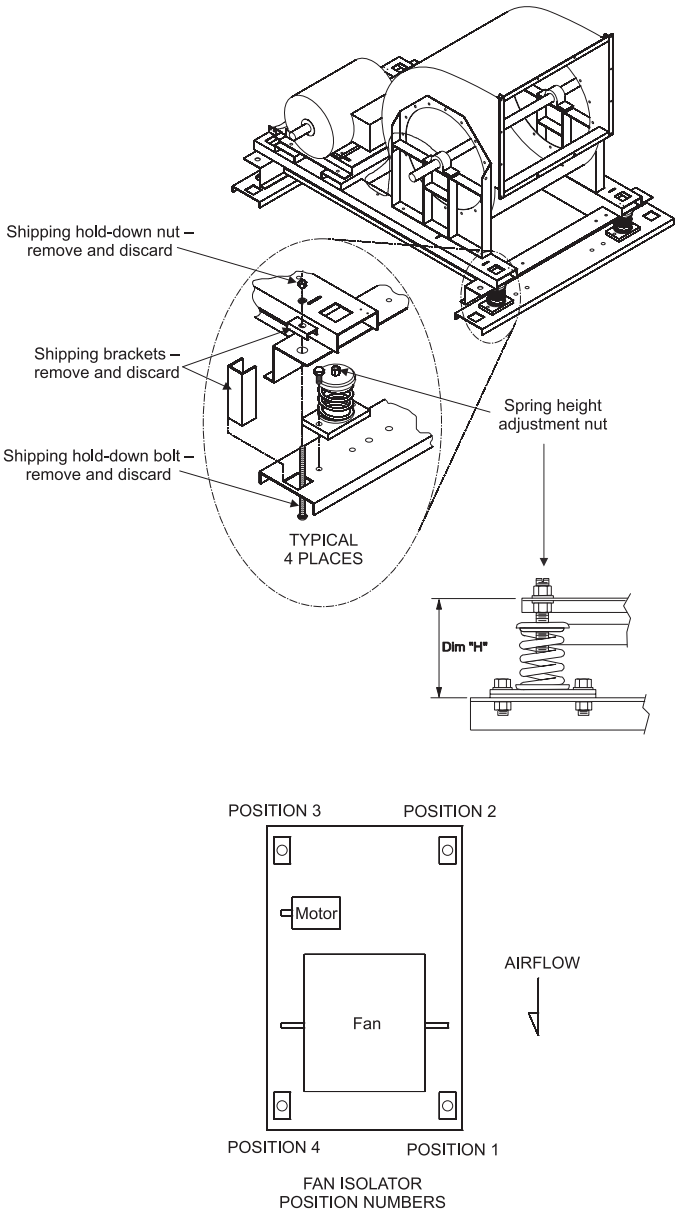


Figure 36: Removing "Motor Beside" Shipping Brackets

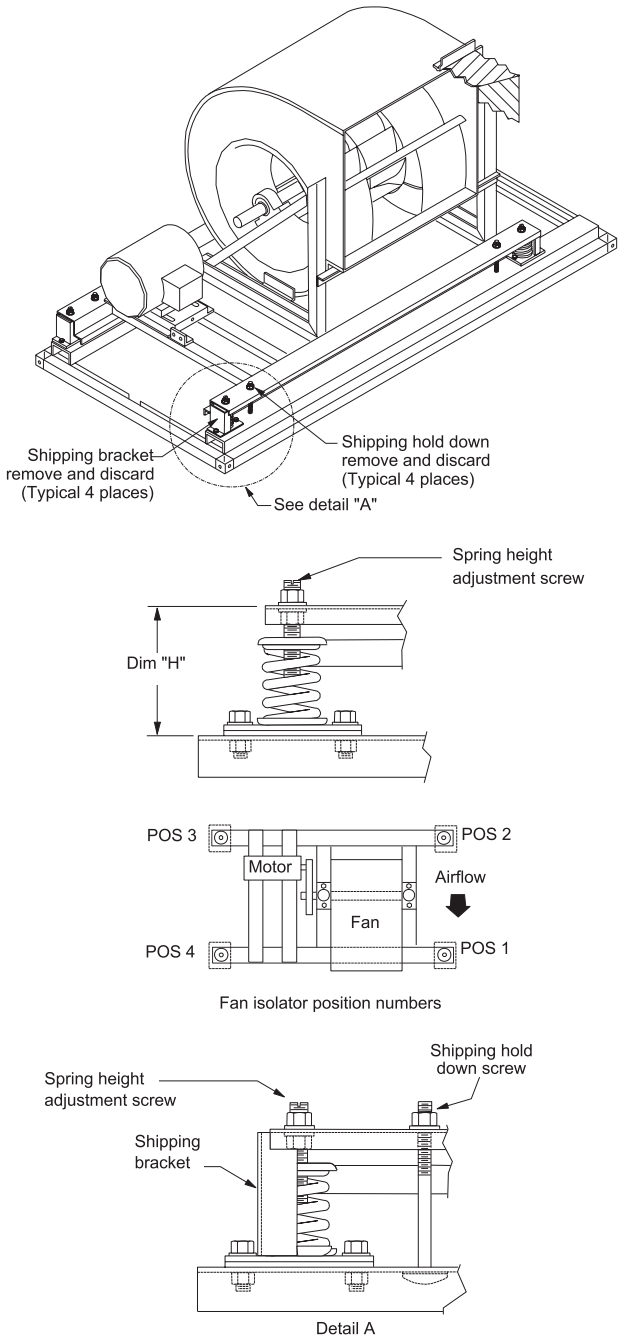
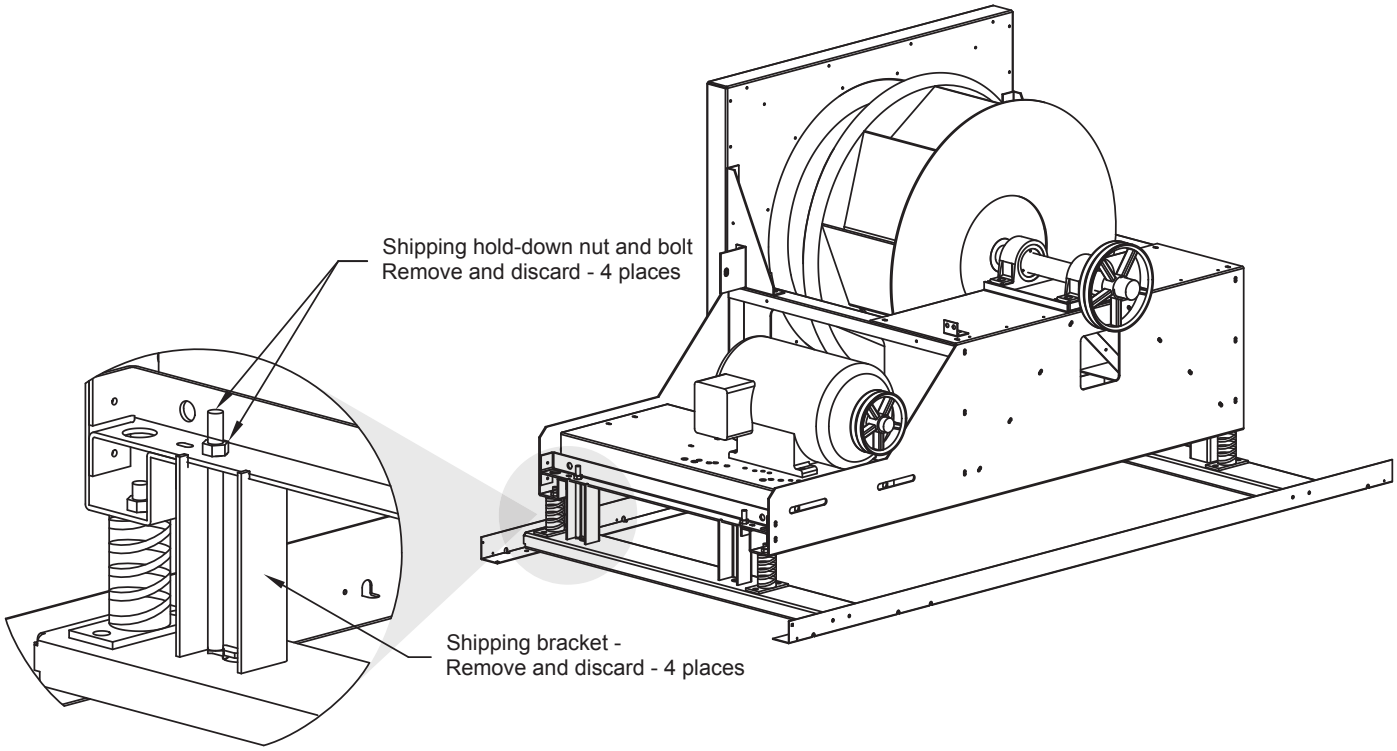


Figure 37: Plenum Fan Typical Shipping Brackets



OSHPD Seismic Anchoring/Mounting

For seismic stability of the unit, additional anchoring and mounting procedures are required. The anchoring options and corresponding spectral response acceleration are given in Table 6. Holes in the Vision/Skyline base frame are to be field drilled. Any mounting hardware is to be field supplied.

Table 6: OSHPD Mounting

Attachment Method	SDS	Attachment System (by Others)	
		Spacing	System
Bolted attachment to steel (Figure 38)	1.93	48	5/8" DIA SAE Grade 5
Welded attachment to steel (Figure 39)	1.84	48	3/16" Weld Leg and 4" welded length
Bolted attachment to Concrete (Figure 40)	1.68	24	Hilti HAD-P M16 × 190/40 with 4-3/4" embedment

Figure 38: Unit with Base Frame Mounted on Steel

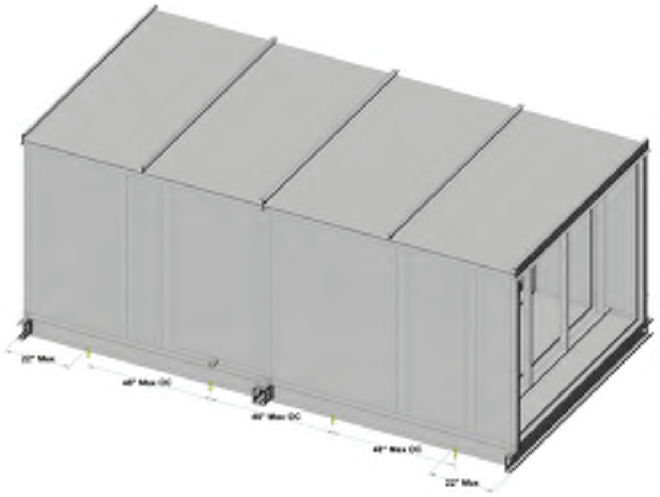


Figure 39: Unit with Base Frame Welded

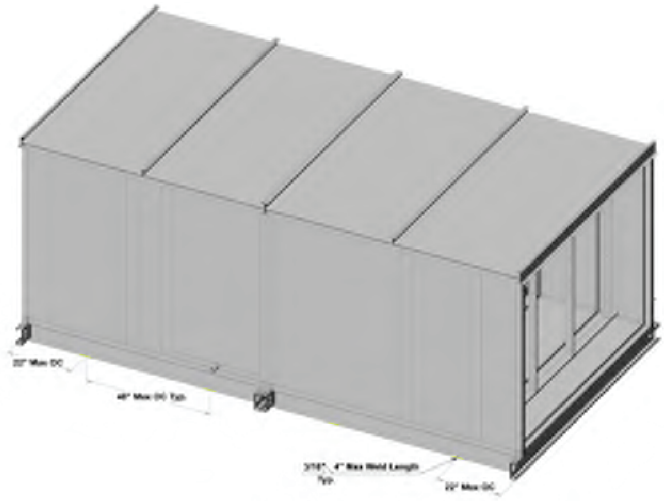


Figure 40: Unit with Base Frame Mounted on Concrete



Wiring

⚠ DANGER

Capacitor Hazardous Voltage! Failure to disconnect power and discharge capacitors before servicing will result in serious injury or death.

Disconnect all electric power (including remote disconnects) before servicing. Perform lockout/tagout procedures to ensure that power can not be energized. For variable frequency drives,or other energy storing components that have been furnished and mounted by either Daikin, or by others, refer to the specific manufacturer's literature for allowable waiting periods For discharge of capacitors. Verify capacitors have been discharged using an appropriate voltmeter.

⚠ CAUTION

Use copper conductors only! Failure to use copper conductors can result equipment damage.

- Electrical service to each fan must correspond to the rated voltage on the motor or electrical panel nameplate and conform to the National Electric Code and local restrictions.
- Connect each fan section metal frame to the building electrical ground.
- A door electrical interlock is not provided as standard.
- Thermal motor protection is external to the unit. Unless the unit is provided with a variable frequency drive (VFD) or a unit mounted starter, thermal protection and a disconnect switch provision per electric codes are provided by others.
- When the unit is factory provided with a disconnect switch, starter or a variable frequency drive (VFD), the components are mounted on the outside of the unit cabinet. Factory wiring is provided from the device to the unit internal motor.
- All electrical components must be grounded to the building central ground. Suitable ground wires and/or (bonding) lugs are provided for all motors, disconnect switches, starters, and variable frequency drives. Provide dedicated ground (bonding) copper conductors in accordance with local and national codes.
- For units provided with a motor only or with an external junction box, wire connections are made with suitable wire nuts or connectors for the gauge wires provided.
- For units provided with a disconnect switch or starter, field wiring will be terminated to lugs. Wire size and lug torque requirements are shown on the unit electrical schematic provided in the component print pocket. All power supply wire connections must be torqued as shown.
- When the unit is provided with a VFD only, refer to the VFD manual for wire size and torque requirements. For instances where multiple motors are being driven by a single VFD, be sure to set up the VFD and size the wiring according to the power requirements of all motors that are being driven by that VFD.
- When not being serviced, close and secure electrical panel doors to prevent ingress of moisture and airborne contaminants.

Control Wiring

- Access to the VFD is through the fan cabinet access door for single fans. Provide shielded cable only as described in the provided VFD manual. Route wire through the panel so that it does not interfere with an other components or access doors. Do not drill through drip pans or drain pans. Refer to the provided VFD installation manual for detailed control wiring instructions.
- For multiple fans in parallel, the VFD(s) are mounted inside of the electrical enclosure, which is mounted on the exterior of the fan section. When multiple fan sections are provided with multiple VFDs, they must be set up so that the fans always start simultaneously and are set to ramp up and down together. Do not attempt to run fans in parallel at different speeds as this can result in uneven airflow that can cause performance, sound, and vibration problems that can lead to failure. Provided that the fan is capable of running fast enough and the motor is sized appropriately, VFDs may be operated up to a maximum recommended frequency of 90 Hertz for 1800 RPM and slower motors. Motors that are 3600 RPM may be operated up to a maximum speed of 4000 RPM or 66.7 Hertz provided the fan is rated that high. Operation above 4000 RPM can damage motor bearings and is not recommended.

Startup Checks

When performing startup and service, always take thorough safety precautions. Only trained, experienced personnel should perform these functions.

⚠ WARNING

ROTATING FAN

Can cause severe injury or death. Before servicing fans,lockout and tag out power.

⚠ WARNING

FIRE/ELECTRIC SHOCK HAZARD

Can cause property damage, personal injury or death. Wire fan power supply and ground motor frame in accordance with local electric codes.

⚠ WARNING

Fan motor requires overload protection.

Failure to provide motor overload protection can result in fire,property damage, electric shock, personal injury, or death. Connect motor to an overload protective device rated incompliance with local electric codes.

⚠ CAUTION

DO NOT OVERHEAT FAN MOTOR

High air temperatures in the fan section can cause the fan motor to burnout. On draw-through air handlers or air handlers with the fan section down the air stream from the heating section, the discharge air temperature of the heating section must not exceed 104°F (40°C).

Before Starting the Unit

⚠ CAUTION

Equipment damage due to loose fasteners represents improper start-up and equipment abuse. It is not covered by the warranty.

Before entering fan section, make sure that fan electrical power source is disconnected and locked in the OFF position.

1. Check that the unit is completely and properly installed with ductwork connected.
2. Check that all constru tion debris is removed and filters are clean.
3. Check that all electrical work is complete and properly terminated.
4. Check that all electrical connections are tight and that the proper voltage is connected. Phase imbalance must not exceed 2%.
5. Do not grease ball bearings on the fan shaft and motor before startup. They are prelubricated.
6. Check tightness of crews in bearings and fan wheel(s). If retightening is needed, position the fan wheel(s) per Table 7, page 29 through Table 9, page 30 and Table 10 through Table 12, page 31. Torque set screws per Table 13 and , page 31.
7. Check alignment of fan and motor sheaves and belt tension. Adjust if necessary. Check tightness of sheave setscrews and/or capscrews (refer to , page 31).
8. Leak test the thermal system to verify that connections are tight.
9. Check that the condensate drain is trapped.
10. Rotate the shaft by hand to be sure it is free.
11. If multiple fans are supplied with a block off plate and it is installed on one of the fans, make sure to only start the fans without the block off plate. Do not start any fan that has the block off plate installed on it.
12. If multiple fans are supplied with isolation dampers, make sure the isolation dampers are fully open before starting the fans.

VFD Setup

Fans ordered with VFDs that were factory installed are setup and tested prior to shipment. Prior to starting the fan(s), double check the VFD settings according to the recommendations in the VFD manual.

Once the correct VFD settings are verified, the fans should be run through a sweep of the full range of operating speeds that are expected to check for any vibration issues. If any areas of concern are located, it is recommended to lock out those frequencies using the VFD (see lock out frequencies or skip frequencies in the VFD manual). This will ensure that the fans will never operate continuously at those points, but will rather pass through them to get to the desired points of operation.

Fan Startup

Start and run fan. See on page 30 for proper fan rotation. Observe the rotation. If the fan operates backward, reverse two legs of the three-phase supply power.

NOTE: Variable pitch fan drives usually are provided for operation in the mid-speed adjustment range. However, the drives usually ship with the adjustment opened up for minimum fan speed. Adjust the drives for the proper airflow. See Fan Drive Adjustments on page 38.

After 48 Hours of Operation

⚠ WARNING

ROTATING FAN

Can cause severe injury or death. Before servicing fans,lockout and tag out power.

1. Disconnect and lock electrical power source.
2. Check tightness of all bearing, wheel, and sheave setscrews (or capscrews). Refer to Table 13.
3. Recheck belt tension and adjust if necessary. Belts tensioned sufficiently to slip one to two seconds at startup will perform satisfactorily, extending life and reducing

Fan Wheel Alignment

Figure 41: Wheel-to-Inlet Funnel Relationship—Fan Wheels (Housed)

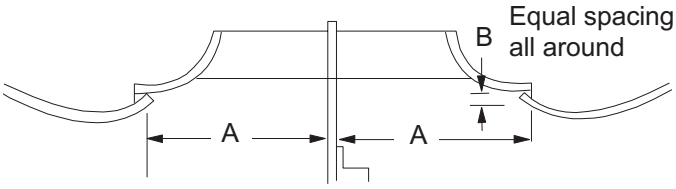


Table 7: Wheel-to-Inlet Funnel Relationship—Fan Wheels(Housed)

Airfoil[1] (in.)					
Unit sizes 003 to 035			Unit sizes 040 to 090		
Diameter	A[2] (mm)	B[3] (mm)	Diameter	A[2] (mm)	B[3] (mm)
13.22	4.56 (116)	0.21 (5.33)	20.00	7.19 (183)	0.31 (7.87)
14.56	5.06 (129)	0.21 (5.33)	22.25	7.69 (195)	0.33 (8.38)
16.18	5.62 (143)	0.21 (5.33)	24.50	8.56 (217)	0.31 (7.87)
17.69	6.90 (175)	0.22 (5.59)	27.00	9.47 (241)	0.63 (16.00)
21.56	7.59 (193)	0.24 (6.10)	30.00	10.47 (266)	0.39 (9.91)
24.00	8.45 (215)	0.23 (5.84)	33.00	11.75 (298)	0.38 (9.65)
—	—	—	36.50	325 (12.78)	0.38 (9.65)
—	—	—	40.25	363 (14.31)	0.50 (12.70)

Note:

[1]To obtain rated air performance, dimensional relationship must be held.

[2]To obtain dimension A, loosen setscrews in wheel hub(s), shiftingwheel(s) axial as needed, retightening setscrews.

[3]To obtain dimension B, loosen screw and washer fasteners around periphery of funnel(s), shifting funnel radially as required, re-torquing fasteners.

Figure 42: Wheel-to-Inlet Funnel Relationship—Forward Curved Fan Wheels

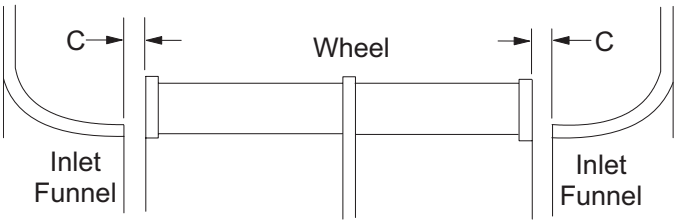


Figure 43: Wheel-to-Inlet Funnel Relationship—Forward Curved Fan Wheels

Forward Curved[1] (in.)			
Unit sizes 003 to 035		Unit sizes 040 to 090	
Diameter	C[2] (mm)	Diameter C[2] (mm)	
9×4	0.25 (6.35)	20 (Class 1 & 2)	0.24 (6.10)
9×7	0.13 (3.30)	22.38 (Class 1 & 2)	0.41 (10.41)
9×9	0.25 (6.35)	25 (Class 1 & 2)	0.47 (11.94)
10	0.22 (5.59)	27.62 (Class 1 & 2)	0.47 (11.94)
12	0.35 (8.89)	30 (Class 1 & 2)	0.47 (11.94)
15	0.44 (11.18)	33 (Class 1 & 2)	0.50 (12.70)
18	0.25 (6.35)	36 (Class 1 & 2)	0.75 (19.05)
20 (Class 1 & 2)	0.73 (8.54)	—	—
22½ (Class 1 & 2)	0.59 (14.99)	—	—
24½ (Class 1 & 2)	0.56 (14.22)	—	—

Note:
[1]To obtain rated air performance, dimensional relationship must be vibration. If retensioning is necessary, be certain to retain held.
[2]Adjust dimension C by loosening wheel hub setscrews, shifting sheave alignment wheel(s) axial as needed, and retightening setscrews.

Figure 44: Wheel-to-Inlet Funnel Relationship— 13 to 36 Belt-Drive Plenum Fans

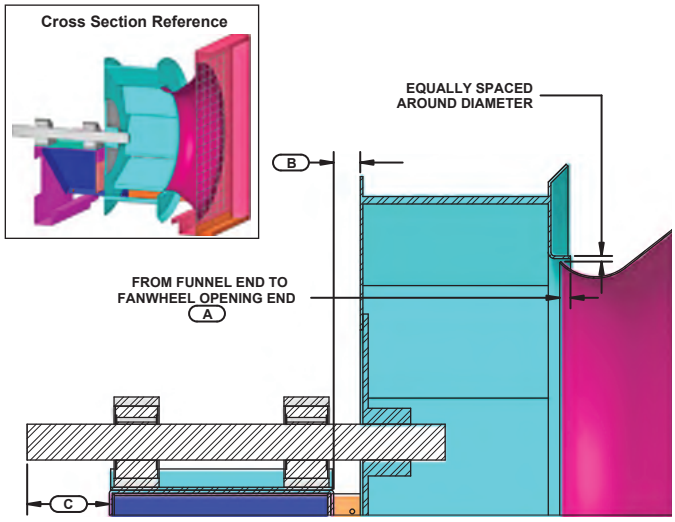


Table 8: Wheel-to-Inlet Funnel Relationship— 13 to 36 Belt-Drive Plenum Fan

Wheel-Funnel Parameters			
Size	**A**	**B**	**C**
13	0.25	0.91	3.50
15	0.25	0.91	3.50
16	0.25	0.91	3.50
18	0.38	0.86	3.88
20	0.42	1.11	3.88
22	0.45	1.11	3.88
24	0.51	1.11	3.88
27	0.55	1.36	4.50
30	0.62	1.36	4.50
33	0.55	1.50	5.00
36	0.63	1.50	5.00

Figure 45: Wheel-to-Inlet Funnel Relationship— 40 to 60 Belt-Drive Plenum Fans

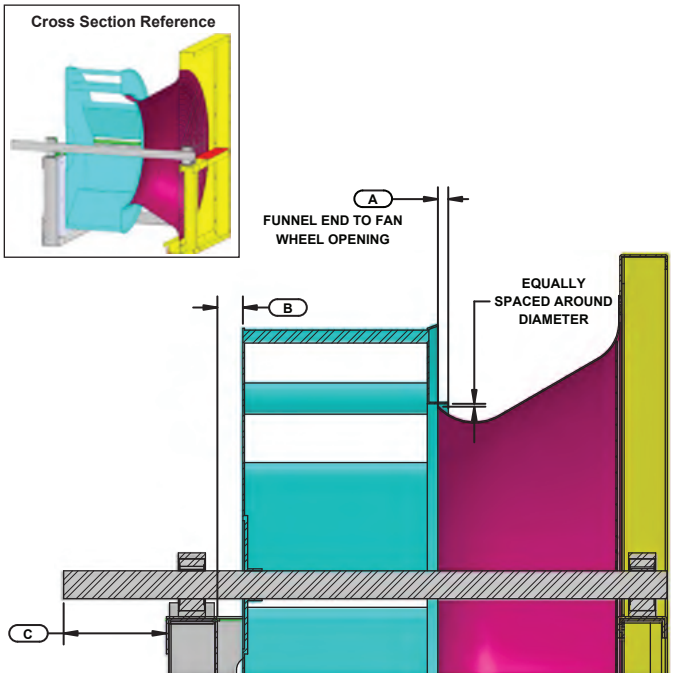


Table 9: Wheel-to-Inlet Funnel Relationship— 40 to 60 Belt-Drive Plenum Fan

Wheel-Funnel Parameters			
Size	**A**	**B**	**C**
40	0.82	2.00	4.88
44	0.91	2.25	5.50
49	1.00	2.50	5.50
54	1.10	2.50	5.50
60	1.23	3.00	5.50

Setscrews on MPQ fan wheels must be installed using a calibrated torque wrench to the value listed below, ±5%.The fasteners must be periodically checked to satisfy agency requirements for components on rotating machinery.

Figure 46: Fan Wheel Rotation

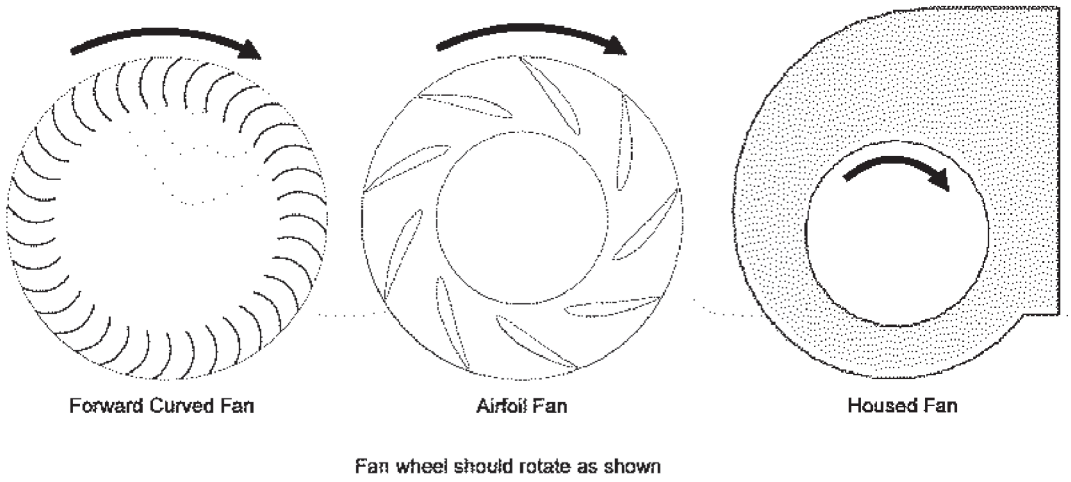


Figure 47: Wheel-to-Inlet Funnel Relationship—Inline Fans Overlap

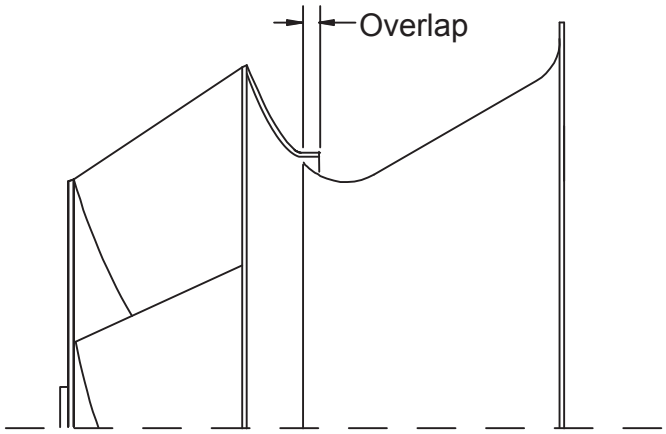


Table 10: Wheel-to-Inlet Funnel Relationship—Inline Fans

Wheel—Funnel Overlap	
Size	**Overlap**
150	.375
165	.438
182	.562
200	.625
222	.688
245	.750
270	.812
300	.875
330	1.000
365	1.125
402	1.250
445	1.375

Table 11: Wheel-to-Inlet Funnel Relationship—Direct-Drive Fans Only Class II fans

Fan Size	Overlap (in.)
11	0.25
12	0.25
15	0.25
16	0.38
18	0.38
20	0.41
22	0.45
24	0.50
27	0.55
30	0.61
33	0.67
36	0.75
40	0.82
44	0.91

Table 12: Wheel-to-Inlet Funnel Relationship—Direct-Drive Class III fans

Fan Size	Overlap (in.)
13	0.12
15	0.19
16	0.25
18	0.31
20	0.38
22	0.44
24	0.50
27	0.56
30	0.62
33	0.75
36	0.81
40	0.88
44	0.94
49	1.0
54	1.06
60	1.12

Table 13: Setscrew Torque Specifications—Class II Plenum

Fan Size	Setscrew Size	Torque (ft.-lb)	
		Aluminum	Steel
11/12/13	3/8	19.2	N/A
15	3/8	19.2	N/A
16	3/8	19.2	N/A
18	3/8	19.2	N/A
20	3/8	19.2	N/A
22	3/8	19.2	N/A
24	3/8	19.2	N/A
27	3/8	19.2	22
30	1/2	41.7	55
33	1/2	41.7	55
36	1/2	41.7	55
40	1/2	41.7	55
44	1/2	41.7	55
49	1/2	41.7	55
54	1/2	41.7	55
60	3/4	115	150

Table 14: Bearing Collar and Wheel Hub Set Screw Torque (All Fans Except Class II Plenum Fans)

Set Screw Diameter (in)	Minimum torque ft/lbs (kg/m)
1/4	5.5 (0.76)
1/16	10.5 (1.45)
3/8	19.0 (2.63)
7/16	29.0 (4.01)
1/2	42.0 (5.81)
5/8	92.0 (12.72)

Fan Array

The Daikin Fan Array is available with optional, factory mounted VFDs. See OM manuals OM 1190 and 1191 for details on the Daikin supplied VFD.

Care should be taken when programing and synchronizing the drives in the Daikin Fan Array such that all fans turn at the same speed. Fans running at unequal speeds can produce vibration and could stall a fan. Definition of fan numbering is given in Figure 48.

The Daikin Fan Array is standard with a manual block off plate. The unit will ship with one block off plate that will come installed on fan 1A. This block off plate is to be removed before unit operation and stored outside of the air tunnel. In the event of a lost fan motor, the block off plate is installed on the non-functional fan to prevent air re-circulation. This is designed to be a temporary measure unit this fan and/or motor is replaced. After fan and/or motor replacement the block off plate is to be removed and stored outside of the air tunnel.

The Daikin Fan Array has an optional gravity actuated block off damper. These dampers are equipped with counter weights.

The Daikin Fan Array has an optional actuated block off damper. These dampers are designed to prevent air recirculation in the event of a lost fan. Care should be taken that the damper actuator only be given a close signal if the fan is not operational (motor burnout for example).

The Daikin Fan Array can be equipped with a fan blank off plate. See Figure 49 with a block off plate mounted to fan 3C. If the unit is ordered with the manual block off plate, it will be installed to fan 1A. This plate has to be removed before start up.

⚠ WARNING

Closing the damper on an operational fan could send the fan into surge that could produce fans stall, excessive vibration, unit damage, or personnel injury.

Figure 48: Daikin Fan Array Configuration

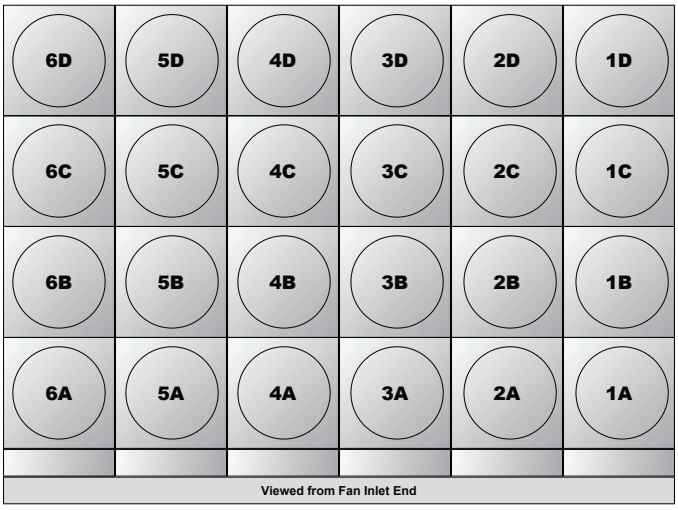
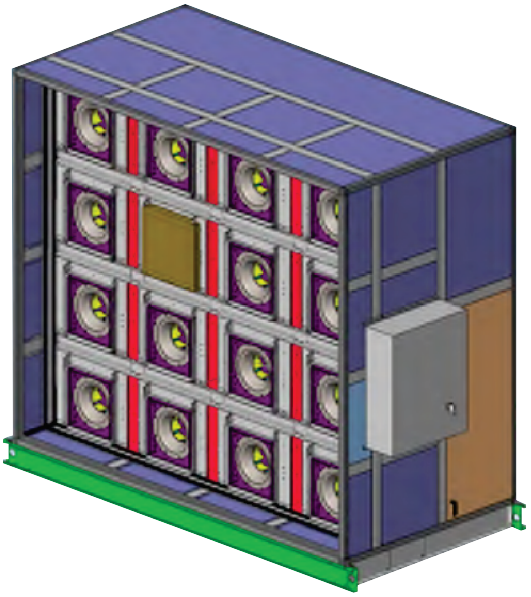


Figure 49: Fan Array with Block Off Plate



Optional Piezometer Ring Airflow Measurement Device

Piezometer rings are available as an option on direct drive plenum fans to measure airflow though the fan. The device consists of a piezometer ring mounted in the throat of the funnel and a static pressure tap mounted near the inlet of the funnel. The pressure drop is measured from the tap located near the inlet of the funnel to the piezometer ring in the throat. The inlet tap is connected to the high-pressure side of the transducer and the piezometer ring is connected to the low-pressure side.

Below are the equations and factors required to calculate flow using the piezometer ring:

Non-Standard Density Method

The following equation is used to measure the flow for non-standard density:

ACFM = C1 × A × √(ΔP/ρ)

where: A = Inlet funnel throat area (square feet) - from Table 2

ΔP = The differential in static pressure from the piezometer ring and the inlet pressure tap (inches w.g.)

ρ = Air density (pounds mass/cubic foot)

C1 = Value from Table 1 below

Standard Density Method

The equation can be simplified by assuming standard density and assuming funnel dimensions match the drawing dimensions. Table 16 shows the factor (F) for each fan size and type. The equation then becomes the following:

For standard air (ρ = 0.075 lb/ft3):

ACFM = F × √ (ΔP)

where: F = factor from Table 2

ΔP = The differential in static pressure from the piezometer ring and the front pressure tap (inches w.g.)

Table 15: DDPL Factors For Free and Ducted Inlet—Non Standard Density Method

Product	C1 Free Inlet	C1 Ducted Inlet
DDPL Size 11-16	753.06	794.06
DDPL Size 18-44	692.03	740.14

Table 16: DDPL Factors For Free and Ducted Inlet—Standard Density Method

DDPL Size	Free Inlet F	Ducted Inlet F	Area A
11 and 12	944.92	996.36	0.344
15	1206.40	1272.08	0.439
16	1518.58	1601.26	0.552
18	1821.92	1948.58	0.721
20	2185.80	2337.76	0.865
22	2713.93	2902.60	1.074
24	3285.02	3513.39	1.300
27	3997.61	4275.53	1.582
30	4945.21	5289.01	1.957
33	5968.62	6383.56	2.362
36	7290.21	7797.03	2.885
40	8869.55	9486.16	3.510
44	10827.92	11580.68	4.285

Optional Transducer for Piezometer Rings

A transducer is available for Piezometer rings. Factory mounting locations for the fan transducer is shown in Figure 50 for direct-drive plenum fans. Figure 51 shows the installation for fan array. Wiring for the transducer is field-supplied and installed.

Figure 50: Direct-drive Plenum Fan Installation

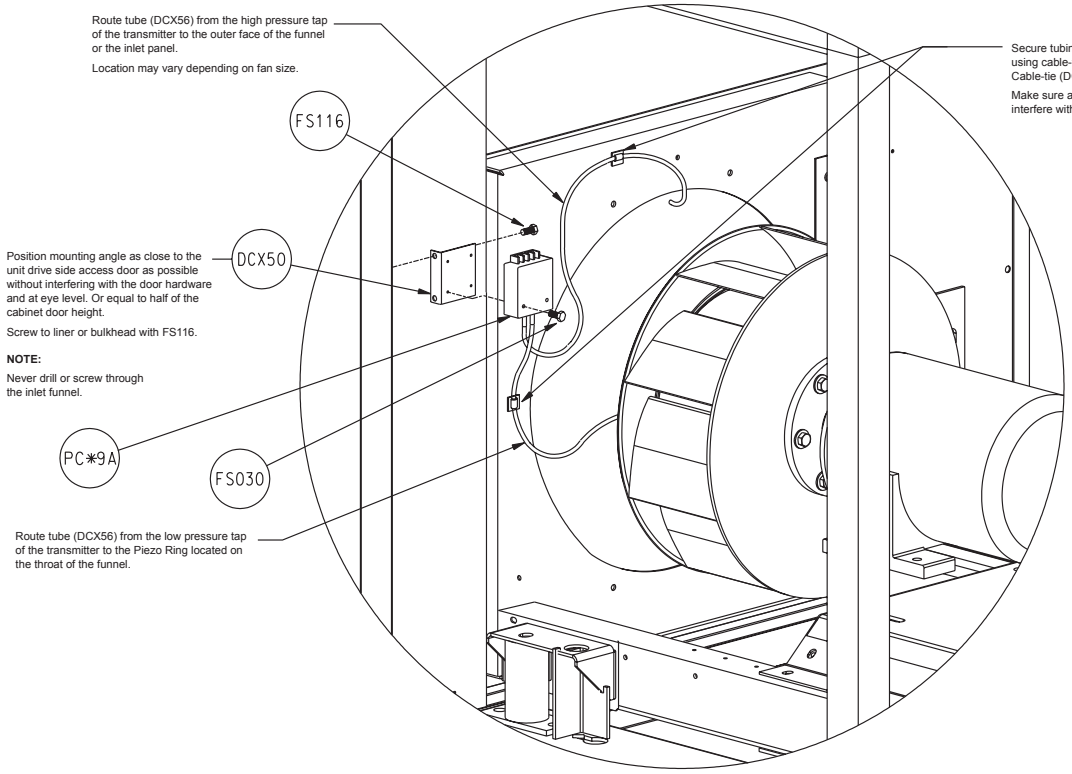
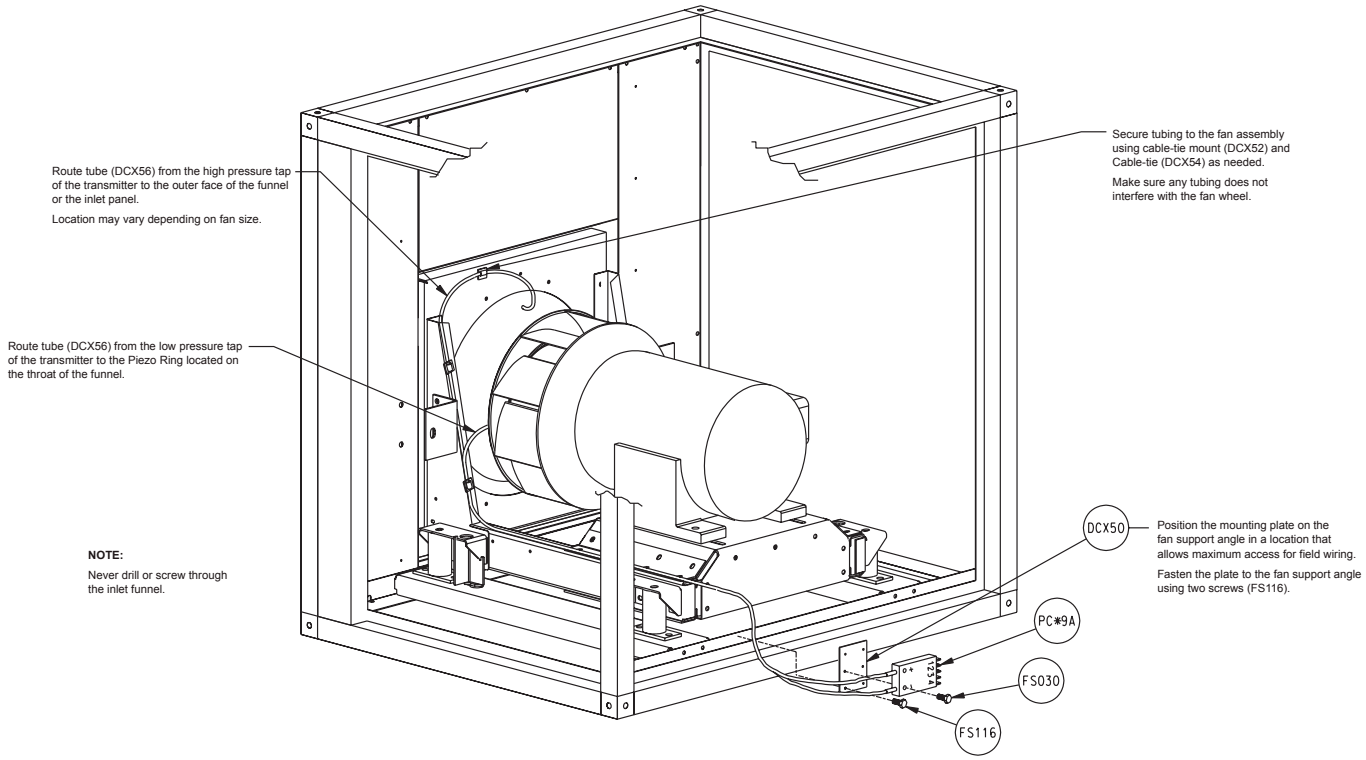


Figure 51: Fan Array Installation



Operating Limits

Do not exceed the operating limits in Table 17 through Table 21. A fan wheel operated beyond the rpm and temperature limits shown can suffer permanent distortion or fracture. The resulting unbalance can cause severe unit vibration.

Table 17: Fan Operating Limits—Unit Sizes 003 to 035

Forward Curved—Housed										
Diameter	9×4	9×7	9×9	10.62	12.62	15	18	20	22.25	24.50
Max. RPM Class I	N/A	2189	2223	1934	1614	1328	1155	1050	944	858
Max. RPM Class II	2244	2854	2896	2518	2091	1725	1450	1200	1030	910

Airfoil—Housed					
13.22	14.56	16.19	19.69	21.56	24.00
3000	3000	2300	2000	1700	1500
4335	3918	3457	2858	2427	2255

Table 18: Fan Operating Limits—Unit Sizes 040–090

Forward Curved—Housed							
Diameter	20	22.38	25	27.62	30.25	33	36
Max. RPM Class I	1010	930	790	690	650	600	560
Max. RPM Class II	1281	1178	1011	910	835	763	715

Airfoil—Housed						
20	22.25	24.5	27	30	33	36.5
2077	1875	1691	1479	1328	1209	1073
2703	2413	2199	1928	1730	1579	1401

Table 19: Fan Operating Limits—Belt-Drive Plenum Fans

Belt-Drive Plenum fans																
Size	13	15	16	18	20	22	24	27	30	33	36	40	44	49	54	60
Max. RPM Class II	3909	3468	2820	2930	2674	2403	2183	1860	1783	1620	1465	1329	1202	1091	986	891
Max. RPM Class III	4000	4000	3887	3735	3409	3065	2780	2423	2182	1984	1759	1598	1447	1314	1178	1071

Table 20: Fan Operating Limits—Direct-Drive Plenum Fans

Direct-Drive Plenum Fans																		
Size	11	12	13	15	16	18	20	22	24	27	30	33	36	40	44	49	54	60
Max. RPM Class II	4000	4000	—	3909	3650	3650	2674	2403	2183	1981	1783	1620	1465	1329	1202	—	—	—
Max. RPM Class III	—	—	4000	4000	3887	3735	3409	3065	2780	2423	2182	1984	1759	1598	1447	1314	1178	1071

Table 21: Fan Operating Limits—Inline Fans, Twin Fans

Inline Fans/Twin Fans												
Diameter	18.25	20	22.25	24.5	27	30	33	36.5	40.25	44.50	49	54.25
Max. RPM Class I	2727	2488	2236	2041	1835	1665	1476	1330	1208	1072	973	880
Max. RPM Class II	3409	3111	2796	2551	2294	2082	1846	1662	1510	1340	1216	1100

Twin Fans						
Diameter	9×9	10.62	12.62	15	18.12	20
Max. RPM	2575	2400	2000	1700	1400	1200
Max. HP	10	15	15	30	40	40

Fan Vibration Levels

Each unit as shipped is trim balanced to operate smoothly. To provide satisfactory operation after shipping and installation, use the accepted industry guidelines for field balancing fans. See Table 22.

Table 22: Vibration Levels

Fan Speed (RPM)	Vibration
800 or less	5 mils maximum displacement
801 or greater	0.20 in/sec. maximum velocity

Note:
Excessive vibration from any cause contributes to premature fan and motor bearing failure. Monitor overall vibration levels every six months of operation. An increase in levels is an indication of potential trouble.

Vibration Causes

1. Wheel imbalance.
   a. Dirt or debris on wheel blades.
   b. Loose set screws in wheel hub or bearing-to-shaft.
   c. Wheel distorted from overspeed.
2. Bent shaft.
3. Drive faulty.
   a. Variable pitch sheaves—axial and radial runout of flanges; uneven groove spacing; out of balance. Also similar faults in driven sheave.
   b. Bad V-belts; lumpy, or mismatched; belt tension too tight or too loose.
4. Bad bearings, loose bearing hold-down bolts.
5. Motor imbalance.
6. Fan section not supported evenly on foundation.

Periodic Maintenance

1. Check all moving parts for wear every six months.
2. Check bearing collar, sheave, and wheel hub setscrews, sheave capscrews, and bearing hold-down bolts for tightness every six months.
3. Annually check and snug all electrical connections. Inspect for signs of water damage such as corrosion and repair if necessary. Check ground conductor and connection integrity and correct if needed.

Ball Bearing Lubrication

⚠ CAUTION

Bearing overheating potential. Can damage the equipment. Do not over lubricate bearings. Use only a high grade mineral grease with a 200°F safe operating temperature. See below for specific recommended lubricants.

Motor Bearings

Supply and return fans—Supply and return fan motors should have grease added after every 2000 hours of operation. Using the following procedure, re-lubricate the bearings while the motor is warm, but not running. Use one of the greases shown in Table 23.

1. Remove and clean upper and lower grease plugs.
2. Insert a grease fitting into the upper hole and add clean grease (Table 23) with a low pressure gun.
3. Run the motor for five minutes before replacing the plugs.

NOTE: Direct-Drive Class II fans that are supplied with TECO motors have double shielded bearings on frame sizes 140T-280T. These bearings are pre-packed with a long life grease and are not regreaseable. Larger frame size TECO motors are regreaseable and follow the same lubrication recommendations as all other motors.

Table 23: Recommended Lubricants and Amounts for Fan Motor Bearings

Manufacturers' Grease	NEMA Size	Amount to Add (oz.)
Texaco, Polystar or Polyrex EM (Exxon Mobile) or Rykon Premium #2 or Penzoil Pen 2 Lube	56 to 140	0.08
	140	0.15
	180	0.19
	210	0.30
	250	0.47
	280	0.61
	320	0.76
	360	0.81
	400	1.25
	440	2.12

NOTE: Specific greasing instructions are located on a tag attached to the motor. If special lubrication instructions are on the motor, they supersede all other instructions.

Fan Shaft Bearings

⚠ CAUTION

For safety, stop rotating quipment. Add one half of the recommended amount shown in Figure 24. Start bearing, and run for a few minu Stop bearing and add the second half of the recommended amount. A temperature rise, sometimes 30°F (1°C after lubrication is normal. Bearing should operate at tempe ature less than 200°F (94°C) and should not exceed 225 (107°C) for intermittent operation. For a lubrication schedule, see Table 22. For applications that are not in the range of the table, contact Daikin.

⚠ CAUTION

Table 24, Table 25 and Table 26 state general lubrication recommendations based on our experience and are intended as suggested or starting points only. For best results, specific applications should be monitored regularly and lubrication intervals and amounts adjusted accordingly.

Any good quality lithium or lithium complex base grease, using mineral oil, conforming to NLGI grade 2 consistency, and an oil viscosity of 455-1135 SUS at 100°F (100-200 cSt at 40°C) may be used for re-lubrication.

Compatibility of grease is critical. Lubricatable bearings are supplied with grease fittings or zerks for ease of lubrication with hand or automatic grease guns. Always wipe the fitting and grease nozzle clean.

Table 24: Lubrication Intervals

Speed	Bearing Temperature	Cleanliness	Lubrication Intervals
(Use NLGI #2 Lithium or Lithium Complex Grease)			
100 RPM	Up to 120°F (50°C)	Clean	6 to 12 months
500 RPM	Up to 150°F (65°C)	Clean	2 to 6 months
1000 RPM	Up to 210°F (100°C)	Clean	2 weeks to 2 months
1500 RPM	Over 210°F (100°C) to 250°F (120°C)	Clean	Weekly
Above 1500 RPM	Up to 150°F (65°C)	Dirty/Wet	1 week to 1 month
Max Catalog Rating	Over 150°F (65°C) to 250°F (120°C)	Dirty/Wet	Daily to 2 weeks
	Above 250°F (120°C)		Contact Browning

Table 25: Recommended Lubricants for Fan Shaft Ball Bearings

Name	Temperature	Base	Thickener	NLGI Grade
Texaco, Premium RB	30° to 350°F (34° to 177°C)	Parafinic Mineral Oil	Lithium	2
Mobil, AW2	40° to 437°F (40° to 175°C)	Mineral Oil	Lithium	2
Mobil, SHC 100	68° to 356°F (50° to 180°C)	Synthetic	Lithium	2
Chevron, Altiplex Synthetic	60° to 450°F (51° to 232°C)	Synthetic	Lithium	2
Exxon, Ronex MP	40° to 300°F (40° to 149°C)	Mineral Oil	Lithium	2

Note:
Temperature ranges over 225°F are shown for lubricants only. High temperature applications are not suitable for standard air handler components.

Table 26: Recommended Fan Lubrication Grease Charge

Shaft Size in Inches (mm)	Weight in Ounces (grams)
1/2 to 3/4 (20)	0.03 (0.85)
7/8 to 1-3/16 (25-30)	0.10 (2.84)
1-1/4 to 1-1/2 (35-40)	0.15 (4.25)
1-11/16 to 1-15/16 (45-50)	0.20 (5.67)
2 to 2-7/16 (55-60)	0.30 (8.51)
2-1/2 to 2-15/16 (65-70)	0.50 (15.59)
3 to 3-7/16 (75-80)	0.85 (24.10)
3-1/2 to 4 (85-105)	1.50 (42.53)

Fan Drive Adjustments

⚠ WARNING

Before servicing fans, lock out and tag out all power to the unit. Fans or belts can cause severe personal injury or death.

⚠ WARNING

Do not open the hinged access door and screw-fastenerd access panels while the unit is operating. Moving parts and strong suction forces can cause severe personal injury or death.

Upon completion of the air balance, replace the variable pitched motor sheave with a properly sized, fixed sheave. A matching fixed sheave provides longer belt and bearing life and minimizes vibration. Initially, it is best to have a variable pitched motor sheave for the purpose of air balancing. Once the balance is achieved, fixed sheaves maintain balancing and alignment more effectively. Replace the adjustable sheaves with fixed sheaves.

With the electrical power disconnected, locked and tagged out, measure the diameter of the V-belt outer surface where it passes around the sheave (pitch diameter). Calculate fan speed from the motor nameplate rpm.

$$\text{Fan RPM} = \text{motor RPM} \times \frac{\text{Measured diameter at motor sheave}}{\text{Measured diameter at fan sheave}}$$

VM/VP Variable Pitch Key Type Sheaves

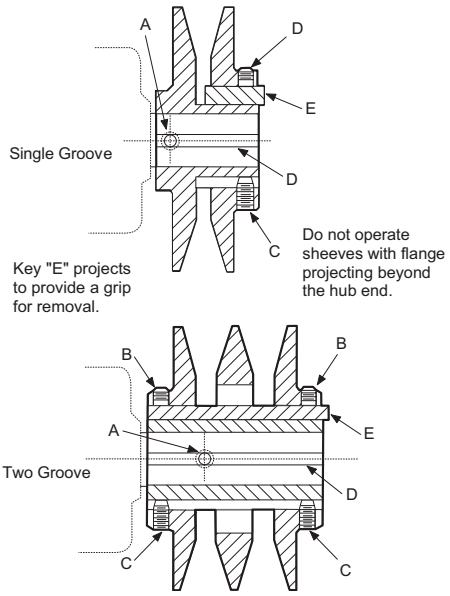
Mounting:

1. Mount all sheaves on the motor or driving shaft with the setscrews **A** toward the motor.
2. Verify that both driving and driven sheaves are in alignment and that shafts are parallel.
3. Fit internal key **D** between sheave and shaft and lock setscrew **A** securely in place.

Adjusting:

1. Loosen setscrews **B** and **C** in moving parts of sheave and pull out external key **E**. (This key projects a small amount to provide a grip for removing.)
2. To adjust sheave pitch diameter for desired speed, open moving parts by half or full turns from closed position. **Do not open more than five full turns for A belts or six full turns for B belts.**
3. Replace external key **E** and securely tighten setscrews **B** over key and setscrews **C** into keyway in fixed half of the sheave.
4. Put on belts and adjust tension. **Do not force belts over grooves.** See Fan Drive Belt on page 42.
5. Make future adjustments by loosening the belt tension and increasing or decreasing the pitch diameter of the sheave by half or full turns as required. Readjust belt tension before starting drive.
6. To provide the same pitch diameter, adjust both halves of the two-groove sheaves by the same number of turns from closed position.
7. Verify that all keys are in place and that all se screws are tight before starting drive. Check setscrews and belt tension after 24 hours service.

Figure 52: VP Type Sheave Adjustment



LVP Variable Speed Sheaves

Mounting:

1. Slide sheave on motor shaft so that the side of the sheave with setscrew **A** is next to the motor when setscrew **A** is in the hub or barrel of the sheave.
2. When setscrew **A** is at an angle in the center flange **B**, mount it away from the motor so that the outer locking ring and flange can be removed to get to the setscrew.
3. To remove the flange and locking ring:
   a. Loosen setscrews **D**.
   b. Loosen but do not remove capscrews **E**.
   c. Remove key **F**.

NOTE: This key projects a small amount to provide a grip for removing.

   d. Rotate the flange counterclockwise until it disengages the threads on the sheave barrel.
4. Verify that the driving and driven sheaves are in alignment and the shafts are parallel. When aligning two-groove sheaves, allow room between the sheave and motor to access capscrews **E**.
5. Insert key **C** between the sheave and the shaft and tighten setscrew **A** securely.
6. If flange and locking ring have been removed, when replacing them make sure that the inner and outer flanges are open from the closed position by the same amount as the other flange. Determine this by accurately measuring the top width of the grooves.
7. Insert key **F**.
8. Tighten setscrews **D** and capscrews **E**.
9. Put on belts and adjust belt tension. Do not force belts over grooves. See Fan Drive Belt.
10. Before starting the drive, ensure that all keys are in place and all setscrews and all capscrews are tight. Check and retighten all screws and retension belts after approximately 24 hours of service.

Adjusting:

1. Slack off belt tension if belts have been installed.
2. Loosen setscrews **D**.
3. Loosen but do not remove capscrews **E**.
4. Remove key **F**.

NOTE: This key projects a small amount providing a grip for removing.

5. Adjust pitch diameter by opening or closing the movable flanges by half or full turns.

NOTE: Two-groove sheaves are supplied with both grooves set at the same pitch diameter. To provide the same pitch diameter for satisfactory operation, move both movable flanges the same number of turns. Do not open sheaves more than five turns for A belts or six turns for B belts.

6. Replace key **F**.
7. Tighten setscrews **D** and capscrews **E**
8. If belts have been installed, readjust belt tension. If belts have not been installed, install them and adjust belt tension. **Do not force belts over grooves.** See Fan Drive Belt on page 42.
9. Before starting the drive, ensure that all keys are in place and all setscrews and all capscrews are tight. Check and retighten all screws and retension belts after approximately 24 hours of operation.
10. Replace variable speed sheaves for 15 hp motors and greater with a fixed pitch sheave after air balancing to maintain fan balance integrity. Fixed sheaves furnished by others.

MVP Variable Speed Sheaves

Mounting:

1. Verify both driving and driven sheaves are in alignment and the shafts are parallel. The centerline of the driving sheave must be in line with the centerline of the driven sheave (Figure 54).
2. Verify that all setscrews are torqued to the values shown in Table 27 before starting drive. Check setscrew torque and belt tension after 24 hours of service.

Adjusting:

1. Adjust motor base forward to release belt tension. Remove the belts for easier adjustment.
2. Loosen, but do not remove both of the locking setscrews **A** in the outer locking ring by using a hex key or torque wrench with a hex bit.
3. Adjust sheave to desired pitch diameter by turning the outer locking ring, using a spanner wrench or drift inserted into the three holes that are located 120° apart on the ring.
4. Any pitch diameter can be obtained within the sheave range. One complete turn of the outer locking ring changes the pitch diameter 0.233".
5. Do not open sheaves more than the following
   a. Do not open **B** sheaves more than 4-3/4 turns for the **A** belts or 6 turns for the **B** belts.
   b. Do not open **C** sheaves more than 9-1/2 turns.
   c. Do not open **5V** sheaves more than 6 turns.
   d. Do not open **8V** sheaves more than 8 turns.
6. Tighten BOTH locking screws **A** in the outer locking ring before operating the drive. Use a torque wrench and tighten to the value shown in Table 27.
7. Replace belts and adjust the motor base to tension the belts properly. See Fan Drive Belt on page 42.
8. Do not loosen any screws other than the two locking screws **A** in the outer locking ring when adjusting the sheave pitch. Do not operate the drive until the locking screws have been set to the torque specifications.

Figure 53: LVP Type Sheave Adjustment

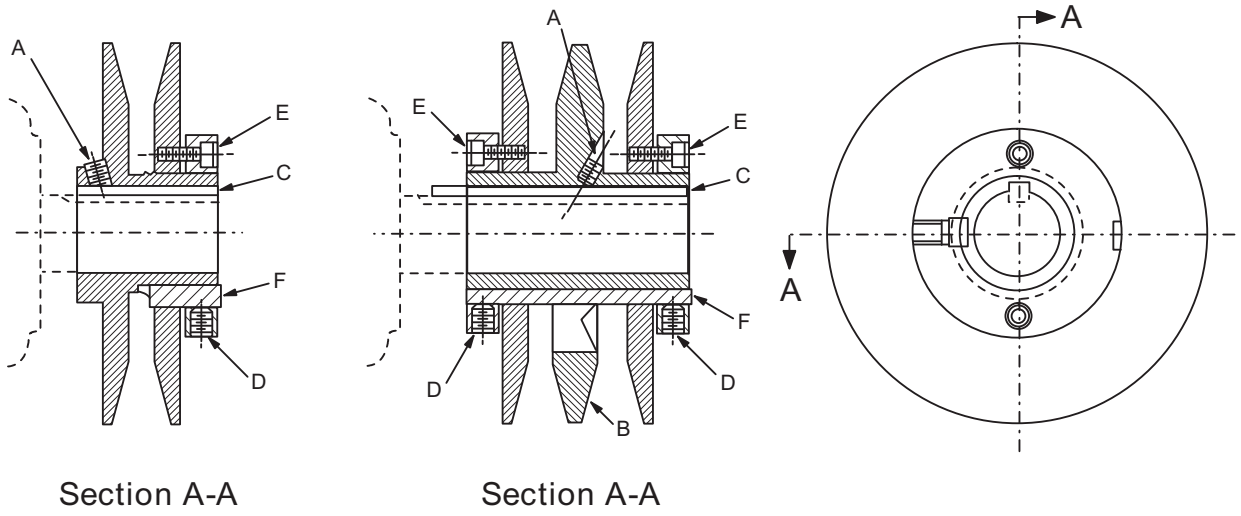
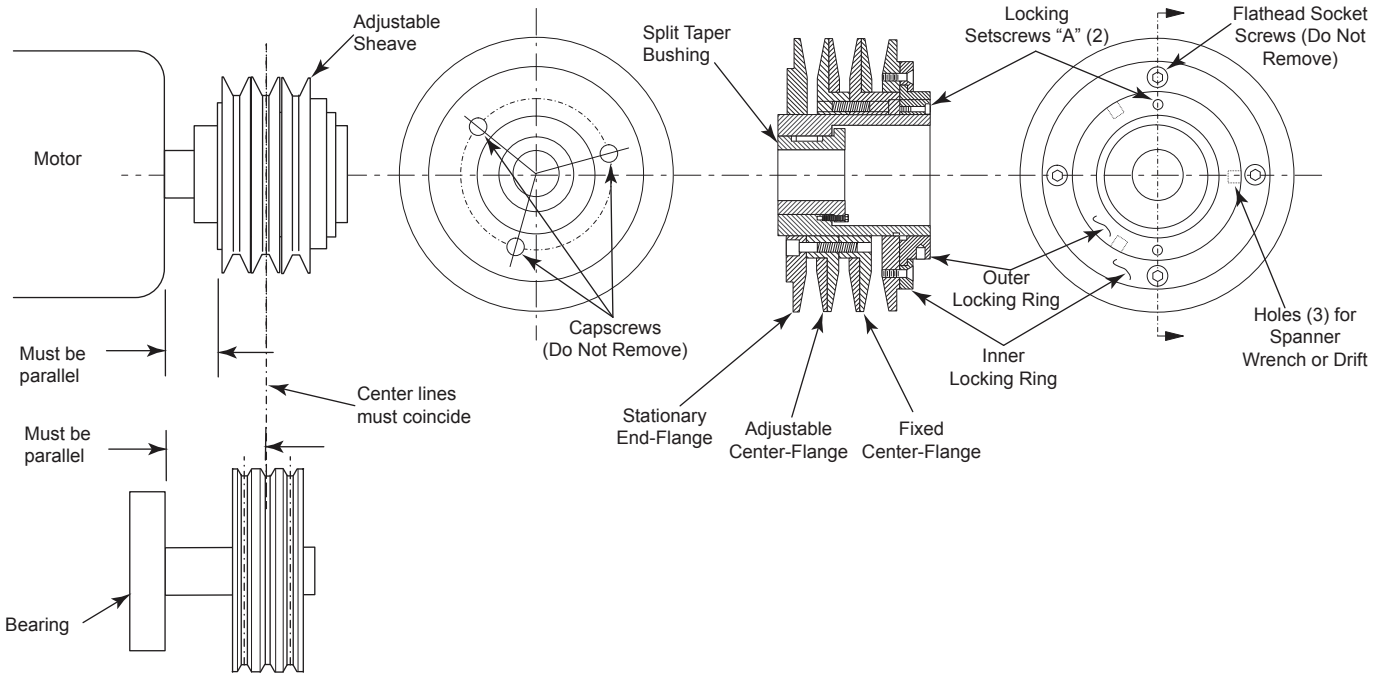


Table 27: Screw Torque Values

Nominal Screw Size (dia–thds/in)	Socket Head Cap Screws		Flat Head Socket Screws	Hollow Head Set Screws Only			
	Seating Torque		Seating Torque	Lengths Equal or Greater Than Dia.		For Lengths (L) Less Than Dia.	
				Seating Torque	Seating Torque	Length (L)	Seating Torque
	(in–lbs)	(in–lbs)	(in–lbs)	(in–lbs)	(in–lbs)	(in)	(in–lbs)
1/4–20NC	150	12.5	100	87	7.3	3/16	50
5/16–11NC	305	25.4	200	165	13.8	1/4	90
3/8–16NC	545	45.4	350	290	24.2	1/4, 5/16	150, 250
1/2–13NC	1300	108.3	N/A	620	51.7	N/A	N/A
5/8–11NC	N/A	N/A	N/A	1225	102.1	N/A	N/A

Figure 54: MVP Sheave Adjustment



Fan Drive Belt

General Rules of Tensioning

1. The ideal tension is the lowest tension at which the belt does not slip under peak load conditions.
2. Check tension frequently during the first 24 to 48 hours of operation.
3. Over tensioning shortens belt and bearing life.
4. Keep belts free from foreign material that can cause slippage.
5. Inspect V-drive on a periodic basis. Adjust tension if the belt is slipping. Do not apply belt dressing. This can damage the belt and cause early failure.

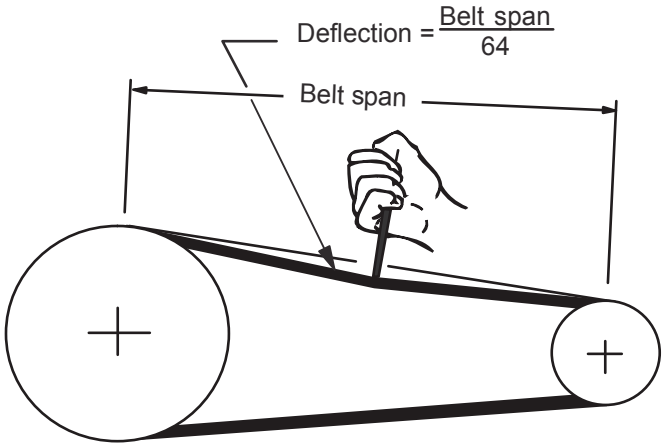
Tension Measurement Procedure

1. Measure the belt span (Figure 55).
2. Place belt tension checker squarely on one belt at the center of the belt span. Apply force to the checker, perpendicular to the belt span, until the belt deflection equals belt span distance divided by 64. Determine the force applied while in this position.
3. Compare this force to the values in Table 28.

Table 28: Belt Deflection Force (per Browning Specifications)

Cross Section	Small Sheave Diameter (in)	Number of Belts (Deflection Force lbs)					
		1		2		3 +	
		Min	Max	Min	Max	Min	Max
A, AX	0.0 to 3.5	3.0	5.0	2.5	4.0	2.0	3.5
	3.6 to 4.4	3.5	5.0	3.0	4.5	2.0	4.0
	4.5 +	4.0	5.5	3.0	5.0	2.5	4.5
B, BX	0.0 to 5.4	5.5	8.0	4.5	7.0	3.5	5.5
	5.5 to 7.6	5.5	8.5	4.5	7.5	3.5	5.5
	7.7 +	6.5	9.0	5.0	8.0	4.0	6.5
5V, 5VX	0.0 to 8.5	7.0	11.0	5.5	9.0	4.0	7.0
	8.6 to 12.0	8.5	13.0	6.5	10.5	5.0	8.0
	12.1 +	10.0	15.0	7.5	11.5	5.5	9.0

Figure 55: Drive Belt Adjustment



⚠ WARNING

Moving belt and fan can cause severe personal injury or death.

During installation and filter maintenance:

- Verify that the belt and fan guards on plenum fan units are always in place.
- Lock and tag out fans to prevent accidental start up.
- Do not enter the filter compartment until the fan is completely stopped.
- Use approved equipment for reaching filters located above normal reach. Do not step on filter frames or unit components.
- Floor surfaces must be dry and free of oil or grease.

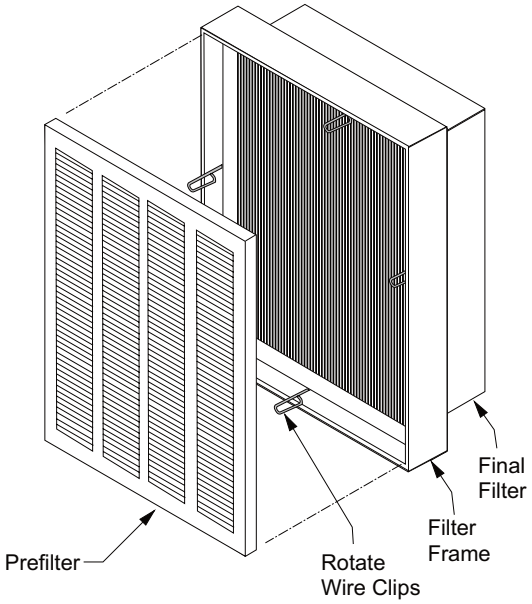
Filters

Front Load Filter Option

Front loaded filter options require that the filters be removed and replaced from inside the unit.

To remove filters, rotate the wire clips. This releases both the prefilter and the final filter. When installing clean filters, check to verify the filters are fully seated in the frame (Figure 56).

Figure 56: Frame and Filters with Holding Clips



Filter Gauges

Filter gauges indicate pressure drop for installed filters. If prefilters are present, the gauge will indicate the pressure drop for both pre- and final filters.

Table 29 shows the typical filter pressure drop for clean filters at rated air flow. The tables also show a final pressure drop for front loaded filters.

Where a single filter gauge is used, the prefilters can be removed to check the pressure drop of the final filters.

Figure 57: Filter Gauge



Table 29: Filter Pressure Drops

Bag filters—DriPak 2000				
Efficiency	45%	65%	85%	95%
Rated velocity (FPM)	625	500	500	500
Initial pressure drop	0.20–0.26	0.21–0.30	0.34–0.48	0.50–0.70
Initial pressure drop	1.0	1.0	1.0	1.0
Cartridge filters—Varicel II MH, 4.25" deep				
Efficiency	65%	85%	95%	
Rated velocity (FPM)	500	500	500	
Initial pressure drop	0.43	0.61	0.70	
Final pressure drop	1.5	1.5	1.5	
Cartridge filters—Varicel SH, 12" deep				
Efficiency	70%			
Rated velocity (FPM)	500			
Initial pressure drop	0.39			
Final pressure drop	1.2			
Pleated panel filters				
Type	Perfect pleat	AMAir 1300 4"		
Efficiency	30%	30%		
Rated Velocity (FPM)	500	625		
Initial Pressure Drop	0.36	0.36		
Final Pressure Drop	1.0	1.0		
5700 filters				
Efficiency	N/A			
Rated velocity (FPM)	500			
Initial pressure drop	0.25			
Final pressure drop	1.0			
Pleated 62 Plus filters				
Size	2"	4"		
Efficiency	70%	70%		
Initial pressure drop	0.42	0.37		
Final pressure drop	1.0	1.0		

Coils

⚠ CAUTION

Sharp fin edges are a potential injury hazard. Avoid contact with them.

1. To obtain maximum performance, the coil must be clean. Check once a year under normal operating conditions and, if dirty, brush or vacuum clean. Use a chemical coil cleaner on multiple row coils. Read and follow the chemical cleaner's instructions as some cleaners may contain harsh chemicals. Take care not to damage fins while cleaning. **CAUTION—Fin edges are sharp.**
2. Drain pans in any air conditioning unit may have some moisture. Algae, etc., can grow due to airborne spores and bacteria. Periodic cleaning is necessary to prevent this buildup from plugging the drain and causing the drain pan to overflow. Also, keep the drain pans clean to prevent the spread of disease. Cleaning should be performed by qualified personnel.
3. Dirt and lint can clog the condensate drain, especially with dirty filters. Inspect twice a year to help avoid overflow.

Winterizing Water Coils

⚠ WARNING

Mold can cause personal injury. Clean drain pan regularly so mold does not develop.

Coils can freeze due to air stratification or failure of outdoor air dampers and/or preheat controls. Drain all coils as thoroughly as possible and then treat in the following manner.

- Fill each coil independently with an antifreeze solution using a small circulating pump and again thoroughly drain.
- Check freezing point of antifreeze before proceeding to next coil. Due to a small amount of water always remaining in each coil, there is a diluting effect. The small amount of antifreeze solution remaining in the coil must always be sufficient enough to prevent freeze-up.

NOTE: Carefully read instructions for mixing antifreeze solution used. Some products have a higher freezing point in their natural state when mixed with water. Daikin is not responsible for the freezing of coils.

Removing and Replacing Components

⚠ WARNING

Before removing any component, lock out and tag out all power to the unit. Fans and belts can cause severe personal injury or death.

Removing a Side or Top Panel

1. Remove the flat head fasteners located along the sides of the panel.
2. Once all fasteners are removed, lift off the panel.

Removing a Frame Channel

Frame channels that run the length of the unit along the top can be removed to allow access to both the side and top of the unit.

1. First remove any adjoining side and top panel(s).
2. Once the side panel is off, remove the flat head fasteners in the corner of the frame channels.
3. Pull the frame channel out the side.
4. If any top panel fastens into the frame channel (when the frame channel is 24" or wider in direction of air flow), remove the fasteners in the top panel before pulling out the channel.

Removing the Fan Section

The fan shaft, motor, and any drive components can be removed and replaced through the access door opening. If required, the side panel can be removed for additional access.

If fan replacement is required, the entire fan assembly can be pulled out the side of the cabinet for housed fan assemblies. The fan assembly includes the fan housing, the bearing support, and the fan base.

1. Remove the side panels and any intermediate supports (follow instructions for side panel removal).
2. Once the panels and any intermediate supports are removed, disconnect the neoprene bulk head seal that is attached to the fan discharge.
3. Remove the four discharge angles that hold the neoprene canvas in place around the discharge opening.
4. Disconnect the fan sled from each of the corner mounts and pull the entire assembly out the side of the unit.
5. After the fan sled is out, loosen the fan bearings and pull out the shaft.
6. Disconnect the fan housing from the fan sled, and bearing support by removing the attaching bolts.
7. Replace the new fan, reconnect the shaft and bearings and put the fan assembly in the cabinet.
8. Replace panels and fasteners.

For plenum fan assemblies, the entire fan cabinet may need to be removed to replace the entire fan assembly depending on the length of the fan section. In some cases, the fan section is not long enough for the assembly to fit out the side of the cabinet. For those cases where it will fit, follow the above steps except the neoprene seal is a D-gasket on the inlet side that needs to be removed for plenum fans. Otherwise, the entire fan cabinet must be removed from the other sections and then the fan assembly can be removed out the discharge side of the cabinet.

Removing and Replacing the Coil

The coil can be removed by the side, top, or a combination of both. The size and configuration of the coil affects how the coil can be removed. Single banks of coil are fastened only on the connection side of the unit. Stacked and staggered coils are fastened on both ends of the coil. See the instructions below for details to remove each coil type.

Before removing the coil, disconnect all piping. The instructions below assume the coil is mounted in a sectionalized coil section where the frame channel can be removed without affecting other components. If the coil section is unitized with other components, removing the top frame channel requires removing additional panels.

Removing Single Coils

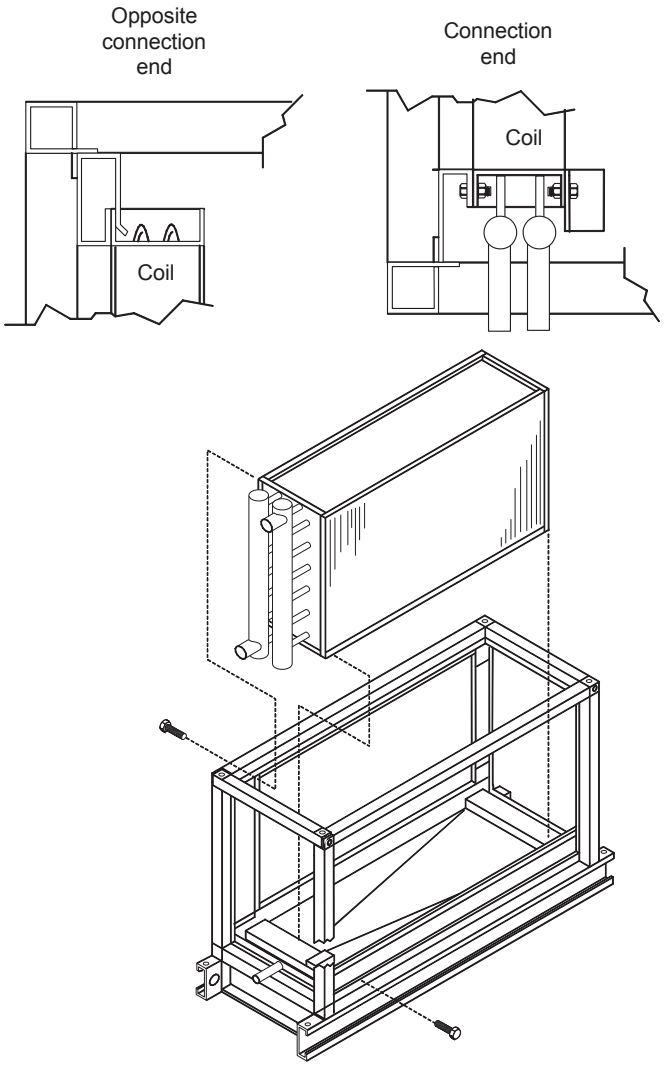
NOTE: Single coils are bolted to the unit on the connection end.The connection end is held in place with a clamp.

1. Disconnect all piping and remove the brass plugs for the vents and drains located in the connections.
2. Remove all screws and remove the access panel.
3. Remove the screws holding the coil in place.
4. Lift and pull the coil out the side.

Installing Single Coils

1. Slide the coil through the opening in the coil section onto the bottom coil rests.
2. To prevent any air bypass around the coil, place coils up against the coil bulkheads (refer to Figure 58).
3. Once the coil is in place, fasten the coil to the section.
4. Caulk the seams between the coil casings and bulkheads (refer to Figure 58).
5. If this is an additional coil being installed and not a replacement, locate the coil supply and return connections dimensionally. Carefully drill holes in the end panels of the unit.
6. Remove the brass plugs for the vents and drains on the connections.
7. Slip the panel over the connections.
8. Replace the brass plugs and panel fasteners.

Figure 58: Single Coil Removal



Removing Stacked Coils

NOTE: Top and bottom stacked coils are held together with steel plate and screws on one side and drain trough and screws on the other side. Remove the plate and trough before removing the coils. The coils cannot be removed attached together.

1. Disconnect all piping and remove the brass plugs for the vents and drains located in the connections.
2. Remove all screws and remove the access panel.
3. Remove the bolts holding the coil in place and then lift and pull out the coil from the side.
4. Remove the steel plate and the drain trough that hold the coils together.
5. Remove the bolts on both ends of the top coil holding it in place and then lift and slide the coil out.
6. Remove the bolts on both ends of the bottom coil holding it in place and then lift and slide the coil out.

Installing Stacked Coils

1. Slide the bottom coil through the opening in the coil section onto the bottom coil rests.
2. Place the coil up against the coil bulkheads to prevent any air bypass around the coil.
3. Once the coil is in place, bolt the coil to the section.
4. Caulk the mounting surface of the steel plate and install the plate on the coils.
5. Caulk the mounting surface of the drain trough and install the drain trough on the coils.
6. Caulk the seams between the coil casings and blockoffs.
7. Connect all piping and install the brass plugs for the vents and drains located in the connections.
8. Install the access panel.

Removing and Installing Staggered Coils

Staggered coils have two banks of coils positioned a few inches apart in the direction of airflow. Both coils are secured to the unit on the connection and opposite connection end of the unit.

1. Disconnect all piping and remove the brass plugs for the vents and drains located in the connections.
2. To access bolts holding the coils in place, remove the panels on both the connection and opposite connection end of the coil section.
3. Each coil is held in place with bolts located in the corners of the coil side plates. Remove the bolts and then lift and pull the coil out the side.
4. The bottom coil is fastened to the air block off plate. Remove the screws attaching this plate to the coil.
5. Once the fasteners holding the coil in place are removed, pull out the coil from either side of the unit.
6. Install the coils in reverse order of removal.

Replacement Parts

When writing to Daikin for service or replacement parts, refer to the model number and serial number of the unit stamped on the serial plate attached to the unit. If replacement parts are required, mention the date of installation of the unit and date of failure, along with an explanation of the malfunctions and a description of the replacement parts required.

Warranty

Consult your local Daikin Representative for warranty details. Refer to Form 933-430285Y. To find your local Daikin Representative, go to www.DaikinApplied.com.

Warranty Return Material Procedure

Defective material may not be returned without permission of authorized factory service personnel of Daikin in Minneapolis, Minnesota, (763) 553-5330. A “Return Goods” tag must be included with the returned material. Enter the required information to expedite handling and prompt issuance of credits. All parts must be returned to the appropriate Daikin facility, designated on the “Return Goods” tag. Transportation charges must be prepaid.

The return of the part does not constitute an order for replacement. Therefore, a purchase order must be entered through the nearest Daikin representative. The order should include part number, model number, and serial number of the unit involved.

Credit will be issued on customer’s purchase order following an inspection of the return part and upon determination that the failure is due to faulty material or workmanship during the warranty period.

Air Handling Equipment Warranty Registration Form

To comply with the terms of Daikin Applied Warranty, complete and return this form within 10 days to Daikin Applied, Warranty Department

Check, test, and start procedure for air handling units with or without heat recovery.

Job Name: _____ **Daikin Applied S.O. No.:** _____

Daikin Applied G.O. No.: _____

Installation address: _____

City: _____ **State:** _____

Purchasing contractor: _____

City: _____ **State:** _____

Name of person doing start-up (print): _____

Company name: _____

Address: _____

City/State/Zip: _____

Unit model number: _____ **Unit serial number:** _____

SF VFD model number: _____ **Serial number:** _____

RF VFD model number: _____ **Serial number:** _____

Circle Yes or No. If not applicable to the type of unit, circle N/A.

I. INITIAL CHECK

A. Is any shipping damage visible?	Yes	No	N/A
B. Are fan drives properly aligned and belts properly adjusted?	Yes	No	N/A
C. Tightened all setscrews on pulleys, bearings and fans?	Yes	No	N/A
D. Have the hold-down bolts been backed off on spring mounted fan isolators?	Yes	No	N/A
E. With the power off, do fans turn freely by hand?	Yes	No	N/A
F. Electrical service corresponds to unit nameplate?	Yes	No	N/A

Volts _____ Hertz _____ Phase _____

G. Is the main disconnect adequately fused and are fuses installed?	Yes	No	N/A
H. Are all electrical power connections tight? (Check compressor, electrical box.)	Yes	No	N/A
I. Is the condensate drain trapped?	Yes	No	N/A
J. Fill the drain pan. Does water drain freely?	Yes	No	N/A
K. Is the unit mounted level?	Yes	No	N/A

II. FAN DATA

A. Check rotation of supply fan?	Yes	No	N/A

B. Voltage at supply fan motor: 1–2_____ V 2–3 _____ V 1–3 _____ V

C. Supply fan motor amp draw per phase: L1 _____ L2 _____ L3 _____

D. Overload amp setting: _____

E. What is the supply fan rpm? _____

F. Check rotation of return fan?	Yes	No	N/A

G. Voltage at return fan motor: 1–2_____ V 2–3 _____ V 1–3 _____ V

H. Return fan motor amp draw per phase: L1 _____ L2 _____ L3 _____

I. Overload amp setting: _____

J. What is the return fan rpm? _____

K. Record supply static pressure at unit: _____ inches of H_20

L. Record return static pressure at unit (with outside air dampers closed) _____ inches of H_20

1

Air Handling Equipment Warranty Registration Form (continued)

III. DAMPERS

A. Are blades and seals present? . . . . . Yes No N/A
B. Do damper open smoothly and shut tight? . . . . . Yes No N/A

IV. ELECTRIC HEAT

A. Electrical heat service corresponds to unit nameplate? . . . . . Yes No N/A

Volts _____ Hertz _____ Phase _____

B. Are there any signs of physical damage to the electric heat coils? . . . . . Yes No N/A
C. Have all electrical terminals been tightened? . . . . . Yes No N/A
D. Does sequence controller stage contactors properly? . . . . . Yes No N/A
E. Electric heater voltage across each phase: _____ L1 _____ L2 _____ L3
F. Amp draw across each phase at each heating stage:

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Phase L1:	_____	_____	_____	_____	_____	_____
Phase L2:	_____	_____	_____	_____	_____	_____
Phase L3	_____	_____	_____	_____	_____	_____

G. FLA: L1 _____ L2_____ L3 _____
H. Operate electric heat with fans off. Electric heat must cycle on high limit control . . . . . Yes No N/A

V. CHILLED WATER

A. Pressure test OK? . . . . . Yes No N/A
B. Drain pan draining OK? Yes No N/A

VI. HOT WATER COIL

A. Pressure test OK? . . . . . Yes No N/A

VI. HEAT RECOVERY

A. Heat wheel rotates freely? . . . . . Yes No N/A
B. Heat wheel VFD operates properly? . . . . . Yes No N/A
C. Heat wheel VFD: Model # _____ Serial # _____
D. Check for air bypass around heat wheel. . . . . Yes No N/A

Comments:

Performed by: _____ **Title:** _____

Signature: _____ **Date of start-up:** _____

Return completed form by mail to:

Daikin Applied Warranty Department
13600 Industrial Park Boulevard
Minneapolis, MN 55441

or by email to:

AAH.Wty_WAR_forms@DaikinApplied.com

Please list any additional comments that could affect the operation of this unit; e.g., shipping damage, failed components, adverse installation applications, etc., on a separate sheet and attach to this form or within the email message.

2

Quality Assurance Survey Report

To whom it may concern:
Please review the items below upon receiving and installing our product. Mark N/A on any item that does not apply to the product.

Job Name: _____ **Daikin Applied G.O. No.** _____

Installation address:_____

City: _____ State: _____

Purchasing contractor:_____

City: _____ State: _____

Name of person doing start-up (print): _____

Company name:_____

Address:_____

City/State/Zip: _____

1. Is there any shipping damage visible? . . . . . Yes No N/A

   Location on unit _____

2. How would you rate the overall appearance of the product; i.e., paint, fin damage, etc.?

   Excellent Good Fair Poor

3. Did all sections of the unit fit together properly? . . . . . Yes No N/A
4. Did the cabinet have any air leakage? . . . . . Yes No N/A

   Location on unit _____

5. Were there any refrigerant leaks? . . . . . Yes No N/A

   From where did it occur? . . . . . Shipping Workmanship Design

6. Does the refrigerant piping have excessive vibration? . . . . . Yes No N/A

   Location on unit _____

7. Did all of the electrical controls function at start-up? . . . . . Yes No N/A

   Comments _____

8. Did the labeling and schematics provide adequate information? . . . . . Yes No N/A
9. How would you rate the serviceability of the product?

   Excellent Good Fair Poor

10. How would you rate the overall quality of the product?

    Excellent Good Fair Poor

11. How does the quality of Daikin Applied products rank in relation to competitive products?

    Excellent Good Fair Poor

    Comments _____

Please list any additional comments which could affect the operation of this unit; i.e., shipping damage, failed components, adverse installation applications, etc. If additional comment space is needed, write the comment(s) on a separate sheet, attach the sheet to this completed Quality Assurance Survey Report, and return it to the Warranty Department with the completed preceding “Equipment Warranty Registration Form”.

People and ideas you can trust.™

Daikin Applied Training and Development

Now that you have made an investment in modern, efficient Daikin equipment, its care should be a high priority. For training information on all Daikin HVAC products, please visit us at www.DaikinApplied.com and click on Training, or call 540-248-9646 and ask for the Training Department.

Warranty

All Daikin equipment is sold pursuant to its standard terms and conditions of sale, including Limited Product Warranty. Consult your local Daikin Applied representative for warranty details. To find your local Daikin Applied representative, go to www.DaikinApplied.com.

Aftermarket Services

To find your local parts office, visit www.DaikinApplied.com or call 800-37PARTS (800-377-2787). To find your local service office, visit www.DaikinApplied.com or call 800-432-1342.

This document contains the most current product information as of this printing. For the most up-to-date product information, please go to www.DaikinApplied.com.

Products manufactured in an ISO Certified Facility.

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Installation and Maintenance Manual IM 782-8

Group: **Applied Air Systems**
Part Number: **IM 782**
Date: **May 2015**

Destiny™ Indoor Air Handler

Sizes 002 through 030



Horizontal Model



Vertical Model

People and ideas you can trust.™

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Hazardous Information Messages

⚠ CAUTION

Cautions indicate potentially hazardous situations, which can result in personal injury or equipment damage if not avoided.

⚠ WARNING

Warnings indicate potentially hazardous situations, which can result in property damage, severe personal injury, or death if not avoided.

⚠ DANGER

Dangers indicate a hazardous situation which will result in death or serious injury if not avoided.

⚠ NOTICE

Notices give important information concerning a process, procedure, special handling or equipment attributes.

⚠ WARNING

Improper installation maintenance can cause equipment damage or personal injury.

Installation and maintenance must be performed by qualified personnel familiar with applicable codes and regulations, and experienced with this type of equipment.

⚠ CAUTION

Destiny units are not designed to be weather resistant; DO NOT install outdoors.

⚠ DANGER

Improper ground may result in severe injury or death.

Check grounding nut tightness before connecting power to the external junction box.

⚠ DANGER

Fan motor require load protection.

Failure to provide overload protection can result in fire, property damage, electric shock, personal injury or death. Connect motor to an overload protective device rated in compliance with local electric codes.

Smoke Control and Management Systems

⚠ WARNING

Improper smoke or fume air handling can result in severe personal injury or death.

A registered professional engineer must design and approve the air conditioner and air handler application to make sure smoke and fume control meet local fire codes and NFPA requirements for the specific building application. Due to the wide variation in building design and ambient operating conditions into which our products can be applied, we do not represent or warrant that our products will be fit and sufficient for smoke and fume control and management purposes. The owner and building designer must consult a registered professional engineer to satisfy themselves in this regard.

The system design and installation must follow accepted industry practice, such as described in the ASHRAE Handbook, the National Electric Code, and other applicable standards. The installation of this equipment must be in accordance with regulations of authorities having jurisdiction and all applicable codes. It is the responsibility of the installer to determine and follow the applicable codes.

Receiving and Handling

1. Carefully check items against the bills of lading to verify all crates and cartons were received. Carefully inspect all units for damage when received. Report visible and concealed damage immediately to the carrier and a file a claim for damage.
2. Destiny air handler units are thoroughly inspected before leaving the factory. Install units carefully to prevent damage.
3. Leave enough space around the unit for proper maintenance, filter removal, lubrication, belt adjustment, and removal of coils, if necessary (refer to Figure 2 on page 6 for service clearances).
4. Use flexible connections on the inlet and outlet duct connections of the unit.
5. For 002–010 sized ceiling hung units, spring isolation of the cabinet is recommended.
6. All fans are dynamically balanced before leaving the factory. Carefully inspect fans for rough handling that can cause misalignment or a damaged shaft.
7. Adequately pitch and trap drain line from drain pan connection.

Storing the Unit

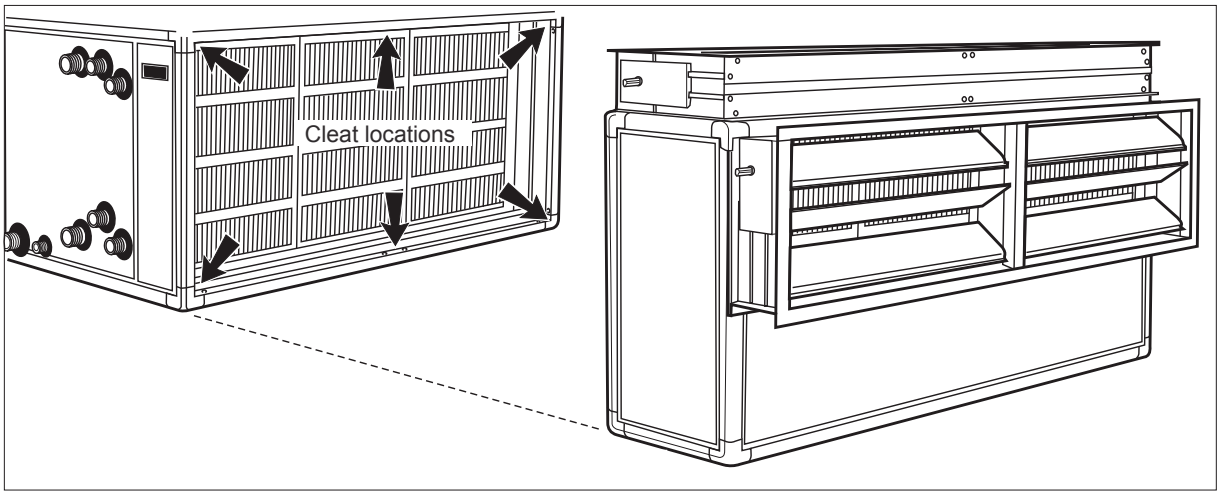
Store unit on a level surface. If air handling units are to be stored for any period of time, it is important to rotate the fan wheel (quarterly, as a minimum) to prevent permanent distortion of drive components. Keep the fan bearings lubricated. Grease may settle in the lower part of the bearing, which may lead to oxidation on the upper portion of the bearing surface.

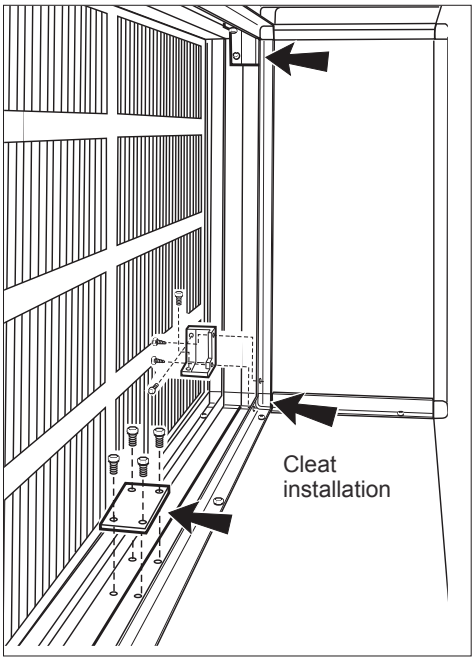
Store units indoors in a clean, dry environment on a level surface. Moisture, debris, and minerals can cause permanent damage to the cabinet and components. Do not allow coverings to trap moisture on the galvanized surface.

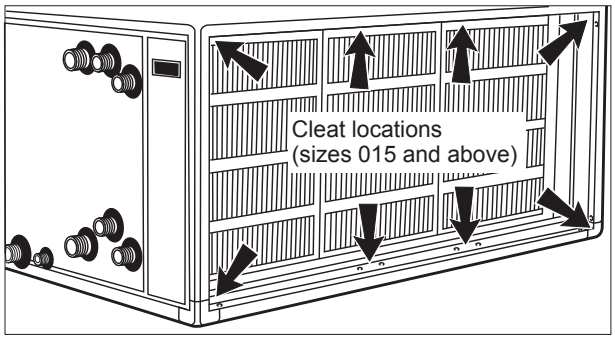
Attaching the Mixing Box

Mixing boxes ship with Destiny units as a field-installed option. Attach the mixing box to the intake end of the air handler using cleats included with the mixing box section. Install the cleats into the interior mounting frames, with the hardware included as shown in Figure 1.

Figure 1: Mixing Box Installation







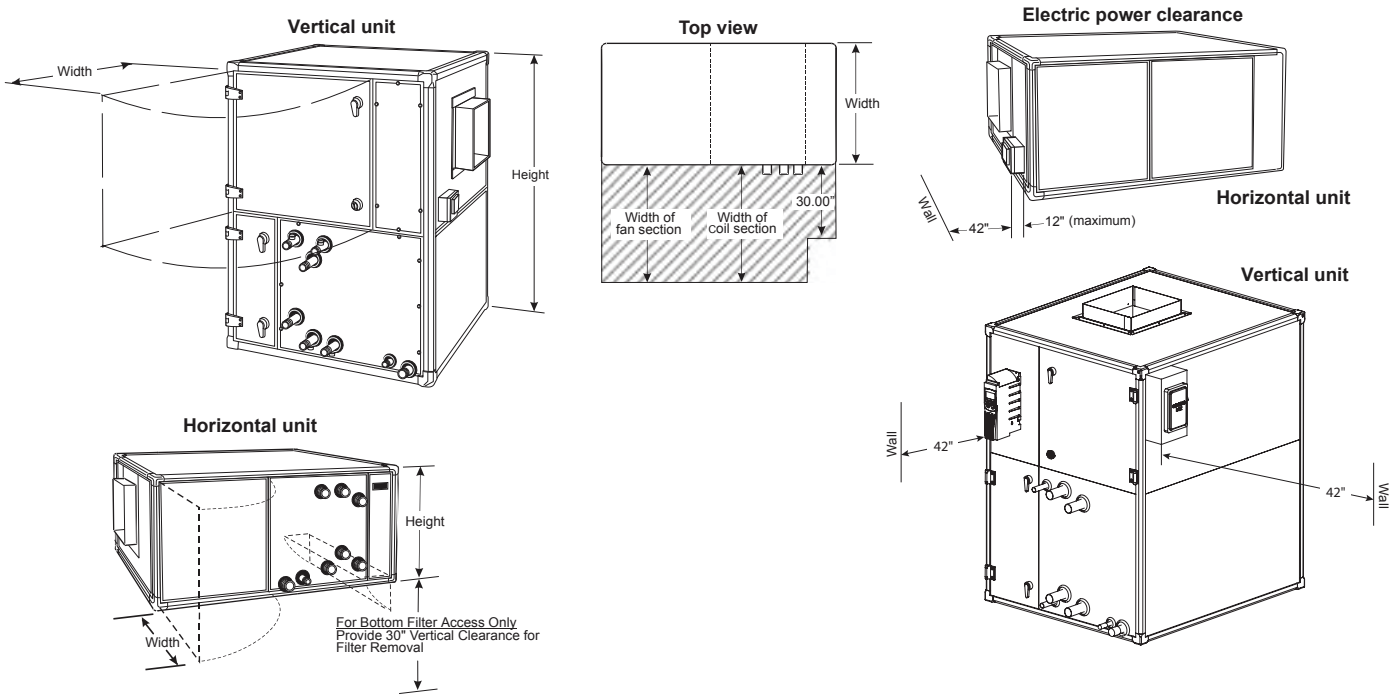
Service Clearances

Leave adequate space around the unit for piping, coils, and drains. Always have access to at least one side of the unit for regular service and maintenance. See Figure 2 for servicing space requirements. Routine maintenance examples include filter replacement, drain pan inspection and cleaning, fan bearing lubrication, and belt adjustment. Provide sufficient space on the drive side of the fan and the connection side of the coil for shaft and coil removal, if necessary (refer to the "Coil Data" section in Catalog 580 for information about coil sizes). Both the fan drive and coil can be field modified to right or left hand to accommodate clearance restrictions. See Reversing the Coil Handing on page 10 and Reversing the Belt Drive Package on page 12.

For routine maintenance, remove panels on either side of the unit. See Panel Removal on page 8. Optional service doors are available for the fan and filter sections. Allow sufficient space for service door(s) to swing completely open, or to meet the clearance requirement of the section it accesses, whichever is greater. Service doors are not interchangeable with access panels on the opposite side of the unit. Determine clearances before specifying doors.

Have at least 42" of clearance in front of electrical power devices (starters, VFDs, disconnect switches, and combination devices). Electrical power devices that are mounted on the side of the unit typically are 6" deep, 12" maximum (see Figure 2).

Figure 2: Servicing Space Requirements



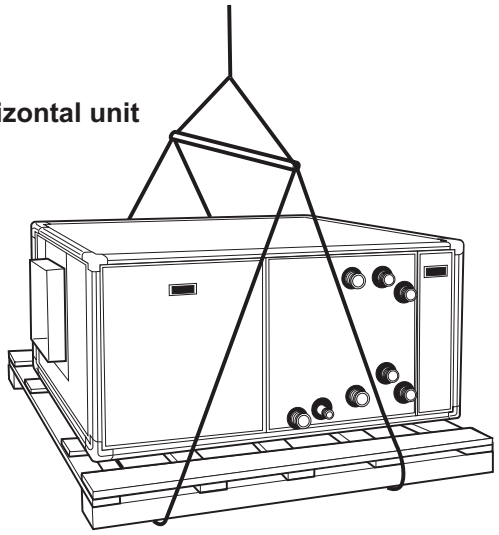
Rigging

Rig units using straps or a sling. Fasten strapping under the skid that ships with the section. If a field-installed mixing box is attached, adjust to balance the unit properly.

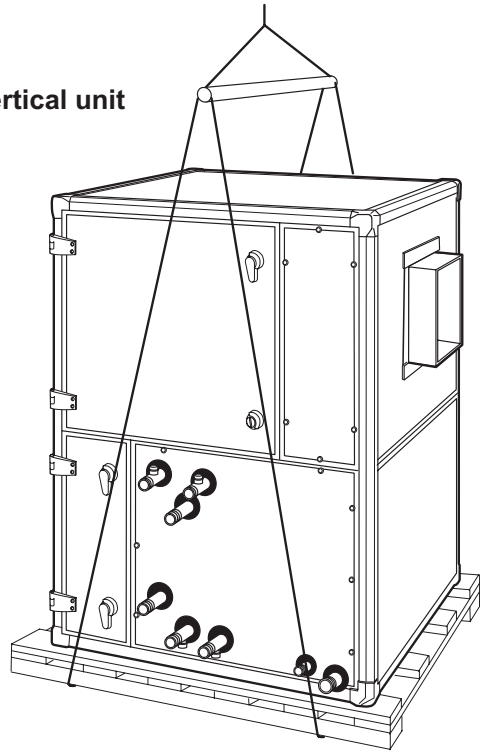
To avoid damage to the unit cabinetry, use spreader bars. Position spreader bars to keep cables from rubbing the frame, connections, or panels. Before hoisting into position, test lift for stability and balance. Avoid twisting or uneven lifting of the unit.

Figure 3: Rigged Unit on Skids

Horizontal unit



Vertical unit

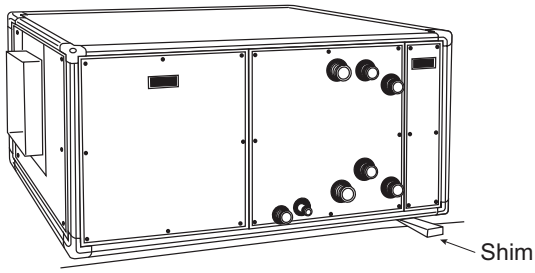


Unit Leveling

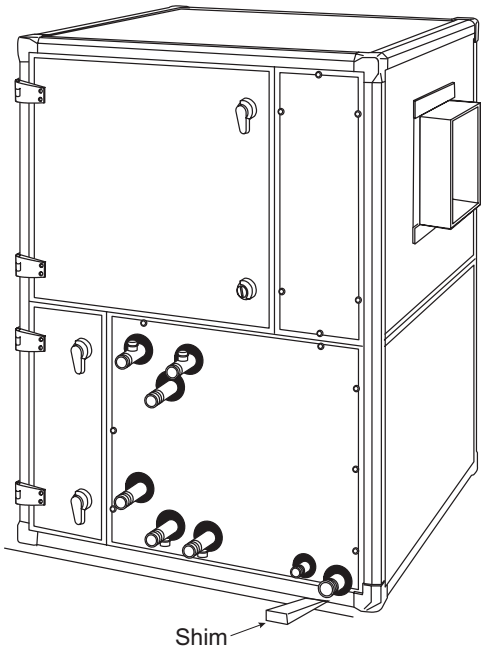
Place the equipment on a flat and level surface (or verify that unit is level when hanging from the ceiling). Where the surface irregularities allow the equipment to distort, shim the base of the unit to a straight line. Distorted units can cause misfit or binding of the doors and panels and improper draining of drain pans.

Figure 4: Leveling the Unit

Horizontal unit



Vertical unit



Panels and Doors

⚠ DANGER

Hazardous moving parts, high static pressure, and/or high voltage. Can cause severe injury or death. Disconnect and lock ALL electric power OFF before entering or servicing unit. Unit may employ multiple power supplies and/or remote disconnects.

Secure drive sheaves to prevent motors and fan from free wheeling.

When leaving the unit, use screw or door handle locking mechanism provided to secure access panel closed and prevent unintentional entry.

Panel Removal

Destiny air handlers have pocket pull handles in alternate sections that allow side panels to be easily removed and handled. To gain access through a side panel, remove the fasteners along the sides of the panel and lift the panel off using the pocket pull handle. If the panel you are accessing does not have a pocket pull handle, remove an adjoining panel with a pocket pull handle and push the panel out from inside the unit.

Fan Section Doors

1. Use a flat head screwdriver and rotate the screw 1/4 turn as shown in Figure 6.
2. Rotate door handle 1/4 turn and open the door.

Figure 5: Panel Removal

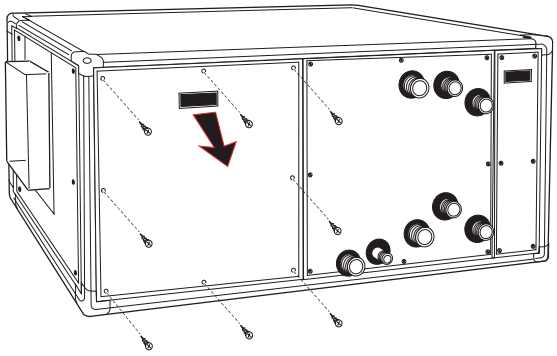
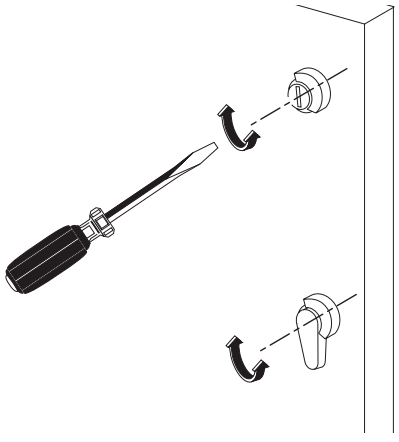


Figure 6: Fan Section Doors



Actuators

⚠ CAUTION

Maximum damper rotation is 70°. Maximum shaft torque is 205 in.-lb. Greater rotation or torque can cause equipment damage.

The factory-mounted actuator has been initially adjusted in the factory. Power and control wiring, as well as fine-tuning adjustment, is to be performed in the field.

The installing contractor is responsible for the mounting of all field-installed actuators. An actuator mounting plate is provided on the shaft side of the damper frame to accommodate many actuators. However, due to the number of options, size variations, and arrangements available, some actuators may require alternate field provided mounting hardware. Provide proper support for the actuator to avoid excessive stress in the cabinet, linkage, or damper shafts.

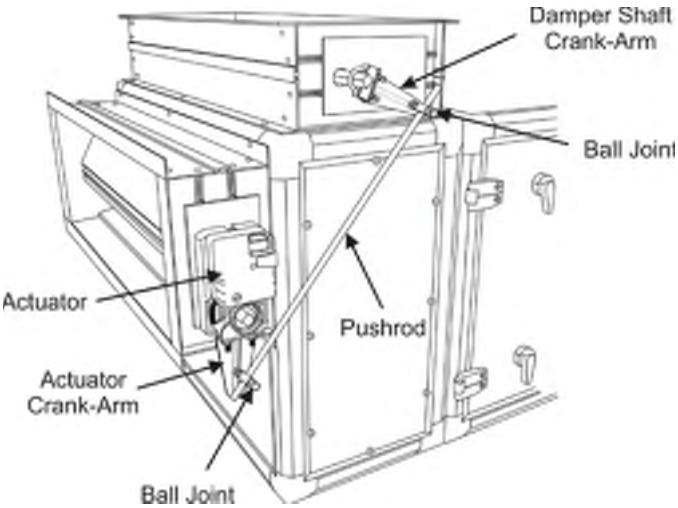
Fresh air and return air dampers can be linked together and driven from the same actuator if the dampers are the same size. If the dampers are different sizes, they must be driven by separate actuators and controlled appropriately.

A typical rotary electric actuator can handle up to 40 square feet of damper. For pneumatic actuators, allow 5 in.-lb. per square foot of damper area.

For good air flow control, adjust the linkage so that the damper blades do not open beyond 70°. Opening a damper blade beyond 70° will have little effect on unit performance.

Do not “over-close” the low-leak damper blades as the blades may lock up if the accompanying seal goes over the center of the adjoining blade. Instead, close the damper blades until the edge seal just lightly contacts the adjoining blade.

Figure 7: Factory Mounted Actuator



Installing Damper Actuator

1. Turn the damper shaft until the blades are fully closed.
2. Place the actuator's universal clamp over the damper shaft (Figure 8). Make sure that the controls on the actuator cover are accessible. Place the actuator in the desired mounting position.
3. Disengage the actuator gear train by pressing the manual override button (Figure 9) and rotate the clamp until centered.
4. Slide the anti-rotation strap (Figure 9) under the actuator so it engages the actuator at the center of the actuator cut out (located on the back side). Bend the bracket as needed to support the back side of the actuator. Secure the strap/actuator to ductwork with self-tapping screws (#8 recommended).
5. Loosen the nuts on the universal clamp. Press the manual override button and rotate the clamp to about 5° (Figure 10) from the closed position (1/16" to 1/8" between stop and clamp).
6. Tighten the two nuts on the universal clamp with a wrench.

Figure 8: Actuator on Damper Shaft

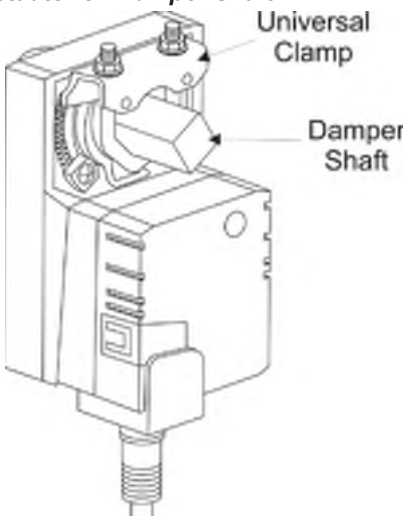


Figure 9: Actuator Manual Override Button and Strap

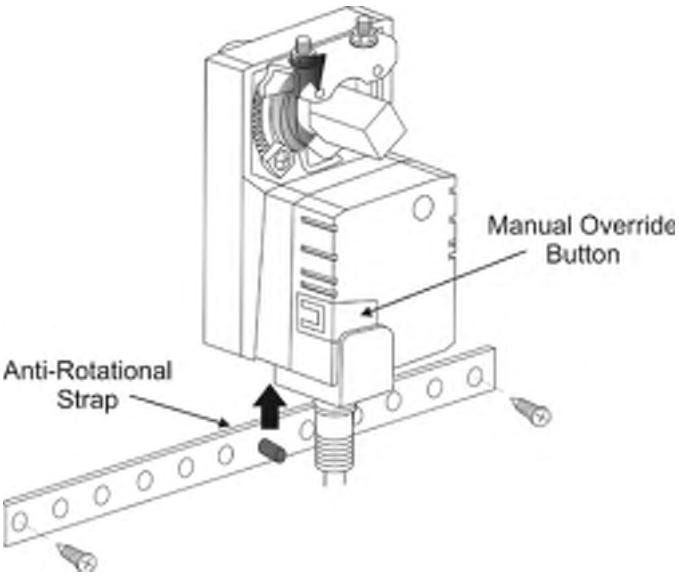
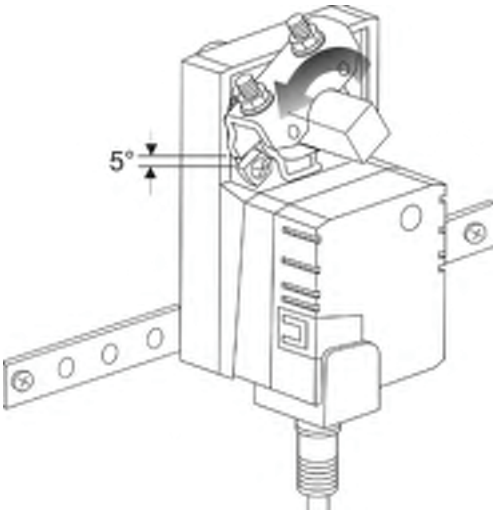


Figure 10: Actuator Universal Clamp Rotation



Reversing the Coil Handing

⚠ CAUTION

Sharp edges and coil surfaces can cause personal injury. Avoid contact with them.

Destiny coils universal-hand and coil connections can be switched to the opposite side of the unit by rotating the coil(s) 180 degrees side to side and reworking the coil section panel on the opposite side of the air handler.

NOTE: Direct expansion (DX) coils require 180 degree rotation on the top to bottom to locate distributor tubes at the leaving face of the coil.

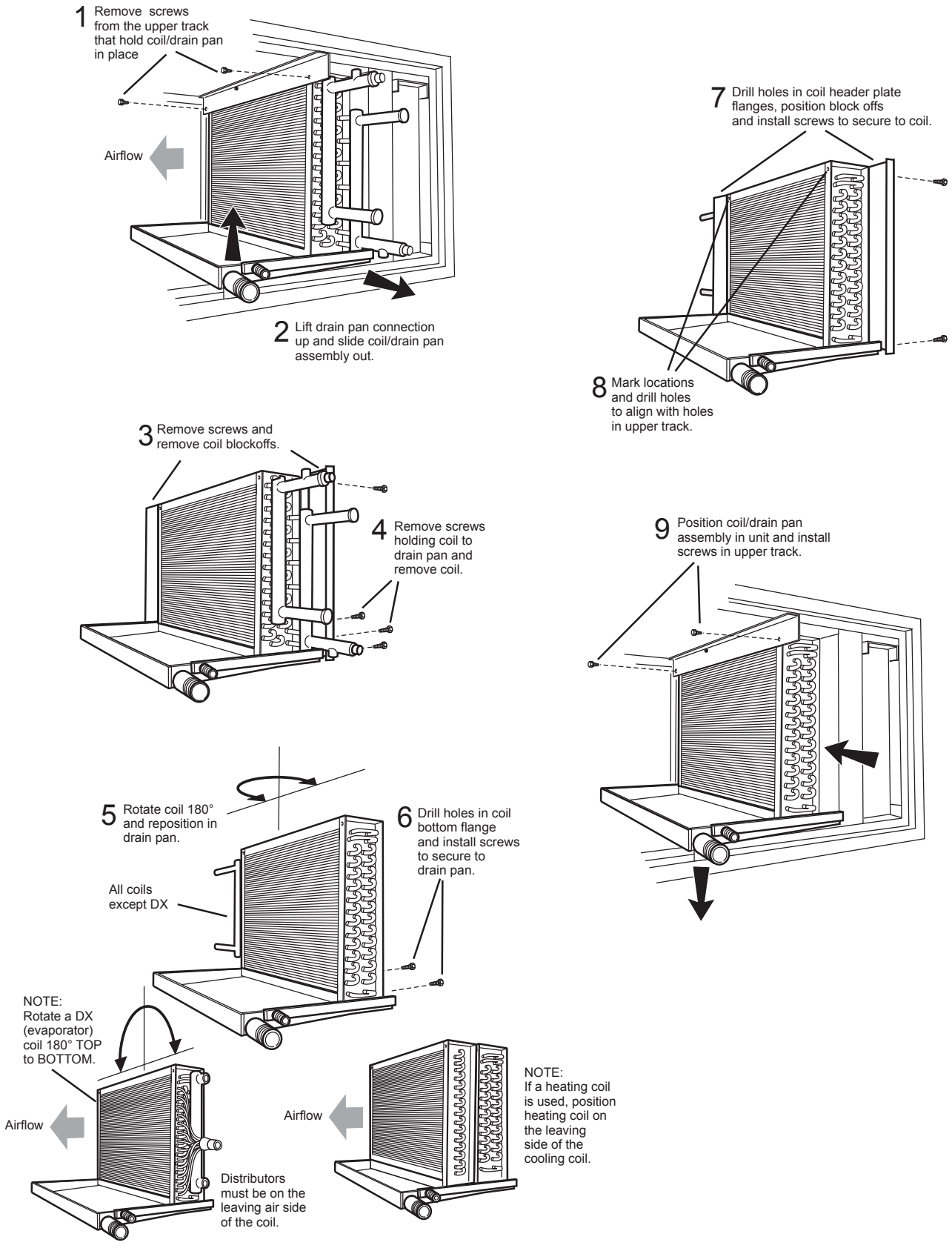
To reverse the coil connections, follow the steps below, (also refer to Figure 11).

1. Remove exterior panels from both sides of the coil section. Remove screws that secure the top of the leaving coil face to the upper track on the inside top of the unit.
2. Lift drain pan condensate connection above the unit frame flange and slide drain pan, coil(s) and baffles out of unit.
3. Remove screws and remove coil blockoffs.
4. Remove screws holding coil to drain pan and remove coil.
5. Rotate the coil 180° and reposition coil blockoffs to the entering air side of the coil.
6. Drill holes if required and fasten the blockoffs to the entering side of the coil.
7. If unit has both heating and cooling coils, position and bolt heating coil and cooling coil casings together in same arrangement in the direction of airflow as unit was shipped from factory. Reheat coils must remain in reheat position; do not place in preheat position. Fasten the first coil in the air stream to the entering side of the drain pan using the same holes provided for the coil before it was rotated.
8. Mark locations and drill holes to align with holes in upper track.
9. Slide the coil, blockoffs and drain pan assembly back into unit the same way it was removed. Check the installation for an airtight fit. Re-install screws that secure the top of the leaving coil face to the upper track on the inside top of the unit.

Depending on whether the air handler was purchased from stock or if it was manufactured for the specific job, the panel on the opposite side may or may not have predrilled connection holes.

1. If connection holes need to be drilled, determine the proper diameter in order to use the existing grommets.
2. Mark connection locations on panel and drill new holes to accommodate connections and grommets.
3. Plug and seal unused connection holes on opposite side panel with new solid grommet or other suitable material.

Figure 11: Reversing the Coil Handing



Reversing the Belt Drive Package

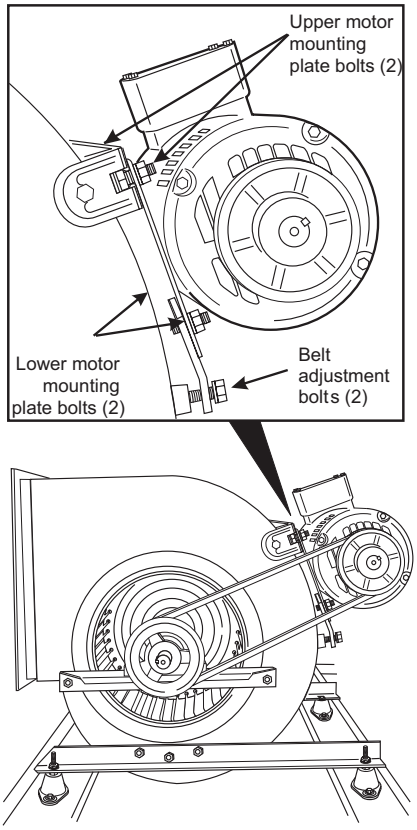
A motor side or “hand” is determined by looking in the direction of air flow with the air contacting the back of the head. The drive package on the air handler can be changed to the other side of the blower. The motor base and motor are attached to back of the fan housing. They can be removed, rotated 180 degrees, and reattached. The fan sheave can be removed and reinstalled on the opposite end of the shaft (Figure 12). Review Fan Drive Adjustments on page 47 when reinstalling the belts.

To reverse the drive package:

1. Loosen the belt adjustment screws to relieve the drive belt tension.
2. Remove the drive belt and the blower pulley.
3. Loosen the two upper bolts on the motor mounting plate and slide the motor out from the blower housing mount.
4. Move the top motor mounting bolts to the bottom motor mounting plate location and vice versa. Fasten securely.
5. Turn the motor 180° and slide it back into the blower housing mount and tighten bolts.
6. Install the blower pulley and the belt to the other side of the blower housing.
7. Adjust belt tension.

NOTE: Change the motor wiring so the motor rotates in the opposite direction.

Figure 12: Reversing the Drive Package



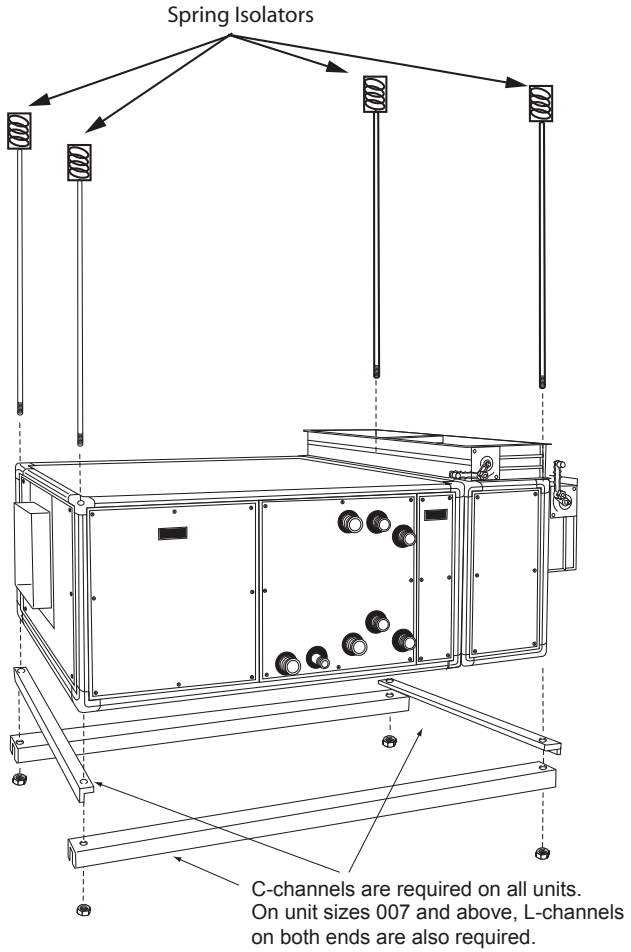
Hanging the Unit from a Ceiling

⚠ WARNING

Do not suspend the unit from the top. The unit top will not support the weight of the unit. Equipment damage and severe personal injury can result.

Before hanging, rig and completely assemble the unit. The Destiny air handler has circular knockouts on the corner connections. Remove the knockouts and suspend the unit using threaded rods and hardware with required C-channels on both sides as shown in Figure 13. On unit sizes 007 and larger, L-channels are required on both ends in addition to C-channels. For 002 - 010 sized ceiling hung units, spring isolation of the cabinet is recommended.

Figure 13: Ceiling Hung Installation, Horizontal Units Only



Piping and Coils

Follow applicable piping design, sizing, and installation information presented in ASHRAE Handbooks in the design and installation of piping. Observe all local codes and industry standards. Do not apply undue stress at the connection to the coil headers. Support pipe work independently of the coils.

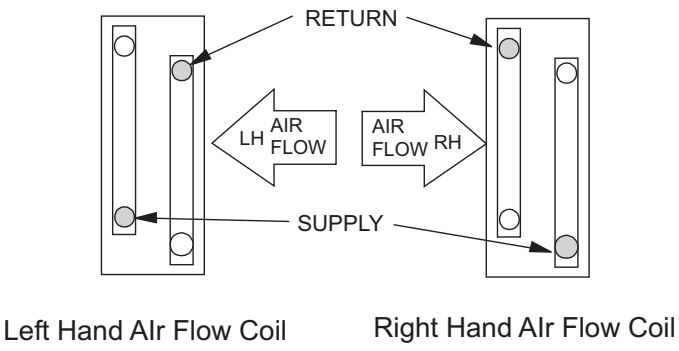
NOTE: Destiny cooling coils are supplied as universal-hand coils. The coils feature four water piping connection stubs for hydronic coils and two suction line connections for DX coils. The connections to be used are clearly marked with labels. Keep other (unmarked) connections capped. Refer to Figure 14 and Figure 15, detailing the correct stubs that are to be connected to the system piping.

Water Cooling Coils

Water cooling coil guidelines are listed below. Also, refer to Figure 14.

1. Water supply, water return, drain, and vent connections extend through the end panel of the coil section. All connections are labeled on the end panel.
2. Water supply and water return connections are copper sweat on units 002 through 010 and male NPT iron pipe on units 015 through 030.
3. When installing couplings, do not apply undue stress to the connection extending through unit panel. Use a backup pipe wrench to avoid breaking the weld between coil connection and header.
4. Follow recommendations of the control manufacturer regarding types, sizing, and installation of controls.

Figure 14: Water Cooling Coil Connections

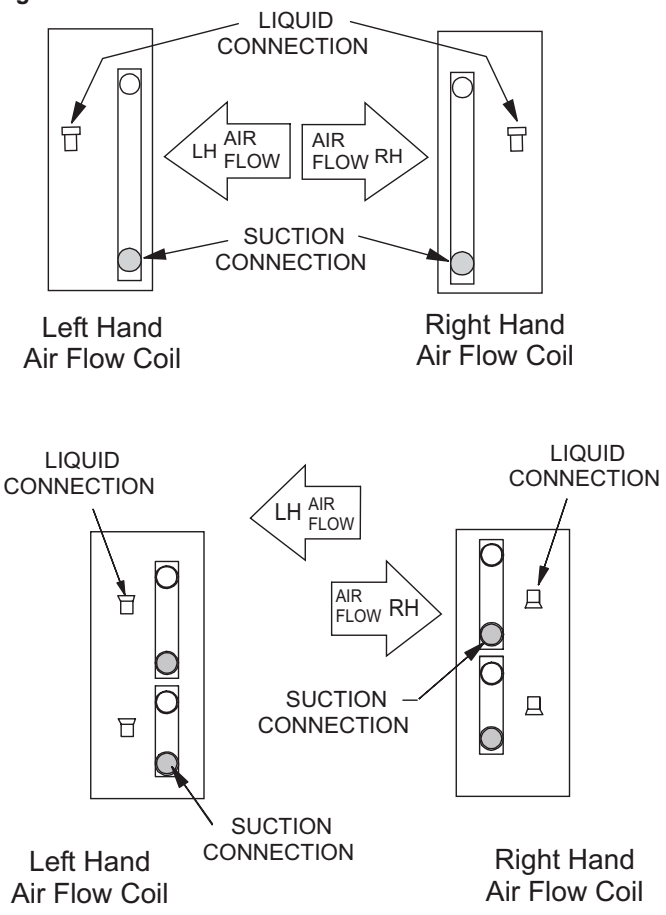


Direct Expansion Coils

Direct expansion coil connection guidelines are listed below. Also, refer to Figure 15.

1. The coil distributor and suction connection extend through the end panel of the coil section.
2. Check nozzle in distributor for proper tonnage.
3. The thermostat expansion valve must be an external equalizer tube type. Connect the equalizer tube provided on the coil (3/16" for units 002 to 010, and 1/4" for units 015 to 030) to the connection on the expansion valve.
4. Use care when piping up the system, making sure all joints are tight and all lines are dry and free of foreign material. For typical refrigerant piping, see the condensing unit product manual.

Figure 15: DX Coil Connections



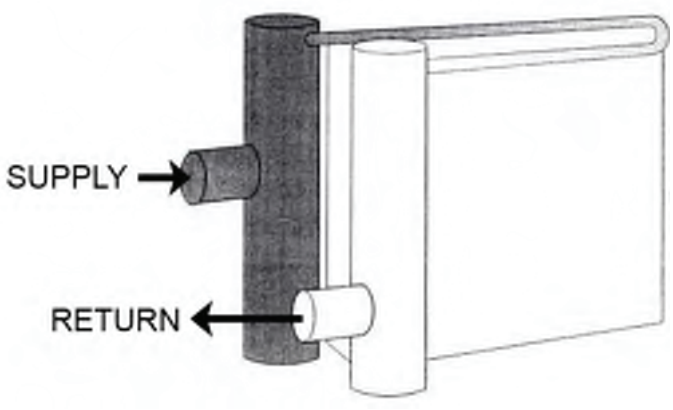
Steam Coils

(provided as Specials only)

Steam coil connection guidelines are listed below. Also, refer to Figure 16.

1. All steam coils are non-distributing (freeae) type. They are not designed to be used in 100% OA applications.
2. Steam supply and steam return connections are typically male NPT iron pipe and are labeled on the end panel of coil section. Connections extend through coil section end panel.
3. When installing couplings, do not apply undue stress to the connection extending through unit panel. Use a backup pipe wrench to avoid breaking the weld between coil connection and header.
4. Support piping independently of coils and provide adequate piping flexibility. Stresses resulting from expansion of closely coupled piping can cause serious damage.
5. Do not reduce pipe size at the coil return connection. Carry return connection size through the dirt pocket, making the reduction at the branch leading to the trap.
6. Install vacuum breakers on all applications to prevent retaining condensate in the coil. Connect the vacuum breaker between the coil inlet and the return main.
7. Do not drip supply mains through the coil.
8. Do not attempt to lift condensate when using modulating or ON/OFF control.
9. Size traps in accordance with manufacturers' recommendations. Be certain the required pressure differential will always be available. Do not undersize.
10. Use float and thermostatic or bucket traps with low pressure steam. On high pressure steam, use bucket traps. Use thermostatic traps only for air venting.
11. Use bucket traps only with ON/OFF control.
12. Locate traps at least 12 inches below the coil return connection.
13. Do not use modulating steam valves on high pressure systems.
14. Size modulating valves properly. Do not undersize.
15. Destiny steam coils are not recommended for freezing conditions or entering temperatures below 35°F (1.6°C).

Figure 16: Steam Coil Connections (Type SS)



Water Heating Coils

Heating coil connection guidelines are listed below. Also, refer to Figure 17 and Figure 18.

1. Water supply and water return connections extend through the end panel of the coil section. All connections are labeled on the end panel.
2. Water supply and water return connections are copper sweat on units 002 through 010 and male NPT iron pipe on units 015 through 030.
3. When installing couplings, do not apply undue stress to the connection extending through unit panel. Use a backup pipe wrench to avoid breaking the weld between coil connection and header.
4. Follow recommendations of the control manufacturer regarding types, sizes, and installation of controls.
5. Hot water coils are not recommended for use with entering air below 40°F.
6. If fresh air and return air are to be heated by a hot water coil, take care in the design of the system to provide thorough mixing before air enters the coil.

Figure 17: Water Heating Coil Connections

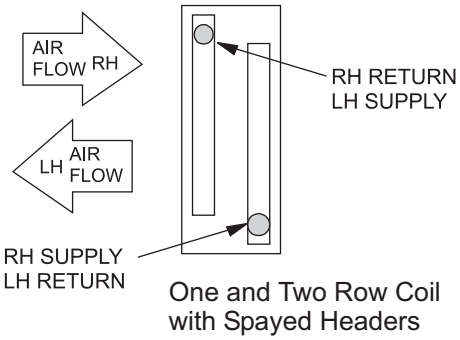
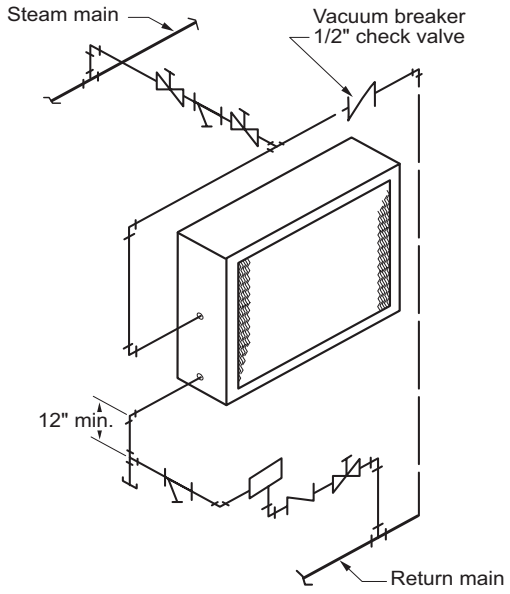


Figure 18: Piping Arrangements

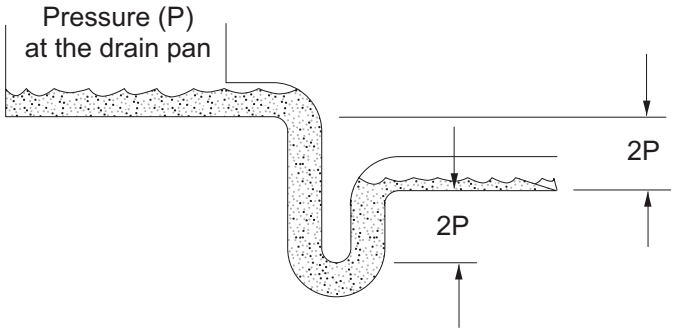


Drain Pan Traps

Destiny air handlers have a drain pan connection on both sides of the unit. Drain connections can be made on either side or both sides. Drain lines and traps should run full size from the drain pan connection. Drain pans should have traps to allow condensate from coils to drain freely. The trap depth and distance between the trap outlet and the drain pan outlet should be twice the static pressure in the drain pan section under normal operation for the trap to remain sealed. Refer to Figure 19.

A secondary drain connection on the drain pan is standard on all Destiny units. Secondary drain connections are required in some applications as a visual means of identifying clogged primary drain lines.

Figure 19: Allow Adequate Distance Between Trap Outlet and Drain Outlet



NOTE: The door panels on some applications have a close clearance over the drain pipes. Extend the drain fitting with a coupling if necessary for door clearance.

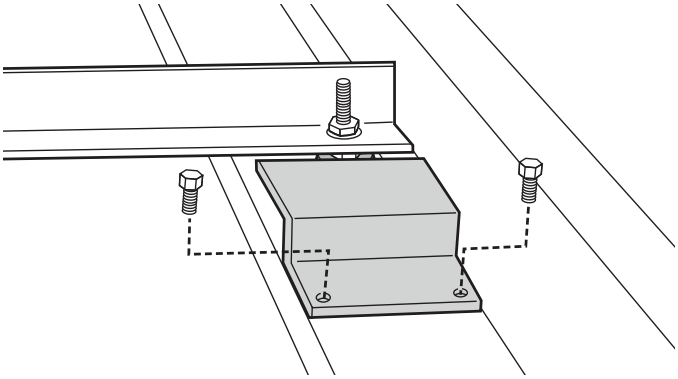
Internal Isolation Assembly Adjustment

Units have internally isolated fan and motor assemblies that are secured with brackets for shipment.

Before Operating the Unit

Remove the shipping bracket and bolts and discard. The shipping brackets located on the opposite drive side of the unit (Figure 20) are difficult to access from the drive side of the unit. Either remove them before the unit is assembled, or remove the panel on the opposite drive side to gain access.

Figure 20: Removing the Shipping Bracket, Sizes 002–010



Spring Mount Adjustments—Twin Fan Units

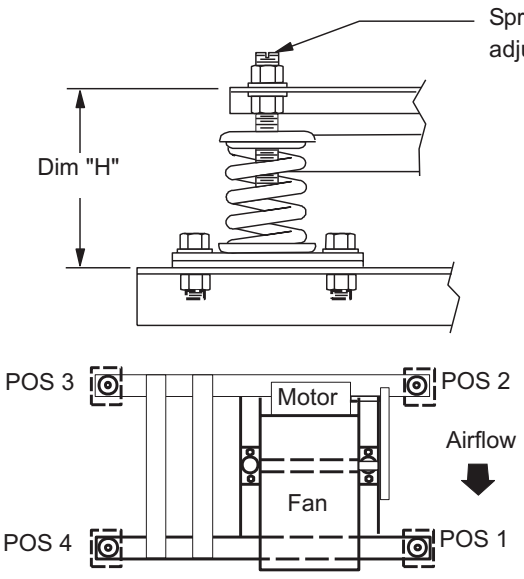
The spring isolators under the four corners of the fan and motor assembly have been factory adjusted while the fan was not running. Refer to Table 1. With the unit operating at normal cfm and static pressure, the isolators should all be at the same height opening. If adjustments are required, loosen the 5/16" capscrew on top of the isolator and turn the adjusting bolt to lower or raise the fan and motor base. Retighten the capscrew when adjustments are completed. See Figure 21.

When seismic snubbers and/or thrust restraints are provided, no additional adjustments are required.

Table 1: Spring Mount Adjustment—Twin Fan Units

Spring mount adjustment at rest, unit sizes 015 to 030 ONLY			
Fan discharge position	**Top or Bottom Horizontal "H"**	**Downblast "H"**	**Upblast "H"**
1	3.75	3.75	4.25
2	4.25	3.75	4.25
3	4.25	3.75	4.25
4	3.75	3.75	4.25

Figure 21: Spring Mount Adjustments—Twin Fan Units



Fan isolator position numbers

Electric Heat Section

(Optional)

Optional factory installed electric heat section consists of open coil duct heater mounted to the unit at the supply fan discharge. Heat section includes heating coils and an electrical control box with single point field power connection for heater and supply air fan.

Factory provided field knockouts are located on the side of the electric heat control panel for field power and control wiring to pass through. A factory installed non-fused disconnect is located in the electric heat control panel to disconnect power to the supply air fan and heater components. All wiring must be in conformance with the national electric code and local restrictions.

Open Coil Duct Heater

- Complete with overload and thermal protection
- Includes fan interlock and air flow switch safety protection
- High quality, alloy nichrome wire [80%Ni / 20%Cr]
- High di-electric level ceramic insulators
- Screw terminals

Single Point Power

- Non-fused disconnect
- Electric heat is factory wired including contactors and fuses per step and as required by UL. Refer to Electric Heat Diagrams on page 23 for typical electric heat wiring diagrams
- Fan motor is factory wired including contactor or starter and fuses as applicable
- Fused control transformer allows the heater and fan to be sequenced by standard 24 volt thermostat
- Indoor control panel with tool access hinged door houses all components

Quality Control

- Heaters are di-electrically tested for 1000V plus twice the rated volts, or 2000V whichever is greater. The resistance of each heater is measured and recorded and must be within 5% of the rated value
- Every heater is checked during the production process and as a final assembly

Figure 22: Heater Nomenclature

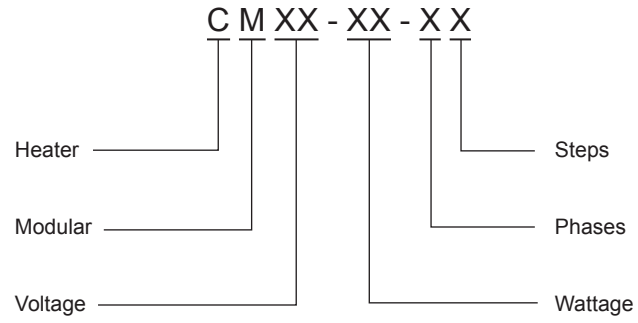
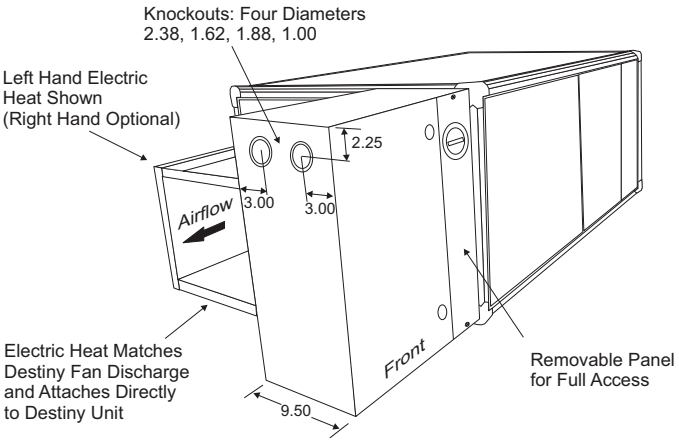


Figure 23: Destiny Unit with Left Hand Electric Heat



Electric Heat kW Options

Table 2: KW Options by Unit Size

	Unit Size					
	002	003	004	005	007	010
KW Range	1.5–10	2.5–20	2.5–20	4–26	6–38	6–55

Heater Amps

Table 3: Heater Amps

KW	Heater Amps				
	120V / 1Ø	240V / 1Ø	240V / 3Ø	480V / 3Ø	600V / 3Ø
1	8.33	4.17	2.41	1.20	0.96
1.5	12.50	6.25	3.61	1.81	1.45
2	16.67	8.33	4.82	2.41	1.93
2.5	20.83	10.42	6.02	3.01	2.41
3	25.00	12.50	7.23	3.61	2.89
3.5	29.17	14.58	8.43	4.21	3.37
4	33.33	16.67	9.63	4.82	3.85
4.5	37.50	18.75	10.84	5.42	4.34
5	41.67	20.83	12.04	6.02	4.82
5.5	45.83	22.92	13.25	6.62	5.30
6	50.00	25.00	14.45	7.23	5.78
6.5	54.17	27.08	15.66	7.83	6.26
7	58.33	29.17	16.86	8.43	6.74
7.5	62.50	31.25	18.06	9.03	7.23
8	66.67	33.33	19.27	9.63	7.71
8.5	70.83	35.42	20.47	10.24	8.19
9	75.00	37.50	21.68	10.84	8.67
10	83.33	41.67	24.08	12.04	9.63
11	91.67	45.83	26.49	13.25	10.60
12	100.00	50.00	28.90	14.45	11.56
13	108.33	54.17	31.31	15.66	12.52
14	116.67	58.33	33.72	16.86	13.49
15	125.00	62.50	36.13	18.06	14.45
16	133.33	66.67	38.54	19.27	15.41
17	141.67	70.83	40.94	20.47	16.38
18	150.00	75.00	43.35	21.68	17.34
19	158.33	79.17	45.76	22.88	18.30
20	N/A	83.33	48.17	24.08	19.27
22	N/A	91.67	52.99	26.49	21.19
24	N/A	100.00	57.80	28.90	23.12
26	N/A	108.33	62.62	31.31	25.05
28	N/A	116.67	67.44	33.72	26.97
30	N/A	125.00	72.25	36.13	28.90
32	N/A	133.33	77.07	38.54	30.83
34	N/A	141.67	81.89	40.94	32.76
36	N/A	150.00	86.71	43.35	34.68
38	N/A	158.33	91.52	45.76	36.61
40	N/A	N/A	96.34	48.17	38.54
45	N/A	N/A	108.38	54.19	43.35
50	N/A	N/A	120.42	60.21	48.17
55	N/A	N/A	132.47	66.23	52.99

Electric Heat Safety

Overcurrent Protection

Overcurrent fuse protection is provided for each stage of electric heat (in lieu of one per 48 amperes).

Thermal (Over Temperature) Protection

Primary - Automatic limit switches, one per step (120°F or 150°F as appropriate).

Backup - Manual reset thermal cutout (180°F).

Fan Interlock Method:

To prevent the heater from being energized unless the fan is on, the heater includes two interlock methods: an airflow switch, and the use of an auxiliary contact in the motor starter contactor (3ph) or a fan relay (1ph).

Airflow Switch:

The airflow switch provides the best means of protection against air failure caused by fan belt or other malfunction. Switches are of the differential pressure, diaphragm-operated type and require a minimum total pressure differential of .05" WC. The switch is factory wired in series with the manual reset cutout.

Minimum Air Velocity

Recommended minimum air flow through a specific heater is shown in Table 4 through Table 10.

Table 4: LAH002 Minimum Air Flow

Heater Capacity, kW	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5
Minimum air flow, CFM	184	218	249	274	292	310	328	344	359	371	382	387	398	396	400
Heater Capacity, kW (cont.)	**9**	**10**													
Minimum air flow, CFM (cont.)	404	409													

Table 5: LAH003 Minimum Air Flow

Heater Capacity, kW	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	10
Minimum air flow, CFM	298	339	368	400	426	446	466	484	501	519	536	550	565	579	605
Heater Capacity, kW (cont.)	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**					
Minimum air flow, CFM (cont.)	620	629	637	646	652	658	660	660	663	663					

Table 6: LAH004 Minimum Air Flow

Heater Capacity, kW	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	10
Minimum air flow, CFM	298	339	368	400	426	446	466	484	501	519	536	550	565	579	605
Heater Capacity, kW (cont.)	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**					
Minimum air flow, CFM (cont.)	620	629	637	646	652	658	660	660	663	663					

Table 7: LAH005 Minimum Air Flow

Heater Capacity, kW	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	10	11	12	13
Minimum air flow, CFM	447	477	511	538	561	584	603	622	641	656	672	706	740	771	794
Heater Capacity, kW (cont.)	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**22**	**24**	**26**					
Minimum air flow, CFM (cont.)	809	824	832	840	847	855	859	866	870	874					

Table 8: LAH005 Minimum Air Flow

Heater Capacity, kW	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	10	11	12	13
Minimum air flow, CFM	447	477	511	538	561	584	603	622	641	656	672	706	740	771	794
Heater Capacity, kW (cont.)	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**22**	**24**	**26**					
Minimum air flow, CFM (cont.)	809	824	832	840	847	855	859	866	870	874					

Table 9: LAH007 Minimum Air Flow

Heater Capacity, kW	6	6.5	7	7.5	8	8.5	9	10	11	12	13	14	15	16	17
Minimum air flow, CFM	637	673	704	729	750	765	790	831	867	903	938	969	1000	1030	1056
Heater Capacity, kW (cont.)	**18**	**19**	**20**	**22**	**24**	**26**	**28**	**30**	**32**	**34**	**36**	**38**			
Minimum air flow, CFM (cont.)	1076	1096	1102	1117	1132	1142	1153	1163	1168	1168	1173	1173			

Table 10: LAH010 Minimum Air Flow

Heater Capacity, kW	6	6.5	7	7.5	8	8.5	9	10	11	12	13	14	15	16	17
Minimum air flow, CFM	637	673	704	729	750	765	790	831	867	903	938	969	1000	1030	1056
Heater Capacity, kW (cont.)	**18**	**19**	**20**	**22**	**24**	**26**	**28**	**30**	**32**	**34**	**36**	**38**	**40**	**45**	
Minimum air flow, CFM (cont.)	1076	1096	1102	1117	1132	1142	1153	1163	1168	1168	1173	1173	1173	1178	

Electric Heat Operation

⚠ CAUTION

Heaters are furnished for zero clearance between the duct and combustible surfaces. However, it is not recommended that any combustible material be allowed to touch any electric duct heater or immediate surrounding areas.

⚠ CAUTION

Heaters are not intended to be installed with less than 20" of straight duct at the outlet of the heater.

⚠ NOTICE

Field wiring necessary temperatures are:

1) 194°F for dry weather.

2) 167°F for humid weather.

The sampling probe is suitable for left-hand or right-hand airflow and in positive pressure applications may require field adjustment so the probe faces upstream. This is normally done during installation by removing two screws, rotating the probe 180° and replacing the screws. Removing the heater from the duct is not necessary.

The electric heater is designed to operate while installed and connected to the unit at the supply air fan discharge, to heat air passing through the heating elements.

Temperature rise is very important and can be obtained using the following calculation:

Temperature Rise = (KW) × (3159) / CFM

NOTE: Maximum leaving air temperature = 120°F

Field Power Wiring

⚠ DANGER

Improper ground may result in severe injury or death. Check grounding nut tightness before connecting power to the external junction box.

⚠ DANGER

Hazardous voltage. Can cause severe injury or death. Disconnect electric power before servicing equipment. More than one disconnect may be required to de-energize the unit.

Wiring must comply with all applicable codes and ordinances. The warranty is voided if wiring is not in accordance with these specifications. An open fuse or starter indicates a short, ground, or overload. Before replacing a fuse or resetting a starter, identify the trouble and correct.

According to the National Electrical Code, a disconnecting means shall be located within sight of and readily accessible from the air conditioning equipment. Power leads must be over-current protected at the point of distribution. The maximum allowable overcurrent protection (MROPD) appears on the unit nameplate.

Supply Power Wiring

1. Allowable voltage tolerances:
    a. 60 Hertz
        – Nameplate 208V: Min. 187V, Max. 229V
        – Nameplate 230V: Min. 207V, Max. 253V
        – Nameplate 460V: Min. 414V, Max. 506V
        – Nameplate 575V: Min. 518V, Max. 633V
    b. 50 Hertz
        – Nameplate 380V: Min. 360V, Max. 418V
2. Minimum Circuit Ampacity (MCA) Calculation is based on the following formulas:
    – Electric heat less than or equal to 50 kW
    MCA = 1.25 (heater FLA + largest motor loads) + (the rest of the loads)
    – Electric heat greater than or equal to 50 kW
    MCA = 1.25 (largest motor load) + (the rest of the loads) + heater FLA
3. Size wires in accordance with Table 310-16 or 310-19 of the National Electrical Code.
4. Wires should be sized for a maximum of 3% voltage drop.

Electrical Installation

1. Electrical service to the fan must correspond to the rated voltage on the motor nameplate and be in conformance with the National Electric Code and local restrictions.
2. The fan section metal frame must be connected to the building electrical ground.
3. A door electrical interlock is not provided as standard
4. Thermal motor protection is external to the unit. Unless the unit is provided with a unit mounted starter, thermal protection and a disconnect switch provision per electric codes are provided by others.
5. When the unit is factory provided with a junction box, disconnect switch, starter, or a variable frequency drive (VFD), the components are mounted on the outside of the unit cabinet. Factory wiring is provided from the device to the unit internal motor.

Variable Frequency Drive (VFD)

(Optional)

⚠ DANGER

Fire hazard. Failure to use fast-blow J-type fuses could result in property d mage, injury, or death. Fast-blow fuses must be installed upstream of a VFD.

⚠ CAUTION

Never operate a fan over the maximum speed indicated on the fan curve, as this may cause fan damage and severe unit vibration.

1. When the unit is provided with a VFD only, refer to the VFD manual for wire size and torque requirements. A fast-blow fused disconnect is recommended for VFD applications. Motor operation below 20 Hz or over 90 Hz is not recommended. For typical wiring diagrams, see Figure 28 and Figure 29.
2. Refer to OM 844 (MD2 drives) or OM 895 (MD3 drives) for VFD set-up details. The drives are installed with only default programming and are to be field configured to meet application requirements. Information on ATV11 drives may be found in VFD manufacturer's manuals.
3. Units with Direct-Drive Plenum fans need to be reprogrammed in the field according to design point parameters. Refer to project documentation and/or fan curves (Figure 32 through Figure 40) for appropriate fan speeds associated with the job. Use the formula below to calculate the maximum frequency associated with the maximum allowable fan speed.

   $F_{max} = 60\ Hz \times (W_{max} / W_{motor})$

   $\mathbf{F_{max}}$ - maximum frequency allowable for particular application (Hz)

   $\mathbf{W_{max}}$ - maximum fan speed (rpm); refer to fan curves

   $\mathbf{W_{motor}}$ - nominal motor speed (1800/3600 rpm); refer to motor nameplate

Refer to Table 34 on page 45 for operating limit information for Backward-Inclined Direct-Drive Plenum fans.

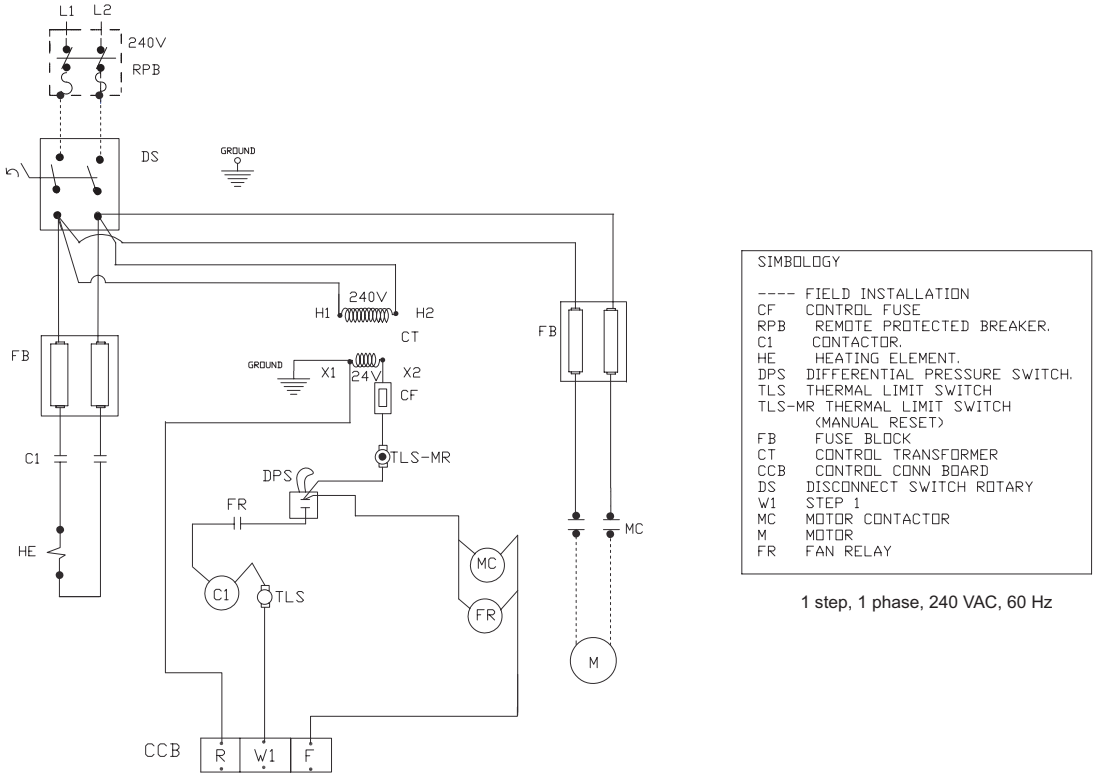
Starters and Disconnects

(Optional)

1. The fan motor is factory wired to an externally mounted control box. Control box options include: disconnect-only (fused and non-fused) and starter-fused disconnect transformer.
2. A fast-blow fused disconnect (J-type fuses) is used in VFD applications.
3. A fused control transformer allows the fan to be sequenced by standard 24-volt thermostat or controller.
4. An indoor panel with tool access hinged door houses all the components and is generally mounted on the unit's bulkhead panel. The panel enclosure has several knockouts located on the side, top, and bottom.
5. All field wiring must be in conformance with the National Electric Code and local restrictions.
6. Refer to Figure 26 and Figure 27 for typical disconnect-only wiring diagrams. Refer to Figure 45 and Figure 46 for typical full control box diagrams.

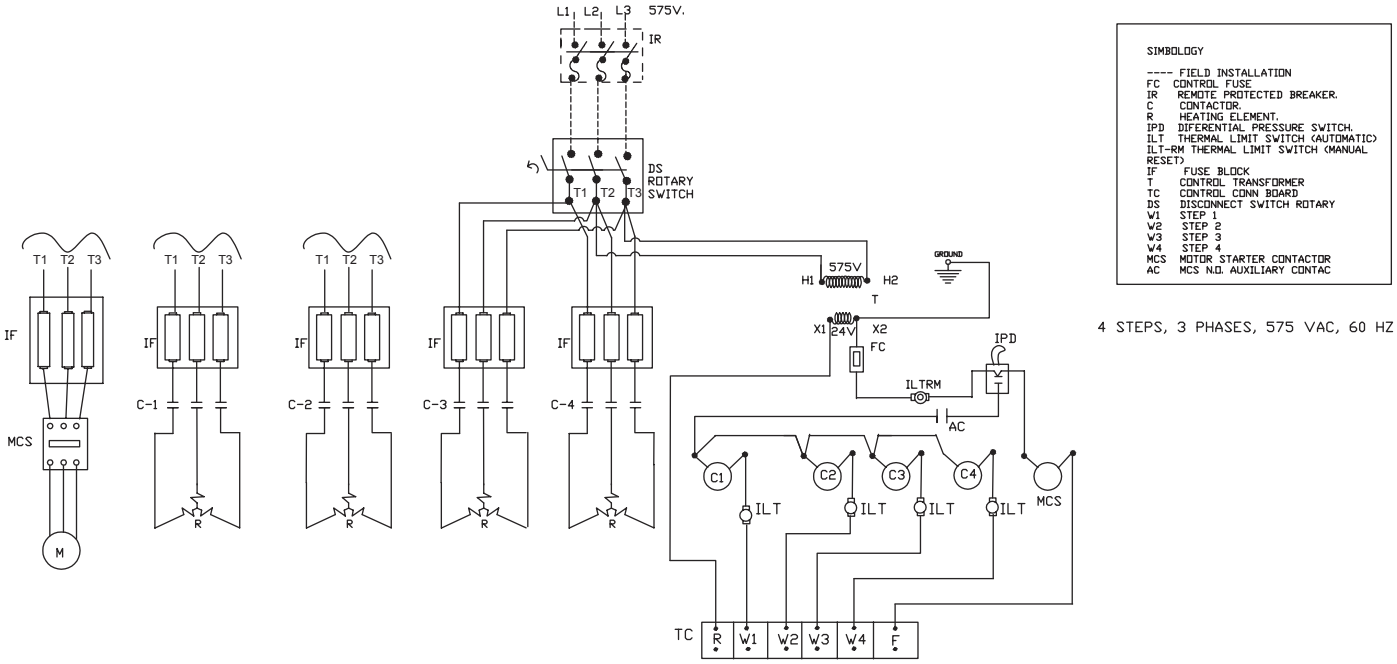
Electric Heat Diagrams

Figure 24: Typical 1-Phase, 240 Volt Electric Heat Wiring Diagram



1 step, 1 phase, 240 VAC, 60 Hz

Figure 25: Typical 3-Phase, 575 Volt Electric Heat Wiring Diagram



4 STEPS, 3 PHASES, 575 VAC, 60 HZ

Disconnect-Only Diagrams

Figure 26: Typical Single-Phase, Disconnect-Only Wiring Diagram

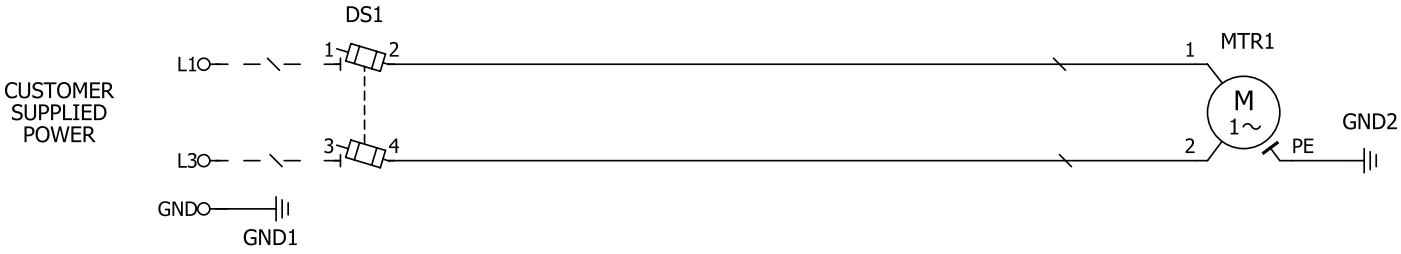
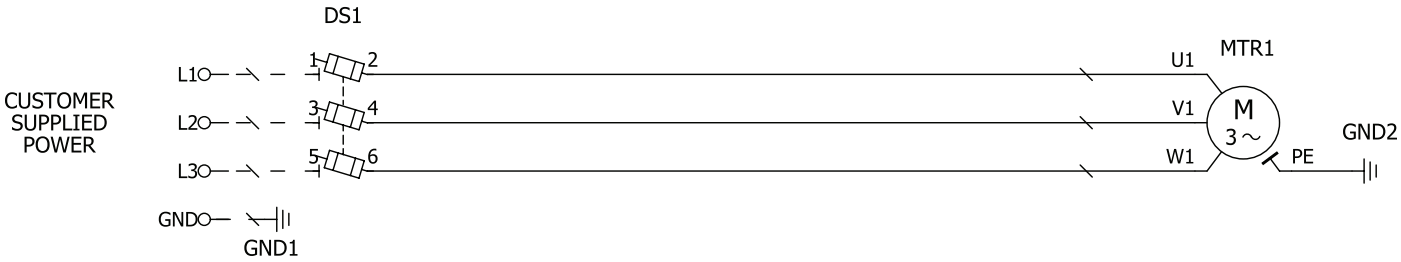


Figure 27: Typical 3-Phase, Disconnect-Only Wiring Diagram



VFD Diagrams

Figure 28: Typical MD2 VFD Wiring Diagram

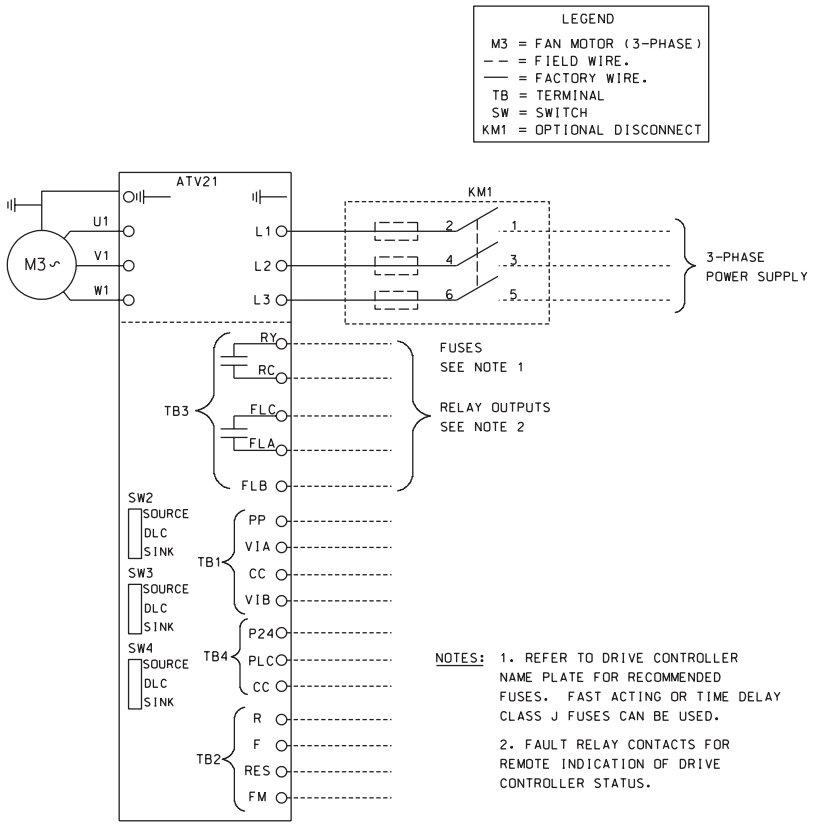


Figure 29: Typical MD3 VFD Wiring Diagram

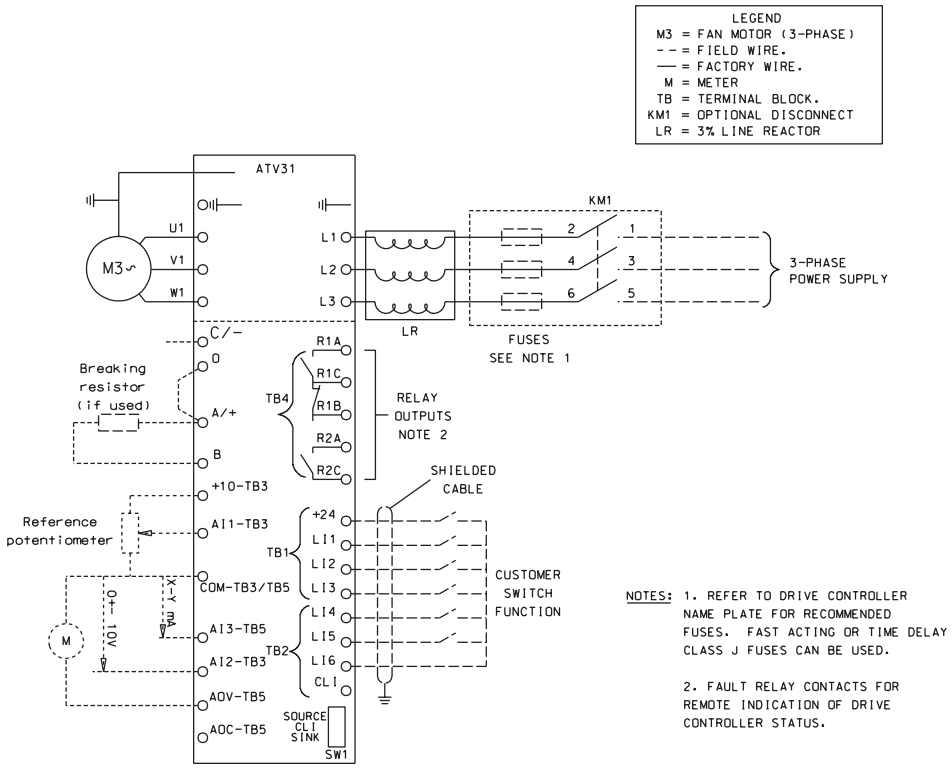


Figure 30: Typical Single-Phase Starter/Disconnect Wiring Diagram

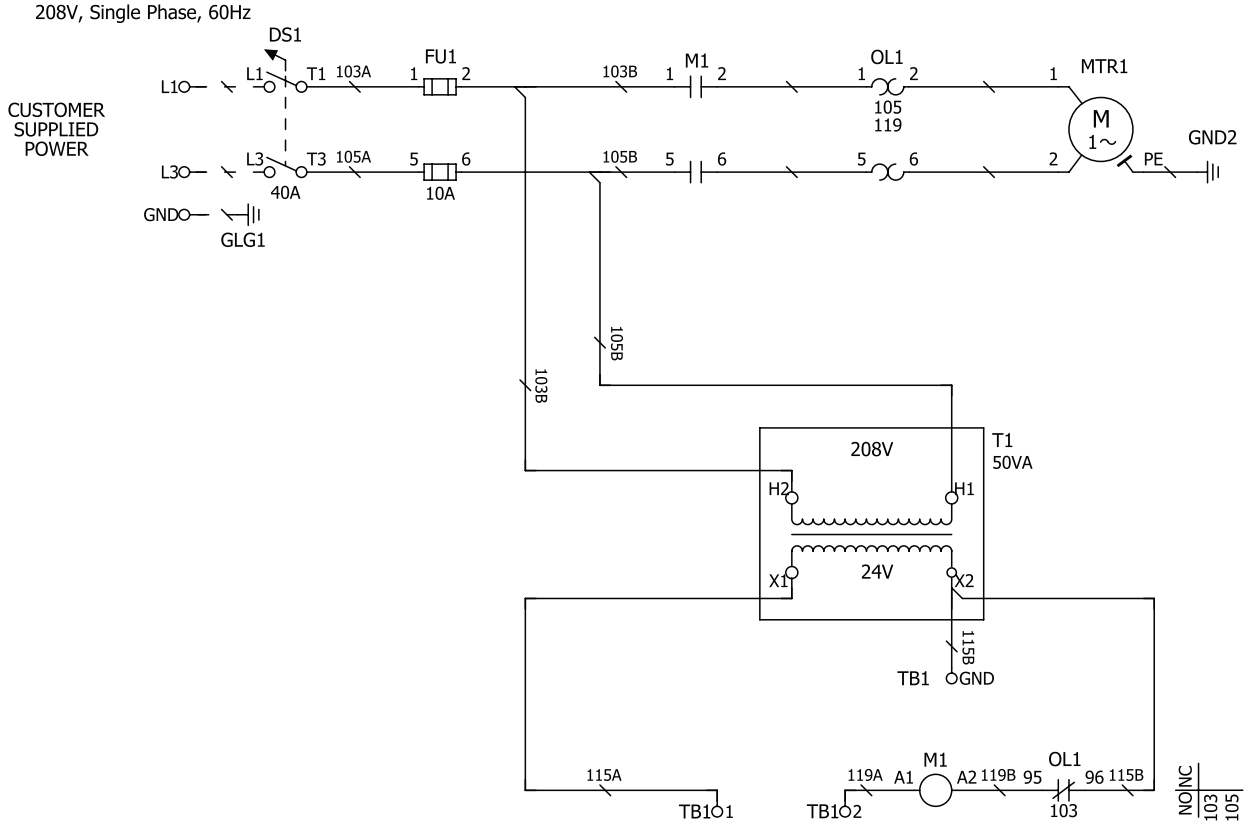
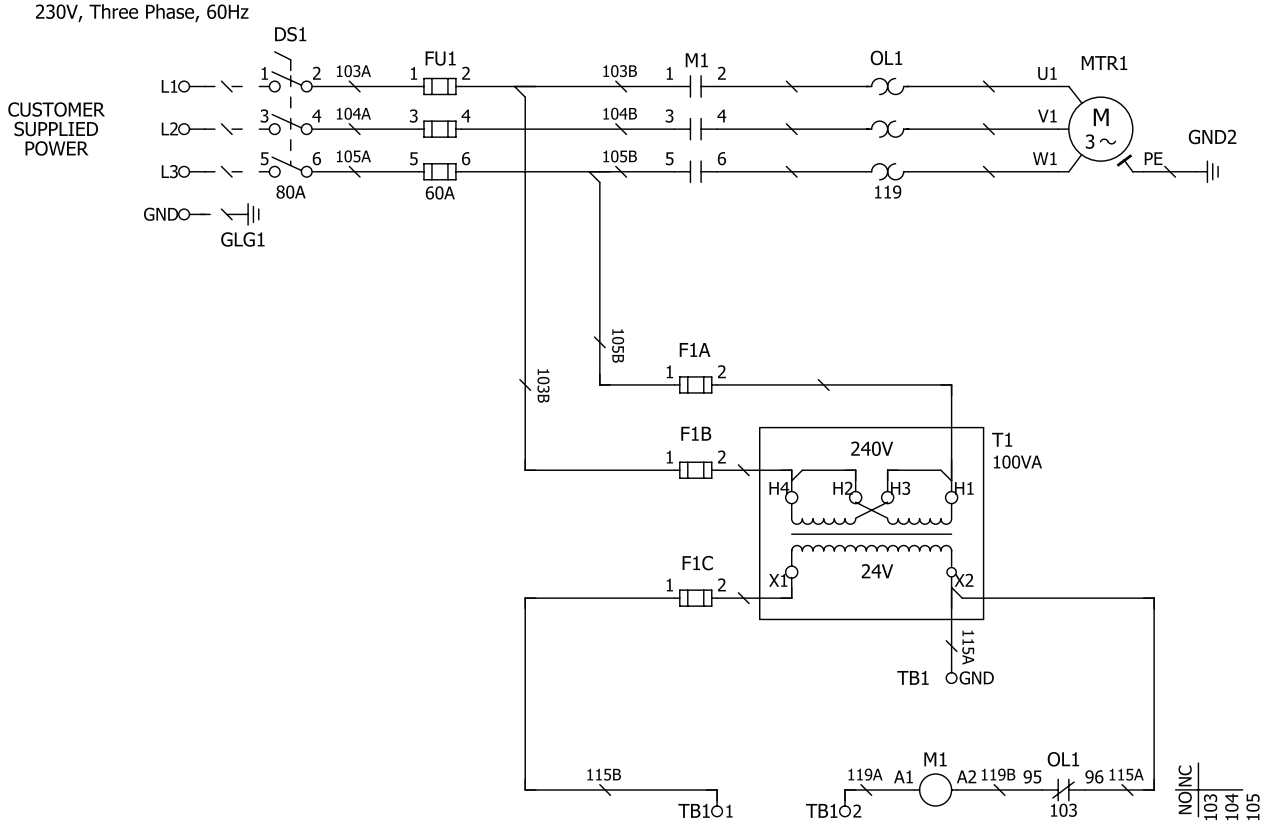


Figure 31: Typical 3-Phase Starter/Disconnect Wiring Diagram



Component and Section Weights

Table 11: Unit Coil Weights

Coil type	Weight—lbs (kg)									
	002	003	004	005	007	010	015	020	025	030
4-row chilled water	31.64 (14.35)	40.56 (18.40)	54.30 (24.64)	59.19 (26.85)	84.80 (38.46)	111.99 (50.80)	185.93 (84.34)	255.08 (115.70)	298.34 (135.32)	341.54 (154.92)
6-row chilled water	39.94 (18.12)	54.81 (24.86)	69.01 (31.30)	86.91 (39.42)	112.30 (50.94)	154.05 (69.88)	261.55 (118.64)	353.14 (160.18)	416.35 (188.85)	477.93 (216.79)
1-row hot water	16.11 (7.31)	19.95 (9.05)	28.36 (12.86)	33.60 (15.24)	45.86 (20.80)	66.07 (29.97)	91.35 (41.44)	116.29 (52.75)	132.03 (59.89)	168.86 (76.59)
2-row hot water	24.36 (11.05)	29.96 (13.59)	38.07 (17.27)	46.13 (20.92)	64.28 (29.16)	83.91 (38.06)	121.10 (54.93)	171.48 (77.78)	197.12 (89.41)	223.03 (101.16)
4-row DX	32.73 (14.85)	42.91 (19.46)	50.11 (22.73)	64.80 (29.39)	88.18 (40.00)	115.42 (52.35)	195.54 (88.70)	248.63 (112.78)	300.8 (136.44)	344.86 (156.43)
6-row DX	43.37 (19.67)	57.01 (25.86)	71.53 (32.45)	91.69 (41.59)	105.18 (47.71)	158.52 (71.90)	268.37 (121.73)	365.31 (165.71)	429.85 (194.98)	493.24 (223.73)

Table 12: Base Unit Cabinet Weights—Horizontal Unit with Forward Curved Fan

Unit size	Weight—lbs (kg)									
	Configuration		Configuration		Configuration		Configuration		Configuration	
	No heat	Reheat coil	No heat	Reheat coil	No heat*	Reheat coil	No heat*	Reheat coil	Preheat coil	
	Flat filters	Flat filters	Angular filters	Angular filters	Flat filters	Flat filters	Angular filters	Angular filters	Flat filters	Angular filters
	Cooling coil	Cooling coil	Cooling coil	Cooling coil	N/A	N/A	N/A	N/A	Cooling coil	Cooling coil
	Fan	Fan	Fan	Fan	Fan	Fan	Fan	Fan	Fan	Fan
002	142.34 (64.56)		187.56 (85.08)		122.36 (55.50)		149.39 (67.76)		157.12 (71.27)	184.19 (83.55)
003	170.89 (77.51)		213.02 (96.62)		148.04 (67.15)		169.18 (76.74)		186.67 (84.67)	208.34 (94.50)
004	207.68 (94.20)		257.99 (117.02)		182.04 (82.47)		205.76 (93.33)		233.73 (106.02)	257.55 (116.82)
005	245.41 (111.32)		317.41 (143.98)		213.25 (96.73)		253.09 (114.80)		267.13 (121.17)	307.89 (139.66)
007	262.71 (119.16)		340.86 (154.61)		224.74 (101.94)		271.81 (123.29)		298.53 (135.41)	346.93 (157.36)
010	302.58 (137.25)		392.63 (178.09)		260.15 (118.00)		312.73 (141.85)		341.67 (154.98)	395.58 (179.43)
015	359.18 (162.92)		463.09 (210.05)		352.58 (159.93)		411.89 (186.83)		419.72 (190.38)	480.74 (218.06)
020	445.55 (202.10)		596.73 (270.67)		440.70 (199.90)		533.01 (241.77)		511.86 (232.18)	606.56 (275.13)
025	559.02 (253.57)		736.09 (333.89)		554.95 (251.72)		658.10 (298.51)		616.52 (279.65)	773.96 (351.06)
030	603.25 (273.63)		817.52 (370.82)		599.00 (271.70)		730.10 (331.17)		633.19 (287.21)	830.10 (376.53)

NOTE: *Ventilation only

Table 13: Base Unit Cabinet Weights—Horizontal Unit with Plenum Fan

Unit size	Weight—lbs (kg)									
	Configuration		Configuration		Configuration		Configuration		Configuration	
	No heat	Reheat coil	No heat	Reheat coil	No heat*	Reheat coil	No heat*	Reheat coil	Preheat coil	
	Flat filters	Flat filters	Angular filters	Angular filters	Flat filters	Flat filters	Angular filters	Angular filters	Flat filters	Angular filters
	Cooling coil	Cooling coil	Cooling coil	Cooling coil	N/A	N/A	N/A	N/A	Cooling coil	Cooling coil
	Fan	Fan	Fan	Fan	Fan	Fan	Fan	Fan	Fan	Fan
002	126 (57)		125 (57)		102 (46)		105 (47)		129 (59)	128 (58)
003	140 (63)		161 (73)		131 (59)		151 (69)		168 (76)	173 (78)
004	220 (100)		214 (97)		193 (88)		193 (88)		225 (102)	252 (114)
005	186 (84)		231 (105)		175 (79)		202 (92)		216 (98)	237 (107)
007	285 (129)		315 (143)		224 (102)		267 (121)		304 (138)	349 (158)
010	309 (140)		395 (179)		270 (122)		316 (143)		392 (178)	454 (206)
015	561 (254)		600 (272)		545 (247)		583 (264)		626 (284)	674 (306)
020	663 (301)		708 (321)		679 (308)		692 (314)		729 (331)	774 (351)
025	743 (337)		740 (335)		698 (317)		845 (383)		767 (348)	788 (357)
030	770 (349)		947 (430)		749 (340)		894 (406)		929 (421)	941 (427)

NOTE: *Ventilation only

Table 14: Base Unit Cabinet Weights—Vertical Unit

Unit size	Weight—lbs (kg)			
	Configuration		Configuration	
	No heat	Reheat coil	No heat*	Reheat coil
	Flat filters	Flat filters	Flat filters	Flat filters
	Cooling coil	Cooling coil	N/A	N/A
	Fan	Fan	Fan	Fan
002	134.70 (61.10)		134.70 (61.10)	
003	183.20 (83.10)		183.20 (83.10)	
004	209.79 (95.16)		209.79 (95.16)	
005	239.00 (108.40)		239.00 (108.40)	
007	349.08 (158.30)		349.08 (158.30)	
010	399.23 (181.09)		399.23 (181.09)	
015	484.20 (219.63)		484.20 (219.63)	
020	566.96 (257.17)		566.96 (257.17)	
025	725.28 (328.98)		725.28 (328.98)	
030	750.14 (340.26)		750.14 (340.26)	

Note: *Ventilation only

Table 15: Electric Heat Weights

Unit size	Weight—lbs (kg)			
	1 Step	2 Steps	3 Steps	4 Steps
002	31 (14.00)	35 (16.00)	—	—
003	32 (14.50)	36 (16.50)	41 (18.50)	45 (20.50)
004	32 (14.50)	36 (16.50)	41 (18.50	45 (20.50)
005	34 (15.50)	39 (17.50)	43 (19.50)	47 (21.50)
007	36 (16.50)	41 (18.50)	45 (20.50)	50 (22.50)
010	36 (16.50)	41 (18.50)	45 (20.50)	50 (22.50)

Table 16: Motor Weights*

Unit size	Motor	Fan motor size – horsepower (hp)											
		0.33	0.5	0.75	1	1.5	2	3	5	7.5	10	15	20
002	Max. weight, lb (kg)	25 (11.33)	27 (12.25)	27 (12.25)	40 (18.41)	44 (19.96)	46 (20.87)	—	—	—	—	—	—
	Frame size	56	56	56	*	**	145T	—	—	—	—	—	—
	Shaft dia., in	5/8	5/8	5/8	*	**	7/8	—	—	—	—	—	—
003	Max. weight, lb (kg)	25 (11.33)	27 (12.25)	27 (12.25)	40 (18.41)	44 (19.96)	46 (20.87)	69 (31.30)	85 (38.55)	—	—	—	—
	Frame size	56	56	56	*	**	145T	182T	184T	—	—	—	—
	Shaft dia., in	5/8	5/8	5/8	*	**	7/8	1-1/8	1-1/8	—	—	—	—
004	Max. weight, lb (kg)	25 (11.33)	27 (12.25)	27 (12.25)	40 (18.41)	44 (19.96)	46 (20.87)	69 (31.30)	85 (38.55)	—	—	—	—
	Frame size	56	56	56	*	**	145T	182T	184T	—	—	—	—
	Shaft dia., in	5/8	5/8	5/8	*	**	7/8	1-1/8	1-1/8	—	—	—	—
005	Max. weight, lb (kg)	—	—	27 (12.25)	40 (18.41)	44 (19.96)	46 (20.87)	69 (31.30)	85 (38.55)	—	—	—	—
	Frame size	—	—	56	*	**	145T	182T	184T	—	—	—	—
	Shaft dia., in	—	—	5/8	*	**	7/8	1-1/8	1-1/8	—	—	—	—
007	Max. weight, lb (kg)	—	—	—	40 (18.41)	44 (19.96)	46 (20.87)	69 (31.30)	85 (38.55)	129 (58.51)	—	—	—
	Frame size	—	—	—	*	**	145T	182T	184T	213T	—	—	—
	Shaft dia., in	—	—	—	*	**	7/8	1-1/8	1-1/8	1-3/8	—	—	—
010	Max. weight, lb (kg)	—	—	—	40 (18.41)	44 (19.96)	46 (20.87)	69 (31.30)	85 (38.55)	129 (58.51)	—	—	—
	Frame size	—	—	—	*	**	145T	182T	184T	213T	—	—	—
	Shaft dia., in	—	—	—	*	**	7/8	1-1/8	1-1/8	1-3/8	—	—	—
015	Max. weight, lb (kg)	—	—	—	—	44 (19.96)	46 (20.87)	69 (31.30)	85 (38.55)	129 (58.51)	129 (58.51)	217 (98.43)	—
	Frame size	—	—	—	—	143T	145T	182T	184T	213T	215T	254T	—
	Shaft dia., in	—	—	—	—	7/8	7/8	1-1/8	1-1/8	1-3/8	1-3/8	1-5/8	—
020	Max. weight, lb (kg)	—	—	—	—	—	46 (20.87)	69 (31.30)	85 (38.55)	129 (58.51)	129 (58.51)	217 (98.43)	—
	Frame size	—	—	—	—	—	145T	182T	184T	213T	215T	254T	—
	Shaft dia., in	—	—	—	—	—	7/8	1-1/8	1-1/8	1-3/8	1-3/8	1-5/8	—
025	Max. weight, lb (kg)	—	—	—	—	—	—	—	85 (38.55)	129 (58.51)	129 (58.51)	217 (98.43)	259 (117.48)
	Frame size	—	—	—	—	—	—	—	184T	213T	215T	254T	256T
	Shaft dia., in	—	—	—	—	—	—	—	1-1/8	1-3/8	1-3/8	1-5/8	1-5/8
030	Max. weight, lb (kg)	—	—	—	—	—	—	—	85 (38.55)	129 (58.51)	129 (58.51)	217 (98.43)	259 (117.48)
	Frame size	—	—	—	—	—	—	—	184T	213T	215T	254T	256T
	Shaft dia., in	—	—	—	—	—	—	—	1-1/8	1-3/8	1-3/8	1-5/8	1-5/8

NOTE:
* 56/56H frame and 5/8" shaft diameter for 1-ph motors. 143T frame and 7/8" shaft diameter for 3-ph motors
** 56/56H frame and 5/8" shaft diameter for 1-ph motors. 143T frame and 7/8" shaft diameter for 3-ph motors
*** Refer to “HP range” in Table 17 and Table 18 on page 30 for applicable motors per unit size

Fan Data

Table 17: Forward Curved Fan Data

	Unit size									
	002	003	004	005	007	010	015	020	025	030
Fan type	DWDI FC	DWDI FC	DWDI FC	DWDI FC	DWDI FC	DWDI FC	Twin DWDI FC	Twin DWDI FC	Twin DWDI FC	Twin DWDI FC
Diameter	7/7	9/9	9/9	10/10	12/12	12/12	10/10	12/12	15/15	15/15
HP range	0.50–2	0.50–3	0.5–5	0.75–5	1–5	1–7.5	2–15	3–15	5–20	5–20
cfm minimum fan limit	206	206	529	529	765	765	1059	1529	2118	2118
cfm maximum fan limit	2,088	2,088	5,765	6,176	8,529	8,529	12,353	17,059	26,706	26,706
Maximum rpm	2,680	2,650	2,650	2,100	1,700	1,700	2,100	1,700	1,500	1,500
Class	1	1	1	1	1	1	1	1	1	1
Motor sheave	VP, VL, VM	VP, VL, VM	VP, VL, VM	VP, VL, VM	VP, VL, VM	VP, VL, VM	VP, VL, VM	VP, VL, VM	VP, VL, VM	VP, VL, VM
Fan sheave	AK, BK	AK, BK	AK, BK	AK, BK	AK, BK	AK, BK	AK, BK	AK, BK	AK, BK	AK, BK
Belt	A, AX, B, BX	A, AX, B, BX	A, AX, B, BX	A, AX, B, BX	A, AX, B, BX	A, AX, B, BX	A, AX, B, BX	A, AX, B, BX	A, AX, B, BX	A, AX, B, BX
Fan shaft diameter	3/4"	3/4"	3/4"	3/4"	1.0"	1.0"	3/4"	1.0"	1.0"	1.0"
Weight—lbs (kg)	19.03 (8.63)	33.95 (15.40)	33.95 (15.40)	41.45 (18.80)	60.85 (27.60)	60.85 (27.60)	79.37 (36.00)	126.77 (57.50)	154.87 (70.25)	154.87 (70.25)

Table 18: Plenum Fan Data

	Unit size									
	002	003	004	005	007	010	015	020	025	030
Fan type	SWSI DD Plenum	SWSI DD Plenum	SWSI DD Plenum	SWSI DD Plenum	SWSI DD Plenum	SWSI DD Plenum	SWSI DD Plenum	SWSI DD Plenum	SWSI DD Plenum	SWSI DD Plenum
Diameter (in)	9	10	11	12.5	14	16	20	22	25	25
HP range	1.5–2	1.5–5	1–5	1–5	1–7.5	1–7.5	1.5–15	2–15	5–20	5–20
cfm minimum fan limit	100	150	200	200	250	325	525	650	800	800
cfm maximum fan limit	1800	2650	4100	4100	5000	5200	9200	12,900	16,150	16,150
Maximum rpm	5175	5175	4245	4245	3600	2625	2265	2310	2060	2060
Weight with smallest motor—lbs (kg)	50 (22.7)	57 (25.9)	59 (26.8)	62 (28.1)	71 (32.2)	86 (39)	147 (66.7)	176 (79.8)	263 (119.3)	263 (119.3)
Weight with largest motor—lbs (kg)	56 (25.4)	84 (38.1)	86 (39)	89 (40.4)	114 (51.7)	154 (69.9)	281 (127.4)	312 (141.5)	363 (164.7)	363 (164.7)

Filter Data

Table 19: Filter Data

	Unit size									
	002	003	004	005	007	010	015	020	025	030
Flat filters										
Flat filter bank number	1	1	1	1	1	1	2	2	2	2
Flat filter (qty) size	(1) 16 × 25	(1) 18 × 24	(2) 16 × 20	(2) 20 × 24	(2) 24 × 24	(3) 20 × 25	(3) 12 × 24 (3) 24 × 24	(6) 24 × 24	(4) 20 × 24 (4) 24 × 24	(6) 16 × 25 (4) 20 × 25
Flat filter depth options	2", 4"	2", 4"	2", 4"	2", 4"	2", 4"	2", 4"	2", 4"	2", 4"	2", 4"	2", 4"
Angular filters										
Angular filter bank number	1	1	1	2	2	2	2	3	3	3
Angular filter (qty) size	(1) 20 × 24	(2) 16 × 20	(2) 20 × 20	(4) 16 × 20	(4) 16 × 25	(6) 16 × 20	(6) 20 × 24	(9) 20 × 24	(6) 20 × 24 (6) 24 × 24	(6) 20 × 24 (6) 24 × 24
Angular filter depth options	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"

Coil Data

Table 20: Coil Data—Chilled Water

	Unit size									
	002	003	004	005	007	010	015	020	025	030
Fin height	14	16	16	22	22	26	32.5	45	45	52.5
Fin length	21	27	34	34	48	54	65	65	80	80
Rows	4, 6	4, 6	4, 6	4, 6	4, 6	4, 6	4, 6	4, 6	4, 6	4, 6
FPI	12	12	12	12	12	12	12	12	12	12
Connection material	Copper sweat	Copper sweat	Copper sweat	Copper sweat	Copper sweat	Copper sweat	Steel NPT	Steel NPT	Steel NPT	Steel NPT
Connection size 4-row	0.875 OD	1.125 OD	1.625 OD	1.625 OD	1.625 OD	1.625 OD	1.5 NPT	2.5 NPT	2.5 NPT	2.5 NPT
Connection size 6-row	0.875 OD	1.125 OD	1.625 OD	1.625 OD	1.625 OD	2.125 OD	2.0 NPT	2.5 NPT	2.5 NPT	2.5 NPT
Casing	Galv./SS	Galv./SS	Galv./SS	Galv./SS	Galv./SS	Galv./SS	Galv./SS	Galv./SS	Galv./SS	Galv./SS

Table 21: Coil Data—DX Coils

	Unit size									
	002	003	004	005	007	010	015	020	025	030
Fin height	14	16	16	22	22	26	32.5	45	45	52.5
Fin length	21	27	34	34	48	54	65	65	80	80
Rows	4, 6	4, 6	4, 6	4, 6	4, 6	4, 6	4, 6	4, 6	4, 6	4, 6
FPI	12	12	12	12	12	12	12	12	12	12
Connection material	Copper sweat	Copper sweat	Copper sweat	Copper sweat	Copper sweat	Copper sweat	Copper sweat	Copper sweat	Copper sweat	Copper sweat
Suction Connection size 4-row	0.875 OD	1.125 OD	1.125 OD	1.125 OD	1.625 OD	1.625 OD	1.625 OD	1.625 OD	1.625 OD	1.625 OD
Liquid Connection size 4-row	0.625 OD	0.625 OD	0.625 OD	0.875 OD	0.875 OD	1.125 OD	0.625 OD	0.875 OD	1.125 OD	1.125 OD
Suction Connection size 6-row	0.875 OD	1.125 OD	1.625 OD	1.625 OD	1.625 OD	2.125 OD	1.625 OD	1.625 OD	2.125 OD	2.625 OD
Liquid Connection size 6-row	0.625 OD	0.625 OD	0.625 OD	1.125 OD	1.125 OD	1.125 OD	0.875 OD	0.875 OD	1.125 OD	1.375 OD
Casing	Galv./SS.	Galv./SS	Galv./SS	Galv./SS	Galv./SS	Galv./SS	Galv./SS	Galv./SS	Galv./SS	Galv./SS
Number of circuits	1	1	1	1	1	1	2	2	2	2
Circuit type	Normal	Normal	Normal	Normal	Normal	Normal	Face split	Face split	Face split	Face split

Table 22: Coil Data—Hot Water Coils

	Unit size									
	002	003	004	005	007	010	015	020	025	030
Fin height	14	16	16	22	22	26	32.5	45	45	52.5
Fin length	21	27	34	34	48	54	65	65	80	80
Rows	1, 2	1, 2	1, 2	1, 2	1, 2	1, 2	1, 2	1, 2	1, 2	1, 2
FPI	12	12	12	12	12	12	12	12	12	12
Connection material	Copper sweat	Copper sweat	Copper sweat	Copper sweat	Copper sweat	Copper sweat	Steel NPT	Steel NPT	Steel NPT	Steel NPT
Connection size 1-row	0.625 OD	0.625 OD	0.875 OD	0.875 OD	1.125 OD	1.375 OD	1.0 NPT	1.5 NPT	1.5 NPT	2.0 NPT
Connection size 2-row	0.875 OD	0.875 OD	1.125 OD	1.125 OD	1.625 OD	1.625 OD	1.5 NPT	2.0 NPT	2.0 NPT	2.0 NPT
Casing	Galv./SS	Galv./SS	Galv./SS	Galv./SS	Galv./SS	Galv./SS	Galv./SS	Galv./SS	Galv./SS	Galv./SS

Drain Pan Data

Table 23: Drain Pan Connections

Standard and optional stainless steel										
	Unit size									
	002	003	004	005	007	010	015	020	025	030
Arrangement	Sloped	Sloped	Sloped	Sloped	Sloped	Sloped	Sloped	Sloped	Sloped	Sloped
Connection size - Main	1" ID MPT	1" ID MPT	1" ID MPT	1" ID MPT	1" ID MPT	1" ID MPT	1-1/4" ID MPT	1-1/4" ID MPT	1-1/4" ID MPT	1-1/4" ID MPT
Connection size - Secondary	1/2" ID MPT	1/2" ID MPT	1/2" ID MPT	1/2" ID MPT	1/2" ID MPT	1/2" ID MPT	1/2" ID MPT	1/2" ID MPT	1/2" ID MPT	1/2" ID MPT

Electric Heat Data

Table 24: Electric Heat Data for Unit Sizes

Unit size	Number of Stages	Voltage/kW Range						
		120/1/60	208/1/60	240/1/60	208/3/60	240/3/60	480/3/60	600/3/60
002	1	1.5–4.5	1.5–8	1.5–9	1.5–10	1.5–10	1.5–10	1.5–10
	2	4–9	4–9	4–10	4–10	4–10	4–10	4–10
003	1	2.5–4.5	2.5–8	2.5–9	2.5–13	2.5–15	2.5–20	2.5–20
	2	4–9	4–16	4–20	4–20	4–20	4–20	4–20
	3	10–13	15–20	15–20	15–20	15–20	15–20	15–20
	4	14–18	20	20	20	20	20	20
004	1	2.5–4.5	2.5–8	2.6–9	2.5–13	2.5–15	2.5–20	2.5–20
	2	4–9	4–16	4–18	4–20	4–20	4–20	4–20
	3	9.5–13	15–20	15–20	15–20	15–20	15–20	15–20
	4	14–18	20	20	20	20	20	20
005	1	4–4.5	4–8	4–9	4–13	4–15	4–24	4–26
	2	4–9	4–16	4–18	4–26	4–26	4–26	4–26
	3	10–13	15–24	15–26	15–26	15–26	15–26	15–26
	4	14–18	20–26	20–26	20–26	20–26	20–26	20–26
007	1	NA	6–8	6–9	6–13	6–15	6–20	6–20
	2	6–9	6–16	6–18	6–26	6–30	6–36	6–36
	3	10–13	15–24	15–26	15–38	15–38	15–38	15–38
	4	14–18	20–32	20–36	20–38	20–38	20–38	20–38
010	1	NA	6–8	6–9	6–13	6–13	6–19	6–19
	2	6–9	6–16	6–18	6–26	6–30	6–36	6–36
	3	10–13	15–24	15–26	15–40	15–45	15–55	15–55
	4	14–18	20–32	20–36	20–55	20–55	20–55	20–55

Fan Curves

Figure 32: 9.0" SWSI - Backward Inclined Plenum Supply Fan at Standard Conditions

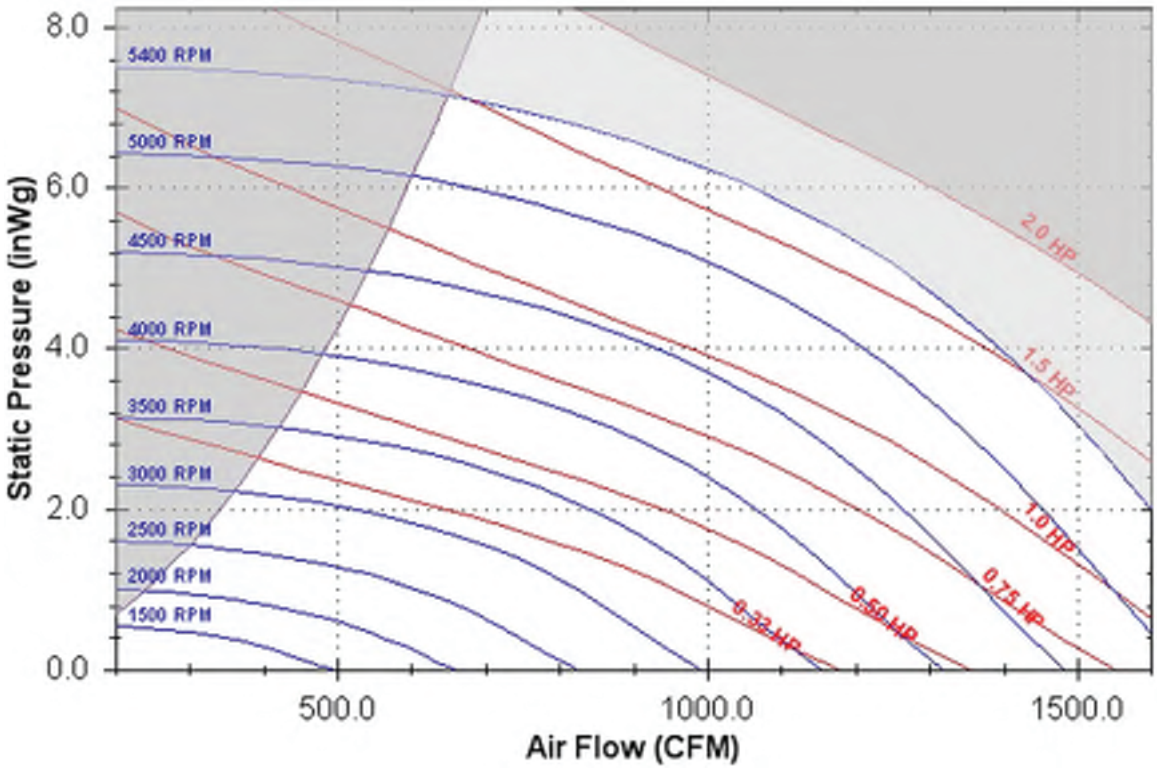


Figure 33: 10.0" SWSI - Backward Inclined Plenum Supply Fan at Standard Conditions

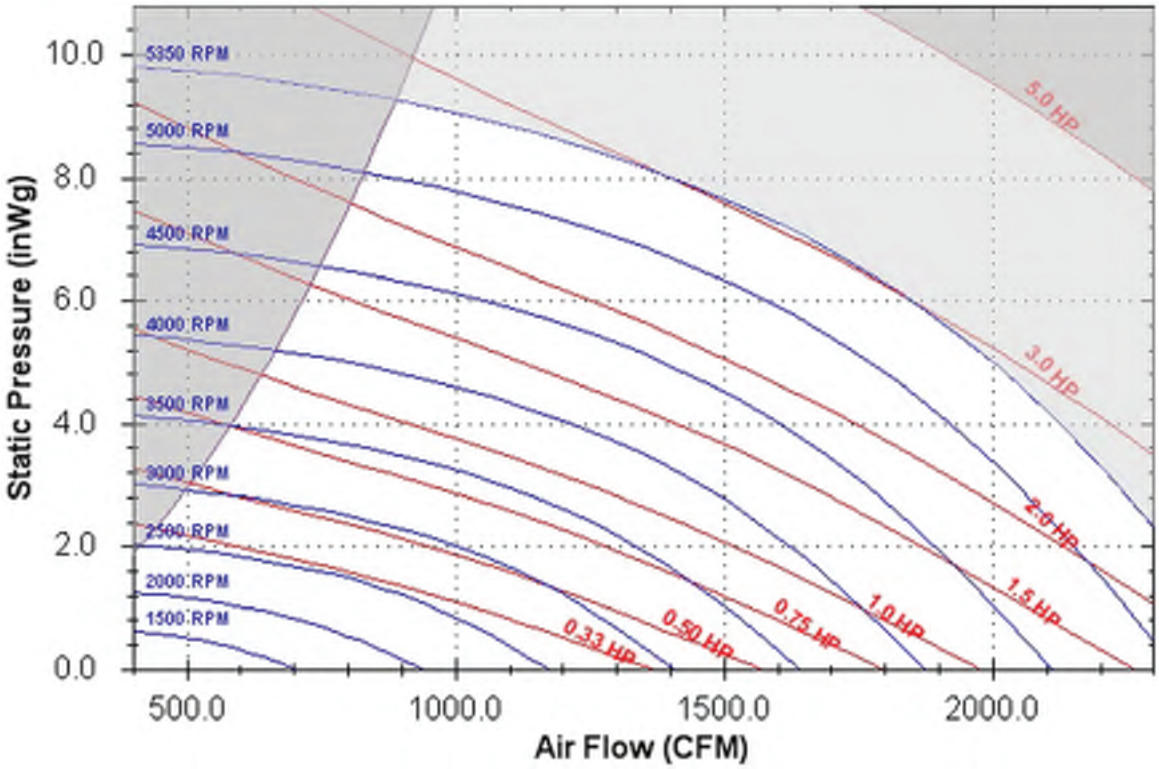


Figure 34: 11.0" SWSI - Backward Inclined Plenum Supply Fan at Standard Conditions

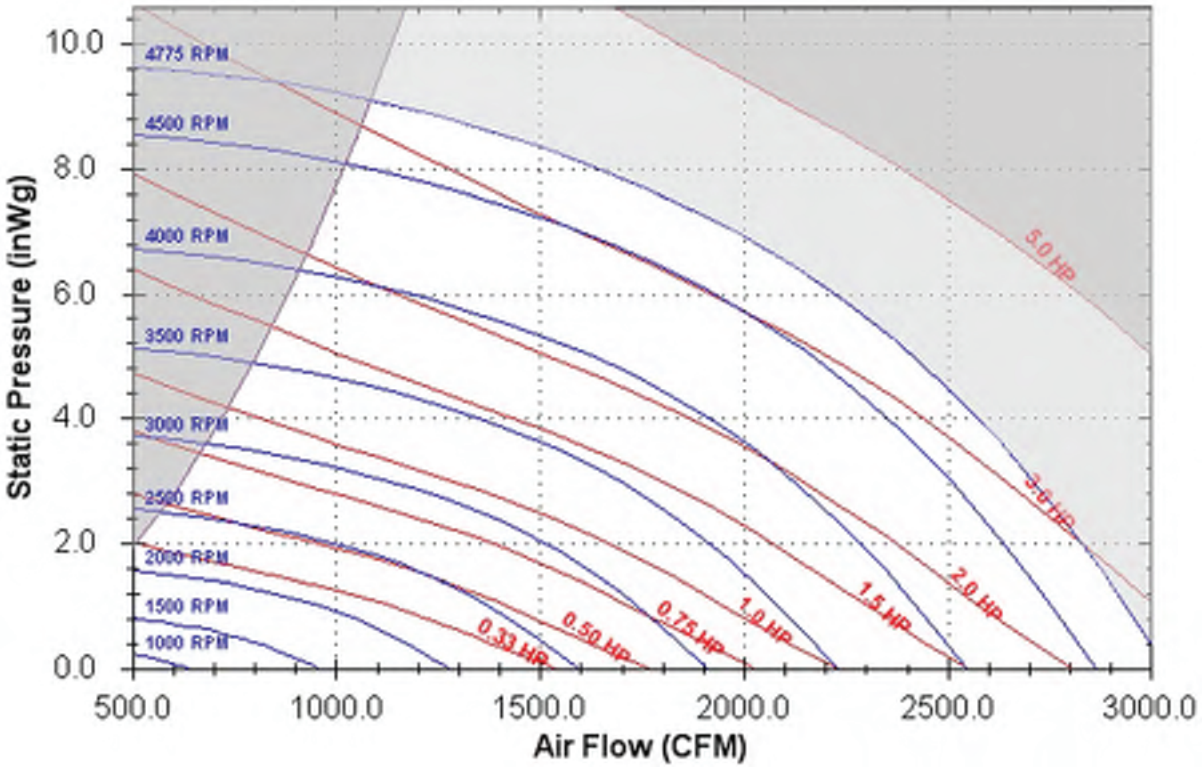


Figure 35: 12.0" SWSI - Backward Inclined Plenum Supply Fan at Standard Conditions

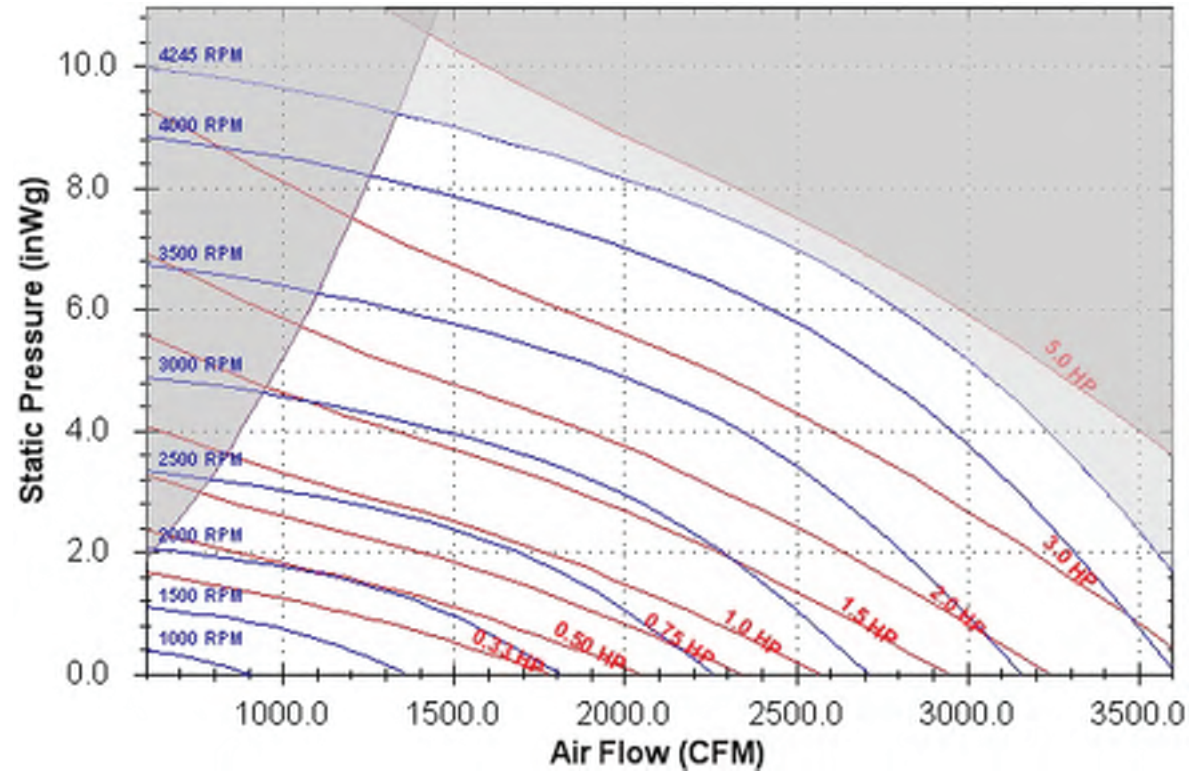


Figure 36: 14.0" SWSI - Backward Inclined Plenum Supply Fan at Standard Conditions

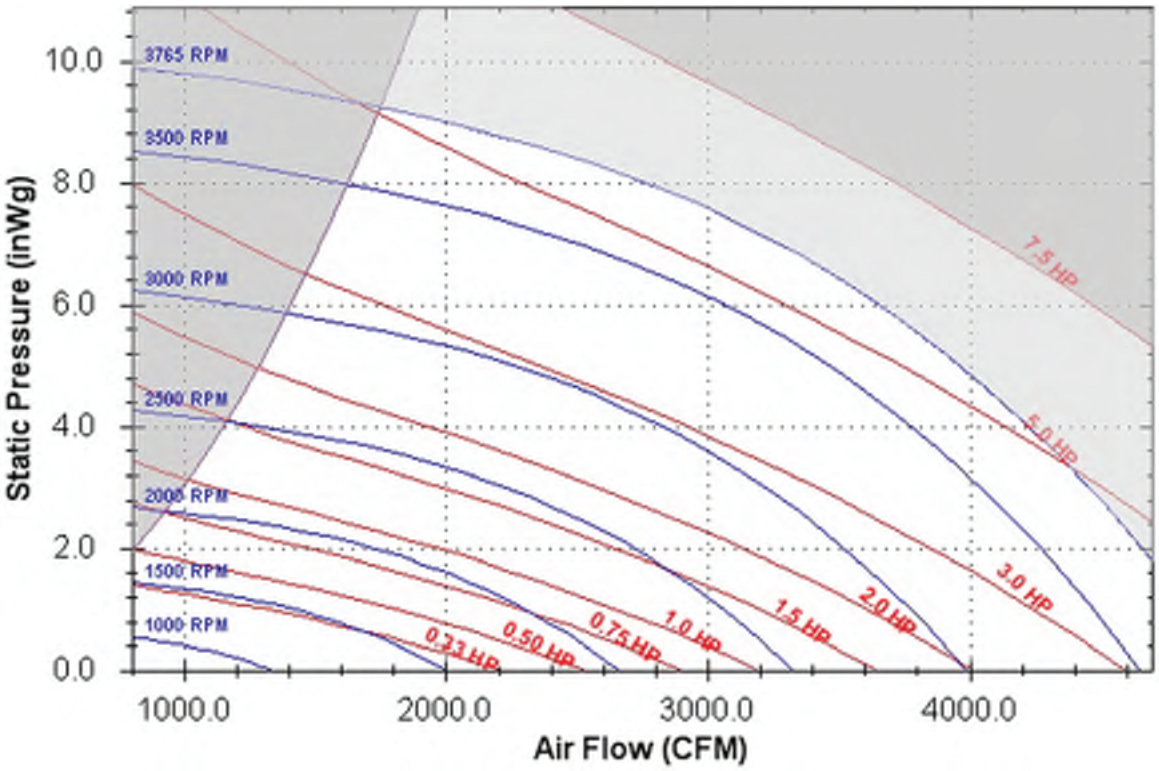


Figure 37: 16.0" SWSI - Backward Inclined Plenum Supply Fan at Standard Conditions

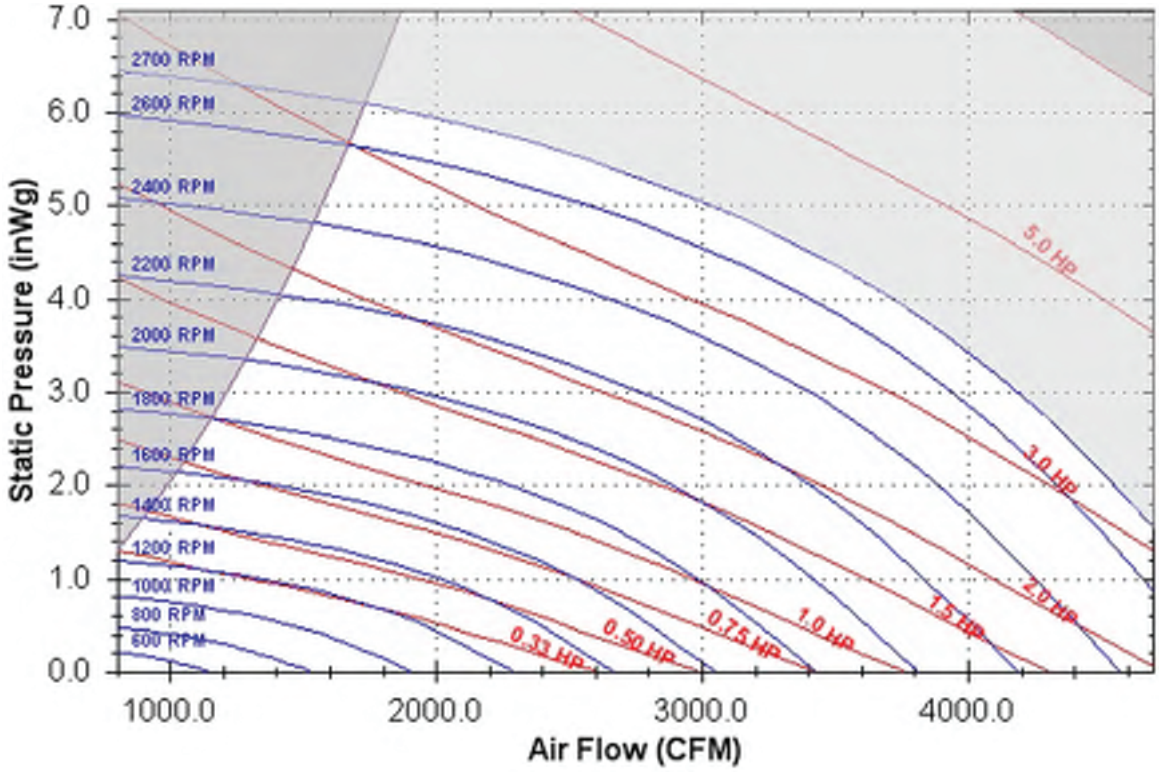


Figure 38: 20.0" SWSI - Backward Inclined Plenum Supply Fan at Standard Conditions

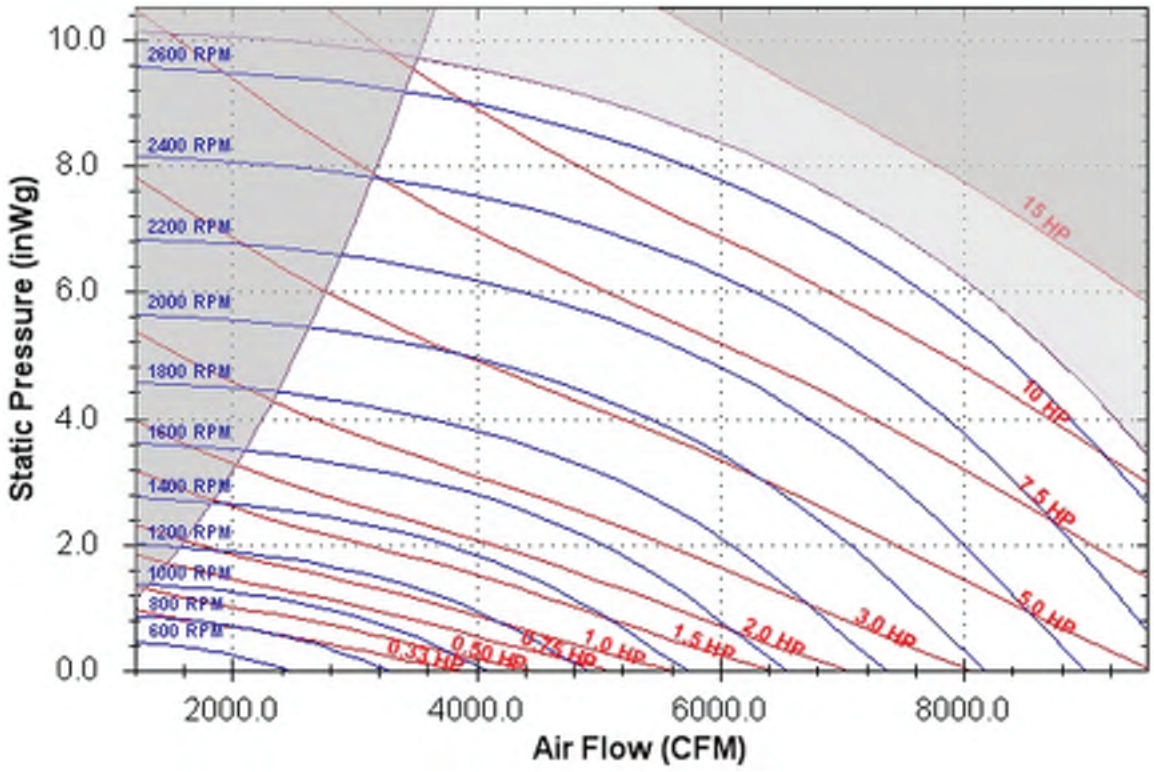


Figure 39: 22.0" SWSI - Backward Inclined Plenum Supply Fan at Standard Conditions

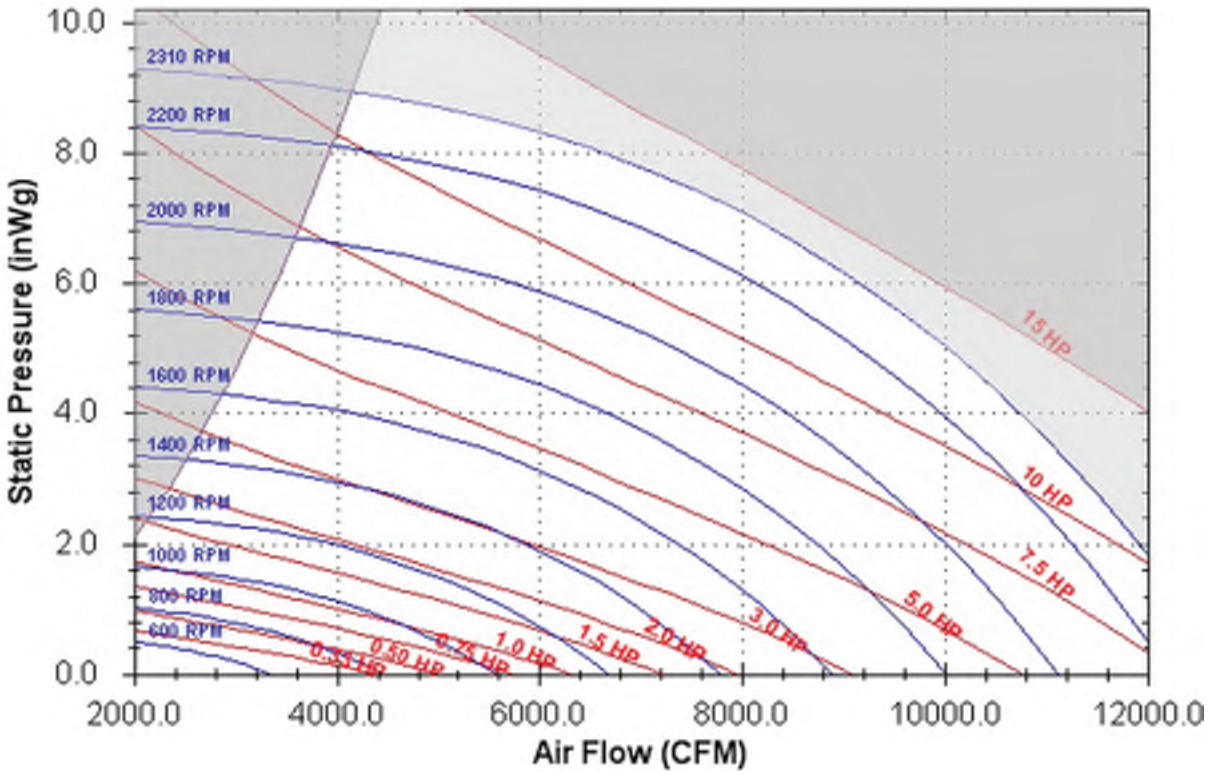
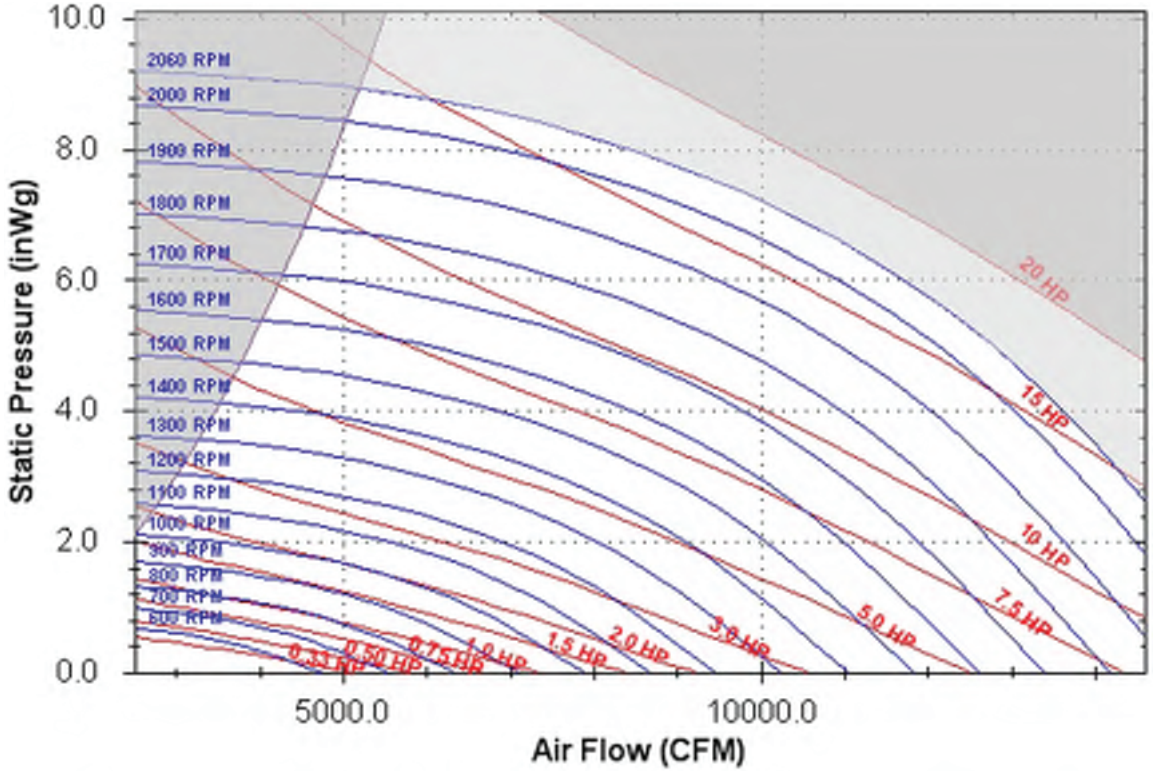


Figure 40: 25.0" SWSI - Backward Inclined Plenum Supply Fan at Standard Conditions



Cabinet Dimensions—Horizontal

Table 25: Cabinet Dimensions—Horizontal Unit

Dimension/ Configuration		Unit size									
		002	003	004	005	007	010	015	020	025	030
Cabinet Dimension		**Unit height and width dimensions in. (mm)**									
Height		20.47 (520)	22.44 (570)	22.44 (570)	28.35 (720)	28.35 (720)	32.48 (825)	39.37 (1000)	51.57 (1310)	51.57 (1310)	59.06 (1500)
Width		28.54 (725)	34.84 (885)	42.52 (1080)	42.52 (1080)	56.50 (1435)	63.00 (1600)	74.41 (1890)	75.00 (1905)	89.96 (2285)	89.96 (2285)
Configuration		**Unit length dimensions in. (mm)**									
Cooling only or cooling with reheat coils	Flat filter	47.84 (1215)	47.84 (1215)	53.35 (1355)	54.72 (1390)	58.86 (1495)	58.86 (1495)	53.74 (1365)	56.30 (1430)	62.00 (1575)	62.00 (1575)
	Angular filter	58.27 (1480)	55.12 (1400)	60.63 (1540)	65.95 (1675)	70.08 (1780)	70.08 (1780)	64.37 (1635)	71.26 (1810)	76.97 (1955)	80.12 (2035)
Cooling with preheat coils	Flat filter	51.97 (1320)	51.97 (1320)	59.25 (15.05)	59.45 (15.10)	65.55 (1665)	65.55 (1665)	62.80 (15.95)	65.35 (1660)	69.09 (17.55)	69.09 (17.55)
	Angular filter	62.40 (15.85)	59.25 (1505)	66.53 (1690)	70.67 (17.95)	76.77 (1950)	76.77 (1950)	73.42 (18.65)	80.32 (2040)	84.06 (2135)	87.20 (2215)
Heating only	Flat filter	39.96 (1015)	39.96 (1015)	45.47 (1155)	45.67 (1160)	49.80 (1265)	49.80 (1265)	52.56 (1335)	55.51 (1410)	61.42 (1560)	61.42 (1560)
	Angular filter	50.39 (1280)	47.24 (1200)	52.76 (1340)	56.89 (1445)	61.02 (1550)	61.02 (1550)	63.19 (1605)	70.47 (1790)	76.38 (1940)	79.53 (2020)
Ventilation only	Flat filter	39.96 (1015)	39.96 (1015)	45.47 (1155)	45.67 (1160)	49.80 (1265)	49.80 (1265)	52.56 (1335)	55.51 (1410)	61.42 (1560)	61.42 (1560)
	Angular filter	50.39 (1280)	47.24 (1200)	52.76 (1340)	56.89 (1445)	61.02 (1550)	61.02 (1550)	63.19 (1605)	70.47 (1790)	76.38 (1940)	79.53 (2020)
Discharge Opening Dimension		**Unit height and width dimensions in. (mm)**									
Height		9.17 (233)	11.77 (299)	11.77 (299)	13.07 (332)	15.51 (394)	15.51 (394)	2 × 13.07* (332)	2 × 15.51* (394)	2 × 18.54* (471)	2 × 18.54* (471)
Width		8.74 (222)	10.20 (259)	10.20 (259)	11.34 (288)	13.46 (342)	13.46 (342)	2 × 11.34* (288)	2 × 13.46* (342)	2 × 15.83* (402)	2 × 15.83* (402)

NOTE: * Twin openings

Figure 41: Horizontal Unit Dimensions

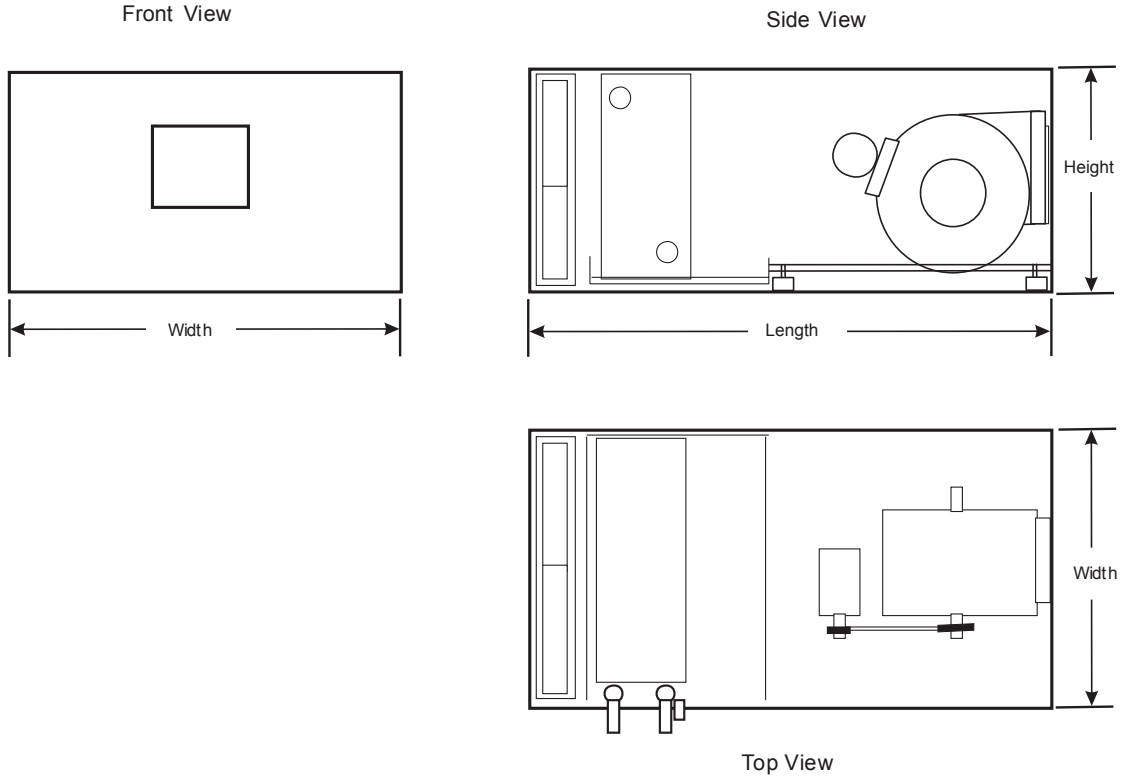
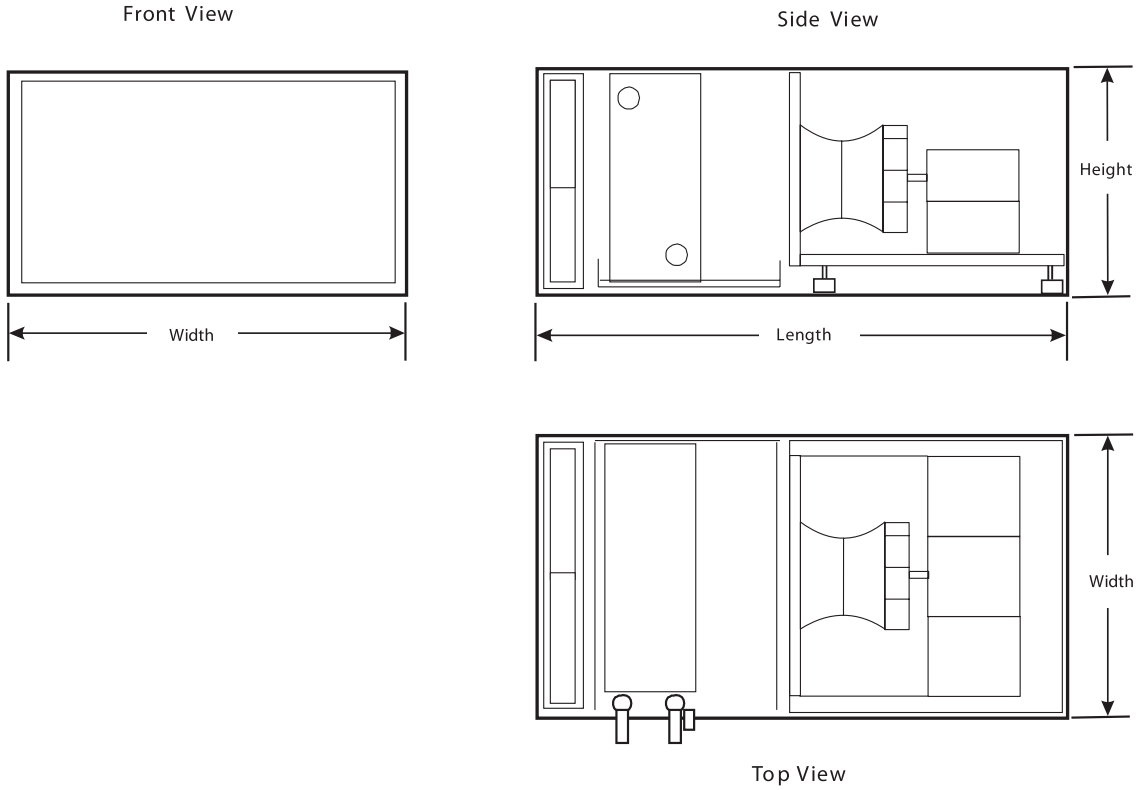


Table 26: Cabinet Dimensions—Horizontal Unit with Plenum Fan

Dimension/ Configuration		Unit size									
		002	003	004	005	007	010	015	020	025	030
Cabinet Dimension		**Unit height and width dimensions in. (mm)**									
Height		20.47 (520)	22.44 (570)	22.44 (570)	28.35 (720)	28.35 (720)	32.48 (825)	39.37 (1000)	51.57 (1310)	51.57 (1310)	59.06 (1500)
Width		28.54 (725)	34.84 (885)	42.52 (1080)	42.52 (1080)	56.50 (1435)	63.00 (1600)	74.41 (1890)	75.00 (1905)	89.96 (2285)	89.96 (2285)
Configuration		**Unit length dimensions in. (mm)**									
Cooling only or cooling with reheat coils	Flat filter	47.83 (1215)	53.94 (1370)	59.45 (1510)	62.01 (1575)	70.08 (1780)	70.08 (1780)	70.87 (1800)	78.35 (1990)	88.54 (2250)	88.54 (2250)
	Angular filter	58.27 (1480)	61.42 (1560)	66.54 (1690)	73.03 (1855)	81.50 (2070)	81.50 (2070)	81.50 (2070)	93.31 (2370)	103.54 (2630)	106.69 (2710)
Cooling with preheat coils	Flat filter	51.97 (1320)	58.27 (1480)	62.99 (1600)	66.73 (1695)	76.77 (1950)	76.77 (1950)	79.92 (2030)	87.40 (2220)	95.67 (2430)	95.67 (2430)
	Angular filter	62.40 (15.85)	65.55 (1665)	70.08 (1780)	77.76 (1975)	88.19 (2240)	88.19 (2240)	90.55 (2300)	102.36 (2600)	110.63 (2810)	95.67 (2430)
Heating only	Flat filter	39.96 (1015)	46.06 (1170)	51.57 (1310)	52.95 (1345)	61.02 (1550)	61.02 (1550)	69.69 (1770)	77.56 (1970)	88.19 (2240)	88.19 (2240)
	Angular filter	50.79 (1290)	53.54 (1360)	58.66 (1490)	63.98 (1625)	72.44 (1840)	72.44 (1840)	80.31 (2040)	92.52 (2320)	103.15 (2620)	105.91 (2690)
Ventilation only	Flat filter	39.96 (1015)	46.06 (1170)	51.57 (1310)	52.95 (1345)	61.02 (1550)	61.02 (1550)	69.69 (1770)	77.56 (1970)	88.19 (2240)	88.19 (2240)
	Angular filter	50.79 (1290)	53.54 (1360)	58.66 (1490)	63.98 (1625)	72.44 (1840)	72.44 (1840)	80.31 (2040)	92.52 (2320)	103.15 (2620)	105.91 (2690)
Discharge Opening Dimension		**Unit height and width dimensions in. (mm)**									
Height		18.11 (460)	20.08 (510)	20.08 (510)	25.98 (660)	25.98 (660)	30.11 (765)	37.00 (940)	49.21 (1250)	49.21 (1250)	56.69 (2225)
Width		26.18 (665)	32.48 (825)	40.16 (1020)	40.16 (1020)	54.13 (1375)	60.63 (1540)	72.05 (1830)	72.64 (1845)	87.60 (2225)	87.60 (2225)

Figure 42: Horizontal Unit Dimensions



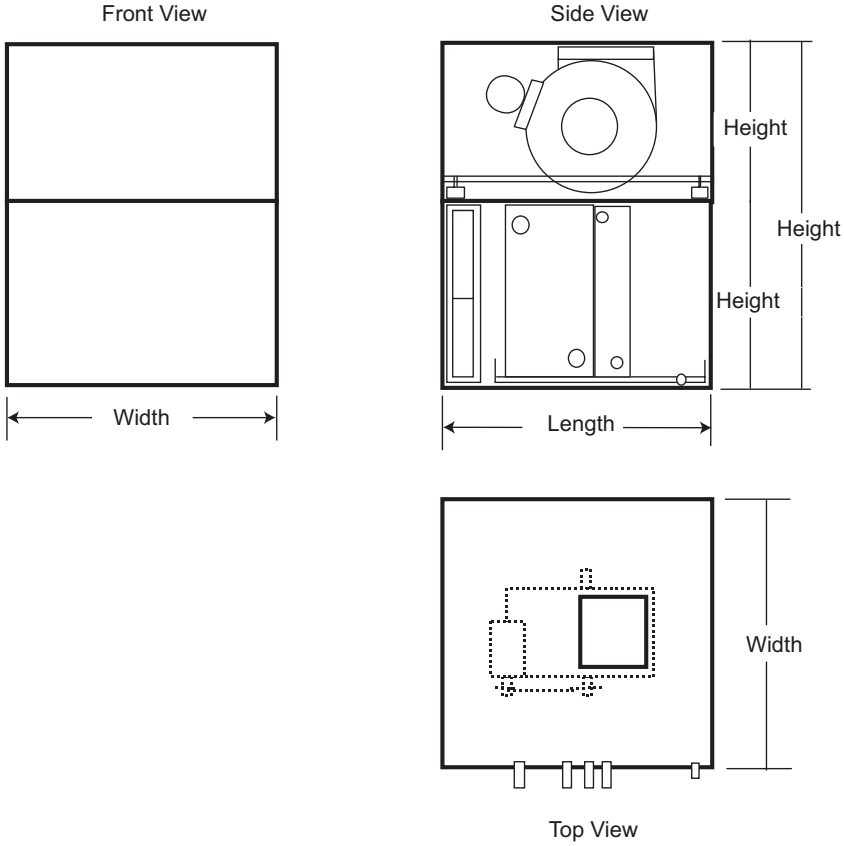
Cabinet Dimensions—Vertical

Table 27: Cabinet Dimensions—Vertical Unit

Dimensions	Unit size									
	002	003	004	005	007	010	015	020	025	030
Cabinet Dimension	**Unit height, length, and width dimensions in. (mm)**									
Width, in (mm)	28.54 (725)	34.84 (885)	42.52 (1080)	42.52 (1080)	56.50 (1435)	62.99 (1600)	74.41 (1890)	75.00 (1905)	89.96 (2285)	89.96 (2285)
Length, in (mm)	29.92 (760)	33.07 (840)	33.07 (840)	36.42 (925)	39.96 (1015)	39.96 (1015)	42.72 (1085)	47.83 (1215)	51.18 (1300)	51.18 (1300)
Upper section height, in (mm)	17.13 (435)	19.88 (505)	19.88 (505)	22.05 (560)	24.61 (625)	24.61 (625)	23.82 (605)	26.97 (685)	31.30 (795)	31.30 (795)
Lower section height, in (mm)	20.47 (520)	22.44 (570)	22.44 (570)	28.35 (720)	28.35 (720)	32.48 (825)	39.37 (1000)	51.57 (1310)	51.57 (1310)	59.06 (1500)
Discharge Opening Dimensions	**Unit height and width dimensions, in. (mm)**									
Height, in (mm)	9.17 (233)	11.77 (299)	11.77 (299)	13.07 (332)	15.51 (394)	15.51 (394)	13.07* (332)	15.51* (394)	18.54* (471)	18.54* (471)
Width, in (mm)	8.74 (222)	10.20 (259)	10.20 (259)	11.34 (288)	13.46 (342)	13.46 (342)	11.34 (288)	13.46 (342)	15.83 (402)	15.83 (402)

NOTE: * Twin openings

Figure 43: Vertical Unit Dimensions

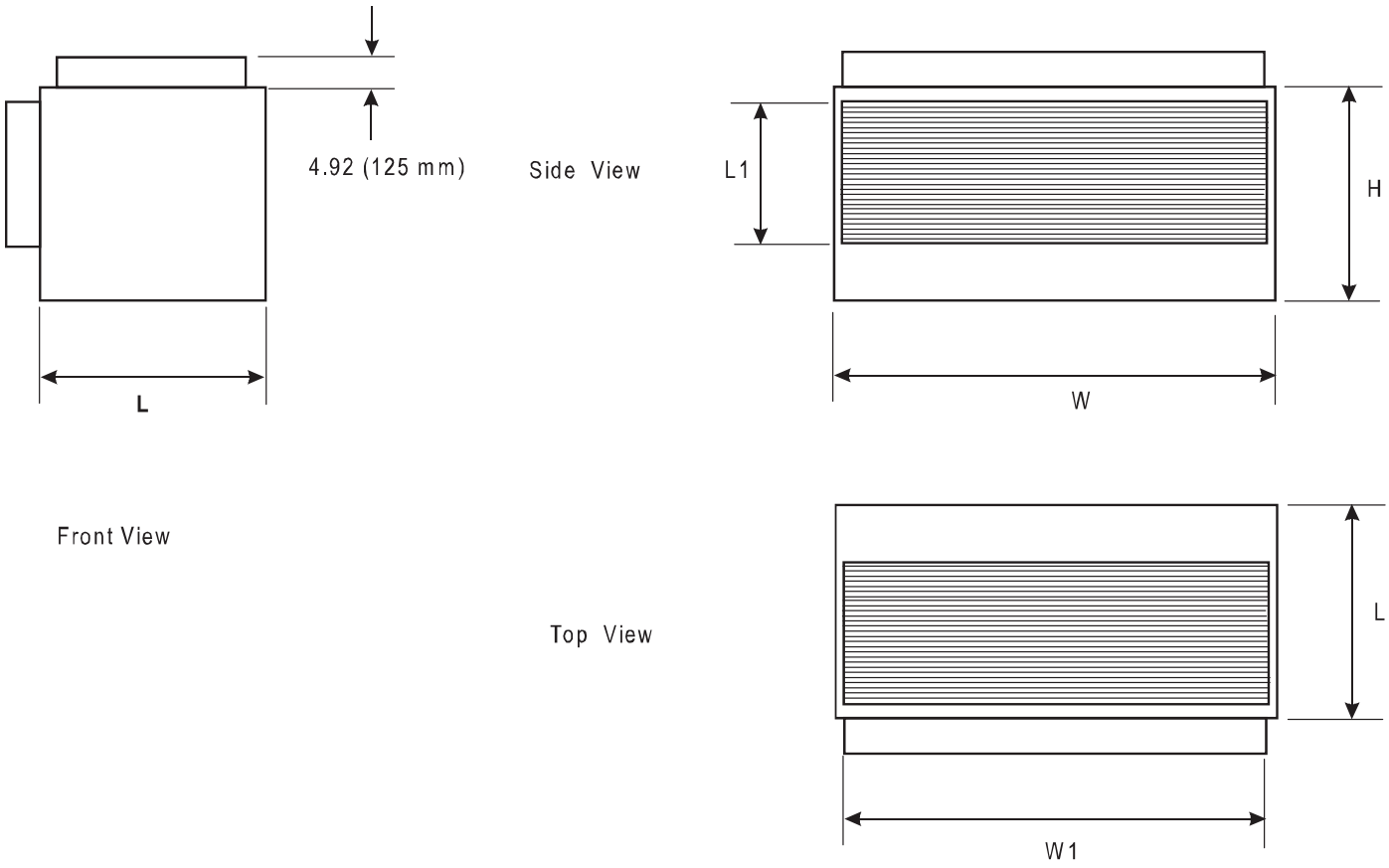


Mixing Box Dimensions

Table 28: Horizontal and Vertical Units

Unit size	Cabinet, in. (mm)			Damper, in. (mm)		
	W	H	L	W1	L1	Area (ft^2)
002	28.54 (725)	20.47 (520)	10.24 (260)	26.18 (665)	7.87 (200)	1.43
003	34.84 (885)	22.44 (570)	10.24 (260)	32.48 (825)	7.87 (200)	1.78
004	42.52 (1080)	22.44 (570)	10.24 (260)	40.16 (1020)	7.87 (200)	2.20
005	42.52 (1080)	28.35 (720)	14.17 (360)	40.16 (1020)	11.81 (300)	3.29
007	56.50 (1435)	28.35 (720)	14.17 (360)	54.13 (1375)	11.81 (300)	4.44
010	62.99 (1600)	32.48 (825)	14.17 (360)	60.63 (1540)	11.81 (300)	4.97
015	74.41 (1890)	39.37 (1000)	18.11 (460)	72.05 (1830)	15.75 (400)	7.88
020	75.00 (1905)	51.57 (1310)	25.98 (660)	72.64 (1845)	23.62 (600)	11.92
025	89.96 (2285)	51.57 (1310)	25.98 (660)	87.60 (2225)	23.62 (600)	14.37
030	89.96 (2285)	59.06 (1500)	29.92 (760)	87.60 (2225)	27.56 (700)	16.76

Figure 44: Mixing Box DImensions



Electric Heat Dimensions—Left/Right Oriented

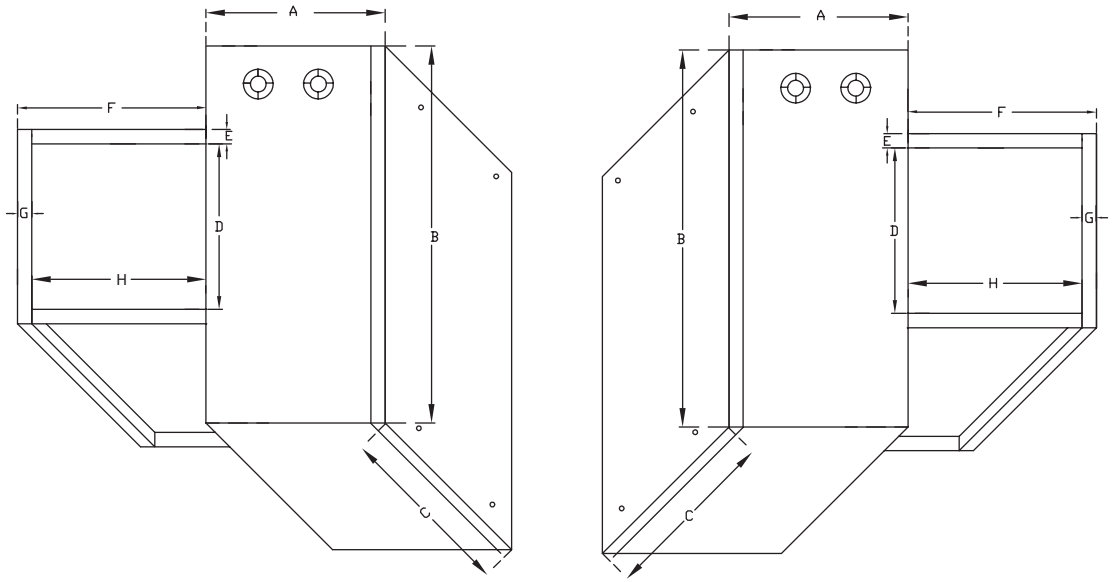
Table 29: Electric Heat Dimensions - in. (mm), Sizes 002 through 004

Dimension, in. (mm)	Unit Size									
	002		003				004			
	1 Step	2 Steps	1Step	2 Steps	3 Steps	4 Steps	1Step	2 Steps	3 Steps	4 Steps
A	9-1/2 (241)	9-1/2 (241)	9-1/2 (241)	9-1/2 (241)	9-1/2 (241)	9-1/2 (241)	9-1/2 (241)	9-1/2 (241)	9-1/2 (241)	9-1/2 (241)
B	20 (508)	20 (508)	22-1/4 (565)	22-1/4 (565)	22-1/4 (565)	22-1/4 (565)	22-1/4 (565)	22-1/4 (565)	22-1/4 (565)	22-1/4 (565)
C	11-1/2 (292)	16 (406)	11-1/2 (292)	16 (406)	20 (508)	24 (610)	11-1/2 (292)	16 (406)	20 (508)	24 (610)
D	8-3/4 (222)	8-3/4 (222)	10-3/8 (264)	10-3/8 (264)	10-3/8 (264)	10-3/8 (264)	10-3/8 (264)	10-3/8 (264)	10-3/8 (264)	10-3/8 (264)
E	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)
F	10 (254)	10 (254)	12-3/4 (324)	12-3/4 (324)	12-3/4 (324)	12-3/4 (324)	12-3/4 (324)	12-3/4 (324)	12-3/4 (324)	12-3/4 (324)
G	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)
H	9-1/4 (235)	9-1/4 (235)	12 (305)	12 (305)	12 (305)	12 (305)	12 (305)	12 (305)	12 (305)	12 (305)

Table 30: Electric Heat Dimensions - in. (mm), Sizes 005 through 010

Dimension, in. (mm)	Unit Size											
	005				007				010			
	1Step	2 Steps	3 Steps	4 Steps	1Step	2 Steps	3 Steps	4 Steps	1Step	2 Steps	3 Steps	4 Steps
A	9-1/2 (241)	9-1/2 (241)	9-1/2 (241)	9-1/2 (241)	9-1/2 (241)	9-1/2 (241)	9-1/2 (241)	9-1/2 (241)	9-1/2 (241)	9-1/2 (241)	9-1/2 (241)	9-1/2 (241)
B	23-1/2 (597)	23-1/2 (597)	23-1/2 (597)	23-1/2 (597)	25 (635)	25 (635)	25 (635)	25 (635)	25 (635)	25 (635)	25 (635)	25 (635)
C	11-1/2 (292)	16 (406)	20 (508)	24 (610)	11-1/2 (292)	16 (406)	20 (508)	24 (610)	11-1/2 (292)	16 (406)	20 (508)	24 (610)
D	11-3/8 (289)	11-3/8 (289)	11-3/8 (289)	11-3/8 (289)	13-1/2 (343)	13-1/2 (343)	13-1/2 (343)	13-1/2 (343)	13-1/2 (343)	13-1/2 (343)	13-1/2 (343)	13-1/2 (343)
E	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)
F	14 (356)	14 (356)	14 (356)	14 (356)	16-1/2 (419)	16-1/2 (419)	16-1/2 (419)	16-1/2 (419)	16-1/2 (419)	16-1/2 (419)	16-1/2 (419)	16-1/2 (419)
G	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)
H	13-1/4 (337)	13-1/4 (337)	13-1/4 (337)	13-1/4 (337)	15-3/4 (400)	15-3/4 (400)	15-3/4 (400)	15-3/4 (400)	15-3/4 (400)	15-3/4 (400)	15-3/4 (400)	15-3/4 (400)

Figure 45: Electric Heat Dimensions



Left Hand

Right Hand

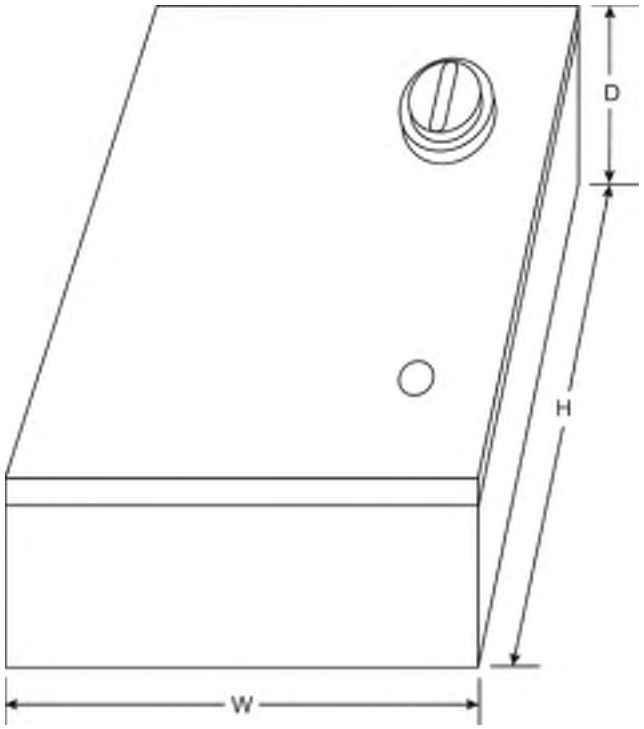
NOTE: Heaters are not intended to be installed with less than 20" of straight duct at the outlet of the heater.

Control Box Dimensions

Table 31: Control Box Dimensions – Left and Right Hand Access

Dimension/Configuration	Unit size									
	002	003	004	005	007	010	015	020	025	030
Disconnect/Starter/Transformer	**Dimensions, in. (mm)**									
Width	8 (203)	8 (203)	8 (203)	8 (203)	8 (203)	8 (203)	12 (305)	12 (305)	12 (305)	12 (305)
Depth	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)
Height	18 (407)	18 (407)	18 (407)	18 (407)	18 (407)	18 (407)	16 (415)	16 (415)	16 (415)	16 (415)
Disconnect Only/Left Hand Access Only	**Dimensions, in. (mm)**									
Width	7 (178)	7 (178)	7 (178)	7 (178)	7 (178)	9 (223)	9 (223)	9 (223)	9 (223)	9 (223)
Depth	5 (125)	5 (125)	5 (125)	5 (125)	5 (125)	6.5 (162)	6.5 (162)	6.5 (162)	6.5 (162)	6.5 (162)
Height	15 (378)	15 (378)	15 (378)	15 (378)	15 (378)	17.5 (444)	17.5 (444)	17.5 (444)	21.3 (540)	21.3 (540)

Figure 46: Control Box Dimensions



Startup Checks

⚠ WARNING

ROTATING FAN

Can cause severe injury or death. Before servicing fans, lockout and tag out power.

⚠ DANGER

FIRE/ELECTRIC SHOCK HAZARD

Can cause property damage, personal injury or death. Wire fan power supply and ground motor frame in accordance with local electric codes.

⚠ DANGER

FAN MOTOR REQUIRES OVERLOAD PROTECTION

Failure to provide motor overload protection can result in fire, property damage, electric shock, personal injury or death. Connect motor to an overload protective device rated in compliance with local electric codes.

⚠ WARNING

DO NOT OVERHEAT FAN MOTOR

High air temperatures the fan section can cause the fan motor to burnout. On draw-through air handlers or air handlers with the fan section down the air stream from the heating section, the discharge air temperature of the heating section must not exceed 104°F (40°C).

⚠ CAUTION

Cautions indicate potentially hazardous situations, which can result in personal injury or equipment damage if not avoided.

When performing startup and service, always take thorough safety precautions. Start-up functions must be performed by trained, experienced personnel.

Before Starting the Unit

Make sure that fan electrical power source is disconnected and locked in the OFF position before entering fan section.

1. With ductwork connected, check the unit for complete and proper install tion.
2. Check that all construction debris is removed and filters are clean.
3. Check that all electrical work is complete and properly terminated. Check that all electrical connections are tight and that the proper voltage is connected. Phase imbalance must not exceed 2%.
4. Ball bearings on fan shaft and motor are prelubricated and do not need grease before startup.
5. Check tightness of setscrews in bearings and fan wheel(s). If retightening is needed, make certain the fan wheel(s) are aligned properly or setscrews are torqued per Table 38 on page 51.
6. Check alignment of fan and motor sheaves and belt tension. Adjust if necessary. Check tightness of sheave setscrews and/or capscrews. See Figure 48 on page 47 and Figure 49 on page 48 and Figure 50 on page 49.
7. Leak test the thermal system to verify that connections are tight.
8. Check that condensate drain is trapped.
9. Rotate shaft by hand to be sure it is free.
10. Fan startup: Fan should start and run. Observe the rotation. If the fan is operating backward, reverse two legs of the three-phase supply power.

NOTE: Variable pitch fan drives are usually provided for operation in the mid-speed adjustment range. However, the drives usually ship with the adjustment opened for minimum fan speed. Adjust the drives for the proper airflow. Refer to Fan Drive Adjustments on page 47.

After first 48 hours of operation:

1. Disconnect and lockout electrical power source.
2. Check tightness of all bearing, wheel, and sheave setscrews (or capscrews). See Table 32.
3. Recheck belt tension and adjust if necessary. Belts tensioned sufficiently to slip one to two seconds at startup will perform satisfactorily, extending life and reducing vibration. If retensioning is necessary, be certain to retain sheave alignment.

Table 32: Bearing Collar and Wheel Hub Setscrew Torque

Setscrew Diameter, in	Minimum torque, ft/lbs (kg/M
1/4	5.5 (0.76)
1/16	10.5 (1.45)
3/8	19.0 (2.63)
7/16	29.0 (4.01)

Operating Limits

Do not exceed the operating limits in Table 33 and Table 34. A fan wheel that is operated beyond the rpm and temperature limits shown may suffer permanent distortion or fracture. The resulting unbalance may cause severe unit vibration.

Table 33: Forward Curved Fan Operating Limits

Forward curved—housed							
Dia., (in)	7–7	9–9	10–10	12–12	Twin 10"	Twin 12"	Twin 15"
Max. rpm	2680	2650	2100	1700	2100	1700	1500

Table 34: Backward Inclined Plenum Fan Operating Limits

Backward inclined —plenum						
Dia., (in)	9	10	11	12.5	14	16
Max. rpm	2680	2650	2100	1700	2100	1700
Dia., (in)	18	20	22	25	28	
Max. rpm	1500	2675	2310	2060	1840	

For units with direct drive plenum fans employing variable frequency drives, use the formula below to calculate the maximum allowable frequency associated with the maximum allowable fan speed.

$\mathbf{F_{max}}$ = 60 Hz × (W_{max} / W_{motor})

$\mathbf{F_{max}}$ – maximum frequency allowable for particular application (Hz)

$\mathbf{W_{max}}$ – maximum fan speed (rpm); refer to fan curves (Figure 32 through Figure 40)

$\mathbf{W_{motor}}$ – nominal motor speed (1800/3600 rpm); refer to motor nameplate

Fan Vibration Levels

Each unit as shipped is trim balanced to operate smoothly. To provide satisfactory operation after shipping and installation, use the accepted industry guidelines for field balancing fans. Vibration ≤ 0.20 in/sec.

NOTE: Excessive vibration from any cause contributes to premature fan and motor bearing failure. Monitor overall vibration levels every six months of operation. An increase in levels is an indication of potential trouble.

Vibration Causes

1. Wheel imbalance
   a. Dirt or debris on wheel blades
   b. Loose setscrews in wheel hub or bearing-to-shaft
   c. Wheel distorted from overspeed
2. Bent shaft
3. Drive faulty
   a. Variable pitch sheaves—Axial and radial runout of flanges, uneven groove spacing, out of balance. Also similar faults in driven sheave.
   b. Bad V-belts, lumpy or mismatched, belt tension too tight or too loose
4. Bad bearings, loose bearing hold-down bolts
5. Motor imbalance
6. Fan section not supported evenly on foundation

Periodic Service and Maintenance

1. Check all moving parts for wear every six months.
2. Check bearing collar, sheave, and wheel hub setscrews, sheave capscrews, and bearing hold-down bolts for tightness every six months.

Ball Bearing Lubrication

1. Motor bearings—All ball bearings are prelubricated and do not require additional grease during installation. However, periodic cleaning out and renewal of grease is necessary. Exercise extreme care when cleaning to prevent foreign matter from entering the bearing. It is also important to avoid over greasing. Only use a high grade, clean mineral grease with the following characteristics.
    a. Melting point preferably over 302°F (150°C).
    b. Does not separate by oil and soap under operating and storage conditions.
    c. Free of abrasive matter, acid, alkali, and moisture.
    d. Specific greasing instructions are located on a label attached to the fan section door.
2. Fan shaft bearings—All ball bearings are prelubricated and do not require additional grease during installation. Periodic greasing is necessary. Bearings are accessible in the fan section. A grease fitting is located on each side of the fan shaft. Do not over lubricate. Wipe off any excess grease to prevent overheating. The lubrication interval varies with the period of operation and temperature of the ambient air. Use the guidelines in the Table 36.

Table 35: Bearing Operating Temperature Range

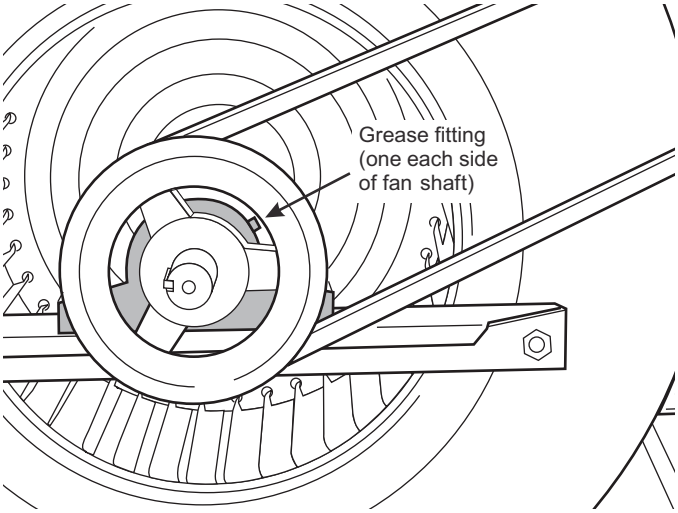
Operation	To 130°F (54°C)	To 150°F (66°C)	Over 150°F (66°C)
Continuous operation	6 months	4 months	2 months
12-hr/day operation	12 months	12 months	6 months

Table 36: Lubricants Recommended for Fan Shaft Ball Bearings

Manufacturer	Product name	Temperature range, °F (°C)
Texaco Lubricants Company	Premium RB	-30 to 300 (-34 to 149)
Keystone Ind. Lubricants	81EP-2	0 to 250 (-18 to 121)
Mobil Oil Corporation	Mobilith SCH100	-40 to 350 (-40 to 177)
Exxon Company, U.S.A.	Ronex MP	-40 to 300 (-40 to 149)
Shell Oil Company	Alvania No. 2	-20 to 240 (-29 to 116)

NOTE: Temperature ranges over 225°F are shown for lubricants only. High temperature applications are not suitable for standard air handler components.

Figure 47: Fan Shaft Bearing Grease Fitting



Fan Drive Adjustments

⚠ WARNING

ROTATING FAN can use severe injury or death. Before servicing fans, lockout and tag out power.

Do not open the hinged access door and access panels while the unit is operating. Moving parts and strong suction forces can cause severe personal injury or death.

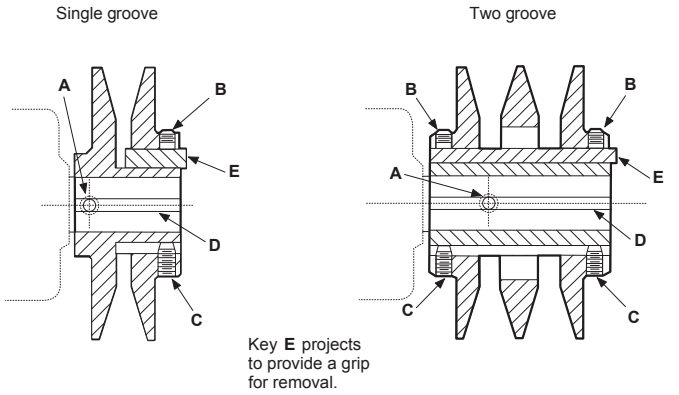
Before entering any fan section, make sure the electrical power source to the fan motor is disconnected, locked out and tagged out.

Upon completion of the air balance, replace the variable pitched motor sheave with a properly sized, fixed sheave. A matching fixed sheave provides longer belt and bearing life and vibration-free operation. Initially, it is best to have a variable pitched motor sheave for the purpose of air balancing. Once the balance is achieved, fixed sheaves maintain balancing and alignment more effectively. Replace the adjustable sheaves with fixed sheaves.

With the electrical power disconnected, locked and tagged out, measure the diameter of the V-belt outer surface where it passes around the sheave (pitch diameter). Calculate fan speed from the motor nameplate rpm.

$$\text{Fan rpm} = \text{Motor rpm} \times \frac{\text{Measured diameter at motor sheave}}{\text{Measured diameter at fan sheave}}$$

Figure 48: VP Type Sheave Adjustment



Note: Do not operate sheave with flange projecting beyond the hub end.

VM and VP Variable Pitch Key Type Sheaves

Mounting:

1. Mount all sheaves on the motor or driving shaft with the setscrews A toward the motor. See Figure 48.
2. Verify that both driving and driven sheaves are in alignment and that shafts are parallel.
3. Fit internal key D between sheave and shaft and lock setscrew A securely in place.

Adjusting:

1. Loosen setscrews B and C in moving parts of sheave and pull out external key E. (This key projects a small amount to provide a grip for removing.)
2. Adjust sheave pitch diameter for desired speed by opening moving parts by half or full turns from closed position.

   Do not open more than five full turns for A belts or six full turns for B belts.
3. Replace external key E and securely tighten setscrews B over key and setscrews C into keyway in fixed half of the sheave.
4. Put on belts and adjust belt tension. **Do not force belts over grooves.** See Fan Drive Belt Adjustment on page 50.
5. Make future adjustments by loosening the belt tension and increasing or decreasing the pitch diameter of the sheave by half or full turns as required. Readjust belt tension before starting drive.
6. Adjust both halves of two-groove sheaves the same number of turns from closed position to provide the same pitch diameter.
7. Verify that all keys are in place and that all setscrews are tight before starting drive. Check setscrews and belt tension after 24 hours service.

LVP Variable Speed Sheaves

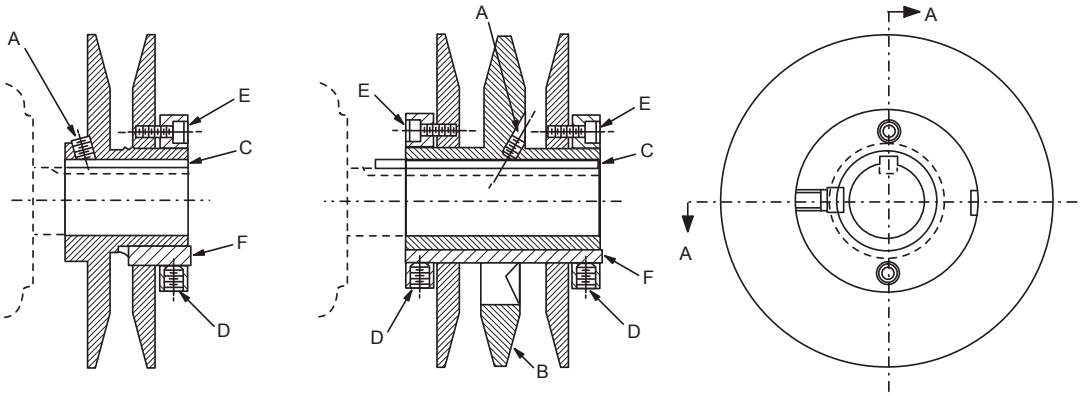
Mounting:

1. Slide sheave on motor shaft so that the side of the sheave with setscrew A is next to the motor, when setscrew A is in the hub or barrel of the sheave. See Figure 50.
2. When setscrew A is at an angle in the center flange B, mount it away from the motor so the outer locking ring and flange can be removed to get to the setscrew.
3. 3 To remove the flange and locking ring:
   a. Loosen setscrews D.
   b. Loosen but do not remove capscrews E.
   c. Remove key F. (This key projects a small amount to provide a grip for removing.)
   d. Rotate the flange counterclockwise until it disengages the threads on the sheave barrel.
4. Verify that the driving and driven sheaves are in alignment and the shafts are parallel. When aligning two-groove sheaves, allow room between the sheave and motor to get to capscrews E.
5. Insert key C between the sheave and the shaft and tighten setscrew A securely.
6. If flange and locking ring have been removed, when replacing them make sure that the inner and outer flanges are open from the closed position by the same amount as the other flange. Determine this by accurately measuring the top width of the grooves.
7. Insert key F.
8. Tighten setscrews D and capscrews E.
9. Put on belts and adjust belt tension. Do not force belts over grooves. See Fan Drive Belt Adjustment on page 50.
10. Be sure that all keys are in place and all setscrews and all capscrews are tight before starting the drive. Check and retighten all screws and retension belts after approximately 24 hours of service.

Adjusting:

1. Slack off belt tension if belts have been installed.
2. Loosen setscrews D.
3. Loosen but do not remove capscrews E.
4. Remove key F. (This key projects out a small amount to provide a grip for removing.)
5. Adjust pitch diameter by opening or closing the movable flanges by half or full turns. (Two-groove sheaves are supplied with both grooves set at the same pitch diameter.) Move both movable flanges the same number of turns to provide the same pitch diameter for satisfactory operation. Do not open sheaves more than five turns for A belts or six turns for B belts.
6. Replace key F.
7. Tighten setscrews D and capscrews E. 9 Verify that all keys are in place and all setscrews and all
8. If belts have been installed, readjust belt tension. If belts have not been installed, install them and adjust belt tension. **Do not force belts over grooves.** See Fan Drive capscrews are tight before starting the drive. Check and retighten all screws and retension belts after approximately 24 hours of operation, Figure 52 on page 50.

Figure 49: LVP Type Sheave Adjustment



Section A-A Section A-A

MVP Variable Speed Sheaves

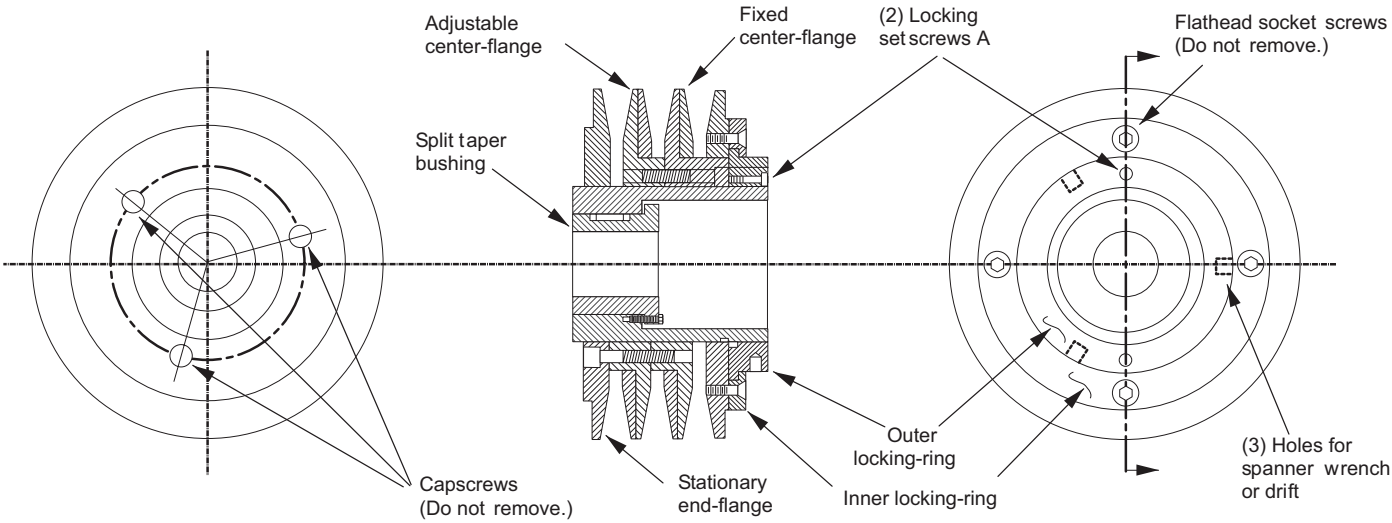
Mounting:

1. Verify that both driving and driven sheaves are in alignment and the shafts are parallel. The centerline of the driving sheave must be in line with the centerline of the driven sheave. See Figure 50.
2. Before starting drive, verify that all setscrews are torqued to the values shown in Table 38 on page 51. Check setscrew torque and belt tension after 24 hours of service.

Adjusting:

1. Adjust motor base forward to release belt tension. For easier adjustment, remove the belts.
2. Loosen, but do not remove both of the locking setscrews A in the outer locking ring by using a hex key or torque wrench with a hex bit.
3. Adjust sheave to desired pitch diameter by turning the outer locking ring. Use a spanner wrench or drift inserted into the three holes that are located 120° apart on the ring.
4. Any pitch diameter can be obtained within the sheave range. One complete turn of the outer locking ring changes the pitch diameter 0.233".
5. Do not open sheaves more than the following amounts:
   - Do not open B sheaves more than 4, 3/4 turns for the A belts or 6 turns for the B belts.
   - Do not open C sheaves more than 9 1/2 turns.
   - Do not open 5V sheaves more than 6 turns.
   - Do not open 8V sheaves more than 8 turns.
6. Before operating the drive, tighten BOTH locking screws A in the outer locking ring. Use a torque wrench and tighten to the value shown in Table 38 on page 51.
7. Replace belts and adjust the motor base to tension the belts properly. See Fan Drive Belt Adjustment on page 50.
8. Do not loosen any screws other than the two locking screws A in the outer locking ring when adjusting the sheave pitch. Do not operate the drive until the locking screws are set to the torque specifications.

Figure 50: MVP Type Sheave Adjustment



Fan Drive Belt Adjustment

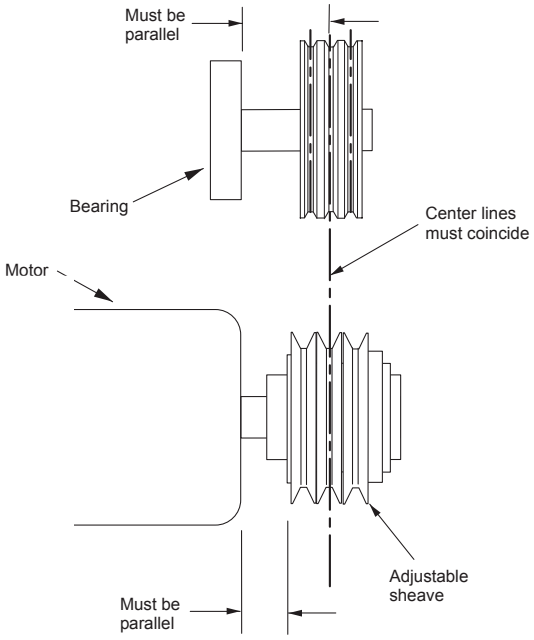
⚠ WARNING

Moving belt and fan can cause severe personal injury or death.

During installation and filter maintenance:

- Lock and tag out fans to prevent accidental start up.
- Do not enter the filter compartment until the fan is completely stopped.
- Use approved equipment for reaching filters located above normal reach. Do not step on filter frames or unit components.
- Floor surfaces must be dry and free of oil or grease.

Figure 51: Sheave/Belt Alignment



General Rules of Tensioning

1. The ideal tension is the lowest tension at which the belt does not slip under peak load conditions.
2. Check tension frequently during the first 24 to 48 hours of operation.
3. Over tensioning shortens belt and bearing life.
4. Keep belts free from foreign material, which may cause slippage.
5. Make V-drive inspection on a periodic basis. Adjust tension if the belt is slipping. Do not apply belt dressing. This may damage the belt and cause early failure.

Tension Measurement Procedure

1. Measure the belt span. See Figure 52.
2. Place belt tension checker squarely on one belt at the center of the belt span. Apply force to the checker, perpendicular to the belt span, until the belt deflection equals belt span distance divided by 64. Determine force applied while in this position.
3. Compare this force to the values in Table 38.
4. Adjust to the minimum value. If the belts slip, add tension.

Figure 52: Drive Belt Adjustment

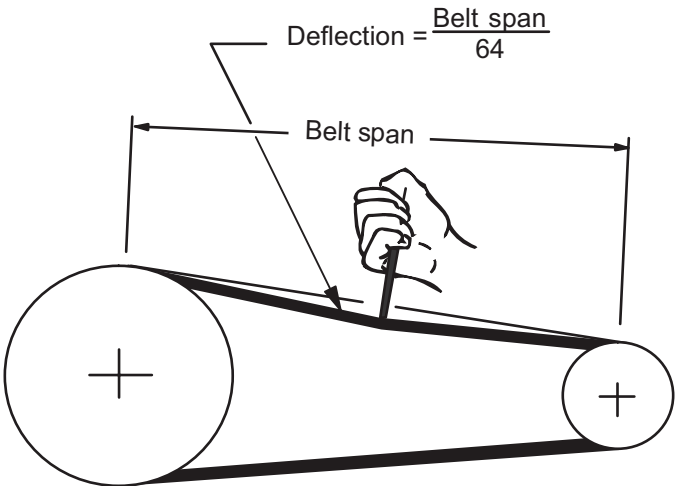


Table 37: Screw Torque Values

Nominal screw size, (dia-thds/in)	Socket head cap screws		Flat head socket screws	Hollow head setscrews only			
				Lengths equal or greater than diameter		For lengths (L) less than diameter	
	Seating torque		Seating torque	Seating torque		Length (L)	Seating torque
	(in-lbs)	(ft-lbs)	(in-lbs)	(in-lbs)	(ft-lbs)	(in)	(in-lbs)
1/4-20NC	150	12.5	100	87	7.3	3/16	50
5/16-11NC	305	25.4	200	165	13.8	1/4	90
3/8-16NC	545	45.4	350	290	24.2	1/4, 5/16	150, 250
1/2-13NC	1300	108.3	N/A	620	51.7	N/A	N/A
5/8-11NC	N/A	N/A	N/A	1225	102.1	N/A	N/A

Table 38: Belt Deflection Force

Cross section	Sheave diameter (inches)		Deflection force (lbs)/belt deflection force			
	Smallest sheave diameter range	RPM range	Cross section A, B, 5V		Cross section AX, BX, 5VX	
			Min	Max	Min	Max
A, AX	3.0 to 3.6	1000 to 2500	2.8	5.5	3.0	6.1
		2501 to 4000	2.1	4.2	2.5	5.0
	3.8 to 4.8	1000 to 2500	3.4	6.8	3.7	7.4
		2501 to 4000	2.4	5.7	3.2	6.4
	5.0 to 7.0	1000 to 2500	4.0	8.0	4.7	9.4
		2501 to 4000	3.5	7.0	3.8	7.6
B, BX	3.4 to 4.2	850 to 2500	—	—	3.6	7.2
		2501 to 4000	—	—	3.1	6.2
	4.4 to 5.6	860 to 2500	4.0	7.9	5.2	10.5
		2501 to 4000	3.3	6.7	4.5	9.1
	5.8 to 8.6	860 to 2500	4.7	9.4	6.3	12.6
		2501 to 4000	4.5	8.9	5.4	10.9
5V, 5VX	4.4 to 6.7	500 to 1749	—	—	7.6	15.2
		1750 to 3000	—	—	6.6	13.2
		3001 to 4000	—	—	4.2	8.5
	7.1 to 10.9	500 to 1740	9.5	18.9	11.0	22.1
		1741 to 3000	8.3	16.7	10.0	20.1
	11.8 to 16.0	500 to 1740	11.7	23.4	12.7	25.5
		1741 to 3000	10.5	21.8	12.5	25.0

Coil Maintenance

⚠ WARNING

SHARP EDGES AND COIL SURFACES are a potential injury hazard. Avoid contact with them.

⚠ NOTICE

Clean drain pan regularly so mold does not develop.

1. For maximum performance, the coil must be clean.

   Check once a year under normal operating conditions and brush or vacuum clean if necessary. Use a chemical coil cleaner on multiple row coils. Read and follow the chemical cleaner instructions since some cleaners may contain harsh chemicals. Take care not to damage fins while cleaning.
2. Drain pans in any air conditioning unit may have some moisture. Algae and other organisms can grow due to airborne spores and bacteria. Clean periodically to prevent build-up from plugging the drain and causing the drain pan to overflow. Keep drain pans clean to prevent the spread of disease. Cleaning should be performed by qualified personnel
3. Dirt and lint can clog the condensate drain, especially with dirty filters. Inspect twice a year to help avoid overflow.

Component Removal and Replacement

Panel Removal

Remove the screws located along the sides of the panel. Pull the panel out using the pocket pull handles. If the panel does not have a pull handle, remove the adjacent panel with a pocket pull or door and pop out the panel from the inside.

Fan Section Removal

The fan shaft, motor and any drive components are removable through the access door or panel opening.

If fan replacement is required, the entire fan assembly can be pulled out the side of the cabinet. The fan assembly includes the fan housing, the bearing support and the fan base.

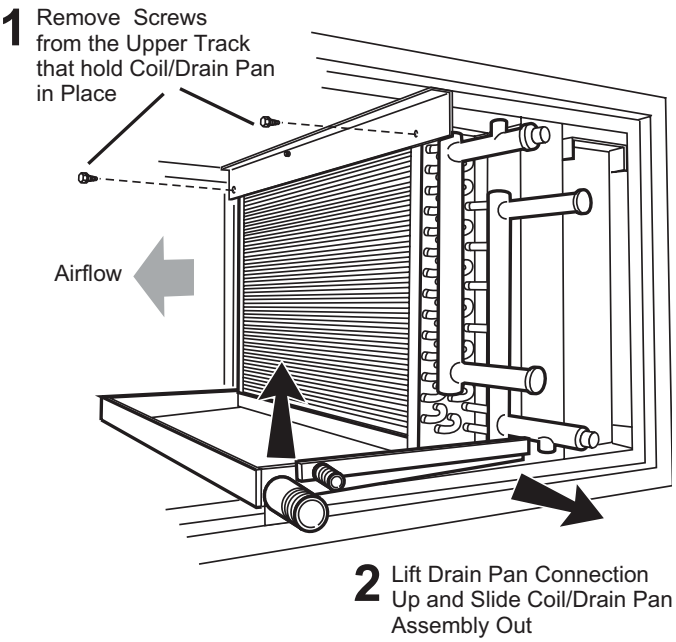
1. To remove the fan assembly, remove the side panels (follow instructions for side panel removal).
2. Disconnect the neoprene bulkhead seal that is attached to the fan discharge. Then disconnect the fan sled from each of the corner mounts and pull the entire assembly out the side of the unit.
3. Loosen the fan bearings and pull out the shaft. Disconnect the fan housing from the fan sled and bearing support by removing the attaching bolts.
4. Replace the new fan, reconnect the shaft and bearings and put the fan assembly in the cabinet. Replace panels and fasteners.

Coil Removal and Replacement

Before removing the coil, disconnect all piping.

1. Remove exterior panels from both sides of the coil section. Remove screws that secure the top of the leaving coil face to the upper track on the inside top of the unit.
2. Lift drain pan condensate connection above the unit frame flange and slide drain pan, coil(s), and baffles out of unit.
3. Slide the coil, blockoffs, and drain pan assembly back into unit the same way it was removed. Check the installation for an airtight fit.
4. Reinstall screws that secure the top of the leaving coil face to the upper track on the inside top of the unit.

Figure 53: Coil Removal



Warranty Details

Consult your local Daikin representative for warranty details. To find your local Daikin representative, go to www.DaikinApplied.com.

Warranty Return Material Procedure

Defective material may not be returned without permission of authorized factory service personnel of Daikin Applied in Minneapolis, Minnesota, (763) 553-5330. A “Return Goods” tag must be included with the returned material. Enter the required information to expedite handling and prompt issuance of credits. All parts must be returned to the appropriate Daikin facility, designated on the “Return Goods” tag. Transportation charges must be prepaid.

The return of the part does not constitute an order for replacement. Therefore, a purchase order must be entered through the nearest Daikin representative. The order should include part number, model number, and serial number of the unit involved.

Credit will be issued on customer’s purchase order following an inspection of the return part and upon determination that the failure is due to faulty material or workmanship during the warranty period.

Replacement Parts

When writing to Daikin Applied for service or replacement parts, refer to the model number and serial number of the unit stamped on the serial plate attached to the unit. If replacement parts are required, mention the date of installation of the unit and date of failure, along with an explanation of the malfunctions and a description of the replacement parts required.

Air Handling
Equipment Warranty Registration Form

To comply with the terms of Daikin Applied Warranty, complete and return this form within 10 days to the Warranty Department of Daikin Applied.

Check, test, and start procedure for air handling units with or without heat recovery and roof mounted air handlers.

GENERAL INFORMATION

Job Name: _____ **GOI No.:** _____

Installation address: _____

City: _____ **State:** _____

Purchasing contractor: _____

City: _____ **State:** _____

Name of person doing start-up: _____

Company name: _____

Address: _____

City/State/Zip: _____

UNIT INFORMATION

Unit model number: _____ **Unit serial number:** _____

SF VFD model number: _____ **Serial number:** _____

RF VFD model number: _____ **Serial number:** _____

13F-4153 (03/15)

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DAIKIN

AHU Equipment Warranty Registration Form (continued)

Select Yes or No. If not applicable to the type of unit, select N/A.

I. INITIAL CHECK

A. Is any shipping damage visible? . . . . . Yes No N/A

B. Are fan drives properly aligned and belts properly adjusted? . . . . . Yes No N/A

C. Tightened all setscrews on pulleys, bearings and fans? . . . . . Yes No N/A

D. Have the hold-down bolts been backed off on spring mounted fan isolators? . . . . . Yes No N/A

E. With the power off, do fans turn freely by hand? . . . . . Yes No N/A

F. Electrical service corresponds to unit nameplate? . . . . . Yes No N/A

Volts _____ Hertz _____ Phase _____

G. Is the main disconnect adequately fused and are fuses installed? . . . . . Yes No N/A

H. Are all electrical power connections tight? (Check compressor, electrical box.) . . . . . Yes No N/A

I. Is the condensate drain trapped? . . . . . Yes No N/A

J. Fill the drain pan. Does water drain freely? . . . . . Yes No N/A

K. Is the unit mounted level? . . . . . Yes No N/A

II. FAN DATA

A. Check rotation of supply fan? . . . . . Yes No N/A

B. Voltage at supply fan motor: . . . . . 1–2_____ V 2–3 _____ V 1–3 _____ V

C. Supply fan motor amp draw per phase: . . . . . L1 _____ L2 _____ L3 _____

D. Overload amp setting: . . . . . _____

E. What is the supply fan rpm? . . . . . _____

F. Check rotation of return fan? . . . . . Yes No N/A

G. Voltage at return fan motor: . . . . . 1–2_____ V 2–3 _____ V 1–3 _____ V

H. Return fan motor amp draw per phase: . . . . . L1 _____ L2 _____ L3 _____

I. Overload amp setting: . . . . . _____

J. What is the return fan rpm? . . . . . _____

K. Record supply static pressure at unit in inches of H_20: . . . . . _____

L. Record return static pressure at unit (with outside air dampers closed) in inches of H_20: . . . . . _____

III. DAMPERS

A. Are blades and seals present? . . . . . Yes No N/A

B. Do damper open smoothly and shut tight? . . . . . Yes No N/A

DAIKIN

AHU Equipment Warranty Registration Form (continued)

Select Yes or No. If not applicable to the type of unit, select N/A.

IV. ELECTRIC HEAT

A. Electrical heat service corresponds to unit nameplate? . . . . . Yes No N/A

Volts _____ Hertz _____ Phase _____

B. Are there any signs of physical damage to the electric heat coils? . . . . . Yes No N/A

C. Have all electrical terminals been tightened? . . . . . Yes No N/A

D. Does sequence controller stage contactors properly? . . . . . Yes No N/A

E. Electric heater voltage across each phase: . . . . . _____ L1 _____ L2 _____ L3

F. Amp draw across each phase at each heating stage:

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Phase L1:	_____	_____	_____	_____	_____	_____
Phase L2:	_____	_____	_____	_____	_____	_____
Phase L3	_____	_____	_____	_____	_____	_____

G. FLA: L1 _____ L2_____ L3 _____

H. Operate electric heat with fans off. Electric heat must cycle on high limit control . . . . . Yes No N/A

V. CHILLED WATER COIL

A. Pressure test OK? . . . . . Yes No N/A

B. Drain pan draining OK? . . . . . Yes No N/A

VI. HOT WATER COIL

A. Pressure test OK? . . . . . Yes No N/A

VII. HEAT RECOVERY

A. Heat wheel rotates freely? . . . . . Yes No N/A

B. Heat wheel VFD operates properly? . . . . . Yes No N/A

C. Heat wheel VFD: . . . . . .Model # _____ Serial # _____

D. Check for air bypass around heat wheel. . . . . Yes No N/A

DAIKIN

AHU Equipment Warranty Registration Form (continued)

Select Yes or No. If not applicable to the type of unit, select N/A.

VIII. Design Flow calibration

A. Verify power is supplied to the MicroTech III unit controller . . . . . Yes No N/A

B. Verify that the shipping screws have been removed from the measuring station vane . . . . . Yes No N/A

C. Examine station for damage . . . . . Yes No N/A

D. Record Level Position after calibration

- LH Level Position . . . . . _____
- RH Level Position . . . . . _____

NOTE: This is viewed in the MicroTech III controller, in the Min OA setup menu.

IX. GAS BURNER CHECK, TEST, & START

Specifications:
For gas, see Forced Draft Gas Burner Installation and Maintenance Bulletin. (IM 684 and IM 685)

A. Gas Furnace:. . . . . Model no. _____

B. Gas Burner: . . . . . .Model no._____ Serial no. _____

C. Gas Type firing: . . . . . .Single Stage _____ Modulation _____

D. Gas Rated firing rate (MBH input): . . . . . ._____

E. Gas Altitude (ft. above sea level): . . . . . ._____

F. Is there a circulating tank? . . . . . Yes No N/A

G. Input (CFH): . . . . . _____

H. Gas pressure at burner (inches w.c.): . . . . . _____

I. CO_2 (%) . . . . . _____

J. CO_2 (%): . . . . . _____

K. Pilot flame only in microamps (steady at low fire): . . . . . _____

L. Pilot Tap-gas pressure (inches w.c.): . . . . . _____

M. Motor only/burner FLA running amps: . . . . . _____

N. High limit control OK? . . . . . Yes No N/A

O. Flame safeguard (microamps): . . . . . _____

P. Flame failure shutoff (seconds): . . . . . _____

DAIKIN

AHU Equipment Warranty Registration Form (continued)

Select Yes or No. If not applicable to the type of unit, select N/A.

Q. Airswitch OK?	Yes	No	N/A
R. High Gas Pressure Switch OK?	Yes	No	N/A
S. Low Gas Pressure Switch OK?	Yes	No	N/A
T. Main Gas Valve Close-off OK?.	Yes	No	N/A

Thank you for completing this form. Please sign and date below.

Signature _____ **Startup date:** _____

Return completed form by mail to:

Daikin Warranty Department, 13600 Industrial Park Boulevard, Minneapolis, MN 55441

or by email to: AAH.Wty_WAR_forms@daikinapplied.com

Please fill out the Daikin Applied "Quality Assurance Survey Report" and list any additional comments that could affect the operation of this unit; e.g., shipping damage, failed components, adverse installation applications, etc. If additional comment space is needed, write the comment(s) on a separate sheet, attach it to the Survey Report and return it to the Warranty Department of Daikin Applied with the completed Equipment Warranty Registration form.

DAIKIN

Quality Assurance Survey Report

To whom it may concern:
Please review the items below upon receiving and installing our product. Select N/A on any item that does not apply to the product.

Job Name: _____ **Daikin Applied G.O. No.** _____

Installation address: _____

City: _____ State: _____

Purchasing contractor: _____

City: _____ State: _____

Name of person doing start-up (print): _____

Company name: _____

Address: _____

City/State/Zip: _____

Unit model number: _____ **Unit serial number:** _____

1. Is there any shipping damage visible? . . . . . Yes No N/A
   Location on unit _____
2. How would you rate the overall appearance of the product; i.e., paint, fin damage, etc.?
   Excellent Good Fair Poor
3. Did all sections of the unit fit together properly? . . . . . Yes No N/A
4. Did the cabinet have any air leakage? . . . . . Yes No N/A
   Location on unit _____
5. Were there any refrigerant leaks? . . . . . Yes No N/A
   From where did it occur? . . . . . Shipping Workmanship Design
6. Does the refrigerant piping have excessive vibration? . . . . . Yes No N/A
   Location on unit _____
7. Did all of the electrical controls function at start-up? . . . . . Yes No N/A
   Comments _____
8. Did the labeling and schematics provide adequate information? . . . . . Yes No N/A
9. How would you rate the serviceability of the product?
   Excellent Good Fair Poor
10. How would you rate the overall quality of the product?
    Excellent Good Fair Poor
11. How does the quality of Daikin Applied products rank in relation to competitive products?
    Excellent Good Fair Poor

    Comments _____

Please list any additional comments which could affect the operation of this unit; i.e., shipping damage, failed components, adverse installation applications, etc. If additional comment space is needed, write the comment(s) on a separate sheet, attach the sheet to this completed Quality Assurance Survey Report, and return it to the Warranty Department with the completed preceding "Equipment Warranty Registration Form".

13-4160 (05/14)
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People and ideas you can trust.™

Daikin Applied Training and Development

Now that you have made an investment in modern, efficient Daikin equipment, its care should be a high priority. For training information on all Daikin HVAC products, please visit us at www.DaikinApplied.com and click on Training, or call 540-248-9646 and ask for the Training Department.

Warranty

All Daikin equipment is sold pursuant to its standard terms and conditions of sale, including Limited Product Warranty. Consult your local Daikin Applied representative for warranty details. To find your local Daikin Applied representative, go to www.DaikinApplied.com.

Aftermarket Services

To find your local parts office, visit www.DaikinApplied.com or call 800-37PARTS (800-377-2787). To find your local service office, visit www.DaikinApplied.com or call 800-432-1342.

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ACH550

Installation, Operation and Maintenance Manual (I, O & M)
ACH550-UH HVAC Drives (1...550 HP)
ACH550-BCR/BDR/VCR/VDR E-Clipse Bypass Drives (1...400 HP)
ACH550-PCR/PDR Packaged Drives with Disconnect (1...550 HP)



Safety

Use of warnings and notes

There are two types of safety instructions throughout this manual:

- Notes draw attention to a particular condition or fact, or give information on a subject.
- Warnings caution you about conditions which can result in serious injury or death and/or damage to the equipment. They also tell you how to avoid the danger. The warning symbols are used as follows:



Electricity warning warns of hazards from electricity which can cause physical injury and/or damage to the equipment.

- **WARNING!** The ACH550 adjustable speed AC drive should ONLY be installed by a qualified electrician.
- **WARNING!** Even when the motor is stopped, dangerous voltage is present at the power circuit terminals U1, V1, W1 (L1, L2, L3) and U2, V2, W2 (T1, T2 T3) and, depending on the frame size, UDC+ and UDC-, or BRK+ and BRK-.
- **WARNING!** Dangerous voltage is present when input power is connected. After disconnecting the supply, wait at least 5 minutes (to let the intermediate circuit capacitors discharge) before removing the cover.
- **WARNING!** Even when power is switched off from the input terminals of the ACH550, there may be dangerous voltage (from external sources) on the terminals of the relay outputs.
- **WARNING!** When the control terminals of two or more drives are connected in parallel, the auxiliary voltage for these control connections must be taken from a single source which can either be one of the drives or an external supply.
- **WARNING!** Disconnect the internal EMC filter when installing the drive on an IT system (an ungrounded power system or a high-resistance-grounded [over 30 ohm] power system).
- **WARNING!** Do not attempt to install or remove EM1, EM3, F1 or F2 screws while power is applied to the drive's input terminals.



General warning warns about conditions, other than those caused by electricity, which can result in physical injury and/or damage to the equipment.

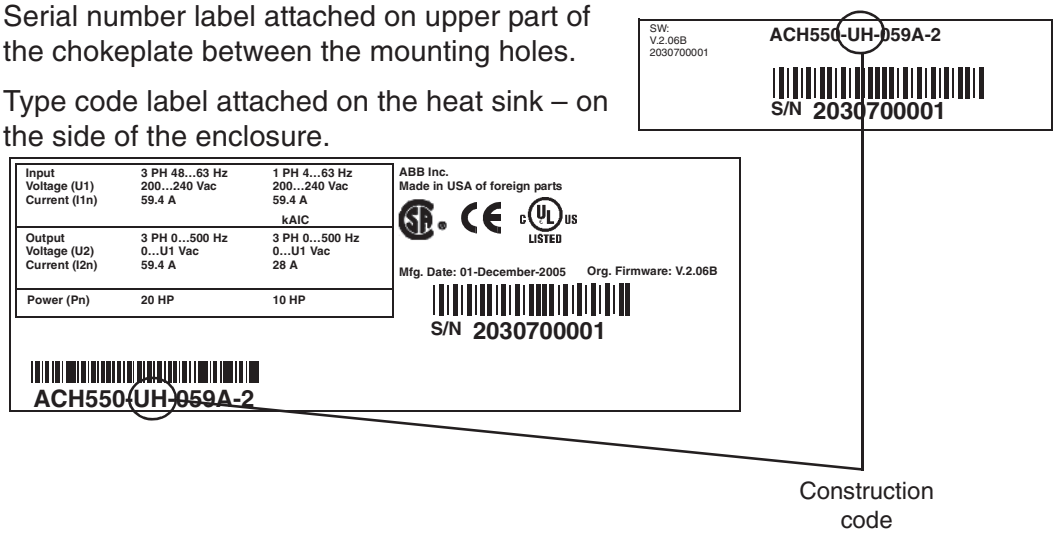
- **WARNING!** Do not control the motor with the disconnecting device (disconnecting means); instead, use the control panel keys or commands via the I/O board of the drive. The maximum allowed number of charging cycles of the DC capacitors (i.e. power-ups by applying power) is five in ten minutes.
- **WARNING!** Never attempt to repair a malfunctioning ACH550; contact the factory or your local Authorized Service Center for repair or replacement.
- **WARNING!** The ACH550 will start up automatically after an input voltage interruption if the external run command is on.
- **WARNING!** The heat sink may reach a high temperature.

Note: For more technical information, contact the factory or your local ABB representative.

Contents

This manual is the Operation and Maintenance Manual for the ACH550 Drives. Complete technical details and programming information are available in the *ACH550 User's Manual*, publication number 3AUA0000081823.

1. To determine the type of your drive, refer to its construction code on either:
   - Serial number label attached on upper part of the chokeplate between the mounting holes.
   - Type code label attached on the heat sink – on the side of the enclosure.



2. According to the construction code, proceed to your drive's installation, operation, diagnostics and maintenance information:
   - UH – Below.
   - VCR, VDR, BCR, BDR (E-Clipse Bypass) – page *39*.
   - PCR, PDR (Packaged Drives with Disconnect) – page *77*.

ACH550-UH

Installation

Study these installation instructions carefully before proceeding. **Failure to observe the warnings and instructions may cause a malfunction or personal hazard.**

WARNING! Before you begin read *Safety* on page *2*.

1. Prepare for installation

Lifting R1…R6

Lift the drive only by the metal chassis.

Lifting R7…R8



WARNING! Handle and ship floor mounted enclosures only in the upright position. These units are not designed to be laid on their backs.

1. Use a pallet truck to move the transport package/enclosure to the installation site.
2. Remove the cabinet side panels for access to the cabinet/pallet mounting bolts. (6 torx screws hold each cabinet side panel in place. Leave the side panels off until later.)
3. Remove the 4 bolts that secure the cabinet to the shipping pallet.



WARNING! Use the lifting lugs/bars at the top of the unit to lift R7/R8 drives.

4. Use a hoist to lift the drive. (Do not place drive in final position until mounting site is prepared.)

Unpack the drive

1. Unpack the drive.
2. Check for any damage and notify the shipper immediately if damaged components are found.
3. Check the contents against the order and the shipping label to verify that all parts have been received.

Tools required

To install the ACH550 you need the following:

- Screwdrivers (as appropriate for the mounting hardware used)
- Wire stripper
- Tape measure
- Drill
- Frame sizes R5…R8 with UL type 12 enclosure: Punch for conduit mounting holes
- Frame sizes R7/R8: pallet truck and hoist
- For installations involving frame size R6…R8: The appropriate crimping tool for power cable lugs.

- Mounting hardware: screws or nuts and bolts, four each. The type of hardware depends on the mounting surface and the frame size:

Frame Size	Mounting Hardware		Note
R1…R4	M5	#10	
R5	M6	1/4 in	
R6	M8	5/16 in	
R7…R8	M10	7/16	Secures free standing cabinets if required.

- For installations involving frame size R7…R8: Hoist.

WARNING! Before installing the ACH550, ensure the input power supply to the drive is off.

WARNING! Metal shavings or debris in the enclosure can damage electrical equipment and create a hazardous condition. Where parts, such as conduit plates require cutting or drilling, first remove the part. If that is not practical, cover nearby electrical components to protect them from all shavings or debris.

Flange Mounting Instructions

Frame size	IP21 / UL type 1		IP54 / UL type 12	
	Kit	Code (English)	Kit	Code (English)
R1	FMK-A-R1	100000982	FMK-B-R1	100000990
R2	FMK-A-R2	100000984	FMK-B-R2	100000992
R3	FMK-A-R3	100000986	FMK-B-R3	100000994
R4	FMK-A-R4	100000988	FMK-B-R4	100000996
R5	AC8-FLNGMT-R5	ACS800-PNTG01U-EN	-	-
R6	AC8-FLNGMT-R6		-	-

2. Prepare the mounting location

1. Mark the position of the mounting holes.

Note: Frame sizes R3 and R4 have four holes along the top. Use only two. If possible, use the two outside holes (to allow room to remove the fan for maintenance).

Note: ACH400 drives can be replaced using the original mounting holes. For R1 and R2 frame sizes, the mounting holes are identical. For R3 and R4 frame sizes, the inside mounting holes on the top of ACH550 drives match ACH400 mounts.

Note: Frame sizes R7 and R8 have mounting holes inside the enclosure base.

Where it is not possible to use either mounting hole at the back of the base, use an L-bracket at the top of the enclosure to secure the cabinet to a wall or to the back of another enclosure. Bolt the L-bracket to the enclosure using the lifting lug bolt hole on the top of the enclosure.

2. Drill holes of appropriate size in the mounting location.

3. Remove front cover

R1…R6, *UL type 1*

1. Remove the control panel, if attached.
2. Loosen the captive screw at the top.
3. Pull near the top to remove the cover.

R1…R6, *UL type 12*

1. If hood is present: Remove screws (2) holding the hood in place.
2. If hood is present: Slide hood up and off of the cover.
3. Loosen the captive screws around the edge of the cover.
4. Remove the cover.

R7…R8, *Cabinet Door*

1. To open the cabinet door, loosen the quarter-turn screws that hold the cabinet door closed.

R7…R8, *Side Panels*

The side panels were removed to take the cabinet off the pallet. Installation access is easier if these panels are kept off throughout the installation.

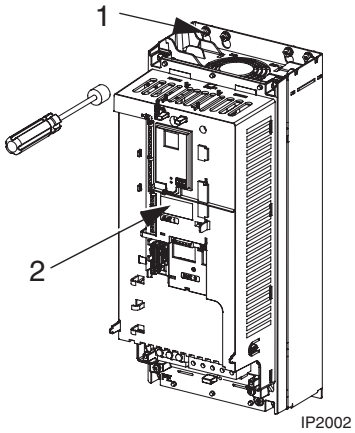
4. Mount the drive

R1…R6, *UL type 1*

1. Position the ACH550 onto the mounting screws or bolts and securely tighten in all four corners.

Note: Use mounting hardware that permits fan replacement without removal.

Note: Lift the ACH550 by its metal chassis.



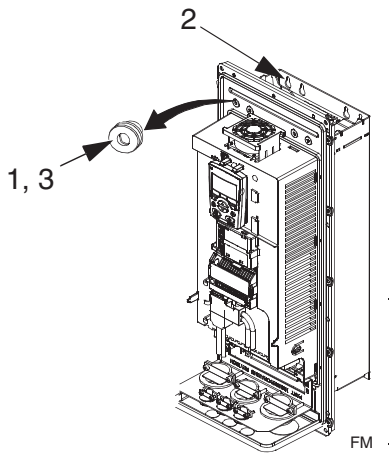
IP2002

2. Non-English speaking locations: Add a warning sticker in the appropriate language over the existing warning on the top of the module.

***R1…R6,** UL type 12*

For the UL type 12 enclosures, rubber plugs are required in the holes provided for access to the drive mounting slots.

1. As required for access, remove the rubber plugs. Push plugs out from the back of the drive.
2. R5 & R6: Align the sheet metal hood (not shown) in front of the drive's top mounting holes. (Attach as part of next step.)
3. Position the ACH550 onto the mounting screws or bolts and securely tighten in all four corners.



Note: Lift the ACH550 by its metal chassis (frame size R6 by the lifting holes on both sides at the top).

4. Re-install the rubber plugs.
5. Non-English speaking locations: Add a warning sticker in the appropriate language over the existing warning on the top of the module.

R7…R8

1. Use a hoist to move the cabinet into position.

Note: If the cabinet location does not provide access to the cabinet sides, be sure to re-mount side panels before positioning cabinet.

2. Install and tighten mounting bolts.

5. Install wiring



WARNING! Ensure the motor is compatible for use with the ACH550. The ACH550 must be installed by a competent person. If in doubt, contact your local ABB sales or service office.

Conduit kit

Wiring R1…R6 drives with the UL type 1 Enclosure requires a conduit kit with the following items:

- conduit box
- screws
- cover

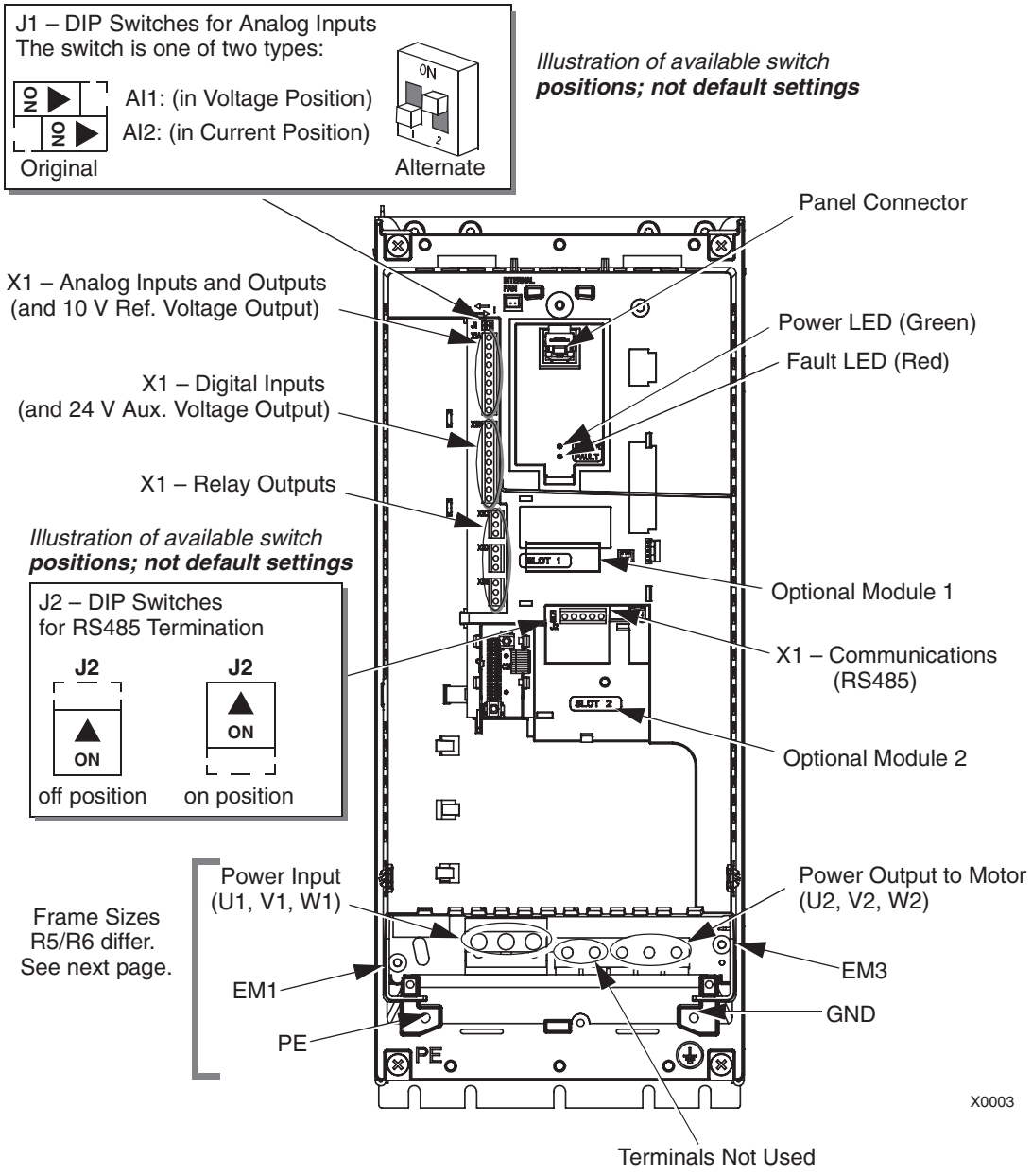
The kit is included with UL type 1 Enclosures.

Connection diagrams

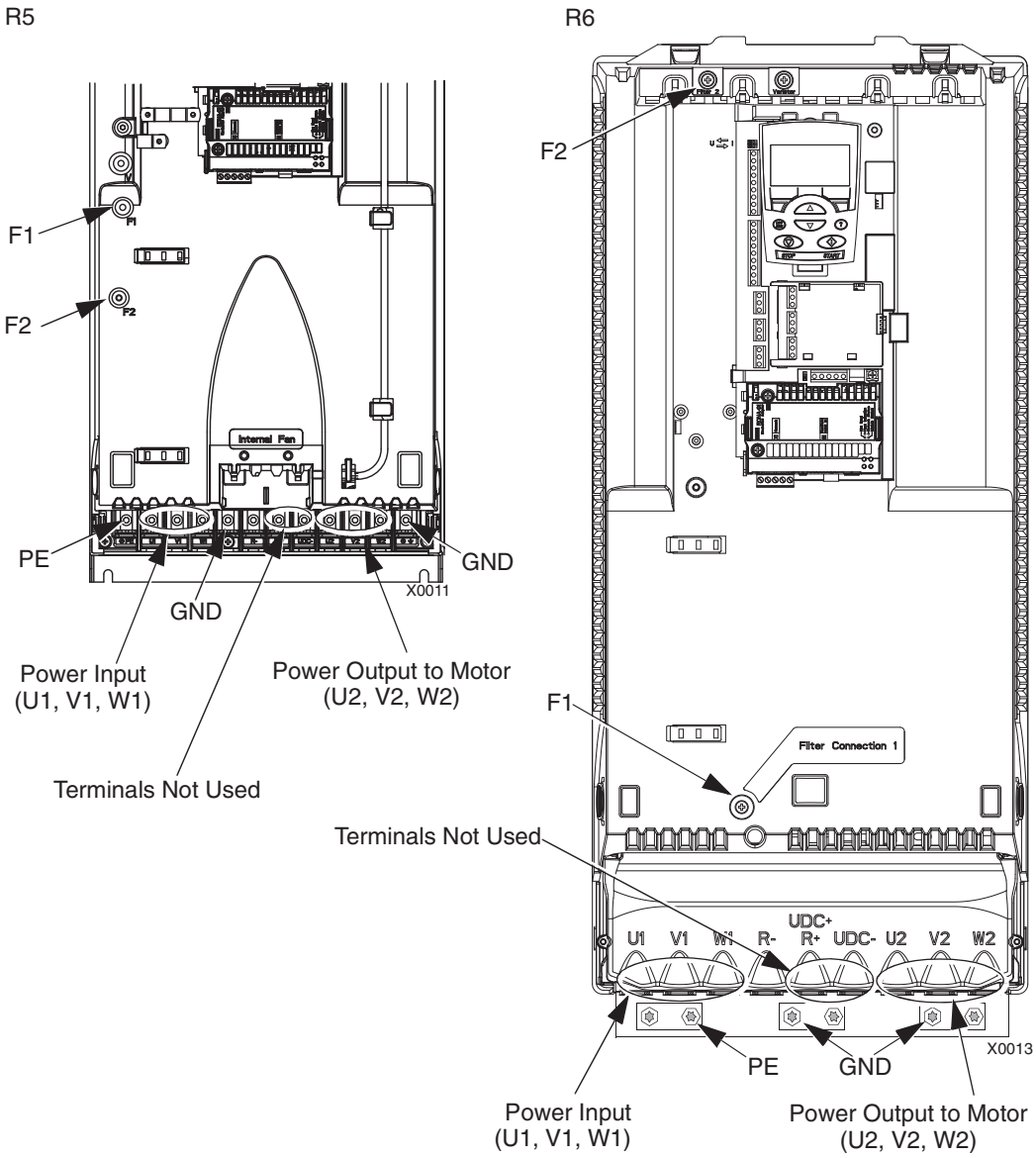
The following diagrams show:

- The terminal layout for frame size R3, which, in general, applies to frame sizes R1...R6, except for the R5/R6 power and ground terminals.
- The R5/R6 power and ground terminals.
- The terminal layout for R7/R8.

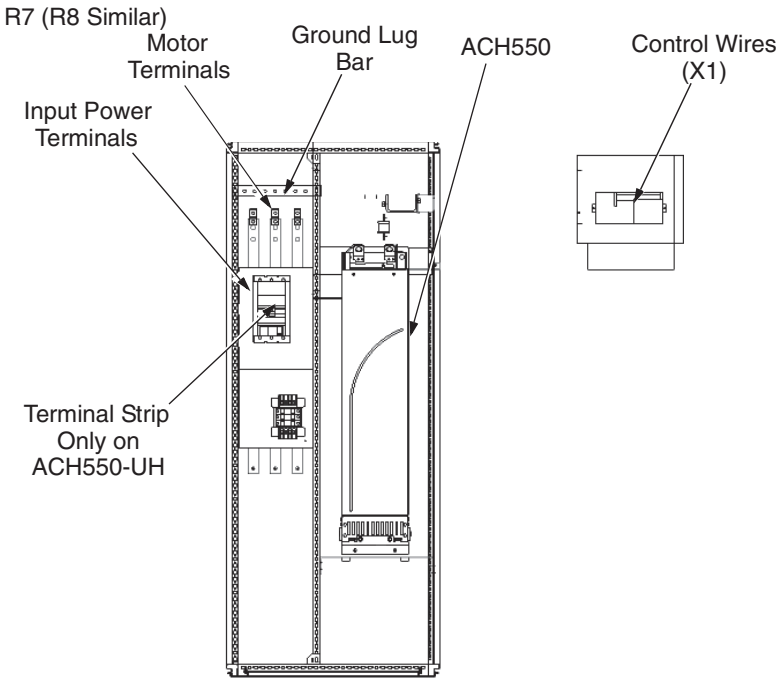
R1…R4 (Diagram shows the R3 frame.)



WARNING! To avoid danger, or damage to the drive, on IT systems and corner grounded TN systems, see section *Disconnecting the internal EMC filter* on page *10*.



WARNING! To avoid danger, or damage to the drive, on IT systems and corner grounded TN systems, see section *Disconnecting the internal EMC filter* on page *10*.



Disconnecting the internal EMC filter

On certain types of systems, you must disconnect the internal EMC filter, otherwise the system will be connected to ground potential through the EMC filter capacitors, which might cause danger, or damage the drive.

Note: When the internal EMC filter is disconnected, the drive is not EMC compatible.

The following table shows the installation rules for the EMC filter screws in order to connect or disconnect the filter, depending on the system type and the frame size. For more information on the different system types, see *Floating networks* on page *12* and *Unsymmetrically grounded networks* on page *11*.

The locations of screws EM1 and EM3 are shown in the diagram on page *8*. The locations of screws F1 and F2 are shown in the diagram on page *9*.

Frame sizes	Screw	Symmetrically grounded TN systems (TN-S systems)	Corner grounded TN systems	IT systems (ungrounded or high-resistance-grounded [> 30 ohm])
R1…R3	EM1	x	x	•
	EM3	x	•	•
R4	EM1	x	x	–
	EM3	x	–	–
R5…R6	F1	x	x	–
	F2	x	x	–

x = Install the screw. (EMC filter will be connected.)
• = Replace the screw with the provided polyamide screw. (EMC filter will be disconnected.)
– = Remove the screw. (EMC filter will be disconnected.)
EM1 and EM3 screws are M4 x 12
F1 and F2 screws are M4 x 16

Ground connections

For personnel safety, proper operation and to reduce electromagnetic emission/pick-up, the drive and the motor must be grounded at the installation site.

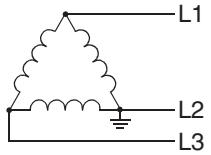
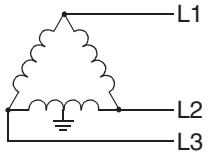
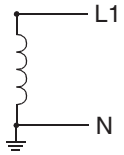
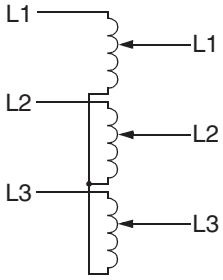
- Conductors must be adequately sized as required by safety regulations.
- Power cable shields must be connected to the drive PE terminal in order to meet safety regulations.
- Power cable shields are suitable for use as equipment grounding conductors only when the shield conductors are adequately sized as required by safety regulations.
- In multiple drive installations, do not connect drive terminals in series.

Unsymmetrically grounded networks

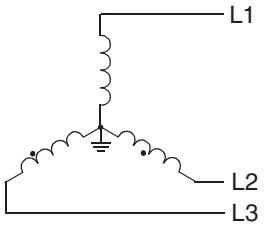
WARNING! Do not attempt to install or remove EM1 or EM3 screws while power is applied to the drive's input terminals.

Unsymmetrically grounded networks are defined in the following table. In such networks, the internal connection provided by the EM3 screw (on frame sizes R1…R4 only) must be disconnected by removing EM3. If the grounding configuration of the network is unknown, remove EM3.

Note: ACH550-UH drives are shipped with the screw removed (but included in the conduit box).

Unsymmetrically Grounded Networks – EM3 Must Be Out			
Grounded at the corner of the delta		Grounded at the mid point of a delta leg	
Single phase, grounded at an end point		Three phase "Variac" without solidly grounded neutral	

EM3 (an M4x16 screw) makes an internal ground connection that reduces electro-magnetic emission. Where EMC (electro-magnetic compatibility) is a concern, and the network is symmetrically grounded, EM3 may be installed. For reference, the diagram at right illustrates a symmetrically grounded network.



Floating networks

WARNING! Do not attempt to install or remove EM1, EM3, F1 or F2 screws while power is applied to the drive's input terminals.

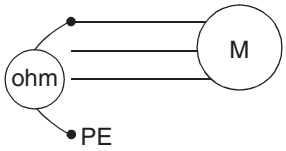
For floating networks (also known as IT, ungrounded, or impedance/resistance grounded networks):

- Disconnect the ground connection to the internal RFI filters:
  - Frame sizes R1…R4: Remove the EM1 screw (unit is shipped with EM3 removed, see *Connection diagrams* on page *8*).
  - Frame sizes R5…R6: Remove both the F1 and F2 screws (see page *9*).
- Where EMC requirements exist, check for excessive emission propagated to neighboring low voltage networks. In some cases, the natural suppression in transformers and cables is sufficient. If in doubt, use a supply transformer with static screening between the primary and secondary windings.
- Do NOT install an external RFI/EMC filter. Using an RFI filter grounds the input power through the filter capacitors, which could be dangerous and could damage the unit.

Checking motor and motor cable insulation

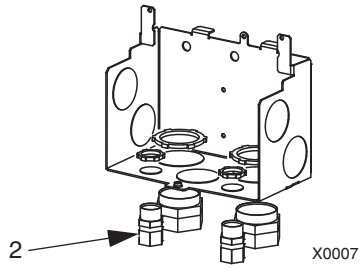
WARNING! Check the motor and motor cable insulation before connecting the drive to input power. For this test, make sure that motor cables are NOT connected to the drive.

1. Complete motor cable connections to the motor, but NOT to the drive output terminals (U2, V2, W2).
2. At the drive end of the motor cable, measure the insulation resistance between each motor cable phase and Protective Earth (PE): Apply a voltage of 1 kV DC and verify that resistance is greater than 1 Mohm.

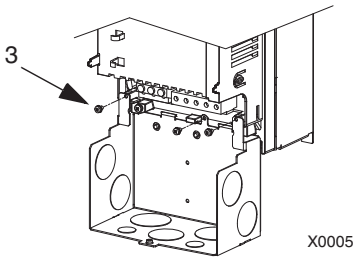


R1…R6, wiring UL type 1 enclosure

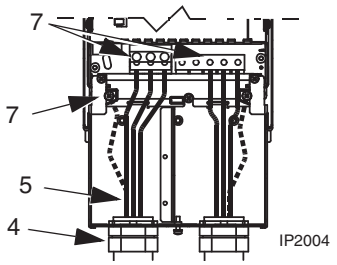
1. Open the appropriate knockouts in the conduit box. (See *Conduit kit* on page *7*.)
2. Install thin-wall conduit clamps (not supplied).



3. Install conduit box.
4. Connect conduit runs for input power, motor and control cables to the box.

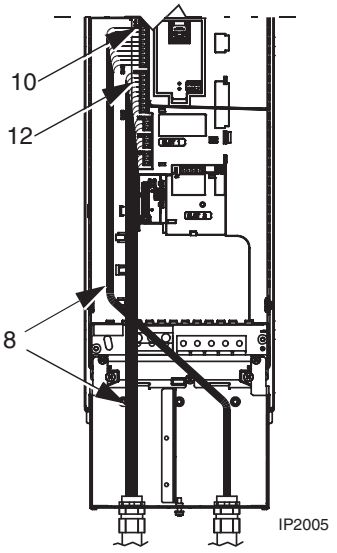


5. Route input power and motor wiring through separate conduits.
6. Strip wires.
7. Connect power, motor, and ground wires to the drive terminals.



Note: For R5 frame size, the minimum power cable size is 25 mm^2 (4 AWG). For R6 frame size, refer to *Power terminal considerations – R6 Frame size* on page *16*.

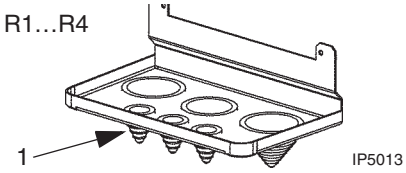
8. Route the control cables through the conduit (not the same conduit as either input power or motor wiring).
9. Use available secure points and tie strap landings to permanently secure control wiring at a minimum distance of 6 mm (1/4") from power wiring.
10. Strip the control cable sheathing and twist the copper screen into a pig-tail.
11. Connect the ground screen pig-tail for digital and analog I/O cables at X1-1. (Ground only at drive end.)
12. Connect the ground screen pig-tail for RS485 cables at X1-28 or X1-32. (Ground only at drive end.)

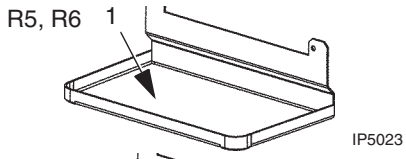


13. Strip and connect the individual control wires to the drive terminals.
14. Install the conduit box cover (1 screw).

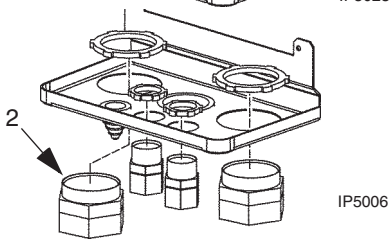
R1…R6, wiring UL type 12 enclosure

1. Step depends on Frame Size:
   - Frame Sizes R1…R4: Remove and discard the cable seals where conduit will be installed. (The cable seals are cone-shaped, rubber seals on the bottom of the drive.)
   - Frame Sizes R4 and R5: Use punch to create holes for conduit connections as needed.

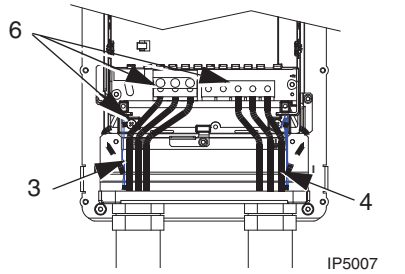




2. For each conduit run (input power, motor and control wiring must be separate), install water tight conduit connectors (not supplied).

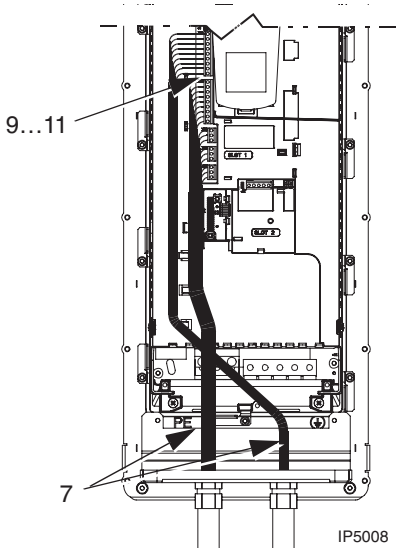


3. Route the power wiring through conduit.
4. Route the motor wiring through conduit (not the same conduit as input power wiring run).
5. Strip the wires.
6. Connect the power, motor, and ground wires to the drive terminals.



Note: For R5 frame size, the minimum power cable size is 25 mm^2 (4 AWG). For R6 frame size, refer to *Power terminal considerations – R6 Frame size* on page *16*.

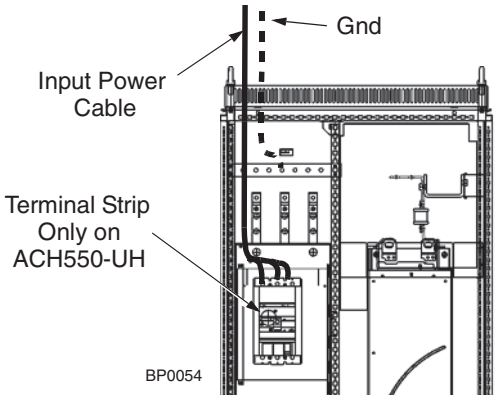
7. Route the control cables through the conduit (not the same conduit as either input power or motor wiring runs).
8. Use available secure points and tie strap landings to permanently secure control wiring at a minimum distance of 6 mm (1/4") from power wiring.
9. Strip the control cable sheathing and twist the copper screen into a pig-tail.
10. Connect the ground screen pig-tail for digital and analog I/O cables at X1-1. (Ground only at drive end.)
11. Connect the ground screen pig-tail for RS485 cables at X1-28 or X1-32. (Ground only at drive end.)
12. Strip and connect the individual control wires to the drive terminals.
13. Install the conduit box cover (1 screw).

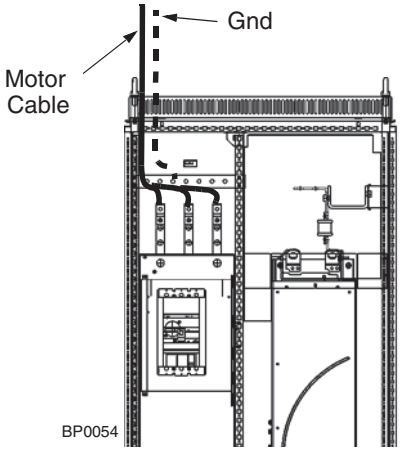


R7…R8, wiring (both enclosure types)

The figures show connections in the R7 cabinet, the R8 cabinet is similar.

1. Remove the conduit connection plate from the top of the left bay.
2. Route the input power, motor and control cables to the top of the cabinet. Each cable type (input power, motor, and control) must be in separate conduit.
3. Use punch to create holes for conduit connections as needed.
4. UL type 12 Enclosure: For each conduit run (input power, motor and control wiring must be separate), install water tight conduit connectors (not supplied).
5. Connect input power and motor cables to the bus terminals.
6. Connect grounds to ground bar.
7. Use available secure points and tie strap landings to permanently secure control wiring at a minimum distance of 6 mm (1/4") from power wiring.
8. Strip the control cable sheathing and twist the copper screen into a pig-tail.
9. Connect the ground screen pig-tail for digital and analog I/O cables at X1-1. (Ground only at drive end.)
10. Connect the ground screen pig-tail for RS485 cables at X1-28 or X1-32. (Ground only at drive end.)
11. Strip and connect the individual control wires to the drive terminals.





Drive's power connection terminals

The following table provides specifications for the drive's power connection terminals.

Frame Size	U1, V1, W1 U2, V2, W2 BRK±, UDC± Terminals						Earthing PE Terminal			
	Min. Wire Size		Max. Wire Size		Torque		Max. Wire Size		Torque	
	mm^2	AWG	mm^2	AWG	Nm	lb-ft	mm^2	AWG	Nm	lb-ft
R1[Note 1]	0.75	18	16	6	1.3	1	16	6	1.3	1
R2[Note 1]	0.75	18	16	6	1.3	1	16	6	1.3	1
R3[Note 1]	2.5	14	25	3	2.7	2	25	3	2.7	2
R4[Note 1]	10	8	50	1/0	5.6	4	50	1/0	5.6	4
R5	16	6	70	2/0	15	11	70	2/0	15	11
R6	95[Note 2]	3/0	185	350 MCM	40	30	185	350 MCM	40	30
R7	16	6	185	350 MCM	40	30	Attach appropriate ring lugs to ground wires and mount with, up to five 13/32 bolts.			
R8	16	6	2x240	2x500 MCM	57	42				

1. Do not use aluminum cable with frame sizes R1…R4.
2. See the following section for smaller wire sizes on frame size R6.

Power terminal considerations – R6 Frame size

WARNING! For R6 power terminals, if compression lugs are supplied, they can only be used for wire sizes that are 95 mm^2 (3/0 AWG) or larger. Smaller wires will loosen and may damage the drive, and require ring lugs as described below.

On the R6 frame size, if the cable size used is less than 95 mm^2 (3/0 AWG) or if no compression lugs are supplied, use ring lugs.

Drive's control connection terminals

The following table provides specifications for the drive's control terminals

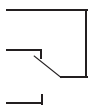
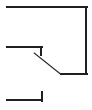
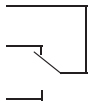
Frame Size	Control			
	Maximum Wire Size		Torque	
	mm^2	AWG	Nm	lb-ft
All	1.5	16	0.4	0.3

Control terminal descriptions

The following full-page diagram provides a general description of the control terminals on the drive.

Note: Terminals 3, 6, and 9 are at the same potential.

Note: For safety reasons the fault relay signals a “fault” when the ACH550 is powered down.

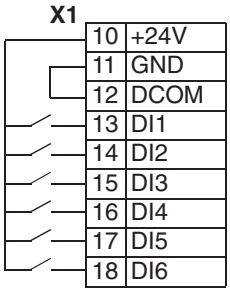
	X1		Drive Control Terminal Description
Analog I/O	1	SCR	Terminal for signal cable screen. (Connected internally to chassis ground.)
	2	AI1	Analog input channel 1, programmable. Default[2] = external reference. Resolution 0.1%, accuracy ±1%. J1:AI1 OFF: 0(2)…10 V (R_i = 312 kΩ)  or, for OFF  for ON  J1:AI1 ON: 0(4)…20 mA (R_i = 100 Ω) 
	3	AGND	Analog input circuit common (connected internally to chassis gnd. through 1 MΩ).
	4	+10 V	Potentiometer reference source: 10 V ±2%, max. 10 mA (1kΩ ≤ R ≤ 10kΩ).
	5	AI2	Analog input channel 2, programmable. Default[2] = PID feedback. Resolution 0.1%, accuracy ±1%. J1:AI2 OFF: 0(2)…10 V (R_i = 312 kΩ)  or, for OFF  for ON  J1:AI2 ON: 0(4)…20 mA (R_i = 100 Ω) 
	6	AGND	Analog input circuit common (connected internally to chassis gnd. through 1 MΩ).
	7	AO1	Analog output, programmable. Default[2] = frequency. 0…20 mA (load < 500 Ω).
	8	AO2	Analog output, programmable. Default[2] = current. 0…20 mA (load < 500 Ω).
	9	AGND	Analog output circuit common (connected internally to chassis gnd. through 1 MΩ).
Digital Inputs[1]	10	+24V	Auxiliary voltage output 24 VDC / 250 mA (reference to GND), short circuit protected.
	11	GND	Auxiliary voltage output common (connected internally as floating).
	12	DCOM	Digital input common. To activate a digital input, there must be ≥+10 V (or ≤-10 V) between that input and DCOM. The 24 V may be provided by the ACH550 (X1-10) or by an external 12…24 V source of either polarity.
	13	DI1	Digital input 1, programmable. Default[2] = start/stop.
	14	DI2	Digital input 2, programmable. Default[2] = not configured.
	15	DI3	Digital input 3, programmable. Default[2] = constant (preset) speed.
	16	DI4	Digital input 4, programmable. Default[2] = safety interlock.
	17	DI5	Digital input 5, programmable. Default[2] = not configured.
	18	DI6	Digital input 6, programmable. Default[2] = not configured.
Relay Outputs	19	RO1C	 Relay output 1, programmable. Default[2] = Ready Maximum: 250 VAC / 30 VDC, 2 A Minimum: 500 mW (12 V, 10 mA)
	20	RO1A	
	21	RO1B	
	22	RO2C	 Relay output 2, programmable. Default[2] = Running Maximum: 250 VAC / 30 VDC, 2 A Minimum: 500 mW (12 V, 10 mA)
	23	RO2A	
	24	RO2B	
	25	RO3C	 Relay output 3, programmable. Default[2] = Fault (-1) Maximum: 250 VAC / 30 VDC, 2 A Minimum: 500 mW (12 V, 10 mA)
	26	RO3A	
	27	RO3B	

1 Digital input impedance 1.5 kΩ. Maximum voltage for digital inputs is 30 V.

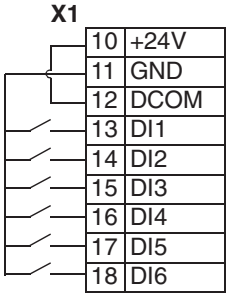
2 Default values depend on the macro used. Values specified are for the HVAC default macro.

You can wire the digital input terminals in either a PNP or NPN configuration.

PNP connection (source)



NPN connection (sink)



Serial communications

Terminals 28...32 provide RS485 serial communication connections used to control or monitor the drive from a fieldbus controller.

6. Check installation

Before applying power, perform the following checks.

✓	Check
	Installation environment conforms to the drive's specifications for ambient conditions.
	The drive is mounted securely.
	Space around the drive meets the drive's specifications for cooling.
	The motor and driven equipment are ready for start.
	For floating networks (R1…R6): The internal RFI filter is disconnected (screws EM1 & EM3 or F1 & F2).
	The drive is properly grounded.
	The input power voltage matches the drive nominal input voltage range.
	The input power connections at U1, V1, and W1 are connected and tightened as specified.
	The input power branch circuit protection is installed.
	The motor connections at U2, V2, and W2 are connected and tightened as specified.
	The input power, motor and control wiring are routed through separate conduit runs.
	NO power factor compensation capacitors are in the motor cable.
	The control connections are connected and tightened as specified.
	NO tools or foreign objects (such as drill shavings) are inside the drive.
	NO alternate power source for the motor (such as a bypass connection) is connected – no voltage is applied to the output of the drive.

7. Re-install cover

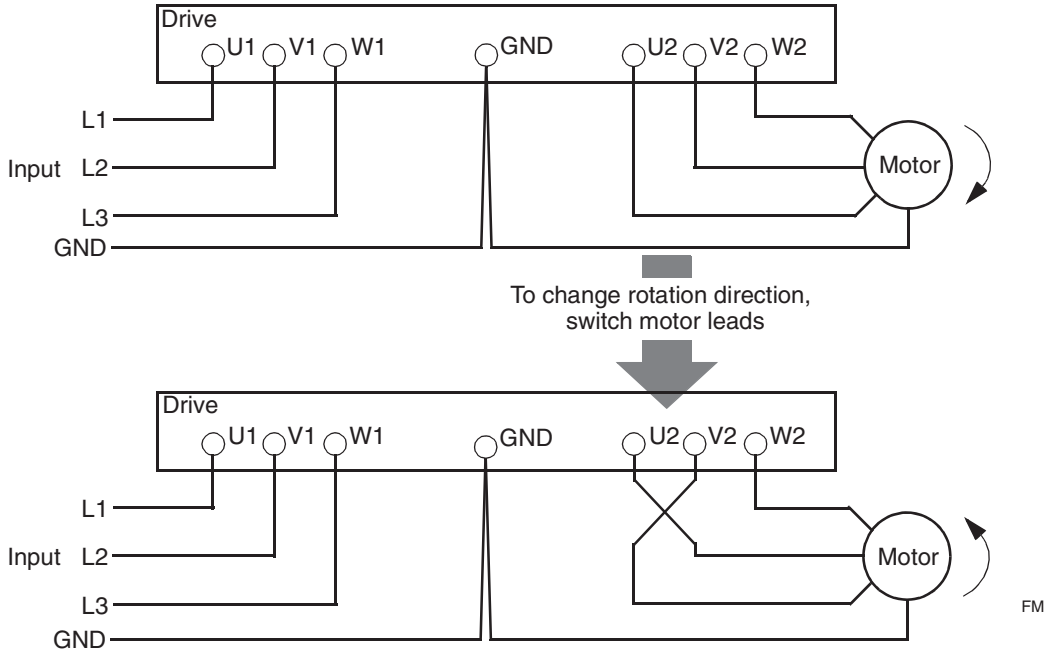
8. Apply power

Always re-install the covers before turning power on.

WARNING! The ACH550 will start up automatically at power up, if the external run command is on.

Apply input power. When power is applied to the ACH550, the green LED comes on.

Note: Before increasing motor speed, check that the motor is running in the desired direction. To change rotation direction, switch motor leads as shown below.



9. Before Start-up

The ACH550 has default parameter settings that are sufficient for many situations. However, review the following situations. Perform the associated procedures as appropriate.

Spin motor

When first installed and started the control panel displays a welcome screen with the following options.

- Press Exit to commission the drive as described in section *Start-up by changing the parameters individually* on page *23*.
- Press Enter to move to the following options:
  - Select “Commission Drive” to commission the drive as described in section Start-Up by *Start-up by using the Start-Up Assistant* on page *23*.
  - Select “Spin Motor” to operate the motor prior to commissioning. This option

operates the motor without any commissioning, except entry of the motor data as described below. Spin Motor is useful, for example, to operate ventilation fans prior to commissioning.

Note: When using Spin Motor, the motor speed is limited to the range 1/3…2/3 of maximum speed. Also, no interlocks are activated. Finally, once the drive is commissioned, the welcome screen and this option no longer appear.

Motor data

The motor data on the ratings plate may differ from the defaults in the ACH550. The drive provides more precise control and better thermal protection if you enter the rating plate data.

1. Gather the following from the motor ratings plate:
   - Voltage
   - Nominal motor current
   - Nominal frequency
   - Nominal speed
   - Nominal power
2. Edit parameters 9905…9909 to the correct values.
   - Assistant Control Panel: The Start-Up Assistant walks you through this data entry.
   - Basic Control Panel: Refer to *ACH550 User's Manual*, for parameter editing instructions.

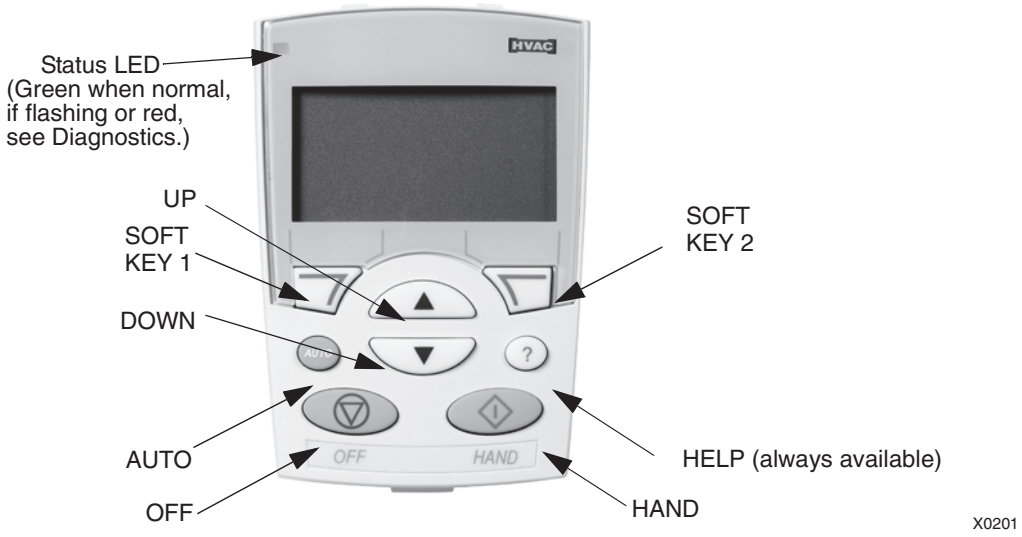
Fault and alarm adjustments

The ACH550 can detect a wide variety of potential system problems. For example, initial system operation may generate faults or alarms that indicate set-up problems.

1. Faults and alarms are reported on the control panel with a number. Note the number reported.
2. Review the description provided for the reported fault/alarm:
   - Use the fault and alarm listings on pages *24* and *29* respectively, or
   - Press the help key (Assistant Control Panel only) while fault or alarm is displayed.
3. Adjust the system or parameters as appropriate.

Operation

The ACH550 HVAC control panel (ACS-CP-B) features:



General display features

Soft key functions

The soft key functions are defined by text displayed just above each key.

Display contrast

To adjust display contrast, simultaneously press  and  or , as appropriate.

HVAC control panel modes

The HVAC control panel has several different modes for configuring, operating and diagnosing the drive. To reach the Standard Display Mode, press EXIT until the LCD display shows status information. Select MENU and use UP/DOWN buttons to select other modes. The modes are:

- **Standard Display Mode –** Shows drive status information and operates the drive.
- **Parameters Mode –** Edits parameter values individually.
- **Start-up Assistant Mode –** Guides the start-up and configuration.
- **Changed Parameters Mode –** Shows changed parameters.
- **Fault Logger Mode –** Shows the drive fault history.
- **Drive Parameter Backup Mode –** Stores or uploads the parameters.
- **Clock Set Mode –** Sets the time and date for the drive.
- **I/O Settings Mode –** Checks and edits the I/O settings.
- **Alarm Mode –** Reporting mode triggered by drive alarms.

Operating the drive

AUTO/HAND – The very first time the drive is powered up, it is in the auto control (AUTO) mode, and is controlled from the Control terminal block X1.

To switch to hand control (HAND) and control the drive using the control panel, press and hold the  or  button.

- Pressing the HAND button switches the drive to hand control while keeping the drive running.
- Pressing the OFF button switches to hand control and stops the drive.

To switch back to auto control (AUTO), press and hold the  button.

Hand/Auto/Off – To start the drive press the HAND or AUTO buttons, to stop the drive press the OFF button.

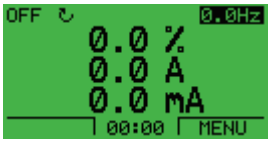
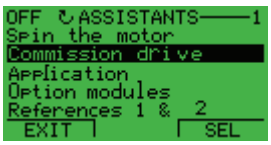
Reference – To modify the reference (only possible if the display in the upper right corner is in reverse video) press the UP or DOWN buttons (the reference changes immediately).

The reference can be modified in the local control mode (HAND/OFF), and can be parameterized (using Group 11 reference select) to also allow modification in the remote control mode.

Note: The Start/Stop, Shaft direction and Reference functions are only valid in local control (HAND/OFF) mode.

Start-up by using the Start-Up Assistant

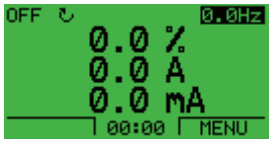
To start the Start-Up Assistant, follow these steps:

1	Select MENU to enter the main menu.		
2	Select ASSISTANTS with the Up/Down buttons and select ENTER.		
3	Scroll to COMMISSION DRIVE with the Up/Down buttons.		
4	Change the values suggested by the assistant to your preferences and then press SAVE after every change.		

The Start-Up Assistant will guide you through the start-up.

Start-up by changing the parameters individually

To change the parameters, follow these steps:

1	Select MENU to enter the main menu.		
2	Select the Parameters mode with the UP/ DOWN buttons and select ENTER to select the Parameters mode.		
3	Select the appropriate parameter group with the UP/DOWN buttons and select SEL		
4	Select the appropriate parameter in a group with the UP/DOWN buttons. Select EDIT to change the parameter value.		
5	Press the UP/DOWN buttons to change the parameter value.		
6	Select SAVE to store the modified value or select CANCEL to leave the set mode. Any modifications not saved are cancelled.		
7	Select EXIT to return to the listing of parameter groups, and again to return to the main menu.		

Complete the control connections by manually entering the parameters.

Note: The current parameter value appears below the highlighted parameter. To view the default parameter value, press the UP/DOWN buttons simultaneously. To restore the default factory settings, select the application macro HVAC Default.

Diagnostics

Fault listing

Fault Code	Fault Name In Panel	Description and Recommended Corrective Action
1	OVERCURRENT	Output current is excessive. Check for and correct: • Excessive motor load. • Insufficient acceleration time (parameters 2202 ACCELER TIME 1 and 2205 ACCELER TIME 2). • Faulty motor, motor cables or connections. • Output disconnect device not interlocked. • Interaction with external input filter.
2	DC OVERVOLT	Intermediate circuit DC voltage is excessive. Check for and correct: • Static or transient overvoltages in the input power supply. • Insufficient deceleration time (parameters 2203 DECELER TIME 1 and 2206 DECELER TIME 2). • Verify that overvoltage controller is ON (using parameter 2005). • Interaction with external input filter.
3	DEV OVERTEMP	Drive heatsink is overheated. Temperature is at or above limit. R1…R4 & R7/R8: 115 °C (239 °F) R5/R6: 125 °C (257 °F) Check for and correct: • Fan failure. • Obstructions in the air flow. • Dirt or dust coating on the heat sink. • Excessive ambient temperature. • Excessive motor load.
4	SHORT CIRC	Fault current. Check for and correct: • A short-circuit in the motor cable(s) or motor. • Supply disturbances.
5	RESERVED	Not used.
6	DC UNDERVOLT	Intermediate circuit DC voltage is not sufficient. Check for and correct: • Missing phase in the input power supply. • Blown fuse. • Undervoltage on mains.
7	AI1 LOSS	Analog input 1 loss. Analog input value is less than AI1FLT LIMIT (3021). Check for and correct: • Source and connection for analog input. • Parameter settings for AI1FLT LIMIT (3021) and 3001 AI<MIN FUNCTION.
8	AI2 LOSS	Analog input 2 loss. Analog input value is less than AI2FLT LIMIT (3022). Check for and correct: • Source and connection for analog input. • Parameter settings for AI2FLT LIMIT (3022) and 3001 AI<MIN FUNCTION.

Fault Code	Fault Name In Panel	Description and Recommended Corrective Action
9	MOT TEMP	Motor is too hot, based on either the drive's estimate or on temperature feedback. • Check for overloaded motor. • Adjust the parameters used for the estimate (3005…3009). • Check the temperature sensors and Group 35 parameters.
10	PANEL LOSS	Panel communication is lost and either: • Drive is in local control mode (the control panel displays HAND or OFF), or • Drive is in remote control mode (AUTO) and is parameterized to accept start/stop, direction or reference from the control panel. To correct check: • Communication lines and connections • Parameter 3002 PANEL COMM ERROR. • Parameters in Group 10: START/STOP/DIR and Group 11: REFERENCE SELECT (if drive operation is AUTO).
11	ID RUN FAIL	The motor ID run was not completed successfully. Check for and correct: • Motor connections • Motor parameters 9905…9909 do not match motor nameplate.
12	MOTOR STALL	Motor or process stall. Motor is operating in the stall region. Check for and correct: • Excessive load. • Insufficient motor power. • Parameters 3010…3012.
14	EXTERNAL FLT 1	Digital input defined to report first external fault is active. See parameter 3003 EXTERNAL FAULT 1.
15	EXTERNAL FLT 2	Digital input defined to report second external fault is active. See parameter 3004 EXTERNAL FAULT 2.
16	EARTH FAULT	Possible ground fault detected in the motor or motor cables. The drive monitors for ground faults while the drive is running and while the drive is not running. Detection is more sensitive when the drive is not running and can produce false positives. Possible corrections: • Check for/correct faults in the input wiring. • Verify that motor cable does not exceed maximum specified length. • A delta grounded input power supply and motor cables with high capacitance may result in erroneous error reports during non-running tests. To disable response to fault monitoring when the drive is not running, use parameter 3023 WIRING FAULT. To disable response to all ground fault monitoring, use parameter 3017 EARTH FAULT.
17	UNDERLOAD	Motor load is lower than expected. Check for and correct: • Disconnected load. • Group 37: USER LOAD CURVE.
18	THERM FAIL	Internal fault. The thermistor measuring the internal temperature of the drive is open or shorted. Contact your local ABB sales representative.
19	OPEX LINK	Internal fault. A communication-related problem has been detected on the fiber optic link between the OITF and OINT boards. Contact your local ABB sales representative.
20	OPEX PWR	Internal fault. Low voltage condition detected on OINT power supply. Contact your local ABB sales representative.

Fault Code	Fault Name In Panel	Description and Recommended Corrective Action
21	CURR MEAS	Internal fault. Current measurement is out of range. Contact your local ABB sales representative.
22	SUPPLY PHASE	Ripple voltage in the DC link is too high. Check for and correct: • Missing mains phase. • Blown fuse. • Interaction with external input filter. Set parameter 2619 to “ON”.
23	ENCODER ERR	Not used (Available only with encoder and parameter Group 50).
23	ENCODER ERR	The drive is not detecting a valid encoder signal. Check for and correct: • Encoder presence and proper connection (reverse wired, loose connection, or short circuit). • Voltage logic levels are outside of the specified range. • A working and properly connected Pulse Encoder Interface Module, OTAC-01. • Wrong value entered in parameter 5001 PULSE NR. A wrong value will only be detected if the error is such that the calculated slip is greater than 4 times the rated slip of the motor. • Encoder is not being used, but parameter 5002 ENCODER ENABLE = 1 (ENABLED).
24	OVERSPEED	Motor speed is greater than 120% of the larger (in magnitude) of 2001 MINIMUM SPEED or 2002 MAXIMUM SPEED. Check for and correct: • Parameter settings for 2001 and 2002. • Adequacy of motor braking torque. • Applicability of torque control. • Brake chopper and resistor.
25	RESERVED	Not used as of the publication of this manual.
26	DRIVE ID	Internal fault. Configuration Block Drive ID is not valid. Contact your local ABB sales representative.
27	CONFIG FILE	Internal configuration file has an error. Contact your local ABB sales representative.
28	SERIAL 1 ERR	Fieldbus communication has timed out. Check for and correct: • Fault setup (3018 COMM FAULT FUNC and 3019 COMM FAULT TIME). • Communication settings (Group 51 or 53 as appropriate). • Poor connections and/or noise on line.
29	EFB CONFIG FILE	Error in reading the configuration file for the embedded fieldbus.
30	FORCE TRIP	Fault trip forced by the fieldbus. See the fieldbus User’s Manual.
31	EFB 1	Fault code reserved for the embedded fieldbus (EFB) protocol application. These codes are not used as of the publication of this manual.
32	EFB 2	
33	EFB 3	
34	MOTOR PHASE	Fault in the motor circuit. One of the motor phases is lost. Check for and correct: • Motor fault. • Motor cable fault. • Thermal relay fault (if used). • Internal fault.

Fault Code	Fault Name In Panel	Description and Recommended Corrective Action
35	OUTPUT WIRING	Possible power wiring error detected. When the drive is not running it monitors for an improper connection between the drive input power and the drive output. Check for and correct: • Proper input wiring – line voltageis NOT connected to drive output. • The fault can be erroneously declared if the input power is a delta grounded system and motor cable capacitance is large. This fault can be disabled using parameter 3023 WIRING FAULT.
36	INCOMP SWTYPE	The drive cannot use the software. • Internal Fault. • The loaded software is not compatible with the drive. • Call support representative.
37	CB OVERTEMP	Drive control board is overheated. Check for and correct: • Excessive ambient temperatures • Fan failure. • Obstructions in the air flow.
101	SERF CORRUPT	Error internal to the drive. Contact your local ABB sales representative and report the error number.
102	RESERVED	
103	SERF MACRO	
104	RESERVED	
105	RESERVED	
201	DSP T1 OVERLOAD	Error in the system. Contact your local ABB sales representative and report the error number.
202	DSP T2 OVERLOAD	
203	DSP T3 OVERLOAD	
204	DSP STACK ERROR	
205	RESERVED (obsolete)	
206	OMIO ID ERROR	
207	EFB LOAD ERR	
1000	PAR HZRPM LIMITS	Parameter values are inconsistent. Check for any of the following: • 2001 MINIMUM SPEED > 2002 MAXIMUM SPEED. • 2007 MINIMUM FREQ > 2008 MAXIMUM FREQ. • 2001 MINIMUM SPEED / 9908 MOTOR NOM SPEED is outside proper range (> 50) • 2002 MAXIMUM SPEED / 9908 MOTOR NOM SPEED is outside proper range (> 50) • 2007 MINIMUM FREQ / 9907 MOTOR NOM FREQ is outside proper range (> 50) • 2008 MAXIMUM FREQ / 9907 MOTOR NOM FREQ is outside proper range (> 50)
1001	PAR PFAREFNG	Parameter values are inconsistent. Check for the following: • 2007 MINIMUM FREQ is negative, when 8123 PFA ENABLE is active.

Fault Code	Fault Name In Panel	Description and Recommended Corrective Action
1002	RESERVED (Obsolete)	
1003	PAR AI SCALE	Parameter values are inconsistent. Check for any of the following: • 1301 AI 1 MIN > 1302 AI 1 MAX. • 1304 AI 2 MIN > 1305 AI 2 MAX.
1004	PAR AO SCALE	Parameter values are inconsistent. Check for any of the following: • 1504 AO 1 MIN > 1505 AO 1 MAX. • 1510 AO 2 MIN > 1511 AO 2 MAX.
1005	PAR PCU 2	Parameter values for power control are inconsistent: Improper motor nominal kVA or motor nominal power. Check for the following: • $1.1 \leq$ (9906 MOTOR NOM CURR * 9905 MOTOR NOM VOLT * 1.73 / P_N) ≤ 3.0 • Where: P_N = 1000 * 9909 MOTOR NOM POWER (if units are kW) or P_N = 746 * 9909 MOTOR NOM POWER (if units are HP, e.g. in US)
1006	EXT ROMISSING	Parameter values are inconsistent. Check for the following: • Extension relay module not connected and • 1410…1412 RELAY OUTPUTS 4…6 have non-zero values.
1007	PAR FBUSMISSING	Parameter values are inconsistent. Check for and correct: • A parameter is set for fieldbus control (e.g. 1001 EXT1 COMMANDS = 10 (COMM)), but 9802 COMM PROT SEL = 0.
1008	PAR PFAWOSCALAR	Parameter values are inconsistent – 9904 MOTOR CTRL MODE must be = 3 (SCALAR: SPEED), when 8123 PFA ENABLE is activated.
1009	PAR PCU1	Parameter values for power control are inconsistent: Improper motor nominal frequency or speed. Check for both of the following: • $1 \leq$ (60 * 9907 MOTOR NOM FREQ / 9908 MOTOR NOM SPEED ≤ 16 • $0.8 \leq$ 9908 MOTOR NOM SPEED / (120 * 9907 MOTOR NOM FREQ / Motor Poles) ≤ 0.992
1010	PAR PFA OVERRIDE	Both the override mode and PFA are activated at the same time. These modes are mutually incompatible, because PFA interlocks cannot be observed in the override mode.
1011	PAR OVERRIDE PARS	Overeride is enabled, but parameters are incompatible. Verify that 1701 is not zero, and (depending on 9904 value) 1702 or 1703 is not zero.
1012	PAR PFA IO 1	IO configuration is not complete – not enough relays are parameterized to PFA. Or, a conflict exists between Group 14, parameter 8117, NR OF AUX MOT, and parameter 8118, AUTOCHNG INTERV.
1013	PAR PFA IO 2	IO configuration is not complete – the actual number of PFA motors (parameter 8127, MOTORS) does not match the PFA motors in Group 14 and parameter 8118 AUTOCHNG INTERV.
1014	PAR PFA IO 3	IO configuration is not complete – the drive is unable to allocate a digital input (interlock) for each PFA motor (parameters 8120 INTERLOCKS and 8127 MOTORS).

Fault history

For reference, the last three fault codes are stored into parameters 0401, 0412, 0413. For the most recent fault (identified by parameter 0401), the drive stores additional data (in parameters 0402…0411) to aid in troubleshooting a problem. For example, parameter 0404 stores the motor speed at the time of the fault.

To clear the fault history (all of the Group 04, Fault History parameters):

1. Using the control panel in Parameters mode, select parameter 0401.
2. Press EDIT.
3. Press UP and Down simultaneously.
4. Press SAVE.

Alarm listing

The following table lists the alarms by code number and describes each.

Alarm Code	Display	Description
2001	OVERCURRENT	Current limiting controller is active. Check for and correct: • Excessive motor load. • Insufficient acceleration time (parameters 2202 ACCELER TIME 1 and 2205 ACCELER TIME 2). • Faulty motor, motor cables or connections. • Output disconnect device not interlocked. • Interaction with external input filter.
2002	OVERVOLTAGE	Over voltage controller is active. Check for and correct: • Static or transient overvoltages in the input power supply. • Insufficient deceleration time (parameters 2203 DECELER TIME 1 and 2206 DECELER TIME 2). • Interaction with external input filter.
2003	UNDERVOLTAGE	Under voltage controller is active. Check for and correct: • Undervoltage on mains.
2004	DIR LOCK	The change in direction being attempted is not allowed. Either: • Do not attempt to change the direction of motor rotation, or • Change parameter 1003 DIRECTION to allow direction change (if reverse operation is safe).
2005	I/O COMM	Fieldbus communication has timed out. Check for and correct: • Fault setup (3018 COMM FAULT FUNC and 3019 COMM FAULT TIME). • Communication settings (Group 51 or 53 as appropriate). • Poor connections and/or noise on line.
2006	AI1 LOSS	Analog input 1 is lost, or value is less than the minimum setting. Check: • Input source and connections • Parameter that sets the minimum (3021) • Parameter that sets the Alarm/Fault operation (3001)
2007	AI2 LOSS	Analog input 2 is lost, or value is less than the minimum setting. Check: • Input source and connections • Parameter that sets the minimum (3022) • Parameter that sets the Alarm/Fault operation (3001)

Alarm Code	Display	Description
2008	PANEL LOSS	Panel communication is lost and either: • Drive is in local control mode (the control panel displays HAND or OFF), or • Drive is in remote control mode (AUTO) and is parameterized to accept start/stop, direction or reference from the control panel. To correct check: • Communication lines and connections • Parameter 3002 PANEL LOSS. • Parameters in Groups 10 START/STOP/DIR and 11: REFERENCE SELECT (if drive operation is AUTO).
2009	DEVICE OVERTEMP	Drive heatsink is hot. This alarm warns that a DEVICE OVERTEMP fault may be near. R1…R4 & R7/R8: 100 °C (212 °F) R5/R6: 110 °C (230 °F) Check for and correct: • Fan failure. • Obstructions in the air flow. • Dirt or dust coating on the heat sink. • Excessive ambient temperature. • Excessive motor load.
2010	MOT OVERTEMP	Motor is hot, based on either the drive's estimate or on temperature feedback. This alarm warns that a Motor Underload fault trip may be near. Check: • Check for overloaded motor. • Adjust the parameters used for the estimate (3005…3009). • Check the temperature sensors and Group 35 parameters.
2011	UNDERLOAD	Motor load is lower than expected. This alarm warns that a Motor Underload fault trip may be near. Check: • Motor and drive ratings match (motor is NOT undersized for the drive) • Settings Group 37: USER LOAD CURVE
2012	MOTOR STALL	Motor is operating in the stall region. This alarm warns that a Motor Stall fault trip may be near.
2013 (note 1)	AUTORESET	This alarm warns that the drive is about to perform an automatic fault reset, which may start the motor. • To control automatic reset, use parameter Group 31: AUTOMATIC RESET.
2014 (note 1)	AUTOCHANGE	This alarm warns that the PFA autochange function is active. • To control PFA, use parameter Group 81: PFA CONTROL
2015	PFA INTERLOCK	This alarm warns that the PFA interlocks are active, which means that the drive cannot start the following: • Any motor (when Autochange is used), • The speed regulated motor (when Autochange is not used).
2016	Reserved	
2017	OFF BUTTON	Note 1.
2018 (note 1)	PID SLEEP	This alarm warns that the PID sleep function is active, which means that the motor could accelerate when the PID sleep function ends. • To control PID sleep, use parameters 4022…4026 or 4122…4126.

Alarm Code	Display	Description
2019	ID RUN	Performing ID run.
2020	OVERRIDE	This alarm warns that the Override function is active, which may start the motor.
2021	START ENABLE 1 MISSING	This alarm warns that the Start Enable 1 signal is missing. • To control Start Enable 1 function, use parameter 1608. To correct, check: • Digital input configuration. • Communication settings.
2022	START ENABLE 2 MISSING	This alarm warns that the Start Enable 2 signal is missing. • To control Start Enable 2 function, use parameter 1609. To correct, check: • Digital input configuration. • Communication settings.
2023	EMERGENCY STOP	Emergency stop activated.
2024	ENCODER ERROR	The drive is not detecting a valid encoder signal. Check for and correct: • Encoder presence and proper connection (reverse wired, loose connection, or short circuit). • Voltage logic levels are outside of the specified range. • A working and properly connected Pulse Encoder Interface Module, OTAC-01. • Wrong value entered in parameter 5001 PULSE NR. A wrong value will only be detected if the error is such that the calculated slip is greater than 4 times the rated slip of the motor. • Encoder is not being used, but parameter 5002 ENCODER ENABLE = 1 (ENABLED).
2025	FIRST START	Signals that a the drive is performing a First Start evaluation of motor characteristics. This is normal the first time the motor is run after motor parameters are entered or changed. See parameter 9910 (MOTOR ID RUN) for a description of motor models.
2026	RESERVED	Not used.
2027	USER LOAD CURVE	This alarm warns that the condition defined by parameter 3701 USER LOAD C MODE has been valid longer that half of the time difined by 3703 USER LOAD C TIME.
2028	START DELAY	Shown during the Start delay. See parameter 2113 START DELAY.

Note 1. Even when the relay output is configured to indicate alarm conditions (e.g. parameter 1401 RELAY OUTPUT 1 = 5 (ALARM) or 16 (FLT/ALARM)), this alarm is not indicated by a relay output.

Maintenance



Warning! Read *Safety* on page *2* before performing any maintenance on the equipment. Ignoring the safety instructions can cause injury or death.

Maintenance intervals

If installed in an appropriate environment, the drive requires very little maintenance. This table lists the routine maintenance intervals recommended by ABB.

Maintenance	Application	Interval	Instruction
Check/replace R7/R8 enclosure inlet air filter	R7/R8 UL type 12 enclosures	Check every 3 months. Replace as needed.	*Frame Sizes R7/R8 – UL type 12 enclosure inlet air filter on page 35*
Check/replace R7/R8 enclosure exhaust air filter.	R7/R8 UL type 12 enclosures	Check every 6 months. Replace as needed.	*Frame Sizes R7/R8 – UL type 12 enclosure exhaust filters on page 37*
Check and clean heatsink.	All	Depends on the dustiness of the environment (every 6…12 months)	See *Heatsink* below.
Replace drive module fan.	All	Every six years	See *Drive module fan replacement on page 33*.
Replace enclosure fan.	UL type 12 enclosures	Every three years.	See *Enclosure fan replacement – UL Type 12 enclosures on page 34*.
Change capacitor.	Frame sizes R5, R6 and R8	Every ten years	See *Capacitors on page 38*.
Replace battery in the Assistant control panel	All	Every ten years	See *Control panel on page 38*.

Heatsink

The heatsink fins accumulate dust from the cooling air. Since a dusty heatsink is less efficient at cooling the drive, overtemperature faults become more likely. In a “normal” environment (not dusty, not clean) check the heatsink annually, in a dusty environment check more often.

Clean the heatsink as follows (when necessary):

1. Remove power from drive.
2. Remove the cooling fan (see section *Drive module fan replacement* on page *33*).
3. Blow clean compressed air (not humid) from bottom to top and simultaneously use a vacuum cleaner at the air outlet to trap the dust.

Note: If there is a risk of the dust entering adjoining equipment, perform the cleaning in another room.

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4. Replace the cooling fan.
5. Restore power.

Drive module fan replacement

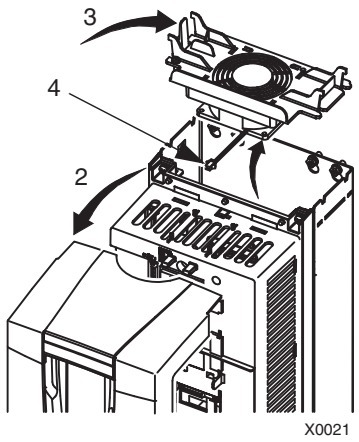
The drive module fan cools the heatsink. Fan failure can be predicted by the increasing noise from fan bearings and the gradual rise in the heatsink temperature in spite of heatsink cleaning. If the drive is operated in a critical part of a process, fan replacement is recommended once these symptoms start appearing. Replacement fans are available from ABB. Do not use other than ABB specified spare parts.

To monitor the running time of the cooling fan, see *Group 29: MAINTENANCE TRIG* instructions.

Frame Sizes R1...R4

To replace the fan:

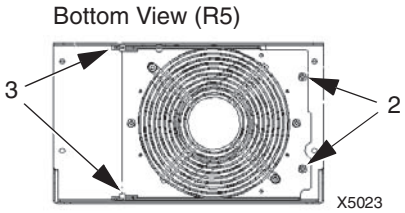
1. Remove power from drive.
2. Remove drive cover.
3. For Frame Size:
   - R1, R2: Press together the retaining clips on the fan cover sides, and lift.
   - R3, R4: Press in on the lever located on the left side of the fan mount, and rotate the fan up and out.
4. Disconnect the fan cable.
5. Install the fan in reverse order.
6. Restore power.

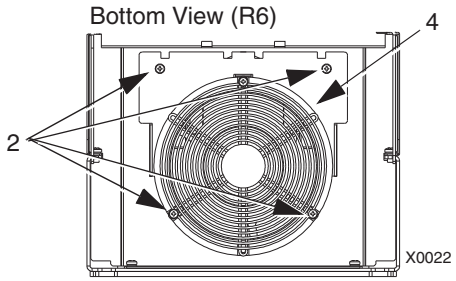


Frame Sizes R5 and R6

To replace the fan:

1. Remove power from drive.
2. Remove the screws attaching the fan.
3. Remove the fan:
   - R5: Swing the fan out on its hinges.
   - R6: Pull the fan out.
4. Disconnect the fan cable.
5. Install the fan in reverse order.
6. Restore power.





Frame Sizes R7 and R8

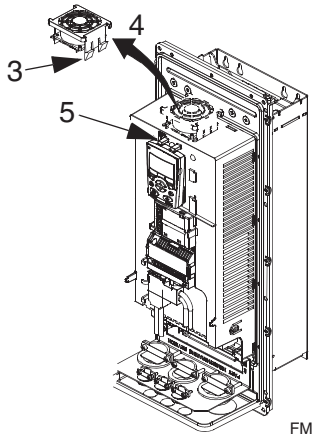
Refer to the installation instructions supplied with the fan kit.

Enclosure fan replacement – UL Type 12 enclosures

UL type 12 enclosures include an additional fan (or fans) to move air through the enclosure.

Frame Sizes R1 to R4

To replace the internal enclosure fan in frame sizes R1 to R4:



1. Remove power from drive.
2. Remove the front cover.
3. The housing that holds the fan in place has barbed retaining clips at each corner. Press all four clips toward the center to release the barbs.
4. When the clips/barbs are free, pull the housing up to remove from the drive.
5. Disconnect the fan cable.
6. Install the fan in reverse order, noting that:
   - The fan air flow is up (refer to arrow on fan).
   - The fan wire harness is toward the front.
   - The notched housing barb is located in the right-rear corner.
   - The fan cable connects just forward of the fan at the top of the drive.

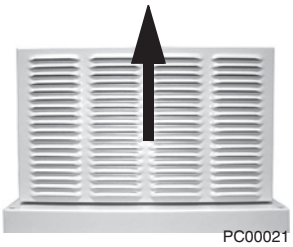
Frame Sizes R5 and R6

To replace the internal enclosure fan in frame sizes R5 or R6:

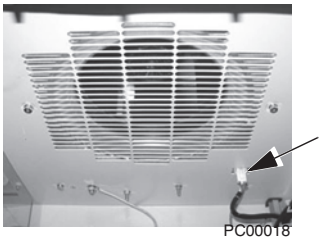
- Remove power from drive.
- Remove the front cover.
- Lift the fan out and disconnect the cable.
- Install the fan in reverse order.
- Restore power.

Frame Sizes R7/R8 – UL type 12 enclosures

The enclosure fan is located in the exhaust box on top of the UL type 12 enclosure.

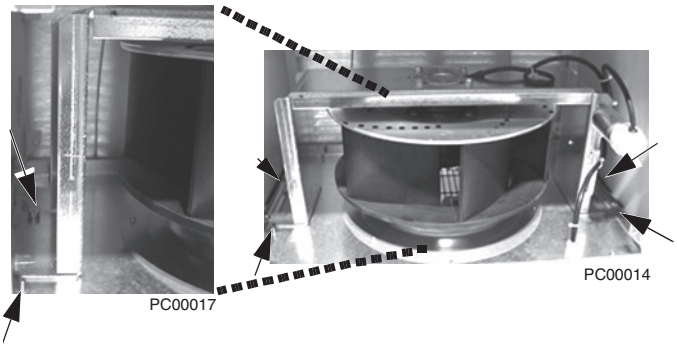


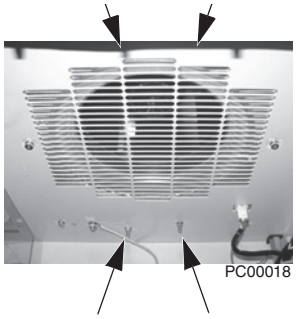
1. Remove the left and right filter frames of the exhaust fan box by lifting them upwards.



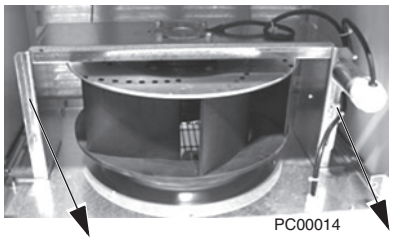
2. Disconnect the fan's electrical connector from the cabinet roof (top right inside the cabinet).

3. Undo the four fastening screws at the corners of the fan frame. The screws are through bolts with nuts on the inside of the cabinet. (Do not drop the hardware into the drive).

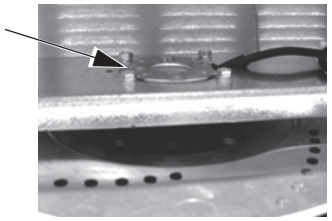




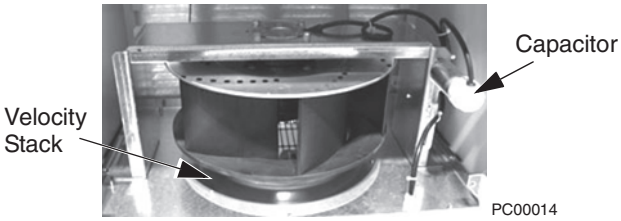
4. Remove the fan and fan frame as one unit.



5. Disconnect the fan wiring and capacitor from the fan frame. Then remove the four screws attaching the fan to the fan frame. Remove the old fan.



6. Install the new fan and capacitor with the replacement part for ABB in the reverse order of the above. Ensure the fan is centered on the velocity stack and rotates freely.



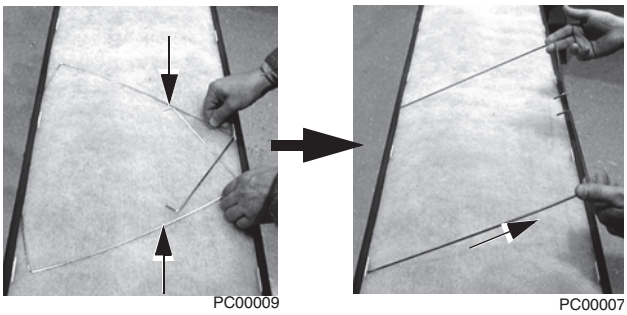
Enclosure air filter replacement – UL Type 12 enclosures

Frame Sizes R7/R8 – UL type 12 enclosure inlet air filter

The inlet air filter for the R7/R8 UL type 12 enclosure is located in the enclosure front door.

1. While holding the top of the filter frame, pull up on the bottom of the frame. The filter frame will slide up approximately 3/4 inch and can then safely removed by tilting away from the cabinet and lifting up.

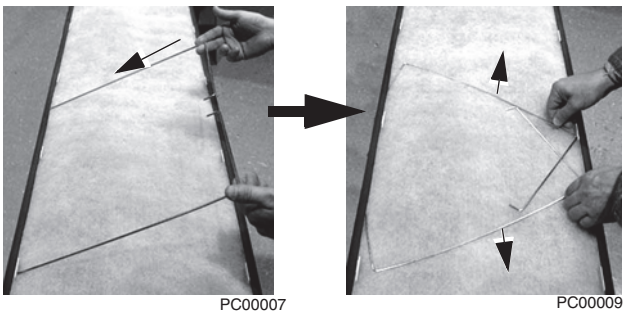
2. Lay the filter frame on a flat work surface. Remove the 3 retaining brackets by squeezing the tabbed corners in towards the middle of each bracket until the bracket clears the filter frame. Save these brackets for replacement. Remove and inspect the filter.

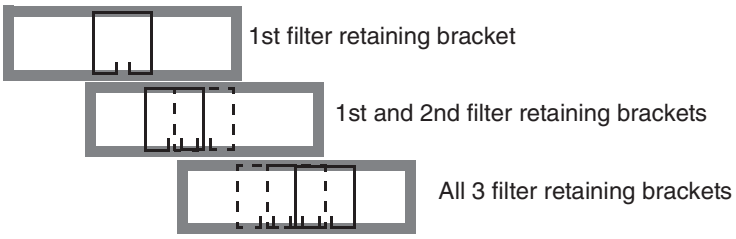

PC00009 PC00007

3. Install the replacement filter. Be sure to tuck the filter into the grove around the entire filter frame. This is very important for proper installation.


PC00013

4. Reinstall the 3 filter restraining brackets. These will prevent the filter from being pulled out of the filter frame.
   - Install the center bracket first.
   - Install the 2nd bracket overlapping the center bracket by 1/2 to the left.
   - Install the 3nd bracket overlapping the center bracket by 1/2 to the right.


PC00007 PC00009

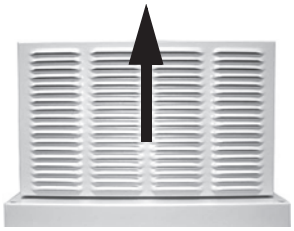


5. Install the filter frame back to the cabinet door. Carefully align the mounting hooks to the slots in the cabinet door. The hooks should be pointing down. Press in at the center of the filter frame with your knee and gently press down with your hands at the top of the frame. The filter frame will slide down approximately 3/4 inch and should be sealed securely to the door around the entire filter frame.

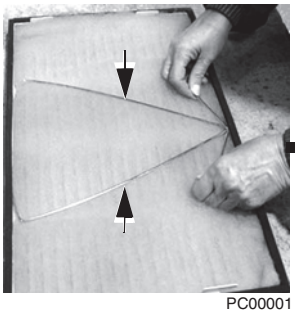
Frame Sizes R7/R8 – UL type 12 enclosure exhaust filters

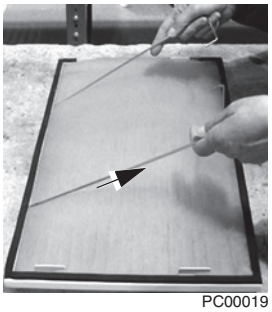
The exhaust filters in the R7/R8 UL type 12 enclosure are located in the exhaust box at the top of the enclosure.

There are 2 filter frames attached to the exhaust box.


PC00021

1. Remove each filter frame:
   - Lift up on the filter frame until it slides approximately 3/4 inch.
   - Pull away from the exhaust box to remove.
2. For each filter frame, remove the wire retainers that hold the filters in place:
   - Lay the filter frames on a flat work surface.
   - The wire retainers have a square “U” shape. Remove by squeezing the open end of the “U” towards the middle of the “square” until the retainer top (open end of “U”) clears the filter frame.


PC00001

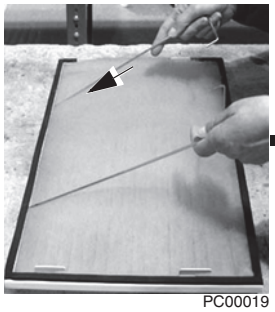

PC00019

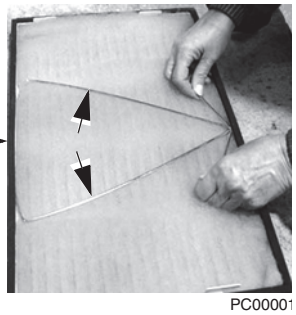
   - Save the retainers for reinstallation.
3. Remove and inspect the filter.
4. Install clean filters.

Note: When installing DUSTLOK® filter media, the white side must face to outside of the cabinet, and the orange side faces in.
Be sure to tuck the filter edges into the groove around the entire filter frame. This detail is very important for proper operation.


PC00022

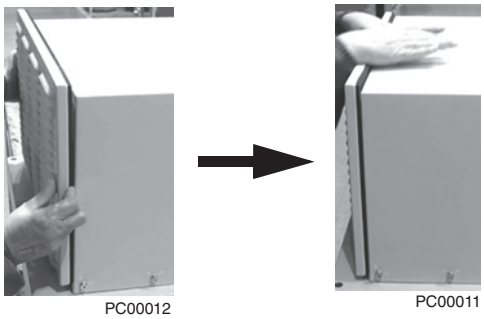
5. Reinstall the filter restrainers.
   - Insert the base of a retainer (bottom of “U” shape) into a filter frame channel.
   - Squeeze the open end of the “U” until it clears the filter frame.
   - Seat the open end of the “U” in the filter frame channel.


PC00019


PC00001

   - Release the retainer to its relaxed, square shape.

6. Install each filter frame to the bonnet on top of the cabinet.
   - Carefully align the frame's mounting hooks with the slots in the bonnet. (The hooks should be pointing down.)
   - Press down at the top of the filter frame. (The filter frame slides down approximately 3/4 inch).
   - Check all around the filter frame for a secure seal to the exhaust box.


PC00012 PC00011

Capacitors

The drive intermediate circuit employs several electrolytic capacitors. Their life span is from 35,000...90,000 hours depending on drive loading and ambient temperature. Capacitor life can be prolonged by lowering the ambient temperature.

It is not possible to predict a capacitor failure. Capacitor failure is usually followed by a input power fuse failure or a fault trip. Contact ABB if capacitor failure is suspected. Replacements for frame size R5, R6 and R8 are available from ABB. Do not use other than ABB specified spare parts.

Control panel

Cleaning

Use a soft damp cloth to clean the control panel. Avoid harsh cleaners which could scratch the display window.

Battery

A battery is only used in Assistant control panels that have the clock function available and enabled. The battery keeps the clock operating in memory during power interruptions.

The expected life for the battery is greater than ten years. To remove the battery, use a coin to rotate the battery holder on the back of the control panel. Replace the battery with type CR2032.

Note: The battery is NOT required for any control panel or drive function, except the clock.

ACH550 E-Clipse Bypass

Installation – drive

Follow the *Installation* instructions for the drive on page *3*. **Failure to observe the warnings and instructions may cause a malfunction or personal hazard.**

WARNING! Before you begin read *Safety* on page *2*.

Installation – bypass

WARNING! When the ACH550 with E-Clipse Bypass is connected to the line power, the Motor Terminals T1, T2, and T3 are live even if the motor is not running. Do not make any connections when the ACH550 with E-Clipse Bypass is connected to the line. Disconnect and lock out power to the drive before servicing the drive. Failure to disconnect power may cause serious injury or death.

1. Install wiring – bypass

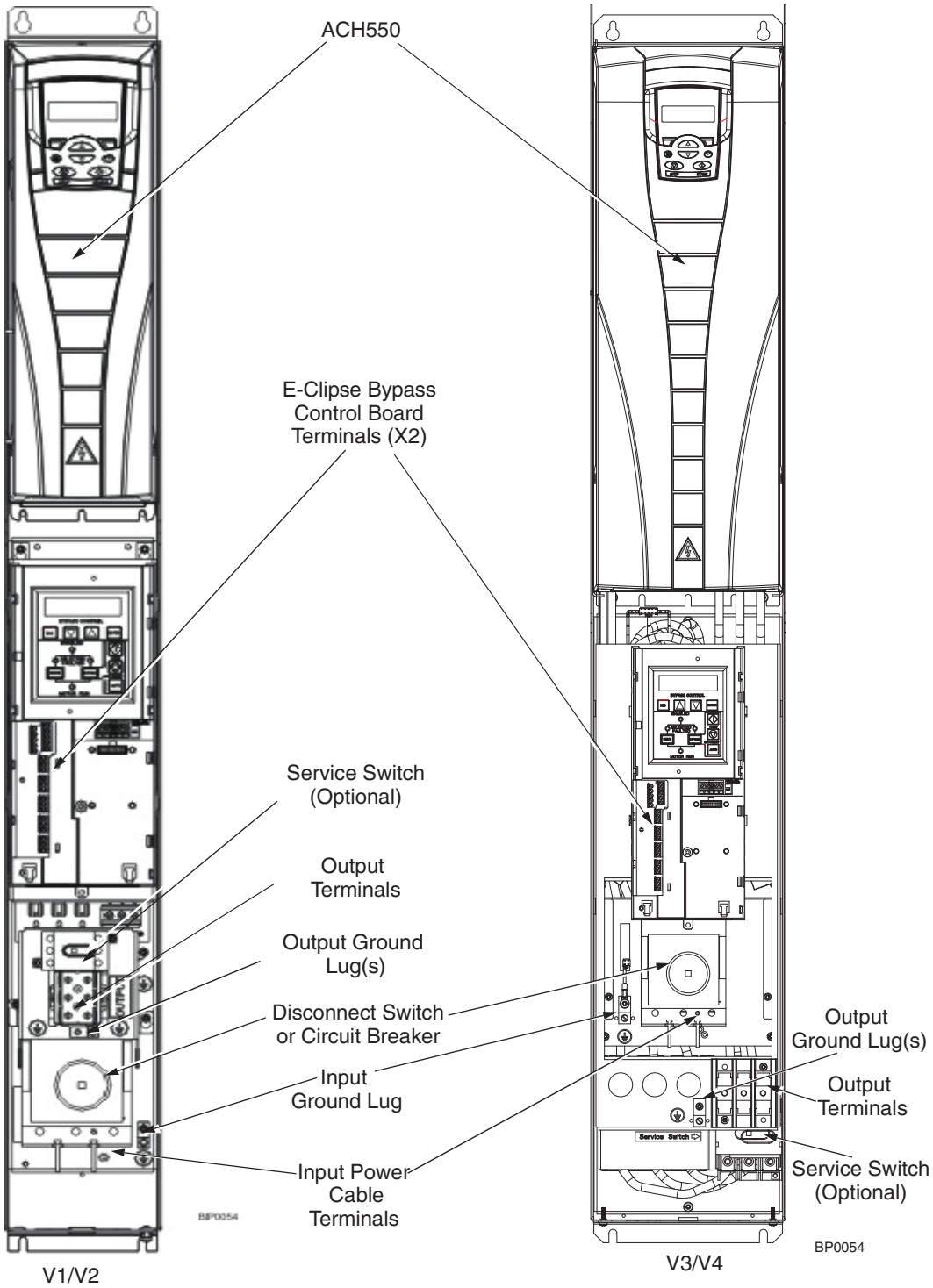
WARNING!

- Do not connect or disconnect input or output power wiring, or control wires, when power is applied.
- Never connect line voltage to drive output Terminals T1, T2, and T3.
- Do not make any voltage tolerance tests (Hi Pot or Megger) on any part of the unit. Disconnect motor wires before taking any measurements in the motor or motor wires.
- Make sure that power factor correction capacitors are not connected between the drive and the motor.

Enclosure Designation	Horsepower Range by Voltage Rating		
	208/240V	480V	600V
V1/V2	1 to 7.5 HP	1 to 15 HP	2 to 15 HP
V3/V4	10 to 25 HP	20 to 60 HP	20 to 60 HP
B1	1 to 7.5 HP	1 to 15 HP	2 to 15 HP
B2	10 to 25 HP	20 to 60 HP	20 to 60 HP
B3	30 to 100 HP	75 to 200 HP	75 to 150 HP
B4	N/A	250 to 550 HP	N/A

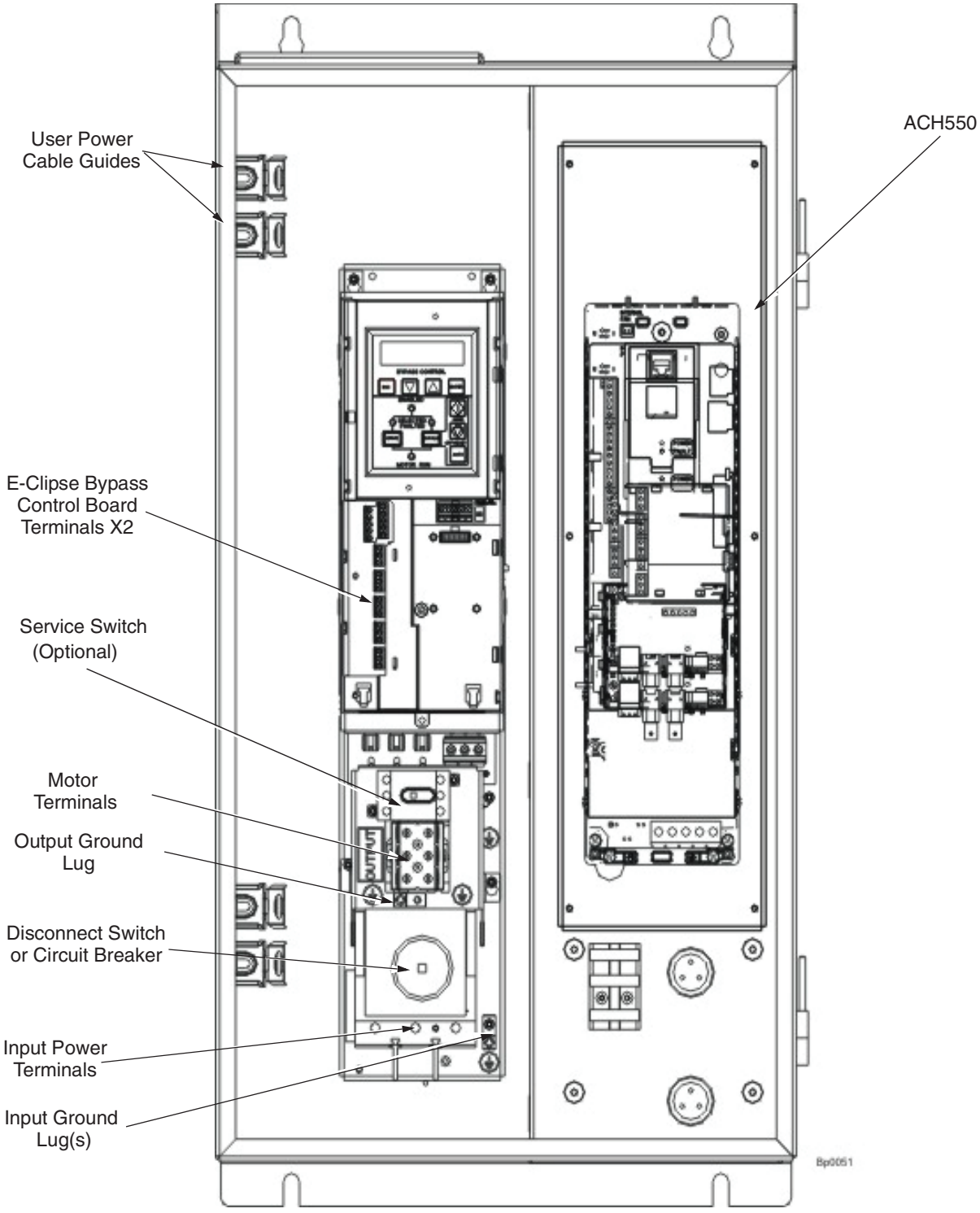
Connection diagrams – Vertical E-Clipse Bypass

ACH550 Vertical E-Clipse Bypass units are configured for wiring access from the bottom only. The following figure shows the Vertical E-Clipse Bypass wiring connection points.

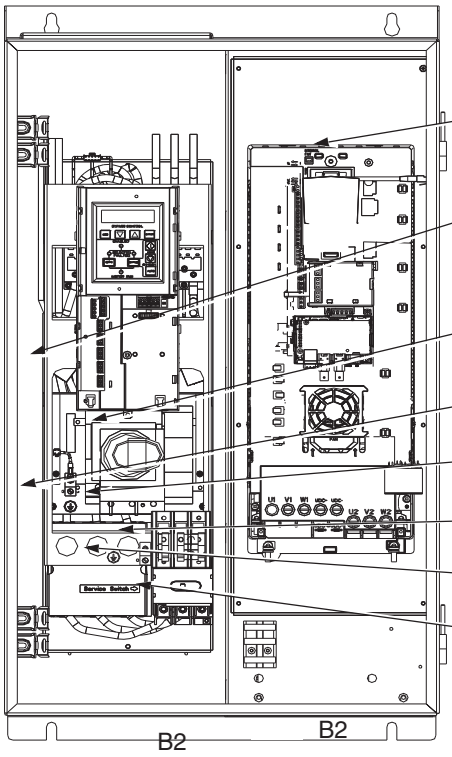


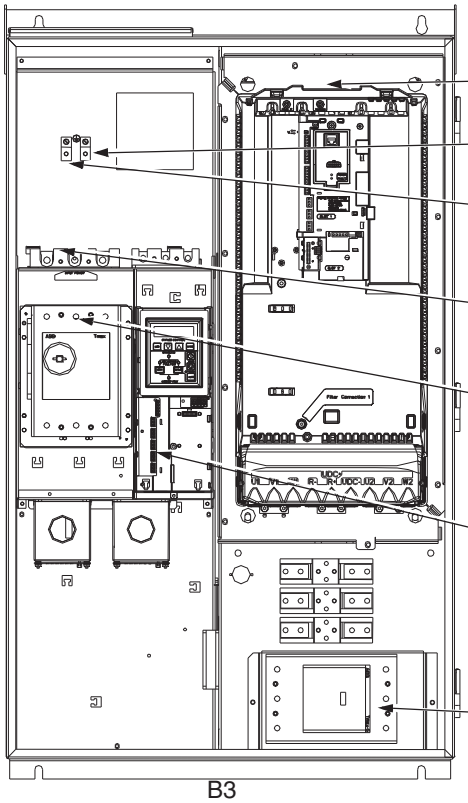
Connection diagrams – Standard E-Clipse Bypass (wall mounted)

ACH550 Standard E-Clipse Bypass units are configured for wiring access from the top. The following figure shows the Standard E-Clipse Bypass (wall mounted) wiring connection points.



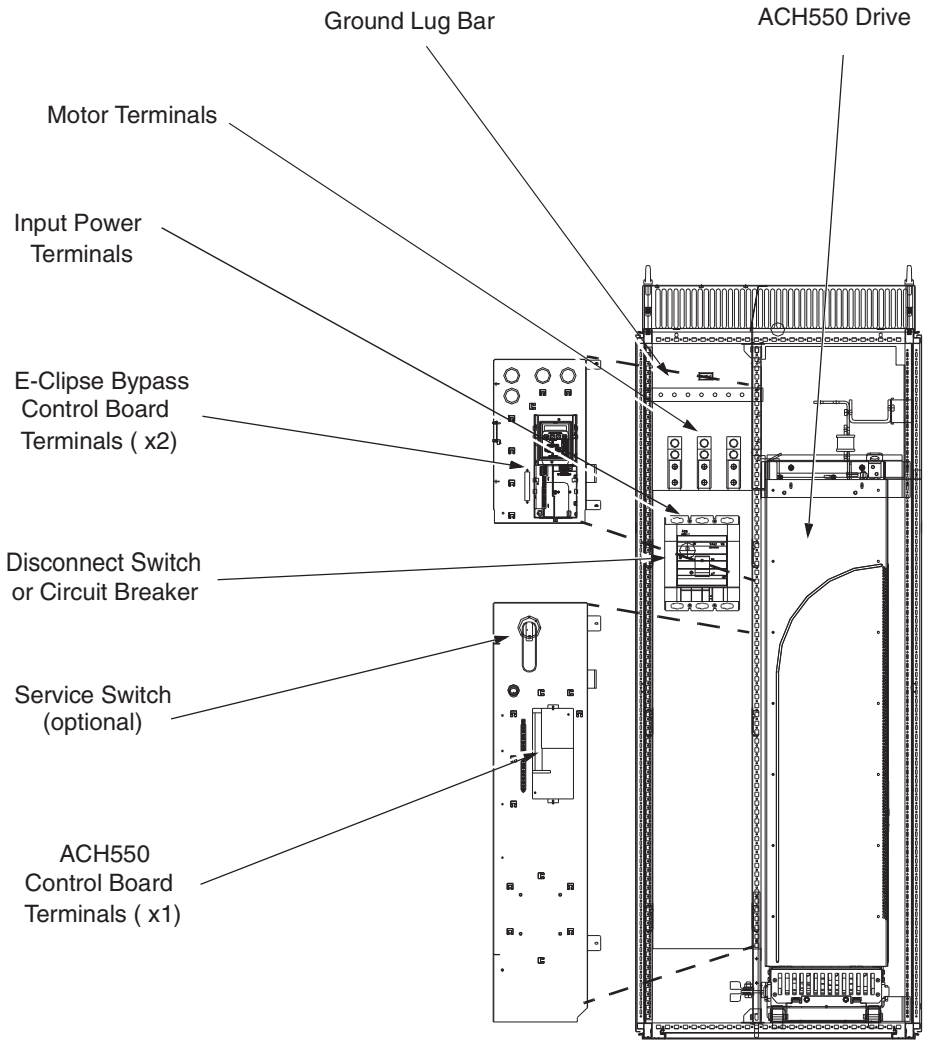
B1


User Power Cable Guides
ACH550 Drive
E-Clipse Bypass Control Board Terminals (X2)
Disconnect Switch or Circuit Breaker
Input Ground Lug
Input Power Terminals
Motor Terminals
Output Ground Lug
Service Switch (optional)
B2
B2


ACH550 Drive
Output Ground Lug
Input Ground Lug
Motor Terminals
Input Power Terminals
E-Clipse Bypass Control Board Terminals (X2)
Service Switch (optional)
B3

Connection diagrams – Standard E-Clipse Bypass (R8, floor mounted)

ACH550 Standard E-Clipse Bypass units are configured for wiring access from the top. The following figure shows the Standard E-Clipse Bypass (floor mounted) wiring connection points.



B4

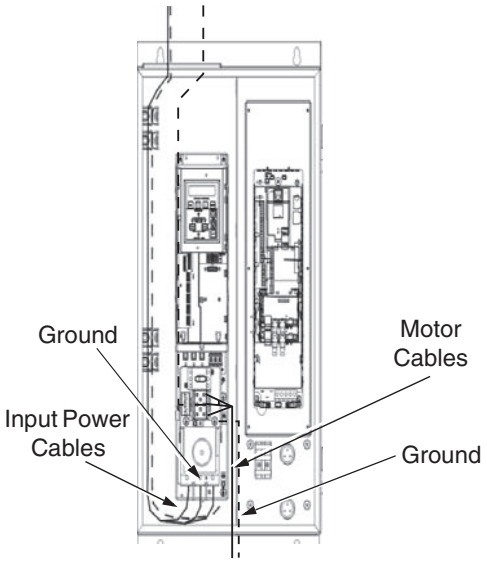
Power connections – Vertical E-Clipse Bypass configurations

Line input connections

Connect the input power to the terminals at the bottom of the disconnect switch or circuit breaker as shown below. Also see *Connection diagrams – Vertical E-Clipse Bypass* on page *40*. Connect the equipment grounding conductor to the ground lug near the input power connection point.

Motor connections

Connect the motor cables to the terminals at the bottom of the bypass section as shown in the figure. Also see *Connection diagrams – Vertical E-Clipse Bypass* on page *43*. Connect the motor grounding conductor to the ground lug near the motor cable terminal block connection point.



Power connections – Standard E-Clipse Bypass configurations (wall mounted)

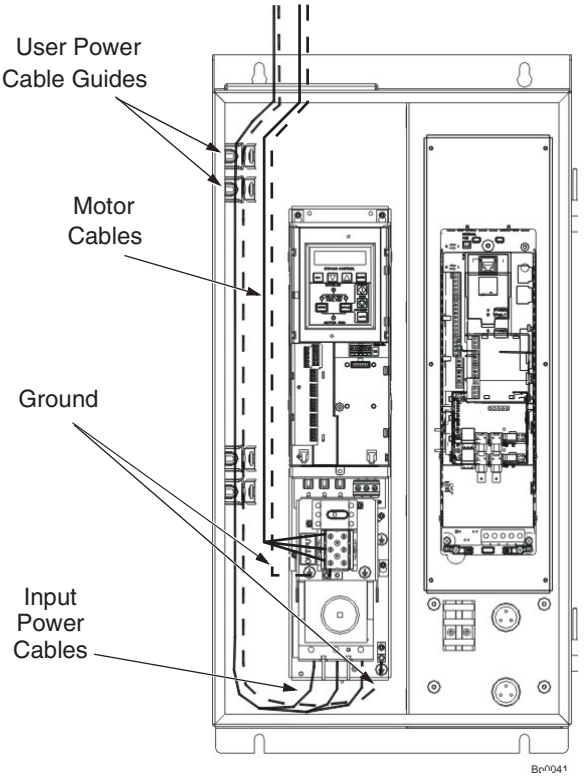
Line input connections

Connect input power to the terminals of the disconnect switch or circuit breaker. Connect the equipment grounding conductor to the ground lug at the top of the enclosure. The figure below shows the connection points for Standard E-Clipse Bypass configurations. Also see *Connection diagrams – Standard E-Clipse Bypass (wall mounted)* on page *41* and *Connection diagrams – Standard E-Clipse Bypass (R8, floor mounted)* on page *43*.

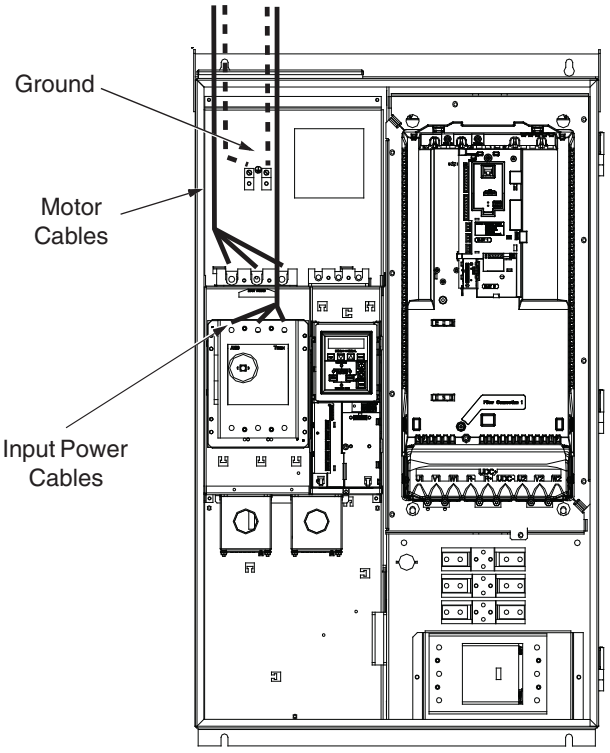
Motor connections

Connect the motor cables to the output terminal block as shown in the figure below. Also see *Connection diagrams – Standard E-Clipse Bypass (wall mounted)* on page *41* and *Connection diagrams – Standard E-Clipse Bypass (R8, floor mounted)* on page *43*. The motor grounding conductor can be connected to the ground lug near the terminal block.

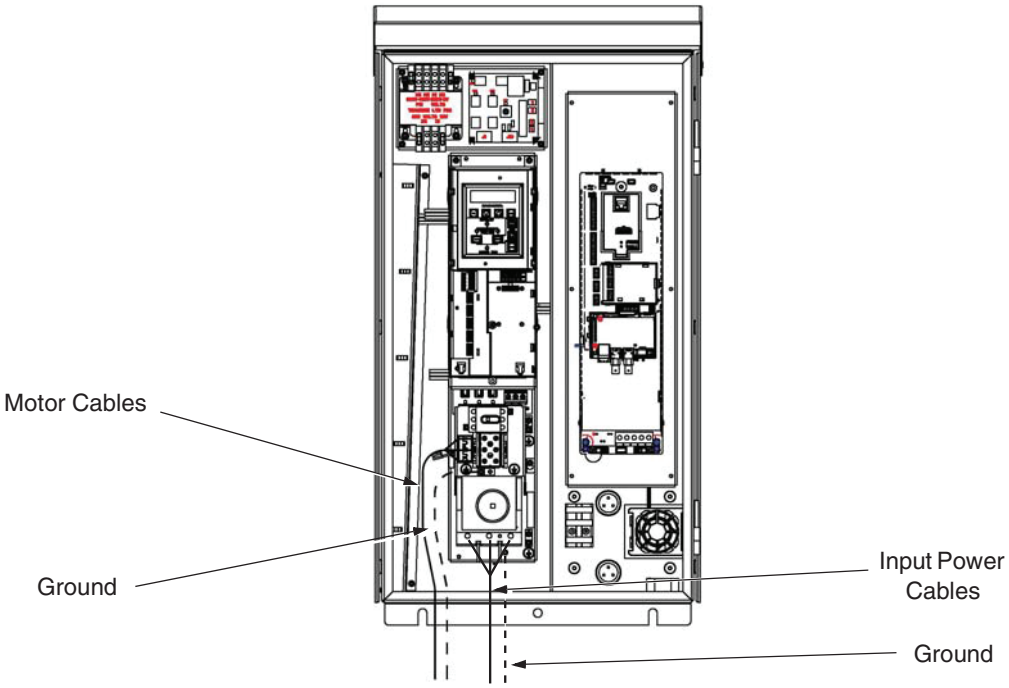
Note: Route cables through the cable guides on the left side of the enclosure. Use separate conduits for input power and motor cables. Follow the guides to separate the cables from each other.



Standard Configuration (B1/B2)



Standard Configuration (B3)



UL Type 3R Configuration (B1/B2)

Note: Type 3R enclosures are designed to be mounted on a wall. For 3R enclosure back plates which maintain 3R integrity when the enclosure is mounted on an open rack system, contact your ABB HVAC Drives Distributor.

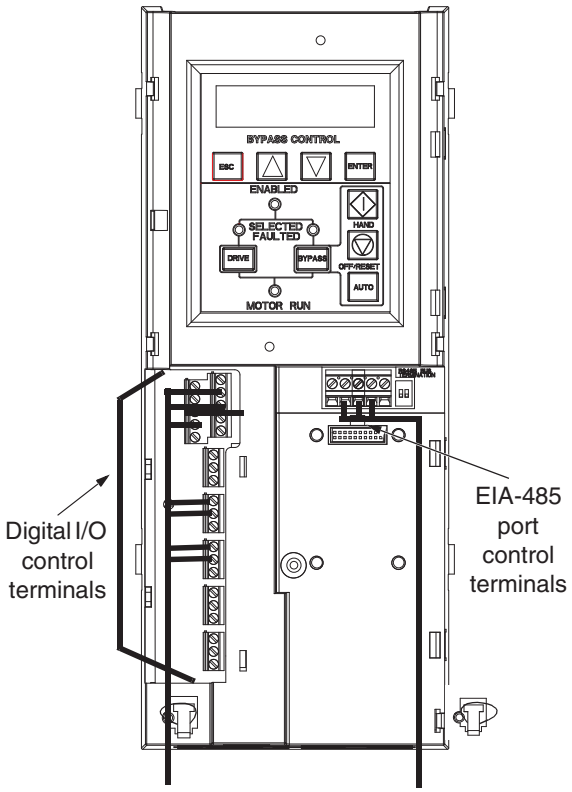
WARNING! Check the motor and motor wiring insulation before connecting the ACH550 to line power. Follow the procedure on page *12*. Before proceeding with the insulation resistance measurements, check that the ACH550 is disconnected from incoming line power. Failure to disconnect line power could result in death or serious injury.

Install the control wiring

Connect control wiring to terminal block X1 on the ACH550 control board and to terminal block X2 on the E-Clipse Bypass control board. For more information on these connections, refer to the following:

- X1 terminal block location and terminal data are defined in the *ACH550-UH User's Manual*.
- X2 terminal block location is illustrated in the figures starting with *Connection diagrams – Vertical E-Clipse Bypass* on page *40*.
- X2 terminal data are provided in *Basic control connections for E-Clipse HVAC Default* on page *52*.
- Basic connections are described in the following paragraphs. Alternate configurations using the E-Clipse Bypass macro are described in the *ACH550 User's Manual*.
- On Terminal Block X1 inside the ACH550, analog inputs and outputs and additional digital input and relay output connections (AI1, AI2, AO1, AO2, DI1…DI6 and RO1…RO6) are available for use.

Note: The E-Clipse Bypass control circuitry uses serial communications connections (X1:28…X1:32) inside the ACH550. These connections are not available for any other purpose and must not be reconfigured.



Basic connections

The figure on page *52* shows the basic control connections for use with the E-Clipse Bypass HVAC Default macro. These connections are described in the following paragraphs.

In typical installations, only analog input wires connect to the ACH550 terminal block, with other control connections made on the E-Clipse Bypass control board.

Use wire ties to permanently affix control/communications wiring to the hooked wire race tie points provided, maintaining a minimum 6 mm (1/4") spacing from power wiring.

Drive's power connection terminals

The following tables list power and motor cable terminal sizes for connections to an input circuit breaker or disconnect switch, a motor terminal block and ground lugs. The tables also list torque that should be applied when tightening the terminals.

Vertical enclosure terminals

<table>
<tr><th rowspan="2">HP</th><th rowspan="2">Identification</th><th rowspan="2">Frame Size</th><th colspan="4">Maximum Wire Size Capacities of Power Terminals</th></tr>
<tr><th>Circuit Breaker</th><th>Disconnect Switch</th><th>Motor Termination</th><th>Ground Lugs</th></tr>
<tr><td colspan="7">208…240 Volt</td></tr>
<tr><td>1</td><td>ACH550-VxR-04A6-2</td><td>R1</td><td rowspan="5">#10
35 in-lbs</td><td rowspan="5">#10
7 in-lbs</td><td rowspan="6">#6
30 in-lbs</td><td rowspan="6">#4
35 in-lbs</td></tr>
<tr><td>1.5</td><td>ACH550-VxR-06A6-2</td><td>R1</td></tr>
<tr><td>2</td><td>ACH550-VxR-07A5-2</td><td>R1</td></tr>
<tr><td>3</td><td>ACH550-VxR-012A-2</td><td>R1</td></tr>
<tr><td>5</td><td>ACH550-VxR-017A-2</td><td>R1</td></tr>
<tr><td>7.5</td><td>ACH550-VxR-024A-2</td><td>R2</td><td>#8
40 in-lbs</td><td rowspan="2">#8
7 in-lbs</td></tr>
<tr><td>10</td><td>ACH550-VxR-031A-2</td><td>R2</td><td rowspan="3">#2
50 in-lbs</td><td>#2
50 in-lbs</td><td rowspan="4">#2
50 in-lbs</td></tr>
<tr><td>15</td><td>ACH550-VxR-046A-2</td><td>R3</td><td>#4
18 in-lbs</td><td rowspan="3">#2/0
120 in-lbs</td></tr>
<tr><td>20</td><td>ACH550-VxR-059A-2</td><td>R3</td></tr>
<tr><td>25</td><td>ACH550-VxR-075A-2</td><td>R4</td><td>#1
50 in-lbs</td><td>#1
55 in-lbs</td></tr>
<tr><td colspan="7">380…480 Volt</td></tr>
<tr><td>1/1.5</td><td>ACH550-VxR-03A3-4</td><td>R1</td><td rowspan="5">#10
35 in-lbs</td><td rowspan="5">#10
7 in-lbs</td><td rowspan="6">#6
30 in-lbs</td><td rowspan="6">#4
35 in-lbs</td></tr>
<tr><td>2</td><td>ACH550-VxR-04A1-4</td><td>R1</td></tr>
<tr><td>3</td><td>ACH550-VxR-06A9-4</td><td>R1</td></tr>
<tr><td>5</td><td>ACH550-VxR-08A8-4</td><td>R1</td></tr>
<tr><td>7.5</td><td>ACH550-VxR-012A-4</td><td>R1</td></tr>
<tr><td>10</td><td>ACH550-VxR-015A-4</td><td>R2</td><td rowspan="2">#8
40 in-lbs</td><td rowspan="3">#8
7 in-lbs</td></tr>
<tr><td>15</td><td>ACH550-VxR-023A-4</td><td>R2</td></tr>
<tr><td>20</td><td>ACH550-VxR-031A-4</td><td>R3</td><td rowspan="3">#3
50 in-lbs</td><td rowspan="3">#2
50 in-lbs</td><td rowspan="6">#2
50 in-lbs</td></tr>
<tr><td>25</td><td>ACH550-VxR-038A-4</td><td>R3</td><td rowspan="3">#4
18 in-lbs</td></tr>
<tr><td>30</td><td>ACH550-VxR-045A-4</td><td>R3</td></tr>
<tr><td>40</td><td>ACH550-VxR-059A-4</td><td>R4</td><td rowspan="3">#1
50 in-lbs</td><td rowspan="3">#2/0
120 in-lbs</td></tr>
<tr><td>50</td><td>ACH550-VxR-072A-4</td><td>R4</td><td>#1
55 in-lbs</td></tr>
<tr><td>60</td><td>ACH550-VxR-078A-4</td><td>R4</td><td>#1
70 in-lbs</td></tr>
</table>

HP	Identification	Frame Size	Maximum Wire Size Capacities of Power Terminals			
			Circuit Breaker	Disconnect Switch	Motor Termination	Ground Lugs
500…600 Volt						
2	ACH550-VxR-02A7-6	R2	#8 62 in-lbs	#8 7 in-lbs	#6 30 in-lbs	#4 35 in-lbs
3	ACH550-VxR-03A9-6	R2				
5	ACH550-VxR-06A1-6	R2				
7.5	ACH550-VxR-09A0-6	R2				
10	ACH550-VxR-011A-6	R2				
15	ACH550-VxR-017A-6	R2				
20	ACH550-VxR-022A-6	R3	#4 62 in-lbs		#2 50 in-lbs	#2 50 in-lbs
25	ACH550-VxR-027A-6	R3				
30	ACH550-VxR-032A-6	R4	#1 62 in-lbs	#4 18 in-lbs	#2/0 120 in-lbs	
40	ACH550-VxR-041A-6	R4				
50	ACH550-VxR-052A-6	R4		#1 55 in-lbs		
60	ACH550-VxR-062A-6	R4		#1 70 in-lbs		

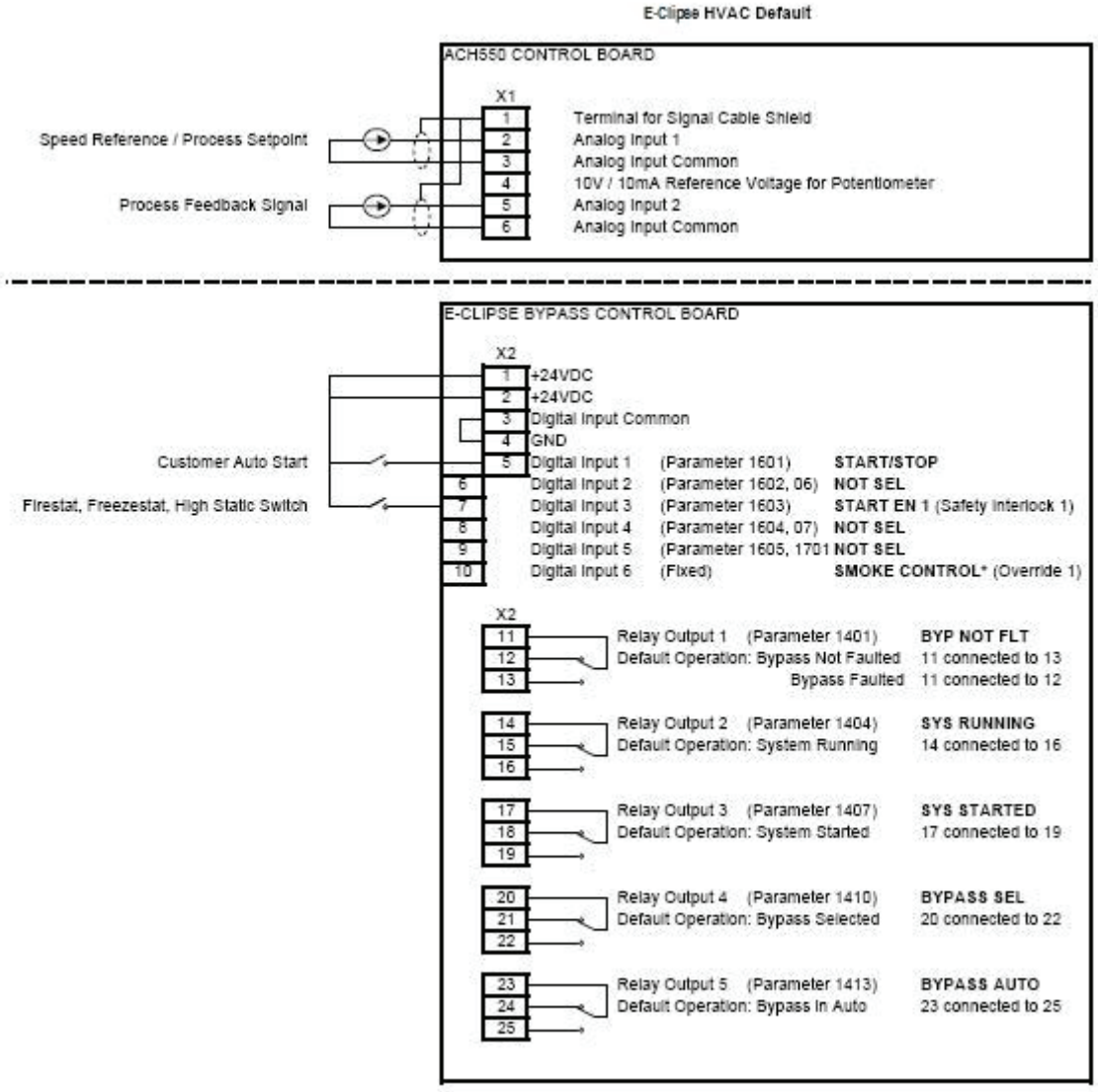
Standard enclosure terminals

HP	Identification	Frame Size	Maximum Wire Size Capacities of Power Terminals			
			Circuit Breaker	Disconnect Switch	Motor Termination	Ground Lugs
208…240 Volt						
1	ACH550-BxR-04A6-2	R1	#8 40 in-lbs	#8 7 in-lbs	#6 30 in-lbs	#4 35 in-lbs
1.5	ACH550-BxR-06A6-2	R1				
2	ACH550-BxR-07A5-2	R1				
3	ACH550-BxR-012A-2	R1				
5	ACH550-BxR-017A-2	R1				
7.5	ACH550-BxR-024A-2	R2				
10	ACH550-BxR-031A-2	R2/R3	#1 50 in-lbs		#2 50 in-lbs	#2 50 in-lbs
15	ACH550-BxR-046A-2	R3		#4 18 in-lbs	#2 120 in-lbs	
20	ACH550-BxR-059A-2	R3				
25	ACH550-BxR-075A-2	R4		#1 55 in-lbs		

HP	Identification	Frame Size	Maximum Wire Size Capacities of Power Terminals			
			Circuit Breaker	Disconnect Switch	Motor Termination	Ground Lugs
208…240 Volt, continued						
30	ACH550-BxR-088A-2	R4	350 MCM 274 in-lbs	#1/0 70 in-lbs	#1 53 in-lbs	3 x #3/0 250 in-lbs
40	ACH550-BxR-114A-2	R4		300 MCM 275 in-lbs	250 MCM 300 in-lbs	
50	ACH550-BxR-143A-2	R6				
60	ACH550-BxR-178A-2	R6			400 MCM 375 in-lbs	
75	ACH550-BxR-221A-2	R6	2 x 250 MCM 274 in-lbs	2 x 250 MCM 274 in-lbs	2 x 500 MCM 375 in-lbs	
100	ACH550-BxR-248A-2	R6				
380…480 Volt						
1/1.5	ACH550-BxR-03A3-4	R1	#8 40 in-lbs	#8 7 in-lbs	#6 30 in-lbs	#4 35 in-lbs
2	ACH550-BxR-04A1-4	R1				
3	ACH550-BxR-06A9-4	R1				
5	ACH550-BxR-08A8-4	R1				
7.5	ACH550-BxR-012A-4	R1				
10	ACH550-BxR-015A-4	R2				
15	ACH550-BxR-023A-4	R2				
20	ACH550-BxR-031A-4	R3	#1 50 in-lbs		#2 50 in-lbs	#2 50 in-lbs
25	ACH550-BxR-038A-4	R3		#4 18 in-lbs		
30	ACH550-BxR-045A-4	R3				
40	ACH550-BxR-059A-4	R4			#2/0 120 in-lbs	
50	ACH550-BxR-072A-4	R4		#1 55 in-lbs		
60	ACH550-BxR-078A-4	R4		#1 70 in-lbs		
75	ACH550-BxR-097A-4	R4	350 MCM 274 in-lbs	#1/0 70 in-lbs	#1 53 in-lbs	3 x #3/0 250 in-lbs
100	ACH550-BxR-125A-4	R5		300 MCM 275 in-lbs	250 MCM 300 in-lbs	
125	ACH550-BxR-157A-4	R6				
150	ACH550-BxR-180A-4	R6			400 MCM 375 in-lbs	
200	ACH550-BxR-246A-4	R6	2 x 250 MCM 274 in-lbs	2 x 250 MCM 274 in-lbs	2 x 500 MCM 375 in-lbs	
250	ACH550-BxR-316A-4	R8	2 x 500 MCM 274 in-lbs	2 x 500 MCM 275 in-lbs	2 x 600 MCM 500 in-lbs	5 Bus bar holes (13/32" bolts)
300	ACH550-BxR-368A-4	R8				
350	ACH550-BxR-414A-4	R8				
400	ACH550-BxR-486A-4	R8				

<table>
<tr><th rowspan="2">HP</th><th rowspan="2">Identification</th><th rowspan="2">Frame Size</th><th colspan="4">Maximum Wire Size Capacities of Power Terminals</th></tr>
<tr><th>Circuit Breaker</th><th>Disconnect Switch</th><th>Motor Termination</th><th>Ground Lugs</th></tr>
<tr><td colspan="7">500…600 Volt</td></tr>
<tr><td>2</td><td>ACH550-BxR-02A7-6</td><td>R2</td><td rowspan="6">#8
62 in-lbs</td><td rowspan="6">#8
7 in-lbs</td><td rowspan="6">#6
30 in-lbs</td><td rowspan="6">#4
35 in-lbs</td></tr>
<tr><td>3</td><td>ACH550-BxR-03A9-6</td><td>R2</td></tr>
<tr><td>5</td><td>ACH550-BxR-06A1-6</td><td>R2</td></tr>
<tr><td>7.5</td><td>ACH550-BxR-09A0-6</td><td>R2</td></tr>
<tr><td>10</td><td>ACH550-BxR-011A-6</td><td>R2</td></tr>
<tr><td>15</td><td>ACH550-BxR-017A-6</td><td>R2</td></tr>
<tr><td>20</td><td>ACH550-BxR-022A-6</td><td>R3</td><td rowspan="6">#1
62 in-lbs</td><td rowspan="2">#2
50 in-lbs</td><td rowspan="5">#2
50 in-lbs</td></tr>
<tr><td>25</td><td>ACH550-BxR-027A-6</td><td>R3</td></tr>
<tr><td>30</td><td>ACH550-BxR-032A-6</td><td>R4</td><td>#4
18 in-lbs</td><td rowspan="3">#2
120 in-lbs</td></tr>
<tr><td>40</td><td>ACH550-BxR-041A-6</td><td>R4</td></tr>
<tr><td>50</td><td>ACH550-BxR-052A-6</td><td>R4</td><td>#1
55 in-lbs</td></tr>
<tr><td>60</td><td>ACH550-BxR-062A-6</td><td>R4</td><td>#1
75 in-lbs</td></tr>
<tr><td>75</td><td>ACH550-BxR-077A-6</td><td>R6</td><td rowspan="4">300 MCM
274 in-lbs</td><td>#1/0
70 in-lbs</td><td>#1
53 in-lbs</td><td rowspan="4">3 x #3/0
250 in-lbs</td></tr>
<tr><td>100</td><td>ACH550-BxR-099A-6</td><td>R6</td></tr>
<tr><td>125</td><td>ACH550-BxR-125A-6</td><td>R6</td><td rowspan="2">300 MCM
275 in-lbs</td><td rowspan="2">250 MCM
300 in-lbs</td></tr>
<tr><td>150</td><td>ACH550-Bx-R144A-6</td><td>R6</td></tr>
</table>

Basic control connections for E-Clipse HVAC Default



Parameters Changed Relative to E-Clipse HVAC Default

Parameter Number	Description	Setting

* Smoke Control (Override1) is a fixed input. Closing Digital Input 6 **will** place the E-Clipse Bypass in Smoke Control mode which may reassign the function of the other Digital Inputs. Refer to the Smoke Control (Override1) documentation.

2. Check installation – bypass

Control panel settings and checks

Apply power to the E-Clipse Bypass unit. The ACH550 Control Panel should show the operating status of the drive. If the E-Clipse Bypass Control Panel displays a PHASE SEQ (Phase Sequence) fault, remove power, wait at least 5 minutes and then swap any two input phase wires. If the motor is a standard 208 V, 60 Hz motor connected to a 208 V drive or a 460 V, 60 Hz motor connected to a 480 V drive, the default parameter settings should be suitable for the initial tests described below. If the motor's rating is not 208 V or 460 V, 60 Hz, the MOTOR NOM VOLT and MOTOR NOM FREQ parameters will need to be properly set before proceeding. Refer to the *ACH550-UH User's Manual* and set the parameters as required.

Note: The settings for ALL external serial communication between the ACH550 with E-Clipse Bypass and any Building Automation System are configured using the E-Clipse Bypass operator panel. DO NOT attempt to configure the external serial communication connection using the ACH550 operator panel!

The settings for internal communication between the ACH550 and the E-Clipse Bypass are configured at the factory and require no adjustment.

Drive Link recovery procedure

If the ACH550 Drive communication settings are unintentionally changed during setup a "Drive Link Fault", "Drive Link Error" or "Drive Setup" alarm may be displayed. Should this occur, accomplish the following steps in order.

Using the ACH550 Drive Keypad

1. Set Parameter 9802 to "STD MODBUS"
2. Set Parameter 9902 to "E-CLIPSE"
3. Cycle Power

Following the above steps, in order, should restore proper communications between the ACH550 Drive and the E-Clipse Bypass. Should the E-Clipse Keypad continue to display a "Drive Link Fault", "Drive Link Error" or "Drive Setup" alarm, check the following parameter settings to ensure they have been recovered. If necessary, individually set the correct parameter settings as indicated below and cycle power.

The only ACH550 Drive macro that provides the proper configuration settings by default is the E-Clipse Bypass macro. If any other ACH550 Drive macro is used, that macro should be selected after completing the initial tests. When using any other macro the following ACH550 Drive parameter values must be set and power cycled or the E-Clipse Bypass will not function properly:

- Parameter 9802 must be set to "STD MODBUS"
- Parameter 1001 must be set to "Comm"
- Parameter 1002 must be set to "Comm"
- Parameter 1601 must be set to "Comm"

- Parameter 1608 must be set to “Comm”
- Parameter 5303 must be set to “76.8 kb/s”
- Parameter 5304 must be set to “8 EVEN 1”
- Parameter 5305 must be set to “DCU PROFILE”
- Parameter 5310 must be set to “103”
- Parameter 5311 must be set to “104”
- Power must be cycled

Refer to the *ACH550-UH User’s Manual* for additional information.

Note: Run motor from drive before attempting bypass operation.

System check: motor connected to ACH550 with E-Clipse Bypass

After performing the control panel checks and setting the ACH550 Drive Start-up Data parameters, check the operation of the ACH550 Drive with E-Clipse Bypass with the motor connected as follows:

1. Disconnect and lock out power to the E-Clipse Bypass unit, wait at least five minutes before disconnecting power.
2. Connect the motor to the output terminals.



CAUTION: If the Bypass Override (Override 2) input contact is closed, the motor will start across the line as soon as power is applied.

If the Safety Interlock and Run Enable input contacts are closed and the Smoke Control (Override 1) input contact is closed, the motor will start across the line as soon as power is applied.

If the Start/Stop, Safety Interlock and Run Enable input contacts are closed and the system is in the Bypass mode and in either Hand or Auto, the motor will start across the line as soon as power is applied.

If the Start/Stop, Safety Interlock and Run Enable input contacts are closed and the system is in the Drive mode with the drive in either Hand or Auto mode, the motor will start on the drive as soon as power is applied.

In order to prevent the motor from starting, the system should be in the Drive mode and the drive should be OFF when the power is disconnected at the end of the previous series of control panel settings and checks.

In order to prevent the motor from running without disconnecting the motor, open the Run Enable and Safety Interlock contacts on bypass control board terminals X2:2, X2:3 and X2:4 before applying power. Set the bypass to Drive mode and the drive to OFF.

---

3. Apply power to the E-Clipse Bypass unit. The ACH550 Control Panel display should be illuminated. On the bypass control panel, both the display and Enabled LED should be illuminated. If the Enabled LED is not illuminated solid green, check to see that closed contacts or jumpers connect terminal X2:3 to X2:4 and X2:2 to X2:7 on the bypass control board.
4. The Drive Selected LED should be illuminated. If not, press the Drive Select key to switch to Drive mode. Leave the system in the Drive mode when proceeding to the next step.
5. Press the Hand key on the ACH550 Control Panel. Press and hold the UP key until the motor just starts rotating.

Note: If the ACH550 Control Panel displays an OVERCURRENT or EARTH FAULT, disconnect and lock out power to the E-Clipse Bypass unit. Wait at least 5 minutes. Disconnect the motor leads from the E-Clipse Bypass unit and Megger each motor lead to ground to determine if the motor is good. Check the power leads from the Drive / Bypass to the motor for damaged or improper wiring. If the ACH550 Control Panel displays any other drive faults, correct the fault condition before proceeding to the next step.



CAUTION: Check motor rotation direction as soon as the motor begins to move. If motor does not rotate in the correct direction, shut down the drive, disconnect and lock out power to the drive and wait five minutes. Swap any two motor output wires (T1, T2, and T3). Incorrect motor rotation direction may cause equipment damage.

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6. Increase the speed to 60 Hz or the highest safe operating speed.
7. Press the OFF key on the drive control panel. The motor should stop.

   If the drive does not operate according to these steps, refer to the ACH550-UH User's Manual.

   If the drive operates according to these steps, your ACH550 with E-Clipse Bypass is ready to use with preset or modified macro settings.

Note: The settings for ALL external serial communication between the ACH550 with E-Clipse Bypass and any Building Automation System are configured using the E-Clipse Bypass operator panel. DO NOT attempt to configure the external serial communication connection using the ACH550 operator panel!

The settings for internal communication between the ACH550 and the E-Clipse Bypass are configured at the factory and require no adjustment.

Note: Both the ACH550 Drive and the E-Clipse Bypass include preset application macros. The only ACH550 Drive macro that provides the proper configuration settings by default is the *E-Clipse HVAC Default macro* (9902 = 15). If any other ACH550 drive macro or any modified setting of the *E-Clipse HVAC Default macro* is used the following ACH550 Drive parameter values must be set and power cycled or the E-Clipse Bypass will not function properly:

- Parameter 9802 must be set to “STD MODBUS”
- Parameter 1001 must be set to “Comm”
- Parameter 1002 must be set to “Comm”
- Parameter 1601 must be set to “Comm”
- Parameter 1608 must be set to “Comm”
- Parameter 5303 must be set to “76.8 kb/s”
- Parameter 5304 must be set to “8 EVEN 1”
- Parameter 5305 must be set to “DCU PROFILE”
- Parameter 5310 must be set to “103”
- Parameter 5311 must be set to “104”
- Power must be cycled

Refer to the *ACH550-UH User’s Manual* for programming instructions.

Note: Run motor from drive before attempting bypass operation.

System check: motor disconnected from the ACH550 with E-Clipse Bypass

If you are familiar with the E-Clipse Bypass operation, you may skip the following section. Otherwise, after performing the system checks and setting the ACH550 Drive Start-up Data parameters, become familiar with the operation of the ACH550 Drive with E-Clipse Bypass without the motor connected as follows:

1. Disconnect and lock out power to the E-Clipse Bypass unit, wait at least five minutes after disconnecting power.
2. Disconnect the motor from the E-Clipse Bypass unit.
3. Apply power to the E-Clipse Bypass unit by turning on the branch circuit disconnect device and the bypass disconnect switch or circuit breaker.
4. The ACH550 Control Panel display should be illuminated. On the E-Clipse Bypass control panel, both the display and *Enabled* LED should be illuminated. If the *Enabled* LED is not illuminated solid green, check to see that closed contacts or jumpers connect terminal X2:3 to X2:4 and X2:2 to X2:7 on the bypass control board.

5. On the E-Clipse Bypass control panel, either the *Drive Selected* or *Bypass Selected* LED should be illuminated. Pressing the *Drive Select* or *Bypass Select* key should switch the bypass back and forth between the *Drive* mode and the *Bypass* mode as indicated by the LEDs above each button. Check that the bypass control panel switches the system between modes. Leave the system in the Bypass mode when proceeding to the next step.
6. Check to see that pressing the:
   - *Auto* key on the bypass control panel causes the bottom line on the E-Clipse Bypass display to indicate "*Bypass in Auto*"
   - Hand key on the bypass control panel generates a Motor Phase Fault.
   - Under normal conditions (motor connected) pressing the Hand key on the bypass control panel causes the bottom line on the E-Clipse Bypass display to indicate "Hand #A Run"
   - OFF key on the bypass control panel causes the bottom line on the E-Clipse Bypass display to indicate "Off Stop"
7. For Steps 8 through 14, ACH550 Drive Parameter 9904 must be set to "Scalar: Freq". After successful completion of Step 13, Parameter 9904 may be set to "Vector: Speed" if very specific application requirements make it necessary to use this type of motor control. Operation using the "Vector: Speed" setting is unnecessary for control of almost all fan and pump applications. Refer to the *ACH550-UH User's Manual* for details on setting parameters.
8. Press the *Drive Select* key on the E-Clipse Bypass control panel. The *Drive Select* LED should be illuminated.
9. Check to see that pressing the:
   - *Auto* key on the bypass control panel causes the E-Clipse Bypass display to indicate "*Bypass in Auto*"
   - *Hand* key on the bypass control panel causes no change to the E-Clipse Bypass display
   - *OFF* key on the bypass control panel causes the E-Clipse Bypass display to indicate "*Bypass in Off"*
10. Press the *HAND* key on the drive control panel. Note that the top line of the control panel display indicates "HAND" and run as a clockwise rotating arrow. The *Drive Run* LED on the E-Clipse Bypass control panel should be illuminated.
11. Press the *UP* arrow on the drive control panel. Note that the speed reference indication in the top line of the drive control panel display increases from "0.0% SP."
12. In the middle line of the drive control panel display, the output current indication should indicate "0.0 A."
13. Press the *DOWN* arrow on the drive control panel until the speed and frequency indications return to "0.0."
14. Press the *OFF* key on the drive control panel. Note that the bottom line of the drive contol panel display indicates "Off."

If the ACH550 Drive and E-Clipse Bypass operate according to these steps, and you have familiarized yourself with their operation, disconnect and lock out power to prepare for the next test.

WARNING! Wait at least five minutes after disconnecting power from the drive before you attempt to service the drive. Bus capacitors in the intermediate DC circuit must discharge before servicing the drive. Using a meter rated for 1000 VDC, check for zero volts at:

- Terminals BRK+ to GND and BRK- to GND (frame size R1/R2)
- Terminals UC+ and UC- (frame size R3…R8).

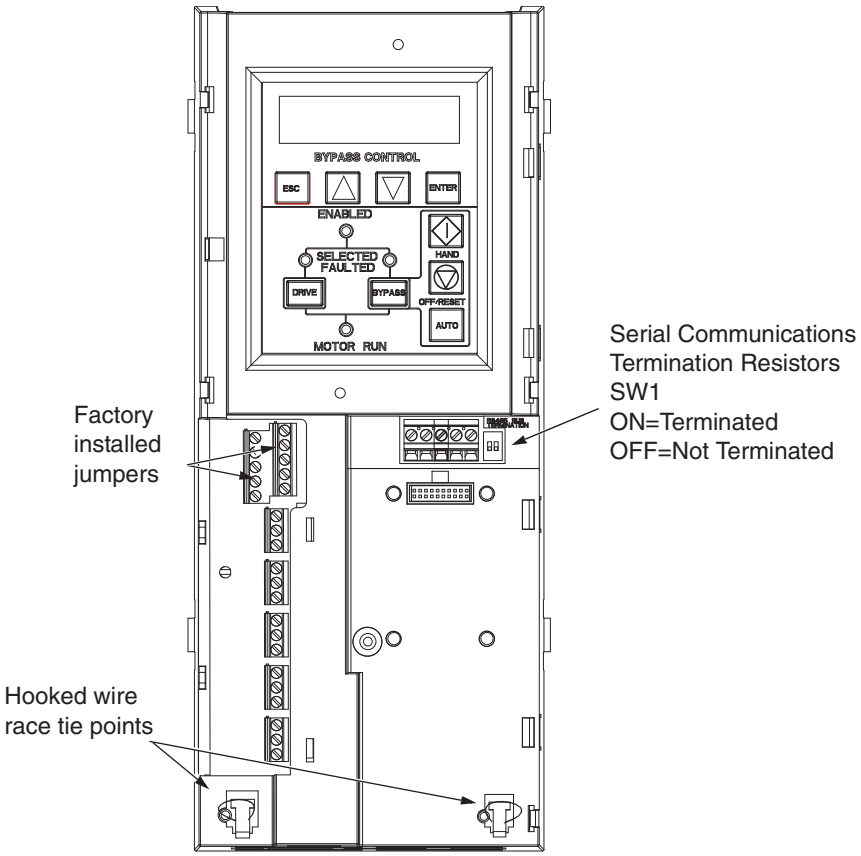
If the drive does not operate according to these steps, refer to the ACH550-UH User's Manual.

3. Check jumpers and switches

The settings described in this section are factory set and, for most situations, do not require adjustment. However, it is a good practice to review these settings to confirm that they are appropriate for the configuration installed.

Jumper and switch locations

The figure below shows the locations of the SW1 DIP switch on the E-Clipse Bypass control board. The function and setting of this switch is explained in the following paragraph.



DIP switch settings

The DIP switch is used to configure the serial communications termination resistors.

To reduce noise on the serial communications network, terminate the EIA-485 network using 120 ohm resistors at both ends of the network. Use the DIP switches to connect or disconnect the on-board termination resistors. Both switches must be positioned in the ON or OFF position to correctly configure the termination resistors.

Note: When using embedded protocols, set SW1 in the OFF position.

Circuit breaker settings

On some ACH550 E-Clipse Bypasses, the circuit breaker has adjustable settings for instantaneous current protection. The factory default settings are practical for most applications. Refer to the “ABB SACE Instruction Sheet” (supplied with these units) for additional information on the adjustment of these settings.

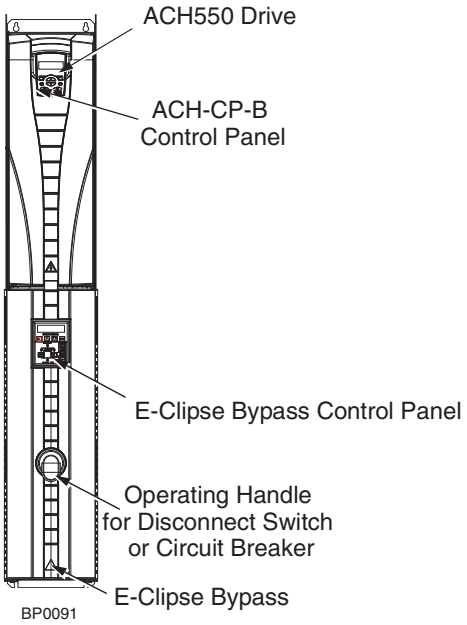
Operation

E-Clipse bypass configurations

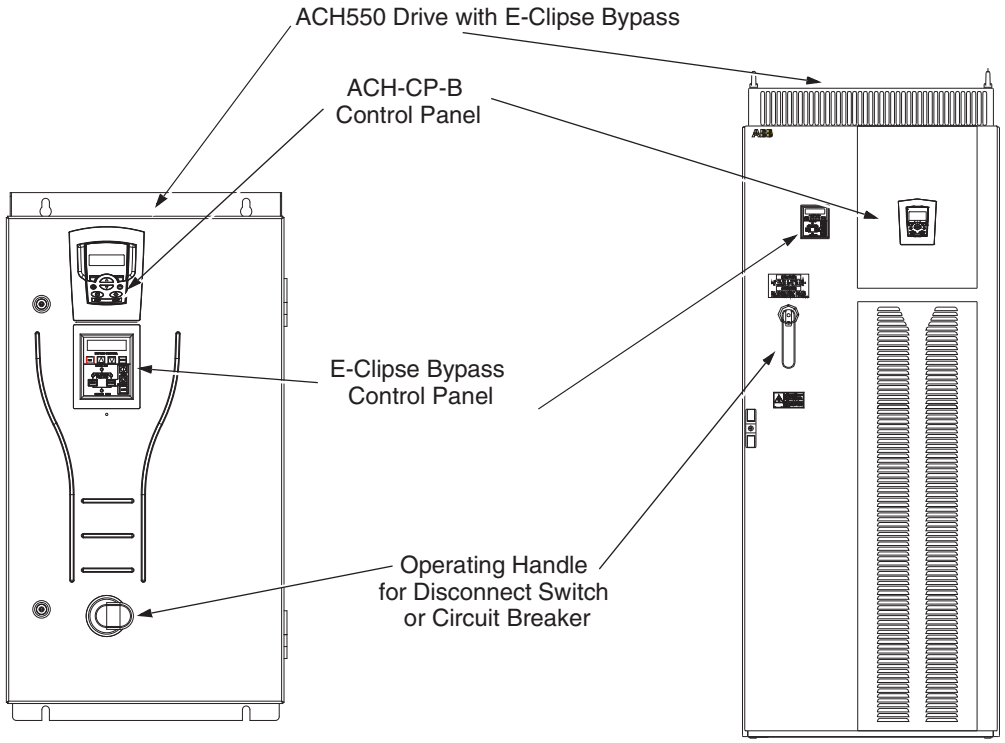
The ACH550 with E-Clipse Bypass is an ACH550 AC adjustable frequency drive in an integrated UL type 1, UL type 12 or UL type 3R package with a bypass motor starter. The ACH550 with E-Clipse Bypass provides:

- Disconnect switch or circuit breaker with door mounted control lever. The lever can be padlocked in the OFF position (padlock not supplied).
- Bypass starter.
- Motor overload protection.
- Local operator panel with indicating lights and multifunction display.
- Provisions for external control connections.
- Embedded communications for major BMS protocols including BACnet, Johnson Controls International N2, Siemens Building Technologies FLN, and Modbus
- Optional fieldbus adapters for connection to additional BMS protocols including LonWorks and Ethernet
- Optional drive service switch (drive input disconnect), the functional equivalent of a three-contactor bypass arrangement.

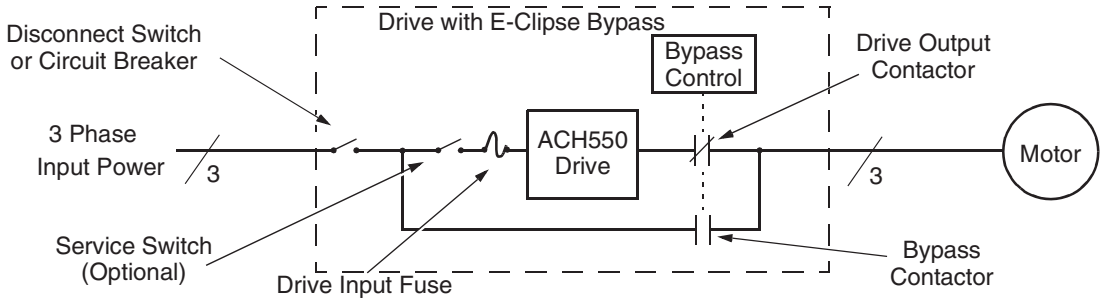
The following shows the front view of the ACH550 E-Clipse Bypass vertical configuration, and identifies the major components.



The following shows the front view of the ACH550 E-Clipse Bypass standard configurations, and identifies the major components.

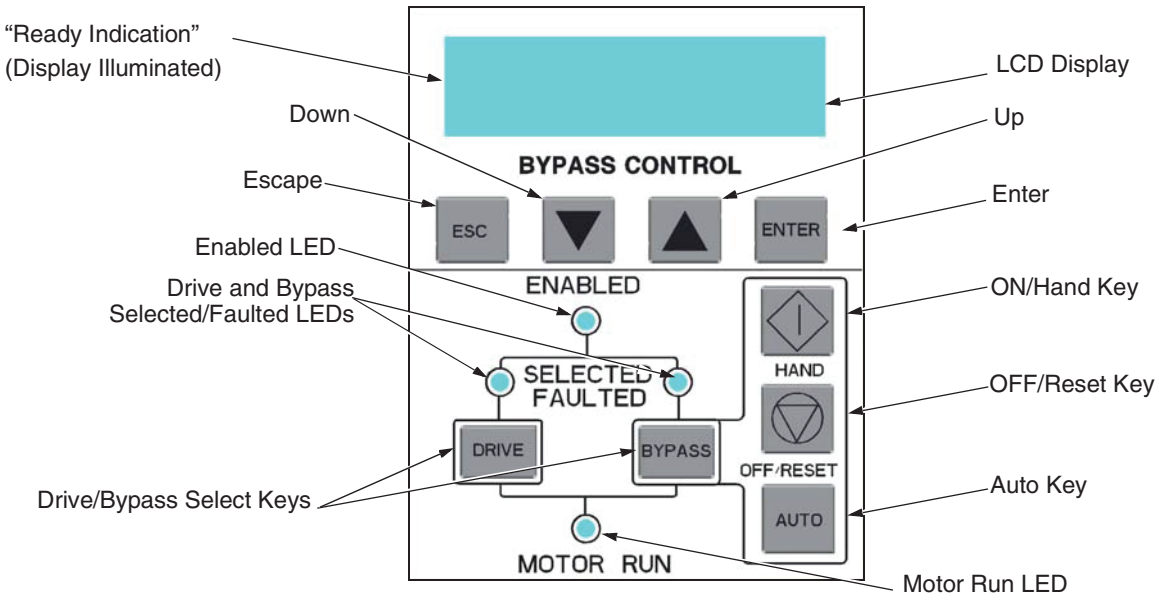


The following is a typical power diagram.



Bypass control

The bypass control panel features:



Ready (Power On) Indication

The *Ready (Power On) indication* is provided by the bypass control panel. The bypass control panel display will be illuminated and text will be displayed when the disconnect switch or circuit breaker is closed and control power is applied to the bypass.

Enabled LED

The *Enabled LED* is illuminated green under the following conditions:

- Both the Safety Interlock(s) and Run Enable contacts are closed.
- The Safety Interlock contact(s) are closed with no Start command present.

The Enabled LED flashes green if the Run Enable contact is open and when the Safety Interlock contact(s) are closed and a Start command is present.

The Enabled LED is illuminated red when the Safety Interlock contact(s) are open.

Motor Run LED

The *Motor Run LED* is illuminated green when the motor is running in either bypass mode or in drive mode. The Motor Run LED flashes green to indicate the system has been placed in an Override condition.

Bypass Faulted LED

The *Bypass Faulted LED* is illuminated or flashes red when the motor or bypass protection functions have shut down the bypass. The specific nature of the fault is indicated on the bypass control display. Refer to the *Diagnostics* section of this manual for more details.

Drive Selected LED

The *Drive Selected LED* is illuminated green when the drive has been selected as the power source for the motor and no drive fault is present.

Bypass Selected LED

The *Bypass Selected LED* is illuminated or flashes green when the bypass has been selected as the power source for the motor and no bypass fault is present.

Drive Faulted LED

The *Drive Faulted LED* is illuminated red when the bypass has lost its communications link with the drive or when the motor or drive protection functions have shut down the drive. The specific nature of the fault is indicated on the drive control panel display. Refer to the *Diagnostics* section on page *65* of the ACH550-UH User's Manual for more details.

Automatic Transfer

The *Automatic Transfer* indication is provided on the bypass control panel. The bypass control display will continuously flash an alarm to indicate the system has automatically transferred to Bypass after a Drive fault. The Bypass Selected LED flashes green when the system has automatically transferred to bypass operation. The bypass event log will also record this event.

Auto Indication

The *Auto Indication* is provided on the bypass control panel default display when the bypass control panel Auto key is pressed. Normally this indicates that the Auto Start contact or serial communications has been selected as the means for starting and stopping the motor in the bypass mode.

Off Indication

The *Off Indication* is provided on the bypass control panel default display when bypass control panel Off key is pressed.

Hand Indication

The *Hand Indication* is provided on the bypass control panel default display when the motor has been started manually in the bypass mode.

Drive Select Key

The *Drive Select Key* selects the drive as the power source for the motor.

Bypass Select Key

The *Bypass Select Key* selects the bypass as the power source for the motor.

Off/Reset Key

The *Off/Reset Key* may be used to manually stop the motor if the motor has been running on bypass power. The Off/Reset key also resets most bypass faults. It may take several minutes before the bypass can be reset after an overload trip. If a bypass fault condition is present the second press of this key places the bypass in the OFF mode.

Auto Key

The *Auto Key* selects the Auto Start contact or serial communications as the means for starting and stopping the motor in the bypass mode.

Hand Key

The *Hand Key* can be used to manually start the motor when the bypass has been selected as the power source for the motor.

Bypass control panel modes

The HVAC Bypass Control Panel has several different modes for configuring, operating and diagnosing the bypass. Select MENU and use the UP/DOWN buttons to select modes. The modes are:

- Default Display mode – Provides (HAND/OFF/AUTO) indication of the bypass operating control mode.
- Bypass Status mode – Provides status indications of the current system operating conditions.
- Start-Up Parameter Mode – Provides a list of parameters or operating conditions that may be configured or viewed during startup.
- Parameter List mode – Used to edit parameter values individually.
- Changed Parameter mode – Displays changed parameters.
- Bypass Fault Display mode – If there is an active bypass fault, the control panel will flash the fault number and fault diagnostic indication in English.
- Bypass Alarm Display mode – If there is an active bypass alarm, the control panel will flash the alarm number and alarm diagnostic indication in English.

Start-up by changing the parameters from the start-up list

To change the parameters, follow these steps:

1	The **Default Display** indicates the **Bypass Control** mode.		DRIVE SELECTED BYPASS IN OFF
2	Press **ENTER** to enter the **Main Menu.**	ENTER	*BYPASS STATUS STARTUP PARAMS

3	Select the **Startup Params** with the **Up/Down** arrows and press **ENTER**.		BYPASS STATUS *STARTUP PARAMS
4	Select the appropriate **Parameter** with the **Up/Down** arrows and press **ENTER**.		*1601 START/STOP 1613 BP DISABLE
5	Press the **Up/Down** arrows to change the **Parameter Value**.		1601 START/STOP [1:DI1]
6	Press **ENTER** to store the modified value or press **ESC** to leave the **Parameter Edit** mode.	ENTER or ESC	*1601 START/STOP 1613 BP DISABLE
7	Press **ESC** to return to the **Main Menu**, and again to return to the. **Default Display**.	ESC	DRIVE SELECTED BYPASS IN OFF

Start-up by changing the parameters individually from the parameter list

To change the parameters, follow these steps:

1	The **Default Display** indicates the **Bypass Control** mode.		DRIVE SELECTED BYPASS IN OFF
2	Press **ENTER** to enter the **Main Menu.**	ENTER	*BYPASS STATUS STARTUP PARAMS
3	Select the **Parameter List** with the **Up/Down** arrows and press **ENTER**.		STARTUP PARAMS *PARAMETER LIST
4	Select the appropriate **Parameter Group** with the **Up/Down** arrows and press **ENTER**.		14 RELAY OUT *16 SYSTEM CTRL
5	Select the appropriate **Parameter** in a group with the **Up/Down** arrows and press **ENTER**.		*1601 START/STOP 1602 RUN ENABLE
6	Press the **Up/Down** arrows to change the **Parameter Value**.		1601 START/STOP [1:DI1]
7	Press **ENTER** to store the modified value or press **ESC** to leave the **Parameter Edit** mode.	ENTER or ESC	*1601 START/STOP 1602 RUN ENABLE
8	Press **ESC** to return to the listing of **Parameter Groups**, and again to return to the **Main Menu**.	ESC ESC	*16 SYSTEM CTRL 17 OVERRIDE

9	Press **ESC** to return to the **Default Display** from the **Main Menu.**	ESC	DRIVE SELECTED BYPASS IN OFF

Note: In the Parameter Edit mode the current parameter value appears below the parameter name.

Note: To view the default parameter value, press the **Up/Down** arrows simultaneously. Press **Enter** to restore the default parameter value or press **ESC** to leave the **Parameter Edit** mode.

Diagnostics

Fault listing

Fault Code	Fault Name In Panel	Fault	Possible Cause	Corrective Action
3001	COIL CURR FBK	RBCU is sensing abnormal current feedback when neither contactor should be energized	Defective component on RBCU	Change RBCU
3002	BYP CNTACT STUCK	M2 contactor indicates it is not prepared to move on a power up check of the contactor or after contact is commanded to open	Defective Contactor Defective RBCU	Disconnect incoming power from unit Check if contactor armature moves freely. If armature moves freely, then change the RBCU. If armature does not move freely, then change individual contactor (M2) or the complete assembly (RCSA-0x)
3003	DRV CNTACT STUCK	M1 contactor indicates it is not prepared to move on a power up check of the contactor or after contact is commanded to open	Defective Contactor Defective RBCU	Disconnect incoming power from unit Check if contactor armature moves freely. If armature moves freely, then change the RBCU. If armature does not move freely, then change individual contactor (M1) or the complete assembly (RCSA-0x)

Fault Code	Fault Name In Panel	Fault	Possible Cause	Corrective Action
3004	BYPASS COIL OPEN	M2 contactor will not close when commanded to do so	Loose J8 connector on RBCU Loose wires on contactor terminals A1 and/or A2 Bad Output on RBCU Bad Contactor	Verify that J8 connector is firmly seated. With incoming power disconnected, check for tightness of A1 and A2 terminals Swap RBCU Change Contactor/ Assembly
3005	DRIVE COIL OPEN	M1 contactor will not close when commanded to do so	Loose J8 connector on RBCU Loose wires on contactor terminals A1 and/or A2 Bad Output on RBCU Bad Contactor	Verify that J8 connector is firmly seated. With incoming power disconnected, check for tightness of A1 and A2 terminals Swap RBCU Change Contactor/ Assembly
3006	UNDERVOLTAGE	Message only occurs if drive is controlling the motor and the power to the bypass is removed before the drive phases back. Message will appear in the fault log. This message will only appear when drive contactor opens when drive is operating	Loose J7 connector on RBCU unit Loose input wiring Incoming power problems	Check that J7 connector is firmly seated in RBCU Check tightness of incoming connections Check Parameter 0413 to view voltage level at time of trip Check upstream protection
3008	DRIVE AI2 LOSS	Only displayed when in Supervisory mode. Indicates that AI2 on the drive has failed.	Check ACH550 manual for AI2 loss	Check ACH550 manual for AI2 loss
3009	MTR OVERLOAD	Bypass opens on motor overload conditions defined in the drive	Drive Mode: Bad Motor Bad CT's Bad RBCU Bypass mode: Bad motor Bad CT's Bad RBCU Either mode: low input voltage	Check if overload condition exists Drive Mode: Refer to 550 manual for proper troubleshooting techniques Bypass Mode: Check that J2 connector is firmly seated in RBCU Use clamp meter to verify mtr current vs. display in parameter 0101 Check input voltage

Fault Code	Fault Name In Panel	Fault	Possible Cause	Corrective Action
3010	INP PHASE A LOSS	Fault will be generated only when trying to close the bypass contactor and the RBCU does not sense voltage on Phase A	Loose J7 connector Loose wiring on Contactor assembly. Blown upstream fuse	Check J7 connector Check yellow wire on input block Check incoming voltage, phase to ground
3011	INP PHASE B LOSS	Fault will be generated only when trying to close the bypass contactor and the RBCU does not sense voltage on Phase B	Loose J7 connector Loose wiring on Contactor assembly. Blown upstream fuse	Check J7 connector Check black wire on input block Check incoming voltage, phase to ground
3012	INP PHASE C LOSS	Fault will be generated only when trying to close the bypass contactor and the RBCU does not senses voltage on Phase C	Loose J7 connector Loose wiring on Contactor assembly. Blown upstream fuse	Check J7 connector Check red on input block Check incoming voltage, phase to ground
3013	DRIVE 1ST START	Fault generated if attempting to close the bypass contactor with out running the bypass in drive mode first.	NA	Run bypass unit in drive mode before attempting bypass mode
3014	COIL POW SUPPLY	Coil power supply has failed to reach rated voltage	Internal failure on RBCU unit Shorted contactor coil	Cycle power on bypass unit. If contactor coil is shorted, fault 3023 or 3024 will be generated. If 3023 or 3024 is generated, replace respective contactor If 3023 or 3024 is not generated on power up, replace RBCU unit.
3016	EARTH FAULT	Declared if attempting to close the bypass contactor when the drive has earth fault declared	Earth fault in motor	Refer to the fault code 16 on page 25.

Fault Code	Fault Name In Panel	Fault	Possible Cause	Corrective Action
3017	MTR UNDERLOAD	If motor power(%) level falls below minimum power level establish in parameter 3003 for the time (s) set in parameter 3002 fault will be generated. Parameter 3003 is a percentage of motor power as defined in the drive via parameter 9909. Fault only applies to bypass mode	Broken belt	Check load Reset bypass keypad Check fault code 17 on page 25, for further action
3018	MAX CYCLE FAULT	Supervisory Mode only. Declared if bypass contactor is closed by supervisory control 16 times within a 1 hour period.	High and low levels of hysteresis band are too tight	Check parameters 3202-3205. Increase time delays on parameters 3204 and 3205
3019	DRIVE LINK FAULT	Supervisory Mode Only. Fault generated if RS-485 link between drive and bypass stops communicating.	Bad cable/connection between drive and bypass. Communication improperly set in drive Parameter 9802. Application Macro improperly set in drive parameter 9902.	Proper seating of cable in drive and RBCU(connector J3) Check drive parameter 9802 (Modbus) and 9902 (E-Clipse) Check drive Group 53 Follow DriveLink recovery procedure
3020	PHASE SEQ	Sequence of 3 phase voltage input is such that bypass operation will result in motor rotation opposite of drive forward operation.	Phase sequence unknown at time of wiring	Swap any two of the three input wires to the bypass unit
3021	PH A CURR FBK	Fault is generated when current in Phase A is detected and the bypass contactor is open	Loose CT connection Bad RBCU Bad CT	Check J2 connector for proper seating Check connector on Current Assembly Replace RBCU Replace RCSA unit
3022	PH C CURR FBK	Fault is generated when current in Phase C is detected and the bypass contactor is open	Loose CT connection Bad RBCU Bad CT	Check J2 connector for proper seating Check connector on Current Assembly Replace RBCU Replace RCSA unit

Fault Code	Fault Name In Panel	Fault	Possible Cause	Corrective Action
3023	BYP COIL SHORTED	Coil characteristics are checked only on power up and coil current is greater than allowable values	Shorted contactor coil Shorted/damaged cable Bad RBCU	Replace RBCU Replace RCSA unit
3024	DRV COIL SHORTED	Coil characteristics are checked only on power up and coil current is greater than allowable values	Shorted contactor coil Shorted/damaged cable Bad RBCU	Replace RBCU Replace RCSA unit
3027	INVALID SUB ASM	Contactor assembly as recorded in the RBCU unit does not match drive information communicated via 485 link	RBCU unit from a different size bypass used to replace a defective RBCU. Parameters not matched after Firmware change.	Contact ABB at 1-800-HELP-365 Option 4
3028	EXT COMM LOSS	Time between fieldbus messages has exceeded timeout interval set with parameter 3005	Incorrect Communication settings in Group 51 & 53. Poor Connections Noise on Communication Line	Check Group 51 & 53 Tighten Connections Check Communication Cable Grounding
3029	EFB CONFIG FILE	Error reading configuration file for embedded fieldbus	Internal Startup error	Cycle Power Replace RBCU
3030	FORCE TRIP	Fault trip forced by external fieldbus	Overriding Control System tripped E-Clipse unit via fieldbus.	Check Overriding Control System
3031 ... 3033	EFB 1...EFB 3	Fault code reserved for embedded fieldbus.	For Bacnet: Device object instances for the drive and or bypass are set greater than 4194302 in paramters 5011 5017 and or 5311 5317 respectively	Check Parameters 5011, 5017 and/or 5311, 5317
3034	MTR PHASE	Detects open motor phase. Detection is done by current transformers in bypass unit.	Internal problem Cable problem Motor problem	Check wiring in E-Clipse Unit Check motor cabling Check Motor Check if 3006 is Disabled
3037	PCB TEMP	RBCU unit has reached 190 degrees Fahrenheit, 88 degrees Celsius	Cabinet cooling has failed Ambient conditions too high Bad RBCU unit	Stop drive and let cool down and restart Add additional cooling Replace RBCU

Fault Code	Fault Name In Panel	Fault	Possible Cause	Corrective Action
3038	NO DRIVE DATA	No drive data available (Group 112)	Bypass not able to extract drive data on initial power up due to: Bad cable/connection between drive and bypass. Communication improperly set in drive Parameter 9802. Application Macro improperly set in drive parameter 9902.	Proper seating of cable in drive and RBCU (connector J3) Check drive parameter 9802 (Modbus) and 9902 (E-Clipse) Check drive Group 53 Follow DriveLink recovery procedure then cycle power to bypass.
3039	FBA PAR CONF	Non embedded fieldbus has detected an error in Group 51 parameters	Incorrect settings in Group 51	Verify Group 51 parameters
3101	SFLASH CORRUPT	Internal checksum error	NA	Cycle power Replace RBCU Upgrade firmware
3102	PMAP FILE	Parameter file is corrupt		Cycle Power Contact ABB with information that preceeded fault
3201	T1 OVERLOAD	T1 program cycle is overloaded	NA	Contact ABB with information that proceeded fault Cycle Power Replace RBCU
3202	T2 OVERLOAD	T2 program cycle is overloaded	NA	Contact ABB with information that proceeded fault Cycle Power Replace RBCU
3203	T3 OVERLOAD	T3 program cycle is overloaded	NA	Contact ABB with information that proceeded fault Cycle Power Replace RBCU
3204	STACK OVERFLOW	Program cycle is overloaded	NA	Contact ABB with information that proceeded fault Cycle Power Replace RBCU

Fault Code	Fault Name In Panel	Fault	Possible Cause	Corrective Action
3205	UNKNOWN CB	Bypass control board type is unknown.	Firmware is not compatible with control board in RBCU.	Firmware 93F and greater compatible with all RCBU hardware. Firmware 93D and earlier can only be loaded in RBCU Rev D and earlier.
3206	UNKNOWN DRIVE	Drive reports rating not found in bypass software	Drive does not match drives configured in bypass RBCU	Replace RBCU or reload with most current firmware
3207	UNKNOWN BYPASS	NA	NA	Replace RBCU or load most current firmware Contact ABB at 1-800-HELP-365 option 4 Replace RBCU or load most current firmware

Fault History

See page 28.

Alarm listing

The following table lists the alarms by code number and describes each.

Alarm Code	Alarm Name In Panel	Alarm	Possible Cause	Corrective Action
4001	INP PHASE A LOSS	Alarm will occur in drive mode. In bypass, alarm will occur if bypass contactor has not closed. Unit will trip on Fault 3010 if the bypass contactor is closed	Loose J8 connector Loose wiring on Contactor assembly. Blown upstream fuse	Check J8 connector Check yellow wire on input block Check incoming voltage, phase to ground
4002	INP PHASE B LOSS	Alarm will occur in drive mode. In bypass, alarm will occur if bypass contactor has not closed. Unit will trip on Fault 3011 if the bypass contactor is closed	Loose J8 connector Loose wiring on Contactor assembly. Blown upstream fuse	Check J8 connector Check black wire on input block Check incoming voltage, phase to ground
4003	INP PHASE C LOSS	Alarm will occur in drive mode. In bypass, alarm will occur if bypass contactor has not closed. Unit will trip on Fault 3012 if the bypass contactor is closed	Loose J8 connector Loose wiring on Contactor assembly. Blown upstream fuse	Check J8 connector Check red wire on input block Check incoming voltage, phase to ground

Alarm Code	Alarm Name In Panel	Alarm	Possible Cause	Corrective Action
4004	AUTO TRANSFER	Message is displayed when the drive faults and the bypass switches to bypass mode as configured in Parameter 1608	Drive fault	Check drive
4005	EXT COMM ERR	Time between fieldbus messages has exceeded timeout interval set with parameter 3005	Incorrect Communication settings in Group 51 & 53. Poor Connections Noise on Communication Line	Check Group 51& 53 Tighten Connections Check Communication Cable Grounding
4006	Selected by PAR 1620: RUN ENABLE DAMPER END SWITCH VALVE OPENING PRE-LUBE CYCLE	Alarm will occur when start order is given and the “RUN Enable” is not present	Run Enable condition is not satisfied. Bad 24v supply Bad digital input	Check 24 Volts on RBCU unit Check for 24 volts on respective DI when condition is satisfied Check Parameter 0103 for status of digital input
4007	PCB TEMP	RBCU unit reached 181 degrees Fahrenheit, 83 degrees Celsius	Cabinet cooling has failed Ambient conditions too high Bad RBCU unit	Stop drive and let cool down and restart Add additional cooling Replace RBCU
4008	DRIVE SETUP	Alarm generated when configuration of drive is such that bypass can not properly control the drive. Specifically, drive parameters 1001,1002,1601, 1608	Incorrect parameters settings	Set Parameter 1001 to “COMM” Set Parameter 1002 to “COMM” Set Parameter 1601 to “COMM” Set Parameter 1608 to “COMM”
4009	BYPASS RUN DELAY	Alarm is generated when a bypass start command is issued and there is non zero time value in bypass parameter 1614	NA	NA
4010	MTR OVERLOAD	Bypass warning if motor overload conditions exist as defined in the drive	Drive Mode: Bad Motor Bad Ct’s Bad RBCU Bypass mode: Bad motor Bad CT’s Bad RBCU Either mode: low input voltage	Drive Mode: Refer to 550 manual for proper troubleshooting techniques Bypass Mode: Check that J2 connector is firmly seated in RBCU Check input voltage Does overload condition exist?

Alarm Code	Alarm Name In Panel	Alarm	Possible Cause	Corrective Action
4011	MTR UNDERLOAD	Alarm comes at half the time of a mtr underload fault. See fault 3017 for further text	NA	Parameter 3002 is the time Parameter 3003 is the level
4012	BYPASS DISABLED	Alarm will be generated if parameter 1613 is set to “Disable”	NA	NA
4013	DRIVE LINK ERROR	Same as Fault 3019 however will occur when not in supervisory mode	Bad cable between drive and bypass Communication improperly set in drive Parameter 98.02(Modbus) Application Macro in 99.02 set to 15 (text)	Proper seating of cable in drive and RBCU(connector J3) Check drive parameter 98.02 and 99.02 Check drive Group 53 Follow DriveLink recovery procedure
4014	DRIVE TEST	Alarm is generated when bypass parameter 1617 is set to “enable”	NA	NA
4015	START DRIVE 1ST	Message displayed on initial “out of box” power up sequence	NA	Run drive in Hand
4016	INP VOLTAGE LOW	3-Phase input voltage has not reached a sufficient level to enable editing of parameters via the keypad. This message is generated within a few seconds of power up	NA	Loose J7 connector Low input voltage. Incoming voltage has not reached at least 155 VAC within a few seconds of powerup
4019	OVERRIDE 1	Alarm is generated when Smoke Control is active	NA	Check Parameter 0103 and 0104 for digital input status
4020	OVERRIDE 2	Alarm is generated when Fireman’s Override is active	NA	Check Parameter 0103 and 0104 for digital input status
4021	Selected by PAR 1621 START ENABLE 1 VIBRATION SWITCH FIRESTAT FREEZESTAT OVERPRESSURE VIBRATION TRIP SMOKE ALARM SAFETY OPEN LOW SUCTION PRES	Alarm will occur when start order is given and the “RUN Enable” is not present	Run Enable condition is not satisfied. Bad 24v supply Bad digital input 24 V common is not tied to Digital input common on bypass when using external 24 v supply	Check 24 Volts on RBCU unit Check for 24 volts on respective DI when condition is satisfied Check Parameter 0103 For status of digital input

Alarm Code	Alarm Name In Panel	Alarm	Possible Cause	Corrective Action
4022	Selected by PAR 1622 START ENABLE 2 VIBRATION SWITCH ... LOW SUCTION PRES	Alarm will occur when start order is given and the “RUN Enable” is not present	Run Enable condition is not satisfied. Bad 24v supply Bad digital input 24 V common is not tied to Digital input common on bypass when using external 24 v supply	Check 24 Volts on RBCU unit Check for 24 volts on respective DI when condition is satisfied Check Parameter 0103 For status of digital input
4023	Selected by PAR 1623 START ENABLE 3 VIBRATION SWITCH ... LOW SUCTION PRES	Alarm will occur when start order is given and the “RUN Enable” is not present	Run Enable condition is not satisfied. Bad 24v supply Bad digital input 24 V common is not tied to Digital input common on bypass when using external 24 v supply	Check 24 Volts on RBCU unit Check for 24 volts on respective DI when condition is satisfied Check Parameter 0103 For status of digital input
4024	Selected by PAR 1624 START ENABLE 4 VIBRATION SWITCH ... LOW SUCTION PRES	Alarm will occur when start order is given and the “RUN Enable” is not present	Run Enable condition is not satisfied. Bad 24v supply Bad digital input 24 V common is not tied to Digital input common on bypass when using external 24 v supply	Check 24 Volts on RBCU unit Check for 24 volts on respective DI when condition is satisfied Check Parameter 0103 For status of digital input
4025	LOCAL DISABLED	Alarm is displayed if MODE LOCK (16.29) is set to AUTO MODE and the Hand or Off key is pressed		
4026	AUTO DISABLED	This alarm is displayed if MODE LOCK (1629) is set to LOCAL MODE and the Auto key is pressed.		
4027	COMM CONFIG ERR	Alarm is displayed if the drive and bypass MAC addresses are equal or invalid.	E-Clipse parameters 5002(BP MAC ID) & 5302 (DV MAC ID) are set to the same value	Change MAC address to unique values
4028	FBA PAR CONF	Non embedded fieldbus has detected an error in Group 51 parameters		Verify Group 51 parameters
4029	DRIVE FAULTED	The drive is faulted.		Reset drive

Bypass status listing

Bypass Status (16 Characters)	Condition	Description
DRIVE/BYPASS?	DRIVE SELECTED BYPASS SELECTED	Displays which one is selected, drive or bypass
SAFETIES?	OPEN CLOSED	Displays if safeties (=START ENABLE 1 and/or START ENABLE 2) have been applied, or if they are missing
RUN PERMISSIVES?	OPEN CLOSED	Displays if RUN ENABLE is present or not
START REQUEST?	NOT PRESENT PRESENT	Displays if start request has been applied to the system
AUTO TRANSFER?	NOT TRANSFERRED TRANSFERRED	Displays if the system is in Auto Transfer state or not. Does not reflect to PAR 16.08 AUTO XFER value itself
BYP OVERRIDE 1?	NOT ACTIVATED ACTIVATED	Status of Override 1
BYP OVERRIDE 2?	NOT ACTIVATED ACTIVATED	Status of Override 2
DRIVE FAULTED?	NO YES	Displays if drive is faulted or not
BYPASS FAULTED?	NO YES	Displays if bypass is faulted or not
SYSTEM STARTED?	NO YES	Displays if system is started or not
SYSTEM RUNNING?	NO YES	Displays if system is running or not
BYPASS ALARMS?	NO ALARMS ALARM ACTIVE	Displays if there is an active alarm(s) in bypass or not
HAND/OFF/AUTO?	OFF MODE HAND MODE AUTO MODE	Displays operating mode of the bypass - OFF, HAND or AUTO

Error messages

#	Error Message	Description
1	CAN'T EDIT PAR IS READ ONLY	Try to save value (=press the ENTER key in Parameter Edit State) of a read-only parameter. E.g. try to change value PAR 01.02 INPUT VOLT
2	CAN'T EDIT WHEN STARTED	Try to change value of a parameter, which is allowed to be changed only when system is not started. E.g. PAR 16.02 RUN ENABLE
3	CAN'T EDIT UP+DOWN ONLY	Try to change value of a "reset only" parameter other than zero. UP+DOWN buttons must be pressed simultaneoulsy for requesting default value of the PAR on the display (value zero), and after that ENTER pressed for saving it (reset the parameter). E.g. PAR 04.01 LAST FAULT
4	CAN'T EDIT INP VOLTAGE LOW	Input voltage too low. Changing of parameters prohibited since system cannot save values to nv-mem w/ insufficient voltage.
5	CAN'T EDIT PAR IS HIDDEN	Try to save value (=press the ENTER key in Parameter Edit State) of a hidden parameter. Should not be possible. If hidden parameters are turned visible, this message is not given.
6	CAN'T EDIT UNDER LO-LIMIT	Try to save value which is over LO-LIMIT of the parameter. Should not be possible when changing parameters from control panel.
7	CAN'T EDIT UNDER HI-LIMIT	Try to save value which is over HI-LIMIT of the parameter. Should not be possible when changing parameters from control panel.
8	CAN'T EDIT ENUM VAL ONLY	Try to save value which is out of enumerated value list. Should not be possible when changing parameters from control panel.
9	CAN'T EDIT NO DEFAULT	Try to request default value (=press UP and DOWN buttons simultaneously) for a parameter which is defined not to have a default value. Should not be possible when changing parameters from control panel.
10	CAN'T EDIT TRY AGAIN.	Parameter system is busy, e.g. application macro change is in process at the same time when someone is trying to save a value for a parameter. Should not be possible when changing parameters from control panel.

Maintenance

See *Maintenance* for the ACH550-UH on page *31*.

ACH550-PCR/PDR

Installation

This information is unique to ACH550 input disconnect configurations (PCR or PDR). The ACH550 with Input Disconnect is an ACH550 AC adjustable frequency drive packaged with an input disconnect switch or circuit breaker. Refer to the *Installation* instructions on page *3*, for all other information. **Failure to observe the warnings and instructions may cause a malfunction or personal hazard.**



WARNING! Before you begin read *Safety* on page *2*.



WARNING! When the ACH550 with Input Disconnect is connected to the line power, the Motor Terminals T1, T2, and T3 are live even if the motor is not running. Do not make any connections when the ACH550 with Input Disconnect is connected to the line. Disconnect and lock out power to the drive before servicing the drive. Failure to disconnect power may cause serious injury or death.

1. Install wiring

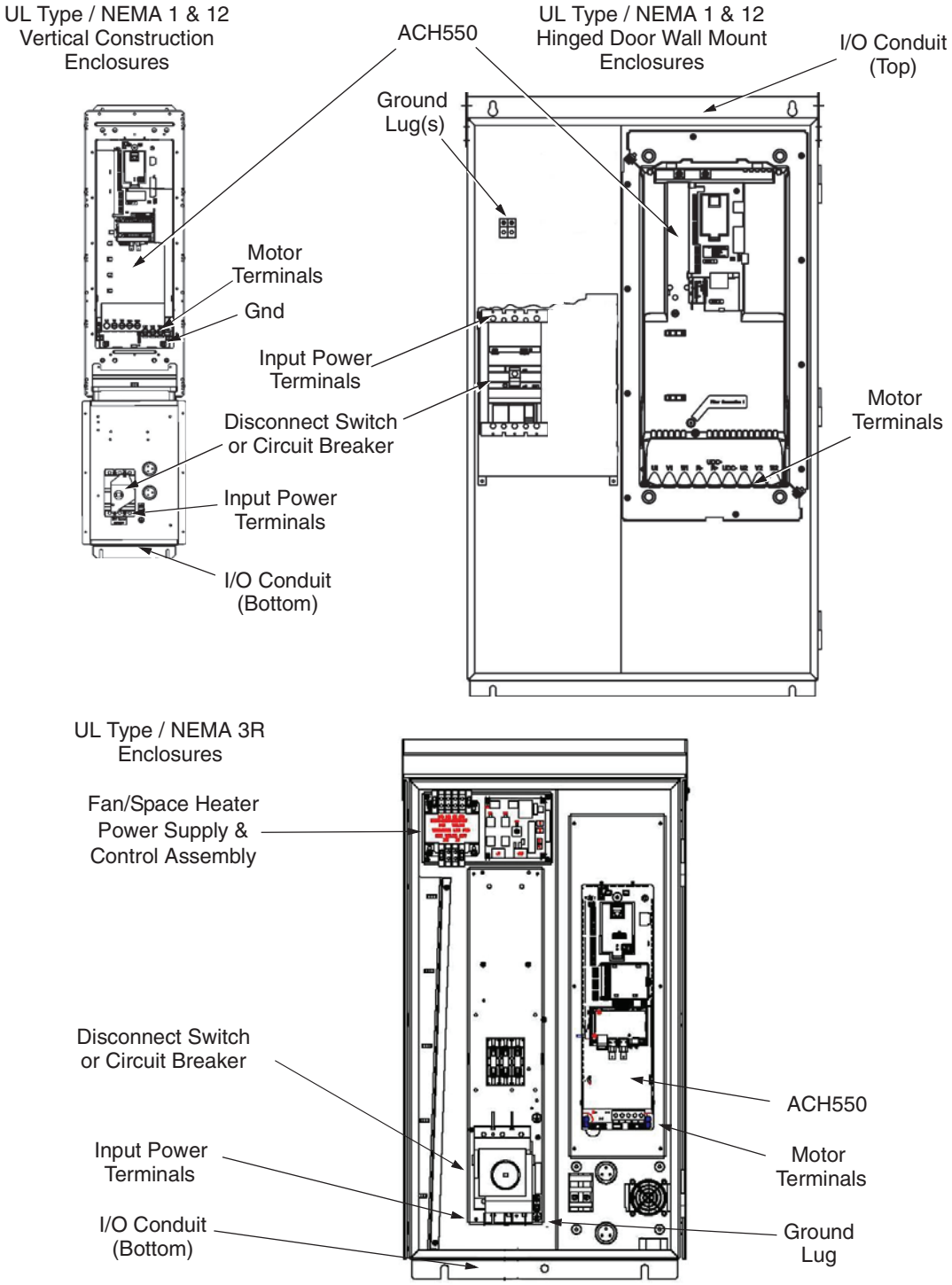


WARNING!

- Metal shavings or debris in the enclosure can damage electrical equipment and create a hazardous condition. Where parts, such as conduit plates require cutting or drilling, first remove the part. If that is not practical, cover nearby electrical components to protect them from all shavings or debris.
- Do not connect or disconnect input or output power wiring, or control wires, when power is applied.
- Never connect line voltage to drive output Terminals T1, T2, and T3.
- Do not make any voltage tolerance tests (Hi Pot or Megger) on any part of the unit. Disconnect motor wires before taking any measurements in the motor or motor wires.
- Make sure that power factor correction capacitors are not connected between the drive and the motor.

Connection diagrams – standard drive with input disconnect (wall mounted)

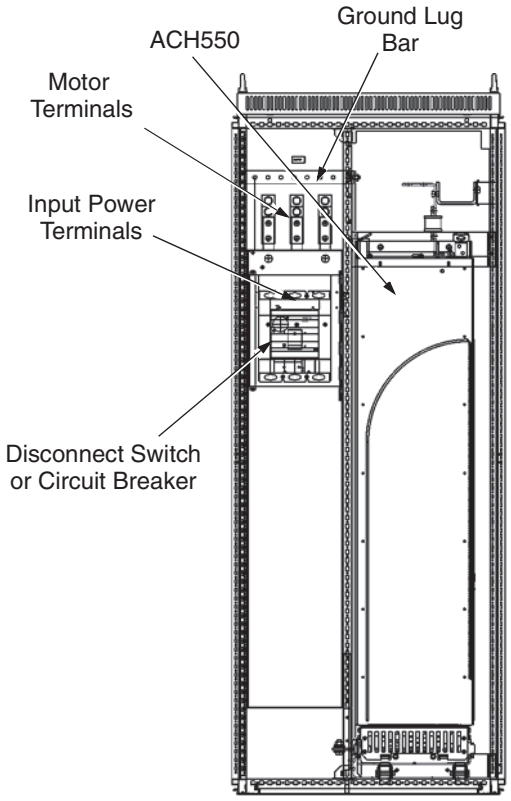
The following figure shows the Standard Drive with Input Disconnect (wall mounted) wiring connection points.



Note: Type 3R enclosures are designed to be mounted on a wall. For 3R enclosure back plates which maintain 3R integrity when the enclosure is mounted on an open rack system, contact your ABB HVAC Drives Distributor.

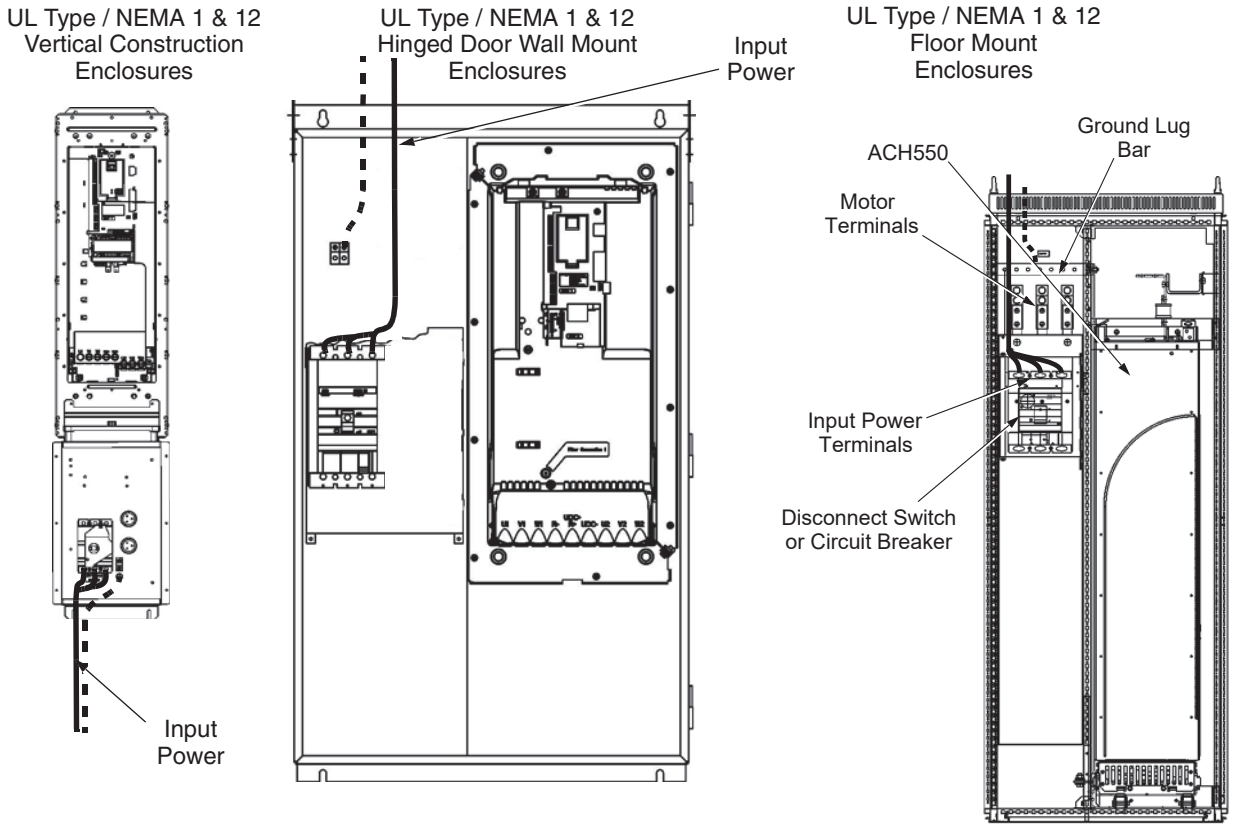
Connection diagrams – standard drive with input disconnect (floor mounted)

Floor mounted UL Type / NEMA 1 & 12 Drive with Input Disconnect units are configured for wiring access from the top and include a removable conduit mounting plate. The following figure shows the wiring connection points.



Line input connections – standard drive with input disconnect configurations

Connect input power to the terminals of the disconnect switch or circuit breaker. Connect the equipment grounding conductor to the ground lug at the top of the enclosure. The figure below shows the connection points for Standard Drive with Input Disconnect configurations.



Dashed line is ground run.

Note: The terminals on disconnect switches for the following rated ACH550-PDR products is 7 in-lbs. Do not use a power driver or over tighten to prevent breaking screw heads or stripping the terminal.

230 VAC	460 VAC	600 VAC
-04A6-2	-03A3-4	-02A7-6
-06A6-2	-04A1-4	-03A9-6
-07A5-2	-06A9-4	-06A1-6
-012A-2	-08A8-4	-09A0-6
-017A-2	-012A-4	-011A-6
-024A-2	-015A-4	-017A-6
-031A-2	-023A-4	

Power connection terminals

The following tables show maximum wire size and required tightening torque for incoming power, grounding and motor terminals.

208/240 Volt		Base Drive Frame Size	Power Wiring Data[2]						
HP	Type Code[1]		Circuit Breaker UL Type/ NEMA 1 &12	Circuit Breaker UL Type / NEMA 3R	Disconnect Switch UL Type/ NEMA 1&12	Disconnect Switch UL Type/ NEMA 3R	Motor Terminals	Ground Lugs UL Type/ NEMA 1&12	Ground Lugs UL Type / NEMA 3R
1	ACH550-PxR-04A6-2	R1	#10 35 in-lbs	#10 35 in-lbs	#10 7 in-lbs	#10 7 in-lbs	Refer to Drive's power connection terminals	#10 35 in-lbs	#10 35 in-lbs
1.5	ACH550-PxR-06A6-2	R1							
2	ACH550-PxR-07A5-2	R1							
3	ACH550-PxR-012A-2	R1							
5	ACH550-PxR-017A-2	R1							
7.5	ACH550-PxR-024A-2	R2	#6 45 in-lbs	#6 45 in-lbs	#8 7 in-lbs	#8 7 in-lbs		#6 35 in-lbs	#6 35 in-lbs
10	ACH550-PxR-031A-2	R2							
15	ACH550-PxR-046A-2	R3	#3 50 in-lbs	#3 50 in-lbs	#4 18 in-lbs	#4 18 in-lbs		#3 50 in-lbs	#3 50 in-lbs
20	ACH550-PxR-059A-2	R3							
25	ACH550-PxR-075A-2	R4	#1 50 in-lbs	#1 50 in-lbs	#1 55 in-lbs	#1 55 in-lbs		#2 50 in-lbs	#2 50 in-lbs
30	ACH550-PxR-088A-2	R4	350 MCM 274 in-lbs	300 MCM 200 in-lbs	#1/0 70 in-lbs	#1/0 70 in-lbs			
40	ACH550-PxR-114A-2	R4			300 MCM 275 in-lbs	300 MCM 200 in-lbs			
50	ACH550-PxR-143A-2	R6						3 x #3/0 250 in-lbs	#2/0 275 in-lbs
60	ACH550-PxR-178A-2	R6							
75	ACH550-PxR-221A-2	R6	2 x 250 MCM 274 in-lbs	2 x 250 MCM 275 in-lbs	2 x 250 MCM 274 in-lbs	2 x 250 MCM 275 in-lbs			350 MCM 100 in-lbs
100	ACH550-PxR-248A-2	R6							

1. "PxR" represents both PCR and PDR.

2. Torque values shown relate to current production. Check component labels on previously installed units for required tightening torque.

480 Volt		Base Drive Frame Size	Power Wiring Data[2]						
HP	Type Code[1]		Circuit Breaker UL Type/ NEMA 1 &12	Circuit Breaker UL Type/ NEMA 3R	Disconnect Switch UL Type/ NEMA 1&12	Disconnect Switch UL Type/ NEMA 3R	Motor Terminals	Ground Lugs UL Type/ NEMA 1&12	Ground Lugs UL Type / NEMA 3R
1/1.5	ACH550-PxR-03A3-4	R1	#10 35 in-lbs	#10 35 in-lbs	#10 7 in-lbs	#10 7 in-lbs	Refer to Drive's power connection terminals	#10 35 in-lbs	#10 35 in-lbs
2	ACH550-PxR-04A1-4	R1							
3	ACH550-PxR-06A9-4	R1							
5	ACH550-PxR-08A8-4	R1							
7.5	ACH550-PxR-012A-4	R1							
10	ACH550-PxR-015A-4	R2	#6 45 in-lbs	#6 45 in-lbs	#8 7 in-lbs	#8 7 in-lbs		#6 35 in-lbs	#6 35 in-lbs
15	ACH550-PxR-023A-4	R2							
20	ACH550-PxR-031A-4	R3	#3 50 in-lbs	#3 50 in-lbs				#3 50 in-lbs	#3 50 in-lbs
25	ACH550-PxR-038A-4	R3			#4 18 in-lbs	#4 18 in-lbs			
30	ACH550-PxR-045A-4	R3							
40	ACH550-PxR-059A-4	R4	#1 50 in-lbs	#1 50 in-lbs				#1 50 in-lbs	#1 50 in-lbs
50	ACH550-PxR-072A-4	R4			#1 55 in-lbs	#1 55 in-lbs			
60	ACH550-PxR-078A-4	R4			#1 50 in-lbs	#1 62 in-lbs			
75	ACH550-PxR-097A-4	R4	350 MCM 274 in-lbs	300 MCM 200 in-lbs	#1/0 70 in-lbs	#1/0 70 in-lbs		3 x #3/0 250 in-lbs	#2 50 in-lbs
100	ACH550-PxR-125A-4	R5			300 MCM 275 in-lbs	300 MCM 200 in-lbs			#2/0 375 in-lbs
125	ACH550-PxR-157A-4	R6							
150	ACH550-PxR-180A-4	R6							
200	ACH550-PxR-246A-4	R6	2 x 250 MCM 274 in-lbs	500 MCM 274 in-lbs	2 x 250 MCM 274 in-lbs	500 MCM 274 in-lbs			350 MCM 100 in-lbs
250	ACH550-PxR-316A-4	R8	2 x 500 MCM 274 in-lbs		2 x 500 MCM 274 in-lbs			5 Bus Bar Holes (13/32")	
300	ACH550-PxR-368A-4	R8							
350	ACH550-PxR-414A-4	R8							
400	ACH550-PxR-486A-4	R8							
450	ACH550-PxR-526A-4	R8	3 x 400 MCM 375 in-lbs		3 x 400 MCM 375 in-lbs				
500	ACH550-PxR-602A-4	R8							
550	ACH550-PxR-645A-4	R8							

1. "PxR" represents both PCR and PDR.

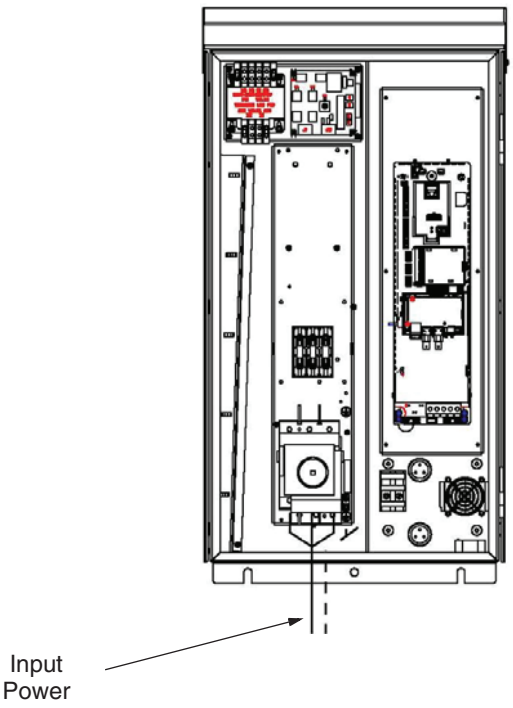
2. Torque values shown relate to current production. Check component labels on previously installed units for required tightening torque.

600 Volt		Frame Size	Power Wiring Data[2]						
HP	Type Code[1]		Circuit Breaker UL Type / NEMA 1 &12	Circuit Breaker UL Type / NEMA 3R	Disconnect Switch UL Type / NEMA 1&12	Disconnect Switch UL Type / NEMA 3R	Motor Terminals	Ground Lugs UL Type / NEMA 1&12	Ground Lugs UL Type / NEMA 3R
2	ACH550-PxR-02A7-6	R2	#6 62 in-lbs	#6 62 in-lbs	#8 7 in-lbs	#8 7 in-lbs	Refer to Drive's power connection terminals	#6 35 in-lbs	#6 35 in-lbs
3	ACH550-PxR-03A9-6	R2							
5	ACH550-PxR-06A1-6	R2							
7.5	ACH550-PxR-09A0-6	R2							
10	ACH550-PxR-011A-6	R2							
15	ACH550-PxR-017A-6	R2							
20	ACH550-PxR-022A-6	R3	#3 62 in-lbs	#3 62 in-lbs				#3 50 in-lbs	#3 50 in-lbs
25	ACH550-PxR-027A-6	R3							
30	ACH550-PxR-032A-6	R4	#1 62 in-lbs	#1 62 in-lbs	#4 18 in-lbs	#4 18 in-lbs		#2 50 in-lbs	#2 50 in-lbs
40	ACH550-PxR-041A-6	R4							
50	ACH550-PxR-052A-6	R4			#1 55 in-lbs	#1 55 in-lbs			
60	ACH550-PxR-062A-6	R4			#1 62 in-lbs	#1 62 in-lbs			
75	ACH550-PxR-077A-6	R6	350 MCM 274 in-lbs	300 MCM 275 in-lbs	#1/0 70 in-lbs	#1/0 70 in-lbs		3 x #3/0 250 in-lbs	
100	ACH550-PxR-099A-6	R6							
125	ACH550-PxR-125A-6	R6			300 MCM 275 in-lbs	300 MCM 200 in-lbs			#2/0 375 in-lbs
150	ACH550-PxR-144A-6	R6							

1. "PxR" represents both PCR and PDR.

2. Torque values shown relate to current production. Check component labels on previously installed units for required tightening torque.

UL Type / NEMA 3R
Enclosures



WARNING! Check the motor and motor wiring insulation before connecting the ACH550 to line power. Follow the procedure on page *12*. Before proceeding with the insulation resistance measurements, check that the ACH550 is disconnected from incoming line power. Failure to disconnect line power could result in death or serious injury.

Note: For the remainder of the wiring (motor and control wiring) refer to page *7*.

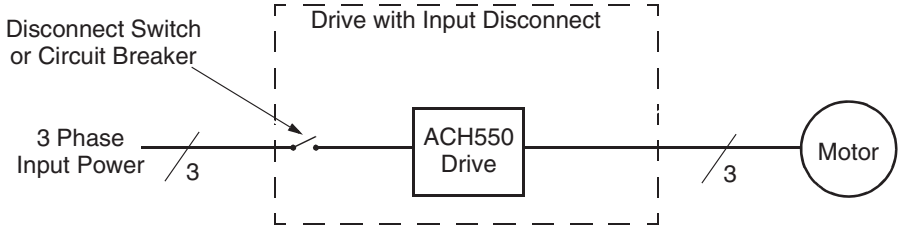
Operation

This information is unique to ACH550 input disconnect configurations (PCR or PDR). Refer to the *Operation* instructions on page *21* for all other information.

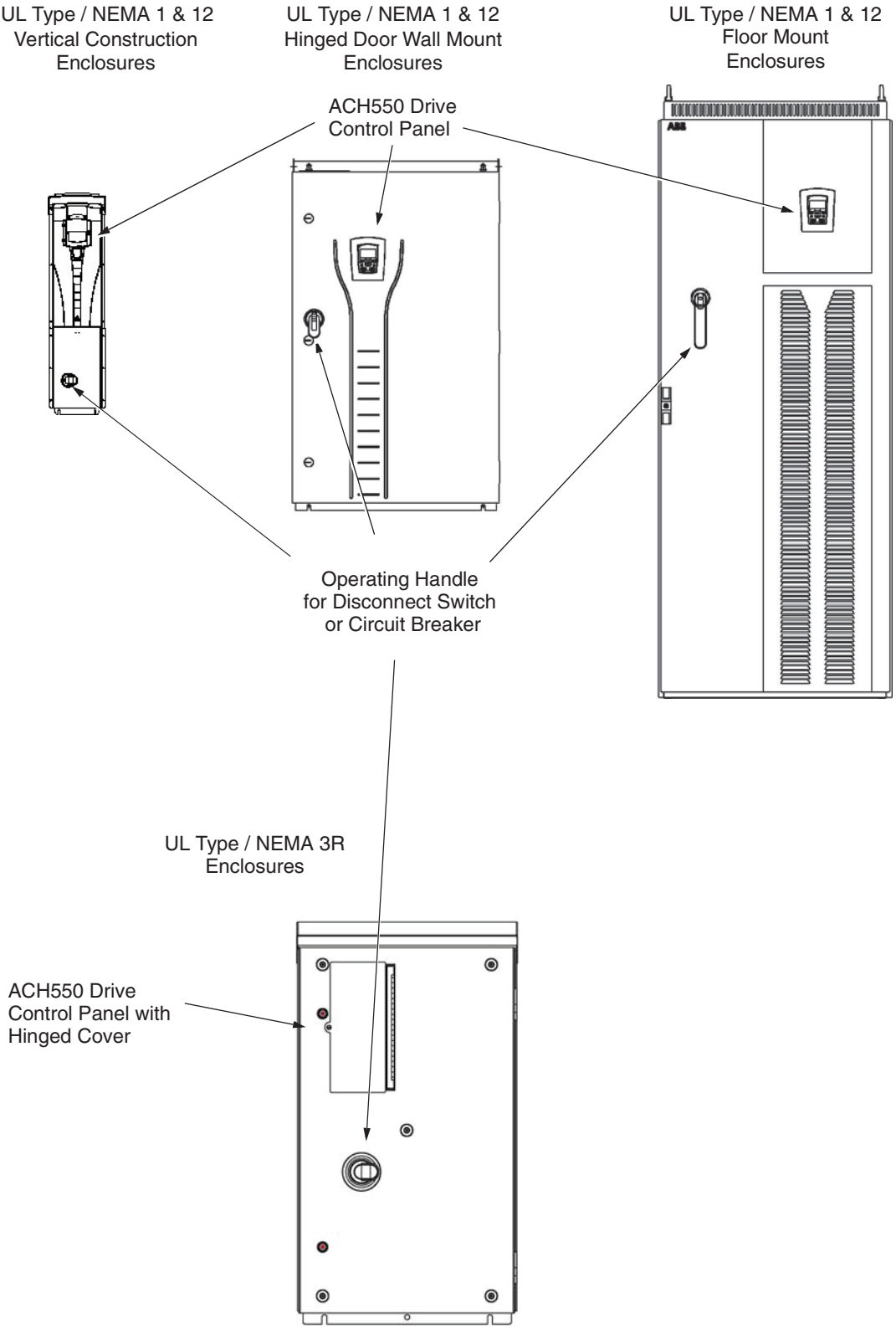
Input disconnect configuration

The ACH550 with Input Disconnect is an ACH550 AC adjustable frequency drive packaged with an input disconnect switch or circuit breaker, and with a door interlocked, external operating handle. The operating handle can be padlocked in the OFF position (padlock not supplied). Enclosure options are UL Type 1, UL Type 12, and UL Type 3R (NEMA 1, NEMA 12, and NEMA 3R).

The following is a typical power diagram.



The following shows the front view of the ACH550 Drive with Input Disconnect standard configurations, and identifies the major components.



Maintenance

Maintenance intervals

If installed in an appropriate environment, the drive requires very little maintenance. This table lists the routine maintenance intervals recommended by ABB for ACH550 enclosures in addition to the intervals on page *31*.

Maintenance	Configuration	Interval	Instruction
Check/replace hinged door wall mount enclosure inlet air filter	Hinged door wall mount UL Type / NEMA 12 enclosures	Check every 3 months. Replace as needed.	*Enclosure air filter replacement – UL Type / NEMA 12 hinged door wall mount enclosures* on page *87*.
Check/replace floor mount enclosure inlet air filter	Floor mount UL Type / NEMA 12 enclosures	Check every 3 months. Replace as needed.	See *Maintenance* on page *34* and *Enclosure air filter replacement – UL Type / NEMA 12 hinged door wall mount enclosures* on page *87*.
Check/replace NEMA 3R enclosure air filters	UL Type / NEMA 3R enclosures - PX3R-5 and higher	Check every 3 months. Replace as needed.	See PX3R dimensional information.
Check/replace floor mount enclosure exhaust air filter.	Floor mount UL Type / NEMA 12 enclosures	Check every 6 months. Replace as needed.	See *Maintenance* on page *35* and *Enclosure air filter replacement – UL Type / NEMA 12 hinged door wall mount enclosures* on page *87*.

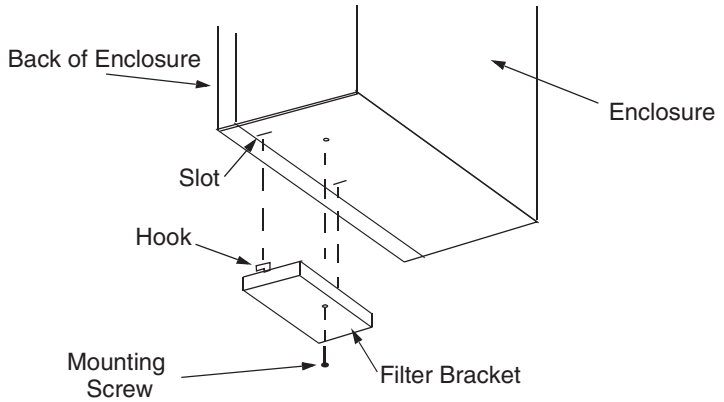
Enclosure air filter replacement – UL Type / NEMA 12 hinged door wall mount enclosures

Filter material

Material	Filter Type
American Air Filter (358-35-06A-12A)	Polykleon White 12.7 mm x 152.4 mm x 304.6 mm stk

This procedure applies to drive with input disconnect configurations in UL Type / NEMA 12 hinged door wall mount enclosures. This filter is located at the bottom of the enclosure. Use the following procedure to check and replace filters.

1. On the enclosure, remove the screw holding the filter bracket in place.
2. Slide the filter bracket forward until the hooks on the bracket clear the slots on the enclosure base. This step allows the filter and bracket to drop free from the enclosure.



3. Lift the filter out of the filter bracket and replace as appropriate.
4. With the filter in the filter bracket, align the hooks on the bracket with the slots in the enclosure base, and press the hooks up into the slots.
5. Slide the filter bracket back, making sure that the hooks catch on the enclosure.
6. Replace the mounting screw. Tighten until the gasket on the bracket is about 50% compressed.

Enclosure air filter replacement – UL Type / NEMA 12 floor mount enclosures

Filter material

Enclosure Type	Inlet (door)	Outlet (roof)
UL Type / NEMA 12	3AUA0000006723 (qty 1)	3AUA0000006722 (qty 2)

Note: When installing the filter media, the white side must face the outside of the cabinet and the colored side must face the inside of the cabinet. Refer to page *34*.

Diagnostics

Refer to the *Diagnostics* instructions on page *24*.

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Installation, Operation and Maintenance Manuals

Job Title: **ICON - Webster Univ - ISB**

Job Site: Webster University
547 Garden Ave

Saint Louis, MO 63119
United States

Customer PO#: Webster ISB 5768
Contractor: ICON MECHANICAL
Elevation: (ft) 709
Date: 1/25/2017
Submitted By: Mark Haas
Agent Order#: 1610111B

H C SHARP COMPANY INC
8301D CREST INDUSTRIAL DRIVE
SAINT LOUIS, MO 63123
US
Phone: 3143516900
Fax: 13143516901
Email Address: karen@hcsharpco.com

ICON - Webster Univ - ISB

Product IOMs

Mark Name	Model Name
EF1, EF3	CUBE
KEF1, EF4	CUE
EF2	LBP
VF2, VF3	SP
VF1	SQ
EF-4 CURB	GPIP (No IOMs)

GREENHECK
Building Value in Air.

Document 471560
Model CUE Direct Drive
Model CUBE Belt Drive
Upblast Centrifugal Roof Exhaust

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage!

Model CUE Direct Drive



Model CUE is a direct drive upblast centrifugal exhaust fan. These fans are specifically designed for roof mounted applications. Performance capabilities range up to 6,400 cfm *(10,874 m^3/hr)* and up to 3 in. wg *(747 Pa)* of static pressure. The maximum continuous operating temperature for fan sizes 098-200 is 400°F *(204°C)* and for fan sizes 060-095 is 160°F *(71°C)*. CUE fans are available in twenty sizes with nominal wheel diameter ranging from 9 to 20 inches *(229 to 508 mm)* (060-200 unit sizes). Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number.

Model CUBE Belt Drive

Model CUBE is a belt drive upblast centrifugal exhaust fan. These fans are specifically designed for roof mounted applications. Performance capabilities range up to 30,000 cfm *(50,970 m^3hr)* and up to 5.0 in. wg *(1240 Pa)* of static pressure. The maximum continuous operating temperature is 400°F *(204°C)*. CUBE fans are available in twenty-seven sizes with nominal wheel diameter ranging from 10 to 48 inches *(254 to 1219 mm*) (099-480 unit sizes). Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number.

General Safety Information

Only qualified personnel should install this fan. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards. Other considerations may be required if high winds or seismic activity are present. If more information is needed, contact a licensed professional engineer before moving forward.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electrical Code (CEC) in Canada.
2. The rotation of the wheel is critical. It must be free to rotate without striking or rubbing any stationary objects.
3. Motor must be securely and adequately grounded.
4. Do not spin fan wheel faster than max cataloged fan RPM. Adjustments to fan speed significantly affects motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.
5. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces or chemicals. Replace cord immediately if damaged.
6. Verify that the power source is compatible with the equipment.
7. Never open access doors to a duct while the fan is running.

DANGER
Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.
CAUTION
When servicing the fan, motor may be hot enough to cause pain or injury. Allow motor to cool before servicing.
CAUTION
Precaution should be taken in explosive atmospheres.
DANGER
Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.
ATTENTION
Lors de toute intervention sur la soufflante, le moteur peut être suffisamment chaud pour provoquer une douleur voire une blessure. Laisser le moteur refroidir avant toute maintenance.
ATTENTION
Faire preuve de précaution dans les atmosphères explosives.

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Receiving

Upon receiving the product, check to ensure all items were accounted for by referencing the delivery receipt or packing list. Inspect each crate or carton for shipping damage before accepting delivery. Alert the carrier of any damage detected. The customer will make a notation of damage (or shortage of items) on the delivery receipt and all copies of the bill of lading which is countersigned by the delivering carrier. If damaged, immediately contact your Greenheck Representative. Any physical damage to the unit after acceptance is not the responsibility of Greenheck Fan Corporation.

Unpacking

Verify that all required parts and the correct quantity of each item have been received. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the bill of lading.

IMPORTANT

Do not lift by the fan hood. Avoid lifting fans in a way that will bend or distort fan parts. Never pass slings or timbers through the venturi of fan. Fans with special coatings or paints must be protected in handling to prevent damage.

Handling

CUE Direct Drive

Lift unit on to the roof utilizing hooks under the horizontal supports. Evenly space the hooks using a minimum of four lifting straps. Use a spreader bar to ensure the straps do not come in contact with the unit, *see Figure 1.*

Figure 1

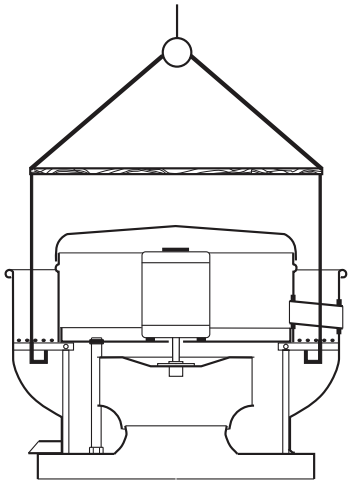


Figure 2

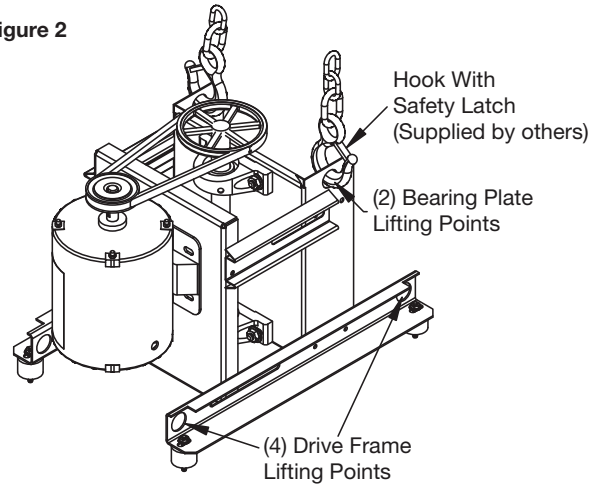
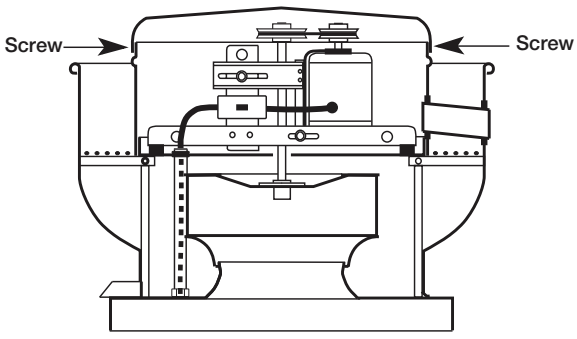


Figure 3



CUBE Belt Drive

When lifting the unit onto the roof, use either the four lifting points on the drive frame or the two lifting points on the bearing plate if present, *see Figure 2* for lifting points. Access to the drive frame is accomplished by removing the screws pointed out in *Figure 3.* The cover can then be removed and placed on a flat surface in an area protected from strong winds.

When CUE/CUBE unit is on the roof, move fan to desired location using lifting points and fasten securely through mounting holes in base. Shims may be necessary depending upon roofing material thickness.

The motor amperage and voltage ratings must be checked for compatibility to supply voltage prior to final electrical connection. For CUE/CUBE installations, the electrical supply should be routed through the conduit chase located between the curb cap and the bottom of the motor compartment or through the breather tube. Wiring must conform to local and national codes.

Storage

Fans are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the fan and accessories while in storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

Indoor

The ideal environment for the storage of fans and accessories is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain or snow. Temperatures should be evenly maintained between 30° to 110°F *(-1° to 43°C)* (wide temperature swings may cause condensation and “sweating” of metal parts). All accessories must be stored indoors in a clean, dry atmosphere. Remove any accumulations of dirt, water, ice or snow and wipe dry before moving to indoor storage. To avoid “sweating” of metal parts allow cold parts to reach room temperature. To dry parts and packages, use a portable electric heater to get rid of any moisture buildup. Leave coverings loose to permit air circulation and to allow for periodic inspection.

The unit should be stored at least 3½ in. *(89 mm)* off the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Aisles between parts and along all walls should be provided to permit air circulation and space for inspection.

Outdoor

Fans designed for outdoor applications may be stored outdoors, if absolutely necessary. Roads or aisles for portable cranes and hauling equipment are needed.

The fan should be placed on a level surface to prevent water from leaking into the fan. The fan should be elevated on an adequate number of wooden blocks so that it is above water and snow levels and has enough blocking to prevent it from settling into soft ground. Locate parts far enough apart to permit air circulation, sunlight and space for periodic inspection. To minimize water accumulation, place all fan parts on blocking supports so that rain water will run off.

Do not cover parts with plastic film or tarps as these cause condensation of moisture from the air passing through heating and cooling cycles.

Fan wheels should be blocked to prevent spinning caused by strong winds.

Inspection and Maintenance During Storage

While in storage, inspect fans once per month. Keep a record of inspection and maintenance performed.

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. At each inspection, rotate the wheel by hand ten to fifteen revolutions to distribute lubricant on motor. If paint deterioration begins, consideration should be given to touch-up or repainting. Fans with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive should be restored to good condition promptly if signs of rust occur. Immediately remove the original rust preventive coating with petroleum solvent and clean with lint-free cloths. Polish any remaining rust from surface with crocus cloth or fine emery paper and oil. Do not destroy the continuity of the surfaces. Thoroughly wipe clean with Tectyl® 506 (Ashland Inc.) or the equivalent. For hard to reach internal surfaces or for occasional use, consider using Tectyl® 511M Rust Preventive, WD-40® or the equivalent.

Removing From Storage

As fans are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion until the fan equipment goes into operation.

IMPORTANT

Installation, troubleshooting and parts replacement is to be performed only by qualified personnel. Consult and follow all applicable national, state and local codes. They will supercede this document.

Dimensional Data

CUE - Direct Drive

Model	Curb Cap	Damper	Roof Opening	*Approx. Weight
CUE 060, 065, 070, 075	17 *(432)*	8 *(203)*	10½ *(267)*	29 *(13)*
CUE 080, 085, 090, 095	19 *(483)*	10 *(254)*	12½ *(318)*	40 *(18)*
CUE 099, 101, 121, 131	19 *(483)*	12 *(305)*	14½ *(368)*	67 *(30)*
CUE 141, 161	22 *(559)*	16 *(406)*	18½ *(470)*	90 *(41)*
CUE 180, 200	30 *(762)*	18 *(457)*	20½ *(521)*	142 *(64)*

- All dimensions are in inches *(millimeters)*. *Approximate weight shown in lbs. *(kg.)* is the largest cataloged Open Drip Proof motor.
- The roof curb should be 1½ in. *(38 mm)* less than the curb cap to allow for roofing and flashing.

CUBE - Belt Drive

Model	Curb Cap	Shaft Bearings	Damper	Roof Opening	*Approx. Weight
CUBE 099, 101, 101HP, 121, 131	19 *(483)*	¾ *(19)*	12 *(305)*	14½ *(368)*	66 *(30)*
CUBE 141, 141HP, 161, 161HP	22 *(559)*	¾ *(19)*	16 *(406)*	18½ *(470)*	87 *(39)*
CUBE 161XP	22 *(559)*	1 *(25)*	16 *(406)*	18½ *(470)*	87 *(39)*
CUBE 180	30 *(762)*	¾ *(19)*	18 *(457)*	20½ *(521)*	126 *(57)*
CUBE 180HP	30 *(762)*	1 *(25)*	18 *(457)*	20½ *(521)*	126 *(57)*
CUBE 200	30 *(762)*	¾ *(19)*	18 *(457)*	20½ *(521)*	142 *(64)*
CUBE 200HP	30 *(762)*	1 *(25)*	18 *(457)*	20½ *(521)*	142 *(64)*
CUBE 220, 220HP, 240, 240 HP, 240 XP	34 *(864)*	1 *(25)*	24 *(610)*	26½ *(673)*	175 *(79)*
CUBE 300, 300HP, 300XP	40 *(1016)*	1 *(25)*	30 *(762)*	32½ *(826)*	313 *(142)*
CUBE 360, 360HP, 360XP	46 *(1168)*	1¼ *(32)*	36 *(914)*	38½ *(978)*	440 *(200)*
CUBE 420	52 *(1321)*	1¼ *(32)*	42 *(1067)*	44½ *(1130)*	578 *(262)*
CUBE 480	58 *(1473)*	1½ *(38)*	48 *(1219)*	50½ *(1283)*	675 *(306)*

- All dimensions are in inches *(millimeters)*. *Approximate weight shown in lbs. *(kg.)* is the largest cataloged Open Drip Proof motor.
- The roof curb should be 1½ in. *(38 mm)* less than the curb cap to allow for roofing and flashing.

Installation

General Ventilation Installation

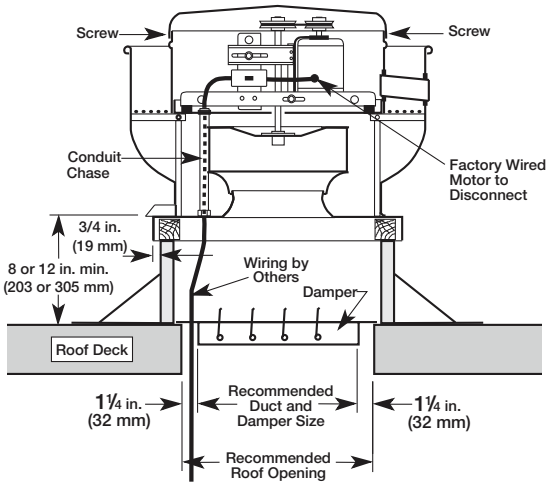


Figure 4 - Typical Roof Mounting Installation

1. On the roof surface, cut an appropriate sized hole and follow manufacturer's instructions on curb installation. Caulk and flash the curb to ensure a water tight seal.

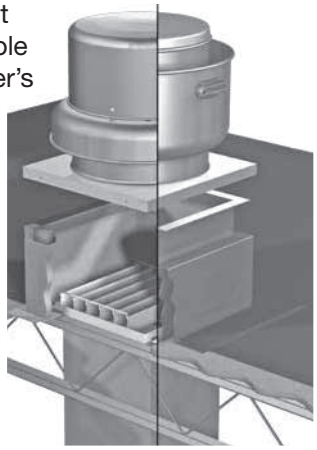


Figure 5 - Roof Curb Installation

2. If unit is equipped with a backdraft damper, it should be installed now.
3. Remove motor cover. Access to the motor compartment is accomplished by removing the screws as shown in *Figure 3,* page 2.
4. On CUBE belt drive fans, use the lifting lugs on the drive frame or bearing plate to lift and place the unit on top of roof curb. Refer to *Figure 2*, page 2.
5. On CUE direct drive fans, lift and place the unit on top of roof curb using hooks under the horizontal supports. Refer to *Figure 1*, page 2.
6. Secure fan to curb using a minimum of eight lag screws, metal screws or other suitable fasteners. Shims may be required depending upon curb installation and roofing material.
7. Verify power line wiring is de-energized before connecting fan motor to power source.
8. For commercial kitchen and UL Listed emergency smoke control applications, the electrical supply must enter the motor compartment through the breather tube. For other non-flammable applications, the electrical supply can be routed through the conduit chase between the curb cap and the bottom of the motor compartment.
9. Connect power supply wiring to the motor as indicated on the motor nameplate or terminal box cover. Check the power source for compatibility with the requirements of your equipment.
10. Check fan wheel for free rotation, recenter if necessary. Check setscrew(s) for tightness.
11. Check all fasteners for tightness.
12. Mount and wire safety disconnect switch under motor cover. Wire control switches at ground level, refer to *Figure 6*.

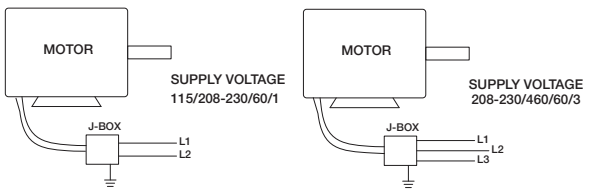


Figure 6 - Typical Wiring Diagram

13. Replace motor cover.

Sidewall Mounting Installation

1. Cut an appropriate sized hole in the wall and follow manufacturer's instructions on curb installation. Mount the curb to the interior of the wall with a minimum of eight 3/8-inch fasteners around the flange. Caulk and flash the curb to ensure a water tight seal.
2. If unit is equipped with a backdraft damper, it should be installed now.
3. Lift the fan into place. Do NOT support the unit by the hood band during installation.
4. Orient fan so the grease trough is downward and secure fan to curb using a minimum of eight lag screws, metal screws, or other suitable fasteners.
5. Follow steps 7 through 13 of General Ventilation Installation instructions on page 4.

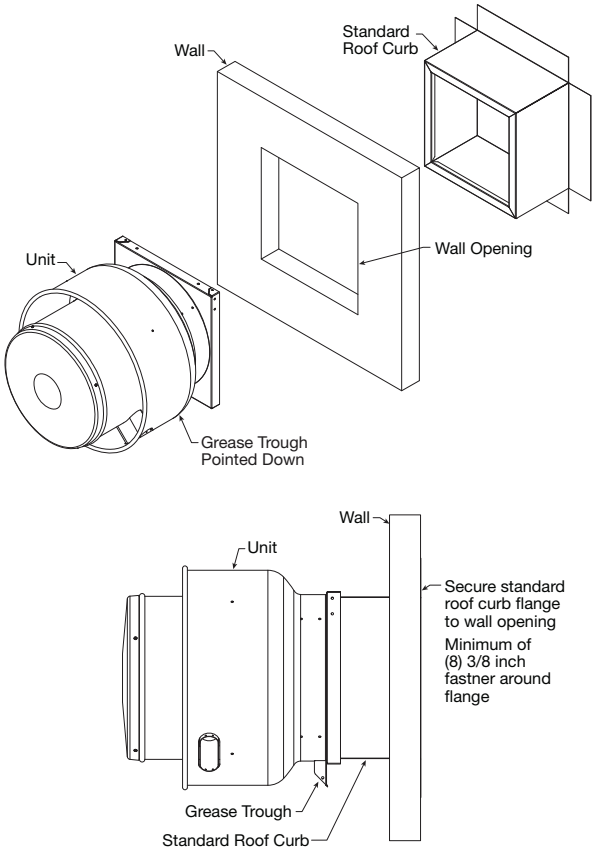
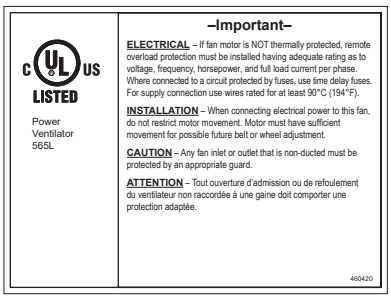


Figure 7 - Typical Sidewall Mounting Installation

Representation of UL Listed Power Ventilator label



Commercial Kitchen Installation

Commercial kitchen installations must comply with NFPA 96. Check local and national codes for these installations, and consult local code authorities for other specific requirements.

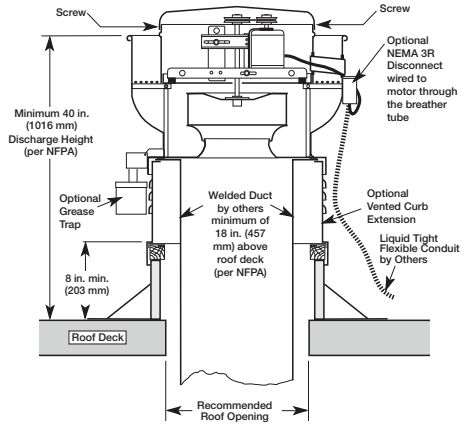


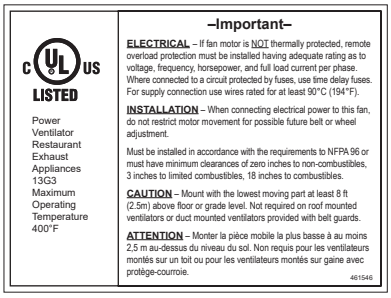
Figure 8 - Typical Roof Mounting Installation

1. The size of the duct must be equal to or larger than the inlet opening of the fan.
2. Secure fan to curb using a minimum of eight lag screws, metal screws or other suitable fasteners.
3. To comply with NFPA 96, the fan discharge must be a minimum of 40 in. *(1016 mm)* above the roof surface and a minimum of 10 ft. *(3048 mm)* from any building air intake.
4. Per NFPA 96, ductwork to an upblast discharge exhaust fan must be constructed of and supported by carbon steel not less than No. 6 MSG *(1.52 mm)* or stainless steel not less than No. 18 MSG *(1.21 mm)* in thickness. Duct must also extend a minimum of 18 in. *(457 mm)* above the roof surface.
5. Ensure that a minimum of 500 ft/min of air velocity through the duct is maintained per NFPA 96, clause 8.2.1.1, 2014 edition and UL 762, Issue #7, clause 6.2, October 14, 2013.
6. The following accessories may be required by NFPA 96 depending upon installation: Grease Trap, Hinge Kit or Hinged Base, Clean-Out Port, and Vented Curb.

IMPORTANT

Minimum duct velocities must be maintained in kitchen exhaust applications. If a speed controller is used, ensure compliance with all applicable codes.

Representation of UL Listed Power Ventilator Restaurant Exhaust Appliances label



Grease Trap Installation

Polypropylene grease trap is designed to collect grease residue and avoid drainage onto roof surface. Follow all local codes, as well as the National Fire Protection Agency (NFPA) where applicable.

NFPA 96: Upblast fans shall have a drain directed to a readily accessible and visible grease receptacle not to exceed 1 gal. *(3.8L)*

Refer to Document 476370 - Grease Trap Installation, Operation and Maintenance Manual for parts list and specific installation instructions.

Grease Trap Maintenance

Regular inspection of grease trap is recommended. Depending on the amount of grease discharged through the fan, the grease trap should be cleaned regularly to ensure proper operation.

- Check grease absorber (if included) every month. Replace grease absorber after every cleaning and/or as needed between cleanings.
- Replacement grease absorbers (P/N 476084) can be ordered from your local Representative.

Hinge Installation

NFPA 96: Upblast exhaust fans shall be supplied with a hinge.

Refer to Document 481366 - Bracket Hinge Kit or **Document 462865/462866 - Hinge Kit** Installation, Operation and Maintenance Manual for parts list and specific installation instructions.

UL Listed Emergency Smoke Control Installation

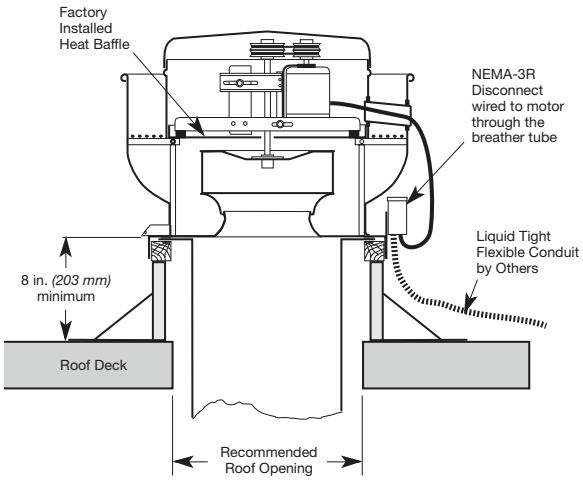


Figure 9 - Typical Roof Mounting Installation

Electrical Connection

For belt drive units in emergency smoke removal installations, the motor's amperage and voltage rating must be checked for compatibility to the supply voltage prior to final electrical connection. Also, the motor itself cannot have thermal overload protection.

The electrical supply must enter the motor compartment through the breather tube and the disconnect must be mounted outside the fan's motor compartment. Emergency smoke removal fans may also require an isolated power supply so that if power is cut to the building in the event of a fire, the fan will continue to operate.

Check the local and national electrical codes for emergency smoke removal fans. Consult local code authorities for your specific requirements.

Representation of UL Listed Power Ventilator for Smoke Control Systems label



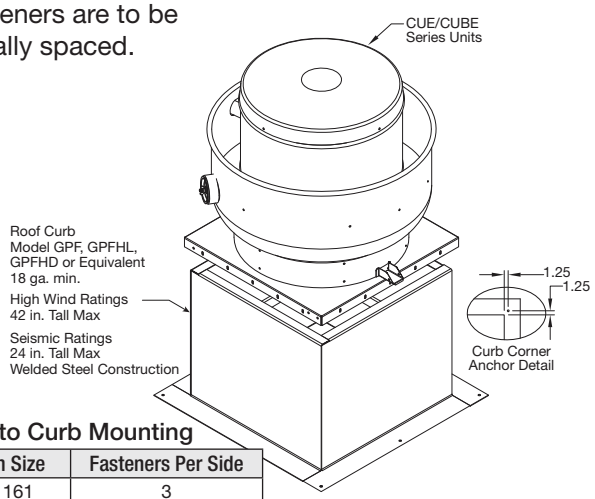
Mounting for Severe Duty Installation

IMPORTANT

Only qualified installers should perform this work. Manufacturer assumes no liability for damages resulting from installation.

Installation instructions for seismic ratings are only recommendations. Final design must be determined by Structural Engineer of Record (SEOR) including requirements for curb construction, mounting of unit to curb and mounting of curb to structure.

Fan to Curb Mounting: 5/16-inch *(7.9 mm)* self-drilling fasteners are to be installed on each side of fan with one fastener 4-inches *(102 mm)* from each edge and one fastener in the center. *Figure 10.* Fasteners are to be equally spaced.



Fan to Curb Mounting

Fan Size	Fasteners Per Side
≤ 161	3
180 to 240	5
≥ 300	9

Figure 10 - Fan to Curb Mounting

Optional Hinged Base Mounting: For installations that include the optional hinged base accessory, the fan must be secured to the hinged base and curb using the correct number of fasteners as shown in the "Fan to Curb Mounting" section. All fasteners must be installed through the curb cap of the fan, the hinged base, and the curb. All fasteners must be reinstalled after each time the fan is hinged open. Refer to *Figure 11*.

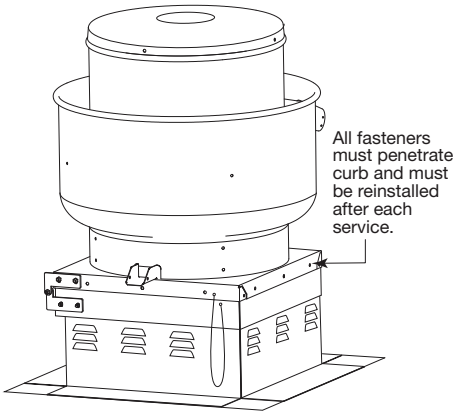


Figure 11 - Fasteners

Curb to Deck Mounting: Fasteners need to be located on all four sides of the curb, *Figures 12a & 12b.*

Figure 12a

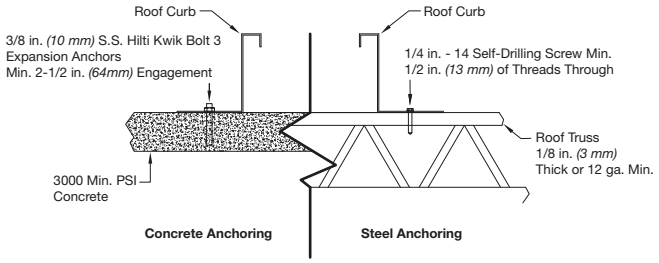
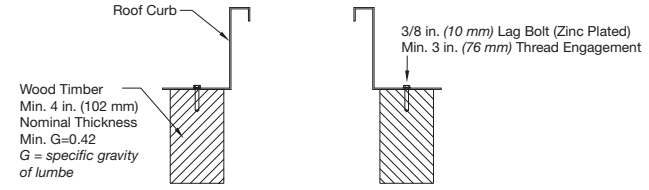


Figure 12b



Timber Anchoring

	High Wind Ratings				Seismic Ratings		
			Fasteners			Fasteners	
	Fan Size	Curb Cap Size inches *(millimeters)*	Per Side	Total	Fan Size	Per Side	Total
Steel	≤ 161	17x17 to 22x22 *(432x432 to 559x559 mm)*	3	12	060-240	2	8
	> 161	26x26 to 40x40 *(660x660 to 1016x1016 mm)*	4	16	300-360	3	12
					420-480	5	20
Concrete	≤ 161	17x17 to 22x22 *(432x432 to 559x559 mm)*	3	12	060-240	2	8
	> 161	26x26 to 40x40 *(660x660 to 1016x1016 mm)*	3	12	300-360	3	12
					420-480	5	20
Wood	≤ 161	17x17 to 22x22 *(432x432 to 559x559 mm)*	3	12	060-240	2	8
	> 161	26x26 to 40x40 *(660x660 to 1016x1016 mm)*	4	16	300-360	3	12
					420-480	5	20

All dimensions are in inches *(millimeters)*.

Pre-Starting Checks

1. Check all fasteners and set screws for tightness. The wheel should rotate freely and be aligned as shown in *Figure 13*.

Model	G - Overlap inch *(mm)*	H - Gap inch *(mm)*
CUE 060-095	–	3/32 *(2)*
CUE 099-161	1/4 *(6)*	–
CUE 180-200	1/2 *(13)*	–
CUBE 099-161	1/4 *(6)*	–
CUBE 180-300	1/2 *(13)*	–
CUBE 360-480	3/4 *(19)*	–

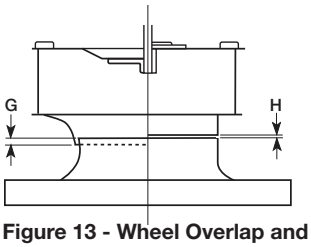


Figure 13 - Wheel Overlap and Gap Dimension

2. Wheel position is preset and the unit is test run at the factory. Movement may occur during shipment and realignment may be necessary.

   CUBE unit: Centering can be accomplished by loosening the bolts holding the drive frame to the vibration isolators and repositioning the drive frame.

   CUBE unit: Wheel and inlet cone overlap can be adjusted by loosening the set screws in the wheel and moving the wheel to the desired position. For both CUE and CUBE models, center wheel on inlet by loosening bolts on support pan and move support pan until properly aligned. For both CUE and CUBE models with wheel hubs and shaft pulleys utilizing a tapered bushing interface, reference page 9 for the tapered bushing removal and move the wheel to the desired position.

3. All CUE and CUBE units - Check wheel rotation (viewing from the shaft side) by momentarily energizing the unit. Rotation should correspond to the rotation decal on the unit, *see Figure 14*. If wheel rotation is incorrect, reverse two of the wiring leads or check motor wiring for single phase.

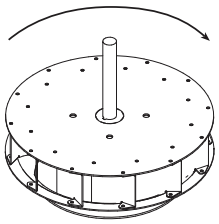


Figure 14

WARNING

Correct direction of wheel rotation is critical. Reversed rotation will result in poor air performance, motor overloading and possible motor burnout.

AVERTISSEMENT

La turbine doit impérativement tourner dans le bon sens. Une rotation en sens inverse entraînerait de mauvaises performances de soufflage, une surcharge du moteur voire un grillage du moteur.

Model CUBE Pre-Starting Belt Tension Checks

4. Always loosen tension enough to install belts without stretching, Do not force the belt(s) *see Figure 15*. Forcing belts will break the cords and cause belt failure.

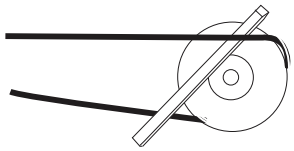


Figure 15

5. For units with two groove pulleys, adjust so the tension is equal in both belts.
6. If adjustments are made, it is very important to check the pulleys for proper alignment. Misaligned pulleys lead to excessive belt wear, vibration, noise and power loss, *see Figure 16*.

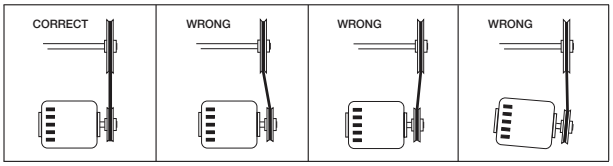


Figure 16

7. Belt tension can be adjusted by loosening four fasteners on the drive frame, *see Figure 17*. The motor plate slides on the slotted adjusting arms and drive frame angles in the same manner.

   Four (4) fasteners in total.

   Identical fasteners on opposing side must also be loosened.

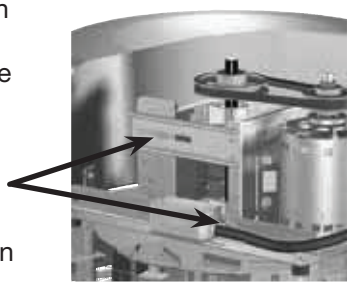


Figure 17

8a. **Sizes 099-161:** Belts should be tensioned just enough to prevent slippage at full load. Belts should have a slight bow on the slack side while running at full load; *see Figure 18a*.

8b. **Sizes 180-480:** Belt tension should be adjusted to allow 1/64 in. *(0.397 mm)* of deflection per inch of belt span. For example, a 15 in. *(381 mm)* belt span should have 15/64 in. *(0.234 mm)* (or about 1/4 in. *(6 mm)*) of deflection with moderate thumb pressure at mid-point between pulleys; *see Figure 18b*.

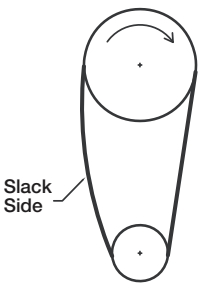


Figure 18a

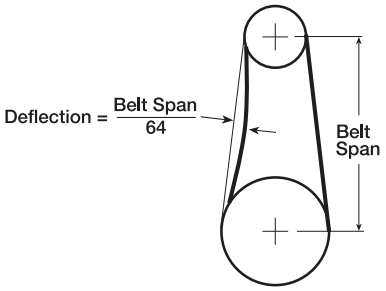


Figure 18b

9. The adjustable motor pulley is factory set for the RPM specified. Speed can be increased by closing or decreased by opening the adjustable motor pulley.
10. Any increase in speed represents a substantial increase in the horsepower required by the unit.
11. Motor amperage should always be checked to avoid serious damage to the motor when speed is varied.

IMPORTANT

The fan has been checked for mechanical noises at the factory prior to shipment. If mechanical noise should develop, suggested corrective actions are offered in the Troubleshooting section.

IMPORTANT

Over tightening will cause excessive bearing wear and noise. Too little tension will cause slippage at startup and uneven wear.

Operation

1. Before starting up or operating fan, check all fasteners for tightness. In particular, check the setscrews in wheel hub (or the tapered bushing, and pulleys if applicable).
2. While in the OFF position or before connecting the fan to power, turn the fan wheel by hand to be sure it is not striking the venturi or any obstacle.
3. Start the fan and shut it off immediately to check rotation of the wheel with directional arrow in the motor compartment, *Reference Figure 14*.
4. When the fan is started, observe the operation and check for any unusual noises.
5. With the system in full operation and all ductwork attached, measure current input to the motor and compare with the nameplate rating to determine if the motor is operating under safe load conditions.
6. Keep inlets and approaches to fan clean and free from obstruction.

IMPORTANT

Adjust (tighten) belt tension after the first 24-48 hours of operation.

Inspection

Inspection of the fan should be conducted at the first 30 minute and 24 hour intervals of satisfactory operation.

30 Minute Interval: Inspect bolts, setscrews and motor mounting bolts. Adjust and tighten as necessary.

24 Hour Interval: Check all internal components. On CUBE unit only, inspect belt alignment and tension. Adjust and tighten as necessary.

Maintenance

DANGER

Disconnect and secure to the “off” position all electrical power to the fan prior to inspection or servicing. Failure to comply with this safety precaution could result in serious injury or death.

DANGER

Pour écarter les risques de blessure grave ou de mort, débrancher et verrouiller l’alimentation électrique en position « Arrêt » avant tout contrôle ou entretien.

IMPORTANT

Uneven cleaning of the wheel will produce an out of balance condition that will cause vibration in the fan.

WARNING

This unit should be made non-functional when cleaning the wheel or housing (fuses removed, disconnect locked off).

AVERTISSEMENT

L’appareil doit être rendu non opérationnel lors du nettoyage de la turbine ou du caisson (fusibles retirés, sectionneur verrouillé).

Installation and maintenance are to be performed only by qualified personnel who are familiar with local codes and regulations and who are experienced with this type of equipment.

Motor maintenance is generally limited to cleaning and lubrication (where applicable). Cleaning should be limited to exterior surfaces only. Removing dust buildup on motor housing ensures proper motor cooling.

Greasing of motors is only intended when fittings are provided. Many fractional horsepower motors are permanently lubricated and should not be lubricated after installation. Motors supplied with grease fittings should be greased in accordance with manufacturer’s recommendations. Where motor temperatures do not exceed 104ºF *(40ºC)*, the grease should be replaced after 2,000 hours of running time as a general rule.

Wheels require very little attention when moving clean air. Occasionally, oil and dust may accumulate causing imbalance. When this occurs the wheel and housing should be cleaned to ensure smooth and safe operation.

All fasteners should be checked for tightness each time maintenance checks are performed prior to restarting unit.

- When installing fans for restaurant exhaust applications follow NFPA 96 for cleaning fans.
- Grease containers must be emptied at regular intervals to prevent overflow.

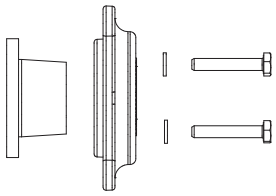
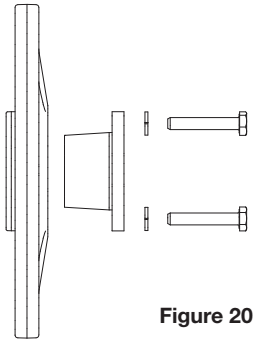
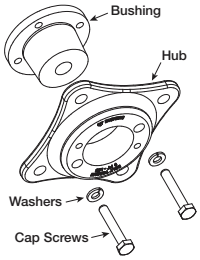
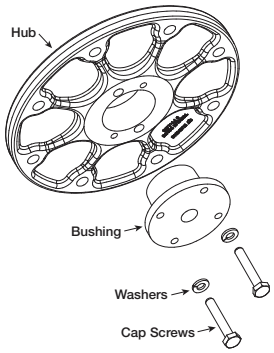
A proper maintenance program will help these units deliver years of dependable service.

Tapered Bushing Hub Installation and Removal

For wheel hubs and shaft pulleys utilizing a tapered bushing interface, follow this procedure for installation and removal. There are two possible set ups for the tapered bushing, both have the same procedure, but orientation of the hub varies.

Tapered Bushing Removal:

1. If present, loosen the setscrew holding the bushing and shaft key in place.
2. Loosen and remove the socket head cap screws which fasten the bushing to the hub as shown in the section views and examples of *Figures 19-22*.

Standard Mounting	Reverse Mounting
	
Figure 19	**Figure 20**
	
	
Figure 21 Standard Bushing Orientation	**Figure 22** Reverse Bushing Orientation

3. **Standard Mounting:** Take the two socket head cap screws that were removed and install them into the visibly threaded holes on the wheel hub.
   Reverse Mounting: Install the two socket head cap screws into the visibly threaded holes of the bushing flange.

4. Once both socket head cap screws are installed, tighten them an eighth of a turn at a time, alternating between the two until the hub comes loose from the bushing.

Bushing Installation:

1. Clean all surfaces of hub and bushing to remove any oil or residue present and do not use any lubricant to install bushing into the hub. For both standard and reverse mounting styles, the socket head cap screws are adjustable from the inlet of the fan.
2. **Standard Mounting:** Slide the bushing and shaft key onto the fan shaft followed by the wheel and hub assembly. If present, use the keyway setscrew to hold the shaft key and bushing in place but DO NOT overtighten as this can damage the bushing. Align the unthreaded holes of the hub with the threaded holes of the tapered bushing.
   Reverse Mounting: Slide the wheel and hub assembly onto the fan shaft followed by the bushing and shaft key. If present, use the keyway setscrew to hold the shaft key and bushing in place but DO NOT overtighten as this can damage the bushing. Align the unthreaded holes of the tapered bushing with the threaded holes of the hub.
3. Install the two bushing socket head cap screws into the aligned holes by hand (or without excessive torque) until the heads of the socket head cap screws are seated against the mating surface.
4. Adjust the height of the wheel in the fan relative to the inlet venturi then tighten the two socket head cap screws an eighth turn at a time in an alternating fashion and to a torque of 10 ft-lbs.

Belt/Bearing Maintenance CUBE Model

1. Belts tend to stretch after a period of time. They should be checked periodically for wear and tightness. When replacing belts, use the same type as supplied with the unit.
2. Matched belts should always be used on units with multi-groove pulleys.
3. For belt replacement, loosen tensioning device enough to allow removal of the belt by hand.
4. Once installed, adjust belts as shown in “Pre-Starting Checks.”
5. To ensure tightness, check pulley setscrews. Proper keys must be in keyways.
6. Fan RPM should not be readjusted. Only use pulleys of identical size and type when replacing pulleys.
7. Shaft bearings can be classified in two groups: relubricating and non-relubricating. All non-relubricating bearings on CUBE fans are factory lubricated and require no further lubrication under normal use (between -20º to 180ºF *(-29º to 82ºC)* in a relatively clean environment).
8. On CUBE belt driven fans, the cast pillow block bearings are factory lubricated and are provided with external grease fittings. Annual lubrication is recommended, or more frequently if needed (see Table 1). Do not over-grease. Use only one or two shots of lubricant with a hand gun. Maximum hand gun rating is 40 psi. Rotate bearings during lubrication where good safety practice permits. Caution should be employed to prevent over packing or contamination.
9. Units installed in hot, humid or dirty locations should be equipped with special bearings. These bearings will require frequent lubrication. Caution should be employed to prevent over packing or contamination.
10. Grease fittings should be wiped clean. The unit should be in operation while lubricating bearings. Extreme care should be used around moving parts.
11. Grease should be pumped in very slowly until a slight bead forms around the seal. A high grade lithium base grease should be used.
12. During the first few months of operation check bearing set screws periodically to ensure tightness.
13. If unit is to be left idle for an extended period, remove belts and store in a cool, dry place to avoid premature belt failure.

Recommended Bearing Lubrication Frequency in Months

NOTE: If unusual environment conditions exist (extreme temperature, moisture or contaminants) more frequent lubrication is required.

A good quality lithium base grease, conforming to NLGI Grade 2 consistency, such as those listed in Table 2 may be used.

Table 1: Suggested Fan Bearing Lubrication Intervals

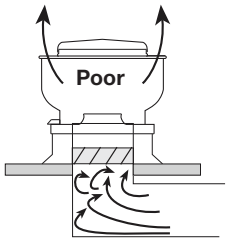
Interval (months)	Type of Service
1 to 3	Heavy duty in dirty, dusty locations; high ambient temperatures; moisture laden atmosphere; vibration.
3 to 6	12 to 24 hours per day, heavy duty, or if moisture is present
6 to 12	8 to 16 hours per day in clean, relatively dry atmosphere
12 to 18	Infrequent operation or light duty in clean atmosphere

Table 2: Grease Manufacturers

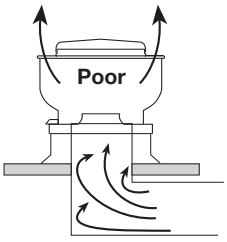
Manufacturer	Grease (NLGI #2)
U.S. Electric Motors	Grease No. 83343
Chevron U.S.A. Inc	Chevron SRI Grease #2
Mobil Oil Corporation	Mobilith
	Mobil 532
Texaco, Inc.	Premium BRB #2
	Texaco Multifak #2
Amoco Oil Co.	Rykon Premium #2
Exxon	Unirex N2
Shell	B Shell Alvania #2

Fan Inlet Connections

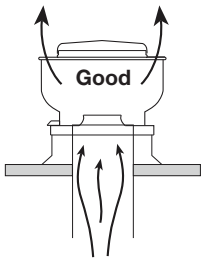
In order to assure proper fan performance, caution must be exercised in fan placement and connection to the ventilation system. Obstructions, transitions, poorly designed elbows, improperly selected dampers, etc, can cause reduced performance, excessive noise and increased mechanical stress. For performance to be as published, the system must provide uniform and stable airflow into the fan.



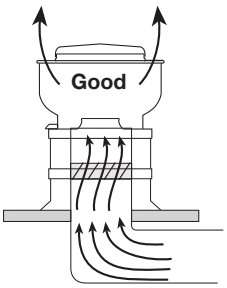
Dampers must open fully. Use motorized dampers in low airflow applications to reduce losses.



Avoid sharp turns or entrance conditions which cause uneven flow. Use turning vanes in elbows to reduce adverse effects.



Avoid sharp turns or entrance conditions which cause uneven flow. Use turning vanes in elbows to reduce adverse effects.



Provide uniform airflow at fan inlet and through the damper to assure optimum performance. Curb cap should be three wheel diameters from the radius. Use turning vanes in duct when possible.

Parts List

Each fan bears a manufacturer's nameplate with model number and serial number embossed. This information will assist the local Greenheck representative and the factory in providing service and replacement parts. Before taking any corrective action, make certain unit is not capable of operation during repairs.

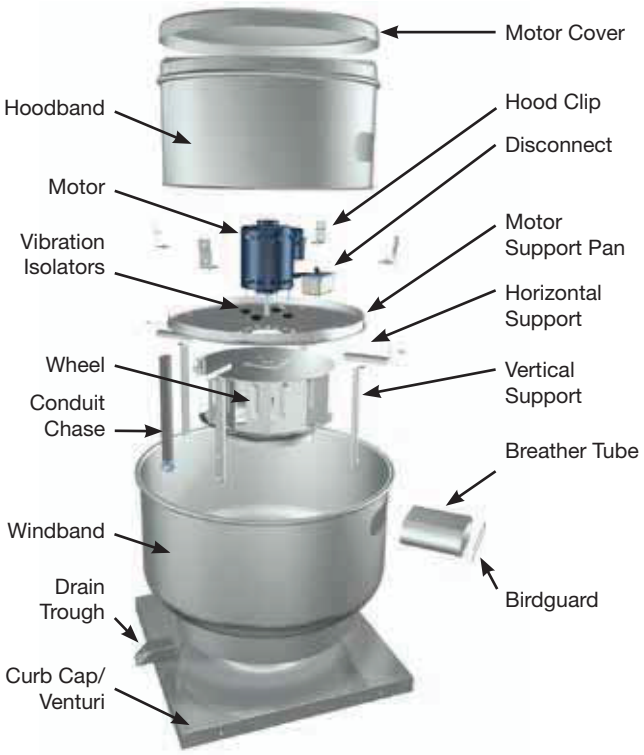
CAUTION

A fan manufactured with an explosion resistant motor does not certify the entire unit to be explosion proof. Refer to UL Listing Mark for the fans approved usage.

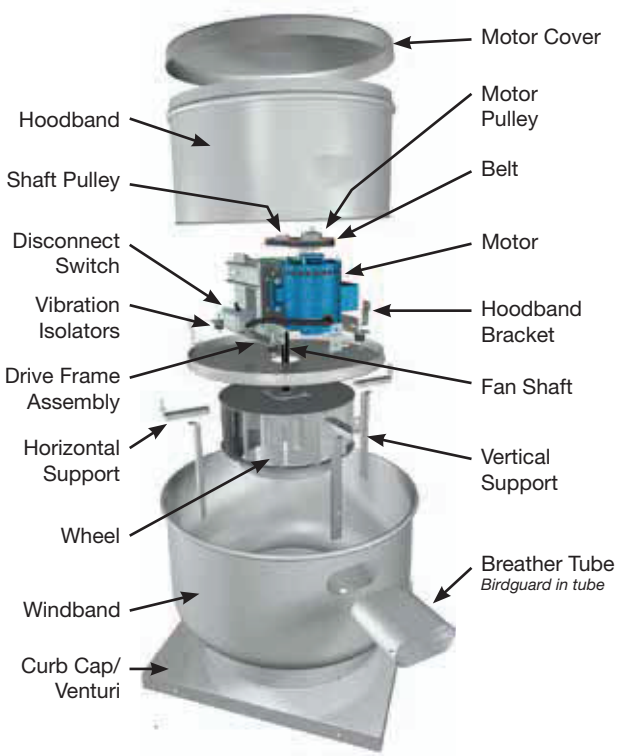
CAUTION

La présence d'un moteur antidéflagrant sur un ventilateur ne garantit pas que tout l'appareil est antidéflagrant. Pour connaître les emplois autorisés de l'appareil, voir son marquage de conformité UL.

CUE Direct Drive



CUBE Direct Drive



NOTE

For replacement, the windband, vertical supports, drain trough and curb cap/venturi come as one complete assembly.

Troubleshooting

WARNING

Before taking any corrective action, make certain unit is not capable of operation during repairs.

AVERTISSEMENT

Avant d'entreprendre toute action corrective, s'assurer que l'appareil ne pourra pas fonctionner durant les réparations.

PROBLEM	CAUSE	CORRECTIVE ACTION
Excessive noise or vibration	Wheel rubbing inlet	Adjust wheel and/or inlet cone. Tighten wheel hub or bearing collars on shaft.
	V-belt drive	Tighten pulleys on motor/fan shaft. Adjust belt tension. Align pulleys properly, see page 8, Figures 15 and 16. Replace worn belts or pulleys.
	Bearings	Replace defective bearing(s). Lubricate bearings. Tighten collars and fasteners.
	Wheel unbalance	Clean all dirt off wheel. Check wheel balance, rebalance in place if necessary.
	Bad bearings	Replace.
	Belts too tight or too loose	Adjust tension, see Figures 17, 18a and 18b.
	Wheel improperly aligned and rubbing	Center wheel on inlet, see Figure 8.
	Loose drive or motor pulleys	Align and tighten. See Pre-Starting Checks, pages 7 and 8.
	Foreign objects in wheel or housing	Remove objects, check for damage or unbalance.
	Fan base not securely anchored	Secure properly.
	Motor hood loose and rattling	Tighten fasteners to secure the motor hood.
	Defective or loose motor bearings	Replace motor with same frame size, RPM-HP
High horsepower	Fan	Check rotation of wheel, see Figure 14. Reduce fan speed.
	Duct system	Resize ductwork. Check proper operation of face and bypass dampers. Check filters and access doors.
Fan does not operate	Electrical supply	Check: fuses/circuit breakers; for switches off; for correct supply voltage.
	Drive	Check for broken belts. Tighten loose pulleys or belts.
	Motor	Assure motor is correct horsepower and not tripping overload protector.
Motor overloads or overheats	Lubrication	Check for excessive or insufficient grease in the bearing.
	Mechanical	Replace damaged bearing. Relieve excessive belt tension. Align bearings. Check for bent shaft.
	Belt slippage	Adjust tension or replace bad belts, see page 8.
	Over/Under line voltage	Contact power company.
	Incorrect wheel rotation	Check motor wiring, Figure 6. Confirm wheel rotation, Figure 9.
	Wheel RPM too high	Check drives or slow down fan by opening variable pitch pulley on motor shaft.
	Undersized motor	Check motor ratings with catalog speed and air capacity chart.
	Motor wired incorrectly	Check motor wiring to wiring diagram located on fan motor.
Reduced airflow	System resistance too high	Check system: Proper operation of backdraft or control dampers, obstruction in ductwork, clean dirty filters.
	Unit running backwards	Correct as shown in Figure 14.
	Excessive dirt buildup on wheels	Clean wheel.
	Improper wheel alignment	Center wheel on inlets, see Pre-Starting Checks and Figure 13.
	Dampers closed	Inspect and repair.
	Blocked duct/clogged filter	Clean or replace.
	Belt slippage	Replace and adjust tension.
	Speed too slow	Check for correct drives.

Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Specific Greenheck product warranties are located on greenheck.com within the product area tabs and in the Library under Warranties.

Greenheck's Centrifugal Upblast and Sidewall Exhaust catalog provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

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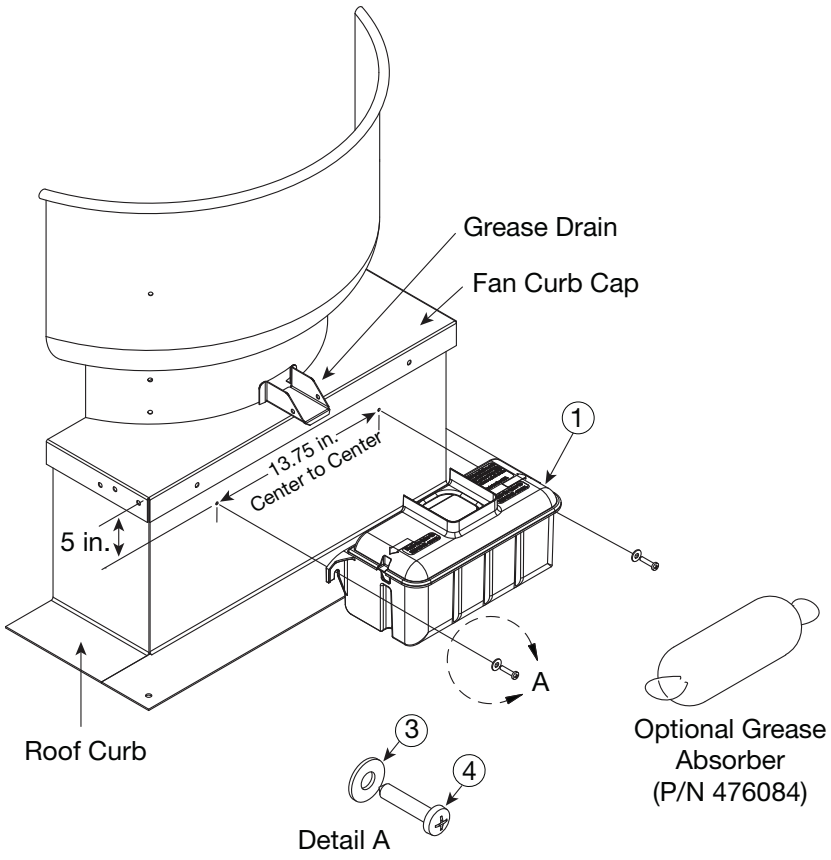
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Document 476370
Grease Trap Installation
Curb and Hinged Base

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage!



Parts List (per diagram)		
Number	**Description**	**Quantity**
1	Grease Trap Assm. without Absorber (475538)	1
2	*** Grease Trap Assm. with Absorber (476085)*	1
3	Flat Washer 1/4-inch x 0.75-inch	2
4	Sheet Metal Screw 1/4-inch x 1-inch	2

***This item not shown on drawing (grease trap assembly with absorber)*

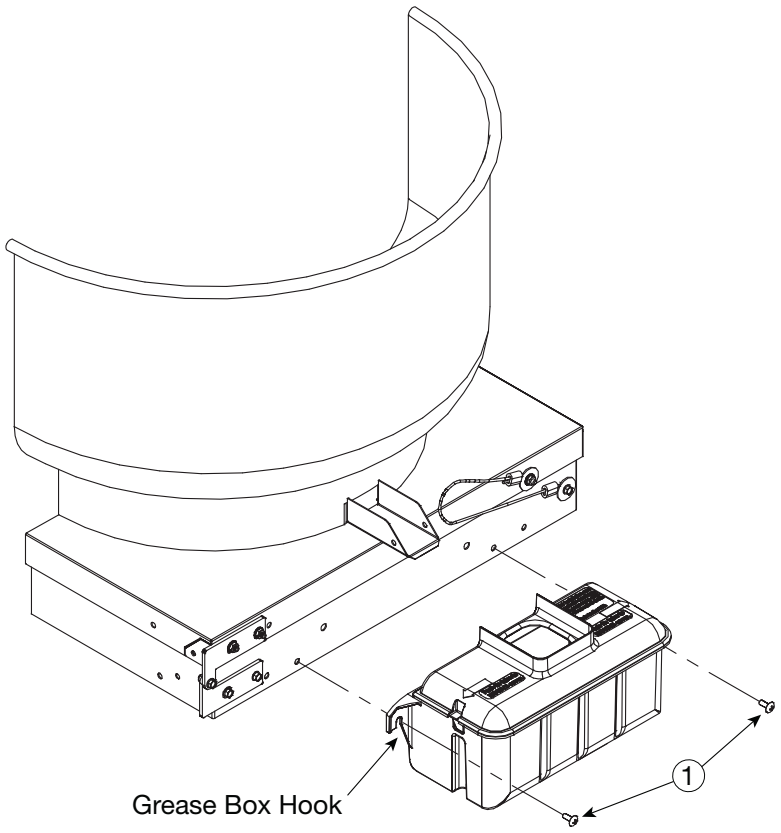
General Safety Information

Follow all local codes, as well as the National Fire Protection Agency (NFPA), where applicable.

NFPA 96: Upblast fans shall have a drain directed to a readily accessible and visible grease receptacle not to exceed 3.8 L (1 gal.)

Installation on Roof Curb

1. Install grease absorber in grease trap (if included) then snap cover into grease trap.
2. Locate and mark the container mounting holes on the extended base or roof curb.
3. Drill 3/16-inch diameter holes in the curb at the marked locations as shown.
4. Attach container with the two supplied 1/4-inch x 1-inch sheet metal fasteners. See detail “A”. If extended base is a vented type, allow vent projections to hold trap away from curb.
5. Fill container with water (after installation and after each cleaning) until it flows out the drain hole. The water will not affect the grease absorbers performance. The unit is now ready for use.
6. Check grease absorber (if included) every month. Replace grease absorber after every cleaning and/or as needed between cleanings. Grease absorber safely holds a 1/2 gallon of grease.
7. Replacement grease absorbers (P/N 476084) can be ordered from your local Greenheck Representative.



Parts List (per diagram)		
Number	**Description**	**Quantity**
1	1/4-20 x 5/8 MS PTH (415729)	2

Polypropylene Grease Trap Material Properties		
Property	**Nominal Value (English)**	**Nominal Value (SI)**
Operating Temperature Range	-40 to 200°F	-40 to 93°C
Melting Temperature Range	320 to 329°F	160 to 165°C
Impact Strength	9.0 ft-lb/in^2	19 kJ/m^2
UV Resistance	Min. 10 Year Life	Min. 10 Year Life
Flammability and Smoke	UL 94 Rated	UL 94 Rated

Grease Trap Installation on Hinged Base

1. Locate two welded nut inserts on the lower portion of the hinged base as shown in the figure. Holes may be located on either the front or hinge side of the hinged base.
2. Insert two supplied 1/4-20 x 5/8-inch phillips truss head screws into nut inserts and start the threads.
3. Position grease trap hooks over the screws and tighten.

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Document 453283
Series L • Models LB, LBP, LD, LDP
Low Silhouette Centrifugal Roof Exhaust Fans

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage!

Series L Exhaust Fans

Greenheck's Series L, low silhouette, models LD, LB, LDP, and LBP centrifugal roof exhaust fans provide the industry's best performance and durability for general clean air applications. Series L exhaust fans have the broadest performance in the industry, up to 1.25 in. wg *(311 Pa)* and 37,500 cfm *(63,713 m^3/hr)*.



General Safety Information

Only qualified personnel should install this fan. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards. Other considerations may be required if high winds or seismic activity are present. If more information is needed, contact a licensed professional engineer before moving forward.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electrical Code (CEC) in Canada.
2. The rotation of the wheel is critical. It must be free to rotate without striking or rubbing any stationary objects.
3. Motor must be securely and adequately grounded.
4. Do not spin fan wheel faster than max cataloged fan RPM. Adjustments to fan speed significantly effects motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.
5. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces, or chemicals. Replace cord immediately if damaged.
6. Verify that the power source is compatible with the equipment.
7. Never open access doors to a duct while the fan is running.

DANGER
Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.
CAUTION
When servicing the fan, motor may be hot enough to cause pain or injury. Allow motor to cool before servicing.
CAUTION
Precaution should be taken in explosive atmospheres.

DANGER
Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.
ATTENTION
Lors de toute intervention sur la soufflante, le moteur peut être suffisamment chaud pour provoquer une douleur voire une blessure. Laisser le moteur refroidir avant toute maintenance.
ATTENTION
Faire preuve de précaution dans les atmosphères explosives.

Receiving

Upon receiving the product, check to ensure all items are accounted for by referencing the delivery receipt or packing list. Inspect each crate or carton for shipping damage before accepting delivery. Alert the carrier of any damage detected. The customer will make notification of damage (or shortage of items) on the delivery receipt and all copies of the bill of lading which is countersigned by the delivering carrier. If damaged, immediately contact your Greenheck Representative. Any physical damage to the unit after acceptance is not the responsibility of Greenheck Fan Corporation.

Unpacking

Verify that all required parts and the correct quantity of each item have been received. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the bill of lading.

Handling

When lifting the unit to the roof, securely fasten straps to the drive frame located in the motor compartment. Access to the motor compartment is accomplished by removing bolts securing the hood to the base. The hood cover will need to be removed for access to the drive frame. The cover can then be removed and placed on a flat surface in an area protected from strong winds.

When unit is on the roof, move fan to desired location and fasten securely through mounting holes in base. Shims may be necessary depending upon roof material thickness.

The motor amperage and voltage ratings must be checked for compatibility to supply voltage prior to final electrical connection. Electrical lead-in wires should be run through the conduit provided between the curb and the bottom of the motor compartment. Wiring must conform to local and national codes.

IMPORTANT

Do not lift by the fan hood. Avoid lifting fans in a way that will bend or distort fan parts. Never pass slings or timbers through the venturi of fan. Fans with special coatings or paints must be protected in handling to prevent damage.

Storage

Fans are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the fan and accessories while in storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

Indoor

The ideal environment for the storage of fans and accessories is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain or snow. Temperatures should be evenly maintained between 30° to 110°F *(-1° to 43°C)*, wide temperature swings may cause condensation and “sweating” of metal parts. All accessories must be stored indoors in a clean, dry atmosphere.

Remove any accumulations of dirt, water, ice, or snow and wipe dry before moving to indoor storage. To avoid “sweating” of metal parts allow cold parts to reach room temperature. To dry parts and packages use a portable electric heater to remove any moisture build up. Leave coverings loose to permit air circulation and to allow for periodic inspection.

The unit should be stored at least 3½ inches *(89 mm)* off the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Aisles between parts and along all walls should be provided to permit air circulation and space for inspection.

Outdoor

Fans designed for outdoor applications may be stored outdoors, if absolutely necessary. Roads or aisles for portable cranes and hauling equipment are needed.

The fan should be placed on a level surface to prevent water from leaking into the fan. The fan should be elevated on an adequate number of wooden blocks so it is above water and snow levels and has enough blocking to prevent it from settling into soft ground. Locate parts far enough apart to permit air circulation, sunlight and space for periodic inspection. To minimize water accumulation, place all fan parts on blocking supports so rain water will run off.

Do not cover parts with plastic film or tarps as these cause condensation of moisture from the air passing through heating and cooling cycles. Fan wheels should be blocked to prevent spinning caused by strong winds.

Inspection and Maintenance During Storage

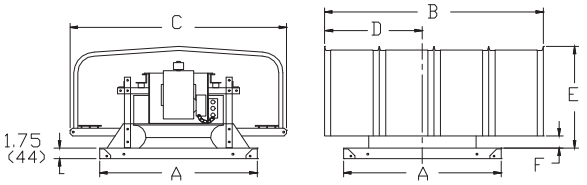
While in storage, inspect fans once per month. Keep a record of inspection and maintenance performed.

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. At each inspection, rotate the wheel by hand ten to fifteen revolutions to distribute lubricant on motor. If paint deterioration begins, consideration should be given to touch-up or repainting. Fans with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive should be restored to good condition promptly if signs of rust occur. Immediately remove the original rust preventive coating with petroleum solvent and clean with lint-free cloths. Polish any remaining rust from surface with crocus cloth or fine emery paper and oil. Do not destroy the continuity of the surfaces. Thoroughly wipe clean with Tectyl® 506 (Ashland Inc.) or the equivalent. For hard to reach internal surfaces or for occasional use, consider using Tectyl® 511M Rust Preventive, WD-40® or the equivalent.

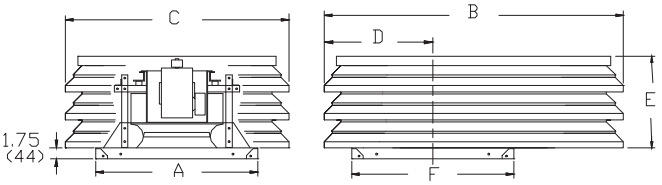
Series L Dimensions

Model LB



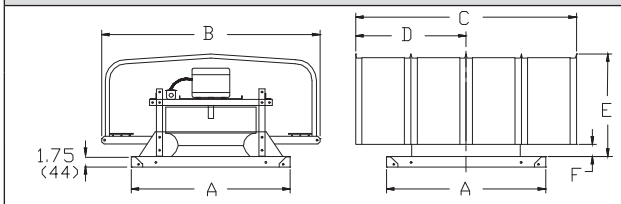
Size	A	B	C	D	E	F	Damper Size	Roof Opening	Weight Galv.
10	22 (559)	39 (991)	28 (711)	17¼ (438)	17 (432)	3¼ (85)	12 (305)	14½ (368)	56 (25)
14	26 (660)	39 (991)	35 (889)	17½ (445)	18 (457)	4 (102)	16 (406)	18½ (470)	81 (37)
18	30 (762)	39 (991)	40 (1016)	17½ (445)	21 (533)	4½ (114)	18 (457)	20½ (521)	135 (61)
21	30 (762)	51 (1295)	43 (1092)	23 (584)	23 (584)	6 (152)	18 (457)	20½ (521)	145 (66)
24	34 (864)	51 (1295)	45½ (1156)	20½ (521)	23½ (597)	6¾ (171)	24 (610)	26½ (673)	188 (85)
30	40 (1016)	63 (1600)	50 (1270)	29½ (749)	26⅝ (676)	8½ (216)	30 (762)	32½ (826)	249 (113)
36	46 (1168)	63 (1600)	60 (1524)	27 (686)	32⅝ (829)	9¾ (248)	36 (914)	38½ (978)	338 (153)
42	52 (1321)	75 (1905)	70⅝ (1794)	33½ (851)	37⅜ (949)	11½ (292)	42 (1067)	44½ (1130)	396 (180)
48	58 (1473)	87 (2210)	70⅜ (1788)	41 (1041)	41½ (1054)	11⅝ (295)	48 (1219)	50½ (1283)	430 (195)
54	64 (1626)	87 (2210)	79½ (2019)	38 (965)	45⅜ (1153)	12½ (318)	54 (1372)	56½ (1435)	596 (270)

Model LBP



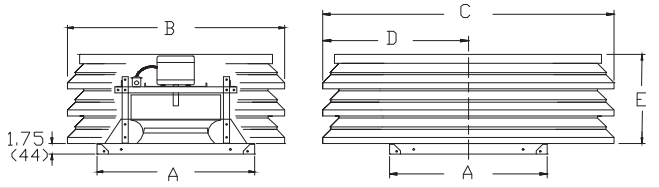
Size	A	B	C	D	E	F	Damper Size	Roof Opening	Weight Alum.
10	22 (559)	38½ (978)	28 (711)	14 (356)	17 (432)	32⅝ (829)	12 (305)	14½ (368)	99 (45)
14	26 (660)	40 (1016)	32 (813)	16 (406)	17 (432)	26 (660)	16 (406)	18½ (470)	116 (53)
18	30 (762)	46 (1168)	36 (914)	19 (483)	24½ (622)	30 (762)	18 (457)	20½ (521)	179 (81)
21	30 (762)	46 (1168)	36 (914)	19 (483)	24½ (622)	30 (762)	18 (457)	20½ (521)	191 (86)
24	34 (864)	49½ (1257)	40 (1016)	20 (508)	23½ (597)	34 (864)	24 (610)	26½ (673)	239 (108)
30	40 (1016)	58 (1473)	46 (1168)	23 (584)	26½ (673)	40 (1016)	30 (762)	32½ (826)	318 (144)
36	46 (1168)	63 (1600)	51¾ (1314)	26 (660)	34⅜ (873)	46 (1168)	36 (914)	38½ (978)	444 (201)
42	52 (1321)	70½ (1791)	58 (1473)	29 (737)	38¼ (972)	52 (1321)	42 (1067)	44½ (1130)	530 (240)
48	58 (1473)	76½ (1943)	64 (1626)	32 (813)	40⅜ (1026)	58 (1473)	48 (1219)	50½ (1283)	579 (263)
54	64 (1626)	83½ (2121)	70 (1778)	35 (889)	43⅝ (1108)	64 (1626)	54 (1372)	56½ (1435)	780 (354)

Model LD



Size	A	B	C	D	E	F	Damper Size	Roof Opening	Weight Galv.
60-75	17 (432)	23 (584)	27 (686)	13½ (343)	13 ⅜ (340)	2 (51)	8 (203)	10½ (267)	37 (17)
80-95	19 (483)	28 (711)	27 (686)	13½ (343)	16 (406)	4 (102)	10 (254)	12½ (318)	45 (20)
100-120	22 (559)	31½ (800)	27 (686)	13½ (343)	23¼ (591)	4 (102)	12 (305)	14½ (368)	57 (26)

Model LDP



Size	A	B	C	D	E	F	Damper Size	Roof Opening	Weight Alum.
60-75	17 (432	23 (584)		11½ (292)	14 (356)	—	8 (203)	10½ (267)	49 (22)
80-95	19 (483)	25 (635)		12½ (318)	17 (432)	—	10 (254)	12½ (318)	63 (29)
100-120	22 (559)	28 (711)		14 (356)	19¼ (489)	—	12 (305)	14½ (368)	82 (37)

All dimensions given in inches (millimeters). Weights given in pounds (kilograms).

Removing From Storage

As fans are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion until the fan equipment goes into operation.

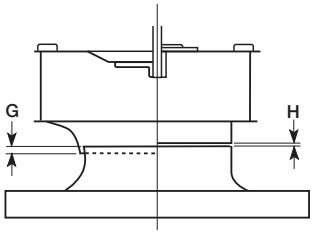
Prestart-up Checks

1. Check all fasteners for tightness. The wheel should rotate freely and be aligned as shown in Figure 1.

WHEEL OVERLAP AND GAP DIMENSIONS

Model	G - Overlap in. *(mm)*	H - Gap in. *(mm)*
LD/LDP 60-095	–	3/32 *(2)*
LD/LDP 100-120	–	1/4 *(6)*
LB/LBP 10-14	1/4 *(6)*	–
LB/LBP 18-24	3/8 *(10)*	–
LB/LBP 30-54	1/2 *(13)*	–

Figure 1

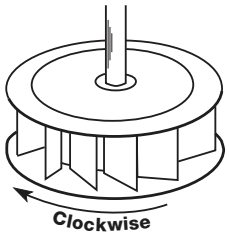


2. Wheel position is preset and the unit is test run at the factory. Movement may occur during shipment, and realignment may be necessary.
3. Centering can be accomplished by loosening the bolts holding the drive frame to the shock mounts and repositioning the drive frame.
4. Wheel and inlet cone overlap can be adjusted by movement of the wheel. See Tapered Bushing Hub Installation and Removal (pg. 5) for directions on repositioning.
5. Check wheel rotation by momentarily energizing the unit. Rotation should be clockwise as shown in Figure 2 and correspond to the rotation decal on the unit. Rotation is determined when the unit is viewed from the motor or shaft pulley side.

WHEEL ROTATION

All Series L fans have clockwise (CW) wheel rotation when viewed from top of fan.

Figure 2



WARNING

Correct direction of wheel rotation is critical. Reversed rotation will result in poor air performance, motor overloading and possible motor burnout.

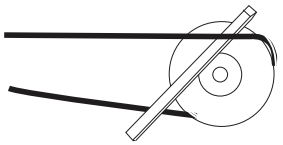
AVERTISSEMENT

La turbine doit impérativement tourner dans le bon sens. Une rotation en sens inverse entraînerait de mauvaises performances de soufflage, une surcharge du moteur voire un grillage du moteur.

Prestart-up Belt Tension Checks

6. Always loosen tension enough to install belt without stretching, see Figure 3.

BELTS



Do not force belt(s). Forcing the belt(s) will break the cords and cause belt failure

Figure 3

7. If adjustments are made, it is very important to check the pulleys for proper alignment. Misaligned pulleys lead to excessive belt wear vibration, noise and power loss (see Figure 4).

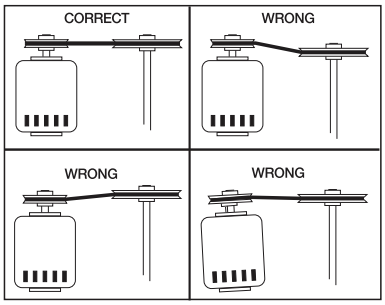


Figure 4

8. Belt tension can be adjusted by loosening four fasteners (marked “R” in Figure 5) on the drive frame. This allows the motor plate to slide on the drive frame angles for proper positioning.

FASTENERS

Identical fasteners on opposing side must also be loosened.

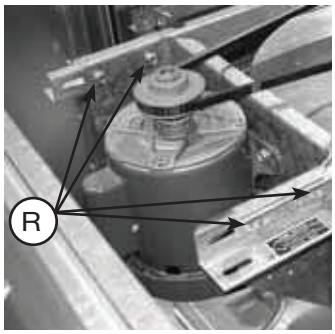


Figure 5

9. Belt tension should be adjusted to allow 1⁄64 in. (0.397 mm) of deflection per inch of belt span. For example, a 15 in. *(381 mm)* belt span should have 15⁄64 in. *(0.234 mm)* (or about 1⁄4 in. *(6 mm)*) of deflection with moderate thumb pressure at mid-point between pulleys (see Figure 6).

IMPORTANT

The fan has been checked for mechanical noises at the factory prior to shipment. If mechanical noise should develop, suggested corrective actions are offered in the Troubleshooting section.

IMPORTANT

Over tightening will cause excessive bearing wear and noise. Too little tension will cause slippage at start-up and uneven wear.

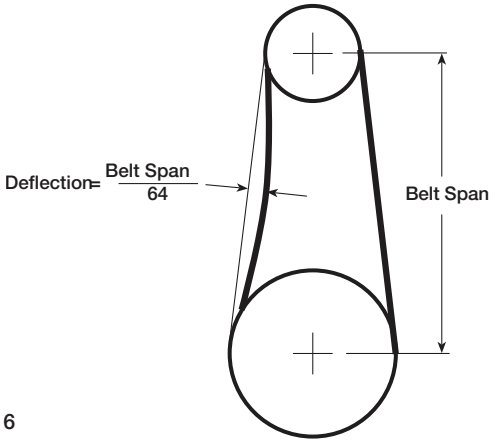


Figure 6

10. The adjustable motor pulley is factory set for the RPM specified. Speed can be increased by closing or decreased by opening the adjustable motor sheave.
11. Two groove variable pitch pulleys must be adjusted an equal number of turns open or closed.
12. Any increase in speed represents a substantial increase in the horsepower required by a unit.
13. Motor amperage should always be checked to avoid serious damage to the motor when speed is varied.

IMPORTANT

Adjust (tighten) belt tension after the first 24-48 hours of operation.

Maintenance

Motor maintenance is generally limited to cleaning and lubrication (where applicable). Cleaning should be limited to exterior surfaces only. Removing dust buildup on motor housing ensures proper motor cooling.

Greasing of motors is only intended when fittings are provided. Many fractional hp motors are permanently lubricated and should not be lubricated further. Motors supplied with grease fittings should be greased in accordance with manufacturers' recommendations. Where motor temperatures do not exceed 104°F *(40°C)*, the grease should be replaced after 2000 hours of running time as a general rule.

Wheels require very little attention when moving clean air. Occasionally, oil and dust may accumulate causing imbalance. When this occurs, the wheel and housing should be cleaned to ensure smooth and safe operation.

All fasteners should be checked for tightness each time maintenance checks are performed prior to restarting unit.

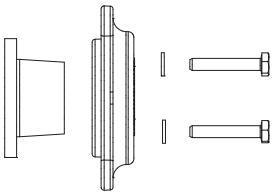
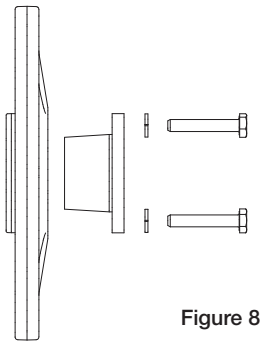
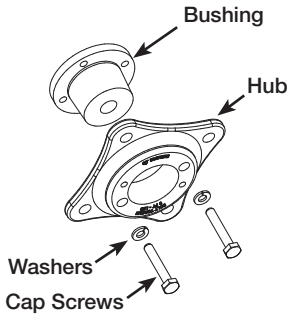
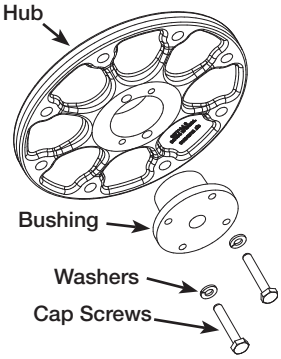
A proper maintenance program will help these units deliver years of dependable service.

Tapered Bushing Hub Installation and Removal

For wheel hubs and shaft pulleys utilizing a tapered bushing interface, follow this procedure for installation and removal. There are two possible setups for the tapered bushing, both have the same procedure but orientation of the hub varies.

Tapered Bushing Removal:

1. (If present): Loosen the setscrew holding the bushing and shaft key in place.
2. Loosen and remove the socket head cap screws fastening the bushing to the hub as shown in the section views and examples of Figures 7-10.

Standard Mounting	Reverse Mounting
 Figure 7	 Figure 8
	
 Figure 9 Standard Bushing Orientation	 Figure 10 Reverse Bushing Orientation

3. **Standard Mounting** - Take the two socket head cap screws that were removed and install them into the visibly threaded holes on the wheel hub.
   Reverse Mounting - Install the two socket head cap screws into the visibly threaded holes of the bushing flange.

4. Once both socket head cap screws are installed, tighten them an eighth of a turn at a time, alternating between the two until the hub comes loose from the bushing.

Bushing Installation:

1. Clean all surfaces of hub and bushing to remove any oil or residue present and do not use any lubricant to install bushing into the hub. For both standard and reverse mounting styles the socket head cap screws are adjustable from the inlet of the fan.
2. **Standard Mounting** - Slide the bushing and shaft key onto the fan shaft followed by the wheel and hub assembly. If present, use the keyway setscrew to hold the shaft key and bushing in place but DO NOT overtighten as this can damage the bushing. Align the unthreaded holes of the hub with the threaded holes of the tapered bushing.
   Reverse Mounting – Slide the wheel and hub assembly onto the fan shaft followed by the bushing and shaft key. If present, use the keyway setscrew to hold the shaft key and bushing in place but DO NOT overtighten as this can damage the bushing. Align the unthreaded holes of the tapered bushing with the threaded holes of the hub.
3. Install the two bushing socket head cap screws into the aligned holes by hand (or without excessive torque) until the heads of the socket head cap screws are seated against the mating surface.
4. Adjust the height of the wheel in the fan relative to the inlet venturi then tighten the two socket head cap screws an eighth turn at a time in an alternating fashion and to a torque of 10 ft-lbs.

Belt/Bearing Maintenance

WARNING
Always disconnect, lock and tag power source before servicing. Failure to disconnect power source can result in fire, shock or serious injury.
AVERTISSEMENT
Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'entretien.
IMPORTANT
Uneven cleaning of the wheel will produce an out of balance condition that will cause vibration in the fan.
WARNING
This unit should be made non-functional when cleaning the wheel or housing (fuses removed, disconnect locked off).
AVERTISSEMENT
L'appareil doit être rendu non opérationnel lors du nettoyage de la turbine ou du caisson (fusibles retirés, sectionneur verrouillé).

1. Belts tend to stretch after a period of time. They should be checked periodically for wear and tightness. When replacing belts, use the same type as supplied with the unit.
2. Matched belts should always be used on units with multi-groove pulleys.
3. For belt replacement, loosen the tensioning device far enough to allow removal of the belt by hand. Do not force belts on or off. This may cause cords to break, leading to premature belt failure.
4. Once installed, adjust belts as shown in "Prestart-up Checks."
5. Shaft bearings can be classified in two groups: relubricating and non-relubricating. All bearings are factory lubricated and require no further lubrication under normal use (between -20ºF and 180ºF *(-29° to 82°C)* in a relatively clean environment).
6. Units installed in hot, humid, or dirty locations should be equipped with special bearings. These bearings will require frequent lubrication. Caution should be employed to prevent overpacking or contamination.
7. Grease fittings should be wiped clean. The unit should be in operation while lubricating. Use extreme care around moving parts.
8. Grease should be pumped in very slowly until a slight bead forms around the seal. A high-grade lithium base grease is recommended.
9. Direct drive units require little maintenance except for cleaning, wheel alignment, and oiling according to motor label instructions.

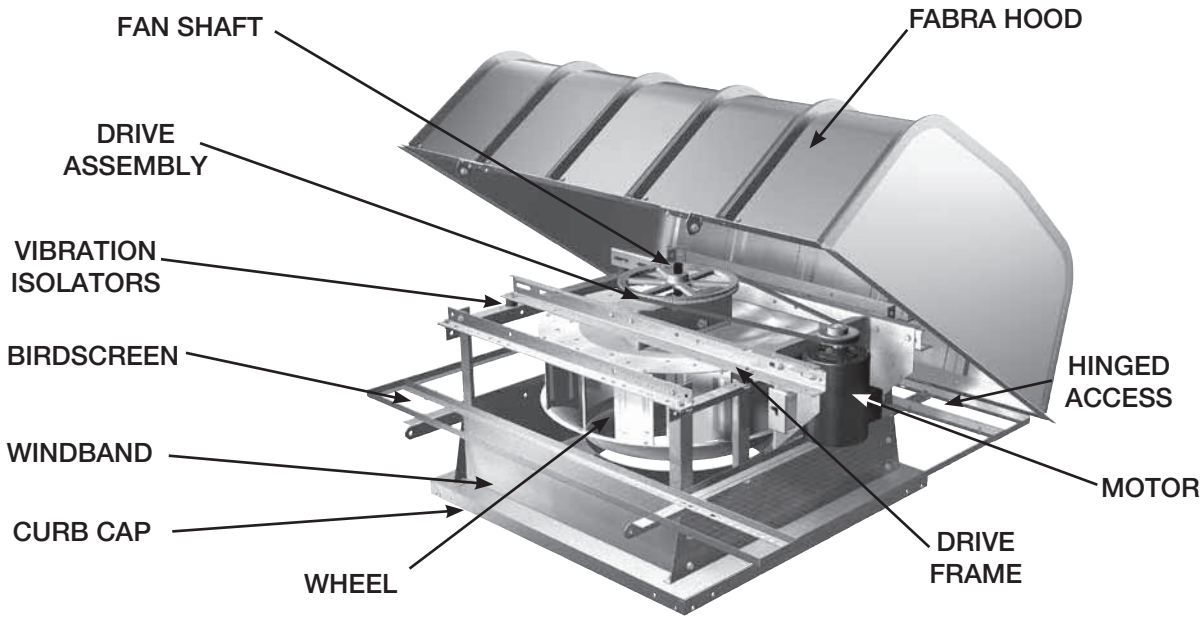
Parts List

Each fan bears a manufacturer's nameplate with model number and serial number embossed. This information will assist the local Greenheck representative and the factory in providing service and replacement parts. Before taking any corrective action, make certain unit is not capable of operation during repairs.

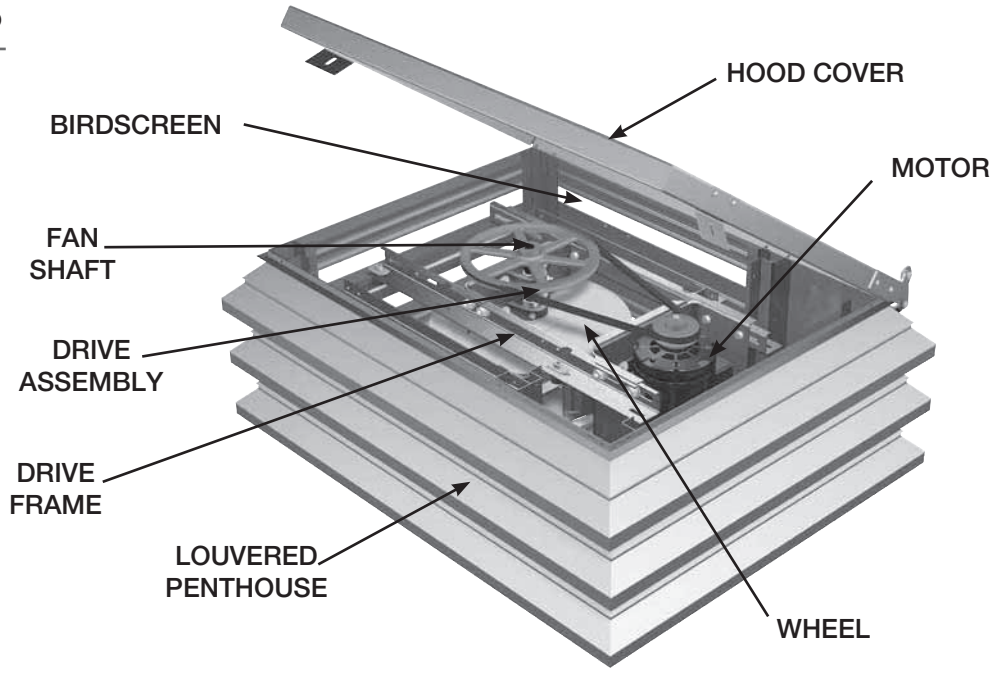
CAUTION
A fan manufactured with an explosion resistant motor does not certify the entire unit to be explosion proof. Refer to UL Listing Mark for the fans approved usage.

CAUTION
La présence d'un moteur antidéflagrant sur un ventilateur ne garantit pas que tout l'appareil est antidéflagrant. Pour connaître les emplois autorisés de l'appareil, voir son marquage de conformité UL.

Model LB



Model LBP



Troubleshooting

WARNING
Before taking any corrective action, make certain unit is not capable of operation during repairs.

AVERTISSEMENT
Avant d'entreprendre toute action corrective, s'assurer que l'appareil ne pourra pas fonctionner durant les réparations.

PROBLEM	CAUSE	CORRECTIVE ACTION
Reduced Airflow	System resistance too high	Check system for proper operation of backdraft or control dampers; remove obstructions in ductwork, etc.
	Unit running backwards	See Prestart-up Checks.
	Fan speed too low	Increase fan speed.
	Excessive dirt buildup on wheel	Clean wheel.
	Improper wheel alignment	Center wheel on inlets.
Excessive Noise or Vibration	Bad Bearings	Replace.
	Belts too tight or too loose	Refer to Figure 6 and adjust tension.
	Wheel improperly aligned and rubbing	Center wheel on inlets. See Figure 1.
	Loose drive or motor pulleys	Align and tighten. See Prestart-up Checks.
	Foreign objects in wheel or housing	Remove objects, check for damage or unbalance.
	Unbalance of wheel caused by excessive dirt and grease buildup	Remove buildup.

Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Specific Greenheck product warranties are located on greenheck.com within the product area tabs and in the Library under Warranties.

Greenheck Series L catalog provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

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Building Value in Air.

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Document 474680
Model SP
Model CSP
Ceiling Exhaust and Inline Fans

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage!

Model SP



Model SP is a direct drive ceiling exhaust fan designed for clean air applications where low sound levels are required. Many options and accessories are available such as lights, motion detectors, ceiling radiation dampers and speed controls. Capacities range from 25 to 1,600 cfm (42 to 2,718 m^3/hr) and 1 in. wg (248 Pa). AMCA Licensed for Sound and Air Performance.

ENERGY STAR® Certified models include:
SP-A, 50, 70, 90, 200, 250, 290 and 410;
SP-B, 50, 70, 80 and 90.

WARNING!

To reduce the risk of fire, electric shock, or injury to persons, observe the following:

- Suitable for use with solid state speed controls.
- Use this unit only in the manner intended by the manufacturer. If you have questions, contact the manufacturer.
- Before servicing or cleaning unit, switch power off at service panel and lock service disconnecting means to prevent power from being switched on accidentally. When the service disconnecting means cannot be locked, securely fasten a prominent warning device, such as a tag, to the service panel.
- Installation work and electrical wiring must be done by qualified person(s) in accordance with all applicable codes and standards, including fire-rated construction.
- Sufficient air is needed for proper combustion and exhausting of gases through the flue (chimney) of fuel burning equipment to prevent back drafting. Follow the heating equipment manufacturer's guideline and safety standards such as those published by the National Fire Protection Association (NFPA), and the American Society for Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) and the local code authorities.
- When cutting or drilling into wall or ceiling, do not damage electrical wiring or other hidden utilities.
- Acceptable for use over a bathtub or shower when installed in a GFCI protected branch circuit. (Up through size SP-A390)
- Never place a switch where it can be reached from a tub or shower.
- Ducted fans must always be vented to the outdoors.
- These fans are not recommended for cooking exhaust applications. They are designed primarily for low temperature, clean air applications only. The diagram shows the minimum distance these fans should be placed in relation to cooking equipment.
- Fan/Light combination not to be installed in a ceiling thermally insulated to a value greater than R40.

CAUTION!

- For general ventilating use only. Do not use to exhaust hazardous or explosive materials and vapors.

Model CSP



Model CSP is a direct drive inline exhaust fan designed for clean air applications where low sound levels are required. Capacities range from 70 to 3,800 cfm (119 to 6,456 m^3/hr) and 1 in. wg (248 Pa). AMCA Licensed for Air Performance.

AVERTISSEMENT!

Pour réduire le risque d'incendie, de choc électrique ou de blessure corporelle, respecter cd qui suit:

- Appareil pouvant être utilisé avec un régulateur de vitesse à semi-conducteurs.
- Utiliser cet appareil exclusivement comme prévu par le fabricant. En cas de questions, communiquer avec le fabricant à l'adresse ou au numéro de téléphone figurant dans la garantie.
- Avant tout entretien ou nettoyage de l'appareil, couper l'alimentation sur le tableau électrique et verrouiller le dispositif de sectionnement pour empêcher toute mise sous tension accidentelle. Si le dispositif de sectionnement ne peut pas être verrouillé, attacher un moyen de mise en garde bien visible, tel qu'un panonceau, au tableau électrique.
- La pose et le câblage électrique doivent être effectués par des personnes qualifiées en conformité avec les codes et normes en vigueur, y compris pour la résistance au feu du bâtiment.
- Une quantité d'air suffisante est nécessaire pour la bonne combustion et l'extraction des gaz brûlés par le conduit d'évacuation (cheminée) d'appareils à combustible afin d'éviter le refoulement. Veiller à suivre les indications du fabricant du matériel de chauffe, les normes de sécurité telles que celles publiées par la National Fire Protection Association (NFPA) et l'American Society for Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) et la réglementation en vigueur.
- Lors de la découpe ou du perçage de murs ou plafonds, ne pas endommager les câbles électriques et autres conduites masquées.
- Pose admissible au-dessus d'une baignoire ou d'une douche sous réserve de raccordement à un circuit de dérivation à protection GFCI (disjoncteur différentiel). (Jusqu'à la taille SP-A390 incluse)
- Ne jamais placer d'interrupteur à un emplacement à portée d'une baignoire ou d'une douche.
- Les caissons d'extraction à gaine doivent toujours être évacués vers l'extérieur.
- Ces caissons ne sont pas conseillés pour les applications d'aspiration de vapeurs de cuisson. Ils sont conçus essentiellement pour l'aspiration d'air propre à basse température. Le schéma indique la distance minimale de placement de ces caissons par rapport à l'équipement de cuisson.
- Le combiné ventilateur/luminaire ne devra pas être installé dans un plafond ayant une isolation thermique d'une valeur supérieure à R40.

ATTENTION!

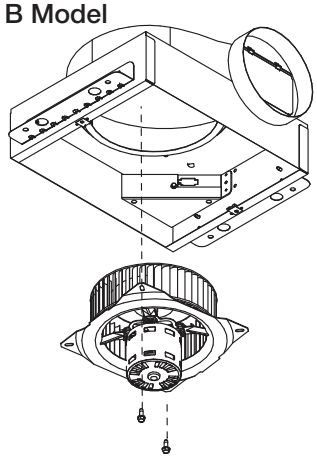
- À utiliser pour la ventilation générale uniquement. Ne pas utiliser pour l'aspiration de matières et vapeurs dangereuses ou explosives.

Prepare the fan

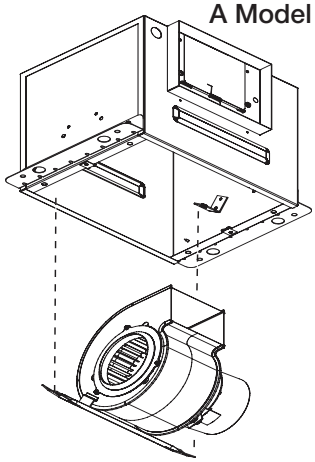
Power Assembly

If power assembly (motor, wheel, and scroll) is not installed in housing, insert the electrical plug into fan socket, then slide scroll end of power assembly into fan housing. Attach by using two sheet metal screws provided.

B Model

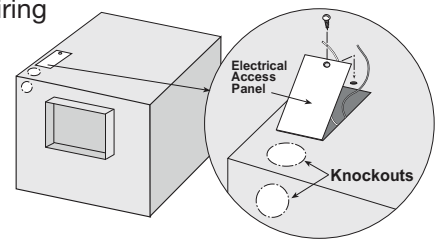


A Model



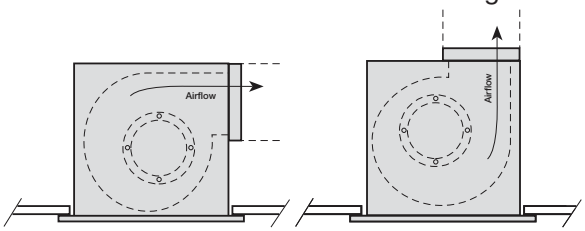
Remove Wiring Knockout

Remove either top or side wiring knockout, depending on wiring direction, by bending it back and forth to break tabs.



Ductwork

Check ductwork to see if the fan's discharge requires rotation from horizontal to vertical discharge.

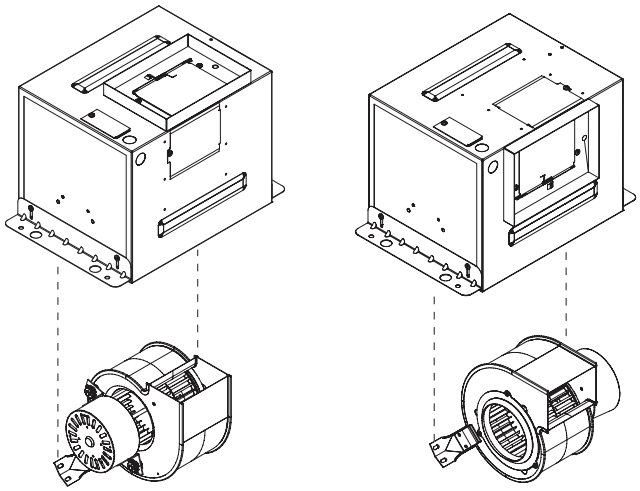


Fan Rotation

To rotate from horizontal to vertical discharge A-Models Only

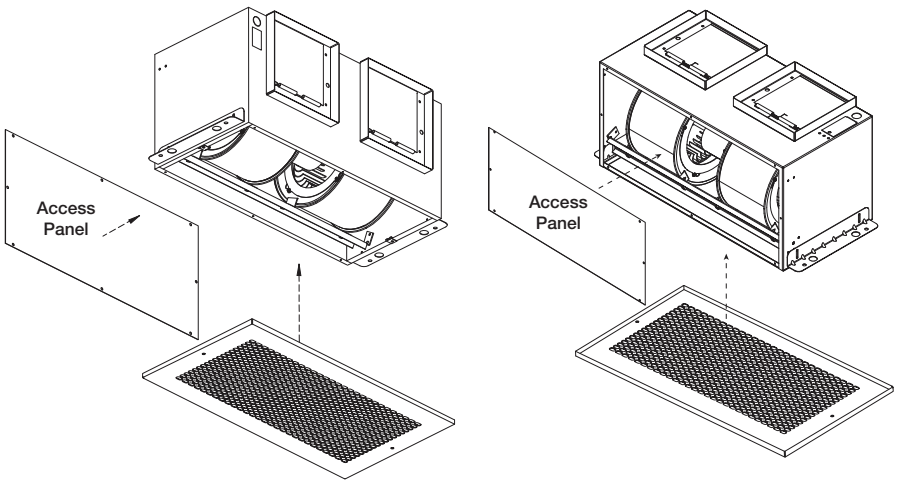
A-50-500, 710, 780 Models

Remove the two screws holding the power assembly in and pull power assembly out. Rotate power assembly 180 degrees and put back into fan. Use the same screws to reattach power assembly to fan housing. Flip fan over and remove the four screws holding the discharge duct and damper assembly. Exchange the assembly with plate mounted on top of fan, as shown in these illustrations.



A-700, 900-1500 Models

Remove the eight screws holding the access panel or collar as shown in picture. Rotate the fan housing so the discharge is facing up. Replace access panel or collar and screws.

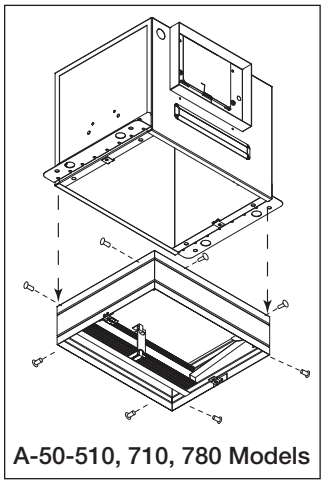


Ceiling Radiation Damper (CRD)

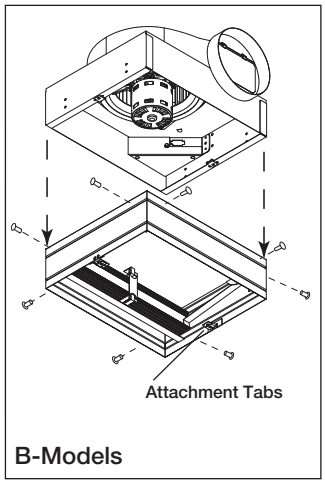
If fan is to be used in a fire resistive membrane ceiling, a ceiling radiation damper must be used.

If the ceiling radiation damper is already mounted to the fan from the factory, proceed to Install the Fan.

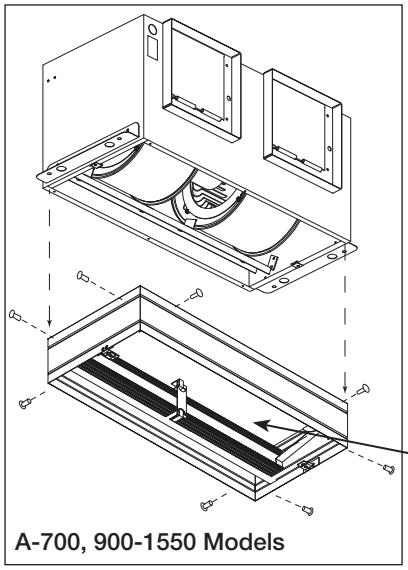
To mount the ceiling radiation damper to fan, make sure grille attachment tabs are facing down. Then place the inlet part of the fan into the ceiling radiation damper collar, and use self-tapping sheet metal screws (by others) to screw through the damper collar and into the fan housing. If the fan/light combination is being used, make sure ceiling radiation damper has an electrical plug in it. The electrical plug must be inserted into the fan. Make sure the electrical wire will not interfere with damper operation as shown in figure below.



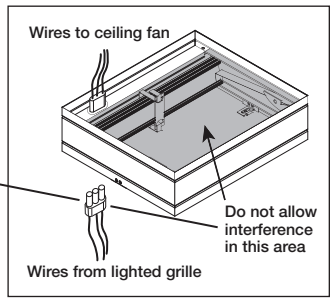
A-50-510, 710, 780 Models



B-Models

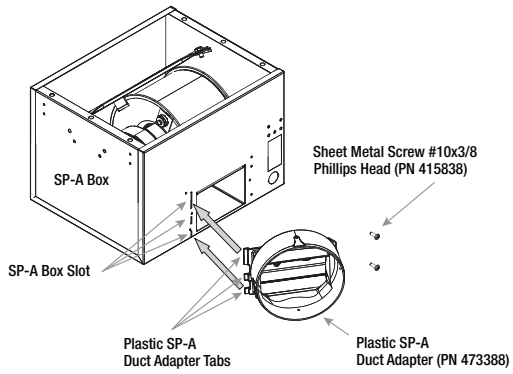


A-700, 900-1550 Models

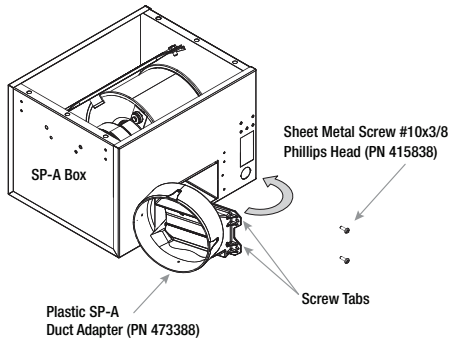


Discharge Installation SP-A 50-90 Models

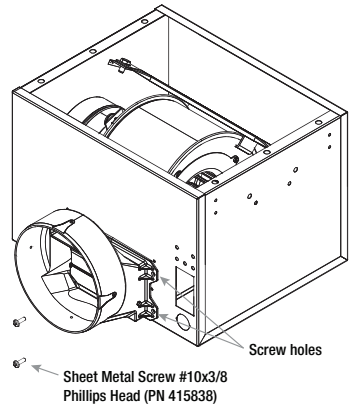
1 Insert plastic duct tab into SP-A box slots.



2 Rotate plastic SP-A duct adapter (PN 473388) until the screw tabs meets SP-A box.

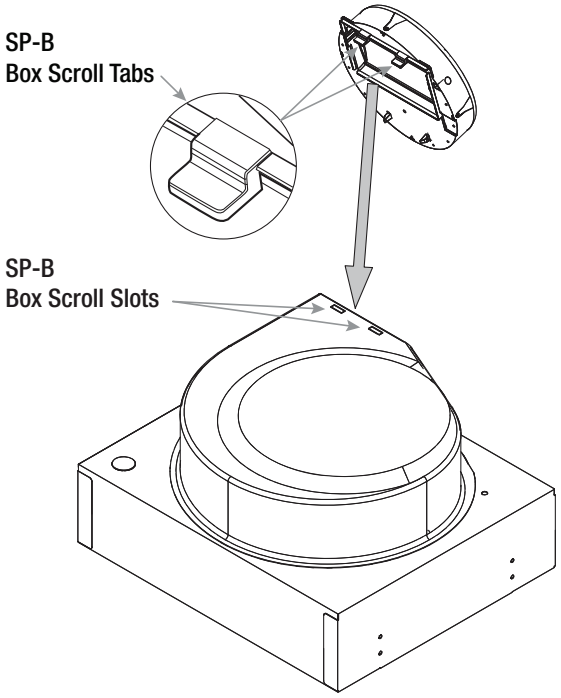


3 Install screws provided to secure discharge.

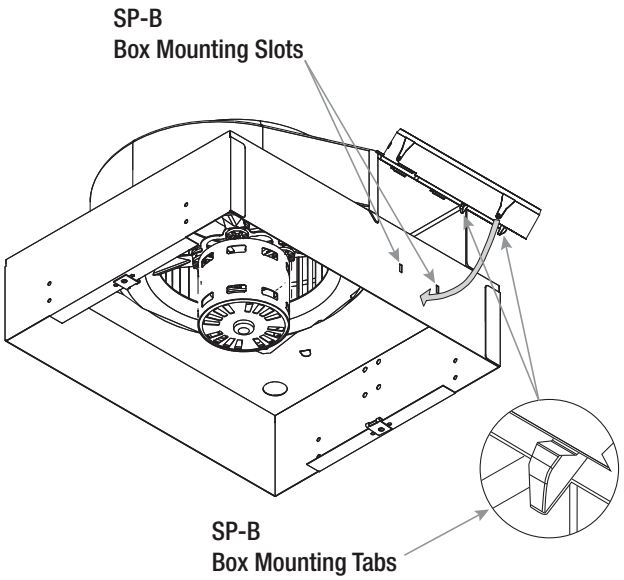


Discharge Installation SP/CSP-B 50-200 Models

1 Insert SP-B box scroll tab into SP-B box scroll slots.

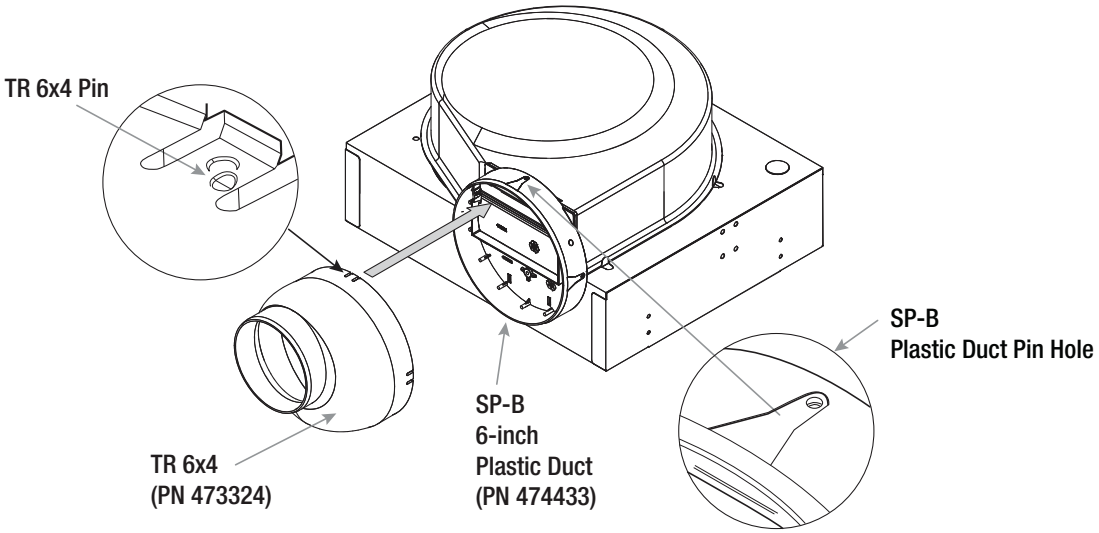


2 Rotate plastic SP-B duct adapter (PN 474433) until the two SP-B mounting tabs fully engage into the two SP-B box mounting slots.



3 **OPTIONAL**

Align the pins on the TR 6x4 adaptor to the duct pin hole on the SP-B 6-inch duct. Push until the adaptor snaps into place.



Install the Fan

1. For best performance, choose a location with the shortest possible duct run and minimum number of elbows. Do not mount near cooking equipment, as shown in Fig. 1.

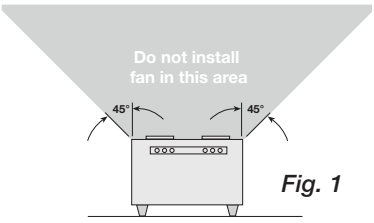


Fig. 1

2. Attach adjustable mounting brackets to fan, but leave the screws loose until proper height is determined, shown in Fig. 2. Cut hole to dimensions shown in table below:

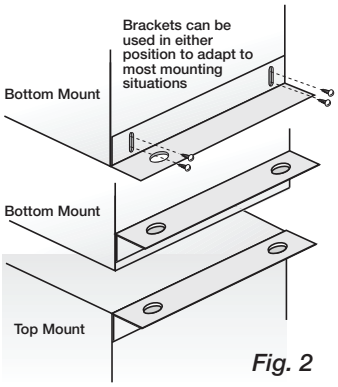


Fig. 2

Ceiling Openings		
Sizes	**Fan or Fan/Light**	**Fan/CRD**
SP-A50, A70, A90 SP-A110, A125, A190	10⅞ x 13⅜	11⅛ x 13⁷⁄₁₆
SP-A200, A250, A290, A390	12⅛ x 14¼	12¼ x 14⅜
SP-A700	23¾ x 11¾	24⅛ x 12¼
SP-A410, A510, A710, A780	14¾ x 18⅜	14⅞ x 18⁷⁄₁₆
SP-A900, A1050, A1410, A1550	14¾ x 24	14⅞ x 24⅛
SP-B 50 - 200	14⅛ x 11¾	14⅜ x 12¼

NOTE

Model SP-A 50-90 are standard with a round duct. Should Model SP-A 110-190 require a round duct, Model RDC (Round Duct Connector) may be ordered from Greenheck for field installation.

For Frame Construction:
Position unit between joists. Position brackets such that bottom edge of housing will be flush with finished ceiling, and tighten the adjustable mounting brackets, shown in Fig. 3.

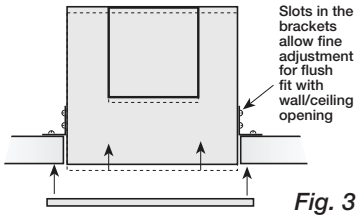
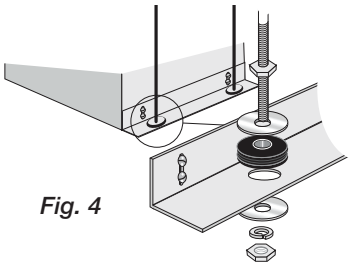


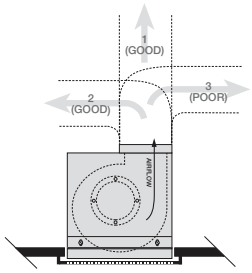
Fig. 3

For Hanging Installations:
Use Greenheck's optional vibration isolator kit Part Number VI Kit. Using the fan's standard adjustable mounting brackets and 10 by 32 threaded rod (by others), hang unit as shown in Fig. 4.


Fig. 4

3. Installation of ductwork is critical to the performance of the fan, shown in Fig. 5. Straight ductwork (1) or ductwork that turns in the same direction as the wheel (2) is recommended. Ductwork turning opposite the wheel direction (3) will cause turbulence and back pressure resulting in poor performance.

Fig. 5



4. Slide ductwork over the fan's discharge collar and securely attach it with sheet metal screws.

Make sure the screws do not interfere with damper operation. Check damper to make sure it opens freely.

Wire the Fan

1. If installed, remove wiring cover. If fan/light combination is being used, make sure the fan plug is connected to the fan receptacle and the light plug is connected to the light receptacle, shown in Fig. 6. Using proper wire connectors, wire the fan as shown in Fig. 7a. For wiring of light proceed to Fig. 7b.

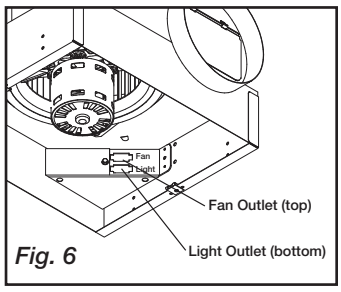
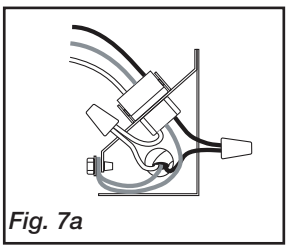
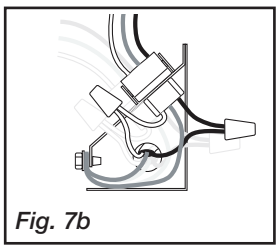


Fig. 6


Fig. 7a


Fig. 7b

115 & 277 Volt
Black wire is "Hot"
White wire is "Neutral"
Green wire is "Ground"

220 - 240 Volt
Black wire is "Hot"
White wire is "Hot"
Green wire is "Neutral/Ground"

2. Push all wiring into the unit's cover and replace wiring cover.

Attach the Grille

1. If lighted grille is being used, plug wire into fan socket.

   If lighted grille and ceiling radiation damper are being used, plug wire from lighted grille into ceiling radiation damper socket. Do not plug wire directly into the fan socket. Make sure the wire does not interfere with the ceiling radiation damper operation.
2. Attach grille with two screws provided. Make sure not to over tighten; over tightening will damage grille.
3. Slide attachment screw covers over the attachment screws, shown in Figure 8 and 9.
4. If lighted grille is being used, install light bulb(s) into light socket(s). For incandescent lights, use maximum 100 watt bulb (by others). For fluorescent lights, use 27W GU24 bulbs. Greenheck has replacement 27W GU24 bulbs call 1-800-355-5354 to order.
5. If lighted grille is being used, snap lens into place, by pushing on the outside edges of lens, shown in Fig. 9. To remove lens, use small screw driver and pry on one side of lens.
6. Turn on power and check fan and light operation.

Fig. 8

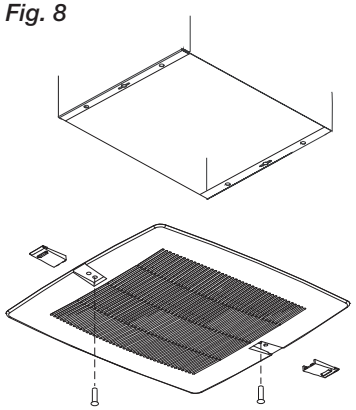
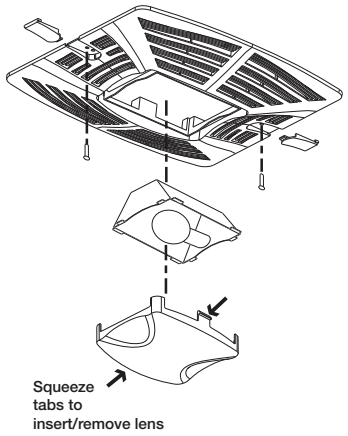


Fig. 9



Converting from ceiling to cabinet design for Model SP fans

All SP convertible sizes will be shipped with grille and duct collar cover.

Conversion Kit Parts List

- Qty. of 1 Blower Box Cover

Tools Required

- Phillips Head Screwdriver

Step 1: Remove grille (A) by removing the two grille screws (B).

Step 2: Remove duct collar cover (C) by removing the four duct collar screws (D).

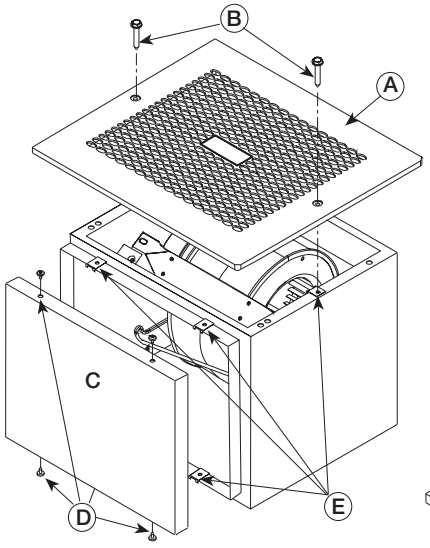
Step 3: Discard grille (A), two grille screws (B), and duct collar cover (C).

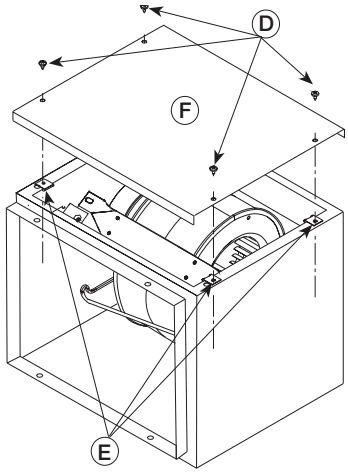
Step 4: Remove the six (6) tinnerman clips (E) by twisting them to one side and pulling straight out. Discard two of the six tinnerman clips.

Step 5: Insert the remaining four tinnerman clips (E) on grille opening side.

Step 6: Place blower box cover (F) over tinnerman clips (E), which were inserted in step 5.

Step 7: Screw the blower box cover (F) into place with four blower box cover screws (D).





SP/CSP models shown are UL and cUL listed E 33599

Other Installation Considerations

Ductwork and Noise

Fiberglass ductboard is a better choice than metal ductwork for reducing fan noise and is highly recommended for low sound applications. Where metal duct is used, sound transmission can be reduced with flexible duct connections between the fan and the duct.

Sound and Location

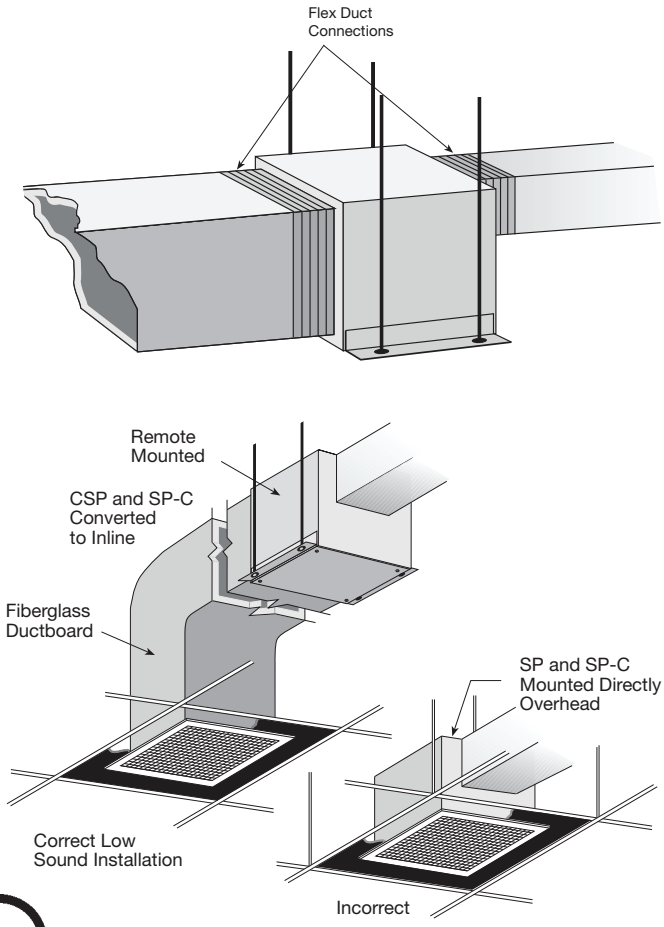
The location of these fans must be taken into consideration before installation. In critical sound installations, insulated ductwork, flexible duct connections or placing the fan in a remote section of ductwork are solutions to meeting the required fan sound levels.

Filters

The addition of an intake filter is highly recommended for these fans, even in clean air environments excess dirt can accumulate on wheels and motors causing reduced performance and imbalance.

Filters, once installed, should be checked and cleaned periodically to maintain performance.

Greenheck offers washable aluminum mesh filters specifically designed for these fans. Please consult our SP/CSP catalog for more information.



SP/CSP models shown are UL and cUL listed E 33599

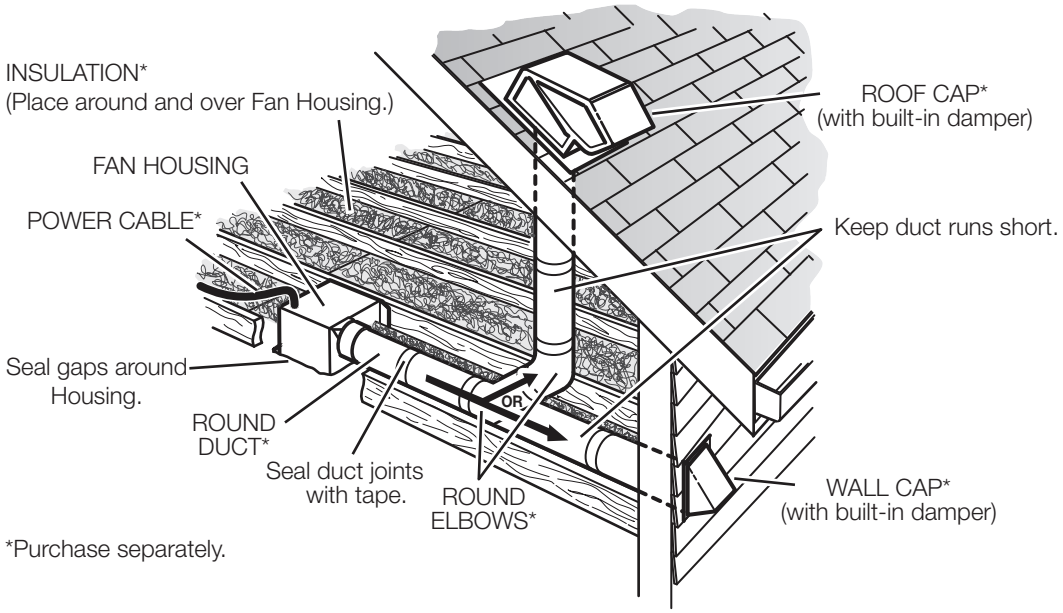
General Maintenance Suggestions

Model SP/CSP ceiling exhaust fans require very little maintenance. But since small problems over time left unchecked could lead to loss of performance or early motor failure, we do recommend that the unit be inspected periodically (once or twice a year).

The fan motor and wheel should be checked for dust and dirt accumulations. Dirt buildup can lead to loss of performance and motor overheating. Cleaning can be accomplished by brushing off any dust that may have accumulated. Even filtered units can accumulate build-up and should be checked when cleaning filters.

The motor should be checked for lubrication at this time. Lubricate only those motors which have an oil hole provided. A few drops of all purpose oil (SAE 20) will be sufficient.

Typical Installation



*Purchase separately.

Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Specific Greenheck product warranties are located on greenheck.com within the product area tabs and in the Library under Warranties.

Greenheck's Centrifugal Ceiling and Cabinet Exhaust Fans catalog provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

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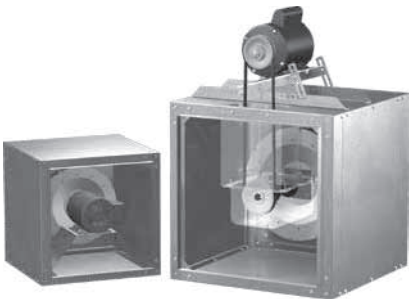
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Document 472058
Models SQ and BSQ
Centrifugal Inline Fans

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage!

Model SQ Direct Drive



Model SQ is a direct drive centrifugal inline exhaust fan. These fans are specifically designed for inline applications. Performance capabilities range up to 5,000 cfm *(8,500 m^3/hr)* and up to 2.0 in. wg *(498 Pa)* of static pressure. SQ fans are available in thirteen sizes with nominal wheel diameter ranging from 6 to 16 inches *(152 to 406 mm)* (060 to 160 unit sizes). Each fan shall bear a permanently affixed manufacturers engraved metal nameplate containing the model number and individual serial number.

Model BSQ Belt Drive

Model BSQ is a belt drive centrifugal inline exhaust fan. These fans are specifically designed for inline applications. Performance capabilities range up to 27,200 cfm *(46,200 m^3/hr)* and up to 4.0 in. wg *(996 Pa)* of static pressure. BSQ fans are available in fourteen sizes with nominal wheel diameter ranging from 7 to 42 inches *(178 to 1067 mm)* (070 to 420 unit sizes). Each fan shall bear a permanently affixed manufacturers engraved metal nameplate containing the model number and individual serial number.

General Safety Information

Only qualified personnel should install this fan. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards. Other considerations may be required if seismic activity is present. If more information is needed, contact a licensed professional engineer before moving forward.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electric Code (CEC) in Canada.
2. The rotation of the wheel is critical. It must be free to rotate without striking or rubbing any stationary objects.
3. Motor must be securely and adequately grounded.
4. Do not spin fan wheel faster than max cataloged fan RPM. Adjustments to fan speed significantly affects motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.
5. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces or chemicals. Replace cord immediately if damaged.
6. Verify that the power source is compatible with the equipment.
7. Never open access doors to a duct while the fan is running.

DANGER
Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.
CAUTION
When servicing the fan, motor may be hot enough to cause pain or injury. Allow motor to cool before servicing.
CAUTION
Precaution should be taken in explosive atmospheres.

DANGER
Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.
ATTENTION
Lors de toute intervention sur la soufflante, le moteur peut être suffisamment chaud pour provoquer une douleur voire une blessure. Laisser le moteur refroidir avant toute maintenance.
ATTENTION
Faire preuve de précaution dans les atmosphères explosives.

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Receiving

Upon receiving the product check to ensure all items are accounted for by referencing the delivery receipt or packing list. Inspect each crate or carton for shipping damage before accepting delivery. Alert the carrier of any damage detected. The customer will make a notation of damage (or shortage of items) on the delivery receipt and all copies of the bill of lading which is countersigned by the delivering carrier. If damaged, immediately contact your Greenheck Representative. Any physical damage to the unit after acceptance is not the responsibility of Greenheck Fan Corporation.

Unpacking

Verify that all required parts and the correct quantity of each item have been received. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the bill of lading.

Handling

Move fan to desired location and determine position of access panels, discharge and motor. Make sure the inlet and outlet have at least 2½ times the wheel diameter (duct diameter) before any obstructions like an elbow or transition. Attach the fan to a suitable framework as specified; hanging or base vibration isolators are recommended. See the SQ & BSQ Fan Dimensions table on pages 4 and 5 for physical dimensions, utilizing Figures 1 and 2. Mounting dimensions and vibration isolator centerline information is provided on pages 6 thru 9. The motor's amperage and voltage ratings must be checked for compatibility to supply voltage prior to final electrical connection. Electrical lead-in wires are then connected to the factory supplied safety disconnect switch. All wiring must conform to local and national codes.

Fan Storage

Fans are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the fan and accessories while in storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

Indoor Storage: The ideal environment for the storage of fans and accessories is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain or snow. Temperatures should be evenly maintained between 30° to 110°F *(-1° to 43°C)* (wide temperature swings may cause condensation and "sweating" of metal parts). All accessories must be stored indoors in a clean, dry atmosphere.

Remove any accumulations of dirt, water, ice or snow and wipe dry before moving to indoor storage. To avoid "sweating" of metal parts allow cold parts to reach room temperature. To dry parts and packages, use a portable electric heater to get rid of any moisture buildup. Leave coverings loose to permit air circulation and to allow for periodic inspection.

The unit should be stored at least 3½ inches *(89 mm)* off the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Aisles between parts and along all walls should be provided to permit air circulation and space for inspection.

Outdoor Storage: Fans designed for outdoor applications may be stored outdoors, if absolutely necessary. Roads or aisles for portable cranes and hauling equipment are needed.
The fan should be placed on a level surface to prevent water from leaking into the fan. The fan should be elevated on an adequate number of wooden blocks so that it is above water and snow levels and has enough blocking to prevent it from settling into soft ground. Locate parts far enough apart to permit air circulation, sunlight and space for periodic inspection. To minimize water accumulation, place all fan parts on blocking supports so that rain water will run off.

Do not cover parts with plastic film or tarps as these cause condensation of moisture from the air passing through heating and cooling cycles.

Fan wheels should be blocked to prevent spinning caused by strong winds.

Inspection and Maintenance During Storage

While in storage, inspect fans once per month. Keep a record of inspection and maintenance performed.

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. At each inspection, rotate the wheel by hand ten to fifteen revolutions to distribute lubricant on motor. If paint deterioration begins, consideration should be given to touch-up or repainting. Fans with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive should be restored to good condition promptly if signs of rust occur. Immediately remove the original rust preventive coating with petroleum solvent and clean with lint-free cloths. Polish any remaining rust from surface with crocus cloth or fine emery paper and oil. Do not destroy the continuity of the surfaces. Thoroughly wipe clean with Tectyl® 506 (Ashland Inc.) or the equivalent. For hard to reach internal surfaces or for occasional use, consider using Tectyl® 511M Rust Preventive, WD-40® or the equivalent.

Removing From Storage

As fans are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion until the fan equipment goes into operation.

Redesigned BSQ Dimensions

In early 2015, the BSQ was redesigned. The redesign changes some mounting dimensions of the fan for sizes 70 through 240. All BSQ fans ordered after July 20th, 2015 will be moving over to this new design, with two exceptions that will still utilize the old design:

1. Any orders prior to July 20th, 2015.
2. Any orders for OSHPD seismic rated units.

Both versions of the fan have their dimensions listed, so it is recommended dimensions be confirmed on these models before the unit is installed. Contact your local sales representative for clarification on ordering information.

SQ & BSQ Fan Dimensions

Model	A	B	C	*D	E	*F	*G	*H	Damper	SQ Weight^	BSQ Weight^
SQ 60-75	12 *(305)*	13 *(330)*	12 *(305)*	8⅞ *(225)*	1 *(25)*	-	-	-	9 *(229)*	26 *(12)*	-
SQ 80-95	15 *(381)*	16 *(406)*	15 *(381)*	11⅞ *(302)*	1 *(25)*	-	-	-	12 *(305)*	41 *(19)*	-
SQ 97,98,99	15 *(381)*	21 *(533)*	15 *(381)*	11⅞ *(302)*	1 *(25)*	-	-	-	12 *(305)*	49 *(22)*	-
BSQ 70-80	15 *(381)*	21 *(533)*	15 *(381)*	11⅞ *(302)*	1 *(25)*	15½ *(394)*	14 *(356)*	12½ *(318)*	12 *(305)*	-	76 *(34)*
BSQ 90	15 *(381)*	21 *(533)*	15 *(381)*	11⅞ *(302)*	1 *(25)*	15½ *(394)*	14 *(356)*	12½ *(318))*	12 *(305)*	-	84 *(38)*
SQ-BSQ 100	17 *(432)*	21 *(533)*	17 *(432)*	13⅞ *(352)*	1 *(25)*	15½ *(394)*	14 *(356)*	12½ *(318)*	14 *(356)*	56 *(25)*	83 *(38)*
SQ-BSQ 120	19 *(483)*	21 *(533)*	19 *(483)*	15⅞ *(403)*	1 *(25)*	17⅞ *(454)*	16 *(406)*	12½*(318)*	16 *(406)*	67 *(30)*	97 *(44)*
SQ-BSQ 130 (HP)	21 *(533)*	21 *(533)*	21 *(533)*	17⅞ *(454)*	1 *(25)*	17⅞ *(454)*	16 *(406)*	12½ *(318)*	18 *(457)*	67 *(35)*	97 *(44)*
SQ-BSQ 140 (HP)	23 *(584)*	22 *(559)*	23 *(584)*	19⅞ *(505)*	1 *(25)*	17⅞ *(454)*	16 *(406)*	12½ *(318)*	20 *(508)*	104 *(47)*	111 *(50)*
SQ-BSQ 160 (HP)	26 *(660)*	26 *(660)*	26 *(660)*	22⅞ *(581)*	1 *(25)*	20½ *(521)*	17 *(432)*	13⅞ *(340)*	23 *(584)*	160 *(73)*	208 *(94)*
BSQ 180 (HP)	28 *(711)*	28 *(711)*	28 *(711)*	23⅞ *(606)*	1½ *(38)*	24⅜ *(619)*	18 *(457)*	13¾ *(349)*	24 *(610)*	26 *(12)*	245 *(111)*
BSQ 200 (HP)	32 *(813)*	32 *(813)*	32 *(813)*	27⅞ *(708)*	1½ *(38)*	28 *(711)*	20 *(508)*	16 *(406)*	28 *(711)*	26 *(12)*	314 *(142*
BSQ 240 (HP)	39 *(991)*	34 *(864)*	39 *(991)*	34⅞ *(886)*	1½ *(38)*	32⅞ *(835)*	22 *(559)*	19 *(483)*	35 *(889)*	26 *(12)*	415 *(188)*
BSQ 300 (HP)	46 *(1168)*	38 *(965)*	46 *(1168)*	41⅞ *(1064)*	1½ *(38)*	34 *(864)*	22 *(559)*	18 *(457)*	42 *(1067)*	26 *(12)*	537 *(244)*
BSQ 360 (HP)	52 *(1321)*	42 *(1067)*	52 *(1321)*	47⅞ *(1216)*	1½ *(38)*	34 *(864)*	22 *(559)*	18 *(457)*	48 *(1219)*	26 *(12)*	686 *(311)*
BSQ 420 (HP)	58 *(1473)*	50 *(1270)*	58 *(1473)*	53⅞ *(1368)*	1½ *(38)*	34 *(864)*	22 *(559)*	18 *(457))*	54 *(1372)*	26 *(12)*	789 *(358)*

All dimensions in inches *(millimeters)* and weight is shown in pounds *(kilograms)*. *May be greater depending on motor.
^Weight shown is largest cataloged Open Drip Proof motor.

Filter Option Dimensions

Model	A	B	C	D	WT.	Filter Size	Filter Quantity
SQ 60-75	22⅛ *(562)*	12 *(305)*	8⅞ *(225)*	1 *(25)*	40 *(18)*	10 x 12 *(254 x 305)*	1
SQ 80-95	45⅝ *(1159)*	15 *(381)*	11⅞ *(302)*	1 *(25)*	74 *(34)*	14 x 25 *(356 x 635)*	1
SQ 97,98,99	50⅝ *(1286)*	15 *(381)*	11⅞ *(302)*	1 *(25)*	80 *(36)*	14 X 25 *(356 X 635)*	1
SQ 100	47¼ *(1200)*	17 *(432)*	13⅞ *(352)*	1 *(25)*	88 *(40)*	16 x 20 *(406 x 508)*	2
SQ 120	52³⁄₁₆ *(1326)*	19 *(483)*	15⅞ *(403)*	1 *(25)*	114 *(52)*	16 x 25 *(406 x 635)*	2
SQ 130	46⅜ *(1178)*	21 *(533)*	17⅞ *(454)*	1 *(25)*	120 *(54)*	20 x 20 *(508 x 508)*	2
SQ 140	52⅜ *(1330)*	23 *(584)*	19⅞ *(505)*	1 *(25)*	174 *(79)*	20 x 25 *(508 x 635)*	2
SQ 160	51⅜ *(1305)*	26 *(660)*	22⅞ *(581)*	1 *(25)*	246 *(112)*	20 x 20 *(508 x 508)*	4
BSQ 70-80-90	50⅝ *(1286)*	15 *(381)*	11⅞ *(302)*	1 *(25)*	117 *(53)*	14 x 25 *(356 x 635)*	1
BSQ 100	47¼ *(1200)*	17 *(432)*	13⅞ *(352)*	1 *(25)*	120 *(54)*	16 x 20 *(406 x 508)*	2
BSQ 120	52³⁄₁₆ *(1326)*	19 *(483)*	15⅞ *(403)*	1 *(25)*	144 *(79)*	16 x 25 *(406 x 635)*	2
BSQ 130 (HP)	46⅜ *(1178)*	21 *(533)*	17⅞ *(454)*	1 *(25)*	140 *(64)*	20 x 20 *(508 x 508)*	2
BSQ 140 (HP)	52⅜ *(1330)*	23 *(584)*	19⅞ *(505)*	1 *(25)*	181 *(82)*	20 x 25 *(508 x 635)*	2
BSQ 160 (HP)	51⅜ *(1305)*	26 *(660)*	22⅞ *(581)*	1 *(25)*	294 *(133)*	20 x 20 *(508 x 508)*	4
BSQ 180 (HP)	55¹⁄₁₆ *(1399)*	28 *(711)*	23⅞ *(606)*	1½ *(38)*	344 *(156)*	20 x 25 *(508 x 635)*	4
BSQ 200 (HP)	66¹¹⁄₁₆ *(1694)*	32 *(813)*	27⅞ *(708)*	1½ *(38)*	441 *(200)*	12 x 25 *(305 x 635)*	3
						16 x 25 *(406 x 635)*	3
BSQ 240 (HP)	68⅞ *(1749)*	39 *(991)*	34⅞ *(886)*	1½ *(38)*	573 *(260)*	20 x 25 *(508 x 635)*	4
						16 x 25 *(406 x 635)*	4
BSQ 300 (HP)	72⅛ *(1832)*	46 *(1168)*	41⅞ *(1064)*	1½ *(38)*	759 *(344)*	20 x 25 *(508 x 635)*	8
BSQ 360 (HP)	79¼ *(2013)*	52 *(1321)*	47⅞ *(1216)*	1½ *(38)*	957 *(434)*	16 x 25 *(406 x 635)*	10
						20 x 25 *(508 x 635)*	5
BSQ 420	93⅛ *(2365)*	58 *(1473)*	53⅞ *(1368)*	1½ *(38)*	1185 *(538)*	16 x 25 *(406 x 635)*	5
						20 x 25 *(508 x 635)*	10

Note: 24-inch side clearance is recommended for accessing and removing filters.
All dimensions in inches *(millimeters)* and weight (WT.) in pounds *(kilograms)*.

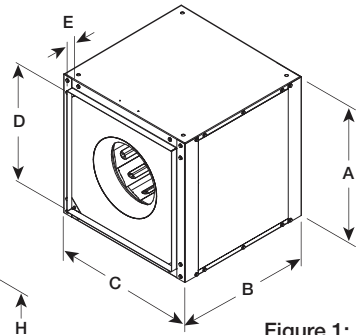


Figure 1:
SQ Dimensions

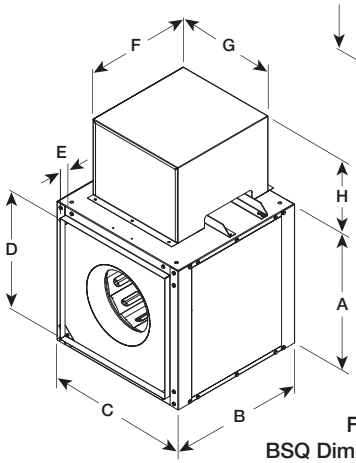


Figure 2:
BSQ Dimensions

Figure 3: Model SQ - Filter Options

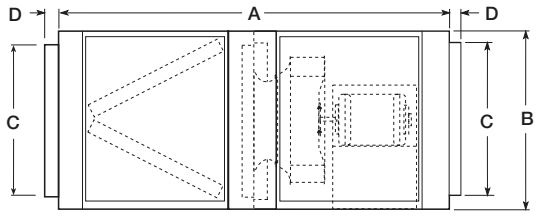
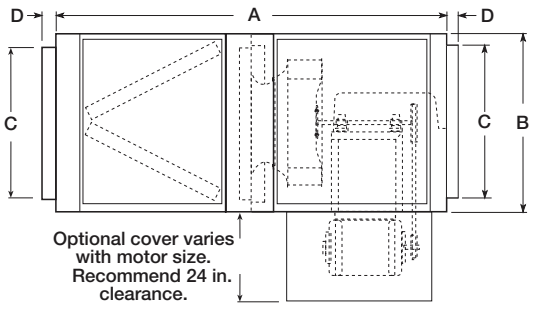


Figure 4: Model BSQ - Filter Options



Redesigned BSQ Dimensions (refer to page 3 for details)

BSQ Fan Dimensions

Model	A	B	C	*D	E	*F	*G	*H	Damper	BSQ Weight^
BSQ 70-90	17⅛ *(435)*	21 *(533)*	17⅛ *(435)*	11⅞ *(302)*	1½ *(37)*	17¾ *(451)*	13 *(330)*	13¼ *(337)*	12 *(305)*	106 *(48)*
BSQ 100	17⅛ *(435)*	21 *(533)*	17⅛ *(435)*	13⅞ *(352)*	1½ *(37)*	17¾ *(451)*	13 *(330)*	13¼ *(337)*	14 *(356)*	107 *(48)*
BSQ 120	19⅛ *(486)*	21 *(533)*	19⅛ *(486)*	15⅞ *(403)*	1½ *(37)*	20 *(508)*	17 *(432)*	13¼ *(337)*	16 *(406)*	124*(56)*
BSQ 130 (HP)	21⅛ *(537)*	21 *(533)*	21⅛ *(537)*	17⅞ *(454)*	1½ *(37)*	20 *(508)*	17 *(432)*	13¼ *(337)*	18 *(457)*	131 *(59)*
BSQ 140 (HP)	23⅛ *(587)*	22 *(559)*	23⅛ *(587)*	19⅞ *(505)*	1½ *(37)*	20 *(508)*	17 *(432)*	13¼ *(337)*	20 *(508)*	146 *(66)*
BSQ 160 (HP)	26⅛ *(664)*	26 *(660)*	26⅛ *(664)*	22⅞ *(581)*	1½ *(37)*	20 *(508)*	17 *(432)*	13¼ *(337)*	23 *(584)*	188 *(85)*
BSQ 180 (HP)	27⅛ *(689)*	28 *(711)*	27⅛ *(689)*	23⅞ *(606)*	1½ *(37)*	20 *(508)*	17 *(432)*	13¼ *(337)*	24 *(610)*	195 *(88)*
BSQ 200 (HP)	31⅛ *(791)*	32 *(813)*	31⅛ *(791)*	27⅞ *(708)*	1½ *(37)*	30 *(762)*	20 *(508)*	16 *(406)*	28 *(711)*	246 *(111)*
BSQ 240 (HP)	38⅛ *(968)*	34 *(864)*	38⅛ *(968)*	34⅞ *(886)*	1½ *(37)*	30 *(762)*	20 *(508)*	16 *(406)*	35 *(889)*	350 *(159)*

All dimensions in inches *(millimeters)* and weight is shown in pounds *(kilograms)*. *May be greater depending on motor.
^Weight shown is largest cataloged Open Drip Proof motor.

Filter Option Dimensions

Model	A	B	C	D	WT.	Filter Size	Filter Quantity
BSQ 70-80-90	53⅝ *(1368)*	17⅛ *(435)*	11⅞ *(302)*	1½ *(37)*	168 *(76)*	16 x 20 *(406 x 508)*	2
BSQ 100	53⅝ *(1368)*	17⅛ *(435)*	13⅞ *(352)*	1½ *(37)*	169 *(77)*	16 x 20 *(406 x 508)*	2
BSQ 120	58¾ *(1492)*	19⅛ *(486)*	15⅞ *(403)*	1½ *(37)*	194 *(88)*	16 x 25 *(406 x 635)*	2
BSQ 130 (HP)	53¼ *(1353)*	21⅛ *(537)*	17⅞ *(454)*	1½ *(37)*	197 *(89)*	20 x 20 *(508 x 508)*	2
BSQ 140 (HP)	59 *(1500)*	23⅛ *(537)*	19⅞ *(505)*	1½ *(37)*	231 *(105)*	20 x 25 *(508 x 635)*	2
BSQ 160 (HP)	58¾ *(1492)*	26⅛ *(664)*	22⅞ *(581)*	1½ *(37)*	285 *(129)*	20 x 20 *(508 x 508)*	4
BSQ 180 (HP)	60¾ *(1543)*	27⅛ *(689)*	23⅞ *(606)*	1½ *(37)*	293 *(133)*	20 x 25 *(508 x 635)*	4
BSQ 200 (HP)	69⅜ *(1762)*	31⅛ *(791)*	27⅞ *(708)*	1½ *(37)*	361 *(164)*	12 x 25 *(305 x 635)*	3
						16 x 25 *(406 x 635)*	3
BSQ 240 (HP)	71½ *(1816)*	38⅛ *(968)*	34⅞ *(886)*	1½ *(37)*	496 *(225)*	20 x 25 *(508 x 635)*	4
						16 x 25 *(406 x 635)*	4

Note: 24-inch side clearance is recommended for accessing and removing filters.
All dimensions in inches *(millimeters)* and weight (WT.) in pounds *(kilograms)*.

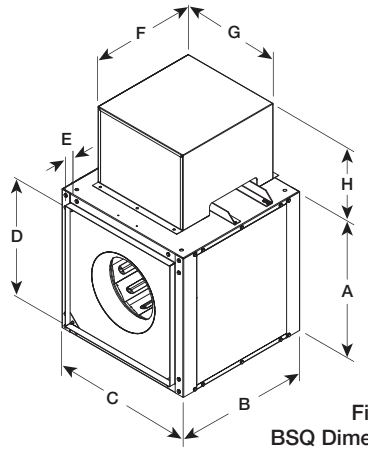
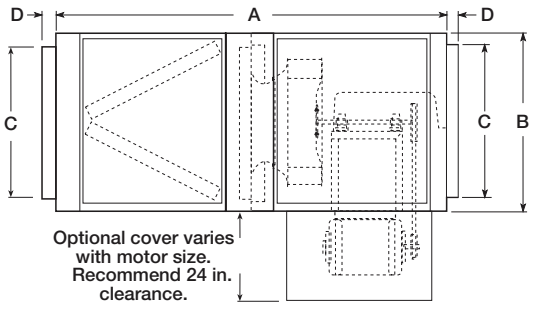


Figure 2:
BSQ Dimensions

Figure 4: Model BSQ - Filter Options



Mounting: SQ /BSQ

All SQ and BSQ fan models can be mounted horizontally, vertically or at an angle. For ease of installation, knockouts are provided at each location where mounting brackets are shown in Figures 5, 6 and 7. Optional brackets are universally adjustable to mount in any of these locations.

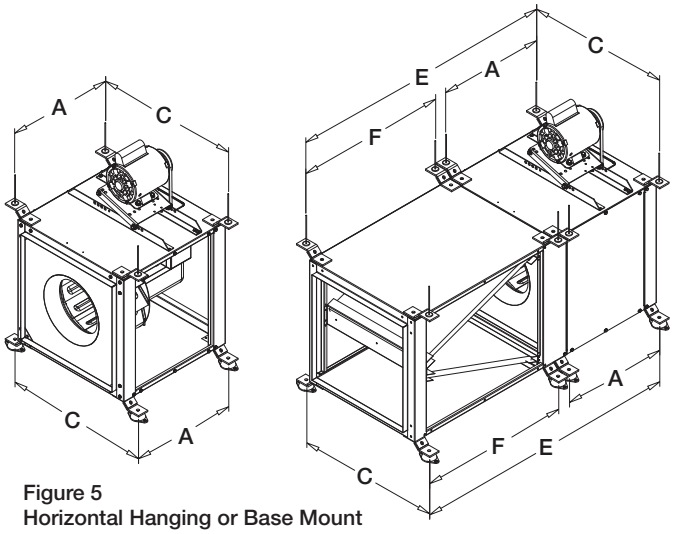


Figure 5
Horizontal Hanging or Base Mount

With either a hanging or base mount the motor may be located on either side. The base mount allows top access panels only.

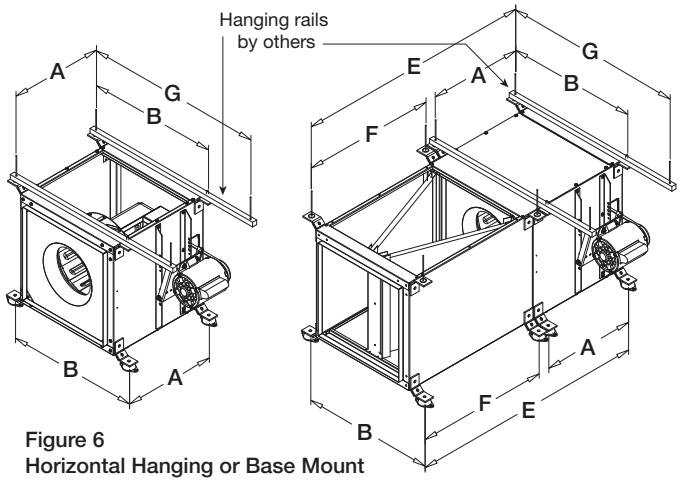


Figure 6
Horizontal Hanging or Base Mount

With a hanging mount, the motor may be located on either top or bottom. The base mount allows top motor location only. Both options provide access panels on two sides.

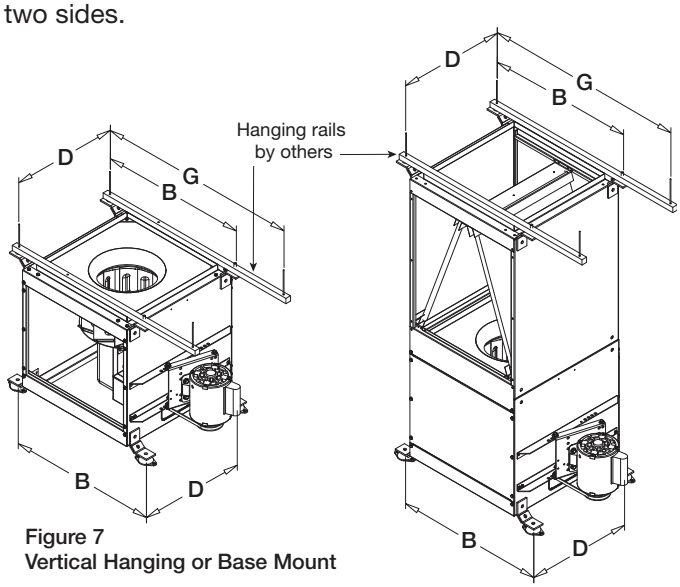


Figure 7
Vertical Hanging or Base Mount

Mounting brackets are turned 90° for vertical mounting. Access panels are located on the two sides adjacent to the motor.

Mounting Dimensional Data

Model	A	B	C	D	E	F	G
SQ 60-75	10⅝ *(269)*	16¾ *(424)*	14⅝ *(372)*	8⅞ *(225)*	19⅞ *(504)*	6⅞ *(176)*	Hanging rails not included. Supplied by others.
SQ 80-95	13¼ *(338)*	19¾ *(500)*	15⅛ *(384)*	9⅜ *(238)*	43 *(1093)*	27⅜ *(695)*	
SQ 97,98,99	18⅝ *(473)*	19¾ *(500)*	15⅛ *(384)*	9⅜ *(238)*	48⅜ *(1228)*	27⅜ *(695)*	
BSQ 70-90	18⅝ *(473)*	19¾ *(500)*	17⅝ *(448)*	11⅞ *(301)*	48⅜ *(1228)*	27⅜ *(695)*	
SQ-BSQ 100	18⅝ *(473)*	21¾ *(551)*	19⅝ *(499)*	13⅞ *(352)*	43¾ *(1112)*	22¾ *(579)*	
SQ-BSQ 120	18⅝ *(473)*	23¾ *(602)*	21⅝ *(549)*	15⅞ *(403)*	49⅛ *(1247)*	28⅛ *(715)*	
SQ-BSQ 130	18⅝ *(473)*	25¾ *(653)*	23⅝ *(600)*	17⅞ *(454)*	44 *(1118)*	23 *(585)*	
SQ-BSQ 140	19⅝ *(498)*	27¾ *(704)*	25⅝ *(651)*	19⅞ *(505)*	50 *(1271)*	28 *(713)*	
SQ-BSQ 160	23½ *(596)*	31 *(789)*	28¾ *(730)*	22⅞ *(581)*	49½ *(1257)*	23⅝ *(601)*	Hanging rails not included. Supplied by others.
BSQ 180	25½ *(646)*	33 *(840)*	28⅝ *(727)*	22¾ *(578)*	52⅝ *(1336)*	24½ *(623)*	
BSQ 200	29¼ *(742)*	37 *(941)*	32¾ *(832)*	26⅞ *(683)*	64⅛ *(1629)*	32¼ *(818)*	
BSQ 240	31⅝ *(803)*	44 *(1119)*	39¾ *(1010)*	33⅞ *(860)*	66½ *(1689)*	32⅛ *(816)*	
BSQ 300	35 *(889)*	51 *(1297)*	46¾ *(1188)*	40⅞ *(1038)*	69⅛ *(1755)*	31⅜ *(797)*	
BSQ 360	39⅜ *(1000)*	57 *(1449)*	52⅝ *(1337)*	46¾ *(1187)*	76⅝ *(1948)*	34¾ *(881)*	
BSQ 420	47 *(1195)*	63 *(1602)*	58⅝ *(1488)*	52¾ *(1338)*	90¼ *(2292)*	40⅝ *(1031)*	

All dimensions in inches *(millimeters)*.

Redesigned BSQ Dimensions

Mounting: BSQ

All BSQ fan models can be mounted horizontally, vertically or at an angle. For ease of installation, knockouts are provided at each location where mounting brackets are shown in Figures 5, 6 and 7. Optional brackets are universally adjustable to mount in any of these locations.

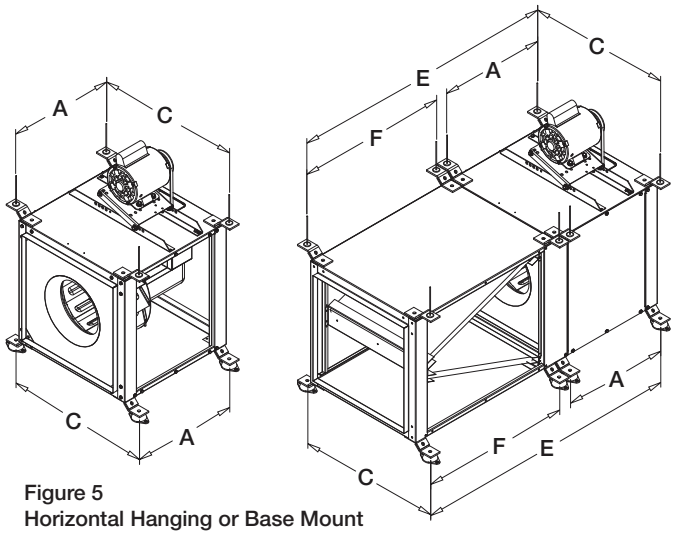


Figure 5
Horizontal Hanging or Base Mount

With either a hanging or base mount the motor may be located on either side. The base mount allows top access panels only.

NOTE

Flex duct is recommended for mounting to the inlet of the fan to allow for fitting adjustments.

If the inlet venturi requires adjustment, it can be detached from the unit via the fasteners located on the inlet panel.

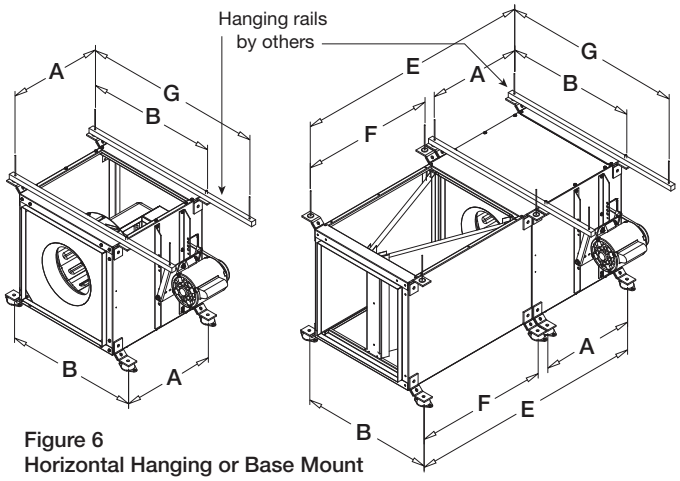


Figure 6
Horizontal Hanging or Base Mount

With a hanging mount, the motor may be located on either top or bottom. The base mount allows top motor location only. Both options provide access panels on two sides.

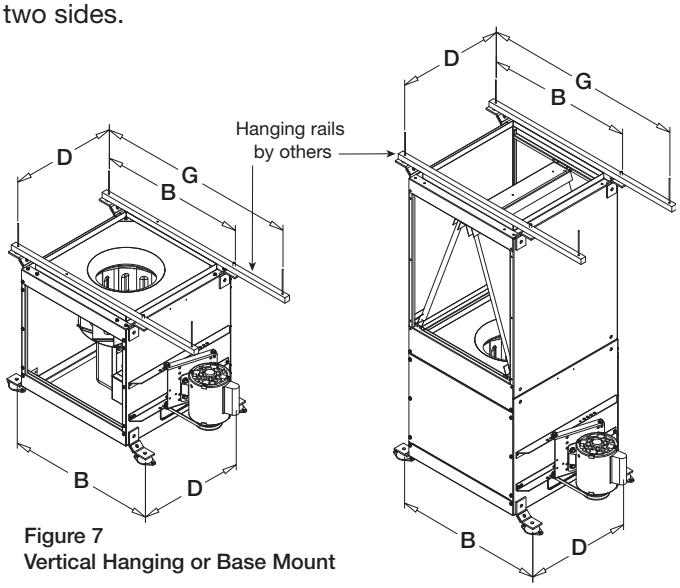


Figure 7
Vertical Hanging or Base Mount

Mounting brackets are turned 90° for vertical mounting. Access panels are located on the two sides adjacent to the motor.

Mounting Dimensional Data							
Model	A	B	C	D	E	F	G
BSQ 70-100	18 *(457)*	21 13/16 *(554)*	19 14/16 *(505)*	14 1/8 *(359)*	50 14/16 *(1292)*	29 14/16 *(758)*	Hanging rails not included. Supplied by others.
BSQ 120	18 *(457)*	23 13/16 *(605)*	21 14/16 *(556)*	16 1/8 *(410)*	55 3/4 *(1416)*	34 3/4 *(883)*	
BSQ 130	18 *(457)*	25 13/16 *(656)*	23 14/16 *(607)*	18 1/8 *(460)*	50 1/4 *(1276)*	29 1/4 *(743)*	
BSQ 140	19 *(483)*	27 13/16 *(707)*	25 14/16 *(657)*	20 1/8 *(511)*	56 *(1424)*	34 *(865)*	
BSQ 160	23 *(584)*	31 3/16 *(792)*	29 *(737)*	23 1/8 *(587)*	55 3/4 *(1416)*	29 3/4 *(756)*	Hanging rails not included. Supplied by others.
BSQ 180	25 *(635)*	32 3/16 *(817)*	30 *(762)*	24 1/8 *(613)*	57 3/4 *(1467)*	29 3/4 *(756)*	
BSQ 200	29 *(737)*	36 3/16 *(919)*	34 *(864)*	28 1/8 *(714)*	66 3/8 *(1686)*	34 3/8 *(873)*	
BSQ 240	31 *(787)*	43 3/16 *(1097)*	41 *(1042)*	35 1/8 *(892)*	68 1/2 *(1740)*	34 1/2 *(876)*	

All dimensions in inches *(millimeters)*.

Duct Length: The inlet and outlet duct length should be approximately two to three wheel diameters long before and after the fan to achieve cataloged performance.

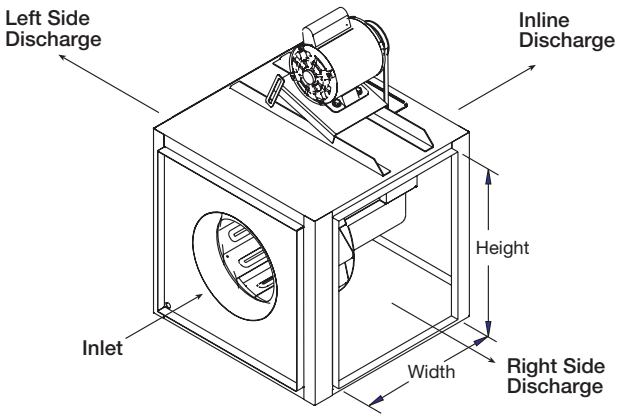


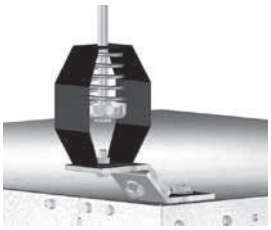
Figure 8

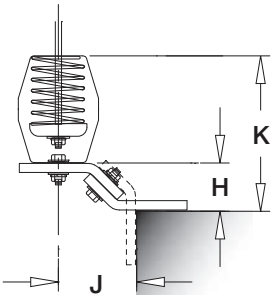
Side Discharge: Make sure discharge is orientated in the same direction as originally ordered, performance will change with different discharge positions. Refer to Figure 8 for proper side discharge definition and the Side Discharge chart for dimensions. Refer to the CAPS program or consult factory for performance corrections.

Side Discharge Duct Openings		
Unit Size	Width	Height
BSQ 70-80-90	11⅞ *(302)*	11⅞ *(302)*
SQ 60-75	9⅞ *(251)*	8⅞ *(225)*
SQ 80-95	12⅞ *(327)*	11⅞ *(302)*
SQ 97-98-99	13⅞ *(352)*	11⅞ *(302)*
SQ 100/BSQ 100	13⅞ *(352)*	13⅞ *(352)*
SQ 120/BSQ 120	15⅞ *(403)*	15⅞ *(403)*
SQ 130/BSQ 130 (HP)	17⅞ *(454)*	17⅞ *(454)*
SQ 140/BSQ 140 (HP)	19⅞ *(505)*	19⅞ *(505)*
SQ 160/BSQ 160 (HP)	22⅞ *(581)*	22⅞ *(581)*
BSQ 180 (HP)	23⅞ *(606)*	23⅞ *(606)*
BSQ 200 (HP)	27⅞ *(708)*	27⅞ *(708)*
BSQ 240 (HP)	28⅞ *(733)*	34⅞ *(886)*
BSQ 300 (HP)	31⅞ *(810)*	41⅞ *(1064)*
BSQ 360 (HP)	32⅞ *(835)*	37⅞ *(962)*
BSQ 420	34⅞ *(886)*	43⅞ *(1114)*

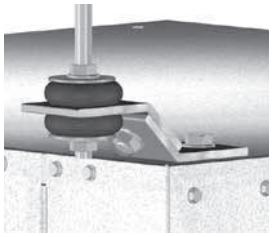
All dimensions in inches *(millimeters)*.

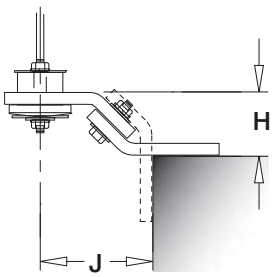
Hanging Spring Isolator





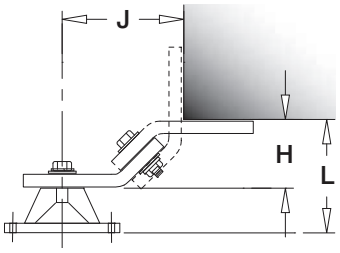
Hanging Neoprene Isolator





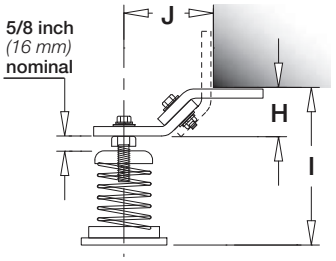
Standing Neoprene Isolator





Standing Spring Isolator



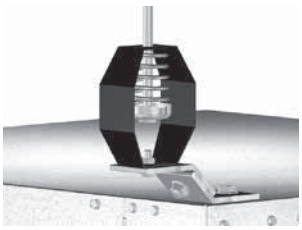


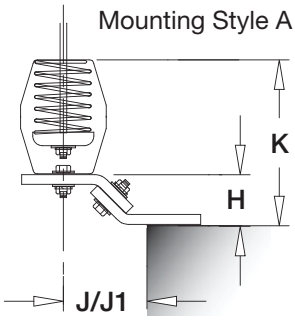
Isolator Dimensional Data					
Model	H	I	J	K	L
SQ 60-75 SQ 80-95 SQ 97-99 BSQ 70-90 SQ-BSQ 100 SQ-BSQ 120 SQ-BSQ 130 SQ-BSQ 140	1⅜ *(35)*	5½ *(140)*	2 *(51)*	6¾ *(171)*	2⁵⁄₁₆ *(59)*
SQ-BSQ 160 BSQ 180 BSQ 200 BSQ 240 BSQ 300 BSQ 360 BSQ 420	1⅜ *(35)*	5½ *(140)*	2 *(51)*	6¾ *(171)*	2⅝ *(67)*

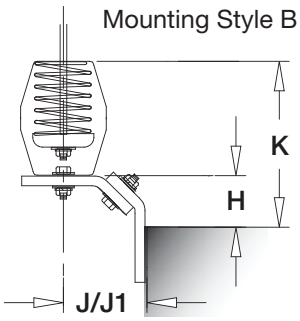
All dimensions in inches *(millimeters)*.

Redesigned BSQ Dimensions

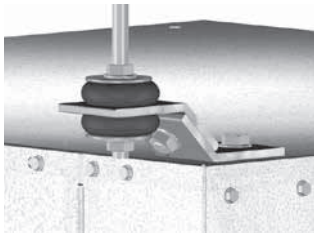
Hanging Spring Isolator

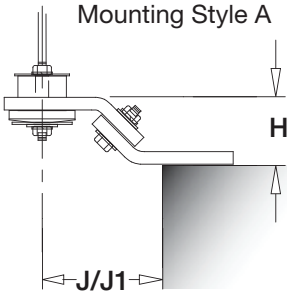


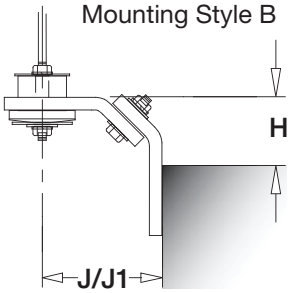




Hanging Neoprene Isolator

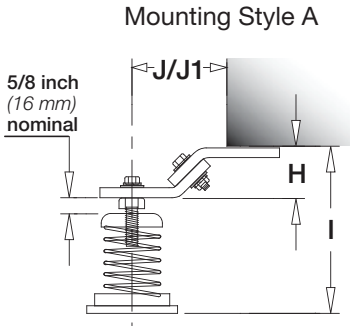


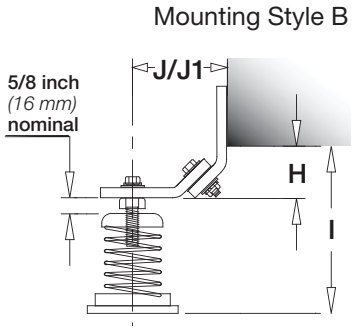




Standing Spring Isolator

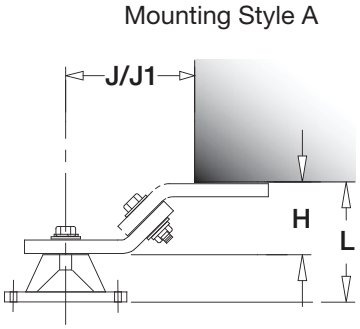


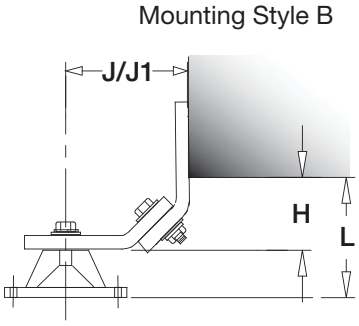




Standing Neoprene Isolator







Isolator Dimensional Data						
Model	H	I	J*	J1**	K	L
BSQ 70-90 BSQ 100 BSQ 120 BSQ 130 BSQ 140	1⅜ *(35)*	5½ *(140)*	1⅜ *(35)*	2⅜ *(60)*	6¾ *(171)*	2⅓ *(59)*
BSQ 160 BSQ 180 BSQ 200 BSQ 240	1⅜ *(35)*	5½ *(140)*	1⅜ *(35)*	2½ *(64)*	6¾ *(171)*	2⅝ *(67)*

All dimensions in inches *(millimeters)*.

*Use dimension J while utilizing Mounting Style A

**Use dimension J1 while utilizing Mounting Style B

Redesigned BSQ Dimensions

Duct Length: The inlet and outlet duct length should be approximately two to three wheel diameters long before and after the fan to achieve cataloged performance.

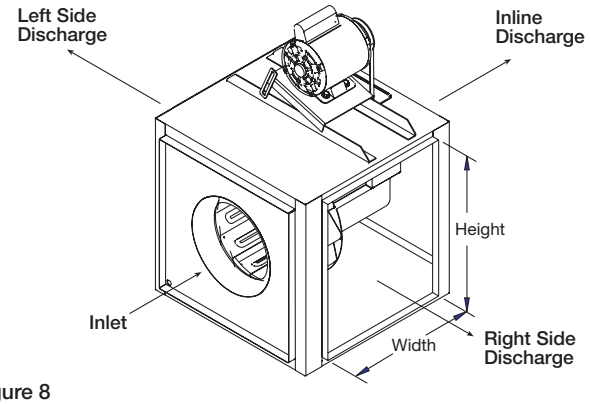


Figure 8

Side Discharge: Make sure discharge is orientated in the same direction as originally ordered, performance will change with different discharge positions. Refer to Figure 8 for proper side discharge definition and the Side Discharge chart for dimensions. Refer to the CAPS program or consult factory for performance corrections.

Side Discharge Duct Openings		
Unit Size	Width	Height
BSQ 70-100	12½ *(317)*	13⅞ *(352)*
BSQ 120	12½ *(317)*	15⅞ *(403)*
BSQ 130 (HP)	12½ *(317)*	17⅞ *(454)*
BSQ 140 (HP)	13½ *(342)*	19⅞ *(505)*
BSQ 160 (HP)	17½ *(444)*	22⅞ *(581)*
BSQ 180 (HP)	19½ *(494)*	23⅞ *(606)*
BSQ 200 (HP)	23½ *(596)*	27⅞ *(708)*
BSQ 240 (HP)	25½ *(647)*	34⅞ *(886)*

All dimensions in inches *(millimeters)*.

Pre Start-Up Checks

1. **Check all fasteners for tightness.** The wheel should rotate freely and be aligned as shown in Figure 9. Wheel position is preset and the unit is tested at the factory. Movement may occur during shipment, and realignment may be necessary. Centering can be accomplished by loosening the bolts holding the inlet (venturi) panel and repositioning. Wheel and inlet cone overlap can be adjusted by loosening the setscrews in the wheel and moving the wheel to the desired position.

Wheel Overlap Dimensions

Model	G - Overlap in. *(mm)*	H - Gap in. *(mm)*
SQ 60-95	-	1/8 *(3)*
SQ 100-160	1/4 *(6)*	-
BSQ 70-160	1/4 *(6)*	-
BSQ 180-240	3/8 *(10)*	-
BSQ 300-420	1/2 *(13)*	-
SQ 97-98-99	1/4 *(6)*	-

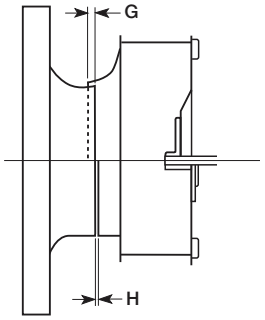


Figure 9

2. **Wheel Rotation:** Direction of wheel rotation is critical. Reversed rotation will result in poor air performance, motor overloading and possible burnout. Check wheel rotation by momentarily energizing the unit (all SQ and BSQ fans have clockwise wheel rotation when viewed from top of fan). Rotation should be clockwise as shown in Figure 10 and correspond to the rotation decal on the unit.

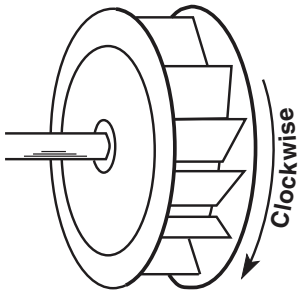


Figure 10

WARNING

Correct direction of wheel rotation is critical. Reversed rotation will result in poor air performance, motor overloading and possible burnout.

AVERTISSEMENT

La turbine doit impérativement tourner dans le bon sens. Une rotation en sens inverse entraînerait de mauvaises performances de soufflage, une surcharge du moteur voire un grillage du moteur.

3. **Vibration Isolators:** After fan is moved to desired location, punch out the four knockout holes which are located on the unit top and bottom panels. Assemble the brackets to the unit according to the appropriate drawings on pages 8 and 9 and refer to respective parts list on page 15. Make certain all connectors are tight and that all washers are in.
4. **For BSQ Fans:** If adjustments are made, it is very important to check the pulleys for proper alignment. Misaligned pulleys lead to excessive belt wear, vibration, noise, and power loss. (see Figure 11 on next page).

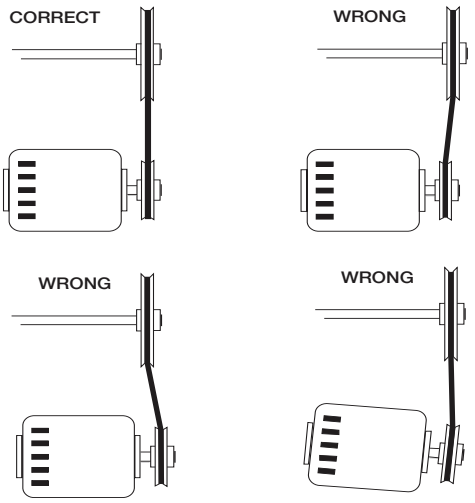


Figure 11

5. **For BSQ Fans:** Belt tension can be adjusted by loosening four fasteners marked “R” on the drive frame. (refer to Figure 13). The motor plate slides on the slotted adjusting arms. Belt tension should be adjusted to allow 1/64 inch of deflection per inch of belt span. For example, a 15 inch belt span should have 15/64 inch (or about 1/4 inch) of deflection with moderate thumb pressure at mid-point between pulleys (see Figure 12). Over-tightening will cause excessive bearing wear and noise. Too little tension will cause slippage at start-up and uneven wear.

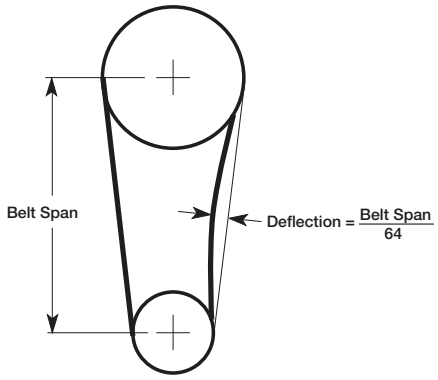
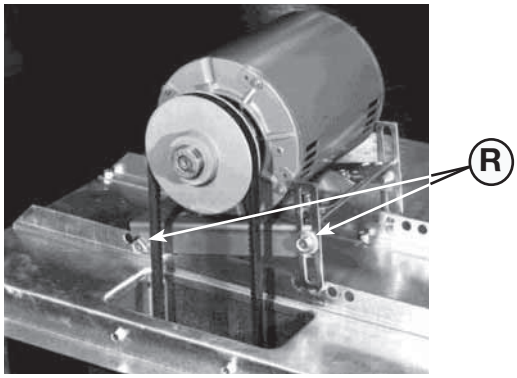


Figure 12



NOTE: Identical fasteners on opposing side must also be loosened.

Figure 13

6. The adjustable motor pulley is factory set for the RPM specified. Speed can be increased by closing or decreased by opening the adjustable motor sheave. Two groove variable pitch pulleys must be adjusted an equal number of turns open or closed. Any increase in speed represents a substantial increase in the horsepower required by a unit. Motor amperage should always be checked to avoid serious damage to the motor when speed is varied.

IMPORTANT

The fan has been checked for mechanical noises at the factory prior to shipment. If mechanical noise should develop, suggested corrective actions are offered in the Troubleshooting section.

IMPORTANT

Over-tightening will cause excessive bearing wear and noise. Too little tension will cause slippage at start-up and uneven wear.

IMPORTANT

Adjust (tighten) belt tension after the first 24-48 hours of operation.

Operation: SQ / BSQ

1. Before starting up or operating fan, check all fasteners for tightness. In particular, check the setscrews in wheel hub (and pulleys, if applicable).
2. While in the OFF position or before connecting the fan to power, turn the fan wheel by hand to be sure it is not striking the venturi or any obstacle.
3. Start the fan and shut it off immediately to check rotation of the wheel with directional arrow in the motor compartment, see Figure 10.
4. When the fan is started, observe the operation and check for any unusual noises.
5. With the system in full operation and all ductwork attached, measure current input to the motor and compare with the nameplate rating to determine if the motor is operating under safe load conditions.
6. Keep inlets and approaches to fan clean and free from obstruction.

Inspection: SQ / BSQ

Inspection of the fan should be conducted at the first 30 minute and 24 hour intervals of satisfactory operation.

30 Minute Interval

Inspect bolts, setscrews and motor mounting bolts. Adjust and tighten as necessary.

24 Hour Interval

Check all internal components. On BSQ unit only, inspect belt alignment and tension. Adjust and tighten as necessary.

Maintenance: SQ / BSQ

Installation and maintenance are to be performed only by qualified personnel who are familiar with local codes and regulations and who are experienced with this type of equipment.

Motor maintenance is generally limited to cleaning and lubrication (where applicable). Cleaning should be limited to exterior surfaces only. Removing dust buildup on motor housing ensures proper motor cooling.

Greasing of motors is only intended when fittings are provided. Many fractional horsepower motors are permanently lubricated and should not be lubricated after installation. Motors supplied with grease fittings should be greased in accordance with manufacturers' recommendations. Where motor temperatures do not exceed 104ºF *(40ºC)*, the grease should be replaced after 2,000 hours of running time as a general rule.

Wheels require very little attention when moving clean air. Occasionally, oil and dust may accumulate causing imbalance. When this occurs the wheel and housing should be cleaned to ensure smooth and safe operation.

All fasteners should be checked for tightness each time maintenance checks are performed prior to restarting unit.

A proper maintenance program will help these units deliver years of dependable service.

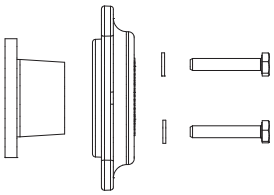
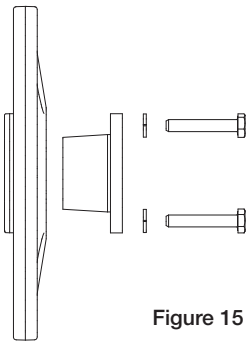
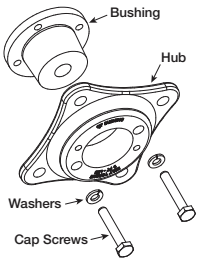
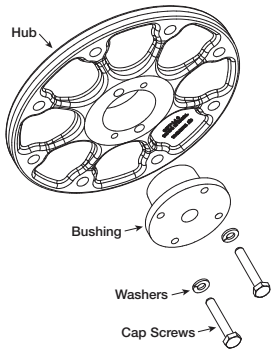
DANGER
Always disconnect, lock and tag power source before servicing. Failure to disconnect power source can result in fire, shock or serious injury.
DANGER
Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.
IMPORTANT
Uneven cleaning of the wheel will produce an out of balance condition that will cause vibration in the fan.
WARNING
This unit should be made non-functional when cleaning the wheel or housing (fuses removed, disconnect locked off).
WARNING
L'appareil doit être rendu non opérationnel lors du nettoyage de la turbine ou du caisson (fusibles retirés, sectionneur verrouillé).

Tapered Bushing Hub Installation and Removal

For wheel hubs and shaft pulleys utilizing a tapered bushing interface, follow this procedure for installation and removal. There are two possible set ups for the tapered bushing, both have the same procedure, but orientation of the hub varies.

Tapered Bushing Removal:

1. If present, loosen the setscrew holding the bushing and shaft key in place.
2. Loosen and remove the socket head cap screws which fasten the bushing to the hub as shown in the section views and examples of Figures 14-17.

Standard Mounting	Reverse Mounting
 Figure 14	 Figure 15
	
 Figure 16 Standard Bushing Orientation	 Figure 17 Reverse Bushing Orientation

3. **Standard Mounting** - Take the two socket head cap screws that were removed and install them into the visibly threaded holes on the wheel hub.
   Reverse Mounting - Install the two socket head cap screws into the visibly threaded holes of the bushing flange.
4. Once both socket head cap screws are installed, tighten them an eighth of a turn at a time, alternating between the two until the hub comes loose from the bushing.

Bushing Installation:

1. Clean all surfaces of hub and bushing to remove any oil or residue present and do not use any lubricant to install bushing into the hub. For both standard and reverse mounting styles, the socket head cap screws are adjustable from the inlet of the fan.
2. **Standard Mounting:** Slide the bushing and shaft key onto the fan shaft followed by the wheel and hub assembly. If present, use the keyway setscrew to hold the shaft key and bushing in place but DO NOT overtighten as this can damage the bushing. Align the unthreaded holes of the hub with the threaded holes of the tapered bushing.
   Reverse Mounting: Slide the wheel and hub assembly onto the fans shaft followed by the bushing and shaft key. If present, use the keyway setscrew to hold the shaft key and bushing in place but DO NOT overtighten as this can damage the bushing. Align the unthreaded holes of the tapered bushing with the threaded holes of the hub.
3. Install the two bushing socket head cap screws into the aligned holes by hand (or without excessive torque) until the heads of the socket head cap screws are seated against the mating surface.
4. Adjust the height of the wheel in the fan relative to the inlet venturi then tighten the two socket head cap screws an eighth turn at a time in an alternating fashion and to a torque of 10 ft-lbs.

Belt/Bearing Maintenance BSQ Unit

1. Belts tend to stretch after a period of time. They should be checked periodically for wear and tightness. When replacing belts, use the same type as supplied with the unit.
2. Matched belts should always be used on units with multi-groove pulleys.
3. For belt replacement, loosen the tensioning device enough to allow removal of the belt by hand. Do not force belts on or off. This may cause cords to break, leading to premature belt failure.
4. Once installed, adjust belts as shown in "Pre-Start-Up Checks."
5. Shaft bearings can be classified in two groups: relubricating and non-relubricating. All bearings on standard model BSQ fans are factory lubricated and require no further lubrication under normal use (between -20ºF and 180ºF *(-29ºC and 82ºC)* in a relatively clean environment).
6. Units installed in hot, humid or dirty locations should be equipped with special bearings. These bearings will require frequent lubrication. Caution should be employed to prevent overpacking or contamination.
7. Grease fittings should be wiped clean. The unit should be in operation while lubricating. Extreme care should be used around moving parts.
8. Grease should be pumped in very slowly until a slight bead forms around the seal. A high grade lithium base grease should be used.

Recommended Relubrication Frequency in Months

NOTE: If unusual environment conditions exist (extreme temperature, moisture or contaminants) more frequent lubrication is required.

A good quality lithium base grease, conforming to NLGI Grade 2 consistency, such as those listed here may be used.

Suggested Fan Bearing Greasing Intervals	
Interval (months)	**Type of Service**
1 to 3	**Heavy duty in dirty, dusty locations; high ambient temperatures; moisture laden atmosphere; vibration.**
3 to 6	**12 to 24 hours per day, heavy duty, or if moisture is present**
6 to 12	**8 to 16 hours per day in clean, relatively dry atmosphere**
12 to 18	**Infrequent operation or light duty in clean atmosphere**

Grease Manufacturers	
Manufacturer	**Grease (NLGI #2)**
U.S. Electric Motors	Grease No. 83343
Chevron U.S.A. Inc	Chevron SRI Grease #2
Mobil Oil Corporation	Mobilith
	Mobil 532
Texaco, Inc.	Premium BRB #2
	Texaco Multifak #2
Amoco Oil Co.	Rykon Premium #2
Exxon	Unirex N2
Shell	B Shell Alvania #2

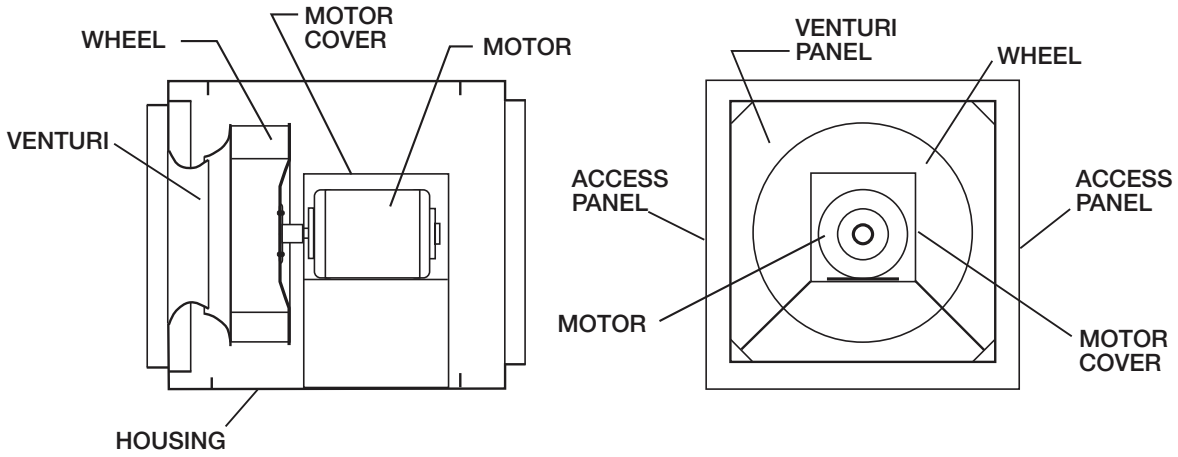
Parts List

Each fan bears a manufacturer's nameplate with model number and serial number embossed. This information will assist the local Greenheck representative and the factory in providing service and replacement parts. Before taking any corrective action, make certain unit is not capable of operation during repairs.

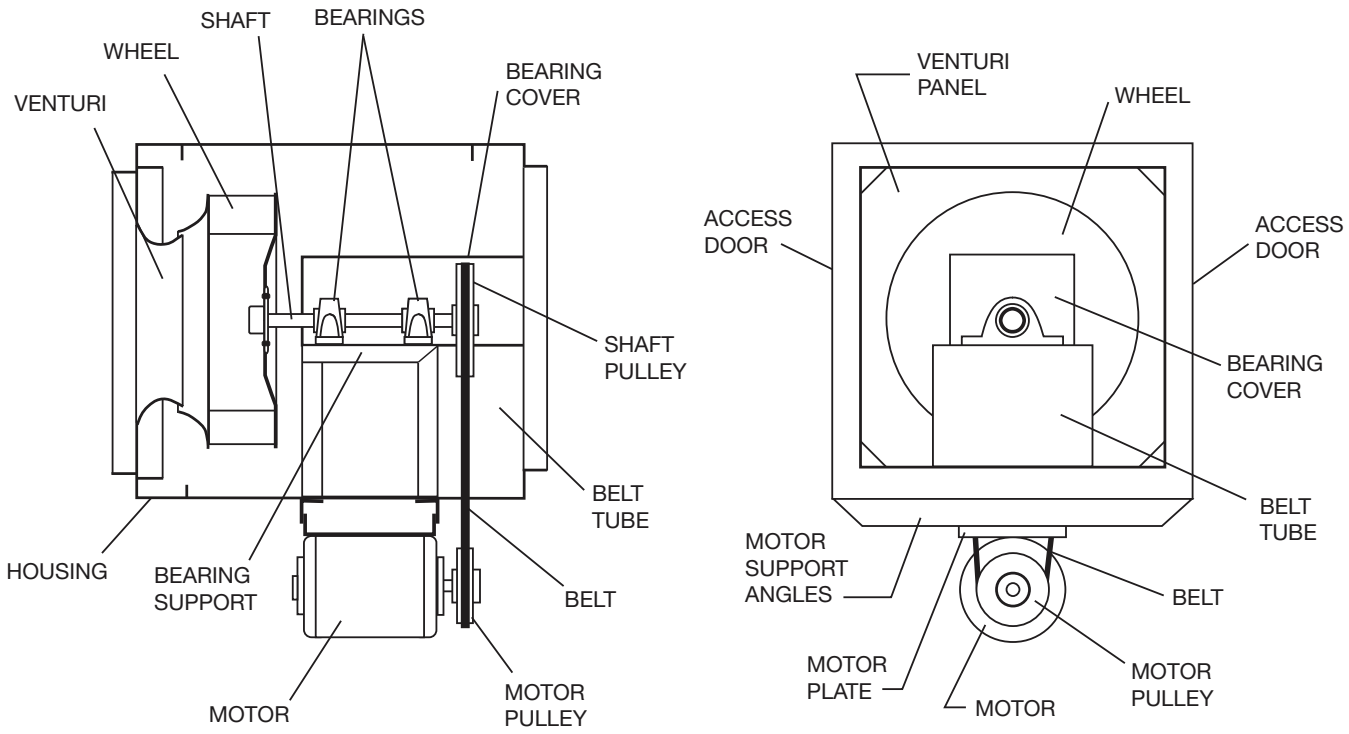
CAUTION
A fan manufactured with an explosion resistant motor does not certify the entire unit to be explosion proof. Refer to UL Listing Mark for the fans approved usage.

CAUTION
La présence d'un moteur antidéflagrant sur un ventilateur ne garantit pas que tout l'appareil est antidéflagrant. Pour connaître les emplois autorisés de l'appareil, voir son marquage de conformité UL.

SQ Direct Drive Centrifugal Inline Exhaust Fan

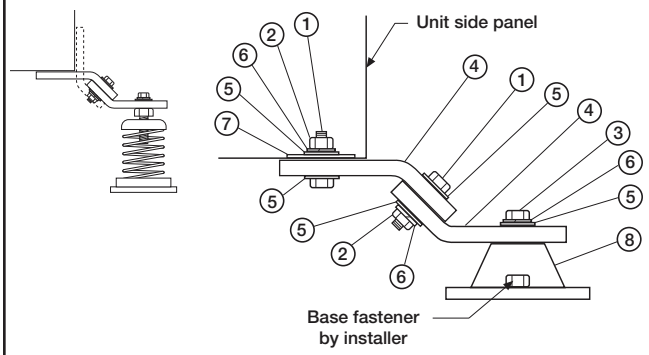


BSQ Belt Drive Centrifugal Inline Exhaust Fan

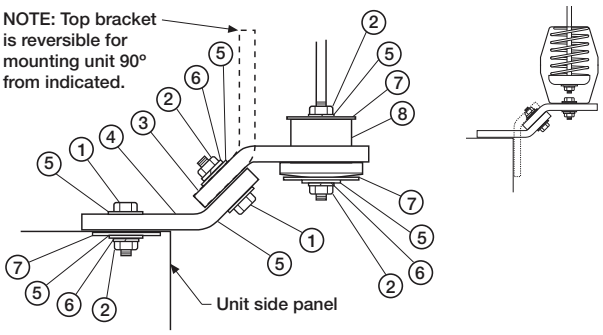


Isolator Parts List

STANDING SUPPORT ISOLATOR



HANGING SUPPORT ISOLATOR



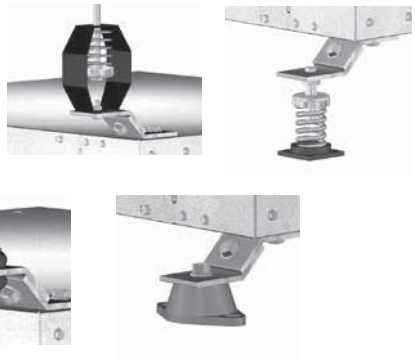
No.	Qty.	Description	SQ-60 thru 140 BSQ-100 thru 140	SQ-160 BSQ-160 thru 420	No.	Qty.	Description	SQ-60 thru 140 BSQ-100 thru 140	SQ-160 BSQ-160 thru 420
1	8	Cadium plated hex head bolts	3/8 in. - 16 x 1 in.	3/8 in.-16 x 1 1/4 in.	1	8	Cadium plated hex head bolts	3/8 in. - 16 x 1 in.	3/8 in.-16 x 1 1/4 in.
2	8	Cadium plated hex nuts	3/8 in. - 16	3/8 in. - 16	2	16	Cadium plated hex nuts	3/8 in. - 16	3/8 in. - 16
3	4	Cadium plated hex head bolts	5/16 in. - 18 x 1 in.	3/8 in. - 16 x 1 in.	3	4	Std. mount bracket with (1) 1/4 in. hole	3/16 in.	1/4 in.
4	8	Std. mount bracket with (2) 7/16 in. holes	3/16 in.	1/4 in.	4	4	Std. mount bracket with (2) 7/16 in. holes	3/16 in.	1/4 in.
5	20	Cadium plated washer	7/8 in. O.D. x 3/8 in. I.D. x 1/16 in.	7/8 in. O.D. x 3/8 in. I.D. x 1/16 in.	5	24	Cadium plated washer	7/8 in. O.D. x 3/8 in. I.D. x 1/16 in.	7/8 in. O.D. x 3/8 in. I.D. x 1/16 in.
6	12	Cadium plated lock washer	3/8 in.	3/8 in.	6	12	Cadium plated lock washer	3/8 in.	3/8 in.
7	4	Cadium plated washer	1 3/8 in. O.D. x 9/16 in. I.D. x 3/32 in.	1 3/8 in. O.D. x 9/16 in. I.D. x 3/32 in.	7	12	Cadium plated washer	1 3/8 in. O.D. x 9/16 in. I.D. x 3/32 in.	1 3/8 in. O.D. x 9/16 in. I.D. x 3/32 in.
8	4	Neoprene or Spring Isolator	Reference appropriate table below for replacement Isolator(s)		8	4	Neoprene or Spring Isolator	Reference appropriate table below for replacement Isolator(s)	

REPLACEMENT SPRING ISOLATOR(S)

MODEL	FAN SIZES					
BSQ	----	70-130	140-180	200	240-300	360-420
SQ	60-100	120-140	160	----	----	----
BASE MOUNT	FDS-1-35 BLUE	FDS-1-70 GREEN	FDS 1-120 GRAY	FDS 1-120 GRAY	FDS-1-220 BROWN	FDS-1-370 ORANGE
HANGING	SH-1-35 BLUE	SH-1-70 GREEN	SH-1-125 GRAY	SH-1-245 BROWN	SH-1-245 BROWN	SH-1-370 ORANGE

REPLACEMENT NEOPRENE ISOLATOR(S)

MODEL	FAN SIZE		
BSQ	70-140	160-200	240-420
SQ	60-140	160	----
BASE MOUNT	R-1 GREEN	R-2 BLACK	R-2 RED
HANGING	40DUR BLACK	50DUR BLACK	50DUR BLACK



Troubleshooting

WARNING

Before taking any corrective action, make certain unit is not capable of operation during repairs.

AVERTISSEMENT

Avant d'entreprendre toute action corrective, s'assurer que l'appareil ne pourra pas fonctionner durant les réparations.

PROBLEM	CAUSE	CORRECTIVE ACTION
Excessive noise or vibration	Wheel unbalance	Clean all dirt off wheel. Check wheel balance, rebalance in place if necessary.
	Bad bearings	Replace.
	Belts too tight or too loose	Adjust tension, see Figure 12.
	Wheel improperly aligned and rubbing	Center wheel on inlet, see Figure 9.
	Loose drive or motor pulleys	Align and tighten. See "Pre Start-Up Checks", see pages 10-11.
	Foreign objects in wheel or housing	Remove objects, check for damage or unbalance.
Reduced airflow	System resistance too high	Check system: Proper operation of backdraft or control dampers, obstruction in ductwork, clean dirty filters.
	Unit running backwards	Correct as shown in Figure 10.
	Excessive dirt buildup on wheels	Clean wheel.
	Improper wheel alignment	Center wheel on inlets, see Pre Start-Up Checks and Figure 9.

Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Specific Greenheck product warranties are located on greenheck.com within the product area tabs and in the Library under Warranty.

Greenheck's Centrifugal Inline Fans catalog, Models SQ and BSQ provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

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PN 469092
Isolator Mounting Accessory for Models SQ/BSQ/BDF

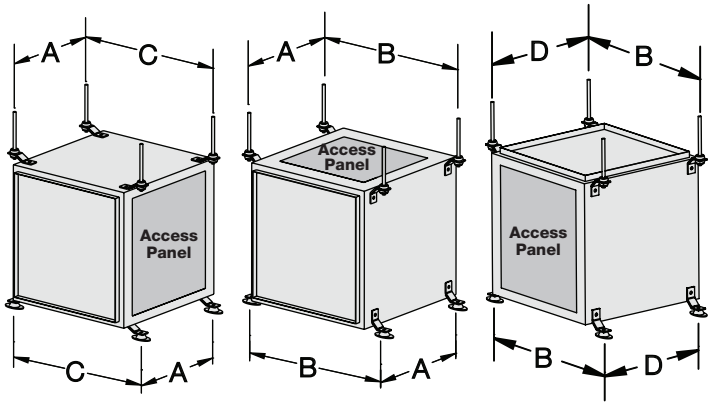
Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage!

Vibration Isolator Dimensional Data

Model	A	B	C	D
BDF-80	20¾ (527)	–	22 11/16 (576)	–
BDF-90	21¾ (552)	–	25⅝ (651)	–
BDF-100	23¾ (603)	–	27⅛ (689)	–
BDF-120	30½ (775)	–	31⅝ (803)	–
BDF-150	32 (813)	–	35 (889)	–
BDF-180	37⅜ (949)	–	44 (1118)	–
BDF-200	47⅜ (1203)	–	51½ (1308)	–
SQ 60-75	10⅝ (270)	17 (432)	15¾ (400)	8⅞ (225)
SQ 80-95	13¼ (337)	20 (508)	18¾ (476)	11⅞ (302)
SQ-100	18⅝ (473)	22⅛ (562)	20¾ (527)	13⅞ (352)
SQ-120	18⅝ (473)	24 (610)	22¾ (578)	16 (406)
SQ-130 (HP)	18⅝ (473)	26⅛ (664)	24¾ (629)	17⅞ (454)
SQ-140 (HP)	19⅝ (498)	28⅛ (714)	26¾ (679)	19⅞ (505)
SQ-160 (HP)	23½ (597)	31 (787)	29¾ (756)	22⅞ (581)
BSQ 70-90	18⅝ (473)	20⅛ (511)	18¾ (476)	11⅞ (302)
BSQ 100	18⅝ (473)	22⅛ (562)	20¾ (527)	13⅞ (352)
BSQ 120	18⅝ (473)	24 (610)	22¾ (578)	16 (406)
BSQ 130 (HP)	18⅝ (473)	26⅛ (664)	24¾ (629)	17⅞ (454)
BSQ 140 (HP)	19⅝ (498)	28⅛ (714)	26¾ (679)	19⅞ (505)
BSQ 160 (HP)	23½ (597)	31 (787)	29¾ (756)	22⅞ (581)
BSQ 180 (HP)	25½ (648)	33½ (851)	29 9/16 (751)	22¾ (578)
BSQ 200 (HP)	29⅛ (740)	37 (940)	33¾ (857)	26¾ (679)
BSQ 240 (HP)	31⅝ (803)	44¼ (1124)	40¾ (1035)	33⅞ (860)
BSQ 300 (HP)	35 (889)	51 (1295)	47¾ (1213)	40⅞ (1038)
BSQ 360 (HP)	38¾ (974)	57¼ (1454)	53½ (1359)	46¾ (1187)
BSQ 420 (HP)	47⅛ (1197)	63 (1600)	59⅞ (1521)	59⅞ (1521)

All dimensions in inches (millimeters).



Models SQ / BSQ / BDF | Models SQ / BSQ | Models SQ / BSQ

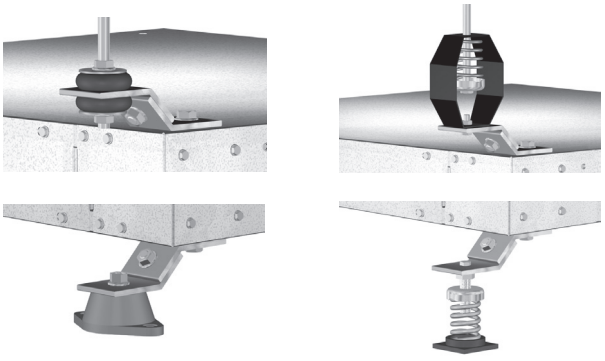
Isolator Mounting

Upon receiving unit, check for any damage and report it immediately to the shipper. Also, check to see that all accessory items are accounted for.

Move fan to the desired location and determine the position in which the unit is to be mounted. Punch out four (4) knock-out holes which are located on the unit top and bottom panels. Assemble the brackets to the unit according to the drawings below and refer to respective parts list (reverse side). Make certain all connectors are tight and that all washers are used.

REPLACEMENT SPRING ISOLATOR(S)						
MODEL	FAN SIZES					
BDF	----	80-90	100-120	----	150-180	200
BSQ	----	70-130	140-180	200	240-300	360-420
SQ	60-100	120-140	160	----	----	----
BASE MOUNT	FDS-1-35 BLUE	FDS-1-70 GREEN	FDS 1-120 GRAY	FDS 1-120 GRAY	FDS-1-220 BROWN	FDS-1-370 ORANGE
HANGING	SH-1-35 BLUE	SH-1-70 GREEN	SH-1-125 GRAY	SH-1-245 BROWN	SH-1-245 BROWN	SH-1-370 ORANGE

REPLACEMENT NEOPRENE ISOLATOR(S)			
MODEL	FAN SIZE		
BDF	80-100	120-150	180-200
BSQ	70-140	160-200	240-420
SQ	60-140	160	----
BASE MOUNT	R-1 GREEN	R-2 BLACK	R-2 RED
HANGING	40DUR BLACK	50DUR BLACK	50DUR BLACK



Pre-Starting Checks

Check all fasteners for tightness.

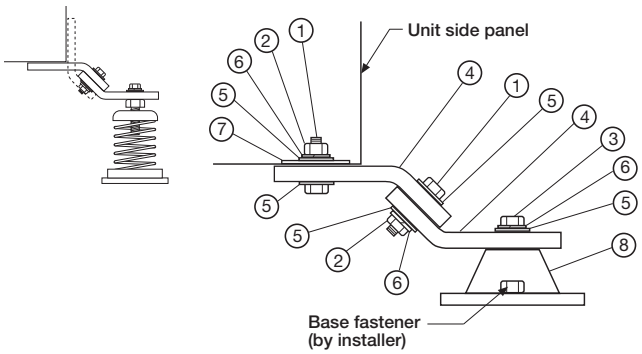
Maintenance

All fasteners should be checked for tightness each time maintenance checks are performed prior to restarting the unit. A proper maintenance program will help these units deliver years of dependable service.

NOTE: Before taking any corrective action, make certain unit is not capable of operation during repairs.

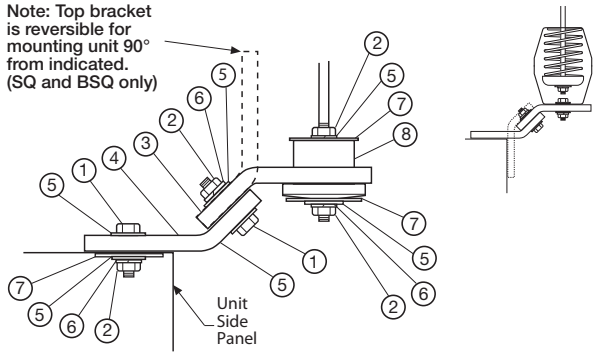
Isolator Parts List

STANDING SUPPORT ISOLATOR



No	Qty	Description	SQ-60 thru 140 BSQ-100 thru 140 BDF-80 thru 150	SQ-160 BSQ-160 thru 420 BDF-180 thru 200
1	8	Cadium plated hex head bolts	3/8 in. - 16 x 1 in.	3/8 in. - 16 x 1 1/4 in.
2	8	Cadium plated hex nuts	3/8 in. - 16	3/8 in. - 16
3	4	Cadium plated hex head bolts	5/16 in. - 18 x 1 in.	3/8 in. - 16 x 1 in.
4	8	St. mount bracket w/2 - 7/16 in. holes	3/16 in.	1/4 in.
5	20	Cadium plated washer	7/8 in. O.D x 3/8 in. I.D. x 1/16 in.	7/8 in. O.D x 3/8 in. I.D. x 1/16 in.
6	12	Cadium plated lock washer	3/8 in.	3/8 in.
7	4	Cadium plated washer	1 3/8 in. O.D x 9/16 in. I.D. x 3/32 in.	1 3/8 in. O.D x 9/16 in. I.D. x 3/32 in.
8	4	Neoprene or Spring Isolator	Reference appropriate table below for replacement Isolator(s)	

HANGING SUPPORT ISOLATOR



No	Qty	Description	SQ-60 thru 140 BSQ-100 thru 140 BDF-80 thru 150	SQ-160 BSQ-160 thru 420 BDF-180 thru 200
1	8	Cadium plated hex head bolts	3/8 in. - 16 x 1 in.	3/8 in. - 16 x 1 1/4 in.
2	16	Cadium plated hex nuts	3/8 in. - 16	3/8 in. - 16
3	4	St. mount bracket w/1 - 1/4 in hole	3/16 in.	1/4 in.
4	4	St. mount bracket w/2 - 7/16 in. holes	3/16 in.	1/4 in.
5	24	Cadium plated washer	7/8 in. O.D x 3/8 in. I.D. x 1/16 in.	7/8 in. O.D x 3/8 in. I.D. x 1/16 in.
6	12	Cadium plated lock washer	3/8 in.	3/8 in.
7	12	Cadium plated washer	1 3/8 in. O.D x 9/16 in. I.D. x 3/32 in.	1 3/8 in. O.D x 9/16 in. I.D. x 3/32 in.
8	4	Neoprene or Spring Isolator	Reference appropriate table below for replacement Isolator(s)	

Warranty

Greenheck warrants this equipment to be free from defects in material and workmanship for a period of one year from the shipment date. Any units or parts which prove to be defective during the warranty period will be replaced at our option when returned to our factory, transportation prepaid. Motors are warranted by the motor manufacturer for a period of one year. Should motors furnished by Greenheck prove defective during this period, they should be returned to the nearest authorized motor service station. Greenheck will not be responsible for any removal or installation costs.
As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Greenheck Models SQ and BSQ catalog provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

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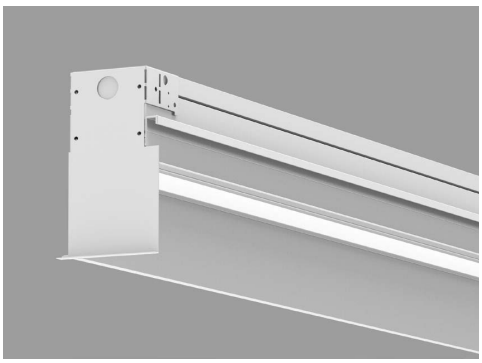
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-18'6"-277-D-1-DTL-W Notes:	**Type:** **RC18-6** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

PROJECT: _____

TYPE: _____

NOTES: _____

DESCRIPTION

Via Skim is designed to illuminate textured or polished vertical surfaces with a grazing light from the wall/ceiling intersection. Via Skim provides continuous illumination across the wall surface.

The intense light distribution is achieved with our Grazing Reflector Optic (GRO) oriented to project light with maximum luminous intensity at 5° from nadir.

The Via Skim is available with two depth options: shallow and deep. Total recessed depth ranges from 4¾" to 7".

ORDER GUIDE

***IC* RATED**

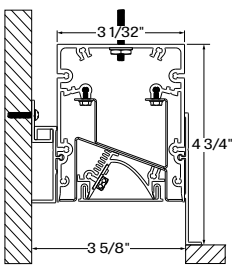
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

18' 6"				
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

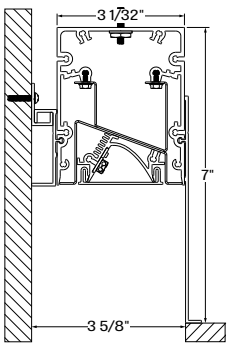
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



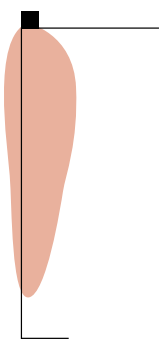
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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Intertek

VIA SKIM 3 LED

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OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

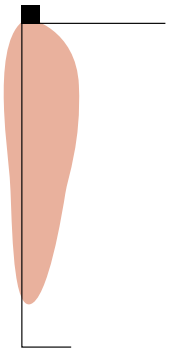
LIGHT SOURCE - LED

Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

PERFORMANCE PER 4' AT 4000K

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	19	1400	75
medium output	4000K	27	2000	74
high output	4000K	42	3000	71

LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

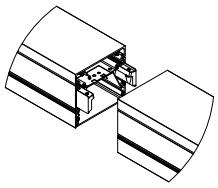
Foot Candles on 20' wide wall, 10' ceiling

128	135	153	144	131	126	134	154	146	136
25.4	24.4	23.5	23.7	23.7	23.8	23.8	23.7	24.8	27.8
12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

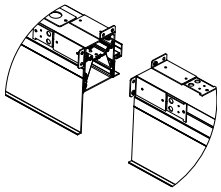
LUMINAIRE LENGTH

All individual sections are joined together onsite using the joiner kits provided. LumenWerx offers joiner kits that are extremely simple to work with in the field and result in a fixture that appears virtually seamless with no light leak at any connection.

Joining system



Drywall joining



Grid joining

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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Intertek

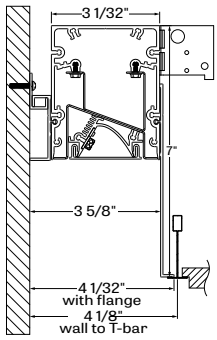
VIA SKIM 3 LED

RECESSED

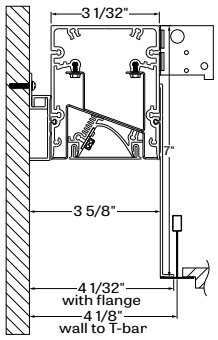
LUMENWERX
WWW.LUMENWERX.COM

MOUNTING OPTIONS

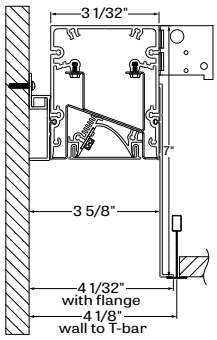
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



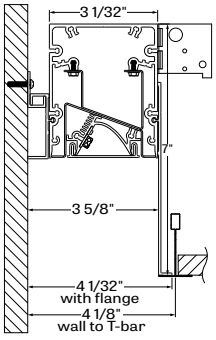
TG9 - tegular 9/16"



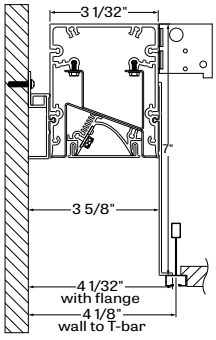
TG15 - tegular 15/16"



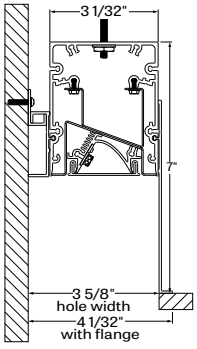
TB9 - t-bar 9/16"



TB15 - t-bar 15/16"



ST - screw slot t-bar



DTL - drywall trimless

FINISH

Interior - 95%, reflective matte powder coated white paint
Exterior - matte white or silver powder coating.
Custom finishes are also available.

CONSTRUCTION

Housing - Extruded Aluminum (0.095" nominal) up to 90% Recycled Content
Interior brackets - Die formed cold rolled sheet steel 18 gauge thick
Joining system - Die cast Zinc (0.95" nominal) and die Formed galvanized sheet 18 gauge
Reflectors - Extruded Aluminum (0.070" nominal) up to 90% Recycled Content.
Recessed flanges - Extruded Aluminum (0.075" nominal) up to 90% Recycled Content
End plate - Die formed cold rolled sheet steel 18 gauge thick

MAINTENANCE

LED boards are housed in a removable cartridge for easy replacement. Driver is accessible from below.

WEIGHT

Via Skim 3 4ft - 11.23lbs - 5.1kg
Via Skim 3 8ft - 22.47lbs - 10.2kg
Via Skim 3 12ft - 33.70lbs - 15.3kg

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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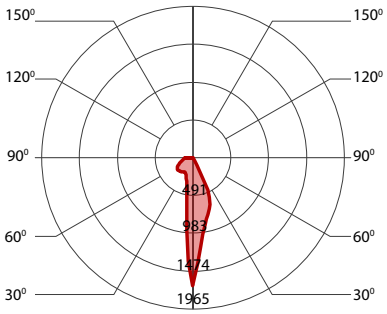
Intertek

VIA SKIM 3 LED

RECESSED

LUMENWERX
WWW.LUMENWERX.COM

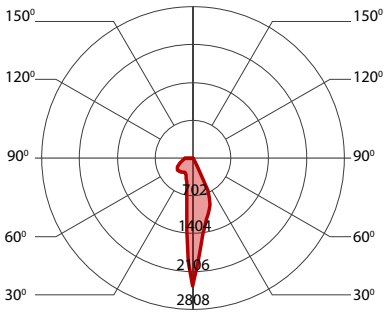
350 LUMEN AT 80CRI - LOW OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	20	1400	71
low output	3500K	19	1400	73
low output	4000K	19	1400	75

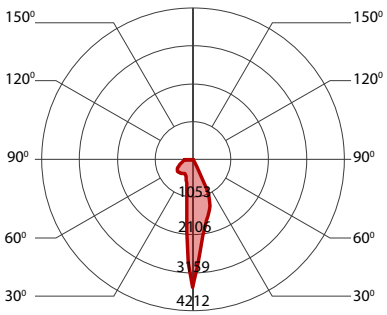
500 LUMEN AT 80CRI - MEDIUM OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	28.5	2000	70
medium output	3500K	28	2000	72
medium output	4000K	27	2000	74

750 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	45	3000	67
high output	3500K	43.5	3000	69
high output	4000K	42	3000	71

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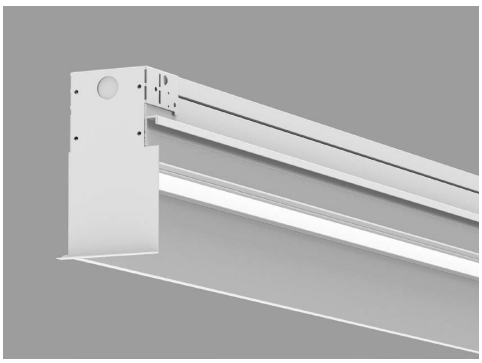
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-34'3"-277-D-1-DTL-W Notes:	**Type:** **RC34-3** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

DESCRIPTION

Via Skim is designed to illuminate textured or polished vertical surfaces with a grazing light from the wall/ceiling intersection. Via Skim provides continuous illumination across the wall surface.
The intense light distribution is achieved with our Grazing Reflector Optic (GRO) oriented to project light with maximum luminous intensity at 5° from nadir.
The Via Skim is available with two depth options: shallow and deep. Total recessed depth ranges from 4¾" to 7".

PROJECT: _____

TYPE: _____

NOTES: _____

ORDER GUIDE

IC RATED

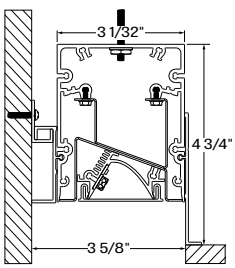
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

34' 3"				
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

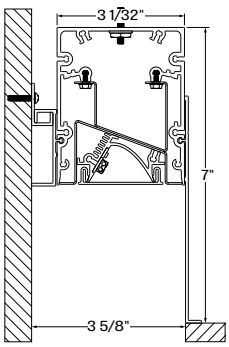
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



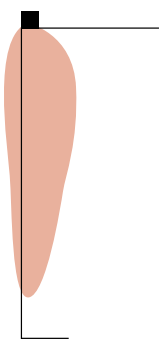
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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Intertek

VIA SKIM 3 LED

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OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

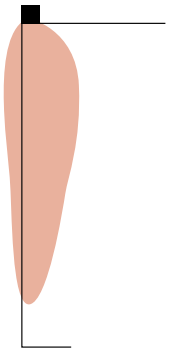
LIGHT SOURCE - LED

Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

PERFORMANCE PER 4' AT 4000K

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	19	1400	75
medium output	4000K	27	2000	74
high output	4000K	42	3000	71

LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

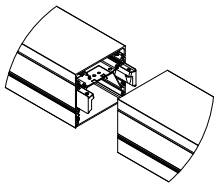
Foot Candles on 20' wide wall, 10' ceiling

128	135	153	144	131	126	134	154	146	136
25.4	24.4	23.5	23.7	23.7	23.8	23.8	23.7	24.8	27.8
12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

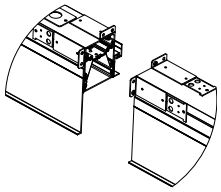
LUMINAIRE LENGTH

All individual sections are joined together onsite using the joiner kits provided. LumenWerx offers joiner kits that are extremely simple to work with in the field and result in a fixture that appears virtually seamless with no light leak at any connection.

Joining system



Drywall joining



Grid joining

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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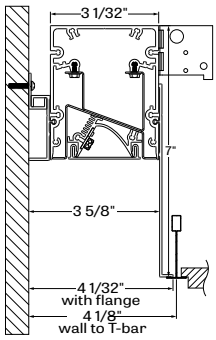
VIA SKIM 3 LED

RECESSED

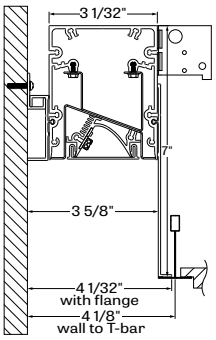
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MOUNTING OPTIONS

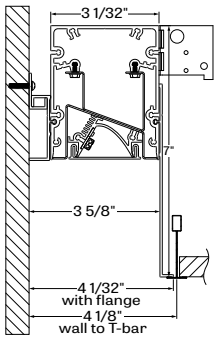
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



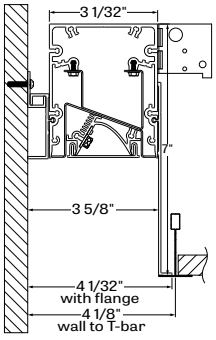
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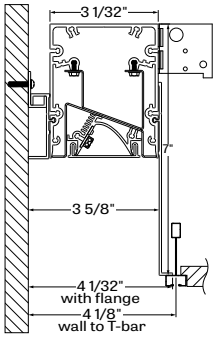
TG15 - tegular 15/16"



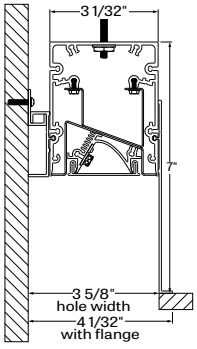
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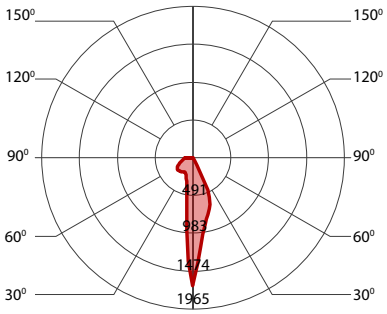
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-34'3"-277-D-1-DTL-W Notes:	**Type:** **RC34-3** LAI16-104794

VIA SKIM 3 LED

RECESSED

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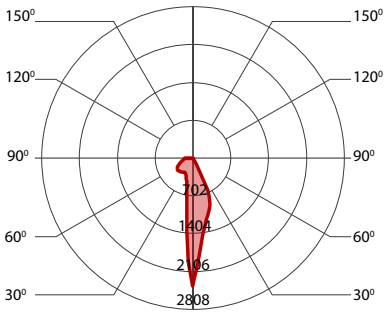
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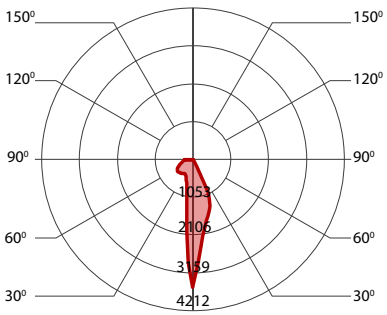
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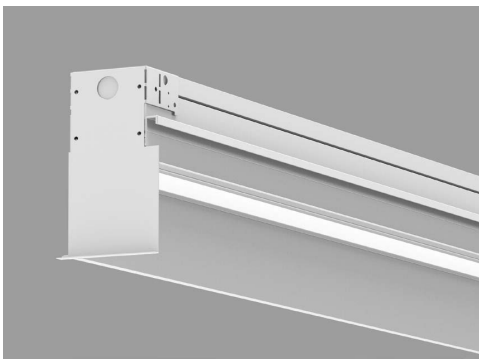
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VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

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PROJECT: _____

TYPE: _____

NOTES: _____

ORDER GUIDE

IC RATED

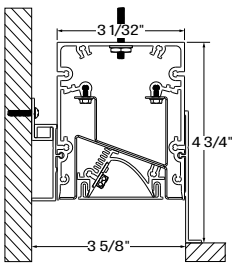
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
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34' 6"				
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

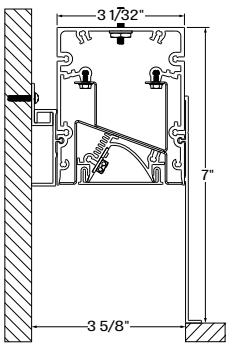
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



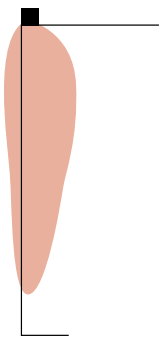
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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VIA SKIM 3 LED

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OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

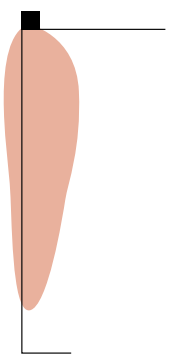
LIGHT SOURCE - LED

Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

PERFORMANCE PER 4' AT 4000K

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	19	1400	75
medium output	4000K	27	2000	74
high output	4000K	42	3000	71

LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

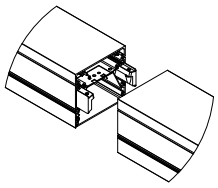
Foot Candles on 20' wide wall, 10' ceiling

128	135	153	144	131	126	134	154	146	136
25.4	24.4	23.5	23.7	23.7	23.8	23.8	23.7	24.8	27.8
12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
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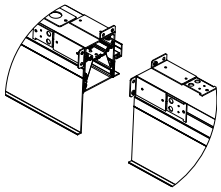
LUMINAIRE LENGTH

All individual sections are joined together onsite using the joiner kits provided. LumenWerx offers joiner kits that are extremely simple to work with in the field and result in a fixture that appears virtually seamless with no light leak at any connection.

Joining system



Drywall joining



Grid joining

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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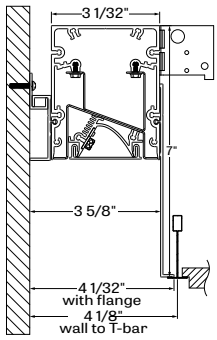
VIA SKIM 3 LED

RECESSED

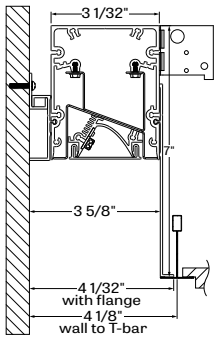
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MOUNTING OPTIONS

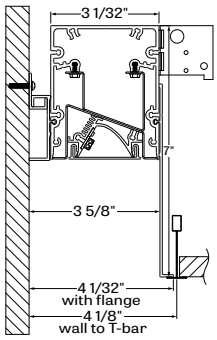
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



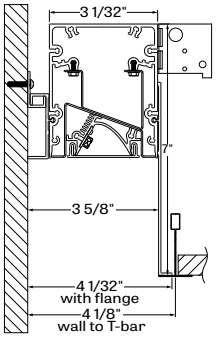
TG9 - tegular 9/16"



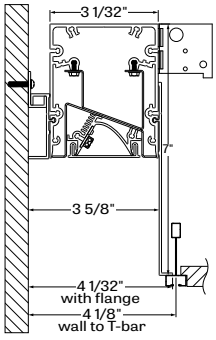
TG15 - tegular 15/16"



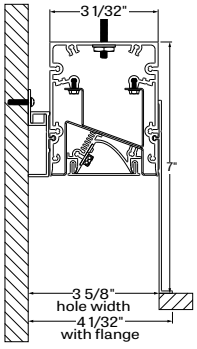
TB9 - t-bar 9/16"



TB15 - t-bar 15/16"



ST - screw slot t-bar



DTL - drywall trimless

FINISH

Interior - 95%, reflective matte powder coated white paint
Exterior - matte white or silver powder coating.
Custom finishes are also available.

CONSTRUCTION

Housing - Extruded Aluminum (0.095" nominal) up to 90% Recycled Content
Interior brackets - Die formed cold rolled sheet steel 18 gauge thick
Joining system - Die cast Zinc (0.95" nominal) and die Formed galvanized sheet 18 gauge
Reflectors - Extruded Aluminum (0.070" nominal) up to 90% Recycled Content.
Recessed flanges - Extruded Aluminum (0.075" nominal) up to 90% Recycled Content
End plate - Die formed cold rolled sheet steel 18 gauge thick

MAINTENANCE

LED boards are housed in a removable cartridge for easy replacement. Driver is accessible from below.

WEIGHT

Via Skim 3 4ft - 11.23lbs - 5.1kg
Via Skim 3 8ft - 22.47lbs - 10.2kg
Via Skim 3 12ft - 33.70lbs - 15.3kg

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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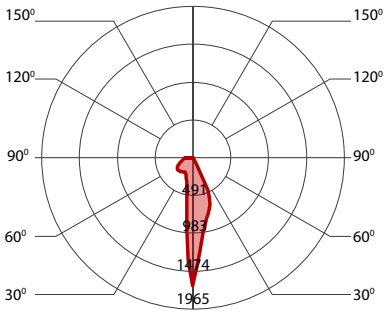
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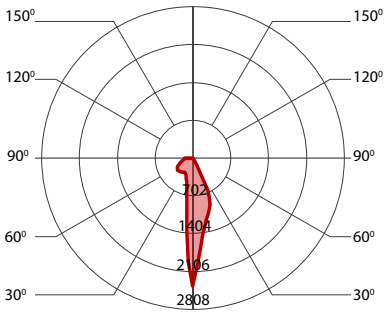
350 LUMEN AT 80CRI - LOW OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	20	1400	71
low output	3500K	19	1400	73
low output	4000K	19	1400	75

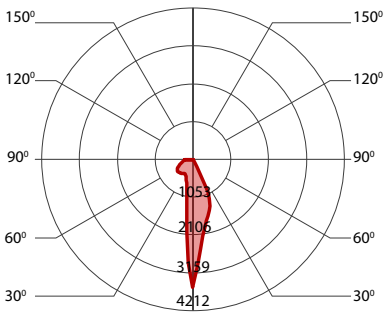
500 LUMEN AT 80CRI - MEDIUM OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	28.5	2000	70
medium output	3500K	28	2000	72
medium output	4000K	27	2000	74

750 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	45	3000	67
high output	3500K	43.5	3000	69
high output	4000K	42	3000	71

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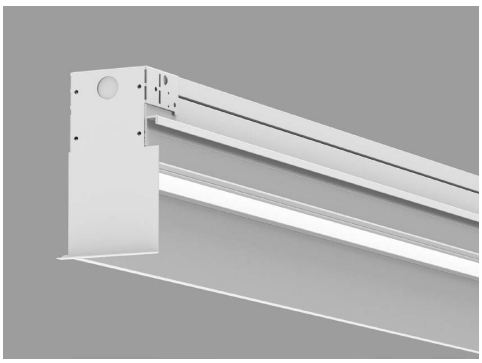
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-43'6"-277-D-1-DTL-W Notes:	**Type:** **RC43-6** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

PROJECT: _____

TYPE: _____

NOTES: _____

DESCRIPTION

Via Skim is designed to illuminate textured or polished vertical surfaces with a grazing light from the wall/ceiling intersection. Via Skim provides continuous illumination across the wall surface.

The intense light distribution is achieved with our Grazing Reflector Optic (GRO) oriented to project light with maximum luminous intensity at 5° from nadir.

The Via Skim is available with two depth options: shallow and deep. Total recessed depth ranges from 4¾" to 7".

ORDER GUIDE

IC RATED

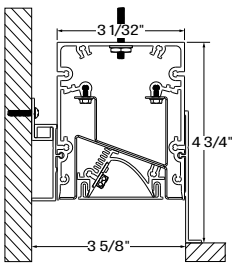
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

43' 6"				
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

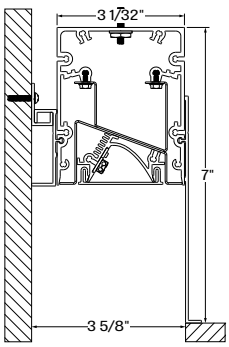
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



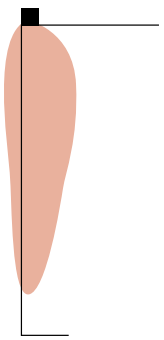
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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OPTICS

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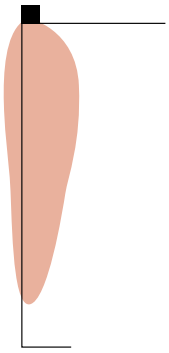
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LIGHT DISTRIBUTION



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Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

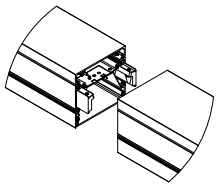
Foot Candles on 20' wide wall, 10' ceiling

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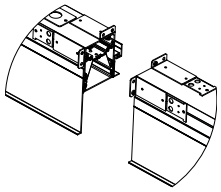
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Joining system



Drywall joining



Grid joining

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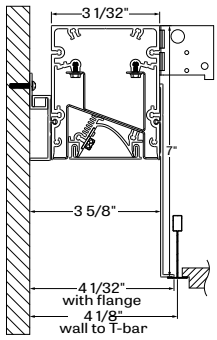
VIA SKIM 3 LED

RECESSED

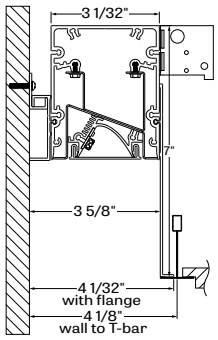
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MOUNTING OPTIONS

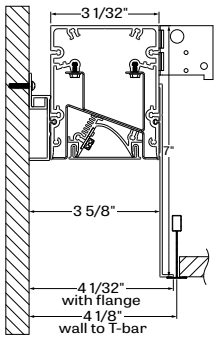
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



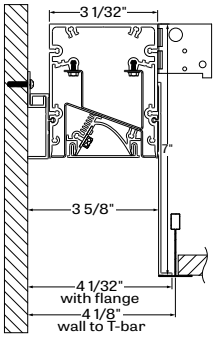
TG9 - tegular 9/16"



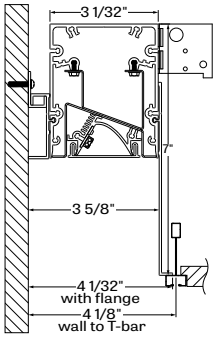
TG15 - tegular 15/16"



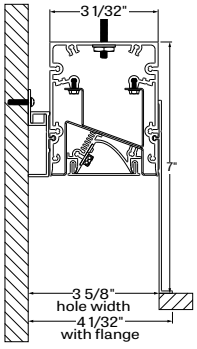
TB9 - t-bar 9/16"



TB15 - t-bar 15/16"



ST - screw slot t-bar



DTL - drywall trimless

FINISH

Interior - 95%, reflective matte powder coated white paint
Exterior - matte white or silver powder coating.
Custom finishes are also available.

CONSTRUCTION

Housing - Extruded Aluminum (0.095" nominal) up to 90% Recycled Content
Interior brackets - Die formed cold rolled sheet steel 18 gauge thick
Joining system - Die cast Zinc (0.95" nominal) and die Formed galvanized sheet 18 gauge
Reflectors - Extruded Aluminum (0.070" nominal) up to 90% Recycled Content.
Recessed flanges - Extruded Aluminum (0.075" nominal) up to 90% Recycled Content
End plate - Die formed cold rolled sheet steel 18 gauge thick

MAINTENANCE

LED boards are housed in a removable cartridge for easy replacement. Driver is accessible from below.

WEIGHT

Via Skim 3 4ft - 11.23lbs - 5.1kg
Via Skim 3 8ft - 22.47lbs - 10.2kg
Via Skim 3 12ft - 33.70lbs - 15.3kg

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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LumenWerx ULC. reserves the right to change or modify product specifications without notification

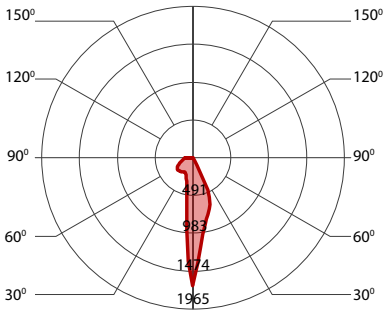
Intertek

VIA SKIM 3 LED

RECESSED

LUMENWERX
WWW.LUMENWERX.COM

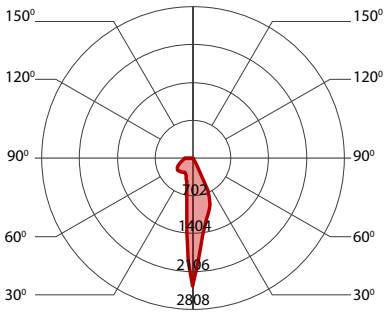
350 LUMEN AT 80CRI - LOW OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	20	1400	71
low output	3500K	19	1400	73
low output	4000K	19	1400	75

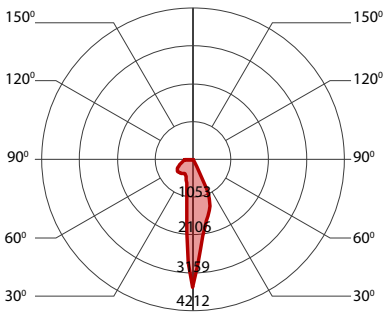
500 LUMEN AT 80CRI - MEDIUM OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	28.5	2000	70
medium output	3500K	28	2000	72
medium output	4000K	27	2000	74

750 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	45	3000	67
high output	3500K	43.5	3000	69
high output	4000K	42	3000	71

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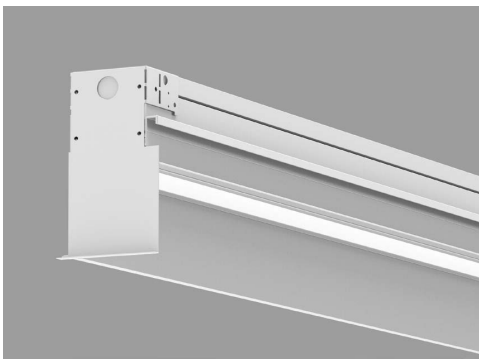
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-45'8"-277-D-1-DTL-W Notes:	**Type:** **RC45-8** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

PROJECT: _____

TYPE: _____

NOTES: _____

DESCRIPTION

Via Skim is designed to illuminate textured or polished vertical surfaces with a grazing light from the wall/ceiling intersection. Via Skim provides continuous illumination across the wall surface.

The intense light distribution is achieved with our Grazing Reflector Optic (GRO) oriented to project light with maximum luminous intensity at 5° from nadir.

The Via Skim is available with two depth options: shallow and deep. Total recessed depth ranges from 4¾" to 7".

ORDER GUIDE

IC RATED

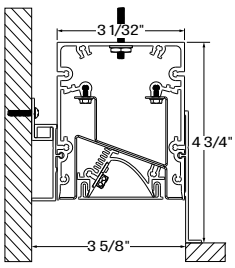
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
~~**V3SKIS**- via skim 3 recessed shallow~~ **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

45' 8"				
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

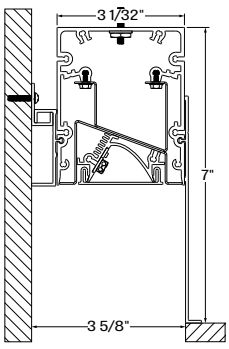
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



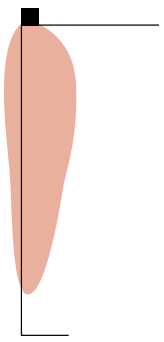
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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Intertek

VIA SKIM 3 LED

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OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

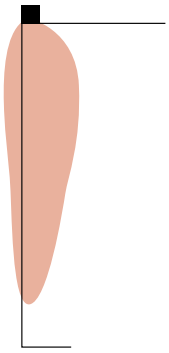
LIGHT SOURCE - LED

Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

PERFORMANCE PER 4' AT 4000K

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	19	1400	75
medium output	4000K	27	2000	74
high output	4000K	42	3000	71

LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

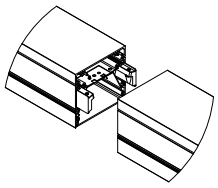
Foot Candles on 20' wide wall, 10' ceiling

128	135	153	144	131	126	134	154	146	136
25.4	24.4	23.5	23.7	23.7	23.8	23.8	23.7	24.8	27.8
12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

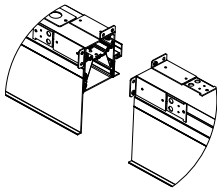
LUMINAIRE LENGTH

All individual sections are joined together onsite using the joiner kits provided. LumenWerx offers joiner kits that are extremely simple to work with in the field and result in a fixture that appears virtually seamless with no light leak at any connection.

Joining system



Drywall joining



Grid joining

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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Intertek

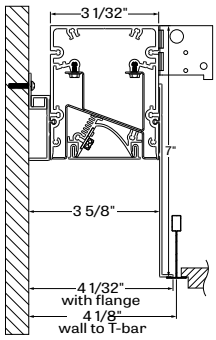
VIA SKIM 3 LED

RECESSED

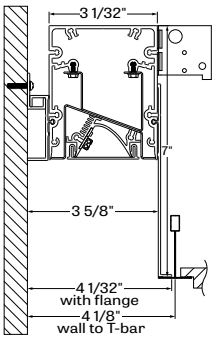
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MOUNTING OPTIONS

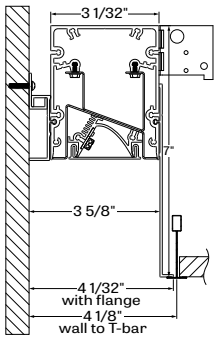
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



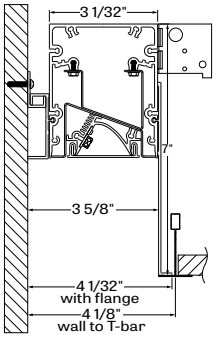
TG9 - tegular 9/16"



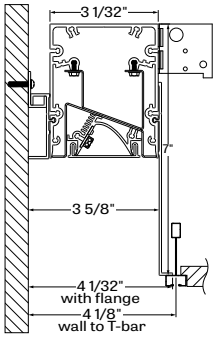
TG15 - tegular 15/16"



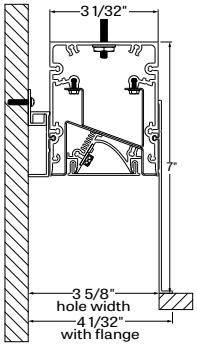
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TB15 - t-bar 15/16"



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Exterior - matte white or silver powder coating.
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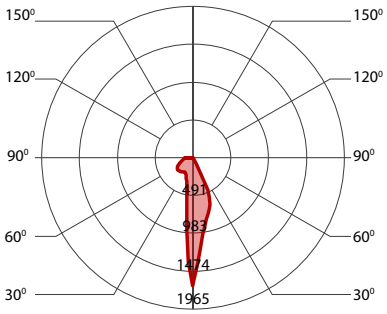
Intertek

VIA SKIM 3 LED

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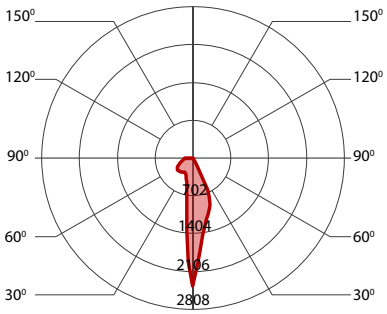
350 LUMEN AT 80CRI - LOW OUTPUT



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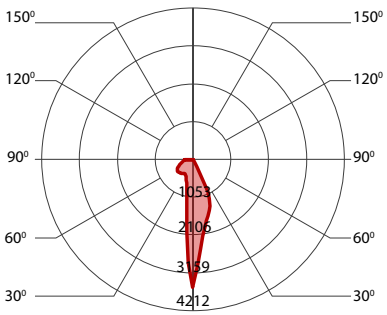
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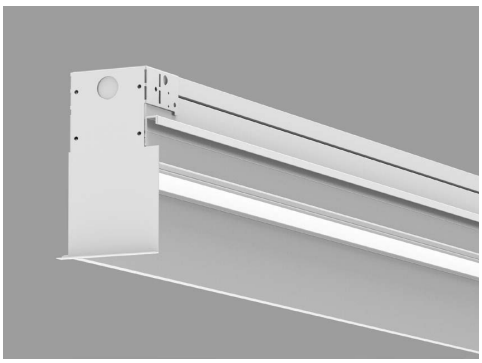
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-6-277-D-1-ST-W Notes:	**Type:** **RCG6** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

PROJECT: _____

TYPE: _____

NOTES: _____

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ORDER GUIDE

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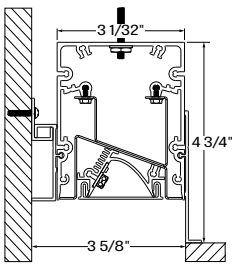
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

6'				
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

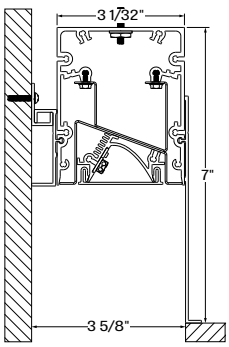
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



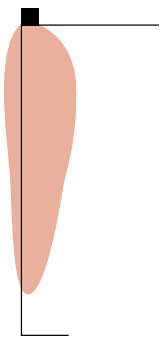
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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Intertek

VIA SKIM 3 LED

RECESSED

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OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

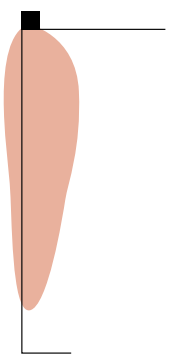
LIGHT SOURCE - LED

Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

PERFORMANCE PER 4' AT 4000K

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	19	1400	75
medium output	4000K	27	2000	74
high output	4000K	42	3000	71

LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

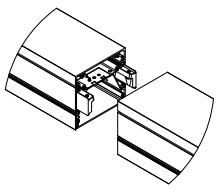
Foot Candles on 20' wide wall, 10' ceiling

128	135	153	144	131	126	134	154	146	136
25.4	24.4	23.5	23.7	23.7	23.8	23.8	23.7	24.8	27.8
12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

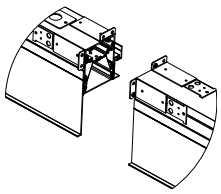
LUMINAIRE LENGTH

All individual sections are joined together onsite using the joiner kits provided. LumenWerx offers joiner kits that are extremely simple to work with in the field and result in a fixture that appears virtually seamless with no light leak at any connection.

Joining system



Drywall joining



Grid joining

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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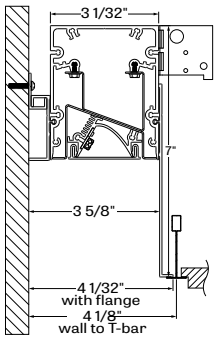
VIA SKIM 3 LED

RECESSED

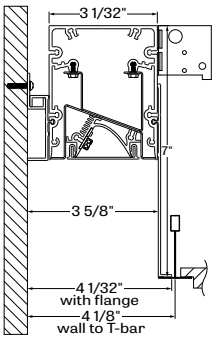
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MOUNTING OPTIONS

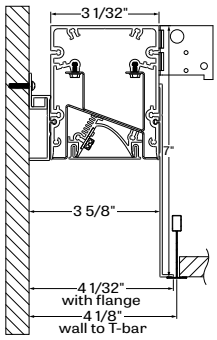
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



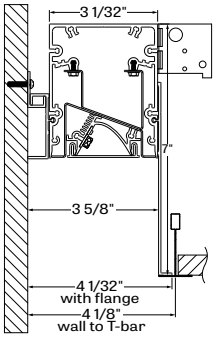
TG9 - tegular 9/16"



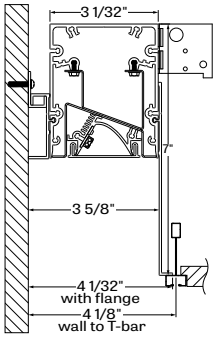
TG15 - tegular 15/16"



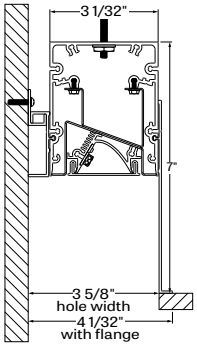
TB9 - t-bar 9/16"



TB15 - t-bar 15/16"



ST - screw slot t-bar



DTL - drywall trimless

FINISH

Interior - 95%, reflective matte powder coated white paint
Exterior - matte white or silver powder coating.
Custom finishes are also available.

CONSTRUCTION

Housing - Extruded Aluminum (0.095" nominal) up to 90% Recycled Content
Interior brackets - Die formed cold rolled sheet steel 18 gauge thick
Joining system - Die cast Zinc (0.95" nominal) and die Formed galvanized sheet 18 gauge
Reflectors - Extruded Aluminum (0.070" nominal) up to 90% Recycled Content.
Recessed flanges - Extruded Aluminum (0.075" nominal) up to 90% Recycled Content
End plate - Die formed cold rolled sheet steel 18 gauge thick

MAINTENANCE

LED boards are housed in a removable cartridge for easy replacement. Driver is accessible from below.

WEIGHT

Via Skim 3 4ft - 11.23lbs - 5.1kg
Via Skim 3 8ft - 22.47lbs - 10.2kg
Via Skim 3 12ft - 33.70lbs - 15.3kg

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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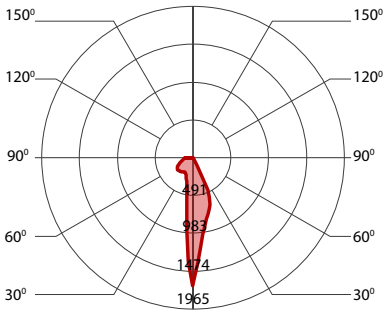
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VIA SKIM 3 LED

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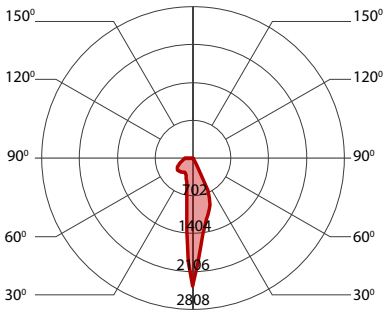
350 LUMEN AT 80CRI - LOW OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	20	1400	71
low output	3500K	19	1400	73
low output	4000K	19	1400	75

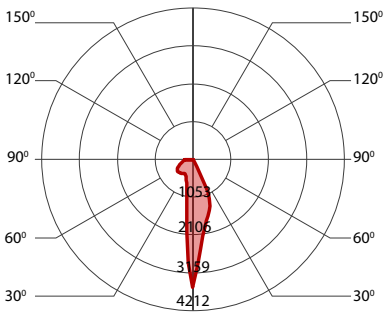
500 LUMEN AT 80CRI - MEDIUM OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	28.5	2000	70
medium output	3500K	28	2000	72
medium output	4000K	27	2000	74

750 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	45	3000	67
high output	3500K	43.5	3000	69
high output	4000K	42	3000	71

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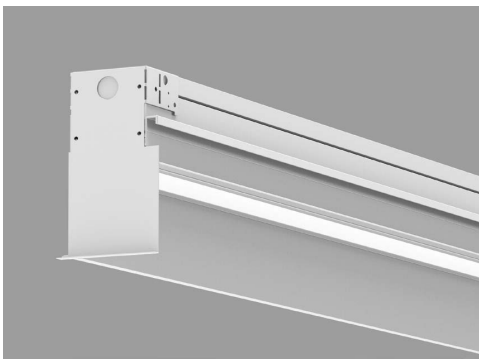
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-9'9"-277-D-1-ST"-W Notes:	**Type:** **RCG9-9** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

DESCRIPTION

Via Skim is designed to illuminate textured or polished vertical surfaces with a grazing light from the wall/ceiling intersection. Via Skim provides continuous illumination across the wall surface.

The intense light distribution is achieved with our Grazing Reflector Optic (GRO) oriented to project light with maximum luminous intensity at 5° from nadir.

The Via Skim is available with two depth options: shallow and deep. Total recessed depth ranges from 4¾" to 7".

PROJECT: _____

TYPE: _____

NOTES: _____

ORDER GUIDE

IC RATED

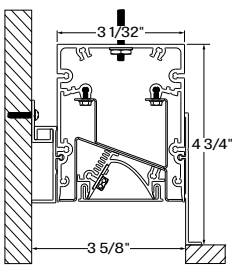
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

9' 9"				
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

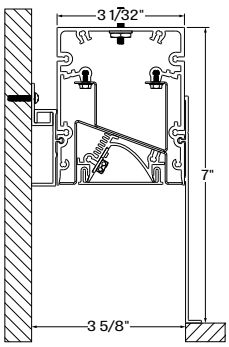
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



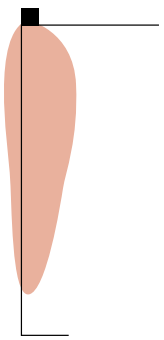
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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VIA SKIM 3 LED

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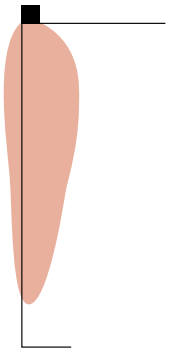
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LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

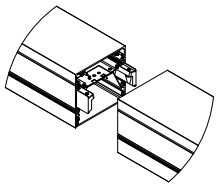
Foot Candles on 20' wide wall, 10' ceiling

128	135	153	144	131	126	134	154	146	136
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12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
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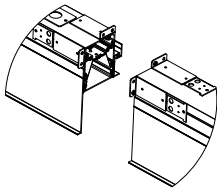
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Drywall joining



Grid joining

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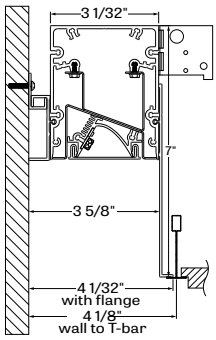
VIA SKIM 3 LED

RECESSED

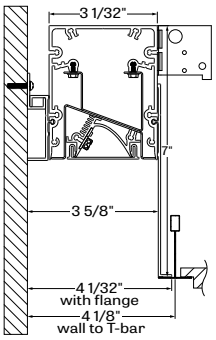
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MOUNTING OPTIONS

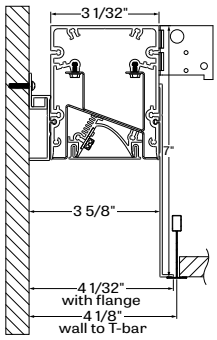
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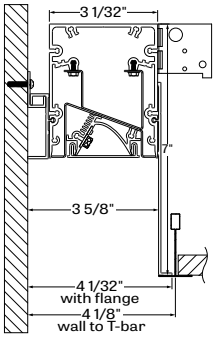
TG9 - tegular 9/16"



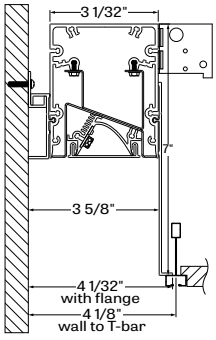
TG15 - tegular 15/16"



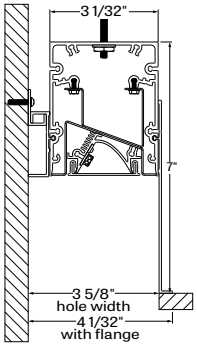
TB9 - t-bar 9/16"



TB15 - t-bar 15/16"



ST - screw slot t-bar



DTL - drywall trimless

FINISH

Interior - 95%, reflective matte powder coated white paint
Exterior - matte white or silver powder coating.
Custom finishes are also available.

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Joining system - Die cast Zinc (0.95" nominal) and die Formed galvanized sheet 18 gauge
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Via Skim 3 8ft - 22.47lbs - 10.2kg
Via Skim 3 12ft - 33.70lbs - 15.3kg

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Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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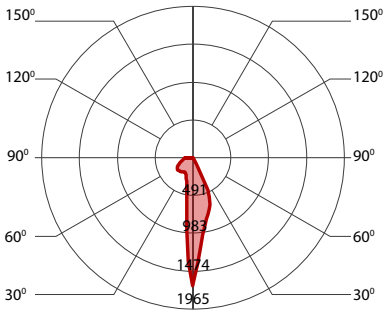
Intertek

VIA SKIM 3 LED

RECESSED

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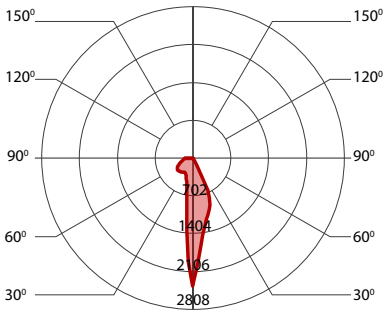
350 LUMEN AT 80CRI - LOW OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	20	1400	71
low output	3500K	19	1400	73
low output	4000K	19	1400	75

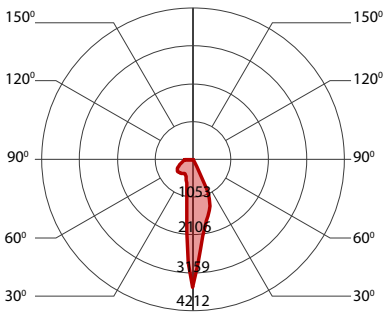
500 LUMEN AT 80CRI - MEDIUM OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	28.5	2000	70
medium output	3500K	28	2000	72
medium output	4000K	27	2000	74

750 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	45	3000	67
high output	3500K	43.5	3000	69
high output	4000K	42	3000	71

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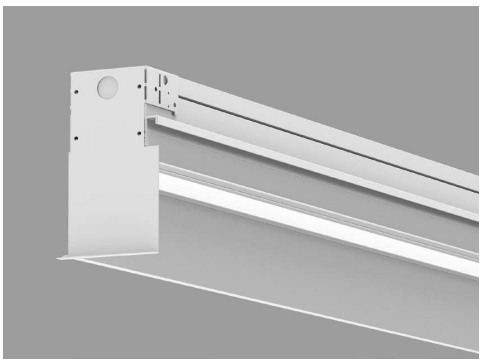
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-10'-277 D-1-ST-W Notes:	**Type:** **RCG10** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

PROJECT: _____

TYPE: _____

NOTES: _____

DESCRIPTION

Via Skim is designed to illuminate textured or polished vertical surfaces with a grazing light from the wall/ceiling intersection. Via Skim provides continuous illumination across the wall surface.

The intense light distribution is achieved with our Grazing Reflector Optic (GRO) oriented to project light with maximum luminous intensity at 5° from nadir.

The Via Skim is available with two depth options: shallow and deep. Total recessed depth ranges from 4¾" to 7".

ORDER GUIDE

***IC* RATED**

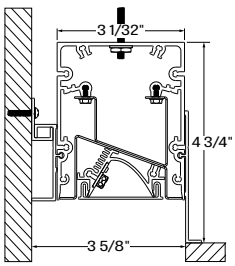
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

10'				
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

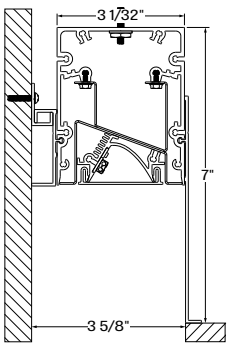
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



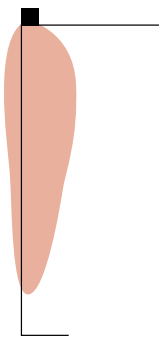
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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VIA SKIM 3 LED

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OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

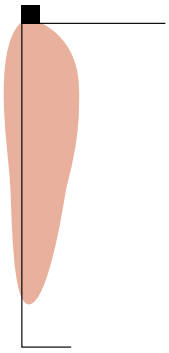
LIGHT SOURCE - LED

Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

PERFORMANCE PER 4' AT 4000K

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	19	1400	75
medium output	4000K	27	2000	74
high output	4000K	42	3000	71

LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

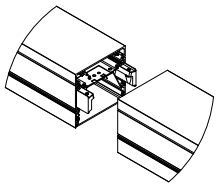
Foot Candles on 20' wide wall, 10' ceiling

128	135	153	144	131	126	134	154	146	136
25.4	24.4	23.5	23.7	23.7	23.8	23.8	23.7	24.8	27.8
12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

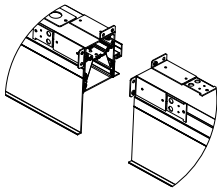
LUMINAIRE LENGTH

All individual sections are joined together onsite using the joiner kits provided. LumenWerx offers joiner kits that are extremely simple to work with in the field and result in a fixture that appears virtually seamless with no light leak at any connection.

Joining system



Drywall joining



Grid joining

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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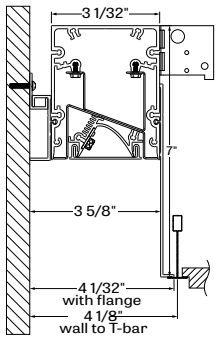
VIA SKIM 3 LED

RECESSED

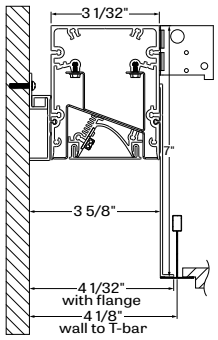
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MOUNTING OPTIONS

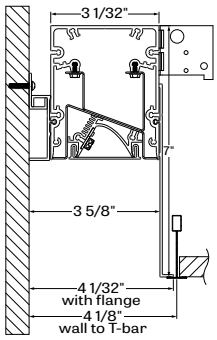
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



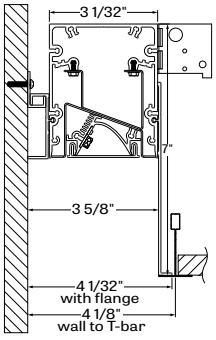
TG9 - tegular 9/16"



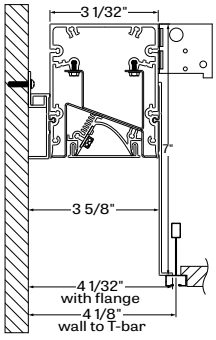
TG15 - tegular 15/16"



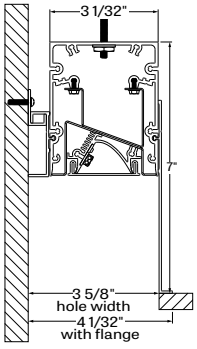
TB9 - t-bar 9/16"



TB15 - t-bar 15/16"



ST - screw slot t-bar



DTL - drywall trimless

FINISH

Interior - 95%, reflective matte powder coated white paint
Exterior - matte white or silver powder coating.
Custom finishes are also available.

CONSTRUCTION

Housing - Extruded Aluminum (0.095" nominal) up to 90% Recycled Content
Interior brackets - Die formed cold rolled sheet steel 18 gauge thick
Joining system - Die cast Zinc (0.95" nominal) and die Formed galvanized sheet 18 gauge
Reflectors - Extruded Aluminum (0.070" nominal) up to 90% Recycled Content.
Recessed flanges - Extruded Aluminum (0.075" nominal) up to 90% Recycled Content
End plate - Die formed cold rolled sheet steel 18 gauge thick

MAINTENANCE

LED boards are housed in a removable cartridge for easy replacement. Driver is accessible from below.

WEIGHT

Via Skim 3 4ft - 11.23lbs - 5.1kg
Via Skim 3 8ft - 22.47lbs - 10.2kg
Via Skim 3 12ft - 33.70lbs - 15.3kg

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

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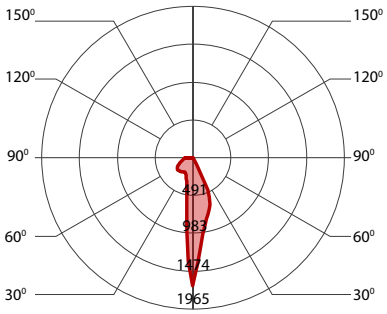
Intertek

VIA SKIM 3 LED

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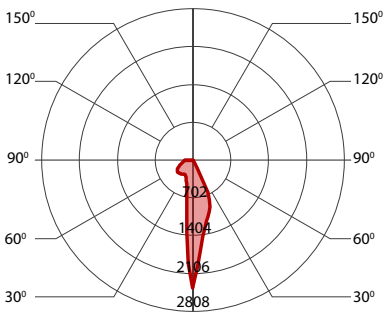
350 LUMEN AT 80CRI - LOW OUTPUT



PERFORMANCE PER 4'

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low output	4000K	19	1400	75

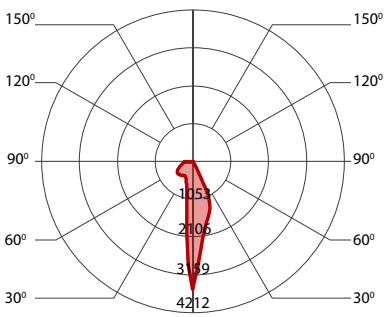
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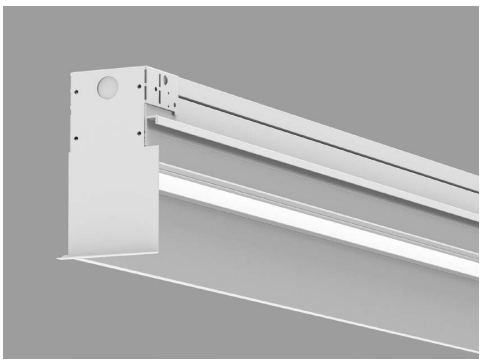
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-10'6"-277-D-1-ST-W Notes:	**Type:** **RCG10-6** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

PROJECT: _____

TYPE: _____

NOTES: _____

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ORDER GUIDE

***IC* RATED**

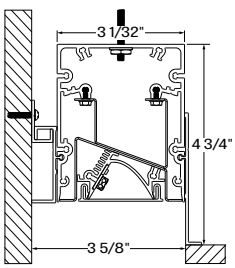
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

10' 6"				
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
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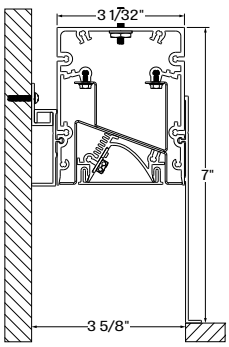
See page 2 for ordering code detailed information

FINISH	OPTIONS
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CROSS SECTION



V3SKIS - via skim shallow



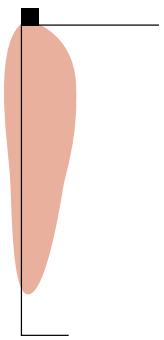
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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VIA SKIM 3 LED

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OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

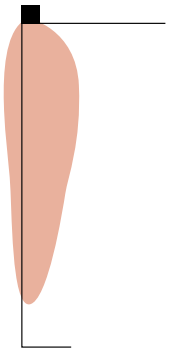
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LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

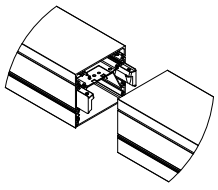
Foot Candles on 20' wide wall, 10' ceiling

128	135	153	144	131	126	134	154	146	136
25.4	24.4	23.5	23.7	23.7	23.8	23.8	23.7	24.8	27.8
12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

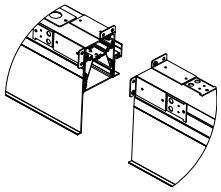
LUMINAIRE LENGTH

All individual sections are joined together onsite using the joiner kits provided. LumenWerx offers joiner kits that are extremely simple to work with in the field and result in a fixture that appears virtually seamless with no light leak at any connection.

Joining system



Drywall joining



Grid joining

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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Intertek

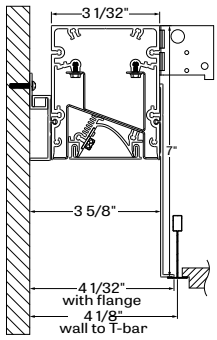
VIA SKIM 3 LED

RECESSED

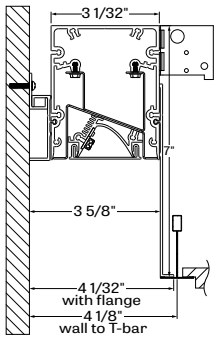
LUMENWERX
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MOUNTING OPTIONS

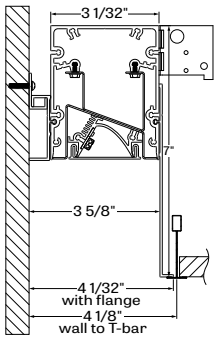
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



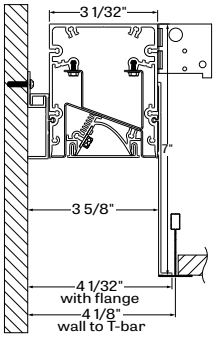
TG9 - tegular 9/16"



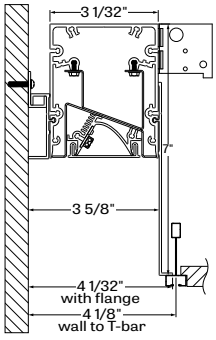
TG15 - tegular 15/16"



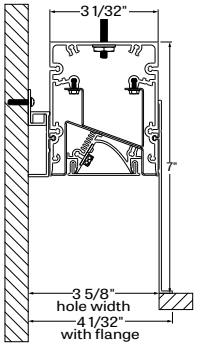
TB9 - t-bar 9/16"



TB15 - t-bar 15/16"



ST - screw slot t-bar



DTL - drywall trimless

FINISH

Interior - 95%, reflective matte powder coated white paint
Exterior - matte white or silver powder coating.
Custom finishes are also available.

CONSTRUCTION

Housing - Extruded Aluminum (0.095" nominal) up to 90% Recycled Content
Interior brackets - Die formed cold rolled sheet steel 18 gauge thick
Joining system - Die cast Zinc (0.95" nominal) and die Formed galvanized sheet 18 gauge
Reflectors - Extruded Aluminum (0.070" nominal) up to 90% Recycled Content.
Recessed flanges - Extruded Aluminum (0.075" nominal) up to 90% Recycled Content
End plate - Die formed cold rolled sheet steel 18 gauge thick

MAINTENANCE

LED boards are housed in a removable cartridge for easy replacement. Driver is accessible from below.

WEIGHT

Via Skim 3 4ft - 11.23lbs - 5.1kg
Via Skim 3 8ft - 22.47lbs - 10.2kg
Via Skim 3 12ft - 33.70lbs - 15.3kg

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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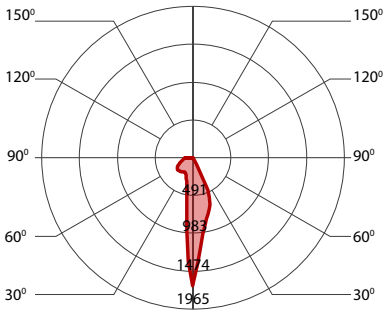
Intertek

VIA SKIM 3 LED

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LUMENWERX
WWW.LUMENWERX.COM

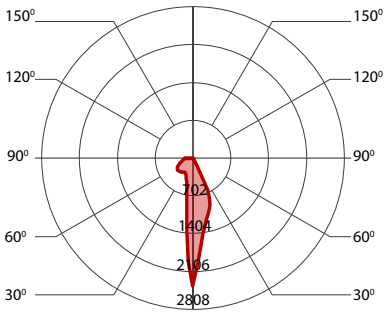
350 LUMEN AT 80CRI - LOW OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	20	1400	71
low output	3500K	19	1400	73
low output	4000K	19	1400	75

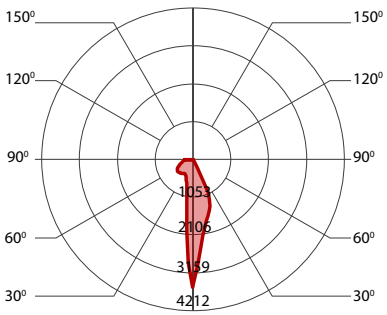
500 LUMEN AT 80CRI - MEDIUM OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	28.5	2000	70
medium output	3500K	28	2000	72
medium output	4000K	27	2000	74

750 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	45	3000	67
high output	3500K	43.5	3000	69
high output	4000K	42	3000	71

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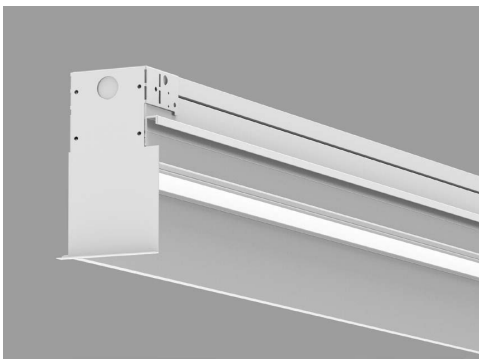
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-12'-277 D-1-ST-W Notes:	**Type:** **RCG12** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

PROJECT: _____

TYPE: _____

NOTES: _____

DESCRIPTION

Via Skim is designed to illuminate textured or polished vertical surfaces with a grazing light from the wall/ceiling intersection. Via Skim provides continuous illumination across the wall surface.

The intense light distribution is achieved with our Grazing Reflector Optic (GRO) oriented to project light with maximum luminous intensity at 5° from nadir.

The Via Skim is available with two depth options: shallow and deep. Total recessed depth ranges from 4¾" to 7".

ORDER GUIDE

IC RATED

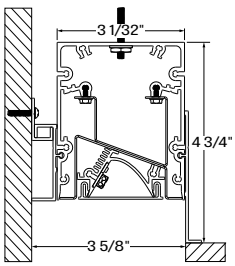
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

12'				
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

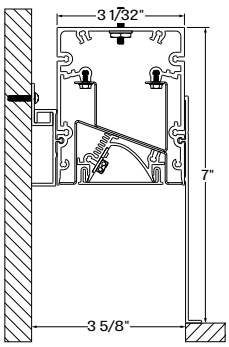
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



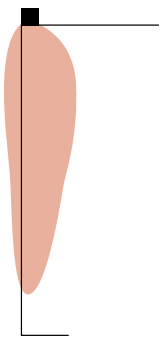
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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VIA SKIM 3 LED

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OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

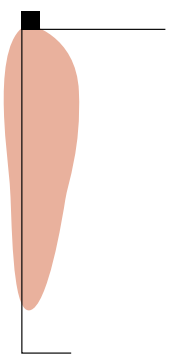
LIGHT SOURCE - LED

Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

PERFORMANCE PER 4' AT 4000K

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	19	1400	75
medium output	4000K	27	2000	74
high output	4000K	42	3000	71

LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

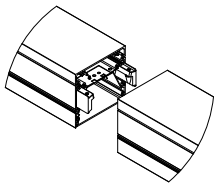
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11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

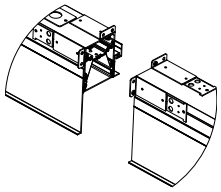
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Drywall joining



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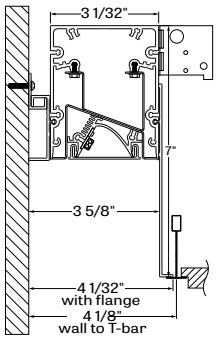
VIA SKIM 3 LED

RECESSED

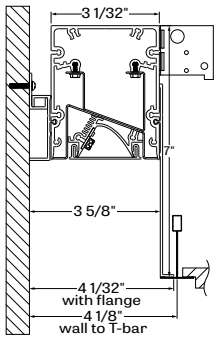
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MOUNTING OPTIONS

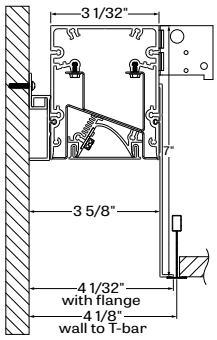
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



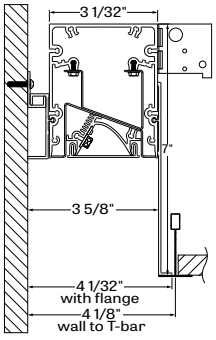
TG9 - tegular 9/16"



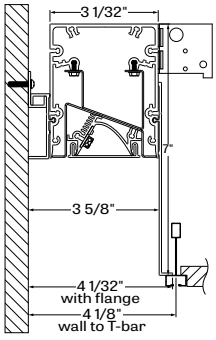
TG15 - tegular 15/16"



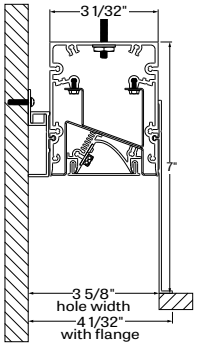
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TB15 - t-bar 15/16"



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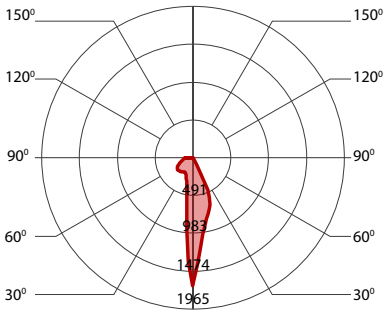
Intertek

VIA SKIM 3 LED

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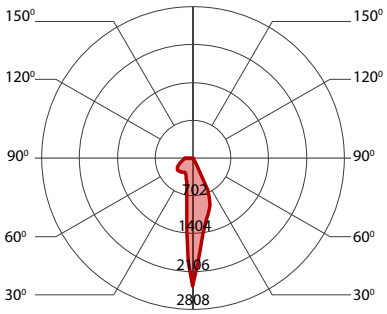
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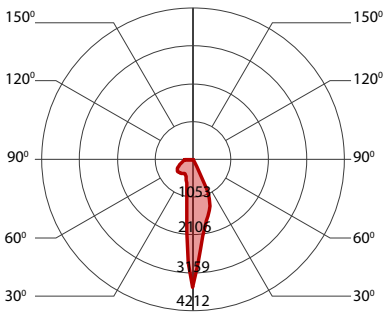
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medium output	3500K	28	2000	72
medium output	4000K	27	2000	74

750 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	45	3000	67
high output	3500K	43.5	3000	69
high output	4000K	42	3000	71

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Intertek

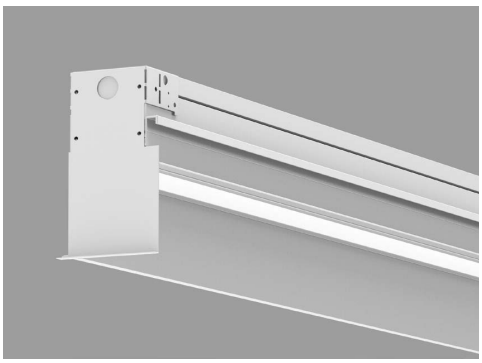
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-15'-277 D-1-ST-W Notes:	**Type:** **RCG15** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

PROJECT: _____

TYPE: _____

NOTES: _____

DESCRIPTION

Via Skim is designed to illuminate textured or polished vertical surfaces with a grazing light from the wall/ceiling intersection. Via Skim provides continuous illumination across the wall surface.

The intense light distribution is achieved with our Grazing Reflector Optic (GRO) oriented to project light with maximum luminous intensity at 5° from nadir.

The Via Skim is available with two depth options: shallow and deep. Total recessed depth ranges from 4¾" to 7".

ORDER GUIDE

***IC* RATED**

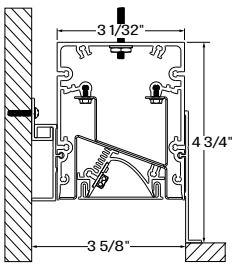
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

15'				
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

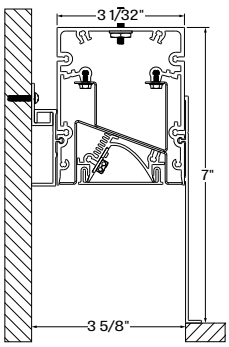
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



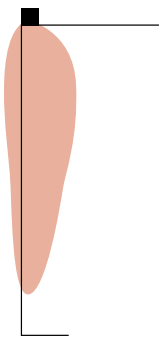
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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Intertek

VIA SKIM 3 LED

RECESSED

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OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

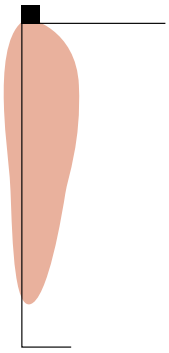
LIGHT SOURCE - LED

Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

PERFORMANCE PER 4' AT 4000K

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	19	1400	75
medium output	4000K	27	2000	74
high output	4000K	42	3000	71

LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

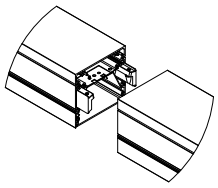
Foot Candles on 20' wide wall, 10' ceiling

128	135	153	144	131	126	134	154	146	136
25.4	24.4	23.5	23.7	23.7	23.8	23.8	23.7	24.8	27.8
12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

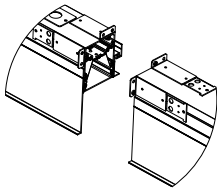
LUMINAIRE LENGTH

All individual sections are joined together onsite using the joiner kits provided. LumenWerx offers joiner kits that are extremely simple to work with in the field and result in a fixture that appears virtually seamless with no light leak at any connection.

Joining system



Drywall joining



Grid joining

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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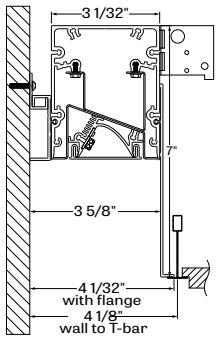
VIA SKIM 3 LED

RECESSED

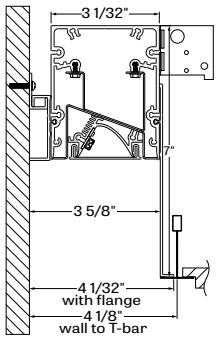
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MOUNTING OPTIONS

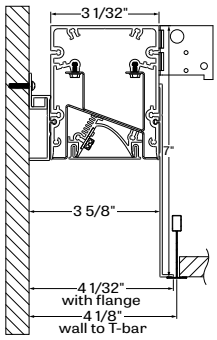
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



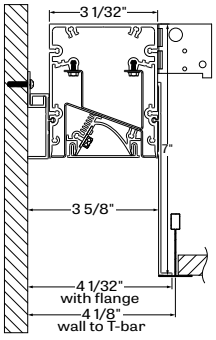
TG9 - tegular 9/16"



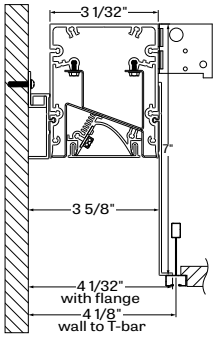
TG15 - tegular 15/16"



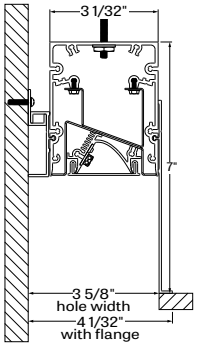
TB9 - t-bar 9/16"



TB15 - t-bar 15/16"



ST - screw slot t-bar



DTL - drywall trimless

FINISH

Interior - 95%, reflective matte powder coated white paint
Exterior - matte white or silver powder coating.
Custom finishes are also available.

CONSTRUCTION

Housing - Extruded Aluminum (0.095" nominal) up to 90% Recycled Content
Interior brackets - Die formed cold rolled sheet steel 18 gauge thick
Joining system - Die cast Zinc (0.95" nominal) and die Formed galvanized sheet 18 gauge
Reflectors - Extruded Aluminum (0.070" nominal) up to 90% Recycled Content.
Recessed flanges - Extruded Aluminum (0.075" nominal) up to 90% Recycled Content
End plate - Die formed cold rolled sheet steel 18 gauge thick

MAINTENANCE

LED boards are housed in a removable cartridge for easy replacement. Driver is accessible from below.

WEIGHT

Via Skim 3 4ft - 11.23lbs - 5.1kg
Via Skim 3 8ft - 22.47lbs - 10.2kg
Via Skim 3 12ft - 33.70lbs - 15.3kg

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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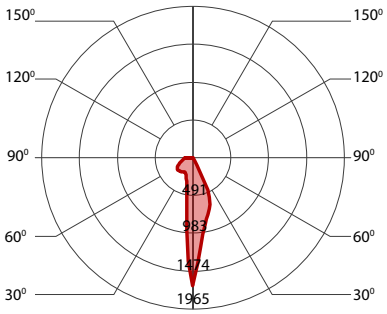
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VIA SKIM 3 LED

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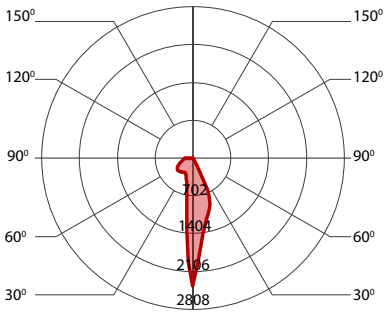
350 LUMEN AT 80CRI - LOW OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	20	1400	71
low output	3500K	19	1400	73
low output	4000K	19	1400	75

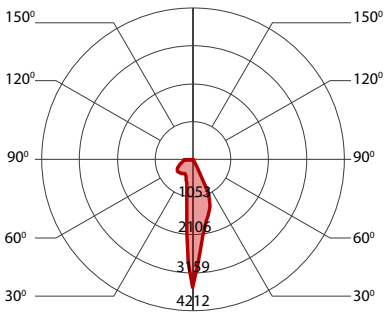
500 LUMEN AT 80CRI - MEDIUM OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	28.5	2000	70
medium output	3500K	28	2000	72
medium output	4000K	27	2000	74

750 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	45	3000	67
high output	3500K	43.5	3000	69
high output	4000K	42	3000	71

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Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
LWERX-V3SKID-GRO-LED-80-500-16FT-27 7-D-1-ST-W

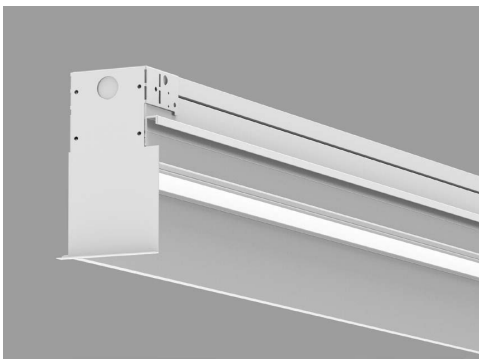
Type:
RCG16
LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

PROJECT: _____
TYPE: _____
NOTES: _____

DESCRIPTION

Via Skim is designed to illuminate textured or polished vertical surfaces with a grazing light from the wall/ceiling intersection. Via Skim provides continuous illumination across the wall surface.
The intense light distribution is achieved with our Grazing Reflector Optic (GRO) oriented to project light with maximum luminous intensity at 5° from nadir.
The Via Skim is available with two depth options: shallow and deep. Total recessed depth ranges from 4¾" to 7".

ORDER GUIDE

IC RATED

	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

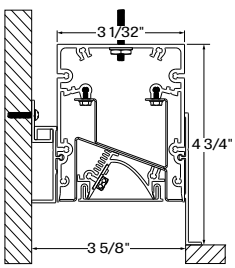
18' 8'

LUMINAIRE LENGTH	VOLTAGE	DRIVER	ELECTRICAL	MOUNTING
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

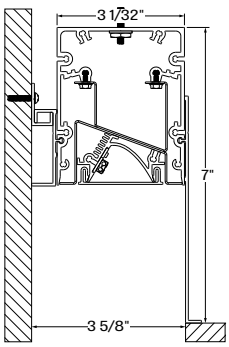
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



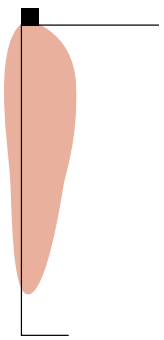
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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Intertek

VIA SKIM 3 LED

RECESSED

LUMENWERX
WWW.LUMENWERX.COM

OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

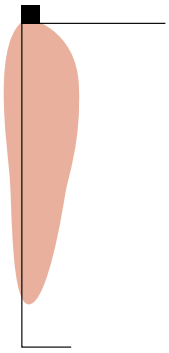
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LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
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Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

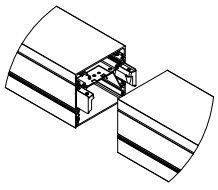
Foot Candles on 20' wide wall, 10' ceiling

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12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

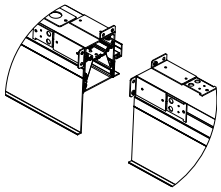
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Drywall joining



Grid joining

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EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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Intertek

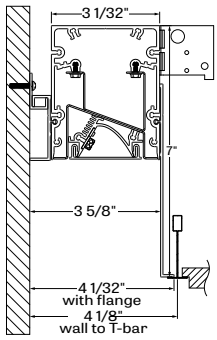
VIA SKIM 3 LED

RECESSED

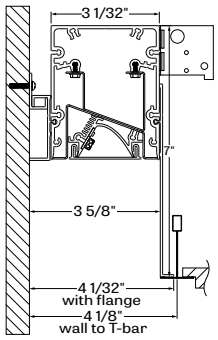
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MOUNTING OPTIONS

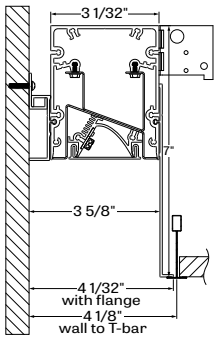
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



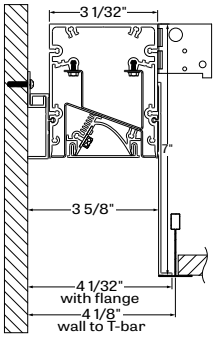
TG9 - tegular 9/16"



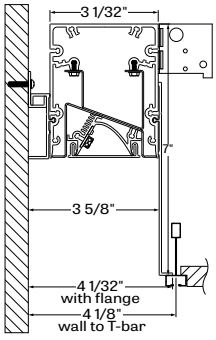
TG15 - tegular 15/16"



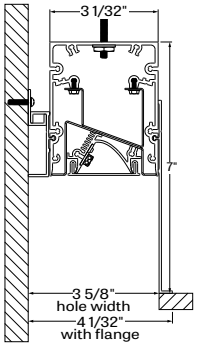
TB9 - t-bar 9/16"



TB15 - t-bar 15/16"



ST - screw slot t-bar



DTL - drywall trimless

FINISH

Interior - 95%, reflective matte powder coated white paint
Exterior - matte white or silver powder coating.
Custom finishes are also available.

CONSTRUCTION

Housing - Extruded Aluminum (0.095" nominal) up to 90% Recycled Content
Interior brackets - Die formed cold rolled sheet steel 18 gauge thick
Joining system - Die cast Zinc (0.95" nominal) and die Formed galvanized sheet 18 gauge
Reflectors - Extruded Aluminum (0.070" nominal) up to 90% Recycled Content.
Recessed flanges - Extruded Aluminum (0.075" nominal) up to 90% Recycled Content
End plate - Die formed cold rolled sheet steel 18 gauge thick

MAINTENANCE

LED boards are housed in a removable cartridge for easy replacement. Driver is accessible from below.

WEIGHT

Via Skim 3 4ft - 11.23lbs - 5.1kg
Via Skim 3 8ft - 22.47lbs - 10.2kg
Via Skim 3 12ft - 33.70lbs - 15.3kg

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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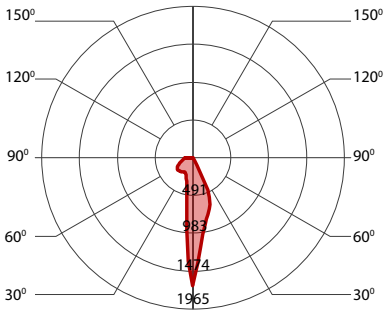
Intertek

VIA SKIM 3 LED

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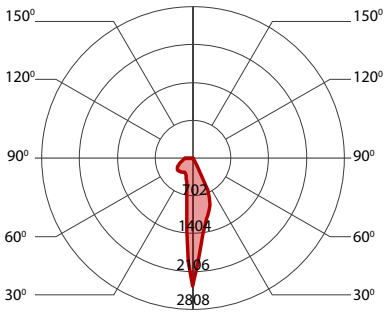
350 LUMEN AT 80CRI - LOW OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	20	1400	71
low output	3500K	19	1400	73
low output	4000K	19	1400	75

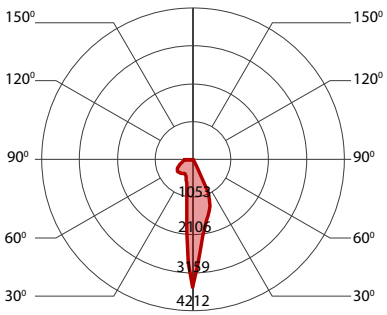
500 LUMEN AT 80CRI - MEDIUM OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	28.5	2000	70
medium output	3500K	28	2000	72
medium output	4000K	27	2000	74

750 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	45	3000	67
high output	3500K	43.5	3000	69
high output	4000K	42	3000	71

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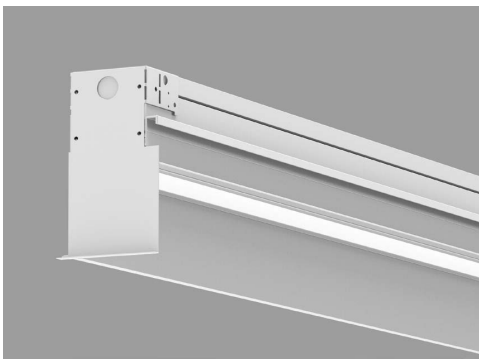
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-20'6"-277-D-1-ST-W Notes:	**Type:** **RCG20-6** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Via skim recessed deep

PROJECT: _____

TYPE: _____

NOTES: _____

DESCRIPTION

Via Skim is designed to illuminate textured or polished vertical surfaces with a grazing light from the wall/ceiling intersection. Via Skim provides continuous illumination across the wall surface.

The intense light distribution is achieved with our Grazing Reflector Optic (GRO) oriented to project light with maximum luminous intensity at 5° from nadir.

The Via Skim is available with two depth options: shallow and deep. Total recessed depth ranges from 4¾" to 7".

ORDER GUIDE

***IC* RATED**

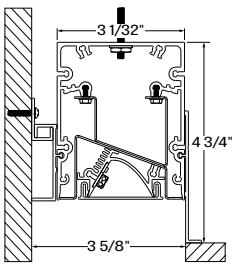
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

20' 6"				
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

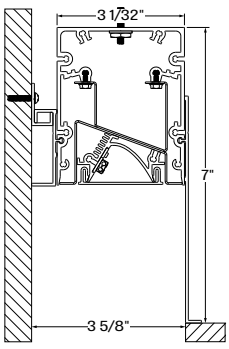
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



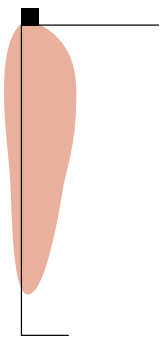
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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VIA SKIM 3 LED

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OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

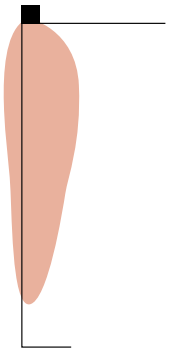
LIGHT SOURCE - LED

Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

PERFORMANCE PER 4' AT 4000K

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	19	1400	75
medium output	4000K	27	2000	74
high output	4000K	42	3000	71

LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

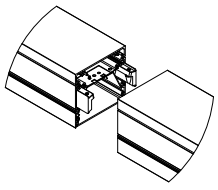
Foot Candles on 20' wide wall, 10' ceiling

128	135	153	144	131	126	134	154	146	136
25.4	24.4	23.5	23.7	23.7	23.8	23.8	23.7	24.8	27.8
12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

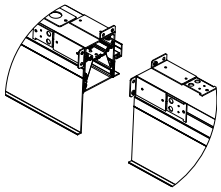
LUMINAIRE LENGTH

All individual sections are joined together onsite using the joiner kits provided. LumenWerx offers joiner kits that are extremely simple to work with in the field and result in a fixture that appears virtually seamless with no light leak at any connection.

Joining system



Drywall joining



Grid joining

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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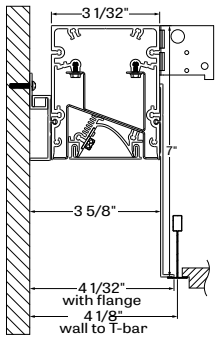
VIA SKIM 3 LED

RECESSED

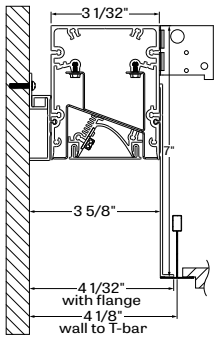
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MOUNTING OPTIONS

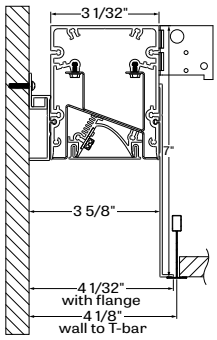
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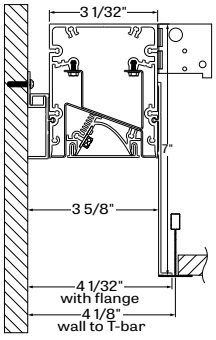
TG9 - tegular 9/16"



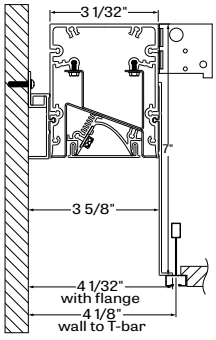
TG15 - tegular 15/16"



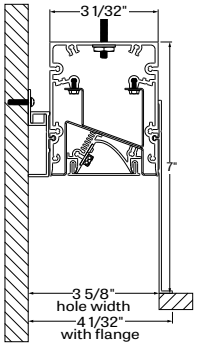
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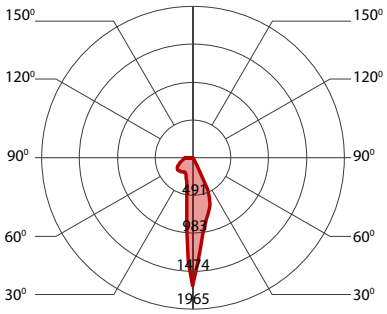
Intertek

VIA SKIM 3 LED

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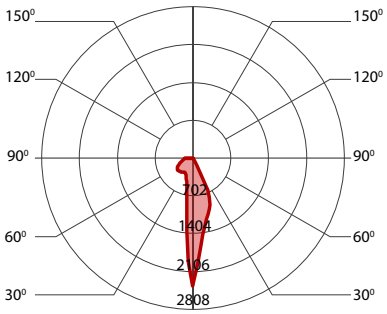
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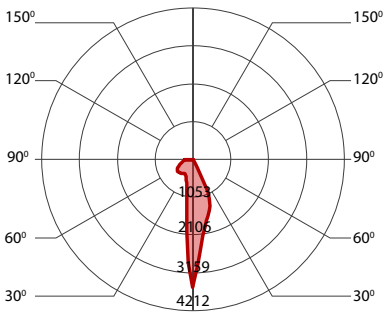
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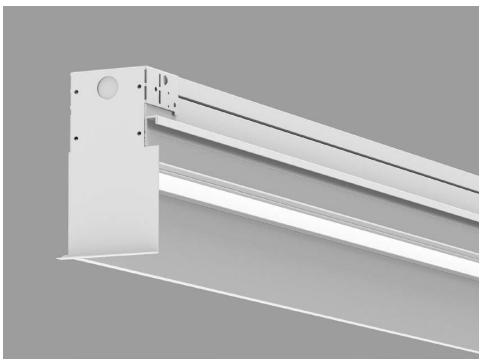
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** V3SKID-GRO-LED-80-500-30-31'-277 D-1-ST-W Notes:	**Type:** **RCG31** LAI16-104794

VIA SKIM 3 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
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Via skim recessed deep

PROJECT: _____

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ORDER GUIDE

IC RATED

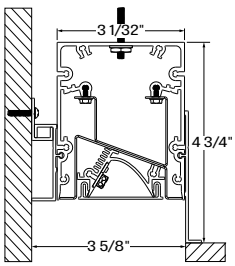
	GRO	LED			
LUMINAIRE ID	**OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
V3SKIS- via skim 3 recessed shallow **V3SKID**- via skim 3 recessed deep	**GRO** - grazing reflector optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**350** - low output 350lm/ft **500** - med output 500lm/ft **750** - high output 750lm/ft	**30** - 3000k **35** - 3500k **40** - 4000k

31'				
LUMINAIRE LENGTH	**VOLTAGE**	**DRIVER**	**ELECTRICAL**	**MOUNTING**
Standard sections - 2', 3', 4', 5', 8' & 12' For all other specify length **#FT** - nominal length in feet **#IN** - length in inches Continuous Run - for luminaires over 12' Minimum Individual section 2'	**120** - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2** - Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires/EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+#EB** - emergency battery pack (for min 4' fixture) **+#EM** - emergency light circuit **+#NL** - night light circuit **+GTD** - generator transfer device	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DTL** - drywall trimles

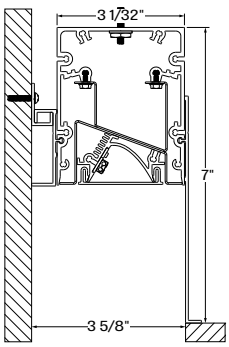
See page 2 for ordering code detailed information

FINISH	OPTIONS
W - matte white **CF#** - custom finish specify RAL#	**FU** - fuse **FWC** - flexible whip cable (6' std) **CP** - Chicago Plenum **CU** - custom

CROSS SECTION



V3SKIS - via skim shallow



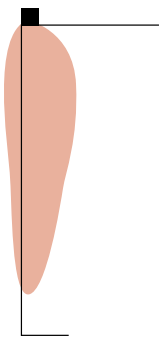
V3SKID - via skim deep

OPTICS



GRO - Grazing Reflector Optic

LIGHT DISTRIBUTION



V3SKIS - via skim shallow

TECHZONE™ & **USG** Compatible with 4" ceiling

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VIA SKIM 3 LED

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OPTICS

GRAZING REFLECTOR OPTIC (GRO) - The intense light distribution is achieved with our Grazing Reflector Optic oriented to project light with maximum luminous intensity at 5° from nadir.

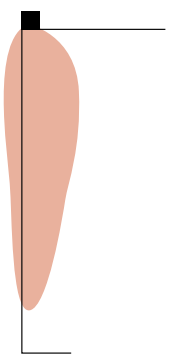
LIGHT SOURCE - LED

Custom linear array of mid-flux LED's are cartridge-mounted with quick-connect wiring to facilitate service and thermal management. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

PERFORMANCE PER 4' AT 4000K

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	19	1400	75
medium output	4000K	27	2000	74
high output	4000K	42	3000	71

LIGHT DISTRIBUTION



VSKI3D-GRO-LED-80-750-NA-40-20
Wall Luminaires: 20' run
Lumen Output: 750 lm/ft
Watts: 10.5 watts/ft
Ceiling Height: 10'
Efficacy: 71 lpw

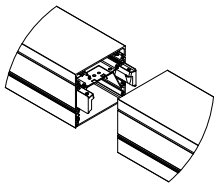
Foot Candles on 20' wide wall, 10' ceiling

128	135	153	144	131	126	134	154	146	136
25.4	24.4	23.5	23.7	23.7	23.8	23.8	23.7	24.8	27.8
12.6	12.6	12.0	11.8	12.1	11.9	12.2	12.2	12.7	14.6
11.5	10.4	9.6	9.8	9.9	9.9	10.0	9.8	10.5	11.7
11.3	10.1	9.7	10.3	10.9	11.0	10.5	9.8	10.3	11.5

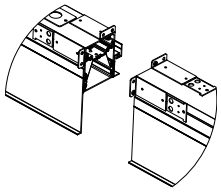
LUMINAIRE LENGTH

All individual sections are joined together onsite using the joiner kits provided. LumenWerx offers joiner kits that are extremely simple to work with in the field and result in a fixture that appears virtually seamless with no light leak at any connection.

Joining system



Drywall joining



Grid joining

ELECTRICAL

Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1000 lumens per 4ft (25°C) emergency lighting output. Recharge time of 24 hours.

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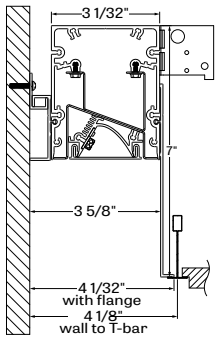
VIA SKIM 3 LED

RECESSED

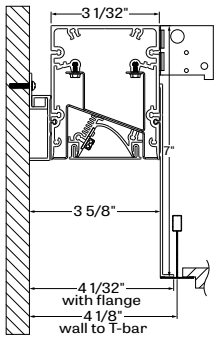
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MOUNTING OPTIONS

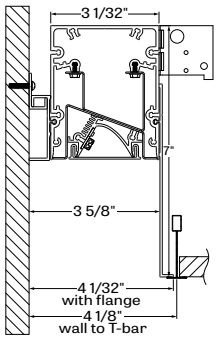
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling, Trimless mounting detail is available for drywall ceilings.



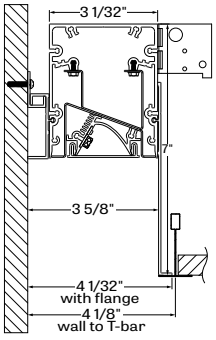
TG9 - tegular 9/16"



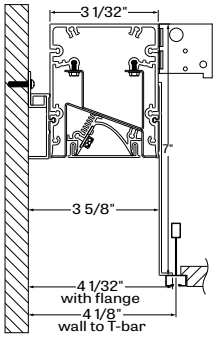
TG15 - tegular 15/16"



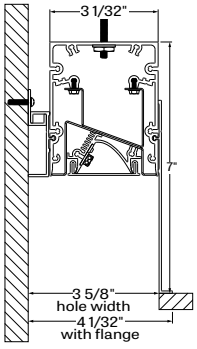
TB9 - t-bar 9/16"



TB15 - t-bar 15/16"



ST - screw slot t-bar



DTL - drywall trimless

FINISH

Interior - 95%, reflective matte powder coated white paint
Exterior - matte white or silver powder coating.
Custom finishes are also available.

CONSTRUCTION

Housing - Extruded Aluminum (0.095" nominal) up to 90% Recycled Content
Interior brackets - Die formed cold rolled sheet steel 18 gauge thick
Joining system - Die cast Zinc (0.95" nominal) and die Formed galvanized sheet 18 gauge
Reflectors - Extruded Aluminum (0.070" nominal) up to 90% Recycled Content.
Recessed flanges - Extruded Aluminum (0.075" nominal) up to 90% Recycled Content
End plate - Die formed cold rolled sheet steel 18 gauge thick

MAINTENANCE

LED boards are housed in a removable cartridge for easy replacement. Driver is accessible from below.

WEIGHT

Via Skim 3 4ft - 11.23lbs - 5.1kg
Via Skim 3 8ft - 22.47lbs - 10.2kg
Via Skim 3 12ft - 33.70lbs - 15.3kg

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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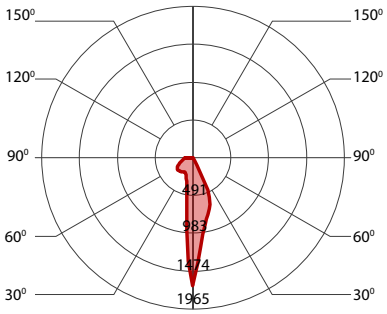
Intertek

VIA SKIM 3 LED

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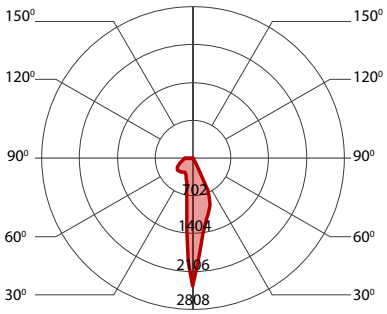
350 LUMEN AT 80CRI - LOW OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	20	1400	71
low output	3500K	19	1400	73
low output	4000K	19	1400	75

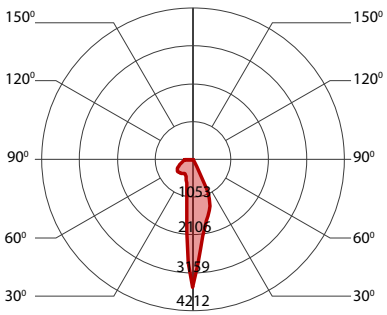
500 LUMEN AT 80CRI - MEDIUM OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	28.5	2000	70
medium output	3500K	28	2000	72
medium output	4000K	27	2000	74

750 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE PER 4'

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	45	3000	67
high output	3500K	43.5	3000	69
high output	4000K	42	3000	71

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Intertek

Submitted by LIGHTING ASSOCIATES, INC.		
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** LD4A13D010TE ERM4A13830 4LM1H Notes:
		Type: RD LAI16-104794

Portfolio

DESCRIPTION

4 inch LED recessed narrow, medium, or wide beam downlight specially designed for LED technology. Two-stage reflector system produces smooth distribution with excellent light control and low aperture brightness. Lumen packages include 900, 1300, 1800 and 2800 lumens with color temperatures of 2700K, 3000K, 3500K, 4000K. Available with dim-to-warm technology – similar to halogen at full power, the 3000K LED warms smoothly as dimmed to 1850K creating a rich warm glow within the space.

Catalog #		Type
Project		
Comments		Date
Prepared by		

SPECIFICATION FEATURES

Lower Shielding Reflector
Self-flanged, spun .050" thick aluminum lower reflector in combination with a lensed upper optical chamber provides superior lumen output with minimal source brightness. Available in all Portfolio Alzak® finishes.

Trim Retention
Lower reflector is retained with two torsion springs holding the flange tightly to the finished ceiling surface.

Plaster Frame / Collar
New Construction Housing: Die cast aluminum 1-1/2" deep collar accommodates ceiling materials up to 2".

Universal Mounting Bracket
Accepts 1/2" EMT, C channel and bar hangers and adjusts 5" vertically from above and below the ceiling.

Junction Box
(4) 1/2" and (2) 3/4" trade size pry outs positioned to allow straight conduit runs. Listed for (8) #12 AWG (four in, four out) 90°C conductors and feed thru branch wiring.

Thermal
Extruded aluminum heat sink conducts heat away from the LED module for optimal performance and long life.

LED
LED system contains a plurality of high brightness white LED's combined with a high reflectance upper reflector and convex transitional lens producing even distribution with no pixilation. Rated for 50,000 hours at 70% lumen maintenance. Auto resetting, thermally protected, LED's are turned off when safe operating temperatures are exceeded. Color variation within 3-step MacAdam ellipses. Flexible disconnect allows for tool-less replacement of LED engine from below ceiling. Available in 80 or 90 CRI.
D2W™ – dim-to-warm shifts CCT from 3000K to 1850K as fixture dims mimicking halogen sources.

Driver
Combination 120-277V 0-10V or 120V trailing edge phase cut driver provides flicker free dimming from 100% to 10%. Optional 1% 0-10V, Fifth Light, DMX or Lutron® Ecosystem. Driver can be serviced from above or through the aperture.

Code Compliance
Thermally protected and cULus listed for protected wet locations. IP66 rated when used with IP66 gasket kit accessory. Optional City of Chicago environmental air (CCEA) marking for plenum applications. EMI/RFI emissions per FCC 47CFR Part 18 Class B consumer limits. Non-IC rated - Insulation must be kept 3" from top and sides of housing. RoHS Compliant. Photometric testing completed in accordance with IES LM 79 standards. LED life testing completed in accordance with LM 80 standards.

Warranty
5-year warranty.



LD4A09 LD4A13 LD4A18 LD4A28 4L

900, 1300 Lumen LED

1800, 2800 Lumen LED

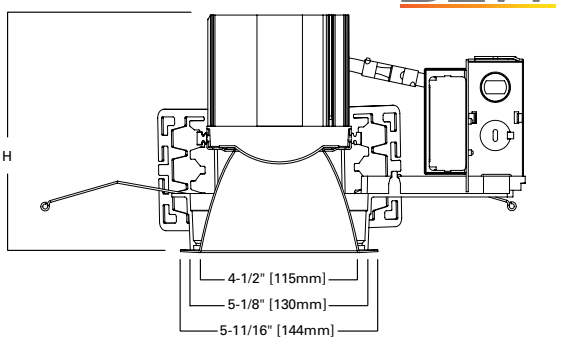
4-Inch

Narrow, Medium, or Wide Beam

Downlight

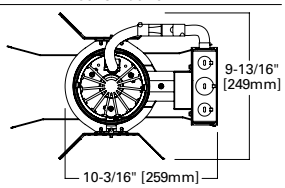
New Construction

D2W™

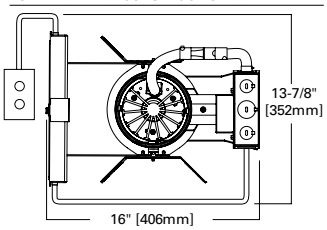


Note: Max Opening 4-3/8" [111mm]

TOP VIEW - NEW CONSTRUCTION



TOP VIEW - NEW CONSTRUCTION WITH BATTERY



Distribution	Lumens	Height
Narrow	900/1300	5-7/16"
Medium	900/1300	5-11/16"
Wide	900/1300	5-3/16"
Narrow	1800/2800	7-7/16"
Medium	1800/2800	7-11/16"
Wide	1800/2800	7-3/16"

Refer to ENERGY STAR® Qualified Products List.

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2016-10-26 09:08:51

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
LD4A13D010TE ERM4A13830 4LM1H
Notes:

Type:
RD
LAI16-104794

ORDERING INFORMATION

EXAMPLE: LD4A13D010TE ERM4A13835 4LM0LI=4" LED Medium Beam Reflector Lens, 1300 lumen, 3,500 K Color with Universal 120 - 277V, 0 - 10 Driver

Housing

LD4A=4" Aperture
LD4ACP=4" Aperture, Chicago Plenum

Lumens[1]

09=900 Lumens
13=1300 Lumens
18=1800 Lumens
28=2800 Lumens

Driver

900, 1300, 1800 and 2800 Lumen
D010TE=120-277V 0-10V 10% Dimming or Trailing Edge 120V Dimming
D5LT=Fifth Light® (DALI) 0% Dimming
DE010=0 to 100% Dimming, 120-277V 50/60Hz, 0-10V
DL3=1 to 100% Dimming, 120-277V Lutron® Hi-Lume, Ecosystem or 3 Wire
DLT=Hi-Lume Forward Phase 2-wire Dimming 120V
DMX=DMX 0% Dimming

900, 1300 and 1800 Lumen
D010TR=120-277V 0-10V 10% Dimming or Leading Edge 120V Dimming

Options[3]

EMBOD=7W Bodine® Emergency Module with Remote Test Switch
IEMBOD=7W Bodine® Emergency Module with Integral Test Switch
EM7=7W Emergency Module with Remote Test Switch[4]
EM14=14W Emergency Module with Remote Test Switch[4, 5]
IEM7=7W Emergency Module with Integral Test Switch[4, 5, 6]
IEM14=14W Emergency Module with Integral Test Switch[4, 5, 6]

Power Module

ERN4A=4" Module for Narrow Beam Reflector
ERM4A=4" Module for Medium Beam Reflector
ERW4A=4" Module for Wide Beam Reflector

Lumens

09=900 Lumen
13=1300
18=1800 Lumen
28=2800 Lumen

CRI

8=80 CRI
9=90 CRI

Color

27=2700° K
30=3000° K
35=3500° K
40=4000° K
27CP=2700° K, Chicago Plenum
30CP=3000° K, Chicago plenum
35CP=3500° K, Chicago Plenum
40CP=4000° K, Chiago Plenum
30D2W= Dim to warm 3000° K to 1850° K (2000 lumen and below, 90 CRI)

Reflector

4LN0=4" Narrow Reflector Lens Assembly, White Polymer Trim Ring
4LN1=4" Narrow Reflector, Self-flanged
4LM0=4" Medium Reflector Lens Assembly, White Polymer Trim Ring
4LM1=4" Medium Reflector, Self-flanged
4LM0E=4" Medium Reflector Lens Assembly, White Polymer Trim Ring for Integral Emergency Option[5]
4LM1E=4" Medium Reflector Self-flanged for Integral Emergency Option[5]
4LW0=4" Wide Reflector Lens Assembly, White Polymer Trim Ring
4LW1=4" Wide Reflector, Self-flanged

Finish

LI=Specular Clear
H=Semi-Specular Clear
WMH=Warm Haze
G=Specular Gold
WH=Wheat
WHH=Wheat Haze
GP=Graphite
GPH=Graphite Haze

B=Specular Black
W=Gloss White

4LM0 Only
BB=Black Baffle
WB=White Baffle

Options

Self-flanged Only
WF= White Painted Flange

Accessories

HB26=C-channel Bar Hanger, 26" Long, Pair
HB50=C-channel Bar Hanger, 50" Long, Pair
RMB22=Wood Joist Bar Hanger, 22" Long, Pair
H347= 347 to 120V Step Down Transformer, 75VA
PORLWTPD1= LumaWatt Pro Wireless Sensor Kit (0-10V only)

H347200=347 to 120V Step Down Transformer, 200VA
TRM4P= Metal Trim Ring, White[2]
TRM4MB=Metal Trim Ring, Black[2]
TRR4=Rimless Trim Ring[2]
LGSKT4IP66=IP66 Gasket Kit

Notes:
1. Nominal Lumens will vary depending on selected color, driver and reflector finish.
2. Order trim with polymer trim ring (Consult specification sheet for color ordering information and options).
3. Not available with Chicago Plenum.
4. Not CSA approved.
5. For use in accessible ceilings only.
6. For use with medium beam accessible ceilings only.

ENERGY

ENERGY DATA			
Sound Rating: Class A standards			
(Values at non-dimming line voltage)			
Minimum Starting Temperature: -30°C (-22°F)			
EMI/RFI: FCC Title 47 CFR, Part 15, Class B (Consumer)			
Input Voltage: UNV (120V - 277V)			
Power Factor: >0.90 (at nominal input 120-277 VAC & 100% of Rated Output Power)			
Input Frequency: 50/60Hz			
2800 Lumen D010TE		**1800 Lumen D010TE**	
Input Power: 43.4W	THD: <17%	Input Power: 31.5W	THD: <20%
120V Input Current: .36A	277V Input Current: .16A	120V Input Current: .27A	277V Input Current: .06A
1300 Lumen D010TE		**900 Lumen D010TE**	
Input Power: 22.4W	THD: <20%	Input Power: 14.1W	THD: <20%
120V Input Current: .12A	277V Input Current: .09A	120V Input Current: .12A	277V Input Current: .06A

	120V		277V	
Lumens	Inrush (A)	Duration (ms)	Inrush (A)	Duration (ms)
900/1000	0.486	0.4	0.848	0.182
1300/1500	0.717	1.58	0.531	1.24
1800/2000	0.832	0.405	1.25	0.788
2800/3000	1.09	0.3	1.23	0.294

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

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RD
LAI16-104794

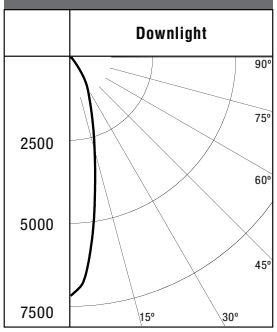
LD4A09 LD4A13 LD4A18 LD4A28 4L

PHOTOMETRICS

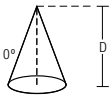
Test Number	P133618
Platform	LD4A18D010TE
Element	ERN4A18835 4LN1LI
Lumens	2368
Efficacy	72.2 Lm/W
SC	0.4



CANDLEPOWER DISTRIBUTION



CONE OF LIGHT



D	FC	L	W
5.5'	233	2.2	2.2
7'	144	2.8	2.8
8'	110	3.2	3.2
9'	87	3.6	3.6
10'	71	4	4
12'	49	4.8	4.8

CANDELA TABLE

Degrees Vertical	Candela
0	7058
5	6145
15	2836
25	1366
35	564
45	50
55	3
65	0
75	0
85	0
90	0

ZONAL LUMEN SUMMARY

Zone	Lumens	%Fixture
0-30	1963	82.9
0-40	2313	97.7
0-60	2367	100
0-90	2368	100
90-180	0	0
0-180	2368	100

LUMINANCE

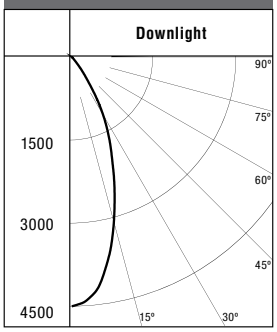
Average Candela Degrees	Average 0° Luminance
45	6933
55	442
65	0
75	0
85	0

1300 lumen multiplier .62. 2800 lumen multiplier 1.12.

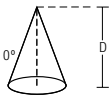
Test Number	P133746
Platform	LD4A18D010TE
Element	ERM4A18835 4LM1LI
Lumens	2507
Efficacy	76.4 Lm/W
SC	0.7



CANDLEPOWER DISTRIBUTION



CONE OF LIGHT



D	FC	L	W
5.5'	148	3.6	3.6
7'	92	4.6	4.6
8'	70	5.2	5.2
9'	55	5.8	5.8
10'	45	6.6	6.6
12'	31	7.8	7.8

CANDELA TABLE

Degrees Vertical	Candela
0	4483
5	4316
15	3105
25	1751
35	594
45	43
55	0
65	0
75	0
85	0
90	0

ZONAL LUMEN SUMMARY

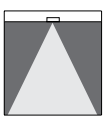
Zone	Lumens	%Fixture
0-30	2055	82.0
0-40	2449	97.7
0-60	2503	99.8
0-90	2507	100.0
90-180	0	0.0
0-180	2507	100.0

LUMINANCE

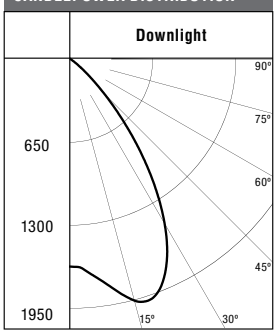
Average Candela Degrees	Average 0° Luminance
45	5954
55	0
65	0
75	0
85	0

1300 lumen multiplier .62. 2800 lumen multiplier 1.17.

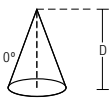
Test Number	P134426
Platform	LD4A18D010TE
Element	ERW4A18835 4LW1LI
Lumens	2572
Efficacy	78.4 Lm/W
SC	1.3



CANDLEPOWER DISTRIBUTION



CONE OF LIGHT



D	FC	L	W
5.5'	58	6.6	6.6
7'	36	8.4	8.4
8'	27	9.6	9.6
9'	22	10.8	10.8
10'	18	12	12
12'	12	14.4	14.4

CANDELA TABLE

Degrees Vertical	Candela
0	1618
5	1666
15	1946
25	1787
35	1108
45	378
55	53
65	3
75	0
85	0
90	0

ZONAL LUMEN SUMMARY

Zone	Lumens	%Fixture
0-30	1520	59.1
0-40	2205	85.7
0-60	2567	99.8
0-90	2572	100
90-180	0	0
0-180	2572	100

LUMINANCE

Average Candela Degrees	Average 0° Luminance
45	52140
55	9022
65	761
75	0
85	0

1300 lumen multiplier .64. 2800 lumen multiplier 1.19.

EM MULTIPLIER DATA

LUMENS	EM MULTIPLIER	
	7	14
900/1000	0.50	0.99
1300/1500	0.29	0.57
1800/2000	0.22	0.44
2800/3000	0.16	0.32

Eaton
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.eaton.com/lighting

Specifications and dimensions subject to change without notice.

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
3131-B1-S-10-AL20F-LSTA4-8416-C330KH-25-NC-277-DIML2
Notes:

Type:
RE
LAI16-104794

BeveLED 2.1

PROJECT INFORMATION

PROJECT _____

DATE _____

TYPE _____

ADJUSTABLE 3131



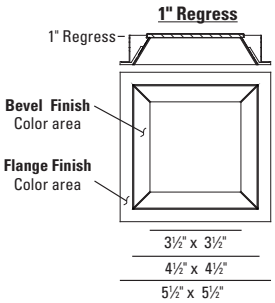
1" Regress

BeveLED 2.1 Recessed Adjustable - BeveLED 2.1 is the most complete recessed LED downlight product family available from USAI Lighting, now with more BeveLED trim finishes, LED classic white color temperatures, innovative housing styles, and dimming driver options than before. With industry-leading performance, BeveLED 2.1 can provide a solution for any project - commercial, corporate and residential installations.

DELIVERED PERFORMANCE

BeveLED 2.1 ADJUSTABLE		9 Watts		12 Watts		16 Watts		24 Watts		33 Watts	
	Color Rendering Index	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI
25° Performance Data	Lumens per Watt	95	74	81	64	81	64	75	59	64	53
	Source Lumens	1150	900	1300	1025	1725	1350	2400	1875	3025	2350
	Delivered Lumens	**850**	**675**	**975**	**750**	**1300**	**1025**	**1800**	**1400**	**2250**	**1750**
10° Performance Data	Lumens per Watt			83	71	84	70	78	65	71	59
	Source Lumens			1150	1000	1575	1300	2175	1800	2725	2275
	Delivered Lumens			**1000**	**850**	**1350**	**1125**	**1875**	**1550**	**2350**	**1950**
	Color Consistency	2-Step MacAdam Ellipse									

Note: 25° data includes solite glass lens. 10° data does not include lens.



CCT MULTIPLIER	2200K	2700K		3000K		3500K	4000K
Color Rendering Index	80+ CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	80+ CRI
Multiplier for Lumen Output	0.72	0.94	0.78	1.00	.78	1.00	1.06

90+ CRI is not available for 2200K, 3500K, or 4000K

HOW TO SPECIFY

Ordering Example: Specify trim code and housing code to order: Example : **3131W - B1- S - 10 - LSTA4 - 8412 - C3 - 27KS - 25 - NC - 277V - DIML2 - CB27**

TRIM ORDERING INFORMATION

TRIM OPTION - BEVEL STYLE - LENS - FLANGE FINISH

3131 _____ - _____ - _____ - _____

3131 Square Adjustable 1" Regress

W Wet location [1]

[1] Wet location, use with B1 trims only.

B1 1" Regress Bevel, Painted Die Cast Matches Flange Finish
AB1 1" Regress Bevel, Black Anodized
AC1 1" Regress Bevel, Clear Matte Anodized

N No Glass (use for 10°)
S Solite (use for 25°)
F Frosted
C Clear

01 Clear Matte (AC Bevel only)
02 Black Anodized (AB Bevel Only)
10 White
13 Statuary Bronze
21 Black
28 Metalized Grey
RAL Custom Color (specify RAL #)

OPTICAL ACCESSORIES

_____ (Order separately)

AL10E
AL15E
AL30E
AS61E
AL20F
AL30F
AL40F
AL55F
AL80F
AS61F

Refer to optical accessories matrix on next page for resulting beamspreads when accessory lens is combined with 10° and 25° optics

Clearly specify quantity in your order

HOUSING ORDERING INFORMATION

HOUSING CODE - WATTAGE - ENGINE CODE - COLOR - REFLECTOR - HOUSING TYPE - SELECT ONE VOLTAGE - DIMMING DRIVER OPTIONS - ACCESSORIES

LSTA4 - _____ - _____ - _____ - _____ - _____ - _____ - _____

LSTA4

8409 9W LED
8412 12W LED
8416 16W LED
8424 24W LED
8433 33W LED

See performance chart for precise lumen information.

C3

22KS 2200K, 80+ CRI
27KS 2700K, 80+ CRI
30KS 3000K, 80+ CRI
35KS 3500K, 80+ CRI
40KS 4000K, 80+ CRI
27KH 2700K, 90+ CRI
30KH 3000K, 90+ CRI

25 25° beam

NC New Construction, all in one
CP Chicago Plenum
IC Insulation-Contact Rated / Airtight

See emergency solutions chart for EM options with these housings

120V
277V

For use with 120V or 277V

DIML2 0-10V dim, 10% (provided standard)
DIML4 Lutron A 3-wire/ECO, 1%
DIML4E Lutron 5 ECO, 5% [2]
DIML4H Lutron H ECO, 1% Fade [2]
DIML6A EldoLED 0-10V, 0.1%, logarithmic / Lutron controls
DIML6B EldoLED 0-10V Linear, 0.1%, linear controls
DIML6E EldoLED 0-10V, 1%, logarithmic/Lutron controls
DIML6F EldoLED 0-10V, 1%, linear controls
DIML7 EldoLED DALI, 0.1%
DIML8 EldoLED DMX, 0.1% [3]

CB27 27" C-Channel Bars
CB52 52" C-Channel Bars
EML Emergency battery [4]
EMLW Emergency battery, wet location [4]

[4] See emergency solutions chart for more details on EM options.

Not available with 347V

8412 12W LED
8416 16W LED
8424 24W LED
8433 33W LED

C2

27KS 2700K, 80+ CRI
30KS 3000K, 80+ CRI
35KS 3500K, 80+ CRI
40KS 4000K, 80+ CRI
27KH 2700K, 90+ CRI
30KH 3000K, 90+ CRI

10 10° beam

2 Step MacAdam ellipse is standard for all

120V

For use with 120V only

DIML3 Lutron A 2-wire, 1% 120V only
DIML9 TRIAC 2-wire, 15% 120V only [2,3]
DIML10 ELV 2-wire, 15% 120V only [2,3]

347V

For use with 347V only

DIML15 0-10V dim, 1% 347 only

[2] N/A with 9W, [3] N/A with 33W

USAI Lighting
www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

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Revised 07/29/2016

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
3131-B1-S-10-AL20F-LSTA4-8416-C330KH-25-NC-277-DIML2
Notes:

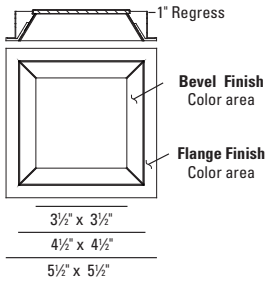
Type:
RE
LAI16-104794

BeveLED2.1

ADJUSTABLE 3131

ADDITIONAL TRIM INFORMATION

1" Regress



3½" x 3½"
4½" x 4½"
5½" x 5½"

BeveLED 2.1 Optical Accessories Matrix		
if you want…	and you have….	
	10°	25°
15° beam	AL10E	N/A
20° beam	AL15E	N/A
25° beam	AL30E	N/A
35° beam	N/A	AL20F
40° beam	N/A	AL30F
45° beam	N/A	AL40F
55° beam	N/A	AL55F
60° beam	N/A	AL80F
20x60° beam	AS61E	N/A
40x60° beam	N/A	AS61F
	size E	size F

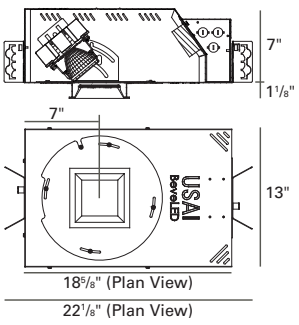
3131 Emergency Solutions

Housing	EM SERVICE	Integral Test Switch	Remote Test Switch	Inverter By Others
NC	Through aperture		X	
CP	N/A			X
IC	N/A			X

347V cannot be offered with EM

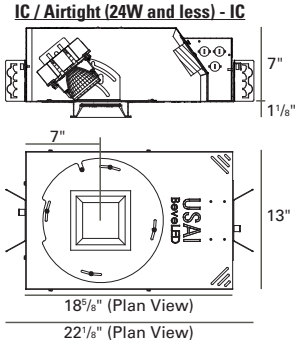
HOUSING INFORMATION

New Construction
Universal Style Housing - NC



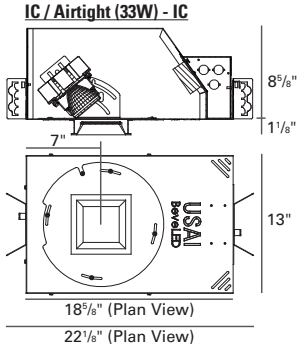
18⅝" (Plan View)
22⅛" (Plan View)

Chicago Plenum (24W and less) - CP
IC / Airtight (24W and less) - IC



18⅝" (Plan View)
22⅛" (Plan View)

Chicago Plenum (33W) - CP
IC / Airtight (33W) - IC



18⅝" (Plan View)
22⅛" (Plan View)

SPECIFICATIONS

TRIM: 4-1/2" square aperture with a 1" regressed bevel and 1/2" flange, retained by two mounting clips. Die cast aluminum bevel is self-flanged and is available in white, statuary bronze, black, and metalized grey finishes. Also available in black anodized or clear matte anodized bevel with self-finish or with contrasting painted flange. Custom color flanges available (provide RAL#).

TRIM LENS: 25° trim is shipped with integral solite lens. 10° does not come with a solite lens unless selected as an option. Frosted lens option available for both. 10° wet location is provided with a clear lens.

REFLECTOR: Interchangeable precision injection molded specular polycarbonate reflector optimized for 10° or 25° beam distribution. Note: 10° optic requires dedicated 10° light engine.

ADJUSTMENT: True hot aiming with center beam optics is adjustable, with a completely tool-less mechanism. 0°-40° lockable vertical tilt with 362° lockable rotation.

FIELD REPLACEABLE LIGHT ENGINE: Available in 5 lumen packages: 9W, 12W, 16W, 24W and 33W. Engine is field replaceable through the aperture without tools. See performance chart for precise lumen output information.

COLOR: BeveLED 2.1 is available in 5 color temperatures (2200K, 2700K, 3000K, 3500K, 4000K). All color options are tightly binned for fixture-to-fixture color consistency within a 2-Step MacAdam Ellipse. 80+ color rendering index provided standard. 90+ CRI available for 2700K and 3000K CCTs.

RATED LIFE: Based on IESNA LM80-2008 50,000 hours at 70% lumen maintenance (L70).

THERMAL MANAGEMENT: Proprietary high performance aluminum die cast heatsink for maximum LED life. Ambient temperatures at fixture location should not exceed 40°C during normal operation.

FIELD REPLACEABLE DRIVER: 0-10V, 100%-10% solid state electronic constant current driver with a high power factor provided standard and sources 2mA. Specify 120V or 277V. Driver complies with IEEE C62.41 surge protection.

DIMMING OPTIONS: Multiple dimming drivers available. See compatibility chart attached. Some on-time delay may be experienced depending on control system used. Note: DIML6A and DIML6E logarithmic control are intended for use with Lutron control systems; DIML6B and DIML6F linear control are intended for use with non-Lutron controls. DIML15 and DIML6 dimming drivers source 2mA.

EMERGENCY: Fixtures provided with a remote test switch are provided with a 24" lead length for location of the test switch. Fixtures that have no USAI EM option may be connected to an inverter (by others) for emergency lighting. See emergency solutions chart for more information on EM test switches and servicing.

MOUNTING: Butterfly brackets and adjustable nailer bars with integral nails provided. Nailer bars are extendible from 14" to 24" centers. C-channel bars are optionally available for acoustical ceiling applications.

MAXIMUM CEILING THICKNESS: As per drawings above.

ACCESSORY HOLDER: Snap in accessory holder shipped with fixture.
10° accepts "E" size lens, maximum 2.
25° accepts "F" size lens, maximum 2.

CEILING CUT OUT: 5-1/16" x 5-1/16"

HOUSING: All-Ways Square® (covered by US Pat. No: US 7,832,889) housing allows alignment of square aperture (up to 20° rotation) after housing installation and prior to finish ceiling installation. Fabricated of 20 ga. galvanized steel with thru wire J-box, 4 in 4 out at min. 90°C, #12 AWG thru branch circuit wiring. IC-rated housings for use with 9W, 12W, and 16W light engines only are rated for direct contact with spray foam insulation of R-42 per inch or less.

LISTINGS: Dry/Damp. Wet location option available with B1 trim only. NRTL/CSA-US tested to UL standards. IBEW union made. Energy Star Qualified under Luminaires Specification V2.0. Please see Energy Star website for exact model #s included in the listing. Please note that the following options are not Energy Star qualified: 22KS, 27KH, and 30KH light engines; B-13, B-21, and AB trim styles; Frosted lens and EM options. CEC/Title 24 Compliant up to 16W maximum. See CEC website for exact models included.

WARRANTY: 5 years

NOTES:
- Not for use in corrosive environment.
- Use of pressure washer voids warranty.

PHOTOMETRICS: Consult factory or website for IES files. Tested in accordance with IESNA LM79-2008.

USAI® Lighting
www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

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Revised 07/29/2016

Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** 3131-B1-S-10-AL20F-LSTA4-8416-C330KH-25-NC-277-DIML2 Notes:	**Type:** **RE** LAI16-104794

BeveLED 2.1

ADJUSTABLE 3131

DELIVERED PERFORMANCE

3131 / 3431 16W 30KS 25°

Coefficients Of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance: 20%

RCC %:	80				70				50			30			10			0
RW %:	70	50	30	0	70	50	30	0	50	30	20	50	30	20	50	30	20	0
RCR: 0	1.19	1.19	1.19	1.19	1.16	1.16	1.16	1.00	1.11	1.11	1.11	1.06	1.06	1.06	1.02	1.02	1.02	1.00
1	1.15	1.12	1.10	1.09	1.12	1.10	1.09	.96	1.06	1.05	1.04	1.03	1.02	1.01	.99	.98	.98	.96
2	1.11	1.07	1.04	1.01	1.08	1.05	1.02	.93	1.02	1.00	.98	.99	.97	.96	.96	.95	.94	.92
3	1.07	1.02	.98	.95	1.05	1.00	.97	.89	.98	.95	.92	.95	.93	.91	.93	.91	.90	.88
4	1.03	.97	.93	.90	1.01	.96	.92	.86	.94	.91	.88	.92	.89	.87	.90	.88	.86	.85
5	.99	.93	.89	.85	.98	.92	.88	.82	.90	.87	.84	.89	.86	.83	.88	.85	.83	.82
6	.96	.89	.85	.81	.95	.89	.84	.79	.87	.83	.81	.86	.83	.80	.85	.82	.80	.79
7	.93	.86	.81	.78	.92	.85	.81	.77	.84	.80	.78	.83	.80	.77	.82	.79	.77	.76
8	.90	.83	.78	.75	.89	.82	.78	.74	.81	.77	.75	.80	.77	.74	.80	.76	.74	.73
9	.87	.80	.75	.72	.86	.79	.75	.72	.79	.75	.72	.78	.74	.72	.77	.74	.72	.71
10	.85	.77	.73	.70	.84	.77	.73	.69	.76	.72	.70	.75	.72	.69	.75	.72	.69	.68

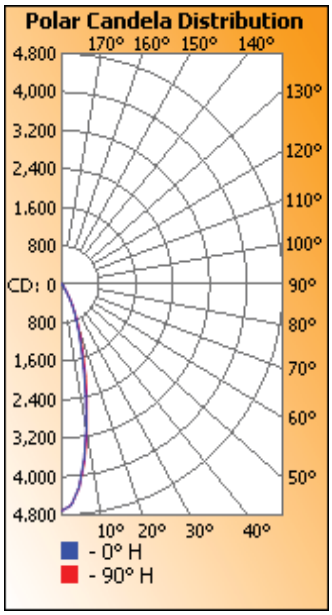
Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	1,185.7	92.3%
0-40	1,268.1	98.7%
0-60	1,282.9	99.9%
60-90	1.6	0.1%
70-100	0.2	0%
90-120	0	0%

Illuminance at a Distance

	Center Beam fc	Beam Width	
2.0ft	1,181.6 fc	0.9 ft	0.9 ft
4.0ft	295.4 fc	1.8 ft	1.9 ft
6.0ft	131.3 fc	2.7 ft	2.8 ft
8.0ft	73.8 fc	3.6 ft	3.7 ft
10.0ft	47.3 fc	4.5 ft	4.7 ft
12.0ft	32.8 fc	5.4 ft	5.6 ft
14.0ft	24.1 fc	6.3 ft	6.5 ft
16.0ft	18.5 fc	7.2 ft	7.5 ft

Vert. Spread: 25.2°
Horiz. Spread: 26.3°



3131 / 3431 33W 30KS 25°

Coefficients Of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance: 20%

RCC %:	80				70				50			30			10			0
RW %:	70	50	30	0	70	50	30	0	50	30	20	50	30	20	50	30	20	0
RCR: 0	1.19	1.19	1.19	1.19	1.16	1.16	1.16	1.00	1.11	1.11	1.11	1.06	1.06	1.06	1.02	1.02	1.02	1.00
1	1.15	1.12	1.10	1.09	1.12	1.10	1.09	.96	1.06	1.05	1.04	1.03	1.02	1.01	.99	.98	.98	.96
2	1.11	1.07	1.04	1.01	1.08	1.05	1.02	.93	1.02	1.00	.98	.99	.97	.96	.96	.95	.94	.92
3	1.07	1.02	.98	.95	1.05	1.00	.97	.89	.98	.95	.92	.95	.93	.91	.93	.91	.90	.88
4	1.03	.97	.93	.90	1.01	.96	.92	.86	.94	.91	.88	.92	.89	.87	.90	.88	.86	.85
5	.99	.93	.89	.85	.98	.92	.88	.82	.90	.87	.84	.89	.86	.83	.88	.85	.83	.82
6	.96	.89	.85	.81	.95	.89	.84	.79	.87	.83	.81	.86	.83	.80	.85	.82	.80	.79
7	.93	.86	.81	.78	.92	.85	.81	.77	.84	.80	.78	.83	.80	.77	.82	.79	.77	.76
8	.90	.83	.78	.75	.89	.82	.78	.74	.81	.77	.75	.80	.77	.74	.80	.76	.74	.73
9	.87	.80	.75	.72	.86	.79	.75	.72	.79	.75	.72	.78	.74	.72	.77	.74	.72	.71
10	.85	.77	.73	.70	.84	.77	.73	.69	.76	.72	.70	.75	.72	.69	.75	.72	.69	.68

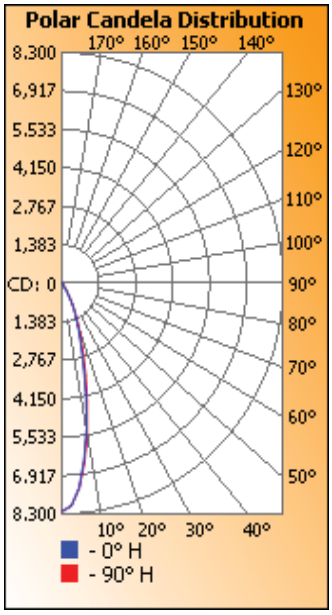
Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	2,065.7	92.3%
0-40	2,209.1	98.7%
0-60	2,235.1	99.9%
60-90	2.8	0.1%
70-100	0.4	0%
90-120	0	0%

Illuminance at a Distance

	Center Beam fc	Beam Width	
2.0ft	2,058.5 fc	0.9 ft	0.9 ft
4.0ft	514.6 fc	1.8 ft	1.9 ft
6.0ft	228.7 fc	2.7 ft	2.8 ft
8.0ft	128.7 fc	3.6 ft	3.7 ft
10.0ft	82.3 fc	4.5 ft	4.7 ft
12.0ft	57.2 fc	5.4 ft	5.6 ft
14.0ft	42.0 fc	6.3 ft	6.5 ft
16.0ft	32.2 fc	7.2 ft	7.5 ft

Vert. Spread: 25.2°
Horiz. Spread: 26.3°



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Revised 07/29/2016

Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** 3131-B1-S-10-AL20F-LSTA4-8416-C330KH-25-NC-277-DIML2 Notes:	**Type:** **RE** LAI16-104794

BeveLED2.1

ADJUSTABLE 3131

DELIVERED PERFORMANCE

3131 / 3431 16W 30KS 10°

Coefficients Of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance: 20%

RCC %:	80				70				50			30			10			0
RW %:	70	50	30	0	70	50	30	0	50	30	20	50	30	20	50	30	20	0
RCR: 0	1.19	1.19	1.19	1.19	1.16	1.16	1.16	1.00	1.11	1.11	1.11	1.06	1.06	1.06	1.02	1.02	1.02	1.00
1	1.15	1.14	1.12	1.10	1.13	1.11	1.10	.98	1.07	1.06	1.05	1.04	1.03	1.02	1.00	1.00	.99	.98
2	1.12	1.09	1.06	1.04	1.10	1.07	1.05	.96	1.04	1.02	1.01	1.01	1.00	.99	.99	.98	.97	.95
3	1.09	1.05	1.02	.99	1.07	1.04	1.01	.93	1.01	.99	.97	.99	.97	.96	.97	.95	.94	.93
4	1.06	1.02	.98	.96	1.05	1.01	.98	.92	.99	.96	.94	.97	.95	.93	.95	.94	.92	.91
5	1.04	.99	.95	.93	1.03	.98	.95	.90	.97	.94	.92	.95	.93	.91	.94	.92	.90	.89
6	1.02	.96	.93	.90	1.01	.96	.92	.88	.95	.92	.89	.93	.91	.89	.92	.90	.88	.87
7	1.00	.94	.91	.88	.99	.94	.90	.87	.93	.90	.88	.92	.89	.87	.91	.89	.87	.86
8	.98	.92	.89	.86	.97	.92	.89	.85	.91	.88	.86	.90	.88	.86	.89	.87	.85	.85
9	.96	.91	.87	.85	.95	.90	.87	.84	.89	.87	.85	.89	.86	.84	.88	.86	.84	.83
10	.94	.89	.86	.84	.94	.89	.86	.83	.88	.85	.83	.87	.85	.83	.87	.85	.83	.82

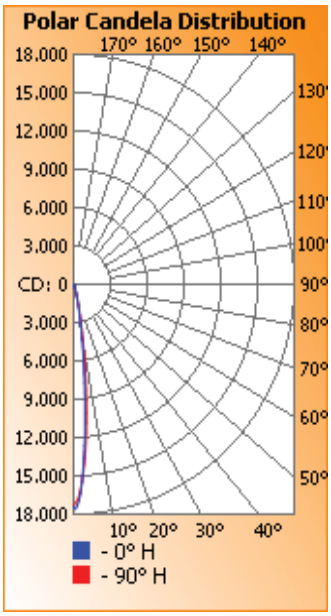
Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	1,242.2	92.2%
0-40	1,291.6	95.9%
0-60	1,339.5	99.5%
60-90	7.1	0.5%
70-100	3.2	0.2%
90-120	0	0%

Illuminance at a Distance

	Center Beam fc	Beam Width	
2.0ft	4,334.6 fc	0.4 ft	0.5 ft
4.0ft	1,083.7 fc	0.9 ft	1.0 ft
6.0ft	481.6 fc	1.3 ft	1.4 ft
8.0ft	270.9 fc	1.7 ft	1.9 ft
10.0ft	173.4 fc	2.1 ft	2.4 ft
12.0ft	120.4 fc	2.6 ft	2.9 ft
14.0ft	88.5 fc	3.0 ft	3.3 ft
16.0ft	67.7 fc	3.4 ft	3.8 ft

Vert. Spread: 12.2°
Horiz. Spread: 13.6°



3131 / 3431 33W 30KS 10°

Coefficients Of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance: 20%

RCC %:	80				70				50			30			10			0
RW %:	70	50	30	0	70	50	30	0	50	30	20	50	30	20	50	30	20	0
RCR: 0	1.19	1.19	1.19	1.19	1.16	1.16	1.16	1.00	1.11	1.11	1.11	1.06	1.06	1.06	1.02	1.02	1.02	1.00
1	1.15	1.14	1.12	1.10	1.13	1.11	1.10	.98	1.07	1.06	1.05	1.04	1.03	1.02	1.00	1.00	.99	.98
2	1.12	1.09	1.06	1.04	1.10	1.07	1.05	.96	1.04	1.02	1.01	1.01	1.00	.99	.99	.98	.97	.95
3	1.09	1.05	1.02	.99	1.07	1.04	1.01	.93	1.01	.99	.97	.99	.97	.96	.97	.95	.94	.93
4	1.06	1.02	.98	.96	1.05	1.01	.98	.92	.99	.96	.94	.97	.95	.93	.95	.94	.92	.91
5	1.04	.99	.95	.93	1.03	.98	.95	.90	.97	.94	.92	.95	.93	.91	.94	.92	.90	.89
6	1.02	.96	.93	.90	1.01	.96	.92	.88	.95	.92	.89	.93	.91	.89	.92	.90	.88	.87
7	1.00	.94	.91	.88	.99	.94	.90	.87	.93	.90	.88	.92	.89	.87	.91	.89	.87	.86
8	.98	.92	.89	.86	.97	.92	.89	.85	.91	.88	.86	.90	.88	.86	.89	.87	.85	.85
9	.96	.91	.87	.85	.95	.90	.87	.84	.89	.87	.85	.89	.86	.84	.88	.86	.84	.83
10	.94	.89	.86	.84	.94	.89	.86	.83	.88	.85	.83	.87	.85	.83	.87	.85	.83	.82

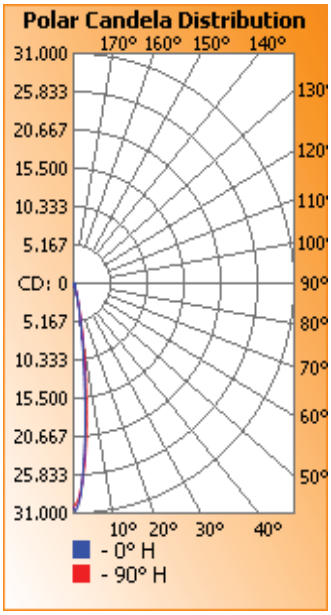
Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	2,164.2	92.2%
0-40	2,250.2	95.9%
0-60	2,333.6	99.5%
60-90	12.5	0.5%
70-100	5.5	0.2%
90-120	0	0%

Illuminance at a Distance

	Center Beam fc	Beam Width	
2.0ft	7,551.6 fc	0.4 ft	0.5 ft
4.0ft	1,887.9 fc	0.9 ft	1.0 ft
6.0ft	839.1 fc	1.3 ft	1.4 ft
8.0ft	472.0 fc	1.7 ft	1.9 ft
10.0ft	302.1 fc	2.1 ft	2.4 ft
12.0ft	209.8 fc	2.6 ft	2.9 ft
14.0ft	154.1 fc	3.0 ft	3.3 ft
16.0ft	118.0 fc	3.4 ft	3.8 ft

Vert. Spread: 12.2°
Horiz. Spread: 13.6°



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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** 3131-B1-S-10-AL20F-LSTA4-8416-C330KH-25-NC-277-DIML2 Notes:	**Type:** **RE** LAI16-104794

USAI Lighting

DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML2

DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

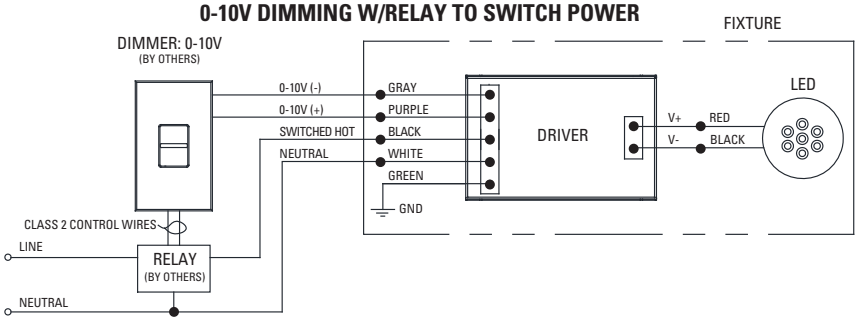
DIML2 LED: 0-10V Dimming Driver Wiring (Dims down to 10%)

DIML2 Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Dimmer*
120V / 277V				Use source current per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
Crestron	iLux dimmer expansion module	CLS-EXP-DIMFLV	100% - 10%	
Crestron	DIN Rail dimmer	DIN-4DIMFLV4	100% - 10%	
Crestron	DIN Rail analog output module	DIN-A08	100% - 10%	
Crestron	8 Channel dimmer module	GLX-DIMFLV8	100% - 10%	
Crestron	8 Channel dimmer module	GLXP-DIMFLV8	100% - 10%	
Leviton	IllumaTech dimmer	IP710-DLX	100% - 10%	
Lightolier (Philips)	Vega	V2000FAMU	100% - 10%	
Lutron	Diva	DVTV-XX	100% - 10%	

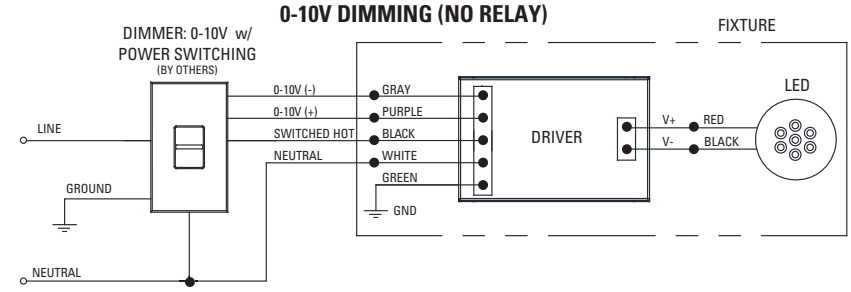
* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML2
0-10V DIMMING W/RELAY TO SWITCH POWER



NOTE:
If switched, non-dimming operation is desired, cap off purple and gray wires individually at installation. Do NOT cap purple and gray wires together.

DIML2
0-10V DIMMING (NO RELAY)



NOTE:
If switched, non-dimming operation is desired, cap off purple and gray wires individually at installation. Do NOT cap purple and gray wires together.

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I2-264-2 Revised 02/15/2016

Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** 3131-B1-S-10-AL20F-LSTA4-8416-C330KH-25-NC-277-DIML2 Notes:	**Type:** **RE** LAI16-104794

USAI Lighting

DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML3

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

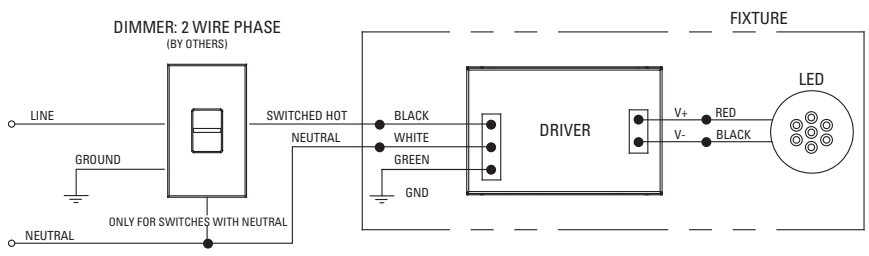
DIML3 LED: Lutron Hi-Lume A-Series 2 Wire Fwd Phase (with neutral) / LED Dimming Driver Wiring (Dims down to 1%) 120V only.

DIML3 Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Dimmer* Fixture Wattage	
120V Only				39W and Less	40W - 80W
ETC	Sensor+ Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
ETC	Unison DRd Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
Lutron	Maestro Wireless® 600W dimmer	MRF2-6ND-120-	100% - 1%	1 – 8	1 – 4
Lutron	Maestro Wireless® 1000W dimmer	MRF2-10ND-120-	100% - 1%	1 – 13	1 – 6
Lutron	HomeWorks® QS adaptive dimmer	HQRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 600W dimmer	HQRD-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 1000 W dimmer	HQRD-10ND-	100% - 1%	1 – 13	1 – 6
Lutron	Caseta Wireless® Pro 1000W dimmer	PD-10NXD-	100% - 1%	1 – 13	1 – 6
Lutron	Stanza® dimmer	SZ-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 adaptive dimmer	RRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 1000 W dimmer	RRD-10ND-	100% - 1%	1 – 6	1 – 3
Lutron	myRoom DIN power module	MQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® QS wallbox power module	HQRJ-WPM-6D-120-	100% - 1%	1 – 26	1 – 13
Lutron	Homeworks® DIN power module	LQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® wallbox power module	HWI-WPM-6D-120	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® QS control unit	QSGR-, QSGRJ-	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® 3000 control unit	GRX-3100-, GRX-3500-	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4U module	HW-RPM-4U-120, LP-RPM-4U-120	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4A module	HW-RPM-4A-120, LP-RPM-4A-120	100% - 1%	1 – 26	1 – 13
Lutron	GP dimming panels	Various	100% - 1%	1 – 26	1 – 13
Lutron	Ariadni CL 250W dimmer	AYCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Diva CL 250W dimmer	DVCL-253P-, DVSCCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Grafik T CL or RF CL dimmer	GT-250M-, GTJ-250M-	100%-1%	1 – 8	1 – 4
Lutron	Nova T CL 250W dimmer	NTCL-250-	100%-1%	1 – 10	1 – 5

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML3
2 WIRE PHASE DIMMING



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USAI Lighting

DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML4

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML4 LED: Lutron Hi-Lume A-Series LED Driver with 3-Wire FL Control / LED Dimming Driver Wiring (Dims down to 1%)

DIML4 3-Wire Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V Only				39W and Less	40W - 80W
ETC	Sensor+ Cabinet	D20 Dimming module	100% - 1%	1–53	1–26
ETC	Unison DRd Cabinet	D20F Dimming module	100% - 1%	1–53	1–26
Lutron	Nova T	NTF-10-	100%–1%	1–41	1 – 20
Lutron	Nova T	NTF-103P-	100%–1%	1–20	1 – 10
Lutron	Nova	NF-10-	100%–1%	1–41	1 – 20
Lutron	Nova	NF-103P-	100%–1%	1–20	1 – 10
Lutron	Vareo	VF-10-	100%–1%	1–20	1 – 10
Lutron	Skylark	SF-10P-, SF-103P-	100%–1%	1–20	1 – 10
Lutron	Diva	DVF-103P-, DVSCF-103P-	100%–1%	1–20	1 – 10
Lutron	Ariadni	AYF-103P-	100%–1%	1–20	1 – 10
Lutron	Vierti	VTF-6A-	100%–1%	1–15	1 – 7
Lutron	Maestro	MAF-6AM-, MSCF-6AM-	100%–1%	1–15	1 – 7
Lutron	Maestro Wireless	MRF2-F6AN-DV-	100%–1%	1–15	1 – 7
Lutron	RadioRA 2	RRD-F6AN-DV-	100%–1%	1–15	1 – 7
Lutron	HomeWorks QS	HQRD-F6AN-DV	100%–1%	1–15	1 – 7
Lutron	Interfaces	PHPM-3F-120, PHPM-3F-DV	100%–1%	1–41	1 – 20
Lutron	GP Dimming Panels	Various	100%–1%	1–41	1 – 20
277V Only				40W and Less	41W - 80W
ETC	Sensor+ Cabinet	D20 Dimming module	100% - 1%	1–53	1–26
ETC	Unison DRd Cabinet	D20F Dimming module	100% - 1%	1–53	1–26
Lutron	Nova T	NTF-10-277-	100%–1%	1–44	1 – 22
Lutron	Nova T	NTF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Nova	NF-10-277-	100%–1%	1–44	1 – 22
Lutron	Nova	NF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Skylark	SF-12P-277-, SF-12P-277-3	100%–1%	1–33	1 – 16
Lutron	Diva	DVF-103P-277-, DVSCF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Ariadni	AYF-103P-277-	100%–1%	1–44	1 – 22
Lutron	Vierti	VTF-6A-	100%–1%	1–33	1 – 16
Lutron	Maestro	MAF-6AM-277-, MSCF-6AM-277-	100%–1%	1–20	1 – 10
Lutron	Maestro Wireless	MRF2-F6AN-DV-	100%–1%	1–33	1 – 16
Lutron	RadioRA 2	RRD-F6AN-DV-	100%–1%	1–33	1 – 16
Lutron	HomeWorks QS	HQRD-F6AN-DV	100%–1%	1–33	1 – 16
Lutron	Interfaces	PHPM-3F-DV	100%–1%	1–88	1 – 44
Lutron	GP Dimming Panels	Various	100%–1%	1–88	1 – 44

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML4 wiring diagrams continued on next page

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USAI Lighting

DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
DIML4 Continued

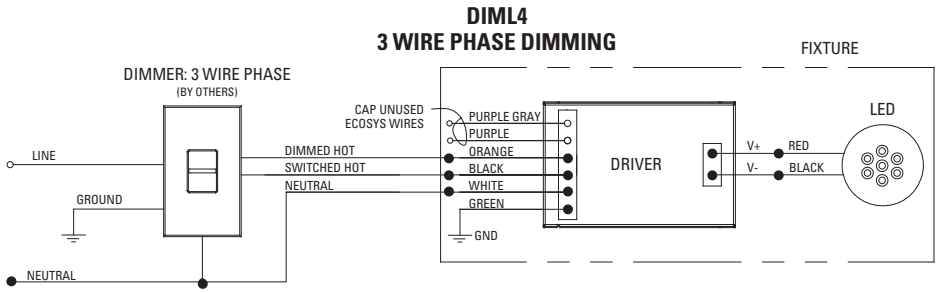
DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML4 LED: Lutron Hi-Lume A-Series LED Driver with 3-Wire FL Control / LED Dimming Driver Wiring (Dims down to 1%)

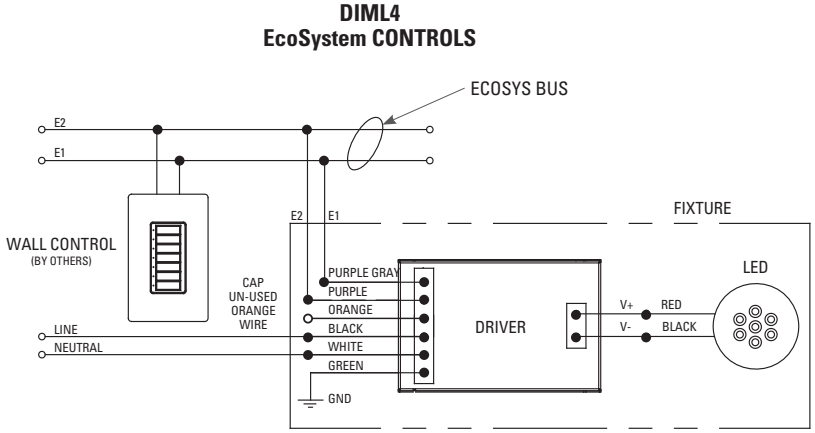


DIML4 LED: Lutron Hi-Lume A-Series LED Driver with EcoSystem Control / LED Dimming Driver Wiring (Dims down to 1%)

DIML4 EcoSystem Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V / 277V				39W and Less	40W - 80W
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	100%–1%	1–32	1–16
Lutron	Energi Savr Node	QSN-1ECO-S, QSN-2ECO-S	100%–1%	1–64	1–32
Lutron	GRAFIK Eye QS (120V ONLY)	QSGRJ- E, QSGR- E	100%–1%	1–64	1–32
Lutron	Quantum	Various	100%–1%	1–64	1–32

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.



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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** 3131-B1-S-10-AL20F-LSTA4-8416-C330KH-25-NC-277-DIML2 Notes:	**Type:** **RE** LAI16-104794

USAI Lighting

DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML4E and DIML4H

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

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2. Only qualified electricians in accordance to local codes should install these fixtures.
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4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML4E LED: Lutron 5 Series EcoSystem LED Driver / LED Dimming Driver Wiring (Dims down to 5%)

DIML4E EcoSystem Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V / 277V				39W and Less	40W - 80W
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	100%–5%	1–32	1–16
Lutron	Energi Savr Node	QSN-1ECO-S, QSN-2ECO-S	100%–5%	1–64	1–32
Lutron	GRAFIK Eye QS (120V ONLY)	QSGRJ- E, QSGR- E	100%–5%	1–64	1–32
Lutron	Quantum	Various	100%–5%	1–64	1–32

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

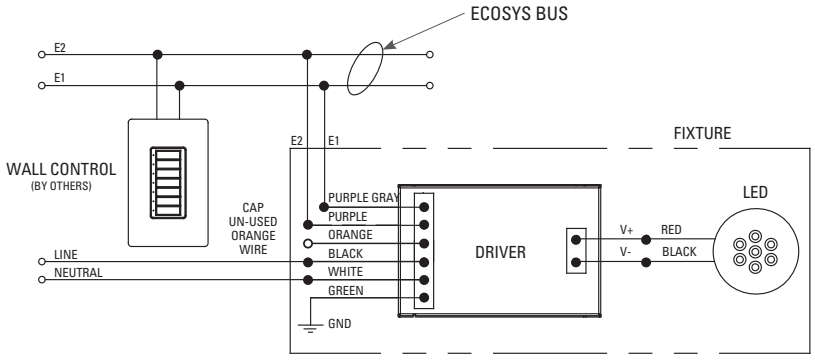
DIML4H LED: Lutron H Series EcoSystem LED Driver with Fade to Black (dims down to 1%)

DIML4E EcoSystem Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V / 277V				39W and Less	40W - 80W
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	100%–1%	1–32	1–16
Lutron	Energi Savr Node	QSN-1ECO-S, QSN-2ECO-S	100%–1%	1–64	1–32
Lutron	GRAFIK Eye QS (120V ONLY)	QSGRJ- E, QSGR- E	100%–1%	1–64	1–32
Lutron	Quantum	Various	100%–1%	1–64	1–32

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML4E and DIML 4H
EcoSystem CONTROLS



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I2-264-4EH Revised 02/15/2016

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LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** 3131-B1-S-10-AL20F-LSTA4-8416-C330KH-25-NC-277-DIML2 Notes:	**Type:** **RE** LAI16-104794

USAI Lighting

DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
DIML6A, 6E
DIML6B, 6F

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML6A and DIML6E LED Dimming Compatibility Table

DIML6A and DIML6E are linearly programmed dimming drivers for use with logarithmic-style dimming controls (e.g., Lutron and others listed in the table below)
DIML6A = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1%
DIML6E = EldoLED ECOdrive 0-10V control dims from 100% to 1%

DIML6A and DIML6E Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range			Qty Fixtures Per Dimmer*
120V & 277V			DIML6A		6E	Refer to manufacturer's
Lutron	Diva	DVTV/NFTV/NTFTV with PP-20	99% -	0.1%	1%	dimmer load rating for
Lutron	Energi Savr Node	QSN-4T16-S	100% -	0.1%	1%	maximum and minimum
Lutron	GP Dimming Panels	TVM2 Module	99% -	0.1%	1%	fixture quantities per
Lutron	Interfaces	GRX-TVI w/ GRX3503	100% -	0.1%	1%	dimmer.
Sensor Switch	nIO	nIO EZ	100% -	0.1%	1%	Enlighted compatible.
enlighted	Control Unit	CU-3E-1R	100% -	0.1%	1%	

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML6B and DIML6F LED Dimming Compatibility Table

DIML6B and DIML6F are logarithmic-programmed dimming drivers for use with linear-style dimming controls (e.g., Crestron, non-Lutron and others listed in the table below)
DIML6B = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1%
DIML6F = EldoLED ECOdrive 0-10V control dims from 100% to 1%

DIML6B and DIML6F Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range			Qty Fixtures Per Dimmer*
120V & 277V			DIML6B		6F	Refer to
Bush-Jaeger	Electronic potentiometer	2112U-101	100% -	0.1%	1%	manufacturer's
Jung	Electronic potentiometer	240-10	100% -	0.1%	1%	dimmer load
Leviton	IllumaTech dimmer	IP710-DLX	100% -	0.1%	1%	rating for
Lightolier (Philips)	Momentum (120V ONLY)	ZP600FAM120	100% -	0.1%	1%	maximum and
Merten	Electronic potentiometer	5729	100% -	0.1%	1%	minimum fixture
Pass & Seymour	Titan	CD4FB-W	100% -	0.1%	1%	quantities per
Watt Stopper	Miro	DCLV1	100% -	0.1%	1%	dimmer.
Synergy	Wallbox Dimmers	ISD BC	100% -	0.1%	1%	Enlighted
ABB	i-bus	SD/S 2.16.1	100% -	0.1%	1%	compatible.
Crestron	Modules	GLX-DIMFLV8, GLXP-DIMFLV8	100% -	0.1%	1%	
Crestron	Green Light	GLPAC-DIMFLV4-, GLPAC-DIMFLV8-	100% -	0.1%	1%	
Crestron	Green Light Power Pack	GLPP-DIMFLVEX-PM, GLPP-1DIMFLV2EX-PM, GLPP-1DIMFLV3EX-PM	100% -	0.1%	1%	
Crestron	DIN Rail Analog Output Module	DIN-A08	100% -	0.1%	1%	
Crestron	DIN Rail 0-10V Fluorescent Dimmer	DIN-4DIMFLV4	100% -	0.1%	1%	
Crestron	iLux 0-10V Dimmer Expansion Module	CLS-EXP-DIMFLV	100% -	0.1%	1%	
enlighted	Control Unit	CU-3E-1R	100% -	0.1%	1%	

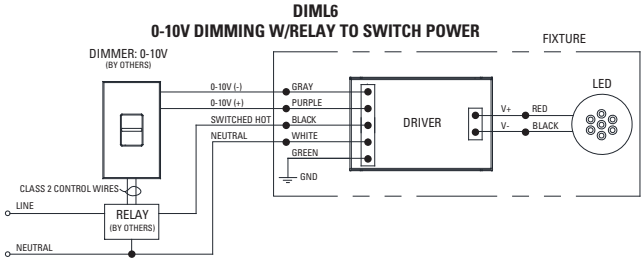
* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIMMING DRIVER WIRING SCHEMES:

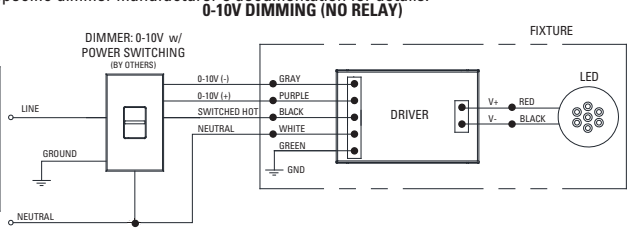
NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

DIML6
0-10V DIMMING W/RELAY TO SWITCH POWER



DIML6
0-10V DIMMING (NO RELAY)



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I2-264-6 Revised 08/19/2016

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LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** 3131-B1-S-10-AL20F-LSTA4-8416-C330KH-25-NC-277-DIML2 Notes:	**Type:** **RE** LAI16-104794

USAI Lighting

DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML7

DIMMING DRIVER WIRING SCHEMES:

NOTES:

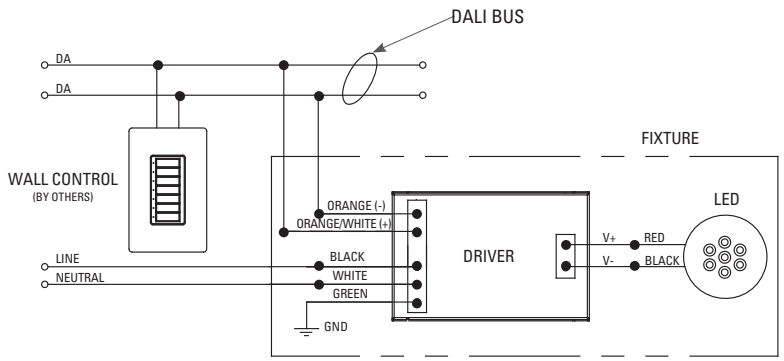
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML7 LED: EldoLED DALI Dimming Driver Wiring (Dims down to 0.1%)

DIML7
DALI CONTROLS



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New Windsor, NY 12553
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I2-264-7 Revised 02/15/2016

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LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** 3131-B1-S-10-AL20F-LSTA4-8416-C330KH-25-NC-277-DIML2 Notes:	**Type:** **RE** LAI16-104794

USAI Lighting

DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML8

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

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2. Only qualified electricians in accordance to local codes should install these fixtures.
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4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

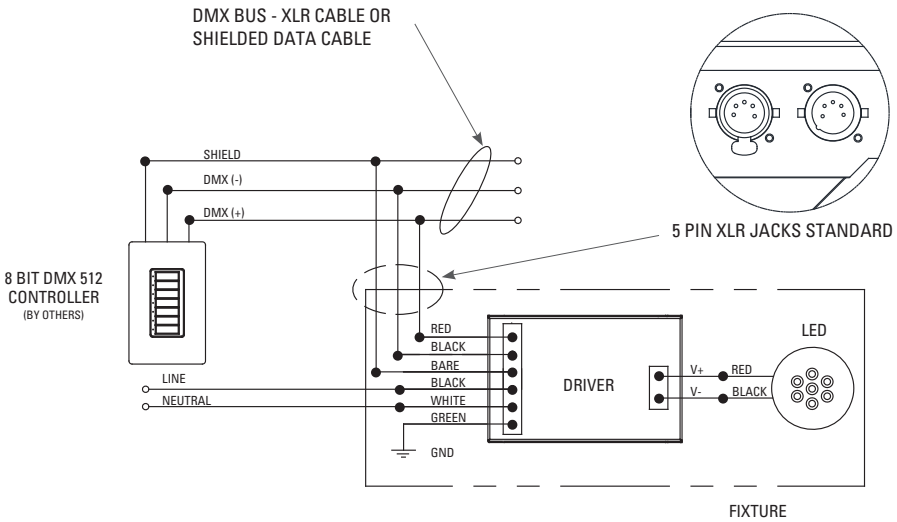
DIML8 LED: EldoLED DMX Dimming Driver Wiring (Dims down to 0.1%)

DMX BUS - XLR CABLE OR
SHIELDED DATA CABLE

The data cable used must meet the following requirements:

- type: shielded, 2-conductor twisted pair
- maximum capacitance between conductors: 30 pF/ft
- maximum capacitance between conductor and shield: 55 pF/ft
- maximum resistance: 0.02 ohms/ft
- normal impedance: 100-140 ohms
- conductive core: 24 AWG is recommended

If 3-wire data cables are preferred, we suggest a Belden 9841 or equivalent cable which meets the specifications for EIA RS-485 applications. Do not use standard microphone cables: they cannot transmit DMX512 data reliably over long distances. NOTE: DMX link termination device (by others) should be used on last fixture in line on a circuit to avoid signal loss.



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USAI Lighting

DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML9

DIMMING DRIVER WIRING SCHEMES:

NOTES:

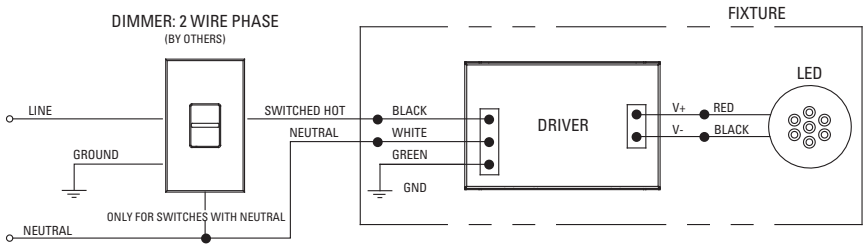
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

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5. Cap any wires not used separately (not together).

DIML9 LED: TRIAC Forward Phase Dimming Driver Wiring (Dims down to 15%) 120V Only

DIML9
2 WIRE PHASE DIMMING



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USAI Lighting

DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML10

DIMMING DRIVER WIRING SCHEMES:

NOTES:

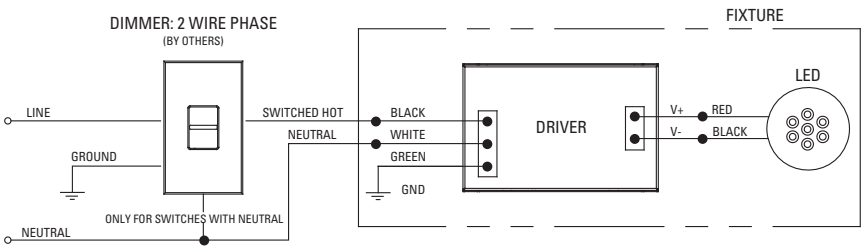
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

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2. Only qualified electricians in accordance to local codes should install these fixtures.
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4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML10 LED: ELV Reverse Phase Dimming Driver Wiring (Dims down to 15%) 120V Only

DIML10
2 WIRE PHASE DIMMING



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USAI Lighting

DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML15

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

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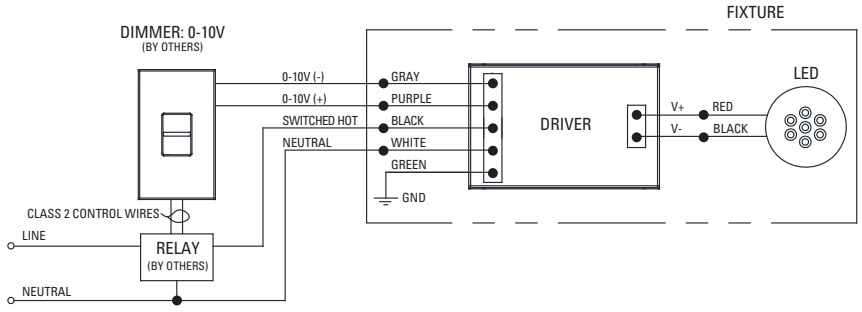
DIML15 LED: 0-10V, 347V Dimming Driver Wiring (Dims down to 1%) 347V Only

DIML15 Dimmer Compatibility Chart

Manufacturer	Product	Dimmed Light Output Range	Qty Fixtures Per Dimmer*
347			Use source current per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
Acuity	Synergy ISD-BC	100% - 1%	
Douglas Lighting	WPN-5721, WPN-5822	100% - 1%	
Hubbell	Light Hawk2 LHD-IRS3-N347-xx	100% - 1%	
Leviton	Illumatech IP710-DLZ with 347V relay	100% - 1%	
Leviton	Centura Fluorescent Control System	100% - 1%	
Lutron	Nova NFTV-* dimmer plus 347V relay	100% - 1%	
Lutron	Diva DVTV-* dimmer plus 347V relay	100% - 1%	

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML15
0-10V DIMMING W/RELAY TO SWITCH POWER



NOTE:
If switched, non-dimming operation is desired, cap off purple and gray wires individually at installation. Do NOT cap purple and gray wires together.

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Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
1011-B1-10-LSLD4-9020-M2-30KS-50-NCSM1-277-DIML6A
Notes:

Type:
RED
LAI16-104794

BeveLED® BASIC Trimless

DOWNLIGHT 1011



1" REGRESS

PROJECT INFORMATION

PROJECT _____

DATE _____

TYPE _____

BeveLED Basic Recessed Downlight - Our narrow footprint housing provides an economical architectural solution while delivering high performance with LEDs.

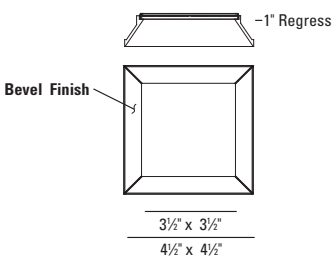
DELIVERED PERFORMANCE

BeveLED Basic DOWNLIGHT	14 Watts	20 Watts
Color Rendering Index	80+ CRI	80+ CRI
Lumens per Watt	68	60
Source Lumens	1100	1500
Delivered Lumens	**1000**	**1300**
Color Consistency	2-Step MacAdam Ellipse	

Performance based on 3000K

CCT MULTIPLIER	2700K	3000K	3500K
Color Rendering Index	80+ CRI	80+ CRI	80+ CRI
Multiplier for Lumen Output	1.00	1.00	1.08

1" Regress



HOW TO SPECIFY

Ordering Example: Specify trim code and housing code to order: Example : **1011W - B1 - S - 10 - LSLD4 - 9014 - M2 - 27KS - 30 - NCSM1 - 277V - DIML2 - CB27**

TRIM ORDERING INFORMATION

TRIM	OPTION	BEVEL STYLE	LENS	B1 BEVEL FINISH
1011	_____	–	–	–
1011 Square Trimless Downlight 1" Regress	**W** Wet location [1]	**B1** 1" Regress Bevel, Die Cast	**S** Solite (provided standard) **F** Frosted	**10** White **13** Statuary Bronze **21** Black **28** Metalized Grey **RAL** Custom Color (specify RAL #)
	[1] Wet location, use with B1 trims only.	**AB1** 1" Regress Bevel, Black Anodized Finish **AC1** 1" Regress Bevel, Clear Matte Anodized Finish	**S** Solite (provided standard) **F** Frosted	(Leave blank for AB1 and AC1 Bevel Styles)



HOUSING ORDERING INFORMATION

HOUSING CODE	WATTAGE	ENGINE CODE	COLOR	REFLECTOR	HOUSING TYPE	SELECT ONE VOLTAGE	DIMMING DRIVER OPTIONS	ACCESSORIES
LSLD4	–	–	–	–	–	–	–	–
LSLD4	**9014** 14W LED, 1000 lumens **9020** 20W LED, 1300 lumens	**M2**	**27KS** 2700K, 80+ CRI **30KS** 3000K, 80+ CRI **35KS** 3500K, 80+ CRI 2 Step MacAdam ellipse is standard for all	**30** 30° beam **50** 50° beam **80** 80° beam	**NCSM1** New Construction 5/8"- 1-1/4" Ceiling Thickness **NCSM2** New Construction 1-1/4"- 2-1/4" Ceiling Thickness **IC** Insulation-Contact Rated / Airtight [2] **CP** Chicago Plenum [2] [2] N/A with EM	**120V** **277V**	**For use with 120V or 277V** **DIML2** 0-10V dim, 10% (provided standard) **DIML4** Lutron A 3-wire/ECO, 1% **DIML6A** EldoLED 0-10V, 0.1%, logarithmic / Lutron controls **DIML6B** EldoLED 0-10V Linear, 0.1%, linear controls **DIML6E** EldoLED 0-10V, 1%, logarithmic/Lutron controls **DIML6F** EldoLED 0-10V, 1%, linear controls **DIML7** EldoLED DALI, 0.1%	**CB27** 27" C-Channel Bars **CB52** 52" C-Channel Bars **EML** Emergency battery [3] **EMLW** Emergency battery, wet location [3] **MLXX** - Millwork Adapter [4] └XX=Specify Color (10, 13, 21, 28, RAL) Millwork not wet listed
						120V	**For use with 120V only** **DIML3** Lutron A 2-wire, 1% 120V only **DIML9** TRIAC 2-wire, 15% 120V only **DIML19** Phase 2-wire dimming, 1% 120V only	[3] NCSM housings require above ceiling access. Not for use with IC or CP housings. [4] N/A with NCSM1 housing

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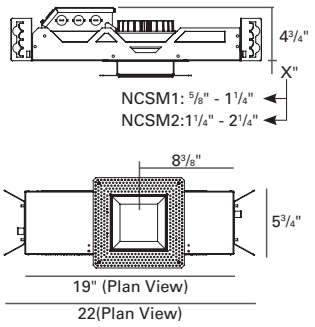
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** 1011-B1-10-LSLD4-9020-M2-30KS-50-NCSM1-277-DIML6A Notes:	**Type:** **RED** LAI16-104794

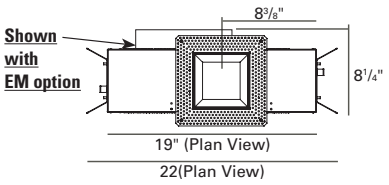
BeveLED® BASIC Trimless

DOWNLIGHT 1011

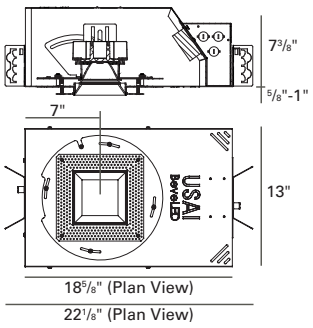
HOUSING INFORMATION

New Construction Narrow Width - NCSM





IC / Airtight - IC
Chicago Plenum - CP



SPECIFICATIONS

TRIM: 4-1/2" square aperture with a 1" regressed bevel, retained by four mounting clips. Die cast aluminum bevel is available in white, statuary bronze, black, and metalized grey finishes. Also available in black anodized or clear matte anodized bevel. Custom color available (provide RAL#).

TRIM LENS: Trim is shipped with integral solite lens standard; frosted lens available as an option.

REFLECTOR: Interchangeable precision injection molded specular polycarbonate reflector optimized for 30°, 50° or 80° beam distribution.

FIELD REPLACEABLE LIGHT ENGINE: Available in 2 lumen packages: 14W (1000 delivered lumens) and 20W (1300 delivered lumens). Engine is field replaceable through the aperture without tools.

COLOR: BeveLED is available in 3 color temperatures (2700K, 3000K, 3500K). All color options are tightly binned for fixture-to-fixture color consistency within a 2-Step MacAdam Ellipse. 80+ color rendering index provided standard.

RATED LIFE: Based on IESNA LM80-2008 50,000 hours at 70% lumen maintenance (L70).

THERMAL MANAGEMENT: Proprietary high performance aluminum die cast heatsink for maximum LED life. Ambient temperatures at fixture location should not exceed 40°C during normal operation.

FIELD REPLACEABLE DRIVER: 0-10V, 100%-10% solid state electronic constant current driver with a high power factor provided standard and sources 2mA. Specify 120V or 277V. Driver complies with IEEE C62.41 surge protection.

DIMMING OPTIONS: Multiple dimming drivers available. See compatibility chart attached. Some on-time delay may be experienced depending on control system used. Note: DIML6A and DIML6E logarithmic control are intended for use with Lutron control systems; DIML6B and DIML6F linear control are intended for use with non-Lutron controls. DIML6 drivers source 2mA.

EMERGENCY: Emergency lighting battery pack is provided with remote test switch and require above ceiling access for service. EM option is not available with IC or CP housings.

MOUNTING: Butterfly brackets and adjustable nailer bars with integral nails provided. Nailer bars are extendible from 14" to 24" centers.

HOUSING: Fabricated of 20 ga. galvanized steel with thru wire J-box, 4 in 4 out at min. 90°C, #12 AWG thru branch circuit wiring. IC rated housing is rated for direct contact with insulation. All-Ways Square® (covered by US Pat. No: US 7,832,889) housing allows alignment of square aperture (up to 20° rotation) after housing installation and prior to finish ceiling installation.

MAXIMUM CEILING THICKNESS: As per drawings above. ML option is for 1" max thickness wood with IC housing and for 2-1/4" max thickness wood with NCSM2 housing. Millwork option is not available with NCSM1 housing.

CEILING CUT OUT: 5-1/16" x 5-1/16"
Millwork: 4-13/16" x 4-13/16"

LISTINGS: Dry/Damp. Wet location option available with B1 trim only. Millwork Dry/Damp only. NRTL/CSA-US tested to UL standards. IBEW union made. Energy Star Qualified under Luminaires Specification V2.0. Please see Energy Star website for exact model #s included in the listing. Please note that only B1-S-10 trims, 30° and 50° optics, and DIML2 dimming drivers are Energy Star Qualified.

WARRANTY: 5 years

NOTES:
- Not for use in corrosive environment.
- Use of pressure washer voids warranty.
- Trimless for drywall installation only.

PHOTOMETRICS: Consult factory or website for IES files. Tested in accordance with IESNA LM79-2008.

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Revised 08/02/2016

Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** 1011-B1-10-LSLD4-9020-M2-30KS-50-NCSM1-277-DIML6A Notes:	**Type:** **RED** LAI16-104794

USAI Lighting

DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML2

DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

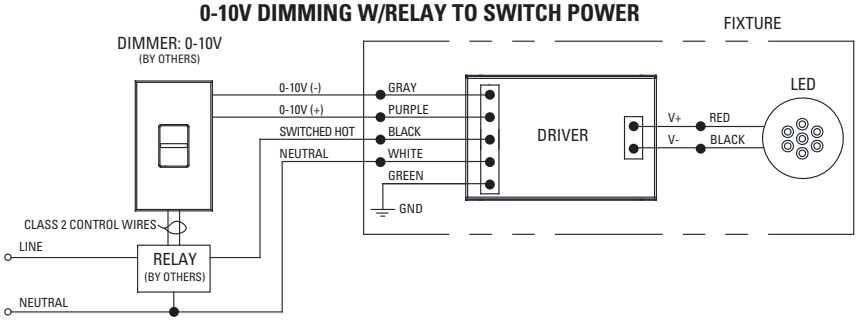
DIML2 LED: 0-10V Dimming Driver Wiring (Dims down to 10%)

DIML2 Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Dimmer*
120V / 277V				Use source current per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
Crestron	iLux dimmer expansion module	CLS-EXP-DIMFLV	100% - 10%	
Crestron	DIN Rail dimmer	DIN-4DIMFLV4	100% - 10%	
Crestron	DIN Rail analog output module	DIN-A08	100% - 10%	
Crestron	8 Channel dimmer module	GLX-DIMFLV8	100% - 10%	
Crestron	8 Channel dimmer module	GLXP-DIMFLV8	100% - 10%	
Leviton	IllumaTech dimmer	IP710-DLX	100% - 10%	
Lightolier (Philips)	Vega	V2000FAMU	100% - 10%	
Lutron	Diva	DVTV-XX	100% - 10%	

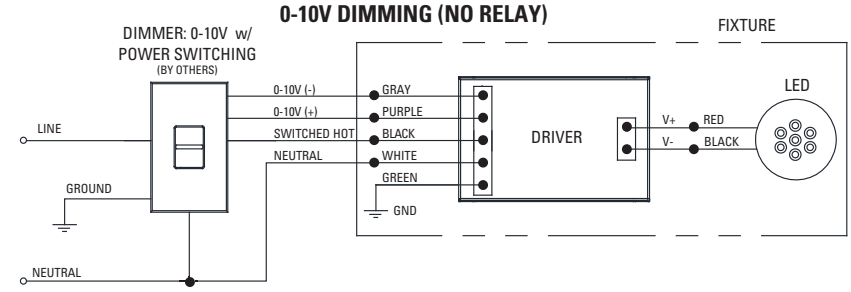
* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML2
0-10V DIMMING W/RELAY TO SWITCH POWER



NOTE:
If switched, non-dimming operation is desired, cap off purple and gray wires individually at installation. Do NOT cap purple and gray wires together.

DIML2
0-10V DIMMING (NO RELAY)



NOTE:
If switched, non-dimming operation is desired, cap off purple and gray wires individually at installation. Do NOT cap purple and gray wires together.

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** 1011-B1-10-LSLD4-9020-M2-30KS-50-NCSM1-277-DIML6A Notes:	**Type:** **RED** LAI16-104794

USAI Lighting

DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML3

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

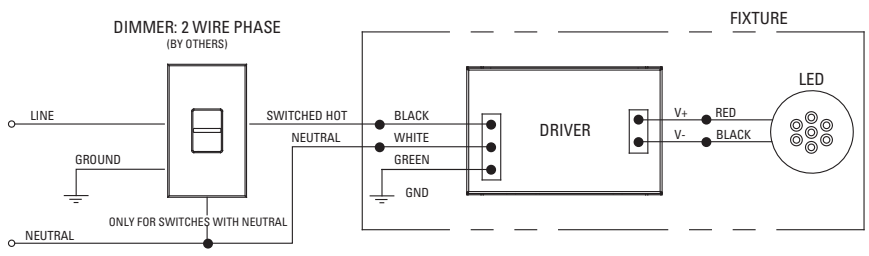
DIML3 LED: Lutron Hi-Lume A-Series 2 Wire Fwd Phase (with neutral) / LED Dimming Driver Wiring (Dims down to 1%) 120V only.

DIML3 Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Dimmer* Fixture Wattage	
120V Only				39W and Less	40W - 80W
ETC	Sensor+ Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
ETC	Unison DRd Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
Lutron	Maestro Wireless® 600W dimmer	MRF2-6ND-120-	100% - 1%	1 – 8	1 – 4
Lutron	Maestro Wireless® 1000W dimmer	MRF2-10ND-120-	100% - 1%	1 – 13	1 – 6
Lutron	HomeWorks® QS adaptive dimmer	HQRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 600W dimmer	HQRD-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 1000 W dimmer	HQRD-10ND-	100% - 1%	1 – 13	1 – 6
Lutron	Caseta Wireless® Pro 1000W dimmer	PD-10NXD-	100% - 1%	1 – 13	1 – 6
Lutron	Stanza® dimmer	SZ-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 adaptive dimmer	RRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 1000 W dimmer	RRD-10ND-	100% - 1%	1 – 6	1 – 3
Lutron	myRoom DIN power module	MQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® QS wallbox power module	HQRJ-WPM-6D-120-	100% - 1%	1 – 26	1 – 13
Lutron	Homeworks® DIN power module	LQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® wallbox power module	HWI-WPM-6D-120	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® QS control unit	QSGR-, QSGRJ-	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® 3000 control unit	GRX-3100-, GRX-3500-	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4U module	HW-RPM-4U-120, LP-RPM-4U-120	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4A module	HW-RPM-4A-120, LP-RPM-4A-120	100% - 1%	1 – 26	1 – 13
Lutron	GP dimming panels	Various	100% - 1%	1 – 26	1 – 13
Lutron	Ariadni CL 250W dimmer	AYCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Diva CL 250W dimmer	DVCL-253P-, DVSCCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Grafik T CL or RF CL dimmer	GT-250M-, GTJ-250M-	100%-1%	1 – 8	1 – 4
Lutron	Nova T CL 250W dimmer	NTCL-250-	100%-1%	1 – 10	1 – 5

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML3
2 WIRE PHASE DIMMING



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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML4

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML4 LED: Lutron Hi-Lume A-Series LED Driver with 3-Wire FL Control / LED Dimming Driver Wiring (Dims down to 1%)

DIML4 3-Wire Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V Only				39W and Less	40W - 80W
ETC	Sensor+ Cabinet	D20 Dimming module	100% - 1%	1–53	1–26
ETC	Unison DRd Cabinet	D20F Dimming module	100% - 1%	1–53	1–26
Lutron	Nova T	NTF-10-	100%–1%	1–41	1 – 20
Lutron	Nova T	NTF-103P-	100%–1%	1–20	1 – 10
Lutron	Nova	NF-10-	100%–1%	1–41	1 – 20
Lutron	Nova	NF-103P-	100%–1%	1–20	1 – 10
Lutron	Vareo	VF-10-	100%–1%	1–20	1 – 10
Lutron	Skylark	SF-10P-, SF-103P-	100%–1%	1–20	1 – 10
Lutron	Diva	DVF-103P-, DVSCF-103P-	100%–1%	1–20	1 – 10
Lutron	Ariadni	AYF-103P-	100%–1%	1–20	1 – 10
Lutron	Vierti	VTF-6A-	100%–1%	1–15	1 – 7
Lutron	Maestro	MAF-6AM-, MSCF-6AM-	100%–1%	1–15	1 – 7
Lutron	Maestro Wireless	MRF2-F6AN-DV-	100%–1%	1–15	1 – 7
Lutron	RadioRA 2	RRD-F6AN-DV-	100%–1%	1–15	1 – 7
Lutron	HomeWorks QS	HQRD-F6AN-DV	100%–1%	1–15	1 – 7
Lutron	Interfaces	PHPM-3F-120, PHPM-3F-DV	100%–1%	1–41	1 – 20
Lutron	GP Dimming Panels	Various	100%–1%	1–41	1 – 20
277V Only				40W and Less	41W - 80W
ETC	Sensor+ Cabinet	D20 Dimming module	100% - 1%	1–53	1–26
ETC	Unison DRd Cabinet	D20F Dimming module	100% - 1%	1–53	1–26
Lutron	Nova T	NTF-10-277-	100%–1%	1–44	1 – 22
Lutron	Nova T	NTF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Nova	NF-10-277-	100%–1%	1–44	1 – 22
Lutron	Nova	NF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Skylark	SF-12P-277-, SF-12P-277-3	100%–1%	1–33	1 – 16
Lutron	Diva	DVF-103P-277-, DVSCF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Ariadni	AYF-103P-277-	100%–1%	1–44	1 – 22
Lutron	Vierti	VTF-6A-	100%–1%	1–33	1 – 16
Lutron	Maestro	MAF-6AM-277-, MSCF-6AM-277-	100%–1%	1–20	1 – 10
Lutron	Maestro Wireless	MRF2-F6AN-DV-	100%–1%	1–33	1 – 16
Lutron	RadioRA 2	RRD-F6AN-DV-	100%–1%	1–33	1 – 16
Lutron	HomeWorks QS	HQRD-F6AN-DV	100%–1%	1–33	1 – 16
Lutron	Interfaces	PHPM-3F-DV	100%–1%	1–88	1 – 44
Lutron	GP Dimming Panels	Various	100%–1%	1–88	1 – 44

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML4 wiring diagrams continued on next page

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
DIML4 Continued

DIMMING DRIVER WIRING SCHEMES:

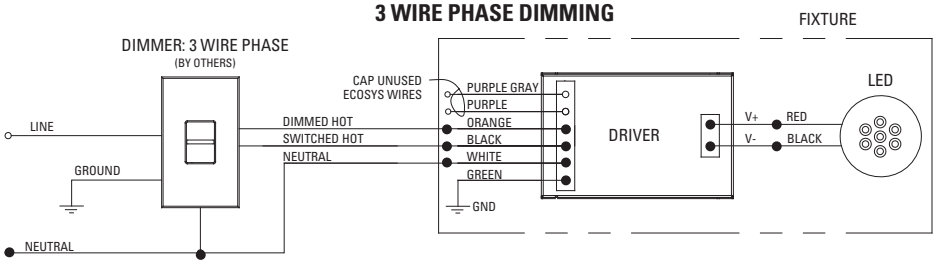
NOTES:
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IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML4 LED: Lutron Hi-Lume A-Series LED Driver with 3-Wire FL Control / LED Dimming Driver Wiring (Dims down to 1%)

DIML4
3 WIRE PHASE DIMMING



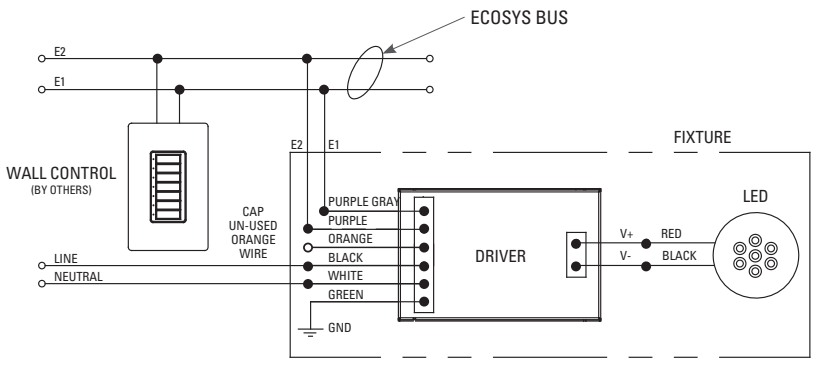
DIML4 LED: Lutron Hi-Lume A-Series LED Driver with EcoSystem Control / LED Dimming Driver Wiring (Dims down to 1%)

DIML4 EcoSystem Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V / 277V				39W and Less	40W - 80W
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	100%–1%	1–32	1–16
Lutron	Energi Savr Node	QSN-1ECO-S, QSN-2ECO-S	100%–1%	1–64	1–32
Lutron	GRAFIK Eye QS (120V ONLY)	QSGRJ- E, QSGR- E	100%–1%	1–64	1–32
Lutron	Quantum	Various	100%–1%	1–64	1–32

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML4
EcoSystem CONTROLS



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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** 1011-B1-10-LSLD4-9020-M2-30KS-50-NCSM1-277-DIML6A Notes:	**Type:** **RED** LAI16-104794

USAI Lighting

DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
DIML6A, 6E
DIML6B, 6F

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
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3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML6A and DIML6E LED Dimming Compatibility Table

DIML6A and DIML6E are linearly programmed dimming drivers for use with logarithmic-style dimming controls (e.g., Lutron and others listed in the table below)
DIML6A = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1%
DIML6E = EldoLED ECOdrive 0-10V control dims from 100% to 1%

DIML6A and DIML6E Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range			Qty Fixtures Per Dimmer*
120V & 277V			DIML6A		6E	Refer to manufacturer's
Lutron	Diva	DVTV/NFTV/NTFTV with PP-20	99% -	0.1%	1%	dimmer load rating for
Lutron	Energi Savr Node	QSN-4T16-S	100% -	0.1%	1%	maximum and minimum
Lutron	GP Dimming Panels	TVM2 Module	99% -	0.1%	1%	fixture quantities per
Lutron	Interfaces	GRX-TVI w/ GRX3503	100% -	0.1%	1%	dimmer.
Sensor Switch	nIO	nIO EZ	100% -	0.1%	1%	Enlighted compatible.
enlighted	Control Unit	CU-3E-1R	100% -	0.1%	1%	

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML6B and DIML6F LED Dimming Compatibility Table

DIML6B and DIML6F are logarithmic-programmed dimming drivers for use with linear-style dimming controls (e.g., Crestron, non-Lutron and others listed in the table below)
DIML6B = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1%
DIML6F = EldoLED ECOdrive 0-10V control dims from 100% to 1%

DIML6B and DIML6F Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range			Qty Fixtures Per Dimmer*
120V & 277V			DIML6B		6F	Refer to
Bush-Jaeger	Electronic potentiometer	2112U-101	100% -	0.1%	1%	manufacturer's
Jung	Electronic potentiometer	240-10	100% -	0.1%	1%	dimmer load
Leviton	IllumaTech dimmer	IP710-DLX	100% -	0.1%	1%	rating for
Lightolier (Philips)	Momentum (120V ONLY)	ZP600FAM120	100% -	0.1%	1%	maximum and
Merten	Electronic potentiometer	5729	100% -	0.1%	1%	minimum fixture
Pass & Seymour	Titan	CD4FB-W	100% -	0.1%	1%	quantities per
Watt Stopper	Miro	DCLV1	100% -	0.1%	1%	dimmer.
Synergy	Wallbox Dimmers	ISD BC	100% -	0.1%	1%	Enlighted
ABB	i-bus	SD/S 2.16.1	100% -	0.1%	1%	compatible.
Crestron	Modules	GLX-DIMFLV8, GLXP-DIMFLV8	100% -	0.1%	1%	
Crestron	Green Light	GLPAC-DIMFLV4-, GLPAC-DIMFLV8-	100% -	0.1%	1%	
Crestron	Green Light Power Pack	GLPP-DIMFLVEX-PM, GLPP-1DIMFLV2EX-PM, GLPP-1DIMFLV3EX-PM	100% -	0.1%	1%	
Crestron	DIN Rail Analog Output Module	DIN-A08	100% -	0.1%	1%	
Crestron	DIN Rail 0-10V Fluorescent Dimmer	DIN-4DIMFLV4	100% -	0.1%	1%	
Crestron	iLux 0-10V Dimmer Expansion Module	CLS-EXP-DIMFLV	100% -	0.1%	1%	
enlighted	Control Unit	CU-3E-1R	100% -	0.1%	1%	

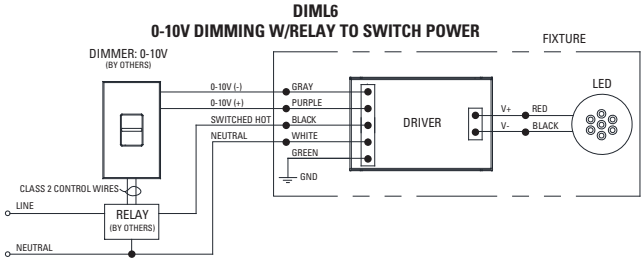
* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIMMING DRIVER WIRING SCHEMES:

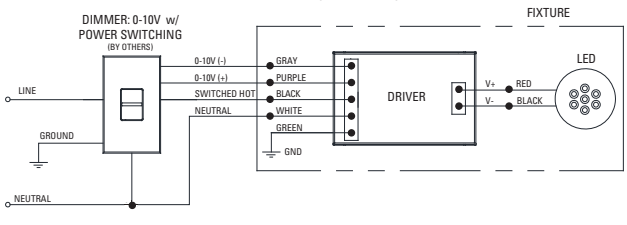
NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

DIML6
0-10V DIMMING W/RELAY TO SWITCH POWER



DIML6
0-10V DIMMING (NO RELAY)



USAI Lighting
1126 River Road
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F 845–561–1130

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I2-264-6 Revised 08/19/2016

Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** 1011-B1-10-LSLD4-9020-M2-30KS-50-NCSM1-277-DIML6A Notes:	**Type:** **RED** LAI16-104794

USAI Lighting

DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML7

DIMMING DRIVER WIRING SCHEMES:

NOTES:

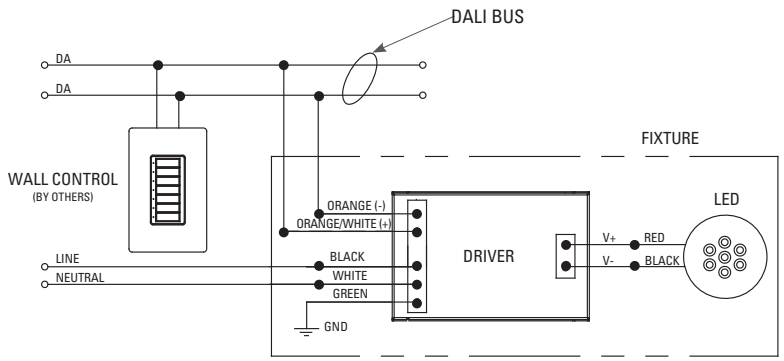
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML7 LED: EldoLED DALI Dimming Driver Wiring (Dims down to 0.1%)

DIML7
DALI CONTROLS



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LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** 1011-B1-10-LSLD4-9020-M2-30KS-50-NCSM1-277-DIML6A Notes:	**Type:** **RED** LAI16-104794

USAI Lighting

DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML9

DIMMING DRIVER WIRING SCHEMES:

NOTES:

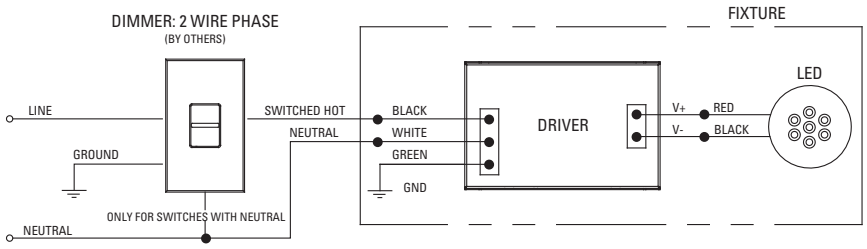
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML9 LED: TRIAC Forward Phase Dimming Driver Wiring (Dims down to 15%) 120V Only

DIML9
2 WIRE PHASE DIMMING



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I2-264-9 Revised 02/15/2016

Submitted by LIGHTING ASSOCIATES, INC.		
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** 1011-B1-10-LSLD4-9020-M2-30KS-50-NCSM1-277-DIML6A Notes:
		Type: **RED** LAI16-104794

USAI Lighting

DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML19

DIMMING DRIVER WIRING SCHEMES:

NOTES:

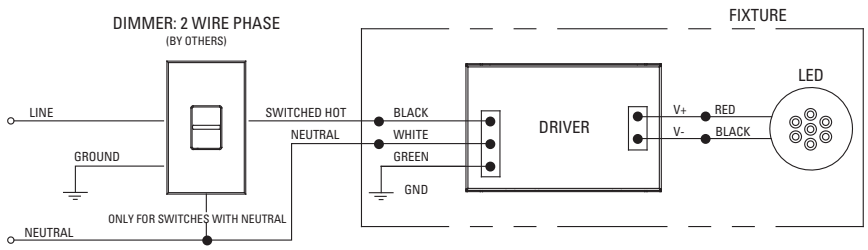
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML19 LED: Hatch XTC series or equivalent - Forward and Reverse Phase Dimming Driver. Dims down to 1% contingent upon dimmer specification and load. 120V only.

DIML19
2 WIRE PHASE DIMMING



DIML19 Dimmer Compatibility Chart

120V ONLY		
Forward Phase / TRIAC Dimming		
Manufacturer	Product	Qty Fixtures Per Dimmer
Leviton	IPL06-10Z	Use fixture wattage per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
	6613-xxx	
Lutron	S-600P	
	S-603P	
	DV-600P	
	DV-603P	
	DVSC-603P	
	CT-600P	
	CT-603P	

120V ONLY		
Reverse Phase / ELV Dimming		
Manufacturer	Product	Qty Fixtures Per Dimmer
Leviton	6615	Use fixture wattage per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
	IPE04-xxx	
Lutron	NTELV-300	
	NTELV-600	
	SELV-300P	
	SELV-303P	
	DVELV-300P	
	DVELV-303P	

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I2-264-19 Revised 07/29/2016

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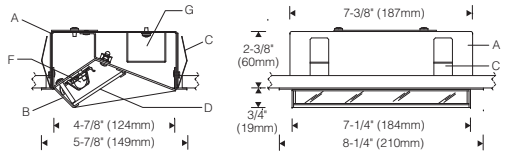
Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
S-222-M007-L(9/16" TEGULAR TILE)-02-M-0-30-ZX
Notes:

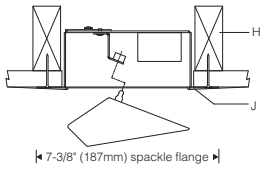
Type:
RF
LAI16-104794

Lighting the Wall
Low profile semi-recessed, integral driver — Solid State (LED) — **Style S222**

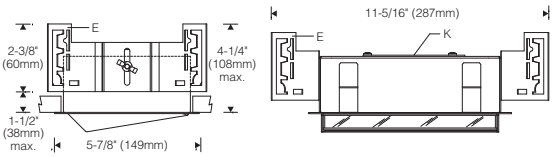
T Mount: Non-accessible Ceiling 1:8 Scale



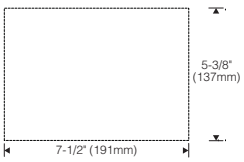
P Mount: Non-accessible Ceiling 1:8 Scale

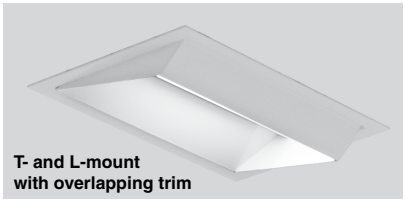


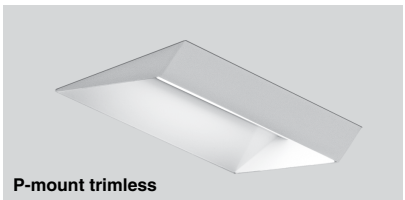
L Mount: Accessible Grid Ceiling 1:8 Scale



Rough Opening




T- and L-mount with overlapping trim


P-mount trimless

Specifications

A Aluminum back box/ trim frame
B Removable aluminum heat sink/housing
C Stainless steel mounting springs (4 included)
D Acrylic lens with elliptical diffusion
E Universal mounting brackets (**L** mount)
F Field serviceable light engine with **fraqtir**™ asymmetric optic
G Integral constant current driver
H Supplemental framing/support (by others)
J Skim coat of plaster
K Wiring access plate

Optical Assembly:
Formed aluminum housing, back box and trim frame; stainless steel hardware and spring mounting clips. Extruded aluminum heat sink, light engine with precision molded asymmetric light bar of high temperature, water-clear acrylic. Light engine may be removed for service or upgrade. Acrylic lens with elliptical diffusion maximizes lateral distribution without disturbing asymmetric forward throw.

Finish:
Housing, back box and trim frame finished in choice of matte or semigloss white. Painted surfaces – 6 stage pretreatment and electrostatically applied thermoset polyester powder coating for a durable abrasion, fade and corrosion resistant finish.

Electrical:
Use 90°C wire for supply connections. Integral electronic HPF constant current driver with quick connector. For complete driver specifications, see website, reference document MA-1303. Access plate on top of back box with two 1/2" knockouts for supply wiring. Internal splice compartment allows for access to splices below ceiling.

12/15 **U.S. Patent 8,465,190; foreign patents pending**

Mounting:
Luminaire installs from below finished ceiling – up to 1-1/2" (38mm) thick.

T mount provided with overlapping trim and spring clips for gypsum board/inaccessible ceilings.

L mount provided with overlapping trim and adjustable brackets for T-bar grid/accessible ceilings. Supplemental support wires, bar hangers, etc. (by others) required for accessible ceilings.

P mount (trimless) provided with perforated spackle flange for gypsum board/inaccessible ceilings. Supplemental framing and/or support required (by others).

Standard: UL listed or CSA certified for dry locations. Suitable for insulated ceilings (Type IC). 5 year warranty, maximum ambient temperature 45°C (113°F).

DLC for interior wall washing only.

LUMILEDS The Brighter Choice

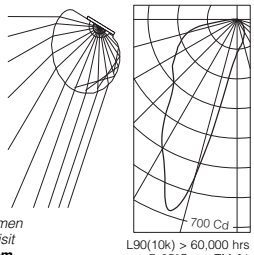
Features

- *Low profile – minimal silhouette focuses attention on the luminous wall, not the luminaire*
- *Shallow recessed depth – fits under ducts at core walls*
- *17W input, output equivalent to 100W tungsten halogen*
- *Wide lateral distribution allows greater on-center spacing*

SW 9.0

Performance

fraqtir *technology uses a combination of refraction and total internal reflection, creating a distribution of light ideal for illuminating surfaces uniformly. Glare is minimized while light delivered to the target is maximized, resulting in high application efficiency.*



L90(10k) > 60,000 hrs @ 25°C per TM-21

For photometric and lumen maintenance reports, visit ***thelightingquotient.com***

elliptipar with fraqtir™ LED

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
S-222-M007-L(9/16" TEGULAR TILE)-02-M-0-30-ZX
Notes:

Type:
RF
LAI16-104794

To Order — Style S222

To form a Catalog Number

S 2 2 2 - ____ - __ - ____ - __ - ____ - __ - ____ - ____
1 2 3 4 5 6 7 8 9 10

Project:

Type:

1 Source
S = Solid state (LED)

2 Style
222 = Low profile semi-recessed 6" x 8", integral driver

3 Drive Current/Light Output
L007 = 7 LEDs @ 350mA (481 lumens, 9W)
M007 = 7 LEDs @ 700mA (877 lumens, 17W)
Based on 3000K/80+ CRI. **Click here** for scaled performance table.
Note: J and K codes are discontinued.

4 Mounting
T = Overlapping flange with spring clips for gypsum board ceiling
L = Overlapping flange with adjustable mounting brackets for accessible ceiling
P = Perforated plaster flange (trimless) for gypsum board ceiling

5 Finish
SW 9.1
02 = Semigloss white
22 = Matte white
99 = Custom RAL or computer matched color to be specified; consult sales representative

6 Voltage/Driver
Electronic Driver	*Electronic Dimming Driver**
8 = 120-277V	**M** = 120-277V

**Dimming range refers to % power input, % light output will vary.
Refer to Driver Information document MA-1303

7 Option
00 = No options
0B = Vertical blade baffle, 25° shielding, matte gray, indoor use
0C = Modified to comply with Chicago plenum code
0M = For use in MRI medical facility (**T** mount only). MRI filters (by others) required on output of each remote driver. Consult factory prior to specification.
XX = For modification not listed, include detailed description. Consult factory prior to specification.

8 Destination Requirement
0 = UL listed or CSA certified for U.S.
J = UL listed or CSA certified for Canada

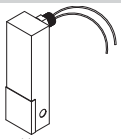
9 Color Temperature
27 = 2700K, 80+ CRI
30 = 3000K, 80+ CRI
35 = 3500K, 80+ CRI
40 = 4000K, 80+ CRI
2H = 2700K, 90+ CRI
3H = 3000K, 90+ CRI
4L = 4000K, 70+ CRI
Note: Additional CCT and CRI options are available; consult factory.

10 Dimming**
00 = Non-dimming
TE = LighTech 120-277V input, dimming range 100-10%, line voltage trailing edge/reverse phase/ELV dimming (controls by others)
ZX = 0-10V analog dimming 120-277V input, dimming range 100%-5%, 0-10V controls by others
EL = eldoLED SOLOdrive 120-277V input, dimming range 100%-0.1%, 0-10V controls by others. Operates up to 4 luminaires; consult factory to specify.
Note: EL is **not** suitable for MRI use (**0M** option).
L3 = Lutron A-Series 120-277V input, dimming range 100%-1%, Lutron EcoBus dimming (controls by others)
LH = Lutron A-Series 120-277V input, dimming range 100%-1%, Lutron 3-wire dimming (controls by others)
**Dimming range refers to % power input, % light output will vary.
Refer to Driver Information document MA-1303

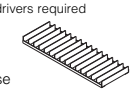
Example
S222-M007-T-02-M-00-0-30-ZX

Low profile indoor LED, wall wash luminaire, formed aluminum housing and trim frame. Semigloss white. **fraqtir** light engine with (7) LEDs. Integral 120-277V, 700mA analog dimming driver compatible with 0-10V dimming controls by others, dims to 5% power (@120V), UL listed or CSA certified for U.S., Type IC, dry location. 3000K/80+ CRI.

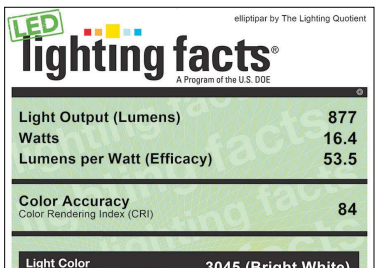
Accessories
Order separately. See Accessories Section for specifications.



AMR02050 = Accessory Magnetic Resonance imaging filter. 2 conductor up to 5 amps, attenuation > 100dB (5MHz to 10GHz)
Note: one filter required per remote driver – consult factory for number of drivers required per luminaire.



AEJV2000 = Vertical blade **baffle** for 8" S222, 25° shielding, matte gray finish, indoor use



700 mA (3000K) output shown above

12/15

elliptipar with fraqtir™ LED

elliptipar *from* **The Lighting Quotient**
114 Boston Post Road, West Haven, Connecticut 06516, USA
Voice 203.931.4455 • Fax 203.931.4464 • **thelightingquotient.com**

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** (1) CSEDI-22-67L35K-DCC-DV-5F-2H (2) EQ-CLIPS Notes:	**Type:** **RG** LAI16-104794

PROJECT INFORMATION

Job Name _____

Fixture Type _____

Catalog Number _____

Approved by _____

SIMPLESEAL™

CSEDI SERIES – LED – INSET DOOR

PRODUCT FEATURES:

- High-output, high-CRI LED lamp sources for accurate color rendition and lighting performance
- Diffused high-efficiency lens for reduced glare
- Recessed ceiling mount; grid or flange - 1'×4' (30.48cm×121.92cm), 2'×2' (60.96cm×60.96cm), 2'×4' (60.96cm×121.92cm)
- Suitable for universal installation into 1.0" (2.54cm) and 1.5" (3.81cm) grid or flange (drywall) ceilings
- One piece inset doorframe, secured to housing with aircraft cables.



1'×4' 2'×2' 2'×4'

SPECIFICATIONS

HOUSING: 20-gauge CRS. Hole-free, one-piece, seam-welded construction. Integral aluminum heat sink for thermal dissipation. 18-gauge housing flange with mitered and welded corners. White TGIC polyester powder coat finish – 5-step pre-treatment. Salt spray test: 1,000 hours; Reflectance: 92%.

DOORFRAME: 18-gauge CRS. One-piece inset-style construction with welded corners. Gloss white TGIC polyester powder coat finish with 5-stage pre-treatment. Doorframe secured to housing with stainless steel aircraft cables and captive, flush-mounted Phillips-head fasteners. Closed-cell silicone gasket seals doorframe to housing.

OPTICS: Symmetric optic includes diffused, impact-resistant acrylic lens.

ELECTRICAL: Available 3500K, 4000K and 5000K color temperatures. 120-277VAC, 50/60Hz electrical input with serviceable high power factor electronic, constant-current driver (<20% THD, >0.95 PF). Standard 0-10V dimming with 3-100% range.

INSTALLATION: Non-IC recessed ceiling mounting into grid and flange application types. Flange installation utilizes included adjustable swing-out mounting brackets. Grid installation suitable for 1" (2.54cm) and 1.5" (3.81cm) T-bar ceilings. Universal installation into grid or flange (drywall) ceiling applications. See Options for continuous row mounting and install frames.

PHOTOMETRICS: Photometry tested to the IESNA LM-79-08 standard. For additional photometric data, please go to www.kenall.com

WARRANTY: Limited five (5) year warranty.

LISTINGS: Luminaire is certified to UL standards by Intertek Testing Laboratories for Wet Location. Certified IP65 per IEC 60598. NSF2 Splash/Non-Food Zone. CCEA Approved. Meets K230 Leakage Standard for luminaire leakage in pressurized environments and FED-STD-209E/Class 100 (ISO 5) Cleanrooms.

LED · ETL · IP65 · NSF · K230 · ISO 5 Class 100 · CCEA Approved

In Stock SKU
CSEDI-24-90L40K-DCC-DV-5F-2H-SYM

ORDERING INFORMATION (Ex: CSEDI-24-67L40K-DCC-DV-2F-2H-SYM)

Model	Size	Lamp Type	Driver	Voltage	Doorframe	Housing	Optics	Options
CSEDI			**DCC**	**DV**			**SYM**	

Size

14	1'×4' (30.48cm×121.92cm)
22	2'×2' (60.96cm×60.96cm)
24	2'×4' (60.96cm×121.92cm)

Lamp Type

1'×4' (30.48cm×121.92cm)

45L35K▼	45 Watt 3500K LED (82 CRI)
45L40K▼	45 Watt 4000K LED (82 CRI)
45L50K▼	45 Watt 5000K LED (82 CRI)
67L35K	67 Watt 3500K LED (82 CRI)
67L40K	67 Watt 4000K LED (82 CRI)
67L50K	67 Watt 5000K LED (82 CRI)
90L35K	90 Watt 3500K LED (82 CRI)
90L40K	90 Watt 4000K LED (82 CRI)
90L50K	90 Watt 5000K LED (82 CRI)

2'×2' (60.96cm×60.96cm)

45L35K▼	45 Watt 3500K LED (82 CRI)
45L40K▼	45 Watt 4000K LED (82 CRI)
45L50K▼	45 Watt 5000K LED (82 CRI)
67L35K	67 Watt 3500K LED (82 CRI)
67L40K	67 Watt 4000K LED (82 CRI)
67L50K	67 Watt 5000K LED (82 CRI)
90L35K	90 Watt 3500K LED (82 CRI)
90L40K	90 Watt 4000K LED (82 CRI)
90L50K	90 Watt 5000K LED (82 CRI)

2'×4' (60.96cm×121.92cm)

45L35K▼	45 Watt 3500K LED (82 CRI)
45L40K▼	45 Watt 4000K LED (82 CRI)
45L50K▼	45 Watt 5000K LED (82 CRI)
67L35K	67 Watt 3500K LED (82 CRI)
67L40K	67 Watt 4000K LED (82 CRI)
67L50K	67 Watt 5000K LED (82 CRI)
90L35K	90 Watt 3500K LED (82 CRI)
90L40K	90 Watt 4000K LED (82 CRI)
90L50K	90 Watt 5000K LED (82 CRI)
135L35K	135 Watt 3500K LED (82 CRI)
135L40K	135 Watt 4000K LED (82 CRI)
135L50K	135 Watt 5000K LED (82 CRI)
180L35K	180 Watt 3500K LED (82 CRI)
180L40K	180 Watt 4000K LED (82 CRI)
180L50K	180 Watt 5000K LED (82 CRI)

Driver Type

DCC	Dimming Constant Current

Voltage

DV	120/277VAC, 50/60Hz
120	120VAC
277	277VAC
347	347VAC

Doorframe Options

5F	20-Ga Type 304 SS Brushed
2F	18-Ga CRS (STD)
AF	Anodized Aluminum
PAF	Painted Fabricated Aluminum

Housing Options

2H	20-Ga CRS (STD)
5H	20-Ga Type 304 SS
PAH	.050" (.13cm) Painted Aluminum

Optics

SYM	Symmetric, Diffused DR Acrylic

Options

LEL‡	Emergency Battery Pack (not available with DV Voltage option)
10KV	10KV/KA Surge Protection per IEEE/ANSI C62.41 Cat. A
AMF▲	Antimicrobial Finish
FS	Fuse & Holder
HJ	Sealed Wireway
IF*†	Install Frame
RF•	Radio Frequency Filter
RM†	Continuous Row Mounting
2C	Two Circuit Wiring

EQ CLIPS

* Add .375" (.95cm) to ceiling cut out dimensions
† Only available when installed in drywall ceilings (flange mount)
• Voltage specific selection required
‡ Height of fixture is 5.875" with LEL Option
▲ Applied only to exposed painted surfaces of luminaire (not available on stainless steel doorframes)
▼ n/a with 2C Option

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** (1) CSEDI-22-67L35K-DCC-DV-5F-2H (2) EQ-CLIPS Notes:	**Type:** **RG** LAI16-104794

For additional photometry, go to www.kenall.com

SIMPLESEAL™

CSEDI SERIES – TECHNICAL DATA

PERFORMANCE

Model	Lamp Type	Initial Delivered Lumens @ 25°C	Efficacy (lm/W)	Input Power (W)	Drive Current (mA)	Estd. L_{70} LED Life (Hrs)
CSEDI14	45L35K	4388	88	50	94	80,000
	45L40K	4678	94	50	94	80,000
	45L50K	4865	97	50	94	80,000
	67L35K	6290	85	74	66	80,000
	67L40K	6706	91	74	66	80,000
	67L50K	6974	95	74	66	80,000
	90L35K	8510	86	99	94	60,000
	90L40K	9072	92	99	94	60,000
	90L50K	9435	95	99	94	60,000
CSEDI22	45L35K	4358	87	50	94	80,000
	45L40K	4647	93	50	94	80,000
	45L50K	4833	97	50	94	80,000
	67L35K	6247	84	74	66	80,000
	67L40K	6660	90	74	66	80,000
	67L50K	6927	93	74	66	80,000
	90L35K	9042	91	99	94	60,000
	90L40K	9640	97	99	94	60,000
	90L50K	10026	101	99	94	60,000
CSEDI24	45L35K	4799	99	48	94	80,000
	45L40K	5116	106	48	94	80,000
	45L50K	5321	110	48	94	80,000
	67L35K	6878	94	73	66	80,000
	67L40K	7333	100	73	66	80,000
	67L50K	7626	104	73	66	80,000
	90L35K	8839	91	98	94	60,000
	90L40K	9423	97	98	94	60,000
	90L50K	9800	100	98	94	60,000
	135L35K	13654	92	148	94	60,000
	135L40K	14556	98	148	94	60,000
	135L50K	15138	102	148	94	60,000
	180L35K	20196	100	199	94	60,000
	180L40K	21531	107	199	94	60,000
	180L50K	22392	111	199	94	60,000

Displayed information is for selected luminaires only. Additional wattages and color temperatures are also available.
Visit www.kenall.com for additional information.

KENALL®

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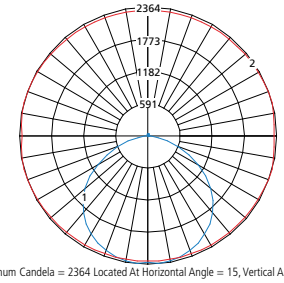
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** (1) CSEDI-22-67L35K-DCC-DV-5F-2H (2) EQ-CLIPS Notes:	**Type:** **RG** LAI16-104794

SIMPLESEAL™

CSEDI SERIES – TECHNICAL DATA

PERFORMANCE

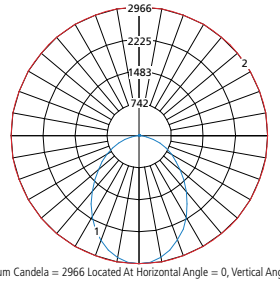
Model: CSEDI14-67L40K-DCC-1-DV-2F-2H



Maximum Candela = 2364 Located At Horizontal Angle = 15, Vertical Angle = 5

1 - Vertical Plane Through Horizontal Angles (15-195) (Through Max. Cd.)
2 - Horizontal Cone Through Vertical Angle (5) (Through Max. Cd.)

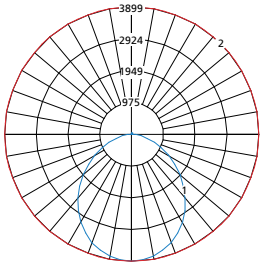
Model: CSEDI22-67L40K-DCC-1-DV-2F-2H



Maximum Candela = 2966 Located At Horizontal Angle = 0, Vertical Angle = 0

1 - Vertical Plane Through Horizontal Angles (0-180) (Through Max. Cd.)
2 - Horizontal Cone Through Vertical Angle (0) (Through Max. Cd.)

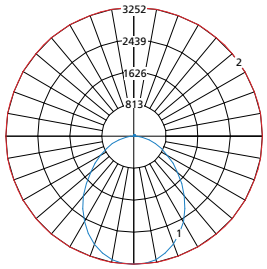
Model: CSEDI22-90L40K-DCC-1-DV-2F-2H-SYM



Max Candela = 3899 Located At Horizontal Angle = 0, Vertical Angle = 0

1 - Vertical Plane Through Horizontal Angles (0 - 180) (Through Max. Cd.)
2 - Horizontal Cone Through Vertical Angle (0) (Through Max. Cd.)

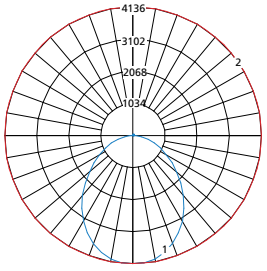
Model: CSEDI24-67L40K-DCC-1-DV-2F-2H



Maximum Candela = 3252 Located At Horizontal Angle = 0, Vertical Angle = 0

1 - Vertical Plane Through Horizontal Angles (0-180) (Through Max. Cd.)
2 - Horizontal Cone Through Vertical Angle (0) (Through Max. Cd.)

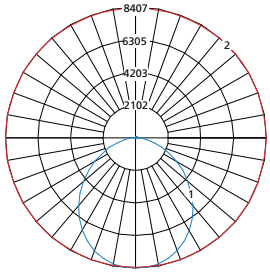
Model: CSEDI24-90L40K-DCC-1-DV-2F-2H



Maximum Candela = 4136 Located At Horizontal Angle = 0, Vertical Angle = 0

1 - Vertical Plane Through Horizontal Angles (0-180) (Through Max. Cd.)
2 - Horizontal Cone Through Vertical Angle (0) (Through Max. Cd.)

Model: CSEDI24-180L40K-DCC-1-DV-2F-2H-SYM

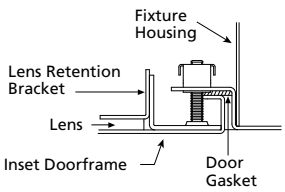


Max Candela = 8407 Located At Horizontal Angle = 0, Vertical Angle = 5

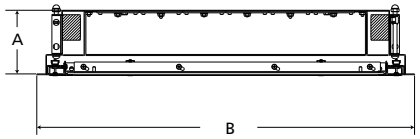
1 - Vertical Plane Through Horizontal Angles (0 - 180) (Through Max. Cd.)
2 - Horizontal Cone Through Vertical Angle (5) (Through Max. Cd.)

DIMENSIONAL DATA

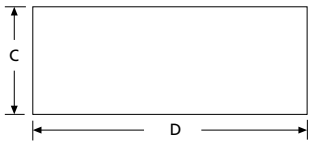
GASKET PROFILE



CROSS SECTION



CEILING CUTOUT



DIMENSIONAL DATA (IN INCHES & CENTIMETERS)

	A	B	C	D
12×48	4.20	11.75 × 47.75	10.85	46.85
30.48cm×121.92cm	10.67	29.85 × 121.29	27.56	119.00
24×24	4.20	23.75 × 23.75	22.85	22.85
60.96cm×60.96cm	10.67	60.33 × 60.33	58.04	58.04
24×48	4.20	23.75 × 47.75	22.85	46.85
60.96cm×121.92cm	10.67	60.33 × 121.29	58.04	119.00

* Add .375" (.95cm) to ceiling cut out dimensions when IF Option is specified

** Height is 5.875" (15 cm) with LEL option

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** LD4A18D010TE ERW4A18830 4LW1H Notes:	**Type:** RH LAI16-104794

Portfolio

DESCRIPTION

4 inch LED recessed narrow, medium, or wide beam downlight specially designed for LED technology. Two-stage reflector system produces smooth distribution with excellent light control and low aperture brightness. Lumen packages include 900, 1300, 1800 and 2800 lumens with color temperatures of 2700K, 3000K, 3500K, 4000K.

Catalog #		Type
Project		
Comments		Date
Prepared by		

SPECIFICATION FEATURES

Lower Shielding Reflector
Self-flanged, spun .050" thick aluminum lower reflector in combination with a lensed upper optical chamber provides superior lumen output with minimal source brightness. Available in all Portfolio Alzak® finishes.

Trim Retention
Lower reflector is retained with two torsion springs holding the flange tightly to the finished ceiling surface.

Plaster Frame / Collar
New Construction Housing: Die cast aluminum 1-1/2" deep collar accommodates ceiling materials up to 2".

Universal Mounting Bracket
Accepts 1/2" EMT, C channel and bar hangers and adjusts 5" vertically from above and below the ceiling.

Junction Box
(4) 1/2" and (2) 3/4" trade size pry outs positioned to allow straight conduit runs. Listed for (8) #12 AWG (four in, four out) 90°C conductors and feed thru branch wiring.

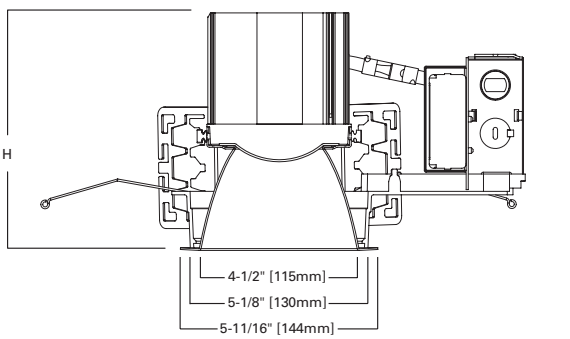
Thermal
Extruded aluminum heat sink conducts heat away from the LED module for optimal performance and long life.

LED
LED system contains a plurality of high brightness white LED's combined with a high reflectance upper reflector and convex transitional lens producing even distribution with no pixilation. Rated for 50,000 hours at 70% lumen maintenance. Auto resetting, thermally protected, LED's are turned off when safe operating temperatures are exceeded. Color variation within 3-step MacAdam ellipses. Flexible disconnect allows for tool-less replacement of LED engine from below ceiling. Available in 80 or 90 CRI.

Driver
Combination 120-277V 0-10V or 120V trailing edge phase cut driver provides flicker free dimming from 100% to 10%. Optional 1% 0-10V, Fifth Light, DMX or Lutron® Ecosystem. Driver can be serviced from above or through the aperture.

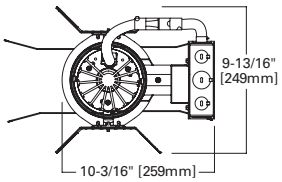
Code Compliance
Thermally protected and cULus listed for protected wet locations. IP66 rated when used with IP66 gasket kit accessory. Optional City of Chicago environmental air (CCEA) marking for plenum applications. EMI/RFI emissions per FCC 47CFR Part 18 Class B consumer limits. Non-IC rated - Insulation must be kept 3" from top and sides of housing. RoHS Compliant. Photometric testing completed in accordance with IES LM 79 standards. LED life testing completed in accordance with LM 80 standards.

Warranty
5 year warranty.

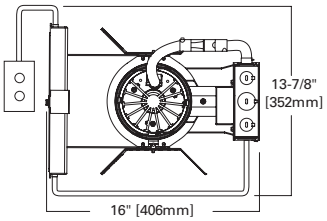


Note: Max Opening 4-3/8" [111mm]

TOP VIEW - NEW CONSTRUCTION



TOP VIEW - NEW CONSTRUCTION WITH BATTERY



Distribution	Lumens	Height
Narrow	900/1300	5-7/16"
Medium	900/1300	5-11/16"
Wide	900/1300	5-3/16"
Narrow	1800/2800	7-7/16"
Medium	1800/2800	7-11/16"
Wide	1800/2800	7-3/16"



LD4A09 LD4A13 LD4A18 LD4A28 4L

900, 1300 Lumen LED

1800, 2800 Lumen LED

4-Inch

Narrow, Medium, or Wide Beam

Downlight

New Construction

Refer to ENERGY STAR® Qualified Products List.

powered by fifthlight technology

ADP110786
2016-02-24 09:08:51

EATON
Powering Business Worldwide

Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** LD4A18D010TE ERW4A18830 4LW1H Notes:	**Type:** **RH** LAI16-104794

ORDERING INFORMATION

EXAMPLE: LD4A13D010TE ERM4A13835 4LM0LI=4″ LED Medium Beam Reflector Lens, 1300 lumen, 3,500 K Color with Universal 120 - 277V, 0 - 10 Driver

Housing

LD4A=4″ Aperture
LD4ACP=4″ Aperture, Chicago Plenum

Lumens[1]

09=900 Lumens
13=1300 Lumens
18=1800 Lumens
28=2800 Lumens

Driver

900, 1300, 1800 and 2800 Lumen
D010TE=120-277V 0-10V 10% Dimming or Trailing Edge 120V Dimming
D5LT=Fifth Light® (DALI) 0% Dimming
DE010=0 to 100% Dimming, 120-277V 50/60Hz, 0-10V
DL3=1 to 100% Dimming, 120-277V Lutron® Hi-Lume, Ecosystem or 3 Wire
DLT=Hi-Lume Forward Phase 2-wire Dimming 120V
DMX=DMX 0% Dimming

900, 1300 and 1800 Lumen
D010TR=120-277V 0-10V 10% Dimming or Leading Edge 120V Dimming

Options[3]

EMBOD=7W Bodine® Emergency Module with Remote Test Switch
IEMBOD=7W Bodine® Emergency Module with Integral Test Switch
EM7=7W Emergency Module with Remote Test Switch[4]
EM14=14W Emergency Module with Remote Test Switch[4, 5]
IEM7=7W Emergency Module with Integral Test Switch[4, 5]
IEM14=14W Emergency Module with Integral Test Switch[4, 5]

Power Module

ERN4A=4″ Module for Narrow Beam Reflector
ERM4A=4″ Module for Medium Beam Reflector
ERW4A=4″ Module for Wide Beam Reflector

Lumens

09=900 Lumen
13=1300
18=1800 Lumen
28=2800 Lumen

CRI

8=80 CRI
9=90 CRI

Color

27=2700° K
30=3000° K
35=3500° K
40=4000° K
27CP=2700° K, Chicago Plenum
30CP=3000° K, Chicago Plenum
35CP=3500° K, Chicago Plenum
40CP=4000° K, Chicago Plenum

Reflector

4LN0=4″ Narrow Reflector Lens Assembly, White Polymer Trim Ring
4LN1=4″ Narrow Reflector, Self-flanged
4LM0=4″ Medium Reflector Lens Assembly, White Polymer Trim Ring
4LM1=4″ Medium Reflector, Self-flanged
4LM0E=4″ Medium Reflector Lens Assembly, White Polymer Trim Ring for Integral Emergency Option[5]
4LM1E=4″ Medium Reflector Self-flanged for Integral Emergency Option[5]
4LW0=4″ Wide Reflector Lens Assembly, White Polymer Trim Ring
4LW1=4″ Wide Reflector, Self-flanged

Finish

LI=Specular Clear
H=Semi-Specular Clear
WMH=Warm Haze
G=Specular Gold
WH=Wheat
WHH=Wheat Haze
GP=Graphite
GPH=Graphite Haze

B=Specular Black
W=Gloss White

4LM0 Only
BB=Black Baffle
WB=White Baffle

Options

Self-flanged Only
WF= White Painted Flange

Accessories

HB26=C-channel Bar Hanger, 26″ Long, Pair
HB50=C-channel Bar Hanger, 50″ Long, Pair
RMB22=Wood Joist Bar Hanger, 22″ Long, Pair
H347= 347 to 120V Step Down Transformer, 75VA
H347200=347 to 120V Step Down Transformer, 200VA
TRM4P= Metal Trim Ring, White[2]
TRM4MB=Metal Trim Ring, Black[2]
TRR4=Rimless Trim Ring[2]
LGSKT4IP66=IP66 Gasket Kit

Notes:
1 Nominal Lumens will vary depending on selected color, driver and reflector finish.
2 Order trim with polymer trim ring (Consult specification sheet for color ordering information and options).
3 Not available with Chicago Plenum.
4 Not CSA approved.
5 For use in accessible ceilings only.
6 For use with medium beam accessible ceilings only.

ENERGY

ENERGY DATA			
Sound Rating: Class A standards			
(Values at non-dimming line voltage)			
Minimum Starting Temperature: -30°C (-22°F)			
EMI/RFI: FCC Title 47 CFR, Part 15, Class B (Consumer)			
Input Voltage: UNV (120V - 277V)			
Power Factor: >0.90 (at nominal input 120-277 VAC & 100% of Rated Output Power)			
Input Frequency: 50/60Hz			
2800 Lumen D010TE		**1800 Lumen D010TE**	
Input Power: 43.4W	THD: <17%	Input Power: 31.5W	THD: <20%
120V Input Current: .36A	277V Input Current: .16A	120V Input Current: .27A	277V Input Current: .06A
1300 Lumen D010TE		**900 Lumen D010TE**	
Input Power: 22.4W	THD: <20%	Input Power: 14.1W	THD: <20%
120V Input Current: .12A	277V Input Current: .09A	120V Input Current: .12A	277V Input Current: .06A

	120V		277V	
Lumens	Inrush (A)	Duration (ms)	Inrush (A)	Duration (ms)
900/1000	0.486	0.4	0.848	0.182
1300/1500	0.717	1.58	0.531	1.24
1800/2000	0.832	0.405	1.25	0.788
2800/3000	1.09	0.3	1.23	0.294

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
LD4A18D010TE ERW4A18830 4LW1H
Notes:

Type:
RH
LAI16-104794

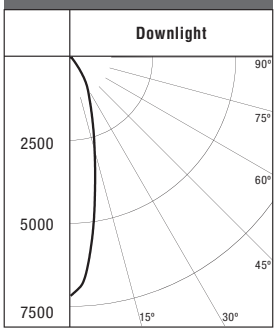
LD4A09 LD4A13 LD4A18 LD4A28 4L

PHOTOMETRICS

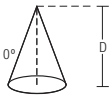
Test Number	P133618
Platform	LD4A18D010TE
Element	ERN4A18835 4LN1LI
Lumens	2368
Efficacy	72.2 Lm/W
SC	0.4



CANDLEPOWER DISTRIBUTION



CONE OF LIGHT



D	FC	L	W
5.5'	233	2.2	2.2
7'	144	2.8	2.8
8'	110	3.2	3.2
9'	87	3.6	3.6
10'	71	4	4
12'	49	4.8	4.8

CANDELA TABLE

Degrees Vertical	Candela
0	7058
5	6145
15	2836
25	1366
35	564
45	50
55	3
65	0
75	0
85	0
90	0

ZONAL LUMEN SUMMARY

Zone	Lumens	%Fixture
0-30	1963	82.9
0-40	2313	97.7
0-60	2367	100
0-90	2368	100
90-180	0	0
0-180	2368	100

LUMINANCE

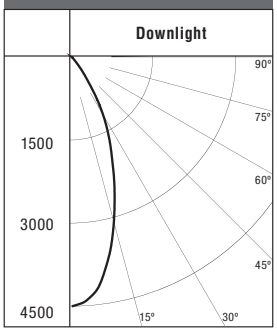
Average Candela Degrees	Average 0° Luminance
45	6933
55	442
65	0
75	0
85	0

1300 lumen multiplier .62. 2800 lumen multiplier 1.12.

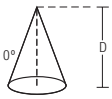
Test Number	P133746
Platform	LD4A18D010TE
Element	ERM4A18835 4LM1LI
Lumens	2507
Efficacy	76.4 Lm/W
SC	0.7



CANDLEPOWER DISTRIBUTION



CONE OF LIGHT



D	FC	L	W
5.5'	148	3.6	3.6
7'	92	4.6	4.6
8'	70	5.2	5.2
9'	55	5.8	5.8
10'	45	6.6	6.6
12'	31	7.8	7.8

CANDELA TABLE

Degrees Vertical	Candela
0	4483
5	4316
15	3105
25	1751
35	594
45	43
55	0
65	0
75	0
85	0
90	0

ZONAL LUMEN SUMMARY

Zone	Lumens	%Fixture
0-30	2055	82.0
0-40	2449	97.7
0-60	2503	99.8
0-90	2507	100.0
90-180	0	0.0
0-180	2507	100.0

LUMINANCE

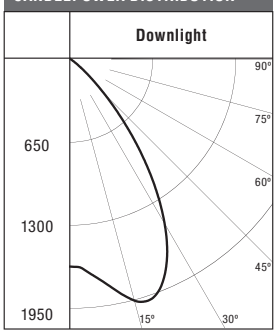
Average Candela Degrees	Average 0° Luminance
45	5954
55	0
65	0
75	0
85	0

1300 lumen multiplier .62. 2800 lumen multiplier 1.17.

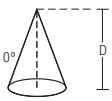
Test Number	P134426
Platform	LD4A18D010TE
Element	ERW4A18835 4LW1LI
Lumens	2572
Efficacy	78.4 Lm/W
SC	1.3



CANDLEPOWER DISTRIBUTION



CONE OF LIGHT



D	FC	L	W
5.5'	58	6.6	6.6
7'	36	8.4	8.4
8'	27	9.6	9.6
9'	22	10.8	10.8
10'	18	12	12
12'	12	14.4	14.4

CANDELA TABLE

Degrees Vertical	Candela
0	1618
5	1666
15	1946
25	1787
35	1108
45	378
55	53
65	3
75	0
85	0
90	0

ZONAL LUMEN SUMMARY

Zone	Lumens	%Fixture
0-30	1520	59.1
0-40	2205	85.7
0-60	2567	99.8
0-90	2572	100
90-180	0	0
0-180	2572	100

LUMINANCE

Average Candela Degrees	Average 0° Luminance
45	52140
55	9022
65	761
75	0
85	0

1300 lumen multiplier .64. 2800 lumen multiplier 1.19.

EM MULTIPLIER DATA

LUMENS	EM MULTIPLIER	
	7	14
900/1000	0.50	0.99
1300/1500	0.29	0.57
1800/2000	0.22	0.44
2800/3000	0.16	0.32

Eaton
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.eaton.com/lighting

Specifications and dimensions subject to change without notice.

Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** LD4A18D010TE ERW4A18830 4LW1H Notes:	**Type:** **RHB** LAI16-104794

Portfolio

DESCRIPTION

4 inch LED recessed narrow, medium, or wide beam downlight specially designed for LED technology. Two-stage reflector system produces smooth distribution with excellent light control and low aperture brightness. Lumen packages include 900, 1300, 1800 and 2800 lumens with color temperatures of 2700K, 3000K, 3500K, 4000K.

Catalog #		Type
Project		
Comments		Date
Prepared by		

SPECIFICATION FEATURES

Lower Shielding Reflector
Self-flanged, spun .050" thick aluminum lower reflector in combination with a lensed upper optical chamber provides superior lumen output with minimal source brightness. Available in all Portfolio Alzak® finishes.

Trim Retention
Lower reflector is retained with two torsion springs holding the flange tightly to the finished ceiling surface.

Plaster Frame / Collar
New Construction Housing: Die cast aluminum 1-1/2" deep collar accommodates ceiling materials up to 2".

Universal Mounting Bracket
Accepts 1/2" EMT, C channel and bar hangers and adjusts 5" vertically from above and below the ceiling.

Junction Box
(4) 1/2" and (2) 3/4" trade size pry outs positioned to allow straight conduit runs. Listed for (8) #12 AWG (four in, four out) 90°C conductors and feed thru branch wiring.

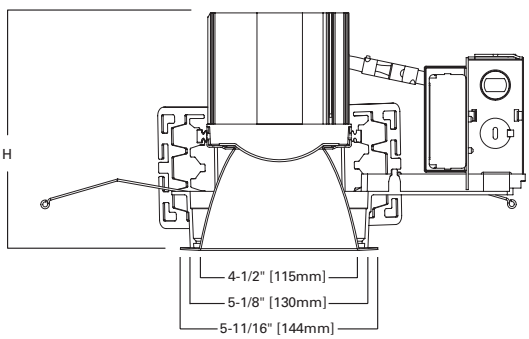
Thermal
Extruded aluminum heat sink conducts heat away from the LED module for optimal performance and long life.

LED
LED system contains a plurality of high brightness white LED's combined with a high reflectance upper reflector and convex transitional lens producing even distribution with no pixilation. Rated for 50,000 hours at 70% lumen maintenance. Auto resetting, thermally protected, LED's are turned off when safe operating temperatures are exceeded. Color variation within 3-step MacAdam ellipses. Flexible disconnect allows for tool-less replacement of LED engine from below ceiling. Available in 80 or 90 CRI.

Driver
Combination 120-277V 0-10V or 120V trailing edge phase cut driver provides flicker free dimming from 100% to 10%. Optional 1% 0-10V, Fifth Light, DMX or Lutron® Ecosystem. Driver can be serviced from above or through the aperture.

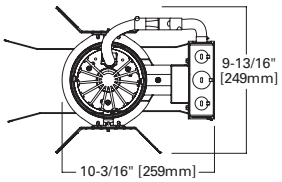
Code Compliance
Thermally protected and cULus listed for protected wet locations. IP66 rated when used with IP66 gasket kit accessory. Optional City of Chicago environmental air (CCEA) marking for plenum applications. EMI/RFI emissions per FCC 47CFR Part 18 Class B consumer limits. Non-IC rated - Insulation must be kept 3" from top and sides of housing. RoHS Compliant. Photometric testing completed in accordance with IES LM 79 standards. LED life testing completed in accordance with LM 80 standards.

Warranty
5 year warranty.

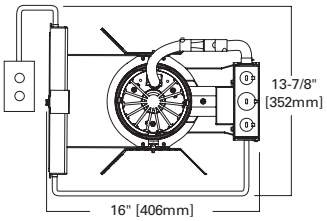


Note: Max Opening 4-3/8" [111mm]

TOP VIEW - NEW CONSTRUCTION



TOP VIEW - NEW CONSTRUCTION WITH BATTERY



Distribution	Lumens	Height
Narrow	900/1300	5-7/16"
Medium	900/1300	5-11/16"
Wide	900/1300	5-3/16"
Narrow	1800/2800	7-7/16"
Medium	1800/2800	7-11/16"
Wide	1800/2800	7-3/16"



LD4A09 LD4A13 LD4A18 LD4A28 4L

900, 1300 Lumen LED

1800, 2800 Lumen LED

4-Inch

Narrow, Medium, or Wide Beam

Downlight

New Construction

Refer to ENERGY STAR® Qualified Products List.

powered by fifthlight technology

ADP110786
2016-02-24 09:08:51

EATON
Powering Business Worldwide

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
LD4A18D010TE ERW4A18830 4LW1H
Notes:

Type:
RHB
LAI16-104794

ORDERING INFORMATION

EXAMPLE: LD4A13D010TE ERM4A13835 4LM0LI=4″ LED Medium Beam Reflector Lens, 1300 lumen, 3,500 K Color with Universal 120 - 277V, 0 - 10 Driver

Housing

LD4A=4″ Aperture
LD4ACP=4″ Aperture, Chicago Plenum

Lumens[1]

09=900 Lumens
13=1300 Lumens
18=1800 Lumens
28=2800 Lumens

Driver

900, 1300, 1800 and 2800 Lumen
D010TE=120-277V 0-10V 10% Dimming or Trailing Edge 120V Dimming
D5LT=Fifth Light® (DALI) 0% Dimming
DE010=0 to 100% Dimming, 120-277V 50/60Hz, 0-10V
DL3=1 to 100% Dimming, 120-277V Lutron® Hi-Lume, Ecosystem or 3 Wire
DLT=Hi-Lume Forward Phase 2-wire Dimming 120V
DMX=DMX 0% Dimming

900, 1300 and 1800 Lumen
D010TR=120-277V 0-10V 10% Dimming or Leading Edge 120V Dimming

Options[3]

EMBOD=7W Bodine® Emergency Module with Remote Test Switch
IEMBOD=7W Bodine® Emergency Module with Integral Test Switch
EM7=7W Emergency Module with Remote Test Switch[4]
EM14=14W Emergency Module with Remote Test Switch[4, 5]
IEM7=7W Emergency Module with Integral Test Switch[4, 5]
IEM14=14W Emergency Module with Integral Test Switch[4, 5]

Power Module

ERN4A=4″ Module for Narrow Beam Reflector
ERM4A=4″ Module for Medium Beam Reflector
ERW4A=4″ Module for Wide Beam Reflector

Lumens

09=900 Lumen
13=1300
18=1800 Lumen
28=2800 Lumen

CRI

8=80 CRI
9=90 CRI

Color

27=2700° K
30=3000° K
35=3500° K
40=4000° K
27CP=2700° K, Chicago Plenum
30CP=3000° K, Chicago Plenum
35CP=3500° K, Chicago Plenum
40CP=4000° K, Chicago Plenum

Reflector

4LN0=4″ Narrow Reflector Lens Assembly, White Polymer Trim Ring
4LN1=4″ Narrow Reflector, Self-flanged
4LM0=4″ Medium Reflector Lens Assembly, White Polymer Trim Ring
4LM1=4″ Medium Reflector, Self-flanged
4LM0E=4″ Medium Reflector Lens Assembly, White Polymer Trim Ring for Integral Emergency Option[5]
4LM1E=4″ Medium Reflector Self-flanged for Integral Emergency Option[5]
4LW0=4″ Wide Reflector Lens Assembly, White Polymer Trim Ring
4LW1=4″ Wide Reflector, Self-flanged

Finish

LI=Specular Clear
H=Semi-Specular Clear
WMH=Warm Haze
G=Specular Gold
WH=Wheat
WHH=Wheat Haze
GP=Graphite
GPH=Graphite Haze

B=Specular Black
W=Gloss White

4LM0 Only
BB=Black Baffle
WB=White Baffle

Options

Self-flanged Only
WF= White Painted Flange

Accessories

HB26=C-channel Bar Hanger, 26″ Long, Pair
HB50=C-channel Bar Hanger, 50″ Long, Pair
RMB22=Wood Joist Bar Hanger, 22″ Long, Pair
H347= 347 to 120V Step Down Transformer, 75VA
H347200=347 to 120V Step Down Transformer, 200VA
TRM4P= Metal Trim Ring, White[2]
TRM4MB=Metal Trim Ring, Black[2]
TRR4=Rimless Trim Ring[2]
LGSKT4IP66=IP66 Gasket Kit

Notes:
1 Nominal Lumens will vary depending on selected color, driver and reflector finish.
2 Order trim with polymer trim ring (Consult specification sheet for color ordering information and options).
3 Not available with Chicago Plenum.
4 Not CSA approved.
5 For use in accessible ceilings only.
6 For use with medium beam accessible ceilings only.

ENERGY

ENERGY DATA			
Sound Rating: Class A standards			
(Values at non-dimming line voltage)			
Minimum Starting Temperature: -30°C (-22°F)			
EMI/RFI: FCC Title 47 CFR, Part 15, Class B (Consumer)			
Input Voltage: UNV (120V - 277V)			
Power Factor: >0.90 (at nominal input 120-277 VAC & 100% of Rated Output Power)			
Input Frequency: 50/60Hz			
2800 Lumen D010TE		**1800 Lumen D010TE**	
Input Power: 43.4W	THD: <17%	Input Power: 31.5W	THD: <20%
120V Input Current: .36A	277V Input Current: .16A	120V Input Current: .27A	277V Input Current: .06A
1300 Lumen D010TE		**900 Lumen D010TE**	
Input Power: 22.4W	THD: <20%	Input Power: 14.1W	THD: <20%
120V Input Current: .12A	277V Input Current: .09A	120V Input Current: .12A	277V Input Current: .06A

	120V		277V	
Lumens	Inrush (A)	Duration (ms)	Inrush (A)	Duration (ms)
900/1000	0.486	0.4	0.848	0.182
1300/1500	0.717	1.58	0.531	1.24
1800/2000	0.832	0.405	1.25	0.788
2800/3000	1.09	0.3	1.23	0.294

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
LD4A18D010TE ERW4A18830 4LW1H
Notes:

Type:
RHB
LAI16-104794

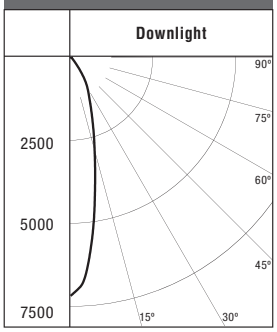
LD4A09 LD4A13 LD4A18 LD4A28 4L

PHOTOMETRICS

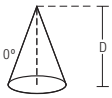
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Efficacy	72.2 Lm/W
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CANDLEPOWER DISTRIBUTION



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5	6145
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90	0

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Zone	Lumens	%Fixture
0-30	1963	82.9
0-40	2313	97.7
0-60	2367	100
0-90	2368	100
90-180	0	0
0-180	2368	100

LUMINANCE

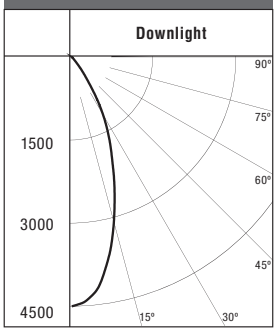
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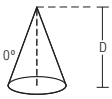
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0-90	2507	100.0
90-180	0	0.0
0-180	2507	100.0

LUMINANCE

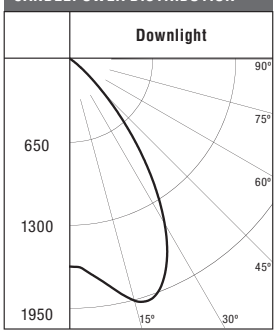
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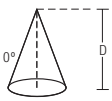
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CANDLEPOWER DISTRIBUTION



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25	1787
35	1108
45	378
55	53
65	3
75	0
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90	0

ZONAL LUMEN SUMMARY

Zone	Lumens	%Fixture
0-30	1520	59.1
0-40	2205	85.7
0-60	2567	99.8
0-90	2572	100
90-180	0	0
0-180	2572	100

LUMINANCE

Average Candela Degrees	Average 0° Luminance
45	52140
55	9022
65	761
75	0
85	0

1300 lumen multiplier .64. 2800 lumen multiplier 1.19.

EM MULTIPLIER DATA

LUMENS	EM MULTIPLIER	
	7	14
900/1000	0.50	0.99
1300/1500	0.29	0.57
1800/2000	0.22	0.44
2800/3000	0.16	0.32

Eaton
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.eaton.com/lighting

Specifications and dimensions subject to change without notice.

Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** RDA4L230K27D2FX4WHT-P2CW MUST CLEARLY STATE COMPATABLE WITH 1% DIMMING Notes:	**Type:** **RJ4** LAI16-104794

CONTECH LIGHTING

RDA4L Series

Mini O2 Multiple LED Recessed Downlight Adjustables

Catalog No. _____

Type _____

Project _____

Specifications/Features

Housing/Mounting

High performance fixture delivering over 1400 lumens per head.
New construction housing design can also be used in remodel applications.
From single to four head units available. The four head unit is available in two configurations: rectilinear and two-by-two square.
Housing may be used for trimmed or trim-less applications.
Heavy duty 18-gauge steel housing; powder coat painted in matte black, white or silver.
Housing weights: 1-head = 5lbs, 2-head = 8lbs, 3-head = 11lbs, 4-head = 13lbs, 4-head 2X2 = 13lbs
Complete fixture [heads, drivers and junction box] can be accessed from below the ceiling.
Wing type mounting brackets allow for 3" vertical adjustment. Brackets will accept optional HB-24 flat hanger bars or HBC-24 "C" channel hangers.

Electrical

UL8750 and Class 2 Compliant; RoHS Compliant, US only.
Output over voltage, over-current and short circuit protection.
Approved for through circuit wiring. Maximum of (8) No. 12 AWG branch circuit conductors (4 in, 4 out).
Junction box has (9) 1/2" pry-outs.
Wire rating: 90°C. Thermally protected.

Lamp

Light engine consists of a single, high lumen output multi-chip LED array available in two wattage/lumen packages: 10W/1100Lm and 14W/1400Lm.
Excellent fixture-to-fixture color consistency within a 2-step MacAdam ellipse tolerance.
Precision TIR optics produce Spot (12°), Medium (29°) and Flood (37°) beam distributions. Each TIR optic has been optically engineered to provide a smooth uniform beam, maximizing output and minimizing glare.
System designed and rated for 50,000 hours at 70% lumen maintenance.
Lamp heads feature a constant tension design for tilt and rotation adjustability. Tilt mechanism can also be locked into place with a provided allen wrench.
Lamp heads provide 370° rotation and 45° tilt adjustability inside housing. For increased adjustability, the lamp head features a firm-feel detent pull-down mechanism (2" extension) which allows the head to tilt up to 90°. The pull-down mechanism can also be locked into place with a provided allen wrench.
Optional FA-44 Snoot/Accessory Holder accepts up to (2) LF16 60MM lenses or FA-16 60MM black honeycomb louver.

Trim Options

Trimmed
Steel powder coat matte black, white and silver trims are available.
Steel torsion springs provide secure retention in housing.
Trimless
Allows ceiling to be finished and painted right to the aperture opening for a clean appearance. Trimless frame is steel with a matte white powder coat finish.

Dimming

All RDA4L Series fixtures are available for non-dimming and dimming applications.

Warranty

This fixture is covered by ConTech's five (5) year full replacement guarantee after date of purchase.

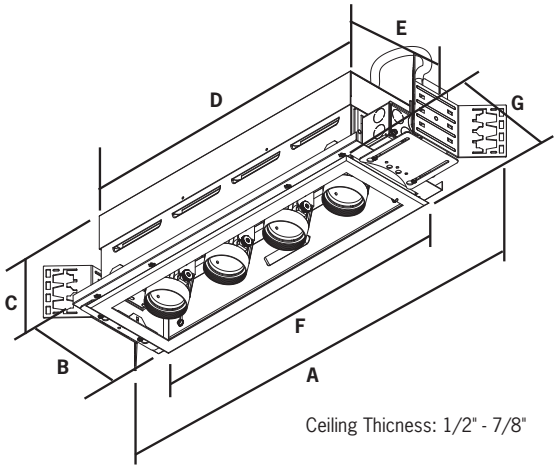
Listing

cCSAus Certified to UL standards. Suitable for dry or damp locations.
cCSAus Certified to UL924 Standard for Emergency Lighting.
Assembled in the USA.



	Series-1	Series-2
Input Voltage		
Non-Dimming	120V AC, 50/60Hz	120V AC, 50/60Hz
Non-Dimming	277V AC, 50/60Hz	277V AC, 50/60Hz
0-10V Dimming	120V AC, 50/60Hz	120V AC, 50/60Hz
0-10V Dimming	277V AC, 50/60Hz	277V AC, 50/60Hz
Triac Dimming: (F. Phase)	120V AC, 50/60Hz	120V AC, 50/60Hz
Triac Dimming: (F. Phase)	277V Not Available	277V AC, 50/60Hz
ELV Dimming (R. Phase)	120V AC, 50/60Hz	120V AC, 50/60Hz
ELV Dimming (R. Phase)	277V AC, 50/60Hz	277V AC, 50/60Hz
Input Wattage*	10	14
Input Current (A)* 120/277	.08/.04	.12/.05
Color Temp	2700K/3000K/ 3500K/4000K	2700K/3000K/ 3500K/4000K
CRI Standard/High	83 (80min) / 90+	83 (80min) / 90+
Driver		
Power Factor	> 0.90	> 0.90
THD	< 20%	< 20%
Dimming		
0-10V Dimming	15-100%	15-100%
Triac Dimming (F. Phase)	10-100% (120V Only)	10-100%
ELV Dimming (R. Phase)	10-100% (120V Only)	10-100%

**Based upon a single head*



Ceiling Thicness: 1/2" - 7/8"

MODEL	OVERALL			HOUSING		TRIM EDGE = 1"		CEILING CUT-OUT	
	LENGTH	WIDTH*	HEIGHT	LENGTH	WIDTH	LENGTH	WIDTH	LENGTH	WIDTH
	A	B	C	D	E	F	G		
X1	15-1/2"	6-7/8"	6-3/4"	5-7/8"	5-1/4"	6-9/16"	6-9/16"	6-1/8"	5-1/2"
X2	20-1/4"	6-7/8"	6-3/4"	10-9/16"	5-1/4"	11-5/16"	6-9/16"	10-7/8"	5-1/2"
X3	24-7/8"	6-7/8"	6-3/4"	15-5/16"	5-1/4"	16"	6-9/16"	15-5/8"	5-1/2"
X4	29-5/8"	6-7/8"	6-3/4"	20"	5-1/4"	20-3/4"	6-9/16"	20-5/16"	5-1/2"
X22	20-1/4"	11-5/8"	6-3/4"	10-9/16"	9-15/16"	11-5/16"	11-5/16"	10-7/8"	10-1/4"

**WING BRACKET (RL-KIT #3) WIDTH = 7-3/8"*

Submitted by LIGHTING ASSOCIATES, INC.		
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** RDA4L230K27D2FX4WHT-P2CW MUST CLEARLY STATE COMPATABLE WITH 1% DIMMING Notes:
		Type: **RJ4** LAI16-104794

CONTECH LIGHTING

RDA4L Series

Mini O2 Multiple LED Recessed Downlight Adjustables

Catalog No. _____

Type _____

Project _____

Ordering Information

Example Order: RDA4LI27KCI2DISX22BLK - P

1% DIMMING STANDARD

Housing	LED Series	Color Temp	Electrical/Dimming	Beam	Lamps	Housing/ Head Finish		Trim Finish		Options
							-		-	
RDA4L	**1** - 1100 Lumens **2** - 1400 Lumens	**27K** - 2700K **30K** - 3000K **35K** - 3500K **40K** - 4000K **27KC** - 2700K, 90+ CRI **30KC** - 3000K, 90+ CRI **35KC** - 3500K, 90+ CRI **40KC** - 4000K, 90+ CRI	**12** - 120V Non-Dimming **27** - 277V Non-Dimming **12D1** - 120V TRIAC (F. Phase) Dimming **27D1**[1] - 277V TRIAC (F. Phase) Dimming **12D2**[1] - 120V 0-10V Dimming **27D2**[1] - 277V 0-10V Dimming **12D5**[1] - 120V ELV (R. Phase) Dimming **27D5**[1] - 277V ELV (R. Phase) Dimming	**S** - Spot **M** - Medium **F** - Flood	**X1** - One Square **X2** - Two Linear **X3** - Three Linear **X4** - Four Linear **X22** - Four Square 2x2	**BLK** - Matte Black **WHT** - Matte White **SL** - Satin Silver		**B** - Matte Black **P** - Matte White **S** - Satin Silver **N** - Trimless		**CP**[2] - Chicago Plenum **ER**[3] - Factory Installed 7W/200mA Emergency Battery Backup, Remote Test Switch **EI**[3] - Factory Installed 7W/200mA Emergency Battery Backup, Internal Test Switch Intalled in Side Wall of Housing

2-CIRCUIT

Consult factory when different beams, color temperatures, lumen packages, or multiple circuits (2-maximum) are required in a single multiple-head fixture.

1. *Series 1 is not available for use with 27D1, 12D2, 27D2, 12D5 or 27D5 dimming options.*
2. *Chicago Plenum is not available for use with Series 2. Cannot be used with the Emergency Battery Backup option.*
3. *Emergency Battery Backup: For use in new construction applications only - requires above ceiling access. Will only energize one (1) head on a multi-head unit - 400 lumen nominal average for either Series 1 or Series 2.*

Accessories

2INOPTIC-S	- 2" TIR Optic, Spot Beam
2INOPTIC-M	- 2" TIR Optic, Medium Beam
2INOPTIC-F	- 2" TIR Optic, Flood Beam
HB-24	- 27" Flat Hanger Bars
HBC-24	- 25" C-Channel Hanger Bars
FA-16 60MM	- 2-3/8" Dia. Black Honeycomb Louver
FA-44-(B, P, S)	- 1" Snoot/Accessory Holder
LF16-* 60MM	- 2-3/8" Dia. Tempered Glass Lenses; Requires FA-44 Snoot/Accessory Holder

Note: When a Snoot, Louver, or Lens is desired, ensure the same quantity is ordered as the number of heads on the unit, e.g. a two-head unit would require two media be ordered.

Color/Pattern Legend
-A (Amber), **-B** (Blue), **-CL** (Clear), **-G** (Green), **-LB** (Light Blue), **-R** (Red), **-RO** (Rose), **-Y** (Yellow), **-73** (Spread Lens), **-LS** (Linear Spread Lens), **-SL** (Soft Light), **-SOL** (Solite), **-UV** (Optivex UV Filter)

Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** RDA4L230K27D2FX4WHT-P2CW MUST CLEARLY STATE COMPATABLE WITH 1% DIMMING Notes:	**Type:** **RJ4** LAI16-104794

CONTECH LIGHTING

RDA4L Series

Mini O2 Multiple LED Recessed Downlight Adjustables

Catalog No. _____

Type _____

Project _____

Photometrics

Multiplication Factors

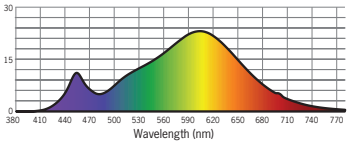
CCT	STANDARD CRI	HIGH CRI	SERIES 1, 11W
2700K	0.94	0.70	0.75
3000K	N/A	0.75	0.75
3500K	1.0	0.81	0.75
4000K	1.0	0.87	0.75

Photometric and wattage information are based upon test performance for a single head unit

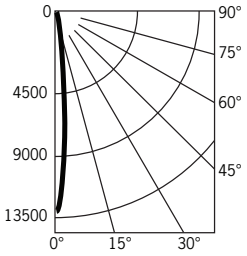
14W Spot Beam, 3000K: RDA4L230K12D1SX1

Designed for 50,000 Hour Lamp Life[1]; LM-63 Test No. 87351

Light Output (Fixture Delivered Lumens): 1184
Total Watts@120V: 13.8; **Lumens Per Watt:** 85.8
Center Beam Candle Power: 13269
Color Rendering Index (CRI)[2]: 83
Color Temperature (CCT)[3]: 3073K
Spectral Power Distribution Chart[4]
LM-79 Test No. 78891



Candela Curve



Candlepower Summary

FROM 0	CANDELA	LUMENS
0	13269	
5	8506	617
15	1364	394
25	190	99
35	33	23
45	20	15
55	15	13
65	12	12
75	6	7
85	3	3
95	0	

Intensity Distribution

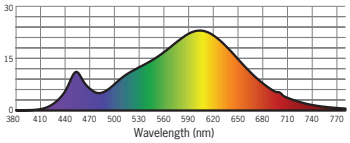
DISTANCE (FT.)	FOOTCANDLES (FC)	BEAM DIAMETER (FT.)
4'	829.3	0.9
6'	368.6	1.3
8	207.3	1.7
10'	132.7	2.2
12'	92.1	2.6
14'	67.7	3.0

Beam Distribution: 12°
Spacing Criterion: 0.22

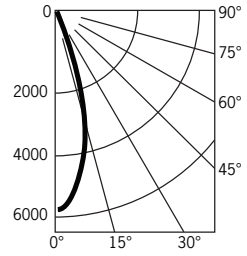
14W Medium Beam, 3000K: RDA4L230K12D1MX1

Designed for 50,000 Hour Lamp Life[1]; LM-63 Test No. 87352

Light Output (Fixture Delivered Lumens): 1432
Total Watts@120V: 13.8; **Lumens Per Watt:** 103.8
Center Beam Candle Power: 5909
Color Rendering Index (CRI)[2]: 83
Color Temperature (CCT)[3]: 3086K
Spectral Power Distribution Chart[4]
LM-79 Test No. 788890



Candela Curve



Candlepower Summary

FROM 0	CANDELA	LUMENS
0	5909	
5	5481	486
15	2711	718
25	278	179
35	52	35
45	10	9
55	3	2
65	1	1
75	1	1
85	0	0
95	0	

Intensity Distribution

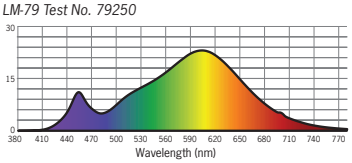
DISTANCE (FT.)	FOOTCANDLES (FC)	BEAM DIAMETER (FT.)
4'	369.3	1.9
6'	164.1	2.9
8'	92.3	3.8
10'	59.1	4.8
12'	41.0	5.7
14'	30.1	6.7

Beam Distribution: 29°
Spacing Criterion: 0.46

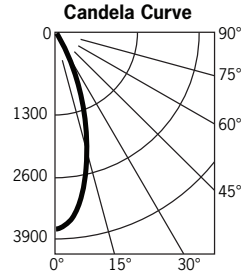
14W Flood Beam, 3000K: RDA4L230K12D1FX1

Designed for 50,000 Hour Lamp Life[1]; LM-63 Test No. 87353

Light Output (Fixture Delivered Lumens): 1478
Total Watts@120V: 13.8; **Lumens Per Watt:** 107.1
Center Beam Candle Power: 3752
Color Rendering Index (CRI)[2]: 83
Color Temperature (CCT)[3]: 3061K
Spectral Power Distribution Chart[4]
LM-79 Test No. 79250



Candela Curve



Candlepower Summary

FROM 0	CANDELA	LUMENS
0	3752	
5	3450	310
15	2254	625
25	960	429
35	115	82
45	25	22
55	5	5
65	3	3
75	2	2
85	1	1
95	0	

Intensity Distribution

DISTANCE (FT.)	FOOTCANDLES (FC)	BEAM DIAMETER (FT.)
4'	234.5	2.3
6'	104.2	3.5
8	58.6	4.6
10'	37.5	5.8
12'	26.1	7.0
14'	19.1	8.1

Beam Distribution: 37°
Spacing Criterion: 0.58

1. Accuracy of rendering colors
2. Color appearance of light source
3. Colors present within the light source

**Dependent on surrounding temperatures*

Submitted by LIGHTING ASSOCIATES, INC.		
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** RDA4L230K27D2FX4WHT-P2CW MUST CLEARLY STATE COMPATABLE WITH 1% DIMMING Notes:
		Type: **RJ4** LAI16-104794

ENERGY RECOVERY PRODUCTS™

ESS010 3-10 W
ESS015 11-15 W
ESS020 16-20 W
ESS030 21-30 W

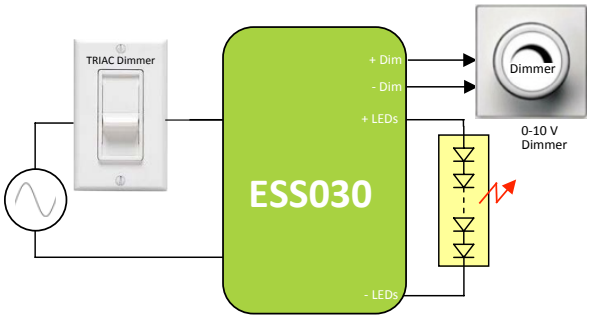
Dual Dimming (0-10 V & TRIAC/ELV) Constant Current LED Drivers with Fast Startup Time

Input Voltage	Max. Output Power	Output Voltage	Output Current	Efficiency	Max. Case Temperature	THD	Power Factor	Dimming Method	Dimming Range	Startup Time
90 to 305 Vac maximum	30 W	14 to 56 Vdc	250 mA to 1.1 A CC	≥ 85% typical	90°C (measured at the hot spot)	< 20%	> 0.9	Forward-Phase, Reverse-Phase & 0 - 10V	1 - 100% (% of Iout)	300 ms

CC: Constant Current

PRODUCT DESCRIPTION

The ESS series of LED drivers is ideally suited for LED lighting applications in office, commercial and residential. These devices are compatible with most industry standard phase-cut wall-based dimmers, both forward-phase (leading-edge) and reverse-phase (trailing edge), and 0-10V wall-based dimmers and offer deep dimming from 100% down to 1%.



TYPICAL APPLICATION DIAGRAM

FEATURES

- Compatible with TRIAC (forward-phase or leading-edge) / ELV (reverse-phase or trailing-edge) and 0–10 V dimmers
- TRIAC dimming only at 120 Vac
- Protections: output open load, over-current and short-circuit (hiccup), and over-temperature with auto recovery
- Conducted and radiated EMI: FCC CFR Title 47 Part 15 Class B (120 Vac) and Class A (277 Vac) and EN55015 (CISPR 15) compliant
- Enables ENERGY STAR® and DLC (DesignLight Consortium®) luminaire compliance
- IP64-rated case
- 90°C maximum case hot spot temperature
- Lifetime: 109,000 hours at 70°C case hot spot temperature (57°C ambient temperature) for ESS030W-0620-42 (26 W)
- Class 2 power supply
- Double-insulated power supply between input and output (class II)
- Worldwide safety approvals

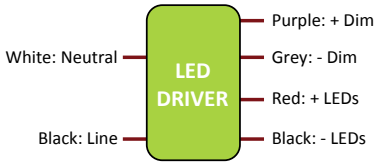


PLASTIC CASE:
L 84 x W 40 x H 25 mm (L 3.30 x W 1.57 x H 0.99 in)

APPLICATIONS

- Recessed lighting (downlights)
- Commercial & Residential lighting
- Architectural lighting

5 Year Warranty - 5 Year Warranty



WIRING DIAGRAM

Submitted by LIGHTING ASSOCIATES, INC.		
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** RDA4L230K27D2FX4WHT-P2CW MUST CLEARLY STATE COMPATABLE WITH 1% DIMMING Notes:
		Type: **RJ4** LAI16-104794

ENERGY RECOVERY PRODUCTS™

ESS010 3-10 W
ESS015 11-15 W
ESS020 16-20 W
ESS030 21-30 W

Dual Dimming (0-10 V & TRIAC/ELV) Constant Current LED Drivers with Fast Startup Time

1 - INPUT SPECIFICATION (@25°C ambient temperature)

	Units	Minimum	Typical	Maximum	Notes
Input Voltage Range (Vin)	Vac	90	120/220/230/240/277	305	The rated output current for each model is achieved at Vin ≥ 108 Vac and at Vin ≥ 198 Vac, at nominal load.
Input Frequency Range	Hz	47	60	63	
Power Factor (PF)		0.9	> 0.9		•At nominal input voltage and with nominal LED voltage •For derivative models < 10W, PF ≥ 0.8 at 277 Vac only •For derivative models < 5W, PF ≥ 0.7 at 277 Vac only
Inrush Current	Meets NEMA-410 requirements				At any point on the sine wave and 25°C
Leakage Current	µA			250 µA @ 120 Vac 500 µA @ 230 Vac 600 µA @ 277 Vac	Measured per IEC60950-1
Input Harmonics	Complies with IEC61000-3-2 for Class C equipment				
Total Harmonics Distortion (THD)				20%	•At nominal input voltage and nominal LED voltage •Complies with DLC (DesignLight Consortium) technical requirements v2.1
Efficiency	%	-	85%	-	Measured with nominal input voltage, a full sinusoidal wave form and without dimmer connected
Isolation	Meets UL60950-1 for class II reinforced/double insulation power supply ☐				

2 - OUTPUT SPECIFICATION (@25°C ambient temperature)

	Units	Minimum	Typical	Maximum	Notes
Output Voltage (Vout)	Vdc	14		56	See ordering information for details
Output Current (Iout)	mA	250		1100	•See ordering information for details •The rated output current for each model is achieved at Vin ≥ 108 Vac and at Vin ≥ 198 Vac, at nominal load.
Output Current Regulation	%	-5	±2.5	5	• At nominal AC line voltage • Includes load and current set point variations
Output Current Overshoot	%	-	-	10	The driver does not operate outside of the regulation requirements for more than 500 ms during power on with nominal LED load and without dimmer.
Ripple Current	≤ 40% of rated output current for each model				•Measured at nominal LED voltage and nominal input voltage without dimming. •Calculated in accordance with the IES Lighting Handbook, 9th edition.
Dimming Range (% of Iout)	%	1		100	The dimming range will be dependent on each specific dimmer.
Start-up Time	ms		300		With nominal LED voltage and without dimmer attached
			400		With nominal LED voltage, with an approved dimmer attached (see list of approved dimmers in page 5) and at the full dimming conduction angle
Output Controls					
+Dim Signal, -Dim Signal	The +Dim/-Dim signal pins can be used to adjust the output setting via a standard commercial wall dimmer, an external control voltage source (0 to 10 Vdc), or a variable resistor when using the recommended number of LEDs. The dimming input permits 1% to 100% dimming.				

ENERGY RECOVERY PRODUCTS™

ESS010	3-10 W
ESS015	11-15 W
ESS020	16-20 W
ESS030	21-30 W

Dual Dimming (0-10 V & TRIAC/ELV) Constant Current LED Drivers with Fast Startup Time

3 - ENVIRONMENTAL CONDITIONS

	Units	Minimum	Typical	Maximum	Notes
Operating Case Temperature (Tc)	°C	-30		+90	Case temperature measured at the hot spot •tc (see label in page 10)
Storage Temperature	°C	-40		+85	
Humidity	%	5	-	95	Non-condensing
Cooling	Convection cooled				
Acoustic Noise	dBA			24	Measured at a distance of 1 meter, without and with approved dimmers
Mechanical Shock Protection	per EN60068-2-27				
Vibration Protection	per EN60068-2-6 & EN60068-2-64				
MTBF	> 300,000 hours when operated at nominal input and output conditions, and at Tc ≤ 70°C				

4 - EMC COMPLIANCE AND SAFETY APPROVALS

EMC Compliance			
Conducted and Radiated EMI		•FCC CFR Title 47 Part 15 Class B at 120 Vac and Class A at 277 Vac, •EN55015 (CISPR 15) compliant at 220/230/240 Vac	
Harmonic Current Emissions		IEC61000-3-2	For Class C equipment
Voltage Fluctuations & Flicker		IEC61000-3-3	
Immunity Compliance	**ESD (Electrostatic Discharge)**	IEC61000-4-2	6 kV contact discharge, 8 kV air discharge, level 3
	RF Electromagnetic Field Susceptibility	IEC61000-4-3	3 V/m, 80 - 1000 MHz, 80% modulated at a distance of 3 meters
	Electrical Fast Transient	IEC61000-4-4	± 2 kV on AC power port for 1 minute, ±1 kV on signal/control lines
	Surge	IEC61000-4-5	± 1 kV line to line (differential mode) /± 2 kV line to common mode ground (tested to secondary ground) on AC power port, ±0.5 kV for outdoor cables
	Conducted RF Disturbances	IEC61000-4-6	3V, 0.15-80 MHz, 80% modulated
	Voltage Dips	IEC61000-4-11	>95% dip, 0.5 period; 30% dip, 25 periods; 95% reduction, 250 periods
Transient Protection	**Ring Wave**		ANSI/IEEE c62.41.1-2002 & c62.41.2-2002 category A, 2.5 kV ring wave

Safety Agency Approvals		
UL	UL8750 recognized	UL60950-1 recognized
cUL	CSA C22.2 60950-1	
CE	IEC61347-2-13 electronic control gear for LED Modules	

Safety	Units	Minimum	Typical	Maximum	Notes
Hi Pot (High Potential)	Vdc	4242			•Insulation between the input (AC line and Neutral) and the output •Tested at the RMS voltage equivalent of 3000 Vac

ENERGY RECOVERY PRODUCTS™

ESS010	3-10 W
ESS015	11-15 W
ESS020	16-20 W
ESS030	21-30 W

Dual Dimming (0-10 V & TRIAC/ELV) Constant Current LED Drivers with Fast Startup Time

5 - PROTECTION FEATURES

Under-Voltage (Brownout)

The ESS series provides protection circuitry such that an application of an input voltage below the minimum stated in paragraph 1 (Input Specification) shall not cause damage to the driver.

Short Circuit

The ESS series is protected against short-circuit such that a short from any output to return shall not result in a fire hazard or shock hazard. The driver shall hiccup as a result of a short circuit or over current fault. Removal of the fault will return the driver to within normal operation. The driver shall recover, with no damage, from a short across the output for an indefinite period of time.

Internal Over temperature Protection

The ESS series incorporates circuitry that prevents internal damage due to an over temperature condition. An over temperature condition may be a result of an excessive ambient temperature or as a result of an internal failure. When the over temperature condition is removed, the driver shall automatically recover.

Output Open Load

When the LED load is removed, the output voltage of the ESS series is limited to 1.3 times the maximum output voltage of each model.

6 - PREDICTED LIFETIME VERSUS CASE AND AMBIENT TEMPERATURE

Lifetime is defined by the measurement of the temperatures of all the electrolytic capacitors whose failure would affect light output under the nominal LED load and worst case AC line voltage. The graph in figure 1 is determined by the electrolytic capacitor with the shortest lifetime, among all electrolytic capacitors. The lifetime of an electrolytic capacitor is measured when any of the following changes in performance are observed:

1) Capacitance changes more than 20% of initial value
2) Dissipation Factor (tan δ): 150% or less of initial specified value
3) Equivalent Series Resistance (ESR): 150% or less of initial specified value
4) Leakage current: less of initial specified value

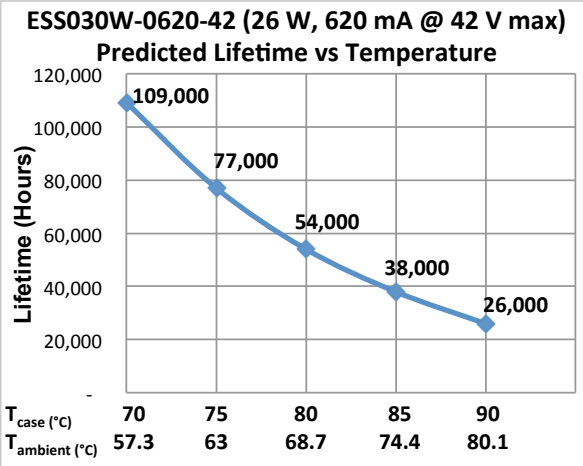


Figure 1

It should be noted the graph "Lifetime vs. Ambient Temperature" may have an error induced in the final application if the mounting has restricted convection flow around the case. For applications where this is evident, the actual case temperature measured at the Tc point in the application should be used for reliability calculations.

ENERGY RECOVERY PRODUCTS™

ESS010 3-10 W
ESS015 11-15 W
ESS020 16-20 W
ESS030 21-30 W

Dual Dimming (0-10 V & TRIAC/ELV) Constant Current LED Drivers with Fast Startup Time

7 - PHASE-CUT DIMMING

Dimming of the driver is possible with standard TRIAC-based incandescent dimmers that chop the AC voltage as shown in Figure 2, or with ELV dimmers. During the rapid rise time of the AC voltage when the dimmer turns on, the driver does not generate any voltage or current oscillations, and inrush current is controlled. During the on-time of the AC input, the driver regulates the output current based upon the conduction angle. The RMS value of the driver output current is proportional to the on-time of the AC input voltage. When operating with an incandescent dimmer, the RMS output current varies depending upon the conduction angle and RMS value of the applied AC input voltage. Figure 3 shows the typical output current versus conduction angle at nominal input voltage.

TRIAC dimming is only offered at 120 Vac.

The ESS010/020/030 series offers dimming compatibility with both phase-cut (reverse-phase and forward-phase) and 0-10V dimmers. Phase-cut dimming always has priority over 0-10 V dimming.

When using low power ESS models (specifically < 10 W) with a reverse-phase or forward-phase dimmer, always make sure the minimum required load is applied to the dimmer. Check the dimmer documentation for minimum load requirements.

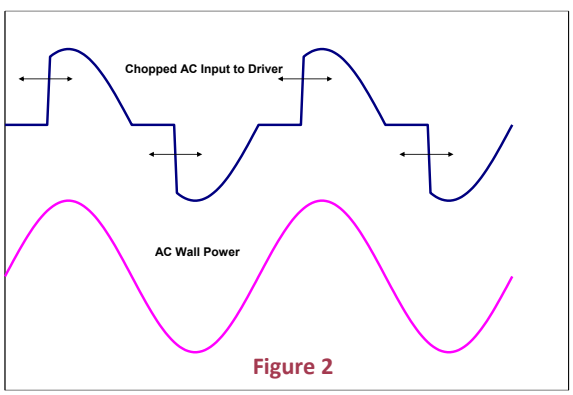


Figure 2

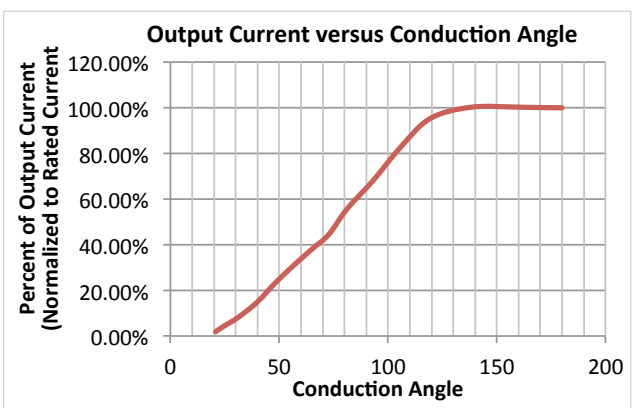


Figure 3

8 - COMPATIBLE PHASE-CUT DIMMERS & DIMMING RANGE

120Vac Dimmers					
Mfg.	**Model**	**Mfg.**	**Model**	**Mfg.**	**Model**
Lutron	S-603PG	**Lutron**	DVELV-303P	**Lutron**	CT-103P
Leviton	IPI06-1LZ	**Lutron**	SELV-300P	**Cooper**	SLC03P
Leviton	6631-2	**Leviton**	6683-IW	**Leviton**	IPE04
Lutron	DVCL-153P	**Leviton**	6161	**Lutron**	MAELV-600
Lutron	DV-600P	**Leviton**	6633-P	**Lutron**	FAELV-500
Lutron	TGCL-153P	**Lutron**	TG-600P	**Lightolier**	ZP260QEW
Lutron	S-600P	**Cooper**	DLC03P	**Cooper**	DAL06P
Leviton	VPE06	**Lutron**	LG-600P		

ENERGY RECOVERY PRODUCTS™

ESS010	3-10 W
ESS015	11-15 W
ESS020	16-20 W
ESS030	21-30 W

Dual Dimming (0-10 V & TRIAC/ELV) Constant Current LED Drivers with Fast Startup Time

9 - 0-10V DIMMING

The ESS drivers operate only with 0-10V dimmers that sink current. They are not designed to operate with 0-10V control systems that source current, as used in theatrical/entertainment systems. Developed in the 1980's, the 0-10V sinking current control method is adopted by the International Electrotechnical Commission (IEC) as apart of their IEC Standard 60929 Annex E.

The method to dim the output current of the driver is done via the +Dim/-Dim Signal pins. The +Dim/-Dim Signal pins respond to a 0 to 10 V signal, delivering 1% to 100% of the output current based on rated current for each model. A pull-up resistor is included internal to the driver. When the +Dim input (purple) is short circuited to the –Dim wire (grey) or to the –LED wire (black), a small amount of current may be present on the output and, in that condition, shimmering may be observed. If the +Dim input is ≤ 1 V and ≥ 0.6 V, the output current is still present, as shown in figure 4.
If the +Dim input is >10V or open circuited, the output current is programmed to 100% of the rated current.
When not used, the –Dim wire (grey) and to the +Dim wire (purple) can be capped or cut off. In this configuration, no dimming is possible and the driver delivers 100% of its rated output current.

The maximum source current (flowing from the driver to the 0-10V dimmer) supplied by the +Dim Signal pin is < 0.6 mA. The tolerance of the output current while being dimmed shall be +/-8% typical until down to 2V.

There are two 0-10V dimming transfer functions available, a linear curve where 10V = 100% of the output current and 1 V = 10 % of the output current (seen in figure 4) or a non-linear curve where the 9V = 100% of the output current and 1V = 1% of the output current (seen in figure 5).
The non-linear curve is recommended when using standard in wall 0-10 V logarithmic dimmers to avoid having insufficient source current available to pull the dimmer up to 10V and to account for the inability of the dimmer to pull below approximately 0.9V. In these type of installations, the modified transfer function will ensure 100% light output and dimming to 1%, regardless of the number of drivers on the 0-10V dimming line.

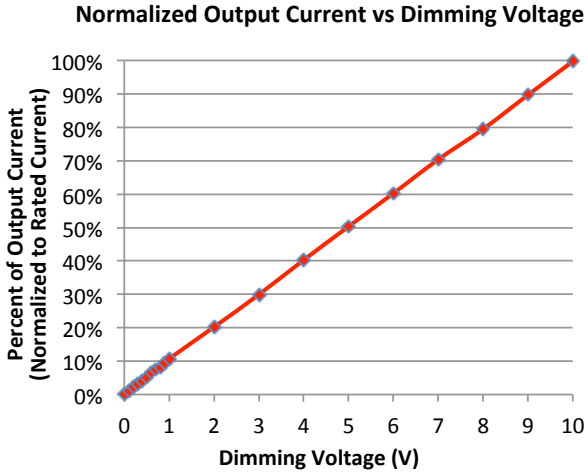


Figure 4

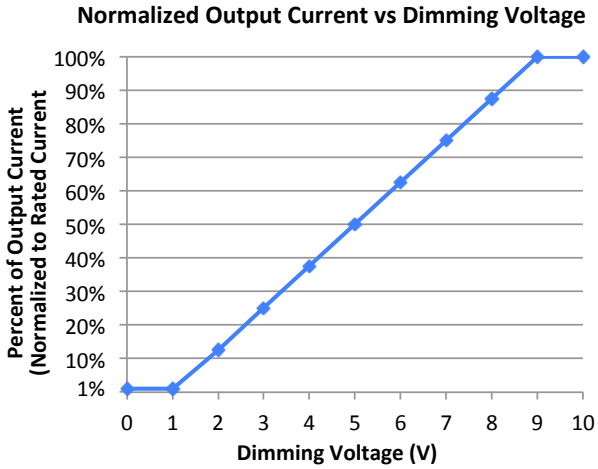


Figure 5

Dual Dimming (0-10 V & TRIAC/ELV) Constant Current LED Drivers with Fast Startup Time

9 - 0-10V DIMMING (CONTINUED)

A fixed or variable resistor can be also used from the dimming input to the return to adjust the output current. Figure 6 show the relationship of the output current to a resistor connected across the 0-10V dimming input.

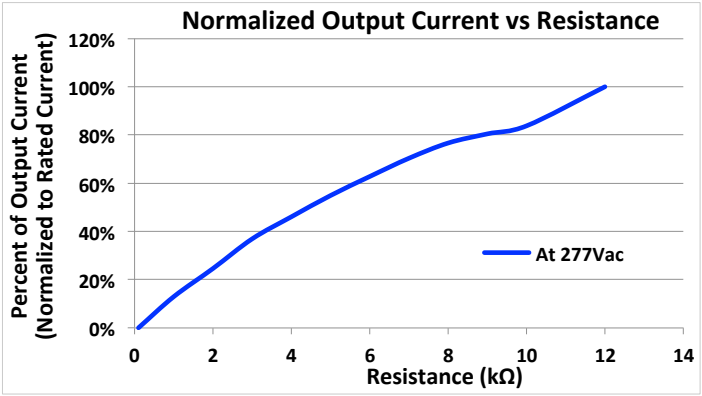


Figure 6

10 - COMPATIBLE 0-10V DIMMERS

- Lutron, Nova series (part number NFTV)
- Lutron, Diva series (part number DVTV)
- Leviton, IllumaTech series (part number IP710-DL)

ENERGY RECOVERY PRODUCTS™

ESS010	3-10 W
ESS015	11-15 W
ESS020	16-20 W
ESS030	21-30 W

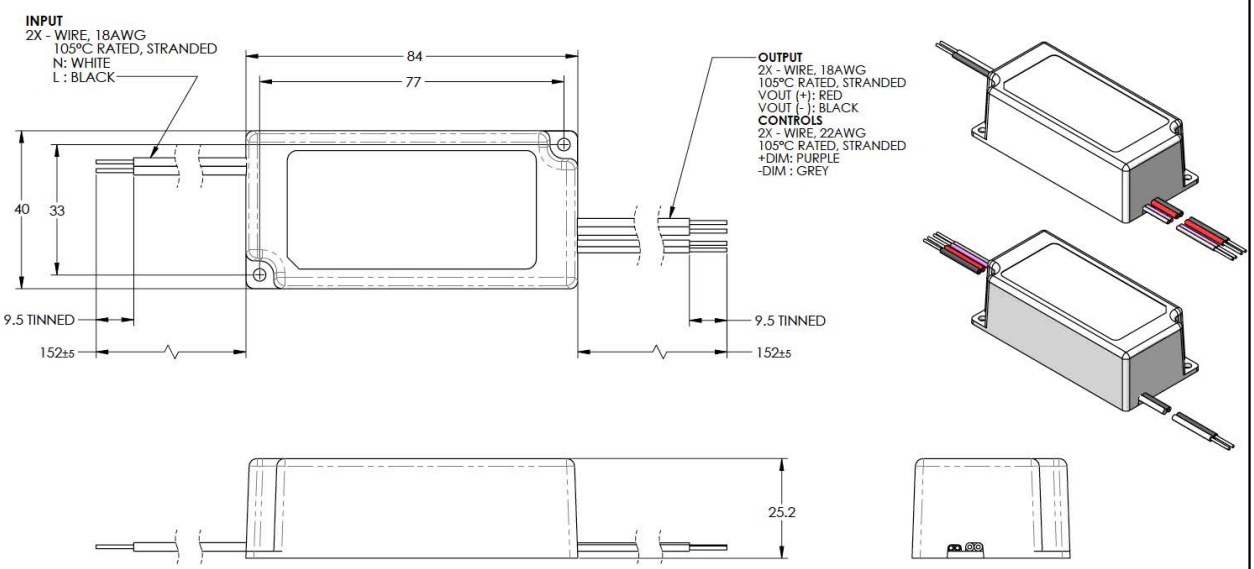
Dual Dimming (0-10 V & TRIAC/ELV) Constant Current LED Drivers with Fast Startup Time

11 - MECHANICAL DETAILS

Packaging Options: Plastic case
I/O Connections: Flying leads, 18 AWG on power leads, 152 mm long, 105°C rated, stranded, stripped by approximately 9.5mm, and tinned. All the wires, on both input and output, have a 300 V insulation rating.
Ingress Protection: IP64 rated
Flammability Rating: UL94 V-0 (5VA available upon request)

12 - OUTLINE DRAWINGS

Dimensions: L 84 x W 40 x H 25.2 mm (L 3.30 x W 1.57 x H 0.99 in)
Volume: 84.7 cm^3 (5.16 in^3)
Weight: 154 g (5.4 oz)



All dimensions are in mm

Figure 7

ENERGY RECOVERY PRODUCTS™

ESS010 3-10 W
ESS015 11-15 W
ESS020 16-20 W
ESS030 21-30 W

Dual Dimming (0-10 V & TRIAC/ELV) Constant Current LED Drivers with Fast Startup Time

13 - ORDERING INFORMATION - MODEL DESCRIPTION

ESS□□□□–□□□□–□□

Series
- 010 (3 - 10 W)
- 015 (11 - 15 W)
- 020 (16 - 20 W)
- 030 (21 - 30 W)

Nominal Vin
- W (120 to 277 Vac)

Iout

Vout Max.

ERP Part Number	Nominal Input Voltage (Vac)	Iout (mA)	Max Output Power (W)	Vout Min (Vdc)	Vout Nom (Vdc)	Vout Max (Vdc)	No Load Voltage (Vdc)
ESS010W: up to 10W							
ESS010W-0250-42	120 - 277	250	10.5	24	37.8	42	50
ESS015W: 11-15W							
ESS015W-0300-42	120 to 277	300	12.6	24	37.8	42	50
ESS015W-0350-32	120 to 277	350	11.2	21	28.8	32	41.6
ESS015W-0350-42	120 to 277	350	14.7	24	37.8	42	50
ESS020W-0350-56	120 to 277	350	19.6	40	50.4	56	60
ESS015W-0440-34	120 to 277	440	15.0	19	30.6	34	44.2
ESS020W: 16-20W							
ESS020W-0450-42	120 to 277	450	18.9	24	37.8	42	50
ESS020W-0500-32	120 to 277	500	16.0	21	28.8	32	41.6
ESS020W-0600-27	120 to 277	600	16.2	20	24.3	27	35
ESS020W-0700-24	120 to 277	700	16.8	14	21.6	24	31.2
ESS030W: 21-30W							
ESS030W-0500-42	120 to 277	500	21.0	24	37.8	42	50
ESS030W-0550-42	120 to 277	550	23.1	24	37.8	42	50
ESS030W-0620-42	120 to 277	620	26.0	24	37.8	42	50
ESS030W-0700-32	120 to 277	700	22.4	21	28.8	32	41.6
ESS030W-0700-39	120 to 277	700	27.3	27	35.1	39	50.7
ESS030W-0700-42	120 to 277	700	29.4	24	37.8	42	50
ESS030W-0900-27	120 to 277	900	24.3	20	24.3	27	35
ESS030W-1100-27	120 to 277	1100	29.7	20	24.3	27	35

For additional options of output current and output voltage, contact your sales representative or send an email to: SaveEnergy@ERPPowerLLC.com

ENERGY RECOVERY PRODUCTS™

ESS010	3-10 W
ESS015	11-15 W
ESS020	16-20 W
ESS030	21-30 W

Dual Dimming (0-10 V & TRIAC/ELV) Constant Current LED Drivers with Fast Startup Time

14 - LABELING

The ESS030W-0700-42 is used in figure 8 as an example to illustrate a typical label.

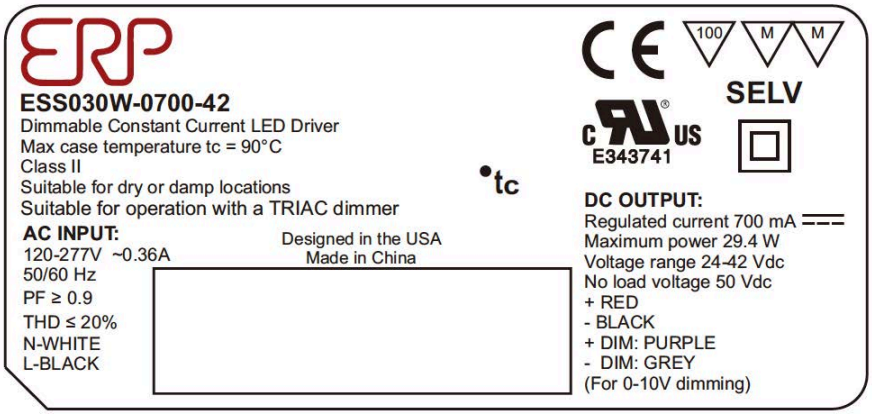


Figure 8

USA Headquarters
Tel: +1-805-517-1300
Fax: +1-805-517-1411
301 Science Drive, Suite 210
Moorpark, CA 93021, USA

CHINA Operations
Tel: +86-756-6266298
Fax: +86-756-6266299
No. 8 Pingdong Road 2
Zhuhai, Guangdong, China 519060

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** (1) 22GRRA-LD4-32-F1-UNV-L835-HCD1-PAF-U (4) EQ-CLIP-U Notes:	**Type:** **RK2** LAI16-104794

COOPER LIGHTING - METALUX®

energy solutions

DESCRIPTION

GRLED is a recessed lensed troffer series which offers a high quality luminaire dedicated with the latest solid state lighting and electronic driver technology for optimal performance and energy efficiency. The GRLED is compatible with all of today's popular ceiling systems and is available with a number of shielding options and accessories for application versatility.

The GRLED series features efficiency, quality and performance. The series is an excellent choice for commercial office spaces, schools, hospitals or retail merchandising areas.

Catalog #		Type	
Project			
Comments		Date	
Prepared by			



22GR
LED

2' X 2' LED TROFFER

General Recessed LED Troffer
For Use in Insulated Ceilings

SPECIFICATION FEATURES

Construction
Rigid housing is die formed of code gauge prime cold rolled steel and features full length die-formed stiffeners and unibody endplate for added strength. Side flanges are hemmed. Innovative design provides superior lens brightness uniformity and visual comfort. Unibody endplates are securely attached with interlocking tabs and screws. Four auxiliary fixture end suspension points provided. Gridlock feature for safety and convenience.

Controls
The GRLED is equipped standard with a 0-10V continuous dimming driver that works with any standard 0-10V control/dimmer. Combine with energy-saving products like occupancy sensors, daylighting controls, and lighting relay panels from Cooper Controls (www.coopercontrol.com) to maximize energy savings.

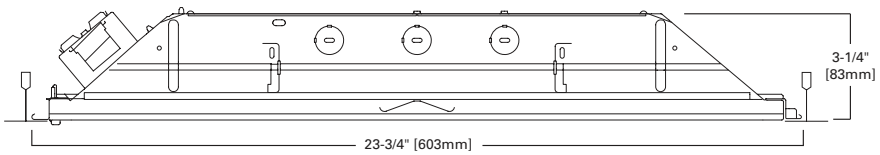
Electrical
Long-Life LED system coupled with electrical driver to deliver optimal performance. LED's available in 3000K, 3500K, 4000K or 5000K with typical CRI 85. Projected life is 60,000 hours at 70% lumen output. cULus listed. Electronic drivers are available for 120-277V applications. A 0-10V dimming driver is standard.

Finish
Multistage, iron phosphate pretreatment ensures maximum bonding and rust inhibition. Housing and driver cover finished with new 90% reflective white enamel for superior performance. "PAF" Painted After Fabrication option also available.

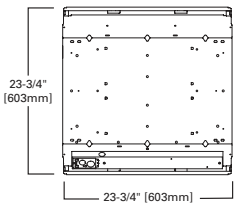
Hinging/Latching
Positive spring loaded steel latches with baked white enamel finish. Safety-lock T-hinges allow hinging and latching either side.

Frame/Optical Shielding
Die formed, flat steel door with frost #12 pattern acrylic prismatic lens offering the balance of rigidity and light stability. Primary stocking skus come standard with robust - .125 lens.

Compliance
Modules are UL recognized components and indoor luminaires are cULus listed for 25°C ambient environments, RoHS compliant, and LED modules comply with IESNA LM-79 and LM-80 standards. DesignLights Consortium® Qualified.



MOUNTING DATA



DOOR FRAMES

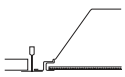


WATTAGE

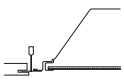
Lumens Package	Wattage
2000	20W
2400	23W
2800	28W
3200	33W
3600	38W
4000	45W
4300	50W

CEILING COMPATIBILITY

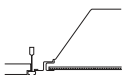
G
Grid/Lay-in Standard



G
Concealed T



G
Slot Grid



Ceiling Type	Trim Type
Exposed Grid	G
Concealed T	G
Slot Grid	G

(Verify compatibility/ consult factory.)

LINEAR DISCONNECT
Safe and convenient means of disconnecting power

Cooper Lighting
by EATON

ADF150148
2015-02-13 16:53:36

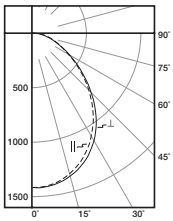
Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
(1) 22GRRA-LD4-32-F1-UNV-L835-HCD1-PAF-U (4) EQ-CLIP-U
Notes:

Type:
RK2
LAI16-104794

PHOTOMETRICS



22GR-LD4-32-F1-UNV-L835-CD1-U
Dimming Driver
Linear LED 3500K
Spacing criterion: (II) 1.1 x mounting height, (⊥) 1.2 x mounting height
Lumens: 3212
Input Watts: 33.2W
Efficacy: 96.7 lm/W
Test Report: 22GR-LD4-32-F1-UNV-L835-CD1-U.IES

Candlepower

Angle	Along II	45°	Across ⊥
0	1411	1411	1411
5	1404	1401	1410
10	1377	1377	1389
15	1328	1334	1350
20	1264	1273	1295
25	1180	1196	1223
30	1080	1101	1131
35	973	992	1020
40	853	867	893
45	730	739	757
50	604	611	624
55	486	489	503
60	378	379	390
65	295	286	293
70	226	211	218
75	170	155	155
80	119	106	103
85	65	55	54
90	0	0	0

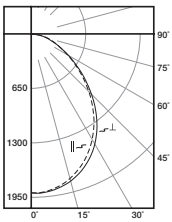
Coefficients of Utilization

Effective floor cavity reflectance 20%

rc	80%				70%				50%			30%			10%			0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	119	119	119	119	116	116	116	116	111	111	111	106	106	106	102	102	102	100
1	110	105	101	97	107	103	99	96	99	96	93	95	92	90	91	89	87	85
2	100	93	86	81	98	91	85	80	87	82	78	84	80	76	81	78	75	73
3	92	82	75	69	90	81	74	68	78	72	67	75	70	66	73	68	65	62
4	85	74	65	59	83	72	65	59	70	63	58	68	62	57	65	60	56	54
5	78	66	58	52	76	65	57	51	63	56	51	61	55	50	59	54	50	48
6	73	60	52	45	71	59	51	45	57	50	45	56	49	45	54	49	44	42
7	68	55	46	41	66	54	46	40	53	45	40	51	45	40	50	44	40	38
8	63	50	42	37	62	50	42	36	48	41	36	47	41	36	46	40	36	34
9	59	46	38	33	58	46	38	33	45	38	33	44	37	33	43	37	33	31
10	56	43	35	30	54	42	35	30	41	35	30	40	34	30	40	34	30	28

Zonal Lumen Summary

Zone	Lumens	% Fixture
0-30	1061	33.0
0-40	1680	52.3
0-60	2691	83.8
0-90	3212	100.0
0-180	3212	100.0



22GR-LD4-43-F1-UNV-L835-CD1-U
Dimming Driver
Linear LED 3500K
Spacing criterion: (II) 1.2 x mounting height, (⊥) 1.2 x mounting height
Lumens: 4310
Input Watts: 50.5W
Efficacy: 85.3 lm/W
Test Report: 22GR-LD4-43-F1-UNV-L835-CD1-U.IES

Candlepower

Angle	Along II	45°	Across ⊥
0	1892	1892	1892
5	1884	1879	1892
10	1845	1846	1863
15	1782	1788	1814
20	1693	1708	1739
25	1582	1604	1639
30	1452	1477	1516
35	1306	1327	1368
40	1142	1161	1199
45	976	991	1020
50	808	821	842
55	651	653	672
60	509	511	523
65	392	384	393
70	302	285	290
75	230	208	209
80	160	141	140
85	88	75	71
90	0	0	0

Coefficients of Utilization

Effective floor cavity reflectance 20%

rc	80%				70%				50%			30%			10%			0%
rw	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
RCR																		
0	119	119	119	119	116	116	116	116	111	111	111	106	106	106	102	102	102	100
1	110	105	101	97	107	103	99	96	99	96	93	95	92	90	91	89	87	85
2	100	93	86	81	98	91	85	80	87	82	78	84	80	76	81	78	75	73
3	92	82	75	69	90	81	74	68	78	72	67	75	70	66	73	68	65	62
4	85	74	65	59	83	72	65	59	70	63	58	68	62	57	65	60	56	54
5	78	66	58	52	76	65	57	51	63	56	51	61	55	50	59	54	50	48
6	73	60	52	45	71	59	51	45	57	50	45	56	49	45	54	49	44	42
7	68	55	46	41	66	54	46	40	53	45	40	51	45	40	50	44	40	38
8	63	50	42	36	62	50	42	36	48	41	36	47	41	36	46	40	36	34
9	59	46	38	33	58	46	38	33	45	38	33	44	37	33	43	37	33	31
10	56	43	35	30	54	42	35	30	41	35	30	40	34	30	40	34	30	28

Zonal Lumen Summary

Zone	Lumens	% Fixture
0-30	1423	33.0
0-40	2254	52.3
0-60	3611	83.8
0-90	4310	100.0
0-180	4310	100.0

ORDERING INFORMATION

SAMPLE NUMBER: 22GR-LD4-27-F1-UNV-L835-CD1-U

HCD = 1% DIMMING DRIVER

Rating
Blank=Standard
ATW-SW4=Chicago Rated

Width / Length
22=2' x 2'

Trim Type [6]
G=Grid/Lay-in (Standard) [1]
G=Concealed T
G=Slot Grid

Series
R=General Purpose Troffer

Door Frame
Standard=Flat White Steel Door (Leave Blank)
FA=Flush White Extruded Aluminum c/w Spring Latch
RA=Regressed White Extruded Aluminum
FAN=Flush Natural Anodized Extruded Aluminum
RAN=Regressed Natural Anodized Extruded Aluminum
FAB=Flush Black Extruded Aluminum
RAB=Regressed Black Extruded Aluminum

LED Type
LD4=LED 4.0

LED Lumens Output [5]
Stock
24=2400
32=3200
43=4300
MTO
20=2000
28=2800
36=3600
40=4000

Shielding
F1=A12 .125 HP (Standard)
A=A12 .095
A125=A12 .125

Voltage [2]
UNV=Universal Voltage 120-277 [3]

Options
GL=Single Element Fuse
GM=Double Element Fuse

Emergency
EL=Emergency Installed, 700 Lumens [4], [9]
EL14=Emergency Installed, 1400 Lumens [4], [9]
EL10W=Emergency Installed, 10 Watts [10]

CCT
L830=3000K
L835=3500K
L840=4000K
L850=5000K

Flex
Multiple Configurations Available

Driver Type
CD=0-10V Dimming Driver
SD=Step-Dim (Bi Level) [11]
5LTD=Fifth Light (DALI) Driver [11]

Number of Drivers
1=1 Driver

Options
PAF=Painted After Fabrication
G1=Gasket, Door Frame and Housing
G2=G1 plus Gasket between Lens and Door
G3=G1 and G2 plus Gasketing on Mounting Surface of Fixture Trims [7], [8]

Packaging
U=Unit Pack
PALC=Palletized Fixtures In Carton

ACCESSORIES

EQ-CLIP-U=T-BAR Safety Earthquake Clips [1]
DF-22-W=2' x 2' Drywall Frame Kit

NOTES: [1] An EQ Grid Clip is recommended for all 9/16" ceiling systems. [2] Products also available in non-US voltages and frequencies for international markets. [3] Not available when specifying emergencies, voltage must be specific. [4] EL options are non-integral. [5] Nominal lumen output. [7] Gasketing only available with aluminum door frame. [8] Gasketing minimum .125. [9] Must specify voltage (120V or 277V) when selecting EL option. [10] For delivered lumens, take lumens per watt of desired fixture and multiply by 10 watts (100 lp/W x 10 = 1000 lumens delivered). [11] Step-Dim (Bi-Level) and Fifth Light (DALI) only available for 3,200 lumen and above.

Specifications & dimensions subject to change without notice. Consult your Cooper Lighting Representative for availability and ordering information.

SHIPPING DATA

Catalog No.	Wt.	Pallet
22GR-LD4-32	10 lbs.	48
22GR-LD4-43	10 lbs.	48

Cooper Lighting by EATON

Eaton
1000 Eaton Boulevard
Cleveland, OH 44122
United States
Eaton.com

Eaton's Cooper Lighting Business
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.eaton.com/lighting

Specifications and dimensions subject to change without notice.

Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** (1) 22GRRA-LD4-32-F1-UNV-L835-HCD1-PAF-U (4) EQ-CLIP-U Notes:	**Type:** **RK2** LAI16-104794

ENERGY AND PERFORMANCE DATA BY CATALOG NUMBER

Stock or MTO*	Catalog Logic	Delivered Lumens	Watts	Efficacy (LPW)
MTO	22GR-LD4-20-F1-UNV-L835-CD1-U	2084	20.10	103.68
Stock	22GR-LD4-24-F1-UNV-L835-CD1-U	2432	23.78	102.27
MTO	22GR-LD4-28-F1-UNV-L835-CD1-U	2804	28.13	99.68
Stock	22GR-LD4-32-F1-UNV-L835-CD1-U	3212	33.15	96.89
MTO	22GR-LD4-36-F1-UNV-L835-CD1-U	3598	38.86	92.59
MTO	22GR-LD4-40-F1-UNV-L835-CD1-U	4016	45.31	88.63
Stock	22GR-LD4-43-F1-UNV-L835-CD1-U	4310	50.43	85.47

*Made to order (MTO) requires a typical four week lead time.

Submitted by LIGHTING ASSOCIATES, INC.		
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** LDA4A13835D010TE LAR35FL 4LA1WWF Notes:

Type: **RL**

LAI16-104794

Portfolio

DESCRIPTION

Low brightness 4-1/2" aperture LED adjustable accent fixture with choice of distribution. Adjustment mechanism enables the LED beam to pivot through the center of the aperture at the ceiling line, allowing maximum light output with no flashback. Offered with flat cut, adjustable accent, pinhole, and lensed wall wash trims.

Catalog #		Type
Project		
Comments		Date
Prepared by		

SPECIFICATION FEATURES

Lower Reflector
Spun 0.050" aluminum. Available in a variety of Alzak® and painted finishes. Two torsion springs pull trim tight to ceiling. Truncated adjustable cut cone allows for full tilt range and flexibility. Lensed wall wash provides even illumination on vertical surfaces. Pinhole includes black oculus to control glare.

Upper Reflector
Field interchangeable optics in 15°, 25° or 35° provides smooth beam without color separation. Media holder fits onto upper reflector and holds up to two lens media.

Trim Ring
Self flanged or white polymer trim ring.

Adjustment Mechanism
Stable aiming and locking mechanism allows smooth 362° rotation and 40° elevation adjustment. Aiming scale enables consistent setting across multiple fixtures.

Housing
One piece die cast 1-1/4" deep collar.18 gauge CRS housing is painted matte black to eliminate stray light. Housing is toolless top accessible.

Universal Mounting Bracket
Accepts 1/2" EMT, C Channel, T bar fasteners and hanger bars. Provides 5" total adjustment.

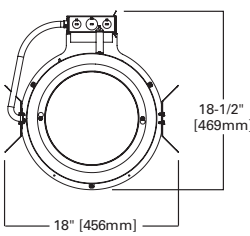
Thermal
Aluminum heat sink conducts heat away from the LED module for optimal performance and longer life.

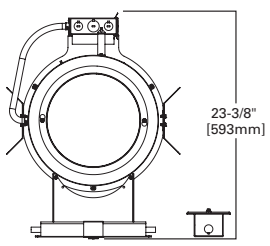
LED
LED system contains a plurality of high brightness white LED's combined with a high reflectance upper reflector producing even distribution with no pixilation. Rated for 50,000 hours at 70% lumen maintenance. Auto resetting, thermally protected, LED's are turned off when safe operating temperatures are exceeded. Color variation within 3-step MacAdam ellipses.

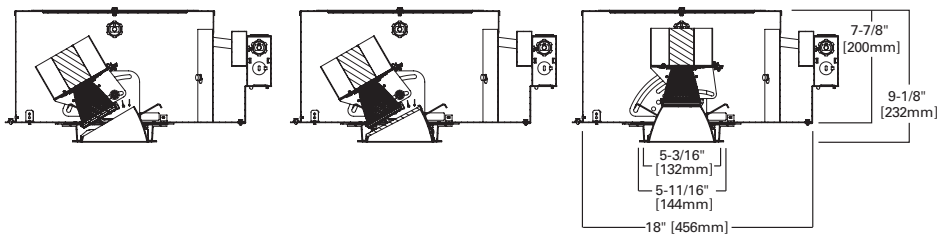
Driver
Combination 120-277V 0-10V or 120V trailing edge phase cut driver provides flicker free dimming from 100% to 10%. Optional 1% 0-10V, Fifth Light, or DMX. Driver can be serviced from above or through the aperture.

Code Compliance
Thermally protected and cULus listed for damp locations with flat cut, pinhole or angle cut and wet location covered ceiling with lensed or lensed wall wash. Optional City of Chicago environmental air (CCEA) marking for plenum applications. EMI/RFI emissions per FCC 47CFR Part 18 Class B consumer limits. 2800 lumen Non-IC rated - Insulation must be kept 3" from top and sides of housing. IC rated up to 1800 lumen. RoHS Compliant. 2800 lumen and above spacing and must follow spacing requirements. Photometric testing completed in accordance with IES LM 79 standards. LED life testing completed in accordance with LM 80 standards.

Warranty
5 year warranty.









LDA4A 4L

900, 1300, 1800, 2800 Lumen LED

4-Inch
Adjustable
Slope
Wall Wash
New Construction

ENERGY DATA
Sound Rating: Class A standards
T ambient -40 + 40°C
Power Factor: >0.90
THD < 20%

900 Lumen		
	120V	277V
Input Power	13.8W	15.0W
Input Current	0.12A	0.06A
Inrush Current	0.49A	0.85A

1300 Lumen		
	120V	277V
Input Power	22.9W	22.9W
Input Current	0.19A	0.09A
Inrush Current	0.72A	0.53A

1800 Lumen		
	120V	277V
Input Power	29.1W	29.4W
Input Current	0.24A	0.12A
Inrush Current	0.79A	1.09A

2800 Lumen		
	120V	277V
Input Power	44.5W	44.2W
Input Current	0.37A	0.17A
Inrush Current	1.09A	1.23A

ENERGY STAR RoHS Compliant

Refer to ENERGY STAR® Qualified Products List.

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** LDA4A13835D010TE LAR35FL 4LA1WWF Notes:	**Type:** **RL** LAI16-104794

ORDERING INFORMATION

Example:
LDA4A09835D010TE LAR25NF 4LLWW1LI = 4" LED, 900 Lumen, Narrow Flood, 90CRI, 3500K, Self Flanged, Lensed Wall Wash

Housing
- **LDA4A**=4" Aperture adjustable/ slope
- **LDA4ACP**=4" Aperture adjustable/slope, Chicago Plenum

Lumens[1]
- **09**=900 (IC Rated)
- **13**=1300 (IC Rated)
- **18**=1800 (IC Rated)
- **28**=2800 (Non-IC)[6]

CRI
- **8**=80 CRI
- **9**=90 CRI

CCT
- **27**=2700
- **30**=3000
- **35**=3500
- **40**=4000

Driver
900, 1300, 1800 and 2800 Lumen
- **D010TE**=120-277V 0-10V 10% dimming or trailing edge 120V
- **D5LT**=120-277V Fifth Light DALI 0% dimming
- **DE010**=120-277V 0-10V 1% dimming
- **DL3**=120-277V, 1-100% Lutron dimming
- **DLT**=Hi-Lume Forward Phase 2-wire dimming 120V
- **DMX**=120-277V DMX 0% dimming

900, 1300 and 1800 Lumen
- **D010TR**=120-277V 0-10V 10% dimming or leading edge 120V

Options[3,7]
- **EMBOD**=7W Bodine® Emergency Module with Remote Test Switch
- **EM7**=7W Emergency Module with Remote Test Switch
- **EM14**=14W Emergency Module with Remote Test Switch

BEAM FORMING REFLECTOR
- **LAR15SP**=15° Reflector
- **LAR25NF**=25° Reflector
- **LAR35FL**=35° Reflector

Reflector
- **4LA0**=4" Adjustable Accent, Polymer Trim Ring
- **4LA1**=4" Adjustable Accent, Self Flanged
- **4LLWW0**=4" Lensed Wall Wash, Polymer Trim Ring
- **4LLWW1**=4" Lensed Wall Wash, Self Flanged
- **4LAL0**=4" Lensed Adjustable Accent, Polymer Trim Ring
- **4LAL1**=4" Lensed Adjustable Accent, Self Flanged
- **4LFC0**=Flat Cut Cone, Polymer Trim Ring
- **4LFC1**=Flat Cut Cone, Self Flanged
- **4LAPIN**=4" Pinhole[4]

Finish
- **LI**=Specular Clear
- **H**=Semi-Specular Clear
- **WMH**=Warm Haze
- **G**=Specular Gold
- **WH**=Wheat
- **WHH**=Wheat Haze
- **GP**=Graphite
- **GPH**=Graphite Haze
- **B**=Specular Black
- **W**=Gloss White

Options
Self-Flanged Only
- **WF**=White Painted Flange

Accessories
- **HB26**=C-channel Bar Hanger, 26" Long, Pair
- **HB50**=C-channel Bar Hanger, 50" Long, Pair
- **RMB22**=Wood Joist Bar Hanger, 22" Long, Pair
- **H347**=347 to 120V Step Down Transformer, 75VA
- **H347200**=347 to 120V Step Down Transformer, 200VA
- **TRM4P**=Metal Trim Ring, White[2]
- **TRM4MB**=Metal Trim Ring, Black[2]
- **TRR4**=Rimless Trim Ring[2]
- **LGSKT4IP66**=IP66 Gasket Kit[5]

Color Filters
- **F22-20**=Red
- **F33-20**=Blue
- **F44-20**=Green
- **F55-20**=Yellow
- **F66-20**=Mercury

Dichronic Filters
- **F71-20**=Peach
- **F72-20**=Amber
- **F73-20**=Green
- **F74-20**=Medium Blue
- **F75-20**=Yellow
- **F76-20**=Red
- **F77-20**=Dark Blue
- **F78-20**=Light Blue
- **F79-20**=Neutral Density
- **F80-20**=Magenta

Beam-Modifying Lenses
- **LSL20**=Linear Spread Lens
- **OSL20**=Overall Spread Lens
- **DIF-20**=Diffused Lens

Louvers
- **LVR-20**=Hex Cell Louver

Snoot
- **PLNC-SN-B**=Snoot

Notes:
1. Nominal Lumens will vary depending on selected color, driver and reflector finish.
2. Order trim with polymer trim ring (Consult specification sheet for color ordering information and options).
3. Not available with Chicago Plenum and requires above ceiling access. Not for use with insulation.
4. Pinhole finish standard white with black occulus (omit finish code).
5. Required for T-24 compliance with lensed trims.
6. Product is marked spacing and must be installed with the following minimum spacing:
   Center to center of adjacent luminaires: 36"
   Center of luminaire to side of building member: 18"
   Minimum overhead clearance: 1/2"
7. Not CSA approved.

EM MULTIPLIER DATA

LUMENS	EM MULTIPLIER	
	7	14
900/1000	0.50	0.99
1300/1500	0.29	0.57
1800/2000	0.22	0.44
2800/3000	0.16	0.32

Submitted by LIGHTING ASSOCIATES, INC.

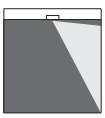
Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
LDA4A13835D010TE LAR35FL 4LA1WWF
Notes:

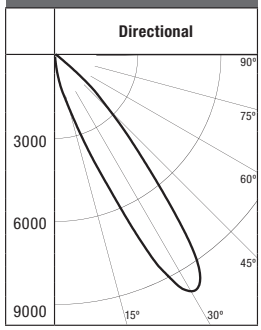
Type:
RL
LAI16-104794

PHOTOMETRICS

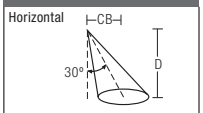
Test Number	P170903
Housing	LDA4A18835D010TE
Trim	LAR15SP 4LA1 30° Tilt
Lumens	1611 Lm
Efficacy	55.3 Lm/W



CANDLEPOWER DISTRIBUTION

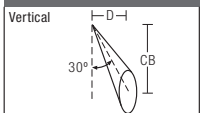


CONE OF LIGHT



MH	FC	L	W	CB
5.5'	50	5.9	3	3.2
7'	31	7.6	3.8	4
8'	23	8.7	4.2	4.6
9'	19	9.8	4.8	5.2
10'	15	10.9	5.4	5.8
12'	10	13.1	6.4	6.9

CONE OF LIGHT



D	FC	L	W	CB
1'	6925	0.3	0.2	1.7
2'	1731	0.7	0.6	3.5
3'	770	1.2	1	5.2
4'	433	1.5	1.2	6.9
5'	277	1.9	1.6	8.7
6'	192	2.4	2	10.4

CANDELA TABLE

Degrees Vertical	Candela
0	94
5	420
15	2152
25	7782
35	8815
45	2530
55	115
65	6
75	0
85	0
90	0

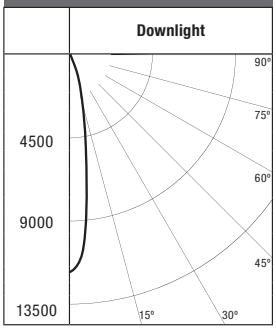
ZONAL LUMEN SUMMARY

Zone	Lumens	%Fixture
0-30	714	44.3
0-40	1329	82.5
0-60	1604	99.6
0-90	1611	100
90-180	0	0
0-180	1611	100

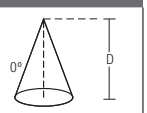
Test Number	P170583
Housing	LDA4A18835D010TE
Trim	LAR15SP 4LFC1
Lumens	1910 Lm
Efficacy	65.6 Lm/W
SC	0.32



CANDLEPOWER DISTRIBUTION



CONE OF LIGHT



MH	FC	L	W
5.5'	400	1.6	1.6
7'	247	2.2	2.2
8'	189	2.4	2.4
9'	149	2.8	2.8
10'	121	3.0	3.0
12'	84	3.6	3.6

CANDELA TABLE

Degrees Vertical	Candela
0	12099
5	10191
15	2956
25	357
35	18
45	2
55	0
65	0
75	0
85	0
90	0

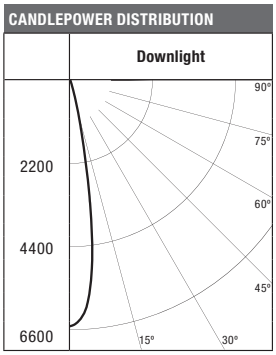
ZONAL LUMEN SUMMARY

Zone	Lumens	%Fixture
0-30	1894	99.1
0-40	1908	99.9
0-60	1910	100
0-90	1910	100
90-180	0	0
0-180	1910	100

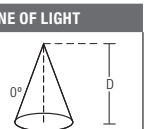
Test Number	P170167
Housing	LDA4A18835D010TE
Trim	LAR15SP 4LPIN
Lumens	738 Lm
Efficacy	25.3 Lm/W
SC	0.34



CANDLEPOWER DISTRIBUTION



CONE OF LIGHT



MH	FC	L	W
5.5'	216	1.8	1.8
7'	133	2.2	2.2
8'	102	2.6	2.6
9'	81	3	3
10'	65	3.2	3.2
12'	45	4	4

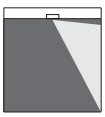
CANDELA TABLE

Degrees Vertical	Candela
0	6521
5	5842
15	767
25	19
35	1
45	0
55	0
65	0
75	0
85	0
90	0

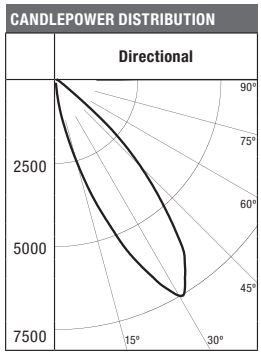
ZONAL LUMEN SUMMARY

Zone	Lumens	%Fixture
0-30	737	99.8
0-40	738	100
0-60	738	100
0-90	738	100
90-180	0	0
0-180	738	100

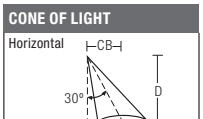
Test Number	P170679
Housing	LDA4A18835D010TE
Trim	LAR25NF 4LA1 30° Tilt
Lumens	1750 Lm
Efficacy	60.1 Lm/W



CANDLEPOWER DISTRIBUTION

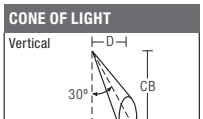


CONE OF LIGHT



MH	FC	L	W	CB
5.5'	42	6.4	4.2	3.2
7'	26	8.1	5.2	4.0
8'	20	9.3	6.0	4.6
9'	16	10.5	6.8	5.2
10'	13	11.6	7.6	5.8
12'	9	14	9.2	6.9

CONE OF LIGHT



D	FC	L	W	CB
1'	5063	0.4	0.4	1.7
2'	1266	1	0.8	3.5
3'	563	1.5	1.4	5.2
4'	316	2.1	2	6.9
5'	203	2.7	2.4	8.7
6'	141	3.2	3	10.4

CANDELA TABLE

Degrees Vertical	Candela
0	116
5	502
15	2876
25	6342
35	6772
45	3335
55	216
65	9
75	0
85	0
90	0

ZONAL LUMEN SUMMARY

Zone	Lumens	%Fixture
0-30	769	44
0-40	1389	79.4
0-60	1742	99.6
0-90	1750	100
90-180	0	0
0-180	1750	100

Eaton
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.eaton.com/lighting

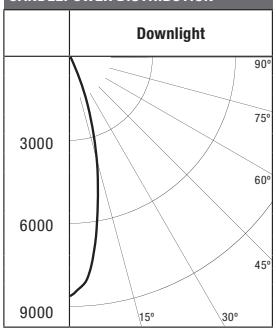
Specifications and dimensions subject to change without notice.

PHOTOMETRICS

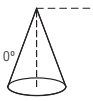
Test Number	P170615
Housing	LDA4A18835D010TE
Trim	LAR25NF 4LFC1
Lumens	2070 Lm
Efficacy	71.1 Lm/W
SC	0.46



CANDLEPOWER DISTRIBUTION



CONE OF LIGHT



MH	FC	L	W
5.5'	287	2.4	2.4
7'	177	3.0	3.0
8'	136	3.6	3.6
9'	107	4.0	4.0
10'	87	4.4	4.4
12'	60	5.4	5.4

CANDELA TABLE

Degrees Vertical	Candela
0	8687
5	7947
15	3834
25	465
35	28
45	3
55	0
65	0
75	0
85	0
90	0

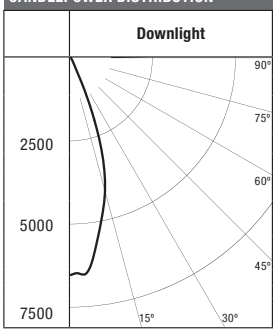
ZONAL LUMEN SUMMARY

Zone	Lumens	%Fixture
0-30	2044	98.8
0-40	2067	99.9
0-60	2070	100
0-90	2070	100
90-180	0	0
0-180	2070	100

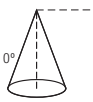
Test Number	P170647
Housing	LDA4A18835D010TE
Trim	LAR35FL 4LFC1
Lumens	2153 Lm
Efficacy	73.9 Lm/W
SC	0.6



CANDLEPOWER DISTRIBUTION



CONE OF LIGHT



D	FC	L	W
5.5'	219	3.2	3.2
7'	135	4.0	4.0
8'	104	4.6	4.6
9'	82	5.2	5.2
10'	66	5.8	5.8
12'	46	7	7

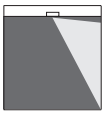
CANDELA TABLE

Degrees Vertical	Candela
0	6625
5	6511
15	4203
25	623
35	34
45	2
55	0
65	0
75	0
85	0
90	0

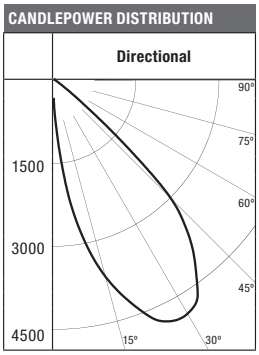
ZONAL LUMEN SUMMARY

Zone	Lumens	%Fixture
0-30	2121	98.5
0-40	2150	99.9
0-60	2153	100
0-90	2153	100
90-180	0	0
0-180	2153	100

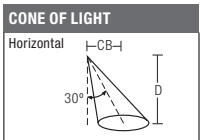
Test Number	P174896
Housing	LDA4A18835D010TE
Trim	LAR35FL 4LA1 30° Tilt
Lumens	1843 Lm
Efficacy	63.3 Lm/W



CANDLEPOWER DISTRIBUTION

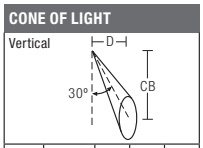


CONE OF LIGHT



MH	FC	L	W	CB
5.5'	45	5.3	4.6	3.2
7'	28	6.9	5.8	4
8'	21	7.8	6.8	4.6
9'	17	8.8	7.6	5.2
10'	14	9.8	8.4	5.8
12'	10	11.8	10.2	6.9

CONE OF LIGHT



D	FC	L	W	CB
1'	3506	0.5	0.6	1.7
2'	876	1.2	1.2	3.5
3'	390	1.9	1.8	5.2
4'	219	2.5	2.6	6.9
5'	140	3.2	3.2	8.7
6'	97	3.9	3.8	10.4

CANDELA TABLE

Degrees Vertical	Candela
0	342
5	1432
15	3794
25	4914
35	4619
45	2960
55	129
65	4
75	0
85	0
90	0

ZONAL LUMEN SUMMARY

Zone	Lumens	%Fixture
0-30	948	51.4
0-40	1514	82.1
0-60	1837	99.7
0-90	1843	100
90-180	0	0
0-180	1843	100

Submitted by LIGHTING ASSOCIATES, INC.

LIGHTING ASSOCIATES

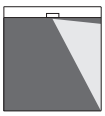
Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
LDA4A13835D010TE LAR35FL 4LA1WWF
Notes:

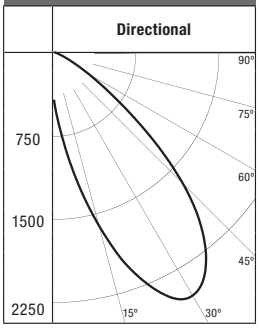
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PHOTOMETRICS

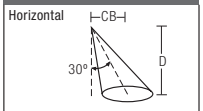
Test Number	P170871
Housing	LDA4A18835D010TE
Trim	LAR35FL 4LLWW1
Lumens	1600 Lm
Efficacy	54.9 Lm/W



CANDLEPOWER DISTRIBUTION

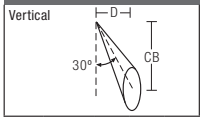


CONE OF LIGHT



MH	FC	L	W	CB
5.5'	19.4	6.5	6	3.2
7'	12	8.2	7.6	4
8'	9.2	9.4	8.8	4.6
9'	7.2	10.6	9.8	5.2
10'	5.9	11.8	11	5.8
12'	4.1	14.2	13.2	6.9

CONE OF LIGHT



D	FC	L	W	CB
1'	1775	0.6	0.6	1.7
2'	444	1.3	1.4	3.5
3'	197	2.0	2.2	5.2
4'	111	2.7	3.0	6.9
5'	71	3.5	3.8	8.7
6'	49	4.1	4.6	10.4

CANDELA TABLE

Degrees Vertical	Candela
0	427
5	726
15	1654
25	2420
35	2384
45	1609
55	551
65	108
75	8
85	3
90	0

ZONAL LUMEN SUMMARY

Zone	Lumens	%Fixture
0-30	596	37.2
0-40	1043	65.2
0-60	1556	97.3
0-90	1600	100
90-180	0	0
0-180	1600	100

SINGLE UNIT FOOTCANDLES

	2 FROM WALL (Distance From Fixture Along Wall)						
DD	●	1'	2'	3'	4'	5'	6'
1'	26.7	10.8	1.2	0.1	0	0	0
2'	142.2	70.1	15	2.7	0.5	0.1	0
3'	103.8	66.8	23.4	6.7	1.7	0.4	0.2
4'	55.3	41	19.8	8.1	2.8	0.9	0.4
5'	28.6	23.1	13.8	7.1	3.2	1.3	0.6
6'	15.6	13.3	9.1	5.5	2.9	1.5	0.8
7'	9.1	8	5.9	4.1	2.5	1.4	0.8
8'	5.6	5	4	2.9	2	1.2	0.8
9'	3.6	3.3	2.8	2.1	1.6	1.1	0.7
10'	2.4	2.2	1.9	1.6	1.2	0.9	0.7

MULTIPLE UNIT FOOTCANDLES

2' FROM WALL (Spacing Between Fixtures)			3' FROM WALL (Spacing Between Fixtures)		
●	2' apart	●	●	3' apart	●
27.9	21.6	27.9	2.3	1.5	2.3
157.2	140.1	157.2	31.9	26.3	31.9
127.3	133.6	127.3	69.9	62.3	69.9
75.1	82	75.1	64.7	66.1	64.7
42.4	46.2	42.4	48.1	51.4	48.1
24.7	26.6	24.7	33.4	36.4	33.4
15	16	15	22.7	24.9	22.7
9.5	10	9.5	15.7	17	15.7
6.4	6.6	6.4	11	11.8	11
4.4	4.5	4.4	7.8	8.4	7.8

Submitted by LIGHTING ASSOCIATES, INC.		
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** (1) NOVRS-22-PMO-HLO-LED-80-3200-30-277-D-1-TB9-W (2) EQ-CLIPS Notes: Providing equal not specified
		Type: **RM2 9/16 STD** LAI16-104794

NOVA22 LED

RECESSED

5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Grid - shown with a Nova flat lens



Grid - shown with a Nova Slope lens

PROJECT: _____

APPROVED BY: _____

SIGNATURE: _____

TYPE	QTY

DESCRIPTION

Nova is an efficient architectural LED troffer with a distinctive luminous shielding that distributes gentle brightness from the sides of its central optical element. Using advanced LED engines, Nova provides highly efficient illumination and offers comprehensive ceiling, electrical, and controls options in 2x2, 1x4, and 2x4 sizes. Nova is available with both Flat and Slope side diffusers.
See separate spec sheets for other available mountings.

DLC QPL LISTED

LED lighting facts LED Product Partner

up to 117 lm/w performance

IC RATED

ORDER GUIDE

	22	PMO	HLO	LED			
LUMINAIRE ID	**SIZE**	**CENTER OPTICS**	**SIDE OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
NOVRF - nova recessed flat **NOVRS** - nova recessed slope	**22** - 2'x2'	**PMO** - Precision Micro-Prism Optic	**HLO** - High-Efficiency Lambertian Optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**2300** - low output 2300lm **3200** - medium output 3200lm **4200** - high output 4200lm	**30** - 3000k **35** - 3500k **40** - 4000k

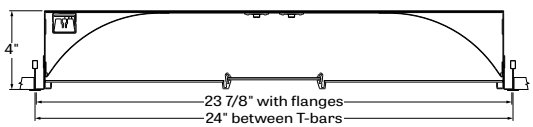
VOLTAGE	DRIVER	ELECTRICAL	MOUNTING	FINISH	CONTROLS
120 - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2**- Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires /EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+EB** - emergency battery pack **+EM** - emergency light circuit **+NL** - night light circuit **+GTD** - generator transfer device **+M** - master (consult factory) **+S** - satellite (consult factory)	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DF** - drywall kit	**W** - matte white **CF#** - custom finish specify RAL#	ONBOARD **OMS** - Motion Sensor & power pack **ODS** - Daylight Sensor & controller WIRELESS **EWC** - EnOcean Wireless Controller **LMC** - Lutron Motion Controller **LDC** - Lutron Daylight Controller

See page 4 for ordering code detailed information

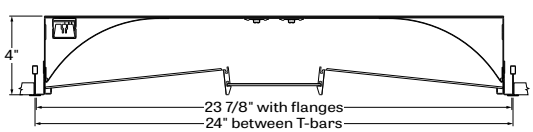
EQ-CLIPS

OPTIONS
FU - fuse
FWC - flexible whip cable (6' std)
AR - air return (for grid only)
CP - Chicago Plenum
CU - custom

CROSS SECTION



NOVRF - nova flat t-bar 9/16



NOVRS - nova slope t-bar 9/16

OPTICS



NOVRS - nova slope



NOVRF - nova flat

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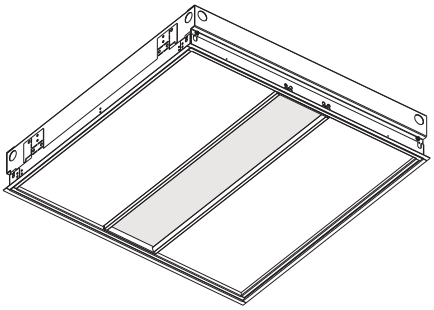
ETL LISTED c US Intertek

NOVA22 LED

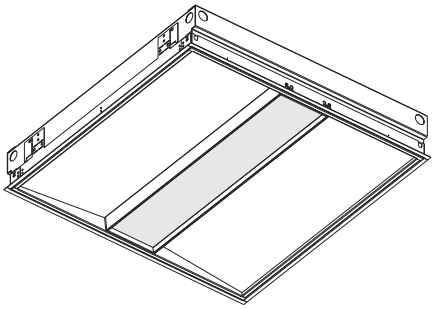
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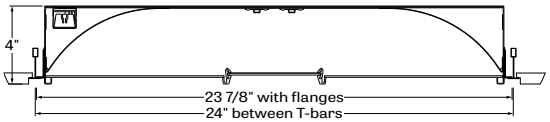
NOVA FLAT



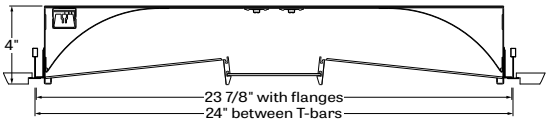
NOVA SLOPE



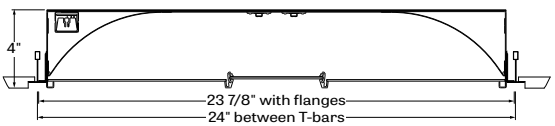
NOVA FLAT - TG9 - tegular 9/16"



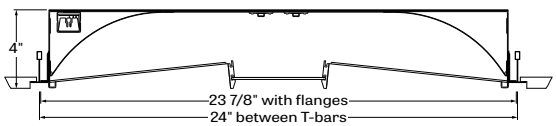
NOVA SLOPE - TG9 - tegular 9/16"



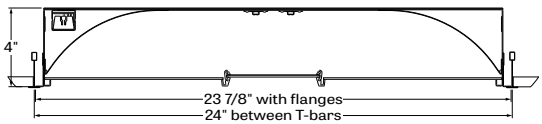
NOVA FLAT - TG15 - tegular 15/16"



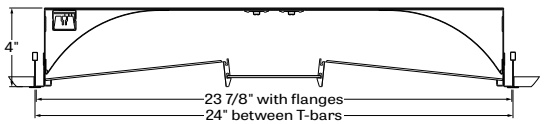
NOVA SLOPE - TG15 - tegular 15/16"



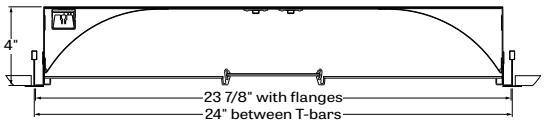
NOVA FLAT - TB9 - t-bar 9/16"



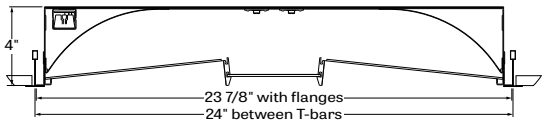
NOVA SLOPE - TB9 - t-bar 9/16"



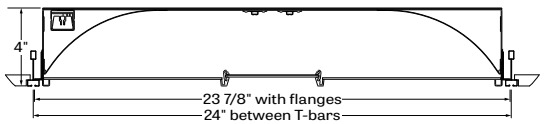
NOVA FLAT - TB15 - t-bar 15/16"



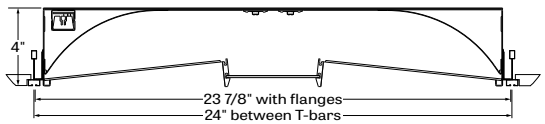
NOVA SLOPE - TB15 - t-bar 15/16"



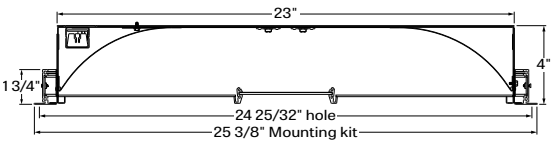
NOVA FLAT - ST- screw slot t-bar



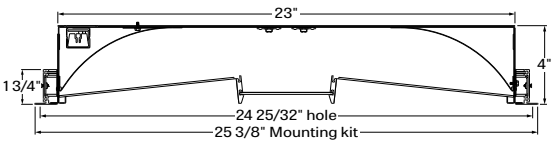
NOVA SLOPE - ST- screw slot t-bar



NOVA FLAT - DW- drywall kit



NOVA SLOPE - DW- drywall kit



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ELECTRICAL CIRCUITS

DIMMING 0-10V -
1 Circuit

1 CIRCUIT	BLK	HOT (CIRCUIT-1)
	WHT	NEUTRAL (CIRCUIT -1)
	GRN	GROUND
	PPL	DIM(+) 0-10V
	GRY	DIM(-) 0-10V

NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

DIMMING 0-10V -
1 Circuit + Emergency Battery

1 CIRCUIT+EB	BLK	HOT (CIRCUIT-1)
	WHT	NEUTRAL (CIRCUIT -1)
	GRN	GROUND
	RED	UNSWITCHED HOT
	PPL	DIM(+) 0-10V
	GRY	DIM(-) 0-10V

NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

LUTRON Hi-LUME A 2 wires -
1 Circuit

1 CIRCUIT	BLK	HOT
	WHT	NEUTRAL
	GRN	GROUND

NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

LUTRON Hi-LUME A 2 wires -
1 Circuit + Emergency Battery

1 CIRCUIT+EB	BLK	HOT
	WHT	NEUTRAL
	GRN	GROUND
	RED	UNSWITCHED HOT

NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

LUTRON Hi-LUME A 3 wires -
1 Circuit

1 CIRCUIT	BLK	HOT
	WHT	NEUTRAL
	GRN	GROUND
	ORG	HOT DIMMING
	PPL	E1 To EcoSystem Digital Link
	GRY	E2

NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

LUTRON Hi-LUME A 3 wires -
1 Circuit+ Emergency Battery

1 CIRCUIT+EB	BLK	HOT
	WHT	NEUTRAL
	GRN	GROUND
	ORG	HOT DIMMING
	RED	UNSWITCHED HOT
ECOSYSTEM	PPL	E1 To EcoSystem Digital Link
	GRY	E2

NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

LUTRON ECOSYSTEM H -
1 Circuit

1 CIRCUIT	BLK	HOT
	WHT	NEUTRAL
	GRN	GROUND
	PPL	E1 To EcoSystem Digital Link
	GRY	E2

NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

LUTRON ECOSYSTEM H -
1 Circuit + Emergency Battery

1 CIRCUIT+EB	BLK	HOT
	WHT	NEUTRAL
	GRN	GROUND
	RED	UNSWITCHED HOT
	PPL	E1 To EcoSystem Digital Link
	GRY	E2

NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

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OPTICS

CENTER LENS - PRECISION MICRO-PRISM-OPTIC (PMO) - utilizes a specially designed catadioptric lens that combines refraction and internal reflection. The square-base prism is 24% the size of those used in a high-performance fluorescent lens. The exclusive two-dimensional array of prisms is designed to eliminate the glare found at higher viewing angles and as such, enables a glare cut-off at a 45° viewing angle.
The acrylic material itself is untinted, relying entirely on catadioptric control for effective source obscuration. A highly efficient TIR process at the acrylic-air interface on the prism surfaces redirects incident light with less than a 0.1% loss per reflection. As a result, these LumenWerx optics attain a high optical efficiency greater than 90%, while maintaining visual comfort at normal viewing angles and presenting a pleasing luminous appearance.

SIDE LENS - HIGH EFFICIENCY LAMBERTIAN OPTIC (HLO) - shielding of diffusing 0.075" thick acrylic with up to 88% transmission and good source obscuration.

LIGHT SOURCE - LED

Custom Linear array of mid-flux LED's are mounted directly to the housing for optimal thermal performance. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	20	2300	117
medium output	4000K	29	3200	112
high output	4000K	38	4200	110

ELECTRICAL

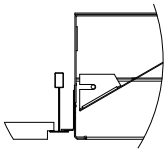
Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

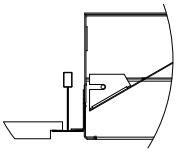
Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1300 lumens (25°C) emergency lighting output. Recharge time of 24 hours.

MOUNTING OPTIONS

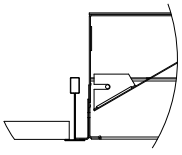
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling



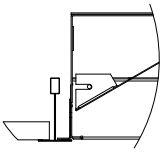
TG9 - tegular 9/16"



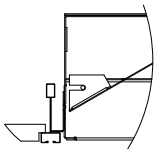
TG15 - tegular 15/16"



TB9 - t-bar 9/16"

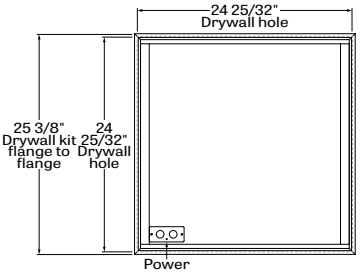


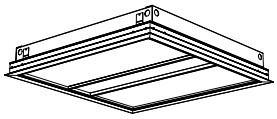
TB15 - t-bar 15/16"



ST - screw slot t-bar

A separate kit for mounting fixtures into drywall ceilings





DF - drywall kit

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FINISH

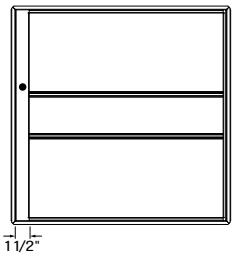
Interior reflectors - 95% reflective, matte white powder coating
Exterior - matte white powder coating.
Custom finish is also available.

CONTROLS

LumenWerx offers several options for integrating motion and daylight controls into NOVA luminaires. Wireless options incorporate a wireless controller/powerpack into the luminaire, which receives signals from a wireless sensor (by others) installed in the space. The advantages of the wireless option include greater flexibility of control options, sensor coverage, and system integration. Onboard options incorporate both the sensor and controller/powerpack. Onboard sensors, while inherently simpler, have limitations of control and coverage.

Onboard

Onboard Motion Sensor and power pack (OMS) provide automatic on and automatic off control, using PIR detection. Sensor is designed to detect fine-motion when installed within 6' of occupants.
Onboard Daylight Sensor and controller (ODS) provide input for 0-10V dimming drivers. Separate switched control of line input is required for on/off control.



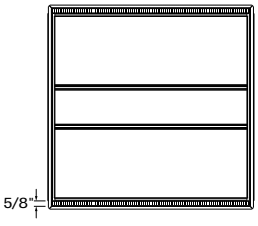
Location of an Onboard sensor

Wireless

EnOcean Wireless Controller (EWC) provides both a power pack for presence detection control and a 0-10V interface for daylight harvesting. EnOcean wireless sensors (by others) mounted in the room signal the onboard EWC. This option permits manual on/automatic off (vacancy) control.
Lutron Motion Controller (LMC) and **Lutron Daylight Controller (LDC)** provide inputs to Ecosystem drivers. Compatible Lutron wireless motion and daylight sensors (by others) mounted in the room signal onboard LPC or LDC. This option permits manual on/automatic off (vacancy) control.

OPTIONS

The air return option consists in a discreet, yet efficient, slot pattern integrated into the side flanges of the luminaire, allowing the airflow to exhaust into plenum space, creating a clean, pleasant look of the ceiling.



Air Return

CONSTRUCTION

Housing - Die formed cold rolled sheet steel 20 gauge thick, matte white powder coating.
Reflectors - Cold rolled steel 0.030" thick precisely die formed, 95% reflective matte white painted.
Interior brackets - Die formed cold rolled sheet steel 20 gauge thick.
Center basket - Extruded Aluminum 0.07" nominal, matte white and lens made in clear PMMA precisely formed into optical micro-structures forms.
Side lenses - Frost impact acrylic lens 88% transmissive.
Drywall kit - Extruded Aluminum 0.07" nominal, matte white powder coating.

WEIGHT

16.52lbs.+2.51lbs. (drywall kit) - 7.5kg+1.14kg (drywall kit)

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
DLC - Testing to DLC requirements, for this product, have been completed by an Accredited Laboratory and certified by DLC.
Lighting facts - testing products and reporting performance results according to industry standards.
Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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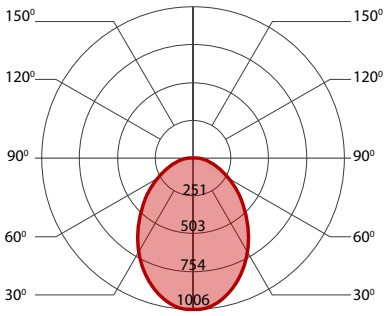
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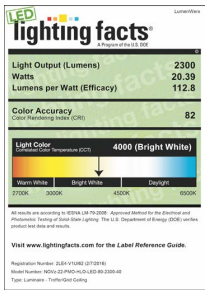
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2300 LUMEN AT 80CRI - LOW OUTPUT

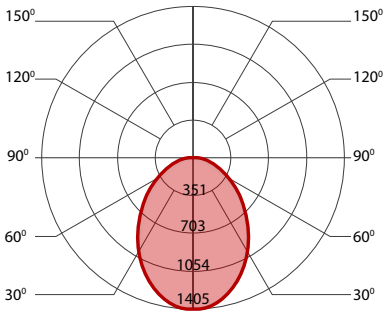


PERFORMANCE

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	20	2300	115
low output	3500K	20	2300	115
low output	4000K	20	2300	117

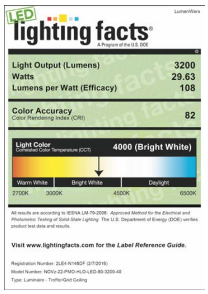


3200 LUMEN AT 80CRI - MEDIUM OUTPUT

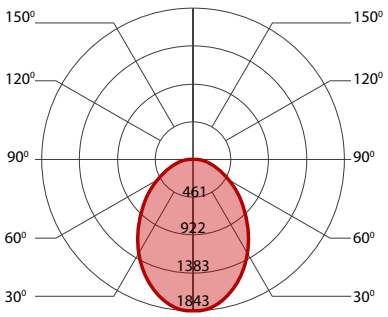


PERFORMANCE

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	29	3200	110
medium output	3500K	29	3200	110
medium output	4000K	29	3200	112

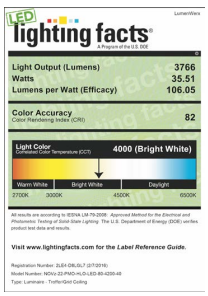


4200 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	39	4200	108
high output	3500K	39	4200	108
high output	4000K	38	4200	110



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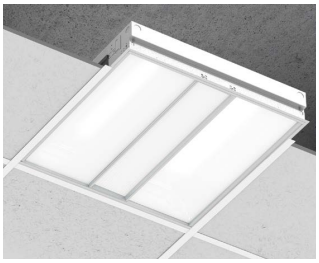
Submitted by LIGHTING ASSOCIATES, INC.		
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** (1) NOVRS-22-PMO-HLO-LED-80-3200-30-277-D-1-TG9-W (2) EQ-CLIPS Notes: Providing equal not specified
		Type: **RM2 9/16 TEG** LAI16-104794

NOVA22 LED

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5 YEARS WARRANTY

LUMENWERX
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Grid - shown with a Nova flat lens



Grid - shown with a Nova Slope lens

PROJECT: _____

APPROVED BY: _____

SIGNATURE: _____

TYPE	QTY

DESCRIPTION

Nova is an efficient architectural LED troffer with a distinctive luminous shielding that distributes gentle brightness from the sides of its central optical element. Using advanced LED engines, Nova provides highly efficient illumination and offers comprehensive ceiling, electrical, and controls options in 2x2, 1x4, and 2x4 sizes. Nova is available with both Flat and Slope side diffusers.
See separate spec sheets for other available mountings.

DLC QPL LISTED

LED lighting facts LED Product Partner

up to 117 lm/w performance

IC RATED

ORDER GUIDE

	22	PMO	HLO	LED			
LUMINAIRE ID	**SIZE**	**CENTER OPTICS**	**SIDE OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
NOVRF - nova recessed flat **NOVRS** - nova recessed slope	**22** - 2'x2'	**PMO** - Precision Micro-Prism Optic	**HLO** - High-Efficiency Lambertian Optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**2300** - low output 2300lm **3200** - medium output 3200lm **4200** - high output 4200lm	**30** - 3000k **35** - 3500k **40** - 4000k

VOLTAGE	DRIVER	ELECTRICAL	MOUNTING	FINISH	CONTROLS
120 - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2**- Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires /EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+EB** - emergency battery pack **+EM** - emergency light circuit **+NL** - night light circuit **+GTD** - generator transfer device **+M** - master (consult factory) **+S** - satellite (consult factory)	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DF** - drywall kit	**W** - matte white **CF#** - custom finish specify RAL#	ONBOARD **OMS** - Motion Sensor & power pack **ODS** - Daylight Sensor & controller WIRELESS **EWC** - EnOcean Wireless Controller **LMC** - Lutron Motion Controller **LDC** - Lutron Daylight Controller

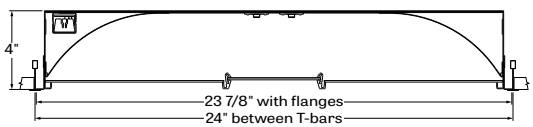
See page 4 for ordering code detailed information

EQ-CLIPS

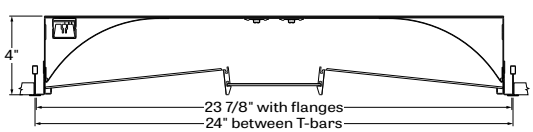
OPTIONS

FU - fuse
FWC - flexible whip cable (6' std)
AR - air return (for grid only)
CP - Chicago Plenum
CU - custom

CROSS SECTION



NOVRF - nova flat t-bar 9/16



NOVRS - nova slope t-bar 9/16

OPTICS



NOVRS - nova slope



NOVRF - nova flat

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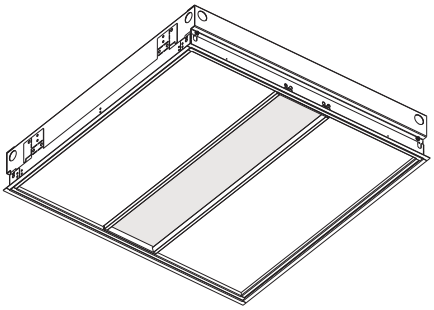
ETL LISTED c US Intertek

NOVA22 LED

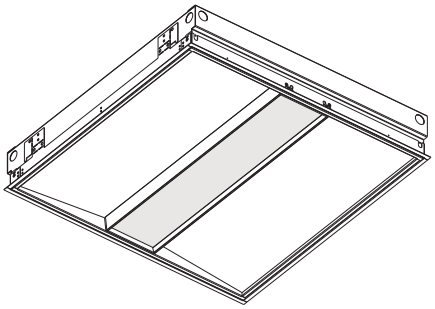
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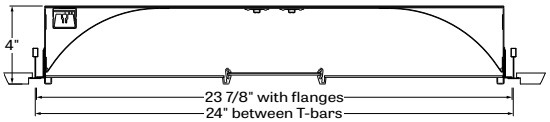
NOVA FLAT



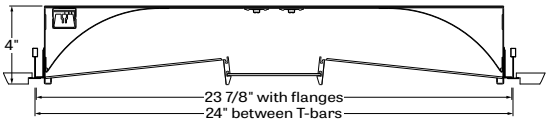
NOVA SLOPE



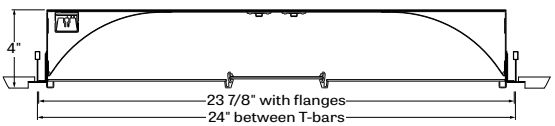
NOVA FLAT - TG9 - tegular 9/16"



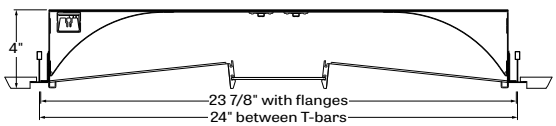
NOVA SLOPE - TG9 - tegular 9/16"



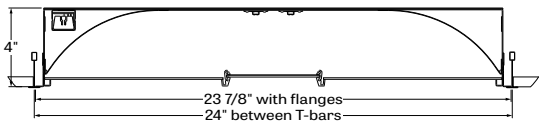
NOVA FLAT - TG15 - tegular 15/16"



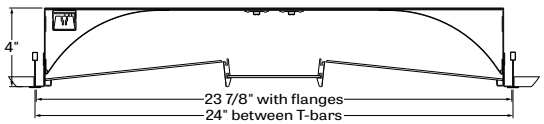
NOVA SLOPE - TG15 - tegular 15/16"



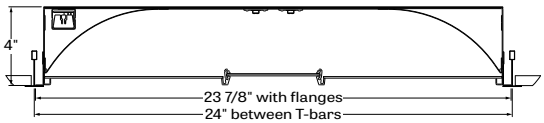
NOVA FLAT - TB9 - t-bar 9/16"



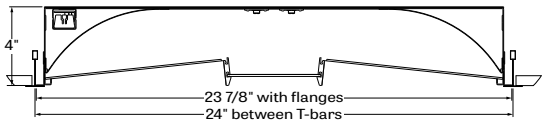
NOVA SLOPE - TB9 - t-bar 9/16"



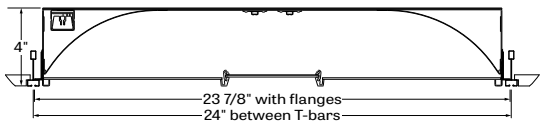
NOVA FLAT - TB15 - t-bar 15/16"



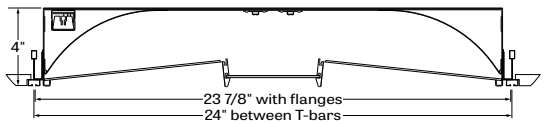
NOVA SLOPE - TB15 - t-bar 15/16"



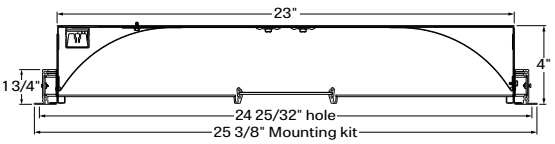
NOVA FLAT - ST- screw slot t-bar



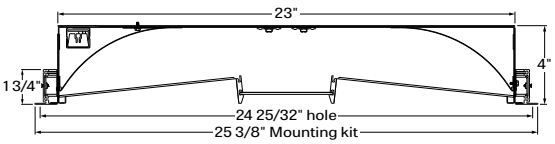
NOVA SLOPE - ST- screw slot t-bar



NOVA FLAT - DW- drywall kit



NOVA SLOPE - DW- drywall kit



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NOVA22 LED

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ELECTRICAL CIRCUITS

DIMMING 0-10V -
1 Circuit

1 CIRCUIT	BLK	HOT (CIRCUIT-1)
	WHT	NEUTRAL (CIRCUIT -1)
	GRN	GROUND
	PPL	DIM(+) 0-10V
	GRY	DIM(-) 0-10V

NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

DIMMING 0-10V -
1 Circuit + Emergency Battery

1 CIRCUIT+EB	BLK	HOT (CIRCUIT-1)
	WHT	NEUTRAL (CIRCUIT -1)
	GRN	GROUND
	RED	UNSWITCHED HOT
	PPL	DIM(+) 0-10V
	GRY	DIM(-) 0-10V

NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

LUTRON Hi-LUME A 2 wires -
1 Circuit

1 CIRCUIT	BLK	HOT
	WHT	NEUTRAL
	GRN	GROUND

NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

LUTRON Hi-LUME A 2 wires -
1 Circuit + Emergency Battery

1 CIRCUIT+EB	BLK	HOT
	WHT	NEUTRAL
	GRN	GROUND
	RED	UNSWITCHED HOT

NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

LUTRON Hi-LUME A 3 wires -
1 Circuit

1 CIRCUIT	BLK	HOT
	WHT	NEUTRAL
	GRN	GROUND
	ORG	HOT DIMMING
	PPL	E1 To EcoSystem Digital Link
	GRY	E2

NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

LUTRON Hi-LUME A 3 wires -
1 Circuit+ Emergency Battery

1 CIRCUIT+EB	BLK	HOT
	WHT	NEUTRAL
	GRN	GROUND
	ORG	HOT DIMMING
	RED	UNSWITCHED HOT
ECOSYSTEM	PPL	E1 To EcoSystem Digital Link
	GRY	E2

NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

LUTRON ECOSYSTEM H -
1 Circuit

1 CIRCUIT	BLK	HOT
	WHT	NEUTRAL
	GRN	GROUND
	PPL	E1 To EcoSystem Digital Link
	GRY	E2

NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

LUTRON ECOSYSTEM H -
1 Circuit + Emergency Battery

1 CIRCUIT+EB	BLK	HOT
	WHT	NEUTRAL
	GRN	GROUND
	RED	UNSWITCHED HOT
	PPL	E1 To EcoSystem Digital Link
	GRY	E2

NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

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OPTICS

CENTER LENS - PRECISION MICRO-PRISM-OPTIC (PMO) - utilizes a specially designed catadioptric lens that combines refraction and internal reflection. The square-base prism is 24% the size of those used in a high-performance fluorescent lens. The exclusive two-dimensional array of prisms is designed to eliminate the glare found at higher viewing angles and as such, enables a glare cut-off at a 45° viewing angle.
The acrylic material itself is untinted, relying entirely on catadioptric control for effective source obscuration. A highly efficient TIR process at the acrylic-air interface on the prism surfaces redirects incident light with less than a 0.1% loss per reflection. As a result, these LumenWerx optics attain a high optical efficiency greater than 90%, while maintaining visual comfort at normal viewing angles and presenting a pleasing luminous appearance.

SIDE LENS - HIGH EFFICIENCY LAMBERTIAN OPTIC (HLO) - shielding of diffusing 0.075" thick acrylic with up to 88% transmission and good source obscuration.

LIGHT SOURCE - LED

Custom Linear array of mid-flux LED's are mounted directly to the housing for optimal thermal performance. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	20	2300	117
medium output	4000K	29	3200	112
high output	4000K	38	4200	110

ELECTRICAL

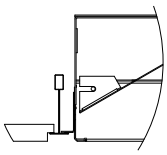
Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

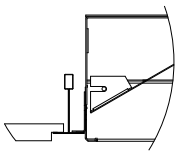
Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1300 lumens (25°C) emergency lighting output. Recharge time of 24 hours.

MOUNTING OPTIONS

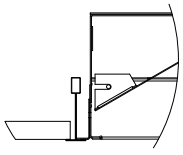
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling



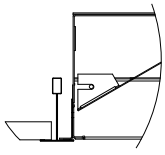
TG9 - tegular 9/16"



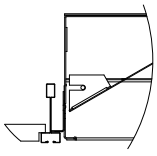
TG15 - tegular 15/16"



TB9 - t-bar 9/16"

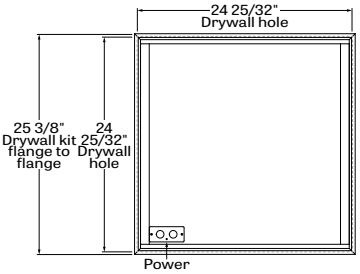


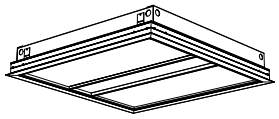
TB15 - t-bar 15/16"



ST - screw slot t-bar

A separate kit for mounting fixtures into drywall ceilings





DF - drywall kit

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FINISH

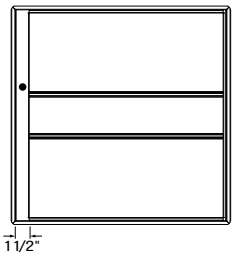
Interior reflectors - 95% reflective, matte white powder coating
Exterior - matte white powder coating.
Custom finish is also available.

CONTROLS

LumenWerx offers several options for integrating motion and daylight controls into NOVA luminaires. Wireless options incorporate a wireless controller/powerpack into the luminaire, which receives signals from a wireless sensor (by others) installed in the space. The advantages of the wireless option include greater flexibility of control options, sensor coverage, and system integration. Onboard options incorporate both the sensor and controller/powerpack. Onboard sensors, while inherently simpler, have limitations of control and coverage.

Onboard

Onboard Motion Sensor and power pack (OMS) provide automatic on and automatic off control, using PIR detection. Sensor is designed to detect fine-motion when installed within 6' of occupants.
Onboard Daylight Sensor and controller (ODS) provide input for 0-10V dimming drivers. Separate switched control of line input is required for on/off control.



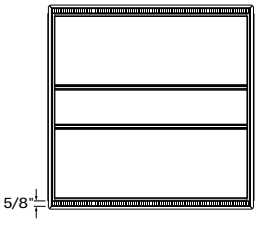
Location of an Onboard sensor

Wireless

EnOcean Wireless Controller (EWC) provides both a power pack for presence detection control and a 0-10V interface for daylight harvesting. EnOcean wireless sensors (by others) mounted in the room signal the onboard EWC. This option permits manual on/automatic off (vacancy) control.
Lutron Motion Controller (LMC) and **Lutron Daylight Controller (LDC)** provide inputs to Ecosystem drivers. Compatible Lutron wireless motion and daylight sensors (by others) mounted in the room signal onboard LPC or LDC. This option permits manual on/automatic off (vacancy) control.

OPTIONS

The air return option consists in a discreet, yet efficient, slot pattern integrated into the side flanges of the luminaire, allowing the airflow to exhaust into plenum space, creating a clean, pleasant look of the ceiling.



Air Return

CONSTRUCTION

Housing - Die formed cold rolled sheet steel 20 gauge thick, matte white powder coating.
Reflectors - Cold rolled steel 0.030" thick precisely die formed, 95% reflective matte white painted.
Interior brackets - Die formed cold rolled sheet steel 20 gauge thick.
Center basket - Extruded Aluminum 0.07" nominal, matte white and lens made in clear PMMA precisely formed into optical micro-structures forms.
Side lenses - Frost impact acrylic lens 88% transmissive.
Drywall kit - Extruded Aluminum 0.07" nominal, matte white powder coating.

WEIGHT

16.52lbs.+2.51lbs. (drywall kit) - 7.5kg+1.14kg (drywall kit)

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
DLC - Testing to DLC requirements, for this product, have been completed by an Accredited Laboratory and certified by DLC.
Lighting facts - testing products and reporting performance results according to industry standards.
Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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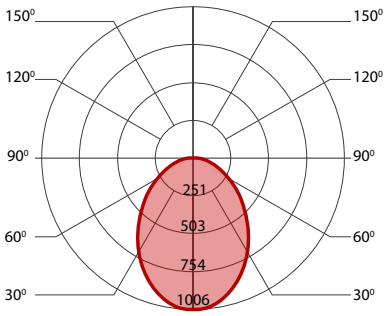
Intertek

NOVA22 LED

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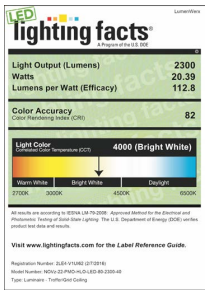
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2300 LUMEN AT 80CRI - LOW OUTPUT

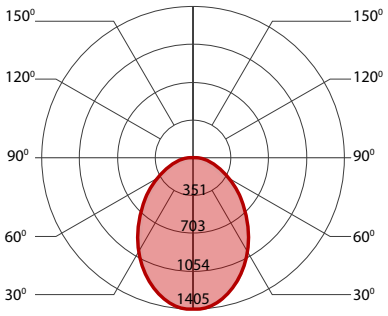


PERFORMANCE

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	20	2300	115
low output	3500K	20	2300	115
low output	4000K	20	2300	117

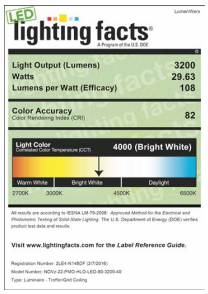


3200 LUMEN AT 80CRI - MEDIUM OUTPUT

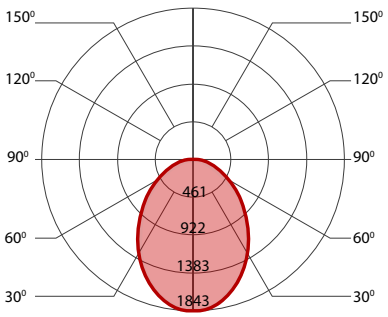


PERFORMANCE

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	29	3200	110
medium output	3500K	29	3200	110
medium output	4000K	29	3200	112

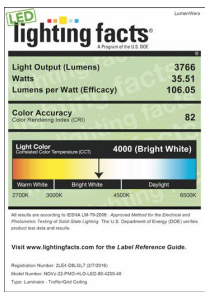


4200 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	39	4200	108
high output	3500K	39	4200	108
high output	4000K	38	4200	110



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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** (1) NOVRS-24-PMO-HLO-LED-80-4000-30-277-D-1-TG9/16-W (4) EQ-CLIPS Notes: Providing equal not specified	**Type:** **RM4** LAI16-104794

NOVA24 LED

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5 YEARS WARRANTY

LUMENWERX
WWW.LUMENWERX.COM



Grid - shown with a Nova flat lens



Grid - shown with a Nova Slope lens

PROJECT: _____

APPROVED BY: _____

SIGNATURE: _____

TYPE	QTY

DESCRIPTION

Nova is an efficient architectural LED troffer with a distinctive luminous shielding that distributes gentle brightness from the sides of its central optical element. Using advanced LED engines, Nova provides highly efficient illumination and offers comprehensive ceiling, electrical, and controls options in 2x2, 1x4, and 2x4 sizes. Nova is available with both Flat and Slope side diffusers.
See separate spec sheets for other available mountings.

DLC QPL LISTED

LED lighting facts LED Product Partner

up to 108 lm/w performance

IC RATED

ORDER GUIDE

	24	PMO	HLO	LED			
LUMINAIRE ID	**SIZE**	**CENTER OPTICS**	**SIDE OPTICS**	**LIGHT SOURCE**	**CRI**	**LUMEN PACKAGES**	**COLOR TEMP.**
NOVRF - nova recessed flat **NOVRS** - nova recessed slope	**24** - 2'x4'	**PMO** - Precision Micro-Prism Optic	**HLO** - High-Efficiency Lambertian Optic	**LED** - high performance LED	**80** - 80CRI **90** - 90CRI	**4000** - low output 4000lm **5500** - medium output 5500lm **6800** - high output 6800lm	**30** - 3000k **35** - 3500k **40** - 4000k

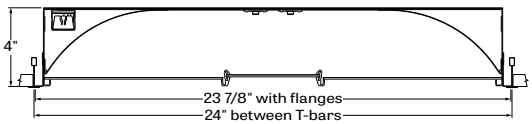
VOLTAGE	DRIVER	ELECTRICAL	MOUNTING	FINISH	CONTROLS
120 - 120V **277** - 277V **UNV** - 120V-277V **347** - 347V	**D** - dimming 0-10V **DA** - Dali **LA2**- Lutron Hi-Lume A - 2 wires 120V **LA3** - Lutron Hi-Lume A - 3 wires /EcoS **LEH** - Lutron EcoSystem H **LE5** - Lutron EcoSystem 5 **OTH** - other (consult factory)	**1** - 1 circuit **+EB** - emergency battery pack **+EM** - emergency light circuit **+NL** - night light circuit **+GTD** - generator transfer device **+M** - master (consult factory) **+S** - satellite (consult factory)	**TG9** - tegular 9/16" **TG15** - tegular 15/16" **TB9** - t-bar 9/16" **TB15** - t-bar 15/16" **ST** - screw slot t-bar **DF** - drywall kit	**W** - matte white **CF#** - custom finish specify RAL#	ONBOARD **OMS** - Motion Sensor & power pack **ODS** - Daylight Sensor & controller WIRELESS **EWC** - EnOcean Wireless Controller **LMC** - Lutron Motion Controller **LDC** - Lutron Daylight Controller

See page 4 for ordering code detailed information

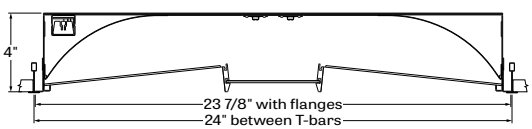
EQ-CLIPS

OPTIONS
FU - fuse
FWC - flexible whip cable (6' std)
AR - air return (for grid only)
CP - Chicago Plenum
CU - custom

CROSS SECTION



NOVRF - nova flat t-bar 9/16



NOVRS - nova slope t-bar 9/16

OPTICS



NOVRS - nova slope



NOVRF - nova flat

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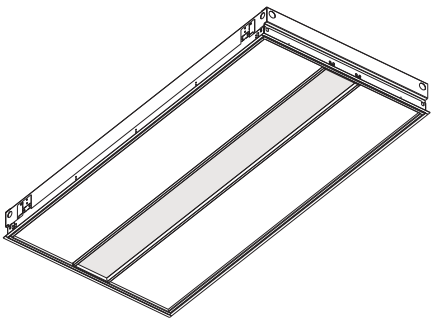
ETL LISTED c US Intertek

NOVA24 LED

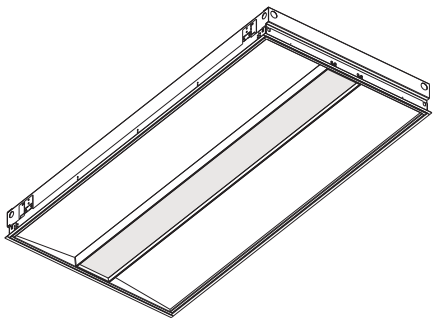
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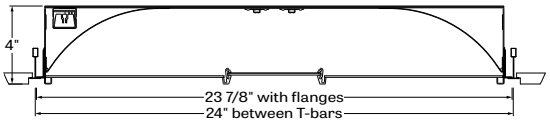
NOVA FLAT



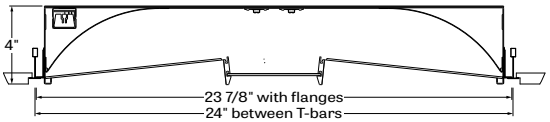
NOVA SLOPE



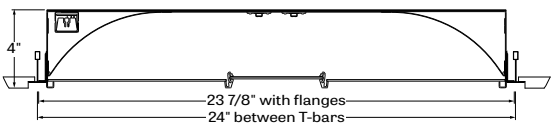
NOVA FLAT - TG9 - tegular 9/16"



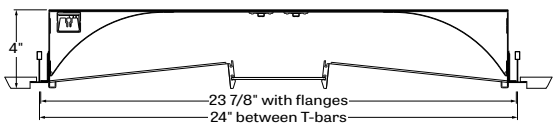
NOVA SLOPE - TG9 - tegular 9/16"



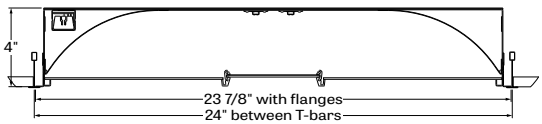
NOVA FLAT - TG15 - tegular 15/16"



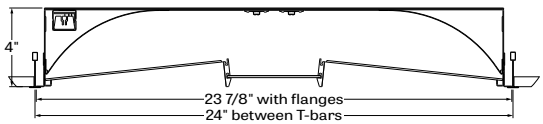
NOVA SLOPE - TG15 - tegular 15/16"



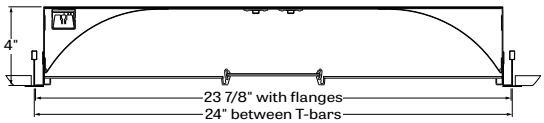
NOVA FLAT - TB9 - t-bar 9/16"



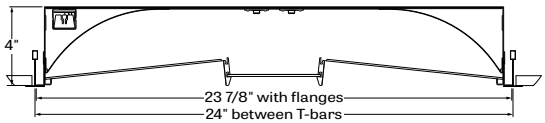
NOVA SLOPE - TB9 - t-bar 9/16"



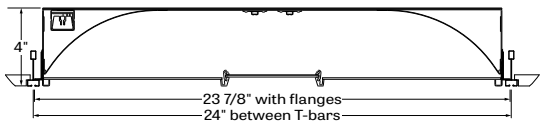
NOVA FLAT - TB15 - t-bar 15/16"



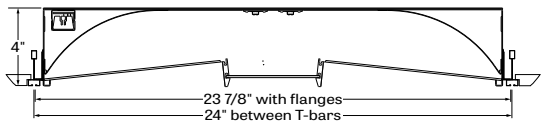
NOVA SLOPE - TB15 - t-bar 15/16"



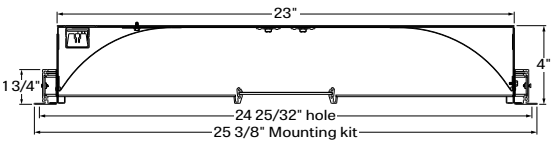
NOVA FLAT - ST- screw slot t-bar



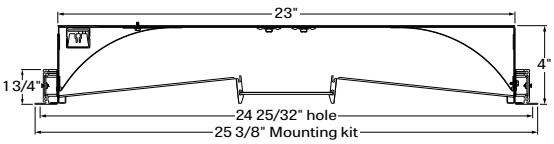
NOVA SLOPE - ST- screw slot t-bar



NOVA FLAT - DW- drywall kit



NOVA SLOPE - DW- drywall kit



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Intertek

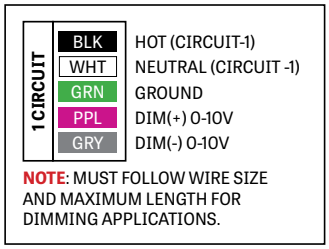
NOVA24 LED

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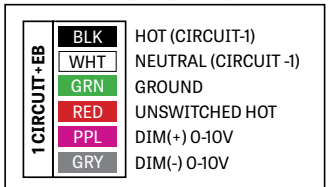
ELECTRICAL CIRCUITS

DIMMING 0-10V -
1 Circuit



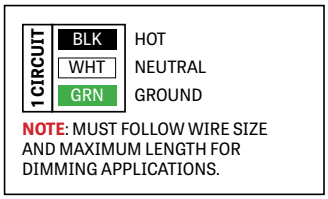
NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

DIMMING 0-10V -
1 Circuit + Emergency Battery



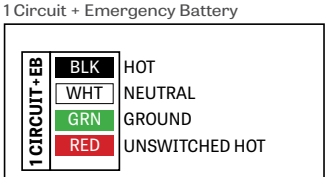
NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

LUTRON Hi-LUME A 2 wires -
1 Circuit



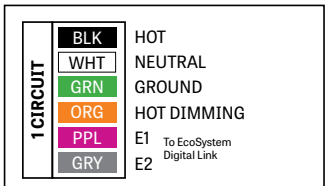
NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

LUTRON Hi-LUME A 2 wires -
1 Circuit + Emergency Battery



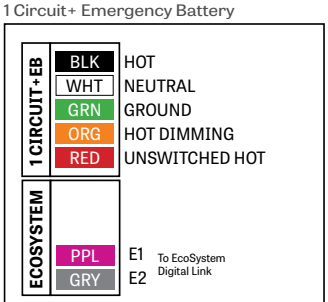
NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

LUTRON Hi-LUME A 3 wires -
1 Circuit



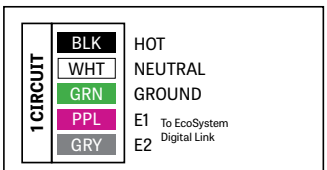
NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

LUTRON Hi-LUME A 3 wires -
1 Circuit+ Emergency Battery



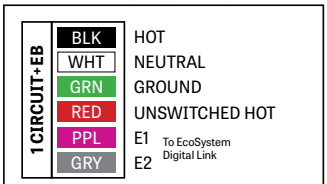
NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

LUTRON ECOSYSTEM H -
1 Circuit



NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

LUTRON ECOSYSTEM H -
1 Circuit + Emergency Battery



NOTE: MUST FOLLOW WIRE SIZE AND MAXIMUM LENGTH FOR DIMMING APPLICATIONS.

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Intertek

NOVA24 LED

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OPTICS

CENTER LENS - PRECISION MICRO-PRISM-OPTIC (PMO) - utilizes a specially designed catadioptric lens that combines refraction and internal reflection. The square-base prism is 24% the size of those used in a high-performance fluorescent lens. The exclusive two-dimensional array of prisms is designed to eliminate the glare found at higher viewing angles and as such, enables a glare cut-off at a 45° viewing angle.
The acrylic material itself is untinted, relying entirely on catadioptric control for effective source obscuration. A highly efficient TIR process at the acrylic-air interface on the prism surfaces redirects incident light with less than a 0.1% loss per reflection. As a result, these LumenWerx optics attain a high optical efficiency greater than 90%, while maintaining visual comfort at normal viewing angles and presenting a pleasing luminous appearance.

SIDE LENS - HIGH EFFICIENCY LAMBERTIAN OPTIC (HLO) - shielding of diffusing 0.075" thick acrylic with up to 88% transmission and good source obscuration.

LIGHT SOURCE - LED

Custom Linear array of mid-flux LED's are mounted directly to the housing for optimal thermal performance. Available in 3000K, 3500K and 4000K with a minimum 80 CRI and an option for 90 CRI with elevated R9 value. Color consistency maintained to within 3 SDCM. LEDs operated at reduced drive current to optimize efficacy and lumen maintenance.
All LEDs have been tested in accordance with IESNA LM-80-08 and the results have shown L80 lumen maintenance greater than 60,000 hours. Absolute product photometry is measured and presented in accordance with IESNA LM-79, unless otherwise indicated.

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	4000K	37	4000	108
medium output	4000K	53	5500	103
high output	4000K	66	6800	103

ELECTRICAL

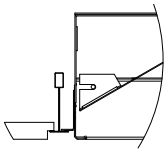
Factory-set adjustable output current electronic driver with 120-277V AC line input. Dimmable from at least 100%-5% with 0-10V control. Rated life (90% survivorship) of 50,000 hours at 50°C max. ambient (and 70°C max. case) temperature. At maximum driver load: Efficiency>84%, PF>0.9, THD<20%. Other specifiable options include Lutron Hi-Lume A (specify 2, 3 or 4 wires), EcoSystem H (100%-1%, fade-to-black) and EcoSystem 5 (100%-5%) dimmable drivers and DALI protocol drivers.

EMERGENCY

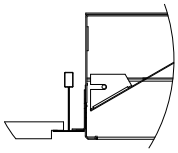
Factory installed long life high temperature recyclable Ni-Cad battery pack with test switch and charge indicator, minimum of 90 minutes operation, up to 1300 lumens (25°C) emergency lighting output. Recharge time of 24 hours.

MOUNTING OPTIONS

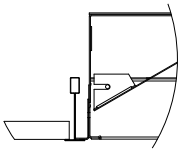
Recess mount into exposed or concealed T-Bar or Tegular grid ceiling



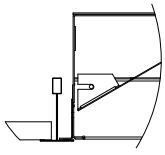
TG9 - tegular 9/16"



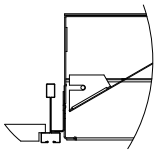
TG15 - tegular 15/16"



TB9 - t-bar 9/16"

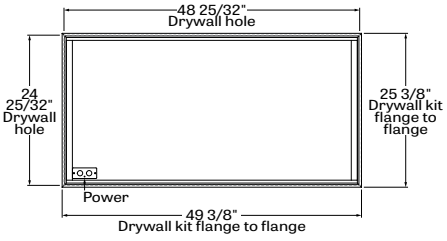


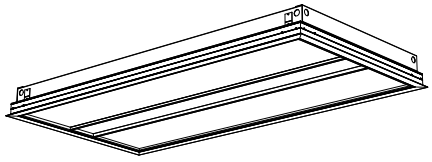
TB15 - t-bar 15/16"



ST - screw slot t-bar

A separate kit for mounting fixtures into drywall ceilings





DF - drywall kit

FINISH

Interior reflectors - 95% reflective, matte white powder coating
Exterior - matte white powder coating.
Custom finish is also available.

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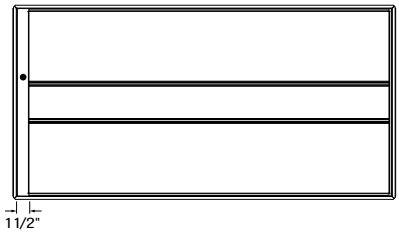
CONTROLS

LumenWerx offers several options for integrating motion and daylight controls into NOVA luminaires. Wireless options incorporate a wireless controller/powerpack into the luminaire, which receives signals from a wireless sensor (by others) installed in the space. The advantages of the wireless option include greater flexibility of control options, sensor coverage, and system integration. Onboard options incorporate both the sensor and controller/powerpack. Onboard sensors, while inherently simpler, have limitations of control and coverage.

Onboard

Onboard Motion Sensor and power pack (OMS) provide automatic on and automatic off control, using PIR detection. Sensor is designed to detect fine-motion when installed within 6' of occupants.

Onboard Daylight Sensor and controller (ODS) provide input for 0-10V dimming drivers. Separate switched control of line input is required for on/off control.



Location of an Onboard sensor

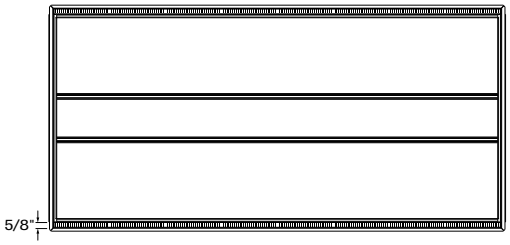
Wireless

EnOcean Wireless Controller (EWC) provides both a power pack for presence detection control and a 0-10V interface for daylight harvesting. EnOcean wireless sensors (by others) mounted in the room signal the onboard EWC. This option permits manual on/automatic off (vacancy) control.

Lutron Motion Controller (LMC) and **Lutron Daylight Controller (LDC)** provide inputs to Ecosystem drivers. Compatible Lutron wireless motion and daylight sensors (by others) mounted in the room signal onboard LPC or LDC. This option permits manual on/automatic off (vacancy) control.

OPTIONS

The air return option consists in a discreet, yet efficient, slot pattern integrated into the side flanges of the luminaire, allowing the airflow to exhaust into plenum space, creating a clean, pleasant look of the ceiling.



Air Return

CONSTRUCTION

Housing - Die formed cold rolled sheet steel 20 gauge thick, matte white powder coating.
Reflectors - Cold rolled steel 0.030" thick precisely die formed, 95% reflective matte white painted.
Interior brackets - Die formed cold rolled sheet steel 20 gauge thick.
Center basket - Extruded Aluminum 0.07" nominal, matte white and lens made in clear PMMA precisely formed into optical micro-structures forms.
Side lenses - Frost impact acrylic lens 88% transmissive.
Drywall kit - Extruded Aluminum 0.07" nominal, matte white powder coating.

WEIGHT

36.23lbs.+3.74lbs. (drywall kit) - 16.45kg+1.7 kg (drywall kit)

CERTIFICATIONS

ETL - Rated for Dry/Damp locations. Conforms to UL Standard 1598 and certified to CAN/CSA Standard C22.2 No. 250.0.
DLC - Testing to DLC requirements, for this product, have been completed by an Accredited Laboratory and certified by DLC.
Lighting facts - testing products and reporting performance results according to industry standards.
Chicago plenum - City of Chicago Approved (CCEA)
IC rated - suitable for direct contact with insulation.

WARRANTY

LumenWerx provides a five-year limited warranty of electrical and mechanical performance of the luminaires, including the LED boards, drivers, and auxiliary electronics. LumenWerx will repair or replace defective luminaires or components at our discretion, provided they have been installed and operated in accordance with our specifications. Other limitations apply, please refer to the full warranty on our website.

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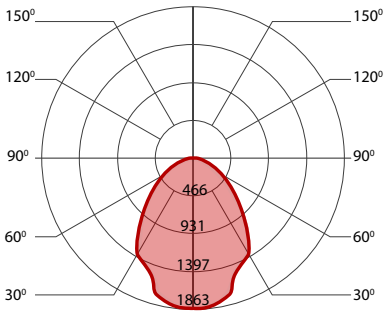
Intertek

NOVA24 LED

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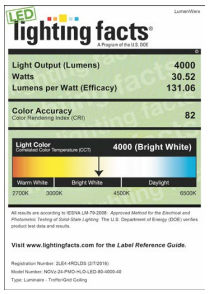
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4000 LUMEN AT 80CRI - LOW OUTPUT

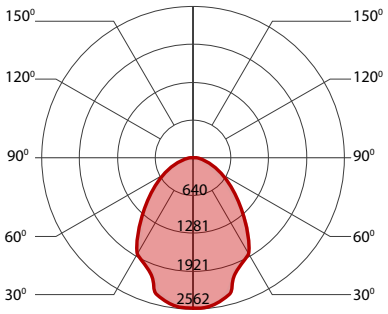


PERFORMANCE

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
low output	3000K	40	4000	101
low output	3500K	38	4000	104
low output	4000K	37	4000	108

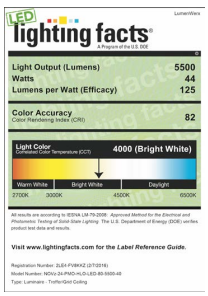


5500 LUMEN AT 80CRI - MEDIUM OUTPUT

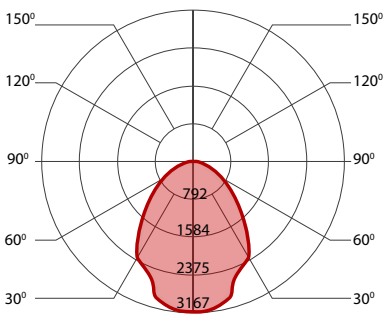


PERFORMANCE

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
medium output	3000K	57	5500	97
medium output	3500K	55	5500	100
medium output	4000K	53	5500	103

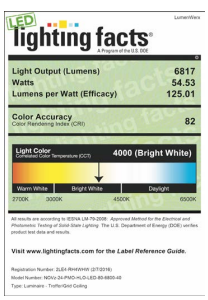


6800 LUMEN AT 80CRI - HIGH OUTPUT



PERFORMANCE

LED output	Color Temp	Watts	Nominal Delivered Lumens	Efficacy LPW
high output	3000K	70	6800	97
high output	3500K	68	6800	100
high output	4000K	66	6800	103



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Intertek

Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-LENGTH-S-3000K-F-277V-SC-WOOD-DIM Notes:	**Type:** **RN** LAI16-104794

IC - RATED | LED | BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

INDUSTRY BEST 10 YEAR LED WARRANTY | 2012 PROGRESS Report SELECTION | pia 13 | LED lighting facts® A Program of the U.S. DOE

Date

Project

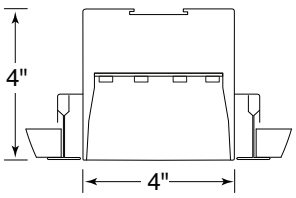
Type

Comments



DESCRIPTION

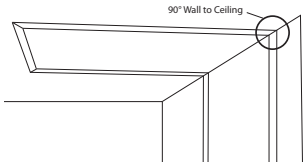
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser (Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

4'

HP-4 R [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]

Finelite **Series HP-4 R** –
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard, B - Boosted Standard, H - High, V - Very High)
LED CRI (8 - 80 CRI min (standard), 9 - 90 CRI min)
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)*
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - screw slot, C3F - flush screw slot, VF - Visible Flange, C2T - 9/16" tegular, C1T - 1" tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - tech zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

Finelite, Inc. • 30500 Whipple Road • Union City, CA 94587-1530 • 510 / 441-1100 • Fax: 510 / 441-1510 • www.finelite.com

Due to continuing product improvements, Finelite reserves the right to change specifications without notice. Please visit www.finelite.com for most current data.

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-LENGTH-S-3000K-F-277V-SC-WOOD-DIM Notes:	**Type:** RN LAI16-104794

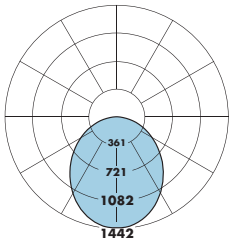
IC - RATED | LED | BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

PHOTOMETRY

Very High Output - 4' Luminaire
Efficacy: 101 lumens per watt
Total luminaire output: 3726 Lumens (932 lumens/foot)
37 Watts (9.3 watts/foot)
Peak Candela Value: 1442 @ 0º
CCT: 3500K
ITL LM79 Report 85128



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1442	1442	1442	1442	1442	
5	1434	1434	1433	1433	1434	136
15	1369	1360	1365	1364	1359	384
25	1241	1226	1232	1225	1219	566
35	1064	1053	1055	1043	1037	657
45	864	853	851	840	834	655
55	650	644	640	631	626	571
65	441	436	433	428	425	428
75	238	237	238	237	236	252
85	70	69	70	72	71	78
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1525	1917	2898	3726

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
381	479	725	932

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
105	104	102	101

* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85128
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

Recessed (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2898 lm x 0.789 = 2287 lm

Total Light Output per Foot =
725 lm/ft x 0.789 = 572 lm/ft

watts/foot = 7.1 W/ft

$$Efficacy = \frac{572\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80\ \text{lm/W}$$

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Due to continuing product improvements, Finelite reserves the right to change specifications without notice. Please visit www.finelite.com for most current data.

Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-LENGTH-S-3000K-F-277V-SC-WOOD-DIM Notes:	**Type:** **RN** LAI16-104794

IC - RATED LED BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

HOUSING



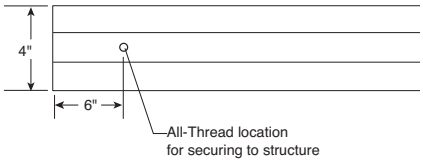
Housing With Extruded Flange (V1)

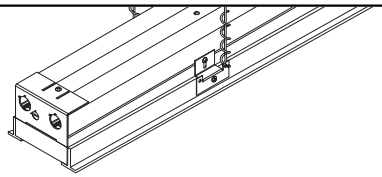
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6





SHEET ROCK INSTALLATION:

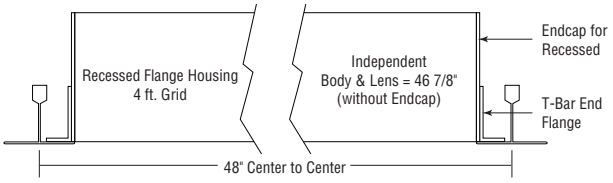
Flex conduit is secured to top of luminaire. Support to structure using All-Thread. All-Thread support holes are located on each end of the luminaire.

T-BAR INSTALLATION:

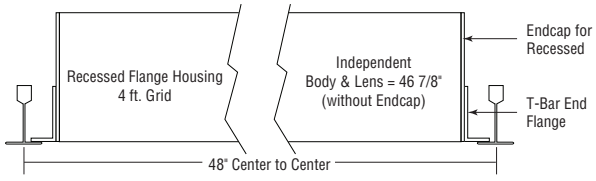
HP-4 R for T-Bar installations comes standard with a splice plate at the end of the luminaire. Mounting brackets (supplied) secure the luminaire to T-Bar and provide support to structure location. All starter/independent luminaires are 1 1/8" shorter than nominal. All joiner/ender luminaire are normal length.

GRID LENGTH DETAIL - 4 ft. example

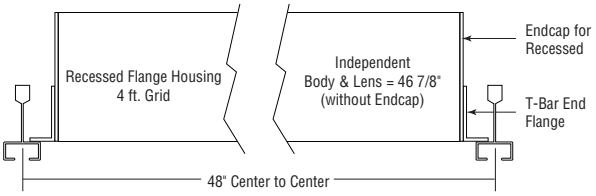
1" T-bar



9/16" T-bar

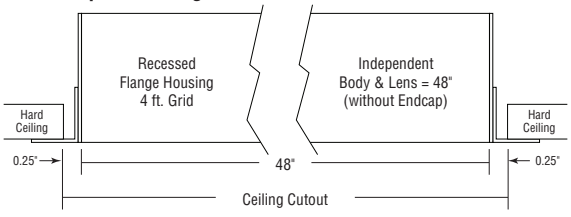


9/16" Screw Slot

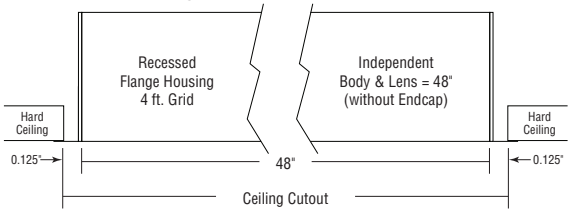


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-LENGTH-S-3000K-F-277V-SC-WOOD-DIM Notes:	**Type:** RN LAI16-104794

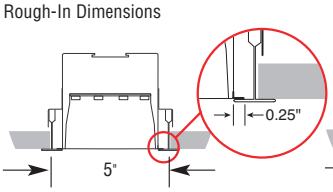
IC - RATED LED BUY AMERICAN ACT OF 2009 COMPLIANT

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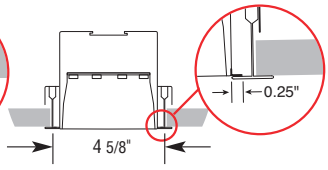
High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR

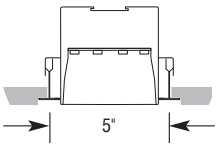
Rough-In Dimensions



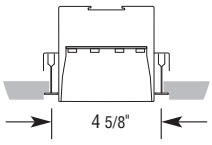
1" T-Bar (C1)



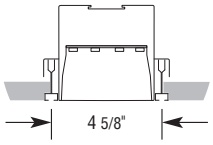
9/16" T-Bar (C2)



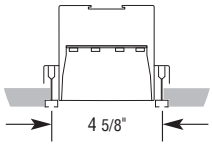
1" Tegular (C1T)



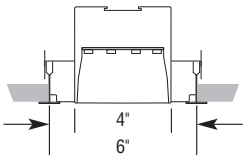
9/16" Tegular (C2T)



Flush Screw Slot (C3F)

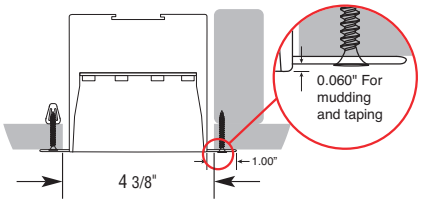


Standard Screw Slot (C3)

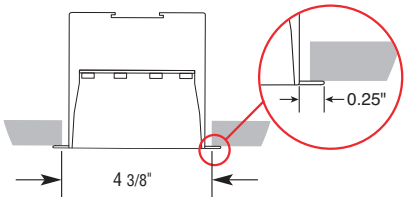


Tech Zone
(TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF)



Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor Occupancy Sensor **INTEGRATED SENSORS:** Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

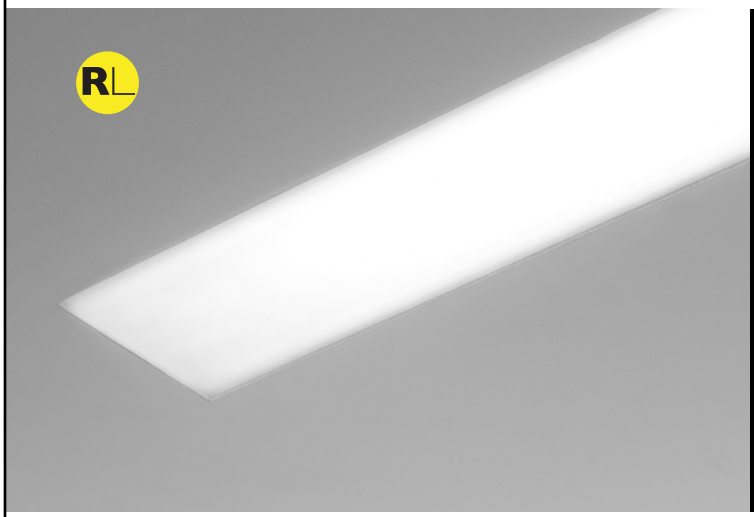
Catalog Number:
FSM4L-SR-875LF-30K-1C-277-LD1-T2-WH-16'
Notes: 9/16 TEG TILE

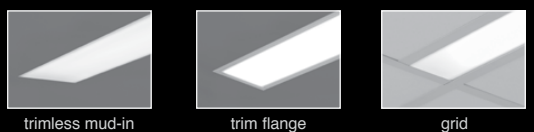
Type:
RP16
LAI16-104794

Seem® 4

LED

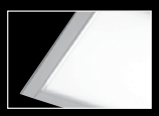
FOCAL POINT®



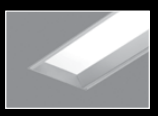

trimless mud-in

trim flange

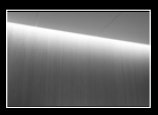
grid

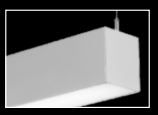

end detail


corner detail


regress lens

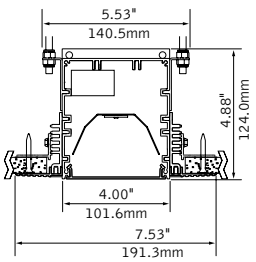

wall to ceiling companion


perimeter companion


suspended companion

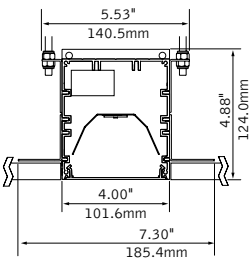
DIMENSIONAL DATA

trimless mud-in



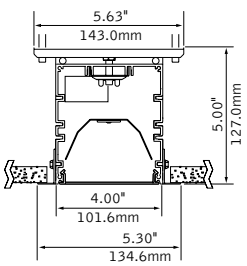
note: 0.375"min - 2.125"max ceiling thickness

hard surface

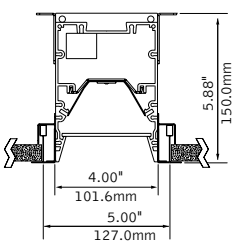


note: 0.375"min - 2.125"max ceiling thickness

trim flange



grid - regress lens shown



FEATURES

Narrow extruded aluminum 4" aperture recessed slot LED.

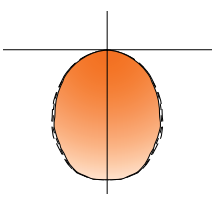
Integrates with ceiling or wall in a variety of mounting styles for a clean, unobtrusive aesthetic.

Individual units and continuous runs in 1' increments.

Frosted acrylic lens provides uninterrupted illumination, without pixels or shadows.

LED position and lens material optimized to provide the perfect blend of high performance and visual comfort.

PERFORMANCE



4' Flush Lens
Nominal output:
375 Lumens per foot

Delivered Lumens: 1500lm

Total System Watts: 15W

PRODUCT OVERVIEW

Lumen Output:	1500-4000lm
Wattage:	15-46W
LPW:	77-103
SDCM:	3
Reported Lumen Maintenance:	L70 @ >60,000hrs

Photometric performance is measured in accordance with IESNA LM-79. Visit focalpointlights.com for complete photometric data. Visit designlights.org/QPL for model specifics.

Submitted by LIGHTING ASSOCIATES, INC.

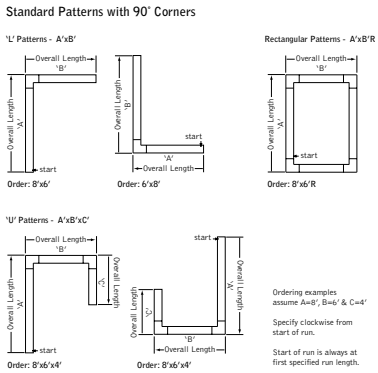
Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
FSM4L-SR-875LF-30K-1C-277-LD1-T2-WH-16'
Notes: 9/16 TEG TILE

Type:
RP16
LAI16-104794

fixture: project:

DETAILS



SPECIFICATIONS

LED System

Proprietary linear LED module incorporates premium LEDs on a robust platform to achieve excellent thermal management. LEDs are placed to promote a uniform appearance. Available in 3000K, 3500K or 4000K with CRI>80, 3SDCM. LED modules and drivers are replaceable from below.

Construction

One piece extruded aluminum housing. 20 Ga. steel end caps. Housing for new construction applications. XFW acceptable for use with wood, consult factory for Type IC availability. 2' unit weight: 18 lbs., 3' unit weight: 24 lbs., 4' unit weight: 30 lbs., 5' unit weight: 36 lbs.

Optic

Reflectors fabricated of 22 Ga. steel finished in High Reflectance White powder coat. Extruded acrylic lens .085" thick with satin finish, up to 8' continuous.

Electrical

Luminaires are pre–wired with factory installed branch circuit wiring and over-molded quick connects. Standard 120-277V constant current driver includes 0-10V analog dimming. Dimming range 100% to 10%.Power factor >.9.

Emergency Battery

Bodine BSL310-CAN. Emergency output - 10 watts for 90 minutes.

Labels

UL and cUL listed. Suitable for Dry or Damp Locations, indoor use only.

Finish

Polyester powder coat applied over a 5-stage pre–treatment.

Lumen Maintenance

Calculated: L70 at 118,000 hours Reported: L70 at >60,000 hours
Derived from EPA TM-21 calculator based on 10,000 hours of test data.

Warranty

LED system rated for operation in ambient environments up to 25°C. 5 year limited warranty.

4' PERFORMANCE CHART

Shielding	Lumens per Foot	Delivered Lumens	Tested System Watts	LPW
Flush Lens	375LF	1500	15	97
	625LF	2500	26	95
	875LF	3500	39	89
	1000LF	4000	46	86
Regress Lens	375LF	1500	15	86
	625LF	2500	26	84
	875LF	3500	39	80
	1000LF	4000	46	77
Regress High Performance	375LF	1500	15	103
	625LF	2500	26	100
	875LF	3500	39	95
	1000LF	4000	46	91

*Based on 3500k, 4' lengths. *Lumen output may vary +/- 5%. Actual wattage may vary +/- 5%

Focal Point LLC reserves the right to change specifications for product improvement without notification.

ORDERING

Luminaire Series		**FSM4L**
Seem 4 LED	FSM4L	
Shielding		
Flush Satin Lens	FL	
Regress Lens (Ceiling applications only)	SR	
Regress High Performance Lens (Ceiling applications only)	SRXP	
Lumen Output		
275 Lumens per foot (Not available with Lutron Drivers.)	275LF	
375 Lumens per foot (Not available with LU5 & LH1 Drivers)	375LF	
625 Lumens per foot (FL & SR 3' minimum with LU5 & LH1 Drivers. SRXP 4' minimum with LU5 & LH1 Drivers.)	625LF	
875 Lumens per foot (SR & SRXP 3' minimum with LU5 & LH1 Drivers)	875LF	
1000 Lumens per foot (Not available with L3D driver)	1000LF	
Color Temperature		
3000K	30K	
3500K	35K	
4000K	40K	
Circuit		**1C**
Single Circuit	1C	
Voltage		
120 Volt	120	
277 Volt	277	
UNV Volt (Cannot be specified with EM option)	UNV	
Driver (See driver reference for driver quantities)		
0-10V - 10% Dimming	LD1	
0-10V - 1% Dimming	L11	
Lutron A-Series 1% EcoSystem Digital (Consult factory for 3-wire control)	L3D	
Lutron H-Series 1% Dimming	LH1	
Lutron 5-Series 5% EcoSystem Digital	LU5	
DALI 1% Dimming	D11	
Ceiling Configuration		
Std. 15/16" Lay-in	G1	
Std. 15/16" Tegular	T1	
Std. 9/16" Lay-in	G2	
Std. 9/16" Tegular	T2	
9/16" Slot-tee Tegular	G3	
Tall 15/16" Lay-in	G4	
Tall 15/16" Tegular	T4	
Tall 9/16" Lay-in	G5	
Tall 9/16" Tegular	T5	
Node 9/16" Tegular	T6	
Trim Flange Drywall (3' minimum with Lutron Drivers)	TF	
Trim Flange Wood (3' minimum with Lutron Drivers)	TFW	
Mud-in Trimless, pre-set for 1/2" Drywall	XF1	
Mud-in Trimless, pre-set for 5/8" Drywall	XF2	
Mud-in Trimless, set thickness in field (Mounting equipment assembled in field)	XFF	
Non-Drywall Hard Surface	XFN	
Hard Surface, Wood	XFW	
Factory Options		
Chicago Plenum	CP	
Emergency Circuit*	EC	
Emergency Battery Pack* (4' lengths or longer, not available at corners)	EM	
6' New York City Flex Whip	FNY	
6' Flex Whip	FW	
Finish		**WH**
Matte White Housing	WH	
Luminaire Length (Leave blank for patterns. Lengths are nominal)		16'
Specify luminaire/row length in 1' increments (Smaller increments available. Consult factory for details.)	X'	
Pattern Options (3' minimum length)		
'L' pattern	A' x B'	
'U' pattern	A' x B' x C'	
Rectangular pattern (Consult factory for other pattern options)	A' x B'R	

QS 10 DAY*

*For more information visit focalpointlights.com/reference or consult factory.
Quickship is a limited offering, visit focalpointlights.com/quickship for specifics.

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
FSM4L-SR-875LF-30K-1C-277-LD1-T2-WH-16'
Notes: 9/16 TEG TILE

Type:
RP16
LAI16-104794

Seem® 4

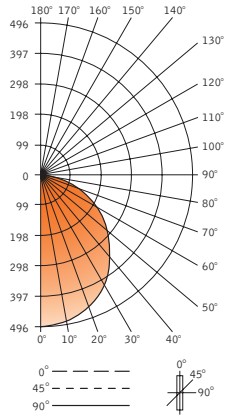
LED - FLUSH LENS

FSM4L-FL-375LF-35K-1C-UNV-LD1-G1-CP-WH-4'

Filename: FSM4LFL375LF35K.IES
Test #: 11499493.01

Lumens: 1423lm
System Watts: 15W
LPW: 95

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°
0°	496	496	496	496	496
5°	493	496	493	493	494
15°	475	479	475	476	477
25°	439	443	439	440	440
35°	386	390	387	387	388
45°	322	325	322	323	324
55°	253	255	253	254	254
65°	176	179	178	179	180
75°	100	102	102	104	104
85°	31	32	31	31	31
90°	0	2	2	2	2
95°	0	0	0	0	0
105°	0	0	0	0	0
115°	0	0	0	0	0
125°	0	0	0	0	0
135°	0	0	0	0	0
145°	0	0	0	0	0
155°	0	0	0	0	0
165°	0	0	0	0	0
175°	0	0	0	0	0
180°	0	0	0	0	0

LUMEN SUMMARY

	Zone	Lumens	% Fixture
	0-30°	384	27.0
	0-40°	627	44.1
	0-60°	1103	77.5
	0-90°	1423	100.00
Total Luminaire	0-180°	**1423**	**100.0**

LUMINANCE DATA (CD/M²)

Vertical Angle	Horizontal 0°	45°	90°
45°	3757	3760	3774
55°	3634	3642	3657
65°	3441	3473	3506
75°	3193	3261	3313
85°	2923	2967	2970

Go to www.focalpointlights.com for additional photometric data.

Seem® 4

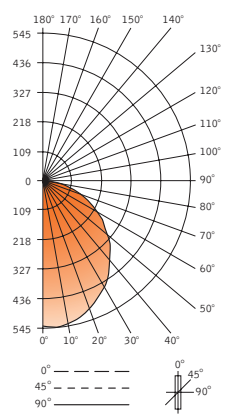
LED - REGRESS LENS

FSM4L-SR-375LF-35K-LD1-1C-120-G1-WH

Filename: FSM4LSR375LF35K.IES
Test #: 17847.0

Lumens: 1333lm
System Watts: 15W
LPW: 89

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	540	540	540	540	540	
5°	545	545	544	545	545	52
15°	520	519	519	519	519	146
25°	469	467	465	465	463	216
35°	418	418	413	402	396	254
45°	343	339	322	305	300	248
55°	261	254	228	209	202	207
65°	178	163	136	119	111	140
75°	88	72	49	34	30	60
85°	22	6	6	6	6	11
90°	0	0	0	0	0	
95°	0	0	0	0	0	0
105°	0	0	0	0	0	0
115°	0	0	0	0	0	0
125°	0	0	0	0	0	0
135°	0	0	0	0	0	0
145°	0	0	0	0	0	0
155°	0	0	0	0	0	0
165°	0	0	0	0	0	0
175°	0	0	0	0	0	0
180°	0	0	0	0	0	

LUMEN SUMMARY

	Zone	Lumens	% Fixture
	0-30°	414	31.0
	0-40°	668	50.1
	0-60°	1122	84.2
	0-90°	1333	100.0
Total Luminaire	0-180°	**1333**	**100.0**

LUMINANCE DATA (CD/M²)

Vertical Angle	Horizontal 0°	45°	90°
45°	4723	4439	4130
55°	4436	3872	3430
65°	4096	3145	2565
75°	3310	1858	1115
85°	2407	702	702

Go to www.focalpointlights.com for additional photometric data.

note: Photometric testing performed in an independent lab with standard lamps and ballasts. Lamp and ballast type and configuration will affect photometric performance.

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
FSM4L-SR-875LF-30K-1C-277-LD1-T2-WH-16'
Notes: 9/16 TEG TILE

Type:
RP16
LAI16-104794

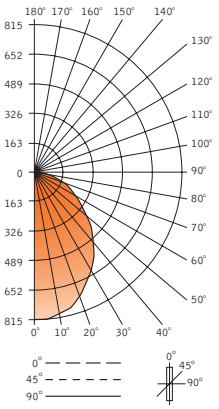
Seem® 4

LED - REGRESS HIGH PERFORMANCE LENS

FSM4L-SRXP-375LF-35K-LD1-1C-120-G1-WH

Filename:	FSM4LSRXP375LF35K.IES	Lumens:	1587lm
Test #:	17852.0	System Watts:	15W
		LPW:	106

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	812	812	812	812	812	
5°	813	813	812	812	812	77
15°	767	761	755	745	741	211
25°	671	662	641	619	605	295
35°	567	553	514	469	450	318
45°	436	418	362	303	283	278
55°	305	285	220	180	168	208
65°	194	169	118	95	90	131
75°	90	68	45	33	30	57
85°	22	10	7	7	7	12
90°	0	0	0	0	0	
95°	0	0	0	0	0	0
105°	0	0	0	0	0	0
115°	0	0	0	0	0	0
125°	0	0	0	0	0	0
135°	0	0	0	0	0	0
145°	0	0	0	0	0	0
155°	0	0	0	0	0	0
165°	0	0	0	0	0	0
175°	0	0	0	0	0	0
180°	0	0	0	0	0	

LUMEN SUMMARY

	Zone	Lumens	% Fixture
	0-30°	583	36.8
	0-40°	901	56.8
	0-60°	1386	87.4
	0-90°	1587	100.0
Total Luminaire	0-180°	**1587**	**100.0**

LUMINANCE DATA (CD/M²)

Vertical Angle	Horizontal 0°	45°	90°
45°	6005	4980	3896
55°	5183	3738	2853
65°	4460	2720	2083
75°	3401	1681	1120
85°	2496	832	832

Go to www.focalpointlights.com for additional photometric data.

note: Photometric testing performed in an independent lab with standard lamps and ballasts. Lamp and ballast type and configuration will affect photometric performance.

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

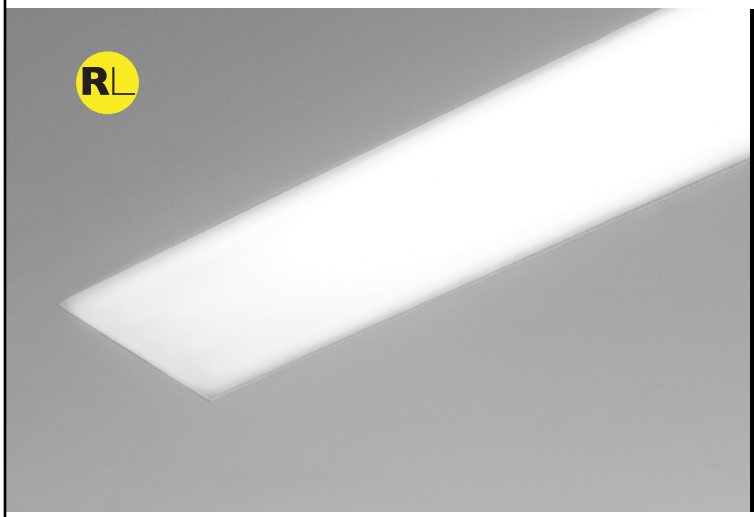
Catalog Number:
FSM4L-SR-875LF-30K-1C-277-LD1-T2-WH-20'
Notes: 9/16 TEG TILE

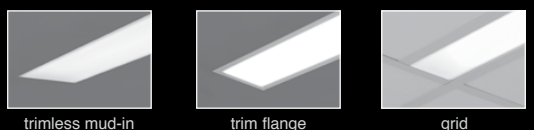
Type:
RP20
LAI16-104794

Seem® 4

LED

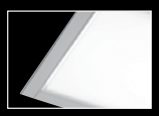
FOCAL POINT®



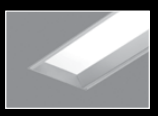

trimless mud-in

trim flange

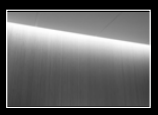
grid

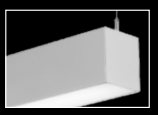

end detail


corner detail


regress lens

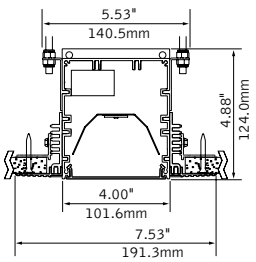

wall to ceiling companion


perimeter companion


suspended companion

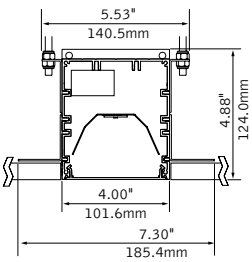
DIMENSIONAL DATA

trimless mud-in



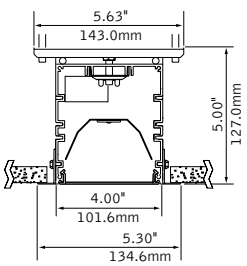
note: 0.375"min - 2.125"max ceiling thickness

hard surface

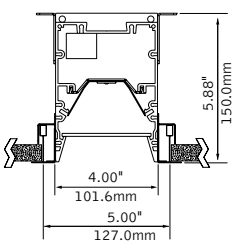


note: 0.375"min - 2.125"max ceiling thickness

trim flange



grid - regress lens shown



FEATURES

Narrow extruded aluminum 4" aperture recessed slot LED.

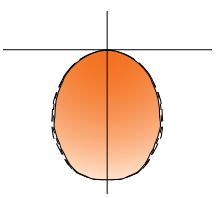
Integrates with ceiling or wall in a variety of mounting styles for a clean, unobtrusive aesthetic.

Individual units and continuous runs in 1' increments.

Frosted acrylic lens provides uninterrupted illumination, without pixels or shadows.

LED position and lens material optimized to provide the perfect blend of high performance and visual comfort.

PERFORMANCE



4' Flush Lens
Nominal output:
375 Lumens per foot

Delivered Lumens: 1500lm

Total System Watts: 15W

PRODUCT OVERVIEW

Lumen Output:	1500-4000lm
Wattage:	15-46W
LPW:	77-103
SDCM:	3
Reported Lumen Maintenance:	L70 @ >60,000hrs

Photometric performance is measured in accordance with IESNA LM-79. Visit focalpointlights.com for complete photometric data. Visit designlights.org/QPL for model specifics.

Submitted by LIGHTING ASSOCIATES, INC.

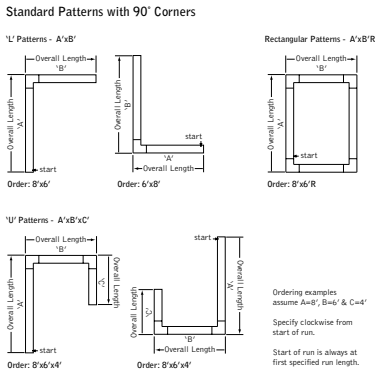
Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
FSM4L-SR-875LF-30K-1C-277-LD1-T2-WH-20'
Notes: 9/16 TEG TILE

Type:
RP20
LAI16-104794

fixture: project:

DETAILS



SPECIFICATIONS

LED System
Proprietary linear LED module incorporates premium LEDs on a robust platform to achieve excellent thermal management. LEDs are placed to promote a uniform appearance. Available in 3000K, 3500K or 4000K with CRI>80, 3SDCM. LED modules and drivers are replaceable from below.

Construction
One piece extruded aluminum housing. 20 Ga. steel end caps. Housing for new construction applications. XFW acceptable for use with wood, consult factory for Type IC availability. 2' unit weight: 18 lbs., 3' unit weight: 24 lbs., 4' unit weight: 30 lbs., 5' unit weight: 36 lbs.

Optic
Reflectors fabricated of 22 Ga. steel finished in High Reflectance White powder coat. Extruded acrylic lens .085" thick with satin finish, up to 8' continuous.

Electrical
Luminaires are pre–wired with factory installed branch circuit wiring and over-molded quick connects. Standard 120-277V constant current driver includes 0-10V analog dimming. Dimming range 100% to 10%.Power factor >.9.

Emergency Battery
Bodine BSL310-CAN. Emergency output - 10 watts for 90 minutes.

Labels
UL and cUL listed. Suitable for Dry or Damp Locations, indoor use only.

Finish
Polyester powder coat applied over a 5-stage pre–treatment.

Lumen Maintenance
Calculated: L70 at 118,000 hours Reported: L70 at >60,000 hours
Derived from EPA TM-21 calculator based on 10,000 hours of test data.

Warranty
LED system rated for operation in ambient environments up to 25°C. 5 year limited warranty.

4' PERFORMANCE CHART

Shielding	Lumens per Foot	Delivered Lumens	Tested System Watts	LPW
Flush Lens	375LF	1500	15	97
	625LF	2500	26	95
	875LF	3500	39	89
	1000LF	4000	46	86
Regress Lens	375LF	1500	15	86
	625LF	2500	26	84
	875LF	3500	39	80
	1000LF	4000	46	77
Regress High Performance	375LF	1500	15	103
	625LF	2500	26	100
	875LF	3500	39	95
	1000LF	4000	46	91

*Based on 3500k, 4' lengths. *Lumen output may vary +/- 5%. Actual wattage may vary +/- 5%

Focal Point LLC reserves the right to change specifications for product improvement without notification.

ORDERING

Luminaire Series		**FSM4L**
Seem 4 LED	FSM4L	
Shielding		
Flush Satin Lens	FL	
Regress Lens (Ceiling applications only)	SR	
Regress High Performance Lens (Ceiling applications only)	SRXP	
Lumen Output		
275 Lumens per foot (Not available with Lutron Drivers.)	275LF	
375 Lumens per foot (Not available with LU5 & LH1 Drivers)	375LF	
625 Lumens per foot (FL & SR 3' minimum with LU5 & LH1 Drivers. SRXP 4' minimum with LU5 & LH1 Drivers.)	625LF	
875 Lumens per foot (SR & SRXP 3' minimum with LU5 & LH1 Drivers)	875LF	
1000 Lumens per foot (Not available with L3D driver)	1000LF	
Color Temperature		
3000K	30K	
3500K	35K	
4000K	40K	
Circuit		**1C**
Single Circuit	1C	
Voltage		
120 Volt	120	
277 Volt	277	
UNV Volt (Cannot be specified with EM option)	UNV	
Driver (See driver reference for driver quantities)		
0-10V - 10% Dimming	LD1	
0-10V - 1% Dimming	L11	
Lutron A-Series 1% EcoSystem Digital (Consult factory for 3-wire control)	L3D	
Lutron H-Series 1% Dimming	LH1	
Lutron 5-Series 5% EcoSystem Digital	LU5	
DALI 1% Dimming	D11	
Ceiling Configuration		
Std. 15/16" Lay-in	G1	
Std. 15/16" Tegular	T1	
Std. 9/16" Lay-in	G2	
Std. 9/16" Tegular	T2	
9/16" Slot-tee Tegular	G3	
Tall 15/16" Lay-in	G4	
Tall 15/16" Tegular	T4	
Tall 9/16" Lay-in	G5	
Tall 9/16" Tegular	T5	
Node 9/16" Tegular	T6	
Trim Flange Drywall (3' minimum with Lutron Drivers)	TF	
Trim Flange Wood (3' minimum with Lutron Drivers)	TFW	
Mud-in Trimless, pre-set for 1/2" Drywall	XF1	
Mud-in Trimless, pre-set for 5/8" Drywall	XF2	
Mud-in Trimless, set thickness in field (Mounting equipment assembled in field)	XFF	
Non-Drywall Hard Surface	XFN	
Hard Surface, Wood	XFW	
Factory Options		
Chicago Plenum	CP	
Emergency Circuit*	EC	
Emergency Battery Pack* (4' lengths or longer, not available at corners)	EM	
6' New York City Flex Whip	FNY	
6' Flex Whip	FW	
Finish		**WH**
Matte White Housing	WH	
Luminaire Length (Leave blank for patterns. Lengths are nominal)		20'
Specify luminaire/row length in 1' increments (Smaller increments available. Consult factory for details.)	X'	
Pattern Options (3' minimum length)		
'L' pattern	A' x B'	
'U' pattern	A' x B' x C'	
Rectangular pattern (Consult factory for other pattern options)	A' x B'R	

QS 10 DAY*

*For more information visit focalpointlights.com/reference or consult factory.
Quickship is a limited offering, visit focalpointlights.com/quickship for specifics.

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
FSM4L-SR-875LF-30K-1C-277-LD1-T2-WH-20'
Notes: 9/16 TEG TILE

Type:
RP20
LAI16-104794

Seem® 4

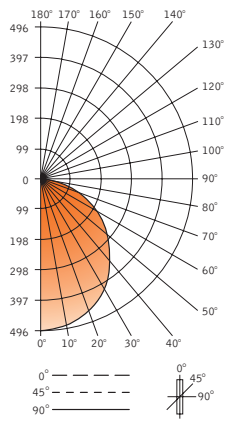
LED - FLUSH LENS

FSM4L-FL-375LF-35K-1C-UNV-LD1-G1-CP-WH-4'

Filename: FSM4LFL375LF35K.IES
Test #: 11499493.01

Lumens: 1423lm
System Watts: 15W
LPW: 95

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°
0°	496	496	496	496	496
5°	493	496	493	493	494
15°	475	479	475	476	477
25°	439	443	439	440	440
35°	386	390	387	387	388
45°	322	325	322	323	324
55°	253	255	253	254	254
65°	176	179	178	179	180
75°	100	102	102	104	104
85°	31	32	31	31	31
90°	0	2	2	2	2
95°	0	0	0	0	0
105°	0	0	0	0	0
115°	0	0	0	0	0
125°	0	0	0	0	0
135°	0	0	0	0	0
145°	0	0	0	0	0
155°	0	0	0	0	0
165°	0	0	0	0	0
175°	0	0	0	0	0
180°	0	0	0	0	0

LUMEN SUMMARY

	Zone	Lumens	% Fixture
	0-30°	384	27.0
	0-40°	627	44.1
	0-60°	1103	77.5
	0-90°	1423	100.00
Total Luminaire	0-180°	**1423**	**100.0**

LUMINANCE DATA (CD/M²)

Vertical Angle	Horizontal 0°	45°	90°
45°	3757	3760	3774
55°	3634	3642	3657
65°	3441	3473	3506
75°	3193	3261	3313
85°	2923	2967	2970

Go to www.focalpointlights.com for additional photometric data.

Seem® 4

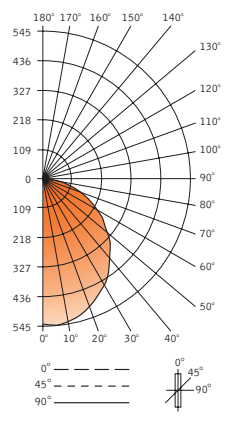
LED - REGRESS LENS

FSM4L-SR-375LF-35K-LD1-1C-120-G1-WH

Filename: FSM4LSR375LF35K.IES
Test #: 17847.0

Lumens: 1333lm
System Watts: 15W
LPW: 89

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	540	540	540	540	540	
5°	545	545	544	545	545	52
15°	520	519	519	519	519	146
25°	469	467	465	465	463	216
35°	418	418	413	402	396	254
45°	343	339	322	305	300	248
55°	261	254	228	209	202	207
65°	178	163	136	119	111	140
75°	88	72	49	34	30	60
85°	22	6	6	6	6	11
90°	0	0	0	0	0	
95°	0	0	0	0	0	0
105°	0	0	0	0	0	0
115°	0	0	0	0	0	0
125°	0	0	0	0	0	0
135°	0	0	0	0	0	0
145°	0	0	0	0	0	0
155°	0	0	0	0	0	0
165°	0	0	0	0	0	0
175°	0	0	0	0	0	0
180°	0	0	0	0	0	

LUMEN SUMMARY

	Zone	Lumens	% Fixture
	0-30°	414	31.0
	0-40°	668	50.1
	0-60°	1122	84.2
	0-90°	1333	100.0
Total Luminaire	0-180°	**1333**	**100.0**

LUMINANCE DATA (CD/M²)

Vertical Angle	Horizontal 0°	45°	90°
45°	4723	4439	4130
55°	4436	3872	3430
65°	4096	3145	2565
75°	3310	1858	1115
85°	2407	702	702

Go to www.focalpointlights.com for additional photometric data.

note: Photometric testing performed in an independent lab with standard lamps and ballasts. Lamp and ballast type and configuration will affect photometric performance.

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
FSM4L-SR-875LF-30K-1C-277-LD1-T2-WH-20'
Notes: 9/16 TEG TILE

Type:
RP20
LAI16-104794

Seem® 4

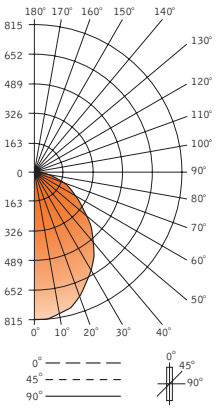
LED - REGRESS HIGH PERFORMANCE LENS

FSM4L-SRXP-375LF-35K-LD1-1C-120-G1-WH

Filename: FSM4LSRXP375LF35K.IES
Test #: 17852.0

Lumens: 1587lm
System Watts: 15W
LPW: 106

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	812	812	812	812	812	
5°	813	813	812	812	812	77
15°	767	761	755	745	741	211
25°	671	662	641	619	605	295
35°	567	553	514	469	450	318
45°	436	418	362	303	283	278
55°	305	285	220	180	168	208
65°	194	169	118	95	90	131
75°	90	68	45	33	30	57
85°	22	10	7	7	7	12
90°	0	0	0	0	0	
95°	0	0	0	0	0	0
105°	0	0	0	0	0	0
115°	0	0	0	0	0	0
125°	0	0	0	0	0	0
135°	0	0	0	0	0	0
145°	0	0	0	0	0	0
155°	0	0	0	0	0	0
165°	0	0	0	0	0	0
175°	0	0	0	0	0	0
180°	0	0	0	0	0	

LUMEN SUMMARY

	Zone	Lumens	% Fixture
	0-30°	583	36.8
	0-40°	901	56.8
	0-60°	1386	87.4
	0-90°	1587	100.0
Total Luminaire	0-180°	**1587**	**100.0**

LUMINANCE DATA (CD/M²)

Vertical Angle	Horizontal 0°	45°	90°
45°	6005	4980	3896
55°	5183	3738	2853
65°	4460	2720	2083
75°	3401	1681	1120
85°	2496	832	832

Go to www.focalpointlights.com for additional photometric data.

note: Photometric testing performed in an independent lab with standard lamps and ballasts. Lamp and ballast type and configuration will affect photometric performance.

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

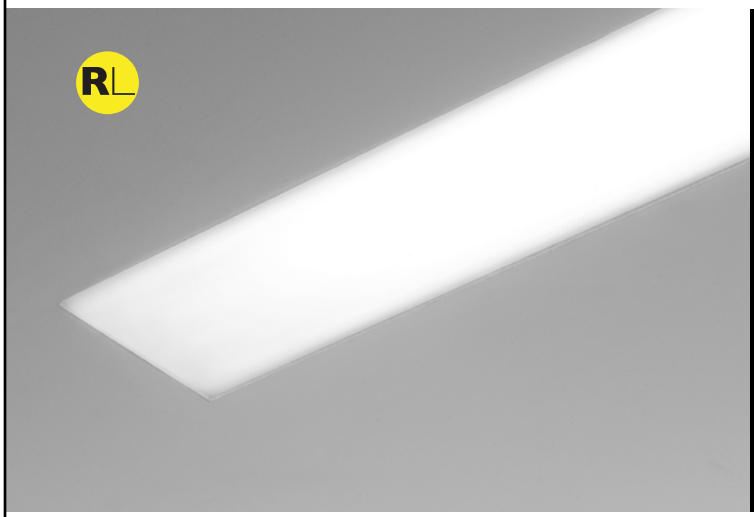
Catalog Number:
FSM4L-SR-875LF-30K-1C-277-LD1-T2-WH-24'
Notes: 9/16 TEG TILE

Type:
RP24
LAI16-104794

Seem® 4

LED

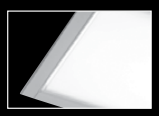
FOCAL POINT®



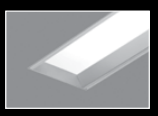

trimless mud-in


trim flange

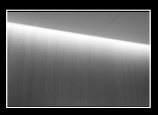

grid

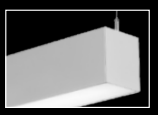

end detail


corner detail


regress lens

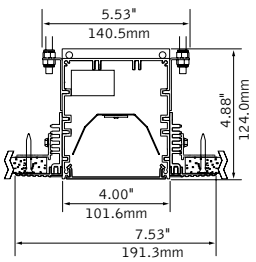

wall to ceiling companion


perimeter companion


suspended companion

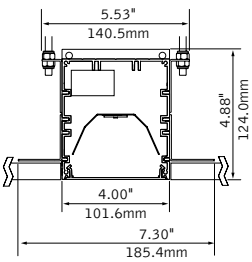
DIMENSIONAL DATA

trimless mud-in



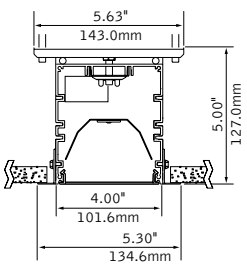
note: 0.375"min - 2.125"max ceiling thickness

hard surface

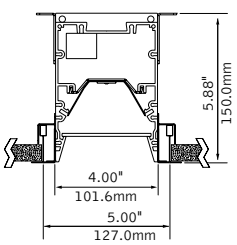


note: 0.375"min - 2.125"max ceiling thickness

trim flange



grid - regress lens shown



FEATURES

Narrow extruded aluminum 4" aperture recessed slot LED.

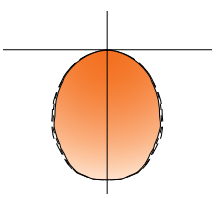
Integrates with ceiling or wall in a variety of mounting styles for a clean, unobtrusive aesthetic.

Individual units and continuous runs in 1' increments.

Frosted acrylic lens provides uninterrupted illumination, without pixels or shadows.

LED position and lens material optimized to provide the perfect blend of high performance and visual comfort.

PERFORMANCE



4' Flush Lens
Nominal output:
375 Lumens per foot

Delivered Lumens: 1500lm

Total System Watts: 15W

PRODUCT OVERVIEW

Lumen Output:	1500-4000lm
Wattage:	15-46W
LPW:	77-103
SDCM:	3
Reported Lumen Maintenance:	L70 @ >60,000hrs

DLC QPL LISTED®

Photometric performance is measured in accordance with IESNA LM-79. Visit focalpointlights.com for complete photometric data. Visit designlights.org/QPL for model specifics.

Submitted by LIGHTING ASSOCIATES, INC.

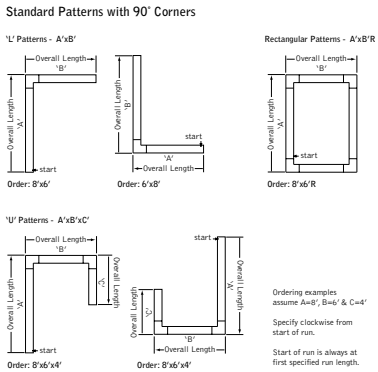
Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
FSM4L-SR-875LF-30K-1C-277-LD1-T2-WH-24'
Notes: 9/16 TEG TILE

Type:
RP24
LAI16-104794

fixture: project:

DETAILS



SPECIFICATIONS

LED System

Proprietary linear LED module incorporates premium LEDs on a robust platform to achieve excellent thermal management. LEDs are placed to promote a uniform appearance. Available in 3000K, 3500K or 4000K with CRI>80, 3SDCM. LED modules and drivers are replaceable from below.

Construction

One piece extruded aluminum housing. 20 Ga. steel end caps. Housing for new construction applications. XFW acceptable for use with wood, consult factory for Type IC availability. 2' unit weight: 18 lbs., 3' unit weight: 24 lbs., 4' unit weight: 30 lbs., 5' unit weight: 36 lbs.

Optic

Reflectors fabricated of 22 Ga. steel finished in High Reflectance White powder coat. Extruded acrylic lens .085" thick with satin finish, up to 8' continuous.

Electrical

Luminaires are pre–wired with factory installed branch circuit wiring and over-molded quick connects. Standard 120-277V constant current driver includes 0-10V analog dimming. Dimming range 100% to 10%.Power factor >.9.

Emergency Battery

Bodine BSL310-CAN. Emergency output - 10 watts for 90 minutes.

Labels

UL and cUL listed. Suitable for Dry or Damp Locations, indoor use only.

Finish

Polyester powder coat applied over a 5-stage pre–treatment.

Lumen Maintenance

Calculated: L70 at 118,000 hours Reported: L70 at >60,000 hours
Derived from EPA TM-21 calculator based on 10,000 hours of test data.

Warranty

LED system rated for operation in ambient environments up to 25°C. 5 year limited warranty.

4' PERFORMANCE CHART

Shielding	Lumens per Foot	Delivered Lumens	Tested System Watts	LPW
Flush Lens	375LF	1500	15	97
	625LF	2500	26	95
	875LF	3500	39	89
	1000LF	4000	46	86
Regress Lens	375LF	1500	15	86
	625LF	2500	26	84
	875LF	3500	39	80
	1000LF	4000	46	77
Regress High Performance	375LF	1500	15	103
	625LF	2500	26	100
	875LF	3500	39	95
	1000LF	4000	46	91

*Based on 3500k, 4' lengths. *Lumen output may vary +/- 5%. Actual wattage may vary +/- 5%

Focal Point LLC reserves the right to change specifications for product improvement without notification.

ORDERING

Luminaire Series		**FSM4L**
Seem 4 LED	FSM4L	
Shielding		
Flush Satin Lens	FL	
Regress Lens (Ceiling applications only)	SR	
Regress High Performance Lens (Ceiling applications only)	SRXP	
Lumen Output		
275 Lumens per foot (Not available with Lutron Drivers.)	275LF	
375 Lumens per foot (Not available with LU5 & LH1 Drivers)	375LF	
625 Lumens per foot (FL & SR 3' minimum with LU5 & LH1 Drivers. SRXP 4' minimum with LU5 & LH1 Drivers.)	625LF	
875 Lumens per foot (SR & SRXP 3' minimum with LU5 & LH1 Drivers)	875LF	
1000 Lumens per foot (Not available with L3D driver)	1000LF	
Color Temperature		
3000K	30K	
3500K	35K	
4000K	40K	
Circuit		**1C**
Single Circuit	1C	
Voltage		
120 Volt	120	
277 Volt	277	
UNV Volt (Cannot be specified with EM option)	UNV	
Driver (See driver reference for driver quantities)		
0-10V - 10% Dimming	LD1	
0-10V - 1% Dimming	L11	
Lutron A-Series 1% EcoSystem Digital (Consult factory for 3-wire control)	L3D	
Lutron H-Series 1% Dimming	LH1	
Lutron 5-Series 5% EcoSystem Digital	LU5	
DALI 1% Dimming	D11	
Ceiling Configuration		
Std. 15/16" Lay-in	G1	
Std. 15/16" Tegular	T1	
Std. 9/16" Lay-in	G2	
Std. 9/16" Tegular	T2	
9/16" Slot-tee Tegular	G3	
Tall 15/16" Lay-in	G4	
Tall 15/16" Tegular	T4	
Tall 9/16" Lay-in	G5	
Tall 9/16" Tegular	T5	
Node 9/16" Tegular	T6	
Trim Flange Drywall (3' minimum with Lutron Drivers)	TF	
Trim Flange Wood (3' minimum with Lutron Drivers)	TFW	
Mud-in Trimless, pre-set for 1/2" Drywall	XF1	
Mud-in Trimless, pre-set for 5/8" Drywall	XF2	
Mud-in Trimless, set thickness in field (Mounting equipment assembled in field)	XFF	
Non-Drywall Hard Surface	XFN	
Hard Surface, Wood	XFW	
Factory Options		
Chicago Plenum	CP	
Emergency Circuit*	EC	
Emergency Battery Pack* (4' lengths or longer, not available at corners)	EM	
6' New York City Flex Whip	FNY	
6' Flex Whip	FW	
Finish		**WH**
Matte White Housing	WH	
Luminaire Length (Leave blank for patterns. Lengths are nominal)		24'
Specify luminaire/row length in 1' increments (Smaller increments available. Consult factory for details.)	X'	
Pattern Options (3' minimum length)		
'L' pattern	A' x B'	
'U' pattern	A' x B' x C'	
Rectangular pattern (Consult factory for other pattern options)	A' x B'R	

QS 10 DAY*

*For more information visit focalpointlights.com/reference or consult factory.
Quickship is a limited offering, visit focalpointlights.com/quickship for specifics.

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
FSM4L-SR-875LF-30K-1C-277-LD1-T2-WH-24'
Notes: 9/16 TEG TILE

Type:
RP24
LAI16-104794

Seem® 4

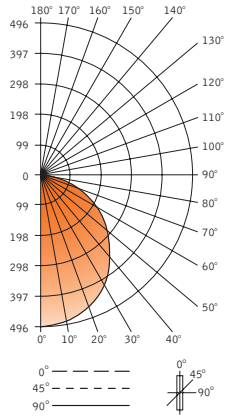
LED - FLUSH LENS

FSM4L-FL-375LF-35K-1C-UNV-LD1-G1-CP-WH-4'

Filename: FSM4LFL375LF35K.IES
Test #: 11499493.01

Lumens: 1423lm
System Watts: 15W
LPW: 95

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°
0°	496	496	496	496	496
5°	493	496	493	493	494
15°	475	479	475	476	477
25°	439	443	439	440	440
35°	386	390	387	387	388
45°	322	325	322	323	324
55°	253	255	253	254	254
65°	176	179	178	179	180
75°	100	102	102	104	104
85°	31	32	31	31	31
90°	0	2	2	2	2
95°	0	0	0	0	0
105°	0	0	0	0	0
115°	0	0	0	0	0
125°	0	0	0	0	0
135°	0	0	0	0	0
145°	0	0	0	0	0
155°	0	0	0	0	0
165°	0	0	0	0	0
175°	0	0	0	0	0
180°	0	0	0	0	0

LUMEN SUMMARY

	Zone	Lumens	% Fixture
	0-30°	384	27.0
	0-40°	627	44.1
	0-60°	1103	77.5
	0-90°	1423	100.00
Total Luminaire	0-180°	**1423**	**100.0**

LUMINANCE DATA (CD/M²)

Vertical Angle	Horizontal 0°	45°	90°
45°	3757	3760	3774
55°	3634	3642	3657
65°	3441	3473	3506
75°	3193	3261	3313
85°	2923	2967	2970

Go to www.focalpointlights.com for additional photometric data.

Seem® 4

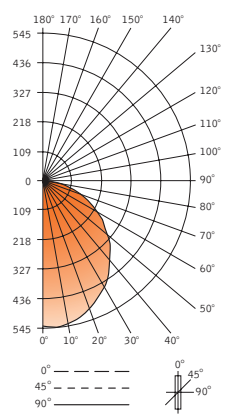
LED - REGRESS LENS

FSM4L-SR-375LF-35K-LD1-1C-120-G1-WH

Filename: FSM4LSR375LF35K.IES
Test #: 17847.0

Lumens: 1333lm
System Watts: 15W
LPW: 89

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	540	540	540	540	540	
5°	545	545	544	545	545	52
15°	520	519	519	519	519	146
25°	469	467	465	465	463	216
35°	418	418	413	402	396	254
45°	343	339	322	305	300	248
55°	261	254	228	209	202	207
65°	178	163	136	119	111	140
75°	88	72	49	34	30	60
85°	22	6	6	6	6	11
90°	0	0	0	0	0	
95°	0	0	0	0	0	0
105°	0	0	0	0	0	0
115°	0	0	0	0	0	0
125°	0	0	0	0	0	0
135°	0	0	0	0	0	0
145°	0	0	0	0	0	0
155°	0	0	0	0	0	0
165°	0	0	0	0	0	0
175°	0	0	0	0	0	0
180°	0	0	0	0	0	

LUMEN SUMMARY

	Zone	Lumens	% Fixture
	0-30°	414	31.0
	0-40°	668	50.1
	0-60°	1122	84.2
	0-90°	1333	100.0
Total Luminaire	0-180°	**1333**	**100.0**

LUMINANCE DATA (CD/M²)

Vertical Angle	Horizontal 0°	45°	90°
45°	4723	4439	4130
55°	4436	3872	3430
65°	4096	3145	2565
75°	3310	1858	1115
85°	2407	702	702

Go to www.focalpointlights.com for additional photometric data.

note: Photometric testing performed in an independent lab with standard lamps and ballasts. Lamp and ballast type and configuration will affect photometric performance.

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
FSM4L-SR-875LF-30K-1C-277-LD1-T2-WH-24'
Notes: 9/16 TEG TILE

Type:
RP24
LAI16-104794

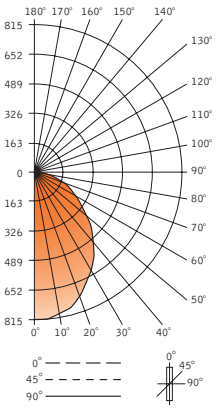
Seem® 4

LED - REGRESS HIGH PERFORMANCE LENS

FSM4L-SRXP-375LF-35K-LD1-1C-120-G1-WH

Filename:	FSM4LSRXP375LF35K.IES	Lumens:	1587lm
Test #:	17852.0	System Watts:	15W
		LPW:	106

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	812	812	812	812	812	
5°	813	813	812	812	812	77
15°	767	761	755	745	741	211
25°	671	662	641	619	605	295
35°	567	553	514	469	450	318
45°	436	418	362	303	283	278
55°	305	285	220	180	168	208
65°	194	169	118	95	90	131
75°	90	68	45	33	30	57
85°	22	10	7	7	7	12
90°	0	0	0	0	0	
95°	0	0	0	0	0	0
105°	0	0	0	0	0	0
115°	0	0	0	0	0	0
125°	0	0	0	0	0	0
135°	0	0	0	0	0	0
145°	0	0	0	0	0	0
155°	0	0	0	0	0	0
165°	0	0	0	0	0	0
175°	0	0	0	0	0	0
180°	0	0	0	0	0	

LUMEN SUMMARY

	Zone	Lumens	% Fixture
	0-30°	583	36.8
	0-40°	901	56.8
	0-60°	1386	87.4
	0-90°	1587	100.0
Total Luminaire	0-180°	**1587**	**100.0**

LUMINANCE DATA (CD/M²)

Vertical Angle	Horizontal 0°	45°	90°
45°	6005	4980	3896
55°	5183	3738	2853
65°	4460	2720	2083
75°	3401	1681	1120
85°	2496	832	832

Go to www.focalpointlights.com for additional photometric data.

note: Photometric testing performed in an independent lab with standard lamps and ballasts. Lamp and ballast type and configuration will affect photometric performance.

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

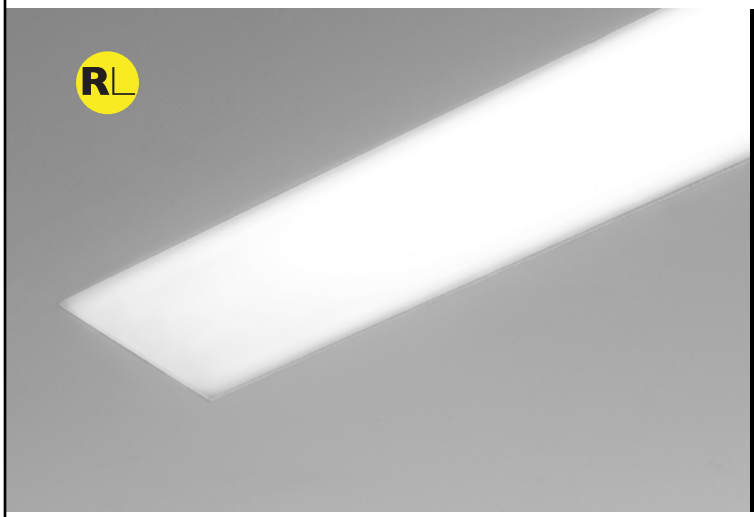
Catalog Number:
FSM4L-SR-875LF-30K-1C-277-LD1-T2-WH-28'
Notes: 9/16 TEG TILE

Type:
RP28
LAI16-104794

Seem® 4

LED

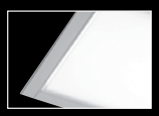
FOCAL POINT®



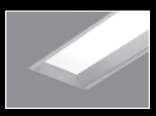

trimless mud-in


trim flange

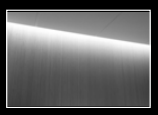

grid

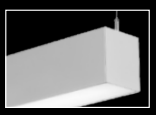

end detail


corner detail


regress lens

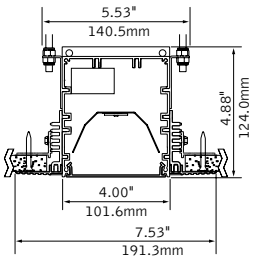

wall to ceiling companion


perimeter companion


suspended companion

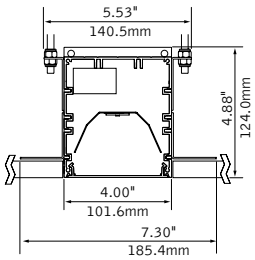
DIMENSIONAL DATA

trimless mud-in



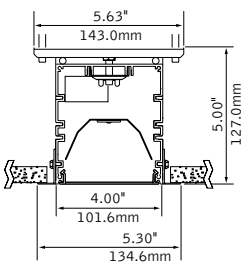
note: 0.375"min - 2.125"max ceiling thickness

hard surface

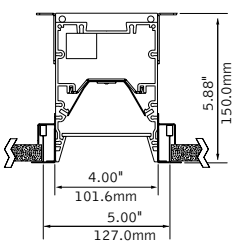


note: 0.375"min - 2.125"max ceiling thickness

trim flange



grid - regress lens shown



FEATURES

Narrow extruded aluminum 4" aperture recessed slot LED.

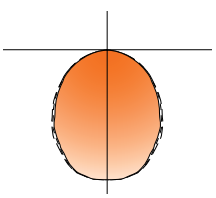
Integrates with ceiling or wall in a variety of mounting styles for a clean, unobtrusive aesthetic.

Individual units and continuous runs in 1' increments.

Frosted acrylic lens provides uninterrupted illumination, without pixels or shadows.

LED position and lens material optimized to provide the perfect blend of high performance and visual comfort.

PERFORMANCE



4' Flush Lens
Nominal output:
375 Lumens per foot

Delivered Lumens: 1500lm

Total System Watts: 15W

PRODUCT OVERVIEW

Lumen Output:	1500-4000lm
Wattage:	15-46W
LPW:	77-103
SDCM:	3
Reported Lumen Maintenance:	L70 @ >60,000hrs

DLC QPL LISTED®

Photometric performance is measured in accordance with IESNA LM-79. Visit focalpointlights.com for complete photometric data. Visit designlights.org/QPL for model specifics.

Submitted by LIGHTING ASSOCIATES, INC.

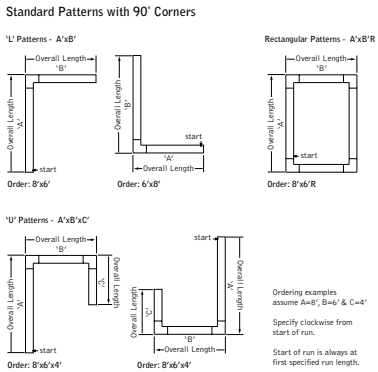
Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
FSM4L-SR-875LF-30K-1C-277-LD1-T2-WH-28'
Notes: 9/16 TEG TILE

Type:
RP28
LAI16-104794

fixture: project:

DETAILS



SPECIFICATIONS

LED System
Proprietary linear LED module incorporates premium LEDs on a robust platform to achieve excellent thermal management. LEDs are placed to promote a uniform appearance. Available in 3000K, 3500K or 4000K with CRI>80, 3SDCM. LED modules and drivers are replaceable from below.

Construction
One piece extruded aluminum housing. 20 Ga. steel end caps. Housing for new construction applications. XFW acceptable for use with wood, consult factory for Type IC availability. 2' unit weight: 18 lbs., 3' unit weight: 24 lbs., 4' unit weight: 30 lbs., 5' unit weight: 36 lbs.

Optic
Reflectors fabricated of 22 Ga. steel finished in High Reflectance White powder coat. Extruded acrylic lens .085" thick with satin finish, up to 8' continuous.

Electrical
Luminaires are pre–wired with factory installed branch circuit wiring and over-molded quick connects. Standard 120-277V constant current driver includes 0-10V analog dimming. Dimming range 100% to 10%.Power factor >.9.

Emergency Battery
Bodine BSL310-CAN. Emergency output - 10 watts for 90 minutes.

Labels
UL and cUL listed. Suitable for Dry or Damp Locations, indoor use only.

Finish
Polyester powder coat applied over a 5-stage pre–treatment.

Lumen Maintenance
Calculated: L70 at 118,000 hours Reported: L70 at >60,000 hours
Derived from EPA TM-21 calculator based on 10,000 hours of test data.

Warranty
LED system rated for operation in ambient environments up to 25°C. 5 year limited warranty.

4' PERFORMANCE CHART

Shielding	Lumens per Foot	Delivered Lumens	Tested System Watts	LPW
Flush Lens	375LF	1500	15	97
	625LF	2500	26	95
	875LF	3500	39	89
	1000LF	4000	46	86
Regress Lens	375LF	1500	15	86
	625LF	2500	26	84
	875LF	3500	39	80
	1000LF	4000	46	77
Regress High Performance	375LF	1500	15	103
	625LF	2500	26	100
	875LF	3500	39	95
	1000LF	4000	46	91

*Based on 3500k, 4' lengths. *Lumen output may vary +/- 5%. Actual wattage may vary +/- 5%

Focal Point LLC reserves the right to change specifications for product improvement without notification.

ORDERING

Luminaire Series		FSM4L
Seem 4 LED	FSM4L	
Shielding		
Flush Satin Lens	FL	
Regress Lens (Ceiling applications only)	SR	
Regress High Performance Lens (Ceiling applications only)	SRXP	
Lumen Output		
275 Lumens per foot (Not available with Lutron Drivers.)	275LF	
375 Lumens per foot (Not available with LU5 & LH1 Drivers)	375LF	
625 Lumens per foot (FL & SR 3' minimum with LU5 & LH1 Drivers. SRXP 4' minimum with LU5 & LH1 Drivers.)	625LF	
875 Lumens per foot (SR & SRXP 3' minimum with LU5 & LH1 Drivers)	875LF	
1000 Lumens per foot (Not available with L3D driver)	1000LF	
Color Temperature		
3000K	30K	
3500K	35K	
4000K	40K	
Circuit		1C
Single Circuit	1C	
Voltage		
120 Volt	120	
277 Volt	277	
UNV Volt (Cannot be specified with EM option)	UNV	
Driver (See driver reference for driver quantities)		
0-10V - 10% Dimming	LD1	
0-10V - 1% Dimming	L11	
Lutron A-Series 1% EcoSystem Digital (Consult factory for 3-wire control)	L3D	
Lutron H-Series 1% Dimming	LH1	
Lutron 5-Series 5% EcoSystem Digital	LU5	
DALI 1% Dimming	D11	
Ceiling Configuration		
Std. 15/16" Lay-in	G1	
Std. 15/16" Tegular	T1	
Std. 9/16" Lay-in	G2	
Std. 9/16" Tegular	T2	
9/16" Slot-tee Tegular	G3	
Tall 15/16" Lay-in	G4	
Tall 15/16" Tegular	T4	
Tall 9/16" Lay-in	G5	
Tall 9/16" Tegular	T5	
Node 9/16" Tegular	T6	
Trim Flange Drywall (3' minimum with Lutron Drivers)	TF	
Trim Flange Wood (3' minimum with Lutron Drivers)	TFW	
Mud-in Trimless, pre-set for 1/2" Drywall	XF1	
Mud-in Trimless, pre-set for 5/8" Drywall	XF2	
Mud-in Trimless, set thickness in field (Mounting equipment assembled in field)	XFF	
Non-Drywall Hard Surface	XFN	
Hard Surface, Wood	XFW	
Factory Options		
Chicago Plenum	CP	
Emergency Circuit*	EC	
Emergency Battery Pack* (4' lengths or longer, not available at corners)	EM	
6' New York City Flex Whip	FNY	
6' Flex Whip	FW	
Finish		WH
Matte White Housing	WH	
Luminaire Length (Leave blank for patterns. Lengths are nominal)		28'
Specify luminaire/row length in 1' increments (Smaller increments available. Consult factory for details.)	X'	
Pattern Options (3' minimum length)		
'L' pattern	A' x B'	
'U' pattern	A' x B' x C'	
Rectangular pattern (Consult factory for other pattern options)	A' x B'R	

QS 10 DAY*

*For more information visit focalpointlights.com/reference or consult factory.
Quickship is a limited offering, visit focalpointlights.com/quickship for specifics.

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
FSM4L-SR-875LF-30K-1C-277-LD1-T2-WH-28'
Notes: 9/16 TEG TILE

Type:
RP28
LAI16-104794

Seem® 4

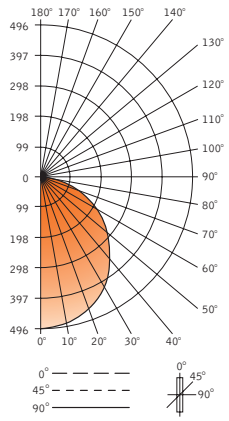
LED - FLUSH LENS

FSM4L-FL-375LF-35K-1C-UNV-LD1-G1-CP-WH-4'

Filename: FSM4LFL375LF35K.IES
Test #: 11499493.01

Lumens: 1423lm
System Watts: 15W
LPW: 95

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°
0°	496	496	496	496	496
5°	493	496	493	493	494
15°	475	479	475	476	477
25°	439	443	439	440	440
35°	386	390	387	387	388
45°	322	325	322	323	324
55°	253	255	253	254	254
65°	176	179	178	179	180
75°	100	102	102	104	104
85°	31	32	31	31	31
90°	0	2	2	2	2
95°	0	0	0	0	0
105°	0	0	0	0	0
115°	0	0	0	0	0
125°	0	0	0	0	0
135°	0	0	0	0	0
145°	0	0	0	0	0
155°	0	0	0	0	0
165°	0	0	0	0	0
175°	0	0	0	0	0
180°	0	0	0	0	0

LUMEN SUMMARY

	Zone	Lumens	% Fixture
	0-30°	384	27.0
	0-40°	627	44.1
	0-60°	1103	77.5
	0-90°	1423	100.00
Total Luminaire	0-180°	**1423**	**100.0**

LUMINANCE DATA (CD/M²)

Vertical Angle	Horizontal 0°	45°	90°
45°	3757	3760	3774
55°	3634	3642	3657
65°	3441	3473	3506
75°	3193	3261	3313
85°	2923	2967	2970

Go to www.focalpointlights.com for additional photometric data.

Seem® 4

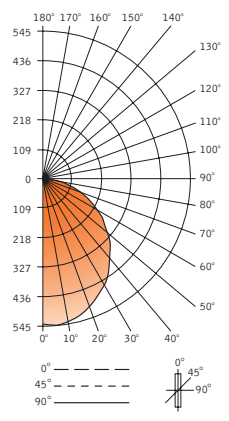
LED - REGRESS LENS

FSM4L-SR-375LF-35K-LD1-1C-120-G1-WH

Filename: FSM4LSR375LF35K.IES
Test #: 17847.0

Lumens: 1333lm
System Watts: 15W
LPW: 89

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	540	540	540	540	540	
5°	545	545	544	545	545	52
15°	520	519	519	519	519	146
25°	469	467	465	465	463	216
35°	418	418	413	402	396	254
45°	343	339	322	305	300	248
55°	261	254	228	209	202	207
65°	178	163	136	119	111	140
75°	88	72	49	34	30	60
85°	22	6	6	6	6	11
90°	0	0	0	0	0	
95°	0	0	0	0	0	0
105°	0	0	0	0	0	0
115°	0	0	0	0	0	0
125°	0	0	0	0	0	0
135°	0	0	0	0	0	0
145°	0	0	0	0	0	0
155°	0	0	0	0	0	0
165°	0	0	0	0	0	0
175°	0	0	0	0	0	0
180°	0	0	0	0	0	

LUMEN SUMMARY

	Zone	Lumens	% Fixture
	0-30°	414	31.0
	0-40°	668	50.1
	0-60°	1122	84.2
	0-90°	1333	100.0
Total Luminaire	0-180°	**1333**	**100.0**

LUMINANCE DATA (CD/M²)

Vertical Angle	Horizontal 0°	45°	90°
45°	4723	4439	4130
55°	4436	3872	3430
65°	4096	3145	2565
75°	3310	1858	1115
85°	2407	702	702

Go to www.focalpointlights.com for additional photometric data.

note: Photometric testing performed in an independent lab with standard lamps and ballasts. Lamp and ballast type and configuration will affect photometric performance.

Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
FSM4L-SR-875LF-30K-1C-277-LD1-T2-WH-28'
Notes: 9/16 TEG TILE

Type:
RP28
LAI16-104794

Seem® 4

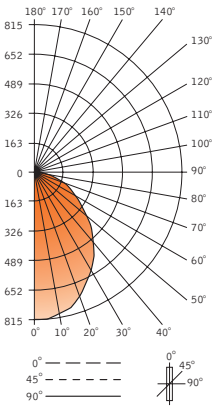
LED - REGRESS HIGH PERFORMANCE LENS

FSM4L-SRXP-375LF-35K-LD1-1C-120-G1-WH

Filename: FSM4LSRXP375LF35K.IES
Test #: 17852.0

Lumens: 1587lm
System Watts: 15W
LPW: 106

CANDLEPOWER DISTRIBUTION



Vertical Angle	Horizontal Angle 0°	22.5°	45°	67.5°	90°	Zonal Lumens
0°	812	812	812	812	812	
5°	813	813	812	812	812	77
15°	767	761	755	745	741	211
25°	671	662	641	619	605	295
35°	567	553	514	469	450	318
45°	436	418	362	303	283	278
55°	305	285	220	180	168	208
65°	194	169	118	95	90	131
75°	90	68	45	33	30	57
85°	22	10	7	7	7	12
90°	0	0	0	0	0	
95°	0	0	0	0	0	0
105°	0	0	0	0	0	0
115°	0	0	0	0	0	0
125°	0	0	0	0	0	0
135°	0	0	0	0	0	0
145°	0	0	0	0	0	0
155°	0	0	0	0	0	0
165°	0	0	0	0	0	0
175°	0	0	0	0	0	0
180°	0	0	0	0	0	

LUMEN SUMMARY

	Zone	Lumens	% Fixture
	0-30°	583	36.8
	0-40°	901	56.8
	0-60°	1386	87.4
	0-90°	1587	100.0
Total Luminaire	0-180°	**1587**	**100.0**

LUMINANCE DATA (CD/M²)

Vertical Angle	Horizontal 0°	45°	90°
45°	6005	4980	3896
55°	5183	3738	2853
65°	4460	2720	2083
75°	3401	1681	1120
85°	2496	832	832

Go to www.focalpointlights.com for additional photometric data.

note: Photometric testing performed in an independent lab with standard lamps and ballasts. Lamp and ballast type and configuration will affect photometric performance.

Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-16'-S-3000K-F-277V-SC-DIM(4X4)-SF Notes: DRYWALL CEILING	**Type:** **RR4X4** LAI16-104794

IC - RATED | LED | BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

Date

Project

Type

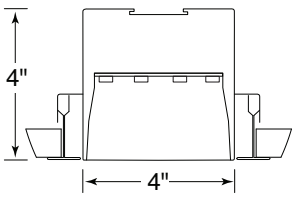
Comments

16FT LINEAR LENGTH
4FT X 4FT SQUARE



DESCRIPTION

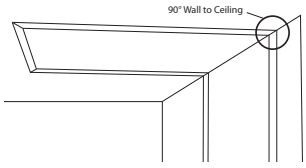
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser (Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

HP-4 R | | | | | | | | | |

Finelite **Series HP-4 R**
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output)
LED CRI (8 - 80 CRI Min (standard), 9 - 90 CRI Min (optional))
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)*
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - Screw Slot, C3F - Flush Screw Slot, VF - Visible Flange, C2T - 9/16" Tegular, C1T - 1" Tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - Tech Zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

Finelite, Inc. • 30500 Whipple Road • Union City, CA 94587-1530 • 510 / 441-1100 • Fax: 510 / 441-1510 • www.finelite.com

Due to continuing product improvements, Finelite reserves the right to change specifications without notice. Please visit www.finelite.com for most current data.

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-16'-S-3000K-F-277V-SC-DIM(4X4)-SF Notes: DRYWALL CEILING	**Type:** RR4X4 LAI16-104794

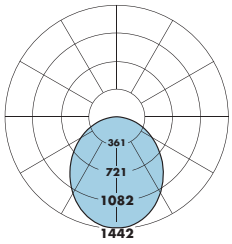
IC - RATED LED BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

PHOTOMETRY

Very High Output - 4' Luminare
Efficacy (Lumen per watt): 102.1
Total luminaire output: 3726 Lumens (932 lumens/foot)
37.7 Watts (9.4 watts/foot)
Peak Candela Value: 1442 @ 0º
CCT: 3500K
ITL LM79 Report 85128



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1442	1442	1442	1442	1442	
5	1434	1434	1433	1433	1434	136
15	1369	1360	1365	1364	1359	384
25	1241	1226	1232	1225	1219	566
35	1064	1053	1055	1043	1037	657
45	864	853	851	840	834	655
55	650	644	640	631	626	571
65	441	436	433	428	425	428
75	238	237	238	237	236	252
85	70	69	70	72	71	78
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1525	1917	2898	3726

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
381	479	725	932

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
105.1	104.1	102.2	100.7

S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output
* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85128

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

Recessed (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2898 lm x 0.789 = 2287 lm

Total Light Output per Foot =
725 lm/ft x 0.789 = 572 lm/ft

watts/foot = 7.1 W/ft

$$Efficacy = \frac{572\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80.1\ lm/W$$

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-16'-S-3000K-F-277V-SC-DIM(4X4)-SF Notes: DRYWALL CEILING	**Type:** **RR4X4** LAI16-104794

IC - RATED LED BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum lens length. Flush frost white snap-in lens standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in lens option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: ≥0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Factory-choice low-profile backup battery available. 8' minimum fixture length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum fixture length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor Occupancy Sensor **INTEGRATED SENSORS:** Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when fixture current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32").

LABELS: Fixture and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

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Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
HP-4-R-16'-S-3000K-F-277V-SC-DIM(4X4)-SF
Notes: DRYWALL CEILING

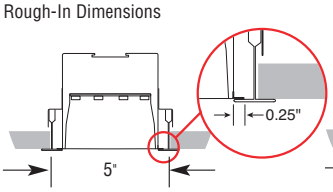
Type:
RR4X4
LAI16-104794

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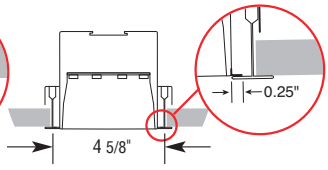
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High Performance 4" Aperture (HP-4) - Recessed

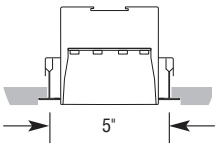
MOUNTING TYPES: T-BAR
Rough-In Dimensions



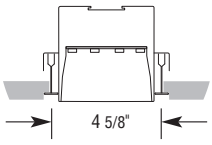
1" T-Bar (C1)



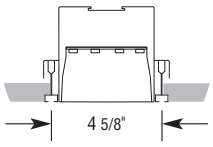
9/16" T-Bar (C2)



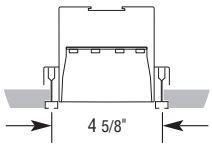
1" Tegular (C1T)



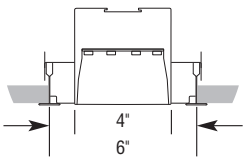
9/16" Tegular (C2T)



Flush Screw Slot (C3F)

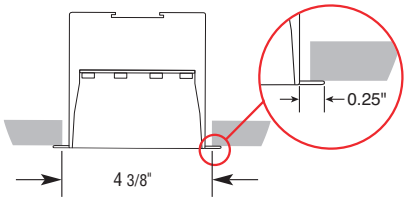


Standard Screw Slot (C3)

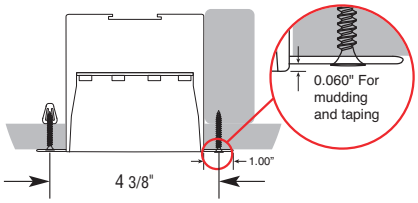


Tech Zone
(TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Visible Flange (VF)



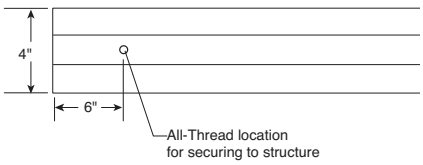
Spackle Flange (SF)

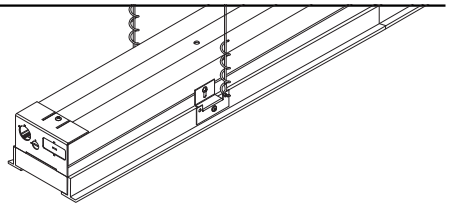

Ceiling Options
C1, C2, C3, VF

Housing With Extruded Flange (V1)


Ceiling Options
C1T, C2T, C3F, SF, TZ6

Housing Without Extruded Flange (V2) Ceiling Hardware Attached





SHEET ROCK INSTALLATION:
Flex conduit is secured to top of fixture. Support to structure using All-Thread. All-Thread support holes are located on each end of the fixture.

T-BAR INSTALLATION:
HP-4 R for T-Bar installations comes standard with a splice plate at the end of the luminaire. Mounting brackets (supplied) secure the fixture to T-Bar and provide support to structure location. All starter/independent fixtures are 1 1/8" shorter than nominal. All joiner/ender fixture are normal length.

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-20'-S-3000K-F-277V-SC-DIM(4X6)-C3F Notes: DRYWALL CEILING	**Type:** **RR4X6 9/16 TEG** LAI16-104794

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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

Date

Project

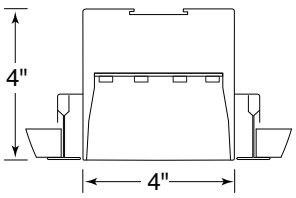
Type

Comments: 20FT LINEAR LENGTH
4FT X 6FT RECTANGLE



DESCRIPTION

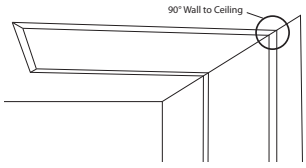
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser (Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

HP-4 R									

Finelite **Series HP-4 R**
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output)
LED CRI (8 - 80 CRI Min (standard), 9 - 90 CRI Min (optional))
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)*
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - Screw Slot, C3F - Flush Screw Slot, VF - Visible Flange, C2T - 9/16" Tegular, C1T - 1" Tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - Tech Zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

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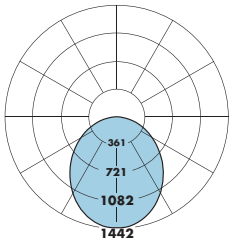
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High Performance 4" Aperture (HP-4) - Recessed

PHOTOMETRY

Very High Output - 4' Luminaire
Efficacy: 101 lumens per watt
Total luminaire output: 3726 Lumens (932 lumens/foot)
37 Watts (9.3 watts/foot)
Peak Candela Value: 1442 @ 0º
CCT: 3500K
ITL LM79 Report 85128



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1442	1442	1442	1442	1442	
5	1434	1434	1433	1433	1434	136
15	1369	1360	1365	1364	1359	384
25	1241	1226	1232	1225	1219	566
35	1064	1053	1055	1043	1037	657
45	864	853	851	840	834	655
55	650	644	640	631	626	571
65	441	436	433	428	425	428
75	238	237	238	237	236	252
85	70	69	70	72	71	78
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1525	1917	2898	3726

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
381	479	725	932

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
105	104	102	101

* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85128
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

Recessed (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2898 lm x 0.789 = 2287 lm

Total Light Output per Foot =
725 lm/ft x 0.789 = 572 lm/ft

watts/foot = 7.1 W/ft

$$Efficacy = \frac{572\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80\ lm/W$$

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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

HOUSING



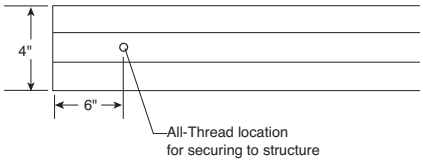
Housing With Extruded Flange (V1)

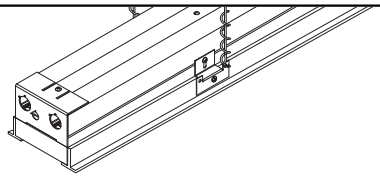
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6





SHEET ROCK INSTALLATION:

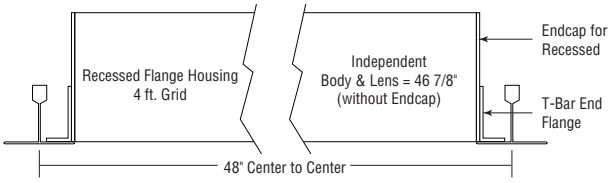
Flex conduit is secured to top of luminaire. Support to structure using All-Thread. All-Thread support holes are located on each end of the luminaire.

T-BAR INSTALLATION:

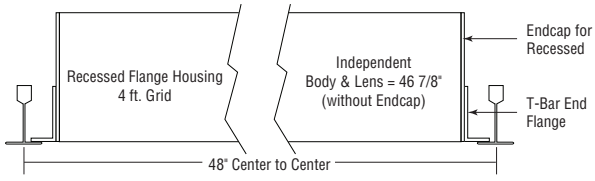
HP-4 R for T-Bar installations comes standard with a splice plate at the end of the luminaire. Mounting brackets (supplied) secure the luminaire to T-Bar and provide support to structure location. All starter/independent luminaires are 1 1/8" shorter than nominal. All joiner/ender luminaire are normal length.

GRID LENGTH DETAIL - 4 ft. example

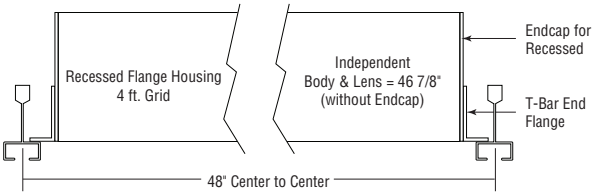
1" T-bar



9/16" T-bar

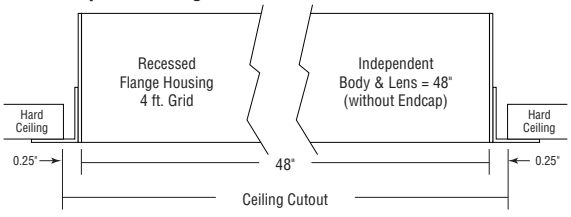


9/16" Screw Slot

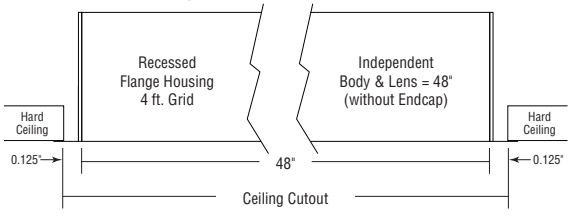


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-20'-S-3000K-F-277V-SC-DIM(4X6)-C3F Notes: DRYWALL CEILING	**Type:** **RR4X6 9/16 TEG** LAI16-104794

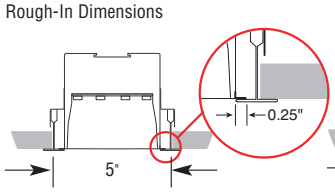
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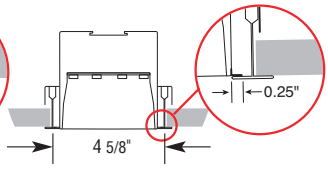
High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR

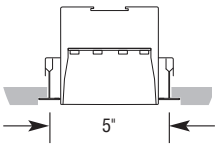
Rough-In Dimensions



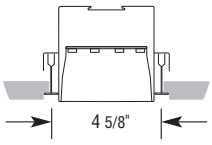
1" T-Bar (C1)



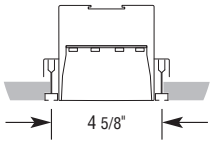
9/16" T-Bar (C2)



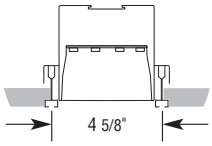
1" Tegular (C1T)



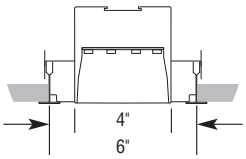
9/16" Tegular (C2T)



Flush Screw Slot (C3F)

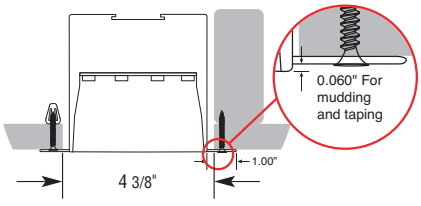


Standard Screw Slot (C3)

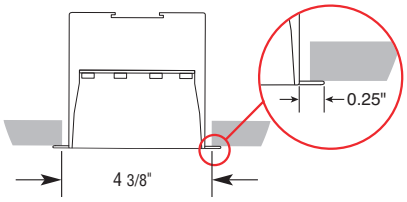


Tech Zone
(TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF)



Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor Occupancy Sensor **INTEGRATED SENSORS:** Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-20'-S-3000K-F-277V-SC-DIM-NL(4X6)-SF Notes: DRYWALL CEILING	**Type:** **RR4X6-DRYWALL** LAI16-104794

IC - RATED | LED | BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

Date

Project

Type

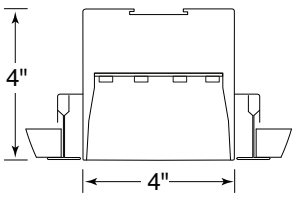
Comments

20FT LINEAR LENGTH
4FT X 6FT RECTANGLE



DESCRIPTION

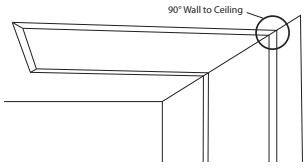
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser
(Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

NL = NIGHT LIGHT CIRCUIT

HP-4 R [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]

Finelite **Series HP-4 R**
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output)
LED CRI (8 - 80 CRI Min (standard), 9 - 90 CRI Min (optional))
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)*
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - Screw Slot, C3F - Flush Screw Slot, VF - Visible Flange, C2T - 9/16" Tegular, C1T - 1" Tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - Tech Zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

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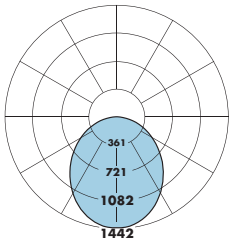
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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

PHOTOMETRY

Very High Output - 4' Luminaire
Efficacy: 101 lumens per watt
Total luminaire output: 3726 Lumens (932 lumens/foot)
37 Watts (9.3 watts/foot)
Peak Candela Value: 1442 @ 0º
CCT: 3500K
ITL LM79 Report 85128



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1442	1442	1442	1442	1442	
5	1434	1434	1433	1433	1434	136
15	1369	1360	1365	1364	1359	384
25	1241	1226	1232	1225	1219	566
35	1064	1053	1055	1043	1037	657
45	864	853	851	840	834	655
55	650	644	640	631	626	571
65	441	436	433	428	425	428
75	238	237	238	237	236	252
85	70	69	70	72	71	78
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1525	1917	2898	3726

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
381	479	725	932

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
105	104	102	101

* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85128
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

Recessed (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2898 lm x 0.789 = 2287 lm

Total Light Output per Foot =
725 lm/ft x 0.789 = 572 lm/ft

watts/foot = 7.1 W/ft

$$Efficacy = \frac{572\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80\ \text{lm/W}$$

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High Performance 4" Aperture (HP-4) - Recessed

HOUSING



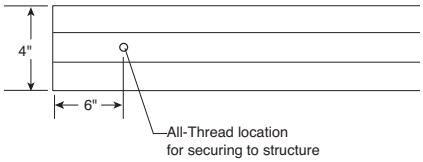
Housing With Extruded Flange (V1)

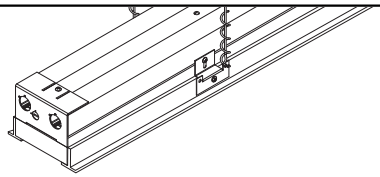
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6





SHEET ROCK INSTALLATION:

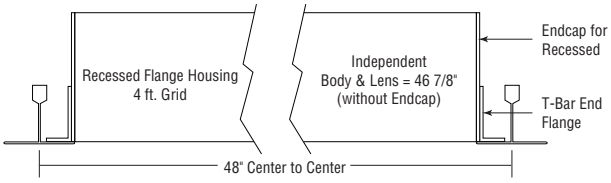
Flex conduit is secured to top of luminaire. Support to structure using All-Thread. All-Thread support holes are located on each end of the luminaire.

T-BAR INSTALLATION:

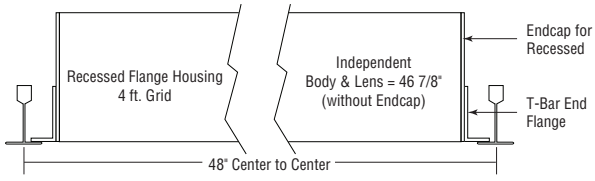
HP-4 R for T-Bar installations comes standard with a splice plate at the end of the luminaire. Mounting brackets (supplied) secure the luminaire to T-Bar and provide support to structure location. All starter/independent luminaires are 1 1/8" shorter than nominal. All joiner/ender luminaire are normal length.

GRID LENGTH DETAIL - 4 ft. example

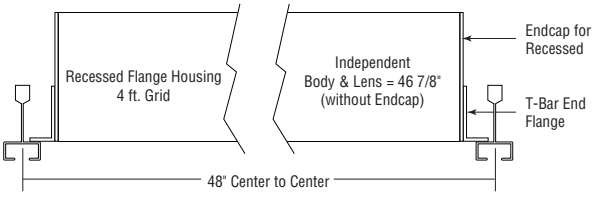
1" T-bar



9/16" T-bar

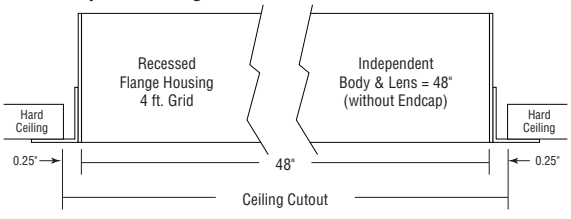


9/16" Screw Slot

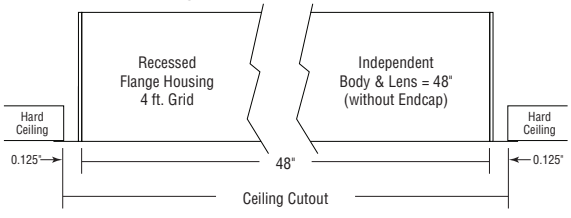


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



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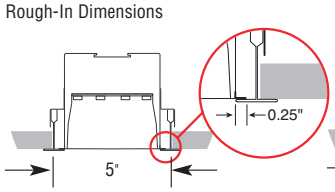
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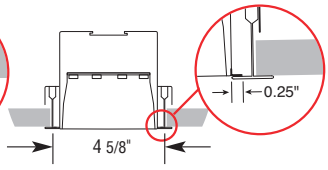
High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR

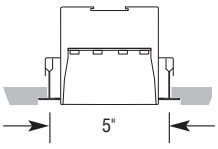
Rough-In Dimensions



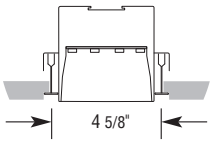
1" T-Bar (C1)



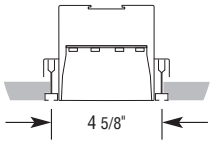
9/16" T-Bar (C2)



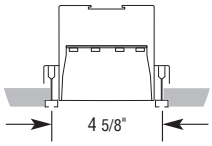
1" Tegular (C1T)



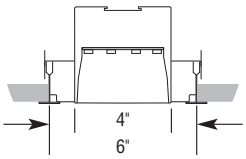
9/16" Tegular (C2T)



Flush Screw Slot (C3F)

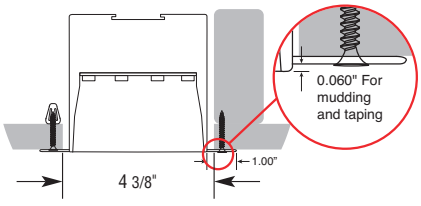


Standard Screw Slot (C3)

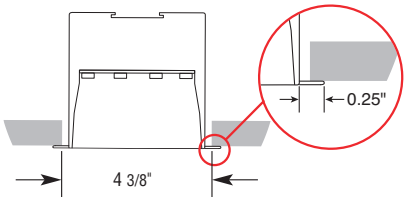


Tech Zone
(TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF)



Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor Occupancy Sensor **INTEGRATED SENSORS:** Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4-R-8'-H-3000K-F-277V-SC-C3F-DIM-.1% Notes:	**Type:** **RS8** LAI16-104794

IC - RATED | LED | BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

Date

Project

Type

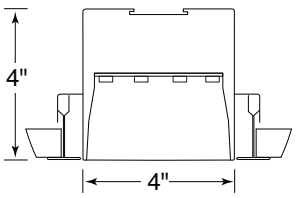
Comments

16FT LINEAR LENGTH
4FT X 4FT SQUARE



DESCRIPTION

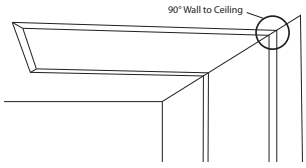
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser
(Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

HP-4 R

Finelite **Series HP-4 R**
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output)
LED CRI (8 - 80 CRI Min (standard), 9 - 90 CRI Min (optional))
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)*
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - Screw Slot, C3F - Flush Screw Slot, VF - Visible Flange, C2T - 9/16" Tegular, C1T - 1" Tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - Tech Zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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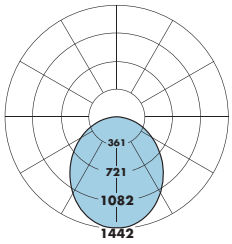
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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

PHOTOMETRY

Very High Output - 4' Luminaire
Efficacy: 101 lumens per watt
Total luminaire output: 3726 Lumens (932 lumens/foot)
37 Watts (9.3 watts/foot)
Peak Candela Value: 1442 @ 0º
CCT: 3500K
ITL LM79 Report 85128



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1442	1442	1442	1442	1442	
5	1434	1434	1433	1433	1434	136
15	1369	1360	1365	1364	1359	384
25	1241	1226	1232	1225	1219	566
35	1064	1053	1055	1043	1037	657
45	864	853	851	840	834	655
55	650	644	640	631	626	571
65	441	436	433	428	425	428
75	238	237	238	237	236	252
85	70	69	70	72	71	78
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1525	1917	2898	3726

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
381	479	725	932

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
105	104	102	101

* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85128
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

Recessed (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2898 lm x 0.789 = 2287 lm

Total Light Output per Foot =
725 lm/ft x 0.789 = 572 lm/ft

watts/foot = 7.1 W/ft

$$\textit{Efficacy} = \frac{572\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80\ \text{lm/W}$$

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FINELITE

High Performance 4" Aperture (HP-4) - Recessed

HOUSING



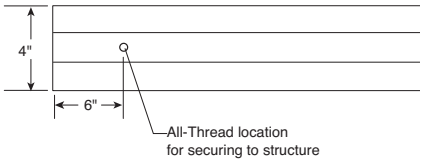
Housing With Extruded Flange (V1)

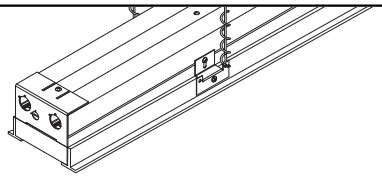
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6





SHEET ROCK INSTALLATION:

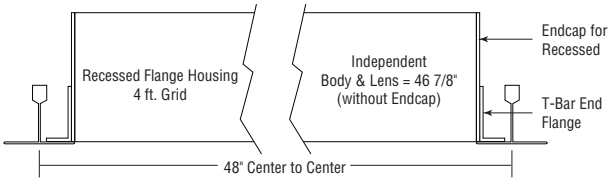
Flex conduit is secured to top of luminaire. Support to structure using All-Thread. All-Thread support holes are located on each end of the luminaire.

T-BAR INSTALLATION:

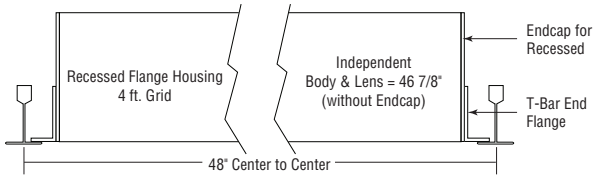
HP-4 R for T-Bar installations comes standard with a splice plate at the end of the luminaire. Mounting brackets (supplied) secure the luminaire to T-Bar and provide support to structure location. All starter/independent luminaires are 1 1/8" shorter than nominal. All joiner/ender luminaire are normal length.

GRID LENGTH DETAIL - 4 ft. example

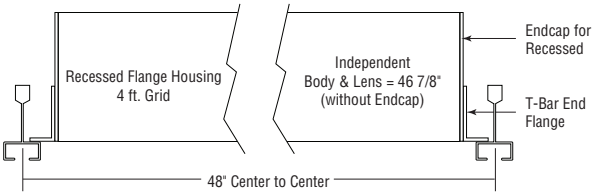
1" T-bar



9/16" T-bar

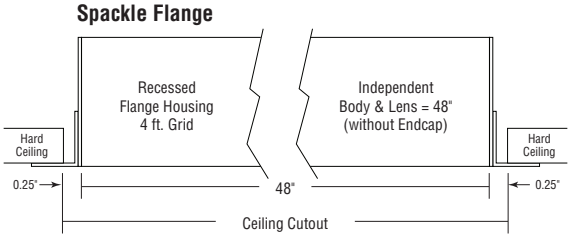


9/16" Screw Slot

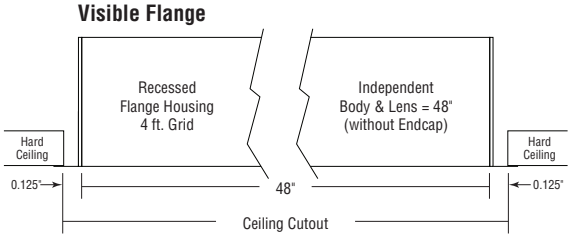


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



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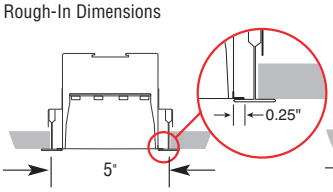
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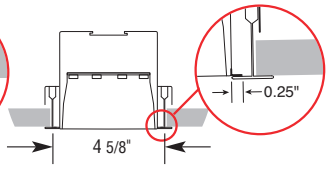
High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR

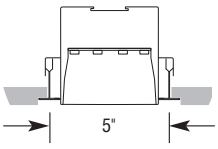
Rough-In Dimensions



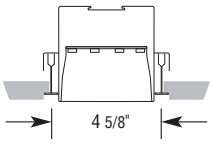
1" T-Bar (C1)



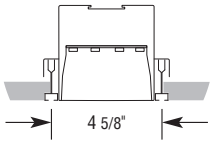
9/16" T-Bar (C2)



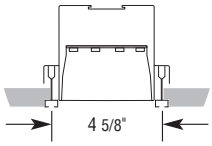
1" Tegular (C1T)



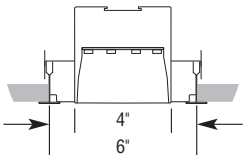
9/16" Tegular (C2T)



Flush Screw Slot (C3F)

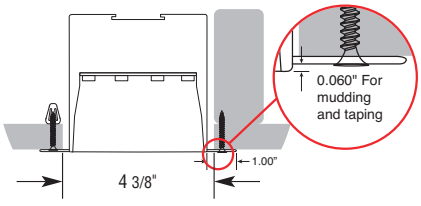


Standard Screw Slot (C3)

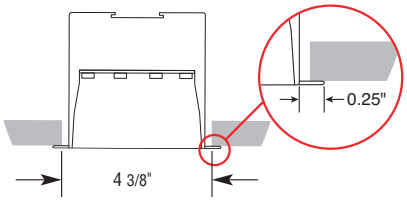


Tech Zone
(TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF)



Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor Occupancy Sensor **INTEGRATED SENSORS:** Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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PROJECT INFORMATION

Job Name _____

Fixture Type _____

Catalog Number _____

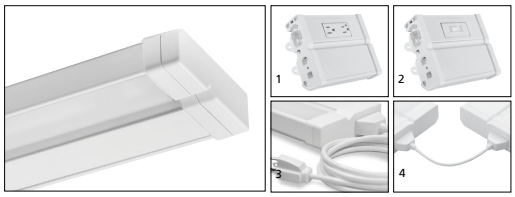
Approved by _____

STRATALUME CONNECTS™

AUC/MAUC SERIES – LED

PRODUCT FEATURES:

- Available in multiple lengths to fit any application
- External mounting feet allow for easy installation
- Antimicrobial finish standard when used in Healthcare applications



1 Wiring Module w/ Hospital Grade Outlet
2 Wiring Module w/ Rocker Switch
3 Power Cordset
4 Interconnect Cordset

SPECIFICATIONS

HOUSING: Extruded marine-grade aluminum. TGIC polyester powder coat finish with five-step pretreatment. Antimicrobial finish standard on housing and driver cover with MAUC series only.

LENS: UV-stabilized, high-impact resistant, extruded frost 100% DR acrylic. Smooth exterior, linear prism interior. Snap-in tool-less entry design.

END CAPS/COVERS: UV-stabilized, high-impact resistant, injection-molded white or black opaque polycarbonate. Black end caps/covers provided when silver finish (SL) is ordered. Light leak-preventing interlocking design.

GASKET: Closed-cell extruded EPDM gasket seals lens to end caps.

ELECTRICAL: LED array with electrically-isolated thermal pads. Maximum 3-step MacAdam variation allowance. See Ordering Information for color temperature options. 80CRI minimum. 120-277VAC, 50/60Hz input with replaceable high power factor electronic constant-current driver (<20% THD, >0.90 PF). Standard 0-10V dimming with 5-100% range. EMC meets or exceeds FCC CFR Part 15. Male and female grounded connectors provided at ends of series-mount fixtures. See Options and Accessories for additional electrical capabilities.

ELECTRICAL ACCESSORIES: Wiring modules available with 15 amp hospital grade outlet or master switch. Construction and installation match fixtures. Cordsets: Custom-molded plugs, SVT cord, snap-together design. Power cordsets connect to left side of fixture series; 120V wall outlet powered, 6 amps max. Interconnect cordsets electrically connect fixtures. Available in white or black finish.

INSTALLATION: External mounting feet allow installation without accessing internal compartments. Four-point mounting required for individual fixtures and initial fixture in series-mount run. Two-point mounting required for subsequent series-mount fixtures. UL fitting for 3/8" flexible conduit or NM wire supplied. Direct wire in rear of fixture uses push-in connectors behind quick-access cover. Direct wire into sides of fixture uses included adapter plate. Maximum current of series-runs 6 amps per circuit (see table on page 3).

WARRANTY: Lifetime Guarantee against defects in workmanship and materials (LEDs and drivers excluded) for the product life of the original installation. Five (5) year warranty on LED lamps and driver for defects resulting in a fixture lumen depreciation of 30% or greater.

LISTINGS: UL and CUL listed for Damp Location. Cord-equipped models listed as Portable Luminaires. NSF2 Splash/Non-Food Zone for MAUC series only. Photometry tested to the IESNA LM-79-08 standard by an ILAC/ISO17025 accredited laboratory.

LED c UL us NSF
MAUC Series

ORDERING INFORMATION (Ex: MAUCLED-I-MW-20L30K-48-120)

Model	Installation Type	Finish	Lamp Type	Length	Voltage	Options	Accessories

Model

AUCLED	Architectural Applications
MAUCLED†	Healthcare Applications

Installation Type

I	Individual Mount
S	Series Mount

Finish

MW†	Matte White
MB†	Matte Black
SL†	Silver
CCW	Custom Color with White end caps
CCB	Custom Color with Black end caps

†Antimicrobial finish standard for MAUC Series

Lamp Type

11L30K	11 Watt 3000K LED
11L35K	11 Watt 3500K LED
11L40K	11 Watt 4000K LED
16L30K	16 Watt 3000K LED
16L35K	16 Watt 3500K LED
16L40K	16 Watt 4000K LED
20L30K	20 Watt 3000K LED
20L35K	20 Watt 3500K LED
20L40K	20 Watt 4000K LED

Length

18	18" – 11 Watt only
24	24" – 11 Watt only
36	36" – 16 Watt only
48	48" – 20 Watt only

Voltage

120	120 Volts
277	277 Volts

Options

CS*	8' Hard-wired Cordset (Individual Mount only)
2C‡	Series Mount Two-Circuit Wiring
FS	Single Fuse & Holder
MS▲	PIR Occupancy Sensor
SW▲	Rocker Switch

Accessories (Series Mount only)**

WML	6" Wiring Module w/o Accessory
WML/HGO*	8" Wiring Module w/ Hospital Grade Outlet
WML/SW	6" Wiring Module w/Rocker Switch
PCL2*‡	2' Straight Power Cordset
PCL3*‡	3' Straight Power Cordset
PCL4*‡	4' Straight Power Cordset
PCL6*‡	6' Straight Power Cordset
PCL10*‡	10' Straight Power Cordset
ICL05‡	6" Straight Interconnect Cordset
ICL1‡	1' Straight Interconnect Cordset
ICL2‡	2' Straight Interconnect Cordset
ICL3‡	3' Straight Interconnect Cordset

* 120 Volts only

** When ordering Accessories, add color suffix: –WHT white, –BLK black, –SLV silver, –CCW/–CCB custom color (–SLV and –CCW/–CCB for Wiring Modules only)

‡ Dimming function not available when specified with series mount installation type

▲ Not available in 18" length when ordered with series mount installation type

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** AUCLED-I-MW-11L30K-24"-120V-MS-SW Notes:	**Type:** **UA2** LAI16-104794

For additional photometry, go to www.kenall.com

STRATALUME CONNECTS™

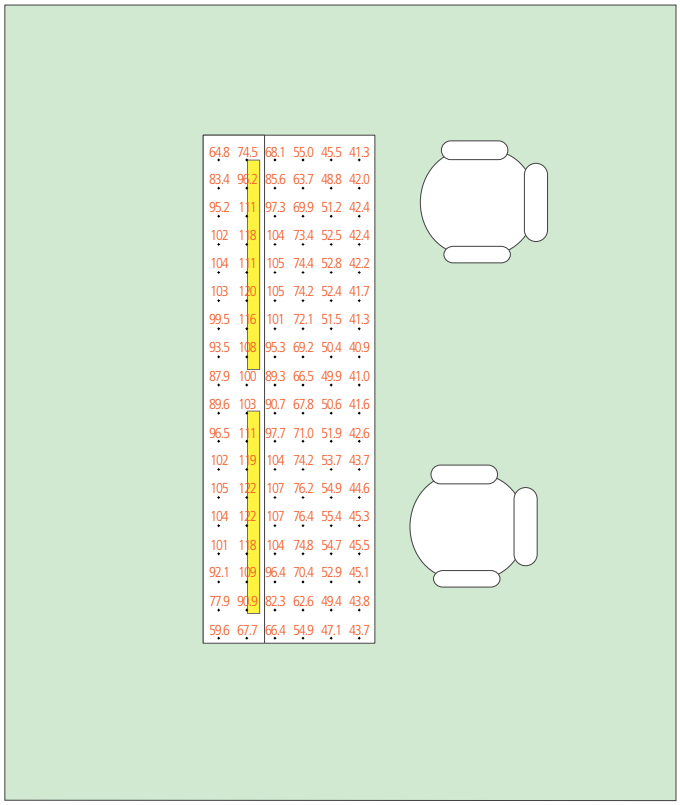
AUC/MAUC SERIES – LED

PERFORMANCE

	Initial Delivered Lumens				
Lamp Type	@ 25°C (lm)	Efficacy (lm/W)	Input Power (W)	Drive Current (mA)	Estd. L_{70} LED Life (hrs)
11L30K	700	54	13	117	92,000
11L35K	700	54	13	117	92,000
11L40K	803	62	13	117	92,000
16L30K	993	55	18	117	92,000
16L35K	993	55	18	117	92,000
16L40K	1140	63	18	117	92,000
20L30K	1287	56	23	117	92,000
20L35K	1287	56	23	117	92,000
20L40K	1473	64	23	117	92,000

Displayed information above is for selected luminaires only. Additional wattages and color temperatures are also available. Visit www.kenall.com for additional information.

TYPICAL LIGHTING LAYOUT (TASK LIGHTING ONLY)



Illuminance	(Fc)
Average	52.96
Maximum	102
Minimum	9.6
Ave/Min Ratio	5.52
Max/Min Ratio	10.63

Product shown: (2) 48" AUCLED with 20L35K lamp.
Calculations are based on 9' ceiling height, 30" task plane, shelf height 20" above task plane, 90/60/20 room reflectance, and 0.80 LLF.

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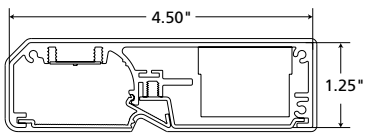
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** AUCLED-I-MW-11L30K-24"-120V-MS-SW Notes:	**Type:** **UA2** LAI16-104794

For additional photometry, go to www.kenall.com

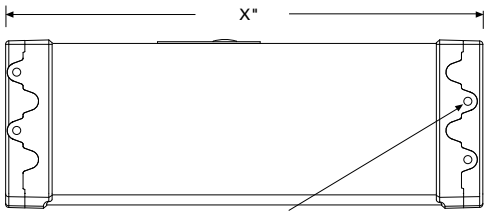
STRATALUME CONNECTS™

AUC/MAUC SERIES – LED

DIMENSIONAL DATA



Solid Front



(4) 0.188" Mounting Holes

LENGTH DIMENSION

MODEL	LENGTH	X (in)	Max Current 120V	Max Current 277V
11L	18"	18.00	0.11	0.05
11L	24"	24.00	0.11	0.05
16L	36"	36.00	0.15	0.07
20L	48"	48.00	0.19	0.09
WML	–	6.00		
WML/HGO	–	8.00		
WML/SW	–	6.00		

NOTE: Subtract 0.54" for each end cover removed to get overall length in series mount applications. When ordering the power or interconnect cordset, allow at least 2" clearance on the side of the fixture. To calculate maximum allowable fixtures in a series run, divide 6 amps maximum current by the maximum current of each fixture.

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** AUCLED-I-MW-20L30K-48"-120V-MS-SW Notes:	**Type:** **UA4** LAI16-104794

PROJECT INFORMATION

Job Name _____

Fixture Type _____

Catalog Number _____

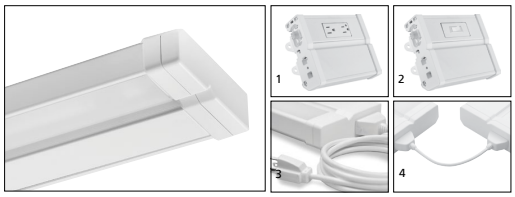
Approved by _____

STRATALUME CONNECTS™

AUC/MAUC SERIES – LED

PRODUCT FEATURES:

- Available in multiple lengths to fit any application
- External mounting feet allow for easy installation
- Antimicrobial finish standard when used in Healthcare applications



1 Wiring Module w/ Hospital Grade Outlet
2 Wiring Module w/ Rocker Switch
3 Power Cordset
4 Interconnect Cordset

SPECIFICATIONS

HOUSING: Extruded marine-grade aluminum. TGIC polyester powder coat finish with five-step pretreatment. Antimicrobial finish standard on housing and driver cover with MAUC series only.

LENS: UV-stabilized, high-impact resistant, extruded frost 100% DR acrylic. Smooth exterior, linear prism interior. Snap-in tool-less entry design.

END CAPS/COVERS: UV-stabilized, high-impact resistant, injection-molded white or black opaque polycarbonate. Black end caps/covers provided when silver finish (SL) is ordered. Light leak-preventing interlocking design.

GASKET: Closed-cell extruded EPDM gasket seals lens to end caps.

ELECTRICAL: LED array with electrically-isolated thermal pads. Maximum 3-step MacAdam variation allowance. See Ordering Information for color temperature options. 80CRI minimum. 120-277VAC, 50/60Hz input with replaceable high power factor electronic constant-current driver (<20% THD, >0.90 PF). Standard 0-10V dimming with 5-100% range. EMC meets or exceeds FCC CFR Part 15. Male and female grounded connectors provided at ends of series-mount fixtures. See Options and Accessories for additional electrical capabilities.

ELECTRICAL ACCESSORIES: Wiring modules available with 15 amp hospital grade outlet or master switch. Construction and installation match fixtures. Cordsets: Custom-molded plugs, SVT cord, snap-together design. Power cordsets connect to left side of fixture series; 120V wall outlet powered, 6 amps max. Interconnect cordsets electrically connect fixtures. Available in white or black finish.

INSTALLATION: External mounting feet allow installation without accessing internal compartments. Four-point mounting required for individual fixtures and initial fixture in series-mount run. Two-point mounting required for subsequent series-mount fixtures. UL fitting for 3/8" flexible conduit or NM wire supplied. Direct wire in rear of fixture uses push-in connectors behind quick-access cover. Direct wire into sides of fixture uses included adapter plate. Maximum current of series-runs 6 amps per circuit (see table on page 3).

WARRANTY: Lifetime Guarantee against defects in workmanship and materials (LEDs and drivers excluded) for the product life of the original installation. Five (5) year warranty on LED lamps and driver for defects resulting in a fixture lumen depreciation of 30% or greater.

LISTINGS: UL and CUL listed for Damp Location. Cord-equipped models listed as Portable Luminaires. NSF2 Splash/Non-Food Zone for MAUC series only. Photometry tested to the IESNA LM-79-08 standard by an ILAC/ISO17025 accredited laboratory.

LED c UL us NSF
MAUC Series

ORDERING INFORMATION (Ex: MAUCLED-I-MW-20L30K-48-120)

Model	Installation Type	Finish	Lamp Type	Length	Voltage	Options	Accessories

Model
- **AUCLED** Architectural Applications
- **MAUCLED**† Healthcare Applications

Installation Type
- **I** Individual Mount
- **S** Series Mount

Finish
- **MW**† Matte White
- **MB**† Matte Black
- **SL**† Silver
- **CCW** Custom Color with White end caps
- **CCB** Custom Color with Black end caps

†Antimicrobial finish standard for MAUC Series

Lamp Type
- **11L30K** 11 Watt 3000K LED
- **11L35K** 11 Watt 3500K LED
- **11L40K** 11 Watt 4000K LED
- **16L30K** 16 Watt 3000K LED
- **16L35K** 16 Watt 3500K LED
- **16L40K** 16 Watt 4000K LED
- **20L30K** 20 Watt 3000K LED
- **20L35K** 20 Watt 3500K LED
- **20L40K** 20 Watt 4000K LED

Length
- **18** 18" – 11 Watt only
- **24** 24" – 11 Watt only
- **36** 36" – 16 Watt only
- **48** 48" – 20 Watt only

Voltage
- **120** 120 Volts
- **277** 277 Volts

Options
- **CS*** 8' Hard-wired Cordset (Individual Mount only)
- **2C**‡ Series Mount Two-Circuit Wiring
- **FS** Single Fuse & Holder
- **MS**▲ PIR Occupancy Sensor
- **SW**▲ Rocker Switch

Accessories (Series Mount only)**
- **WML** 6" Wiring Module w/o Accessory
- **WML/HGO*** 8" Wiring Module w/ Hospital Grade Outlet
- **WML/SW** 6" Wiring Module w/Rocker Switch
- **PCL2*‡** 2' Straight Power Cordset
- **PCL3*‡** 3' Straight Power Cordset
- **PCL4*‡** 4' Straight Power Cordset
- **PCL6*‡** 6' Straight Power Cordset
- **PCL10*‡** 10' Straight Power Cordset
- **ICL05‡** 6" Straight Interconnect Cordset
- **ICL1‡** 1' Straight Interconnect Cordset
- **ICL2‡** 2' Straight Interconnect Cordset
- **ICL3‡** 3' Straight Interconnect Cordset

* 120 Volts only

** When ordering Accessories, add color suffix: –WHT white, –BLK black, –SLV silver, –CCW/–CCB custom color (–SLV and –CCW/–CCB for Wiring Modules only)

‡ Dimming function not available when specified with series mount installation type

▲ Not available in 18" length when ordered with series mount installation type

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** AUCLED-I-MW-20L30K-48"-120V-MS-SW Notes:	**Type:** **UA4** LAI16-104794

For additional photometry, go to www.kenall.com

STRATALUME CONNECTS™

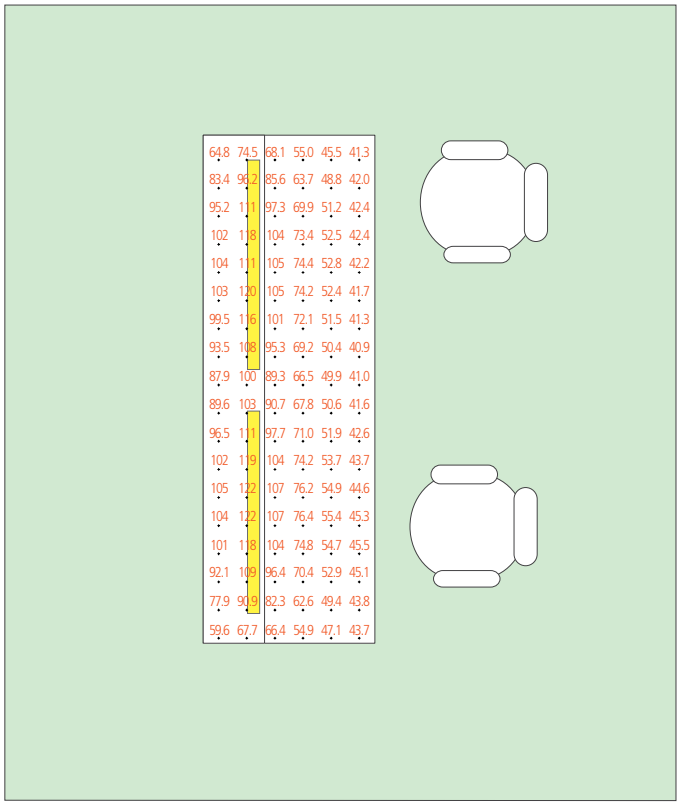
AUC/MAUC SERIES – LED

PERFORMANCE

	Initial Delivered Lumens				
Lamp Type	@ 25°C (lm)	Efficacy (lm/W)	Input Power (W)	Drive Current (mA)	Estd. L_{70} LED Life (hrs)
11L30K	700	54	13	117	92,000
11L35K	700	54	13	117	92,000
11L40K	803	62	13	117	92,000
16L30K	993	55	18	117	92,000
16L35K	993	55	18	117	92,000
16L40K	1140	63	18	117	92,000
20L30K	1287	56	23	117	92,000
20L35K	1287	56	23	117	92,000
20L40K	1473	64	23	117	92,000

Displayed information above is for selected luminaires only. Additional wattages and color temperatures are also available. Visit www.kenall.com for additional information.

TYPICAL LIGHTING LAYOUT (TASK LIGHTING ONLY)



Illuminance	(Fc)
Average	52.96
Maximum	102
Minimum	9.6
Ave/Min Ratio	5.52
Max/Min Ratio	10.63

Product shown: (2) 48" AUCLED with 20L35K lamp.
Calculations are based on 9' ceiling height, 30" task plane, shelf height 20" above task plane, 90/60/20 room reflectance, and 0.80 LLF.

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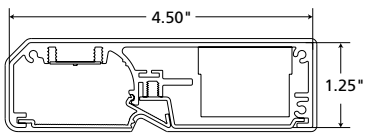
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** AUCLED-I-MW-20L30K-48"-120V-MS-SW Notes:	**Type:** **UA4** LAI16-104794

For additional photometry, go to www.kenall.com

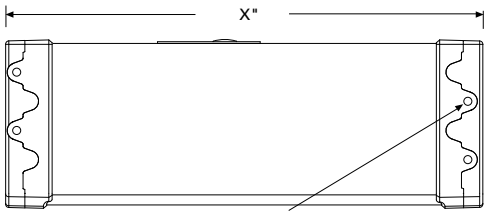
STRATALUME CONNECTS™

AUC/MAUC SERIES – LED

DIMENSIONAL DATA



Solid Front



(4) 0.188" Mounting Holes

LENGTH DIMENSION

MODEL	LENGTH	X (in)	Max Current 120V	Max Current 277V
11L	18"	18.00	0.11	0.05
11L	24"	24.00	0.11	0.05
16L	36"	36.00	0.15	0.07
20L	48"	48.00	0.19	0.09
WML	–	6.00		
WML/HGO	–	8.00		
WML/SW	–	6.00		

NOTE: Subtract 0.54" for each end cover removed to get overall length in series mount applications. When ordering the power or interconnect cordset, allow at least 2" clearance on the side of the fixture. To calculate maximum allowable fixtures in a series run, divide 6 amps maximum current by the maximum current of each fixture.

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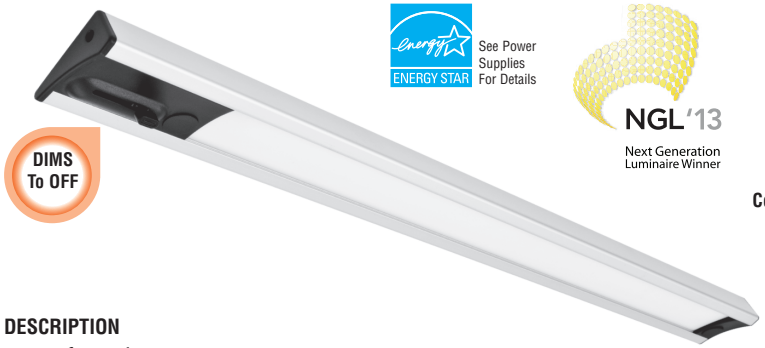
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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** UC-E-45"-FINISH-PS-21W Notes: MAGNETIC MOUNTING INCLUDED	**Type:** **UB4** LAI16-104794

FINELITE

BUY AMERICAN ACT OF 2009 COMPLIANT

Edge *by Finelite™*



ENERGY STAR See Power Supplies For Details

NGL '13 Next Generation Luminaire Winner

Date

Project

Type

Comments

DESCRIPTION

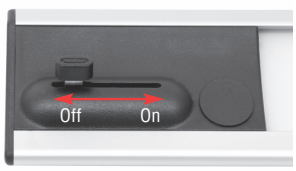
Edge *by Finelite™* delivers the right amount of task illumination for a fraction of the energy required by conventional undercabinet luminaires. Available in three different sizes, Edge *by Finelite™* can be used as a stand alone unit, daisy chained or in conjunction with Finelite LED desk lamps. Use it to create pleasant and sustainable work areas that allow for true occupant control.

P/S LED



LIGHT ENGINE

Edge uses mid-powered LEDs spaced uniformly for even distribution on the task plane.



FULL RANGE, ON-BOARD DIMMING TO OFF

Edge comes equipped with individual dimming to off on each luminaire.



EVEN GLOW DIFFUSER

Edge's Even Glow diffuser covers the LEDs for improved distribution, minimizes multiple shadow effects, and is easy to clean for applications requiring periodic wipe down.

21W & 60W



8W



POWER SUPPLIES:

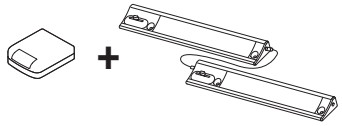
The power supply draws no power during off-state. Available with 8W, 21W or 60W power supplies to meet a variety of application needs.

ENERGY STAR

ENERGY STAR® QUALIFIED WITH FOLLOWING CONFIGURATIONS

ES1

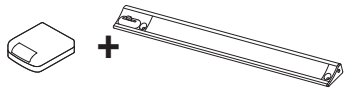
Two 12" units on an 8W power supply only



OR

ES2

One 22" unit on an 8W power supply only



ORDERING GUIDE

Sample Number: UC-E – 22"– S – PS-8W – OCC - ES2

Lamp (UC-E)
Length (12", 22", 45")†
Finish (Silver)
Power Supply (PS-8W* PS-21W PS-60W)
Occupancy Sensor (OCC)**
ENERGY STAR* (ES1, ES2)

† 45" can use 21W or 60W power supply.
** Edge is ENERGY STAR® qualified when using two 12" units (ES1) or one 22" (ES2) unit on an 8W power supply.*
*** OCC sensor available for PS-21W & PS-60W only.*

Finelite, Inc. • 30500 Whipple Road • Union City, CA 94587-1530 • 510 / 441-1100 • Fax: 510 / 441-1510 • www.finelite.com

Due to continuing product improvements, Finelite reserves the right to change specifications without notice. Please visit www.finelite.com for most current data.

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Submitted by LIGHTING ASSOCIATES, INC.

Job Name:
WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE
Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)

Catalog Number:
UC-E-45"-FINISH-PS-21W

Notes: MAGNETIC MOUNTING INCLUDED

Type:
UB4

LAI16-104794

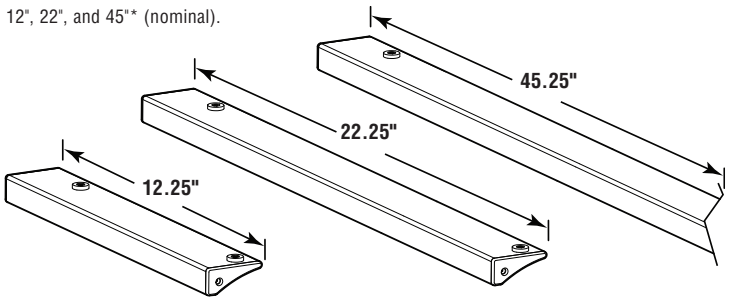
FINELITE

BUY AMERICAN ACT OF 2009 COMPLIANT

Edge *by Finelite*™

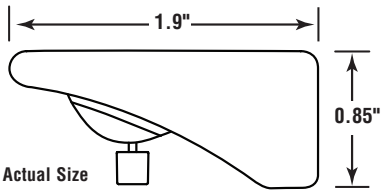
LENGTHS:

12", 22", and 45"* (nominal).



OCCUPANCY SENSOR

Optional occupancy sensor available for use with 21W or 60W power supply.



worry-free 5 year warranty

5 year warranty on all Edge *by Finelite* components.

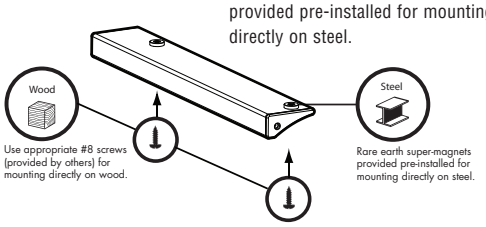
TECHNICAL SPECIFICATIONS

- Buy American Act of 2009 Compliant
- Efficacy (Lumens per Watt): 45": 62.2* / 22": 62.2 / 12": 48.9
- Light Output (Lumens): 45": 760* / 22": 380 / 12": 196
- Power Consumption: 45": 12.2W* / 22": 6.1W / 12": 4W
- Color Temperature: 3500K
- Color Rendering (CRI): 87
- R9 Value: 22": 32 / 12": 34
- L_{90}: Rated for 100,000 hours to 90% of initial lumens**
- LM-79 tested and LM-80 data is available
- Complies with FCC requirements for commercial and residential use
- Compatible with Personal Lighting System (PLS)
- End of life statement: 86% recyclable at the end of its useful life
- ETL Listed
- RoHS Compliant

** 45" performance is projected.*
*** L_{90} lifetime is estimated by the LED manufacturer based on independent testing of the Edge luminaire.*

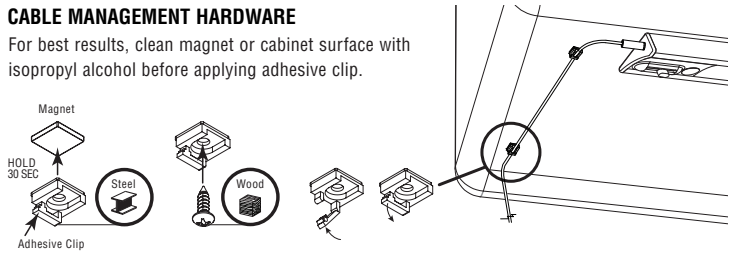
RARE EARTH MAGNETS

Powerful rare earth super magnets provided pre-installed for mounting directly on steel.



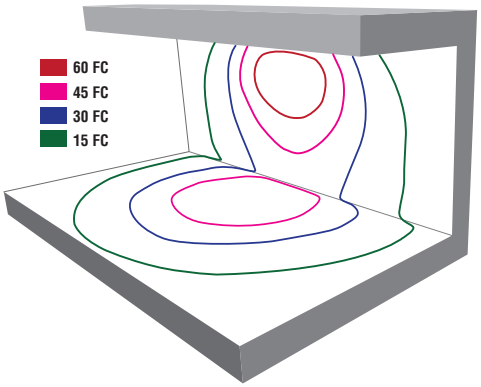
CABLE MANAGEMENT HARDWARE

For best results, clean magnet or cabinet surface with isopropyl alcohol before applying adhesive clip.



PHOTOMETRIC PERFORMANCE

Superior lateral throw provides proper illumination over a wide area. Example below: 22" unit installed on a 4' binder bin.

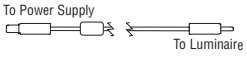


One 22" Edge provides ample illumination beneath a 4' binder area. For additional output specify a 45" luminaire rather than two 22" luminaires.

CABLES

Edge *by Finelite* comes standard with (1) 12' power cable and cable management hardware.

• Power Cables



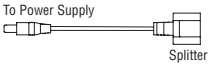
Cat No. CPNC-12 [12' Power Cable]

• Patch Cables



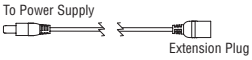
Daisy chains two male 1.3mm jacks.
Cat No. CP-3 [3" Patch Cable]
Cat No. CP-6 [6" Patch Cable]
Cat No. CP-14 [14" Patch Cable]
Cat No. CP-28 [28" Patch Cable]

• Splitter Cable



Cat No. CY-6 [6" Splitter Cable]

• Extension Cable



Cat No. CX-8 [8' Extension Cable]

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** PS-60W WITH TWIST LOCK L5-15P PLUG Notes:	**Type:** **UB4** LAI16-104794

FINELITE

Power Supplies and Occupancy Sensor

8W



21W and 60W





Occ Sensor

Date	
Project	
Type	
Comments	

Power Supplies	8W*	21W**	60W**
Input Voltage:	100-240v VAC 50-60hz	100-240v VAC 50-60hz	100-240v VAC 50-60hz
Output Voltage:	24 VDC (6.5W max.)	24 VDC (23W max.)	24 VDC (65W max.)
Output Jack:	1 x 2.5 mm	4 x 2.5 mm	4 x 2.5 mm
Dimensions:	3.5” x 4.3” x 1.4”	5.5” x 5.2” x 1.4”	5.5” x 5.2” x 1.4”
Finish:	Matte Black	Matte Black	Matte Black
Listed:	ETL	UL/ C-UL	UL/ C-UL
Power Cord:	5’ AC supplied	5’ AC supplied	5’ AC supplied

*Consumes no power in off-state. ** Optional occupancy sensor available.

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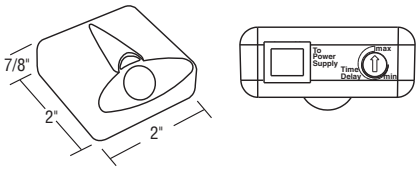
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FINELITE

Power Supplies and Occupancy Sensor

Occupancy Sensor



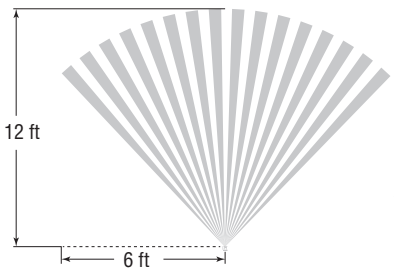
Cat No.: Occ
Uses passive infrared (PIR) technology to detect occupancy. User adjustable time delay of 30 seconds to 30 minutes. Fresnel lens with up to 120° and 300 square feet of coverage. ASIC technology reduces components and enhances reliability. UL / C-UL Listed.

Sensor Placement

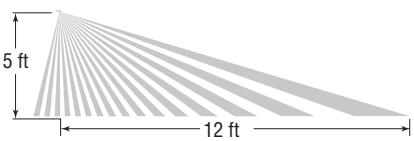
The occupancy sensor uses a multi-segmented Fresnel lens to view a coverage area. Position the sensor to have a clear view of motion (especially hand motion) in the workspace. Make sure that it does not view open doors or entrances where people passing by may be detected.

Below, the diagrams depict the occupancy sensor's coverage patterns. These diagrams illustrate the areas in which the sensor will best sense motion. Use the diagrams as a general reference to help determine the positioning and orientation of the occupancy sensor.

Coverage Patterns



Overhead View



Side View

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LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** CP-28 Notes: NEED TO VERIFY LENGTH	**Type:** **UB4** LAI16-104794

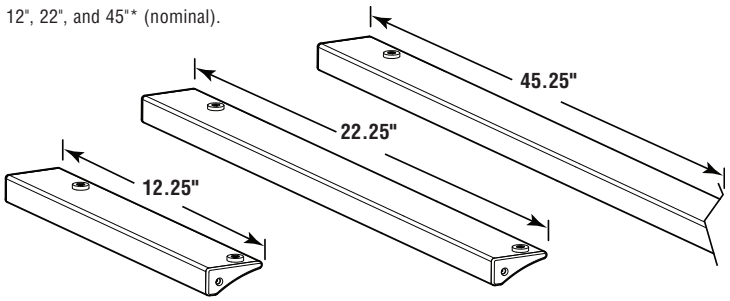
FINELITE

BUY AMERICAN ACT OF 2009 COMPLIANT

Edge *by Finelite*™

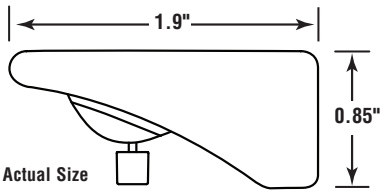
LENGTHS:

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OCCUPANCY SENSOR

Optional occupancy sensor available for use with 21W or 60W power supply.



worry-free 5 year warranty

5 year warranty on all Edge *by Finelite* components.

TECHNICAL SPECIFICATIONS

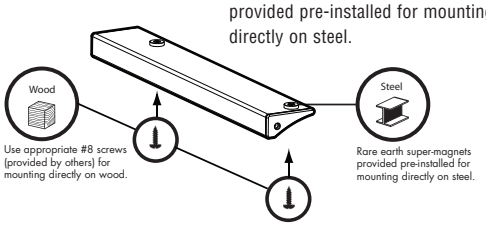
- Buy American Act of 2009 Compliant
- Efficacy (Lumens per Watt): 45": 62.2* / 22": 62.2 / 12": 48.9
- Light Output (Lumens): 45": 760* / 22": 380 / 12": 196
- Power Consumption: 45": 12.2W* / 22": 6.1W / 12": 4W
- Color Temperature: 3500K
- Color Rendering (CRI): 87
- R9 Value: 22": 32 / 12": 34
- L_{90}: Rated for 100,000 hours to 90% of initial lumens**
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- End of life statement: 86% recyclable at the end of its useful life
- ETL Listed
- RoHS Compliant

** 45" performance is projected.*

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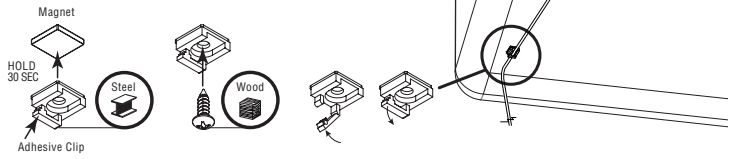
RARE EARTH MAGNETS

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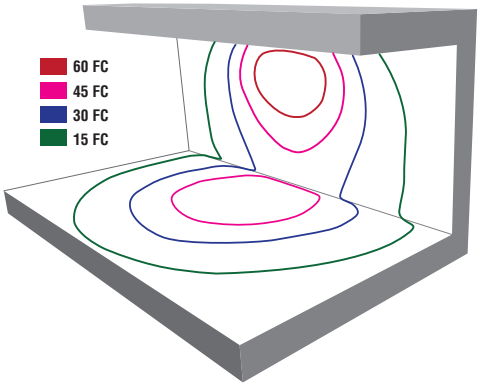
CABLE MANAGEMENT HARDWARE

For best results, clean magnet or cabinet surface with isopropyl alcohol before applying adhesive clip.



PHOTOMETRIC PERFORMANCE

Superior lateral throw provides proper illumination over a wide area. Example below: 22" unit installed on a 4' binder bin.

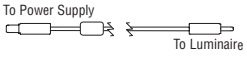


One 22" Edge provides ample illumination beneath a 4' binder area. For additional output specify a 45" luminaire rather than two 22" luminaires.

CABLES

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• Power Cables



Cat No. CPNC-12 [12' Power Cable]

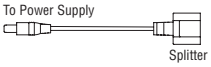
• Patch Cables



Daisy chains two male 1.3mm jacks.

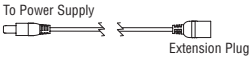
Cat No. CP-3 [3" Patch Cable]
Cat No. CP-6 [6" Patch Cable]
Cat No. CP-14 [14" Patch Cable]
Cat No. CP-28 [28" Patch Cable]

• Splitter Cable



Cat No. CY-6 [6" Splitter Cable]

• Extension Cable



Cat No. CX-8 [8' Extension Cable]

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4R-4'-S-3000K-277V-SC-SF Notes:	**Type:** **WA** LAI16-104794

IC - RATED | LED | BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

Date

Project

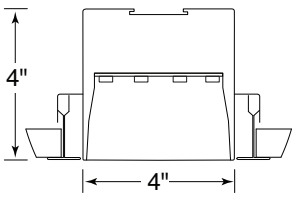
Type

Comments



DESCRIPTION

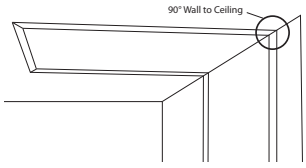
High Performance 4" Aperture Recessed (HP-4 R) is a patented, linear LED luminaire. HP-4 R is the first recessed linear LED luminaire to feature On-Grid™ mounting for standard lengths, making installation quick and easy.



Flush Diffuser (Standard)

DIMENSIONS & DIFFUSER

Glare-free experience is attained with mid-power LEDs and a precise diffuser to eliminate pixilation.



MITERED ANGLES

Fully illuminated corners have internal secondary diffusers to ensure against light leaks. Custom angles are available.

Tailored Lighting
10 working days

TAILORED LIGHTING

Any length greater than 2 feet, in increments down to 1/16th-inch (± 1/32") and 90-degree mitered corners in a single plane.

ORDERING GUIDE

Sample Number: HP-4 R - 32' - S - 8 - 35 - F - 120V - SC - C1 - OBO

4'	HP-4 R									

Finelite **Series HP-4 R**
Length (Minimum 2', increments accurate to 1/16th" (± 1/32"), standard)
Light Output (S - Standard, B - Boosted Standard, H - High, V - Very High)
LED CRI (8 - 80 CRI min (standard), 9 - 90 CRI min)
LED Color Temperature (30 - 3000K, 35 - 3500K, 40 - 4000K)
Downlight Diffuser Option (F - Flush (standard))
Voltage (120V, 277V)
Circuiting (SC - Single Circuit)*
Mounting (C1 - 1" T-Bar, C2 - 9/16" T-Bar, C3 - screw slot, C3F - flush screw slot, VF - Visible Flange, C2T - 9/16" tegular, C1T - 1" tegular, SF - Spackle Flange, TZ6 (C1, C2, C2T, C3, C3T) - tech zone 6")
Integrated Sensor (OBO - Occupancy Sensor, OBD - Daylight)

*Contact factory for switching options.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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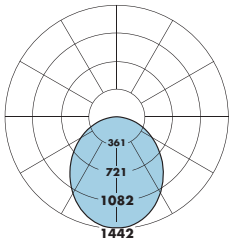
IC - RATED LED BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

PHOTOMETRY

Very High Output - 4' Luminaire
Efficacy: 101 lumens per watt
Total luminaire output: 3726 Lumens (932 lumens/foot)
37 Watts (9.3 watts/foot)
Peak Candela Value: 1442 @ 0º
CCT: 3500K
ITL LM79 Report 85128



CANDLEPOWER SUMMARY

	0.0	22.5	45	67.5	90	Flux
0	1442	1442	1442	1442	1442	
5	1434	1434	1433	1433	1434	136
15	1369	1360	1365	1364	1359	384
25	1241	1226	1232	1225	1219	566
35	1064	1053	1055	1043	1037	657
45	864	853	851	840	834	655
55	650	644	640	631	626	571
65	441	436	433	428	425	428
75	238	237	238	237	236	252
85	70	69	70	72	71	78
90	0	0	0	0	0	

Total Light Output, 3500K, 80 CRI (Lumens) - 4' Luminaire			
S*	**B***	**H***	**V****
1525	1917	2898	3726

Light Output, 3500K, 80 CRI (Lumens Per Foot)			
S*	**B***	**H***	**V****
381	479	725	932

Power (Watts Per Foot)			
S*	**B***	**H***	**V****
3.6	4.6	7.1	9.3

Efficacy, 3500K, 80 CRI (Lumens Per Watt)			
S*	**B***	**H***	**V****
105	104	102	101

* Family Correlation based on 4' luminaire 3500K Very High Output (V) test - 120V.
** Correlation based on ITL report: 85128
S - Standard Output, B - Boosted Standard Output, H - High Output, V - Very High Output

Lumen Adjustment Factors - 80 CRI	
3000K	0.985
3500K	1.000
4000K	1.032

Lumen Adjustment Factors - 90 CRI	
3000K	0.746
3500K	0.760
4000K	0.789

Apply a lumen adjustment factor to calculate lumens for the desired CCT and CRI.

SAMPLE LUMEN ADJUSTMENT CALCULATION

Recessed (H), 4000K, 90 CRI

Lumen Adjustment Factor = 0.789

Total Light Output =
2898 lm x 0.789 = 2287 lm

Total Light Output per Foot =
725 lm/ft x 0.789 = 572 lm/ft

watts/foot = 7.1 W/ft

$$\textit{Efficacy} = \frac{572\ \frac{lm}{ft}}{7.1\ \frac{W}{ft}} = 80\ \text{lm/W}$$

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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IC - RATED LED BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

High Performance 4" Aperture (HP-4) - Recessed

HOUSING



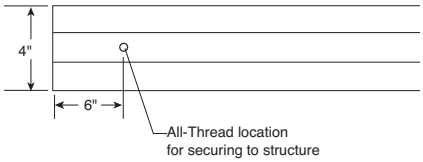
Housing With Extruded Flange (V1)

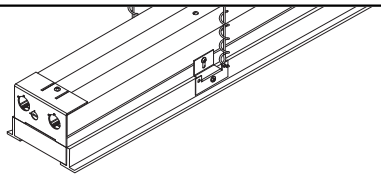
Ceiling Options
C1, C2, C3, VF



Housing Without Extruded Flange (V2) Ceiling Hardware Attached

Ceiling Options
C1T, C2T, C3F, SF, TZ6





SHEET ROCK INSTALLATION:

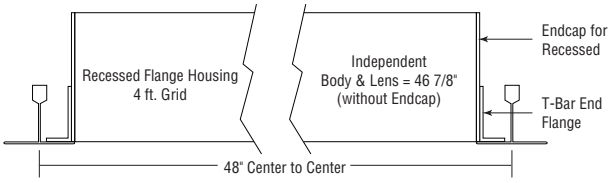
Flex conduit is secured to top of luminaire. Support to structure using All-Thread. All-Thread support holes are located on each end of the luminaire.

T-BAR INSTALLATION:

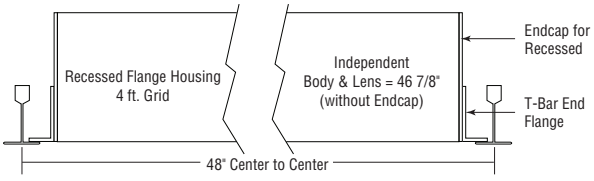
HP-4 R for T-Bar installations comes standard with a splice plate at the end of the luminaire. Mounting brackets (supplied) secure the luminaire to T-Bar and provide support to structure location. All starter/independent luminaires are 1 1/8" shorter than nominal. All joiner/ender luminaire are normal length.

GRID LENGTH DETAIL - 4 ft. example

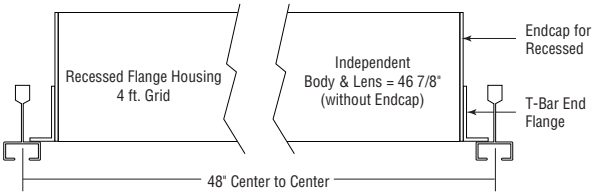
1" T-bar



9/16" T-bar

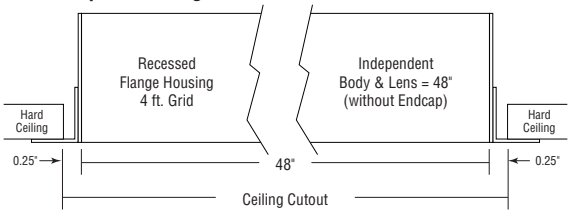


9/16" Screw Slot

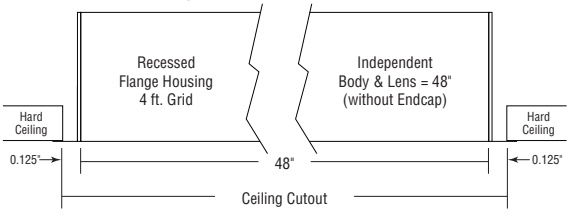


HARD CEILING LENGTH DETAIL - 4 ft. example

Spackle Flange



Visible Flange



Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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Due to continuing product improvements, Finelite reserves the right to change specifications without notice. Please visit www.finelite.com for most current data.

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Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** HP-4R-4'-S-3000K-277V-SC-SF Notes:	**Type:** **WA** LAI16-104794

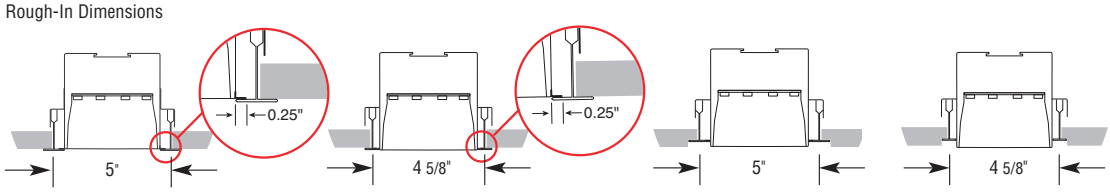
IC - RATED LED BUY AMERICAN ACT OF 2009 COMPLIANT

FINELITE

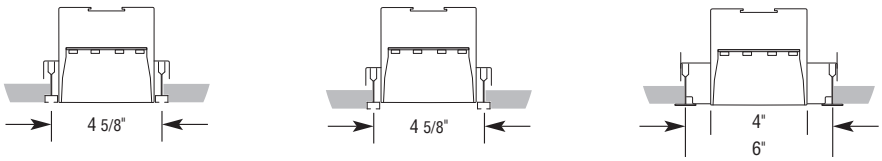
High Performance 4" Aperture (HP-4) - Recessed

MOUNTING TYPES: T-BAR

Rough-In Dimensions

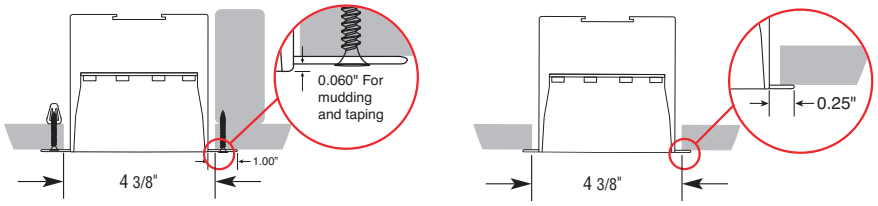


1" T-Bar (C1) | 9/16" T-Bar (C2) | 1" Tegular (C1T) | 9/16" Tegular (C2T)



Flush Screw Slot (C3F) | Standard Screw Slot (C3) | Tech Zone (TZ6- C1, C2. C2T, C3, C3F)

MOUNTING TYPES: CUTOUT DIMENSIONS



Spackle Flange (SF) | Visible Flange (VF)

SPECIFICATIONS

CONSTRUCTION: Precision-cut 6061-T6 extruded aluminum body. Internal joiner system, plug-together wiring, standard. Housing is powder coated.

ENDCAPS: Flat endcaps add 0.05" to each end of luminaire.

MITERED CORNERS: Illuminated 90° corners in a single plane, with Flush downlight diffuser, standard. Custom angles are available (90° minimum on inside corners), contact factory.

REFLECTORS: Die-formed 20-gauge cold-rolled steel reflectors are finished in 96 LG high reflectance matte white powder coat paint.

DOWNLIGHT DIFFUSER: 12' maximum diffuser length. Flush frost white snap-in diffuser standard, 73% transmissive, 99% diffusion. Internal secondary diffusers at corners ensure visually seamless, uniform, continuous illumination. Frost white snap-in diffuser option, 73% transmissive, 99% diffusion.

LIGHT OUTPUT: Four lumen packages available, Standard Output (S), Boosted Standard Output (B), High Output (H), and Very High Output (V). A separate chart summarizes lumen distribution and wattage. Light engines are replaceable.

LUMEN MAINTENANCE: 90% of initial light output (L90) at 100,000+ hours; 70% of initial light output (L70) at 200,000+ hours.

DRIVER: Replaceable 120V/277V Constant Current Reduction dimming driver standard. Can be wired dimming or non-dimming. 0-10V dimming controls with a range of 10%- 100%. Dimming to 1% available; consult factory. Driver is fully accessible from below the ceiling. Power Factor: 0.9. Total Harmonic Distortion (THD) <20%. Expected driver lifetime: 100,000 hours.

LUTRON DRIVER OPTIONS: Lut3W-3-wire, LutES-EcoSystem, Lut2W-2-wire.

ELECTRICAL: Optional emergency to generator/inverter wiring, internal generator transfer switch, nightlight wiring, step-dimming driver, backup battery. Chicago Plenum option. Factory-choice low-profile backup battery available. 8' minimum luminaire length for low profile battery pack. Bodine BSL722 battery pack also available; 4' minimum luminaire length. Backup battery delivers 1300 lumens. Half of a 4' section will be illuminated in emergency mode.

Daylight Sensor | Occupancy Sensor

INTEGRATED SENSORS: Integrated PIR (Passive Infrared) occupancy and/or daylight sensors available with Flush downlight diffusers. Refer to Occupancy Sensor and Daylight Sensor tech sheets for more info.

MOUNTING: Standard bracket design works with most lay-in ceiling types. Brackets secure luminaire to the ceiling grid from above. Tie-in T-Bar brackets. Connect luminaire to T-Bar for securing to structure. Consult local codes for tie-wire recommendations.

FEED: Standard with one 18-gauge/5-conductor single-circuit feed. 14-gauge feed used when luminaire current exceeds 5 amps. Optional 6' flex conduit whips available.

LENGTHS: Any length, 2-foot minimum, in increments down to 1/16th-inch (± 1/32"). 12-foot maximum section length.

LABELS: Luminaire and electrical components are ETL-listed conforming to UL 1598 in the U.S.A. and CAN/CSA C22.2 No. 250.0 in Canada. In accordance with NEC Code 410.73 (G), this luminaire contains an internal driver disconnect. Damp Location. IC-Rated. Finelite products use electronic components that are RoHS compliant, and the mechanical components of the luminaire have been verified to not knowingly contain any restricted substances listed per RoHS Directive 2002/95/EC.

WEIGHT: 2.8 lb/ft.

WARRANTY: 10-year performance-based warranty on all standard components. Optional accessories such as emergency battery packs are covered by their individual manufacturer warranties.

Protected by one or more US Patents: 8915613; D702,391; D702,390; D700,732

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Submitted by LIGHTING ASSOCIATES, INC.		
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** LPX6 Notes: Providing equal not specified

Type:

XA

LAI16-104794

COOPER LIGHTING - SURE-LITES®

DESCRIPTION

LPX Series LED Exit is a polycarbonate unit suitable for general purpose applications. With the new advanced standard features and industry leading innovations, they are now the most universal, energy friendly, easiest to stock and install, and safest Exits in their class.

Catalog #		Type
Project		
Comments		Date
Prepared by		

SPECIFICATION FEATURES

Electrical

- General Features
- Field selected red and green sign capability standard on all units (units shipped red, field convert to green with supplied parts).
- Dual Voltage Input 120/277 VAC, 60Hz

- AC Only
- Optional 2C (Two circuit, FTBR) available in 120/277 VAC in standard and emergency operation

- Self Powered
- Sure-Lites EZ Key patented external battery disconnect feature – prevents unnecessary battery drainage, saves on installation time
- Solid-state Voltage Limited Charger
- Brownout Circuit
- Low-Voltage Disconnect
- Test Switch/Power Indicator Light
- Standard 24 hour recharge time (max)
- Eagle Eye™ Self-Diagnostic feature available as option

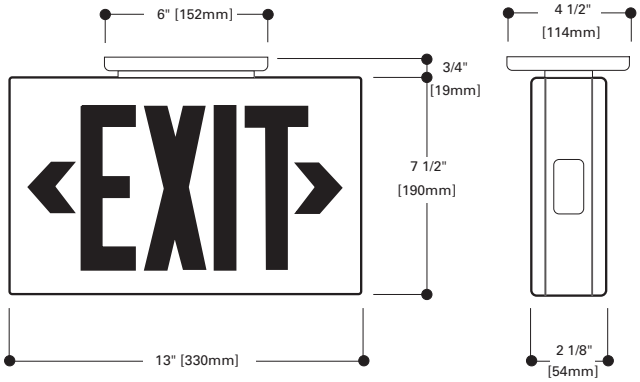
Housing Construction
- All components are injection molded, color stable, high impact UL 94-5VA rated polycarbonate material
- White or black textured finish standard
- Components are of snap-fit construction to facilitate under 5-minute installation
- Reinforcing ribs throughout to provide maximum strength
- Molded-in wireways facilitate internal wire routing and connections
- All components including battery and electronics are located inside the exit housing
- Snap-out or snap-in chevron directional indicators have full 3/4" stroke
- Knockout provided on housing for surface attachment
- Universal exits can be field configured as single face or double face
- Snap-fit canopy with captive mounting screws included with all exits
- Exit can be ceiling, wall, or end mounted
- Universal J-box mounting pattern

Lamp Data
- AC LED: Red and green LED lamps provide uniform diffused illumination
- DC: Red and green LED DC lamps (Brighter in emergency mode)

Code Compliance
- UL 924 Listed
- UL Damp Location (0-40° C)
- Life Safety NFPA 101
- NEC/OSHA
- Most State and Local Codes
- Suitable for Floor Proximity Installation
- UL Listed for 2C (FTBR)
- Patent Numbers 5,735,498 and 5,678,336

Warranty
- Exit: 1-Year
- Battery: 15-year pro-rata

Eagle Eye Self Diagnostics





LPX SERIES

POLYCARBONATE EXIT
SURFACE MOUNT
LED LAMPS
EXIT LIGHTING

ENERGY DATA
Maximum power consumption under all charge conditions:

AC Only, 120V - Red
Amps: 0.07
Watts: 0.98
Power Factor: 0.12

AC Only, 120V - Green
Amps: 0.07
Watts: 1.02
Power Factor: 0.13

AC Only, 277V - Red
Amps: 0.07
Watts: 1.04
Power Factor: 0.06

AC Only, 277V - Green
Amps: 0.07
Watts: 1.12
Power Factor: 0.06

Self Powered, 120V - Red
Amps: 0.07
Watts: 0.98
Power Factor: 0.12

Self Powered, 120V - Green
Amps: 0.07
Watts: 1.00
Power Factor: 0.13

Self Powered, 277V - Red
Amps: 0.07
Watts: 1.03
Power Factor: 0.06

Self Powered, 277V - Green
Amps: 0.07
Watts: 1.09
Power Factor: 0.05

COOPER Lighting
www.cooperlighting.com

Specifications and dimensions subject to change without notice.
Consult your representative for additional options and finishes.

Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** LPX6 Notes: Providing equal not specified	**Type:** **XA** LAI16-104794

ORDERING INFORMATION

Sample Number: LPX7, LPX7SD90, LPX6SG8, LPX7SD23050

Available Accessories (Order Separately)

[ ] [ ] [ ] [ ] [ ] [ ] [-]

Family
LPX = Polycarbonate Exit, LED

Series [1]
6 = AC Only
7 = Self Powered

Face Options
Blank = Single and Double

Housing Finish
Blank = White
BK = Black

Options
Blank = No additional options
2C = Two Circuit Option (*LPX6 only*)
SD = Self Diagnostics Option (*LPX7 only*)
22050 = 220V 50 Hz
23050 = 230V 50 Hz
24050 = 240V 50 Hz
34760 = 347V 60 Hz

SD Options
Blank = No additional options
20 = Flasher
90 = Fire Alarm Interface

Protection Devices
WG10 = Wall mount wire guard
WGS11 = Ceiling or End
VS1 = Polycarbonate Vandal Shield
VS1WP = Polycarbonate Vandal Shield, Weather Proof

Pendant Kit
LPX18PKWH = 18″ Pendant Kit, White
LPX18PKHTWH = 18″ Hang True Pendant Kit, White
LPX18PKBK = 18″ Pendant Kit, Black
LPX18PKHTBK = 18″ Hang True Pendant Kit, Black

[1] Also available in stock LPX6 and LPX7 units with the initial setup as Green with the capability to convert to Red in the field. To order these units, please use the catalog number LPX6-G or LPX7-G.

TECHNICAL DATA

Lamps
LPX Series Exits use energy efficient, long life LED's to provide uniform diffuse illumination of the exit face. These red and green LEDs require no maintenance and consume less than one watt, on average.

Housing Construction
Rugged, durable, injection molded polycarbonate materials are used throughout the LPX Series Exits. All structural components are designed with reinforcing ribs to add additional rigidity and to maximize structural integrity. These materials are impact and scratch resistant, and they have been UV stabilized to resist discoloration due to age and ultraviolet radiation. All components are designed to be of snap-fit construction - no mechanical fasteners – to facilitate installation in under 5-minutes. Any components required for installation (wirenuts, wire leads, universal metal J-box bracket, etc.) are all included with each exit. The universal design of the LPX Series Exits enables universal exits to be configured as single face or double face in the field. All LPX Series Exits can be wall, ceiling, or end mounted; a rugged, snap-fit, low profile canopy with captive screws is included with every exit for ceiling and end mounting applications.

Lens
Lenses for the LPX Series Exits are made from durable, impact resistant polycarbonate. All exit faces are designed with full 3/4" stroke snap-out or snap-in chevron directional indicators to insure maximum visibility and compliance with the latest codes. Units come with red lenses installed and green lenses included for field selectable red or green signs.

Sure-Lites EZ Key External Battery Disconnect (Self Powered Only)
Patented technology that allows installers to externally control the battery connection. Better than line latching, allows installers to choose when the battery is connected so that it stays fresh longer. Allows battery to be disconnected after installation but before building is occupied, enabling emergency circuit to be shut down for power savings.

Brownout Circuit (Self Powered Only)
The brownout circuit on Sure-Lites' exits monitors the flow of AC current to the exit and activates the emergency lighting system when a predetermined reduction of AC power occurs. This dip in voltage will cause most ballasted fixtures to extinguish causing loss of normal lighting even though a total power failure has not occurred.

Solid-State Transfer (Self Powered Only)
The LPX Series Exit incorporates solid-state switching which eliminates corroded and pitted contacts or mechanical failures associated with relays. The switching circuit is designed to detect a loss of AC voltage and automatically energizes the lamps using DC power. Upon restoration of AC power, the DC power will be disconnected and the charger will automatically recharge the battery.

Low Voltage Disconnect (Self Powered Only)
When the battery's terminal voltage falls, the low-voltage circuitry disconnects the lighting load. The disconnect remains in effect until normal utility power is restored, preventing deep battery discharge.

Test Switch/Power Indicator Light (Self Powered Only)
A test switch located on the side of the exit permits the activation of the emergency circuit for a complete operational systems check. The Power Indicator Light provides visual assurance that the AC power is on.

Sealed Nickel Cadmium Battery (Self Powered Only)
Sure-Lites sealed nickel cadmium batteries are maintenance-free with a life expectancy of 15 years. The sealed rechargeable nickel cadmium battery offers high discharge rates and stable performance over a wide range of temperatures, from 0-40° C. The specially designed re-sealable vent automatically controls cell pressure, assuring safety and reliability. This battery is best suited for harsh ambient temperatures because the electrolyte is not active in the electrochemical process.

"2C" (AC Only)
The "2C" Option enables the Exits to operate per the requirements of UL 924 when connected simultaneously to both normal and emergency power circuits (two circuit operation–UL Category FTBR–Emergency Lighting and Power Equipment). The "2C" Option is a factory assembly change which alters the standard Exit such that it complies with and is UL Listed under the FTBR Category. This option should only be used for exits which are intended to be connected simultaneously to normal and emergency power circuits. Both circuits have universal 120/277 VAC standard.

Eagle Eye™ Self Diagnostics Option (Self Powered Only)
The self-diagnostic unit will automatically perform all tests required by UL924, and NFPA 101. The system indicates the status of the exit at all times using the LED indicator near the test switch on the side of the unit. A 90 minute battery power (emergency mode) simulation test will occur randomly once every 12 months. A 30 second battery power simulation test will occur every 30 days.

Warranty
All Sure-Lites' products are backed by a firm one-year warranty against defects in material and workmanship. Maintenance-free, long-life, sealed nickel cadmium batteries carry a fifteen-year pro-rata warranty.

Submitted by LIGHTING ASSOCIATES, INC.		
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** LPX18PKWH Notes:

Type:

XA

LAI16-104794

COOPER LIGHTING - SURE-LITES®

DESCRIPTION

LPX Series LED Exit is a polycarbonate unit suitable for general purpose applications. With the new advanced standard features and industry leading innovations, they are now the most universal, energy friendly, easiest to stock and install, and safest Exits in their class.

Catalog #		Type
Project		
Comments		Date
Prepared by		

SPECIFICATION FEATURES

Electrical

- General Features
- Field selected red and green sign capability standard on all units (units shipped red, field convert to green with supplied parts).
- Dual Voltage Input 120/277 VAC, 60Hz

- AC Only
- Optional 2C (Two circuit, FTBR) available in 120/277 VAC in standard and emergency operation

- Self Powered
- Sure-Lites EZ Key patented external battery disconnect feature – prevents unnecessary battery drainage, saves on installation time
- Solid-state Voltage Limited Charger
- Brownout Circuit
- Low-Voltage Disconnect
- Test Switch/Power Indicator Light
- Standard 24 hour recharge time (max)
- Eagle Eye™ Self-Diagnostic feature available as option

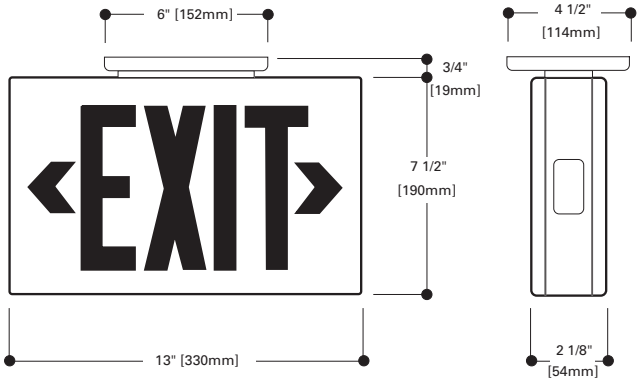
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- AC LED: Red and green LED lamps provide uniform diffused illumination
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- Patent Numbers 5,735,498 and 5,678,336

Warranty
- Exit: 1-Year
- Battery: 15-year pro-rata

Eagle Eye Self Diagnostics





LPX SERIES

POLYCARBONATE EXIT
SURFACE MOUNT
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Watts: 1.04
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Power Factor: 0.13

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Power Factor: 0.06

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Watts: 1.09
Power Factor: 0.05

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						-

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Patented technology that allows installers to externally control the battery connection. Better than line latching, allows installers to choose when the battery is connected so that it stays fresh longer. Allows battery to be disconnected after installation but before building is occupied, enabling emergency circuit to be shut down for power savings.

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The self-diagnostic unit will automatically perform all tests required by UL924, and NFPA 101. The system indicates the status of the exit at all times using the LED indicator near the test switch on the side of the unit. A 90 minute battery power (emergency mode) simulation test will occur randomly once every 12 months. A 30 second battery power simulation test will occur every 30 days.

Warranty
All Sure-Lites' products are backed by a firm one-year warranty against defects in material and workmanship. Maintenance-free, long-life, sealed nickel cadmium batteries carry a fifteen-year pro-rata warranty.

Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** EUX6R Notes: Providing equal not specified	**Type:** **XB** LAI16-104794

SURE-LITES®

DESCRIPTION

The EU Series Edge-lit Exit provides an attractive yet easy to install edge-lit exit sign. The crystal clear lens panel provides excellent light distribution and exit visibility. Long-life, energy efficient LED lamps reduce energy costs and eliminate routine lamp maintenance.

Catalog #		Type
Project		
Comments		Date
Prepared by		

SPECIFICATION FEATURES

Electrical
- Dual Voltage Input 120/277 VAC, 60Hz
- Solid-state Voltage Limited Charger
- Solid-state Switching
- Brownout Circuit
- Low-Voltage Disconnect
- Overload/Short Circuit Protection
- Test Switch/Power Indicator Light

Housing Construction
- Anodized Aluminum housing
- Black powder coat painted die-cast canopy provided
- All components including battery and electronics are located inside the exit housing
- EUS Series Exit can be universally surface mounted, ceiling, wall, or end
- EUR Series Exit is recess mounted in accessible ceiling only
- Universal J-box mounting pattern

Trim Panel
- Injection molded, high impact, clear acrylic panel
- Universal, single or double face panels available
- Red or Green letter colors
- Universal, Field Installable Chevrons in Red or Green
- Mirror background included with double face exits
- Edge reflector for optimized efficiency and visibility

Battery
- Sealed Nickel Cadmium (Self-Powered exits only)
- Maintenance-Free, Long-Life
- Full Recharge Time, 24 hrs. (max.)

Code Compliance
- UL 924 Damp Location Listed
- Life Safety NFPA 101
- NEC/OSHA
- Most State and Local Codes

Lamp Data
- AC LED: Long-life LED lamps provide uniform diffused illumination
- DC: LED DC lamps

Warranty
- Exit: 1-Year
- Battery: 15 year pro-rata



EUR SERIES (RECESSED EDGELIT)



EUS SERIES (SURFACE EDGELIT)

EUR/EUS SERIES

EDGE-LIT UNIVERSAL EXITS
AC ONLY
SELF POWERED
SINGLE OR DOUBLE FACE
EMERGENCY
LED LAMPS
EXIT LIGHTING

ORDERING INFORMATION

Family
EU=Series Edge-lit Exit

Mounting
R=Recessed Mount
S=Surface Mount

Series
60=LED Lamps AC only
70=LED Lamps, Self_Powered

Face Options
__=Universal (Single or Double Face)
1=Single Sided Only
2=Double Sided Only

Battery
__=Sealed Lead Calcium (Self-Powered)

Housing Trim Finish
__=Anodized Aluminium

Letters/ Background Color
R=Red
G=Green

Chevron Direction
__=_ Universal Stick-On Chevrons

Voltage
__=Dual Voltage, 120-277V

ENERGY DATA

Charge Mode:
120V = 3.6W Max.
277V = 4.5W Max.

Input Current:
120V = 0.03A Max.
277V = 0.02A Max.

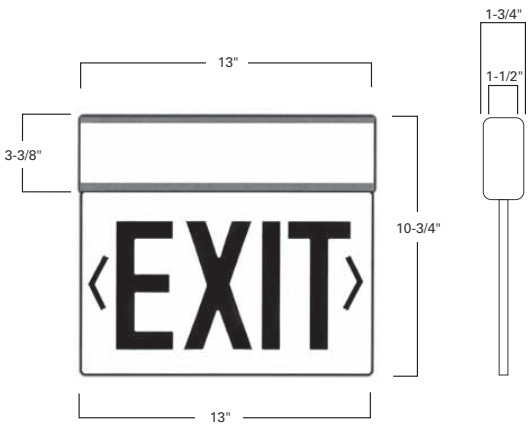
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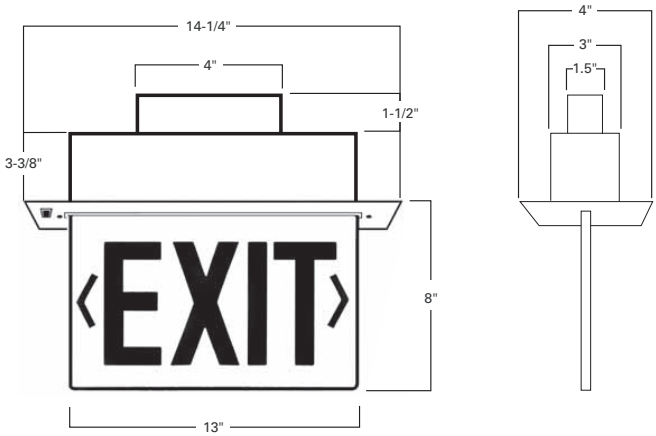
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** EUX6R Notes: Providing equal not specified	**Type:** **XB** LAI16-104794

DIMENSIONS

Surface
EUS Series



Recessed
EUR Series



TECHNICAL DATA

Lamps
The EU Series Edge-Lit Exits use energy efficient, long-life LED's to provide uniform diffuse illumination of the exit face. The low operating costs and zero maintenance requirement makes LED lamps the wisest choice for exit signs today. Emergency illumination is provided by LED lamps in the self-powered models.

Housing Construction
Rugged, durable anodized aluminum housing is impact resistant. Black powder coat painted mounting canopy provided. Housing is designed to allow easy swap out of exit lens when necessary. All EUS Series Exits can be wall, ceiling, or end mounted.

Trim Panel
Trim panels for the EU Series Edgelit Exits are injection molded from impact-resistant clear acrylic. The single face lens is available with a clear background. All double face lens come standard with a mirror background. Universal, fieldinstallable chevrons are provided in Red or Green allowing for universal configuration of the exit sign based on the directional needs of the application. The edge reflector further enhances visibility.

Solid-State Charger
Supplied with a 120/277 VAC, voltage regulated solid-state charger, the battery is recharged immediately upon restoration of AC current after a power failure. The charge circuit reacts to the condition of the battery in order to maintain peak battery capacity and maximize battery life. Solidstate construction recharges the battery following a power failure in accordance with UL 924.

Brownout Circuit
The brownout circuit on the exit monitors the flow of AC current to the exit and activates the emergency lighting system when a predetermined reduction of AC power occurs. This dip in voltage will cause most ballasted fixtures to extinguish causing loss of normal lighting even though a total power failure has not occurred.

Solid-State Transfer
The EU Series Edge-Lit Exit incorporates solid-state switching which eliminates corroded and pitted contacts or mechanical failures associated with relays. The switching circuit is designed to detect a loss of AC voltage and automatically energizes the lamps using DC power. Upon restoration of AC power, the DC power will be disconnected and the charger will automatically recharge the battery.

Test Switch/Power Indicator Light
A test switch located on the side of the exit permits the activation of the emergency circuit for a complete operational systems check. The Power Indicator Light provides visual assurance that the AC power is on.

Sealed Nickel Cadmium Battery (Self Powered Only)
Sure-Lites sealed nickel cadmium batteries are maintenance-free with a life expectancy of 15 years. The sealed rechargeable nickel cadmium battery offers high discharge rates and stable performance over a wide range of temperatures, from 0-40°C. The specially designed re-sealable vent automatically controls cell pressure, assuring safety and reliability. This battery is best suited for harsh ambient temperatures because the electrolyte is not active in the electrochemical process.

Warranty
All Sure-Lites' products are backed by a firm one-year warranty against defects in material and workmanship. Maintenance-free, long-life, sealed nickel cadmium batteries carry a fifteen year pro-rata warranty.

Eaton
1000 Eaton Boulevard
Cleveland, OH 44122
United States
Eaton.com

Eaton's Cooper Lighting Business
1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.cooperlighting.com

Specifications and dimensions subject to change without notice.

Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** EUX6R Notes: Providing equal not specified	**Type:** **XC** LAI16-104794

SURE-LITES®

DESCRIPTION

The EU Series Edge-lit Exit provides an attractive yet easy to install edge-lit exit sign. The crystal clear lens panel provides excellent light distribution and exit visibility. Long-life, energy efficient LED lamps reduce energy costs and eliminate routine lamp maintenance.

Catalog #		Type
Project		
Comments		Date
Prepared by		

SPECIFICATION FEATURES

Electrical
- Dual Voltage Input 120/277 VAC, 60Hz
- Solid-state Voltage Limited Charger
- Solid-state Switching
- Brownout Circuit
- Low-Voltage Disconnect
- Overload/Short Circuit Protection
- Test Switch/Power Indicator Light

Housing Construction
- Anodized Aluminum housing
- Black powder coat painted die-cast canopy provided
- All components including battery and electronics are located inside the exit housing
- EUS Series Exit can be universally surface mounted, ceiling, wall, or end
- EUR Series Exit is recess mounted in accessible ceiling only
- Universal J-box mounting pattern

Trim Panel
- Injection molded, high impact, clear acrylic panel
- Universal, single or double face panels available
- Red or Green letter colors
- Universal, Field Installable Chevrons in Red or Green
- Mirror background included with double face exits
- Edge reflector for optimized efficiency and visibility

Battery
- Sealed Nickel Cadmium (Self-Powered exits only)
- Maintenance-Free, Long-Life
- Full Recharge Time, 24 hrs. (max.)

Code Compliance
- UL 924 Damp Location Listed
- Life Safety NFPA 101
- NEC/OSHA
- Most State and Local Codes

Lamp Data
- AC LED: Long-life LED lamps provide uniform diffused illumination
- DC: LED DC lamps

Warranty
- Exit: 1-Year
- Battery: 15 year pro-rata



EUR SERIES (RECESSED EDGELIT)



EUS SERIES (SURFACE EDGELIT)

ORDERING INFORMATION

Family
EU=Series Edge-lit Exit

Mounting
R=Recessed Mount
S=Surface Mount

Series
60=LED Lamps AC only
70=LED Lamps, Self_Powered

Face Options
__=Universal (Single or Double Face)
1=Single Sided Only
2=Double Sided Only

Battery
__=Sealed Lead Calcium (Self-Powered)

Housing Trim Finish
__=Anodized Aluminium

Letters/ Background Color
R=Red
G=Green

Chevron Direction
__=_ Universal Stick-On Chevrons

Voltage
__=Dual Voltage, 120-277V

EUR/EUS SERIES

EDGE-LIT UNIVERSAL EXITS
AC ONLY
SELF POWERED
SINGLE OR DOUBLE FACE
EMERGENCY
LED LAMPS
EXIT LIGHTING

ENERGY DATA

Charge Mode:
120V = 3.6W Max.
277V = 4.5W Max.

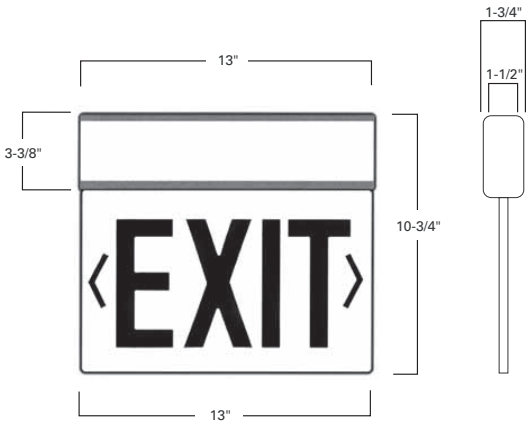
Input Current:
120V = 0.03A Max.
277V = 0.02A Max.

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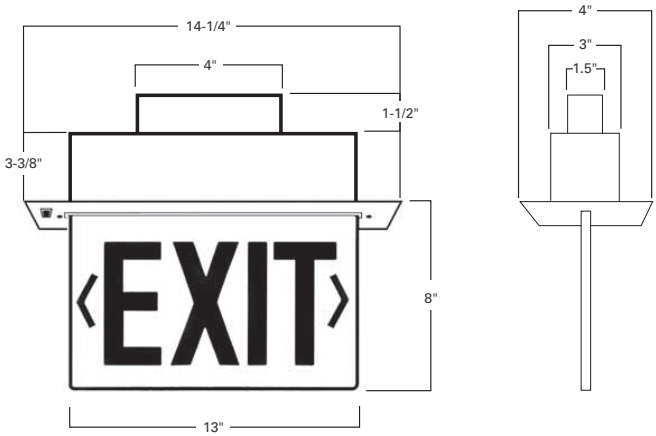
Submitted by LIGHTING ASSOCIATES, INC.			
LIGHTING ASSOCIATES	**Job Name:** WEBSTER UNIVERSITY INTERDISCPLINARY SCIENCE BUILDING - FIXTURE QUOTE Engineer: WILLIAM TAO AND ASSOCIATES (SAINT LOUIS)	**Catalog Number:** EUX6R Notes: Providing equal not specified	**Type:** **XC** LAI16-104794

DIMENSIONS

Surface
EUS Series



Recessed
EUR Series



TECHNICAL DATA

Lamps
The EU Series Edge-Lit Exits use energy efficient, long-life LED's to provide uniform diffuse illumination of the exit face. The low operating costs and zero maintenance requirement makes LED lamps the wisest choice for exit signs today. Emergency illumination is provided by LED lamps in the self-powered models.

Housing Construction
Rugged, durable anodized aluminum housing is impact resistant. Black powder coat painted mounting canopy provided. Housing is designed to allow easy swap out of exit lens when necessary. All EUS Series Exits can be wall, ceiling, or end mounted.

Trim Panel
Trim panels for the EU Series Edgelit Exits are injection molded from impact-resistant clear acrylic. The single face lens is available with a clear background. All double face lens come standard with a mirror background. Universal, fieldinstallable chevrons are provided in Red or Green allowing for universal configuration of the exit sign based on the directional needs of the application. The edge reflector further enhances visibility.

Solid-State Charger
Supplied with a 120/277 VAC, voltage regulated solid-state charger, the battery is recharged immediately upon restoration of AC current after a power failure. The charge circuit reacts to the condition of the battery in order to maintain peak battery capacity and maximize battery life. Solidstate construction recharges the battery following a power failure in accordance with UL 924.

Brownout Circuit
The brownout circuit on the exit monitors the flow of AC current to the exit and activates the emergency lighting system when a predetermined reduction of AC power occurs. This dip in voltage will cause most ballasted fixtures to extinguish causing loss of normal lighting even though a total power failure has not occurred.

Solid-State Transfer
The EU Series Edge-Lit Exit incorporates solid-state switching which eliminates corroded and pitted contacts or mechanical failures associated with relays. The switching circuit is designed to detect a loss of AC voltage and automatically energizes the lamps using DC power. Upon restoration of AC power, the DC power will be disconnected and the charger will automatically recharge the battery.

Test Switch/Power Indicator Light
A test switch located on the side of the exit permits the activation of the emergency circuit for a complete operational systems check. The Power Indicator Light provides visual assurance that the AC power is on.

Sealed Nickel Cadmium Battery (Self Powered Only)
Sure-Lites sealed nickel cadmium batteries are maintenance-free with a life expectancy of 15 years. The sealed rechargeable nickel cadmium battery offers high discharge rates and stable performance over a wide range of temperatures, from 0-40°C. The specially designed re-sealable vent automatically controls cell pressure, assuring safety and reliability. This battery is best suited for harsh ambient temperatures because the electrolyte is not active in the electrochemical process.

Warranty
All Sure-Lites' products are backed by a firm one-year warranty against defects in material and workmanship. Maintenance-free, long-life, sealed nickel cadmium batteries carry a fifteen year pro-rata warranty.

Eaton
1000 Eaton Boulevard
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United States
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1121 Highway 74 South
Peachtree City, GA 30269
P: 770-486-4800
www.cooperlighting.com

Specifications and dimensions subject to change without notice.

VarioLED™ Flex HYDRA LD White



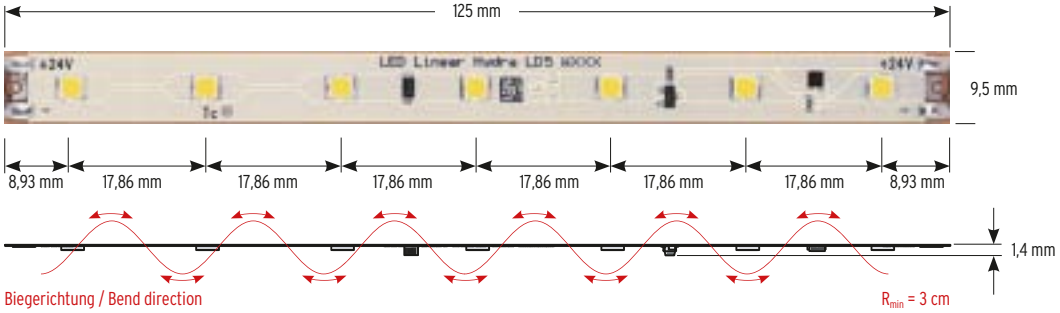


!Ra/CRI up to 95
!up to 144 Lumen/Watt

White

- up to 40.3 Watt/m
- up to 4350 Lumen/m
- ! One Bin Only: 3 MacAdam
- up to Ra/CRI 95

Abmessungen & verfügbare Längen Dimensions & available lengths



Elektrische & Optische Betriebsdaten Electrical & output data

Teilungsmaß Step length	125 mm/7 LED
Spannung Voltage (V)	24 Volt (23 V_{min}, 25 V_{max})
Temperatur Temperature[2]	Tc_{min} = -25°C
Lagertemperatur Storage temperature	Ts_{min} = -30°C, Ts_{max} = 85°C
Außentemperatur Ambient temperature	Ta_{min} = -25°C
Ra CRI	bis zu up to 95
R9	bis zu up to 65

VarioLED™ Flex HYDRA	LD5	LD10	LD15	LD25	LD40
Leistung Power (W/m)[1]	4,8	9,6	15,4	25	40,3
Effizienz Efficacy (lm/W)[1] @ W850	144	144	144	144	108
max. Länge max. length (m)	7,5	5	4	3	2
Watt/VPE Watt/Reel (W)[1]	36	48	61,6	75	80,6
Anzahl LED/VPE Number LED/Reel	420	280	224	168	112
Strom Current	1,5 A/25 mA per Step	2 A/50 mA per Step	2,56 A/80 mA per Step	3,12 A/130 mA per Step	3,36 A/210 mA per Step
Temp. Tc-Punkt Temp. Tc-point (Tc_{max})[2]	70°C	70°C	70°C	75°C	85°C
max. Außentemp. max. Ambient temp. (Ta_{max})	50°C	50°C	50°C	45°C	35°C

Farbtemperatur Color temperature			LD5	LD10	LD15	LD25	LD40
			lumen/meter (lm/m)[1]				
W820		2000 K	400	800	1280	2090	-
W822		2200 K	460	920	1470	2380	-
W825		2500 K	520	1050	1680	2720	3440 (W824)
W827	W927	2700 K	470	1110	1780	2890	3740
W830	W930	3000 K	480	1180	1890	3070	3980
W835	W935	3500 K	490	1240	1980	3220	4230
W840	W940	4000 K	500	1270	2030	3290	4340
W850		5000 K	690	1380	2210	3600	4350

Tj Away®
LED LINEAR™ TECHNOLOGY

Up to 15 W/m no need for additional heat sinking on Al profile, more than 15 W/m VarioContour must be used to act as a heatsink (page 358).

ONE BIN ONLY

L80/B10 > 60.000 h — Lebensdauer Lifetime

Wx27/339 — Photometrischer Code Photometric code

LM 79 — LM 79 konform LM 79 compliant

LM 80 — LM 80 konform LM 80 compliant

[1] Die angegebenen Daten sind typische Werte. Aufgrund von Produktionstoleranzen und der Toleranzen der elektrischen Bauteile können die Werte der elektrischen Leistung und des Lichtstroms um bis zu 10% nach oben oder unten abweichen.

[2] Der Tc-Punkt ist auf jedem Step des LED-Modules gekennzeichnet. Der Tc-Punkt sollte im thermisch eingeschwungenen Zustand gemäß EN 60598-1 gemessen werden.

[1] The given data are typical values. Due to tolerances of the production process and the electrical components, values for light output and electrical power can vary up to 10%.

[2] The position of the Tc-point is marked on each step of the LED strip. The Tc-point should be measured in thermal equilibrium according to IEC EN 60598-1.

Nähere Erläuterungen zu Änderungen, Grenzwerten und Schwankungen im Herstellungsprozess finden Sie auf Seite 408.

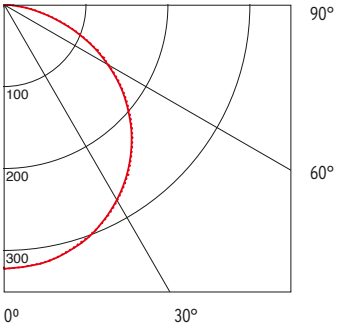
For more details regarding catalogue changes, min and max data sheet values and production tolerances please see page 409.



Photo: Contagious Agency

24 V, flexible LED strip with reflective, white surface and 3M adhesive tape on the back. With a step measurement of 125 mm and a LED pitch of 17.86 mm the first choice for indirect cove lighting and other applications without direct top view. Japanese LEDs of the highest quality. 120° beam angle. Very good color reproduction up to CRI 96. "One Bin Only" within 3 MacAdam guarantees constant color temperature and high light quality at a lifetime of >60.000 hrs (L80/B10). Flexible circuit board material (FPCB) with LED Linear™ Tj Away® Technology for optimal heat management. Constant light output and extended lifetime thanks to an integrated constant current source on the circuit board. Protected against electrostatic discharge +/- 2,000 V. Made in Germany.

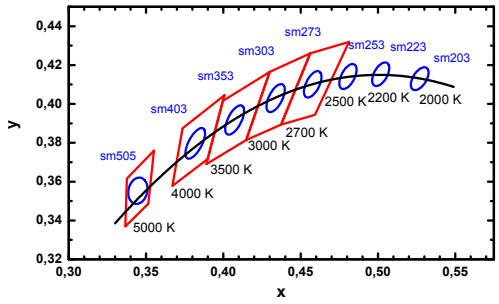
VarioLED™ Flex HYDRA LD



cd/1.000 lumen

C0/C180 ••••••• C90/C270

Binning



Black Body Curve
LED Linear Binning
ANSI Binning

[3] valid for LD5, LD10; LD15, LD25; for LD40 please refer to the datasheet on www.led-linear.com

Bestellnummer Order code

	Flex tape	Variant	Color rendering	Color temperature
Ihre Bestellnummer Your order code	VarioLED Flex HYDRA	LD _ _	W _	_ _
Bestellnummer Beispiel Order code example	VarioLED Flex HYDRA	LD5	W9	27

Zubehör Accessories

erforderlich required

Konverter
Power supply unit
z. B. e. g.
Art.-# 16000075

Kabel 2-adrig
Cable mono
z. B. e. g.
Art.-# 14000030

optional optional

Steuerprotokoll
Power control system
z. B. e. g.
Art.-# 17000037

Al-Profil
Al profile

Cover Clear
- 15 % Lumen

Cover Diffuse
- 25 % Lumen

Cover Opal
- 40 % Lumen

Linsen Lenses
- 12 % Lumen

Details siehe Seite 338 ff.
Details on page 338 ff.

Profile/Optiken Profiles / Optics

60°

VarioContour	002	004	005	007	013	016
B x H mm (ohne Optiken) W x H mm (without optics)	19,5 x 15	19,5 x 19,5	19,5 x 12,5	25 x 32		
Maximale elektrische Leistung Maximum electrical power (W/m)	25 W/m	40 W/m	15 W/m	40 W/m	25 W/m	40 W/m
Profile kompatibel zur gleichen elektrischen Leistungsklasse und ggfs. Optik Profiles compatible to same electrical power rating and optics (if applicable)	001, 011, 012	020	019	015		
Linearlinse* (klar, diffus, 10° ... 90°) **Linear optic*** (clear, diffuse, 10° ... 90°)						
Runde Abdeckung* (klar, diffus, opal) **Round cover*** (clear, diffuse, opal)						
Flache Abdeckung* (klar, diffus, opal) **Low square/L² cover*** (clear, diffuse, opal)						
Hohe Abdeckung* (klar, diffus, opal) **High square cover*** (clear, diffuse, opal)						
Reflektor* (25°, 65°, Wandfluter) **Reflector*** (25°, 65°, Wall washer)						

weitere Profile auf Seite 358 ff more profiles please see page 358 ff

VarioLED™ Flex HYDRA LD White IP67



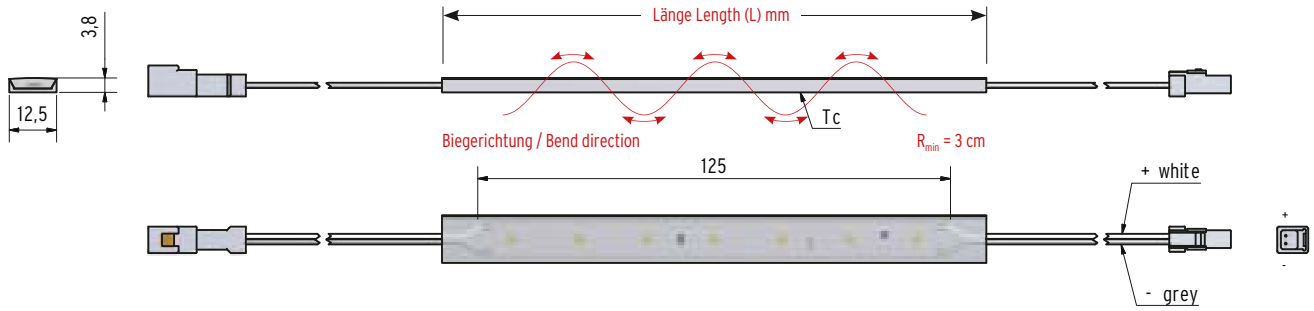






Water & UV resistant flexible linear LED luminaire in up to 7,5 m length in polyurethane encapsulation with white casing and with 200 mm IP67 mini connectors on both ends.

Abmessungen & verfügbare Längen Dimensions & available lengths



L = N x 125 + 19; L_{min} = 1 x 125 + 19 = 144 mm; LD5 ≙ L_{max} = 7.519 mm; LD10 ≙ L_{max} = 5.019 mm; LD15 ≙ L_{max} = 4.019 mm
(LD5 ≙ N = 1... 60, LD10 ≙ N = 1... 40, LD15 ≙ N = 1... 32)

Tc-point: Entire encapsulated flexboard rear side

Electrical & output data

Farbtemperatur Color temperature[2]				LD5	LD10	LD15
				lumen/meter (lm/m)[1]		
W820		2500 K		340	680	1090
W822		2900 K		390	780	1250
W825		3300 K		450	890	1430
W827	W927	3800 K	3600 K	400	950	1510
W830	W930	4300 K	4300 K	400	1000	1600
W835	W935	5100 K	4900 K	420	1050	1690
W840	W940	6100 K	6600 K	430	1080	1720
W850		9600 K		590	1180	1880

[1] The given data are typical values. Due to tolerances of the production process and the electrical components, values for light output and electrical power can vary up to 10%.

[2] In case of IP67 products, tolerances in the color temperature can occur. For further explanation, please see page 476.

Same data as for VarioLED™ Flex HYDRA LD apply, except: 30% light loss and color shift compared to non encapsulated LED strip.

Please ask for custom specific adaptions like cable length and plugs.

Order code

	Flex tape	Variant	Color rendering	Color temperature	Length	Ingress protection
Ihre Bestellnummer Your order code	VarioLED Flex HYDRA	LD_ _	W_	_ _	_ _ _ _	IP67
Bestellnummer Beispiel Order code example	VarioLED Flex HYDRA	LD5	W9	27	7519	IP67

Accessories

erforderlich required

- 24 V DC — Konverter, Power supply unit, z. B. e. g., Art.-# 16000154
- Buchse, Female connector, z. B. e. g., Art.-# 15000142

optional optional

- Steuerprotokoll, Power control system, z. B. e. g., Art.-# 17000037
- 3M Klebeband, 3M Adhesive tape, Art.-# 18200035
- Transparenter Montageclip, Transparent mounting clip, Art.-# 13000115

Details siehe Seite 338 ff. Details on page 338 ff.

Sicherheits- und Montagehinweise siehe Seite 410 ff. Safety and assembly information please see page 412 ff.

VarioLED™ HYDRA LD White IP67


VarioLED™ HYDRA LD5 IP67, Contour 013

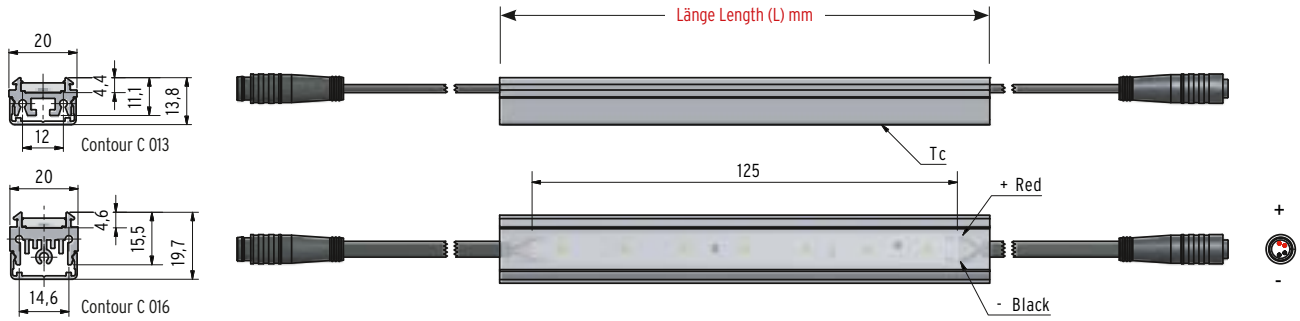

VarioLED™ HYDRA LD25 IP67, Contour 016





Water & UV resistant linear LED luminaire in aluminum profile with up to 4 m length, polyurethane encapsulation and 110 mm IP67 connectors on both ends.

Dimensions & available lengths



L = N x 125 + 19; L_{min} = 1 x 125 + 19 = 144 mm; LD5/LD10/LD15 ≙ L_{max} = 4.019 mm; LD25 ≙ L_{max} = 3.019 mm
(LD5/LD10/LD15 ≙ N = 1... 32, LD25 ≙ N = 1... 15)

Tc-point: Entire Al-profile rear side

Electrical & output data

Color temperature[2]				LD5 in C 013	LD10 in C 013	LD15 in C 016	LD25 in C 016
				lumen/meter (lm/m)[1]			
W820		2500 K		320	640	1030	1670
W822		2900 K		370	730	1170	1910
W825		3300 K		420	840	1340	2180
W827	W927	3800 K	3600 K	370	890	1420	2310
W830	W930	4300 K	4300 K	380	940	1510	2450
W835	W935	5100 K	4900 K	390	990	1590	2580
W840	W940	6100 K	6600 K	400	1010	1620	2630
W850		9600 K		550	1110	1770	2880

[1] The given data are typical values. Due to tolerances of the production process and the electrical components, values for light output and electrical power can vary up to 10%.

[2] In case of IP67 products, tolerances in the color temperature can occur. For further explanation, please see page 476.

Same data as for VarioLED™ Flex HYDRA LD apply, except: 30% light loss and color shift compared to non encapsulated LED strip.

Please ask for custom specific adaptions like cable length and plugs.

Order code

	Flex tape	Variant	Color rendering	Color temperature	Length	Ingress protection
Ihre Bestellnummer Your order code	VarioLED HYDRA	LD__	W_	__	____	IP67
Bestellnummer Beispiel Order code example	VarioLED HYDRA	LD5	W9	27	4019	IP67

Accessories

erforderlich required



Konverter
Power supply unit
z. B. e. g.
Art.-# 16000154


Buchse
Female connector
z. B. e. g.
Art.-# 15000091

optional optional



Steuerprotokoll
Power control system
z. B. e. g.
Art.-# 17000037


Halteklammer
Mounting Clip
Art.-# 10000040


Montage-Profil
Mounting Profile
Art.-# 10000039

Details siehe Seite 338 ff. Details on page 338 ff.

PROFESSIONAL
OUTDOOR LIGHTING

Type: EC

Model:

Project: WEBSTER ISB

SPECIFICATION SHEET

MODEL 1043 Architectural Series • Up & Accent

FIXTURE SPECIFICATIONS:

DOOR:
Die-cast, low copper content, A360 aluminum offers maximum corrosion protection. Stainless steel fasteners affixed to a minimalistic styled flat door (standard). Door is designed to shed water from the lens surface.Also available as an accessory is a die-cast medium shield **CS**.

HOUSING:
Die-cast A360 aluminum. Optic and driver compartment separately sealed while being electrically connected. Housing aiming achieved via a Vista patented Infinity Knuckle (see MOUNTING).

FINISH:
Durable powder coat finish available in Glossy Gray, Black, Architectural Bronze, Dark Bronze, Verde, Pewter, Architectural Brick, Granite, Terracotta, Rust, Hunter Green, Mocha, Special Bronze, Weathered Bronze, Weathered Iron, and White. Custom Powder coat finishes available on request.

LED:
Cree® MT-G2 High Density Array (HDA) driven at 500mA, 700mA, 750mA, 1000mA, 1400mA, or 1750mA.

COLOR TEMPERATURE:
LED's are offered in 3000°K, 3500°K, 4000°K, or 5000°K CCT ANSI white 4 step Cree® Easy White™ bins

LIGHT DISTRIBUTION:
Very Narrow Spot **VNS** (16° FWHM), Narrow Spot **NS** (19° FWHM), Medium Flood **MF** (30° FWHM), and Wide Flood **WF** (46° FWHM).

REFLECTOR:
High-purity, vacuum metalized, specular or semi-specular optics designed for maximum performance and uniformity. Very Narrow Spot **VNS** optic incorporates an internal source shield to eliminate unwanted glare outside the beam pattern.

LENS/SEAL:
2.7 mm thick tempered and seamed clear glass sealed with a closed cell molded silicone gasket.

WIRING:
Prewired with 150° C-rated wire.

DRIVER:
Integral CUL listed LED driver. Non-dimmable **(ND)**, dimming drivers available in 0-10V **(010)**, TRIAC dimming (120V input only) **(LE)** or ELV dimming **(TE)**.

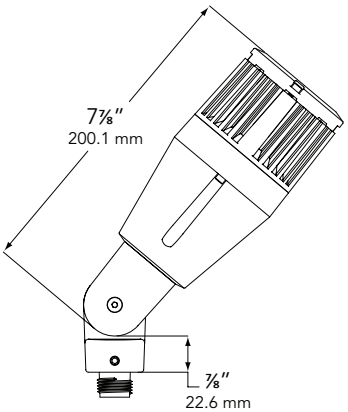
ACCESSORIES:
Barn Doors **BD**, Full Shield **FS**, and Half Shield **HS** available. Accessories are attached into pre-existing slots located on the underside of the fixture door providing for a fastener free appearance.

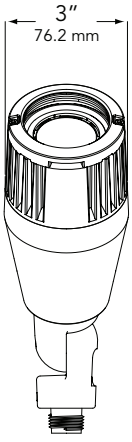
MOUNTING:
Infinity Knuckle - Die-cast, copper-free aluminum with stainless steel stem. A fully sealed spherical grommet allows infinite adjustment capabilities.

CERTIFICATION:
UL & CUL wet location certified.

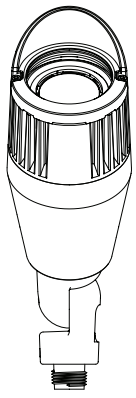
All Vista luminaires are **MADE IN THE U.S.A.**

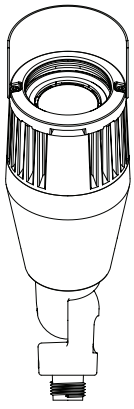
DIMENSIONS:

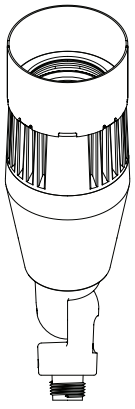


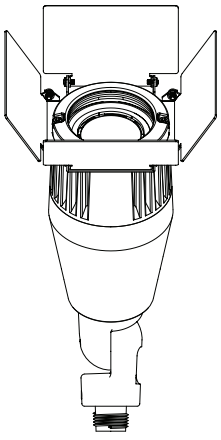


STANDARD


CAST MEDIUM SHIELD


HALF LIGHT SHIELD


FULL LIGHT SHIELD
(2 HALF SHIELDS)


BARN DOORS

c UL us LISTED

Vista Professional Outdoor Lighting reserves the right to modify the design and/or construction of the fixture shown without further notification.

1625 Surveyor Avenue • Simi Valley, CA 93063 • (805) 527-0987 • (800) 766-VISTA (8478)
FAX: (888) 670-VISTA (8478) • email@vistapro.com • www.vistapro.com

PROFESSIONAL
OUTDOOR LIGHTING

SPECIFICATION SHEET

MODEL 1043 Architectural Series • Up & Accent Lights

LAMP SPECIFICATIONS

LED:
- High lumen output LED powered for high efficacy.
- Cree® MT-G2 High Density Array (HDA), driven at 500mA, 700mA, 750mA, 1000mA, 1400mA, or 1750mA.
- 3000°K, 3500°K, 4000°K, or 5000°K CCT ANSI white 4 step Cree® Easy White™ bins.
- 135-1212 Delivered Lumens.

OPTICS/AIMING:
- High-purity, vacuum metalized, specular or semi-specular optics designed for maximum performance and uniformity.
- Very Narrow Spot **VNS** (16° FWHM), Narrow Spot **NS** (19° FWHM), Medium Flood **MF** (30° FWHM), and Wide Flood **WF** (46° FWHM).
- Housing aiming achieved via a Vista patented Infinity Knuckle (see MOUNTING).

ELECTRICAL:
- Multi-Volt **MV** 120V-277V universal input.
- Prewired with 150° C-rated wire.
- Constant current 700mA or 1A output driver (non-dimmable).
- Dimmable constant current drivers available in 500mA, 750mA, 1000mA, 1400mA, 1750mA outputs. Available in linear 0-10V dimming **(010)**, TRIAC dimming **(LE)**, or ELV dimming **(TE)**. (Note: TRIAC dimming available with 120V input only).

FIXTURE ORDERING INFORMATION

TO ORDER FIXTURE: Select appropriate choice from each column as in the following example.

EXAMPLE: 1043-GG-NS-40-C-MV-ND-HS

MODEL	FINISH	DISTRIBUTION	COLOR TEMP	DELIVERED LUMENS	VOLTAGE	DIMMING	ACCESSORIES
1043	**GG** - Glossy Gray **B** - Black **Z** - Architectural Bronze **DZ** - Dark Bronze **LZ** - Light Bronze **G** - Verde **P** - Pewter **BR** - Architectural Brick **GT** - Granite **TC** - Terracotta **R** - Rust **HG** - Hunter Green **M** - Mocha **SB** - Special Bronze **WB** - Weathered Bronze **WI** - Weathered Iron **W** - White	**VNS** - Very Narrow Spot* **NS** - Narrow Spot** **MF** - Medium Flood** **WF** - Wide Flood**	**30** - 3000°K **35** - 3500°K **40** - 4000°K **50** - 5000°K	**A** - 0-200 Lumens **B** - 200-400 Lumens **C** - 400-600 Lumens **D** - 600-750 Lumens **E** - 750-1050 Lumens **F** - 1050-1250 Lumens * 1043 VNS ** 1043 NS, MF, WF	**MV** - Multi-Volt (120V-277V)	**ND** - No Dimming **010** - 0-10V Dimming **LE** - TRIAC Dimming **TE** - ELV Dimming	**BD** - Barn Doors **FS** - Full Light Shield **HS** - Half Light Shield **CS** - Cast Shield Honeycomb louver

* 1043-VNS only available in A, B Delivered Lumen Packages.
** 1043-NS, MF, WF only available in B, C, D, E, F Delivered Lumen Packages

LUMEN OUTPUT PACKAGES

Watts / Lumens

Beam Spread	A	B	C	D	E	F
VNS	4.1 Watts / 135 Lumens	15.6 Watts / 361 Lumens				
NS		4.1 Watts / 364 Lumens	7.4 Watts / 566 Lumens	10.0 Watts / 738 Lumens	15.6 Watts / 1035 Lumens	19.1 Watts / 1212 Lumens
MF		4.1 Watts / 321 Lumens	7.4 Watts / 487 Lumens	9.7 Watts / 711 Lumens	15.6 Watts / 1035 Lumens	19.7 Watts / 1188 Lumens
WF		4.1 Watts / 332 Lumens	7.6 Watts / 542 Lumens	11.4 Watts / 687 Lumens	15.3 Watts / 967 Lumens	19.0 Watts / 1052 Lumens

Vista Professional Outdoor Lighting reserves the right to modify the design and/or construction of the fixture shown without further notification.

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FAX: (888) 670-VISTA (8478) • email@vistapro.com • www.vistapro.com

PROFESSIONAL
OUTDOOR LIGHTING

Type: EC MOUNTING STAKE

Model:

Project: WEBSTER ISB

SPECIFICATION SHEET

MODEL MP-150 Mounting Pedestal Landscape Series • Accessories

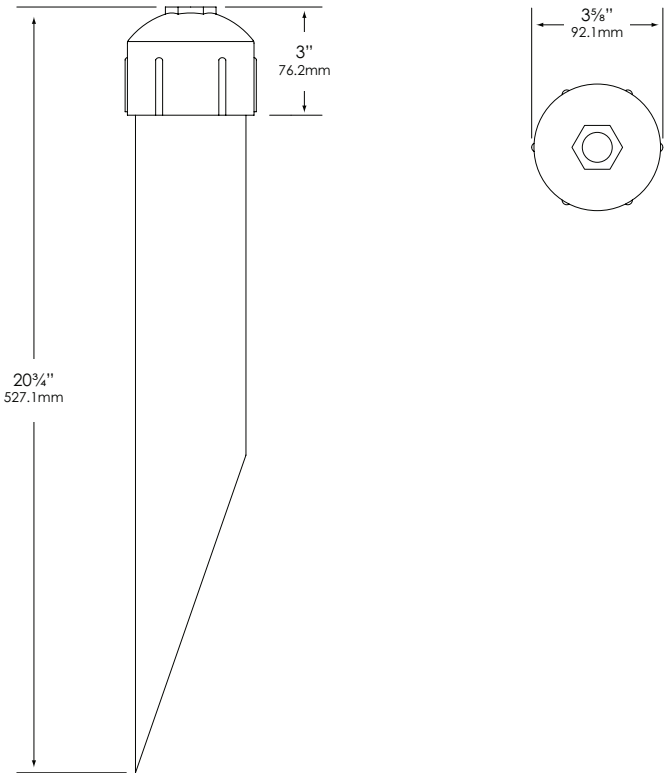
FIXTURE SPECIFICATIONS:

DESCRIPTION:
3" diameter, black PVC mounting pedestal.

MOUNTING:
½" FPT for fixture mounting.

All Vista luminaires are MADE IN THE U.S.A.

DIMENSIONS:



Vista Professional Outdoor Lighting reserves the right to modify the design and/or construction of the fixture shown without further notification.

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FAX: (888) 670-VISTA (8478) • email@vistapro.com • www.vistapro.com

VarioLED™ Flex HYDRA LD White



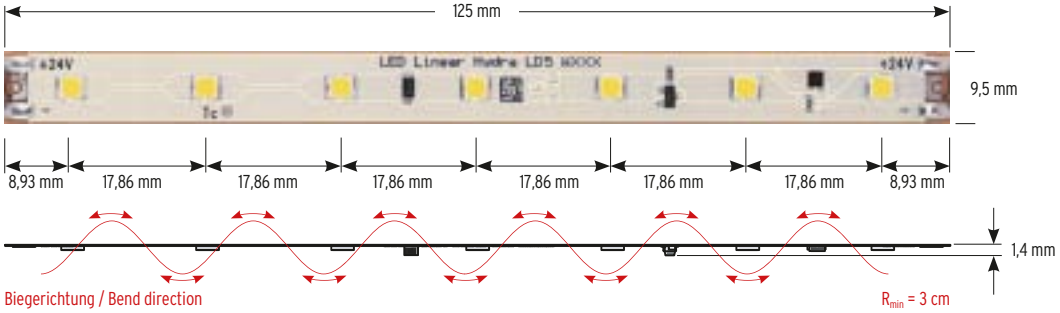


Ra/CRI up to 95
up to 144 Lumen/Watt

White

up to 40.3 Watt/m
up to 4350 Lumen/m
One Bin Only: 3 MacAdam
up to Ra/CRI 95

Abmessungen & verfügbare Längen Dimensions & available lengths



Elektrische & Optische Betriebsdaten Electrical & output data

Teilungsmaß Step length	125 mm/7 LED
Spannung Voltage (V)	24 Volt (23 V_{min}, 25 V_{max})
Temperatur Temperature[2]	Tc_{min} = -25°C
Lagertemperatur Storage temperature	Ts_{min} = -30°C, Ts_{max} = 85°C
Außentemperatur Ambient temperature	Ta_{min} = -25°C
Ra CRI	bis zu up to 95
R9	bis zu up to 65

VarioLED™ Flex HYDRA	LD5	LD10	LD15	LD25	LD40
Leistung Power (W/m)[1]	4,8	9,6	15,4	25	40,3
Effizienz Efficacy (lm/W)[1] @ W850	144	144	144	144	108
max. Länge max. length (m)	7,5	5	4	3	2
Watt/VPE Watt/Reel (W)[1]	36	48	61,6	75	80,6
Anzahl LED/VPE Number LED/Reel	420	280	224	168	112
Strom Current	1,5 A/25 mA per Step	2 A/50 mA per Step	2,56 A/80 mA per Step	3,12 A/130 mA per Step	3,36 A/210 mA per Step
Temp. Tc-Punkt Temp. Tc-point (Tc_{max})[2]	70°C	70°C	70°C	75°C	85°C
max. Außentemp. max. Ambient temp. (Ta_{max})	50°C	50°C	50°C	45°C	35°C

Farbtemperatur Color temperature			LD5	LD10	LD15	LD25	LD40
			lumen/meter (lm/m)[1]				
W820		2000 K	400	800	1280	2090	-
W822		2200 K	460	920	1470	2380	-
W825		2500 K	520	1050	1680	2720	3440 (W824)
W827	W927	2700 K	470	1110	1780	2890	3740
W830	W930	3000 K	480	1180	1890	3070	3980
W835	W935	3500 K	490	1240	1980	3220	4230
W840	W940	4000 K	500	1270	2030	3290	4340
W850		5000 K	690	1380	2210	3600	4350

Tj Away®
LED LINEAR™ TECHNOLOGY

Up to 15 W/m no need for additional heat sinking on Al profile, more than 15 W/m VarioContour must be used to act as a heatsink (page 358).

ONE BIN ONLY

L80/B10 > 60.000 h — Lebensdauer Lifetime

Wx27/339 — Photometrischer Code Photometric code

LM 79 — LM 79 konform LM 79 compliant

LM 80 — LM 80 konform LM 80 compliant

[1] Die angegebenen Daten sind typische Werte. Aufgrund von Produktionstoleranzen und der Toleranzen der elektrischen Bauteile können die Werte der elektrischen Leistung und des Lichtstroms um bis zu 10% nach oben oder unten abweichen.

[2] Der Tc-Punkt ist auf jedem Step des LED-Modules gekennzeichnet. Der Tc-Punkt sollte im thermisch eingeschwungenen Zustand gemäß EN 60598-1 gemessen werden.

[1] The given data are typical values. Due to tolerances of the production process and the electrical components, values for light output and electrical power can vary up to 10%.

[2] The position of the Tc-point is marked on each step of the LED strip. The Tc-point should be measured in thermal equilibrium according to IEC EN 60598-1.

Nähere Erläuterungen zu Änderungen, Grenzwerten und Schwankungen im Herstellungsprozess finden Sie auf Seite 408.

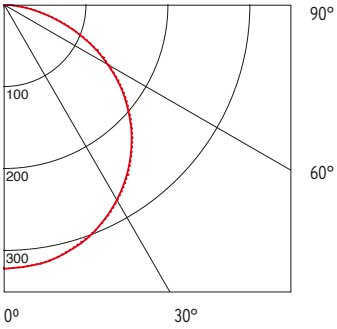
For more details regarding catalogue changes, min and max data sheet values and production tolerances please see page 409.



Photo: Contagious Agency

24 V, flexible LED strip with reflective, white surface and 3M adhesive tape on the back. With a step measurement of 125 mm and a LED pitch of 17.86 mm the first choice for indirect cove lighting and other applications without direct top view. Japanese LEDs of the highest quality. 120° beam angle. Very good color reproduction up to CRI 96. "One Bin Only" within 3 MacAdam guarantees constant color temperature and high light quality at a lifetime of >60.000 hrs (L80/B10). Flexible circuit board material (FPCB) with LED Linear™ Tj Away® Technology for optimal heat management. Constant light output and extended lifetime thanks to an integrated constant current source on the circuit board. Protected against electrostatic discharge +/- 2,000 V. Made in Germany.

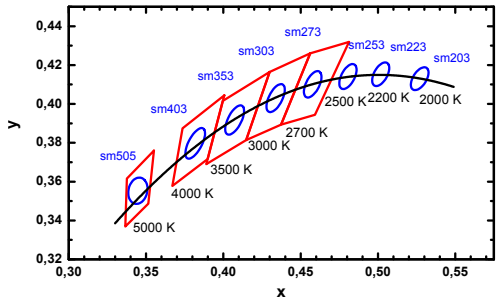
VarioLED™ Flex HYDRA LD



cd/1.000 lumen

C0/C180 ••••••• C90/C270

Binning



Black Body Curve
LED Linear Binning
ANSI Binning

[3] valid for LD5, LD10; LD15, LD25; for LD40 please refer to the datasheet on www.led-linear.com

Bestellnummer Order code

	Flex tape	Variant	Color rendering	Color temperature
Ihre Bestellnummer Your order code	VarioLED Flex HYDRA	LD _ _	W _	_ _
Bestellnummer Beispiel Order code example	VarioLED Flex HYDRA	LD5	W9	27

Zubehör Accessories

erforderlich required

Konverter
Power supply unit
z. B. e. g.
Art.-# 16000075

Kabel 2-adrig
Cable mono
z. B. e. g.
Art.-# 14000030

optional optional

Steuerprotokoll
Power control system
z. B. e. g.
Art.-# 17000037

Al-Profil
Al profile

Cover Clear
- 15 % Lumen

Cover Diffuse
- 25 % Lumen

Cover Opal
- 40 % Lumen

Linsen Lenses
- 12 % Lumen

Details siehe Seite 338 ff.
Details on page 338 ff.

Profile/Optiken Profiles / Optics

90°

VarioContour	002	004	005	007	013	016
B x H mm (ohne Optiken) W x H mm (without optics)	19,5 x 15	19,5 x 19,5	19,5 x 12,5	25 x 32		
Maximale elektrische Leistung Maximum electrical power (W/m)	25 W/m	40 W/m	15 W/m	40 W/m	25 W/m	40 W/m
Profile kompatibel zur gleichen elektrischen Leistungsklasse und ggfs. Optik Profiles compatible to same electrical power rating and optics (if applicable)	001, 011, 012	020	019	015		
Linearlinse* (klar, diffus, 10° ... 90°) **Linear optic*** (clear, diffuse, 10° ... 90°)	✕	✓	✕	✕	✓	✓
Runde Abdeckung* (klar, diffus, opal) **Round cover*** (clear, diffuse, opal)	✓	✓	✓	✕	✓	✓
Flache Abdeckung* (klar, diffus, opal) **Low square/L² cover*** (clear, diffuse, opal)	✓	✓	✓	✓	✕	✕
Hohe Abdeckung* (klar, diffus, opal) **High square cover*** (clear, diffuse, opal)	✓	✓	✓	✓	✕	✕
Reflektor* (25°, 65°, Wandfluter) **Reflector*** (25°, 65°, Wall washer)	✕	✕	✕	✓	✕	✕

weitere Profile auf Seite 358 ff more profiles please see page 358 ff

VarioLED™ Flex HYDRA LD White IP67



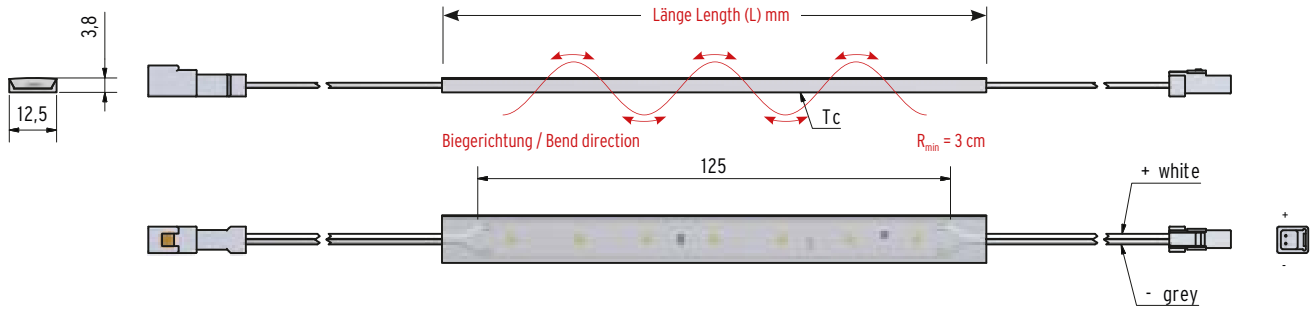






Water & UV resistant flexible linear LED luminaire in up to 7,5 m length in polyurethane encapsulation with white casing and with 200 mm IP67 mini connectors on both ends.

Abmessungen & verfügbare Längen Dimensions & available lengths



L = N x 125 + 19; L_{min} = 1 x 125 + 19 = 144 mm; LD5 ≙ L_{max} = 7.519 mm; LD10 ≙ L_{max} = 5.019 mm; LD15 ≙ L_{max} = 4.019 mm
(LD5 ≙ N = 1... 60, LD10 ≙ N = 1... 40, LD15 ≙ N = 1... 32)

Tc-point: Entire encapsulated flexboard rear side

Electrical & output data

Farbtemperatur Color temperature[2]				LD5	LD10	LD15
				lumen/meter (lm/m)[1]		
W820		2500 K		340	680	1090
W822		2900 K		390	780	1250
W825		3300 K		450	890	1430
W827	W927	3800 K	3600 K	400	950	1510
W830	W930	4300 K	4300 K	400	1000	1600
W835	W935	5100 K	4900 K	420	1050	1690
W840	W940	6100 K	6600 K	430	1080	1720
W850		9600 K		590	1180	1880

[1] The given data are typical values. Due to tolerances of the production process and the electrical components, values for light output and electrical power can vary up to 10%.

[2] In case of IP67 products, tolerances in the color temperature can occur. For further explanation, please see page 476.

Same data as for VarioLED™ Flex HYDRA LD apply, except: 30% light loss and color shift compared to non encapsulated LED strip.

Please ask for custom specific adaptions like cable length and plugs.

Order code

	Flex tape	Variant	Color rendering	Color temperature	Length	Ingress protection
Ihre Bestellnummer Your order code	VarioLED Flex HYDRA	LD_ _	W_	_ _	_ _ _ _	IP67
Bestellnummer Beispiel Order code example	VarioLED Flex HYDRA	LD5	W9	27	7519	IP67

Accessories

erforderlich required

- 24 V DC — Konverter, Power supply unit, z. B. e. g., Art.-# 16000154
- Buchse, Female connector, z. B. e. g., Art.-# 15000142

optional optional

- Steuerprotokoll, Power control system, z. B. e. g., Art.-# 17000037
- 3M Klebeband, 3M Adhesive tape, Art.-# 18200035
- Transparenter Montageclip, Transparent mounting clip, Art.-# 13000115

Details siehe Seite 338 ff. Details on page 338 ff.

Sicherheits- und Montagehinweise siehe Seite 410 ff. Safety and assembly information please see page 412 ff.

VarioLED™ HYDRA LD White IP67


VarioLED™ HYDRA LD5 IP67, Contour 013

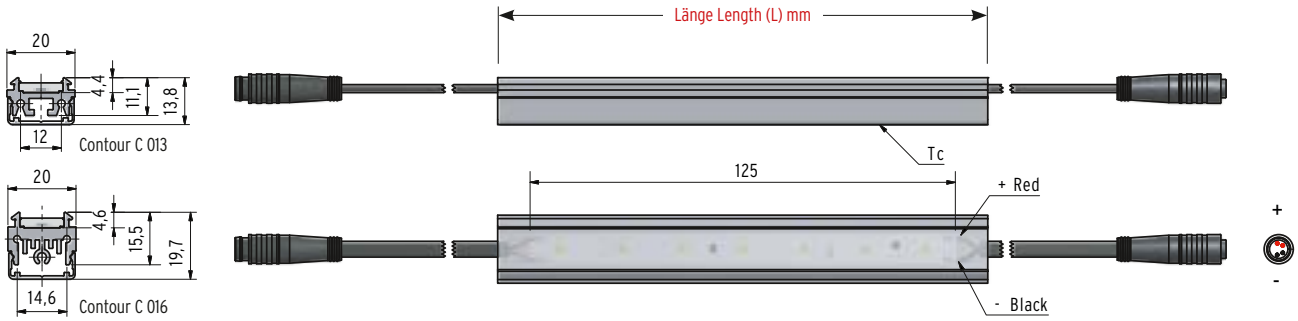

VarioLED™ HYDRA LD25 IP67, Contour 016





Water & UV resistant linear LED luminaire in aluminum profile with up to 4 m length, polyurethane encapsulation and 110 mm IP67 connectors on both ends.

Dimensions & available lengths



L = N x 125 + 19; L_{min} = 1 x 125 + 19 = 144 mm; LD5/LD10/LD15 ≙ L_{max} = 4.019 mm; LD25 ≙ L_{max} = 3.019 mm
(LD5/LD10/LD15 ≙ N = 1... 32, LD25 ≙ N = 1... 15)

Tc-point: Entire Al-profile rear side

Electrical & output data

Color temperature[2]				LD5 in C 013	LD10 in C 013	LD15 in C 016	LD25 in C 016
				lumen/meter (lm/m)[1]			
W820		2500 K		320	640	1030	1670
W822		2900 K		370	730	1170	1910
W825		3300 K		420	840	1340	2180
W827	W927	3800 K	3600 K	370	890	1420	2310
W830	W930	4300 K	4300 K	380	940	1510	2450
W835	W935	5100 K	4900 K	390	990	1590	2580
W840	W940	6100 K	6600 K	400	1010	1620	2630
W850		9600 K		550	1110	1770	2880

[1] The given data are typical values. Due to tolerances of the production process and the electrical components, values for light output and electrical power can vary up to 10%.

[2] In case of IP67 products, tolerances in the color temperature can occur. For further explanation, please see page 476.

Same data as for VarioLED™ Flex HYDRA LD apply, except: 30% light loss and color shift compared to non encapsulated LED strip.

Please ask for custom specific adaptions like cable length and plugs.

Order code

	Flex tape	Variant	Color rendering	Color temperature	Length	Ingress protection
Ihre Bestellnummer Your order code	VarioLED HYDRA	LD__	W_	__	____	IP67
Bestellnummer Beispiel Order code example	VarioLED HYDRA	LD5	W9	27	4019	IP67

Accessories

erforderlich required



Konverter
Power supply unit
z. B. e. g.
Art.-# 16000154


Buchse
Female connector
z. B. e. g.
Art.-# 15000091

optional optional



Steuerprotokoll
Power control system
z. B. e. g.
Art.-# 17000037


Halteklammer
Mounting Clip
Art.-# 10000040


Montage-Profil
Mounting Profile
Art.-# 10000039

Details siehe Seite 338 ff. Details on page 338 ff.

WEBSTER ISB- TYPE EB 60 °
TYPE ED 90°

Linear lenses



Description	LinearOptic 003/006 Clear 30°
Art.-No.	12000020
Unit	meter (m)
Min. OQ	30

Linear lens 30° for VarioContour 013/016 (L x H x W) 2,000 mm x 8 mm x 20.5 mm



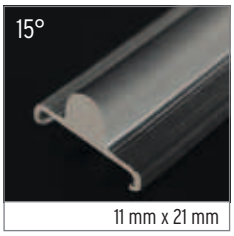
Description	LinearOptic 003/006 Clear 60°
Art.-No.	12000021
Unit	meter (m)
Min. OQ	30

Linear lens 60° for VarioContour 013/016 (L x H x W) 2,000 mm x 8 mm x 20.5 mm



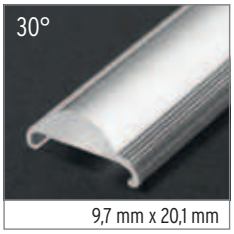
Description	LinearOptic 003/006 Clear 90°
Art.-No.	12000022
Unit	meter (m)
Min. OQ	30

Linear lens 90° for VarioContour 01 3/016 (L x H x W) 2,000 mm x 8 mm x 20.5 mm



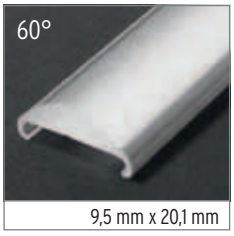
Description	LinearOptic 003/006 Diffuse 15°
Art.-No.	12000049
Unit	meter (m)
Min. OQ	30

Linear lens 15° diffuse for VarioContour 013/016, (L x H x W) 2,000 mm x 11 mm x 21 mm



Description	LinearOptic 003/006 Diffuse 30°
Art.-No.	12000029
Unit	meter (m)
Min. OQ	30

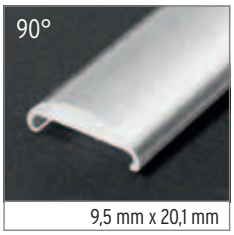
Linear lens 30° diffuse for VarioContour 013/016, (L x H x W) 2,000 mm x 9.7 mm x 20.1 mm



Description	LinearOptic 003/006 Diffuse 60°
Art.-No.	12000031
Unit	meter (m)
Min. OQ	30

EB

Linear lens 60° diffuse for VarioContour 013/016, (L x H x W) 2,000 mm x 9.5 mm x 20.1 mm

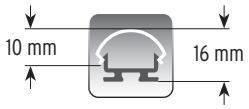


Description	LinearOptic 003/006 Diffuse 90°
Art.-No.	12000032
Unit	meter (m)
Min. OQ	30

ED

Linear lens 90° diffuse for VarioContour 013/016, (L x H x W) 2,000 mm x 9.5 mm x 20.1 mm

MOUNTING CLIPS FOR EB & ED



VarioContour 003



9,5 mm x 20,1 mm

EB

Bezeichnung Description	LinearOptic 003/006 Diffuse 60°
Artikelnummer Art.-No.	12000031
Einheit Unit	meter (m)
Min. VPE Min. OQ	30

Linearlinse 60° diffus für VarioContour 003/006, (L x H x B) 2.000 mm x 9,5 mm x 20,1 mm; empfohlen für VarioLED™ Flex APOLLO2, DONAR2, HERCULES, KRONOS und ZEUS2
Linear lens 60° diffuse for VarioContour 003/006, (L x H x W) 2,000 mm x 9.5 mm x 20.1 mm; recommended for VarioLED™ Flex APOLLO2, DONAR2, HERCULES, KRONOS and ZEUS2



9,5 mm x 20,1 mm

ED

Bezeichnung Description	LinearOptic 003/006 Diffuse 90°
Artikelnummer Art.-No.	12000032
Einheit Unit	meter (m)
Min. VPE Min. OQ	30

Linearlinse 90° diffus für VarioContour 003/006, (L x H x B) 2.000 mm x 9,5 mm x 20,1 mm; empfohlen für VarioLED™ Flex APOLLO2, DONAR2, HERCULES, KRONOS und ZEUS2
Linear lens 90° diffuse for VarioContour 003/006, (L x H x W) 2,000 mm x 9.5 mm x 20.1 mm; recommended for VarioLED™ Flex APOLLO2, DONAR2, HERCULES, KRONOS and ZEUS2



Bezeichnung Description	VarioClip 003/006
Artikelnummer Art.-No.	13000006
Einheit Unit	Stück/piece (pc)
Min. VPE Min. OQ	10

Halteklammer aus Kunststoff für VarioContour 003/006, (L x H x B) 33,45 mm x 18,7 mm x 6,5 mm
Plastic mounting clip for VarioContour 003/006, (L x H x W) 33.45 mm x 18.7 mm x 6.5 mm



Bezeichnung Description	VarioClip 003/006 15°
Artikelnummer Art.-No.	13000006-15°
Einheit Unit	Stück/piece (pc)
Min. VPE Min. OQ	10

Halteklammer aus Kunststoff für VarioContour 003/006 mit 15° Neigungswinkel, (L x H x B) 35 mm x 20,8 mm x 10,8 mm
Plastic mounting clip for VarioContour 003/006 with inclination angle 15°, (L x H x W) 35 mm x 20.8 mm x 10.8 mm



Bezeichnung Description	VarioClip 003/006 30°
Artikelnummer Art.-No.	13000006-30°
Einheit Unit	Stück/piece (pc)
Min. VPE Min. OQ	10

Halteklammer aus Kunststoff für VarioContour 003/006 mit 30° Neigungswinkel, (L x H x B) 35 mm x 20,8 mm x 14,8 mm
Plastic mounting clip for VarioContour 003/006 with inclination angle 30°, (L x H x W) 35 mm x 20.8 mm x 14.8 mm

EB & ED MOUNTING CLIPS



Bezeichnung Description	VarioClip 003/006 45°
Artikelnummer Art.-No.	13000006-45°
Einheit Unit	Stück/piece (pc)
Min. VPE Min. OQ	10

Halteklammer aus Kunststoff für VarioContour 003/006 mit 45° Neigungswinkel, (L x H x B) 35 mm x 19,5 mm x 18,1 mm
Plastic mounting clip for VarioContour 003/006 with inclination angle 45°, (L x H x W) 35 mm x 19.5 mm x 18.1 mm

Type SA -

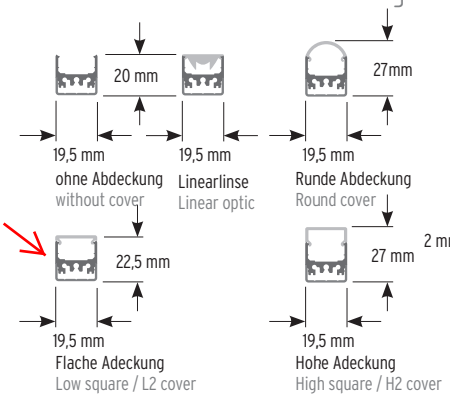
Each run configured to give +/- 3" spacing between columns (880mm and 1380mm lengths are non standard but required to meet lengths needed)

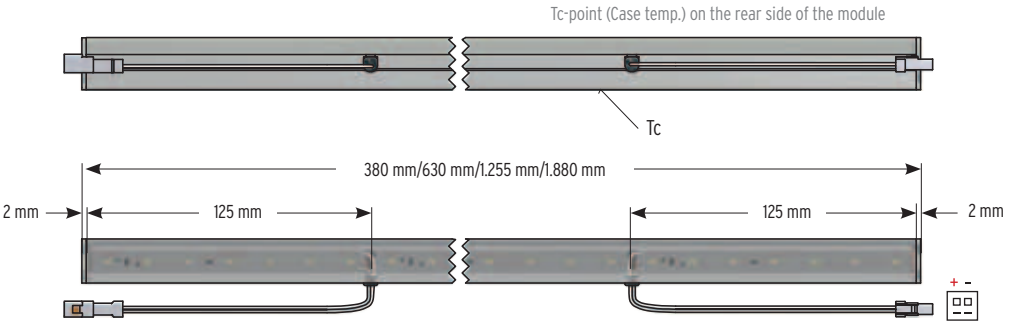
XOOLINE™ HYDRA White IP40[1]



24 V, LED-linear luminaire in an aluminum profile, offering 12 high quality optics to choose from. The diffuser optics, clear, diffuse or opal covers, make soft light settings possible. Among the linear optics, a 10° wall grazer or 30° and 60° general illumination optics allow precise light control. Available in 4 standardized lengths, including mounting profile. With protection ratings of IP10 and IP40. Japanese LED of the highest quality. "One Bin Only" within 3 MacAdam guarantees constant color temperature and highest light quality at a lifetime of > 60,000 h (L80/B10). Up to CRI 96. Made in Germany.

Dimensions & available lengths





Elektrische & Optische Betriebsdaten Electrical & output data

Voltage	24 Volt (23 V_{min}, 25 V_{max})
Temperature[3]	Tc_{min} = -25°C, Tc_{max} (untere Tabelle Table below)
Storage temperature	Ts_{min} = -30°C, Ts_{max} = 85°C
Ambient temperature	Ta_{min} > -25°C, Ta_{max} (untere Tabelle Table below)
Ra CRI	bis zu up to 95
R9	bis zu up to 65

XOOLINE™ HYDRA	LD5	LD10	LD15	LD25	LD40	HD6	HD10	HD15	HD25	HD36
Power (W/m)[2]	5	10	15	25	40	6	10	15	25	36
Efficacy (lm/W)[2]	132	131	140	137	103	132	131	140	137	139
max. serielle Lauflänge bei einer Einspeisung max. serial run length (mm)	7500	5000	4000	3000	2000	5000	5000	4000	3000	2000
Temp. Tc-Punkt Temp. Tc-point (Tc_{max})[3]	70°C	70°C	70°C	75°C	85°C	70°C	70°C	70°C	75°C	85°C
max. Außentemp. max. Ambient temp. (Ta_{max})	50°C	50°C	40°C	40°C	35°C	50°C	50°C	50°C	45°C	35°C

Color temperature			LD5	LD10	LD15	LD25	LD40	HD6	HD10	HD15	HD25	HD36
			lumen/meter (lm/m)[1] @clear cover[4]									
W820		2000 K	380	760	1220	1980	-	460	760	1220	1980	2900
W822		2200 K	440	870	1390	2270	-	520	870	1390	2270	3310
W825		2500 K	500	1000	1590	2590	3370	600	1000	1590	2590	3780
W827	W927	2700 K	450	1060	1690	2750	3560	530	890	1690	2750	4010
W830	W930	3000 K	450	1120	1790	2910	3780	540	910	1790	2910	4260
W835	W935	3500 K	470	1180	1880	3060	4020	560	930	1880	3060	4470
W840	W940	4000 K	480	1200	1920	3130	4120	570	960	1920	3130	4570
W850		5000 K	660	1310	2100	3420	4130	790	1310	2100	3420	5000

ONE BIN ONLY

L80/B10 > 60.000 h — Lebensdauer Lifetime

Wx27/ 339 — Photometrischer Code Photometric code

LM 79 — LM 79 konform LM 79 compliant

LM 80 — LM 80 konform LM 80 compliant

Schutz gegen kornförmige Fremdkörper > 1 mm
Protection against granular objects > 1 mm

[1] Without cover the IP protection level is reduced from IP40 to IP10.

[2] The given data are typical values. Due to tolerances of the production process and the electrical components, values for light output and electrical power can vary up to 10%.

[3] The Tc-point should be measured in thermal equilibrium according to IEC EN 60598-1.

[4] Sample values.
! Note: -25% luminous flux at opal and -2% with diffuse cover.

Order code

Your order code	XOOLINE HYD	____	W_	__	____	___-C00_	IP__
Order code example	XOOLINE HYD	HD10	W9	27	1880	OL-C002	IP40

LED tape
HYDRA LD5 ..... LD5
HYDRA LD10 ..... LD10
HYDRA LD15 ..... LD15
HYDRA LD25 ..... LD25
HYDRA LD40 ..... LD40
HYDRA HD6 ..... HD6
HYDRA HD10 ..... HD10
HYDRA HD15 ..... HD15
HYDRA HD25 ..... HD25
HYDRA HD36 ..... HD36

Color rendering
› 80 8
› 90 (only LD5, HD6, HD10) 9

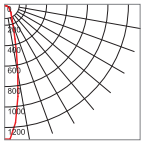
Color temperature
2000 K 20
2200 K 22
2500 K 25
2700 K 27
3000 K 30
3500 K 35
4000 K 40
5000 K 50

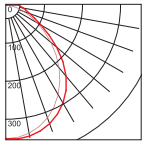
Length
380 mm 0380
630 mm 0630
1255 mm 1255
1880 mm 1880
880 mm ..... 880^
1380 mm ..... 1380^

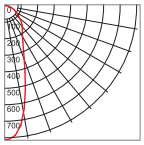
Cover / Lens options
No cover/lens ..... NC-C00x[5]
10° Diffuse 10D-C004
30° Diffuse 30D-C004
60° Diffuse 60D-C004
Opal round cover ..... OR-C00x[5]
Diffuse round cover ..... DR-C00x[5]
Clear round cover ..... CR-C00x[5]
Opal low square cover ..... OL-C00x[5]
Diffuse low square cover ..... DL-C00x[5]
Clear low square cover ..... CL-C00x[5]
Opal high square cover ..... OH-C00x[5]
Diffuse high square cover ..... DH-C00x[5]
Clear high square cover ..... CH-C00x[5]

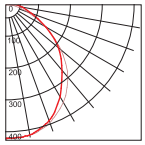
Ingress protection
IP10 (without optic / cover) IP10
IP40 ..... IP40

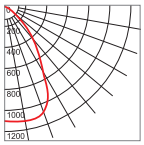
^ non standard lengths added for legths needed on project

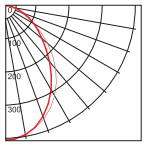

Lineare Linse, 10°[6]
Linear lens, 10°[6]

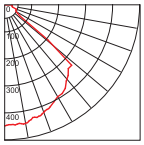

Diffuse Abdeckung, rund[6]
Diffuse cover, round[6]

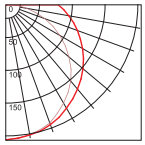

Lineare Linse, 30°[6]
Linear lens, 30°[6]

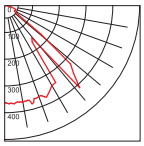

Diffuse Abdeckung, hoch[6]
Diffuse cover, high square[6]

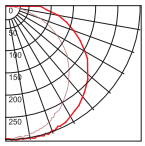

Lineare Linse, 60°[6]
Linear lens, 60°[6]

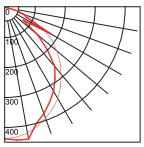

Diffuse Abdeckung, flach[6]
Diffuse cover, flat[6]

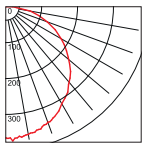

Klare Abdeckung, rund[6]
Clear cover, round[6]


Opale Abdeckung, rund[6]
Opal cover, round[6]


Klare Abdeckung, hoch[6]
Clear cover, high square[6]


Opale Abdeckung, hoch[6]
Opal cover, high square[6]


Klare Abdeckung, flach[6]
Clear cover, flat[6]


Opale Abdeckung, flach[6]
Opal cover, flat[6]

[5] C004 für HYDRA HD36 und LD40 notwendig, ansonsten C002
[5] C004 required for HYDRA HD36 and LD40 tapes, C002 else.
[6] DIN 5040:A40
· Nähere Erläuterungen zu Änderungen, Grenzwerten und Schwankungen im Herstellungsprozess finden Sie auf Seite 398.
· For more details regarding catalogue changes, min and max data sheet values and production tolerances please see at page 399.

Please choose your accessories

Mounting	Art.-#	
☑ Montagekanal in voller Länge (autom. für jede Leuchte im Lieferumfang enthalten) Full length mounting channel (automatically included for every fixture)	10000039	

Recommended drivers	Art.-#	
☐ VarioPSU 24V/100W IP20/IP40 Black, 220 - 240 V supply	16000075	

Anschlusskabel vom Netzgerät Lead connector from driver	Art.-#	
☐ VarioCon Female Mini 2 x 0,34 mm², 2 m IP67	15000142	
☐ VarioCon Extension Mini 2 x 0,34 mm², 2 m IP67	15000144	
☐ VarioCon Female Mini Protection Cap Mono IP67	15000218	

Empfohlene Steuerungen Recommended controls	Art.-#	
☐ VarioControl LinearDrive 210D DALI	17000037	

TYPE EH 074684 (IRON RUST & BLACK)-17258

PRODUCT CODE 074684

PROJECT

TYPE

ALUTECHRO

Wet location

ADA COMPLIANT

IP 66

Part number	074684
Lampholder:	LED
Wattage (W):	11 W
Colour / RAL:	ANODIZED ALUMINUM - WHITE LED
Degree of protection:	IP 66
Kelvin:	3000
Optic:	ASIMMETRIC WIDE REFLECTOR
Luminaire lumen output:	396 lm
Lifetime:	35000 h
cULus:	
Voltage:	120/277V





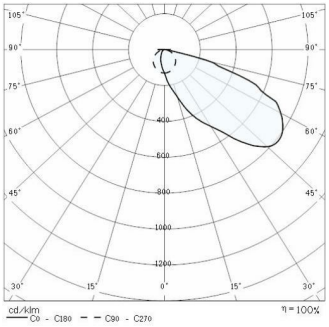
0-10V DIMMING



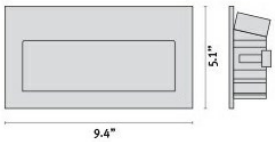
Description

Series of Class I LED luminaires for recessed wall mounting.
- Housing in silver anodised aluminum.
- All versions are equipped with either white 3000 K or 4000 K LEDs.
- LED driver included.
- Fixtures provided complete with LED circuit.
- Colour rendering index CRI > 80.
- LED circuit designed in compliance with the current Lumen Maintenance (LM80) regulation, with reliable quality of light for a life up to 50,000 hours, corresponding to L70 Ta 25°C. Luminaire, driver and other components that differ from the LED circuit not included.
- IP 65 connector included.
- Supplied with 1 m long H0RNF-5 cable (different lengths available on demand).
- Recessed stainless steel housing to be ordered separately.
- Consult factory for custom colors.
- Consult factory for non-catalogued kelvin temps.

TECHNICAL DATA

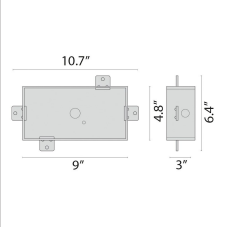


TECHNICAL DRAWINGS



MANDATORY ACCESSORIES

ALU TECH RO



076494

Recessed Alu RO

TYPE EL

99856-99626-RAL-COLOR

BEGA LED system bollard - luminaire head with shielded light - 360°

Type: EL
BEGA Product:
Project: WEBSTER ISB
Voltage:
Color:
Options:
Modified:

Enclosure: Housing constructed of die-cast aluminum. Die-castings are marine grade, copper free (≤ 0.3% copper content) A360.0 aluminum alloy. Glass diffuser, inside white. Fully gasketed for weather tight operation using molded silicone gasket.

Installation: BEGA LED system bollards are designed for easy attachment to system bollard tubes using an interlocking stainless steel mechanism and stainless steel set screw threaded into stainless steel insert. An accompanying bollard tube must be selected for proper installation, see below chart for compatible tube options.

Electrical: 24.3W LED luminaire, 28.6 total system watts, -30°C start temperature. Integral 120V through 277V electronic LED driver, 0-10V dimming. LED module(s) are available from factory for easy replacement. Standard LED color temperature is 3000K with a >80 CRI. Available in 4000K (>80 CRI); add suffix K4 to order.
Note: LEDs supplied with luminaire. Due to the dynamic nature of LED technology, LED luminaire data on this sheet is subject to change at the discretion of BEGA-US. For the most current technical data, please refer to www.bega-us.com.

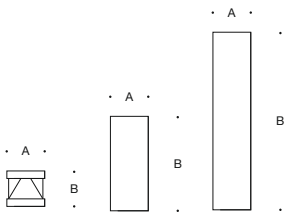
Finish: All BEGA standard finishes are polyester powder coat with minimum 3 mil thickness. Available in four standard BEGA colors: Black (BLK); White (WHT); Bronze (BRZ); Silver (SLV). To specify, add appropriate suffix to catalog number. Custom colors supplied on special order.

< VERIFY COLOR

CSA certified to U.S. and Canadian standards, suitable for wet locations. Protection class IP65

Weight: 10.2 lbs

Luminaire Lumens: 1671



Bollard heads · **shielded with reflector · 180°**

	Lamp	A	B
99 856	24.3 W LED	7 1/2	7 1/4

Bollard tubes for luminaire heights **19 3/4 · 21 3/4**

		A	B	Anch. unit
99 615		7 1/2	14 1/2	**79 817**

Bollard tubes for luminaire heights **31 1/2 · 39 1/4**

	Integrated components	Door	A	B	Anch. unit
99 622	—	✔	7 1/2	32	**79 818**
99 644	1 LED floodlight 19.3 W	✔	7 1/2	32	**79 818**
99 626	GFCI outlet	✔	7 1/2	32	**79 818**
99 658	Passive infrared motion sensor	✔	7 1/2	32	**79 818**
99 635	Emergency lighting battery 10 W	✔	7 1/2	32	**79 818**



BEGA-US 1000 BEGA Way, Carpinteria, CA 93013 (805) 684-0533 FAX (805) 566-9474 www.bega-us.com
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Type RQ
Webster ISB

Wall Wash WW4

one or two T5 or T5HO lamps

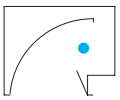
or one or two T8 lamps

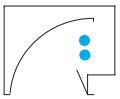


Linear Lighting

Wall Wash WW4

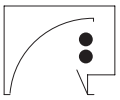
T5 options

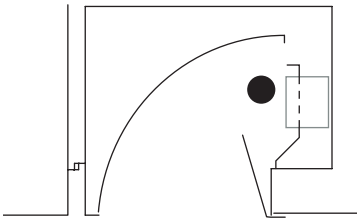




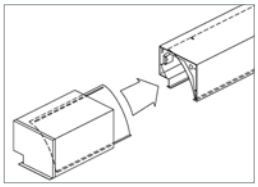
T8 options



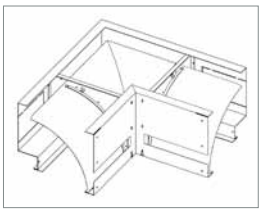




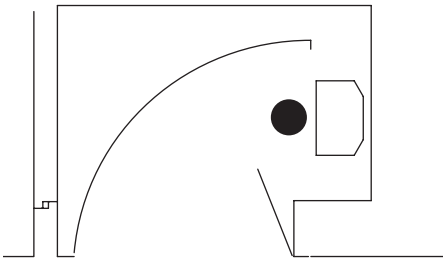
T5 Wall Wash
6"H. x 8"W.
5½" aperture



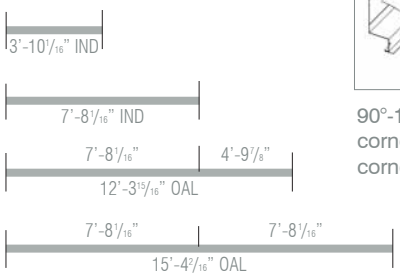
Telescoping sleeves and corners allow 1"– 6" adjustment per sleeve.

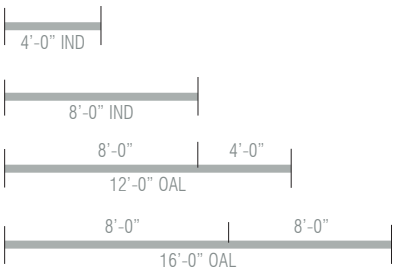


90°-135° inside and outside corners standerd. Custom corners consult factory.



T8 Wall Wash
8"H. x 10"W.
7 1/16" aperture





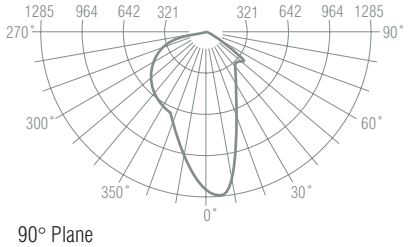
For design use only. Not for construction. See www.linearltg.com for engineering drawings specific to job.

- Pre-painted white steel housing
- 1 or 2 T5 or T5HO lamps
- 1 or 2 T8 lamps
- Up to 8' one-piece reflector factory installed
- 90° to 135° corners
- Telescoping sleeves available for wall-to-wall installation
- Factory pre-wired
- UL/CUL labels
- Weight per foot: 7 lbs. approx.

WW4-D-2-T5-NS

Efficiency: 55.6%

Max. candlepower at 15°: 1284



90° Plane

See www.linearltg.com for complete photometrics.

Catalog No. | Dir. Lamps Ballast Voltage | Shielding Mounting Color | Add'l options | Row length

WW4 – **D-** ___ - ___ - ___ – **NS - R - BW** – ___ – ___

Fixture | Lamps & Electrical Options | Mechanical & Aesthetic Options | Add'l | Feet

Lamps & Electrical Options

Direction: **D** Direct

Lamps: **1 or 2**; **2SG** 2 lamps, staggered†

Ballast: **ET5** Electronic T5; **ET5HO** High Output T5; **ET8** Electronic T8

Voltage: **120** or **277**; **347**

Mechanical & Aesthetic Options

Shielding: **NS** No Shielding

Mounting: **R** Recessed

Color: **BW** Baked White

See color chart for add'l colors

Add'l

NO No Option
AR Air Return
CB Checkerboard Circuit "A" or "B"
EC Emergency Circuit
ED Electronic Dimming*
EM Emergency Ballast**
FU Fusing
ISB10 Inst Start Blst <10%††
LS LutronEcoSys Sensor Feed
NL Night Light
PBIS Premium Blst Inst Start
PBPS Premium Blst Prog Start
PSB10 Prog Start Blst <10%††
RFI Radio Frq Int Suprsr
SC Separate Circuits
SG Staggered Lamps†
SF Special Feature *please define*

Feet

Fixture lengths
2', 3', 4', 5', 6', 8'

Verify Voltage

** Dimming ballasts may not be available for all T5/T5HO lamp lengths. Consult factory.* *†† ISB10 and PSB10 available with T8 only.* *† Available with 2-lamp configuration only.*
*** EM packs may not be available for all T5/T5HO lamp lengths. Consult factory.*

See www.linearltg.com for IES files and additional information.

Linear Lighting Corp.
31-30 Hunters Point Ave., Long Island City, NY 11101 ©9/10
718-361-7552 Fax 718-937-2747 Web: www.linearltg.com

Type EF36
Webster ISB

Cree Edge™ Series

LED Pathway Luminaire

Product Description

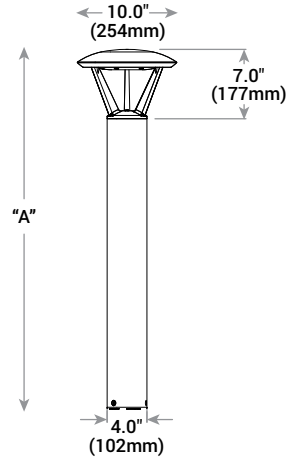
Durable die-cast aluminum luminaire housing mounts directly to 4" (102mm) diameter pole (included) without visible mounting hardware for clean apperance. Pole mounts to rugged die cast aluminum internal flange secured by three 3/8" - 16x6" anchor bolts with 1-1/4" hook (provided). **Note:** T45 Torx 3/8" socket required for head installation. Top mounted LEDs for superior optical performance and light control.
Applications: Landscape, walk-ways and general site lighting

Performance Summary

- Patented NanoOptic® Product Technology
- Made in the U.S.A. of U.S. and imported parts
- **CRI:** Minimum 70 CRI
- **CCT:** 4000K (+/- 300K), 5700K (+/- 500K) standard
- **Limited Warranty†:** 10 years on luminaire/10 years on Colorfast DeltaGuard® finish

† See www.cree.com/lighting/products/warranty for warranty terms





Model	Dim. "A"	Weight*
Landscape (P0)	13" (330mm)	12.7 lbs. (5.8kg)
Landscape (P1)	18" (457mm)	13.3 lbs. (6.0kg)
Pathway (P3)	36" (914mm)	17.9 lbs. (8.1kg)
Pathway (P4)	42" (1068mm)	18.6 lbs. (8.4kg)
Pedestrian (P8)	96" (2438mm)	28.4 lbs (12.9kg)

* Add 4.5 lbs. (2.0kg) for 347-480V

Accessories

Field-Installed
Upgrade Kit - Used for replacement of existing bollards with a bolt hole circle of 5.75" (146mm) XA-XBP8RSV XA-XBP8RWH XA-XBP8RPB XA-XBP8RBK XA-XBP8RBZ

Ordering Information

Example: PWY-EDG-2M-P0-02-E-UL-SV-350

PWY-EDG			02	E				
Product	**Optic**	**Mounting**	**LED Count (x9)**	**Series**	**Voltage**	**Color Options**	**Drive Current**	**Options**
PWY-EDG	**2M** Type II Medium **3M** Type III Medium **5M** Type V Medium **5S** Type V Short	**P0** 13" (330mm) landscape **P1** 18" (457mm) landscape **P3** 36" (914mm) pathway **P4** 42" (1067mm) pathway **P8** 96" (2438mm) pedestrian	02	E	**UL** Universal 120-277V **UH** Universal 347-480V - Available with P3, P4, and P8 mounts only **12** 120V **27** 277V	**BK** Black **BZ** Bronze **SV** Silver **WH** White Verify Color	**350** 350mA **525** 525mA - Available with P1, P3, P4, and P8 mounts only	**40K 4000K Color Temperature** - Minimum 70 CRI - Color temperature per luminaire **F Fuse** - When code dictates fusing, use time delay fuse - Refer to ML spec sheet for availability with ML options **HL Hi/Low (Dual Circuit Input)** - Refer to HL spec sheet for details - Sensor not included **TL Two-Level (175/525 w/integrated sensor control)** - Refer to TL spec sheet for details **TL2 Two-Level (0/350 w/integrated sensor control)** - Refer to TL spec sheet for details **TL3 Two-Level (0/525 w/integrated sensor control)** - Refer to TL spec sheet for details **WB Welded Base Plate** - Standard on P8 mount option, available with P3 and P4 mount - Includes welded base cover

Product Specifications

CONSTRUCTION & MATERIALS

- Durable die-cast aluminum luminaire housing mounts directly to 4" (102mm) diameter pole (included) without visible mounting hardware for clean appearance
- Pole mounts to rugged die cast aluminum internal flange secured by three 3/8"-16x6" anchor bolts with 1-1/4" hook(provided)
- **Note:** T45 Torx 3/8" socket required for head installation
- Top mounted LEDs for superior optical performance and light control
- Exclusive Colorfast DeltaGuard® finish features an E-Coat epoxy primer with an ultradurable powder topcoat, providing excellent resistance to corrosion, ultraviolet degradation and abrasion. Black, bronze, silver and white are available
- **Weight:** See Dimension and Weight Chart on page 1

ELECTRICAL SYSTEM

- **Input Voltage:** 120-277V or 347-480V, 50/60Hz, Class 1 drivers
- **Power Factor:** > 0.9 at full load at 120V
- **Total Harmonic Distortion:** < 20% at full load at 120V
- Integral 10kV surge suppression protection standard
- To address inrush current, slow blow fuse or type C/D breaker should be used

REGULATORY & VOLUNTARY QUALIFICATIONS

- cULus Listed
- Suitable for wet locations
- 10kV surge suppression protection tested in accordance with IEEE/ANSI C62.41.2
- Luminaire and finish endurance tested to withstand 5,000 hours of elevated ambient salt fog conditions as defined in ASTM Standard B 117
- Meets Buy American requirements within ARRA

Electrical Data*

LED Count (x9)	System Watts 120-277V	System Watts 347-480V	Total Current					
			120V	208V	240V	277V	347V	480V
350mA								
02	22	28	0.18	0.12	0.10	0.10	0.09	0.13
525mA								
02	34	40	0.29	0.19	0.17	0.15	0.12	0.13

* Electrical data at 25˚C (77˚F)

Recommended Cree Edge™ Series Lumen Maintenance Factors (LMF)[1]

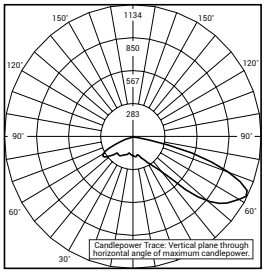
Ambient	Initial LMF	25K hr Projected[2] LMF	50K hr Projected[2] LMF	75K hr Calculated[3] LMF	100K hr Calculated[3] LMF
5˚C (41˚F)	1.04	0.99	0.97	0.95	0.93
10˚C (50˚F)	1.03	0.98	0.96	0.94	0.92
15˚C (59˚F)	1.02	0.97	0.95	0.93	0.91
20˚C (68˚F)	1.01	0.96	0.94	0.92	0.90
25˚C (77˚F)	1.00	0.95	0.93	0.91	0.89

[1] Lumen maintenance values at 25˚C are calculated per TM-21 based on LM-80 data and in-situ luminaire testing
[2] In accordance with IESNA TM-21-11, Projected Values represent interpolated value based on time durations that are within six times (6X) the IESNA LM-80-08 total test duration (in hours) for the device under testing ((DUT) i.e. the packaged LED chip)
[3] In accordance with IESNA TM-21-11, Calculated Values represent time durations that exceed six times (6X) the IESNA LM-80-08 total test duration (in hours) for the device under testing ((DUT) i.e. the packaged LED chip)

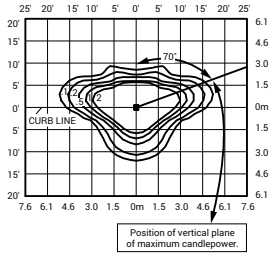
Photometry

All published luminaire photometric testing performed to IESNA LM-79-08 standards by a NVLAP accredited laboratory. To obtain an IES file specific to your project consult: www.cree.com/Lighting/Tools-and-Support/Exterior-IES-Configuration-Tool

2M



RESTL Test Report #: PL5758-001
PWY-EDG-2M-**-02-E-UL-350-40K
Initial Delivered Lumens: 1,549

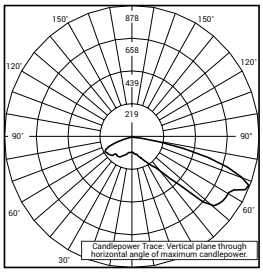


PWY-EDG-2M-**-02-E-UL-350-40K
Mounting Height: 3' (0.9m) A.F.G.
Initial Delivered Lumens: 1,565
Initial FC at grade

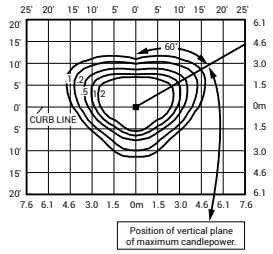
Type II Medium Distribution				
LED Count (x9)	4000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
350mA				
02	1,565	B1 U0 G1	1,625	B1 U0 G1
525mA				
02	2,191	B1 U0 G1	2,276	B1 U0 G1

* Initial delivered lumens at 25˚C (77˚F)
** For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: www.ies.org/PDF/Erratas/TM-15-11BugRatingsAddendum.pdf

3M



RESTL Test Report #: PL5698-001
PWY-EDG-3M-**-02-E-UL-350-40K
Initial Delivered Lumens: 1,470

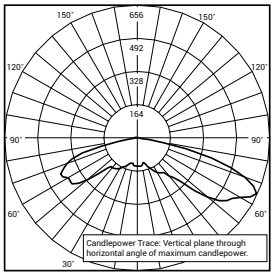


PWY-EDG-3M-**-02-E-UL-350-40K
Mounting Height: 3' (0.9m) A.F.G.
Initial Delivered Lumens: 1,389
Initial FC at grade

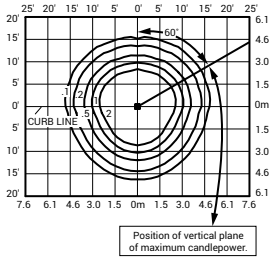
Type III Medium Distribution				
LED Count (x9)	4000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
350mA				
02	1,389	B1 U0 G1	1,442	B1 U0 G1
525mA				
02	1,944	B1 U0 G1	2,019	B1 U0 G1

* Initial delivered lumens at 25˚C (77˚F)
** For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: www.ies.org/PDF/Erratas/TM-15-11BugRatingsAddendum.pdf

5M



RESTL Test Report #: PL5798-001
PWY-EDG-5M-**-02-E-UL-350-40K
Initial Delivered Lumens: 1,780



PWY-EDG-5M-**-02-E-UL-350-40K
Mounting Height: 3' (0.9m) A.F.G.
Initial Delivered Lumens: 1,666
Initial FC at grade

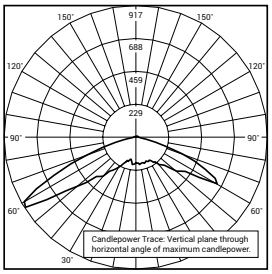
Type V Medium Distribution				
LED Count (x9)	4000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
350mA				
02	1,666	B1 U2 G1	1,730	B1 U2 G1
525mA				
02	2,333	B2 U2 G2	2,422	B2 U2 G2

* Initial delivered lumens at 25˚C (77˚F)
** For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: www.ies.org/PDF/Erratas/TM-15-11BugRatingsAddendum.pdf

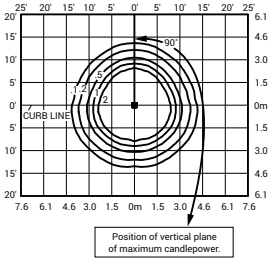
Photometry

All published luminaire photometric testing performed to IESNA LM-79-08 standards by a NVLAP accredited laboratory. To obtain an IES file specific to your project consult: www.cree.com/Lighting/Tools-and-Support/Exterior-IES-Configuration-Tool

5S



RESTL Test Report #: PL5759-001
PWY-EDG-5S-**-02-E-UL-350-40K
Initial Delivered Lumens: 1,897

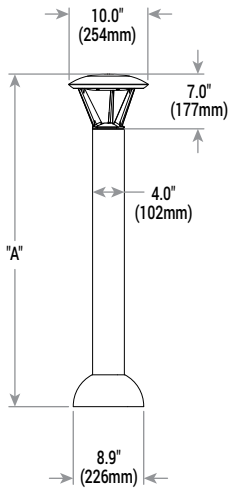


PWY-EDG-5S-**-02-E-UL-350-40K
Mounting Height: 3' (0.9m) A.F.G.
Initial Delivered Lumens: 1,868
Initial FC at grade

Type V Short Distribution				
LED Count (x9)	4000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
350mA				
02	1,868	B1 U2 G1	1,940	B1 U2 G1
525mA				
02	2,615	B1 U2 G1	2,716	B1 U2 G1

* Initial delivered lumens at 25˚C (77˚F)
** For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: www.ies.org/PDF/Erratas/TM-15-11BugRatingsAddendum.pdf

with Welded Base



Model	Dim. "A"	Weight*
Pathway (P3)	36" (914mm)	17.9 lbs. (8.1kg)
Pathway (P4)	42" (1068mm)	18.6 lbs. (8.4kg)
Pedestrian (P8)	96" (2438mm)	28.4 lbs (12.9kg)

* Add 4.5 lbs. (2.0kg) for 347-480V

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US: www.cree.com/lighting T (800) 236-6800 F (262) 504-5415

Type EF42
Webster ISB

Cree Edge™ Series

LED Pathway Luminaire

Product Description

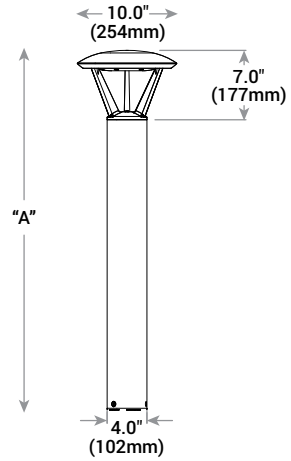
Durable die-cast aluminum luminaire housing mounts directly to 4" (102mm) diameter pole (included) without visible mounting hardware for clean apperance. Pole mounts to rugged die cast aluminum internal flange secured by three 3/8" - 16x6" anchor bolts with 1-1/4" hook (provided). **Note:** T45 Torx 3/8" socket required for head installation. Top mounted LEDs for superior optical performance and light control.
Applications: Landscape, walk-ways and general site lighting

Performance Summary

- Patented NanoOptic® Product Technology
- Made in the U.S.A. of U.S. and imported parts
- **CRI:** Minimum 70 CRI
- **CCT:** 4000K (+/- 300K), 5700K (+/- 500K) standard
- **Limited Warranty†:** 10 years on luminaire/10 years on Colorfast DeltaGuard® finish

† See www.cree.com/lighting/products/warranty for warranty terms





Accessories

Field-Installed
Upgrade Kit - Used for replacement of existing bollards with a bolt hole circle of 5.75" (146mm) XA-XBP8RSV XA-XBP8RWH XA-XBP8RPB XA-XBP8RBK XA-XBP8RBZ

Model	Dim. "A"	Weight*
Landscape (P0)	13" (330mm)	12.7 lbs. (5.8kg)
Landscape (P1)	18" (457mm)	13.3 lbs. (6.0kg)
Pathway (P3)	36" (914mm)	17.9 lbs. (8.1kg)
Pathway (P4)	42" (1068mm)	18.6 lbs. (8.4kg)
Pedestrian (P8)	96" (2438mm)	28.4 lbs (12.9kg)

* Add 4.5 lbs. (2.0kg) for 347-480V

Ordering Information

Example: PWY-EDG-2M-P0-02-E-UL-SV-350

PWY-EDG			02	E				
Product	**Optic**	**Mounting**	**LED Count (x9)**	**Series**	**Voltage**	**Color Options**	**Drive Current**	**Options**
PWY-EDG	**2M** Type II Medium **3M** Type III Medium **5M** Type V Medium **5S** Type V Short	**P0** 13" (330mm) landscape **P1** 18" (457mm) landscape **P3** 36" (914mm) pathway **P4** 42" (1067mm) pathway **P8** 96" (2438mm) pedestrian	02	E	**UL** Universal 120-277V **UH** Universal 347-480V - Available with P3, P4, and P8 mounts only **12** 120V **27** 277V	**BK** Black **BZ** Bronze **SV** Silver **WH** White Verify Color	**350** 350mA **525** 525mA - Available with P1, P3, P4, and P8 mounts only	**40K 4000K Color Temperature** - Minimum 70 CRI - Color temperature per luminaire **F Fuse** - When code dictates fusing, use time delay fuse - Refer to ML spec sheet for availability with ML options **HL Hi/Low (Dual Circuit Input)** - Refer to HL spec sheet for details - Sensor not included **TL Two-Level (175/525 w/integrated sensor control)** - Refer to TL spec sheet for details **TL2 Two-Level (0/350 w/integrated sensor control)** - Refer to TL spec sheet for details **TL3 Two-Level (0/525 w/integrated sensor control)** - Refer to TL spec sheet for details **WB Welded Base Plate** - Standard on P8 mount option, available with P3 and P4 mount - Includes welded base cover

Product Specifications

CONSTRUCTION & MATERIALS

- Durable die-cast aluminum luminaire housing mounts directly to 4" (102mm) diameter pole (included) without visible mounting hardware for clean appearance
- Pole mounts to rugged die cast aluminum internal flange secured by three 3/8"-16x6" anchor bolts with 1-1/4" hook(provided)
- **Note:** T45 Torx 3/8" socket required for head installation
- Top mounted LEDs for superior optical performance and light control
- Exclusive Colorfast DeltaGuard® finish features an E-Coat epoxy primer with an ultradurable powder topcoat, providing excellent resistance to corrosion, ultraviolet degradation and abrasion. Black, bronze, silver and white are available
- **Weight:** See Dimension and Weight Chart on page 1

ELECTRICAL SYSTEM

- **Input Voltage:** 120-277V or 347-480V, 50/60Hz, Class 1 drivers
- **Power Factor:** > 0.9 at full load at 120V
- **Total Harmonic Distortion:** < 20% at full load at 120V
- Integral 10kV surge suppression protection standard
- To address inrush current, slow blow fuse or type C/D breaker should be used

REGULATORY & VOLUNTARY QUALIFICATIONS

- cULus Listed
- Suitable for wet locations
- 10kV surge suppression protection tested in accordance with IEEE/ANSI C62.41.2
- Luminaire and finish endurance tested to withstand 5,000 hours of elevated ambient salt fog conditions as defined in ASTM Standard B 117
- Meets Buy American requirements within ARRA

Electrical Data*

LED Count (x9)	System Watts 120-277V	System Watts 347-480V	Total Current					
			120V	208V	240V	277V	347V	480V
350mA								
02	22	28	0.18	0.12	0.10	0.10	0.09	0.13
525mA								
02	34	40	0.29	0.19	0.17	0.15	0.12	0.13

* Electrical data at 25˚C (77˚F)

Recommended Cree Edge™ Series Lumen Maintenance Factors (LMF)[1]

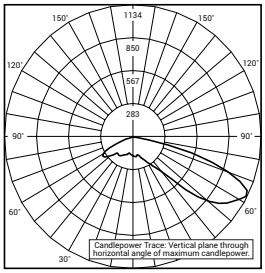
Ambient	Initial LMF	25K hr Projected[2] LMF	50K hr Projected[2] LMF	75K hr Calculated[3] LMF	100K hr Calculated[3] LMF
5˚C (41˚F)	1.04	0.99	0.97	0.95	0.93
10˚C (50˚F)	1.03	0.98	0.96	0.94	0.92
15˚C (59˚F)	1.02	0.97	0.95	0.93	0.91
20˚C (68˚F)	1.01	0.96	0.94	0.92	0.90
25˚C (77˚F)	1.00	0.95	0.93	0.91	0.89

[1] Lumen maintenance values at 25˚C are calculated per TM-21 based on LM-80 data and in-situ luminaire testing
[2] In accordance with IESNA TM-21-11, Projected Values represent interpolated value based on time durations that are within six times (6X) the IESNA LM-80-08 total test duration (in hours) for the device under testing ((DUT) i.e. the packaged LED chip)
[3] In accordance with IESNA TM-21-11, Calculated Values represent time durations that exceed six times (6X) the IESNA LM-80-08 total test duration (in hours) for the device under testing ((DUT) i.e. the packaged LED chip)

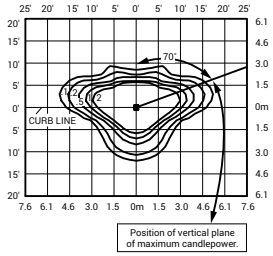
Photometry

All published luminaire photometric testing performed to IESNA LM-79-08 standards by a NVLAP accredited laboratory. To obtain an IES file specific to your project consult: www.cree.com/Lighting/Tools-and-Support/Exterior-IES-Configuration-Tool

2M



RESTL Test Report #: PL5758-001
PWY-EDG-2M-**-02-E-UL-350-40K
Initial Delivered Lumens: 1,549

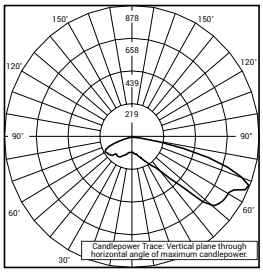


PWY-EDG-2M-**-02-E-UL-350-40K
Mounting Height: 3' (0.9m) A.F.G.
Initial Delivered Lumens: 1,565
Initial FC at grade

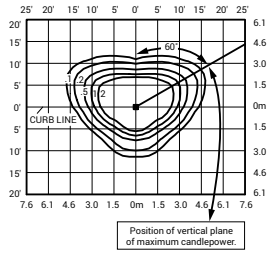
Type II Medium Distribution				
LED Count (x9)	4000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
350mA				
02	1,565	B1 U0 G1	1,625	B1 U0 G1
525mA				
02	2,191	B1 U0 G1	2,276	B1 U0 G1

* Initial delivered lumens at 25˚C (77˚F)
** For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: www.ies.org/PDF/Erratas/TM-15-11BugRatingsAddendum.pdf

3M



RESTL Test Report #: PL5698-001
PWY-EDG-3M-**-02-E-UL-350-40K
Initial Delivered Lumens: 1,470

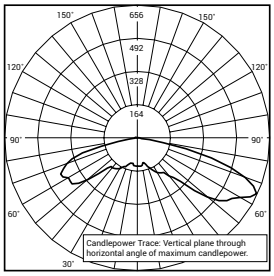


PWY-EDG-3M-**-02-E-UL-350-40K
Mounting Height: 3' (0.9m) A.F.G.
Initial Delivered Lumens: 1,389
Initial FC at grade

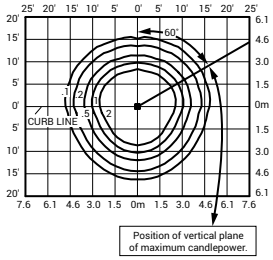
Type III Medium Distribution				
LED Count (x9)	4000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
350mA				
02	1,389	B1 U0 G1	1,442	B1 U0 G1
525mA				
02	1,944	B1 U0 G1	2,019	B1 U0 G1

* Initial delivered lumens at 25˚C (77˚F)
** For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: www.ies.org/PDF/Erratas/TM-15-11BugRatingsAddendum.pdf

5M



RESTL Test Report #: PL5798-001
PWY-EDG-5M-**-02-E-UL-350-40K
Initial Delivered Lumens: 1,780



PWY-EDG-5M-**-02-E-UL-350-40K
Mounting Height: 3' (0.9m) A.F.G.
Initial Delivered Lumens: 1,666
Initial FC at grade

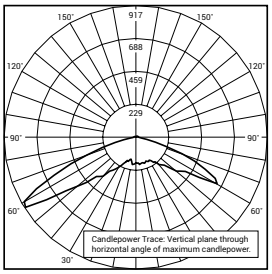
Type V Medium Distribution				
LED Count (x9)	4000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
350mA				
02	1,666	B1 U2 G1	1,730	B1 U2 G1
525mA				
02	2,333	B2 U2 G2	2,422	B2 U2 G2

* Initial delivered lumens at 25˚C (77˚F)
** For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: www.ies.org/PDF/Erratas/TM-15-11BugRatingsAddendum.pdf

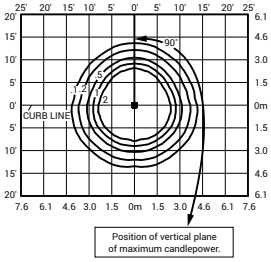
Photometry

All published luminaire photometric testing performed to IESNA LM-79-08 standards by a NVLAP accredited laboratory. To obtain an IES file specific to your project consult: www.cree.com/Lighting/Tools-and-Support/Exterior-IES-Configuration-Tool

5S



RESTL Test Report #: PL5759-001
PWY-EDG-5S-**-02-E-UL-350-40K
Initial Delivered Lumens: 1,897

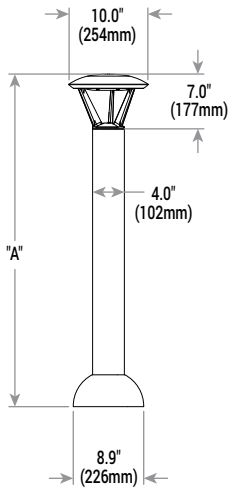


PWY-EDG-5S-**-02-E-UL-350-40K
Mounting Height: 3' (0.9m) A.F.G.
Initial Delivered Lumens: 1,868
Initial FC at grade

Type V Short Distribution				
LED Count (x9)	4000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
350mA				
02	1,868	B1 U2 G1	1,940	B1 U2 G1
525mA				
02	2,615	B1 U2 G1	2,716	B1 U2 G1

* Initial delivered lumens at 25˚C (77˚F)
** For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: www.ies.org/PDF/Erratas/TM-15-11BugRatingsAddendum.pdf

with Welded Base



Model	Dim. "A"	Weight*
Pathway (P3)	36" (914mm)	17.9 lbs. (8.1kg)
Pathway (P4)	42" (1068mm)	18.6 lbs. (8.4kg)
Pedestrian (P8)	96" (2438mm)	28.4 lbs (12.9kg)

* Add 4.5 lbs. (2.0kg) for 347-480V

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US: www.cree.com/lighting T (800) 236-6800 F (262) 504-5415

OW2480 – PASSAGE ™
Mullion Mount with Remote Power Supply

VISA LIGHTING

Type: EK (ASI 039) Project: WEBSTER ISB

VisaLighting.com/products/Passage

Fill in shaded boxes using information listed below

Order Code:	OW2480	L30K-H	–	MVOLT	GLIM	
	MODEL	A SOURCE		B VOLTAGE	C FINISH	D OPTIONS



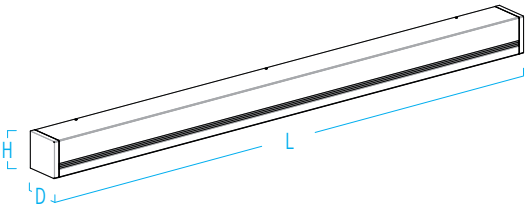
Passage is a sleek outdoor fixture for mounting horizontally over doorways, on facades, along paths of egress and window mullions

DIMENSIONS

Depth is measured from wall to front of fixture

L = Length H = Height D = Depth

L	37-1/4″	(946 mm)
H	2-1/2″	(64 mm)
D	2-1/2″	(64 mm)



A SOURCE (Select one) B VOLTAGE

MVOLT fixture accepts 120 through 277 input voltage
Dimmable 0-10V to 10%
82CRI, within 3-step MacAdam

	Source	CCT	Delivered Lumens	Power (Watts)	Voltage
•	**L30K-L**	3000K	550	18	**MVOLT**
	L35K-L	3500K			
•	**L40K-L**	4000K			
•	**L30K-H**	3000K	1700	47	
	L35K-H	3500K			
•	**L40K-H**	4000K			

C FINISHES (Select one)

See page 2 for color chart

Powder Coat Painted Finishes (Standard)

AG7038	Agate Grey	**GW9002**	Grey White
BMAT	Bronze Matte	**HTHR**	Heather
BRNZ	Bronze	**JB9005**	Jet Black
BSIL	Blade Silver	**OBRZ**	Old Bronze
CVBL	Cove Blue	**PB1035**	Pearl Beige
CW9001	Cream White	**RUST**	Rust
GLIM	Glimmer	**SUNG**	Sungold
GSIL	Graphite Silver	**TW9016**	Traffic White

D OPTIONS (Multiple Selections Allowed)

⚠ Option availability may be interdependent with Voltage, Source or Other Options

DS Dual circuit switching (includes 2 drivers).
Lumen output and wattage is split in half for each circuit

XPS Express 10 day shipping.
Items marked with a bullet (•) are not available with **XPS**

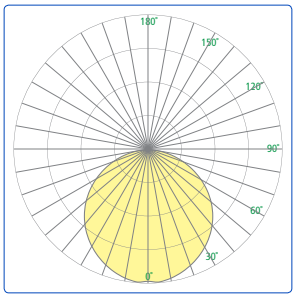
XPS LED ADA Compliant ETL Listed 5 Year Warranty

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OW2480 – PASSAGE™
Mullion Mount with Remote Power Supply

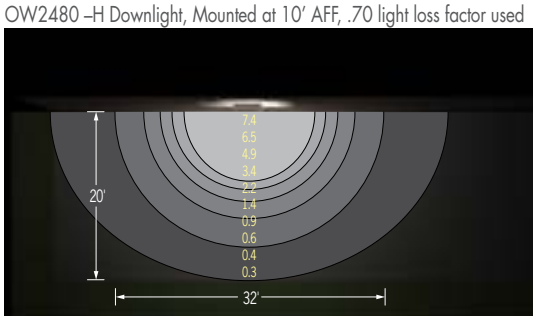
VISA LIGHTING

Photometrics

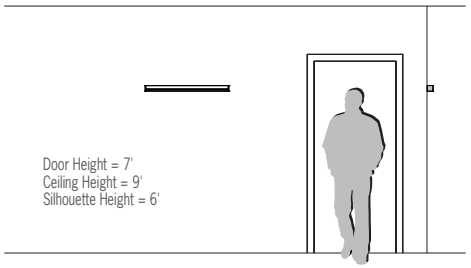


Path of Egress

OW2480 –H Downlight, Mounted at 10' AFF, .70 light loss factor used



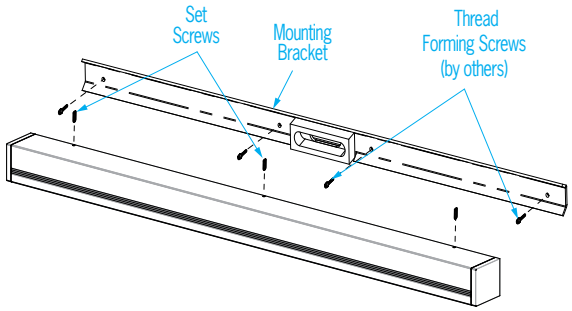
Relative Scale Drawing



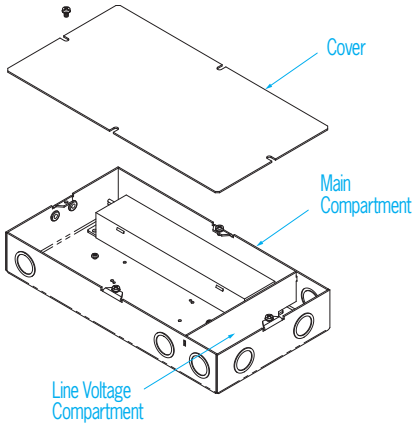
Technical Information

- High or low lumen output options
- Light Engines by Visa Lighting
- Remote power supply included (suitable for indoor, Type IC)
- Modular design for replacement of LED source and power supply
- Orient as uplight or downlight
- Optional dual circuit switching
- IP65 rated
- Bracket mounting system simplifies installation and maintenance
- Window mullion mount; Minimum mullion width 2.5"
- Tamper resistant fasteners
- Polycarbonate diffuser
- No VOC powder coat paint finish
- ETL listed for wet location (remote power supply is listed for damp location)

Mullion Mounting Detail



Remote Power Supply Enclosure



Specify color code when ordering. For accurate color matching, individual paint and finish samples are available upon request
For additional information see VisaLighting.com/materials-finishes

Painted Finishes (Standard)

TW9016
Traffic White (RAL9016)

CW9001
Cream (RAL9001)

GW9002
Grey White (RAL9002)

JB9005
Jet Black (RAL9005)

AG7038
Agate Grey (RAL7038)

HTHR
Heather

CVBL
Cove Blue

BSIL
Blade Silver

GSIL
Graphite Silver

GLIM
Glimmer

SUNG
Sungold

BRNZ
Bronze

OBRZ
Old Bronze

BMAT
Bronze Matte

PB1035
Pearl Beige (RAL1035)

RUST
Rust

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SSL TG | LIGHTING & CONTROLS REPRESENTATIVES

Qut Cd B17-0086

To

Villa Lighting Supply
2929 Chouteau Ave
St Louis, MO 63103-2903
PH: (314) 531-2600 Fax (314) 531-8720

Project

Job/Project Name:
WEBSTER ISB- TYPE SA

Qty	Type	Mfg	Description
	NOTE		Start of Import
Note			XOOLINE HYDRA LD25 W830 IP40 W/ LOW DIFFUSE LENS
Note		LEDL	ROOM 491
4	SA-29'-2"	LEDL	XOOLINE HYD LD25 830/1880-DL-C002-IP40 length - 6.16'
1		LEDL	CUSTOM XOOLINE HYD LD25 830/1380-DL-C002-IP40 length - 4.52'
Note		LEDL	EACH PIECE MUST HOME RUN BACK TO POWER SUPPLY
5		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
5		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
5		SSLT	HLG-60H-24A 60w 24v LED driver 90-305vac (on/off)
Note		LEDL	MAXIMUM 1 X 6.16' PIECES PER 60W POWER SUPPLY
5		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 489
1	SA-9'-5"	LEDL	XOOLINE HYD LD25 830/0380-DL-C002-IP40 length - 1.24'
2		LEDL	XOOLINE HYD LD25 830/1255-DL-C002-IP40 length - 4.11'
1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-100H-24A 100w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 483
4	SA-29'-11"	LEDL	XOOLINE HYD LD25 830/1880-DL-C002-IP40 length - 6.16'
1		LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'
Note		LEDL	CONNECT MAXIMUM 1 X 6.16' + 1 X 2.88' PIECES IN SERIES
4		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142

4		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
3		SSLT	HLG-60H-24A 60w 24v LED driver 90-305vac (on/off)
Note		LEDL	MAXIMUM 1 X 6.16' PIECES PER 60W POWER SUPPLY
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
Note		LEDL	MAXIMUM 1 X 6.16' + 1 X 2.88' PIECES PER 80W POWER SUPPLY
4		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 452
3	SA-8'-11"	LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'
1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 454
3	SA-8'-11"	LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'
1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 456
3	SA-8'-11"	LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'
1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 407
1	SA-18'-11"	LEDL	XOOLINE HYD LD25 830/1880-DL-C002-IP40 length - 6.16'
3		LEDL	XOOLINE HYD LD25 830/1255-DL-C002-IP40 length - 4.11'
Note		LEDL	CONNECT MAXIMUM 2 X 4.11' PIECES IN SERIES
3		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
3		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218

1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
Note		LEDL	MAXIMUM 2 X 4.11' PIECES PER 80W POWER SUPPLY
2		SSLT	HLG-60H-24A 60w 24v LED driver 90-305vac (on/off)
Note		LEDL	MAXIMUM 1 X 6.16' PIECES PER 60W POWER SUPPLY
3		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 405
3	SA-8'-10"	LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'
1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 403 CURVED
4	SA-8'	LEDL	**XOOLINE HYD LD25 830/0380-DL-C002-IP40** length -14.96" each
1		LEDL	**XOOLINE HYD LD25 830/0880-DL-C002-IP40**
1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 401 CURVED
4	SA-17'	LEDL	**XOOLINE HYD LD25 830/0380-DL-C002-IP40** length - 14.96"e
4		LEDL	**XOOLINE HYD LD25 830/0630-DL-C002-IP40** length - 2.06'
Note		LEDL	CONNECT MAXIMUM 1 X 4.11' + 2 X 2.06' PIECES IN SERIES
2		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
2		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
2		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
Note		LEDL	MAXIMUM 1 X 4.11' + 2 X 2.06' PIECES PER 80W POWER SUPPLY
2		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 354
2	SA-14'-3"	LEDL	XOOLINE HYD LD25 830/1255-DL-C002-IP40 length - 4.11'
2		LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'
Note		LEDL	CONNECT MAXIMUM 2 X 4.11' PIECES IN SERIES
2		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67

			15000142
2		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
Note		LEDL	MAXIMUM 2 X 4.11' PIECES PER 80W POWER SUPPLY
1		SSLT	HLG-60H-24A 60w 24v LED driver 90-305vac (on/off)
Note		LEDL	MAXIMUM 2 X 2.88' PIECES PER 60W POWER SUPPLY
2		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 352
5	SA-23'-11"	LEDL	XOOLINE HYD LD25 830/1255-DL-C002-IP40 length - 4.11'
1		LEDL	XOOLINE HYD LD25 830/0630-DL-C002-IP40 length - 2.06'
1		LEDL	XOOLINE HYD LD25 830/0380-DL-C002-IP40 length - 1.24'
Note		LEDL	CONNECT MAXIMUM 2 X 4.11' PIECES IN SERIES
3		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
3		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
3		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
Note		LEDL	MAXIMUM 2 X 4.11' PIECES PER 80W POWER SUPPLY
3		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 348
3	SA-8'-11"	LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'
1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 346
3	SA-8'-11"	LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'
1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 344
3	SA-8'-11"	LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'

1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 342
2	SA-12'-7"	LEDL	XOOLINE HYD LD25 830/1880-DL-C002-IP40 length - 6.16'
Note		LEDL	EACH LENGTH MUST HOME RUN BACK TO POWER SUPPLY
2		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
2		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
2		SSLT	HLG-60H-24A 60w 24v LED driver 90-305vac (on/off)
Note		LEDL	MAXIMUM 1 X 6.16' PIECE PER 60W POWER SUPPLY
2		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 342
1	SA-11'	LEDL	XOOLINE HYD LD25 830/1880-DL-C002-IP40 length - 6.16'
1		LEDL	CUSTOM XOOLINE HYD LD25 830/1380-DL- C002-IP40 length - 4.52'
Note		LEDL	EACH LENGTH MUST HOME RUN BACK TO POWER SUPPLY
2		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
2		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-100H-24A 100w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 339
2	SA-13'-2"	LEDL	XOOLINE HYD LD25 830/1255-DL-C002-IP40 length - 4.11'
2		LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL- C002-IP40 length - 2.88'
Note		LEDL	CONNECT MAXIMUM 2 X 4.11' PIECES IN SERIES
2		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
2		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
Note		LEDL	MAXIMUM 2 X 4.11' PIECES PER 80W POWER SUPPLY
1		SSLT	HLG-60H-24A 60w 24v LED driver 90-305vac (on/off)
Note		LEDL	MAXIMUM 2 X 2.88' PIECES PER 60W POWER SUPPLY
2		LEDL	LINEAR DRIVE DC 211D-LG

Note		LEDL	ROOM 337
3	SA-8'-11"	LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'
1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 335
3	SA-8'-11"	LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'
1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 333
3	SA-8'-11"	LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'
1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 331
3	SA-8'-11"	LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'
1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 329
3	SA-8'-11"	LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'
1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG

Note		LEDL	ROOM 327
3	SA-8'-11"	LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'
1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 325
2	SA-16'-3"	LEDL	XOOLINE HYD LD25 830/1255-DL-C002-IP40 length - 4.11'
2		LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'
1		LEDL	XOOLINE HYD LD25 830/0630-DL-C002-IP40 length - 2.06'
Note		LEDL	CONNECT MAXIMUM 2 X 4.11' PIECES IN SERIES
2		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
2		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
2		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
Note		LEDL	MAXIMUM 2 X 4.11' PIECES PER 80W POWER SUPPLY
2		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 325
3	SA-8'-9"	LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'
1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 323
3	SA-8'-11"	LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'
1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 321
3	SA-8'-11"	LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40

			length - 2.88'
1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 319
3	SA-8'-11"	LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'
1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 317
3	SA-8'-11"	LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'
1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 315
3	SA-8'-11"	LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'
1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	ROOM 313
3	SA-8'-11"	LEDL	CUSTOM XOOLINE HYD LD25 830/0880-DL-C002-IP40 length - 2.88'
1		LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1		LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1		SSLT	HLG-80H-24A 80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
Note		LEDL	COMMON AREA NORTH OF 354
1	SA-2'	LEDL	XOOLINE HYD LD25 830/0630-DL-C002-IP40

		LENGTH - 24.80"
1	LEDL	VARIOCON FEMALE MINI 2 X 0.34MM2 2M IP67 15000142
1	LEDL	VARIOCON FEMALE MINI PROTECTION CAP MONO 15000218
1	SSLT	HLG-40H-24A 40w 24v LED driver 90-305vac (on/off)
1	LEDL	LINEAR DRIVE DC 211D-LG
115	LEDL	ADJUSTABLE MOUNTING BRACKET 002/004 (SET OF 2) 13000082
15	LEDL	VARIOCON EXTENSION MINI 2 X 0.34MM2 0.1M IP67 15000143

Qut Cd D17-0024

To	**Project**
Melissa Cantin Villa Lighting Supply 2929 Chouteau Ave St Louis, MO 63103-2903 PH: (314) 531-2600 Fax (314) 531-8720	Job/Project Name: WEBSTER TYPE EB Entry Date: 4/5/2017

Qty	Type	Mfg	Description
		LEDL	VARIOLED HYDRA LD10 W825 (3300K) IP67 IN
		LEDL	003 CONTOUR W/ 30 DEG DIFFUSE LENS
		LEDL	1 RUN @ 17'
		LEDL	ACTUAL LENGTH = 16.65'
		LEDL	THE 17' LENGTH WILL BE MADE OF 4 X 4.16' PIECES
2	EB-17'	LEDL	VARIOLED HYDRA LD10 W825/1269MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS, 500MM BLACK
		LEDL	OPEN ON ONE END AND FEMALE BLACK CONNECT
2		LEDL	VARIOLED HYDRA LD10 W825/1269MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS, MALE BLACK
		LEDL	CONNECT ONLY
16		LEDL	VARIOCLIPS 003/006 45 DEG.
		LEDL	13000006-45
1		SSLT	HLG-60H-24A
		SSLT	60w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
		LEDL	
		LEDL	1 RUN @ 19'-5" (19.41')
		LEDL	ACTUAL LENGTH = 18.64'
		LEDL	THE 19'-5" LENGTH WILL BE MADE OF 3 X 6.21'
		LEDL	PIECES
1	EB-19'-5"	LEDL	VARIOLED HYDRA LD10 W825/1894MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS, 500MM BLACK
		LEDL	OPEN ON ONE END AND FEMALE BLACK CONNECT
1		LEDL	VARIOLED HYDRA LD10 W825/1894MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS, MALE BLACK
		LEDL	CONNECT ONLY
1		LEDL	VARIOLED HYDRA LD10 W825/1894MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS, 500MM BLACK
		LEDL	OPEN ON ONE END ONLY

18		LEDL	VARIOCLIPS 003/006 45 DEG.
		LEDL	13000006-45
1		SSLT	HLG-80H-24A
		SSLT	80w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
		LEDL	
		LEDL	3 RUNS @ 15'-9" (15.75')
		LEDL	ACTUAL LENGTH = 15.36'
		LEDL	EACH 15'-9" LENGTH WILL BE MADE OF 2 X 4.98'
		LEDL	+ 1 X 5.39' PIECES
3	EB-15'-9"	LEDL	VARIOLED HYDRA LD10 W825/1519MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS, 500MM BLACK
		LEDL	OPEN ON ONE END AND FEMALE BLACK CONNECT
3		LEDL	VARIOLED HYDRA LD10 W825/1644MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS
3		LEDL	VARIOLED HYDRA LD10 W825/1519MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS, MALE BLACK
		LEDL	CONNECT ONLY
45		LEDL	VARIOCLIPS 003/006 45 DEG.
		LEDL	13000006-45
3		SSLT	HLG-60H-24A
		SSLT	60w 24v LED driver 90-305vac (on/off)
3		LEDL	LINEAR DRIVE DC 211D-LG
		LEDL	
		LEDL	1 RUN @ 13'-6" (13.5')
		LEDL	ACTUAL LENGTH = 13.31'
		LEDL	THE 13'-6" LENGTH WILL BE MADE OF 2 X 4.57' +
		LEDL	1 X 4.16' PIECES
1	EB-13'-6"	LEDL	VARIOLED HYDRA LD10 W825/1394MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS, 500MM BLACK
		LEDL	OPEN ON ONE END AND FEMALE BLACK CONNECT
1		LEDL	VARIOLED HYDRA LD10 W825/1269MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS
1		LEDL	VARIOLED HYDRA LD10 W825/1394MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS, MALE BLACK
		LEDL	CONNECT ONLY
12		LEDL	VARIOCLIPS 003/006 45 DEG.
		LEDL	13000006-45
1		SSLT	HLG-60H-24A
		SSLT	60w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
		LEDL	
		LEDL	1 RUN @ 11'-1" (11.08')
		LEDL	ACTUAL LENGTH = 10.78'
		LEDL	THE 11'-1" LENGTH WILL BE MADE OF 2 X 5.39'
		LEDL	PIECES
1	EB-11'-1"	LEDL	VARIOLED HYDRA LD10 W825/1644MM IP67 IN

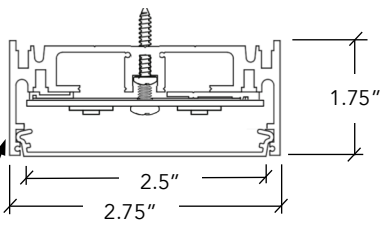
		LEDL	003 W/ 60 DEG DIFFUSE LENS, 500MM BLACK
		LEDL	OPEN ON ONE END AND FEMALE BLACK CONNECT
1		LEDL	VARIOLED HYDRA LD10 W825/1644MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS, MALE BLACK
		LEDL	CONNECT ONLY
10		LEDL	VARIOCLIPS 003/006 45 DEG.
		LEDL	13000006-45
1		SSLT	HLG-60H-24A
		SSLT	60w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
		LEDL	1 RUN @ 15'-6" (15.5')
		LEDL	ACTUAL LENGTH = 15.36'
		LEDL	THE 15'-6" LENGTH WILL BE MADE OF 2 X 4.98' +
		LEDL	1 X 5.39' PIECES
1	EB-15'-6"	LEDL	VARIOLED HYDRA LD10 W825/1519MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS, 500MM BLACK
		LEDL	OPEN ON ONE END AND FEMALE BLACK CONNECT
1		LEDL	VARIOLED HYDRA LD10 W825/1644MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS
1		LEDL	VARIOLED HYDRA LD10 W825/1519MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS, MALE BLACK
		LEDL	CONNECT ONLY
15		LEDL	VARIOCLIPS 003/006 45 DEG.
		LEDL	13000006-45
1		SSLT	HLG-60H-24A
		SSLT	60w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
		LEDL	
		LEDL	1 RUN @ 15'-10" (15.83')
		LEDL	ACTUAL LENGTH = 15.77'
		LEDL	THE 15'-10" LENGTH WILL BE MADE OF 2 X 5.39'
		LEDL	+ 1 X 4.98' PIECES
1	EB-15'-10"	LEDL	VARIOLED HYDRA LD10 W825/1644MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS, 500MM BLACK
		LEDL	OPEN ON ONE END AND FEMALE BLACK CONNECT
1		LEDL	VARIOLED HYDRA LD10 W825/1519MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS
1		LEDL	VARIOLED HYDRA LD10 W825/1644MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS, MALE BLACK
		LEDL	CONNECT ONLY
15		LEDL	VARIOCLIPS 003/006 45 DEG.
		LEDL	13000006-45
1		SSLT	HLG-60H-24A
		SSLT	60w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
		LEDL	
		LEDL	1 RUN @ 15'-7" (15.58')

		LEDL	ACTUAL LENGTH = 15.36'
		LEDL	THE 15'-7" LENGTH WILL BE MADE OF 2 X 4.98' +
		LEDL	1 X 5.39' PIECES
1	EB-15'-7"	LEDL	VARIOLED HYDRA LD10 W825/1519MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS, 500MM BLACK
		LEDL	OPEN ON ONE END AND FEMALE BLACK CONNECT
1		LEDL	VARIOLED HYDRA LD10 W825/1644MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS
1		LEDL	VARIOLED HYDRA LD10 W825/1519MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS, MALE BLACK
		LEDL	CONNECT ONLY
15		LEDL	VARIOCLIPS 003/006 45 DEG.
		LEDL	13000006-45
1		SSLT	HLG-60H-24A
		SSLT	60w 24v LED driver 90-305vac (on/off)
1		LEDL	LINEAR DRIVE DC 211D-LG
		LEDL	
		LEDL	2 RUNS @ 14'-6" (14.5')
		LEDL	ACTUAL LENGTH = 14.13'
		LEDL	EACH 14'-6" LENGTH WILL BE MADE OF 2 X 4.57'
		LEDL	+ 1 X 4.98' PIECES
2	EB-14'-6"	LEDL	VARIOLED HYDRA LD10 W825/1394MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS, 500MM BLACK
		LEDL	OPEN ON ONE END AND FEMALE BLACK CONNECT
2		LEDL	VARIOLED HYDRA LD10 W825/1519MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS
2		LEDL	VARIOLED HYDRA LD10 W825/1394MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS, MALE BLACK
		LEDL	CONNECT ONLY
24		LEDL	VARIOCLIPS 003/006 45 DEG.
		LEDL	13000006-45
2		SSLT	HLG-60H-24A
		SSLT	60w 24v LED driver 90-305vac (on/off)
2		LEDL	LINEAR DRIVE DC 211D-LG
		LEDL	
		LEDL	1 RUN @ 9'-8" (9.66')
		LEDL	ACTUAL LENGTH = 9.55'
		LEDL	THE 9'-8" LENGTH WILL BE MADE OF 1 X 4.57' +
		LEDL	1 X 4.98' PIECES
1	EB-9'-8"	LEDL	VARIOLED HYDRA LD10 W825/1394MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS, 500MM BLACK
		LEDL	OPEN ON ONE END AND FEMALE BLACK CONNECT
1		LEDL	VARIOLED HYDRA LD10 W825/1519MM IP67 IN
		LEDL	003 W/ 60 DEG DIFFUSE LENS, MALE BLACK
		LEDL	CONNECT ONLY
8		LEDL	VARIOCLIPS 003/006 45 DEG.
		LEDL	13000006-45

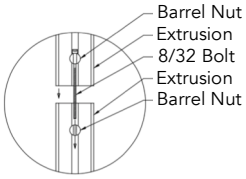
1	SSLT	HLG-40H-24A
	SSLT	40w 24v LED driver 90-305vac (on/off)
1	LEDL	LINEAR DRIVE DC 211D-LG
	LEDL	THE FOLLOWING ARE 6M IP68 CABLES. 1 PER RUN
	LEDL	(RUN SET UP) AS REQUIRED.
300	LEDL	VARIOCABLE MONO 2 X 0.34 MM2 IP68 - PER FT
	LEDL	14000030
	LEDL	THE ABOVE ITEM TO BE DONE IN 15 X 6M PIECES

Printed: 04/05/17 14:24:48 Per: TIM R LAMBERTH Email: tlamberth@ssltg.com

CROSS SECTION



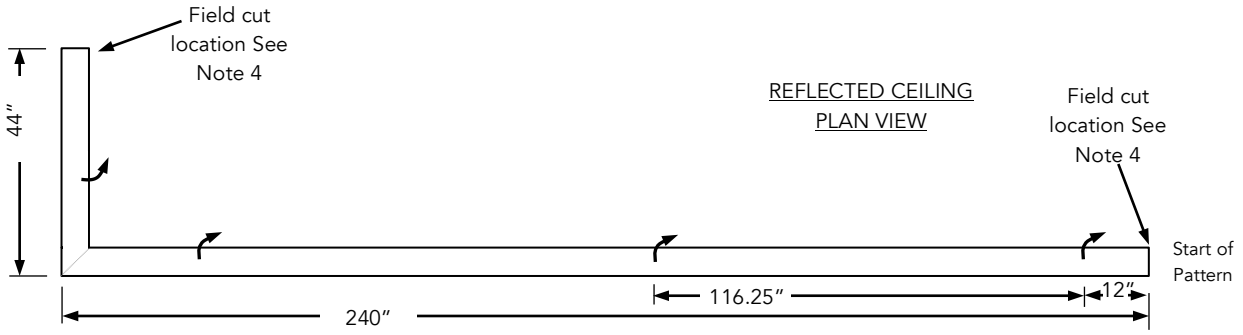
Entire Housing to be finished white.



STRAIGHT CONNECTION

Symbol = Feed cable exit location

1. 2.5″ wide acrylic white lens, continuous run up to 26ft. Snap in fit.
2. Extruded aluminum housing, 6005T5 material up to 12′ max length. Couple together via cross bolts to ensure straightness.
3. 3000K 85CRI LED in light guide. Mounted via screws 12″ O.C. #1AML = 4.9w/ft, 2AML = 9.8w/ft.
4. Housings with FC option may be field cut up to 6″ at end opposite feed cable. **Must use blade for non-ferrous material, 80 teeth minimum.**
   A. Cut both housing and LED panel in same pass (panel has NO LEDs in it initially)
   B. After cutting, remove the LED panel and return to factory in FedEx box provided.
   PANELS MUST BE RETURNED, EVEN IF NOT CUT, AS THEY ARE TEMPLATE & CANNOT BE DUPLICATED
   C. Install housings while factory adds LED boards to the cut panels. Allow1-2 weeks for panels.
5. CL2P cable - 75′ length exits back of fixture.
6. Remote power supply (not shown). Multiple fixtures connect to each power supply. 120-277Vac input, 24Vdc constant voltage output. #N100 = non-dim, #D010 = 0-10V dimmable. One power supply for every 200W.
7. Order length includes .125″ thick stamped end caps at end of pattern.



Approved by: _____

Date: _____

NOTE: **ALL DIMENSIONS TO BE VERIFIED OR CORRECTED UPON RELEASE**
ABOVE DRAWINGS NOT TO SCALE

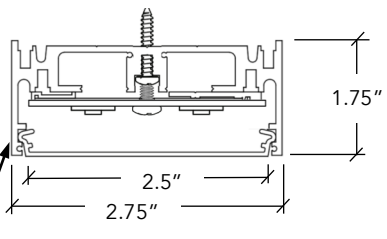
TYPE	CATALOG #	WATTAGE
BA LVL-1	HL25-2AML3-30-1-W-R-S-240FC-RT90-44FC-WH-in-CL2P75 / R-x-N100-UNV	237

REVISIONS	DESCRIPTION	DATE	BY

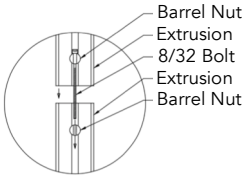
DESCRIPTION: Webster University Stairwell
CUSTOMER:
DRAWN BY: DZ
SCALE: N.T.S.
PROJECT NO.: 142-17
DATE: 5/10/17
SHEET: 1

dado lighting

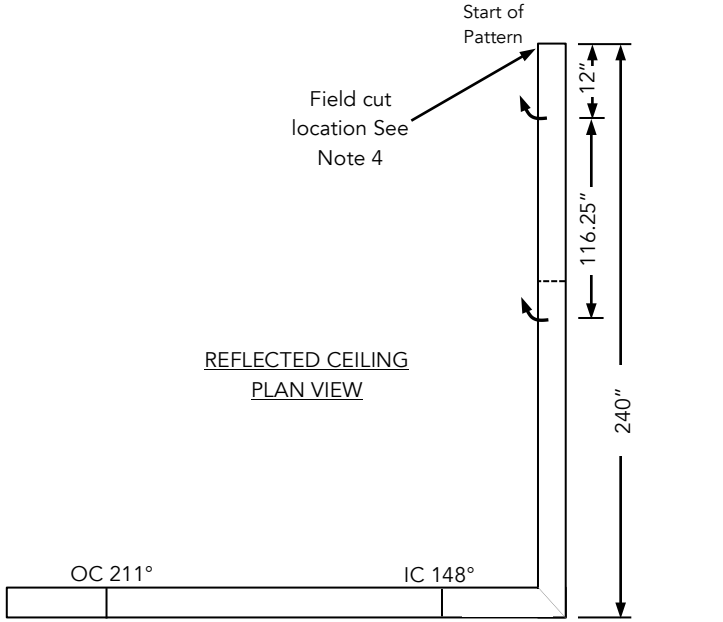
CROSS SECTION



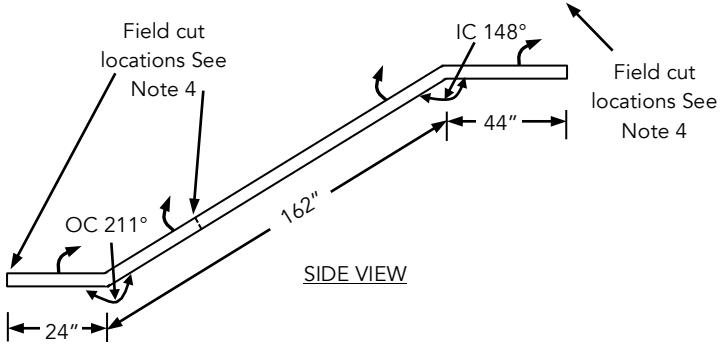
Entire Housing to be finished white.



STRAIGHT CONNECTION



REFLECTED CEILING PLAN VIEW



SIDE VIEW

Symbol = Feed cable exit location

1. 2.5″ wide acrylic white lens, continuous run up to 26ft. Snap in fit.
2. Extruded aluminum housing, 6005T5 material up to 12′ max length. Couple together via cross bolts to ensure straightness.
3. 3000K 85CRI LED in light guide. Mounted via screws 12″ O.C. #1AML = 4.9w/ft, 2AML = 9.8w/ft.
4. Housings with FC option may be field cut up to 6″ at end opposite feed cable. **Must use blade for non-ferrous material, 80 teeth minimum.**
   A. Cut both housing and LED panel in same pass (panel has NO LEDs in it initially)
   B. After cutting, remove the LED panel and return to factory in FedEx box provided.
   PANELS MUST BE RETURNED, EVEN IF NOT CUT, AS THEY ARE TEMPLATE & CANNOT BE DUPLICATED
   C. Install housings while factory adds LED boards to the cut panels. Allow1-2 weeks for panels.
5. CL2P cable – 75′ length exits back of fixture. Up to 10′ of #12 wire can be added in field to reach power supply. Consult factory for longer cables if j-box cannot be within 25ft of fixture.
6. Remote power supply (not shown). Multiple fixtures connect to each power supply. 120-277Vac input, 24Vdc constant voltage output. #N100 = non-dim, #D010 = 0-10V dimmable. One power supply for every 200W.
7. Order length includes .125″ thick stamped end caps at ends of pattern.

Approved by: _____

Date: _____

NOTE: **ALL DIMENSIONS TO BE VERIFIED OR CORRECTED UPON RELEASE**
ABOVE DRAWINGS NOT TO SCALE

TYPE	CATALOG #	WATTAGE
BA LVL-2	HL25-2AML3-30-1-W-R-S-240FC-RT90-44FC-IC148-162FC-OC211-24FC-WH-in-CL2P75 / R-x-N100-UNV	385

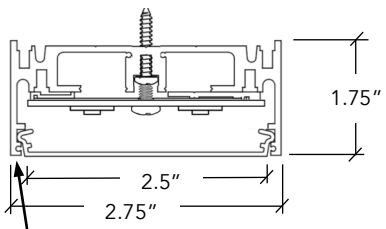
REVISIONS

DESCRIPTION	DATE	BY

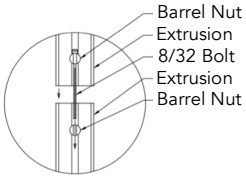
DESCRIPTION: Webster University Stairwell
CUSTOMER:
DRAWN BY: DZ
SCALE: N.T.S.
PROJECT NO.: 142-17
DATE: 5/10/17
SHEET: 2

dado lighting

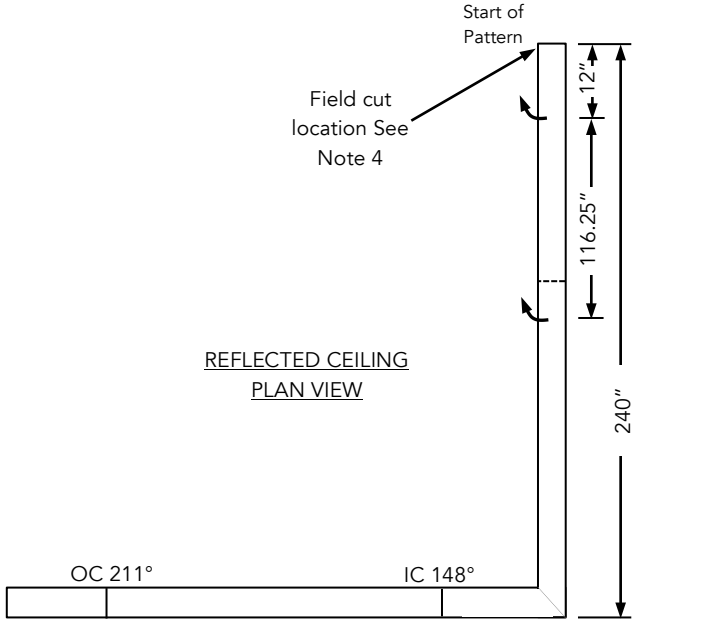
CROSS SECTION



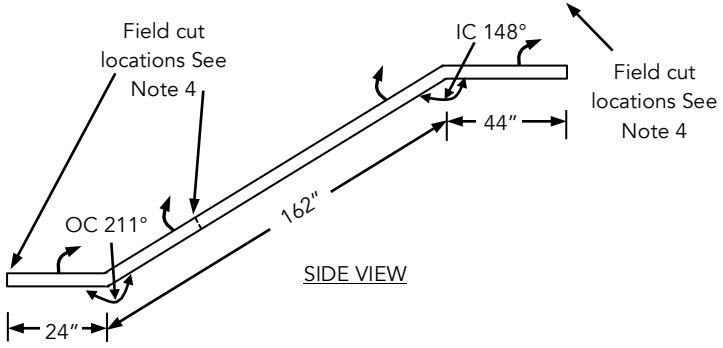
Visible lips of housing to be finished white.



STRAIGHT CONNECTION



REFLECTED CEILING PLAN VIEW



SIDE VIEW

Symbol = Feed cable exit location

1. 2.5″ wide acrylic white lens, continuous run up to 26ft. Snap in fit.
2. Extruded aluminum housing, 6005T5 material up to 12′ max length. Couple together via cross bolts to ensure straightness.
3. 3000K 85CRI LED in light guide. Mounted via screws 12″ O.C. #1AML = 4.9w/ft, 2AML = 9.8w/ft.
4. Housings with FC option may be field cut up to 6″ at end opposite feed cable. **Must use blade for non-ferrous material, 80 teeth minimum.**
   A. Cut both housing and LED panel in same pass (panel has NO LEDs in it initially)
   B. After cutting, remove the LED panel and return to factory in FedEx box provided.
   PANELS MUST BE RETURNED, EVEN IF NOT CUT, AS THEY ARE TEMPLATE & CANNOT BE DUPLICATED
   C. Install housings while factory adds LED boards to the cut panels. Allow1-2 weeks for panels.
5. CL2P cable – 75′ length exits back of fixture. Up to 10′ of #12 wire can be added in field to reach power supply. Consult factory for longer cables if j-box cannot be within 25ft of fixture.
6. Remote power supply (not shown). Multiple fixtures connect to each power supply. 120-277Vac input, 24Vdc constant voltage output. #N100 = non-dim, #D010 = 0-10V dimmable. One power supply for every 200W.
7. Order length includes .125″ thick stamped end caps at ends of pattern.

Approved by: _____

Date: _____

NOTE: **ALL DIMENSIONS TO BE VERIFIED OR CORRECTED UPON RELEASE**
ABOVE DRAWINGS NOT TO SCALE

TYPE	CATALOG #	WATTAGE
BA LVL-3	HL25-2AML3-30-1-W-R-S-240FC-RT90-44FC-IC148-162FC-OC211-24FC-WHE-in-CL2P75 / R-x-N100-UNV	385

REVISIONS	DESCRIPTION	DATE	BY

DESCRIPTION: Webster University Stairwell
CUSTOMER:
DRAWN BY: DZ
SCALE: N.T.S.
PROJECT NO.: 142-17
DATE: 5/10/17
SHEET: 3

dado lighting

Automatic Controls equipment systems, inc.
St. Louis, MO, 63128
T: (314) 722-2727 F: (314) 722-2728

Project Name: Webster University - Interdisciplinary Science Building Lighting Controls
Project Number: WU-02-16
Drawing Designation: [redacted]
Drawing Date: [redacted]

Page	Manufacturer	Part Number	Part Description
2	Acuity Controls	CM-PDT-9-R	Ceiling Mount Occupancy Sensor, Dual Technology (PIR/Microphonics), Small Motion 360°, Low Voltage Relay
5	Acuity Controls	WV-16-R	Wide View Occupancy Sensor, PIR, w/ Low Voltage Relay
7	Acuity Controls	WV-PDT-16-R	Dual Technology Wide View Occupancy Sensor w/ Low Voltage Relay
9	Automated Logic	AMR	ARCnet to MS/TP Router
11	Blue Ridge Technologies	CTS1CH-WH	Capacitive Touch Station, 1 Channel, White (wallplate not included)
11	Blue Ridge Technologies	CTS1RL-WH	Capacitive Touch Station, 1 Raise/Lower, White (wallplate not included)
11	Blue Ridge Technologies	CTS3PR-WH	Capacitive Touch Station, 3 Preset, White (wallplate not included)
11	Blue Ridge Technologies	CTS2RL-WH	Capacitive Touch Station, 2 Raise/Lower, White (wallplate not included)
13	Blue Ridge Technologies	LS24O	Light Level Sensor, 10VDC, Indoor, 0-50FC, Recessed Ceiling Mount
15	Blue Ridge Technologies	RPDS08-08-0-XO-10	Relay Panel Dimming Standard, 8 Relay Capacity
15	Blue Ridge Technologies	RPDS08-08-0-00-10	Relay Panel Dimming Standard, 8 Relay Capacity
17	Blue Ridge Technologies	RPDS16-16-4-X1-20	Relay Panel Dimming Standard, 16 Relay Capacity
19	Blue Ridge Technologies	SCDS-X1	Satellite, Dimming Standard, UL924, 120/277
21	Blue Ridge Technologies	SCDS-00	Satellite, Dimming Standard, 120/277
21	Blue Ridge Technologies	SCSS-00	Satellite, Switching Standard, 120/277
23	Blue Ridge Technologies	ZCDS-X1-00	Zone Controller, Dimming Standard, UL924, 120/277
25	Blue Ridge Technologies	ZCDS-00-00	Zone Controller, Dimming Standard, 120/277
27	IR-Tec	BPD-500-SR-L	IR-TEC Light Level Sensor, 10VDC Linear Photodiode, Indoor, 0-50FC, Recessed Ceiling Mount

Catalog Number: | Date: | Project:

OVERVIEW

The **CM** family of ceiling mount occupancy sensors provide a range sensor solutions for applications with finished ceilings (e.g. ceiling tiles, sheetrock, plaster). **CM** family sensors utilize 100% digital Passive Infrared (PIR) detection and are available with several lens options, providing flexibility for multiple mounting height and coverage pattern requirements. Dual technology (**PDT**) occupancy detection can also be added as an option for applications where occupants are stationary for long periods of time.

FEATURES

- 360° coverage pattern
- Push- button programmable, adjustable time delays, and multiple operating modes
- 100 hr lamp burn-in timer
- No field calibration or sensitivity adjustments required
- Convenient test mode
- Green LED indicator

SPECIFICATIONS

Size:	4.55" diameter and 1.55" deep
Weight:	6 oz
Mounting:	3.5" octagon box, ceiling tile surface, single gang box
Color:	White
Operating Voltage:	12-24 VAC/VDC
Current Draw:	Standard 4 mA ,w/ **R** option 16 mA
Dimming Load:	Sinks <20 mA; ~40 Ballasts @ .5 mA each
Rcmd. Power Pack:	**PP20**

ROHS compliant

AcuityControls Sensor Switch

CM
CM PDT





Warranty

Five-year limited warranty. Complete warranty terms located at:
www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx

Note: Actual performance may differ as a result of end-user environment and application.

Specifications subject to change without notice.

c UL US LISTED

ORDERING INFORMATION

CM Family					Example: CM PDT 11 R LT
Series	**Detection Technology**	**Coverage Type**	**Relay**	**Additional Features (choose 1)**	**Temp / Humidity**
CM Ceiling Mount Sensor	[blank] PIR PDT* Dual Technology (PIR/ Microphonics)	6 High Bay 360° 9 Small Motion 360° 10 Large Motion 360° 11 Hallway	[blank] None R Low Voltage Relay	[blank] None D Occupancy Controlled Dimming P Photocell ADC** Photocell w/ Dimming	[blank] Standard LT Low Temp/ High humidity

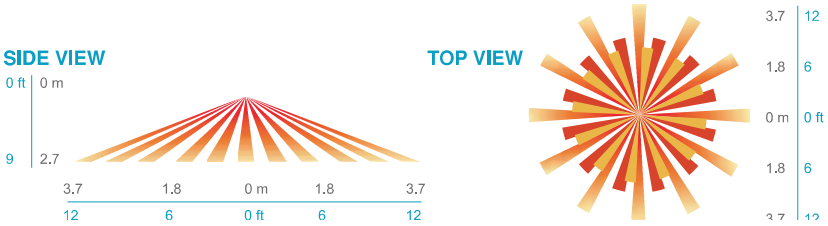
* **PDT** option not available on **CM 6** models
** **ADC** option not available on **CM6** models

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COVERAGE PATTERNS

SMALL MOTION 360 (Model # CM 9/ CM PDT 9[1])

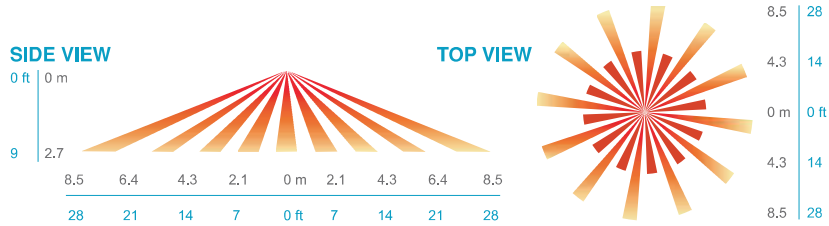
- Best choice for small motion (e.g. hand movements) detection
- 360 conical shaped pattern
- Provides 12 ft (3.66 m) radial coverage (~500 ft²) when mounted to standard 9 ft (2.74 m) ceiling
- 8 to 15 ft (2.44 to 4.57 m) mounting heights provide 10 to 20 ft (3.05 to 6.10 m) radial coverage
- Lens assembly is marked with a gray ring around lens to differentiate versus the #10 lens



[1] Sensors with Microphonics™ provides overlapping detection of human activity over the complete PIR coverage area. Advanced filtering is also utilized to prevent non-occupant noises from keeping the lights on.

LARGE MOTION 360 (Model # CM 10/ CM PDT 10[1])

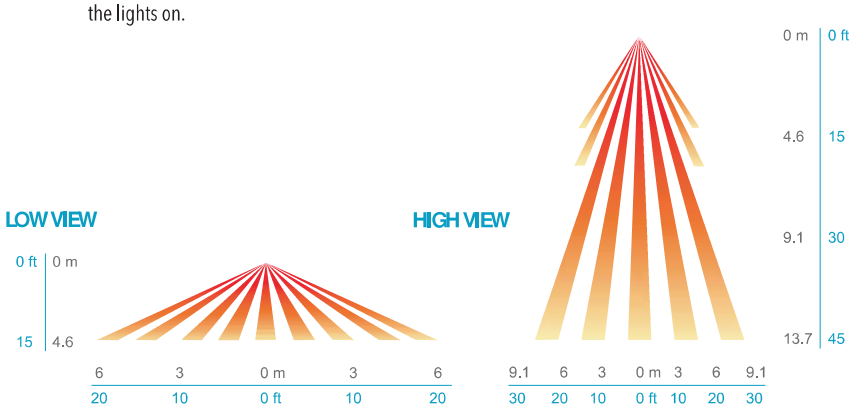
- Best choice for large motion detection (e.g. walking)
- 360 conical shaped pattern
- Provides ~24 ft (7.32 m) radial coverage (~2000 ft²) when mounted at 9 ft (2.74 m)
- 7 to 15 ft (2.13 to 4.57 m) mounting heights provide 16 to 36 ft (4.88 to 10.97 m) radial coverage
- Detection range improves when walking across beams compared to into beams



[1] Sensors with Microphonics™ provides overlapping detection of human activity over the complete PIR coverage area. Advanced filtering is also utilized to prevent non-occupant noises from keeping the lights on.

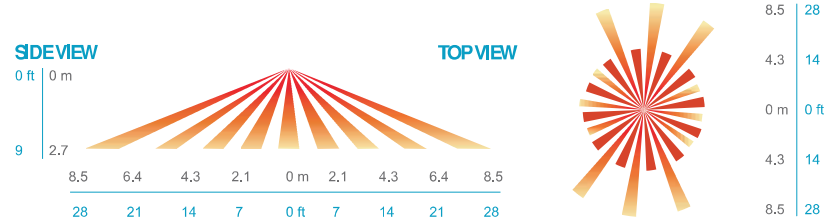
HIGH MOUNT 360 (Model # CM 6)

- Best choice for 15 to 45 ft (4.57 to 13.72 m) mounting heights
- 15 to 20 ft (4.57 to 6.10 m) radial coverage overlaps area lit by a typical high bay fixture
- Excellent detection of large motion (e.g. walking) up to 35 ft (10.76 m)
- Excellent detection of extra large motion (e.g. forklifts) up to a 45 ft (13.72 m)



HIGH MOUNT HALLWAY (Model # CM 11/CM PDT 11[1])

- Best choice for large motion detection
- Provides 28 ft (8.53 m) of coverage when mounted to standard 9 ft (2.74 m) ceiling
- 7 to 15 ft (2.13 to 4.57m) mounting heights provide 16 to 36 ft (4.88 to 10.97m) hallway coverage



[1] Sensors with Microphonics™ provides overlapping detection of human activity over the complete PIR coverage area. Advanced filtering is also utilized to prevent non-occupant noises from keeping the lights on.

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WIRING (DO NOT WIRE HOT)

STANDARD WIRING

RED - Power Input (12-24 VAC/VDC)
BLACK - Common

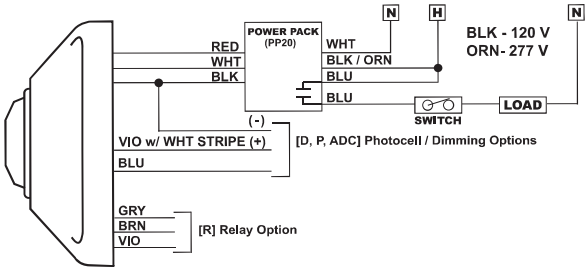
WHITE - Occupancy State (high VDC for occupied)

PHOTOCELL/DIMMING OPTIONS (D, P, ADC)

BLUE - Direct output to power pack for providing photocell control and/or secondary dim time out. Output is high VDC with occupancy & low light. Output also held high during secondary dim time out. For multi-level control, use two power packs and connect White wire to primary load and Blue to daylight load.

VIOLET w/ WHITE STRIPE - Connect to 0-10 VDC control wire (typically Violet) from 0-10 VDC dimmable ballast

GRAY from Ballast - Connect to sensor Black wire

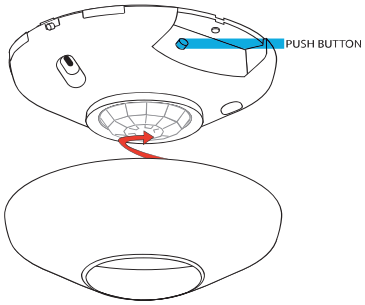


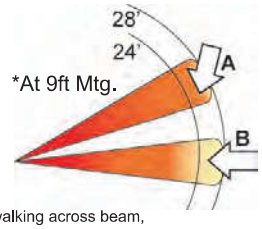
RELAY OPTION (R)

GRAY / BROWN - Connected during occupied state
VIOLET / BROWN - Connected during unoccupied state
Note: Relay is energized during unoccupied state

INSTALLATION

- Mount sensor directly to a ceiling tile or a metallic grid (two self-tapping screws provided).
- Sensor's mounting holes also align with 3.5" octagon or single gang handy box (screws not provided).
- Sensor will detect motions crossing segments more effectively than motions parallel to beams.
- For optimal detection, position sensor such that segments are crossed upon entrance and unable to view outside the space.
- **PDT** models: For maximum Microphonics sensitivity avoid locating sensor near HVAC air diffusers





A: When walking across beam, detection will occur at approximately 28 feet. (8.53 m)
B: When walking into beam, detection will occur at approximately 24 feet. (7.32 m)

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Catalog Number:	Date:	Project:

OVERVIEW

The **WV 16** Series Wide View occupancy sensor is designed to mount in a corner and detect small motions up to 40 ft (12.19 m) away, and larger motions up to 70 ft (21.34 m) away. This makes it ideal for 30 ft x 30 ft (9.14 m x 9.14 m) classrooms or corridors up to 70 ft (21.34 m) long (for specific long narrow hallway applications, see **HW13** product data sheet). The enclosure's convenient tilting feature enables the sensor to be mounted at any height from 8 to 10 ft (2.44 to 3.05 m). When corner or wall mounting is not possible, the **WV BR** bracket accessory can be used to mount the **WV 16** to the ceiling. Additionally, the **WV 16** may be used in combination with other sensors to customize coverage for very large or irregularly shaped spaces. For rooms with obstructions, use the **WV PDT 16** Series sensor which adds Microphonics™ detection.

FEATURES

- 100% Digital PIR Detection, Excellent RF Immunity
- 120 by 40 ft (12.19 m) Coverage for Small Motion
- Adjustable Time Delay
- Push-Button Programmable
- Convenient Test Mode
- No Field Calibration or Sensitivity Adjustments Required
- 100 hr Lamp Burn-in Timer

SPECIFICATIONS

Size:	3.0" H x 3.6" W x 1.75" D (7.62 cm x 9.14 cm x 4.45 cm)
Weight:	5 oz
Mounting:	Directly to corner or to ceiling using **WV BR** bracket
Color:	White
Operating Voltage:	12-24 VAC/VDC
Current Draw:	Standard, 4 mA
	w/ **R** option, 16 mA
Rcmd Power Pack:	**PP20**

ROHS compliant

AcuityControls Sensor Switch™

WV 16
Wide View Sensor



Warranty

Five-year limited warranty. Complete warranty terms located at:
www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx

Note: Actual performance may differ as a result of end-user environment and application.

Specifications subject to change without notice.

c UL US LISTED

ORDERING INFORMATION

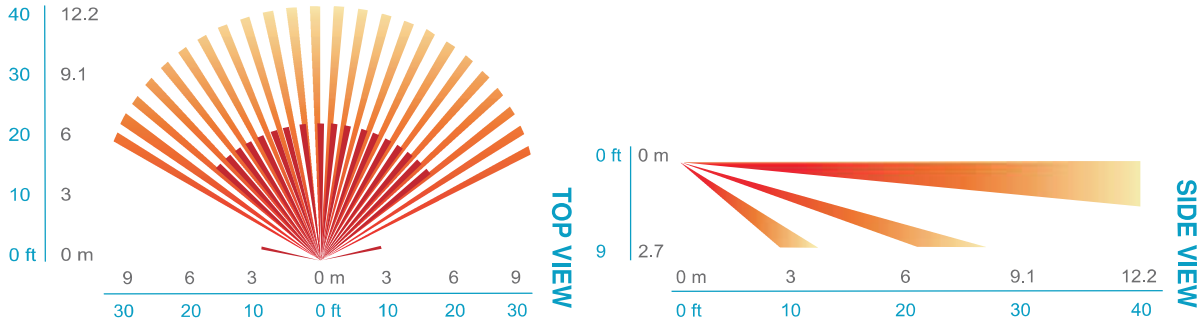
WV 16									Example: WV 16 R LT KIT
Series		**Relay**		**Photocell**		**Temp / Humidity**		**Bracket Kit**	
WV 16	Wide View Sensor	[blank]	None	[blank]	None	[blank]	Standard	[blank]	Sensor Only
		R	Low Voltage Relay	P	Photocell	LT	Low Temp	KIT	Sensor & WV BR Bracket

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COVERAGE PATTERN

16 WIDE VIEW LENS

- Small motion (e.g. hand movements) detection up to 40 ft (12.19 m).
- Large motion (e.g. walking) detection up to 70 ft (21.34 m).
- Designed for 8 to 10 ft (2.44 to 3.05 m) high mounting in room corner



WIRING (DO NOT WIRE HOT)

STANDARD WIRING

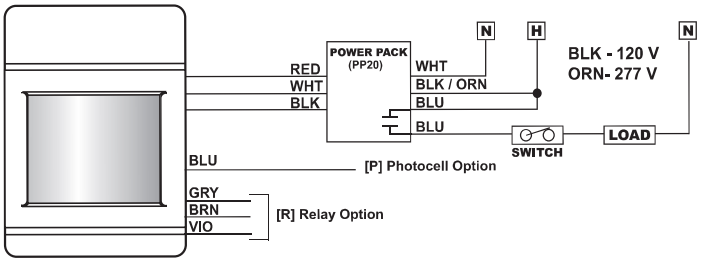
RED - Power Input (12-24 VAC/ VDC)
BLACK - Common
WHITE - Occupancy State (high VDC for occupied)

PHOTOCELL/DIMMING OPTIONS (P)

BLUE - Direct output to power pack for providing photocell control. Output is high VDC with occupancy & low light. For multi-level control, use two power packs and connect White wire to primary load and Blue to daylight load.

RELAY OPTION (R)

GRAY / BROWN - Connected during occupied state
VIOLET / BROWN - Connected during unoccupied state
Note: Relay is energized during unoccupied state



WV 16 (TS-WV-001A)

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Catalog Number:	Date:	Project:

OVERVIEW

Classrooms are the ideal application for the **WV PDT 16** Dual Technology Wide View Sensor. Installed in the corner of the room along the entrance wall, this inconspicuous sensor provides line of sight PIR detection of small movements up to 40 ft (12.19 m) away, and combines overlapping Microphonics™ for detection around obstructions. Many classrooms are filled with shelving, projects, or lab benches. Total coverage of the room is always maintained no matter how cluttered the space becomes. The **WV PDT 16** is also used in corridors due to its ability to view up to 70 ft (21.34 m) for walking motions, or large open storage areas where obstructions may block the PIR's ability to view. For large lecture halls, multiple **WV PDT 16**s may be wired together, or along with any other low voltage sensors.

FEATURES

- 100% Digital PIR Detection, Excellent RF Immunity
- 120 by 40 ft (12.19 m) Coverage for Small Motion
- Patented Dual Technology with PIR / Microphonics Detection
- Adjustable Time Delay
- Push-Button Programmable
- Convenient Test Mode
- No Field Calibration or Sensitivity Adjustments Required
- 100 hr Lamp Burn-in Timer

SPECIFICATIONS

Size:	3.0" H x 3.6" W x 1.75" D (7.62 cm x 9.14 cm x 4.45 cm)
Weight:	5 oz
Mounting:	Directly to corner or to ceiling using **WV BR** bracket
Color:	White
Operating Voltage:	12-24 VAC/VDC
Current Draw:	Standard, 4 mA
	w/ **R** option, 16 mA
Rcmd Power Pack:	**PP20**

ROHS Compliant, Title 24 Component

AcuityControls Sensor Switch

WV PDT 16
Wide View Sensor



Warranty

Five-year limited warranty. Complete warranty terms located at:
www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx

Note: Actual performance may differ as a result of end-user environment and application.

Specifications subject to change without notice.

c UL US LISTED

ORDERING INFORMATION

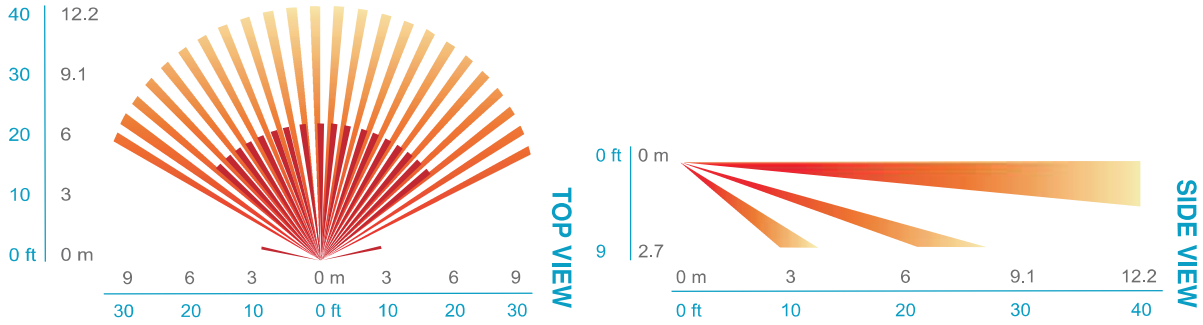
WV PDT 16									Example: WV PDT 16 R LT KIT
Series		**Relay**		**Photocell**		**Temp / Humidity**		**Bracket Kit**	
WV PDT 16	Wide View Sensor	[blank]	None	[blank]	None	[blank]	Standard	[blank]	Sensor Only
		R	Low Voltage Relay	P	Photocell	LT	Low Temp	KIT	Sensor & WV BR Bracket

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COVERAGE PATTERN

16 WIDE VIEW LENS

- Small motion (e.g. hand movements) detection up to 40 ft (12.19 m).
- Large motion (e.g. walking) detection up to 70 ft (21.34 m).
- Designed for 8 to 10 ft (2.44 to 3.05 m) high mounting in room corner



WIRING (DO NOT WIRE HOT)

STANDARD WIRING

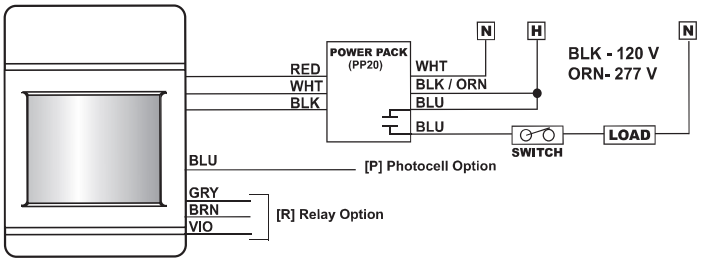
RED - Power Input (12-24 VAC/ VDC)
BLACK - Common
WHITE - Occupancy State (high VDC for occupied)

PHOTOCELL/DIMMING OPTIONS (P)

BLUE - Direct output to power pack for providing photocell control. Output is high VDC with occupancy & low light. For multi-level control, use two power packs and connect White wire to primary load and Blue to daylight load.

RELAY OPTION (R)

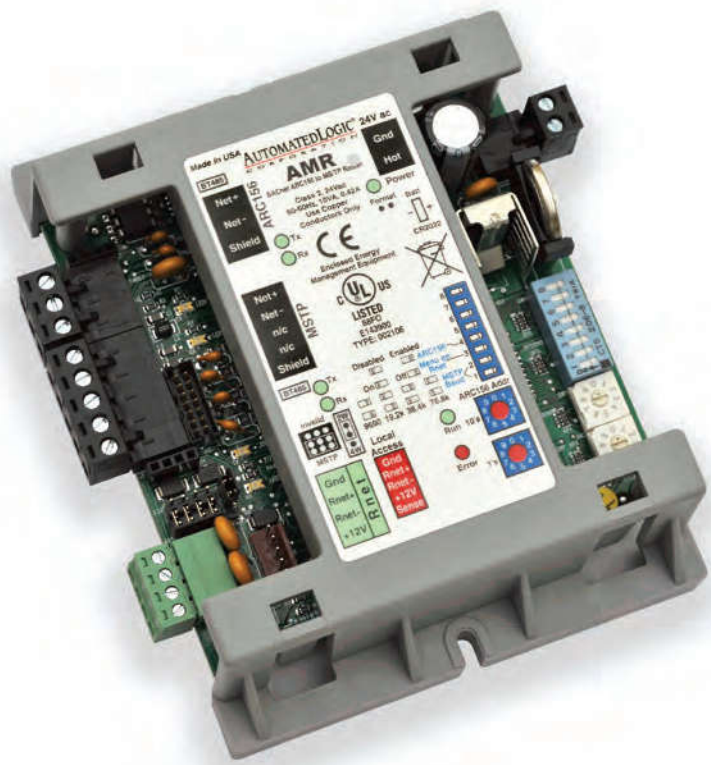
GRAY / BROWN - Connected during occupied state
VIOLET / BROWN - Connected during unoccupied state
Note: Relay is energized during unoccupied state



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AMR

BACnet MS/TP Connectivity Made Simple!



Automated Logic's AMR makes routing between ARC156 to BACnet MS/TP networks easy! The AMR is compact, rugged and cost effective, enabling faster ARC156 BACnet networks to be routed to slower MS/TP devices or networks.

Key Features and Benefits

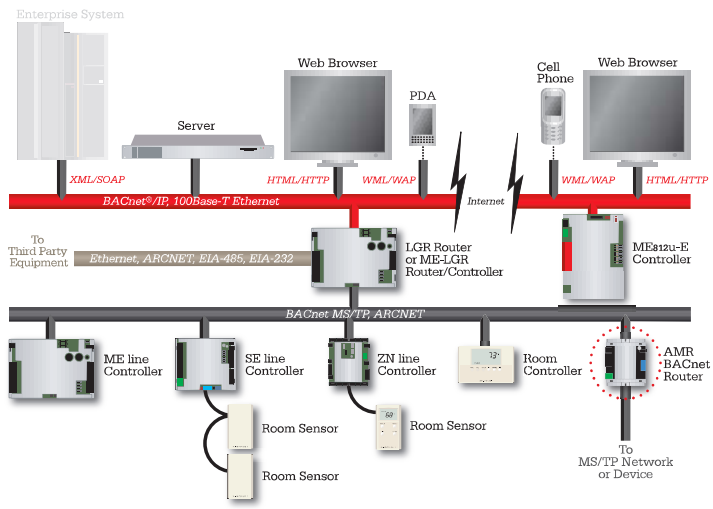
- Serves as an economical field router to a single piece of equipment/device using BACnet MS/TP or a network of devices that communicate using BACnet MS/TP. (Note: Recommended maximum is 32 BACnet MS/TP devices.)
- Rotary address switches for setting the AMR's network address.
- Rnet port for local communication and driver download.
- Battery-backed real-time clock + RAM ensures continuous operation during power failures and communications failures.
- Flash memory allows for easy field upgrades over network.
- 16-bit microprocessor combined with ARCNET 156 kbps communications offers ample horsepower and speed for equipment integration requirements.

AUTOMATEDLOGIC®
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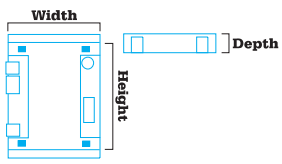
CSAMR

AMR

Specifications



BACnet Support:	Conforms to the Advanced Application Controller (B-AAC) Standard Device Profile as defined in ANSI/ASHRAE Standard 135-2004 (BACnet) Annex L.
Communication:	The following ports are available: - ARC156 port for communication with the ARC156 network. - MSTP port for communication with the MS/TP network on EIA-485 (2-wire). The AMR acts as a master device on the MS/TP network. - Local Access port for system start-up and troubleshooting. - Rnet port not used.
Microprocessor:	High speed 16-bit microprocessor with ARCNET communication co-processor.
Memory:	1 MB non-volatile battery-backed RAM, 4 MB Flash memory, 16-bit memory bus.
Real-time Clock:	Battery-backed real-time clock keeps track of time in event of power failure.
Battery:	10-year Lithium CR2032 battery provides a minimum of 10,000 hours of data retention during power outages.
Status Indicators:	LED's indicate status of communications, running, errors, and power.
Protection:	Incoming power and network connections are protected by non-replaceable internal solid-state polyswitches that reset themselves when the condition that causes a fault returns to normal. The power and network connections are also protected against voltage transient and surge events.
BT485 Connector:	A BT485 is attached to a control module at the beginning and end of a network segment to add bias and to terminate a network segment.
Listings:	UL-916 (PAZX), cUL-916 (PAZX7), FCC Part 15-Subpart B-Class A, CE EN50082-1997.
Environmental Operating Range:	0 to 130°F (-17.8 to 54.4°C), 10–90% relative humidity, non-condensing. NOTE: Control module must be installed within the building.
Power Requirements:	24 Vac ±10%, 50–60 Hz, 10 VA, single Class 2 source only 20 VA or less. 26 Vdc ±10%, 5W.
Physical:	Rugged GE C2950 Cycoloy plastic.
Weight:	0.4 lbs (0.2 kg).
Dimensions:	4" (10.2cm) width by 5" (12.7cm) height.
Mounting:	5 9/16" (14.1 cm) between mounting slot centerlines. Recommended panel depth: 1.75" (5.1 cm)



Automated Logic Corporation . 1150 Roberts Boulevard . Kennesaw, Georgia 30144 . 770/429-3000 . Fax 770/429-3001 . www.automatedlogic.com

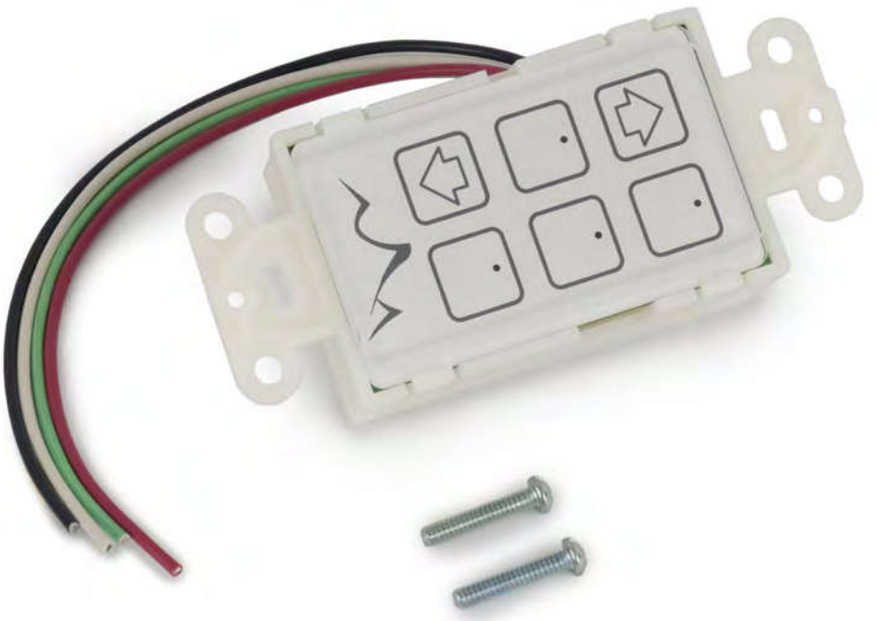
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BLUE RIDGE TECHNOLOGIES™
UNIFIED LIGHTING CONTROL

Capacitive Touch Station

Project | Part Number | Ref.

Data Sheet : Catalog Page 70



Overview

Capacitive Touch Stations (CTS) provide local occupant interface on the CANbus Network. CTS are available in three versions; Channel On/Off, Channel Raise/Lower, and Preset, with several button layouts. The CTS interface features LED and audible chirp indication as well as schedule transition warnings. CTS fit decorator style wall plates, are gang-able with other devices, and are available in four standard colors.

Features

Resides on CANbus Network
Available Colors: Black, Gray, Light Almond, or White
Fits decorator style wall plates
Gang-able with other decorator style devices
Cleaning mode for wipe down without disturbing lights
Extended life cycle
- No moving switch parts
- LED indicator

Preset Station applicable on platforms w/dimming capable Controller Board only

General Specifications

Construction: Acrylic face, ABS/polycarbonate back box / mounting frame
Dimensions:
  Station: 4.13”(105mm)H x 1.75”(44mm)W x 1.13”(29mm)D
  Capacitive Touch Surface: 0.5”(13mm)H x 0.5”(13mm)W per button
Weight: 3oz (85g)
Mounting: Standard single gang or multi-gang switch box, (2) #6/32 screws (included), and Decorator style wall plate (not included)
Operating Environment: 32-125°F (0-50°C), 20-95%RH, non-condensing

Warranty

Two (2) year limited manufacturer warranty from date of shipment (extended warranty optional)

Power

Power / Draw: 24VDC / 15mA per CTS

CANbus Specifications

Network Slot / Address: DIP switch selectable
Topology: Daisy Chain Wiring only
Wire Requirement: CL3P, 18AWG Two Twisted Pairs
Max 1300’ (396m), 120Ω characteristic impedance, capacitance conductor-to-conductor 15pF/ft
Network Termination: DIP switch

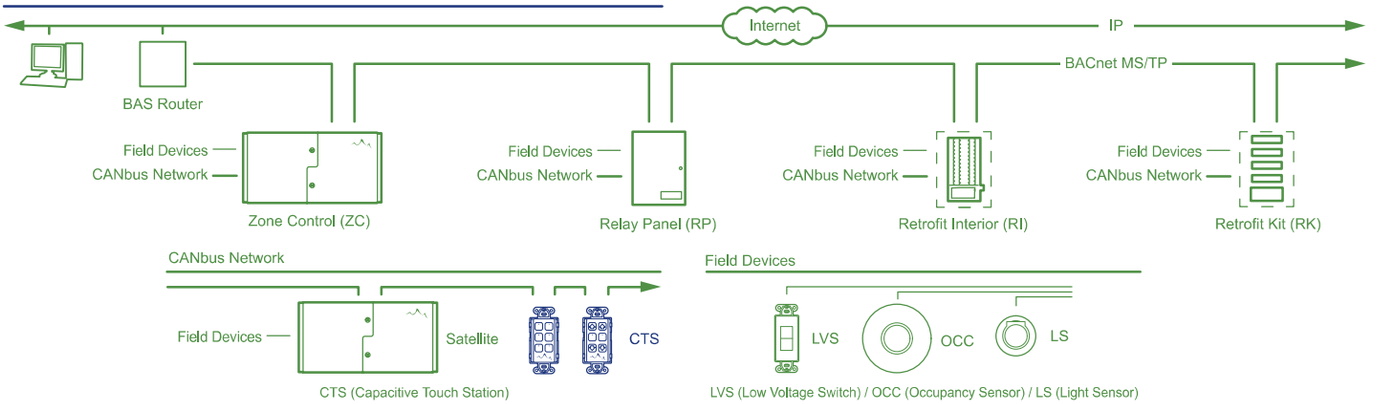
Station Specifications

Button Layout
  Channel On/Off: 1, 2, 3, 4, and 6
  Channel Raise/Lower: 3 (raise, lower, and On/Off), 6 (2 raise, 2 lower, and 2 On/Off)
  Preset: 6 (preset 1, 2, 3, raise, lower, and On/Off), 6 (preset 1, 2, 3, 4, 5, and 6)
Button Operation
  On/Off and Preset: Momentary On/Off
  Raise/Lower: Press and hold for raise or lower
Indicator Operation (On/Off and Preset Buttons)
  Audible Indication: Chirp when button is pressed
  LED Status Indication: LED is on when associated lighting is on. LED is dimly lit when associated lighting is off providing locator light.
  LED Schedule Transition Warning: Rapid blinking
Button Configuration
  Button-channel links are stored in the Controller Board Configuration Database.
  Default: Buttons have a default setting enabling basic function before system configuration.
  Channel On/Off: Each button is linked to a Channel
  Channel Raise/Lower: Each set of buttons is linked to a Channel
  Preset: Each button is linked to Preset
3-way / 4-way Operation: Requires CTS of same type and button layout. Accomplished by using same network address (may require additional power).

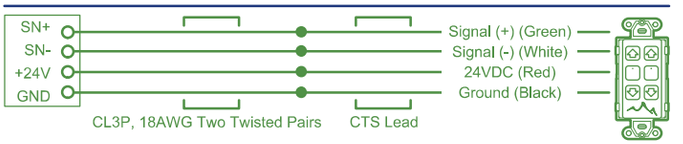
Capacitive Touch Station

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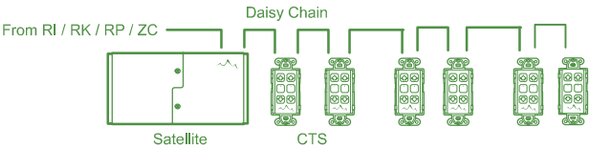
General Architecture



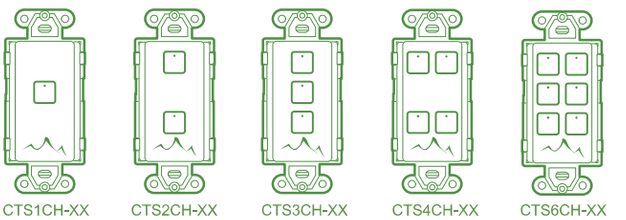
RI / RK / RP / ZC / Satellite Terminations



CANbus Network Structure



Button Layout Options





Ordering Information

CTS X XX - XX

Channel or Preset Quantity

X = 1	1 Channel (On-Off) or 1 Channel (Raise-Lower)
2	2 Channels (On-Off) or 2 Channels (Raise-Lower)
3	3 Channels (On-Off) or 3 Presets
4	4 Channels (On-Off)
6	6 Channels (On-Off) or 6 Presets

Station Configuration

XX = CH	Channel On-Off Station
RL	Raise-Lower Station
PR	Preset Station (platforms w/dimming capable Controller Board only)

Color Options

XX = WH	White

Custom colors including Black, Grey, and Light Almond are available contact Blue Ridge Technologies for details

BLUE RIDGE TECHNOLOGIES™
UNIFIED LIGHTING CONTROL

Light Sensor 24

Project		Part Number		Ref.	

Data Sheet : Catalog Page 78



Overview
LS24 is a photodiode light level sensor compatible with Aperio Platform products. The 0-10VDC signal converts to both Foot-candle (FC) and LUX values to facilitate local as well as BAS daylight harvesting functions. LS24 features a compact white polymer housing and is available for atrium, indoor, outdoor, or skylight applications.

Features
UL and ETL Listed
Compatible with all platforms
Available for various applications

General Specifications
Construction: White polymer
Approximate Weight: 1oz(30g)
Operating Environment: -40-140°F (-40-60°C)

Photodiode Specifications
Type: Blue enhanced photodiode
Signal: 0-10VDC linear
Time Response: 10 second full range
Tolerance: 12%
Repeatability: +/-0.5%
Linearity: 2%
Temperature: +/-10%

Electrical Specifications
Power Input / Draw: 24VDC / 1mA
Leads: 6”(152mm)L,18AWG, 3-wire
- Red: 24VDC
- Black: Common
- Yellow: Signal

Certifications
UL Listed, UL916, US/Canada
ETL Listed, US/Canada
NEC Class 2
CEC Title 24
RoHS

Warranty
Two (2) year limited manufacturer warranty from date of shipment (extended warranty optional)

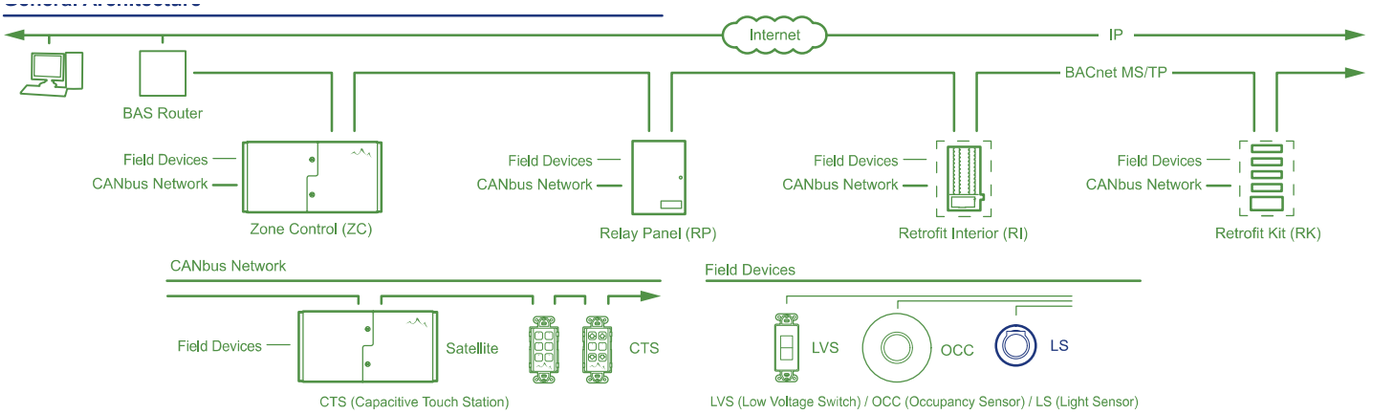
Atrium Sensor (LS24A) Specifications
Dimensions: 2.19”(56mm) Protrusion when mounted x 1.31”(33mm)Dia.
Mounting Method: Male 1/2”NPT / 1/2”Knockout
Mounting Orientation: Sensor window horizontal
Sensor Range: 0-1000FC

Outdoor Sensor (LS24O) Specifications
Dimensions: 2.19”(56mm) Protrusion when mounted x 1.31”(33mm)Dia.
Mounting Method: Male 1/2” NPT / 1/2”Knockout
Mounting Orientation: Sensor window horizontal with hood up
Sensor Range: 0-250FC

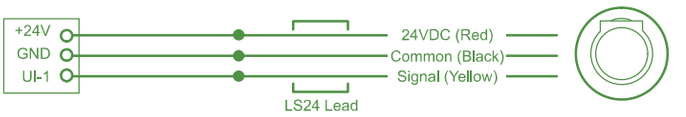
Sky Light Sensor (LS24S) Specifications
Dimensions: 2.19”(56mm) Protrusion when mounted x 1.31”(33mm)Dia.
Mounting Method: Male 1/2” NPT / 1/2”Knockout
Mounting Orientation: Sensor window up
Sensor Range: 0-2000FC

Light Sensor 24

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Universal Input Terminations



Ordering Information

Part Number	Description
LS24A	Light Level Sensor, 10VDC Linear Photodiode for Atrium Use
LS24O	Light Level Sensor, 10VDC Linear Photodiode for Outdoor Use
LS24S	Light Level Sensor, 10VDC Linear Photodiode for Sky Light Use

BLUE RIDGE TECHNOLOGIES™
UNIFIED LIGHTING CONTROL

Relay Panel 08

Project | Part Number | Ref.



Overview
Relay Panel (RP) is a UL Listed lighting control panel. RP may be scheduled from any BACnet BAS and is compatible with all low voltage switches, occupancy sensors, and light level sensors. RP mounts near the circuit breaker panel to provide centralized control of branch lighting circuits. Relay Panel 08 (RP08) features up to 8 Lighting Tough Relays (LTR) and a removable door.

Features
UL Listed
Switching and Dimming (DLH / Presets) models available
BACnet MS/TP communication to BAS network
Sub network for Satellite and Capacitive Touch Stations (CTS)
Line and low voltage compartment separation
Upgradable Controller Board firmware
Available 347VAC Transformer

General Specifications
Construction: 16ga steel with black powder coat finish
Dimensions:
- Enclosure: 14.75”(375mm)H x 13.00”(330mm)W x 5.75”(146mm)D
- Door Surface Mount: 14.94”(379mm)H x 13.16”(334mm)W

Weight: 20.5lbs(9.3 kg)
Mounting: Surface mounted
Operating Environment: 32-125°F (0-50°C), 20-95%RH, non-condensing, Type 1 (dry / indoor environment)

Certifications
UL Listed, UL916 Standard for Energy Management Equipment, US/Canada
FCC Part 15
CEC Title 24
Electronics meet or exceed IEC Level 3

Warranty
Two (2) year limited manufacturer warranty from date of shipment (extended warranty optional).

Firmware Specifications (Controller Board)
Platform: Aperio Open Control Platform
Time Clock: Real-time clock with BACnet time sync
Schedule: BACnet Schedule, Monday – Sunday, Holidays, and Exceptions
Non-Volatile Memory: 16MB total, 2MB for trend data (15min trend requires 2K per day)
RAM: 2MB total, data stored in non-volatile memory upon power loss
Configuration: Tech Kit 2.0(see data sheet for details)
Configuration Connection: Micro-B USB or Bluetooth Wireless

Low Voltage Specifications (Controller Board)
Power In: 24VAC +/-10%, 30VA, 50-60 Hz
Auxiliary Out: 24VAC, 800mA (devices with full wave rectified power supply only)
Universal Input (UI) and Satellite / Station Network Power Out: 24VDC, 200mA total
Universal Input: 24 two-wire inputs
Universal Input Software Configuration:
- Digital Input (DI)
- Analog Input (AI): 0-5VDC, 0-10VDC, or 4-20mA

Universal Input Wire Requirement / Maximum Length: 18AWG (Solid or Stranded) / 500’(152m)

BAS Network Specifications
Protocol: BACnet MS/TP
Baud Rate: DIP switch selectable 9.6K, 19.2K, 38.4K, 76.8K, or 115.2K
Device Profile: BACnet Advance Application Controller (AAC)
Address Range: 1 – 99 selectable with rotary dials
Unit Load: 1/8 unit load
Topology: RS-485, half duplex, daisy chain wiring
Wire Requirement / Maximum Length: CL3P, 22AWG, 2 conductor, shielded, low cap / 4000’(1216m)
Points: See *PIC Statement*

Satellite / Station Network Specifications
Compatible with CTS and Satellite devices. See data sheet for details.

Transformer Specifications
Type: 30VA Inherently Limited
Primary: Dual Tap 120 or 277VAC +/-10%, 30VA, 50-60 Hz
Secondary: 24VAC +/-10% Inherently Limited
Wire Requirement: 18AWG Minimum (Solid or Stranded)

LTR Specifications
Type:
- UL Listed
- SPST latching with manual override lever
- Electrically operated mechanically held, pulse driven
- Short Circuit Current Rating (SCCR) 30,000A @ 277 VAC

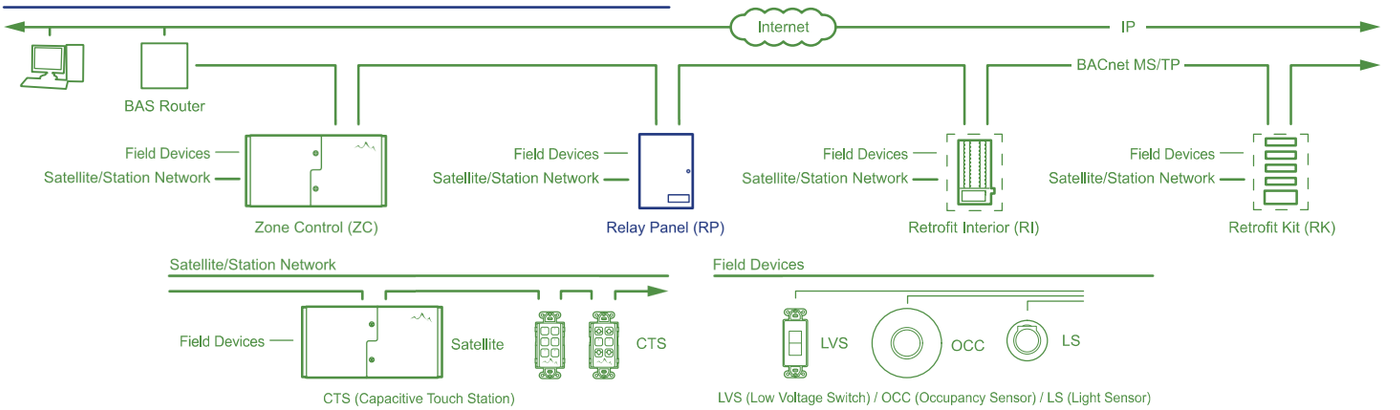
Maximum Ratings: Tungsten 20A @ 347VAC / Ballast 30A @ 347VAC / Resistive 20A @ 347VAC / 1.5HP @ 120VAC
Load Terminal: Universal screw terminal, box type clamp
Terminal Capacity (per side): (2) 14-10AWG or (1) 8AWG (Solid or Stranded copper wire)

Optional Equipment Specifications
347 Transformer Specifications
- Type: 50VA Inherently Limited UL Listed
- Primary: Single Tap 347VAC, 50VA, 60 Hz
- Secondary: 24VAC +/-10% Inherently Limited
- Wire Requirement: 18AWG Minimum (Solid or Stranded)

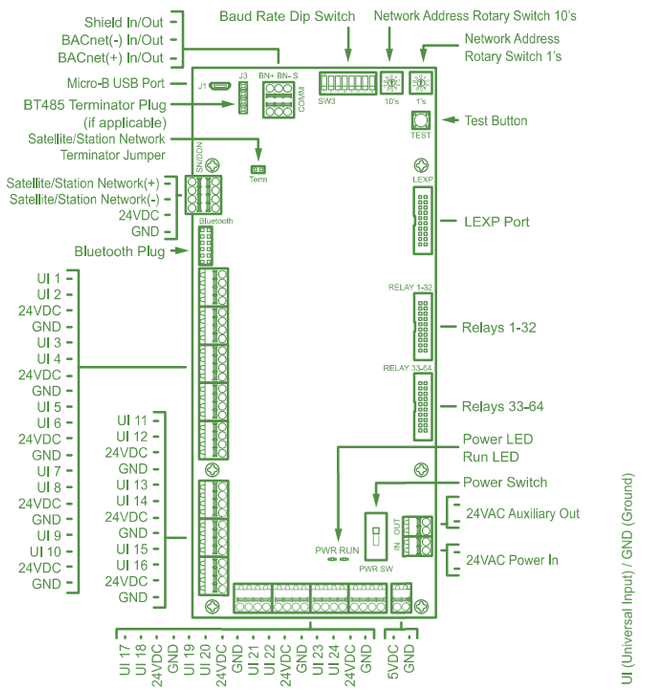
Relay Panel 08

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General Architecture



Controller Board Terminations



Ordering Information

RP XX 08 - XX - X

Controller Board Options

XX = SS Switching Standard: Supports Satellite / CTS for Switching Applications

DS Dimming Standard: Supports Satellite / CTS for Dimming (DLH) Applications

Quantity of Relays Installed

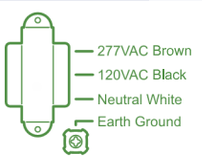
XX = 01 thru 08 Up to 8 Relays Installed

Power Options

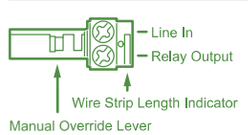
X = 0 120 / 277VAC Transformer

1 347VAC Transformer

Transformer Terminations



LTR Terminations



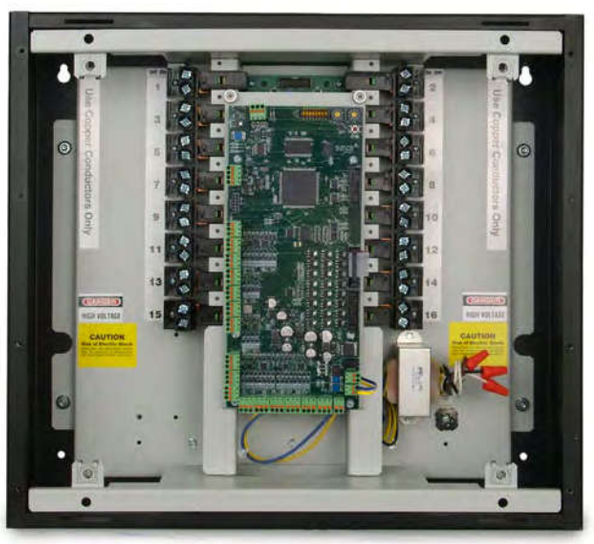
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UNIFIED LIGHTING CONTROL

Relay Panel 16

Project | Part Number | Ref.

Overview

Relay Panel (RP) is a UL Listed lighting control panel. RP may be scheduled from any BACnet BAS and is compatible with all low voltage switches, occupancy sensors, and light level sensors. RP mounts near the circuit breaker panel to provide centralized control of branch lighting circuits. Relay Panel 16 (RP16) features up to 16 Lighting Tough Relays (LTR) in a black powder coated steel enclosure with a hinged reversible door.



Features

UL Listed
Switching and Dimming (DLH / Presets) models available
BACnet MS/TP communication to BAS network
Sub network for Satellite and Capacitive Touch Stations (CTS)
Line and low voltage compartment separation
Upgradable Controller Board firmware
Available options:

- Low/Line Voltage Bays
- Multi-pole Lighting Contactors
- 24VAC Auxiliary Transformer
- 24VDC Power Supply
- BACnet IP Router
- UL924 Emergency Bypass
- 347VAC Transformer

General Specifications

Construction: 16ga steel with black powder coat finish
Dimensions:
  Enclosure: 16.20”(411mm)H x 18.00”(457mm)W x 5.75”(146mm)D
  Door Surface Mount: 16.45”(418mm)H x 18.08”(459mm)W
  Door Recessed (Flush):17.70”(450mm)H x 19.58”(497mm)W
Weight: 32lbs(14.5kg)
Mounting: Surface or recess mounted
Operating Environment: 32-125°F (0-50°C), 20-95%RH, non-condensing, Type 1 (dry / indoor environment)

Certifications

UL Listed, UL916 Standard for Energy Management Equipment, US/Canada
FCC Part 15
CEC Title 24
Electronics meet or exceed IEC Level 3

Warranty

Two (2) year limited manufacturer warranty from date of shipment (extended warranty optional).

Firmware Specifications (Controller Board)

Platform: Aperio Open Control Platform
Time Clock: Real-time clock with BACnet time sync
Schedule: BACnet Schedule, Monday – Sunday, Holidays, and Exceptions
Non-Volatile Memory: 16MB total, 2MB for trend data (15min trend requires 2K per day)
RAM: 2MB total, data stored in non-volatile memory upon power loss
Configuration: Tech Kit 2.0 (see data sheet for details)
Configuration Connection: Micro-B USB or Bluetooth Wireless

Low Voltage Specifications (Controller Board)

Power In: 24VAC +/-10%, 30VA, 50-60 Hz
Auxiliary Out: 24VAC, 800mA (devices with full wave rectified power supply only)
Universal Input (UI) and Satellite / Station Network Power Out: 24VDC, 200mA total
Universal Input: 24 two-wire inputs
Universal Input Software Configuration:
  Digital Input (DI)
  Analog Input (AI): 0-5VDC, 0-10VDC, or 4-20mA
Universal Input Wire Requirement / Maximum Length: 18AWG (Solid or Stranded) / 500’(152m)

BAS Network Specifications

Protocol: BACnet MS/TP
Baud Rate: DIP switch selectable 9.6K, 19.2K, 38.4K, 76.8K, or 115.2K
Device Profile: BACnet Advance Application Controller (AAC)
Address Range: 1 – 99 selectable with rotary dials
Unit Load: 1/8 unit load
Topology: RS-485, half duplex, daisy chain wiring
Wire Requirement / Maximum Length: CL3P, 22AWG, 2 conductor, shielded, low cap / 4000’(1216m)
Points: See *PIC Statement*

Satellite / Station Network Specifications

Compatible with CTS and Satellite devices. See data sheet for details.

Transformer Specifications

Type: 30VA Inherently Limited
Primary: Dual Tap 120 or 277VAC +/-10%, 30VA, 50-60 Hz
Secondary: 24VAC +/-10% Inherently Limited
Wire Requirement: 18AWG Minimum (Solid or Stranded)

LTR Specifications

Type:
  UL Listed
  SPST latching with manual override lever
  Electrically operated mechanically held, pulse driven
  Short Circuit Current Rating (SCCR) 30,000A @ 277 VAC
Maximum Ratings: Tungsten 20A @ 347VAC / Ballast 30A @ 347VAC / Resistive 20A @ 347VAC / 1.5HP @ 120VAC
Load Terminal: Universal screw terminal, box type clamp
Terminal Capacity (per side): (2) 14-10AWG or (1) 8AWG (Solid or Stranded copper wire)

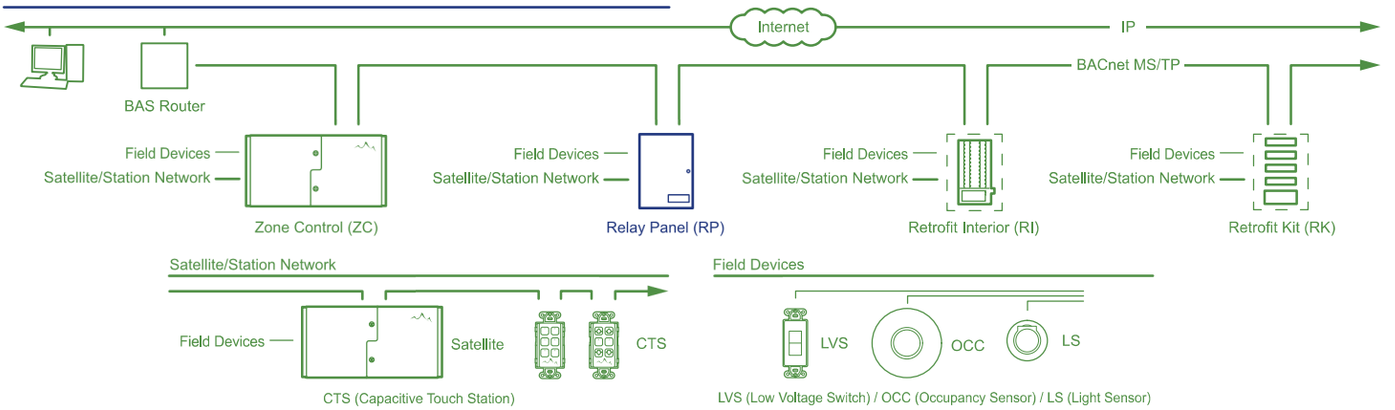
Optional Equipment Specifications

See Relay Panel Optional Equipment Data Sheet

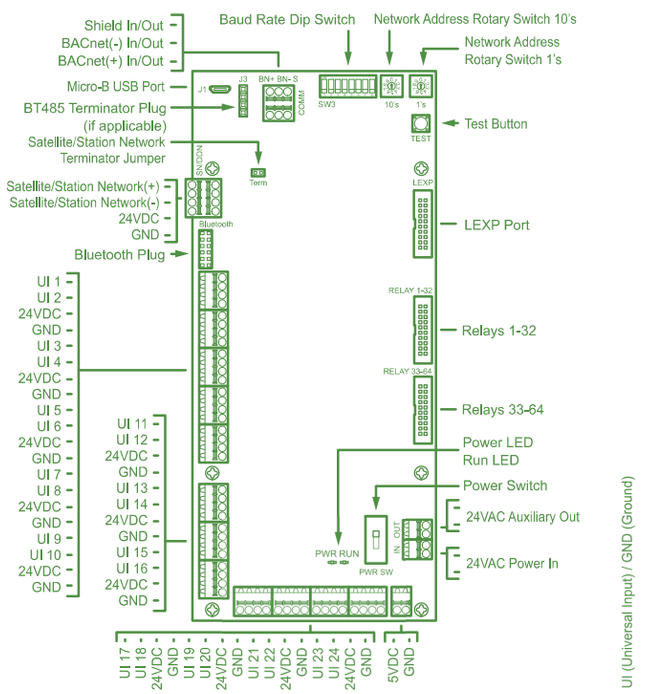
Relay Panel 16

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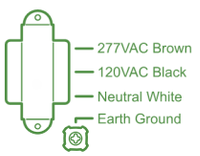
General Architecture



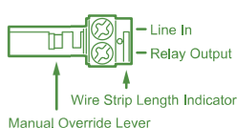
Controller Board Terminations



Transformer Terminations



LTR Terminations



Ordering Information*

RP XX 16 - XX - X - XX - XX - XX

Controller Board Options

XX = SS	Switching Standard: Supports Satellite / CTS for Switching Applications
DS	Dimming Standard: Supports Satellite / CTS for Dimming (DLH) Applications

Quantity of Relays Installed

XX = 01 thru 16	Up to 16 Relays Installed

Power Options

X = 0	120 / 277VAC Transformer
1	347VAC Transformer
2	120 / 277VAC Transformer + 120 / 277VAC Auxiliary Transformer
3	347VAC Transformer + 347VAC Auxiliary Transformer

Special Options

XX = 00	None
X1	UL924 Emergency Bypass (Relays 1-16 only)

Low Voltage Bay Options (Bottom of Panel)

XX = Blank	None
L1	9" Bay
LA	9" Bay + (1) 2.5A 24VDC Power Supply
LB	9" Bay + (2) 2.5A 24VDC Power Supply
LC	9" Bay + (1) BACnet IP Router
LD	9" Bay + (1) BACnet IP Router + (1) 2.5A 24VDC Power Supply
LE	9" Bay + (1) BACnet IP Router + (2) 2.5A 24VDC Power Supply

Line Voltage Bay Options with Dead Front Cover (Top of Panel)

XX = Blank	None
H1	9" Bay
HA	9" Bay + (1) 4 Pole 30A Electrically Held Lighting Contactor, 120V Coil
HB	9" Bay + (2) 4 Pole 30A Electrically Held Lighting Contactor, 120V Coil
HC	9" Bay + (4) 4 Pole 30A Electrically Held Lighting Contactor, 120V Coil
HD	9" Bay + (1) 4 Pole 30A Electrically Held Lighting Contactor, 277V Coil
HE	9" Bay + (2) 4 Pole 30A Electrically Held Lighting Contactor, 277V Coil
HF	9" Bay + (4) 4 Pole 30A Electrically Held Lighting Contactor, 277V Coil

* See Price List for Recessed (Flush) door panels.

BLUE RIDGE TECHNOLOGIES™
UNIFIED LIGHTING CONTROL

Satellite UL924

Project		Part Number		Ref.	



Overview
Satellite is a distributed lighting control expander that includes an additional circuit for control of emergency lighting during normal operation and provides emergency function during power loss.

Features
UL924 Emergency Function
Plenum Rated
Resides on CANbus Network
Line and low voltage compartment separation
Additional Inputs and Outputs
- 6 Universal Inputs
- 2 Line Voltage Inputs
- 2 Relay Outputs
- 2 Analog Outputs on dimming model

Dimming model applicable on platforms w/dimming capable Controller Board only

General Specifications
Construction: 20ga steel white powder coat finish
Dimensions: 5.063"(129mm)H x 10.00"(254mm)W x 2.50"(64mm)D
Weight: 3lbs (1.36kg)
Mounting: 4" or 4 11/16" junction box (Check local code requirements)
Operating Environment: 0-140°F(-18-60°C), 10-90% RH, non-condensing
Type 1 (dry / indoor environment)
Plenum Rated

Power
Input: 120- 277VAC, 50/60hz, +/- 10%, single phase, 20A circuit
Output: 24VDC,, 200mA total

Certifications
UL Listed, UL916/UL924, US/Canada
FCC Part 15
CEC Title 24
Electronics meet or exceed IEC Level 3

Warranty
Two (2) year limited manufacturer warranty from date of shipment (extended warranty optional).

Line Voltage Specifications (FI-1 Board)
Relay Maximum Load Rating per Circuit: 20A tungsten @120VAC, 20A ballast @ 277VAC, 20A resistive @ 277VAC, 1.5HP @ 120 VAC
Line In: Powers ZC and feeds Relay Output 1
Line In 2: Feeds Relay Output 2
Relay: 2 mechanically latching relays with manual override lever
Relay Status: Opto-isolated Power Tap (PT) on load side of relay contacts
Line Voltage Input: 2 inputs, utilize same power as Line 1 or 2
Line Voltage Input Type: Configurable for maintained or state-change
Wire Requirement: 14-10AWG (Solid or Stranded copper wire only)

Low Voltage Specifications (FI-2 Board)
Universal Input (UI)
Universal Input: 6 two-wire inputs
Universal Input Software Configuration:
Digital Input (DI)
Analog Input (AI): 0-5VDC, 0-10VDC, or 4-20mA
Universal Input Wire Requirement / Maximum Length: 18AWG (Solid or Stranded) / 500'(152m)
Analog Output: 2 outputs
Analog Output Compatibility: 0-10VDC dimming ballasts (see *Ballast Compatibility Data Sheet* for details)
Analog Output Sink / Source: 100mA / 5mA per output
Analog Output Wire Requirement / Maximum Length: 18AWG (Solid or Stranded) / 1,000' (304m)

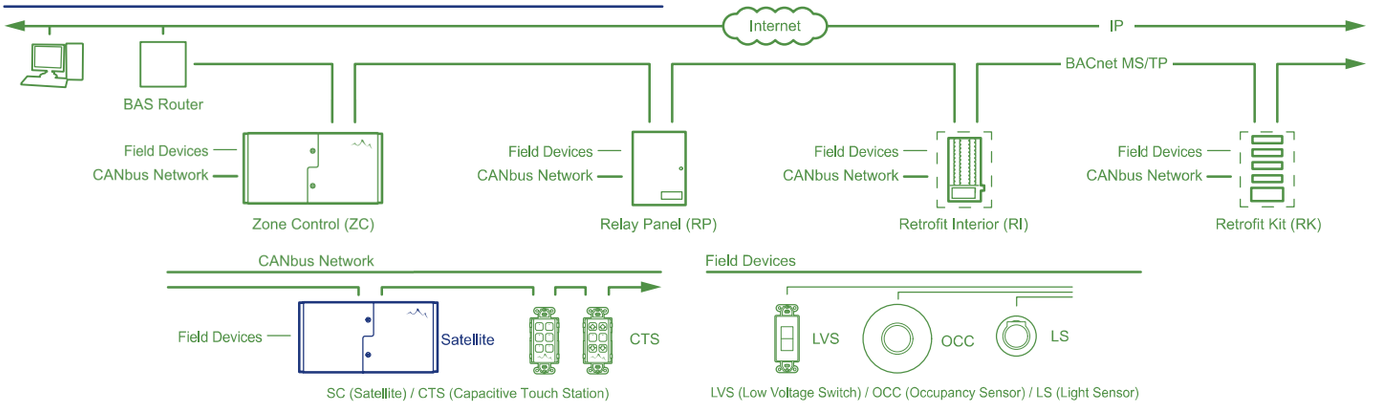
CANbus Specifications
Protocol: CANbus
Maximum Satellite: 3 ZC Standard, 12 ZC Extended, 16 RI / RP (RI / RP are limited to a maximum of 64 zones including those added with Satellite
CANbus Network Slot: Rotary dial selectable
Topology: Daisy Chain Wiring only
Wire Requirement / Maximum Length: CL3P, 18AWG, Twisted Pairs, 4 conductors,
Unshielded / 1300'(396.24m)
Network Termination: Jumper

Sequence of Operations
1. Emergency circuit is controlled by Relay 2. The SC UL924 configuration jumper is set for Emergency Action Close Relay 2.
2. Power loss is detected by the SC UL924.
3. Emergency circuit controlled by Relay 2 is forced ON. Analog Outputs also move to full output (applicable on dimming SC only). No external power source or input is required for SC UL924 emergency function.
4. Relay 1 remains in present state (On/Off).
5. Generator transfer switch (not located in the SC UL924) reacts and allows generator to feed dedicated emergency circuits previously fed by normal (utility) power. Relay 2 is already ON, so the only possible source of delay in emergency lighting is the generator or emergency transfer switch.
6. Dedicated emergency lighting circuit will remain On while emergency power source is applied.
7. Normal power is restored and the emergency transfer switch returns all circuits to normal power.
8. Relay 2 will remain On and Analog Outputs will maintain full output during normal power restoration.
9. Relay 1 remains in present state (On/Off).
10. SC UL924 resumes normal control of Relays as well as Analog Outputs and returns lighting to the correct level.

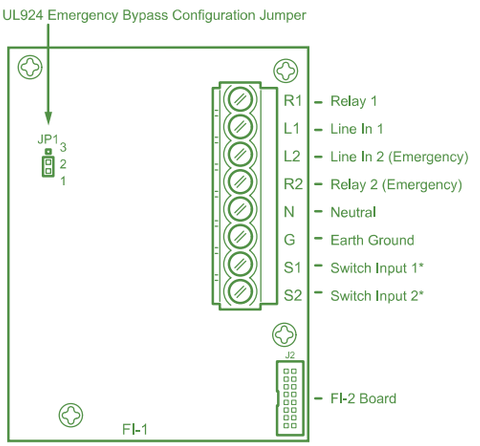
Satellite UL924

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General Architecture

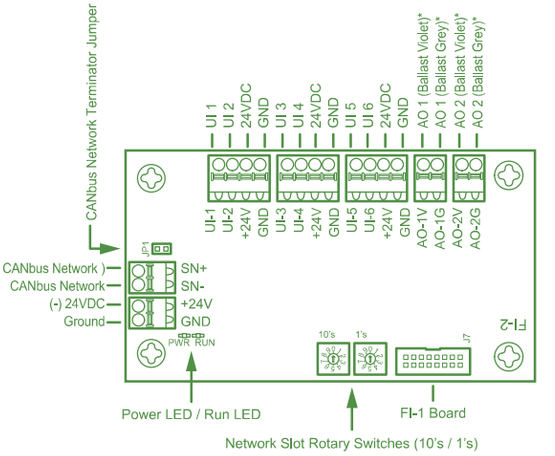


FI-1 Board Terminations



*Must utilize same power source as Line In 1 or Line In 2.

FI-2 Board Terminations



*Applicable on Satellite with Dimming Option only.

Ordering Information

SC XX - X1

Controller Options	
XX = SS	Switching
DS	Dimming (platforms w/dimming capable Controller Board only)

BLUE RIDGE TECHNOLOGIES™
UNIFIED LIGHTING CONTROL

Satellite

Project		Part Number		Ref.	

Data Sheet : Catalog Page 68



Overview
Satellite is a distributed lighting control expander. This compact junction box mounted package provides additional input and output capacity on the CANbus Network. Satellite is available for switching and dimming applications.

Features
UL Listed and Plenum Rated
Resides on CANbus Network with Capacitive Touch Stations (CTS)
Line and low voltage compartment separation
Additional Inputs and Outputs
- 6 Universal Inputs
- 2 Line Voltage Inputs
- 2 Relay Outputs
- 2 Analog Outputs on dimming model

Dimming model applicable on platforms w/dimming capable Controller Board only

General Specifications
Construction: 20ga steel white powder coat finish
Dimensions: 5.063”(129mm)H x 10.00”(254mm)W x 2.50”(64mm)D
Weight: 3lbs (1.36kg)
Mounting: 4” or 4 11/16” junction box (Check local code requirements)
Operating Environment: 0-140°F(-18-60°C), 10-90% RH, non-condensing
Type 1 (dry / indoor environment)
Plenum Rated

Power
Input: 120- 277VAC, 50/60hz, +/- 10%, single phase, 20A circuit
Output: 24VDC,, 200mA total

Certifications
UL Listed, UL916/UL924, US/Canada
FCC Part 15
CEC Title 24
Electronics meet or exceed IEC Level 3

Warranty
Two (2) year limited manufacturer warranty from date of shipment (extended warranty optional).

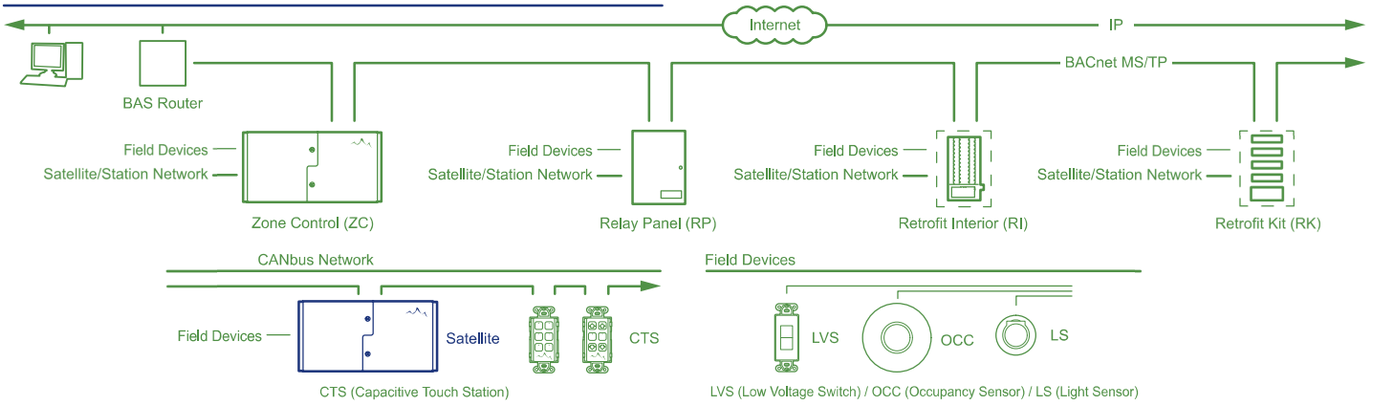
Line Voltage Specifications (FI-1 Board)
Relay Maximum Load Rating per Circuit: 20A tungsten @120VAC, 20A ballast @ 277VAC, 20A resistive @ 277VAC, 1.5HP @ 120 VAC
Line In: Powers ZC and feeds Relay Output 1
Line In 2: Feeds Relay Output 2
Relay: 2 mechanically latching relays with manual override lever
Relay Status: Opto-isolated Power Tap (PT) on load side of relay contacts
Line Voltage Input: 2 inputs, utilize same power as Line 1 or 2
Line Voltage Input Type: Configurable for maintained or state-change
Wire Requirement: 14-10AWG (Solid or Stranded copper wire only)

Low Voltage Specifications (FI-2 Board)
Universal Input (UI)
Universal Input: 6 two-wire inputs
Universal Input Software Configuration:
  Digital Input (DI)
  Analog Input (AI): 0-5VDC, 0-10VDC, or 4-20mA
Universal Input Wire Requirement / Maximum Length: 18AWG (Solid or Stranded) / 500’(152m)
Analog Output: 2 outputs
Analog Output Compatibility: 0-10VDC dimming ballasts (see *Ballast Compatibility Data Sheet* for details)
Analog Output Sink / Source: 100mA / 5mA per output
Analog Output Wire Requirement / Maximum Length: 18AWG (Solid or Stranded) / 1,000’ (304m)

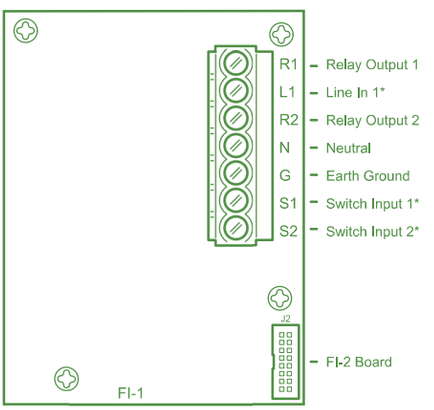
CANbus Specifications
Protocol: CANbus
Maximum Satellite: 3 ZC Standard, 12 ZC Extended, 16 RI / RP, RI / RP are limited to a maximum of 64 zones including those added with Satellite
CANbus Network Slot: Rotary dial selectable
Topology: Daisy Chain Wiring only
Wire Requirement / Maximum Length: CL3P, 18AWG, Twisted Pairs, 4 conductors, Unshielded / 1300’(396.24m)
Network Termination: Jumper

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General Architecture

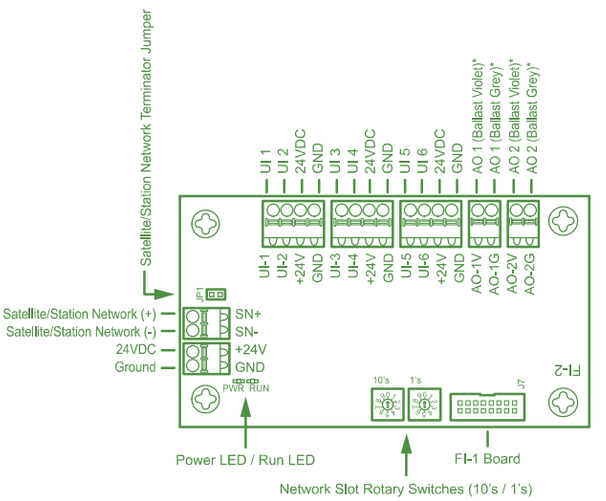


FI-1 Board Terminations



*FI-1 terminations are compatible with 120, 230, or 277VAC single phase circuits. Do not mix voltages or phase on the same unit.

FI-2 Board Terminations



*Applicable on Satellite with Dimming Option only.

Ordering Information

SC XX - XX

Power Options	
XX = 00	120, 230, 277VAC
Controller Board Options	
XX = SS	Switching
DS	Dimming (platforms w/dimming capable Controller Board only)

BLUE RIDGE TECHNOLOGIES™
UNIFIED LIGHTING CONTROL

Zone Control UL924

Project		Part Number		Ref.	

Data Sheet : Catalog Page 66



Overview

Zone Control UL924 (ZC UL924) has all the energy saving features of Zone Control (ZC). ZC UL924 includes an additional circuit for energy management control of emergency lighting during normal operation while maintaining emergency function during power loss.

Sequence of Operations

1. Emergency circuit is controlled by Relay 2. The ZC UL924 configuration jumper is set for Emergency Action Close Relay 2.
2. Power loss is detected by the ZC UL924.
3. Emergency circuit controlled by Relay 2 is forced ON. Analog Outputs also move to full output (applicable on dimming ZC only). No external power source or input is required for ZC UL924 emergency function.
4. Relay 1 remains in present state (On/Off).
5. Generator transfer switch (not located in the ZC UL924) reacts and allows generator to feed dedicated emergency circuits previously fed by normal (utility) power. Relay 2 is already ON, so the only possible source of delay in emergency lighting is the generator or emergency transfer switch.
6. Dedicated emergency lighting circuit will remain On while emergency power source is applied.
7. Normal power is restored and the emergency transfer switch returns all circuits to normal power.
8. Relay 2 will remain On and Analog Outputs will maintain full output during normal power restoration.
9. Relay 1 remains in present state (On/Off).
10. ZC UL924 resumes normal control of Relays as well as Analog Outputs and returns lighting to the correct level.

General Specifications

Construction: 20ga steel white powder coat finish
Dimensions: 5.063”(129mm)H x 10.00”(254mm)W x 2.50”(64mm)D
Weight: 3lbs (1.36kg)
Mounting: 4” or 4 11/16” junction box (Check local code requirements)
Operating Environment: 0-140°F(-18-60°C), 10-90% RH, non-condensing
Type 1 (dry / indoor environment)
Plenum Rated

Power

Input: 120- 277VAC, 50/60hz, +/- 10%, single phase, 20A circuit
Output: 24VDC,, 200mA total

Certifications

UL Listed, UL916/UL924, US/Canada
FCC Part 15
CEC Title 24
Electronics meet or exceed IEC Level 3

Warranty

Two (2) year limited manufacturer warranty from date of shipment (extended warranty optional).

Line Voltage Specifications (FI-1 Board)

Relay Maximum Load Rating per Circuit: 20A tungsten @120VAC, 20A ballast @ 277VAC, 20A resistive @ 277VAC, 1.5HP @ 120 VAC
Line In: Powers ZC and feeds Relay Output 1
Line In 2: Feeds Relay Output 2
Relay: 2 mechanically latching relays with manual override lever
Relay Status: Opto-isolated Power Tap (PT) on load side of relay contacts
Line Voltage Input: 2 inputs, utilize same power as Line 1 or 2
Line Voltage Input Type: Configurable for maintained or state-change
Wire Requirement: 14-10AWG (Solid or Stranded copper wire only)

Low Voltage Specifications (FI-2 Board)

Universal Input (UI)
Universal Input: 6 two-wire inputs
Universal Input Software Configuration:
  Digital Input (DI)
  Analog Input (AI): 0-5VDC, 0-10VDC, or 4-20mA
Universal Input Wire Requirement / Maximum Length: 18AWG (Solid or Stranded) / 500’(152m)
Analog Output: 2 outputs
Analog Output Compatibility: 0-10VDC dimming ballasts (see *Ballast Compatibility Data Sheet* for details)
Analog Output Sink / Source: 100mA / 5mA per output
Analog Output Wire Requirement / Maximum Length: 18AWG (Solid or Stranded) / 1,000’ (304m)

BAS Network Specifications

Protocol: BACnet MS/TP
Baud Rate: DIP switch selectable 9.6K, 19.2K, 38.4K, 76.8K, or 115.2K
Device Profile: BACnet Advance Application Controller (AAC)
Address Range: 1 – 99 selectable with rotary dials
Unit Load: 1/8 unit load
Topology: RS-485, half duplex, daisy chain wiring
Wire Requirement / Maximum Length: CL3P, 22AWG, 2 conductor, shielded, low cap / 4000’(1216m)
Points: See *PIC Statement*

CANbus Network Specifications

Compatible with CTS and Satellite devices. See indivdiual data sheet for details.
Topology: Daisy Chain Wiring only
Wire Requirement / Maximum Length: CL3P, 18AWG, Twisted Pairs, 4 conductors, Unshielded / 1300’(396.24m)
Network Termination: Jumper

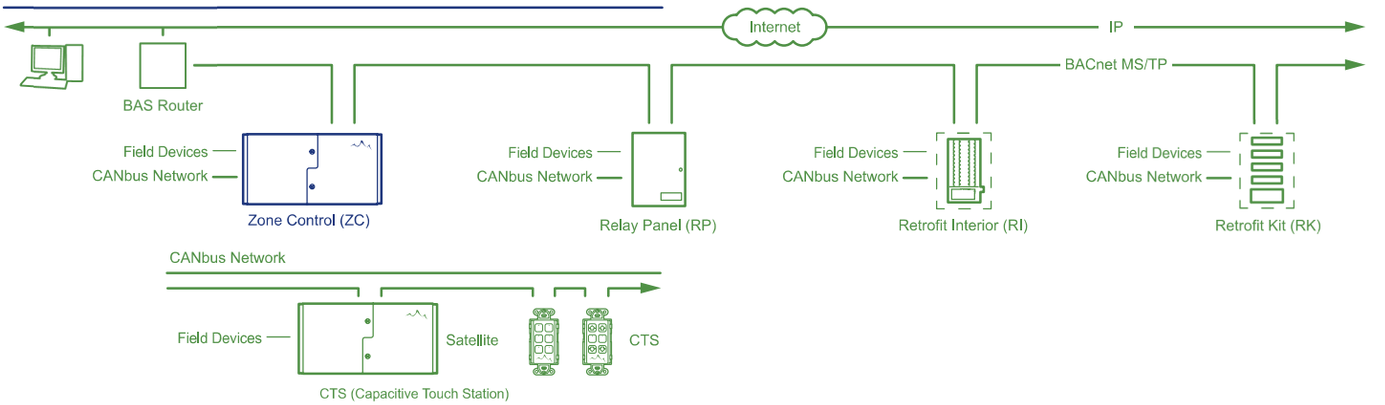
Firmware Specifications (Controller Board)

Platform: Aperio Open Control Platform
Time Clock: Real-time clock with BACnet time sync
Schedule: BACnet Schedule, Monday – Sunday, Holidays, and Exceptions
Non-Volatile Memory: 16MB total, 2MB for trend data (15min trend requires 2K per day)
RAM: 2MB total, data stored in non-volatile memory upon power loss
Configuration: Tech Kit 2.0 (see data sheet for details)
Configuration Connection: Micro-B USB or Bluetooth Wireless

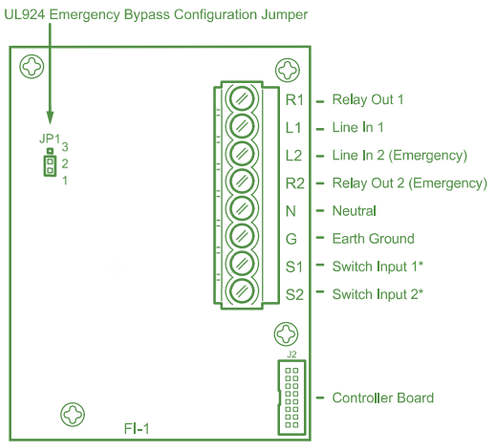
Zone Control UL924

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General Architecture

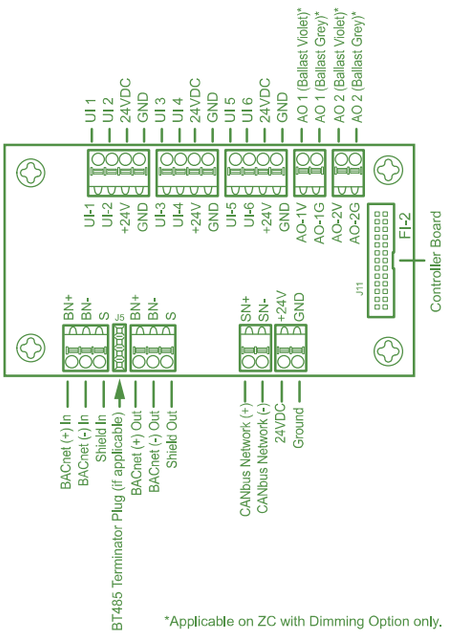


FI-1 Board Terminations



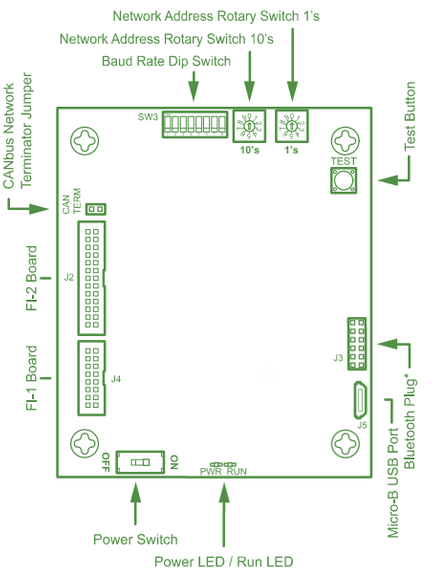
*Must utilize same power source as Line In 1 or Line In 2.

FI-2 Board Terminations



*Applicable on ZC with Dimming Option only.

Controller Board Terminations



*Applicable on ZC with Bluetooth Wireless Option only.

Ordering Information

ZC XX - XX - XX

Wireless Options	
XX = 00	No Wireless
BT	Bluetooth
Power Options	
XX = X1	UL924 Emergency Bypass 120, 230, 277VAC (Relay 2)
Controller Board Options	
XX = SS	Switching Standard: Maximum 8 Relays / 3 Satellite / 8 CTS
DS	Dimming Standard: DLH, Maximum 8 Relays / 3 Satellite / 8 CTS / 8 Preset
DE	Dimming Extended: DLH, Maximum 16 Relays / 12 Satellite / 16 CTS / 16 Preset

BLUE RIDGE TECHNOLOGIES™
UNIFIED LIGHTING CONTROL

Zone Control

Project		Part Number		Ref.	

Data Sheet : Catalog Page 60



Overview

Zone Control (ZC) is a distributed lighting controller in a compact junction box mounted package. ZC may be scheduled from any BACnet BAS, and it is compatible with all low voltage switches, occupancy sensors, and light level sensors. ZC is suited for new or existing buildings, and may be scaled from basic to advanced control sequences; including daylight harvesting (DLH), load shedding, equipment optimization, and trending.

Features

UL Listed and Plenum Rated
BACnet MS/TP communication to BAS network
Line and low voltage compartment separation
Switching and Dimming (DLH / Presets) models available
CANbus network for Satellite and Capacitive Touch Stations (CTS)
Standard and Extended models available:

- Standard - up to 8 relays / channels with Satellite
- Extended - up to 16 relays / channels with Satellite

Micro-USB and Bluetooth (optional) ports for configuration
Monitor and measure equipment performance:

- Track lamp, ballast, and relay life
- Track schedule, occupancy sensor, manual control, and daylight harvest savings

General Specifications

Construction: 20ga steel white powder coat finish
Dimensions: 5.063”(129mm)H x 10.00”(254mm)W x 2.50”(64mm)D
Weight: 3lbs (1.36kg)
Mounting: 4” or 4 11/16” junction box (Check local code requirements)
Operating Environment: 0-140°F(-18-60°C), 10-90% RH, non-condensing
Type 1 (dry / indoor environment)
Plenum Rated

Power

Input: 120- 277VAC, 50/60hz, +/- 10%, single phase, 20A circuit
Output: 24VDC,, 200mA total

Certifications

UL Listed, UL916/UL924, US/Canada
FCC Part 15
CEC Title 24
Electronics meet or exceed IEC Level 3

Warranty

Two (2) year limited manufacturer warranty from date of shipment (extended warranty optional).

Line Voltage Specifications (FI-1 Board)

Relay Maximum Load Rating per Circuit: 20A tungsten @120VAC, 20A ballast @ 277VAC, 20A resistive @ 277VAC, 1.5HP @ 120 VAC
Line In: Powers ZC and feeds Relay Output 1
Line In 2: Feeds Relay Output 2
Relay: 2 mechanically latching relays with manual override lever
Relay Status: Opto-isolated Power Tap (PT) on load side of relay contacts
Line Voltage Input: 2 inputs, utilize same power as Line 1 or 2
Line Voltage Input Type: Configurable for maintained or state-change
Wire Requirement: 14-10AWG (Solid or Stranded copper wire only)

Low Voltage Specifications (FI-2 Board)

Universal Input (UI)
Universal Input: 6 two-wire inputs
Universal Input Software Configuration:
Digital Input (DI)
Analog Input (AI): 0-5VDC, 0-10VDC, or 4-20mA
Universal Input Wire Requirement / Maximum Length: 18AWG (Solid or Stranded) / 500’(152m)
Analog Output: 2 outputs
Analog Output Compatibility: 0-10VDC dimming ballasts (see *Ballast Compatibility Data Sheet* for details)
Analog Output Sink / Source: 100mA / 5mA per output
Analog Output Wire Requirement / Maximum Length: 18AWG (Solid or Stranded) / 1,000’ (304m)

BAS Network Specifications

Protocol: BACnet MS/TP
Baud Rate: DIP switch selectable 9.6K, 19.2K, 38.4K, 76.8K, or 115.2K
Device Profile: BACnet Advance Application Controller (AAC)
Address Range: 1 – 99 selectable with rotary dials
Unit Load: 1/8 unit load
Topology: RS-485, half duplex, daisy chain wiring
Wire Requirement / Maximum Length: CL3P, 22AWG, 2 conductor, shielded, low cap / 4000’(1216m)
Points: See *PIC Statement*

CANbus Network Specifications

Compatible with CTS and Satellite devices. See individual data sheet for details.
Topology: Daisy Chain Wiring only
Wire Requirement / Maximum Length: CL3P, 18AWG, Twisted Pairs, 4 conductors, Unshielded / 1300’(396.24m)
Network Termination: Jumper

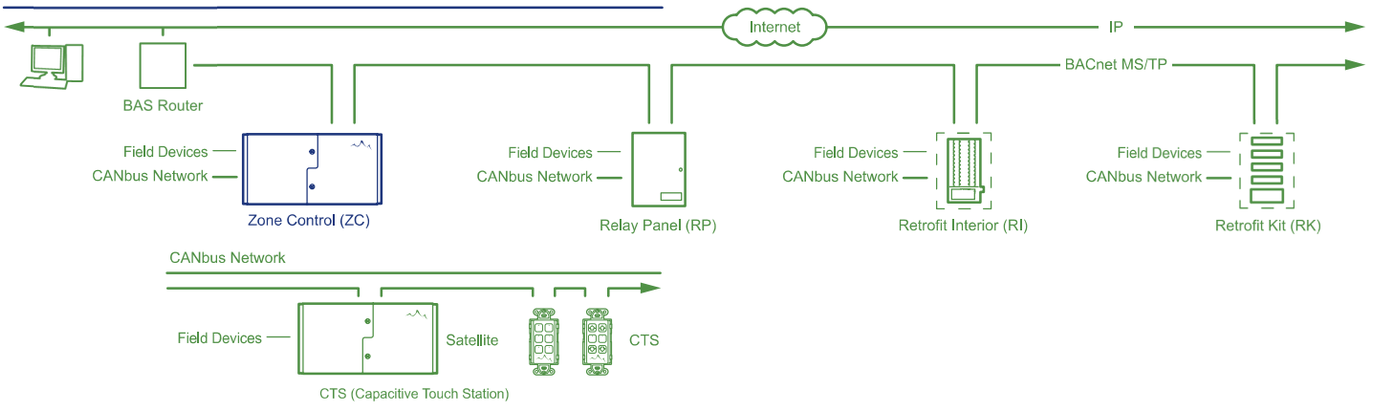
Firmware Specifications (Controller Board)

Platform: Aperio Open Control Platform
Time Clock: Real-time clock with BACnet time sync
Schedule: BACnet Schedule, Monday – Sunday, Holidays, and Exceptions
Non-Volatile Memory: 16MB total, 2MB for trend data (15min trend requires 2K per day)
RAM: 2MB total, data stored in non-volatile memory upon power loss
Configuration: Tech Kit 2.0 (see data sheet for details)
Configuration Connection: Micro-B USB or Bluetooth Wireless

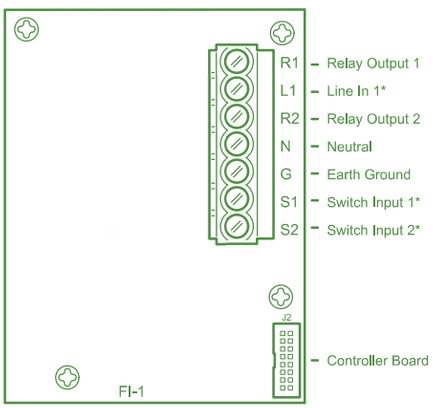
Zone Control

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General Architecture

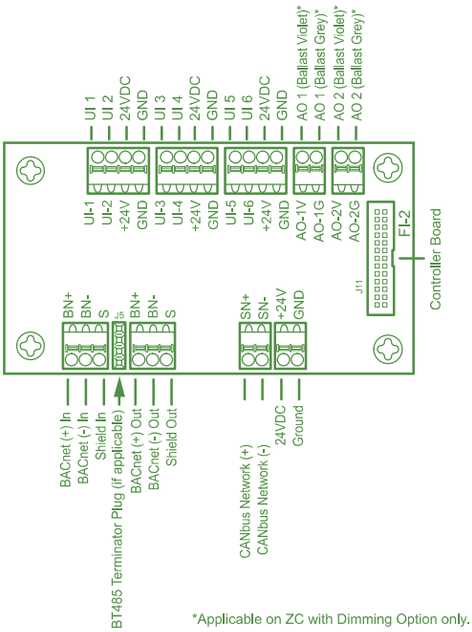


FI-1 Board Terminations



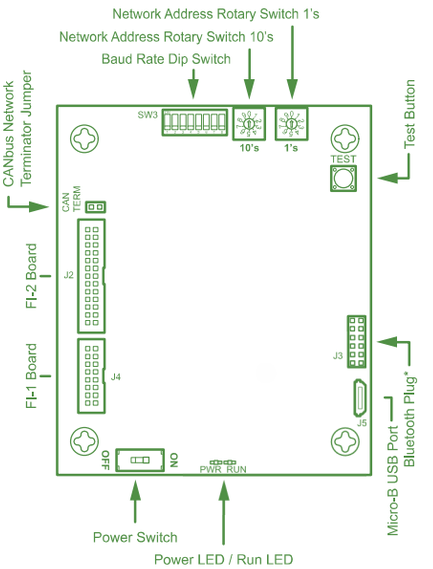
*FI-1 terminations are compatible with 120, 230, or 277VAC single phase circuits. Do not mix voltages or phase on the same unit.

FI-2 Board Terminations



*Applicable on ZC with Dimming Option only.

Controller Board Terminations



*Applicable on ZC with Bluetooth Wireless Option only.

Ordering Information

ZC XX - XX - XX

Wireless Options

XX = 00	No Wireless
BT	Bluetooth

Power Options

XX = 00	120, 230, 277VAC

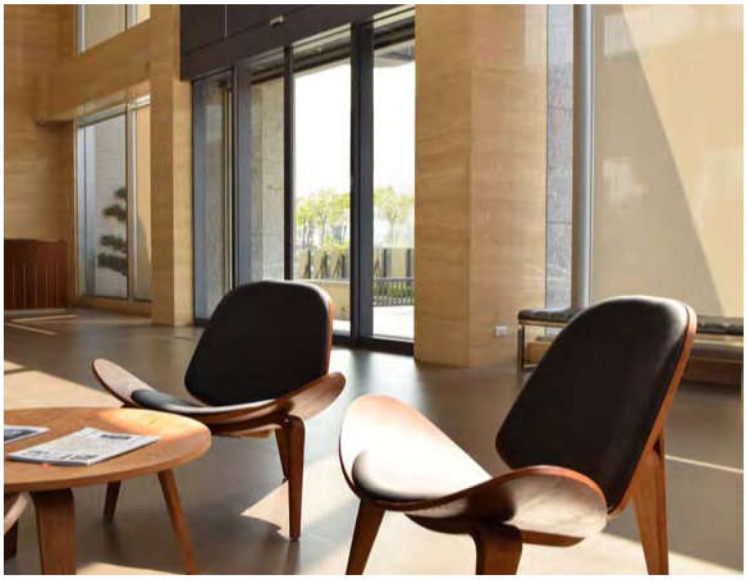
Controller Board Options

XX = SS	Switching Standard: Maximum 8 Relays / 3 Satellite / 8 CTS
DS	Dimming Standard: DLH, Maximum 8 Relays / 3 Satellite / 8 CTS / 8 Preset
DE	Dimming Extended: DLH, Maximum 16 Relays / 12 Satellite / 16 CTS / 16 Preset

TRANS

BPD-500 series

Low Voltage Daylight Sensor





OVERVIEW

The BPD-500 series member of the TRANS family is a low voltage daylight sensor designed for automatic daylighting control. This sensor is able to continuously measure the ambient light level in the controlled area and respond with digital and analog outputs for automatic lighting control via an IR-TEC Power Pack or panel system.

This daylight sensor employs a cutting edge digital ambient light sensor (ALS) with an advanced algorithm to provide closed loop, dynamic ambient light level sensing capability. When the ambient light level is lower/higher than the setpoint for a period of time, the sensor will automatically engage/disengage its isolated dry contact output to turn the connected light ON/OFF. In addition to the digital output, the sensor also provides 0-10V analog output to report the ambient light level change of the controlled area in timely basis.

The innovative Accu-Set digital potentiometer makes ON/OFF threshold adjustment easier, faster and more accurate than conventional potentiometer. Like all sensors in the TRANS family, the BPD-500 series is also available in various mounting options. This feature offers a second-to-none design and installation flexibility for daylight harvesting and control applications in sustainable buildings.

FEATURES

- Digital data control ambient light sensor
- Human-eye matching spectral response
- Sensor operation LED indicator built-in
- 12~24VDC low voltage power operation
- Isolated dry contact for ON/OFF switching
- 0~10V present ambient light level output
- Accu-Set digital ON/OFF threshold settings
- Available with variety of mounting options

APPLICATION

The BPD-500 series daylight sensor can be used in various applications to meet the requirements for daylight harvesting in areas defined as daylight control zones.

- ☑ Educational
- ☑ Industrial/retail
- ☑ Public Buildings
- ☑ Commercial

c UL us LISTED

TITLE 20/24

iR-TEC
Specializing in Building Sensors

BPD-500 series
Low Voltage Daylight Sensor

TRANS

OPERATION

The BPD-500 series is a closed loop daylight sensor operated by 12-24VDC to provide digital and analog outputs for automatic daylighting control. The sensor can be applied to control lights in areas that receive sufficient daylight, thus the electric lights can be reduced or switched OFF via IR-TEC Power Pack or panel system. The isolated dry contact will be activated when the ambient light level is lower than the ON setpoint. The relay output will be disengaged when the ambient light level is higher than the OFF setpoint.

Mounting Options

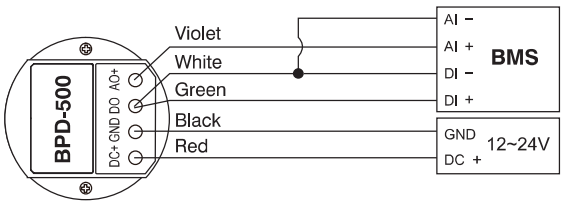
The BPD-500SX series can be mounted into the ceiling or attached to a fixture. The mounting options are available by combining a specific mounting bracket from the chart below. The bracket will be shipped with the sensor when ordered with the respective code.

Code	Mounting Option	Mounting Bracket
F	Fixture Integrated	---
W*	Wet Location	---
E	Fixture External	EMB-500
S	Ceiling Surface	SMB-500
P*	IP-66 Fixture External	PMB-500
C	Junction Box	CMB-500
R	Ceiling Recess	RMB-500

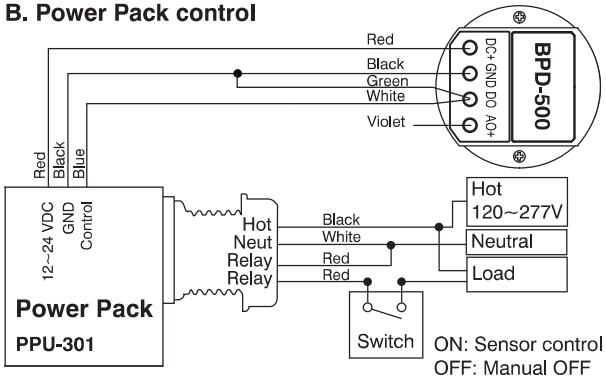
*Available for IP-66 fixture integration

Wiring Diagram

A. Building Management System control



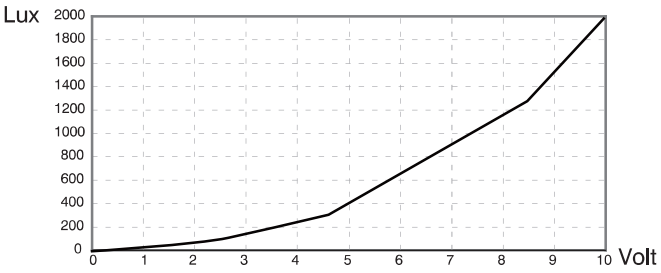
B. Power Pack control



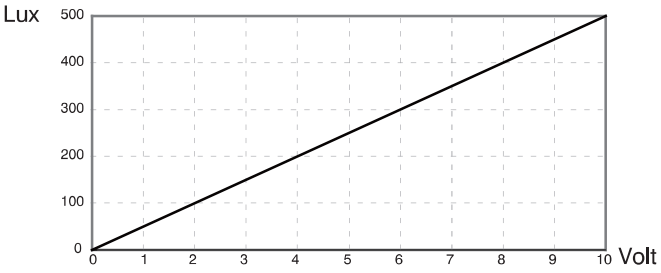
Output vs Ambient Light Level

The analog output of BPD-500 series will vary with ambient light level. The below charts indicate the output vs ambient light of different models.

BPD-500Sx (0~2,000 Lux)



BPD-500Sx-L (0~500 Lux)



The above charts are based on the test result result from manufacturer's lab. Actual performance may vary with different installation site.

SPECIFICATIONS

Power supply	12~24 VDC ± 5%
Photo sensor	Digital data control ambient light sensor
Current drain	15mA typical
Digital output (DO)	Isolated dry contact, max. 1A
Analog output (AO)	0-10V
Sensing range	BPD-500Sx: Approx. 0.2~200 fc (2~2,000 lux)
	BPD-500Sx-L: Approx. 0.2~50 fc (2~500 lux)
Mounting height	8~12 ft. (2.4~3.6m)
Field of view	Approx. 80°
Threshold setting	7-level Accu-Set digital potentiometer
Op. humidity	Max. 95% RH
Op. temperature	-40°F~131°F (-40°C~55°C)
Dimensions	Ø2.56"x H1.77" (Ø65 x H45mm)

WEBSTER UNIVERSITY ISB

Operations and Maintenance Manual

Factory Order #: 37999262

04/28/2017

Distributor:
GRAYBAR ELECTRIC CO 5818836

Contractor/Installer:
GUARANTEE ELECTRIC

Louis Feldhaus
Sales Representative

Kevin Sieges
Project Manager
North American Operating Division
636-329-2268
Kevin.Sieges@schneider-electric.com

Life Is On Schneider Electric

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DRAWINGS

UNIT SUBSTATION 1: US-1

METAL-ENCLOSED SWGR - US-1

POWER-DRY XFMR - US-1

SWBD - US-1

UNIT SUBSTATION LITERATURE

METAL-ENCLOSED SWITCHGEAR

Metal-Enclosed Switchgear - Instruction Bulletin

Type HVL Load Interrupter Switch Instruction Bulletin

POWER-DRY TRANSFORMER

Power-Dry II Dry Type Transformers Instruction Bulletin

Model 98A Digital Temperature Controller - Instruction Bulletin

SWITCHBOARD

Power-Style QED-2 Switchboards Instruction Bulletin

NEMA - Instructions for Distribution Switchboards Rated 600 Volts or Less

Surgelogic Internal Modular Assembly (IMA) Surge Protective Device (SPD) - Instruction Bulletin

PowerLogic PM8000 Series - User Manual

Masterpact NW Low-Voltage Power/Insulated Case Circuit Breaker Installation

Masterpact NW Low-VoltagePower/Insulated Case Circuit Breaker User Guide

Masterpact NT and NW Circuit Breakers Maintenance and Field Testing Guide

Masterpact NW Circuit Breakers Undervoltage Trip (MN), Shunt Trips (MX1 and MX2), and Shunt Clo

Primary High Current Injection Field Test Procedure for MDGF Systems - Instruction Bulletin

Micrologic 2.0A, 3.0A, 5.0A, & 6.0A Trip Units - Instruction Bulletin

Micrologic 2.0, 3.0 & 5.0 Trip Units - Instruction Bulletin

INTEGRATED POWER CENTERS

DRAWINGS

SB1

SB2

1EH1 - 1EL1

1SH1 - 1SL1

LITERATURE

Integrated Power Center 2 (IPC2) - Instruction Bulletin

Integrated Power Center 2 (IPC2) - Application Guide Data Bulletin

I-Line Circuit Breaker Power Distribution Panelboards Information Manual

NF/NFOM Panelboards Information Manual

NQ/NQM Panelboards and QONQ Load Centers Information Manual

NEMA- Instructions for Panelboards Rated 600 Volts or Less

PK27GTA Equipment Grounding Bar - Instruction Bulletin

Dry-Type Transformers 1000 Volts and Below Instruction Bulletin

PANELBOARDS

LITERATURE

I-Line Circuit Breaker Power Distribution Panelboards - Information Manual

NF/NFOM Panelboards - Information Manual

NQ/NQM Panelboards & QONQ Load Centers - Information Manual

Panelboards Rated 600 Volts or Less - NEMA General Instructions

Surgelogic I-Line Plug-on Surge Protective Device (SPD) - Instruction Bulletin

IMA Surge Protective Device - Instruction Bulletin

Surgelogic NQ SurgeLoc Brick Assembly Surge Protective Devices (SPDs) - Instructi

CONTACTORS AND STARTERS

LITERATURE

Types SB & SC Combo Starters - Service Bulletin

8502/8536 Type SC, 2 & 3 Pole AC Magnetic Contactors & Starters Instruction Bulletin

Type M & T Series A Manual Starters - Instruction Bulletin

SAFETY SWITCHES

LITERATURE

Safety Switches 30-1200A - Instruction Bulletin

CIRCUIT BREAKER

LITERATURE

EDB, EGB, & EJB Circuit Breakers - Instruction Bulletin

H & J Frame Circuit Breakers AL & CU Lug Kits - Instruction Bulletin

POWER MONITORING AND CONTROL

LITERATURE

PowerLogic Multi-Point Communications Terminator (MCTAS-485 & MCT-485) - Insta

SQUARE D

by Schneider Electric

Job Name:	WEBSTER UNIVERSITY ISB	Square D Quotation #:	37999262
Job Location:	WEBSTER GROVES, MO	Quotation Revision #:	
		Sales Contact:	LNP
		Sales Contact Location:	400
Purchaser:	GRAYBAR ELECT CO 5818836	Customer:	GUARANTEE ELECTRIC
Purchaser PO #:	4702257122	Customer PO #:	
User:	WEBSTER UNIVERSITY	Architect:	WILLIAM TAO & ASSOC INC
User Location:		Cons. Engineer:	
Drawing Status:	RECORD		

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SQUARE D FACTORY ORDER NUMBER: 37999262–001

Equipment Designation	Equipment Type	Drawing Type	Drawing Number	Page	Revision Level
US–1	METAL ENCLOSED SWITCHGEAR	ELECTRICAL BILL OF MATERIAL	T37999262–001–BM	1	–
		ENGRAVED NAMEPLATES	T37999262–001–EP	1	–
		ELEVATION	F37999262–001–01	1	–
		TOP VIEW/FLOOR PLAN	F37999262–001–02	1	–
		GENERAL NOTES	F37999262–001–03	1	–
		DETAIL VIEW	F37999262–001–51	1	–
		ONE LINE DIAGRAM	O37999262–001–01	1	–
		CONTROL SCHEMATIC	C37999262–001–01	1	–
		RATING NAMEPLATE	N37999262–001–01	1	–

Summary Bill of Material

Printed 10/14/16 3:38:02 PM by SESA245059

Find #	Part Number	Qty Per	Total Qty	Function	Supplier	Description	Rev
001	44036-325-50	1.00	1.00	89	SQUARE D COMPANY	SWITCH, TYPE HVL,15KV, 600A, 40KA, UPRIGHT, GLASS POLYESTER, SILVER PLATED.	
002	55GFMSJD200E	3.00	3.00	FU	SQUARE D COMPANY	FUSE, CURRENT LIMITING, 200E, 5.5KV, 65KAIC, 17.4" CLIP SPACING, SINGLE BARREL, TYPE DIN/E.	
003	44038-249-50	1.00	1.00	89/a,b	SQUARE D COMPANY	10 POLE AUXILIARY CONTACT ASSEMBLY (5a/5b.)	
004	DLA350	2.00	2.00	LUG	CONNECTOR MFG INC.	LUG, SET SCREW, ALUMINUM, TYPE DLA, (2) #6-350 MCM AL/CU, 1 HOLE (1/2") PAD.	
005	YA26A3	3.00	3.00	LUG	BURNDY	LUG, CRIMP, #1-2/0 AL/CU, (2) 1/2" HOLES, OLIVE.	
006	44036-412-02	1.00	1.00	UL LABEL	SQUARE D COMPANY	UL LABEL (U.S. & CANADA).	

Job Name:	**WEBSTER UNIVERSITY ISB**			Engineer:	IVK
Order Qty:	1	Rev:	0	Order:	**017-37999262-001-00-01**
Status:	RA	Catalog No:	Metal Enclosed Switchgear	Doc Nbr:	T37999262-001-BM

ENGRAVED NAMEPLATES DATA SHEET

Doc No. 10277
Rev Date 2/15/13

AE: IVK

PRODUCT CODE (MC, ME, MCC) ME

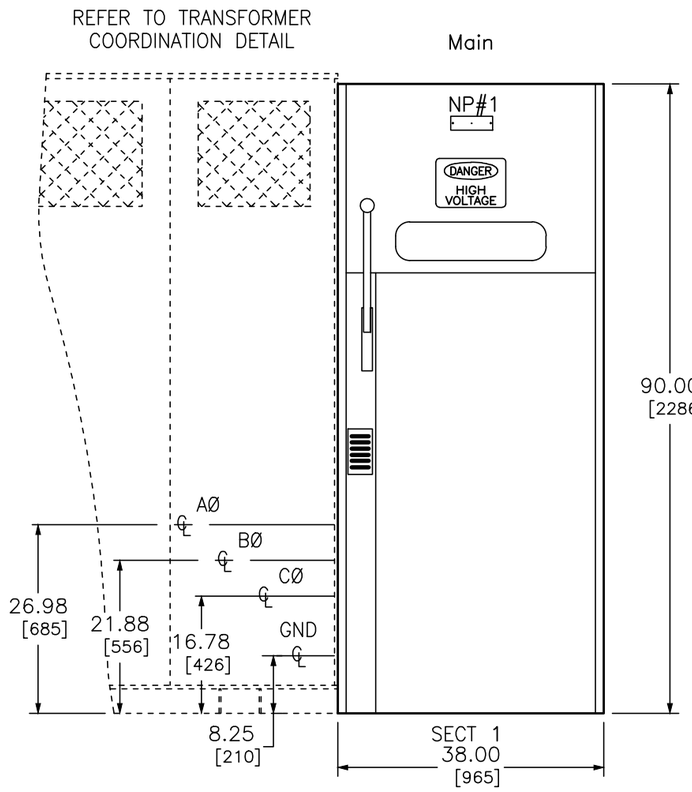
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WB	WHITE/BLACK		A	0.75"	4.6"	3/16"	2	26
BW	BLACK/WHITE		B	0.75"	2.0"	1/8"	3	11
RW	RED/WHITE		C	9001 DEVICE		1/8"	3	14
			D	2.0"	6.0"	5/16"	4	19
			E	1.0"	2.5"	1/8"	4	16
			F	0.75"	2.0"	1/8"	3	11

CODES A-E ARE FOR DOOR MOUNTED DEVICES.
CODE F APPLIES TO INTERNALLY MOUNTED DEVICES.
SPECIAL NAMEPLATES ARE CODED SA, SB, SC, ... WITH ASSOCIATED DETAILS NOTED.

SPECIAL NAMEPLATE WITH 2.5” HEIGHT AND GREATER SHALL BE PROVIDED WITH FOUR 0.125” MOUNTING HOLES. 0.25” FROM EACH END (TOP, BOTTOM, LEFT OR RIGHT OF THE EDGE) TO THE CENTER OF THE MOUNTING HOLES.

NP #	TYPE	SIZE	QTY	TEXT CONTENT
1	WB	D	1	US-1

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--	–	----	--	--/--/--
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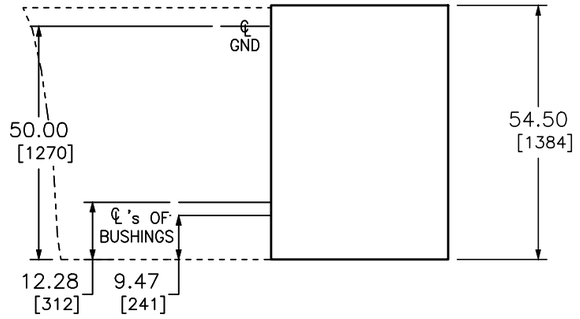


FRONT ELEVATION

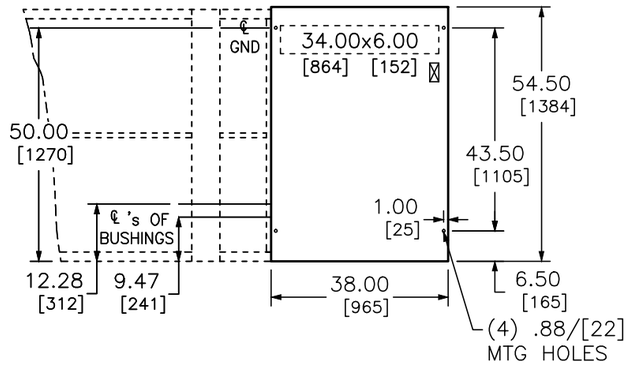
DUAL DIMENSIONS: INCHES
MILLIMETERS

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	METAL ENCLOSED SWITCHGEAR
DRAWN BY:	CAD	DRAWING TYPE:	ELEVATION
ENGR:	VINAY KUMAR		
DATE:	OCTOBER 14, 2016		
DRAWING STATUS:	RECORD	DWG# F37999262-001-01	PG 1 OF 1 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--	–	----	--	--/--/--	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--	–	----	--	--/--/--	–	----	--	--/--/--



TOP VIEW



FLOOR PLAN

DUAL DIMENSIONS: INCHES
MILLIMETERS

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US–1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	METAL ENCLOSED SWITCHGEAR
DRAWN BY:	CAD	DRAWING TYPE:	TOP VIEW/FLOOR PLAN
ENGR:	VINAY KUMAR		
DATE:	OCTOBER 14, 2016		
DRAWING STATUS:	RECORD	DWG# F37999262–001–02	PG 1 OF 1 REV –

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–	----	--	--/--/--	–	----	--	--/--/--	–	----	--	--/--/--

GENERAL NOTES:

PRODUCT DESCRIPTION AND RATINGS:

POWER SYSTEM DATA:

4160 VOLTS, 3 PHASE, 3 WIRE WYE SOLIDLY GROUNDED
5.0 kV MAXIMUM VOLTAGE RATING
60 kV BIL, 60 HERTZ FREQUENCY
CONTROL POWER NOT REQUIRED

BUS SYSTEM DATA:

600A COPPER, SILVER PLATED MAIN BUS
GLASS POLYESTER BUS SUPPORTS
SILVER PLATED COPPER GROUND BUS
40 kA Asym (25 kA Sym) MAIN BUS BRACING

ENCLOSURE DATA:

TYPE 1 INDOOR CONSTRUCTION
CATEGORY "B" ENCLOSURE
ANSI #61 FINISH
FRONT AND REAR ACCESS IS AVAILABLE
PADLOCK PROVISIONS

HANDLING:

SWITCHGEAR SECTIONS ARE FURNISHED WITH LIFTING ANGLES AND ARE SHIPPED ON SKIDS.
ROLLERS OR FORKLIFT SHALL ONLY BE USED WITH SKID IN PLACE.
LINEUP WEIGHT 1300.00 LBS/589.68 KG
Shipping Split – 1, 1300.00 LBS/589.68 KG

CODE STANDARDS:

THIS EQUIPMENT BEARS THE UL LISTING MARK FOR THE UNITED STATES.

PRODUCT INFORMATION:

#12 AWG, TYPE SIS CURRENT CIRCUIT WIRING

AIR COOLED TRANSFORMER CLARIFICATION:

PLEASE NOTE: ALL TRANSFORMER CONNECTION
QUOTATIONS ARE BASED ON "AIR COOLED" KVA
RATINGS. "FORCED AIR" RATINGS ARE NOT IN THE
PRODUCT SELECTOR. "FORCED AIR" RATINGS MAY
REQUIRE DIFFERENT FUSE/ENCLOSURE.
CONTACT MVQG OR ORDER ENGINEERING
FOR ADDITIONAL INFORMATION.

INSTRUCTION BULLETIN:

MANUAL HVL INST. MANUAL

OPTIONS/ACCESSORIES:

LIST OF MISC. ACCESSORIES:

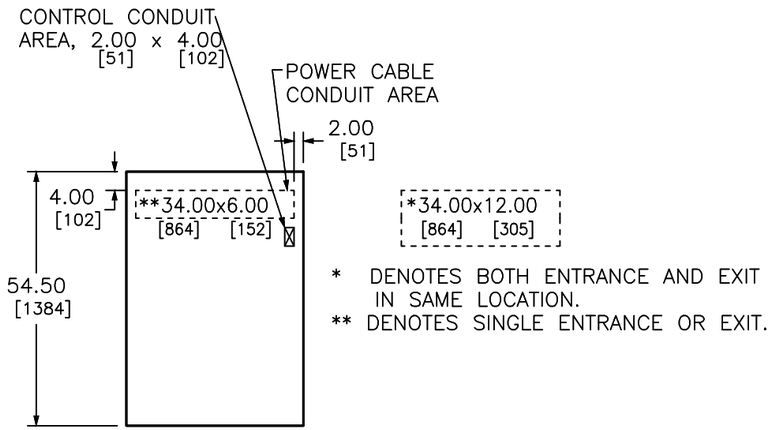
1 SET OF CERTIFIED TEST REPORTS
2a/2b AUXILIARY CONTACTS WIRED OUT TO CUSTOMER TERMINAL BLOCK IN Section 1

LIST OF MISC. STRUCTURE OPTIONS:

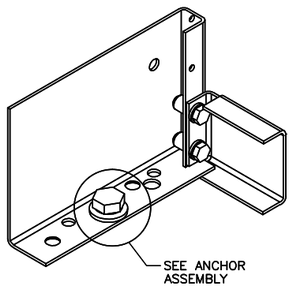
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JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	METAL ENCLOSED SWITCHGEAR
DRAWN BY:	CAD	DRAWING TYPE:	GENERAL NOTES
ENGR:	VINAY KUMAR		
DATE:	OCTOBER 14, 2016		
DRAWING STATUS:	RECORD	DWG# F37999262-001-03	PG 1 OF 1 REV –

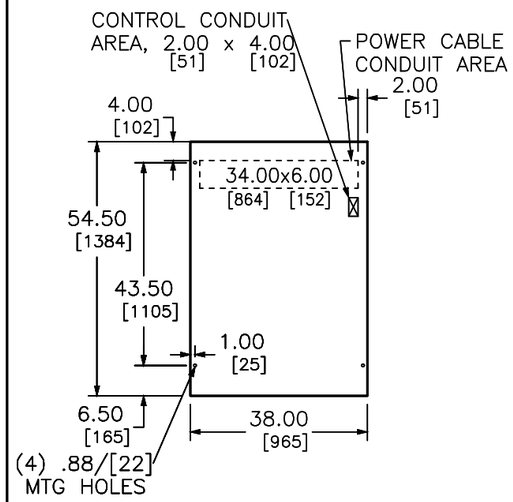
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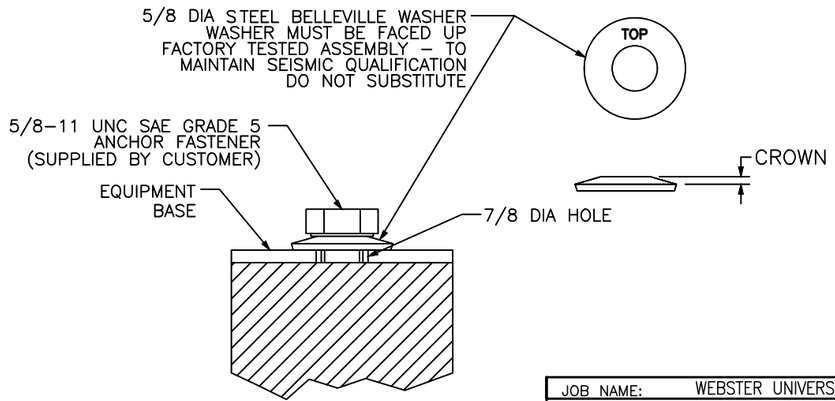


* DENOTES BOTH ENTRANCE AND EXIT IN SAME LOCATION.
** DENOTES SINGLE ENTRANCE OR EXIT.



MOUNTING DETAILS





ANCHOR ASSEMBLY

SITE PREPARATION – SWITCHGEAR INSTALLATION

GOOD SITE PREPARATION IS NECESSARY TO ELIMINATE COSTLY, TIME–CONSUMING INSTALLATION PROBLEMS AND ENSURE PROPER SWITCHGEAR OPERATION. COMPARE THE SITE PLANS AND SPECIFICATIONS WITH THE SWITCHGEAR DRAWINGS TO BE SURE THERE ARE NO DISCREPANCIES. CHECK THE SITE TO ENSURE THAT THE EQUIPMENT WILL FIT PROPERLY.

THE FLOOR SHOULD BE FLAT AND LEVEL WITHIN $\frac{1}{16}$ INCH PER FOOT, OR A MAXIMUM OF $\frac{1}{4}$ INCH WITHIN THE AREA OF THE SWITCHGEAR, TO PREVENT DISTORTION OF THE ENCLOSURES. ALLOW AISLE SPACE AT THE FRONT, BACK, AND ENDS OF THE SWITCHGEAR TO PERMIT ACCESS FOR EQUIPMENT MAINTENANCE; USUALLY A MINIMUM OF FIVE FEET IS NEEDED ON ALL SIDES.

PROVIDE AREA VENTILATION AT ALL TIMES TO MAINTAIN THE AMBIENT TEMPERATURE AROUND THE EQUIPMENT BETWEEN –30°C AND +40°C.

ADEQUATE LIGHTING AND CONVENIENCE OUTLETS SHOULD BE AVAILABLE NEAR THE SWITCHGEAR. ROUTE SEWER, WATER, AND STEAM LINES AWAY FROM THE EQUIPMENT. PROVIDE FLOOR DRAINS TO PREVENT WATER BUILDUP.

REVIEW THE ASSEMBLY DRAWINGS TO ENSURE THAT THE SWITCHGEAR SECTIONS WILL BE ASSEMBLED IN THE CORRECT ORDER. IF THE SWITCHGEAR WILL CONNECT TO AN EXISTING LINEUP, MOUNT THE CONNECTING SECTIONS FIRST.

MOUNT THE VARIOUS SHIPPING SECTIONS ON THE SAME PLANE AND LEVEL THEM TO ENSURE PROPER CONNECTION. AFTER LEVELING EACH SECTION, BOLT IT TO THE PREVIOUSLY INSTALLED SWITCHGEAR.

EACH SECTION INCLUDES THE NECESSARY MEANS FOR ANCHORING IT TO THE FLOOR. FASTEN INDOOR UNITS TO THE FLOOR USING THE HOLES LOCATED IN THE BOTTOM FLANGES OF THE ENCLOSURE. FASTEN OUTDOOR ENCLOSURES TO THE FOUNDATION USING THE HOLES LOCATED IN THE BOTTOM CROSS CHANNELS.

REMOVE THE LIFTING ANGLES FROM THE SIDE OF THE BASE AND STORE. TO BLOCK ENTRY OF WATER, EXTRANEOUS OBJECTS, OR WILDLIFE, REPLACE HARDWARE IN THE HOLES WHERE THE LIFTING ANGLES WERE REMOVED. THE BUS CONNECTORS FOR THE SHIPPING SPLITS ARE INCLUDED WITH THE SWITCHGEAR.

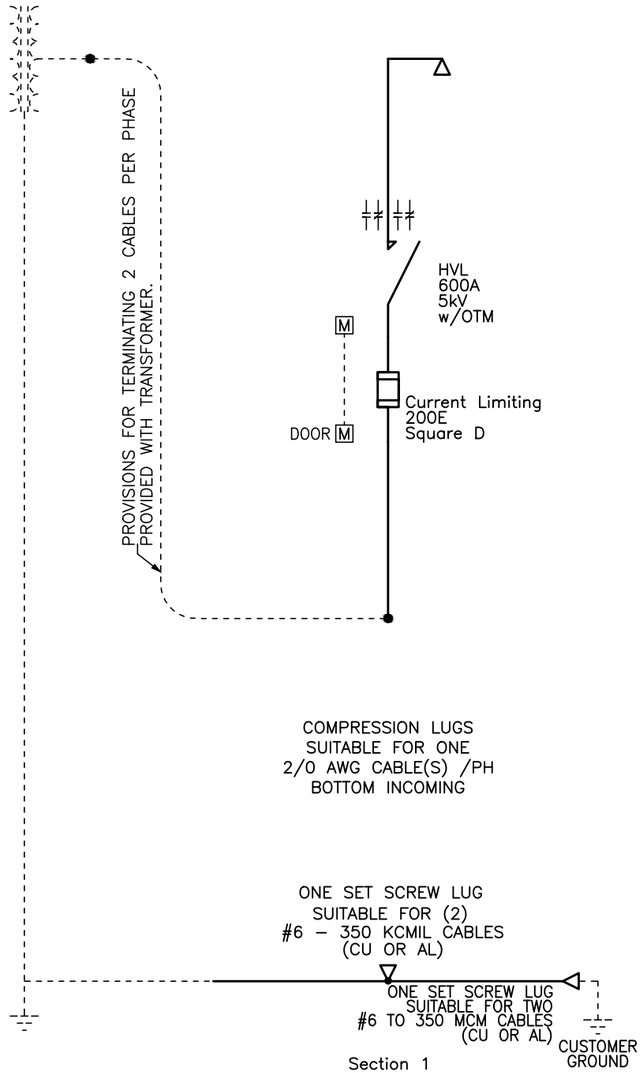
DUAL DIMENSIONS: INCHES / MILLIMETERS

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US–1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	METAL ENCLOSED SWITCHGEAR
DRAWN BY:	CAD	DRAWING TYPE:	DETAIL VIEW
ENGR:	VINAY KUMAR		
DATE:	OCTOBER 14, 2016		
DRAWING STATUS:	RECORD	DWG#	F37999262–001–51

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--	–	----	--	--/--/--

Power–Dry
TRANSFORMER
1000/1333 kVA

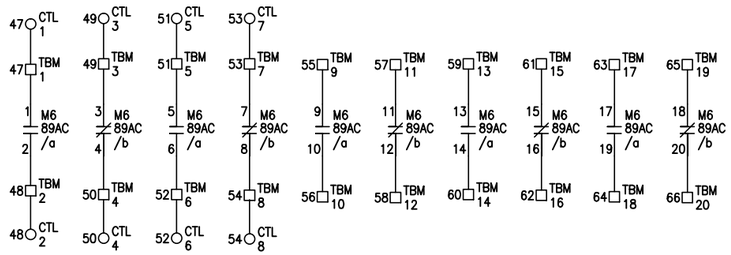
Main
UL/C–UL LABEL



Section 1

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US–1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	METAL ENCLOSED SWITCHGEAR
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:	VINAY KUMAR		
DATE:	OCTOBER 14, 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–001–01	PG 1 OF 1 REV –

REV	DESCRIPTION	BY	DATE	—	————	——	——/——/——	—	————	——	——/——/——
—	————	——	——/——/——	—	————	——	——/——/——	—	————	——	——/——/——



HVL SWITCH AUXILIARY CONTACTS
CONTACTS SHOWN WITH SWITCH OPEN
○ CTL– SPARE CONTACT WIRED TO CUSTOMER TERMINAL BLOCK

SECT 01

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US–1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	METAL ENCLOSED SWITCHGEAR
DRAWN BY:	CAD	DRAWING TYPE:	CONTROL SCHEMATIC
ENGR:	VINAY KUMAR		
DATE:	OCTOBER 14, 2016		
DRAWING STATUS:	RECORD	DWG# C37999262–001–01	PG 1 OF 1 REV —

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

HVL

LOAD CURRENT INTERRUPTER SWITCH

FACTORY ORDER NO.		0
SWITCH PART NO.		44036-325-50
MANUFACTURE DATE		
RATED MAXIMUM VOLTAGE	kV	5.0
IMPULSE WITHSTAND (BIL)	kV	60
NORM. FREQ. WITHSTAND	kV	19
FREQUENCY	HZ	60
CONTINUOUS CURRENT	A SYM	600
LOAD INTERRUPTING CURRENT	A SYM	600
MOMENTARY CURRENT	kA ASYM	40
SHORT TIME – CURRENT	kA SYM	25
– TIME	SEC	2
FAULT CLOSING CURRENT	kA ASYM	40

FUSE/RATING		SQ D 200E
FUSE CATALOG NO.		55GFMSJD200E
INTEGRATED SWITCH & FUSE SHORT CIRCUIT CURRENT	kA SYM	65

METAL ENCLOSED SWITCHGEAR

MAIN BUS AMPACITY	A	600
MAIN BUS BRACING	kA ASYM	40

SQUARE D COMPANY
SMYRNA, TN USA
44036-437-01

Section 1

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	METAL ENCLOSED SWITCHGEAR
DRAWN BY:	CAD	DRAWING TYPE:	RATING NAMEPLATE
ENGR:	VINAY KUMAR		
DATE:	OCTOBER 14, 2016		
DRAWING STATUS:	RECORD	DWG# N37999262-001-01	PG 1 OF 1 REV –

JOB NAME: WEBSTER UNIVERSITY ISB
JOB LOCATION: WEBSTER GROVES, MO

PURCHASER: GRAYBAR ELECT CO 5818836
PURCHASER PO #:

USER: WEBSTER UNIVERSITY
USER LOCATION:

DRAWING STATUS: RECORD

SQUARE D QUOTATION NUMBER: 37999262
QUOTATION REVISION #:
SALES CONTACT: LNP
SALES CONTACT LOCATION: 400

CUSTOMER: GUARANTEE ELECTRIC
CUSTOMER PO #:

ARCHITECT: WILLIAM TAO & ASSOC INC
CONS. ENGINEER:

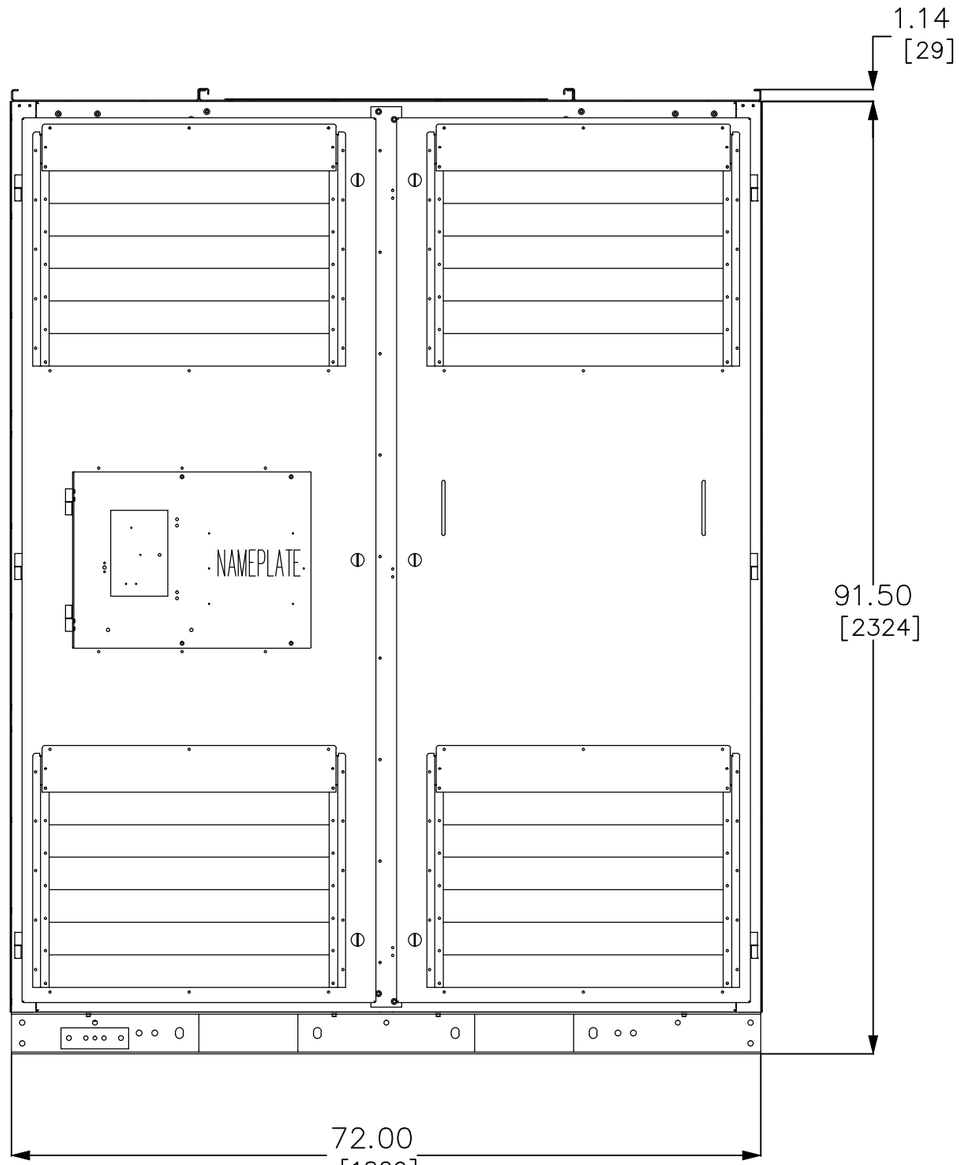
TABLE OF CONTENTS

SQUARE D FACTORY ORDER NUMBER: 37999262–002

EQUIPMENT DESIGNATION:	EQUIPMENT TYPE:	DRAWING TYPE:	DRAWING NUMBER:	PAGE:	REVISION LEVEL:
US–1	UNIT SUBSTATION TRANSFORMER	ELEVATION	F37999262–002–01–1	1	A
		FLOOR PLAN AND NOTES	F37999262–002–01–2	2	A
		LEFT/RIGHT VIEW	F37999262–002–01–3	3	A
		RATING NAMEPLATE	N37999262–002–01–1	1	A
		WIRING DIAGRAM	W37999262–002–01–1	1	A
		WIRING DIAGRAM	–NA–	2	–
		WIRING DIAGRAM	–NA–	3	–
		WIRING DIAGRAM	–NA–	4	–
		WIRING DIAGRAM	–NA–	5	–
		WIRING DIAGRAM	–NA–	6	–
		WIRING DIAGRAM	–NA–	7	–
		WIRING DIAGRAM	–NA–	8	–

REV.: A

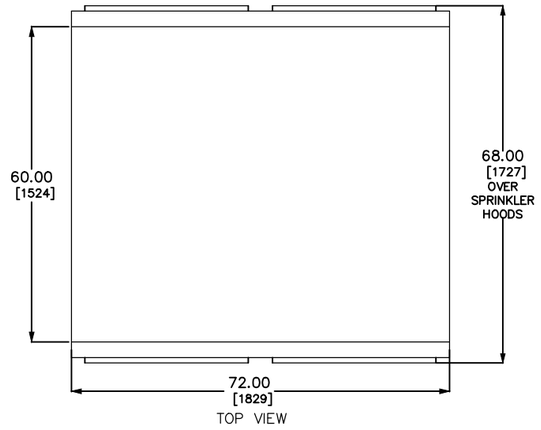
REV	DESCRIPTION	BY	DATE
A	ADD SEISMIC VIEWS, CHNGD TO NEW VIEWS, CHNGD TO RECORD	DG	10/04/16



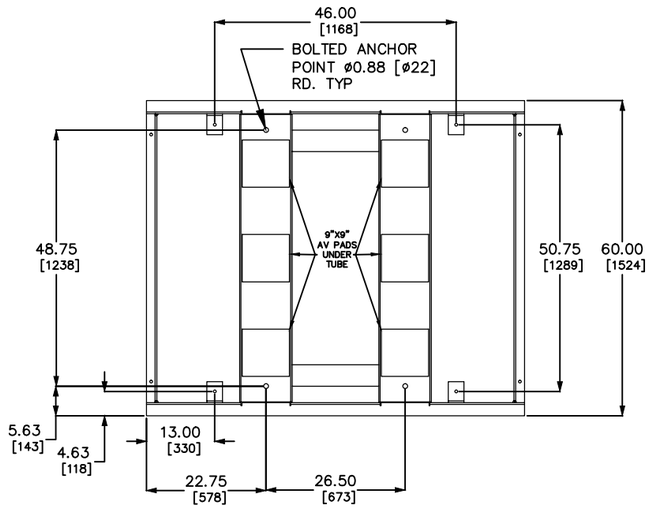
DUAL DIMENSIONS: INCHES
MILLIMETERS

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES, MO	EQUIPMENT TYPE:	UNIT SUBSTATION TRANSFORMER
DRAWN BY:	GSV	DRAWING TYPE:	ELEVATION
ENGR:	JF		SQUARE D Schneider Electric
DATE:	06/29/16		
DRAWING STATUS:	RECORD	DWG# F37999262-002-01-1	PG 1 OF 3 REV A

REV	DESCRIPTION	BY	DATE
A	ADD SEISMIC VIEWS, CHNGD TO NEW VIEWS, CHNGD TO RECORD	DG	10/04/16



TOP VIEW



FLOOR PLAN

ENCLOSURE : NEMA 1 (INDOOR VENTILATED) WITH OUTDOOR GRILLS
FINISH TYPE : ANSI 61 PAINT
PRODUCT TYPE : VPI
KVA : 1000/1333
HV : 4160V
HV KVBIL : 30
HV CONNECTION : D
LV : 480Y/277V
LV KVBIL : 10
LV CONNECTION : Y
TAPS : 4368/4264/4160/4056/3952
IMPEDANCE : 5.75%
TEMPERATURE RISE : 115/115°C
COOLING CLASS : AA/FA
HERTZ : 60
PHASE : 3
LV WINDINGS : CU
HV WINDINGS : CU
SOUND LEVEL : 64 dB
INSULATION CLASS : 220°C
APPROXIMATE WEIGHT CORE AND COIL : 6300 / 2859 lbs/kg
APPROXIMATE WEIGHT TOTAL : 8000 / 3630 lbs/kg
MINIMUM CORE & COIL DIMENSIONS WILL BE : 60"W x 49"H x 28"D

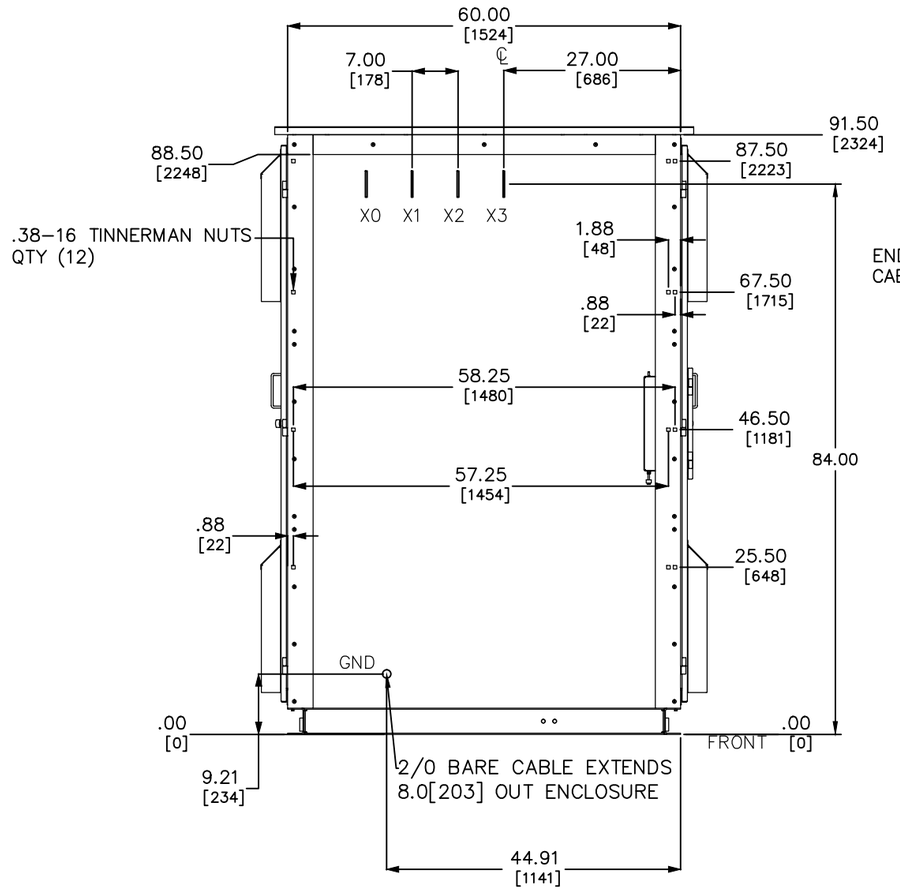
FEATURES:
SILVER FLASH PHASE BUS EXCEPT COIL BUS
GROUND CABLE
EXTERNAL GROUND PADS
ALUMINUM NAMEPLATE
STANDARD ISOLATION PADS
ANSI STANDARDS
UL LISTING
220 DEGREE C INSULATION
SQUARE D TEMPERATURE MONITOR 98A W/FANS
INTERMEDIATE CLASS LIGHTING ARRESTER OF 3 KV QTY (3)
INDOOR CABINET WITH DRIP HOOD & SPRINKLER HOODS
SEISMIC SDS 1.85
LAMACOID ID TAG T-US1

NOTES:
: MAINTAIN 24.00" VENTILATION FROM ANY VENTILATED SURFACE.
: CUSTOMER MOUNTING HOLE PATTERNS ARE ± 1/16".ALL OTHER MEASUREMENTS UNLESS OTHERWISE SPECIFIED ARE ± 1 /
: STAINLESS STEEL GROUND PADS LOCATED ON (2) CORNERS WITH (2) .50-13 TAPPED HOLES ON 1.75 CENTERS
: ENCLOSURES FRONT AND REAR PROVIDED WITH HINGED DOORS & DRIP HOOD & SPRINKLER HOODS
: UNIT SUITABLE FOR ROLLING AND SKIDDING IN ANY DIRECTION
: LIFTING & JACKING PROVIDED

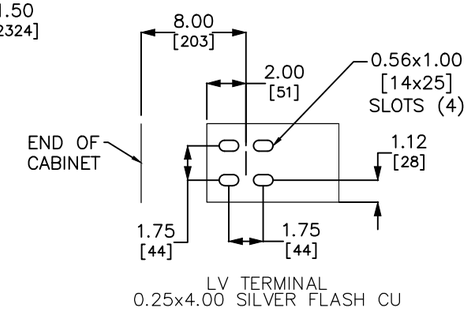
DUAL DIMENSIONS: INCHES
MILLIMETERS

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES, MO	EQUIPMENT TYPE:	UNIT SUBSTATION TRANSFORMER
DRAWN BY:	GSV	DRAWING TYPE:	FLOOR PLAN AND NOTES
ENGR:	JF		SQUARE D Schneider Electric
DATE:	06/29/16		
DRAWING STATUS:	RECORD	DWG#	F37999262-002-01-2

REV	DESCRIPTION	BY	DATE
A	ADD SEISMIC VIEWS, CHNGD TO NEW VIEWS, CHNGD TO RECORD	DDG	10/04/16

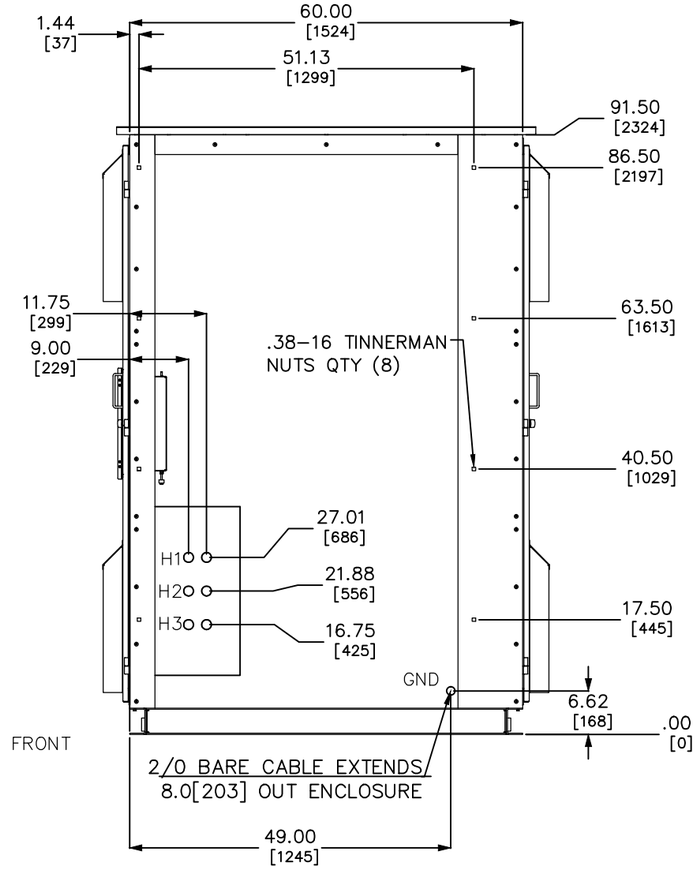


LV SIDE



LV TERMINAL
0.25x4.00 SILVER FLASH CU

HV TERMINAL
#2 15KV CABLE
HV CABLE LENGTHS
OUT OF THE ENCLOSURE
H1 – 25.00[635]
H2 – 35.00[889]
H3 – 50.00[1270]
CABLE SIZE – (1) – #2
(SHIPPED LOOSE)



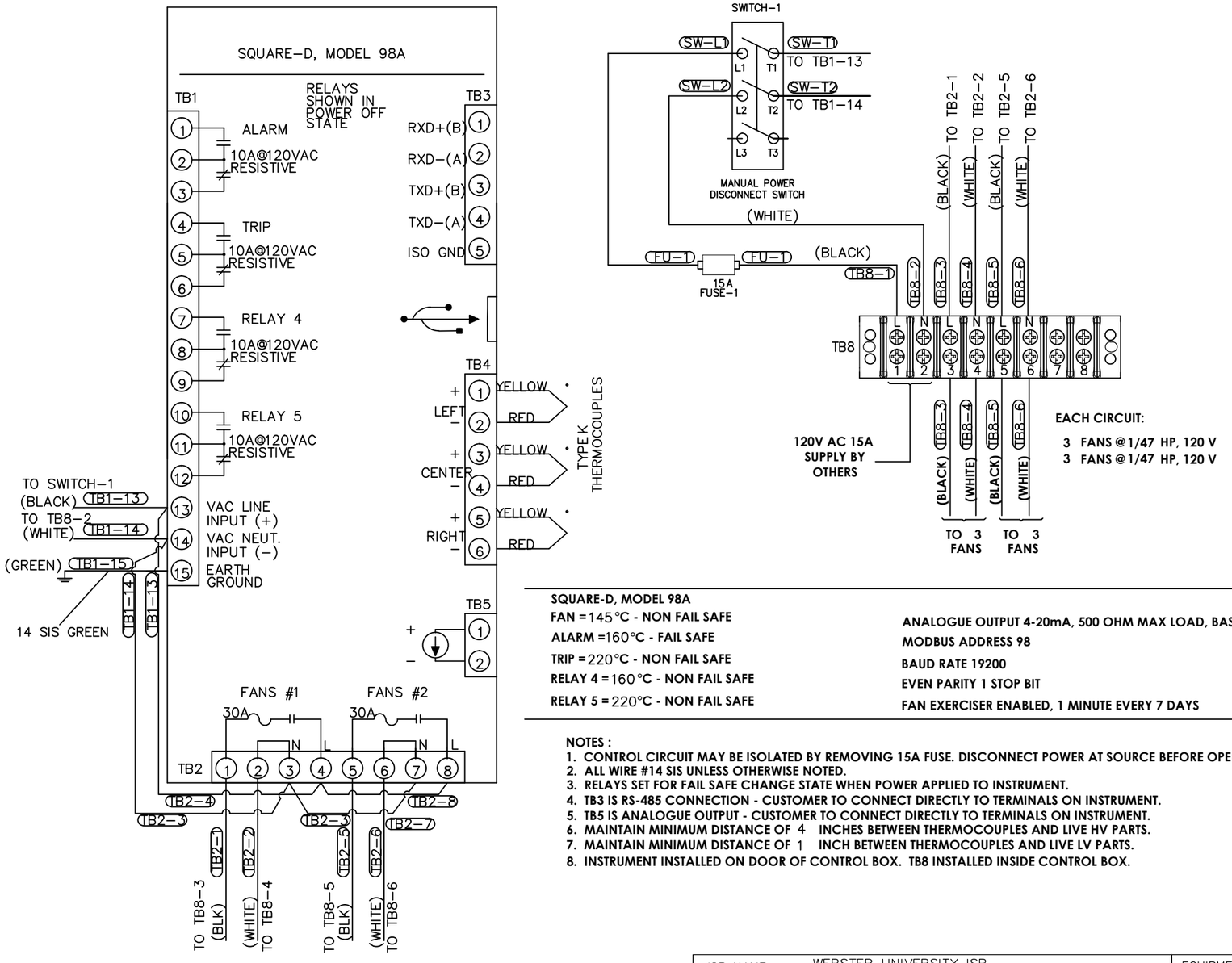
HV SIDE

DUAL DIMENSIONS: INCHES
MILLIMETERS

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US–1
JOB LOCATION:	WEBSTER GROVES, MO	EQUIPMENT TYPE:	UNIT SUBSTATION TRANSFORMER
DRAWN BY:	GSV	DRAWING TYPE:	LEFT/RIGHT VIEW
ENGR:	JF		
DATE:	06/29/16		
DRAWING STATUS:	RECORD	DWG#	F37999262–002–01–3

PG 3 OF 3 REV A

REV	DESCRIPTION	BY	DATE
A	ADD SEISMIC VIEWS, CHNGD TO NEW VIEWS, CHNGD TO RECORD	DG	10/04/16



SQUARE-D, MODEL 98A

FAN = 145 °C - NON FAIL SAFE

ALARM = 160 °C - FAIL SAFE

TRIP = 220 °C - NON FAIL SAFE

RELAY 4 = 160 °C - NON FAIL SAFE

RELAY 5 = 220 °C - NON FAIL SAFE

ANALOGUE OUTPUT 4-20mA, 500 OHM MAX LOAD, BASED ON HOTTEST WINDING

MODBUS ADDRESS 98

BAUD RATE 19200

EVEN PARITY 1 STOP BIT

FAN EXERCISER ENABLED, 1 MINUTE EVERY 7 DAYS

NOTES :

1. **CONTROL CIRCUIT MAY BE ISOLATED BY REMOVING 15A FUSE. DISCONNECT POWER AT SOURCE BEFORE OPENING FUSE HOLDER.**
2. **ALL WIRE #14 SIS UNLESS OTHERWISE NOTED.**
3. **RELAYS SET FOR FAIL SAFE CHANGE STATE WHEN POWER APPLIED TO INSTRUMENT.**
4. **TB3 IS RS-485 CONNECTION - CUSTOMER TO CONNECT DIRECTLY TO TERMINALS ON INSTRUMENT.**
5. **TB5 IS ANALOGUE OUTPUT - CUSTOMER TO CONNECT DIRECTLY TO TERMINALS ON INSTRUMENT.**
6. **MAINTAIN MINIMUM DISTANCE OF 4 INCHES BETWEEN THERMOCOUPLES AND LIVE HV PARTS.**
7. **MAINTAIN MINIMUM DISTANCE OF 1 INCH BETWEEN THERMOCOUPLES AND LIVE LV PARTS.**
8. **INSTRUMENT INSTALLED ON DOOR OF CONTROL BOX. TB8 INSTALLED INSIDE CONTROL BOX.**

DUAL DIMENSIONS: INCHES / MILLIMETERS

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US–1
JOB LOCATION:	WEBSTER GROVES, MO	EQUIPMENT TYPE:	UNIT SUBSTATION TRANSFORMER
DRAWN BY:	GSV	DRAWING TYPE:	WIRING DIAGRAM
ENGR:	JF		SQUARE D Schneider Electric
DATE:	06/29/16		
DRAWING STATUS:	RECORD	DWG#	W37999262–002–01–1

PG 1 OF 1 REV A

REV	DESCRIPTION	BY	DATE
A	ADD SEISMIC VIEWS, CHNGD TO NEW VIEWS, CHNGD TO RECORD	DG	10/04/16

NAMEPLATE MATERIAL = 0.031 ALUMINUM

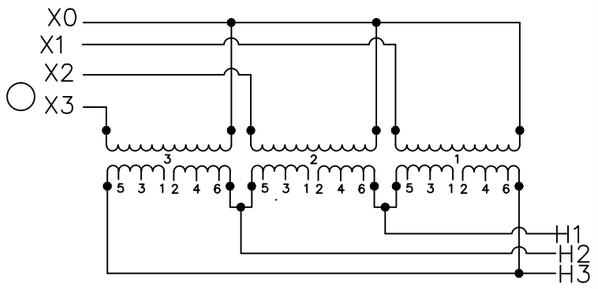
SQUARE D
Schneider Electric
SORGEL® TRANSFORMER

POWER DRY II™ SER.NO. 37999262-002-01

DRY TYPE TRANSFORMER

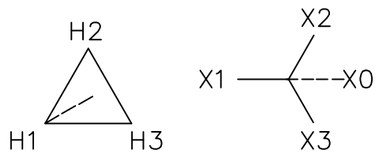
DISTRIBUTION TRANSFORMER
56Y1
E147879
LISTED

kVA	1000/1333	CLASS	AA/FA	TEMP. RISE	115/115 °C	CONDUCTOR	CU/CU
HV	4160V	TYPE	VPI	NEMA-1 ENCLOSURE		APROX. WT. (LBS/kg)	
kV BIL	30HV/10LV	PHASE	3	EXPOSURE CATEGORY	C	CORE & COIL	6300/2858
LV	480Y/277V	IMP.....	5.75 %	INST. BOOK	43500-054-20R2	TOTAL	8000/3629
LV AMP.	1203/1604	HZ	60	JOB. NO.			
AVG./MAX.AMB.	30 / 40 °C	DATE		Manufactured in MEXICO			



DE-ENERGIZE TRANSFORMER BEFORE CHANGING TAPS

VOLTS	HV AMPERES AA	HV AMPERES FA		CONN TAP EACH COIL
4368	132	176		1-2
4264	135	180		2-3
4160	139	185		3-4
4056	142	189		4-5
3952	146	194		5-6



UL TYPE K
TEMPERATURE CLASS: 220

nsdpl826

CUSTOMER NOTE: NAMEPLATE DRAWING IS FOR YOUR INFORMATION AND REVIEW. THE IMPEDANCE IS LEFT BLANK SINCE THE DRAWING IS SUBMITTED PRIOR TO MANUFACTURING. THE ACTUAL TESTED VALUE IS ENGRAVED ON THE METAL NAMEPLATE AT THE TIME OF SHIPMENT. THIS DRAWING IS NOT SUBSEQUENTLY REVISED TO ADD THE TESTED VALUE.

DUAL DIMENSIONS: INCHES / MILLIMETERS

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES, MO	EQUIPMENT TYPE:	UNIT SUBSTATION TRANSFORMER
DRAWN BY:	GSV	DRAWING TYPE:	RATING NAMEPLATE
ENGR:	JF		SQUARE D Schneider Electric
DATE:	06/29/16	DWG#	N37999262-002-01-1
DRAWING STATUS:	RECORD	PG	1 OF 1
		REV	A

SQUARE D
by Schneider Electric

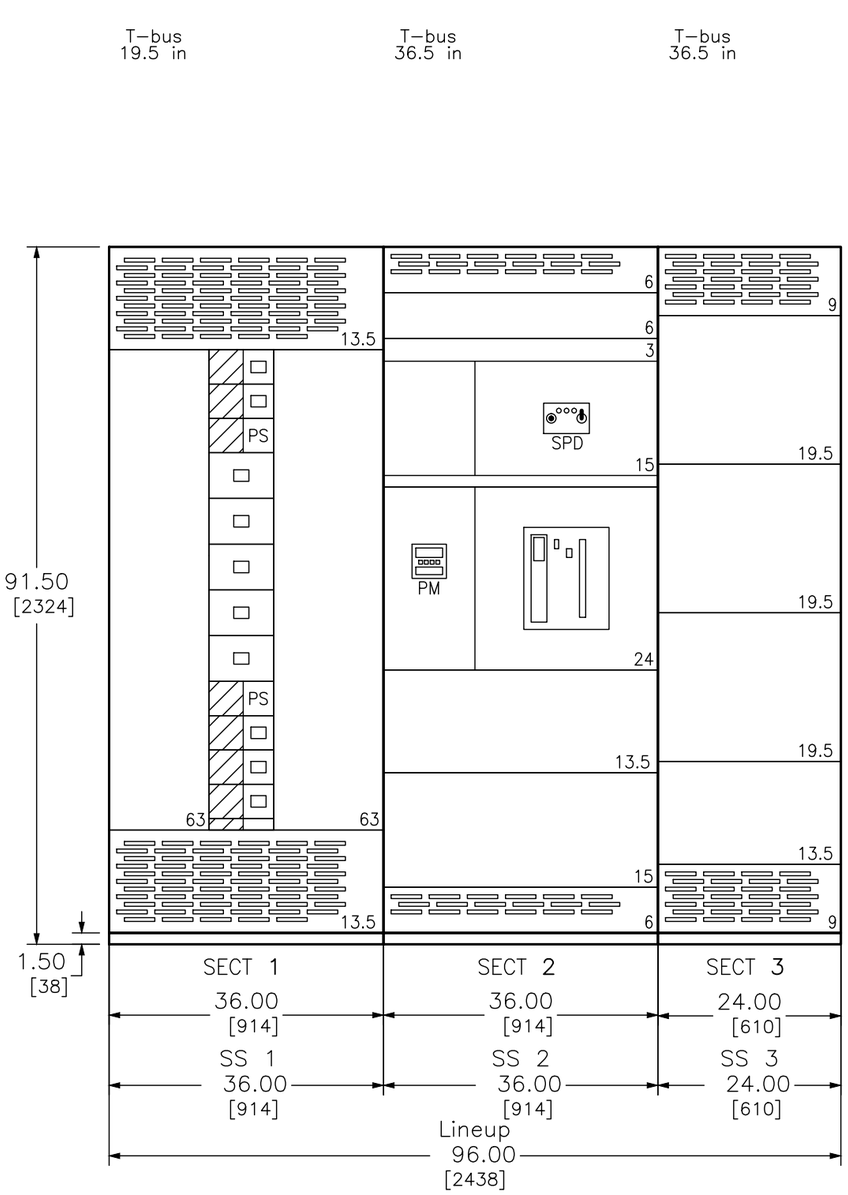
Job Name:	WEBSTER UNIVERSITY ISB	Square D Quotation #:	37999262
Job Location:	WEBSTER GROVES, MO	Quotation Revision #:	
		Sales Contact:	LNP
		Sales Contact Location:	400
Purchaser:	GRAYBAR ELECT CO 5818836	Customer:	GUARANTEE ELECTRIC
Purchaser PO #:		Customer PO #:	
User:	WEBSTER UNIVERSITY	Architect:	WILLIAM TAO & ASSOC INC
User Location:		Cons. Engineer:	
Drawing Status:	RECORDL		

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SQUARE D FACTORY ORDER NUMBER: 37999262–003

Equipment Designation	Equipment Type	Drawing Type	Drawing Number	Page	Revision Level
US–1	QED Switchboard	GENERAL NOTES	F37999262–003–01	1	–
		SIDE, TOP VIEW & FLOOR PLAN	F37999262–003–01	2	–
		CENTER OF GRAVITY	F37999262–003–01	3	–
		ONE LINE	O37999262–003–01	1	–
		SCHEDULE	O37999262–003–01	2	–
		ELEMENTARY DIAGRAM	E37999262–003–01	1	–
			E37999262–003–01	2	A
			E37999262–003–02	1	–
			E37999262–003–03	1	–
			E37999262–003–07	1	–
			E37999262–003–08	1	–
		WIRING DIAGRAM	W37999262–003–02	1	–
			W37999262–003–03	1	A

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--	–	----	--	--/--/--



SWITCHBOARD GENERAL NOTES

PRODUCT DESCRIPTION & RATINGS

Power System Data

480Y/277V 3Ph 4W 60Hz / 3 Phase Wye
Solidly Grounded
System Short Circuit Current Rating: 35kA RMS
Incoming Section 3 Close Coupled to Transformer Through the Side/Right of Lineup

Bus System Data

1600A Silver Plated Copper Main Bus
(2) .25x2.00 IN/6x51 mm Cu Bus Bar Per Phase/Neutral
(1) .25x.875 IN/6x22 mm Cu Ground Bus
Insulated/Taped bus

Enclosure Data

Type 1 Free Standing
Exterior Paint Color: ANSI 61
Front & Rear Accessibility Required
Handling: Rollers & Lifting Assemblies
Nameplate Mounting Type: Adhesive (Field Installed)
Equipment Nameplate: White Surface/Black Letters
Device Nameplate: White Surface / Black Letters

Estimated Shipping Weight

Shipping Split 1 1090.00 lbs / 494.42 kgs
Shipping Split 2 1105.00 lbs / 501.23 kgs
Shipping Split 3 630.00 lbs / 285.77 kgs
Complete Lineup 2825.00 lbs / 1281.42 kgs

Code Standards

U.L. Deadfront and suitable for use as Service Entrance
when not more than six (6) disconnecting means are provided.

Rating Nameplates

ST1– Deadfront– Section Bus 1600A
ST2– Service Entrance – Section Bus 1600A
ST3– Deadfront– Section Bus 300A

PRODUCT INFORMATION

Wiring

All wiring to be SIS Wire type

Instruction Bulletins

Reference 80043–055 For Handling, Installation,
Anchoring, Inspection And Maintenance Information

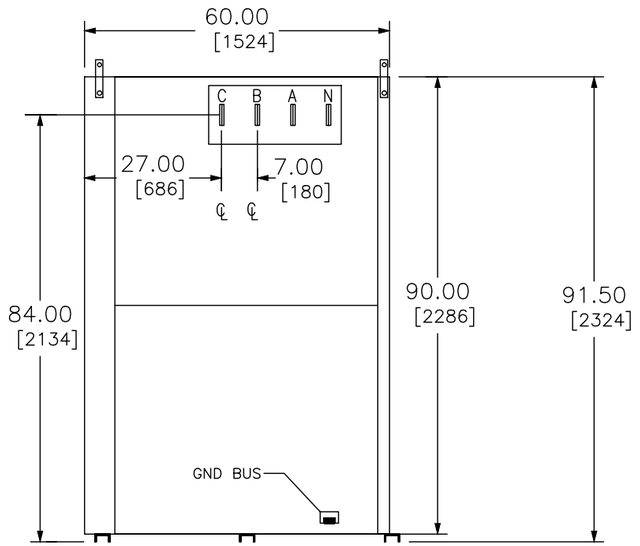
Product Accessories/Options

Certified Test Report
Seismic Qualified
24V Trip Unit Display Power
Masterpact NW 3–Pole Breaker Lifting Bar Assembly
Test Kit (Handheld)

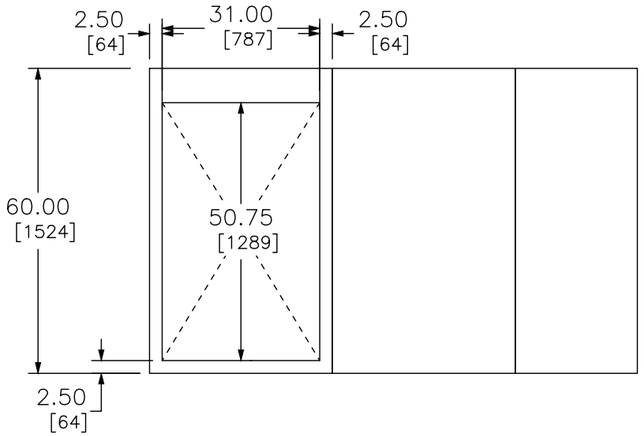
DUAL DIMENSIONS: INCHES
MILLIMETERS

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US–1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD
DRAWN BY:	ROW	DRAWING TYPE:	GENERAL NOTES
ENGR:	R.WOLFE		
DATE:	OCTOBER 21, 2016		
DRAWING STATUS:	RECORD	DWG# F37999262–003–01	PG 1 OF 3 REV –

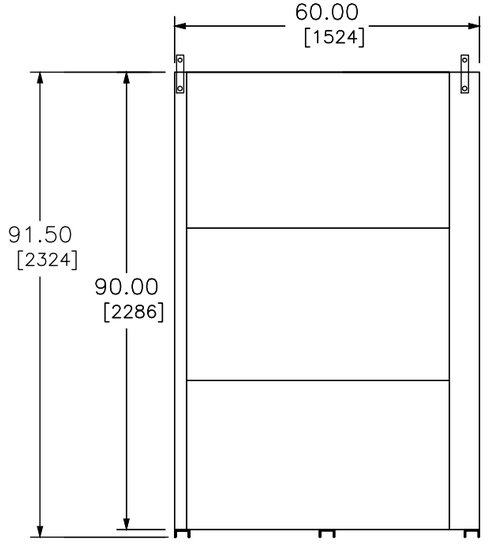
REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--	–	----	--	--/--/--
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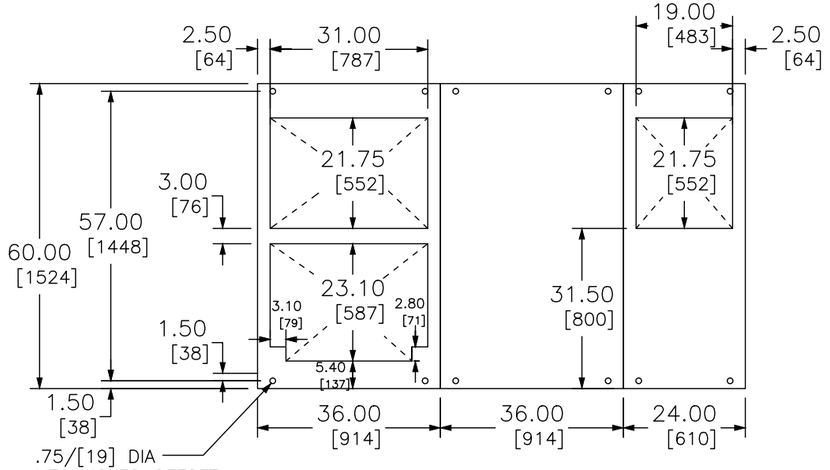
RIGHT SIDE VIEW



TOP VIEW – FRONT



LEFT SIDE VIEW



FLOOR PLAN – FRONT

DUAL DIMENSIONS: INCHES
MILLIMETERS

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD
DRAWN BY:	ROW	DRAWING TYPE:	SIDE, TOP VIEW & FLOOR PLAN
ENGR:	R.WOLFE		
DATE:	OCTOBER 24, 2016		
DRAWING STATUS:	RECORD	DWG# F37999262-003-01	PG 2 OF 3 REV –

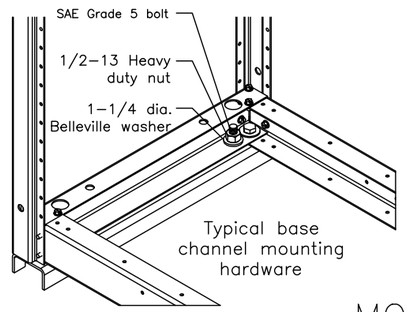
REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--	–	----	--	--/--/--
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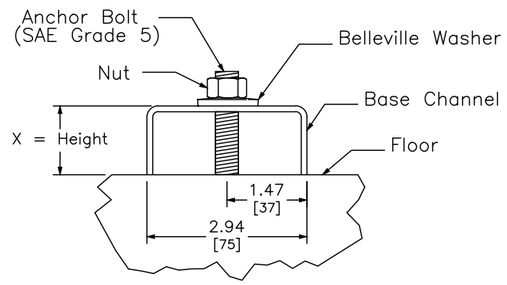
REQUIREMENTS FOR SEISMIC RATING

ANCHORING CONDITIONS:

To Maintain Seismic Qualifications, Equipment Must Be Installed Per Manual (See General Notes) And Per Any Seismic Anchoring Details Provided By Others. Do Not Install Equipment Before Approved Seismic Anchoring Details Have Been Obtained And Site Prepararations Have Been Made In Accordance With The Approved Seismic Anchoring Details. All Post–Installed Anchors Shall Be Approved For Seismic Loads.

Consideration Must Be Made For Conduit Entry Into Each Section When Developing Mounting Pad Reinforcement Locations. See Conduit Entry Details (Floor Plan) For Dimensional Information.





MOUNTING DETAILS

Each Section Must Be Anchored At All Locations (Refer To Floor Plan And Mounting Detail Above). Anchor Bolt Mounting Points Are .75/[19] Diameter Holes Located 1.50/[38] Or 3.00/[76] Above The Base of the Section. Use Dimensions From The Floor Plan To Determine Mounting Locations.

The Belleville Washer (Shown In Detail Above) Used For Anchoring Connections Is A Tested Component And Is Required To Maintain Position Retention Of The Equipment. The Slip Critical Connection Performance Of The Bolted Connection Was Established To The Shake Table Tested Seismic Capacity Of The Equipment As Shown On The Equipment Seismic Certificate Supplied At The Time Of Order.

CENTER OF GRAVITY CALCULATIONS:

Elevation Center Of Gravity: 55 in. (1387.00mm) Up From Floor
Vertical Center Of Gravity: Use Centerline Of Section From Left To Right
Depth Center Of Gravity: Use CenterLine Of The Section From Front To Rear

SECTION WEIGHT:

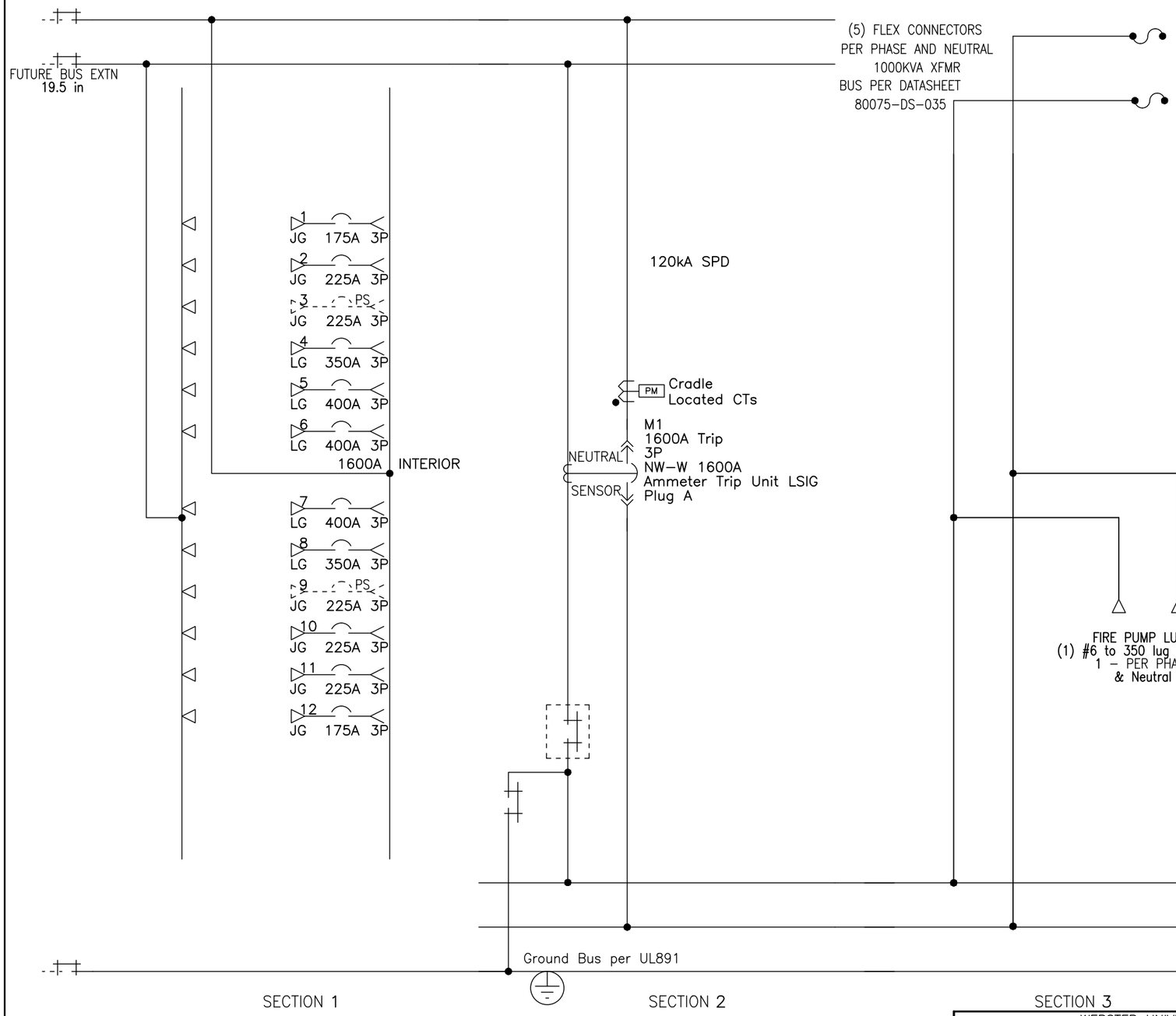
The Weights Given Below Are The Maximum For Each Section And Should Be Used For Calculating Seismic Anchoring Requirements

Section 1	1090.00 lbs	/ 494.42	kgs
Section 2	1105.00 lbs	/ 501.23	kgs
Section 3	630.00 lbs	/ 285.77	kgs

DUAL DIMENSIONS: INCHES
MILLIMETERS

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US–1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD
DRAWN BY:	ROW	DRAWING TYPE:	CENTER OF GRAVITY
ENGR:	R.WOLFE		
DATE:	SEPTEMBER 30, 2016		
DRAWING STATUS:	RECORD	DWG# F37999262–003–01	PG 3 OF 3 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--	–	----	--	--/--/--
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JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD
DRAWN BY:	ROW	DRAWING TYPE:	ONE LINE
ENGR:	R.WOLFE		
DATE:	SEPTEMBER 30, 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-003-01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--	–	----	--	--/--/--
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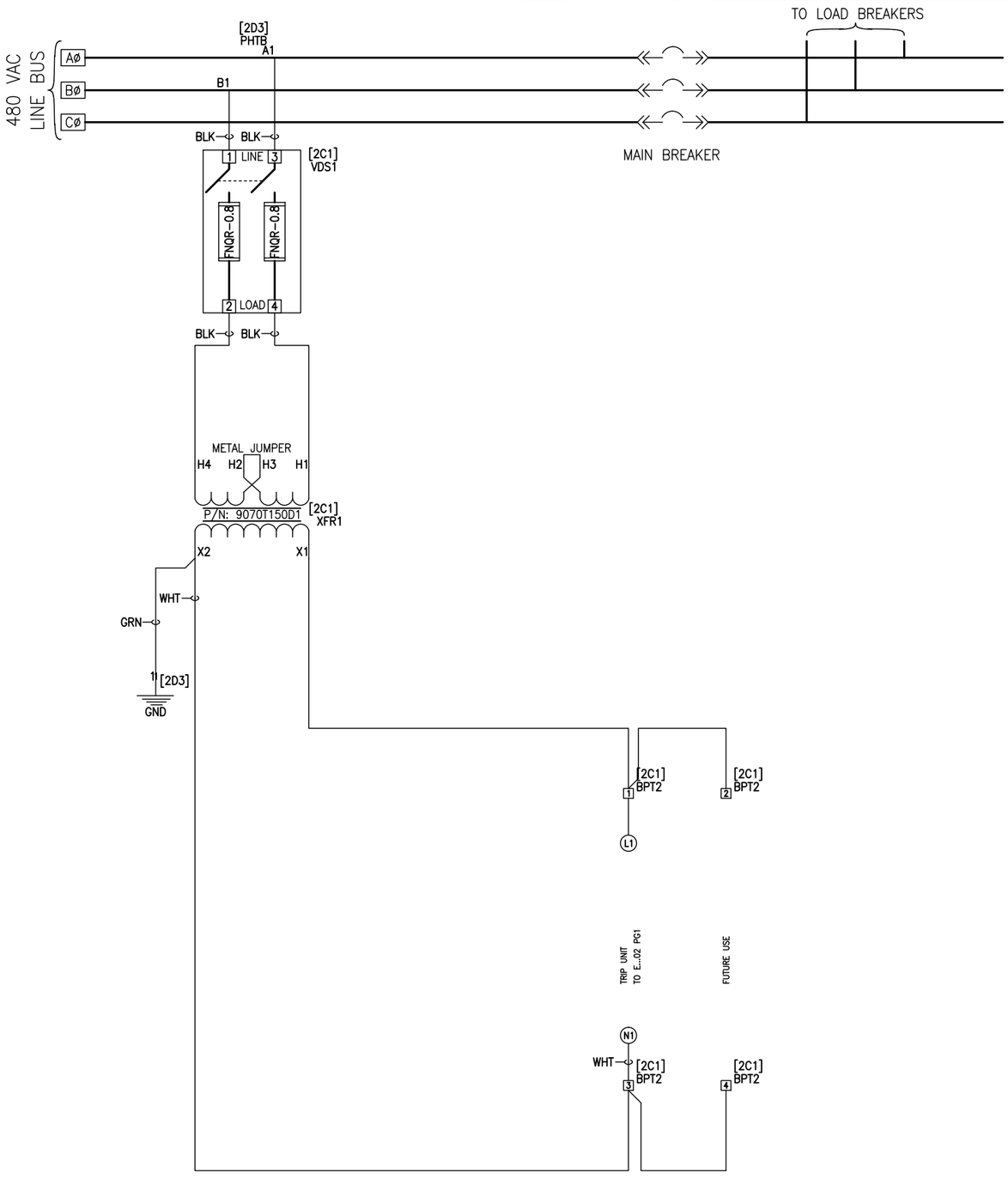
POWER STYLE QED–2 SWITCHBOARD

SECT NO	CKT NO	GMD HEIGHT	DEVICE/FRAME RATING	TRIP AMP	FUSE/ TRIP	#P	DESIGNATION	N/P	LUG/WIRE INFORMATION				ACCESSORIES / NOTES
									QTY	PHASE WIRE RANGE	QTY	NEUT WIRE RANGE	
–	–	–	Equipment Nameplate	–	–	–	US–1	Yes	–	–	–	–	– –
1	1	4.5 in	JG 250A	175A	S–LI	3P	1NH1–4NH1	Yes	1	3/0 – 350 kcmil	1	3/0 – 350kcmil	
1	2	4.5 in	JG 250A	225A	S–LI	3P	SPARE	Yes	1	3/0 – 350 kcmil	1	3/0 – 350kcmil	
1	3	4.5 in	JG 250A (PS)	(225A)	(LI)	3P	Blank Nameplate	Yes	1	3/0 – 350 kcmil	1	3/0 – 350kcmil	
1	4	6 in	LG 400A	350A	S–LI	3P	SB1	Yes	1	600 kcmil (Cu Only)	1	600 kcmil (Cu Only)	LK5
1	5	6 in	LG 400A	400A	S–LI	3P	ATSSB	Yes	2	3/0 – 250 kcmil	2	3/0 – 250 kcmil	
1	6	6 in	LG 400A	400A	S–LI	3P	SPARE	Yes	2	3/0 – 250 kcmil	2	3/0 – 250 kcmil	
1	7	6 in	LG 400A	400A	S–LI	3P	BNH1	Yes	2	3/0 – 250 kcmil	2	3/0 – 250 kcmil	
1	8	6 in	LG 400A	350A	S–LI	3P	SB2	Yes	1	600 kcmil (Cu Only)	1	600 kcmil (Cu Only)	LK5
1	9	4.5 in	JG 250A (PS)	(225A)	(LI)	3P	Blank Nameplate	Yes	1	3/0 – 350 kcmil	1	3/0 – 350kcmil	
1	10	4.5 in	JG 250A	225A	S–LI	3P	1NH2	Yes	1	3/0 – 350 kcmil	1	3/0 – 350kcmil	
1	11	4.5 in	JG 250A	225A	S–LI	3P	ATSLS	Yes	1	3/0 – 350 kcmil	1	3/0 – 350kcmil	
1	12	4.5 in	JG 250A	175A	S–LI	3P	SPARE	Yes	1	3/0 – 350 kcmil	1	3/0 – 350kcmil	
2	–	–	120kA SPD	–	–	–	–	–	–	–	–	–	SPD
2	M1	–	NW 1600A Plug A	1600A	A–LSIG	3P	MAIN	Yes	–	–	–	–	CP,GF,SDE1,OF4,MX1,CCKK PM8K,TU
3	–	–	Incoming Connection	–	–	–	–	–	–	XFMR	–	XFMR	CPF
3	–	–	Fire Pump Lugs	–	–	–	–	–	1	#6 – 350 kcmil	1	#6 – 350 kcmil	

LEGEND	
CCKK	Cradle Cell Key Kit
CP	Control Power
CPF	Control Power – Xfmr Fan
GF	Ground Fault
LK5	AL400L61K3 Lug Kit
MX1	Shunt Trip
OF4	4 Form C Breaker Aux Contacts
PM8K	Power Meter PM8XXX
SDE1	Over Current Trip Switch
SPD	Surge Protection Device
TU	24V Trip Unit Display Power

NAMEPLATE INFORMATION:	JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION: US–1
MOUNTING TYPE: Adhesive (Field Installed)	JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE: QED SWITCHBOARD
EQUIPMENT: White Surface/Black Letters	DRAWN BY:	ROW	DRAWING TYPE: SCHEDULE
DEVICE: White Surface / Black Letters	ENGR:	R.WOLFE	
	DATE:	SEPTEMBER 30, 2016	
	DRAWING STATUS:	RECORD	DWG# 037999262–003–01 PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--	–	----	--	--/--
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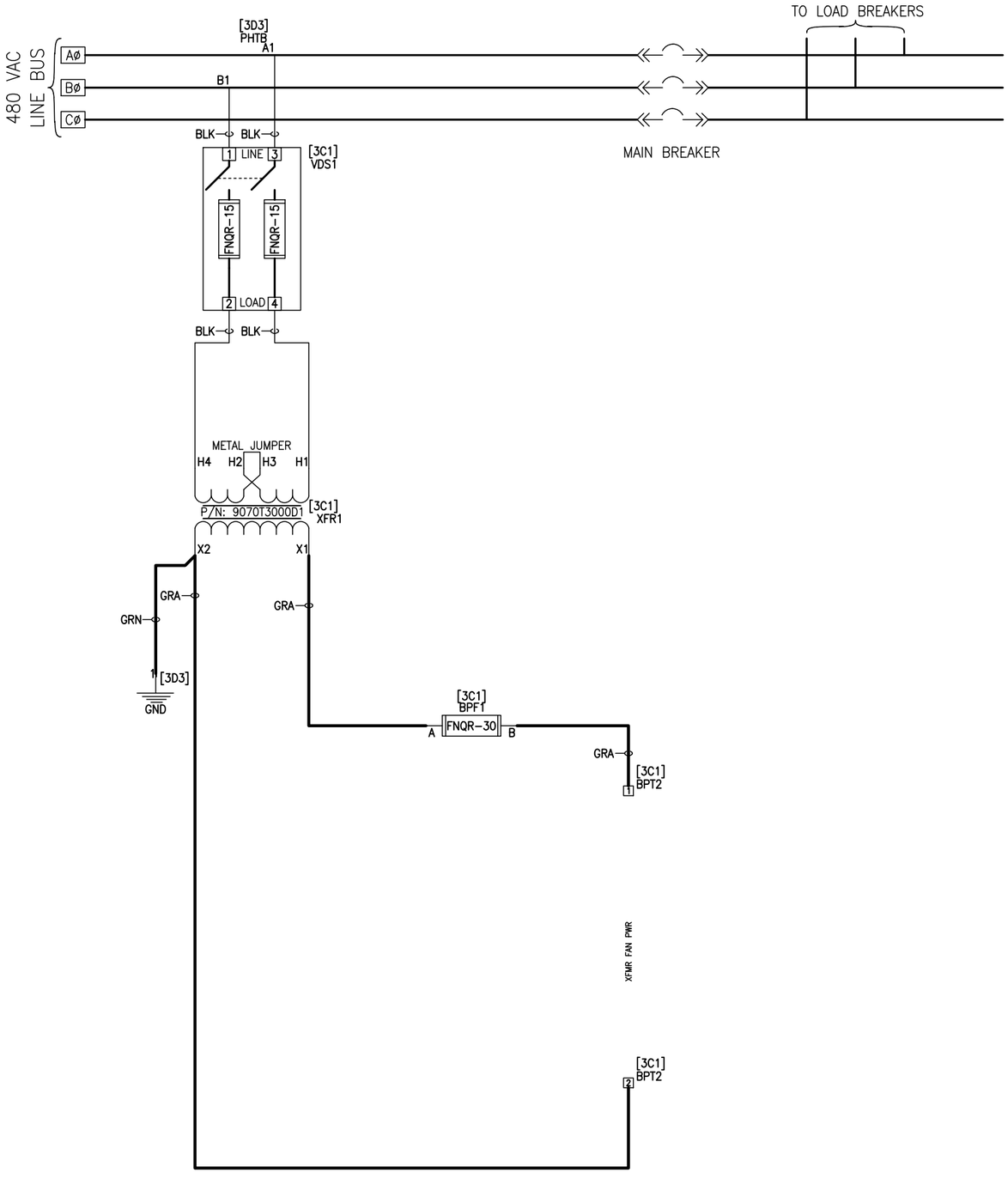


NOTES:
1. ALL CONTROL WIRING TO BE TYPE "SIS" (UL LISTED) UNLESS OTHERWISE NOTED.
2. ALL CONTROL FUSES MOUNTED IN FUSED PULLOUTS.
3. USE #14 AWG WIRE UNLESS OTHERWISE NOTED.
4. ALL CONDUCTORS TO BE RED WIRE UNLESS OTHERWISE NOTED.

150 VA CONTROL POWER (480:120VAC)

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD
DRAWN BY:	ROW	DRAWING TYPE:	ELEMENTARY DIAGRAM
ENGR:	R.WOLFE		SQUARE D Schneider Electric
DATE:	OCTOBER 04, 2016		
DRAWING STATUS:	RECORD	DWG# E37999262-003-01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--	–	----	--	--/--
A	CHANGE PAGE DESCRIPTION FROM 150VA TO 3000VA	RW	10/27/2016	–	----	--	--/--	–	----	--	--/--

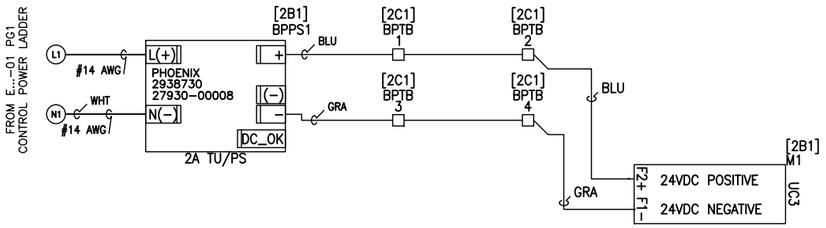


NOTES:
1. ALL CONTROL WIRING TO BE TYPE "SIS" (UL LISTED) UNLESS OTHERWISE NOTED.
2. ALL CONTROL FUSES MOUNTED IN FUSED PULLOUTS.
3. USE #14 AWG WIRE UNLESS OTHERWISE NOTED.
4. ALL CONDUCTORS TO BE RED WIRE UNLESS OTHERWISE NOTED.

3000 VA CONTROL POWER (480:120VAC)

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD
DRAWN BY:	ROW	DRAWING TYPE:	ELEMENTARY DIAGRAM
ENGR:	R.WOLFE		SQUARE D Schneider Electric
DATE:	OCTOBER 04, 2016		
DRAWING STATUS:	RECORD	DWG# E37999262-003-01	PG 2 OF 2 REV A

REV	DESCRIPTION	BY	DATE								
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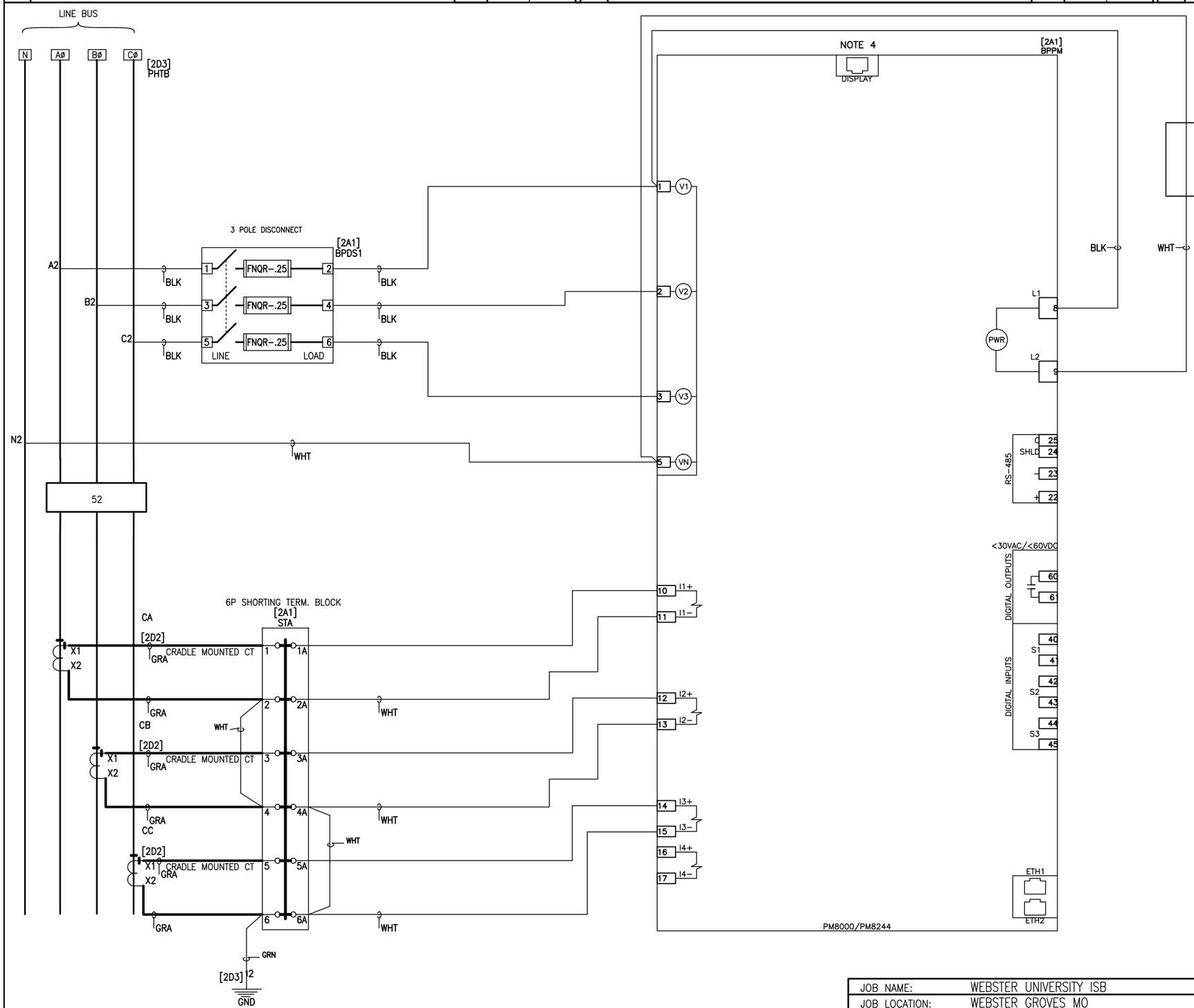
NOTES:

1. POWER SUPPLY CAN ONLY PROVIDE POWER FOR CIRCUIT BREAKER TRIP UNITS.
2. SEPARATE ALL AC CONTROL WIRING FROM COMMUNICATIONS CIRCUIT.
3. ALL CONDUCTORS TO BE #16 SIS UNLESS OTHERWISE NOTED.
4. TWIST SHIELDS TOGETHER, FOLD BACK AGAINST THE OUTER INSULATION, AND HEAT SHRINK SHIELDS AND CABLES.
5. ALL WIRING TO BE RED WIRE UNLESS OTHERWISE NOTED.
6. ALL SHIPPING SPLIT TERMINAL BLOCKS ARE LOCATED ON FRONT LOWER TIE CHANNEL BEHIND BOTTOM FRONT COVER.

Trip Unit External Power Wiring Elementary

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD
DRAWN BY:	ROW	DRAWING TYPE:	ELEMENTARY DIAGRAM
ENGR:	R.WOLFE		SQUARE D Schneider Electric
DATE:	OCTOBER 04, 2016		
DRAWING STATUS:	RECORD	DWG# E37999262-003-02	PG 1 OF 1 REV —

REV	DESCRIPTION	BY	DATE
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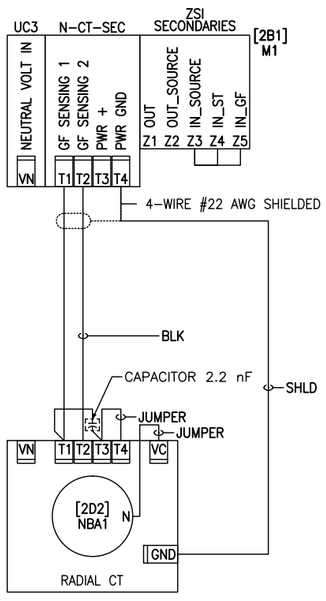


NOTE
1. USE 14 GAUGE RED WIRE MINIMUM, UNLESS OTHERWISE NOTED, USE 12 GAUGE GROUND WIRE FOR CANADIAN ORDERS.
2. SEPARATE ALL AC CONTROL WIRING FROM COMMUNICATIONS CIRCUIT.
3. CONTROL POWER CAN BE DRAWN FROM FUSED VOLTAGE INPUTS ONLY WHEN LINE–TO–NEUTRAL VOLTAGE IS BELOW 457V AC. SEPARATELY DERIVED 120V CONTROL POWER ALSO ACCEPTABLE. ALWAYS FUSE L1 (PIN 8), FUSE L2 (PIN 9) WHEN USING AN UNGROUNDED NEUTRAL.
4. USE DISPLAY CABLE SUPPLIED WITH POWER METER.
5. FOR ADDITIONAL INFORMATION AND COMMUNICATION WIRING SEE POWERLOGIC POWER METER SERIES 800 INSTRUCTION 7EN02–0336–00 – PM8000 USER MANUAL.
6. MULTIPLE METERS MAY BE FED BY SAME DISCONNECT. INDIVIDUAL FUSING IS REQUIRED.
7. SPLICE THE SHIELD WIRES WHEN CONNECTING THE BELDEN 8723 (OR EQUIVALENT) CABLE FOR COMMUNICATIONS.
8. GROUNDED TERMINAL OF THE SHORTING BLOCK TO BE A PAN HEAD SCREW.
9. ALL CONTROL WIRING TO BE "SIS" (UL LISTED) UNLESS OTHERWISE NOTED.

PowerLogic Power Meter Wiring Elementary

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US–1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD
DRAWN BY:	ROW	DRAWING TYPE:	ELEMENTARY DIAGRAM
ENGR:	R.WOLFE		SQUARE D Schneider Electric
DATE:	OCTOBER 04, 2016		
DRAWING STATUS:	RECORD	DWG# E37999262–003–03	PG 1 OF 1 REV —

REV	DESCRIPTION	BY	DATE								
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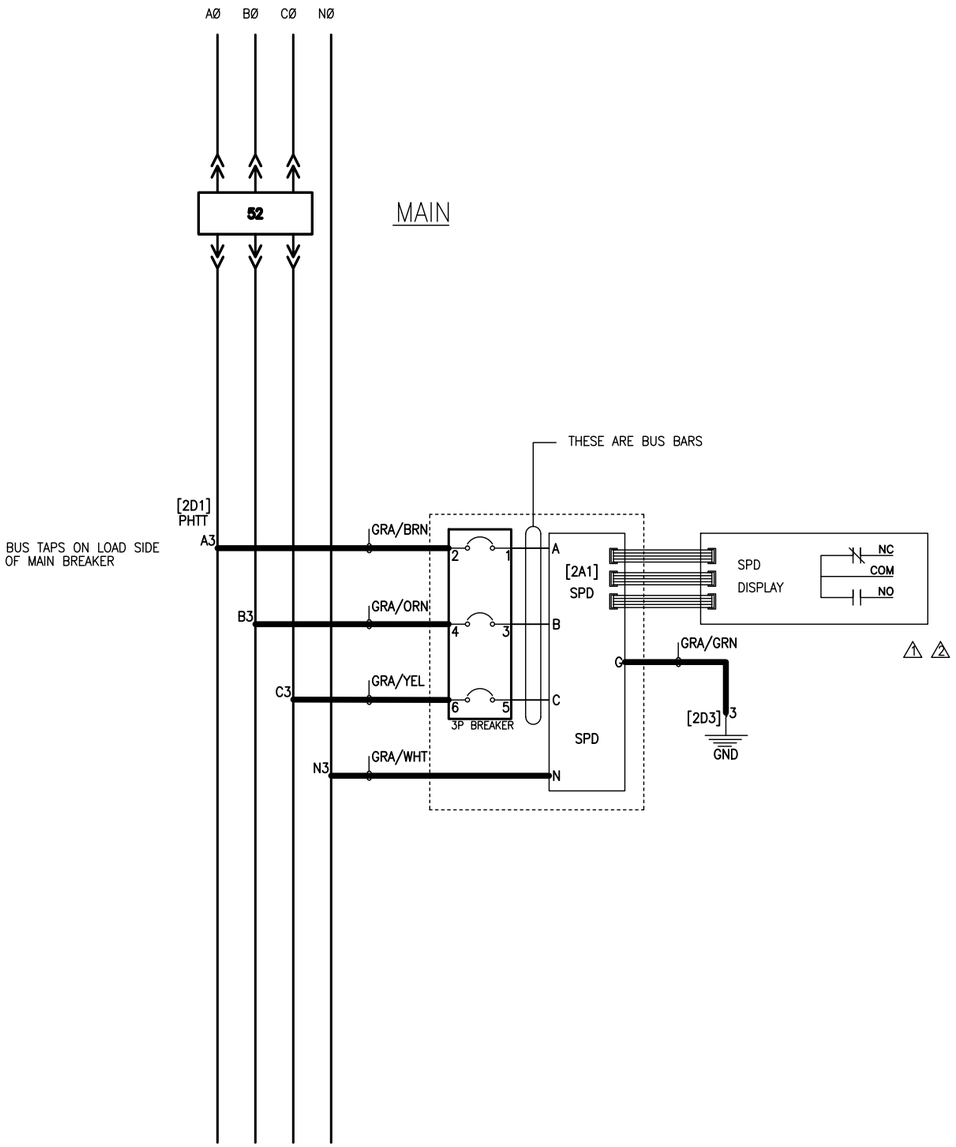
NOTES:
1. ALL CONTROL WIRING TO BE TYPE "SIS" (UL LISTED) UNLESS OTHERWISE NOTED.
2. USE #22 AWG SHIELDED WIRE UNLESS OTHERWISE NOTED.
3. ALL SYMBOLS ARE SHOWN WITH CIRCUIT BREAKER OPEN, CONNECTED AND CHARGED.
4. JUMPER BETWEEN T1 & T2 IS ONLY PRESENT WHEN NEUTRAL CT IS NOT CONNECTED.
5. ALL CONDUCTORS TO BE RED WIRE UNLESS OTHERWISE NOTED.
6. Vn CONNECTION ONLY REQUIRED FOR 5.0P,6.0P,5.0H,AND 6.0H TRIP UNITS.

4 Vn CONNECTION ONLY REQUIRED FOR 5.0P,6.0P,5.0H,AND 6.0H TRIP UNITS.

RADIAL GROUND FAULT

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD
DRAWN BY:	ROW	DRAWING TYPE:	ELEMENTARY DIAGRAM
ENGR:	R.WOLFE		SQUARE D Schneider Electric
DATE:	OCTOBER 04, 2016		
DRAWING STATUS:	RECORD	DWG# E37999262-003-07	PG 1 OF 1 REV —

REV	DESCRIPTION	BY	DATE								
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NOTES:

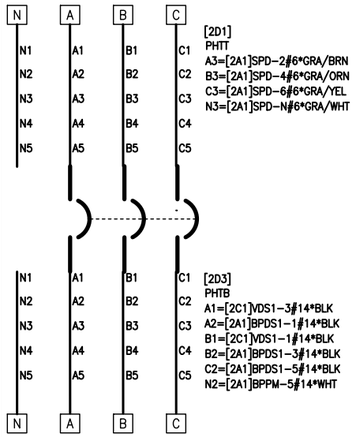
1. ALL WIRING TO BE TYPE #6 AWG RED SIS (UL LISTED) WIRE UNLESS OTHERWISE NOTED.
2. DISPLAY FORM C DRY CONTACTS ARE RATED @ 24VDC/AC – 2 AMPS.
3. CABLES MUST BE AS SHORT AS POSSIBLE WITH A MINIMUM NUMBER OF LARGE RADIUS BENDS. MAXIMUM LENGTH OF CABLE FROM NEUTRAL AND GROUND BUS CONNECTIONS TO TVSS UNIT SHALL NOT EXCEED 8 FEET. MAXIMUM NUMBER OF BENDS SHALL NOT EXCEED 4. MINIMUM RADIUS SHALL BE 3 INCHES. CABLES MUST BE SECURELY FASTENED THROUGHOUT THEIR LENGTH.
4. FOR EQUIPMENT BUILT TO ANSI C37.20.1 OR CSA C22.2 NO. 31–M89, SINGLE CONDUCTOR CABLE MAY BE TYPE SIS AND COLOR CODES MAY BE DISREGARDED FOR SINGLE CONDUCTORS.
5. PATCH CABLES MUST BE PROTECTED WHERE THEY CROSS THE HINGE SIDE DOOR FLANGE FROM DISPLAY TO INSTRUMENT COMPARTMENT, PATCH CABLES MUST BE KEPT SEPARATED FROM POWER WIRING.

SPD Wiring Elementary

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD
DRAWN BY:	ROW	DRAWING TYPE:	ELEMENTARY DIAGRAM
ENGR:	R.WOLFE		SQUARE D Schneider Electric
DATE:	OCTOBER 04, 2016		
DRAWING STATUS:	RECORD	DWG# E37999262-003-08	PG 1 OF 1 REV —

REV	DESCRIPTION	BY	DATE	–	----	--	--/--	–	----	--	--/--
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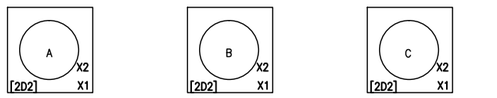
BUS CONNECTION



[2D1]
PHTT
A3=[2A1]SPD–2#6*GRA/BRN
B3=[2A1]SPD–4#6*GRA/ORN
C3=[2A1]SPD–6#6*GRA/YEL
N3=[2A1]SPD–N#6*GRA/WHT

[2D3]
PHTB
A1=[2C1]VDS1–3#14*BLK
A2=[2A1]BPDS1–1#14*BLK
B1=[2C1]VDS1–1#14*BLK
B2=[2A1]BPDS1–3#14*BLK
C2=[2A1]BPDS1–5#14*BLK
N2=[2A1]BPPM–5#14*WHT

CURRENT TRANSFORMERS



CA
X1=[2A1]STA–1#10*GRA
X2=[2A1]STA–2#10*GRA

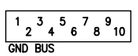
CB
X1=[2A1]STA–3#10*GRA
X2=[2A1]STA–4#10*GRA

CC
X1=[2A1]STA–5#10*GRA
X2=[2A1]STA–6#10*GRA



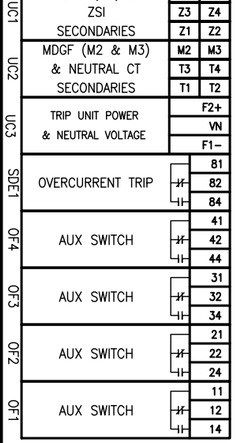
[2D2]
NBA1
GND=[2B1]M1–T4#22*SHLD
T1=[2B1]M1–T1#22
T2=[2B1]M1–T2#22*BLK
JUMP N & VC*JUMPER
JUMP T3 & T4*JUMPER

GROUND BUS



[2D3]
GND
1=[2C1]XFR1–X2#14*GRN
2=[2A1]STA–6#14*GRN
3=[2A1]SPD–G#6*GRA/GRN

BREAKER CELL

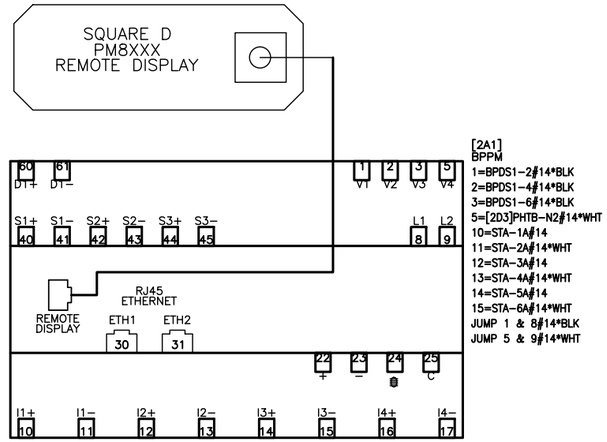


[2B1]
M1
F1–=[2C1]BPTB–4*GRA
F2+=[2C1]BPTB–2*BLU
T1=[2D2]NBA1–T1#22
T2=[2D2]NBA1–T2#22*BLK
T4=[2D2]NBA1–GND#22*SHLD
JUMP Z3 & Z4
JUMP Z3 & Z5

SHIPPING SPLIT

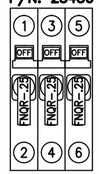
NOTES:
1. ALL CONTROL WIRING TO BE TYPE "SIS" (UL LISTED) UNLESS OTHERWISE NOTED.
2. ALL CONTROL FUSES MOUNTED IN FUSED PULLOUTS.
3. USE #16 AWG WIRE UNLESS OTHERWISE NOTED.
4. ALL WIRES TO BE RED UNLESS OTHERWISE NOTED.

MOUNTING PAN(S)



[2A1]
BPPM
1=BPDS1–2#14*BLK
2=BPDS1–4#14*BLK
3=BPDS1–6#14*BLK
5=[2D3]PHTB–N2#14*WHT
10=STA–1A#14
11=STA–2A#14*WHT
12=STA–3A#14
13=STA–4A#14*WHT
14=STA–5A#14
15=STA–6A#14*WHT
JUMP 1 & 8#14*BLK
JUMP 5 & 9#14*WHT

P/N: HUA21788
P/N: 25430–20025



[2A1]
BPDS1
1=[2D3]PHTB–A2#14*BLK
2=BPPM–1#14*BLK
3=[2D3]PHTB–B2#14*BLK
4=BPPM–2#14*BLK
5=[2D3]PHTB–C2#14*BLK
6=BPPM–3#14*BLK

P/N: 27110–00000

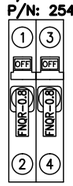
[2A1]
STA

[2D2]CA–X1#10*GRA	1	1A	BPPM–10#14
[2D2]CA–X2#10*GRA	2	2A	BPPM–11#14*WHT
[2D2]CB–X1#10*GRA	3	3A	BPPM–12#14
[2D2]CB–X2#10*GRA	4	4A	BPPM–13#14*WHT
[2D2]CC–X1#10*GRA	5	5A	BPPM–14#14
[2D3]GND–2#14*GRN	6	6A	BPPM–15#14*WHT

[2D2]CC–X2#10*GRA,

JUMP 2 & 4#14*WHT
JUMP 4A & 6A#14*WHT

P/N: HUA21787
P/N: 25430–20080



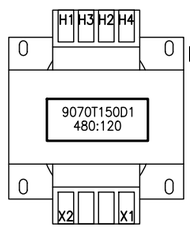
[2C1]
VDS1
1=[2D3]PHTB–B1#14*BLK
2=XFR1–H4#14*BLK
3=[2D3]PHTB–A1#14*BLK
4=XFR1–H1#14*BLK

P/N: HUA22509
P/N: HUA17403, HUA22512

[2C1]
BPT2

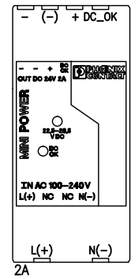
XFR1–X1#14	1	[2B1]BPPS1–L(+)#14
	2	
XFR1–X2#14*WHT	3	[2B1]BPPS1–N(–)#14*WHT
	4	

JUMP 1 & 2 [L]
JUMP 3 & 4 [L]



[2C1]
XFR1
H1=VDS1–4#14*BLK
H4=VDS1–2#14*BLK
X1=BPT2–1#14
X2=BPT2–3*WHT,[2D3]GND–1##14*GRN
JUMP H2 & H3

[2B1]
BPPS1
+=[2C1]BPTB–1*BLU
–=[2C1]BPTB–3*GRA
L(+)=[2C1]BPT2–1#14
N(–)=[2C1]BPT2–3#14*WHT



2A

P/N: HUA22509
P/N: HUA17403, HUA22512

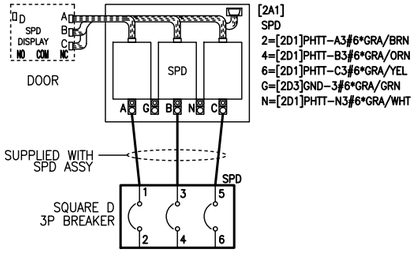
[2C1]
BPTB

	1	[2B1]BPPS1–+*BLU
	2	[2B1]M1–F2+*BLU
	3	[2B1]BPPS1––*GRA
	4	[2B1]M1–F1–*GRA

JUMP 1 & 2 [L]
JUMP 3 & 4 [L]

INSTRUMENT COMPARTMENT

PHASE, NEUTRAL, AND GND CONDUCTORS MUST BE TWISTED TOGETHER WITH A WIRE LENGTH LESS THAN 8 FT.



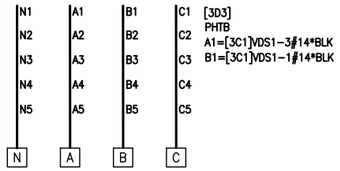
[2A1]
SPD
2=[2D1]PHTT–A3#6*GRA/BRN
4=[2D1]PHTT–B3#6*GRA/ORN
6=[2D1]PHTT–C3#6*GRA/YEL
G=[2D3]GND–3#6*GRA/GRN
N=[2D1]PHTT–N3#6*GRA/WHT

Section 2 Wiring Diagram

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US–1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD
DRAWN BY:	ROW	DRAWING TYPE:	WIRING DIAGRAM
ENGR:	R.WOLFE		SQUARE D Schneider Electric
DATE:	SEPTEMBER 30, 2016		
DRAWING STATUS:	RECORD	DWG# W37999262–003–02	PG 1 OF 1 REV –

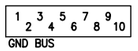
REV	DESCRIPTION	BY	DATE	–	----	--	--/--	–	----	--	--/--
A	CHANGE TEXT: MTW TO SIS	RW	10/27/2016	–	----	--	--/--	–	----	--	--/--

BUS CONNECTION



CURRENT TRANSFORMERS

GROUND BUS



[3D3]
GND
1=[3C1]XFR1-X2#10*GRN

BREAKER CELL

SHIPPING SPLIT

NOTES:
1. ALL CONTROL WIRING TO BE TYPE "SIS" (UL LISTED) UNLESS OTHERWISE NOTED.
2. ALL CONTROL FUSES MOUNTED IN FUSED PULLOUTS.
3. USE #16 AWG WIRE UNLESS OTHERWISE NOTED.
4. ALL WIRES TO BE RED UNLESS OTHERWISE NOTED.

MOUNTING PAN(S)

P/N: HUA21787
P/N: 25430-21500



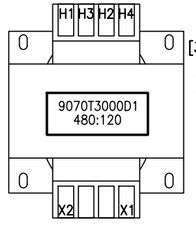
[3C1]
VDS1
1=[3D3]PHTB-B1#14*BLK
2=XFR1-H4#14*BLK
3=[3D3]PHTB-A1#14*BLK
4=XFR1-H1#14*BLK

P/N: 9080GC6
P/N: 9080GC6B
[3C1]
BPT2

BPF1-B#10*GRA		1
XFR1-X2#10*GRA		2



[3C1]
BPF1
A=XFR1-X1#10*GRA
B=BPT2-1#10*GRA



[3C1]
XFR1
H1=VDS1-4#14*BLK
H4=VDS1-2#14*BLK
X1=BPF1-A#10*GRA
X2=BPT2-2*GRA,[3D3]GND-1##10*GRN
JUMP H2 & H3

Section 3 Wiring Diagram

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	US-1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	QED SWITCHBOARD
DRAWN BY:	ROW	DRAWING TYPE:	WIRING DIAGRAM
ENGR:	R.WOLFE		SQUARE D Schneider Electric
DATE:	OCTOBER 04, 2016		
DRAWING STATUS:	RECORD	DWG# W37999262-003-03	PG 1 OF 1 REV A

Metal-Enclosed Switchgear

2.4 kV to 38 kV
Class 6040

Instruction Bulletin

Retain for future use.



a brand of Schneider Electric

SQUARE D

HAZARD CATEGORIES AND SPECIAL SYMBOLS

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** property damage.

NOTE: Provides additional information to clarify or simplify a procedure.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

ENGLISH

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SECTION 1—INTRODUCTION

This bulletin contains instructions for the proper installation, operation, and maintenance of metal-enclosed switchgear manufactured by Schneider Electric. This product line offers switching, metering, and interrupting capabilities for medium voltage systems ranging from 2.4 kV to 38 kV. The equipment is available in a variety of arrangements in both indoor and outdoor enclosures. Metal-enclosed switchgear enclosures house the following types of equipment:

- Load interrupter (HVL) switches, fused and unfused. See the HVL switch instruction bulletin provided with your equipment for operating instructions.
- VISI/VAC, circuit interrupters. See the VISI/VAC interrupter instruction bulletin provided with your equipment for operating instructions.
- Bus transition and special enclosures

Metal-enclosed switchgear is often used with unit substations, applied as service entrance equipment, chosen for protecting substation transformers, or used to sectionalize high voltage feeder systems.

Equipment may be furnished in single or multiple bay units. Sections are shipped completely assembled for ease of handling and installation. The bus material can be copper or aluminum, and carries a continuous rating of 600, 1200, or 2000 amperes with momentary short circuit ratings of 20, 40, or 61 kA. Metal-enclosed switchgear manufactured by Schneider Electric is designed, manufactured, and tested in accordance with ANSI standards C37.20.3, C37.57, and NEMA SG5 where applicable.

Accessories and Optional Equipment

When accessories or optional equipment are included with metal-enclosed switchgear, refer to the instruction bulletins that accompany the shipment. Follow the manufacturer's instructions carefully when operating these devices.

General Description—Assembly

Metal-enclosed switchgear units are designed and manufactured as either single bay or a multiple bay lineups. Each bay is a separate, rigid, self-contained structure fabricated of heavy gauge steel.

Multiple bay switchgear generally consists of a lineup of individual feeder switch bays connected to a common main bus. A ground bus is bolted to the frame of each bay for the complete length of the lineup. The end cubicle can be adapted to accept future feeder switch bays.

Indoor Enclosures

Indoor switchgear enclosures (Figure 1 on page 5) include these standard features:

- Lifting eyes at the top corners of each section
- Provisions for future expansion (when using main cross bus)
- Clear acrylic window for inspection of blade position
- Steel enclosure per ANSI C37.20.3
- Ground pad in single bay enclosures and full-length ground bus in multiple bay enclosures
- Door interlock (electrical and/or mechanical) which prevents opening the front door while the switch or circuit interrupter is closed
- Switch or circuit interrupter interlock (electrical and/or mechanical) which prevents operating the main device while the front door is open
- Provisions for padlocking the switch handle (HVL) or the locking pull handle (VISI/VAC)
- Provisions for padlocking the front door
- Key interlocking, available when requested

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Figure 1: Indoor Switchgear



Outdoor Enclosures

Outdoor switchgear enclosures (Figure 2) are designed and manufactured with the following standard features:

- Roof sloped to rear for precipitation runoff
- Operating handles are enclosed to prevent tampering
- Formed steel welded base
- Full-height front doors with gasketing
- Steel enclosure per ANSI C37.20.3
- Removable full-height rear panels
- Strip heaters in each switch bay
- Stay rods to hold hinged doors in open position

Figure 2: Outdoor Switchgear



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SECTION 2—SAFETY PRECAUTIONS

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH.

- Only qualified electrical workers with training and experience on high voltage circuits should perform work described in this set of instructions. Such work should be performed only after reading this complete set of instructions.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- Turn off all power before working on or inside equipment.
- The successful operation of metal-enclosed switchgear depends upon proper handling, installation, operation, and maintenance. Neglecting fundamental installation and maintenance requirements may lead to personal injury, as well as damage to electrical equipment or other property.
- Metal-enclosed switchgear has interlocks designed to prevent unsafe operation, but it is not possible to eliminate every hazard with interlocks. Therefore, the person using this device is responsible for recognizing the potential hazards, for wearing protective safety equipment, and for taking adequate safety precautions.
- Do not make any adjustments to the equipment or operate the system with safety features removed. Contact your local Schneider Electric representative for additional instructions if the device does not function as described in this manual.
- Before performing visual inspections, tests, or maintenance on the equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, grounded, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Before replacing covers or closing doors, carefully inspect the bus work area for tools and objects left inside the equipment. Use care while removing or installing panels so that they do not extend into the energized bus; avoid handling the panels, which would cause personal injury.
- Before making any electrical connection, take every precaution to see that all leads to be connected are de-energized with proper safety grounds applied.

Failure to follow these instructions will result in death or serious injury.

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SECTION 3—RECEIVING, HANDLING, AND STORAGE

Receiving

Metal-enclosed switchgear is shipped on skids with protective wrapping to prevent damage during normal transit. Check the packing list against the equipment received to ensure the order and shipment are complete. Claims for shortages or other errors must be made in writing to Schneider Electric within 30 days after receipt of shipment. Failure to do so constitutes unqualified acceptance and a waiver of all such claims by the purchaser.

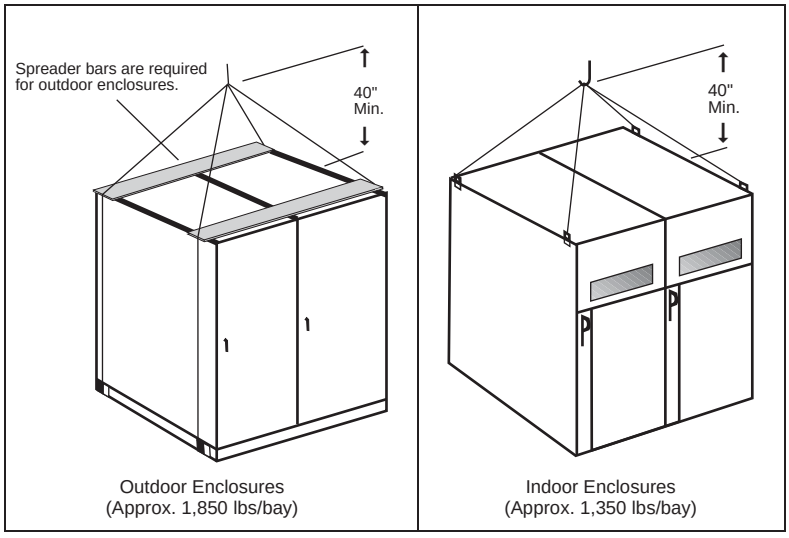
Also upon receipt, immediately inspect the switchgear for damage which may have occurred during transit. If damage is found or suspected, immediately file a claim with the carrier and notify Schneider Electric.

Handling

Use care when uncrating, rolling, hoisting, or handling the switchgear. Removable lifting eyes are provided for inserting hooks to lift each section as shown in Figure 3. Metal-enclosed switchgear is designed to be handled only in an upright position.

Use only lifting equipment suitable for the weight of the switchgear. Review the shipping documentation for the actual weight of the equipment to be handled. When an overhead crane is not available, rollers or pipes may be used for moving the switchgear to its location.

Figure 3: Lifting Methods



Outdoor Enclosures
(Approx. 1,850 lbs/bay)

Indoor Enclosures
(Approx. 1,350 lbs/bay)

After outdoor equipment is placed in its planned location, apply a bead of caulk or similar material between the base of the switchgear and the foundation, as well as between the shipping sections, to prevent water from entering beneath the switchgear. Caulk after the equipment is placed in its final location.

⚠ CAUTION

HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE.

- Do not remove the skids until the shipping sections are at the final location.
- Always use the skids to prevent equipment distortion.

Failure to follow these instructions can result in serious injury or equipment damage.

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Storage

If the switchgear is stored before being placed into service, keep it in a clean, dry place that is free from corrosive elements and mechanical abuse. Energize the heaters inside the switchgear, or add heat from a separate source, such as a light bulb or blower. Use a minimum of 100 watts of heat per vertical section to keep the equipment dry during storage.

Covering the equipment with a tarpaulin may be necessary to protect it from contaminants or moisture. Do not store indoor units outdoors.

In areas of high humidity, such as installations near oceans or rivers, monitor the equipment closely. If necessary, use additional heat to keep the switchgear dry. Contact the factory if the internal heaters do not adequately prevent condensation for your location.

SECTION 4—INSTALLATION

Site Preparation

Good site preparation is necessary to eliminate costly, time-consuming installation problems and ensure proper switchgear operation. Compare the site plans and specifications with the switchgear drawings to be sure there are no discrepancies. Check the site to ensure that the equipment will fit properly.

The floor should be flat and level within 1/16 inch per foot, or a maximum of 1/4 inch within the area of the switchgear, to prevent distortion of the enclosures. Allow aisle space at the front, back, and ends of the switchgear to permit access for equipment maintenance; usually a minimum of five feet is needed on all sides.

Provide area ventilation at all times to maintain the ambient temperature around the equipment between 0°C and 40°C.

Adequate lighting and convenience outlets should be available near the switchgear. Route sewer, water, and steam lines away from the equipment. Provide floor drains to prevent water buildup.

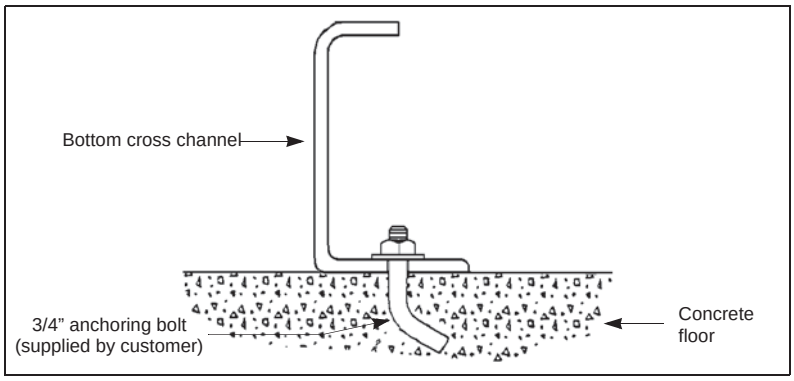
Switchgear Installation

Review the assembly drawings to ensure that the switchgear sections will be assembled in the correct order. If the switchgear will connect to an existing lineup, mount the connecting sections first.

Mount the various shipping sections on the same plane and level them to ensure proper connection. After leveling each section, bolt it to the previously installed switchgear.

Each section includes the necessary means for anchoring it to the floor. Fasten indoor units to the floor using the holes located in the bottom flanges of the enclosure. Fasten outdoor enclosures to the foundation using the holes located in the bottom cross channels (see Figure 4).

Figure 4: Anchoring Method for Outdoor Enclosures



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Remove the lifting angles from the side of the base and store. To block entry of water, extraneous objects, or wildlife, replace hardware in the holes where the lifting angles were removed. The bus connectors for the shipping splits are included with the switchgear.

⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE.

Install the shipping split bus connectors only after the shipping sections are fastened in place and no additional movement will be made to the assembly.

Failure to follow this instruction can result in equipment damage.

Follow these steps when installing the switchgear:

1. Make sure the bus connector contact surfaces are clean and bright. Install the bus connectors one phase at a time. Loosely bolt the bus joints.

   After all three bus bars are in place and properly aligned, tighten the bolts using a torque wrench. See Table 1 for torque values.

Table 1: Torque Values (ft lbs)

Bolt Size	Sheet Metal Joints (SAE #2 Steel Bolts)	Electrical Connections (SAE #5 Steel Bolts)
1/4-20	7 ft lbs	10 ft lbs
5/16-18	14 ft lbs	20 ft lbs
3/8-16	21 ft lbs	35 ft lbs
1/2-13	42 ft lbs	70 ft lbs

2. Connect the ground bus splice at each shipping section. Remove the hardware, position the splice plate, and tighten the hardware perTable 1.

⚠ CAUTION

HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE.

The ground bus must be connected and bonded in accordance with applicable industry standards and/or codes to ensure proper operation of equipment and safety of personnel.

Failure to follow this instruction can result in serious injury or equipment damage.

3. Consult the customer wiring diagrams for re-connection of control wiring at the shipping breaks, when applicable. Each wire has been identified and previously connected during assembly when tested at the factory.

   Make all outgoing control connections according to the wiring diagrams. After wiring is complete, carefully check all connections to ensure they are tight and correct.

Cable Connections

Before making the cable connections, determine the phase identity of each cable. Viewing the switchgear from the front, standard bus sequence is normally phased A-B-C left to right, top to bottom, or front to rear, unless labeled otherwise.

When cable terminations are made, follow the cable manufacturer's instructions in stripping the shield and cleaning the unshielded portion of the cable. Install the appropriate stress cone in accordance with the stress cone manufacturer's instructions.

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Forming Cables

When forming cables for termination within switchgear, avoid sharp turns, corners, and edges which could damage or weaken the cable insulation. Follow the cable manufacturer's instructions carefully in determining the minimum bending radius of cables.

When installing cables in switchgear, the clearances shown in Table 2 must be maintained to avoid insulation breakdown and flashover.

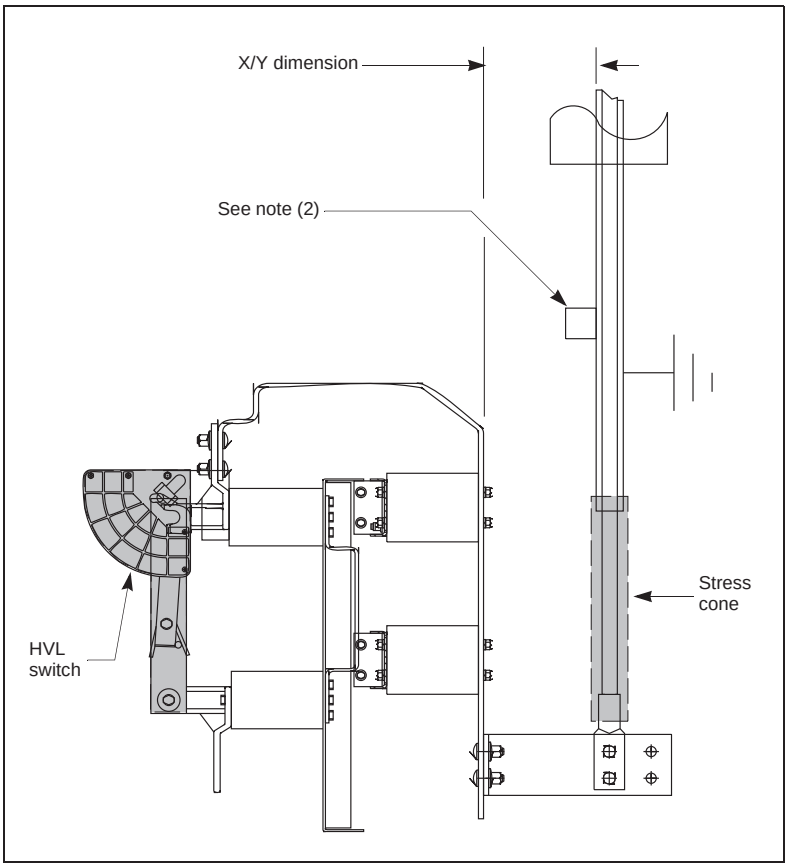
NOTE: Clearances also apply to any grounded component in the assembly (e.g., stress cone ground).

Table 2: Clearance Requirements for Shielded Cables

kV Rating	X Inches Shields Bare	Y Inches Shields Insulated	Cable Support Assembly
5	4	3	44037-613-50
15	5	4	44037-613-50
25	8	7	44039-523-50
29	8	7	44039-523-50
38	10	9	44039-523-51

NOTE:
(1) X and Y clearances apply to both insulated and bare bus bars.
(2) If required, cable support assemblies are available to hold cables away from bus bars.

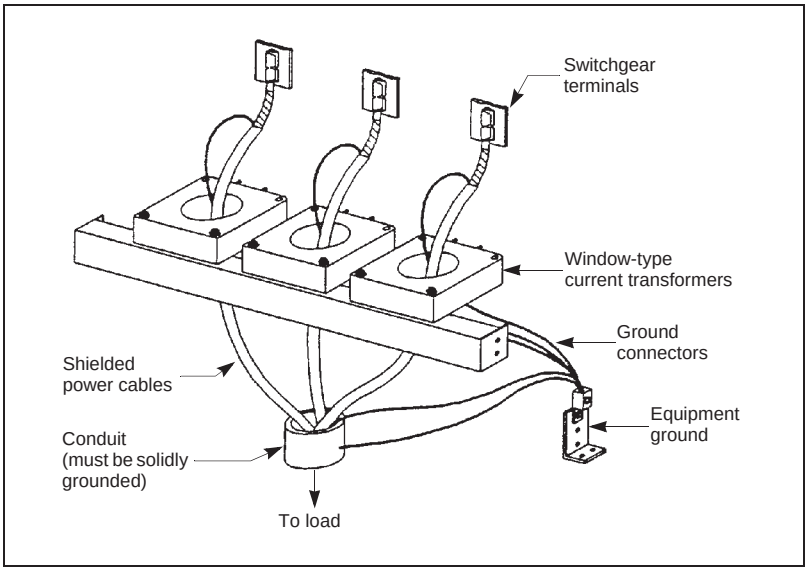
Figure 5: Shielded Cable Clearances



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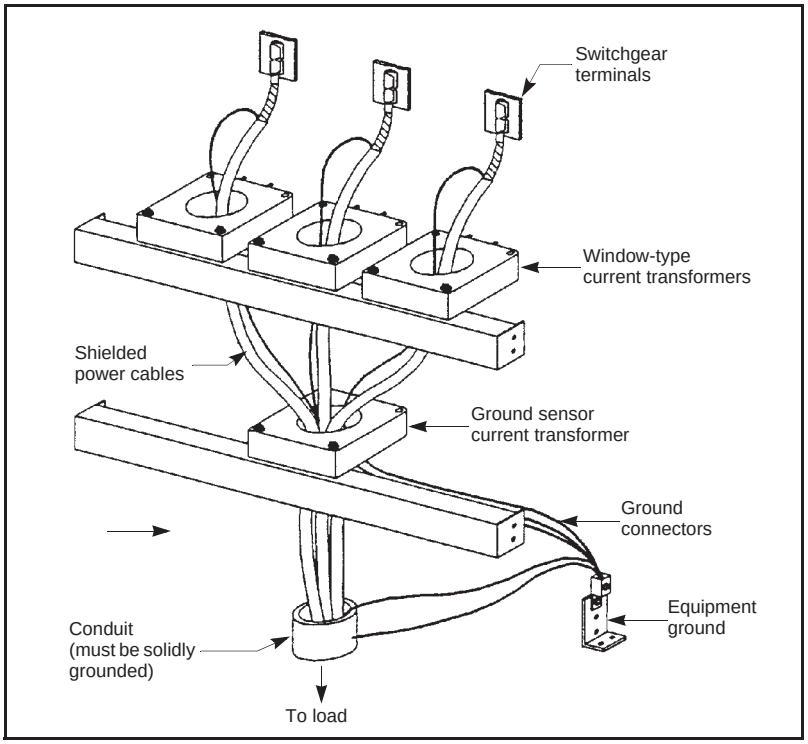
Figure 6: Shielded Cable Connections (through current transformers)



Shielded Cables Through Window-Type Current Transformers

When routing shielded cable through window-type current transformers (Figure 5) or ground sensor current transformers (Figure 6), the shield-ground connection wire is normally routed back through the current transformer and solidly grounded. Occasionally, special four-wire systems require a different routing of the neutral conductor.

Figure 7: Shielded cable connections (through ground sensor current transformers)



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Unshielded Cable Connections

To meet switchgear requirements, provide adequate clearances between cables, conduits, and bus (figure 7). These items must be securely fastened or braced to withstand short circuit forces and to prevent strain on the terminals.

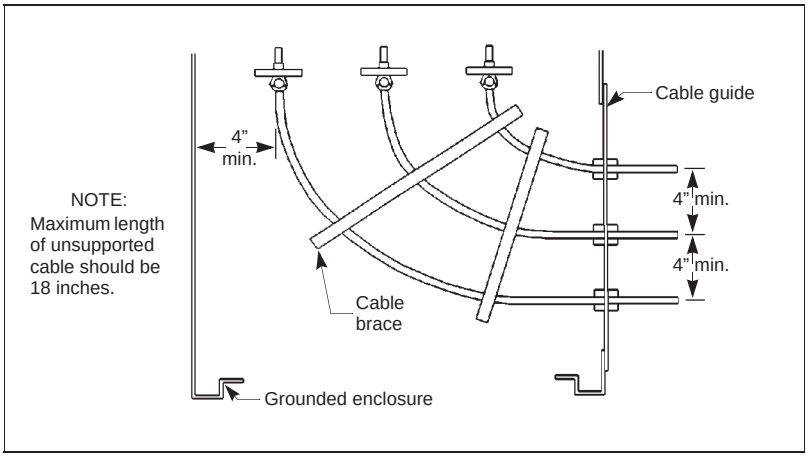
⚠ WARNING

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH.

Maintain a minimum clearance of 4 inches between insulated cable and ground metal parts or other phases.

Failure to follow this instruction can result in death or serious injury.

Figure 8: Example of Unshielded Cable Bracing



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SECTION 5—INITIAL PREPARATION

After the switchgear is installed and all interconnections are made, test the equipment and give it a final check before placing it in service.

⚠ WARNING

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH.

Exercise extreme care to prevent the equipment from being energized while conducting the preliminary tests. If disconnect switches cannot be opened, disconnect the line leads.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

If the switchgear has been stored for several months or has been exposed to high humidity, a standard 60 cycle hi-pot test will normally indicate if the equipment is satisfactory for service. See Table 3 on page 15 for test values and additional information. Follow other equipment testing procedures as required by customer in-house standards.

When all connections are made and preliminary testing is complete, perform the following inspections:

1. Check all control wiring with the wiring diagrams; ensure that all connections are properly made, all fuses are installed, current transformer circuits are complete, and loose connections are tightened.
2. Before any source of electric power is energized, make a final check of the equipment. Inspect every compartment for loose parts, tools, litter, and miscellaneous construction items.
3. Ensure that all insulating surfaces, including the primary support insulators and isolation barriers, are clean and dry.
4. Check all conductor fasteners and bolted connections for proper tightening torque (see Table 1 on page 9, for torque values).
5. Ensure that all barriers and covers are fastened in place.
6. Review key interlock schemes carefully (if used). Insert only the proper keys in the locks. Remove all extra keys; store them where only authorized personnel can access them.

SECTION 6—INTERLOCKS

Mechanical interlocks are designed as standard features to minimize hazards to the operator while operating the switchgear. For example, the door interlock prevents opening the front door while the load interrupter switch is closed.

Key interlocks are optional equipment, often supplied in conjunction with metal-enclosed switchgear to direct proper operation of the equipment. The key interlock schemes are usually described on the switchgear assembly drawings.

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SECTION 7—OPERATING INSTRUCTIONS

Switch Operation

For specific information regarding operation of switches or circuit interrupters, refer to the separate instruction manuals for those devices.

High Voltage Fuses

High voltage fuses provide overcurrent protection for the high-voltage switch; they also give short-circuit interrupting protection up to the short-circuit rating of the equipment. Schneider Electric equipment can use either current limiting fuses or boric acid fuses.

When replacing or performing maintenance on fuses, always follow the safety precautions and steps listed below.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH.

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E
- This equipment must only be installed and serviced by qualified electrical personnel.
- Never operate energized switch with door open.
- Turn off switch before removing or installing fuses or making load side connections.
- After operating HVL switch to the open position, always look through the viewing window and verify all three main and interrupter blades are fully open.
- Always use a properly rated voltage sensing device at all line and load fuse clips to confirm switch is off.
- Turn off power supplying switch before doing any other work on or inside switch.

Failure to follow these instructions will result in death or serious injury.

1. Turn off all sources of power to the equipment, padlock, and tag all upstream or downstream sources which could energize the fuses.
2. Open the access door to the fuses. Confirm that all electric power to the fuses has been disconnected (use a voltage sensor designed for this purpose).
3. Wearing rubber gloves, grasp the fuse with a “hot stick” and remove it from the fuse clip assembly. Follow the procedures prescribed by the fuse manufacturer.
4. Still using rubber gloves and a hot stick, install new fuses.
5. When replacing “bolted-in” fuses, it may be necessary to handle the fuses by hand. Use extra caution in confirming that the bus is de-energized and grounded before replacing these types of fuses.

SECTION 8—MAINTENANCE

Inspection Schedule

Perform inspection and maintenance on the basis of operating conditions and experience. Abnormal conditions may require immediate attention while regularly scheduled maintenance will depend on availability of “down time” and qualified personnel.

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After a circuit experiences a fault current or stressful condition, inspect the equipment at the first opportunity. Otherwise, inspect the switchgear at least once each year.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH.

Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E

Failure to follow these instructions will result in death or serious injury.

Individual Devices

The maintenance schedule for individual devices—such as meters and relays—should be based upon recommendations contained in the individual instruction manual for each device. Coordinate the various schedules with the overall maintenance program.

Inspection Procedure

Give the equipment installation a thorough overall maintenance check at least annually in the six areas described below.

Bus And Connections. De-energize the primary circuits before cleaning. Perform a standard 60-cycle hi-pot test to measure bus integrity.

Table 3: Field Test Voltages

Equipment Rating	Field Test Voltage	
	(AC)	(DC)
4.76 kV	14 kV	20 kV
15 kV	27 kV	38 kV
25 kV	45 kV	63 kV
38 kV	60 kV	85 kV

Apply the voltage to each phase individually for one minute with the other two phases and the enclosure grounded. To avoid damage during the test, disconnect the instrument transformers and remove the fuses.

If the test is unsuccessful, inspect the insulators for leakage paths. If necessary, clean the surface of the insulator(s) and re-test.

Connections. Inspect connections for symptoms which might indicate overheating or weakened insulation. Remove dust from busses, connections, supports, and enclosure surfaces. Wipe clean with a solvent such as denatured alcohol.

Instruments, Relays, And Other Devices. Maintain each device according to the specific instructions supplied. Inspect the devices and their contacts for dust or dirt; wipe clean.

Control Wiring. Check wiring connections for tightness and damage.

Mechanical Parts. Manually operate mechanical moving parts such as switch assemblies, interlocks, and doors.

Ventilation. Check all bus areas, grille work, and air passages for obstructions and dirt accumulation.

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SECTION 9—REPLACEMENT PARTS

When ordering renewal or spare parts, include as much information as possible. In many cases, the part number of a new part can be obtained from identification of the old part.

Always include the description of the part. Specify the rating, vertical section, and factory order number of the equipment in which the part is to be used.

Table 4: Replacement Parts

Description	Part No.
Insulator—Porcelain 15 kV (6")	80029-002-03
Insulator—Glass Poly. 15 kV (6")	29903-01930
Strip Heater (1000W, 240V)	80031-030-01
Contact Grease (Mobilgrease 28)	1615-100950

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SECTION 10—INSTALLATION AND MAINTENANCE LOG

Date	Initials	Actions

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Date	Initials	Actions

Schneider Electric

330 Weakley Road
Smyrna, TN 37167 U.S.A.
1-888-SquareD
(1-888-778-2733)
www.SquareD.com

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Replaces 6040-2, dated 02/2004

01/2005

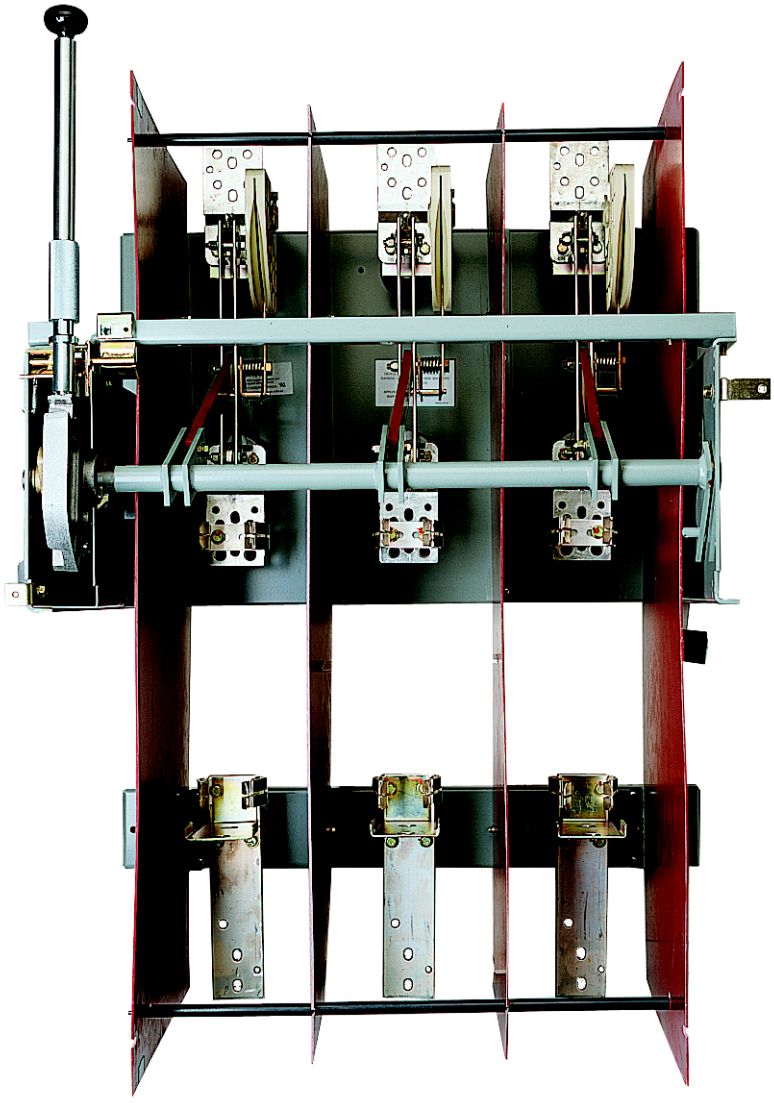
Type HVL Load Interrupter Switch

5/15 kV, upright or inverted
25.8 kV, upright only
38 kV, upright only

Class Number 9840

Instruction Bulletin

Retain for future use.



a brand of Schneider Electric

SQUARE D

HAZARD CATEGORIES AND SPECIAL SYMBOLS

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** property damage.

NOTE: Provides additional information to clarify or simplify a procedure.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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SECTION 1—INTRODUCTION

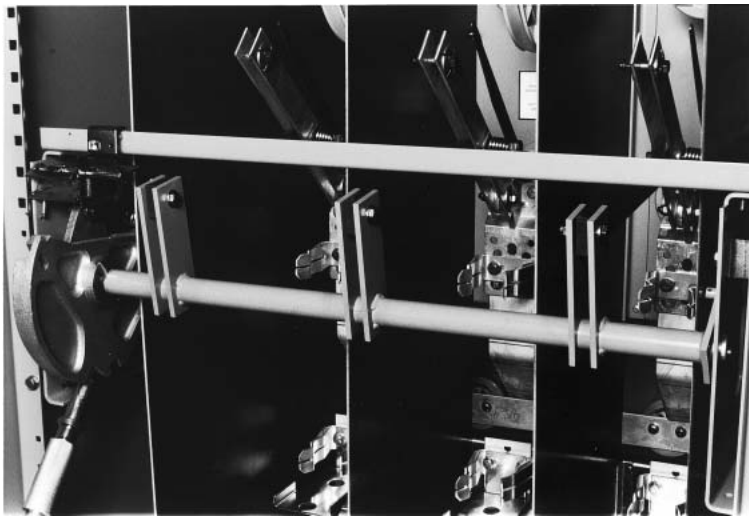
This bulletin contains instructions for the proper installation, operation, and maintenance of the HVL load interrupter switch manufactured by Schneider Electric. The HVL switch is a single-throw type switch. It is a primary component in many 2.4 kV to 38 kV power distribution systems, providing switching and overcurrent protection (when provided with fuses). HVL switches are typically used in unit substations, service entrance equipment, substation transformer protection, and sectioning of high voltage feeder systems.

The HVL switch can be mounted in indoor and outdoor enclosures, and is available in the following arrangements:

- 5/15 kV, upright or inverted, 600 A and 1200 A
- 25.8 and 38 kV, upright only, 600 A and 1200 A

Switches may come from the factory mounted in single or multiple bay units. They may also be furnished separately for OEM customers to use in their enclosures.

Figure 1: 15 kV HVL Switch



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SECTION 2—SAFETY PRECAUTIONS

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH.

- Only qualified electrical workers with training and experience on high voltage circuits should perform work described in this set of instructions. These workers must understand the hazards involved in working with or near high voltage equipment. Such work should be performed only after reading this complete set of instructions.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- Turn off all power before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm the power is off.
- The successful operation of HVL switches depends upon proper handling, installation, operation, and maintenance. Neglecting fundamental installation and maintenance requirements may lead to personal injury, as well as damage to electrical equipment or other property.
- HVL switches have features designed to promote proper operation, but it is not possible to eliminate every hazard with these features. Therefore, the person using this device is responsible for recognizing the potential hazards, for wearing protective safety equipment, and for taking adequate safety precautions.
- Do not make any adjustment to the equipment or operate the system with safety features removed. Contact your local Schneider Electric representative for additional instructions if the HVL switch does not function as described in this manual.
- Before performing visual inspections, tests, or maintenance on this device, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, grounded, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Before replacing covers or closing doors, carefully inspect the equipment for tools and objects left inside. Use care while removing or installing panels so that they do not extend into energized bus.
- Before making any electrical connection, take every precaution to see that all connections are de-energized and grounded.
- Introducing foreign objects into this equipment can cause a short circuit which can result in severe damage, personal injury, or death. Short circuits can release large amounts of energy due to a rapid expansion of super-heated, ionized gases. Products of this instantaneous expansion can quickly engulf and burn personnel before preventive action can be taken. The short circuit source can cause additional injuries by propelling personnel or objects several feet from the equipment.

  Some foreign objects that can cause short circuits are tools, test leads and instruments not designed for high voltage circuits, wire, and other conducting or semiconducting materials.

Failure to follow these instructions will result in death or serious injury.

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SECTION 3—RECEIVING, HANDLING, AND STORAGE

RECEIVING

HVL switches are normally mounted in metal-enclosed switchgear built by Schneider Electric, or in a customer's proprietary enclosure. Check the packing list against the equipment received to ensure the order and shipment are complete. Claims for shortages or other errors must be made in writing to Schneider Electric within 60 days after receipt of shipment. Failure to do so constitutes unqualified acceptance and a waiver of all such claims by the purchaser.

Also upon receipt, immediately inspect the switchgear for damage which may have occurred during transit. If damage is found or suspected, immediately file a claim with the carrier and notify Schneider Electric.

HANDLING

Use care when uncrating, rolling, hoisting, or handling the switch. Use only lifting equipment suitable for the weight of the switch. Review the shipping documentation for the actual weight to be handled.

STORAGE

If the switch is stored before being placed into service, keep it in a clean, dry place that is free from corrosive elements and mechanical abuse. Energize the heaters inside the switchgear, or add heat from a separate source, such as a light bulb or blower. Use a minimum of 100 watts of heat per vertical section to keep the equipment dry during storage.

Covering the equipment with a tarpaulin may be necessary to protect it from contaminants or moisture. Do not store units outdoors.

In areas of high humidity, such as installations near oceans or rivers, monitor the equipment closely. If necessary, use additional heat to keep the switch dry. Contact the factory if the internal heaters do not prevent condensation inside the switchgear.

⚠ CAUTION

HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE.

- Do not remove the skids until the shipping sections are at the final location.
- Always use the skids to prevent equipment distortion.

Failure to follow these instructions can result in serious injury or equipment damage.

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SECTION 4—INSTALLATION

SITE PREPARATION

Refer to the metal-enclosed switchgear instruction bulletin that was shipped with your equipment; follow site preparation instructions in that manual.

SWITCH INSTALLATION

The HVL switch is shipped factory-mounted in an enclosure or separately for OEM customers. If the switch is factory-mounted in its enclosure, the switchgear is designed to comply with applicable standards. Refer to the metal-enclosed switchgear instruction bulletin for installation instructions.

If the HVL switch is shipped without an enclosure, perform these checks:

- Verify that the mounting provisions align with the holes in the switch frame.
- Ensure that the bus and fuse connections align properly. There should be no stress on the connections or extensions.
- Tighten hardware according to the recommendations shown in Table 1.
- Install insulating barriers where necessary to provide the required clearance between energized bus and grounded parts.
- To view the switch position, a transparent window is recommended in the front panel or door, opposite the contact break area.

  The switch and enclosure must interlock in conformance with the planned interlock scheme.

Table 1: Tightening Torques

Bolt Size	Sheet Metal Joints (SAE #2 Steel Bolts)	Electrical Connections (SAE #5 Steel Bolts)
1/4-20	7 lb-ft (9.5 N•m)	—
5/16-18	14 lb-ft (18.9 N•m)	—
3/8-16	21 lb-ft (28.4 N•m)	35 lb-ft (47.2 N•m)
1/2-13	42 lb-ft (56.7 N•m)	70 lb-ft (94.5 N•m)

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SECTION 5—INITIAL PREPARATION

After the switch is installed and all interconnections made, test the equipment and give it a final check before placing it in service.

A standard 60 cycle hi-pot test will normally indicate if the equipment is satisfactory for service. See Table 2 on page 12 for test values. Follow other equipment testing procedures as required by in-house standards.

⚠ WARNING

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH.

Exercise extreme care to prevent the switch from being energized while conducting the preliminary tests. If disconnect switches cannot be opened, disconnect the line leads.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

After preliminary testing is complete but before energizing the HVL switch, perform the following inspections:

1. Check all control wiring (when present) with the wiring diagrams to ensure that connections are properly made.
2. Inspect all insulating surfaces for dirt and moisture, including the primary support insulators and isolation barriers. If necessary, wipe with a clean cloth.
3. Check all conductor fasteners and bolted connections for proper tightening torque; see the table on Table 1 on page 7 for values. Bolts with a torque seal have already been fastened at the factory.
4. Fasten all barriers and covers in place.
5. Insert the proper keys in the interlocks, when used.

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SECTION 6—INTERLOCKS

Mechanical interlocks are standard features designed to minimize hazards to the operator while operating the switchgear. For example, the door interlock is designed to prevent opening the front door while the load interrupter switch is closed.

Key interlocks are optional equipment, often supplied in conjunction with metal-enclosed switchgear to direct proper operation of the equipment. The key interlock schemes are usually described on the switchgear assembly drawings.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH.

When equipment is supplied with extra interlock keys, to be used during installation, the user is responsible for removing the extra keys. After reviewing the key interlock specifications, the user should provide only the necessary keys to properly operate the equipment. Extra keys should be destroyed or placed in a secure place, accessible to only selected personnel.

Failure to follow these instructions will result in death or serious injury.

Figure 2: Key Interlock



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SECTION 7—OPERATING SEQUENCES

SWITCH OPENING

The switch opens in the following sequence:

1. In the closed position, the main blade mates with the stationary contact. The circuit current flows through the main blades while in this position (Figure 3).

Figure 3: Blades Closed



2. Pull the operating handle back and down. If the switch is motor-operated, the motor relay is activated by a local control switch or remote signal.
3. As the operating handle (or motor) moves toward the open position, the mechanism springs are charged. When the springs are fully charged, they toggle over the top dead center position, quickly discharging force to the operating shaft.
4. The operating shaft motion forces the main blades away from the stationary contacts. The interrupting blades are held closed, momentarily carrying all the circuit current (Figure 4).

Figure 4: Main Blade Open, Interrupter Blade Closed



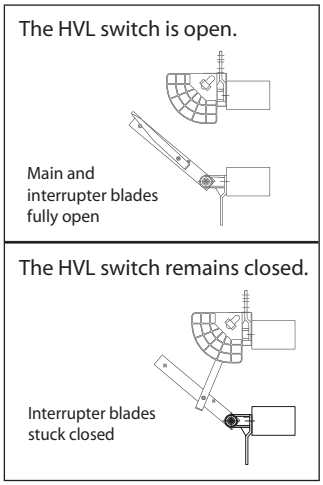
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5. Once the main blades have separated well beyond arcing distance, the interrupting blades disengage from the stationary contacts. The resulting arc is elongated and cooled by the arc chute.
6. The main and interrupting blades continue to the fully open position (Figure 5). Spring pressure holds the blades and mechanism in the open position.

Figure 5: Blades Open



Figure 6: Blade Positions



⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

After operating the HVL switch to the OPEN position, always look through the viewing window and verify that all three main and interrupter blades are fully open (see Figure 6). If any of the blades remain closed, do not work on or in this switch, or on downstream equipment. Contact Schneider Electric.

Failure to follow these instructions will result in death or serious injury.

SWITCH CLOSING

The switch closes in the following sequence:

1. If the switch is in an enclosure, close the door (to activate the switch interlock). Set the key interlock mechanism to ensure proper operation.
2. Close the switch by lifting the operating handle up and forward. If the switch is motor-operated, the motor relay is activated by a local control switch or remote signal.
3. As the operating handle (or motor) moves toward the closed position, the mechanism springs are charged. When the springs are fully charged, they toggle over the top dead center position, quickly discharging force to the operating shaft.
4. The operating shaft moves the blades toward the closed position.
5. The blades fully close and are maintained in the closed position by the operating shaft arms and the connector links.
6. The interrupter blades are captured behind the stationary arcing contacts, which delay the blades during the successive opening operation.

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SECTION 8—MAINTENANCE

INSPECTION SCHEDULE

Perform inspection and maintenance on the basis of operating conditions and experience. Abnormal conditions may require immediate attention while regularly scheduled maintenance will depend on availability of “downtime” and qualified personnel.

After a fault current or stressful condition on a circuit, inspect the switch at the first opportunity. Otherwise, inspect the switch once each year. In a clean indoor or otherwise controlled environment the inspection interval could be extended up to five years.

⚠ DANGER

HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE.

- Perform inspections, maintenance procedures, and parts replacement only with the primary source(s) of power disconnected and locked open. Be absolutely sure there is no backfeed through any feeder circuit .
- Always use a properly rated voltage sensing device to confirm the power is off.

Failure to follow this instruction will result in death, serious injury, or equipment damage.

INSPECTION PROCEDURE

Give the switch an overall maintenance check in the following areas. As stated in the warning above, make sure the equipment is de-energized before performing any maintenance or parts replacement.

Dielectric

Perform a standard 60-cycle hi-pot test to measure insulation integrity. Use the test voltage levels in Table 2.

Table 2: Field Test Voltages

Equipment Rating	Field Test Voltages	
	(AC)	(DC)
4.76 kV	14 kV	20 kV
8.25 kV	19 kV	27 kV
15 kV	27 kV	38 kV
25.8 kV	45 kV	63 kV
38 kV	60 kV	85 kV

Apply the voltage to each phase individually for one minute, with the other two phases and the enclosure grounded. If the test is unsuccessful, inspect the insulators for leakage paths. If necessary, clean the surface of the insulator(s) and test again. If the results are still unacceptable, please notify your local Schneider Electric sales representative.

Connections

Inspect connections for symptoms which might indicate overheating or weakened insulation. If necessary, re-tighten hardware according to the values in Table 1 on page 7. Remove dust from busses, connections, supports, and enclosure surfaces. Wipe clean with a solvent such as denatured alcohol.

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Interrupter Blades

Inspect the switch interrupter blades about every 100 operations. When one-third of the arcing tip is burned away, replace the blade assembly and arc chute assembly as described in the following sections.

Main Blades

Wipe the main blade and jaw occasionally to remove dust accumulation. Lubricate the main blade and jaw with a light film of Mobilgrease 28. Never clean the contacts with an abrasive material. Do not lubricate the interrupter blades or arcing tips.

Control Wiring

Check any wiring connections for tightness.

Mechanical Parts

Manually operate mechanical moving parts such a switch assemblies, interlocks, doors, etc.

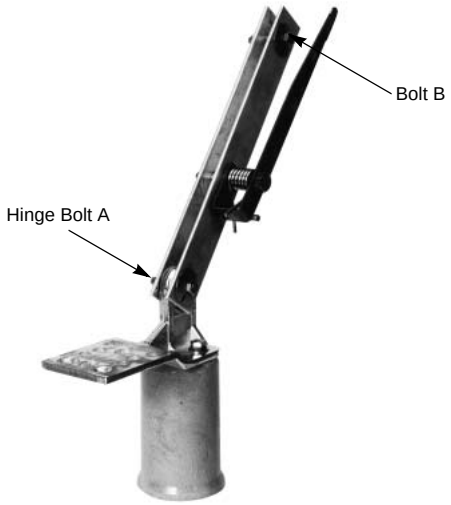
BLADE REPLACEMENT AND ADJUSTMENT

Before performing any maintenance or parts replacement, turn off all power to the switch and use a properly rated testing device to confirm the power is off. Lubricate all bearings and moving metal parts with Mobilgrease 28.

The contact pressure of the main and interrupter blades is factory-adjusted; it should require no readjustment with normal switch operation. If field maintenance is required, follow these steps:

1. Begin with the switch in the open position. Disconnect the connector links from the main shaft by removing the bolts, spacers, and nuts.
2. Remove the main and interrupter blade assembly by removing hinge bolt A (Figure 7).

Figure 7: Blade Assembly



3. Clean and lubricate the jaw and hinge contact surfaces using Mobil 28® red grease.

⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE.

Do not lubricate the interrupter blades or arcing tips.

Failure to follow this instruction can result in product damage.

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4. Attach the new blade assembly to the hinge using hinge bolt A (Figure 7 on page 13). Ensure that the silver tungsten arcing tip on the interrupter blade faces the arc chute. Align and adjust the blade assembly as described below.

   Blade Alignment:

   — Check alignment of each main blade with the jaw. The interrupter blade must also be centered with the arc chute assembly.

   — If alignment is necessary, loosen the jaw and hinge casting mounting bolts, align the blades, and re-tighten bolts. The arc chute assembly must be in the extreme upper position to ensure that the interrupter blade does not strike the mounting bracket inside the arc chute.

   — Open the switch blades by hand. The interrupter blade must remain in the arc chute until it disengages from the stationary contacts in the arc chute, allowing the interrupter blade to spring outward.

⚠ CAUTION

HAZARD OF PERSONAL INJURY OR EQUIPMENT DAMAGE.

The blades release at a very high velocity. Use caution when manually opening blades. Keep hands and objects clear of the blade path.

Failure to follow this instruction can result in serious injury or product damage.

Blade Adjustment:

— Disconnect the connector links from the main shaft.

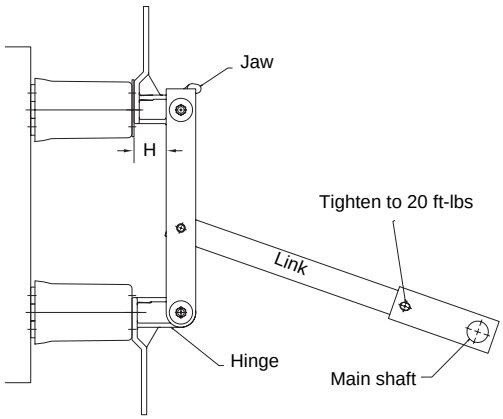
— Open the blades and tighten bolt A until the lubricated hinge friction is just sufficient to support the weight of the blades when horizontal.

— Close the blades and tighten bolt B until the force required to disconnect the blades (applied at bolt B) matches the force shown in Table 3. Apply the force perpendicular to the closed blades.

Table 3: Blade Disconnect Forces

HVL Switch Short Circuit Rating	Pullout Force
40 kA	60-70 lb
61 kA/80 kA	90-110 lb

Figure 8: Blade Penetration



⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Tightening the HVL switch main contact bolts A and B to more than 20 ft-lbs will cause the interrupting or main blades to remain closed even though the switch handle indicates the switch is OPEN.

Failure to follow this instruction will result in death or serious injury.

5. Reassemble the connector links to the main shaft and then close the switch. Adjust the distance H (see Figure 8) between the bottom of the main blades and the top of the arc chute bracket to 1.88 in. for 600 A switches and 1.75 in. for 1200 A switches. Torque the links to the main shaft to 20 ft-lbs.

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ARC CHUTE ASSEMBLY REPLACEMENT

Follow these steps to replace the arc chute assembly.

1. Before performing any maintenance or parts replacement, turn off all power to the switch and use a properly rated testing device to confirm the power is off.
2. Start with the switch in the closed position. Disconnect the insulating links from the main shaft by removing the bolts, spacers, and nuts.
3. Open each blade assembly. Remove the two bolts holding the jaw and arc chute assembly to the insulator.
4. Re-assemble the jaw and new arc chute assembly. Tighten the two mounting bolts until they are finger-tight.
5. Close each blade assembly, aligning the main blade with the jaw. Align the interrupter blade with the center of the arc chute assembly and tighten bolts.
6. Following the steps described in the Blade Adjustment section, adjust the blades.

Figure 9: Arc Chute Assembly



SWITCH JAW OR SWITCH HINGE CASTINGS REPLACEMENT

Follow these steps to replace the switch jaw or switch hinge castings:

1. Before performing any maintenance or parts replacement, turn off all power to the switch and use a properly rated testing device to confirm the power is off.
2. Start with the switch in the closed position. Disconnect the insulating links from the main shaft by removing the bolts, spacers, and nuts.
3. Open each blade assembly. Remove the two bolts holding the jaw or hinge casting to the insulator.
4. Re-assemble the blade assembly, arc chute assembly, and new casting(s). Tighten the mounting bolts until finger-tight.
5. Close each blade assembly, aligning the main blade with the jaw. Align the interrupter blade with the center of the arc chute assembly and tighten bolts.
6. Following the steps described in the Blade Adjustment section, adjust the blades.

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INSULATOR REPLACEMENT

Follow these steps to replace the insulator(s):

1. Before performing any maintenance or parts replacement, turn off all power to the switch and use a properly rated testing device to confirm the power is off.
2. Start with the switch in the closed position. Disconnect the insulating links from the main shaft by removing the bolts, spacers, and nuts.
3. Open each blade assembly. Remove the two bolts holding the jaw or hinge casting to the insulator. Remove the mounting bolts holding the insulator.
4. Change out the insulator(s) and re-assemble the casting(s), blade assembly, and arc chute assembly. Tighten the front mounting bolts until finger-tight.
5. Close each blade assembly, aligning the main blade with the jaw. Align the interrupter blade with the center of the arc chute assembly and tighten bolts.
6. Following the steps described in the Blade Adjustment section, adjust the blades.

CONNECTOR LINK REPLACEMENT

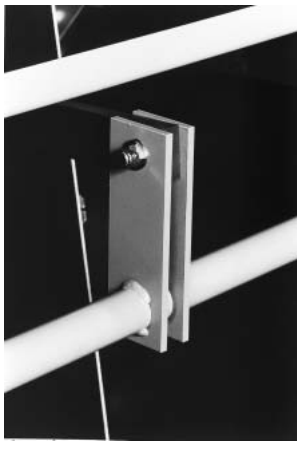
Follow these steps to replace the insulator connector links.

1. Before performing any maintenance or parts replacement, turn off all power to the switch and use a properly rated testing device to confirm the power is off.
2. Start with the switch in the closed position. Disconnect the connector links from the main shaft by removing the bolts, spacers, and nuts.
3. Re-assemble the new insulator links.
4. Before operating the switch, grasp the main blades, making sure there is a slight amount of play between the main blade spacer and the jaw. The spacer should turn freely at all times.

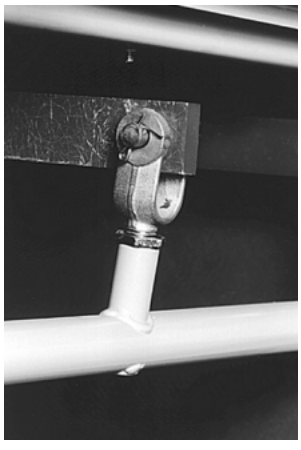
Figure 10 illustrates new- and old-style main shaft connections.

NOTE: Parts are no longer available for old-style connections.

Figure 10:Main Shaft Connections



New Style



Old Style

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SECTION 9—REPLACEMENT PARTS

When ordering parts, include as much information as possible. Often, the part number of a new part can be obtained from identification of the old part. Always include the description of the part. Specify the rating, vertical section, and factory order number of the equipment in which the part is to be used.

Table 4: 5/15 kV Replacement Parts [1, 2, 3]

Figure 10 Item Number	Description	Part No.
A	Arc Chute Assembly	44035-198-50
B	Interrupter Blade Assembly	44035-199-50
C	Shoulder Bolt Locknut	80025-005-01 23201-10240
D	Spacer	44035-002-01
E	Spring	44035-216-01
F	Main Blade (1200 A) [4] Main Blade (600 A) [4]	44035-204-01 44035-203-01
G	Switch Jaw (1200 A) Switch Jaw (600 A)	44035-001-02 44035-001-01
H	Switch Hinge Casing (1200 A) Switch Hinge Casing (600 A)	44035-202-02 44035-202-01
I	Insulator—Glass Polyester (up to 15 kV) Insulator—Porcelain (up to 15 kV)	29903-01930 80029-002-03
J	Connector Link	44035-208-01
K	Spacer Locknut 3/8 Screw Washer	44035-002-01 23201-10240 21401-24560 23601-00240
L	Interlock Pivot Assembly	44036-161-50
M [5]	Barrier Assembly—Unfused, 29” (737 mm) L Barrier Assembly, 48” (1219 mm) L Barrier Assembly, 60” (1524 mm) L, SM4, SM5 Barrier Assembly, 60” (1524 mm) L, CLE3, RBA800 Barrier Assembly, 60” (1524 mm) L, RBA200, RBA400 Barrier Assembly—Inverted, 29” (737 mm) L Barrier Assembly—Inverted, 48” (1219 mm) L	44037-571-50 44037-077-50 44037-078-50 44037-079-50 44037-078-50 44037-572-50 44037-081-50
Not Shown	Contact Grease (Mobil 28) Switch Handle Assembly [6]	1615-100950 44036-320-50

1 Consult factory for parts not included in this table.

2 Contact the factory for 80 kA switch parts.

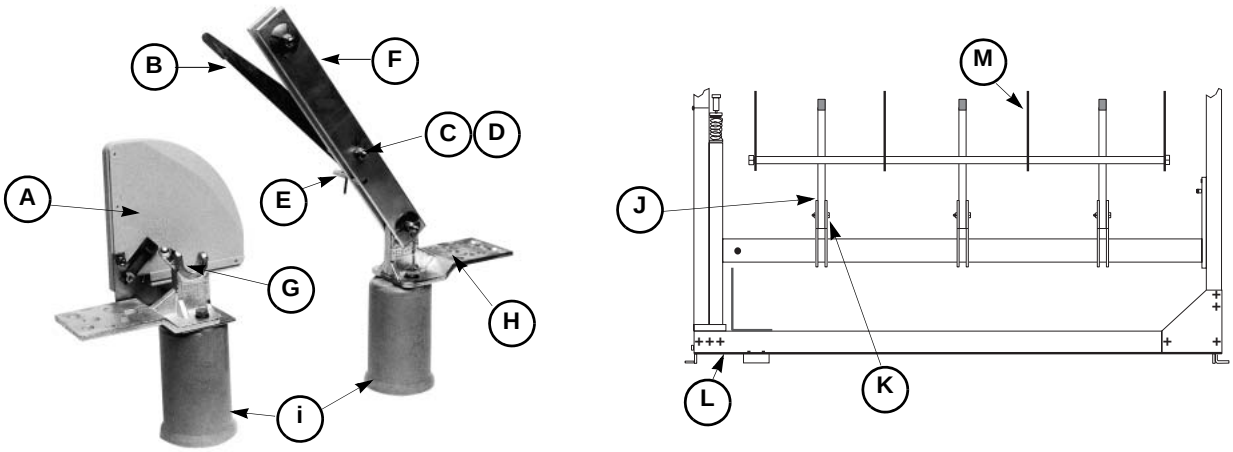
3 New motor operator after 1996. See Instruction Bulletin 9840-5 for details.

4 Continuous current rating.

5 Shipped disassembled.

6 New handle casting design after 1991.

Figure 11: 5/15 kV Replacement Parts



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Table 5: 25.8 and 38 kV Replacement Parts [1, 2]

Figure 11 Item Number	Description		25.8 kV Square D Part No.	38.0 kV Square D Part No.
A	Arc Chute Assembly		44035-198-50	44035-198-50
B	Interrupter Blade		44035-199-50	44035-199-50
C	Shoulder Bolt Locknut		80025-005-01 23201-10240	80025-005-01 23201-10240
D	Spacer		44035-002-01	44035-002-01
E	Spring		44035-216-01	44035-216-01
F	Main Blade	(1200 A) [3] (600 A) [3]	44035-808-01 44035-807-01	— 44035-806-01
G	Switch Jaw Casting	(1200 A) (600 A)	44035-001-01 44035-001-01	— 44035-001-01
H	Switch Hinge Casting	(1200 A) (600 A)	44035-202-01 44035-202-01	— 44035-202-01
I	Insulator	25.8/38 kV (porcelain)	29903-01996	29903-01996
J	Connector Link	polyester	44035-208-02	44035-208-05
K	Spacer Locknut 3/8-inch Screw Washer		44035-002-01 23201-10240 21401-24560 23601-00240	44035-002-01 23201-10240 21401-24560 23601-00240
L	Interlock Pivot Assembly		44036-161-50	44036-161-50
M	Barrier Assemblies [4]		44035-629-(50, 51, 54)	44035-629-(52, 53)
Not Shown	Contact Grease (Mobil 28) Operator Crank Switch Handle [5]	 (Center Knob) (Side Knob)	1615-100950 44035-145-01 80026-001-50 80026-001-51	1615-100950 44035-145-01 80026-001-50 80026-001-51

1 Consult factory for parts not included in this table.

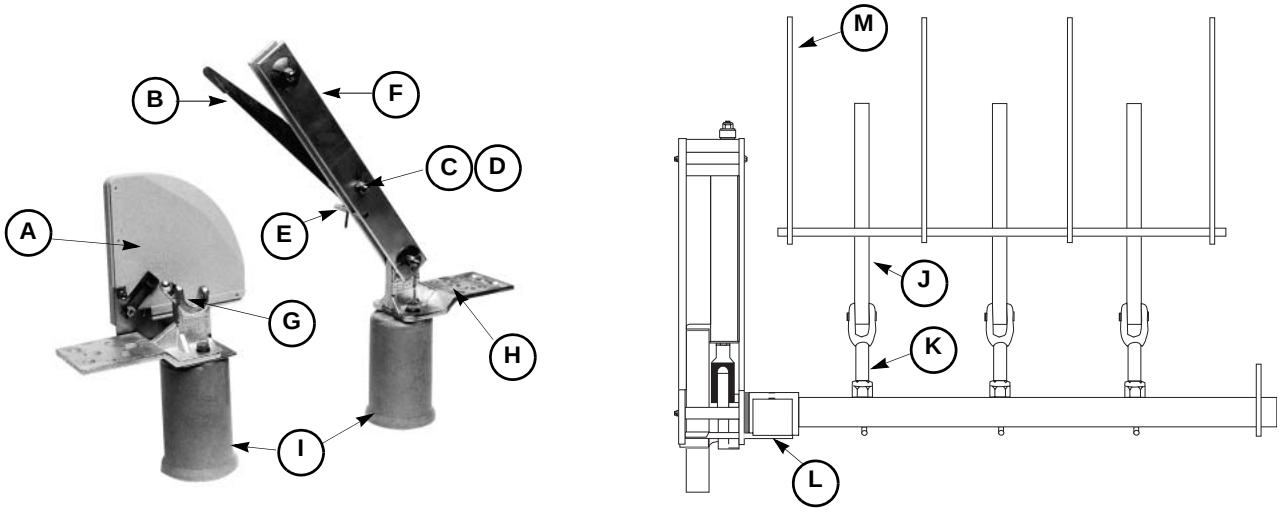
2 New motor operator after 1996. See Instruction Bulletin 9840-5 for details.

3 Continuous current rating.

4 Shipped disassembled.

5 New handle casting design after 1991

Figure 12: 25.8 and 38 kV Replacement Parts



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SECTION 10—INSTALLATION AND MAINTENANCE LOG

Date	Initials	Actions

Schneider Electric

330 Weakley Road
Smyrna, TN 37167 U.S.A.
1-888-SquareD
(1-888-778-2733)
www.SquareD.com

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Replaces 9840-3, dated 02/2004

01/2005

Power-Dry II™

Dry Type Transformers
Class 7420

Instruction Bulletin

Retain for future use.



a brand of Schneider Electric

SQUARE D

NOTICE

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result** in death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result** in death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result** in minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result** in property damage.

NOTE: Provides additional information to clarify or simplify a procedure.

PLEASE NOTE

Electrical equipment should be serviced only by qualified electrical maintenance personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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SECTION 1—INTRODUCTION

This instruction bulletin details information about installing, operating, and maintaining ventilated and nonventilated dry type transformers. Each transformer has its own specification and unique construction features. These features are detailed in the transformer outline and nameplate drawings.

This instruction bulletin is not an application guide for the ventilated dry type transformers or a substitute for adequate training in safe working procedures for this and related electrical equipment. Installation of this electrical equipment may require special licenses or training. Consult applicable national, industry, and local codes for specific requirements.

The successful operation of any transformer depends on various factors such as installation, loading, service conditions, and maintenance. Electrical systems in which transformers, along with vacuum or SF^6 circuit breakers, are used are capable of high frequency overvoltages which will not be suppressed by lightning arresters. These medium voltage systems may require a detailed, high frequency overvoltage system analysis and/or the addition of high frequency overvoltage protection. The transformer should be installed in conditions as specified in ANSI/IEEE Section C57.12.01 *Usual Service Conditions*, unless the transformer is designed specifically for operation in conditions other than the usual service conditions.

NOTE: If additional information is needed that is not covered by this instruction bulletin, contact the nearest Schneider Electric Field Sales Office, or Square D Services at 1-800-634-2003.

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SECTION 2—
SAFETY PRECAUTIONS

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- Read and understand this entire instruction bulletin before installing, operating, or maintaining a dry type transformer. Follow all applicable local and national codes.
- Disconnect all power and verify the transformer is de-energized before servicing the transformer. Operation of a primary protective device may be evidence of a faulted transformer. Do not re-energize the transformer until the cause of operation of the primary protective device is found and corrected.
- Many parts of the transformer operate at high voltages. DO NOT TOUCH. Use only electrically insulated tools and clothing, and protective gear when working around electrical equipment.
- Do not rely on visual indications such as switch position or fuse removal for determining a de-energized condition. Always assume that a terminal is energized unless it is checked with a properly rated meter to ensure the terminal is de-energized and grounded.
- Before servicing the transformer, ensure all static charge has been discharged by grounding the coils with an appropriate grounding device.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

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SECTION 3—RECEIVING, HANDLING, AND STORAGE

Ventilated open wound transformers are shipped either completely assembled in a sheet metal enclosure or as a core and coil assembly. They are covered with a clear plastic sheet to prevent entrance of moisture and dust.

Figure 1: Typical Packaging of Transformers for Shipment



Typical Packaging for an Enclosed-indoor Ventilated Dry Transformer



Typical Crating and Cover for a Core and Coil Assembly

Initial Inspection

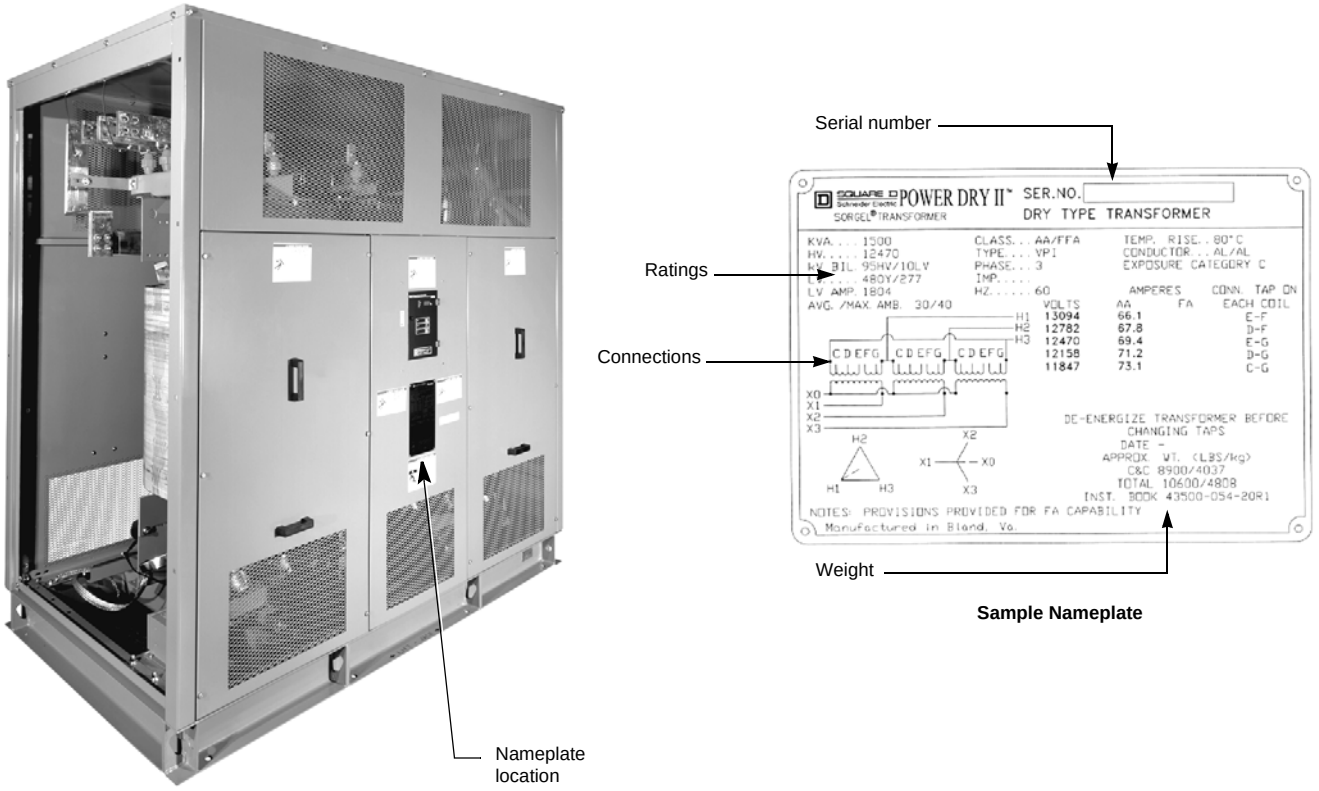
Before unloading the transformer, perform the following inspection:

1. Remove the protective covering.
2. Verify that the serial number on the transformer nameplate (Figure 2 on page 8) matches the serial number listed on the bill of lading. If the numbers do not match, contact your field sales representative immediately.
3. Review the shipping papers to ensure shipment is complete. Accessories, hardware, or both may arrive in a separate container on a separate pallet.
4. Inspect the transformer for any obvious external damage that may have occurred during shipment. An internal inspection of the enclosure is not usually required unless possible external damage has been observed. If an internal inspection is required, carefully inspect the leads, bolted mechanical and electrical joints, the core and coils, and accessory equipment such as fans, controls, heater strips, control power transformers, or current transformers. List any noticeable damage on the receiving papers, file a claim with the carrier at once, and notify Schneider Electric .
5. After completing all of the above steps and if no problems are found, off load the transformer. Refer to “Handling” below.

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Figure 2: Typical Transformer Nameplate



Sample Nameplate

Ventilated Transformer (shown with optional features)

Handling

Observe the following safety measures when handling the transformer:

⚠ DANGER

HAZARD OF FALLING EQUIPMENT AND CRUSHING

- Transformer is top heavy and may become unbalanced.
- Verify that the capacity of the handling equipment is adequate for the transformer weight.
- Keep all unnecessary personnel away while handling and moving the transformer.

Failure to follow these instructions will result in death or serious injury.

Unloading and Lifting

Whenever possible, use a crane to unload the transformer. In some cases, smaller transformers may be shipped in a box-type trailer that cannot be unloaded with a crane. In these cases, a forklift may be used to unload the transformer.

The approximate weight of the transformer is shown on the nameplate. Verify that the capacity of the handling equipment is adequate for the weight of the transformer.

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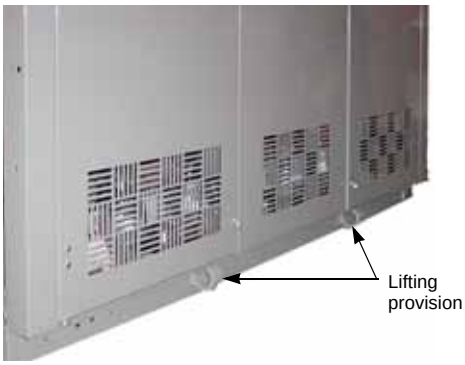
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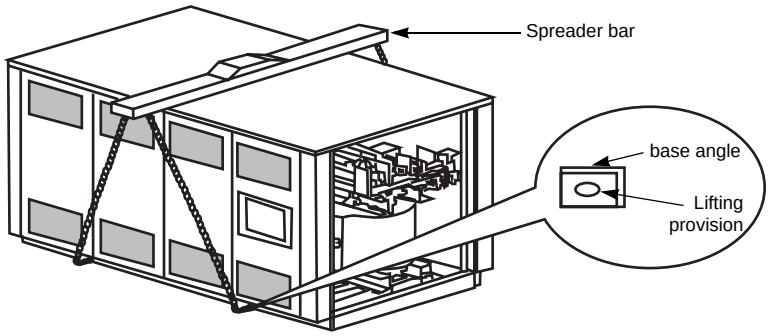
External Lifting Procedures

The transformer assembly may be lifted from provisions on the base frame using lifting slings, chains, or cables with spreaders. Care should be taken to avoid damage to the enclosure by allowing at least 20 feet from the top of the enclosure to the lift hook, or by using a spreader bar (Figure 3).

1. Use spreaders or spanner bars (Figure 3) to provide the vertical lift on lifting pads and slings to prevent crushing or otherwise damaging the frame or its finish.

Figure 3: Using a Spreader Bar



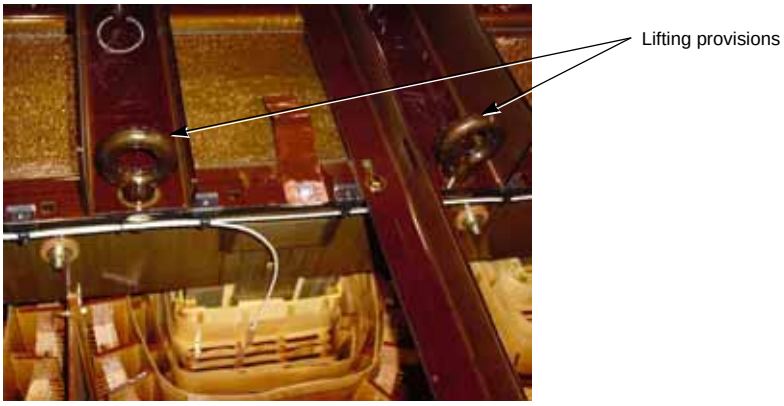


2. Select or adjust the rigging lengths to compensate for any unequal weight distribution of load and to maintain the transformer in an upright position.
3. Do not allow the angle between the lifting cables and vertical to exceed 45° in order to reduce the tension on the rigging and the compressive load on the lifting or spanner bars and spreaders.
4. Do not pass ropes or cables through the lift holes in bars, angles, or channels. Use slings with safety hooks or shackles.
5. Small cushioned pads may be placed on the transformer sides and cover to avoid contact with the enclosure.

Optional Lifting Procedures

If external lifting is not possible, removal of the enclosure top (Figure 4) allows easy attachment of shackles to the lifting provisions located on the top core clamps.

Figure 4: Recommended Method of Lifting from Overhead



NOTE: Cable pull angles should not exceed 45° from vertical. Avoid tilting. Unit is top heavy.

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Using a Forklift

If the transformer must be unloaded with a forklift, observe the following safety precautions.

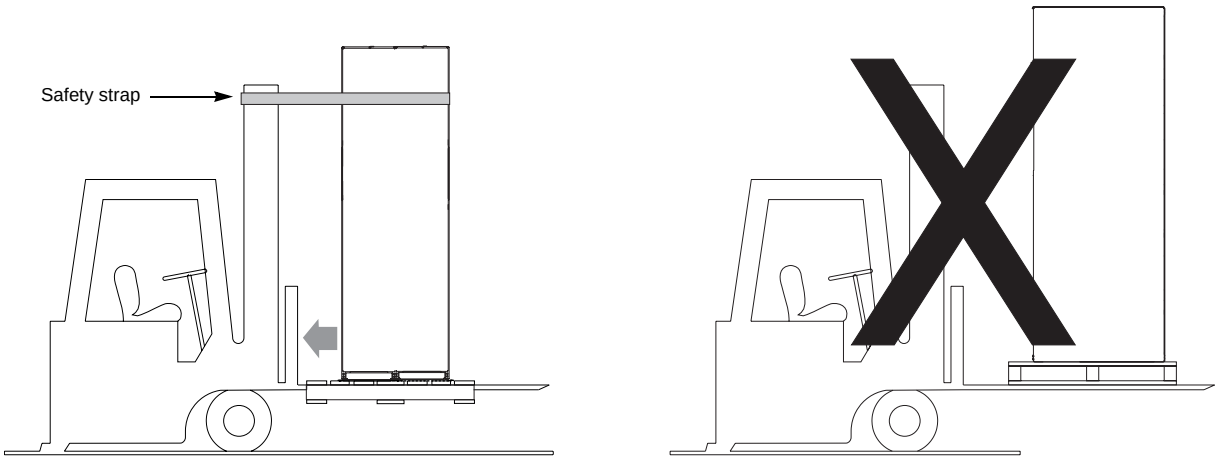
⚠ DANGER

HAZARD OF FALLING EQUIPMENT AND CRUSHING

- Transformer is top heavy and may become unbalanced.
- Verify that the capacity of the handling equipment is adequate for the transformer weight.
- Stabilize the transformer with a safety strap to reduce the possibility of tipping.
- Keep all unnecessary personnel away while handling and moving the transformer.

Failure to follow these instructions will result in death or serious injury.

Figure 5: Handling Using a Forklift



Towing and Moving

After the transformer has been off loaded, moving the transformer into position by a crane is preferred. When a crane cannot be used, the transformer can be skidded or moved on rollers. When doing so, take extra care not to damage the transformer.

The enclosure is a “bolt-together” design. If necessary, the enclosure can be disassembled to facilitate installation.

NOTE: Any disassembly and reassembly of the enclosure will be the sole responsibility of the owner and may void the warranty. Contact Schneider Electric for more information.

Storing

If the transformer must be stored, it is preferable to locate it in its permanent location on a concrete pad. If a level concrete surface is not available, take precautions to keep the unit from contacting an earthen surface. Protect the transformer and the connection points from the environment. Store an indoor unit indoors only. Maintain adequate ventilation so that air can flow through the transformer enclosure.

To reduce condensation and avoid moisture absorption in the transformer while it is being stored, immediately install space heaters, incandescent lamps, other small electric heaters. See “Drying the Core and Coil Assembly” on page 16 for more information.

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If the transformer is stored for an extended time, make periodic inspections of the transformer exterior and interior for corrosion or other possible damage. Always make an internal inspection before the transformer is placed in service. If you have any concerns, contact Schneider Electric.

SECTION 4—INSTALLATION

NOTE: Complete start-up services are available from Square D Services. They can provide assistance in a variety of areas, from installation to comprehensive testing and verification of the new equipment. Contact Square D Services at 1-800-634-2003, 24-hours a day.

Transformer Location Indoor

Follow all local and national codes when locating the transformer. Make sure the ventilated openings, on the top and bottom of the enclosure, are clear. The transformer must be at least 12 inches (305 mm) from walls or other obstructions to allow circulation of air through and around each unit.

For indoor installations, consult local and national codes to ensure all applicable requirements are satisfied. If the transformer is located near combustible materials, make sure the transformer meets or exceeds the minimum clearances as required by the National Electrical Code® (NEC) or other applicable local codes.

Locate the transformer on a level foundation strong enough to support the weight of the transformer, preferably of reinforced concrete. The manufacturer recommends that you do not place the transformer directly on an earthen surface. Ensure the foundation has adequate drainage. Seismic regulations may require that the transformer be anchored to the pad.

Restricting Access to the Transformer

Ventilated dry type transformers are not designed or constructed to be tamperproof. Install the transformer in an area that is secure and that allows only authorized personnel access to the transformer.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

The transformer is not tamperproof, therefore restrict access to it. Allow only authorized personnel access to the transformer.

Failure to follow these instructions will result in death or serious injury.

Transformer Location Outdoor

For outdoor installations, consult local and national codes to ensure all applicable requirements are satisfied. If the transformer is located near combustible materials, make sure the transformer meets or exceeds the minimum clearances as required by the NEC or other applicable local codes. The transformer must be at least 12 inches (305 mm) from walls or other obstructions to allow circulation of air through and around each unit. Ventilated and nonventilated, outdoor substation transformers and pad-mounted unit substations are designed for installation on a well-drained, concrete pad. Unless specified otherwise, the transformer is supplied without a bottom plate in the enclosure. If installing the transformer in a elevated position where the bottom is exposed, add a bottom plate (for rodent resistance) with provisions for drainage to the enclosure.

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Atmospheric Conditions

Atmospheric conditions and accessibility are important considerations when locating the transformer outdoors. Install outdoor ventilated transformers in locations that are free from unusual dust or chemical fumes.The enclosure helps protect the transformer from atmospheric conditions such as dust, rain, or snow. Also, the enclosure is designed to divert water from energized parts, insulation, and wiring. However, it may not protect against internal condensation or ice, or completely stop snow from entering. If possible, locate the transformer in a shielded area such as in the corner of a building or landscaped windbreak to provide extra protection from driving wind, rain, or snow. When subjected to severe weather, outdoor dry type transformers should be inspected to determine if added protection is necessary.

Accessibility

Outdoor pad-mounted enclosures have a hinged door on the low voltage compartment with a handle suitable for padlocking. Access to the high voltage is possible only after the low voltage door is opened, allowing authorized personnel access through a second door. Also consider accessibility for maintenance when locating the transformer. Installations where the transformer may be fully exposed to the public spaces, such as shopping centers or school yards may require additional precautions.

The pad-mounted enclosure design meets the ANSI and NEMA standard rod entry test to prevent the entrance of a rod having a diameter of 0.125 inch (3.175 mm) at any point on the enclosure. Ventilated enclosures have the same provisions as the nonventilated, except that the ventilated units have ventilation openings, which are designed according to the ANSI and NEMA standard rod entry test to prevent the entrance of a rod having a diameter of 0.500 inch (12.7 mm).

Cable Connections

When cable connections are required, conductors suitable for at least 194° F (90° C) should be used. Minimum clearance at terminals should be maintained in accordance with the following table.

Table 1: Terminal Clearances

Transformer BIL	Minimum Clearance (in.)
10	1.00
20	1.00
30	1.50
45	2.50
60	3.50
75	4.75
95	6.00
110	7.50
125	8.75
150	11.25
200	15.50

All connections should be made without placing undue stress on the terminals. Connectors should be securely fastened in place and adequately supported with allowances for expansion and contraction.

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Lightning Arresters

At times, it becomes necessary to ship the specified lightning arresters loose to the job site due to physical size and/or to prevent damage. See Figure 6 for the typical installation method.

Figure 6: Installing Lightning Arresters



⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Low voltage on the transformer windings may exceed 600 V. Do not touch the windings.

Failure to follow these instructions will result in death or serious injury.

The transformer has both high voltage (HV) and low voltage (LV) winding connections. Multiple tap positions are available on the HV winding to allow for adjustments, which may be necessary because of the specific supply voltage or transformer load characteristics. If tap adjustments are necessary, see “Changing Tap Positions to Adjust Voltage” on page 20. Connection points are clearly labeled on the transformer. Refer to the nameplate and wiring diagram to make the electrical connections.

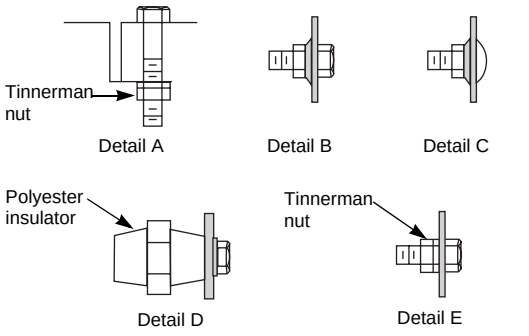
Follow these guidelines when making connections:

1. Clean the contact areas of the terminals (if applicable).
2. Use leads that are long enough to avoid mechanical strain caused by expansion and contraction. Strain can cause loose connections over time.
3. Using a torque wrench, ensure all bolted connections are torqued to the values given on the transformer label and in this bulletin. Refer to Table 2 on page 14 for torque information.

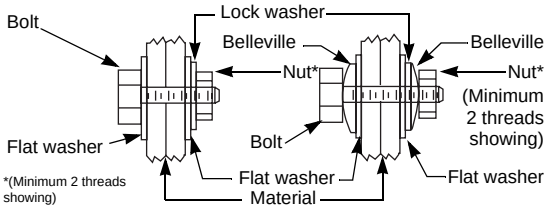
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Table 2: Torque Guidelines



Bolt Size	Grade	Application (see diagram at left)	Torque Range
.38–16	2	Detail A	3–6 lb-ft (4.0–8.1 N•m)
.38–16	2	Detail B, C, D	15–20 lb-ft (20.3–27.1 N•m)
.75–10	5	Detail B	100–155 lb-ft (135.7–210.3 N•m)
.25–20	2	Detail E	3–6 lb-ft (4.0–8.1 N•m)
.50–13	2	Detail B, D	40–50 lb-ft (54.3–67.8 N•m)
.50–13	5	Detail B	40–70 lb-ft (54.3–95.0 N•m)
.62–11	2	Detail B	80–90 lb-ft (108.5–122.1 N•m)
1.00–14	1018	Detail B	110–170 lb-ft (149.2–230.6 N•m)
.62–11	5	Detail B	110–130 lb-ft (149.2–176.4 N•m)



Electrical Connections		
Bolt Size	**Grade**	**Torque Range**
.38–16	2	15–20 lb-ft (20.3–27.1 N•m)
.50–13	2	40–50 lb-ft (54.3–67.8 N•m)
.62–11	2	80–90 lb-ft (108.5–122.1 N•m)
.62–11	5	110–130 lb-ft (149.2–176.4 N•m)

Electrical Connections for Pad-Mounted Transformers

Pad-mounted dry type transformers are provided with HV and LV terminals for primary and secondary connections. Multiple tap connections are available on the HV windings to allow for adjustments, which may be necessary because of the specific supply voltage or transformer load characteristics. If tap adjustments are necessary, see “Changing Tap Positions to Adjust Voltage” on page 20. Connection points are clearly labeled on the transformer. Refer to the nameplate and wiring diagram to make the electrical connections.

High Voltage Bushing Connections

Depending on the transformer specification, HV bushings are either live-front with exposed-metal terminals or molded dead-front (Figure 7).

Live Front: Lugs are required to terminate the cable on a live front bushing. If the live front design and shielded cable are used, install a cable stress relief terminator kit on each high voltage cable.

Dead Front: Install an elbow terminator kit on the cable to connect to the dead front bushing. On the dead-front design, the elbow terminator kit includes the necessary cable stress relief.

Contact the Square D Medium Voltage Transformer facility at 704-283-7411 for application or order information regarding live front or dead front terminator kits. Installation instructions are provided with the terminator kits. Elbow terminators and stress cones are not provided by the manufacturer.

Figure 7: Dead Front Molded HV Bushings



Universal Bushing Well
(requires a separate insert)



One-Piece Integrated Bushing
(well and insert molded in one-piece construction)

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The one-piece integrated bushing is shipped with a red plastic protective cap to protect the internal bushing contact points from dirt or moisture. Leave this cap in place until the transformer is energized. When the transformer is energized, plug the ground cap onto any unused bushing well or insert to avoid partial discharge and subsequent bushing damage.

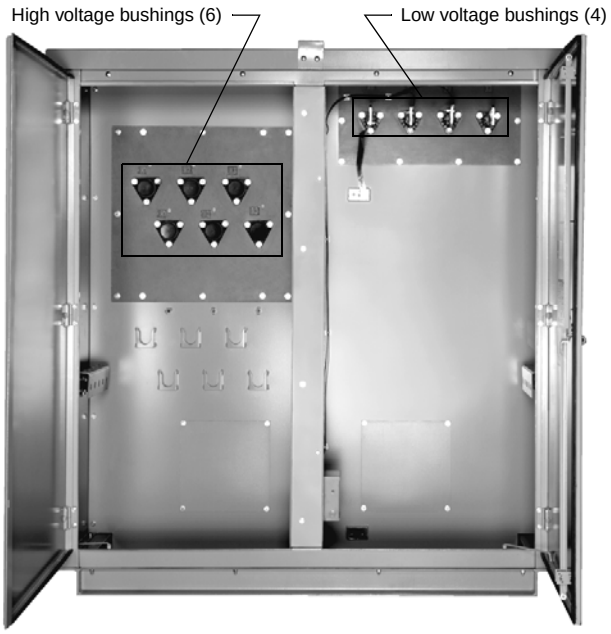
The transformer nameplate (Figure 2 on page 8) illustrates the internal wiring and external marking of each bushing. Refer to the nameplate on the transformer for clarity on where to connect each incoming cable.

On live front designs, ensure that adequate air clearances are between all energized parts in accordance with the latest ANSI Standard C57.12.22.

Low Voltage Bushing Connections

Low voltage terminals through 600 V are supplied with NEMA standard hole drillings and spacings, but are not supplied with lugs. Lugs may be stacked or mounted on either face of the spade. For 600 V bushings only, maintain a minimum of one inch air clearance between phase to phase or phase to ground.

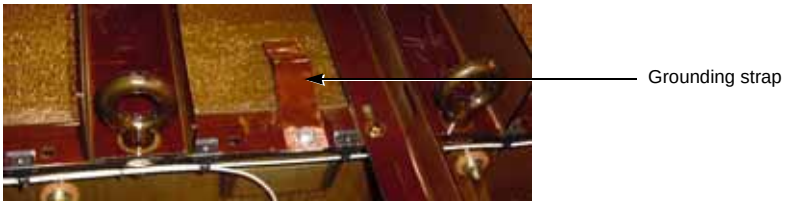
Figure 8: Typical Locations for Bushings on Pad Mounted Dry Type



Grounding

To ground the transformer, use only the ground pads on the base of the transformer. Do not use hold-down bolts or cleats, or any other component to establish the transformer ground.

Figure 9: Core Ground Strap Location



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⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- When grounding the transformer, conform to all applicable codes. Improper grounding can cause high voltage on the transformer secondary terminals.
- Secondary voltages may reach supply voltage levels. Under certain fault conditions, the secondary voltages from line to ground of transformers with ungrounded secondary windings (such as delta, floating wye and open delta) may approach a level as high as the supply voltage. DO NOT TOUCH THE WINDINGS.
- Before servicing the transformer, ensure all static charge has been discharged by grounding the coils with an appropriate grounding device.

Failure to follow these instructions will result in death or serious injury.

SECTION 5—START-UP TESTING

NOTE: Complete start-up services are available from Square D Services. They can provide assistance in a variety of areas, from installation to comprehensive testing and verification of the new equipment. Contact Square D Services at 1-800-634-2003, 24-hours a day.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified personnel should perform these tests.
- Disconnect ALL high voltage, low voltage, and neutral connections.
- Disconnect auxiliary equipment such as lightning arresters, the fan and temperature control system, meters, or any other low voltage control system that is connected to the windings that are involved in these tests.
- DO NOT disconnect the ground connection to the transformer frame.

Failure to follow these instructions will result in death or serious injury.

Before energizing the transformer and placing it in service, the manufacturer recommends that the following tests be performed at the installation site:

- **Insulation Resistance:** Measures the resistance of the insulation between the primary and secondary windings and from each winding to ground.
- **Turns Ratio:** Measures the ratio of the primary to secondary turns to check for possible insulation degradation in the windings.
- **Core Megger® Test**: Measures the resistance to the flow of current through and over the surface of the transformer insulation. Results can indicate possible insulation deterioration. Applicable for units ordered with an isolated core only.

Drying the Core and Coil Assembly

If the transformer is to be held in storage or will undergo periods of de-energization, it is recommended that space heaters be used to prevent accumulation of moisture on the core and coil assembly. The space heaters are typically 120 volt/50 watt and are usually thermostatically controlled. Heaters are mounted directly beneath the coils, front and back, on brackets attached to the bottom core clamps and mounting feet. Two heaters are used per coil, with three heaters on the high-voltage side and three on the

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low-voltage side. Space heaters are provided with a terminal block for connection to an external power source.

Using the Insulation Resistance Test to Determine Drying Time

The transformer core and coils must be dry before the transformer can be tested and energized. If the transformer has more than surface moisture present, more extensive drying may be required to ensure that the core and coils are dry. To dry the transformer, apply external heat to the transformer using the heater or lamp method described above. For transformers without an enclosure, the core and coil assembly can also be placed in a suitably ventilated oven.

Drying time depends on the condition of the transformer, size, voltage, amount of moisture absorbed, and method of drying. Measuring insulation resistance is valuable in determining the drying status.

Normal humidity has little effect on energized dry type transformers. If a shutdown occurs during a period of low humidity, no special precautions are necessary before re-energizing the transformer.

However, under conditions of high humidity, take precautions to ensure there is no condensation inside the transformer. Space heaters (optional) placed inside the housing should be energized to provide protection against this condition. As a simple rule, always keep the transformer a few degrees above the ambient temperature.

⚠ CAUTION

FIRE HAZARD

Constant attendance during the drying process is recommended. Have a suitable fire extinguisher on hand for use in the event of an emergency.

Failure to follow this instruction can result in injury or equipment damage.

Drying

To remove moisture from a transformer that has been exposed to high humidity, spray, or extended storage, the following methods are recommended:

1. **Applications of external heat**
   External heat is applied by passing heated air through the inlets in the bottom of the transformer housing. Direct the air so that it passes through the winding ducts and not only around the sides of the coils. Adequate ventilation is essential during this process. The most effective way to apply external heat is to place the core and coil assembly into a well ventilated oven.
2. **Heating by circulation of current**
   Heating by circulation of current is accomplished by short circuiting the secondary terminals of the transformer and applying impedance voltage to the primary terminals. This will produce 100% rated current in all windings. To obtain the impedance voltage, multiply the “per unit” value of the nameplate % impedance by the primary voltage noted on the nameplate. For example, for 13,800 volts with 5.75% impedance, multiply 0.0575 x 13,800 = 794 volts.

The heating process should be continued until an insulation test gives satisfactory results. In no case should the windings exceed 302° F (150° C) at the hottest measurable spot while applying the circulating current method.

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Use of Insulation Resistance for Determining Drying Time

Drying time depends on the condition of the transformer, size, voltage, amount of moisture absorbed and the method of drying used.

The measurement of insulation resistance is a value in determining the status of drying. Take measurements before starting the drying process and at two hour intervals during drying. The initial value, if taken at ambient temperature, may be high even though the insulation may not be dry. Keep the temperature of the transformer constant during the drying period to obtrain comparative readings.

As the transformer is heated, the presence of moisture will be evident by the rapid drop in resistance measurements. Following this period, the insulation resistance will generally increase gradually until near the end of the drying period when it will increase more rapidly. Sometimes it will rise and fall through a short range before steadying, because moisture in the interior of the insulation is working out through the initially dried portions. A curve with the time as abscissa and resistance as ordinate can be plotted. Continue the drying until the resistance levels off and remains relatively constant for three to four hours.

Before taking resistance measurements, the transformer should be de-energized and the winding should be short circuited and grounded for at least one minute to drain any static charge. All readings should be taken at the same time of application of the test voltage, preferably one minute.

Insulation resistance measurements should be taken in this order:

1. Primary to ground with secondary grounded.
2. Secondary to ground with primary grounded.
3. Primary and secondary to ground.

If winding resistance is used in determining winding temperature, contact the factory to obtain the needed information.

Insulation Resistance Testing

Before performing the insulation resistance test, use a vacuum cleaner to clean the core and coil assembly. When measured in accordance with ANSI/IEEE Standard C57.94, the minimum insulation resistance should be as listed in Table 3:

Table 3: Insulation Resistance Values

Winding kV Class	Insulation Resistance (MΩ)
1.2	600
2.5	1000
5.0	1500
8.7	2000
15.0	3000

Turns Ratio Test

Perform the turns ratio test at each tap position and for the full winding.

1. Use a Transformer Turns Ratio (TTR) to measure the ratio between the primary and secondary windings.
2. Compare these measurements to the transformer nameplate voltage ratio. The measurements should be within 1/2 of 1% of the nameplate voltage ratio. Refer to ANSI C57.12.91 for additional information.

Core Megger® Test

The core of a ventilated dry type transformer is constructed using one of two methods. For standard construction, the core is not insulated from the clamping structure. The core and clamping structure are at the same potential. In this case, the core Megger test is not applicable.

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When specified, the transformer core is totally isolated from the core clamping structure by a layer of insulation. The core does not make contact with the clamping structure. A core ground strap is inserted between the laminations to ground the core to the clamping structure. A core Megger test can be performed to measure the resistance of the flow of current through and over the surface of the transformer insulation.

Before the core Megger test can be performed, inspect the transformer. The copper-foil ground strap extends out from the top of the core and attaches to the top core clamp. Follow these steps to perform the core Megger test:

1. Obtain a 1000 V megohmmeter.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Read and understand the equipment manufacturer's instructions. Use caution while operating the megohmmeter.

Failure to follow these instructions will result in death or serious injury.

2. Disconnect the core ground strap from the core clamp. Make sure the ground strap is clear from any contact with the transformer ground to isolate the clamp structure.
3. Taking care not to pull the core ground strap out of the core, attach the hot lead of the megohmmeter to the core ground strap.
4. Attach the ground lead of the megohmmeter to the core clamping bolt, which is next to the core ground strap. Ensure the lead and core ground strap are not in contact with the ground.
5. Energize the megohmmeter.

   NOTE: A reading of 10 megohms or greater is acceptable. If the reading is less than 10 megohms, contact Square D Services at 1-800-634-2003.
6. Reattach the core ground strap to the core clamp.

SECTION 6—OPERATION

Energizing the Transformer

Before energizing the transformer, do the following:

1. Remove all shipping braces and shipping bolts (if present). They are clearly tagged or painted yellow.

   NOTE: DO NOT remove the fiberglass tubing (if provided) that surrounds the high voltage cables.
2. Verify the operation of fans, motors, controllers, relays, or other auxiliary devices.
3. Verify the selection of taps and ratio connections against the transformer nameplate information.
4. Torque all connections according to the torque guidelines in Table 2 on page 14 and ensure clearances are adequate between the transformer enclosure and internal bus bars.
5. Remove all hand tools, equipment, or any other foreign material from inside the enclosure. **Do not** leave tools or other equipment on the core and coil assembly.
6. Energize the transformer.

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⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Only qualified personnel with appropriate measurement devices should measure the voltages on the transformer.

Failure to follow these instructions will result in death or serious injury.

7. Check the transformer nameplate before measuring voltages and ensure that properly rated meters are used to verify the primary and secondary transformer voltages.
8. Verify the voltages on the transformer primary and secondary.

If the voltages are not as required, use the taps to adjust the voltage. See the following section, “Changing Tap Positions to Adjust Voltage”.

Changing Tap Positions to Adjust Voltage

To change the tap position:

⚠ DANGER

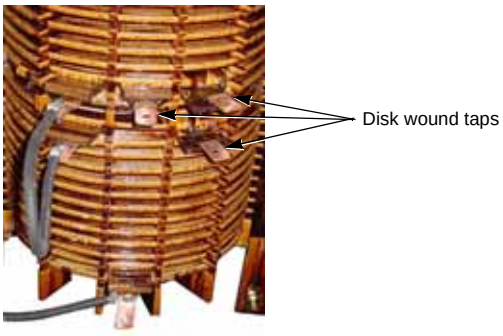
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Before performing this procedure, review “Section 2—Safety Precautions” on page 6.
- Do not change the tap connections when the transformer is energized.
- Disconnect all power and verify the transformer is de-energized before servicing the transformer. Use a properly rated meter to measure for the presence of voltage at the terminal and to verify the transformer is de-energized. Do not rely on visual indications such as switch position or fuse removal for determining a de-energized condition.
- Ensure no paths are present for backfeeding power to the transformer (such as through a tie-breaker).

Failure to follow these instructions will result in death or serious injury.

NOTE: Do not bend or position the hardware in a manner that would reduce clearance between tap terminals.

Figure 10: Disk Wound Tap Connections



1. De-energize the transformer following the safety messages above and your company’s lock-out/tag-out procedures.
2. Remove the enclosure panel or door to access the transformer high voltage windings.
3. Use an appropriate grounding device to ground the coils and discharge any static charge.
4. Locate the tap jumpers.
5. Change the tap jumpers on each phase to the appropriate tap connection (Figure 10). The tap jumpers must be on the same tap position for each phase.
6. Torque the tap connections. Refer to the torque values in Table 2 on page 14.

   NOTE: For multiple voltages or other special arrangements, see the transformer nameplate.
7. Inspect the enclosure to ensure all hand tools, equipment, or any other foreign materials are removed from the enclosure.

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8. Re-install the door or enclosure panel.
9. Energize the transformer.

Sound Level

All transformers have an inherent sound level that varies with the size of the units. The fundamental frequency is twice that of the applied voltage.

Sound waves may be amplified by means of reflected waves and/or radiated waves via walls, floors, ceilings, mechanical vibrations of air ducts, conduits, and mounting bases. For average expected sound levels, refer to NEMA ST-20.

To meet NEMA listed average sound levels, each unit should be installed in a location where there is a 10-foot clearance on all sides except floor or ground. Units located in close proximity to hard surfaces may produce higher than average sound levels. When transformers must be located in noise sensitive areas, precautions should be taken to avoid amplification of the transformer sound.

Install the unit in an area where the noise will be least objectionable. Avoid rooms where hard surfaces are in close proximity to the transformer.

Use acoustic absorbing materials on walls, floors, and ceilings. Avoid installation of units in corners, hallways, and stairways, and near heating and air conditioning ducts.

Reduction of Structure Borne Noise

Loosen anchor bolts between the transformer and enclosure and let the unit rest on the vibration pads only. (Except on certified seismic units.)

Use flexible conduit and bus connections.

Avoid mounting the unit on walls, balconies, and floors with low masses. Avoid uneven mounting surfaces. If specified, low sound level transformers can be provided for most applications.

SECTION 7—MAINTENANCE

Complete start-up services are available from Square D Services. They can provide assistance in a variety of areas, from installation to comprehensive testing and verification of the new equipment. Contact Square D Services at 1-800-634-2003, 24-hours a day.

Inspect the transformer regularly. The frequency of inspection depends on operating conditions. If the transformer is operating in usual service conditions as defined in ANSI/IEEE C57.12.01, an inspection every two years may be sufficient. However, for unusual locations where the air is contaminated with particles such as dust or chemical fumes, inspect the transformer every three months or sooner. After the first few inspections, determine a more definite schedule based on the existing conditions. Perform the following procedures for maintenance.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Before performing this procedure, review “Section 2—Safety Precautions” on page 6.
- Before servicing the transformer, ensure all static charge has been discharged by grounding the coils with an appropriate grounding device.

Failure to follow these instructions will result in death or serious injury.

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1. De-energize the transformer following the preceding safety messages and your facility's lock-out /tag-out procedures.
2. Ground unit for one minute to drain static charge.
3. Clear away any debris or other foreign objects from all ventilation openings. If the transformer design includes an optional solid base, make sure air can flow through the bottom grills of the enclosure.
4. Remove the enclosure panel or door to access the transformer high voltage windings.
5. Check the enclosure for deterioration. If deterioration is present, determine the cause and correct (if possible). Repaint deteriorated areas.
6. Replace corroded hardware, as required. See "Replacement Parts" on page 24.
7. Ensure all interior surfaces are clean by following the procedure in "Cleaning" below.
8. Inspect safety labels and replace as necessary.
9. See "Energizing the Transformer" on page 19 to power up the transformer.

After a Major Fault

1. If the transformer is energized, de-energize the transformer following the safety messages above and your facility's lock-out/tag-out procedures.
2. Remove the enclosure panels and inspect the transformer core and coil assembly for any physical damage. If damage has occurred, contact the Square D Medium Voltage Transformer facility at 704-283-7411.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Do not re-energize the transformer if the transformer has been damaged.

Failure to follow these instructions will result in death or serious injury.

3. Using a torque wrench, ensure all bolted connections are torqued according to the torque guidelines in Table 2 on page 14.
4. Perform the tests described in "Section 5—Start-Up Testing" on page 16. DO NOT re-energize the transformer if the test results are not acceptable. If no damage has occurred and all test results are acceptable, perform maintenance by following the procedures in "Section 7—Maintenance" on page 21.

Cleaning

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Before performing this procedure, review "Section 2—Safety Precautions" on page 6.
- Before servicing the transformer, ensure all static charge has been discharged by grounding the coils with an appropriate grounding device.

Failure to follow these instructions will result in death or serious injury.

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To clean the transformer, do the following:

1. De-energize the transformer following the safety messages above and your facility's lock-out/tag-out procedures.
2. Ground unit for one minute to drain static charge.
3. Remove the enclosure panel or door to access the transformer high voltage windings.

⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE

Do not push or pull the cloth through the coils.

Failure to follow this precaution can result in injury or equipment damage.

4. Wipe down all parts of the core, being careful not to cut yourself on any sharp edges or protrusions.
5. Use an industrial vacuum cleaner to clean the ventilation openings and remove dirt and dust from the core, coils, insulators, and remaining structures.
6. Remove all rags or other maintenance equipment from the coil ducts and check for tools when finished. Confirm that the coil ducts are clear.

SECTION 8—OPTIONAL EQUIPMENT

This section provides information about optional equipment and replacement parts.

Temperature Monitoring Systems

Optional temperature control modules are available on ventilated dry type transformers.The monitor controls the fans and provides alarm indication. See the manufacturer's instruction manual included with the transformer documentation package for detailed information about the installation, operation, and maintenance of the monitor.

The factory pre-set temperature alarm and control settings for ventilated transformers are listed in Table 4.

Table 4: Factory-Set Temperature Alarm and Control Settings

Stage	Temperature Rise
	Transformers with 80 °C / 150 °C Temperature Rise Rating
Fan On	110 °C
Alarm On	125 °C
Trip Signal	220 °C
	Transformers with 115 °C / 150 °C Temperature Rise Rating
Fan On	145 °C
Alarm On	160 °C
Trip Signal	220 °C
	Transformers with 150 °C Temperature Rise Rating
Fan On	180 °C
Alarm On	195 °C
Trip Signal	220 °C

Fans (Forced Air)

When provided, bladed fans located under the transformer coils provide the forced air cooling.

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Neutral Grounding Resistors

If specified, optional neutral grounding resistors may be supplied. See the manufacturer's instruction manual included with the transformer documentation package for detailed information about the resistors.

Other Optional Equipment

Other optional equipment, such as monitors, current or potential transformers, or space heaters, may be supplied if specified.

Replacement Parts

Some replacement parts for the transformer are available. Contact your Schneider Electric field sales representative for price and availability. Provide full nameplate information and a description of the part needed. Sketches or photographs may be useful in describing the part.

SECTION 9— TROUBLESHOOTING

If any of the problems listed in Table 5 are identified, the transformer should be removed from service at once. Immediate attention to the problem may prevent dangerous conditions or expensive repairs. In many instances, the trouble can be found quickly and the unit returned to service.

If the trouble cannot be corrected, do not re-energize the transformer. Contact the factory immediately.

Further inspection may require disassembly of the core and coils. This work must be performed by a factory representative or authorized repair facility.

Table 5: Troubleshooting Guide

Circuit	Symptom	Cause
Electric	Overheating	Continuous overload; wrong external connections; poor ventilation; high surrounding air temperature [a]; damaged or improperly directed fan blades; high harmonic or unbalanced loads
	Reduced or zero voltage	Shorted turns; loose primary tap connections
	Excess secondary voltage	High input voltage; improper primary tap connections
	Unbalanced secondary voltages	Overload; tap connections not on identical tap positions; neutral ungrounded
	Insulation failure	Continuous overloads; dirt accumulation on coils; mechanical damage in handling; lightning or switching surges
	Breakers or fuses opening	Short circuit; overload
	Excessive cable heating	Improperly bolted connection; incorrect cable size for load; incorrect cable routing
	High voltage to ground [b]	Usually a static charge condition
Magnetic	Vibration and noise	Low frequency; high input voltage; core clamps loosened in shipment/handling; improper tap connection
	Overheating	High input voltage; improper loads; harmonics; dirty core
	High exciting current	Low frequency; high input voltage; shorted turns
Dielectric	Smoke	Insulation failure
	Burned insulation	Lightning surge; switching/line disturbance; broken bushings, taps, or arresters; excess dirt or dust on coils
	Overheating	Clogged air ducts or inadequate ventilation
	Breakers or fuses opening	Insulation failure

[a] Rating is based on 86° F (30° C) average temperature over a 24-hour period, with peaks not to exceed 104° F (40° C).
[b] Using rectifier or VTVM meter.

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MAINTENANCE LOG

Date	Initials	Maintenance Performed

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Date	Initials	Maintenance Performed

Schneider Electric

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(1-888-778-2733)
www.us.SquareD.com

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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09/2005

Model 98A Digital Temperature Controller
For Medium Voltage Transformers
Class 7300, 7400

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Instruction Bulletin

43500-054-34R1

11/2011

Retain for future use.

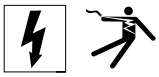


SQUARE D™

by Schneider Electric

Hazard Categories and Special Symbols

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates an electrical hazard exists that will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** property damage.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Introduction

The Model 98A digital temperature controller can continuously monitor up to three Type K thermocouples in the windings of a dry type transformer. Based on winding temperatures, the controller has the capability to perform the following functions.

- The controller can display the current winding temperature of each phase. It also stores and displays the highest phase temperature, identifying which phase caused that high temperature.
- The controller can operate relays that activate the fans or blowers, sound the high temperature alarm, or actuate a high temperature trip. The controller compares the highest of the three phase temperatures to temperature set points that are stored in the controller's memory. These set points can be reviewed from the controller.
- The default state of the Alarm relay is normally energized so that the alarm sounds upon power failure (fail-safe). The default state of all other relays is normally de-energized (non-fail-safe).
- An internal audible device (buzzer) sounds when the alarm is ON. The audible device can be silenced using the Front Panel Silence button without changing the state of the Alarm relay.
- Two auxiliary relays with non-energized default states are available.
- A Fan Exerciser circuit turns the fans ON for one minute every seven days.
- The controller can interface as part of a complete PowerLogic™ power monitoring and control system manufactured by Schneider Electric. The controller can transfer real-time information to the PowerLogic system about the winding temperatures, status of the relays, and the temperature set points contained within the controller's memory. Once in the PowerLogic system, the information can be used in tables, graphs, and reports.
- The controller can be tested to check its operation at any time. However, the controller continuously performs internal checks and will display error codes if a problem with its operation is detected.

Table 1 shows the outputs from the controller. For details about the functionality of the controller, see "Operation" on page 13.

Table 1: Controller Outputs

Data	Reading	Action
Current Temperature	Left Phase	Displays corresponding phase temperature on the LCD..
	Center Phase	
	Right Phase	
	Maximum Stored	Displays corresponding maximum phase temperature on the LCD..
Relay Set Points and Status	Fan	Activates fans or blowers and lights up the fan LED.
	Alarm	Sounds the alarm buzzer and lights up the alarm LED.
	Trip	Actuates a relay and lights up the trip LED.
	Auxiliary 1	Actuates a relay and lights up the AUX1 LED.
	Auxiliary 2	Actuates a relay and lights up the AUX2 LED.

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NOTE: This instruction bulletin is not an application guide for the Model 98A controller or a substitute for adequate training in safe working procedures for this and related electrical equipment. Installation of this electrical equipment may require special licenses or training. Consult applicable national, industry, and local codes for specific requirements that may apply.

The successful operation of this device depends on various factors such as installation, service conditions, and maintenance. Unless designed for other specific applications, this device should be installed on a transformer that is operating under the conditions specified in IEEE C57.12.01.

NOTE: If additional information is needed that is not covered by this instruction bulletin, contact your local Schneider Electric representative.

Safety Precautions

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- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- Read and understand this entire instruction bulletin before operating or maintaining the Model 98A Digital Temperature Controller. Also read and understand the bulletin that ships with the transformer before installing, operating, or maintaining a dry type transformer. Follow all applicable local and national codes.
- The controller is designed to be operated and maintained while the transformer is energized. However, many parts of the transformer operate at high voltages. DO NOT TOUCH any transformer parts. Use only electrically insulated tools when working around electrical equipment.
- Disconnect all power and verify the transformer is de-energized before servicing the transformer. Operation of a primary protective device may be evidence of a faulted transformer. Do not re-energize the transformer until the cause of operation of the primary protective device is found and corrected.
- Do not rely on visual indications such as switch position or fuse removal for determining a de-energized condition. Always assume that a terminal is energized unless it is checked with a properly rated meter to ensure the terminal is de-energized and grounded.

Failure to follow these instructions will result in death or serious injury.

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Installation

The Model 98A controller is installed on the transformer at the factory when the transformer is ordered with a forced air cooling package, with provisions for future air cooling (package without fans), or with provisions for transformer monitoring only.

NOTE: Any disassembly and reassembly of the enclosure or any other part of the transformer will be the sole responsibility of the owner and may void the warranty. Square D Services is available to ensure a factory-authorized installation of the controller.

The Model 98A controller is factory installed in a control box that allows access to the controller without de-energizing the transformer. Do not energize the transformer if the box has been tampered with or removed.

The control box provides additional user safety and shields the controller from free flowing air currents, such as those caused when the fans turn on. Moving air could cause the controller to report incorrect readings.

If the controller has been purchased separately and has not been factory installed, contact Square D Services for recommended installation instructions.

Connections

The type of connection required depends on the use of the controller.

- **Power connections**—If the controller is factory installed without self-contained power, two power connections are required: one for control power and one for fan power. All other wiring is completed at the transformer manufacturing facility.
- **Remote monitoring connections**—If the controller is being used with a remote display and remote alarm, the controller must be wired for this use.
- **PowerLogic system connections**—If the controller is part of a PowerLogic power monitoring and control system, the controller must be connected to the PowerLogic system.

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- Review “Safety Precautions” on page 6 before making any connections.
- Ensure all personnel, tools, controller wiring, and other work material or equipment are cleared from the transformer and the control box before turning ON power to the controller.

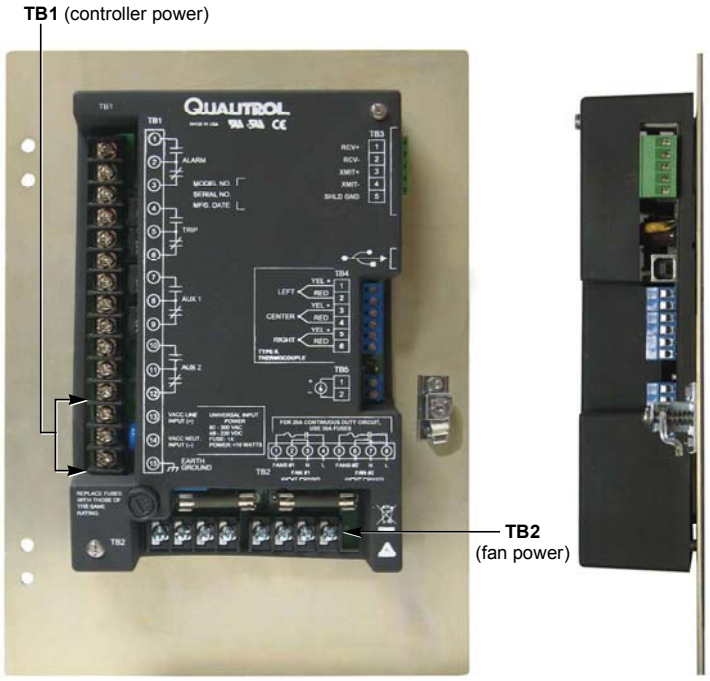
Failure to follow these instructions will result in death or serious injury.

Connecting to the Power Source

The Model 98A controller is equipped with a universal power supply (UPS) that can accept 80–300 Vac, 50/60 Hz or 48–220 Vdc to power the controller only. If the transformer is provided with a self-contained power supply, the power supply is factory-wired. When an external power supply is provided, see the wiring diagram provided with the transformer for power supply connections.

The power supply for the fans or blowers is factory-wired if the transformer is provided with a self-contained power supply. When an external power supply is provided, see the wiring diagram provided with the transformer for power supply connections.

Figure 1: Power Source Connections



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Before applying power, make sure all personnel and equipment are clear of the fans or blowers.

Failure to follow these instructions can result in injury or equipment damage.

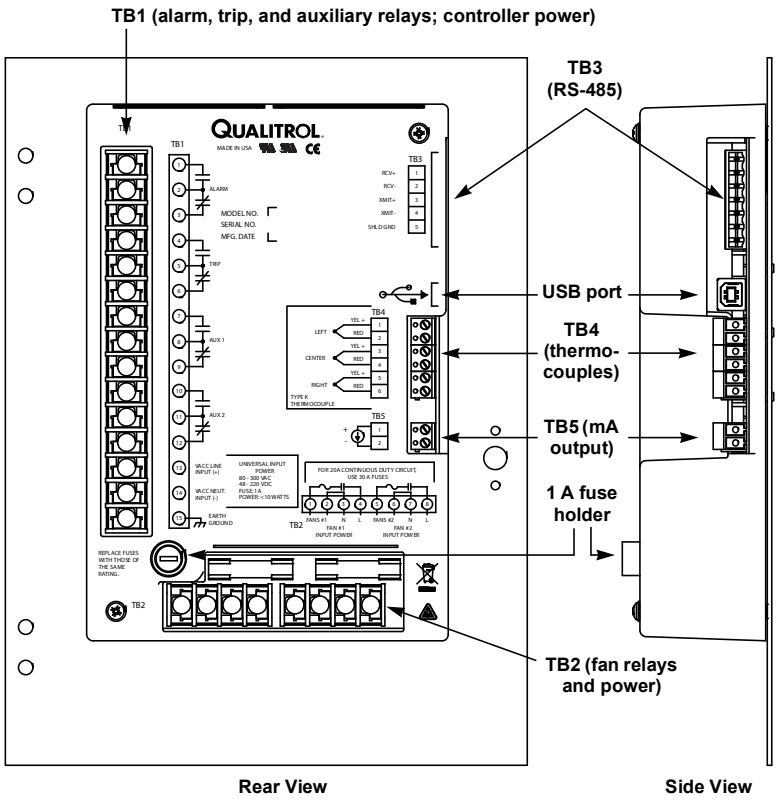
When the controller is powered on, the fans or blowers turn ON and then, after approximately one minute, OFF. This can be used as an initial test to ensure all fans or blowers are operating.

A 5 x 20 mm, 1 A, Type F fuse located in the round fuse holder on the back cover protects the controller. If the fuse blows, make sure the power input voltage connections have been properly made.

Do not replace and re-energize the controller until the situation is corrected. If it is determined that the controller is properly connected, ensure that all power is off, replace the fuse, and re-energize the controller. If the situation cannot be corrected, contact the Schneider Electric Customer Information Center at 1-888-778-2733, or send an e-mail to monroe-after-shipment@us.schneider-electric.com.

All other connections are pre-wired at the transformer facility. Table 2 on page 10 shows the pre-wired connections.

Figure 2: Wiring Terminals/Connectors



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⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE

The transformer may not operate as designed if the fan, alarm, or trip settings are changed. Only an authorized Schneider Electric representative can make set point changes to the controller. If changes to the factory settings are needed, contact the Schneider Electric Customer Information Center at 1-888-778-2733, or send an e-mail to monroe-after-shipment@us.schneider-electric.com.

Failure to follow this instruction can result in injury or equipment damage.

Table 2: Factory Pre-wired Connections

Connection Type	Controller Terminal	Description	Connection Information
Thermocouples	TB4-1 to TB4-2	Thermocouple sensor #1 (left phase)	Type K thermocouples are standard. The yellow lead is connected to the positive terminal (1, 3, or 5) and the red lead is connected to the negative terminal (2, 4, or 6).
	TB4-3 to TB4-4	Thermocouple sensor #2 (center phase)	
	TB4-5 to TB4-6	Thermocouple sensor #3 (right phase)	
mA output	TB5-1, 2	Milliampere output current loop	Provides a current proportional to the present highest temperature. TB5-1 is the positive terminal.
Controller power	TB1-13, 14, 15	Universal power supply 80–300 Vac, 50/60 Hz or 48–220 Vdc	Required only if the transformer is not provided with a self-contained power supply.
Fan power	TB2-3, 4, 7, 8	Fan voltage	
Relay contacts	TB2-1, 2	Fan #1 controls the fans or blowers through a fuse.	Each fan circuit is protected by its own fuse and controlled by a separate relay with a SPST Form A contact.The contact is open when no power is applied to the unit. The alarm, trip, and auxiliary relay contacts are SPDT Form C. The alarm relay is normally energized and changes state when power is lost. The trip and auxiliary relays are normally de-energized and do not change state when power is lost.
	TB2-5, 6	Fan #2 controls the fans or blowers through a fuse. The Fan #2 circuit is electrically separate from the Fan #1 circuit.	
	TB1-1, 2, 3	Alarm—SPDT (Form C) contacts at TB1-1, 2, and 3 indicate an alarm condition. This relay is usually set to be energized in the normal state so that the loss of control power will cause an alarm.	
	TB1-4, 5, 6	Trip—SPDT (Form C) contacts at TB1-4, 5, and 6 indicate that the temperature being monitored has reached the trip state. This relay is usually set to be de-energized in the off state.	
	TB1-7, 8, 9	Auxiliary 1—SPDT (Form C) contacts at TB1-7, 8, and 9	
	TB1-10, 11, 12	Auxiliary 2—SPDT (Form C) contacts at TB1-10, 11, and 12	

Connecting to Remote Current Loop Output

The temperature controller provides a milliampere analog signal for use with remote meter or SCADA systems. Access this output on TB5 terminals 1 (+) and 2 (-). The output is preset at 4–20 mA.

USB Link

A USB data link is used by the factory to install the standard configuration. A USB plug is provided for this link.

NOTE: Connect a USB cable only when a configuration update is required. No permanent wires should be attached to this connector.

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Communications Wiring

The Model 98A controller is equipped with an RS-485 communication port. The RS-485 standard allows daisy chaining up to 32 devices on a single communications link.

A five-terminal connector on the side of the controller (Figure 3) provides a four-wire, RS-485 connection when wired as shown in Table 3. Connect terminals 1 and 3 and terminals 2 and 4 to create a 2-wire network.

The controller can be connected to the serial communication port of any Modbus™ master device, such as a PowerLogic EGX Ethernet gateway.

To daisy chain the Model 98A with other Modbus RTU-compatible devices, use a shielded communications cable containing one twisted pair for 2-wire networking or two twisted pairs for 4-wire networking. For example, use a Belden 9841 or equivalent cable for 2-wire networking or a Belden 9842 or equivalent cable for 4-wire networking. See Table 3 for the RS-485 terminal block connector designations.

The Model 98A controller is designed to interface with the PowerLogic power monitoring and control system from Schneider Electric using the Modbus RTU protocol. All communication setup functions that are normally performed at the controller can be performed remotely via a PC.

To set the parameters for the RS-485 connection, see “Communications Setup” on page 12.

Figure 3: RS-485 Terminal Connections

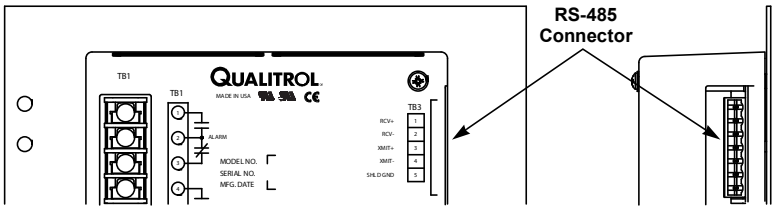


Table 3 shows the block connector designations for the RS-485 terminals.

Table 3: RS-485 Terminal Connector Designations

Terminal Number	Designation
1	Receive +
2	Receive –
3	Transmit +
4	Transmit –
5	Shield ground

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Communications Setup

The communications setup of the Model 98A controller can be changed from the front panel by the following procedure:

1. Press and hold all three buttons until the unit stops cycling through the readings (approximately ten seconds).

   The controller then displays the current baud rate. See Table 4.

Table 4: Baud Rates

Display	Bits per Second
12	1200
24	2400
48	4800
96	9600
192	19,200

   Pressing the SILENCE/TEST (top) button will step the display **up** through the baud rate choices shown in Table 4. Pressing the MANUAL/AUTO (bottom) button will step the display **down** through the choices.

2. When the desired baud rate is displayed, press the RESET (middle) button.

   The display then shows the current parity setting:

Table 5: Parity Settings

Display	Description
PE	Even parity (standard)
PO	Odd parity
P--	No parity

3. When the desired parity is displayed, press the RESET (middle) button.

   The display then shows the current stop-bit setting.

   If parity is even or odd, the display will show S1 and cannot be changed.

   If no parity has been selected, the number of stop bits can be set to 1 or 2 (S1 or S2). S1 is used if the unit is communicating through a modem; otherwise, S2 is standard.

4. When the desired stop bit is displayed, press the RESET (middle) button. The display shows the current address setting.

   Pressing the SILENCE/TEST (top) button will step the display **up** through the addresses. Pressing the MANUAL/AUTO (bottom) button will step the display **down** through the addresses.

   NOTE: Legal Modbus addresses are 1-255.

5. Press the RESET (middle) button to return the controller to normal operation and save the settings. If a button is not pressed for 30 seconds, the unit will automatically return to normal operation and the communications setup will be unchanged.

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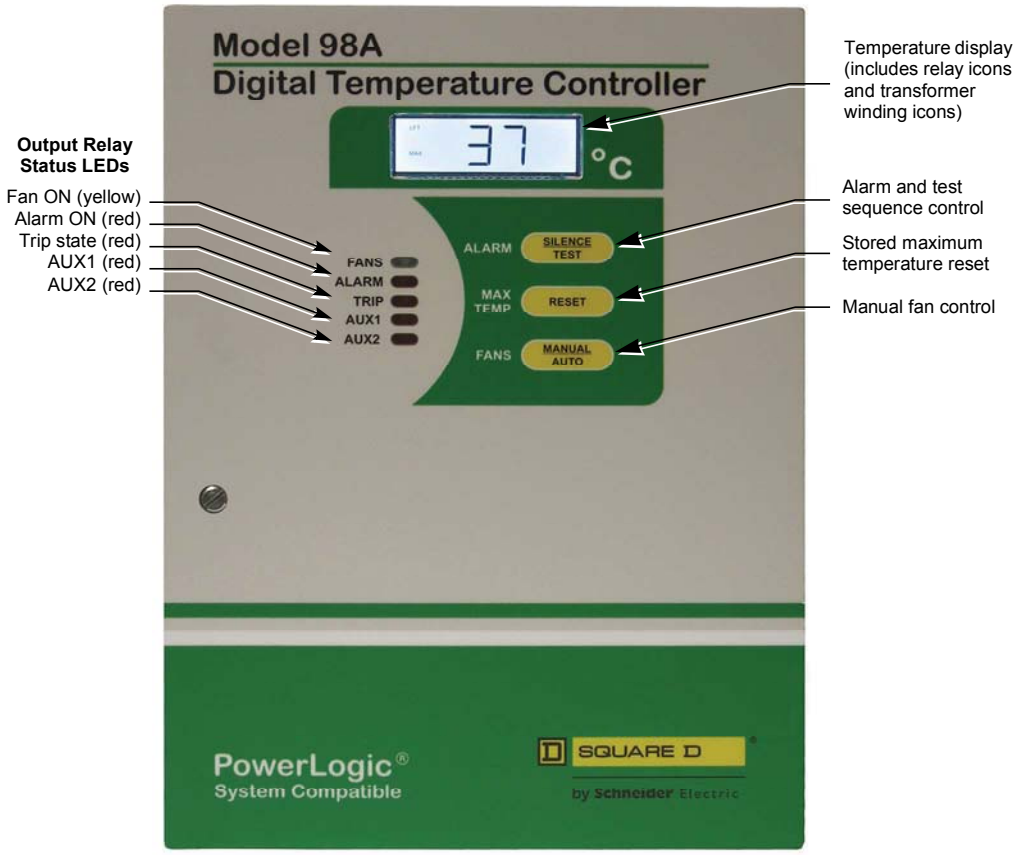
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Operation

The front panel of the Model 98A controller displays transformer temperature data, communicates the state of the outputs, and allows review of the set points. It is also possible to control the fans and alarm, and reset the maximum temperature setting using the buttons on the front panel.

Output Relay Status LEDs

Figure 4: Front Panel Detail



Five LEDs indicate the status of the output relays:

- The yellow FANS LED illuminates when the fan relay is activated. This is triggered when the transformer temperature is above the temperature set point of the fan relay.
- The red ALARM LED indicates that the alarm relay is in the alarm state when the alarm temperature set point is exceeded.
- The red TRIP LED indicates that the trip relay is in the trip state when the maximum temperature set point is exceeded. The trip relay provides a contact that can be used to take the transformer off line.
- The red AUX1 LED indicates that the first auxiliary relay is in the active state.
- The red AUX2 LED indicates that the second auxiliary relay is in the active state.

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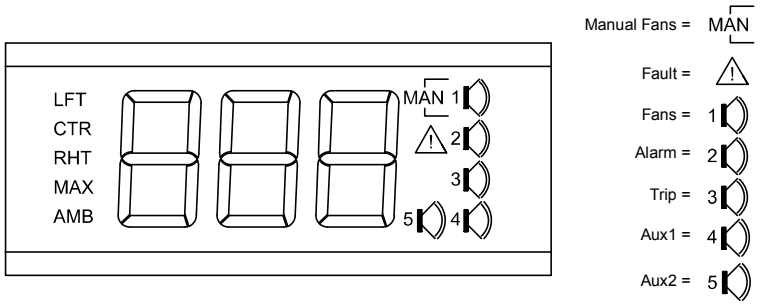
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Temperature Display

The temperature display (Figure 5) consists of a three-digit, seven-segment, back-lit LCD display that can show temperatures from 0–250 °C and four individual icons that identify the temperature being displayed. The display shows each reading for approximately one second and then automatically steps to the next reading.

During normal operation, the display cycles through the three winding temperatures and the single highest temperature recorded. While the maximum stored temperature is displayed, both the MAX icon and the icon representing the winding that caused the maximum reading turn ON. The maximum temperature can be reset at any time (see “Resetting the Maximum Stored Temperature” on page 15). See “Thermocouples and the Temperature Display” on page 17 for technical details about the temperature readings.

Figure 5: Temperature Display



Manually Controlling the Fans or Blowers

Pressing the MANUAL/AUTO button manually activates the fan relay and turns the fans or blowers ON. The yellow FANS LED illuminates to show that the fans are ON and the Manual Fan icon (MAN) displays to show that the fan function is in manual mode.

When the fan function is in manual mode, pressing the MANUAL/AUTO button returns the function to automatic mode. If the temperature is below the set point that activates the fans, the fans will turn OFF and the yellow FANS LED and the Manual Fan icon (MAN) will no longer be displayed. However, if the temperature is above the set point, the Manual Fan icon (MAN) will no longer be displayed, but the fans or blowers and the FANS LED will remain ON until the temperature falls below the set point.

You can press the MANUAL/AUTO button any time to verify that the fan relay and the fans or blowers are operating properly.

Silencing the Alarm

Whenever an alarm is activated, an internal buzzer sounds and the ALARM LED illuminates. To silence the buzzer, press the SILENCE/TEST button. The buzzer remains off until a new alarm occurs. The ALARM LED remains illuminated until the temperature drops below the set point or the problem has been corrected. Silencing the buzzer does not eliminate the problem that caused the alarm. Promptly find and correct the situation that caused it.

If the buzzer sounds but the ALARM LED is not illuminated, check the 1 A fuse located in the round fuse holder on the back cover.

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Reviewing Set Points

When the alarm is not sounding, pressing the SILENCE/TEST button starts a test sequence to verify that the controller is operating properly and allows a review of the set points. The test sequence performs the following checks at two-second intervals:

1. Displays the FAN ON temperature set point and lights the FANS LED.
2. Displays the ALARM temperature set point and lights the ALARM LED.
3. Displays the TRIP temperature set point, and lights the TRIP LED.
4. Displays the AUX1 temperature set point and lights the AUX1 LED.
5. Displays the AUX2 temperature set point and lights the AUX2 LED.
6. Displays the ambient temperature inside the controller.
7. Displays 888 on the temperature display, turns on all icons on the display, turns on all relay status LEDs, and turns on the alarm.

Resetting the Maximum Stored Temperature

Press the maximum temperature RESET button to clear the memory of the maximum stored temperature. This causes the current highest winding temperature to become the stored maximum temperature.

Controller Error Codes

During normal operation, the controller is constantly checking itself for proper operation. If a problem is detected, the controller displays one of the error codes described in Table 6.

Table 6: Error Codes

Display	Reason	Description	Corrective Action
– – –	Failed thermocouple or reversed connection	Shows **– – –** on the display when that particular sensor temperature should be displayed. Shows which sensor is malfunctioning. The system activates the alarm, turns ON the fans, and continues to function using the remaining input channels. If the controller detects an open-circuited thermocouple, the alarm sounds and the faulty channel is displayed. A failed thermocouple does not cause a trip. The **– – –** display also indicates a reversed thermocouple connection when the thermocouple is 30 °C below the terminal block temperature.	1. Inspect the thermocouples for possible damage. If damaged, repair or replace. 2. Make sure the thermocouples are wired according to the wiring diagram on page 9.
E11	Failed A/D converter	Shows **E11** on all channels, turns ON the fan relay, and activates the alarm.	1. Disconnect power to the controller. 2. Remove the hinges and disconnect the wiring. 3. Contact your Schneider Electric representative to obtain a Returned Material Authorization, then return the controller to the Schneider Electric Medium Voltage Transformer Facility.
E22	Failed ambient temperature sensor	Shows **E22** on all channels, sets ambient temperature to 30 °C, activates the alarm, turns ON the fans, and continues to operate using a 30 °C ambient temperature.	
E33	Failed EEROM after initial start up	Shows **E33** on all channels, continues to operate, activates the alarm, and turns ON the fan relay.	
	Failed EEROM at power up	Shows **E33** on all channels, turns ON the fan relay, and activates the alarm.	
Blank	Failed display driver	Blank temperature, that is, nothing is shown on the digital display. The controller continues to operate, activates the alarm, and turns ON the fan relay.	

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Maintenance

Inspect the controller regularly during normal transformer inspection. The frequency of inspection depends on operating conditions. If the controller is installed in a Square D™ brand transformer that is operating in usual service conditions as defined in IEEE C57.12.01, an inspection every five years may be sufficient. However, for unusual locations where the air is contaminated with particles such as dust or chemical fumes, the transformer and controller should be inspected every three months or sooner. After the first few inspections, determine a more definite schedule based on the existing conditions. Perform the following procedures for maintenance.

NOTE: If any problem is found during maintenance, contact your local Schneider Electric representative.

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- Before performing this procedure, review “Safety Precautions” on page 6.
- Before servicing the controller, turn OFF power to the controller and fans.

Failure to follow these instructions will result in death or serious injury.

Testing the Fans or Blowers

The controller has an automatic fan exerciser that turns the fans ON for a short time at preset intervals. However, during a scheduled inspection of the transformer, turn the blowers or fans ON to confirm that they are working properly. See “Manually Controlling the Fans or Blowers” on page 14.

Testing the Controller

Start the controller’s test sequence by pressing the SILENCE/TEST button while an alarm is not sounding. The temperature display shows the stored set points and the internal temperature of the controller. The controller also tests the digital LCD display, all the LEDs, and the alarm buzzer. For details, see “Reviewing Set Points” on page 15.

Specifications

For reference purposes, typical controller specifications are shown in Tables 7–11.

Table 7: Factory Set Points

Rated Average Transformer Temperature Rise [a]	Relay Set Points					
	Fans or Blowers		Alarm		Emergency Shutdown	
	ON	OFF	ON	OFF	Dry Type Transformers	Cast-Coil Transformers
80 °C	110 °C	100 °C	125 °C	123 °C	220 °C	185 °C
115 °C	145 °C	135 °C	160 °C	158 °C	220 °C	185 °C
150 °C	180 °C	170 °C	195 °C	193 °C	220 °C	—

[a] Based on NEMA and IEEE Standards of 30 °C average and 40 °C maximum ambient for any 24-hour period below 3,300 ft. (990 m) altitude.

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Thermocouples and the Temperature Display

Three Type K thermocouple sensors are factory-connected to TB4-1(+) and 2(-); TB4-3(+) and 4(-); and TB4-5(+) and 6(-). See Figure 2 on page 9.

NOTE: If replacement of a thermocouple is required, use only Type K thermocouples. Connect the YELLOW lead to a positive terminal (1, 3, or 5) and the RED lead to a negative terminal (2, 4, or 6).

The digital temperature displayed is always the total of ambient plus approximate hot-spot temperatures, not the average temperature rise. For example, a transformer is rated for a 150 °C average temperature rise when carrying the rated full load in a 20 °C ambient temperature. The thermocouple sensors are installed near the theoretical hot spot of the coils. NEMA and IEEE standards permit a 30 °C maximum differential between average and hot-spot temperatures.

Therefore, the digital display would indicate approximately 20 °C + 30 °C + 150 °C = 200 °C total. The alarm would operate at this point to warn that the transformer is approaching the maximum temperature limit of the insulation system.

Table 8: Performance Specifications

Performance Measurement		Specification		
Input Power		80–300 Vac, 50/60 Hz, < 10 W 48–220 Vdc, universal power supply, < 8 W		
Range		0–250 °C		
Display Resolution		1 °C increments		
Accuracy		±3 °C		
Memory Retention		40 years (with power OFF)		
Relay Ratings		**Volts**	**Resistive**	**Horsepower**
	Fans	120 Vac	30 A	1 Hp
		240 Vac	30 A	2 Hp
	Alarm and Trip	120 Vac	10 A	—
		240 Vac	8 A	—
Remote Output Current Loop		0–1 mA = into 10,000 Ω maximum load		
		0–10 mA = into 1,000 Ω maximum load		
		0–20 mA = into 500 Ω maximum load		
		4–20 mA = into 500 Ω maximum load		
		0–5 V		
Accuracy		±3 °C		

Table 9: Mechanical Specifications (Panel Mount Unit)

Mechanical Measurement	Specification
Front Panel	8 in. (203.2 mm) Wide x 11 in. (279.4 mm) High Graphic overlay is UV resistant for outdoor use.
Mounting Panel	Panel mount through 5.37 in. (136.4 mm) Wide x 7.97 in. (202.4 mm) High cutout.
Depth	2.22 in. (56.4 mm)
Weight	3 lbs. (1.4 kg)
Terminals	Screw terminal; maximum 12-gauge wire

Table 10: Approvals

Registered per UL standard 873.
Registered per Canadian standard C22.2 No. 24-93.
Declaration of Conformance CE.

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Table 11: Model 98A Register List

Modbus Register No.	Description	Comments
Read Registers		
40001	Temperature left phase	Normal temp range is 0–255d in low byte. A value of 8000h indicates invalid data.
40002	Temperature center phase	
40003	Temperature right phase	
40004	ETM status	bit 0 = **1** = some other bit is 1 bit 1 = **1** = ON, fan state bit 2 = **1** = ON, alarm state bit 3 = **1** = ON, trip state bit 4 = **1** = ON, buzzer state bit 5 = **1** = ON, manual fan state bit 6 = **1** = ON, auxiliary relay 1 bit 7 = **1** = ON, auxiliary relay 2
40005	Maximum stored temperature	Normal temperature range is 0–255d in low byte.
40006	Phase with maximum stored temperature	bit 0 is always a **1** bit 1 = **1** indicates maximum stored temp was left phase bit 2 = **1** indicates maximum stored temp was center phase bit 3 = **1** indicates maximum stored temp was right phase
40007	Temperature at unit's terminal block	The low byte indicates temperature at the instrument terminal block in °C. Temperatures below zero will show as zero.
40008	Diagnostic status	bit 0 = **1** = some other bit is 1 bit 1 = **1** = failed A/D converter bit 3 = **1** = failed terminal block temperature sensor bit 4 = **1** = failed EEROM bit 5 = **1** = failed display driver
40009	Phase status	bit 0 = **1** = some other bit is 1 bit 1 = **1** = left phase disabled bit 2 = **1** = center phase disabled bit 3 = **1** = right phase disabled bit 4 = **1** = left phase has failed sensor bit 5 = **1** = center phase has failed sensor bit 6 = **1** = right phase has failed sensor bit 7 = **1** = fan exerciser is disabled
40010	Fan setpoint	Setpoint and deadband are 8-bit data in the low order byte.
40011	Alarm setpoint	
40012	Trip setpoint	
40013	Fan deadband	
40014	Alarm deadband	
40015	Trip deadband	
40016	Fan exercise interval	1–720 hours (up to 30 days)
40017	Fan exercise run time	1–120 minutes
40018	Time since last ran exercise	1–720 hours (up to 30 days)
40019	Firmware version	
48188	Device I.D.	15060d (15060–15069 reserved for ETM)
Write Registers		
40050	Set manual fan function ON/OFF	0001 turns the fan ON. 0000 sets the fan to AUTO.
40051	Reset maximum stored temperature	0001 sets the maximum temperature stored to the current maximum temperature.
40052	Reset unit	0001 resets the unit.
40053	Buzzer control	0001 turns the buzzer ON. 0000 turns the buzzer OFF.

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Model 98A Digital Temperature Controller for Medium Voltage Transformers
Instruction Bulletin

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Instruction Bulletin

80043-055-12
05/2015

Retain for future use.

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SQUARE D™
by Schneider Electric

Hazard Categories and Special Symbols

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Section 1—Introduction

This manual contains instructions for the proper installation, operation, and maintenance of Power-Style™ QED-2 switchboard equipment manufactured by Schneider Electric. Engineering, installation, and operating staff supervisors should familiarize themselves with this manual and become acquainted with the appearance and characteristics of each piece of equipment mounted or contained in the switchboard.

These instructions and procedures apply to Power-Style QED-2 switchboard installations by Schneider Electric. When special features or non-standard components are incorporated in the switchboard, detailed instructions for these components are included in the instruction material holder.

NOTE: There are references to Series 2 switchboards in several places in this instruction bulletin. To determine if the QED-2 switchboard is a Series 2 model, check the rating nameplate located on the front cover. If the switchboard is a Series 2 model, the nameplate indicates that. If it is not a Series 2 model, there is not a Series designation.

Inspection and Packaging

Every Power-Style QED-2 switchboard is carefully inspected and packaged at the assembly plant. Construction of the switchboard is checked, both structurally and electrically, for compliance with all specifications, codes, and standards. After a complete inspection, the switchboard is prepared for shipment. Each section is shipped separately for easier handling before installation. The factory order number, an identification number, and the shipping weights are plainly marked on each shipping section.

Document Replacement

Contact your local Schneider Electric representative to replace lost or damaged wiring diagrams and instruction sheets. Use the factory order number as a reference.

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Section 2—Safety Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must be installed and serviced only by qualified personnel.
- Perform such work only after reading and understanding all of the instructions contained in this bulletin.
- Turn off all power supplying this equipment before working on or inside equipment.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume all circuits are live until they are de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm power is off.
- Practice lock-out/tag-out procedures according to OSHA requirements.
- Handle this equipment carefully and install, operate, and maintain it correctly in order for it to function properly. Neglecting fundamental installation and maintenance requirements may lead to personal injury, as well as damage to equipment or other property.
- Carefully inspect your work area and remove any tools and objects left inside the equipment.
- Replace all devices, doors, and covers before turning on power to this equipment.
- All instructions in this manual assume that the customer has taken these measures before performing maintenance or testing.

Failure to follow these instructions will result in death or serious injury.

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Section 3—Receiving, Handling, and Storing

Receiving

Upon receipt, check the packing list against the equipment received to ensure the order and shipment are complete. Also upon receipt, immediately inspect switchboard sections for any damage that occurred in transit. If damage is found or suspected, file a claim with the carrier immediately and notify the nearest Schneider Electric representative.

Handling

⚠ WARNING

SPECIAL HANDLING REQUIREMENTS

- Do not lay the equipment on its front or sides.
- Lay equipment only on its back when special handling is required.
- Do not ship the equipment lying down.

Failure to follow these instructions can result in serious injury or equipment damage.

Ensure that proper equipment, such as an overhead crane, is available at the installation site to handle the switchboard. This equipment helps avoid injury to personnel and damage to the switchboard.

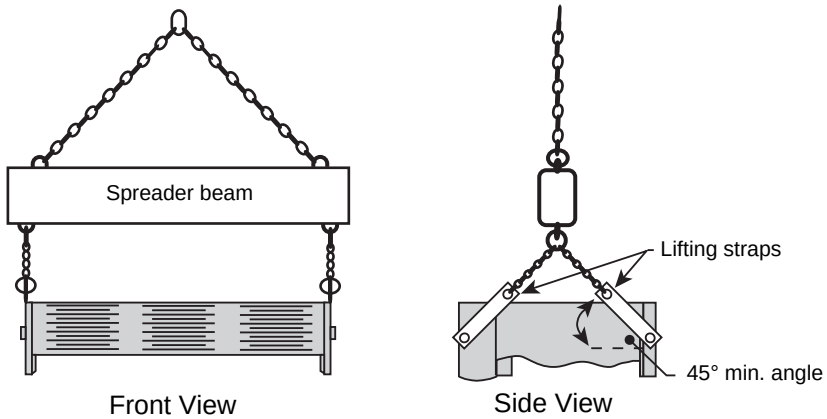
The shipping weight of each shipping section is marked on the packing list. Verify the lifting capacity of the equipment being used to handle the switchboard in accordance with the shipping weight of each shipping section. Keep the switchboard upright during handling.

Schneider Electric recommends using an overhead crane, lifting straps, and cables or chains to handle the switchboard. This method and alternative handling methods are discussed in this section.

Handling with Lifting Straps

Schneider Electric provides lifting straps as standard equipment for NEMA Type 1 switchboard shipping sections rated 3,000 A or less. Instruction labels on each shipping section include drawings and written instructions outlining the proper use of the lifting straps (Figure 1). Use rigid spreaders or a spanner bar to provide vertical lift on the lifting straps. This helps avoid damage to the frame or finish.

Figure 1 – Lifting with an Overhead Crane, Lifting Straps, and Cables or Chains



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Follow these instructions to handle the switchboard:

1. Use load-rated cables or chains with safety hooks or shackles. Do not pass cables or chains through holes in lifting straps.
2. Use a load-rated spreader beam to prevent structure damage. Rig so that the minimum angle between the lifting cables or chains and equipment top is 45 degrees.

Follow these instructions for laying equipment on its back:

1. Remove shipping skid and equipment back covers.
2. Use overhead cranes, lifting straps, and cables or chains for laying equipment on its back.
3. Rate of drop or pickup for laying equipment on its back is four feet per minute or less.
4. Reverse the procedure to stand the equipment in its upright position.
5. Reinstall back covers.

The warning label (Figure 2) is attached to both the front and rear of the switchboard.

Figure 2 – Warning Label, Rainproof Switchboards

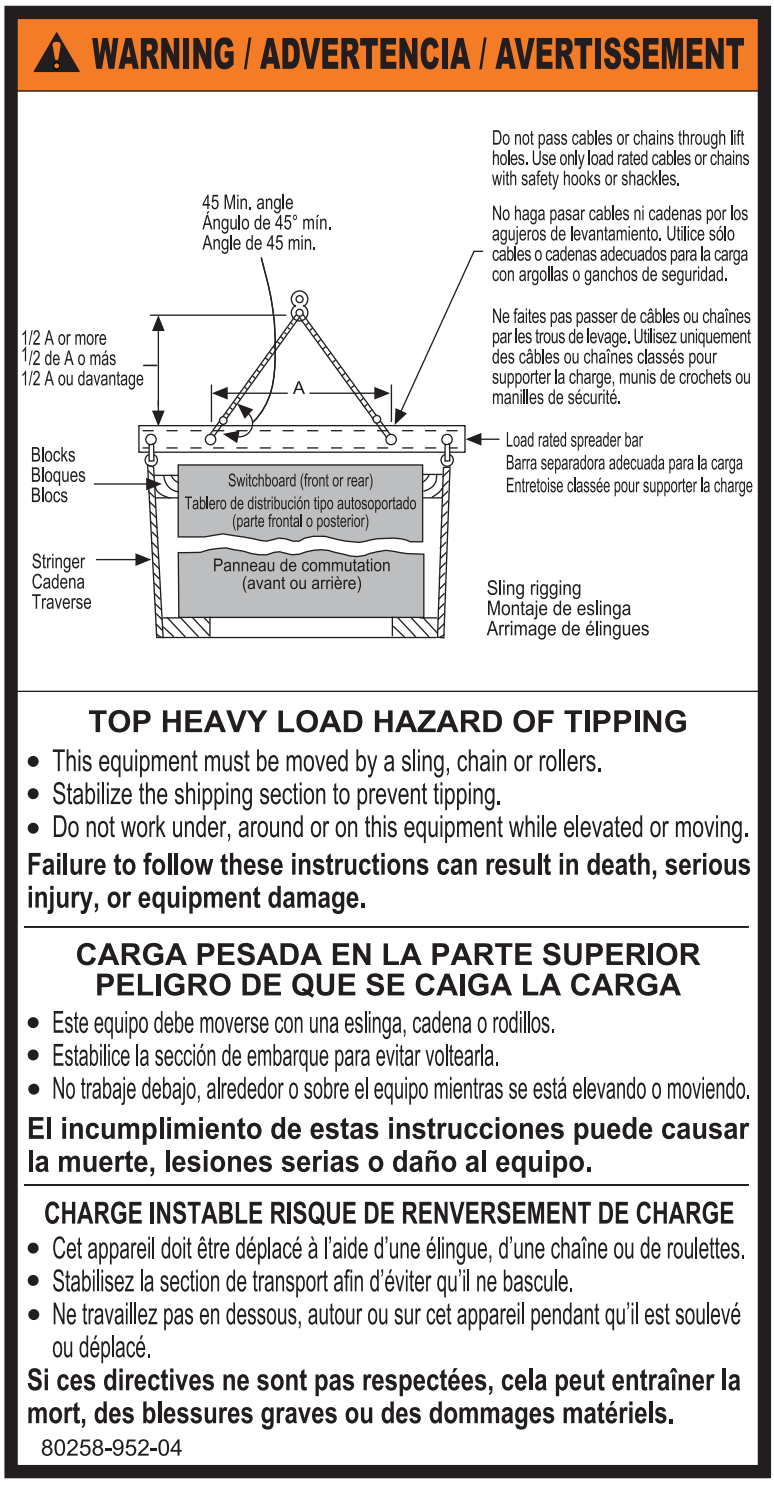


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Handling without Lifting Straps

Lifting straps are not furnished on shipping sections rated more than 3,000 A, or on rainproof switchboards. Use rollers, slings, or other means to handle the shipping sections. The handling label (Figure 3) is affixed to each of these sections.

Figure 3 – Handling Instruction Label, Switchboards without Lifting Straps



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⚠ WARNING

TOP HEAVY LOAD—HAZARD OF TIPPING

- Stabilize the shipping section to reduce the possibility of tipping.
- Consult with a certified rigging and lifting expert for any situation not covered in these instructions.

Failure to follow these instructions can result in death or serious injury.

When elevating a shipping section not equipped with lifting straps, use an overhead crane equipped with either of the following:

- A chain coupled to a sling rigging
- A wire cable with safety hooks and shackles

Wrap the sling completely around the switchboard and shipping stringers.

NOTE: A forklift is an alternative method of handling the switchboard. Always check the fork lengths to ensure that the forks extend under the entire switchboard. Carefully balance the load, and always use a safety strap when handling or moving a switchboard with a forklift (Figure 4 on page 15).

Storing

When storing the switchboard before installation, cover the top and openings of the equipment during the construction period to protect the switchboard from dust and debris.

If a switchboard is not installed and energized immediately, store it in a clean, dry space with a consistent temperature to prevent condensation. Store the switchboard indoors, if possible. Preferably, store it in a heated building with adequate air circulation and protect it from dirt, fumes, water, and physical damage. Storing the switchboard outdoors can cause harmful condensation inside the switchboard.

NOTE: Install portable electric heaters of approximately 250 watts per vertical section in both indoor-type and rainproof-type switchboard enclosures for adequate protection during storage.

Before energizing the space heaters, remove all loose packing or flammable materials inside the switchboard. Outdoor switchboards are not weather-resistant until completely and properly installed; treat them the same as indoor switchboards until after installation.

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Figure 4 – Forklift Safety Label

⚠ WARNING

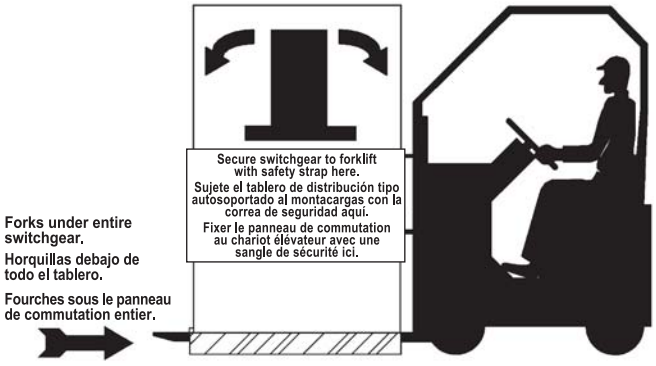
HAZARD OF EQUIPMENT DAMAGE
• Secure to forklift with safety strap.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

⚠ ADVERTENCIA

PELIGRO DE DAÑO AL EQUIPO
• Sujete al montacargas con la correa de seguridad.
El incumplimiento de estas instrucciones puede causar la muerte, lesiones serias o daño al equipo.

⚠ AVERTISSEMENT

RISQUE DE BLESSURES OU DE DOMMAGES MATÉRIELS
• Fixer au chariot élévateur avec une sangle de sécurité.
Si ces directives ne sont pas respectées, cela peut entrainer la mort ou des blessures graves ou des dommages matériels.



Remove label after installation.
Retire la etiqueta después de la instalación.
Enlever l'étiquette après l'installation.

Special Handling Requirements

Do not lay the equipment on its front or sides. Doing so will damage unit.
Lay equipment only on its back when special handling is required.
See Instruction Bulletin for special handling instructions for laying equipment on its back.
Equipment is NOT to be shipped lying down.
Failure to follow these instructions can result in death, serious injury or equipment damage.

Requisitos especiales de manejo

No coloque el equipo sobre su frente o lados ya que podría dañarse la unidad.
Coloque el equipo sobre su parte posterior solamente cuando sea necesario manejarlo de manera especial.
Consulte el boletín para obtener las instrucciones especiales de manejo para colocar el equipo sobre su parte posterior.
El equipo NO deberá transportarse acostado.
El incumplimiento de estas instrucciónes puede causar la muerte, lesiones serias o daño al equipo.

Exigences de manutention spéciales

Ne couchez pas l'appareil sur sa face avant ou sur las côtés. Faire ainsi l'endommagerait.
Couchez l'appareil sur le dos uniquement lorsqu'une manutention spéciale est nécessaire.
Consultez les directives d'utilisation pour les instructions de manutention spéciales pour coucher l'appareil sur le dos.
N'expédiez PAS l'appareil sur son dos.
Si ces directives ne sont pas respectées, cela peut entrainer la mort ou des blessures graves ou des dommages matériels.

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Section 4—Installation

Correct installation of Power-Style QED-2 switchboards is essential for proper operation of all switchboard components. Study the associated instruction books and all drawings carefully. In most cases, all drawings are sent to the purchaser before a switchboard is shipped to enable adequate planning.

NOTE: The top of the switchboard will not support the weight of the installer.

Location

Find the designated area on the building floor plan where the switchboard will be installed. The location chosen for installation should provide working clearances complying with Section 110-26 of the National Electrical Code® (NEC®) or Section 2-308 of the Canadian Electrical Code (CEC) Part 1.

- Front-accessible switchboards require field connections, including mains, branches, ground bus, and neutral bus, to be accessible and maintainable from the front.
- For switchboards having rear ventilation, allow a minimum 1/2-in. (13 mm) clearance between the rear of the switchboard and the wall for proper ventilation. Equipment drawings identify switchboards requiring rear or side access.
- Switchboards that require rear access for installation, field connections, or maintenance (such as filter replacement), require 30 in. (762 mm) of working space per NEC 110-26.
- If the switchboard is in a wet location or outside of the building, enclose it in an outdoor enclosure or equipment to prevent moisture or water from entering and accumulating within the enclosure. Outdoor-rated switchboards drain to the rear, so there must be at least a 1/2-in. (13 mm) clearance between the rear of the switchboard and a wall or other obstruction for proper drainage.

Foundation Preparation

The floor or foundation must be strong enough to support the weight of the switchboard without sagging. The surrounding floor area should gently slope toward a drain.

NOTE: For seismic qualifications, read the section “Anchoring for Seismic Qualifications” on page 20 before pouring the floor or foundation.

Power-Style QED-2 switchboards are assembled on true and level floors at the assembly plant. To ensure correct bus bar alignment, the mounting pad or final installation site must be smooth and level. If parallel steel floor channels are imbedded for mounting the switchboard, take extra care to ensure the floor channels are level over their entire length to avoid distortion of the switchboard structure. Each channel should be level with the finished floor.

When pouring the foundation, make provisions for conduits entering the switchboard from below and carrying the incoming and/or outgoing cables, control wiring, and ground cable. The bottom view in the equipment drawing shows the available conduit area for correct layout.

Conduits should project above the finished floor by about 2 in. (51 mm). However, to simplify moving the shipping sections into place, install the conduits flush with the concrete and, after the sections are in their final position, add the appropriate extension sleeves. Otherwise, raising the shipping section on timbers or lifting it by a crane to

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clear the conduit hubs will be necessary. Before pouring the foundation, consider installing additional conduits for future circuits.

Switchboard Preparation

Remove dirt and debris from the foundation and surrounding area before moving the switchboard into final position.

After the switchboard has been moved to its final installation site, take each shipping section off its shipping stringers. For switchboards greater than 24 in. (610 mm) deep, the center base channel can be removed.

Remove all packing materials. If the switchboard is equipped with a bottom closure plate in each vertical section, remove and retain the plates for reuse. When bottom closure plates are furnished, the customer must make any holes necessary for conduit entering the bottom of the switchboard. After making the holes, reinstall the closure plate.

General Installation

NOTICE

HAZARD OF EQUIPMENT DAMAGE

Level and align adjacent shipping sections with one another. Ensure proper alignment of horizontal main through bus and proper splice bus connections.

Failure to follow these instructions can result in equipment damage.

Install the switchboard into its final position by leveling progressively each section and bolting the frames together, if separated. Position shipping sections as follows:

1. Maneuver each shipping section into the desired position using the procedures under “Handling” on page 11.
2. Carefully lower the section over the conduit stubs to comply with the “available conduit area” as shown in the bottom view of the equipment drawings. Otherwise, there might not be sufficient cable bending space.
3. Level the shipping section.
4. After installation of each section is complete, make the through bus splice connection to the preceding section before installing the next section.

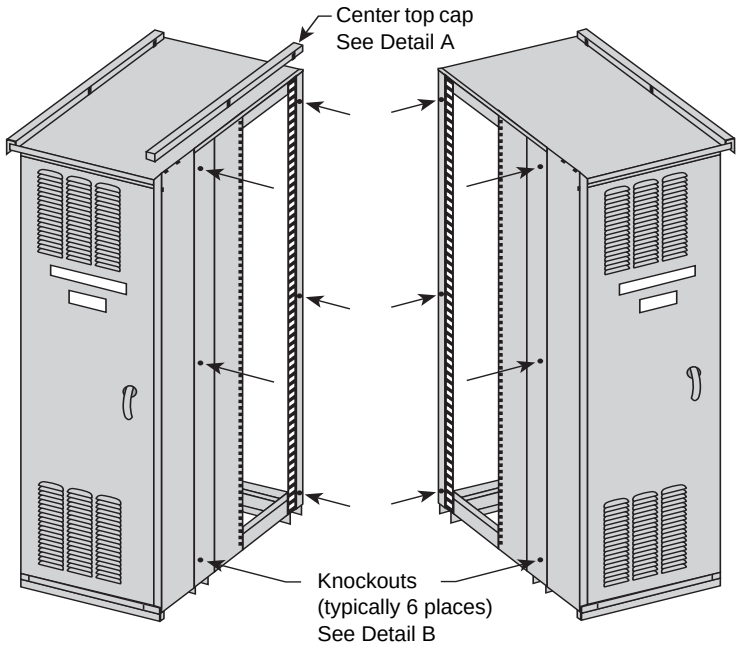
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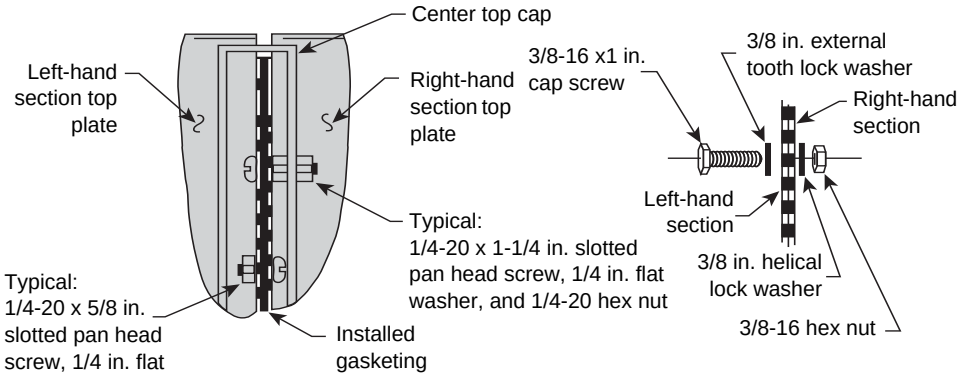
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Joining Shipping Sections—Outdoor Switchboards

1. Remove the center top cap (Figure 5) from the left-hand section, and retain all hardware for reuse.

Figure 5 – Joining Adjacent Sections—Outdoor Switchboards





Detail A **Detail B**

2. When possible, open or remove the front and rear doors and panels, providing access to bolt adjacent shipping sections together.
3. Remove three 0.5-in. (13 mm) diameter knockouts from the front vertical corner channel and three from the rear vertical corner channel (a total of six per frame side) as indicated by the arrows in Figure 5.
4. Position each adjacent section, carefully leveling it and aligning it with the previous section. If lifting straps are provided, completely remove them from

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the sides being bolted together so the sections can be joined flush. The only gasket required between sections is provided on the roof flange.

NOTE: If lifting strap removal is not required to join sections, leave the lifting strap on the switchboard. Verify that the bolt is tight to maintain NEMA Type 3R integrity.

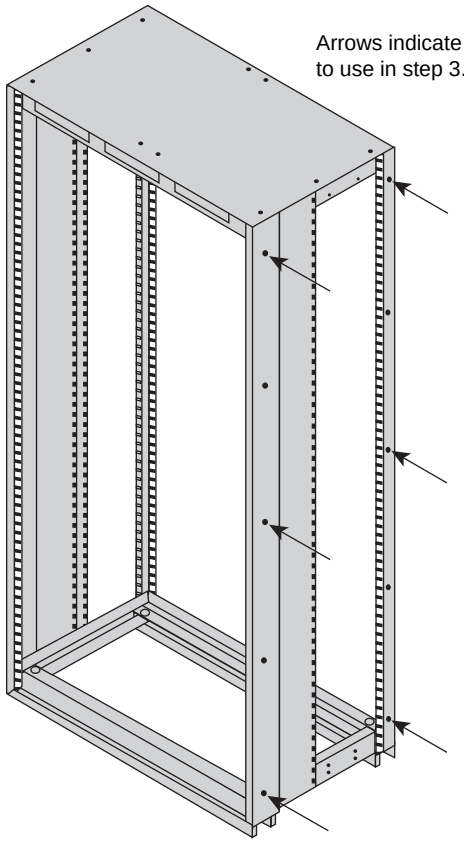
5. Six bolts (3/8-16 x 1 in.) are provided. Place them through the holes created in step 3 to join adjacent sections.
6. Make the through bus splice connections to the preceding section.
7. Replace the center top cap removed in step 1.
8. Replace and secure the front and rear doors and panels removed in step 2.

Joining Shipping Sections—Indoor Switchboards

1. Position each adjacent section, carefully leveling and aligning it with the previous section. If lifting straps are provided, completely remove them from the sides being bolted together so the sections can be joined flush.

   NOTE: Leave the other lifting straps on the switchboard if their removal is not required to join adjacent sections flush.

   Figure 6 – Indoor Switchboards



2. Open or remove the front and rear doors and panels, providing access to bolt adjacent shipping sections together.
3. Six bolts (3/8-16 x 1 in.) are provided. Place the bolts through the existing holes in the front and rear vertical corner channels to join adjacent sections (Figure 6).
4. Make the through bus splice connections to the preceding section.
5. Replace and secure all front and rear doors and panels removed in step 2.

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Anchoring for Seismic Qualifications

QED-2 equipment that is seismically certified has been qualified to the site-specific seismic requirements of the listed model building codes and/or standards. Optional construction features may be required, depending on the location of the installation and the particular code and/or standard of interest. Seismic certificates of compliance are provided with all seismically certified QED-2 equipment. To maintain the validity of this certification, the installation instructions provided in this bulletin must be followed.

Responsibility for Mitigation of Seismic Damage

For the purposes of the model building codes, QED-2 equipment are considered nonstructural building components. Equipment capacity was determined from triaxial seismic shake table test results as defined in the International Code Counsel Evaluation Service (ICCES) Acceptance Criteria for Seismic Qualification Testing of Nonstructural Components (AC156). Unless otherwise indicated, an equipment importance factor of 1.5 (Ip = 1.5) was used, indicating that equipment functionality was verified before and after shaker table seismic simulation testing. This importance factor is indicative of critical facilities where maximizing the probability of post event functionality is a priority. The Building Seismic Safety Council (BSSC) recognizes AC 156 as an appropriate methodology in the 2003 National Earthquake Hazard Reduction Program (NEHRP) Commentary (FEMA 450 Part 2). The National Institute of Building Sciences established the BSSC in 1979 to develop and promote regulatory provisions for earthquake risk mitigation at the national level.

Incoming and outgoing cable and conduit must also be considered as related but independent systems. They must be designed and restrained to withstand the forces generated by the seismic event without increasing the load transferred to the equipment. For applications where seismic hazard exists, bottom entry and/or exit of cable and conduit is preferred. This system must be able to transfer the loads created by a seismic event to the load-bearing path of the building structural system.

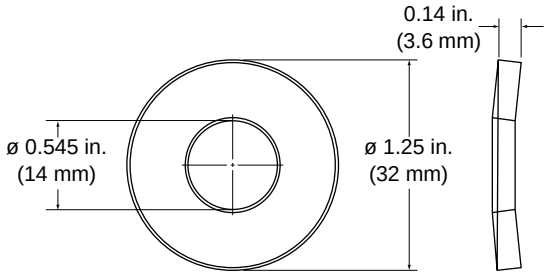
Maintaining Seismic Certification

Seismic qualification of nonstructural components by Schneider Electric is just one link in the total chain of responsibility required to maximize the probability that the equipment will be intact and functional after a seismic event. During a seismic event, the equipment must be able to transfer the loads that are created through the mounting pad and anchorage to the load-bearing path of the building structural system. The structural civil engineer or design engineer of record is responsible for detailing the equipment connection and anchorage requirements for the given installation. The installer and manufacturers of the anchorage restraint system are responsible for assuring that the mounting requirements are met. Schneider Electric is not responsible for the specification and performance of these systems.

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Anchoring QED-2 Equipment for Seismic Applications

Figure 7 – Belleville Washer



Formed base channels run the width of the section. The channels and connecting braces provide a minimum 0.75-in. (19 mm) diameter hole for fastening the section to the floor. To anchor the QED-2 switchboard to the floor properly, use all four mounting locations for NEMA Type 1 enclosures less than 36 in. deep, all six mounting locations for 36–70 in. deep enclosures, and six of the eight mounting locations for enclosures greater than 70-in. deep (see Figure 8 on page 23).

Use 0.5 in. (13 mm) diameter anchor bolts (Grade 5 minimum, provided by others) for the installation of equipment. Use one 1.25 in. (32 mm) outer diameter Grade 5 Belleville washer (provided by others; see Figure 7) under the head of each bolt or anchor nut. To develop the full strength of the anchor, torque the hardware to the value specified by the anchor manufacturer, or as recommended in the seismic restraint detailing supplied by the Structural Civil Engineer of record for the project (see Figure 9 on page 24).

Additionally, each NEMA Type 1 enclosed section includes four top-located hard points for attaching two upper lateral braces (braces and hardware supplied by others) to the QED-2 structure for top structural restraint (see Figures 10 and 11 on page 25).

Top structural restraint is required for all QED-2 equipment installed:

- where the site-specific 0.2 second spectral ground motion exceeds 2.67 g (as determined from the code-referenced ground motion maps or the site-specific seismic hazard engineering study), or
- when displacement at the top of the equipment cannot be tolerated, or
- for all QED-2 corner sections used for seismic applications.

To develop the full strength of the upper structural anchor, install and torque the hardware as specified by the anchor manufacturer or the seismic restraint detailing supplied by the Structural Civil Engineer of record for the project.

NOTE: Anchoring hardware is not furnished with the QED-2 equipment.

After the QED-2 switchboard and adjacent equipment are properly joined and the entire structure is bolted to the floor, install the incoming service conductors and load side cables. During an earthquake, the top of the QED-2 switchboard can move in any direction. Any top incoming cables must accommodate this motion. Do not use the QED-2 enclosure (particularly the top) to mount exterior equipment.

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Base Anchoring

1. To anchor the switchboard to the floor properly, use all of the designated 0.75 in. (19 mm) diameter mounting hole locations as illustrated in Figure 8 on page 23. The enclosure dimensions corresponding to Figure 8 are listed in Table 1.

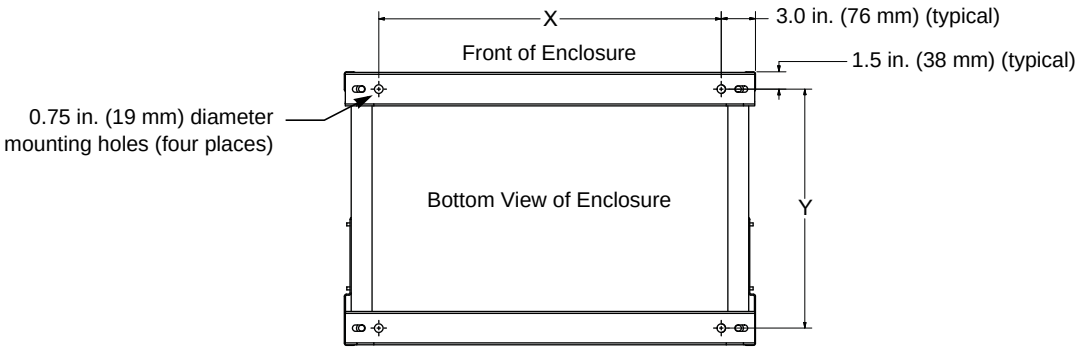
Table 1 – Enclosure X,Y, Z Dimensions in Inches (mm)

Enclosure Width → / Enclosure Depth ↓	12 in. (305 mm)	24 in. (610 mm)	30 in. (762 mm)	36 in. (914 mm)	42 in. (1067 mm)	48 in. (1219 mm)	54 in. (1372 mm)
24 in. (610 mm)	X = 6 (152) Y = 21 (533)	X = 18 (457) Y = 21 (533)	X = 24 (610) Y = 21 (533)	X = 30 (762) Y = 21 (533)	X = 36 (914) Y = 21 (533)	X = 42 (1067) Y = 21 (533)	X = 48 (1219) Y = 21 (533)
36 in. (914 mm)	X = 6 (152) Z = 16.5 (419) Y = 33 (838)	X = 18 (457) Z = 16.5 (419) Y = 33 (838)	X = 24 (610) Z = 16.5 (419) Y = 33 (838)	X = 30 (762) Z = 16.5 (419) Y = 33 (838)	X = 36 (914) Z = 16.5 (419) Y = 33 (838)	X = 42 (1067) Z = 16.5 (419) Y = 33 (838)	X = 48 (1219) Z = 16.5 (419) Y = 33 (838)
48 in. (1219 mm)	X = 6 (152) Z = 22.5 (572) Y = 45 (1143)	X = 18 (457) Z = 22.5 (572) Y = 45 (1143)	X = 24 (610) Z = 22.5 (572) Y = 45 (1143)	X = 30 (762) Z = 22.5 (572) Y = 45 (1143)	X = 36 (914) Z = 22.5 (572) Y = 45 (1143)	X = 42 (1067) Z = 22.5 (572) Y = 45 (1143)	X = 48 (1219) Z = 22.5 (572) Y = 45 (1143)
54 in. (1372 mm)	X = 6 (152) Z = 25.5 (648) Y = 51 (1295)	X = 18 (457) Z = 25.5 (648) Y = 51 (1295)	X = 24 (610) Z = 25.5 (648) Y = 51 (1295)	X = 30 (762) Z = 25.5 (648) Y = 51 (1295)	X = 36 (914) Z = 25.5 (648) Y = 51 (1295)	X = 42 (1067) Z = 25.5 (648) Y = 51 (1295)	X = 48 (1219) Z = 25.5 (648) Y = 51 (1295)
60 in. (1524 mm)	X = 6 (152) Z = 28.5 (724) Y = 57 (1448)	X = 18 (457) Z = 28.5 (724) Y = 57 (1448)	X = 24 (610) Z = 28.5 (724) Y = 57 (1448)	X = 30 (762) Z = 28.5 (724) Y = 57 (1448)	X = 36 (914) Z = 28.5 (724) Y = 57 (1448)	X = 42 (1067) Z = 28.5 (724) Y = 57 (1448)	X = 48 (1219) Z = 28.5 (724) Y = 57 (1448)
72 in. (1829 mm)	X = 6 (152) Z_1 = 28.5 Z_2 = 40.5 (1029) Y = 69 (1753)	X = 18 (457) Z_1 = 28.5 (724) Z_2 = 40.5 (1029) Y = 69 (1753)	X = 24 (610) Z_1 = 28.5 (724) Z_2 = 40.5 (1029) Y = 69 (1753)	X = 30 (762) Z_1 = 28.5 (724) Z_2 = 40.5 (1029) Y = 69 (1753)	X = 36 (914) Z_1 = 28.5 (724) Z_2 = 40.5 (1029) Y = 69 (1753)	X = 42 (1067) Z_1 = 28.5 (724) Z_2 = 40.5 (1029) Y = 69 (1753)	X = 48 (1219) Z_1 = 28.5 (724) Z_2 = 40.5 (1029) Y = 69 (1753)

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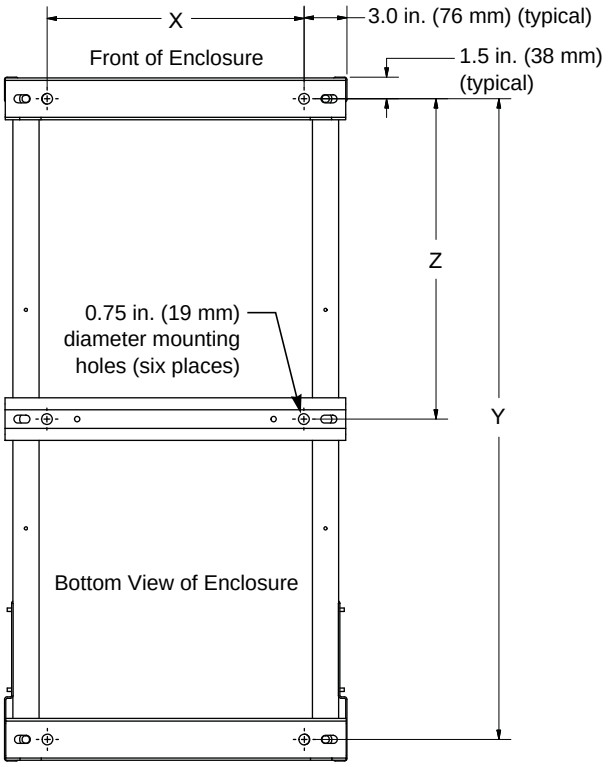
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Figure 8 – Base Channel Floor Anchor Bolt Locations

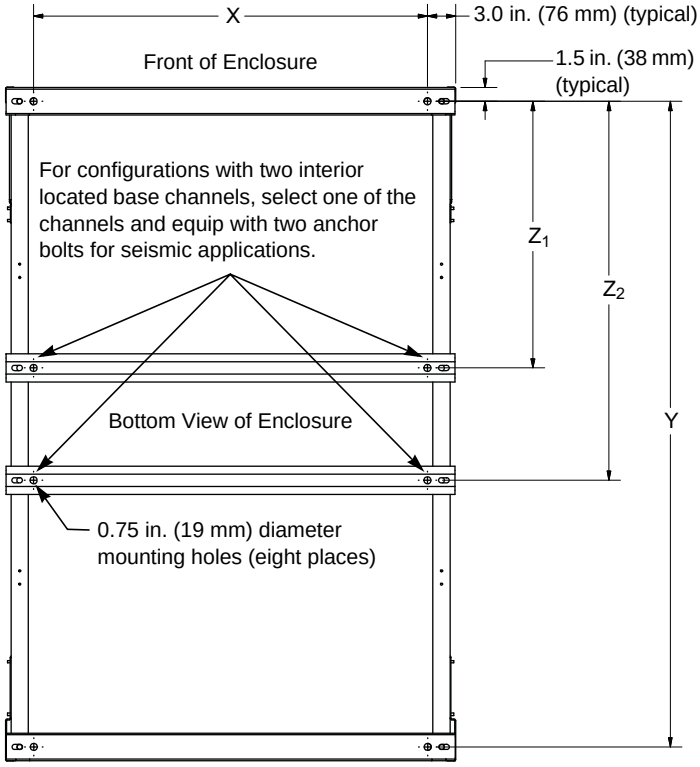


Enclosures < 36 in. Deep

NOTE: See Table 1 on page 22 for X, Y, Z dimensional values.



Enclosures 36–70 in. Deep

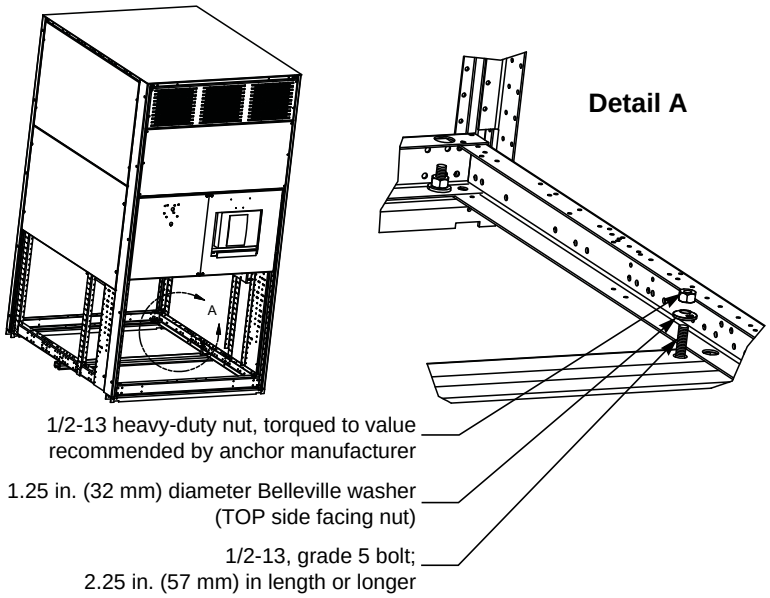


Enclosures > 70 in. Deep

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2. Depending on the frame size (see Figure 8 on page 23), use either four or six 1/2-13 Grade 5 bolts in the locations shown in Figure 9.

Figure 9 – Base Channel Mounting Hardware



NOTE: Base channel mounting hardware detail shown for reference purposes only. Anchoring hardware is not furnished with the switchboard. Covers and internal hardware shown removed for illustration purposes.

3. Once the switchboard is in place, secure the base channels to each bolt using a 1.25 in. (32 mm) diameter Belleville washer between a 1/2-13 hardened nut and the switchboard frame as illustrated in Figure 9.

   NOTE: The “TOP” side of the Belleville washer must be facing the nut.

4. Torque each nut to the value recommended by the anchor manufacturer to develop the full strength of the anchor.

Top Anchoring/Restraint

For installation at locations with an Ss greater than 2.67 g (as determined from the current version of the International Building Code), or where displacement cannot be tolerated at the top of the switchboard during a seismic event, use top restraints attached to the equipment hard points.

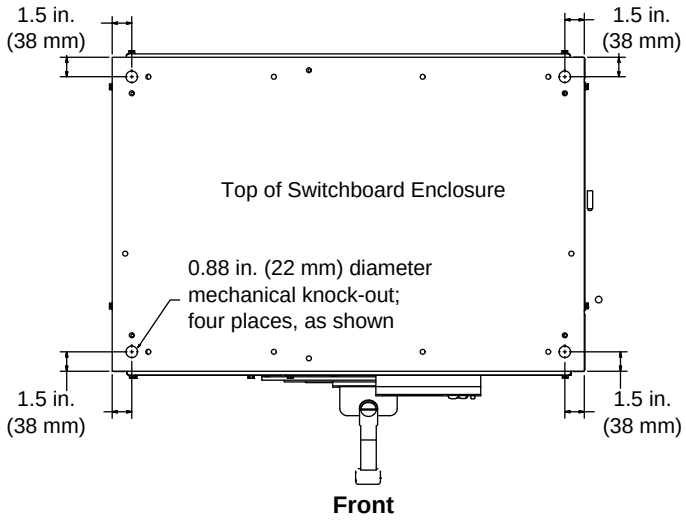
NOTE: Anchoring hardware is not furnished with the switchboard.

1. The four 0.88-in. (22 mm) diameter mechanical knock-outs shown in Figure 10 on page 25 serve as hard points for application of a top restraint system.

   NOTE: By code, it is the responsibility of the Building Design Professional to determine the top restraint methodology for the intended building application.

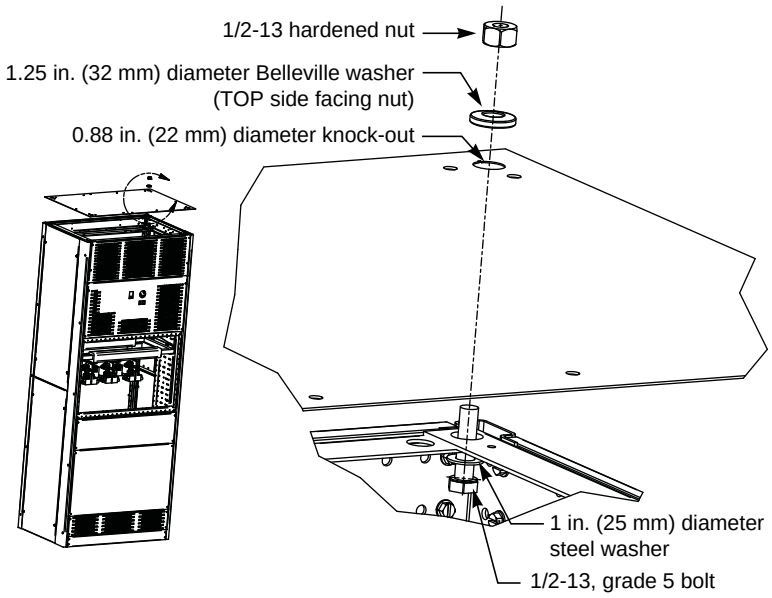
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Figure 10 – Top Anchor Hard-Point Locations



2. Detach the top plate from the main switchboard enclosure. Retain the screws.
3. Remove the four 0.88 in. (22 mm) diameter mechanical knock-outs as directed by the Building Design Professional.
4. With the knock-outs removed, reattach and re-secure the top plate to the enclosure using the screws removed in Step 2.
5. Attach the top restraint system using a 1/2-13, Grade 5 bolt, a 1 in. (25 mm) diameter steel washer, a 1.25 in. (32 mm) diameter Belleville washer, and a hardened 1/2-13 nut as shown in Figure 11.

Figure 11 – Top Anchor Mounting Hardware



6. After all switchboard sections are properly joined and the entire structure is properly anchored, install the incoming service conductors and load side cables.
7. Do not use the switchboard enclosure (particularly the top) to mount exterior equipment, except for conduit.

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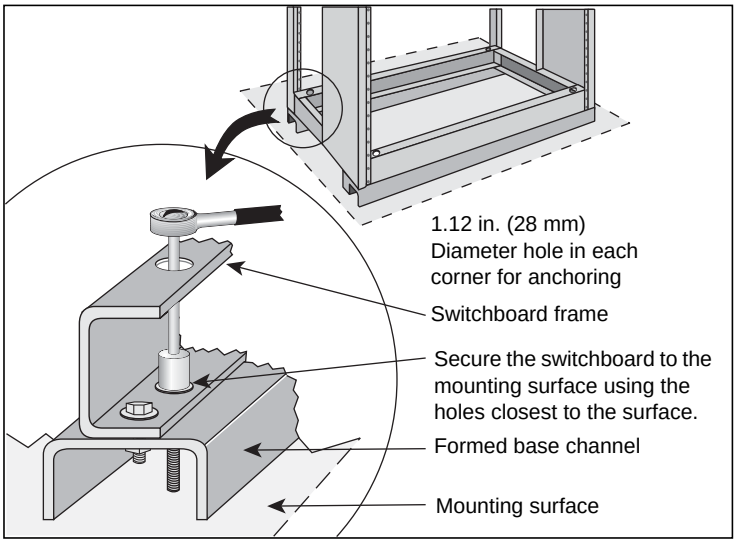
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Anchoring the Switchboard

Although sections are freestanding, a hard bump or shifting movement can result in damage to the splice joints between sections and conduit hubs connected to the sections. Therefore, each vertical section must be anchored to the floor.

Formed base channels run the width of the shipping section. The channels have 1.12-in. (28 mm) diameter holes for fastening the section to the floor (Figure 12). Anchor each section to the floor with 1/2-in. (Grade 2 minimum) bolts with flat washers and anchors suitable for installation of electrical equipment (not furnished).

Figure 12 – Switchboard Base Channels



After all switchboard sections are properly joined and the entire structure is bolted to the floor, install the incoming service conductors and load side cables.

NOTE: If the switchboard consists of only one shipping section, proceed to “Grounding and Bonding” on page 28.

Through Bus Splice Connections

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Do not install through bus splice connectors with the switchboard energized.

Failure to follow these instructions will result in death or serious injury.

Through bus splice connectors and/or hardware, along with installation instructions, are provided with each shipping split. Follow the installation instructions, and torque splice bolts to the value given in “Section 9—Torque Values for Electrical Connections” on page 53.

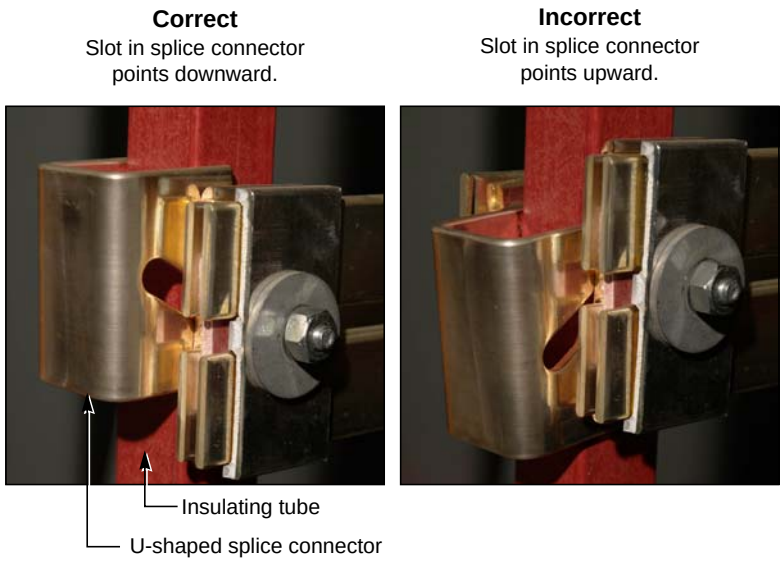
If through bus bars are wrapped with an insulative material, cover the splice connections with the material provided.

For splice connections with bus on the front and rear of an insulating tube, ensure the U-shaped, copper connector is centered around the tube. Figure 13 on page 27 shows the proper orientation of the connector.

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NOTE: The U-shaped connector will fit snugly against the insulating tube when installed correctly. It is pulled away from the insulating tube in Figure 13 to show the orientation of the connector slot.

Figure 13 – Proper Orientation of U-shaped Splice Connector



Ground Bus Splice Connections

Align and secure the ground bus splice connection between shipping sections. Torque connections to 100 lb-in (11 N•m) (Figure 14 or 15).

NOTE: Proper installation is essential for equipment ground-fault systems.

Figure 14 – Ground Bus Splice Connection

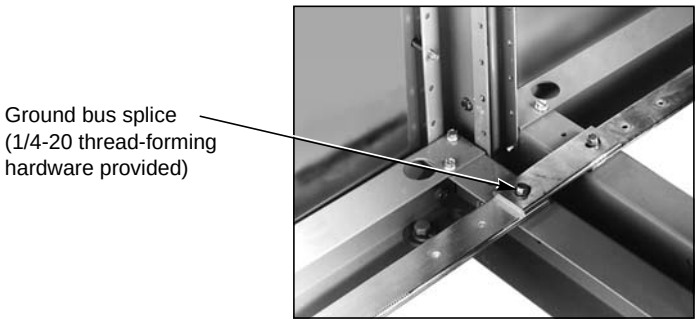


Figure 15 – Series 2 Ground Bus Splice Connection



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Grounding and Bonding

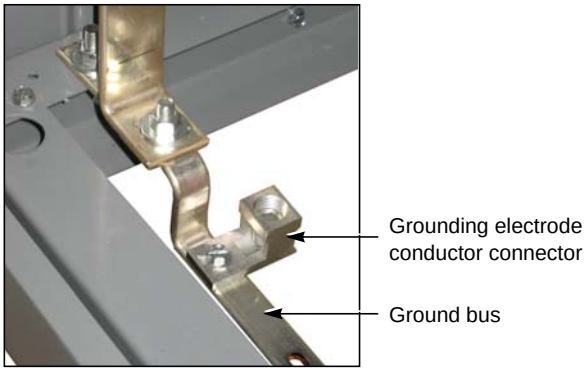
NOTE: A system is “grounded” if it is grounded at any point ahead of the switchboard, whether the grounded conductor (neutral) is carried through to the loads, or not.

Service Equipment—Grounded System

For solidly *grounded* systems used as either service equipment or as a main switchboard on a separately derived system:

1. Run a grounding electrode conductor from the grounding electrode at the installation site to the grounding electrode conductor connector (ground lug) located on the switchboard ground bus (or on the neutral bus, if so indicated on the equipment drawing) (Figure 16). Select the material and size of this grounding electrode conductor to comply with Sections 250-62 and 250-66 of the NEC or Sections 10-204 and 10-206 of the 1998 CEC, and install it as specified in Section 250-64 of the NEC or Section 10-908 of the 1998 CEC.

Figure 16 – Grounding Electrode Connector



2. Install the main bonding jumper between the neutral bus and the ground bus (Figure 17 or 18 on 29). For torque values, refer to “Section 9—Torque Values for Electrical Connections” on page 53.

   NOTE: If the switchboard is fed from multiple sources (for example, double-ended systems), there may be two or more main bonding jumpers to install.

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Figure 17 – Main Bonding Jumper

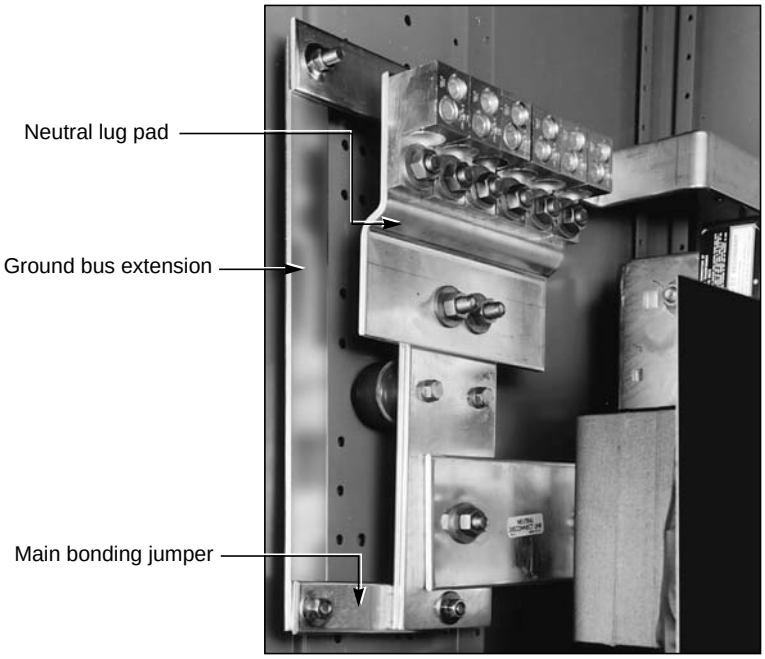
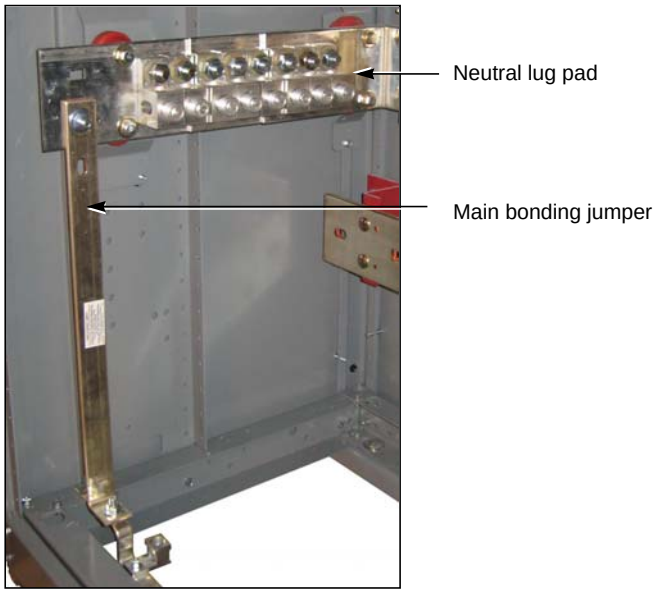


Figure 18 – Series 2 Main Bonding Jumper



In Canada, a main bonding jumper bus or cable is provided between the neutral bus and ground bus. When the bonding jumper must be disconnected (for example, for a Megger® test), remove the main bonding jumper bus or cable lug with cable from the neutral bus. This is normally located near the line neutral lugs. Secure the main bonding jumper bus or cable and lug to maintain the required distance from phases and neutral.

NOTE: If the switchboard is fed from multiple sources (for example, a double-ended system like a main-tie-main), there may be two or more main bonding jumpers installed.

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Service Equipment—Ungrounded System

For *ungrounded* systems used as either service equipment, or as a main switchboard on a separately derived system:

1. Run a grounding electrode conductor from the grounding electrode at the installation site to the grounding electrode conductor connector (ground lug) located on the switchboard ground bus (Figure 16 on page 28).
2. Select the material and size of this grounding electrode conductor to comply with Sections 250-62 and 250-66 of the NEC or Sections 10-700 and 10-702 of the 1998 CEC, and install it as specified in Section 250-64 of the NEC or Section 10-204 of the 1998 CEC.

Not Service Equipment

For either *grounded or ungrounded* systems, when a switchboard is not used as service equipment nor as a main switchboard on a separately derived system:

Use equipment grounding conductors sized according to Section 250-122 of the NEC or Section 10-206 of the 1998 CEC to connect the switchboard frame and ground bus to the service ground.

High-Impedance Grounded Neutral Systems

For high-impedance grounded neutral systems:

Ground the system following the instructions provided with the system grounding equipment and in compliance with Section 250-36 of the NEC. Confirm that the switchboard frame and ground bus are bonded in accordance with Section 250-102 of the NEC.

Busway Connections

Schneider Electric switchboards are manufactured with two different styles of busway connections. Qwik Flange™ is used on indoor switchboards only.

The other type of busway connection is the “dummy” flanged end. This type is used on some indoor switchboards, but primarily on outdoor units. The dummy flanged end must be removed to allow actual busway flanged end installation. Either the dummy or actual busway flanged end must be in place before energizing the switchboard.

NOTE: Do not use the switchboard to support the weight of the busway connection. Support busway independently. When busway is installed, make sure no areas of the roof are bowed downward. This will help prevent pooling of water.

Busway Connection—NEMA Type 1 (Indoor) Only (Qwik Flange™)

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Turn off all power supplying the switchboard and busway before installing connections.

Failure to follow these instructions will result in death or serious injury

Follow the instructions in this section to make Qwik Flange busway connections (see Figures 19 and 20 on page 31):

1. Remove any protective covering from the opening in the switchboard.
2. Slip the busway joint into the switchboard connectors.
3. Check the joint bolt alignment; the center line (C/L) of the joint bolt to the switchboard surface should be 0.95 in. (24 mm) (Figure 19 on page 31).
4. Attach the side closing plates using two 5/16-in. bolts (provided). When installed properly, the holes in the side closing plates align with the holes in both the switchboard and busway.

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Figure 19 – Qwik Flange Installation

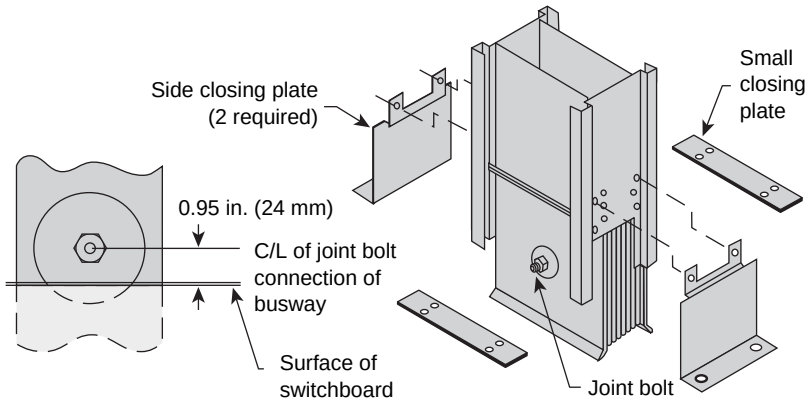
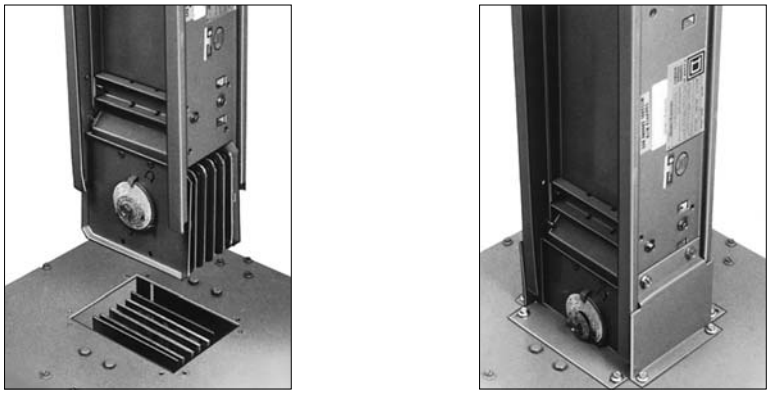


Figure 20 – Qwik Flange



5. Use an 18-in. (457 mm) or longer wrench to torque the joint bolt until the outer break-away head twists off. Do not allow the break-away bolt head or red warning disc to drop into the switchboard.
6. Slip the remaining two small closing plates into position by aligning with the holes in the switchboard. Use the four 1/4-20 screws provided to secure the equipment.
7. Confirm proper phasing of the installed busway before energizing.

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Busway Connections—NEMA Type 1 (Non-Qwik Flange) and NEMA Type 3R

If this style of connection for busway is furnished, the busway "dummy" flanged end must be removed before installing busway (Figure 21 on page 32).

⚠ DANGER

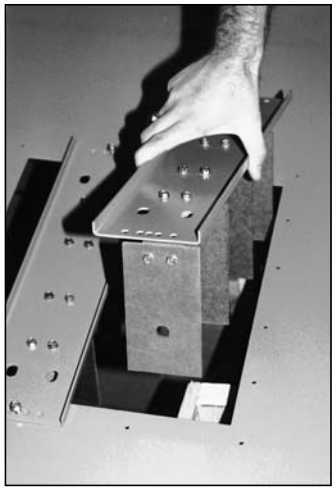
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Turn off all power supplying the switchboard and busway before installing connections.

Failure to follow these instructions will result in death or serious injury.

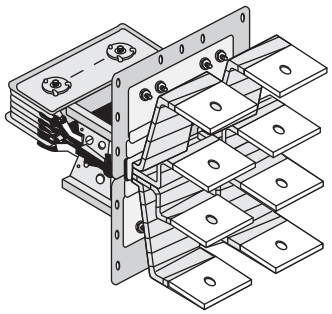
1. From inside the switchboard, remove the 1/2-in. bolts that fasten the switchboard bus to the busway dummy nonmetallic flanges. Retain all hardware for reuse.
2. Remove all screws securing the busway dummy flanged end to the switchboard enclosure.
3. Remove the busway dummy flanged end (Figure 21).

Figure 21 – Removing the Busway Dummy Flanged End



4. Install the actual busway flanged end to the switchboard bus connectors provided in the switchboard (Figure 22). Insert the flanges between the switchboard bus connectors so that the mounting holes in the collar of the flanged end align with the pre-drilled holes in the switchboard enclosure.

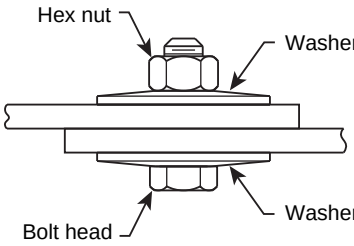
Figure 22 – Flanged-End Connections



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5. Line up the holes in the bus bar flanges, and reinstall the 1/2-in. (13 mm) hardware that was removed in step 1 on page 32 and as shown in Figure 23.

Figure 23 – Reinstalling the 1/2-In. (13 mm) Hardware



NOTE: The convex side (marked “Top”) of one conical washer should be against the bolt head, and the convex side of the second conical washer should be against the hex nut.

6. Torque the bolts inserted in step 5 as indicated in “Section 9—Torque Values for Electrical Connections” on page 53.
7. Assemble the busway collar to the switchboard enclosure with the screws provided.
8. Ensure that the busway integral ground is connected to the switchboard ground bus.
9. Confirm busway phasing before energizing.

Conduit Area

1. Locate and terminate all conduit in the switchboard enclosure in the “available conduit area” designated on the equipment drawing.

   NOTE: On switchboards greater than 24 in. (610 mm) deep, the center base channel can be removed for additional conduit area. **Exception:** Do not remove any base channels when seismic restraint is required.
2. Install the conduit properly. Use hubs, locknuts, and bushings to protect the cables and prevent condensation on the conduit from entering the switchboard.

   NOTE: If top entry, do not use the top of the switchboard to support the weight of the conduit. Support the conduit independently. When conduit is installed, make sure no areas of the roof are bowed downward. This will help prevent pooling of water.

   If bottom closure plates are furnished, the customer must remove the plates, make holes in them for any conduit entering the bottom of the switchboard, and then reinstall the plates.

   Under seismic conditions, consider using top restraints if movement of the top of the switchboard is an issue.
3. Bond all conduit hubs to the switchboard enclosure with approved electrical connections.

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Cable Pulling

Power-Style QED-2 switchboards are constructed to customer specifications for the cable entrance arrangement (for example, top or bottom feed). Switchboard components are arranged to give proper cable clearance and bending space for cables entering or exiting the switchboard as specified on the equipment drawing.

1. Use only cable sizes suitable for a proper fit with the corresponding lugs.
2. Pull the proper number of line side and load side cables according to the load served and the NEC or CEC.
3. Position the cables inside the switchboard so that they are not subject to physical damage.
4. Maintain the largest possible bending radii and proper clearance to bus bars and grounded parts. If any cables are lying or bearing on structural members, support them to relieve this condition or place suitable protective material at the bearing point to protect the cable insulation.
5. Be certain to run all phase conductors, including the neutral, through the same opening where cables enter or leave the switchboard, or pass through any metal that has magnetic properties. Otherwise, overheating can result. See Section 300-20(a) of NEC.
6. When instructed, brace or cable-lace the conductors.

Cable Terminations

1. Use a proper insulation stripping tool to strip a length of insulation from the end of the cable sufficient to fit into the full length of the lug barrel. Be careful not to nick or ring the strands.
2. Thoroughly clean aluminum cable contact surfaces with a wire brush, or scrub them with an abrasive cloth to remove oxides and foreign matter.
3. Immediately apply an acceptable joint compound to the bare aluminum surfaces.
4. If compression-type lugs are furnished on any switch or circuit breaker, or as the main incoming power lugs, unbolt and remove them to create sufficient room for crimping the lugs to the cables with the crimping tool.
   a. Insert the cable into the lug barrel and, using the crimping tool, make the specified number of crimps per the recommendations of the manufacturer.
   b. Wipe excess joint compound from the connector and insulation.
   c. With the cables connected, remount the lugs onto the bus bars, switches, or circuit breakers. Torque the bolts to the values given in “Section 9—Torque Values for Electrical Connections” on page 53.
5. Set screw-type lugs may be furnished as main incoming lugs and are standard on molded case circuit breakers and QMB/QMJ/QMQB[1] fusible switches. Torque these lugs to, **but do not exceed**, the specified values. Torque values for circuit breaker and switch lugs are marked on these units. Torque values for other switchboard lugs are marked on the switchboard (Table 7 on page 53).

[1] QMQB switches are available in Canada only.

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Cable Restraint for Short-Circuit Current Rating (SCCR)

Cable restraint is recommended for lugs mounted on bus when the following conditions are met:

- Unsupported cable lengths are greater than 3.5 ft. (1 m) [1]

AND

- Cables meet the **Yes** criteria shown in Table 2.

Table 2 – Cable Restraint Criteria

Cable Ampacity	Available Short Circuit Fault Current (RMS)			
	< 65 kA	65 to < 85 kA	85 to < 150 kA	150 to 200 kA
≤ 800 A	No	Yes	Yes	Yes
1200 A	No	No	Yes	Yes
1600 A	No	No	Yes	Yes
2000 A	No	No	Yes	Yes
2500 A	No	No	No	Yes
3000 A	No	No	No	Yes
≥ 4000 A	No	No	No	No

OR

- When otherwise specified.

NOTE: For I-Line™ circuit breakers, or if the lugs are in the circuit breaker, refer to the instruction bulletin for the specific circuit breaker.

Figure 24 – Cable Restraint Example



[1] Cable length is measured from the end of the lug to the conduit fitting through which the cable exits.

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NOTICE

HAZARD OF CABLE MOVEMENT UNDER SHORT-CIRCUIT CONDITIONS

Restrain all cables, including neutral cables, in the switchboard installation when the conditions stated on page 35 are met.

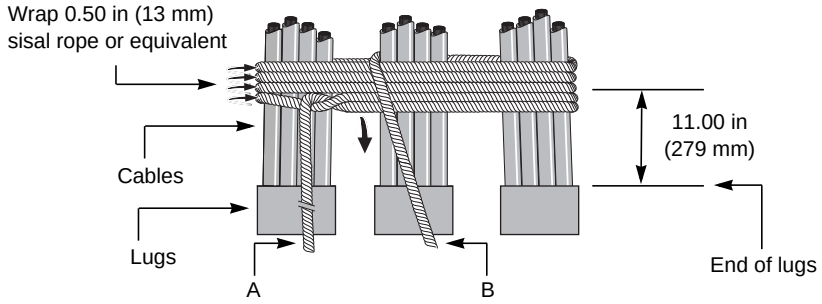
Failure to follow these instructions can result in equipment damage.

When cable restraints are required, perform the following steps.

NOTE: Wrap cables using 1/2-in. (13 mm) diameter sisal rope, 3/8-in. (9.5 mm) diameter nylon rope, or equivalent.

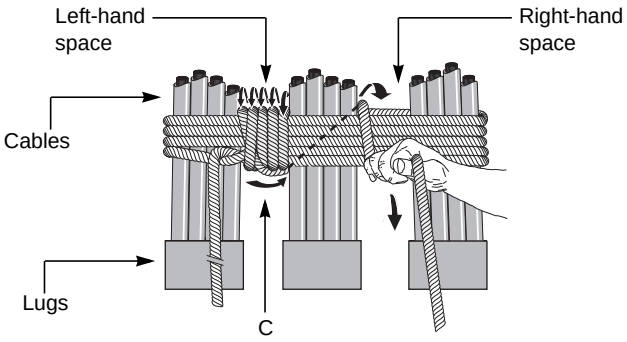
1. Begin wrapping the cables (Figure 25) a maximum distance of 11 in. (279 mm) from the end of the lugs. Continue to wrap the cables on 11-in. (279 mm) center(s) up to the point where the cables leave the enclosure.
   a. Wrap the cables four (4) times as shown, leaving 3 ft. (1 m) of excess rope at the first end (A).
   b. Pull the rope (B) taut.

Figure 25 – Wrapping Cables (neutral cables not shown)



2. Wrap the rope several times (Figure 26) until the space between the cables is completely filled.
   a. Weave the final rope loop underneath the previous loop (C).
   b. Bring the rope through the right-hand space.
   c. Pull the rope taut.

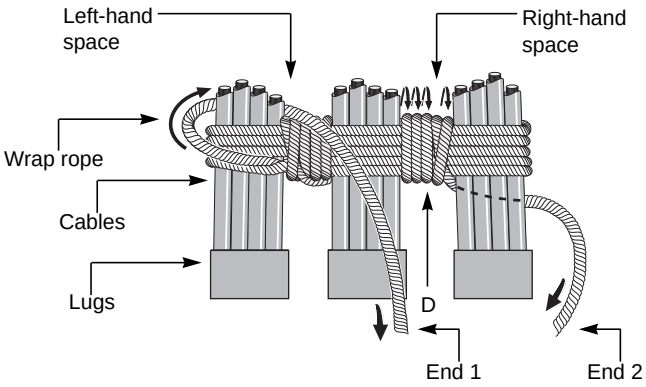
Figure 26 – Wrapping the Space Between Cables



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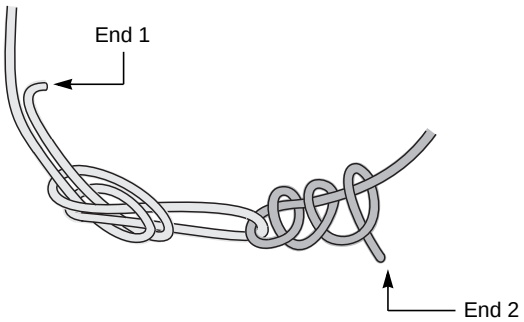
3. Wrap the rope several times until the space between the cables (Figure 27) is completely filled.
   a. Weave the final rope loop underneath the previous rope loop (D).
   b. Pull the rope taut.

Figure 27 – Finish Wrapping the Space Between Cables



4. Tie the rope ends (1) and (2) together (Figure 28) until they are taut. Cut off excess rope, and tape ends to prevent fraying.

Figure 28 – Tying Rope Ends Together



5. Recheck torques of wire binding screws after securing the cables.

   NOTE: Refer to the torque label supplied with the switchboard for torque values.

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Section 5—Pre-energizing Checkout Procedure

Conduct a complete inspection **before** the switchboard is energized to ensure that all components function and operate properly. **Complete every step of the checkout procedure listed before energizing the switchboard.**

1. Check all field-installed bus bar connections. Torque values are listed in “Section 9—Torque Values for Electrical Connections” on page 53.
2. Check all accessible connections for tightness.
3. Check all factory- and field-installed lug terminations for tightness.
4. Check the rigidity of all bus bar supports.
5. Check the switchboard enclosure for dents or other damage that reduces electrical clearances inside the switchboard.
6. Remove all foam blocks, or other temporary cushioning or retaining material, from the electrical devices.
7. Manually open and close all switches, circuit breakers, and other operating mechanisms, checking for correct alignment and free operation.
8. Operate all electrically operated switches, circuit breakers, and other devices equipped with remote operators (not under load). An auxiliary source of control power may be necessary to accomplish this.
9. Check all relays, meters, and instrumentation to verify that all field- installed wiring connections are made properly and that the devices function properly.
10. Current transformers (CTs) supplied for customer use require connection to a metering device load before energizing. Verify that the metering device load is properly connected, including main switchboard connections to remote equipment.
11. All CT circuits supplied by Schneider Electric for customer metering use are shorted for shipment. Remove shorting terminal screws on shorting terminal blocks or jumpers and store in the block.
12. Factory-installed circuit breakers may have an adjustable magnetic or electronic trip which is factory set to the lowest setting. To provide coordinated operation during a fault, adjust the trip as outlined in the instruction manual provided with the circuit breaker. All poles are adjusted simultaneously, using a screwdriver, by the single setting.
13. If ground-fault protection is furnished on type BP switch, adjust the relay to the desired ground current pickup setting. The relay is shipped from the factory at the lowest setting of 120 A for the relay. Relay pickup range is from 120–1,200 A for the relay.

    NOTE: For molded case circuit breakers, refer to “Section 11—Reference Publications” on page 56 for circuit breaker information.
14. Check the torque on all bolts of the fuses mounted in Bolt-Loc™ switches, 21–30 lb-ft (28–41 N•m), and in QMB/QMJ/QMQB[1] switches (as marked on the device).

[1] QMQB switches are available in Canada only.

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NOTICE

HAZARD OF EQUIPMENT DAMAGE

Do not pry open or spread the fuse mounting clips. Doing so can cause a loose connection, resulting in overheating.

Failure to follow these instructions can result in equipment damage.

15. Examine fuse clip contact pressure and contact means (QMB/QMJ/QMQB[1] fusible switches). If there is any sign of looseness, contact Schneider Electric Services at 1-888-778-2733 (US) or 1-800-565-6699 (Canada). Loose fuse clips can result in overheating.
16. Check all QMB/QMJ/QMQB[1] fusible switches, verifying that the proper fuses with the required interrupting rating and continuous current rating are installed. Do not use renewable link fuses in Square D™ brand fusible switches.
17. Verify that all grounding connections are correctly made. If the switchboard is used as a service entrance, double check to see that the main bonding jumper is connected (Figure 17 on page 29).

⚠CAUTION

HAZARD OF EQUIPMENT DAMAGE OR INJURY

- Remove the long-time rating plug before electrical insulation testing a circuit breaker that has a label stating “Warning: Disconnect Plug Before Dielectric Test.”
- Some Micrologic™ trip units are not rated for voltages that would occur during electrical resistance insulation testing.
- Open all control and metering disconnects from the control circuits.

Failure to follow these instructions can result in injury or equipment damage.

18. Conduct an electrical insulation resistance (Megger®) test to ensure that the switchboard is free from short circuits and undesirable grounds.
    a. Open all control power and metering disconnects or remove the fuses from the control circuits.
    b. Disconnect the neutral connection at any surge protective device or other electronic device before performing the electrical insulation resistance test; reconnect to the device after the test.
    c. With the neutral isolated from the ground and the power switches and circuit breakers open, conduct electrical insulation tests from phase-to-phase, phase-to-ground, phase-to-neutral, and neutral-to-ground.
    d. If the resistance reads less than one megohm while testing with the branch circuit devices in the open position, the system may be unsafe and should be investigated.
    e. Consult Schneider Electric Services at 1-888-778-2733 (US) or 1-800-565-6699 (Canada) to help correct any problems.
19. After completing the electrical insulation resistance test, replace all control power fuses that were removed and close power disconnects that were opened.
20. Check all field-installed wiring. Make certain it is clear of all live parts, and when instructed, secured to withstand fault currents.

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21. Verify that all control wiring between sections is connected.
22. Vacuum to remove any dust, scrap wire, or other debris.

NOTICE
HAZARD OF EQUIPMENT DAMAGE Do not use an air hose to blow out the switchboard. Dust can settle inside relays and overcurrent devices, causing overheating and improper operation. **Failure to follow these instructions can result in equipment damage.**

23. Replace all covers and barriers; check for any pinched wires, and close doors. Make certain all enclosure parts are aligned properly and securely fastened.

Ground Fault Protection Systems

Paragraph 230-95(c) of the National Electrical Code requires that all equipment ground-fault protection systems be tested when first installed. If the circuit breaker has equipment ground-fault protection installed, test it at this time.

1. Make sure the trip unit is powered. The trip unit is powered if:
   - — The circuit breaker is closed or bottom fed and has more than 100 V of load voltage on two phases (P or H trip unit only).
   - — The full-function or hand-held test kit is connected and on.
   - — The 24 Vdc external power supply is connected.
   - — An external voltage tap is installed and voltage of more than 100 V is present on two phases (P or H trip unit only).
2. If the system is a radial (single-ended) system, press the ground-fault Push-to-Test button. The circuit breaker trips, and the trip unit ground-fault indicator light comes on.
3. Record results on the ground fault system test log.

NOTE: If a complete check of the ground-fault system is necessary, use primary injection testing. If the system is multiple source and/or requires field connections at the job site, use primary injection testing.

NOTE: Some ground fault systems require field connections at the job site. Consult the switchboard interconnection wiring drawing for details.

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Section 6—Energizing the Switchboard

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Correct short-circuit conditions detected during the checkout procedures described in “Section 5—Pre-energizing Checkout Procedure” beginning on page 38.
- Qualified electrical personnel must be present when energizing this equipment for the first time.
- Follow the instructions in this section to energize the switchboard properly.

Failure to follow these instructions will result in death or serious injury.

1. Make sure there is not a load on the switchboard when it is energized. Turn off all downstream loads.
2. Energize the switchboard in the following sequence:
   a. Turn on all control power disconnects before energizing the switchboard. Refer to the record drawings supplied with equipment to see if control power disconnects are supplied.
   b. Close any open doors and/or covers.
   c. Close all main devices.
   d. Close each branch circuit breaker or branch fusible switch.
   e. Proceed to each panelboard and other downstream load.
3. After all overcurrent protective devices are closed, turn on all loads (for example, lighting circuits, contactors, heaters, and motors).

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Section 7—Maintaining the Switchboard

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Inspect and perform preventive maintenance only on switchboards and equipment that has been de-energized and electrically isolated (unless otherwise specified). This helps ensure that accidental contact cannot be made with energized parts.
- Follow safety-related work practices as described in NFPA 70E, Part II at all times.

Failure to follow these instructions will result in death or serious injury.

Periodic maintenance of the switchboard includes cleaning, lubrication, and exercising component parts. The interval between maintenance checks can vary depending upon the amount of usage and environmental conditions of each installation. The maximum recommended inspection interval is one year. This definition for periodic maintenance applies throughout this manual, unless otherwise noted.

Always inspect the switchboard after a fault. (Refer to “Section 8—Adverse Circumstances”, beginning on page 50). Service bulletins for the various disconnecting and overcurrent devices mounted in the switchboard are available through your local Schneider Electric representative.

General Inspection and Cleaning

1. Vacuum the switchboard interior to remove any dirt or dust deposits. Wipe all bus bars, insulators, cables, etc., with a clean, dry, lint-free cloth.
2. Check the switchboard interior carefully for moisture, condensation build-up, or signs of any previous wetness. Moisture can cause insulation failures and rapid oxidation of current-carrying parts. Inspect all conduit entrances and cracks between the enclosure panels for dripping leaks. Condensation in conduits can be a source of moisture and must not be allowed to drip onto live parts or insulating material. Take the necessary steps to eliminate the moisture and seal off all leaks.

NOTICE

HAZARD OF EQUIPMENT DAMAGE

- Do not use an air hose to blow out the switchboard. Dust can settle inside relays and overcurrent devices, causing overheating and improper operation.
- Do not allow paint, chemicals, or petroleum-based solvents to contact plastics or insulating materials.

Failure to follow these instructions can result in equipment damage.

3. Inspect the switchboard for any signs of overheating. Discoloration and flaking of insulation or metal parts are indications of overheating.

   NOTE: If overheating occurs, be sure that all conditions that caused the overheating have been corrected. Loose or contaminated connections can cause overheating.

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4. Check for signs of rodent nesting in the switchboard. If required, use a good exterminating technique in the general area of the switchboard.

   NOTE: Do not place or use exterminating substances and chemicals inside the switchboard. Some products attract rodents.
5. Carefully inspect all devices for any visibly worn-out, cracked, or missing parts.
6. Manually open and close switches and circuit breakers several times to verify they are working properly.
7. Verify that all key interlocks and door interlocking provisions are working properly.

Bus Bar Joints, Lug Terminations, and Insulating Materials

1. Bus bar joints are maintenance-free. Do not retighten them after the pre-energizing checkout procedure is complete.

NOTICE
HAZARD OF EQUIPMENT DAMAGE • Do not sand or remove plating on any bus bar, splice bar, or terminal lug. • Damage to plating can result in overheating. Replace damaged part. Contact Schneider Electric Services at 1-888-778-2733 (US) or 1-800-565-6699 (Canada). **Failure to follow these instructions can result in equipment damage.**

2. Check all bus bar joints and terminal lugs for any pitting, corrosion, or discoloration resulting from high temperatures or subjection to high fault conditions. If any damage has occurred, replace the bus bars or lugs. If cleaning is required, use Lectra-Clean®, made by CRC.
3. Inspect all insulating materials. Before re-energizing the switchboard, replace insulators with any visible damage (such as cracks).

General Lubrication Information

For field maintenance re-lubrication of blade/jaw components in switches 600 V and below, use BG20 High Performance Synthetic Grease from Dow Corning (Schneider Electric catalog number SWLUB). This grease is applicable for the following switches:

- Bolt-Loc
- QMB Main and Branch
- QMJ Branch
- QMQB[1] Main and Branch

For bus/plug-on connections, use electric joint compound, Schneider Electric catalog number PJC7201.

For Masterpact™ NW drawout connections, use only Schneider Electric catalog number S48899 Electric Joint Compound.

Automatic Transfer Switches

Consult the documentation provided by the manufacturer for all installation, operation, and maintenance instructions for these devices.

[1] QMQB switches are available in Canada only.

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Bolt-Loc Bolted Pressure Contact Switch Maintenance (800–4,000 A)

Refer to the Bolt-Loc switch installation and maintenance manual for complete information (manual is shipped with the switchboard). If the manual is not available, refer to “Section 11—Reference Publications” on page 56, and contact your local Schneider Electric representative to obtain the appropriate manuals.

1. Exercise the operating mechanism at least once a year to ensure proper operation.
2. The Bolt-Loc switch is shipped from the factory properly lubricated. Periodic cleaning and lubrication of the switch is required. The maintenance interval between lubrications depends on factors such as usage and ambient conditions. The maximum recommended maintenance interval is one year for current-carrying parts and five years for operating mechanisms.

⚠ DANGER

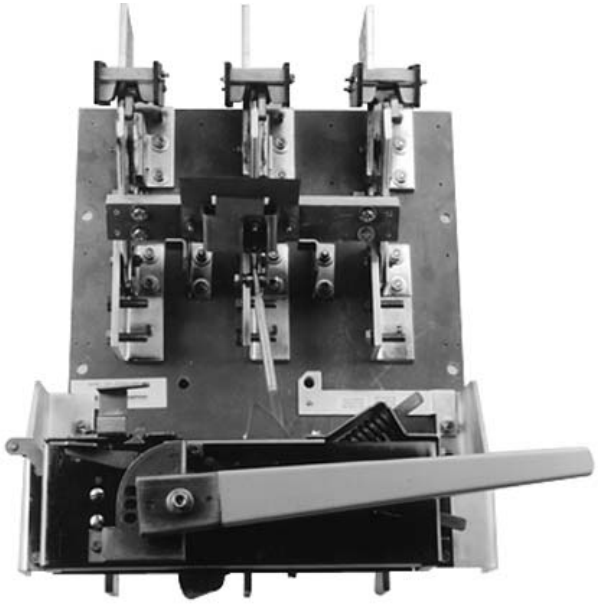
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Always check line and load ends of the fuses for voltage before starting the replacement procedure. The Bolt-Loc switch can be part of a multiple source system in which the fuses can be energized when the Bolt-Loc switch is in the “open” position.

Failure to follow these instructions will result in death or serious injury.

3. To replace the fuse:
   a. Open the switch before opening the fuse door.

Figure 29 – Type BP Bolt-Loc Fusible Switch



   b. Open the fuse door, releasing the interlock as described in the instructions on the door.
   c. Observe the switch blades to confirm the switch is “open.”
   d. Check the line and load ends of fuses for voltage using a properly rated voltage sensing device. No voltage should be present.

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e. Remove all fuses. Retain the hardware for reuse.

f. Using a non-abrasive cleaner such as Lectra-Clean, made by CRC, wipe clean the fuse mounting pads on the switch and the terminals of each new fuse. Check the alignment of fuse terminals before installing new fuses.

g. Install new fuses using the same hardware removed in Step e. Tighten to 21–30 lb-ft (28–41 N•m).

4. Close the fuse door, and check the fuse door interlock with the switch in the ON position. The fuse doors should not open using normal hand force.

Circuit Breakers

Schneider Electric circuit breakers are designed and manufactured as sealed units requiring minimal periodic maintenance.

Exercise circuit breakers at least once a year to ensure proper operation. For general maintenance:

1. Trip the circuit breaker by pushing the Push-To-Trip or “Open” button located on the face of the circuit breaker. Refer to the appropriate circuit breaker manual for the specific location of this button.
2. Manually open and close the circuit breaker two to three times.

Figure 30 – PowerPact™ R-Frame Circuit Breaker



NOTE: Schneider Electric instruction bulletin 48049-900-0x, *Field Testing and Maintenance Guide for Thermal-Magnetic and Micrologic™ Electronic Trip Molded Case Circuit Breakers*, provides more in-depth information.

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⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- If adjusting circuit breaker settings, do not set the long-time trip rating at a higher ampacity than the rating of the bus bar or load cables it supplies; overheating can occur.
- Before energizing the switchboard, fill all unused I-Line circuit breaker mounting spaces with blank fillers and/or extensions as listed in Table 3.

Failure to follow these instructions will result in death or serious injury.

Refer to individual circuit breaker instruction manuals shipped with the switchboard for additional maintenance information, such as changing rating plugs, sensor plugs, or adjustable settings and removing circuit breakers. If the instruction manual is not available, refer to “Section 11—Reference Publications” on page 56 for the appropriate number, or contact your local Schneider Electric representative.

Table 3 – I-Line™ Blank Fillers and Extensions

Item	Height	Catalog No.	Branch Circuit Side	Circuit Breaker Frame
Blank Fillers	1.50 in. (38 mm)	HNM1BL	Both Sides	Not applicable
	4.50 in. (114 mm)	HNM4BL	Both Sides	
Blank Extensions	1.50 in. (38 mm)	HLW1BL	Wide Side	All applications except PowerPact H/J circuit breakers with Micrologic trip unit 5/6.
	4.50 in. (114 mm)	HLW4BL	Wide Side	
	1.50 in. (38 mm)	HLN1BL	Narrow Side	
	4.50 in. (114 mm)	HLN4BL	Narrow Side	
	4.50 in. (114 mm)	HLN4EBL	Narrow Side	Only PowerPact H/J circuit breakers with Micrologic trip unit 5/6.
	4.50 in. (114 mm)	HLW4EBL	Wide Side	

NOTICE

HAZARD OF EQUIPMENT DAMAGE

- Do not remove the protective lubricant on the plug-on connectors.
- If additional lubrication is required, apply a coating of electrical joint compound, catalog number PJC7201, to the contact surfaces of the plug-on connector.

Failure to follow these instructions can result in equipment damage.

3. The universal test set, catalog number UTS3, is available to test Schneider Electric Powerpact P and R circuit breakers equipped with Micrologic trip units. It runs trip unit tests automatically, with prompts to the user for initial information. Test modules for each circuit breaker frame are used to store data necessary for automatic tests. Series B Micrologic trip units require test module CBTMB, which is included in UTS3.

   A pocket tester, catalog number S434206, or UTA tester, catalog number STRV00910, are available for Schneider Electric Powerpact H, J, and L circuit breakers with Micrologic trip units. These testers supply power to the Micrologic trip units and allow for settings to be adjusted through the keypad located on the circuit breaker or through a PC using the USB interface.

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Masterpact NW trip units require the full-function test set, catalog number S33595, or the hand-held test set, catalog number S33594.

NOTE: Tests can be conducted with a circuit breaker installed in the switchboard; circuit breaker removal is not required. **The switchboard must be de-energized.**

QMB/QMJ/QMQB[1] Fusible Switches

Refer to the QMB/QMJ/QMQB[1] instruction manual for complete maintenance information. If the instruction manual is not available, refer to "Section 11—Reference Publications" on page 56 of this manual for the appropriate number. Contact your local Schneider Electric representative to obtain the manual.

Switch Maintenance

1. Periodically exercise the switch to ensure proper operation. This period should not exceed one year.
2. Check the cover interlock with the switch in the ON position. The cover should not open using normal hand force.
3. Inspect the switch interior for any damaged or cracked parts, and replace as necessary.
4. For fusible switch units, check the fuse mounting clips or bolted contact area for corrosion or discoloration (indicating overheating). Replace them if necessary.
5. For additional maintenance instructions, see the label on the inside of the door.

Fuse Replacement (Fusible Switches Only)

1. Turn the switch to the OFF position before opening the door.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Always check line and load ends of the fuses for voltage before starting the fuse replacement procedure with a properly rated voltage sensing device.

Failure to follow these instructions will result in death or serious injury.

2. Observe the switch blades to confirm that the switch is in the OFF position.
3. Using a properly rated voltage sensing device, verify that line and load ends of the fuse are not energized.
4. Observe all warning labels specifying the type of fuse to use. Do not substitute a non-current limiting fuse, or attempt in any way to defeat the rejection feature of the fuse clips furnished with the switch. Do not use renewable link fuses in Schneider Electric fusible switches.

NOTICE

HAZARD OF EQUIPMENT DAMAGE

Do not pry open or spread the fuse mounting clips. Doing so can cause a loose connection, resulting in overheating and nuisance fuse blowing.

Failure to follow these instructions can result in equipment damage.

[1] QMQB switches are available in Canada only.

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Installing QMB/QMJ/QMQB[1] Fusible Switches

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Remove power for these sections before installing or removing QMB/QMJ/QMQB[1] switches.
- Do not use a main as a branch unit or a branch as a main.
- All unused spaces must be filled with blank fillers before energizing the switchboard. Refer to Tables 4 and 5 for sizes and catalog numbers.

Failure to follow these instructions will result in death or serious injury.

Table 4 – QMB/QMJ Fusible Switch Blank Fillers

Height	Catalog No.
1.50 in. (38 mm)	QMB1BLW
3.00 in. (76 mm)	QMB3BLW
6.00 in. (152 mm)	QMB6BLW
15.00 in. (381 mm)	QMB15BLW

Table 5 – QMQB[1] Fusible Switch Blank Fillers

Height	Catalog No.
2x: 1.375 in. (35 mm)	QFS1
8x: 5.50 in. (140 mm)	QFS5
10x: 6.875 in. (175 mm)	QFS6
14x: 9.625 in. (244 mm)	QFS9
24x: 16.50 in. (419 mm)	QFS16

NOTICE

HAZARD OF EQUIPMENT DAMAGE

Do not remove the protective lubricant on the plug-on connectors.

Failure to follow these instructions can result in equipment damage.

1. Turn off the main power.
2. Turn the switch handle(s) to the OFF position. Align switch plug-on connectors with QMB panel vertical bus, and plug switch onto panel.
3. Place and partially tighten all unit mounting screws that mount to the QMB panel mounting rails.
4. Tighten all screws evenly. The unit mounting flange and plug-on connectors must be seated securely.

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Removing QMB/QMJ/QMQB[1] Fusible Switches

1. Turn off the main power.
2. Turn switch handle(s) to the OFF position.
3. Disconnect the load wires.
4. For QMB and QMJ switches, remove mounting screws holding the switch to the mounting rail. For QMQB[1] switches, remove the bolts holding the switch to the line terminal.
5. Unplug the switch.

Ground-Fault Protection Systems

Check the terminal connections on the ground-fault protection system at least once a year for tightness and corrosion. If the system can be tested without tripping the main or branch device, directions for testing the system are in the device manual. Otherwise, testing the ground-fault protection system will trip the main or branch device to which it is connected. If the ground-fault sensor or relay is physically or electrically damaged, replace it.

If the ground-fault protection system does not operate properly and additional equipment has been connected to the installation since the last maintenance test/check, de-energize the entire system, and check for grounds on the neutral downstream from the main bonding jumper. If no downstream grounds are detected and the ground fault system is not operating properly, contact Schneider Electric Services at 1-888-778-2733 (US) or 1-800-565-6699 (Canada).

If no additions have been made to the installation and the ground-fault protection system does not operate properly, contact Schneider Electric Services at 1-888-778-2733 (US) or 1-800-565-6699 (Canada).

Refer to the ground-fault field test instruction manual for additional testing information. If the manual is not available, refer to “Section 11—Reference Publications” on page 56 of this manual to obtain the appropriate number. Contact your local Schneider Electric representative to obtain this manual.

[1] QMQB switches are available in Canada only.

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Section 8—Adverse Circumstances

This section includes, but is not limited to, all electrical components of the switchboard.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Turn off all power supplying the switchboard before cleaning.
- Always use a properly rated voltage sensing device to confirm all power is off.
- Before energizing the switchboard, all unused circuit breaker mounting spaces must be filled.

Failure to follow these instructions will result in death or serious injury.

NOTE: Before attempting to re-energize the switchboard following adverse circumstances, contact Schneider Electric Services at 1-888-778-2733 (US) or 1-800-565-6699 (Canada) for special instructions.

Inspection Following a Short Circuit

If a short circuit occurs, make a thorough inspection of the entire system, and verify that no damage to conductors or insulation has occurred. High mechanical and thermal stresses developed by short-circuit currents can damage conductors and insulation. Check the overcurrent-protection device that interrupted the short-circuit current for possible arcing damage.

Do not open sealed devices, such as molded case circuit breakers. Replace these devices if they are damaged. Before energizing the switchboard, all unused circuit breaker mounting spaces must be filled. For more information about these devices, refer to the appropriate instruction manual listed in “Section 11—Reference Publications” on page 56.

Clean-up Following a Short Circuit

The insulating properties of some organic insulating materials can deteriorate during an electrical arc. If so:

1. Remove any soot or debris.
2. Replace carbon-tracked insulation.

Water-Soaked Switchboards

Do not clean or repair a switchboard that has been exposed to large volumes of water or submerged at any time. Current-carrying parts, insulation systems, and electrical components may be damaged beyond repair. **Do not energize the switchboard.** Contact Schneider Electric Services at 1-888-778-2733 (US) or 1-800-565-6699 (Canada).

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Water-Sprayed or Splashed Switchboards (Clean Water Only)

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Turn off all power supplying this equipment before working on it.

Failure to follow these instructions will result in death or serious injury.

If the switchboard has been sprayed or splashed with small amounts of clean water, make a thorough inspection of the entire system, and verify that no damage to conductors or insulation has occurred. Do not open sealed devices such as molded case circuit breakers or fuses. Replace these devices if they are damaged. For more information about these devices, refer to the appropriate instruction manual listed in “Section 11—Reference Publications”.

Inspection and Clean-up of Clean Water Sprayed or Splashed Switchboards

Follow steps 1–10 only if:

- No signs of physical damage to the equipment are present.
- The switchboard has not been submerged or exposed to water for long periods of time.
- The water that has been in contact with the switchboard has not been contaminated with sewage, chemicals, or other substances that can negatively affect the integrity of the electrical equipment.
- The water that has been in contact with the switchboard has not entered any area of the enclosure that may contain wiring installed as intended and located above any live part. Specifically, inspect for water entering through conduits located above live parts.

If any one or more of these conditions have not been met, contact Schneider Electric Services at 1-888-778-2733 (US) or 1-800-565-6699 (Canada).

If **ALL** of the conditions listed have been met, proceed as follows:

1. Turn off all power supplying this equipment before working on or inside the equipment.
2. Always use a properly rated voltage sensing device to confirm all power is off.
3. Disconnect and electrically isolate the switchboard so that no contact can be made with energized parts.
4. Wipe off all moisture from the bus bars, insulators, and insulating material with a clean, dry, lint-free cloth. Do **not** use cleaning agents or water displacement sprays.
5. Prepare the switchboard for insulation resistance (Megger®) testing by disconnecting all line side supply connections and all load side cable connections to isolate the switchboard from the wiring system.

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⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE OR INJURY

- Remove the long-time rating plug before electrical insulation testing a circuit breaker that has a label stating “Warning: Disconnect Plug Before Dielectric Test.”
- Some Micrologic trip units are not rated for voltages that would occur during electrical resistance insulation testing.
- Open all control and metering disconnects from the control circuits.

Failure to follow these instructions can result in injury or equipment damage.

6. Turn all circuit breakers or switches to their ON position. The switchboard must remain de-energized.
7. Use a megohmmeter with a capacity of 500–1,000 Vdc and apply voltage from:
   a. Each phase-to-ground with circuit breaker on.
   b. Phase-to-phase with circuit breaker on.
8. Record resistance values. Refer to “Section 10—Switchboard Insulation Resistance Chart” on page 55.
9. If resistance measurements are less than 0.5 megohm, call Schneider Electric Services at 1-888-778-2733 (US) or 1-800-565-6699 (Canada) for recommendations.
10. If resistance measurements are greater than 0.5 megohm, the equipment can be energized using the procedures listed in “Section 6—Energizing the Switchboard” on page 41.

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Section 9—Torque Values for Electrical Connections

Table 6 – Incoming, Branch, and Neutral Lug

Socket Size Across Flats	Torque Value
1/4 in.	180 lb-in (20 N•m)
5/16 in.	250 lb-in (28 N•m)
3/8 in.	340 lb-in (38 N•m)
1/2 in. ★	450 lb-in (51 N•m)

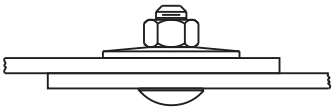
★ Certain lugs require 620 lb-in (70 N•m) and are marked as such.

Table 7 – Multiple Conductor Neutral and/or Ground Bar

Screw Type	Lug Wire Range	Conductor Size	Torque Value
Slotted Head	14–4	14-10 Cu, 12-10 Al	20 lb-in (2 N•m)
		8 Cu-Al	25 lb-in (3 N•m)
		6-4 Cu-Al	35 lb-in (4 N•m)
	14–1/0	14-8 Cu-Al	36 lb-in (4 N•m)
		6-1/0 Cu-Al	45 lb-in (5 N•m)
Socket Head	14–1/0	All	100 lb-in (11 N•m)
	6–300 kcmil	All	275 lb-in (31 N•m)

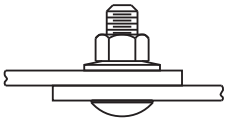
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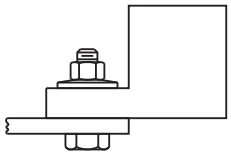


Carriage bolt
Hex nut
Conical washer

Hardware Description	Torque Value
1/2 in.	720–840 lb-in (81–95 N•m)

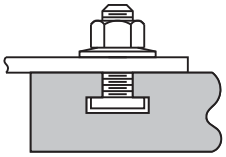


Carriage bolt
Conical washer assembly
Keps nut



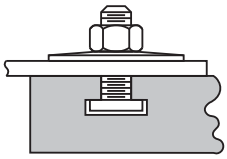
Hex head bolt
Conical washer assembly
Keps nut

Hardware Description	Torque Value
1/4 in.	50–75 lb-in (6–8 N•m)
5/16 in.	80–125 lb-in (9–14 N•m)
3/8 in.	175–225 lb-in (20–25 N•m)
1/2 in.	250–350 lb-in (28–40 N•m)



Square head (Tee) bolt
Conical washer assembly
Keps nut

Hardware Description	Torque Value
1/4 in.	50–75 lb-in (6–8 N•m)
3/8 in.	175–225 lb-in (20–25 N•m)
1/2 in.	250–350 lb-in (28–40 N•m)



Square head (Tee) bolt
Conical washer

Hardware Description	Torque Value	
	Conical Washer OD	Square Head (Tee) Bolt Conical Washer
3/8 in.	0.87 in. (22 mm)	250–280 lb-in (28–32 N•m)
	1.00 in. (25 mm)	130–150 lb-in (15–17 N•m)
1/2 in.	1.25 in. (32 mm) 2.25 in. (57 mm)	450–550 lb-in (51–62 N•m)



Hex head bolt
(2) Conical washers

Hardware Description	Torque Value	
	Conical Washer OD	Hex Head Bolt (2) Conical Washers
5/16 in.	0.90 in. (23 mm)	145–160 lb-in (16–18 N•m)
3/8 in.	0.87 in. (22 mm)	250–280 lb-in (28–32 N•m)
	1.00 in. (25 mm)	130–150 lb-in (15–17 N•m)
1/2 in.	1.25 in. (32 mm) 2.25 in. (57 mm) 3.00 in. (76 mm)	720–840 lb-in (81–95 N•m)

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Section 10—Switchboard Insulation Resistance Chart

Always use a 500 or 1,000 Vdc megohmmeter when testing insulation resistance.

NOTE: The Neutral–Ground column is provided to record the results of the pre-energizing checkout procedure only.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Turn off all power to the switchboard before testing.
- Always use a properly rated voltage sensing device to confirm power is off.

Failure to follow these instructions will result in death or serious injury.

Date	Phase–Phase			Phase–Ground			Neutral–Ground
	All Disconnects Open						
	a-b	b-c	c-a	a-ground	b-ground	c-ground	Neutral–Ground
Date	All Disconnects Closed						
	a-b	b-c	c-a	a-ground	b-ground	c-ground	Neutral–Ground

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Section 11—Reference Publications

Schneider Electric publications are available through your local Schneider Electric representative. These publications include device replacement procedures and listings of spare parts to make ordering and servicing of replacement parts quick and convenient. Any maintenance procedure or device not listed, such as an I-Line interior, is not customer serviceable.

Contact your local Schneider Electric representative for information at 1-888-778-2733 in the US, or at 1-800-565-6699 in Canada. Or, refer to the Technical Library at http://www.schneider-electric.us/ to obtain the appropriate publications.

For information about obtaining NEMA documents, write to:

National Electrical Manufacturers Association (NEMA)
Attention: Customer Service
1300 North 17th Street
Suite 1847
Rosslyn, VA 22209

Other Reference Publications	Publication Number
General Instructions for Proper Installation, Operation, and Maintenance of Switchboards Rated 600 V or Less	NEMA Publication PB2.1
Application Guide for Ground Fault Protective Devices for Equipment	NEMA Publication PB2.2
Circuit Breakers	NEMA Publication AB-4
Enclosed and Miscellaneous Distribution Switches	NEMA Publication KS-1
Electrical Equipment Maintenance	NFPA 70B-1999

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Section 12—Installation and Maintenance Log

Date	Initials	Maintenance Performed

Date	Initials	Maintenance Performed

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ANSI/NEMA PB 2.1-2013

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Foreword

This publication is a guide of practical information containing instructions for the proper handling, installation, operation, and maintenance of deadfront distribution switchboards rated 600 Volts or less.

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency regarding handling, installation, operation, or maintenance.

It is recommended that work described in this set of instructions be performed only by qualified personnel familiar with the construction and operation of switchboards and that such work be performed only after reading this complete set of instructions. For specific information not covered by these instructions, you are urged to contact the manufacturer of the switchboard directly.

PB 2.1-2013 revises and supersedes PB 2.1-2007.

In the preparation of this standards publication input of users and other interested parties has been sought and evaluated. Inquiries, comments, and proposed or recommended revisions should be submitted to the concerned NEMA product section by contacting the following:

Senior Technical Director, Operations
National Electrical Manufacturers Association
1300 North 17th Street, Suite 900
Rosslyn, Virginia, 22209

This standards publication was developed by the Panelboard and Distribution Board Section. Section approval of the standard does not necessarily imply that all section members voted for its approval or participated in its development. At the time it was approved, the Panelboard and Distribution Board Section was composed of the following members:

Eaton Corporation.—Pittsburgh, PA
GE Industrial Solutions—Plainville, CT
Hubbell, Inc.—Bridgeport, CT
Milbank Manufacturing Company—Kansas City, MO
Penn Panel & Box Company—Collingdale, PA
Reliance Controls Corporation—Racine, WI
Siemens Industry, Inc.—Norcross, GA
Schneider Electric—Palatine, IL

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Section 1
GENERAL

1.1 SCOPE

This publication covers floor-mounted deadfront switchboards which consist of an enclosure, molded case and low-voltage power circuit breakers, fusible or non-fusible switches, instruments, and metering, monitoring, or control equipment, with associated interconnections and supporting structures. These units are used in the distribution of electricity at:

a. 600 volts and less
b. 6000 amperes or less

1.2 REFERENCES

National Electrical Manufacturers Association
1300 North 17th Street, Suite 900
Rosslyn, Virginia 22209

AB 4 *Guidelines for Inspection and Preventive Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications*

PB *Application Guide for Ground Fault Protective Devices for Equipment*

Guidelines for Handling Water Damaged Electrical Equipment

National Fire Protection Association
Batterymarch Park
Quincy, MA 02269

NFPA 70 *National Electrical Code®*

NFPA 70E *Standard for Electrical Safety in the Workplace*

1.3 GENERAL

WARNING—HAZARDOUS VOLTAGES IN ELECTRICAL EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. UNLESS OTHERWISE SPECIFIED, INSPECTION AND MAINTENANCE SHOULD ONLY BE PERFORMED ON SWITCHBOARDS AND EQUIPMENT TO WHICH POWER HAS BEEN TURNED OFF, DISCONNECTED, AND ELECTRICALLY ISOLATED SO THAT NO ACCIDENTAL CONTACT CAN BE MADE WITH ENERGIZED PARTS. FOLLOW ALL MANUFACTURER'S WARNINGS AND INSTRUCTIONS.

Safety related work practices, as described in NFPA 70E, should be followed at all times.
All requirements of the *National Electrical Code®* NFPA 70 should be followed.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE SWITCHBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE SWITCHBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

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1.3.1 Successful Operation

The successful operation of switchboards is dependent upon proper handling, installation, operation, and maintenance. Neglecting fundamental installation and maintenance requirements may lead to severe personal injury, death, or damage to electrical equipment or other property.

1.3.2 Qualified Personnel

Installation, operation, and maintenance of switchboards should be conducted only by qualified personnel.

1.3.3 Definition of Qualified Personnel

For purposes of these guidelines, a qualified person is one who is familiar with the installation, construction, and operation of the equipment and the hazards involved. In addition, the person is:

1.3.3.1 Knowledgeable of Requirements

Knowledgeable of the requirements of the *National Electrical Code*® and of all other applicable codes, laws, and standards.

1.3.3.2 Trained and Authorized to Test, Energize, Clear, Ground, Tag, and Lockout

Trained and authorized to test, energize, clear, ground, tag, and lockout circuits and equipment in accordance with established safety practices.

1.3.3.3 Trained in Proper Care and Use of Protective Equipment

Trained in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, and flash resistant clothing in accordance with established safety practices.

1.3.3.4 Trained in Rendering First Aid

Trained in rendering first aid.

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Section 2
HANDLING

NOTE—These guidelines are provided to help avoid personal injury and equipment damage during handling and to facilitate moving the switchboard at the job site.

2.1 MANUFACTURER'S HANDLING INSTRUCTIONS

Follow the manufacturer's handling instructions for the specific equipment, if available.

2.2 CARE TO AVOID DAMAGE

Handle the switchboard with care to avoid damage to components, the frame or finish.

2.3 UPRIGHT POSITION

Keep the switchboard in an upright position unless otherwise indicated by the manufacturer.

2.4 EQUIPMENT CAPACITY

Verify that handling equipment capacity is sufficient for the switchboard weight.

2.5 CONCEALED DAMAGE

When the switchboard is received, unpack it sufficiently to inspect it for concealed damage and to determine that the shipment is complete and correct.

2.6 STORAGE PRIOR TO INSTALLATION

If the switchboard is to be stored prior to installation, replace the packing for protection during that period. When conditions permit, leave the packing intact until the switchboard or sections are at their final installation location. If the packing is removed, cover the top and any openings to protect the equipment against dust and debris during the construction period. (See section 3).

2.7 SHIPPING SKID

The switchboard should remain secured to the shipping skid to prevent distortion of the bottom of the frame during moving.

2.8 ROD OR PIPE ROLLERS

Rod or pipe rollers, with the aid of pinch bars, provide a simple method of moving the switchboard on one floor level if there is little or no incline. Steady the load to prevent tipping.

2.9 FORKLIFT TRUCK

A forklift truck may offer a more convenient method of handling the switchboard and has the added advantage of permitting it to be hoisted between levels. Balance the load carefully and use a safety strap when handling or moving switchboards with a forklift.

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2.10 OVERHEAD HOISTING

When it is necessary to move the switchboard between elevations without a suitable platform elevator, overhead hoisting may be required. Lifting plates and eye bolts (Figure 2-1), or channels, angles, or bars with lift holes (Figure 2-2) may be provided as a permanent or removable part of the switchboard. If they are not, cable, chain, or band slings (Figure 2-3) may be rigged around the switchboard.

2.10.1 Rigid Spreaders or Spanner Bars

Use rigid spreaders (Figure 2-1) or spanner bars (Figure 2-3) to provide the vertical lift on eye bolts and lifting slings to avoid crushing or otherwise damaging the frame or its finish. Lifting bars on long lineups may require additional spreaders to reduce the horizontal compressive force.

2.10.2 Rigging Lengths

Select or adjust the rigging lengths to compensate for any unequal weight distribution of load and to maintain the switchboard in an upright position.

2.10.3 Angle between Lifting Cables and Vertical

Do not allow the angle between the lifting cables and vertical to exceed 45 degrees in order to reduce the tension on the rigging and the compressive load on the lifting or spanner bars and spreaders.

2.10.4 Slings with Safety Hooks or Shackles

Do not pass ropes or cables through the lift holes in bars, angles, or channels. Use slings with safety hooks or shackles.

2.10.5 Removal of Switchboard Top Covers

The switchboard may contain a heavy transformer with overhead lifting means. Consult the manufacturer regarding the removal of the switchboard top covers and the utilization of such internal lifting means.

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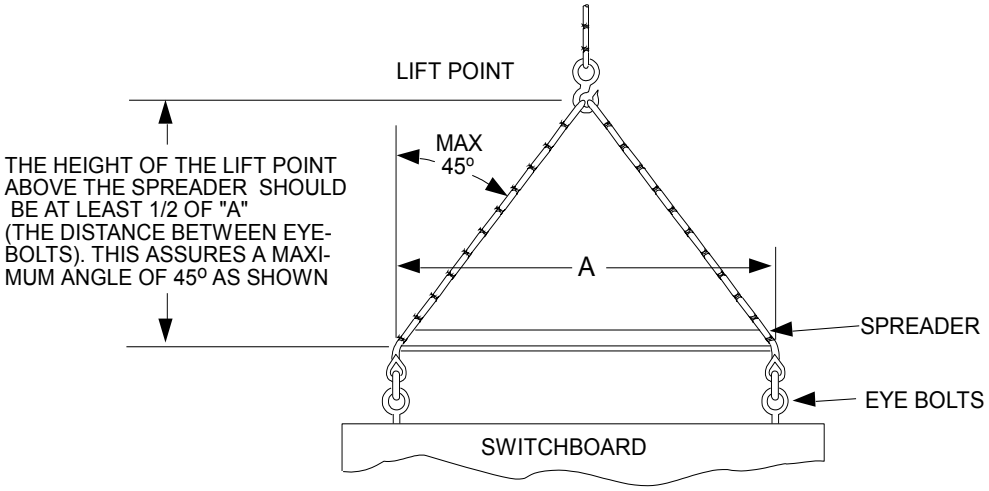


Figure 2-1
LIFTING WITH EYE BOLTS

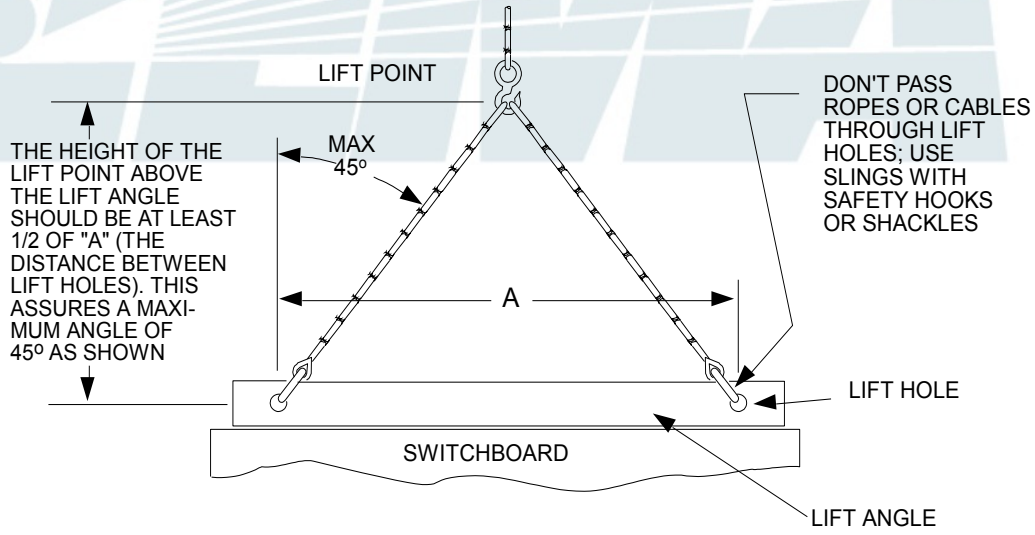


Figure 2-2
LIFTING WITH INTEGRAL LIFT ANGLE

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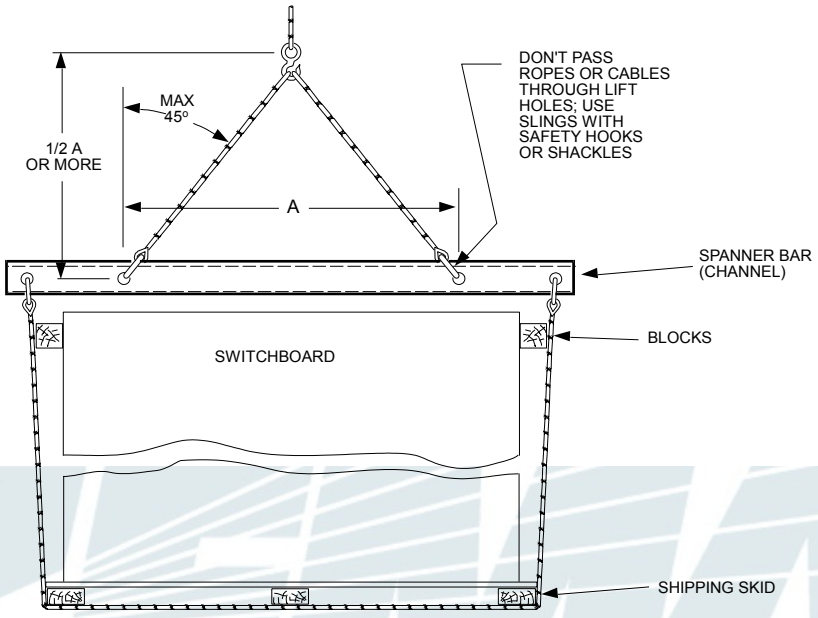


Figure 2-3
LIFTING WITH SLING RIGGING

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Section 3
STORAGE

3.1 CLEAN, DRY SPACE HAVING UNIFORM TEMPERATURE

A switchboard that is not installed and energized immediately should be stored in a clean, dry space having a uniform temperature to prevent condensation. Preferably, it should be stored in a heated building having adequate air circulation and protected from dirt, fumes, water, and physical damage.

3.2 PROTECTION FROM WEATHER AND DIRT

It is recommended that switchboards should not be stored outdoors. However, if it must be stored outdoors, cover it securely to provide protection from weather and dirt. Temporary electrical heating should be installed to prevent condensation; approximately 250 watts per section is adequate for the average switchboard size and environment. All loose packing or flammable materials inside the switchboard should be removed before energizing space heaters.

3.3 OUTDOOR SWITCHBOARDS ARE NOT WEATHER RESISTANT UNTIL INSTALLED

Outdoor switchboards are not weather resistant until completely and properly installed and should be treated exactly the same as indoor switchboards until after they are installed.

3.4 UN-ENERGIZED OUTDOOR SWITCHBOARD SHOULD BE KEPT DRY INTERNALLY

An un-energized outdoor switchboard should be kept dry internally by installing temporary heating (see 3.2) or by energizing any self-contained space heaters.

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Section 4
INSTALLATION OF SWITCHBOARD OR ENCLOSURE

4.1 MANUFACTURER'S INSTALLATION INSTRUCTIONS

Install the switchboard in a neat and workmanlike manner following the manufacturer's installation instructions, if available.

4.2 LOCATION

Locate the switchboard in the area indicated on the building plans. The switchboard enclosure should be suitable for the environment or protected by other means. Additional precautions may be necessary, during installation, to prevent moisture, water, or other contaminants from entering and accumulating within the enclosures. Clearances or working spaces are as follows:

4.2.1 Clearance from Walls

Clearance from walls (not rear accessible)—minimum of 1/2 inch.

4.2.2 Working Clearances

Working clearances vary substantially depending on voltage and specific applications. See Section 110.26 of the *National Electrical Code®.*

NOTE—Spaces for working clearances and clearances from walls should not be used for storage. Working spaces should have adequate lighting.

4.3 CHANNEL SILLS

When channel sills are used, they should be embedded in the concrete floor or grouted on the surface. In either case, they should be installed in an aligned position and be level over the entire length prior to installing the switchboard.

4.4 CONDUIT AND OTHER RACEWAYS

Position the switchboard so that the raceway stubs or floor openings are located in the area specified on the manufacturer's drawing. In the absence of drawings, locate the switchboard over the raceways or floor openings so as to provide cable bending space and clearances to energized parts or other obstructions. See Section 408.5 of the *National Electrical Code®*.

4.5 LEVELING AND SECURING

Install the switchboard in its final position, progressively leveling each section and bolting the frames together if they are separated. If necessary, secure the switchboard to walls or other supporting surfaces. Security should not depend on wooden plugs driven into holes in masonry, concrete, plaster, or similar materials.

4.6 SPLICE BUS

Connect all through and ground bus at shipping breaks, using the splice bus and hardware supplied with the switchboard. Tighten bolted connections in accordance with the manufacturer's torque specifications. If not furnished, consult the manufacturer.

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4.7 GROUNDING AND BONDING

Ground and bond the switchboard as follows:

4.7.1 Grounded Systems

Switchboard used as service equipment for a grounded system or as a main switchboard for a separately derived system.

4.7.1.1 Grounding Electrode System in Switchboard

If the connection for the grounding electrode system is to be in the switchboard, install a grounding electrode conductor sized in accordance with Sections 250.66 or 250.166 of the *National Electrical Code*® from the grounding electrode to the switchboard ground bus or ground terminal designated by the manufacturer. See Sections 250.62 and 250.64 of the *National Electrical Code*®.

4.7.1.2 Switchboards Used as Service Equipment on Grounded Systems

Switchboards used as service equipment on systems that are grounded at any point are required to have a grounded conductor brought to the switchboard in accordance with Section 250.24(C) of the *National Electrical Code*®. This conductor is required even if the switchboard is supplying loads that are only phase-to-phase connected.

4.7.1.3 Installation of Main Bonding Jumper

Unless already done at the factory, install the main bonding jumper from the incoming grounded conductor bus (neutral) to the ground bus or other location designated by the manufacturer.

4.7.1.4 Steps 4.7.1.1 Through 4.7.1.3

Steps 4.7.1.1 through 4.7.1.3 must effectively connect together the grounding electrode, the switchboard frame, all outgoing equipment grounding conductors, and the grounded conductor bus (neutral) of the system on the supply side of any neutral disconnecting link.

4.7.1.5 Neutral Disconnecting Link

Do not connect any grounding conductors to the load side of any neutral disconnecting link or any sensor used for ground fault protection. Do not connect equipment grounding conductors directly to the grounded conductor bus (neutral).

4.7.1.6 Dual Fed Switchboard or System

Where the switchboard or system is dual fed (double-ended) and has ground fault protection, special precautions are necessary to accomplish proper grounding and bonding. Follow the manufacturer's instructions.

4.7.2 Ungrounded Systems—Service Equipment or Separately Derived System Main

4.7.2.1 Conductor Sized in Accordance with *National Electrical Code*®

Install a grounding electrode conductor sized in accordance with Sections 250.66 or 250.166 of the *National Electrical Code*® from the grounding electrode to the switchboard ground bus or ground terminal designated by the manufacturer. See Sections 250.62 and 250.64 of the *National Electrical Code*®. This should effectively connect together the grounding electrode, the switchboard frame, and all outgoing equipment grounding conductors.

4.7.3 Grounded or Ungrounded Systems

Applications other than service equipment or other than main for separately derived systems.

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4.7.3.1 Grounding Conductor Size in Accordance with *National Electrical Code*®

Ground the switchboard frame and any ground bus by means of an equipment grounding conductor having a size in accordance with Section 250.122 of the *National Electrical Code*® and run with the main supply conductors or by bonding to the raceway enclosing the main supply conductors in accordance with Sections 250.118 and 250.120 of the *National Electrical Code*®.

4.8 UNUSED OPENINGS

Effectively close all unused openings in the switchboard enclosure.

4.9 DAMP INDOOR LOCATIONS

In damp indoor locations, shield the switchboard so as to prevent moisture and water from entering and accumulating therein.

4.10 UNUSUAL SERVICE CONDITIONS

Unless the switchboard has been designed for unusual service conditions, it should not be located where it will be exposed to ambient temperatures above 40°C (104°F), high humidity, corrosive or explosive fumes, dust, vapors, dripping or standing water, abnormal vibration, mechanical shock, tilting, or other unusual operating conditions.

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Section 5
INSTALLATION OF CONDUIT AND CONDUCTORS

5.1 PREVENT MOISTURE OR WATER FROM ENTERING

Conduits and other raceways should be installed to prevent moisture or water from entering and accumulating within the enclosure. All metallic raceways (including stubs) should be bonded to the switchboard. All raceways should be located in the areas recommended by the manufacturer to avoid conductor interference with structural members and live parts. Before pulling any conductors into the switchboard, verify that their size, temperature rating, and conductor insulation comply with the switchboard markings. See Section 110.14(C) of the *National Electrical Code*®.

5.2 TEMPERATURE RATINGS

Care should be exercised to ensure that the types and temperature ratings of conductors being installed in the switchboard are suitable for use with the terminals which have been provided.

5.3 COMPRESSION (CRIMP) TERMINALS

If compression (crimp) terminals are used, crimp with the tool(s) recommended by the manufacturer.

5.4 STRIPPING INSULATION FROM CONDUCTORS

Care should be exercised in stripping insulation from the conductors so as not to nick or ring the conductor. For aluminum, clean all oxide from the stripped portion and apply an oxide inhibiting compound. All mechanical terminals should be tightened per the manufacturer's torque specifications. If not furnished, consult the manufacturer.

5.5 PROPER WIRING METHODS

Refer to Article 300 of the *National Electrical Code*® for proper wiring methods. Conductors should enter the switchboard in the section in which they are to be terminated, except as noted in Section 408.3(A)(3) of the *National Electrical Code®.*

5.6 CONDUCTOR LOCATION IN SWITCHBOARD

Provision should be made to locate conductors in the switchboard so that they will be free from physical damage and to avoid overheating. If required by the manufacturer's instructions, secure the conductors as necessary in order to withstand short-circuit forces. The largest practical bending radii should be maintained to avoid damaging the insulation and causing terminals to loosen. Exercise care so that the conductors will not interfere with any moving parts.

5.7 CONDUCTORS 1/0 AWG IN SIZE AND LARGER

Conductors 1/0 AWG in size and larger may be run in parallel. All parallel conductors should be of the same size, length, and material to assure the equal division of current, as required by Section 310.10(H) of the *National Electrical Code*®. If conductors pass through metal having magnetic properties, all of the circuit conductors, including the neutral, should be run through the same opening, as specified by Section 300.20(A) of the *National Electrical Code*®.

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5.8 INCOMING AND OUTGOING CONTROL CONNECTIONS

All incoming and outgoing control connections should be made in accordance with the switchboard manufacturer's schematic and wiring diagrams.

5.9 PREVENT CONDUCTOR INSULATION FROM CRACKING OR SPLITTING

Installation of conductors should be done at temperatures above freezing to prevent conductor insulation from cracking or splitting, unless the conductor insulation is suitable for installation at temperatures below freezing.

5.10 *NATIONAL ELECTRICAL CODE*®, SECTION 725.136

Refer to the *National Electrical Code*®, Section 725.136 for the separation requirements for conductors of Class 2 and Class 3 remote control, signaling and power-limited circuits.

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Section 6
INSTALLATION OF SWITCHBOARD INTERIOR

6.1 INSTRUCTIONS IF SWITCHBOARD INTERIOR WAS NOT FACTORY–MOUNTED

Follow these instructions if the switchboard interior(s) was not mounted at the factory.

6.2 UNPACKING

Exercise care in unpacking the switchboard interior to prevent damage.

6.3 INSPECTION

Check for shipping damage and check to make sure the interior is the correct one for the installation.

6.4 STORAGE

Store the switchboard interior in a clean dry place where it will not be subject to physical damage.

6.5 CLEANING

Clean the switchboard enclosure of all foreign material prior to the installation of the interior. If parts at connection points are splattered with cement, plaster, paint, or other foreign material, remove the foreign material with great care to avoid damage to the plating.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE SWITCHBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE SWITCHBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

6.6 MANUFACTURER'S INSTRUCTIONS

Carefully follow the switchboard manufacturer's instructions.

6.7 INTERIOR INSTALLATION

Install the interior and tighten it securely in the enclosure. Install the section bus connection to the through bus, if needed.

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Section 7
STEPS TO BE TAKEN BEFORE ENERGIZING

7.1 ACCESSIBLE ELECTRICAL CONNECTIONS

Tighten all accessible electrical connections to the manufacturer's torque specifications. If such information is not provided with the equipment, consult the manufacturer.

7.2 BLOCKS OR OTHER TEMPORARY HOLDING MEANS

Remove all blocks or other temporary holding means used for shipment from all component devices and the switchboard interior.

7.3 INTEGRITY OF ALL BUS MOUNTING MEANS

Check the integrity of all bus mounting means.

7.4 ENCLOSURE

Check the enclosure to see that it has not been damaged in such a manner as to reduce electrical spacings.

7.5 OPERATING MECHANISMS

Manually exercise all switches, circuit breakers, and other operating mechanisms to make certain that they operate freely.

Check the integrity of all electrical and mechanical interlocks and padlocking mechanisms. For key interlocked systems, assure that only the required number of keys are accessible to the operator

7.6 ELECTRICAL INSULATION RESISTANCE TEST

Conduct an electrical insulation resistance test to ensure that the switchboard is free from short circuit or ground fault conditions. With the neutral isolated from ground and the switches and circuit breakers open, conduct electrical insulation resistance tests from phase to phase, phase to ground, phase to neutral, and neutral to ground. If the resistance reads less than 1 megohm while testing with the branch circuit devices in the open position, the system may be unsafe and should be investigated. If after the investigation and possible corrections, low readings are still observed, the manufacturer should be contacted. Some electronic equipment (metering, SPD, etc.) may be damaged by this testing. Refer to the manufacturer’s equipment markings for guidelines.

7.7 ELECTRICAL RELAYS, METERS, AND INSTRUMENTATION

Check electrical relays, meters, and instrumentation to determine that connections are made properly and that the devices function properly.

7.8 ELECTRICALLY OPERATED SWITCHES, CIRCUIT BREAKERS, AND OTHER MECHANISMS

With loads disconnected, electrically exercise all electrically operated switches, circuit breakers, and other mechanisms to determine that the devices operate properly. An auxiliary source of control power may be necessary to provide power to the electrical operators.

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7.9 GROUND FAULT PROTECTION SYSTEM

Test the ground fault protection system (if furnished) in accordance with the manufacturer's instructions. See Section 230.95 of the *National Electrical Code*® and NEMA PB 2.2.

7.10 ADJUSTABLE TIME CURRENT TRIP DEVICE SETTINGS

Set any adjustable time current trip device settings to the proper values.

NOTE—Experience has indicated that damage from overcurrent can be reduced if the devices used for overload and short-circuit protection are set to operate instantaneously (that is, without intentional time delay) at 115 percent of the highest value of phase current which is likely to occur as the result of any anticipated motor starting or welding currents.

7.11 FIELD WIRING

Make certain that field wiring is clear of live parts and, when specified by the manufacturer, physically secured to withstand the effects of short circuits.

7.12 GROUNDING CONNECTIONS

Check to determine that all grounding connections are properly made. If the switchboard is used as service equipment, make certain that the neutral, if present, is properly bonded to the cabinet. If there is no ground bus, make certain that the sections of the switchboard which are shipped separately are connected in such a way as to ensure a continuous grounding path.

7.13 FOREIGN MATERIAL

Remove all foreign material from the inside of the switchboard before closing the enclosure.

7.14 COVERS AND DOORS

Install covers, close doors, and make certain that no conductors are pinched and that all enclosure parts are properly aligned and tightened. Hinged covers or doors must open a minimum of 90 degrees when installed.

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Section 8
ENERGIZING EQUIPMENT

WARNING—HAZARDOUS VOLTAGES IN ELECTRICAL EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. ENERGIZING A SWITCHBOARD FOR THE FIRST TIME AFTER INITIAL INSTALLATION OR MAINTENANCE IS POTENTIALLY DANGEROUS.

8.1 QUALIFIED PERSONNEL PRESENT

Only qualified personnel should energize equipment for the first time. If short circuit conditions caused by damage or poor installation practices have not been detected in the checkout procedure specified in Section 7, serious personal injury and damage can occur when the power is turned on.

8.2 NO LOAD ON SWITCHBOARD

There should be no load on the switchboard while it is being energized. Turn off all the downstream loads.

8.3 ENERGIZED IN SEQUENCE

The equipment should be energized in sequence by starting at the source end of the system and working towards the load end. In other words, energize the main devices, then the feeder devices, and then the branch-circuit devices. Turn the devices on with a firm positive motion.

8.4 AFTER ALL MAIN, FEEDER, AND BRANCH CIRCUIT DEVICES HAVE BEEN CLOSED

After all main, feeder, and branch circuit devices have been closed, loads such as lighting circuits, contactors, heaters, and motors may be turned on.

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Section 9
MAINTENANCE

9.1 MAINTENANCE PROGRAM FOR SWITCHBOARDS

A maintenance program for switchboards should be conducted on a regularly scheduled basis in accordance with the following:

9.2 FIELD TEST

A switchboard which has been carrying its regular load for at least 3 hours just prior to inspection should be field tested by feeling the deadfront surfaces of circuit breakers, switches, interior trims, doors, and enclosure sides with the palm of the hand. If the temperature of these surfaces does not permit you to maintain contact for at least 3 seconds, this may be an indication of trouble and investigation is necessary. Thermographic (infrared) scanning has become a useful method of investigating thermal performance.

WARNING—HAZARDOUS VOLTAGES IN ELECTRICAL EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. UNLESS OTHERWISE SPECIFIED, INSPECTION AND MAINTENANCE SHOULD ONLY BE PERFORMED ON SWITCHBOARDS TO WHICH POWER HAS BEEN TURNED OFF, DISCONNECTED AND ELECTRICALLY ISOLATED SO THAT NO ACCIDENTAL CONTACT CAN BE MADE WITH ENERGIZED PARTS. FOLLOW ALL MANUFACTURER'S WARNINGS AND INSTRUCTIONS.

Safety related work practices, as described in NFPA 70E, should be followed at all times.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE SWITCHBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE SWITCHBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

9.3 SWITCHBOARD INSPECTION ONCE EACH YEAR

Inspect the switchboard once each year or after any severe short circuit.

9.4 ACCUMULATION OF DUST AND DIRT

If there is an accumulation of dust and dirt, clean out the switchboard by using a brush, vacuum cleaner, or clean lint-free rags. Avoid blowing dust into circuit breakers or other components. Do not use a blower or compressed air.

9.4.1 All Visible Electrical Joints and Terminals

Carefully inspect all visible electrical joints and terminals in the bus and wiring system.

9.4.2 All Conductors and Connections

Visually check all conductors and connections to be certain that they are clean and secure. Loose and/or contaminated connections increase electrical resistance which can cause overheating. Such overheating is indicated by discoloration or flaking of insulation and/or metal parts. Pitting or melting of connecting surfaces is a sign of arcing due to a loose, or otherwise poor connection. Parts which show evidence of overheating or looseness should be cleaned and re-torqued or replaced if damaged. Tighten bolts and nuts at bus joints to manufacturer's torque specifications.

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CAUTION—DO NOT REMOVE PLATING FROM ALUMINUM PARTS IN JOINTS OR TERMINATIONS. DAMAGE TO PLATING CAN RESULT IN OVERHEATING. REPLACE DAMAGED ALUMINUM PARTS.

9.4.3 Fuse Clip Contact Pressure and Contact Means

Examine fuse clip contact pressure and contact means. If there is any sign of overheating or looseness follow the manufacturer's maintenance instructions or replace the fuse clips. Loose fuse clips can result in overheating.

9.4.4 All Conditions Which Caused Overheating

Be sure that all conditions which caused the overheating have been corrected.

9.5 PROPER AMPERE, VOLTAGE, AND INTERRUPTING RATINGS

Check circuit breakers, switches, and fuses to ensure they have the proper ampere, voltage, and interrupting ratings. Ensure that non-current-limiting devices are not used as replacements for current-limiting devices. Never attempt to defeat rejection mechanisms which are provided to prevent the installation of the incorrect class of fuse.

9.5.1 All Mechanisms Are Free and in Proper Working Order

Operate each switch or circuit breaker several times to ensure that all mechanisms are free and in proper working order. Replace as required. See NEMA AB 4 for maintenance of molded case circuit breakers.

9.6 OPERATION OF ALL MECHANICAL COMPONENTS

Check the operation of all mechanical components. Replace as required.

9.6.1 Full On and Off Positions

Exercise switch operating mechanisms and external operators for circuit breakers to determine that they operate freely to their full on and off positions.

9.6.2 Integrity of Electrical and Mechanical Interlocks

Check the integrity of all electrical and mechanical interlocks and padlocking mechanisms. For key interlocked systems, assure that only the required number of keys are accessible to the operator.

9.6.3 Missing or Broken Parts

Whenever practical, check all devices for missing or broken parts, proper spring tension, free movement, corrosion, dirt, and excessive wear.

9.6.4 Manufacturer's Instructions

Adjust, clean, and lubricate or replace parts according to the manufacturer's instructions.

9.6.4.1 Clean, Nonmetallic, Light, Grease or Oil

Use clean, nonmetallic, light grease or oil as instructed.

9.6.4.2 Molded Case Circuit Breakers

Do not oil or grease parts of molded case circuit breakers.

9.6.4.3 Lubrication with Clean, Light Grease

If no instructions are given on the devices, sliding copper contacts, operating mechanisms, and interlocks, they may be lubricated with clean, light grease.

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9.6.4.4 Excess Lubrication

Wipe off excess lubrication to avoid contamination.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE SWITCHBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE SWITCHBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

9.6.5 Readily Accessible Copper Electrical Contacts, Blades, and Jaws

Clean and dress readily accessible copper electrical contacts, blades, and jaws according to the manufacturer's instructions when inspection indicates the need.

9.7 DETERIORATED INSULATING MATERIAL AND ASSEMBLIES

Look for and replace deteriorated insulating material and assemblies where sealing compounds have melted.

9.8 MOISTURE OR SIGNS OF PREVIOUS WETNESS

Look for any moisture or signs of previous wetness or dripping inside the switchboard.

NOTE—Condensation in conduits or dripping from outside sources is one known cause of switchboard malfunction.

9.8.1 Conduits Which Have Dripped Condensate

Seal off any conduits which have dripped condensate, and provide means for further condensate to drain away from the switchboard.

9.8.2 Cracks or Openings

Seal off any cracks or openings which have allowed moisture to enter the enclosure. Eliminate the source of any dripping on the enclosure and any other source of moisture.

9.8.3 Insulating Material Which is Damp

Replace or thoroughly dry and clean any insulating material which is damp or wet or shows an accumulation of deposited material from previous wettings.

9.8.4 Moisture Damaged Component Device

Inspect all component devices. Replace any component device which shows evidence of moisture damage or has been subjected to water damage or flooding. Additional information may be found in the NEMA document “Guidelines for Handling Water Damaged Electrical Equipment”.

9.9 WATER DAMAGE

In the event of water damage, e.g., flooding or sprinkler discharge, the manufacturer should be consulted before clean up and corrective action is attempted.

9.10 SEVERE ELECTRICAL SHORT CIRCUIT

If a severe electrical short circuit has occurred, the excessive currents may have resulted in structural component and/or bus and conductor damage due to mechanical distortion, thermal damage, metal deposits, or smoke. Examine all devices and bus supports for cracks or breakage. The manufacturer should be consulted before clean up and correction is attempted.

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9.11 GROUND FAULT PROTECTION SYSTEM

Test the ground fault protection system (if furnished) in accordance with the manufacturer's instructions. See Section 230.95 of the *National Electrical Code*® and NEMA Standards Publication PB 2.2.

9.12 INSULATION RESISTANCE

Check insulation resistance (See 7.6) under any of the following conditions:

a. If a severe short circuit has occurred. (See 9.10)
b. If it has been necessary to replace parts or clean insulating surfaces
c. If the switchboard has been exposed to high humidity, condensation, or dripping moisture.

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Section 10
PERMISSIBLE LOADING OF SWITCHBOARDS

10.1 SWITCHBOARDS WITHOUT MAIN OVERCURRENT PROTECTIVE DEVICES

For switchboards without main overcurrent protective devices (main lug switchboard), the total continuous load current through the supply bus should not exceed the current rating of the switchboard.

10.2 SWITCHBOARDS WITH A SINGLE MAIN OVERCURRENT PROTECTIVE DEVICE

For switchboards with a single main overcurrent protective device, the total continuous load current on the protective device should not exceed 80 percent of its ampere rating unless the device is rated to carry 100 percent of its ampere rating.

10.3 SWITCHBOARDS WITH A MULTIPLE MAIN OVERCURRENT PROTECTIVE DEVICE

For switchboards with a multiple main overcurrent protective devices, the total continuous current through the supply bus should not exceed the current rating of the switchboard. The total continuous load current on each main overcurrent protective device should not exceed 80 percent of its ampere rating unless the device is rated to carry 100 percent of its ampere rating.

10.4 FEEDER AND BRANCH CIRCUIT OVERCURRENT PROTECTIVE DEVICES IN SWITCHBOARDS

For feeder and branch circuit overcurrent protective devices in switchboards, the total continuous load current on the overcurrent protective device should not exceed 80 percent of its ampere rating unless the device is rated to carry 100 percent of its ampere rating.

10.5 HARMONICS IN THE ELECTRICAL SYSTEM

Some types of electrical equipment cause harmonics in the electrical system which may result in overheating. This condition should be considered when determining switchboard loading.

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Surgelogic™
Internal Modular Assembly (IMA)
Surge Protective Device (SPD)

Dispositif de protection contre les surtensions transitoires (SPD) de type assemblage modulaire interne (IMA)

ENGLISH

Instruction Bulletin

8222-0050, Rev. 01 06/2016

Retain for future use.



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Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

⚠ CAUTION

LOSS OF BRANCH CIRCUIT POWER/LOSS OF SURGE SUPPRESSION

- Perform periodic inspection of the Surge Protective Device status indicator lights as part of the preventative maintenance schedule.
- Promptly service the Surge Protective Device when an alarm state exists.
- Use dry contacts to signal an alarm state to the central supervisory system for unmanned, inaccessible, or critical installations.
- Use multiple Surge Protective Devices to achieve redundancy for critical applications.

Failure to follow these instructions can result in injury or equipment damage.

At end-of-life conditions, Surge Protective Devices (SPDs) can lose their ability to block power system voltage and attempt to draw excessive current from the line. This SPD is equipped with overcurrent and overtemperature components that disconnect the surge suppression elements from the electrical supply should the surge suppression elements reach end of life. Tripping of the branch circuit breaker or fuse feeding the SPD can occur when the surge suppression elements reach end of life.

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⚠ CAUTION

LOSS OF SURGE SUPPRESSION

- Do not energize the Surge Protective Devices until the electrical system is completely installed, inspected, tested, and all conductors have been connected and functional, including the neutral.
- Verify the voltage rating of the device and system before energizing the Surge Protective Device.
- Perform high-potential insulation testing, or any other tests where Surge Protective Device components will be subjected to voltages higher than their rated turn-on voltage, with the neutral and Surge Protective Device disconnected from the power source.

Failure to follow these instructions can result in injury or equipment damage.

Introduction

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

Note: For troubleshooting, call the Surgelogic Technical Assistance Group at 1-800-577-7353.

Proper installation is imperative to maximize the IMA SPD's effectiveness and performance. Follow the steps outlined in this instruction bulletin to ensure proper installation. Read the entire instruction bulletin before beginning the installation. These instructions are not intended to replace national or local electrical codes. Check all applicable electrical codes to verify compliance. Installation of IMA surge suppressors should only be performed by qualified electrical personnel.

Unpacking and Preliminary Inspection

Inspect the entire shipping container for damage or signs of mishandling before unpacking the device. Remove the packing material and further inspect the device for any obvious shipping damage. If any damage is found and is a result of shipping or handling, immediately file a claim with the shipping company.

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Storage

The device should be stored in a clean, dry environment. Storage temperature is -40 °F to +149 °F (-40°C to +65°C). All of the packaging materials should be left intact until the device is ready for installation.

Safety Labels

English, Spanish, and French versions of all safety labels (Danger, Warning, and Caution) are provided.

Location Considerations

Environment

The device is designed to operate in an ambient temperature range of -4 °F to +149 °F (-20°C to +65°C) with a relative humidity of 0 to 95% non-condensing. The operating temperature of the LCD on the diagnostic display panel is +14 °F to +140 °F (-10°C to +60°C). Refer to the product catalog for further details on enclosures. All IMA devices operate normally without reduction in performance when subjected to shock and vibrations described in IEC 60721-3-3, Class 3M4.

Audible Noise

The device background noise is negligible and does not restrict the location of the installation.

Mounting

Refer to page 13 for typical mounting dimensions.

Service Clearance

The service clearance should meet all applicable code requirements.

Equipment Performance

To obtain the maximum system performance, locate the device as close to the circuit being addressed as possible, to minimize the interconnecting wiring length. For every foot of wire length, approximately 160 Volts (6 kV / 3 kA, 8/20 microsecond) is added to the suppressed voltage. The Voltage Protection Rating (VPR) is located on the device nameplate and is measured six inches from the enclosure sidewall, according to UL® 1449.

Electrical

Voltage Rating

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Confirm the Surge Protective Device voltage rating on the module or nameplate label is the same as the operating voltage.

Failure to follow these instructions will result in death or serious injury.

Prior to mounting the SPD, verify that the device has the same voltage rating as the power distribution system in which it is installed. Compare the nameplate voltage on the SPD with the nameplate voltage of the electrical distribution equipment.

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The specifier or user of the device must be familiar with the configuration and arrangement of the power distribution system in which any SPD is to be installed. The system configuration of any power distribution system is based strictly on how the secondary windings of the transformer supplying the service entrance main or load are configured. This includes whether or not the transformer windings are referenced to earth via a grounding conductor. The system configuration is not based on how any specific load or equipment is connected to a particular power distribution system. See Table 1 for the service voltage of each SPD.

Table 1: Voltage Rating

Service Voltage	Peak Surge Current Rating Per Phase	Catalog Numbers [1]
120/240 V, 1-phase, 3-wire + ground	120	TVS1IMA12_
	160	TVS1IMA16_
	240	TVS1IMA24_
	320	TVS1IMA32_
	480	TVS1IMA48_
208Y/120 V, 3-phase, 4-wire +ground Wye [2]	120	TVS2IMA12_
	160	TVS2IMA16_
	240	TVS2IMA24_
	320	TVS2IMA32_
	480	TVS2IMA48_
240/120 V, 3-phase, 4-wire + ground High-Leg Delta	120	TVS3IMA12_
	160	TVS3IMA16_
	240	TVS3IMA24_
	320	TVS3IMA32_
	480	TVS3IMA48_
480Y/277 V, 3-phase, 4-wire + ground Wye [3]	120	TVS4IMA12_
	160	TVS4IMA16_
	240	TVS4IMA24_
	320	TVS4IMA32_
	480	TVS4IMA48_
480 V, 3-phase, 3-wire + ground Delta [4]	100	TVS5IMA10_
	120	TVS5IMA12_
	160	TVS5IMA16_
	200	TVS5IMA20_
	240	TVS5IMA24_
	320	TVS5IMA32_
	480	TVS5IMA48_
240 V, 3-phase, 3-wire + ground Delta	100	TVS6IMA10_
	120	TVS6IMA12_
	160	TVS6IMA16_
	200	TVS6IMA20_
	240	TVS6IMA24_
	320	TVS6IMA32_
	480	TVS6IMA48_
600/347 V, 3-phase, 4-wire + ground Wye	120	TVS8IMA12_
	160	TVS8IMA16_
	240	TVS8IMA24_
	320	TVS8IMA32_
	480	TVS8IMA48_

Continued–

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Table 1: Voltage Rating

600 V, 3-phase, 3-wire + ground Delta [5]	100	TVS9IMA10_
	120	TVS9IMA12_
	160	TVS9IMA16_
	180	TVS9IMA18_
	200	TVS9IMA20_
	240	TVS9IMA24_
	320	TVS9IMA32_

1 Catalog numbers are representational. Actual catalog numbers require a suffix to indicate UL Type.

2 208Y/120 series also applies to the following voltage 220Y/127.

3 480Y/277 series applies to the following voltages 380Y/220, 400Y/230 and 415Y/240.

4 480 V Delta series also applies to the following voltages: 480Y/277V HRG.

5 600 V Delta series also applies to the following voltages: 600Y/347V HRG.

Terminals, Wire Size, and Installation Torque

Terminals are provided for phase (line), neutral, and equipment ground connections. The IMA terminals accept a range of 12 AWG to 2 AWG copper wire for phase, neutral, and ground connectors.

Table 2: Terminal Torque

Power Connection	Torque
AØ, BØ, CØ and N	35 lb-in. (4 N•m)
Ground	

Branch Circuit Overcurrent Protection

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Use conductors rated for the Overcurrent Protection Device (OCPD) per applicable codes.
- Use conductors rated for the application per applicable codes.

Failure to follow these instructions will result in death or serious injury.

UL 1449 Type 1 SPDs have been designed and approved for line side applications prior to the main service disconnect without supplemental overcurrent protection. Type 2 SPDs must be installed on the load side of the main Overcurrent Protection Device (OCPD). All installations should either provide or include a disconnecting means.

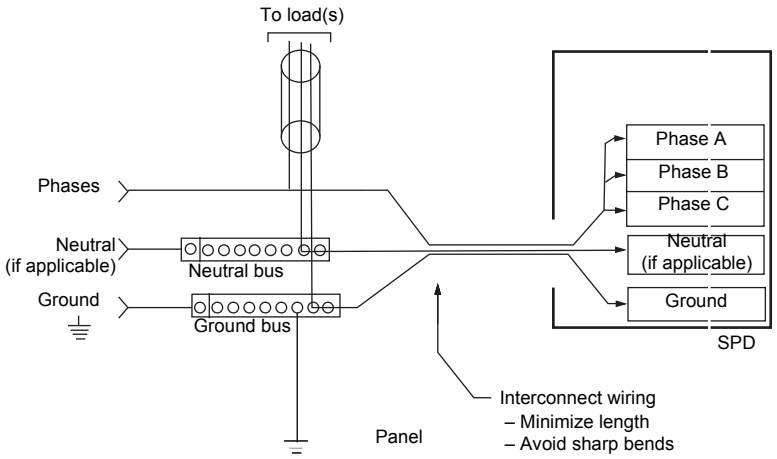
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Location of Surge Protective Device (SPD)

Locate the SPD as close as possible to the circuit being addressed to minimize the wire length and optimize SPD performance. Avoid long wire runs so that the device will perform as intended. To reduce the impedance that the wire displays to surge currents, the phase, neutral, and ground conductors must be routed within the same conduit and tightly bundled or twisted together to optimize device performance. Avoid sharp bends in the conductors. See Figure 1.

Figure 1: Surge Protective Device Wiring Practice



Grounding

⚠ WARNING

HAZARDOUS TOUCH VOLTAGE

- Connect the Surge Protective Device ground terminal to the building grounding grid structure.
- Use an appropriately sized equipment grounding conductor.
- When using metallic raceway or conduit:
  - — Do not use isolation bushings to interrupt the metallic raceway or conduit.
  - — Maintain electrical continuity at all raceway and conduit connections using appropriate bonding devices.
- Do not use a separate isolated ground for the Internal Modular Assembly device.
- Verify proper equipment connection to the grounding system.
- Verify ground grid continuity by performing regularly scheduled inspections and testing as part of a comprehensive electrical maintenance program.

Failure to follow these instructions can result in death or serious injury.

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General

The IMA has SPD elements connected from phase to ground. It is critical that there be a robust and effective connection to the building grounding structure. The grounding connection must utilize an equipment grounding conductor run with the phase and neutral connection of the power system. Do not connect the SPD to a separate isolated ground.

For best overvoltage suppression by the IMA SPD, use a single-point ground system where the service entrance grounding electrode system is connected to, and bonded to, all other available electrodes, building steel, metal water pipes, driven rods, etc. (for reference, see NEC Art 250). The ground impedance measurement of the electrical system should be as low as possible and in compliance with all applicable codes.

Power System Grounding

In addition to the power system configuration and voltage, the power system grounding method must be considered when selecting the appropriate IMA device. Refer to the following chart for information concerning the suitability of IMA device to specific power system grounding method.

Table 3: Grounding Methods

IMA Device Catalog Number	Power System Grounding Method
TVS1IMA__	Solidly-Grounded
TVS2IMA__	
TVS3IMA__	
TVS4IMA__	
TVS8IMA__	
TVS5IMA__	Ungrounded / HRG
TVS6IMA__	
TVS9IMA__	

Solidly-Grounded Power Systems

⚠CAUTION

SURGE PROTECTIVE DEVICE DAMAGE AND POWER SYSTEM OVERVOLTAGE

- Do not connect devices rated for use on solidly-grounded power systems to resistance-grounded (for example, High Resistance Ground) or ungrounded power systems.
- Verify that the service entrance equipment is bonded to ground in accordance with all applicable codes.
- Verify that the neutral terminal of the power system transformer feeding the device is bonded to system ground in accordance with all applicable codes.

Failure to follow these instructions can result in equipment damage.

SPDs rated for use on solidly-grounded power systems must not be connected to resistance-grounded or ungrounded power systems. Such a connection can result in damage to the SPD.

Always verify the power system grounding configuration prior to application of power to the device. Confirm that all ground bonds are installed at both the service entrance equipment and power system transformer prior to application of power.

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Delta and Resistance-Grounded Power Systems

⚠ CAUTION

SURGE PROTECTIVE DEVICE DAMAGE AND POWER SYSTEM OVERVOLTAGE

- Ungrounded power systems are inherently unstable and can produce excessively high line-to-ground voltages during certain fault conditions. During these fault conditions any electrical equipment, including an SPD, may be subjected to voltages which exceed their designed ratings. This information is being provided to the user so that an informed decision can be made before installing any electrical equipment on an ungrounded power system.
- Resistance-grounded power systems must be maintained in an over-damped state to limit voltage overshoot and duration during operation.
- Verification and adjustment of correct power system damping should be done:
  - — Periodically as part of normal system maintenance.
  - — Following power system modifications.

Failure to follow these instructions can result in equipment damage.

The IMA product is intended for use on resistance-grounded power systems where the power system has been set for, and is maintained in, an over-damped state. For the power system to be over-damped, the current through the grounding resistor during a bolted phase-to-ground fault must be significantly greater than the total charging current of the system.

Periodic engineering evaluation of the power system is required to determine the worst-case charging current of the system and to adjust the grounding resistance accordingly. As the power system is modified, the value of the grounding resistor must be evaluated and adjusted to maintain the system in the over-damped state.

Installation

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

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UL Conditions of Acceptability

For use only in equipment where the acceptability of the combination is determined by Underwriters Laboratories®. When installed in the end-use equipment, the following are among the considerations to be made:

1. A suitable electrical enclosure shall be provided in the end-use product.
2. The device is intended for factory wiring only with the suitability of the connections (including spacings between factory connectors) determined in the end-use application.
3. Voltage Protection Rating (VPR) shall be determined in the end-product where applicable.
4. The SPD unit has been subjected to the following tests of UL1449:
   a. Surge Testing (VPR)
   b. Nominal Discharge Test (20 kA)
   c. Operational Voltage Test
   d. Dielectric Voltage Withstand
   e. Current Tests (Short Circuit Current, Intermediate Currents, Limited Currents)
5. The component SPD has been evaluated to Short Circuit Rating tests (SCCR), per UL 1449) at 200 kA rms available fault current, without external Overcurrent Protective Devices (OCPD) or external enclosures.

Wiring

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Confirm the Surge Protective Device voltage rating on the module or nameplate label is the same as the operating voltage.

Failure to follow these instructions will result in death or serious injury.

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Follow the steps listed below when making wiring connections:

1. Turn off all power supplying this equipment before working on or inside any enclosure containing this equipment.
2. Confirm the SPD voltage rating and configuration is the same as the system voltage and power system configuration to which it will be connected.
3. Identify proper location for surge protective device. Locate as close as possible to the panel being addressed so the wires are as short as possible. Mount unit securely.

   Note: The surge protective device must be installed in an accessible location as described in the NEC.
4. Install in accordance with national and local electrical codes for overcurrent protection recommendations and wire ampacity considerations.

   Note: The neutral connection is not present on three-wire, three-phase wye ground or two-wire single-phase mid-point ground power systems. For these systems, bond the neutral and ground lugs together in the SPD. For a High Resistance Ground (HRG) or Delta SPD, no neutral connection exists. For installation wiring see Figures 6 and 7.

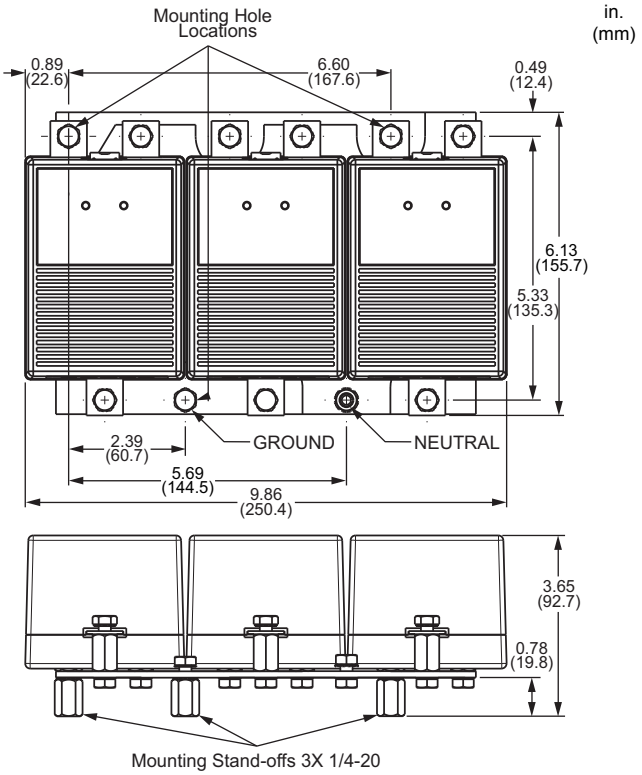
   Note: See Terminals, Wire Size, and Installation Torque and Table 2 on page 7 for acceptable wire size and installation torque.
5. Twist conductors ½ turn or more for every twelve inches of length. Do not loop or coil wires. Be sure to maintain adequate wire bending space per NEC.
6. If the remote signaling contacts of the diagnostic display panel are to be used, refer to the section, “Dry Contacts”, on page 18 for wiring instructions.
7. On a High-Leg Delta installation, note the high leg connection per wiring diagram. See Figure 5.
8. Replace all devices, doors and covers before turning on power to the equipment. If the SPD is properly installed and functioning, the green LED indicators on the display will be lit.

For questions pertaining to the installation of this device, contact the Surgelogic Technical Assistance Group at 1-800-577-7353.

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Figure 2: Dimensions and Mounting



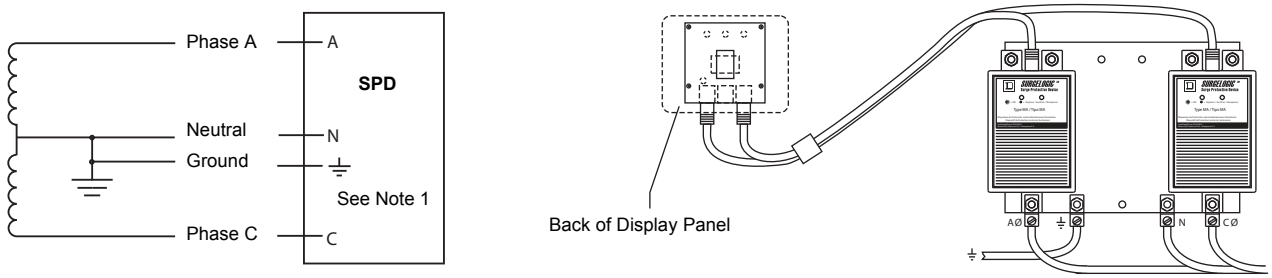
Note: The neutral connection will not be present on Delta and HRG configurations.

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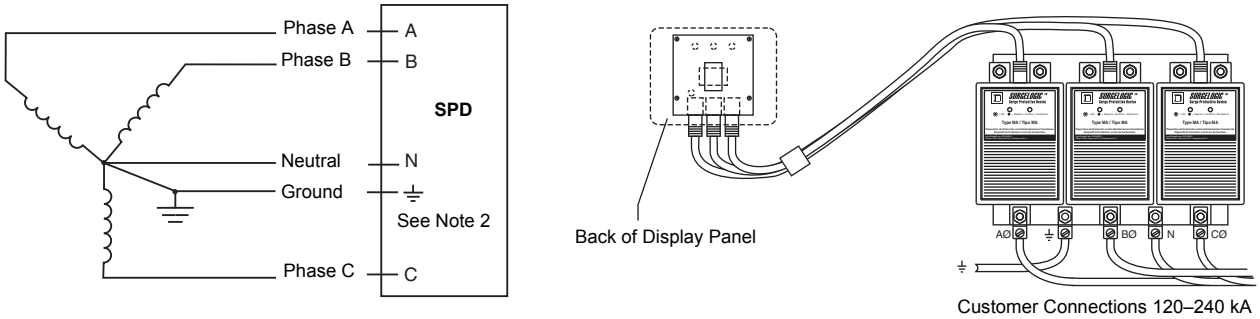
Wiring Diagrams

Figure 3: Single-Phase, Three-Wire, Grounded Installation Integral Switch



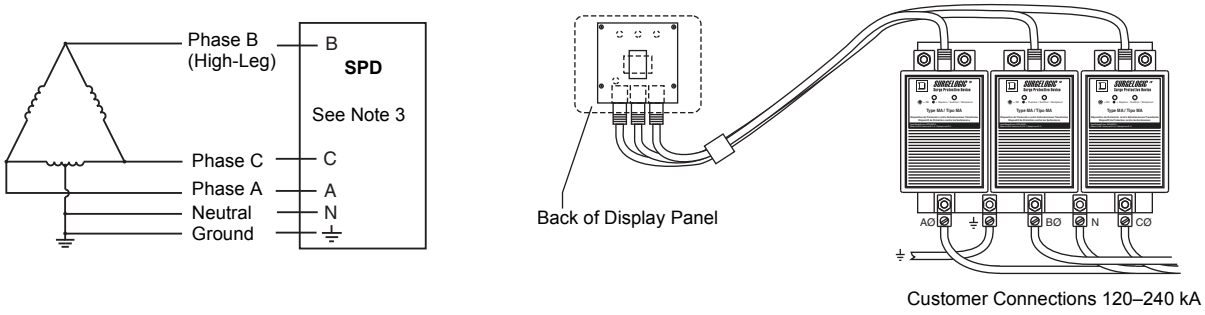
Note 1: The neutral conductor may not be present on three-wire, grounded neutral power systems. For these systems, tie the neutral and ground lugs on the SPD together.

Figure 4: Three-Phase, Three- or Four-Wire, Grounded Wye Installation



Note 2: The neutral conductor is not present on three-wire, grounded neutral power systems. For these systems tie the neutral and ground lugs of the SPD together.

Figure 5: Three-Phase, Three- or Four-Wire, High-Leg Delta Installation



Note 3: The high-leg of the power system must connect to phase B of the SPD. The neutral conductor is not present on three-wire, grounded neutral power systems. For these systems tie the neutral and ground lugs on the SPD together.

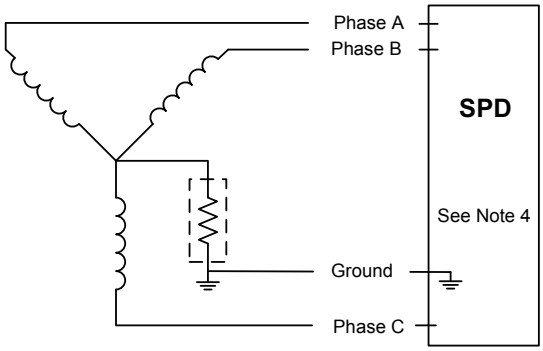
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Wiring Diagrams for HRG and Delta Systems

Figure 6: High Resistance Ground (HRG) Wye Installation

Note 4: The neutral conductor is not present on HRG wye grounded power systems.



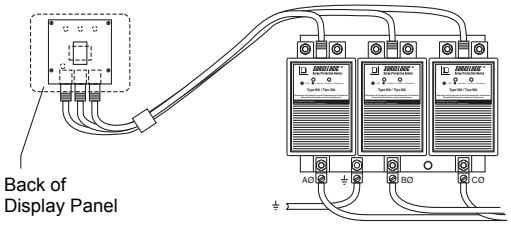
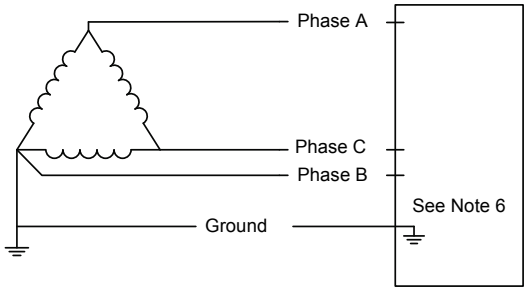


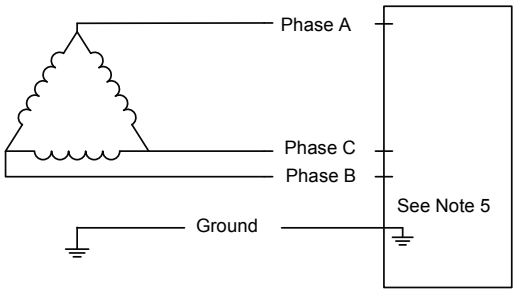
Figure 7: Three-Phase Three-Wire + Ground, Delta Installation

Note 5: The ground connection of the Delta SPD shall be connected to the system ground conductor. The neutral conductor is not present on Delta systems.

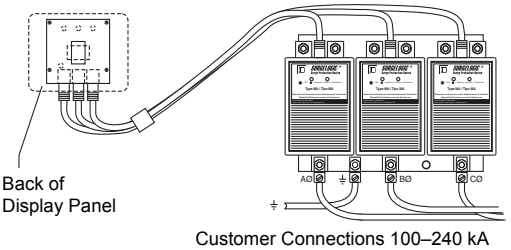
Corner Grounded Delta



Ungrounded Delta



Note 6: The ground connection of the Delta SPD shall be connected to the system ground conductor. The neutral conductor is not present on Delta systems. Phase B of the electrical system is typically the grounded phase.



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Operation

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

LED Status Indicators

The SPD diagnostic display panel shows the status of each MA module with diagnostically controlled green/red LEDs (see Figure 8). If a unit is operating correctly, all of the phase LEDs will be illuminated green. To test the integrity of the diagnostics for each phase, push the button below the phase LEDs on the diagnostic display panel. The green LED will turn red and the alarm will sound, if the alarm is enabled. Releasing the test button will complete the test; the red LED will turn green and the alarm will shut off.

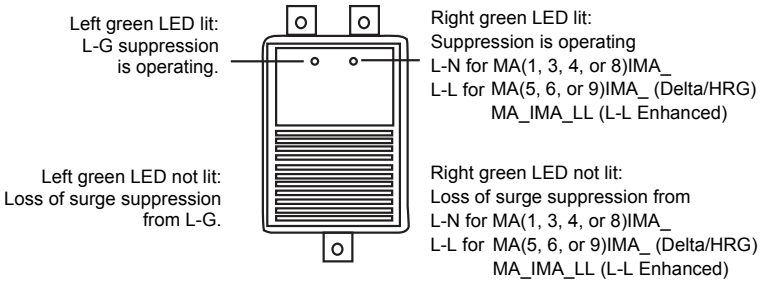
If an inoperable condition occurs on any phase, the audible alarm sounds and the corresponding phase LED on the diagnostic display panel is illuminated red. This indicates that the device needs service by qualified electrical personnel. The audible alarm can be silenced, until a qualified person is able to evaluate and service the SPD, by pressing the alarm enable/disable button. The alarm will silence and the green alarm LED will not be lit. The red phase LED will continue to be illuminated until the inoperative condition had been cleared.

On an MA module (see Figure 8), if either LED is not lit, the module should be replaced. If both green LEDs are not lit and the diagnostic display panel has power, then power has been lost to that phase or the module should be replaced (refer to Table 2 on page 7). Refer to the final equipment instruction bulletin for MA module disconnection and access instructions.

When power is applied to the SPD and one or more of the diagnostic display panel LEDs are red, and one or more MA module LEDs are out, the appropriate MA module should be replaced. Refer to “Maintenance and Troubleshooting” on page 21 for proper troubleshooting procedures and Table 5 for replacement modules. If the module LEDs are green and the diagnostic display LEDs are red, please call the Surgelogic Technical Assistance Group at 1-800-577-7353.

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Figure 8: MA Module LEDs



Replacement Modules

Table 4: IMA Replacement Modules

System Voltage	Peak Surge Current Rating (kA)	Catalog Numbers[1]		
		Phase A	Phase B	Phase C
120/240 V, 1-phase, 3-wire + ground	120 160 240	MA1IMA12_ MA1IMA16_ MA1IMA24_	— — —	MA1IMA12_ MA1IMA16_ MA1IMA24_
208Y/120 V, 3-phase, 4-wire + ground Wye [2]	120 160 240	MA1IMA12_ MA1IMA16_ MA1IMA24_	MA1IMA12_ MA1IMA16_ MA1IMA24_	MA1IMA12_ MA1IMA16_ MA1IMA24_
120/240 V, 3-phase, 4-wire + ground High-Leg Delta [3]	120 160 240	MA1IMA12_ MA1IMA16_ MA1IMA24_	MA3IMA12_ MA3IMA16_ MA3IMA24_	MA1IMA12_ MA1IMA16_ MA1IMA24_
240 V, 3-phase, 3-wire + ground Delta	120 160 240	MA6IMA12_ MA6IMA16_ MA6IMA24_	MA6IMA12_ MA6IMA16_ MA6IMA24_	MA6IMA12_ MA6IMA16_ MA6IMA24_
480Y/277 V, 3-phase, 4-wire + ground Wye [4]	120 160 240	MA4IMA12_ MA4IMA16_ MA4IMA24_	MA4IMA12_ MA4IMA16_ MA4IMA24_	MA4IMA12_ MA4IMA16_ MA4IMA24_
480 V, 3-phase, 3-wire + ground Delta [5]	120 160 240	MA5IMA12_ MA5IMA16_ MA5IMA24_	MA5IMA12_ MA5IMA16_ MA5IMA24_	MA5IMA12_ MA5IMA16_ MA5IMA24_
600Y/347 V, 3-phase, 4-wire + ground Wye	120 160 240	MA8IMA12_ MA8IMA16_ MA8IMA24_	MA8IMA12_ MA8IMA16_ MA8IMA24_	MA8IMA12_ MA8IMA16_ MA8IMA24_
600 V, 3-phase, 3-wire + ground Delta [6]	120 160 180	MA9IMA12_ MA9IMA16_ MA9IMA18_	MA9IMA12_ MA9IMA16_ MA9IMA18_	MA9IMA12_ MA9IMA16_ MA9IMA18_

1 Catalog numbers are representational. Actual catalog numbers require a suffix to indicate UL Type.

2 208Y/120 series also applies to the following voltage 220Y/127.

3 High-Leg Delta (Phase B modules are different than Phase A and Phase C modules).

4 480Y/277 series applies to the following voltages 380Y/220, 400Y/230 and 415Y/240.

5 480 V Delta series also applies to the following voltages: 480Y/277V HRG.

6 600 V Delta series also applies to the following voltages: 600Y/347V HRG.

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Table 5: Replacement Diagnostic Cables

TVS19PCK	Three 19 in. (48.3 cm) cables
TVS36PCK	Three 36 in. (91.4 cm) cables
TVS60PCK	Three 60 in. (152.4 cm) cables
TVS192PCK	Three 192 in. (487.7 cm) cables

Audible Alarm

Push the alarm enable/disable button to enable or disable the alarm (see Figure 9). If the green alarm LED is lit the alarm is enabled. If the green alarm LED is not lit the alarm is disabled.

Surge Counter

The surge counter displays the number of transient voltage surges since the counter was last reset. The counter is battery powered to retain memory in the event of a power loss to the IMA module. To reset the surge counter, remove all power and press the small switch located inside the unit on the underside of the diagnostic circuit board near the diagnostic display connectors (also refer to Figure 10). This will reset the counter to zero.

Dry Contacts

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Use 600 V ac rated dry contact wiring.
- Dry contact wiring must have less than 1/16 in. (1.6 mm) exposed wire from the dry contact block.
- Maintain at least 1.0 in. (25 mm) separation between dry contact wiring and the power wiring in the enclosure.

Failure to follow these instructions will result in death or serious injury.

The IMA series SPD is provided with dry contacts. The connection for the dry contacts is located on the back of the diagnostic display panel, (lower right corner, refer to Figure 10), and will accept 22 AWG (0.33 mm^2) to 14 AWG (2.1 mm^2) stranded or solid wire. The dry contacts are three-position, Form “C” type with Normally Open, Normally Closed, and Common connections.

In the unpowered state the contact is closed between terminals NC and COM. This is also the alarm condition. The opposite state, closed between terminals NO and COM, indicates that power is on to the unit and that no alarm condition exists (See Table 6).

These contacts can be used for remote indication of the SPD’s operating status to a computer interface board or emergency management system. Also, these contacts are designed to work with the SPD remote monitor option described in the next section.

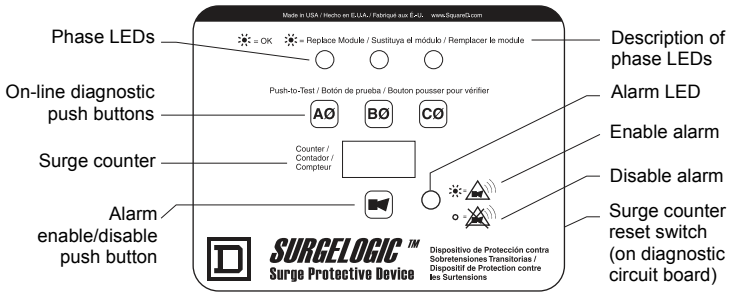
Table 6: Dry Contact Configuration

Alarm Contact Terminals	Contact State with Power Applied
NO to COM	Closed
NC to COM	Open

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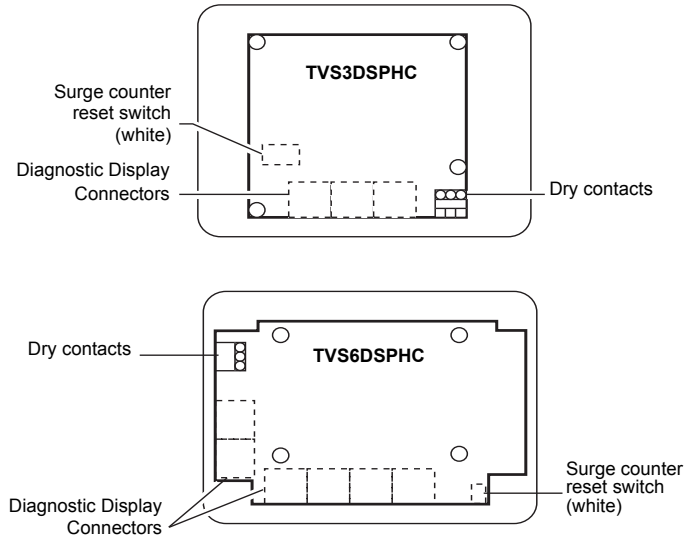
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Figure 9: Three-Phase Diagnostic Display Panel with Surge Counter



Note: Phase B is not present on single-phase applications.

Figure 10: Rear of Diagnostic Circuit Board



Care must be taken when installing the dry contact wiring because the terminals are on a moving door. Avoid the door hinge, any switches, and the high voltage areas of the enclosure when routing the wiring. To avoid the door hinge, tie wrap any dry contact wiring to the existing cable harness which crosses the hinge. Once the dry contact wiring is secured on a non-moving point of the enclosure, it is the user's responsibility to maintain at least 1.0 in. (25 mm) separation between 600 V ac rated dry contact wiring and the power wiring in the enclosure.

The dry contacts are designed for a maximum voltage of 24 V dc / 24 V ac and a maximum current of 2 A. Higher energy applications may require additional relay implementation outside the SPD. Damage to the SPD relay caused by use with energy levels in excess of those discussed in this instruction bulletin are not covered by warranty. For application questions, contact the Surgelogic Technical Assistance Group at 1-800-577-7353.

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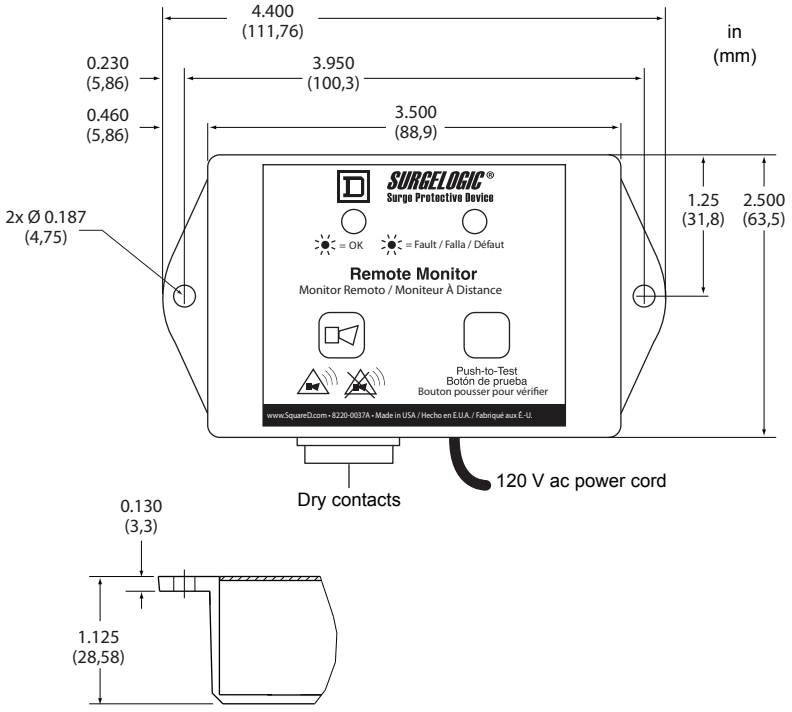
Remote Monitor Option

The remote monitor option has two LEDs, one red and one green, and an audible alarm with an enable/disable switch. Normal status is a lit green LED, and no audible alarm. To test the integrity of the remote monitor, press the push-to-test switch. If the alarm is enabled, the green LED will turn off, the red LED will turn on, and the alarm will sound. Releasing the switch will complete the test; the red LED will turn off, the green LED will turn on and the alarm will shut off.

If suppression on any phase is lost, the green LED will turn off, the red LED will turn on and an alarm will sound. The audible alarm can be silenced by pushing the alarm enable/disable button. The alarm will silence and the green alarm LED will not be lit. The red LED will continue to be illuminated until the inoperative condition has been cleared.

The remote monitor includes a 120 V ac to 12 V dc adapter with a six-foot power cord. Connections are made to the SPD diagnostic panel with Form “C”, three-position dry contacts (provided) and the appropriate length of solid or stranded 22 AWG (0.33 mm^2) to 14 AWG (2.1 mm^2) not provided.

Figure 11: Remote Monitor Option (TVS12RMU)



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Maintenance and Troubleshooting

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

Preventative Maintenance

Inspect the SPD periodically to maintain reliable system performance and continued transient voltage surge suppression. Periodically check the state of the diagnostic display panel LED status indicators. Routinely use the built-in diagnostics to inspect for inoperative modules.

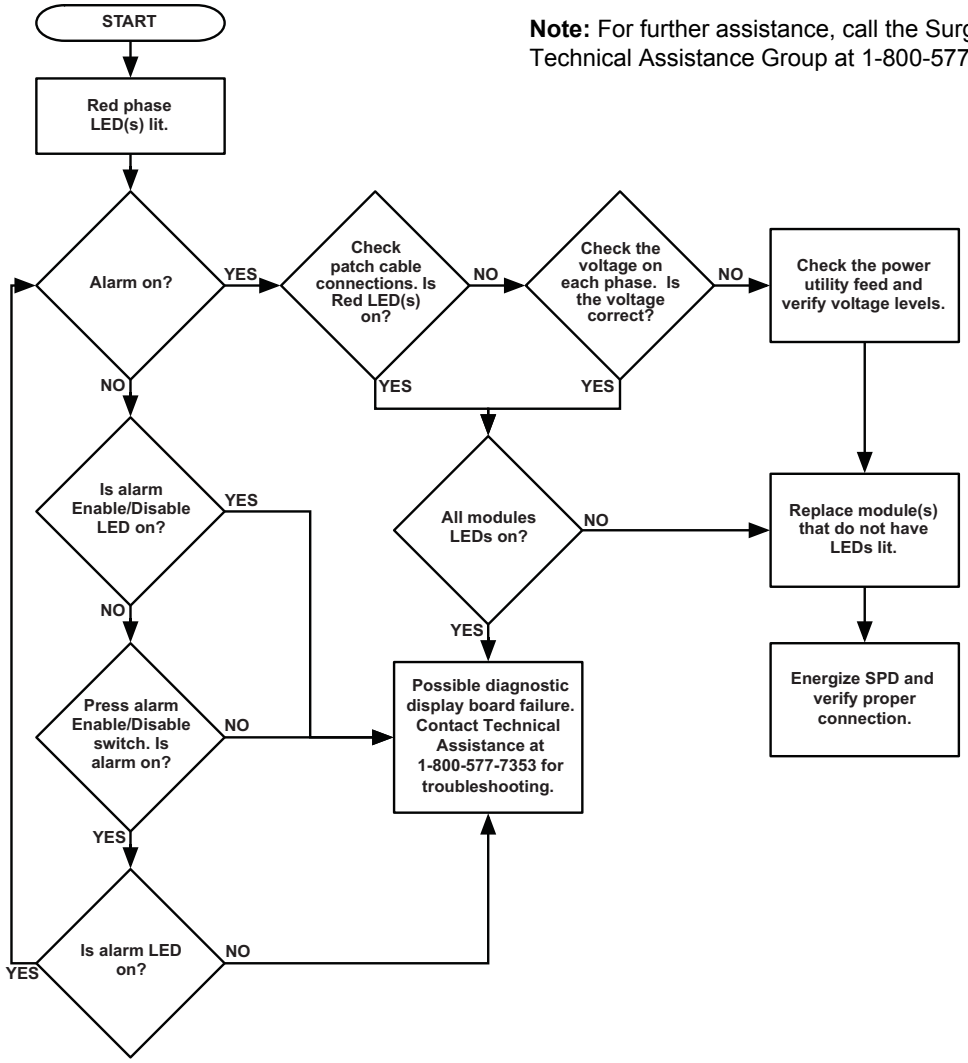
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ENGLISH

Troubleshooting

If a module shows two green indicator lights and the display panel shows a red phase indicator light, follow the Troubleshooting Flow Chart in Figure 12 below.

Figure 12: Troubleshooting Flow Chart



Note: For further assistance, call the Surgelogic Technical Assistance Group at 1-800-577-7353.

Replacement Parts

The following replacement parts are available. For ordering information please contact your local distributor or refer to the product catalog.

- MA modules. Replacement instructions are included with the replacement parts.
- Diagnostic display panel assemblies. Replacement instructions are included with the replacement parts.

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PowerLogic™ PM8000 series

User manual

7EN02-0336-00
11/2014





Schneider Electric

Safety information

Important information

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Please note

Electrical equipment should be installed, operated, serviced and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

Notices

Legal information

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Electrical equipment should be installed, operated, serviced and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

As standards, specifications and designs change from time to time, please ask for confirmation of the information given in this publication.

FCC Part 15 notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that of the receiver.
- Consult the dealer or an experienced radio/TV technician for help.

The user is cautioned that any changes or modifications not expressly approved by Schneider Electric could void the user's authority to operate the equipment.

CAN ICES-3 (B) /NMB-3(B)

About this manual

This manual discusses features of the PowerLogic™ PM8000 series power meter and provides installation and configuration instructions. Throughout the manual, the term “meter” refers to all models of the PM8000. All differences between the models, such as a feature specific to one model, are indicated with the appropriate model number or description.

This manual assumes you have an understanding of power metering and are familiar with the equipment and power system in which your meter is installed.

Topics not covered by this manual

This manual does not provide configuration information for advanced features where an expert user would perform advanced configuration. It also does not include instructions on how to incorporate meter data or perform meter configuration using energy management systems or software, other than ION Setup. ION Setup is a free configuration tool available for download from www.schneider-electric.com.

Please contact your local Schneider Electric representative to learn what additional training opportunities are available regarding ION meters.

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Chapter 1 Safety precautions

Installation, wiring, testing and service must be performed in accordance with all local and national electrical codes.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA, CSA Z462 or applicable local standards.
- Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Do not exceed the device's ratings for maximum limits.
- Never short the secondary of a voltage transformer (VT).
- Never open circuit a current transformer (CT).
- Always use grounded external CTs for current inputs.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

UNINTENDED OPERATION

Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Chapter 2 Introduction

PM8000 overview

The PowerLogic™ PM8000 series power and energy meters help meet the needs of your energy monitoring and cost management applications. All PM8000 meters comply to international metering accuracy standards. You can customize your meter by loading specialized frameworks, and adding option modules and incorporating mounting accessories into the physical installation.

Meter features

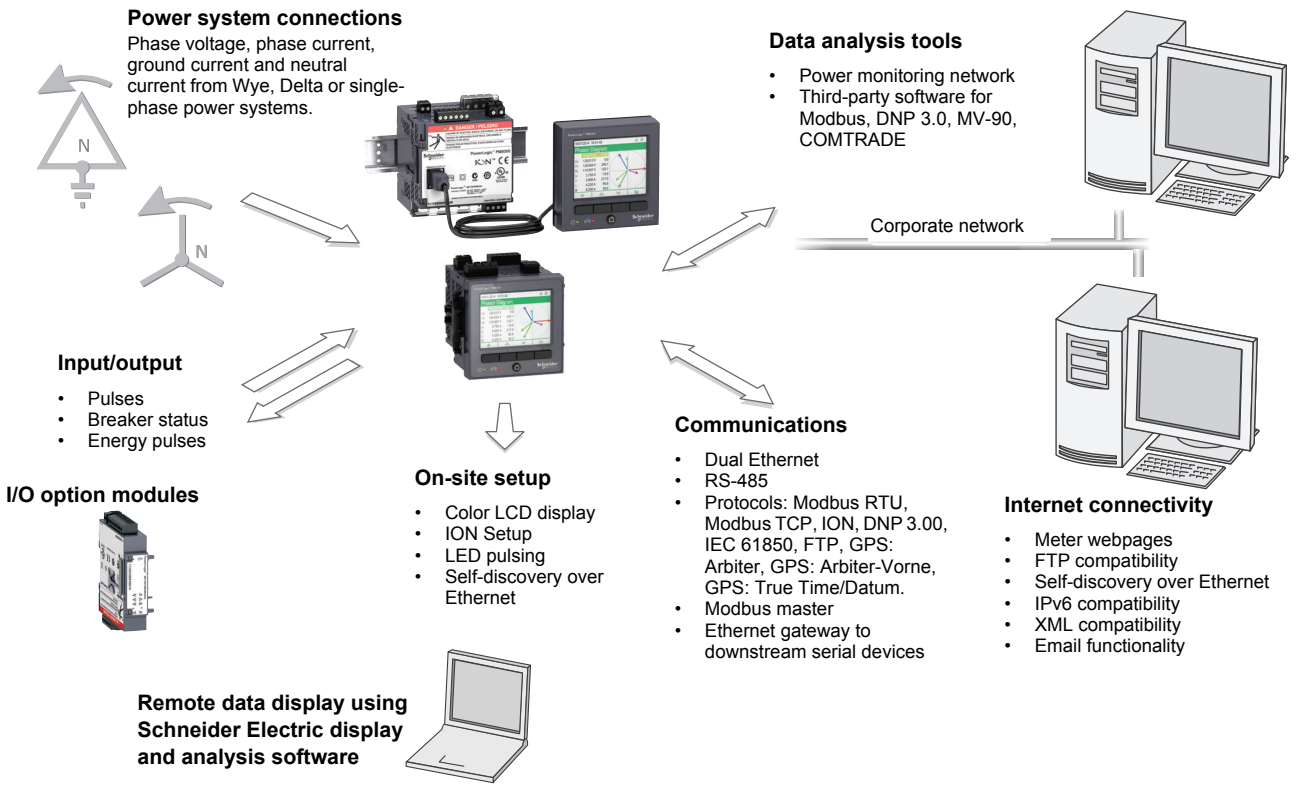
Feature
True RMS metering to the 63rd harmonic
Active (kW), reactive (kVAR) and apparent (kVA) power
600 V direct connection on voltage inputs
Minimum/maximum readings of metered data
Power quality readings (THD)
Downloadable firmware and template
Configuration through integrated or remote display
Modbus master, Ethernet gateway protocols supported
Web interface
Sag/Swell capture for voltage and currents
Time synchronization to 1 ms accuracy
Dual port Ethernet (two physical ports, one Ethernet IP address)
WAGES support
Time of use support
Trending and forecasting
Alarms (active and historic) display viewing and acknowledgment
Multiple languages supported

Your meter in an energy management system

In an energy management system the PM8000 meter collects and aggregates data. This data is used to perform non-critical control or shared with other equipment in the energy management system. Data from the meter can be used by energy management software to help with energy cost management, trending and forecasting, network management, power quality analysis, and more.

The meter is user-configurable to adapt to many situations. Communications allow data to be shared simultaneously across multiple networks, built-in and optional I/O provides monitoring and non-critical control capabilities, and a variety of display and analysis tools can be used to monitor your system.

The following graphic outlines your meter's capabilities in an energy management system.



Measured parameters

Your meter provides bi-directional 4-quadrant energy metering. The following is a selection of some of the values provided by your meter.

Energy

Your meter provides active, reactive and apparent energy values, including:

- kWh, kVARh, kVAh delivered and received
- kWh, kVARh, kVAh net (delivered - received)
- kWh, kVARh, kVAh total (delivered + received)
- Volt-squared-hours and amp-squared-hours

Energy parameters can be logged automatically on a programmed schedule.

All energy values represent the total for all three phases.

Demand

Your meter supports several demand calculation methods, including block, rolling block, synchronized and predicted demand. It can measure demand on any instantaneous value and record peak (maximum) and minimum demand with time and date information. Demand measurements include:

- kW, kVAR, kVA demand
- kW, kVAR, kVA peak demand
- Amps, Volts demand

Instantaneous

Your meter provides one second and half-cycle measurements, per phase and totals for many values, including:

- Voltage and current
- Apparent power (kVA), active power (kW) and reactive power (kVAR)
- Power factor and frequency
- Voltage and current unbalance

Harmonics

Your meter provides harmonic distortion metering, recording and real-time values for all voltage and current inputs, including:

- Individual harmonics (including magnitude and phase angle) up to the 63rd harmonic
- Total even harmonic distortion (TEHD) and total odd harmonic distortion (TOHD)
- Total harmonic distortion (THD) or total demand distortion (TDD)
- K-factor, Crest factor

Min/max recording

Your meter records new minimum and maximum data every recording interval for the following vlaues:

- Voltage and current
- kW, kVAR and kVA
- Power factor
- Frequency
- Voltage unbalance
- Plus any measured value

Power quality

Your meter measures and records voltage and current sags and swells. Your meter also has many power quality related features, including:

- Disturbance direction detection: this allows the meter to analyze disturbance (sag/swell) information to help determine the direction of the disturbance relative to the meter.
- Setpoint learning: this allows the meter to learn the power quality characteristics of your system, to help identify what constitutes a sag or a swell.
- COMTRADE: this allows the meter to save waveform data in COMmon format for TRAnsient Data Exchange (COMTRADE) on its internal FTP server.

Your meter includes the following power quality compliance:

- EN50160: Your meter measures and presents statistics for determining EN50160 compliance.
- IEC 61000-4-30: Your meter complies with the IEC 61000-4-30 power quality standard.
- IEC 62586-1: Your meter complies with the IEC 62586-1 power quality standard.

Localization options

The meter can be customized to use different regional settings, including:

- The language used for the display and webpages
- Time, date and digit formats
- IEC/IEEE symbols and calculations

Data display and analysis tools

Software

Your meter integrates with display and analysis software available from Schneider Electric™, such asStruxureWare™ Power Monitoring Expert that lets you analyze and monitor your system and produce reports for different departments in your organization. This software is designed to make use of your meter's advanced capabilities. You can also use the data acquired by the meter in a variety of third-party systems.

Display

Use the meter's display for local monitoring and standalone applications. The color LCD display lets you view real-time values, events and alarms, and perform basic device configuration. Connect a remote display to a meter without an integrated display to get the same functions as those provided on the integrated display.

Active and historical alarms

The meter's display shows an alarm icon and the alarm LED flashes if your meter detects an active alarm condition. Depending on the priority of the alarm, your meter's display also flashes. You can view and acknowledge active alarms and historic alarms and events through the display and software webpages. An active alarm becomes a historic alarm when the alarm condition no longer exists.

Meter internal web server feature

Your meter's internal web server provides quick and easy access to real-time energy and basic power quality information without special software using an on-board web server combined with an Ethernet port. The built-in web pages display selected energy and power quality information through the web-enabled device; these pages also support basic meter configuration.

Email messaging feature

You can configure your meter to automatically email information, whether notification of a high-priority event or a regularly scheduled send of logged data, to an external email address. Specify the type of event that triggers an email alert, such as a power quality disturbances or interval for logged data. Email messages from your meter are received like any other email message.

Supported protocols

Your meter's fundamental protocol and architecture is ION. You can integrate the meter into various industry-standard networks. Data that the meter measures can be made available to other devices using Modbus, DNP 3.0 and SNMP as well as the MV-90 translation system. You can configure the meter to import data from other devices on

these networks. Your meter supports the IEC 61850 protocol and COMTRADE waveform data format.

Your meter also supports IPv6, DPWS and RSTP Ethernet protocols.

ION Setup device configuration tool

ION Setup is a free configuration tool for your meter that allows you to remotely configure your meter's features over Ethernet or serial communications.

- Use the Setup Assistant to guide you through the process of configuring your meter.
- Use the real-time data screens to verify your meter's configuration.
- Use the data screens to view your meter's recorded data.
- Use the charting function to view your meter's recorded waveforms.

You can download ION Setup from www.schneider-electric.com.

NOTE: Advanced users with a thorough understanding of their meter's architecture, protocols, and the power system in which their meter is installed, can use the advanced mode of ION Setup to create specialized features on their meter.

Related topics

- See the online ION Setup help, available from www.schneider-electric.com, for instructions on connecting to your meter and accessing the Setup Assistant.

Additional information and files

The most up-to-date documentation about your meter is available for download from www.schneider-electric.com. You can also contact your local Schneider Electric representative for more information.

Installation sheets

Multilingual installation sheets are shipped with each device or accessory, and provide the information required to install the product.

ION reference

The ION reference describes ION architecture (the common software architecture in all ION devices) and provides an explanation of each of the ION modules.

ION device template reference

The ION device template reference details the type and quantity of ION modules available on your device and how they are configured in the default template.

ION Setup

ION Setup is a free meter configuration tool that can be downloaded for free at www.schneider-electric.com. It has online help that provides instructions on how to connect to and configure your meter using ION Setup.

Technical notes

Technical notes provide instructions for using meter features and for creating custom configurations.

Protocol documents

Each protocol document contains information explaining how your meter interacts with a protocol, such as DNP 3.0, IEC 61850 and MV-90.

Additional files

Additional files for your meter are available for download from www.schneider-electric.com.

File type	Description
Firmware (*.upg)	Firmware upgrade files let you upgrade your meter's firmware to get new features.
Template (*.dcf)	Template files let you replace your meter's existing template with an updated template with new features.
Protocol files	Files required to support a particular protocol on your meter, such as the MIB file for SNMP and your meter's Modbus register map.
Remote display (*.bin) and option module (*.si9) firmware	Firmware upgrade files let you upgrade your remote display or option module's firmware.

Display and analysis software

Documentation for display and analysis software available from Schneider Electric, such as StruxureWare Power Monitoring Expert, is available for download from www.schneider-electric.com.

Chapter 3 Hardware reference

This section provides additional information regarding physical characteristics and capabilities.

Related topics

- See your device's installation sheets, available from www.schneider-electric.com, for installation instructions and specifications.
- See "Specifications" on page 181 for additional specifications.

Meter types

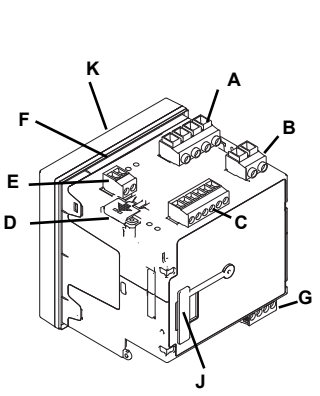
The PM8000 series is available in two physical form factors, and has several accessories:

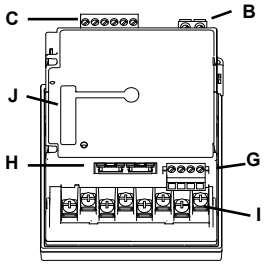
Model	Commercial reference	Description
PM8240	METSEPM8240	Panel-mounted meter with integrated display
PM8243	METSEPM8243	DIN rail-mounted meter without display, which can be connected to a remote display
PM8244	METSEPM8244	DIN rail-mounted meter packaged with a remote display
PM89RD96	METSEPM89RD96	Remote display (for DIN meter only)
PM89M2600	METSEPM89M2600	Digital I/O option module (2 out, 6 in)
PM89M0024	METSEPM89M0024	Analog I/O option module (2 out, 4 in))
PM8000SK	METSEPM8000SK	PM8000 voltage and current sealing kit
METSEPMAK	METSEPMAK	PM8000 mounting adapter kit for remote display and DIN meter

Related topics

- See the PM8000 catalog pages, available from www.schneider-electric.com, or consult your local Schneider Electric representative for the most up-to-date information about your device, its options and accessories.

Panel meter

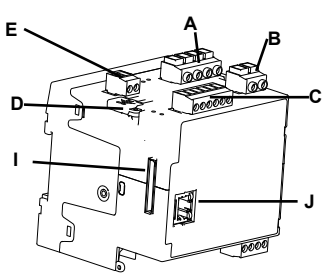


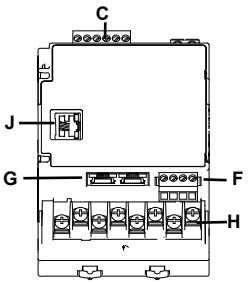


A	Voltage inputs
B	Control power
C	Digital inputs (3)
D	Revenue lock switch cover
E	Digital output
F	Gasket
G	RS-485
H	Ethernet (2)
I	Current inputs
J	Option module connector
K	Display

Mounting hardware and accessories not shown.

DIN meter





A	Voltage inputs
B	Control power
C	Digital inputs (3)
D	Revenue lock switch cover
E	Digital output
F	RS-485
G	Ethernet (2)
H	Current inputs
I	Option module connector
J	Remote display connector

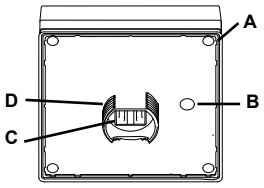
Mounting hardware and accessories not shown.

Related topics

- See the PM8000 catalog pages, available from www.schneider-electric.com, or consult your local Schneider Electric representative for information about your device, its options and accessories.

Remote meter display (RMD)

The remote meter display can be used with DIN meters. It has the same buttons, icons and LEDs as the display on a panel meter, and is powered by the connection to the meter. A remote display cannot be used with meters that have an integrated display.



A	Gasket
B	Alignment pin location
C	Display connection
D	Mounting post

Mounting hardware and accessories not shown.

Option modules

Option modules are ordered separately from your meter, and can be connected to your meter without specialized equipment.

Related topics

- See the PM8000 catalog pages, available from www.schneider-electric.com, or consult your local Schneider Electric representative for information about option modules available for your meter.

Mounting adaptors

There are different mounting adaptor accessories that can help when installing your meter in existing panels and cutouts where the default mounting hardware is not appropriate. Mounting adaptor kits are ordered separately from the meter.

Related topics

- See the PM8000 catalog pages, available from www.schneider-electric.com, or consult your local Schneider Electric representative for information about mounting adaptors available for your meter.

Other accessories

Voltage and current input covers

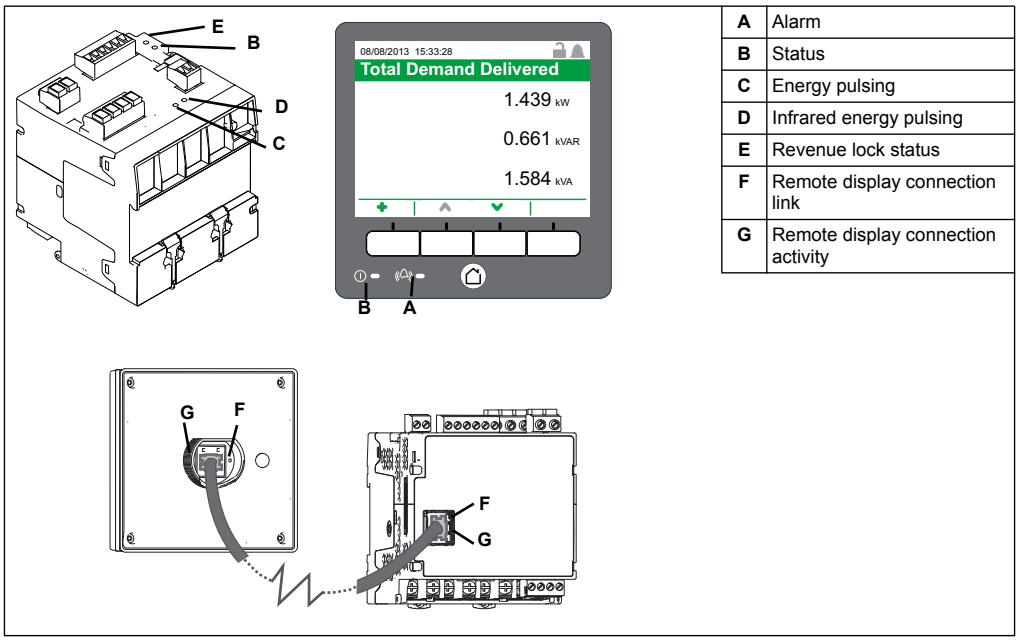
Sealable voltage and current input covers are available and can be ordered separately for your meter. These covers are included for meter models where sealable voltage and current covers are required to comply with revenue or regulatory standards.

Replacement hardware

You can order replacement mounting and installation hardware for your meter and accessories.

Indicator LEDs

LED locations



A	Alarm
B	Status
C	Energy pulsing
D	Infrared energy pulsing
E	Revenue lock status
F	Remote display connection link
G	Remote display connection activity

Related topics

- See“Alarm and status LED indicators” on page 28 for a description of alarm and status LED behavior.

Energy pulsing LED behavior

The visible and infrared LEDs are configured by default to pulse based on the energy (kWh) received by the meter. You can configure the pulse weight (pulses per kWh) and the energy source.

Energy pulsing is used to help verify the energy measurement accuracy of your meter for revenue purposes.

Related topics

- See “Energy pulsing overview” on page 145 for more information about energy pulsing on your meter.
- See “Verifying accuracy” on page 175 for more information about how to perform accuracy verification testing on your meter.

Revenue lock LED behavior

State	Description
Off	The meter is not revenue locked.
On	The meter is revenue locked.
Flashing	New revenue lock state is pending; power cycle your meter to set the revenue lock to on or off.

Remote display connector LED behavior

There are two LEDs in the remote display connector.

LED	Description
Green (link)	On: link established. Off: no link established with the remote display. Check the connections to the remote display and DIN meter.
Yellow (activity)	Flashing: active communications between the meter and the remote display. Off: no communication activity. Check remote display and meter operation.

Chapter 4 Mounting and installation

This section provides supplemental information to help mount and install your meter. It is intended to be used in conjunction with the installation sheet that ships in the box with your meter and accessories. See your device's installation sheet for information related to installation, such as dimensions, mounting and wiring instructions.

The latest technical documentation related to your meter and accessories is available for download from www.schneider-electric.com.

Before you begin

Carefully read and follow the safety precautions and instructions in the installation sheet before working with your meter or accessory.

Safety precautions

Installation, wiring, testing and service must be performed in accordance with all local and national electrical codes.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA, CSA Z462 or applicable local standards.
- Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Do not exceed the device's ratings for maximum limits.
- Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.
- Never short the secondary of a voltage transformer (VT).
- Never open circuit a current transformer (CT).
- Always use grounded external CTs for current inputs.

Failure to follow these instructions will result in death or serious injury.

1. Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
2. Always use a properly rated voltage sensing device to confirm that all power is off.

Mounting

Panel mount meters

The meter retainer clips, located on either side of the meter base and used to secure the meter in the panel, do not usually require any tools to install. If necessary, for panels with limited space, you can use a long-handled slot screwdriver to help install the meter retainer clips.

Mounting adaptors

There are different mounting adaptor accessories that can help when installing your meter in existing panels and cutouts where the default mounting hardware is not appropriate. Mounting adaptors are ordered separately from the meter.

Related topics

- See the PM8000 catalog pages, available from www.schneider-electric.com, or consult your local Schneider Electric representative for information about your device, its options and accessories.

Wiring

This information is supplemental to the installation sheets that shipped with your meter or accessory.

Remote display mounting and wiring

- The remote display can only be used with the DIN meter; it cannot be used by meters with an integrated display.
- The remote display's power and communications is provided through a single, direct, point-to-point connection from the remote display to the DIN meter.

Meter wiring

Power system wiring

You can connect the meter's voltage inputs directly to the phase voltage lines of the power system if the power system's line-to-line or line-to-neutral voltages do not exceed the meter's direct connect maximum voltage limits. The maximum voltage allowed for direct connection may be lower than the manufacturer-specified limits, depending on the local electrical codes and regulations.

If your system voltage is greater than the specified direct connect maximum voltage, you must use PTs (potential transformers) to step down the voltages.

Serial communications (RS-485) wiring

Devices connected to the bus, including the meter, converter(s) and other hardware, must be wired as follows:

- Connect the shield of each segment of the cable to ground at one end only.
- Isolate cables as much as possible from sources of electrical noise.
- Use an intermediate terminal strip to connect each device to the bus. This allows for easy removal of a device for servicing if necessary.
- Install a ¼ Watt termination resistor between the positive and negative terminals of the device at each end of a straight-line bus. The resistor should match the nominal impedance of the RS-485 cable. Consult the cable manufacturer for the cable impedance value.
- Turn on RS-485 biasing if your meter is the RS-485 master device.
- Avoid device connections that cause a branch or "Tee" in the main RS-485 bus as they can lead to signal reflections that may result in interference.
- Do not connect more that two cables at any connection point on the RS-485 bus.

RS-485 terminals

+	Data plus. This transmits/receives the non-inverting data signals.
-	Data minus. This transmits/receives the inverting data signals.
⏚	Shield. Connect the bare wire to this terminal to help suppress signal noise that may be present. Ground the shield wiring at one end only (either at the master or the last slave device, but not both).
C	Signal common. This provides the voltage reference (zero volts) for the RS-485 signals.

NOTE: If some devices in your RS-485 network do not have the common (C) terminal, use the bare wire in the RS-485 cable to connect the common terminal from the meter to the shield terminal on the devices that do not have the common terminal.

Ethernet communications

Your meter's dual port Ethernet connections enable you to use straight-line or network loop (ring) topologies. If local network loop Ethernet topologies are required, you must enable RSTP for your meter's Ethernet communications to function.

Only use unshielded CAT5/5e UTP Ethernet cables to wire your meter's Ethernet communications. Other cable types may provide an undesired ground path.

NOTICE

EQUIPMENT DAMAGE

Only use unshielded CAT5/5e UTP Ethernet cables.

Failure to follow these instructions may result in equipment damage.

Option modules

Perform an option bus reset to restart the option bus and re-initialize the option modules attached to your meter.

Related topics

- See "Option modules" on page 43 for more information about option modules.
- See "Resets" on page 153 for more information about the resets available on your meter.

Default values for commissioning

Parameter	Default value
Display password (also for logging onto meter webpages)	0
Username (for logging onto meter webpages)	8000
IP address	169.254.0.10
Subnet mask	255.255.0.0
Gateway	0.0.0.0
Unit ID	1
Language	English

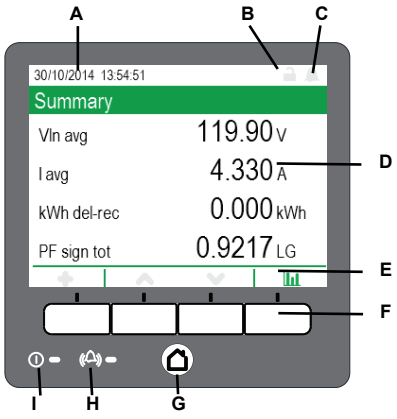
Related topics

- See “Setup menu” on page 33 for instructions on how to perform basic configuration using the display.
- See “Self-discovery over Ethernet” on page 53 for information on how your meter can automatically appear on your network.
- See “Meter webpages” on page 115 for instructions on how to perform basic configuration using your meter’s webpages.
- See the ION Setup online help, available from www.schneider-electric.com, for instructions on how to connect to and configure your meter.

Chapter 5 Display and meter setup

Your meter can have either an integrated or an optional remote display. The display allows you to view meter data and perform basic configuration. The integrated and remote display screens have the same meter data and setup screens. Only meters without an integrated display can use the remote display.

Display overview



A	Date/time
B	Revenue lock icon
C	Alarm icon
D	Display
E	Navigation icons
F	Navigation buttons
G	Home button
H	Alarm LED
I	Status LED

Home button

Pressing the home button takes you to the associated menu screen. If you are in a data screen, pressing the home button takes you to the display menu, and pressing home twice takes you to the summary display screen. If you are in a setup screen, pressing home takes you to the setup menu, and pressing home again takes you to the display menu.

Revenue lock icon

The revenue lock icon indicates the lock status of the meter. When gray and open, the meter is unlocked. When green and closed, the meter is locked. You can lock and unlock your meter using the revenue lock switch located on the body of your meter.

Alarm icon

The alarm icon indicates the highest level and state of alarms detected by your meter. For example, if the meter detects a low priority and a high priority active alarm, the alarm icon indicates a high priority active alarm.

NOTE: Alarms can only be viewed and acknowledged through your meter's display.

Icon	Description
	Active alarm indicator: • Red: high priority alarm state detected • Yellow: medium priority alarm state detected • Blue: low priority alarm state detected The alarm indicator flashes until you acknowledge the alarm. The alarm indicator changes to the historic alarm indicator of the appropriate level when the alarm state is no longer detected by the meter. **NOTE:** Your meter's display backlight flashes for unacknowledged high priority active alarms.

Icon	Description
	Unacknowledged historic alarm indicator: • Red: unacknowledged high priority historic alarm • Yellow: unacknowledged medium priority historic alarm **NOTE:** Low priority historical alarms are not indicated. The active alarm indicator changes to the historic alarm indicator of the appropriate level when the alarm state is no longer detected by the meter.
	No active or unacknowledged high or medium priority historic alarms

Related topics

- See “Revenue locking” on page 173 for more information about your meter’s revenue locking feature.
- See “Alarms and alerts” on page 147 for more information about your meter’s alarms.

Alarm and status LED indicators

Your meter has two LED indicators on the display. These LEDs cannot be configured for other uses.

LED	Description
Status	Off: unpowered Steady green: normal operation Flashing red: no communications (remote display only) Steady red: firmware upgrade required (remote display only) Flashing red/green: startup or firmware upgrade sequence in progress
Alarm	Off: no active or unacknowledged historic alarms On: acknowledged active alarm Flashing: active alarm **NOTE:** Your meter’s display backlight flashes for unacknowledged high priority active alarms.

Related topics

- See “Indicator LEDs” on page 21 for a description of the meter’s communication and status LEDs.

Navigation symbols

Navigation symbols are displayed on the bottom of the screen above their corresponding navigation button.

NOTE: If the symbol is gray, that navigation function is not available.

Symbol	Description
	**More** Pressing this button displays additional screens.
	**Left** Pressing this button moves the displayed cursor one position to the left. If you are in a more or info screen, it returns you to the previous screen.
	**Right** Pressing this button moves the displayed cursor one position to the right.

Symbol	Description
	**Up** Pressing this button takes you to the previous screen or menu item.
	**Down** Pressing this button takes you to the next screen or menu item.
	**Select** Pressing this button selects or confirms the highlighted value.
	**Cancel** Pressing this button cancels the current selection and returns you to the previous screen.
	**Graphic** Pressing this button takes you to a graphical data display.
	**Numeric** Pressing this button takes you to a numeric data display.
	**Info** Pressing this button takes you to a detailed information screen.
	**Edit** Pressing this button allows you to edit the displayed parameter.
	Pressing these buttons allow you to navigate parameter tables in the setup screens.
	Pressing both buttons allows you to perform the described action.

More screens access

Pressing the navigation button associated with the more icon brings up a list of additional screens related to the displayed screen. Press cancel to remove the list. If you do not press any button, the list automatically disappears after a short period of time.

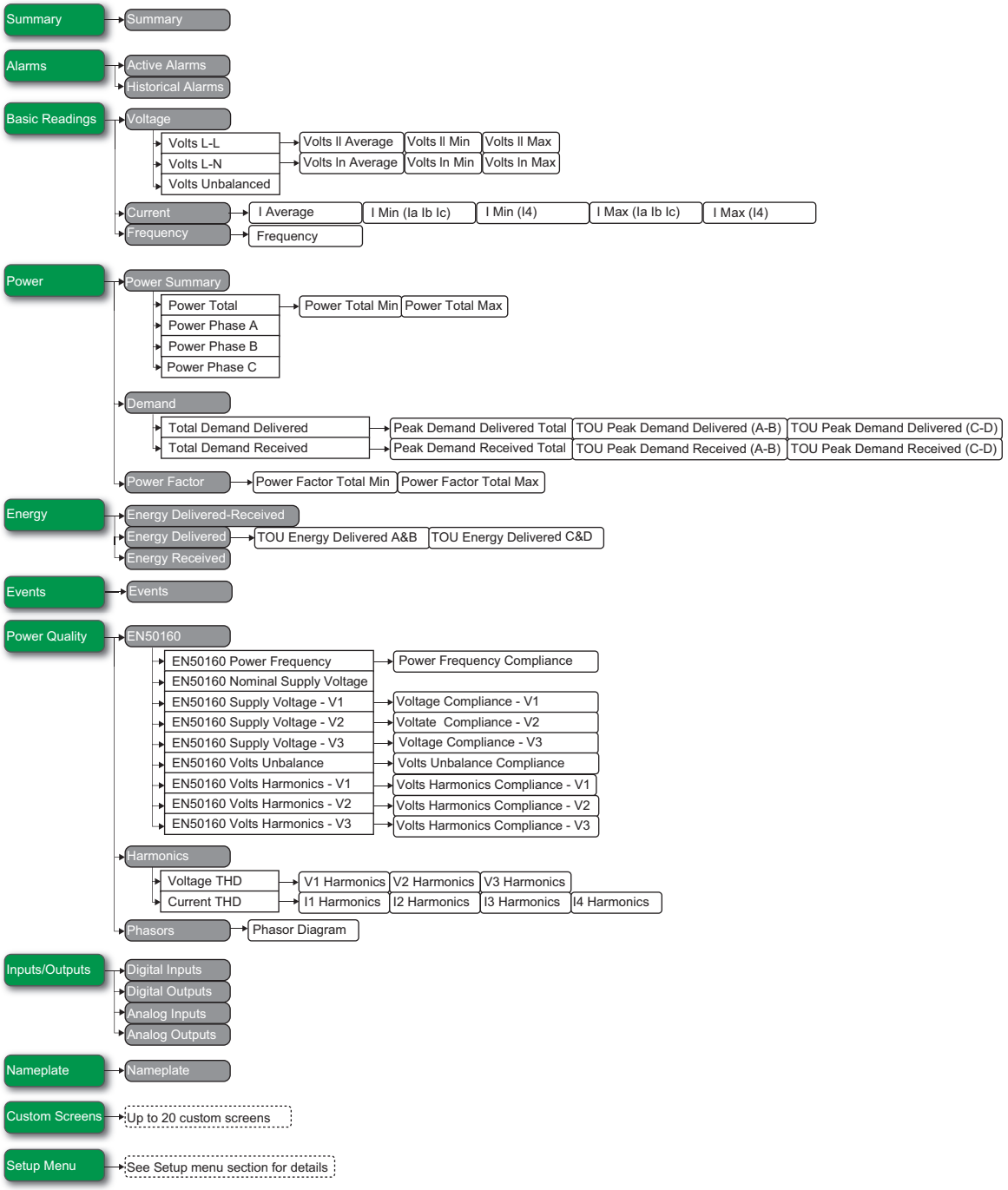
Overrange indication

If any value measured by the meter is too large to fit on the meter's display, the meter initially reduces the size of the text to try and make the value fit. If the value is still too large to be displayed, the meter truncates the value starting with the least significant digit, and encloses the truncated value in a red box.

Display menu

The display menu allows you to select data for viewing and to access the setup menu.

NOTE: Your meter's menus may appear slightly different than shown depending on your display settings.



Viewing data using your meter's display

Use the navigation buttons to view data on your meter's display.

The following examples show how to use the navigation buttons to view data in numeric or graphical format, select and view additional menu screens, and view detailed information about alarms and acknowledge them.

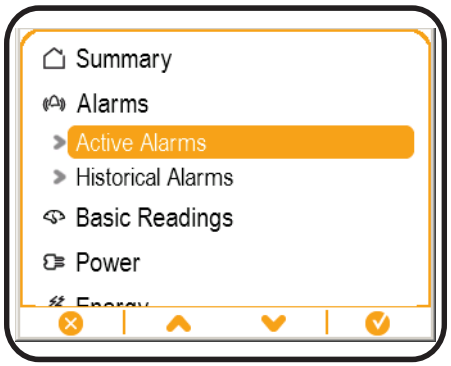
NOTE: Your display may appear differently than shown, depending on your meter's power system and display settings.

NOTE: Your navigation icons change color depending on the type of screen being viewed. If an icon is gray, that navigation option is not available and nothing will happen when you press the button associated with that icon.

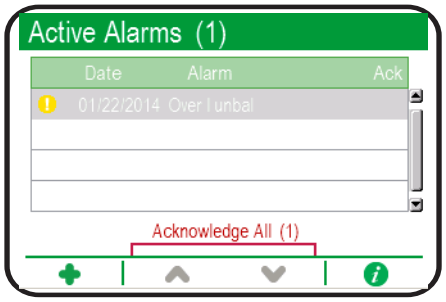
Example: viewing the alarm screens

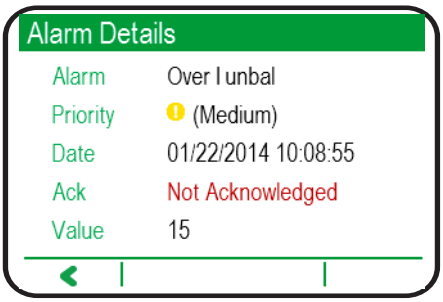
Use the display navigation buttons to access the alarm screens, display detailed information, and acknowledge active and historic alarms.

1. Press ⌂ to display the menu. Press ▲ or ▼ until **Alarms** is highlighted. Press ✓ to display the alarm screens. Press ▼ until Active Alarms is highlighted. Press ✓ to display Active Alarms.The Active Alarms title lists, in brackets, the total number of active alarms.



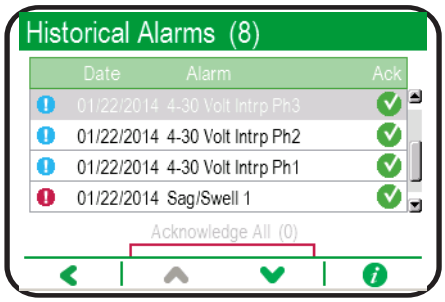
2. Press ▲ or ▼ to highlight a specific alarm, in this case an unbalanced currents alarm. Press ⓘ to display detailed information about the highlighted alarm, and press ◀ to return to the Active Alarms screen. Press both ▲ and ▼ simultaneously to acknowledge all active alarms.





3. Press ⌂ to display the menu. Press ▼ to highlight Historical Alarms. Press ✓ to display Historical alarms.The Historical Alarms title lists, in brackets, the total number of historic alarms.

4. Press ▲ or ▼ to highlight a specific alarm, in this case a 4-30 voltage interruption alarm. Press ⓘ to display detailed information about the highlighted alarm. Press both ▲ and ▼ simultaneously to acknowledge all historical alarms.

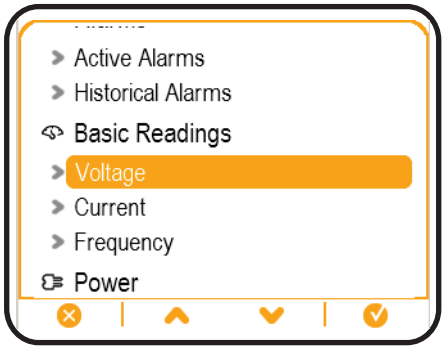


5. Press ⌂ to return to the menu.

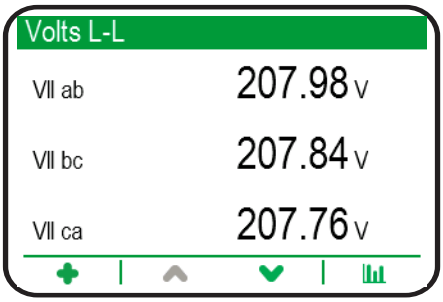
Example: viewing the voltage screens

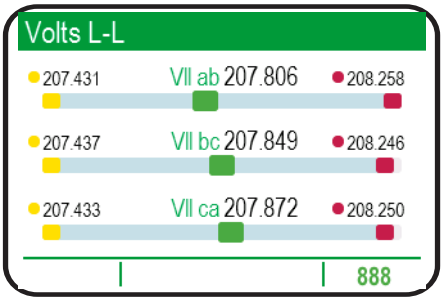
Use the display navigation buttons to view screens, display detailed information, and display graphical representations of measured voltage data.

1. Press ⌂ to display the menu. Press ▲ or ▼ until Basic Readings is highlighted. Press ✓ to view the basic readings screens. Press ▼ until Voltage is highlighted. Press ✓ to view the voltage screens.Voltage line-to-line values are displayed.

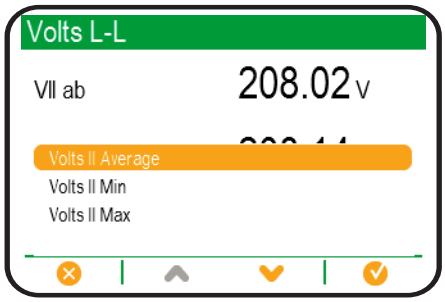


2. Press 📊 to view a graphical display of historic voltage values, then press 888 to return to the numeric display. Press ✚ to show a list of additional screens.

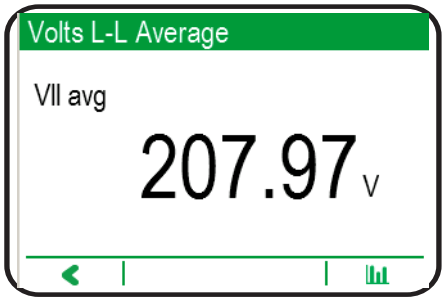




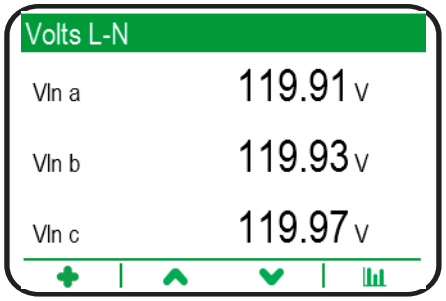
3. Press ▲ or ▼ to highlight an additional screen, in this case, Volts II Average. Press ✓ to go to the highlighted screen. Volts II Average displays the average line-to-line voltage.



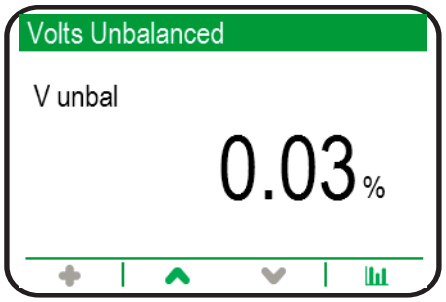
4. Press to view a graphical display of average voltage values, then press 888 to return to the numeric display. Press to return to Volts L-L.



5. Press to view Volts L-N, which also has additional screens and the ability to view the information in a graphical format.



6. Press again to view Volts Unbalanced. This is the last voltage screen, so is grayed out and unavailable. Press to return to Volts L-N, and press again to return to Volts L-L.

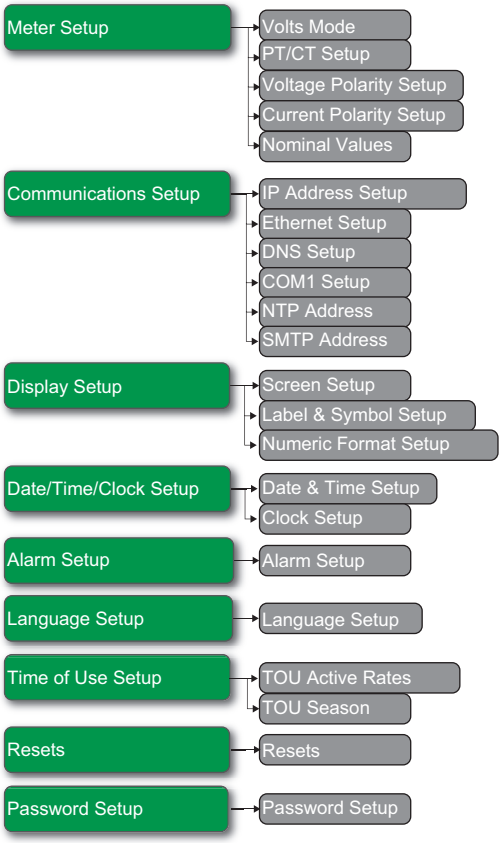


Setup menu

Meter configuration can be performed through the display, using the meter's webpages or through software. This section contains information on how to set up the meter using the display. You must have your meter's security settings configured to allow front panel (display) programming in order to set up the meter using the display.

NOTE: Your display may appear differently than shown, depending on your meter's power system and display settings.

NOTE: Some setup parameters cannot be configured when revenue security is enabled.



Related topics

- See “Revenue locking” on page 173 for more information about your meter’s revenue security and protected parameters.
- See “Security” on page 47 for information about front panel (display) programming security settings.
- See “Accessing the meter’s webpages” on page 116 for instructions on how to access your meter’s webpages.
- See “ION Setup device configuration” on page 84 for instructions on how to configure your meter using ION Setup.

Setting up your meter using the display

Use the navigation buttons and displayed parameters to configure your meter.

The following example shows how to use the navigation buttons to select parameters, enter numeric information or select parameter values from lists.

NOTE: Your display may appear differently than those shown, depending on your meter’s power system and display and localization settings.

NOTE: Your navigation icons change color depending on the type of screen being viewed. If an icon is gray, that navigation option is not available and nothing will happen when you press the button associated with that icon.

NOTE: Your meter goes back to displaying data after a period of inactivity in the setup menu screens.

NOTE: Your meter locks you out of display configuration after you have exceeded the maximum number of attempts to enter an password.

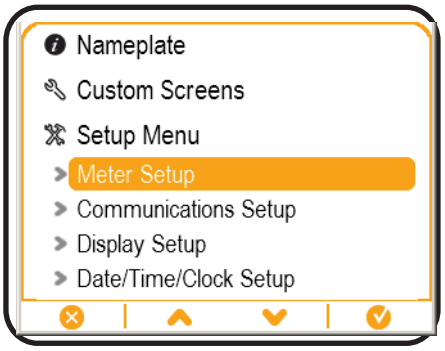
Your meter's default display password is 0 (zero).

Example: setting volts mode and PT/CT ratios

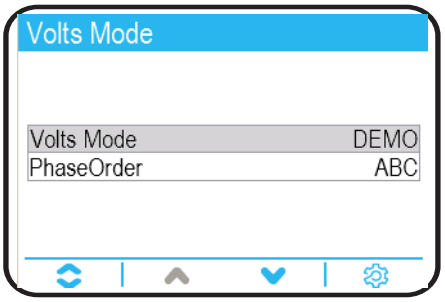
Use the display navigation buttons to set your meter's volts mode and PT ratios.

NOTE: Potential transformers (PT) are also known as voltage transformers (VT).

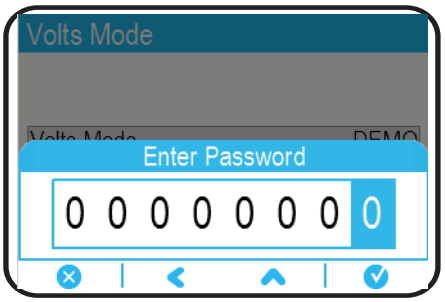
1. Press ⌂ to display the menu. Press ▼ until Setup Menu is highlighted. Press ✓ to display the Setup Menu.The **Setup Menu** lists the setup selections on your meter.



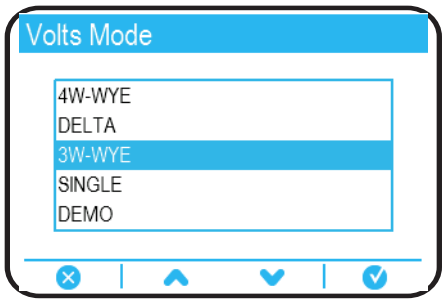
2. Press ▲ or ▼ to highlight the different setup menu selections. Highlight Meter Setup and press ✓ to select the meter setup screens.The Volts Mode setup screen is displayed.
3. Press ⇄ to highlight Volts Mode. Press ⚙ to edit the Volts Mode.The Enter Password screen is displayed.



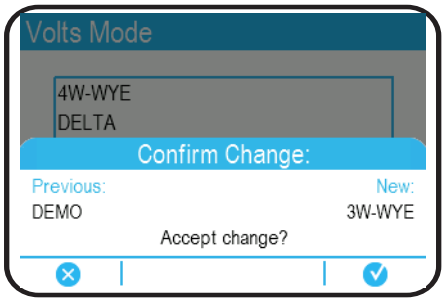
4. Press ▲ to change the value of the highlighted digit (0 - 9). Press ◀ to go to the next digit. Press ✓ to enter your password.The volts mode configuration screen is displayed.



5. Press ▲ or ▼ to highlight the desired volts mode from the list, in this case, 3W-WYE. Press ✓ to select the highlighted volts mode. A confirmation screen is displayed, showing your meter's previous setting and newly selected setting.

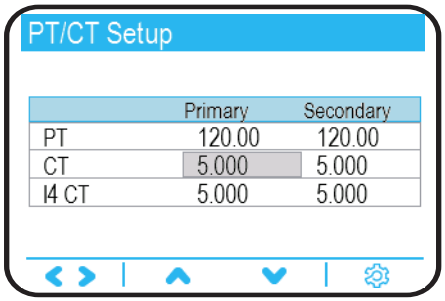


6. Press ✓ to confirm, and the new setting is applied to your meter. Press ✗ to cancel and maintain your meter's original setting.



7. In the Volts Mode screen, press ▼ to go to the PT/CT Setup screen.
8. In the PT/CT Setup screen, press ◄ ► to highlight the potential transformer (PT) or current transformer (CT) value for editing. Press ⚙ to edit the highlighted value.

   NOTE: If you have exceeded the password timeout period, you are prompted to enter your meter's display password.



9. Press ▲ to change the value of the highlighted digit (0 - 9). Press ◄ to go to the next digit. Press ✓ to enter the new value. When the confirmation screen is displayed, press ✓ to confirm the new value or ✗ to revert to the original value.

Related topics

- See “Minimum configuration requirements for basic metering” on page 37 for information on the values that must be configured on your meter.
- See “Security” on page 47 for information about the security features of your meter.

Minimum configuration requirements for basic metering

At a minimum, you must configure the following parameters to help your meter perform basic metering functions.

Setup screen	Screen	Minimum configuration
Meter Setup	Volts Mode	Volts Mode
	PT/CT Setup	PT, CT and I4 CT Primary and Secondary
	Nominal values	V nominal, I nominal, Nominal Frequency

NOTE: You must also configure all the parameters related to the meter features you are using, for example, you must configure the DNS server address if you are using the meter’s DNS feature.

Setup parameters

The following sections list the parameters that can be configured using your meter’s display.

NOTE: Some parameters may appear differently than shown, depending on your meter’s power system and display settings.

Meter setup

Screen title	Parameter	Values	Description
Volts Mode	Volts Mode	4W-Wye, Delta, 3W-Wye, Single, Demo	The power system’s configuration
	PhaseOrder	ABC, ACB	The power system’s phase order
PT/CT Setup	PT Primary	1 to 999,999.99	The potential transformer’s primary winding voltage rating **NOTE:** PTs are also referred to as a VTs or voltage transformers.
	PT Secondary	1 to 999,999.99	The potential transformer’s secondary winding voltage rating **NOTE:** PTs are also referred to as a VTs or voltage transformers.
	CT Primary	1 to 999,999.99	The current transformer’s primary winding current rating
	CT Secondary	1 to 999,999.99	The current transformer’s secondary winding current rating.
	I4 Primary	1 to 999,999.99	The I4 current transformer’s primary winding current rating
	I4 Secondary	1 to 999,999.99	The I4 current transformer’s secondary winding current rating
Voltage Polarity Setup	Va Polarity	Normal, Inverted	The polarity of the potential transformer on Va
	Vb Polarity	Normal, Inverted	The polarity of the potential transformer on Vb
	Vc Polarity	Normal, Inverted	The polarity of the potential transformer on Vc
Current Polarity Setup	Ia Polarity	Normal, Inverted	The polarity of the current transformer on Ia
	Ib Polarity	Normal, Inverted	The polarity of the current transformer on Ib
	Ic Polarity	Normal, Inverted	The polarity of the current transformer on Ic
	I4 Polarity	Normal, Inverted	The polarity of the current transformer on I4
Nominal Values	V Nominal	1 to 999,999	The nominal (normal) voltage of the power system
	I Nominal	1 to 999,999	The nominal (normal) current of the power system
	Nominal Frequency	50, 60	The nominal (normal) frequency of the power system

Communications Setup

Screen title	Parameter	Values	Description
IP Address Setup	IP Address	As defined by your network's system administrator	Sets the IP address for the meter **NOTE:** Your meter's default IP address is 169.254.0.10
	SubnetMask		Used if subnetting applies to your network
	Gateway		Used in networks with multiple segments
	MAC Address	Not configurable	Your meter's media access control (MAC) address.
Ethernet Setup	Enable RSTP	Yes, No	Specifies if rapid spanning tree protocol (RSTP) is enabled **NOTE:** If local network loop or ring Ethernet topologies are required, you must enable RSTP for your meter's Ethernet communications to function
	Enable ION Over TCP	Yes, No	Specifies if ION protocol communications are enabled over Ethernet
	Enable Web Server	Yes, No	Specifies if the meter's internal web server is enabled
DNS Setup	Primary DNS	As defined by your network's system administrator	Sets the address for the primary DNS server that is configured to resolve domain names
	Secondary DNS		Sets the address for the secondary DNS server that is configured to resolve domain names
COM1 Setup	Protocol	ION, Modbus RTU, Modbus Master, DNP v3.00, EtherGate, GPS: Truetime/Datum, GPS: Arbiter, GPS: Arbiter-Vorne, Factory	Sets the communications protocol for your meter's RS-485 port
	Baud Rate	2400, 4800, 9600, 19200, 38400, 57600, 115200	Sets the data rate, in bits per second
	RTS Delay	0 to 1	Sets the transmit delay in seconds
	Unit ID	1 to 9999	Sets the meter's unique ID on the RS-485 network **NOTE:** Modbus serial device range 0 to 247
	Serial Port	8N1, 8N2, 8E1, 8E2, 8O1, 8O2	Sets the parity and stop bits for the port
	RS485 Bias	Off, On	Turns on biasing when mastering devices over the RS-485 port
NTP Address	NTP Server	As defined by your network's system administrator	Specifies the IP address of the SNTP or NTP server used by the meter for time synchronization
SMTP Address	SMTP Server	As defined by your network's system administrator	Specifies the IP address of the SMTP server used by the meter for sending email

Display Setup

Screen title	Parameter	Values	Description
Screen Setup	Backlight Timeout	0 to 720	Specifies how many seconds the display's backlight remains lit after the last button press
Label & Symbol Setup	Phase Lbls	ABC, 123	Sets the voltage and current phase labels
	Measurement Symbols	IEEE, IEC	Specifies whether IEEE or IEC measurement symbols are applied to displayed values
	PF Convention	IEEE, IEC	Specifies whether IEEE or IEC power factor conventions are applied to displayed values
Numeric Format Setup	Digit Grouping	1000.0, 1,000.0, 1 000,0	Specifies how digits are grouped for display
	Volts Resolution	1., 1.X, 1.XXX, 1.XXXX	Specifies the number of decimal places displayed for voltages
	Current Resolution	1., 1.X, 1.XXX, 1.XXXX	Specifies the number of decimal places displayed for currents
	Power Resolution	1., 1.X, 1.XXX, 1.XXXX	Specifies the number of decimal places displayed for power and energy measurements

Date/Time/Clock Setup

Screen title	Parameter	Values	Description
Date & Time Setup	Time Format	12 H, 24 H	Specifies how the time is displayed
	Date Format	MM/DD/YYYY, DD/MM/YYYY, YYYY/MM/DD	Specifies how the date is displayed
	TZ Offset	-12:00:00 to 12:00:00	Sets the time zone of the meter's location, relative to UTC
	DST Offset	-3:00:00 to 3:00:00	Sets the daylight savings time offset of the meter's location

Screen title	Parameter	Values	Description
Clock Setup	Clock Source	Internal, Line Freq, COMM	Specifies the time synchronization source
	Time Sync Source	COM1, Ethernet, Ethernet - ION, Ethernet - DNP, IRIG-B	Specifies the port to receive time synchronization signals
	Time Sync Type	UTC, Local	Specifies whether time synchronization signals are received in local time or UTC

Alarm Setup

⚠ WARNING

UNINTENDED OPERATION

Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

You can disable alarms through the display in order to prevent nuisance alarms:

Screen title	Parameter	Description
Alarm Setup[1]	Over I unbal	Over unbalanced current alarm
	Over THD V1	V1 over total harmonic distortion (THD) voltage alarm
	Over THD V2	V2 over total harmonic distortion (THD) voltage alarm
	Over THD V3	V3 over total harmonic distortion (THD) voltage alarm
	Over P sd	Over kW sliding demand alarm
	Over Ia	Ia over current alarm
	Over Ib	Ib over current alarm
	Over Ic	Ic over current alarm
	Over I4	I4 over current alarm
	Over V unbal	Over unbalanced voltage alarm
	V1 Setpoint	V1 setpoint alarm
	V2 Setpoint	V2 setpoint alarm
	V3 Setpoint	V3 setpoint alarm
	Freq Setpoint	Frequency setpoint alarm
	Sag/Swell 1	Voltage sag/swell alarm
	Current Sag Ph1	Current sag alarms for phase 1
	Current Sag Ph2	Current sag alarms for phase 2
	Current Sag Ph3	Current sag alarms for phase 3
	4-30 Volt Intrp Ph1	4-30 voltage interruption power quality alarm for phase 1
	4-30 Volt Intrp Ph2	4-30 voltage interruption power quality alarm for phase 2
	4-30 Volt Intrp Ph3	4-30 voltage interruption power quality alarm for phase 3
	Current Swell Ph1	Current swell alarms for phase 1
	Current Swell Ph2	Current swell alarms for phase 2
	Current Swell Ph3	Current swell alarms for phase 3

[1] Any Setpoint or Relative Setpoint module with an event priority greater than the low alarm event priority is also displayed on this screen.

You can only enable or disable alarms using the display. Alarm configuration is done using ION Setup. Alarms with a priority less than low (info only or none) are not displayed.

You must configure all the parameters related to the alarm for alarm functions to operate. For example, for the Over Ia alarm to operate, you must enter the nominal value and the conditions that define an alarm state, even if the alarm is shown as Enabled on the Alarm Setup screen.

Language Setup

Select the language to be shown on the meter's display. By default, your meter has the following languages:

- English
- Spanish
- French
- German
- Italian
- Portuguese
- Russian
- Chinese (simplified)

Resets

NOTICE

LOST DATA

Save your meter's data before performing a reset.

Failure to follow these instructions can result in data loss.

The following resets can be performed using the display:

Screen title	Parameter	Description
Resets	Master Reset	• Clears all the cumulative and derived quantities from the meter (including demand, peak demand, energy, revenue and test mode parameters) • Clears meter event and waveform logs • Clears COMTRADE waveform records from the meter's internal FTP server • Clears the meter's data logs
	Peak Demand Reset	Clears the peak demand values logged in the meter
	Min/Max Reset	Clears all accumulated maximum and minimum values stored in the meter
	Digital Input Count Reset	Clears the digital input state change counters
	Harmonics Min/Max Reset	Clears all accumulated maximum and minimum harmonics values stored in the meter
	Disturbance Count Reset	Clears the sag/swell event counter
	EN50160 Reset	Clears all EN50160 parameters and statistics accumulated in the meter
	Option Modules Reset	Restarts all option modules attached to the meter

Password Setup

It is strongly recommended that you change your meter's display (front panel) password from the default value of 0 (zero).

If your meter's user access information is lost, you must return the meter to the factory, where your meter is reset to its factory defaults and all logged data is lost.

NOTICE

DATA LOSS

Record your device's user and password information in a secure location

Failure to follow these instructions may result in data loss.

Screen title	Parameter	Values	Description
Password Setup	Password	0 to 99999999	Sets the password that must be entered in order to configure parameters using the meter's display **NOTE:** This is also the password used to access the meter's webpages when standard security is enabled

Display behavior

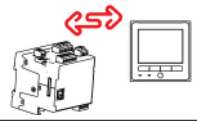
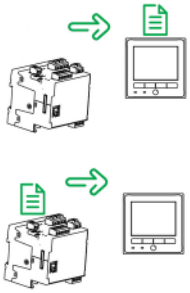
Display backlight

Your meter's display backlight dims after a defined period of inactivity.

When the meter detects an unacknowledged active high priority alarm, the display flashes until the alarm is acknowledged.

Remote display troubleshooting icons

Your meter's remote display shows the following troubleshooting icons in addition to the meter's status LED information:

Icon	Description
	Your remote display cannot communicate to your meter. Check the connection between your meter and the display. Check the meter's status LED to confirm that the meter is operating normally.
	Your remote display needs updated firmware for compatibility with your meter.
	Your remote display is undergoing a firmware upgrade. Do not disconnect your remote display from your meter.

Related topics

- See “Loading remote display firmware using FTP” on page 80 for instructions on how to load remote display firmware.

Localization

The localization settings on the meter affect how information is displayed as well as how some values are calculated. Options include language, number formats as well as the IEEE (Institute of Electrical and Electronics Engineers) or IEC (International Electrotechnical Commission) conventions used for power, power factor and energy.

You can configure your meter’s localization settings using ION Setup.

Related topics

- See the online ION Setup help, available from www.schneider-electric.com, for instructions on how to connect to and configure your meter.
- See “Power and power factor conventions” on page 157 for details on IEEE and IEC power and power factor conventions.

Custom displays

You can create custom displays using ION Setup.

Related topic

- See “Creating custom displays using ION Setup” on page 111 for instructions on how to create custom displays on your meter.

Lost user access

If you lose your meter’s user access information, contact your local Schneider Electric representative for instructions on how to return your meter for factory reconfiguration.

NOTE: Have your meter’s serial number available for reference.

Chapter 6 Option modules

This section supplements the option module installation sheets and provides additional information regarding physical characteristics and capabilities.

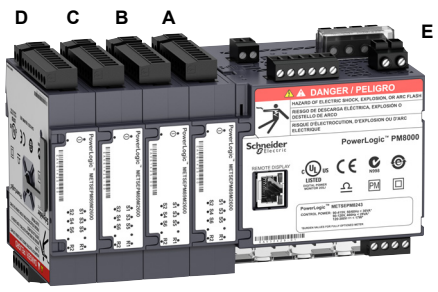
Related topics

- See your device's installation instructions, available from www.schneider-electric.com, for installation instructions and specifications.
- See the PM8000 catalog pages, available from www.schneider-electric.com, or consult your local Schneider Electric representative for information about option modules available for your meter.

Option modules overview

Option modules are ordered separately from your meter, and can be connected to your meter without specialized equipment. Up to four option modules can be added to your meter.

Option modules are identified based on the physical order of the attached modules. The option module attached directly to the meter is module A, the module attached to module A is module B, and so on. The option module identifier is added to the ION module name and ION label to uniquely describe each possible combination of option modules.



A	Option module A
B	Option module B
C	Option module C
D	Option module D
E	Meter

For example, a meter with two option modules, consisting of an analog option module directly attached to the meter (A) and a digital option module attached second (B), describes the Q2 analog output of module A as Port A Q2 and the S3 digital input of module B as Port B S3.

Option modules support

Maximum number of option modules

Depending on the type and quantity of option modules attached to your meter, you may need to reduce your meter's maximum operating temperature.

For a panel mount meter, one limitation on the number of modules that can be attached is the physical strength of the meter mounting hardware. If your meter is mounted in an area subject to vibration or other physical stresses, your meter's ability to physically support multiple option modules and maintain a seal against the mounting surface may be affected.

NOTICE

EQUIPMENT DAMAGE

Do not exceed the maximum number of option modules.

Failure to follow these instructions will result in equipment damage.

Related topics

- See “Specifications” on page 181 for more information about the maximum number and type of attached option modules.

I/O option modules

I/O option modules provide increased digital and analog input/output (I/O) capabilities for your meter.

⚠ WARNING

UNINTENDED OPERATION

Do not use the meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

These I/O modules can be used to monitor the status of breakers, control analog or digital transducers, or receive signals that can be interpreted to provide WAGES data for your energy system. For applications requiring high accuracy, such as energy pulsing to verify accuracy, the digital output on the meter base is recommended.

Your meter’s digital and analog outputs may change state during a firmware upgrade. Option modules are offline during an option module firmware upgrade; they will not communicate to the meter and the outputs may change state during the upgrade process.

Analog I/O option modules

Your meter’s analog I/O option modules can measure and output either low voltage or current using standard analog transducers such as 4 - 20 mA current transducers.

Analog option module data viewing

To view analog option module data on your meter’s display, go to **Inputs/Outputs** and select either **Analog Inputs** or **Analog Outputs**. If there are no I/O of the specified type, an informative message is displayed.

To view analog option module data on your meter’s webpages, connect to your meter’s webpages, go to **Monitoring > Inputs/Outputs** and select either **Analog Inputs** or **Analog Outputs**. If there are no I/O of the specified type, an informative message is displayed.

Related topics

- See “Analog inputs/outputs” on page 141 for information about analog I/O.

Digital I/O option modules

You can add digital I/O option modules to increase your meter’s capabilities.

Digital option module data viewing

To view digital option module data on your meter’s display, go to **Inputs/Outputs** and select either **Digital Inputs** or **Digital Outputs**. If there are no I/O of the specified type, an informative message is displayed.

To view digital option module data on your meter’s webpages, connect to your meter’s webpages, go to **Monitoring > Inputs/Outputs** and select either **Digital Inputs** or **Digital Outputs**. If there are no I/O of the specified type, an informative message is displayed.

Related topics

- See “Digital inputs/outputs” on page 145 for information about digital I/O.

Option module troubleshooting

Your meter’s option modules operate sequentially; if one module is non-functional all downstream modules may be affected. If your meter cannot communicate with an option module, by default it cycles power to that module and all downstream modules, making multiple attempts to communicate. After the maximum number of communication attempts has been exceeded the meter will remove power to that module and all downstream modules.

When troubleshooting option modules, attach each option module directly to the meter and verify its operation. If each option module operates when directly connected, use combinations of modules or known good modules to help identify the issue.

Events related to option module initialization and operation are stored in your meter’s onboard event log. Perform an option bus reset to restart the option bus and re-initialize the option modules attached to your meter.

Information about your option module’s type, serial number, firmware version and present status is available in the Factory and Diagnostics modules.

Related topics

- See the *ION Reference*, available from www.schneider-electric.com, for more information about the Factory and Diagnostics modules.

Option module reset

During an option module reset, your option module may not operate normally, and digital and analog outputs may change state.

⚠ WARNING

UNINTENDED OPERATION

Do not use this meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

You can reset your meter's option module bus through the display or using ION Setup. This power cycles all the modules attached to your meter. If you have queued firmware updates for your option modules on your meter's internal FTP site, the firmware updates are performed. Your option modules do not operate normally during an option module reset.

By default, your meter is configured so that your meter automatically performs an option bus reset when needed to help keep the option modules operating normally. Contact Technical Support for instructions on changing this default configuration.

Related topics

- See "Meter resets" on page 153 for more information about the resets you can perform on your meter.
- See "Firmware and templates" on page 77 for information about uploading option module firmware.

Chapter 7 Security

Security overview

You can configure standard or advanced security on your meter, as well as optional revenue security.

Your meter comes with configurable security that you can set to either standard or advanced, which helps protect against unauthorized configuration of your meter and access to your meter's data through the meter's display or communications. Your meter has features that allow you to enable/disable Ethernet protocols and port numbers. Your meter also supports revenue locking, which incorporates revenue security on all revenue-related parameters and revenue sealing.

Your meter ships from the factory with standard security enabled.

Standard and advanced security features

Security allows you to configure the following security features to your meter:

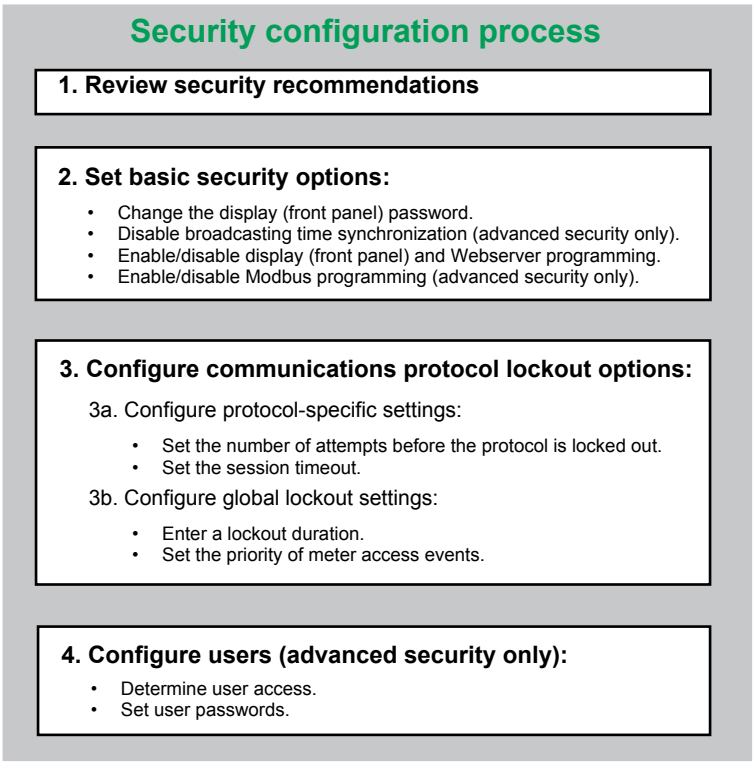
Parameter	Standard/advanced	Details
Meter password	Standard/advanced	The meter's password is used to confirm user access when configuring the meter through the display or over communications. The default meter password is 0 (zero).
Active web server	Standard/advanced	This option allows you to enable or disable the ability to configure your device using webpages.
Allow Modbus programming	Advanced only	This option can only be enabled in advanced security and is disabled for standard security.
Allow front panel programming	Standard/advanced	This option allows you to enable or disable the ability to configure your device using the display.
Allow broadcasting time synchronization	Advanced only	This option can only be disabled in advanced security and is enabled for standard security.
Protocol lockout	Standard/advanced	This option allows you to configure the number of access attempts before lockout, lockout duration and meter access event priorities.

Advanced security user configuration

Advanced security allows you to configure users with specific access levels and passwords.

Security configuration process

The following is an overview of the process to configure security on your meter:



Communications protocol lockout overview

The communications protocol lockout security feature allows you to set the number of invalid login attempts that each user can make using a particular protocol and communications method before being locked out (a user is defined as a user login and password combination). For protocols that are not session-based (ION), you can configure how often the device registers invalid login attempts by configuring the session timeout. You can also configure the lockout duration for all configurable protocols.

NOTE: If protocol lockout is set to 0 (zero) there is no limit to the number of invalid login attempts and the protocol will never be locked out. However, the invalid login attempt events are recorded if the meter access events are configured to record invalid access attempts.

Session timeout specifies the active duration for a protocol; during this time, repeated invalid login attempts using the same USER/password combination are not registered (repeated invalid attempts with different combinations are still registered). Session timeout only applies to protocols which are not session-based and send credentials with each packet, and should be configured to help prevent accidental lockouts and filling the meter's event log with protocol access events.

Once a user is locked out, the device will not accept login attempts from that user on that protocol and communications method until the lockout duration has passed. Invalid login attempts accumulate until the user has completed a valid login or been locked out. For example, once USER01 has been locked out using ION over Ethernet, USER01 cannot access the device using ION over Ethernet until the lockout duration has

passed, even if USER01 enters the correct password. However, if the user enters the correct USER/password combination before being locked out, the invalid attempt counter is reset to zero. Even if the user is locked out using ION over Ethernet, that user can still access the device by entering the correct USER/password combination over a different protocol and communications method (for example, connecting to the device's RS-485 serial port using Modbus protocol).

Related topics

- See "Configuring standard security using ION Setup" on page 87 for instructions on how to set basic security and configure communications protocol lockouts.
- See "Protocols, ports and connections" on page 52 for details of the supported Ethernet protocols, enabling/disabling protocols and changing port numbers.
- See "Specifications" on page 181 for the number of configurable users in advanced security.
- See the ION Reference for more information about the Security Options, Security User and Communications modules.

Security recommendations and best practices

Recommended security configuration

The following meter configuration is recommended to help improve security on your meter.

- Ensure that your meter requires a password for configuration through the display or communications.
- Configure the protocol lockouts to help minimize access to your meter.
- Enable advanced security on your meter.
  - Configure users and passwords to help minimize access to your meter.
- Save a copy of your meter's ION Setup security configuration (*.scf) file in a secure location for future reference or troubleshooting. Your meter's security configuration file can be loaded onto other meters of the same type to configure their security settings.

Password best practices

- Change your meter's display (front panel) password from the default value of 0 (zero).
- Make your meter's display and user-specific passwords as complex as possible.
- Schedule regular changes to your meter's display and user passwords.
- Record your meter's display and user passwords in a secure location.

If your meter's user access information is lost, you must return the meter to the factory, where your meter is reset to its factory defaults and all logged data is lost.

NOTICE
DATA LOSS Record your device's user and password information in a secure location. **Failure to follow these instructions may result in data loss.**

Additional security recommendations

- Disable communications for all unused Ethernet network protocols.
- For the highest level of security, use a revenue-locked meter with advanced security enabled and configured for minimum access.
- Save a copy of your meter's security configuration (*.scf) file in a secure location for future reference or troubleshooting. Your meter's security configuration file can be loaded onto other meters of the same type to configure their security settings.
- Set your meter's time synchronization source to a secure communications port, and disable time synchronization on all other ports.

Related topics

- See "Protocols, ports and connections" on page 52 for more information about your meter's Ethernet network protocols.

Changing your meter's display password using the display

You can change your display password using your meter's display.

NOTE: The display password is also used as the webpage password if standard security is enabled.

1. Go to **Setup Menu > Password Setup**.
2. Configure your meter's display password.

Related links

- See "Setting up your meter using the display" on page 34 for instructions on how to configure your meter using the display.

Chapter 8 Communications

Your meter has one RS-485 connection and two Ethernet connections. The two Ethernet connections have the same IP address; you cannot connect your meter to two different Ethernet networks.

Ethernet communications

Connections

The meter supports a single IP address on both of its two physical Ethernet connections.

Related topics

- See your device's installation instructions, available from www.schneider-electric.com, for communication connection details.

Ethernet LEDs

Your meter has two LEDs that indicate the status of its Ethernet communications:

Link (data rate)	On: valid Ethernet connection • Yellow: data rate is 10 Mbps • Green: data rate is 100 Mbps
Act (activity)	Flashing green: data is being transferred

Related topics

- See your meter's installation sheet for Ethernet wiring information.
- See "Ethernet communications" on page 183 for your meter's Ethernet specifications.

Configuration

In order to use Ethernet communications, you must configure your device's IP address; you must also configure the subnet and gateway information if required by your network. You need to enter network information for any Ethernet servers used by the device (such as for SNTP time synchronization).

NOTE: Contact your network system administrator for your IP address and other Ethernet network configuration values.

Configure your device's Ethernet settings by using the display or directly connecting to your meter and using a web browser to access the device's webpages. Modify your meter's Ethernet settings to those provided by your network system administrator before connecting the device to your local area network (LAN).

After the meter's Ethernet port is configured and connected to the LAN, you can use ION Setup to configure other meter setup parameters

Related topics

- See “Setting up your meter using the display” on page 34 for instructions on how to configure Ethernet communications using your meter’s display.
- See “Self-discovery over Ethernet” on page 53 for instructions on how to connect to and identify your meter over a directly connected network.
- See “Configuring network communications using ION Setup” on page 90 for instructions on how to configure your meter’s Ethernet communications using ION Setup.
- See the *ION Reference,* available from www.schneider-electric.com, for more information about the Communications module and its settings.

Protocols, ports and connections

The Ethernet protocols supported by your device allow simultaneous connections on the following IP service ports:

Protocol	Port (default)	Number of connections
ION	7700	8[1]
DNP	20000	
Modbus TCP	502	
Modbus RTU over Ethernet	7701	
Modbus TCP (dedicated)	502	32
EtherGate	7801	1
FTP	21 (20)	2
Webserver (HTTP)[2]	80	10
SNMP	161	N/A
SMTP server (email) outgoing only	25	1
NTP	123	1
IEC 61850	102	4

[1] These 8 simultaneous connections can be used by ION, Modbus TCP, Modbus RTU over Ethernet, or DNP. You can have a maximum of 3 DNP connections.

[2] This is used for the meter’s webpages.

By enabling or disabling TCP/IP protocols, you can control whether or not your meter accepts new socket connection requests from the TCP/IP protocols supported by the meter. Changing settings does not impact existing connections. Depending on the protocol, you can also change the port number.

If you configure communications so that you cannot communicate to and configure your meter, you must return the meter to the factory, where your meter is reset to its factory defaults and all logged data is lost.

NOTICE

DATA LOSS

Ensure you maintain sufficient access to communicate to and configure your device.

Failure to follow these instructions may result in data loss.

Related topics

- See “Protocols” on page 57 for more information about the protocols supported by your meter.
- See “Network settings” on page 90 for instructions on how to enable/disable your meter’s TCP/IP protocols using ION Setup.

Ethernet topologies

Your device's Ethernet ports have the same IP address. The second Ethernet port acts as an Ethernet switch to help simplify network connections and reduce installation time and costs, by having shorter Ethernet cable runs between devices without needing additional Ethernet routers or repeaters. Your Ethernet connection source should be installed in a location that helps minimize the overall Ethernet cable routing length and complexity of your network.

Each of your device's Ethernet ports has full transmit/receive bandwidth: this means they do not split the signal, so connecting both of your device's Ethernet ports should not impact your communications speed.

When wiring your meter's Ethernet communications, it is recommended to only use straight-line topology. If local network loop or ring Ethernet topologies are required, you must enable RSTP (rapid spanning tree protocol) for your meter's Ethernet communications to function.

Internet protocol (IP) versions and supported features

Your meter supports both IPv4 and IPv6 (local addressing).

Your meter supports DPWS (devices profile for web services). This feature allows for self-discovery of the meter when directly connected on IPv6 local area networks.

Related topics

- See "Configuring network communications using ION Setup" on page 90 for instructions on how to enable and disable IPv6 on your meter.

Self-discovery over Ethernet

When you connect your meter directly to your computer, your meter automatically appears on the network. By default, the meter is named PM8000_<last six digits of MAC address>.

NOTE: You do not need to configure your meter's IP address for self-discovery over Ethernet; an IPv6 address is automatically generated from your meter's MAC address and self-discovery takes place over IPv6.

For example, a meter with a MAC address of 0060784173393 appears on the network as PM8000_713393.

Double-clicking the meter's network icon takes you to the meter's webpages, where you can view data and perform basic meter configuration.

NOTE: For self-discovery, the meter must be connected directly to the computer using only a cable or switches, and not by a router.

Serial communications

The meter supports serial communications through the RS-485 port. Up to 32 devices can be connected on a single RS-485 bus.

In an RS-485 network, there is one master device, typically an Ethernet to RS-485 gateway. It provides the means for RS-485 communications with multiple slave devices (for example, meters). For applications that require only one dedicated computer to

communicate with the slave devices, an RS-232 to RS-485 converter can be used as the master device.

Related topics

- See your device's installation instructions, available from www.schneider-electric.com, for details on how to physically wire your meter's RS-485 connections.
- See "RS-485 communications" on page 183 for specifications related to serial communications.

Serial protocols and ports

Your meter supports the following protocols on its RS-485 serial port:

Protocol
ION
Modbus RTU
Modbus Master
DNP 3.0
EtherGate
GPS: Truetime/Datum[1]
GPS: Arbiter[1]
GPS: Arbiter-Vorne[1]

[1] These protocol settings are for connecting to a GPS receiver communicating in serial ASCII format.

Related topics

- See "Protocols" on page 57 for more information about the protocols supported by your meter.

RS-485 connections

Your meter has one RS-485 connection.

Related topics

- See the "RS-485 communications" on page 183 for maximum devices and wire length.
- See your device's installation instructions, available from www.schneider-electric.com, for communication connection details.

RS-485 configuration

Before connecting your device to the RS-485 bus, use the meter's display, webpages or ION Setup to configure your meter's default RS-485 settings so that it has a unique unit identifier (address) and the following settings match the rest of the devices on the RS-485 bus:

- Protocol
- Baud rate
- Parity and stop bits

You can configure the following settings to help optimize communications performance:

- RTS delay
- RS-485 bias

You can use a communications converter (USB to RS-485 or RS-232 to RS-485) or an Ethernet gateway device to connect to your meter.

RS-485 bias

You can use the RS-485 bias setting to fine tune communications. Turn on the RS-485 bias when the meter is acting as a master over RS-485 communications and turn off the RS-485 bias when the meter is acting as a slave. You can configure RS-485 biasing through the meter's display or ION Setup.

RS-485 and gateway communications

Your meter can act as a gateway from the devices on the RS-485 bus to another communications port on the meter. For example, you can configure your meter as an Ethernet gateway, which lets you communicate through the meter's Ethernet port to the serial devices connected to the meter's RS-485 port using the ION protocol (EtherGate) or Modbus protocol (Modbus gateway).

Related topics

- See the "Configuring an EtherGate gateway using ION Setup" on page 93 for instructions on how to configure EtherGate on your meter.
- See the "Configuring a Modbus gateway using ION Setup" on page 92 for instructions on how to configure Modbus gateway on your meter.

Configuring communications using the display

You can configure your meter's basic communications settings using the display.

Before configuring Ethernet parameters, make sure you obtain your meter's IP address and other network information from your network administrator or IT department.

Before configuring serial parameters, make sure you have a unique unit ID for your meter and know the serial network settings (protocol, baud rate, parity and stop bits).

1. Go to **Setup Menu** > **Communications Setup** > **IP Address Setup**. Configure your meter's IP Address and other network information as required.

   NOTE: Your meter's default IP address is 169.254.0.10

2. Press the down button to access the next screen of meter communications settings and configure as required.

Related links

- See "Setup menu" on page 33 for a description how to navigate and use your meter's display.

Chapter 9 Protocols

Protocols overview

Your meter supports several different protocols over its Ethernet and serial connections.

Your meter's default protocol implementation meets the needs of most systems with only basic configuration. You can customize these implementations to meet your specific needs; these are advanced procedures that require an understanding of ION architecture, the supported protocols, and the communications network and power system that your meter is connected to.

ION

ION is the native protocol and architecture of your meter. The basic building blocks of ION architecture are the ION modules, each of which is specialized to perform a specific task and contains data and instructions on how to manage that data. ION modules are combined (linked) together to create the meter's functions and features. ION modules that are linked together to perform a specialized task are called a framework, such as the Power Quality framework. These different functional frameworks are then grouped together to define the entire meter, and are collectively referred to as the device template.

Your meter ships with a default device template which provides extensive capabilities. You can also configure your meter's template to modify your meter's existing functions or to create new functions.

Related topics

- See the *ION Reference,* available from www.schneider-electric.com, for further information about ION architecture and a detailed description of the different ION modules.
- See the *ION Device Template Reference,* available from www.schneider-electric.com, for details on the modules and their configuration in your meter's default template.

Modbus

Modbus is a master/slave communications protocol where the master initiates transactions and the slave(s) responds with the requested information or action. Your device can function as a Modbus slave or Modbus master, depending on how it is configured. Your device comes with Modbus slave functionality configured and ready to use. You can add custom Modbus information to the default Modbus slave data provided by your device.

Key terms

Term	Definition
Modbus gateway	A communications method that lets you communicate through an Ethernet gateway device to a Modbus serial network connected to that device.
Modbus master	A device that issues commands and receives responses from Modbus slave devices. Serial Modbus networks can only have one Modbus master per network.

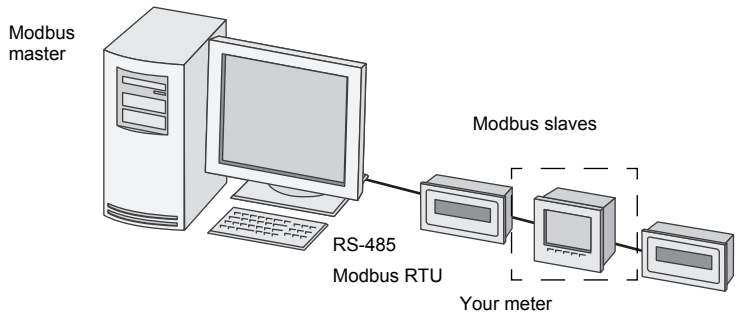
Term	Definition
Modbus RTU	Serial Modbus protocol format; Modbus RTU transmits data using binary. Master and slave devices must use the same format.
Modbus register/address	Identifies the data to read/write. Modbus register maps are available for Modbus slave devices and detail the information available from the slave device. More than one register may be used to store a single value.
Modbus slave	A device that responds to Modbus commands and performs actions or provides information back to the Modbus master. Most Modbus networks contain multiple slave devices.
Modbus TCP	The Ethernet Modbus protocol format.
Modbus unit ID	The identifier for a slave Modbus device.

Related topics

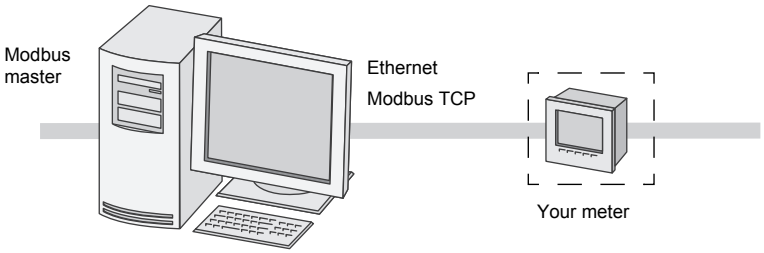
- See “Ethernet gateway (EtherGate and Modbus gateway)” on page 62 for more information about Modbus gateways.
- See “Configuring custom Modbus data using ION Setup” on page 91 for instructions on adding custom Modbus data to your device.
- Download your device’s Modbus map, available from www.schneider-electric.com.
- See the *ION Reference*, available from www.schneider-electric.com, for details about the Modbus Master Device, Modbus Master Map, Modbus Master Options, and Data Mapping modules.
- Go to www.modbus.org for information about the Modbus protocol.

Modbus network examples

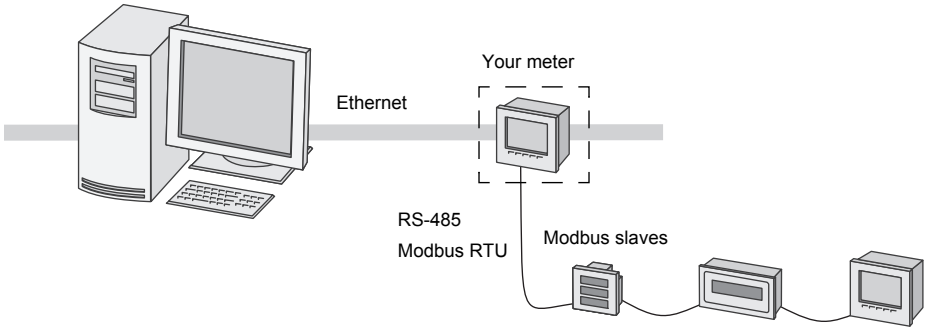
Your meter as a Modbus slave on a serial network



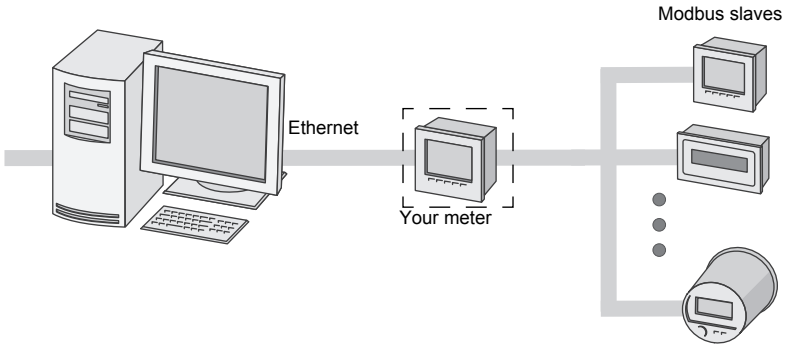
Your meter as a Modbus slave over Ethernet



Your meter as a Modbus master with serial Modbus slave devices



Your meter as a Modbus master with Ethernet Modbus slave devices



Supported features

Modbus data classes

Class	Description
Coils	Digital bits that can be read and written to
Input status	Digital bits that can be read
Input registers	16-bit integers that can be read
Holding registers	16-bit integers that can be read and written to

Modbus data formats

Format	Type	# of Modbus registers used
Unsigned 16-bit	Integer	1
Signed 16-bit	Integer	1
Unsigned 32-bit	Integer	2
Signed 32-bit	Integer	2
Unsigned 32-bit M10k	Integer	2
Signed 32-bit M10k	Integer	2
IEEE float[1]	Floating point	2
Packed Boolean for inputs	Integer	1
Packed Boolean for coils	Integer	1
Unsigned 16-bit read/write	Integer	1
Signed 64 bit	Integer	4

[1] Meters acting as Modbus masters support two versions of IEEE float with different word orders: high/low = Big Endian, low/high = Little Endian.

16-bit data (one word) is transmitted with most-significant byte first and least-significant byte second.

32-bit data (two words) is transmitted with the most-significant word first and the least-significant word second.

Modbus function codes

Function	Description	Master/slave
1	Read coil status	Master and slave
2	Read input status	Master and slave
3	Read holding registers	Master and slave
4	Read input registers	Master
5	Write to a coil	Master
6	Write to a holding register	Master and slave
15	Write to multiple coils	Master
16	Write to multiple holding registers	Master and slave
17	Report slave ID (serial only)	Master and slave
43 (subcode 14)	Read device identification	Master and slave
100	Read scattered holding registers	Master and slave

Modbus commands

A Modbus master command to unit ID 0 is broadcast (sent to) all Modbus slave devices. The only supported broadcast command is preset multiple registers.

For serial Modbus networks with only one slave device, the master can send commands using the single connection, one-to-one address of unit ID 248, regardless of the slave device's actual unit ID.

Modbus implementation

Modbus exception codes

Code	Name	Description
01	Illegal function	The requested command is invalid.
02	Illegal address	This code indicates one of the following: • The requested address is invalid for that function. • The requested address is not within the valid register range for this device. • The requested address is protected by device security.
03	Illegal value	This code indicates one of the following: • The requested value is not allowed for that register in the device. • The requested register is part of a multi-word value.

Modbus invalid read registers responses

Invalid type	Read response
Unmapped (unused)[1] register	0x8000
Reserved[1] register responses by type	
Signed integer 16-bit	0x8000
Unsigned integer 16-bit	0xFFFF
Signed integer 32-bits	0x80000000
Unsigned integer 32-bits	0xFFFFFFFF
Signed integer 64-bits	0x8000000000000000
Float32	0xFFC00000 (NaN = Not a number)

[1] Unmapped (unused) registers are registers that will never be used by the meter, and therefore have no defined format. Reserved registers have a defined format and are intended for use by the meter, its options or its variants.

Modbus invalid write registers response

If the meter receives a write command to a Modbus register address that does not have a register mapped, the meter does not respond. No data is written or stored, and the meter does not send back a rejection to the request.

If the meter receives a write command to a read-only Modbus register address, exception code 3 (illegal value) is returned.

Fixed and configurable Modbus map

Your device has a fixed (static) register map for meter data and a flexible, user-configured register map.

Modbus security

Your meter's onboard security options include Modbus-specific settings. These security settings may need to be configured in order to write Modbus data to the meter.

Modbus TCP ports

Port	Descriptions
502	Modbus TCP
7701	Modbus RTU over Ethernet

Modbus best practices

Serial

In order for your meter to operate as a serial Modbus device, you must complete the following prerequisites:

Prerequisite	Description
Wiring	The device's serial connection must be wired correctly. The Modbus slave devices must have communications wiring to the Modbus master.
Protocol	Slave: for your meter to be a serial Modbus slave, the meter's protocol must be set to Modbus RTU. Master and slave devices must use the same format. Master: for your meter to be a serial Modbus master, the meter's protocol must be set to Modbus Master.
Baud rate	The baud rate must be the same for all devices on the serial Modbus network.
Stop bits and parity	The communication stop bits and parity (for example, 8N1) must be the same for all devices on the serial Modbus network.
Unit ID	Each device on the serial Modbus network must have a unique unit ID (also called the device address).

Ethernet

In order for your meter to operate as an Ethernet Modbus device, you must complete the following prerequisites.

NOTE: You do not need to perform any Modbus-specific configuration for your meter to function as a Modbus slave device over Ethernet.

Prerequisite	Description
Ethernet	All devices must have a working Ethernet connection.
IP address	All devices must have a unique IP address.
Port	All devices must be communicating over Ethernet port 502 for Modbus TCP.

NOTE: Devices supporting multiple simultaneous Modbus TCP connections can have communications delays. Adjust your network timeout settings to accommodate this.

Modbus master

In order for your meter to operate as a Modbus master, you must complete the following prerequisites.

NOTE: These settings are required in addition to the serial or Ethernet Modbus prerequisites.

Prerequisite	Description
Modbus slave devices	All Modbus slave devices must be communicating and appropriately configured.
Protocol	• Modbus mastering serial devices: the master's serial port protocol must be set to Modbus master. • Modbus mastering Ethernet devices: the master must be communicating to the slave devices over Ethernet port 502.
Mastered devices	The Modbus master device must have the slave device information entered for mastering.

Modbus map

Your device's Modbus register information (map) is available for download from www.schneider-electric.com. The Modbus register information includes:

- registers and mapped values
- formats and scaling
- additional details where applicable

Configuring your meter for Modbus using the display

You can use the display to configure your meter as a Modbus slave or partially configure your meter for Modbus mastering.

NOTE: Before your begin, your meter's communications must be wired and configured.

Your meter does not require any Modbus-specific configuration to act as a Modbus slave device over Ethernet.

1. Navigate to **Setup Menu** > **Communications Setup** and select the serial communications setup screen.
2. Configure the serial port's Modbus parameters as required.

Parameter	Setting
Protocol	Modbus RTU or Modbus master
RS485 Bias	• Off if the meter is a Modbus slave • On if the meter is a Modbus master

3. Configure the meter's other serial port parameters as required.

   For Modbus master, you must add the Modbus slave devices using ION Setup.

Related topics

- See "Setting up your meter using the display" on page 34 for instructions on display menu navigation.

Ethernet gateway (EtherGate and Modbus gateway)

Ethernet gateway is a communications method that allows you to communicate through a gateway device to a serial network.

When a meter with gateway capabilities is installed on an Ethernet network, a master device (such as an energy management system) can communicate through the

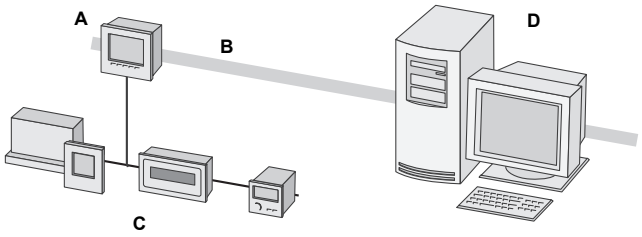
gateway meter to a serial network of devices connected to the gateway meter's serial port(s). The maximum number of devices on the serial network is determined by the limitations of the gateway meter's serial port.

There are two types of Ethernet gateways that you can configure on your meter:

- EtherGate: a single TCP connection communicates through the gateway meter to a serial network of ION devices.
- Modbus gateway: up to a maximum of 32 Modbus master TCP connections communicate through the gateway meter to a serial network of Modbus devices.

EtherGate

The meter can function as an Ethernet gateway (EtherGate). EtherGate is a protocol-agnostic communications method that lets you communicate through a gateway meter to a serial network of devices letting ION or other RTU over TCP data pass through the gateway meter to other networks, including third party systems. When a meter installed on the Ethernet network has EtherGate enabled, a master device (such as an energy management system) can communicate through the gateway meter to a serial network of devices wired to the gateway meter's COM port. You must create an additional communications connection to the gateway meter in order to read its information.



A	Gateway meter
B	Ethernet (single TCP connection)
C	Serial network of devices
D	Master device (one only)

For EtherGate, you must install the serial devices, configure them and connect them to your Ethernet-connected gateway meter. Ensure that each serial device is configured with the same protocol and baud rate and has a unique unit ID. Configure the gateway meter's serial port to use the EtherGate protocol, create the EtherGate site in ION Setup or an energy management system, and add the serial devices to the EtherGate site.

NOTE: EtherGate supports only one master device.

Related topics

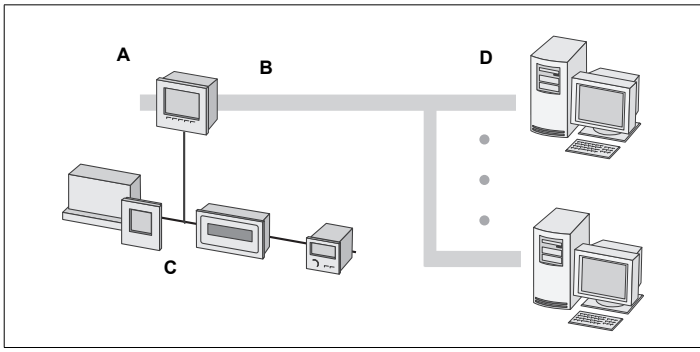
- See "Configuring an EtherGate gateway using ION Setup" on page 93 for instructions on setting up an EtherGate gateway.
- See "Specifications" on page 181 for how many serial devices your meter can support.

Modbus gateway

In a Modbus gateway configuration, a Modbus master device can communicate using Ethernet through the gateway meter to downstream serial devices.

A Modbus request is sent through Ethernet using Modbus/TCP to the gateway meter. If this request is addressed with the slave ID of one of the downstream serial devices, the meter forwards the message to that device using Modbus RTU. When the downstream device responds, the gateway meter forwards the response back to the

Modbus master. In addition to Modbus slave addresses 0 - 247, the Modbus gateway supports slave address 255, which sends a Modbus request to the gateway meter only.



A	Gateway meter
B	Ethernet (multiple Modbus master TCP connections)
C	Downstream serial Modbus slave devices
D	Multiple Modbus master devices

The maximum number of Modbus gateway Ethernet connections available is equal to the number of Modbus TCP connections the gateway meter can handle.

For Modbus gateway, you must install the serial Modbus slave devices, configure them and connect them to your Ethernet-connected Modbus gateway meter. Ensure that each serial device is configured to communicate over Modbus with the same baud rate and has a unique unit ID. Configure the gateway meter's serial port to use the Modbus master protocol and enable the Modbus gateway feature, create a Modbus gateway site in ION Setup or an energy management system, and add the serial devices to the Modbus gateway site.

Related topics

- See "Configuring a Modbus gateway using ION Setup" on page 92 for instructions on setting up a Modbus gateway.
- See "Specifications" on page 181 for how many serial devices your meter can support.

Configuring EtherGate using the display

You can use the meter's display to configure a serial port to use the EtherGate protocol.

1. Navigate to **Setup Menu** > **Communications Setup** and go to the serial communications setup screen.
2. Set the serial port's protocol to EtherGate. Configure the other serial port parameters as required.

Related topics

- See "Setting up your meter using the display" on page 34 for instructions on how to navigate and use your meter's display.

FTP

Your meter has an internal FTP server where you can load custom webpages and other files onto your meter, and where the meter provides files created by meter features such as COMTRADE waveform records.

File transfer protocol (FTP) is a standard, client-server network protocol used to transfer files over TCP (Ethernet) networks.

NOTE: You can update the firmware on your meter's accessories using your meter's FTP site.

FTP memory allocation

Your meter's FTP memory usage changes when you copy a file to the meter's internal FTP site or modify a feature that uses the meter's FTP site.

If you attempt to load a file onto your meter's FTP site that is too large, your FTP program displays an error, and you must delete files from your meter's internal FTP site to free up memory before loading the file.

If you modify a meter feature which uses FTP memory, such as increasing the number of COMTRADE waveform records, the meter checks to confirm sufficient space is available on its internal FTP site before enabling the modified feature. If there is insufficient space, the feature is disabled, and you must delete files from your meter's FTP site to increase the available space before enabling the feature.

FTP file structure and permissions

Your meter's FTP folder structure is as follows:

- COMTRADE: you can read COMTRADE files from these folders, but you cannot delete or add files to these folders.
- IEC61850: you can add an IEC 61850 configuration (CID) file to this folder to activate the IEC 61850 protocol functions of your meter.
- optionModuleUpg and rmdUpg: you can load firmware update files for your meter's remote display or option modules into these folders.
- documents: this folder is intended for user storage. You can read, write and delete any type of files in this folder.
- web: this folder is where the meter's default webpages are stored and where you can add custom webpages to the meter by copying them into the appropriate sub-folders.

FTP filename requirements

FTP filenames are limited to standard ASCII characters, meaning that they cannot contain a blank space, quotation marks or \, /, *, ?, < or >, and are limited to 68 characters in length, including the file extension. The "/" character is only used as part of the FTP file directory information.

NOTE: FTP files from your meter can only be accessed and modified by Windows-based machines.

Supported FTP features

Ports

Port	Description
21	Command connection
20	Data connection (active and passive)

Your meter's command connection FTP port is configurable, and the data connection port is automatically assigned to the command connection port number minus 1.

FTP software

The recommended FTP software is Filezilla, WinSCP or Windows Explorer running on a Windows-based machine.

Related topics

- See “Specifications” on page 181 for the maximum number of FTP sessions and default timeout value.

Accessing your meter’s FTP server

You must have FTP software such as Filezilla, WinSCP or Windows Explorer running on a Windows-based machine to transfer files to and from your meter’s internal FTP server.

1. Start your FTP software.
2. Connect to your meter via FTP by entering your meter’s IP address. Depending on your FTP software and meter security settings, you may be prompted for login credentials.

   NOTE: With standard meter security (no user configured), enter login credentials of 8000 and the meter password to connect to the meter. For advanced meter security, enter a valid user and password.
3. Navigate to the appropriate folder on your meter.
4. Close your FTP software to disconnect from the meter. The FTP connection automatically disconnects once the FTP timeout period has elapsed.

SNMP

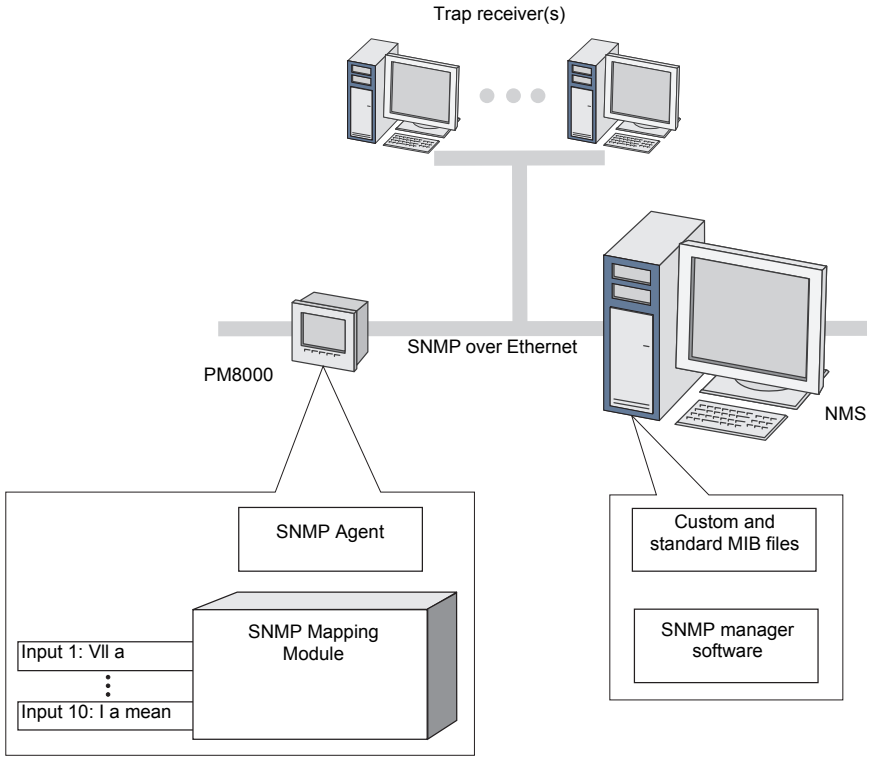
Simple Network Management Protocol (SNMP) is part of the Transmission Control Protocol/Internet Protocol (TCP/IP) protocol suite. It is an application layer protocol that enables the exchange of network management information between devices, allowing you to manage network performance and to identify and solve problems on networks with devices of various types.

Your meter supports SNMP once you have enabled SNMP on your meter. You need to upload the your meter’s MIB file (available from www.schneider-electric.com) into the NMS managing your meter.

Key terms

Term	Definition
Agent	Software resident on the managed device which interfaces between the device and the NMS.
Managed device	Your meter in the SNMP network.
Community string	A text string that helps authenticate requests between the managed device and the NMS.
Managed object	Any parameter referenced in the MIB file, for example the parameters linked to the SNMP Mapping module on your meter.
MIB	A management information base which organizes the OIDs in a hierarchical tree.
NMS	A network management station, manager or client that executes applications to monitor and control devices. An NMS must have the standard and custom MIB files and SNMP manager software.
OID	An object identifier that uniquely identifies and labels a managed object in the MIB.
Trap receiver	An NMS that is configured to receive traps and whose IP address is an SNMP trap destination.

The meter in an SNMP system



SNMP implementation

MIB files

SNMP requires that you load your meter's ION MIB file (available for download from www.schneider-electric.com) into the NMS.

Your meter is compliant with MIB-II as defined by the standard MIB file RFC 1213. You must install RFC 1213, which is required to read basic network information for the meter (for example, TCP/IP traffic or number of packets received), if it is not included with your SNMP manager software.

Community strings

A community string is a text string which acts to help authenticate requests from the NMS to your meter. There are two community strings on your meter:

- Read Only Community: this community string is used by SNMP `get` (read-only) requests. The read only community string's initial factory-set value is **public**.
- Read Write Community: this community string is used by SNMP `set` (read/write) requests. The read write community string's initial factory-set value is **private**.

NOTE: You can also use the read write community string for SNMP `get` (read-only) requests.

If your meter receives an incorrect community string, it generates an AuthenticationFailure trap.

System strings

A system string is a text string which can be configured to provide information about your meter. There are three system strings on your meter:

- System contact: enter the name of the SNMP system administrator.
- System name: enter a descriptive name for your meter.
- System location: enter a description of your meter's location.

SNMP trapping

SNMP trapping allows your meter's agent to notify the NMS of events with an unsolicited SNMP message (a "trap" of the meter's alarm event). You can enter up to four IP addresses for SNMP trap notification for generic and enterprise-specific traps. For enterprise traps, you must also define the number of events or maximum time delay before SNMP traps are sent to the NMS.

SNMP trapping is only supported on SNMP v2.

Generic SNMP traps supported by your meter are:

- Coldstart: the meter (SNMP agent) is starting.
- Linkup: the SNMP agent is enabled.
- AuthenticationFailure: the meter (SNMP agent) has received an incorrect community value.

Enterprise-specific SNMP traps supported by your meter are:

- Low: trap of events with a low event priority.
- Medium: trap of events with a medium event priority.
- High: trap of events with a high event priority.

Trap	Event priority range
Low	64 - 127
Medium	128 - 191
High	192 - 255

NOTE: The number of events or maximum time delay settings only apply to enterprise SNMP traps.

SNMP Mapping module

The SNMP Mapping module is linked by default to the most commonly used meter values to make them available to SNMP. Modification of the SNMP Mapping module is an advanced procedure that should only be undertaken by those with an advanced understanding of SNMP, ION architecture and their meter's template.

Related topics

- See the *ION Reference,* available from www.schneider-electric.com, for detailed information on the SNMP Mapping, SNMP Options and Alarm Options modules.
- See "Configuring SNMP using your meter's webpages" on page 117 for instructions on how to configure your meter's SNMP functions using your meter's webpages.
- See "Configuring SNMP using ION Setup" on page 94 for instructions on how to configure your meter's SNMP functions using ION Setup.

Default SNMP mapping

Enabling SNMP provides SNMP access to the meter values linked to the SNMP Mapping module. You can configure the SNMP Mapping module to link to different meter values. By default, the following meter values are linked to the SNMP Mapping module:

I a	kVAR tot	Vll ca	Vln avg	Ib mean	kW sd mx del-rec
I b	kVA tot	Vll avg	Freq	Ic mx	kW sd del
I c	PF sign tot	Vln a	Ia mx	Ic mean	kW sd rec
I avg	Vll ab	Vln b	Ia mean	kW sd mx del	kW sd del-rec
kW tot	Vll bc	Vln c	Ib mx	kW sd mx rec	kVAR sd mx del
kVAR sd mx rec	kVAR sd mx del-rec	kVAR sd del	kVAR sd rec	kVAR sd del-rec	kVA sd mx del
kVA sd mx rec	kVA sd mx del-rec	kVA sd del	kVA sd rec	kVA sd del-rec	kWh del
kWh rec	kWh del-rec	kVARh del	kVARh rec	kVARh del-rec	kVAh del
kVAh rec	kVAh del-rec				

The following meter information is always provided by default and cannot be configured:

Voltsmode	Model number
Serial number	Device name
Firmware version	MIB version

If you change your meter's default values you must modify the custom MIB file to reflect the new values.

Changing your meter's default SNMP configuration assumes that you have an advanced understanding of ION architecture, SNMP, and the communications network and power system that your meter is connected to.

Related topics

- See the *ION Reference,* available from www.schneider-electric.com, for detailed information on the SNMP Mapping module.

Configuring your SNMP MIB file

You must configure your MIB file if you have modified the default SNMP information provided by the meter in order for the MIB file labels to reflect the modified values.

Download the ION MIB file from www.schneider-electric.com.

NOTE: You should only configure the variable name and description. Changing other fields in your MIB file may cause the client software to report problems or return errors when trying to retrieve or view parameters.

The variable name must conform to the following rules:

- The first character must be a letter.
- The first character must be lower case.
- The name must not contain any special characters such as *, ?, &.
- The name must not contain spaces.

1. Open your meter's MIB file in a text editing program (such as Notepad).
2. Update the variable name and description so they match the meter values connected to the SNMP Mapping module.

3. Save your meter's MIB file. Make sure you keep the original file extension of .MIB.

Example—This example shows an original and an updated OID entry in an MIB file, where the default meter value of voltage line-to-neutral phase A is modified in the meter's SNMP Mapping module and is now connected to voltage line-to-neutral phase C.

Original OID entry	
Vln_a	OBJECT-TYPE
SYNTAX	DisplayString (SIZE (0. . 255))
ACCESS	read-only
STATUS	mandatory
DESCRIPTION	"Host Meter Voltage Line A to Neutral Units = V (Volts)" ::= { schneiderElectric 34 }

You must update the variable name and description to match the meter values connected to the SNMP Mapping module:

Value	Original	Updated
Variable name	Vln_a	Vln_c
Description	"Host Meter Voltage Line A to Neutral Units = V (Volts)" ::= { schneiderElectric 34 }	Host Meter Voltage Line C to Neutral Units = V (Volts)" ::= { schneiderElectric 34 }

The SNMP client software reads the original and updated file as follows:

Original	Updated
variable name: Vln_a Description: "SNM1 Input 1 - Voltage (line-to-neutral) phase A"	variable name: Vln_c Description: "SNM1 Input 1 - Voltage (line-to-neutral) phase C"

IEC 61850

IEC 68150 is an Ethernet-based protocol designed for electrical substations. It is a standardized method of communications, developed to support integrated systems composed of multi-vendor, self-describing IEDs (intelligent electronic devices) that are networked together.

Your meter can be integrated into an IEC 61850 system as an IED (or server) supporting concurrent IEC 61850 client connections and an FTP connection (used for transferring data or configuration files).

Related topics

- Go to the IEC (International Electrotechnical Commission) website at www.iec.ch for information about the IEC 61850 protocol.
- See the *IEC 68150 and ION Technology* protocol document, available from www.schneider-electric.com, for more information about how IEC 61850 is implemented on your meter.
- See the *ION Reference,* available from www.schneider-electric.com, for a description of the IEC 61850 ION modules.

Implementation

Your meter comes configured with a default set of meter data available to IEC 61850. This default set of meter data is used in the default data sets and reports in the ICD file(s) available for download from www.schneider-electric.com.

NOTE: Select the ICD file that matches your meter's option module configuration.

You must load a valid IEC 61850 configuration (CID) file into the meter's internal FTP site in order to activate the IEC 61850 features of your meter.

NOTE: Your meter can have only one IEC 61850 configuration (CID) file loaded onto its internal FTP storage. If additional CID files are loaded, IEC 61850 functions are deactivated until the additional files are removed.

Your meter has up to five dedicated IEC 61850 client connections.

You can load the IEC 61850 configuration file and configure the IEC 61850 custom modules using ION Setup.

Related topics

- See "FTP" on page 64 for information about your meter's FTP connections and folders.
- See "Loading an IEC 61850 configuration file using ION Setup" on page 95 for instructions on how to load your meter's CID file.
- See "Configuring additional data for IEC 61850 using ION Setup" on page 95 for instructions on how to add extra meter data to IEC 61850.
- See "Configuring digital outputs for IEC 61850 control using ION Setup" on page 113 for instructions on how to configure your meter's digital outputs for IEC 61850.

COMTRADE

COMTRADE stands for COMmon format for TRAnsient Data Exchange defined by IEC 60255-24 edition 2001-05, and defines a common format for power quality event (disturbance) data in order to simplify retrieval, analysis and exchange of disturbance data between multiple sources and vendors.

The format of your meter's COMTRADE files is as defined by IEC 60255-24 edition 2001-05.

Your meter can automatically generate COMTRADE files and store them on the meter's internal FTP site. COMTRADE is configured as part of the default waveform recording but not enabled from the factory.

COMTRADE can be used in conjunction with IEC 61850.

NOTE: If you are generating COMTRADE waveform information, the associated waveform recorders cannot be modified unless COMTRADE is disabled. If the waveform recorders are not configured identically, COMTRADE waveform information will not be generated.

Related topics

- See the *COMTRADE and ION technology technical* note for detailed information about COMTRADE file formats and implementation
- See "Configuring COMTRADE waveform recording using ION Setup" on page 110 for instructions on how to enable and configure COMTRADE waveform recording
- See "FTP" on page 64 for information about your meter's FTP connections and folders.

DNP

The Distributed Network Protocol Version 3.0 (DNP 3.0) is an open protocol used in the electric utility industry for communications and interoperability among substation

computers, Remote Terminal Units (RTUs), Intelligent Electronic Devices (IEDs, e.g. meters), and master stations.

Your meter can be integrated into a DNP network as a DNP slave.

Supported features

Your meter supports a maximum of three concurrent connections (sessions) using the DNP 3.0 protocol; one for each serial port, up to three using Ethernet, or a combination of both. Combinations available depend on the meter's communications options. A session consists of all incoming and outgoing DNP Master/Slave traffic on one of the meter's communications ports.

Default implementation

Your meter is pre-configured for basic DNP Slave functionality. For serial DNP communications, you must assign the DNP protocol to the appropriate serial communication port on your meter; you do not have to configure your meter’s Ethernet port(s).

You can modify your meter’s default DNP map using configuration software.

Importing data using DNP 3.0

Data can be imported into the meter from a DNP control relay or analog output device. This is an advanced feature intended for users with an in-depth understanding of the DNP 3.0 and ION protocols.

Related topics

- See the *PM8000 DNP 3.0 Device Profile* document, available from www.schneider-electric.com, for detailed information on your meter’s default DNP map and implementation.
- See the online ION Setup help for instructions on connecting to your meter and accessing the Setup Assistant, which can be used to modify your meter’s DNP port settings and default DNP map.
- See the *Multiport DNP 3.0 and ION Technology* technical note, available from www.schneider-electric.com, for more information on how your meter supports DNP 3.0.

Chapter 10 Time and time synchronization

Your meter supports different time types and time synchronization methods to adjust its internal clock.

Time overview

Your meter's internal clock is used for keeping time, timestamping data and determining intervals for time-based measurements. The meter's clock does not affect externally logged data.

Your meter monitors the passage of time using the frequency of an internal oscillator or the frequency of the line power being measured. You can view your meter's time and date information using the display or through software. To improve your meter clock's accuracy, you can use an external time reference, such as a Global Positioning System (GPS) signal.

Your meter's battery maintains the internal clock when the meter is unpowered.

Your meter displays local time based on the meter's time sync source and settings for timezone and daylight savings time. You can configure your meter's date and time format.

Related topics

- See "Configuring time and time synchronization using ION Setup" on page 96 for instruction on configuring your meter's clock settings.
- See the *Time synchronization and timekeeping* technical note, available from www.schneider-electric.com, for more information about time formats and settings.
- See the *ION Reference,* available from www.schneider-electric.com, for a detailed description of the Clock module and its operation.

Time synchronization overview

The time synchronization source and the duration between time synchronization messages determines the accuracy of the meter's clock.

The clock is adjusted by synchronizing the meter's time with another time source. Time synchronization messages can be automatically generated and sent to your meter from your energy management system software or other time source such as an SNTP/NTP server or GPS receiver. You can also manually trigger a time synchronization message from your energy management system or configuration software.

NOTE: To help maintain data integrity, some energy management systems impose a blackout rule where time synchronization messages near energy interval boundaries are ignored.

Time synchronization sources

Use only one time synchronization source or method on each network to help prevent conflicting time synchronization information. For meters connected to energy management software, the same time synchronization method must be set for all meters connected to the system to help prevent timestamp inconsistencies.

NOTE: If you are configuring your meter clock remotely from another time zone, make sure you modify the meter's configuration to match local time.

For time synchronization sources with a resolution of one second or more, the meter time is only adjusted by a time synchronization message if the difference between the meter time and the message time is greater than one second.

Related topics

- See "Configuring time and time synchronization using ION Setup" on page 96 for instructions on configuring your meter's time synchronization settings.

Supported time synchronization sources

The following time synchronization sources are available to your meter:

- Meter configuration software (ION Setup): Configuration software can manually synchronize the time of your meter based on the clock of the computer running the configuration software. Configuration software synchronization is usually performed when the meter is initially commissioned.
- Energy management system: Energy management systems can synchronize the time of your meter to be consistent with other meters on the network.
- Simple Network Time Protocol (SNTP): SNTP can synchronize the time of your meter up to ± 1 second of other meters on an Ethernet network. For SNTP time synchronization, your meter must be connected to an Ethernet network that has an active SNTP server and be configured with the server's information.
- GPS receiver (IRIG-B): A GPS receiver using IRIG-B can synchronize the time of a meter up to ± 1 ms of Coordinated Universal Time (UTC). A dedicated serial network is required to implement a GPS scheme. For IRIG-B, one of your meter's digital inputs must be connected to the IRIG-B network, and the digital input must be configured for IRIG-B time synchronization in addition to configuring your meter's clock.

NOTE: Use the digital inputs located on the meter base for IRIG-B time synchronization and other high-accuracy applications.

- GPS over serial: A GPS receiver can synchronize the time of a meter up to ± 1 ms of Coordinated Universal Time (UTC). For GPS over serial, your meter's serial port must be connected to a GPS receiver, and the serial port communications must be configured with the correct protocol setting.
- Network Time Protocol (NTP): NTP can typically synchronize the time of a meter to ± 10 to 100 ms, depending on network configuration. To implement NTP time synchronization, your meter must be connected to an Ethernet network that has an active NTP server and be configured with the server's information.

Configuring time information using your meter's display

1. Go to **Setup Menu > Date/Time/Clock Setup > Date & Time Setup**.
2. Configure your time and date formats, time zone offset, and daylight savings time offset. Press the down button to access the Clock Setup screen.
3. Configure the clock and time synchronization source, and the time synchronization time format.

Related topics

- See “Setting up your meter using the display” on page 34 for instructions on how to navigate and user your meter’s display.

Chapter 11 Firmware and templates

You can load different firmware versions and templates onto your meter.

Firmware and template overview

Firmware is your meter's operating system that enables the functions of your meter. Your meter's template defines the meter's features such as its power measurement and analyzing functionality. Your meter ships from the factory with a default template, or you can customize your meter's template to create features specific to your meter's application. You can save your customized template and upload it to other meters of the same type.

You can view your meter's firmware version on your meter's display, webpages and through ION Setup.

You can upgrade your meter's firmware and template using ION Setup. Firmware updates and new factory templates are available for download from www.schneider-electric.com.

Your meter and accessories do not operate normally during firmware and template upgrades.Your meter's digital and analog outputs may change state during a firmware upgrade. Option modules are offline during an option module firmware upgrade; they will not communicate to the meter and the outputs may change state during the upgrade process.

⚠ WARNING

UNINTENDED OPERATION

Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Loading firmware or template onto your meter clears the meter's recorded data.

NOTICE

DATA LOSS

Ensure that all important data has been recorded before uploading firmware or a template to your device.

Failure to follow these instructions can result in data loss.

Typical workflows

To update your meter to the latest available firmware and factory template:

- Download the latest firmware and template for your meter.
- Load the firmware onto your meter; the firmware upgrade process includes upgrading the meter template.

To take an existing meter out of service and replace it with a new meter:

- Save the template from the existing meter.
- Load the existing meter's template onto the new meter; the new meter will now have the customized features from the existing meter.

To update your meter's firmware without updating your meter's template:

- Save your meter's template.
- Download the latest firmware.
- Load the firmware onto your meter. When prompted for a template file, select the template you saved from your meter.

To update the firmware on your meter's remote display:

- Download the display firmware.
- Load the firmware onto the meter's internal FTP site using either an FTP program or ION Setup. The results of the firmware update are stored in the meter's event log.

To update the firmware on your meter's option module(s):

- Download the option module firmware; make sure that the firmware matches the option module type.
- Load the firmware onto the meter's internal FTP site using either an FTP program or ION Setup.
- Power cycle or perform an option bus reset to start the option module firmware upgrade.

NOTE: If the meter is power cycled or an option module reset is performed while there are option module firmware upgrade files loaded on the meter's FTP site, the option module firmware is upgraded.

Related topics

- Visit the company website at www.schneider-electric.com and search for "PM8000" to see the available firmware and templates.
- See "Loading meter firmware using ION Setup" on page 84 for more information about loading meter firmware.
- See the online ION Setup help for instructions on how to load meter templates.

Firmware overview

Your meter has the latest firmware loaded onto it at the factory.

Firmware is your meter's operating system. When new firmware is available for your meter, you can upgrade to the latest version to get the added features and functionality. The firmware version loaded on your meter is shown on your meter's display. You can use ION Setup to upgrade the firmware on your meter.

You must load a meter template as part of the firmware upgrade process. You can save your meter's existing framework before performing a firmware upgrade and then reload it back onto the meter if you do not want to change your meter's template.

Your meter's remote display and option module use firmware information from the meter, but they may also need to have their internal firmware updated if internal components change. To load and update to your meter's remote display firmware, you need to copy the file to your meter's internal FTP server.

You can download firmware files from www.schneider-electric.com.

Related topics

- See the online ION Setup help, available from www.schneider-electric.com, for more information on downloading, saving and loading your meter's template.

Laptop computer upgrade considerations

Laptop computers generally have different default power properties than desktop computers. Incorrect power options can adversely affect device upgrading because the connection between the laptop and the device must be maintained in order for the upgrade to proceed. If the laptop's hard disk shuts down or the laptop enters system standby mode, this connection is broken and the upgrade procedure must be restarted.

If you are upgrading your meter's firmware using a laptop computer, follow these guidelines:

- Plug the laptop computer into a wall outlet. Do not run the laptop on its battery.
- Configure the laptop's hard disks so that they do not shut down after a certain period of time (for example, set to "never").
- Turn off the laptop's power suspension (for example, system stand-by) and hibernate options.
- Disable the laptop's option to power down when it is closed. This prevents a shut down if the laptop is accidentally closed.
- Disable the laptop's screen saver; screen savers can burden the CPU.

Firmware upgrade considerations

Ensure that the firmware version you are upgrading to is compatible with your meter, and that the version number is greater than your existing firmware (or else you will downgrade your meter).

Your meter's existing template may not work with different firmware versions if significant meter features have been added or modified.

Remote display (RMD) upgrade behavior

Your meter's remote display will upgrade as soon as the upgrade file is put in the remote display upgrade folder on your meter's internal FTP site. It is deleted as part of the upgrade process.

NOTE: If your meter's remote display loses power during firmware upload, the display will revert to its original firmware and you will have to reload the firmware file.

The results of your remote display firmware upgrade are stored in your meter's event log. Detailed information about your remote display, such as serial number and firmware version is provided in the Factory module.

Related topics

- See “Remote display troubleshooting icons” on page 41 for a description of the icons displayed by the remote display when a display firmware upgrade is required.
- See the *ION Reference,* available from www.schneider-electric.com, for more information about the Factory module.

Option module(s) upgrade behavior

To upgrade option modules, you must load the upgrade file into the appropriate folder on the meter’s internal FTP site. The upgrade is triggered by either a power cycle or option module reset. After the upgrade is performed, the upgrade file is deleted from the meter’s internal FTP site before the option module is reset to run the new firmware. The option module firmware will not upgrade if more than one upgrade file is in the folder. The upgrade file must be the correct file type and match the type of module being upgraded.

All option modules do not perform their regular functions during firmware upgrade. If more than one option module is being upgraded, the firmware on the option module closest to the meter is done first, then the next closest, proceeding to the furthest module from the meter base requiring upgrading. A single option module firmware upgrade should not take more than five minutes.

The option module upgrade results are stored in your meter’s event log. Detailed information about the option module, such as serial number and firmware version is provided in the Factory module. Information about the option module type and details of the option module’s state is provided in the Diagnostics module.

Related topics

- See the *ION Reference,* available from www.schneider-electric.com, for more information about the Factory and Diagnostic module.

Loading remote display firmware using FTP

You can upload firmware to your meter’s remote display by loading the firmware upgrade file onto your meter’s internal FTP site.

You must have:

- Your meter’s remote display firmware upgrade (.BIN) file. You can download upgrade files from www.schneider-electric.com.
- The remote display connected to your meter, and have access to your meter’s internal FTP site.

1. Connect to your meter’s internal FTP site. Open the remote display upgrade (rmdUpg) folder.
2. Drag the remote display firmware file into the remote display upgrade folder. The file is immediately transferred to the remote display, and is not stored on the meter.
3. Watch your meter’s display to confirm the firmware upgrade is taking place
4. Review the remote display firmware upgrade details stored in the meter’s event log to confirm that the upload was successful.

Related topics

- See “Accessing your meter’s FTP server” on page 66 for instructions on how to connect to your meter using FTP.
- See “Event log overview” on page 134 for instructions on how to view your meter’s event log.
- See “Remote display troubleshooting icons” on page 41 for more information about the firmware-related icons shown on your meter’s remote display.
- See “Loading remote display firmware using ION Setup” on page 85 for instructions on how to load remote display firmware using ION Setup.

Loading option module firmware using FTP

You can upload firmware to your meter’s option modules by loading the firmware upgrade file onto your meter’s internal FTP site.

You must have:

- Your meter’s option module firmware upgrade (.SI9) file(s). You can download upgrade files from www.schneider-electric.com.
- The option module connected to your meter, and have access to your meter’s internal FTP site.

Your meter’s digital and analog outputs may change state during a firmware upgrade. Option modules are offline during an option module firmware upgrade; they will not communicate to the meter and the outputs may change state during the upgrade process.

⚠ WARNING

UNINTENDED OPERATION

Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

NOTE: If your meter’s option module loses power during firmware upload, the option module will revert to its original firmware and you will have to reload the firmware file.

1. Connect to your meter’s internal FTP site. Open the option module upgrade (optionModuleUpg) folder.
2. Drag the option module firmware file into the appropriate option module folder. Repeat for all modules that you want to load firmware onto.
3. Power cycle or perform an option module reset to upload the new firmware to the option module(s).
4. Review the option module firmware update details stored in the meter’s event log to confirm that the upgrade was successful.

Related topics

- See “Accessing your meter’s FTP server” on page 66 for instructions on how to connect to your meter using FTP.
- See “Event log overview” on page 134 for instructions on how to view your meter’s event log.
- See “Loading option module firmware using ION Setup” on page 86 for instructions on how to load option module firmware using ION Setup.

Chapter 12 ION Setup

This section details the device configuration you can perform using ION Setup.

ION Setup overview

ION Setup is a free, downloadable device configuration tool. Devices can be configured over communications links whether they are locally or remotely located.

Devices such as your meter, based on ION architecture, have two different configuration methods using ION Setup.

- The standard method uses the setup assistant; a user-friendly tool that walks you through the process of setting up your meter. It is the recommended method for most users.
- The advanced method allows you to view and configure the ION modules directly. This is an advanced procedure that should only be done by those users who are expert in ION architecture and the systems in which the device is installed.

In addition to configuring your device, you can generate reports and view real-time and logged data using ION Setup.

Basic configuration can be done using your device's display or web pages, but many features are configured using ION Setup.

You can download ION Setup from www.schneider-electric.com. It is recommended that you always upgrade to the latest version of ION Setup to help properly configure features available on your device.

⚠ WARNING

UNINTENDED OPERATION

Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Refer to the online ION Setup help for precautions and detailed information.

⚠ WARNING

INACCURATE DATA RESULTS

Verify that associated devices and ION Setup are configured correctly.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Performing resets and configuring features such as data or waveform recorders will clear recorded data.

NOTICE
DATA LOSS Ensure that all important data has been recorded before configuring device. **Failure to follow these instructions can result in data loss.**

Related topics

- See the online ION Setup help, available from www.schneider-electric.com, for instructions on how to use ION Setup and how to connect to your device using ION Setup

ION Setup device communication

Your device communicates to ION Setup using the ION protocol through its RS-485 serial communications port or over Ethernet.

If you are communicating over Ethernet, there are IP service ports set to the ION protocol, so you do not need to perform any additional device configuration to access your device using ION Setup. If you are communicating over RS-485, you will need to set the serial communications protocol to ION as well as configuring the rest of your serial communications settings.

Related topics

- See “Serial communications” on page 53 for instructions on how to configure your meter’s serial communication.

ION Setup device configuration

The best practice for configuring your device is to go through all the screens in the setup assistant and fill in the appropriate information for each feature as you go. The setup assistant has on-screen information and step-by-step wizards to help guide you through the process of configuring your device’s features.

This section contains additional information for ION Setup configuration tasks that are unique or have been modified for your device’s features and settings.

Template screen

Loading meter firmware using ION Setup

You can load firmware onto your meter using ION Setup.

You can download firmware for your meter from www.schneider-electric.com.

You must load a meter template as part of the firmware upgrade process. You can save your meter’s existing template by navigating to **Template > Save to PC** in the ION Setup Assistant and clicking **Save** to save your meter’s template as a .DCF file. You can also use a template that you have saved from another meter of the same type, or download a factory template from www.schneider-electric.com.

Ensure that you record your meter's user and password information in a secure location before upgrading the meter's firmware. If your meter's user and password information is lost, you must return the meter for factory reconfiguration, which resets your meter to its factory defaults and destroys all logged data.

Your meter's digital and analog outputs may change state during a firmware upgrade.

⚠ WARNING

UNINTENDED OPERATION

Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

1. Obtain the meter firmware (.UPG) and framework (.DCF) that you want to load onto your meter. Save the files where they can be accessed by the computer running ION Setup.
2. Start ION Setup.
3. Open the Setup Assistant for your meter.
4. Select the Template screen.
5. Click the Firmware Upgrade tab, then click **Upgrade**. Enter your meter's password (if prompted) and click **OK**.
6. Navigate to the meter firmware (.UPG) file and click **Open**. Enter your ION Setup password when prompted and click **OK**.
7. Navigate to the meter framework (.DCF) file and click **OK**. The Template Paste Options dialog box appears. Select the check boxes for the settings you want to retain (not overwrite) and click **OK**.

   A dialog box describes the template upload and firmware upgrade progress, verifies the firmware, and finishes with an overview stating whether the firmware and framework were successfully uploaded onto your meter.

Loading remote display firmware using ION Setup

This procedure is specific to the DIN meters with a remote display, and cannot be performed on meters with an integrated display.

You can load updates to your meter's remote display firmware using ION Setup over an Ethernet connection.

You must have:

- Your meter's remote display firmware update (.BIN) file. You can download update files from www.schneider-electric.com.
- The remote display connected to your meter.
- FTP access to your meter from the computer running ION Setup.

NOTE: If your meter's remote display loses power during firmware upload, the display will revert to its original firmware and you will have to reload the firmware file.

1. Obtain the remote display firmware (.BIN) that you want to load onto your display. Save the files where they can be accessed by the computer running ION Setup.
2. Start ION Setup.
3. Open the Setup Assistant for your meter.
4. Select the Template screen.
5. Click the Firmware Upgrade tab, then click **Upgrade**. Enter your meter's password (if prompted) and click **OK**.
6. Navigate to where you have stored the remote display firmware. Select the Remote Display firmware file (*.BIN) as the file type. Select the remote display firmware (.BIN) file and click **Open**. Enter your ION Setup password when prompted and click **OK**.

   A dialog box describes the firmware upgrade progress, verifies the firmware, and finishes with an overview stating whether the firmware was successfully uploaded

Loading option module firmware using ION Setup

You can upload firmware to your meter's option modules using ION Setup over an Ethernet connection.

You can only upload firmware to the same type of module; if you have different types of option modules connected to your meter, you must perform the upload process for each module type.

You must have:

- Your meter's option module firmware upgrade (.SI9) file. You can download upgrade files from www.schneider-electric.com.
- The option module connected to your meter, and have access to your meter's internal FTP site.
- FTP access to your meter from the computer running ION Setup.

All option modules do not perform their regular functions during firmware upgrade; they will not communicate to the meter and the outputs may change state during the upgrade process.

⚠ WARNING

UNINTENDED OPERATION

Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

1. Obtain the option module firmware (.SI9) files that you want to load onto your option module(s). Save the files where they can be accessed by the computer running ION Setup.
2. Start ION Setup.
3. Open the Setup Assistant for your meter.
4. Select the Template screen.

5. Click the Firmware Upgrade tab, then click **Upgrade**. Enter your meter's password (if prompted) and click **OK**.
6. Navigate to where you have stored the option module firmware. Select the Option Module firmware file (*.SI9) as the file type. Select the option module firmware (.SI9) file and click **Open**. Enter your ION Setup password when prompted and click **OK**.
7. A dialog box describes the firmware upgrade progress, verifies the firmware, and finishes with an overview stating whether the firmware was successfully uploaded

Basic setup screen

There are no additional tasks specific to your device for this screen.

Security

It is strongly recommended that you change your meter's display (front panel) password from the default value of 0 (zero).

If your meter's display (front panel) or user passwords are lost, or if you configure communications so that you cannot communicate to and configure your meter, you must return the meter to the factory, where your meter is reset to its factory defaults and all logged data is lost.

NOTICE

DATA LOSS

- Record your device's display and user password information in a secure location.
- Ensure you maintain sufficient access to communicate to and configure your device.

Failure to follow these instructions may result in data loss.

Configuring standard security using ION Setup

You can fully configure standard and advanced security on your meter using ION Setup.

In order to change security settings, you must be logged into ION Setup with an appropriate ION Setup user level. You must also have the appropriate meter-level security access to configure meter security.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Security**. Select Security Mode and click **Edit**. The open dialog box appears.
4. Select the appropriate security configuration file (*.scf) to configure your meter:
   - Standard: allows you to configure basic security and communications protocol lockout.
   - Advanced: includes the standard security features and adds user access/ password security settings.

5. The standard options or advanced options configuration screen appears. Configure the security parameters as required, some parameters can only be configured using advanced security:

Parameter	Standard/advanced	Details
Meter password	Standard/advanced	Default meter password is 0 (zero).
Active web server	Standard/advanced	This option allows you to enable or disable the ability to configure your device using webpages.
Allow Modbus programming	Advanced only	This option can only be enabled in advanced security and is disabled for standard security.
Allow front panel programming	Standard/advanced	This option allows you to enable or disable the ability to configure your device using the display.
Allow broadcasting time synchronization	Advanced only	This option can only be disabled in advanced security and is enabled for standard security.

   Click **Next** to configure protocol access information. The protocol lockout screen is displayed.

6. In the protocol lockout screen select the protocols that you want to be protected by the protocol lockout function. Select each protocol and click **Edit** to configure the protocol-specific parameters:

Parameter	Values	Description
Protocol lockout	0 - 255	The number of invalid login attempts before access is denied. If protocol lockout = 0, there is no limit to the number of invalid login attempts and the protocol will never be locked out.
Session timeout	1 - 43200 minutes (30 days)	The interval between access checks for non-session based protocols.

7. Enter the lockout duration (in minutes).
8. Click **Events** to configure user access event priorities. The Event Priorities screen appears.
9. Configure the user access event priorities.
10. If you have selected standard security, click **Finish**. You are prompted to save your security configuration to a file which can be loaded onto other meters.

    NOTE: If you chose to save your security file, enter a descriptive name and click **Save**. It is recommended that you do not overwrite the default security files.

    If you have selected advanced security, click **Next** to configure user access and passwords.

Related topics

- See “Configuring network communications using ION Setup” on page 90 for instructions on how to enable/disable Ethernet protocols and configure protocol port numbers.
- See “Security recommendations and best practices” on page 49 for recommendations for your meter’s security settings.

Configuring users and passwords using ION Setup (advanced security only)

In order to change security settings, you must be logged into ION Setup with an appropriate ION Setup user level. You must also have the appropriate meter-level security access to configure meter security.

You must have configured the standard security settings on your meter using ION Setup.

This task assumes that you are in the user configuration screen in the security wizard in ION Setup.

1. In the user/passwords screen, select (check) the user that you want to configure to view the user access options.
2. Select the appropriate values to configure the user's access:

Access	Description
Time sync	The user can set the meter's time and time synchronization parameters.
Read	The user can view all parameters except the security configuration.
Peak demand reset	The user can reset peak demand values.
Test mode	The user can put the meter into test mode (not applicable to the PM8000).
Full meter config	The user can configure all aspects of the meter except demand resets, test mode or security.
Security config	The user can configure security.

   Some access levels require that multiple access options be selected.
3. Select the user and click **Password**. The password entry screen appears.
4. Enter the desired password and click **OK**.
5. Continue configuring user access and passwords for each unique user of the meter.

   NOTE: Select **Show password when user selected** to display the password associated with that user. This feature is intended to help ensure that the correct password is entered for each user.
6. Click **Finish** to save your security configuration to the meter. You are prompted to save your security configuration to a file which can be loaded onto other meters.

   NOTE: If you chose to save your security file, enter a descriptive name and click **Save**. It is recommended that you do not overwrite the default security files.

Loading an existing security configuration file (.scf) using ION Setup

You can load an existing security configuration file (*.scf) onto your meter using ION Setup. The *.scf file can be a configuration for either standard or advanced security and must be from the same model of meter.

In order to change security settings, you must be logged into ION Setup with an appropriate ION Setup user level. You must also have the appropriate meter-level security access to configure meter security.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to Security. Select Security Mode and click **Send**. The Open dialog box appears.
4. Navigate to the location of the *.scf file you want to load onto your meter. Select the *.scf file and click **Open**. The *.scf file is loaded onto your meter.

Serial Settings

Configuring your meter as a Modbus slave using ION Setup

You can configure your meter as a Modbus slave using ION Setup.

Your meter's serial connection must be wired and configured correctly. The same mode of serial communication must be used for all devices on the network.

Your meter does not require any Modbus-specific configuration to act as a Modbus slave device over Ethernet.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Communications** > **Serial settings**. Select the tab for the serial port you want to configure.
4. Highlight the parameter and click **Edit** to configure the serial port's Modbus parameters as required.

Parameter	Setting
Protocol	Modbus RTU or Modbus master
RS485 bias	• Off if the meter is a Modbus slave • On if the meter is a Modbus master

5. Configure the meter's other serial port parameters as required.

Related topics

- See your device's Modbus map, available from www.schneider-electric.com, for Modbus register information.

Network settings

Configuring network communications using ION Setup

You can configure your device's Ethernet settings using ION Setup.

If you are connected to your device over Ethernet, changing Ethernet configuration parameters without another method of configuration enabled may cause loss of communications with your device and render it inoperable. In this case a factory reconfiguration of your device is required, which resets your device to its factory defaults and all logged data is lost.

NOTICE

DATA LOSS

Ensure you maintain sufficient access to communicate to and configure your device.

Failure to follow these instructions can result in data loss.

1. Start ION Setup.
2. Open the Setup Assistant for your device.
3. Select **Communications** > **Network Settings** and click the **TCP/IP** tab.
4. Select a setting and then click **Edit**. Configure the settings (for example, IP address, subnet or gateway) to match your communications system.

Parameter	Value	Description
Ethernet device name	configurable	This name is associated with your meter when using DPWS. By default, it is the meter type and the last 6 characters of its MAC address (example: PM8000_354386).
Enable IPv6	Yes/no	Specifies if IPv6 is enabled or disabled.
IP address	Contact your local network administrator for parameter values.	The Internet protocol address of your device.
SubnetMask		The Ethernet IP subnetwork address of your network.
Gateway		The Ethernet IP gateway address of your network.
Rx timeout	configurable	Specifies the number of seconds the meter waits for communication acknowledgments.
Modbus TCP Idle Timeout	configurable	Specify number of seconds the meter waits before disconnecting an idle Modbus TCP connection.
Modbus Gateway	Disabled/COM1	Specify the port on which Modbus Gateway sends/receives Modbus TCP requests. Note: For Modbus gateway to function properly, the serial port protocol must be set to Modbus Master.
MAC address	Read-only	The media access control (MAC) address is factory set and is for reference only.

5. Click the **Protocols** tab.
6. Select a protocol and then click **Edit**. Select whether the protocol connection requests are accepted by the meter, and configure the port number. Existing connections are not affected, but any new connections must comply with the meter's latest settings.

   NOTE: The protocol port number is not configurable on all protocols.

Related topics

- See "Configuring standard security using ION Setup" on page 87 for instructions on how to configure protocol read/write access.

3rd party protocols

Configuring custom Modbus data using ION Setup

You can configure your meter's Modbus map using ION Setup.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Communications** > **3rd party protocols** and click on the **Modbus slave** tab.
4. Select the map name and click **Edit**. The Modbus map editor is displayed.
5. Select a parameter and click **Edit** to configure:
   - the data associated with that register value
   - the register value
   - the register's format and scaling
6. Click **Add** to add a new Modbus register, **Delete** to remove a Modbus register, **Set Name** to create a new name for your Modbus map, or **Save As** to save your Modbus map as a separate file.
7. Click **OK**. Your Modbus changes are implemented on your meter.

Related topics

- Refer to your device's Modbus map, available from www.schneider-electric.com, for Modbus register information.

Configuring your meter as a Modbus master using ION Setup

You can configure your device to Modbus master slave devices over serial or Ethernet.

Make sure your master and slave devices have the prerequisite communications wiring and configuration before configuring your meter as a Modbus master.

NOTE: Devices supporting multiple simultaneous Modbus TCP connections can have communications delays. Adjust your network timeout settings to accommodate this.

The meter as a Modbus master over TCP/IP attempts to communicate with a slave device for up to 100 seconds (as per the RFC1122 standard) before moving on to the next slave device.

1. Start ION Setup
2. Open the Setup Assistant for your meter.
3. Navigate to **Communications** > **3rd Party Protocols** and click on the Modbus Master tab.
4. Click **Add** to add a Modbus slave device. The Modbus Device dialog appears.
5. Enter the Modbus slave information:
   - Enter the Modbus slave device's name and a label suffix (if applicable).
   - Select the device type of the slave device from **Device Type**.
   - Enter the unit ID of the Modbus slave device into **Slave ID**.
   - Select the serial or TCP connection from **Connected via**. This is the connection from the Modbus master to the slave device.
6. Click **Connections**. The Modbus Master Connections dialog appears.
7. Select the tab that corresponds to the connection you are configuring (for example, if you selected TCP Connection 1 from **Connected via**, select the TCP 1 tab) and configure it based on the connection type.

Connection type	Configuration
Serial connection	Select the serial communications port that is connected to the Modbus slave devices from the Assigned Port list.
TCP connection	Enter the IP address of the Modbus slave device, making sure that the IP port is set to 502.

   Click **OK** to return to the Modbus Device dialog.
8. Click **OK** to add the slave device. The device now appears on the list. Repeat these steps to add all of your Modbus slave devices.

Related topics

- See "Modbus" on page 57 for Modbus master and slave prerequisites for communications wiring and configuration.

Configuring a Modbus gateway using ION Setup

You can configure Modbus gateway on your meter using ION Setup.

Before you begin, make sure you have completed the following tasks:

- Confirm the serial network of devices are wired and configured to have the same baud rate, serial port settings (for example, 8N1), and protocol (Modbus).
- Confirm each serial device has a unique unit identifier.
- Confirm the serial network of devices are connected to the gateway meter's serial communication port.
- Confirm your gateway meter is communicating over Ethernet.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Communications** > **Serial settings** and select the tab for the communications port that the serial network is connected to.
4. Select **Protocol** and click **Edit**. The protocol selection screen appears.
5. Set the protocol to Modbus Master.
6. Navigate to **Communications** > **Network settings** and select the TCP/IP tab. Select **Modbus Gateway** and click **Edit**. The Modbus gateway selection screen is displayed.
7. Select the communications port that the serial network is connected to (and you just set to use the Modbus master protocol) and click **OK**. The Modbus gateway connection is created.
8. Create an Ethernet gateway site to access the serial network of devices through your gateway meter.

Configuring an EtherGate gateway using ION Setup

You can configure EtherGate on your meter using ION Setup.

Before you begin, make sure you have completed the following tasks:

- Confirm the serial network of devices are wired and configured to have the same baud rate, serial port settings (for example, 8N1), and protocol (ION).
- Confirm each serial device has a unique unit identifier.
- Confirm the serial network of devices are connected to the gateway meter's serial communication port.
- Confirm your gateway meter is communicating over Ethernet.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Communications** > **Serial settings** and select the tab for the communications port that the serial network is connected to.
4. Select **Protocol** and click **Edit**. The protocol selection screen appears.
5. Set the protocol to **EtherGate**.
6. Create an Ethernet gateway site to access the serial network of devices through your gateway meter.

Creating an Ethernet gateway site using ION Setup

You can create an EtherGate or Modbus gateway site in ION Setup to view serial devices connected to your meter when it is functioning as an Ethernet gateway.

You must have Ethernet gateway communications configured and your gateway and serial devices connected and communicating.

1. Start ION Setup.
2. Right-click on your workstation icon and select **Insert Item**. The New Network item dialog appears.
3. Select **Site** and click **OK**. The New Site dialog appears.
4. Select the **General** tab and configure the site.

Parameter	Values/Options	Description
Name	-	Ethernet gateway site name
Comm Link	Ethernet	Ethernet communications
Ethernet options	Gateway	Ethernet gateway communications
Gateway Info: IP Addr	-	IP address of the Ethernet gateway meter
Gateway Info: Port	7801, 502	• 7801 for EtherGate • 502 for Modbus gateway

5. Click **OK** to create the site.
6. Right-click on your newly created site and select **Insert Item**. The New Network Item dialog appears.
7. Make sure your newly created Ethernet gateway site is selected in **Attach to**. Select **Device** and click **OK**. The New Device dialog appears.
8. Enter the details of your serial device. Click **OK** to add the serial device to your Ethernet gateway site. Repeat for all the serial devices on the gateway meter.

NOTE: Use a separate standard Ethernet connection in ION Setup to connect to and read data from your Ethernet gateway meter.

Configuring SNMP using ION Setup

You can enable SNMP and configure SNMP trapping using ION Setup.

You must download the ION MIB file from www.schneider-electric.com.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Communications > Network Settings** and select the **SNMP** tab.
4. Configure your meter's SNMP parameters by selecting the parameter and clicking **Edit**. Click **OK** in the editing screen to set the parameter value.

Parameter	Description
Enable SNMP	Enables or disables SNMP on your meter.
Enable Traps	Enables or disables SNMP trapping on your meter.
Trap Rcvr Addr1 - Trap Rcvr Addr4	Enter up to four trap receiver IP addresses where trap messages will be sent.
Read only community	Enter the community string used for SNMP get (read-only) requests.
Read write community	Enter the community string used for SNMP set (read/write) requests. **NOTE:** You can use the read/write community string for SNMP get (read-only) requests.

Parameter	Description
System contact	Enter the name of your SNMP system administrator.
System name	Enter a descriptive name for your meter.
System location	Enter your meter's location.

5. Review the rest of the SNMP information and modify if necessary.

Related topics

- See the "SNMP" on page 66 for more information about how SNMP is implemented on your device.

Loading an IEC 61850 configuration file using ION Setup

You can load an IEC 61850 configuration (CID) file using ION Setup over an Ethernet connection.

You must have:

- The IEC 68150 configuration file stored in a location accessible by ION Setup. The configuration file is created by customizing the IEC 61850 device (ICD) file, which can be downloaded from www.schneider-electric.com.
- FTP access to your meter from the computer running ION Setup.

NOTE: Your meter can have only one IEC 61850 configuration (CID) file loaded onto its internal FTP site. If additional CID files are loaded, IEC 61850 functions are deactivated until the additional files are removed.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Communications > 3rd Party Protocols** and select the **IEC 61850** tab.
4. Highlight a parameter and click **Upload**. Navigate to where you stored your meter's CID file, select the file, and click **Open**.

   Your meter reviews the CID file to determine if it is valid. This process may take several minutes.

   The CID status indicates whether the meter has received and validated an IEC 61850 CID file and is operating as an IEC 61850 server.

Related topics

- See "IEC 61850" on page 70 for more information about IEC 61850 on your device.

Configuring additional data for IEC 61850 using ION Setup

You can map additional data to IEC 61850 using ION Setup.

You must have a valid IEC 61850 configuration file loaded onto your meter for IEC 61850 functionality, but it is not necessary for configuring additional data.

NOTE: You can configure additional data at any time, whether or not IEC 61850 is operating on your meter.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.

3. Navigate to **Communications > 3rd Party Protocols** and select the **IEC 61850** tab.
4. Select the information type that corresponds to the type of meter information that you want to add to your IEC 61850 data. Select analog for numeric information and digital for boolean or binary information. Click **Edit**. The custom configuration screen is displayed.
5. Select the desired meter value from those available. If the value you want is not shown, select **Show all available registers**.
6. Select an IEC 61850 leaf to associate with the meter data, and click **>>** to map the value. Click **<<** to unmap values. Click **OK** to send and save your changes to the meter.

Related topics

- See “IEC 61850” on page 70 for more information about IEC 61850 on your device.

Clock

Configuring time and time synchronization using ION Setup

You can set the time and date and configure the time synchronization settings using ION Setup.

NOTE: The clock screen is where you set the start date for the time of use feature.

NOTE: You must manually adjust the date and time information if the device is installed in a different time zone location from the computer running ION Setup.

1. Start ION Setup.
2. Open the Setup Assistant for your device.
3. Navigate to **Clock** and select the **Timezone** tab.
4. Select any parameter and click **TimeSync** to synchronize your device’s date and time with the computer that is running ION Setup.

   Click the **DST Settings** tab to modify your meter’s daylight savings time start and end dates, if required.
5. Select the parameter that you want to configure and click **Edit**. Enter the password if prompted.

Parameter	Value	Definition
Timezone	—	Sets the timezone based on the timezones available from the computer’s operating system. **NOTE:** This is also where you can synchronize your meter’s DST settings with the computer’s.
Time sync type	Local time or UTC	Specifies the time format of the time sync message • UTC: Coordinated Universal time: for the purposes of meter configuration, it is equivalent to Greenwich Mean Time (GMT). • Local time: the local time, with DST and timezone information applied.
Time sync source	COM1, Ethernet, Ethernet - ION, Ethernet - DNP, IRIG-B	Sets which device port accepts time synchronization messages. Time synchronization messages on other ports are ignored

Parameter	Value	Definition
Clock Source	Internal, Line frequency, COMM	Sets the source for the clock: • Internal: the meter's internal clock. • Line frequency: the frequency of the measured power system as the clock source. • COMM: the meter's communication port (used by the GPS time sync source).
DST Offset	Numeric Bounded Format/Elapsed Interval Format	Specifies the amount of time the meter clock is moved forward when entering Daylight Savings. A value of zero disables this feature and clock does not adjust for DST.
Start of the Week	Monday - Sunday	Specifies the start day of the week used for Trending and Forecasting. **NOTE:** Changing the start day of the week clears all trending and forecasting data.

For SNTP/NTP time synchronization, you must set the **Time sync type** to **UTC** and the **Time sync source** to **Ethernet**.

For GPS/IRIG-B time synchronization, you must set the **Time sync source** to **IRIGB** and the **Clock Source** to **COMM**.

6. For SNTP/NTP time synchronization, you must also enter the following information under **Communications** > **Network Settings** > **NTP**:

Parameter	Value	Definition
Enable NTP Time Sync	NTP, SNTP, No	NTP: specifies NTP time synchronization. SNTP: specifies SNTP time synchronization. **NOTE:** SNTP is recommended for revenue-related applications. No: neither NTP nor SNTP time synchronization are used.
NTP Time Sync Interval	Numeric value or elapsed interval value	Specifies how often the meter synchronizes over SNTP. **NOTE:** This parameter is not used for NTP.
NTP Event Logging Threshold (NTP only)	1000 to 1000000	Specifies the minimum time difference (in milliseconds) for a time synchronization to be logged as an event. This parameter can be configured to help prevent the meter's event log from being flooded with time synchronization events.
NTP Server	Server IP address or domain name	Specifies the IP address (or fully qualified domain name if DNS is active) of the SNTP or NTP server.

7. For serial GPS time synchronization, you must also enter the following information under **Communications** > **Serial settings**:

Parameter	Definition
Protocol	Select the GPS setting that matches your GPS receiver.
Baud rate	The recommended baud rate for GPS time synchronization is 9600 bps.
Serial port	The recommended stop bits/parity for GPS time synchronization is 8N1.

Related topics

- See "Time and time synchronization" on page 73 for more information about time and time synchronization on your meter.
- See "Electrical characteristics" on page 181 for information on the IRIG-B standard and specifications.

Demand

There are no additional documented tasks specific to your device for this screen.

Energy pulsing

NOTE: This screen is where you can configure the energy pulsing for accuracy verification testing.

Configuring energy pulsing using ION Setup

You can configure your meter's digital output and energy pulsing LED for energy pulsing.

Ensure that the digital output port or energy pulsing LED is available for energy pulsing and not associated with another function.

When configuring your meter, the configuration interface may show all of the possible ports, regardless of what is physically available on your meter.

NOTE: For applications where accuracy is important, use the digital output or energy pulsing LED located on the base of the meter.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Select **Energy pulsing**.
4. Select **LED** and configure the following basic parameters for your meter's energy pulsing LED.

Parameter	Description
Source	The energy source used for LED energy pulsing.
W Kt	The amount of source energy required to make the LED pulse.
W Pulse Width	The minimum time in seconds between LED pulse transitions. **NOTE:** There is a minimum 50% duty cycle on all pulses.
Wh pulse ovrld	Pulsing normally indicates that the energy pulsing LED should be operating normally. Pulsing suspended indicates that the energy pulsing LED is not able to pulse quickly enough. Modify the W Kt value to decrease the number of energy pulses.

NOTE: Only configure parameters other than those described if you have advanced knowledge of ION and the power system your meter is connected to.

5. Select an energy pulsing source tab (such as Wh Del) to configure energy pulsing using your meter's digital output..

Parameter	Description
Kt	The amount of energy source required to make one pulse. For example, in the Wh Del tab, the Kt value would be amount of real energy delivered (Wh Del) per pulse.
Pulse Width	The minimum time in seconds between pulse transitions. **NOTE:** There is a minimum 50% duty cycle on all pulses.
Port	Select an output port from the list. Only available output ports are shown.
(source) ovrld	Pulsing normally indicates that the output port should be operating normally. Pulsing suspended indicates that the output port is not able to pulse quickly enough. Modify the Kt value to decrease the number of energy pulses.

NOTE: Only configure parameters other than those described if you have advanced knowledge of ION and the power system your meter is connected to.

Energy applications

Configuring conditional energy using ION Setup

You can enable and configure conditional energy settings using ION Setup.

When configuring your meter, the configuration interface may show all of the possible ports, regardless of what is physically available on your meter.

One of your device's digital inputs must be connected and configured to define when conditional energy is accumulated.

1. Start ION Setup.

2. Open the Setup Assistant for your meter.
3. Navigate to **Energy Applications** > **Digital Input Based**. Review the digital inputs assigned to applications to help ensure there are no conflicting usages.
4. Select **Conditional Energy** and click **Edit**. The **Conditional Energy Setup** screen is displayed.
5. Select **Enabled** to enable the conditional energy feature.
6. Click **Select** to define the digital input. The input's state determines whether conditional energy is accumulated. When this digital input is on, conditional energy is accumulated.

   NOTE: It is recommended to set **Assigned Input** to No Connection to disable the conditional energy feature by removing any port associations.
7. Click **OK** to save your configuration.

Configuring standard input metering using ION Setup

You can configure input metering with standard units and rates using ION Setup.

When configuring your meter, the configuration interface may show all of the possible ports, regardless of what is physically available on your meter.

NOTE: Your device's digital input must be connected to the input metering pulse source. Review the digital inputs assigned to applications to help you understand your existing configuration.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Energy Applications** > **Digital Input Based**.
4. Select the input metering channel you want to configure and click **Edit**. The **Input Metering Channel Setup** screen is displayed.
5. Select **Enabled** to enable the input metering feature.
6. Click **Select** to define which digital input is the pulse source for the input metering channel.

   NOTE: It is recommended to set **Assigned Input** to No connection to disable the input metering channel by removing any port associations.
7. Configure the remaining parameters as required.

Parameter	Description
Pulse Weight	Enter the value per pulse.
Units	Select the measurement units associated with the pulse.
Demand Period	Enter the frequency in minutes that input metering data is calculated in your energy management system.
Rate	Select the rate associated with the defined Units.
Source ID	Enter a data identifier. This value is added to the input metering channel's data to uniquely identify the data within your energy management system.

8. Click **OK** to save your configuration.
9. Configure your meter to log the input metering data if required.

Related topics

- See the ION Setup online help, available from www.schneider-electric.com, for instructions on how to add input metering data to your meter's onboard data logs.

Configuring custom input metering using ION Setup

You can configure input metering with custom units and rates using ION Setup.

When configuring your meter, the configuration interface may show all of the possible ports, regardless of what is physically available on your meter.

NOTE: Your device's digital input must be connected to the input metering pulse source. Review the digital inputs assigned to applications to help you understand your existing configuration.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Energy Applications** > **Digital Input Based**.
4. Select the input metering channel you want to configure and click **Edit**. The **Input Metering Channel Setup** screen is displayed.
5. Select **Enabled** to enable the input metering feature.
6. Click **Select** to define which digital input is the pulse source for the input metering channel.

   NOTE: It is recommended to set **Assigned Input** to No connection to disable the input metering channel by removing any port associations.
7. Clear the **Standard quantity** checkbox.The screen changes to display custom input metering parameters.
8. Configure the remaining parameters as required.

Parameter	Description
Pulse Weight	Enter the value per pulse.
Units	Enter the measurement units associated with the pulse. **NOTE:** Include source identification information by entering "@" followed by the source identifier.
Demand Period	Enter the frequency in minutes that input metering data is calculated in your energy management system.
Rate	Enter the rate associated with the defined Units.
Scaling	Select the scaling value based on the relationship between Units and Rate.
Time Base	Select the value and units to match the Rate.

9. Click **OK** to save your configuration.
10. Configure your meter to log the input metering data if required.

Related topics

- See the ION Setup online help, available from www.schneider-electric.com, for instructions on how to add input metering data to your meter's onboard data logs.

Configuring incremental energy using ION Setup

You can configure incremental energy using ION Setup.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.

3. Navigate to **Energy Applications** > **Incremental Energy**.
4. Select **Status** and click **Edit**. The incremental energy configuration screen is displayed.

   NOTE: To display parameters for configuration, select **Enable**.
5. Select the parameter to configure and click **Edit**.

Parameter	Range	Description
Status	Enable/disable	Enables the incremental energy feature
Start time	12:00 am to 11:59 pm	The incremental energy first interval's start time. The start time must be prior to the end time for energy accumulation.
End time	12:01 am to 12:00 am	The end time for incremental energy. The end time must be after the start time and be less than or equal to 12 am (midnight)
Interval duration	Configurable	The increment period for the incremental energy duration.

Your changes are made to the meter.

NOTE: Configuring any parameter resets the incremental energy values recorded by your meter.

Onboard I/O

⚠ WARNING

UNINTENDED OPERATION

Do not use this meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Configuring onboard digital inputs using ION Setup

You can use ION Setup to configure your meter's digital inputs.

Digital inputs are available on your meter. You can add more digital inputs using optional I/O modules.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **I/O** > **Digital Inputs**. The tabs correspond to each digital input. Click on the tab for the digital input you want to edit.
4. Configure the digital input by selecting the parameter and clicking **Edit**.

Parameter	Value/Range	Description
Input Mode	Pulse, KYZ, A/C, IRIG-B[1]	Specifies how the meter processes the signal: • Pulse: the meter counts an entire pulse (from off-on to on-off) as one input. • KYZ: the meter counts a transition (from off-on or from on-off) as one input. • A/C: the meter detects analog signals where the ON condition is based on the presence of an AC signal. • IRIG-B[1]: the meter detects an IRIG-B time synchronization signal.
Polarity	Inverting/Non-Inverting	Specifies if the signal from the digital port is inverted or not inverted.
Debounce	0.000 - 1.000	Specifies how long (in seconds) the signal must remain in a state to be considered a valid state change.
Port	Defined by your meter's hardware	Your meter's physical digital input port.

[1] IRIG-B can only be connected to one of the digital inputs located on the meter base, not an option module. You must also configure your meter's clock to use IRIG-B time synchronization.

5. Once the parameter has been configured, click **OK** to save the setting to the meter.

Related topics

- See "Time synchronization overview" on page 73 for IRIG-B time synchronization information

Configuring onboard digital outputs using ION setup

You can configure your meter's digital outputs using ION Setup.

One form A digital output is available on the base of the meter. You can add more digital outputs using optional I/O modules.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to either onboard or expansion I/O, Digital Outputs, and select a digital output tab.
4. Configure the digital output by selecting the parameter and clicking **Edit**.

Parameter	Value/Range	Description
Source	Digital/Boolean	Link this input to the value that drives the state of the digital output. If Source is not linked, the digital output state is driven by the Force ON, Force OFF values.
Force ON	Pulse	Link this input to a pulse that forces the digital output on for the PulseWidth duration, regardless of the Source input.
Force OFF[1]	Pulse	Link this input to a pulse that forces the digital output off.
Normal[1]	Pulse	Pulsing this input will switch the driver of the digital output from Force ON to Source.
Polarity	Inverting/non-inverting	Specifies if the signal to the digital port is inverted or not inverted.
PulseWidth	0 - 2,000,000	Specifies the duration of the pulse, in seconds. Setting this parameter to 0 sets the digital output continuously on.
Port	-	The physical digital output port connection. Only available ports are shown.

[1] These parameters are only valid when pulse width is set to 0.

The digital output is configured.

Expansion Modules

Option I/O modules

You can configure your meter's I/O option modules using ION Setup.

The I/O option module screen has tabs corresponding to the four possible option module, based on how the option modules are connected to the meter. Each has tab an area where the module's ports are listed for viewing and configuration. The module's type and status is displayed.

Status examples	Description
None	No option module detected
Normal	The option module is operating normally
Option module added	A new option module is detected
Option module removed	The option module has been removed
Invalid SI9	The option module's firmware is not supported
Invalid card	The option module type is not supported

In the option module tabs you can also reset your meter's option modules. This power cycles all the option modules. Option module functions are not available during a bus reset and option module digital and analog outputs will change state.

⚠ WARNING

UNINTENDED OPERATION

Do not use this meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Configuring I/O option module analog inputs using ION Setup

You can configure analog inputs using ION Setup.

Analog inputs are available on the optional I/O modules you can connect to the base of your meter.

Calculate your zero scale and full scale values based on the analog source and the input range of your meter.

Make sure that the analog input port that you want to use is properly configured and connected to a valid external analog signal source.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Expansion Module > Option I/O Modules**, and select the module tab that corresponds to the option module with the analog input you want to configure.
4. Select the analog input channel and click **Edit**. The setup screen for that analog input is displayed.
5. Configure the analog input by selecting the parameter and clicking **Edit**.

Parameter	Value/Range	Description
Zero scale	0 to $\pm10^9$	The minimum source value that matches the minimum analog input signal.
Full scale	0 to $\pm10^9$	The maximum source value that matches the maximum analog input signal.
Port	-	The physical analog input port connection.
Mode	Voltage, current	Determines whether the analog input is monitoring voltage or current.

The analog input is configured.

Configuring option module analog outputs using ION Setup

You can configure option module analog outputs using ION Setup.

Analog outputs are available on the optional I/O modules you can connect to the base of your meter.

Calculate your zero scale and full scale values based on the measured value and the analog output range of your meter.

Make sure that the analog output port that you want to use is properly connected to an analog receiver.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Expansion Module > Option I/O Modules**, and select the module tab that corresponds to the option module with the analog output you want to configure.
4. Select the analog output channel and click **Edit**. The setup screen for that analog output is displayed.
5. Configure the analog output by selecting the parameter and clicking **Edit**.

Parameter	Value/Range	Description
Zero scale	0 to $\pm 10^9$	The minimum source value that matches the minimum analog output signal.
Full scale	0 to $\pm 10^9$	The maximum source value that matches the maximum analog output signal.
Port	-	The physical analog output port connection.
Mode	Voltage, current	Determines whether the analog output is putting out voltage or current

The analog output is configured.

Configuring option module digital inputs using ION Setup

You can use ION Setup to configure your meter's digital inputs.

Digital inputs are available on your meter. You can add more digital inputs using optional I/O modules.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Expansion Module > Option I/O Modules**, and select the module tab that corresponds to the option module with the digital input you want to configure.
4. Select the digital input channel and click **Edit**. The setup screen for that digital input is displayed.
5. Configure the digital input by selecting the parameter and clicking **Edit**.

Parameter	Value/Range	Description
Input Mode	Pulse, KYZ, A/C, IRIG-B[1]	Specifies how the meter processes the signal: • Pulse: the meter counts an entire pulse (from off-on to on-off) as one input. • KYZ: the meter counts a transition (from off-on or from on-off) as one input. • A/C: the meter detects analog signals where the ON condition is based on the presence of an AC signal. • IRIG-B[1]: the meter detects an IRIG-B time synchronization signal.
Polarity	Inverting/Non-Inverting	Specifies if the signal from the digital port is inverted or not inverted.
Debounce	0.000 - 1.000	Specifies how long (in seconds) the signal must remain in a state to be considered a valid state change.
Port	Defined by your meter's hardware	Your meter's physical digital input port.

[1] IRIG-B can only be connected to one of the digital inputs located on the meter base, not an option module.

6. Once the parameter has been configured, click **OK** to save the setting to the meter.

Configuring option module digital outputs using ION setup

You can configure your meter's digital outputs using ION Setup.

One form A digital output is available on the base of the meter. You can add more digital outputs using optional I/O modules.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Expansion Module > Option I/O Modules**, and select the module tab that corresponds to the module with the digital output you want to configure.
4. Select the digital output channel and click **Edit**. The setup screen for that digital output is displayed.
5. Configure the digital output by selecting the parameter and clicking **Edit**.

Parameter	Value/Range	Description
Source	Digital/Boolean	Link this input to the value that drives the state of the digital output. If Source is not linked, the digital output state is driven by the Force ON, Force OFF values.
Force ON	Pulse	Link this input to a pulse that forces the digital output on for the PulseWidth duration, regardless of the Source input.
Force OFF[1]	Pulse	Link this input to a pulse that forces the digital output off.
Normal[1]	Pulse	Pulsing this input will switch the driver of the digital output from Force ON to Source.
Polarity	Inverting/non-inverting	Specifies if the signal to the digital port is inverted or not inverted.
PulseWidth	0 - 2,000,000	Specifies the duration of the pulse, in seconds. Setting this parameter to 0 sets the digital output continuously on.
Port	-	The physical digital output port connection. Only available ports are shown.

[1] These parameters are only valid when pulse width is set to 0.

The digital output is configured.

Logging

There are no additional tasks specific to your device for this screen.

Revenue

There are no additional tasks specific to your device for this screen.

Alarming

⚠ WARNING

UNINTENDED OPERATION

Do not use this meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Configuring setpoint/standard alarms using ION Setup

You can use ION Setup to configure the standard alarm settings.

1. Start ION Setup
2. Open the Setup Assistant for your meter.
3. Navigate to **Alarming** and click the **Standard** tab.
4. Select a setpoint and click **Edit**.
5. Enter unit password and click **OK,** if required. The **Setpoint Setup** screen is displayed.
6. Configure the setpoint values as required.

Parameter	Value/Range	Description
By Percentage	By Percentage/By Value	When available, specifies if the Pickup and Dropoff entries are by percentage or by value. If the option is not available, pickup and dropoff entries are by value.
Force Off	Checked/Unchecked	Forcing the alarm off disables all functions of the associated input. To stop an alarm from being displayed without affecting other meter features, set the alarm priority to Info only.
Label	String value	When available, lets you modify the default label so it more clearly identifies the alarm. Letters, numbers, underscores are permitted. Spaces are not permitted.
Pickup	Numeric value	Use this setting to provide a value for when the alarm turns on.
Pickup Delay	Numeric value	This specifies the number of seconds the digital input must be in the alarm pickup state before the alarm turns on.
Dropout	Numeric value	Use this setting to provide a value for when the alarm turns off.
Dropout Delay	Numeric value	This specifies the number of seconds the digital input must be below the alarm dropoff state before the alarm turns off.
Alarm Priority	None, Info only, Low, Medium or High	Specifies the priority level of the standard alarm. To disable the alarm, set priority to Info only.
Custom Priority	0-255	Select custom priority to view and configure the event priority of the event associated with the alarm. The event log cutoff value is displayed for reference; priorities above the cutoff are stored in the meter's event log.

7. Click **Save** to save the settings to your meter.

Related topics

- See "Alarms overview" on page 147 for more information about your meter's alarms and alarm configuration.

Configuring sag/swell alarms using ION Setup

You can use ION Setup to configure the sag/swell alarm settings.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Alarming** > **Sag/Swell**.
4. Select a parameter and click **Edit**.
5. Configure the parameters as required.

Parameter	Value/Range	Description
Nominal voltage	1 to 999,999	Specifies the nominal voltage value used for sag/swell detection.
Voltage Swell%	Percentage of nominal	Specifies the swell limit expressed as a percentage of the nominal voltage.
Voltage Sag%	Percentage of nominal	Specifies the sag limit expressed as a percentage of the nominal voltage.
Nominal Current	1 to 999,999	Specifies the nominal current value used for sag/swell detection.
I Sag Pickup	Numeric value	Specifies the percentage the current must deviate from the nominal current in order to be classified as a sag.
I Sag Dropout	Numeric value	Specifies the additional amount that the current must recover in order to signal the end of the sag.
I Swell Pickup	Numeric value	Specifies the percentage the current must deviate from the nominal current in order to be classified as a swell.
I Swell Dropout	Numeric value	Specifies the additional amount that the current must recover in order to signal the end of the swell.

Related topics

- See “Alarms overview” on page 147 for more information about your meter’s alarms and alarm configuration.

Configuring digital input alarms using ION Setup

You can use ION Setup to configure the digital alarm settings.

When configuring your meter, the configuration interface may show all of the possible ports, regardless of what is physically available on your meter.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate **Alarming** > **Digital Input**.
4. Configure the digital input alarm settings by selecting an input and clicking **Edit**. Some settings are not configurable and are grayed out.

Parameter	Value/Range	Description
Input	Input On/Input Off	Specifies the input state/alarm behavior: • Input On: the alarm is on when the digital input is on. • Input Off: the alarm is on when the digital input is off.
Force Off	Checked/Unchecked	Forcing the alarm off disables all functions of the associated input To stop an alarm from being displayed without affecting digital input features, set the alarm priority to Info only.
Label	String value	When available, lets you modify the default label so it more clearly identifies the alarm. Letters, numbers, and underscores are permitted. Spaces are not permitted.
Alarm Priority	None, Info only, Low, Medium or High	Specifies the priority level of the digital input alarm. To disable the alarm, set priority to Info only.
Custom Priority	0-255	Select custom priority to view and configure the event priority of the event associated with the alarm. The event log cutoff value is displayed for reference; event priorities above the cutoff are stored in the meter’s event log.

5. Click **Save** to save the changes to the meter.

Related topics

- See “Alarms overview” on page 147 for more information about your meter’s alarms and alarm configuration.

Implementing alarm setpoint learning using ION Setup

You can use ION Setup to implement setpoint learning, which analyzes your power system and recommends settings.

NOTE: Your meter’s power system must be stable in order to learn valid setpoint values.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Alarming > Standard**.

   NOTE: You can manually configure setpoint values by selecting the setpoint and clicking **Edit**.
4. Select a setpoint and click **Learn**. The **Global Setpoint Learning** screen is displayed.
5. Select the setpoint tabs to view existing configured or learned setpoint information.
6. Click **Setup**. The **Alarm Learning Setup** screen is displayed.
7. Configure the learning parameters for each setpoint and click **Save**:

Parameter	Value/Range	Description
Install mode	Automatic, Manual	• Automatic: the learned values are automatically applied if valid. • Manual: the learned values are stored for you to review and enter.
Duration	1-365	Days for maximum learning duration

8. Click **Start All** to begin setpoint learning for all setpoints.
   – When setpoint learning is in progress, an asterisk is displayed next to the setpoint.
   – Click **Abort** to stop learning for a specific setpoint. To stop all setpoint learning, repeat for each setpoint tab.
9. Apply the learned setpoint values:
   – Automatic: the setpoint values are automatically applied unless the learning process has issues or the learned values are invalid.
   – Manual: navigate to **Alarming** > **Setpoints** and click **Learn**. On each setpoint tab, click **Install** to apply the learned values to that setpoint.

NOTE: If you click **Install** while learning is in progress (in either manual or automatic installation mode), it stops the learning process and prompts you for confirmation that you want to stop learning and install the learned values. Once you confirm, the learned values are automatically installed or prepared for manual installation.

Related topics

- See “Setpoint learning overview” on page 137 for more information about setpoint learning.

Implementing sag/swell limit learning using ION Setup

You can use ION Setup to implement voltage sag/swell learning, which analyzes your power system and recommends settings.

NOTE: Your meter's power system must be stable in order to learn valid sag/swell limits.

You must have configured your meter's nominal voltage in order to learn valid sag/swell limits.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Alarming** > **Sag/Swell**.
4. Select the **Voltage Swell %** or **Voltage Sag %** and click **Learn**. The **Global Setpoint Learning** screen is displayed.

   NOTE: You can manually configure the limit values by selecting the parameter and clicking **Edit**.
5. Click **Setup**. The **Alarm Learning Setup** screen is displayed. Configure the learning parameters:

Parameter	Value/Range	Description
Install mode	Automatic, Manual	• Automatic: the learned values are automatically applied. • Manual: the learned values are stored for you to review and enter.
Duration	1-365	Days for maximum learning duration

   Click **Start** to begin sag/swell learning. Click **Abort** to stop learning.
6. Apply the learned sag/swell limits:
   – Automatic: the limits are automatically applied unless there are issues with the learning process.
   – Manual: navigate to **Power quality** > **Sag/Swell**. Select the **Swell limit %** or **Sag limit %** and click **Learn**. Click **Install** to apply the learned limits.

NOTE: If you click **Install** while learning is in progress (in either manual or automatic installation mode), it stops the learning process and prompts you for confirmation that you want to stop learning and install the learned limits. Once you have confirmed, the learned limits are automatically installed or prepared for manual installation.

Related topics

- See "Setpoint learning overview" on page 137 for more information about setpoint learning, including sag/swell learning.

Power Quality

Configuring waveform recording using ION Setup

You can configure waveform recording using ION Setup.

For waveform recording to trigger automatically, you must enter your system's nominal (normal) voltage and current values, and then the amount of deviation from the nominal required to trigger waveform recording.

Changing your meter's waveform recording configuration clears your meter's existing waveform records.

NOTICE

DATA LOSS

Ensure that all important data has been recorded before configuring waveform recording.

Failure to follow these instructions can result in data loss.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Alarming** and click the **Sag/Swell** tab. Configure your meter's sag/swell detection parameters:

Parameter	Value/Range	Description
Nominal voltage	0 - 999,999	Specifies the nominal voltage value used for sag/swell detection.
Voltage Swell %	Percentage of nominal	Specifies how much a measured value must exceed the nominal in order to be considered a swell.
Voltage Sag %	Percentage of nominal	Specifies how much a measure value must fall below the nominal in order to be considered a sag.
Nominal current	0 - 999,999	Specifies the nominal current used by Swell and Sag limit % for a current sag or a current swell.
Current Sag Pickup	Numeric value	Specifies the percentage the current must deviate from the nominal current in order to be classified as a sag.
Current Sag Dropoff	Numeric value	Specifies the additional amount that the current must recover in order to signal the end of the sag.
Current Swell Pickup	Numeric value	Specifies the percentage the current must deviate from the nominal current in order to be classified as a swell.
Current Swell Dropout	Numeric value	Specifies the additional amount that the current must recover in order to signal the end of the event.

4. Navigate to **Power Quality** and click the **Sag/Swell** tab to configure your meter's waveform recording parameters.

Parameter	Description
Sag/Swell depth	Specifies the number of records the sag/swell data log can hold
Waveform depth	Specifies the maximum number of waveform records stored on the meter.
Waveform format	Specifies the number of samples per cycle and the number of cycles that are stored in a waveform record.
Post event cycles	Specifies the number of cycles recorded after the waveform is triggered. NOTE: The maximum number of post event cycles cannot exceed the number of cycles in the waveform record.
Hysteresis %	Specifies the difference in magnitude between the start and end thresholds for a power quality event.

NOTE: COMTRADE status must be set to **Disabled** before modifying the waveform format.

Configuring COMTRADE waveform recording using ION Setup

You can enable and configure COMTRADE waveform recording using ION Setup.

COMTRADE is configured as part of the default waveform recording but not enabled from the factory.

Your meter's COMTRADE files' format complies with the standard defined by IEC 60255-24 edition 2001-05.

1. Start ION Setup.

2. Open the Setup Assistant for your meter.
3. Navigate to **Power Quality > COMTRADE**.
4. Configure the COMTRADE parameters:

Parameter	Value	Description
Status	Enabled/Disabled	Enabled: COMTRADE files are generated. Disabled: COMTRADE files are not generated.
Depth	1 or more	The number of COMTRADE records stored on the meter. • By default the oldest COMTRADE record will be overwritten by the newest record. • A message is displayed if the Depth value exceeds the available memory. • A single COMTRADE record uses approximately 45 kB of meter memory.

COMTRADE records are stored as read-only files on your meter's internal FTP server, and are deleted when you perform a Master reset of the meter.

NOTE: To configure waveform recording, you must disable COMTRADE, configure waveform recording, and then enable COMTRADE. COMTRADE records are not generated if the waveform recorders have inconsistent settings.

Downloading COMTRADE files using ION Setup

You can download COMTRADE waveform records from the meter's internal FTP server to another network location using ION Setup.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Power Quality > COMTRADE**.
4. Select the status parameter and click **Save**. The **Upload COMTRADE files** screen is displayed.
5. Select the criteria for the COMTRADE files you want to load from your meter's internal FTP site to another network location. Click **OK**.

   NOTE: If no COMTRADE files are downloaded, the ION Setup status bar provides a descriptive message.

Related topics

- See "COMTRADE" on page 71 for additional information about COMTRADE format waveform data.

Custom displays

Creating custom displays using ION Setup

You can use ION Setup to program new custom displays.

1. Start ION Setup.
2. Open the Setup Assistant for your meter.
3. Navigate to **Custom Displays**.
4. Select **Custom Displays** from the **Front Panel** tab and click **Edit**. ION Setup loads your meter's display information into the **Display Editor** screen.

5. Rename, delete, or change the order of custom displays through the **Display Editor** screen. Click **New** to add a new display. Click **Edit** to bring up the **Display setup** screen, where you can configure new or existing custom displays.
6. Configure your screen type:
   - **Screen Type**: Specify the number of parameters displayed on the screen.
   - **Screen Title**: Enter the title to be shown at the top of your custom display.
7. Click **Edit** to select the displayed parameters. The number of parameters displayed is determined in the Screen Type selection described above.
8. Select your digit display properties:
   - **Resolution**: Specifies the number of decimal places displayed.
   - **Last Digit:** Specifies whether the last number is rounded or truncated.
9. Click **Send** to save the changes in the meter.

Verification

Performing meter resets using ION Setup

You can perform meter resets on your meter using ION Setup.

Revenue-locked meters must be unlocked to perform resets that impact revenue data.

Meter resets clear the meter's onboard data logs and other related information.

NOTICE

DATA LOSS

Ensure all important data from the device has been retrieved before performing a reset.

Failure to follow these instructions can result in data loss.

1. Open the Setup Assistant for your meter.
2. Select the **Verification** screen.
3. Select **Normal Mode** and click **Display**.
4. Select the desired tab in the **Normal Mode** dialog box. Depending on the tab selected, different resets are available.

Tab	Reset available
Energy	Master Reset
Rolling Demand	Peak Reset Master Reset
Volts, Amps and Power	Master Reset
Conditional Energy	Cnd Reset Master Reset
Input Metering	IM(n) Reset **NOTE:** n is the input metering number, for example IM1. Peak Reset Master Reset

5. Click the appropriate button to perform the reset.

For some resets, the meter indicates that the reset is in progress. Do not configure or power down your meter until it indicates that the reset is complete or some parameters may not be completely reset.

Related topics

- See “Revenue locking” on page 173 for more information on revenue locked meters.

Reports

There are no additional tasks specific to your device for this screen.

Advanced ION Setup tasks

These configuration tasks are intended for advanced users with a thorough understanding of ION architecture, the features of their device, and the power system in which it is installed.

Configuring digital outputs for IEC 61850 control using ION Setup

You can configure your digital outputs so that they can be used for non-critical control via IEC 61850.

Your meter has a comprehensive default implementation of IEC 61850 which meets the needs of most systems with only basic configuration. You can customize this implementation so that IEC 61850 can be used to control your meter’s digital outputs; this is an advanced procedure that requires in-depth knowledge of your meter, its underlying architecture, and the system in which it is installed.

⚠ WARNING

UNINTENDED OPERATION

Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

1. Start ION Setup
2. Connect to your meter in advanced mode.
3. Navigate to the GGIO Onboard folder and double-click on the module in the right-hand pane.
4. Select the Setup Registers tab.
5. Select the *SPCS Control Mode* register that corresponds to the digital output you want to control through IEC 61850 and click **Edit**. A dialog appears.
6. Select IEC 61850 CTLVAL from the dropdown list and click **OK**.
7. Select the Inputs tab.

8. Select the digital output *Status* register for the digital output that you want to control through IEC 61850. Click **Delete**.

   NOTE: This digital input register must be deleted in order to prevent a circular reference that will cause the affected modules to go offline.

9. Click **Send** to send your changes to the meter.
10. Select the Setup Registers tab and confirm that the Digital Output module's setup registers are appropriately configured.
11. Select the Inputs tab.
12. Select the *Source* register and click **Edit**.
13. Navigate to the IEC 61850 GGIO Onboard folder and select the *SPCS.stVal* output register that corresponds to the digital output.
14. Click **OK** and **Send** to save your changes to the meter.

Related topics

- See the *ION Reference,* available from www.schneider-electric.com, for information about the IEC 61850 GGIO and Digital output modules.
- See "IEC 61850" on page 70 for more information about how IEC 61850 is implemented on your meter.

Chapter 13 Meter webpages

Overview

This section describes the meter's webpages. The meter's Ethernet connection allows you to access the meter so you can view data and perform trending and forecasting and some basic configuration using a web browser. You can also view standard filetypes through the meter's webpages and create custom webpages for your meter.

⚠ WARNING

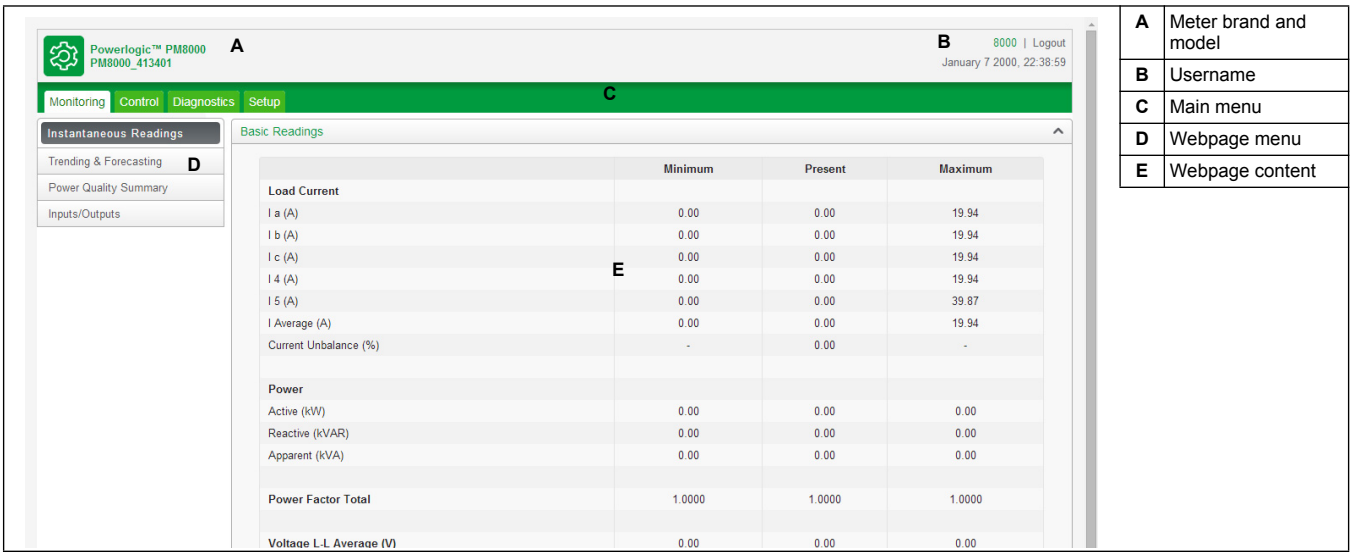
INACCURATE DATA RESULTS

- Do not rely solely on data displayed on the display or in software to determine if this device is functioning correctly or complying with all applicable standards.
- Do not use data displayed on the display or in software as a substitute for proper workplace practices or equipment maintenance.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Webpage interface

Your meter comes with default webpages that contain the typical elements shown below.



A	Meter brand and model
B	Username
C	Main menu
D	Webpage menu
E	Webpage content

NOTE: This graphic is representative only, and your meter's webpages may appear differently than shown.

Default webpages

The following default webpages are available on your meter.

Main menu	Webpage menu	Webpage content
Monitoring	Instantaneous Readings	• Basic readings • Energy readings • Demand readings • Voltage readings • Power Quality
	Trending & Forecasting	Select the target and interval for trending and forecasting and view the results.
	Power Quality Summary	• Harmonics • ITI (CBEMA)-SEMI • NEMA Motor Derating Curve • EN50160
	Inputs/Outputs	• Digital inputs • Digital outputs • Analog inputs • Analog outputs
Control	Resets	Perform resets, and view when previous resets were performed.
Diagnostics	Statistics	• Communications • Ethernet • Serial port • Meter - Basic • Meter - Advanced
	Phasor diagram	View the phasor diagram and numeric values.
Setup	Ethernet	• Basic Settings • Advanced settings
	Serial Port	• Basic Settings • Advanced Settings
	SNMP Parameters	Configure your meter's SNMP parameters.
	NTP	Configure your meter's NTP parameters.
	SMTP	Configure your meter's SMTP parameters.
	Date & Time	Configure your meter's time and time synchronization.
	Preferences	Enter your meter's nameplate information.
	Metering	Configure the parameters that impact metered data.
Maintenance[1]	-	Custom. No default content.

[1] By default the Maintenance menu is empty, and the menu is not displayed until information is added to it.

Accessing the meter's webpages

You can access the meter's webpages through the meter's Ethernet connection using a web browser.

You must have cookies enabled in order to access your meter's webpages.

If you configure communications so that you cannot communicate to and configure your meter, you must return the meter to the factory, where your meter is reset to its factory defaults and all logged data is lost.

NOTICE

DATA LOSS

Ensure you maintain sufficient access to communicate to and configure your device.

Failure to follow these instructions may result in data loss.

1. Open a web browser and enter your meter's IP address in the address box. The webpage login prompt is displayed.

2. Enter a valid username and password, select your desired **Language** from the drop-down list, and click **Log In**. Your meter's webpages are displayed.

   NOTE: The username and password are defined by your meter's security configuration; if standard security is enabled, the password is the same as the display password with a default username of 8000. The default display password is 0 (zero). To help increase the security of your meter's configuration and data, configure your meter's username and passwords to be different from the default values.

   The meter's Monitoring webpage is displayed, showing real-time data.

3. Select the main menu tab that corresponds to the category of information you want to view, and select the webpage menu from the list on the left. The webpage content is displayed. Click the webpage content headings to expand and view the meter's data.

4. Select **Setup** to view and edit your meter's configuration.

Related topics

- See "Trending and forecasting" on page 127 for instructions on configuring and viewing logging and trending information on the meter's webpages.
- See "Security overview" on page 47 for instructions on how to configure security settings on your meter.

Configuring SNMP using your meter's webpages

You can configure SNMP trapping using your meter's webpages.

You must download the ION MIB file from www.schneider-electric.com.

1. Connect to your meter's webpages.
2. Go to **Setup** > **SNMP Parameters**.
3. Configure your meter's SNMP parameters by selecting the parameter value.

Parameter	Range	Description
Enable SNMP	Yes/no	Enables or disables SNMP on your meter.
SNMP Port Number	161 (default)	Enter your meter's SNMP port number.
System contact	—	Enter the name of your SNMP system administrator.
System name	—	Enter a descriptive name for your meter.
System location	—	Enter your meter's location.
Read-only Community Name	—	Enter the community string used for SNMP get (read-only) requests.
Read-write Community Name	—	Enter the community string used for SNMP set (read/write) requests. NOTE: You can use the read/write community string for SNMP get (read-only) requests.
Enable SNMP Traps	Enable/disable	Enables or disables SNMP trapping on your meter.
Enable High Priority Alarms	Yes/no	Enables trapping of events that create high priority alarms.
Enable Med Priority Alarms	Yes/no	Enables trapping of events that create medium priority alarms.
Enable Low Priority Alarms	Yes/no	Enables trapping of events that create low priority alarms.
Report Buffer Size	1 - 30	Enter the maximum number of trap messages to be stored before the trap messages are sent. Traps are sent when the number of trap messages is equal to or greater than this value.
Report Hold Time	1 - 300 seconds	Enter the maximum duration for trap messages to be held. Trap messages are sent when the time after a trap event has occurred is equal to or greater than this value.
Trap Rcvr1 Addr - Trap Rcvr4 Addr	—	Enter up to four trap receiver IP addresses, where trap messages will be sent.

4. Click **Apply** to configure the meter's SNMP parameters.

Viewing files using your meter's webpages

You can load files of a variety of standard formats, such as *.pdf, *.jpg and *.png into the webpage folders on your meter's internal FTP site where they can be viewed using your meter's webpages. Videos in *.mp4 format can be played in most browsers. The filenames must be compatible with your meter's FTP filename requirements.

NOTE: Image files are shown at full-size (100%). Scale images to the desired size before loading them onto your meter's internal FTP site.

1. Access your meter's internal FTP site.
2. Open the web folder. Copy your file into the subfolder that corresponds to the webpage main menu tab you want to access your file from.
3. Connect to your meter's webpages. Select the main menu item that corresponds to the folder where you stored your file in step 2. Your file is listed in the webpage menu.
4. Select your file from the webpage menu to view.

Example

To view a schematic diagram (oneline.pdf) of your power system from the Monitoring menu of your meter's webpages:

1. Access your meter's internal FTP site.
2. Copy oneline.pdf into **web > monitoring**.
3. Access your meter's internal webpages and select the **Monitoring** menu. In the webpage menu click oneline.pdf to view your power system schematic.

Related topics

- See "FTP" on page 64 for instructions on how to connect to your meter over FTP.
- See "FTP filename requirements" on page 65 for a listing of characters not permitted in a FTP filename.

Creating custom webpages for your meter

You can create custom webpages to view data or access configuration parameters from your meter.

Download the PM8000 Modbus registers map from www.schneider-electric.com.

1. Connect to your meter's internal FTP site.
2. Go to **web > examples**. Select samplereadings.html to create a data value webpage, or select sampleconfiguration.html to create a configuration parameters webpage.
3. Save a copy of the sample file. This filename is the webpage name.
4. Open your webpage in an HTML or webpage editor program.
5. Modify the webpage to reference the desired meter data or parameters from the Modbus registers map, and update the other fields where required. Save your custom webpage.

The meter will display translated content if it exists in the meter's memory. If translated content is not available, English is displayed.

6. Connect to your meter's internal FTP site.
   - If you have created a data viewing webpage, copy your custom webpage to **web** > **monitoring**.
   - If you have created a configuration webpage, copy your custom webpage to **web** > **setup**.
7. Login to your meter's webpages. Your custom webpage is available from the webpage menu under the monitoring (data viewing) or setup (configuration) tab.

Related topics

- See "Sample data viewing webpage" on page 119 for a detailed description of the webpage's configurable fields.
- See "Sample setup webpage" on page 122 for detailed description of the webpage's configurable fields.
- See "FTP" on page 64 for instructions on how to connect to your meter over FTP.

Sample data viewing webpage

You can create custom data viewing webpages using the sample webpage stored on your meter.

The sample webpages are stored in the documents folder on your meter's internal FTP site.

The PM8000 Modbus register map is available from www.schneider-electric.com.

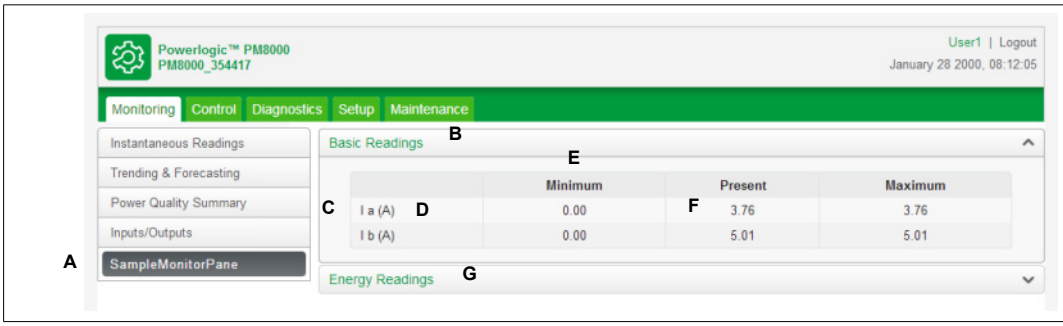
If required, the PM8000 ION handles document is packaged with the meter firmware file which is available for download from www.schneider-electric.com.

The data viewing webpage must be stored on your meter's internal FTP site in the folder for Monitoring. The custom webpage is viewed by selecting the Monitoring main menu tab on your meter's webpage.

Configuring the HTML code other than where described is an advanced procedure and should only be performed by those with an advanced understanding of webpages and how your meter processes them.

Sample webpage data viewing result

NOTE: This graphic is representative only, and your meter's webpages may appear different than shown.



A	HTML filename
B	Content pane title
C	Row heading
D	Units
E	Column heading
F	Named register instantaneous value
G	Second content pane title

Sample data viewing webpage content

Line #	Sample HTML
1	SampleMonitorPane.html
2	
3	
4	<h3 target="sample-readings">$%localizedString(Basic Readings)#$</h3>
5	
6	<table class="datatable">
7	<tr>
8	<th> </th>
9	<th>$%localizedString(Minimum)#$</th>
10	<th>$%localizedString(Present)#$</th>
11	<th>$%localizedString(Maximum)#$</th>
12	</tr>
13	<tr class="minor">
14	<td>$%localizedString(I a)#$ </td>
15	<td regname="I a mn"></td>
16	<td regname="I a"></td>
17	<td regname="I a mx"></td>
18	</tr>
19	<tr class="minor">
20	<td>$%localizedString(I b)#$ </td>
21	<td regname="I b mn"></td>
22	<td regname="I b"></td>
23	<td regname="I b mx"></td>
24	</tr>
25	</table>
26	
27	<h3 target="sample-energy">$%localizedString(Energy Readings)#$</h3>
28	
29	<table class="datatable">
30	<tr>
31	<th> </th>
32	<th>$%localizedString(Present)#$</th>
33	</tr>
34	<tr>
35	<td>$%localizedString(Active Energy)#$ </td>
36	<td regname="kWh del-rec"></td>
37	</tr>
38	<tr>
39	<td>$%localizedString(Reactive Energy)#$ </td>
40	<td regname="kVARh del-rec"></td>
41	</tr>
42	</table>
43	
44	
45	
46	
47	<script type="text/javascript">

Line #	Sample HTML
48	
49	`instantaneousReadings.initInstantaneousReadings('sample-readings');`
50	
51	`</script>`
52	`</div>`

Sample webpage data viewing content description

Line #	Description
1	`SampleMonitorPane.html` The HTML filename, including the HTML extension (.html). This filename must comply with FTP filename conventions (no spaces or special characters). The filename (without the HTML extension) is the name shown on the webpage menu.

4	`<h3 target="sample-readings">`
	This creates the first webpage content pane. “sample-readings” is the name of the webpage content. This name must be unique.
	`$%localizedString(Basic Readings)#$</h3>`
	Basic Readings is the title of the webpage content pane. This title is translated if possible.

5	`<div id="sample-readings">` This must match the name of the webpage content in line 4.
9	`<th>$%localizedString(Minimum)#$</th>` Minimum is the heading for the first column. This heading is translated if possible.
10	`<th>$%localizedString(Present)#$</th>` Present is the heading for the second column. This heading is translated if possible.
11	`<th>$%localizedString(Maximum)#$</th>` Maximum is the heading for the last column. This heading is translated if possible.

14	`<td>$%localizedString(I a)#$`
	I a is the row heading. This heading is translated if possible.
	`<span unitsreg="I a"></span></td>`
	This displays the units that the meter has defined for the named register I a.

15	`<td regname="I a mn"></td>` This displays the instantaneous value of the named register I a mn.[1]
16	`<td regname="I a"></td>` This displays the instantaneous value of the named register I a.[1]
17	`<td regname="I a mx"></td>` This displays the instantaneous value of the named register I a mx.[1]

20	`<td>$%localizedString(I b)#$`
	I b is the second row heading. This heading is translated if possible.
	`<span unitsreg="I b"></span></td>`
	This displays the units that the meter has defined for the named register I b.

21	`<td regname="I b mn"></td>` This displays the instantaneous value of the named register I b mn.[1]
22	`<td regname="I b"></td>` This displays the instantaneous value of the named register I b.[1]
23	`<td regname="I b mx"></td>` This displays the instantaneous value of the named register I bmx.[1]

27	`<h3 target="sample-energy">`
	This creates the second webpage content pane. Sample-energy is the name of the webpage content. This name must be unique.
	`$%localizedString(Energy Readings)#$</h3>`
	Energy Readings is the title of the webpage content pane. This title is translated if possible.

28	`<div id="sample-energy">` This must match the name of the webpage content in line 27.

Line #	Description
32	`<th>$%localizedString(Present)#$</th>` Present is the heading for the last column. This heading is translated if possible.

35	`<td>$%localizedString(Active Energy)#$`
	Active Energy is the row heading. This heading is translated if possible.
	`<span unitsreg="kWh del-rec"></span></td>`
	This displays the units that the meter has defined for the named register kWh del-rec.

36	`<td regname="kWh del-rec"></td>` This displays the instantaneous value of the named register kWh del-rec.[1]

39	`<td>$%localizedString(Reactive Energy)#$`
	Reactive Energy is the row heading. This heading is translated if possible.
	`<span unitsreg="kVARh del-rec"></span></td>`
	This displays the units that the meter has defined for the named register kVARh del-rec.

40	`<td regname="kVARh del-rec"></td>` This displays the instantaneous value of the named register kVARh del-rec.[1]
49	`instantaneousReadings.initInstantaneousReadings('sample-readings');` Sample-readings is the unique name of the first webpage content name. This HTML code updates all of the webpage's values.

[1] Named registers are listed in the PM8000 Modbus registers map. If the desired value is not listed, you can reference the value by its ION handle, using the following format: <td regname="_0x####"></td>, where #### is the hexadecimal value of the ION handle.

Sample setup webpage

You can create custom setup webpages using the sample webpage stored on your meter.

Sample webpages are stored in the documents folder on your meter's internal FTP site.

The PM8000 register map is available from www.schneider-electric.com.

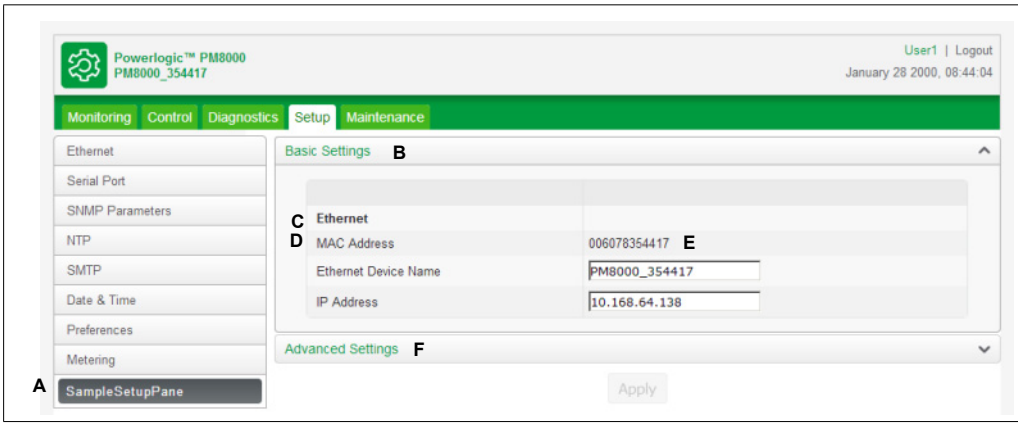
The PM8000 ION handles document is packaged with the meter firmware file which is available for download from www.schneider-electric.com.

Custom setup webpages must be stored on your meter's internal FTP site in the folder for Setup. The custom webpage is viewed by selecting the Setup main menu tab on your meter's webpage.

Configuring the HTML code other than where described is an advanced procedure and should only be performed by those with an advanced understanding of webpages and how your meter processes them.

Sample webpage setup result

NOTE: This graphic is representative only, and your meter's webpages may appear different than shown.



A	HTML filename
B	Content pane title
C	Sub-heading
D	Row heading
E	Named register value
F	Second content pane title

Sample setup webpage content

Line #	Sample HTML
1	SampleSetupPane.html
2	
3	
4	<form id="formSampleSettings">
5	
6	
7	<h3 target="sample-basic">$%localizedString(Basic Settings)#$</h3>
8	
9	<table class="formtable">
10	<tr>
11	<th> </th>
12	<th> </th>
13	</tr>
14	<tr>
15	<td>$%localizedString(Ethernet)#$</td>
16	<td> </td>
17	</tr>
18	<tr class="minor">
19	<td>$%localizedString(MAC Address)#$</td>
20	<td regname="MAC Address"></td>
21	</tr>
22	<tr class="minor">
23	<td>$%localizedString(Ethernet Device Name)#$</td>
24	<td><input name="Ethernet Device Name" type="text" /></td>
25	</tr>
26	<tr class="minor">
27	<td>$%localizedString(IP Address)#$</td>
28	<td><input name="IP Address" type="text" /></td>
29	</tr>
30	</table>
31	
32	
33	
34	<h3 target="sample-advanced">$%localizedString(Advanced Settings)#$</h3>

Line #	Sample HTML
35	
36	<table class="formtable" id="frameFormatDropdownContainer">
37	<tr>
38	<th> </th>
39	<th> </th>
40	</tr>
41	<tr>
42	<td>$%localizedString(TCP Keep Alive Minutes)#$</td>
43	<td><input type="text" name="TCP Keep Alive Minutes" class="small" /> </td>
44	</tr>
45	<tr>
46	<td>$%localizedString(Enable Web Server)#$</td>
47	<td><select name="Enable Web Server"></select> </td>
48	</tr>
49	</table>
50	
51	
52	
53	
54	<input type="submit" class="apply" value='$%localizedString(Apply)#$' />
55	
56	</form>
57	
58	
59	<script type="text/javascript">
60	
61	SetupPane.init('formSampleSettings');
62	formChangeDetection.initFormChangeDetection('#formSampleSettings', '#dialogFormChanges');
63	
64	</script>
65	

Sample setup webpage content description

Line #	Description
1	SampleSetupPane.html The HTML filename, including the HTML extension (.html). This filename must comply with FTP filename conventions (no spaces or special characters). The filename (without the HTML extension) is the name shown on the webpage menu.
4	<form id="formSampleSettings"> “formSampleSettings” is the name of the webpage content. This name must be unique
7	<h3 target="sample-basic"> This creates the first webpage content pane. “sample-basic” is the name of the webpage content. This name must be unique. $%localizedString(Basic Settings)#$</h3> Basic Settings is the title of the webpage content pane. This title is translated if possible.
8	 This must match the name of the webpage content in line 7.
15	<td>$%localizedString(Ethernet)#$</td> Ethernet is the subheading. This heading is translated if possible.

Line #	Description
19	`<td>$%localizedString(MAC Address)#$</td>` MAC Address is the row heading. This heading is translated if possible.
20	`<td regname="MAC Address"></td>` This displays the value of the read-only named register MAC Address.[1]
23	`<td>$%localizedString(Ethernet Device Name)#$</td>` Ethernet Device Name is the row heading. This heading is translated if possible.
24	`<td><input name="Ethernet Device Name" type="text" /></td>` This displays the instantaneous value of the configurable named register Ethernet Device Name in a text-edit field.[1] The type must match the named register type, in this case, an alphanumeric string.
27	`<td>$%localizedString(IP Address)#$</td>` IP Address is the row heading. This heading is translated if possible.
28	`<td><input name="IP Address" type="text" /></td>` This displays the instantaneous value of the configurable named register IP Address in a text-edit field.[1] The type must match the named register type, in this case, an alphanumeric string.

34	`<h3 target="sample-advanced">`
	This creates the second webpage content pane. Sample-advanced is the name of the webpage content. This name must be unique.
	`$%localizedString(Advanced Settings)#$</h3>`
	Advanced Settings is the title of the webpage content pane. This title is translated if possible.

35	`<div id="sample-advanced">` This must match the name of the webpage content in line 34.
42	`<td>$%localizedString(TCP Keep Alive Minutes)#$</td>` TCP Keep Alive Minutes is the row heading. This heading is translated if possible.

43	`<td><input type="text" name="TCP Keep Alive Minutes" class="small" />`
	This displays the instantaneous value of the configurable named register TCP Keep Alive Minutes in a text-edit field.[1]
	The type must match the named register type, in this case, an alphanumeric string.
	`<span unitsreg="TCP Keep Alive Minutes"></span></td>`
	This displays the units that the meter has defined for the named register TCP Keep Alive Minutes.
	NOTE: There are no defined units for TCP Keep Alive Minutes, so no units are displayed.

46	`<td>$%localizedString(Enable Web Server)#$</td>` Enable Web Server is the row heading. This heading is translated if possible.
47	`<td><select name="Enable Web Server"></select> </td>` Enable Web Server is the named register that is displayed. Named registers are listed in the PM8000 registers map. The type must match the named register type, in this case, an enumerated value that is displayed as a drop-down list.
61	`SetupPane.init('formSampleSettings');` This must match the webpage content name from line 4.
62	`formChangeDetection.initFormChangeDetection('#formSampleSettings', '#dialogFormChanges');` This must match the webpage content name from line 4. This HTML code updates all of the webpage's values.

[1] Named registers are listed in the PM8000 registers map. If the desired value is not listed, you can reference the value by its ION handle, using the following format: <td regname="_0x####"></td>, where #### is the hexadecimal value of the ION handle.

Chapter 14 Trending and forecasting

Trending and forecasting overview

Trending and forecasting is a feature on your device that predicts the next set of measured or calculated data by plotting and analyzing trends in historical data.

Trending and forecasting data is a useful tool to help analyze changes in load and power quality and forecasting values such as demand. For your meter's trending and forecasting feature to work, you only need to give the meter time to accumulate data.

Related topics

- See the *ION Reference,* available from www.schneider-electric.com, for detailed information about the Trending and Forecasting module.

Trending and forecasting implementation

Data used for trending and forecasting is logged for the following intervals:

- Every hour for the last 24 hours
- Every day for the last month
- Every week for the last 8 weeks
- Every month for the last 12 months

The following parameters are configured for trending and forecasting by default:

kW sd del-rec (demand)	Freq (frequency)
Vll ab	I a mean
Vll bc	I b mean
Vll ca	I c mean
Vll avg	I avg mean

You can configure the start day of the week for trending and forecasting using ION Setup.

Related topics

- See "Accessing the meter's webpages" on page 116 for instructions on how to access your meter's webpages.
- See "Viewing trending and forecasting data on your meter's webpages" on page 127 for instructions on how to view trending and forecasting data.
- See "Configuring time and time synchronization using ION Setup" on page 96 for instructions on how to reset your meter's start day of the week.

Viewing trending and forecasting data on your meter's webpages

You can select data for forecasting and trending and view the resulting information using your meter's webpages.

For trending and forecasting to operate, your meter must have accumulated data for at least two of the specified intervals; for example, if you want to view a daily graph, your meter must have accumulated data for at least two previous days before the present day.

1. Log in to your meter's webpages.

2. Click **Monitoring** > **Trending & Forecasting**.
3. Select the **Target** and **Interval**. The graph for the selected data is displayed.

Chapter 15 Data, waveform and event logging

Overview

This section describes the meter's logging features. Your meter can support up to 50 logs (data recorders) which can each record up to 16 different parameters.

Your meter has a number of onboard default logs (also called data recorders) that are used to store data related to:

- Power quality and compliance
- Trending and forecasting
- Energy/revenue metering
- Meter events

Your meter also logs voltage and current waveform data when a sag or swell is detected. You must enter your power system's nominal values and configure your meter so that it can identify sags and swells. You can configure your meter's setpoint learning feature to learn your power system's normal operating values and use that information to help identify voltage sags and swells.

Logged data can be retrieved by energy management software.

Related topics

- See "Minimum configuration requirements for basic metering" on page 37 for information on entering your nominal values through the meter's display.

Default logging capacity

The following table summarizes the default logging depths and intervals for your meter's onboard data and waveform recorders:

Data recorder number	Log name	Depth	Interval
1	Revenue Log	3360 (35 days)	900 seconds (15 minutes)
9	Loss Log	3360 (35 days)	900 seconds (15 minutes)
2, 3, 4	Historic Logs	3360 (35 days)	900 seconds (15 minutes)
39	Daily Nominal Log	450	Triggered on demand
7, 8	Harmonics Logs	840 (35 days)	3600 seconds (1 hour)
N/A	Waveform recorders (6 total)	30	Triggered on demand
N/A	COMTRADE records	1	Triggered by waveform recording
10	Energy/Demand (EgyDmd Log)	3360 (35 days)	900 seconds (15 minutes)
5	Sag/Swell Log	100	Triggered on demand
N/A	Event Log	500	Triggered on demand
11, 12, 17, 19 - 26, 28, 29, 32, 35	EN50160 Logs	varies	EN50160 intervals
6, 16, 37, 38, 40	4-30 Logs	varies	IEC61000-4-30 intervals

Changing the log depths

Use ION Setup to change the number of records (depth) stored in the log. Changing how log records information (circular, or stop-when-full) is an advanced procedure to change the *RecordMode* setup register in the Data Recorder and Waveform Recorder modules.

Data logs and circular format waveform recorders have a minimum depth of 2 records.

Changing the log intervals

You can use ION Setup to change the logging intervals for the revenue and energy demand log.

Changing the interval for other data logs is an advanced procedure to modify the Periodic Timer module's *Period* setup register, which triggers the data log's recording.

Do not change the Periodic Timer module's *Sync Mode* setup register.

The default Periodic Timer modules that control the frequency of different data recording are as follows:

- Revenue Log Trg: controls the frequency of the logging of revenue values
- Loss Log Trg: controls the frequency of Loss Compensation Data logging
- EgyDmd Log Trg: controls the frequency of logging for the Energy and Demand Log (this log is used by ION Enterprise software to generate reports.
- Hist Log Trg: controls the frequency of Historic Data logging
- Harm Log Trg: controls the frequency of Harmonics logging

Programming your meter to write to any data recorder at continuous intervals shorter than 60 seconds (heavy logging configuration) can cause loss of data in the event of a power failure.

NOTICE

DATA LOSS

Use an uninterruptible power supply (UPS) if you program your meter for heavy logging.

Failure to follow these instructions can result in data loss.

Data log memory calculations

The amount of memory required to store data and event logs depends on the number of parameters being logged and the frequency with which these parameters are logged. The memory required is calculated as follows:

Memory consumption for each record (in Bytes) = [(number of parameters x 5) + 8]

For example, a data log recording three parameters consumes 23 Bytes of data. If the data is recorded every 15 minutes for 35 days, the data log requires approximately 80 kiloBytes of logging memory.

Waveform record memory calculations

The meter can simultaneously capture waveforms triggered by events on all channels to a maximum of 96 cycles for each waveform record. The memory required is calculated as follows:

Memory consumption for each waveform (in Bytes) = [2 x number of samples per cycle + 12] x [number of cycles in waveform x 2] + 32.

A single waveform record requires approximately 8 kB of memory.

Related topics

- See the ION Setup online help, available from www.schneider-electric.com, for more information about the logging memory allocations and other meter logging memory information displayed by the ION Setup Assistant.

Data logging overview

Your meter has data logging capabilities, including a special type of data log which is an event log, which logs prioritized events.

Data logs are recorded by your meter and stored in the meter's memory inside configurable data logs. Your meter's data logs are retained if the meter loses power.

Logged data can be used by energy management software. Logs can be configured to either overwrite the oldest data when full (circular), or to stop writing data to the log when the number of logged records reaches the maximum log depth (stop-when-full).

Your meter ships with a comprehensive data-logging configuration consisting of data logs set up to record values at specific intervals or on conditions. Your meter's default data logging configuration should be sufficient for most applications, but you can also reconfigure existing logs or create new logs for custom applications if needed.

Your meter can also be configured to email data log information.

Related topics

- See "Default logging capacity" on page 129 for details about your meter's default logging configuration.
- See the *Internal email client feature* technical note, available from www.schneider-electric.com, for instructions on how to configure your meter to email logged data.

Default data logging configuration

The default data logging configuration might be used by other components of your power monitoring system. Do not change the default configuration of any of the logs, unless you understand the impact of the change on these power monitoring system components and the data they use and on your meter's memory.

Revenue log

The Revenue Log is configured for use with UTS MV-90 billing software. The default values logged by the Revenue Log are as follows:

Parameter	Description
kWh del int	Interval kWh delivered
kWh rec int	Interval kWh received

Parameter	Description
kVARh del int	Interval kVARh delivered
kVARh rec int	Interval kVARh received

Historic data logs

Three historic data logs are used to record standard power system quantities, such as phase current, phase voltage and power factor. These logs are labeled Hist Mean Log, Hist High Log, and Hist Low Log. By default, they log the following values:

Hist Mean Log	
Vll ab mean	I avg mean
Vll bc mean	I 4 mean
Vll ca mean	kW tot mean
Vll avg mean	kVAR tot mean
V unbal mean	kVA tot mean
Ia mean	PF lag mean
Ib mean	PF lead mean
Ic mean	Freq mean

Hist High Log	
Vll ab high	I avg high
Vll bc high	I 4 high
Vll ca high	kW tot high
Vll avg high	kVAR tot high
V unbal high	kVA tot high
Ia high	PF lag high
Ib high	PF lead high
Ic high	Freq high

Hist Low Log	
Vll ab low	I avg low
Vll bc low	I 4 low
Vll ca low	kW tot low
Vll avg low	kVAR tot low
V unbal low	kVA tot low
Ia low	PF lag low
Ib low	PF lead low
Ic low	Freq low

Loss log

The Loss Log is configured to record loss values. By default, it logs the following values:

Parameter	Description
MU Ia^2h int	Phase A interval current squared hours
MU Ib^2h int	Phase B interval current squared hours
MU Ic^2h int	Phase C interval current squared hours
MU Vllab^2h int	Phase A interval voltage Line-to-Line squared hours
MU Vllbc^2h int	Phase B interval voltage Line-to-Line squared hours
MU Vllca^2h int	Phase C interval voltage Line-to-Line squared hours
MU Vln a^2h int	Phase A interval voltage Line-to-Neutral squared hours
MU Vln b^2h int	Phase B interval voltage Line-to-Neutral squared hours
MU Vln c^2h int	Phase C interval voltage Line-to-Neutral squared hours

Harmonics logs

Two harmonics logs record various harmonics data, including K-factor and Total Harmonic Distortion (THD). These recorders are labeled Harm Mean Log and Harm High Log. By default, they log the following values:

Harm Mean Log	
V1 THD mean	I1 K Fac mean
V2 THD mean	I2 K Fac mean
V3 THD mean	I3 K Fac mean
I1 THD mean	
I2 THD mean	
I3 THD mean	

Harm High Log	
V1 THD high	I1 K Fac high
V2 THD high	I2 K Fac high
V3 THD high	I3 K Fac high
I1 THD high	
I2 THD high	
I3 THD high	

Energy/Demand log

The Energy/Demand log records energy and demand data used by energy management software to generate reports. Changing the logged data can prevent the generation of reports that use this data.

Sag/swell log

The Sag/swell Log provides details of power quality events. By default, it logs the following values:

SS1 DistDur	SS1 DistV1Min	SS1 DistV1Max	SS1 DistV1Avg
SS1 DistV1Engy	SS1 DistV2Min	SS1 DistV2Max	SS1 DistV2Avg
SS1 DistV2Engy	SS1 DistV3Min	SS1 DistV3Max	SS1 DistV3Avg
SS1 DistV3Engy	SS1 DistNominal	SS1 Swell Lim	SS1 Sag Lim

EN50160 compliance logs

The EN50160 compliance logs are used to record EN50160 compliance parameters:

Data recorder	EN50160 component logged
EN50160 Frq/Mg	Power frequency and supply magnitude
EN50160 Hrm Vlt	Harmonics
EN50160 Intrp	Short/log interruptions
EN50160 Ovrvlt1	Temporary overvoltage
EN50160 Ovrvlt2	
EN50160 Prm-f/V	Parameter data (disabled by default)
EN50160 Prm-Vlr	
EN50160 Vunbal	Voltage unbalance

Data recorder	EN50160 component logged
EN50160 PrmHrm1	Parameter data (disabled by default)
EN50160 PrmHrm2	
EN50160 Vlt Dp1	Supply voltage dips
EN50160 Vlt Dp2	
EN50160 Vlt Dp3	
EN50160 Vlt Dp4	
EN50160 Vlt Dp5	

The meter logs EN50160 counter data for present and previous observation periods as well as EN51060 events.

4-30 compliance logs

Four 4-30 compliance logs are used to log parameters related to the International Electrotechnical Commission's IEC 61000-4-30 standards' power quality compliance and to create reports:

Data recorder	4-30 parameters logged
4-30 10m Log	• PqFlag • V1 • V2 • V3 • V1 THD (Total Harmonic Distortion) • V2 THD • V3 THD • NegSeqComp (Vneg/Vpos) • ZeroSeqComp (Vzero/Vpos) • Power Freq
4-30 10s Freq	• Power Frequency • PqFlag
4-30 2hr Log	• PqFlag • V1 • V2 • V3 • V1 THD (Total Harmonic Distortion) • V2 THD • V3 THD • NegSeqComp (Vneg/Vpos) • ZeroSeqComp (Vzero/Vpos) • Power Freq

Data recorder	4-30 parameters logged
4-30 3s Log	• PqFlag • V1 • V2 • V3 • V1 THD (Total Harmonic Distortion) • V2 THD • V3 THD • NegSeqComp (Vneg/Vpos) • ZeroSeqComp (Vzero/Vpos)
4-30 V Intrp DrtnAll	• Voltage interruption duration (all voltages)

Related topics

- See the *4-30 Compliance and ION Meters* technical note, available from www.schneider-electric.com, for more information about your meter's 4-30 compliance.
- See the *EN50160 2010 compliance and ION meters* technical note, available from www.schneider-electric.com, for more information about your meter's EN50160 compliance.

Advanced logging configuration

Adding or deleting data logs or their parameters outside of the ION Setup Assistant should only be undertaken by those with an advanced understanding of ION architecture and their meter's template.

Related topics

- See the *ION Reference,* available from www.schneider-electric.com, for more information about ION Architecture and ION modules.

Event log overview

Your meter records events produced by the meter's ION modules or external meter events.

Meter events, such as meter configuration or changes to I/O state, have priority values associated with them, so you can control what events are logged. Each event has a priority based on its type and severity, and for most events you can configure the priority. The event log records the date and time of the event, along with relevant details about the event.

Your meter's event log can be viewed through the meter's display and ION Setup.

Event log data example:

Date/Time	Cause	Value	Effect	Value
11/10/2014 11:21:13.577 AM	Ethernet	FTP	Front Panel	Auth FAIL
11/10/2014 11:21:43.000 AM	Front Panel	Remote Display	Front Panel	File received on RMD
11/10/2014 11:24:45.000 AM	Front Panel	Remote Display	Front Panel	RMD firmware upgrade successful
11/10/2014 11:24:48.135 AM	Front Panel	Remote Display	Front Panel	RMD disconnected
11/10/2014 11:25:15.820 AM	Front Panel	Remote Display	Front Panel	RMD connected
11/10/2014 11:29:27.316 AM	Ethernet	FTP	Front Panel	Auth FAIL

NOTE: This example is representative only, and your meter's event log may appear different than shown.

Related topics

- See the *ION Reference,* available from www.schneider-electric.com, for more information about the Event Log Controller module and other ION modules.
- See “Viewing data using your meter’s display” on page 30 for instructions on how to view your meter’s event log through the display.
- See “Default event log configuration” on page 135 for more information about your meter’s events and priorities.

Default event log configuration

Your meter’s event log might be used by other components of your power monitoring system. Do not change the default event log configuration unless you understand the impact of the change on the power monitoring system components and the data they use and on your meter’s memory.

Changing the default event log configuration should only be undertaken by those with an advanced understanding of ION architecture and their meter’s template.

By default, your meter logs all configuration changes, meter access events, and power system events. You can configure certain features, such as the digital inputs, so an event is logged when the feature changes state (for example, the digital input changes from off to on).

The event log is controlled by the Event Log Controller module, which allows you to set a priority cutoff for event logging. Events with a priority number greater than the cutoff value are logged, and events with lower priorities are discarded. By default, this value is set so that all relevant events are recorded in the meter’s event log. Event priority values range from 0 to 255 with a typical cutoff value of 5.

NOTE: Alarms are generated by events from certain ION modules. The alarm level is determined by the priority of the associated event. To disable the alarm but still record the associated event, set the alarm priority to info only. To disable the alarm and the event, set the alarm priority to none.

Related topics

- See the *ION Reference,* available from www.schneider-electric.com, for more information about the Event Log Controller module and event priorities for specific ION modules.
- See “Alarms overview” on page 147 for details of alarm operation and configuration.

Waveform recording overview

Your meter is able to record voltage and current waveform information.

Waveform information is used to help identify power system disturbances, which are an increasing concern for industrial plants, hospitals, data centers and other facilities where the equipment is sensitive to voltage or current sags, swells, and momentary interruptions. Waveform information is also used to help ensure compliance with power quality standards.

In addition to measuring and recording numerical values for voltage and current, your meter can also capture the sinusoidal waveform data. The current and voltage waveform data provides additional information for analysis of the system’s power quality or a power quality event.

You can manually trigger waveform recordings or configure them to trigger automatically when there is a power quality or power system event. For waveform recording to trigger automatically, you must enter your system's nominal (normal) voltage and current values, and then the amount of deviation from the nominal required to trigger waveform recording.

Your meter's waveform data storage format is defined by:

- Cycles: the number of cycles (based on your power system's frequency) included in the waveform (its duration).
- Samples: samples per cycle, which is the number of waveform data points collected in each cycle.

This gives you the option to record a lot of information for a very short duration or less information over a longer duration. You can also configure a delay in starting waveform recording which allows you to record pre- and post-event data.

You can use your meter to detect ITI (CBEMA) - type disturbances, and can determine information regarding the magnitude and duration of each disturbance. This information can be used by your energy management system to plot the disturbance on a CBEMA curve.

COMTRADE waveform data is available from your meter.

NOTE: If you are generating COMTRADE waveform information, the associated waveform recorders cannot be modified unless COMTRADE is disabled. If the waveform recorders are not configured identically, COMTRADE waveform information will not be generated.

Key terms

Term	Definition
COMTRADE	COMmon format for TRAnsient Data Exchange (COMTRADE) is a common format for waveform data.
ITI (CBEMA)	A curve that graphically describes an AC input voltage envelope which can be typically tolerated by information technology equipment. Meter waveform information is plotted on this curve to help evaluate power quality.
Nominal	The normal or usual parameter value. For example, the nominal voltage for many power systems is 120 V.
Sag	A power event where the voltage or current drops below the nominal value.
Swell	A power event where the voltage or current rises above the nominal value.

Related topics

- See the *ION Reference,* available from www.schneider-electric.com, for more information on the Waveform Recorder module and its settings.
- See "COMTRADE" on page 71 for more information about COMTRADE waveform data.
- See "Minimum configuration requirements for basic metering" on page 37 for information on the values that must be configured for your meter to perform power quality calculations.
- See "Setpoint learning overview" on page 137 for information about configuring your meter to learn your power system's normal acceptable range of values.

Default waveform recording configuration

Your meter's waveform recording operates once your nominal values are configured.

Your meter has the following default waveform recorders:

Waveform recorder	Description
Wfm Rc V1-Sg/Sw	V1 voltage waveforms recorded during a defined sag or swell event.
Wfm Rc V2-Sg/Sw	V2 voltage waveforms recorded during a defined sag or swell event.
Wfm Rc V3-Sg/Sw	V3 voltage waveforms recorded during a defined sag or swell event.
Wfm Rc I1-Sg/Sw	I1 current waveforms recorded during a defined sag or swell event.
Wfm Rc I2-Sg/Sw	I2 current waveforms recorded during a defined sag or swell event.
Wfm Rc I3-Sg/Sw	I3 current waveforms recorded during a defined sag or swell event.

Setpoint learning overview

Your meter can detect disturbances or values that are outside of a defined acceptable range. If you do not know what that acceptable range is or what threshold constitutes a voltage disturbance, your meter can learn these values by monitoring normal operating values to determine what constitutes a voltage sag or swell in order to help identify high and low setpoints.

NOTE: To help your meter learn the most accurate values possible, it is important that learning occur during a period of normal operation. Do not schedule learning during a period of unusual operations in your system. Do not modify your meter's configuration during the learning period as it may stop the learning process.

You can configure the meter so that learned values are applied automatically once the learning period is complete or require that they are reviewed and manually applied. If a learned value is invalid, the learned values are not automatically applied, but logged for review.

Setpoint learning can be used to identify the following values:

Feature	Values
Setpoints (Alarms)	High limit Low limit Sustain until ON Sustain until OFF
Sag	Voltage sag limit
Swell	Voltage swell limit

Learning installation mode and learning duration

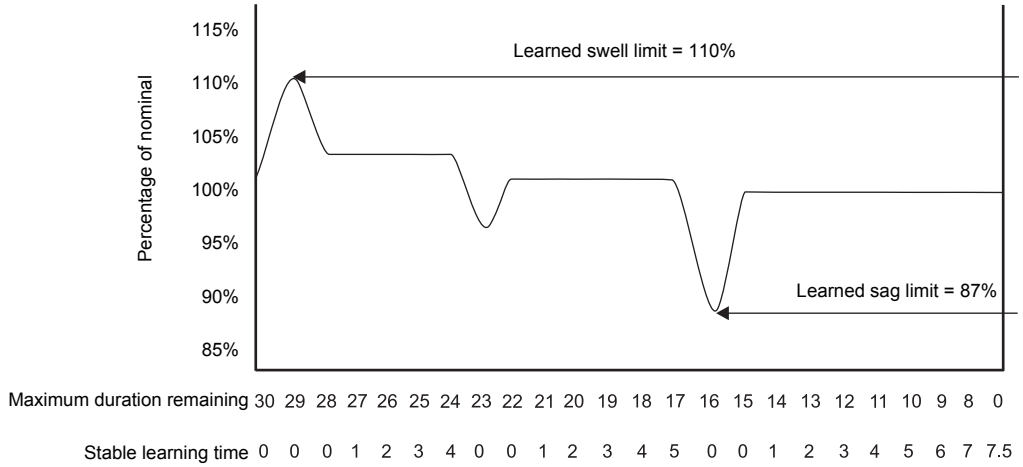
There are two learning installation modes:

- Manual: the meter learns the applicable values but does not begin using the learned values. The learned values are recorded for review, and you can decide to use the learned values or adjust them as required before manually implementing the learned values.
- Automatic: the meter learns the applicable values and begins using those learned values automatically at the end of the learning period. If a learned value is invalid, the meter does not apply the value, but the value is recorded in the event log.

You can configure the maximum learning duration. The actual learning duration may vary, depending on the stability of the system. If the system is stable for a period equal to one quarter of the maximum learning duration, learning is complete; otherwise, the learning period will be the maximum learning duration.

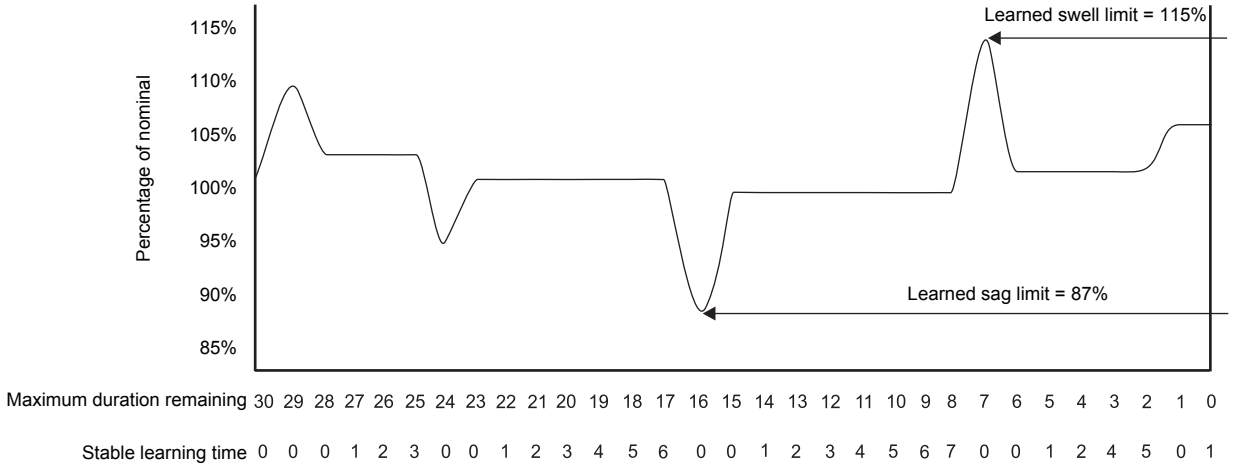
Example: Setpoint learning duration in a stable system

In this example, the learning duration is 30 days. When the system is stable for 7.5 days (one quarter of 30 days) learning is complete.



Example: Setpoint learning duration in an unstable system

In this example, the learning duration is 30 days. Because the system is not stable for 7.5 days (one quarter of 30 days) learning is complete at the end of the maximum learning duration.



Related topics

- See “Implementing sag/swell limit learning using ION Setup” on page 108 for instructions on how to configure learning for determination of sags or swells.
- See “Implementing alarm setpoint learning using ION Setup” on page 108 for instructions on how to configure learning for determination of power system events.
- See the *ION Reference,* available from www.schneider-electric.com, for more information on Sag/Swell, Setpoint and Relative Setpoint modules.

Chapter 16 Inputs/outputs

Inputs/outputs overview

Your meter has onboard digital I/O which can be increased by adding optional digital and analog I/O modules to expand your meter's I/O capabilities.

Your meter's digital and analog outputs may change state when being configured, during an option module reset or power cycle, or during firmware or framework upgrade.

⚠ WARNING

UNINTENDED OPERATION

Do not use the meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Your meter's inputs are used to monitor and receive signals from external sources, and its outputs are used to send signals to external sources.

Example:

- You can use a digital input to monitor a breaker to verify how many times the breaker trips. When the breaker reaches its limit for the number of trips, you can use the digital output to light an LED next to the breaker to help remind maintenance personnel know it is due to be replaced.
- You can use a digital output to pulse based on energy measurements.
- You can use an analog input to monitor an analog flowmeter to measure how much water flows through a pipe, and use the meter's analog output to send a signal to an analog-controlled valve to modify the valve position and change the flow rate.

Your PM8000 meter base has:

- 3 digital inputs
- 1 form A digital output
- 2 energy pulsing LEDs (one visible, one infrared)

You can view information about your meter's I/O through the display and webpages, and configure your meter's I/O using ION Setup.

NOTE: The digital outputs can handle voltages less than their specified maximum. For higher voltage applications, use an external relay in the switching circuit.

Related topics

- See your device's installation instructions, available from www.schneider-electric.com, for I/O wiring and installation instructions.

Input/output ION modules

You need to configure the following ION modules in order to use the meter's digital or analog I/O.

- Digital input: uses the Digital Input module, which tells the meter how to interpret incoming signals.
- Digital output: uses one of three ION modules depending on the application.
  - Digital Output module: monitors a change of state to control relay operation via a hardware output device.
  - Pulser module: transfers high-speed pulses to a hardware pulse counting device that is used to track energy usage.
  - Calibration Pulser module: integrates instantaneous power inputs, then outputs high-speed pulses to an LED that can be monitored for energy accuracy verification.

  NOTE: All of these modules can act as intermediaries between the physical hardware port and the other modules in the meter. They define the characteristics of the outgoing signals.
- Analog input: uses the Analog Input module, which tells the meter how to interpret an incoming analog voltage or current signal from transducers.
- Analog output: uses the Analog Output module to deliver a continuous direct voltage or current analog signal to transducers.

Input/output ION modules, ports and labels

You can configure the Digital Output, Digital Input, Analog Input, Analog Output, Pulser and Calibration Pulser ION modules to specify which port handles the outgoing or incoming signals. To assign a port to one of these modules, simply modify the *Port* setup register by picking a port from the enumerated list.

The following tables describe the ports that can be configured to handle outgoing or incoming signals:

ION module type	ION module name	Hardware port (device label)	Port name (ION label)	Description
Onboard digital output port				
Digital Output	Port D1	D1	Port D1	Form A output
Calibration Pulser	Wh Pulser -LED	N/A	kWh Pulse LED	Energy pulsing
Onboard digital input ports				
Digital Input	Port S1	S1	Port S1	Externally excited
	Port S2	S2	Port S2	Externally excited
	Port S3	S3	Port S3	Externally excited

ION module type	ION module name	Hardware port (device label)	Port name (ION label)	Description
Option module(s) digital input ports				
Digital Input	Port A/B/C/D-S1-S6	S1 - S6	Port A S1 - S6 Port B S1 - S6 Port C S1 - S6 Port D S1 - S6	Option module digital inputs
Option module(s) digital output ports				
Digital Output	Port A/B/C/D D1 - D2	Relay 1 - Relay 2	Port A D1 - D2 Port B D1 - D2 Port C D1 - D2 Port D D1 - D2	Option module digital output
Option module(s) analog input ports				
Analog Input	Port A/B/C/D A1 - A4	A1 - A4	Port A A1 - A4 Port B A1 - A4 Port C A1 - A4 Port D A1 - A4	Option module analog input
Option module(s) analog output ports				
Analog Output	Port A/B/C/D Q1 - Q2	Q1 - Q2	Port A Q1 - Q2 Port B Q1 - Q2 Port C Q1 - Q2 Port D Q1 - Q2	Option module analog output

NOTE: When configuring your meter, the configuration interface may show all of the possible ports, regardless of what is physically available on your meter.

Related topics

- See “Option modules” on page 43 for a description of how the ports are named based on the option module location with respect to the meter base.

IRIG-B time synchronization

You can connect an IRIG-B time source to one of meter’s digital inputs for IRIG-B time synchronization; for improved accuracy use the digital inputs on the meter base. For IRIG-B time synchronization, you must configure both the meter’s digital input and the meter’s clock.

Related topics

- See “Configuring onboard digital inputs using ION Setup” on page 101 for instructions on how to set your meter’s digital inputs for IRIG-B time synchronization.
- See “Configuring time and time synchronization using ION Setup” on page 96 for instructions on how to configure your meter’s time synchronization settings for IRIG-B time synchronization.

Analog inputs/outputs

Your meter’s analog I/O option modules can measure and output either low voltage or current using standard analog transducers such as 4 - 20 mA current transducers.

For analog input operation, your meter takes an analog input signal and provides the resulting scaled value. For analog output operation, your meter takes an input value and scales it to the appropriate signal value to send out the physical analog output port.

You can view analog I/O values from your meter’s display or webpages.

Analog input voltage and current mode

In current mode, the analog inputs have a low input resistance while the meter is powered on, and a high input resistance when the meter is powered off. In voltage mode, the analog inputs have a high input resistance regardless of whether the meter is powered or not.

NOTE: When unpowered, your meter's analog inputs act like they are in voltage mode (high input resistance).

When connected to a current output transducer, this high resistance can create a high voltage. Standard (i.e., 4 to 20 mA) current transducers have open circuit protection and are able to handle a high input resistance; however, if non-standard transducers are used high voltages may be generated. Your meter's analog input has circuitry to limit this voltage, but it may not be sufficient with a very high-power current source.

NOTICE

EQUIPMENT DAMAGE

- Ensure the analog input is configured for the correct voltage or current mode before connecting or activating the current transducer.
- Do not exceed the device's ratings for maximum limits.

Failure to follow these instructions will result in equipment damage.

Related topics

- See "Option modules" on page 184 for your option module's analog voltage and current range specifications.

Analog input behavior

Analog inputs may show a value below zero scale if an open circuit is detected on the input port.

Analog output behavior

Your meter's analog output, once configured, outputs voltage or current signals. If your meter's analog output source becomes unavailable (N/A) the analog output level should go to zero (0 V / 0 mA) under most conditions.

When your meter is powered off or configured to send voltage, the meter registers as a high impedance.

The electrical signal on the analog output is DC; make sure proper polarity is observed when wiring external devices to the analog output ports.

An unexpected change of state of the analog outputs can result when the supply power to the meter is interrupted, during an upgrade of the meter's firmware or framework or option module firmware or a during an option module reset.

⚠ WARNING

UNINTENDED OPERATION

Do not use this meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Related topics

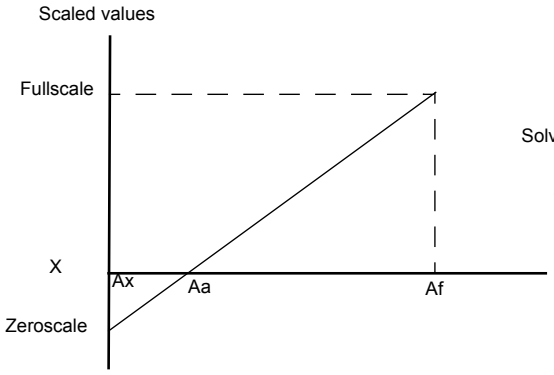
- See “Configuring I/O option module analog inputs using ION Setup” on page 103 and “Configuring option module analog outputs using ION Setup” on page 104 for instructions on how to configure your analog inputs and outputs using ION Setup.
- See the *ION Reference,* available from www.schneider-electric.com, for more information about the Analog Input and Analog Output module settings.

How to calculate analog I/O zero scale and full scale values

Your meter receives an analog signal through its analog input port and scales it before displaying or logging the value. Your meter can also output a scaled analog signal based on measured values such as power. You must calculate the zero scale and full scale values to help ensure the scaled values are correctly interpreted.

Analog inputs will show a value below zero scale if an open circuit is detected on the input port.

The relationship between the analog source range, the zero and full scale values, and the final value provided by your meter, is as follows:



$$\frac{Af - Aa}{Af - Ax} = \frac{Fullscale - X}{Fullscale - Zeroscale}$$

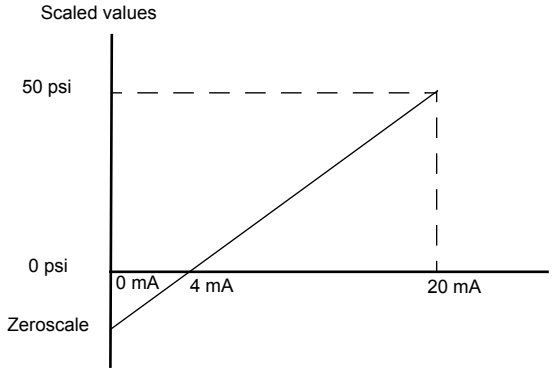
Solving for Zeroscale:

$$Zeroscale = Fullscale - \frac{Fullscale - X}{Af - Aa}(Af - Ax)$$

- Aa = the lowest reading in the nominal operating range that is measured by the meter’s analog input port or produced by the meter’s analog output port
- Af = the highest reading in the nominal operating range that is measured by the meter’s analog input port or produced by the meter’s analog output port
- Ax = the analog input source minimum value or the external analog receiver’s minimum value
- X = the scaled equivalent of Ax

Example (analog input)

The meter's analog input port can measure from 4 - 20 mA, and you need to monitor a steam pressure sensor which measures between 0 - 50 psi of steam. The steam pressure sensor's output ranges from 4 - 20 mA.



$$Zeroscale = Fullscale - \frac{Fullscale - X}{Af - Aa}(Af - Ax)$$

$$Zeroscale = 50 - \frac{50 - 0}{20 - 4}(20 - 0)$$

$$Zeroscale = 50 - 62.5 = -12.5 \text{ psi}$$

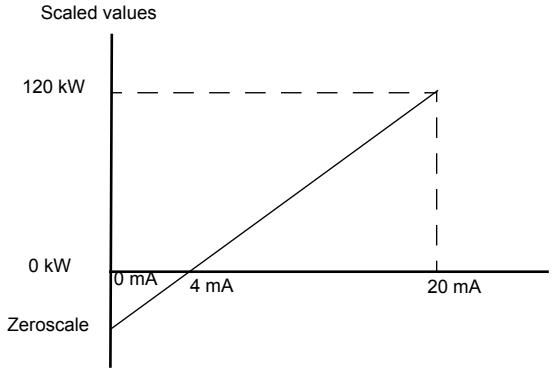
- Af = 20 mA
- Aa = 4 mA
- Ax = 0 mA
- Fullscale = 50 psi

Calculating the Zeroscale value from the equation above gives -12.5 psi.

Configuring the meter's analog input with Fullscale = 50 psi and Zeroscale = -12.5 psi produces an output value ranging from 0 - 50 psi represented by a 4 - 20 mA signal.

Example (analog output)

The meter is monitoring a 0 to 120 kW system and outputs the real power over a 4 to 20 mA analog output. The receiving device is expecting the 0 to 120 kW signal to be represented by the 4 to 20 mA signal.



$$Zeroscale = Fullscale - \frac{Fullscale - X}{Af - Aa}(Af - Ax)$$

$$Zeroscale = 120 - \frac{120 - 0}{20 - 4}(20 - 0)$$

$$Zeroscale = 120 - 150 = -30 \text{ kW}$$

- Af = 20 mA
- Aa = 4 mA
- Ax = 0 mA
- Fullscale = 120 kW
- X = 0 kW

Calculating the Zeroscale value from the equation above gives -30 kW.

Configuring the meter's analog output with Fullscale = 120 kW and Zeroscale = -30 kW produces an output value ranging from 0 - 120 kW represented by a 4 - 20 mA signal.

Digital inputs/outputs

Your meter has three digital inputs and one digital output, and you can add digital I/O option modules to increase your meter's capabilities.

Digital I/O allows the meter to send and receive digital signals, including sending energy pulse information that can be used for verifying accuracy or receiving IRIG-B information for time synchronization. You can view the digital I/O values from your meter's display or webpages.

For high-accuracy applications like IRIG-B time synchronization or verifying accuracy, use the meter's onboard digital I/O.

Your meter's digital inputs can be used for input metering and incremental energy applications.

An unexpected change of state of the digital outputs can result when the supply power to the meter is interrupted, during an upgrade of the meter's firmware or framework or option module firmware or a during an option module reset.

⚠ WARNING

UNINTENDED OPERATION

Do not use this meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Related topics

- See "Conditional energy" on page 167 for details about your meter's conditional energy feature.
- See "Input metering overview" on page 168 for details about your meter's input metering feature.
- See "IRIG-B time synchronization" on page 141 for information about IRIG-B time synchronization.
- See "Configuring onboard digital inputs using ION Setup" on page 101 for instructions on how to configure your digital inputs.
- See "Configuring onboard digital outputs using ION setup" on page 102 for instructions on how to configure your digital outputs.

Energy pulsing overview

You can use your meter's digital output or energy pulsing LEDs for energy pulsing.

Energy pulsing is when the meter sends a readable pulse or signal based on the measured energy. This pulse can be used for accuracy verification or as an input to another energy monitoring system. You must calculate your pulse values as either pulses per kWh or as kWh per pulse, as defined by your meter, and set the energy value as active, reactive, or apparent delivered, received, or delivered plus received.

For applications where energy pulsing accuracy is required, use the meter's onboard digital output.

Related topics

- See “Verifying accuracy” on page 175 for instructions on how to perform accuracy verification testing on your meter.
- See the *ION Reference*, available from www.schneider-electric.com, for more information about Calibration Pulser and Pulser modules.

Calculate your maximum kWh/pulse (pulse weight) value

To calculate the kWh/pulse (pulse weight) value, divide the highest kW value you can expect by the required pulse rate. Make sure the required pulse rate does not exceed the maximum pulse rate for the digital output.

NOTE: To convert from kWh/pulse to pulse/kWh you must invert (take the reciprocal) of the value. For example, 1.8 kWh/pulse becomes 0.556 pulse/kWh.

Example

For a maximum load of 1600 kW and a pulse rate of 2 pulses per second, calculate the kWh/pulse value as follows:

1. Convert 1600 kW load into kWh/second:

   (1600 kW)*(1hr) = 1600 kWh

   (1600 kWh)/(3600 sec) = (X kWh)/(1sec)

   X = 0.444 kWh/sec

2. Calculate the kWh required per pulse:

   (0.444 kWh/sec)/(2 pulses per second) = 0.222 kWh/pulse

3. Adjust for the KY giving one pulse per 2 transitions if necessary.

   (0.222 kWh/pulse)/(2) = 0.111 kWh/pulse

Chapter 17 Alarms and alerts

Your meter can display various alarms through the display, and can be configured to send an alert.

⚠ WARNING

INACCURATE DATA RESULTS

Confirm your alarm is properly configured.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Alarms overview

An alarm is a notification of a specific event that is annunciated through the display, and can be viewed and acknowledged using your meter's display.

You can configure your meter to generate and display alarms when predefined events are detected in the meter's measured values or operating states. Your meter also records and stores meter events in the meter's onboard event log.

Your meter comes with many alarms. Some are preconfigured, while others need to be configured before your meter can generate alarms. Your meter's default alarms can be customized, as needed, such as changing the priority. You can create custom alarms using the advanced features of your meter.

NOTE: To stop an alarm from being displayed without impacting other metering features, set its alarm priority to info only.

Related topics

- See "Event log overview" on page 134 for more information about your meter's on-board event log.
- See the *ION Reference,* available from www.schneider-electric.com, for more information about the Setpoint module.

Alarm types

Your meter has the following types of alarms:

Type	Description
Setpoint (standard)	Setpoint alarms define an alarm by comparing the actual value of a parameter to a specified limit or range of values. These include measured voltage and current values and calculated power quality values. Some setpoint alarms use high-speed measurements for up to 1 millisecond resolution.
Digital	Digital alarms define an alarm condition based on a digital input's on/off state.
Disturbance (sag/swell)	Disturbance alarms define an alarm based on a measured sag or swell.
Unary	Unary alarms are not configurable, and generate an alarm based on the meter's state, for example, the meter powering up.

Alarms have two states:

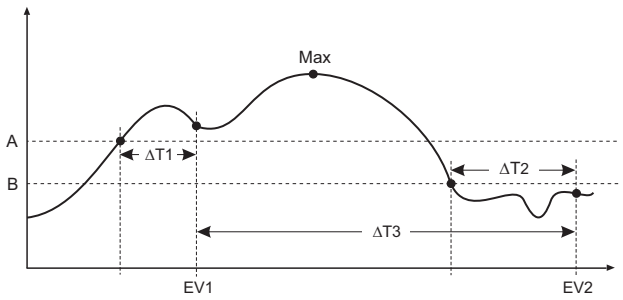
- Active: the meter detects the alarm condition is met.
- Historical: the alarm condition previously existed but the condition has since returned to a non-alarm state.

Setpoint (standard) alarms

You must define the pickup, dropout and set the time delay for these alarms. You can define the pickup and dropout values as actual values, or as a percentage of the nominal value, and set the time delay to minimize nuisance alarms.

The setpoint alarms operate as either over or under alarms, or as bounding alarms (both over and under values are alarmed).

Example of over setpoint alarm operation



A	Pickup
B	Dropout
ΔT1	Pickup time delay
ΔT2	Dropout time delay
ΔT3	Alarm duration
EV1	Start of alarm
MAX	Maximum value for alarm
EV2	End of alarm

When the monitored value rises above the pickup (A) and remains there long enough to satisfy the pickup time delay period (ΔT1), the setpoint alarm is active. When the value falls below the dropout (B) and remains there long enough to satisfy the dropout time delay period (ΔT2), the alarm is no longer active and becomes a historic alarm.

The meter records the date and time when the alarm event starts (EV1) and when it ends (EV2). The meter records the maximum value (Max) during the alarm period.

Disturbance (sag/swell) alarms

You must configure nominal voltage and current for these alarms to function. For voltage disturbances, enter the percentage deviation from the nominal that defines a sag or swell. For current disturbances, enter the percentage deviation from the nominal that defines the pickup and dropout points for a current sag or a current swell.

Digital alarms

These alarms are triggered when the associated digital input changes state. You can configure the alarm to be active when the digital input is on or off, depending on the alarm's purpose.

For example, if you used a digital input to monitor a breaker that is always supposed to be on, you would set the alarm to be active when the breaker has tripped.

NOTE: To stop a digital alarm from being displayed, set the alarm priority to info only. Disabling (force off) the digital alarm off will disable all functions of the associated digital input.

Related topics

- See the *ION Reference,* available from www.schneider-electric.com, for more information about the Setpoint and Relative Setpoint module, Digital Input module, Sag/Swell module and Disturbance Analyzer modules.
- See "Configuring setpoint/standard alarms using ION Setup" on page 106 for instructions on how to configure alarms on your meter using ION Setup.

Alarm event priorities

Your meter's alarm priorities correspond to the following event priority ranges:

Alarm priority	Event priority
High (red)	192 - 255
Medium (yellow)	128 - 191
Low (blue)	64 - 127
Info only (no alarm)[1]	1 - 63
None (no alarm or event)[1]	0

[1] Alarms with priority of info only or none are not indicated or displayed.

Info only and none event priority

Alarms with a priority of info only or none are not shown on the meter's display, and do not function as alarms. If the alarm's priority is set to info only, and the event priority is greater than the event log cutoff value, the associated event is recorded in the meter's event log. If the alarm's priority is set to none, the event priority is automatically set to zero, and no associated event is logged in the meter's event log.

For events that you want to log for future reference or troubleshooting, but don't want alarm functions, set the alarm priority to info only.

For nuisance events that frequently occur and you have no desire to log for reference or troubleshooting, set the alarm priority to none.

Related topics

- See "Event log overview" on page 134 for more information about event priority and the meter's event log.

Alarm indicators

Your meter's display has an alarm indicator to show you what alarm levels have been detected (active or historic) and whether they have been acknowledged. For active high priority alarms, the meter's display will also flash until the alarm is acknowledged. There is also an alarm LED to indicate the meter's alarm condition.

Alarm	Alarm icon	Alarm icon flash	Alarm LED	Meter display
Active high	Red solid bell	Flash if not acknowledged	• Flash if not acknowledged • Steady if acknowledged	Flash if not acknowledged
Active medium	Yellow solid bell	Flash if not acknowledged	• Flash if not acknowledged • Steady if acknowledged	No flash
Active low	Blue solid bell	Flash if not acknowledged	• Flash if not acknowledged • Steady if acknowledged	No flash
Historic high	Red outline bell	Flash if not acknowledged	• Flash if not acknowledged • Steady if acknowledged	No flash
Historic medium	Yellow outline bell	Flash if not acknowledged	• Flash if not acknowledged • Steady if acknowledged	No flash
Historic low	Blue outline bell	Flash if not acknowledged	• Flash if not acknowledged • Steady if acknowledged	No flash

Alarm	Alarm icon	Alarm icon flash	Alarm LED	Meter display
No active or unacknowledged alarms	Gray solid bell	No flash	Off	No flash

If there are multiple active alarms, the meter displays the alarm condition associated with the most important active alarm. If there are multiple unacknowledged historic alarms, the meter displays the alarm condition associated with the most important unacknowledged historic alarm.

NOTE: To stop an alarm from being displayed without impacting other metering features, set the alarm priority to info only.

Default alarms

Your meter comes with the following default alarms.

NOTE: Some alarms require configuration in order to operate.

Name	Priority	Description
Current Sag Ph1 - 3	High	Current sag alarms for phase 1, 2, 3
Current Swell Ph1 - 3	High	Current swell alarms for phase 1, 2, 3
Sag/Swell	High	Voltage sag/swell alarm
Over I unbal	Medium	Over unbalanced current alarm
Over V unbal	Medium	Over unbalanced voltage alarm
Over THD V1 - 3	Medium	Over total harmonic distortion (THD) voltage alarms
Over kW (P) sd	Medium	Over kW sliding demand alarm
Over I a - c, (1 -3) 4	Medium	Over current alarms
V1 - V3 Setpoint	Medium	Voltage setpoint alarms
Freq Setpoint	Medium	Frequency setpoint alarm
4-30 Volt Intrp Ph1 - 3	Low	4-30 voltage interruption power quality alarms
Digital In	Info only	Digital input alarms Number of alarms determined by the total number of available digital inputs **NOTE:** These alarms are not displayed by default.

Alarm information

You can view the following information about an alarm from your meter's display. Only alarms with a priority of low, medium or high are displayed.

Parameter	Description
Alarm	The name of the alarm (for example, Over THD V1).
Priority	Low, medium or high alarm priority.
Date	The date and time the alarm was triggered.
Duration	The duration of the alarm (only applies to inactive alarms).
Ack	The date and time when the alarm was acknowledged (only applies to acknowledged alarms).
Value	Active alarm: The maximum value detected when the alarm was triggered. Historic alarm: The maximum value detected during the duration of the alarm.

Disabling alarms through your meter's display

You can disable alarms through the meter's display when you are performing maintenance tasks on your system and want to prevent nuisance alarms.

NOTE: To stop an alarm from being displayed without impacting other metering features, set the alarm priority to info only.

⚠ WARNING

INACCURATE DATA RESULTS

Confirm your alarm is properly configured.

Failure to follow these instructions can result in death, serious injury or equipment damage.

1. Navigate to **Setup Menu > Alarm Setup**. Press the edit button to access the enable/disable screen. Use the up and down arrows to scroll through the available alarms. Simultaneously press the up and down arrow to enable or disable the highlighted alarm.
2. Press the select button to confirm your settings.
3. Complete the system maintenance tasks.
4. Enable the alarms you disabled in step 1.

Related topics

- See “Setting up your meter using the display” on page 34 for instructions on how to navigate and use your meter’s display.

Alerting

An alert is an external notification produced by the meter to indicate changes, for example, a change of state for a digital input, or a power quality event such as a sag or swell.

Alerts are generated when a pulse or trigger that is configured to indicate the alert condition activates. You can configure alerts to send notification emails or messages to your energy management system through your meter’s existing Ethernet communications connections. You can configure alert messages as a simple text string or you can also include device information. You can configure the alert’s priority so that alerts are also recorded in the meter’s event log.

You can configure multiple alerts on a single meter, each having different activation triggers, messages and/or transmission types. For instance, you can have two alerts, one generating an email, the other sending a message to your energy management system, but using the same trigger conditions; or you can have two alerts with different conditions that send two unique emails to two different email addresses. You can also generate alerts based on triggers from devices connected to your meter.

Creating alerts is an advanced feature that requires familiarity with ION architecture and your power system and communications network. To create an alert, you must configure the Alert module using a configuration tool. You must also configure your device’s communications as needed to send the alerts, such as configuring your meter’s SMTP settings and connecting it via Ethernet to an SMTP mail server in order to send an alert by email.

Related topics

- See the *ION meter alerts* technical note, available from www.schneider-electric.com, for detailed information on creating and configuring alerts.
- See the *ION Reference*, available from www.schneider-electric.com, for detailed information about the Alert module and its operation.

Chapter 18 Resets

Resets overview

Resets allow you to clear various accumulated parameters stored on your meter or re-initialize meter accessories.

Meter resets clear your meter's onboard data logs and other related information. Resets are typically performed after you make changes to the meter's basic setup parameters (such as PT/CT settings) to clear obsolete or invalid data in preparation for putting the meter into active service.

You must enter a valid password in order to perform a reset.

NOTE: Revenue-locked meters must be unlocked to perform meter resets that affect revenue data.

Related topics

- See "Revenue locking" on page 173 for more information locking and unlocking revenue locked meters.

Meter resets

You can perform various meter resets through the meter's display or ION Setup.

Your meter's digital and analog outputs may change state or may not function during resets.

⚠ WARNING

HAZARD OF UNINTENDED OPERATION

Do not use the meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Meter resets clear the meter's onboard data logs and other related information.

NOTICE

DATA LOSS

Ensure all important data from the device has been retrieved before performing a reset.

Failure to follow these instructions can result in data loss.

Reset	Description
Master Reset	• Clears all the cumulative and derived quantities from the meter (including demand, peak demand, energy and revenue parameters). • Clears meter event and waveform logs. • Clears COMTRADE waveform records from the meter's internal FTP server. • Clears the meter's data logs.
Peak Demand Reset	Clears the peak demand values logged in the meter. **NOTE:** The peak demand reset has a lockout period that sets the minimum time allowed between consecutive resets.
Min/Max Reset	Clears all accumulated maximum and minimum values stored in the meter.
Digital Input Count Reset	Clears the digital input status change counters.
Harmonics Min/Max Reset	Clears all accumulated maximum and minimum harmonics values stored in the meter.
Disturbance Count Reset	Clears the sag/swell event counter. The sag/swell event counter counts the number of sag/swells that have occurred since power-up or the last reset, to provide power quality information to energy management systems.
EN50160 Reset	Clears all EN50160 parameters and statistics accumulated in the meter.
Option modules reset	Resets communications to the meter's expansion modules.
Conditional energy reset[1]	Clears the conditional energy values stored in the meter.
Input metering reset[1]	Clears the input metering values stored in the meter.

[1] These resets are only available through ION Setup.

Related topics

- See "Peak demand reset lockout" on page 172 for more information about the peak demand reset lockout.

Performing meter resets using the display

You can perform meter resets from the display after entering a valid password.

Revenue-locked meters must be unlocked to perform resets that impact revenue data.

Your meter's digital and analog outputs may change state or may not function during resets.

⚠ WARNING

HAZARD OF UNINTENDED OPERATION

Do not use the meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Meter resets clear the meter's onboard data logs and other related information.

NOTICE

DATA LOSS

Ensure all important data from the device has been retrieved before performing a reset.

Failure to follow these instructions can result in data loss.

1. Navigate to **Setup Menu > Resets**.
2. Press the edit button to access the configuration menu and use the up and down buttons to navigate through and select the resets you want to perform. Press the select button to perform the resets.

Related topics

- See “Revenue locking” on page 173 for more information on revenue locked meters.

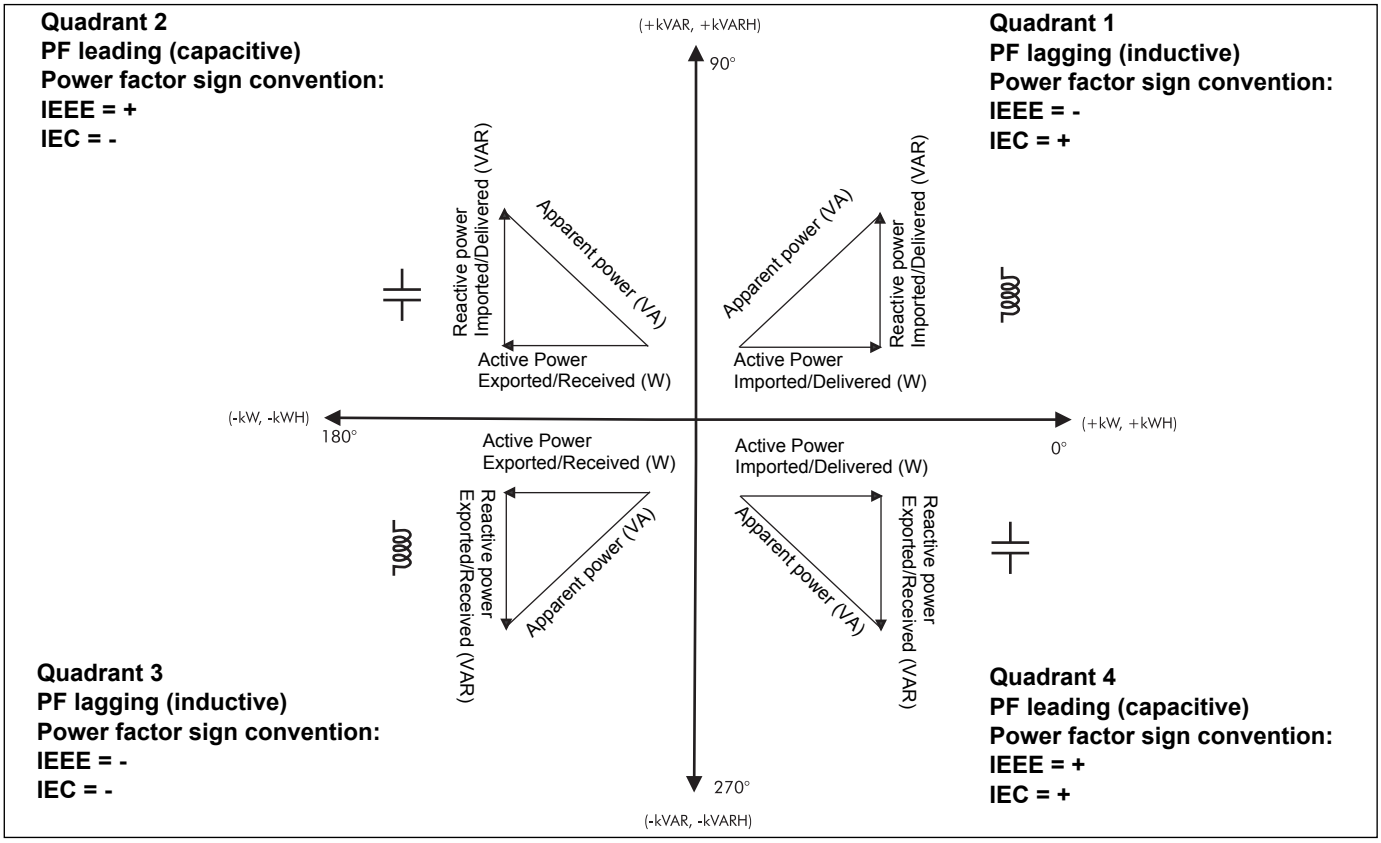
Chapter 19 Power and power factor

This section describes how the meter interprets and calculates power and power factor.

NOTE: The descriptions in this section assume that you are an electrical energy consumer, not a supplier.

Power and power factor conventions

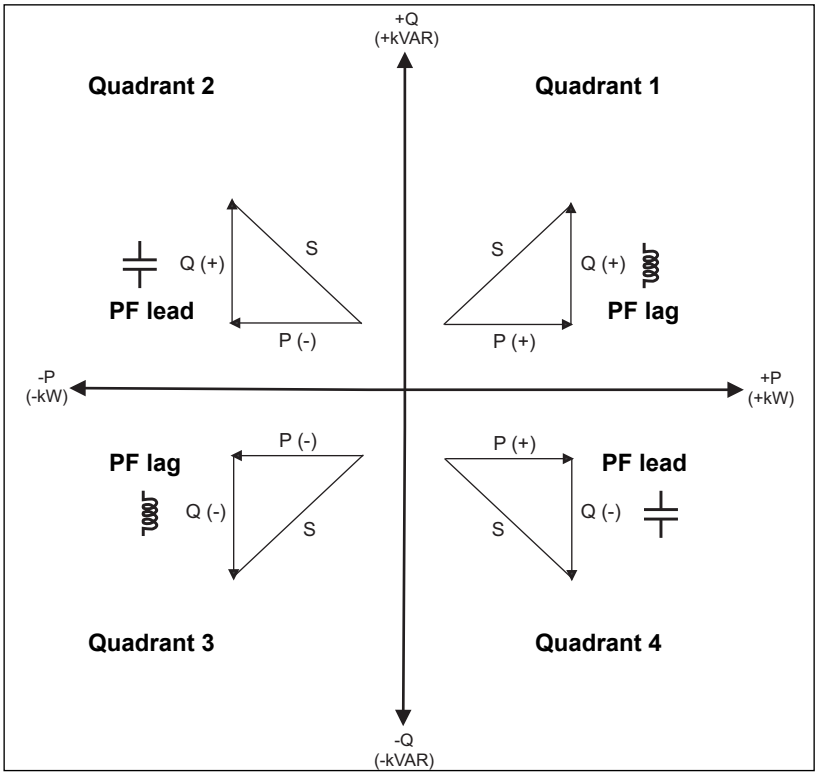
Values for power and power factor are interpreted according to the conventions shown in the diagram below.



Apparent, active and reactive power (PQS)

A typical AC electrical system load has both resistive and reactive (inductive or capacitive) components. Resistive loads consume real power (P). Reactive power (Q) is either consumed (inductive loads) or generated (capacitive loads).

Apparent power (S) is the capacity of your measured power system to provide real and reactive power.



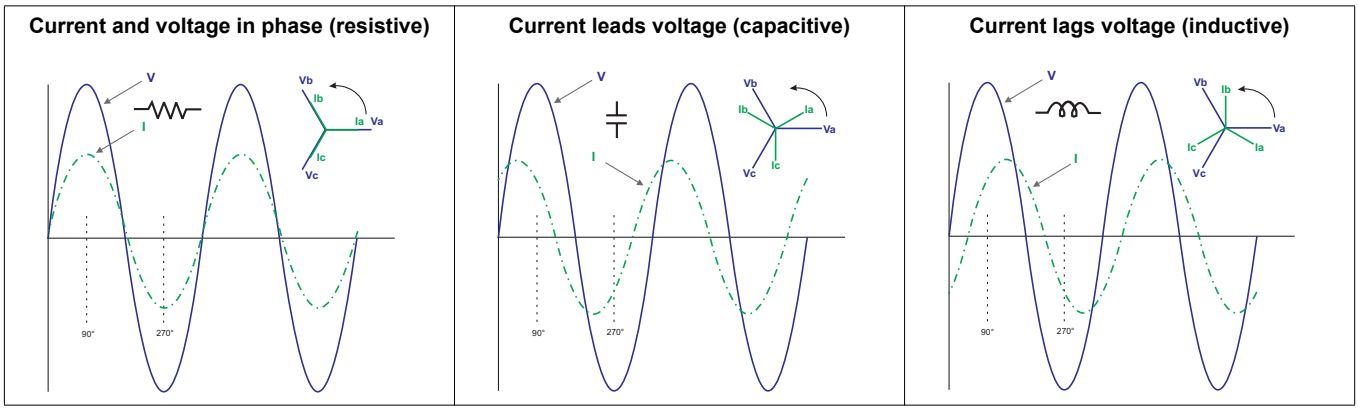
The units for power are watts (W or kW) for real power P, vars (VAR or kVAR) for reactive power Q, and volt-amps (VA or kVA) for apparent power S.

Positive real power P(+) flows from source to load, and negative real power P(-) flows from the load to the power source.

Current phase shift from voltage

For purely resistive loads, the current waveform is in phase with the voltage waveform. For capacitive loads, current leads voltage. For inductive loads, current lags voltage. The following diagram shows how voltage and current waveforms shift based on load type under ideal (laboratory) conditions.

Current lead / lag and load type



Power factor (PF)

Power factor (PF) is the ratio of real power (P) to apparent power (S) and is provided as a number between -1 and 1 or as a percentage from -100% to 100%, where the sign is determined by convention.

$$PF = \frac{P}{S}$$

An ideal, purely resistive load has no reactive components, so its power factor is one (PF = 1, or unity power factor). Inductive or capacitive loads introduce a reactive power (Q) component to the circuit which causes the PF to become closer to zero.

Related topic

- See “Power and power factor conventions” on page 157 for power factor sign convention information.

True PF and displacement PF

The meter supports true power factor and displacement power factor values:

- True power factor includes harmonic content.
- Displacement power factor only considers the fundamental frequency.

NOTE: Unless specified, the power factor displayed by the meter is true power factor.

PF min/max convention

The meter uses the following convention for power factor minimums and maximums.

For negative PF readings:

- The minimum PF value is the measurement closest to -0.
- The maximum PF value is the measurement closest to -1.

For positive PF readings:

- The maximum PF value is the measurement closest to +1.
- The minimum PF value is the measurement closest to +0.

Chapter 20 Power quality

Your meter measures voltage and current harmonics up to the 63rd harmonic, and calculates several harmonic distortion values as well as K-factor and crest factor values.

You must configure your meter with nominal values for voltage, current and frequency for the power system being monitored in order for the meter to perform power quality calculations. Your meter also creates a phasor diagram, including numeric values for magnitude and angle, to represent your power system.

Related topics

- See “Minimum configuration requirements for basic metering” on page 37 for instructions on setting basic metering values through your meter’s display.
- See ““Specifications” on page 181 for the power quality standards your meter is compliant to.
- See the *Power quality: ION meters and EN50160:2010* technical note, available from www.schneider-electric.com, for a detailed description of the EN50160 data and statics measured by your meter to monitor compliance to the EN50160 standard.
- See the *4-30 compliance and ION meters* technical note, available from www.schneider-electric.com, for details on how your meter complies with the 4-30 standard.

Sag/swell overview

Your meter monitors your power system’s voltage and current for sags and swells (INCITS (CBEMA) Type 2 and Type 3 disturbances); it then reports the disturbance’s magnitude and duration.

You can manually enter the limits (criteria) used by the meter to identify a sag or swell, or you can have your meter learn sag/swell limits by monitoring your power system.

Related topics

- See “Configuring waveform recording using ION Setup” on page 109 for instructions on how to manually enter sag/swell limits.
- See“Implementing sag/swell limit learning using ION Setup” on page 108 for instructions on to start setpoint learning and have the learned values used by your meter to identify sags/swells.
- See “Waveform recording overview” on page 135 for details on how your meter records voltage and current waveform information.

Harmonics overview

Voltage and current harmonics are measured or calculated by your device, for use in standards compliance and power quality analysis.

Harmonics are integer multiples of the fundamental frequency of your monitored power system. Harmonics information is valuable for power quality analysis, determining properly rated transformers, maintenance and troubleshooting, and is required for compliance to system power quality standards such as EN50160 and meter power quality standards such as IEC 61000-4-30.

Harmonics measurements include per-phase magnitudes and angles (relative to the fundamental frequency of the phase A voltage) for the fundamental and higher harmonics. The device's power system configuration determines which phases are present, and how line-to-line or line-to-neutral voltage harmonics and current harmonics are calculated.

Harmonics are used to identify whether the supplied system power meets required power quality standards, or if non-linear loads are affecting your power system. Power system harmonics can cause current flow on the neutral conductor, and damage to equipment such as increased heating in electric motors. Power conditioners or harmonic filters can be used to minimize unwanted harmonics.

Your meter provides harmonic information up to the 63rd harmonic. Harmonic information can be viewed on the meter's display, and is recorded by your meter.

Related topics

- See "Viewing harmonics information using the display" on page 164 for information on how to view harmonics values on your meter's display.
- See the *ION Reference,* available from www.schneider-electric.com, for details about the Harmonics Measurement and Harmonics evaluation modules.
- See "Default data logging configuration" on page 131 for information on how harmonic information is logged on your meter.

Crest factor and K-factor overview

Crest factor is the ratio of peak to RMS values, and is available for both voltage and current. For a pure sinusoidal waveform, crest factor is equal to the square root of 2. The meter uses the following equation to calculate crest factor:

$$\text{Crest factor} = \frac{V_{peak}}{V_{RMS}}$$

$$\text{Crest factor} = \frac{I_{peak}}{I_{RMS}}$$

K-factor relates to the heating effect of a distorted current in a transformer to a sinusoidal current with the same RMS magnitude: it describes a transformer's ability to serve non-linear loads with out exceeding rated temperature rise limits. The K-factor is equal to the sum of the squares of the harmonic currents multiplied by the squares of the harmonic order. The meter uses the following equation to calculate K-factor:

$$\text{K-factor} = \frac{\sum_{h=1}^{63} (I_h^2 \times h^2)}{\sum_{h=1}^{63} (I_h^2)}$$

Where "h" is the harmonic order and "I_h" is the RMS current of harmonic order "h".

Related topics

- See the *ION Reference,* available from www.schneider-electric.com, for details about the Harmonics Measurement module.
- See "Harmonics logs" on page 132 for information on how K-factor information is logged on your meter.

Total harmonic distortion overview

Total Harmonic Distortion (THD) is a measure of the total per-phase voltage or current harmonic distortion present in the power system. It provides a general indication of the quality of a waveform. THD is calculated for each phase of both voltage and current.

The meter uses the following series of equations to calculate THD.

Harmonic content calculations

Harmonic content (H_C) is equal to the RMS value of all the non-fundamental harmonic components in one phase of the power system, and this value is used in THD calculations. The meter uses the following equation to calculate H_C:

$$H_C = \sqrt{(H_2)^2 + (H_3)^2 + (H_4)^2 \ldots}$$

THD calculations

THD is a quick measure of the total distortion present in a waveform and is the ratio of harmonic content (H_C) to the fundamental harmonic (H_1). The meter uses the following equation to calculate THD:

$$THD = \frac{H_C}{H_1} x 100 percent$$

thd and TDD

Your meter can be configured to provide thd (total harmonic distortion using the total RMS value for the content rather than the fundamental content) and TDD (total demand distortion, the harmonic current distortion against the maximum demand of the electrical system.

$$thd = \frac{H_C}{RMS} x 100 percent$$

$$TDD = \frac{H_C}{Demand_{Max}} x 100 percent$$

This is an advanced procedure that should only be performed by users with an advanced knowledge of power quality, ION architecture, and the power system being monitored.

Related topics

- See “Viewing data using your meter’s display” on page 30 for information on how to view total harmonic distortion values on your meter’s display.
- See the *ION Reference,* available from www.schneider-electric.com, for details about the Harmonics Measurement module.

Phasor overview

Phasors are used to represent the voltage and current relative magnitude and angles. They can be viewed through your meter’s display or webpages.

The length of the lines in the phasor diagram represent the relative magnitude of the voltages with respect to the other phase voltages, and the currents with respect to the other phase currents. All angles are measured with respect to the Va/V1 phase. The Va/V1 phasor is fixed to the right-hand horizontal axis (positive x-axis). Positive angles are measured counterclockwise.

Numeric values are provided for the magnitude and relative angle for each voltage and current phase.

Phasor information can be used to troubleshoot incorrect connections on the meter's voltage and current inputs, if you know how the phasors should be oriented for your power system.

Related topics

- See "Viewing data using your meter's display" on page 30 for instructions on how to navigate and use your meter's display.

Viewing harmonics information using the display

You can view detailed harmonics data through your meter's display.

1. Navigate to **Power Quality** > **Harmonics**. The total harmonic distortion (THD) screens are displayed.
2. Press the more button, and select the desired harmonics. The per-phase harmonics are graphically displayed.
3. Press the left and right buttons to move to individual harmonics. The harmonic number, magnitude and angle are displayed.

Related topics

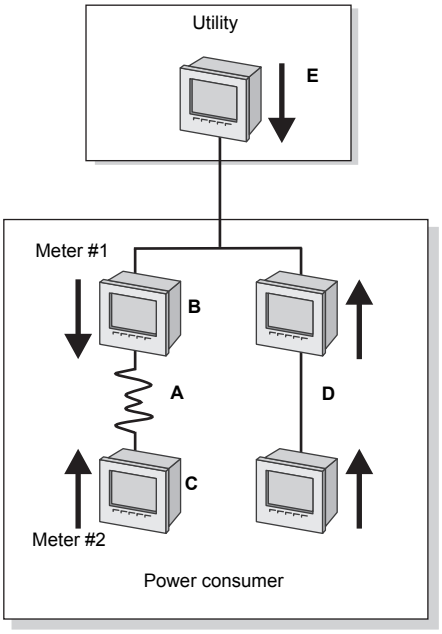
- See "Viewing data using your meter's display" on page 30 for instructions on how to navigate and use your meter's display.

Disturbance direction detection overview

Your meter has disturbance direction detection capabilities to help you determine the location of a power system disturbance. When a disturbance occurs, the meter analyzes the disturbance information to determine the direction of the disturbance relative to the meter. This analysis includes a confidence level indicating the level of certainty that the disturbance is in the determined direction, and is stored in your meter's event log.

Disturbance direction detection is enabled on your meter by default and does not require any additional configuration beyond setting the nominal voltage and nominal frequency.

Disturbance direction detection can help locate the source of a disturbance when used in a system of disturbance direction detection devices, as shown in the diagram below.



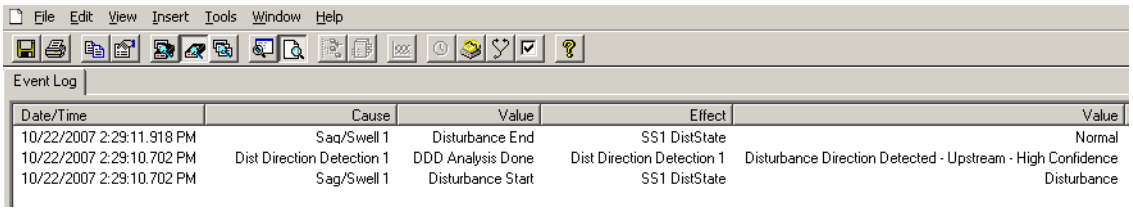
A	Disturbance location
B	Meter #1 reports downstream disturbance
C	Meter #2 reports upstream disturbance
D	Meters report upstream disturbance
E	Meter reports downstream disturbance

The arrows show the direction the meters have determined for the disturbance. With this information, you can determine that the disturbance occurred between meter #1 and meter #2, and can focus on that section of your system to find the cause of the disturbance.

Viewing disturbance direction detection events

The results of the disturbance direction detection algorithm appear in the meter's event log. The image below shows an example of how the Disturbance Direction Detection event appears in your meter's event log when viewed using ION Setup.

NOTE: You can view your meter's event log through the display and ION Setup.



Date/Time	Cause	Value	Effect	Value
10/22/2007 2:29:11.918 PM	Sag/Swell 1	Disturbance End	SS1 DistState	Normal
10/22/2007 2:29:10.702 PM	Dist Direction Detection 1	DDD Analysis Done	Dist Direction Detection 1	Disturbance Direction Detected - Upstream - High Confidence
10/22/2007 2:29:10.702 PM	Sag/Swell 1	Disturbance Start	SS1 DistState	Disturbance

Related topics

- See the *ION Reference,* available from www.schneider-electric.com, for more detailed information about the Disturbance Direction Detection module.
- See "Event log overview" on page 134 for more information about your meter's event log.

Chapter 21 Energy and demand

This section includes information on the energy monitoring features of your meter, conditional energy and WAGES (water, air, gas, electricity, steam) input metering. It also provides information on the different power demand calculation methods you can configure on your meter.

Conditional energy

Conditional energy allows you to define an accumulation period for real and reactive energy using one of your meter's digital inputs.

You can use conditional energy to track four-quadrant accumulated energy during a specific period; for example you may want to track accumulated energy values during a particular process controlled using a programmable logic controller (PLC).

Conditional energy is accumulated until it is reset. The conditional energy reset date and time information is stored in the meter's event log.

Related topics

- See "Configuring conditional energy using ION Setup" on page 98 for instructions on how to enable and trigger conditional energy accumulation.
- See "Power and power factor conventions" on page 157 for a detailed description of four-quadrant energy values.

WAGES monitoring overview

Water, air, gas, electric and steam (WAGES) monitoring allows you to monitor and analyze of your energy system's energy sources and utilities usage.

Your meter's digital inputs can be used to count pulses from transducers and convert the pulses to energy measurements for WAGES applications.

This can help you:

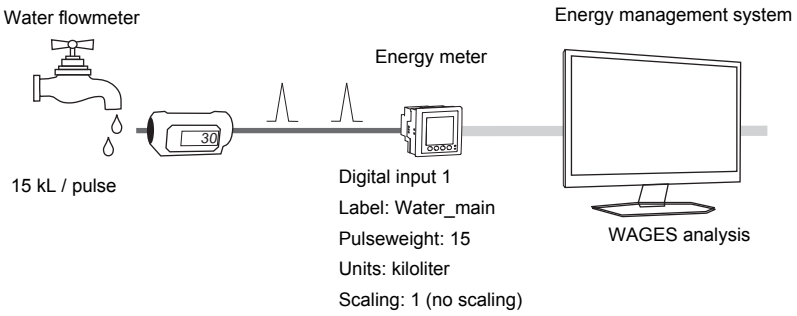
- Identify losses or inefficiencies.
- Modify demand to reduce costs.
- Optimize energy source usage.

Your energy system may use several different types of energy. You may consume steam or compressed air for industrial processes, electricity for lights and computers, water for cooling and natural gas for heating. WAGES collects the usage information from all these different energy sources for a more complete energy analysis.

WAGES example

You can connect your meter's digital input to a transducer that sends a pulse for every 15 kiloliters (4000 US Gal) of water. This information is then labeled, scaled, given a

unit of measure and logged in the meter's onboard memory for subsequent loading into your energy management system.



Related topics

- See "Input metering overview" on page 168 for a description of how your meter supports WAGES information.

Input metering overview

Your meter's digital inputs can be used to count pulses from transducers and convert the pulses to energy measurements for WAGES applications.

Your meter's input metering channels count pulses received from the digital inputs assigned to each channel. The incoming pulses are used in calculating and measuring consumption data (e.g. BTU, kWh, L, kg). Each channel must have the following values configured to match the pulse data:

- Pulse weight: the value per pulse.
- Units: the unit of measure associated with the metered quantity.
- Rate: the time base associated with input metering accumulations. For units with a defined rate, this value is used for scaling.
- Demand period: how frequently the input metering data is calculated in your energy management system.

You can use standard units and rates to configure input metering, or you can create custom input metering parameters for specialized applications.

Standard input metering example

Your meter's onboard digital input S1 is monitoring a flow meter (identified as FL3) that sends one pulse for every 100 liters of water. Your energy management system has a demand period of 15 minutes, and calculates the input metering data using an hourly rate.

Parameter	Value
Assigned Input	S1
Standard quantity	Selected
Pulse Weight	100
Units	L
Rate	l/hr
Demand period	15 minutes
Source ID	FL3

Custom input metering example

Your meter's onboard digital input S1 is monitoring a flowmeter (BF5) installed inside bottle-filling equipment. The desired measurement quantity is bottles/shift (numbers of bottles filled during an eight-hour shift). Each bottle takes 0.4 liters of liquid, and the flowmeter pulses once for every 100 liters. Your energy management system has a demand period of 15 minutes, and calculates the input metering data using an hourly rate.

Pulse weight calculation:

$$\frac{100 \text{ (liters/pulse)}}{0.4 \text{ (liters/bottle)}} = 250 \text{ (bottles/pulse)}$$

Parameter	Value
Assigned Input	S1
Standard quantity	Cleared
Pulse Weight	250
Units	Bottles@BF5
Rate	Bottles/shift
Demand period	15 minutes
Scaling	1
Time Base	8 hours

Incremental energy

Incremental energy allows you to define a start time, end time, and the time interval (increments) for incremental energy accumulation. At the end of each interval, the energy accumulated during that period is stored. By default, the meter only records the previous interval's incremental energy and the instantaneous energy accumulations in the active interval.

The first interval of incremental energy accumulation begins at the specified start time. Incremental energy ends at the specified end time, which may result in a truncated interval if the interval duration does not divide evenly into the overall incremental energy duration (for example, an interval duration of three hours with an overall duration of five hours truncates the last interval duration to two hours). The latest value for the specified end time is midnight (24:00).

Your start time must be before the end time and after midnight, and the period over which incremental energy is accumulated cannot include midnight. This is because your meter's start and end times are defined relative to midnight.

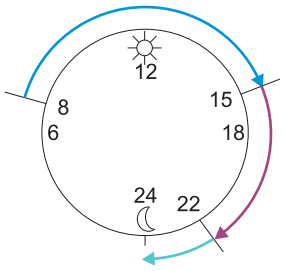
Start: 6am, End: 12am, interval: 3hrs	Incremental energy accumulates from 6am to midnight in intervals of 3 hours.
Start: 6am, End: 2am, interval: 3hrs	Incremental energy will not function. End time must be after start time and before or equal to midnight.

Incremental energy helps provide information for analyzing energy and power usage against present or future utility rates, and is useful for comparing different time-of-use rate structures.

When configuring incremental energy, shorter incremental energy periods provide more granular data which can make the data easier to use for comparison purposes.

Incremental energy example

- Start time: 8 am or 08:00
- End time: 12 am or 24:00
- Interval: 420 minutes (7 hours)



A	First interval (08:00 to 15:00)
B	Second interval (15:00 to 22:00)
C	Third interval (22:00 to 24:00)

The first incremental energy interval is from 8 am (start time) to 3 pm, and is seven hours long. The second incremental energy interval is from 3 pm to 10 pm, and is also seven hours long. The third interval is from 10 pm to 12 am, and is only 2 hours long because 12 am is the specified end time. These intervals repeat every 24 hours until the configuration is changed or incremental energy feature is disabled.

Related topics

- See “Configuring incremental energy using ION Setup” on page 100 for instructions on how to configure your meter’s start and end times and interval values.

Demand

Demand (also referred to as power demand) is a measure of average power consumption over a fixed time interval. Peak (or maximum) demand is the highest demand level recorded over the billing period. Your meter calculates the average current demand and kW, kVAR and kVA demand using sliding window demand methods.

The meter supports coincident demand values when a peak demand is detected.

Your meter’s default configuration is suitable for most applications, or you can customize it for your specific application.

You can configure the minimum time between consecutive demand resets.

NOTE: If not specified, references to “demand” are assumed to mean “power demand”.

Related topics

- See “Peak demand reset lockout” on page 172 for information about your meter’s peak demand reset lockout feature.
- See the ION Setup online help for instructions on how to configure demand on your meter.
- See the *ION Reference,* available from www.schneider-electric.com, for detailed information on how Sliding Window Demand modules measure and calculate demand values.
- See“Viewing data using your meter’s display” on page 30 for instructions on how to navigate and use your meter’s display.

Sliding window demand

To calculate demand values, your meter uses the sliding window averaging (or rolling interval) method which divides the demand interval into a set number of subintervals of specified duration.

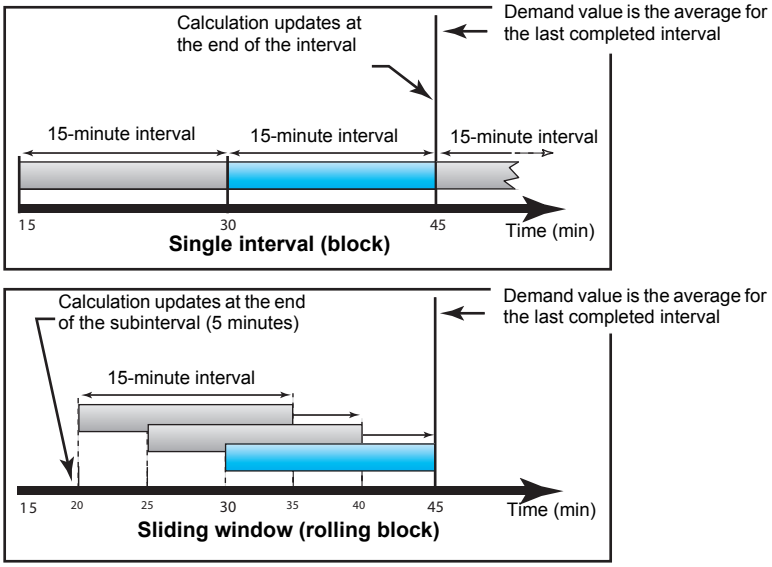
The demand is measured electronically based on the average load level over the most recent set of subintervals.

Sliding window demand also provides predicted demand values.

Examples of sliding window demand

This example shows two different ways of configuring a 15-minute demand interval:

- Single interval (also called block or timed block): the 15-minute demand interval is defined as a single subinterval with a duration of 15 minutes.
- Sliding window (also called rolling block): the 15-minute demand interval is defined as three subintervals with a duration of 5 minutes each. This method offers better response time than a single interval.



Peak demand

Power utilities generally bill commercial customers based on their peak usage levels, called peak demand (in kW) and energy consumption (in kWh). Peak (or maximum) demand is the highest demand level recorded over the billing period. You can view peak demand values on your meter’s display.

Peak demand reset lockout

The demand reset lockout time sets the minimum time allowed between consecutive demand resets; the meter ignores any attempts to reset demand that occur within the lockout period.

The peak demand reset lockout period is user-configurable, with a default value of 25 days.

Related topics

- See the ION Setup online help, available from www.schneider-electric.com, for instructions on how to configure the peak demand reset lockout period.
- See “Meter resets” on page 153 for more information about the resets available on your meter.

Chapter 22 Revenue

Revenue overview

This section describes your meter's revenue-related features: revenue locking, time of use, PT/CT (potential transformer/current transformer) correction and the recommended process for verifying the accuracy of your meter.

Revenue locking

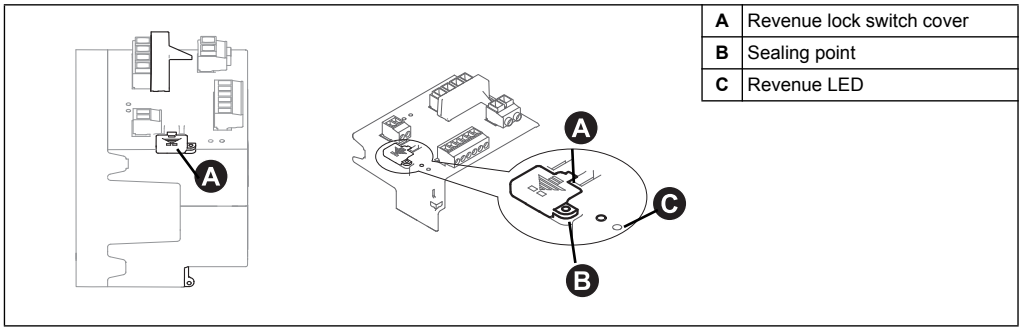
Revenue locking your meter helps prevent modifications to revenue-related settings and data on your meter, or tampering with your meter's voltage and current connections. Revenue locking may be required to help meet government regulations and utility security requirements, or can be used to help ensure the validity of revenue data.

Related topics

- See the PM8000 catalog pages, available from www.schneider-electric.com, or consult your local Schneider Electric representative for information about your device, its options and accessories.
- Download the *ION Device Template Reference*, available from www.schneider-electric.com, to view a complete listing of revenue-locked parameters and data.
- See "Revenue lock LED behavior" on page 22 for revenue lock LED behavior.

Revenue lock switch

You can revenue lock your meter using the revenue lock switch located on the meter base. This switch is accessed through a sealable cover.



A	Revenue lock switch cover
B	Sealing point
C	Revenue LED

Revenue locking your meter

You can revenue lock and unlock your meter using the revenue lock switch located on the meter base.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA or applicable local standards.
- Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
- Always use a properly rated voltage sensing device to confirm that all power is off.

Failure to follow these instructions will result in death or serious injury.

1. Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
2. Always use a properly rated voltage sensing device to confirm that all power is off.
3. Open the revenue lock switch cover.
4. Locate the revenue lock switch. Click the switch to toggle revenue locking on or off.
5. Close the revenue lock switch cover and make sure it is firmly in place.
6. Seal the revenue lock switch cover if required.

Time of use

Time of use (TOU) is often used when a utility has set up schedules with different rates based on time of day, type of day and date when energy is consumed.

You can view the TOU active rates and seasons through your meter's display.

Related topics

- See "Viewing data using your meter's display" on page 30 for instructions on how to view the TOU active rate and seasons through the meter's display.
- See the ION Setup online help, available from www.schneider-electric.com, for instructions on how to configure time of use on your meter.
- See the *ION Reference,* available from www.schneider-electric.com, for a description of the Time of Use module and its settings.

PT/CT correction

The primary application for PT/CT (potential transformer / current transformer) correction is to apply correction factors for ratio errors and phase angle errors to instrument transformers. PT/CT correction, also called instrument transformer correction, can help reduce the need to replace transformers in installations where high accuracy is required.

PT/CT correction is done for each current and voltage input to the meter and only affects 1-second power meter data and values derived from it, such as energy or demand. No high-speed, harmonics or waveform values are affected by the correction.

NOTE: For those familiar with ION architecture, the relevant 1-second Power Meter module outputs are compensated using the Instr Xformer (ITC) Correction module, and therefore so are all other modules that use that Power Meter module's data.

Related topics

- See the ION Setup online help, available from www.schneider-electric.com, for instructions on how to configure PT/CT correction on your device.
- See the *ION Reference,* available from www.schneider-electric.com, for detailed information about the Instr Xformer Correction (ITC) module and how it applies PT/CT correction to your device.

Verifying accuracy

All meters are tested and verified at the factory in accordance with International Electrotechnical Commission (IEC) and American National Standards Institute (ANSI) standards.

Your digital power meter typically does not require re-calibration. However, in some installations, a final accuracy verification of the meter is required, especially if the meter is used for revenue or billing applications.

Testing overview

The most common method for testing meter accuracy is to apply test voltages and currents from a stable power source and compare the meter's readings with readings from a reference device or energy standard.

Accuracy test requirements

Signal and power source

The meter maintains its accuracy during voltage and current signal source variations but its energy pulsing output needs a stable test signal to help produce accurate test pulses. The meter's energy pulsing mechanism needs approximately 10 seconds to stabilize after every source adjustment.

The meter must be connected to control power in order to conduct accuracy verification testing.

Control equipment

Control equipment is required for counting and timing the pulse outputs from the energy pulsing LED or the digital output.

- Most standard test benches have an arm equipped with optical sensors to detect LED pulses (the photodiode circuitry converts detected light into a voltage signal).
- The reference device or energy standard typically has digital inputs that can detect and count pulses coming from an external source (for example, the meter's digital output).

NOTE: The optical sensors on the test bench can be disrupted by strong sources of ambient light (such as camera flashes, florescent tubes, sunlight reflections, floodlights, etc). This can cause test errors. Use a hood, if necessary, to block out ambient light.

Environment

The meter should be tested at the same temperature as the testing equipment. The ideal temperature is about 23 °C (73 °F). Make sure the meter is warmed up sufficiently before testing.

A warm-up time of 30 minutes is recommended before beginning energy accuracy verification testing. At the factory, the meters are warmed up to their typical operating temperature before calibration to help ensure that the meters reach their optimal accuracy at operating temperature.

Most high precision electronic equipment requires a warm up time before it reaches its specified performance levels. Energy meter standards allow the manufacturers to specify meter accuracy derating due to ambient temperature changes and self-heating.

Your meter complies with and meets the requirements of these energy metering standards.

Reference device or energy standard

To help ensure the accuracy of the test, it is recommended that you use a reference device or reference energy standard with a specified accuracy that is 6 to 10 times more accurate than the meter under test. Before you start testing, the reference device or energy standard should be warmed up as recommended by its manufacturer.

Verify the accuracy and precision of all measurement equipment used in accuracy testing (for example, voltmeters, ammeters, power factor meters).

Energy pulsing

Your meter has two energy pulsing LEDs, one visible light and one infrared, located on the meter base. These LEDs emit pulses that are then used to determine the accuracy of the meter's energy measurements. The pulses of light indicate accumulated energy; the meter's accumulations are compared with the reference/standard's accumulated energy in order to help determine the meter's accuracy.

Your meter also has a digital output that can be used for energy pulsing. The relay closes (low impedance) and then opens (high impedance) to represent a pulse. If the accuracy testing equipment has a voltage requirement, a current-limited wetting supply voltage must be provided.

NOTE: Digital outputs on option modules should not be used meter accuracy testing.

Related topics

- See “Electrical characteristics” on page 181 for your device’s power supply, measurement accuracy and other specifications.
- See “LED locations” on page 21 for the location of the energy pulsing LEDs
- See“Energy pulsing overview” on page 145 for instructions on how to configure your meter’s digital output for energy pulsing.

Verifying accuracy test

The following are guidelines for testing the meter; your meter shop may have specific testing methods.

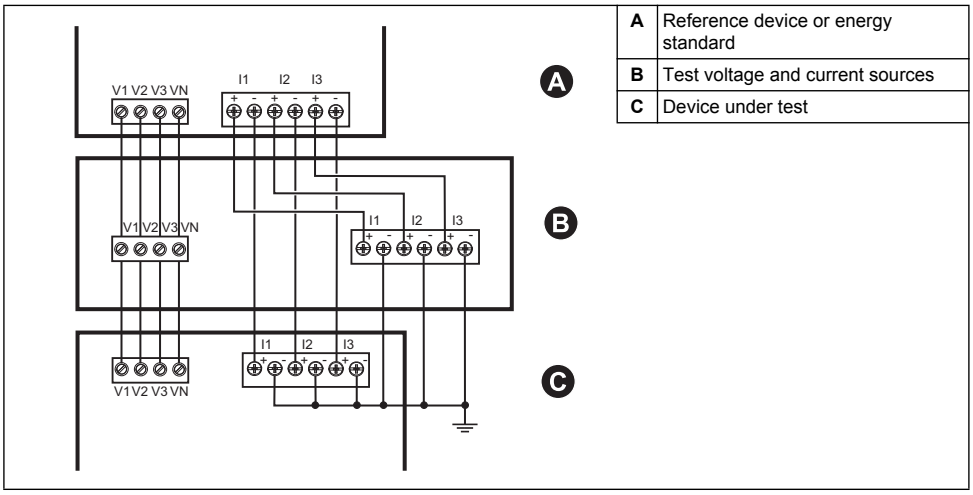
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA or applicable local standards.
- Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Do not exceed the device's ratings for maximum limits.
- Verify the device's power source meets the specifications for your device's power supply.

Failure to follow these instructions will result in death or serious injury.

1. Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
2. Use a properly rated voltage sensing device to confirm power is off.
3. Connect the test voltage and current source to the reference device or energy standard. Ensure all voltage inputs to the meter under test are connected in parallel and all currents inputs are connected in series.



A	Reference device or energy standard
B	Test voltage and current sources
C	Device under test

4. Connect the control equipment used for counting the standard output pulses using one of these methods:

Energy pulsing LED	Align the red or infrared light sensor on the standard test bench armature over the corresponding energy pulsing LED.
Digital output	Connect the meter's onboard digital output to the standard test bench pulse counting connections.

NOTE: When selecting which method to use, be aware that the energy pulsing LEDs and digital output may have different pulse rate limits.

5. Before performing the verification test, let the test equipment power up the meter and apply voltage for at least 30 seconds. This helps stabilize the internal circuitry of the meter.

6. Set the meter's volts mode to 4W-Wye (4 wire Wye).
7. Disable PT/CT correction unless you want the correction included in the verification test.
8. Depending on the method selected for counting the energy pulses, configure the meter's energy pulsing LEDs or the digital output to perform energy pulsing. Set the meter's energy pulse constant so it is synchronized with the reference test equipment.
9. Perform accuracy verification on the test points. Run each test point for at least 30 seconds to allow the test bench equipment to read an adequate number of pulses. Allow 10 seconds of dwell time between test points.

Related topics

- See "PT/CT correction" on page 174 for details of how PT/CT corrections (also called instrument transformer correction) affects your meter's measurements.

Calculate the number of required pulses

The reference test equipment typically requires you to specify the number of pulses required for a test duration of "t" seconds. Normally, the number of pulses required is at least 25 pulses, and the test duration is greater than 30 seconds.

Use the following formula to calculate the required number of pulses:

$$\text{Number of pulses} = \frac{Ne * V * I * PF * t}{3600 * Kt}$$

Where:

- Ne = number of metering elements used
- V = test point voltage in line-to-neutral volts [V] per phase
- I = test point current in amps [A] per phase
- t = test duration in seconds [s] which must be longer than 30 seconds
- PF = power factor
- Kt = pulse constant programmed in the meter under test in Wh/pulse

Round up the result of the calculation to the nearest integer number of pulses.

Example calculation for number of required pulses

This example calculates the number of pulses required for an inductive load 3-phase test point with a test duration of 60s; the source is configured to use V = 120V, I = 5A, PF = -0.5; the pulse constant of the meter under test is Kt = 1.8 Wh/pulse.

$$8.3 = \frac{3 * 120V * 5A * 0.5 * 60\ s}{3600 * 1.8}$$

Round the number up to the nearest integer: Number of pulses = 9

Calculate the percentage error

For every test point:

$$\text{Energy Error} = \frac{EM - ES}{ES} * 100\%$$

Where:

- EM = energy measured by the meter under test
- ES = energy measured by the reference device or energy standard.

If accuracy verification indicates that there may be inaccuracies with your meter, they may be caused by typical sources of test errors. If there are no sources of test errors present, please contact your local Schneider Electric representative.

Related topics

- See “Typical sources of test errors” on page 179 for possible causes of test errors.
- See “Power factor (PF)” on page 159 for information on how the meter calculates power factor.

Test points

The meter should be tested at full and light loads and at lagging (inductive) power factors to help ensure testing over the entire range of the meter. The test amperage and voltage input rating are labeled on the meter. Refer to the installation sheet or data sheet for your meter’s nominal current, voltage and frequency specifications.

Sample Watt-hour test points

Watt-hour test point	Sample accuracy verification test point
Full load	100% to 200% of the nominal current, 100% of the nominal voltage and nominal frequency at unity power factor or one (1).
Light load	10% of the nominal current, 100% of the nominal voltage and nominal frequency at unity power factor or one (1).
Inductive load (lagging power factor)	100% of the nominal current, 100% of the nominal voltage and nominal frequency at 0.50 lagging power factor (current lagging voltage by 60° phase angle).

Sample Var-hour test points

Var-hour test point	Sample accuracy verification test point
Full load	100% to 200% of the nominal current, 100% of the nominal voltage and nominal frequency at zero power factor (current lagging voltage by 90° phase angle).
Light load	10% of the nominal current, 100% of the nominal voltage and nominal frequency at zero power factor (current lagging voltage by 90° phase angle).
Inductive load (lagging power factor)	100% of the nominal current, 100% of the nominal voltage and nominal frequency at 0.87 lagging power factor (current lagging voltage by 30° phase angle).

Typical sources of test errors

If excessive errors are observed during accuracy testing, examine your test setup and test procedures to eliminate typical sources of measurement errors:

- Loose connections of voltage or current circuits, often caused by worn-out contacts or terminals. Inspect terminals of test equipment, cables, test harness and the meter under test.

- Device ambient temperature is significantly different than 23 °C (73 °F).
- Floating (ungrounded) neutral voltage terminal in any configuration with unbalanced phase voltages.
- Inadequate device control power, resulting in the device resetting during the test procedure.
- Ambient light interference or sensitivity issues with the optical sensor.
- Unstable power source causing energy pulsing fluctuations.
- Incorrect test setup: not all phases connected to the reference device or the energy standard. All phases connected to the device under test should also be connected to the reference meter/standard.
- Moisture (condensing humidity), debris or pollution present in the device under test.

Chapter 23 Specifications

The information contained in this section is subject to change without notice. You can download updated documentation from www.schneider-electric.com or contact your local Schneider Electric representative for the latest updates.

This section provides additional specifications for your meter and accessories. See your device's installation sheet for specifications related to installation, such as measured voltage and current ranges, inputs/outputs and control power information.

See your product's technical datasheet at www.schneider-electric.com for the most up-to-date and complete specifications.

Mechanical characteristics

<table>
<tr><th>Model</th><th>Characteristic</th><th>Specification</th></tr>
<tr><td rowspan="8">Panel mount</td><td>Mounting position</td><td>Vertical</td></tr>
<tr><td>IP</td><td>IP30 meter body (except connectors), IP54 front display</td></tr>
<tr><td>Display type</td><td>¼ VGA color graphic TFT LCD 320 x 240 resolution</td></tr>
<tr><td>Display backlight</td><td>White LED</td></tr>
<tr><td>Viewable area</td><td>70.6 x 52.9 mm (2.78 x 2.08 in)</td></tr>
<tr><td>Keypad</td><td>5 button</td></tr>
<tr><td>Maximum number of option modules</td><td>4 (based on mechanical stress and required IP rating)</td></tr>
<tr><td>Operating temperature</td><td>-25 °C to Max temp (-13 °F to Max temp)
Maximum operation temperature is based on the quantity and type of attached option modules.
<table><tr><th>Max temp</th><th>Digital (2 out, 6 in)</th><th>Analog (2 out, 4 in)</th></tr><tr><td>70 °C (158 °F)</td><td>0 - 4</td><td>0, 1</td></tr><tr><td>70 °C (158 °F)</td><td>0</td><td>2</td></tr><tr><td>60 °C (140 °F)</td><td>1, 2</td><td>2 - 4</td></tr></table></td></tr>
<tr><td rowspan="4">DIN meter</td><td>Mounting position</td><td>Horizontal TS35 DIN rail</td></tr>
<tr><td>IP</td><td>IP30 (except connectors)</td></tr>
<tr><td>Maximum number of option modules</td><td>4</td></tr>
<tr><td>Operating temperature</td><td>-25 °C to Max temp (-13 °F to Max temp)
Maximum operation temperature is based on the quantity and type of attached option modules.
<table><tr><th>Max temp</th><th>Digital (2 out, 6 in)</th><th>Analog (2 out, 4 in)</th></tr><tr><td>70 °C (158 °F)</td><td>0 - 4</td><td>0, 1</td></tr><tr><td>70 °C (158 °F)</td><td>0</td><td>2</td></tr><tr><td>60 °C (140 °F)</td><td>1, 2</td><td>2 - 4</td></tr></table></td></tr>
</table>

Mechanical compliance

Vibration	IEC 60068-2-6
Shock	IEC 60068-2-27

Electrical characteristics

Type of measurement: RMS up to the 63rd harmonic on three-phase systems, 128 samples per cycle, zero blind.

NOTE: Reactive energy and demand values are based on the fundamental, and do not include higher harmonics. Other energy and demand values are measured using the entire signal including harmonics. Contact Technical Support for more information.

Accuracy

Measurement accuracy	IEC 62053-22 - active energy	Class 0.2S
	IEC 62053-24 - reactive energy	Class 0.5S
	IEC 61557-12	PMD/SD/K70/0.2 and PMD/SS/K70/0.2
	Active power	± 0.2% IEC 61557-12 Class 0.2
	Reactive power	± 1% IEC 61557-12 Class 1
	Apparent power	± 0.5% IEC 61557-12 Class 0.5
	Current (per phase)	± 0.2% IEC 61557-12 Class 0.2
	Voltage (L-N)	± 0.2% IEC 61557-12 Class 0.2
	Frequency	± 0.02% IEC 61557-12 Class 0.02
Power quality accuracy	IEC 61000-4-30	Class S
	IEC 62586-1	PQI-S-FI1
	Voltage unbalance	± 0.5% IEC 61557-12 Class 0.5
	Voltage harmonics	± 2% IEC 61557-12 Class 2
	Voltage THD	± 2% IEC 61557-12 Class 2
	Current harmonics	± 2% IEC 61557-12 Class 2
	Current THD	± 2% IEC 61557-12 Class 2

Voltage and current inputs

Voltage inputs	VT (PT) primary	1.0 MV AC max
	Specified accuracy voltage	57 to 400 V L-N / 100 to 690 V L-L (Wye) or 100 to 600 V L-L (Delta)
	Specified accuracy frequency	42 to 69 Hz (50/60 Hz nominal)
Current inputs	Specified accuracy current range	50 mA to 10A

Control power

AC/DC control power	Operating range	50/60 Hz ± 10%: 90 to 415 V AC L-N ± 10% 400 Hz: 90 to 120 V AC ± 10% 120 to 300 V DC ± 10%
	Ride-through time	100 ms (6 cycles at 60 Hz) min., any condition 200 ms (12 cycles at 60 Hz) typ., 120 V AC 500 ms (30 cycles at 60 Hz) typ., 415 V AC

Inputs/outputs

Digital output	Number/type	1 Form A Solid State max 30 V AC / 60 V DC / 75mA
	On resistance	13 to 40 Ω at 25 °C (77 °F)
	Pulse frequency	≤ 25 Hz
	Signal type	Continuous or pulse

Digital inputs	Number/type	3 externally excited max 30 V AC / 60 V DC
	Frequency	≤ 25 Hz
	Minimum pulse width	20 ms
	Response time	20 ms
	Current draw	ON: ≤ 2.5 mA OFF: ≤ 0.5 mA
	Event timestamp accuracy	± 1 ms
	IRIG-B	IRIG-B00x format (unmodulated IRIG-B time code) • Coded expressions 0 to 7 are supported but the year data is not used.

Communications

RS-485 communications

Number of ports	1
Maximum cable length	1200 m (4000 ft)
Maximum number of devices (unit loads)	32
Parity	None, even, odd
Baud rate	2400 - 115200, recommend 19200

Ethernet communications

Number of ports	2 (the second connector functions as an Ethernet switch for networking devices)
Cable type	CAT5/5e UTP (use unshielded cable only)
Connector type	RJ45 modular jack (2)
Maximum cable length	100 m (328 ft) per TIA/EIA 568-5-A
Mode	10Base-T, 100Base-TX, auto-MDIX
Data rate	up to 100 Mbps
FTP	Maximum simultaneous transfer connections (sessions): 2 Default timeout period: 90 seconds
IEC 61850 maximum simultaneous client connections	4

EMC (electromagnetic capability)

Product standards	IEC 62052-11 IEC 61326-1
Immunity to electrostatic discharge	IEC 61000-4-2
Immunity to radiated fields	IEC 61000-4-3
Immunity to fast transients	IEC 61000-4-4
Immunity to surges	IEC 61000-4-5
Immunity to conducted disturbances	IEC 61000-4-6
Immunity to power frequency magnetic fields	IEC 61000-4-8
Immunity to conducted disturbances, 2 - 150 kHz	CLC/TR 50579
Immunity to voltage dips and interruptions	IEC 61000-4-11
Immunity to ring waves	IEC 61000-4-12
Radiated and conducted emissions	FCC part 15 ICES-003 EN55022, EN55011
Surge withstand capability (SWC)	ANSI C37.90.1

Safety

Safety construction	IEC/EN 61010-1 ed.3, CAT III, 400 VLN / 690 V LL UL 61010-1 ed.3 and CSA-C22.2 No. 61010-1 ed.3, CATIII, 347 V LN / 600 V LL IEC/EN 62052-11, Protective Class II

General characteristics

Clock

Characteristic	Specifications
Clock drift	20 ppm max at 25 °C (77 °F)
Battery backup time	Minimum 7 years under specified storage conditions

LEDs

LED	Characteristic	Specifications
Energy pulsing LEDs (visible and infrared)	Type	Visible orange, infrared
	Wavelength	600 - 609 nm (orange) 825 - 925 nm (infrared)
	Maximum pulse rate	42 - 69 Hz (based on line frequency)

Other

Characteristic	Specification
Meter start time	Typical 18 seconds (power up to measurement)
Meter memory	512 MB
Data update rate	Regular data: 1 second
	High-speed: 50 - 60 Hz half-cycle
Advanced security users	Up to 16 users

Remote display

Characteristic	Specification
IP degree of protection (IEC 60529)	Front: IP54 Rear: IP30
Cable	CAT5/5e UTP (use unshielded cable only)
Mounting position	Vertical
Display type	¼ VGA color graphic TFT LCD 320 x 240 resolution
Display backlight	White LED
Viewable area	70.6 x 52.9 mm (2.78 x 2.08 in)
Keypad	5 button

Option modules

Model	Characteristic	Specification
METSEPM89M0024 Analog (2 out, 4 in)	Max analog input current/voltage	20 mA / 30 V DC
	Input resistance	< 300 Ω (current mode) > 500 kΩ (voltage mode)
METSEPM89M0024 Analog (2 out, 4 in) and METSEPM89M2600 Digital (2 out, 6 in)	Modules per PM8000 series meter	Up to 4
	Operating temperature for PM8000 series meter	-25 °C to Max temp (-13 °F to Max temp) Maximum operating temperature is based on the quantity and type of attached option modules.

Max temp	Digital	Analog
70 °C (158 °F)	0 - 4	0, 1
70 °C (158 °F)	0	2
60 °C (140 °F)	1, 2	2 - 4

Related topics

- Visit the website at www.schneider-electric.com and search for “PM8000 technical datasheet” for the most up-to-date and complete specifications.
- See your remote meter display’s installation sheet for remote meter display specifications.
- See your option module’s installation sheet for option module specifications.
- Visit the company website at www.schneider-electric.com and search for “PM8000” to get additional or updated documentation.

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Masterpact™ NW Low-Voltage Power/Insulated Case Circuit Breaker—Installation

ENGLISH

Class 0613

Instruction Bulletin

HRB28361
Rev. 02, 02/2015

Retain for future use.



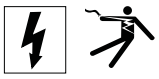
SQUARE D™

by Schneider Electric

ENGLISH

Hazard Categories and Special Symbols

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

ANSI



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

FCC Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. This Class A digital apparatus complies with Canadian ICES-003.

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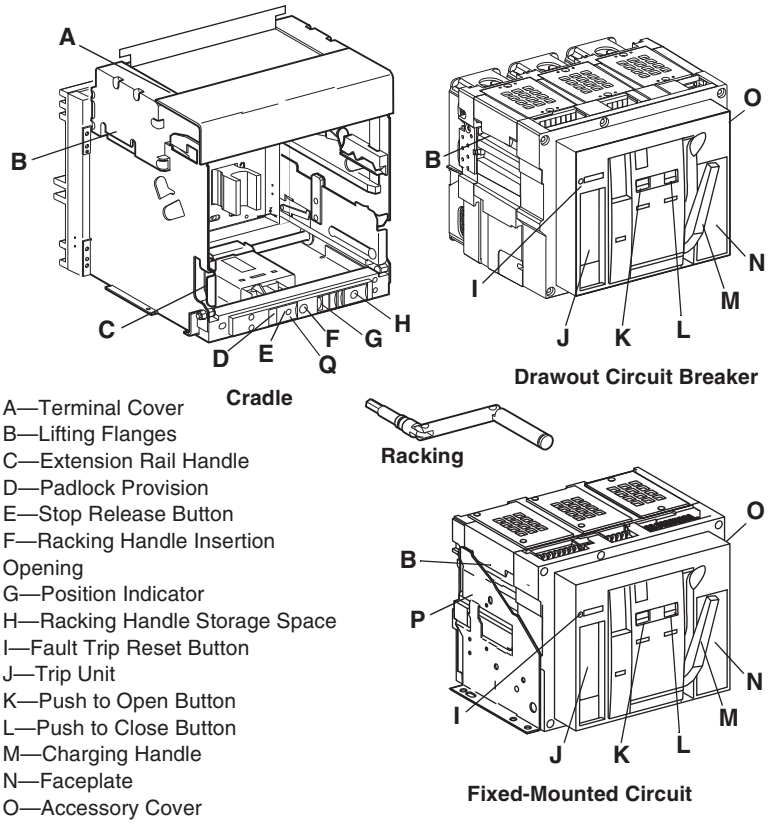
ENGLISH

Section 1— General Information

Introduction

The Masterpact NW low-voltage power circuit breaker[1] and insulated case circuit breaker are designed to mount in a drawout cradle, using rear-mounted, plug-on pressure connections to provide electrical connection to the cradle. A fixed-mounted circuit breaker is also available.

Figure 1 – Circuit Breaker and Cradle



A—Terminal Cover
B—Lifting Flanges
C—Extension Rail Handle
D—Padlock Provision
E—Stop Release Button
F—Racking Handle Insertion Opening
G—Position Indicator
H—Racking Handle Storage Space
I—Fault Trip Reset Button
J—Trip Unit
K—Push to Open Button
L—Push to Close Button
M—Charging Handle
N—Faceplate
O—Accessory Cover
P—Fixed Mounting Brackets
Q—Cradle Date Code

These circuit breakers comply with the following standards:

Low-Voltage Power Circuit Breaker (Drawout and Fixed)	Insulated Case Circuit Breaker (Drawout and Fixed)
ANSI C37.13 ANSI C37.16 ANSI C37.17 ANSI C37.50 UL1066[1] CSA C22.2 No 31[1] NEMA SG3	UL489[2] NEMA AB1 CSA C22.2 No. 5-02[3]

[1] cULus

[2] UL® Listed

[3] CSA® Certified

[1] In this manual the phrase “circuit breaker” means circuit breaker and switch.

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Type L1F 800–2000 A low-voltage power circuit breakers and Type LF 800–2000 A insulated case circuit breakers are tested to show the arc-flash hazard risk category as referenced by NFPA 70E.

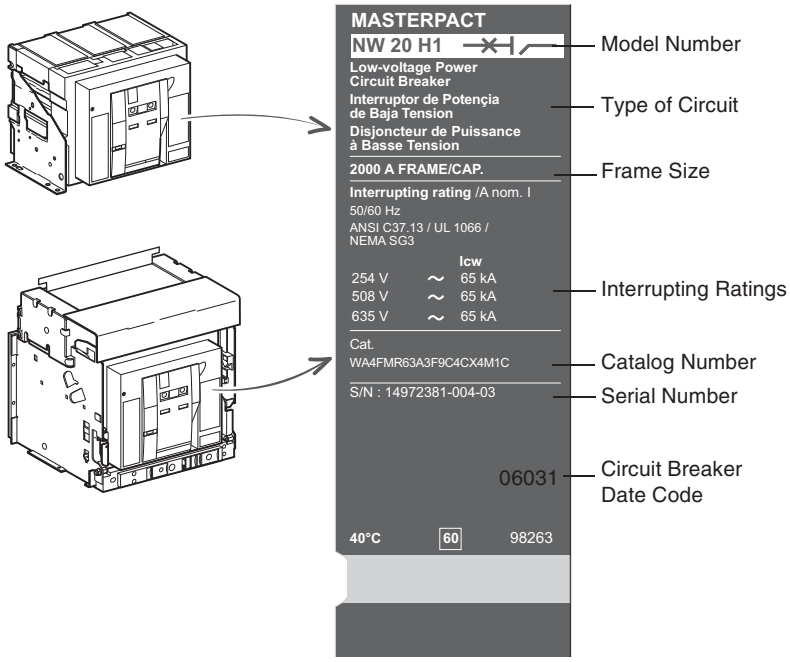
This bulletin provides installation instructions for Masterpact NW circuit breakers. Tripping functions are controlled by the Micrologic™ trip unit.

Information about a specific circuit breaker can be found on the faceplate label on the front of the circuit breaker.

Information about the accessories installed in the circuit breaker can be found on the accessory label on the right side of the circuit breaker.

For complete information on available circuit breaker models, frame sizes, interrupting ratings, sensor sizes and trip units, see catalog 0613CT1001, *Masterpact NT and NW Universal Power Circuit Breakers* on the Schneider Electric website.

Figure 2 – Faceplate Information



For additional information see the following user guides available on the Schneider Electric™ website:

- Bulletin 0613IB1204: *Masterpact™ NW Low-Voltage Power/Insulated Case Circuit Breaker User Guide*
- Bulletin 0613IB1205: *Masterpact™ NW Dimensional Drawings*
- Bulletin 0613IB1202: *Masterpact™ NT and NW Field Testing and Maintenance Guide*
- Bulletin 48049-136-05: *Micrologic 2.0A, 3.0A, 5.0A, and 6.0A Electronic Trip Units*
- Bulletin 48049-330-03: *Micrologic 5.0H and 6.0H Electronic Trip Units*
- Bulletin 48049-137-05: *Micrologic 5.0P and 6.0P Electronic Trip Unit*
- Bulletin 48049-207-05: *Micrologic 2.0, 3.0 and 5.0 Electronic Trip Units*

To access the website go to:

http://www.schneider-electric.com

For application assistance, please call 1-888-778-2733.

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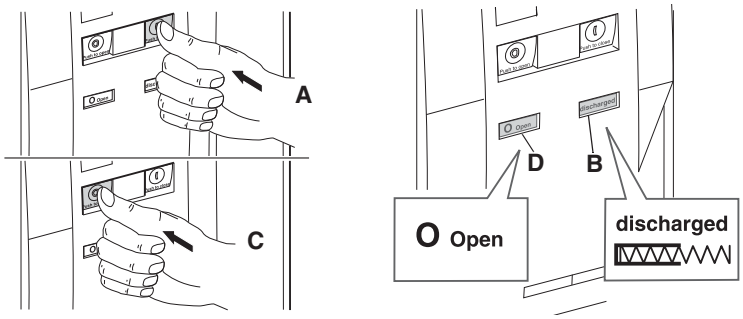
Before Working on Circuit Breaker

1. Turn circuit breaker off:

   Press “Push to close” button (**Figure 3, A**) to discharge spring, as indicated by window (**B**).

   Press “Push to open” button (**C**) to open contacts, as indicated by window (**D**).

Figure 3 – Turn Off Circuit Breaker



2. Disconnect power from circuit breaker.

   — For drawout circuit breaker: rack circuit breaker to disconnected position (**Figure 4, A**). See Drawout Circuit Breaker Disconnection, page 70.

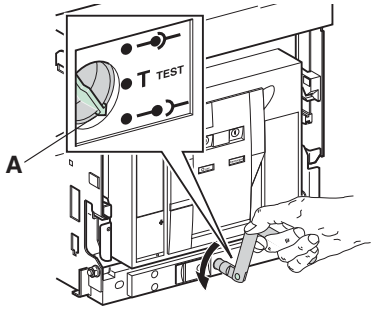
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Beware of potential hazards, wear personal protective equipment and take adequate safety precautions.

Failure to follow these instructions will result in death or serious injury.

Figure 4 – Disconnect Drawout Circuit Breaker



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— For fixed-mounted circuit breaker: turn off all power supplying equipment before working on or inside equipment.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

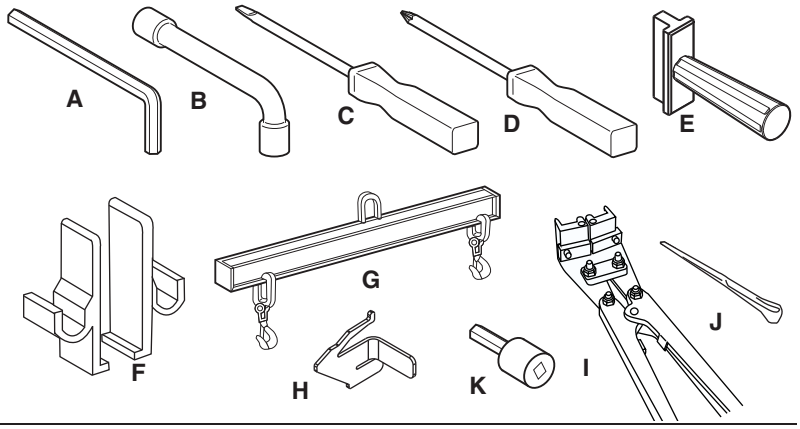
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Tools

Table 1 – Tools Required

A. Hex Key, 5 mm
B. Angled Socket Wrench, 1/2 in.
C. Straight Blade Screwdriver (#2 Pozidriv® or Slotted)
D. Torx® 20 Screwdriver
E. Cluster Reset Tool, Cat. No. CLUSRETOOL
F. Lifting Hooks, Cat. No. S48906
G. Crossbar
   W-Frame, Cat. No. S48900
   Y-Frame, Cat. No. S48901
H. Cradle Interlock Defeat Tool (Drawout Circuit Breaker Only, Provided)
I. Cluster Positioning Tool, Cat. No. S47542
J. Wago® Wire Insert Tool, Wago Part No. 209-129
K. 10 mm Hex Adapter for Cradle Racking Mechanism



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Unpacking and Inspection

NOTE: Repacking instructions can be found in bulletin 0613IB1203, *Masterpact NW Low-Voltage Power/Insulated Case Circuit Breaker–User Guide*, found on the Schneider Electric™ web site (see page 5).

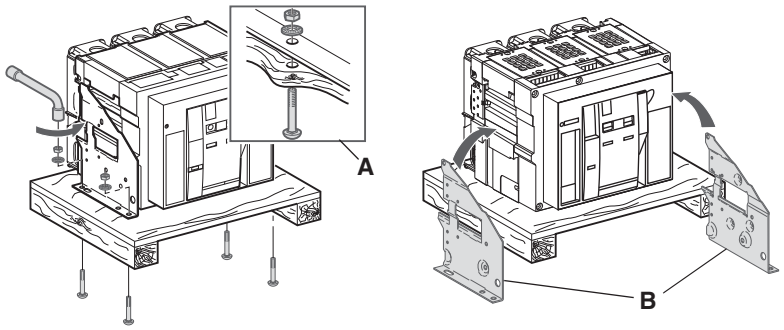
NOTICE
HAZARD OF EQUIPMENT DAMAGE
Do not place circuit breaker on its back. Doing so can damage the clusters.
Failure to follow these instructions can result in equipment damage.

Unpack Circuit Breaker

NOTE: Do not place the circuit breaker on its back. Doing so can damage the clusters.

1. Remove the four bolts, nuts and washers (**Figure 5, A**) securing the circuit breaker to the pallet.
2. On drawout circuit breakers only: remove the shipping brackets (**B**).

Figure 5 – Unpack Circuit Breaker

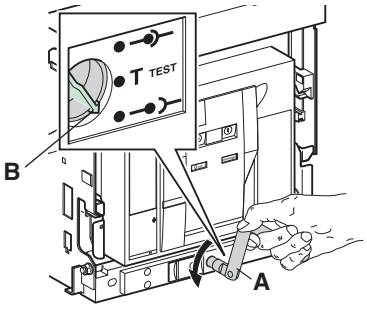


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Unpack Circuit Breaker Shipped in Cradle

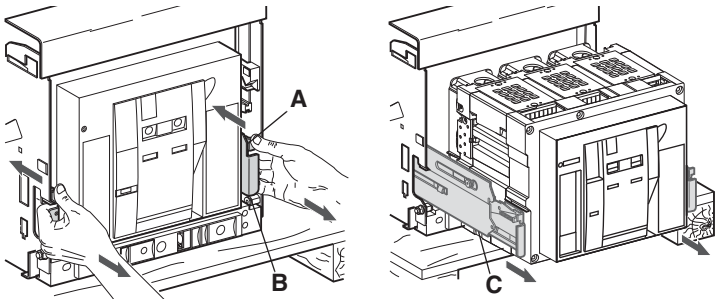
1. Rack the circuit breaker (**Figure 6, A**) to the disconnected position (**B**) (refer to Drawout Circuit Breaker Disconnection, page 70).

Figure 6 – Disconnect Circuit Breaker



2. Pressing in the latching tabs (**Figure 7, A**), pull out on the extension rail handles (**B**) until the extension rails are fully extended (**C**).

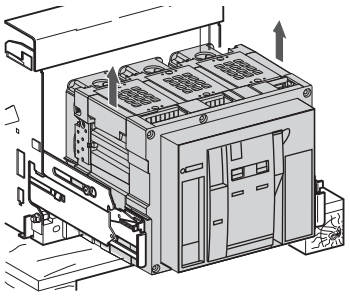
Figure 7 – Pull Out Circuit Breaker



NOTE: Do not place the circuit breaker on its back. Doing so can damage the clusters.

3. Remove circuit breaker. See Cradle Removal, page 37.

Figure 8 – Remove Circuit Breaker and Cradle

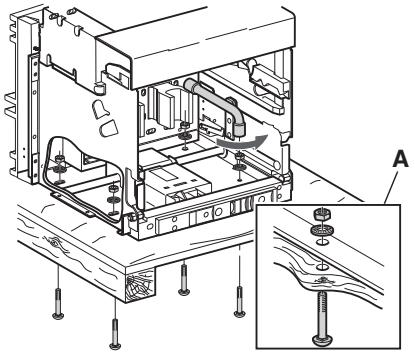


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Unpack Cradle

1. Remove the four bolts, nuts and washers (Figure 9, A) securing cradle to pallet.
2. Remove cradle from pallet. See Lifting, page 16.

Figure 9 – Unpack Cradle



Cluster Inspection, Replacement and Lubrication

Cluster Inspection

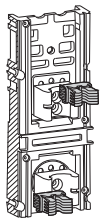
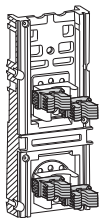
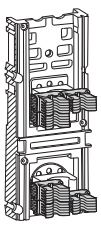
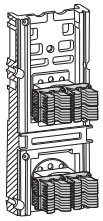
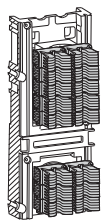
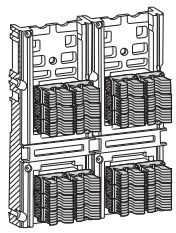
1. Inspect clusters and cluster supports on back of the drawout circuit breaker. Make sure clusters are installed and configured properly as shown in Table 3.
2. Visually inspect clusters for signs of damage such as:
   - — Discolored areas
   - — Visible copper on fingers
   - — Cracked or broken springs
   - — Not aligned with other clusters (indicates spring damage)
3. Visually inspect clusters for wear.

Table 2 – Number of Clusters Per Pole

Type	N / N1	H1	HA	H / H2 / H3 / HF	L / L1 / LF / L1F / HB / HC
NW08	2	4	4	4 / 4 / 6 / 4	8
NW12	2	—	—	4	8
NW16	6	6	6	6	8
NW20	8	8	8	8	16
NW25/NW30	—	—	—	16	16
NW32	—	16	16	16	24
NW40/NW50	—	—	24	24	24
NW60	—	—	—	24	24

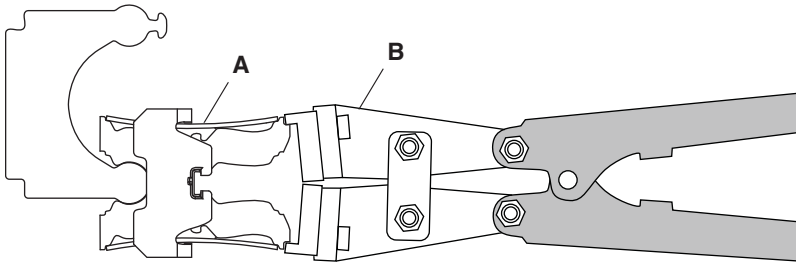
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Table 3 – Cluster Configuration

Number of Clusters Per Pole **NOTE:** Cluster shields are not shown.					
2	4	6	8	16	24
					

4. Replace any cluster which does not pass inspection. Install new clusters (A) using cluster positioning tool (B).

Figure 10 – Install New Clusters



Cluster Lubrication

CAUTION

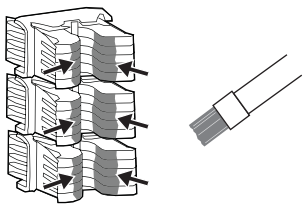
HAZARD OF EQUIPMENT DAMAGE

Inspect the cluster for lubrication when the circuit breaker is removed from the cradle.

Failure to follow these instructions can result in equipment damage.

Use grease kit (catalog number S48899) to lubricate cluster jaws as shown in Figure 11.

Figure 11 – Cluster Grease Application



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Cradle Stab Lubrication

The cradle stabs must be inspected and lubricated when the cradle is first installed and again during maintenance periods after all power has been disconnected.

⚠ DANGER

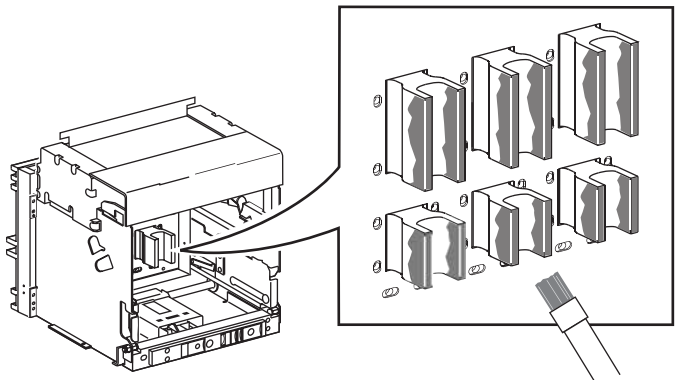
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Confirm that both sides of stab are coated with lubricant. If necessary, use grease kit (catalog number S48899) to lubricate stab.

Figure 12 – Cradle Stab Grease Application



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Section 2— Lifting and Transporting

Both the circuit breaker and cradle have lifting flanges for lifting. To lift circuit breaker, use an overhead lifting device attached to the lifting flanges, following the directions given in this section.

⚠ DANGER

HAZARD OF DEVICE FALLING

- Be sure lifting equipment has lifting capacity for the unit being lifted.
- Follow manufacturer's instructions for use of lifting equipment.
- Wear hard hat, safety shoes and heavy gloves.

Failure to follow these instructions will result in death or serious injury.

Weights

Table 4 – Weights

Frame Rating	Connector Type[1]	Weights (lb./kg.)								
		Circuit Breaker		Cradle		Connector		Pallet	Total	
		3-Pole	4-Pole	3-Pole	4-Pole	3-Pole	4-Pole		3-Pole	4-Pole
800–2000 A, Drawout	FCF	109/50	142/65	97/44	116/53	42/19	55/25	17/8	265/121	330/151
	FCT	109/50	142/65	97/44	116/53	84/38	109/50	17/8	307/140	384/176
	RCTH/RCTV	109/50	142/65	97/44	116/53	17/8	22/10	17/8	240/110	297/136
800–2000 A, Fixed-Mounted	FCF	109/50	142/65	—	—	42/19	55/25	17/8	168/77	214/98
	FCT	109/50	142/65	—	—	84/38	109/50	17/8	210/96	268/123
	RCTH/RCTV	109/50	142/65	—	—	17/8	22/10	17/8	143/66	181/83
2500–3000 A, Drawout	RCTH/RCTV	127/58	165/75	124/57	149/68	26/12	34/15	17/8	294/135	365/166
	FCT	127/58	165/75	124/57	149/68	80/36	104/47	17/8	348/159	435/198
2500–3000 A, Fixed-Mounted	FCT	127/58	165/75	—	—	80/36	104/47	17/8	224/102	286/130
	RCTH/RCTV	127/58	165/75	—	—	26/12	34/15	17/8	170/78	216/98
2000 A L1/L1F & 3200 A, Drawout	RCOV	127/58	165/75	124/57	149/68	100/46	130/59	17/8	368/169	461/210
3200 A, Fixed	RCOV	127/58	165/75	—	—	100/46	130/59	17/8	244/112	312/142
4000 A, (W-Frame) Fixed-Mounted	RCOV (Special)	127/58	165/75	—	—	115/52	145/66	17/8	259/118	327/149
3200 A L1 & 4000 A, Drawout	FCF	227/103	295/134	278/126	334/152	84/38	109/50	39/18	628/285	777/354
	FCT	227/103	295/134	278/126	334/152	168/76	218/99	39/18	712/324	886/403
	RCTH/RCTV	227/103	295/134	278/126	334/152	52/24	68/31	39/18	596/271	736/335
4000 A, Fixed-Mounted	RCTH/RCTV	227/103	295/134	—	—	52/24	68/31	39/18	318/145	402/183
5000 A, Drawout	FCT	227/103	295/134	278/126	334/152	168/77	218/99	39/18	712/324	886/403
	RCTH/RCTV	227/103	295/134	278/126	334/152	52/24	68/31	39/18	596/271	736/335
5000 A, Fixed-Mounted	RCTH/RCTV	227/103	295/134	—	—	52/24	68/31	39/18	318/145	402/183
6000 A, Drawout	RCTV	227/103	295/134	278/126	334/152	396/180	528/240	39/18	940/427	1196/544
6000 A, Fixed-Mounted	RCTV	227/103	295/134	—	—	396/180	528/240	39/18	662/301	862/392

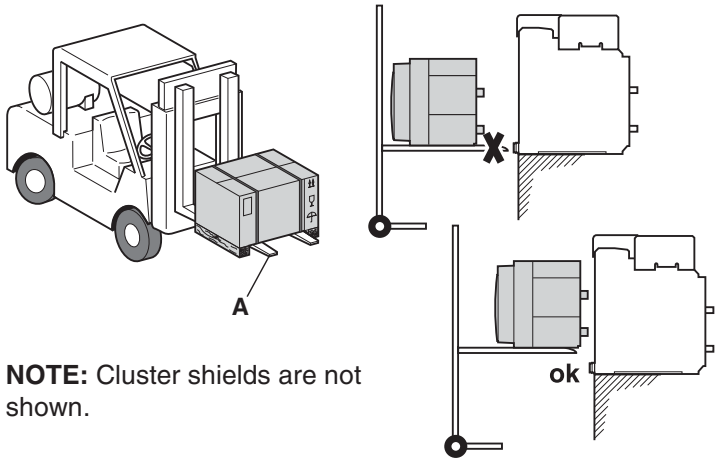
[1]FCF = Front-connected flat connector.
FCT = Front-connected "T" connector.
RCTH = Rear-connected "T" horizontal connector.
RCTV = Rear-connected "T" vertical connector.
RCOV = Rear-connected offset vertical.

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Using a Platform Lift

When using a platform lift, lift flanges (**Figure 13, A**) should not extend beyond the back of the circuit breaker.

Figure 13 – Using a Platform Lift



NOTE: Cluster shields are not shown.

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Lifting

Lifting Drawout Circuit Breaker

NOTICE
HAZARD OF EQUIPMENT DAMAGE Cradle must be secured before installing or removing circuit breaker. **Failure to follow these instructions can result in equipment damage.**

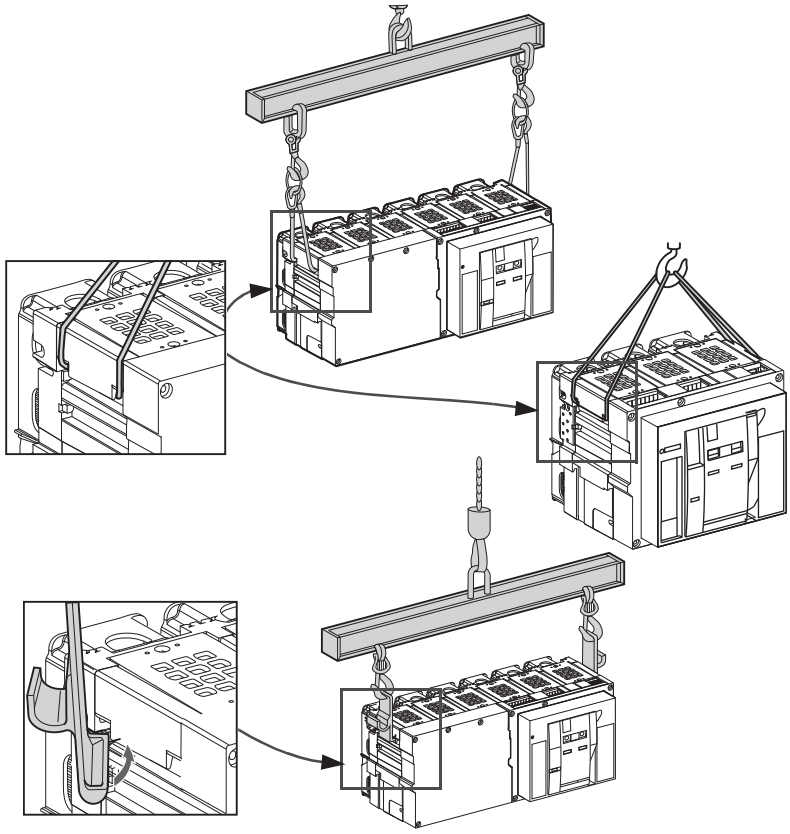
Lift using lifting flanges on sides of the circuit breaker, lifting hooks, and crossbar.

Lifting Hook Kit: S48906

W-Frame Crossbar Kit: S48900

Y-Frame Crossbar Kit: S48901

Figure 14 – Lifting Drawout Circuit Breaker

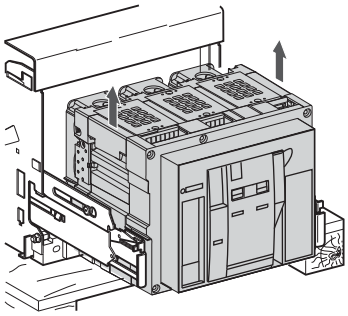


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Lifting Cradle or Fixed-Mounted Circuit Breaker

NOTE: If circuit breaker is installed in cradle, remove circuit breaker from cradle before lifting cradle. To remove circuit breaker, see page 46.

Figure 15 – Removing Circuit Breaker From Cradle



Lift using the lifting flanges on the sides of the cradle or circuit breaker, a piece of bar stock through the connectors, lifting hooks, and crossbar.

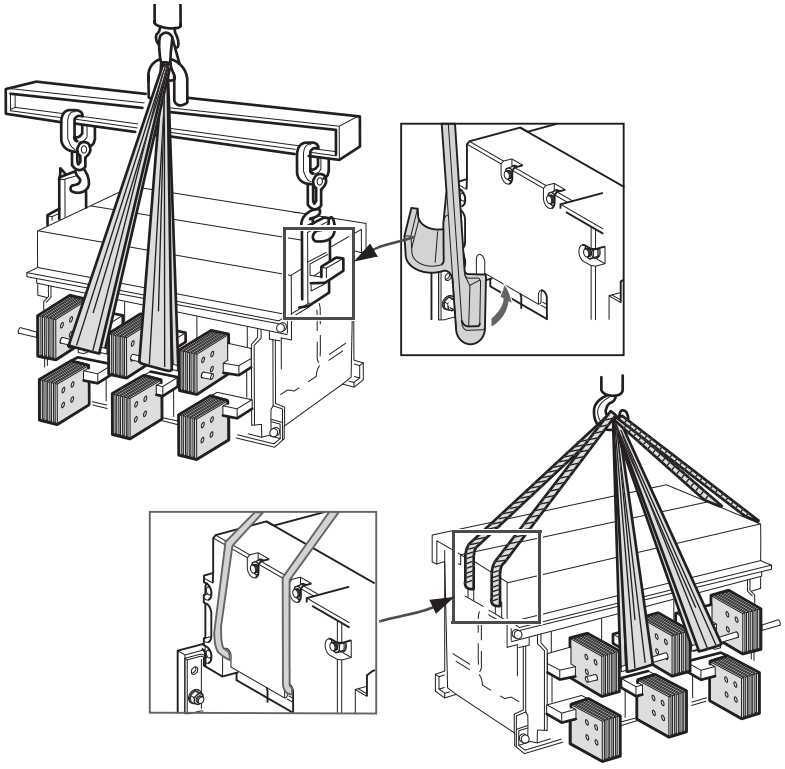
Lifting Hook Kit: S48906

W-Frame Crossbar Kit: S48900

Y-Frame Crossbar Kit: S48901

NOTE: Connectors must be supported while lifting cradle or fixed-mounted circuit breaker.

Figure 16 – Lifting Cradle or Fixed-Mounted Circuit Breaker



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Section 3— Drawout Circuit Breaker Installation

Equipment is normally shipped with cradles installed and circuit breakers shipped separately.

For equipment shipped without cradles installed, install cradles as described below.

For equipment shipped with cradles installed, see page 38 for circuit breaker installation.

NOTE: When cradles are shipped separately from equipment:

- Standard-width 800–3000 A and 3200 A circuit breakers can be shipped installed in the cradles;
- Wide-construction 3200 A L1 and 4000–6000 A circuit breakers must be shipped separately.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Cradle Installation

Install Accessories

Install any required cradle accessories which were not factory installed.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

Do not place tools or other materials on top of cradle.

Failure to follow these instructions will result in death or serious injury.

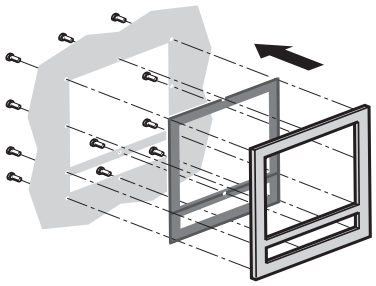
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Install Door Escutcheon

If equipment has a door cutout, install the escutcheon shipped with cradle.

1. If not already present, cut opening in the equipment door and drill holes around the opening for the escutcheon. For opening dimensions and hole spacing, refer to bulletin 0613IB1205 on the Schneider Electric™ website (for website information see page 5).
2. Install escutcheon.

Figure 17 – Install Door Escutcheon

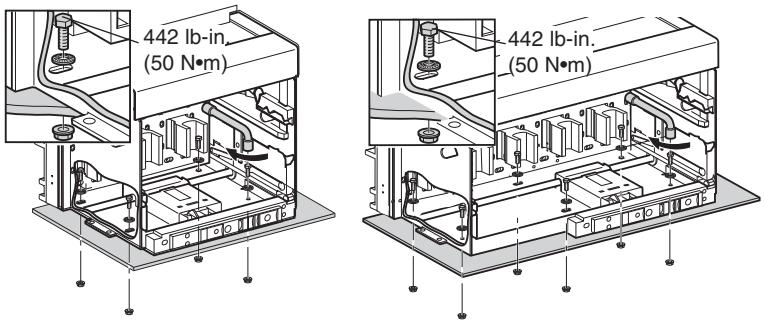


Secure Cradle

1. Turn off all power supplying the equipment before working on or inside equipment.

1. If mounting holes are not already present, drill mounting holes in the pan for mounting the cradle. For cradle mounting hole pattern dimensions, refer to bulletin 0613IB1205 on the Schneider Electric website (for website information see page 5).
2. Check flatness of the mounting surface. Surface must be flat to within 0.08 in. (2 mm).
3. Mount the cradle to the pan, using 3/8 in. bolts, washers, and nuts.

Figure 18 – Secure Cradle



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Clearance Requirements

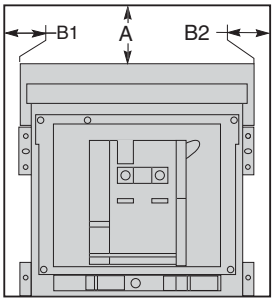
⚠ DANGER

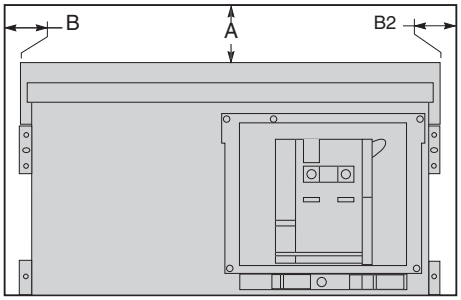
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

Clearance requirements must be met for proper operation of the equipment.

Failure to follow these instructions will result in death or serious injury.

Table 5 – Clearance Requirements





Minimum Clearance	UL 1066 Listed (ANSI C37.50)				UL 489 Listed			
	A		B1 + B2		A		B1 + B2	
	in.	mm	in.	mm	in.	mm	in.	mm
Insulated Parts	0	0	0	0	0	0	0	0
Metal Parts	0	0	2.36	60	0	0	4.36	111

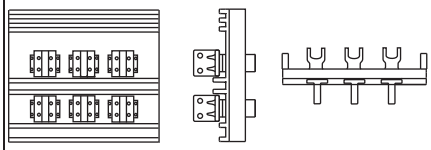
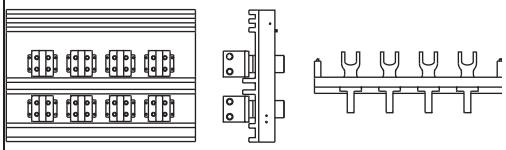
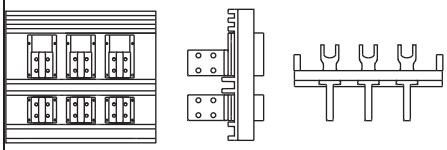
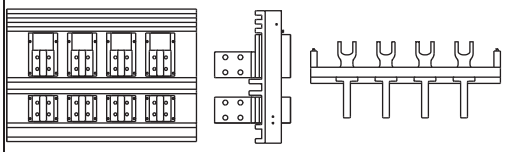
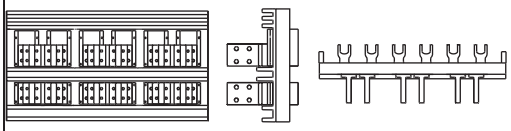
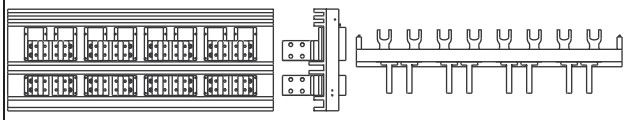
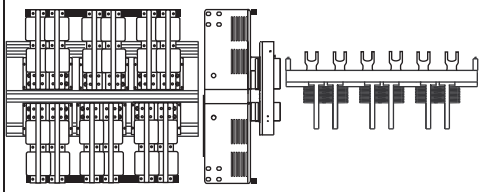
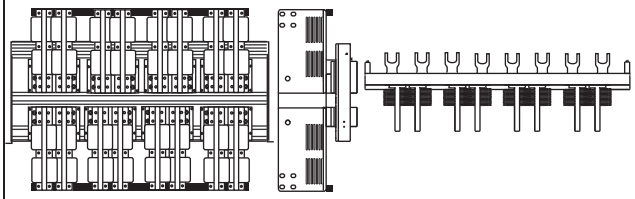
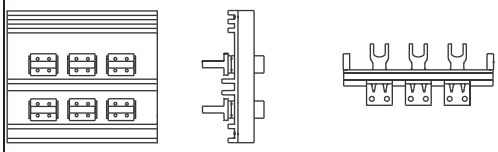
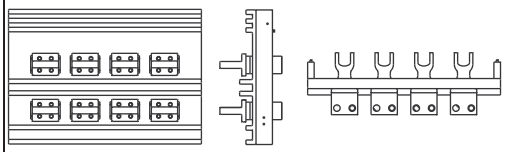
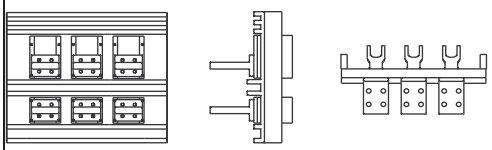
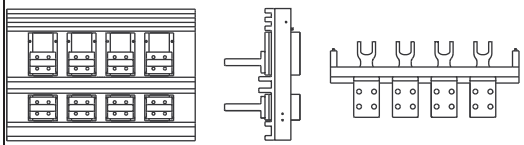
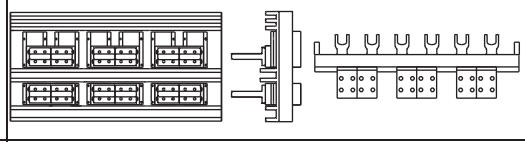
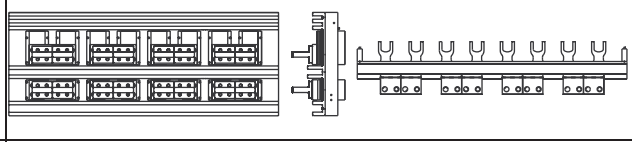
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Install Connectors

Standard connectors are shown in Table 6. Secure connectors and torque bolts to 142–159 lb-in. (16–18 N•m). For information on non-standard connectors, contact the field office.

For connector dimensions, refer to bulletin 0613IB1205 on the Schneider Electric website (for website information see page 5).

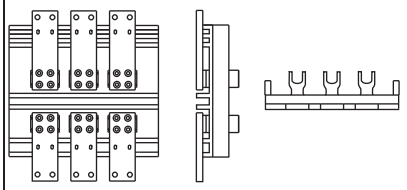
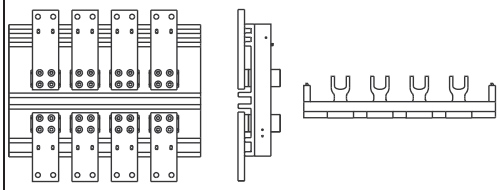
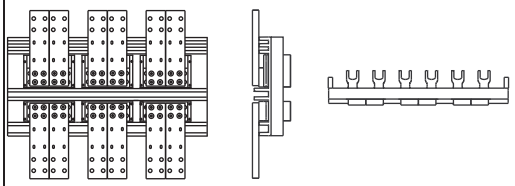
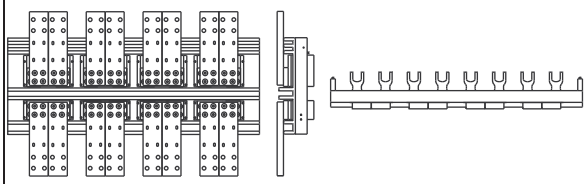
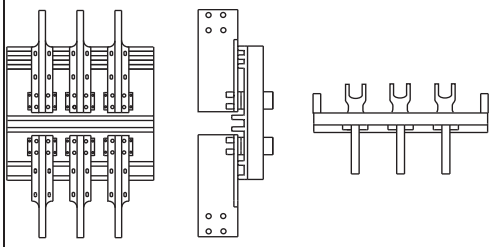
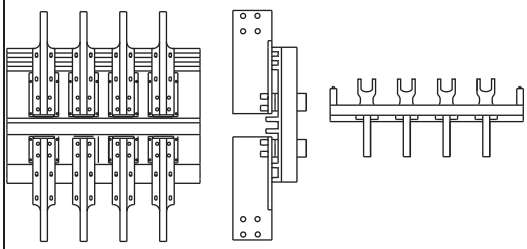
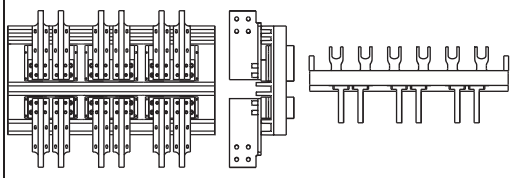
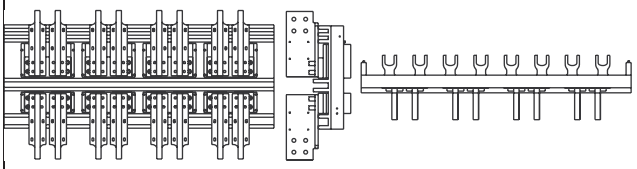
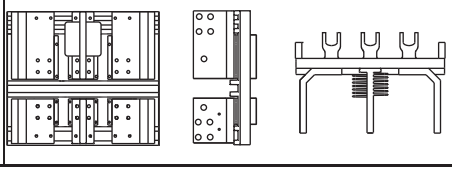
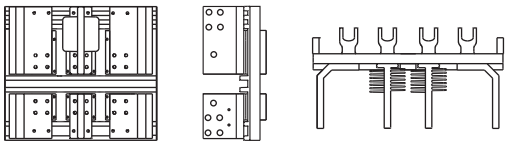
Table 6 – Standard Connectors

Type	Rating	Three-Pole Layout Front – Side – Top	Four-Pole Layout Front – Side – Top
Rear-Connected “T” Vertical (RCTV)	800–2000 A		
	2500–3000 A		
	4000–5000 A		
	6000 A		
Rear-Connected “T” Horizontal (RCTH)	800–2000 A		
	2500–3000 A		
	3200 A L1 4000–5000 A		

Continued on next page

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Table 6 – Standard Connectors *(continued)*

Type	Rating	Three-Pole Layout Front – Side – Top	Four-Pole Layout Front – Side – Top
Front-Connected Flat (FCF)	800–2000 A		
	3200 A L1 4000 A		
Front-Connected “T” (FCT)	800–3000 A		
	3200 A L1 4000–5000 A		
Rear-Connected Offset Vertical (RCOV)	3200 A 2000 A L1/L1F		

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Install Bussing

NOTICE

HAZARD OF EQUIPMENT DAMAGE

The busbar supports must be placed to support the weight of the bussing system and to withstand magnetic forces caused by short-circuit currents. See **Figure 19, A**.

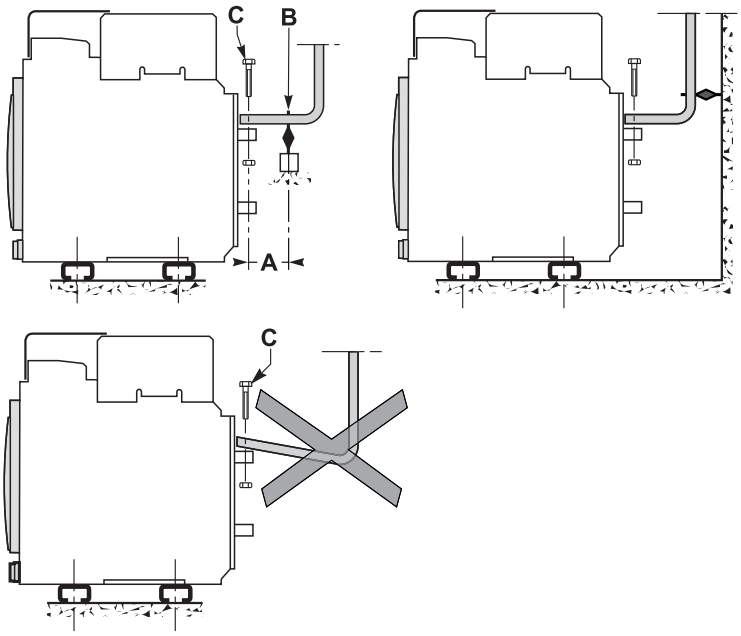
Failure to follow these instructions can result in equipment damage.

NOTE: Installer is responsible for bussing to connectors.

- Bus supports must be braced (**Figure 19, B**) to prevent short circuit forces from deflecting the connectors. The busbar supports (**A**) must be placed to support the weight of the bussing system and to withstand magnetic forces caused by short-circuit currents.
- Busbars should be adjusted to ensure that the connection points are correctly positioned before the bolts (**C**) are inserted. Bussing must be supported by framework of the switchgear, with no weight on connectors.

Bussing requirements by the circuit breaker and connectors are shown in Table 7.

Figure 19 – Busbar Connections



NOTE: The installer is responsible for bussing to the connectors. Bussing must be supported by the framework of the switchgear, with no weight on the connectors. Bus supports must be braced to prevent short circuit forces from deflecting the connectors.

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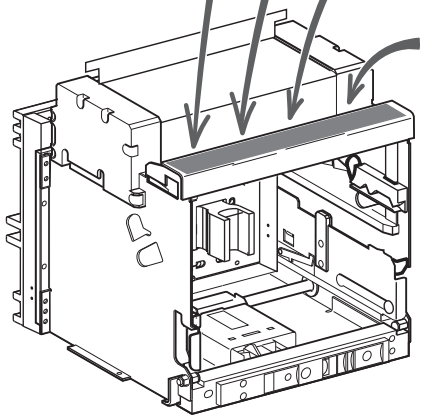
Table 7 – Bus Size Required

Circuit Breaker		Complies with	Connectors	Bus Per Connector	
Rating	Type			Number	Size
800 A, 1200 A	N/N1/H/H1/H2/H3/L /LF/L1/L1F	ANSI C37.50 UL 489	RCTH, RCTV, FCF, FCT	1	0.25 x 3 in. (6 x 76 mm)
1600 A	N/N1/H/H1/H2/H3/L /LF/L1/L1F	ANSI C37.50 UL 489	RCTH, RCTV, FCF, FCT	2	0.25 x 3 in. (6 x 76 mm)
2000 A	N/N1/H/H1/H2/H3/L /LF	ANSI 37.50 UL 489	RCTH	3	0.25 x 3 in. (6 x 76 mm)
			RCTV, FCT	2	0.25 x 4 in. (6 x 102 mm)
			FCF	3	0.25 x 3 in. (6 x 76 mm)
	L1/L1F	ANSI 37.50	RCOV	2	0.25 x 4 in. (6 x 102 mm)
2500 A	H/L	UL 489	RCTH	5	0.25 x 3 in. (6 x 76 mm)
			RCTV, FCT	2	0.25 x 5 in. (6 x 127 mm)
3000 A	H/L	UL 489	RCTH	8	0.25 x 3 in. (6 x 76 mm)
	H/L		RCTV, FCT	4	0.25 x 4 in. (6 x 102 mm)
3200 A	H1/H2/H3	ANSI 37.50	RCOV	3	0.25 x 5 in. (6 x 127 mm)
	L1		RCTH, FCF	3	0.25 x 6 in. (6 x 152 mm)
	L1		RCTV,FCT	3	0.25 x 5 in. (6 x 127 mm)
4000 A	H/H2/H3/L/L1	ANSI 37.50 UL 489	RCTH	4	0.25 x 6 in. (6 x 152 mm)
			RCTV, FCT	4	0.25 x 5 in. (6 x 127 mm)
		ANSI 37.50	FCF	4	0.25 x 6 in. (6 x 152 mm)
		UL 489	FCF	5	0.25 x 6 in. (6 x 152 mm)
5000 A	H/H2/H3/L/L1	ANSI 37.50 UL 489	RCTH	8	0.25 x 6 in. (6 x 152 mm)
			RCTV, FCT	6	0.25 x 5 in. (6 x 127 mm)
6000 A	H/L	UL 489	RCTV	6	0.25 x 6 in. (6 x 152 mm)

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Accessory Connections Using Push-In Connectors

Figure 20 – Terminal Layout for Push-In Connector Installation



CD3	CD2	CD1
834	824	814
832	822	812
831	821	811

or

CE6	CE5	CE4
364	354	344
362	352	342
361	351	341

Com		UC1		UC2		UC3	UC4	M2C/M6C	SDE2/RES	SDE1	CE3	CE2	CE1
E5	E6	Z5	M1	M2	M3	F2 +	V3	484/Q3	184/K2	84	334	324	314
E3	E4	Z3	Z4	T3	T4	VN	V2	474/Q2	182	82	332	322	312
E1	E2	Z1	Z2	T1	T2	F1 -	V1	471/Q1	181/K1	81	331	321	311

MN/MX2	MX1	XF	PF	MCH
D2/C12	C2	A2	254	B2
/C13	C3	A3	252	B3
D1/C11	C1	A1	251	B1

OF24	OF23	OF22	OF21	OF14	OF13	OF12	OF11	OF4	OF3	OF2	OF1	CT3	CT2	CT1
244	234	224	214	144	134	124	114	44	34	24	14	934	924	914
242	232	222	212	142	132	122	112	42	32	22	12	932	922	912
241	231	221	211	141	131	121	111	41	31	21	11	931	921	911

or

EF24	EF23	EF22	EF21	EF14	EF13	EF12	EF11
248	238	228	218	148	138	128	118
246	236	226	216	146	136	126	116
245	235	225	215	145	135	125	115

or

CE9	CE8	CE7
394	384	374
392	382	372
391	381	371

or

CD6	CD5	CD4
864	854	844
862	852	842
861	851	841

Function	Connector	Description
Auxiliary Contacts	OF[1]	Open/Closed Circuit Breaker or Switch Position Contacts
	EF	Combined Connected and Closed Contact
Cradle Contacts	CD	Disconnected Position Contacts
	CE	Connected Position Contacts
	CT	Test Position Contacts
Remote Operation	SDE	Electrical Fault Alarm Contact
	RES	Remote Reset
	MN	Undervoltage Trip Device
	MX[2]	Shunt Trip
	XF[2]	Shunt Close
	PF	Ready-to-Close Contact
	MCH	Spring-Charging Motor

[1] OF1, OF2, OF3 and OF4 contacts are standard.

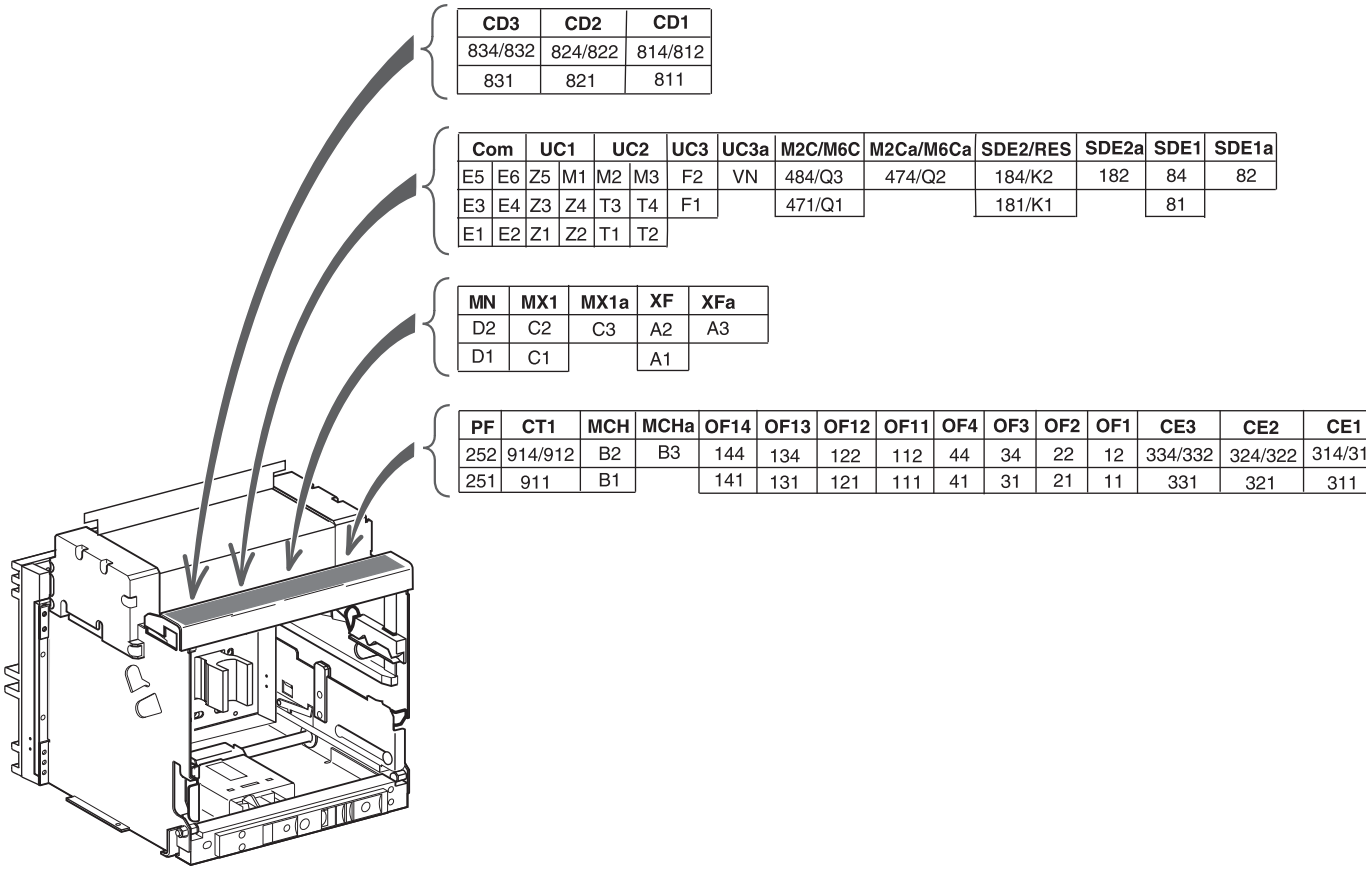
[2] When communicating MX1 or XF coils are used, terminal (C3 or A3) must be connected to line even if the communication module is not installed. The bypass circuit through terminal C2/A2 is only momentary duty (0.5 sec). For continuous duty, use the communications command.

Trip Unit Type					
Basic	A	P	H	Connector	Description
–	•	•	•	Com: E1–E6	Communication
–	•	•	•	UC1: Z	Zone-Selective Interlocking
					Z1 = ZSI OUT signal
					Z2 = ZSI OUT
					Z3 = ZSI IN Signal
					Z4 = ZSI IN Short Time
					Z5 = ZSI IN Ground Fault
–	•	•	•	UC1: M1	Modified Differential Ground Fault (MDGF)
–	•	•	•	UC2: T	External Neutral
–	•	•	•	UC2: M	Modified Differential Ground Fault (MDGF)
–	•	•	•	UC3: F	24 Vdc External Power Supply
–	–	•	•	UC3: Vn	External Neutral Plug
–	–	•	•	UC4	External Phase Voltage Sensing
–	–	•	•	M2C/M6C	Two Programmable Contacts (internal relay) or Six Programmable Contacts (for connection to external M6C module).

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Accessory Connections Using Ring Terminal Connectors

Figure 21 – Terminal Layout for Ring Terminal Connector Installation



Function	Connector	Description
Auxiliary Contacts	OF[1]	Open/Closed Circuit Breaker or Switch Position Contacts
	EF	Combined Connected and Closed Contact
Cradle Contacts	CD	Disconnected Position Contacts
	CE	Connected Position Contacts
	CT	Test Position Contacts
Remote Operation	SDE	Electrical Fault Alarm Contact
	RES	Remote Reset
	MN	Undervoltage Trip Device
	MX[2]	Shunt Trip
	XF[2]	Shunt Close
	PF	Ready-to-Close Contact
	MCH	Spring-Charging Motor

[1] OF1, OF2, OF3 and OF4 contacts are standard.

[2] When communicating MX1 or XF coils are used, terminal (C3 or A3) must be connected to line even if the communication module is not installed. The bypass circuit through terminal C2/A2 is only momentary duty (0.5 sec). For continuous duty, use the communications command.

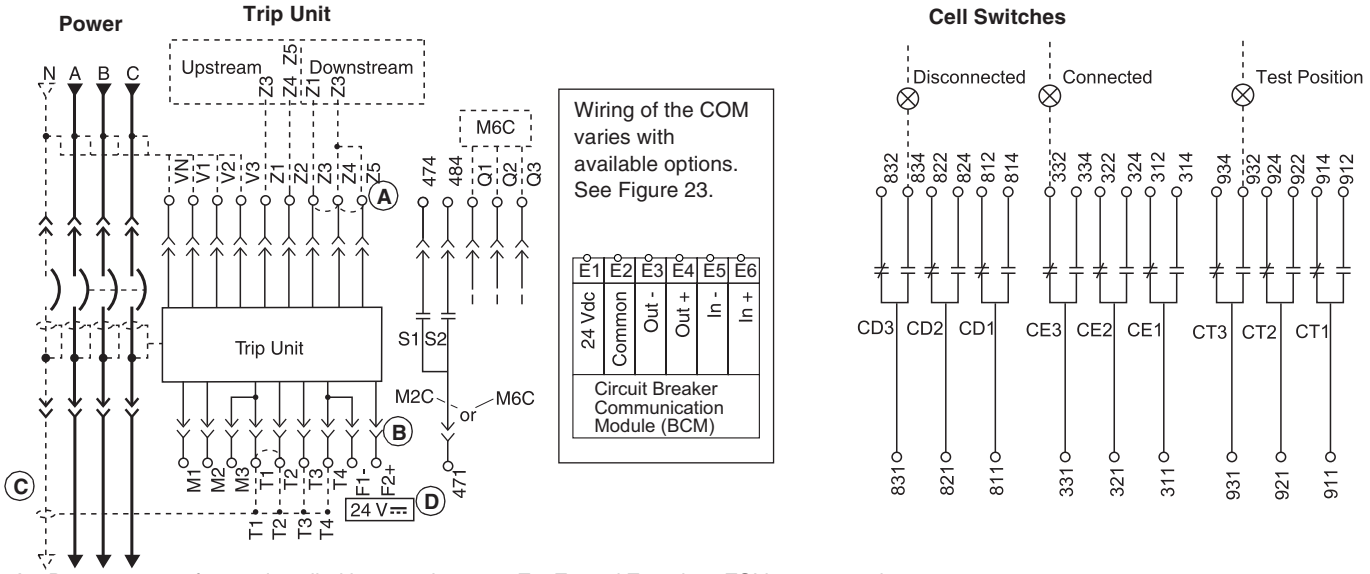
Trip Unit Type					
Basic	A	P	H	Connector	Description
–	•	•	•	Com: E1–E6	Communication
–	•	•	•	UC1: Z	Zone-Selective Interlocking
					Z1 = ZSI OUT Signal
					Z2 = ZSI OUT
					Z3 = ZSI IN Signal
					Z4 = ZSI IN Short Time
					Z5 = ZSI IN Ground Fault
–	•	•	•	UC1: M1	Modified Differential Ground Fault (MDGF)
–	•	•	•	UC2: T	External Neutral
–	•	•	•	UC2: M	Modified Differential Ground Fault (MDGF)
–	•	•	•	UC3: F	24 Vdc External Power Supply
–	–	•	•	UC3: Vn	External Neutral Plug
–	–	•	•	UC4	External Phase Voltage Sensing
–	–	•	•	M2C/M6C	Two Programmable Contacts (internal relay) or Six Programmable Contacts (for connection to external M6C module)

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Wiring Diagrams for Auxiliary Connections

NOTE: All diagrams are showing circuit breaker open, connected and charged.

Figure 22 – Wiring Diagrams for Auxiliary Connections



A—Do not remove factory-installed jumpers between Z3, Z4 and Z5 unless ZSI is connected.
B—Do not remove factory-installed jumper between T1 and T2 unless neutral CT is connected. Do not install jumper between T3 and T4.
C—For proper wiring of neutral CT, refer to wiring schematics, pages 32 and 33.
D—24 Vdc power supply for trip unit must be separate and isolated from 24 Vdc power supply for communication modules.

Markings for Push-In Type Terminals

Cell Switches		
CD3	CD2	CD1
834	824	814
832	822	812
831	821	811

or

CE6	CE5	CE4
364	354	344
362	352	342
361	351	341

Trip Unit								Cell Switches		
COM	UC1	UC2	UC3	UC4	M2C/M6C	SDE2/Res.	SDE1	CE3	CE2	CE1
E5 E6	Z5 M1	M2 M3	F2+	V3	484/Q3	184/K2	84	334	324	314
E3 E4	Z3 Z4	T3 T4	VN	V2	474/Q2	182	82	332	322	312
E1 E2	Z1 Z2	T1 T2	F1–	V1	471/Q1	181/K1	81	331	321	311

Markings for Ring Terminals

Cell Switches		
CD3	CD2	CD1
834/832	824/822	814/812
831	821	811

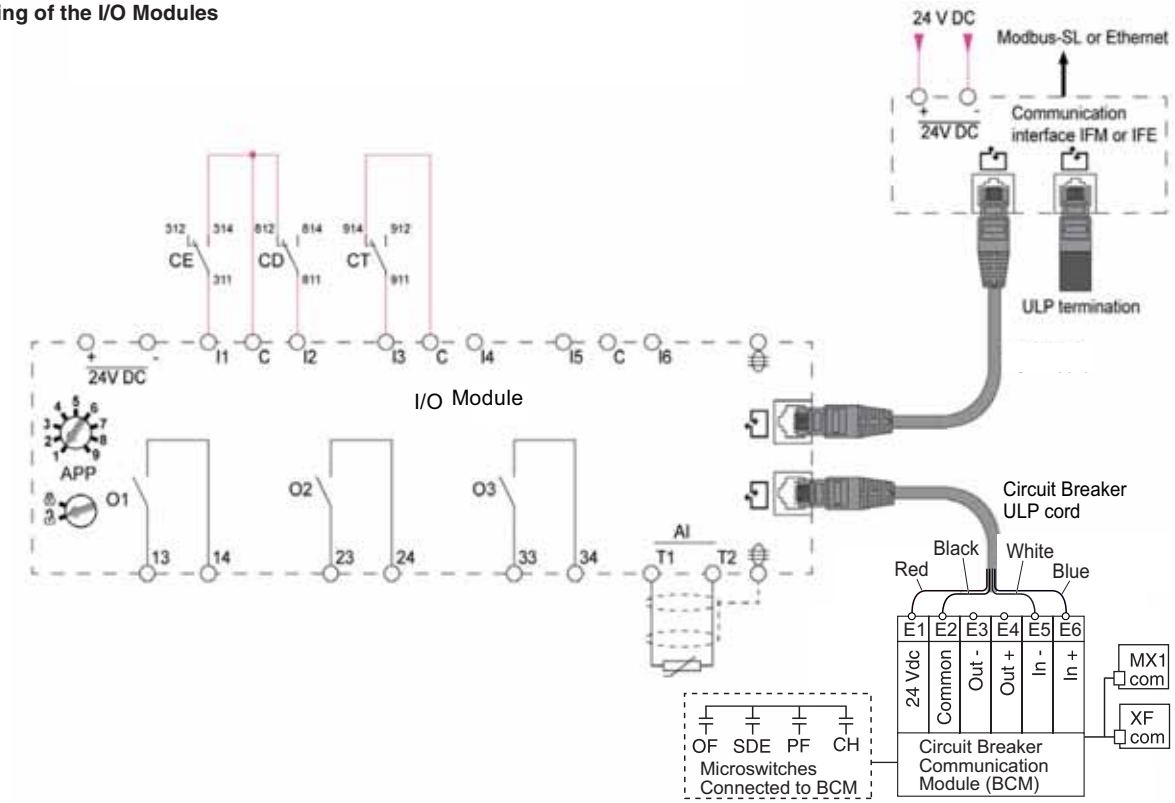
Trip Unit											
COM	UC1	UC2	UC3	UC3a	M2C/M6C	M2Ca/M6Ca	SDE2/Res.	SDE2a	SDE1	SDE1a
E5 E6	Z5 M1	M2 M3	F2	VN	484/Q3	474/Q2	184/K2	182	84	82
E3 E4	Z3 Z4	T3 T4	F1		471/Q1		181/K1		81	
E1 E2	Z1 Z2	T1 T2								

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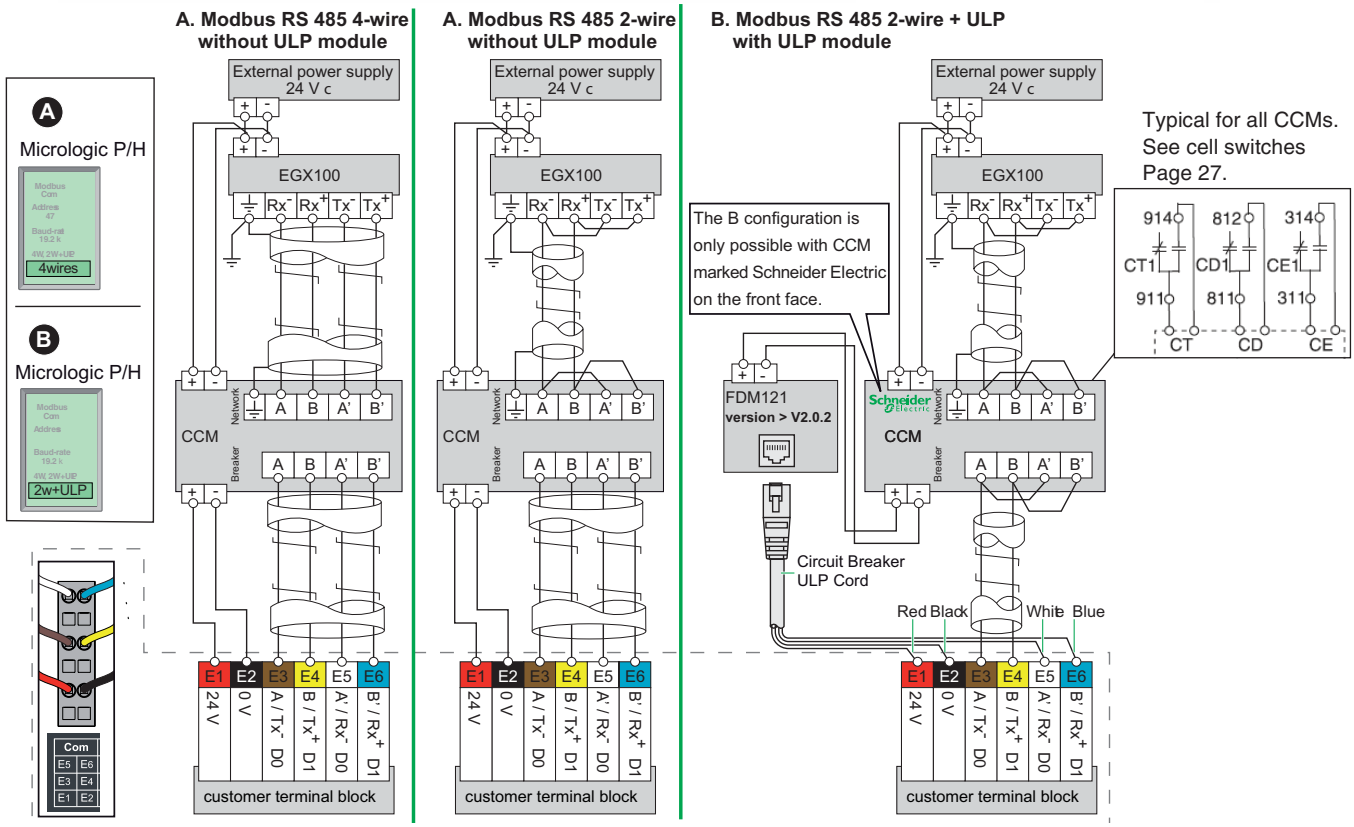
ENGLISH

Figure 23 – Wiring Diagrams for the COM Option

Wiring of the I/O Modules

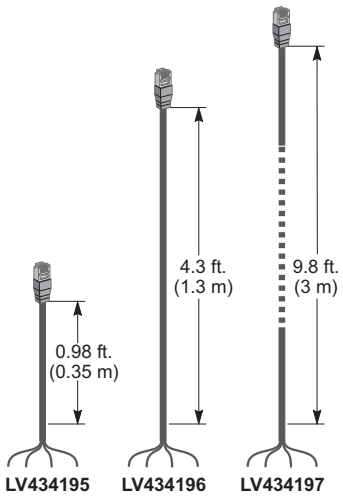


Wiring of the COM Option (Modbus BCM ULP and CCM Modules



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Figure 24 – Communication Components and FDM121 Connections

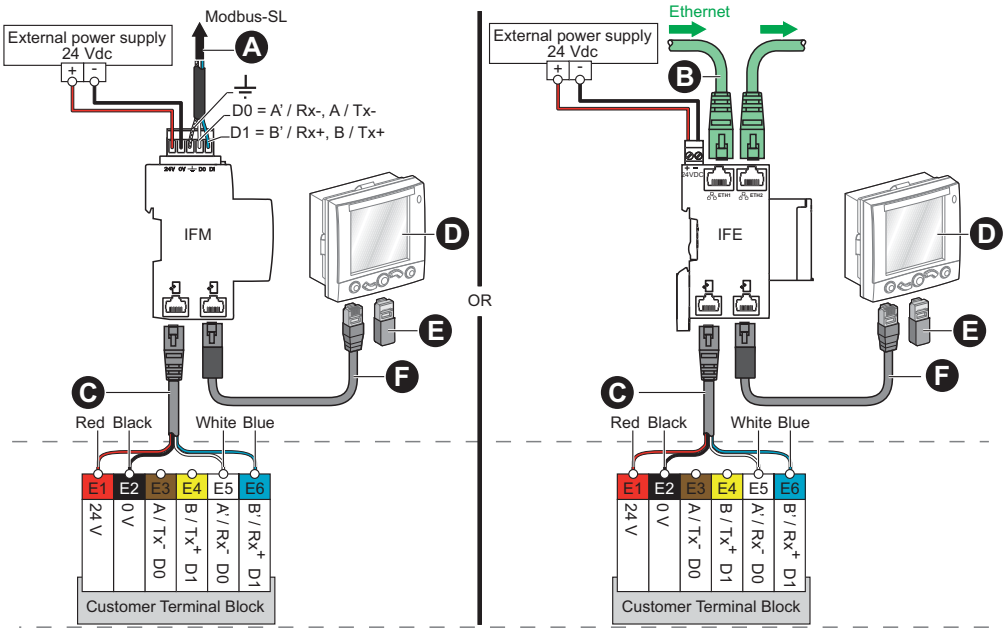


Circuit Breaker ULP Cord

Connections

Masterpact circuit breaker is connected to the ULP devices (FDM121 display, IFM, IFE or IO unit) via the circuit breaker ULP cord.

- Cord is available in three lengths: 0.98 ft. (0.35 m), 4.3 ft. (1.3 m) and 9.8 ft. (3 m).
- Lengths up to 32.9 ft. (10 m) are possible using extensions.



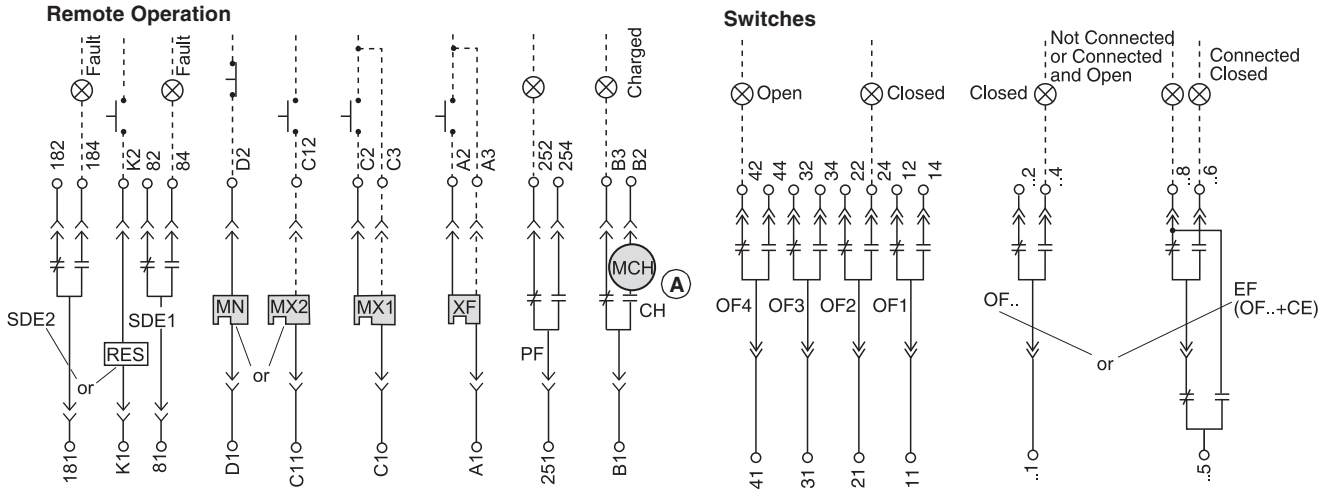
A. Modbus Network
B. Ethernet Network
C. Circuit Breaker ULP Cord
D. FDM Display
E. ULP Termination
F. ULP Cable

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NOTE: All diagrams are showing circuit breaker open, connected and charged.

Figure 25 – Wiring Diagrams for Auxiliary Connections



A—When remote operation features are used, make sure there is a minimum of four seconds for the spring charging motor (MCH) to completely charge the circuit breaker closing springs prior to actuating the shunt close (XF) device.

Markings for Push-In Type Terminals

Remote Operation					Auxiliary Switches												Cell Switches		
MN/MX2	MX1	XF	PF	MCH	OF24	OF23	OF22	OF21	OF14	OF13	OF12	OF11	OF4	OF3	OF2	OF1	CT3	CT2	CT1
D2/C12	C2	A2	254	B2	244	234	224	214	144	134	124	114	44	34	24	14	934	924	914
C13	C3	A3	252	B3	242	232	222	212	142	132	122	112	42	32	22	12	932	922	912
D1/C11	C1	A1	251	B1	241	231	221	211	141	131	121	111	41	31	21	11	931	921	911

or

EF24	EF23	EF22	EF21	EF14	EF13	EF12	EF11
248	238	228	218	148	138	128	118
246	236	226	216	146	136	126	116
245	235	225	215	145	135	125	115

or

CD6	CD5	CD4
864	854	844
862	852	842
861	851	841

or

CE9	CE8	C7
394	384	374
392	382	372
391	381	371

Markings for Ring Terminals

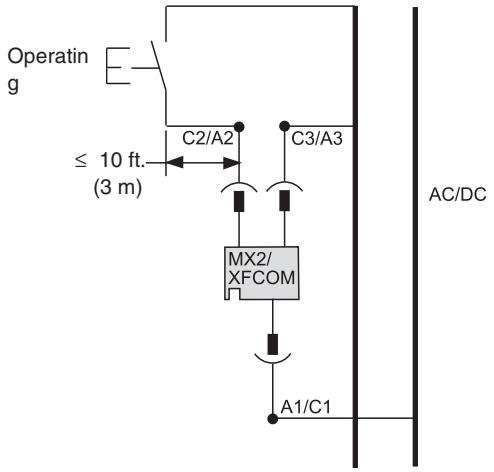
Remote Operation									Auxiliary Switches								Cell Switches		
MN	MX1	MX1a	XF	XFa	PF	CT1	MCH	MCHa	OF14	OF13	OF12	OF11	OF4	OF3	OF2	OF1	CE3	CE2	CE1
D2	C2	C3	A2	A3	252	914/912	B2	B3	144	134	122	112	44	34	22	12	334/332	324/322	314/312
D1	C1		A1		251	911	B1		141	131	121	111	41	31	21	11	331	321	311

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Communicating Shunt Trip (MX) and Shunt Close (XF)

A recommended wiring schematic for the communicating style shunt trip or shunt close coils is shown in Figure 26. Induced voltages in the circuit at terminal C2 and/or A2 can cause the shunt trip or shunt close to not work properly. The best way to prevent the induced voltages is keep the circuit to terminal C2 and A2 as short as possible. If it is impossible to keep the circuit less than ten feet (three meters), use an interposing relay near terminal C2 or A2.

Figure 26 – Communicating Wiring Schematic

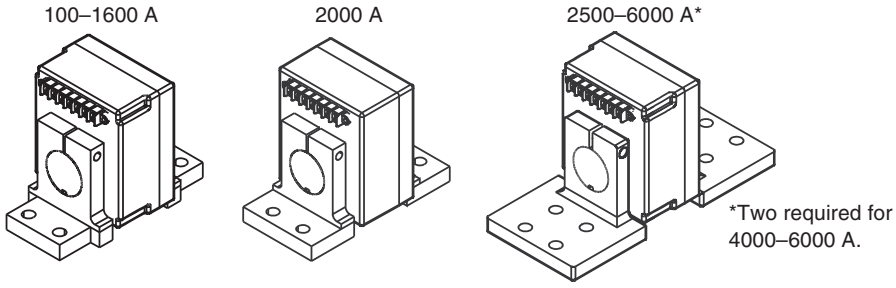


Ground-Fault Protection for Equipment

If the circuit breaker does not have an integral ground-fault tripping or alarm, skip this subsection.

A three-phase, four-wire circuit requires an external neutral current transformer (CT).

Figure 27 – Neutral Current Transformers



Connect the neutral CT to the circuit breaker according to wiring diagrams.

1. Connect the primary:
   - — If the load is connected to lower end of the circuit breaker, connect the load neutral to the H1 terminal of the neutral CT.
   - — If the source power is connected to the lower end of the circuit breaker, connect the source neutral to the H1 terminal of the neutral CT.

NOTE: The equipment grounding connection must be upstream (line side) of the neutral CT and a neutral connection must exist from the supply transformer to the equipment.

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For circuit breakers using Micrologic™ 5.0P, 5.0H, 6.0P, or 6.0H trip units, connect terminal Vn on the neutral current transformer to the Vn terminal of the control wiring terminal. (This is necessary to allow the trip unit to make voltage measurements.) Terminals Vc and Vn are internally connected.

NOTICE

HAZARD OF IMPROPER TRIP SYSTEM OPERATION

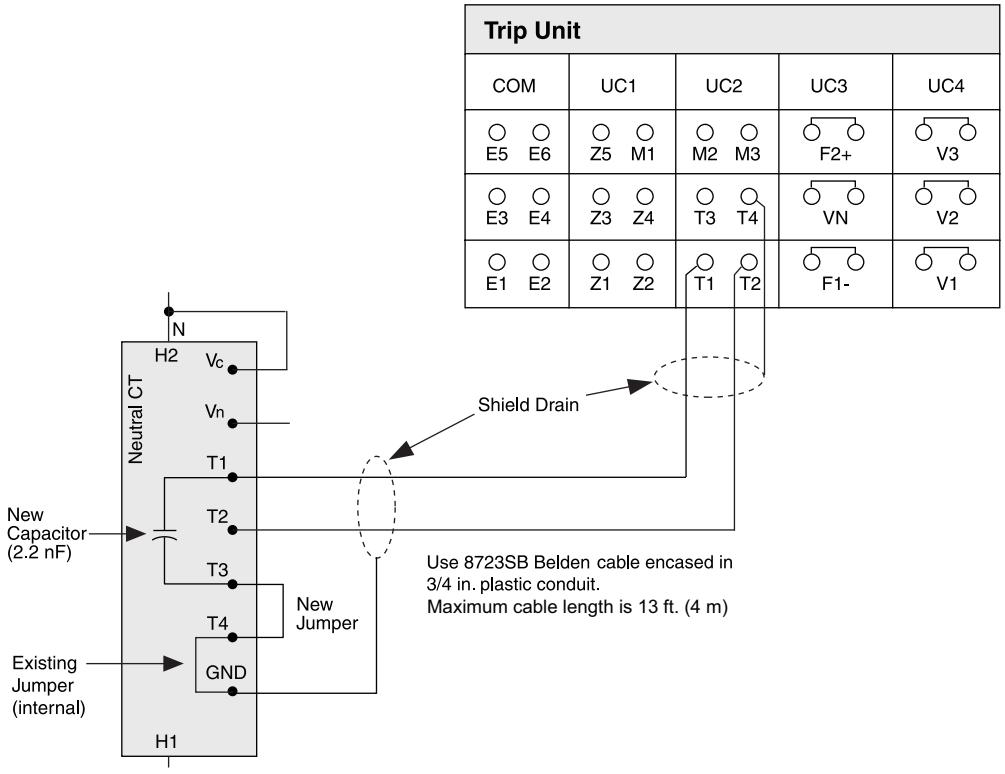
F1 and F2 must be isolated from ground. Verify all wiring per the instructions in this bulletin.

Failure to follow these instructions can result in a nuisance trip during closing.

2. Remove the factory-installed jumper connecting T1 and T2.
3. Feed the Belden® cable and plastic conduit from the neutral CT to the cradle terminals.
4. Connect the cable per the appropriate schematic in Figure 28 or 29.
5. Verify all wiring.

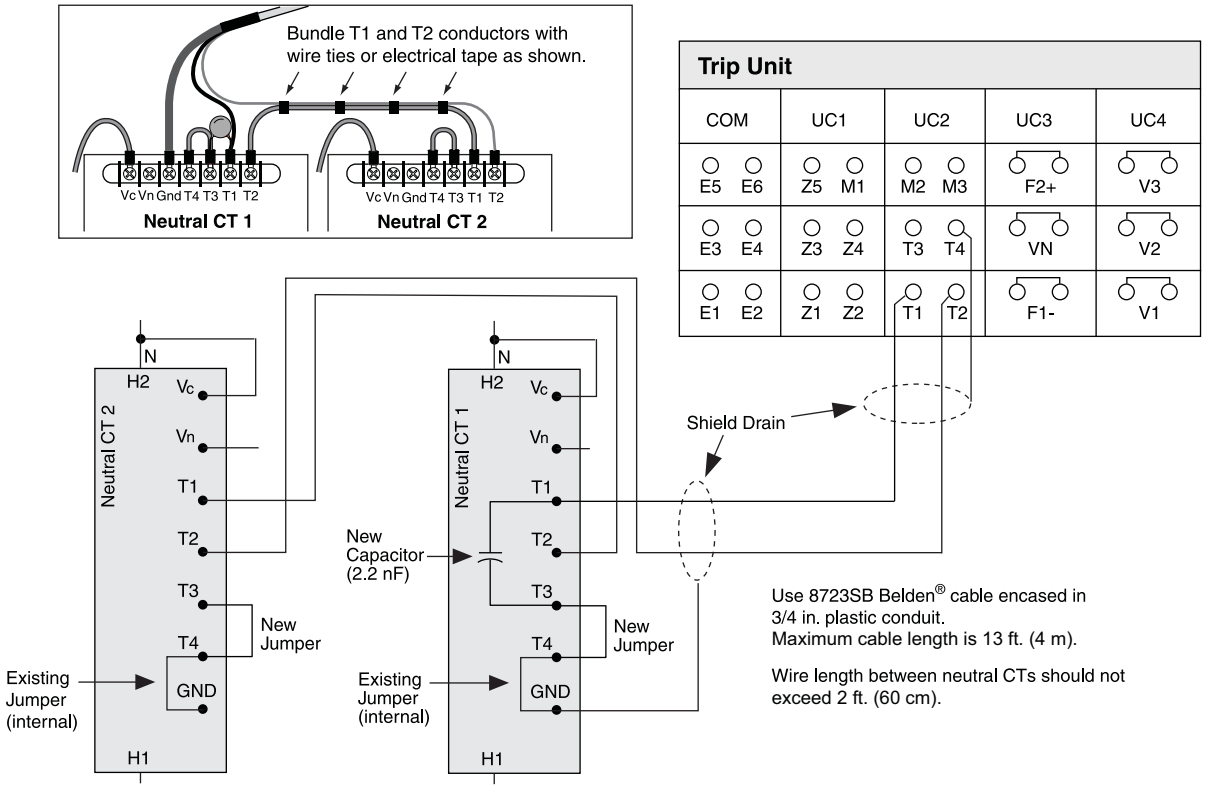
NOTE: Modified differential ground-fault circuitry and ground-source return ground-fault circuitry require the use of a modified differential ground-fault module (MDGF) and special current transformers. For wiring of those systems, see the instructions with the MDGF.

Figure 28 – Wiring Schematic for 800–4000 A Standard-Width NW Circuit Breakers



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Figure 29 – Wiring Schematic for 3200–6000 A Wide-Construction NW Circuit Breakers

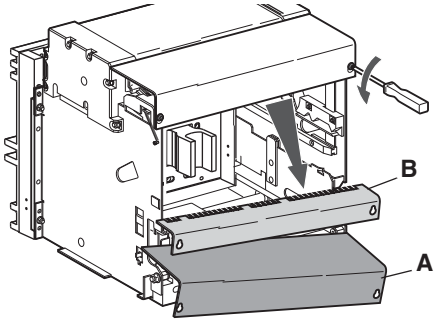


Accessory Wiring—Push-In Connectors

NOTE: Place cradle in test position to install or remove push-in connectors. Place in test position as described on page 70.

1. Remove the optional terminal cover (**Figure 30, A**), if installed, and the wiring cover (**B**).

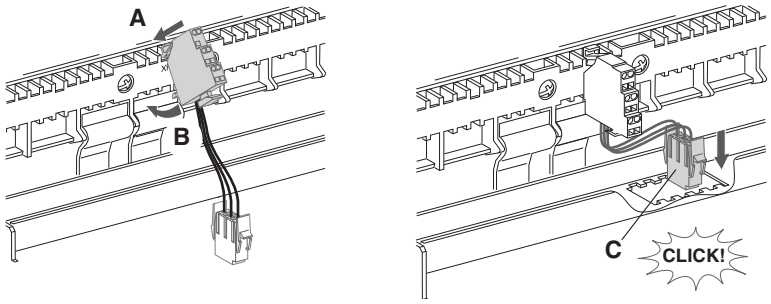
Figure 30 – Remove Covers



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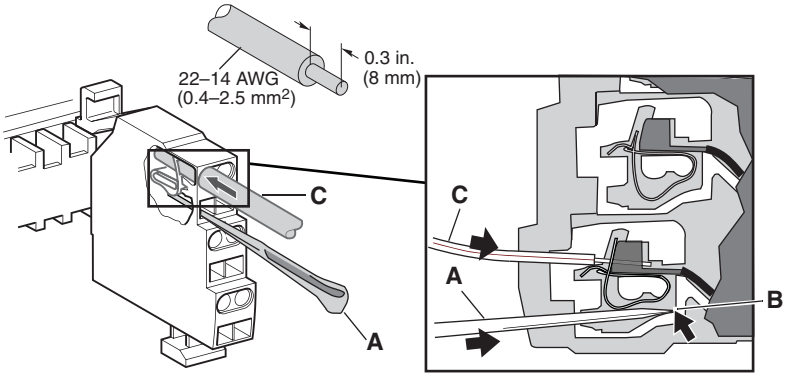
2. Install each push-in connectors in the correct slot (**Figure 31, A**). (Refer to the label on the cradle for standard positioning information.) Rotate the push-in connector down (**B**) to snap in place.
3. Install the wiring connector (**C**). Connector positions are indicated on front of the connector support.

Figure 31 – Install Push-In Connector



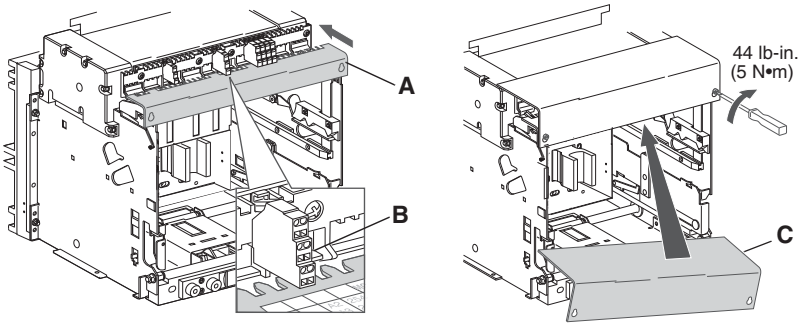
4. Push the Wago wire insert tool (**Figure 32, A**, Wago part no. 209-129) fully into the connector (to point **B**) and install control wires (**C**).

Figure 32 – Install Control Wires



5. Replace the wiring cover (**Figure 33, A**), sliding the top under the installed push-in connectors (**B**).
6. Replace the optional terminal cover (**C**), if installed.

Figure 33 – Replace Covers

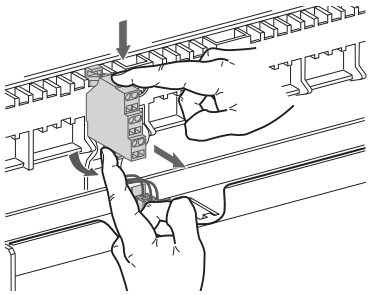


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NOTE: Remove a push-in connector in reverse order of installation.

Remove the connector by pressing down on top of connector (**Figure 40, A**) while pushing up and out on bottom (**B**) to rotate connector off of latch.

Figure 34 – Remove Push-In Connector

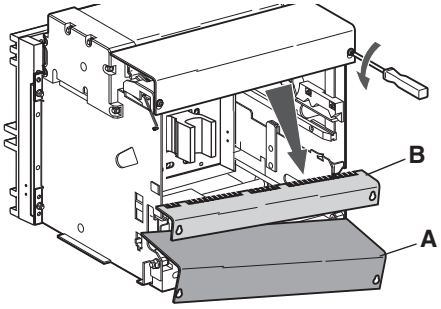


Accessory Wiring—Ring Terminal Connector

NOTE: Place the cradle in its test position to install or remove ring terminal connectors. Place in test position as detailed on page 70, Drawout Circuit Breaker Disconnection.

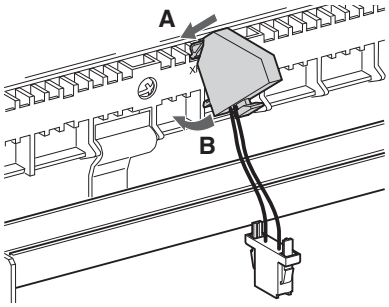
1. Remove the optional terminal cover (**Figure 35, A**), if installed, and the wiring cover (**B**).

Figure 35 – Remove Covers



2. Install each ring terminal connector in the correct slot (**Figure 36, A**). (Refer to the label on the cradle for standard positioning information.) Rotate the ring terminal block down (**B**) to snap in place.

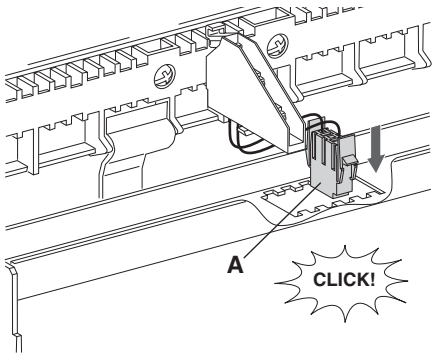
Figure 36 – Install Ring Terminal Connector



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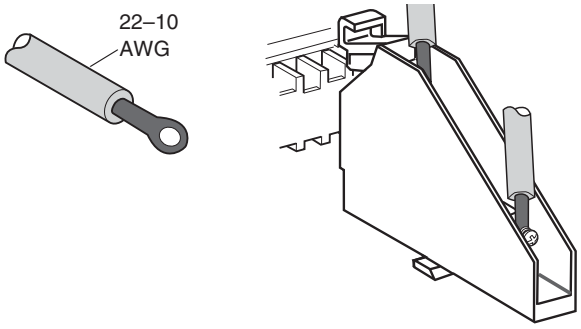
3. Install the wiring connector (**Figure 37, A**). Connector positions are indicated on front of the connector support.

Figure 37 – Install Wiring Connector



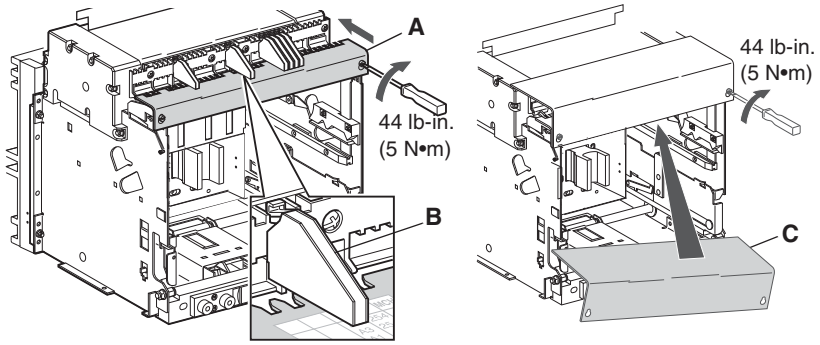
4. Install the ring terminals on the control wire. Secure the ring terminal on the ring terminal block.

Figure 38 – Install Control Wires



5. Replace the wiring cover (**Figure 39, A**), sliding the top under the installed ring terminal connectors (**B**).
6. Replace the optional terminal cover (**C**), if installed.

Figure 39 – Replace Wiring Cover

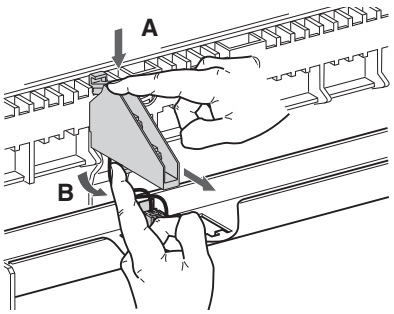


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NOTE: To remove a ring terminal connector, the circuit breaker must be in test position. Remove the ring terminal connector in reverse order of installation.

Remove the connector by pressing down on top of connector (**Figure 40, A**) while pushing up and out on bottom (**B**) to rotate connector off of latch.

Figure 40 – Remove Ring Terminal Connector



Cradle Removal

1. Turn off all power supplying the equipment before working on or inside equipment.
2. Remove the cradle in reverse order of installation.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.

Failure to follow these instructions will result in death or serious injury.

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Circuit Breaker Installation

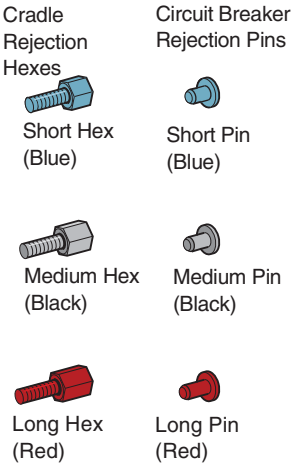
Cradle Rejection Kit

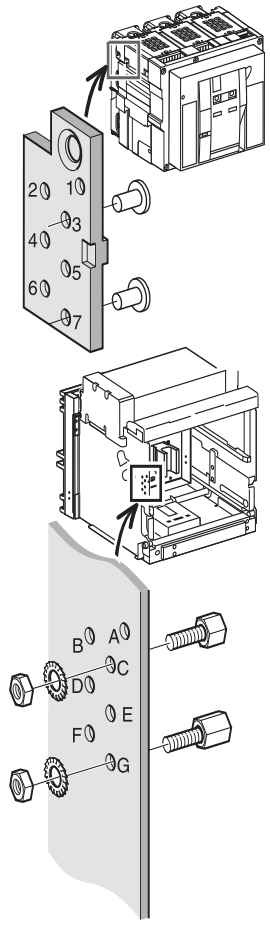
To prevent a Masterpact circuit breaker with an inappropriate ampacity or interrupting rating from being installed in the cradle, install rejection pins on cradle and circuit breaker prior to installing circuit breaker.

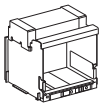
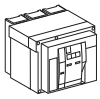
1. Determine rejection pin pattern required. (See Table 8 or 9.)

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Table 8 – Recommended Cradle Rejection Pin Keying for Standard UL 1066 (ANSI C37.50) Listed Circuit Breakers





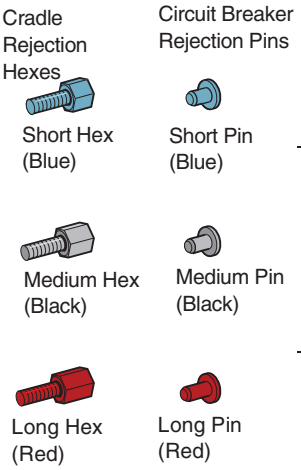
Type														
	A	B	C	D	E	F	G	1	2	3	4	5	6	7
800 A N1	Black	Black	Black	Red	Blue	Blue	Black	Blue	Blue	Blue	—	Black	Black	Blue
800 A H1	Black	Black	Black	Blue	Red	Black	Blue	Blue	Blue	Blue	Black	—	Blue	Black
800 A H2	Black	Black	Black	Red	Red	Blue	Blue	Blue	Blue	Blue	—	—	Black	Black
800 A H3	Black	Black	Black	Blue	Blue	Red	Blue	Blue	Blue	Blue	Black	Black	—	Black
800 A L1	Black	Black	Black	Red	—	Red	Blue	Blue	Blue	Blue	—	Red	—	Black
800 A L1F	Black	Black	Black	—	Red	Red	Blue	Blue	Blue	Blue	Red	—	—	Black
800 A HF	Black	Black	Black	Blue	—	Red	Red	Blue	Blue	Blue	Black	Red	—	—
800 A HC	Black	Blue	Black	Red	—	Red	Red	Blue	Black	Blue	—	Red	—	—
800 A HA	Black	Black	Black	Red	Red	—	Red	Blue	Blue	Blue	—	—	Red	—
1600 A N1	—	Red	Blue	Red	Blue	Blue	Black	Red	—	Black	—	Black	Black	Blue
1600 A H1	—	Red	Blue	Blue	Red	Black	Blue	Red	—	Black	Black	—	Blue	Black
1600 A H2	—	Red	Blue	Red	Red	Blue	Blue	Red	—	Black	—	—	Black	Black
1600 A H3	—	Red	Blue	Blue	Blue	Red	Blue	Red	—	Black	Black	Black	—	Black
1600 A L1	—	Red	Black	Red	—	Red	Blue	Red	—	Blue	—	Red	—	Black
1600 A L1F	—	Red	Black	—	Red	Red	Blue	Red	—	Blue	Red	—	—	Black
1600 A HF	—	Red	Black	Blue	—	Red	Red	Red	—	Black	Black	Red	—	—
1600 A HC	—	Red	Blue	Red	—	Red	Red	Red	—	Black	—	Red	—	—
1600 A HA	—	Red	Blue	Red	Red	—	Red	Red	—	Black	—	—	Red	—
2000 A H1	Red	—	Red	Blue	Red	Black	Blue	—	Red	—	Black	—	Blue	Black
2000 A H2	Red	—	Red	Red	Red	Blue	Blue	—	Red	—	—	—	Black	Black
2000 A H3	Red	—	Red	Blue	Blue	Red	Blue	—	Red	—	Black	Black	—	Black
2000 A L1	Red	—	Red	Red	—	Red	Blue	—	Red	—	—	Red	—	Black
2000 A L1 Wide*	—	Red	Red	Red	Blue	Red	Black	Red	—	—	—	Black	—	Blue
2000 A L1F	Red	—	Red	—	Red	Red	Blue	—	Red	—	Red	—	—	Black
2000 A HF	Red	—	Red	Blue	—	Red	Red	—	Red	—	Black	Red	—	—
2000 A HC	Red	—	Blue	Red	—	Red	Red	—	Red	Black	—	Red	—	—
2000 A HA	Red	—	Red	Red	Red	—	Red	—	Red	—	—	—	Red	—
3200 A H1	Blue	Black	Red	Black	Red	Black	Black	Black	Blue	—	Blue	—	Blue	Blue
3200 A H2	Blue	Black	Red	Red	Red	Black	Blue	Black	Blue	—	—	—	Blue	Black
3200 A H3	Blue	Black	Red	Blue	Black	Red	Blue	Black	Blue	—	Black	Blue	—	Blue
3200 A HF	Blue	Black	Red	—	—	Red	Red	Black	Blue	—	Red	Red	—	—
3200 A HC	—	Black	Red	Red	—	Red	Red	Red	Blue	—	—	Red	—	—
3200 A HC Wide*	Red	Blue	Black	Red	Black	Red	Red	—	Black	Blue	—	Blue	—	—
3200 A L1 Wide*	Red	Black	Blue	Red	Black	Red	Black	—	Blue	Black	—	Blue	—	Blue
3200 A HA	—	Black	Red	Red	Red	—	Red	Black	Blue	—	—	—	Red	—
4000 A H2 Wide*	Black	Red	Blue	Red	Red	Black	Blue	Blue	—	Black	—	—	Blue	Black
4000 A H3 Wide*	Black	Red	Blue	Blue	Black	Red	Blue	Blue	—	Black	Black	Blue	—	Black
4000 A HA Wide*	Blue	Red	Blue	Red	Red	—	Red	Black	—	Blue	—	—	Red	—
4000 A HC Wide*	Blue	Red	Blue	Red	Blue	Red	Red	Black	—	Blue	—	Black	—	—
4000 A HF Wide*	Blue	Red	Blue	Blue	Black	Red	Red	Black	—	Blue	Black	Blue	—	—
4000 A L1 Wide*	Black	Red	Blue	Red	Blue	Red	Black	Blue	—	Black	—	Black	—	Blue
5000 A H2	Red	Black	Black	Red	Red	Black	Blue	—	Blue	Blue	—	—	Blue	Black
5000 A H3	Red	Black	Black	Blue	Black	Red	Blue	—	Blue	Blue	Black	Blue	—	Black
5000 A HA	Red	Black	Blue	Red	Red	—	Red	—	Blue	Black	—	—	Red	—
5000 A HF	Red	Black	Blue	Blue	Black	Red	Red	—	Blue	Black	Black	Blue	—	—
5000 A HC	Red	Black	Blue	Red	Blue	Red	Red	—	Blue	Black	—	Black	—	—
5000 A L1	Red	Black	Black	Red	Blue	Red	Black	—	Blue	Blue	—	Black	—	Blue
6000 A H2	Black	Black	Red	Red	Red	Black	Blue	Blue	Blue	—	—	—	Blue	Black
6000 A H3	Black	Black	Red	Blue	Black	Red	Blue	Blue	Blue	—	Black	Blue	—	Black
6000 A HA	Blue	Blue	Red	Red	Red	—	Red	Black	Black	—	—	—	Red	—
6000 A HF	Blue	Blue	Red	Blue	Black	Red	Red	Black	Black	—	Black	Blue	—	—
6000 A HC	Blue	Blue	Red	Red	Blue	Red	Red	Black	Black	—	—	Black	—	—
6000 A L1	Black	Black	Red	Red	Blue	Red	Black	Blue	Blue	—	—	Black	—	Blue

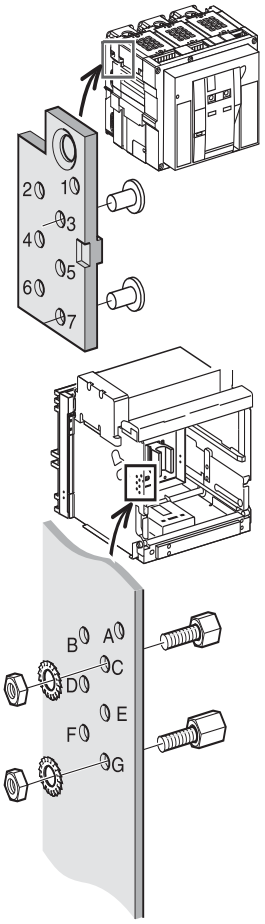
* Wide construction version.

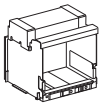
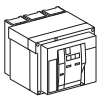
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ENGLISH

Table 9 – Recommended Cradle Rejection Pin Keying for Standard UL 489 Listed Circuit Breakers





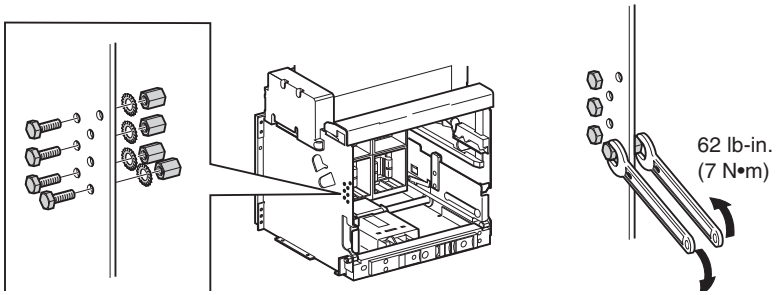
Type														
	A	B	C	D	E	F	G	1	2	3	4	5	6	7
800 A N	Black	Black	Black	Red	Red	Red	—	Blue	Blue	Blue	—	—	—	Red
800 A H	Black	Black	Blue	Blue	Blue	Blue	Red	Blue	Blue	Black	Black	Black	Black	—
800 A L	Black	Black	Black	Red	—	Blue	Red	Blue	Blue	Blue	—	Red	Black	—
800 A LF	Black	Blue	Black	Blue	Red	Blue	Red	Blue	Black	Blue	Black	—	Black	—
800 A HF	Black	Blue	Black	—	Red	Red	Black	Blue	Black	Blue	Red	—	—	Blue
800 A HB	Blue	Black	Black	Red	Red	Red	Black	Black	Blue	Blue	—	—	—	Blue
1200 A N	Red	Blue	Black	Red	Red	Red	—	—	Black	Blue	—	—	—	Red
1200 A H	Red	Blue	Black	Blue	Blue	Blue	Red	—	Black	Blue	Black	Black	Black	—
1200 A L	Red	Blue	Black	Red	—	Blue	Red	—	Black	Blue	—	Red	Black	—
1200 A LF	Red	Blue	Blue	Blue	Red	Blue	Red	—	Black	Black	Black	—	Black	—
1200 A HF	Red	Black	Blue	—	Red	Red	Red	—	Blue	Black	Red	—	—	—
1200 A HB	Black	Blue	Blue	Red	Red	Red	Red	Blue	Black	Black	—	—	—	—
1600 A N	—	Red	Blue	Red	Red	Red	—	Red	—	Black	—	—	—	Red
1600 A H	—	Red	Black	Blue	Blue	Blue	Red	Red	—	Blue	Black	Black	Black	—
1600 A L	—	Red	Black	Red	—	Blue	Red	Red	—	Blue	—	Red	Black	—
1600 A LF	—	Red	Blue	Blue	Red	Blue	Red	Red	—	Black	Black	—	Black	—
1600 A HF	—	Red	Blue	—	Red	Red	Red	Red	—	Black	Red	—	—	—
1600 A HB	—	Red	—	Red	Red	Red	Red	Red	—	Red	—	—	—	—
2000 A N	Red	—	Red	Red	Red	Red	—	—	Red	—	—	—	—	Red
2000 A H	Red	—	Red	Blue	Blue	Blue	Red	—	Red	—	Black	Black	Black	—
2000 A L	Red	—	Red	Red	—	Blue	Red	—	Red	—	—	Red	Black	—
2000 A LF	Red	—	Black	Blue	Red	Blue	Red	—	Red	Blue	Black	—	Black	—
2000 A HF	Black	—	Red	—	Red	Red	Red	Blue	Red	—	Red	—	—	—
2000 A HB	Red	—	—	Red	Red	Red	Red	—	Red	Red	—	—	—	—
2500 A H	—	Blue	Red	Red	Red	Red	—	Red	Blue	—	Black	Black	Black	—
2500 A L	—	Black	Red	Blue	Blue	Blue	Red	Red	Black	—	—	—	—	Red
2500 A HF	—	Blue	Red	—	Red	Red	Red	Red	Black	—	Red	—	—	—
2500 A HB	—	—	Red	Red	Red	Red	Red	Red	Red	—	—	—	—	—
3000 A H	Blue	Red	—	Red	Red	Red	—	Black	—	Red	—	—	—	Red
3000 A L	Black	Red	—	Blue	Blue	Blue	Red	Blue	—	Red	Black	Black	Black	—
3000 A HF	Blue	Red	—	—	Red	Red	Red	Black	—	Red	Red	—	—	—
3000 A HB	—	Black	Blue	Red	Red	Red	Red	Red	Blue	Black	—	—	—	—
4000 A H Wide*	Black	Red	Blue	Blue	Blue	Black	Red	Blue	—	Black	Black	Black	Blue	—
4000 A L Wide*	Black	Red	Blue	Red	Blue	Blue	Red	Blue	—	Black	—	Black	Black	—
4000 A HF Wide*	Blue	Red	Blue	—	Red	Red	Red	Black	—	Blue	Red	—	—	—
4000 A HB Wide*	Blue	Red	Blue	Black	Red	Blue	Red	Black	—	Blue	Blue	—	Black	—
5000 A H	Red	Black	Black	Blue	Blue	Black	Red	—	Blue	Blue	Black	Black	Blue	—
5000 A L	Red	Black	Black	Red	Blue	Blue	Red	—	Blue	Blue	—	Black	Black	—
5000 A HF	Red	Black	Blue	—	Red	Red	Red	—	Blue	Black	Red	—	—	—
5000 A HB	Red	Black	Blue	Black	Red	Blue	Red	—	Blue	Black	Blue	—	Black	—
6000 A H	Black	Black	Red	Blue	Blue	Black	Red	Blue	Blue	—	Black	Black	Blue	—
6000 A L	Black	Black	Red	Red	Blue	Blue	Red	Blue	Blue	—	—	Black	Black	—
6000 A HF	Blue	Blue	Red	—	Red	Red	Red	Black	Black	—	Red	—	—	—
6000 A HB	Blue	Blue	Red	Black	Red	Blue	Red	Black	Black	—	Blue	—	Black	—

* Wide construction version.

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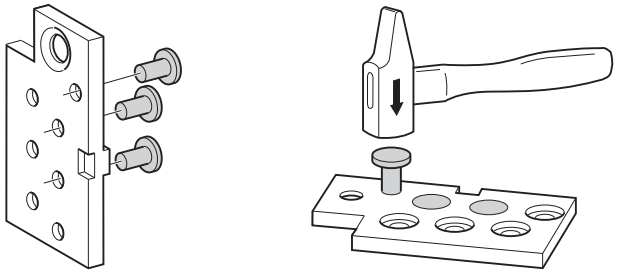
2. Install cradle rejection pins in the pattern determined from Table 8 or 9.

Figure 41 – Install Cradle Rejection Pins



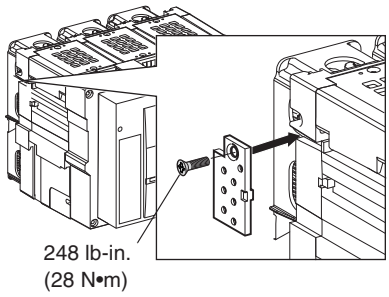
3. Install the circuit breaker rejection pins into the rejection pin plate in the pattern determined from Table 8 or 9.

Figure 42 – Install Circuit Breaker Rejection Pins



4. Install the rejection pin plate on the circuit breaker.

Figure 43 – Install Rejection Pin Plate



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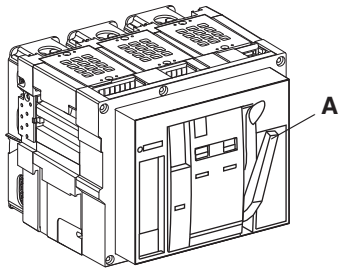
Install Accessories

Install any required circuit breaker accessories which were not factory installed.

If installing electrical accessories, remove accessory cover.

NOTICE
HAZARD OF EQUIPMENT DAMAGE Use caution when removing or replacing the circuit breaker accessory cover. The spring-charging handle (**Figure 44, A**) extends through the circuit breaker accessory cover and can be damaged when removing the accessory cover. **Failure to follow these instructions can result in equipment damage.**

Figure 44 – Spring Charging Handle

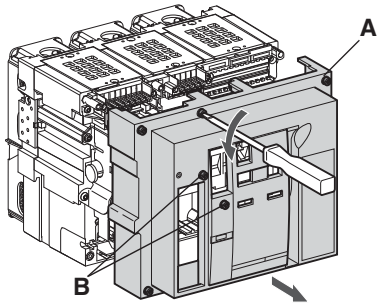


Loosen the accessory cover screws and remove the accessory cover (**Figure 45, A**).

NOTE: Screws (**B**) are for Type L, LF, L1, and L1F circuit breakers only.

Install accessory as instructed in the instructions packed with each accessory.

Figure 45 – Remove Accessory Cover

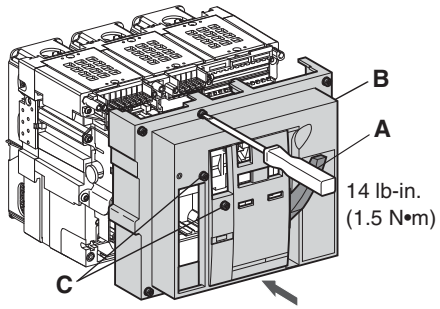


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Replace the accessory cover by pulling the handle (**Figure 46, A**) forward and sliding the circuit breaker accessory cover (**B**) down over the handle. Tighten the accessory cover screws.

NOTE: Screws (**C**) are for Type L, LF, L1, and L1F circuit breakers only.

Figure 46 – Replace Accessory Cover



Install Circuit Breaker

NOTICE

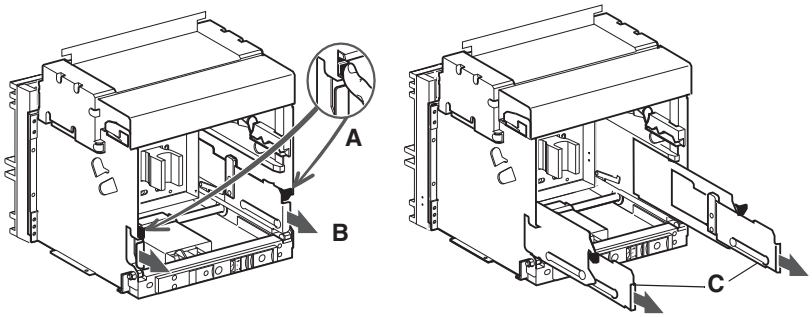
HAZARD OF EQUIPMENT DAMAGE

Cradle must be secured when installing or removing circuit breaker.

Failure to follow these instructions can result in equipment damage.

1. Press the latching tabs (**Figure 47, A**), then pull out the extension rail handles (**B**) until the extension rails (**C**) are fully extended.
2. Inspect the circuit breaker clusters for missing or misaligned clusters. See page 11 for information on checking, installing, and lubricating clusters.

Figure 47 – Pull Out Rails



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NOTICE

HAZARD OF EQUIPMENT DAMAGE

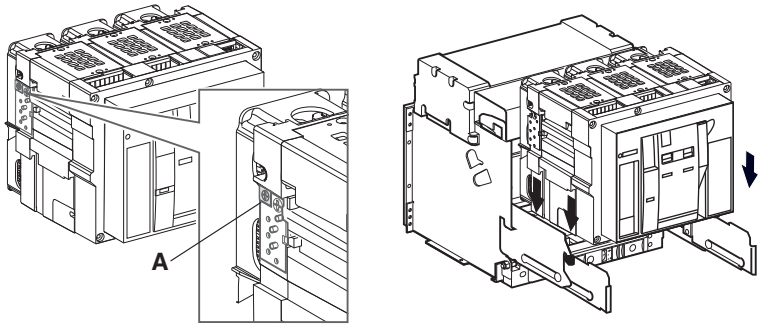
The shutter actuator must be installed on the circuit breaker for proper operation of cell shutters.

Failure to follow these instructions can result in equipment damage.

3. For cells with shutters, check that the shutter actuator (**Figure 48, A**) is installed on the circuit breaker.
4. Install the circuit breaker on the extension rails. See page 16 for proper lifting equipment.

   NOTE: The cradle must be secured on a pallet if it is not installed in the equipment prior to installing the circuit breaker.

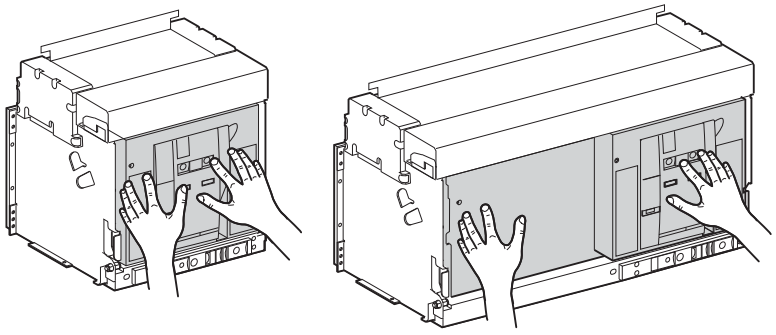
Figure 48 – Check Shutter Actuator



5. Push in the circuit breaker.
6. Connect the circuit breaker. See page 68, Drawout Circuit Breaker Connection for instructions on connecting the circuit breaker.

   See Section 6—Operation for instructions on operating the circuit breaker.

Figure 49 – Push In Circuit Breaker



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Test Equipment Ground-Fault Protection

Paragraph 230-95(c) of the National Electrical Code requires that all equipment ground-fault protection systems be tested when first installed. If the circuit breaker has equipment ground-fault protection installed, test it at this time.

Make sure the trip unit is powered. The trip unit is powered if:

- The circuit breaker is closed or bottom-fed and has more than 100 V of load voltage on two phases (P or H trip unit only).
- The full-function or hand-held test kit is connected and on.
- A 24 Vdc external power supply is connected.
- An external voltage tap is installed and a voltage of more than 100 V is present on two phases (P or H trip unit only).

If this is a radial (single-ended) system, press the ground-fault push-to-test button (**Figure 50, A**). The circuit breaker will trip and the trip unit ground-fault indicator light will come on.

Record results in Table 10.

If a complete check of the ground-fault system is necessary, use primary injection testing. If the system has multiple sources and/or requires field connections at the job site, use primary injection testing.

Figure 50 – Test Ground-Fault Push-to-Test

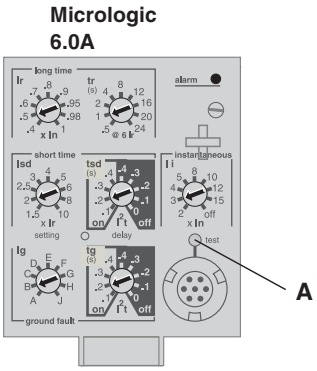


Table 10 – Ground-Fault Test Results

Date	Ground-Fault Settings	Test Results	Signature

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Circuit Breaker Removal

NOTICE

HAZARD OF EQUIPMENT DAMAGE

Cradle must be secured when installing or removing circuit breaker.

Failure to follow these instructions can result in equipment damage.

⚠ DANGER

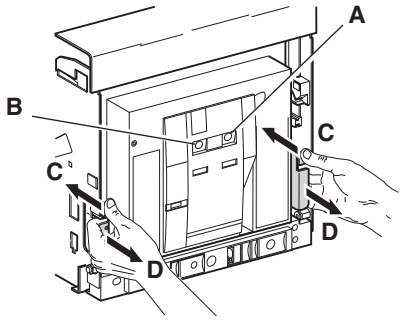
HAZARD OF DEVICE FALLING

- Be sure lifting equipment has lifting capacity for the unit being lifted. Follow manufacturer's instructions for use of lifting equipment.
- Wear hard hat, safety shoes and heavy gloves.

Failure to follow these instructions will result in death or serious injury.

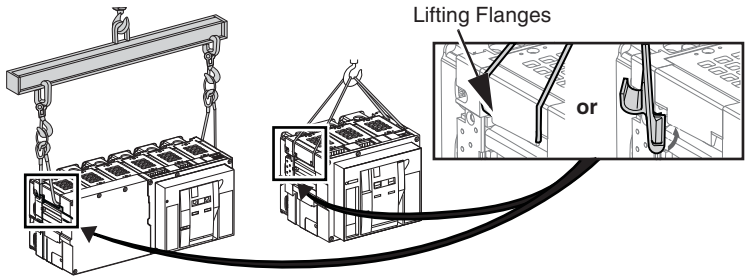
1. Disconnect circuit breaker as detailed on page 70, Drawout Circuit Breaker Disconnection.
2. With the circuit breaker in the disconnected position, press the "push ON" button (**Figure 51, A**) to close the circuit breaker.
3. Press the "push OFF" button (**B**) to open the circuit breaker.
4. Press latching tabs (**C**), then pull out extension rail handles (**D**).

Figure 51 – Circuit Breaker Removal



5. Remove circuit breaker from cradle rails using lifting flanges on sides of circuit breaker, see Section 2—Lifting and Transporting.

Figure 52 – Overhead Lifting



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Section 4— Fixed-Mounted Circuit Breaker Installation

Circuit Breaker Installation

Turn off all power supplying this equipment before working on or inside equipment.

Install Accessories

Install circuit breaker accessories not purchased as factory installed at this time.

If installing electrical accessories, remove accessory cover.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

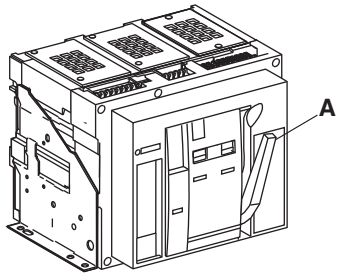
NOTICE

HAZARD OF EQUIPMENT DAMAGE

Use caution when removing or replacing the circuit breaker accessory cover. The spring-charging handle (**Figure 53, A**) extends through the circuit breaker accessory cover and can be damaged when removing the accessory cover.

Failure to follow these instructions can result in equipment damage.

Figure 53 – Spring Charging Handle

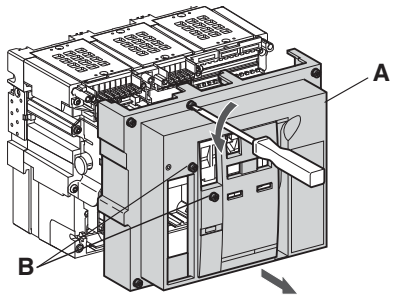


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1. Loosen the accessory cover screws and remove the accessory cover (**Figure 54, A**).

   NOTE: Screws (**B**) are for Type L and L1 circuit breakers only.
2. Install accessories as instructed in the instructions packed with each accessory.

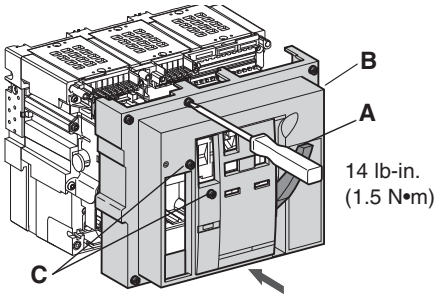
Figure 54 – Remove Accessory Cover



3. Replace the accessory cover by pulling the handle (**Figure 55, A**) forward and sliding the circuit breaker accessory cover (**B**) down over the handle. Tighten the accessory cover screws.

   NOTE: Screws (**C**) are for Type L and L1 circuit breakers only.

Figure 55 – Replace Accessory Cover



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Clearance Requirements

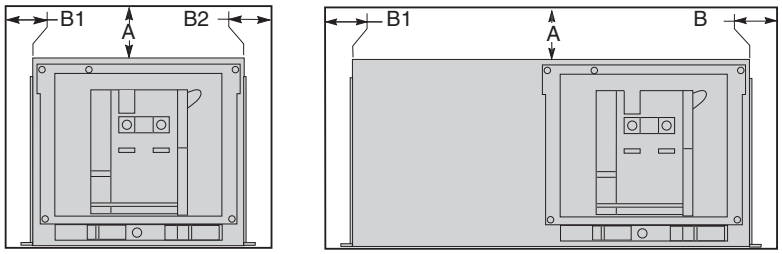
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

Clearance requirements must be met for proper operation of the equipment.

Failure to follow these instructions will result in death or serious injury.

Table 11 – Clearance Requirements



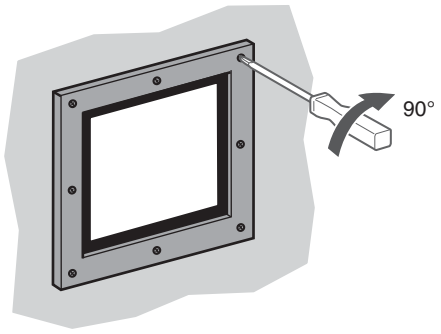
Minimum Clearance	A		B1 + B2	
	in.	mm	in.	mm
Insulated Parts	5.91	150	2.36	60
Metal Parts	5.91	150	5.72	120

Install Door Escutcheon

If the equipment has a door cutout, install the escutcheon shipped with circuit breaker.

1. If not already present, cut an opening in the equipment door for the escutcheon. For the opening dimensions, refer to bulletin 0613IB1205 on the Schneider Electric™ website (for website information see page 5).
2. Install the escutcheon.

Figure 56 – Install Door Escutcheon



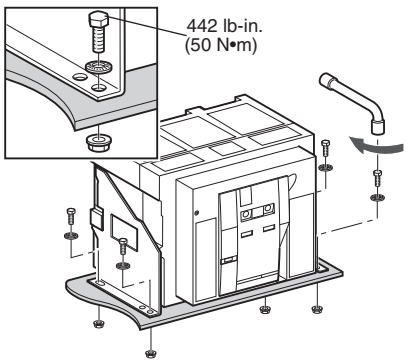
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Install Circuit Breaker

1. If mounting holes are not already present, drill the mounting holes in the pan for mounting the circuit breaker. For circuit breaker mounting hole pattern dimensions, refer to bulletin 0613IB1205 on the Schneider Electric website (for website information see page 5).
2. Check flatness of the mounting surface. Mounting surface must be flat to within 0.08 in. (2 mm).
3. Mount the circuit breaker to pan, using 3/8 in. bolts, washers, and nuts.

NOTE: Vertical mounting brackets are available, if needed.

Figure 57 – Secure Circuit Breaker



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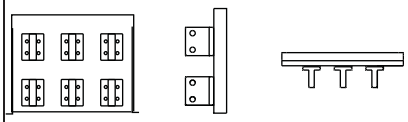
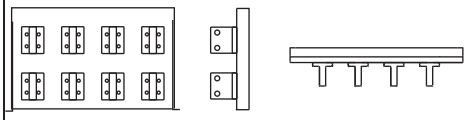
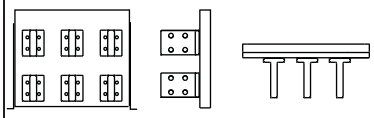
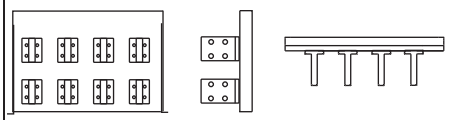
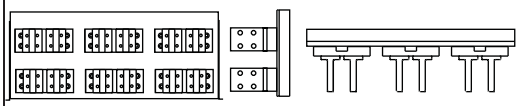
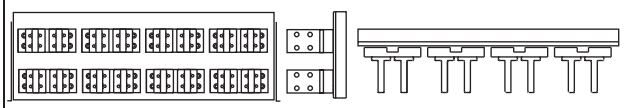
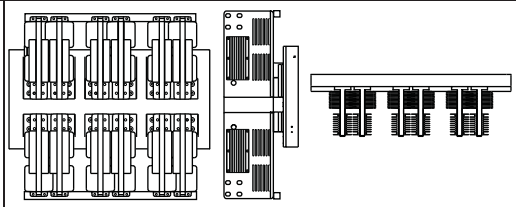
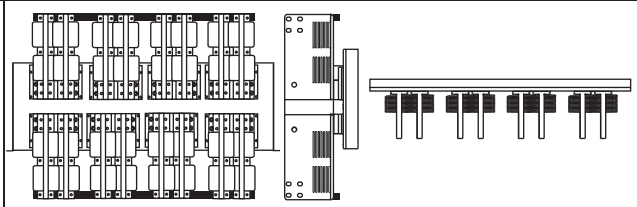
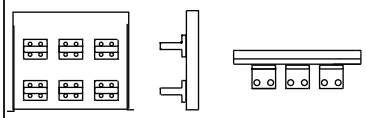
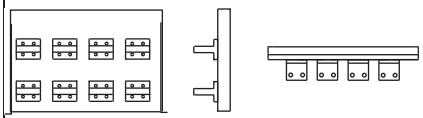
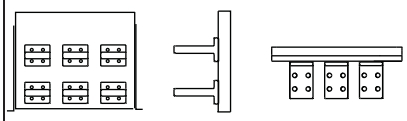
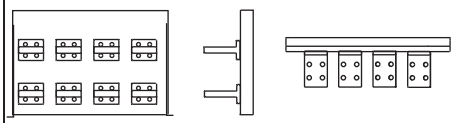
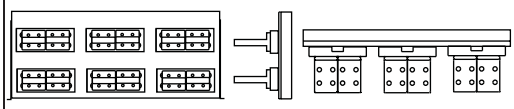
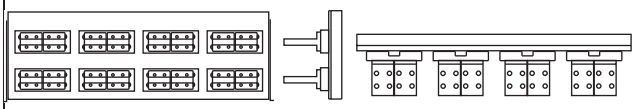
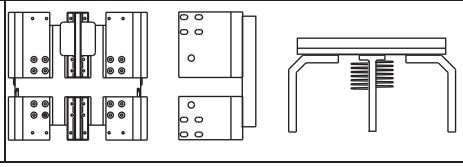
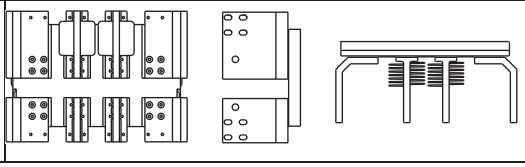
Install Connectors

Standard connectors are shown in Table 12. Tighten the mounting screws to 142–159 lb-in. (16–18 N•m).

For information on non-standard connectors, contact the field office.

For connector dimensions, refer to bulletin 0613IB1205 on the Schneider Electric website (for website information see page 5).

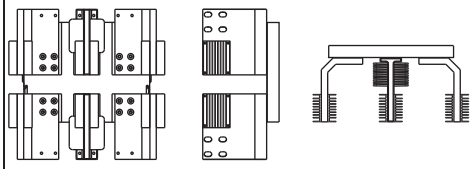
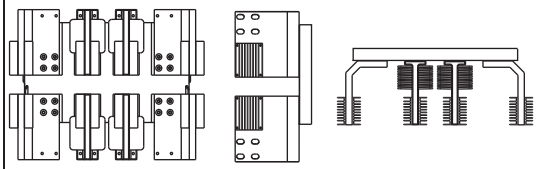
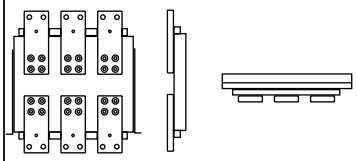
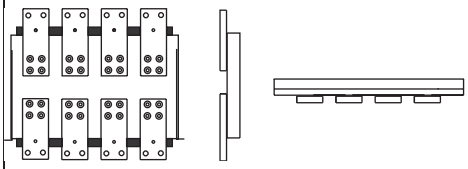
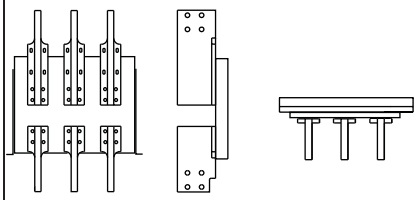
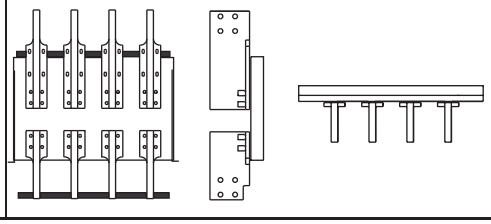
Table 12 – Standard Connectors

Type	Rating	3-Pole Layout Front – Side – Top	4-Pole Layout Front – Side – Top
Rear-Connected "T" Vertical (RCTV)	800–2000 A		
	2500–3000 A		
	4000–5000 A		
	6000 A		
Rear-Connected "T" Horizontal (RCTH)	800–2000 A		
	2500–3000 A		
	4000–5000 A		
Rear-Connected Offset Vertical (RCOV)	3200 A		

Continued on next page

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Table 12 – Standard Connectors *(continued)*

Type	Rating	3-Pole Layout Front – Side – Top	4-Pole Layout Front – Side – Top
Rear-Connected Offset Vertical (RCOV Special)	4000 A W-frame		
Front-Connected Flat (FCF)	800–2000 A		
Front-Connected “T” (FCT)	800–3000 A		

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Install Bussing

NOTICE

HAZARD OF EQUIPMENT DAMAGE

The busbar supports must be placed to support the weight of the bussing system and to withstand magnetic forces caused by short-circuit currents. See **Figure 58, A**.

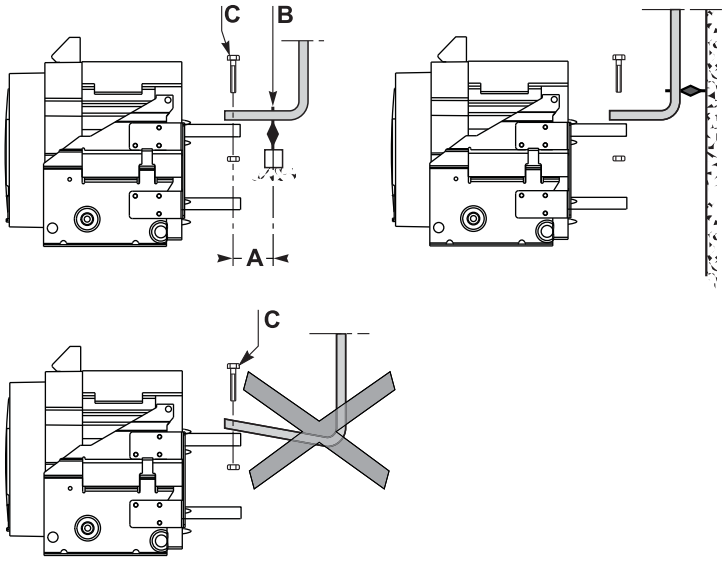
Failure to follow these instructions can result in equipment damage.

NOTE: Installer is responsible for bussing to connectors.

- Bus supports must be braced (**Figure 58, B**) to prevent short circuit forces from deflecting the connectors. The busbar supports (**A**) must be placed to support the weight of the bussing system and to withstand magnetic forces caused by short-circuit currents.
- Busbars should be adjusted to ensure that the connection points are correctly positioned before the bolts (**C**) are inserted. Bussing must be supported by framework of the switchgear, with no weight on connectors.

Bussing requirements by circuit breaker and connector are shown in Table 13.

Figure 58 – Busbar Connections



NOTE: The installer is responsible for bussing to connectors. Bussing must be supported by framework of the switchgear, with no weight on the connectors. Bus supports must be braced to prevent short circuit forces from deflecting the connectors.

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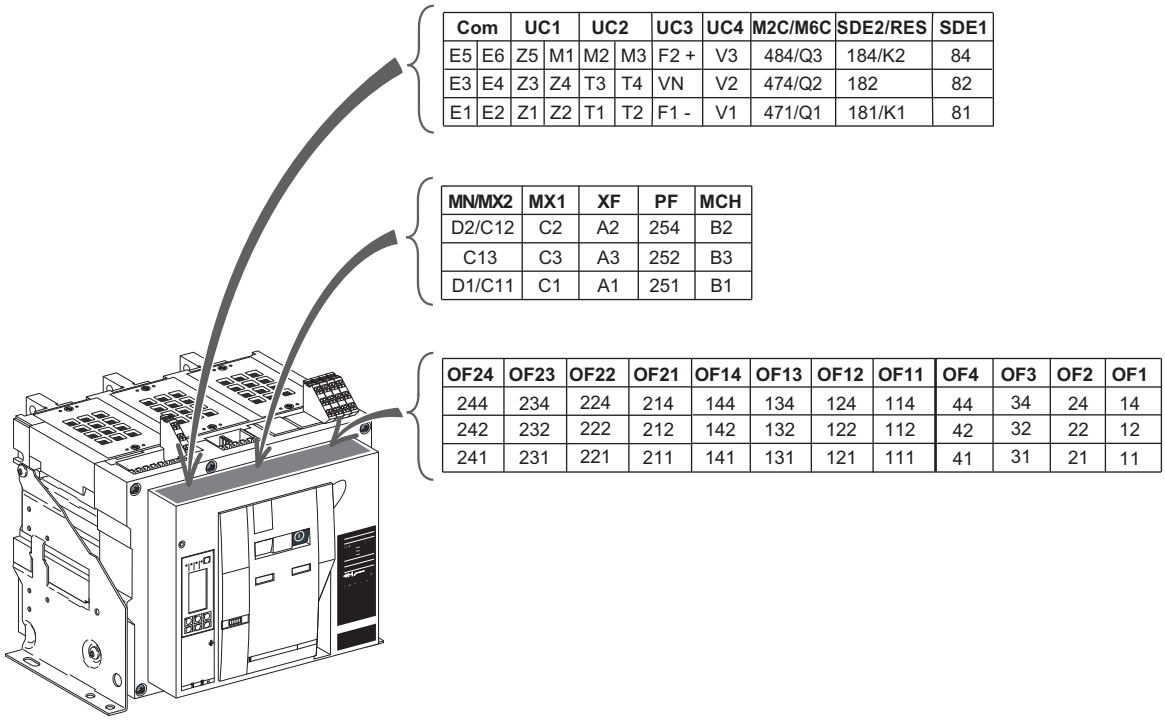
Table 13 – Bus Size Required

Circuit Breaker		Complies with	Connectors	Bus Per Connector	
Rating	**Type**			**Number**	**Size**
800–1200 A	N/N1/H/H1/H2/H3	ANSI C37.50 UL 489	RCTH, RCTV, FCF, FCT	1	0.25 x 3 in. (6 x 76 mm)
1600 A	N/N1/H/H1/H2/H3	ANSI C37.50 UL 489	RCTH, RCTV, FCF, FCT	2	0.25 x 3 in. (6 x 76 mm)
2000 A	N/N1/H/H1/H2/H3	ANSI 37.50 UL 489	RCTH	3	0.25 x 3 in. (6 x 76 mm)
			RCTV, FCT	2	0.25 x 4 in. (6 x 102 mm)
			FCF	3	0.25 x 3 in. (6 x 76 mm)
2500 A	H	UL 489	RCTH	5	0.25 x 3 in. (6 x 76 mm)
			RCTV, FCT	2	0.25 x 5 in. (6 x 127 mm)
3000 A	H	UL 489	RCTH	8	0.25 x 3 in. (6 x 76 mm)
	H		RCTV, FCT	4	0.25 x 4 in. (6 x 102 mm)
3200 A	H1/H2/H3	ANSI 37.50	RCOV	3	0.25 x 5 in. (6 x 127 mm)
4000 A (W-Frame)	H1/H2/H3	ANSI 37.50	RCOV (Special)	4	0.25 x 5 in. (6 x 127 mm)
4000 A	H/H2/H3	ANSI 37.50 UL 489	RCTH	4	0.25 x 6 in. (6 x 152 mm)
			RCTV, FCT	4	0.25 x 5 in. (6 x 127 mm)
		ANSI 37.50	FCF	4	0.25 x 6 in. (6 x 152 mm)
		UL 489	FCF	5	0.25 x 6 in. (6 x 152 mm)
5000 A	H/H2/H3	ANSI 37.50 UL 489	RCTH	8	0.25 x 6 in. (6 x 152 mm)
			RCTV, FCT	6	0.25 x 5 in. (6 x 127 mm)
6000 A	H	UL 489	RCTV	6	0.25 x 6 in. (6 x 152 mm)

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Accessory Connections Using Push-In Connectors

Table 14 – Terminal Layout for Push-In Connector Installation



Com		UC1		UC2		UC3	UC4	M2C/M6C	SDE2/RES	SDE1
E5	E6	Z5	M1	M2	M3	F2 +	V3	484/Q3	184/K2	84
E3	E4	Z3	Z4	T3	T4	VN	V2	474/Q2	182	82
E1	E2	Z1	Z2	T1	T2	F1 -	V1	471/Q1	181/K1	81

MN/MX2	MX1	XF	PF	MCH
D2/C12	C2	A2	254	B2
C13	C3	A3	252	B3
D1/C11	C1	A1	251	B1

OF24	OF23	OF22	OF21	OF14	OF13	OF12	OF11	OF4	OF3	OF2	OF1
244	234	224	214	144	134	124	114	44	34	24	14
242	232	222	212	142	132	122	112	42	32	22	12
241	231	221	211	141	131	121	111	41	31	21	11

Function	Connector	Description
Auxiliary Contacts	OF[1]	Open/Closed Circuit Breaker or Circuit Breaker Position Contacts
	EF	Combined Connected and Closed Contact
Remote Operation	SDE	Electrical Fault Alarm Contact
	RES	Remote Reset
	MN	Undervoltage Trip Device
	MX[2]	Shunt Trip
	XF[2]	Shunt Close
	PF	Ready-to-Close Contact
	MCH	Spring-Charging Motor

[1] OF1, OF2, OF3 and OF4 contacts are standard.
[2] When communicating MX1 or XF coils are used, terminal (C3 or A3) must be connected to line even if the communication module is not installed. The bypass circuit through terminal C2/A2 is only momentary duty (0.5 sec). For continuous duty, use the communications command.

Trip Unit Type					
Basic	A	P	H	Connector	Description
–	•	•	•	Com: E1–E6	Communication
–	•	•	•	UC1: Z	Zone-Selective Interlocking
					Z1 = ZSI OUT Signal
					Z2 = ZSI OUT
					Z3 = ZSI IN Signal
					Z4 = ZSI IN Short Time
					Z5 = ZSI IN Ground Fault
–	•	•	•	UC1: M1	Modified Differential Ground Fault (MDGF)
–	•	•	•	UC2: T	External Neutral
–	•	•	•	UC2: M	Modified Differential Ground Fault (MDGF)
–	•	•	•	UC3: F	24 Vdc External Power Supply
–	–	•	•	UC3: Vn	External Neutral Plug
–	–	•	•	UC4	External Phase Voltage Sensing
–	–	•	•	M2C/M6C	Two Programmable Contacts (internal relay) or Six Programmable Contacts (for connection to external M6C module)

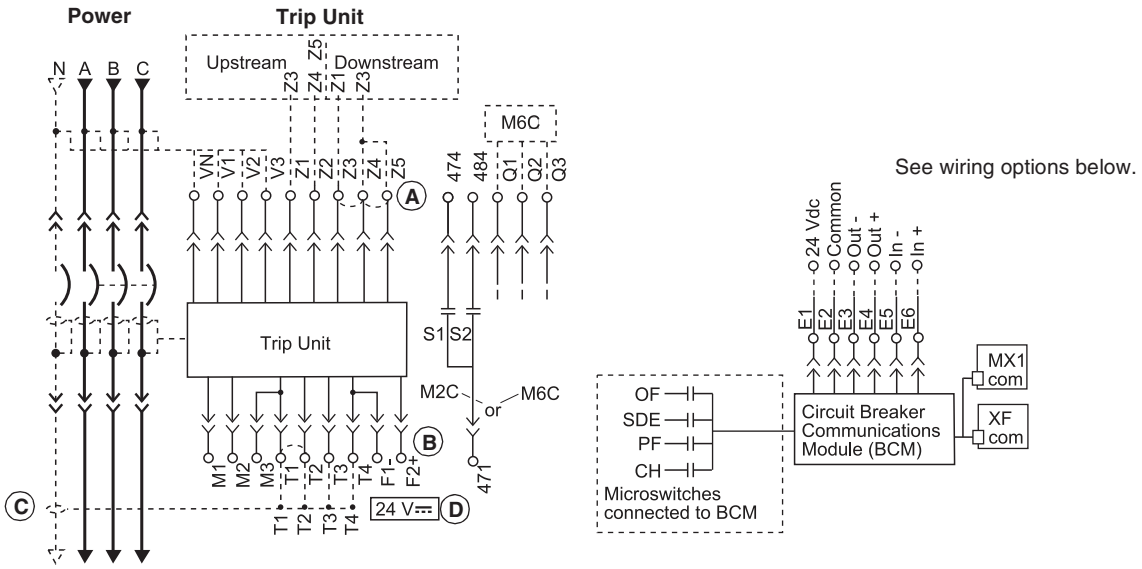
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Wiring Diagrams for Auxiliary Connections

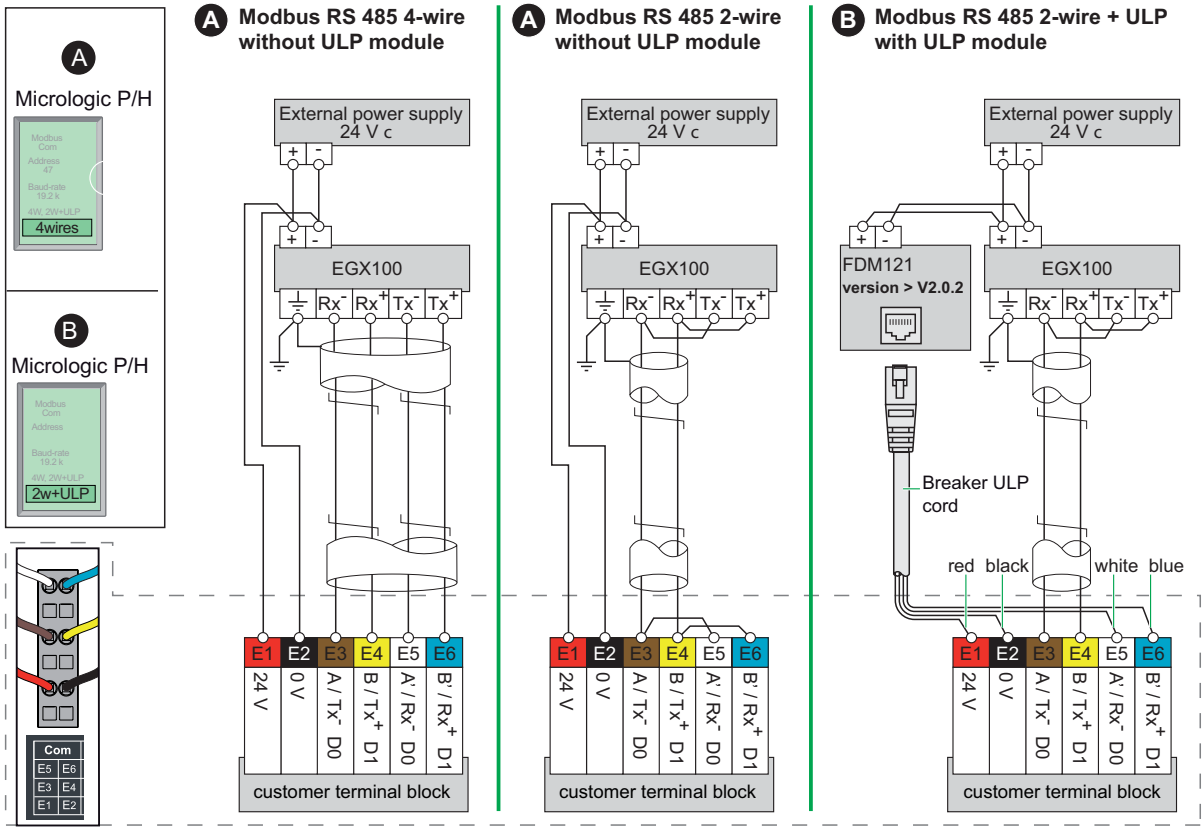
NOTE: All diagrams are showing circuit breaker open, connected and charged.

Figure 59 – Wiring Diagrams for Auxiliary Connections



A—Do not remove factory-installed jumpers between Z3, Z4 and Z5 unless ZSI is connected.
B—Do not remove factory-installed jumper between T1 and T2 unless neutral CT is connected. Do not install jumper between T3 and T4.
C—For proper wiring of neutral CT, refer to wiring schematics on page 61.
D—24 Vdc power supply for trip unit must be separate and isolated from 24 Vdc power supply for communication modules.

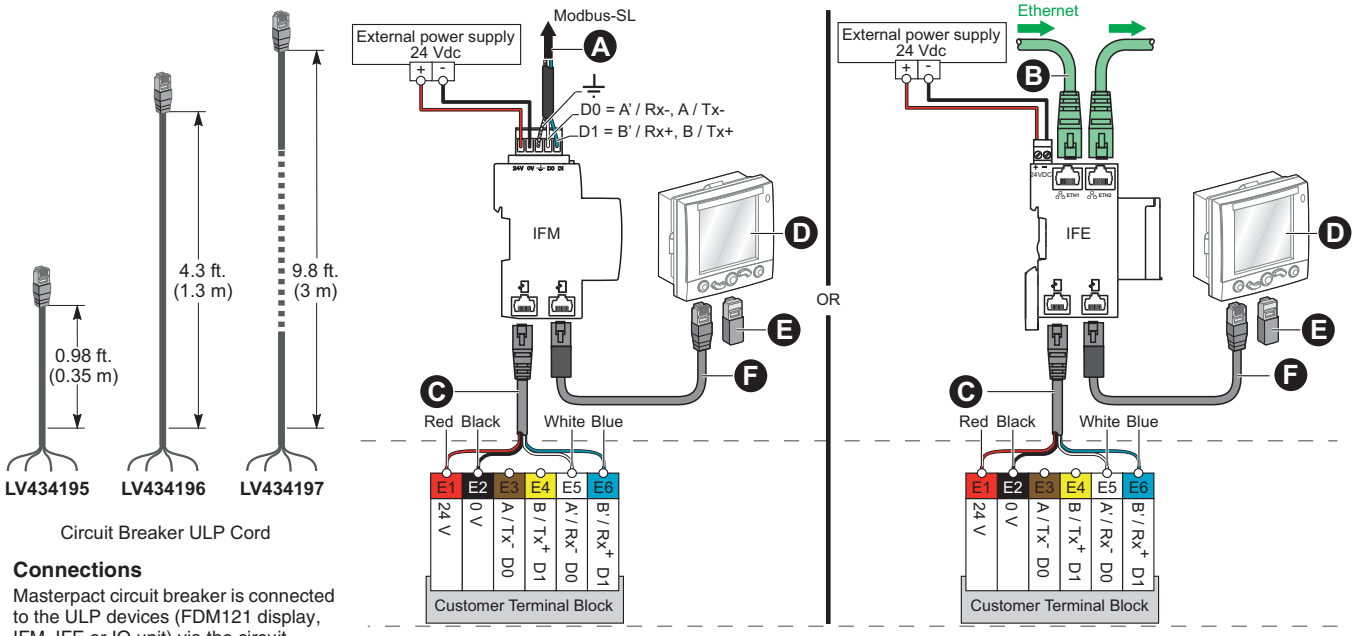
Wiring of the COM Option (Modbus BCM with or without ULP Module)



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Figure 59 – Wiring Diagrams for Auxiliary Connections *(continued)*

Communication Components and FDM121 Connections



Circuit Breaker ULP Cord

Connections

Masterpact circuit breaker is connected to the ULP devices (FDM121 display, IFM, IFE or IO unit) via the circuit breaker ULP cord.

- Cord is available in three lengths: 0.98 ft. (0.35 m), 4.3 ft. (1.3 m) and 9.8 ft. (3 m).
- Lengths up to 32.9 ft. (10 m) are possible using extensions.

A. Modbus Network
B. Ethernet Network
C. Circuit Breaker ULP Cord
D. FDM Display
E. ULP Termination
F. ULP Cable

Markings for Push-In Type Terminals

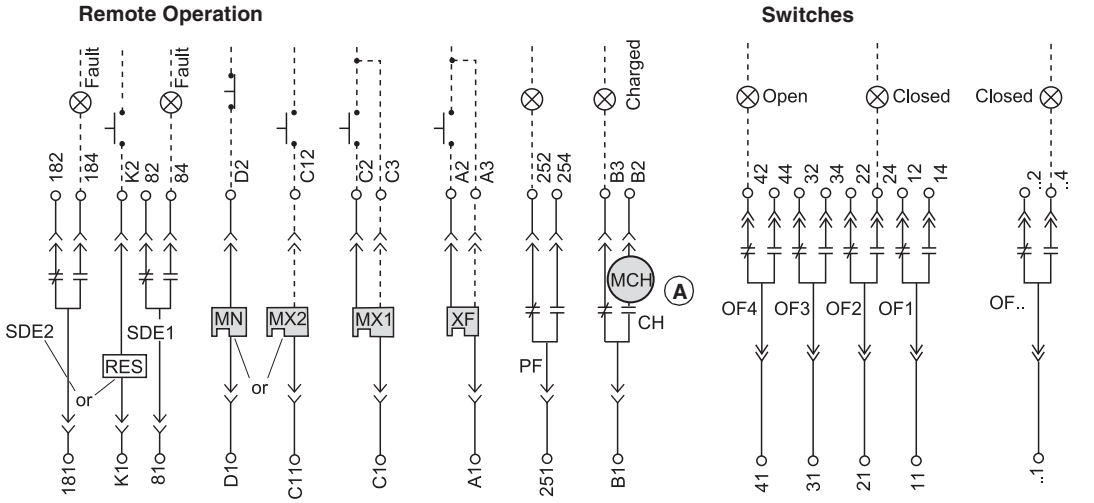
Trip Unit							
COM	**UC1**	**UC2**	**UC3**	**UC4**	**M2C/M6C**	**SDE2/Res.**	**SDE1**
E5 E6	Z5 M1	M2 M3	F2+	V3	484/Q3	184/K2	84
E3 E4	Z3 Z4	T3 T4	VN	V2	474/Q2	182	82
E1 E2	Z1 Z2	T1 T2	F1–	V1	471/Q1	181/K1	81

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NOTE: All diagrams are showing circuit breaker open, connected and charged.

Figure 60 – Wiring Diagrams for Auxiliary Connections



A—When remote operation features are used, make sure there is a minimum of four seconds for the spring charging motor (MCH) to completely charge the circuit breaker closing springs prior to actuating the shunt close (XF) device.

Markings for Push-In Type Terminals

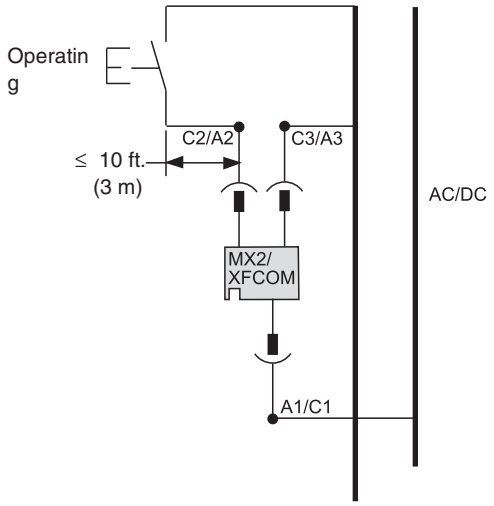
Remote Operation					Auxiliary Switches											
MN/MX2	MX1	XF	PF	MCH	OF24	OF23	OF22	OF21	OF14	OF13	OF12	OF11	OF4	OF3	OF2	OF1
D2/C12	C2	A2	254	B2	244	234	224	214	144	134	124	114	44	34	24	14
C13	C3	A3	252	B3	242	232	222	212	142	132	122	112	42	32	22	12
D1/C11	C1	A1	251	B1	241	231	221	211	141	131	121	111	41	31	21	11

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Communicating Shunt Trip (MX) and Shunt Close (XF)

A recommended wiring schematic for the communicating style shunt trip or shunt close coils is shown in Figure 61. Induced voltages in the circuit at terminal C2 and/or A2 can cause the shunt trip or shunt close to not work properly. The best way to prevent the induced voltages is keep the circuit to terminal C2 and A2 as short as possible. If it is impossible to keep the circuit less than ten feet (three meters), use an interposing relay near terminal C2 or A2.

Figure 61 – Communicating Wiring Schematic

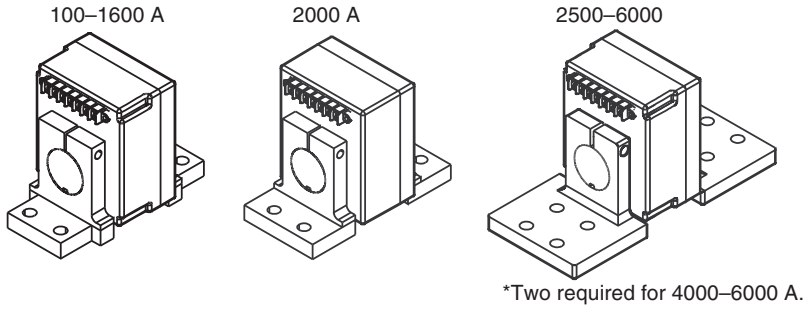


Ground-Fault Protection for Equipment

If the circuit breaker does not have integral ground-fault tripping or alarm, skip this subsection.

A three-phase, four-wire circuit requires an external neutral current transformer (CT). Connect the neutral CT to the circuit breaker according to the wiring diagrams in Figures 63 and 64.

Figure 62 – Neutral Current Transformers



*Two required for 4000–6000 A.

1. Connect the primary:
   - — If load is connected to the lower end of the circuit breaker, connect the load neutral to the H1 terminal of neutral CT.
   - — If the source power is connected to the lower end of the circuit breaker, connect the source neutral to the H1 terminal of the neutral CT.

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NOTE: The equipment grounding connection must be upstream (line side) of the neutral CT and a neutral connection must exist from the supply transformer to the equipment.

2. For circuit breakers using Micrologic™ 5.0P, 5.0H, 6.0P, or 6.0H trip units, connect terminal Vn on the neutral current transformer to the Vn terminal of the control wiring terminal. (This is necessary to allow the trip unit to make voltage measurements.) Terminals Vc and Vn are internally connected.

CAUTION

HAZARD OF IMPROPER TRIP SYSTEM OPERATION

F1 and F2 must be isolated from ground. Verify all wiring per the instructions in this bulletin.

Failure to follow these instructions can result in a nuisance trip during closing.

3. Remove the factory-installed jumper connecting T1 and T2.
4. Feed Belden cable from the neutral CT to the cradle terminals.
5. Connect the cable per the appropriate schematic in Figure 63 or 64.
6. Verify all wiring.

NOTE: Modified differential ground-fault circuitry and ground-source return ground-fault circuitry require the use of a modified differential ground-fault module (MDGF) and special current transformers. For wiring of those systems, see the instructions with the MDGF.

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Figure 63 – Wiring Schematic for 800–4000 A Standard-Width NW Circuit Breakers

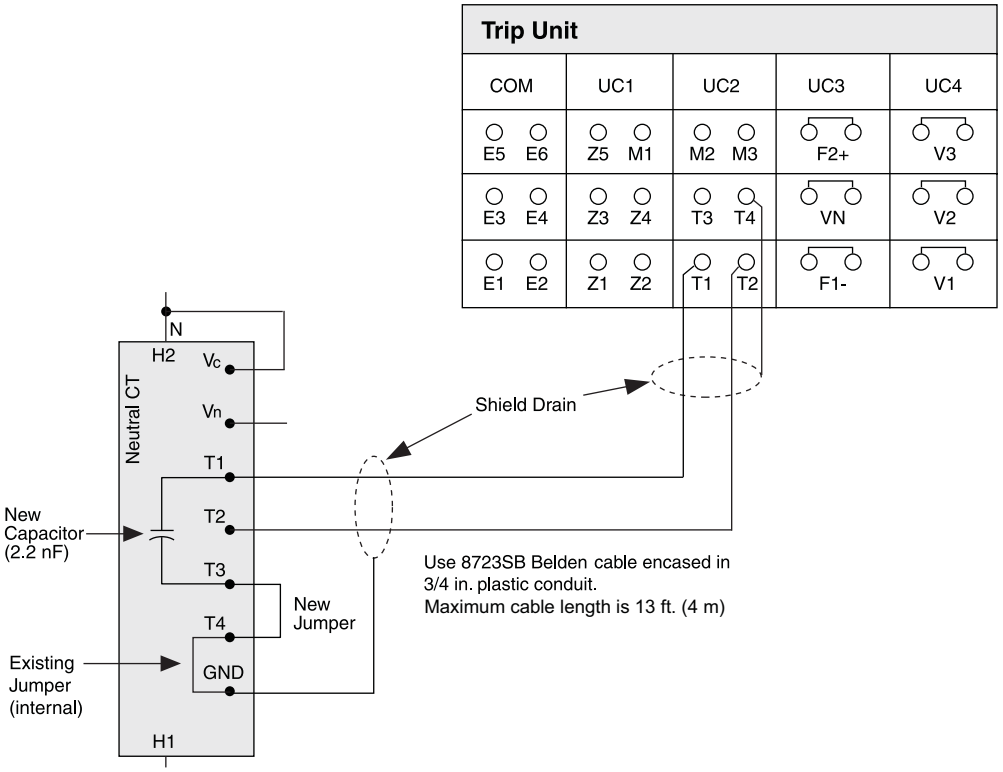
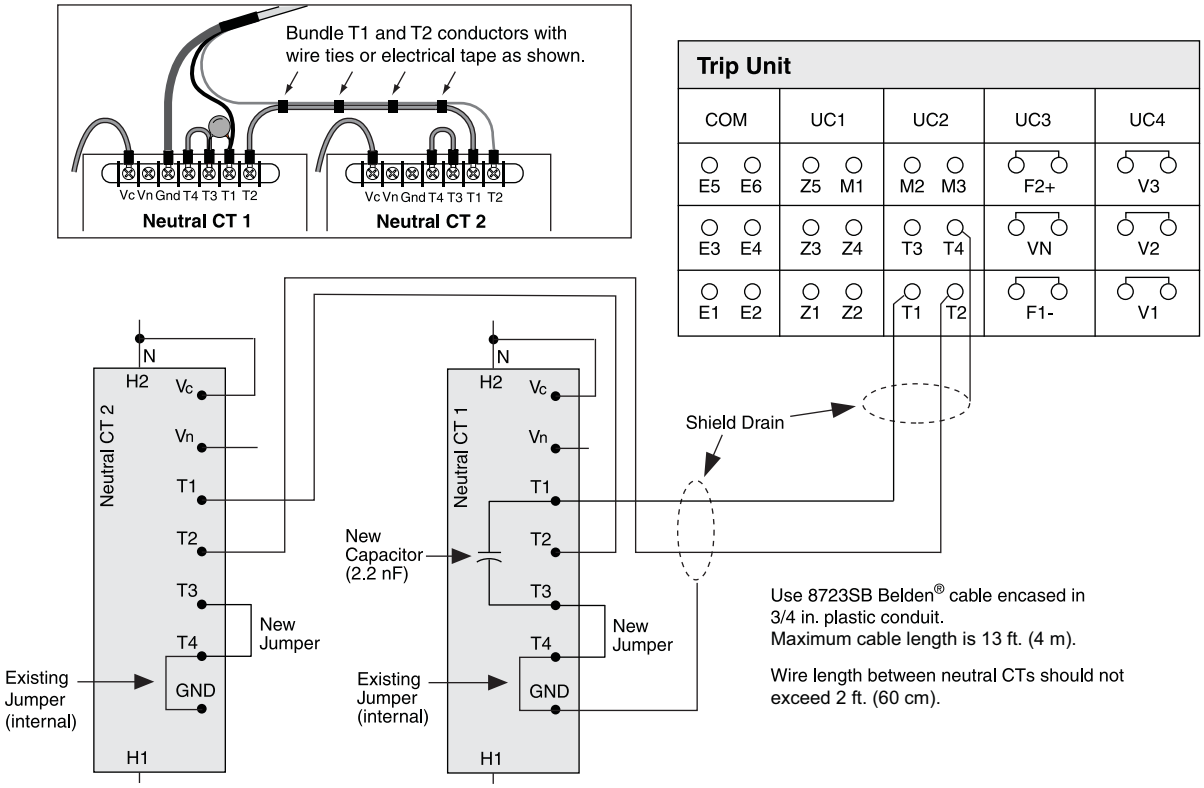


Figure 64 – Wiring Schematic for 3200–6000 A Wide-Construction NW Circuit Breakers

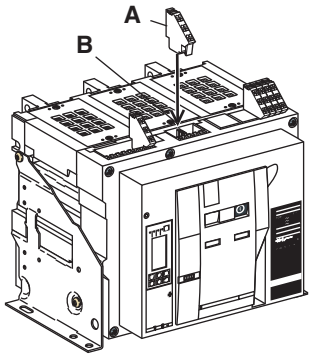


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Accessory Wiring

1. Install push-in connector (**Figure 65, A**) in the correct slot (**B**). Connector positions are shown on label next to connector slots.

Figure 65 – Install Push-In Connector

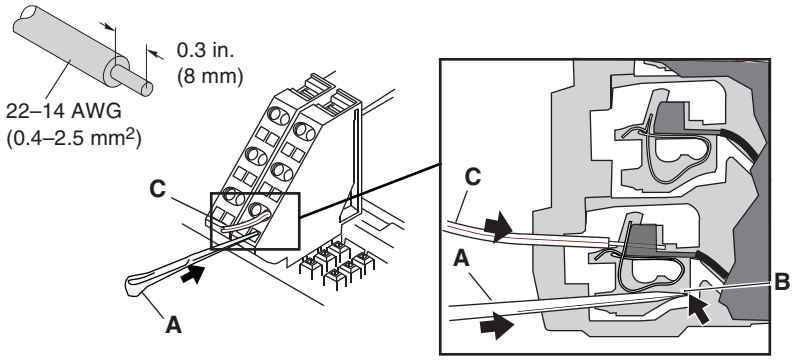


2. Push a Wago wire insert tool (**Figure 66, A**, Wago part no. 209-129) fully into the connector (to point **B**) and install the control wires (**C**).

NOTE: Remove a push-in connector in reverse order of installation.

See Section 6—Operation for instructions on operating circuit breaker.

Figure 66 – Install Control Wires



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Test Equipment Ground-Fault Protection

Paragraph 230-95(c) of the National Electrical Code requires that all equipment ground-fault protection systems be tested when first installed. If the circuit breaker has equipment ground-fault protection installed, test it at this time.

Make sure the trip unit is powered. The trip unit is powered if:

- The circuit breaker is closed or bottom-fed and has more than 100 V of load voltage on two phases (P or H trip unit only).
- A full-function or hand-held test kit is connected and on.
- A 24 Vdc external power supply is connected.
- An external voltage tap is installed and voltage of more than 100 V is present on two phases (P or H trip unit only).

If this is a radial (single-ended) system, press the ground-fault push-to-test button (**Figure 67, A**). The circuit breaker will trip and the trip unit ground-fault indicator light will come on.

Record results in Table 15.

If a complete check of the ground-fault system is necessary, use primary injection testing. If the system has multiple sources and/or requires field connections at the job site, use primary injection testing.

Figure 67 – Test Ground-Fault Push-to-Test

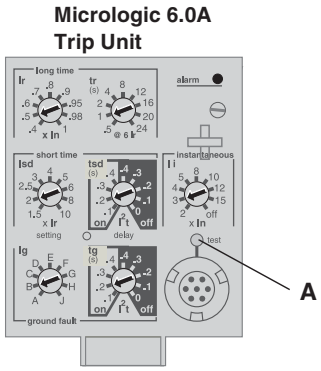


Table 15 – Ground-Fault Test Results

Date	Ground-Fault Settings	Test Results	Signature

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Circuit Breaker Removal

1. Turn off all power supplying this equipment before working on or inside equipment.
2. Remove the circuit breaker in reverse order of installation. Use lifting methods as detailed in Section 2—Lifting and Transporting.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

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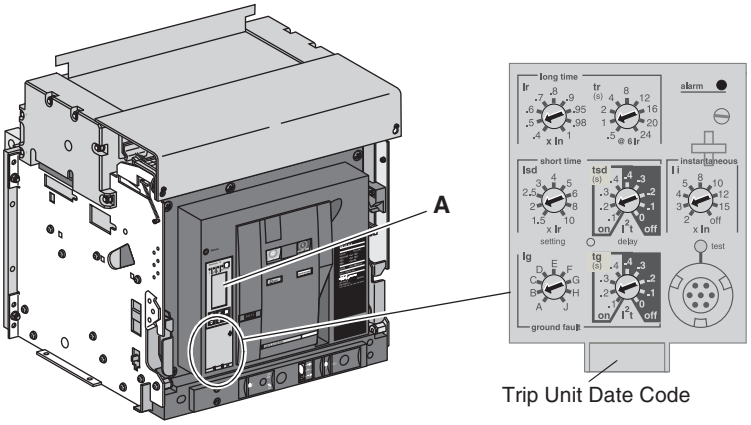
Section 5— Trip Unit

Protective functions, measurement functions, and communications are controlled by the Micrologic™ trip unit (**Figure 68, A**) installed in the circuit breaker. The trip unit is field replaceable for easy upgrading of functionality.

For complete information on the trip unit, its functions, and field replacement, see the trip unit user guide available from the Schneider Electric™ website.

For complete information on which trip units are available and their capabilities, see catalog 0613CT1001, *Masterpact NT and NW Universal Power Circuit Breakers* on the Schneider Electric website (for website information see page 5).

Figure 68 – Micrologic Trip Unit



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ENGLISH

Section 6— Operation

Drawout Circuit Breaker Status

⚠ DANGER

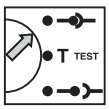
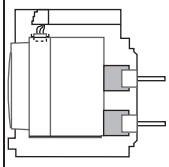
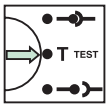
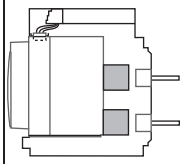
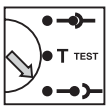
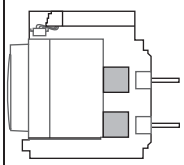
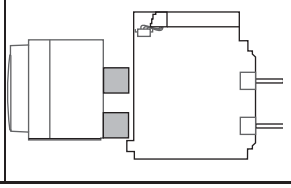
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.

Failure to follow these instructions will result in death or serious injury.

Connection or disconnection of the drawout circuit breaker requires insertion of the racking handle (while pressing the “Push to open” button). If interlocks, padlocks, or an open door lock are in place, the racking handle cannot be inserted.

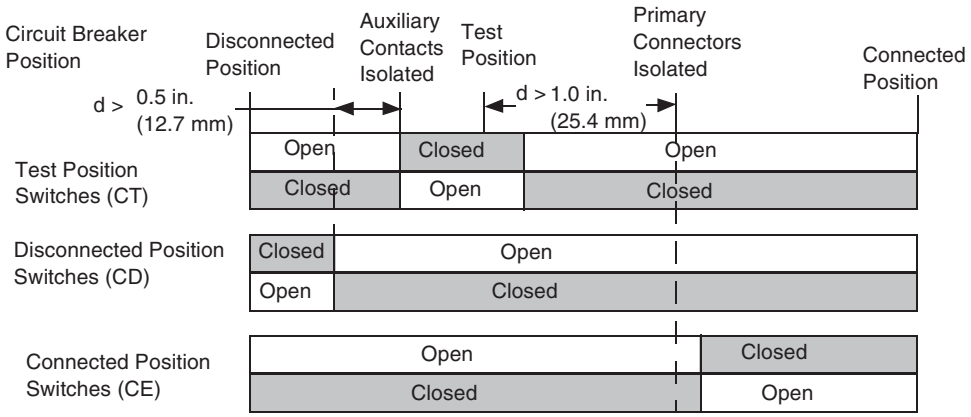
Table 16 – Drawout Circuit Breaker Positions

Position Indicator	Connector Position (Cluster shield not shown)	Connectors		Circuit Breaker Status
		Clusters	Secondary (Control)	
Connected 		Engaged	Engaged	Can be operated. Ready for service.
Test 		Disengaged	Engaged	Can be operated. Can have operation and control systems tested.
Disconnected 		Disengaged	Disengaged	Can be operated. Can be removed from carriage.
Withdrawn 		Disengaged	Disengaged	Removed from carriage.

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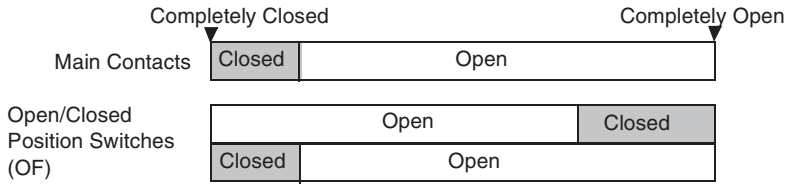
As the circuit breaker position changes, the position contacts change states.

Figure 69 – Device Position Operation



As the circuit breaker main contacts operate, the auxiliary contacts change positions.

Figure 70 – Device Contact Operation



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Drawout Circuit Breaker Connection

NOTICE

HAZARD OF EQUIPMENT DAMAGE

- Use the racking handle provided to rack the circuit breaker into or out of the cradle.
- Do not use power tools for racking.
- Do not continue to turn handle after stop release button has popped out.

Failure to follow these instructions can result in equipment damage.

⚠ DANGER

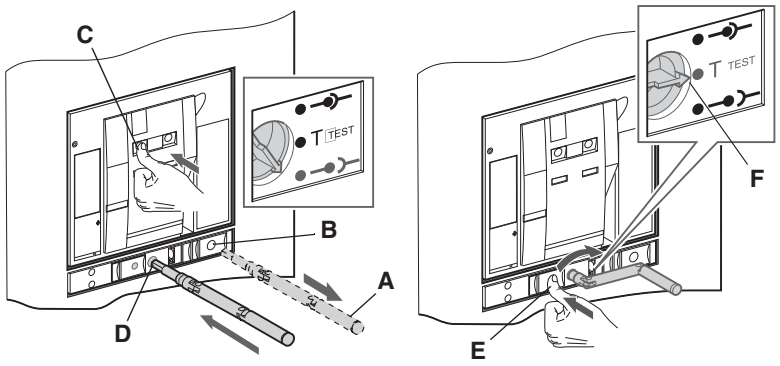
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.

Failure to follow these instructions will result in death or serious injury.

1. Disconnect the load from the secondary disconnects.
2. Remove the racking handle (**Figure 71, A**) from its storage hole (**B**).
3. While pressing the “Push to open” button (**C**), insert the racking handle in the racking slot (**D**).
4. Push the stop release button (**E**).
5. Turn the racking handle clockwise until the test position (**F**) is reached. The stop release button will pop out.

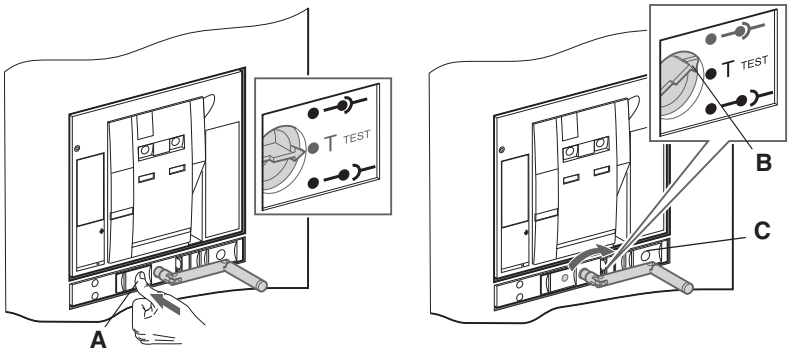
Figure 71 – Rack Circuit Breaker to Test Position



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6. Push the stop release button (**Figure 72, A**).
7. Turn the racking handle clockwise until the connected position (**B**) is reached. The stop release button will pop out. Replace the racking handle in its storage hole (**C**).
8. Reconnect the load to the secondary disconnects.

Figure 72 – Rack Circuit Breaker to Connected Position



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Drawout Circuit Breaker Disconnection

NOTICE

HAZARD OF EQUIPMENT DAMAGE

- Use the racking handle provided to rack the circuit breaker into or out of the cradle.
- Do not use power tools for racking.
- Do not continue to turn handle after stop release button has popped out.

Failure to follow these instructions can result in equipment damage.

⚠ DANGER

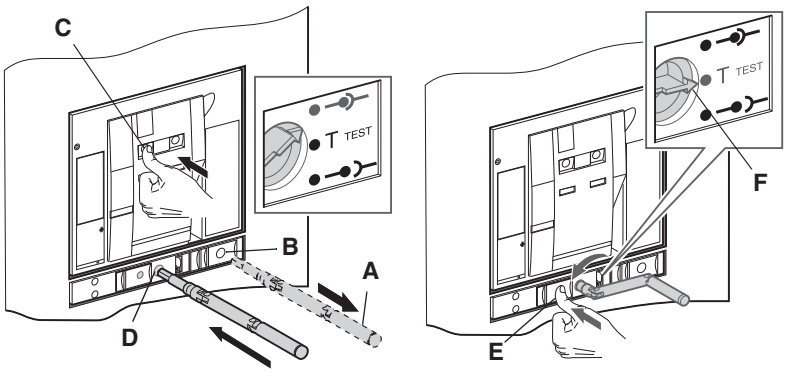
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.

Failure to follow these instructions will result in death or serious injury.

1. Remove the load from the secondary disconnects.
2. Remove the racking handle (**Figure 73, A**) from its storage hole (**B**).
3. While pressing the “Push to open” button (**C**), insert the racking handle in the racking slot (**D**).
4. Push the stop release button (**E**). Turn the racking handle counterclockwise until the test position (**F**) is reached. The stop release button will pop out.

Figure 73 – Rack Circuit Breaker to Test Position



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5. Push the stop release button (**Figure 74, A**).
6. Turn the racking handle counterclockwise until the disconnected position (**B**) is reached. The stop release button will pop out. Replace the racking handle in its storage hole.
7. Reconnect the load to the secondary disconnects.

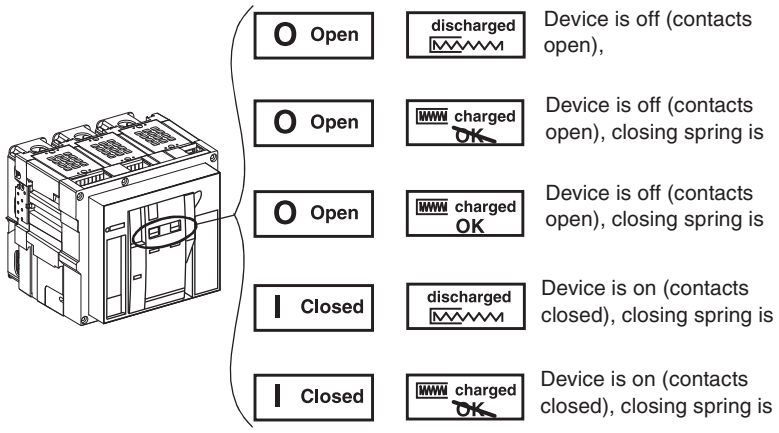
Figure 74 – Rack Circuit Breaker to Disconnected Position



Circuit Breaker Operation

The circuit breaker is closed by means of a two-step stored energy mechanism. Status indicators on the front of the circuit breaker indicate whether the circuit breaker is open or closed, and whether the closing spring is charged or discharged. The opening springs are automatically charged when the circuit breaker closes.

Figure 75 – Status Indicators



[1] Not OK to turn on will be shown if:
Shunt trip is energized
Circuit breaker is not connected, test, disconnected or withdrawn position
Undervoltage trip is not energized

Anti-Pumping Function

The Masterpact circuit breaker is designed to mechanically provide an anti-pumping function. If either the shunt close or shunt trip coil is continuously powered, or both are powered at the same time, the circuit breaker will open and cannot be closed until the power has been removed. This prevents the circuit breaker from cycling between closing and opening (called pumping).

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When remote operation features are used, make sure there is a minimum of four seconds for the spring charging motor (MCH) to completely charge the circuit breaker closing springs prior to actuating the shunt close (XF) coil. The ready-to-close switch (PF) can be series connected with the shunt close (XF) coil to prevent premature closing.

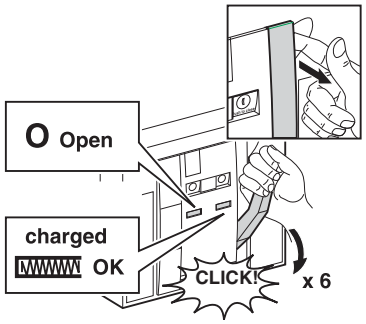
Charging the Closing Spring

To close the circuit breaker, the closing spring must be charged with sufficient energy for closing.

- Manual Charge: Use the charging handle to charge the closing spring.
- Automatic Charge: If the optional MCH spring-charging motor is installed, the spring is automatically charged after closing.

NOTE: The closing spring on the drawout circuit breaker will automatically discharge when the circuit breaker is moved from the disconnect to the withdrawn position.

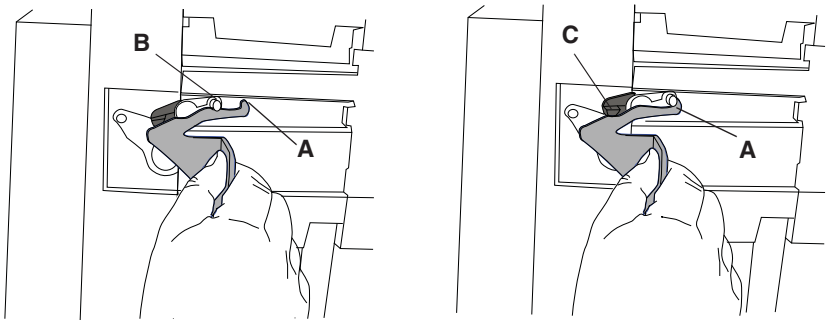
Figure 76 – Manual Spring Charge



NOTE: To close a drawout circuit breaker when it is not installed in the cradle, the cradle interlock must be defeated before the circuit breaker charging spring can be charged. A cradle interlock defeat tool is shipped with every circuit breaker. To install:

1. Slide the interlock defeat tool (**Figure 77, A**) into the groove under the interlock lever (**B**) on the right side of the circuit breaker.
2. Slide the tool toward the front of the circuit breaker and lock it in place under the cradle interlock shaft (**C**).

Figure 77 – Defeating Cradle Interlock



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Close Circuit Breaker

To close the circuit breaker, the following conditions must be met:

- The device is open (O).
- The charging spring is charged.
- “OK” is displayed.

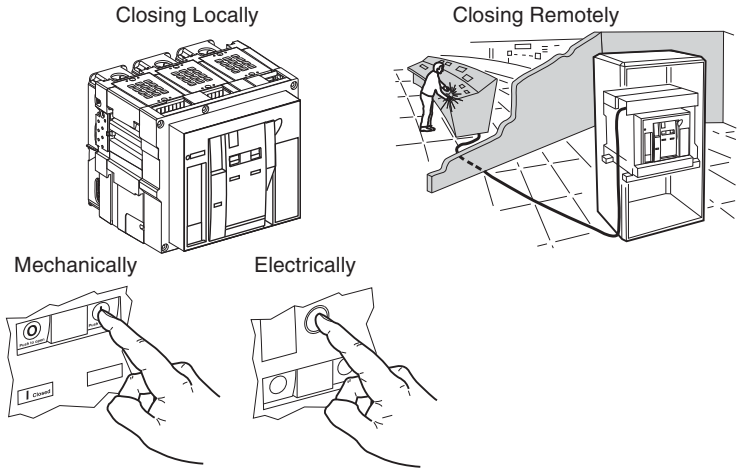
NOTE: The circuit breaker cannot be closed while an opening order is being received. If the “not OK” symbol is displayed, an order to open is being received (electrically or manually) and must be ended before the “OK” will be displayed.

If the above conditions are met, close the device:

- Mechanically: press the “Push to close” button on the circuit breaker.
- Electrically: if the optional shunt close (XF) is installed, press the optional electrical-close push button (BPFE) on the circuit breaker or a push button at a remote location.

  For more information, refer to the circuit breaker user guide on the Schneider Electric™ website (for website information see page 5).

Figure 78 – Close Circuit Breaker



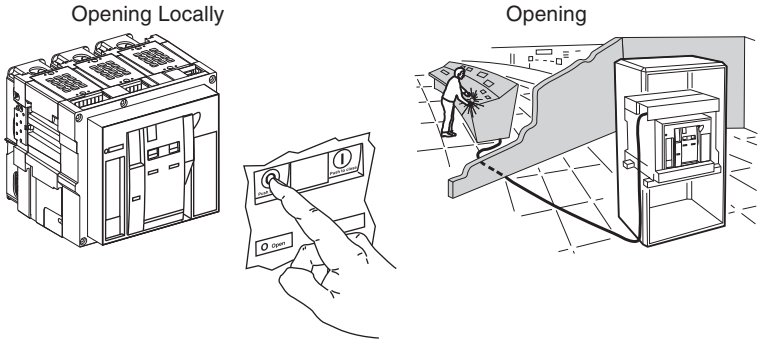
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Open Circuit Breaker

- Mechanically: press the “Push to open” button on the circuit breaker.
- Electrically: operate remotely through the optional shunt trips (MX1 and MX2), undervoltage trip device (MN), or time-delay module for undervoltage trip accessory (MNR).

  For more information, refer to the circuit breaker user guide on the Schneider Electric website (for website information see page 5).

Figure 79 – Turn Off Circuit Breaker



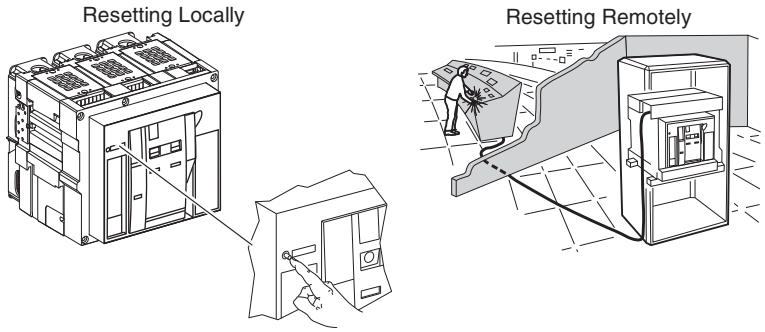
Reset Circuit Breaker

After a fault trip, the circuit breaker must be reset.

- Mechanically: press the “Reset” button located above the trip unit.

  Electrically: use the electrical reset option (RES) after an electrical fault. For more information, refer to the circuit breaker user guide on the Schneider Electric website (for website information see page 5).

Figure 80 – Reset Circuit Breaker



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Neutral Protection

Neutral protection protects the neutral conductors against overheating.

- For a three-pole circuit breaker with a P or H trip unit, neutral protection is possible if a neutral current transformer is used.
  - — Adjust the neutral using the trip unit keypad of the P or H trip unit.
  - — Possible settings are OFF, N/2, N, or 1.6N.
  - — Factory setting is OFF.

Oversize neutral protection (1.6N) requires the use of the appropriate oversize neutral current transformer. See price list for correct neutral current transformer.

NOTICE

HAZARD OF EQUIPMENT DAMAGE

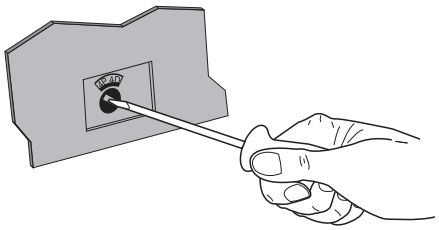
If a four-pole circuit breaker neutral pole switch is set to 4P 3D setting, the current in the neutral must not exceed the rated current of the circuit breaker.

For a three-pole circuit breaker with oversize neutral protection (1.6N), select the appropriate oversize neutral current transformer.

Failure to follow these instructions can result in equipment damage.

- For a four-pole circuit breaker, set the system type using the circuit breaker neutral selector dial (see Figure 81).
  - — With a P or H trip unit, make fine adjustments using the trip unit keypad, with the circuit breaker dial setting providing the upper limit for adjustment.
  - — Factory setting is 4P 4D.

Figure 81 – Four-Pole Circuit Breaker Neutral Selector Dial



Neutral Protection Settings for Four-Pole Circuit Breaker

Circuit Breaker Selector Dial	P or H Trip Unit Keypad Setting
4P 3D	Off, N/2, N
3P N/2	N/2
4P 4D	N/2, N

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- Neutral protection conductor type has four possible settings:
  - — Off (4P 3D)—Neutral protection is turned off.
  - — N/2 (3P N/2)—Neutral conductor capacity is one-half that of the line conductors.
  - — N (4P 4D)—Neutral conductor capacity is the same as that of the line conductors.
  - — 1.6N—Neutral conductor capacity is 1.6 times that of the line conductors. (Three pole circuit breaker with P or H trip unit only.)

Table 17 – Micrologic™ Trip Unit Conductor Type

Setting	Long-Time Pickup		Short-Time Pickup		Instantaneous		Ground-Fault Pickup	
	Trip Unit	Neutral	Trip Unit	Neutral	Trip Unit	Neutral	Trip Unit	Neutral
OFF	Ir	None	Isd	None	Ii	None	Ig	None
N/2	Ir	1/2 Ir	Isd	1/2 Isd	Ii	Ii	Ig	Ig
N	Ir	Ir	Isd	Isd	Ii	Ii	Ig	Ig
1.6N	Ir	1.6 x Ir	Isd	1.6 x Isd*	Ii	Ii	Ig	Ig

*In order to limit the range, limited to 10 x In.

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Section 7— Locks, Interlocks, and Accessories

A number of optional locking and interlocking devices and accessories are available for the Masterpact circuit breaker and cradle. The operation of these devices is described in bulletin 0613IB1203: *Masterpact™ NW Low-Voltage Power/Insulated Case Circuit Breaker with ArcBlok Technology—User Guide* available on the Schneider Electric™ website (for website information see page 5).

For a complete listing of the available locks, interlocks, and accessories, see catalog 0613CT1001, *Masterpact NT and NW Universal Power Circuit Breakers* on the Schneider Electric website. For more information, refer to the circuit breaker user guide on the Schneider Electric website (for website information see page 5).

For detailed installation instructions on field-installable locks, interlocks, and accessories refer to the installation instructions shipped with the devices.

Accessories can be installed in an installed circuit breaker or an installed cradle.

Installing Circuit Breaker Accessories

Place the circuit breaker in the disconnect position. See Circuit Breaker Disconnection, page 70, for instructions on disconnecting the circuit breaker.

Install circuit breaker accessories, see “Install Accessories” on page 42.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.

Failure to follow these instructions will result in death or serious injury.

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Installing Cradle Accessories

1. Turn off all power supplying this equipment before working on or inside equipment.
2. Remove the circuit breaker from the cradle. See Circuit Breaker Removal, page 46 for instructions on removing the circuit breaker.
3. Install accessory as instructed in the instructions packed with the individual accessory.
4. Replace the circuit breaker in the cradle. See Circuit Breaker Installation, page 38, for instructions on installing the circuit breaker.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

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Section 8— Testing, Maintenance and Troubleshooting

For information on field testing, maintenance, and troubleshooting see bulletin 0613IB1201, Masterpact NT and NW Field Testing and Maintenance Guide, which can be found on the Schneider Electric website:

http://www.schneider-electric.com

For application assistance, please call 1-888-778-2733.

Table 18 – Troubleshooting Guide

Problem	Probable Causes	Solutions
Circuit breaker cannot be closed locally or remotely	Circuit breaker padlocked or keylocked in the “OPEN” position.	Disable the locking function.
	Circuit breaker interlocked mechanically in a source changeover system.	• Check the position of the other circuit breaker in the changeover system. • Modify the situation to release the interlock.
	Circuit breaker not completely connected.	Complete racking in (connection) of the circuit breakers.
	The reset button signalling a fault trip has not been reset.	• Clear the fault. • Push the reset button on the front of the circuit breaker.
	Stored energy mechanism is not charged.	• Charge the mechanism manually. • If it is equipped with an MCH spring charging motor, check the supply of power to the motor. If the problem persists, replace the spring charging motor.
	MX opening shunt release (shunt trip) is permanently supplied with power.	There is an opening order. Determine the origin of the order. The order must be cancelled before the circuit breaker can be closed.
	MN undervoltage release (UVR) not supplied with power.	• There is an opening order. Determine the origin of the order. • Check the voltage and the supply circuit (V 0.84 Vn). • If the problem persists, replace the release.
	XF closing release (shunt close) continuously supplied with power, but circuit breaker is not “ready to close” (XF not wired in series with PF contact).	Open the supply of power to the XF closing release, then send the closing order again using the XF, but only if the circuit breaker is “ready to close”.
	Circuit breaker uses a Micrologic P or H trip unit, which has a permanent trip order with minimum voltage and minimum frequency protection in the Trip mode and the trip unit powered.	Disable these protection function son the Micrologic P or H control unit.
Circuit breaker cannot be closed remotely but can be opened locally using the closing pushbutton.	Closing order not executed by the XF closing release (shunt close).	Check the voltage on the supply circuit (0.85–1.1 Vn). If the problem persists, replace the XF release.
Circuit breaker cannot be opened remotely but can be opened locally	Closing order not executed by the MX opening release (shunt trip).	Check the voltage on the supply circuit (0.7–1.1 Vn). If the problem persists, replace the XF release.
	Opening order not executed by the MN undervoltage release (UVR).	Drop in voltage is insufficient or residual voltage (> 0.35 Vn) across the terminals of the undervoltage release. If the problem persists, replace the MN release.
Circuit breaker cannot be opened locally.	Operating mechanism malfunction or damaged contacts.	Contact a Schneider Electric service center.
Circuit breaker can be reset locally but not remotely.	Insufficient supply voltage for the MCH spring charging motor.	• Check the voltage and the supply circuit (0.7–1.1 Vn). • If the problem persists, replace the MCH release.
Unexpected tripping with activation of the reset button signalling a fault trip.	A fault is present: • Overload • Earth fault (ground fault) • Short-circuit detected by the trip unit.	• Determine and clear the causes of the fault. • Check the condition of the circuit breaker before putting it back into service.

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Table 18 – Troubleshooting Guide

Problem	Probable Causes	Solutions
Unexpected tripping without activation of the reset button signalling a fault	MN undervoltage release (UVR) supply voltage too low.	Check the voltage on the supply circuit (V>0.58 Vn).
	Load-shedding order sent to the MX opening release (shunt trip).	• Check the overall load on the distribution system. • If necessary, modify the settings of the devices in the installation.
	Unnecessary opening order from the MX opening release (shunt trip).	Determine the origin of the order.
Instantaneous opening after each attempt to close the circuit breaker with activation of the reset button signalling a fault trip.	Thermal memory.	• See the trip unit user manual. • Press the reset button.
	Transient overcurrent when closing.	• Modify the distribution system or the trip unit settings. • Check the condition of the circuit breaker before putting it back into service. • Press the reset button.
	Closing on a short-circuit.	• Clear the fault. • Check the condition of the circuit breaker before putting it back into service. • Press the reset button.
Nuisance tripping of the circuit breaker with activation of the reset button signalling a fault trip.	Reset button is not pushed in completely.	Push the reset button in completely.
Cannot insert crank in connected, test, or disconnected position.	A padlock or keylock is present on the cradle or a door interlock is present.	Disable the locking function.
Cannot turn the crank.	The reset button has not been pressed.	Press the reset button while turning racking handle (crank).
Circuit breaker cannot be removed from the cradle.	Circuit breaker is not in the disconnected position.	Turn the racking handle (crank) until the circuit breaker is in the disconnected position and the reset button is out.
	The rails are not completely out.	Pull the rails all of the way out.
	Racking handle (crank) has not been removed from the racking mechanism.	Remove and store the racking handle.
Circuit breaker cannot be racked in (placed in connected position).	Cradle/ circuit breaker mismatch protection (cell keying) is preventing racking.	Check that the cradle corresponds with the circuit breaker.
	The disconnecting-contact clusters are incorrectly positioned.	Reposition the clusters.
	Cradle is locked in the disconnected position.	Disable the cradle locking function.
	The reset button has not been pressed, preventing rotation of the crank.	Press the reset button while turning racking handle (crank).
	The circuit breaker has not been sufficiently inserted into the cradle.	Insert the circuit breaker completely so that it is engaged in the racking mechanism.
Circuit breaker cannot be locked in disconnected position.	The circuit breaker is not in the right position.	Check the circuit breaker position by making sure that the rest button is out.
	Racking handle (crank) has not been removed from the racking mechanism.	Remove and store the racking handle.
Circuit breaker cannot be locked in connected or test position.	Check that locking in any position is enabled.	Contact a Schneider Electric service center.
	The circuit breaker is not in the right position.	Check the circuit breaker position by making sure the reset button is out.
	Racking handle (crank) has not been removed from the racking mechanism.	Remove and store the racking handle.
The crank cannot be inserted to connect or disconnect the circuit breaker.	The rails are not completely in.	Push the rails all the way in.
The right-hand rail of the cradle or the circuit breaker cannot be drawn out.	Racking handle (crank) has not been removed from the racking mechanism.	Remove and store the racking handle.

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HRB28361, Rev. 02, 02/2015
Replaces HRB28361 05/2014

Masterpact™ NW Low-Voltage Power/Insulated Case Circuit Breaker—User Guide

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Class 0613

Instruction Bulletin

0613IB1204 R06/15
06/2015

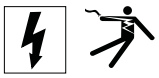
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Hazard Categories and Special Symbols

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **can result in** death or serious injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

FCC Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. This Class A digital apparatus complies with Canadian ICES-003.

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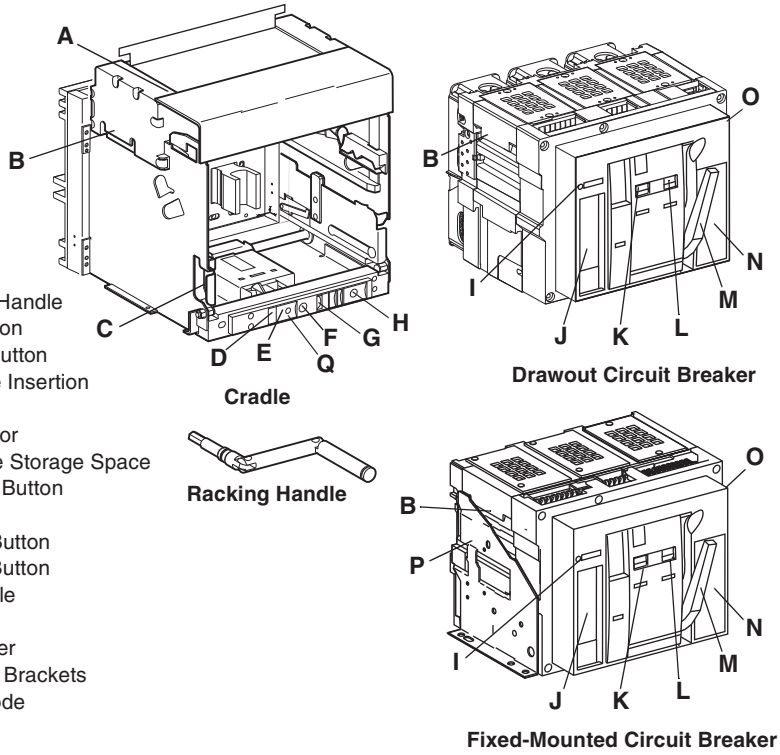
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Section 1— General Information

Introduction

The Masterpact NW low-voltage power circuit breaker[1] and insulated case circuit breaker are designed to mount in a drawout cradle, using rear-mounted, plug-on pressure connections to provide electrical connection to the cradle. A fixed-mounted circuit breaker is also available.

Figure 1 – Circuit Breaker and Cradle



A—Terminal Cover
B—Lifting Flanges
C—Extension Rail Handle
D—Padlock Provision
E—Stop Release Button
F—Racking Handle Insertion Opening
G—Position Indicator
H—Racking Handle Storage Space
I—Fault Trip Reset Button
J—Trip Unit
K—Push to Open Button
L—Push to Close Button
M—Charging Handle
N—Faceplate
O—Accessory Cover
P—Fixed Mounting Brackets
Q—Cradle Date Code

These circuit breakers comply with the following standards.

Low-Voltage Power Circuit Breaker (Drawout/Fixed-Mounted)	Insulated Case Circuit Breaker (Drawout/Fixed-Mounted)
ANSI C37.13 ANSI C37.16 ANSI C37.17 ANSI C37.50 UL1066[1] CSA C22.2 No 31[1] NEMA SG3	UL 489[2] NEMA AB1 CSA C22.2 No. 5-02[3]

[1] cULus.

[2] UL® Listed.

[3] CSA® Certified.

[1] In this manual the phrase “circuit breaker“ means circuit breaker and switch.

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Type L1F 800–2000 A low-voltage power circuit breakers and Type LF 800–2000 A insulated case circuit breakers are tested to show the arc-flash hazard risk category as referenced by NFPA 70E or CSA Z462.

This bulletin provides operating information for Masterpact NW circuit breakers. Tripping functions are controlled by the Micrologic™ trip unit. For information on the trip unit, see the trip unit manual.

For additional information see the following user guides available on the Schneider Electric™ website:

- Bulletin HRB28361: *Masterpact™ NW Low-Voltage Power/Insulated Case Circuit Breaker Installation*
- Bulletin 0613IB1205: *Masterpact™ NW Dimensional Drawings*
- Bulletin 0613IB1202: *Masterpact™ NT and NW Field Testing and Maintenance Guide*
- Bulletin 48049-136-05: *Micrologic 2.0A, 3.0A, 5.0A, and 6.0A Electronic Trip Units*
- Bulletin 48049-330-03: *Micrologic 5.0H and 6.0H Electronic Trip Units*
- Bulletin 48049-137-05: *Micrologic 5.0P and 6.0P Electronic Trip Unit*
- Bulletin 48049-207-05: *Micrologic 2.0, 3.0 and 5.0 Electronic Trip Units*
- Bulletin 1040IB1401: *IFE Ethernet Interface for LV Circuit Breakers User Guide (UL)*
- Bulletin 0613IB1317: *IO Module - Input/Output Interface for LV Circuit Breakers - User Guide*
- Bulletin DOCA0037EN: *FDM128 - Display for 8 LV Devices User Guide*
- Bulletin DOCA0088EN: *FDM121 - Display for LV Circuit Breaker User Guide*
- Bulletin 48940-329-01: *ULP (Universal Logic Plug) System User Guide*
- Bulletin 0613IB1313: *Masterpact NT/NW and PowerPact P- and R-Frame Modbus User Guide*
- Bulletin NHA67346: *Energy Reduction Maintenance Setting (ERMS) Installation*

To access the website go to: http://www.schneider-electric.com

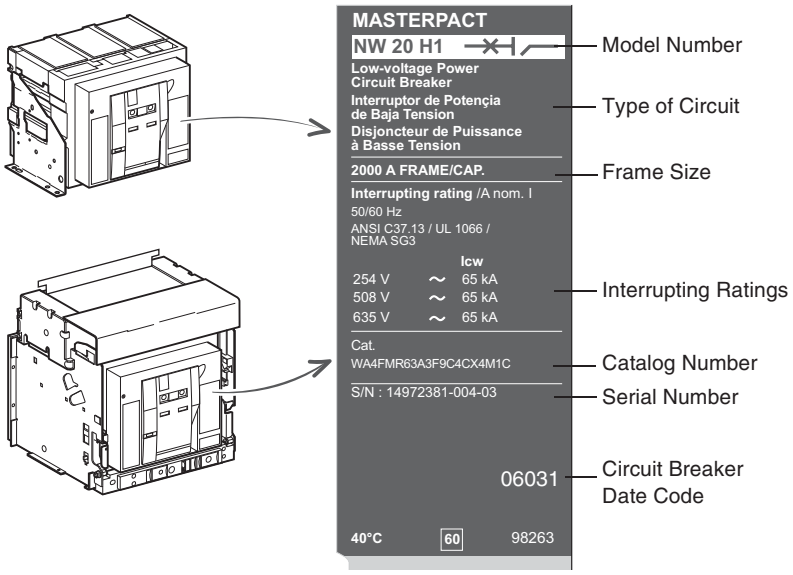
For application assistance, please call 1-888-778-2733.

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Labeling

Information about a specific circuit breaker can be found on the faceplate label on the front of the circuit breaker.

Figure 2 – Faceplate Information



Information about the accessories installed in the circuit breaker can be found on the accessory label on the right side of the circuit breaker.

For complete information on available circuit breaker models, frame sizes, interrupting ratings, sensor sizes and trip units, see 0613CT1001, *Masterpact NT and NW Universal Power Circuit Breakers* on the Schneider Electric website.

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Frame Sizes and Interrupting Ratings

Available frame sizes and ratings are shown in Table 1. For complete information on available circuit breaker and switch models, frame sizes, interrupting ratings, sensor sizes and trip units, see the Masterpact NW catalog.

Table 1 – Frame Sizes and Interrupting Rating

UL1066 Listed (ANSI C37.50)						UL489 Listed					
Frame Size	Type[1]	Model Number	Interrupting Ratings			Frame Size	Type[1]	Model Number	Interrupting Ratings		
			254 Vac	508 Vac	635 Vac				240 Vac	480 Vac	600 Vac
800 A	N1	NW08N1	42 kA	42 kA	42 kA	800 A	N	NW08N	65 kA	65 kA	50 kA
	H1, HA	NW08H1/HA	65 kA	65 kA	65 kA		H, HF	NW08H/HF	100 kA	100 kA	85 kA
	H2	NW08H2	85 kA	85 kA	85 kA		L, HB	NW08L/HB	200 kA	150 kA	100 kA
	H3, HF	NW08H3/HF	100 kA	100 kA	85 kA		LF	NW08LF	200 kA	150 kA	100 kA
	L1, HC	NW08L1/HC	200 kA	200 kA	130 kA	1200 A	N	NW12N	65 kA	65 kA	50 kA
	L1F	NW08L1F	200 kA	200 kA	130 kA		H, HF	NW12H/HF	100 kA	100 kA	85 kA
1600 A	N1	NW16N1	42 kA	42 kA	42 kA		L, HB	NW12L/HB	200 kA	150 kA	100 kA
	H1, HA	NW16H1/HA	65 kA	65 kA	65 kA		LF	NW12LF	200 kA	150 kA	100 kA
	H2	NW16H2	85 kA	85 kA	85 kA	1600 A	N	NW16N	65 kA	65 kA	50 kA
	H3, HF	NW16H3/HF	100 kA	100 kA	85 kA		H, HF	NW16H/HF	100 kA	100 kA	85 kA
	L1, HC	NW16L1/HC	200 kA	200 kA	130 kA		L, HB	NW16L/HB	200 kA	150 kA	100 kA
	L1F	NW16L1F	200 kA	200 kA	130 kA		LF	NW16LF	200 kA	150 kA	100 kA
2000 A	H1, HA	NW20H1/HA	65 kA	65 kA	65 kA	2000 A	N	NW20N	65 kA	65 kA	50 kA
	H2	NW20H2	85 kA	85 kA	85 kA		H, HF	NW20H/HF	100 kA	100 kA	85 kA
	H3, HF	NW20H3/HF	100 kA	100 kA	85 kA		L, HB	NW20L/HB	200 kA	150 kA	100 kA
	L1, HC	NW20L1/HC	200 kA	200 kA	130 kA		LF	NW20LF	200 kA	150 kA	100 kA
	L1F	NW20L1F	200 kA	200 kA	130 kA	2500 A	H, HF	NW25H/HF	100 kA	100 kA	85 kA
3200 A	H1, HA	NW32H1/HA	65 kA	65 kA	65 kA		L, HB	NW25L/HB	200 kA	150 kA	100 kA
	H2	NW32H2	85 kA	85 kA	85 kA	3000A	H, HF	NW30H/HF	100 kA	100 kA	85 kA
	H3, HF	NW32H3/HF	100 kA	100 kA	85 kA		L, HB	NW30L/HB	200 kA	150 kA	100 kA
	L1, HC	NW32L1/HC	200 kA	200 kA	130 kA	4000 A	H, HF	NW40H/HF	100 kA	100 kA	85 kA
4000 A[2] (W-Frame)	H1, HA	NW40BH1/HA	65 kA	65 kA	65 kA		L, HB	NW40L/HB	200 kA	150 kA	100 kA
	H2	NW40BH2	85 kA	85 kA	85 kA	5000 A	H, HF	NW50H/HF	100 kA	100 kA	85 kA
	H3, HF	NW40BH3/HF	100 kA	100 kA	85 kA		L, HB	NW50L/HB	200 kA	150 kA	100 kA
4000 A	H2, HA	NW40H2/HA	85 kA	85 kA	85 kA	6000 A	H, HF	NW60H/HF	100 kA	100 kA	85 kA
	H3, HF	NW40H3/HF	100 kA	100 kA	85 kA		L, HB	NW60L/HB	200 kA	150 kA	100 kA
	L1, HC	NW40L1/HC	200 kA	200 kA	130 kA						
5000 A	H2, HA	NW50H2/HA	85 kA	85 kA	85 kA						
	H3, HF	NW50H3/HF	100 kA	100 kA	85 kA						
	L1, HC	NW50L1/HC	200 kA	200 kA	130 kA						
6000 A	H2, HA	NW60H2/HA	85 kA	85 kA	85 kA						
	H3, HF	NW60H3/HF	100 kA	100 kA	85 kA						
	L1, HC	NW60L1/HC	200 kA	200 kA	130 kA						

1 N, H, L, N1, H1, H2, H3, L1, LF, L1F: Circuit Breaker
NA, HA: Non-Automatic Switch
HB, HC, HF: Automatic Switch

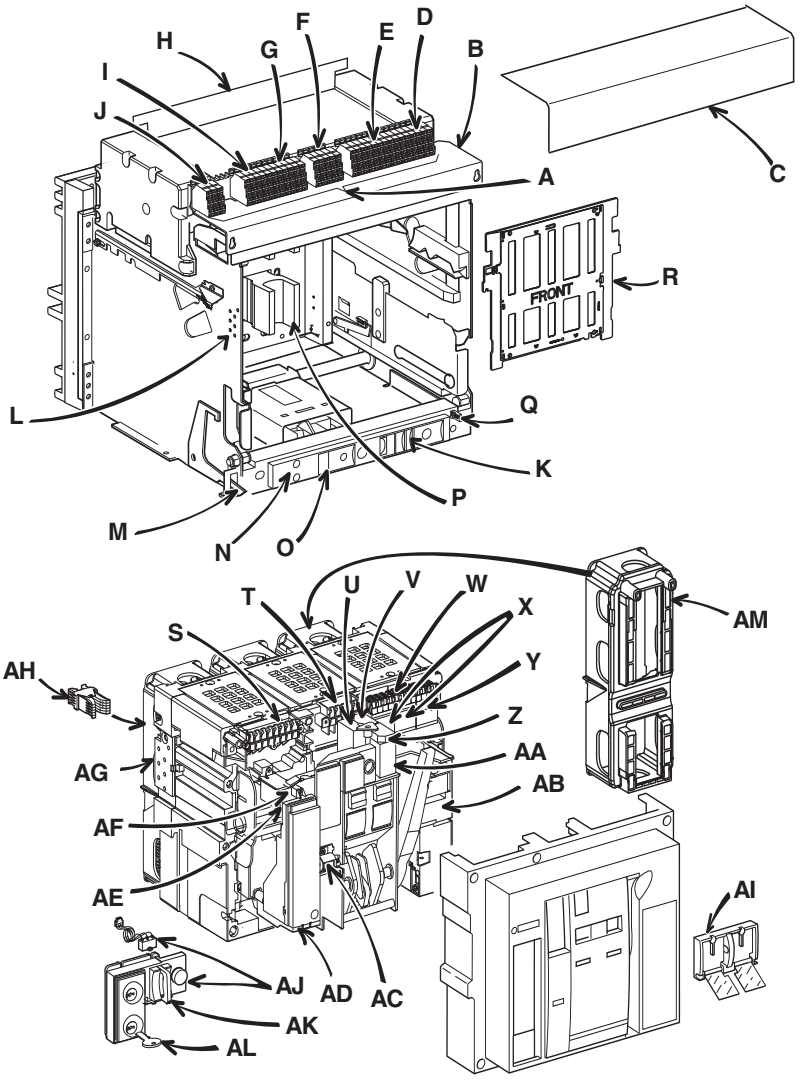
2 4000 A W-frame (standard width) circuit breaker is not available in L1 interrupting rating or in drawout construction. See Bulletin 0613IB1205: Masterpact NW Dimensional Drawings for dimensions.

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Accessories and Accessory Connections

Figure 3 – Accessories and Accessory Connections

A. Auxiliary or secondary terminals
B. Wiring terminal cover
C. Terminal cover (optional)
D. Position indicating contact terminal block
E. Auxiliary contact terminal block
F. Accessory control terminal block
G. Position indicating contact terminal block
H. Tool shield
I. Trip unit terminal block
J. Position indicating contact terminal block
K. Shutter lock
L. Cradle rejection feature
M. Door interlock
N. Key interlock
O. Padlock provision
P. Primary connectors
Q. Racking interlock for open door
R. Shutters
S. Trip unit connection to overcurrent trip switch
T. Auxiliary control connection
U. MX2 shunt trip or MN undervoltage trip device
V. MX1 shunt trip
W. Auxiliary contact connections
X. Two blocks of four additional OF switches or combined “connected, closed” EF switches
Y. Block of four form C auxiliary contacts (OF)
Z. XF shunt close
AA. PF ready-to-close contact
AB. MCH spring-charging motor
AC. Operation counter
AD. Sensor plug
AE. SDE1 overcurrent trip switch
AF. SDE2 overcurrent trip switch or RES electric reset
AG. Rejection pin plate
AH. Cluster
AI. Push button padlockable cover
AJ. BPFE electrical close push button
AK. Padlock attachment
AL. Key interlock
AM. Cluster Shield



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Operating Conditions

Masterpact circuit breakers can be used:

- At ambient temperatures between -13°F (-25°C) and 158°F (70°C) Mechanical closing of the circuit breaker (by pushbutton) is possible down to -31°F (-35°C)
- Altitude ≤ 13,000 ft. (3900 m)

Operating at other that 104°F (40°C) and at altitudes greater than 6600 ft. (2000 m) may require re-rating, overbussing, heating, or cooling. See Tables 2 and 3 for re-rating values for both UL 489 and UL 1066 (ANSI C37.50) Listed circuit breakers. For 122°F (50°C) overbussing with no derating, contact the field office.

Masterpact circuit breakers have been tested for operation in industrial atmospheres. It is recommended that the equipment be cooled or heated to the proper operating temperature (max. 104°F [40°C]) and kept free of excessive vibration and dust.

Table 2 – Temperature Re-rating Values (per ANSI C37.20.1)

Maximum Ambient Temperature											
°F °C	140 60	122 50	104 40	86 30	77 25	68 20	50 10	32 0	14 -10	-4 -20	-22 -30
Current	0.83	0.92	1.00	1.07	1.11	1.14	1.21	1.27	1.33	1.39	1.44

Table 3 – Altitude Re-rating Values (per ANSI C37.20.1 Table 10)

Altitude	**≤ 6600 ft. (≤ 2000 m)**	**8500 ft. (2600 m)**	**13000 ft. (3900 m)**
Voltage	1.00	0.95	0.80
Current	1.00	0.99	0.96

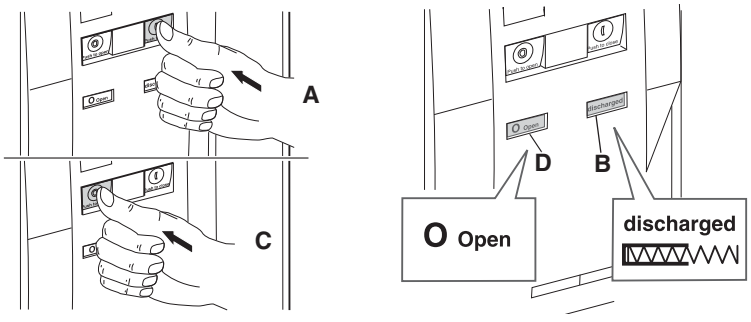
Before Working on Circuit Breaker

1. Turn circuit breaker off:

   Press “Push to close” button (**Figure 4, A**) to discharge spring, as indicated by window (**B**).

   Press “Push to open” button (**C**) to open contacts, as indicated by window (**D**).

Figure 4 – Turn Off Circuit Breaker



2. Disconnect power from circuit breaker.

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⚠ DANGER

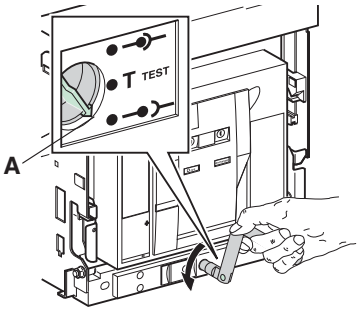
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.

Failure to follow these instructions will result in death or serious injury.

— For drawout circuit breaker: rack circuit breaker to disconnected position (**Figure 5, A**). See Drawout Circuit Breaker Disconnection, page 24.

Figure 5 – Disconnect Drawout Circuit Breaker



⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

For fixed-mounted circuit breaker: turn off all power supplying equipment before working on or inside equipment.

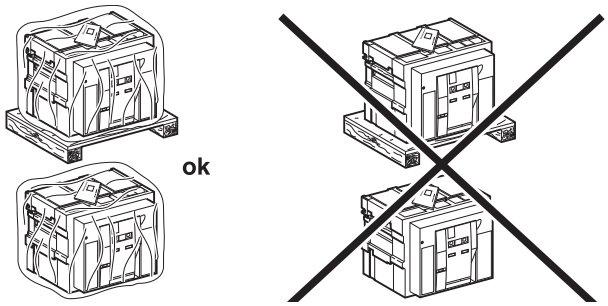
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Storage

Store circuit breaker in original shipping carton or other protective weatherproof covering.

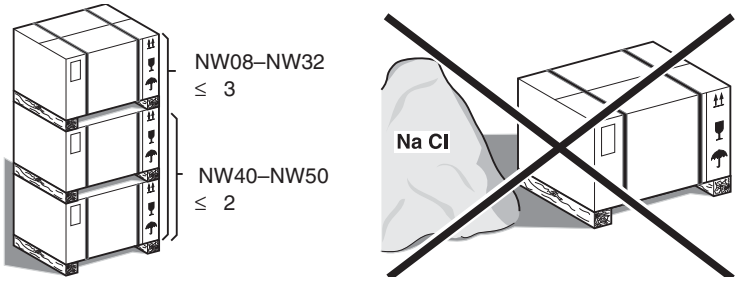
Figure 6 – Storing Circuit Breaker



Do not overstack circuit breakers.

Do not store circuit breaker in corrosive or salt-air environment.

Figure 7 – Storing Circuit Breaker

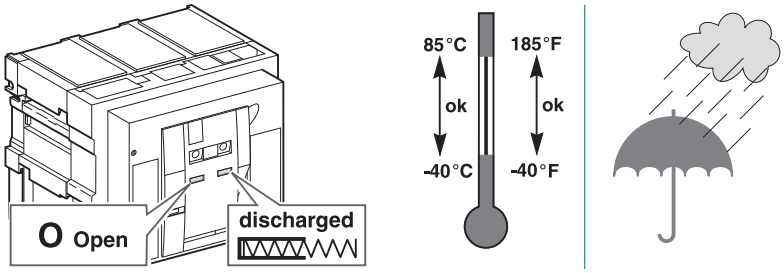


Store circuit breaker with main contacts open and spring discharged.

Store circuit breaker without trip unit at -40° F (-40°C) to +185°F (+85°C).

Store circuit breaker with trip unit and trip units at -13°F (-25°C) to +185°F (+85°C).

Figure 8 – Storing Circuit Breaker



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Section 2— Lifting and Transporting

Both the circuit breaker and cradle have lifting flanges for lifting. To lift circuit breaker, use an overhead lifting device attached to the lifting flanges, following the directions given in this section.

⚠ DANGER

HAZARD OF DEVICE FALLING

- Be sure lifting equipment has lifting capacity for the unit being lifted.
- Follow manufacturer's instructions for use of lifting equipment.
- Wear hard hat, safety shoes and heavy gloves.

Failure to follow these instructions will result in death or serious injury.

Weights

Table 4 – Weights

Frame Rating	Connector Type[1]	Weights (lbs./kg.)								
		Circuit Breaker		Cradle		Connector		Pallet	Total	
		3 Pole	4 Pole	3 Pole	4 Pole	3 Pole	4 Pole		3 Pole	4 Pole
800–2000 A, Drawout	FCF	109/50	142/65	97/44	116/53	42/19	55/25	17/8	265/121	330/151
	FCT	109/50	142/65	97/44	116/53	84/38	109/50	17/8	307/140	384/176
	RCTH/RCTV	109/50	142/65	97/44	116/53	17/8	22/10	17/8	240/110	297/136
800–2000 A, Fixed-Mounted	FCF	109/50	142/65	—	—	42/19	55/25	17/8	168/77	214/98
	FCT	109/50	142/65	—	—	84/38	109/50	17/8	210/96	268/123
	RCTH/RCTV	109/50	142/65	—	—	17/8	22/10	17/8	143/66	181/83
2500–3000 A, Drawout	RCTH/RCTV	127/58	165/75	124/57	149/68	26/12	34/15	17/8	294/135	365/166
	FCT	127/58	165/75	124/57	149/68	80/36	104/47	17/8	348/159	435/198
2500–3000 A, Fixed-Mounted	FCT	127/58	165/75	—	—	80/36	104/47	17/8	224/102	286/130
	RCTH/RCTV	127/58	165/75	—	—	26/12	34/15	17/8	170/78	216/98
2000 A L1/L1F & 3200 A, Drawout	RCOV	127/58	165/75	124/57	149/68	100/46	130/59	17/8	368/169	461/210
3200 A, Fixed-Mounted	RCOV	127/58	165/75	—	—	100/46	130/59	17/8	244/112	312/142
4000 A, (W-Frame) Fixed-Mounted	RCOV (Special)	127/58	165/75	—	—	115/52	145/66	17/8	259/118	327/149
3200 A L1 & 4000 A, Drawout	FCF	227/103	295/134	278/126	334/152	84/38	109/50	39/18	628/285	777/354
	FCT	227/103	295/134	278/126	334/152	168/76	218/99	39/18	712/324	886/403
	RCTH/RCTV	227/103	295/134	278/126	334/152	52/24	68/31	39/18	596/271	736/335
4000 A, Fixed-Mounted	RCTH/RCTV	227/103	295/134	—	—	52/24	68/31	39/18	318/145	402/183
5000 A, Drawout	FCT	227/103	295/134	278/126	334/152	168/77	218/99	39/18	712/324	886/403
	RCTH/RCTV	227/103	295/134	278/126	334/152	52/24	68/31	39/18	596/271	736/335
5000 A, Fixed-Mounted	RCTH/RCTV	227/103	295/134	—	—	52/24	68/31	39/18	318/145	402/183
6000 A, Drawout	RCTV	227/103	295/134	278/126	334/152	396/180	528/240	39/18	940/427	1196/544
6000 A, Fixed-Mounted	RCTV	227/103	295/134	—	—	396/180	528/240	39/18	662/301	862/392

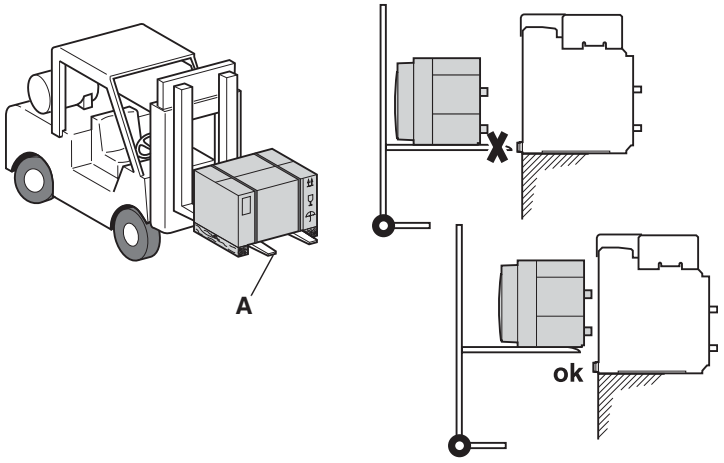
[1]FCF = Front-connected flat connector.
FCT = Front-connected "T" connector.
RCTH = Rear-connected "T" horizontal connector.
RCTV = Rear-connected "T" vertical connector.
RCOV = Rear-connected offset vertical.

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Using a Platform Lift

When using a platform lift, lift flanges (**Figure 9, A**) should not extend beyond back of circuit breaker.

Figure 9 – Using a Platform Lift



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Lifting

Lifting Drawout Circuit Breaker

NOTICE
HAZARD OF EQUIPMENT DAMAGE Cradle must be secured before installing or removing circuit breaker. **Failure to follow these instructions can result in equipment damage.**

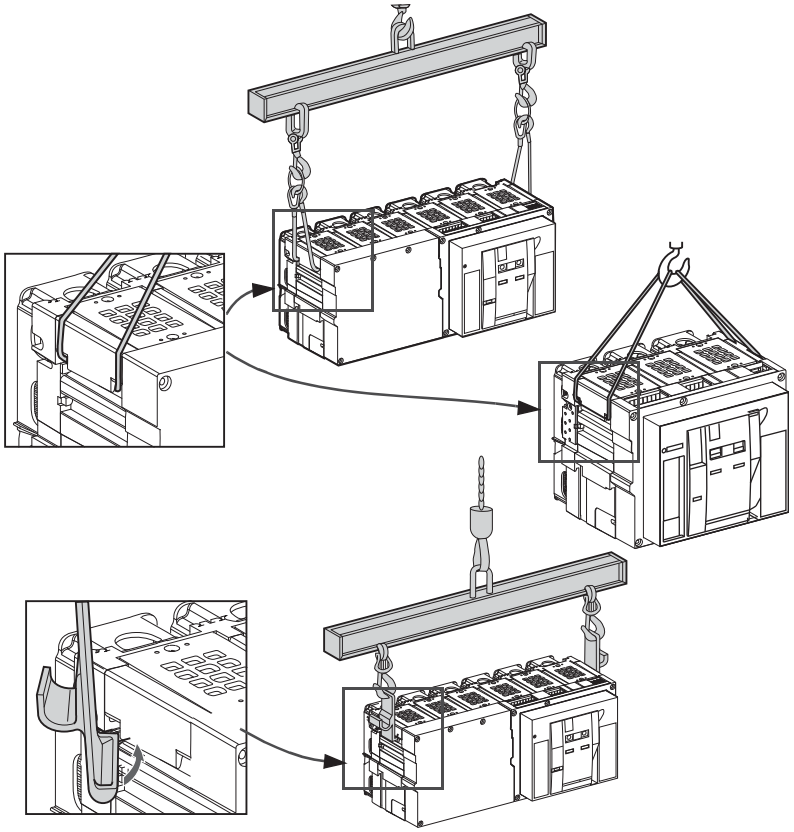
Lift using lifting flanges on sides of circuit breaker, lifting hooks and crossbar.

Lifting Hook Kit: S48906

W-Frame Crossbar Kit: S48900

Y-Frame Crossbar Kit: S48901

Figure 10 – Lifting Drawout Circuit Breaker

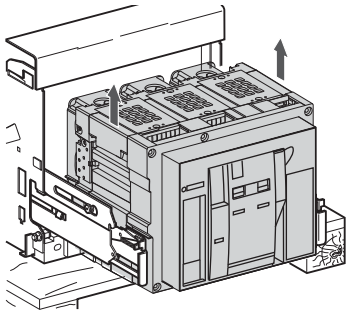


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Lifting Cradle or Fixed-Mounted Circuit Breaker

NOTE: If circuit breaker is installed in cradle, remove circuit breaker from cradle before lifting cradle. To remove circuit breaker, see page 17.

Figure 11 – Removing Circuit Breaker From Cradle



Lift using lifting flanges on sides of cradle or circuit breaker, a piece of bar stock through the connectors, lifting hooks and crossbar.

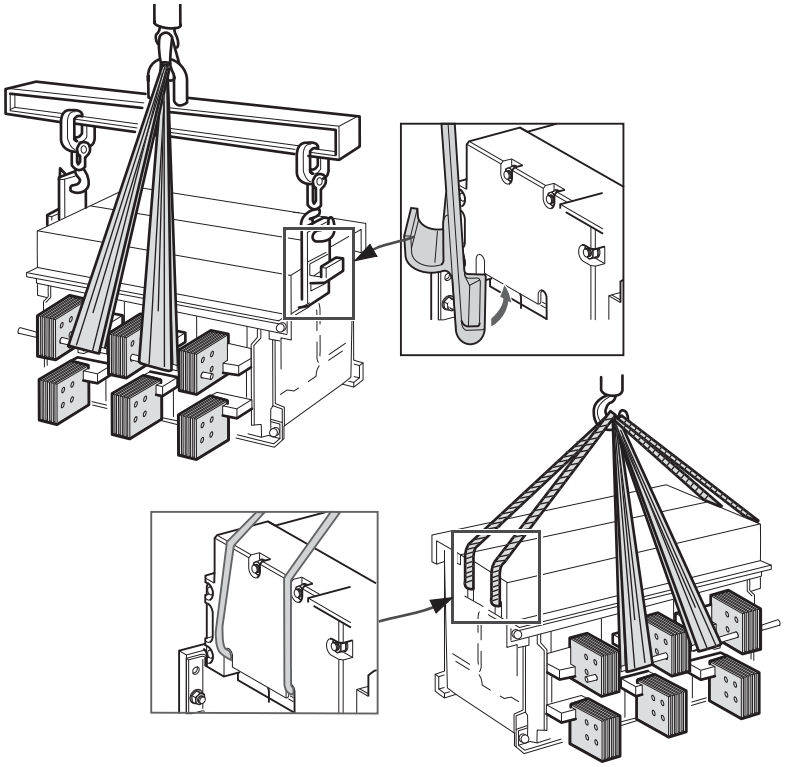
Lifting Hook Kit: S48906

W-Frame Crossbar Kit: S48900

Y-Frame Crossbar Kit: S48901

NOTE: Connectors must be supported while lifting cradle or fixed-mounted circuit breaker.

Figure 12 – Lifting Cradle or Fixed-Mounted Circuit Breaker



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Section 3— Trip Unit

Protective functions, measurement functions and communications are controlled by the Micrologic™ trip unit (**Figure 13, A**) installed in the circuit breaker. The trip unit is field replaceable for easy upgrading of functionality.

For complete information on the trip unit, its functions and field replacement, see the trip unit user guide. For complete information on trip unit availability and capabilities, refer to catalog 0613CT1001, Masterpact NT and NW Universal Power Circuit Breakers. Both are available from the Schneider Electric™ website:

http://www.schneider-electric.com

Figure 13 – Micrologic Trip Unit

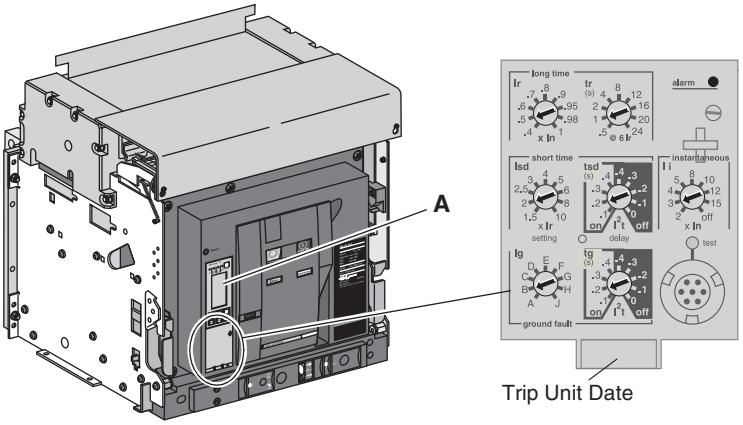


Table 5 describes the features available on the 3.0 and 5.0 standard trip units, the 3.0A, 5.0A, and 6.0A trip units with ammeters, the 5.0P and 6.0P power measurement trip units and the 5.0H and 6.0H harmonic measurement trip units.

Figure 14 – Micrologic Trip Units



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Table 5 – Micrologic Trip Unit Features

	Micrologic Trip Unit								
	X = Standard Feature O= Available Option								
	Standard		Ammeter			Power		Harmonics	
Feature	3.0	5.0	3.0A	5.0A	6.0A	5.0P	6.0P	5.0H	6.0H
LI	X		X						
LSI		X		X		X		X	
LSIG/Ground-Fault Trip[2]					X		X		X
Ground-Fault Alarm/No Trip[1,2]						X		X	
Ground-Fault Alarm and Trip[1,2]							X		X
Adjustable Rating Plugs	X	X	X	X	X	X	X	X	X
True RMS Sensing	X	X	X	X	X	X	X	X	X
UL® Listed	X	X	X	X	X	X	X	X	X
Thermal Imaging	X	X	X	X	X	X	X	X	X
Phase-Loading Bar Graph			X	X	X	X	X	X	X
LED for Long-Time Pick-Up	X	X	X	X	X	X	X	X	X
LED for Trip Indication			X	X	X	X	X	X	X
Digital Ammeter			X	X	X	X	X	X	X
Zone-Selective Interlocking				X	X	X	X	X	X
Communications			O	O	O	X	X	X	X
LCD Dot Matrix Display						X	X	X	X
Advanced User Interface						X	X	X	X
Protective Relay Functions						X	X	X	X
Neutral Protection[2]						X	X	X	X
Contact Wear Indication						X	X	X	X
Incremental Fine Tuning of Settings						X	X	X	X
Selectable Long-Time Delay Bands						X	X	X	X
Power Measurement						X	X	X	X
Power Quality Measurements								X	X
Waveform Capture								X	X

[1]Requires the M2C or M6C programmable contact module.
[2]Requires neutral current transformer for 3-phase, 4-wire system.

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ENGLISH

Section 4— Operation

Drawout Circuit Breaker Status

⚠ DANGER

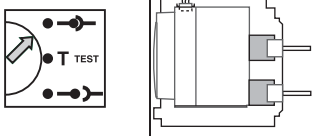
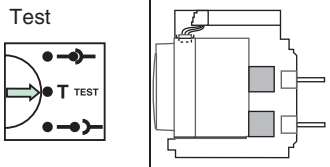
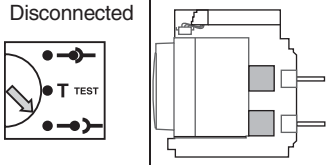
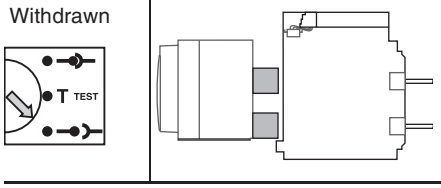
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.

Failure to follow these instructions will result in death or serious injury.

Connection or disconnection of the drawout circuit breaker requires insertion of the racking handle (while pressing “Push to open” button). If interlocks, padlocks or an open door lock are in place, the racking handle cannot be inserted.

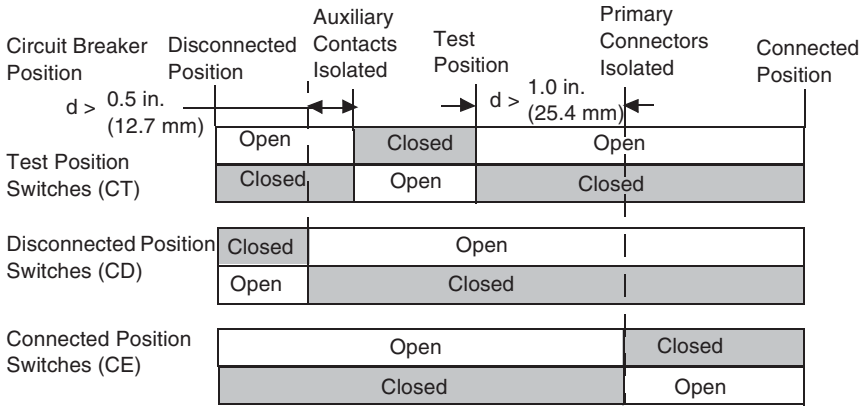
Table 6 – Drawout Circuit Breaker Positions

Position Indicator	Connector Position (Cluster shields not shown)	Connectors		Circuit Breaker Status
		Clusters	Secondary (Control)	
Connected 		Engaged	Engaged	Can be operated. Ready for service.
Test 		Disengaged	Engaged	Can be operated. Can have operation and control systems tested.
Disconnected 		Disengaged	Disengaged	Can be operated. Can be removed from carriage.
Withdrawn 		Disengaged	Disengaged	Removed from carriage.

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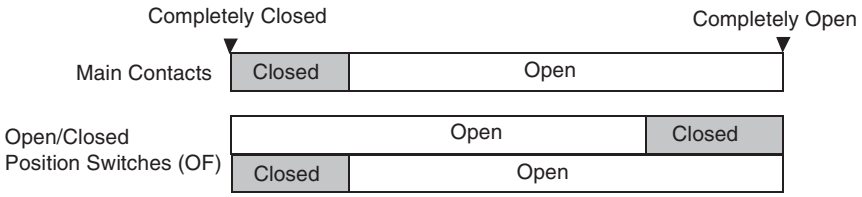
As the circuit breaker position changes, the position contacts change states.

Figure 15 – Device Position Operation



As the circuit breaker main contacts operate, the auxiliary contacts change positions.

Figure 16 – Device Contact Operation



Drawout Circuit Breaker Connection

NOTICE

HAZARD OF EQUIPMENT DAMAGE

- Use racking handle provided to rack circuit breaker into or out of cradle.
- Do not use power tools for racking.
- Do not continue to turn handle after stop release button has popped out.

Failure to follow these instructions can result in equipment damage.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.

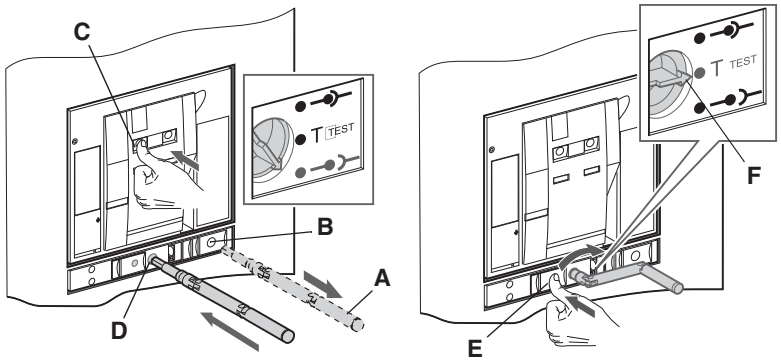
Failure to follow these instructions will result in death or serious injury.

1. Disconnect the load from the secondary disconnects.
2. Remove the racking handle (**Figure 17, A**) from its storage hole (**B**).

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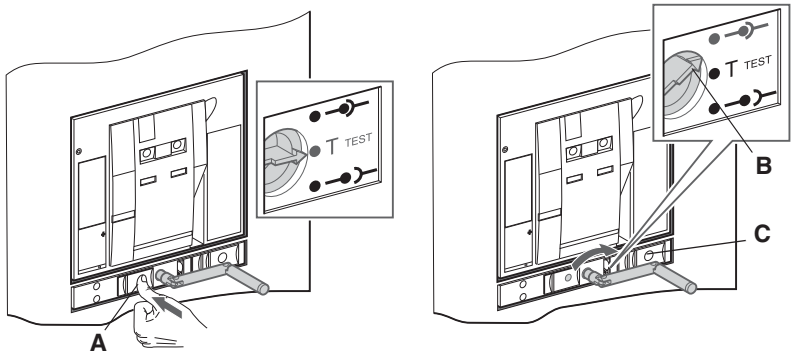
3. While pressing the “Push to open” button (**C**), insert the racking handle in the racking slot (**D**).
4. Push the stop release button (**E**).
5. Turn the racking handle clockwise until the test position (**F**) is reached. The stop release button will pop out.

Figure 17 – Rack Circuit Breaker to Test Position



6. Push the stop release button (**Figure 18, A**).
7. Turn the racking handle clockwise until the connected position (**B**) is reached. The stop release button will pop out. Replace the racking handle in its storage hole (**C**).
8. Reconnect the load to the secondary disconnects.

Figure 18 – Rack Circuit Breaker to Connected Position



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Drawout Circuit Breaker Disconnection

NOTICE

HAZARD OF EQUIPMENT DAMAGE

- Use racking handle provided to rack circuit breaker into or out of cradle.
- Do not use power tools for racking.
- Do not continue to turn handle after stop release button has popped out.

Failure to follow these instructions can result in equipment damage.

⚠ DANGER

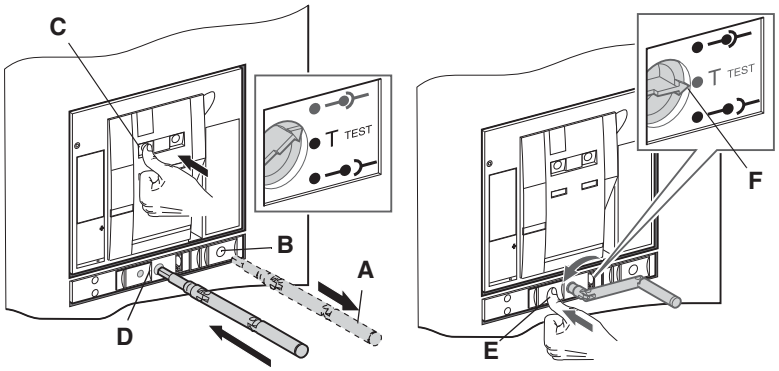
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.

Failure to follow these instructions will result in death or serious injury.

1. Remove the load from the secondary disconnects.
2. Remove the racking handle (**Figure 19, A**) from its storage hole (**B**).
3. While pressing the “Push to open” button (**C**), insert the racking handle in the racking slot (**D**).
4. Push the stop release button (**E**). Turn the racking handle counterclockwise until the test position (**F**) is reached. The stop release button will pop out.

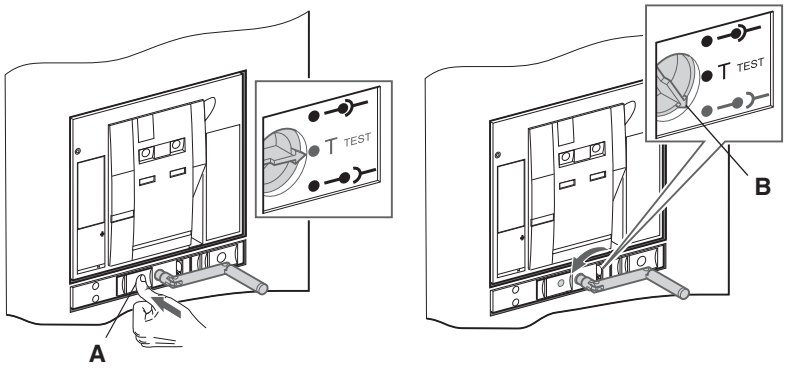
Figure 19 – Rack Circuit Breaker to Test Position



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5. Push the stop release button (**Figure 20, A**).
6. Turn the racking handle counterclockwise until the disconnected position (**B**) is reached. The stop release button will pop out. Replace the racking handle in its storage hole.
7. Reconnect the load to the secondary disconnects.

Figure 20 – Rack Circuit Breaker to Disconnected Position



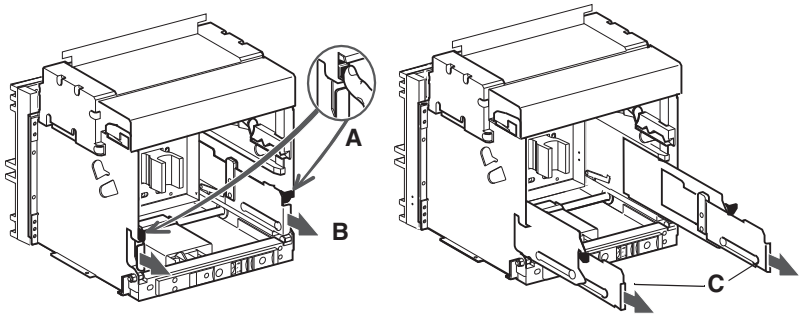
Circuit Breaker Installation and Removal

Circuit Breaker Installation

NOTICE
HAZARD OF EQUIPMENT DAMAGE Cradle must be secured when installing or removing circuit breaker. **Failure to follow these instructions can result in equipment damage.**

1. Press the latching tabs (**Figure 21, A**), then pull out the extension rail handles (**B**) until the extension rails (**C**) are fully extended.
2. Inspect the circuit breaker clusters for missing or misaligned clusters. See the bulletin shipped with the circuit breaker for information on checking, installing, and lubricating clusters.

Figure 21 – Pull Out Rails

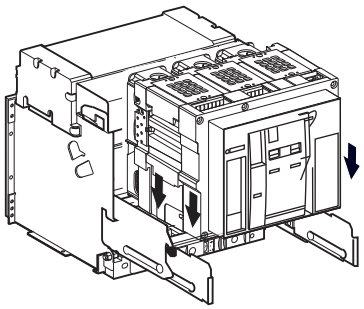


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3. Install the circuit breaker on the extension rails. See page 17 for proper lifting equipment.

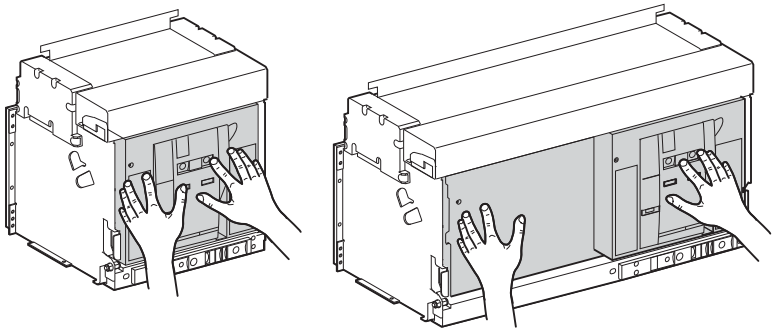
   NOTE: The cradle must be secured on a pallet if it is not installed in the equipment prior to installing the circuit breaker.

Figure 22 – Install Circuit Breaker



4. Push in the circuit breaker.
5. Connect the circuit breaker. See page 22, Drawout Circuit Breaker Connection for instructions on connecting the circuit breaker.

Figure 23 – Push In Circuit Breaker



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Circuit Breaker Removal

NOTICE

HAZARD OF EQUIPMENT DAMAGE

Cradle must be secured when installing or removing circuit breaker.

Failure to follow these instructions can result in equipment damage.

⚠ DANGER

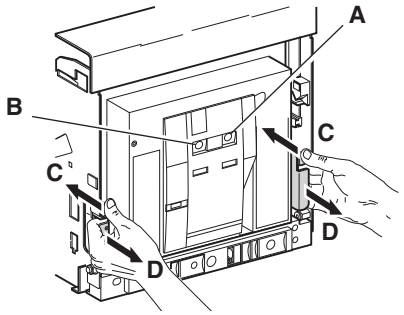
HAZARD OF DEVICE FALLING

- Be sure lifting equipment has lifting capacity for the unit being lifted. Follow manufacturer's instructions for use of lifting equipment.
- Wear hard hat, safety shoes and heavy gloves.

Failure to follow these instructions will result in death or serious injury.

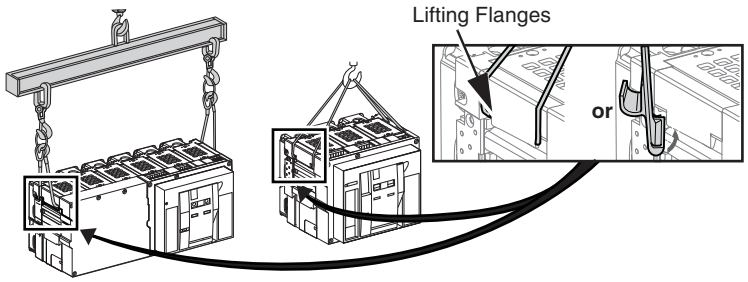
1. Disconnect circuit breaker as detailed on page 24, Drawout Circuit Breaker Disconnection.
2. With the circuit breaker in the disconnected position, press the "push ON" button (**Figure 24, A**) to close the circuit breaker.
3. Press the "push OFF" button (B) to open the circuit breaker.
4. Press latching tabs (**C**), then pull out extension rail handles (**D**).

Figure 24 – Circuit Breaker Removal



5. Remove circuit breaker from cradle rails using lifting flanges on sides of circuit breaker, see Section 2—Lifting and Transporting.

Figure 25 – Overhead Lifting

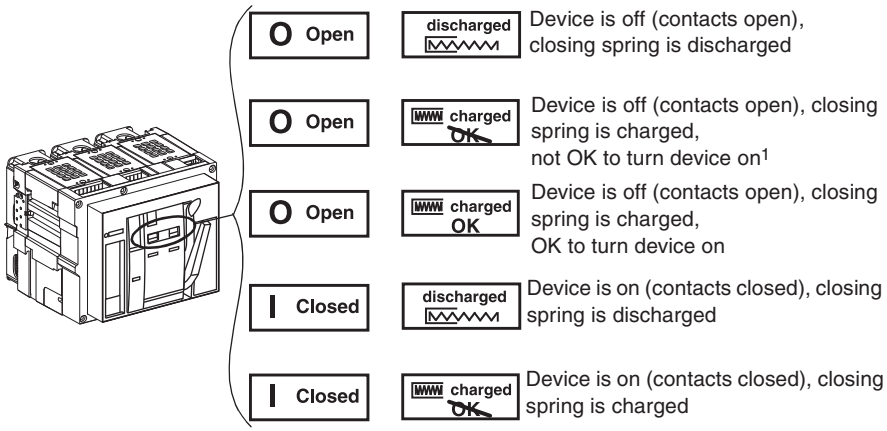


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Circuit Breaker Operation

The circuit breaker is closed by means of a two-step stored energy mechanism. Status indicators on the front of the circuit breaker indicate whether the circuit breaker is open or closed, and whether the closing spring is charged or discharged. Opening springs are automatically charged when the circuit breaker closes.

Figure 26 – Status Indicators



[1]It is not OK to turn device on if:

- Shunt trip is energized.
- Circuit breaker is not in connected, test, disconnected or withdrawn position.
- Undervoltage trip is not energized.
- Mechanical interlock is locking mechanism in the open position.

Anti-Pumping Function

The Masterpact circuit breaker is designed to mechanically provide an anti-pumping function. If either the shunt close or shunt trip coil is continuously powered, or both are powered at the same time, the circuit breaker will open and cannot be closed until the power has been removed. This prevents the circuit breaker from cycling between closing and opening (called pumping).

If the circuit breaker is equipped with a communicating-style shunt trip or shunt close (see page 48), the operation of the coil is impulse only. The plungers in the coils do not maintain an interlock on the closing mechanism. An opening signal and a closing signal cannot be sent simultaneously.

When remote operation features are used, make sure there is a minimum of four seconds for the spring charging motor (MCH) to completely charge the circuit breaker closing springs prior to actuating the shunt close (XF) coil. The ready-to-close switch (PF) (see page 47) can be series connected with the shunt close (XF) coil to prevent premature closing.

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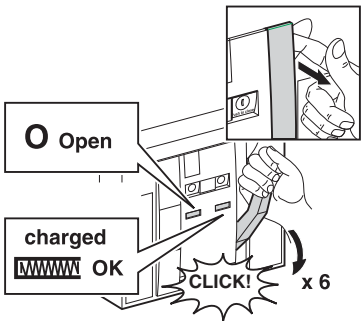
Charging the Closing Spring

To close the circuit breaker, the closing spring must be charged with sufficient energy for closing.

- Manual Charge: Use charging handle to charge closing spring.
- Automatic Charge: If the optional MCH spring-charging motor is installed, the spring is automatically charged after closing.

NOTE: The closing spring on the drawout circuit breaker will automatically discharge when the circuit breaker is moved from disconnect to withdrawn position.

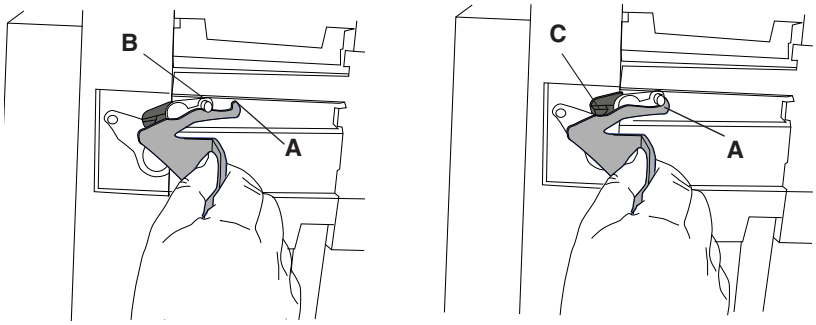
Figure 27 – Manual Spring Charge



NOTE: To close a drawout circuit breaker when it is not installed in the cradle, the cradle interlock must be defeated before the circuit breaker charging spring can be charged. A cradle interlock defeat tool is shipped with every circuit breaker. To install:

1. Slide the interlock defeat tool (**Figure 28, A**) into the groove under the interlock lever (**B**) on the right side of the circuit breaker.
2. Slide the tool toward the front of the circuit breaker and lock it in place under the cradle interlock shaft (**C**).

Figure 28 – Defeating Cradle Interlock



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Close Circuit Breaker

To close the circuit breaker, the following conditions must be met:

- The device is open (O).
- The charging spring is charged.
- “OK” is displayed.

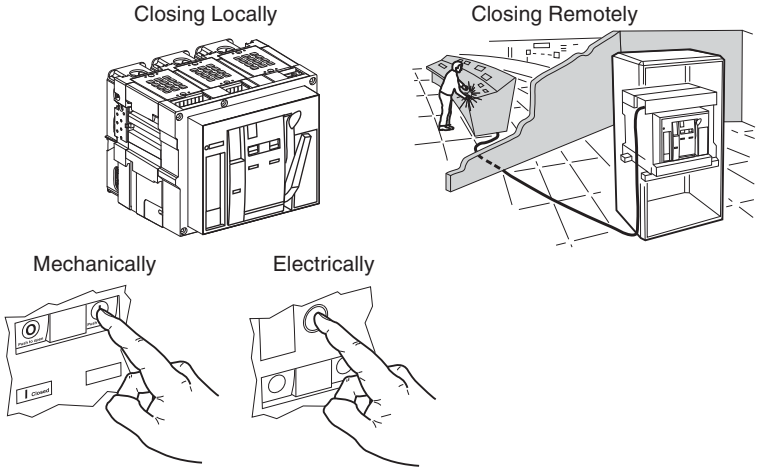
NOTE: The circuit breaker cannot be closed while an opening order is being received. If the “not OK” symbol is displayed, an order to open is being received (electrically or manually) and must be ended before the “OK” will be displayed.

If the above conditions are met, close the device by:

- Mechanically: press the “Push to close” button on the circuit breaker.
- Electrically: if the optional shunt close (XF) is installed, press the optional electrical-close push button (BPFE) on the circuit breaker or a push button at a remote location.

See pages 48 and 49 for more information about these options.

Figure 29 – Close Circuit Breaker



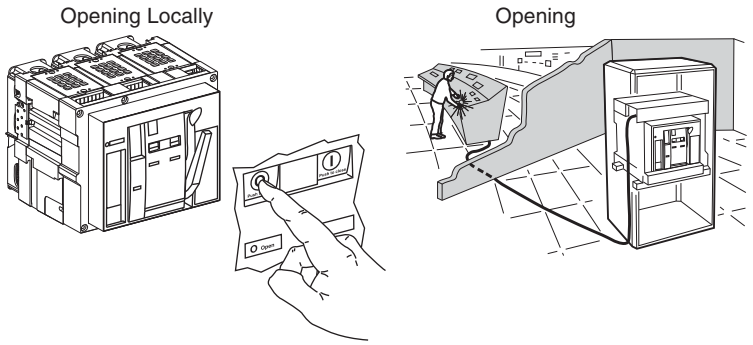
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Open Circuit Breaker

- Mechanically: press “Push to open” button on the circuit breaker.
- Electrically: remotely operate using the optional shunt trips (MX1 and MX2), undervoltage trip device (MN), or time-delay module for undervoltage trip accessory (MNR).

See pages 49 and 49 for more information about these options.

Figure 30 – Turn Off Circuit Breaker

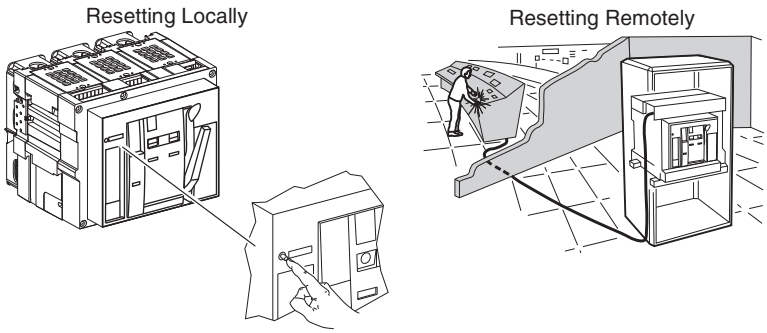


Reset Circuit Breaker

After a fault trip, the circuit breaker must be reset.

- Mechanically: press the “Reset” button located above the trip unit.
- Electrically: use the electrical reset option (RES) after an electrical fault. See page 47 for more information about this option.

Figure 31 – Reset Circuit Breaker



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Neutral Protection

Neutral protection protects the neutral conductors against overheating.

- For a three-pole circuit breaker with a P or H trip unit, neutral protection is possible if a neutral current transformer is used.
  - — Adjust the neutral using the trip unit keypad of the P or H trip unit.
  - — Possible settings are OFF, N/2, N, or 1.6N.
  - — Factory setting is OFF.

Oversize neutral protection (1.6N) requires the use of the appropriate oversize neutral current transformer. See price list for correct neutral current transformer.

CAUTION

HAZARD OF EQUIPMENT DAMAGE

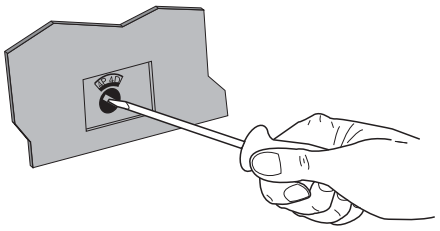
If a four-pole circuit breaker neutral pole switch is set to 4P3D setting, the current in the neutral must not exceed the rated current of the circuit breaker.

For a three-pole circuit breaker with oversize neutral protection (1.6N), select the appropriate oversize neutral current transformer.

Failure to follow these instructions can result in equipment damage.

- For a four-pole circuit breaker, set the system type using the circuit breaker neutral selector dial (see **Figure 32**).
  - — With a P or H trip unit, make fine adjustments using the trip unit keypad, with the circuit breaker dial setting providing the upper limit for adjustment.
  - — The factory setting is 4P 4D.

Figure 32 – Four-Pole Circuit Breaker Neutral Selector Dial



Neutral Protection Settings for Four-Pole Circuit Breaker

Circuit Breaker Selector Dial	P or H Trip Unit Keypad Setting
4P 3D	Off, N/2, N
3P N/2	N/2
4P 4D	N/2, N

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- The neutral protection conductor type has four possible settings:
  - — Off (4P 3D)—Neutral protection is turned off.
  - — N/2 (3P N/2)—Neutral conductor capacity is one-half that of the line conductors.
  - — N (4P 4D)—Neutral conductor capacity is the same as that of the line conductors.
  - — 1.6N—Neutral conductor capacity is 1.6 times that of the line conductors. (3P circuit breaker with P or H trip unit only.)

Table 7 – Micrologic™ Trip Unit Conductor Type

Setting	Long-Time Pickup		Short-Time Pickup		Instantaneous		Ground-Fault Pickup	
	Trip Unit	Neutral	Trip Unit	Neutral	Trip Unit	Neutral	Trip Unit	Neutral
OFF	Ir	None	Isd	None	Ii	None	Ig	None
N/2	Ir	1/2 Ir	Isd	1/2 Isd	Ii	Ii	Ig	Ig
N	Ir	Ir	Isd	Isd	Ii	Ii	Ig	Ig
1.6N	Ir	1.6 x Ir	Isd	1.6 x Isd*	Ii	Ii	Ig	Ig

*In order to limit the range, limited to 10 x In.

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Section 5— Locks and Interlocks

A number of optional locking and interlocking devices are available for the Masterpact circuit breaker and cradle. The operation of most of these devices is described in this section. For a complete listing of available locks and interlocks, see catalog 0613CT1001, *Masterpact NT and NW Universal Power Circuit Breakers* on the Schneider Electric™ website.

For detailed installation instructions on field-installable locks and interlocks, refer to the installation instructions shipped with the devices.

Push Button Lock

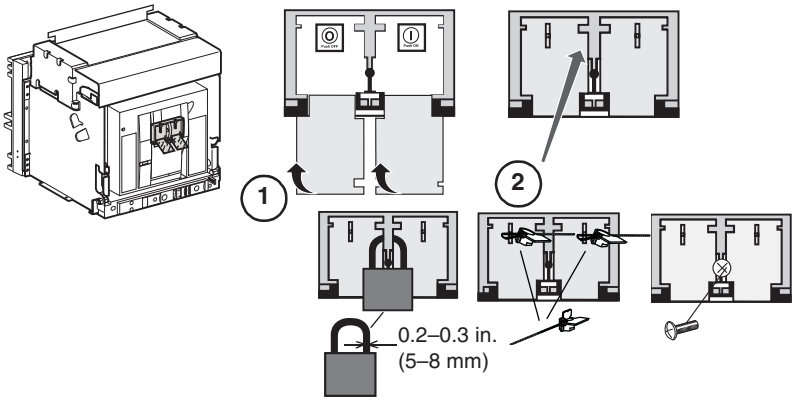
The push button lock prevents the circuit breaker from being opened or closed using the push buttons.

- Optional.
- Can be secured with a padlock, sealing lead or two screws.

To Lock:

1. Install the push button lock over the “Push to open” and “Push to close” buttons.
2. Close the plastic covers of the lock.
3. Lock the plastic cover in place using a padlock, wire seal, or screws.

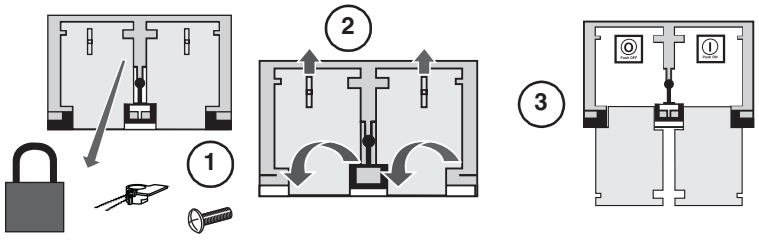
Figure 33 – To Lock Push Buttons



To Unlock:

1. Remove the padlock, wire seal, or screws.
2. Open the plastic covers of lock.
3. The buttons can be pushed.

Figure 34 – To Unlock Push Buttons



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Open Position Padlock and Open Position Padlock with Key Lock

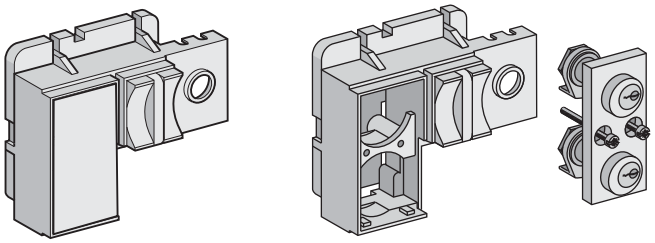
The padlocks prevent the circuit breaker from being closed, either with the push buttons or remotely.

- Optional.
- Secured with one to three padlocks.

The open position padlock and key lock is:

- Optional.
- Available with the Kirk® key lock
- Can be secured with:
  - — One padlock;
  - — One or two key locks;
  - — Or both.

Figure 35 – Open Position Padlock and Open Position Padlock and Key Lock

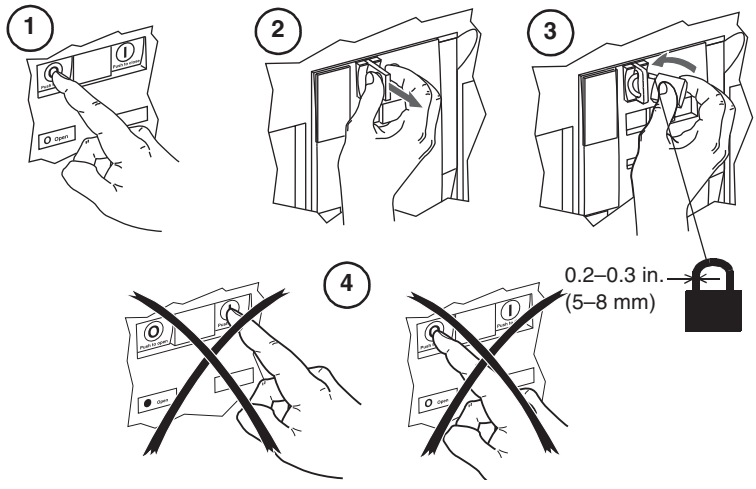


Locking with a Padlock

To Lock (**Figure 36**):

1. Open the circuit breaker.
2. Pull out the tab.
3. Attach the padlock.
4. Verify the controls are disabled.

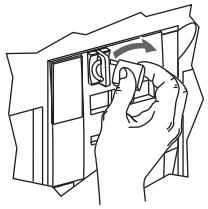
Figure 36 – Locking with a Padlock



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To Unlock (**Figure 37**), remove the padlock.

Figure 37 – Remove the Padlock

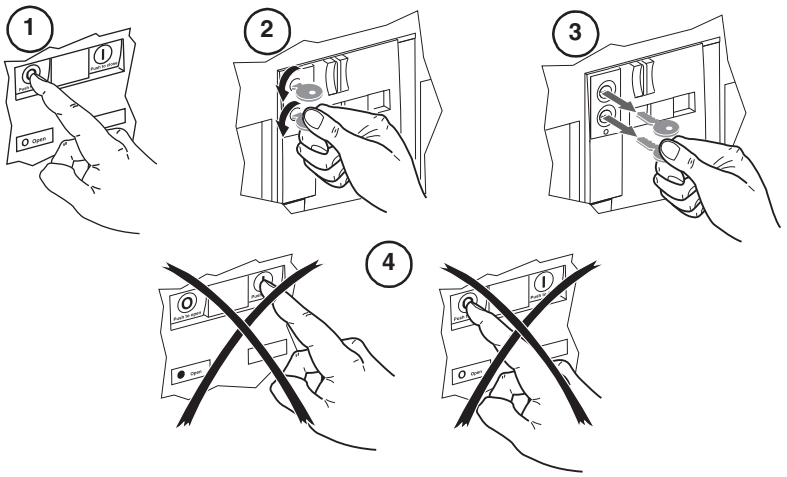


Locking with a Key Lock

To Lock (**Figure 38**):

1. Open the circuit breaker.
2. Turn the key(s).
3. Remove the key(s).
4. Verify the controls are disabled.

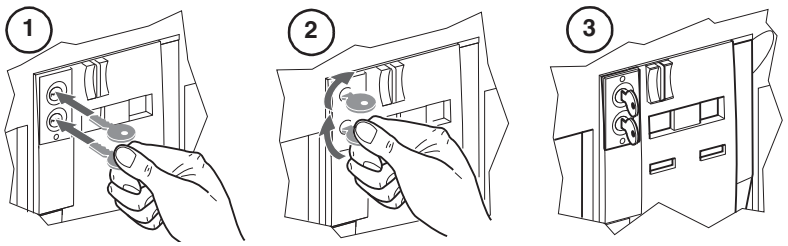
Figure 38 – Locking with Key Lock



To Unlock (**Figure 39**):

1. Insert the key(s).
2. Turn the key(s).
3. Leave the key(s) captive.

Figure 39 – Unlocking the Key Lock



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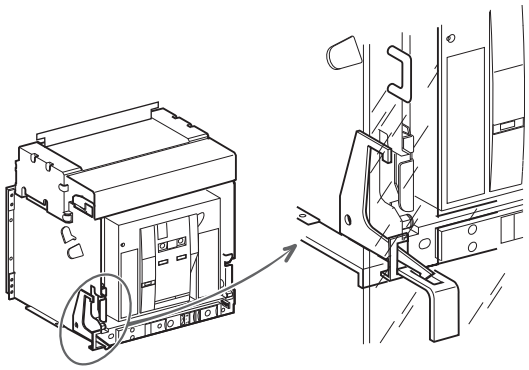
Equipment Door Interlock

If the door lock accessory is installed, the equipment door can only be opened when the circuit breaker is in the disconnected position.

- For drawout circuit breaker only.
- Optional.
- Normally mounts on the right side of the cradle.
- Can be ordered for mounting on the left of the cradle.
- Allows the door to be closed with the circuit breaker in any position.

Table 8 – Door Interlock

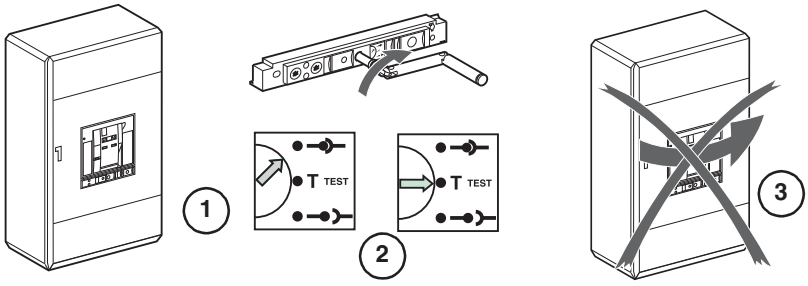
Circuit Breaker Position	Interlock Hook	Door
Connected	Lowered	Locked
Test	Lowered	Locked
Disconnected	Raised	Unlocked



To Lock (**Figure 40**):

1. Close the enclosure door.
2. Move the circuit breaker to the test or connected position.
3. Verify the door is locked.

Figure 40 – Locking the Door Interlock

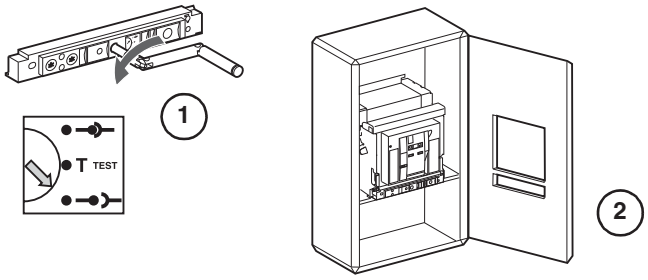


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To Unlock (**Figure 41**):

1. Move the circuit breaker to the disconnected position.
2. Verify the door is unlocked.

Figure 41 – Unlocking the Door Interlock

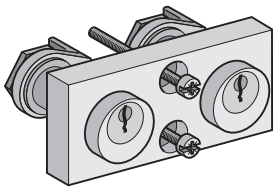


Cradle Locks

The cradle locks prevent the drawout circuit breaker from being racked in or out (by preventing insertion of racking handle) and from being moved from the disconnected position to the fully withdrawn position (by locking the drawout rails).

- Secured with one to three padlocks (standard) and/or with one or two key locks (optional).
- Keylocks are available with the Kirk key lock.
- Allows the cradle to be locked in any position (connected, test, and disconnected).
- Mounted on the cradle.

Figure 42 – Optional Key Interlock



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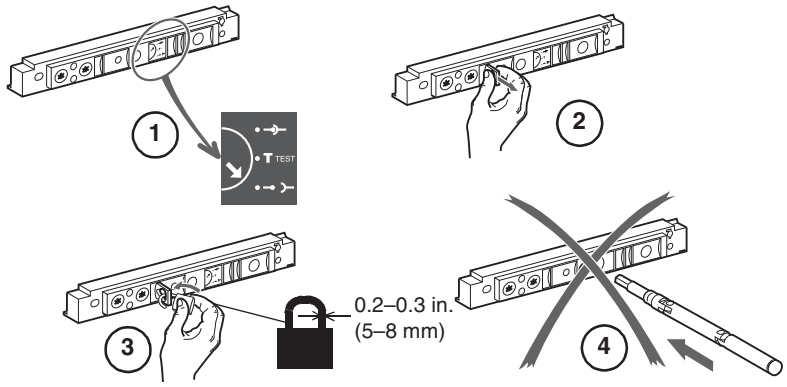
Locking Cradle with a Padlock (Standard)

To Lock (**Figure 43**):

1. Make sure the cradle indicator is in the disconnected, test, or connected position.
2. Pull out the tab.
3. Attach the padlock(s).
4. Verify racking handle cannot be inserted.

NOTE: If circuit breaker is padlocked in disconnected position, the circuit breaker cannot be pulled out from the disconnected position to the fully withdrawn position.

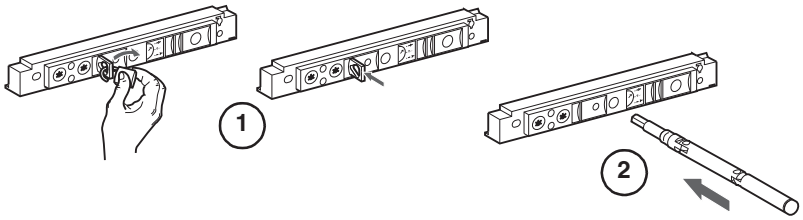
Figure 43 – Locking Cradle With a Padlock



To Unlock (**Figure 44**):

1. Remove the padlock(s).
2. Verify the racking handle can be inserted.

Figure 44 – Unlocking Cradle Padlock



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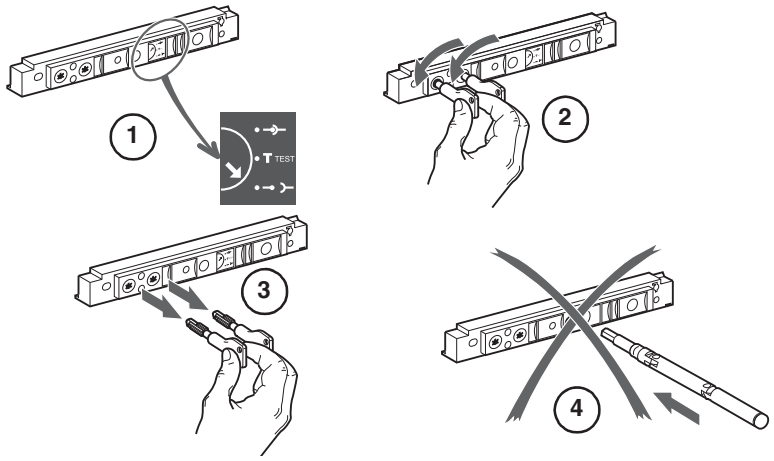
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Locking Cradle with a Key Lock

To Lock (**Figure 45**):

1. Make sure the cradle indicator is in the disconnected, test, or connected position.
2. Turn the key(s).
3. Remove the key(s).
4. Verify the racking handle cannot be inserted.

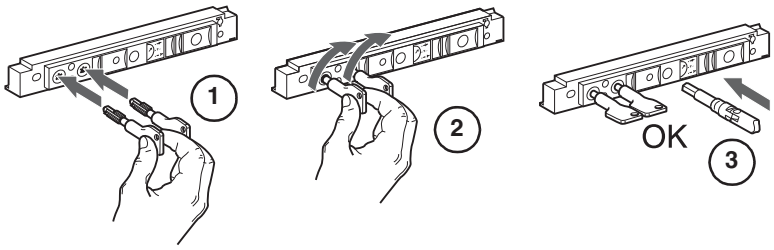
Figure 45 – Locking Cradle with a Key Lock



To Unlock (**Figure 46**):

1. Insert the key(s).
2. Turn the key(s).
3. Leave the key(s) captive.

Figure 46 – Unlocking Cradle Key Lock



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Cradle in Any Position Locks

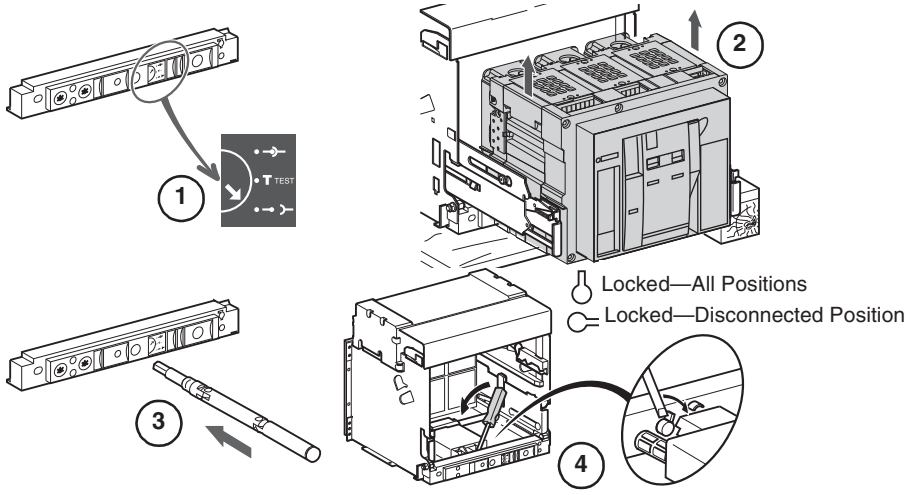
Padlocks and/or key locks used to lock the cradle in the disconnected position can be converted to lock the device in any position (connected, test, or disconnected).

To convert the lock (**Figure 47**):

1. Make sure cradle indicator is in the disconnected position.
2. Remove the circuit breaker from the cradle. (See circuit breaker removal instructions).
3. Insert the racking handle.
4. Rotate the latch to the left. The cradle can now be locked in any position.

NOTE: To return cradle to locking only in the disconnected position, rotate latch to the right.

Figure 47 – Convert Cradle Lock



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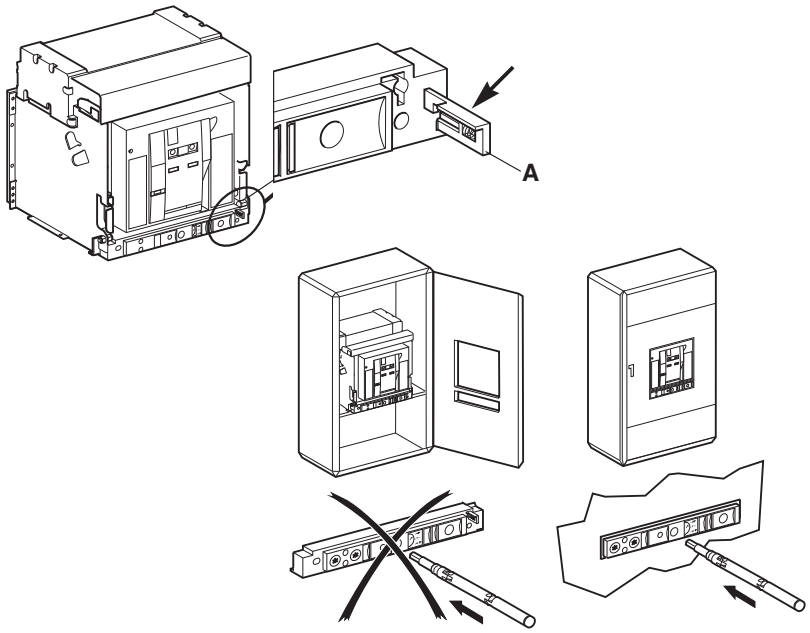
Open Door Racking Interlock

The open door racking interlock prevents the racking handle from being inserted if the equipment door is open.

- Optional.
- Mounts on the right side of the cradle.

To deactivate, pull out the interlock (**Figure 48, A**).

Figure 48 – Interlocking Cradle Position

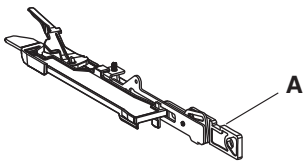


Shutter Lock

The shutter lock (**Figure 49, A**) is used to prevent connection of the circuit breaker by locking the shutter in the closed position.

- Optional.
- Allows the shutter to be padlocked.

Figure 49 – Shutter Lock

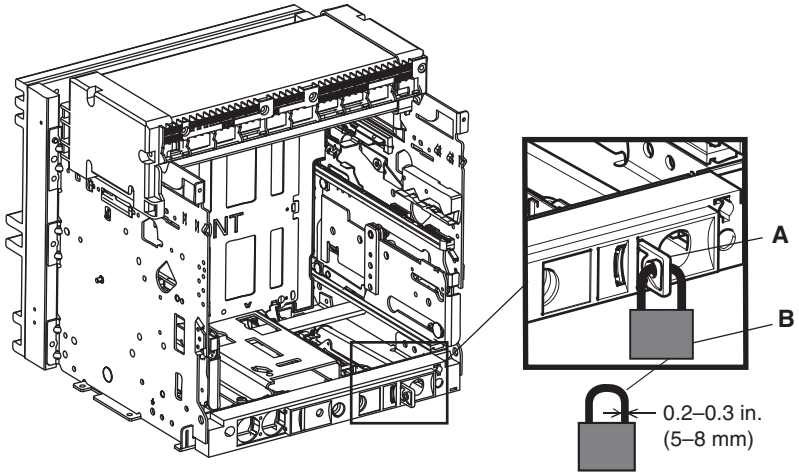


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To Lock:

Pull end of shutter indicator arm out of shutter indicator slot (Figure 50, A). Insert padlock (B) through padlock hole.

Figure 50 – Locking the Shutters

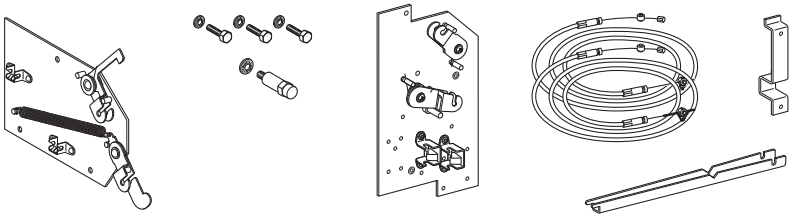


Cable Door Interlock

The cable door interlock prevent the panel door from being opened if the circuit breaker is closed.

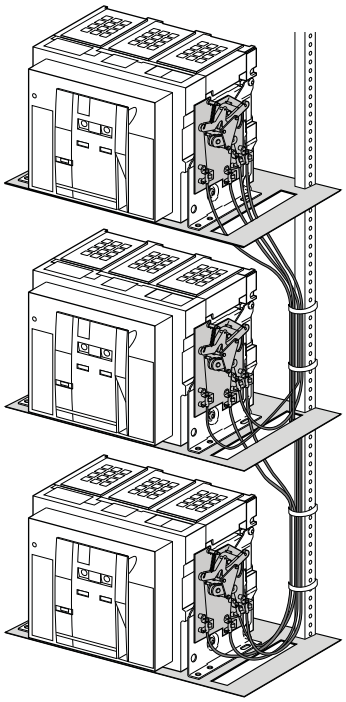
- Optional.
- Must be installed after the circuit breaker is installed in the enclosure.

Figure 51 – Cable Door Interlock Kit



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Source Changeover Interlock



The source changeover interlock kit provides interlocking between three circuit breakers.

- Kit S48608 provides interlocking between two “main” circuit breakers connected to the same power source and a third circuit breaker connected to a generator power source.
  - — Four interlocking positions are possible.
  - — The generator circuit breaker is “locked open” when either or both of the main circuit breakers are closed.
- Kit S48609 provides interlocking between two “main” circuit breakers connected to the same power source and one “tie” or external source circuit breaker.
  - — The tie circuit breaker can be in first, second or third position.
  - — Two of the three circuit breakers can be in the closed position at any given time.
- Kit S48610 provides interlocking between three “main” circuit breakers connected to a single power source.
  - — Only one of the three circuit breakers can be in the closed position at any give time.
  - — The other two circuit breakers will be held in the “locked open” position.

Table 9 – Possible Interlock Configurations

	Vertical Configuration		**Horizontal Configuration**	
	W-Frame	Y-Frame	W-Frame	Y-Frame
W-Frame	3	3	3	2 x W-Frame 1 x Y-Frame
Y-Frame	3	3	2 x W-Frame 1 x Y-Frame	Contact the Field Sales Office

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Section 6— Accessories

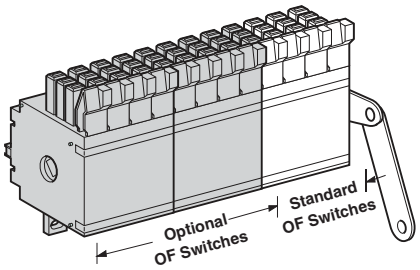
This section describes commonly used accessories. For a complete listing of available accessories, see catalog 0613CT1001, *Masterpact NT and NW Universal Power Circuit Breakers* on the Schneider Electric™ website.

Auxiliary Switches (OF)

Auxiliary switches (OF) change state when the minimum isolating distance between the main contacts is reached.

- Standard, four switches per circuit breaker, rated 10 A.
- Optional additional OF switches available, rated 6 A:
  - — Two blocks of four additional OF switches are available with push-in terminal blocks.
  - — One block of four additional OF switches are available with ring terminal blocks.
- Indicates the position of the main contacts on the circuit breaker.
- Form C contacts, NO/NC with common neutral.

Figure 52 – Switches (OF)



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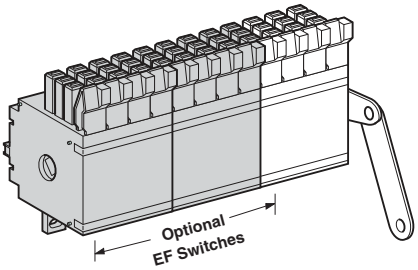
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Connected/Closed Switches (EF)

Connected/closed switches (EF) combine “connected device” and “closed device” information, indicating “the circuit is closed.”

- Optional.
- Maximum of eight switches per circuit breaker with push-in terminal blocks.
- Each switch becomes associated with an OF switch when installed in its connector location.
- Form C contacts, NO/NC with common neutral.
- Not available with ring terminal connector.

Figure 53 – Switches (EF)



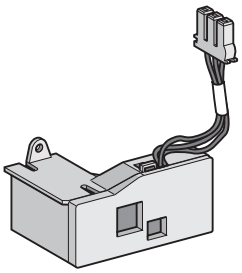
Overcurrent Trip Switch (SDE)



The overcurrent trip switch (SDE) provides remote indication that the circuit breaker has opened because of an electrical fault.

- Standard
- Not available on non-automatic switches
- One form C contacts, NO/NC with common neutral

Additional Overcurrent Trip Switch (SDE2)

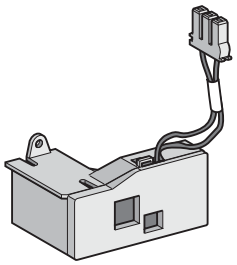


The additional overcurrent trip switch (SDE2) provides remote indication that the circuit breaker has opned because of an electrical fault.

- Optional.
- Not available on non-automatic switches
- Not compatible with RES option
- One form C contact, NO/NC with common neutral

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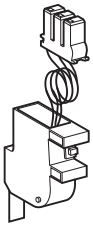
Electric Reset (RES)



The electric reset (RES) resets the circuit breaker remotely after an electrical fault.

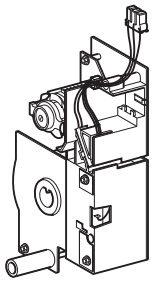
- Optional
- Not compatible with SDE2 option

Ready-to-Close Switch (PF)



- The ready-to-close switch (PF) indicates that the following conditions are met and the circuit breaker can be closed:
  - — The circuit breaker is open.
  - — The closing springs are charged.
  - — The circuit breaker in not locked/interlocked in open position.
  - — There is no standing closing order.
  - — There is no standing opening order.
- Optional.
- One form C contacts used for push-in connector, NO/NC with common neutral.
- NO contact used for ring terminal connector.

Spring-Charging Motor (MCH)



The spring-charging motor (MCH) charges the closing springs automatically after the circuit breaker closes.

- Optional
- Charging time: 4 seconds maximum
- Operating rate: 3 cycles/minute, maximum
- Minimal voltage: 0.85–1.1 of rated voltage
- Maximum power consumption: 180 VA

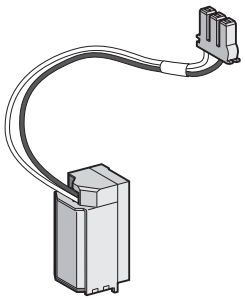
Spring-Charged Contact (CH)

The spring-charged contact (CH) indicates that the circuit breaker is charged.

- Standard with the spring-charging motor
- Form C contacts, NO/NC with common neutral

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Shunt Trip (MX1 / MX1-COM / MX2)
Shunt Close (XF / XF-COM)



Shunt trip: opens the circuit breaker when energized.

Shunt close: closes the circuit breaker when energized, if the device is ready to close.

NOTE: For a circuit breaker having a circuit breaker communications module (BCM) installed, order MX1-COM and/or XF-COM. These will have three wires instead of the two shown in the illustration.

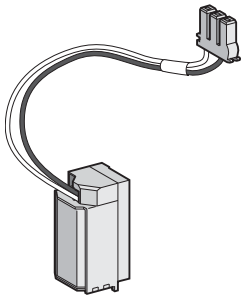
- Optional.
- One or two shunt trips per circuit breaker.
- One shunt close per circuit breaker.
- Shunt trip and shunt close are the same coil, their action is determined by the location of the coil.
- Circuit breaker response time
  - — MX1, MX1-COM and MX2 opening time:
    50 ms ± 10 ms
  - — XF and XF-COM closing time:
    70 ms ± 10 ms for NW ≤ 4000 A
    80 ms ± 10 ms for NW > 4000 A

  NOTE: Shunt trip (MX1) and shunt close (XF) circuits must be energized for a minimum of 200 ms.
- Operating thresholds:
  - — MX1, MX1-COM, and MX2:
    0.7 to 1.1 x rated voltage
  - — XF and XF-COM:
    0.85 to 1.1 x rated voltage
- Continuous power supply possible (continuous duty).
  For MX1-COM/XF-COM use the comm command for continuous duty. The bypass circuit through terminal C2/A2 is only for momentary duty (0.5 sec. max).
- Maximum power consumption: 4.5 VA maintained, 200 VA inrush.
- MX1-COM can be operated remotely by the circuit breaker communication module (BCM).

XF-COM can be operated remotely by either the electrical close button (BPFE) or the circuit breaker communication module (BCM).

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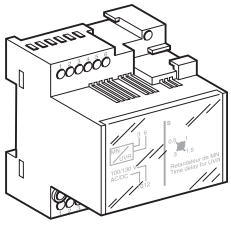
Undervoltage Trip (MN)



The undervoltage trip (MN) opens the circuit breaker when its supply voltage drops below the threshold voltage.

- Optional
- Not compatible with the MX2 shunt trip
- Response time: 90 ms (+5 ms/-5 ms)
- Operating thresholds:
  - — Opening: 0.35 to 0.7 x rated voltage
  - — Closing: 0.85 x rated voltage
- Continuous power supply required to keep circuit breaker closed
- Maximum power consumption: 20 VA

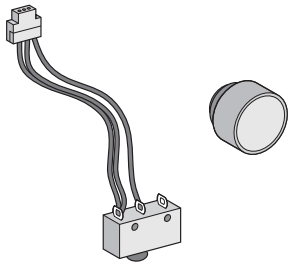
Time-Delay Module for Undervoltage Trip (MNR)



The time-delay module for the undervoltage trip (MNR) can be used to set an adjustable time delay before the undervoltage trip opens the circuit breaker in order to prevent nuisance tripping from a momentary voltage drop. The time-delay mechanism is connected in series with the undervoltage trip (MN) and is installed outside of the circuit breaker.

- Optional
- Available in fixed or adjustable delay versions:
  - — Delay time: 0.5 s, 1 s, 1.5 s, 3 s
  - — Fixed time: 0.25 s

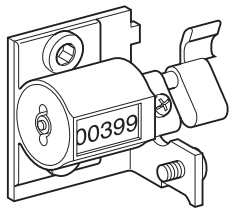
Electrical Closing Push Button (BPFE)



The electrical closing push button (BPFE) closes the circuit breaker electrically using the shunt close (XF).

- Optional
- Located on accessory cover of circuit breaker
- Requires installation of shunt close (XF-COM)
- Cannot be used in combination with a communication module

Operations Counter (CDM)



The operations counter (CDM) registers the total number of operating cycles for the circuit breaker.

- Optional
- Can be installed on circuit breaker with or without spring charging motor

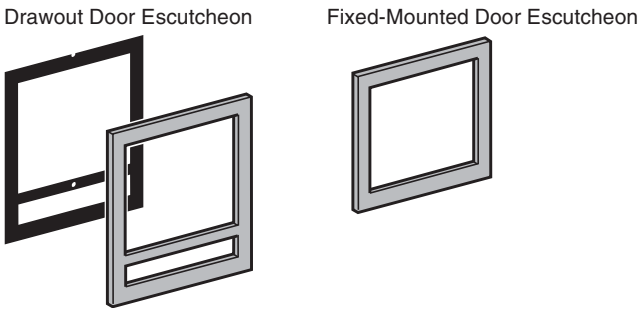
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Door Escutcheon (CDP)

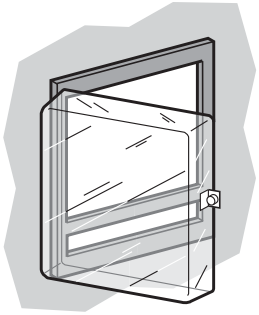
The door escutcheon (CDP) provides an IP40, IK07 (equivalent to NEMA 1) seal for the door.

- Standard

Figure 54 – Door Escutcheon (CDP)



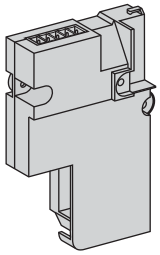
Transparent Cover (CCP)



Mounted on the door escutcheon (CDP), the transparent cover (CCP) provides a IP55, IK10 (equivalent to NEMA 3R/12) seal.

- Optional
- Drawout circuit breaker only

Circuit Breaker Communication Module (BCM)



The circuit breaker communications module (BCM) provides communication between circuit breaker trip unit and the communication network.

- Optional on 3.0A, 5.0A, and 6.0A trip units.
- Standard on 5.0P, 6.0P, 5.0H, and 6.0H trip units.
- Not compatible with the 3.0 or 5.0 trip units.
- Dedicated switches can be used to read status of circuit breaker.
- Actuators (MX/XF) can be used to control the circuit breaker.

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I/O (Input/Output) Module



The I/O (input/output) application module for low-voltage circuit breakers links the communication network with the circuit breaker communication module. It connects the Masterpact circuit breaker to a ULP (Universal Logic Plug) system with built-in functions and applications.

- Delivered with the drawout circuit breakers ordered with the COM option for cradle management.
- Must be installed on a DIN rail near the device.
- Must be connected to the ULP system and to the position contacts (CD, CT, CE) that transmit the position of the device in the cradle.
- Compliant with the ULP system specifications.
- Two I/O application modules can be connected in the same ULP network.

The I/O application module resources are:

- Six digital inputs that are self powered for either NO and NC dry contact or pulse counter.
- Three digital outputs that are a bistable relay (5 A maximum).
- One analog input for PT100 temperature sensor.

Ethernet Interface Module (IFE)



The IFE interface and IFE interface + gateway enable Masterpact NW circuit breakers to be connected to an Ethernet network.

- Provides an Ethernet access to one or several LV circuit breakers.
- Functions:
  - — Interface: connects one circuit breaker to the IFE interface using its ULP port.
  - — Gateway: connects several circuit breakers on a Modbus network using the IFE interface + gateway master Modbus port.
- Dual 10/100 Mbps Ethernet port for simple daisy chain connection.
- Device profile web service for discovery of the IFE interface, IFE interface + gateway on the LAN.
- ULP compliant for placing the IFE interface in the switchboard.
- Ethernet interface for Masterpact circuit breakers.
- Gateway for Modbus-SL connected devices (IFE interface + gateway only).
- Embedded set-up web pages.
- Embedded monitoring web pages.
- Embedded control web pages.
- Built-in e-mail alarm notification.

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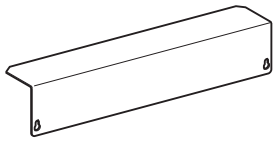
Modbus Interface Module (IFM)



An IFM Modbus communication interface is required for connection of a Masterpact circuit breaker to a Modbus network.

- Requires the circuit breaker be provided with a ULP port. The port is available on the BCM embedded module.
- The IFM is defined as an IMU (Intelligent Modular Unit) in the ULP connection system documentation.
- Connects the circuit breaker as a slave to the Modbus master. Its electrical values, alarm status, open/close signals can be monitored or controlled by a Programmable Logic Controller or any other system.

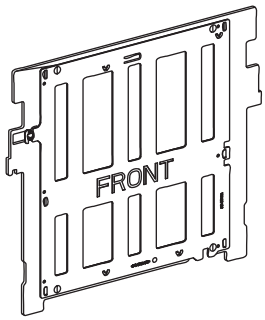
Terminal Cover (CB)



The terminal cover (CB) prevents access to the accessory terminal blocks.

- Drawout circuit breaker only
- Optional
- Mounts on the cradle

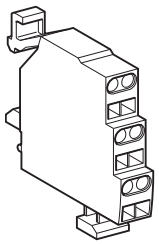
Shutters



The shutters automatically block access to the primary connectors when the circuit breaker is in the test or disconnected position.

- Drawout circuit breaker only
- Optional
- For information on locking the shutters, see page 42

Cradle Position Switch (CE, CD, and CT)



The cradle position switch (CE, CD, or CT) indicates the circuit breaker position in the cradle.

- Drawout circuit breaker only
- Optional
- One to three position switches for each type:
  - — CE: Connected
  - — CD: Disconnected
  - — CT: Test
- Normally-open and normally-closed contacts
- Available as push-in connector switch (shown) or ring tongue terminal connector switch

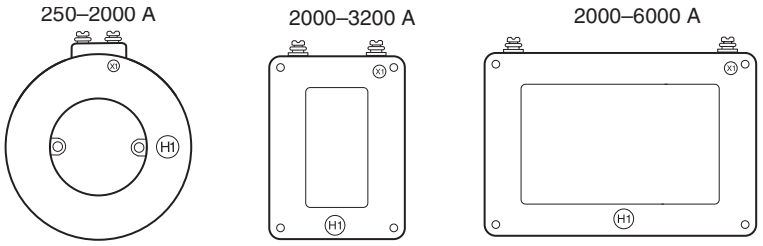
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Metering Current Transformers

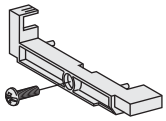
The metering current transformer is used to scale line currents down to usable values for measuring or control purposes.

- Optional (for drawout circuit breaker only)
- Mounts inside the cradle
- Accurate with the 0.3% accuracy class
- Five ampere output at full load
- A standard wiring harness is provided when metering current transformers are factory mounted

Figure 55 – Metering Current Transformers



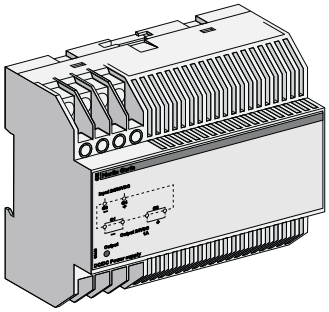
Sensor Plugs



The sensor plug is used to set the current sensor rating (In) of the circuit breaker.

- Standard
- Field replaceable

External Power Supply Module



The external power supply module is used with the Micrologic™ A, P, and H trip units to provid.e external power to the trip unit.

- Optional
- Makes it possible to:
  - — Display currents less than 20% of sensor (In)
  - — Maintain display of last trip unit status even after opening of circuit breaker
  - — Store in memory the value of the interrupted current and time-stamp event (P and H trip units only)
- Provides power to the circuit breaker communication module and the cradle communication module
- Field replaceable
- Output:
  - — voltage: 24 Vdc
  - — current: 1 A
  - — ripple < 5%.
- Input Voltage:
  - — Vac: 110–130, 200–240, 380–415
  - — Vdc: 24–30, 48–60, 100–125
  - — 10 VA/10 W consumption

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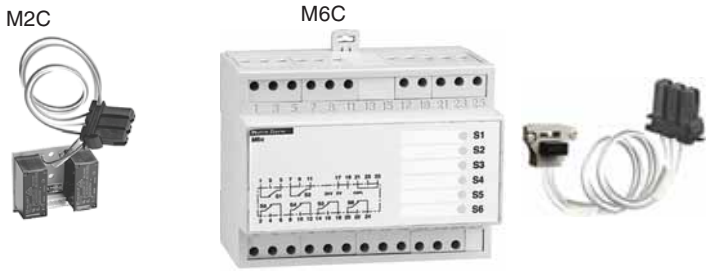
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Programmable Contact Modules (M2C and M6C)

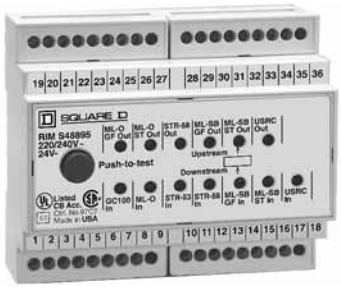
Programmable contact modules (M2C and M6C) are used to indicate the type of fault and the instantaneous and delayed threshold overruns.

- Optional
- For Micrologic P and H trip units only
- Programmable via the trip unit or through the communications network
- Requires 24 Vdc power supply
- Contact ratings:
  - — 5 A/240 Vac
  - — 1.8 A/24 Vdc
  - — 1.5 A/48 Vdc
  - — 0.4 A/125 Vdc

Figure 56 – Programmable Contact Modules (M2C and M6C)



Restraint Interface Module (RIM)



The restraint interface module (RIM) allows zone-selective interlocking communications between circuit breakers with Micrologic trip units and other select devices.

- Optional
- For Micrologic A, P, and H trip units only
- Requires external power supply:
  - — 120 Vac or 24 Vdc
  - — 220/240 Vac or 24 Vdc

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Ground-Fault Interface Module (MDGF/SGR)

The ground-fault interface module provides interface between trip unit types A, P, or H (with MDGF or SGR) and MDGF sensor(s).

- Optional
- Field installable
- For use on circuit breakers with 400 A or higher sensor.

Figure 57 – Ground-Fault Interface Module (MDGF/SGR) and Sensor



Hand-Held Test Kit



The hand-held test kit is used to verify trip unit operation and the tripping and pole-opening sequence.

- Optional
- Can also be used to:
  - — Inhibit thermal imaging for primary injection testing
  - — Inhibit ground fault for primary injection testing
  - — Self-restrain zone-selective interlocking (ZSI)
  - — Supply control power to the trip unit for settings via the keypad when the circuit breaker is open (Micrologic A, P, and H trip units only)

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Full-Function Test Kit



The full-function test kit is used to verify LSIG functionality.

- Optional
- Can be used to check trip unit operation, for example:
  - — Display of settings
  - — Operating tests on the electronic component
  - — Automatic and manual tests on protection functions (trip curve verification)
  - — Tests on the zone-selective interlocking (ZSI) functions
  - — Inhibit thermal imaging for primary injection testing
  - — Inhibit ground fault for primary injection testing
  - — Self-restrain zone-selective interlocking (ZSI)
- Can also be used to:
  - — Check mechanical operation of the circuit breaker
  - — Check the electrical continuity of the connection between the MITOP (tripping coils) and the trip unit

Print the trip unit and circuit breaker test report when used in conjunction with a PC (FFTK Report Generator software, Catalog No. FFTKRPT-V1-0, is required

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Section 7— Installing Accessories

Accessories can be installed in an installed circuit breaker or an installed cradle.

Installing Circuit Breaker Accessories

Drawout Circuit Breaker

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.

Failure to follow these instructions will result in death or serious injury.

Place circuit breaker in disconnect position. See Drawout Circuit Breaker Disconnection, page 24, for instructions on disconnecting the circuit breaker.

Fixed-Mounted Circuit Breaker

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Turn off all power supplying this equipment before working on or inside equipment.

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Install Circuit Breaker Accessories

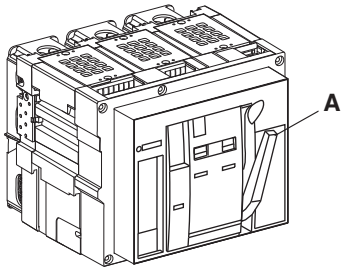
NOTICE

HAZARD OF EQUIPMENT DAMAGE

Use caution when removing or replacing the circuit breaker accessory cover. The spring-charging handle (**Figure 58, A**) extends through the circuit breaker accessory cover and can be damaged when removing the accessory cover.

Failure to follow these instructions can result in equipment damage.

Figure 58 – Spring Charging Handle



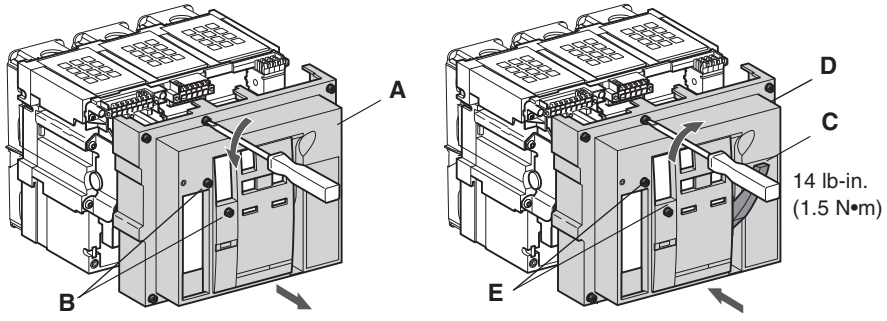
If installing electrical accessories, remove the accessory cover.

1. Loosen the accessory cover screws and remove the accessory cover (**Figure 59, A**).

   NOTE: Screws (**B**) are for Type L, LF, L1 and L1F circuit breakers only.
2. Install accessories as instructed in the instructions packed with the individual accessory.
3. Replace the accessory cover by pulling the spring-charging handle (C) forward and sliding the circuit breaker accessory cover (D) down over the handle. Tighten the accessory cover screws.

   NOTE: Screws (E) are for Type L, LF, L1 and L1F circuit breakers only.

Figure 59 – Install Accessories



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Drawout Circuit Breaker

The drawout circuit breaker can now be placed back in connected position. See Drawout Circuit Breaker Connection, page 22 for instructions on connecting the circuit breaker.

Fixed-Mounted Circuit Breaker

The fixed-mounted circuit breaker can now be placed back in service.

Installing Cradle Accessories

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

1. Turn off all power supplying this equipment before working on or inside equipment.
2. If circuit breaker is installed in cradle, remove it following the instructions in “Circuit Breaker Removal” on page 27.
3. Install each accessory as instructed in the instructions packed with the individual accessory.
4. Replace the circuit breaker in the cradle, see “Circuit Breaker Installation” on page 25.

The drawout circuit breaker can now be placed back in connected position. See Drawout Circuit Breaker Connection, page 22 for instructions on connecting the circuit breaker.

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Section 8— Testing, Maintenance and Troubleshooting

For information on field testing, maintenance, and troubleshooting see bulletin 0613IB1201, *Masterpact NT and NW Field Testing and Maintenance Guide*, which can be found on the Schneider Electric™ website:

http://www.schneider-electric.com

For application assistance, please call 1-888-778-2733.

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Section 9— Repacking

Materials Required

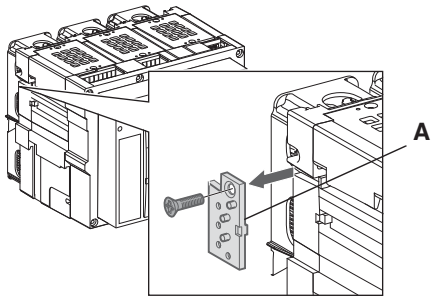
- Pallet
- Packing Carton
- Shipping Brackets, insert nuts and bolts
- Four Carriage Bolts, 3/8 x 12, 2 in. (50 mm) long minimum
- Four Washers, 3/8 in.
- Four Nuts, 3/8 x 12

Repacking

Repacking Circuit Breaker

1. If drawout circuit breaker is installed in the cradle, remove it following the instructions in “Circuit Breaker Removal” on page 27.
   If fixed-mounted circuit breaker is installed in equipment, remove it following the instructions in the bulletin shipped with the circuit breaker.
2. Remove the rejection pin plate (**Figure 60, A**) from side of the circuit breaker, if installed.

Figure 60 – Remove Rejection Pin Plate



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NOTICE

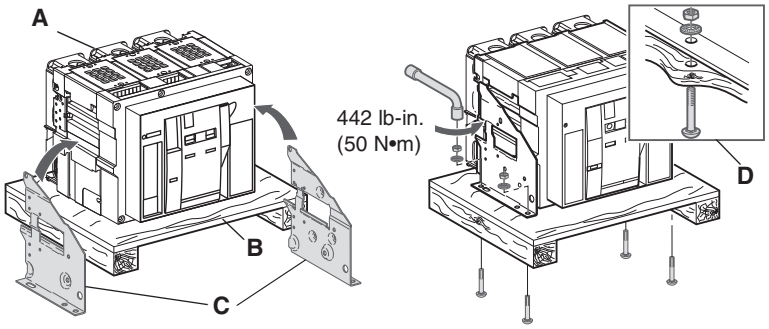
HAZARD OF EQUIPMENT DAMAGE

Circuit breaker must be secured to the pallet with shipping brackets.

Failure to follow these instructions can result in equipment damage.

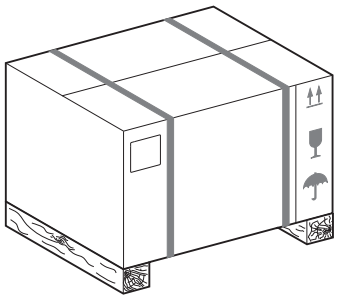
3. Place the circuit breaker (**Figure 61, A**) onto the pallet (**B**).
4. For drawout circuit breakers, place the shipping brackets (**C**) on the circuit breaker. If shipping brackets are needed, consult the local field office. Bolt the shipping brackets to the circuit breaker. (Fixed-mounted circuit breakers use the mounting bracket installed on the circuit breaker as the shipping bracket.)
5. Secure the shipping brackets to pallet with four bolts, nuts and washers (**D**).

Figure 61 – Secure Circuit Breaker



6. Place the packing carton over the circuit breaker and secure with tape.

Figure 62 – Secure Packing Carton

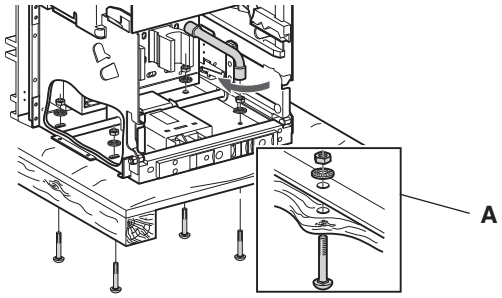


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Repacking Cradle

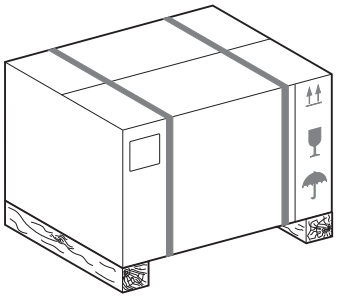
1. If the cradle is installed in equipment, remove it following the instructions in the installation bulletin shipped with the circuit breaker.
2. Secure the cradle to the pallet using four bolts, nuts and washers (**Figure 63, A**).

Figure 63 – Secure Cradle



3. Place the packing carton over the cradle and secure with tape.

Figure 64 – Secure Packing Carton

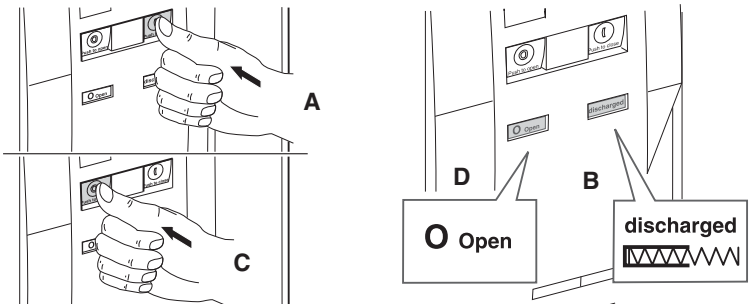


Repacking Circuit Breaker and Cradle

NOTE: 3200 A L1 and all 4000, 5000 and 6000 A circuit breaker and cradle units must be shipped separately.

1. Press the “Push to close” button (**Figure 65, A**) to discharge the spring (**B**).
2. Press the “Push to open” button (**C**) to open contacts (**D**).

Figure 65 – Turn Off Circuit Breaker



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NOTICE

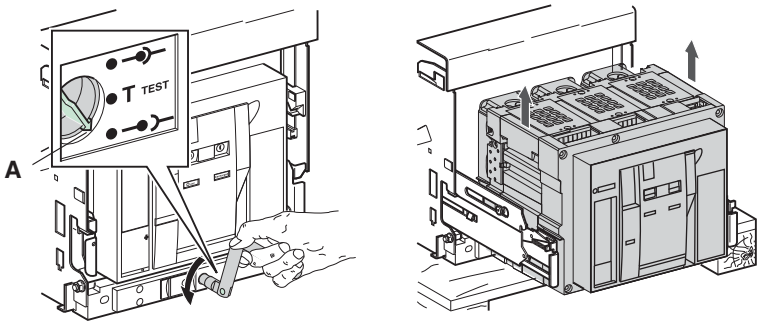
HAZARD OF EQUIPMENT DAMAGE

Cradle must be secured when installing or removing circuit breaker.

Failure to follow these instructions can result in equipment damage.

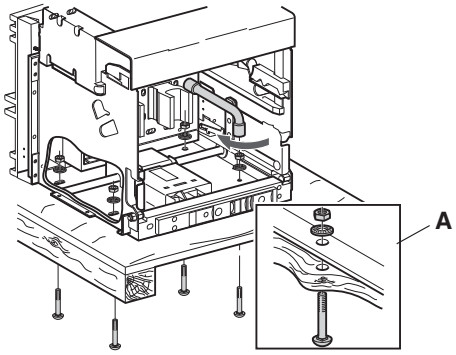
3. Rack the circuit breaker to the disconnected position (Figure 66, A) (refer to Drawout Circuit Breaker Disconnection, page 24).
4. Remove the circuit breaker following the instructions in “Circuit Breaker Removal” on page 27.

Figure 66 – Remove Circuit Breaker



5. If the cradle is installed in equipment, remove it following the instructions in the installation bulletin shipped with the circuit breaker.
6. Secure the cradle to the pallet using four bolts, nuts and washers (Figure 67, A).
7. Replace the circuit breaker in the cradle following the instructions in “Circuit Breaker Installation” on page 25.

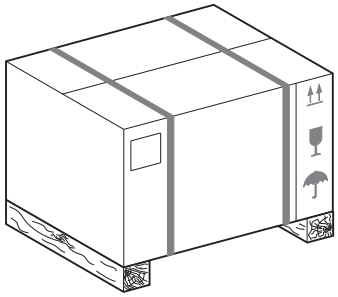
Figure 67 – Remove Circuit Breaker and Secure Cradle



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8. Place the packing carton over cradle and secure carton with tape.

Figure 68 – Secure Packing Carton



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Maintenance and Field Testing Guide

for Masterpact™ NT and NW Circuit Breakers

Class 0613

Instruction Bulletin

0613IB1202 R08/15
08/2015

Retain for future use.



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Hazard Categories and Special Symbols

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

FCC Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. This Class A digital apparatus complies with Canadian ICES-003.

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Section 1— Introduction

The service life of circuit breakers depends on proper application, correct installation, environmental conditions and preventive maintenance.

To maintain the device's operating and safety characteristics, Schneider Electric™ recommends that systematic checks and periodic maintenance be carried out by qualified personnel.

The standard generally used as a basis for field-testing requirements is the National Electrical Manufacturers Association® standard, NEMA AB 4, “Guidelines for Inspection and Preventive Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications”. If additional information, assistance, or on-site service is required contact the local field sales office.

The inspection, preventive maintenance, and field-testing instructions provided in this document are intended for use with Masterpact™ NT and NW circuit breakers with the Micrologic™ electronic trip system. Please read this document carefully and keep it at hand. It provides detailed information on:

- the various types of maintenance required.
- what must receive maintenance.
- the risks involved if the component ceases to operate correctly.
- what is understood by the terms normal, improved and severe environment and operating conditions.
- the periodic preventive maintenance that should be carried out under normal environment and operating conditions as well as the level of competence required for the operations.
- the environment and operating conditions that accelerate device aging and the limits governing use of mechanical and electric accessories and subassemblies.
- the product guides available in order to maintain the device in proper operating condition.

This publication is not intended, nor is it adequate, to verify proper electrical performance of a circuit breaker that has been disassembled, modified, rebuilt, refurbished, or handled in any manner not intended or authorized by Schneider Electric.

Safety Precautions

1. Only qualified electrical workers with training and experience on low-voltage circuits should perform work described in these instructions. Workers must understand the hazards involved in working with or near low-voltage equipment. Such work should be performed only after reading this complete set of instructions.
2. Some inspections or procedures require that certain parts of the electrical system remain energized at hazardous voltage during the procedure. Observe all specific safety messages (Danger, Warning, Caution) throughout this manual.
3. Wear personal protective equipment, recognize potential hazard, and take adequate safety precautions when performing the procedures outlined in this manual.

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Types of Maintenance

There are three types of maintenance discussed in this bulletin:

- Corrective
- Preventive
- Predictive

Corrective Maintenance

Corrective maintenance repairs items that are no longer functioning properly.

Incidents During System Startup

Many problems during system startup result from non-observance of the startup instructions or lack of knowledge concerning the equipment and/or switchgear procedures. Schneider Electric user guides contain instructions for operators or maintenance personnel on how to correct these problems.

- The list of the available user guides and data bulletins may be found at the end of this document.
- The PDF files for these documents may be downloaded from the www.schneider-electric.com site.

Incidents During Operation

Contact the local field sales office.

Preventive Maintenance

Preventive maintenance consists in carrying out, at predetermined intervals or according to prescribed criteria, checks intended to reduce the probability of a failure or deterioration in the operation of a system.

There are two types of preventive maintenance:

- Periodic maintenance
  For each type of product, maintenance recommendations are intended to maintain systems or their subassemblies in correct operating condition over the targeted service life, and must be carried out according to the time intervals stipulated in this document.
  Under no circumstances can Schneider Electric be held responsible for any damage caused by the failure of a device if the periodic checks were not carried out in accordance with the recommendations in this document.
- Conditional maintenance
  Conditional maintenance is performed when programmed alarms indicate that a predefined threshold has been reached. To that end, sensors must be installed on the switchgear and in the switchboard.
  To a certain extent, conditional maintenance reduces the recommended periodic maintenance that requires an annual shutdown of the installation. Conditional maintenance is the means to optimize installation maintenance. For more information on the possibilities offered by conditional maintenance, contact Schneider Electric Services.

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Predictive Maintenance

Predictive maintenance is based on the recording and analysis of system parameters to detect drift from the initial state and significant trends. Using predictive maintenance, the customer can anticipate the corrective action required to ensure equipment safety and continuity of service, and plan the action for the most convenient time.

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Section 2— Preventive Maintenance

The tables in this section provide recommended preventive maintenance and time intervals. Recommendations are based on the operating conditions of the device.

Table 1 – Preventive Maintenance

Maintenance Type	Done By	Operating Conditions	Frequency
Type II	Certified customer employee	Normal	Every year
		Favorable	Every two years
		Severe	Twice a year
Type III	Certified customer employee	Normal	Every two years
		Favorable	Every four years
		Severe	Every year
Type IV	Schneider Electric Service	All	• Every five years • After tripping due to a short-time or instantaneous short-circuit • After five trips due to overloads.
Storage Check	Certified customer employee	All	After prolonged storage

Operating Conditions

Normal Conditions

Table 2 – Normal Operating and Environmental Conditions

Temperature	Average annual temperature < 77°F (25 °C) outside the switchboard
Percent load	< 80% of I_n (sensor rating)
Harmonics	Harmonic current per phase < 30% of I_n (sensor rating)
Relative humidity	< 70%
Corrosive atmosphere	Device installed in environment category 3C1 or 3C2 (IEC 60721-3-3) in Tables 14 and 20
Salt environment	No salt mist
Dust	Low level Device protected in switchboard equipped with filters or ventilated IP54 (Nema 3) enclosure
Vibration	Permanent vibration < 0.2 g

Under these conditions, the maintenance that must be carried out every one, two or five years on Masterpact NT/NW subassemblies and the level of competence required on the part of service agents are described in the tables on pages 11, 12, and 13.

At the end of each five year period, the maintenance guide must be systematically repeated.

Beyond the above limits, the circuit breakers suffer accelerated aging that may result in malfunctions. For this reason, periodic checks must be carried out at shorter time intervals. On the other hand, when special efforts are made to improve the operating and environment conditions, the preventive-maintenance operations can be carried out less often.

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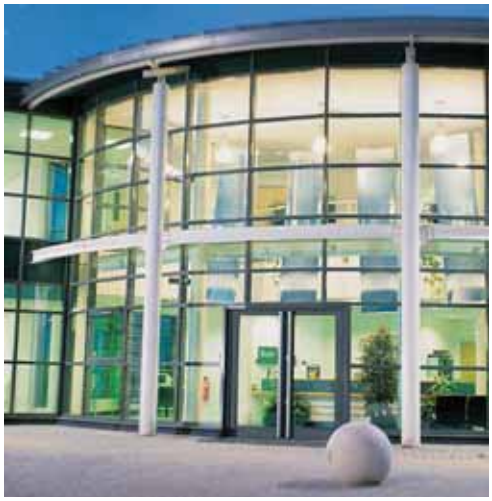
Favorable Conditions

The time interval between Type II and Type III preventive maintenance can be doubled if **all** of the conditions presented below are met. The Type IV preventive maintenance program is still recommended for every 5th year.

Table 3 – Favorable Operating and Environmental Conditions

Protection	Device is protected from environmental conditions
Temperature	Average annual temperature < 77°F (25 °C) outside the switchboard. The device is installed in an air-conditioned room or in a ventilated enclosure
Percent Load	< 50% of I_n (sensor rating)
Relative Humidity	< 50%
Corrosive Atmosphere	Device installed in a protected room (air is conditioned and purified)
Salt Environment	None
Dust	Negligible Device protected in switchboard equipped with filters or ventilated IP54 (Nema 3) enclosure
Vibration	None

Figure 1 – Favorable Conditions



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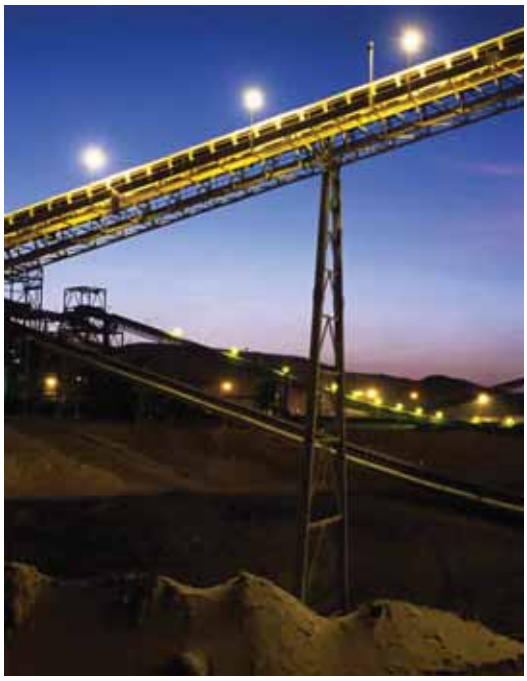
Severe Conditions

The time interval between two preventive maintenance visits must be reduced by half **if any of the conditions** presented below are present unless the device is protected from the condition.

Table 4 – Severe Operating and Environmental Conditions

Temperature (annual average)	Average annual temperature between 95 °F and 113 °F [35 °C and 45 °C] around the switchboard
Percent Load	> 80% of I_n (sensor rating)
Relative Humidity	> 80%
Corrosive Atmosphere	Device installed in environment category 3C3 or 3C4 without any particular protection, see Table 14
Salt Environment	Installation < 6.2 miles (10 kilometers) from seaside and device without any particular protection
Dust	High level of dust and equipment is not protected See Table 13
Vibration	Continuous vibrations between 0.2 and 0.5 g

Figure 2 – Severe Conditions



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Preventive Maintenance Operations

Level II Preventive Maintenance

It is recommended that Level II preventive maintenance be done every year.

Level II maintenance consists of minor preventive maintenance such as greasing and operating checks, as well as repairs by standard exchange of certain assemblies, carried out by a certified customer employee according to the manufacturer maintenance instructions. See the instruction bulletin and user guides for procedures. See Section 4 for what must be maintained.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, or NOM-029-STPS.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Disconnect all power sources before performing maintenance inspections. Assume that all circuits are live until they are completely de-energized, tested, grounded and tagged. Consider all sources of power, including the possibility of backfeeding and control power.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Table 5 – Level II Preventive Maintenance

Check	Year					Tool
Device	1	2	3	4	5[1]	
Check the general condition of the device (accessory cover, trip unit, case, cradle, connections)	X	X	X	X	X	None
Mechanism						
Open/close device manually and electrically	X	X	X	X	X	None
Charge device electrically	X	X	X	X	X	None
Check complete closing of device's poles	X	X	X	X	X	None
Check number of device operating cycles	X	X	X	X	X	Operation counter
Breaking Unit (Arc Chutes + Contacts)						
Check the filters cleanliness and the attachment of the arc-chute	X	X	X	X	X	Racking crank
Control Accessories						
Check auxiliary wiring and insulation	X	X	X	X	X	None
Trip Unit						
Trip trip unit using test tool and check operation of contacts SDE and SDE2	X	X	X	X	X	HHTK or FFTK
Check ground fault protection function (Micrologic 6.0)	X	X	X	X	X	None
Device Locking						
Open and close keylocks installed on device	X	X	X	X	X	None
Open and close padlock system installed on device	X	X	X	X	X	None
Cradle (For Drawout Circuit Breakers)						
Remove device from cradle and put it back	X	X	X	X	X	None
Check operation of position contacts (CE, CT, CD, EF)	X	X	X	X	X	None
Check operation of safety shutters	X	X	X	X	X	None
Cradle Locking						
Open and close keylocks installed on cradle	X	X	X	X	X	None
Operate padlocking system	X	X	X	X	X	None

[1] These checks and tests will be carried out by Schneider Electric Services in case of diagnostic the fifth year (see page 13).

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Level III Preventive Maintenance

It is recommended that Level III preventive maintenance be done every two years.

Level III maintenance consists of preventive maintenance such as general adjustments, troubleshooting and diagnosis of breakdowns, repairs by exchange of components or functional parts, minor mechanical repairs, carried out by a qualified customer technician using the tools specified in the manufacturer maintenance instructions. See the instruction bulletin and user guides for procedures.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, or NOM-029-STPS.
- This equipment must be installed and serviced by qualified electrical personnel.
- Disconnect all power sources before performing maintenance inspections. Assume that all circuits are live until they are completely de-energized, tested, grounded and tagged. Consider all sources of power, including the possibility of backfeeding and control power.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Table 6 – Level III Preventive Maintenance

Check	Year					Tool
Mechanism	1	2	3	4	5[1]	
Check spring charging motor charging time at 0.85 of rated voltage		X		X	X	Stopwatch + external power supply
Check general condition of mechanism		X		X	X	Screwdriver
Breaking Unit (Arc Chutes + Contacts)						
Check condition of breaking unit		X		X	X	Screwdriver
Control Accessories						
Check operation of indication contacts (OF / PF / MCH)		X		X	X	External power supply
Check closing operation of control auxiliary XF		X		X	X	Ohmmeter
Check opening operation of control auxiliary MX at 0.70 of rated voltage		X		X	X	External power supply
Check operation of control auxiliary MN/MNR between 0.35 and 0.7 of rated voltage		X		X	X	External power supply
Check delay of MNR devices at 0.35 and 0.7 of rated voltage		X		X	X	External power supply
Check MX tripping time		X		X	X	Tester
Trip Unit						
Check tripping curves using test tool, signaling LED (tripped, overload). Save results on PC		X		X	X	FFTK FFTK report generator
Cradle (For Drawout Circuit Breakers)						
Remove dirt and any foreign material, then regrease cradle		X		X	X	Mobilith® SHC00
Regrease disconnecting contact clusters (specific case of corrosive atmosphere)		X		X	X	Mobilith SHC00
Power Connections						
Check and tighten loose connections	Only after a visual inspection showing overheating marks					Racking crank

[1] These checks and tests will be carried out by Schneider Electric Services in case of diagnostic the fifth year (see page 13).

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Level IV Preventive Maintenance

It is recommended that Level IV preventive maintenance be done every five years.

Level IV maintenance consists of manufacturer diagnostic and replacement of components by the Schneider Electric Services support department. See the instruction bulletin and user guides for procedures.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, or NOM-029-STPS.
- This equipment must be installed and serviced by qualified electrical personnel.
- Disconnect all power sources before performing maintenance inspections. Assume that all circuits are live until they are completely de-energized, tested, grounded and tagged. Consider all sources of power, including the possibility of backfeeding and control power.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Table 7 – Level IV Preventive Maintenance

Check	Year					Tool
Case	5	10	15	20	25	
Measure insulation resistance	X	X	X	X	X	Ohmmeter
Mechanism						
Check tripping forces (crescent shaped part)	X	X	X	X	X	Tester
Breaking Unit (Arc Chutes + Contacts)						
Measure resistance of input/output contact	X	X	X	X	X	Ohmmeter + injection unit
Control Accessories						
Check the service life of the accessories XF, MX, MN	X	X	X	X	X	“service life” software
Preventative replacement of control accessories	—	—	X	—	—	None
Micrologic Trip Unit						
Check continuity of the tripping chain by primary injection for each phase	X	X	X	X	X	Injection unit
Cradle (For Drawout Circuit Breakers)						
Check connection/disconnection torque	X	X	X	X	X	Racking crank
Clean and regrease racking screw	X	X	X	X	X	Grease

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Maintenance After Storage

Storage Conditions

Devices must be stored in a dry, ventilated area, protected from rain, water and chemical agents. They must be well protected against dust, rubble, paint, etc.

If storage is for an extended period, the following storage conditions are necessary:

- relative humidity in the room must be maintained below 70%.
- circuit breakers with trip units without LCD displays may be stored in the original packaging at temperatures between -40 °F to +185 °F (-40 °C to +85 °C).
- circuit breakers with trip units with LCD displays may be stored in the original packaging at temperatures between -13 °F to +185 °F (-25 °C to +85 °C).
- devices must be stored in the open (OFF) position with the charging springs discharged.

Checks and Maintenance

After extended storage, the checks below must be carried out before installation to ensure correct device operation.

Storage ≤ 2 years

Run the Level II and III second year program on the subassemblies below:

- mechanism
- trip unit
- device and cradle locking
- cradle

Storage > 2 years

Run the Level III and IV fifth year diagnostic program on the subassemblies below:

- mechanism
- control accessories
- trip unit
- device and cradle locking
- cradle

If the devices were stored under severe conditions (high temperature, corrosive atmosphere), it is necessary to:

- check the surface condition of the metal parts (zinc) and the copper parts (silver coatings [Ag] or tinning [Sn]).
- check the greasing for the device and cradle.
- regrease the clusters and check primary contacts.

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Section 3— Accelerated Aging

Causes of Accelerated Aging



A switchboard and the switchgear age, whether they are in operation or not. Aging is due primarily to the influence of the environment and the operating conditions.

Influence of the environment

A device placed in a given environment is subjected to its effects.

The main environmental factors that accelerate device aging are:

- temperature
- percent load
- relative humidity
- salt environment
- current harmonics
- dust
- corrosive atmospheres.

Table 8 – Ambient Temperature (Outside the Switchboard)[1]

Influence	Appearance	Consequences
The mechanical characteristics of plastic parts (insulation, case) are increasingly deteriorated by temperature the higher it rises.	Change in color	Breaking of parts leading to failure of functions
Hardening of grease Elimination of grease on primary contact clusters	Change in color and viscosity Caramel color of grease on clusters	Device cannot be operated Increase of racking forces exerted on clusters
Deterioration of insulating varnishes on coils	Burning smell.	Failure of coils (CT, MN, MX, XF, MCH, electrical reset).
Hardening of glues on labels	Visual	Loss of labels
Deterioration of electronic components	Modified display of LCDs	Loss of display Nuisance tripping or no tripping
Deterioration of opto-electronic devices and SCRs.	Not identifiable	Possible transmission of erroneous orders
Loss of battery backup power	Not identifiable	Fault indications not displayed
Temperature Thresholds in °C		
≤ 77°F (25°C)	78–95°F (26–35°C)	96–113°F (36–45°C)
Optimum operating conditions	An 18°F (10°C) increase in the ambient temperature is equivalent to a 5% increase in the percent load	A 35°F (20°C) increase in the ambient temperature is equivalent to a 10% increase in the percent load
Recommendation		
Preventive maintenance		
Implement the standard program	Carry out more frequent periodic checks (see page 8)	Carry out more frequent periodic checks (see page 8)
Installation		
No particular precautions required	No particular precautions required	Install forced-air ventilation in the switchboard or air-conditioning for the electrical room

[1] The ambient temperature affects the device temperature, which is affected by the percent load. Major variations in temperature (greater than 54°F [30°C]) cause both mechanical stresses (thermal expansion) and condensation that can accelerate aging.

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Table 9 – Percent Load (Sensor Rating I_n)[1]

Influence	Appearance	Consequences
Aging of plastic insulation	Change in color of insulation	Breaking of parts leading to failure of functions
Aging of grease	Change in color and viscosity	Increase in mechanical friction
Aging of electronic components	Modified display of LCDs	A 10°C increase (i.e. a 90% load) cuts the service life of components by approximately half.
Deterioration of characteristics: • steel springs (above 100°C) • stainless steel springs (above 200°C)	Rupture	Non-operation of mechanism

Thresholds				
≤ 80, 24/24 hours	≤ 90%, 8/24 hours	≤ 90%, 24/24 hours	I_n, 8/24 hours	I_n, 24/24 hours
Maximum percent load generally taken into account in sizing the installation. At this percent load, temperature rise is reduced approximately 40% with respect to a 100 percent load.	At this percent load, temperature rise is reduced only 20%. Heating and cooling cycles impact on the mechanical junctions of the power circuit.	The thermal stress for continuous operation is three times higher than in the previous case, but the absence of thermal cycles slows aging of the electromechanical components.	Between 90 and 100%, temperature rise is close to its maximum value. Heating and cooling cycles impact on the mechanical junctions of the power circuit, with major impact on aging.	Between 90 and 100%, temperature rise is close to its maximum value. This situation has a major impact on aging.
Recommendations				
Preventive Maintenance				
Implement the standard program	Increase frequency of periodic checks (see page 8)	Preventive maintenance is difficult due to the continuous process	Increase frequency of periodic checks (see page 8)	Preventive maintenance is difficult due to the continuous process. Plan more frequent periodic checks.
Installation				
			Provide ventilation for switchboard	Spread the load over other circuit breakers Install a device with a higher rating.

[1] The percent load affects the device temperature, which is itself affected by the ambient temperature.

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Table 10 – Relative Humidity

Influence	Appearance	Consequences
Corrosion of metal surfaces that is accelerated when a pollutant is present (corrosive gas, salt, chlorine, etc.)	Appearance of: • red rust on iron • white rust on zinc • blue deposit on copper • black deposit on silver	Increase in friction Risk of mechanical rupture resulting in non-operation of mechanisms Increase in contact resistance (clusters and main contacts)
Deterioration of dielectric qualities of plastics	White traces on case	Risk of a reduction in insulation
Deterioration of electronic components, in particular printed circuit boards and silver-coated components. This phenomenon is worsened by the presence of H_2S corrosive gas (hydrogen sulphide).	Not visible Appearance of dendrites on electronic boards	Short-circuiting of circuits resulting in non-operation of control-unit protection, measurement, indication and communication functions.
Deterioration of electronic components, in particular non-varnished copper circuits.	Not visible Erosion of copper tracks Oxidation of metal connectors of components and metal cases Oxidation of connectors of integrated-circuits mounted on supports	Failure due to short-circuit or open circuit Rupture of component connectors along case Poor contact with integrated-circuit supports
Degradation of opto-electronic components.		Failure of data transmission.
Thresholds in%		
< 70%	70 to 85%	> 85%
Level of relative humidity generally found in continental and temperate zones. The level is generally lower in switchboards due to the internal temperature rise. No significant deterioration is noted at this level.	Level of relative humidity generally found in zones close to water. Possible appearance of condensation on cold parts and accelerated rusting.	Level of relative humidity generally found in tropical zones and certain factories (e.g. paper mills). Increased risk of condensation and rust resulting in difficulties to disconnect devices, risk of non-opening or non-closing.
Recommendation		
Preventive Maintenance		
Preventive maintenance	Carry out more frequent periodic checks (see page 8) Measurement of insulation is advised every 5 years	Carry out more frequent periodic checks (see page 8) Inspect for rust on metal parts Measurement of insulation is imperative every two years
Installation		
No particular precautions required		Install heating elements in the switchboard

Figure 3 – High-Humidity Environment Greenhouse



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Table 11 – Salt Environment

Influence	Appearance	Consequences
Corrosion of metal parts	Appearance of: • white rust on zinc coatings • red rust on steel	Increase in friction. Freezing of mechanism Broken springs. Blocking of cores of MX / XF / MN control accessories.
Risk of salt deposits on electronic circuit when thick salt mists occur.	Appearance of salt bridges on electronic boards.	Failure of electronic systems due to short-circuiting of circuits, particularly non-varnished circuits.
Risk of conducting salt deposits on the device when thick salt mists occur.	White deposit	Deterioration of device dielectric withstand resulting in risk of phase-to-frame short circuit and a phase-to-phase short circuit if an overload occurs.
Thresholds		
No salt mist	Moderate salt mist < 6 miles (10 km)from seaside	Significant salt mist < 0.6 miles (1 km) from seaside
No influence.	Moderate aging of switchgear.	Rapid aging of exposed switchgear. On average, service life is divided by a factor of three for non-protected devices.
Recommendation		
Preventive Maintenance		
Implement the standard program.	Carry out more frequent periodic checks (see page 8).	Carry out more frequent periodic checks (see page 8). Test the dielectric withstand every two years.
Installation		
No particular precautions required.	No particular precautions required.	Switchgear must be protected from salt mist. Increase the switchboard protection category to IP54 (NEMA 3). Create a protected room.

Figure 4 – Salt Environment (Seaside)

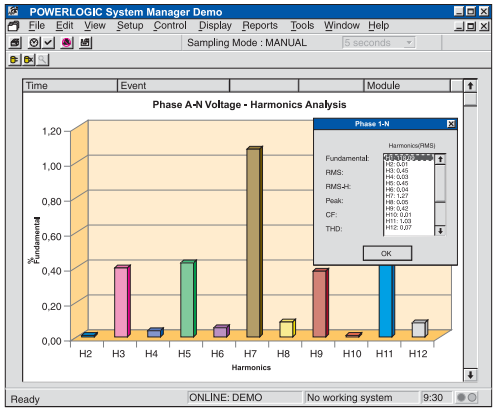


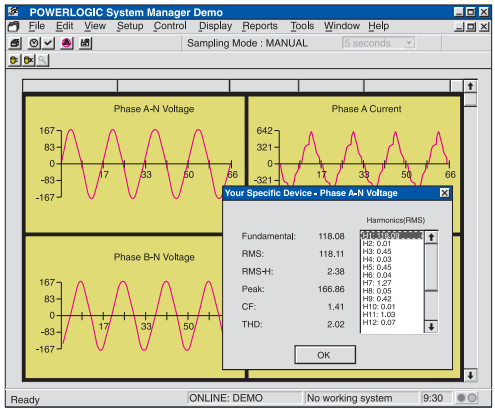
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Table 12 – Harmonics

Influence	Appearance	Consequences
Increase in skin effect, proximity effect, iron losses, eddy currents	Change in color of terminals, insulators and grease Modified display of LCDs	Harmonics cause temperature rise greater than that of the fundamental current
Possible overload of neutral if third-order harmonics and their multiples are present	Distorted waveform	Erroneous current value Nuisance tripping if non-rms trip units
Thresholds in % of I_n		
THDi y 30%	THDi 30 to 50%	THDi > 50%
No notable influence on aging	At 40% THDI, heat loss is approximately 10% higher, corresponding to 5% more current	
Recommendation		
Preventive Maintenance		
Implement the standard program	Carry out more frequent periodic checks (see page 8)	Carry out more frequent periodic checks (see page 8)
Installation		
No particular precautions required	Standard filtering with an inductor to reduce harmonics	If necessary, oversize the neutral Oversize switchgear

Figure 5 – Harmonics





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Table 13 – Dust

Influence	Appearance	Consequences
Deposit on grease of mechanisms (device and cradle)	Change in color and texture of greases	Premature wear of mechanisms because dust mixed with grease can be abrasive Increase in mechanical friction and freezing of moving parts Risk of device not moving on cradle Risk of device non-opening or non-closing
Deposit on grease of clusters	Change in color and texture of greases	Increase in racking forces exerted Increased contact resistance and temperature rise
Deposit on displays		Screen data not legible
Deposit on insulation		Reduced insulation resistance (depends on type of dust) This phenomenon is worsened by the presence of humidity
Deposit on device contacts		Increased contact resistance and temperature rise
Deposit on opto-electronic communication system		Failure of communication-data transmission between devices
Dust Deposit		
Low Level	Moderate	High
Quantity of dust generally deposited on and around devices in commercial buildings and on standard industrial premises	Quantity of dust found in **protected switchboards** installed in dusty environments such as cement works, grain mills, incineration installations, plastic and steel mills, mines, etc.	Quantity of dust deposited on and around devices inside **non-protected switchboards** installed in dusty environments such as cement works, grain mills, incineration installations, plastic and steel mills, mines, etc.
Recommendations		
Preventive maintenance		
Implement the standard program It is advised to vacuum cleaner dust deposits	Carry out more frequent periodic cleaning (see page 8)	Carry out more frequent periodic cleaning (see page 8)
Installation		
Switchboard with standard IP (NEMA 1)	Make sure the switchboard remains closed	Special equipment required to protect the switchgear is mandatory

Figure 6 – Dust Occurrence



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Table 14 – Corrosive Atmosphere

Corrosive atmosphere	Influence	Appearance	Consequences	Thresholds (ppm[1] in volume) Average value (see next page for Categories 3C1, 3C2, 3C3, 3C4)
SO_2 Sulphur dioxide	Corrosion of silver, aluminum and bare copper. Phenomenon accelerated by high temperature and relative humidity.	Blackening of exposed silver surfaces. Appearance of dendrites on electronic and power circuits.	Increased resistance of disconnecting contacts exposed to air. Excessive device temperature rise. Short-circuiting of circuits resulting in non-operation of the trip unit.	3C1: 0.037 3C2: 0.11 3C3: 1.85 3C4: 4.8
H_2S Hydrogen sulphide	Sulphurization of silver, this phenomenon is accelerated by high temperatures.	Major blackening of exposed silver surfaces. Appearance of dendrites on electronic and power circuits.	Increased resistance of disconnecting contacts exposed to air. Excessive device temperature rise. Short-circuiting of circuits resulting in non-operation of the trip unit.	3C1: 0.0071 3C2: 0.071 3C3: 2.1 3C4: 9.9
Cl_2 Chlorine	Corrosion of metal parts.	Oxidation Inter-granular corrosion of stainless steel.	Increase in friction. Risk of mechanical rupture. Breaking of stainless-steel springs.	3C1: 0.034 3C2: 0.034 3C3: 0.1 3C4: 0.2
NH_3 Ammoniac	Attacks polycarbonates, corrodes copper.	Cracking of polycarbonates. Blackening of copper.	Risk of rupture. Increased temperature rise.	3C1: 0.42 3C2: 1.4 3C3: 4 3C4: 49
NO_2 Nitrogen oxide	Corrosion of metal parts.	Oxidation.	Increased temperature rise.	3C1: 0.052 3C2: 0.26 3C3: 1.56 3C4: 5.2
Oily atmospheres	Attacks polycarbonates.	Cracking of polycarbonates.	Risk of rupture. Increased temperature rise.	

[1] ppm = Parts Per Million.

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Table 15 – Environment Categories as per Standard IEC 60721-3-3

Class			
3C1	3C2	3C3	3C4
Rural zones or urban zones with low industrial activity.	Urban zones with scattered industrial activity and heavy traffic.	Immediate vicinity of industrial pollution. Example, paper mills, water treatment, chemicals, synthetic fibers, smelting plants.	Inside polluting industrial premises. Example: paper mills, water treatment, chemicals, synthetic fibers, smelting plants.
Presence of Corrosive Gases			
Negligible	Low level	Significant level	High level
Impact on switchgear			
No impact on service life because concentrations are very low.	Moderate impact on service life.	Major impact, particularly concerning temperature rise. For electronic systems, no impact on varnished boards and gold-plated contacts.	Significantly reduced service life if no particular precautions are taken. For electronic systems, no impact on varnished boards and gold-plated contacts.
Recommendation			
Preventive maintenance			
Implement the standard program.	Implement the standard program. "Pyratex“ grease can be used for the disconnecting contacts, but must be changed annually (see the manufacturer procedure).	Carry out more frequent periodic checks (see page 8). Change the grease on the disconnecting contacts.	Carry out more frequent periodic checks (see page 8). Change the grease on the disconnecting contacts.
Installation			
No particular precautions required.	No particular precautions required.	Use fixed rather than drawout devices.	Install the switchgear in a room protected from the pollution. Use fixed rather than drawout devices, or use gold-plated disconnecting contacts.

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Operating Conditions

Operating conditions directly affect the service life of switchgear due to the limited electrical and mechanical endurance levels of the various subassemblies. Operating conditions include:

- vibrations,
- the number of operating cycles,
- the interrupted currents.

Table 16 – Vibrations

Influence	Appearance	Consequences	
Premature deterioration of contact surfaces (clusters and main contacts).	Not identifiable.	Increased device temperature rise.	
Loosening of bolted assemblies.	Not identifiable.	Increase in mechanical clearance.	
Wear of mechanical parts.	Not identifiable.	Broken springs. Increase in mechanical clearance between parts.	
Appearance of fretting corrosion on auxiliary connections.	Not identifiable.	Erroneous information or loss of continuity in data or supply, excessive temperature rise.	
Breaking of connectors on large electronic components (e.g. large capacitors).	Not identifiable.	Failure of protection function.	
Wear of adjustment switches on the trip unit.	Not identifiable.	Nuisance tripping or no tripping.	
Thresholds			
< 0.2 g	0.2 g to <0.5 g	0.5 g to 0.7 g	> 0.7 g
Normal condition, no impact on service life.	Reduced service life.	Significant increase in incidents.	Forbidden for standard devices
Recommendation			
Preventive maintenance			
Implement the standard program.	Carry out more frequent periodic checks (see table).	Carry out more frequent periodic checks (see page 8). Check in particular the tightness of connections.	
Installation			
No particular precautions required.	No particular precautions required. Install switchgear on a rubber mounting bushing.	Install switchgear on a rubber mounting bushing.	Use special devices.

Table 17 – Number of Operating Cycles

Influence		Consequences
The number of operating cycles depends directly on the electrical and mechanical endurance of the device.		Device service life depends on the daily number of operating cycles.
Device Service Life (depends on the daily number of operating cycles)		
≤ 30 cycles per month	≤ 60 cycles per month	≤ 120 cycles per month
Corresponds to one cycle per day. For a device endurance of 10,000 cycles and an interrupted current of less than 0.4 I_n, the service life is 30 years.	Corresponds to two cycles per day. For a device endurance of 10,000 cycles and an interrupted current of less than 0.4 I_n, the service life is 15 years.	Corresponds to four cycles per day. For a device endurance of 10,000 cycles and an interrupted current of less than 0.4 I_n, the service life is 10 years.

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Table 18 – Interrupted Current

Influence	Appearance	Consequences
Wear of fixed and moving contacts.	Deterioration of contacts.	Beyond the electrical-endurance limit, device temperature rise increases due to the greater contact resistance and a reduction in the pressure of contacts.
Wear of the arc chutes (insulating materials, separators).	Deterioration of insulation.	Beyond the electrical-endurance limit, the insulation separators). (input/output and between phases) is reduced, which results in a reduction of device suitability for isolation and can create an unsafe condition.
Thresholds		
≤ I_n (Sensor Rating)	> I_n to ≤ 4 I_n (Sensor Rating)	> 4I_n to ≤ 8 I_n (Sensor Rating)
This level of interrupted current corresponds to the mechanical durability (see Mechanical endurance).	This level of interrupted current corresponds to expected levels of short time events.	This level of interrupted current corresponds to the severe short circuit events. Requires inspection of contacts and arc chutes.

Figure 7 – Wear on Contacts





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Section 4— What Must be Maintained

Inspect arc chamber/arc chutes, main contacts, spring charging motor, and trip devices after the operations listed in Table 19.

Table 19 – Electrical Operations

Circuit Breaker Type	Number of Electrical Operations (Open-Close Cycle)			
	Arc Chamber	Main Contacts	Spring-Charging Motor (MCH)	Trip Devices (MX/XF)
NW08–NW16 Types N/N1/H/H1/H2/H3/HA/HF	10,000	10,000	12,500	12,500
NW08–NW16 Types L/LF/L1/L1F/HB/HC	3,000	3,000	12,500	12,500
NW20 Types N/H/H1/H2/H3/HA/HF	8,000	8,000	10,000	12,500
NW20 Types L/LF/L1/L1F/HB/HC	3,000	3000	10,000	12,500
NW32 Types H1/H2/H3/HA/HF NW25-NW30 Types H/L/HB/HF	5,000	5,000	10,000	12,500
NW40B (W-Frame) Types H1/H2/H3/HA/HF	5,000	5,000	10,000	12,500
NW40–NW50-NW60 Types H/H2/H3/L/L1/HA/HB/HC/HF NW32 Type L1	1,500	1,500	5,000	12,500

Molded Case



The case is an essential element in the circuit breaker. First, it provides a number of safety functions by:

- providing functional insulation between the phases themselves and between the phases and the exposed conductive parts in order to resist transient overvoltages caused by the distribution system
- providing a barrier, preventing direct user contact with live parts
- protecting against the effects of electrical arcs and overpressures caused by short-circuits.

Second, it serves to support the operating mechanism as well as the mechanical and electrical accessories of the circuit breaker.

On the case, there should be:

- no traces of grime (grease), excessive dust or condensation which all reduce insulation
- no signs of burns or cracks which could weaken the case and thus its capacity to withstand short-circuits.

Preventive maintenance for cases consists of:

- a visual inspection of its condition and cleaning with a dry cloth or a vacuum cleaner. All cleaning products with solvents are strictly forbidden.
- Measuring the insulation every five years and following trips due to a short-circuit.

Replace the circuit breaker if there are signs of burns or cracks.

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Arc Chutes



During a short-circuit, the arc chute serves to extinguish the arc and to absorb the high level of energy along the entire path of the short-circuit. It also contributes to arc extinction under rated current conditions. An arc chute that is not in good condition may not be capable of fully clearing the short-circuit and ultimately result in the destruction of the circuit breaker.

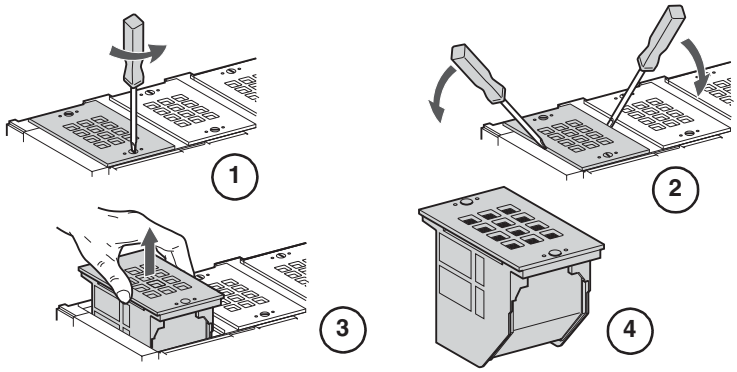
The arc chutes must be regularly checked. The fins of the arc chutes may be blackened (due to the gases produced at I_n) but must not be significantly damaged. What is more, the filters must not be blocked to avoid internal overpressures. Use a vacuum cleaner rather than a cloth to remove dust from the outside of the arc chutes.

Arc Chamber Maintenance

1. Unscrew the mounting screws.
2. Use screwdrivers to lift arc chamber from circuit breaker.
3. Remove arc chamber.
4. Inspect arc chamber. Check that arc chamber body is not broken and that the plates are intact and not significantly burned or melted.

If necessary, replace arc chamber.

Figure 8 – Arc Chamber Maintenance



Main Contacts



The contacts make and break the current under normal conditions (rated current for the installation) and under exceptional conditions (overloads and short-circuits). The contacts are eroded by the many opening and closing cycles and can be particularly deteriorated by short-circuit currents. Worn contacts may result in abnormal temperature rise and accelerate device aging.

It is imperative to remove the arc chutes and visually check contact wear at least once a year and following each short-circuit event.

The contact-wear indicators constitute an absolute minimum value that must not be overrun.

To plan and reduce the number of shutdowns, an electronic wear counter is available with the Micrologic P and H. A visual check is required when the counter reaches 100. When the counter reaches 300, the contacts are worn out and must be replaced.

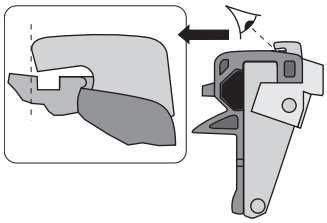
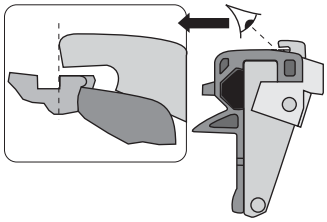
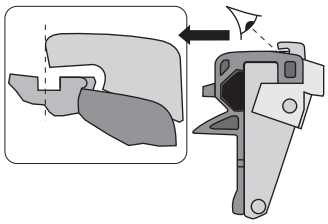
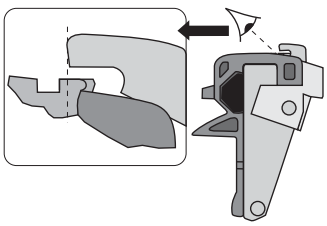
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Main Contact Maintenance

1. Remove the arc chambers.
2. Close the circuit breaker and check the condition of the contacts.

If contacts are worn, the circuit breaker block assembly must be replaced.

Table 20 – Contact Wear

Standard	Frame Size	Interruption Type	Poles	New Contacts	Contacts Need to be Replaced
ANSI	250 A	H1/H2/H3/N1	3P		
	3200–4000 A	H2/H3	3P		
	800–1600 A	N1	4P		
	800–2000 A	H1/HA	4P		
	800–2000 A	H2/H3/HF	3P/4P		
	3200 A	H1/HA/H2/H3/HF	4P		
	3200 A	HF	3P/4P		
UL	250 A	H/N	3P		
	2000–3000 A	L/HB	3P		
	800–3000 A	H/HF	3/4P/4P RHN		
	800–2000 A	N	3P/4P		
ANSI	250 A	L1/L1F	3P		
	800–2000 A	H1/HA/L1/HC/L1F	3P		
	3200–5000 A	L1/HC	3P		
	4000–5000 A	H2/HA/H3/HF	3P/4P		
	800–1600 A	N1	3P		
	3200–4000 A	H1/HA	3P		
UL	250 A	L/LF	30		
	4000–6000 A	H/HF	3P/4P/4P RHN		
	4000–6000 A	L/HB	3P		
	800–1600 A	L/HB	3P		
	800–2000 A	LF	3P		

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Device and Cradle Mechanisms



Mechanical operation of the circuit breaker may be hindered by dust, vibration, aggressive atmospheres, no greasing, or excessive greasing. Operating safety is ensured by dusting and general cleaning, proper greasing, and regular opening and closing of the circuit breaker.

Dusting

Dusting is best carried out using a vacuum cleaner.

Cleaning

Cleaning should be carried out using a cloth or brush that is perfectly clean and dry, without using any solvents, avoiding greased parts except for grease on electrical contacts. Application of products under pressure or containing solvents (trichloroethane, trichloroethylene, WD40®) is strictly forbidden.

The main problems of products under pressure are the following:

- it may be impossible to regrease inaccessible lubrication points (which are greased for the life of the product)
- corrosion of points that are not regreased
- damage caused by the pressure
- risk of temperature rise due to the presence of an insulating solvent in the contact zones
- elimination of special protection
- deterioration of plastic materials.



Greasing

This operation is carried out after cleaning on certain mechanical parts as described in the maintenance procedures, using the various greases recommended by Schneider Electric. Grease must not be over applied because the excess, if mixed with dust, may result in mechanism malfunctions. Generally speaking, under normal operating conditions, the pole-operating mechanism does not require any regreasing as it is greased for the life of the product.

- The clusters and disconnecting-contacts must be greased according to the defined intervals using the greases indicated by Schneider Electric.
- The main contacts must not be greased.

Operating Cycles

The need for continuity of service in an installation generally means that power circuit breakers are rarely operated. While an excessive number of operating cycles accelerates device aging, it is also true that a lack of operation over a long period can result in mechanical malfunctions. Regular operation is required to maintain the normal performance level of each part involved in the opening and closing cycles.

In installations where power circuit breakers are used in source changeover systems, it is advised to periodically operate the circuit breaker for the alternate source.

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Auxiliary Circuits



Control Accessories

MX and XF shunt releases are respectively used to remotely open and close the circuit breaker using an electrical order or through a communication network.

The MN undervoltage release is used to break the power circuit if the distribution system voltage drops or fails.

Communicating MX and XF releases and MN releases are continuously supplied and their internal electronic components may suffer accelerated aging if there is temperature rise in the circuit breaker.

Preventive maintenance consists of periodically checking operation at minimum values.



Auxiliary Wiring

Auxiliary wiring is used to transmit orders to the various control devices and to transmit status condition information. Incorrect connections or damaged insulation may result in either non-operation of the circuit breaker or nuisance tripping.

Auxiliary wiring must be regularly checked and replaced as needed, particularly if there are vibrations, high ambient temperatures or corrosive atmospheres.



Indication Contacts

The contacts indicating the status of the circuit-breaker (ON / OFF), of the cradle (CE, CD, CT), a trip due to an electrical fault (SDE), or that the circuit breaker is ready to close (PF) provide the operator with the status information required to react correspondingly. Any incorrect indications may result in erroneous device operation. Contact failure (wear, loose connections) may result from vibrations, corrosion or abnormal temperature rise and preventive maintenance must ensure that contacts correctly conduct or isolate according to their positions.



Spring Charging Motor

The spring charging motor (MCH) automatically recharges the operating-mechanism springs as soon as the circuit breaker is closed. The spring charging motor makes it possible to instantaneously reclose the device following an opening. This function may be indispensable for safety reasons. The charging lever serves simply as a backup means if the auxiliary voltage fails. Periodic checks on the spring charging motor operation and the charging time are required to ensure the device function.

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Electronic Trip Unit



If an electric fault occurs in the installation, the electronic trip unit detects the fault and orders the circuit breaker to open.

Electronic components and circuit boards are sensitive to the environment (ambient temperature, humid and corrosive atmospheres) and to severe operating conditions (magnetic fields, vibrations, etc.). To ensure correct operation, it is necessary to periodically check:

- the chain of action resulting in a trip
- the response time as a function of the level of the fault current.

Use HHTK or FFTK test kits for secondary injection testing or test with primary injection.

Communication Module and Accessories





I/O Module IFM Module



IFE Module

Using the communication bus, the communication option transmits data to a remote site for use by various departments (maintenance, management, production, etc.).

A break in the transmission of data can result in:

- production losses due to unawareness concerning the status of a circuit breaker
- financial losses due to incorrect system management, diagnostic errors, etc.

Periodic checks on the orders (read, write, commands) transmitted by the communication bus are required to maintain a high degree of reliability and confidence in the communication system.

Connections

The connections between the various distribution systems in a switchboard (busbars, cables) and the switchgear are a major source of heat loss. Incorrect tightening may lead to thermal runaway which in turn can provoke damage to the device, the cable insulation, or result in a short-circuit and/or a fire. This type of malfunction is often due to disregard for installation requirements during switchboard assembly.

NOTE: Connections must never use different materials (copper/aluminium).

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Fixed Circuit Breakers



Fixed circuit breaker connections use lugs or bars. When made in compliance with Schneider Electric recommendations (tightening torque, hardware, and contact washer), this type of connection does not require any particular maintenance.

Otherwise, regularly check the temperature-rise points. If there is a change in color of copper or tinning:

- dismantle the connections
- clean and scrape the contact surfaces
- then reassemble the connections using new hardware.

Check the terminals.

Drawout Circuit Breakers (Cradle)



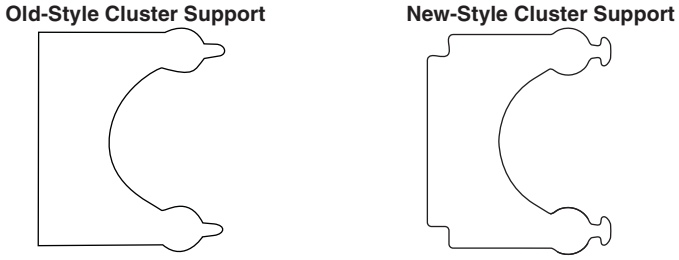
Drawout circuit breaker connections are made up of two parts, the clusters and disconnecting contacts. This type of connection is critical and requires periodic cleaning in compliance with the described procedures. The grease facilitates the connection between the clusters and the disconnecting contacts and avoids damaging the silver-coated surface by reducing the racking-in friction.

In sulphurous (corrosive) atmospheres (H2S/SO2), it is necessary to implement the cleaning procedure using the Thiourea solution, with mandatory regreasing using fluorous grease (such as Pyratex® EP). This type of grease protects the silver and copper-coated contacts against sulphurizing. Because silver or copper sulphide is insulating it creates an increase in the contact resistance and thus greater temperature rise. The grease breaks down over time and it is therefore necessary to replace it regularly.

Cluster Inspection and Lubrication (Masterpact NW Drawout Circuit Breakers Only)

1. If the circuit breaker is equipped with cluster retainers, remove the retainers as necessary to inspect the clusters and cluster supports.
2. If the circuit breaker is equipped with ArcBlok or cluster shields, use the S47542 cluster tool to remove the clusters for inspection.

Figure 9 – Cluster Support Profiles



Make sure clusters are installed properly as shown in Table 21.

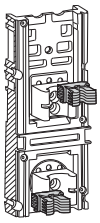
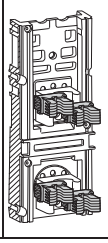
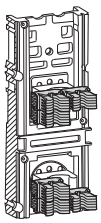
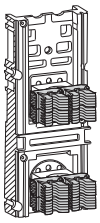
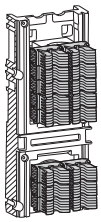
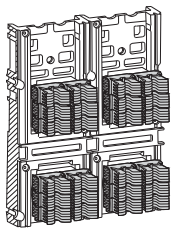
3. Visually inspect clusters for wear or signs of damage such as:
   - — discolored areas
   - — visible copper on fingers
   - — cracked or broken springs
   - — missing clusters
   - — not aligned with other cluster (indicates spring damage)
4. Visually inspect clusters for wear.

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5. For circuit breakers with cluster retainers: check that all clusters have cluster retainers.

NOTE: Circuit breakers with cluster shields or ArcBlok shields do not need the cluster retention kits. Do not attempt to install the cluster retention kits on those circuit breakers.

Table 21 – Cluster Configuration

Number of Clusters Per Pole					
2	4	6	8	16	24
					

Cluster Replacement

NOTICE

HAZARD OF EQUIPMENT DAMAGE

- If clusters are removed for any reason, clusters must be installed using cluster positioning tool S47542.
- Lubricate clusters as shown in Cluster Lubrication on page 37.
- Do not install anything in the cluster jaw except 3/8 in. (9.5 mm) wide bus bar or Cluster Reset Tool, catalog number CLUSRETOOL.

Failure to follow these instructions can result in equipment damage.

If Masterpact NW clusters are worn or damaged, new clusters must be installed using cluster positioning tool S47542.

Table 22 – Number of Clusters Per Pole

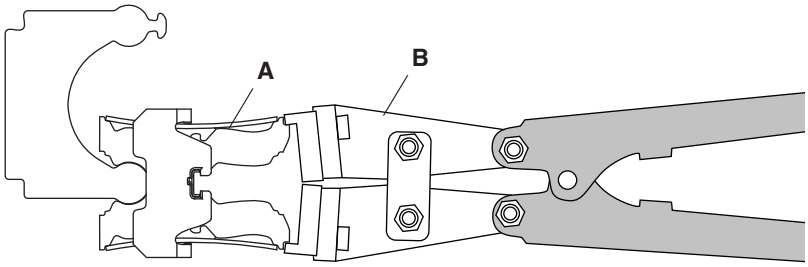
Type		N/N1	H1	HA	H / H2 / H3 / HF	L / L1 / LF / L1F / HB / NC
V ∿	NW08	2	4	4	4 / 6 / 6 / 4	8
	NW12	2	—	—	4	8
	NW16	6	6	6	6	8
	NW20	8	8	8	8	16
	NW25 / NW30	—	—	—	16	16
	NW32	—	16	16	16	24
	NW40/NW50	—	—	24	24	24
	NW60	—	—	—	24	24
V ⎓	NW80 / NW12 / NW16 / NW20 / NW25	8				
	NW30 / NW40	16				

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— Replace worn or damaged clusters on all cluster configurations.

— Install new clusters (Figure 10, A) using cluster positioning tool S47542 (B).

Figure 10 – Cluster Replacement



If clusters and cluster supports are not damaged and the circuit breaker is not equipped with a cluster shield or ArcBlok Shield, you can continue to use the cluster retainer kits. If necessary, retrofit using new cluster supports, finger clusters and cluster shields/ArcBlok shields.

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Table 23 – Cluster Retainer Kits

Description	Frame Size	Interruption Type	Clusters Per Pole	Cluster Retainer Kit		Retainer Color	
				3P	4P	Upper	Lower
UL489 Listed Masterpact NW Circuit Breaker	800/1600 A	N	2 or 6	CRK2000A3P	CRK2000A4P	No Color	No Color
		H	4 or 6	CRK2000A3P	CRK2000A4P	No Color	No Color
		L/LF	8	CRK2000A3P	N/A	No Color	No Color
	2000 A	N/H	8	CRK2000A3P	CRK2000A4P	No Color	No Color
		L/LF	16	CRK3000L3P	N/A	Red	Black
	2500/3000 A	H	16	CRK3200A3P	CRK3200A4P	Red	Black
		L	16	CRK3000L3P	N/A	Red	Black
	4000/5000/6000 A	H	24	CRK6000A3P	CRK6000A4P	Black	Black
		L	24	CRK6000A3P	N/A	Black	Black
UL489 Listed Masterpact NW Automatic Switches	800/1600 A	HF	4 or 6	CRK2000A3P	CRK2000A4P	No Color	No Color
		HB	8	CRK2000A3P	N/A	No Color	No Color
	2000 A	HF	8	CRK2000A3P	CRK2000A4P	No Color	No Color
		HB	16	CRK3000L3P	N/A	Red	Black
	2500/3000 A	HF	16	CRK3200A3P	CRK3200A4P	Red	Black
		HB	16	CRK3000L3P	N/A	Red	Black
	4000/5000/6000 A	HF	24	CRK6000A3P	CRK6000A4P	Black	Black
		HB	24	CRK6000A3P	N/A	Black	Black
ANSI C37 Certified Masterpact NW Circuit Breaker	800/1600 A	N1	2 or 6	CRK2000A3P	CRK2000A4P	No Color	No Color
		H1/H2/H3	4 or 6	CRK2000A3P	CRK2000A4P	No Color	No Color
		L1/L1F	8	CRK2000A3P	N/A	No Color	No Color
	2000 A	H1/H2/H3	8	CRK2000A3P	CRK2000A4P	No Color	No Color
		L1/L1F	16	CRK3000L3P	N/A	Red	Black
	3200 A	H1/H2/H3	16	CRK3200A3P	CRK3200A4P	Red	Black
		L1	24	CRK6000A3P	N/A	Black	Black
	4000/5000 A	H2/H3	24	CRK6000A3P	CRK6000A4P	Black	Black
		L1	24	CRK6000A3P	N/A	Black	Black
ANSI C37 Certified Masterpact NW Non-Automatic Switches	800/1600 A	HA	4 or 6	CRK2000A3P	CRK2000A4P	No Color	No Color
	2000 A	HA	8	CRK2000A3P	CRK2000A4P	No Color	No Color
	3200 A	HA	16	CRK3200A3P	CRK3200A4P	Red	Black
	4000/5000 A	HA	24	CRK6000A3P	CRK6000A4P	Black	Black
ANSI C37 Certified Masterpact NW Automatic Switches	800/1600 A	HF	4 or 6	CRK2000A3P	CRK2000A4P	No Color	No Color
		HC	8	CRK2000A3P	N/A	No Color	No Color
	2000 A	HF	8	CRK2000A3P	CRK2000A4P	No Color	No Color
		HC	16	CRK3000L3P	N/A	Red	Black
	3200 A	HF	16	CRK3200A3P	CRK3200A4P	Red	Black
		HC	24	CRK6000A3P	N/A	Black	Black
	4000/5000 A	HF	24	CRK6000A3P	CRK6000A4P	Black	Black
		HC	24	CRK6000A3P	N/A	Black	Black
Cluster Retainer Clip	All	All	—	CRCLIP	—	—	—

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⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

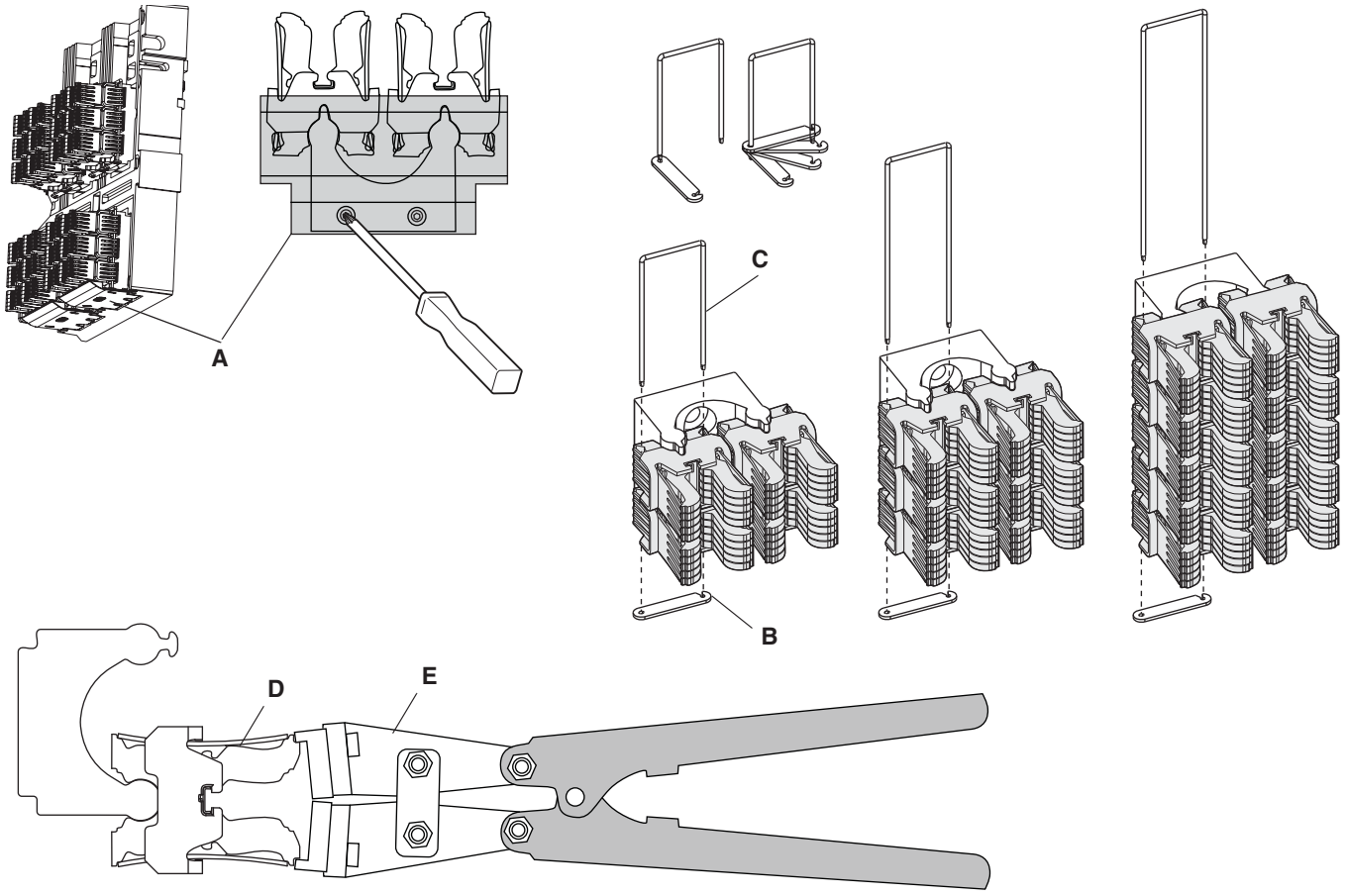
Install the correct cluster retainer identified by color depending on circuit breaker size and type. See Table 23.

Failure to follow these instructions will result in death or serious injury.

NOTE: Cluster retainer clip cannot be reused. Use new cluster retainer clip, part number CRCLIP.

1. Replace worn or damaged clusters on all cluster configurations except lower clusters on 16 and 24 cluster configurations.
   a. Remove lower connector plate (Figure 11, A), if present. Retain plate, screws and washers.
   b. Remove cluster retainer clip (B) and cluster retainer (C), if equipped. Discard cluster retainer clip. Remove worn or damaged clusters.
   c. Install new clusters (D) using cluster positioning tool S47542 (E).
   d. Secure clusters using cluster retainer (C) and new cluster retainer clip (B). See Table 23 for correct cluster retention kit and cluster retainer color.
   e. Replace lower connector plate (A), if previously removed. Secure using previously-retained screws and washers. Torque screws to 17.7 lb-in. (2 N•m).

Figure 11 – Cluster Replacement



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⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

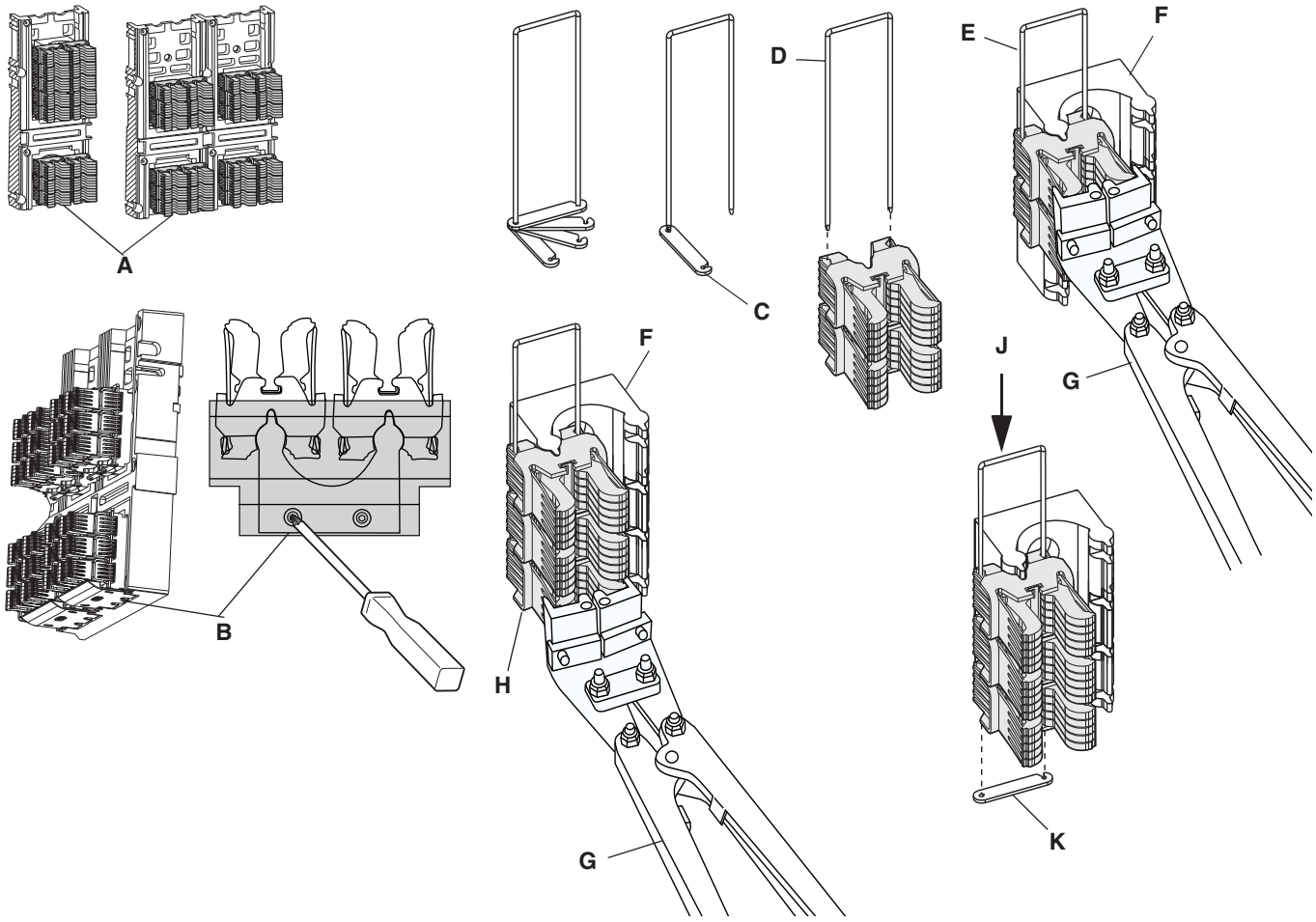
Install the correct cluster retainer identified by color depending on circuit breaker size and type. See Table 23.

Failure to follow these instructions will result in death or serious injury.

2. Replace worn or damaged clusters on lower set of clusters on 16 and 24 cluster configurations (Figure 12, A):
   a. Remove lower connector plate (B), if present. Retain plate, screws and washers.
   b. Remove cluster retainer clip (C) and cluster retainer (D), if equipped. Discard cluster retainer clip. Remove all clusters, discard worn or damaged clusters.
   c. Slide cluster retainer (D) through two clusters until bottom of cluster retainer is even with bottom of lower cluster. See Table 23 for correct cluster retainer kit and color.
   d. Install the two clusters and cluster retainer (E) on top two notches of cluster support (F) using cluster positioning tool S47542 (G).
   e. Install the third cluster (H) on bottom notch of cluster support (F) using cluster positioning tool S47542 (G).
   f. Slide cluster retainer (J) through third cluster and secure using new cluster retainer clip (K).
   g. Repeat for clusters on other side of cluster support.
   h. Replace lower connector plate (B), if previously removed. Secure using previously-retained screws and washers. Torque screws to 17.7 lb-in. (2 N•m).

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Figure 12 – Cluster Replacement



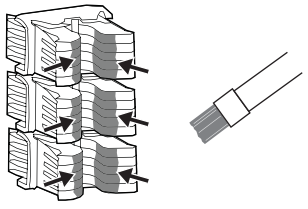
Cluster Lubrication

NOTICE
HAZARD OF EQUIPMENT DAMAGE Inspect the cluster for lubrication when the circuit breaker is removed from the cradle. **Failure to follow these instructions can result in equipment damage.**

Use grease kit (catalog number S48899) to lubricate cluster jaws as shown in Figure 13.

NOTE: Remove any existing grease from cluster assembly before applying new grease to clusters.

Figure 13 – Cluster Grease Application



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Cradle Stab Lubrication

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, or NOM-029-STPS.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

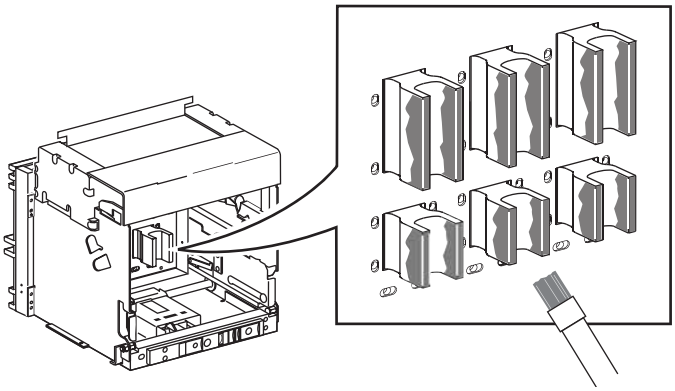
Failure to follow these instructions will result in death or serious injury.

The cradle stabs must be inspected and lubricated when the cradle is first installed and again during maintenance periods after all power has been disconnected.

Confirm that both sides of stab are coated with lubricant. If necessary, use grease kit (catalog number S48899) to lubricate stab.

NOTE: Remove any existing grease from cradle stabs before applying new grease to them.

Figure 14 – Cradle Stab Grease Application



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Section 5— Troubleshooting

Table 24 – Troubleshooting and Solutions

Issue	Probable causes	Solutions
Circuit breaker cannot be closed locally or remotely.	1. Circuit breaker padlocked or keylocked in the “open” position. 2. Circuit breaker interlocked mechanically in a source changeover system. 3. Circuit breaker not completely connected. 4. The reset button signaling a fault trip has not been reset. 5. Stored energy mechanism not charged. 6. MX opening shunt release permanently supplied with power. 7. MN undervoltage release not supplied with power. 8. XF closing release continuously supplied with power, but circuit breaker not “ready to close” (XF not wired in series with PF contact). 9. Permanent trip order of a Micrologic P or H trip unit with minimum voltage and minimum frequency protection in Trip mode and the trip unit powered.	1. Disable the locking function. 2. Check the position of the other circuit breaker in the changeover system. Modify the situation to release the interlock. 3. Complete racking in (connection) of the circuit breaker. 4. Clear the fault. Push the reset button on the front of the circuit breaker. 5. Charge the mechanism manually If it is equipped with an MCH spring charging motor, check the supply of power to the motor. If the problem persists, replace the spring charging motor (MCH). 6. There is an opening order. Determine the origin of the order. The order must be cancelled before the circuit breaker can be closed. 7. There is an opening order. Determine the origin of the order. Check the voltage and the supply circuit ($U > 0.85\ U_n$). If the problem persists, replace the undervoltage release. 8. Cut the supply of power to the XF closing release. then send the closing order again via the XF, but only if the circuit breaker is “ready to close”. 9. Disable these protection functions on the Micrologic P or H trip unit.
Circuit breaker cannot be closed remotely but can be opened locally using the closing pushbutton.	Closing order not executed by the XF closing release.	Check the voltage and the supply circuit ($0.85 - 1.1\ U_n$). If the problem persists, replace the XF release.
Unexpected tripping without activation of the reset button signaling a fault trip.	1. MN undervoltage release supply voltage too low. 2. Load-shedding order sent to the MX opening release by another device. 3. Unnecessary opening order from the MX opening release.	1. Check the voltage and the supply circuit ($U > 0.85\ U_n$). 2. Check the overall load on the distribution system If necessary, modify the settings of devices in the installation. 3. Determine the origin of the order.
Unexpected tripping with activation of the reset button signaling a fault trip.	A fault is present: • overload • earth fault • short-circuit detected by the trip unit	Determine and clear the causes of the fault. Check the condition of the circuit breaker before putting it back into service.
Instantaneous opening after each attempt to close the circuit breaker with activation of the reset button signaling a fault trip.	1. Thermal memory. 2. Transient overcurrent when closing. 3. Closing on a short circuit.	1. See the user manual of the trip unit. Press the reset button. 2. Modify the distribution system or the trip unit settings. Check the condition of the circuit breaker before putting it back into service. Press the reset button. 3. Clear the fault. Check the condition of the circuit breaker before putting it back into service. Press the reset button.

Continued on next page

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Table 24 – Troubleshooting and Solutions *(continued)*

Issue	Probable causes	Solutions
Circuit breaker cannot be opened remotely, but can be opened locally.	1. Opening order not executed by the MX opening release. 2. Opening order not executed by the MN undervoltage release.	1. Check the voltage and the supply circuit (0.7 - 1.1 U_n). If the problem persists, replace the MX release. 2. Drop in voltage insufficient or residual voltage (> 0.35 U_n) across the terminals of the undervoltage release. If the problem persists, replace the MN release.
Circuit breaker cannot be opened locally.	Operating mechanism malfunction or welded contacts.	Contact a Schneider Electric service center.
Circuit breaker can be reset locally but not remotely.	Insufficient supply voltage for the MCH spring charging motor.	Check the voltage and the supply circuit (0.7 - 1.1 Un). If the problem persists, replace the MCH release.
Nuisance tripping of the circuit breaker with activation of the reset button signaling a fault trip.	Reset button not pushed in completely.	Push the reset button in completely.
Impossible to insert the crank in connected, test or disconnected position.	A padlock or keylock is present on the cradle or a door interlock is present.	Disable the locking function.
Impossible to turn the crank.	The reset button has not been pressed.	Press the reset button
Circuit breaker cannot be removed from cradle.	1. Circuit breaker not in disconnected position. 2. The rails are not completely out.	1. Turn the crank until the circuit breaker is in disconnected position and the reset button out. Remove crank and store it. 2. Pull the rails all the way out.
Circuit breaker cannot be connected (racked in).	1. Cradle/circuit breaker mismatch protection. 2. The safety shutters are locked. 3. The disconnecting-contact clusters are incorrectly positioned. 4. Cradle locked in disconnected position. 5. The reset button has not been pressed, preventing rotation of the crank. 6. The circuit breaker has not been sufficiently inserted in the cradle.	1. Check that the cradle corresponds with the circuit breaker. 2. Remove the lock(s). 3. Reposition the clusters. 4. Disable the cradle locking function. 5. Press the reset button. 6. Insert the circuit breaker completely so that it is engaged in the racking mechanism.
Circuit breaker cannot be locked in disconnected position.	1. The circuit breaker is not in the right position. 2. The crank is still in the cradle.	1. Check the circuit breaker position by making sure the reset button is out. 2. Remove the crank and store it.
Circuit breaker cannot be locked in connected, test or disconnected position.	1. Check that locking in any position is enabled. 2. The circuit breaker is not in the right position. 3. The crank is still in the cradle.	1. Contact a Schneider service center. 2. Check the circuit breaker position by making sure the reset button is out. 3. Remove the crank and store it.
The crank cannot be inserted to connect or disconnect the circuit breaker.	The rails are not completely in.	Push the rails all the way in.
The right-hand rail (cradle alone) or the circuit breaker cannot be drawn out.	The crank is still in the cradle.	Remove the crank and store it.

Continued on next page

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Table 24 – Troubleshooting and Solutions *(continued)*

Issue	Probable causes	Solutions
Circuit breaker cannot be closed locally or remotely.	Circuit breaker padlocked or keylocked in the “open” position.	Disable the locking function.
	Circuit breaker interlocked mechanically in a source changeover system.	• Check the position of the other circuit breaker in the changeover system. • Modify the situation to release the interlock.
	Circuit breaker not completely connected.	• Terminate racking in (connection) of the circuit breaker.
	The reset button signaling a fault trip has not been reset.	• Clear the fault. • Push the reset button on the front of the circuit breaker.
	Stored energy mechanism not charged.	• Charge the mechanism manually. • If it is equipped with a an MCH spring charging motor, check the supply of power to the motor. If the problem persists, replace the spring charging motor (MCH).
	MX opening shunt release permanently supplied with power.	• There is an opening order. Determine the origin of the order. • The order must be cancelled before the circuit breaker can be closed.
	MN undervoltage release not supplied with power.	• There is an opening order. Determine the origin of the order. • Check the voltage and the supply circuit ($U > 0.85\ U_n$). If the problem persists, replace the release.
	XF closing release continuously supplied with power, but circuit breaker not “ready to close” (XF not wired in series with PF contact).	Cut the supply of power to the XF closing release, then send the closing order again via the XF, but only if the ‘circuit breaker is “ready to close.”
	Permanent trip order in the presence of a Micrologic P or H trip unit with minimum voltage and minimum frequency protection in Trip mode and the trip unit powered.	Disable these protection functions on the Micrologic P or H trip unit.
Circuit breaker cannot be closed remotely but can be opened locally using the closing pushbutton.	Closing order not executed by the XF closing release	• Check the voltage and the supply circuit ($0.85 - 1.1\ U_n$). • If the problem persists, replace the XF release.
Unexpected tripping without activation of the reset button signaling a fault trip.	MN undervoltage release supply voltage too low.	Check the voltage and the supply circuit ($U > 0.85\ U_n$).
	Load-shedding order sent to the MX opening release by another device.	• Check the overall load on the distribution system • If necessary, modify the settings of devices in the installation
	Unnecessary opening order from the MX opening release.	Determine the origin of the order
Unexpected tripping with activation of the reset button signaling a fault trip.	A fault is present: • overload • earth fault • short-circuit detected by the trip unit	• Determine and clear the causes of the fault. • Check the condition of the circuit breaker before putting it back into service
Instantaneous opening after each attempt to close the circuit breaker with activation of the reset button signaling a fault trip.	Thermal memory.	• See the user manual of the trip unit. • Press the reset button.
	Transient overcurrent when closing.	• Modify the distribution system or the control-unit settings. • Check the condition of the circuit breaker before putting it back into service. • Press the reset button.
	Closing on a short circuit.	• Clear the fault. • Check the condition of the circuit breaker before putting it back into service. • Press the reset button.

Continued on next page

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Table 24 – Troubleshooting and Solutions *(continued)*

Issue	Probable causes	Solutions
Circuit breaker cannot be opened remotely, but can be opened locally.	Opening order not executed by the MX opening release.	Check the voltage and the supply circuit (0.7 - 1.1 Un). If the problem persists, replace the MX release.
	Opening order not executed by the MN undervoltage release.	Drop in voltage insufficient or residual voltage (> 0.35 Un) across the terminals of the undervoltage release. If the problem persists, replace the MN release.
Circuit breaker cannot be opened locally.	Operating mechanism malfunction or welded contacts.	Contact a Schneider Electric service center.
Circuit breaker can be reset locally but not remotely.	Insufficient supply voltage for the MCH spring charging motor.	Check the voltage and the supply circuit (0.7 - 1.1 Un). If the problem persists, replace the MCH release.
Nuisance tripping of the circuit breaker with activation of the reset button signaling a fault trip.	Reset button not pushed-in completely.	Push the reset button in completely.
Impossible to insert the crank in connected, test or disconnected position.	A padlock or keylock is present on the cradle or a door interlock is present.	Disable the locking function.
Impossible to turn the crank.	The reset button has not been pressed.	Press the reset button.
Circuit breaker cannot be removed from cradle.	Circuit breaker not in disconnected position.	Turn the crank until the circuit breaker is in disconnected position and the reset button out.
	The rails are not completely out.	Pull the rails all the way out.
Circuit breaker cannot be connected (racked in)	Cradle/circuit breaker mismatch protection.	Check that the cradle corresponds with the circuit breaker.
	The safety shutters are locked.	Remove the lock(s).
	The disconnecting-contact clusters are incorrectly positioned.	Reposition the clusters.
	Cradle locked in disconnected position.	Disable the cradle locking function.
	The reset button has not been pressed, preventing rotation of the crank.	Press the reset button.
	The circuit breaker has not been sufficiently inserted in the cradle.	Insert the circuit breaker completely so that it is engaged in the racking mechanism.
Circuit breaker cannot be locked in disconnected position	The circuit breaker is not in the right position.	Check the circuit breaker position by making sure the reset button is out.
	The crank is still in the cradle.	Remove the crank and store it.
Circuit breaker cannot be locked in connected, test or disconnected position	Check that locking in any position is enabled.	Contact a Schneider service center.
	The circuit breaker is not in the right position.	Check the circuit breaker position by making sure the reset button is out.
	The crank is still in the cradle.	Remove the crank and store it.
The crank cannot be inserted to connect or disconnect the circuit breaker	The rails are not completely in.	Push the rails all the way in.
The right-hand rail (cradle alone) or the circuit breaker cannot be drawn out	The crank is still in the cradle.	Remove the crank and store it.

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Section 6— Testing

Procedures

Visual Inspections During Operation

While circuit breaker is energized:

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HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, or NOM-029-STPS.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Take precautions to ensure that no accidental contact is made with live components during this check.

Failure to follow these instructions will result in death or serious injury.

1. Verify circuit breaker application and rating.

   Make sure that the circuit breaker is properly applied within labeled voltage, ampere rating, maximum current interrupting ratings and to Company recommendations. Compare the circuit breaker faceplate data to the installation drawings. Verify trip unit settings on Micrologic electronic-trip circuit breakers with the coordination study. After completing inspection and maintenance procedures, insure that all trip unit settings for all functions are set according to the coordination study.

2. Check for overheating while equipment is energized.

   While the circuit breaker is normally operating, under load and at operating temperature, check the exposed, accessible, insulated face of the circuit breaker and adjacent dead front surfaces of the enclosure for overheating. To do this, use an infrared temperature probe to check the temperature. If the temperature exceeds 140°F (60°C), the cause should be investigated.

   Allow initially energized circuit breaker at least three hours to reach operating temperature. Compare the surface temperature of individual circuit breakers with the surface temperature of other circuit breakers in the installation. Circuit breaker surface temperatures vary according to loading, position in the panelboard and ambient temperature. If the surface temperature of a circuit breaker is considerably higher than adjacent circuit breakers, the cause should be investigated.

   Thermographic inspection methods may also be used to evaluate overheating with equipment energized (see Thermographic Inspection, page 44).

3. Check for cracks in the circuit breaker case.

   Any circuit breaker with a cracked case should be replaced because its ability to withstand short-circuit interruption stresses is reduced.

4. Inspect the enclosure.

   The enclosure should be clean and dry. All covers and trim pieces should be in place.

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Thermographic Inspection

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Only qualified electrical workers with training and experience on low-voltage circuits should perform thermographic inspections. These workers must understand the hazards involved in working with or near low-voltage equipment. Perform such work only after reading this complete set of instructions.

Failure to follow these instructions will result in death or serious injury.

Infrared thermographic inspection techniques may be useful in evaluating the operating condition of circuit breakers and terminations. Comparison to stored infrared thermographic images may be useful for the preventive maintenance of circuit breakers and end-use equipment. The actual amount of heat emitted is a function of both load current and ambient conditions. Interpretation of infrared survey requires experience and training in this type of inspection.

Allow initially energized circuit breakers at least three hours to reach operating temperature. Compare the thermographic images of individual circuit breakers to previously stored images of the same circuit breakers.

Performance Tests

Do the performance tests in the order given to maximize the accuracy of the test results.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, or NOM-029-STPS.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- Do not touch the circuit breaker terminals or the test leads while the circuit breaker is being tested.

Failure to follow these instructions will result in death or serious injury.

NOTE: Never do the contact resistance test before doing the instantaneous primary injection testing. The primary injection testing will ensure the contacts are clear of resistive films, oxidation and foreign material.

The following tests are intended to verify that a circuit breaker is operating properly. Precisely controlled factory testing conditions are used to establish the characteristic trip curves. If field test results fall outside the characteristic trip curve tolerance band, carefully evaluate the test conditions and methods for accuracy.

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When questionable conditions or results are observed during inspection and performance tests, consult the local field sales office. Circuit breakers with accessories or factory modifications may require special investigation. If it is necessary to return a circuit breaker to the manufacturing facility, use proper packaging and packing materials to avoid shipping damage.

Dielectric Testing Masterpact Circuit Breakers with Micrologic P or H Trip Systems

NOTICE

HAZARD OF EQUIPMENT DAMAGE

- Dielectric tests (high potential, insulation resistance, or Megger tests) may damage Micrologic P and H trip units.
- Remove rating plug from trip unit prior to testing.
- Replace trip unit if rating plug was not removed during tests or if trip unit was exposed to more than 700 Vac.

Failure to follow these instructions can result in equipment damage.

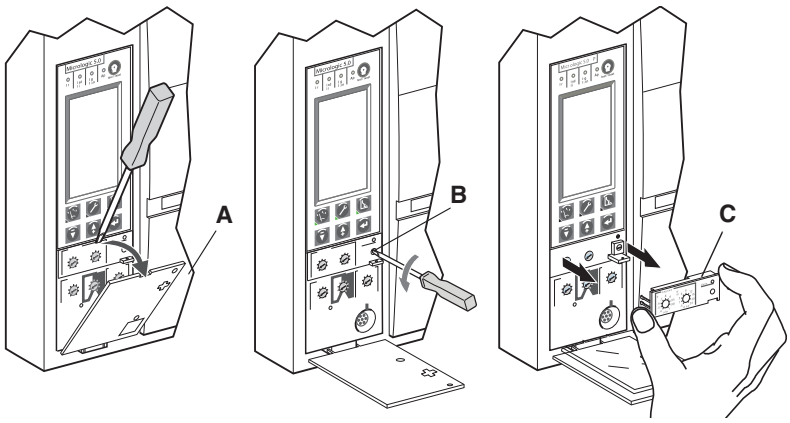
Dielectric tests (high potential, insulation resistance or Megger tests) are used to ensure the proper isolation and insulation between phases and between each phase and ground. The equipment used to conduct these tests creates a high-potential voltage (thousands of volts) to verify dielectric or insulation integrity.

The rating plug on Micrologic P and H trip units connect/disconnect the trip unit with the voltage connections in the circuit breaker. Before conducting any high-voltage tests on circuit breakers with Micrologic P and H trip units, remove the rating plug as shown

NOTE: Only Micrologic P and H trip units have phase voltage connections into the trip unit. For other types of trip units, it is not necessary to remove the rating plug prior to dielectric testing.

1. Open switch cover (Figure 15, A).
2. Unscrew rating plug mounting screw (B).
3. Remove rating plug (C).

Figure 15 – Removing Rating Plug



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NOTICE

HAZARD OF EQUIPMENT DAMAGE

Do not apply test voltage to control circuits or accessory terminals; damage to electronic and/or low-voltage components can result.

Failure to follow these instructions can result in equipment damage.

Insulation Resistance Test

Severe environmental conditions can reduce the dielectric strength of molded case circuit breakers. Check insulation resistance during electrical system testing.

To check the insulation resistance, perform the following steps:

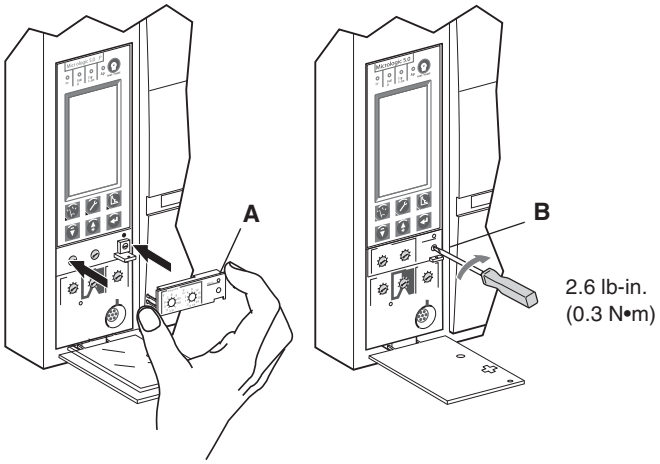
1. De-energize and isolate the circuit breaker:
2. Clean the circuit breaker as described earlier.
3. Using a megohmmeter with a capacity of 500–1000 Vdc, apply voltage from:
   a. Each phase-to-ground with the circuit breaker on (circuit breaker contacts closed).
   b. Phase-to-phase with the circuit breaker on (circuit breaker contacts closed).
   c. Between each line and load terminal with the circuit breaker off (circuit breaker contacts open).
4. Record resistance values. Resistance values of less than one megohm (1,000,000 ohm) should be investigated.

After testing is complete, replace rating plug if previously removed:

1. Replace rating plug (Figure 16, A).
2. Tighten rating plug mounting screw (B).

NOTE: If the rating plug is not installed, the circuit breaker will default to a long-time pickup setting of 0.4 x the sensor (I_n) and some of the advanced functions will not be operable.

Figure 16 – Replacing Rating Plug



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Micrologic Trip Unit Checks

Circuit breakers with Micrologic trip units can have their trip unit operation tested with secondary injection testing using the one of the available test kits. (See page 58 for test kits.)

Secondary injection testing does not test the current transformers and connections. Primary injection testing can be used to ensure that all trip system connections have been correctly made.

If the circuit breaker is tested by the primary injection method, the Powerlogic™ system can remain connected to the circuit breaker during testing without affecting the results.

NOTE: Testing a circuit breaker connected to a Powerlogic system causes the Powerlogic system to react as if the circuit breaker were experiencing the actual faults.

Procedure to Defeat Zone-Selective Interlocking

Zone-selective interlocking is a method of communication between electronic-trip overcurrent protective devices. Zone-selective interlocking allows interlocked devices at different levels to work together as a system in which a short circuit or ground fault is isolated and cleared with minimum time delay. The purpose of defeating zone-selective interlocking is to verify the characteristics of the specific circuit breaker short-time and ground-fault trip delay functions. For test purposes, zone-selective interlocking can be inhibited on Masterpact circuit breakers equipped with Micrologic trip units by using the Hand-Held or Full-Function Test Kit.

Secondary Injection Testing

Field installation of a trip unit requires secondary injection testing with a Full-Function Test Kit. This will ensure that the newly-installed trip unit is functioning properly. The test will require opening and closing the circuit breaker. Follow the procedures outlined in the instruction bulletins shipped with the circuit breaker and the Full-Function Test Kit.

1. Make sure the circuit breaker is isolated from all upstream and downstream devices.
2. Perform secondary injection testing as outlined in the instruction bulletin shipped with the full-function test kit. Verify that all applicable trip unit functions are operating properly.
3. Repeat step 2 with the circuit breaker in the open position.

   NOTE: The test kit states that the circuit breaker should be closed when performing the test. Do not close the circuit breaker for this step.
4. If any test fails, do not put the circuit breaker into service and contact the local sales office for factory authorization service.

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ENGLISH

Primary Injection Testing

Primary injection testing can be used to ensure that all trip system connections have been correctly made.

NOTE: Secondary injection testing continues to be the Schneider Electric preferred method for testing circuit breakers. Improper primary injection testing can cause damage to the circuit breakers. Failure to conduct primary injection testing in the proper manner could result in circuit breakers passing testing, while ultimately damaging the integrity of the circuit breaker long term.

NOTICE

HAZARD OF EQUIPMENT DAMAGE

- Circuit breakers are heavy and can be damaged with improper handling. Use care when handling and transporting circuit breakers to test equipment.
- Make connection to the circuit breaker carefully using rated cable and appropriate connection methods. Do not use clamps or other methods that can score or otherwise damage the finish of the connectors.
- When connecting a drawout-type circuit breaker, use approved primary injection test kit. Adjust circuit breaker position so circuit breaker clusters align with the primary injection test kit.

Failure to follow these instructions can result in equipment damage.

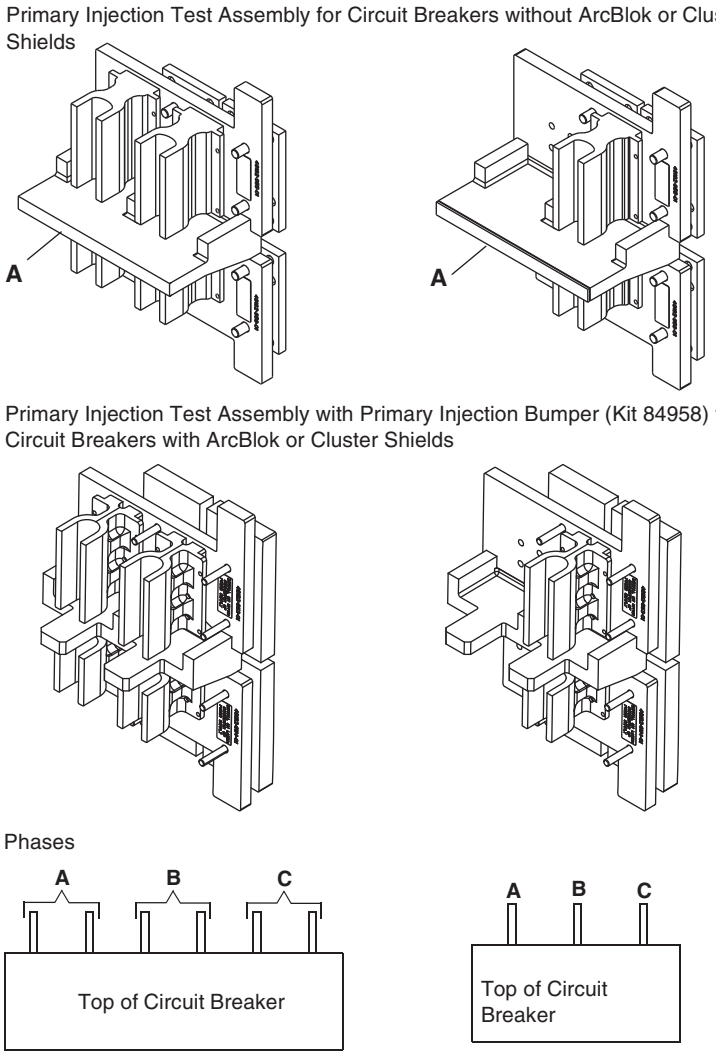
1. If performing primary injection testing on drawout circuit breakers, connect circuit breaker to power supply using primary injection test kits.

Table 25 – Primary Injection Test Kit

Circuit Breaker Type	Power Supply	Test Kit Required
Masterpact NW without ArcBlok or Cluster Shields	Phoenix®	ULW10025
	MultiAmp ®	ULW10026
Masterpact NW with ArcBlok or Cluster Shields	Phoenix®	ULW10025 and Primary Injection Bumper Kit 84958
	MultiAmp ®	ULW10026 and Primary Injection Bumper Kit 84958
Masterpact NT	Phoenix or MulitAmp	ULW10027
PowerPact	Phoenix or MulitAmp	ULW10027
All Types	Other Than Phoenix or MultiAmp	Contact Field Office

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Figure 17 – Masterpact NW Primary Injection Test Assembly



a. Install primary injection test kit following instructions shipped with the test kit.

b. Adjust height of the circuit breaker so the stop (A, above) between the top and bottom plates of the test kit is between the top and bottom connectors of the circuit breaker when it is in the connected positions.

c. Align the circuit breaker so that the clusters on the circuit breaker phase being tested line up with the connectors with the primary injection test kit.

d. Use grease kit, catalog number S48899, to lubricate connectors. Do not install anything in the cluster jaw except approved test kit.

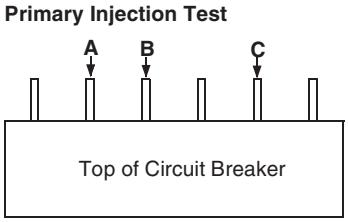
NOTE: Remove any existing grease from cluster assembly before applying new grease to clusters.

2. If performing primary injection testing on fixed circuit breakers, connect circuit breaker to power supply using rated cable and appropriate connection method.

NOTE: Wide-construction circuit breakers only—When primary injection testing a circuit breaker with six bus connectors, current is injected into phases as shown in Figure 18. Do not inject current into outside busses.

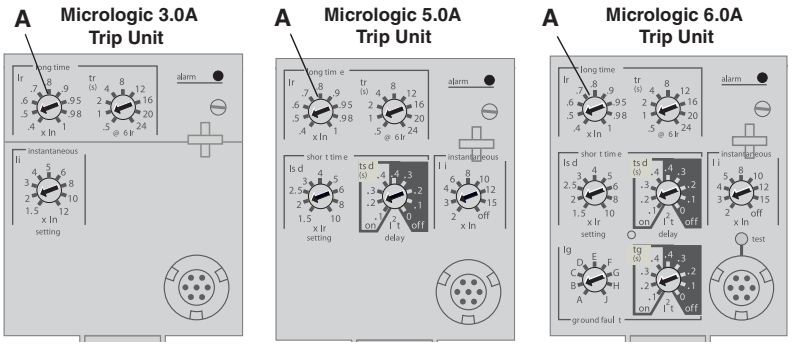
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Figure 18 – Wide-Construction Circuit Breakers



3. Record each of the original trip unit switch settings. (Settings must be reset after testing is complete.)
4. Set the long-time pickup (I_r) switch (A) to the minimum setting.

Figure 19 – Record Switch Settings



a. For ground-fault and/or zone-selective interlocked trip units, use the hand-held or full-function test kit to inhibit ground-fault and zone-selective interlocking functions.

b. If an auxiliary power supply is being used for the Micrologic trip unit, disconnect the auxiliary power supply.

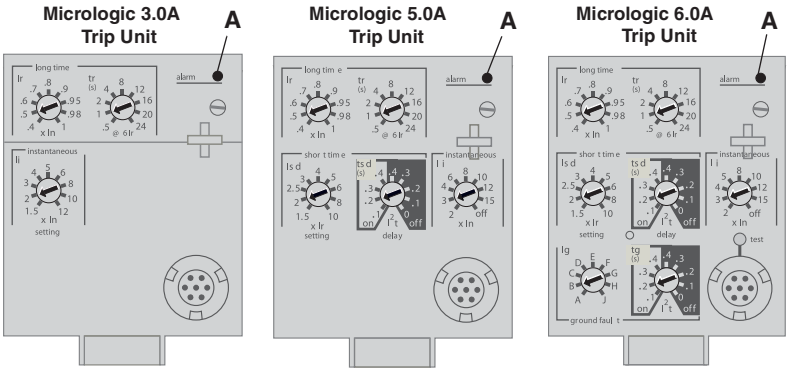
c. Find the primary injection current needed by multiplying the long-time pickup current (long-time pickup setting I_r x sensor plug I_n) x 125% (i.e. I_r x I_n x 1.25).

d. Inject primary current into A-phase and monitor the overload indicator light. Verify that the overload indicator light (A) lights between 105% and 120% of the I_r x I_n value.

e. Repeat for all phases and neutral (if applicable).

f. If overload indicator light does not light correctly, check all trip unit connections and test setup. If unit still fails primary injection testing, contact the local sales office.

Figure 20 – Overload Indicator Light



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Circuit Breakers with Integral Ground Fault Protection

Micrologic electronic-trip circuit breakers with the integral ground-fault protection function require special attention when testing overload and short-circuit functions. The single-pole primary injection tests for the inverse-time overcurrent, short-time and instantaneous functions will cause ground-fault trips due to the return current path not going through the circuit breaker. To overcome this difficulty, use the Hand-Held or Full-Function Test Kit to defeat the ground-fault function on Masterpact or PowerPact™ circuit breakers equipped with Micrologic trip units.

NOTE: When the hand-held or full-function test kits are used to inhibit ground-fault, the test kit puts the trip unit in "TEST MODE". While the trip unit is in this mode, the logs, alarms, and advanced protections are turned off so that a test trip is not recorded as an actual event. See the test kit instructions for further information.

Ground-Fault Protection and Indication Only Tests for Radial Systems

Ground-Fault Trip Test

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, or NOM-029-STPS.
- This equipment must be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

The ground-fault function of a Micrologic electronic-trip circuit breaker provides ground-fault protection for equipment with adjustable pickup and delay values. the ground-fault delay feature determines how long the circuit breaker waits before initiating a trip signal during a ground fault. Performance of the ground-fault functions of the circuit breaker can be tested using a high-current, low-voltage ac power supply.

Test Procedure

1. Completely de-energize and remove the circuit breaker from service.
2. Before testing, record pickup and delay setting for all functions. Reset the trip unit to these same settings after the test procedure is completed.
3. If testing a circuit breaker that is equipped with zone-selective interlocking, follow the procedure to defeat zone-selective interlocking on page 47. If you are using a secondary injection test kit for these tests, carefully read and follow the test kit instructions about zone-selective interlocking.

   NOTE: Failure to defeat zone-selective interlocking will result in trip time inaccuracy.

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4. Use these settings for the test:

   Long-time Pickup/Ampere Rating = Max.

   Long-time/Overload Delay = Max

   Short-time/Short-circuit Delay = Max. (I^2t IN or ON)

   Instantaneous = Max.

   Ground-fault Pickup = Min.

   Ground-fault Delay = 0.2

5. Follow the hookup procedure appropriate to the test application.

   For circuit breakers without a neutral current transformer, go to step 8.

   For circuit breakers with the integral ground-fault function in a three-phase, four-wire system, an externally-mounted neutral current transformer (CT) must be used. The neutral CT is connected to the circuit breaker by a shielded cable (14 AWG [2.1 mm2] wire is recommended).

   NOTE: When testing, disconnect or turn off 24 Vdc control power to F1 and F2, if equipped and disconnect the Hand-Held or Full-Function Test Kit from the trip unit, if connected.

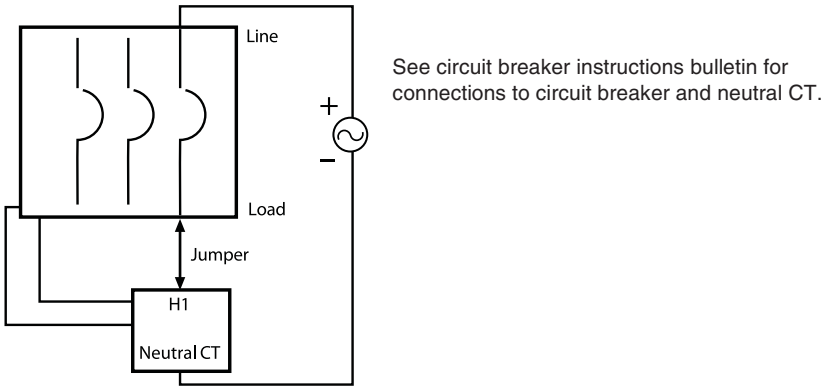
6. Verify correct phasing of the neutral CT (three-phase, four-wire systems) by performing a No Trip Test as follows:

   a. Connect the circuit breaker and neutral CT as shown in Figure 21. The jumper must go from the load connection on the circuit breaker to the H1 connection on the neutral CT (or the side of the neutral CT that has the red dot). Connect the secondary of the neutral CT according to the circuit breaker instruction manual or the neutral CT instructions.

   b. Apply current above the ground-fault pickup level and maintain longer than the ground-fault delay.

   c. The circuit breaker must not trip. No trip indicates that both the phase CT and neutral CT are phased properly.

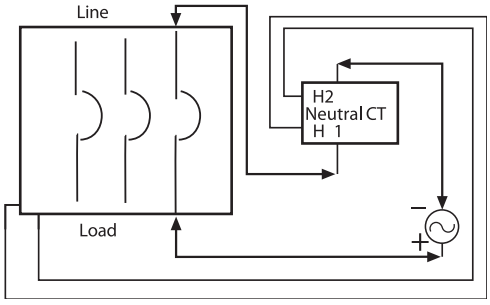
Figure 21 – Test Hookup Diagram for Neutral CT Phasing Test



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7. Verify the correct size of the neutral CT (three-phase, four-wire systems) by performing a Trip Test as follows:
   a. Connect the circuit breaker and neutral CT as shown in Figure 22. Connect the polarity (+) terminal of the high current injection unit to the load side of the circuit breaker. The jumper must go from the line connection on the circuit breaker to the H1 connection on the neutral CT (or the side of the neutral CT that has the red dot). Connect the non-polarity (-) terminal of the high current injection unit to H2 on the neutral CT (on the line side of the circuit breaker). Connect the secondary of the neutral CT according to the circuit breaker instruction manual or the neutral CT instructions.
   b. Apply current.
   c. The circuit breaker must trip at half the value of the ground-fault pickup. Tripping indicates that both the phase CT and neutral CT have the same turns ratio (same size).

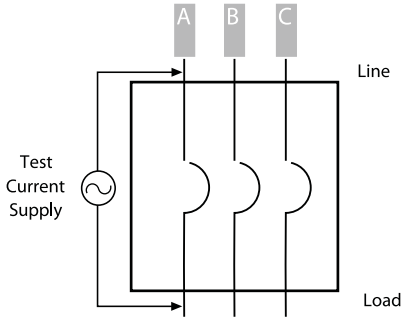
Figure 22 – Test Hookup Diagram for Neutral CT Size Test



See circuit breaker instructions bulletin for connections to circuit breaker and neutral CT.

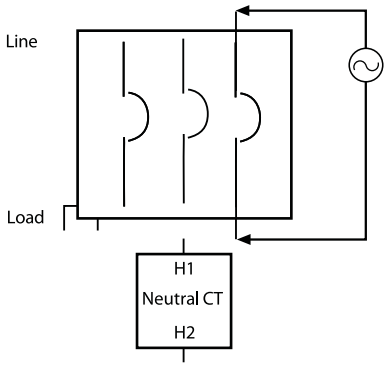
8. Test ground fault pickup and delay by performing a trip test as follows:
   a. Connect the circuit breaker as shown in Figure 23, (three-phase, three-wire systems) or Figure 24 (three-phase, four-wire systems).

Figure 23 – Test Hookup Diagram for Circuit Breaker Without Neutral CT



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Figure 24 – Test Hookup Diagram for Ground-Fault Pickup and Delay Test



NOTE: The recommended method of testing ground-fault pickup and delay is the “pulse” method. This method will be the most accurate, but requires that the test equipment have a calibrated image-retaining oscilloscope or high-speed sampling rate digital ammeter. An accurate timer is needed to monitor delay time.

b. After the circuit is properly connected and closed, apply current in short pulses of 10-cycle duration. Starting at 70% of the expected trip value,

c. Reclose the circuit breaker and reduce the current level; pulse again to determine if the pickup level found was overshot.

d. Repeat steps b and c to further isolate the pickup point.

e. To determine delay time, test each pole of the circuit breaker individually at 150% of the ground-fault pickup setting. Monitor the time from this pickup point until the circuit breaker trips to obtain the delay time.

f. Record pickup and delay values and compare the results to the trip curve.

The ground-fault test can also be done using secondary injection testing using the Full-Function Test Kit. Secondary injection testing does not test the current transformers and connections.

Table 26 – Maximum Micro-Ohms Per Pole

Masterpact	**Micro-Ohms (u ohm)**	
Type	**Drawout**	**Fixed**
NT06—NT10 H1/H2/L1	38.72	26.39
NT12–NT16 H1/H2	36	26
NW08 N1	42	19
NW08 H/L	30	13
NW10 N1	42	19
NW10 H/L	30	13
NW12 N1	42	19
NW12 H/L	27	13
NW16 N1	37	19
NW16 H/L	27	13
NW20 H/L	27	13
NW25 H1/H2/H3	19	8
NW 32 H1/H2/H3	13	8
NW40 H1/H2/H3	11	8
NW40b, NW50, NW63	7	5

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Contact Resistance Test

Circuit breaker pole resistance tests are not reliable indicators of circuit breaker performance because the resistance values are influenced by a number of transient factors including contact surface oxidation, foreign material between the contacts, and testing methods. NEMA AB 4 paragraph 6.4.1 states: “The millivolt drop of a circuit breaker pole can vary significantly due to inherent variability in the extreme low resistance of the electrical contacts and connectors. Such variations do not necessarily predict unacceptable performance and shall not be used as the sole criteria for determination of acceptability.”

High pole resistance may also be caused by eroded contacts, low contact force, and loose termination. The only one of these factors likely to be present on a new circuit breaker is a loose termination, since the contacts are new and there has been no opportunity for contact pressure to have drifted from the factory setting. A loose termination can be corrected in the field.

If a contact resistance test is done, it is important to do it after the contacts have been conditioned by instantaneous primary injection testing to ensure the contacts are clear of resistive films, oxidation and foreign material. If the circuit breaker has been in service with no performance issues, (overheating or nuisance tripping), contact resistance measurements are redundant and of little value.

Square D™ recommends that a Digital Low Resistance Ohmmeter (DLRO) be used, using a 10 A dc test current for circuit breaker ratings below 100 A, and using 100 A dc for circuit breakers rated 100 A and above. the median (middle) value of three readings (toggling the circuit breaker between each reading) should be recorded for each pole tested. If this value is equal to or less than the value listed in Table 26, the pole is acceptable. If the reading is higher, the cause should be investigated and corrected if possible. Contact your local field office for more information.

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Circuit Breakers with Direct Current Protection

The Masterpact NW DC circuit breakers are designed, manufactured and calibrated for use on ungrounded, uninterruptable power supplies (UPS). The maximum nominal (loaded) voltage is 500 Vdc and the maximum floating (unloaded) voltage is 600 Vdc.

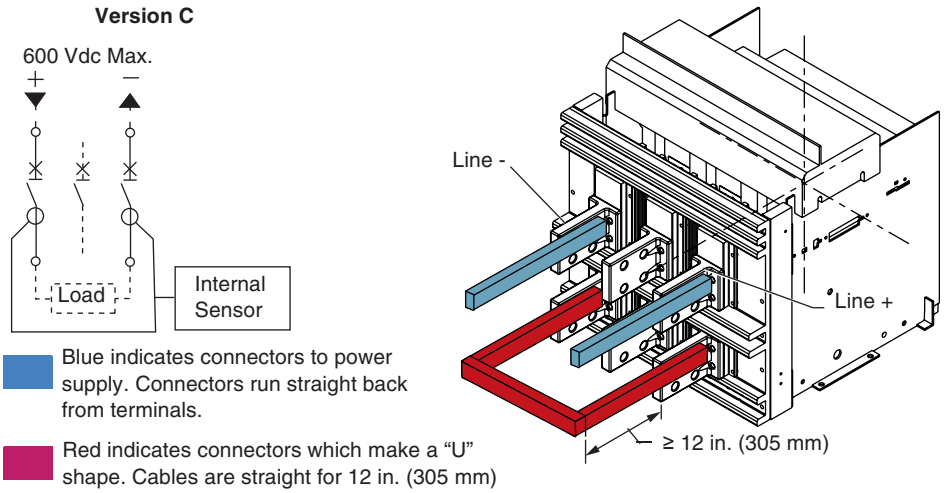
These circuit breakers are UL Listed when applied with all poles connected in series as shown on the label of the circuit breaker. The series connection is customer provided and external to the circuit breakers.

The Masterpact NW DC circuit breakers are special circuit breakers for dc applications only and must be tested using dc current.

- Select the correct time-current trip curve. The trip curves show both the thermal and magnetic trip ranges of the circuit breakers.
- Use a dc power supply to test the circuit breakers as follows:
  - — Time constant ≤ 25 ms
  - — DC ripple constant ≤ 1% rms
- Remove the circuit breaker from the enclosure. If removing the circuit breaker is not practical, test the circuit breaker in the end-use equipment. If the test results fall outside of the trip curve tolerance, remove the circuit breaker from the enclosure and retest.
- Use correctly sized cable (per National Electrical Code® [NEC®] tables) with a minimum of four feet (1.22 m) of cable per connection.
- Connect a dc power supply to the circuit breaker with all poles connected in series as shown on the circuit breaker label (see Figure 25–27).
- Make sure connections to circuit breaker are properly torqued.
- Apply a dc test current to the circuit breaker of approximately 70% of the expected value to trip the circuit breaker. The tripping mechanism in the circuit breaker reacts to the magnetic fields created by the current flowing through the circuit breaker. If the circuit breaker does not trip, increase the test current on successive trials until it does trip. When the circuit breaker trips:
  a. Reset and close the circuit breaker.
  b. Reapply the dc test current to trip the circuit breaker again.
  c. Record the current and compare to the trip curve.

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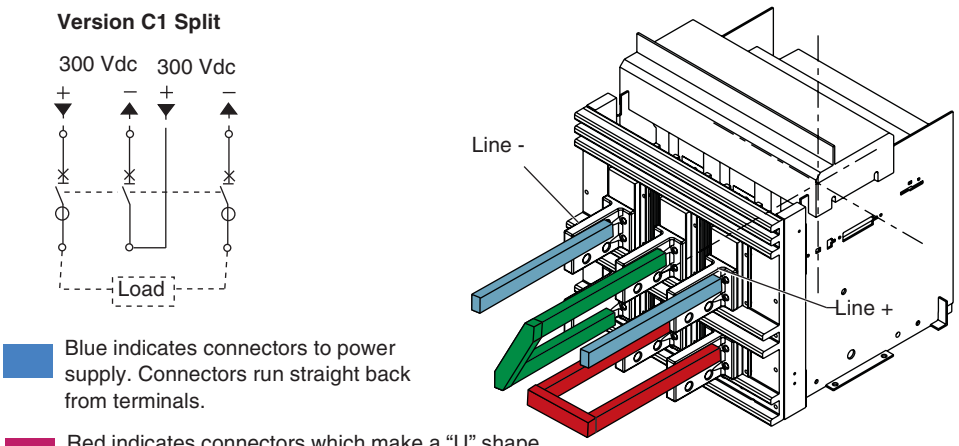
Figure 25 – Version C Wiring Configuration



Blue indicates connectors to power supply. Connectors run straight back from terminals.

Red indicates connectors which make a “U” shape. Cables are straight for 12 in. (305 mm) before bending.

Figure 26 – Version C1 Split Configurations



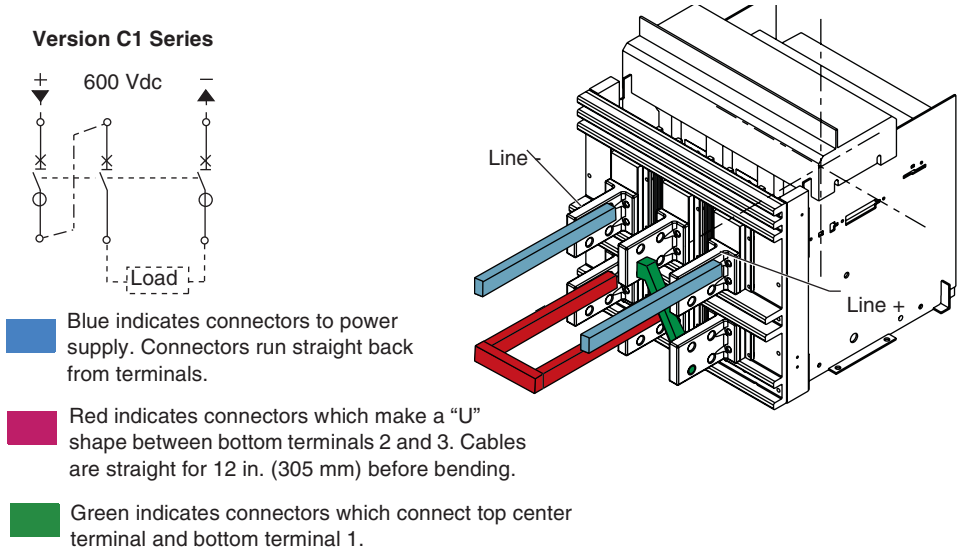
Blue indicates connectors to power supply. Connectors run straight back from terminals.

Red indicates connectors which make a “U” shape between bottom terminals 1 and 2. Cables are straight for 12 in. (305 mm) before bending.

Green indicates connectors which make a “U” shape between top center terminal and bottom terminal 3. Cables are straight for 12 in. (305 mm) before bending.

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Figure 27 – Version C1 Series Configurations



Remove Test Connections Upon Completing Testing:

- — Remove test connections from circuit breaker.
- — Inspect connections for damage caused by testing.
- — For drawout circuit breakers, inspect, lubricate, and reset clusters before installing circuit breaker, see page 31.
- — Reset the long-time pickup switch to original settings, as recorded above.
- — If an auxiliary power supply is being used for the Micrologic trip unit, reconnect the auxiliary power supply.

Test Kit Information

Full-Function Test Kit

The Full-Function Test Kit is a microprocessor-based system used to test Compact™ NSJ, Masterpact and PowerPact circuit breakers with Micrologic electronic-trip units. The Full-Function Test Kit is a secondary injection tester and does not test the current transformers and connections.

The Full-Function Test Kit is designed to be used as a stand-alone test unit or in conjunction with a personal computer. The Full-Function Test Kit alone performs the following tests:

- Protection function verification (LSIG)
- Compliance with trip curve
- Electrical and mechanical tests of trip system
- Zone-selective interlocking tests
- Inhibition of ground-fault protection for use during primary injection testing
- Inhibition of thermal imaging for use during primary injection testing
- Supply control power to the trip unit to energize displays

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Hand-Held Test Kit

The Hand-Held Test Kit is a small battery-powered unit. It is designed to provide convenient secondary injection tests on Compact NSJ, Masterpact and PowerPact circuit breakers with Micrologic electronic-trip units. The Hand-Held Test Kit is powered by five 9 V batteries and can be used to do the following:

- Verify trip unit operation by tripping the circuit breaker with a secondary injection signal
- Supply control power to the trip unit to energize displays
- Inhibit thermal imaging for primary injection testing
- Inhibit ground-fault for primary injection testing
- Zone-selective interlocking tests[1]

Anti-Pumping Feature

All Masterpact NT and NW circuit breakers are designed with an anti-pumping feature which always gives priority to an opening order over a closing order. Specifically, if opening and closing orders occur simultaneously, the charged mechanism discharges without any movement of the main contacts keeping the circuit breaker in the open (OFF) position. In the event that opening and closing orders are simultaneously maintained, the standard mechanism provides an anti-pumping function which continues to keep the main contacts in the open position. In addition, after fault tripping or opening the circuit breaker intentionally (using the manual or electrical controls and with the closing coil continuously energized) the circuit breaker cannot be closed until the power supply to the closing coil is discontinued and then reactivated.

Anti-Pump Check for Electrically Operated Circuit Breakers

If desired, use the following procedure to assure that the anti-pump feature works properly.

1. Open the circuit breaker.
2. Energize the control power for the spring charging motor, shunt trip and shunt close.
3. Spring charging motor will charge the springs whenever they are discharged (during circuit breaker closing).
4. Make sure all interlocks, etc. are disengaged and the circuit breaker is ready to close. Press and hold the Close pushbutton (use the remote close button connected to the shunt close if desired). Verify the circuit breaker closed. Wait for the spring charging motor to complete the spring charge.
5. While continuing to hold the Close button, press the Open button. Make sure the circuit breaker opens and does not reclose.
6. Release the Close button.
7. If circuit breaker does not attempt to reclose, the anti-pump feature is working correctly.
8. Press the Open button and then the Close button.
9. Press and release the Close pushbutton (use the remote close button connected to the shunt close if desired). Verify the circuit breaker closed. Wait for the spring charging motor to complete the spring charge.

[1] Only provides power to trip unit to indicate a ZSI signal was received. Will not initiate the command to send a ZSI restraint signal.

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10. Press the Open button. Make sure the circuit breaker opens.
11. Repeat steps 8, 9 and 10 to make sure the circuit breaker opens and closes correctly.

Anti-Pump Check for Manually Operated Circuit Breakers

1. Open the circuit breaker.
2. Operate the spring charging handle to charge the closing springs.
3. Make sure all interlocks, etc. are disengaged and the circuit breaker is ready to close. Press and hold the Close pushbutton. Verify the circuit breaker closed.
4. Operate the spring charging handle to charge the closing springs.
5. While continuing to hold the Close button, press the Open button. Make sure the circuit breaker opens and does not reclose.
6. Release Close button.
7. If circuit breaker does not attempt to reclose, the anti-pump feature is working correctly.
8. Press the Open button and then the Close button.

Additional Information

For more information concerning Schneider Electric and Square D brand circuit breakers, refer to the appropriate instruction manual. These manuals contain installation instructions, mounting information, safety features, wiring diagrams, and troubleshooting charts for specific circuit breakers.

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Section 7— Available Bulletins

Table 27 – List of Available Bulletins

	Masterpact NT	Masterpact NW
Catalogs		
Universal Power Circuit Breakers	0613CT0001	0613CT0001
DC Circuit Breakers	—	0613CT0501
Certified to ABS-NVR	0613CT0601	0613CT0601
Instruction Bulletins		
UL rated	HRB39231	HRB28361
IEC Rated	HRB39244	HRB39225
UL Rated DC	—	HRB39255
IEC Rated UL	—	HRB39254
ArcBlok	—	HRB23946
User Guides		
UL Rated	0613IB1209	0613IB1204
IEC Rated	0613IB1210	0613IB1208
UL Rated DC	—	0613IB1211
IEC Rated UL	—	0613IB1212
ArcBlok	—	0613IB1203
Trip Unit User Guide		
Standard (Micrologic 2.0, 3.0 and 5.0) Trip Units	48049-207-05	48049-207-05
Micrologic A Trip Units	48049-136-05	48049-136-05
Micrologic P Trip Units	48049-137-05	48049-137-05
Micrologic H Trip Units	48049-330-03	48049-330-03
Modbus Communication for Micrologic		
Traditional 4-Wire Modbus	0613IB1201	0613IB1201
Ethernet/Modbus + ULP	0613IB1303	0613IB1313
Test Instructions		
Full-Function Test Kit (FFTK)	48049-183-06	48049-183-06
Hand-Held Test Kit (HHTK)	48049-184-03	48049-184-03
Dielectric Testing	48049-550-01	48049-550-01
ERMS Testing	NHA67346	NHA67346
List of Accessory Instructions		
	See the Schneider Electric website.	

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0613IB1202 R08/15, 08/2015
Replaces 0613IB1202 R07/13

ECN 587C Replaces / Reemplaza / Remplace 48049-146-01 04/2001

Undervoltage Trip (MN), Shunt Trips (MX1 and MX2), and Shunt Close (XF) for Masterpact® NW Circuit Breakers
Disparo por baja tensión (MN), disparos en derivación (MX1 y MX2), y cierre en derivación (XF) para los interruptores Masterpact® NW
Déclencheur sur baisse de tension (MN), déclencheurs shunt (MX1 et MX2) et fermeture en shunt (XF) pour disjoncteurs Masterpact® NW

Retain for future use. / Conservar para uso futuro. / À conserver pour usage ultérieur.

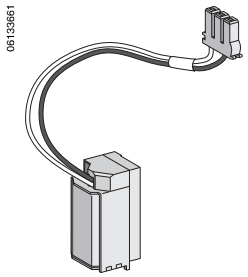
NOTE: Each of these accessory devices requires the installation of either a push-in connector or a ring terminal connector.

NOTA: Cada uno de estos dispositivos accesorios requieren la instalación de un conector de terminal a presión o un conector de terminal de anillo.

REMARQUE : Chacun de ces dispositifs accessoires exige l'installation d'un connecteur-poussoir ou d'un connecteur de borne à anneau.

Device / Dispositivo / Dispositif	Circuit Breaker / Interruptor automático / Disjoncteur	12 V⎓	24–30 V∿ / V⎓	48–60 V∿ / V⎓	100–130 V∿ / V⎓	200–240 V∿ / V⎓	277 V∿	380–480 V∿
Undervoltage Trip (MN) / Disparo por baja tensión (MN) / Déclencheur sur baisse de tension (MN)	Fixed / Fijo / Fixe	—	S47380	S47381	S47382	S47383	—	S47385
	Drawout / Removible / Débrochable	—	S48501	S48502	S48503	S48504	—	S48506
Shunt Trip (MX1), Shunt Close (XF) / Disparo en derivación (MX1), cierre en derivación (XF) / Déclencheur shunt (MX1), fermeture en shunt (XF)	Fixed, no communication / Fijo, sin comunicación / Fixe, sans communication	S47359	S47360	S47361	S47362	S47363	S47364	S47365
	Drawout, no communication / Removible, sin comunicación / Débrochable, sans communication	S48490	S48491	S48492	S48493	S48494	S48495	S48496
	Fixed, with communication / Fijo, con comunicación / Fixe, avec communication	S47320	S47321	S47322	S47323	S47324	S47325	S47326
	Fixed, with communication / Fijo, con comunicación / Fixe, avec communication	S48457	S48458	S48459	S48460	S48461	S48462	S48463
Second Shunt Trip (MX2) / Segundo disparo en derivación (MX2) / Deuxième déclencheur shunt (MX2)	Fixed, no communication / Fijo, sin comunicación / Fixe, sans communication	S47359	S47360	S47361	S47362	S47363	S47364	S47365
	Drawout, no communication / Removible, sin comunicación / Débrochable, sans communication	S48490	S48491	S48492	S48493	S48494	S48495	S48496

KIT CONTENTS | CONTENIDO DEL ACCESORIO | CONTENU DU KIT



NOTE: Shunt trips and shunt close used with communication feature have three wires.

NOTA: Los disparos en derivación y el cierre en derivación, utilizados con la función de comunicación, tienen tres hilos.

REMARQUE : Les déclencheurs shunt et le fermeture en shunt utilisés avec la fonction de communication, ont trois fils.

NECESSARY TOOLS | HERRAMIENTAS NECESARIAS | OUTILS NÉCESSAIRES

Screwdriver (Pozidriv® No. 2 or 3 pt., or slotted) | Desatornillador (Pozidriv® no. 2 ó 3, o de punta plana) | Tournevis (Pozidriv® à embout n° 2, n° 3 ou plat)

INSTALLATION

INSTALACIÓN

INSTALLATION

⚠ DANGER / PELIGRO / DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

PELIGRO DE DESCARGA ELÉCTRICA, EXPLOSIÓN O DESTELLO POR ARQUEO

- Utilice equipo de protección personal (EPP) apropiado y siga las prácticas de seguridad eléctrica establecidas por su Compañía, consulte la norma 70E de NFPA.
- Solamente el personal eléctrico especializado deberá instalar y prestar servicio de mantenimiento a este equipo.
- Desenergice el equipo antes de realizar cualquier trabajo en él.
- Siempre utilice un dispositivo detector de tensión nominal adecuado para confirmar la desenergización del equipo.
- Vuelva a colocar todos los dispositivos, las puertas y los frentes antes de energizar el equipo.

El incumplimiento de estas instrucciones podrá causar la muerte o lesiones serias.

RISQUE D'ÉLECTROCUTION, D'EXPLOSION OU D'ÉCLAIR D'ARC

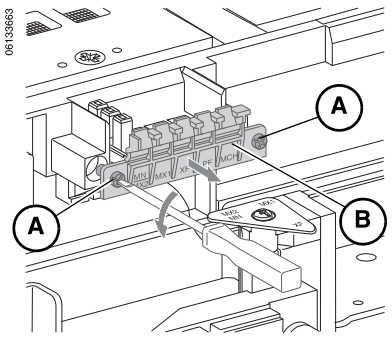
- Portez un équipement de protection personnelle (ÉPP) approprié et observez les méthodes de travail électrique sécuritaire. Voir NFPA 70E.
- Seul un personnel qualifié doit effectuer l'installation et l'entretien de ce appareil.
- Couper l'alimentation de l'appareil avant d'y travailler.
- Utilisez toujours un dispositif de détection de tension ayant une valeur nominale appropriée pour vous assurer que l'alimentation est coupée.
- Replacez tous les dispositifs, les portes et les couvercles avant de mettre l'appareil sous tension.

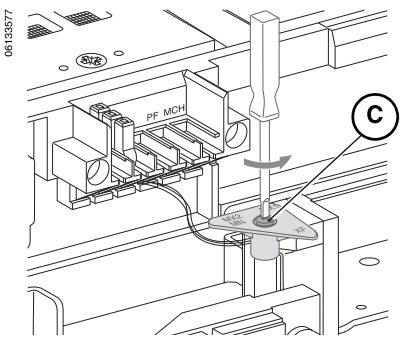
Si ces directives ne sont pas respectées, cela entraînera la mort ou des blessures graves.

1. Disconnect circuit breaker as directed in the circuit breaker instruction bulletin shipped with the circuit breaker.
2. Turn off or trip fixed circuit breaker by pressing push-to-trip button.
3. Remove accessory cover as directed in the circuit breaker instruction bulletin shipped with the circuit breaker.
4. Remove two screws (A) from center wiring cover and remove the wiring cover (B).
5. Loosen coil retainer screw (C) three turns

1. Desconecte el interruptor tal como se indica en el boletín de instrucciones correspondiente incluido.
2. Desconecte o dispare el interruptor fijo presionando el botón de disparo.
3. Retire la cubierta de accesorios tal como se indica en el boletín de instrucciones correspondiente incluido.
4. Retire los dos tornillos (A) de la cubierta central del cableado y retire la cubierta (B).
5. Dé tres vueltas al tornillo del sujetador de la bobina (C) para aflojarlo

1. Débrancher le disjoncteur selon les directives d'utilisation du disjoncteur qui l'accompagnent.
2. Déclencher ou mettre le disjoncteur fixe hors tension en appuyant sur le bouton pousser-pour-déclencher.
3. Enlever le couvercle des accessoires selon les directives d'utilisation accompagnent le disjoncteur
4. Retirer les deux vis (A) du couvercle de câblage de centre et enlever le couvercle (B)
5. Desserrer la vis du dispositif de retenue de bobine (C) de trois tours.



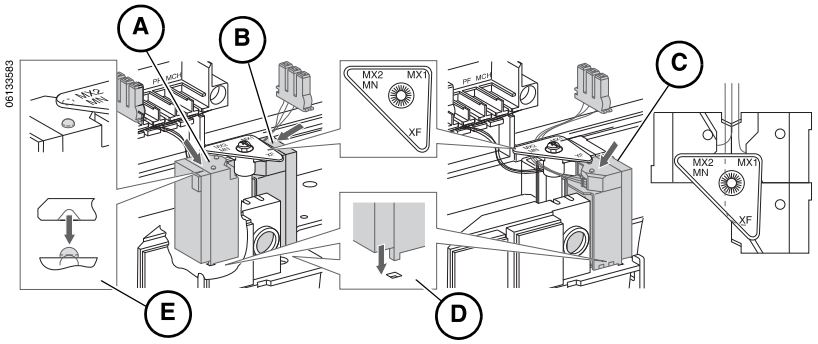


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6. Lift coil retainer and install undervoltage trip MN or shunt trip MX2 (A), shunt trip MX1 (B) and/or shunt close XF (C) as shown below, placing tabs in designated holes (D) and aligning nubs on coil(s) with indentations on coil retainer (E)

6. Levante el sujetador de la bobina e instale el disparo por baja tensión MN o disparo en derivación MX2 (A), disparo en derivación MX1 (B) y/o cierre en derivación XF (C) como se muestra. Coloque las lengüetas en los agujeros designados (D) y alinee las muescas en la(s) bobina(s) con las hendiduras en el sujetador de la bobina (E).

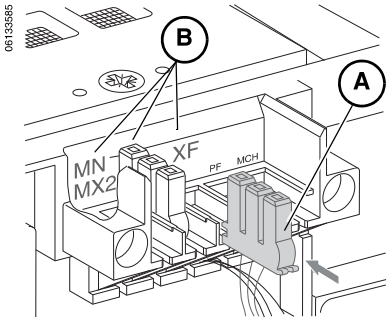
6. Soulever le dispositif de retenue de bobine et installer le déclencheur sur baisse de tension MN ou le déclencheur shunt MX2 (A), le déclencheur shunt MX1 (B) ou le fermeture en shunt XF (C), comme indiqué. Insérer les languettes dans les trous désignés (D) et aligner les ergots sur les bobines avec les bosses du dispositif de retenue de bobine (E).

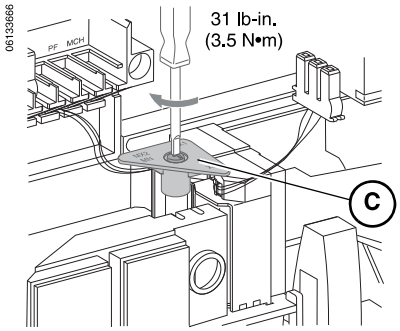


7. Install coil wiring (A) into corresponding auxiliary control connection slots (B).
8. Lower coil retainer (C) and secure with screw

7. nstale el cableado de la bobina (A) en la(s) ranura(s) correspondiente(s) (B) de la conexión al control auxiliar.
8. Vuelva a colocar el sujetador de la bobina (C) y sujételo con el tornillo.

7. Installer le câblage de la bobine (A) dans la fente correspondante (B) de la connexion de commande auxiliare.
8. Remettre en place le dispositif de retenue de bobine (C) et le fixer à l'aide de la vis.

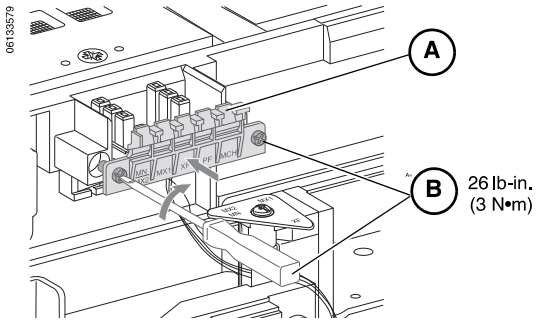




9. Reinstall wiring cover (A) using two previously removed screws (B)

9. Vuelva a instalar la cubierta del cableado (A) utilizando los dos tornillos retirados anteriormente (B).

9. Réinstaller le couvercle de câblage (A) à l'aide des deux vis (B) précédemment retirées.



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⚠ DANGER / PELIGRO / DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH Replace circuit breaker accessory cover before energizing circuit breaker to prevent access to live terminals. **Failure to follow these instructions will result in death or serious injury.**	**PELIGRO DE DESCARGA ELÉCTRICA, EXPLOSIÓN O DESTELLO POR ARQUEO** Vuelva a colocar la cubierta de accesorios del interruptor antes de energizarlo para evitar acceso a las terminales energizadas. **El incumplimiento de estas instrucciones podrá causar la muerte o lesiones serias.**	**RISQUE D'ÉLECTROCUTION, D'EXPLOSION OU D'ÉCLAIR D'ARC** Replacez le couvercle des accessoires du disjoncteur avant de remettre le disjoncteur sous tension pour empêcher l'accès aux bornes sous tension. **Si ces directives ne sont pas respectées, cela entraînera la mort ou des blessures graves.**

10. Replace circuit breaker accessory cover as directed in the circuit breaker instruction bulletin shipped with the circuit breaker.
11. The circuit breaker can now be placed in service.

10. Vuelva a colocar la cubierta de accesorios del interruptor tal como se indica en el boletín de instrucciones correspondiente incluido.
11. El interruptor está listo para ponerse en sevicio.

10. Replacer le couvercle des accessoires du disjoncteur selon les directives d'utilisation du disjoncteur qui l'acompagnent.
11. Le disjoncteur est prêt pour être mis en service.

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Solamente el personal especializado deberá instalar, hacer funcionar y prestar servicios de mantenimiento al equipo eléctrico. Schneider Electric no asume responsabilidad alguna por las consecuencias emergentes de la utilización de este material.

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Seul un personnel qualifié doit effectuer l'installation, l'utilisation, l'entretien et la maintenance du matériel électrique. Schneider Electric n'assume aucune responsabilité des conséquences éventuelles découlant de l'utilisation de cette documentation.

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Primary High Current Injection

Field Test Procedure for Modified Differential Ground Fault Protection Systems Class 6036

Instruction Bulletin

Retain for future use.





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SQUARE D

HAZARD CATEGORIES AND SPECIAL SYMBOLS

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** property damage.



Provides additional information to clarify or simplify a procedure.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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SECTION 1—INTRODUCTION

Description

This bulletin contains inspection and testing instructions for modified differential ground fault protection systems manufactured by Schneider Electric.
The modified differential ground fault protection system used in Schneider Electric multiple-source switchboard and switchgear line-ups will use one of two types of ground fault current sensing techniques.

The first type is zero sequence sensing, which uses a single sensor to surround all three phase conductors and the neutral conductor. The second type is residual sensing, where each phase and the neutral conductor are surrounded by its own sensor. In normal conditions, the vector sum of the phase currents with the neutral current should equal zero. In a ground fault condition, the vector sum yields a current that is used in a protective relaying scheme to automatically open main or tie circuit breakers (or switches) as required.

NOTE: All diagrams are shown as residual sensing.

Testing

Paragraph 230-95(c) of the National Electrical Code® (NEC)® requires that all ground fault protection systems be performance tested when first installed. Schneider Electric recommends testing be done:

- When the equipment is installed at its permanent location.
- As a part of normal maintenance.
- If the distribution system is altered in any way.

Field testing determines that the ground fault protection system is operational. Consider the following information when using this instruction bulletin:

- The diagrams in this bulletin are provided to illustrate high current injection test connections, but are not intended to depict the ground fault protection system in its entirety as installed in the field. Review all instruction manuals and wiring diagrams provided with the equipment for actual system configuration. Verify that all sensors are installed and wired with correct polarity per the wiring diagrams.
- This field test procedure is not a check of the calibration of any sensing relay.
- Record results within the ground fault test logs (Tables 1–3 on pages 31–33). If test results are not acceptable, recheck the connections and retest. If results are still unacceptable, contact Square D Services at 1-888-Square D (1-888-778-2733).

Tools Required

The following tools are required to inspect and test the modified differential ground fault protection system:

- A high current injection test unit capable of injecting 1000 A. Test jumpers are typically copper welding cables. Use cables and connections that give low impedance.
- Hand-held test kit by Schneider Electric for Micrologic®
  Type A, H and P trip units.

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Systems Covered

This test procedure is restricted to the following types of systems:

- Main-Main, Grounded Wye Configuration
- Main-Tie-Main, Grounded Wye, Non-Relayed Tie Configuration
- Main-Tie-Main, Grounded Wye, Relayed Tie Configuration

NOTE: A relayed system has ground fault protection on the Tie device. A non-relayed system has no ground fault protection on the Tie device.

NOTE: Systems with configurations beyond what are covered in this document can be tested with similar methods as those shown. All possible configurations of open and closed circuit breakers must be tested for both TRIP and NO TRIP functionality. TRIP tests always have the TEST JUMPER connected phase-to-ground. NO TRIP tests always have the TEST JUMPER connected phase-to-neutral (if neutral is not present, connect TEST JUMPER phase-to-phase).

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SECTION 2—SAFETY PRECAUTIONS

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This test procedure must be performed only by qualified electrical personnel.
- Turn off all power before working on or inside the equipment. Assume that circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Always practice lock-out/tag-out procedures according to the OSHA requirements.
- Conduct electrical testing to confirm that no short-circuits were created during installation, maintenance, or testing.
- Carefully inspect your work area and remove any tools and objects left inside the equipment.
- Replace all devices, doors, and covers before turning on power to this equipment.
- All instructions in this manual are written with the assumption that the customer has taken these measures before performing maintenance or testing.

Failure to follow these instructions will result in death or serious injury.

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SECTION 3—MAIN-MAIN, GROUNDED WYE CONFIGURATION

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying the equipment before working on or inside the equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

1. Turn off all power supplying this equipment before working on or inside equipment. Use a properly rated voltage sensing device to confirm power is off.
2. Verify that all ground bus bar splices are solidly connected. For each main, verify that the ground bonding connection is made ahead of the neutral disconnect link and on the line side of any ground fault sensor. See Figure 1.
3. For each main, verify that a neutral connection exists from the supply transformer to the equipment.
4. For residual sensing systems, verify that all phase and neutral sensors are connected with correct polarity on both primary and secondary. Refer to the drawings supplied with the equipment.
5. For zero sequence sensing systems, verify that all phase conductors and the neutral pass through the sensor in the same direction, and that grounding conductors do not pass through the sensor. Also, verify that the sensor is connected with the correct polarity on both primary and secondary. Refer to the drawings supplied with the equipment.
6. Remove each main's neutral disconnect link to isolate wiring system neutrals from both supply and ground.
7. Measure the system neutral-to-ground insulation resistance to ensure that no ground connections exist on the load side of the ground fault protection system. The resistance should be at least 1.0 megohm. Remove all connections that exist from neutral-to-ground found during the test. Do not reconnect these grounds after the test is completed.
8. Replace each main's neutral disconnect link.
9. Record all pick-up and time delay settings for each circuit breaker and/or ground fault relay under test in Table 4 on page 34. After testing, return all settings to original values.
10. Adjust the ground fault pick-up setting on each circuit breaker and/or ground fault relay to its lowest current setting.
11. Adjust the ground fault time delay setting on each circuit breaker and/or ground fault relay under test to 0.1 seconds (I2T OUT or OFF).
12. Adjust the long-time, short-time, and instantaneous pick-up and time delay settings on each circuit breaker under test to their highest settings.
13. For each circuit breaker equipped with the Micrologic® Type A, H, or P trip unit, connect a hand-held test unit, and activate the thermal-imaging inhibit function according to the test unit instructions. This step is necessary to inhibit trip history and contact wear counter functions. After testing, de-activate the thermal-imaging inhibit function according to the

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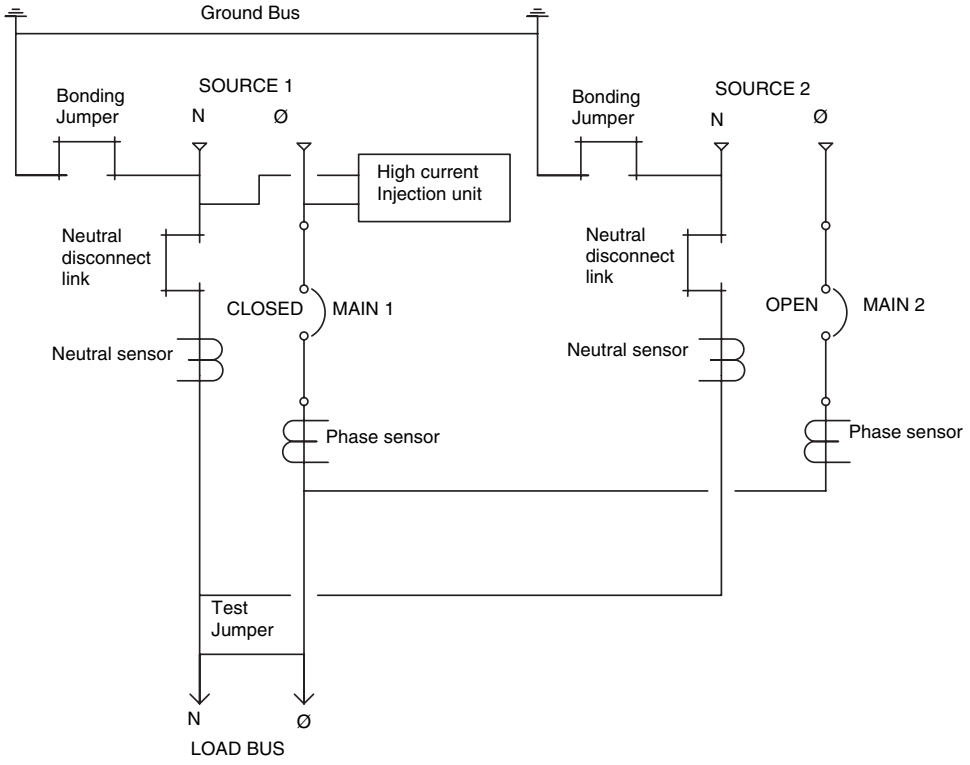
test unit instructions. Refer to bulletin 48049-184-XX for additional information.

14. Disconnect the ground fault protection control power source, if internally derived, and provide control power from an external source. Refer to wiring diagrams supplied for specific connections. After testing, disconnect external control power and re-connect internal control power circuit.

Test No. 1

1. Close MAIN 1 circuit breaker (or switch), and open MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 1 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 1.
3. On the load bus, connect a high current jumper between Phase A and the neutral (N). See Figure 1.
4. Inject 1000 A into Phase A. MAIN 1 circuit breaker (or switch) should not trip on ground fault. Record the actual results for Test No. 1 in Table 1 on page 31.
5. Repeat Test No. 1 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 1.

Figure 1: Main-Main Test No. 1 (No Trip) Injection Unit and Test Jumper Connections



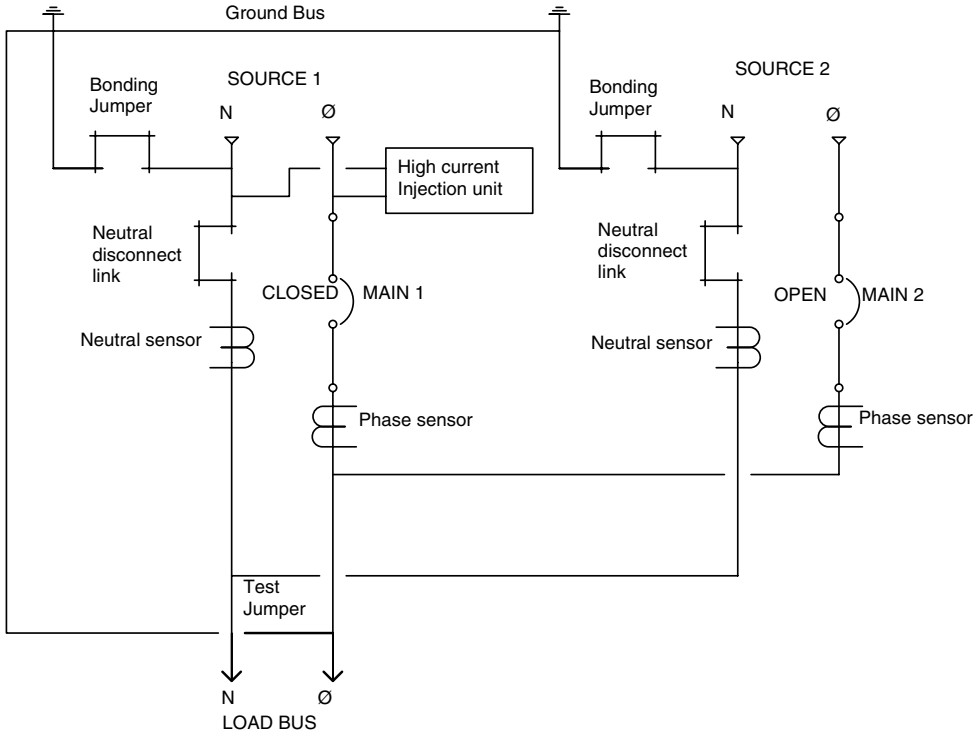
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Test No. 2

1. Close MAIN 1 circuit breaker (or switch), and open MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 1 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 2.
3. On the load bus, connect a high current jumper between Phase A and the ground. See Figure 2.
4. Inject 1000 A into Phase A. MAIN 1 circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 2 in Table 1 on page 31.
5. Repeat Test No. 2 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 1.

Figure 2: Main-Main Test No. 2 (Trip) Injection Unit and Test Jumper Connections

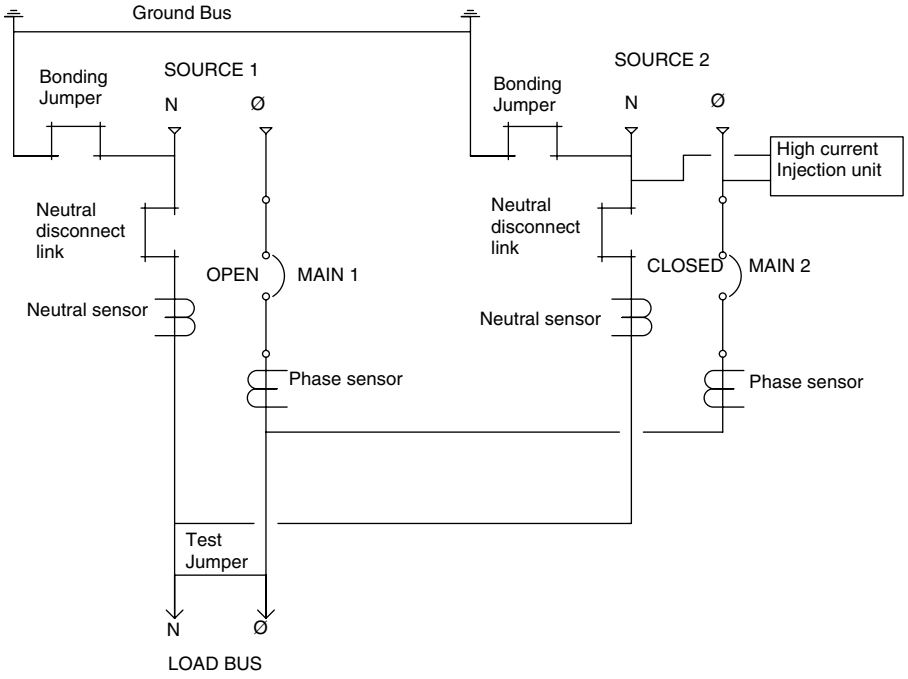


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Test No. 3

1. Close MAIN 2 circuit breaker (or switch), and open MAIN 1 circuit breaker (or switch).
2. On the line side of MAIN 2 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 3.
3. On the load bus, connect a high current jumper between Phase A and the neutral (N). See Figure 3.
4. Inject 1000 A into Phase A. MAIN 2 circuit breaker (or switch) should not trip on ground fault. Record the actual results for Test No. 3 in Table 1 on page 31.
5. Repeat Test No. 3 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 1.

Figure 3: Main-Main Test No. 3 (No Trip) Injection Unit and Test Jumper Connections

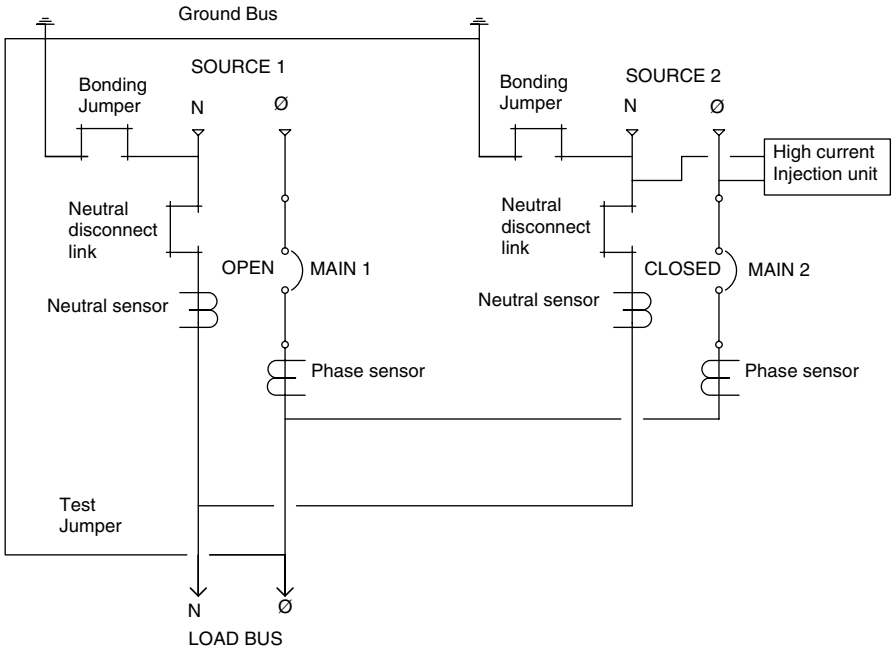


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Test No. 4

1. Close MAIN 2 circuit breaker (or switch), and open MAIN 1 circuit breaker (or switch).
2. On the line side of MAIN 2 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 4.
3. On the load bus, connect a high current jumper between Phase A and the ground. See Figure 4.
4. Inject 1000 A into Phase A. MAIN 2 circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 4 in Table 1 on page 31.
5. Repeat Test No. 4 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 1.
6. After testing, return all settings to the original values previously recorded.

Figure 4: Main-Main Test No. 4 (Trip) Injection Unit and Test Jumper Connections



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SECTION 4—MAIN-TIE-MAIN, GROUNDED WYE, NON-RELAYED TIE CONFIGURATION

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying the equipment before working on or inside the equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

1. Turn off all power supplying this equipment before working on or inside equipment. Use a properly rated voltage sensing device to confirm power is off.
2. Verify that all ground bus bar splices are solidly connected. For each main, verify that the ground bonding connection is made ahead of the neutral disconnect link and on the line side of any ground fault sensor. See Figure 5.
3. For each main, verify that a neutral connection exists from the supply transformer to the equipment.
4. For residual sensing systems, verify that all phase and neutral sensors are connected with correct polarity on both primary and secondary. Refer to the drawings supplied with the equipment.
5. For zero sequence sensing systems, verify that all phase conductors and the neutral pass through the sensor in the same direction, and that grounding conductors do not pass through the sensor. Also, verify that the sensor is connected with the correct polarity on both primary and secondary. Refer to the drawings supplied with the equipment.
6. Remove each main's neutral disconnect link to isolate wiring system neutrals from both supply and ground.
7. Measure the system neutral-to-ground insulation resistance to ensure that no ground connections exist on the load side of the ground fault protection system. The resistance should be at least 1.0 megohm. Remove all connections that exist from neutral-to-ground found during the test. Do not reconnect these grounds after the test is completed.
8. Replace each main's neutral disconnect link.
9. Record all pick-up and time delay settings for each circuit breaker and/or ground fault relay under test in Table 4 on page 34. After testing, return all settings to original values.
10. Adjust the ground fault pickup setting on each circuit breaker and/or ground fault relay to its lowest current setting.
11. Adjust the ground fault time delay setting on each circuit breaker and/or ground fault relay under test to 0.1 seconds (I2T OUT or OFF).
12. Adjust the long-time, short-time, and instantaneous pick-up and time delay settings on each circuit breaker under test to their highest settings.
13. For each main circuit breaker equipped with the Micrologic® Type A, H, or P trip unit, connect a hand-held test unit, and activate the thermal-imaging inhibit function according to the test unit instructions. This step is necessary to inhibit trip history and contact wear counter functions. After testing, de-

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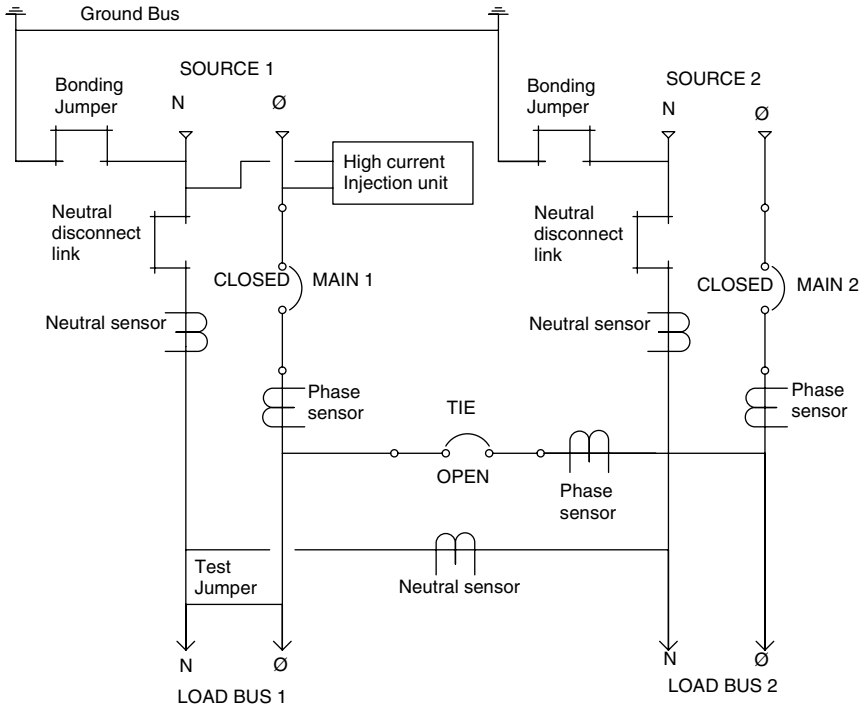
activate the thermal-imaging inhibit function according to the test unit instructions. Refer to bulletin 48049-184-XX for additional information.

14. Disconnect the ground fault protection control power source, if internally derived, and provide control power from an external source. Refer to the wiring diagrams supplied for specific connections. After testing, disconnect external control power and re-connect internal control power circuit.

Test No. 1

1. Close MAIN 1 circuit breaker (or switch). Open TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 1 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 5.
3. On the load bus, connect a high current jumper between Phase A and the neutral (N). See Figure 5.
4. Inject 1000 A into Phase A. MAIN 1 circuit breaker (or switch) should not trip on ground fault. Record the actual results for Test No. 1 in Table 2 on page 32.
5. Repeat Test No. 1 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 2.

Figure 5: Main-Tie-Main Test No. 1 (No Trip) Injection Unit and Test Jumper Connections

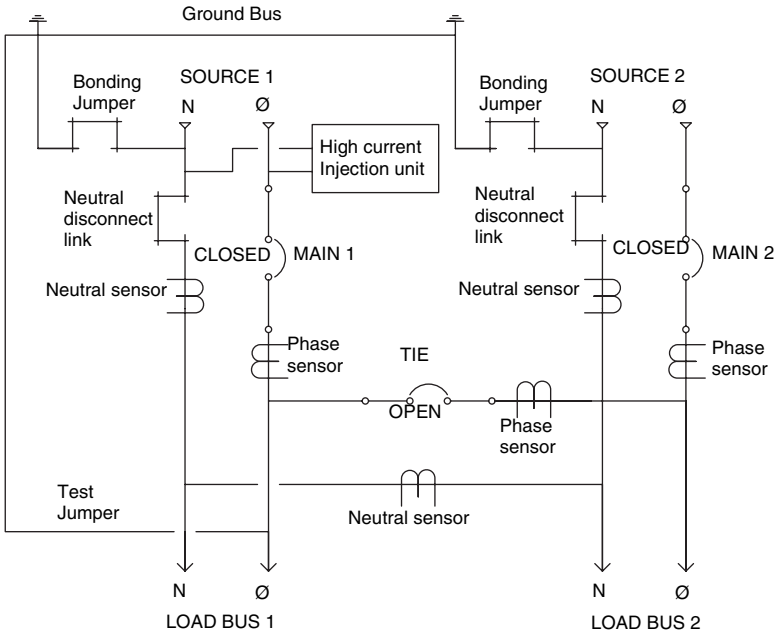


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Test No. 2

1. Close MAIN 1 circuit breaker (or switch). Open TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 1 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 6.
3. On the load bus, connect a high current jumper between Phase A and the ground. See Figure 6.
4. Inject 1000 A into Phase A. MAIN 1 circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 2 in Table 2 on page 32.
5. Repeat Test No. 2 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 2.

Figure 6: Main-Tie-Main Test No. 2 (Trip) Injection Unit and Test Jumper Connections

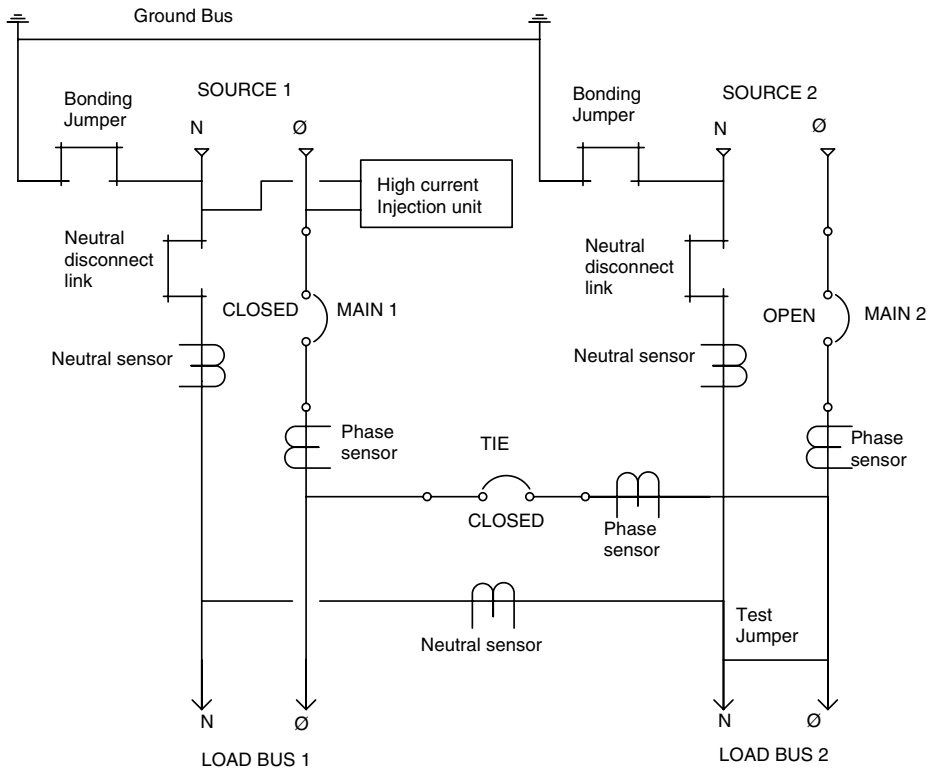


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Test No. 3

1. Close MAIN 1 circuit breaker (or switch). Close TIE circuit breaker (or switch), and open MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 1 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 7.
3. On the load bus, connect a high current jumper between Phase A and the neutral (N). See Figure 7.
4. Inject 1000 A into Phase A. Neither MAIN 1 circuit breaker (or switch) nor TIE circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 3 in Table 2 on page 32.
5. Repeat Test No. 3 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 2.

Figure 7: Main-Tie-Main Test No. 3 (No Trip) Injection Unit and Test Jumper Connections

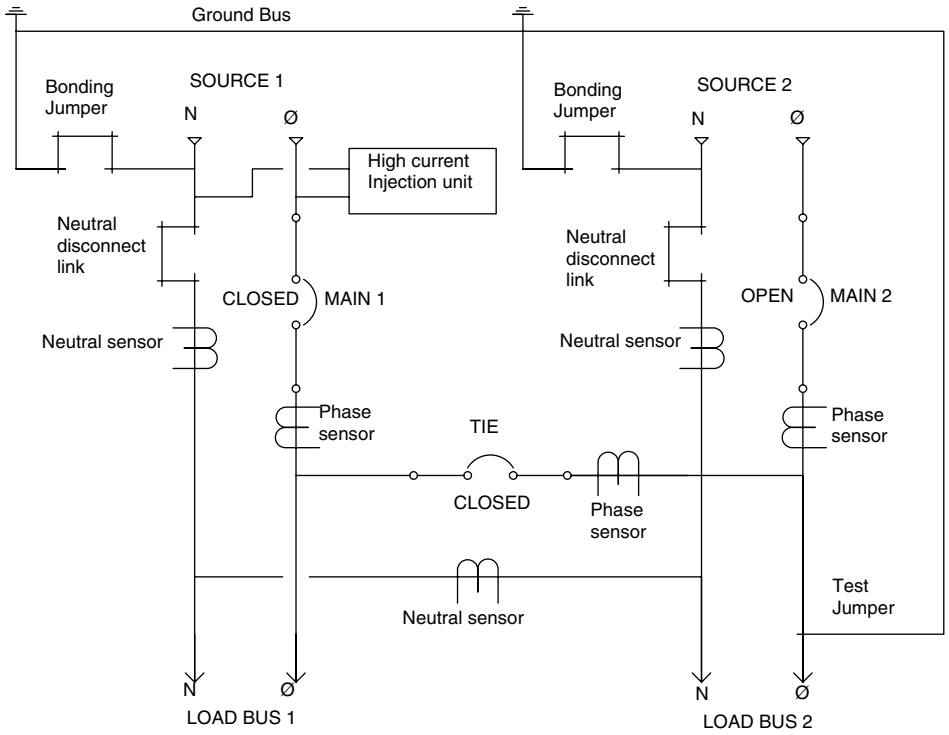


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Test No. 4

1. Close MAIN 1 circuit breaker (or switch). Close TIE circuit breaker (or switch), and open MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 1 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 8.
3. On the load bus, connect a high current jumper between Phase A and the ground. See Figure 8.
4. Inject 1000 A into Phase A. MAIN 1 circuit breaker (or switch) should trip on ground fault, but TIE circuit breaker (or switch) should not trip on ground fault. Record the actual results for Test No. 4 in Table 2 on page 32.
5. Repeat Test No. 4 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 2.

Figure 8: Main-Tie-Main Test No. 4 (Trip) Injection Unit and Test Jumper Connections

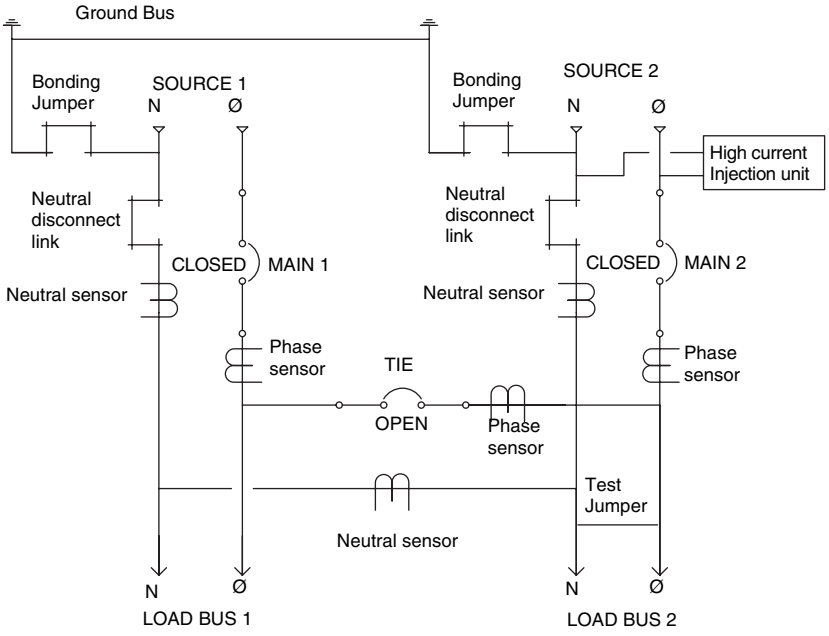


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Test No. 5

1. Close MAIN 1 circuit breaker (or switch). Open TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 2 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 9.
3. On the load bus, connect a high current jumper between Phase A and the neutral (N). See Figure 9.
4. Inject 1000 A into Phase A. MAIN 2 circuit breaker (or switch) should not trip on ground fault. Record the actual results for Test No. 5 in Table 2 on page 32.
5. Repeat Test No. 5 for Phases B and C (not required for zero sequence systems). Record the actual results for this in Table 2.

Figure 9: Main-Tie-Main Test No. 5 (No Trip) Injection Unit and Test Jumper Connections

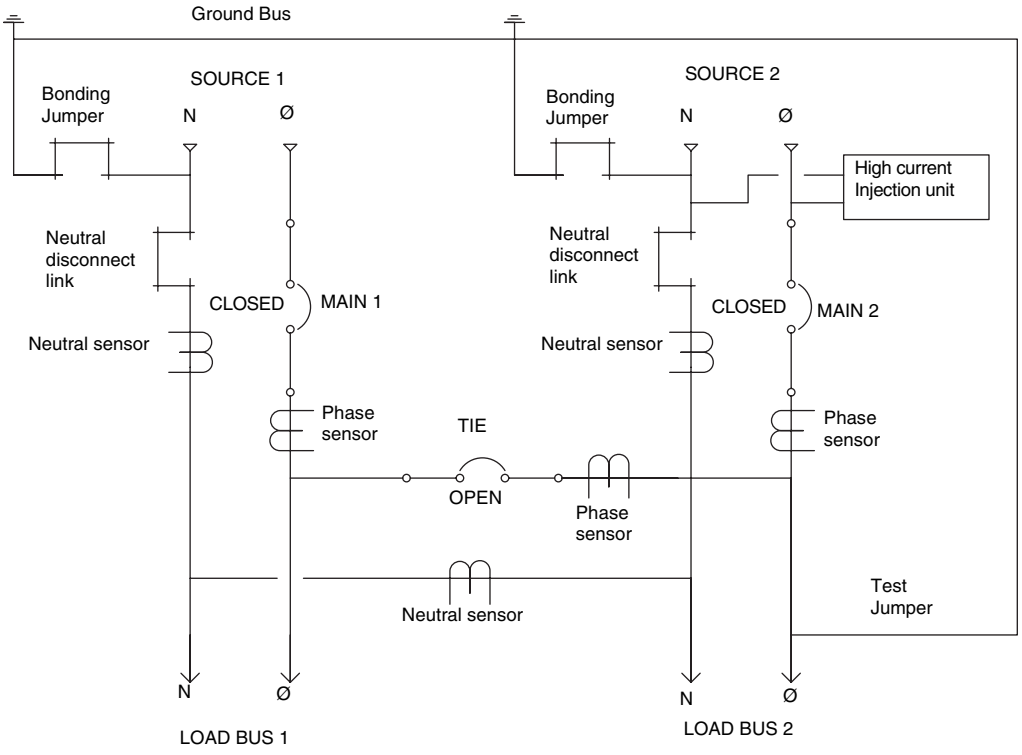


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Test No. 6

1. Close MAIN 1 circuit breaker (or switch). Open TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 2 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 10.
3. On the load bus, connect a high current jumper between Phase A and the ground. See Figure 10.
4. Inject 1000 A into Phase A. MAIN 2 circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 6 in Table 2 on page 32.
5. Repeat Test No. 6 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 2.

Figure 10: Main-Tie-Main Test No. 6 (Trip) Injection Unit and Test Jumper Connections



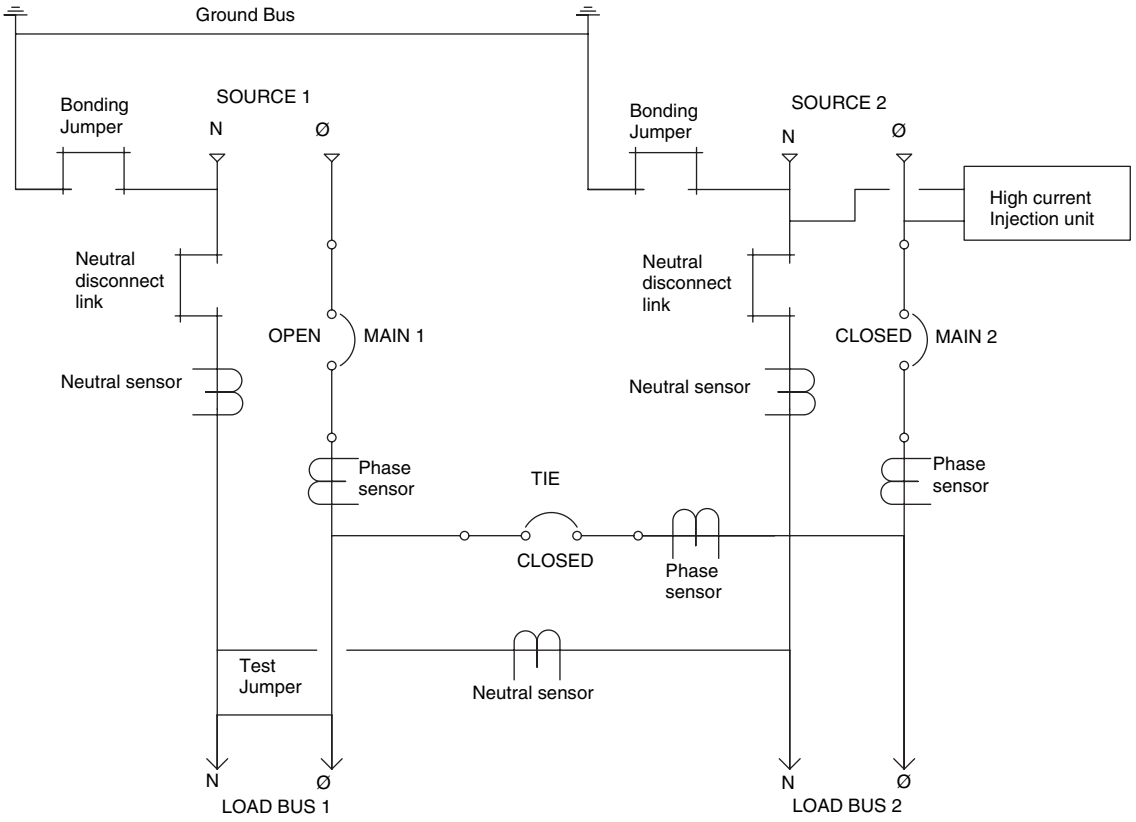
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Test No. 7

1. Open MAIN 1 circuit breaker (or switch). Close TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 2 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 11.
3. On the load bus, connect a high current jumper between Phase A and the neutral (N). See Figure 11.
4. Inject 1000 A into Phase A. Neither MAIN 2 circuit breaker (or switch) nor TIE circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 7 in Table 2 on page 32.
5. Repeat Test No. 7 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 2.

Figure 11: Main-Tie-Main Test No. 7 (No Trip) Injection Unit and Test Jumper Connections

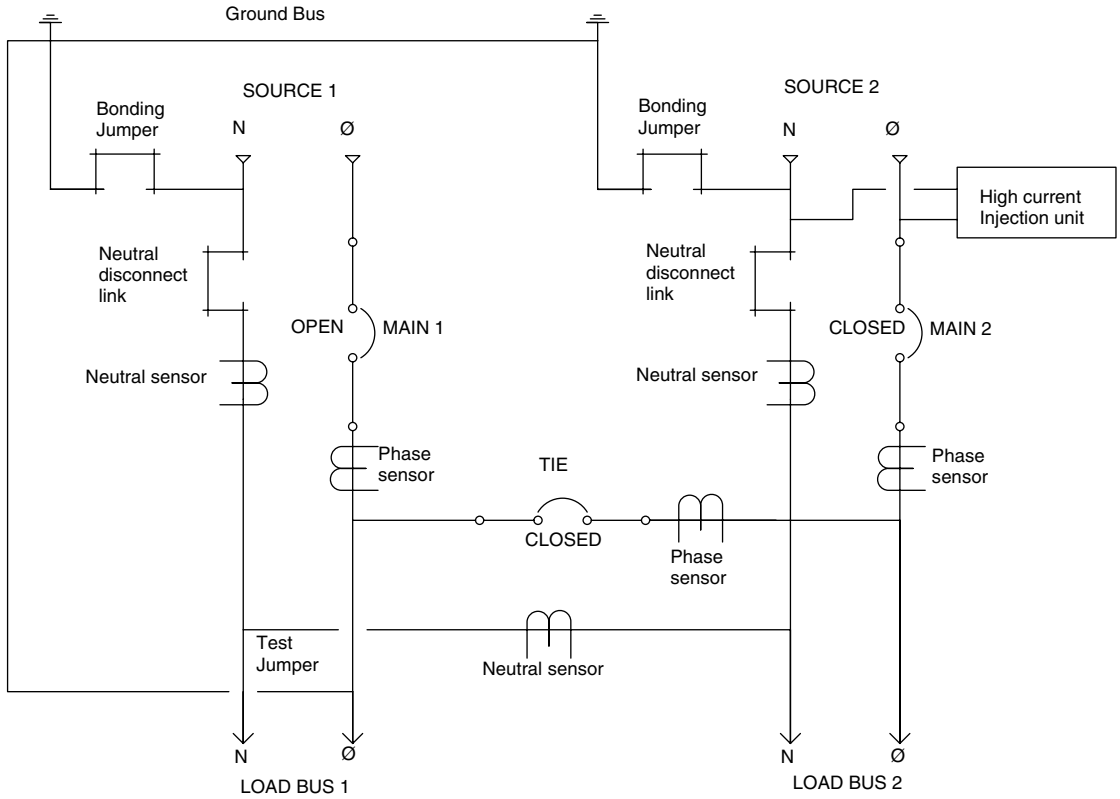


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Test No. 8

1. Open MAIN 1 circuit breaker (or switch). Close TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 2 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 12.
3. On the load bus, connect a high current jumper between Phase A and the ground. See Figure 12.
4. Inject 1000 A into Phase A. MAIN 2 circuit breaker (or switch) should trip on ground fault, but TIE circuit breaker (or switch) should not trip on ground fault. Record the actual results for Test No. 8 in Table 2 on page 32.
5. Repeat Test No. 8 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 2.
6. After testing, return all settings to the original values previously recorded.

Figure 12: Main-Tie-Main Test No. 8 (Trip) Injection Unit and Test Jumper Connections



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SECTION 5—MAIN-TIE-MAIN, GROUNDED WYE, RELAYED TIE CONFIGURATION

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying the equipment before working on or inside the equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

1. Turn off all power supplying this equipment before working on or inside equipment. Use a properly rated voltage sensing device to confirm power is off.
2. Verify that all ground bus bar splices are solidly connected. For each main, verify that the ground bonding connection is made ahead of the neutral disconnect link and on the line side of any ground fault sensor. See Figure 13.
3. For each main, verify that a neutral connection exists from the supply transformer to the equipment.
4. For residual sensing systems, verify that all phase and neutral sensors are connected with correct polarity on both primary and secondary. Refer to the drawings supplied with the equipment.
5. For zero sequence sensing systems, verify that all phase conductors and the neutral pass through the sensor in the same direction, and that grounding conductors do not pass through the sensor. Also, verify that the sensor is connected with the correct polarity on both primary and secondary. Refer to the drawings supplied with the equipment.
6. Remove each main's neutral disconnect link to isolate wiring system neutrals from both supply and ground.
7. Measure the system neutral-to-ground insulation resistance to ensure that no ground connections exist on the load side of the ground fault protection system. The resistance should be at least 1 megohm. Remove all connections that exist from neutral-to-ground found during the test. Do not reconnect these grounds after the test is completed.
8. Replace each main's neutral disconnect link.
9. Record all pick-up and time delay settings for each circuit breaker and/or ground fault relay under test in Table 4 on page 34. After testing, return all settings to original values.
10. Adjust the ground fault pick-up setting on each circuit breaker and/or ground fault relay to its lowest current setting.
11. Adjust the ground fault time delay setting on each circuit breaker and/or ground fault relay under test to 0.1 seconds (I2T OUT or OFF).
12. Adjust the long-time, short-time, and instantaneous pick-up and time delay settings on each circuit breaker under test to their highest settings.
13. For each main and tie circuit breaker equipped with the Micrologic® Type A, H, or P trip unit, connect a hand-held test unit, and activate the thermal-imaging inhibit function according to the test unit instructions. This step is necessary to inhibit trip history and contact wear counter

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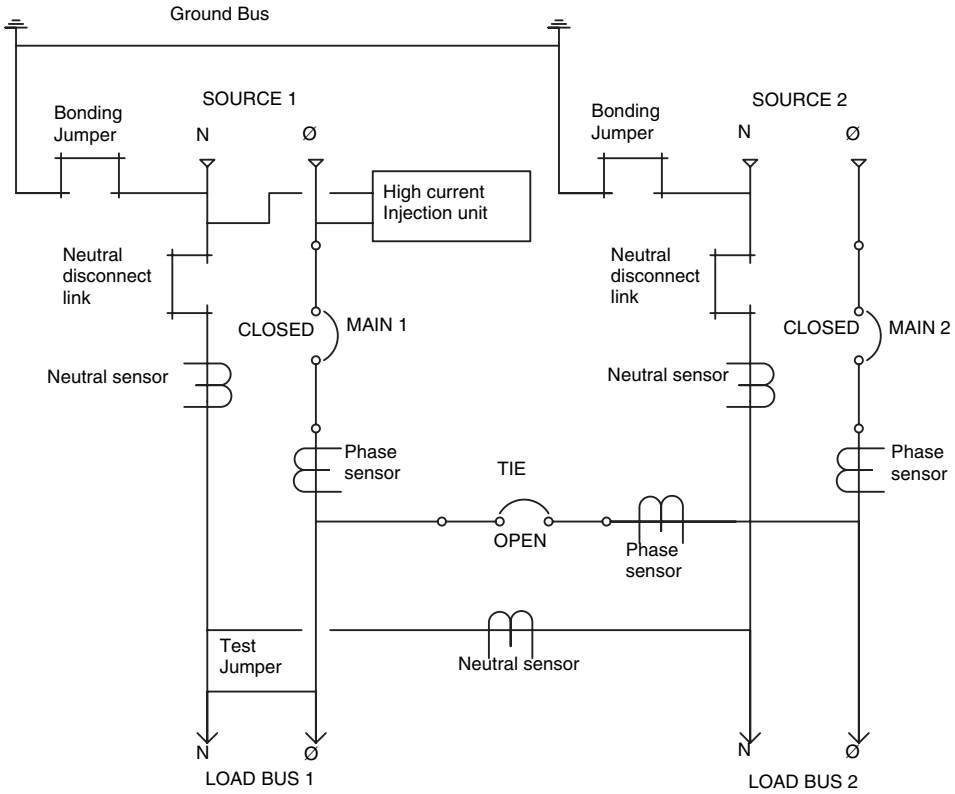
functions. After testing, de-activate the thermal-imaging inhibit function according to the test unit instructions. Refer to bulletin 48049-184-XX for additional information.

14. Disconnect the ground fault protection control power source, if internally derived, and provide control power from an external source. Refer to the wiring diagrams supplied for specific connections. After testing, disconnect external control power and re-connect internal control power circuit.

Test No. 1

1. Close MAIN 1 circuit breaker (or switch). Open TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 1 breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 13.
3. On the load bus, connect a high current jumper between Phase A and the neutral (N). See Figure 13.
4. Inject 1000 A into Phase A. MAIN 1 breaker (or switch) should not trip on ground fault. Record the actual results for Test No. 1 in Table 3 on page 33.
5. Repeat Test No. 1 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 3.

Figure 13: Main-Tie-Main Test No.1 (No Trip) Injection Unit and Test Jumper Connections



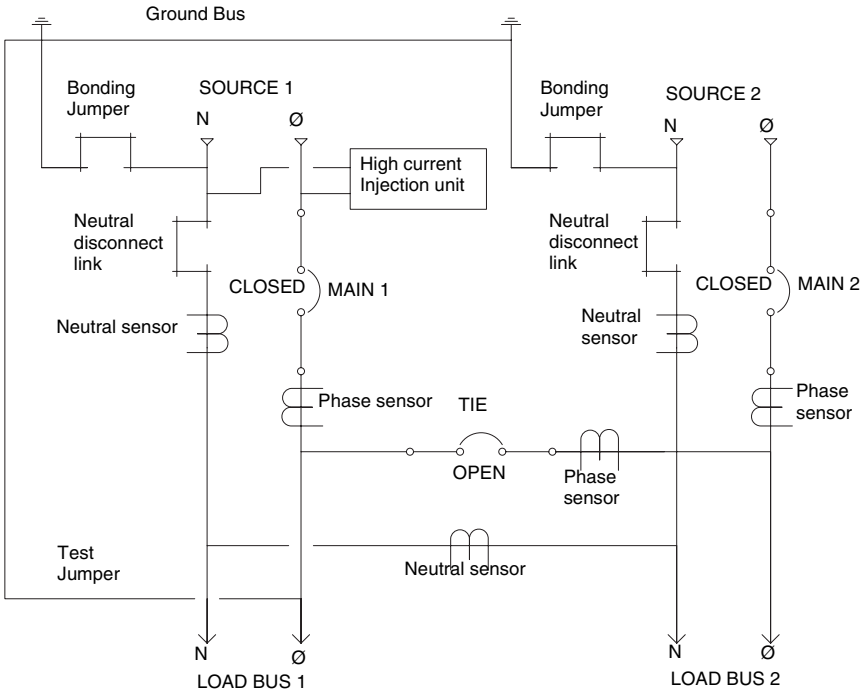
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Test No. 2

1. Close MAIN 1 circuit breaker (or switch). Open TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 1 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 14.
3. On the load bus, connect a high current jumper between Phase A and the ground. See Figure 14.
4. Inject 1000 A into Phase A. MAIN 1 circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 2 in Table 3 on page 33.
5. Repeat Test No. 2 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 3.

Figure 14: Main-Tie-Main Test No. 2 (Trip) Injection Unit and Test Jumper Connections

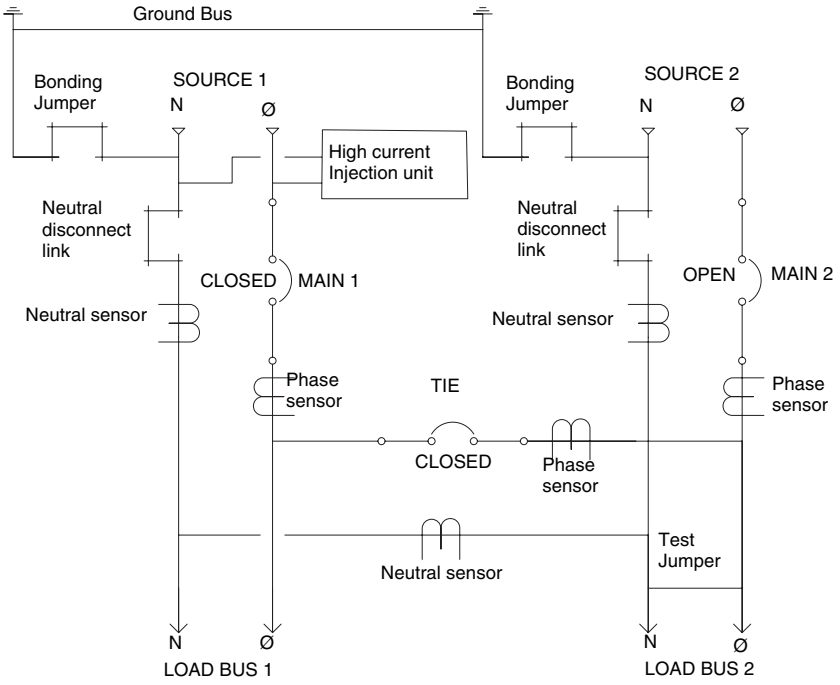


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Test No. 3

1. Close MAIN 1 circuit breaker (or switch). Close TIE circuit breaker (or switch), and open MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 1 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 15.
3. On the load bus, connect a high current jumper between Phase A and the neutral (N). See Figure 15.
4. Inject 1000 A into Phase A. Neither MAIN 1 circuit breaker (or switch) nor TIE circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 3 in Table 3 on page 33.
5. Repeat Test No. 3 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 3.

Figure 15: Main-Tie-Main Test No. 3 (No Trip) Injection Unit and Test Jumper Connections

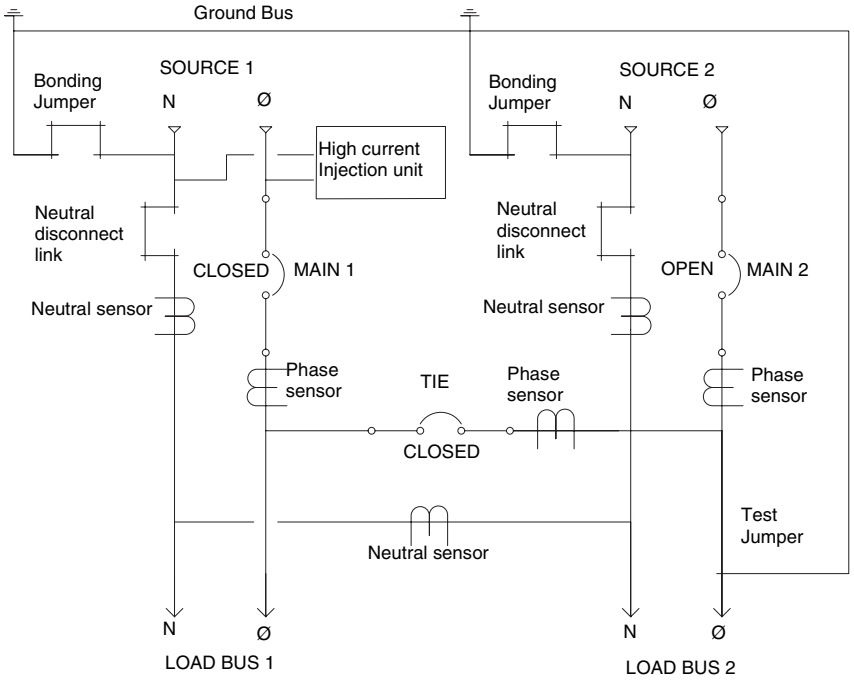


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Test No. 4

1. Close MAIN 1 circuit breaker (or switch). Close TIE circuit breaker (or switch), and open MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 1 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 16.
3. On the load bus, connect a high current jumper between Phase A and the ground. See Figure 16.
4. Inject 1000 A into Phase A. MAIN 1 circuit breaker (or switch) should not trip on ground fault, but TIE circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 4 in Table 3 on page 33.
5. Repeat Test No. 4 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 3.

Figure 16: Main-Tie-Main Test No. 4 (Trip) Injection Unit and Test Jumper Connections

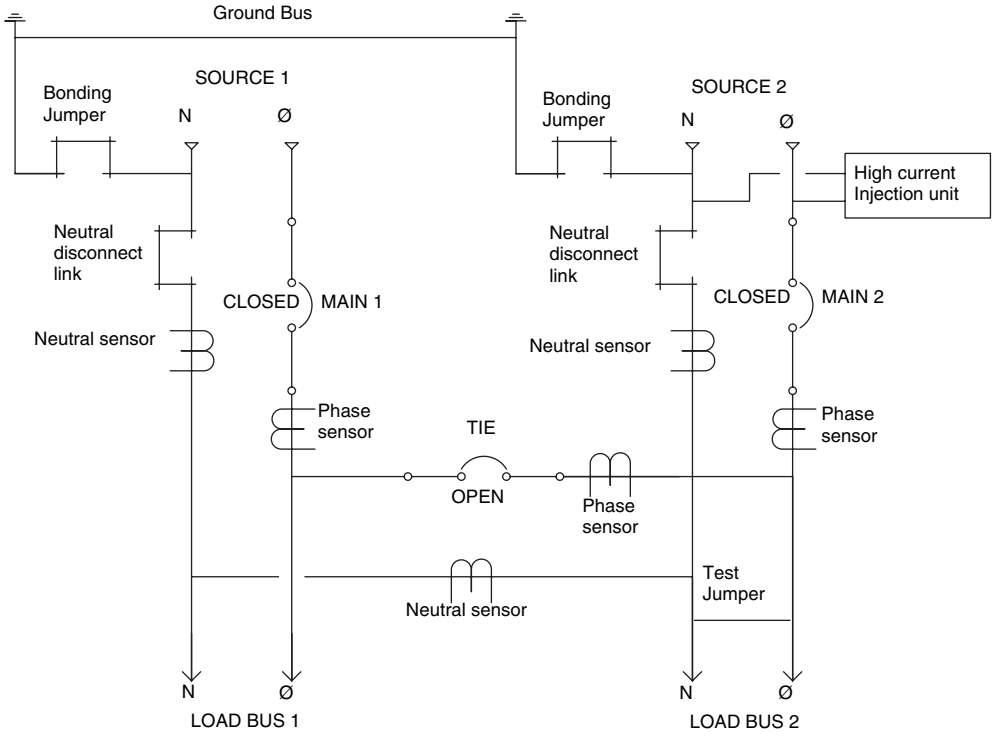


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Test No. 5

1. Close MAIN 1 circuit breaker (or switch). Open TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 2 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 17.
3. On the load bus, connect a high current jumper between Phase A and the neutral (N). See Figure 17.
4. Inject 1000 A into Phase A. MAIN 2 circuit breaker (or switch) should not trip on ground fault. Record the actual results for Test No. 5 in Table 3 on page 33.
5. Repeat Test No. 5 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 3.

Figure 17: Main-Tie-Main Test No. 5 (No Trip) Injection Unit and Test Jumper Connections



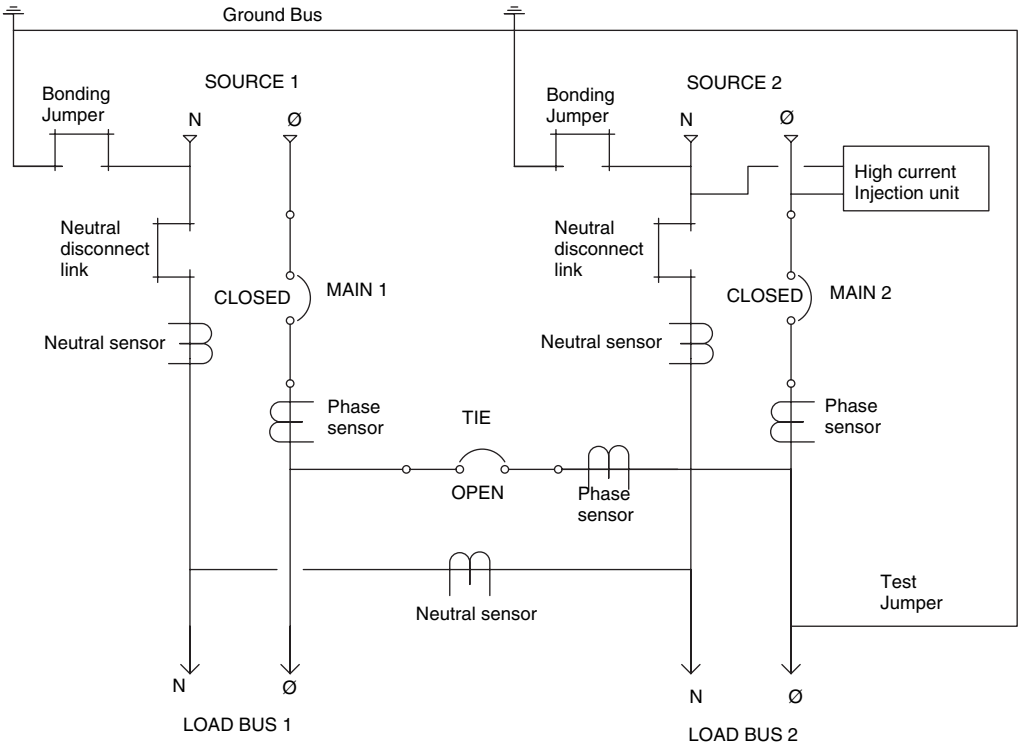
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Test No. 6

1. Close MAIN 1 circuit breaker (or switch). Open TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 2 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 18.
3. On the load bus, connect a high current jumper between Phase A and the ground. See Figure 18.
4. Inject 1000 A into Phase A. MAIN 2 circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 6 in Table 3 on page 33.
5. Repeat Test No. 6 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 3.

Figure 18: Main-Tie-Main Test No. 6 (Trip) Injection Unit and Test Jumper Connections

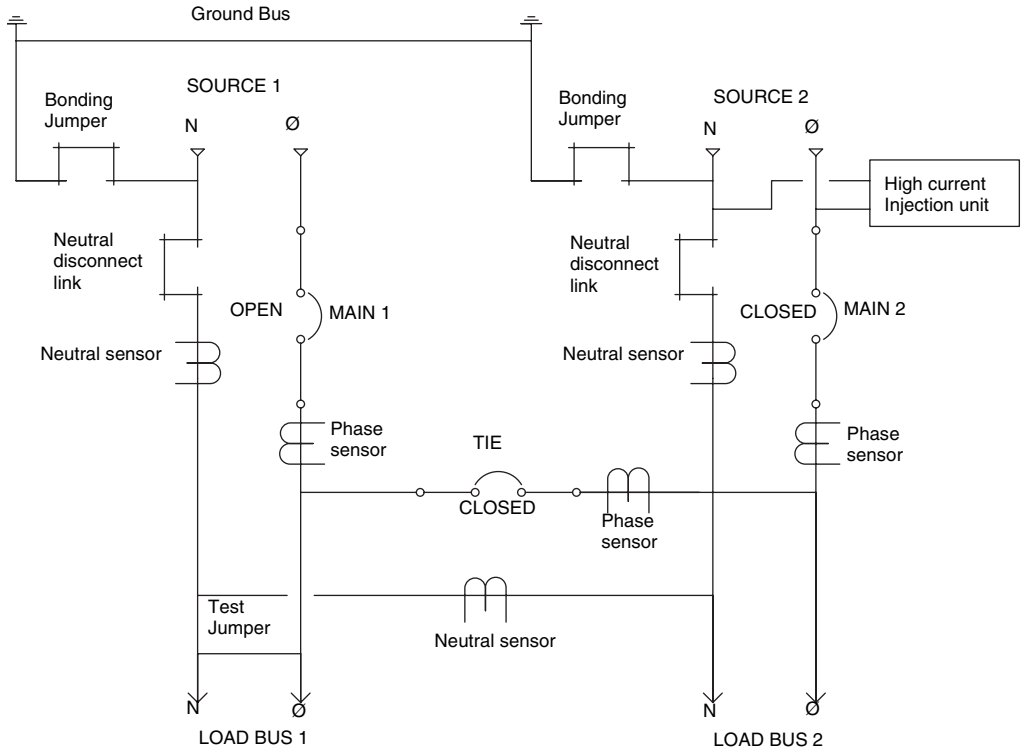


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Test No. 7

1. Open MAIN 1 circuit breaker (or switch). Close TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 2 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 19.
3. On the load bus, connect a high current jumper between Phase A and the neutral (N). See Figure 19.
4. Inject 1000 A into Phase A. Neither MAIN 2 circuit breaker (or switch) nor TIE circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 7 in Table 3 on page 33.
5. Repeat Test No. 7 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 3.

Figure 19: Main-Tie-Main Test No. 7 (No Trip) Injection Unit and Test Jumper Connections



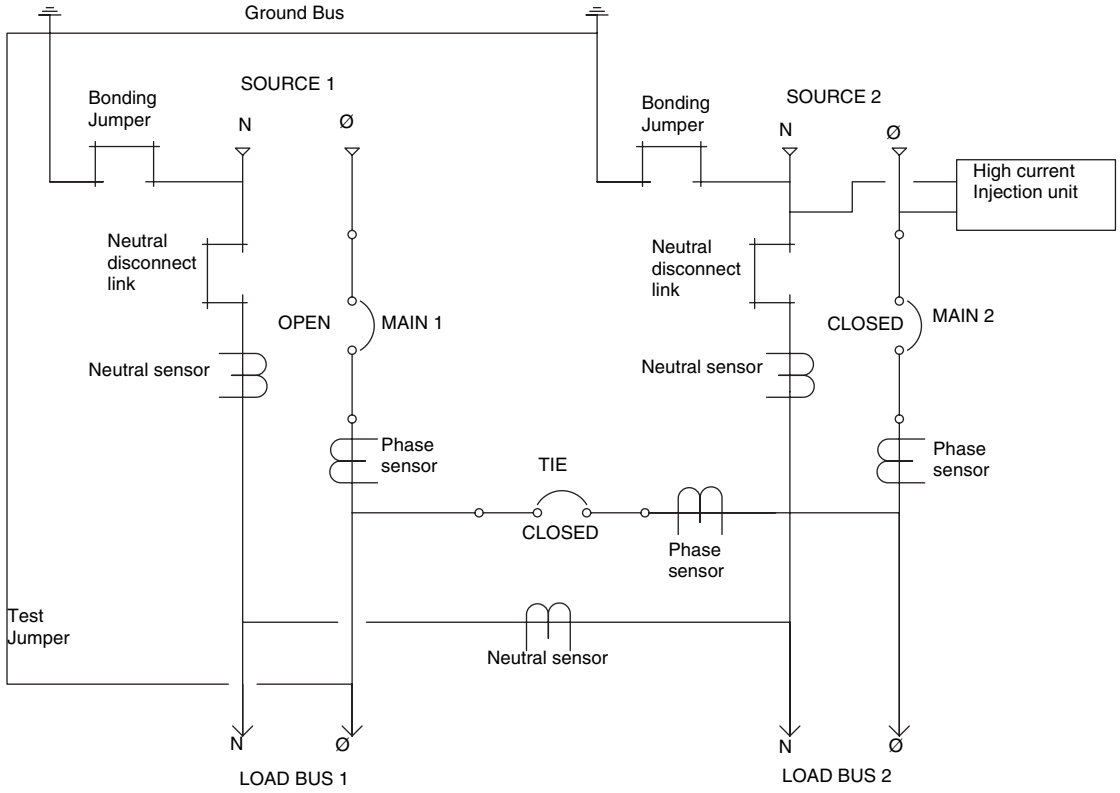
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Test No. 8

1. Open MAIN 1 circuit breaker (or switch). Close TIE circuit breaker (or switch), and close MAIN 2 circuit breaker (or switch).
2. On the line side of MAIN 2 circuit breaker (or switch), connect the high current injection unit between Phase A and the neutral (N). See Figure 20.
3. On the load bus, connect a high current jumper between Phase A and the ground. See Figure 20.
4. Inject 1000 A into Phase A. MAIN 2 circuit breaker (or switch) should not trip on ground fault, but TIE circuit breaker (or switch) should trip on ground fault. Record the actual results for Test No. 8 in Table 3 on page 33.
5. Repeat Test No. 8 for Phases B and C (not required for zero sequence systems). Record the actual results for this test in Table 3.
6. After testing, return all settings to the original values previously recorded.

Figure 20: Main-Tie-Main Test No. 8 (Trip) Injection Unit and Test Jumper Connections



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SECTION 6—MAIN-MAIN TEST PROCEDURE LOG

Table 1: Main-Main Test Procedure Log

Test No.	Jumper Connection	Circuit Breaker Status		Injection Current	Expected Results	Actual Results		
		MAIN 1	MAIN 2			Phase A	Phase B	Phase C
1	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Closed	Open	1000 A	"No Trip" MAIN 1 Circuit Breaker			
2	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Closed	Open	1000 A	"Trip" MAIN 1 Circuit Breaker			
3	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Open	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker			
4	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Open	Closed	1000 A	"Trip" MAIN 2 Circuit Breaker			

Test No.	Jumper Connection	Circuit Breaker Status		Injection Current	Expected Results	Actual Results		
		MAIN 1	MAIN 2			Phase A	Phase B	Phase C
1	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Closed	Open	1000 A	"No Trip" MAIN 1 Circuit Breaker			
2	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Closed	Open	1000 A	"Trip" MAIN 1 Circuit Breaker			
3	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Open	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker			
4	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Open	Closed	1000 A	"Trip" MAIN 2 Circuit Breaker			

Test No.	Jumper Connection	Circuit Breaker Status		Injection Current	Expected Results	Actual Results		
		MAIN 1	MAIN 2			Phase A	Phase B	Phase C
1	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Closed	Open	1000 A	"No Trip" MAIN 1 Circuit Breaker			
2	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Closed	Open	1000 A	"Trip" MAIN 1 Circuit Breaker			
3	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Open	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker			
4	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Open	Closed	1000 A	"Trip" MAIN 2 Circuit Breaker			

Test No.	Jumper Connection	Circuit Breaker Status		Injection Current	Expected Results	Actual Results		
		MAIN 1	MAIN 2			Phase A	Phase B	Phase C
1	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Closed	Open	1000 A	"No Trip" MAIN 1 Circuit Breaker			
2	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Closed	Open	1000 A	"Trip" MAIN 1 Circuit Breaker			
3	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Open	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker			
4	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Open	Closed	1000 A	"Trip" MAIN 2 Circuit Breaker			

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SECTION 7—MAIN-TIE-MAIN NON-RELAYED TEST PROCEDURE LOG

Table 2: Main-Tie-Main Non-Relayed Test Procedure Log

Test No.	Jumper Connection	Circuit Breaker Status			Injection Current	Expected Results	Actual Results		
		MAIN 1	TIE	MAIN 2			Phase A	Phase B	Phase C
1	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Closed	Open	Closed	1000 A	"No Trip" MAIN 1 Circuit Breaker			
2	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Closed	Open	Closed	1000 A	"Trip" MAIN 1 Circuit Breaker			
3	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Closed	Closed	Open	1000 A	"No Trip" MAIN 1 Circuit Breaker			
4	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Closed	Closed	Open	1000 A	"Trip" MAIN 1 Circuit Breaker			
5	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Closed	Open	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker			
6	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Closed	Open	Closed	1000 A	"Trip" MAIN 2 Circuit Breaker			
7	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Open	Closed	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker			
8	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Open	Closed	Closed	1000 A	"Trip" MAIN 2 Circuit Breaker			

Test No.	Jumper Connection	Circuit Breaker Status			Injection Current	Expected Results	Actual Results		
		MAIN 1	TIE	MAIN 2			Phase A	Phase B	Phase C
1	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Closed	Open	Closed	1000 A	"No Trip" MAIN 1 Circuit Breaker			
2	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Closed	Open	Closed	1000 A	"Trip" MAIN 1 Circuit Breaker			
3	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Closed	Closed	Open	1000 A	"No Trip" MAIN 1 Circuit Breaker			
4	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Closed	Closed	Open	1000 A	"Trip" MAIN 1 Circuit Breaker			
5	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Closed	Open	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker			
6	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Closed	Open	Closed	1000 A	"Trip" MAIN 2 Circuit Breaker			
7	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Open	Closed	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker			
8	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Open	Closed	Closed	1000 A	"Trip" MAIN 2 Circuit Breaker			

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SECTION 8—MAIN-TIE-MAIN RELAYED TEST PROCEDURE LOG

Table 3: Main-Tie-Main Relayed Test Procedure Log

Test No.	Jumper Connection	Circuit Breaker Status			Injection Current	Expected Results	Actual Results		
		MAIN 1	TIE	MAIN 2			Phase A	Phase B	Phase C
1	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Closed	Open	Closed	1000 A	"No Trip" MAIN 1 Circuit Breaker			
2	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Closed	Open	Closed	1000 A	"Trip" MAIN 1 Circuit Breaker			
3	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Closed	Closed	Open	1000 A	"No Trip" MAIN 1 Circuit Breaker "No Trip" TIE Circuit Breaker			
4	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Closed	Closed	Open	1000 A	"No Trip" MAIN 1 Circuit Breaker "Trip" TIE Circuit Breaker			
5	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Closed	Open	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker			
6	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Closed	Open	Closed	1000 A	"Trip" MAIN 2 Circuit Breaker			
7	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Open	Closed	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker "No Trip" TIE Circuit Breaker			
8	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Open	Closed	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker "Trip" TIE Circuit Breaker			

Test No.	Jumper Connection	Circuit Breaker Status			Injection Current	Expected Results	Actual Results		
		MAIN 1	TIE	MAIN 2			Phase A	Phase B	Phase C
1	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Closed	Open	Closed	1000 A	"No Trip" MAIN 1 Circuit Breaker			
2	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Closed	Open	Closed	1000 A	"Trip" MAIN 1 Circuit Breaker			
3	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Closed	Closed	Open	1000 A	"No Trip" MAIN 1 Circuit Breaker "No Trip" TIE Circuit Breaker			
4	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Closed	Closed	Open	1000 A	"No Trip" MAIN 1 Circuit Breaker "Trip" TIE Circuit Breaker			
5	Phase of LOAD BUS 2 to Neutral of LOAD BUS 2	Closed	Open	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker			
6	Phase of LOAD BUS 2 to Ground of LOAD BUS 2	Closed	Open	Closed	1000 A	"Trip" MAIN 2 Circuit Breaker			
7	Phase of LOAD BUS 1 to Neutral of LOAD BUS 1	Open	Closed	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker "No Trip" TIE Circuit Breaker			
8	Phase of LOAD BUS 1 to Ground of LOAD BUS 1	Open	Closed	Closed	1000 A	"No Trip" MAIN 2 Circuit Breaker "Trip" TIE Circuit Breaker			

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SECTION 9—LOG OF TESTS AND SETTINGS

Table 4: Log of Tests and Settings

Date	Test	Circuit Breaker ID	Settings		Results and Signature
			Pick-Up	Time Delay	
	Installation				

Schneider Electric USA

1010 Airpark Center Drive
Nashville, TN 37217 USA
1-888-SquareD
(1-888-778-2733)
www.us.SquareD.com

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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04/2005

Micrologic™ 2.0A, 3.0A, 5.0A, and 6.0A Electronic Trip Units

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Instruction Bulletin

48049-136-05
Rev. 02, 06/2015

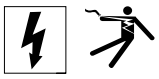
Retain for future use.



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Hazard Categories and Special Symbols

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

ANSI 

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.



IEC 

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

FCC Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. This Class A digital apparatus complies with Canadian ICES-003.

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Section 1— General Information

Introduction

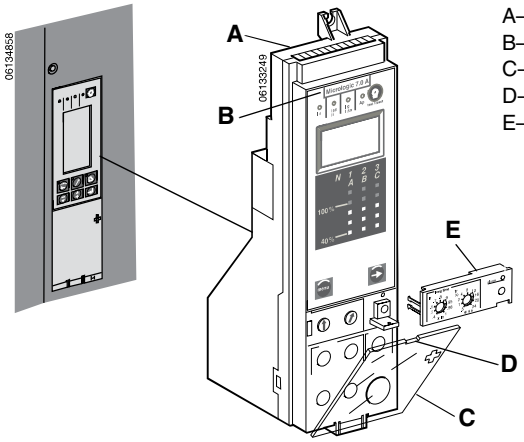
Micrologic™ trip units (A) provide adjustable tripping functions on electronic trip circuit breakers. The product name (B) specifies the level of protection provided by the trip unit.

Micrologic 3.0A

- Type of protection
  - 2—Basic IEC protection (LS0)
  - 3—Basic UL protection (LI)
  - 5—Selective protection (LSI)
  - 6—Selective protection plus ground fault protection for equipment (LSIG)
- Trip unit series
  - 0—Indicates the first version
- Type of measurement
  - None—Provides protection only
  - A—Provides protection plus ammeter measurements

Micrologic trip units are field replaceable to allow for upgrading of the trip unit in the field. For complete information on available circuit breaker models, frame sizes, interrupting ratings, sensor plugs, rating plugs and trip units, see the product catalog.

Figure 1 – Micrologic Trip Unit



A—Micrologic Trip Unit
B—Product Name
C—Switch Cover
D—Switch Cover Opening Slot
E—Adjustable Rating Plug

Communications

Micrologic trip units can communicate with other devices if the optional Circuit Breaker Communication Module (BCM) is installed. For information on the register lists and other communication devices refer to bulletin 0613IB1313: *Modbus Communications System*.

Trip Unit Settings

On the face of the trip unit are adjustable switches to allow changing of trip characteristics. Trip units are shipped with the long-time pickup switch set at 1.0 and all other trip unit adjustments set at their lowest settings.

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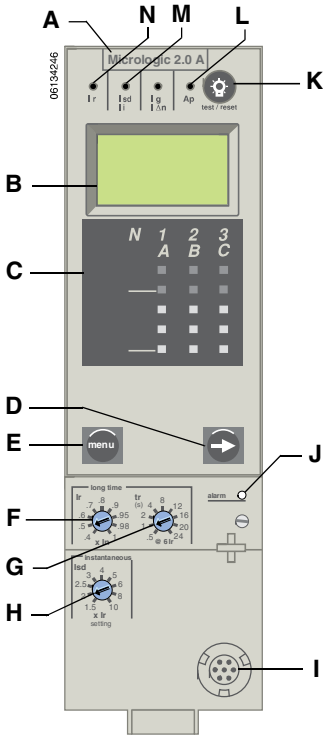
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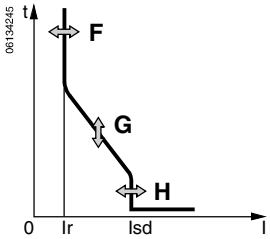
Micrologic 2.0A Trip Unit

The Micrologic 2.0A trip unit provides basic IEC (LS0) protection and a built-in ammeter.

NOTE: For use with IEC circuit breakers only.

Figure 2 – 2.0A Trip Unit





A. Trip unit name
B. Alphanumeric display
C. Three-phase bar graph
D. Scroll button
E. Menu button
F. Long-time pickup (Ir) switch
G. Long-time delay (tr) switch
H. Short-time pickup (Isd) switch[1]
I. Test plug receptacle
J. Overload indicator light
K. Reset button for battery status check and trip indicator LED
L. Self-protection indicator light
M. Short-time or instantaneous trip indicator light
N. Long-time trip indicator light

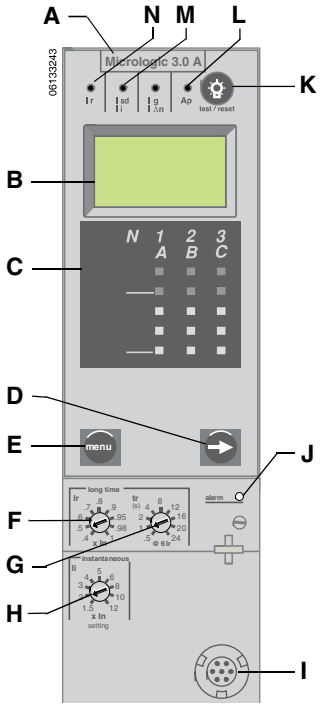
[1] Short-time delay is factory set at 0 (no delay), thus short-time pickup provides instantaneous protection.

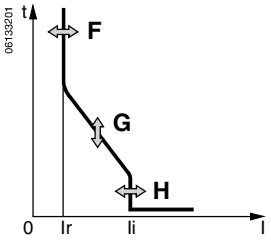
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Micrologic 3.0A Trip Unit

The Micrologic 3.0A trip unit provides basic UL (LI) protection and a built-in ammeter.

Figure 3 – 3.0A Trip Unit





A. Trip unit name
B. Alphanumeric display
C. Three-phase bar graph
D. Scroll button
E. Menu button
F. Long-time pickup (Ir) switch
G. Long-time delay (tr) switch
H. Instantaneous pickup (Ii) switch
I. Test plug receptacle
J. Overload indicator light
K. Reset button for battery status check and trip indicator LED
L. Self-protection indicator light
M. Short-time or instantaneous trip indicator light
N. Long-time trip indicator light

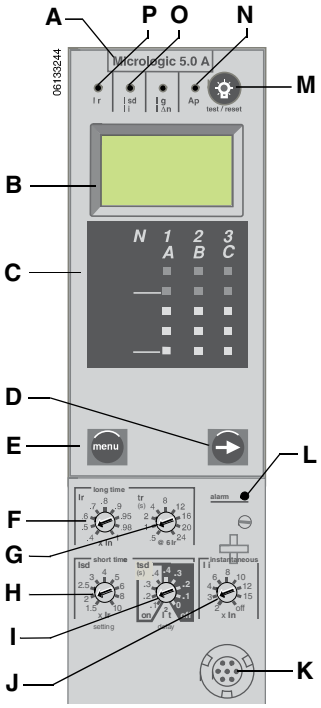
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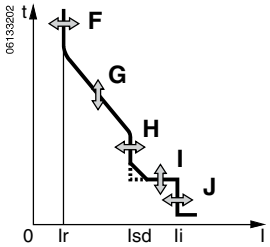
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Micrologic 5.0A Trip Unit

The Micrologic 5.0A trip unit provides selective (LSI) protection and a built-in ammeter.

Figure 4 – 5.0A Trip Unit





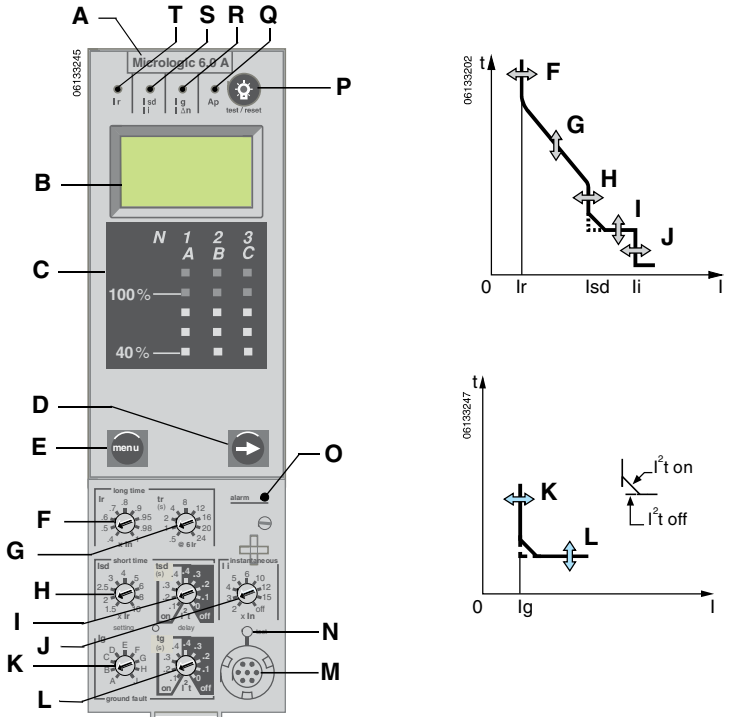
A. Trip unit name
B. Alphanumeric display
C. Three-phase bar graph
D. Scroll button
E. Menu button
F. Long-time pickup (Ir) switch
G. Long-time delay (tr) switch
H. Short-time pickup (Isd) switch
I. Short-time delay (tsd) switch
J. Instantaneous pickup (Ii) switch
K. Test plug receptacle
L. Overload indicator light
M. Reset button for battery status check and trip indicator LED
N. Self-protection indicator light
O. Short-time or instantaneous trip indicator light
P. Long-time trip indicator light

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Micrologic 6.0A Trip Unit

The Micrologic 6.0A trip unit provides selective and ground-fault protection for equipment (≤ 1200 A) (LSIG) and a built-in ammeter.

Figure 5 – 6.0A Trip Unit



A. Trip unit name
B. Alphanumeric display
C. Three-phase bar graph
D. Scroll button
E. Menu button
F. Long-time pickup (Ir) switch
G. Long-time delay (tr) switch
H. Short-time pickup (Isd) switch
I. Short-time delay (tsd) switch
J. Instantaneous pickup (Ii) switch
K. Ground-fault pickup (Ig) switch
L. Ground-fault delay (tg) switch
M. Test plug receptacle
N. Ground fault push-to-trip button
O. Overload indicator light
P. Reset button for battery status check and trip indicator LED
Q. Self-protection indicator light
R. Ground-fault trip indicator light
S. Short-time or instantaneous trip indicator light
T. Long-time trip indicator light

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Zone-Selective Interlocking

Short-time and ground-fault protection can be interlocked to provide zone-selective interlocking.

NOTE: Use I^2t off with ZSI for proper coordination. Using I^2t on with ZSI is not recommended as the delay in the upstream device receiving a restraint signal could result in the trip unit tripping in a time shorter than the published trip curve.

NOTE: Setting short-time delay (tsd) or ground-fault delay (tg) to the 0 setting will eliminate selectivity for that circuit breaker.

Control wiring links several trip units in the distribution network and in the event of a fault, a trip unit will obey the set delay time only if receiving a signal from a downstream trip unit.

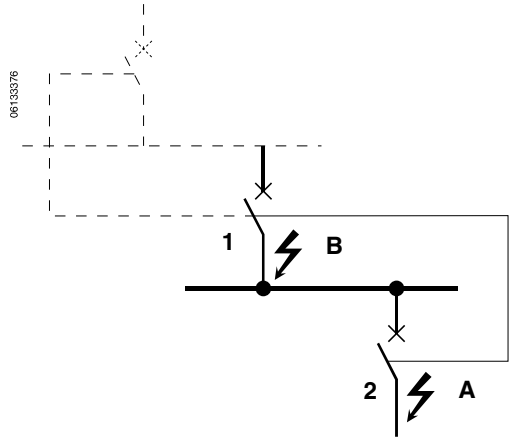
If the trip unit does not receive a signal, tripping will be instantaneous (with no intentional delay).

- The fault is cleared instantaneously by the nearest upstream circuit breaker.
- Thermal stresses (I^2t) in the network are minimized without any effect on the correct time delay coordination of the installation.

Figure 6 shows circuit breakers 1 and 2 zone-selective interlocked.

- A fault at A is seen by circuit breakers 1 and 2. Circuit breaker 2 trips instantaneously and also informs circuit breaker 1 to obey set delay times. Thus, circuit breaker 2 trips and clears the fault. Circuit breaker 1 does not trip.
- A fault at B is seen by circuit breaker 1. Circuit breaker 1 trips instantaneously since it did not receive a signal from the downstream circuit breaker 2. Circuit breaker 1 trips and clears the fault. Circuit breaker 2 does not trip.

Figure 6 – Zone-Selective Interlocking



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Trip Unit Switches

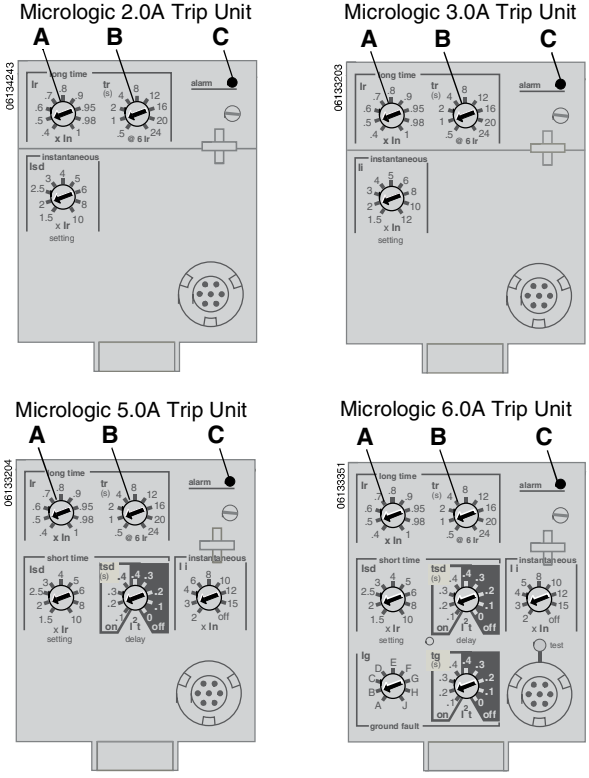
Long-Time Protection

Long-time protection protects equipment against overloads.

NOTE: Micrologic trip units are powered from the circuit to always provide fault protection. All other functions (display, metering, communications, etc.) require external power. See page 18 for more information.

- Long-time protection is standard on all trip units.
- The long-time pickup (Ir) (A) sets the maximum current level (based on sensor plug rating In) which the circuit breaker can continuously carry. If current exceeds this value, circuit breaker will trip after the preset time delay. The long-time pickup (Ir) is adjustable from 0.4–1.0 times the sensor plug rating (In).
- The long-time delay (tr) (B) sets the length of the time that the circuit breaker will carry an overcurrent (below the short-time or instantaneous pickup current level) before tripping. See Table 1 on page 12 for delay settings.
- Both long-time pickup and long-time delay are on the field-replaceable adjustable rating plug. To change settings to more precisely match the application, various rating plugs are available. For instructions on replacing the rating plug, see Section 5 —Adjustable Rating Plug Replacement.
- For Masterpact™ NT and NW circuit breakers, the In value can be changed by replacing the sensor plug below the trip unit. For further information, see the instructions packed with the sensor plug replacement kit.
- The overload indicator light (C) indicates that the Ir long-time pickup threshold has been exceeded.
- Long-time protection uses true RMS measurement.

Figure 7 – Long-Time Protection Switches



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Table 1 – Micrologic Trip Unit Long-Time Delay Values

Setting[1]	**Long-Time Delay in Seconds[2]**								
tr at 1.5 x Ir	12.5	25	50	100	200	300	400	500	600
tr at 6 x Ir	0.5	1	2	4	8	12	16	20	24
tr at 7.2 x Ir	0.34[3]	0.69	1.38	2.7	5.5	8.3	11	13.8	16.6

[1]Ir = In x long-time pickup. In = sensor rating. Trip threshold between 1.05 and 1.20 Ir.
[2]Time-delay accuracy +0/-20%
[3]For Micrologic 5.0A and 6.0A trip units, when tsd is set to 0.4 on or 4.0 off, then tr = 0.5 instead of 0.34.

Thermal imaging provides continuous temperature rise status of the wiring, both before and after the device trips. This allows the circuit breaker to respond to a series of overload conditions which could cause conductor overheating, but would go undetected if the long-time circuit was cleared every time the load dropped below the pickup setting or after every tripping event.

NOTE: If checking trip times, wait a minimum of 15 minutes after circuit breaker trips before resetting to allow the thermal imaging to reset completely to zero or use a full-function test kit to defeat the thermal imaging.

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Short-Time Protection

Short-time protection protects equipment against short circuits.

- Short-time protection is standard on 2.0A, 5.0A and 6.0A trip units. It is not available on 3.0A trip units.
- Short-time protection is based on the long-time pickup (Ir).
- The short-time pickup (Isd) (A) sets current level (below instantaneous trip level) at which circuit breaker will trip after the preset time delay.
- The short-time delay (tsd) (B) sets the length of time that the circuit breaker will carry an overcurrent above the short-time pickup current level before tripping. It is adjustable on the 5.0A and 6.0A trip unit and factory set to zero on the 2.0A trip unit.

Figure 8 – Short-Time Protection Switches

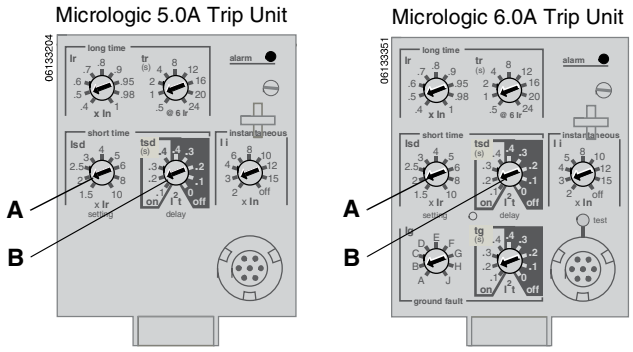


Table 2 – Micrologic Trip Unit Short-Time Delay Values

Setting	Short-Time Delay				
I^2t off (Isd at 10 Ir) (seconds)	0	0.1	0.2	0.3	0.4
I^2t on (Isd at 10 Ir) (seconds)		0.1	0.2	0.3	0.4
tsd (min. trip) (milliseconds)	20	80	140	230	350
tsd (max. trip) (milliseconds)	80	140	200	320	500

- The I^2t on/I^2t off option provides improved selectivity with downstream protective devices:
  - — With I^2t off selected, fixed time delay is provided.
  - — With I^2t on selected, inverse time I^2t protection is provided up to 10 x Ir. Above 10 x Ir, fixed time delay is provided.
- Intermittent currents in the short-time tripping range which do not last sufficiently long to trigger a trip are accumulated and shorten the trip delay appropriately.
- Short-time protection can be zone-selective interlocked (ZSI) with upstream or downstream circuit breakers.
- Setting tsd to the 0 setting turns off zone-selective interlocking.
- Short-time protection uses true RMS measurement.
- Short-time pickup and delay can be adjusted to provide selectivity with upstream or downstream circuit breakers.

NOTE: Use I^2t off with ZSI for proper coordination. Using I^2t on with ZSI is not recommended as the delay in the upstream device receiving a restraint signal could result in the trip unit tripping in a time shorter than the published trip curve.

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Instantaneous Protection

Instantaneous protection protects equipment against short circuits with no intentional time delay.

- Instantaneous protection (Ii) (A) is standard on the 3.0A, 5.0A and 6.0A trip units.
- Instantaneous protection on 2.0A trip units is achieved by using short-time protection (Isd) with the short-time delay factory set to 0 (zero).
- Instantaneous protection on the 3.0A, 5.0A and 6.0A trip units is based on the circuit breaker sensor rating (In).
- Instantaneous protection on the 2.0A trip unit is based on the long-time pickup setting (Ir).
- Circuit breaker open command is issued as soon as threshold current is exceeded.
- Instantaneous protection uses peak current measurement.
- When instantaneous protection switch is set to off, the instantaneous protection is disabled.

Figure 9 – Instantaneous Protection Switches

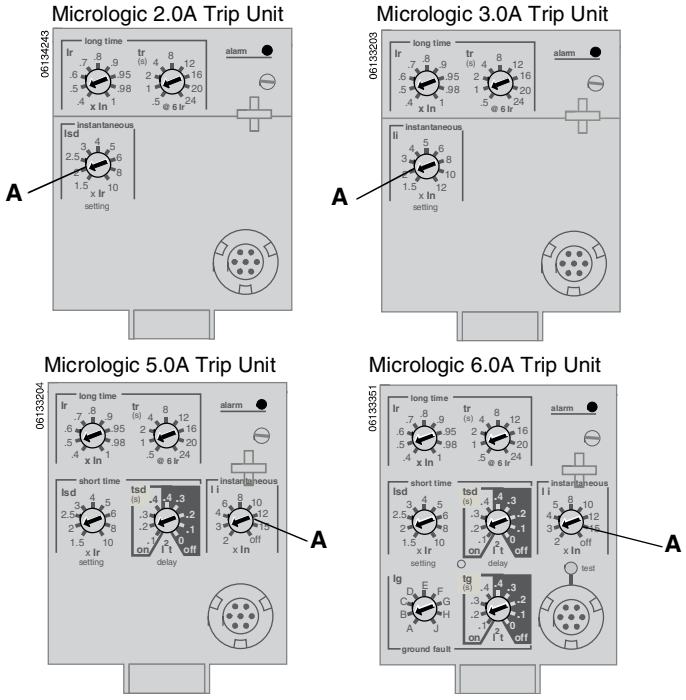


Table 3 – Micrologic Instantaneous Values

Setting	Interruption Current								
2.0A Isd (= Ir x..)	1.5	2	2.5	3	4	5	6	8	10
3.0A Ii (= In x..)	1.5	2	3	4	5	6	8	10	12
5.0A Ii (= In x..)	2	3	4	6	8	10	12	15	off
6.0A Ii (= In x..)	2	3	4	6	8	10	12	15	off

Ii = UL and ANSI instantaneous
Isd = IEC instantaneous (short-time with zero delay)
In = sensor rating
Ir = long-time pickup

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Ground-Fault Protection

Equipment ground-fault protection protects conductors against overheating and faults from ground-fault currents (≤ 1200 A).

- Equipment ground-fault protection is standard on 6.0A trip units.
- Ground-fault pickup (Ig) (A) sets ground current level where circuit breaker will trip after the preset time delay.
- Ground-fault delay (tg) (B) sets the length of time that the circuit breaker will carry a ground-fault current above the ground-fault pickup current level before tripping.
- Equipment ground-fault protection can be zone-selective interlocked (ZSI) with upstream or downstream circuit breakers.
- Setting the ground-fault delay (tg) to the 0 setting turns off zone-selective interlocking.
- Neutral protection and equipment ground-fault protection are independent and can operate concurrently.

NOTE: Use I^2t off with ZSI for proper coordination. Using I^2t on with ZSI is not recommended as the delay in the upstream device receiving a restraint signal could result in the trip unit tripping in a time shorter than the published trip curve.

Figure 10 – Ground-Fault Protection Switches

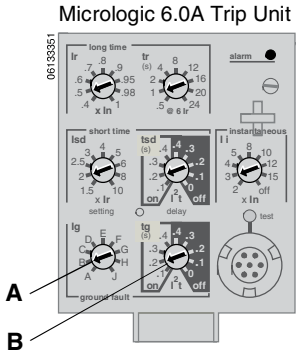


Table 4 – Micrologic Trip Unit Ground-Fault Pickup Values

Ig (= In x....)	A	B	C	D	E	F	G	H	J
In ≤ 400 A	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
400 A < In ≤ 1200 A	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
In > 1200 A	500 A	640 A	720 A	800 A	880 A	960 A	1040 A	1120 A	1200 A

In = sensor rating.
Ig = ground-fault pickup.

Table 5 – Micrologic Trip Unit Ground-Fault Delay Values

Setting	Ground-Fault Delay				
I^2t off (ms at In) (seconds)	0	0.1	0.2	0.3	0.4
I^2t on (ms at In) (seconds)	–	0.1	0.2	0.3	0.4
tsd (min. trip) (milliseconds)	20	80	140	230	350
tsd (max. trip) (milliseconds)	80	140	200	320	500

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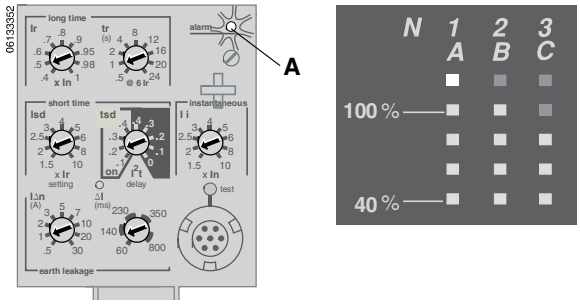
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Indicator Lights

Overload Indicator Light

The overload indicator light (A) lights when the Ir long-time pickup level has been exceeded (over 100% on the bar graph).

Figure 11 – Overload Indicator Light



Trip Indicator Lights

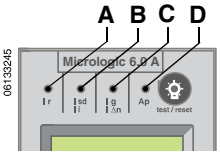
The Ir trip indicator light (A) lights when a trip occurs because the Ir long-time pickup level was exceeded.

The Isd/Ii trip indicator light (B) lights when a trip occurs because the Isd short-time pickup or the Ii instantaneous pickup was exceeded.

The Ig trip indicator light (C) lights when a trip occurs because the Ig ground fault pickup was exceeded.

The Ap self-protection indicator light (D) lights when the trip unit overheats, the instantaneous override level is exceeded, or a trip unit power supply failure occurs.

Figure 12 – Trip Indicator Lights



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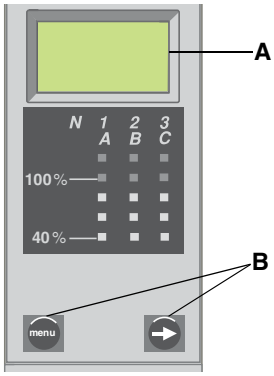
Ammeter

The ammeter monitors and displays the circuit breaker currents. An alphanumeric screen (A) continuously displays the phase at the highest load. Navigation buttons (B) can be pressed to display the various monitored currents.

The process of checking the ammeter values can be stopped at any time. After several seconds, Micrologic trip units automatically return to displaying the phase at the highest load.

See the following section for addition information concerning the ammeter.

Figure 13 – Ammeter



Trip Unit Testing

Trip unit functions can be tested using primary injection testing or secondary injection testing.

Micrologic Trip Unit Configuration

Control Power

Table 6 – Pickup Values

Sensor Plug Value (In)	Minimum Ground-Fault Pickup
100–250 A	30% of Sensor Rating
400–1200 A	20% of Sensor Rating
1600–6300 A	500 A

The A trip unit was designed to be used with or without an external 24 Vdc power supply.

The following will be powered and functional even if the trip unit is not externally powered:

- Fault protection for LSIG functions. The A trip unit is fully circuit powered for fault protection.
- LED trip indication (powered by an onboard battery). The battery's only function is to provide LED indication if all other power is off
- All display functions and trip unit features power-up with current flow on one phase greater than or equal to the values in Table 6.
- Ground-fault push-to-trip button works for testing ground fault with current flow on one phase greater than or equal to the values in Table 6.

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The ground-fault push-to-trip is also functional if a Hand-Held Test Kit or Full-Function Test Kit is powering the trip unit.

The following will be powered and functional with external power:

- All of the above functions which are functional without external power.
- Ammeter and bar graph displays are functional with or without current flowing through the circuit breaker. With current flow between 0 and 20% of sensor value, the ammeter may not be accurate.
- Trip settings and max. current readings can be accessed on the display be pressing the navigation buttons with or without current flowing through the circuit breaker.
- Ground-fault push-to-trip button works for testing ground fault with or without current flowing through the circuit breaker.
- Optional Modbus communications are functional, using a separate 24 Vdc power supply for the circuit breaker communications module. This separate 24 Vdc power supply is required to maintain the isolation between the trip unit and communications.

The ground-fault push-to-trip is also functional if a Hand-Held Test Kit or Full-Function Test Kit is powering the trip unit.

External Power Supply

⚠ CAUTION

HAZARD OF SHOCK, ARC FLASH OR EQUIPMENT DAMAGE

Trip unit and communication module must use separate power supplies.

Failure to follow this instruction can result in personal injury or equipment damage.

The trip unit display can be powered by a 24 Vdc external power supply.

Table 7 – Power Supply Specifications

Function	Specification
Power for Trip Unit Alone	24 Vdc, 50 mA
Minimum Input-to-Output Isolation	2400 V
Output (Including Max. 1% Ripple)	±5%
Dielectric Withstand (Input/Output)	3 kV rms
Connections	Connections UC3 F1 (-) F2 (+) 24 Vdc

Power supply is used for graphic screen display when the circuit breaker is open or not carrying current.

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Section 2— Ammeter

Display

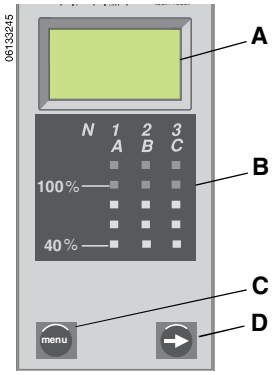
NOTE: The ammeter display will function only if the trip unit is powered. The trip unit is powered by the circuit breaker carrying more than 0.20 x In of load current, by being connected to a 24 Vdc external power supply, or by having the Full-Function Test Kit or Hand-Held Test Kit connected and on. Even with external power supplied, current through the circuit breaker must exceed 0.20 x In for the ammeter reading to be accurate to within 1.5%.

A. Alphanumeric screen: Displays ammeter information
B. Bar graph: Displays currents using an LED bar graph
C. Menu button: Used to navigate between the various menus
D. Scroll button: Used to scroll to the next screen in the menus

The default display is the current value of the phase at the highest load.

If no information is displayed, contact the local field office.

Figure 14 – Ammeter



Ammeter Measurements

Micrologic A trip units measure the true RMS value of currents. They provide continuous current measurement from 0.2 to 20 x In with an accuracy of 1.5% (including sensors). No auxiliary source is needed where I > 0.2 x In. The optional external power supply (24 Vdc) makes it possible to display currents where I < 0.2 x In.

A digital LCD screen continuously displays the most heavily loaded phases (Imax) or displays the Ia, Ib, Ic, Ig, and (on 4-pole circuit breakers only) In stored current and setting values by successively pressing the navigation button.

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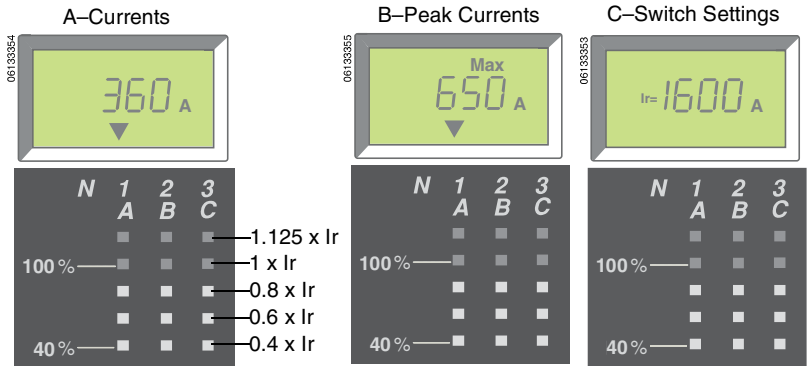
Accessing Information

Three different menus can be accessed:

A. Current measurements
B. Stored peak current measurements
C. Switch settings

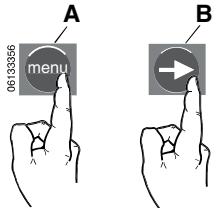
In addition, the ammeter can be used to address the circuit breaker communication module (BCM) in circuit breakers which have the optional circuit breaker communication module installed.

Figure 15 – Menus



To access the next menu, press the menu button (A). To access the next screen in a menu, press the scroll button (B).

Figure 16 – Navigation Buttons



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Current Menu

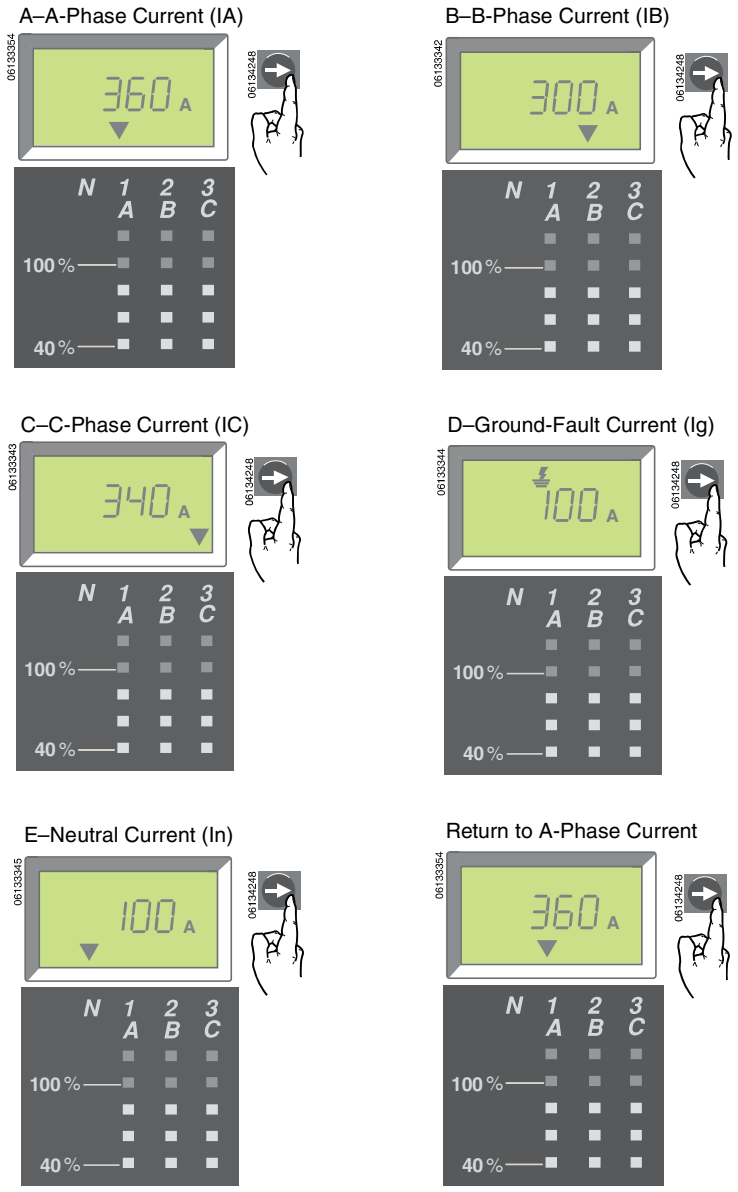
The current (default) menu displays:

A. Phase current (IA) in A phase
B. Phase current (IB) in B phase
C. Phase current (IC) in C phase
D. Ground-fault current (Ig) (Micrologic 6.0A trip units only)
E. Neutral current (In)

To display next current, press scroll button.

NOTE: Neutral current is only displayed with a 4-pole circuit breaker with the neutral protection set to half or full. Refer to bulletin 48041-082-03 for NC CT wiring guidelines.

Figure 17 – Current Menus



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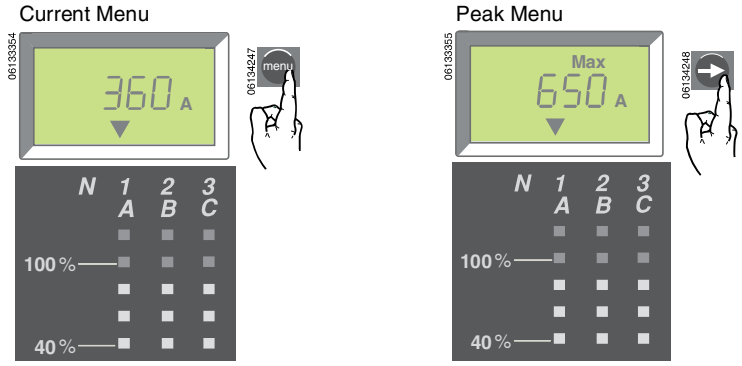
Peak Menu

To access the peak menu:

1. Current menu is displayed.
2. Press menu button.
3. Peak menu appears.

To access menu screens, press scroll button.

Figure 18 – Access the Peak Menu



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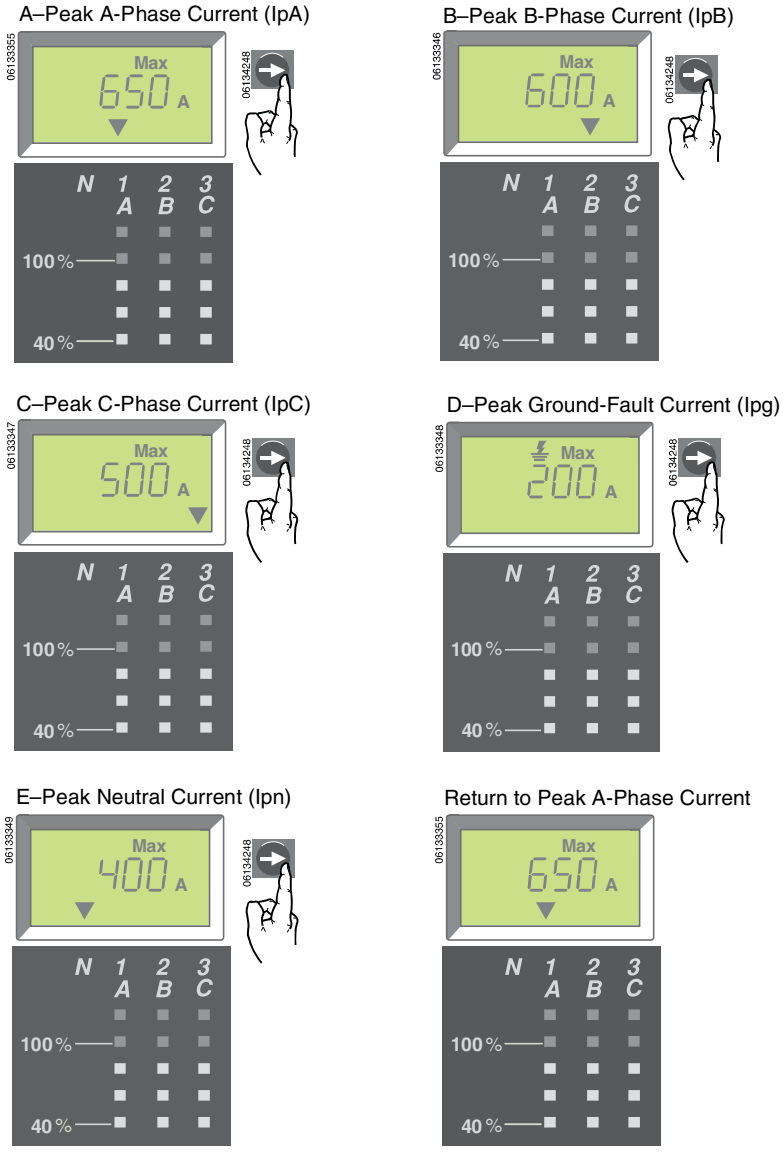
The peak menu displays:

A. Peak current (IpA) in A phase
B. Peak current (IpB) in B phase
C. Peak current (IpC) in C phase
D. Peak ground-fault current (Ipg) (Micrologic 6.0A trip unit only)
E. Peak neutral current (Ipn)

To display next peak current, press scroll button.

To reset a max value, scroll to the particular max value screen to be reset and hold the scroll button for three seconds.

Figure 19 – Peak Menus



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Switch Settings Menu

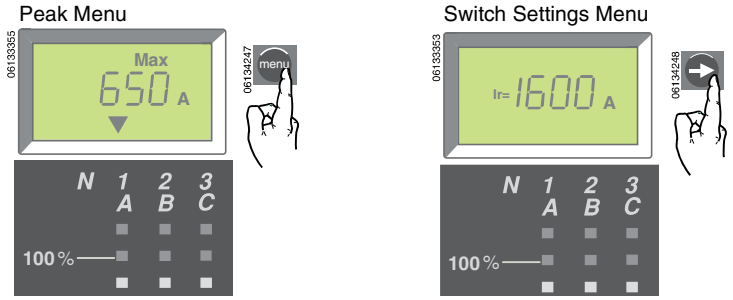
The switch settings menu displays the values at which the switches are set.

To access the switch settings menu:

1. Peak menu is displayed.
2. Press menu button.
3. Switch settings menu will appear.

To access menu screens, press scroll button.

Figure 20 – Access the Switch Settings Menu



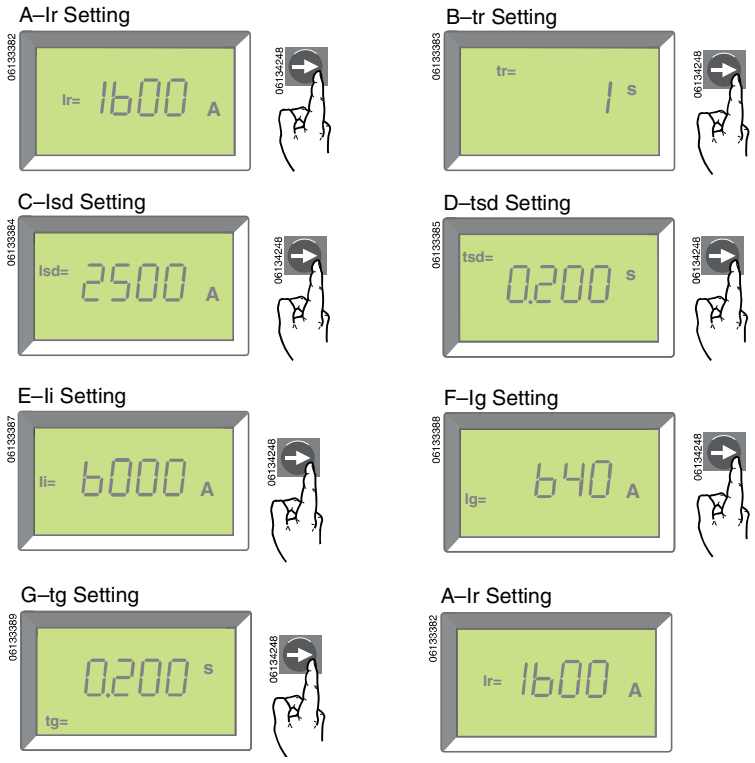
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The switch settings menu displays:

A. Long-time pickup (Ir) setting
B. Long-time delay (tr) setting
C. Short-time pickup (Isd) setting
D. Short-time delay (tsd) setting
E. Instantaneous pickup (Ii) setting
F. Ground-fault pickup (Ig) setting (6.0A trip units only)
G. Ground-fault delay (tg) setting (6.0A trip units only)

To display next switch setting, press scroll button.

Figure 21 – Trip Unit Switch Settings



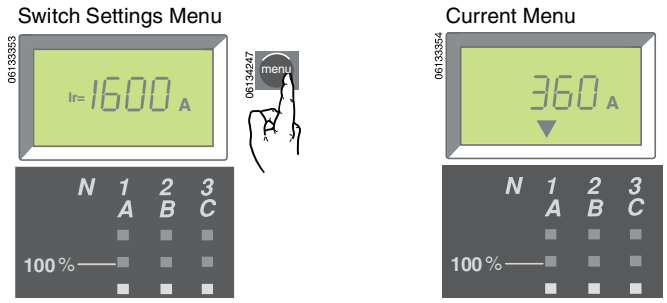
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To return to the current menu:

1. Switch settings menu is displayed.
2. Press menu button.
3. Current menu will appear.

Or wait several seconds and ammeter will automatically return to the current (i.e., default) menu.

Figure 22 – Return to Current Menu



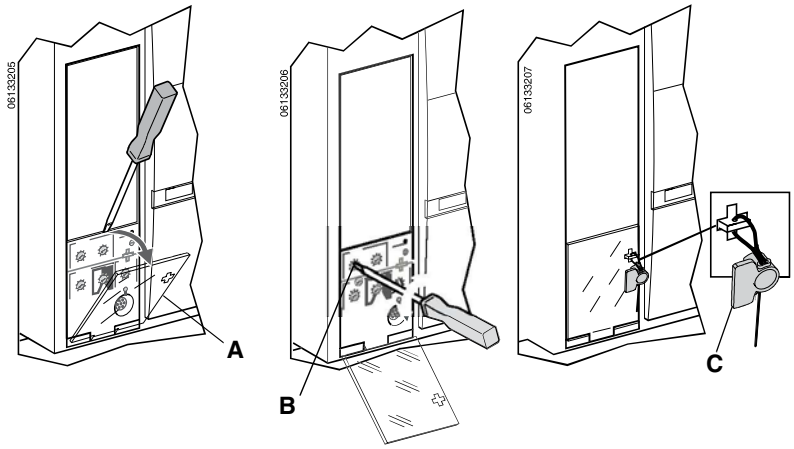
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Section 3— Operation

Switch Setting Adjustment

1. Open switch cover (A).
2. Adjust the appropriate switches (B) to desired values.
3. Replace switch cover. Use wire seal MICROTUSEAL (C, not provided), if necessary, to provide tamper evidence.

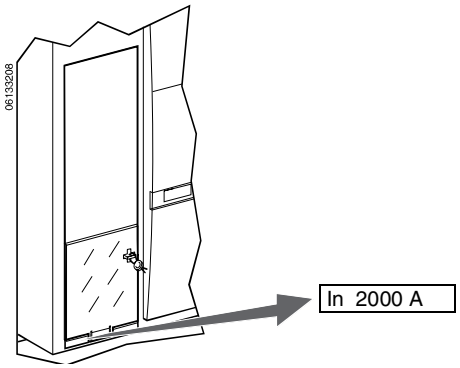
Figure 23 – Adjust Switch Settings



Examples

Circuit breaker is rated 2000 A.

Figure 24 – Circuit Breaker Rating



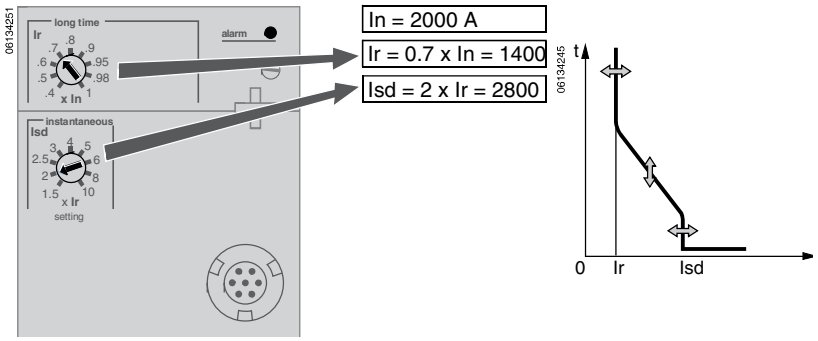
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Micrologic 2.0A Trip Unit

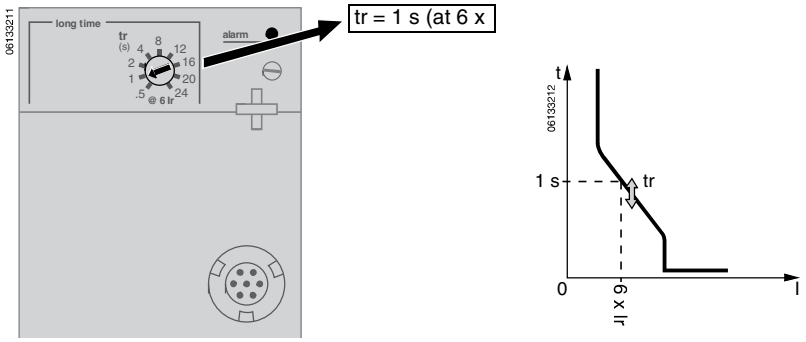
1. Set pickup levels.

Figure 25 – Set Pickup Levels



2. Set time delay.

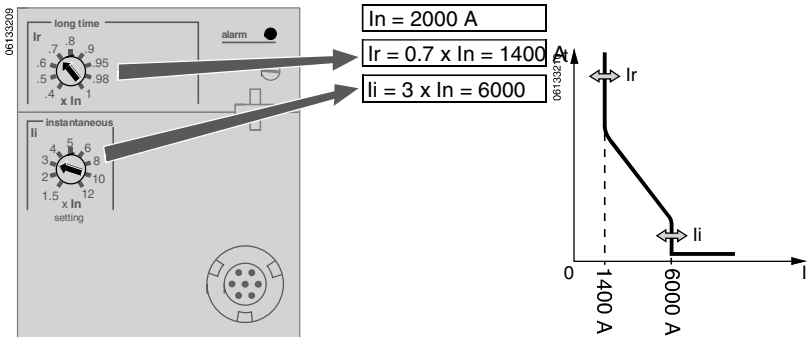
Figure 26 – Set Time Delay



Micrologic 3.0A Trip Unit

1. Set pickup levels.

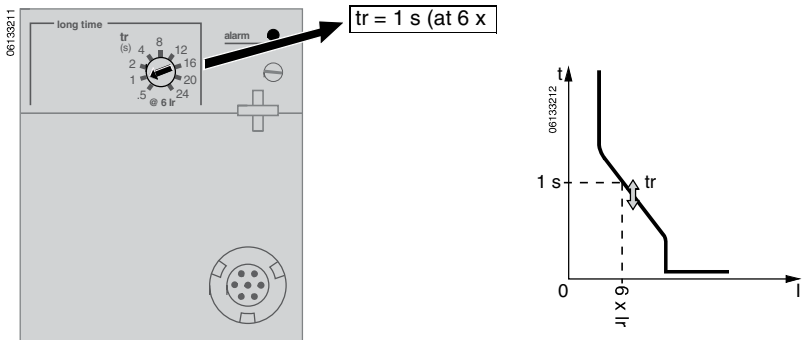
Figure 27 – Set Pickup Levels



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2. Set time delay.

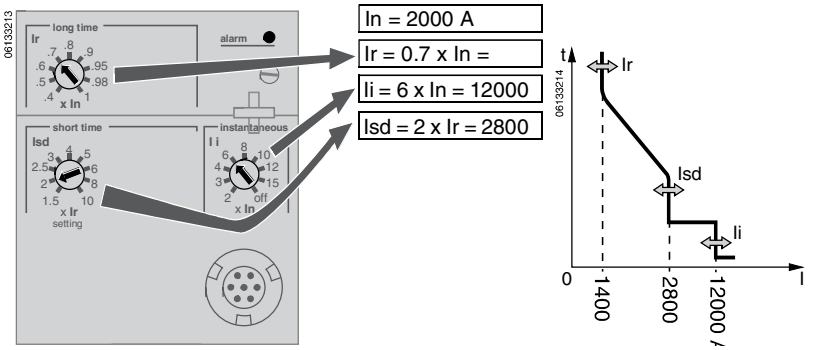
Figure 28 – Set Time Delay



Micrologic 5.0A Trip Unit

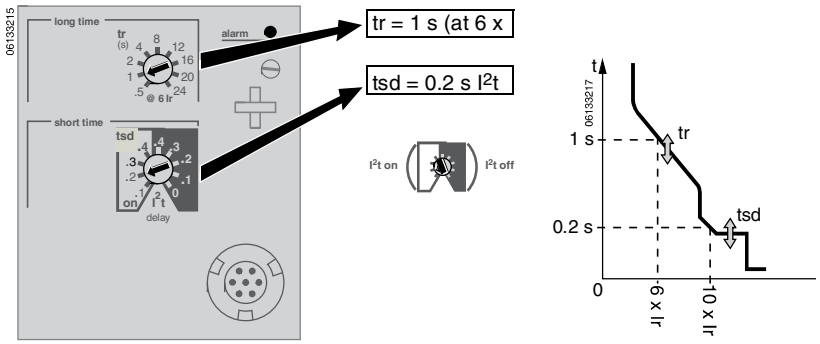
1. Set pickup levels.

Figure 29 – Set Pickup Levels



2. Set time delay.

Figure 30 – Set Time Delays



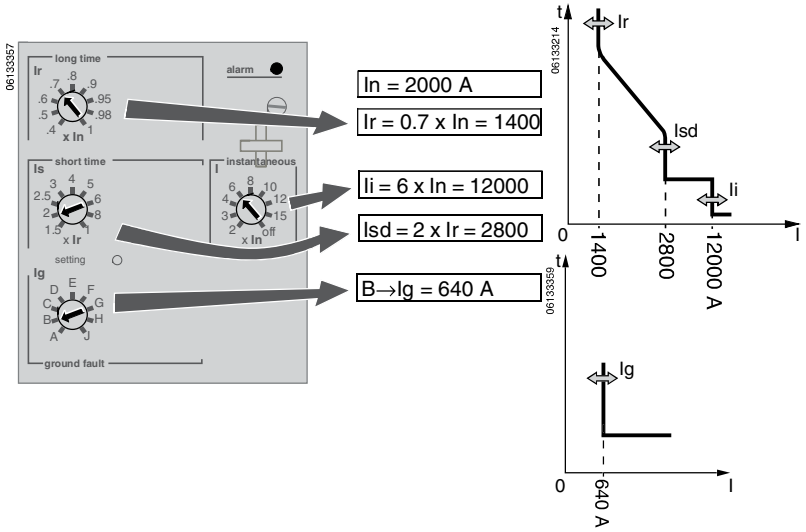
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Micrologic 6.0A Trip Unit

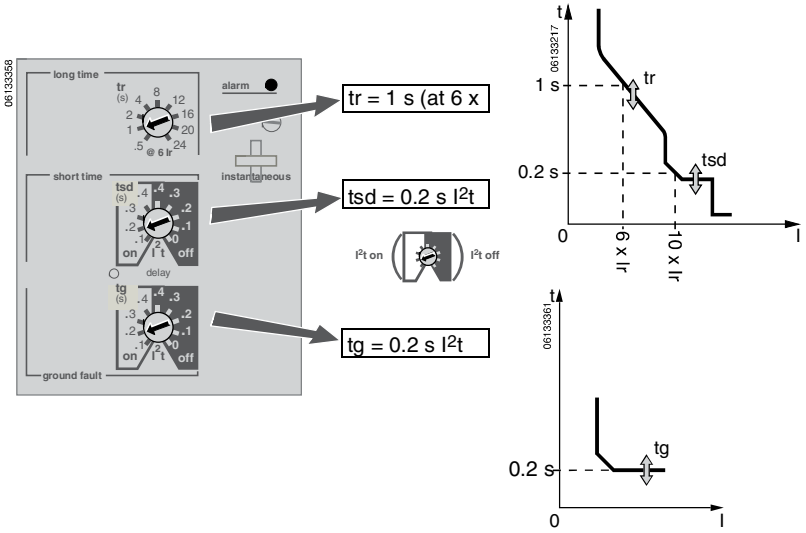
1. Set pickup levels.

Figure 31 – Set Pickup Levels



2. Set time delays.

Figure 32 – Set Pickup Levels



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Zone-Selective Interlocking (ZSI)

The number of devices which can be interlocked are shown in Table 8.

Table 8 – ZSI Combinations

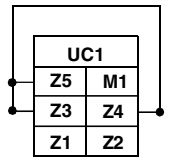
Upstream Device (receives input from RIM) / Downstream Device (sends output to RIM)	Micrologic #.0x Trip Units	Square D Micrologic Series B Trip Units	Square D GC-100 Ground-Fault Relay for Equipment Protection	Square D GC-200 Ground-Fault Relay for Equipment Protection	Merlin Gerin STR58 Trip Units	Federal Pioneer USRC and USRCM Trip Units
Micrologic #.0x Trip Units	15	R	R	15	15	R
Square D Micrologic Series B Trip Units	R	26	R	R	R	15
Square D GC-100 Ground-Fault Relay for Equipment Protection	R	R	7	R	R	R
Square D GC-200 Ground-Fault Relay for Equipment Protection	15	R	R	15	15	R
Merlin Gerin STR58 Trip Units	15	R	R	15	15	R
Merlin Gerin STR53 Trip Units	15	R	R	15	15	R
Federal Pioneer USRC and USRCM Trip Units	R	15	R	R	R	15
Square D Add-On Ground Fault Module for Equipment Protection	R	5	R	R	R	R

R—RIM module is required to restrain any devices.

Numerical References—Maximum number of upstream circuit breakers which can be restrained without requiring a RIM Module.

Circuit breaker terminals are shipped with terminals Z3, Z4 and Z5 jumpered to self-restrain the short-time and ground-fault functions. Remove the jumpers when activating zone-selective interlocking.

Figure 33 – Jumpered Terminals

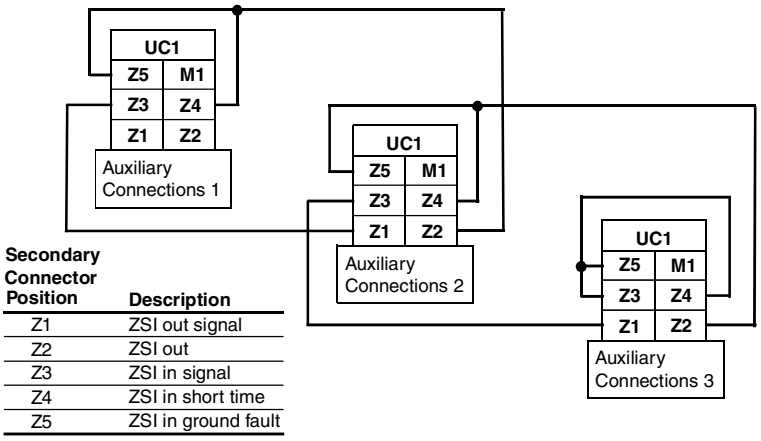


Auxiliary Connections

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Wire circuit breakers for zone-selective interlocking.

Figure 34 – ZSI Wiring Example



Secondary Connector Position	Description
Z1	ZSI out signal
Z2	ZSI out
Z3	ZSI in signal
Z4	ZSI in short time
Z5	ZSI in ground fault

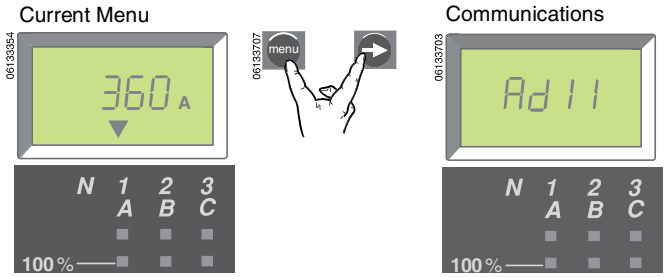
Communication Module Values

If the optional circuit breaker communication module (BCM) is installed, use the ammeter to set communication module values.

To access the communication module menu:

1. Current menu is displayed.
2. Simultaneously press both menu button and scroll button down for three seconds.
3. Communication module addressing menu will appear.

Figure 35 – Access Communication Module Menu



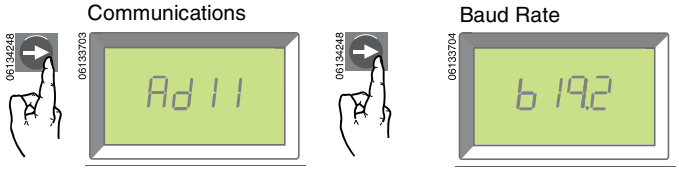
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Set communication module values:

1. Press and release scroll button to sequence addresses (1 through 47). When the correct address number is reached, enter the value by pressing and holding scroll button until the display stops flashing.

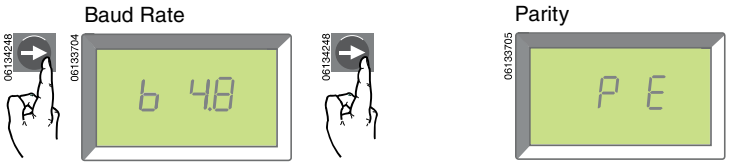
   Baud rate screen will appear after address has been entered.

Figure 36 – Set Communication Module Values



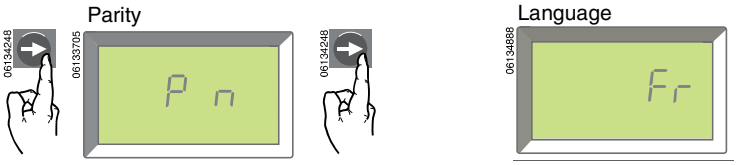
2. Press and release scroll button to sequence baud rates (4.8k, 9.6k or 19.2k). When the desired baud rate appears, enter the value by pressing and holding scroll button until the display stops flashing.

   Parity screen will appear after baud rate has been entered.



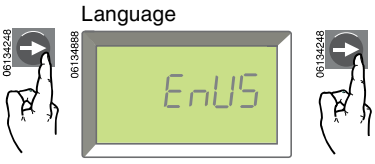
3. Press and release scroll button to sequence parities (E [even] or n [none]). When the desired parity appears, enter the value by pressing and holding scroll button until the display stops flashing.

   Languages screen will appear after parity has been entered.



4. Press and release scroll button to scroll through languages (French [Fr], US English [En US], UK English [En], German [d], Spanish [SP] or Italian [It]). When the desired language appears, enter the value by pressing and holding scroll button until the display stops flashing.

   Ammeter display will return to the default screen after language is entered.



After the communication module values have been set, ammeter will automatically return to the current (i.e., default) menu.

Refer to the *Modbus Communications Guide* 0613IB1313 for other components and setup instructions.

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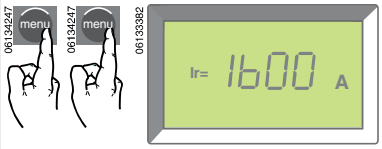
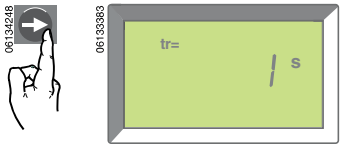
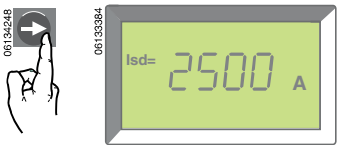
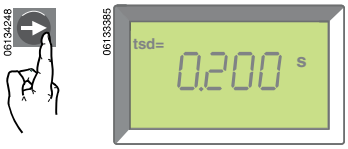
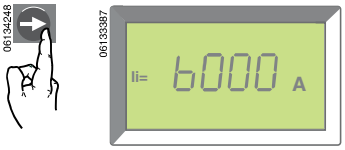
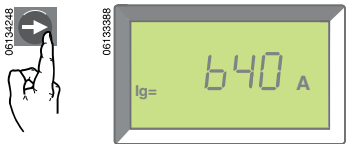
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Trip Unit Settings Check

Use the ammeter switch setting menu to check the trip unit settings.

1. Press menu button twice.
2. Switch settings menu will appear.
3. Press scroll button to advance to next screen.
4. After checking trip unit settings, press menu button once to return to main menu.

Table 9 – Trip Unit Settings

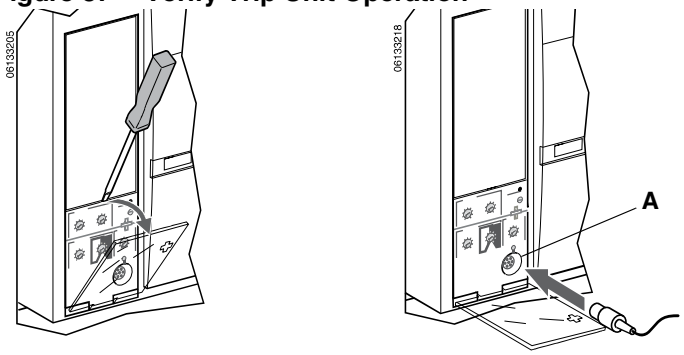
Setting		Window	2.0A	3.0A	5.0A	6.0A
Ir	Long-Time Pickup		X	X	X	X
tr	Long-Time Delay		X	X	X	X
Isd	Short-Time Pickup		X		X	X
tsd	Short-Time Delay				X	X
Ii	Instantaneous Pickup			X	X	X
Ig	Ground-Fault Pickup					X
tg	Ground-Fault Delay					X

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Trip Unit Operation Verification

Use a test kit connected to the trip unit test plug receptacle (A) to verify trip unit is functioning as desired. See instructions shipped with test kit to perform verification tests.

Figure 37 – Verify Trip Unit Operation



Equipment Ground-Fault Trip Functions Testing

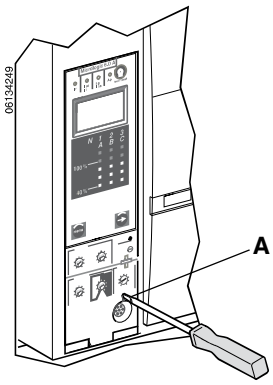
Paragraph 230-95 (c) of the National Electrical Code requires that all equipment ground-fault protection systems be tested when first installed.

With the circuit breaker closed, test the ground-fault (Micrologic 6.0A trip unit only) trip functions. For instructions on how to close circuit breaker, refer to the circuit breaker installation instructions shipped with the circuit breaker.

1. Press the ground-fault test button (A). Circuit breaker should trip.
2. If circuit breaker does not trip, contact the local field office.

NOTE: Trip unit must be powered to test ground-fault trip function. The trip unit is powered if the circuit breaker is carrying more than 0.20 x In of load current, if the 24 Vdc external power supply is connected or if the Full-Function Test Kit or Hand-Held Test Kit is connected and on.

Figure 38 – Test Equipment Ground-Fault Trip Function



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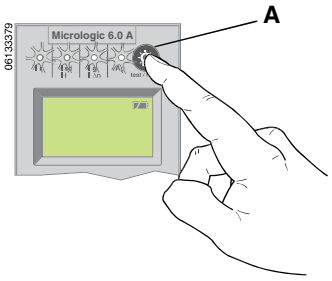
Trip Unit Resetting

When the circuit breaker trips, the fault indicator will remain lit until the trip unit is reset.

Press the reset/test button (A) to reset the trip unit after trip.

Do not return circuit breaker to service until cause of trip is determined. For more information, refer to the circuit breaker installation instructions shipped with the circuit breaker.

Figure 39 – Reset Trip Unit



Trip Unit Status Check

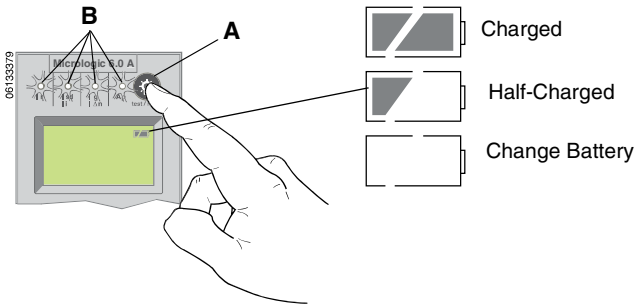
NOTE: Trip unit must be powered to test battery. The trip unit is powered if the circuit breaker is carrying more than 0.20 x In of load current, if the 24 Vdc external power supply is connected or if the Full-Function Test Kit or Hand-Held Test Kit is connected and on.

To check trip unit battery and trip indicators, press the test/reset button (A).

- All trip indicators (B) will light up
- Battery status will be displayed
- If no battery status is displayed, there is no battery installed.
- The battery bar graph reading is valid after the reset button has been released.
- If the battery bar graph shows the battery needs to be changed, use Square D battery catalog number S33593:
  - — lithium battery
  - — 1.2AA, 3.6 V, 800 ma/h

For instructions on replacing battery, see Section 6—Battery Replacement.

Figure 40 – Check Trip Unit Status



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Section 4— Trip Unit Replacement

Trip unit replacement must be done by qualified persons, as defined by the National Electric Code, who are familiar with the installation and maintenance of power circuit breakers.

Before replacing trip unit, confirm that the circuit breaker is in good working condition. If the condition of the circuit breaker is unknown, do not proceed. For assistance in evaluating the condition of the circuit breaker, call Technical Support.

Read this entire section before starting the replacement procedure.

NOTE: If trip unit being replaced is a Micrologic 2.0, 3.0 or 5.0 trip unit, order connector block S33101 and circuit breaker or cradle wiring harness if necessary.

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- Failure to follow these instructions for installation, trip test and primary injection testing may result in the failure of some or all protective function.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- Replacement/upgrading of a trip unit in the field must be done by qualified persons, as defined by the National Electric Code, who are familiar with the installation and maintenance of power circuit breakers.
- Before replacing/upgrading trip unit, confirm that the circuit breaker is in good working condition. If the condition of the circuit breaker is unknown, do not proceed. For assistance in evaluating the condition of the circuit breaker, call Technical Support.
- If the circuit breaker fails to function properly in any manner upon completion of the trip unit installation, immediately remove the circuit breaker from service and call Field Services.
- Turn off all power supplying this equipment before working on or inside equipment. Follow instructions shipped with circuit breaker to disconnect and reconnect circuit breaker.
- Replace all devices, doors and covers before returning equipment to service.

Failure to follow this instruction will result in death or serious injury.

Required Tools

- Torque-controlled screwdriver, set at 7 in-lbs (0.8 N•m) ± 10% (Lindstrom torque driver MAL500-2 or equivalent)
- Micrologic Full-Function Test Kit (part number S33595)

Preparation

Record Switch Settings

Record all trip unit switch settings for later use.

Circuit Breaker Disconnection

Disconnect circuit breaker as directed in the circuit breaker instruction bulletin shipped with the circuit breaker. The circuit breaker must be completely isolated. (For a drawout circuit breaker, place circuit breaker in the disconnected position.

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For a fixed-mounted circuit breaker, all voltage sources, including auxiliary power, must be disconnected.)

Circuit Breaker Accessory Cover Removal

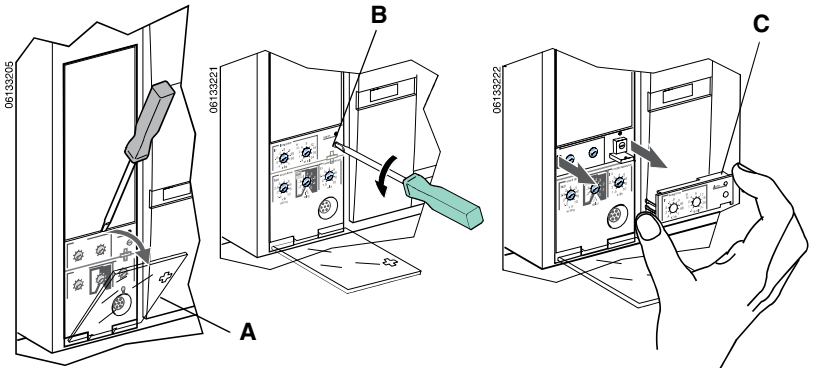
Remove circuit breaker accessory cover as directed in the Install Accessories section of the circuit breaker instruction bulletin shipped with the circuit breaker.

Rating Plug Removal

A small Phillips screwdriver is needed to remove the adjustable rating plug.

1. Open switch cover (A).
2. Unscrew adjustable rating plug mounting screw (B).
3. Remove adjustable rating plug (C). Save for installation in replacement trip unit.

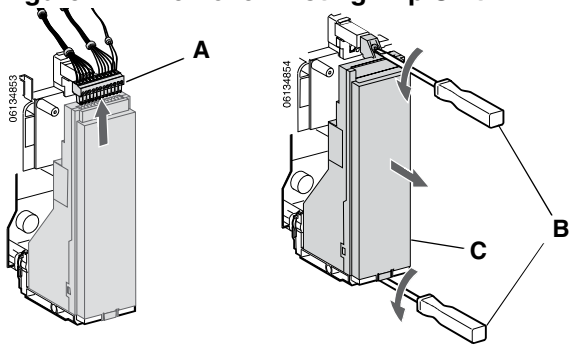
Figure 41 – Remove Adjustable Rating Plug



Trip Unit Removal

1. Remove connector block (A) from top of trip unit, if present.
2. Loosen two trip unit screws (B).
3. Slide out trip unit (C).

Figure 42 – Remove Existing Trip Unit



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Trip Unit Replacement

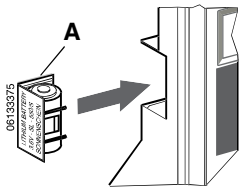
Battery Installation

If a new trip unit is being installed, install the trip unit battery.

Install battery holder with battery (A) in trip unit, observing the correct polarity as indicated on the battery compartment.

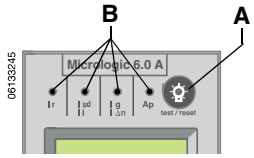
NOTE: Battery holder with battery is located under the side flap in the cardboard box the trip unit is shipped in.

Figure 43 – Install Battery



Press test/reset button (A). All four indicator lights (B) should light. If they do not light, check polarity of battery and retest. If indicator lights still do not light up when test/reset button is pressed, stop installation and contact the local sales office for factory authorized service

Figure 44 – Trip Indicator Lights



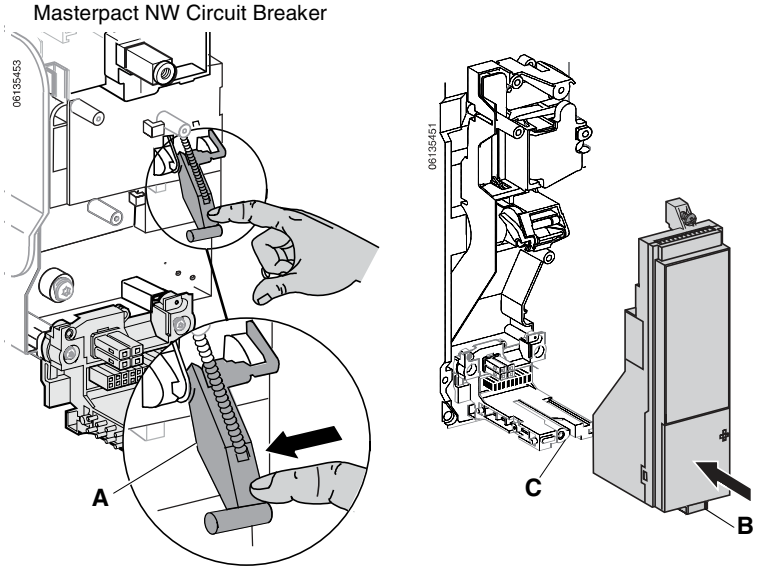
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Trip Unit Installation

1. Inspect trip unit connector pins and surfaces. If there is any damage, misaligned pins, or contamination, stop installation and contact the local sales office for factory authorized service.
2. Inspect trip unit mounting base on the circuit breaker. Clear any debris from area and check that all accessory wiring is properly routed for the trip unit being installed. If there is any damage or contamination, stop installation and contact the local sales office for factory authorized service.
3. For Masterpact NW circuit breaker only: Manually depress trip unit interlock (A) and hold it in place during steps 4–6.
4. Align guide rail (B) on bottom of trip unit with guide rail slot (C) on trip unit mounting base in circuit breaker and gently slide the trip unit in until it stops.

NOTE: The Masterpact NT and NW trip unit mounting bases are shock mounted and therefore can flex slightly.

Figure 45 – Install Trip Unit



NOTICE
HAZARD OF EQUIPMENT DAMAGE Check installation of trip unit to assure proper connections and seating. **Failure to follow this instruction can result in equipment damage or improper circuit breaker tripping.**

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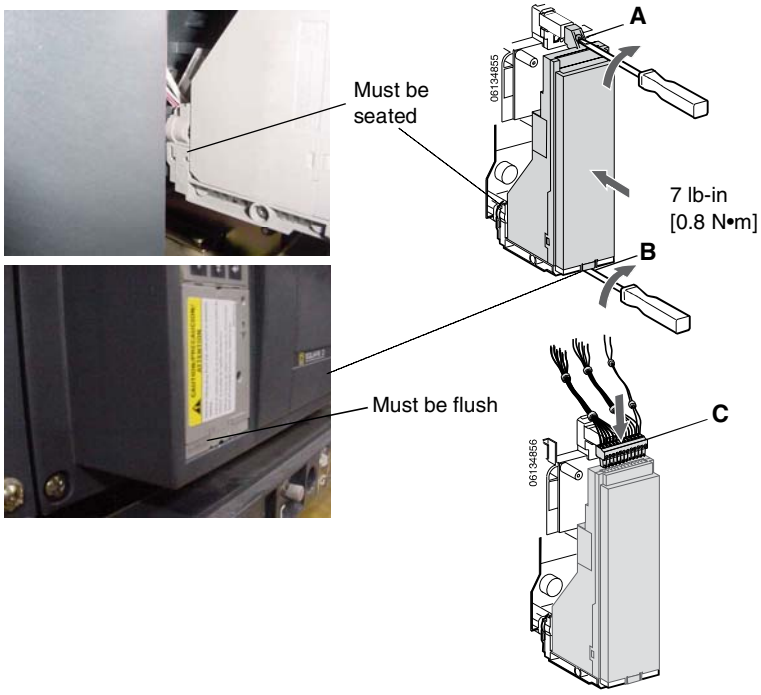
5. Align the trip unit so top mounting screw (A) aligns with the top threaded insert and start the screw by turning the screw two full rotations.
6. Use a torque-controlled screwdriver to drive the bottom screw (B) to 7 in-lbs (0.8 N•m) ± 10%. The back of the trip unit must be flush with the trip unit mounting base.
7. Use a torque-controlled screwdriver to drive the top screw to 7 in-lbs (0.8 N•m) ± 10%. Mounting tab must be flush with the mounting standoff and sensor plug.

NOTE: The face of the closed switch cover must be flush with adjoining mounting base surfaces. If these surfaces are not flush, stop installation and contact the local sales office for factory authorized service.

NOTE: If you are upgrading from a Micrologic 2.0, 3.0 or 5.0 trip unit, the connector block must be ordered separately (Part Number S33101). See instructions shipped with the connector block for installation into circuit breaker.

8. Install connector block (C) into top of trip unit.

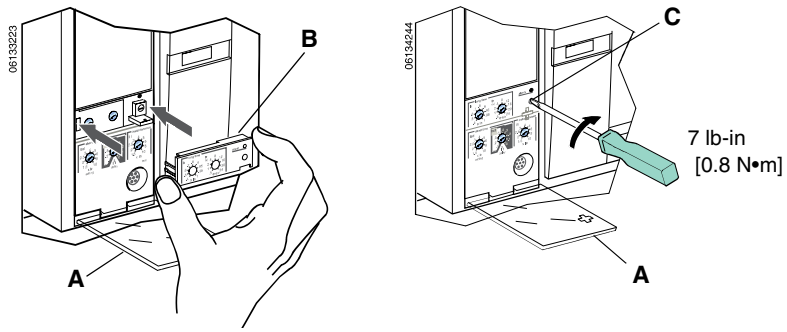
Figure 46 – Install Trip Unit



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9. Install adjustable rating plug into the trip unit.
   a. Open switch cover (A) on new trip unit.
   b. Inspect mounting area for debris and contamination.
   c. Gently push adjustable rating plug (B) into new trip unit.
   d. Tighten adjustable rating plug mounting screw (C). The plug will be drawn into position flush with front face as screw is tightened.
10. Set trip unit switches to values recorded above or per coordination study results.
11. Close switch cover (A).

Figure 47 – Install Adjustable Rating Plug



Circuit Breaker Accessory Cover Replacement

Replace circuit breaker accessory cover as directed in the Install Accessories section of the circuit breaker instruction bulletin shipped with the circuit breaker.

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Trip Unit Installation Check

Secondary Injection Testing

Field installation of a trip unit requires secondary injection testing with the Full-Function Test Kit. to ensure that the newly-installed trip unit is functioning properly. The test will require opening and closing the circuit breaker. Follow the procedures outlined in the instruction bulletins shipped with the circuit breaker and the test kit.

1. Make sure the circuit breaker is isolated from all upstream and downstream devices.
2. Perform secondary injection testing as outlined in the instruction bulletin shipped with the test kit. Verify that all applicable trip unit functions are operating properly.
3. Repeat step 2 with the circuit breaker in the open position.

   NOTE: The test kit states that the circuit breaker should be closed when performing the test. Do not close the circuit breaker for this step.
4. If any test fails, do not put the circuit breaker into service and contact the local sales office for factory authorization service.

Primary Injection Testing

Primary injection testing is recommended to ensure that all trip system connections have been correctly made. Perform primary injection testing per the instructions in the Field Testing and Maintenance Guide, bulletin number 0600IB1201.

Check Accessory Operation

1. Installed accessories – Validate the proper operation of all installed accessories. See the corresponding accessory instruction bulletins for operational testing procedures.
2. Zone selective interlocking – If the circuit breaker is part of a ZSI system, follow the zone selective interlocking test procedures as outlined in the Full Function Test Kit instruction bulletin.
3. Communications – If communication modules exist, validate circuit breaker has re-established communications with the supervisor.

Trip Unit Setup

1. If an auxiliary power supply is being used for the Micrologic trip unit, reconnect the auxiliary power supply.
2. Reset the trip unit switches to original values, as recorded at the beginning of this section.

Circuit Breaker Reconnection

Reconnect circuit breaker as directed in the circuit breaker instruction bulletin shipped with the circuit breaker.

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Section 5— Adjustable Rating Plug Replacement

NOTE: To select correct replacement rating plug, see the product catalog.

NOTE: If adjustable rating plug is removed, the circuit breaker will default to a long-time pickup rating of 0.4 x In and a long-time delay at whatever setting was selected before the rating plug was removed.

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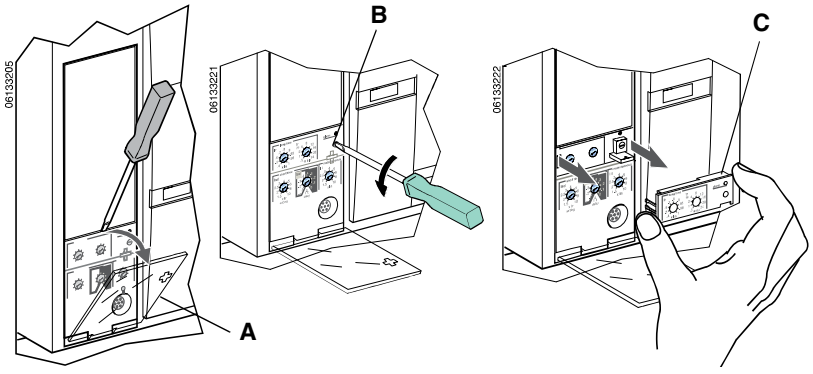
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment. Follow instructions shipped with circuit breaker to disconnect and reconnect circuit breaker.
- Replace all devices, doors and covers before returning equipment to service.

Failure to follow this instruction will result in death or serious injury.

Rating Plug Removal

1. Open circuit breaker contacts:
   - — For Masterpact NT and NW circuit breakers, press the “Push to open” button on the circuit breaker.
   - — For other circuit breakers, move handle to the off (O) position.
2. Open switch cover (A).
3. Unscrew adjustable rating plug mounting screw (B).
4. Remove adjustable rating plug (C).

Figure 48 – Remove Adjustable Rating Plug

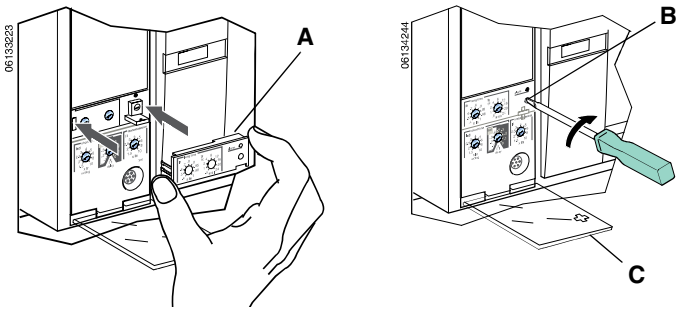


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New Rating Plug Installation

1. Inspect mounting area for debris and contamination.
2. Gently push in new adjustable rating plug (A).
3. Tighten adjustable rating plug mounting screw (B).
4. Set the switches on the trip unit (see Section 3 —Operation).
5. Close switch cover (C).

Figure 49 – Install New Adjustable Rating Plug



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Section 6— Battery Replacement

Circuit Breaker Disconnection

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment. Follow instructions shipped with circuit breaker to disconnect and reconnect circuit breaker.
- Replace all devices, doors and covers before returning equipment to service.

Failure to follow this instruction will result in death or serious injury.

Disconnect circuit breaker as directed in the circuit breaker instruction bulletin shipped with the circuit breaker.

Accessory Cover Removal

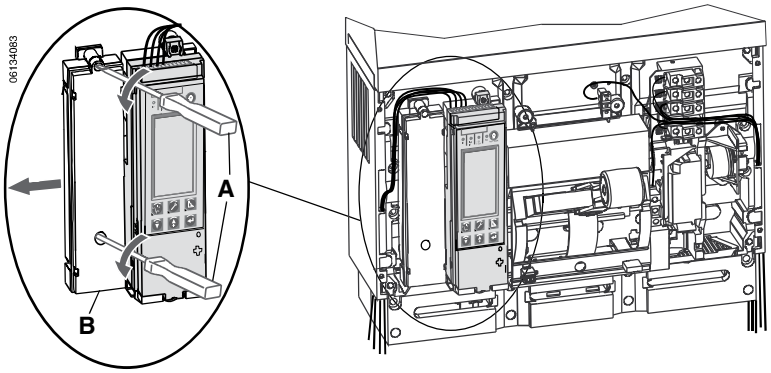
Remove circuit breaker accessory cover as directed in the Install Accessories section of the circuit breaker instruction bulletin shipped with the circuit breaker.

Withstand Module Shifting

NOTE: Some R-frame and NS1600b–NS3200 circuit breakers have a withstand module that needs to be moved to access the battery.

Loosen screws (A) securing withstand module (B). Swing module to side to access trip unit battery cover. Do not remove withstand module connector.

Figure 50 – Shift Withstand Module

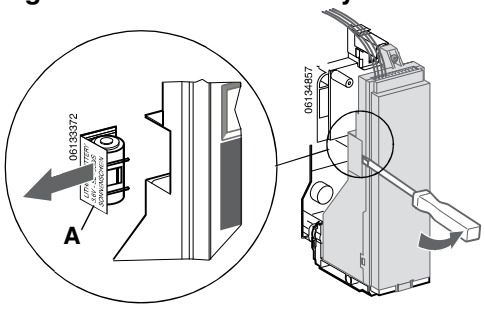


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Battery Replacement

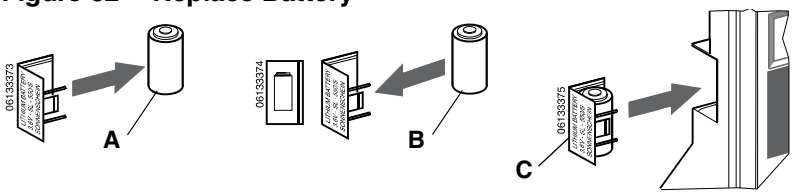
1. Insert small screwdriver blade into battery housing cover notch and rotate to slide battery housing cover (A) out of trip unit.

Figure 51 – Remove Battery Cover



2. Remove battery (A).
3. Insert new battery (B). Make sure that the polarity is correct.
4. Replace battery housing cover (C).

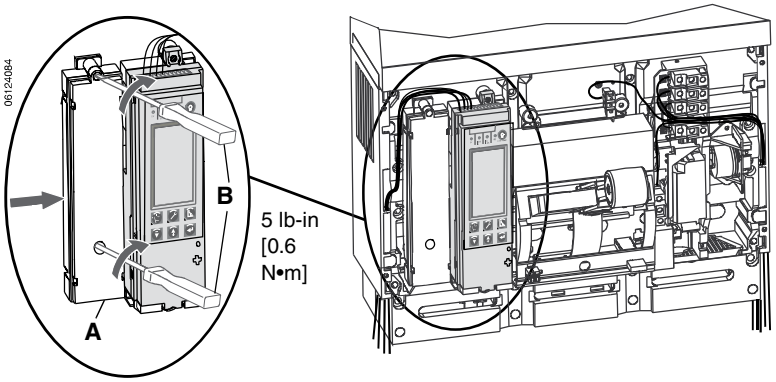
Figure 52 – Replace Battery



Withstand Module Replacement

If the withstand module was moved to access the battery, replace the withstand module (A) and tighten the screws (B).

Figure 53 – Replace Withstand Module



Accessory Cover Replacement

Replace circuit breaker accessory cover as directed in the Install Accessories section of the circuit breaker instruction bulletin shipped with the circuit breaker.

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Circuit Breaker Reconnection

Reconnect circuit breaker as directed in the circuit breaker instruction bulletin shipped with the circuit breaker.

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48049-136-05, Rev. 02, 06/2015
Replaces 48049-136-05 Rev. 01, 07/2012

Micrologic™ 2.0, 3.0 and 5.0 Electronic Trip Units

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Instruction Bulletin

48049-207-05
Rev. 01, 07/2012

Retain for future use.

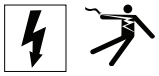


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Hazard Categories and Special Symbols

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

ANSI



This is the safety alert symbol. It is used to alert you to personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.



IEC



⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

FCC Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. This Class A digital apparatus complies with Canadian ICES-003.

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Section 1—General Information

Introduction

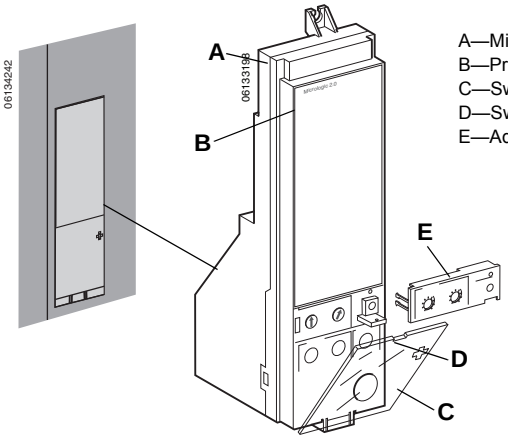
Micrologic™ trip units (A) provide adjustable tripping functions on electronic trip circuit breakers. The product name (B) specifies the level of protection provided by the trip unit.

Micrologic 3.0 Trip Unit

- Type of protection
  - 2—Basic IEC protection (LS0)
  - 3—Basic UL protection (LI)
  - 5—Selective protection (LSI)
- Trip unit series
  - 0—Indicates the first version

Micrologic trip units are field replaceable to allow for upgrading of the trip unit in the field. For complete information on available circuit breaker models, frame sizes, interrupting ratings, sensor plugs, rating plugs and trip units, see the product catalog.

Figure 1: Micrologic Trip Unit



A—Micrologic Trip Unit
B—Product Name
C—Switch Cover
D—Switch Cover Opening Slot
E—Adjustable Rating Plug

Trip Unit Settings

On the face of the trip unit are adjustable switches to allow changing of trip characteristics. Trip units are shipped with the long-time pickup switch set at 1.0 and all other trip unit adjustments set at their lowest settings.

Micrologic 2.0 Trip Unit

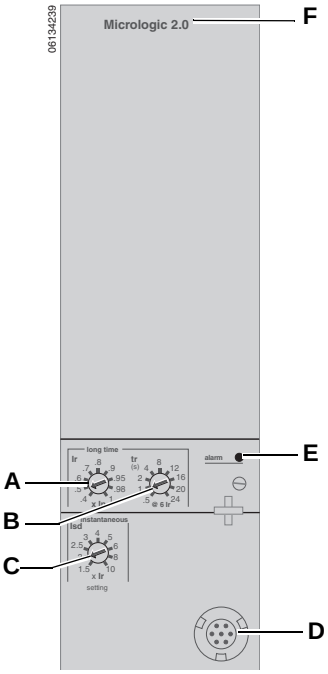
NOTE: For use with IEC circuit breakers only.

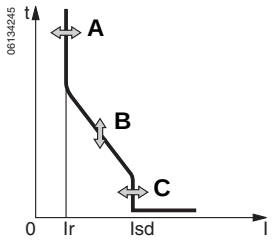
The Micrologic 2.0 trip unit provides basic IEC (LS0) protection.

A. Long-time pickup (Ir) switch
B. Long-time delay (tr) switch
C. Short-time pickup (Isd) switch*
D. Test plug receptacle
E. Overload indicator light
F. Trip unit name

*Short-time delay is factory set at 0 (no delay), thus short-time pickup provides instantaneous protection.

Figure 2: Micrologic 2.0 Trip Unit





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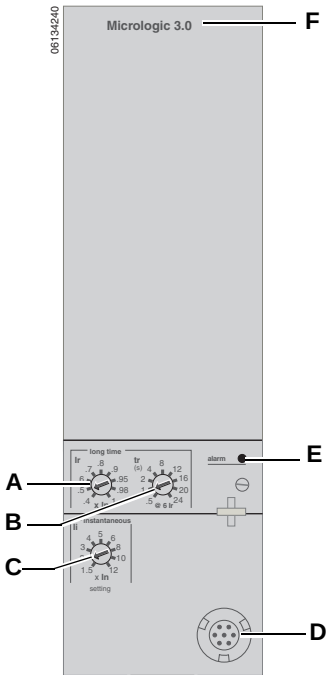
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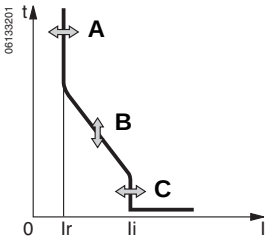
Micrologic 3.0 Trip Unit

The Micrologic 3.0 trip unit provides basic (LI) protection.

A. Long-time pickup (Ir) switch
B. Long-time delay (tr) switch
C. Instantaneous pickup (Ii) switch
D. Test plug receptacle
E. Overload indicator light
F. Trip unit name

Figure 3: Micrologic 3.0 Trip Unit



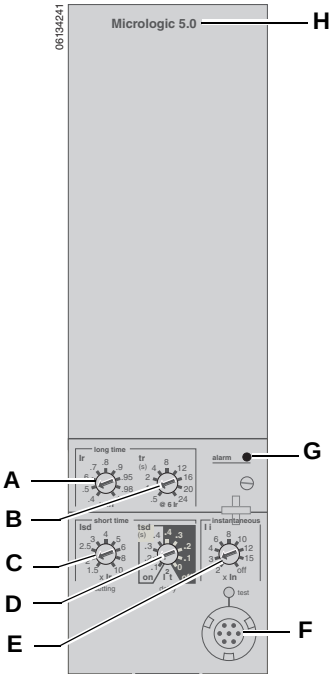


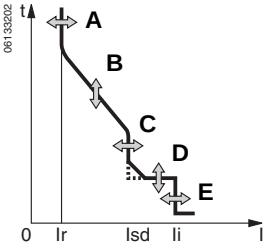
Micrologic 5.0 Trip Unit

The Micrologic 5.0 trip unit provides selective (LSI) protection.

A. Long-time pickup (Ir) switch
B. Long-time delay (tr) switch
C. Short-time pickup (Isd) switch
D. Short-time delay (tsd) switch
E. Instantaneous pickup (Ii) switch
F. Test plug receptacle
G. Overload indicator light
H. Trip unit name

Figure 4: Micrologic 5.0 Trip Unit





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Trip Unit Switches

Long-Time Protection

Long-time protection protects equipment against overloads.

- Long-time protection is standard on all trip units.
- The long-time pickup (Ir) (A) sets maximum current level (based on sensor plug rating In) which circuit breaker will carry continuously. If current exceeds this value, circuit breaker will trip after the preset time delay. The long-time pickup (Ir) is adjustable from 0.4–1.0 times the sensor plug rating (In).
- The long-time delay (tr) (B) sets the length of time that the circuit breaker will carry an overcurrent below the short-time or instantaneous pickup current level before tripping. See Table 1 for long-time delay settings.
- The overload indicator light (C) indicates that the Ir long-time pickup threshold has been exceeded.
- Both long-time pickup and long-time delay are on the field-replaceable adjustable rating plug. To change settings to more precisely match the application, various rating plugs are available. For instructions on replacing the rating plug, see Section 4—Adjustable Rating Plug Replacement.
- The In value can be changed by replacing the sensor plug below the trip unit. For further information, see the instructions packed with the sensor plug replacement kit.
- Long-time protection uses true RMS measurement.

Thermal imaging provides continuous temperature rise status of the wiring, both before and after the device trips. This allows the circuit breaker to respond to a series of overload conditions which could cause conductor overheating, but would go undetected if the long-time circuit was cleared every time the load dropped below the pickup setting or after every tripping event.

NOTE: If checking trip times, wait a minimum of 15 minutes after circuit breaker trips before resetting to allow the thermal imaging to reset completely to zero.

Figure 5: Long-Time Protection Switches

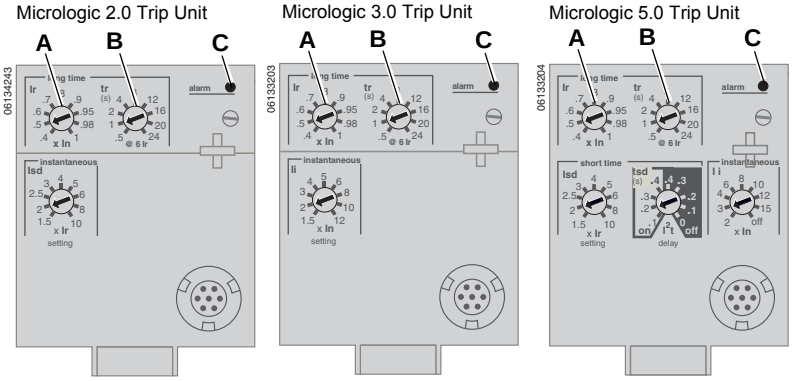


Table 1: Micrologic Trip Unit Long-Time Delay Values

Setting[1]	Long-Time Delay in Seconds[2]								
tr at 1.5 x Ir	12.5	25	50	100	200	300	400	500	600
tr at 6 x Ir	0.5	1	2	4	8	12	16	20	24
tr at 7.2 x Ir	0.34[3]	0.69	1.38	2.7	5.5	8.3	11	13.8	16.6

[1]In = sensor rating. Ir = In x long-time pickup. Trip threshold between 1.05 and 1.20 Ir.
[2]Time-delay accuracy +0/-20%
[3]For Micrologic 5.0 trip units, when tsd is set to 0.4 off or 0.4 on, then tr = 0.5 instead of 0.34.

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Short-Time Protection

Short-time protection protects equipment against short circuits.

- Short-time protection is standard on 2.0 and 5.0 trip units. It is not available on 3.0 trip units.
- Short-time protection is based on the long-time pickup (Ir)
- The short-time pickup (Isd) (A) sets the current level (below instantaneous trip level) where the circuit breaker will trip after the preset time delay.
- The short-time delay (tsd) (B) sets the length of time that the circuit breaker will carry an overcurrent above the short-time pickup current level before tripping. It is adjustable on the 5.0 trip unit and factory set to zero on the 2.0 trip unit.
- The I^2t on/I^2t off option provides improved selectivity with downstream protective devices:
- With I^2t off selected, fixed time delay is provided.
  - — With I^2t on selected, inverse time I^2t protection is provided up to 10 x Ir. Above 10 x Ir, a fixed time delay is provided.
  - — Intermittent currents in the short-time tripping range which do not last sufficiently long to trigger a trip are accumulated and shorten the trip delay appropriately.
- Setting tsd to the 0 setting turns off time-delay features.
- Short-time protection uses true RMS measurement.
- Short-time delay can be adjusted to provide selectivity with a downstream circuit breaker.

Figure 6: Short-Time Protection Switches

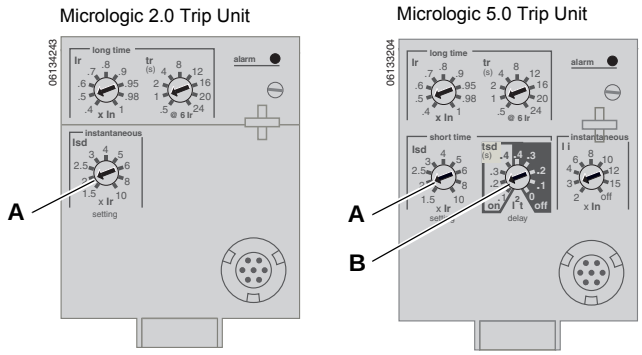


Table 2: Micrologic Trip Unit Short-Time Delay Values

Setting	Short-Time Delay				
I^2t off (Isd at 10 Ir) (seconds)	0	0.1	0.2	0.3	0.4
I^2t on (Isd at 10 Ir) (seconds)	–	0.1	0.2	0.3	0.4
tsd (min. trip) (milliseconds)	20	80	140	230	350
tsd (max. trip) (milliseconds)	80	140	200	320	500

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Instantaneous Protection

Instantaneous protection protects equipment against short circuits with no intentional time delay.

- Instantaneous protection (Ii) (A) is standard on 3.0 and 5.0 trip units.*
- Instantaneous protection for 2.0 trip units is based on the circuit breaker sensor rating (Ir).
- Instantaneous protection for 3.0 and 5.0 trip units is based on the long-time delay pickup (In).
- Circuit breaker open command is issued as soon as threshold current is exceeded.
- Instantaneous protection for 3.0 and 5.0 trip units use peak current measurement. Instantaneous protection for 2.0 trip units use RMS current measurement.
- When instantaneous protection switch is set to off, the instantaneous protection is disabled.

*Instantaneous protection on 2.0 trip units is achieved by using short-time protection (Isd) with short-time delay factory set to 0 (zero).

Figure 7: Instantaneous Protection Switches

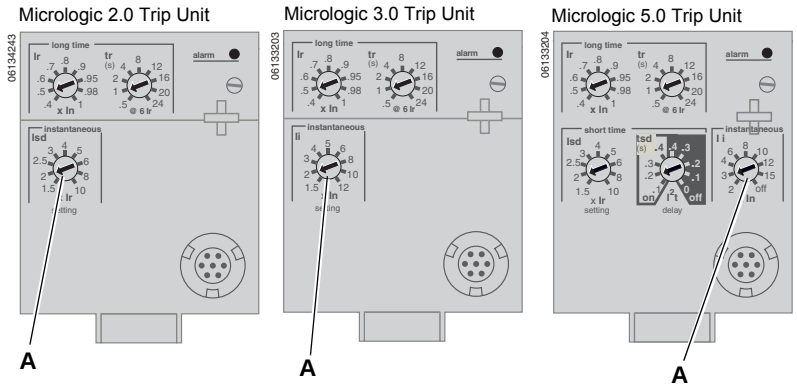


Table 3: Micrologic Instantaneous Values

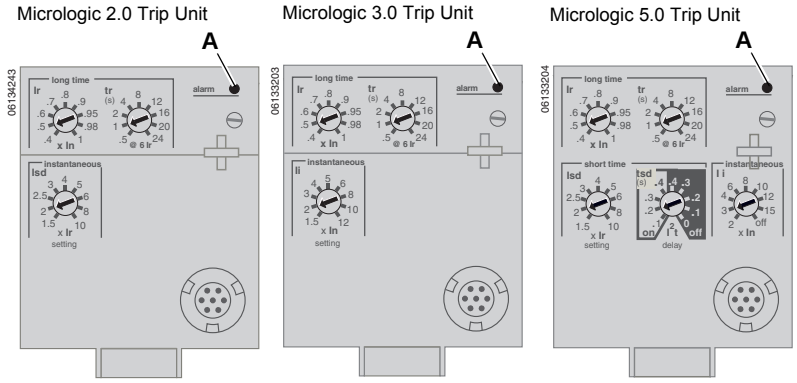
Setting	Interruption Current								
2.0 Isd (= Ir x..)	1.5	2	2.5	3	4	5	6	8	10
3.0 Ii (= In x..)	1.5	2	3	4	5	6	8	10	12
5.0 Ii (= In x..)	2	3	4	6	8	10	12	15	off

Ii = UL and ANSI instantaneous
Isd = IEC instantaneous (short-time with zero delay)
In = sensor rating
Ir = long-time pickup

Overload Indicator Light

The overload indicator light (A) lights when the Ir long-time pickup level has been exceeded.

Figure 8: Overload Indicator Lights



Trip Unit Testing

Trip unit functions can be tested using primary injection testing or secondary injection testing.

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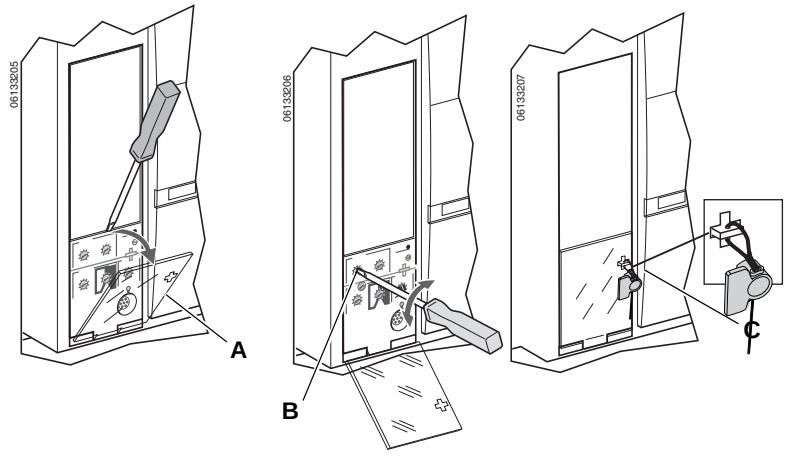
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Section 2—Operation

Switch Adjustment

1. Open switch cover (A).
2. Adjust the appropriate switches (B) to desired values.
3. Replace switch cover. Use wire seal MICROTUSEAL (C), if necessary, to provide tamper evidence.

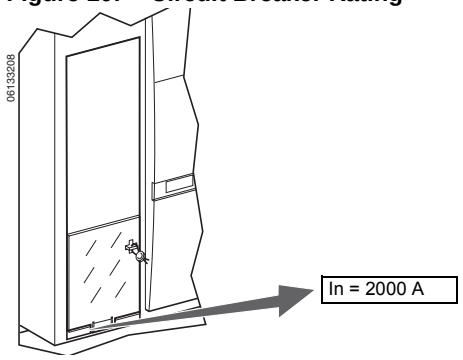
Figure 9: Adjust Switch Settings



Examples

Circuit breaker is rated 2000 A.

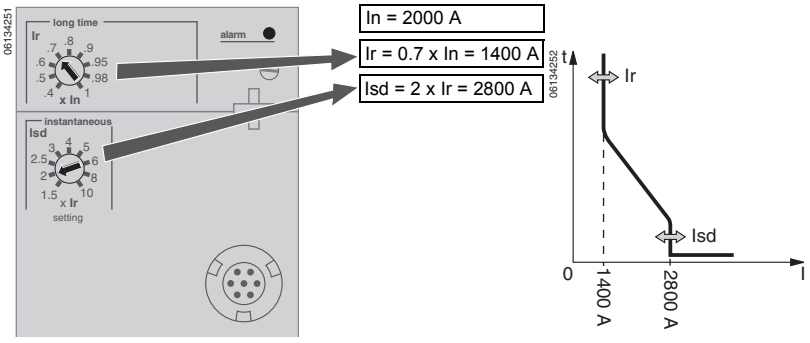
Figure 10: Circuit Breaker Rating



Micrologic 2.0 Trip Unit

1. Set pickup levels.

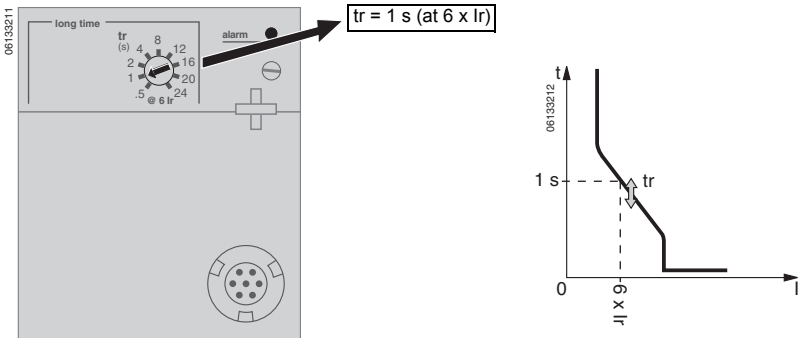
Figure 11: Set Pickup Levels



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2. Set time delay.

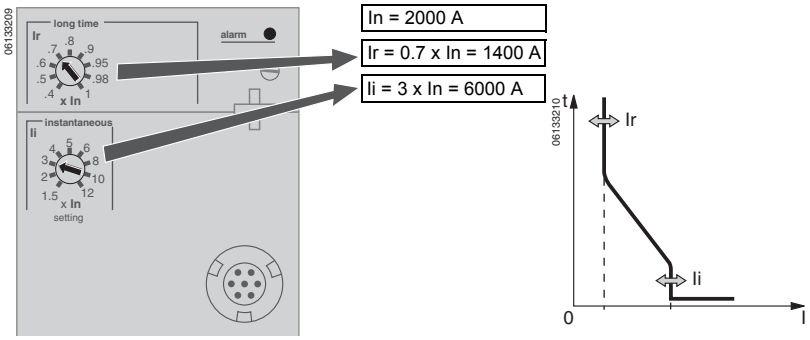
Figure 12: Set Time Delay



Micrologic 3.0 Trip Unit

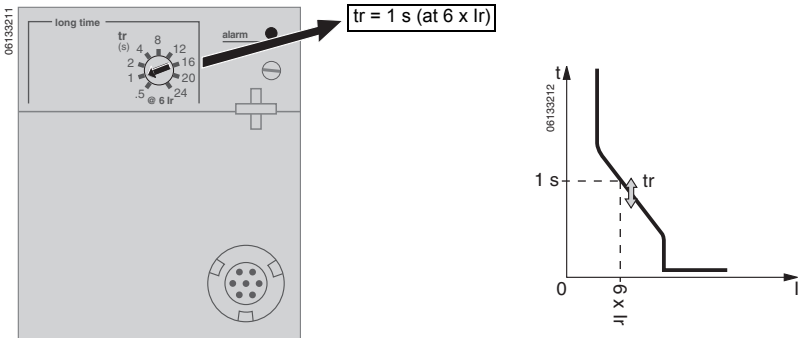
1. Set pickup levels.

Figure 13: Set Pickup Levels



2. Set time delay.

Figure 14: Set Time Delay



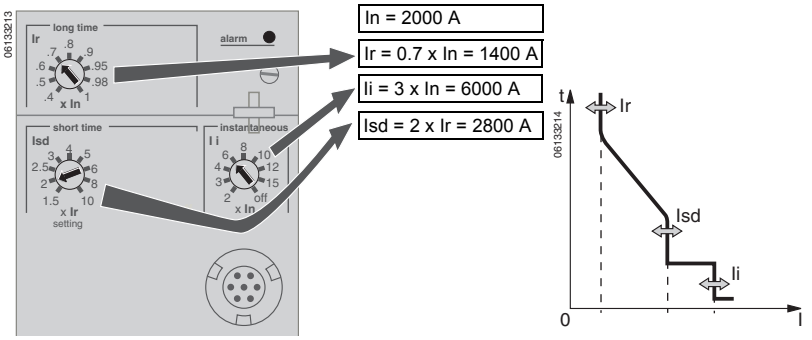
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Micrologic 5.0 Trip Unit

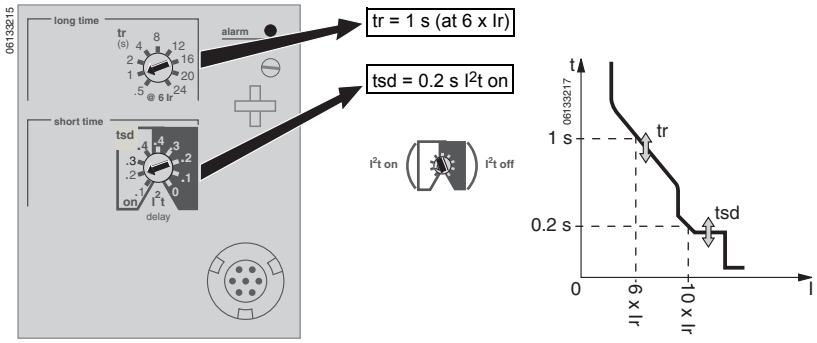
1. Set pickup levels.

Figure 15: Set Pickup Levels



2. Set time delay.

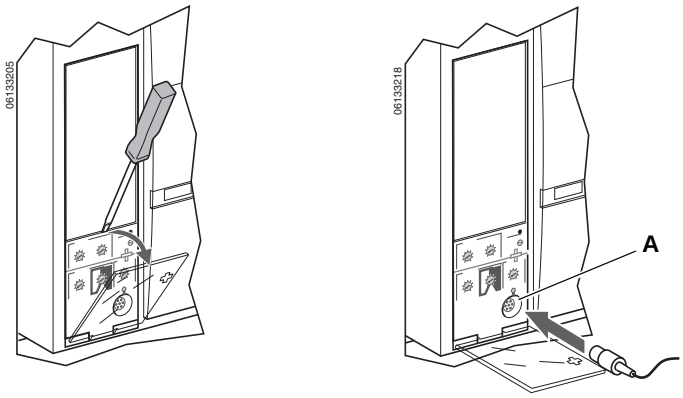
Figure 16: Set Time Delay



Trip Unit Operation Verification

Use a test kit connected to the trip unit test plug receptacle (A) to verify trip unit is functioning as desired. See instructions shipped with test kit to perform verification tests.

Figure 17: Verify Trip Unit Operation



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Section 3—Trip Unit Replacement

Trip unit replacement must be done by qualified persons, as defined by the National Electric Code, who are familiar with the installation and maintenance of power circuit breakers.

Before replacing trip unit, confirm that the circuit breaker is in good working condition. If the condition of the circuit breaker is unknown, do not proceed. For assistance in evaluating the condition of the circuit breaker, call Technical Support.

Read this entire section before starting the replacement procedure.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Failure to follow these instructions for installation, trip test and primary injection testing may result in the failure of some or all protective function.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- Replacement/upgrading of a trip unit in the field must be done by qualified persons, as defined by the National Electric Code, who are familiar with the installation and maintenance of power circuit breakers.
- Before replacing/upgrading trip unit, confirm that the circuit breaker is in good working condition. If the condition of the circuit breaker is unknown, do not proceed. For assistance in evaluating the condition of the circuit breaker, call Technical Support.
- If the circuit breaker fails to function properly in any manner upon completion of the trip unit installation, immediately remove the circuit breaker from service and call Field Services.
- Turn off all power supplying this equipment before working on or inside equipment. Follow instructions shipped with circuit breaker to disconnect and reconnect circuit breaker.
- Replace all devices, doors and covers before returning equipment to service.

Failure to follow this instruction will result in death or serious injury.

Required Tools

- Torque-controlled screwdriver, set at 7 in-lbs (0.8 N•m) ± 10% (Lindstrom torque driver MAL500-2 or equivalent)
- Micrologic Full-Function Test Kit (part number S33595)

Preparation

Record Switch Settings

Record all trip unit switch setting for later use.

Circuit Breaker Disconnection

Disconnect circuit breaker as directed in the circuit breaker instruction bulletin shipped with the circuit breaker. The circuit breaker must be completely isolated. (For a drawout circuit breaker, place circuit breaker in the disconnected position. For a fixed-mounted circuit breaker, all voltage sources, including auxiliary power, must be disconnected.)

Circuit Breaker Accessory Cover Removal

Remove circuit breaker accessory cover as directed in the Install Accessories section of the circuit breaker instruction bulletin shipped with the circuit breaker.

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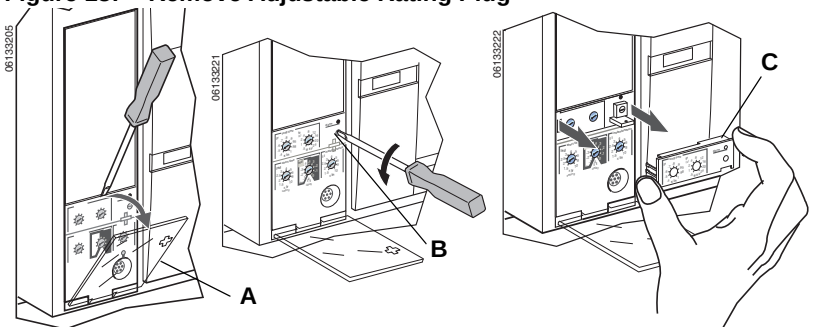
ENGLISH

Rating Plug Removal

A small Phillips screwdriver is needed to remove the adjustable rating plug.

1. Open switch cover (A).
2. Unscrew adjustable rating plug mounting screw (B).
3. Remove adjustable rating plug (C). Save for installation in replacement trip unit.

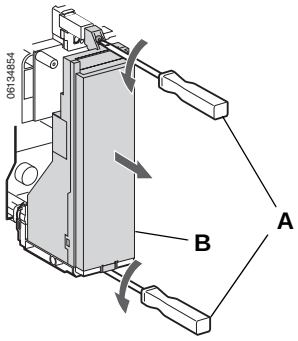
Figure 18: Remove Adjustable Rating Plug



Trip Unit Removal

1. Loosen two trip unit screws (A).
2. Slide out trip unit (B).

Figure 19: Remove Existing Trip Unit



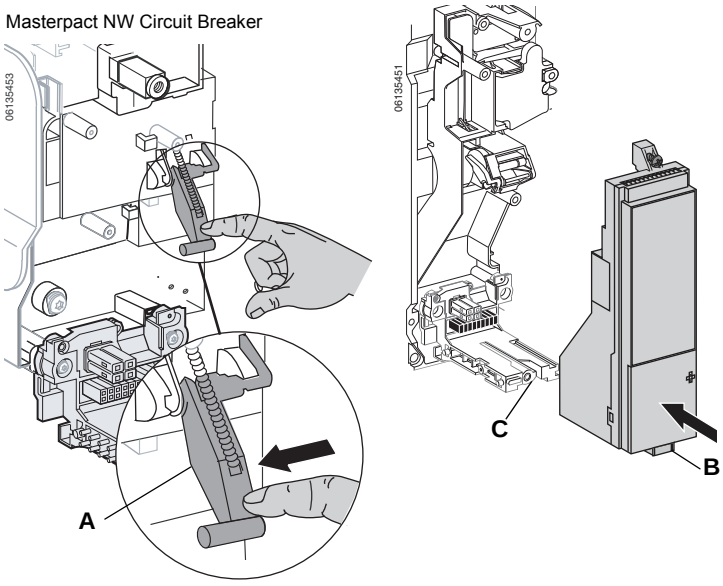
Trip Unit Replacement

Trip Unit Installation

1. Inspect trip unit connector pins and surfaces. If there is any damage, misaligned pins, or contamination, stop installation and contact the local sales office for factory authorized service.
2. Inspect trip unit mounting base on the circuit breaker. Clear any debris from area and check that all accessory wiring is properly routed for the trip unit being installed. If there is any damage or contamination, stop installation and contact the local sales office for factory authorized service.
3. For Masterpact NW circuit breaker only: Manually depress trip unit interlock (A) and hold it in place during steps 4–6 below.
4. Align guide rail (B) on bottom of trip unit with guide rail slot (C) on trip unit mounting base in circuit breaker and gently slide the trip unit in until it stops.

NOTE: The Masterpact NT and NW trip unit mounting bases are shock mounted and therefore can flex slightly.

Figure 20: Install Trip Unit



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ENGLISH

⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE

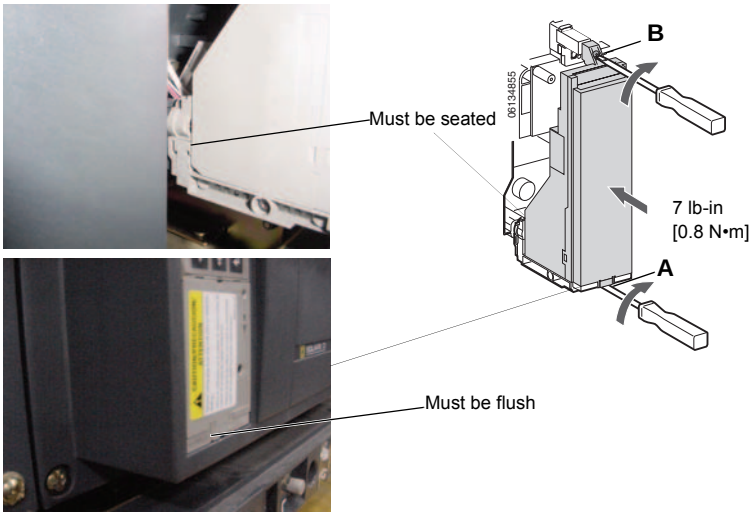
Check installation of trip unit to assure proper connections and seating.

Failure to follow this instruction can result in equipment damage or improper circuit breaker tripping.

5. Align the trip unit so top mounting screw (B) aligns with the top threaded insert and start the screw by turning the screw two full rotations.
6. Use a torque-controlled screwdriver to drive the bottom screw to 7 in-lbs (0.8 N•m) ± 10%. The back of the trip unit must be flush with the trip unit mounting base.
7. Use a torque-controlled screwdriver to drive the top screw to 7 in-lbs (0.8 N•m) ± 10%. Mounting tab must be flush with the mounting standoff and sensor plug.

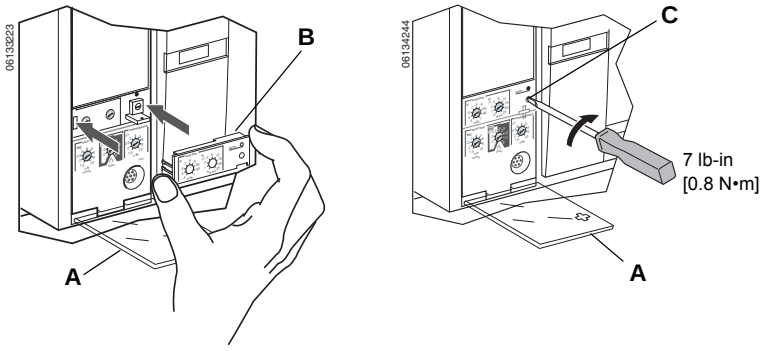
NOTE: The face of the closed switch cover must be flush with adjoining mounting base surfaces. If these surfaces are not flush, stop installation and contact the local sales office for factory authorized service.

Figure 21: Install Trip Unit



8. Install adjustable rating plug into the trip unit.
   a. Open switch cover (A) on new trip unit.
   b. Inspect mounting area for debris and contamination.
   c. Gently push adjustable rating plug (B) into new trip unit.
   d. Tighten adjustable rating plug mounting screw (C). The plug will be drawn into position flush with front face as screw is tightened.
9. Set trip unit switches to values recorded above or per coordination study results.
10. Close switch cover (A).

Figure 22: Install Adjustable Rating Plug



Circuit Breaker Accessory Cover Replacement

Replace circuit breaker accessory cover as directed in the Install Accessories section of the circuit breaker instruction bulletin shipped with the circuit breaker.

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Trip Unit Installation Check

Secondary Injection Testing

Field installation of a trip unit requires secondary injection testing with a Full-Function Test Kit. This will ensure that the newly-installed trip unit is functioning properly. The test will require opening and closing the circuit breaker. Follow the procedures outlined in the instruction bulletins shipped with the circuit breaker and the Full-Function Test Kit.

1. Make sure the circuit breaker is isolated from all upstream and downstream devices.
2. Perform secondary injection testing as outlined in the instruction bulletin shipped with the Full-Function Test Kit. Verify that all applicable trip unit functions are operating properly.
3. Repeat step 2 with the circuit breaker in the open position.

   NOTE: The test kit will state that the circuit breaker should be closed when performing the test. Do not close the circuit breaker for this step.
4. If any test fails, do not put the circuit breaker into service and contact the local sales office for factory authorization service.

Primary Injection Testing

Primary injection testing is recommended to ensure that all trip system connections have been correctly made. Perform primary injection testing per the instructions in the Field Testing and Maintenance Guide, bulletin 0600IB1201.

Trip Unit Setup

Reset the trip unit switches to original values, as recorded at the beginning of this section.

Circuit Breaker Reconnection

Reconnect circuit breaker as directed in the circuit breaker instruction bulletin shipped with the circuit breaker.

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Section 4—Adjustable Rating Plug Replacement

NOTE: To select correct replacement rating plug, see the product catalog.

NOTE: If adjustable rating plug is removed, the circuit breaker will default to a long-time pickup rating of 0.4 x In and a long-time delay at whatever setting was selected before the rating plug was removed.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

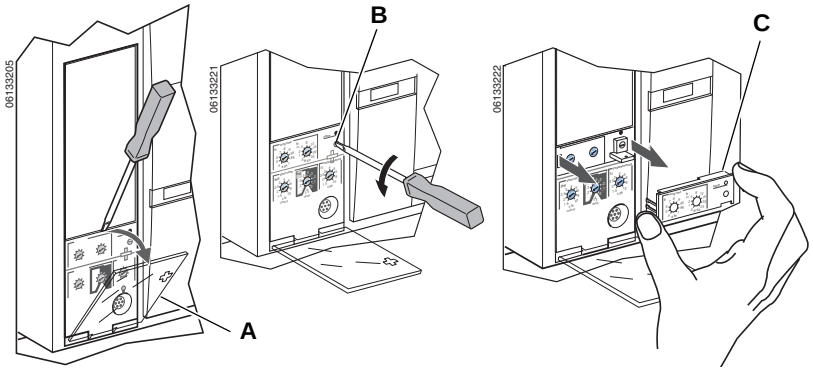
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment. Follow instructions shipped with circuit breaker to disconnect and reconnect circuit breaker.
- Replace all devices, doors and covers before returning equipment to service.

Failure to follow this instruction will result in death or serious injury.

Rating Plug Removal

1. Open circuit breaker contacts:
   - — For NT and NW circuit breakers, press the “Push to open” button on the circuit breaker.
   - — For other circuit breakers, move handle to the off (O) position.
2. Open switch cover (A).
3. Unscrew adjustable rating plug mounting screw (B).
4. Remove adjustable rating plug (C).

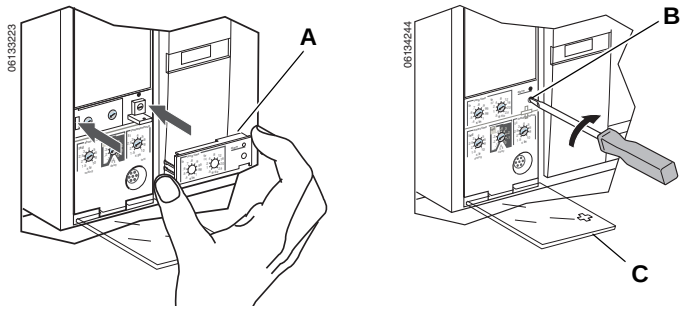
Figure 23: Remove Adjustable Rating Plug



New Rating Plug Installation

1. Inspect mounting area for debris and contamination.
2. Gently push in new rating plug (A).
3. Tighten adjustable rating plug mounting screw (B).
4. Set the switches on the trip unit (see Section 2—Operation).
5. Close switch cover (C).

Figure 24: Install New Adjustable Rating Plug



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Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

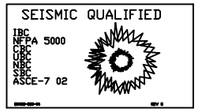
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48049-207-05 Rev. 01, 07/2012
Replaces 48049-207-05 10/2007
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REV	DESCRIPTION	BY	DATE	–	----	--	--/--	–	----	--	--/--
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SEISMIC QUALIFIED LABEL REQUIRED

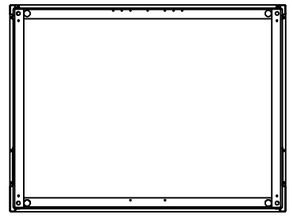


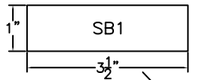
FACTORY INSTALLED POWER CABLES

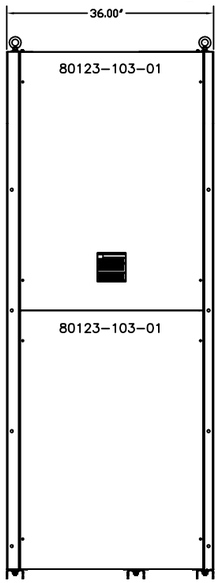
CABLED FROM	CONNECT TO	CABLED FROM	CONNECT TO	PHASE WIRE SIZE	QTY PER PHASE
-----	-----	-----	-----	–	–
-----	-----	-----	-----	–	–

PANEL INFORMATION

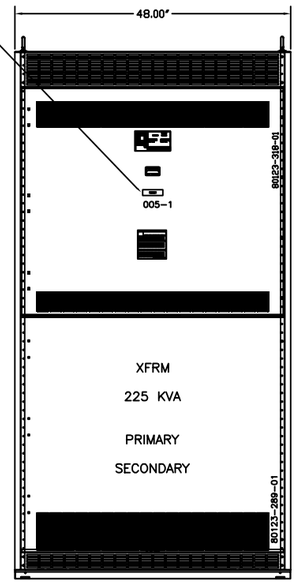
CELL REFERENCE	DESCRIPTION	PANEL FEED	TOP BRACKET LOCATION	MIDDLE BRACKET LOCATION	BOTTOM BRACKET LOCATION	DIVIDER HOLE LOCATION	GROUND BAR
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2	----------	-----	–/–	–/–	–/–	–	-----

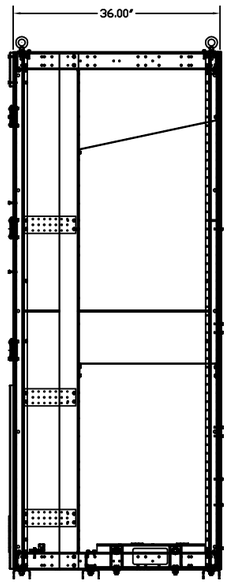

TOP VIEW



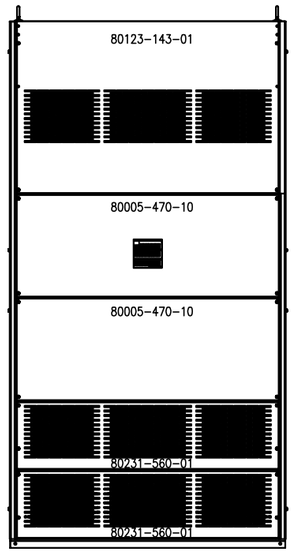


LEFTSIDE VIEW
(STD COVERS)





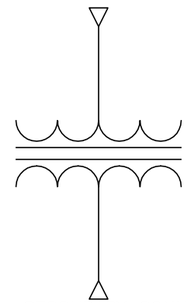
RIGHTSIDE VIEW
(NO COVERS)



BACK VIEW (COVERS REQ'D)

ENCLOSURE DATA:
NEMA TYPE 1
COLOR: ANSI 49

PRIMARY CONNECTION
CABLED TO REMOTE



SECONDARY CONNECTION
CABLED TO PANEL SB1

TRANSFORMER DATA:

DESIGNATION: XFRM

2255 KVA (EX225T3HB)

ENERGY EFFICIENT

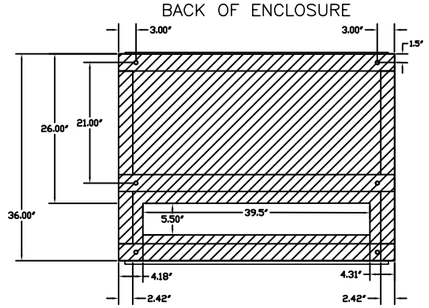
TRANSFORMER VOLTAGE:
3–PH 480V – 208Y/120V

TRANSFORMER WINDINGS:
ALUMINUM WINDINGS

OPTIONS:
H–220°C INS, 80°C RISE
52dB 1975lbs 25J

GROUND BUS PER UL891

BACK OF ENCLOSURE



FRONT OF ENCLOSURE
BOTTOM VIEW

NOTE
BRANCH CIRCUIT WIRING DONE BY SQUARE D WILL BE COLOR CODED!

480V/277V	208V/120V
A PHASE – BROWN	A PHASE – BLACK
B PHASE – ORANGE	B PHASE – RED
C PHASE – YELLOW	C PHASE – BLUE
NEUTRAL – GRAY	NEUTRAL – WHITE

ALL WIRING ABOVE #10 AWG TO BE PHASE COLORED ON EACH END.

GENERAL NOTES

1. REFERENCE INSTRUCTIONS BULLETIN 80043–708–XX FOR HANDLING, INSTALLATION, ANCHORING, INSPECTION & MAINTENANCE.
2. SOLID LINE (——) REPRESENTS FACTORY INSTALLED CABLES.
3. INSTALL (1) 220–9309 LOCKABLE LATCH ON EACH PANELBOARD COVER DOOR,
4. REFER TO INTERNAL DATA SHEETS FOR ASSEMBLY INSTRUCTIONS.

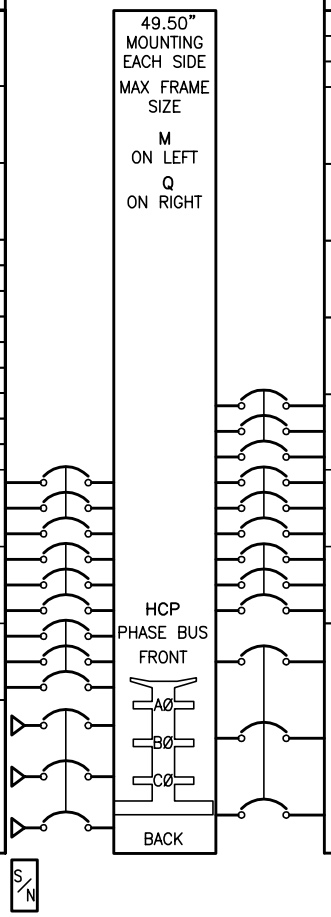
STRUCTURE BOM ASSEMBLY #
8012330959

INDICATES EQUIPMENT THAT INTERFERES WITH CONDUIT ENTRY

JOB NAME:	WEBSTER UNIVERSITY ISP	EQUIPMENT DESIGNATION:	SB1
JOB LOCATION:	WEBSTER GROVEES, MO	EQUIPMENT TYPE:	NEXT GEN / TRANSFORMER COMBO
DRAWN BY:	AMS	DRAWING TYPE:	ELEVATION / ONE LINE
ENGR:	AMS		SQUARE D Schneider Electric
DATE:	10/3/2016		
DRAWING STATUS:	RECORD	DWG# 37999262–005–1–01–1	PG 1 OF 4 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

CKT NO	ACCESSORIES	TYPE	RATING AMP/P	PHASE BUS CONN
	40517-407-01 (4½" FILLER)			
	40517-407-01 (4½" FILLER)			
	40517-407-01 (4½" FILLER)			
	40517-408-01 (1½" FILLER)			
	40517-408-01 (1½" FILLER)			
	40517-408-01 (1½" FILLER)			
	40517-408-01 (1½" FILLER)			
	40517-408-01 (1½" FILLER)			
	40517-408-01 (1½" FILLER)			
	40517-408-01 (1½" FILLER)			
	40517-408-01 (1½" FILLER)			
	40517-408-01 (1½" FILLER)			
1		QD	225/3	ABC
3		QD	225/3	ABC
5		QD	225/3	ABC
	BRANCH MOUNTED MAIN	MG	800/3	ABC



PHASE BUS CONN	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
			40517-408-01 (1½" FILLER)	
			40517-408-01 (1½" FILLER)	
			40517-408-01 (1½" FILLER)	
			40517-407-01 (4½" FILLER)	
			40517-407-01 (4½" FILLER)	
			40517-407-01 (4½" FILLER)	
			40517-407-01 (4½" FILLER)	
ABC	225/3	QD		2
ABC	225/3	QD		4
ABC	225/3	QD		6
ABC	60/3	HL	SPD	

HCP50868/40517-428-51

PHYSICAL DATA

- ENCLOSURE: INTERIOR ONLY

  FRONT CAT#: N/A
  BOX CAT#: N/A
  DIMENSIONS:
  "H X "W X "D
  WIRE BENDING SPACE:
  TOP
  BOTTOM
  SIDE

- BUSSING: COPPER BUS
  STANDARD PLATING
- SPECIAL:
  COPPER SOLID NEUTRAL
  COPPER GROUND BAR

ELECTRICAL DATA

- SYSTEM: 208Y/120 VAC 3PH 4W 60 HZ
  25,000 AMPS SYMS. SCCR
- MAIN: MAIN BREAKER: 800A
  BOTTOM FEED
- BRANCH MOUNTING TYPE: PLUG-ON

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	PANEL SB1
JOB LOCATION:	WEBSTER GROVES, MO	EQUIPMENT TYPE:	I-LINE
DRAWN BY:	AMS	DRAWING TYPE:	IPC2
ENGR:	AMS		SQUARE D Schneider Electric
DATE:	9/30/2016		
DRAWING STATUS:	RECORD	DWG# 37999262-005-2-01-1	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE								
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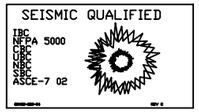
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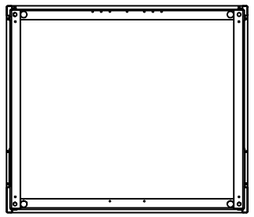
CABLE FROM	CONNECT TO	CABLE TO	CONNECT TO	WIRE SIZE	QTY PER PHASE
PANEL SB1	MAIN BREAKER (800A)	225 KVA TRANSFOMER	SECONDARY LUGS	300 kcmil	3
CONNECT FEEDER TO MAIN AND ROLL UP INSIDE ENCLOSURE, NEED APPROX 12' PER PHASE.					

PANELS INFORMATION:

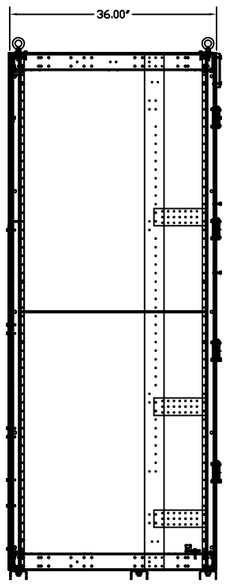
CELL REFERENCE	PANEL	PANEL FEED	TOP BRACKET LOCATION	BOTTOM BRACKET LOCATION	DIVIDER HOLE LOCATION	GROUND BAR
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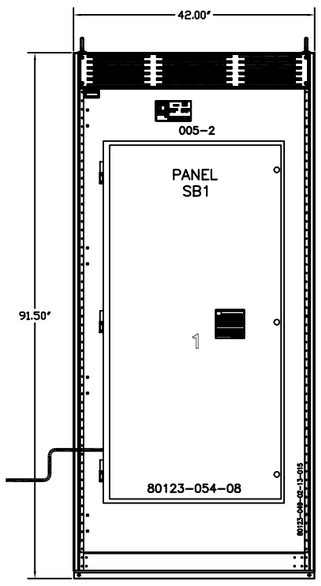




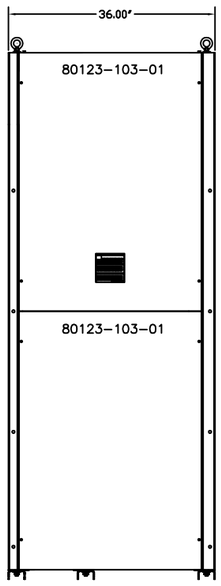
TOP VIEW



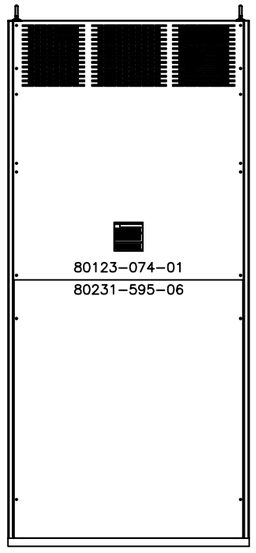
LEFTSIDE VIEW
(NO COVERS)



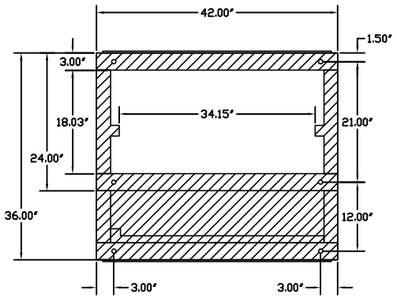
BACK OF ENCLOSURE



RGHTSIDE VIEW
(STD COVERS)



BACK VIEW (COVERS REQ'D)



FRONT OF ENCLOSURE
BOTTOM VIEW

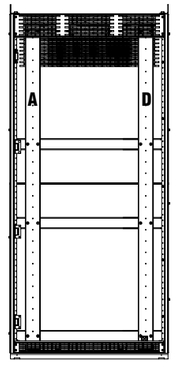
NOTE
BRANCH CIRCUIT WIRING DONE BY SQUARE D
WILL BE COLOR CODED!

120V/208V	277V/480V
A PHASE – BLACK WIRE	A PHASE – BROWN WIRE
B PHASE – RED WIRE	B PHASE – ORANGE WIRE
C PHASE – BLUE WIRE	C PHASE – YELLOW WIRE
NEUTRAL – WHITE WIRE	NEUTRAL – GRAY WIRE

ALL WIRING ABOVE #10 AWG TO BE PHASE COLORED ON EACH END.

GENERAL NOTES

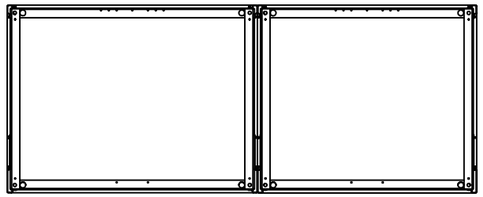
1. REFERENCE INSTRUCTION BULLETIN 80043–708–03 FOR HANDLING, INSTALLATION, ANCHORING, INSPECTION & MAINTANENCE.
2. SOLID LINE (————)REPRESENTS FACTORY INSTALLED CABLES.
3. INSTALL 1–220–9309 LOCKABLE LATCH ON EACH PANELBOARD COVER DOOR.
4. REFER TO DATA SHEETS 80123–DS–000P1 TO 80123–DS–022P1 FOR ASSEMBLY INSTRUCTIONS.



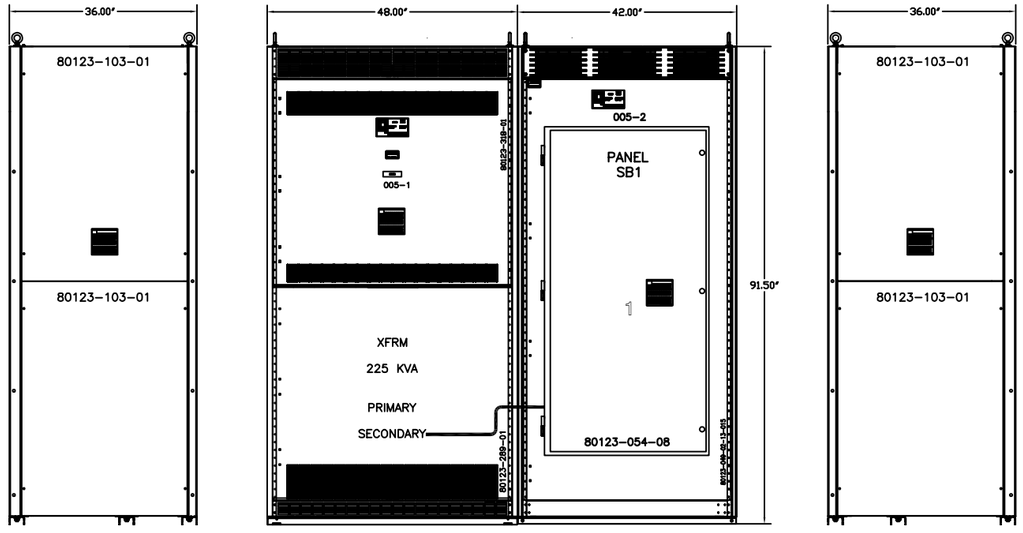
STRUCTURE BOM ASSEMBLY #
8012316158I

JOB NAME:	WEBSTER UNIVERSITY ISP	EQUIPMENT DESIGNATION:	SB1
JOB LOCATION:	WEBSTER GROVEES, MO	EQUIPMENT TYPE:	NEXT GEN / TRANSFORMER COMBO
DRAWN BY:	AMS	DRAWING TYPE:	ELEVATION / ONE LINE
ENGR:	AMS		SQUARE D Schneider Electric
DATE:	10/3/2016		
DRAWING STATUS:	RECORD	DWG# 37999262–005–2–01–2	PG 3 OF 4 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--	–	-----	--	--/--
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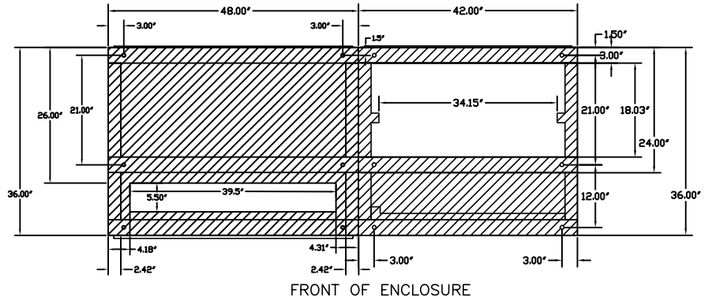
TOP VIEW TOP VIEW



LEFTSIDE VIEW (STD COVERS)

BACK OF ENCLOSURE

RGHTSIDE VIEW (STD COVERS)

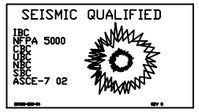


FRONT OF ENCLOSURE
BOTTOM VIEW

JOB NAME:	WEBSTER UNIVERSITY ISP	EQUIPMENT DESIGNATION:	SB1
JOB LOCATION:	WEBSTER GROVEES, MO	EQUIPMENT TYPE:	NEXT GEN / TRANSFORMER COMBO
DRAWN BY:	AMS	DRAWING TYPE:	ELEVATION / ONE LINE
ENGR:	AMS		SQUARE D Schneider Electric
DATE:	10/3/2016		
DRAWING STATUS:	RECORD	DWG# 37999262-005 LINE UP	PG 4 OF 4 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--	–	----	--	--/--
–	-----	--	--/--	–	----	--	--/--	–	-----	--	--/--

SEISMIC QUALIFIED LABEL REQUIRED

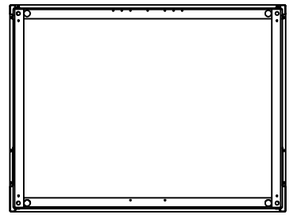


FACTORY INSTALLED POWER CABLES

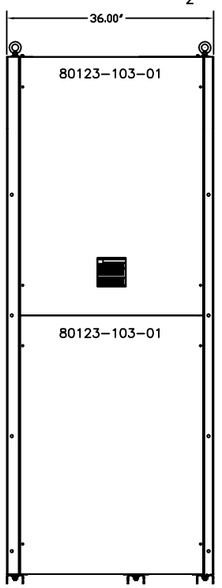
CABLED FROM	CONNECT TO	CABLED FROM	CONNECT TO	PHASE WIRE SIZE	QTY PER PHASE
-----	-----	-----	-----	–	–
-----	-----	-----	-----	–	–

PANEL INFORMATION

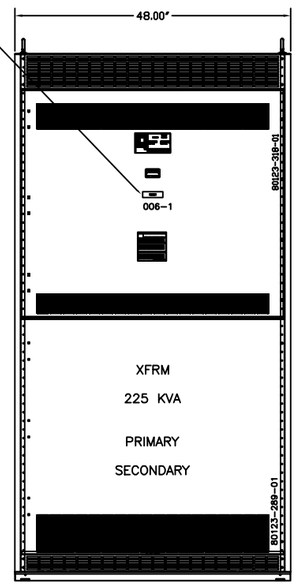
CELL REFERENCE	DESCRIPTION	PANEL FEED	TOP BRACKET LOCATION	MIDDLE BRACKET LOCATION	BOTTOM BRACKET LOCATION	DIVIDER HOLE LOCATION	GROUND BAR
1	----------	-----	–/–	–/–	–/–	–	-----
2	----------	-----	–/–	–/–	–/–	–	-----

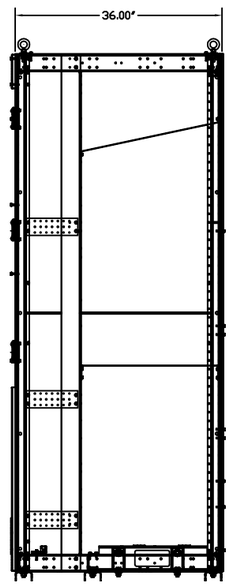


TOP VIEW

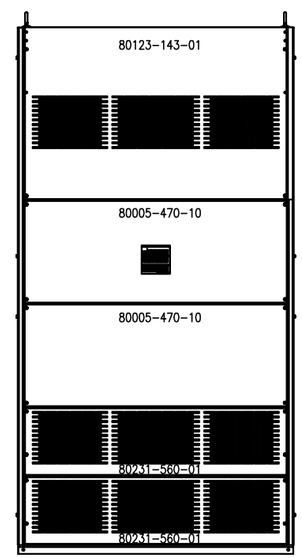


LEFTSIDE VIEW
(STD COVERS)





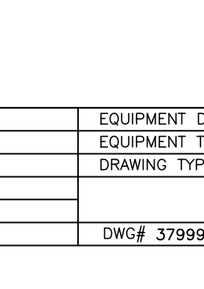
RIGHTSIDE VIEW
(NO COVERS)



BACK VIEW (COVERS REQ'D)

ENCLOSURE DATA:
NEMA TYPE 1
COLOR: ANSI 49

PRIMARY CONNECTION
CABLED TO REMOTE



SECONDARY CONNECTION
CABLED TO PANEL ----

TRANSFORMER DATA:

DESIGNATION: XFRM

2255 KVA (EX225T3HB)

ENERGY EFFICIENT

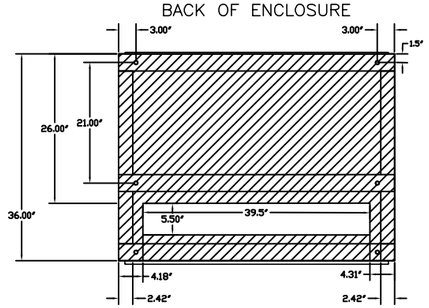
TRANSFORMER VOLTAGE:
3–PH 480V – 208Y/120V

TRANSFORMER WINDINGS:
ALUMINUM WINDINGS

OPTIONS:
H–220°C INS, 80°C RISE
52dB 1975lbs 25J

GROUND BUS PER UL891

BACK OF ENCLOSURE



FRONT OF ENCLOSURE
BOTTOM VIEW

NOTE
BRANCH CIRCUIT WIRING DONE BY SQUARE D WILL BE COLOR CODED!

480V/277V	208V/120V
A PHASE – BROWN	A PHASE – BLACK
B PHASE – ORANGE	B PHASE – RED
C PHASE – YELLOW	C PHASE – BLUE
NEUTRAL – GRAY	NEUTRAL – WHITE

ALL WIRING ABOVE #10 AWG TO BE PHASE COLORED ON EACH END.

GENERAL NOTES

1. REFERENCE INSTRUCTIONS BULLETIN 80043–708–XX FOR HANDLING, INSTALLATION, ANCHORING, INSPECTION & MAINTENANCE.
2. SOLID LINE (▬▬) REPRESENTS FACTORY INSTALLED CABLES.
3. INSTALL (1) 220–9309 LOCKABLE LATCH ON EACH PANELBOARD COVER DOOR,
4. REFER TO INTERNAL DATA SHEETS FOR ASSEMBLY INSTRUCTIONS.

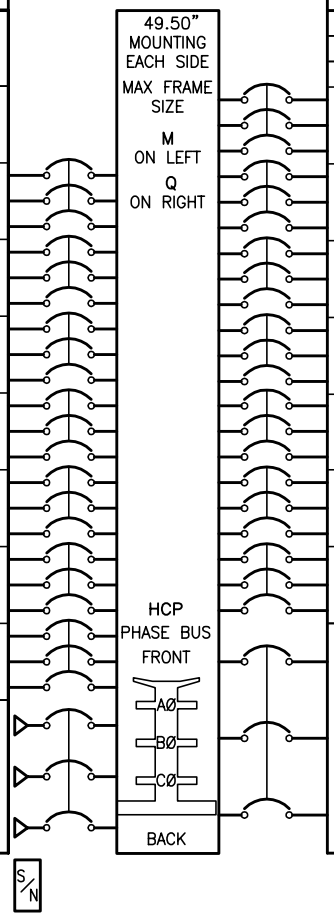
STRUCTURE BOM ASSEMBLY #
8012330959

▨ INDICATES EQUIPMENT THAT INTERFERES WITH CONDUIT ENTRY

JOB NAME:	WEBSTER UNIVERSITY ISP	EQUIPMENT DESIGNATION:	SB2
JOB LOCATION:	WEBSTER GROVEES, MO	EQUIPMENT TYPE:	NEXT GEN / TRANSFORMER COMBO
DRAWN BY:	AMS	DRAWING TYPE:	ELEVATION / ONE LINE
ENGR:	AMS		SQUARE D Schneider Electric
DATE:	10/3/2016		
DRAWING STATUS:	RECORD	DWG# 37999262–006–1–01–1	PG 1 OF 4 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

CKT NO	ACCESSORIES	TYPE	RATING AMP/P	PHASE BUS CONN
	40517-407-01 (4½" FILLER)			
	40517-407-01 (4½" FILLER)			
1		QD	225/3	ABC
3		QD	225/3	ABC
5		QD	225/3	ABC
7		QD	225/3	ABC
9		QD	225/3	ABC
11		QD	225/3	ABC
13		QD	225/3	ABC
	BRANCH MOUNTED MAIN	MG	800/3	ABC



PHASE BUS CONN	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
			40517-408-01 (1½" FILLER)	
			40517-408-01 (1½" FILLER)	
			40517-408-01 (1½" FILLER)	
ABC	225/3	QD		2
ABC	225/3	QD		4
ABC	225/3	QD		6
ABC	225/3	QD		8
ABC	225/3	QD		10
ABC	225/3	QD		12
ABC	225/3	QD		14
ABC	60/3	HL	SPD	

HCP50868/40517-428-51

PHYSICAL DATA

- ENCLOSURE: INTERIOR ONLY

  FRONT CAT#: N/A
  BOX CAT#: N/A
  DIMENSIONS:
  "H X "W X "D
  WIRE BENDING SPACE:
  TOP
  BOTTOM
  SIDE

- BUSSING: COPPER BUS
  STANDARD PLATING
- SPECIAL:
  COPPER SOLID NEUTRAL
  COPPER GROUND BAR

ELECTRICAL DATA

- SYSTEM: 208Y/120 VAC 3PH 4W 60 HZ
  25,000 AMPS SYMS. SCCR
- MAIN: MAIN BREAKER: 800A
  BOTTOM FEED
- BRANCH MOUNTING TYPE: PLUG-ON

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	PANEL SB2
JOB LOCATION:	WEBSTER GROVES, MO	EQUIPMENT TYPE:	I-LINE
DRAWN BY:	AMS	DRAWING TYPE:	IPC2
ENGR:	AMS		SQUARE D Schneider Electric
DATE:	9/30/2016		
DRAWING STATUS:	RECORD	DWG# 37999262-006-2-01-1	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--	–	----	--	--/--
–	----	--	--/--	–	----	--	--/--	–	----	--	--/--

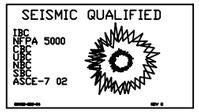
FACTORY INSTALLED POWER CABLES:

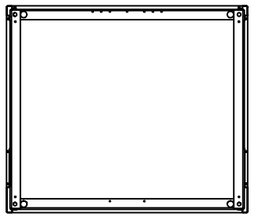
CABLE FROM	CONNECT TO	CABLE TO	CONNECT TO	WIRE SIZE	QTY PER PHASE
PANEL SB2	MAIN BREAKER (800A)	225 KVA TRANSFOMER	SECONDARY LUGS	300 kcmil	3
CONNECT FEEDER TO MAIN AND ROLL UP INSIDE ENCLOSURE, NEED APPROX 12' PER PHASE.					

PANELS INFORMATION:

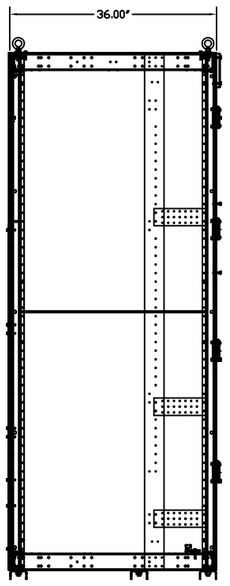
CELL REFERENCE	PANEL	PANEL FEED	TOP BRACKET LOCATION	BOTTOM BRACKET LOCATION	DIVIDER HOLE LOCATION	GROUND BAR
1	PANEL SB2	BOTTOM	A–3/D–3	A–26/D–26	----	PK32DGTACU

SEISMIC QUALIFIED LABEL REQUIRED

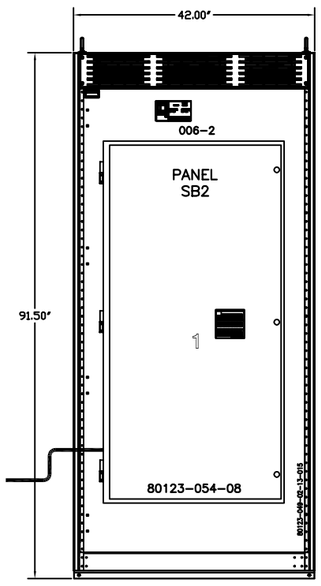




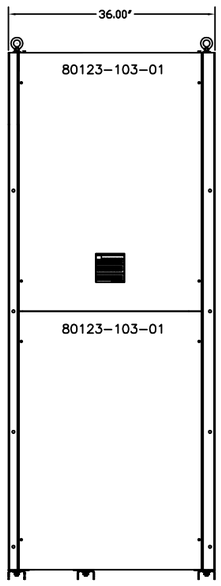
TOP VIEW



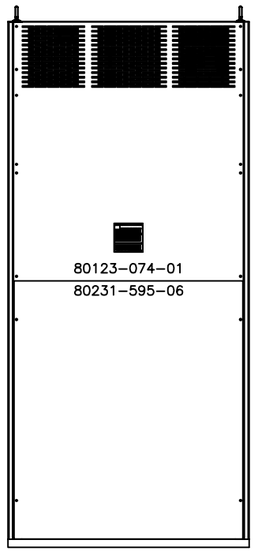
LEFTSIDE VIEW
(NO COVERS)



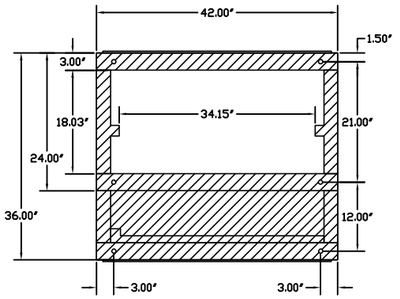
BACK OF ENCLOSURE



RGHTSIDE VIEW
(STD COVERS)



BACK VIEW (COVERS REQ'D)



FRONT OF ENCLOSURE
BOTTOM VIEW

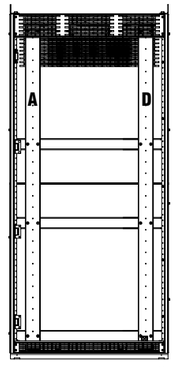
NOTE
BRANCH CIRCUIT WIRING DONE BY SQUARE D
WILL BE COLOR CODED!

120V/208V	277V/480V
A PHASE – BLACK WIRE	A PHASE – BROWN WIRE
B PHASE – RED WIRE	B PHASE – ORANGE WIRE
C PHASE – BLUE WIRE	C PHASE – YELLOW WIRE
NEUTRAL – WHITE WIRE	NEUTRAL – GRAY WIRE

ALL WIRING ABOVE #10 AWG TO BE PHASE COLORED ON EACH END.

GENERAL NOTES

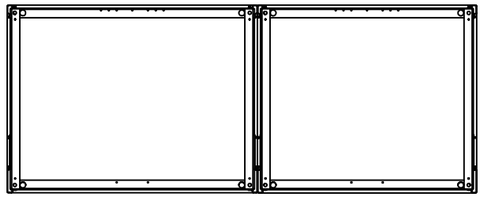
1. REFERENCE INSTRUCTION BULLETIN 80043–708–03 FOR HANDLING, INSTALLATION, ANCHORING, INSPECTION & MAINTANENCE.
2. SOLID LINE (————)REPRESENTS FACTORY INSTALLED CABLES.
3. INSTALL 1–220–9309 LOCKABLE LATCH ON EACH PANELBOARD COVER DOOR.
4. REFER TO DATA SHEETS 80123–DS–000P1 TO 80123–DS–022P1 FOR ASSEMBLY INSTRUCTIONS.



STRUCTURE BOM ASSEMBLY #
8012316158I

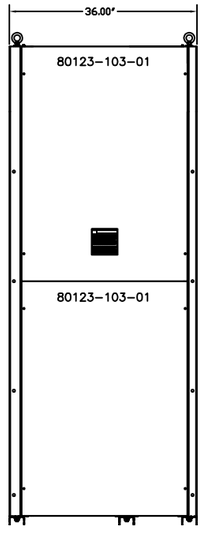
JOB NAME:	WEBSTER UNIVERSITY ISP	EQUIPMENT DESIGNATION:	SB2
JOB LOCATION:	WEBSTER GROVEES, MO	EQUIPMENT TYPE:	NEXT GEN / TRANSFORMER COMBO
DRAWN BY:	AMS	DRAWING TYPE:	ELEVATION / ONE LINE
ENGR:	AMS		SQUARE D Schneider Electric
DATE:	10/3/2016		
DRAWING STATUS:	RECORD	DWG# 37999262–006–2–01–2	PG 3 OF 4 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--	–	-----	--	--/--
–	----	--	--/--	–	----	--	--/--	–	-----	--	--/--

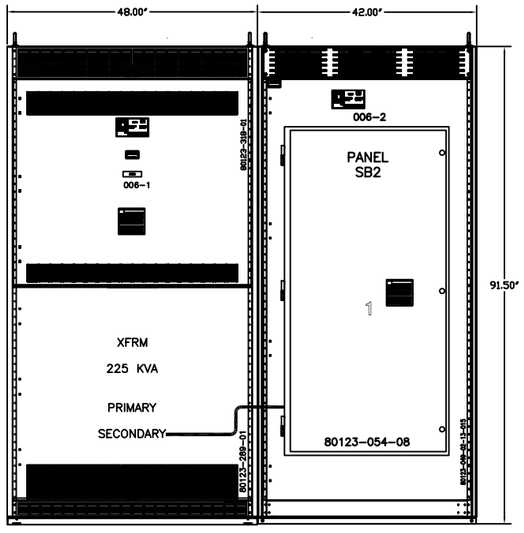


TOP VIEW

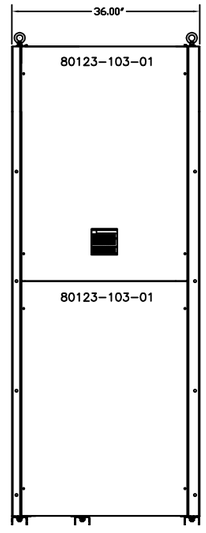
TOP VIEW



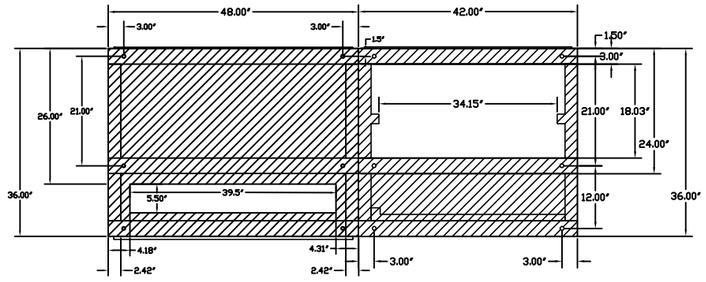
LEFTSIDE VIEW
(STD COVERS)



BACK OF ENCLOSURE



RGHTSIDE VIEW
(STD COVERS)

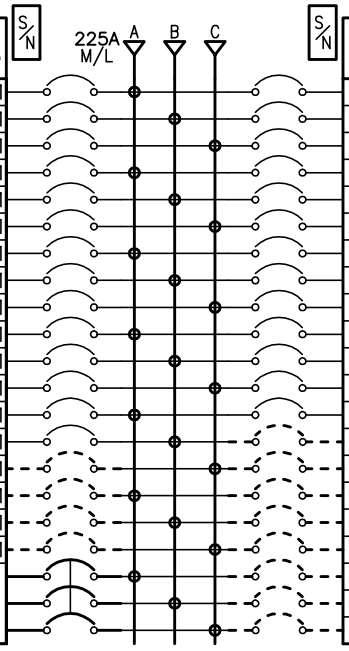


FRONT OF ENCLOSURE
BOTTOM VIEW

JOB NAME:	WEBSTER UNIVERSITY ISP	EQUIPMENT DESIGNATION:	SB2
JOB LOCATION:	WEBSTER GROVEES, MO	EQUIPMENT TYPE:	NEXT GEN / TRANSFORMER COMBO
DRAWN BY:	AMS	DRAWING TYPE:	ELEVATION / ONE LINE
ENGR:	AMS		SQUARE D Schneider Electric
DATE:	10/3/2016		
DRAWING STATUS:	RECORD	DWG# 37999262-006 LINE UP	PG 4 OF 4 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
1	UPDATED PRINT	AMS	12/7/16	–	----	--	--/--/--

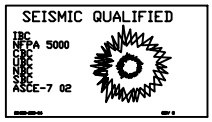
CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		EGB	20/1
3		EGB	20/1
5		EGB	20/1
7		EGB	20/1
9		EGB	20/1
11		EGB	20/1
13		EGB	20/1
15		EGB	20/1
17		EGB	20/1
19		EGB	20/1
21		EGB	20/1
23		EGB	20/1
25		EGB	20/1
27		EGB	20/1
29	PREPARED SPACE	EGB	20/1
31	PREPARED SPACE	EGB	20/1
33	PREPARED SPACE	EGB	20/1
35	PREPARED SPACE	EGB	20/1
37	XFRM PRIMARY	EGB	45/3
39			
41			



RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/1	EGB		2
20/1	EGB		4
20/1	EGB		6
20/1	EGB		8
20/1	EGB		10
20/1	EGB		12
20/1	EGB		14
20/1	EGB		16
20/1	EGB		18
20/1	EGB		20
20/1	EGB		22
20/1	EGB		24
20/1	EGB		26
20/1	EGB	PREPARED SPACE	28
20/1	EGB	PREPARED SPACE	30
20/1	EGB	PREPARED SPACE	32
20/1	EGB	PREPARED SPACE	34
20/1	EGB	PREPARED SPACE	36
20/1	EGB	PREPARED SPACE	38
20/1	EGB	PREPARED SPACE	40
20/1	EGB	PREPARED SPACE	42

37999262–FM1

SEISMIC QUALIFIED LABEL REQUIRED



PHYSICAL DATA

- ENCLOSURE: INTERIOR ONLY

  FRONT CAT#: N/A
  BOX CAT#: N/A
  DIMENSIONS:
  "H X "W X "D
  WIRE BENDING SPACE:
  TOP
  BOTTOM
  SIDE
  PBA 507A
- BUSSING: COPPER BUS
  STANDARD PLATING
- SPECIAL:
  SPD SURGE SUPPRESSION
  PEAK SURGE RATING: 100kA
  WITH DRY CONTACTS
  WITH SURGE COUNTER
  STANDARD SOLID NEUTRAL
  STANDARD GROUND BAR

ELECTRICAL DATA

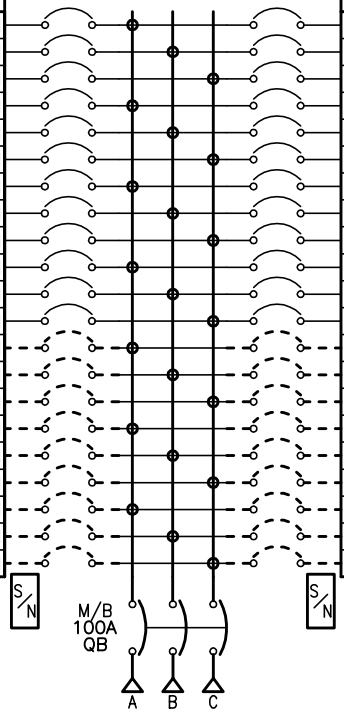
- SYSTEM: 480Y/277 VAC 3PH 4W 60 HZ
  35,000 AMPS SYMS.
- MAIN LUGS: 225A
  ACC:
  TOP FEED
- BRANCH MOUNTING TYPE: BOLT–ON

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	PANEL 1EH1
JOB LOCATION:	WEBSTER GROVES, MO	EQUIPMENT TYPE:	NF
DRAWN BY:	AMS	DRAWING TYPE:	IPC2
ENGR:	AMS		SQUARE D Schneider Electric
DATE:	10/3/2016		
DRAWING STATUS:	RECORD	DWG# 37999262–007–1–01–1	PG 1 OF 4 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

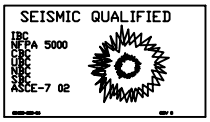
CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		QOB	20/1
3		QOB	20/1
5		QOB	20/1
7		QOB	20/1
9		QOB	20/1
11		QOB	20/1
13		QOB	20/1
15		QOB	20/1
17		QOB	20/1
19		QOB	20/1
21		QOB	15/1
23		QOB	15/1
25	PREPARED SPACE	QOB	20/1
27	PREPARED SPACE	QOB	20/1
29	PREPARED SPACE	QOB	20/1
31	PREPARED SPACE	QOB	20/1
33	PREPARED SPACE	QOB	20/1
35	PREPARED SPACE	QOB	20/1
37	PREPARED SPACE	QOB	20/1
39	PREPARED SPACE	QOB	20/1
41	PREPARED SPACE	QOB	20/1

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/1	QOB		2
20/1	QOB		4
20/1	QOB		6
20/1	QOB		8
20/1	QOB		10
20/1	QOB		12
20/1	QOB		14
20/1	QOB		16
20/1	QOB		18
20/1	QOB		20
15/1	QOB		22
15/1	QOB		24
20/1	QOB	PREPARED SPACE	26
20/1	QOB	PREPARED SPACE	28
20/1	QOB	PREPARED SPACE	30
20/1	QOB	PREPARED SPACE	32
20/1	QOB	PREPARED SPACE	34
20/1	QOB	PREPARED SPACE	36
20/1	QOB	PREPARED SPACE	38
20/1	QOB	PREPARED SPACE	40
20/1	QOB	PREPARED SPACE	42



NQ442L2CSR/NQMB2QSK/QBL32100

SEISMIC QUALIFIED LABEL REQUIRED



PHYSICAL DATA

- o ENCLOSURE: INTERIOR ONLY

  FRONT CAT#: N/A
  BOX CAT#: N/A
  DIMENSIONS:
  "H X "W X "D
  WIRE BENDING SPACE:
  TOP
  BOTTOM
  SIDE

- o BUSSING: COPPER BUS
  STANDARD PLATING
- o SPECIAL:
  STANDARD SOLID NEUTRAL
  STANDARD GROUND BAR

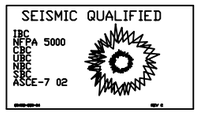
ELECTRICAL DATA

- o SYSTEM: 208Y/120V 3PH 4W 60Hz
  10,000 AMPS SYMS. SCCR
- o MAIN BREAKER: 100A
  ACC:
  BOTTOM FEED
- o BRANCH MOUNTING TYPE: BOLT–ON

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	PANEL 1EL1
JOB LOCATION:	WEBSTER GROVES, MO	EQUIPMENT TYPE:	NQ
DRAWN BY:	AMS	DRAWING TYPE:	IPC2
ENGR:	AMS		SQUARE D Schneider Electric
DATE:	10/3/2016		
DRAWING STATUS:	RECORD	DWG# 37999262-007-1-01-2	PG 2 OF 4 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--	–	----	--	--/--
1	UPDATED PRINT	AMS	12/7/16	–	----	--	--/--	–	----	--	--/--

SEISMIC QUALIFIED LABEL REQUIRED



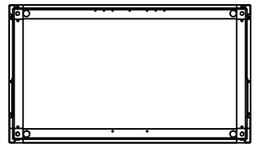
FACTORY INSTALLED POWER CABLES

CABLED FROM	CONNECT TO	CABLED FROM	CONNECT TO	PHASE WIRE SIZE	QTY PER PHASE
PANEL 1EH1	MAIN LUGS	LOAD LUGS	1EH1 PRIMARY DISCONNECT (225A)	#4/0	1
T–1EL1 30 KVA	PRIMARY LUGS	PANEL 1EH1	BREAKER (45A) CKT 37	#8	1
T–1EL1 30 KVA	SECONDARY LUGS	PANEL 1EL1	MAIN BREAKER (100A)	#3	1

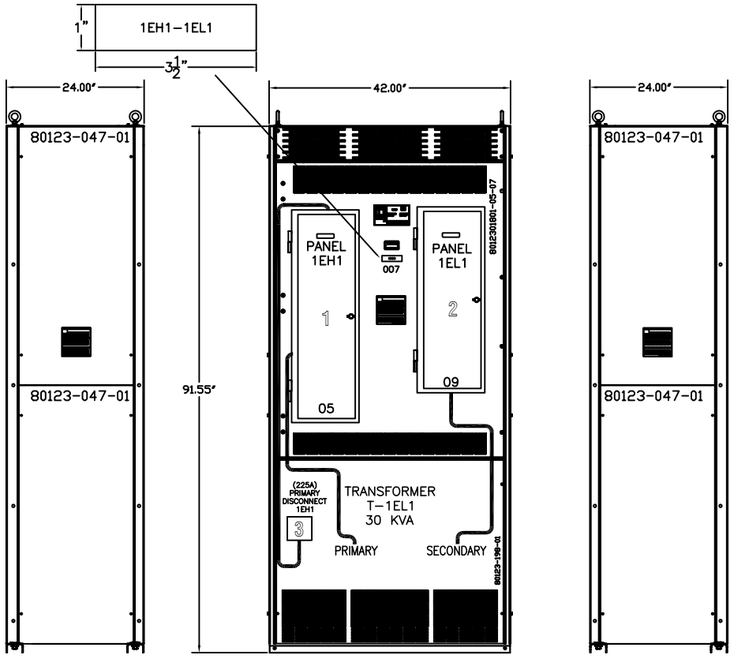
PANEL INFORMATION

CELL REFERENCE	DESCRIPTION	PANEL FEED	TOP BRACKET LOCATION	MIDDLE BRACKET LOCATION	BOTTOM BRACKET LOCATION	DIVIDER HOLE LOCATION	GROUND BAR
1	PANEL 1EH1	TOP	A/B	–/–	K/L	–	PK27GTACU
2	PANEL 1EL1	BOTTOM	C/D	–/–	G/H	–	PK27GTACU
3	(8012320552) JGL36225	---	–/–	–/–	–/–	–	----

ENCLOSURE DATA:
NEMA TYPE 1
COLOR: ANSI 49



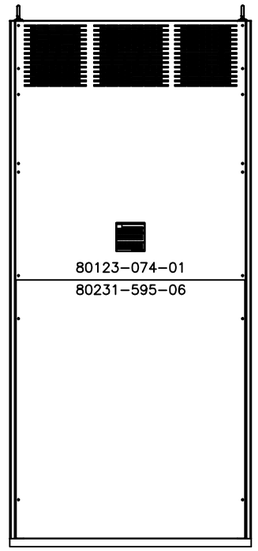
TOP VIEW



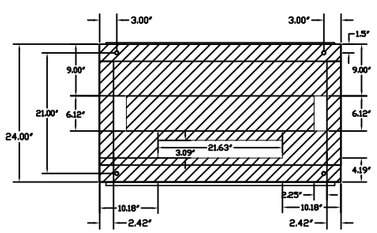
LEFTSIDE VIEW
(STD COVERS)

BACK OF ENCLOSURE

RIGHTSIDE VIEW
(STD COVERS)



BACK VIEW (COVERS REQ'D)



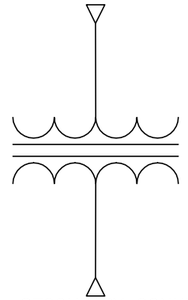
FRONT OF ENCLOSURE
BOTTOM VIEW

NOTE
BRANCH CIRCUIT WIRING DONE BY SQUARE D WILL BE COLOR CODED!

480V/277V	208V/120V
A PHASE – BROWN	A PHASE – BLACK
B PHASE – ORANGE	B PHASE – RED
C PHASE – YELLOW	C PHASE – BLUE
NEUTRAL – GRAY	NEUTRAL – WHITE

ALL WIRING ABOVE #10 AWG TO BE PHASE COLORED ON EACH END.

PRIMARY CONNECTION
CABLED TO PANEL 1EH1



SECONDARY CONNECTION
CABLED TO PANEL 1EL1

TRANSFORMER DATA:

DESIGNATION: T–1EL1

30 KVA (EX30T3HF)

ENERGY EFFICIENT

TRANSFORMER VOLTAGE:
3–PH 480V – 208Y/120V

TRANSFORMER WINDINGS:
ALUMINUM WINDINGS

OPTIONS:
H–220°C INS, 115°C RISE
42dB 400lbs 18K

GROUND BUS PER UL891

GENERAL NOTES

1. REFERENCE INSTRUCTIONS BULLETIN 80043–708–XX FOR HANDLING, INSTALLATION, ANCHORING, INSPECTION & MAINTENANCE.
2. SOLID LINE (——) REPRESENTS FACTORY INSTALLED CABLES.
3. INSTALL (1) 220–9309 LOCKABLE LATCH ON EACH PANELBOARD COVER DOOR,
4. REFER TO INTERNAL DATA SHEETS FOR ASSEMBLY INSTRUCTIONS.

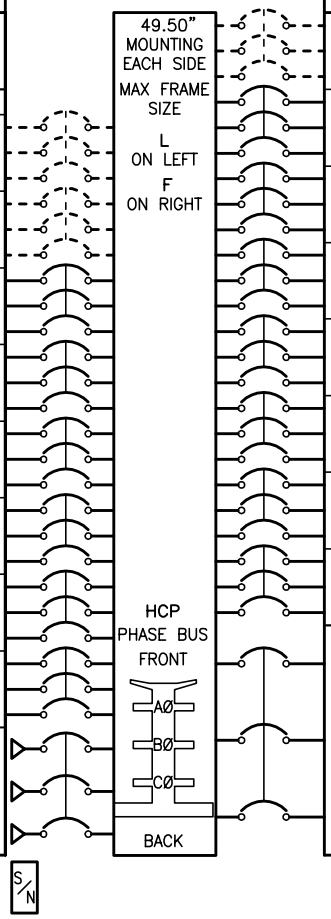
STRUCTURE BOM ASSEMBLY #
8012302870

INDICATES EQUIPMENT THAT INTERFERES WITH CONDUIT ENTRY

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1EH1–1EL1
JOB LOCATION:	WEBSTER GROVES, MO	EQUIPMENT TYPE:	NEXT GEN / TRANSFORMER COMBO
DRAWN BY:	AMS	DRAWING TYPE:	ELEVATION / ONE LINE
ENGR:	AMS		SQUARE D Schneider Electric
DATE:	10/3/2016		
DRAWING STATUS:	RECORD	DWG# 37999262–007–1–01–3	PG 3 OF 4 REV –

REV	DESCRIPTION	BY	DATE				
–	----	--	--/--/--	–	----	--	--/--/--

CKT NO	ACCESSORIES	TYPE	RATING AMP/P	PHASE BUS CONN
	40517-407-01 (4½" FILLER)			
	40517-408-01 (1½" FILLER)			
1	PS 4.50" FP	FA	100/3	ABC
3	PS 4.50" FP	FA	100/3	ABC
5		JG	150/3	ABC
7		FH	60/3	ABC
9		FH	60/3	ABC
11		FH	60/3	ABC
13		FH	35/3	ABC
15		FH	35/3	ABC
	BRANCH MOUNTED MAIN	LH	400/3	ABC



PHASE BUS CONN	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
ABC	100/3	FA	PS 4.50" FP	2
ABC	45/3	FH		4
ABC	15/3	FH		6
ABC	15/3	FH		8
ABC	15/3	FH		10
ABC	15/3	FH		12
ABC	15/3	FH		14
ABC	70/3	FH	XFRM PRIMARY	16
ABC	60/3	HL	SPD	

HCP50864/40517-426-51

PHYSICAL DATA

- ENCLOSURE: INTERIOR ONLY

  FRONT CAT#: N/A
  BOX CAT#: N/A
  DIMENSIONS:
  "H X "W X "D
  WIRE BENDING SPACE:
  TOP
  BOTTOM
  SIDE

- BUSSING: COPPER BUS
  STANDARD PLATING
- SPECIAL:
  COPPER SOLID NEUTRAL
  COPPER GROUND BAR

ELECTRICAL DATA

- SYSTEM: 480Y/277 VAC 3PH 4W 60 HZ
  25,000 AMPS SYMS. SCCR
- MAIN: MAIN BREAKER: 400A
  BOTTOM FEED
- BRANCH MOUNTING TYPE: PLUG-ON

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	PANEL 1SH1
JOB LOCATION:	WEBSTER GROVES, MO	EQUIPMENT TYPE:	I-LINE
DRAWN BY:	AMS	DRAWING TYPE:	IPC2
ENGR:	AMS		SQUARE D Schneider Electric
DATE:	11/1/2016		
DRAWING STATUS:	RECORD	DWG# 37999262-008-1-01-1	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--	–	----	--	--/--
–	----	--	--/--	–	----	--	--/--	–	----	--	--/--

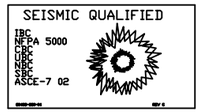
FACTORY INSTALLED POWER CABLES:

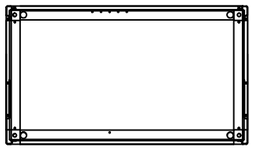
CABLE FROM	CONNECT TO	CABLE TO	CONNECT TO	WIRE SIZE	QTY PER PHASE
PANEL 1SH1	BREAKER (70A/3P)	TRANSFORMER T–1SL1	PRIMARY LUGS	#4	1
CONNECT FEEDER TO PANEL 1SH1 AND ROLL UP INSIDE ENCLOSURE, NEED APPROX 12' PER PHASE.					

PANELS INFORMATION:

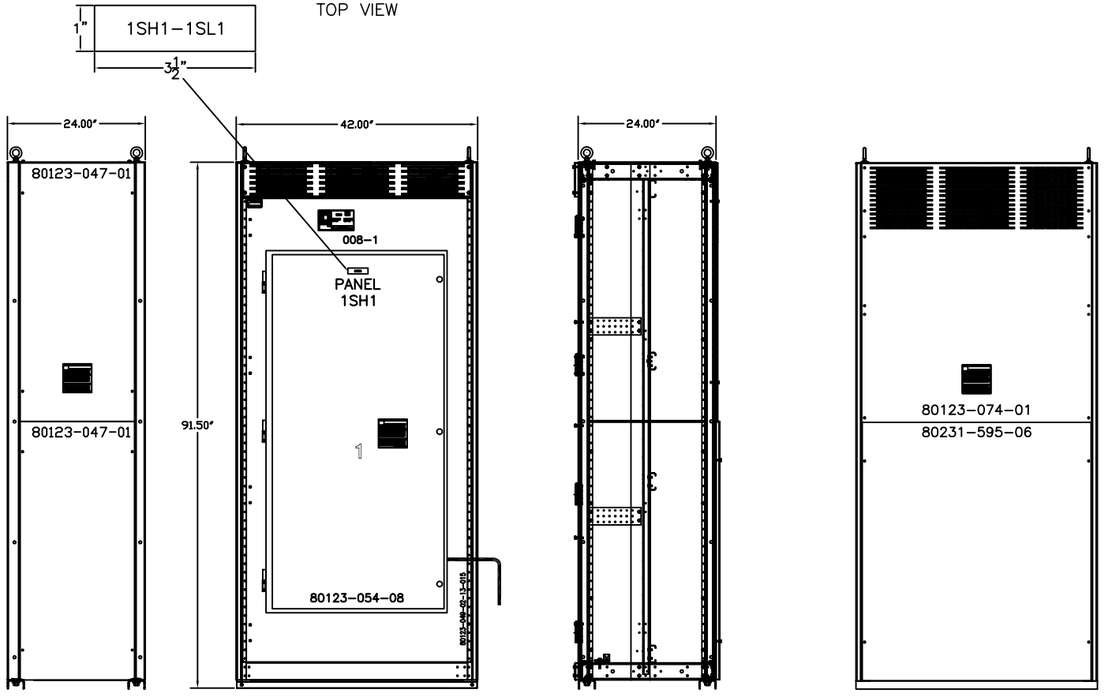
CELL REFERENCE	PANEL	PANEL FEED	TOP BRACKET LOCATION	BOTTOM BRACKET LOCATION	DIVIDER HOLE LOCATION	GROUND BAR
1	PANEL 1SH1	BOTTOM	A–3/D–3	A–26/D–26	----	PK32DGTACU

SEISMIC QUALIFIED LABEL REQUIRED





TOP VIEW

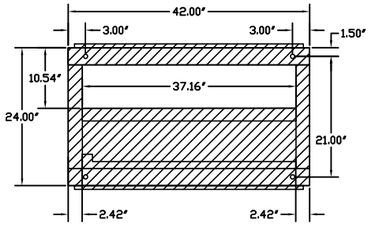


LEFTSIDE VIEW (STD COVERS)

BACK OF ENCLOSURE

RIGHTSIDE VIEW (NO COVERS)

BACK VIEW (COVERS REQ'D)



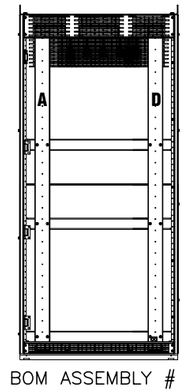
FRONT OF ENCLOSURE BOTTOM VIEW

NOTE
BRANCH CIRCUIT WIRING DONE BY SQUARE D WILL BE COLOR CODED!

480V/277V
A PHASE – BROWN
B PHASE – ORANGE
C PHASE – YELLOW
NEUTRAL – GRAY
ALL WIRING ABOVE #10 AWG TO BE PHASE COLORED ON EACH END.

GENERAL NOTES

1. REFERENCE INSTRUCTION BULLETIN 80043–708–03 FOR HANDLING, INSTALLATION, ANCHORING, INSPECTION & MAINTANENCE.
2. SOLID LINE (——)REPRESENTS FACTORY INSTALLED CABLES.
3. INSTALL 1–220–9309 LOCKABLE LATCH ON EACH PANELBOARD COVER DOOR.
4. REFER TO DATA SHEETS 80123–DS–000P1 TO 80123–DS–022P1 FOR ASSEMBLY INSTRUCTIONS.

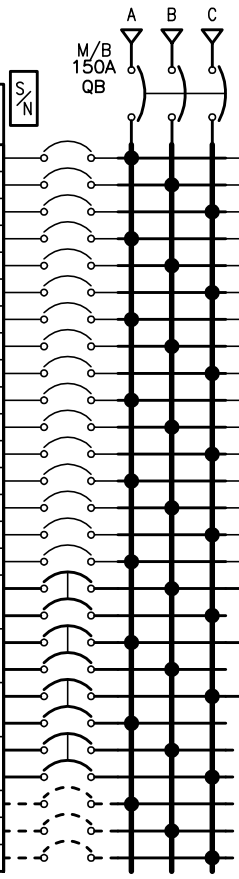


STRUCTURE BOM ASSEMBLY #
8012306361I

INDICATES EQUIPMENT THAT INTERFERES WITH CONDUIT ENTRY

JOB NAME:	WEBSTER UNIVERSITY ISP	EQUIPMENT DESIGNATION:	1SH1–1SL1
JOB LOCATION:	WEBSTER GROVEES, MO	EQUIPMENT TYPE:	NEXT GEN / TRANSFORMER COMBO
DRAWN BY:	AMS	DRAWING TYPE:	ELEVATION / ONE LINE
ENGR:	AMS		SQUARE D Schneider Electric
DATE:	11/2/2016		
DRAWING STATUS:	RECORD	DWG# 37999262–008–1–01–2	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
1	UPDATED PRINT	AMS	12/6/16	–	----	--	--/--/--

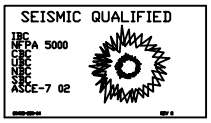


CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		QOB	20/1
3		QOB	20/1
5		QOB	20/1
7		QOB	20/1
9		QOB	20/1
11		QOB	20/1
13		QOB	20/1
15		QOB	20/1
17		QOB	20/1
19		QOB	20/1
21		QOB	20/1
23		QOB	20/1
25		QOB	20/1
27		QOB	20/1
29		QOB	20/1
31		QOB	20/1
33		QOB	30/2
35			
37		QOB	30/2
39			
41		QOB	30/2
43			
45		QOB	30/2
47			
49	PREPARED SPACE	QOB	20/1
51	PREPARED SPACE	QOB	20/1
53	PREPARED SPACE	QOB	20/1

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/1	QOB		2
20/1	QOB		4
20/1	QOB		6
20/1	QOB		8
20/1	QOB		10
20/1	QOB		12
20/1	QOB		14
20/1	QOB		16
20/1	QOB		18
20/1	QOB		20
20/1	QOB		22
20/1	QOB		24
20/1	QOB		26
20/1	QOB		28
20/1	QOB		30
20/1	QOB		32
150/3	QOB–VH		34
			36
			38
			40
			42
			44
20/1	QOB	PREPARED SPACE	46
20/1	QOB	PREPARED SPACE	48
20/1	QOB	PREPARED SPACE	50
20/1	QOB	PREPARED SPACE	52
20/1	QOB	PREPARED SPACE	54

NQ454L2C/NQMB2Q/QBL32150

SEISMIC QUALIFIED LABEL REQUIRED



PHYSICAL DATA

- ENCLOSURE: INTERIOR ONLY

  FRONT CAT#: N/A
  BOX CAT#: N/A
  DIMENSIONS:
  "H X "W X "D
  WIRE BENDING SPACE:
  TOP
  BOTTOM
  SIDE
  PBA 709A
- BUSSING: COPPER BUS
  STANDARD PLATING
- SPECIAL:
  COPPER SOLID NEUTRAL
  COPPER GROUND BAR

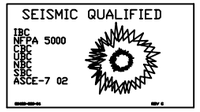
ELECTRICAL DATA

- SYSTEM: 208Y/120 VAC 3PH 4W 60 HZ
  10,000 AMPS SYMS. SCCR
- MAIN BREAKER: 150A
  TOP FEED
- BRANCH MOUNTING TYPE: BOLT–ON

JOB NAME:	WEBSTER UNIVERSITY ISP	EQUIPMENT DESIGNATION:	1SL1
JOB LOCATION:	WEBSTER GROVEES, MO	EQUIPMENT TYPE:	NQ PANEL
DRAWN BY:	AMS	DRAWING TYPE:	IPC2
ENGR:	AMS		
DATE:	11/2/2016		
DRAWING STATUS:	RECORD	DWG# 37999262-008-2-01-1	PG 3 OF 5 REV –

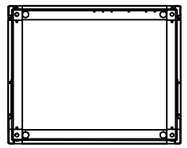
REV	DESCRIPTION	BY	DATE								
–	----	--	--/--	–	----	--	--/--	–	----	--	--/--
–	----	--	--/--	–	----	--	--/--	–	----	--	--/--

SEISMIC QUALIFIED LABEL REQUIRED



FACTORY INSTALLED POWER CABLES

CABLED FROM	CONNECT TO	CABLED FROM	CONNECT TO	PHASE WIRE SIZE	QTY PER PHASE
TRANSFORMER T–1SL1	150A/3P MAIN BRK	PANEL 1SL1	SECONDARY LUGS	#1/0	1

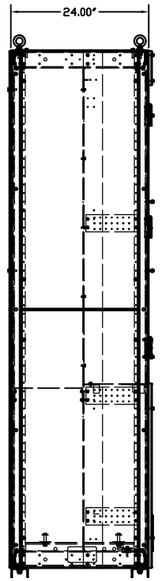


TOP VIEW

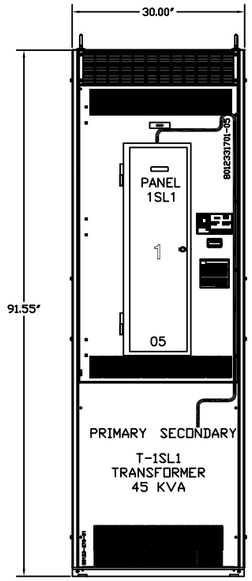
PANEL INFORMATION

SECTION #	CELL REFERENCE	DESCRIPTION	PANEL FEED	TOP BRACKET LOCATION	BOTTOM BRACKET LOCATION	GROUND BAR
2	1	PANEL 1SL1	TOP	B/C	J/K	PK27GTACU

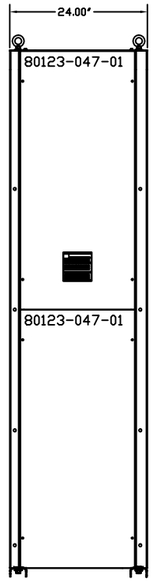
ENCLOSURE DATA:
NEMA TYPE 1 FREE STANDING
COLOR: ANSI 49



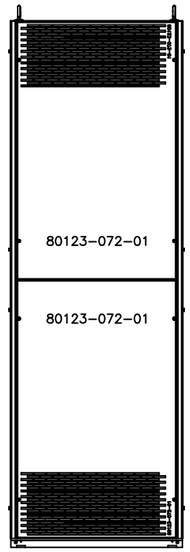
LEFTSIDE VIEW
(NO COVERS)



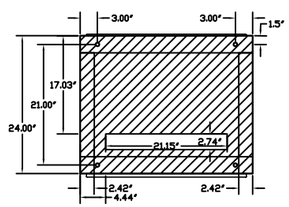
BACK OF ENCLOSURE



RIGHTSIDE VIEW
(STD COVERS)



BACK VIEW (COVERS REQ'D)



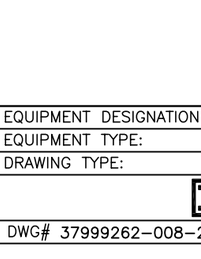
FRONT OF ENCLOSURE
BOTTOM VIEW

NOTE
BRANCH CIRCUIT WIRING DONE BY SQUARE D WILL BE COLOR CODED!

480V/277V	208V/120V
A PHASE – BROWN	A PHASE – BLACK
B PHASE – ORANGE	B PHASE – RED
C PHASE – YELLOW	C PHASE – BLUE
NEUTRAL – GRAY	NEUTRAL – WHITE

ALL WIRING ABOVE #10 AWG TO BE PHASE COLORED ON EACH END.

PRIMARY CONNECTION
CABLED TO PANEL 1SH1



SECONDARY CONNECTION
CABLED TO PANEL 1SL1

TRANSFORMER DATA:

DESIGNATION: T–1SL1

45 KVA (EX45T3HF)

ENERGY EFFICIENT

TRANSFORMER VOLTAGE:
3–PH 480V – 208Y/120V

TRANSFORMER WINDINGS:
ALUMINUM WINDINGS

OPTIONS:
H–220°C INS, 115°C RISE

GROUND BUS PER UL891

GENERAL NOTES

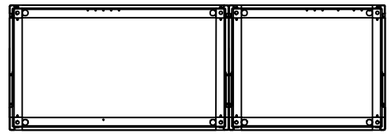
1. REFERENCE INSTRUCTIONS BULLETIN 80043–708–XX FOR HANDLING, INSTALLATION, ANCHORING, INSPECTION & MAINTENANCE.
2. SOLID LINE (——) REPRESENTS FACTORY INSTALLED CABLES.
3. INSTALL (1) 220–9309 LOCKABLE LATCH ON EACH PANELBOARD COVER DOOR,
4. REFER TO INTERNAL DATA SHEETS FOR ASSEMBLY INSTRUCTIONS.

STRUCTURE BOM ASSEMBLY #
8012330955R

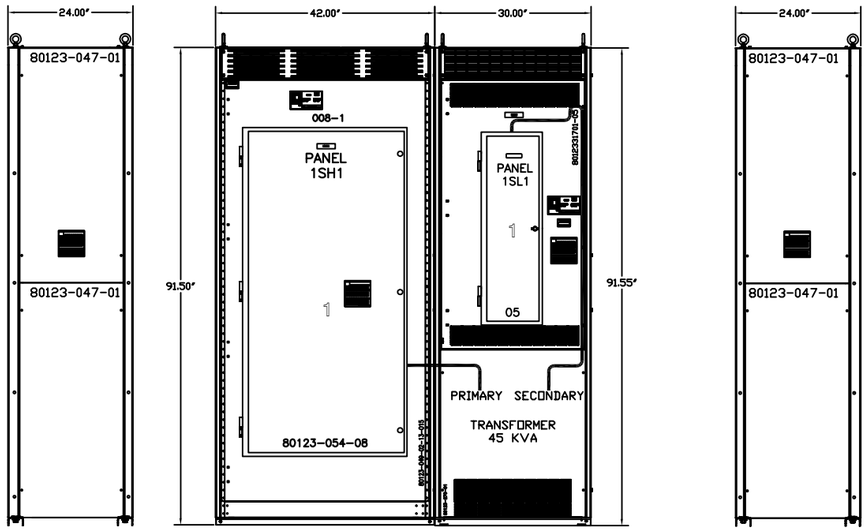
INDICATES EQUIPMENT THAT INTERFERES WITH CONDUIT ENTRY

JOB NAME:	WEBSTER UNIVERSITY ISP	EQUIPMENT DESIGNATION:	1SH1–1SL1
JOB LOCATION:	WEBSTER GROVEES, MO	EQUIPMENT TYPE:	NEXT GEN / TRANSFORMER COMBO
DRAWN BY:	AMS	DRAWING TYPE:	ELEVATION / ONE LINE
ENGR:	AMS		SQUARE D Schneider Electric
DATE:	11/2/2016		
DRAWING STATUS:	RECORD	DWG# 37999262–008–2–01–2	PG 3 OF 5 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--	–	----	--	--/--
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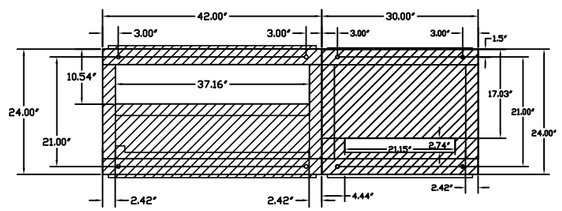
TOP VIEW TOP VIEW



LEFTSIDE VIEW
(STD COVERS)

RIGHTSIDE VIEW
(STD COVERS)

BACK OF ENCLOSURE



FRONT OF ENCLOSURE
BOTTOM VIEW

JOB NAME:	WEBSTER UNIVERSITY ISP	EQUIPMENT DESIGNATION:	1SH1–1SL1
JOB LOCATION:	WEBSTER GROVEES, MO	EQUIPMENT TYPE:	NEXT GEN / TRANSFORMER COMBO
DRAWN BY:	AMS	DRAWING TYPE:	ELEVATION / ONE LINE
ENGR:	AMS		SQUARE D Schneider Electric
DATE:	11/2/2016		
DRAWING STATUS:	RECORD	DWG# 37999262–008 LINE UP	PG 5 OF 5 REV –

Integrated Power Center 2 (IPC2™)
Integrated Power and Control Solutions (IPaCS)
Class 2735

Instruction Bulletin

80043-708-04
07/2010

Retain for future use.



SQUARE D
by Schneider Electric

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HAZARD CATEGORIES AND SPECIAL SYMBOLS

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** property damage.

NOTE: Provides additional information to clarify or simplify a procedure.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Section 1—Introduction

This bulletin contains instructions for the proper installation, operation, and maintenance of Square D® Integrated Power and Control Solutions (IPaCS™) Integrated Power Center 2 (IPC2™) equipment manufactured by Schneider Electric. The purchaser's engineering, installation, and operating staff supervisors should familiarize themselves with this bulletin and become acquainted with the appearance and characteristics of each piece of equipment mounted or contained in the IPC2.

These instructions and procedures apply to IPC2 installations by Schneider Electric. When special features or non-standard components are incorporated in the IPC2, detailed instructions for these components are included in the instruction material holder.

Inspection and Packaging

Every IPC2 is carefully inspected and packaged at the assembly plant. Construction of the IPC2 is checked, both structurally and electrically, for compliance with all specifications, codes, and standards. After a complete inspection, the IPC2 is prepared for shipment. The factory order number, the identification number, and the shipping weights are plainly marked on each shipping block.

Document Replacement

Contact your nearest Schneider Electric field office to replace lost or damaged wiring diagrams and instruction sheets. Use the factory order number as a reference.

Section 2—Safety Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must be installed and serviced only by qualified personnel.
- Perform such work only after reading and understanding all of the instructions contained in this bulletin.
- Turn off all power supplying this equipment before working on or inside equipment.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume all circuits are live until they are completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm power is off.
- Handle this equipment carefully and install, operate, and maintain it correctly in order for it to function properly. Neglecting fundamental installation and maintenance requirements may lead to personal injury, as well as damage to equipment or other property.
- Disconnect the neutral connection at any TVSS or other electronic device prior to performing electrical insulation resistance tests; reconnect to the device after testing.
- Carefully inspect your work area and remove any tools and objects left inside the equipment.
- Replace all devices, doors, and covers before turning on power to this equipment.
- All instructions in this bulletin assume that the customer has taken these measures before performing maintenance or testing.

Failure to follow these instructions will result in death or serious injury.

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Section 3—Receiving, Handling, and Storing

Receiving

Upon receipt, check the packing list against the equipment received to ensure the order and shipment are complete. Also upon receipt, immediately inspect the IPC2™ shipping blocks for any damage that may have occurred in transit. If damage is found or suspected, file a claim with the carrier immediately and notify the nearest Schneider Electric representative. Claims for shortages or errors must be made in writing to Schneider Electric within 60 days after delivery. Failure to give such notice will constitute unqualified acceptance and a waiver of all such claims by the purchaser.

Delivery of equipment to a carrier at any of the Schneider Electric plants or other shipping points constitutes delivery to the purchaser regardless of freight payment and title. All risk of loss or damage pass to the purchaser at that time.

For details concerning claims for equipment shortages and other errors, refer to Schneider Electric “Terms and Conditions of Sale.”

Handling

CAUTION

HAZARD OF EQUIPMENT DAMAGE

Do not lay the NEMA 1 enclosed IPC2 equipment on its back or front. Do not lay the NEMA 1 enclosed IPC2 equipment on its side during transit to the job site. When necessary at the job site, the NEMA 1 enclosed IPC2 equipment may be carefully and gently laid onto its side. The NEMA 1 enclosed IPC2 equipment should be returned to its upright position as soon as possible. Then inspect the structure and its contents to ensure all components and insulators remained undamaged and secured before continuing the installation of the IPC2 equipment.

All IPC2 equipment with drip hoods or with NEMA 3R enclosures must always be kept upright during handling.

Failure to follow these instructions can result in equipment damage.

Ensure that proper equipment, such as an overhead crane, is available at the installation site to handle the IPC2.

The shipping weight of each shipping block is marked on the packing list. Verify the lifting capacity of the equipment being used to handle the IPC2 in accordance with the shipping weight of each shipping block. Whenever possible, keep the NEMA 1 enclosed IPC2 equipment upright during handling. If it is necessary to lay this equipment down, see the caution statement on this page for instructions. All IPC2 equipment with drip hoods or with NEMA 3R enclosures must always be kept upright during handling.

Schneider Electric recommends using an overhead crane, lifting eyebolts, and cables or chains to handle the NEMA 1 enclosed IPC2. This method and alternative handling methods are discussed in this section.

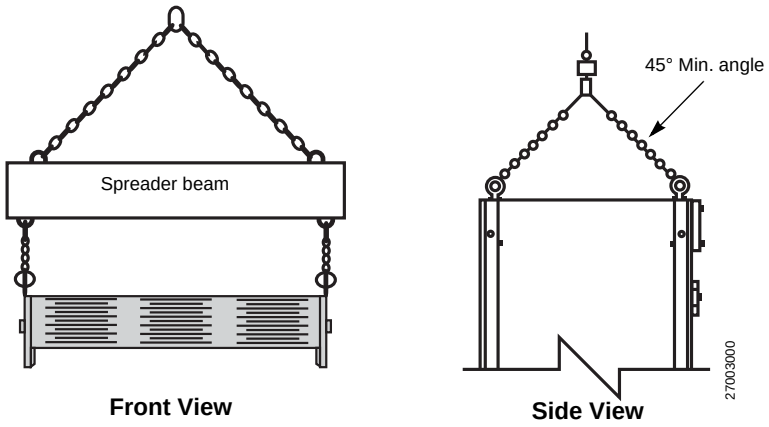
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Handling NEMA 1 IPC2 Enclosures with Lifting Eyebolts

Schneider Electric provides lifting eyebolts as standard equipment for NEMA 1 enclosed IPC2 shipping blocks. Instruction labels on each shipping block include drawings and written instructions outlining the proper use of the lifting eyebolts (Figure 1). Use rigid spreaders or a spanner bar to provide vertical lift on the lifting eyebolts. This will help prevent damage to the frame or finish.

NOTE: For NEMA 1 enclosures with drip hoods, see “Handling NEMA 3R Enclosures or NEMA 1 IPC2 Enclosures with Drip Hoods” on page 9.

Figure 1: Lifting with an Overhead Crane, Lifting Eyebolts, and Cables or Chains



Front View **Side View**

Follow these instructions to handle the NEMA 1 enclosed IPC2:

1. Use load-rated cables or chains with safety hooks or shackles. Do not pass cables or chains through holes in lifting means.
2. Use a load-rated spreader beam to prevent structure damage. Rig so that the minimum angle between the lifting cables or chains and equipment top is 45 degrees.

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The following lifting warning labels (Figure 2) are attached to the IPC2.

Figure 2: Lifting Warning Labels for IPC2



Front Label on IPC2



Rear Label on IPC2



Label Applied Adjacent to Lifting Eyebolts

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Handling NEMA 3R Enclosures or NEMA 1 IPC2 Enclosures with Drip Hoods

Rollers or slings may be used to handle the shipping blocks. When elevating a shipping block without the use of the lifting eyebolts, an overhead crane equipped with either of the following may be used:

- Load rated chain coupled to a sling rigging
- Load rated wire cable with safety hooks and shackles

Wrap the sling completely around the IPC2 and shipping stringers (see Figure 3).

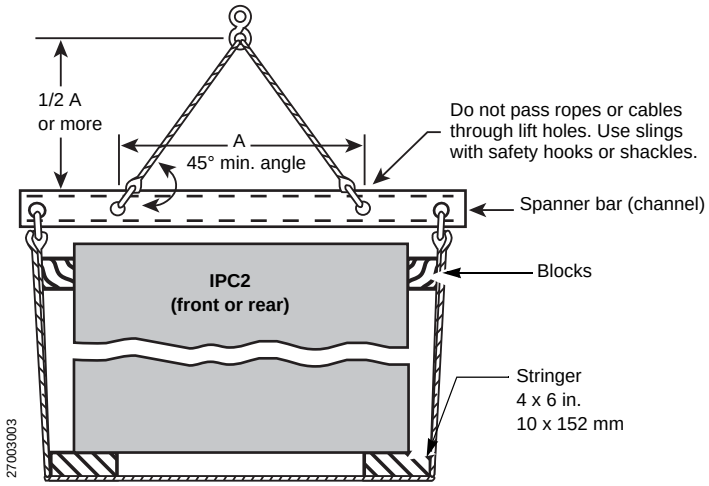
⚠ WARNING

HAZARD OF EQUIPMENT DAMAGE—TOP HEAVY LOAD

Stabilize the shipping block to reduce the possibility of tipping.

Failure to follow these instructions can result in death or serious injury.

Figure 3: IPC2 in Sling Rigging



A forklift is an alternative method of handling the IPC2.

NOTE: Always check the fork lengths to ensure that the forks extend under the entire IPC2. Carefully balance the load, and always use a safety strap when handling or moving an IPC2 with a forklift (Figure 4).

Figure 4: Forklift Safety Strap



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Storing

When storing the IPC2 before installation, cover the top and any openings of the equipment during the construction period to protect the IPC2 from dust and debris.

If the IPC2 is not installed and energized immediately, store it in a clean, dry space with a consistent temperature to prevent condensation. Store the IPC2 indoors, if possible. Preferably, store it in a heated building with adequate air circulation and protect it from dirt, fumes, water, and physical damage. Storing the IPC2 outdoors may cause harmful condensation inside the IPC2.

NOTE: Install portable electric heaters of approximately 250 watts per vertical section in both indoor-type and rainproof-type IPC2 enclosures for adequate protection during storage.

Before energizing the space heaters, remove all loose packing or flammable materials inside the IPC2. Outdoor IPC2 equipment is not weather-resistant until completely and properly installed; treat them the same as indoor IPC2 equipment until after installation.

Section 4—Installation

Correct installation of IPC2™ equipment is essential for proper operation of all IPC2 components. Study the associated instruction books and all drawings carefully. In most cases, all drawings are sent to the purchaser before an IPC2 is shipped to enable adequate advance planning.

NOTE: While installing IPC2 equipment, do not use the top of the IPC2 as a support for the weight of the installer.

Location

Find the designated area on the building floor plan where the IPC2 will be installed. The location chosen for installation should provide working clearances complying with Section 110-26 of the National Electrical Code® (NEC®) or Section 2-308 of the Canadian Electrical Code (CEC) Part 1. IPC2 equipment requires field connections, including mains, branches, and ground bus, to be accessible and maintainable from the front.

Foundation Preparation

The floor or foundation must be strong enough to support the weight of the IPC2 without sagging. The surrounding floor area should gently slope toward a drain.

NOTE: For seismic qualifications, read the section “Anchoring the IPC2 for Seismic Qualifications” on page 17 before pouring the floor or foundation.

IPC2 equipment is assembled on true and level floors at the assembly plant. To ensure correct alignment with adjoining equipment, the mounting pad or final installation site must be smooth and level. If parallel steel floor channels are imbedded for mounting the IPC2, take extra care to ensure the floor channels are level over their entire length to avoid distortion of the IPC2 structure. Each channel should be level with the finished floor.

When pouring the foundation, make provisions for conduits entering the IPC2 from below and carrying the incoming and/or outgoing cables, control wiring, and ground cable. The bottom view in the equipment drawing shows the available conduit area for correct layout.

Conduits should project above the finished floor by about 2.00 in. (51 mm). However, to simplify moving the shipping blocks into place, install the conduits flush with the concrete and, after the blocks are in their final position, add the appropriate extension sleeves. Otherwise, raising the shipping block on timbers or lifting it by a crane to clear the conduit hubs will be necessary.

NOTE: Before pouring the foundation, consider installing additional conduits for future circuits.

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IPC2 Preparation

- Remove dirt and debris from the foundation and surrounding area before moving the IPC2 into final position.
- After the IPC2 has been moved to its final installation site, take each shipping block off its shipping stringers.
- Remove all packing materials.

General Installation

Install the IPC2 into its final position by leveling progressively each section and bolting the frames together, if separated. Position shipping sections as follows:

1. Maneuver each shipping section into the desired position using the procedures under “Handling” on page 6.
2. Carefully lower the equipment over the conduit stubs to comply with the “available conduit area” as shown in the bottom view of the equipment drawings. Otherwise, there may not be sufficient cable bending space.
3. Level the shipping section.
4. After the installation of each section is complete, make the ground bus splice connection to the preceding section before installing the next section.

CAUTION

HAZARD OF EQUIPMENT DAMAGE

Level and align adjacent shipping sections with one another. Ensure proper alignment of horizontal main through bus and proper splice bus connections.

Failure to follow these instructions can result in equipment damage.

Joining Shipping Sections—Indoor IPC2 and Switchboards

1. Position each adjacent section, carefully leveling and aligning it with the previous section.
2. Open or remove the front and rear doors and panels, providing access to bolt adjacent shipping sections together.
3. Six bolts (3/8-16 x 1 inch) are provided. Place the bolts through the existing holes in the front and rear vertical corner channels to join adjacent sections (Figure 5).
4. Make the ground bus splice connections to the preceding section. See “Ground Bus Splice Connections Between IPC2 and Power-Style® QED Switchboards” on page 13.
5. Replace and secure all front and rear doors and panels removed in step 2.

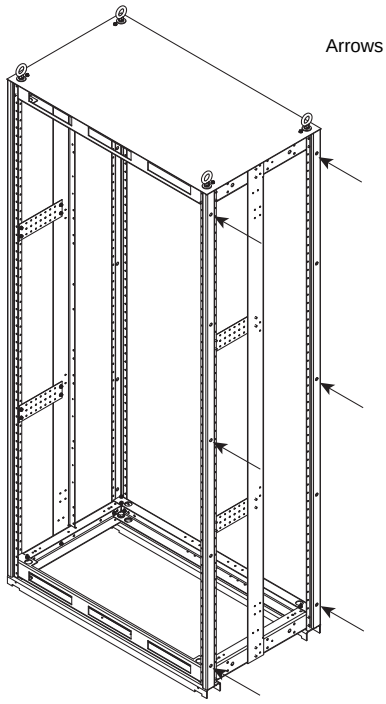
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must be installed and serviced only by qualified personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death and serious injury.

Figure 5: Indoor IPC2



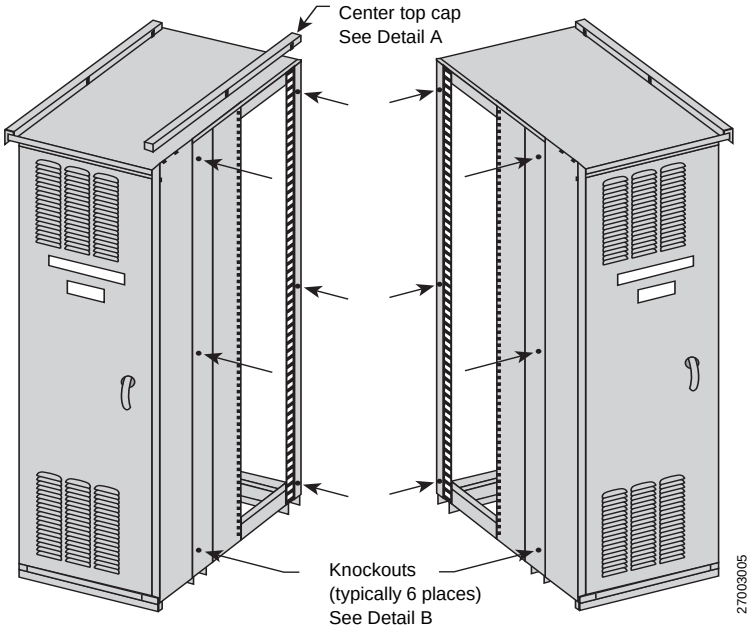
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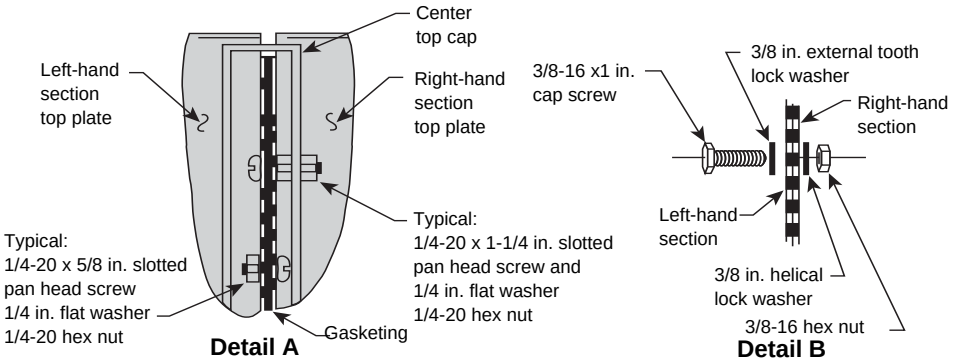
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Joining Shipping Sections—Outdoor IPC2 and Switchboards

1. Remove the center top cap (Figure 6) from the left-hand section, and retain all hardware for reuse.

Figure 6: Joining Adjacent Sections—Outdoor IPC2 and Switchboards





2. When possible, open or remove the front and rear doors and panels, providing access to bolt adjacent shipping sections together.
3. Remove three 0.50-in. (13 mm) diameter knockouts from the front vertical corner channel and three from the rear vertical corner channel (a total of six per frame side) as indicated by the arrows in Figure 6. Ensure the knockouts do not fall into the structure.
4. Position each adjacent section, carefully leveling it and aligning it with the previous section.
5. Six bolts (3/8-16 x 1 inch) are provided. Place them through the holes created in step 3 to join adjacent sections. See Detail B.
6. Make the ground bus splice connections to the preceding section. See “Ground Bus Splice Connections Between IPC2 and Power-Style® QED Switchboards” on page 13.
7. Replace the center top cap removed in step 1. See Figure 6, Detail A.
8. If applicable, replace and secure all the front and rear doors and panels removed in step 2.

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Ground Bus Splice Connections Between IPC2 and Power-Style® QED Switchboards

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

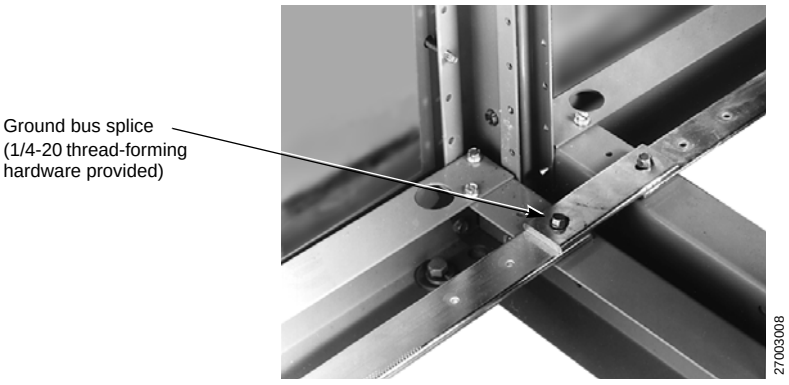
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must be installed and serviced only by qualified personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death and serious injury.

Align and secure the ground bus splice connection between shipping sections. Torque connections to 100 lb-in (11 N•m). See Figure 7.

NOTE: Proper installation is essential for equipment ground-fault systems.

Figure 7: Ground Bus Splice Connection



IPC2 Connection to Indoor Integrated Power Center (IPC) and Modular Panelboard System (MPS)

Integrated Power Center (IPC) and IPC2 Enclosure Splice

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must be installed and serviced only by qualified personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Preparing the IPC2

NOTE: Before joining shipping blocks, ensure the IPC equipment is installed per the Integrated Power Center instruction bulletin no. 80043-056-__.

1. Remove dirt and debris from the foundation and surrounding area before moving the IPC2 enclosure into its final position.
2. After the IPC2 enclosure has been moved to its final installation site, take the equipment off its shipping stringers.

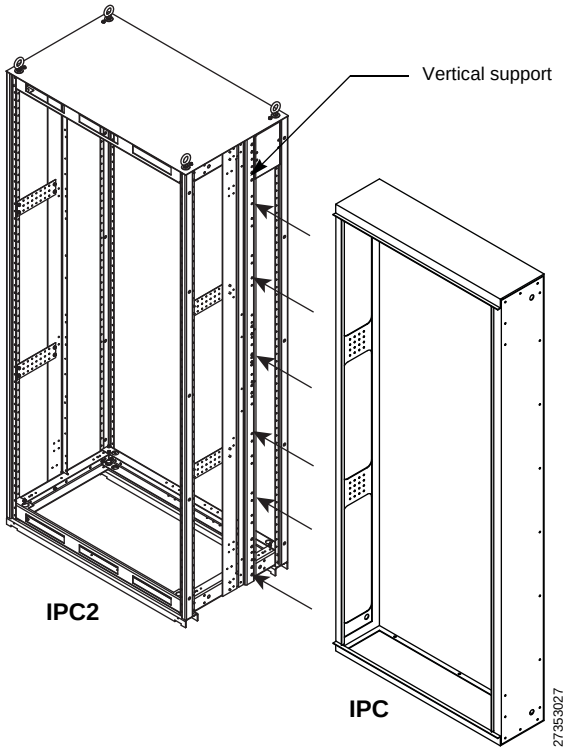
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Joining Shipping Sections

1. Remove the side covers from the IPC2 enclosure to access the vertical support. Open or remove the front doors of the IPC to access the side panels.
2. Position the IPC2 enclosure and IPC sections adjacent to one another, carefully leveling and aligning the rear of each section.

Figure 8: IPC2 and IPC Shipping Sections



3. Locate and move any factory-installed cables through the side openings into the appropriate sections.
4. Bolts (1/4-20 x 1 inch), washers, and nuts are provided in the IPC structure. Seven sets of hardware will be used to join the sections. Align the section splicing holes in the front of the IPC side panel with the corresponding holes in the IPC2 vertical support.
5. Place the bolts through the holes in the IPC2 vertical support and IPC side panels to join the adjacent sections (Figure 8). Secure each bolt with a washer and nut until the connection is finger-tight.
6. Torque the hardware to 72 lb-in (8 N•m) to complete bolting the sections together.
7. Connect any factory-installed cables per Table 3 on page 32.
8. Replace the side covers on the IPC2 enclosure.

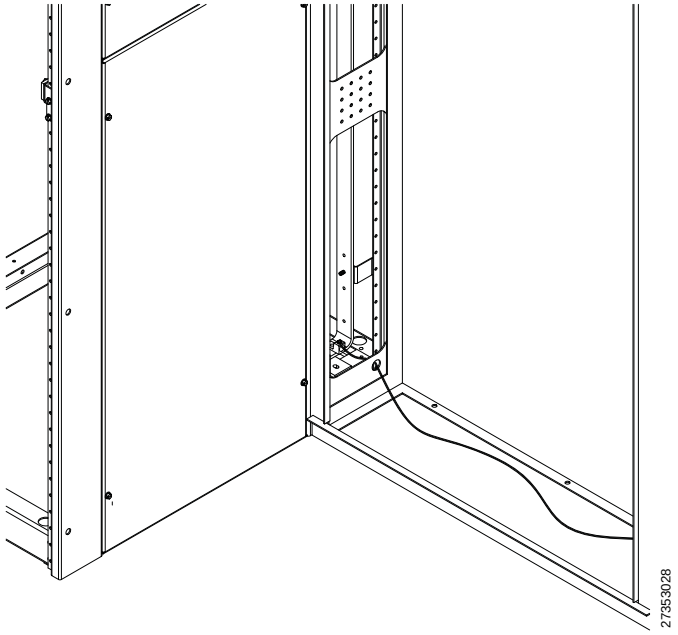
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Making Ground Cable Splice Connections

1. Align and secure the ground cable connection between the IPC shipping sections per the *Integrated Power Center* instruction bulletin (see Figure 9).

   NOTE: Proper installation is essential for equipment ground-fault systems.
2. Locate the ground lug on the horizontal ground bus bar in the bottom of the IPC2 enclosure.
3. Place the stripped end of the ground cable from the IPC sections into the lug on the IPC2 ground bar (Figure 9).
4. Torque the ground cable connection per Table 3 on page 32.
5. Replace the IPC door, and reinstall the side covers on the IPC2 enclosure if not already completed.

Figure 9: Ground Splice Connection



Modular Panelboard System (MPS) and IPC2 Enclosure Splice

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must be installed and serviced only by qualified personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

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Preparing the IPC2

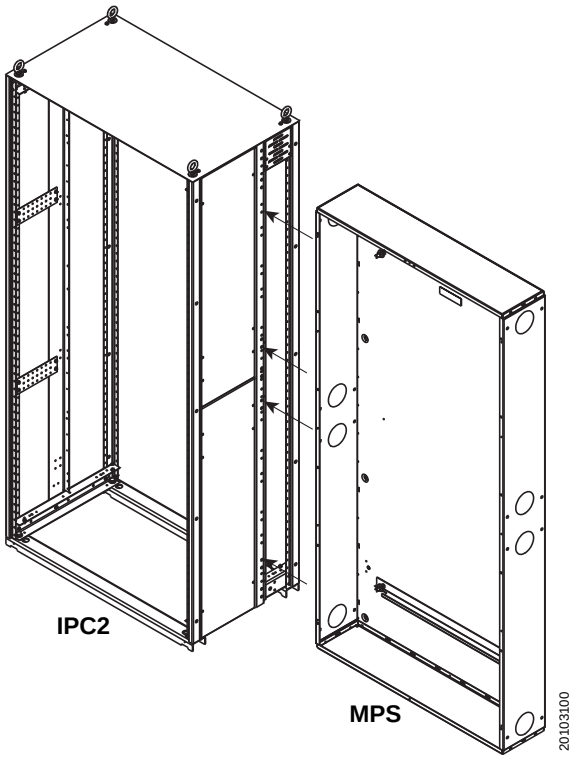
NOTE: Before joining shipping blocks, ensure the MPS equipment is positioned in its final location.

1. Remove dirt and debris from the foundation and surrounding area before moving the IPC2 enclosure into its final position.
2. After the IPC2 enclosure has been moved to its final installation site, take the equipment off its shipping stringers.

Joining Shipping Sections

1. Remove the side covers from the IPC2 enclosure to access the vertical support. Remove the front covers of the MPS to access the side panels of adjacent sections.
2. Position the IPC2 enclosure and MPS sections adjacent to one another, carefully leveling and aligning the rear of each sections.

Figure 10: IPC2 and MPS Shipping Sections



3. Locate and move any factory-installed cables through the side openings into the appropriate sections.
4. Bolts (3/8-16-x 1 inch), washers, and nuts are provided in the MPS structure. Four sets of hardware will be used to join the sections. Align the section splicing holes in the front of the MPS side panel with the corresponding holes in the IPC2 vertical support.
5. Place the bolts through the holes in the IPC2 vertical support and MPS side panels to join the adjacent sections (Figure 10). Secure each bolt with a washer and nut until the connection is finger-tight.
6. Torque the hardware to 72 lb-in (8 N•m) to complete bolting the sections together.
7. Connect any factory-installed cables per Table 3 on page 32.
8. Replace the side covers on the IPC2 enclosure.

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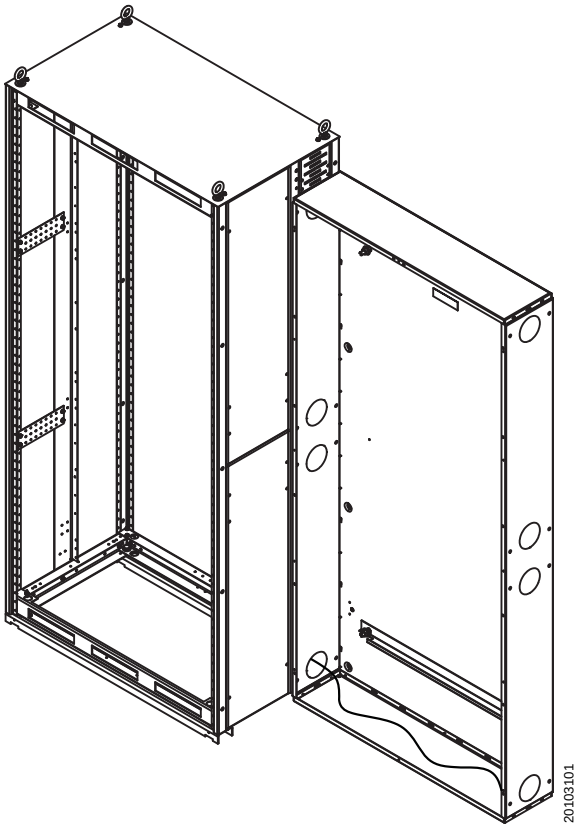
Making Ground Cable Splice Connections

1. Run ground cable from the MPS ground bar to the IPC2 enclosure ground bar (see Figure 11).

   NOTE: Proper installation is essential for equipment ground-fault systems.

2. Locate the ground lug on the horizontal ground bus bar in the bottom of the IPC2 enclosure.
3. Place the stripped end of the ground cable into the lug on the IPC2 ground bar (Figure 11).
4. Torque the ground cable connection per Table 3 on page 32.
5. Replace the MPS covers, and reinstall the side covers on the IPC2 enclosure if not already completed.

Figure 11: Ground Splice Connection



Anchoring the IPC2 for Seismic Qualifications

IPC2 equipment that is seismically certified has been qualified to the site-specific seismic requirements of the listed model building codes and/or standards. Optional construction features may be required, depending on the location of the installation and the particular code and/or standard of interest. Seismic certificates of compliance are provided with all seismically-certified IPC2 equipment. To maintain the validity of this certification, the installation instructions provided in this bulletin must be followed.

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Responsibility for Mitigation of Seismic Damage

For the purposes of the model building codes, IPC2 equipment is considered as nonstructural building components. Equipment capacity was determined from tri-axial seismic shake table test results as defined in the International Code Counsel Evaluation Service (ICCES) Acceptance Criteria for Seismic Qualification Testing of Nonstructural Components (AC156). Unless otherwise indicated, an equipment importance factor of 1.5 (Ip =1.5) was used, indicating that equipment functionality was verified before and after shaker table seismic simulation testing. This importance factor is indicative of critical facilities where maximizing the probability of post event functionality is a priority. AC156 is published by the ICC ES and has been recognized by the Building Seismic Safety Council (BSSC) as an appropriate methodology in the 2003 National Earthquake Hazard Reduction Program (NEHRP) Commentary (FEMA 450 Part 2). The National Institute of Building Sciences established the BSSC in 1979 to develop and promote regulatory provisions for earthquake risk mitigation at the national level.

Incoming and outgoing cable and conduit must also be considered as related but independent systems. They must be designed and restrained to withstand the forces generated by the seismic event without increasing the load transferred to the equipment. For applications where seismic hazard exists, bottom entry and/or exit of cable and conduit is preferred. This system must be capable of transferring the loads created to the load-bearing path of the building structural system.

Maintaining Seismic Certification

Seismic qualification of nonstructural components by Schneider Electric is just one link in the total chain of responsibility required to maximize the probability that the equipment will be intact and functional after a seismic event. During a seismic event, the equipment must be able to transfer the loads that are created through the mounting pad and anchorage to the load-bearing path of the building structural system.

The structural civil engineer or design engineer of record is responsible for detailing the equipment connection and anchorage requirements for the given installation. The installer and manufacturers of the anchorage restraint system are responsible for assuring that the mounting requirements are met. Schneider Electric is not responsible for the specification and performance of these systems.

Anchoring IPC2 for Seismic Applications

Formed base channels run the width of the section. The channels and connecting braces provide a 0.62-in. (16 mm) minimum diameter hole for fastening the section to the floor. To properly anchor the IPC2 to the floor, use all four mounting locations for 24-in. deep NEMA 1 enclosures, all six mounting locations for 36-in. deep NEMA 1 enclosures and 35-in. deep NEMA 3R enclosures, and all eight mounting locations for 47-in. deep NEMA 3R enclosures and all corner sections. Use ½-in. (12.7 mm) diameter anchor bolts (Grade 5 minimum, provided by others) for the installation of equipment. Use one 1.25-in (31.75 mm) outer diameter Grade 5 belleville washer (Square D part no. 23903-33201, stored inside each seismically qualified structure next to the front bottom base channel) under the head of each bolt or anchor nut. To develop full strength of the anchor, torque the hardware to the value specified by the anchor manufacturer or seismic restraint detailing supplied by the Structural Civil Engineer of record for the project.

Additionally, each NEMA 1 enclosed section includes two rear top-located eyebolts that may be removed to allow the user to attach two upper lateral braces (braces and hardware supplied by others) to the IPC2 structure for top structural restraint.

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Top structural restraint is required for all IPC2 equipment installed:

- where the site-specific 0.2 second spectral ground motion exceeds 2.67 g's (as determined from the code-referenced ground motion maps or the site-specific seismic hazard engineering study),
- or when displacement at the top of the equipment cannot be tolerated,
- or for all IPC2 corner sections used for seismic applications.

To develop full strength of the upper structural anchor, install and torque the hardware as specified by the anchor manufacturer or seismic restraint detailing supplied by the Structural Civil Engineer of record for the project.

NOTE: Most of the anchoring hardware is not furnished with the IPC2 equipment, with the exception of the Grade 5 belleville washer (Square D part no. 23903-33201) mentioned above.

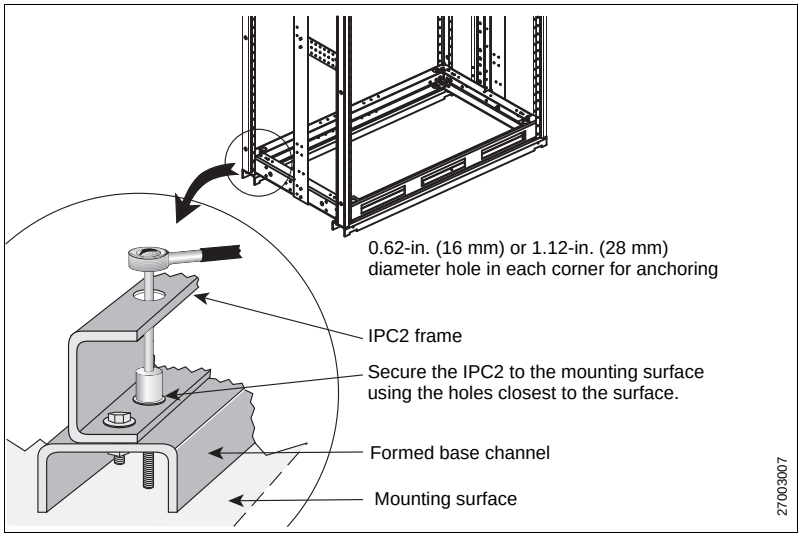
After the IPC2 and adjacent equipment are properly joined together and the entire structure is bolted to the floor, install the incoming service conductors and load side cables. During an earthquake, the top of the IPC2 can move in any direction. Any top incoming cables must accommodate this motion. The IPC2 enclosure (particularly the top) should not be used to mount exterior equipment.

Anchoring the IPC2

Although sections are freestanding, a hard bump or shifting movement can result in damage to the splice joints between sections and conduit hubs connected to the sections. Therefore, each vertical section must be anchored to the floor.

Formed base channels run the width of the shipping section. For fastening the section to the floors, the channels have 0.62-in. (16 mm) diameter holes for seismic applications or 1.12-in. (28 mm) diameter holes for non-seismic applications (see Figure 12 below). Anchor each section to the floor with 1/2-in. diameter (Grade 2 minimum) bolts with flat washers and anchors suitable for installation of electrical equipment (not furnished).

Figure 12: IPC2 Base Channels



After all equipment sections are properly joined together and the entire structure is bolted to the floor, install the incoming service conductors and load side cables.

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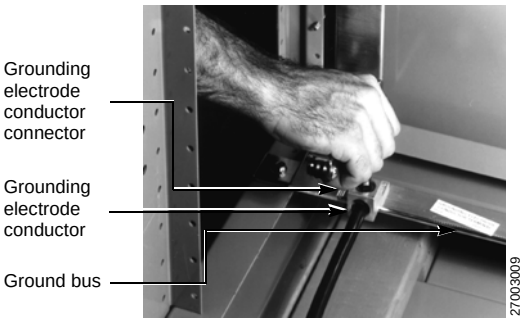
Grounding and Bonding

NOTE: A system is “grounded” if it is grounded at any point ahead of the IPC2, whether the grounded conductor (neutral) is carried through to the loads, or not.

Service Equipment—Grounded System

For solidly *grounded* systems used as either service equipment or as a main IPC2 on a separately derived system:

Figure 13: Grounding Electrode Connector



1. Run a grounding electrode conductor from the grounding electrode at the installation site to the grounding electrode conductor connector (ground lug) located on the IPC2 ground bus (Figure 13). Select the material and size of this grounding electrode conductor to comply with Sections 250-62 and 250-66 of the NEC® or Sections 10-204 and 10-206 of the CEC, and install it as specified in Section 250-64 of the NEC or Section 10-908 of the CEC.
2. Install the main bonding jumper (provided with the IPC2) between the neutral assembly of the service entrance panelboard located in the IPC2 equipment and a ground lug located on the IPC2 unit ground bus. For torque values, refer to Table 3 on page 32.

   NOTE: If the IPC2 is fed from multiple sources (for example, double-ended systems), there may be two or more main bonding jumpers to install.

In Canada, a main bonding jumper cable is provided between the neutral assembly and ground bus. When disconnection of the bonding jumper is required (for example, for a Megger® test), remove the cable lug with cable from the neutral assembly. This is normally located near the line neutral lugs. Secure the cable and lug to maintain the required distance from phases and neutral.

NOTE: If the IPC2 is fed from multiple sources (for example, a double-ended system like a main-tie-main), there may be two or more main bonding jumpers installed.

Service Equipment—Ungrounded System

For *ungrounded* systems used as either service equipment, or as a main IPC2 on a separately derived system:

1. Run a grounding electrode conductor from the grounding electrode at the installation site to the grounding electrode conductor connector (ground lug) located on the IPC2 ground bus (Figure 13).
2. Select the material and size of this grounding electrode conductor to comply with Sections 250-62 and 250-66 of the NEC or Sections 10-700 and 10-702 of the CEC, and install it as specified in Section 250-64 of the NEC or Section 10-204 of the CEC.

Not Service Equipment

For either *grounded or ungrounded* systems, when an IPC2 is used neither as service equipment, nor as a main IPC2 on a separately derived system:

Use equipment grounding conductors sized according to Section 250-122 of the NEC or Section 10-206 of the CEC to connect the IPC2 frame and ground bus to the service ground.

High-Impedance Grounded Neutral Systems

For high-impedance grounded neutral systems:

Ground the system following the instructions provided with the system grounding equipment and in compliance with Section 250-36 of the NEC. Confirm that the IPC2 frame and ground bus are bonded in accordance with Section 250-102 of the NEC.

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Conduit Area

1. Locate and terminate all conduit in the IPC2 enclosure in the “available conduit area” designated on the equipment drawing.
   a. When cables are entering the top of the IPC2, remove the IPC2 top plate and retain the hardware for reuse. For future reference, note that the top plates used on the 36-in. deep Transformer Combo structures include a rear-located notch.
   b. Add cutouts in the top plate as needed. Ensure no metal shavings are allowed to fall into the IPC2.
   c. Reinstall the top plate and secure it with the hardware retained in step a. For 36-in. deep Transformer Combo structures, ensure the top plate is installed with the notch located at the rear.
2. Install the conduit properly. Use hubs and ring connectors to protect the cables and prevent condensation on the conduit from entering the IPC2.

   NOTE: If top entry, do not use the top of the IPC2 to support the weight of the conduit. Support the conduit independently.

   Under seismic conditions, the top of the IPC2 can move as much as 3.00 in. (76 mm) in any direction. Any top incoming cables must accommodate this motion.
3. Bond all conduit, stubs, and ring connectors to the IPC2 enclosure with approved electrical connections.

IPC2 Top Plate Closing Plugs

A closing plug bag kit used to fill the four holes that result from the removal of the four top-located lifting eyebolts is provided with each structure. This kit is located inside the structure next to the front base channel. Install the closing plugs whenever the lifting eyebolts are removed. If additional plugs are needed, order kit number 80123-154-50 that includes four individual plugs.

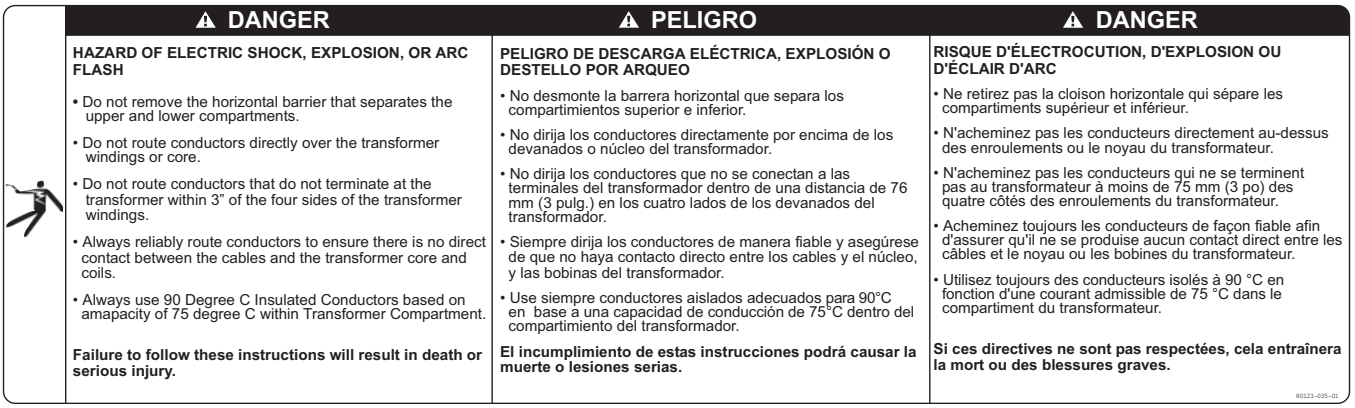
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Cable Pulling

IPC2 units are constructed to customer specifications for the cable entrance arrangement (for example, top or bottom feed). IPC2 components are arranged to give proper cable clearance and bending space for cables entering or exiting the IPC2 as specified on the equipment drawing.

Figure 14: General IPC2 Danger Label



1. Use only cable sizes suitable for a proper fit with the corresponding lugs.
2. Pull the proper number of line side and load side cables according to the load served and the NEC or CEC.
3. Position the cables inside the IPC2 so that they are not subject to physical damage.
4. Maintain the maximum possible bending radii and proper clearance to bus bars and grounded parts. If any cables are lying or bearing on structural members, support them to relieve this condition or place suitable protective material at the bearing point to protect the cable insulation.

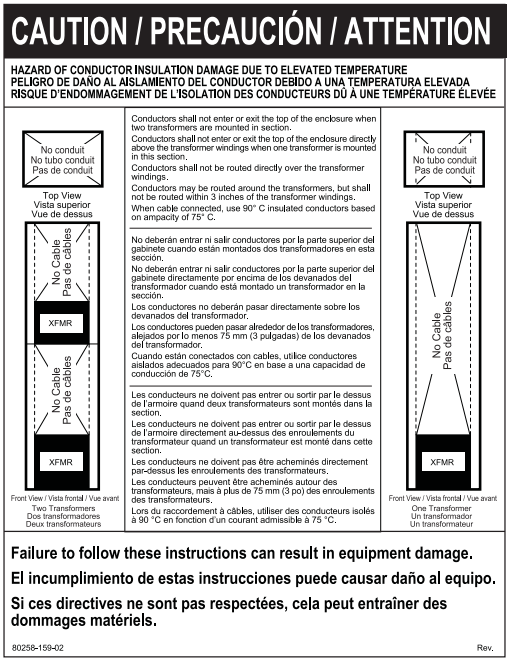
   Additionally, when it is necessary to route feeder cables through the Transformer Combo transformer compartment, the installer must reliably route the cables as to ensure there is no direct contact between the cables and the transformer core or coils. **Do not** route cables directly over the transformer core or coils. Use of the cable support brackets on each side of the structure is recommended.

5. **Be certain to run all phase conductors, including the neutral, through the same opening where cables enter or leave the IPC2, or pass through any metal that has magnetic properties. Otherwise, overheating can result. See Section 300-20(a) of NEC.**
6. When instructed, brace or cable-lace the conductors.

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Cable Terminations

Figure 15: Conductor Insulation Caution Label



1. Use a proper insulation stripping tool to strip a length of insulation from the end of the cable sufficient to fit into the full length of the lug barrel. Be careful not to nick or ring the strands.
2. Thoroughly clean aluminum cable contact surfaces with a wire brush, or scrub them with an abrasive cloth to remove oxides and foreign matter.
3. Immediately apply an acceptable joint compound to the bare aluminum surfaces.
4. If compression-type lugs are furnished, unbolt and remove them to create sufficient room for crimping the lugs to the cables with the crimping tool.
   a. Insert the cable into the lug barrel and, using the crimping tool, make the specified number of crimps per the manufacturer's recommendations.
   b. Wipe excess joint compound from the connector and insulation.
   c. With the cables connected, remount the lugs onto the bus bars or circuit breakers. Torque the bolts to the values given in "Section 9—Torque Values for Electrical Connections" on page 31.
5. Set screw-type lugs may be furnished as main incoming lugs and are standard on molded case circuit breakers. Torque these lugs **to, but do not exceed**, the specified values. Torque values for circuit breaker lugs are marked on these units. Torque values for other IPC2 lugs are marked on the IPC2.

Ground-Fault Protection for Equipment

⚠ WARNING

LOSS OF EQUIPMENT
GROUND-FAULT PROTECTION

Do not connect grounding conductors to any load neutral terminal(s).

Failure to follow these instructions can result in death or serious injury.

According to Section 230-95(c) of the NEC, "The ground-fault protection system shall be performance tested when first installed . . . . A written record of this test shall be made and shall be available to the authority having jurisdiction."

Schneider Electric tests the factory-installed ground-fault system prior to shipment. However, improper grounding of the IPC2 and devices downstream at the job site will defeat the ground-fault system. Performance testing of the ground-fault system, as stated in the NEC, requires injecting sufficient current into the system to test the ground fault. High current injection by a certified testing organization will test the polarity of the ground-fault sensors, interconnection wiring, and proper bonding of the neutral.

NOTE: Some equipment ground-fault systems require field connections at the job site. Consult the IPC2 interconnection wiring drawing for details.

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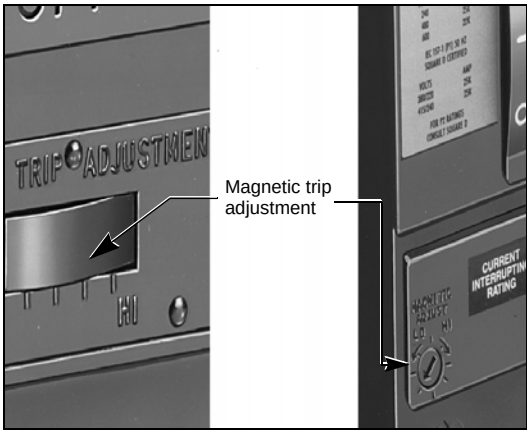
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Section 5—Pre-Energizing Checkout Procedure

Conduct a complete inspection **before** the IPC2™ is energized to ensure that all components function and operate properly. **Complete every step of the checkout procedure listed before energizing the IPC2.**

1. Check the ground bus bar connections. Torque values are listed in Table 3 on page 32.
2. Check all accessible connections for tightness.
3. Check all factory- and field-installed lug terminations for tightness.
4. Check the IPC2 enclosure for dents or other damage that reduces electrical clearances inside the IPC2.
5. Remove all foam blocks, or other temporary cushioning or retaining material, from the electrical devices.
6. Manually open and close all switches, circuit breakers, and other operating mechanisms, checking for correct alignment and free operation.
7. Operate all electrically operated switches, circuit breakers, and other devices equipped with remote operators (not under load). An auxiliary source of control power may be necessary to accomplish this.
8. Check all relays, meters, and instrumentation to verify that all field-installed wiring connections are made properly and that the devices function properly.
9. Current transformers (CTs) supplied for customer use require connection to a metering device load before energizing. Verify that the metering device load is properly connected, including main IPC2 connections to remote equipment.
10. All CT circuits supplied by Schneider Electric for customer metering use are shorted for shipment. Remove shorting terminal screws on shorting terminal blocks or jumpers and store in the block.
11. Factory-installed molded case circuit breakers, 250 A frames or larger, may have an adjustable magnetic trip, which is shipped on the “LO” setting. The markings between “LO” and “HI” settings represent a range of instantaneous magnetic trip values of 5–10 times the circuit breaker’s continuous current rating. To provide coordinated operation during a fault, adjust the magnetic trip as outlined in the respective instruction bulletin. All poles are adjusted simultaneously, using a screwdriver, by the single setting (Figure 16).
12. On IPC2 units containing an electronic trip circuit breaker, set the tripping characteristic curve of the adjustable electronic trip unit per the job requirements, or as outlined in the respective instruction bulletin.
13. If ground-fault protection is furnished on molded case circuit breakers, refer to “Section 11—Reference Publications” on page 34 for information to obtain circuit breaker publications.
14. Inspect all cables to ensure the insulation has not been damaged in any fashion.
15. Verify that all grounding connections are correctly made. If the IPC2 is used as a service entrance, double check to see that the main bonding jumper is connected.

Figure 16: Instantaneous Trip Setting



CAUTION

HAZARD OF EQUIPMENT DAMAGE

Do not pry open or spread the fuse mounting clips. This can cause a loose connection, resulting in overheating.

Failure to follow these instructions can result in equipment damage.

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16. Conduct an electrical insulation resistance (Megger®) test to ensure that the IPC2 is free from short circuits and undesirable grounds.
    a. Open all control power and metering disconnects or remove the fuses from the control circuits.
    b. Disconnect the neutral connection at any TVSS or other electronic device prior to performing the electrical insulation resistance test; reconnect to the device after the test.
    c. With the neutral isolated from the ground and the power switches and circuit breakers open, conduct electrical insulation tests from phase-to-phase, phase-to-ground, phase-to-neutral, and neutral-to-ground. If the resistance reads less than one megohm while testing with the branch circuit breaker devices in the open position, the system may be unsafe and should be investigated. Consult Square D Services at 1-888-778-2733 (US) or 1-800-265-3374 (Canada) to help correct any problems.
17. Record resistance values. See “Section 10—IPC2™ Power Center Insulation Resistance Chart” on page 33.
18. After completing the electrical insulation resistance test, replace all control power fuses that may have been removed, and close power disconnects that have been opened.
19. Check all field-installed wiring. Make certain it is clear of all live parts, and when instructed, secured to withstand fault currents.

    NOTE: MG-, MJ-, P-, and R-frame circuit breakers require cable lacing within the IPC2 unit. Follow lacing instructions provided with these circuit breakers.
20. Verify that all control wiring between sections is connected.
21. Vacuum to remove any dust, scrap wire, or other debris.
22. Replace all covers; check for any pinched wires, and close doors. Make certain all enclosure parts are aligned properly and securely fastened.

⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE OR INJURY

- Remove the long-time rating plug before electrical insulation testing a circuit breaker that has a label stating “Warning: Disconnect Plug Before Dielectric Test.”
- Some Micrologic® trip units are not rated for voltages that would occur during electrical resistance insulation testing.
- Open all control and metering disconnects from the control circuits.

Failure to follow these instructions can result in injury or equipment damage.

CAUTION

HAZARD OF EQUIPMENT DAMAGE

Do not use an air hose to blow out the IPC2. The dust may settle inside relays and overcurrent devices, causing overheating and improper operation.

Failure to follow these instructions can result in equipment damage.

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Section 6—Energizing the IPC2™

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Correct short-circuit conditions detected during the checkout procedures described in “Section 5—Pre-Energizing Checkout Procedure”, beginning on page 24.
- Qualified electrical personnel must be present when energizing this equipment for the first time.
- Follow the instructions in this section to properly energize the IPC2.

Failure to follow these instructions will result in death or serious injury.

1. No load should be on the IPC2 when it is energized. Turn off all downstream loads.
2. Energize the IPC2 in the following sequence:
   a. Turn on all control power disconnects before energizing the IPC2. Refer to the record drawings supplied with equipment to see if control power disconnects are supplied.
   b. Close any open doors and/or covers.
   c. Close the main device(s).
   d. Close each branch circuit breaker or branch fusible switch.
   e. Proceed to each panelboard and other downstream load.
3. After all overcurrent protective devices are closed, turn on all loads (e.g., lighting circuits, contactors, heaters, and motors).

Section 7—Maintaining the IPC2™

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- Always practice lock-out/tag-out procedures according to OSHA requirements.
- Inspect and perform preventive maintenance only on IPC2 equipment to which power has been turned to the OFF position, disconnected, and electrically isolated (unless otherwise specified) so that no accidental contact can be made with energized parts.

Failure to follow these instructions will result in death or serious injury.

Periodic maintenance of the IPC2 includes cleaning, lubrication, and exercising component parts. The interval between maintenance checks can vary depending upon the amount of usage and environmental conditions of each installation. The maximum recommended inspection interval is one year. This definition for periodic maintenance applies throughout this bulletin, unless otherwise noted.

Always inspect the IPC2 after a fault. (Refer to “Section 8—Adverse Circumstances”, beginning on page 30.) Service bulletins for the various disconnecting and overcurrent devices mounted in the IPC2 are available through your local Schneider Electric field office.

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General Inspection and Cleaning

The following danger label is applied to the IPC2 only when a breaker is installed in the bottom compartment of a transformer combo section.

Figure 17: Breaker in Bottom Compartment of Transformer Combo Section Danger Label



The following danger label is applied to the IPC2 at a control panel location.

Figure 18: Control Panel Danger Label



1. Turn off all power supplying this equipment before working on or inside equipment.
2. If equipped with a breaker in the transformer section, identify the use of this breaker before working on or inside this equipment.
3. Always practice lock-out/tag-out procedures according to OSHA requirements.
4. Always use a properly rated voltage sensing device to confirm all power is off.
5. Vacuum the IPC2 interior to remove any dirt or dust deposits. Wipe all bus bars, insulators, cables, etc., with a clean, dry, lint-free cloth.
6. Check the IPC2 interior carefully for moisture, condensation build-up, or signs of any previous wetness. Moisture can cause insulation failures and rapid oxidation of current-carrying parts. Inspect all conduit entrances and cracks between the enclosure panels for dripping leaks. Condensation in conduits may be a source of moisture and must not be allowed to drip onto live parts or insulating material. Take the necessary steps to eliminate the moisture and seal off all leaks.
7. Inspect the IPC2 for any signs of overheating. Discoloration, flaking, and cracking of insulation or metal parts are indications of overheating.

   Inspection of the cable insulation within the Transformer Combo transformer compartment is imperative.

   NOTE: If overheating occurs, be sure that all conditions that caused the overheating have been corrected. Loose or contaminated connections can cause overheating.
8. Check for signs of rodent nesting in the IPC2. If required, use a good exterminating technique in the general area of the IPC2.

   NOTE: Do not place or use exterminating substances and chemicals inside the IPC2. Some of these products attract rodents.
9. Carefully inspect all devices for any visibly worn-out, cracked, or missing parts.
10. Manually open and close switches and circuit breakers several times to verify they are working properly.
11. Verify that all locking mechanisms are working properly.

CAUTION

HAZARD OF EQUIPMENT DAMAGE

- Do not use an air hose to blow out the IPC2. The dust may settle inside relays and overcurrent devices, causing overheating and improper operation.
- Do not allow paint, chemicals, or petroleum-based solvents to contact plastics or insulating materials.

Failure to follow these instructions can result in equipment damage.

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Panel Bus Bar Joints, Lug Terminations, and Insulating Materials

CAUTION

HAZARD OF EQUIPMENT DAMAGE

- Do not sand or remove plating on any bus bar, splice bar, or terminal lug.
- Damage to plating can result in overheating. Replace damaged part. Contact Square D Services at 1-888-778-2733 (US) or 1-800-265-3374 (Canada).

Failure to follow these instructions can result in equipment damage.

1. Do not retighten panel bus bar joints after the pre-energizing checkout procedure is complete.
2. Check all panel bus bar joints and terminal lugs for any pitting, corrosion, or discoloration resulting from high temperatures or subjection to high fault conditions. If any damage has occurred, contact Square D Services in the US at 1-888-Square D (1-888-778-2733) or in Canada at 1-800-265-3374 to help correct any problems. If cleaning is required, use Lectra-Clean®, made by CRC Industries, Inc.
3. Inspect all insulating materials. Before re-energizing the IPC2, replace insulators with any visible damage (such as cracks).

General Lubrication Information

For field maintenance re-lubrication of bus/plug-on connections, use Schneider Electric catalog number PJC7201 (Electric Joint Compound).

Automatic Transfer Switches

Consult the manufacturer's bulletin about these devices for all installation, operation, and maintenance instructions.

Circuit Breakers

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- If circuit breaker settings are adjusted, do not set the long time trip rating at a higher ampacity than the rating of the bus bar or load cables it supplies; overheating can occur.
- Before energizing the IPC2, all unused circuit breaker mounting spaces must be filled with blank fillers and/or extensions as listed in Table 1.

Failure to follow these instructions will result in death or serious injury.

Schneider Electric circuit breakers are designed and manufactured as totally sealed units requiring minimal periodic maintenance.

Exercise circuit breakers at least once a year to ensure proper operation. For general maintenance:

1. Trip the circuit breaker by pushing the Push-To-Trip or "Open" button located on the face of the circuit breaker. Refer to the appropriate circuit breaker bulletin for the specific location of this button.
2. Manually open and close the circuit breaker two to three times.

   NOTE: Schneider Electric bulletin 0600DB9901 "Field Testing and Maintenance Guide for Micrologic® Electronic Trip and Thermal-magnetic Molded Case Circuit Breakers" provides more in-depth information. Refer to "Section 11—Reference Publications" on page 34 and contact your local Schneider Electric field office to obtain this bulletin.

   Refer to individual circuit breaker instruction bulletins shipped with the IPC2 for additional maintenance information, such as changing rating columns or adjustable settings and removing circuit breakers. If the instruction bulletins are not available, see "Section 11—Reference Publications" on page 34, and contact your local Schneider Electric field office for information to obtain the appropriate bulletins.

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CAUTION

HAZARD OF EQUIPMENT DAMAGE

- Do not remove the protective lubricant on the plug-on connectors.
- If additional lubrication is required, apply a coating of electrical joint compound, catalog number PJC7201, to the plug-on connector's contact surfaces.

Failure to follow these instructions can result in equipment damage.

Table 1: Blank Fillers and Extensions

	Height	Catalog No.
NF Filler Plate	1.00 in. (25 mm)	EFP
NQOD Filler Plate	0.75 in. (19 mm)	QOFP
I-Line® Blank Fillers	1.50 in. (38 mm) 4.50 in. (114 mm)	HNM1BL HNM4BL
I-Line Blank Extensions	1.50 in. (38 mm) 4.50 in. (114 mm)	HLW1BL HLW4BL

3. The universal test set, Schneider Electric catalog number UTS3, is available to test all Schneider Electric circuit breakers equipped with Micrologic® trip units. It runs trip unit tests automatically, with prompts to the user for initial information. Test modules for each circuit breaker frame are used to store data necessary for automatic tests. Series B Micrologic trip units require test module CBTMB, which is included in UTS3.

   Masterpact® and Powerpact® circuit breakers with Micrologic trip units require the full-function test set (catalog no. 533595) or hand-held test set (catalog no. 533594).

   NOTE: Tests may be conducted with a circuit breaker installed in the IPC2; removing the circuit breaker is not required. The IPC2 must be de-energized.

Ground-Fault Protection for Equipment

Check the terminal connections on the equipment ground-fault protection system at least once a year for tightness and corrosion. If the system can be tested with or without tripping the main or branch device, directions for testing the system are in the device bulletin. Otherwise, testing the equipment ground-fault protection system will trip the main or branch device to which it is connected. If the equipment ground-fault sensor or relay is physically or electrically damaged, replace it.

If the ground-fault protection system does not operate properly and additional equipment has been connected to the installation since the last maintenance test/check, de-energize the entire system and check for grounds on the neutral downstream from the main bonding jumper. If no downstream grounds are detected and the equipment ground-fault system is not operating properly, contact Square D Services in the US at 1-888-Square D (1-888-778-2733) or in Canada at 1-800-265-3374.

Refer to Schneider Electric bulletin 0600DB9901 *"Field Testing and Maintenance Guide for Micrologic® Electronic Trip and Thermal-magnetic Molded Case Circuit Breakers"* for additional testing information. If the bulletin is not available, refer to "Section 11—Reference Publications" on page 34 and contact your local Schneider Electric field office to obtain the bulletin.

Other Manufacturers' Devices

Consult the manufacturers' bulletins about these devices for all installation, operation, and maintenance instructions.

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Section 8—Adverse Circumstances

This section includes, but is not limited to, all electrical components of the IPC2™.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- Turn off all power supplying this equipment before working on or inside the equipment.
- Always use a properly rated voltage sensing device to confirm all power is off.
- Before energizing the IPC2, all unused circuit breaker mounting spaces must be filled.

Failure to follow these instructions will result in death or serious injury.

NOTE: Before attempting to re-energize the IPC2 following an adverse circumstance, contact Square D Services in the US at 1-888-Square D (1-888-778-2733) or in Canada at 1-800-265-3374, for special instructions.

Inspection Following a Short Circuit

High mechanical and thermal stresses developed by short circuit currents may damage conductors and insulation. If a short circuit occurs, make a thorough inspection of the entire system and verify that no damage to conductors or insulation has occurred. Check the overcurrent protection device that interrupted the short circuit current for possible arcing damage.

Do not open sealed devices, such as molded case circuit breakers. These devices should be replaced if damaged. Before energizing the IPC2, all unused circuit breaker mounting spaces must be filled. For more information about these devices and to obtain the appropriate bulletin, refer to “Section 11—Reference Publications” on page 34.

Clean-up Following a Short Circuit

The insulating properties of some organic insulating materials may deteriorate during an electrical arc. If so:

1. Remove any soot or debris.
2. Replace carbon-tracked insulation.

Water-Soaked Equipment

Do not clean or repair an IPC2 that has been exposed to large volumes of water or submerged at any time. Current-carrying parts, insulation systems, and electrical components may be damaged beyond repair. Do not energize the IPC2. Contact Square D Services, and also refer to Square D Data Bulletin 0110DB0401R9/05.

Water-Sprayed or Splashed Equipment (Clean Water Only)

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- Turn off all power supplying this equipment before working on or inside the equipment.
- Always use a properly rated voltage sensing device to confirm all power is off.

Failure to follow these instructions will result in death or serious injury.

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If the IPC2 has been sprayed or splashed with small amounts of clean water, make a thorough inspection of the entire system and verify that no damage to conductors or insulation has occurred. Do not open sealed devices such as molded case circuit breakers or fuses. These devices should be replaced if damaged. For more information about these devices and to obtain the appropriate instruction bulletin, refer to “Section 11—Reference Publications” on page 34.

Inspection and Clean-up of Clean Water Sprayed or Splashed Equipment

⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE OR INJURY

- Remove the long-time rating plug before electrical insulation testing a circuit breaker that has a label stating “Warning: Disconnect Plug Before Dielectric Test.”
- Some Micrologic trip units are not rated for voltages that would occur during electrical resistance insulation testing.
- Open all control and metering disconnects from the control circuits.

Failure to follow these instructions can result in injury or equipment damage.

Follow the steps below only if:

- No signs of physical damage to the equipment are present.
- The IPC2 has not been submerged or exposed to water for long periods of time.
- The water that has been in contact with the IPC2 has not been contaminated with sewage, chemicals, or other substances that can negatively affect the integrity of the electrical equipment.
- The water that has been in contact with the IPC2 has not entered any area of the enclosure that may contain wiring located above any live part. Specifically, inspect for water entering through conduits located above live parts.

If any of these conditions have not been met, contact Square D Services in the US at 1-888-Square D (1-888-778-2733) or in Canada at 1-800-265-3374.

1. Turn off all power supplying this equipment before working on or inside the equipment.
2. Always use a properly rated voltage sensing device to confirm all power is off.
3. Disconnect and electrically isolate the IPC2 so no contact can be made with energized parts.
4. Wipe off all moisture from the panel bus, insulators, and insulating material with a clean, dry, lint-free cloth. Do not use cleaning agents or water displacement sprays.
5. Prepare the IPC2 for insulation resistance (Megger®) testing by disconnecting all line-side supply connections and all load-side cable connections to isolate the IPC2 from the wiring system.
6. Turn all circuit breakers or switches to the ON position. The IPC2 must remain completely de-energized.
7. Use a megohmmeter with a capacity of 500–1000 Vdc, and apply voltage from:
   a. each phase-to-ground with circuit breaker on
   b. phase-to-phase with circuit breaker on
8. Record resistance values. See “Section 10—IPC2™ Power Center Insulation Resistance Chart” on page 33.
9. If resistance measurements are less than 1.0 megohm, call Square D Services for recommendations.
10. If resistance measurements are greater than 1.0 megohm, the equipment can be energized using the procedures listed in “Section 6—Energizing the IPC2™” on page 26.

Section 9—Torque Values for Electrical Connections

Table 2: Multiple Conductor Neutral and/or Ground Terminal

Screw Type	Lug Wire Range	Conductor Size	Torque Value
Slotted Head	14–4	14-10 Cu, 12-10 Al	20 lb-in (2.25 N•m)
		8 Cu-Al	25 lb-in (2.8 N•m)
		6-4 Cu-Al	35 lb-in (3.9 N•m)
	14–1/0	14-8 Cu-Al	36 lb-in (4 N•m)
		6-1/0 Cu-Al	45 lb-in (5.08 N•m)
Socket Head	14–1/0	All	100 lb-in (11.3 N•m)
	6–300 kcmil	All	275 lb-in (31 N•m)

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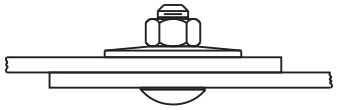
Table 3: Incoming, Branch, Neutral, and Ground Lugs

Socket Size Across Flats	Torque Value
1/8 in.	45 lb-in (5 N•m)
5/32 in.	100 lb-in (11 N•m)
3/16 in.	120 lb-in (13 N•m)
7/32 in.	150 lb-in (17 N•m)
1/4 in.	180 lb-in (20.3 N•m)
5/16 in.	250 lb-in (28.2 N•m)
3/8 in.	340 lb-in (38.4 N•m)
1/2 in.•	450 lb-in (50.8 N•m)
9/16 in.	600 lb-in (68 N•m)

• 1/2 in. lug marked with 620 lb-in (70 N•m) should be torqued as such.

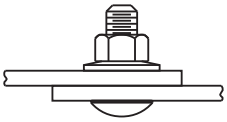
Table 4: Contactors, Terminal Block Conductor, and Torque Data

Device	Conductor Type	Lug Torque
Square D Class 8903 Contactor Types		
LO/LX 20—1200	Cu only, 75° C rated minimum	20 lb-in (2.25 N•m)
SMO1, 2, 3, 4, 10, 11, 12, 13		20 lb-in (2.25 N•m)
SVO1, 2, 3, 4, 10, 11, 12	Cu–Al, 75° C rated minimum	275 lb-in (31 N•m)
SPO1, 2, 3, 4, 10, 11, 12, 13		50 lb-in (6 N•m)
SQO1, 2, 3, 4, 10, 11, 12, 13		80 lb-in (9 N•m)
Square D Class 8910 Contactor Types		
DPA 32, 33, 34	Cu only, 75° C rated minimum	18 lb-in (2 N•m)
Square D Class 9080 Terminal Blocks		
GR6	Cu only, 75° C rated minimum	18–20 lb-in (2 N•m)
GC6		32–35 lb-in (4 N•m)

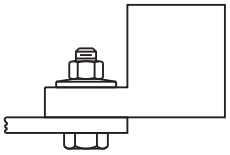


Carriage bolt
Hex nut
Conical washer

Hardware Description	Torque Value
1/2 in.	720–840 lb-in (81–95 N•m)

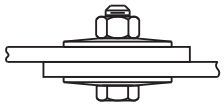


Carriage bolt
Conical washer assembly
(Keps nut)



Hex head bolt
Conical washer assembly
(Keps nut)

Hardware Description	Torque Value
1/4 in.	50–75 lb-in (6–8 N•m)
5/16 in.	80–125 lb-in (9–14 N•m)
3/8 in.	175–225 lb-in (20–25 N•m)
1/2 in.	250–350 lb-in (28–40 N•m)



Hex head bolt
(2) Conical washers

Hardware Description	Torque Value	
	Conical Washer OD	Hex Head Bolt (2) Conical Washers
5/16 in.	0.90 in. (23 mm)	145–160 lb-in (16–18 N•m)
3/8 in.	0.87 in. (22 mm)	250–280 lb-in (28–32 N•m)
	1.00 in. (25 mm)	130–150 lb-in (15–17 N•m)
1/2 in.	1.25 in. (32 mm)	720–840 lb-in (81–95 N•m)
	2.25 in. (57 mm)	
	3.00 in. (76 mm)	

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Section 10—IPC2™ Power Center Insulation Resistance Chart

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- Turn off all power supplying this equipment before working on or inside the equipment.
- Always use a properly rated voltage sensing device to confirm all power is off.

Failure to follow these instructions will result in death or serious injury.

Always use a 500 or 1,000 Vdc megohmmeter when testing insulation resistance.

NOTE: The Neutral–Ground column is provided to record the results of the pre-energizing checkout procedure only.

Date	Phase–Phase			Phase–Ground			Neutral–Ground
	All Disconnects Open						
	a-b	b-c	c-a	a-ground	b-ground	c-ground	Neutral–Ground
Date	All Disconnects Closed						
	a-b	b-c	c-a	a-ground	b-ground	c-ground	Neutral–Ground

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Section 11—Reference Publications

Schneider Electric publications are available through your local Schneider Electric field office. These publications include device replacement procedures and spare parts listings to make ordering and servicing of replacement parts quick and convenient.

Contact the nearest Schneider Electric field office for information in the US at 1-888-Square D (1-888-778-2733) or in Canada at 1-800-265-3374. Or, refer to the Technical Library at http://ecatalog.squared.com/techlib/ to obtain the appropriate publications.

For information about obtaining NEMA documents, write to:

National Electrical Manufacturers Association (NEMA)
Attention: Customer Service
1300 North 17th Street
Suite 1847
Rosslyn, VA 22209

Other Reference Publications	Publication Number
General Instructions for Proper Installation, Operation, and Maintenance of Switchboards Rated 600 V or Less	NEMA Publication PB2.1
Application Guide for Ground-Fault Protective Devices for Equipment	NEMA Publication PB2.2
Circuit Breakers	NEMA Publication AB-4
Enclosed and Miscellaneous Distribution Switches	NEMA Publication KS-1
Electrical Equipment Maintenance	NFPA 70B-1999

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Integrated Power Center 2 (IPC2™)
Instruction Bulletin

Schneider Electric
105 Summit Park Drive
Salisbury, NC 28146 USA
1-888-SquareD
(1-888-778-2733)
www.schneider-electric.us

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Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Replaces 80043-708-03 06/2007
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2230DB0601R3/09
03/2009
Salisbury, NC, USA

Replaces 2230DB0601R4/08

Data Bulletin

Integrated Power Center 2 (IPC2™) Application Guide
Class 2230

Retain for future use.

Introduction

Square D® Integrated Power and Control Solutions (IPaCS) integrates electrical distribution and controls in a factory assembled and pre-wired solution. Designed with the flexibility to meet individual customer requirements, Integrated Power Center 2 (IPC2™) enclosures are available with NQ®, NF, and I-Line® panelboard interiors and distribution dry transformers.

Optional distribution and control equipment include Powerlink® lighting control, contactors, PowerLogic monitoring and metering, automatic transfer switches, and transient voltage surge suppressors (TVSS). IPC2 solutions can be further customized to include third party components such as building management systems.

All IPC2 sections are available in Type 1, Type 1 with driphood, or Type 3R enclosures. IPC2 equipment is listed to UL891.

The 42-circuit limitation for Lighting and Appliance Panelboards has been removed from Article 408 of the 2008 National Electrical Code® (NEC®) edition. If the 2008 NEC edition has not been adopted for use in your area, you are still required to adhere to the 42-circuit rule for Lighting and Appliance panelboards.

Figure 1: Integrated Power Center 2 (IPC2™)

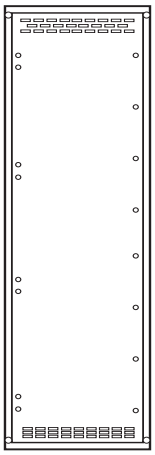


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Full Height or Stacked Equipment Space

Figure 2: Equipment Space 24 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



Equipment Space—1/2 Height or Full Height

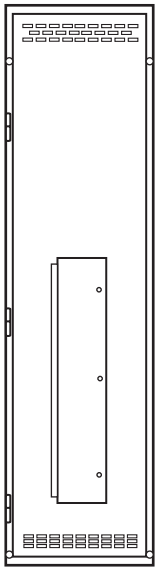
- Backplate size 17.75 in. w x 40.75 in. h
- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
  - — Unwired: Mounted in cell only
  - — Line side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

For max. quantity of contactors see “Appendix” on page 78.

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Full Height NQ or NF Panelboard

Figure 3: NQ—Full Height 24 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

NQ—Full Height

SCCR 10–200 kA

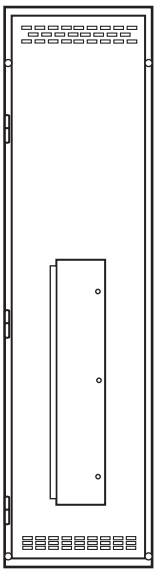
208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max. MLO, 42, 54, 72 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed circuit breakers (225 A max.)
    - Sub-feed lugs
    - TVSS
- 400 A max. MLO, 84 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed lugs
- 600 A max. MLO, 42, 54, 72 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed circuit breakers (225 A max.)
    - TVSS
- 600 A max. MLO, 84 circuits
  - — Option: Feed-through lugs
- 400 A max. vertical Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed circuit breakers (225 A max.), not available with 200% neutral
    - TVSS
- 400 A max. vertical Main circuit breaker, 54 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Feed-through lugs
    - TVSS
- 400 A max. vertical Main circuit breaker, 72, 84 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Feed-through lugs

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Figure 2 (cont.)



- 600 A max. vertical Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Feed-through lugs
    - TVSS
- 600 A max. vertical Main circuit breaker, 54, 72, 84 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Feed-through lugs

NF Full Height or NF Powerlink G3 Full Height

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

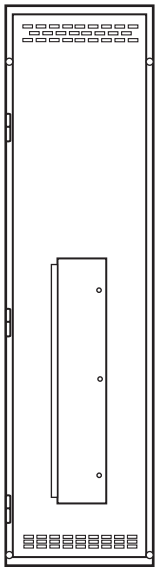
- 250 A MLO, 42, 54, 66 circuits
  - — Branch circuit breakers: 125 A max. at 480 V at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options (choose one):
    - Sub-feed circuit breakers (250 A max.)
    - Sub-feed lugs
    - TVSS (54 circuits max.)
- 400 A MLO, 42, 54 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options (choose one):
    - Sub-feed circuit breakers (250 A max.)
    - Sub-feed lugs
    - TVSS
- 400 A MLO, 66 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed lug
- 400 A MLO, 84 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- 600 A MLO, 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed circuit breakers (250 A max.)
    - TVSS

250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

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Figure 2 (cont.)



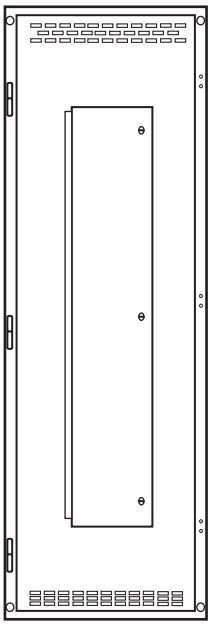
- 600 A MLO, 54, 66, 84 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Options: None
- 250 A max. Main circuit breaker, 42, 54 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed circuit breakers (250 A max.)
    - TVSS
- 250 A max. Main circuit breaker, 66 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Feed-through lugs
- 400 A max. Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options (choose one):
    - Sub-feed circuit breakers (250 A max.)
    - Feed-through lugs
    - TVSS
- 400 A max. Main circuit breaker, 54 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Feed-through lugs
- 600 A max. Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options (choose one):
    - Sub-feed circuit breakers (250 A max.)
    - Feed-through lugs
    - TVSS
- 600 A max. Main circuit breaker, 54 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- NF Powerlink G3 Master 600 A MLO, or a Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 600 A MLO, or a Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel

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Full Height Single Row I-Line Panel

Figure 3: 30 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



HCP-SU Single Row I-Line

SCCR 10–200 kA

600 Vac max.

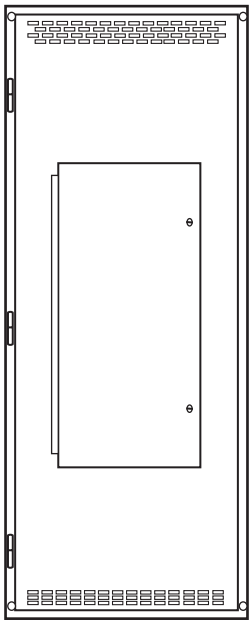
Single Row Mounting

- 800 A max. MLO with 54-in. circuit breaker mounting space without a Main Lug kit
  - — Feeder circuit breaker: 600 A
  - — Options:
    - Non Linear (200% neutral), 400 A max.
    - Sub-feed lugs
    - TVSS
- 800 A max. Back-Fed MCB with 54-in. circuit breaker mounting space without a Main circuit breaker
  - — Feeder circuit breaker: 600 A
  - — Options:
    - Non Linear (200% neutral), 400 A max.
    - Sub-feed lugs
    - TVSS

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Full Height HCM, I-Line Panel

Figure 4: 36 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



HCM I-Line

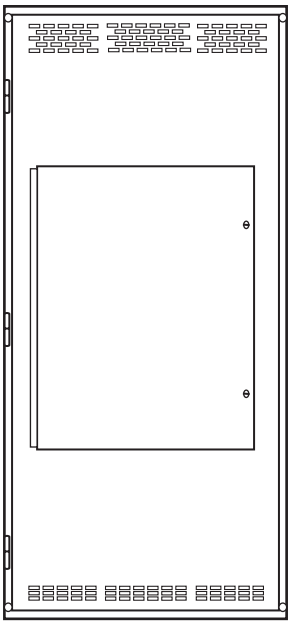
SCCR 10–200 kA

600 Vac max., double-row mounting

- 800 A max. MLO with 99-in. circuit breaker mounting space
  - — Feeder circuit breaker: 250 A max.
  - — Options:
    - Sub-feed lugs
    - TVSS
- 800 A max. Vertical Main circuit breaker with 36-in. circuit breaker mounting space
  - — Feeder circuit breaker: 250 A max.
  - — Options:
    - Sub-feed lugs
    - TVSS

Full Height HCP, I-Line Panel

Figure 5: 42 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



HCP I-Line

SCCR 10–200 kA

600 Vac max., double-row mounting

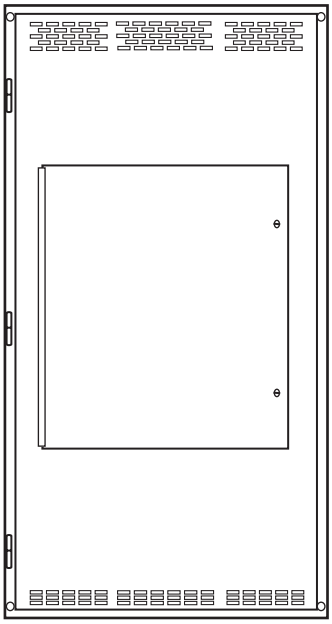
- 1200 A max. MLO with 99-in. max. circuit breaker mounting space
  - — Feeder circuit breaker: 800 A max.
  - — Options:
    - Sub-feed lugs
    - TVSS
- 800 A Main circuit breaker (Backfed) with 99-in. max. circuit breaker mounting space without a Main circuit breaker
  - — Feeder circuit breaker: 800 A max.
  - — Options:
    - Sub-feed lugs
    - TVSS

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Full Height HCR-U, I-Line Panel

Figure 6: 48 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



HCR-U I-Line

SCCR 10–200 kA

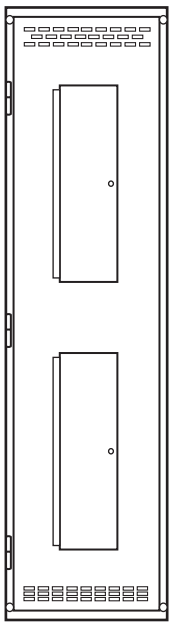
600 Vac max., double-row mounting

- 1200 A MLO, max. with 108-in. max. circuit breaker mounting space without the Main Lug Kit
  - — Feeder circuit breaker: 1200 A max.
  - — Options:
    - Non Linear (200% neutral)
    - Sub-feed lugs
    - TVSS
- 1200 A max., Main circuit breaker (Backfed), with 108-in. max. circuit breaker mounting space without a Main circuit breaker
  - — Feeder circuit breaker: 1200 A max.
  - — Options:
    - Non Linear (200% neutral)
    - Sub-feed lugs
    - TVSS

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Stacked NQ/NF Panels

Figure 7: 24 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



NQ Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max. MLO—max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs, not available with 200% neutral
- 225/250 A max. Main circuit breaker, max. 42 circuits
  - — Branch circuit breakers: 150 max.
  - — Stacking rules:
    - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
    - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs), and 1–225 A max. MLO, 42 circuit interiors (Options: None)

60–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

NF Stacked or NF Powerlink G3 Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max. 42 circuits, top or bottom
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A MLO, max. 36 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel

100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

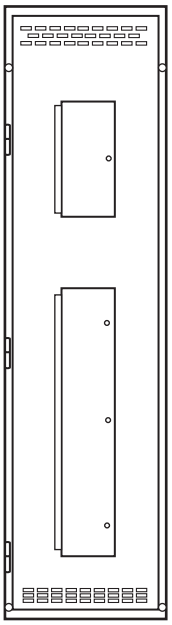
300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

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Stacked NQ or NF Panelboard

Figure 8: 24 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



NQ Stacked Top (1/4 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 100 A MLO, max. 18 circuits
  - — Branch circuit breakers: 100 A max.
  - — Options: None
- 100 A, Main circuit breaker (Backfed), max. 15 circuits
  - — Branch circuit breakers: 100 A max.
  - — Options: None

NQ Stacked Bottom (3/4 Height)

SCCR 10–200 kA

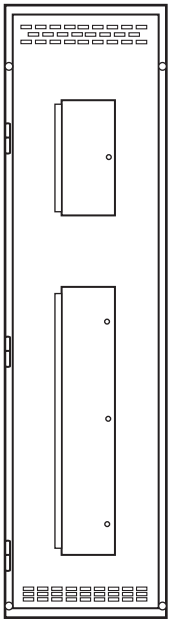
208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A MLO, max. 42, 54 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed circuit breaker (225 A max.)
    - TVSS
- 225 A MLO, max. 72, 84 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 400 A MLO, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 600 A MLO, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Feed-through lugs
- 225/250 A max. Vertical Main circuit breaker, 42 circuits max.
  - — Branch circuit breakers: 150 A max.
  - — Option: Feed-through lugs
- 250 A max. Vertical Main circuit breaker, 54, 72 circuits max.
  - — Branch circuit breakers: 150 A max.
  - — Options: None

60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

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Figure 8 (cont.)



250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

NF Stacked Bottom or NF Powerlink G3 Stacked Bottom

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

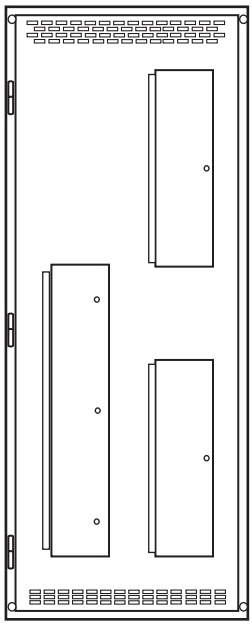
- 250 A MLO, max. 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed lugs
- 400 A MLO, max. 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed lugs
- 250 A Vertical Main circuit breaker, max. 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- NF Powerlink G3 Master 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Master 250 A, Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 250 A, Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel

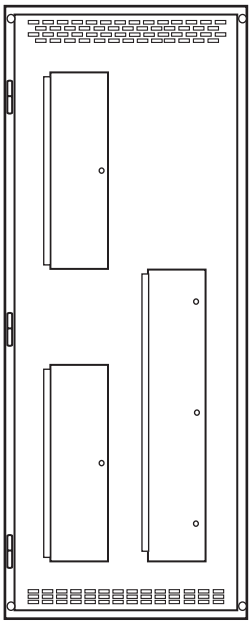
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Side-by-Side NQ Panelboard

Figure 9: 36 in. w x 91.5 in. x 24 in. d Type 1 Enclosure





For max. quantity of contactors see the “Appendix” on page 78.

NQ Side-by-Side—NF not permitted

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A MLO 42, 54, 72, 84 circuits max.
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Sub-feed circuit breaker (225 A max.)
    - Sub-feed lugs
    - TVSS
- 225/250 A Vertical Main circuit breaker, 42, 54, 72, 84 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed circuit breaker (225 A max.)
    - TVSS

60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

NQ Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO 42 circuits, top or bottom
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Stacking rules:
    - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
    - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs) and 1–225 A max. MLO, 42 circuit interiors (Options: None)

60–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

Equipment Space—Stacked

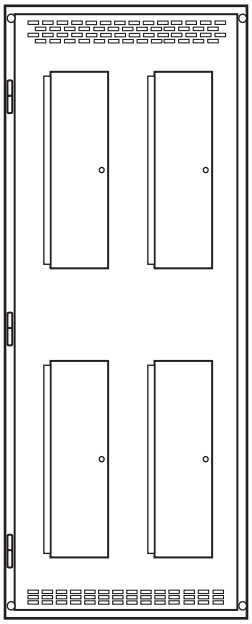
Backplate size 17.75-in. w x 40.75-in. h

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
  - — Unwired: Mounted in cell only
  - — Line side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

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Side-by-Side Stacked NQ Panelboard

Figure 10: 36 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



NQ Stacked—NF not permitted

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO 42 circuits, top or bottom
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Stacking rules:
    - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
    - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs) and 1–225 A max. MLO, 42 circuit interiors (Options: None)

60–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

Equipment Space—Stacked

Backplate size 17.75-in. w x 40.75-in. h

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
  - — Unwired: Mounted in cell only
  - — Line side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

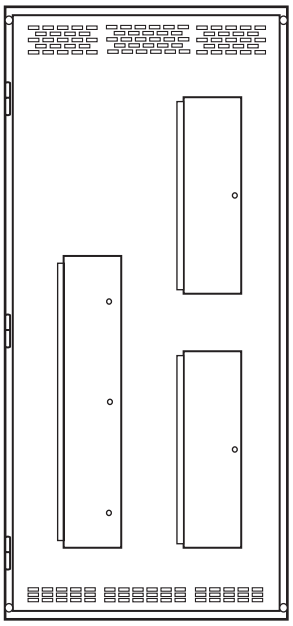
For max. quantity of contactors see “Appendix” on page 78.

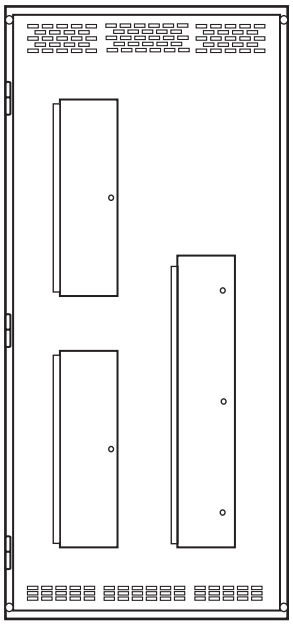
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Side-by-Side NF Panelboard

Figure 11: 42 in. w x 91.5 in. x 24 in. d Type 1 Enclosure





NF Stacked or NF Powerlink G3 Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max. 42 circuits, top or bottom
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A MLO, max. 36 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel

100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

Equipment Space—Stacked

Backplate size 17.75-in. w x 40.75-in. h

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
  - — Unwired: Mounted in cell only
  - — Line side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

For max. quantity of contactors see “Appendix” on page 78.

NF Side-by-Side or NF Powerlink G3 Side-by-Side

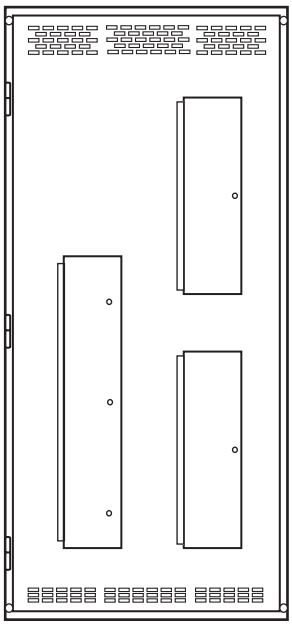
SCCR 10–200 kA

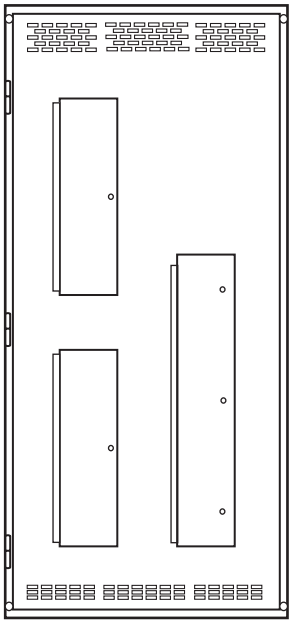
208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- 250 A MLO 42, 54, 66, 84 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options (choose one):
    - Sub-feed circuit breaker (250 A max.)
    - Sub-feed lugs
    - TVSS

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Figure 11 (cont.)





250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

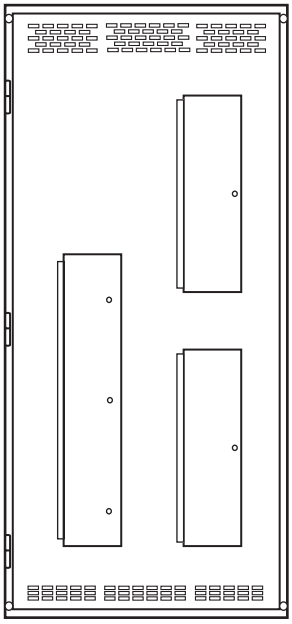
300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

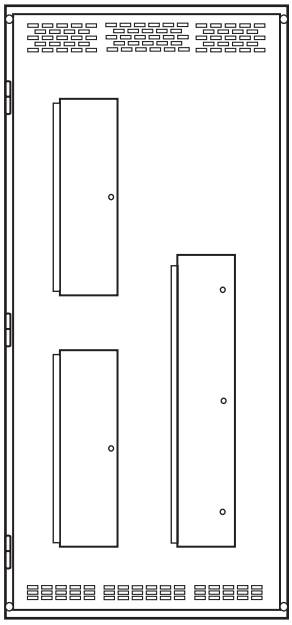
- 400 A MLO 42, 54 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options (choose one):
    - Sub-feed circuit breaker (2-250 A or 1-400 A max.)
    - Sub-feed lugs
    - TVSS
- 400 A MLO 66 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers are not available in this circuit count
  - — Option: Sub-feed lugs
- 400 A MLO 84 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- 600 A MLO 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options (choose one):
    - Sub-feed circuit breaker (2-250 A or 1-400 A max.)
    - Sub-feed lugs
    - TVSS
- 600 A MLO 54, 66, 84 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers are not available in 66 or 84 circuit interiors
  - — Options: None
- 250 A Main circuit breaker, 42, 54 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed circuit breaker (250 A max.)
    - TVSS
- 250 A Main circuit breaker, 66 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers are not available in this circuit count
  - — Option: Feed-through lugs

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Figure 11 (cont.)



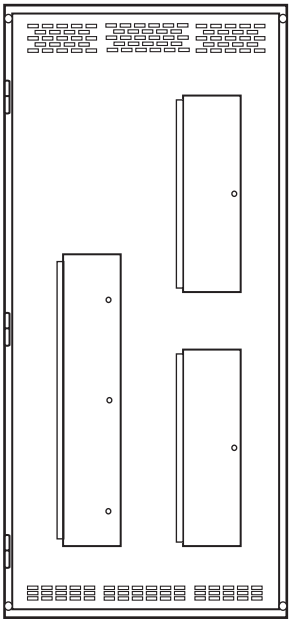


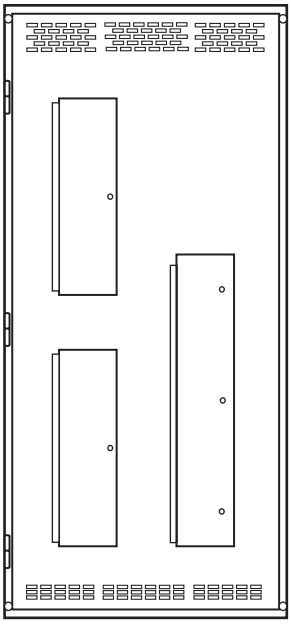
- 400 A Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed circuit breaker (2-250 A or 1-400 A max.)
    - TVSS
- 400 A Main circuit breaker, 54 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Feed-through lugs
- 600 A Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed circuit breaker (2-250 A or 1-400 A max.)
    - TVSS
- 600 A Main circuit breaker, 54 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- NF Powerlink G3 Master 600 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 600 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Master 600 A Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 600 A Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel

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Side-by-Side NQ Panelboard

Figure 12: 42 in. w x 91.5 in. x 24 in. d Type 1 Enclosure





NQ Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max. MLO 42 circuits, top or bottom
  - — Branch circuit breakers: 150 A max.
  - — Options: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Stacking rules:
    - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
    - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs) and 1–225 A max. MLO, 42 circuit interiors (Options: None)

60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

Equipment Space—Stacked

Backplate size 17.75-in. w x 40.75-in. h

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
  - — Unwired: Mounted in cell only
  - — Line side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

For max. quantity of contactors see “Appendix” on page 78.

NQ Side-by-Side

SCCR 10–200 kA

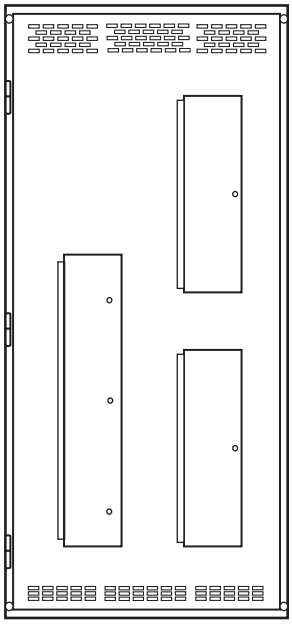
208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

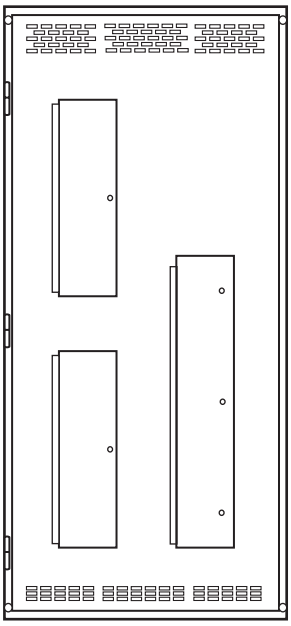
- 400 A MLO, 42, 54, 72 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Sub-feed circuit breaker (225 A max.)
    - Sub-feed lugs
    - TVSS

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Figure 12 (cont.)





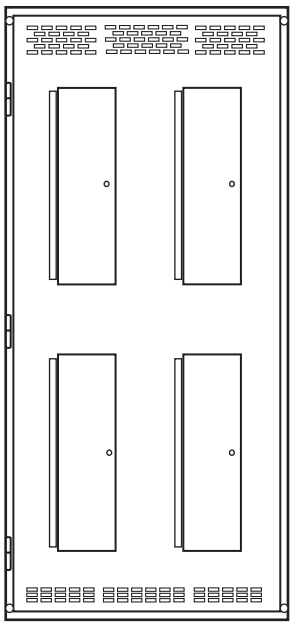
- 400 A MLO, 84 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 600 A MLO, 42, 54, 72 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Sub-feed circuit breaker (225 A max.)
    - Feed-through lugs
    - TVSS
- 600 A MLO, 84 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Feed-through lugs
- 400 A Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed circuit breaker (225 A max.)
    - TVSS
- 400 A Main circuit breaker, 54 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Feed-through lugs
    - TVSS
- 400 A Main circuit breaker, 72, 84 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Feed-through lugs
- 600 A Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Feed-through lugs
    - TVSS
- 600 A Main circuit breaker, 54, 72, 84 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Feed-through lugs

60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

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Stacked NQ, NF, or NF Powerlink G3 Panelboard

Figure 13: 42 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



NQ Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max. MLO, 42 circuits, top or bottom
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Stacking rules:
    - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
    - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs) and 1–225 A max. MLO, 42 circuit interiors (Options: None)

60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

NF Stacked or NF Powerlink G3 Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W

- NF 400 A MLO, max. 42 circuits, top or bottom
  - — Branch breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.)
  - — Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A MLO, max. 36 circuits, 480Y/277 Vac 3Ø4W max.
  - — Same options as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Same options as NF panel

100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

Equipment Space—Stacked

Backplate size 17.75-in. w x 40.75-in. h

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
  - — Unwired: Mounted in cell only
  - — Line side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

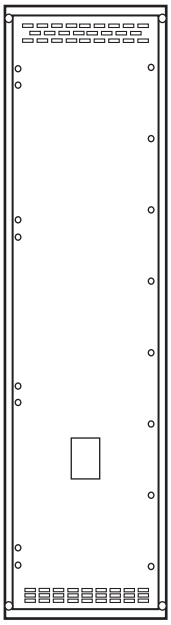
For max. quantity of contactors see “Appendix” on page 78.

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Automatic Transfer Switch Section

Figure 14: 24 in. w x 91.5 in. x 24 in. d ATS/Individually-Mounted Circuit Breaker Type 1 Enclosure



Stacked Automatic Transfer Switch (1/2 Height)

SCCR 10–65 kA (240 Vac)

SCCR 10–65 kA (480Y/277 Vac)

SCCR 10–50 kA (600Y/347 Vac)

600Y/347 Vac 3Ø4W, or 480Y/277 Vac 3Ø4W, or 208Y/120 Vac 3Ø4W, or 120/240 Vac 1Ø3W

ATS Ampere ratings 30–400 A with or without switched neutral

Options:

- Programmable Engine Exerciser (11BG)
- Two Utility and two Generator auxiliary contacts (14 AA/14 BA)
- Strip heater with Thermostat (External 120 Volt power source) (44 A)
- Strip heater with Thermostat (Internal Power Source) (44 G)
- Transfer to emergency alarm horn and silence switch (City of Chicago) includes 11BG (62W)
- Serial module (RS-485 interface) (72 A)
- Connectivity Module (Ethernet TCP/IP network) (72E)
- Surge Suppressor
  - (73VN1) for Utility, 1 required—240 volts, 1 phase
  - (73VB1) for Utility and Generator, 2 required—240 volts, 1 phase
  - (73VN3) for Utility, 1required—208 volts, 3 phase
  - (73VB3) for Utility and Generator—2 required 208 volts, 3 phase

Individually Mounted Circuit Breakers (1/2 Height)

SCCR 10–100 kA

15–800 A circuit breaker trip rating; 600 Vac max.

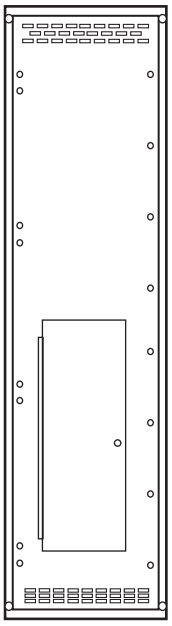
Circuit breaker options:

- 120 Vac shunt trip
- Handle padlock attachment

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Stacked Automatic Transfer Switch—Stacked NF or NQ

Figure 15: 24 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



Automatic Transfer Switch (1/2 Height)

SCCR 10–65 kA (240 Vac)

SCCR 10–65 kA (480Y/277 Vac)

SCCR 10–50 kA (600Y/347 Vac)

600Y/347 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, 208Y/120 Vac 3Ø4W, or 120/240 Vac 1Ø3W

ATS Ampere ratings 30–400 A with or without switched neutral

Options:

- Programmable Engine Exerciser (11BG)
- Two utility and two generator auxiliary contacts—14 AA/14 BA
- Strip heater with Thermostat (External 120 Volt power source) (44 A)
- Strip heater with Thermostat (Internal Power Source) (44 G)
- Transfer to emergency alarm horn and silence switch (City of Chicago) includes 11BG (62W)
- Serial module (RS-485 interface) (72 A)
- Connectivity Module (Ethernet TCP/IP network) (72E)
- Surge Suppressor
  - (73VN1) for Utility, 1 required—240 volts, 1 phase
  - (73VB1) for Utility and Generator, 2 required—240 volts, 1 phase
  - (73VN3) for Utility, 1 required—208 volts, 3 phase
  - (73VB3) for Utility and Generator—2 required 208 volts, 3 phase

Equipment Space (1/2 Height)

Backplate size 17.75-in. w x 40.75-in. h

Short circuit current rating (SCCR), see document no. 2010DB0201

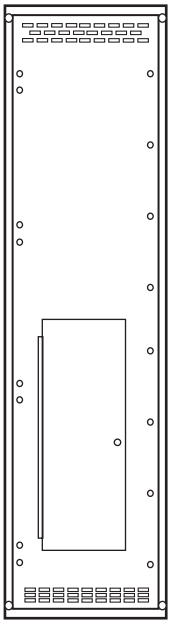
- Contactor options:
  - 8903 Type LO, 20 A electrically held and LX mechanically held
  - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
  - Unwired: Mounted in cell only
  - Line side wired: Line side wired to a branch circuit breaker(s)
  - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

For max. quantity of contactors see “Appendix” on page 78.

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Figure 15 (cont.)



NQ Stacked Combination

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max. MLO, 42 circuits, top or bottom
  - — Branch circuit breakers: 150 A max.
  - — Options: Sub-feed lugs
- 250 A max. Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

NF Stacked Combination or NF Powerlink G3 Stacked Combo

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max. 42 circuits, top or bottom
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: Sub-feed lugs
- NF Powerlink G3 Master, 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave, 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel

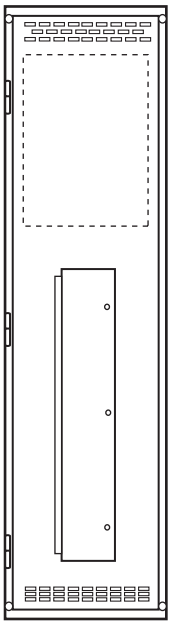
100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

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Stacked Equipment Space

Figure 16: 24 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

Equipment Space (1/4 Height)

Backplate size 17.5 in. w x 20.38 in. h

SCCR, see document no. 2010DB0201

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options
  - — Unwired: Mounted in cell only
  - — Line side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

For max. quantity of contactors see “Appendix” on page 78.

NQ Stacked Combination (3/4 Height)

SCCR 10–200 kA

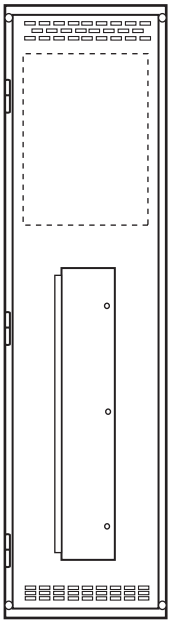
208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A MLO, max. 42, 54 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225 A MLO, max. 72, 84 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 400 A MLO, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 600 A MLO, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Feed-through lugs
- 225/250 A max. Vertical Main circuit breaker, 42 circuits max.
  - — Branch circuit breakers: 150 A max.
  - — Option: Feed-through lugs
- 250 A max. Vertical Main circuit breaker, 54, 72 circuits max.
  - — Branch circuit breakers: 150 A max.
  - — Options: None

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Figure 16 (cont.)



250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

NF Stacked Combination or NF Powerlink G3 Stacked Combination

SCCR 10–200 kA

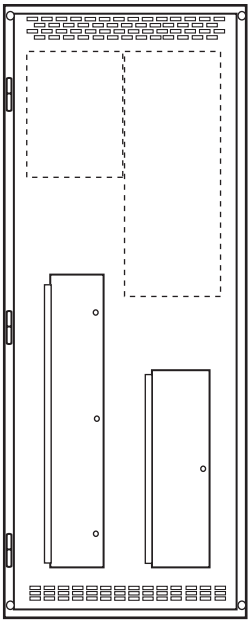
208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W

- 250 A MLO, max. 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options (choose one):
    - Sub-feed lugs
    - TVSS
- 250 A MLO, max. 54 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed lugs
- 400 A MLO, max. 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed lugs
- 250 A Vertical Main circuit breaker, max. 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- NF Powerlink G3 Master 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Master 250 A, Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 250 A, Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel

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NQ Stacked Combination

Figure 17: 36 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



60 A–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

For max. quantity of contactors see “Appendix” on page 78.

Equipment Space— Left (1/4 Height)

Backplate size 13.75 in. w x 20.38 in. h

SCCR, see document no. 2010DB0201

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
  - — Unwired: Mounted in cell only
  - — Line side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

NQ Stacked Combination— Left (3/4 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO, 42, 54 circuits max.
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed circuit breaker (225 A max.)
    - TVSS
- 225 A max. MLO, 72, 84 circuits max.
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Feed-through lugs
- 225/250 A max. Main circuit breaker, 54 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

Equipment Space— Right (1/2 Height)

Backplate size 13.75 in. w x 40.75 in. h

SCCR, see document no. 2010DB0201

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options
  - — Unwired: Mounted in cell only
  - — Line side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks.

NQ Stacked Combination— Right (1/2 Height)

SCCR 10–200 kA

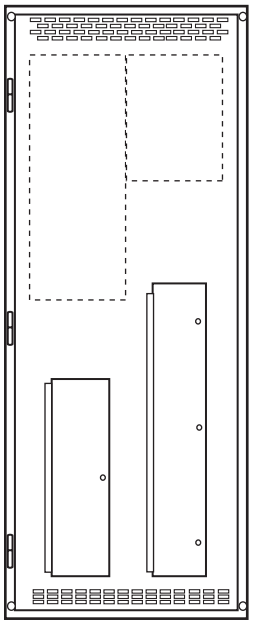
208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: Sub-feed lugs
- 225/250 A max. Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

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Figure 18: 36 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



60 A–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

For max. quantity of contactors see “Appendix” on page 78.

Equipment Space— Left (1/2 Height)

Backplate size 13.75 in. w x 40.75 in. h

SCCR, see document no. 2010DB0201

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
  - — Unwired: Mounted in cell only
  - — Line side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

NQ Stacked Combination 1/2 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO, 42 circuits max.
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

Equipment Space— Right (1/4 Height)

Backplate size 13.75 in. w x 20.38 in. h

SCCR, see document no. 2010DB0201

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options
  - — Unwired: Mounted in cell only
  - — Line side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

NQ Stacked Combination (3/4 Height)

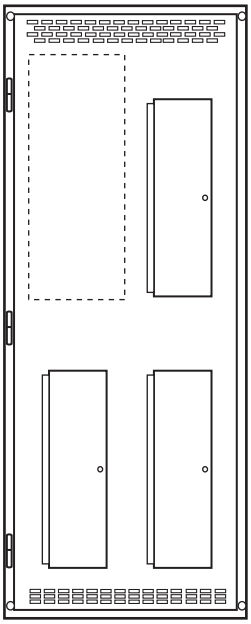
SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO, 42, 54 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed circuit breaker (225 A max.)
    - TVSS
- 225 A max. MLO, 72, 84 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed circuit breaker (225 A max.)
    - TVSS
- 225/250 A max. Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Feed-through lugs
- 225/250 A max. Main circuit breaker, 54, 72 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

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Figure 19: 36 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



60 A–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

For max. quantity of contactors see “Appendix” on page 78.

Equipment Space—1/2 Height—Left

Backplate size 13.75 in. w x 40.75 in. h

SCCR, see document no. 2010DB0201

- Contactor options:
  - 8903 Type LO, 20 A electrically held and LX mechanically held
  - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options
  - Unwired: Mounted in cell only
  - Line side wired: Line side wired to a branch circuit breaker(s)
  - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

NQ Stacked Combination—Left

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO 42 circuits
  - Branch circuit breakers: 150 A max.
  - Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
  - Branch circuit breakers: 150 A max.
  - Options: None

NQ Stacked—Right

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO, 42 circuits, top or bottom
  - Branch circuit breakers: 150 A max.
  - Option: Sub-feed lugs
- 250 A max. Main circuit breaker, 42 circuits
  - Branch circuit breakers: 150 A max.
  - Stacking rules:
    - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
    - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs) and 1–225 A max. MLO, 42 circuit interiors (Options: None)

NQ Stacked Combination—Right

SCCR 10–200 kA

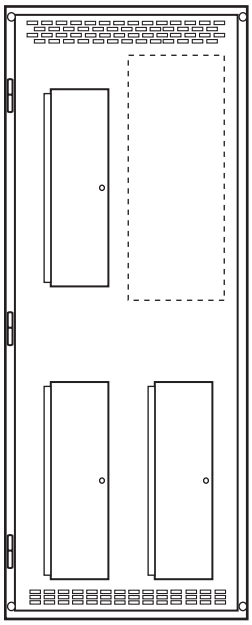
208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO, 42/54 circuits
  - Branch circuit breakers: 150 A max.
  - Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
  - Branch circuit breakers: 150 A max.
  - Stacking rules:
    - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
    - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs) and 1–225 A max. MLO, 42 circuit interiors (Options: None)

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Figure 20: 36 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



60 A–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

For max. quantity of contactors see “Appendix” on page 78.

NQ Stacked Combination—Left

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Stacking rules:
    - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
    - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs) and 1–225 A max. MLO, 42 circuit interiors (Options: None)

NQ Stacked Combination—Left

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Stacking rules:
    - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
    - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs) and 1–225 A max. MLO, 42 circuit interiors (Options: None)

Equipment Space—1/2 Height—Right

Backplate size 13.75 in. w x 40.75 in. h

SCCR, see document no. 2010DB0201

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options
  - — Unwired: Mounted in cell only
  - — Line side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

NQ Stacked—Right

SCCR 10–200 kA

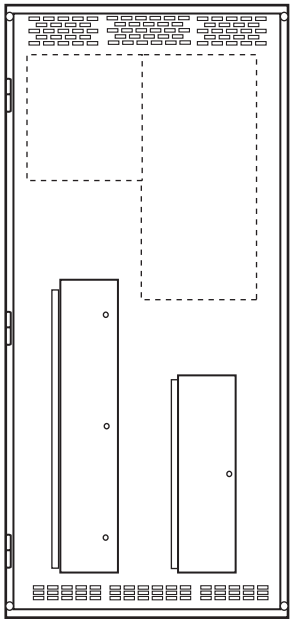
208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO, 42 circuits, top or bottom
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

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NQ, NF, or NF Powerlink G3 Stacked Combination

Figure 21: 42 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



60 A–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

For max. quantity of contactors see “Appendix” on page 78.

Equipment Space—Left (1/4 Height)

Backplate size 17.75 in. w x 20.38 in. h

SCCR, see document no. 2010DB0201

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options
  - — Unwired: Mounted in cell only
  - — Line side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

NQ Stacked Combination (3/4 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO, 42, 54 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed circuit breaker (225 A max.)
    - TVSS
- 225 A max. MLO, 72, 84 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 400 A max. MLO, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225/250 A Vertical Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Feed-through lugs
- 225/250 A Vertical Main circuit breaker, 54, 72 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: None

Equipment Space—Right (1/2 Height)

Backplate size 17.75 in. w x 40.75 in. h

SCCR, see document no. 2010DB0201

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options
  - — Unwired: Mounted in cell only
  - — Line side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

NQ Stacked Combination (1/2 Height)

SCCR 10–200 kA

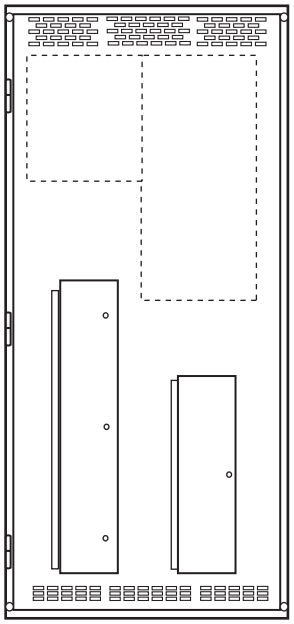
208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max. MLO, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225/250 A Vertical Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

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Figure 21 (cont.)



100 A–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300 A–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

NF Stacked Combination or NF Powerlink G3 Stacked Combination (3/4 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 250 A max. MLO, 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options (choose one):
    - Sub-feed lugs
    - TVSS
- NF 250 A max. MLO, 54 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed lugs
- NF 400 A max. MLO, 42 circuits, top or bottom
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed lugs
- 250 A Vertical Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- NF Powerlink G3 Master 400 A MLO, max. 36 circuits, 480Y/277 Vac 3Ø4W max.
  - — Same options as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Same options as NF panel
- NF Powerlink G3 Master 250 A, Main circuit breaker max. 36 circuits, 480Y/277 Vac 3Ø4W max.
  - — Same options as NF panel
- NF Powerlink G3 Slave 250 A, Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Same options as NF panel

NF Stacked Combination or NF Powerlink G3 Stacked Combination (1/2 Height)

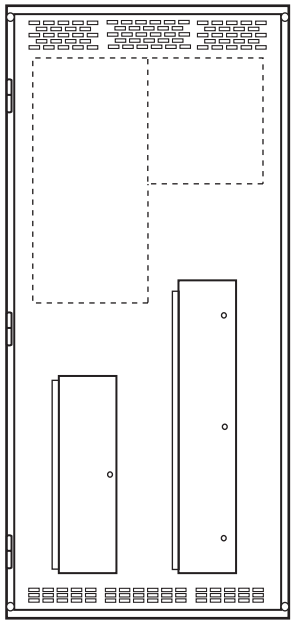
SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max 42 circuits, top or bottom
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel

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Figure 22: 42 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



60 A–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

For max. quantity of contactors see “Appendix” on page 78.

Equipment Space—Left (1/2 Height)

Backplate size 17.75 in w x 40.75 in h

SCCR, see document no. 2010DB0201

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and, mechanically held
- Contactor wiring options
  - — Unwired: Mounted in cell only
  - — Line side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

NQ Stacked Combination (1/2 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max. MLO, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225/250 A Vertical Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

Equipment Space—Right (1/4 Height)

Backplate size 17.75 in w x 20.38 in h

SCCR, see document no. 2010DB0201

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and, mechanically held
- Contactor wiring options
  - — Unwired: Mounted in cell only
  - — Line side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

NQ Stacked Combination (3/4 Height)

SCCR 10–200 kA

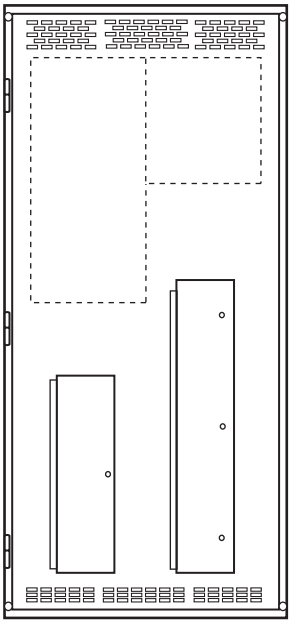
208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO, 42, 54 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Through-feed lugs
    - Sub-feed Circuit Breaker (225 A max.)
    - TVSS
- 225 A max. MLO, 72, 84 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 400 A max. MLO, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: Sub-feed lugs
- 225/250 A Vertical Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: Feed-through lugs
- 225/250 A Vertical Main circuit breaker, 54, 72 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

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Figure 22 (cont.)



100 A–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300 A–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

NF Stacked Combination or NF Powerlink G3 Stacked Combination (1/2 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A max. MLO, 42 circuits, top or bottom
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel

NF Stacked Combination or NF Powerlink G3 Stacked Combination (3/4 Height)

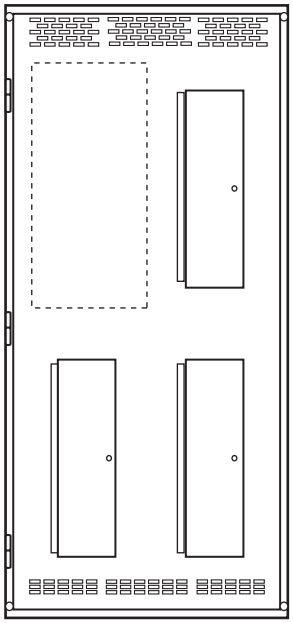
SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 250 A max. MLO, 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options (choose one):
    - Sub-feed lugs
    - TVSS
- NF 250 A max. MLO, 54 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed lugs
- NF 400 A MLO, max. 42 circuits, top or bottom
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed lugs
- 250 A Vertical Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- NF Powerlink G3 Master 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Master 250 A, Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 250 A Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel

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Figure 23: 42 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



60 A–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral in combination with any of the options listed.

100 A–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300 A–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

For max. quantity of contactors see “Appendix” on page 78.

Equipment Space—Left (1/2 Height)

Backplate size 17.75-in w x 40.75-in h

SCCR, see document no. 2010DB0201

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and, LX mechanically held
  - — 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options
  - — Unwired: Mounted in cell only
  - — Line side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

NQ Stacked Combination (1/2 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max., MLO, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225/250 A max., Vertical Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

NF/NF Powerlink G3 Stacked Combination (1/2 Height)

SCCR 10 kA–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max. 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A MLO, max. 36 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel

NQ Stacked—Right (top or bottom)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max., MLO, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Stacking rules:
    - Stacking configuration 1: Two (2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
    - Stacking configuration 2: One (1)–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs) and one (1)–225 A max. MLO, 42 circuit interiors (Options: None)

NF/NF Powerlink G3 Stacked (top or bottom)

SCCR 10–200 kA

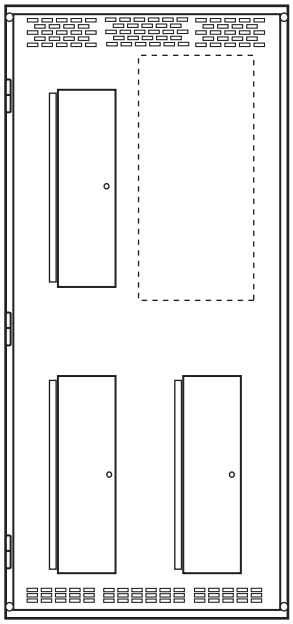
208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max. 42 circuits, top or bottom
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A MLO, max. 36 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel

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Figure 24: 42 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



60 A–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

100 A–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300 A–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

For max. quantity of contactors see “Appendix” on page 78.

NQ Stacked—Left

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max., MLO, 42 circuits
- Branch circuit breakers: 150 A max.
  - — Options: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Stacking rules:
    - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
    - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Options: Feed-through lugs) and 1–225 A max. MLO, 42 circuit interiors (Options: None)

NF/NF Powerlink G3 Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max. 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A, MLO, max. 36 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel

Equipment Space—Right (1/2 Height)

Backplate size 17.75-in. w x 40.75-in. h

SCCR, see document no. 2010DB0201

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
  - — Unwired: Mounted in cell only
  - — Line side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

NQ Stacked Combination (1/2 Height)

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max., MLO, 42 circuits
- Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 250 A max., Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

NF/NF Powerlink G3 Stacked Combination

SCCR 10–200 kA

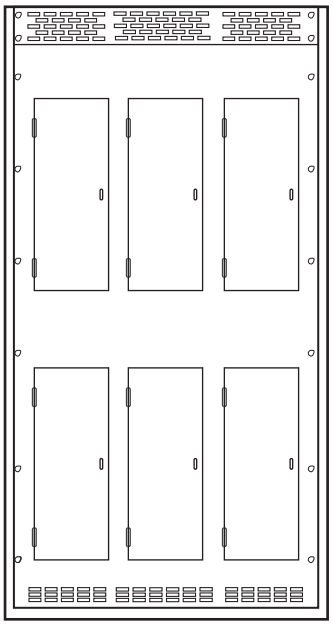
208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max. 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A MLO, max. 36 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel

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Stacked Combination

Figure 25: 48 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



NQ Stacked—NF panel is not permitted

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max., MLO, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Stacking rules:
    - Stacking configuration 1: 2–225/250 A max. Main circuit breaker, 42 circuit interiors (Options: None)
    - Stacking configuration 2: 1–225 A max. Main circuit breaker, 42 circuit interiors (Option: Feed-through lugs) and 1–225 A max. MLO, 42 circuit interiors (Options: None)

60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

Equipment Space (1/2 Height) (any of the six locations)

Backplate size 13.75-in. w x 40.75-in. h

SCCR, see document no. 2010DB0201

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options
  - — Unwired: Mounted in cell only
  - — Line side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s) with load side wired to the terminal blocks

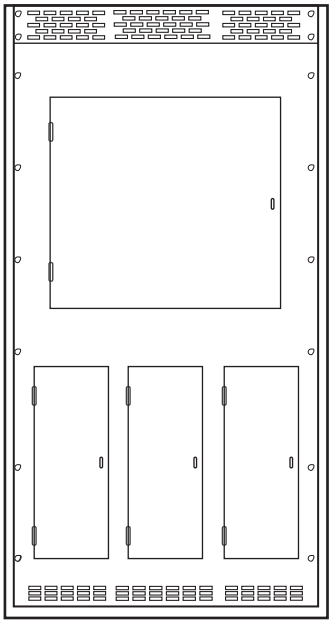
For max. quantity of contactors see “Appendix” on page 78.

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Stacked, Combo, Side-by-Side Panelboard

Figure 26: 48 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



HCP I-Line

SCCR 10–200 kA

600 Vac max., double-row mounting

- 800 A max. MLO with 27-in. max. circuit breaker mounting space
  - — Feeder circuit breaker: 800 A max.
  - — Options (choose one):
    - Sub-feed lugs
    - TVSS
- 800 A max. Main circuit breaker (Backfed) with 27-in. max. circuit breaker mounting space without a Main circuit breaker
  - — Feeder circuit breaker: 800 A max.
  - — Options (choose one):
    - Sub-feed lugs
    - TVSS

NQ—Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

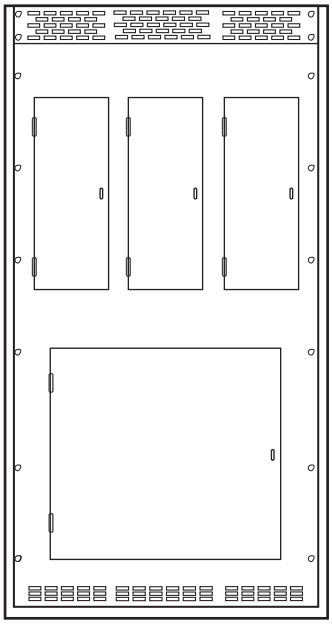
- 225 A MLO, max. 42/54 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

60–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

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Stacked, Side-by-Side, Combo Panelboard

Figure 27: 48 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



HCP I-Line

SCCR 10–200 kA

600 Vac max., double-row mounting

- 800 A MLO with 27-in. max., circuit breaker mounting space
  - — Feeder circuit breaker: 800 A max.
  - — Options (choose one):
    - Sub-feed lugs
    - TVSS
- 800 A Main circuit breaker (Backfed), with 27-in. max., circuit breaker mounting space without a Main circuit breaker
  - — Feeder circuit breaker: 800 A max.
  - — Options (choose one):
    - Sub-feed lugs
    - TVSS

NQ—Stacked

SCCR 10–200 kA

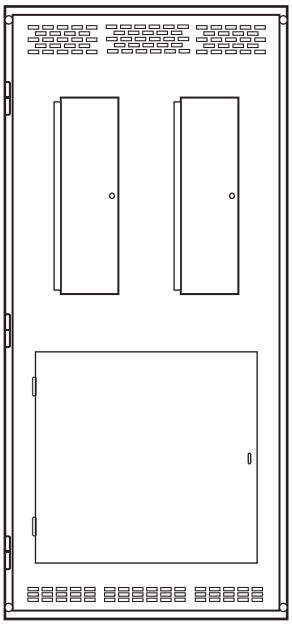
208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A MLO, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

60–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

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Figure 28: 42 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



NQ—Stacked—Left and Right

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A MLO, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

NF/NF Powerlink G3 Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max. 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: Sub-feed lugs
- NF Powerlink G3 Master 400 A, MLO, max. 42 circuits 480Y/277 Vac 3Ø4W
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel

HCP I-Line—Stacked

SCCR 10–200 kA

600 Vac max., double-row mounting

- 800 A MLO with 27-in. max. circuit breaker mounting space
  - — Feeder circuit breaker: 800 A max.
  - — Options (choose one):
    - Sub-feed lugs
    - TVSS
- 800 A Main circuit breaker (Backfed), with 27-in. max. circuit breaker mounting space without a Main circuit breaker
  - — Feeder circuit breaker: 800 A max.
  - — Options (choose one):
    - Sub-feed lugs
    - TVSS

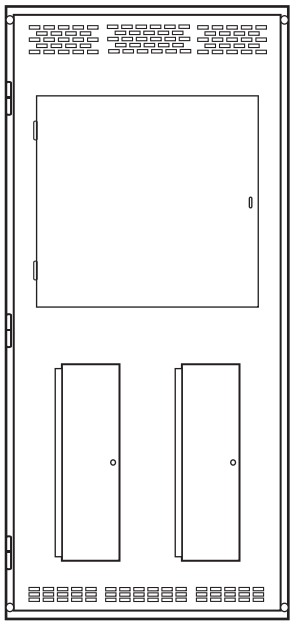
60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

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Figure 29: 42 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



HCP I-Line—Stacked

SCCR 10–200 kA

600 Vac max., double-row mounting

- 800 A MLO with 27-in. max. circuit breaker mounting space
  - — Feeder circuit breaker: 800 A max.
  - — Options (choose one):
    - Sub-feed lugs
    - TVSS
- 800 A Main circuit breaker (Backfed) with 27-in. max. circuit breaker mounting space without a Main circuit breaker
  - — Feeder circuit breaker: 800 A max.
  - — Options (choose one):
    - Sub-feed lugs
    - TVSS

NQ—Stacked—Left and Right

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A MLO, max. 42/54 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

NF/NF Powerlink G3 Stacked

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 480Y/277 Vac 3Ø4W or 600Y/347 Vac 3Ø4W NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max. 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A, 36 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel

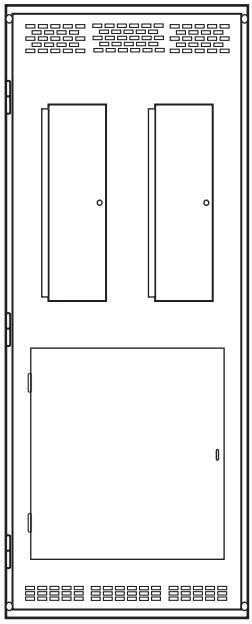
100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

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Figure 30: 36 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



NQ—Stacked—Left and Right

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A MLO, max. 42/54 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

60–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

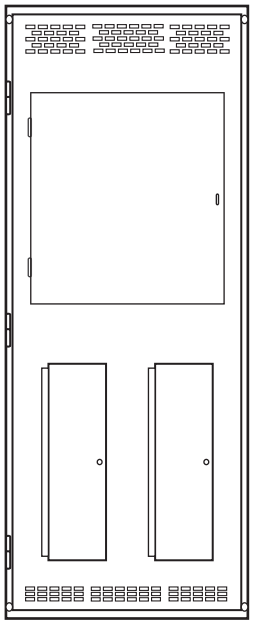
HCM I-Line—Stacked

SCCR 10–200 kA

600 Vac max., double-row mounting

- 800 A MLO with 27-in. max. circuit breaker mounting space
  - — Feeder circuit breaker: 250 A max.
  - — Options (choose one):
    - Sub-feed lugs
    - TVSS

Figure 31: 36 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



HCM I-Line—Stacked

SCCR 10–200 kA

600 Vac max., double-row mounting

- 800 A MLO with 27-in. max. circuit breaker mounting space
  - — Feeder circuit breaker: 250 A max.
  - — Options (choose one):
    - Sub-feed lugs
    - TVSS

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NQ—Stacked—Left and Right

SCCR 10–200 kA

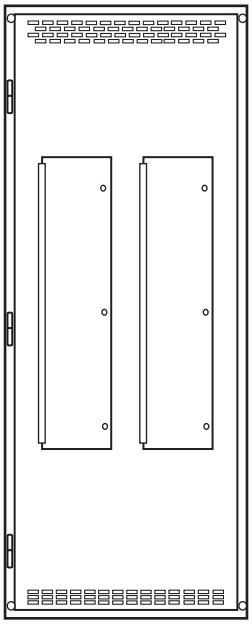
208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A MLO, max. 42/54 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, max. 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

60–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

Side-by-Side Panelboard

Figure 32: 36 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



NQ Side-by-Side—NF not permitted

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

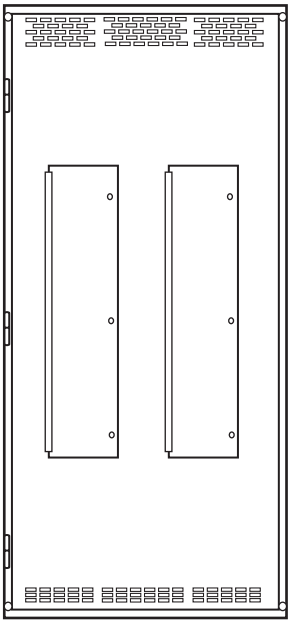
- 225 A MLO 42, 54, 72, 84 circuits max.
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Sub-feed circuit breaker (225 A max.)
    - Sub-feed lugs
    - TVSS
- 250 A Vertical Main circuit breaker, 42, 54, 72, 84 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Sub-feed circuit breaker (225 A max.)
    - Sub-feed lugs
    - TVSS

60–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

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Figure 33: 42 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



NQ Side-by-Side

SCCR 10–200 kA

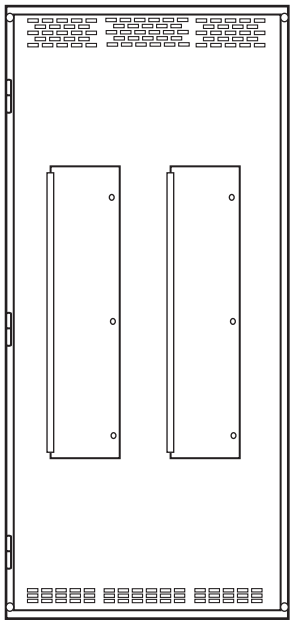
208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max. MLO 42, 54, 72 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Sub-feed circuit breaker (225 A max.)
    - Sub-feed lugs
    - TVSS
- 400 A max. MLO 84 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 600 A max. MLO 42, 54, 72 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed circuit breaker (225 A max.)
    - TVSS
- 600 A max. MLO 84 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Feed-through lugs

60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

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Figure 33 (cont.)



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

- 400 A max. vertical Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed circuit breaker (225 A max.)
    - TVSS
- 400 A max. vertical Main circuit breaker, 54 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Feed-through lugs
    - TVSS
- 400 A max. vertical Main circuit breaker, 72, 84 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Feed-through lugs
- 600 A max. vertical Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Feed-through lugs
    - TVSS
- 600 A max. vertical Main circuit breaker, 54, 72, 82 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Feed-through lugs

NF Side-by-Side or NF Powerlink G3 Side-by-Side

SCCR 10–200 kA

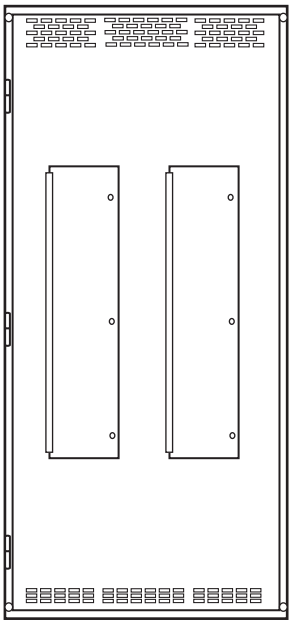
208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- 250 A MLO 42, 54, 66 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options (choose one):
    - Sub-feed circuit breaker (250 A max.)
    - Sub-feed lugs
    - TVSS
- 400 A MLO 42, 54 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options (choose one):
    - Sub-feed circuit breaker (250 A max.)
    - Sub-feed lugs
    - TVSS

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Figure 33 (cont.)



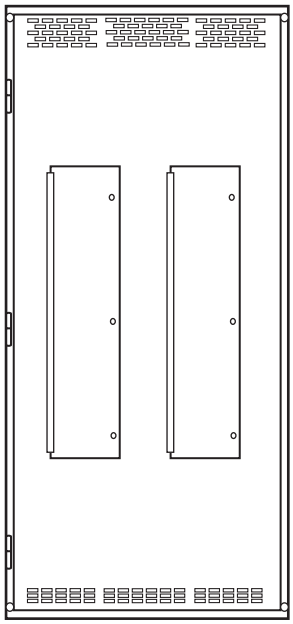
100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

- 400 A MLO 66 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers are not available in this circuit count
  - — Option: Sub-feed lugs
- 400 A MLO 84 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers are not available in this circuit count
  - — Options: None
- 600 A MLO 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed circuit breaker (250 A max.)
    - TVSS
- 600 A MLO 54, 66, 84 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers are not available in this circuit count
  - — Options: None
- 250 A max. Main circuit breaker, 42, 54 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed circuit breaker (250 A max.)
    - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
    - TVSS
- 250 A max. Main circuit breaker, 66 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers are not available in this circuit count
  - — Option: Feed-through lugs
- 400 A max. Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed circuit breaker (250 A max.)
    - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
    - TVSS
- 400 A max. Main circuit breaker, 54 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Feed-through lugs

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Figure 33 (cont.)





100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

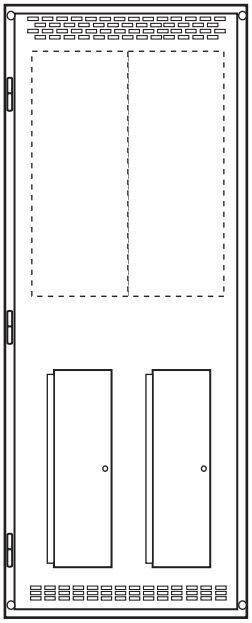
- 600 A max. Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options (choose one):
    - Feed-through lugs
    - Sub-feed circuit breaker
    - TVSS
- 600 A max. Main circuit breaker, 54 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- NF Powerlink G3 Master 600 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Master 600 A Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 600 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 600 A Main circuit breaker, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel

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NQ Stacked Combination

Figure 34: 36 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



Equipment Space—Right/Left (1/2 Height)

Backplate size 13.75-in. w x 40.75-in. h

SCCR, see document no. 2010DB0201

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and, mechanically held
- Contactor wiring options
  - — Unwired: Mounted in cell only
  - — Line side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

For max. quantity of contactors see “Appendix” on page 78.

NQ Stacked Combination—Right/Left

SCCR 10–200 kA

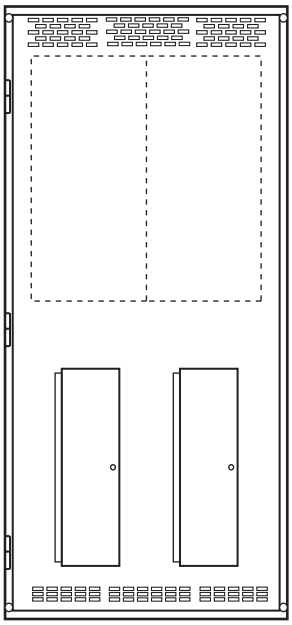
208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 225 A max. MLO, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225/250 A max. Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

60–250 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

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Figure 35: 42 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



Equipment Space—Right/Left (1/2 Height)

Backplate size 17.75-in. w x 40.75-in. h

SCCR, see document no. 2010DB0201

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options
  - — Unwired: Mounted in cell only
  - — Line side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

For max. quantity of contactors see “Appendix” on page 78.

NQ Stacked Combination Right/Left

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 400 A max. MLO, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 225/250 A Vertical Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

NF Stacked Combination or NF Powerlink G3 Stacked Combination

SCCR 10–200 kA

208Y/120 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, or 600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max.

- NF 400 A MLO, max. 42 circuits, top or bottom
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed lugs
- NF Powerlink G3 Master 400 A MLO, max. 36 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel
- NF Powerlink G3 Slave 400 A MLO, max. 42 circuits, 480Y/277 Vac 3Ø4W max.
  - — Options: Same as NF panel

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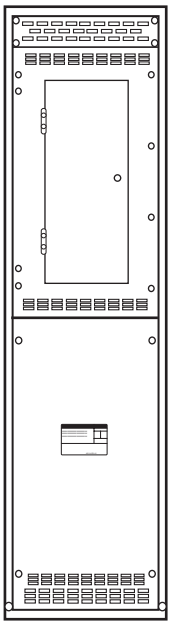
IPC2: Transformer Combo

The Transformer Combo integrates panelboards, individually mounted circuit breakers or lighting contactors with a dry type transformer into one factory-assembled and pre-wired solution.

All configurations have factory-installed Type THHN copper cable.

Transformer Combo Section

Figure 36: 24 in. w x 91.5 in. x 24 in. d Type 1 Enclosure Top cell: NF Panelboard, NQ Panelboard Bottom cell: Transformer



100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

NF Panelboard Interiors or NF Powerlink Panelboard

SCCR 10–200 kA

600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max., 480Y/277 Vac 3Ø4W, 208Y/120 Vac 3Ø4W, or 120/240 Vac 1Ø3W

- 200–400 A MLO 30 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed circuit breaker (250 A max., not available with Powerlink)
- 60–400 A MLO 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- 60–250 A Main circuit breaker 42 circuits
  - — Branch circuit breakers: 125 A max. or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- 300–400 A Main circuit breaker 30 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None (not available with Powerlink)

Or

NQ Panelboard Interior

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 60–400 A MLO 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None
- 60–225 A Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Feed-through lugs
- 250–400 A Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

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Transformer

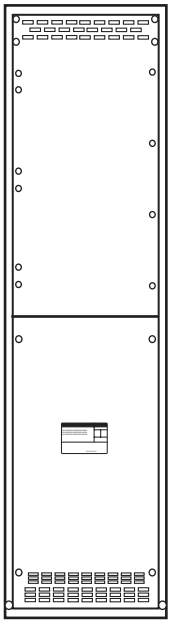
Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 15, 30, or 45 kVA, 3Ø, EE, 150 degree C Rise
- 15 or 30 kVA, 3Ø, EE, 80 and 115 degree C Rise
- 15 or 30 kVA, 3Ø, EE, 150 degree C rise rated K4/K13
- 15 kVA, 3Ø, EE, 80 and 115 degree C rise rated K4/K13

Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.7, or 50 kVA, 1Ø, EE, 150 degree C Rise
- 15, 25, or 37.7 kVA, 1Ø, EE, 80 and 115 degree C Rise

Figure 37: 24 in. w x 91.5 in. x 24 in. d Type 1 Enclosure Top cell: Equipment Space Bottom cell: Transformer



Equipment Space Options

- 3rd party equipment
- Contactors options:
  - 20 A to 200 A
  - Electrically held or mechanically held
- Contactor wiring options:
  - Unwired: Mounted in cell only
  - Load side wired: Line side wired to a branch circuit breaker(s)
  - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

Transformer

Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 15, 30 or 45 kVA 3Ø kVA, EE, 150 degree C Rise
- 15 or 30 kVA 3Ø EE, 80 and 115 degree C Rise
- 15 or 30 kVA 3Ø EE, 150 degree C rise rated K4/K13
- 15 kVA 3Ø EE 80 and 115 degree C rise rated K4/K13

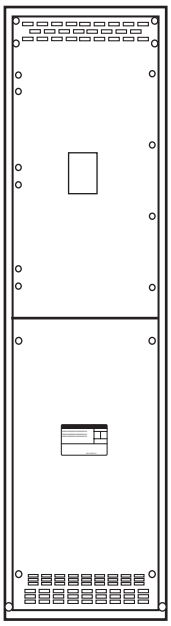
Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.5 or 50 kVA 1Ø EE, 150 degree C Rise
- 15, 25 or 37.7 kVA 1Ø EE, 80 and 115 degree C Rise

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Figure 38: 36 in. w x 91.5 in. x 24 in. d Type 1 Enclosure Top cell: One Individually-Mounting Circuit Breaker Bottom cell: Transformer



Individually-Mounted Circuit Breakers

SCCR 10–100 kA

15–800 A circuit breaker trip rating; 600 Vac max.

Circuit breaker options:

- 120 Vac shunt trip
- Handle padlock attachment

Transformer

Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

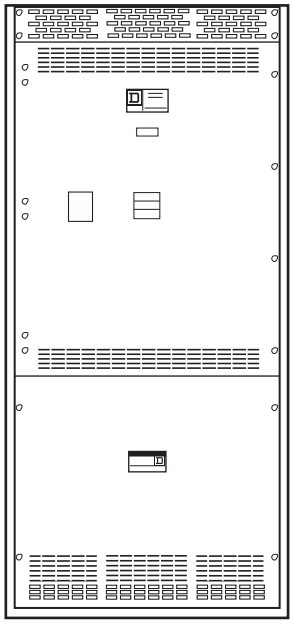
- 15, 30 or 45 kVA 3Ø kVA, EE, 150 degree C Rise
- 15 or 30 kVA 3Ø EE, 80 and 115 degree C Rise
- 15 or 30 kVA 3Ø EE, 150 degree C rise rated K4/K13
- 15 kVA 3Ø EE 80 and 115 degree C rise rated K4/K13

Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.5 or 50 kVA 1Ø EE, 150 degree C Rise
- 15, 25 or 37.7 kVA 1Ø EE, 80 and 115 degree C Rise

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Figure 39: 42 in. w x 91.5 in. x 24 in. d Type 1 Enclosure Top Left: Individually-Mounted Circuit Breaker Top Right: Equipment Space Bottom: Transformer



Individually-Mounted Circuit Breaker

SCCR 10–100 kA

15–800 A circuit breaker trip rating; 600 Vac max.

- Circuit breaker options:
  - — 120 Vac shunt trip
  - — Handle padlock attachment

Equipment Space

- With removable back pan for third party equipment, or with contactors
- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
  - — Unwired: Mounted in cell only
  - — Load side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

Transformer

Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 15, 30, 45, 75, 112.5 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise
- 150, 225 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 112, 150 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 112, 150 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 15, 30, 45 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13
- 75, 112 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13

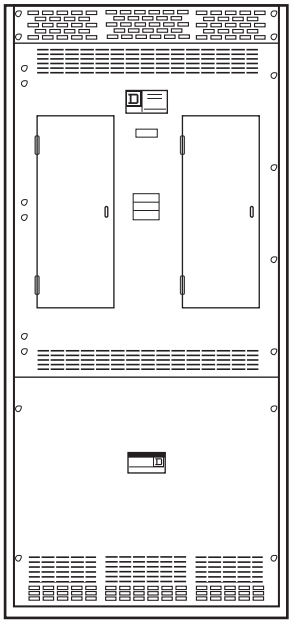
Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.5, 50, 75 kVA, EE, 150 degree C Rise
- 15, 25, 37.5, 50 kVA, 24 in. depth min., EE, 80 and 115 degree C Rise
- 75 kVA, 36 in. depth min., EE, 80 and 115 degree C Rise

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Figure 40: 42 in. w x 91.5 in. x 24 in. d Type 1 Enclosure Top Left: NF, NF Powerlink, NQ Top Right: NF, NF Powerlink, NQ Bottom: Transformer



100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

NF Panelboard Interior or NF Powerlink Panelboard

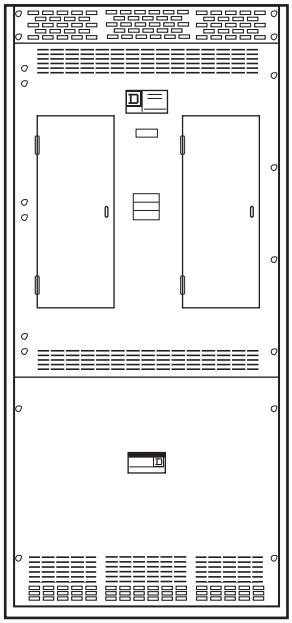
SCCR 10–100 kA

600Y/347 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, 208Y/120 Vac 3Ø4W, or 120/240 Vac 1Ø3W

- 60–250 A MLO 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- 300–400 A MLO 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- 300–400 A MLO 30 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed circuit breaker (250 A max., not available with Powerlink)
- 60–250 A Main circuit breaker 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- 300–400 A Main circuit breaker 30 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None (not available with Powerlink)

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Figure 40 (cont.)



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

NQ Panelboard Interior

SCCR 10–100 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 60–225 A MLO 42 circuits
  - — Branch circuit breakers: 225 A max.
  - — Options (choose one):
    - Sub-feed lugs
    - TVSS
- 60–400 A MLO 42 circuits
  - — Branch circuit breakers: 225 A max.
  - — Option: Sub-feed lugs
- 450–600 A MLO 42 circuits
  - — Branch circuit breakers: 225 A max.
  - — Options: None

If a 600 A interior is selected for one of the top two cells, no interior is permitted in the other top cell.

- 60–225 A Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 225 A max.
  - — Option: Feed-through lugs
- 250–400 A Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 225 A max.
  - — Options: None

Transformer

Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 15, 30, 45, 75, 112.5 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise
- 150, 225 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 112, 150 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 112, 150 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 15, 30, 45 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13
- 75, 112 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13

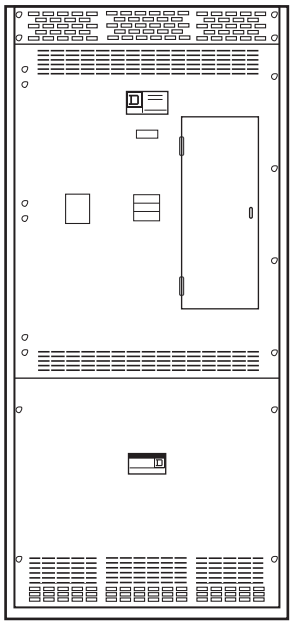
Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.5, 50, 75 kVA, EE, 150 degree C Rise
- 15, 25, 37.5, 50 kVA, 24 in. depth min., EE, 80 and 115 degree C Rise
- 75 kVA, 36 in. depth min., EE, 80 and 115 degree C Rise

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Figure 41: 42 in. w x 91.5 in. x 24 in. d Type 1 Enclosure Top Left: Individually-Mounted Circuit Breaker Top Right: NF, NF Powerlink, NQ Bottom: Transformer



Individually-Mounted Circuit Breaker

SCCR 10–100 kA

15–800 A circuit breaker trip rating; 600 Vac max.

- Circuit breaker options:
  - — 120 Vac shunt trip
  - — Handle padlock attachment

NF Panelboard Interior or NF Powerlink Panelboard

SCCR 10–100 kA

600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max., 480Y/277 Vac 3Ø4W, 208Y/120 Vac 3Ø4W, or 120/240 Vac 1Ø3W

- 60–250 A MLO 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- 300–400 A MLO 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- 300–400 A MLO 30 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed circuit breakers (250 A max., not available with Powerlink)
- 60–250 A Main circuit breaker 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- 300–400 A Main circuit breaker 30 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None (not available with Powerlink)

100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

NQ Panelboard Interior

SCCR 10–100 kA

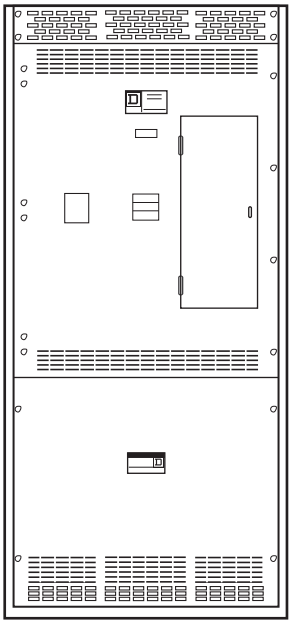
208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 60–225 A MLO 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Sub-feed lugs
    - TVSS

60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

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Figure 41 (cont.)



- 60–400 A MLO 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 450–600 A MLO 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

If a 600 A interior is selected for one of the top two cells, no interior is permitted in the other top cell.

- 60–225 A Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Feed-through lugs
- 250–400 A Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

Transformer

Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 15, 30, 45, 75, 112.5 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise
- 150, 225 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 112, 150 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 112, 150 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 15, 30, 45 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13
- 75, 112 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13

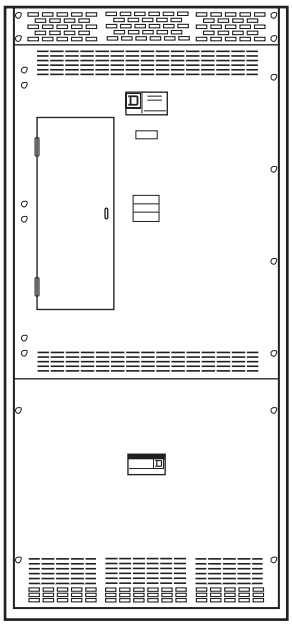
Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.5, 50, 75 kVA, EE, 150 degree C Rise
- 15, 25, 37.5, 50 kVA, 24 in. depth min., EE, 80 and 115 degree C Rise
- 75 kVA, 36 in. depth min., EE, 80 and 115 degree C Rise

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Figure 42: 42 in. w x 91.5 in. x 24 in. d Type 1 Enclosure Top Left: NF, NF Powerlink, NQ Top Right: Equipment Space Bottom: Transformer



NF Panelboard Interior or NF Powerlink Panelboard

SCCR 10–100 kA

600Y/347 Vac 3Ø4W, 480Y/277 Vac 3Ø4W, 208Y/120 Vac 3Ø4W, or 120/240 Vac 1Ø3W

- 60–250 A MLO 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- 300–400 A MLO 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- 300–400 A MLO 30 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed circuit breakers (250 A max., not available with Powerlink)
- 60–250 A Main circuit breaker 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- 300–400 A Main circuit breaker 30 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None (not available with Powerlink)

100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

NQ Panelboard Interior

SCCR 10–100 kA

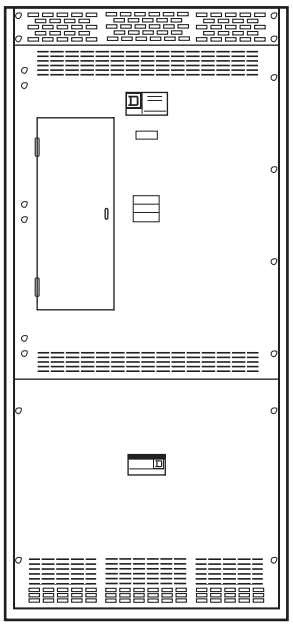
208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 60–225 A MLO 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Sub-feed lugs
    - TVSS
- 60–400 A MLO 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 400 A max. MLO, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs

60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

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Figure 42 (cont.)



- 225/250 A Vertical Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None
- 450–600 A MLO 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

If a 600 A interior is selected for one of the top two cells, no interior is permitted in the other top cell.

- 60–225 A Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Feed-through lugs
- 250–400 A Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

Equipment Space

With removable back pan for third party equipment or with contactors

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
  - — Unwired: Mounted in cell only
  - — Load side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

Transformer

Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 15, 30, 45, 75, 112.5 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise
- 150, 225 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 112, 150 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 112, 150 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 15, 30, 45 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13
- 75, 112 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13

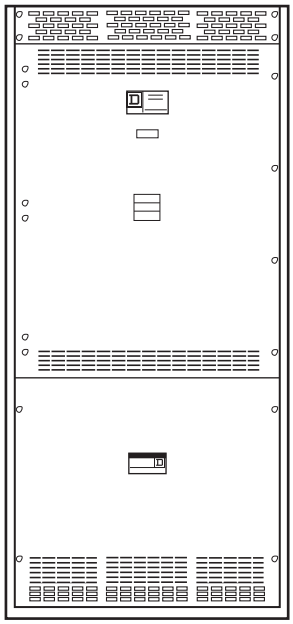
Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.5, 50, 75 kVA, EE, 150 degree C Rise
- 15, 25, 37.5, 50 kVA, 24 in. depth min., EE, 80 and 115 degree C Rise
- 75 kVA, 36 in. depth min., EE, 80 and 115 degree C Rise

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Figure 43: 42 in. w x 91.5 in. x 24 in. d Type 1 Enclosure Top Left: Equipment Space Top Right: Equipment Space Bottom: Transformer



Equipment Space

With removable back pan for third party equipment or with contactors

- Contactor options:
  - — 8903 Type LO, 20 A electrically held and LX mechanically held
  - — 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
  - — Unwired: Mounted in cell only
  - — Load side wired: Line side wired to a branch circuit breaker(s)
  - — Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

Transformer

Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

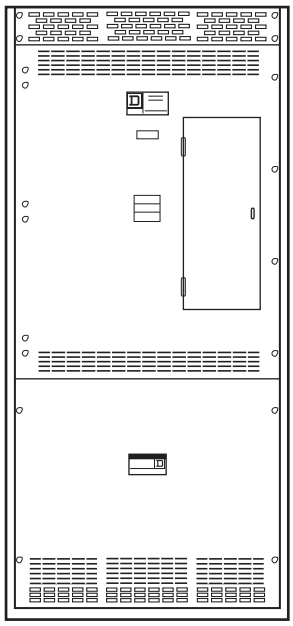
- 15, 30, 45, 75, 112.5 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise
- 150, 225 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 112, 150 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 112, 150 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 15, 30, 45 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13
- 75, 112 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13

Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.5, 50, 75 kVA, EE, 150 degree C Rise
- 15, 25, 37.5, 50 kVA, 24 in. depth min., EE, 80 and 115 degree C Rise
- 75 kVA, 36 in. depth min., EE, 80 and 115 degree C Rise

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Figure 44: 42 in. w x 91.5 in. x 24 in. d Type 1 Enclosure Top Left: Equipment Space Top Right: NF, NF Powerlink, NQ Bottom: Transformer



Equipment Space

With removable back pan for customer-installed devices or with contactors

- Contactor options:
  - 8903 Type LO, 20 A electrically held and LX mechanically held
  - 8903 Type S, 30–200 A electrically and mechanically held
- Contactor wiring options:
  - Unwired: Mounted in cell only
  - Load side wired: Line side wired to a branch circuit breaker(s)
  - Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

NF Panelboard Interior or NF Powerlink Panelboard

SCCR 10–100 kA

600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max., 480Y/277 Vac 3Ø4W, 208Y/120 Vac 3Ø4W, or 120/240 Vac 1Ø3W

- 60–250 A MLO 42 circuits
  - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - Options: None
- 300–400 A MLO 42 circuits
  - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - Options: None
- 300–400 A MLO 30 circuits
  - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - Option: Sub-feed circuit breaker (250 A max., not available with Powerlink)
- 60–250 A Main circuit breaker 42 circuits
  - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - Options: None
- 300–400 A Main circuit breaker 30 circuits
  - Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - Options: None (not available with Powerlink)

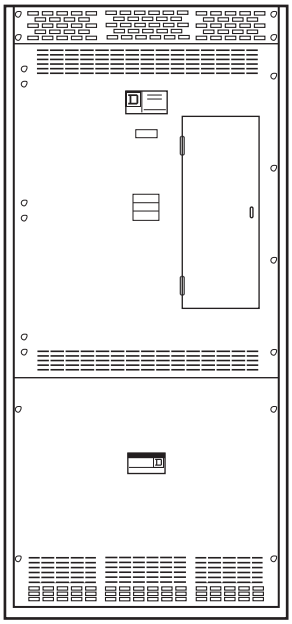
100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

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Figure 44 (cont.)



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

NQ Panelboard Interior

SCCR 10–100 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 60–225 A MLO 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Sub-feed lugs
    - TVSS
- 60–400 A MLO 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 450–600 A MLO 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

If a 600 A interior is selected for one of the top two cells, no interior is permitted in the other top cell.

- 60–225 A Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: Feed-through lugs
- 250–400 A Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

Transformer

Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

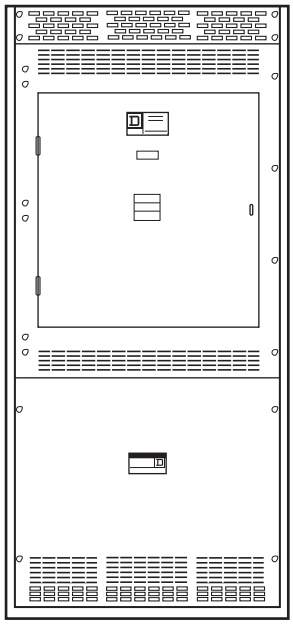
- 15, 30, 45, 75, 112.5 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise
- 150, 225 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 112, 150 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 112, 150 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 15, 30, 45 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13
- 75, 112 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13

Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.5, 50, 75 kVA, EE, 150 degree C Rise
- 15, 25, 37.5, 50 kVA, 24 in. depth min., EE, 80 and 115 degree C Rise
- 75 kVA, 36 in. depth min., EE, 80 and 115 degree C Rise

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Figure 45: 42 in. w x 91.5 in. x 24 in. d Type 1 Enclosure Top: I-Line Panel Bottom: Transformer Type 1 Enclosure



I-Line Panelboard Interior

SCCR 10–100 kA

600 Vac max.

- 225–800 A MLO with 45-in. mounting space
  - — Max. branch circuit breaker 800 A
- 225–800 A Main circuit breaker with 45-in. mounting space without Main circuit breaker kit
  - — Max. branch circuit breaker 800 A

Transformer

Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 15, 30, 45, 75, 112.5 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise
- 150, 225 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 112, 150 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 112, 150 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 15, 30, 45 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13
- 75, 112 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13

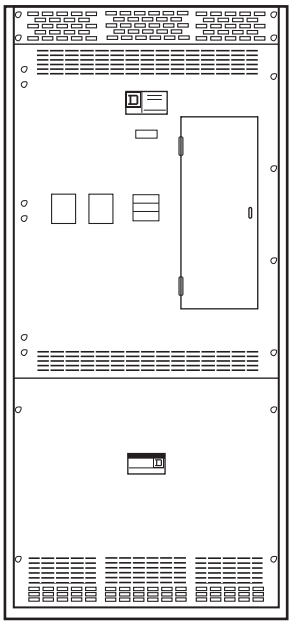
Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.5, 50, 75 kVA, EE, 150 degree C Rise
- 15, 25, 37.5, 50 kVA, 24 in. depth min., EE, 80 and 115 degree C Rise
- 75 kVA, 36 in. depth min., EE, 80 and 115 degree C Rise

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Figure 46: 42 in. w x 91.5 in. x 24 in. d Type 1 Enclosure Top Left: Two Individually-Mounted Circuit Breakers Top Right: Main Lug Only Panel Bottom: Transformer



Individually-Mounted Circuit Breaker

SCCR 10–100 kA

15–800 A circuit breaker trip rating; 600 Vac max.

- Circuit breaker options:
  - — 120 Vac shunt trip
  - — Handle padlock attachment

NF Panelboard Interior or NF Powerlink Panelboard

SCCR 10–100 kA

600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max., 480Y/277 Vac 3Ø4W, 208Y/120 Vac 3Ø4W, or 120/240 Vac 1Ø3W

- 60–250 A MLO 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- 300–400 A MLO 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- 300–400 A MLO 30 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed circuit breaker (250 A max., not available with Powerlink)
- 60–250 A Main circuit breaker 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None
- 300–400 A Main circuit breaker 30 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None (not available with Powerlink)

100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

NQ Panelboard Interior

SCCR 10–100 kA

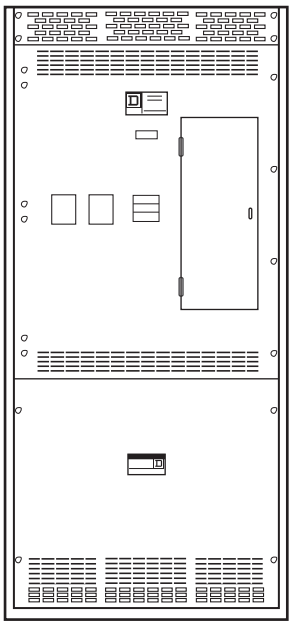
208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 60–225 A MLO 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options (choose one):
    - Sub-feed lugs
    - TVSS

60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

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Figure 46 (cont.)



- 60–400 A MLO 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 450–600 A MLO 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

If a 600 A interior is selected for one of the top two cells, no interior is permitted in the other top cell.

- 60–225 A Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Feed-through lugs
- 250–400 A Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None

Transformer

Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 15, 30, 45, 75, 112.5 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise
- 150, 225 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 112, 150 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise
- 15, 30, 45, 75 kVA, 24 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 112, 150 kVA, 36 in. depth min., 3Ø EE 150 degree C Rise, K4/K13
- 15, 30, 45 kVA, 24 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13
- 75, 112 kVA, 36 in. depth min., 3Ø EE 80 and 115 degree C Rise, K4/K13

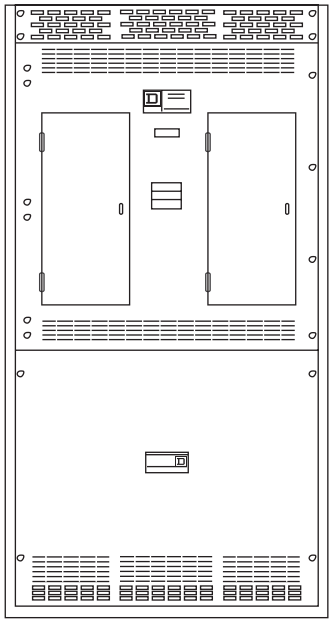
Single Phase 480 Vac or 600 Vac primary, 120/240 Vac secondary:

- 15, 25, 37.5, 50, 75 kVA, EE, 150 degree C Rise
- 15, 25, 37.5, 50 kVA, 24 in. depth min., EE, 80 and 115 degree C Rise
- 75 kVA, 36 in. depth min., EE, 80 and 115 degree C Rise

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Figure 47: 48 in. w x 91.5 in. x 36 in. d Type 1 Enclosure Top Left or Top Right, NF, NQ Panelboard Bottom: Transformer



60–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

NF Panelboard Interior or NF Powerlink Panelboard

SCCR 10–200 kA

600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max., 480Y/277 Vac 3Ø4W, 208Y/120 Vac 3Ø4W, or 120/240 Vac 1Ø3W

- 60–250 A MLO, 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: Sub-feed lugs
- 60–250 A MLO, 54 circuits (top feed only)
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None

100–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

NQ Panelboard Interior

SCCR 10–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 60–225 A MLO, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 60–225 A MLO, 54 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None
- 250–400 A MLO, 42 circuit
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 450–600 A MLO, 42 circuit
  - — Branch circuit breakers: 150 A max.
  - — Options: None

If a 600 A interior is selected for one of the top two cells, no interior is permitted in the other top cell.

- 60–225/250 A Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: TF lugs (bottom feed only)

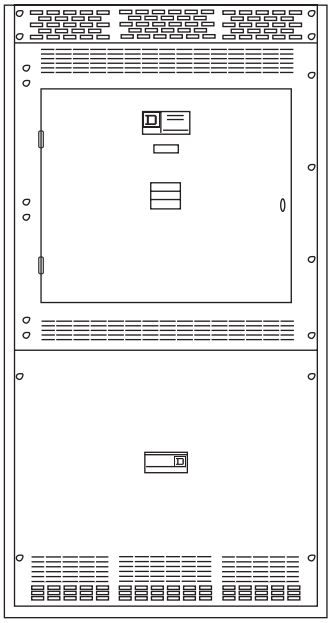
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Transformer

Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 300 kVA 3Ø, EE, 150 degree C rise rated
- 225 kVA 3Ø, EE, 80 and 115 degree C rise rated
- 225 kVA 3Ø, EE, 150 degree C rise rated with K4/K13
- 150 kVA 3Ø, EE, 80 and 115 degree C rise rated with K4/K13

Figure 48: 48 in. w x 91.5 in. x 36 in. d Type 1 Enclosure Top Cell, I-Line Panelboard Bottom: Transformer



I-Line Panelboard Interior

SCCR 10–200 kA

600 Vac max.

- 800 A max. MLO with 27-in. of circuit breaker mounting space without a main lug kit
  - — Max. branch circuit breaker 800 A
  - — Options (choose one):
    - Sub-feed lugs
    - TVSS unit
- 800 A max. Back-fed Main circuit breakers interiors with 27 in. of circuit breaker mounting space without a Main circuit breaker.
  - — Max. branch circuit breaker 800 A
  - — Options (choose one):
    - Sub-feed lugs
    - TVSS unit

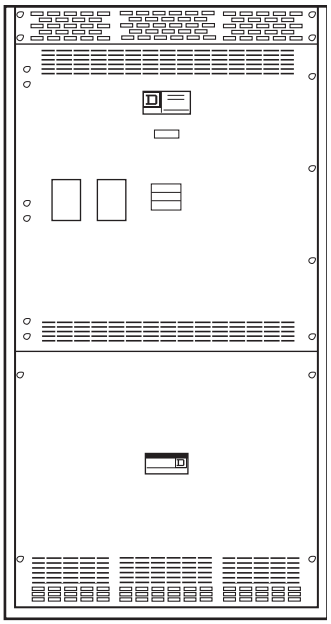
Transformer

Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 300 kVA 3Ø, EE, 150 degree C rise rated
- 225 kVA 3Ø, EE, 80 and 115 degree C rise rated
- 225 kVA 3Ø, EE, 150 degree C rise rated with K4/K13
- 150 kVA 3Ø, EE, 80 and 115 degree C rise rated with K4/K13

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Figure 49: 48 in. w x 91.5 in. x 36 in. d Type 1 Enclosure Top Left: Two Individually-Mounted Circuit Breakers Top Right: Equipment Space Bottom: Transformer



Individually-Mounted Circuit Breaker

SCCR 10 kA–100 kA

15 A–800 A circuit breaker trip rating; 600 V max.

Two circuit individually mounted circuit breakers mounted side by side

Circuit breaker options:

- 120 V shunt trip
- Handle padlock attachment

Equipment Space

Third party equipment

Contactors options:

- 20 A to 200 A
- Electrically held or mechanically held

Contactor wiring options:

- Unwired: Mounted in cell only
- Load side wired: Line side wired to a branch circuit breaker(s)
- Fully wired: Line side wired to a branch circuit breaker(s), load side wired to the terminal blocks

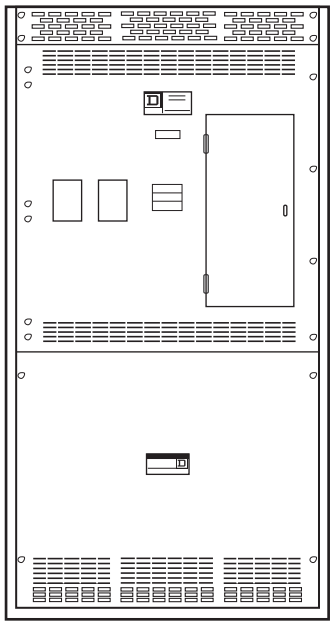
Transformer

Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 300 kVA 3Ø, EE, 150 degree C rise rated
- 225 kVA 3Ø, EE, 80 and 115 degree C rise rated
- 225 kVA 3Ø, EE, 150 degree C rise rated with K4/K13
- 150 kVA 3Ø, EE, 80 and 115 degree C rise rated with K4/K13

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Figure 50: 48 in. w x 91.5 in. x 36 in. d Type 1 Enclosure Top Left: Two Individually-Mounted Circuit Breakers Top Right: NF, NF Powerlink, NQ Bottom: Transformer



Individually-Mounted Circuit Breaker

SCCR 10 kA–100 kA

15 A–800 A circuit breaker trip rating; 600 V max.

Two circuit individually mounted circuit breakers mounted side by side

Circuit breaker options:

- 120 V shunt trip
- Handle padlock attachment

NF Panelboard Interiors or NF Powerlink Panelboard

SCCR 10 kA–200 kA

600Y/347 Vac 3Ø4W, NF Powerlink G3 480Y/277 Vac 3Ø4W max., or 480Y/277 Vac 3Ø4W, or 208Y/120 Vac 3Ø4W, or 120/240 Vac 1Ø3W

- 60 A–250 A MLO, 42 circuits
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Option: SF lugs
- 60 A–250 A MLO, 54 circuits (top feed only)
  - — Branch circuit breakers: 125 A max. at 480 V or 110 A max. at 600 V
  - — Powerlink G3 branch circuit breakers: 20 A 3P or 30 A 2P max.
  - — Options: None



100 A–250 A NF MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

300 A–400 A NF MLO or Main circuit breaker: An optional 200% neutral can not be combined with any other option in this configuration.

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60 A–400 A NQ MLO or Main circuit breaker: An optional 200% rated neutral is available in combination with any of the options listed.

NQ Panelboard Interior

SCCR 10 kA–200 kA

208Y/120 Vac 3Ø4W or 120/240 Vac 1Ø3W

- 60–225 A MLO, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 60–225 A MLO, 54 circuits
  - — Branch circuit breakers: 150 A max.
  - — Options: None
- 250–400 A MLO, 42 circuit
  - — Branch circuit breakers: 150 A max.
  - — Option: Sub-feed lugs
- 450–600 A MLO, 42 circuit
  - — Branch circuit breakers: 150 A max.
  - — Options: None

  If a 600 A interior is selected for one of the top two cells, no interior is permitted in the other top cell.
- 60–225/250 A Main circuit breaker, 42 circuits
  - — Branch circuit breakers: 150 A max.
  - — Option: TF lugs (bottom feed only)

Transformer

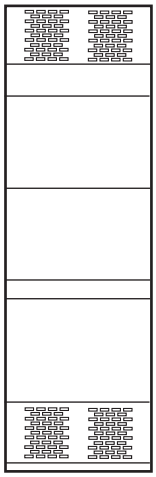
Three Phase 480 Vac or 600 Vac primary, 208Y/120 Vac secondary:

- 300 kVA 3Ø, EE, 150 degree C rise rated
- 225 kVA 3Ø, EE, 80 and 115 degree C rise rated
- 225 kVA 3Ø, EE, 150 degree C rise rated with K4/K13
- 150 kVA 3Ø, EE, 80 and 115 degree C rise rated with K4/K13

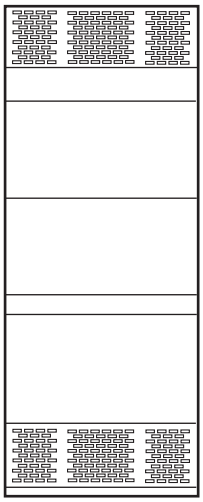
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Stacked Transformer Section

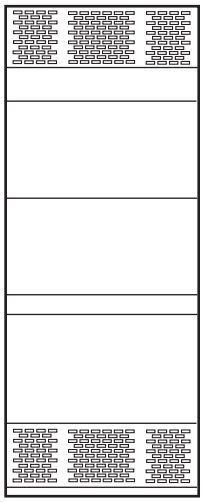
24 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



36 in. w x 91.5 in. x 24 in. d Type 1 Enclosure



36 in. w x 91.5 in. x 36 in. d Type 1 Enclosure



Only valid configurations are shown.

Stacked Transformer 24 in. W x 24 in. D Enclosure — 480 V

Table 1: 480 V Primary — 208Y/120 Secondary 3Ø Transformers

Type	Location	Configurations [1]			
EE 150° C Rise	Top	Blank	EE15T3H	EE15T3H	EE30T3H
	Bottom	EE15T3H	EE15T3H	EE30T3H	EE45T3H
	Top	Blank	EE15T3HCU	EE15T3HCU	EE30T3HCU
	Bottom	EE15T3HCU	EE15T3HCU	EE30T3HCU	EE45T3HCU
	Top	Blank	EE30T3H	EE30T3H	EE45T3H
	Bottom	EE30T3H	EE30T3H	EE45T3H	EE45T3H
	Top	Blank	EE30T3HCU	EE30T3HCU	EE45T3HCU
	Bottom	EE30T3HCU	EE30T3HCU	EE45T3HCU	EE45T3HCU
EE 115° C Rise	Top	Blank	EE15T3HF	EE15T3HF	EE30T3HF
	Bottom	EE15T3HF	EE15T3HF	EE30T3HF	EE30T3HF
	Top	Blank	EE15T3HFCU	EE15T3HFCU	EE30T3HFCU
	Bottom	EE15T3HFCU	EE15T3HFCU	EE30T3HFCU	EE30T3HFCU
EE 80° C Rise	Top	Blank	EE15T3HB	EE15T3HB	EE30T3HB
	Bottom	EE15T3HB	EE15T3HB	EE30T3HB	EE30T3HB
	Top	Blank	EE15T3HBCU	EE15T3HBCU	EE30T3HBCU
	Bottom	EE15T3HBCU	EE15T3HBCU	EE30T3HBCU	EE30T3HBCU

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Table 1: 480 V Primary — 208Y/120 Secondary 3Ø Transformers *(continued)*

Type	Location	Configurations [1]			
K-13 150° C Rise	Top	Blank	EE15T3HISNPL	EE15T3HISNPL	EE30T3HISNPL
	Bottom	EE15T3HISNPL	EE15T3HISNPL	EE30T3HISNPL	EE30T3HISNPL
	Top	Blank	EE15T3HISCUNPL	EE15T3HISCUNPL	EE30T3HISCUNPL
	Bottom	EE15T3HISCUNPL	EE15T3HISCUNPL	EE30T3HISCUNPL	EE30T3HISCUNPL
K-13 115° C Rise	Top	Blank	EE15T3HFISNPL	EE15T3HFISNPL	EE30T3HFISNPL
	Bottom	EE15T3HFISNPL	EE15T3HFISNPL	EE30T3HFISNPL	EE30T3HFISNPL
	Top	Blank	EE15T3HFISCUNPL	EE15T3HFISCUNPL	EE30T3HFISCUNPL
	Bottom	EE15T3HFISCUNPL	EE15T3HFISCUNPL	EE30T3HFISCUNPL	EE30T3HFISCUNPL
K-4 150° C Rise	Top	Blank	EE15T3HISNL	EE15T3HISNL	EE30T3HISNL
	Bottom	EE15T3HISNL	EE15T3HISNL	EE30T3HISNL	EE30T3HISNL
	Top	Blank	EE15T3HISCUNL	EE15T3HISCUNL	EE30T3HISCUNL
	Bottom	EE15T3HISCUNL	EE15T3HISCUNL	EE30T3HISCUNL	EE30T3HISCUNL
K-4 115° C Rise	Top	Blank	EE15T3HFISNL	EE15T3HFISNL	EE30T3HFISNL
	Bottom	EE15T3HFISNL	EE15T3HFISNL	EE30T3HFISNL	EE30T3HFISNL
	Top	Blank	EE15T3HFISCUNL	EE15T3HFISCUNL	EE30T3HFISCUNL
	Bottom	EE15T3HFISCUNL	EE15T3HFISCUNL	EE30T3HFISCUNL	EE30T3HFISCUNL

[1] A single phase transformer may be combined with three phase transformer provided:
a) The three phase transformer must be bottom located
b) The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

Table 2: 480 V Primary — 120/240 Secondary 1Ø Transformers

Type	Location	Configurations [1]				
EE 150° C Rise	Top	Blank	EE15S3H	EE15S3H	EE15S3H	EE15S3H
	Bottom	EE15S3H	EE15S3H	EE25S3H	EE37S3H	EE50S3H
	Top	Blank	EE15S3HCU	EE15S3HCU	EE15S3HCU	EE15S3HCU
	Bottom	EE15S3HCU	EE15S3HCU	EE25S3HCU	EE37S3HCU	EE50S3HCU
	Top	Blank	EE25S3H	EE25S3H	EE25S3H	—
	Bottom	EE25S3H	EE25S3H	EE37S3H	EE50S3H	—
	Top	Blank	EE25S3HCU	EE25S3HCU	EE25S3HCU	—
	Bottom	EE25S3HCU	EE25S3HCU	EE37S3HCU	EE50S3HCU	—
	Top	Blank	EE37S3H	EE37S3H	—	—
	Bottom	EE37S3H	EE37S3H	EE50S3H	—	—
	Top	Blank	EE37S3HCU	EE37S3HCU	—	—
	Bottom	EE37S3HCU	EE37S3HCU	EE50S3HCU	—	—

[1] A single phase transformer may be combined with three phase transformer provided:
a) The three phase transformer must be bottom located
b) The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

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Stacked Transformer 24 in. W x 24 in. D Enclosure — 600 V

Table 3: 600 V Primary — 208Y/120 Secondary 3Ø Transformers

Type	Location	Configurations [1]			
EE 150° C Rise	Top	Blank	EE15T65H	EE15T65H	EE30T65H
	Bottom	EE15T65H	EE15T65H	EE30T65H	EE45T65H
	Top	Blank	EE15T65HCU	EE15T65HCU	EE30T65HCU
	Bottom	EE15T65HCU	EE15T65HCU	EE30T65HCU	EE45T65HCU
	Top	Blank	EE30T65H	EE30T65H	EE45T65H
	Bottom	EE30T65H	EE30T65H	EE45T65H	EE45T65H
	Top	Blank	EE30T65HCU	EE30T65HCU	EE45T65HCU
	Bottom	EE30T65HCU	EE30T65HCU	EE45T65HCU	EE45T65HCU

[1] A single phase transformer may be combined with three phase transformer provided:
a) The three phase transformer must be bottom located
b) The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

Table 4: 600 V Primary — 120/240 Secondary 1Ø Transformers

Type	Location	Configurations [1]				
EE 150° C Rise	Top	Blank	EE15S3534H	EE15S3534H	EE15S3534H	EE15S3534H
	Bottom	EE15S3534H	EE15S3534H	EE25S3534H	EE37S3534H	EE50S3534H
	Top	Blank	EE15S3534HCU	EE15S3534HCU	EE15S3534HCU	EE15S3534HCU
	Bottom	EE15S3534HCU	EE15S3534HCU	EE25S3534HCU	EE37S3534HCU	EE50S3534HCU
	Top	Blank	EE25S3534H	EE25S3534H	EE25S3534H	—
	Bottom	EE25S3534H	EE25S3534H	EE37S3534H	EE50S3534H	—
	Top	Blank	EE25S3534HCU	EE25S3534HCU	EE25S3534HCU	—
	Bottom	EE25S3534HCU	EE25S3534HCU	EE37S3534HCU	EE50S3534HCU	—
	Top	Blank	EE37S3534H	EE37S3534H	—	—
	Bottom	EE37S3534H	EE37S3534H	EE50S3534H	—	—
	Top	Blank	EE37S3534HCU	EE37S3534HCU	—	—
	Bottom	EE37S3534HCU	EE37S3534HCU	EE50S3534HCU	—	—

[1] A single phase transformer may be combined with three phase transformer provided:
a) The three phase transformer must be bottom located
b) The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

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Stacked Transformer 36 in. W x 24 in. D Enclosure — 480 V

Table 5: 480 V Primary — 208Y/120 Secondary 3Ø Transformers

Type	Location	Configurations [1]			
EE 150° C Rise	Top	Blank	EE15T3H	EE15T3H	—
	Bottom	EE75T3H	EE75T3H	EE112T3H	—
	Top	Blank	EE30T3H	EE30T3H	—
	Bottom	EE75T3H	EE75T3H	EE112T3H	—
	Top	Blank	EE45T3H	EE45T3H	—
	Bottom	EE75T3H	EE75T3H	EE112T3H	—
	Top	Blank	EE75T3H	EE75T3H	—
	Bottom	EE75T3H	EE75T3H	EE112T3H	—
	Top	Blank	EE15T3HCU	EE15T3HCU	—
	Bottom	EE75T3HCU	EE75T3HCU	EE112T3HCU	—
	Top	Blank	EE30T3HCU	EE30T3HCU	—
	Bottom	EE75T3HCU	EE75T3HCU	EE112T3HCU	—
	Top	Blank	EE45T3HCU	EE45T3HCU	—
	Bottom	EE75T3HCU	EE75T3HCU	EE112T3HCU	—
	Top	Blank	EE75T3HCU	EE75T3HCU	—
	Bottom	EE75T3HCU	EE75T3HCU	EE112T3HCU	—
EE 115° C Rise	Top	Blank	EE15T3HF	EE30T3HF	EE30T3HF
	Bottom	EE45T3HF	EE45T3HF	EE45T3HF	EE75T3HF
	Top	Blank	EE45T3HF	EE45T3HF	—
	Bottom	EE45T3HF	EE45T3HF	EE75T3HF	—
	Top	Blank	EE15T3HFCU	EE30T3HFCU	—
	Bottom	EE45T3HFCU	EE45T3HFCU	EE45T3HFCU	—
	Top	Blank	EE45T3HFCU	EE45T3HFCU	—
	Bottom	EE45T3HFCU	EE45T3HFCU	EE75T3HFCU	—
EE 80° C Rise	Top	Blank	EE15T3HB	EE30T3HB	EE45T3HB
	Bottom	EE45T3HB	EE45T3HB	EE45T3HB	EE45T3HB
	Top	Blank	EE75T3HB	—	—
	Bottom	EE75T3HB	EE75T3HB	—	—
	Top	Blank	EE15T3HBCU	EE30T3HBCU	EE45T3HBCU
	Bottom	EE45T3HBCU	EE45T3HBCU	EE45T3HBCU	EE45T3HBCU
	Top	Blank	EE30T3HBCU	EE45T3HBCU	—
	Bottom	EE75T3HBCU	EE75T3HBCU	EE75T3HBCU	—
	Top	Blank	EE75T3HBCU	—	—
	Bottom	EE75T3HBCU	EE75T3HBCU	—	—
K-13 150° C Rise	Top	Blank	EE15T3HISNLP	EE30T3HISNLP	EE45T3HISNLP
	Bottom	EE45T3HISNLP	EE45T3HISNLP	EE45T3HISNLP	EE45T3HISNLP
	Top	Blank	EE15T3HISCUNLP	EE30T3HISCUNLP	EE45T3HISCUNLP
	Bottom	EE45T3HISCUNLP	EE45T3HISCUNLP	EE45T3HISCUNLP	EE45T3HISCUNLP
	Top	Blank	EE30T3HISNLP	EE45T3HISNLP	—
	Bottom	EE75T3HISNLP	EE75T3HISNLP	EE75T3HISNLP	—
	Top	Blank	EE15T3HISCUNLP	EE30T3HISCUNLP	EE45T3HISCUNLP
	Bottom	EE75T3HISCUNLP	EE75T3HISCUNLP	EE75T3HISCUNLP	EE75T3HISCUNLP

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Table 5: 480 V Primary — 208Y/120 Secondary 3Ø Transformers *(continued)*

Type	Location	Configurations [1]				
K-13 115° C Rise	Top	Blank	EE15T3HFISNLP	EE30T3HFISNLP	EE45T3HFISNLP	
	Bottom	EE45T3HFISNLP	EE45T3HFISNLP	EE45T3HFISNLP	EE45T3HFISNLP	
	Top	Blank	EE15T3HFISCUNLP	EE30T3HFISCUNLP	EE45T3HFISCUNLP	
	Bottom	EE45T3HFISCUNLP	EE45T3HFISCUNLP	EE45T3HFISCUNLP	EE45T3HFISCUNLP	
	Top	Blank	EE30T3HFISNLP	EE45T3HFISNLP	—	
	Bottom	EE75T3HFISNLP	EE75T3HFISNLP	EE75T3HFISNLP	—	
	Top	Blank	EE15T3HFISCUNLP	EE30T3HFISCUNLP	EE45T3HFISCUNLP	
	Bottom	EE75T3HFISCUNLP	EE75T3HFISCUNLP	EE75T3HFISCUNLP	EE75T3HFISCUNLP	
K-4 150° C Rise	Top	Blank	EE15T3HISNL	EE30T3HISNL	EE45T3HISNL	
	Bottom	EE45T3HISNL	EE45T3HISNL	EE45T3HISNL	EE45T3HISNL	
	Top	Blank	EE15T3HISCUNL	EE30T3HISCUNL	EE45T3HISCUNL	
	Bottom	EE45T3HISCUNL	EE45T3HISCUNL	EE45T3HISCUNL	EE45T3HISCUNL	
	Top	Blank	EE30T3HISNL	EE45T3HISNL	—	
	Bottom	EE75T3HISNL	EE75T3HISNL	EE75T3HISNL	—	
	Top	Blank	EE15T3HISCUNL	EE30T3HISCUNL	EE45T3HISCUNL	
	Bottom	EE75T3HISCUNL	EE75T3HISCUNL	EE75T3HISCUNL	EE75T3HISCUNL	
K-4 115° C Rise	Top	Blank	EE15T3HFISNL	EE30T3HFISNL	EE45T3HFISNL	
	Bottom	EE45T3HFISNL	EE45T3HFISNL	EE45T3HFISNL	EE45T3HFISNL	
	Top	Blank	EE15T3HFISCUNL	EE30T3HFISCUNL	EE45T3HFISCUNL	
	Bottom	EE45T3HFISCUNL	EE45T3HFISCUNL	EE45T3HFISCUNL	EE45T3HFISCUNL	
	Top	Blank	EE30T3HFISNL	EE45T3HFISNL	—	
	Bottom	EE75T3HFISNL	EE75T3HFISNL	EE75T3HFISNL	—	
	Top	Blank	EE15T3HFISCUNL	EE30T3HFISCUNL	EE45T3HFISCUNL	
	Bottom	EE75T3HFISCUNL	EE75T3HFISCUNL	EE75T3HFISCUNL	EE75T3HFISCUNL	

[1] A single phase transformer may be combined with three phase transformer provided:
a) The three phase transformer must be bottom located
b) The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

Table 6: 480 V Primary — 120/240 Secondary 1Ø Transformers

Type	Location	Configurations [1]					
EE 150° C Rise	Top	Blank	EE15S3H	EE25S3H	EE37S3H	EE50S3H	EE75S3H
	Bottom	EE75S3H	EE75S3H	EE75S3H	EE75S3H	EE75S3H	EE75S3H
	Top	Blank	EE15S3HCU	EE25S3HCU	EE37S3HCU	EE50S3HCU	EE75S3HCU
	Bottom	EE75S3HCU	EE75S3HCU	EE75S3HCU	EE75S3HCU	EE75S3HCU	EE75S3HCU

[1] A single phase transformer may be combined with three phase transformer provided:
a) The three phase transformer must be bottom located
b) The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

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Stacked Transformer 36 in. W x 24 in. D Enclosure — 600 V

Table 7: 600 V Primary — 208Y/120 Secondary 3Ø Transformers

Type	Location	Configurations [1]		
EE 150° C Rise	Top	Blank	EE15T65H	EE15T65H
	Bottom	EE75T65H	EE75T65H	EE112T65H
	Top	Blank	EE30T65H	EE30T65H
	Bottom	EE75T65H	EE75T65H	EE112T65H
	Top	Blank	EE45T65H	EE45T65H
	Bottom	EE75T65H	EE75T65H	EE112T65H
	Top	Blank	EE75T65H	EE75T65H
	Bottom	EE75T65H	EE75T65H	EE112T65H
	Top	Blank	EE30T65HCU	EE30T65HCU
	Bottom	EE75T65HCU	EE75T65HCU	EE112T65HCU
	Top	Blank	EE45T65HCU	EE45T65HCU
	Bottom	EE75T65HCU	EE75T65HCU	EE112T65HCU
	Top	Blank	EE75T65HCU	EE75T65HCU
	Bottom	EE75T65HCU	EE75T65HCU	EE112T65HCU

[1] A single phase transformer may be combined with three phase transformer provided:
a) The three phase transformer must be bottom located
b) The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

Table 8: 600 V Primary — 120/240 Secondary 1Ø Transformers

Type	Location	Configurations [1]					
EE 150° C Rise	Top	Blank	EE15S3534H	EE25S3534H	EE37S3534H	EE50S3534H	EE75S3534H
	Bottom	EE75S3534H	EE75S3534H	EE75S3534H	EE75S3534H	EE75S3534H	EE75S3534H
	Top	Blank	EE15S3534HCU	EE25S3534HCU	EE37S3534HCU	EE50S3534HCU	EE75S3534HCU
	Bottom	EE75S3534HCU	EE75S3534HCU	EE75S3534HCU	EE75S3534HCU	EE75S3534HCU	EE75S3534HCU

[1] A single phase transformer may be combined with three phase transformer provided:
a) The three phase transformer must be bottom located
b) The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

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Stacked Transformer 36 in. W x 36 in. D Enclosure — 480 V

Table 9: 480 V Primary — 208Y/120 Secondary 3Ø Transformers

Type	Location	Configurations [1]					
EE 150° C Rise	Top	Blank	EE15T3H	EE30T3H	EE45T3H	EE75T3H	EE112T3H
	Bottom	EE112T3H	EE112T3H	EE112T3H	EE112T3H	EE112T3H	EE112T3H
	Top	Blank	EE15T3HCU	EE30T3HCU	EE45T3HCU	EE75T3HCU	EE112T3HCU
	Bottom	EE112T3HCU	EE112T3HCU	EE112T3HCU	EE112T3HCU	EE112T3HCU	EE112T3HCU
	Top	Blank	EE15T3H	EE30T3H	EE45T3H	EE75T3H	EE112T3H
	Bottom	EE150T3H	EE150T3H	EE150T3H	EE150T3H	EE150T3H	EE150T3H
	Top	Blank	EE15T3HCU	EE30T3HCU	EE45T3HCU	EE75T3HCU	EE112T3HCU
	Bottom	EE150T3HCU	EE150T3HCU	EE150T3HCU	EE150T3HCU	EE150T3HCU	EE150T3HCU
	Top	Blank	EE15T3H	EE30T3H	EE45T3H	EE75T3H	EE112T3H
	Bottom	EE225T3H	EE225T3H	EE225T3H	EE225T3H	EE225T3H	EE225T3H
	Top	Blank	EE15T3HCU	EE30T3HCU	EE45T3HCU	EE75T3HCU	EE112T3HCU
	Bottom	EE225T3HCU	EE225T3HCU	EE225T3HCU	EE225T3HCU	EE225T3HCU	EE225T3HCU
EE 115° C Rise	Top	Blank	EE30T3HF	EE45T3HF	EE75T3HF	—	—
	Bottom	EE112T3HF	EE112T3HF	EE112T3HF	EE112T3HF	—	—
	Top	Blank	EE45T3HFCU	EE75T3HFCU	—	—	—
	Bottom	EE112T3HFCU	EE112T3HFCU	EE112T3HFCU	—	—	—
	Top	Blank	EE30T3HF	EE45T3HF	EE75T3HF	—	—
	Bottom	EE150T3HF	EE150T3HF	EE150T3HF	EE150T3HF	—	—
	Top	Blank	EE45T3HFCU	EE75T3HFCU	—	—	—
	Bottom	EE150T3HFCU	EE150T3HFCU	EE150T3HFCU	—	—	—
EE 80° C Rise	Top	Blank	EE75T3HB	—	—	—	—
	Bottom	EE112T3HB	EE112T3HB	—	—	—	—
	Top	Blank	EE30T3HBCU	EE45T3HBCU	EE75T3HBCU	—	—
	Bottom	EE112T3HBCU	EE112T3HBCU	EE112T3HBCU	EE112T3HBCU	—	—
	Top	Blank	EE75T3HB	—	—	—	—
	Bottom	EE150T3HB	EE150T3HB	—	—	—	—
	Top	Blank	EE30T3HBCU	EE45T3HBCU	EE75T3HBCU	—	—
	Bottom	EE150T3HBCU	EE150T3HBCU	EE150T3HBCU	EE150T3HBCU	—	—
K-13 150° C Rise	Top	Blank	EE30T3HISNLP	EE45T3HISNLP	EE75T3HISNLP	—	—
	Bottom	EE75T3HISNLP	EE75T3HISNLP	EE75T3HISNLP	EE75T3HISNLP	—	—
	Top	Blank	EE15T3HISCUNLP	EE30T3HISCUNLP	EE45T3HISCUNLP	EE75T3HISCUNLP	—
	Bottom	EE75T3HISCUNLP	EE75T3HISCUNLP	EE75T3HISCUNLP	EE75T3HISCUNLP	EE75T3HISCUNLP	—
	Top	Blank	EE30T3HISNLP	EE45T3HISNLP	EE75T3HISNLP	—	—
	Bottom	EE112T3HISNLP	EE112T3HISNLP	EE112T3HISNLP	EE112T3HISNLP	—	—
	Top	Blank	EE15T3HISCUNLP	EE30T3HISCUNLP	EE45T3HISCUNLP	EE75T3HISCUNLP	—
	Bottom	EE112T3HISCUNLP	EE112T3HISCUNLP	EE112T3HISCUNLP	EE112T3HISCUNLP	EE112T3HISCUNLP	—
	Top	Blank	EE30T3HISNLP	EE45T3HISNLP	EE75T3HISNLP	—	—
	Bottom	EE150T3HISNLP	EE150T3HISNLP	EE150T3HISNLP	EE150T3HISNLP	—	—
	Top	Blank	EE15T3HISCUNLP	EE30T3HISCUNLP	EE45T3HISCUNLP	EE75T3HISCUNLP	—
	Bottom	EE150T3HISCUNLP	EE150T3HISCUNLP	EE150T3HISCUNLP	EE150T3HISCUNLP	EE150T3HISCUNLP	—
K-13 115° C Rise	Top	Blank	EE30T3HFISNLP	EE45T3HFISNLP	EE75T3HFISNLP	—	—
	Bottom	EE75T3HFISNLP	EE75T3HFISNLP	EE75T3HFISNLP	EE75T3HFISNLP	—	—
	Top	Blank	EE15T3HFISCUNLP	EE30T3HFISCUNLP	EE45T3HFISCUNLP	EE75T3HFISCUNLP	—
	Bottom	EE75T3HFISCUNLP	EE75T3HFISCUNLP	EE75T3HFISCUNLP	EE75T3HFISCUNLP	EE75T3HFISCUNLP	—
	Top	Blank	EE30T3HFISNLP	EE45T3HFISNLP	EE75T3HFISNLP	—	—
	Bottom	EE112T3HFISNLP	EE112T3HFISNLP	EE112T3HFISNLP	EE112T3HFISNLP	—	—

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Table 9: 480 V Primary — 208Y/120 Secondary 3Ø Transformers *(continued)*

Type	Location	Configurations [1]					
K-13 115° C Rise	Top	Blank	EE15T3HFISCUNLP	EE30T3HFISCUNLP	EE45T3HFISCUNLP	EE75T3HFISCUNLP	—
	Bottom	EE112T3HFISCUNLP	EE112T3HFISCUNLP	EE112T3HFISCUNLP	EE112T3HFISCUNLP	EE112T3HFISCUNLP	—
	Top	Blank	EE30T3HFISNLP	EE45T3HFISNLP	EE75T3HFISNLP	—	—
	Bottom	EE150T3HFISNLP	EE150T3HFISNLP	EE150T3HFISNLP	EE150T3HFISNLP	—	—
	Top	Blank	EE15T3HFISCUNLP	EE30T3HFISCUNLP	EE45T3HFISCUNLP	EE75T3HFISCUNLP	—
	Bottom	EE150T3HFISCUNLP	EE150T3HFISCUNLP	EE150T3HFISCUNLP	EE150T3HFISCUNLP	EE150T3HFISCUNLP	—
K-4 150° C Rise	Top	Blank	EE30T3HISNL	EE45T3HISNL	EE75T3HISNL	—	—
	Bottom	EE75T3HISNL	EE75T3HISNL	EE75T3HISNL	EE75T3HISNL	—	—
	Top	Blank	EE15T3HISCUNL	EE30T3HISCUNL	EE45T3HISCUNL	EE75T3HISCUNL	—
	Bottom	EE75T3HISCUNL	EE75T3HISCUNL	EE75T3HISCUNL	EE75T3HISCUNL	EE75T3HISCUNL	—
	Top	Blank	EE30T3HISNL	EE45T3HISNL	EE75T3HISNL	—	—
	Bottom	EE112T3HISNL	EE112T3HISNL	EE112T3HISNL	EE112T3HISNL	—	—
	Top	Blank	EE15T3HISCUNL	EE30T3HISCUNL	EE45T3HISCUNL	EE75T3HISCUNL	—
	Bottom	EE112T3HISCUNL	EE112T3HISCUNL	EE112T3HISCUNL	EE112T3HISCUNL	EE112T3HISCUNL	—
	Top	Blank	EE30T3HISNL	EE45T3HISNL	EE75T3HISNL	—	—
	Bottom	EE150T3HISNL	EE150T3HISNL	EE150T3HISNL	EE150T3HISNL	—	—
	Top	Blank	EE15T3HISCUNL	EE30T3HISCUNL	EE45T3HISCUNL	EE75T3HISCUNL	—
	Bottom	EE150T3HISCUNL	EE150T3HISCUNL	EE150T3HISCUNL	EE150T3HISCUNL	EE150T3HISCUNL	—
K-4 115° C Rise	Top	Blank	EE30T3HFISNL	EE45T3HFISNL	EE75T3HFISNL	—	—
	Bottom	EE75T3HFISNL	EE75T3HFISNL	EE75T3HFISNL	EE75T3HFISNL	—	—
	Top	Blank	EE15T3HFISCUNL	EE30T3HFISCUNL	EE45T3HFISCUNL	EE75T3HFISCUNL	—
	Bottom	EE75T3HFISCUNL	EE75T3HFISCUNL	EE75T3HFISCUNL	EE75T3HFISCUNL	EE75T3HFISCUNL	—
	Top	Blank	EE30T3HFISNL	EE45T3HFISNL	EE75T3HFISNL	—	—
	Bottom	EE112T3HFISNL	EE112T3HFISNL	EE112T3HFISNL	EE112T3HFISNL	—	—
	Top	Blank	EE15T3HFISCUNL	EE30T3HFISCUNL	EE45T3HFISCUNL	EE75T3HFISCUNL	—
	Bottom	EE112T3HFISCUNL	EE112T3HFISCUNL	EE112T3HFISCUNL	EE112T3HFISCUNL	EE112T3HFISCUNL	—
	Top	Blank	EE30T3HFISNL	EE45T3HFISNL	EE75T3HFISNL	—	—
	Bottom	EE150T3HFISNL	EE150T3HFISNL	EE150T3HFISNL	EE150T3HFISNL	—	—
	Top	Blank	EE15T3HFISCUNL	EE30T3HFISCUNL	EE45T3HFISCUNL	EE75T3HFISCUNL	—
	Bottom	EE150T3HFISCUNL	EE150T3HFISCUNL	EE150T3HFISCUNL	EE150T3HFISCUNL	EE150T3HFISCUNL	—

[1] A single phase transformer may be combined with three phase transformer provided:
a) The three phase transformer must be bottom located
b) The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

Table 10: 480 V Primary — 120/240 Secondary 1Ø Transformers

Type	Location	Configurations [1]						
EE 150° C Rise	Top	Blank	EE15S3H	EE25S3H	EE37S3H	EE50S3H	EE75S3H	EE100S3H
	Bottom	EE100S3H	EE100S3H	EE100S3H	EE100S3H	EE100S3H	EE100S3H	EE100S3H
	Top	Blank	EE15S3HCU	EE25S3HCU	EE37S3HCU	EE50S3HCU	EE75S3HCU	EE100S3HCU
	Bottom	EE100S3HCU	EE100S3HCU	EE100S3HCU	EE100S3HCU	EE100S3HCU	EE100S3HCU	EE100S3HCU
	Top	Blank	EE15S3H	EE25S3H	EE37S3H	EE50S3H	EE75S3H	EE100S3H
	Bottom	EE167S3H	EE167S3H	EE167S3H	EE167S3H	EE167S3H	EE167S3H	EE167S3H
	Top	Blank	EE15S3HCU	EE25S3HCU	EE37S3HCU	EE50S3HCU	EE75S3HCU	EE100S3HCU
	Bottom	EE167S3HCU	EE167S3HCU	EE167S3HCU	EE167S3HCU	EE167S3HCU	EE167S3HCU	EE167S3HCU

[1] A single phase transformer may be combined with three phase transformer provided:
a) The three phase transformer must be bottom located
b) The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

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Stacked Transformer 36 in. W x 36 in. D Enclosure — 600 V

Table 11: 600 V Primary — 208Y/120 Secondary 3Ø Transformers

Type	Location	Configurations [1]					
EE 150° C Rise	Top	Blank	EE15T65H	EE30T65H	EE45T65H	EE75T65H	EE112T65H
	Bottom	EE112T65H	EE112T65H	EE112T65H	EE112T65H	EE112T65H	EE112T65H
	Top	Blank	EE30T65HCU	EE45T65HCU	EE75T65HCU	EE112T65HCU	—
	Bottom	EE112T65HCU	EE112T65HCU	EE112T65HCU	EE112T65HCU	EE112T65HCU	—
	Top	Blank	EE15T65H	EE30T65H	EE45T65H	EE75T65H	EE112T65H
	Bottom	EE150T65H	EE150T65H	EE150T65H	EE150T65H	EE150T65H	EE150T65H
	Top	Blank	EE30T65HCU	EE45T65HCU	EE75T65HCU	EE112T65HCU	—
	Bottom	EE150T65HCU	EE150T65HCU	EE150T65HCU	EE150T65HCU	EE150T65HCU	—
	Top	Blank	EE15T65H	EE30T65H	EE45T65H	EE75T65H	EE112T65H
	Bottom	EE225T65H	EE225T65H	EE225T65H	EE225T65H	EE225T65H	EE225T65H
	Top	Blank	EE30T65HCU	EE45T65HCU	EE75T65HCU	EE112T65HCU	—
	Bottom	EE225T65HCU	EE225T65HCU	EE225T65HCU	EE225T65HCU	EE225T65HCU	—

[1] A single phase transformer may be combined with three phase transformer provided:
a) The three phase transformer must be bottom located
b) The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

Table 12: 600 V Primary — 120/240 Secondary 1Ø Transformers

Type	Location	Configurations [1]						
EE 150° C Rise	Top	Blank	EE15S3534H	EE25S3534H	EE37S3534H	EE50S3534H	EE75S3534H	EE100S3534H
	Bottom	EE100S3534H	EE100S3534H	EE100S3534H	EE100S3534H	EE100S3534H	EE100S3534H	EE100S3534H
	Top	Blank	EE15S3534HCU	EE25S3534HCU	EE37S3534HCU	EE50S3534HCU	EE75S3534HCU	EE100S3534HCU
	Bottom	EE100S3534HCU	EE100S3534HCU	EE100S3534HCU	EE100S3534HCU	EE100S3534HCU	EE100S3534HCU	EE100S3534HCU
	Top	Blank	EE15S3534H	EE25S3534H	EE37S3534H	EE50S3534H	EE75S3534H	EE100S3534H
	Bottom	EE167S3534H	EE167S3534H	EE167S3534H	EE167S3534H	EE167S3534H	EE167S3534H	EE167S3534H
	Top	Blank	EE15S3534HCU	EE25S3534HCU	EE37S3534HCU	EE50S3534HCU	EE75S3534HCU	EE100S3534HCU
	Bottom	EE167S3534HCU	EE167S3534HCU	EE167S3534HCU	EE167S3534HCU	EE167S3534HCU	EE167S3534HCU	EE167S3534HCU

[1] A single phase transformer may be combined with three phase transformer provided:
a) The three phase transformer must be bottom located
b) The kVA rating of the single phase transformer must be equal to or smaller than the three phase transformer.

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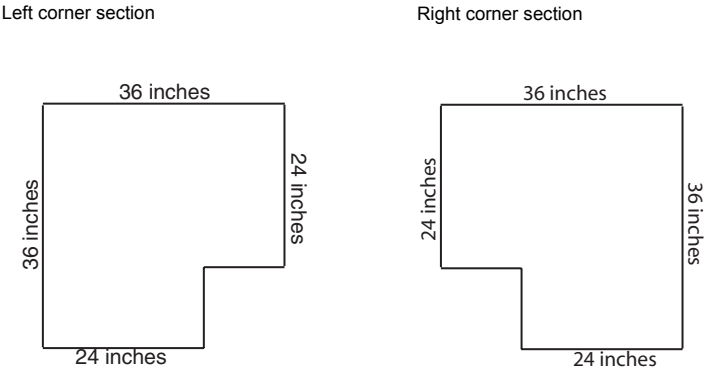
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IPC2 Corner Section

Full Height Corner Sections

Figure 51: 36 in. w x 91.5 in. x 36 in. Type 1 Enclosure

NOTE: This is the corner section looking down from above.



Appendix

Quantity of Electrically Held Contactors per Equipment Space Cell								
Contactors	**24 in. w**		**36 in. w**		**42 in. w**		**48 in. w**	
	1/4 in. h	**1/2 in. h**	**1/4 in. h**	**1/2 in. h**	**1/4 in. h**	**1/2 in. h**	**1/4 in. h**	**1/2 in. h**
8903 Type S 2,3 pole 30 A	6	12	6	12	6	12	6	12
8903 Type S 4,5 pole 30 A	6	12	4	8	6	12	4	8
8903 Type S 2,3 pole 60 A	6	12	4	8	6	12	4	8
8903 Type S 4,5 pole 60 A	2	4	2	4	2	4	2	4
8903 Type S 2,3 pole 100 A	2	6	2	6	2	6	2	6
8903 Type S 4,5 pole 100 A	1	2	1	2	1	2	1	2
8903 Type S 2,3 pole 200 A	2	4	2	4	2	4	2	4
8903 Type S 4,5 pole 200 A	1	2	1	2	1	2	1	2
8903 Type LO 2-4 pole	10	20	8	16	10	20	8	16
8903 Type LO 6 pole	6	12	4	8	6	12	4	8
8903 Type LO 8-12 pole	4	8	3	6	4	8	3	6

Quantity of Mechanically Held Contactors per Equipment Space Cell								
Contactors	**24 in. w**		**36 in. w**		**42 in. w**		**48 in. w**	
	1/4 in. h	**1/2 in. h**	**1/4 in. h**	**1/2 in. h**	**1/4 in. h**	**1/2 in. h**	**1/4 in. h**	**1/2 in. h**
8903 Type S 2,3 pole 30 A	3	6	3	6	3	6	3	6
8903 Type S 4,5 pole 30 A	3	6	2	4	3	6	2	4
8903 Type S 2,3 pole 60 A	3	6	2	4	3	6	2	4
8903 Type S 4,5 pole 60 A	2	4	2	4	2	4	2	4
8903 Type S 2,3 pole 100 A	2	4	2	4	2	4	2	4
8903 Type S 4,5 pole 100 A	1	2	1	2	1	2	1	2
8903 Type S 2,3 pole 200 A	2	4	2	4	2	4	2	4
8903 Type S 4,5 pole 200 A	1	2	1	2	1	2	1	2
8903 Type LX 2-4 pole	5	10	4	8	5	10	4	8
8903 Type LX 6 pole	3	6	2	4	3	6	2	4
8903 Type LX 8-12 pole	2	4	2	4	2	4	2	4

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I-Line™ Circuit Breaker Power Distribution Panelboards

Information Manual
Class 2110

ENGLISH

Instruction Bulletin
80043-309-20

Retain for future use.



SQUARE D™

by Schneider Electric

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Hazard Categories and Special Symbols

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Introduction

This bulletin contains instructions for installing Square D™ brand I-Line™ circuit breaker panelboards. These panelboards are Underwriters Laboratories (cULus) listed and accept I-Line branch circuit breakers.



For technical support on the installation of this panelboard, contact the Schneider Electric at customer support 1-888-778-2733.



See the labels on the equipment for rating and safety information. Additional equipment labels are provided with this document.

Safety Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside the equipment.
- Always use a properly-rated voltage sensing device to confirm all power is off.
- Read and understand this entire instruction bulletin and the latest edition of the NEMA PB 1.1 standards publication included before installing, operating, or maintaining this equipment.
- Local codes vary, but are adopted and enforced to promote safe electrical installations. A permit may be needed to do electrical work, and some codes may require an inspection of the electrical work.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

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Installation

This section provides instructions for the following I-Line panelboard procedures:

- Interior Mounting into Square D Brand Enclosures, on page 9
- Neutral Bonding Strap Installation, on page 12
- I-Line Circuit Breaker Installation and Removal, on page 14
- Interior Trim Barrier Preparation, on page 18

Interior Mounting into Square D Brand Enclosures

A separate standards publication, titled “General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less” (NEMA PB1.1-2007), has been provided with this equipment. Familiarize yourself with the content of this document before proceeding with any of the following procedures.

If you did not receive a copy of this document, or if you have any questions regarding this equipment, contact your local distributor or Schneider Electric representative.

NOTICE

HAZARD OF EXCESSIVE HEAT DUE TO LOOSE CONNECTION

- Ensure all connections are properly tightened.
- Refer to the torque information label provided on the panelboard before tightening the connections.

Failure to follow these instructions can result in equipment damage.

To properly mount and install the I-Line panelboard enclosure, please refer to the NEMA PB 1.1-2007 standards publication, and follow the instructions below for either “Surface Mounting (Enclosure Mounted on Wall)” or “Flush Mounting (Enclosure Recessed in Wall).”

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Surface Mounting (Enclosure Mounted on Wall)

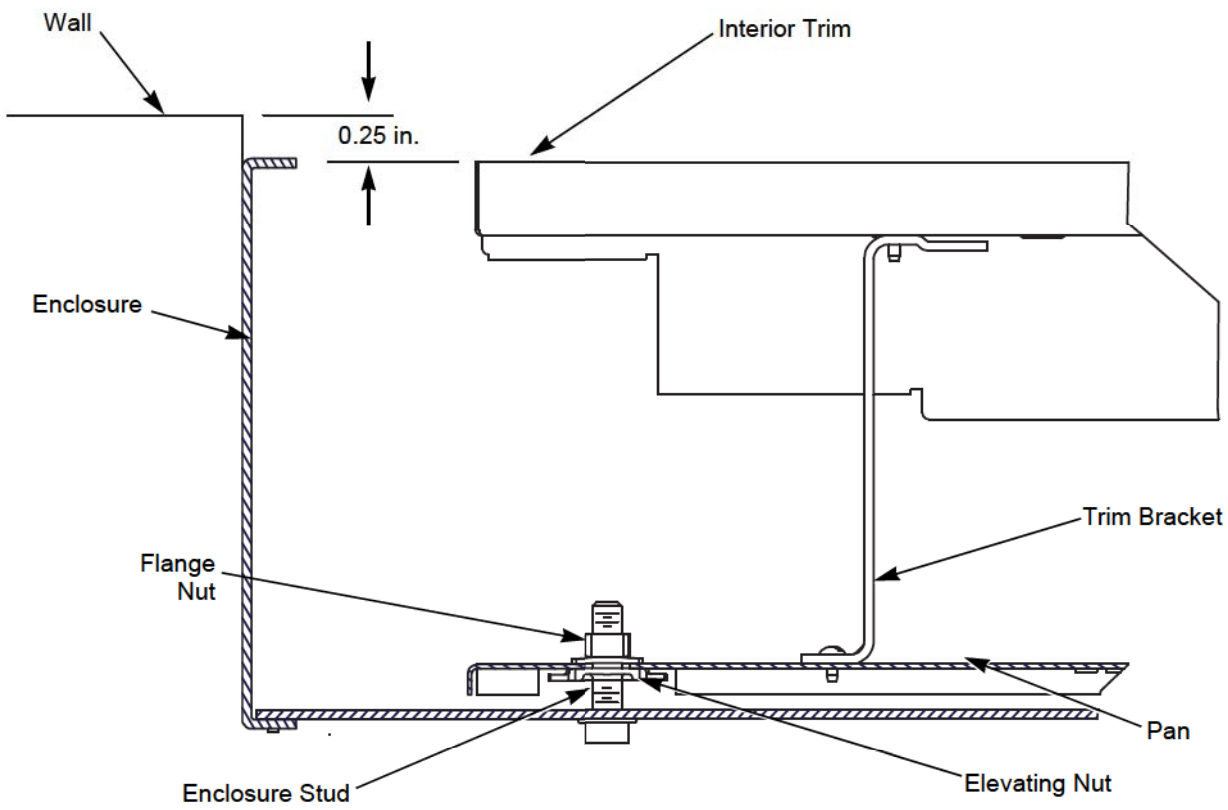
1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Install one elevating nut on each enclosure stud.
3. Remove the interior trim from the trim brackets.
4. Install the interior as described below:
   a. Set the interior on the enclosure studs and secure with flange nuts (see Figure 1). Screwdriver blade may be inserted in elevating nut slot to facilitate adjustment.
   b. Adjust each elevating nut to maintain a maximum distance of 0.125 in. between the interior trim and the front/door assembly.
   c. Tighten the flange nuts against the pan.
   d. Remount the interior trim after wiring.
5. If used as service entrance equipment, neutral bonding is required (see “Neutral Bonding Strap Installation” on page 12).
6. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

Flush Mounting (Enclosure Recessed in Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1-2007 standards publication.
2. Install one elevating nut on each enclosure stud.
3. Remove the interior trim from the trim brackets.
4. Install the interior as described below:
   a. Set the interior on the enclosure studs and secure with flange nuts (see Figure 1 on page 10). Screwdriver blade may be inserted in elevating nut slot to facilitate adjustment.
   b. Adjust each elevating nut to position the lip of the interior trim approximately 0.25 in. from the outside wall line.
   c. Tighten the flange nuts against the pan.
   d. Remount the interior trim after wiring.
5. If used as service entrance equipment, neutral bonding is required. See the “Neutral Bonding Strap Installation” instructions on page 12.
6. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

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Figure 1: Interior Mounting into Square D Brand Enclosures



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Neutral Bonding Strap Installation

The neutral bonding strap should be used only when the panelboard is **installed** as service equipment.

To properly bond the neutral to the panelboard, follow the instructions for either “Standard Neutral Bonding Strap Installation” or “Neutral with Current Transformer Bonding Strap Installation” on pages 13 and 14, respectively.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- Turn off all power supplying this equipment before working on or inside the equipment.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Always use a properly-rated voltage sensing device to confirm all power is off.
- The main bonding strap should be used only when the panelboard is installed as service equipment.
- Do not mix the mounting screws with the interior trim screws.

Failure to follow these instructions will result in death or serious injury.

NOTE: The bonding strap parts are found in the bag assembly provided with the interior.

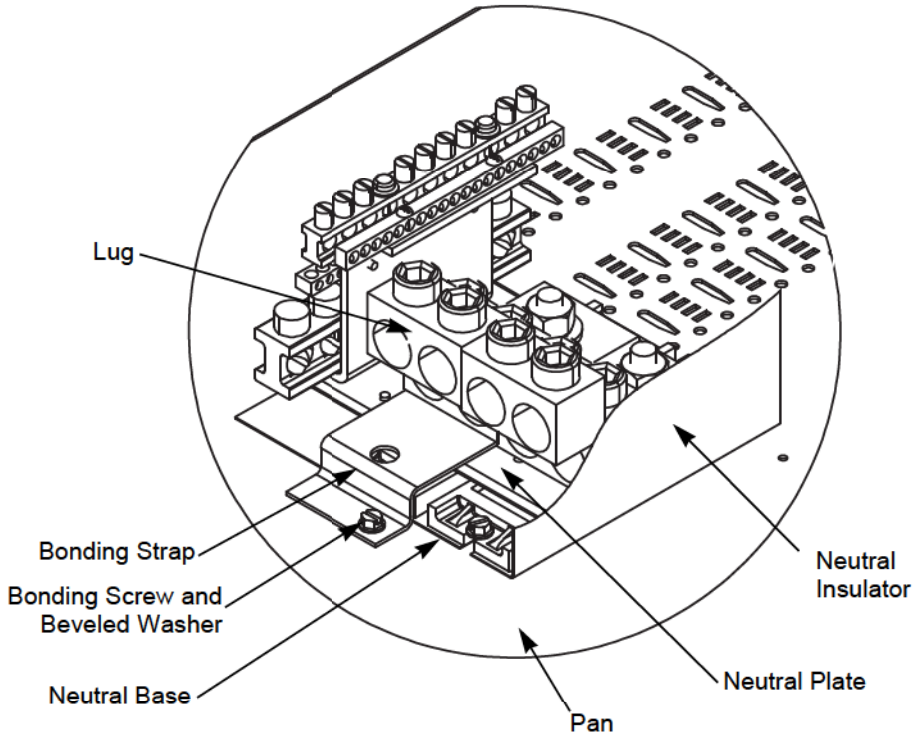
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Standard Neutral Bonding Strap Installation

To install a neutral bonding strap on an I-Line panelboard, refer to Figure 2 and follow the instructions below.

1. Remove lug. Retain lug and fastening hardware.
2. Place bonding strap between neutral plate and lug, as shown.
3. Secure bonding strap to pan with bonding screw and beveled washer. Tighten the bonding screw to 65–75 lb-in (7.3–8.5 N•m).
4. Reinstall lug with the hardware retained in step 1. Tighten to 60–70 lb-in (6.8–7.9 N•m).

Figure 2: Standard Neutral Bonding Strap Installation



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Neutral with Current Transformer Bonding Strap Installation

To install a neutral bonding strap on an I-Line panelboard with a current transformer, refer to Current Transformer Neutral Bonding Installation Instructions, Schneider Electric document 80043-706-xx or 80043-789-xx, that is supplied with the current transformer neutral.

I-Line Circuit Breaker Installation and Removal

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly-rated voltage sensing device to confirm that all power is off.
- All unused spaces must be filled with blank fillers.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

I-Line Circuit Breaker Installation

Refer to Figure 3 on page 16 for the following instructions:

1. Turn off all power to the panelboard.
2. Remove the interior trim barrier.
3. Turn the circuit breaker off. Position the circuit breaker jaws against the bus bar stack so the guiding boss on the bottom of the circuit breaker is oriented towards the alignment groove in the bus insulator base, and the “fingers” of the circuit breaker mounting bracket fit into the keyslots in the pan.

   NOTE: Install the main circuit breaker adjacent to the main lugs.
4. Place a screwdriver through the rectangular hole in the circuit breaker mounting bracket and into the screwdriver slot in the mounting pan. Ratchet the circuit breaker firmly into the bus bar stack and align the retaining screw with the 0.219 in. (5.6 mm) mounting hole in the pan.
5. Tighten the retaining screw securely to prevent the circuit breaker from moving.

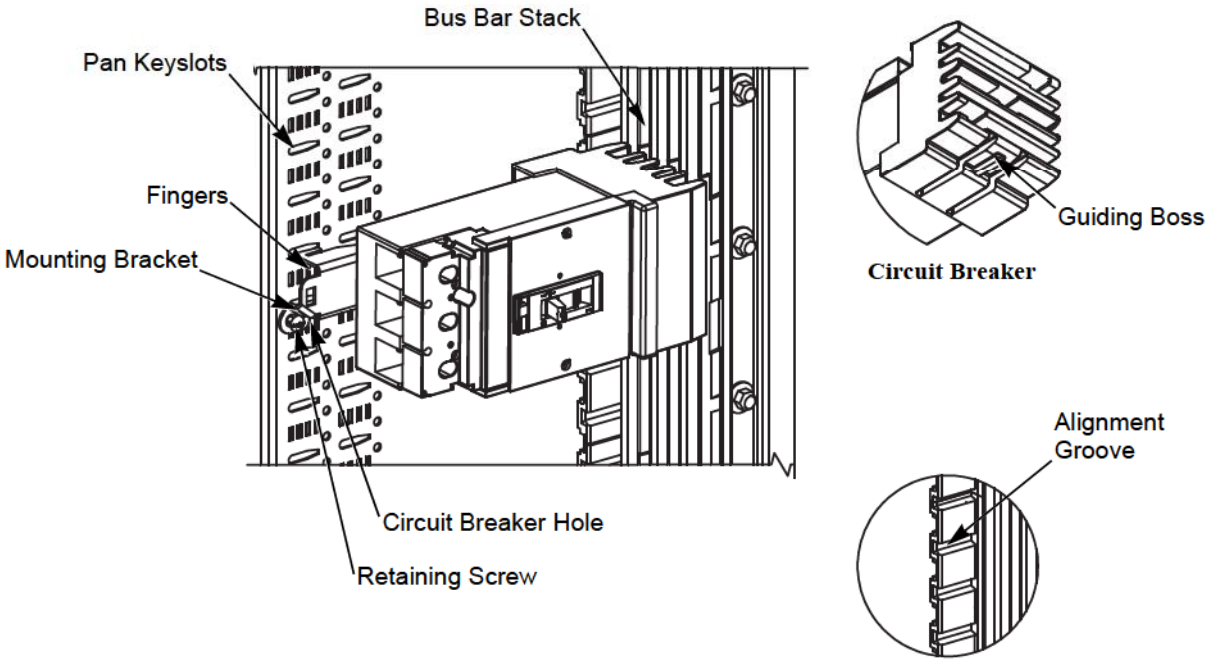
   NOTE: Ensure the retaining screw is tight, but do not tighten it enough to bend the mounting bracket.
6. **For main circuit breakers only:**
   Attach the “Main Breaker” label to the circuit breaker cover.
7. Reinstall the interior trim barrier.
8. Re-energize the panelboard.
9. Turn the circuit breaker on.

NOTE: I-Line circuit breakers are supplied with factory-applied joint compound on the plug-on connectors. The compound must not be removed because it contributes to the overall performance of the connection.

Whenever an I-Line circuit breaker is removed and reinstalled, the joint compound must be reapplied. A two-ounce container of compound especially formulated for I-Line plug-on connectors is available for purchase (catalog number PJC-7201).

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Figure 3: I-Line Circuit Breaker Installation and Removal



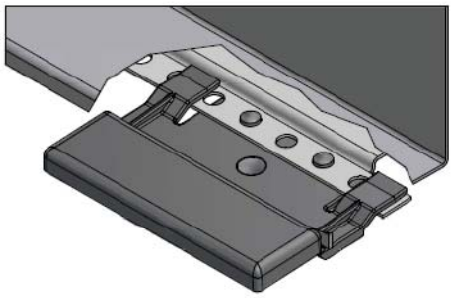
I-Line Circuit Breaker Removal

Refer to Figure 3 for the following instructions:

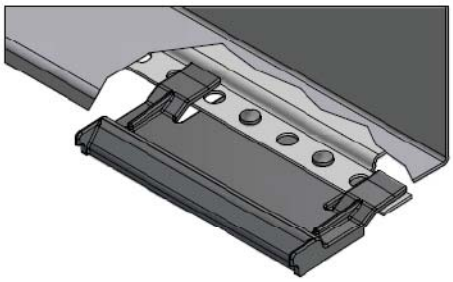
1. Turn off all power to the panelboard.
2. Turn the circuit breaker off.
3. Remove the interior trim barrier.
4. Loosen the retaining screw(s) in the circuit breaker mounting bracket until the screw(s) is completely removed from the 7/32 in. (5.6 mm) mounting hole in the mounting pan.
5. Place the screwdriver through the rectangular hole in the circuit breaker mounting bracket and into the screwdriver slot in the mounting pan. Ratchet the circuit breaker away from the bus bar stack.
6. Lift the circuit breaker away from the bus bars.
7. Install the blank fillers where the circuit breaker was removed, using Table 1 on page 18 as reference.
8. Secure the blank filler extensions to the interior trim barrier (HCPSU, HCP, and HCRU panelboards only), using Table 1 on page 18 for reference. Mount the extension over the mounting bracket in the deadfront as shown in Figure 4 on page 17.

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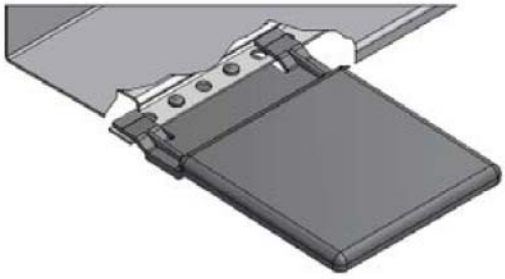
Figure 4: Blank Extension Installation



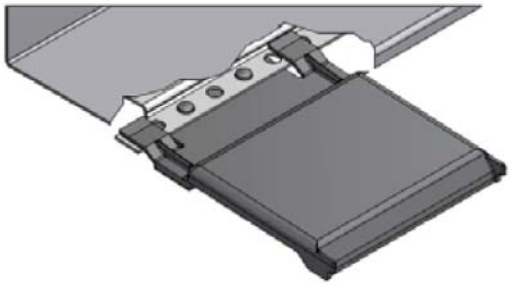
Blank Extension HLN4BL on narrow side



Blank Extension HLN4EBL on narrow side



Blank Extension HLW4BL on wide side



Blank Extension HLW4EBL on wide side

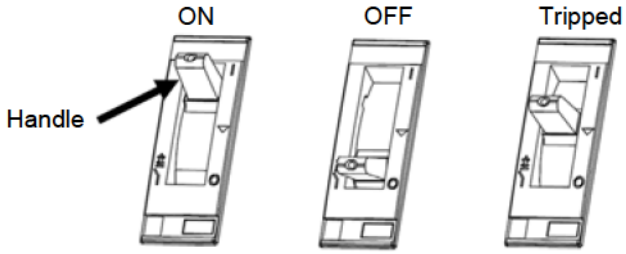


9. Reinstall the interior trim barrier.
10. Re-energize the panelboard.

Circuit Breaker Reset Instructions

If the circuit breaker is tripped, the handle will be at the mid-position between ON and OFF. To reset the circuit breaker, push the handle to the OFF position, then to the ON position.

Figure 5: Circuit Breaker Handle Positions



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Interior Trim Barrier Preparation

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Before energizing the panelboard, all unused spaces must be filled with blank fillers.
- Replace all devices, doors, and covers before energizing this equipment.

Failure to follow these instructions will result in death or serious injury.

Table 1: Blank Fillers and Blank Extensions Catalog Numbers

Blank Extensions

Circuit Breaker Frame	Circuit Breaker Mounting Height	Branch Circuit Side	Catalog Number
All applications except Powerpact H/J with Micrologic Trip Unit 5/6	1.5 in. (38.1 mm)	Wide Side	HLW1BL
	4.5 in. (114.3 mm)	Wide Side	HLW4BL
	1.5 in. (38.1 mm)	Narrow Side	HLN1BL
	4.5 in. (114.3 mm)	Narrow Side	HLN4BL
Only Powerpact H/J Frames with Micrologic Trip Unit 5/6	4.5 in. (114.3 mm)	Narrow Side	HLN4EBL
	4.5 in. (114.3 mm)	Wide Side	HLW4EBL

Blank Fillers

	Mounting Height	Catalog Number	
All Applications	1.5 in. (38.1 mm)	HNM1BL	—
	4.5 in. (114.3 mm)	HNM4BL	

I-Line Stack Assemblies

NOTICE

RISK OF IMPROPER ASSEMBLY

- Do not disassemble the I-Line Bus Stack Assembly.
- If maintenance is required, contact Schneider Electric.

Failure to follow these instructions can result in severe equipment damage and will void the warranty.

I-Line Solid Neutral Assemblies

Table 2: I-Line Solid Neutral Assembly Catalog Numbers

Amps	Catalog Number
225	HC2SN
400	HC4SN [1], HCW4SN [2]
600	HC6SN [1], HCW6SN [2]
800	HC8SN [1], HCW8SN [2]
	HCPSU8SN [3]
800 [7]	HCPSU8SNCW [5]
1200 [2]	HCW12SN
1200 [2, 8]	HCWM12SN [4]
1200 [2, 7]	HCR12SNCTW [6]

1 Used on type HCN and HCM panelboards only.

2 Used on 400 A, 600 A, 800 A, 1200 A HCP (main lugs), and 600 A, 800 A (main circuit breaker).

3 Used on type HCP-SU panelboards only.

4 Used on type HCR-U panelboards only.

5 Used on type HCP-SU panelboards only.
For use with circuit breaker types PG, PJ, PK, PL.

6 Used on type HCR-U panelboards only.
For use with circuit breaker types PG, PJ, PK, RG, RJ, RK.

7 Including neutral CT for 3Ø4W systems.

8 Used on type HCR-U universal panelboards only.

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Appendix 1: Specifications

Typical Wiring

Table 3: Panelboard Typical Wiring [1]

	1-Phase Panelboards		3-Phase Panelboards	
Voltage AC [2]	Phase	Wires	Phase	Wires
208Y/120 [3]	—	—	3	4
120/240 [3]	1	3	—	—
240 [4]	3	3	—	—
600	1	2	—	—
480Y/277 [3]	—	—	3	4
240/120 [3, 6]	—	—	3	4 Delta
600	—	—	3	3 Delta
600Y/347 [3, 5]	—	—	3	4
125/250 Direct Current	—	3	—	—
250 Direct Current	—	2	—	—

1 Additional information is provided on the panelboard. See the main circuit breaker rating, if used.

2 Unless otherwise specified.

3 Requires use of solid neutral assembly. See panelboard.

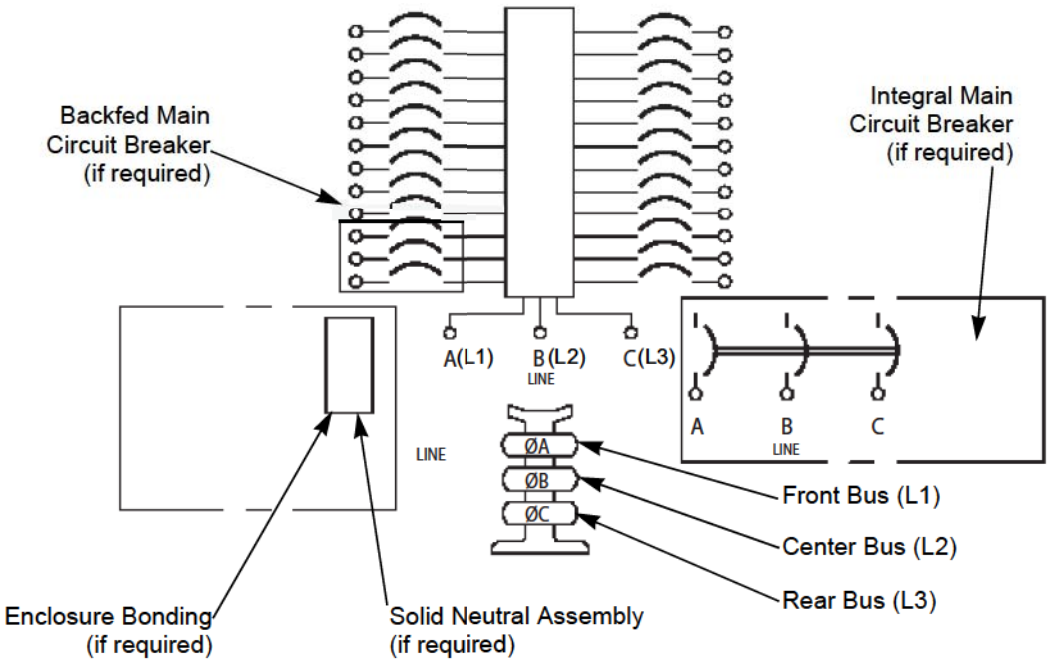
4 For grounded “B” phase system.

5 For use in Canada only.

6 When wiring for delta systems, phases “A” and “C” must be 120 V to neutral, with phase “B” 208 V to neutral. Connect only circuit breakers rated 240 V AC minimum, not 120 V or 120/240 V to “B” phase.

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Figure 6: Main Lugs / Main Circuit Breaker Wiring Diagram



NOTE: For 1Ø systems, the center bus is not used.

NOTE: Branch connections phasing is determined by the circuit breaker selected. See the latest catalog or the Digest for circuit breaker selection.

NOTE: Assure that the circuit breaker voltage rating is appropriate for the system. With the selection of proper units, any of the listed voltage systems can be used.

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Panelboard Ratings

Refer to NEC section 110-22, 2011 Edition and CEC rule 12-014, 2002 Edition for more information. The series rated system label is located in the bag assembly. Short circuit tests are conducted at 100–105% of the maximum panelboard voltage. Interiors with CE mark meet IEC 61439-1 and IEC 61439-2.

Table 4: Series Connected Circuit Breaker Ratings (RMS Symmetrical)

Maximum System Voltage AC [2]	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker [1]	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
120	42,000	MG	FY	1
	65,000	QG, LH	FA, FD	
	100,000	FJ, QJ	FD	
		QJ, LC	FA	
		LJ	FH	
	200,000	LR	FH, FY	
208Y/120	100,000	QJ	FA, FD	2, 3
		QJ, PH, PJ, RJ	QD, QG	
240	35,000	MG	FA	1
	42,000	KA	FD	1, 2, 3
		LA, MA	HD, JD, QD	2, 3
	50,000	MG	FA	
		MG	FA (25 A MAX.)	1
	65,000	HG, JG	FA, HD	2, 3
		JG	JD, QD	
		QG	FA, FD, QD	
		LH, MH, PA, PG, RG	HD, JD, QD	
		FG, FH, MH, MX, PJ	FD	1, 2, 3
		FC, KC, KH, LC, LH	FD, FG	
		LH	FA	
		LH	LA	2, 3
		MG	HD, JD, KA	
		DG	FH, HD, JD, KA, LA, MA	2, 3
		LG	HD, JD, KA, LA, MA	
		LG	LD	3
	85,000	RL	FH, KH	2, 3

Continued on next page

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Table 4: Series Connected Circuit Breaker Ratings (RMS Symmetrical) *(Continued)*

Maximum System Voltage AC [2]	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker [1]	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
240	100,000	FC, KC, LC, LX	FD, FG, FJ	1
		PH, PJ, RJ	QD, QG	2, 3
		QJ	FD	2
		FJ	FD	2, 3
		LJ	HD, HG, JD, JG, FH, KA, LA, MA, MG	
		LJ	LD, LG	3
		FC, KC	FA, FH, FD, FG, FJ	2, 3
		LC, LX	FH, FD, FG, FJ	
		KC, LC, LX	KA	
		KC, LC	KH	
		LC	LA, LH, MG	
		LC	FA	1, 2, 3
		HJ, JJ	FA, FH, HD, HG	2, 3
		JJ	JD, JG	
		LC, LX, MJ, PJ, RJ	HD, HG, JD, JG	
		MJ	LA, LH	
		DJ	FH, HD, HG, JD, JG, KA, LA, MA, MG	
	125,000	RL	RG	
		HL, JL	HD, HG, HJ, FA, FH	
		JL	JD, JG, JJ	
		PC, PH, PL, RL	HD, HG, JD, JG	
		PC, PL, RL	HJ, JJ	
	200,000	FI, KI, LI, LXI	HD, HG, HJ	
		KI, LI, LXI	JD, JG, JJ	
		FI, KI, LI, LXI	FD, FG, FJ	1
		FI, KI	FA, FH, FC, FD, FG, FJ	2, 3
		LI, LXI	FH, FD, FG, FJ	
		LI	FC	
		KI, LI, LXI	KA, QD, QG, QJ	
		LI	KC	
		JR	QD	
		LR	FH, HJ, HL, JJ, JL, QD, QG, QJ, LA, LH	

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Table 4: Series Connected Circuit Breaker Ratings (RMS Symmetrical) *(Continued)*

Maximum System Voltage AC [2]	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker [1]	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
277	18,000	LD	FY	1
	25,000	FH, KA	FD	
	35,000	FG, KH, LH	FD	
		DG, LG	FH, FY	
	65,000	FJ	FD	
		FC, KC	FA, FH, FY, FD, FG	
		LC, LX (400 A MAX.)	FH	
		LC, LX (600 A MAX.)	FY, FD, FG	
		DJ	FH, FY	
		LL	FY	
		LJ	FH, FY	
	100,000	DL, LL	FH, FJ	
	200,000	FI, KI	FA, FH, FY, FD, FG, FJ	
		HR, JR	FA, FY, FJ	
		LI, LXI, (400 A MAX.)	FH	
		LI, LXI, (600 A MAX.)	FY, FD, FG, FJ	
		LR	FH, FY	
480	22,000	MG	FA	2, 3
	30,000	KH, LA, MA, MX, PA, PC, PX, PJ	FH	
		LA, MA, PA, PC, PX	KA	
		LA, MA, PA	HD, JD	
		MG	FA (25 A MAX.), FH, KA	
	35,000	MH, MX, PA	HD, JD	
		HG, JG	FA, HD	
		JG	JD	
		LH, MG, PG, RG	HD, JD	
		LH	HG, JG	2, 3
		DG	FH, HD, JD, KA, LA, MA	
		LG	LD	3
		LG	HD, JD, FH, KA, LA, MA	2, 3

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Table 4: Series Connected Circuit Breaker Ratings (RMS Symmetrical) *(Continued)*

Maximum System Voltage AC [2]	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker [1]	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
480	42,000	MJ	FH (25 A MAX.)	2, 3
		RL	RG	
	50,000	MJ	KA, KH	
	65,000	FC, KC	FA, FH	
		HJ, JJ	FA, FH, HD, HG	
		JJ	JD, JG	
		LC, LI, LX, LXI	HD, HG, JD, JG	
		LC, LX, (400 A MAX.)	FH	
		KC, LC, LX	KA	
		LC, LX	LA	
		DJ	FH, HD, HG, JD, JG, KA, LA, MA	
		LJ	LD, LG	3
		LJ	HD, HG, JD, JG, FH, KA, LA, MA	2, 3
	100,000	HL, JL	FA, FH, HD, HG, HJ	2, 3
		JL	JD, JG, JJ	
		JR	FA	
		LI, LXI (600 A MAX.)	KA	
		PC, PH, PL, RL	HJ, JJ	
		RL	RG	
		DL	FH, HD, HG, HJ, JD, JG, JJ, KA, LA, MA	
		LL	LD, LG, LJ	3
		LL	HD, HG, HJ, JD, JG, JJ, FH, KA, LA, MA	2, 3
	200,000	FI, KI	FA, FH, FC, HD, HG, HJ	
		HR	FA, HD, HG, HJ, HL	
		JR	HD, HG, HJ, HL, JD, JG, JJ, JL	
		KI	JD, JG, JJ, KA	
		LI	FC, KA, KC, LA, HJ, HL, JJ, JL	
		LXI	KA, HJ, HL, JJ, JL	
		LR	FH, HJ, HL, JJ, JL, LA, LH	

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Table 4: Series Connected Circuit Breaker Ratings (RMS Symmetrical) *(Continued)*

Maximum System Voltage AC [2]	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker [1]	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
480Y/277	25,000	FH, KA	FD	2, 3
	35,000	FG, KH, LH	FD	
	65,000	FJ	FD	
		FC, KC	FD, FG	
		LC, LX (600 A MAX.)	FD, FG	
	200,000	FI, KI	FD, FG, FJ	
		LI, LXI (600 A MAX.)	FD, FG, FJ	
600	18,000	HG, JG	FA, HD	
		JG	JD	
		MG, PG, RG	HD, JD	
		MG	FA	
		LG	LD	3
		LG	HD, JD	2, 3
	25,000	HJ, JJ	FA, HD, HG	
		JJ	JD	
		PJ, RJ	MG	
		LJ	LD, LG	3
		LJ	JD, JG, HD, HG, MA	2, 3
	35,000	LC	FH, HD, HG, HJ, JD, JG, JJ, LA	2, 3
	50,000	HL, JL	FA, HD, HG, HJ	
		JL	JD, JG, JJ	
		PK	HJ, JJ, MJ	
		LL	LD, LG, LJ	3
		LL	HD, HG, HJ, JD, JG, JJ, MA	2, 3
	100,000	FI, KI	HD, HG, HJ	
		KI	JD, JG, JJ	
		HR	FA, HD, HG, HJ, HL	
		JR	FA, HD, HG, HJ, HL, JD, JG, JJ, JL	
		KI, LI	FH	
		LI	LA	

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Table 4: Series Connected Circuit Breaker Ratings (RMS Symmetrical) *(Continued)*

Maximum System Voltage AC [2]	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker [1]	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
600Y/347	18,000	MG	FA (25 A MAX.)	1
	25,000	MJ	FA (25 A MAX.)	
	50,000	HL, JL	FJ	

1 LD, LG, LJ, and LL are only available in 3-pole configurations.

2 For indicated circuit breakers rated less than this maximum voltage the indicated short circuit current rating also applies, but at the voltage rating of the circuit breaker.

Table 5: Series Connected Fuse Ratings (RMS Symmetrical)

Maximum System Voltage AC [1]	Maximum Short Circuit Current Rating	Remote Main Fuse		Square D Branch Circuit Breaker Catalog Designation (2- or 3-Pole) Unless Otherwise Stated
		Max A	Class	
120/240 1Ø 208Y/120	100,000	1200 A	L, T (300 V)	QD, QG
		800 A	T (600 V)	
		600 A	J, RK5	
240	65,000	1200 A	L, T (300 V)	QD
		800 A	T (600 V)	
		600 A	J, RK5	
	100,000	1200 A	L, T (300 V)	QD, QG (2-Pole)
		800 A	T (600 V)	
		600 A	J, RK5	
			J, T (600 V)	FA, FH, KA, KH, KC, LA, LH, MA, MH, MX, PG
			RK5	FH, KA, KH, LA, LH, MA, MH, MX, PG, HD, HG, HJ, HL, JD, JG, JJ, JL
			J	HD, HG, HJ, HL, JD, JG, JJ, JL
		800 A	T (600 V)	FH, KA, KH, LA, LH, MA, MH, MX, PG
			T (300 V)	PG
			L	FH, KA, KH, LA, LH, MA, MH, MX, PG
		1200 A	L	FH, KH, LA, LH, MA, MH, MX, PG
			T (600 V)	HD, HG, HJ, HL, JD, JG, JJ, JL
		1600/2000 A	L	KH, MA, MH, MX, PG
		4000 A	L	HD, HG, HJ, HL, JD, JG, JJ, JL

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Table 5: Series Connected Fuse Ratings (RMS Symmetrical) *(Continued)*

Maximum System Voltage AC [1]	Maximum Short Circuit Current Rating	Remote Main Fuse		Square D Branch Circuit Breaker Catalog Designation (2- or 3-Pole) Unless Otherwise Stated
		Max A	Class	
240	200,000	600 A	J, T (600 V)	FA(3 POLE ONLY) FH, FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
			RK5	FH, FC, HD, HG, HJ, HL, JD, JG, JJ, JL, KH, KC, LA, LH, LC, MA, MH, MX, NC, NX, PG,PJ, PL
			J	HD, HG, HJ, HL, JD, JG, JJ, JL
		800 A	T (600 V)	FH, FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
			T (300 V)	PG, PJ, PL
			L	FH, FC, KH, KC, LA, LH, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
		1200 A	L	FC, KH, KC, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
			T (600 V)	HD, HG, HJ, HL, JD, JG, JJ, JL
		1600/2000 A	L	NA, NC, NX, PJ, PL
		4000 A	L	HD, HG, HJ, HL, JD, JG, JJ, JL
480	100,000	400 A	J, T(600 V)	HD, HG, HJ, HL, JD, JG, JJ, JL
		600 A	J, RK5	HJ, HL, JJ, JL
			J, T (600 V)	FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, PG, PJ
			RK5	FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, PG, PJ
		800 A	L, T(600V)	FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, PG, PJ
		1200 A	L	FC, KH, KC, LA, LH, LC, MA, MH, MX, NA, PG, PJ
			T (600 V)	HJ, HL, JJ, JL
		1600 A	L	KC, LC, MA, MH, MX, NA, PG, PJ
		2000 A	L	KC, LC, MH, MG, MJ, MX, NA, PG, PJ
		4000 A	L	HJ, HL, JJ, JL
	200,000	200 A	RK5	HJ, HL
		400 A	J	FA, FH, FC, HJ, HL, JJ, JL, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
			T (600 V)	FA, FH, FC, HJ, HL, JJ, JL, KA, KH, KC, LA, LH, MA, MH, MX, NA, NC, NX
		600 A	J	FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, MG, MJ, NA, NC, NX, PG, PJ, PL
			T(600 V)	KA, KH, KC, LA, LH, MA, MH, MX, NA, NC, NX
			RK5	KC, LA, LH, LC, MA, MH, MX, MG, MJ, NC, NX, PG, PJ

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Table 5: Series Connected Fuse Ratings (RMS Symmetrical) *(Continued)*

Maximum System Voltage AC [1]	Maximum Short Circuit Current Rating	Remote Main Fuse		Square D Branch Circuit Breaker Catalog Designation (2- or 3-Pole) Unless Otherwise Stated
		Max A	Class	
480	200,000	800 A	T(300 V)	PG, PJ, PL
			T(600 V)	KA, KH, KC, LA, LH, MA, MH, MX, MG, MJ, NA, NC, NX, PG, PJ, PL
			L	KC, LA, LH, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
		1200 A	L	KC, LC, MA, MH, MX, MG, MJ, NA, NC, NX, PG, PJ, PL
		1600/2000 A	L	NA, NC, NX
600	100,000	30 A	CC	HG, JG (Molded Case Switches)
		200 A	J	HD, HG, HJ, HL, JD, JG, JJ, JL
		400 A	J, T (600 V)	HJ, HL, JJ, JL
		600 A	R	MG, MJ
		1200 A	L	MG, MJ
	200,000	600 A	J	MG, MJ
		800 A	T (600 V)	MG, MJ

1 For indicated circuit breakers rated less than this maximum voltage. The indicated short circuit current rating also applies, but at the voltage rating of the circuit breaker.

Additional Short Circuit Current Ratings

Square D I-Line plug-on lugs installed in this panelboard and protected by indicated Square D circuit breakers are suitable for use where the available short circuit current is not greater than that shown in the following table. The short circuit current rating cannot exceed the rating marked on the protecting circuit breaker. The protecting circuit breakers may be the main, or if plugged onto the same I-Line bus stack, may be downstream from the plug-on lugs.

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Table 6: Short Circuit Current Ratings for Plug-On Lugs with Protective Circuit Breakers[1]

Catalog Number and Ampere Rating	Protecting Circuit Breakers			Maximum Available Short Circuit Current	
	Catalog Prefix	Number of Poles	Maximum Amperes	RMS Sym. kA	Volts AC
SL100, 100 A SL225, 225 A SL250, 250 A SL400, 400 A SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	FA	2, 3	100	25	240
				18	480
				14	600
	FH	2, 3	100	65	240
				25	480
				18	600
	FD	2, 3	100	25	240
				18	480Y
	FG	2, 3	100	65	240
				35	480Y
	FJ	2, 3	100	100	240
				65	480Y
SL225, 225 A SL400, 400 A SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	KA	2, 3	225	42	240
				25	480
				22	600
	KH	2, 3	225	65	240
				35	480
				25	600
	KC	2, 3	225	100	240
				65	480
	KI	2, 3	225	200	240
				200	480
				100	600
SL400, 400 A SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A SL33930, 1200 A SL33931, 1200 A	DG	3	400	65	240
				35	480
	DJ	3	400	100	240
				65	480
	DL	3	400	125	240
				100	480
SL800, 800 A SL800M5. 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	DG	3	600	65	240
				35	480
	DJ	3	600	100	240
				65	480
	DL	3	600	125	240
				100	480

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Table 6: Short Circuit Current Ratings for Plug-On Lugs with Protective Circuit Breakers[1] *(Continued)*

Catalog Number and Ampere Rating	Protecting Circuit Breakers			Maximum Available Short Circuit Current	
	Catalog Prefix	Number of Poles	Maximum Amperes	RMS Sym. kA	Volts AC
SL250, 250 A SL400, 400 A SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	HD/JD	2, 3	150/250	25	240
				18	480
				14	600
	HG/JG	2, 3	150/250	65	240
				35	480
				18	600
	HJ/JJ	2, 3	150/250	100	240
				65	480
				25	600
	HL/JL	2, 3	150/250	125	240
				100	480
				50	600
	HR/JR	2, 3	150/250	200	240
				200	480
				100	600
	KI	2, 3	250	200	240
				200	480
				100	600
SL400, 400 A SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	LA	2, 3	400	42	240
				30	480
				22	600
	LH	2, 3	400	65	240
				35	480
				25	600
	LD	3	400	25	240
				18	480
				14	600
	LG	3	400	65	240
				35	480
				18	600
	LJ	3	400	100	240
				65	480
				25	600
	LL	3	400	125	240
				100	480
				50	600
	LR	3	400	200	240
				200	480
				100	600
SL400, 400 A SL800, 800 A SL1200, 1200 A S33930, 1200 A S33931, 1200 A	LC/LX	2, 3	400	100	240
				65	480
				35	600
	LI/LXI	2, 3	400	200	240
				200	480
				100	600

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Table 6: Short Circuit Current Ratings for Plug-On Lugs with Protective Circuit Breakers[1] *(Continued)*

Catalog Number and Ampere Rating	Protecting Circuit Breakers			Maximum Available Short Circuit Current	
	Catalog Prefix	Number of Poles	Maximum Amperes	RMS Sym. kA	Volts AC
SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	LD	3	600	25	240
				18	480
				14	600
	LG	3	600	65	240
				35	480
				18	600
	LJ	3	600	100	240
				65	480
				25	600
	LL	3	600	125	240
				100	480
				50	600
	LR	3	600	200	240
				200	480
				100	600
SL800, 800 A SL1200, 1200 A S33930, 1200 A S33931, 1200 A	LC/LX	2, 3	600	100	240
				65	480
				35	600
	LI/LXI	2, 3	600	200	240
				200	480
				100	600
	MA	2, 3	800	42	240
				30	480
				22	600
	MH/MX	2, 3	800	65	240
				65	480
				25	600
SL800M5, 800 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A	MG, PG	2, 3	800	65	240
				35	480
				18	600
	MJ, PJ	2, 3	800	100	240
				65	480
				25	600
	PK	2, 3	800	65	240
				50	480
				50	600
	PL	2, 3	800	125	240
				100	480
				25	600
	MA/MH/MX	2, 3	800	65	240
				65	480
				25	600

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Table 6: Short Circuit Current Ratings for Plug-On Lugs with Protective Circuit Breakers[1] *(Continued)*

Catalog Number and Ampere Rating	Protecting Circuit Breakers			Maximum Available Short Circuit Current	
	Catalog Prefix	Number of Poles	Maximum Amperes	RMS Sym. kA	Volts AC
SL1200, 1200 A S33930, 1200 A	NA	2, 3	1200	100	240
				50	480
				25	600
	NC/NX	2, 3	1200	125	240
				100	480
				65	600
SL1200P5, 1200A SL1200P6, 1200A SL1200P7, 1200A	PG/RG	2, 3	1200	65	240
				35	480
				18	600
	PJ/RJ	2, 3	1200	100	240
				65	480
				25	600
	PK	2, 3	1200	65	240
				50	480
				50	600
	RK	2, 3	1200	65	240
				65	480
				65	600
	PL	2, 3	1200	125	240
				100	480
				25	600
	RL	2, 3	1200	125	240
				100	480
				50	600
S33930, 1200 A S33931, 1200 A	MG	2, 3	800	65	240
	PG	2, 3	1200	35	480
				18	600
	MJ	2, 3	800	100	240
	PJ	2, 3	1200	65	480
				25	600
	PK	2, 3	1200	65	240
				50	480
				50	600
	PL	2, 3	1200	125	240
				100	480
S33930, 1200 A	RG	2, 3	1200	65	240
				35	480
				18	600
	RJ	2, 3	1200	100	240
				65	480
				25	600
	RL	2, 3	1200	125	240
				100	480
				50	600
	RK	2, 3	1200	65	240/480/600

[1] S33930, S33931, SL1200P5, SL1200P6, SL1200P7, SL kits are rated 1200 A and may be applied to 1200 ampere loads when installed into HCRU panelboards restrictively on the wide side.

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CE Marking

Interiors with the "CE" mark meet the IEC 61439-1 and IEC 61439-2 standards. Main Lug interiors with the "CE" mark have been tested to withstand 42,000 RMS symmetrical amperes for 30 cycles. Only IEC rated circuit breakers may be used with "CE" marked interiors and the short circuit rating of the interior is limited to the lowest IEC rated branch breaker unless series rated with an IEC rated main breaker in Table 4. (See Digest for details)

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Appendix 2: Accessory Kits

An assortment of field-installable accessory kits are available for I-Line panelboards:

- Equipment Ground Bar Kits, on page 36
- Mechanical Interlock Kits, on page 36
- Main Lug Kits, on page 37
  - — Versa-Crimp Lugs and Versatile Compression Lug Kits — Aluminum, on page 37
  - — Versa-Crimp Lugs and Versatile Compression Lug Kits — Copper, on page 37
- Circuit Breaker Lug Kits, on page 38
  - — Versa-Crimp Lugs and Versatile Compression Lug Kits, on page 38
- Extension Kits, on page 40

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Equipment Ground Bar Kits

Equipment ground bar kits, suitable for copper or aluminum wire, meet the grounding needs of I-Line panelboards. Select the required kit according to the interior catalog number. Kits can be field installed.

Table 7: Equipment Ground Bar Kits Specifications

Panelboard	Use Ground Bar Kit Catalog Number	
	Aluminum [1]	Copper [2]
HCN	PK27GTA	PK27GTACU
HCM, HCP, HCRU	PK32DGTA	PK32DGTACU

1 Aluminum bars suitable for 60° C or 75° C Copper or Aluminum conductors.

2 Copper bars suitable for 60° C or 75° C Copper conductors.

NOTE: Ground bar mounting locations are identified by the ground symbol ⏚ stamped into the back wall of the enclosure.

Mechanical Interlock Kits

Kits can be field installed.

Table 8: Mechanical Interlocks Specifications

Catalog Number	Circuit Breaker Combinations		Panelboard Type
	Mains	Auxiliary	
HFK3DTI	FA	FA	HCN, HCM, HCP, HCRU
HFM3DTI	LA	FA	HCRU
HLM3DTI	LA	LA	HCP, HCRU
HPFK3DTI	MG/MJ	FA/KA	HCP, HCPSU, HCRU
HPHJ3DTI	MG/MJ	H/J	HCP, HCPSU, HCRU
HPL3DTI	MG/MJ	LA	HCP, HCPSU, HCRU
HPP3DTI	MG/MJ	MG/MJ	HCP, HCPSU, HCRU

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Main Lug Kits

Versa-Crimp® and Versatile™ Kits can be field installed.

Table 9: Versa-Crimp Lugs and Versatile Compression Lug Kits — Aluminum

Panelboard Amps	Wire Range	Kit Catalog Number	Versa-Crimp® Tool	Crimp Lug Adapter Kit
225 A	4–300 kcmil AL/CU 21.1–151 mm^2	VCEL-030-516H1	VC-6 Series	—
400 A				HCN400VCA HCM400VCA HCW400VCA
	500–750 kcmil AL 253–380 mm^2	VCEL-075-12H1	VC-6FT, VC-8	—
600 A	2/0–500 kcmil AL/CU 67.4–253 mm^2	VCEL-050-38H1	VC-6 FT	HCN600VCA HCM600VCA HCW600VCA
800 A		VCEL-050-12H1		HCM800VCA HCW800VCA
1200 A	500–750 kcmil AL 253–380 mm^2 500 kcmil CU 253 mm^2	VCEL-075-12H1 [1]	VC-6FT, VC-8	HCW1200VCA

[1] When this lug is installed, the box extension HC-4212-DEX (F or S) must be added to the incoming cable end of the enclosure.

Table 10: Versa-Crimp Lugs and Versatile Compression Lug Kits — Copper

Panelboard Amps	Wire Range	Kit Catalog Number	Versa-Crimp® Tool	Crimp Lug Adapter Kit
225 A	2/0–300 kcmil CU 67.4–151 mm^2	VCELC-030-38H1	VC-6-3 VC7 VC6-FT VC7-FT	—
400 A				HCN400VCA HCM400VCA HCW400VCA
	400–750 kcmil CU 203–380 mm^2	VCELC-075-12H1	VC-6FT VC7-FT VC8	—
600 A	250–500 kcmil CU 127–253 mm^2	VCELC-050-12H1	VC6-3 VC7 VC6-FT VC7-FT	HCN600VCA HCM600VCA HCW600VCA
800 A				HCM800VCA HCW800VCA
1200 A	400–750 kcmil CU 203–380 mm^2	VCELC-075-12H1	VC-6FT VC7-FT VC8	HCW1200VCA

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Circuit Breaker Lug Kits

Versa-Crimp® and Versatile™ Kits can be field installed.

Table 11: Versa-Crimp Lugs and Versatile Compression Lug Kits [1]

Aluminum	Wire Range [2]	Versa-Crimp Tool	Copper	Wire Range [2]	Versa-Crimp Tool
VC100FA VC100FD	8–1/0 8.36–53,5 mm²	VC-6	CVC100FA CVC100FD	6–1/0 CU 13.3–53.5 mm²	VC-6 Series
VC250KA3	4–300 kcmil 21.1–151 mm²		CVC250KA3	2/0–300 kcmil CU 67.4–151 mm²	
VC250KA35	250–350 kcmil 127–177 mm²		CVC400LA3	4–300 kcmil CU 21.1–151 mm²	
VC400LA35	250–350 kcmil 127–177 mm²		CVC400LA5 CVC600MA5	250–500 kcmil CU 127–253 mm²	
VC400LA3	4–300 kcmil 21.1–151 mm²		CVC1200NE5	2/0–500 kcmil 67.4–253 mm²	
VC400LA5	2/0–500 kcmil 67.4–253 mm²		CVC1200NE7	500–750 kcmil AL 253–380 mm² 500 kcmil CU 253 mm²	
VC400LA7	500–750 kcmil AL 253–380 mm² 500 kcmil CU 253 mm²	VC-6 FT VC-8			
VC400LA7	2/0-500 kcmil 67.4–253 mm²	VC-6 Series	—		
VC800MA7	500–750 kcmil AL 253–380 mm² 500 kcmil CU 253 mm²	VC-6 FT VC-8			
VC1200NE5	2/0–500 kcmil 67.4–253 mm²	VC-6 Series			
VC1200NE7	500–750 kcmil AL 253–380 mm² 500 kcmil CU 253 mm²	VC-6 FT VC-8			
YA060HD	# 6–#2 AWG	[3]	CYA060HD	# 6–1/0 AWG CU	[3]
YA150HD	# 1–4/0 AWG		CYA150JD	# 4–2/0 AWG CU	
YA150JD	# 1–3/0 AWG		CYA150HD	# 6–1/0 AWG CU	
YA250J35	3/0–350 kcmil		CYA250J3	1/0–350 kcmil CU	

1 Always ensure compression lugs are installed in panelboards that will provide wire bending space in accordance with NEC Article 312.6, 2011 Edition.

2 Unless otherwise specified, wire sizes apply to both aluminum and copper conductors.

3 Use crimp tools in accordance with instructions that are provided within each lug kit.

Table 12: Compression Lug Kits for L-, MG-, MJ-, P-, and R-Frame Circuit Breaker [1]

Aluminum	Wire Range [2]	Versa-Crimp Tool	Copper	Wire Range [2]	Versa-Crimp Tool
YA250P3	2/0–300 kcmil 67.4–151 mm²	4, 5	CYA400P5	4/0–500 kcmil CU 107–253 mm²	4, 5
YA300P5	4/0–500 kcmil 107–253 mm²		CYA600P5	4/0–500 kcmil CU 107–253 mm²	
YA400P3	2/0–300 kcmil 67.4–151 mm²		CYA800P7	500–750 kcmil CU 253–380 mm²	
YA400P7	500–750 kcmil 253–380 mm²		CYA1200R5	4/0–500 kcmil CU 107–253 mm²	
YA600P5	4/0–500 kcmil 107–253 mm²		CYA1200R7	500–750 kcmil CU 253–380 mm²	
YA800P7 [3]	500–750 kcmil 253–380 mm²		—		
YA1200R3	2/0–300 kcmil 67.4–151 mm²				
YA1200R5	4/0–500 kcmil 107–253 mm²				
YA1200R7	500–750 kcmil 253–380 mm²				
YA400L31K3 [7]	#4–300 kcmil 21–151 mm²	4	CYA400L31K3 [7]	2/0–300 kcmil 67.4–151 mm²	4
YA600L32K3 [7]			CYA600L32K3 [7]		
YA400L51K3 [7]	2/0–500 kcmil 67.4–253 mm²		CYA400L51K3 [7]	250–500 kcmil 127–253 mm²	
YA600L52K3 [7]			CYA600L52K3 [7]		
YA400L71K3 [6, 7]	500–750 kcmil 253–380 mm²		—		

1 Always ensure compression lugs are installed in panelboards that will provide wire bending space in accordance with NEC Article 312.6, 2011 Edition.

2 Unless otherwise specified, wire sizes apply to both aluminum and copper conductors.

3 When this lug is installed on a vertically mounted main circuit breaker, in an HCP interior, add box extension HC-4212-DEX (F or S) to the end of that enclosure.

4 Use crimp tools in accordance with instructions that are provided within each lug kit.

5 Always ensure compression lugs are installed in panelboards that will provide wire bending space in accordance with NEC Article 312.6, 2011 Edition. I-LINE panelboards with a Type 1 enclosure require a 5.0 in. extended width box when the branch breakers use these lugs (these compression lugs may not be used in weatherproof enclosures). Contact your local Schneider Electric representative for assistance.

6 This lug is only allowed in HCP/HCPSU panelboards with Type 1 enclosures with a 5.0 in. wide side extension.

7 For L-frame circuit breakers only.

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Extension Kits

Table 13: Extension Kits for HCN, HCM, HCRU and HCP Panelboards

Catalog Number	For Use With
HC2609EX [1]	HC26--B [2]
HC2609DEX [1]	HC26--DB [2]
HC3209EX [1]	HC32--B [2]
HC4212DEX [1]	HC42--DB [2]
HC4406DEX [1]	HC44--DB [2]
HC4412DEX [1]	HC44--DB [2]

[1] Add “F” for flush, “S” for surface as required.

[2] Series E1 Enclosures.

NOTE: Kits can be field installed. Extension kit must be attached to enclosure before mounting enclosure to wall.

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1-888-778-2733
www.us.SquareD.com

80043-309-20
Replaces 80043-309-19

NF/NFOM Panelboards
Information Manual
Class 1670

Instruction Bulletin

80043-741-02

Retain in the directory card pocket for future use.



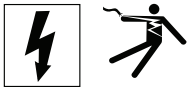
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HAZARD CATEGORIES AND SPECIAL SYMBOLS

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, can result in death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, can result in minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, can result in property damage.



Provides additional information to clarify or simplify a procedure.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Introduction

This bulletin contains instructions for installing Square D® brand NF and NFOM circuit breaker panelboards. These panelboards are Underwriters Laboratories (cULus) listed and accept ECB, EDB, EGB, and EJB branch circuit breakers.



For technical support on the installation of this panelboard, contact the Square D/Schneider Electric Customer Information Center at 1-888-SquareD (1-888-778-2733).



See the labels on the equipment for rating and safety information. Additional equipment labels are provided with this document.

Safety Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Read and understand this entire instruction bulletin and the included NEMA PB 1.1 standards publication before installing, operating, or maintaining this equipment.
- Local codes vary, but are adopted and enforced to promote safe electrical installations. A permit may be needed to do electrical work, and some codes may require an inspection of the electrical work.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside the equipment.
- Always use a properly-rated voltage sensing device to confirm all power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

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Installation

This section provides instructions for the following NF/NFOM panelboard procedures:

- “Interior Mounting for Square D Brand Enclosures” on page 8
- “Neutral Bonding Strap Installation” on page 11
- “ECB, EDB, EGB, and EJB Circuit Breaker Installation and Removal” on page 15
- “Circuit Breaker Reset Instructions” on page 17
- “Interior Trim Preparation” on page 18

Interior Mounting for Square D Brand Enclosures

A separate standards publication, titled “General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less” (NEMA PB1.1), has been provided with this equipment. Familiarize yourself with the content of this document before proceeding with any of the following procedures.

If you did not receive a copy of this document, or if you have any questions regarding this equipment, contact your local distributor or Schneider Electric representative.

CAUTION

HAZARD OF EQUIPMENT DAMAGE

- Ensure all connections are properly tightened.
- Refer to the torque information label provided on the panelboard before tightening the connections.

Failure to follow these instructions can result in equipment damage.

To properly mount and install the NF/NFOM panelboard interior, please refer to the NEMA PB 1.1 standards publication, and follow the instructions below for either “Surface Mounting (Enclosure Mounted on Wall)” or “Flush Mounting (Enclosure Recessed in Wall).”

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Surface Mounting (Enclosure Mounted on Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Remove the interior trim from the trim brackets.
3. Install the interior as described below:
   a. Thread the provided elevating nuts on the enclosure studs.
   b. Set the interior on the enclosure studs. (See Figure 1 on page 10).
   c. Tighten the flange nuts against the interior side rails until the rails are against the back of the enclosure.
   d. Remount the interior trim after wiring.
4. If used as service entrance equipment, neutral bonding is required. See the “Neutral Bonding Strap Installation” instructions on page 11.
5. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

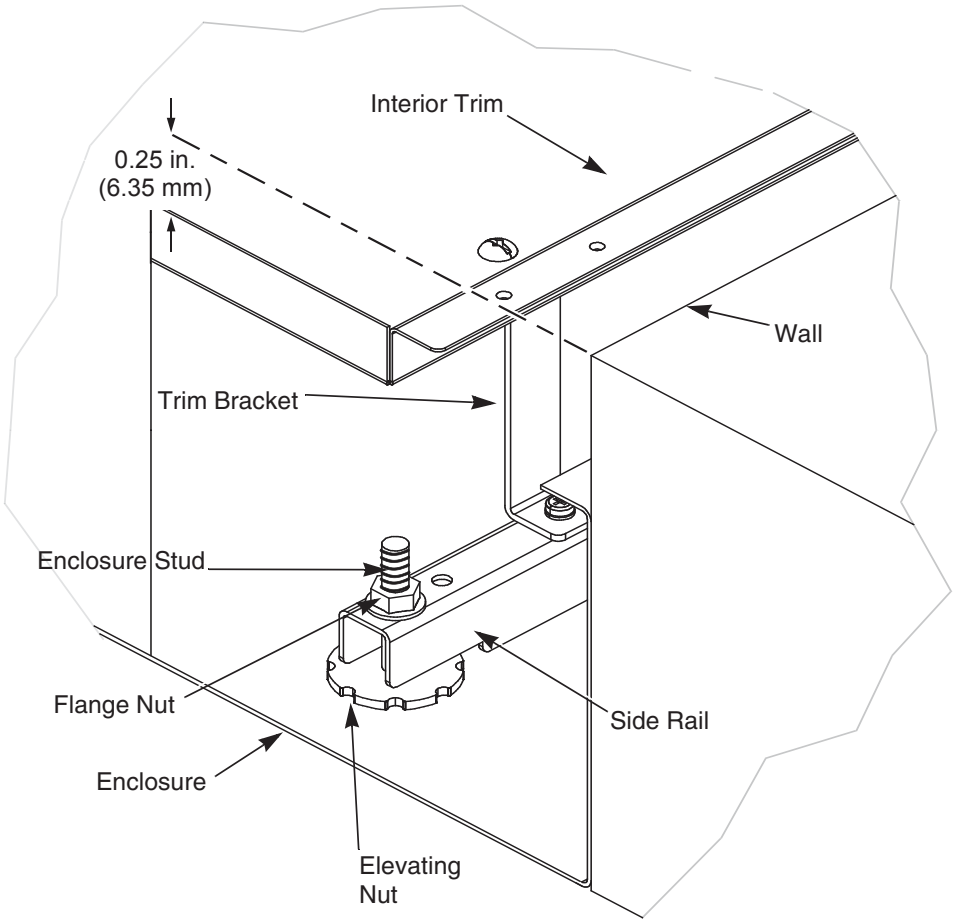
Flush Mounting (Enclosure Recessed in Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Remove the interior trim from the trim brackets.
3. Install the interior as described below:
   a. Thread the provided elevating nuts on the enclosure studs.
   b. Set the interior on the enclosure studs (see Figure 1 on page 10). Place the flange nuts onto the enclosure studs, but do not tighten.
   c. Adjust the elevating nuts so that the lip of the interior trim is approximately 0.25 inches (6.35 mm) from wall line.
   d. Tighten the flange nuts against the side rails.
   e. Remount the interior trim after wiring.
4. If used as service entrance equipment, neutral bonding is required. See the “Neutral Bonding Strap Installation” instructions on page 11.
5. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

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Figure 1: Interior Mounting of Square D Brand Enclosures



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Neutral Bonding Strap Installation

The neutral bonding strap should be used only when the panelboard is **installed** as service equipment.

To properly bond the neutral to the panelboard, follow the instructions for either “125 A or 250 A Maximum NF Panelboards”, “400 A or 600 A Maximum NF Panelboards”, or “800 A Maximum NF Panelboards” below, and on pages 12–14.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Turn off all power supplying this equipment before working on or inside the equipment.
- The main bonding strap should be used only when the panelboard is installed as service equipment.
- Do not mix the mounting screws with the interior trim screws.

Failure to follow these instructions will result in death or serious injury.

NOTE: The bonding strap parts are found in the bag assembly provided with the interior.

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125 A or 250 A Maximum NF Panelboards

To install a neutral bonding strap on a 125 A or 250 A maximum NF panelboard, refer to Figure 2 and follow the instructions below.

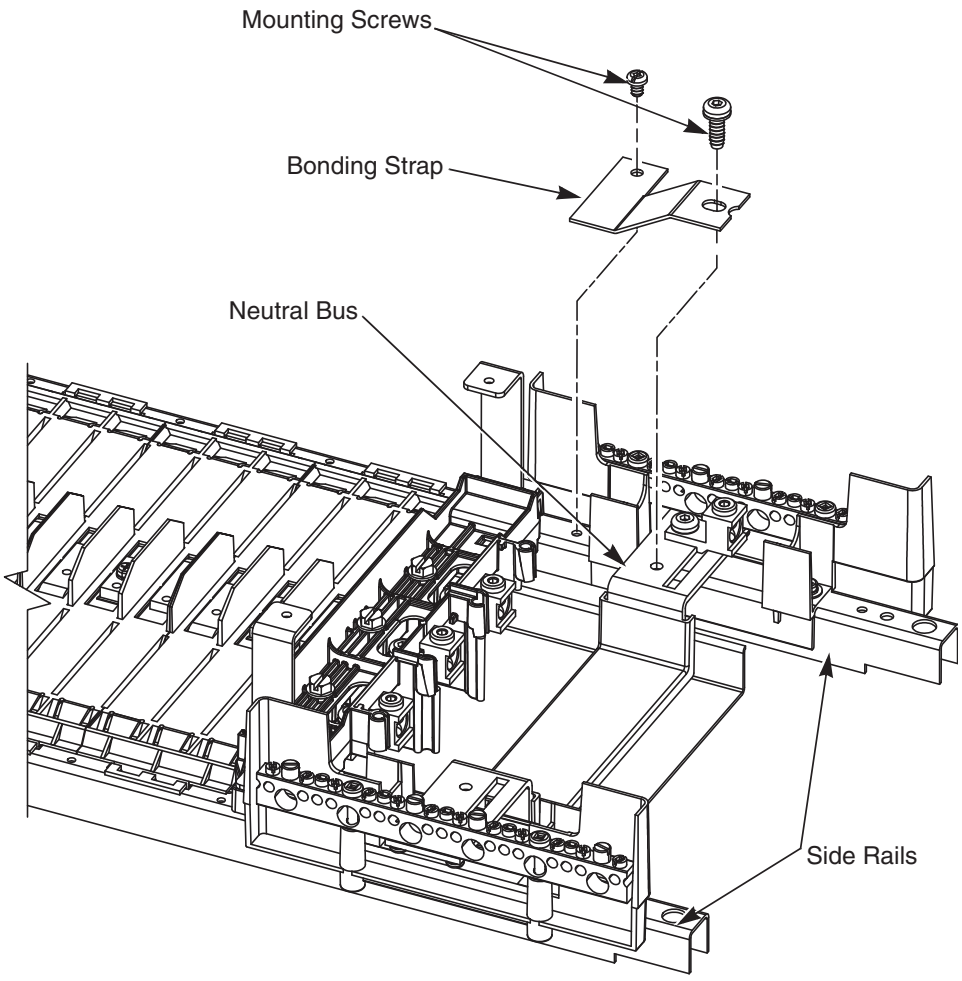
1. Align the bonding strap on the side rail, as pictured.

   NOTE: For some applications, it may be necessary to remove the lug (not pictured) before installing the bonding strap.

2. Insert the two mounting screws, as pictured. Tighten the 10-32 screw to 10–12 lb-in (1.1–1.4 N•m) and the 1/4-20 screw to 25–30 lb-in (2.8–3.4 N•m).

   NOTE: If the lug was removed in Step 1, reinstall it on top of the bonding strap. Use the 1/4-20 x 3/4 in. mounting screw. Lug mounting screws are provided in the bonding strap bag assembly.

Figure 2: Bonding Strap Installation — 125 A or 250 A Maximum NF Panelboards



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400 A or 600 A Maximum NF Panelboards

To install a neutral bonding strap on a 400 A or 600 A maximum NF panelboard, refer to Figure 3 and follow the instructions below.

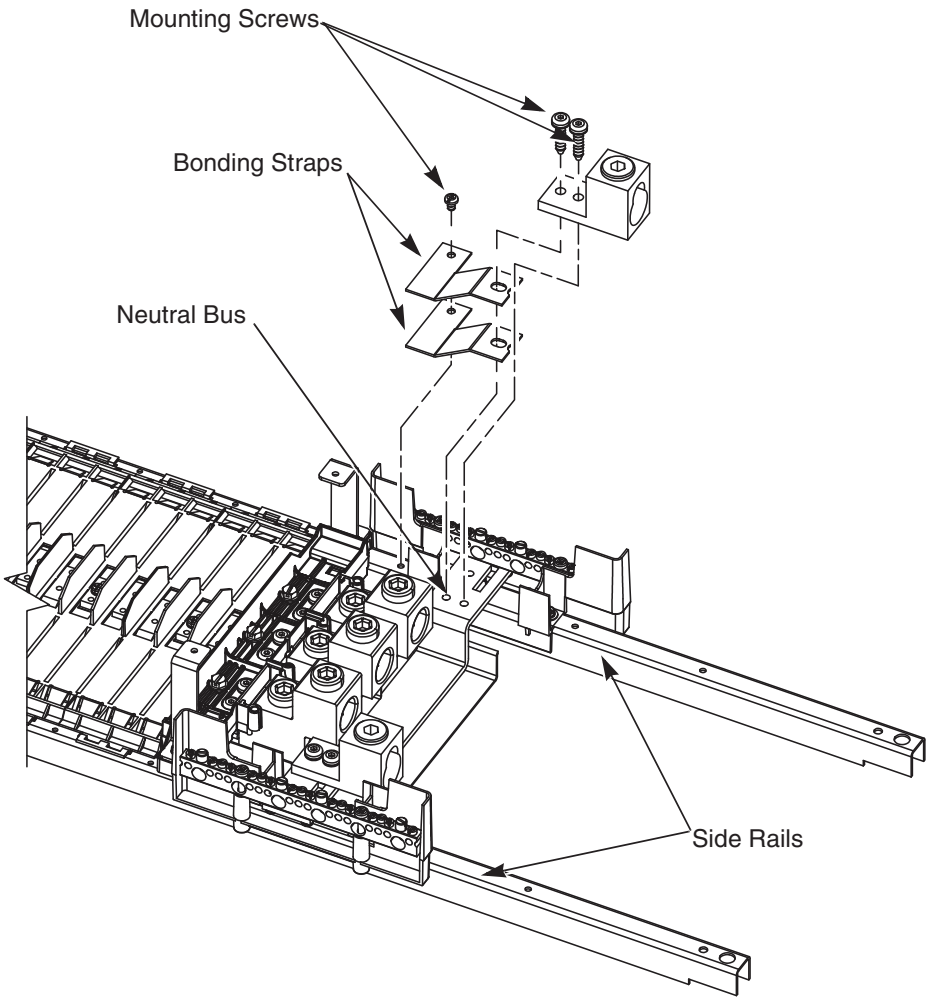
1. Align the two bonding straps on the side rail, as pictured.

   NOTE: For some applications, it may be necessary to remove the lug before installing the bonding strap.

2. Insert the three mounting screws, as pictured. Tighten the 10-32 screw to 10–12 lb-in (1.1–1.4 N•m) and the two 1/4-20 screws to 60–65 lb-in (6.8–7.3 N•m).

   NOTE: If the lug was removed in Step 1 above, reinstall it on top of the bonding strap. Use the 1/4-20 x 1 1/8 in. mounting screws. Lug mounting screws are provided in the bonding strap bag assembly.

Figure 3: Bonding Strap Installation — 400 A or 600 A Maximum NF Panelboards



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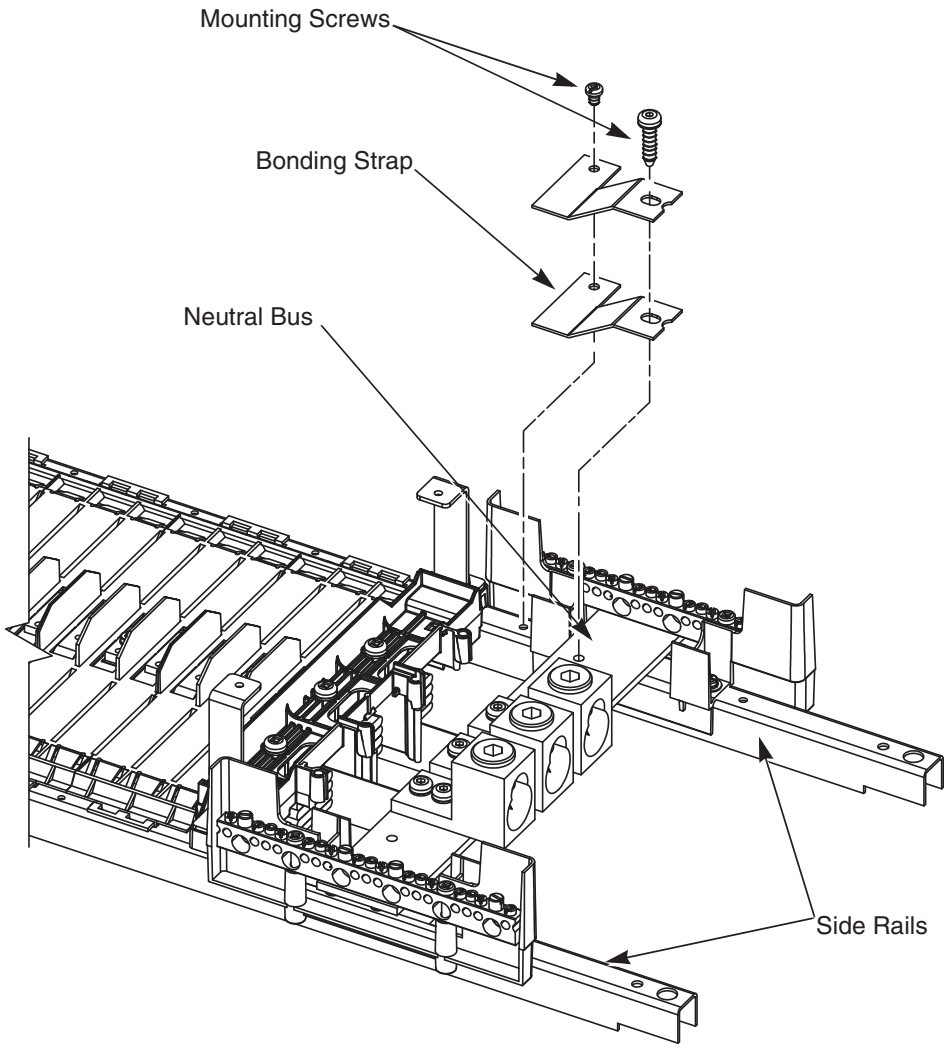
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800 A Maximum NF Panelboards

To install a neutral bonding strap on an 800 A maximum NF panelboard, refer to Figure 4 and follow the instructions below.

1. Align the two bonding straps on the side rail, as pictured.
2. Insert the two mounting screws, as pictured. Tighten the 10-32 screw to 10–12 lb-in (1.1–1.4 N•m) and the 1/4-20 screw to 60–65 lb-in (6.8–7.3 N•m).

Figure 4: Bonding Strap Installation — 800 A Maximum NF Panelboards



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ECB, EDB, EGB, and EJB Circuit Breaker Installation and Removal

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly-rated voltage sensing device to confirm that all power is off.
- All unused spaces must be filled with blank fillers.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

ECB, EDB, EGB, and EJB Circuit Breaker Installation

Refer to Figure 5 on page 16 for the following instructions:

1. Turn off all power to the panelboard.
2. Turn the breaker off.
3. Remove the interior trim.
4. With the bolt-on connector end of the circuit breaker slightly elevated, insert the mounting foot into the slot in the phase cover.
5. Rotate the breaker down and back until the captive screw(s) align with the tapped holes in the breaker connectors.
6. Engage the screws into the branch connector hole and tighten it to 20–30 lb-in (2.3–3.4 N•m).
7. Install the load wire.
8. Reinstall the interior trim.

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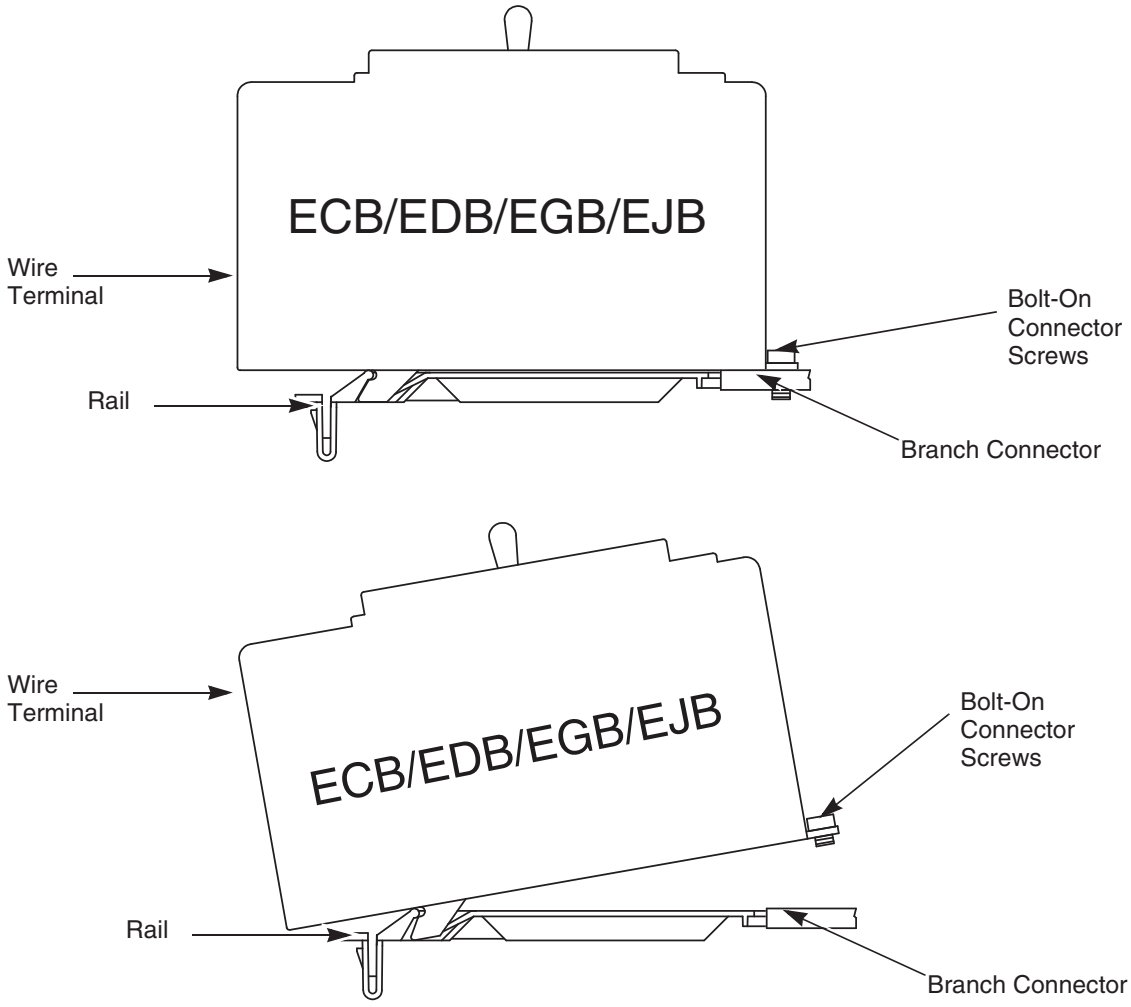
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ECB, EDB, EGB, and EJB Circuit Breaker Removal

Refer to Figure 5 on page 16 for the following instructions:

1. Turn off all power to the panelboard.
2. Remove the interior trim.
3. Turn the breaker off.
4. Remove the load wire.
5. Loosen the screw(s) in the breaker connector and lift the breaker off of the panelboard.
6. Reinstall the interior trim.

Figure 5: ECB, EDB, EGB, and EJB Circuit Breaker Installation and Removal

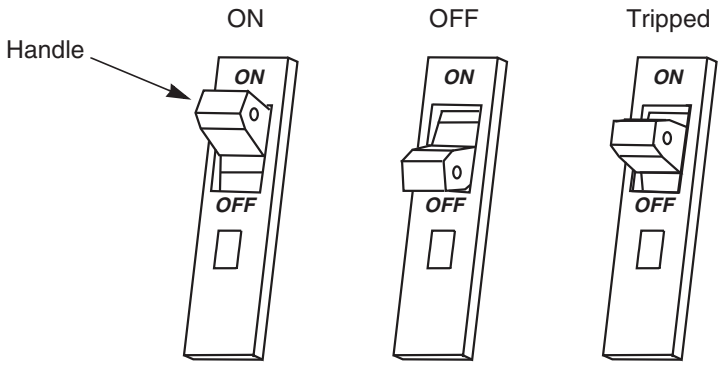


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Circuit Breaker Reset Instructions

If the circuit breaker is tripped, the handle will be at the mid-position between ON and OFF. To reset the circuit breaker, push the handle to the OFF position, then to the ON position.

Figure 6: Circuit Breaker Handle Positions



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Interior Trim Preparation

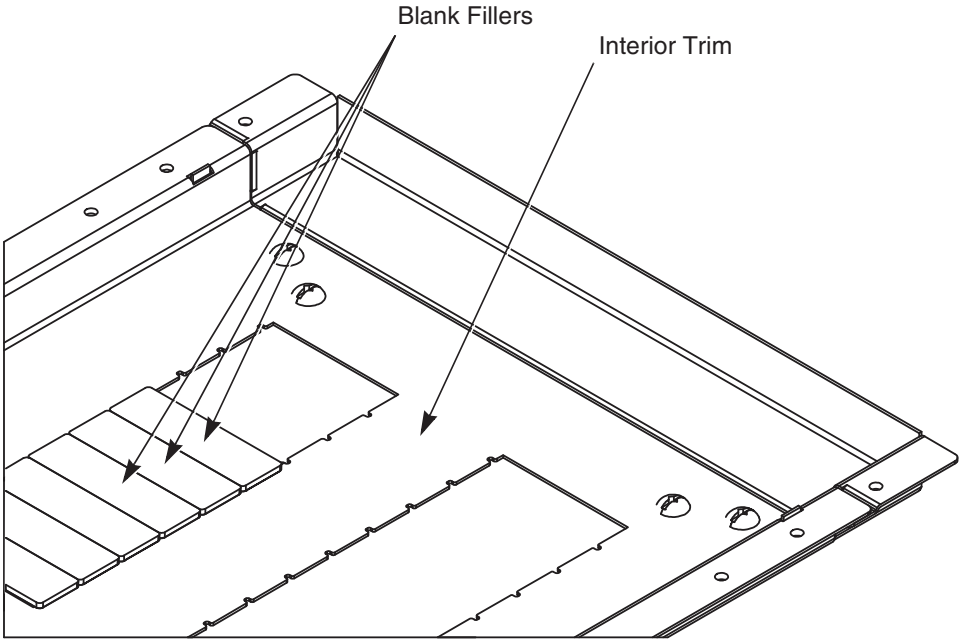
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Before energizing the panelboard, all unused spaces must be filled with blank fillers.
- Replace all devices, doors, and covers before energizing this equipment.

Failure to follow this instruction will result in death or serious injury.

Figure 7: Interior Trim Diagram



NOTE: The back of the interior trim lists the catalog number for its corresponding compatible blank fillers.

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Appendix 1: Specifications

Typical Wiring

NOTE: Do not use on 600 V or 480 V, 3-phase 3-wire delta systems.

Table 1: Panelboard Typical Wiring[1]

	1-Phase Panelboards		3-Phase Panelboards	
Voltage AC	**Phase**	**Wires**	**Phase**	**Wires**
600Y/347	1	3	3	4
480Y/277	1	3	3	4
208Y/120	1	3	3	4
120/240	1	3	—	—
240[2]	1	2	3	3
240	3	3	—	—
240/120[3]	—	—	3	4 Delta

1 Additional information is provided on the panelboard. See the main circuit breaker rating, if used.

2 For this system, the neutral is not used.

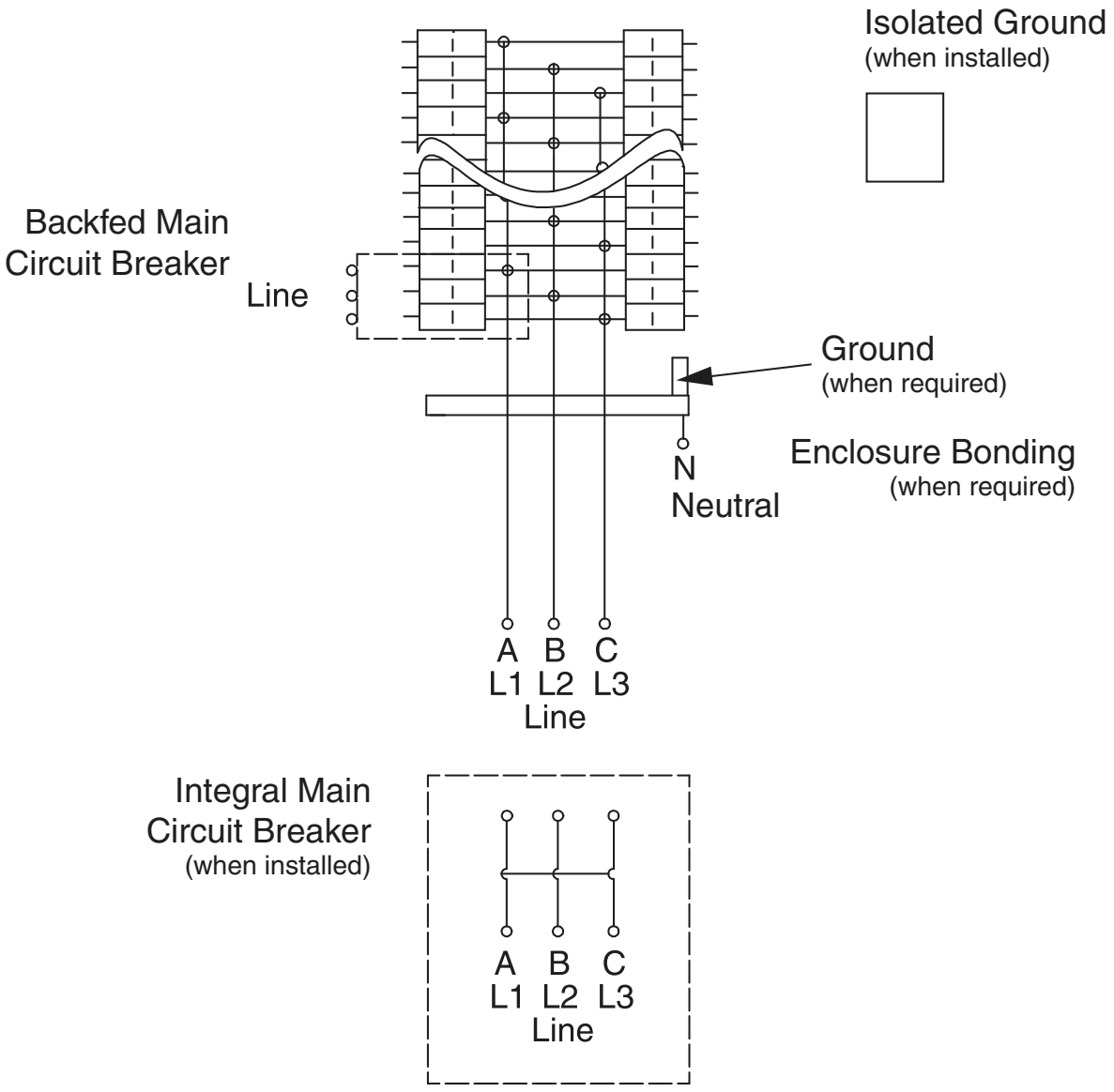
3 When wiring for a delta system, phases “A” and “C” must be 120 V to neutral, phase “B” 208 V to neutral.

Integral Main or Sub-Feed
(FI, KI, H, J, LA, LC, LH, EDB, EGB, EJB)

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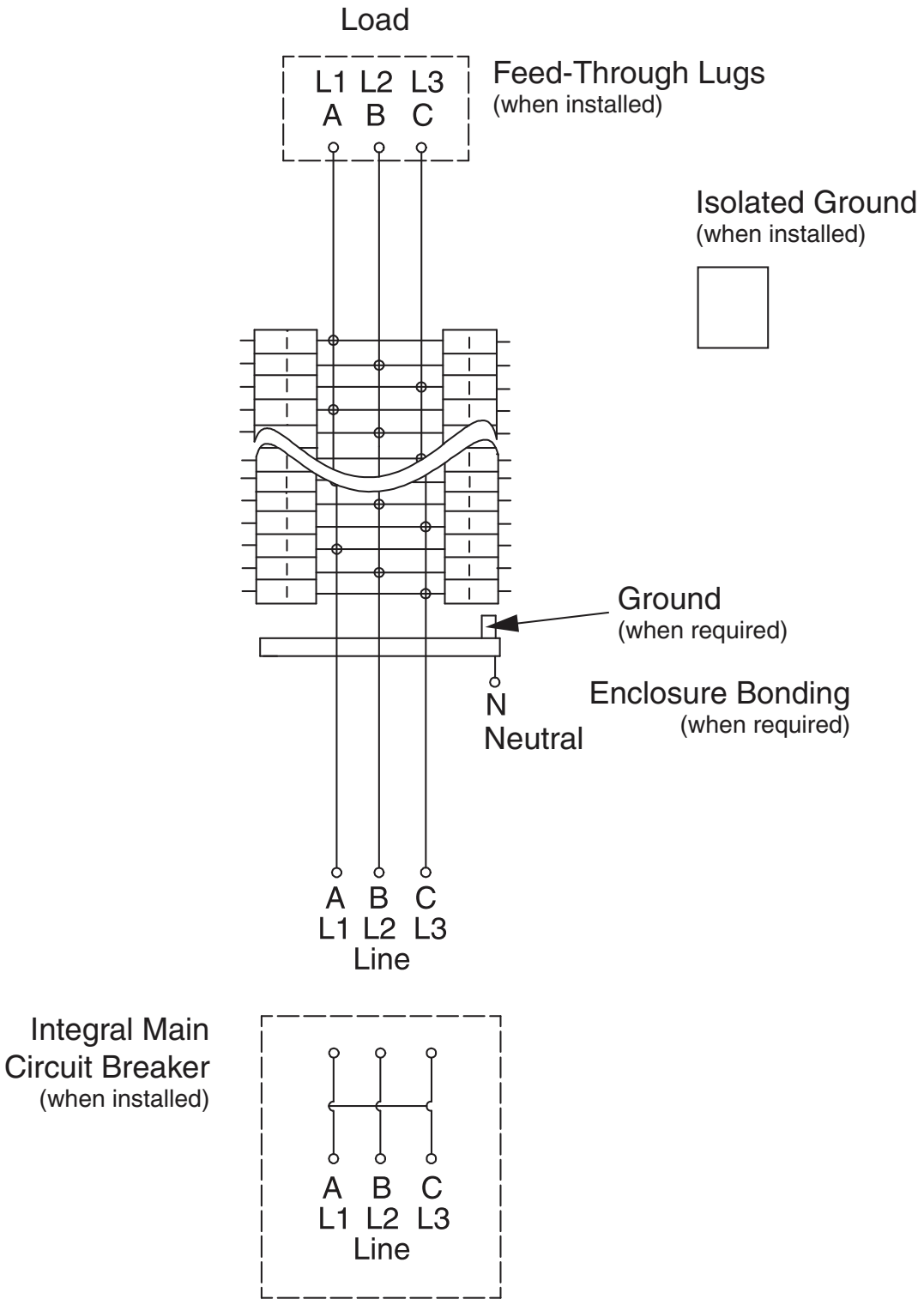
Figure 8: NF/NFOM 125–250 A Main Lugs or Main Breaker Diagram



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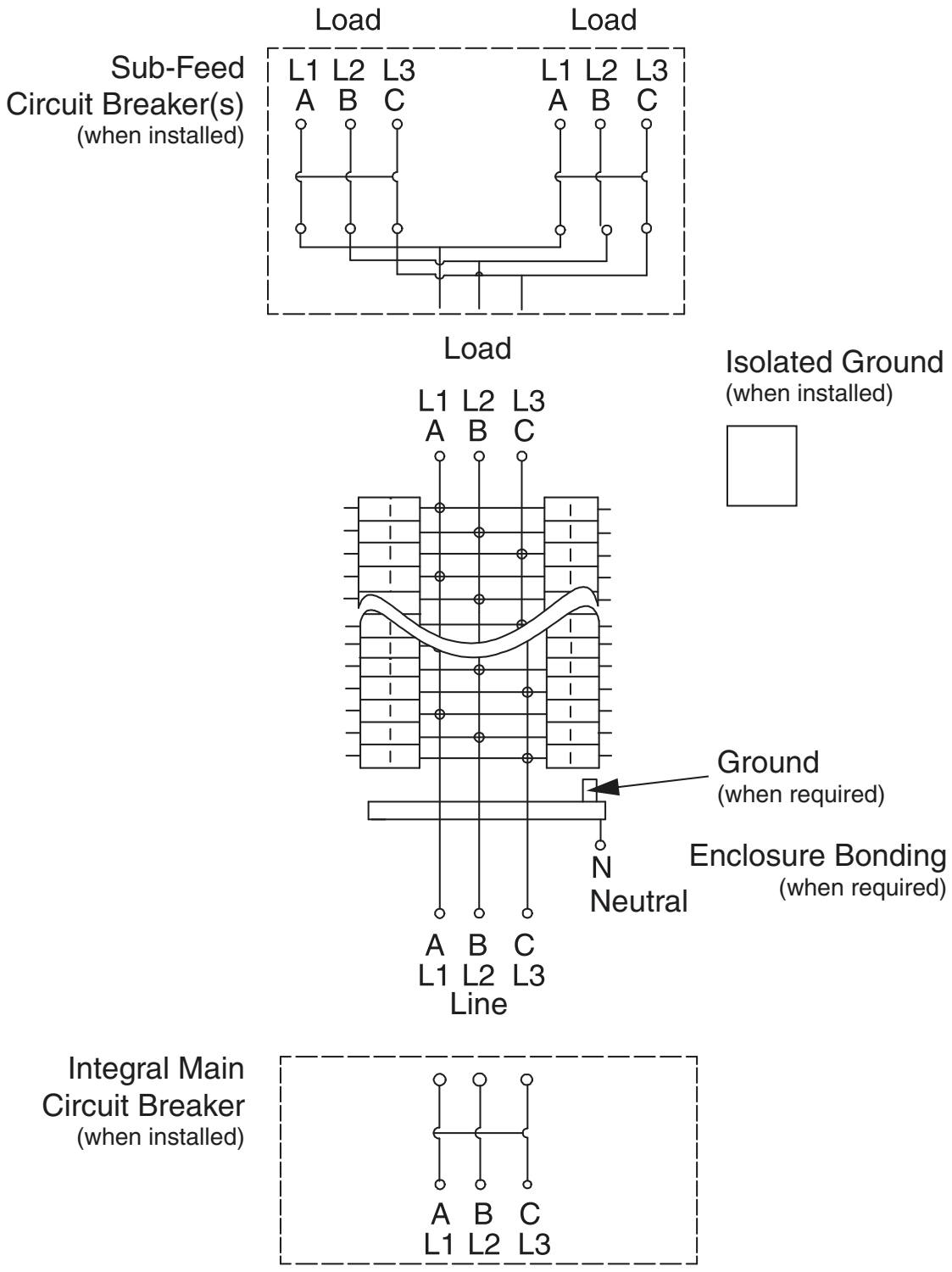
Figure 9: NF 400–800 A Main Lugs or Main Circuit Breaker with or without Feed-Through Lugs Diagram



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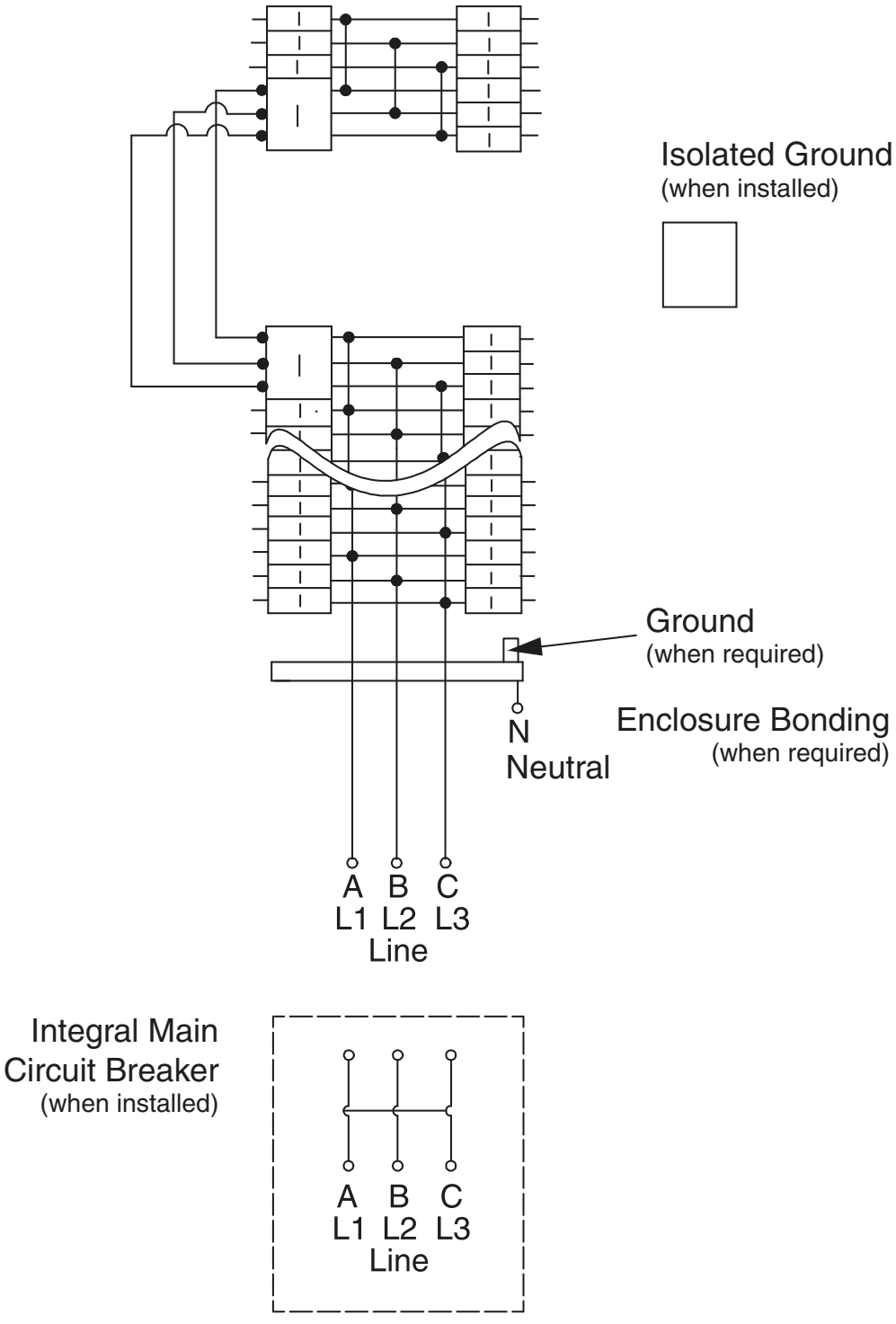
Figure 10: NF 400–800 A Main Circuit Breaker with Feed-Through Lugs or Sub-Feed Circuit Breakers Diagram



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Figure 11: Typical NF Panelboard with Split Bus Diagram



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Panelboard Ratings

Refer to NEC section 110-22 and CEC rule 14-014 for more information. The series rated system label is located in the bag assembly.

NOTE: 125 A ED/EG/EJ breakers are 480Y/277 Vac maximum only.

Table 2: Series Connected Breaker Ratings (RMS Symmetrical)

Max. System Voltage AC[1]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges
120 120/240 240	65,000	EG, FH, FG, KH, LH, MH, MX, HG, JG, DG	EDB, EDB–EPD
		EG	ECB–G3
	100,000	EJ, FC, FJ, KC, LC, LX, HJ, JJ	EDB, EDB–EPD, EGB
		DJ	EDB, EGB
		EJ, FC, KC, HJ, JJ	ECB–G3
	125,000	HL, JL	EDB, EDB–EPD, EGB, ECB–G3
	200,000	FI, KI, LI, LXI	EDB, EDB–EPD, EGB, EJB
		FI, KI	ECB–G3
		Class J or T (600 V) 200 A Max Fuses	ECB–G3
277 480Y/277	35,000	EG. FG, KH, LH, HG, JG, DG	EDB, EDB–EPD
		EG, HG, JG	ECB–G3
	65,000	EJ, FC, FJ, KC, LC, LX, HJ, JJ, DJ	EDB, EDB–EPD, EGB
		EJ, FC, KC, HJ, JJ	ECB–G3
	100,000	HL, JL	EDB, EDB–EPD, EGB, EJB
		DL	EDB, EGB, EJB
		400 A Max Fuses	EDB, EDB–EPD, EGB, EJB
	200,000	FI, KI, LI, LXI	EDB, EDB–EPD, EGB, EJB
		FI, KI	ECB–G3
		200 A Max Fuses	EDB, EDB–EPD, EGB, EJB, ECB–G3
600Y/347	18,000	HG, JG, MG	EDB
	25,000	EJ, FI, KH, KI, LC, LE, LX, LI, LXI, HJ, JJ	EDB, EGB
		LH	(15–70 A) EDB, EGB
	35,000	LC, LE, LX	EDB, EGB, EJB
	50,000	HL, JL	EDB, EGB, EJB
	65,000	FI, KI	EDB, EGB, EJB
		LI, LXI	EJB
	200,000	Class J or T (600 V) 200 A Max Fuses	EDB, EGB, EJB

[1] Short circuit tests are conducted at 100–105% of the maximum rated voltage of the panelboard.

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Short Circuit Current Rating for Main Lug Interiors with Sub-Feed or Feed-Through Lugs

Main lug interiors equipped with sub-feed or feed-through lugs, where the device feeding the interior is unknown or not a Square D device, are rated to 25,000 RMS symmetrical amperes at 600Y/347 Vac maximum for three cycles. Use of one of the Square D circuit breakers of the correct ampere rating, listed as main circuit breakers on page 19, ahead of these lugs will result in a rating equal to that of the circuit breaker.

CAUTION

HAZARD OF EQUIPMENT DAMAGE

Use only one wire per phase for incoming circuit breaker connections when the integral LH main circuit breaker is upstream of the feed-through lugs.

Failure to follow these instructions can result in equipment damage.

CE Marking

Interiors with the “CE” mark meet the IEC 60439-1 standard.

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Appendix 2: Accessory Kits

An assortment of field-installable accessory kits are available for NF panelboards:

- Equipment Ground Bar Kits, on page 27
- Sub-Feed Lug Kits 125–400 A Panelboards, on page 27
- Main Lug Kits
  - — Mechanical Lug Kits — Aluminum, on page 28
  - — Mechanical Lug Kits — Copper, on page 28
  - — Versa-Crimp® Compression Lug Kits — Aluminum, on page 29
  - — Versa-Crimp® Compression Lug Kits — Copper, on page 29

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Equipment Ground Bar Kits

Equipment ground bar kits, suitable for copper or aluminum wire, meet the grounding needs of NF panelboards.

Table 3: Equipment Ground Bar Kits Specifications

Panelboard		Use Ground Bar Kit Catalog Number	
Branch Circuit	**Mains Rating**	**Aluminum[1]**	**Copper[2]**
1–42	800 A Maximum	(1) PK27GTA	(1) PK27GTACU
54–84		(2) PK27GTA	(2) PK27GTACU

1 Aluminum bars suitable for 60° C or 75° C Copper or Aluminum conductors.

2 Copper bars suitable for 60° C or 75° C Copper conductors.

Ground bar mounting locations are identified by the ground symbol ⏚ stamped into the backwall of the enclosure.

Sub-Feed Lug Kits 125–400 A Panelboards

Sub-Feed main lugs are available for 125, 250, or 400 A applications.

Table 4: Sub-Feed Lugs kits for 125–400 A Panelboard Applications

Main Amps	Kit Catalog Number	Maximum Circuits
125	NF125SFL	18, 30
250	NF250SFL	30, 42, 54, 66, 84
400	NF400SFL	30, 42, 54, 66, 84

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Main Lug Kits

Table 5: Mechanical Lug Kits — Aluminum

Panelboard Amps	Kit Catalog Number	Wire Range
125	Standard	#6–350 kcmil 13.3–177.3 mm^2
250	Standard	
400	Standard	(1) 1/0–750 kcmil (2) 1/0–350 kcmil (1) 53.48–380 mm^2 (2) 53.48–177.3 mm^2
600	Standard	(2) 1/0–750 kcmil (2) 53.48–380 mm^2
800	Standard	(3) 1/0–750 kcmil (3) 53.48–380 mm^2

Table 6: Mechanical Lug Kits — Copper

Panelboard Amps	Kit Catalog Number	Wire Range
125	NFCUM1	#6–350 kcmil 13.3–177.3 mm^2
250	NFCUM2	
400	NFCUM4	(1) 1/0–750 kcmil (2) 1/0–350 kcmil (1) 53.48–380 mm^2 (2) 53.48–177.3 mm^2
600	NFCUM6	(2) 1/0–750 kcmil (2) 53.48–380 mm^2

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Table 7: Versa-Crimp® Compression Lug Kits — Aluminum

Panelboard Amps	Kit Catalog Number	Wire Range	Crimp Tool
125	NFALV1	#4–300 kcmil 21.15–152 mm^2	VC6
250	NFALV2	250–350 kcmil 126.7–177.3 mm^2	
400	NFALV4	(2) 2/0–500 kcmil (2) 67.43–253.4 mm^2	
600	NFALV6		

Table 8: Versa-Crimp® Compression Lug Kits — Copper

Panelboard Amps	Kit Catalog Number	Wire Range	Crimp Tool
125	NFCUV1	#6–1/0 kcmil 13.30–53.48 mm^2	VC6-3
250	NFCUV2	(1) 2/0–300 kcmil (1) 67.43–152 mm^2	VC6-FT, VC7, VC7-FT, VC8
400	NFCUV4	(1) 400–750 kcmil (1) 202.7–380 mm^2	
600	NFCUV6	(2) 250–500 kcmil (2) 126.7–253.4 mm^2	VC6 Series

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Notes

NF/NFOM Panelboards Information Manual
Boletín de instrucciones para tableros de alumbrado y distribución NF y NFOM
Directives d'utilisation pour panneaux de distribution NF/NFOM

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Solamente el personal especializado deberá instalar, hacer funcionar y prestar servicios de mantenimiento al equipo eléctrico. Schneider Electric no asume responsabilidad alguna por las consecuencias emergentes de la utilización de este material.

Seul un personnel qualifié doit effectuer l'installation, l'utilisation, l'entretien et la maintenance du matériel électrique. Schneider Electric n'assume aucune responsabilité des conséquences éventuelles découlant de l'utilisation de cette documentation.

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NQ/NQM Panelboards and QONQ Load Centers

Information Manual
Class 1640

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Instruction Bulletin

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Hazard Categories and Special Symbols

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Introduction

This bulletin contains instructions for installing Square D™ brand NQ circuit breaker panelboards and QONQ load centers. These panelboards and load centers are Underwriters Laboratories (cULus) listed and accept QO™ and QOB branch circuit breakers.



For technical support on the installation of this panelboard, contact the Square D/Schneider Electric Customer Information Center at (1-888-778-2733).



See the labels on the equipment for rating and safety information. Additional equipment labels are provided with this document.

Safety Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or NOM-029-STPS.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn OFF all power supplying this equipment before working on or inside the equipment.
- Always use a properly-rated voltage sensing device to confirm all power is OFF.
- Read and understand this entire instruction bulletin and the included NEMA PB 1.1 standards publication before installing, operating, or maintaining this equipment.
- Local codes vary, but are adopted and enforced to promote safe electrical installations. A permit may be needed to do electrical work, and some codes may require an inspection of the electrical work.
- Replace all devices, doors and covers before turning ON power to this equipment.

Failure to follow these instructions will result in death or serious injury.

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Installation

This section provides instructions for the following NQ panelboard and QONQ load center procedures:

- “Interior Mounting for Square D Brand Enclosures” on page 6
- “Neutral Bonding Strap/Cable Installation” on page 9
- “QO and QOB Circuit Breaker Installation and Removal” on page 12
- “Circuit Breaker Reset Instructions” on page 15
- “Interior Trim Preparation” on page 16

Interior Mounting for Square D Brand Enclosures

A separate standards publication, titled “General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less” (NEMA PB1.1), has been provided with this equipment. Familiarize yourself with the content of this document before proceeding with any of the following procedures.

If you did not receive a copy of this document, or if you have any questions regarding this equipment, contact your local distributor or Schneider Electric representative.

NOTICE

HAZARD OF EQUIPMENT DAMAGE DUE TO LOOSE CONNECTIONS

- Ensure all connections are properly tightened.
- Refer to the torque information label provided on the panelboard before tightening the connections.

Failure to follow these instructions can result in equipment damage.

To properly mount and install the NQ panelboard or QONQ load center interior, please refer to the NEMA PB 1.1 standards publication, and follow the instructions below for either ““Surface Mounting (Enclosure Mounted on Wall)” on page 7” or ““Flush Mounting (Enclosure Recessed in Wall)” on page 7.”

Surface Mounting (Enclosure Mounted on Wall)

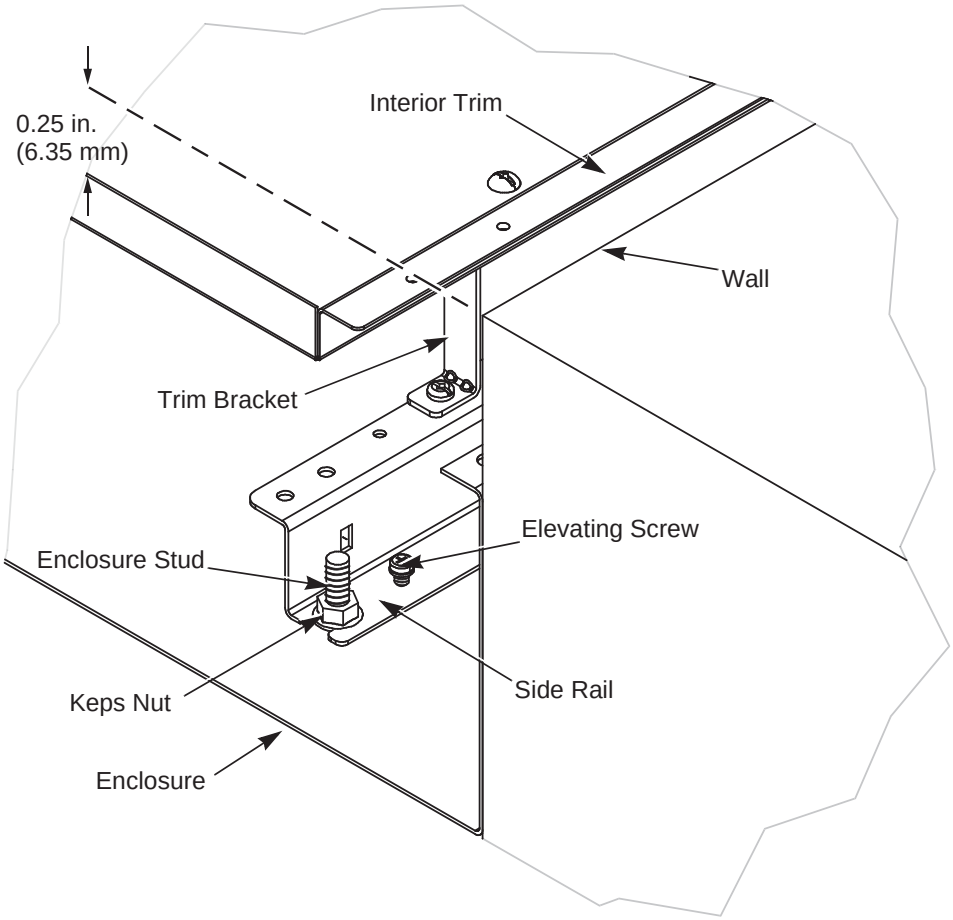
1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Remove the interior trim from the trim brackets.
3. Install the interior as described below:
   a. Set the interior on the enclosure studs. An elevating screw is not required (See Figure 1 on 8).
   b. Tighten the keps nuts against the interior side rails until the rails are against the back of the enclosure.
   c. Remount the interior trim after wiring.
4. If used as service entrance equipment, neutral bonding is required. See the “Neutral Bonding Strap/Cable Installation” instructions on page 9.
5. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

Flush Mounting (Enclosure Recessed in Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Remove the interior trim from the trim brackets.
3. Install the interior as described below:
   a. Thread the (4) 10-32 x .875 in. self-tapping, elevating screws provided with the flush trim into the side rails.
   b. Set the interior on the enclosure studs (see Figure 1 on 8). Place the keps nuts onto the enclosure studs, but do not tighten.
   c. Adjust the screws so that the lip of the interior trim is approximately 0.25 inches (6.35 mm) from wall line.
   d. Tighten the keps nuts against the side rails.
   e. Remount the interior trim after wiring.
4. If used as service entrance equipment, neutral bonding is required. See the “Neutral Bonding Strap/Cable Installation” instructions on page 9.
5. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

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Figure 1: Interior Mounting of Square D Brand Enclosures



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Neutral Bonding Strap/Cable Installation

The neutral bonding strap/cable should be used only when the panelboard is **installed** as service entrance equipment.

To properly bond the neutral to the panelboard, follow the instructions for either “100 or 250 A Maximum NQ Panelboards” or “400 or 600 A Maximum NQ Panelboards and QONQ Load Centers” below and on page 11, respectively.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or NOM-029-STPS.
- Turn OFF all power supplying this equipment before working on or inside the equipment.
- The main bonding strap/cable should be used only when the panelboard is installed as service entrance equipment.
- Do not mix the mounting screws with the interior trim screws.

Failure to follow these instructions will result in death or serious injury.

NOTE: The bonding strap/cable parts are found in the bag assembly provided with the interior.

100 or 250 A Maximum NQ Panelboards

To install a neutral bonding strap on a 100 or 250 A maximum NQ panelboard, refer to Figure 2 and follow the instructions below.

1. Align the bonding strap on the side rail, as pictured.

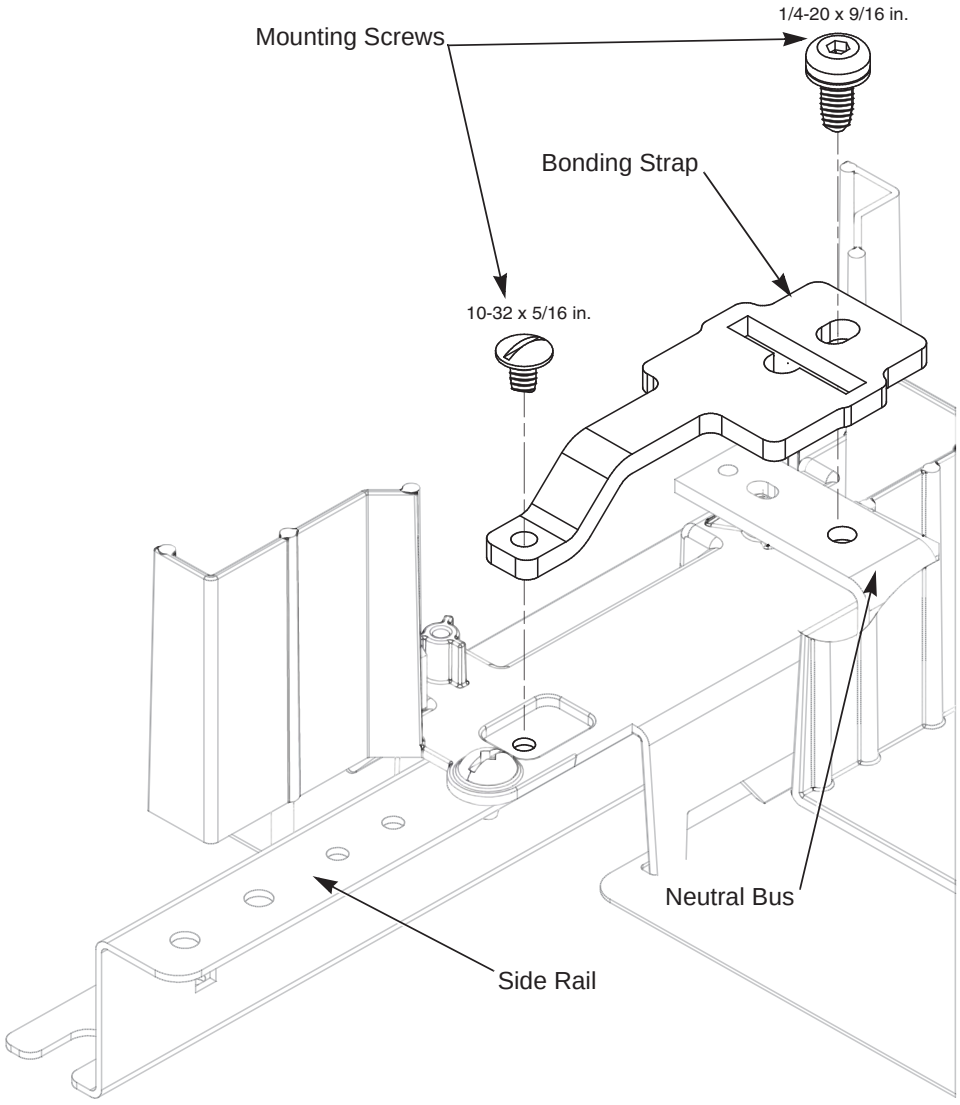
   NOTE: For some applications, it may be necessary to remove the lug (not pictured) before installing the bonding strap.

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2. Insert the two mounting screws, as pictured. Tighten the 10-32 screw to 10–12 lb-in (1.1–1.4 N•m) and the 1/4-20 to 25–30 lb-in (2.8–3.4 N•m).

   NOTE: If the lug was removed in Step 1 above, reinstall it on top of the bonding strap. Use the 1/4-20 x 11/16 in. mounting screw with feed-through lug, sub-feed lug, sub-feed breaker, or 200% neutral applications. Use the 1/4-20 x 7/8 in. lug mounting screw with 200% neutral on 225 A applications with feed-through lug, sub-feed lug, or sub-feed circuit breaker applications. Lug mounting screws are provided in the bonding strap bag assembly.

Figure 2: Bonding Strap Installation — 100 or 250 A Maximum NQ Panelboards



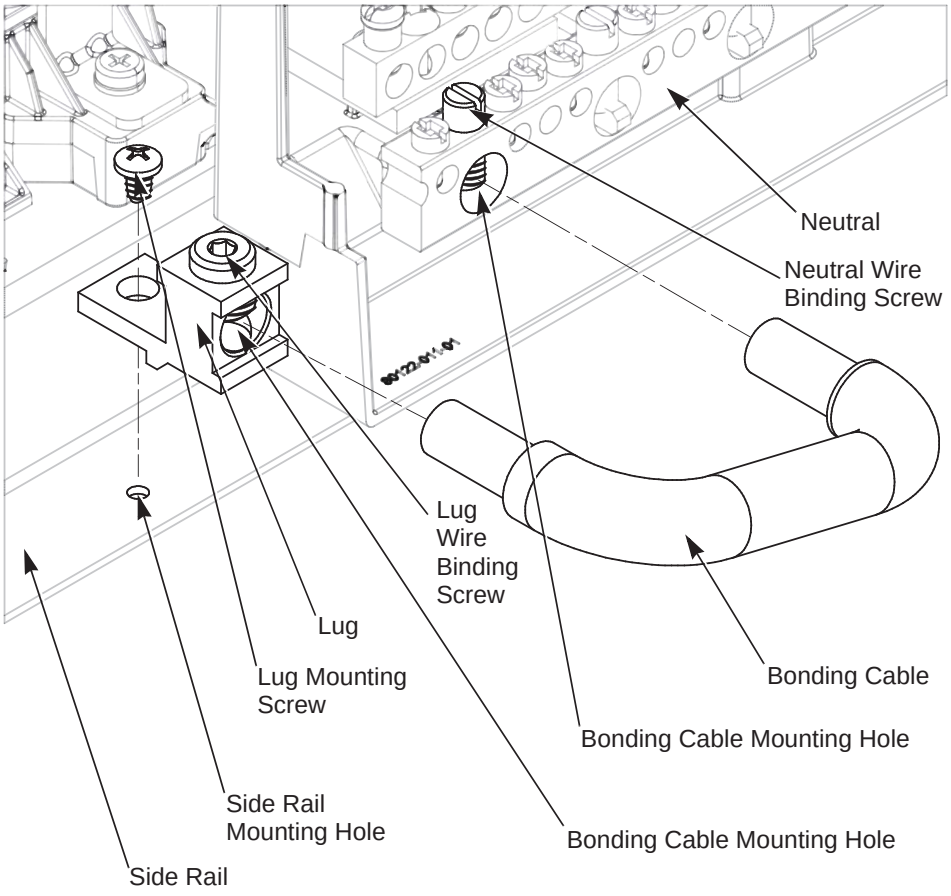
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400 or 600 A Maximum NQ Panelboards and QONQ Load Centers

To install a neutral bonding cable on a 400 or 600 A maximum NQ panelboard and QONQ load center, refer to Figure 3 and follow the instructions below.

1. Align the lug on the side rail mounting hole, as pictured.
2. Tighten the lug mounting screw against the side rail to 10–12 lb-in (1.1–1.4 N•m).
3. Align the bonding cable, as pictured, and insert it into the lug and neutral mounting holes.
4. Tighten both the lug wire binding screw and the neutral wire binding screw to 45–50 lb-in (5.1–5.6 N•m).

Figure 3: Bonding Cable Installation — 400 or 600 A Maximum NQ Panelboards and QONQ Load Centers



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QO and QOB Circuit Breaker Installation and Removal

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or NOM-029-STPS.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn OFF all power supplying this equipment before working on or inside equipment.
- Always use a properly-rated voltage sensing device to confirm that all power is OFF.
- All unused spaces must be filled with blank fillers.
- Replace all devices, doors and covers before turning ON power to this equipment.

Failure to follow these instructions will result in death or serious injury.

QO and QOB Breaker Installation

Refer to Figure 4 on 14 for the following instructions:

1. Turn OFF all power to the panelboard.
2. Turn the breaker OFF.
3. Remove the interior trim.
4. Snap the wire terminal end of the circuit breaker onto the mounting rail.
5. Engage the branch connector.

   For QO Circuit Breakers:

   a. Push inward until the plug-on jaws fully engage the branch connector.

   For QOB Circuit Breakers:

   a. Push inward until the breaker connector is centered on the branch connector mounting hole. Engage the screw into the branch connector hole and tighten it to the torque values shown on the interior wiring and torque diagram.

6. Install the load wire.
7. Reinstall the interior trim.

QO and QOB Breaker Removal

Refer to Figure 4 on 14 for the following instructions:

1. Turn OFF all power to the panelboard.
2. Remove the interior trim.
3. Remove the load wire.
4. Disengage the branch connector.

   For QO Circuit Breakers:

   a. Pull outward until the plug-on jaws fully disengage the branch connector.

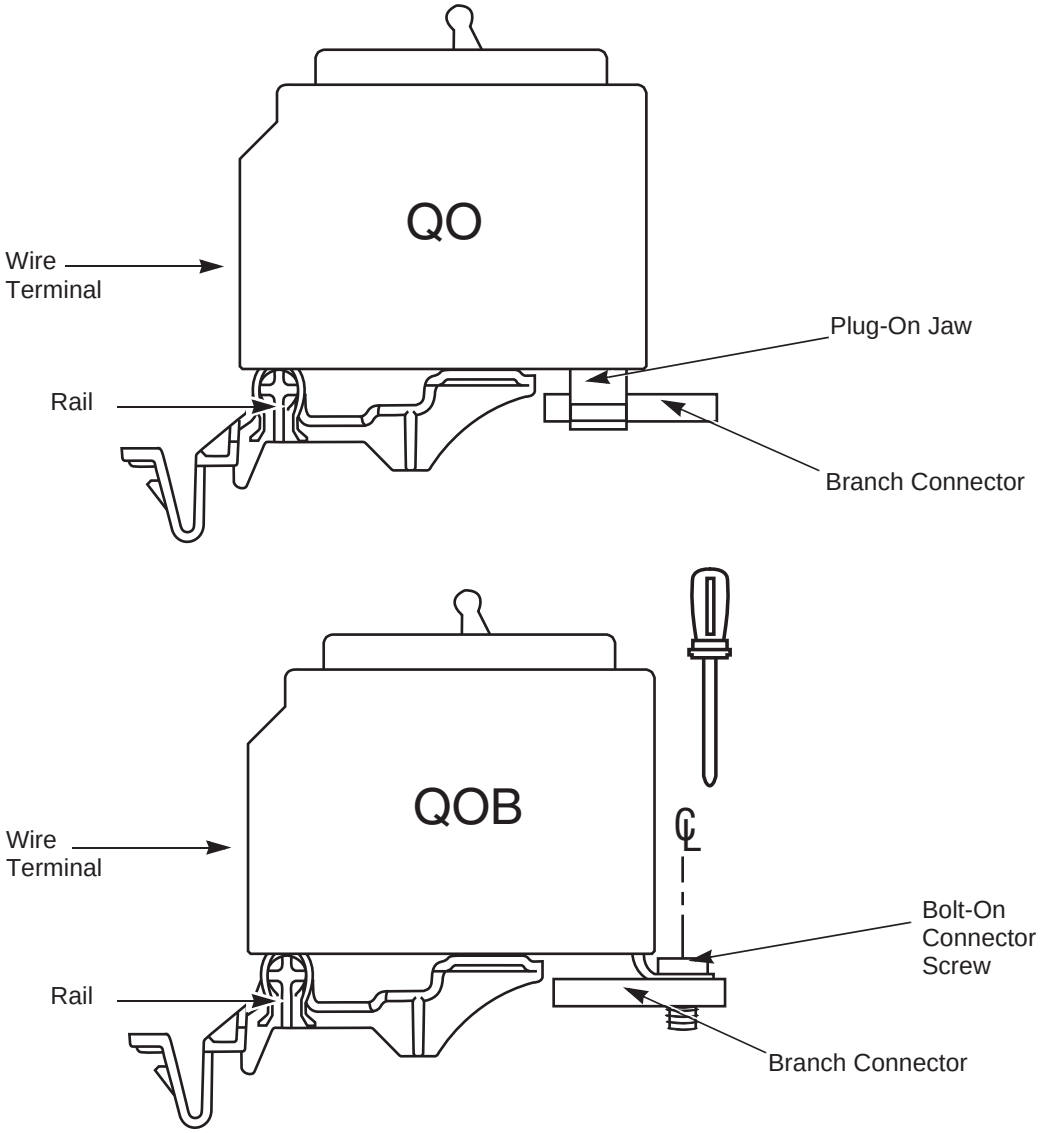
   For QOB Circuit Breakers:

   a. Loosen the screw in the breaker connector and pull the breaker off of the branch connector.

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5. Snap the wire terminal end of the circuit breaker off of the mounting rail.
6. Reinstall the interior trim.

Figure 4: QO and QOB Circuit Breaker Installation and Removal

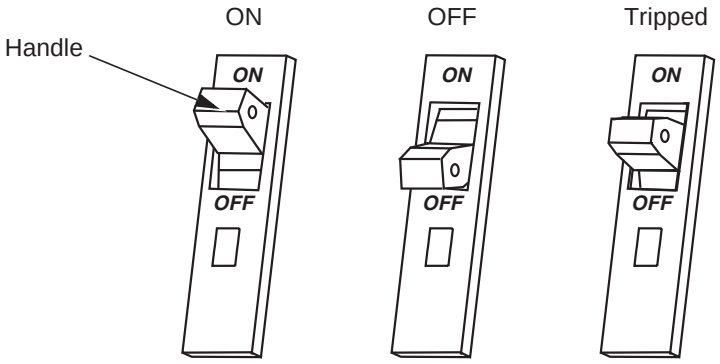


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Circuit Breaker Reset Instructions

If the circuit breaker is tripped, the handle will be at the mid-position between ON and OFF. To reset the circuit breaker, push the handle to the OFF position, then to the ON position.

Figure 5: Circuit Breaker Handle Positions



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Interior Trim Preparation

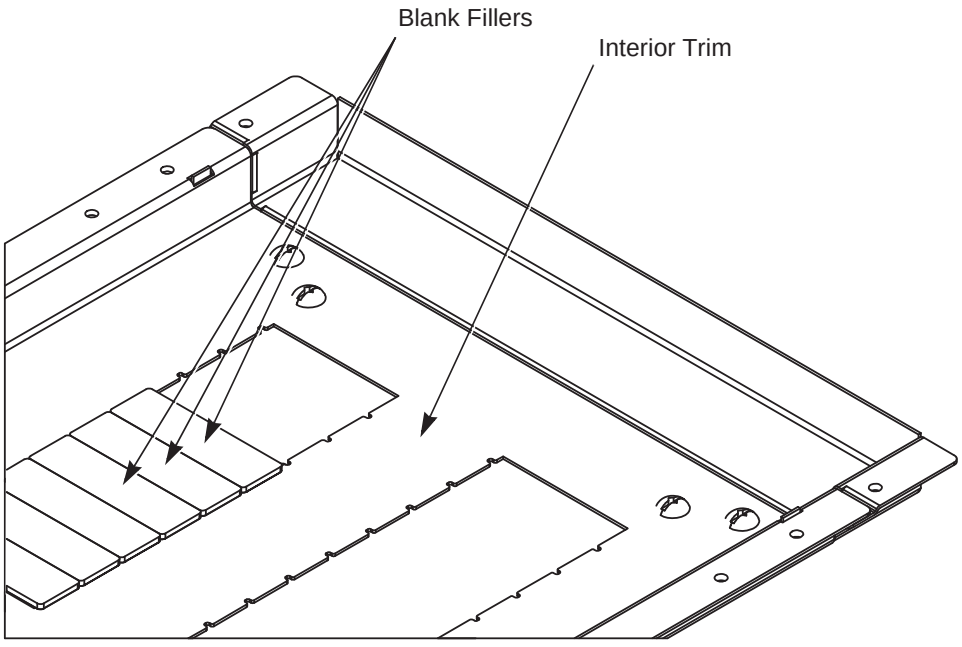
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or NOM-029-STPS.
- Before energizing the panelboard, all unused spaces must be filled with blank fillers.
- Replace all devices, doors, and covers before energizing this equipment.

Failure to follow this instruction will result in death or serious injury.

Figure 6: Interior Trim Diagram



NOTE: The back of the interior trim lists the catalog number for its corresponding compatible blank fillers.

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Appendix 1: Specifications

Typical Wiring

Table 1: Panelboard Typical Wiring[1]

	1-Phase Panelboards		3-Phase Panelboards	
Voltage AC	**Phase**	**Wires**	**Phase**	**Wires**
208Y/120	—	—	3	4
120/240	1	3	—	—
240[2]	1	2	3	3
240[3]	1	3	—	—
240/120[4]	—	—	3	4 Delta

1 Additional information is provided on the panelboard. See the main circuit breaker rating, if used.

2 For this system, the neutral is not used and only circuit breakers rated 240 V AC minimum should be used. Do not use circuit breakers rated 120 V or 120/240 V AC.

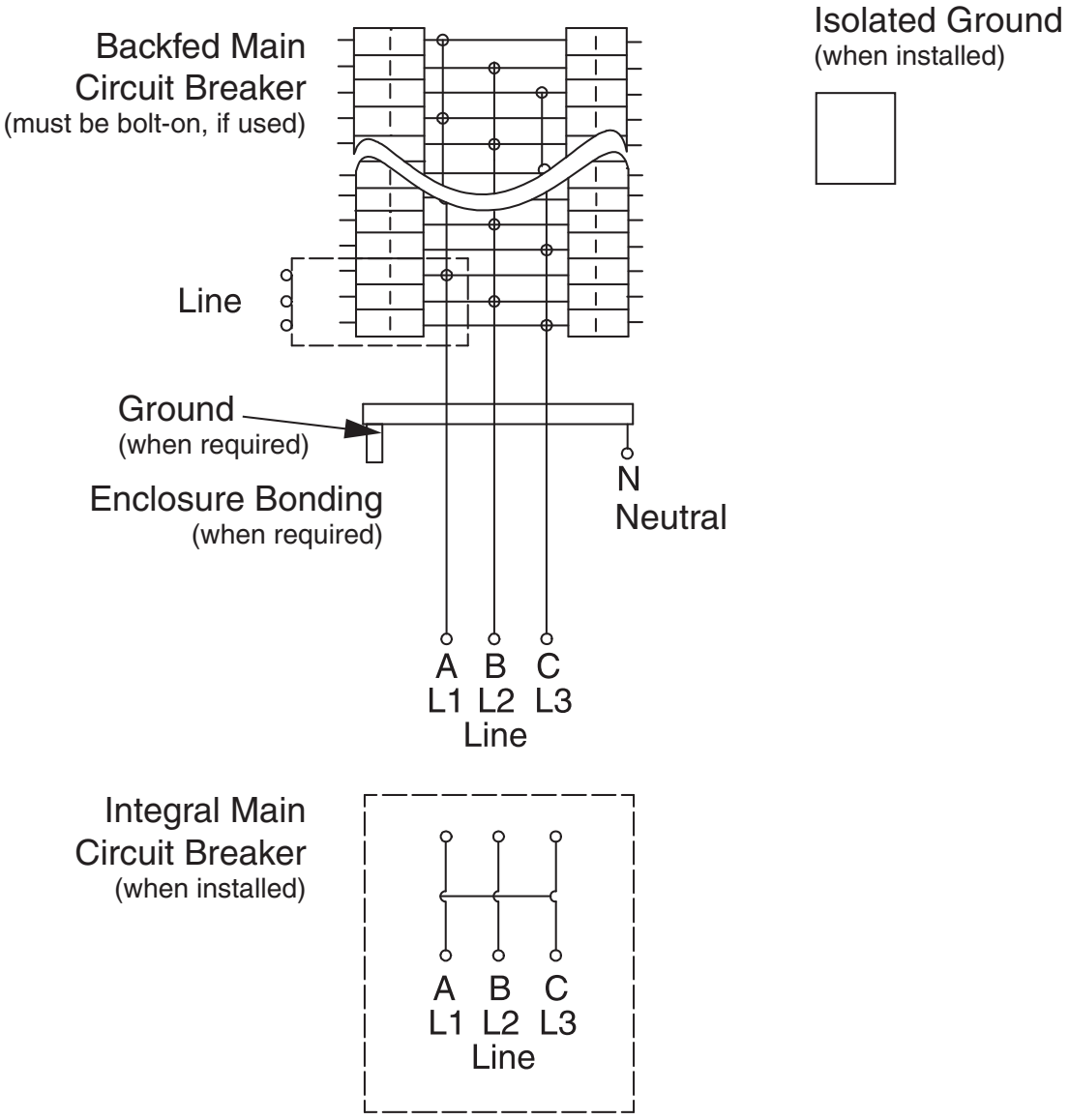
3 For a grounded “B” phase system, only circuit breakers rated 240 V AC minimum should be used. Do not use circuit breakers rated 120 V or 120/240 V AC.

4 When wiring for a delta system, phases “A” and “C” must be 120 V to neutral, phase “B” 208 V to neutral. Connect only circuit breakers rated 240 V AC minimum. Do not use circuit breakers rated 120 V or 120/240 V to “B” phase.

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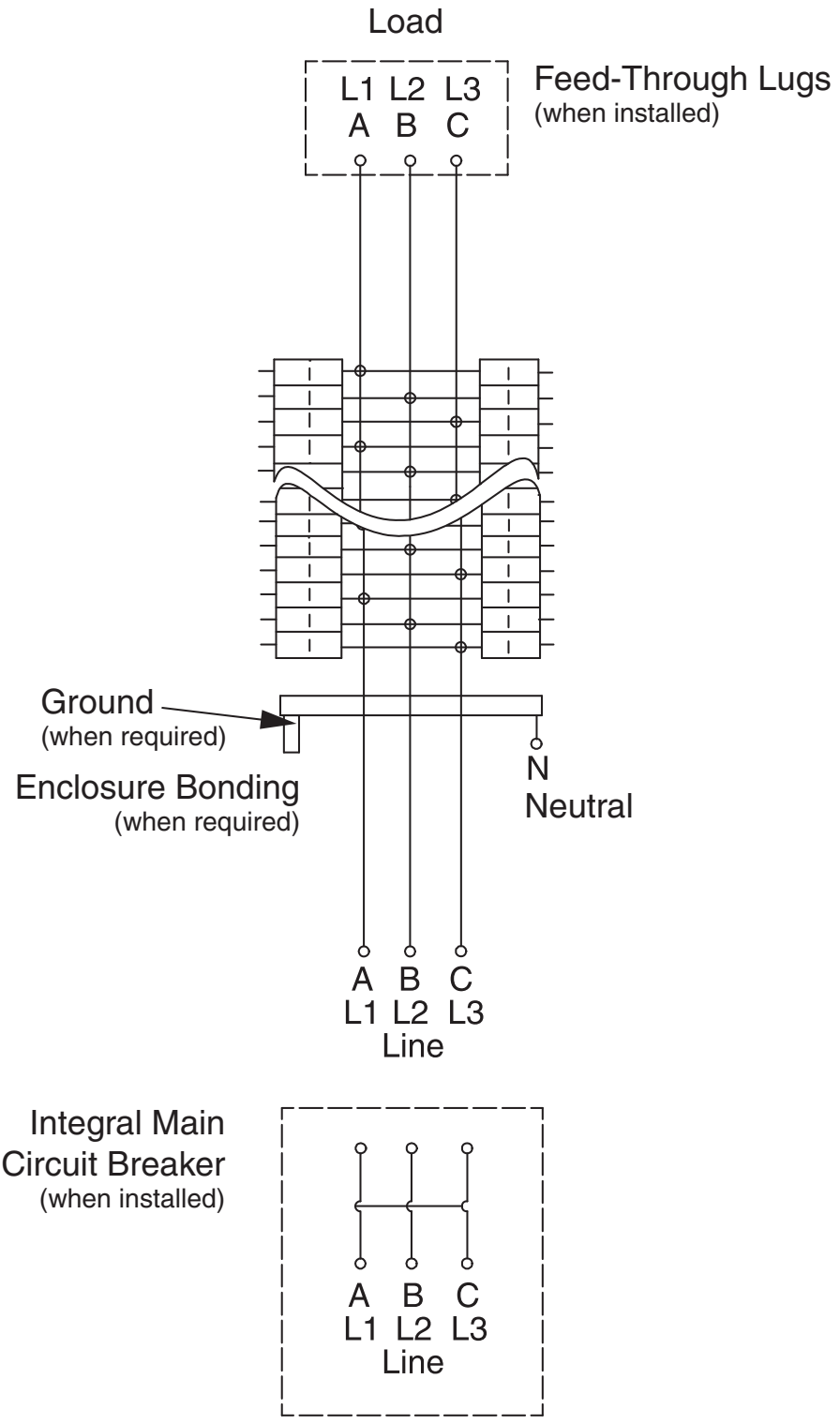
Integral Main or Sub-Feed:
DJ, FI, KI, H, J, LA, LC, LH, QB, QD, QG, QJ, QO(B)VH

Figure 7: NQ/NQM 100–225 A Main Lugs or 100–250 A Main Breaker Diagram



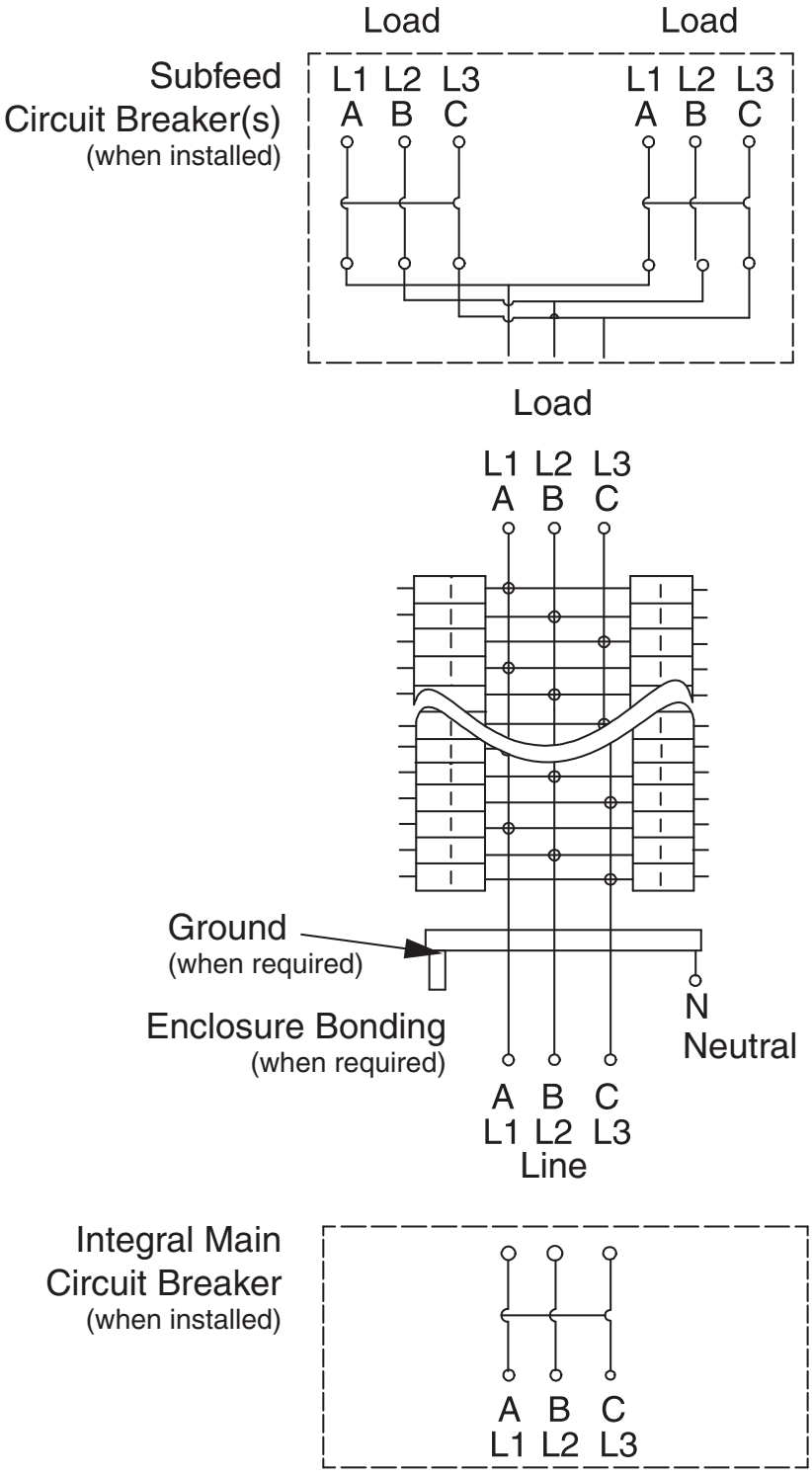
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Figure 8: NQ Panelboard or QONQ Load Center 400–600 A Main Lugs or Main Circuit Breaker with or without Feed-Through Lugs Diagram



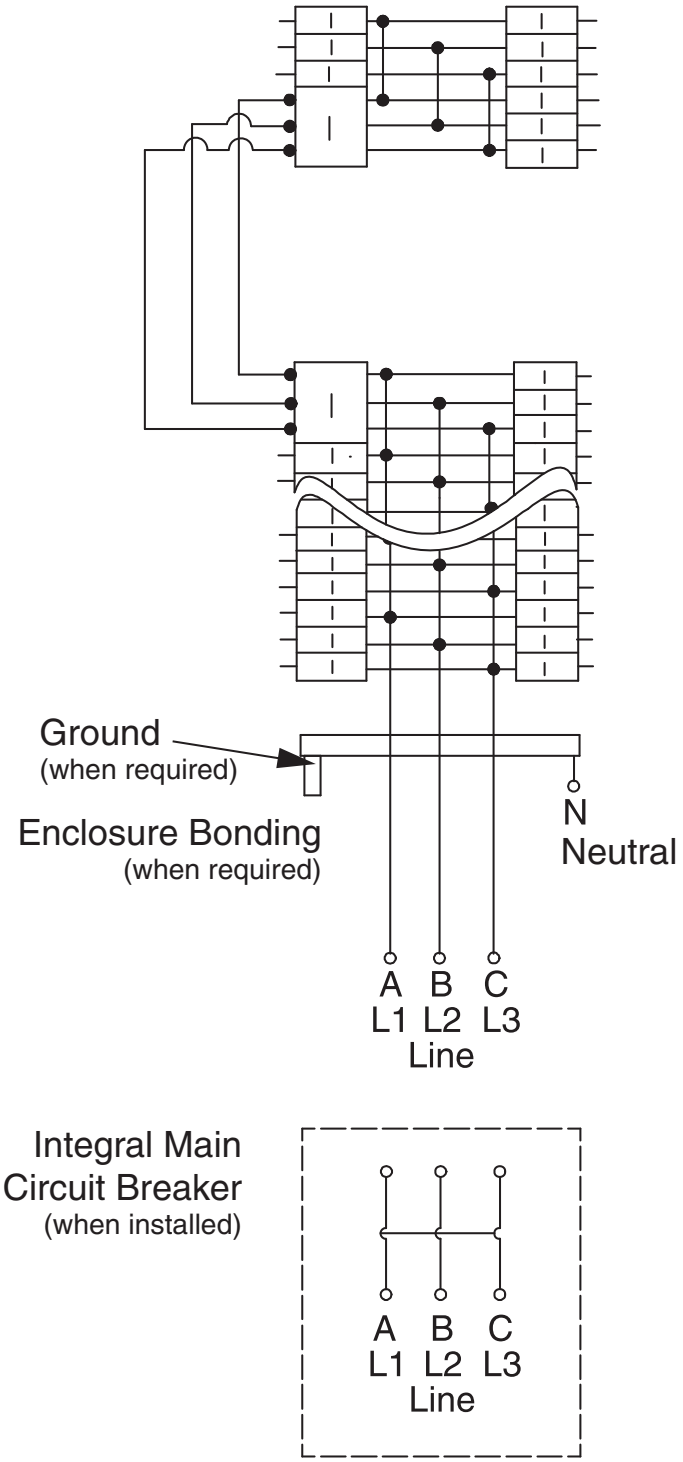
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Figure 9: NQ Panelboard or QONQ Load Center 400–600 A Main Circuit Breaker with Feed-Through Lugs or Sub-Feed Circuit Breakers Diagram



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Figure 10: Typical NQ Panelboard with Split Bus Diagram



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Panelboard Ratings

Refer to NEC section 110-22 and CEC rule 14-014 for more information. The series rated system label is located in the bag assembly.

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical)

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
120/240 1P/3W	22,000	MG	QO (B)	15–30 A	—	—
	25,000	LD, HD, JD	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	65,000	HG, JG	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LG	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LJ	QO (B) GFI	15–30 A	40–60 A	—
			QO (B) EPD	15–30 A	40–60 A	—
	100,000	HJ, JJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
120/240 1P/3W	100,000	LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) H	—	15–100 A	—
			QO (B) GFI	—	15–30 A	—
			QO (B) EPD	—	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		DJ 400 A	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	—	150 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		QJ	QO (B)	15–70 A	15–125 A	—
			QO (B) AS	15–30 A	15–30 A	—
			QO (B) VH	—	150 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	125,000	HL, JL	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
208Y/120 3P/4W	18,000	LA/LH (L) 34200MC	QO (B)	15–30 A	15–30 A	15–30 A
		LA/LH (L) 34225MC				
		LA/LH (L) 34250MC				
		LA/LH (L) 34400MC				

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
208Y/120 3P/4W	25,000	LD	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–30 A	15–125 A	15–150 A
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	30,000	DJ-W 150 A MC[7]	QO (B)	15–70 A	15–100 A	—
			QO (B) VH	—	15–125 A	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
		DJ-W 250 A MC[7]	QO (B)	15–70 A	15–100 A	—
			QO (B) VH	—	—	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
		DJ-W 600 A MC[7]	QO (B)	15–70 A	15–100 A	—
			QO (B) VH	—	—	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
	65,000	LG	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
208Y/120 3P/4W	65,000	LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LL	QO (B) GFI	—	—	15–30 A
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	100,000	DJ 400 A	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	—	—	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		QJ	QO (B)	15–70 A	15–125 A	15–30 A
			QO (B) VH	—	—	15–150 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	15–30 A	15–60 A	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	—	15–30 A	—
			QO (B) EPD	—	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	22,000	QO (B) VH	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	25,000	QD	QO (B)	15–70 A	15–125 A	15–30 A
			QO (B) VH	—	—	35–150 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		ED, FD	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		KD	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) AS	15–30 A	15–30 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
		HD, JD	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	25,000	LD	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–30 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	42,000	LA, MA	Q2L-H	—	100–225 A	100–225 A
			QDL	—	70–225 A	70–225 A
		LC 400 A	QO (B)	15–70 A	15–70 A	—
			QO (B) VH	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LC 600 A	QO (B) VH	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		MG	QO (B) VH	15–30 A	15–30 A	15–30 A
	65,000	LC 400 A	QO (B)	15–30 A	15–30 A	—
			QO (B) VH	15–30 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LC 600 A	QO (B) VH	15–30 A	15–125 A	15–150 A
			QO (B) GFI	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		DJ 400 A	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	—	—	15–150 A
			QO (B) H	—	15–100 A	—

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	65,000	DJ_W	QO (B)	15–70 A	15–150 A	—
			QO (B)-VH	—	110–125 A	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		DJ, DG, DL 150–600 A	QO (B) EPD	—	—	15–30 A
		EG, FG, KG	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		QG	QO (B)	15–70 A	15–125 A	15–30 A
			QO (B) VH	—	—	35–150 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		HG, JG	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		FC_ or KC_22___	QO (B)	15–70 A	15–100 A	15–100 A
		FC_ or KC_34___	QO (B) AS	15–30 A	15–30 A	15–30 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	65,000	LG	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) GFI	15–30 A	40–60 A	—
			QO (B) EPD	15–30 A	40–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
		LL	QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	100,000	FC_ or KC_22___	QO (B) GFI	15–30 A	15–30 A	—
		FC_ or KC_34___	QO (B) AFI	15–20 A	—	—
		DJ 400 A	QO (B)	15–70 A	15–125 A	—
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		EJ	QO (B)	15–70 A	15–125 A	15–100 A
		LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	—	15–30 A	—
			QO (B) EPD	—	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	100,000	HJ, JJ	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	35–150 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	125,000	HL, JL	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	35–150 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	200,000	FI, KI, HR, JR	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
240 3P/3W or 240 1P/2W (two pole only)	22,000	QO (B) VH	QO (B)	—	—	15–100 A
			QO (B) GFI	—	—	15–50 A
			QO (B) PL	—	15–30 A	—
		Q2-H	QO (B)	—	—	15–30 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240 3P/3W or 240 1P/2W (two pole only)	25,000	QD	QO (B)	—	—	15–30 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
			QO (B) PL	—	15–60 A	15–30 A
			QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) GFI	—	—	15–50 A
		ED, FD	QO (B)	—	—	15–100 A
			QO (B) GFI	—	—	15–50 A
		KD	QO (B)	—	—	15–100 A
		HD, JD	QO (B)	—	—	15–100 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	—	—	15–50 A
	25,000	LD	QO (B) VH	—	—	15–150 A
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	42,000	LA, MA	QDL	—	70–225 A	70–225 A
		LC 400 A	QO (B) VH	—	—	15–100 A
		LC 600 A	QO (B) VH	—	—	15–100 A
		MG	QO (B) VH	—	—	150 A
	65,000	LC 400 A	QO (B) VH	—	—	15–100 A
		LC 600 A	QO (B) VH	—	—	15–30 A
		DJ 400 A	QO (B) VH	—	—	15–150 A
			QO (B) H	—	15–100 A	—
		DJ, DG, DL 150–600 A	QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
		EG, FG, KG	QO (B)	—	—	15–100 A
			QO (B) GFI	—	—	15–50 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240 3P/3W or 240 1P/2W (two pole only)	65,000	QG	QO (B)	—	—	15–30 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
		QG, HG, JG	QO (B) PL	—	—	15–30 A
		HG, JG	QO (B)	—	—	15–100 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
		FC_ or KC_22___	QO (B)	—	—	15–100 A
		FC_ or KC_34___	QO (B) AS	—	15–30 A	15–30 A
		LG	QO (B) VH	—	—	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
		LJ	QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
		LL	QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	100,000	FC_ or KC_24___	QO (B) GFI	—	15–30 A	—
		FC_ or KC_34___				
		DJ 400 A	QO (B) H	—	15–100 A	—
	100,000	EJ, FJ	QO (B)	—	—	15–100 A
		LJ	QO (B) VH	—	—	15–100 A
			QO (B) H	—	15–100 A	—
		HJ, JJ	QO (B)	—	—	15–100 A
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	35–150 A
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240 3P/3W or 240 1P/2W (two pole only)	125,000	HL, JL	QO (B)	—	—	15–100 A
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	35–150 A
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	200,000	FI, KI, HR, JR	QO (B)	—	—	15–100 A
120/240 1P/3W	42,000	400 A Max. Class T3 Fuses	QO (B) VH	15–70 A	15–125 A	—
	65,000	400 A Max. Class J Fuses	QO (B) VH	15–70 A	15–150 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		400 A Max. Class T6 Fuses	QO (B) VH	15–70 A	15–150 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	100,000	200 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	200,000	400 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
208Y/120 3P/4W	200,000	200 A Max. Class T6, J Fuses	QO (B)	15–70 A	15–125 A	—
			QO (B) GFI	—	—	15–50 A
			QO (B) EPD	—	—	15–50 A
		400 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	42,000	400 A Max. Class T3 Fuses	QO (B) VH	15–30 A	15–125 A	—
	50,000	400 A Max. Class T3 Fuses	QO (B) VH	—	—	15–30 A
	65,000	400 A Max. Class J Fuses	QO (B) VH	15–70 A	15–125 A	—
			QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		400 A Max. Class T6 Fuses	QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) AFI	15–20 A	—	—
	100,000	200 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) VH	—	—	15–30 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
			QOT	15–30 A	15–30 A	—
	200,000	200 A Max. Class J or T6 Fuses	QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
		400 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240 3P/3W or 240 1P/2W (two pole only)	50,000	400 A Max. Class J or T6 Fuses	QO (B) VH	—	—	15–30 A
	65,000	400 A Max. Class J Fuses	QO (B) VH	—	—	15–30 A
			QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
		400 A Max. Class T6 Fuses	QO (B) VH	—	—	15–150 A
			QOB VH 1φ, 2W only	—	150 A	—
	100,000	200 A Max. Class T3 Fuses	QO (B)	—	—	15–100 A
			QO (B) VH	—	—	15–30 A
240 3P/3W or 240 1P/2W (two pole only)	200,000	200 A Max. Class J or T6 Fuses	QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
		400 A Max. Class T3 Fuses	QO (B)	—	—	15–100 A
			QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A

1 For shown circuit breakers rated less than this maximum voltage, the indicated short circuit current rating also applies, but at the voltage rating of the circuit breaker.

2 Short circuit tests are conducted at 100–105% of the maximum rated voltage of the panelboard.

3 Suffixes HID, SWD, and SWN may also be applied to the applicable branch circuit breakers shown above. Suffix SWN may **not** be applied in combination with LC main breakers.

4 Where QO (B) circuit breakers are shown above, QO (B) H, QO (B) VH, and QH (B) circuit breakers may also be used.

5 Where QO (B) GFI circuit breakers are shown above, QO (B) EPD and/or QO (B) EPE circuit breakers may also be used. QO-EPE only comes in 3 pole construction.

6 Where QO (B) AFI circuit breakers are shown above, QO (B) CAFI circuit breakers may also be used.

7 To achieve selective coordination, the rating of the DJ main circuit breaker must be at least two times greater than the ampere rating of any branch circuit breaker.

Table 3: NQ Panel Mission Critical Breaker Selectivity

Maximum SCCR (RMS Symmetrical)	Integral or Remote Main Circuit Breakers	Branch Circuit Breakers			
		Type	1-pole	2-pole	3-pole
Fully Rated and Selective to 10kA at 208Y/120 Vac or at 240/120 Vac	J-W, 250 A L-W, 250 A	QO(B)	10–70	10–125	10–125
		QO(B)-H			
		QO(B)-VH			
		QH			
Series Rated and Selective to 12kA at 208Y/120 Vac or at 240/120 Vac	J-W, 250 A	QO(B)	10–70	10–125	10–60
		QO(B)-H			
		QO(B)-VH			
		QH			
Series Rated and Selective to 15kA at 208Y/120 Vac or at 240/120 Vac	J-W, 250 A	QO(B)	10–60	10–60	10–30
		QO(B)-H			
		QO(B)-VH			
		QH			
Series Rated and Selective to 18kA at 208Y/120 Vac or at 240/120 Vac	J-W, 250 A	QO(B)	10–30	10–30	—
		QO(B)-H			
		QO(B)-VH			
		QH			
	L-W, 250 A	QO(B)	10–60	10–60	10–60
		QO(B)-H			
		QO(B)-VH			
		QH			
Series Rated and Selective to 30kA at 208Y/120 Vac or at 240/120 Vac	L-W, 400 A L-W, 600 A	QO(B)	15–70	15–150	15–150
		QO(B)-H			
		QO(B)-VH			
		QH			

Including AFI, CAFI, EPD and GFI Circuit Breakers

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Table 4: Short Circuit Current Rating[1] for Main Lug Interiors with Sub-Feed or Feed-Through Lugs

Maximum System Voltage AC	Maximum Current Rating	Branch Circuits	Application	Adder[2]	Maximum Short Circuit Current Rating[3]
240	100	18, 30	SFL and FTL	—	10,000
	225	30, 42, 54, 72, 84	SFL	6 inches (152.4 mm)	
		42	FTL	—	
		30, 54, 72, 84		6 inches (152.4 mm)	
	400	30, 42, 54, 72, 84	SFL	—	25,000
		30, 84	FTL	—	
		42, 54, 72		6 inches (152.4 mm)	
	600	30, 42, 54, 72, 84	FTL	12 inches (304.8 mm)	

1 This rating applies to main lug interiors, equipped with sub-feed or feed-through lugs, where the device feeding the interior is unknown or not a Square D brand device. Use of a Square D brand main circuit breaker ahead of these lugs will result in a rating equal to the rating of the breaker. Short circuit tests are conducted at 100–105% of the maximum rated voltage of the panelboard.

2 The adder is the additional length of the enclosure.

3 RMS symmetrical amperes, for three cycles.

CE Marking

Interiors with the "CE" mark meet the IEC 61439-1 and IEC 61439-2 standards.
Main lug interiors with the "CE" mark have been tested to withstand 10,000 RMS symmetrical amperes for 30 cycles.
Interiors with the "CE" mark are only approved for use with QOXD or QOBXD branch circuit breakers which carry the "CE" mark.

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Appendix 2: Accessory Kits

An assortment of field-installable accessory kits are available for NQ panelboards:

- Equipment Ground Bar Kits
- Oversized Lug Kits for 100–250 A Panelboards
- Sub-Feed Lug Kits for 100–400 A Panelboards
- Main Lug Kits
  - — Mechanical Lug Kits—Aluminum
  - — Mechanical Lug Kits—Copper
  - — Versa-Crimp® Compression Lug Kits—Aluminum
  - — Versa-Crimp Compression Lug Kits—Copper

Equipment Ground Bar Kits

Equipment ground bar kits, suitable for copper or aluminum wire, meet the grounding needs of NQ panelboards and QONQ load centers.

Table 5: Equipment Ground Bar Kits Specifications

Panelboard		Use Ground Bar Kit Catalog Number	
Branch Circuit	**Mains Rating**	**Aluminum[1]**	**Copper[2]**
1–42	600 A Maximum	(1) PK27GTA	(1) PK27GTACU
54–84		(2) PK27GTA	(2) PK27GTACU

1 Aluminum bars suitable for 60° C or 75° C Copper or Aluminum conductors.

2 Copper bars suitable for 60° C or 75° C Copper conductors.

NOTE: Ground bar mounting locations are identified by the ground symbol ⏚ stamped into the backwall of the enclosure.

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Oversized Lug Kits for 100–250 A Panelboards

Oversized lug kits are available for applications where termination conductors of 3 AWG or larger are required for the neutral.

Table 6: Oversized Lug Kits for 100–250 A Panelboards Specifications

Circuit Breaker Rating	Kit Catalog Number	Wire Range
70 A	QO70AN	(1) 10–2 Al ([1] 5.76–33.6 mm^2) (1)14–4 Cu ([1] 2.08–21.1 mm^2)
80–125 A	Q1100AN	(1) 4–1/0 Al/Cu ([1] 42.4–53.5 mm^2)
125–150 A	Q1150AN	(1) 1–4/0 Al/Cu ([1] 42.4–107 mm^2)

Sub-Feed Lug Kits for 100–400 A Panelboards

Sub-feed main lugs are available for 100, 225, or 400 A applications.

Table 7: Sub-Feed Lug Kits for 100–400 A Panelboards Specifications

Main Amps	Kit Catalog Number	Maximum Circuits
100	NQSFL1	18, 30
225	NQSFL2	30[1], 42[1], 54[1], 72[1], 84[1]
400	NQSFL4	30, 42, 54, 72, 84

[1] These panels require an additional 6 inches (152.4 mm) for the box and trim, for proper wire bending space.

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Main Lug Kits

Table 8: Mechanical Lug Kits — Aluminum

Panelboard Amps	Kit Catalog Number	Wire Range
100	Standard	#6–2/0 AWG (13.3–67.43 mm^2)
225	Standard	#6–350 kcmil (13.3–177.3 mm^2)
400	Standard	(1) 1/0–750 kcmil (2) 1/0–350 kcmil ([1] 53.48–380 mm^2) ([2] 53.48–177.3 mm^2)
600	Standard	(2) 1/0–750 kcmil ([2] 53.48–380 mm^2)
	NQALM6A	(3) #6–250 kcmil ([3] 13.3–127 mm^2)

Table 9: Mechanical Lug Kits — Copper

Panelboard Amps	Kit Catalog Number	Wire Range
100	NQCUM1	#6–2/0 AWG (13.3–67.43 mm^2)
225	NQCUM2	#6–250 kcmil (13.3–127 mm^2)
400	NQCUM4	(1) 1/0–750 kcmil (2) 1/0–350 kcmil ([1] 53.48–380 mm^2) ([2] 53.48–177.3 mm^2)
600	NQCUM6	

Table 10: Versa-Crimp® Compression Lug Kits — Aluminum

Panelboard Amps	Kit Catalog Number	Wire Range	Crimp Tool
100	NQALV1	#8–1/0 AWG (8.36–53.48 mm^2)	VC6 (All)
225	NQALV2	#4–300 kcmil (21.15–152 mm^2)	
400	NQALV4	(2) 2/0–500 kcmil ([2] 67.43–253.4 mm^2)	VC6-3, VC6-FT
600	NQALV6		

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Table 11: Versa-Crimp® Compression Lug Kits — Copper

Panelboard Amps	Kit Catalog Number	Wire Range	Crimp Tool
100	NQCUV1	#6–1/0 AWG (13.30–53.48 mm^2)	VC6 (All), VC7 (All)
225	NQCUV2	2/0–300 kcmil (67.43–152 mm^2)	VC6-3, VC7, VC6-FT, VC7-FT
400	NQCUV4	400–750 kcmil (202.7–380 mm^2)	VC6-FT, VC7-FT, VC8
600	NQCUV6	(2) 250–500 kcmil ([2] 126.7–253.4 mm^2)	VC6-3, VC7, VC6-FT, VC7-FT

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Foreword

This publication is a guide of practical information containing instructions for the proper installation, operation, and maintenance of panelboards rated 600 volts or less.

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency regarding installation, operation, or maintenance.

It is recommended that work described in this set of instructions be performed only by qualified personnel familiar with the construction and operation of panelboards and that such work be performed only after reading this complete set of instructions. For specific information not covered by these instructions, you are urged to contact the manufacturer of the panelboard directly.

In the preparation of this standards publication input of users and other interested parties has been sought and evaluated. Inquiries, comments, and proposed or recommended revisions should be submitted to the concerned NEMA product section by contacting the following: These recommendations will be reviewed periodically and updated as necessary.

Senior Technical Director, Operations
National Electrical Manufacturers Association
1300 North 17th Street, Suite 900
Rosslyn, Virginia 22209

Publication PB 1.1- 2013 revises and supersedes PB 1.1-2007.

This standards publication was developed by the Panelboard and Distribution Board Product Group of the LVDE Section. Product Group approval of the standard does not necessarily imply that all Product Group members voted for its approval or participated in its development. At the time it was approved, the Product Group was composed of the following members:

Eaton Corporation.—Pittsburgh, PA
GE Industrial Solutions—Plainville, CT
Hubbell, Inc.—Orange, CT
Milbank Manufacturing Company—Kansas City, MO
Penn Panel & Box Company—Collingdale, PA
Reliance Controls Corporation—Racine, WI
Siemens Industry, Inc.—Norcross, GA
Schneider Electric —Palatine, IL

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Section 1
SCOPE

This publication covers single panelboards or groups of panel units suitable for assembly in the form of single panelboards, including buses, and with or without switches or automatic overload protective devices (fuses or circuit breakers), or both. These units are used in the distribution of electricity at 600 volts and less with:

1600—ampere mains or less
1200—ampere branch circuits or less

Specifically excluded are live-front panelboards, panelboards employing cast enclosures for special service conditions, and panelboards designed primarily for residential and light commercial service equipment.

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Section 2
REFERENCES

National Fire Protection Association (NFPA)
Batterymarch Park
Quincy, MA 02269

NFPA 70 *National Electrical Code®*
NFPA 70E *Standard for Electrical Safety in the Workplace*

National Electrical Manufacturers Association (NEMA)
1300 North 17th Street, Suite 900
Rosslyn, Virginia 22209

AB 4 *Guidelines for Inspection and Preventative Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications*

PB 2.2 *Application Guide for Ground Fault Protective Devices for Equipment*

Guidelines for Handling Water Damaged Electrical Products

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Section 3
GENERAL

WARNING—HAZARDOUS VOLTAGES IN ELECTRICAL EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. UNLESS OTHERWISE SPECIFIED, INSPECTION AND MAINTENANCE SHOULD ONLY BE PERFORMED ON PANELBOARDS AND EQUIPMENT TO WHICH POWER HAS BEEN TURNED OFF, DISCONNECTED AND ELECTRICALLY ISOLATED SO THAT NO ACCIDENTAL CONTACT CAN BE MADE WITH ENERGIZED PARTS. FOLLOW ALL MANUFACTURER'S WARNINGS AND INSTRUCTIONS.

Safety-related work practices, as described in NFPA 70E, should be followed at all times.
All requirements of the *National Electrical Code*® NFPA 70 should be followed.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE PANELBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE COMPONENTS DURING INSTALLATION OR MAINTENANCE.

3.1 SUCCESSFUL OPERATION OF PANELBOARDS

The successful operation of panelboards is dependent upon proper installation, operation, and maintenance. Neglecting fundamental installation and maintenance requirements may lead to personal injury, death, or damage to electrical equipment or other property.

3.2 QUALIFIED PERSONNEL

Installation, operation, and maintenance of panelboards should be conducted only by qualified personnel.

3.3 DEFINITION OF QUALIFIED PERSONNEL

For purposes of these guidelines, a qualified person is one who is familiar with the installation, construction, and operation of the equipment and the hazards involved. In addition, the person is:

3.3.1 Requirements

Knowledgeable of the requirements of the *National Electrical Code*® and of all other applicable codes, laws, and standards.

3.3.2 Established Safety Practices

Trained and authorized to test, energize, clear, ground, tag, and lockout circuits and equipment in accordance with established safety practices.

3.3.3 Protective Equipment

Trained in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, and flash resistant clothing in accordance with established safety practices.

3.3.4 First Aid

Trained in rendering first aid.

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3.4 SUITABLE RATINGS

Verify that all equipment being installed has ratings suitable for the installation.

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Section 4
INSTALLATION OF PANELBOARD CABINETS (BOXES)

4.1 INSTALLATION INSTRUCTIONS

Installation of the cabinet in a neat and workmanlike manner. Follow the manufacturer's installation instructions.

4.2 LOCATION IN BUILDING

Locate the cabinet so that it is readily accessible and not exposed to physical damage.

4.3 FLAMMABLE MATERIAL

Locate the cabinet well away from flammable material.

4.4 UNUSUAL SERVICE CONDITIONS

Do not locate the cabinet where it will be exposed to ambient temperatures above 40°C (104°F), corrosive or explosive fumes, dust, vapors, dripping or standing water, abnormal vibration, mechanical shock, high humidity, tilting, or unusual operating conditions, unless the cabinet/panelboard combination has been designed and so identified by the manufacturer for these conditions.

4.5 INDOOR DAMP LOCATIONS

Locate or shield the cabinet so as to prevent moisture and water from entering and accumulating therein. Mount the cabinet so that there is at least 1/4 inch of air space between the cabinet and the wall or other supporting surface.

4.6 WET LOCATIONS

Cabinets should be specifically approved for wet locations. Mount the cabinet so that there is at least 1/4 inch of air space between the cabinet and the wall or other supporting surface.

4.7 CLEARANCE FROM CEILING

Do not locate the cabinet against a non-fireproof ceiling; allow a space of 3 feet between the ceiling and cabinet unless an adequate fireproof shield is provided.

4.8 SPACE AROUND THE CABINET

When selecting a location, provide sufficient access and working space around the cabinet (see Section 110.26 of the *National Electrical Code*®). The width of the working space in front of the panelboard should be at least 30 inches, or the width of the cabinet, whichever is greater, and this space should not be used as storage. The working space should have adequate lighting and a minimum head room of 6 feet 6 inches.

4.9 MOUNTING OF CABINET

The cabinet should be reliably secured to the mounting surface. Do not depend on wooden plugs driven into holes in masonry, concrete, plaster, or similar materials. (See Section 110.13 of the *National Electrical Code*®.)

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4.10 FLUSH MOUNTING IN WALL

In walls of concrete, tile, or other noncombustible material, install the cabinet so that its front edge will not set back more than 1/4 inch from the finished surface. In walls of wood or other combustible material, cabinets should be flush with or project beyond the finished surface. (See Section 312.3 of the *National Electrical Code*®.)

4.11 UNUSED OPENINGS IN CABINET

Effectively close unused openings in the cabinet to provide protection which is substantially equivalent to that afforded by the wall of the cabinet.

4.12 GROUNDING OF PANELBOARD CABINETS

Ground the cabinet as specified in Article 250 of the *National Electrical Code*®. When the cabinet contains service equipment, it is necessary to bond the cabinet to the grounded (neutral) service conductor.

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Section 5
INSTALLATION OF CONDUIT AND CONDUCTORS

5.1 CONDUITS INSTALLATION

Conduits should be installed so as to prevent moisture or water from entering and accumulating within the enclosure. Provision should be made to protect conductors from abrasion in accordance with Article 312 of the *National Electrical Code*®.

5.2 KNOCKOUTS REMOVAL

Knockouts should be removed as follows:

IMPORTANT—Remove knockouts, ONE AT A TIME, alternating INWARD and OUTWARD.

5.2.1 First Step—Remove Center Knockout

Remove center knockout INWARD.

5.2.1.1 Screwdriver Blade

Place screwdriver blade against point farthest from tie and strike INWARD (Figure 1). Bend back and forth to break tie.

5.2.2 Next Step—Remove Rings

Remove rings ONE AT A TIME without straining remaining rings.

5.2.2.1 Pry First Ring

Pry first ring OUTWARD with screwdriver midway between ties, using pliers flat against box under screwdriver (Figure 2). Bend ring sections OUTWARD with pliers, then back and forth to break ties (Figure 5-3).

5.2.2.2 Second Ring

Remove second ring INWARD by striking screwdriver (with blade against point midway between ties) then breaking ring sections inward and back and forth to break ties.

5.3 *NATIONAL ELECTRICAL CODE*®, ARTICLE 300

Refer to the *National Electrical Code*®, Article 300 for proper wiring methods. See 6.7 for making proper connections.

5.4 CONDUCTOR LENGTH

Keep conductor length to a minimum within the wiring gutter. Excessive conductor length will result in additional heating and may result in overheating. However, conductors should be long enough to reach the terminal location in a manner that avoids strain on the terminal.

5.5 EXERCISE CARE

Exercise care to maintain the largest practical bending radius of conductors; otherwise the insulation may be damaged and terminal connections may become loosened. Deflection of conductors shall comply with *NEC*® Section 312.6.

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5.6 *NATIONAL ELECTRICAL CODE*®, SECTION 725.136

Refer to the *National Electrical Code*®, Section 725.136 for the separation requirements for conductors of Class 2 and Class 3 remote-control, signaling and power-limited circuits.

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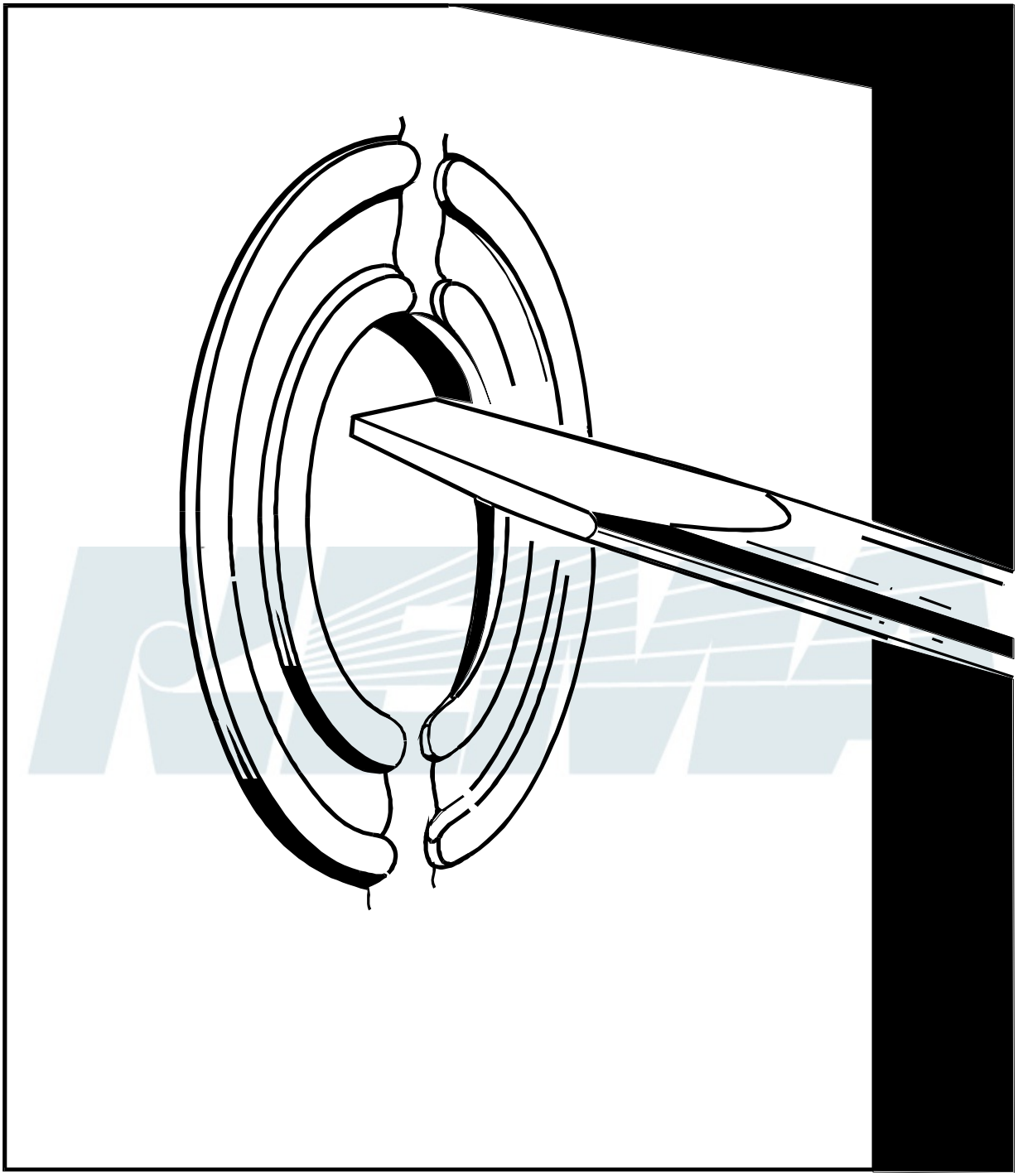


Figure 5–1
KNOCKOUT REMOVAL—STEP 1

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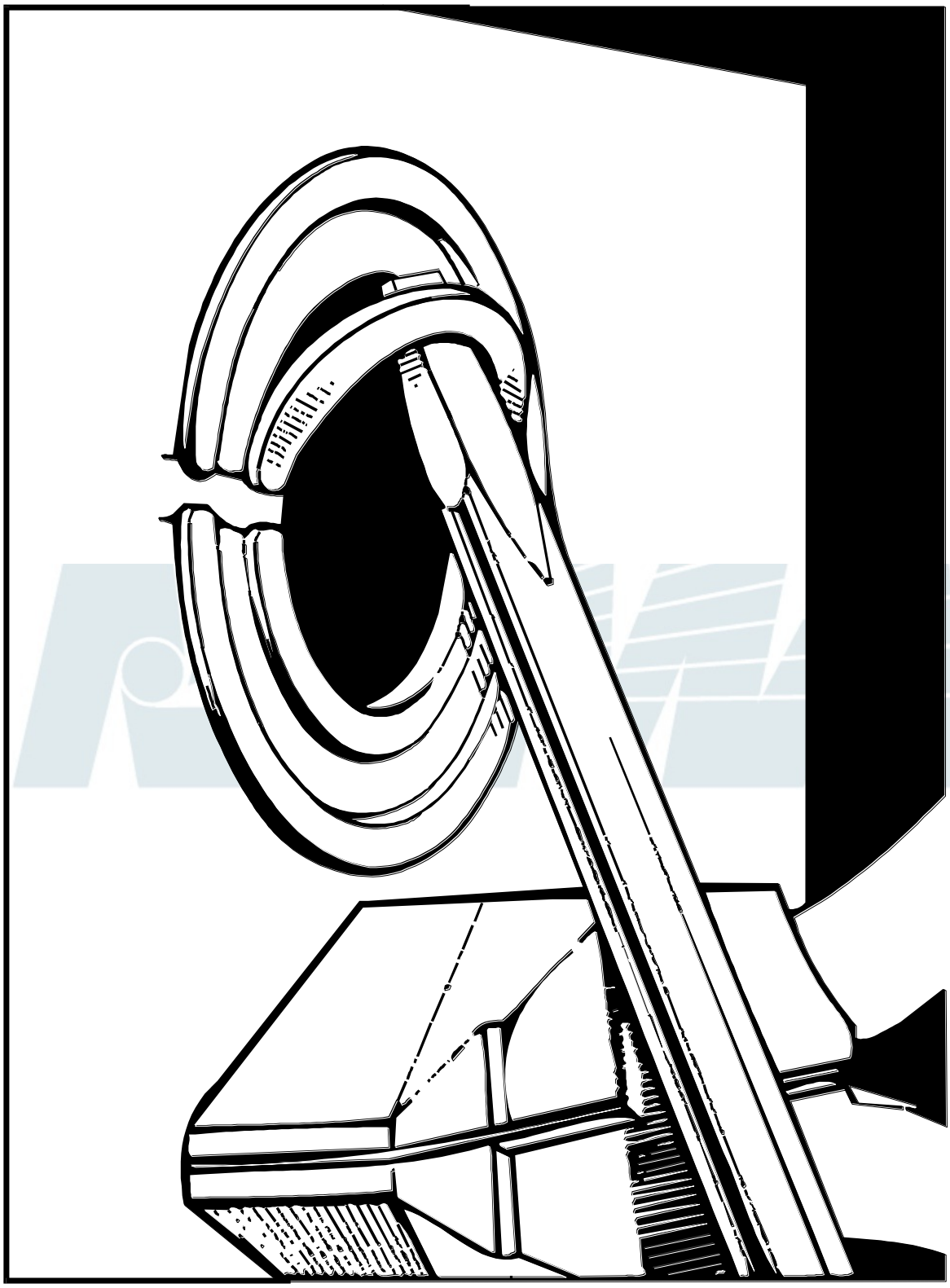


Figure 5–2
KNOCKOUT REMOVAL—STEP 2

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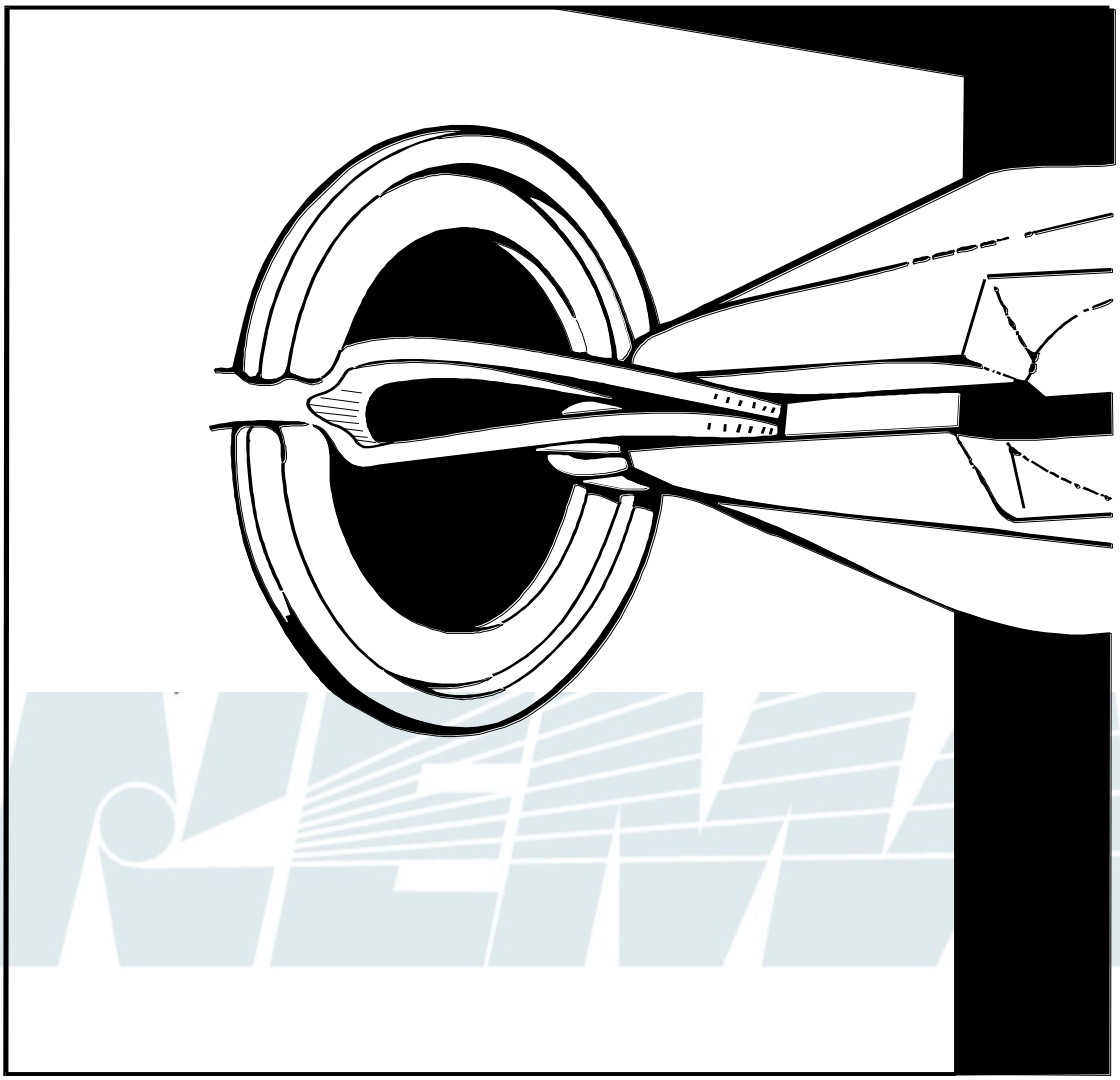


Figure 5–3
KNOCKOUT REMOVAL—STEP 3

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Section 6
INSTALLATION OF PANELBOARD

6.1 PROPER STORAGE

Store the panelboard in a clean, dry place located so that mechanical damage from work personnel in the area is not likely to happen.

6.2 UNPACKING

Care should be exercised in unpacking the panelboard to prevent damage and loss of instruction materials and loose parts.

6.3 INSPECTION

Check for shipping damage and check to make sure that the panelboard is the correct one for installation in the cabinet.

6.4 CARE

Care should be taken to protect the panelboard internal parts from contamination during the installation process.

6.4.1 Cleaning

Clean the cabinet of all foreign materials. If parts at connection points are spattered with cement, plaster, paint, or other foreign material, remove the foreign materials with great care to avoid damage to the plating.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE PANELBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE PANELBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

6.5 MANUFACTURER'S INSTRUCTIONS

Carefully follow the manufacturer's instructions and labels.

6.6 INSTALLATION

6.6.1 Alignment Devices

Adjust the alignment devices where provided.

6.6.2 Panelboard

Install the panelboard, finalize its alignment, and tighten it securely in the cabinet.

6.6.3 Flange of Deadfront Shield

Unless otherwise instructed by the manufacturer, adjust the panelboard so that the flange of the deadfront shield is no more than 3/16 inch from (1) the front of the cabinet for surface mounting or (2) the surrounding wall surfaces for flush mounting.

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6.7 LINE AND BRANCH CONDUCTORS

Connect Line and Branch Conductors

6.7.1 Conductors

Use care in stripping insulation from conductors so as not to nick or ring the conductor. For aluminum, clean all oxide from the stripped portion and apply an antioxide compound.

6.7.1.1 Wiring Gutters

Distribute and arrange conductors neatly in the wiring gutters. (See Section 5.)

6.7.1.2 Types and Temperature Ratings

Care should be exercised to ensure that the types and temperature ratings of conductors being installed in the panelboard are suitable for use with the terminals, which have been provided.

6.7.1.3 Tighten All Terminals

Use the manufacturer's torque values. (See 7.1).

6.8 PANELBOARD GROUNDING AND BONDING

Ground the panelboard cabinet in accordance with 4.12. (See Section 408.40 of the *National Electrical Code*®.)

6.8.1 Equipment Grounding Conductors

Where separate equipment grounding conductors are used, prepare equipment grounding conductors in accordance with 6.7.1 and connect them to the equipment grounding terminal bar. Check to be sure that the terminal bar is securely bonded to the cabinet or panelboard frame and that it is not connected to the neutral bar except at service equipment (as permitted in Section 250.28 of the *National Electrical Code*®) or at separately derived systems (as permitted in Section 250.30 of the *National Electrical Code*®).

NOTE—An equipment grounding terminal bar is not always required. For example, when a properly installed metallic raceway is used as the equipment grounding path or when the grounded conductor terminals (neutral bar) complies with the conditions of the last sentence of Section 408.40 of the *National Electrical Code*®.

6.9 PROPER TYPE OR CLASS AND RATING

When installing circuit breakers or fuses, ensure that they are of the proper type or class and rating.

6.10 DEBRIS

Clean the cabinet of all debris, which has accumulated during the panelboard installation Ensure that all foreign materials, including cement, plaster and paint (overspray) are cleaned and removed. Remove all such materials with great care to avoid damage to conductors, plating, etc. (see 6.4.1).

6.11 STEPS IN SECTION 7

If the job is complete, perform the steps in Section 7 and then install the cabinet front (see Section 8).

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Section 7
STEPS TO BE TAKEN BEFORE ENERGIZING

7.1 ACCESSIBLE ELECTRICAL CONNECTIONS

Tighten all accessible electrical connections to the manufacturer's torque specifications. If such information is not provided with the equipment, consult the manufacturer.

7.2 BLOCKS AND PACKING MATERIALS

Make certain that all blocks and packing materials used for shipment have been removed from all component devices and the panelboard.

7.3 SWITCHES, CIRCUIT BREAKERS, AND OTHER OPERATING MECHANISMS

Manually exercise all switches, circuit breakers, and other operating mechanisms to make certain they operate freely. If devices with self-test function are installed, perform test and verify proper operation per the manufacturer's instructions.

Check the integrity of all electrical and mechanical interlocks and padlocking mechanisms. For key interlocked systems, assure that only the required number of keys are accessible to the operator.

7.4 SHORT CIRCUITS AND GROUND FAULTS

To make sure that the system is free from short circuits and ground faults, conduct an insulation resistance test phase to ground and phase to phase with the switches or circuit breakers in both the open and closed positions. If the resistance reads less than 1 megohm while testing with the branch circuit devices in the open position, the system may be unsafe and should be investigated. If after investigation and possible correction, low readings are still observed, the manufacturer should be contacted. Some electronic equipment (metering, SPD, etc.) may be damaged by this testing. Refer to the manufacturers equipment markings for guidelines.

7.5 GROUND FAULT PROTECTION SYSTEM

Test the ground fault protection system (if furnished) in accordance with the manufacturer's instructions. See Section 230.95 of the *National Electrical Code*® and NEMA PB 2.2, *Application Guide for Ground Fault Protective Devices for Equipment*.

7.6 ADJUSTABLE TIME CURRENT TRIP DEVICE SETTINGS

Set any adjustable time current trip device settings to the proper values.

NOTE—Experience has indicated that damage from overcurrent can be reduced if the devices used for overload and short-circuit protection are set to operate instantaneously (that is, without intentional time delay) at 115 percent of the highest value of phase current which is likely to occur as the result of any anticipated motor starting or welding currents.

7.7 GROUNDING CONNECTIONS

Check to determine that all grounding connections are properly made. If the panelboard is used as service equipment, make certain that the neutral, if present, is properly bonded to the cabinet.

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7.8 FOREIGN MATERIAL

Remove all foreign material from the panelboard and cabinet before installing the cabinet front. Make certain that all deadfront shields are properly aligned and tightened. Install the cabinet front in accordance with Section 8.

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Section 8
INSTALLATION OF CABINET FRONT

8.1 CABINET FRONT OR TRIM PACKAGE

The cabinet front or trim package is designed to prevent damage to the front during shipment and handling.

8.2 UNPACKING

Care should be used when unpacking and handling the cabinet front.

8.3 COVERS AND DOORS

Install covers, close doors, and make certain that no conductors are pinched and that all enclosure parts are properly aligned and tightened. Hinged covers or doors must open a minimum of 90 degrees when installed.

8.4 TOUCH-UP

A suitable paint or other corrosion-resistant finish should be applied to those places where the finish is damaged.

8.5 FRONT ALIGNMENT

The cabinet front may be provided with an adjusting means to align it squarely with the building even though the cabinet may be slightly out of plumb with the building.

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Section 9
ENERGIZING EQUIPMENT

WARNING—HAZARDOUS VOLTAGES IN ELECTRICAL EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. ENERGIZING A PANELBOARD FOR THE FIRST TIME AFTER INITIAL INSTALLATION OR MAINTENANCE IS POTENTIALLY DANGEROUS.

9.1 QUALIFIED PERSONNEL

Only qualified personnel should energize equipment for the first time. If short circuit conditions caused by damage or poor installation practices have not been detected in the procedures specified in Section 7, serious personal injury and damage can occur when the power is turned on.

9.2 LOAD ON THE PANELBOARD

There should be no load on the panelboard when it is energized. Turn off all of the downstream loads.

9.3 ENERGIZED IN SEQUENCE

The equipment should be energized in sequence by starting at the source end of the system and working towards the load end. In other words, energize the main devices, then the feeder devices, and then the branch-circuit devices. Turn the devices on with a firm positive motion.

9.4 LOADS SUCH AS LIGHTING CIRCUITS, CONTACTORS, HEATERS, AND MOTORS

After all main, feeder, and branch circuit devices have been closed, loads such as lighting circuits, contactors, heaters, and motors may be turned on.

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Section 10
MAINTENANCE

10.1 MAINTENANCE PROGRAM

A maintenance program for panelboards should be conducted on a regularly scheduled basis in accordance with the following:

10.2 PANELBOARD WHICH HAS BEEN CARRYING ITS REGULAR LOAD FOR AT LEAST 3 HOURS

A panelboard which has been carrying its regular load for at least 3 hours just prior to inspection should be field tested by feeling the deadfront surfaces of circuit breakers, switches, interior trims, doors, and enclosure sides with the palm of the hand. If the temperature of these surfaces does not permit you to maintain contact for at least 3 seconds, this may be an indication of trouble and investigation is necessary. Thermographic (infrared) scanning has become a useful method of investigating thermal performance.

WARNING—HAZARDOUS VOLTAGES IN ELECTRICAL EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. UNLESS OTHERWISE SPECIFIED, INSPECTION AND MAINTENANCE SHOULD ONLY BE PERFORMED ON PANELBOARDS TO WHICH POWER HAS BEEN TURNED OFF, DISCONNECTED AND ELECTRICALLY ISOLATED SO THAT NO ACCIDENTAL CONTACT CAN BE MADE WITH ENERGIZED PARTS. FOLLOW ALL MANUFACTURER'S WARNINGS AND INSTRUCTIONS.

Safety related work practices, as described in NFPA 70E, should be followed at all times.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE PANELBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE PANELBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

10.3 INSPECT PANELBOARD ONCE EACH YEAR

Inspect the panelboard once each year or after any severe short circuit.

10.4 ACCUMULATION OF DUST AND DIRT

If there is an accumulation of dust and dirt, clean out the panelboard by using a brush, vacuum cleaner, or clean lint-free rags. Avoid blowing dust into circuit breakers or other components. Do not use a blower or compressed air.

10.4.1 Visible Electrical Joints and Terminals

Carefully inspect all visible electrical joints and terminals in the bus and wiring system.

10.4.2 Conductors and Connections

Visually check all conductors and connections to be certain that they are clean and secure. Loose and/or contaminated connections increase electrical resistance which can cause overheating. Such overheating is indicated by discoloration or flaking of insulation and/or metal parts. Pitting or melting of connecting surfaces is a sign of arcing due to a loose or otherwise poor connection. Parts which show evidence of overheating or looseness should be cleaned and re-torqued or replaced if damaged. Tighten bolts and nuts at bus joints to manufacturer's torque specifications.

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CAUTION—DO NOT REMOVE PLATING FROM ALUMINUM PARTS IN JOINTS OR TERMINATIONS. DAMAGE TO PLATING CAN RESULT IN OVERHEATING. REPLACE DAMAGED ALUMINUM PARTS.

10.4.3 Fuse Clip Contact Pressure and Contact Means

Examine fuse clip contact pressure and contact means. If there is any sign of overheating or looseness, follow the manufacturer's maintenance instructions or replace the fuse clips. Loose fuse clips can result in overheating.

10.4.4 Plug Fuses

Re-tighten plug fuses.

10.4.5 Conditions Which Caused Overheating

Be sure that all conditions which caused the overheating have been corrected.

10.5 PROPER AMPERE, VOLTAGE, AND INTERRUPTING RATINGS

Check circuit breakers, switches, and fuses to ensure they have the proper ampere, voltage, and interrupting ratings. Ensure that non-current-limiting devices are not used as replacements for current-limiting devices. Never attempt to defeat rejection mechanisms which are provided to prevent the installation of the incorrect class of fuse.

10.5.1 Mechanisms Free and in Proper Working Order

Operate each switch or circuit breaker several times to ensure that all mechanisms are free and in proper working order. Replace as required. See NEMA AB-4 for maintenance of molded case circuit breakers.

10.6 OPERATION OF ALL MECHANICAL COMPONENTS

Check the operation of all mechanical components. Replace as required.

10.6.1 Switch Operating Mechanisms

Exercise switch operating mechanisms and external operators for circuit breakers to determine that they operate freely to their full on and off positions.

10.6.2 Integrity of Electrical and Mechanical Interlocks

Check the integrity of all electrical and mechanical interlocks and padlocking mechanisms. For key interlocked systems, assure that only the required number of keys are accessible to the operator.

10.6.3 Missing or Broken Parts

Whenever practical, check all devices for missing or broken parts, proper spring tension, free movement, corrosion, dirt, and excessive wear.

10.6.4 Manufacturer's Instructions

Adjust, clean, and lubricate or replace parts according to the manufacturer's instructions.

10.6.4.1 Clean Nonmetallic Light Grease or Oil

Use *clean* nonmetallic light grease or oil as instructed.

10.6.4.2 Molded Case Circuit Breakers

Do *not* oil or grease parts of molded case circuit breakers.

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10.6.4.3 Clean, Light Grease

If no instructions are given on the devices, sliding copper contacts, operating mechanisms, and interlocks may be lubricated with clean, light grease.

10.6.4.4 Excess Lubrication

Wipe off excess lubrication to avoid contamination.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE PANELBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE PANELBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

10.6.5 Accessible Copper Electrical Contacts, Blades, and Jaws

Clean and dress readily accessible copper electrical contacts, blades, and jaws according to the manufacturer's instructions when inspection indicates the need.

10.7 DAMAGED INSULATING MATERIAL AND ASSEMBLIES

Look for and replace damaged insulating material and assemblies where sealing compounds have deteriorated.

10.8 MOISTURE OR SIGNS OF PREVIOUS WETNESS OR DRIPPING

Look for any moisture or signs of previous wetness or dripping inside the cabinet.

NOTE—Condensation in conduits or dripping from outside sources is one known cause of panelboard malfunction.

10.8.1 Conduits Which Have Dripped Condensate

Seal off any conduits which have dripped condensate, and provide means for further condensate to drain away from the panelboard.

10.8.2 Cracks or Openings

Seal off any cracks or openings which have allowed moisture to enter the enclosure. Eliminate the source of any dripping on the enclosure and any other source of moisture.

10.8.3 Insulating Material Which is Damp or Wet

Replace or thoroughly dry and clean any insulating material, which is damp or wet or shows an accumulation of deposited material from previous wettings.

10.8.4 Component Devices Which Show Evidence of Moisture Damage

Inspect all component devices. Replace any component device which shows evidence of moisture damage or has been subjected to water damage or flooding. Additional information may be found in the NEMA document “Guidelines for Handling Water Damaged Electrical Products.”

10.9 BEFORE CLEANUP AND CORRECTIVE ACTION IS ATTEMPTED

In the event of water damage, e.g., flooding or sprinkler discharge, the manufacturer should be consulted before clean up and corrective action is attempted.

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10.10 SEVERE ELECTRICAL SHORT CIRCUIT

If a severe electrical short circuit has occurred, the excessive currents may have resulted in structural component and/or bus and conductor damage due to mechanical distortion, thermal damage, metal deposits, or smoke. Examine all devices and bus supports for cracks or breakage. The manufacturer should be consulted before cleanup and correction is attempted.

10.11 GROUND FAULT PROTECTION SYSTEM

Test the ground fault protection system (if furnished) in accordance with the manufacturer's instructions. See Section 230.95 of the *National Electrical Code*® and NEMA PB 2.2 *Application Guide for Ground Fault Protective Devices for Equipment.*

10.12 INSULATION RESISTANCE

Check insulation resistance (see 7.4) under any of the following conditions:

10.12.1 Severe Short Circuit

If a severe short circuit has occurred (see 10.10);

10.12.2 Parts Replaced

If it has been necessary to replace parts or clean insulating surfaces;

10.12.3 Panelboard Exposed to High Humidity

If the panelboard has been exposed to high humidity, condensation, or dripping moisture.

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Section 11
PERMISSIBLE LOADING OF PANELBOARDS

11.1 *NATIONAL ELECTRICAL CODE®*

In compliance with the *National Electrical Code*®, the normal continuous loads (3 hours or more) of panelboard circuits should be not more than 80 percent of the rating of the overcurrent protective device, unless the marking of the device indicates that it is suitable for continuous duty at 100 percent of its rating.

11.2 HARMONICS IN ELECTRICAL SYSTEM

Some types of electrical equipment cause harmonics in the electrical system, which may result in overheating. This condition should be considered when determining panelboard loading.

§

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Replaces
Reemplaza
Remplace
40272-214-03
09/2001

40559-377-50/51

Series / Serie / Serié 0

40272-214-04
06/2006
Lexington, KY, USA

15681

PK27GTA Equipment Grounding Bar
Accesorio de la barra de tierra del equipo PK27GTA
Kit de barre de m.à.l.t. de l'appareil PK27GTA

Retain for future use. / Conservar para uso futuro. / À conserver pour usage ultérieur.

Contents / Contenido / Contenu

1 Equipment grounding bar / Barra de puesta a tierra del equipo / Barre de m.à.l.t. de l'appareil
2 Mounting screws / Tornillos de montaje / Vis de montage
1 2/0 Lug / Zapata 2/0 / Cosse 2/0
1 Wire binding screw / Tornillo de sujeción de cables / Vis de fixation de fils
1 Lug mounting screw / Tornillo de montaje de la zapata / Vis de montage de cosse
1 Equipment grounding label / Etiqueta de puesta a tierra del equipo / Etiquette de m.à.l.t. de l'appareil

⚠ DANGER / PELIGRO / DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

PELIGRO DE DESCARGA ELÉCTRICA, EXPLOSIÓN O DESTELLO POR ARQUEO

- Utilice equipo de protección personal (EPP) apropiado y siga las prácticas de seguridad eléctrica establecidas por su Compañia, consulte la norma 70E de NFPA.
- Solamente el personal eléctrico especializado deberá instalar y prestar servicio de mantenimiento a este equipo.
- Desenergice el equipo antes de realizar cualquier trabajo en él.
- Siempre utilice un dispositivo detector de tensión nominal adecuado para confirmar la desenergización del equipo.
- Vuelva a colocar todos los dispositivos, las puertas y las cubiertas antes de volver a energizar el equipo.

El incumplimiento de estas instrucciones podrá causar la muerte o lesiones serias.

RISQUE D'ÉLECTROCUTION, D'EXPLOSION OU D'ÉCLAIR D'ARC

- Portez un équipement de protection personnelle (ÉPP) approprié et observez les méthodes de travail électrique sécuritaire. Voir NFPA 70E.
- Seul un personnel qualifié doit effectuer l'installation et l'entretien de cet appareil.
- Coupez l'alimentation de l'appareil avant d'y travailler.
- Utilisez toujours un dispositif de détection de tension ayant une valeur nominale appropriée pour vous assurer que l'alimentation est coupée.
- Replacez tous les dispositifs, les portes et les couvercles avant de mettre l'appareil sous tension.

Si ces directives ne sont pas respectées, cela entraînera la mort ou des blessures graves.

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- When mounting with one screw, use the center mounting hole and position the two outer mounting holes on the two matching nubs.
- Use the two outer mounting holes when mounting with two screws.
- Tighten mounting screw(s) to 30 lb-in. (3.4 N•m) after overcoming starting torque.

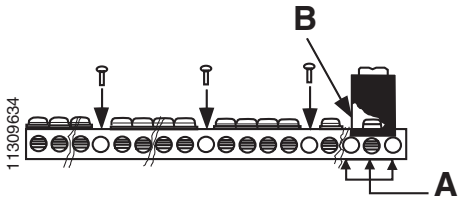
1. Remove any three adjacent wire binding screws (A), install lug as shown.
2. Tighten lug mounting screw (B) to 40 lb-in. (4.5 N•m).

- Cuando realice la instalación con un tornillo, utilice el agujero de montaje central y coloque los otros dos agujeros de montaje exteriores sobre las muescas correspondientes.
- Utilice los dos agujeros de montaje externos para la instalación con dos tornillos.
- Apriete los tornillos de montaje a 3,4 N•m (30 lbs-pulg) una vez realizado el apriete inicial.

1. Retire cualquiera de los tres tornillos de sujeción de cables adyacentes (A) e instale la zapata como se muestra.
2. Apriete el tornillo de montaje de la zapata (B) a 4,5 N•m (40 lbs-pulg).

- Pour l'installation avec une seule vis, utiliser le trou de montage central et placer les deux trous de montage extérieurs sur les deux ergots correspondants.
- Utiliser les deux trous de montage extérieurs pour l'installation à deux vis.
- Serrer la ou les vis de montage à 3,4 N•m (30 lb-po) après le serrage de départ.

1. Retirer n'importe quelles trois vis de fixation de fils adjacentes (A) et installer la cosse comme indiqué.
2. Serrer la vis de montage de cosse (B) à 4,5 N•m (40 lb-po).



Lug Wire Size / Calibre del cable de la zapata / Calibre du fil de cosse	Torque (lb-in.) / Par de apriete (lbs-pulg) / Couple de serrage (lb-po)
#6-2/0 Cu / Al	50

Apply equipment grounding bar label to enclosure beside equipment grounding bar. See equipment grounding bar label for torque requirements.

Adhiera la etiqueta de la barra de puesta a tierra del equipo al gabinete junto a la barra de tierra. Consulte la etiqueta para conocer los valores de par de apriete.

Placer l'étiquette de barre de m.à.l.t. de l'appareil sur le coffret, à côté de la barre de m.à.l.t. Consulter l'étiquette de m.à.l.t. de l'appareil pour obtenir le couple de serrage.

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Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

Solamente el personal especializado deberá instalar, hacer funcionar y prestar servicios de mantenimiento al equipo eléctrico. Schneider Electric no asume responsabilidad alguna por las consecuencias emergentes de la utilización de este material.

Seul un personnel qualifié doit effectuer l'installation, l'utilisation, l'entretien et la maintenance du matériel électrique. Schneider Electric n'assume aucune responsabilité des conséquences éventuelles découlant de l'utilisation de cette documentation.

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Dry-Type Transformers
1000 Volts and Below
Class 7400

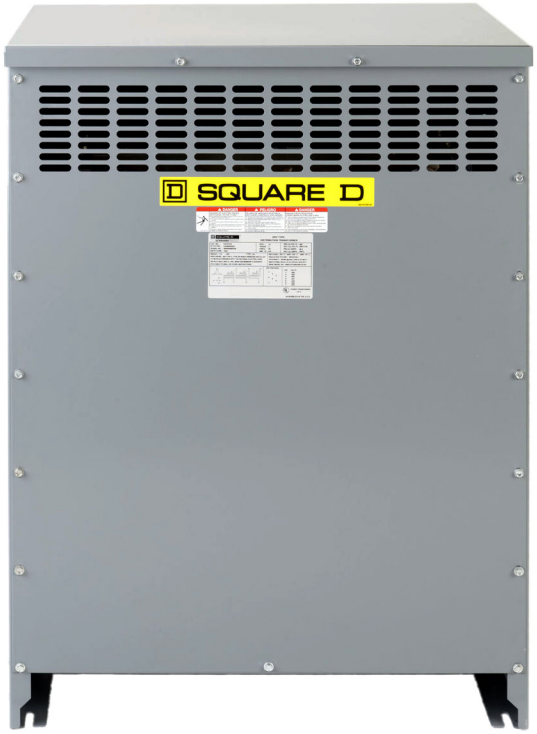
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Instruction Bulletin

43006-850-01
Rev. 02, 11/2015

Retain for future use.





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Hazard Categories and Special Symbols

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Section 1—Introduction

This instruction bulletin provides installation, operation and maintenance instructions for dry-type transformers 1000 volts and below for use in commercial and industrial applications.

NOTE: This bulletin should be used only by qualified personnel.

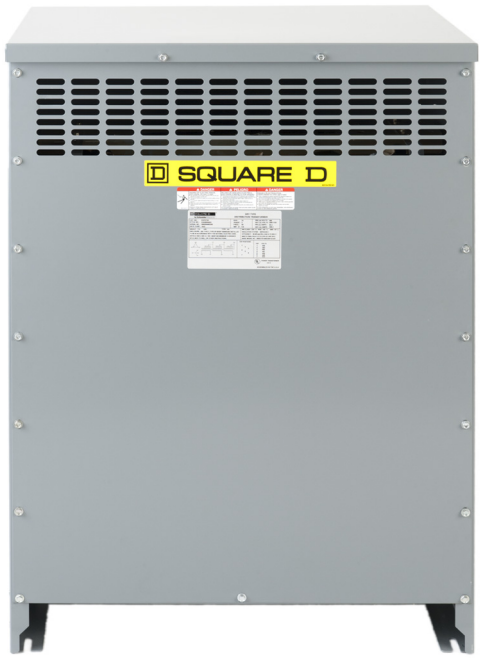
The following dry-type transformer product families are included in this instruction bulletin. Typical transformers are shown in Figures 1–6.

- Low Voltage Distribution Transformers, Three-phase and Single-phase
  - — General Purpose—50 and 60 Hz
  - — Energy Efficient (EE)—60 Hz
  - — Energy Efficient 2016 (EX)—60 Hz
  - — Non-linear Offering (NL, NP or NLP)—50 and 60 Hz
  - — Harmonic Mitigating Transformers (HM)—50 and 60 Hz
  - — Open Core and Coil (OC)
- Drive Isolation Transformers (DIT)
- Non-ventilated Transformers (NV)

Figure 1: Energy Efficient 2016 Transformers (EX)



Figure 2: Energy Efficient 2016 Transformers (EX)



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Figure 3: Open Core and Coil

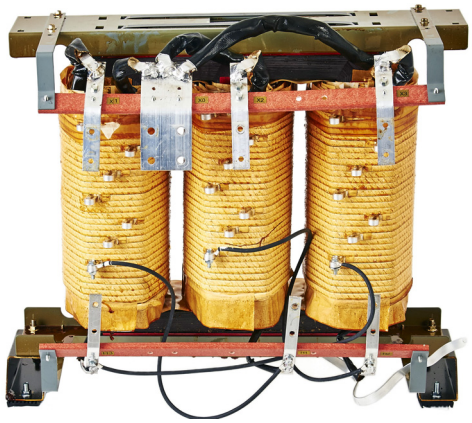


Figure 4: Energy Efficient (EE) Ventilated Transformer



Figure 5: Non-Linear (NL, NP, NLP) and Harmonic Mitigating (HM)



Figure 6: Non-ventilated Transformer



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Section 2—Safety Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, NOM-029-STPS-2011, or CSA Z462.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Perform such work only after reading and understanding all of the instructions contained in this bulletin.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume all circuits are live until they are completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always practice lock-out/tag-out procedures according to OSHA requirements.
- Carefully inspect your work area, and remove any tools and objects left inside the equipment.
- Replace all devices, doors, and covers before turning on power to this equipment.
- All instructions in this manual are written with the assumption that the customer has taken these measures before performing maintenance or testing.

Failure to follow these instructions will result in death or serious injury.

Codes and Standards

It is the responsibility of the users of this document to use qualified electrical personnel and to comply with applicable federal, state and local electrical codes when installing electrical products and systems.

This document adheres to the codes and standards as outlined by the National Fire Protection Association® (NFPA). Refer to NFPA 70: 2014 Edition National Electrical Code (NEC®).

Disclaimer Statement

Electrical equipment should be installed, operated, serviced and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Section 3—Receiving, Handling and Storing

Receiving

1. Upon receipt, remove the packaging.
   - — Immediately inspect the new transformer for shipping damage.
   - — Refer to Replacement Parts and Accessories on page 41 for replacement parts, accessories (e.g., touch-up paint) and spare parts for minor damage.
2. Check the packing list against the product nameplate.
   - — Verify that the order and shipment align with each other and that the shipment is complete.

   NOTE: Follow Schneider Electric Conditions of Sale for shortages and errors.
3. Repackage the transformers for storage if they are not to be installed immediately.
   - — Cover all ventilation openings to protect against exposure to moisture, dust and contaminants.
   - — Leave packing materials intact until the transformers are ready to install.
4. Refer to “Conditions of Sale” for details regarding claims for equipment shortages and other errors. Contact your local Schneider Electric distributor for additional assistance.

Handling

Handle transformers carefully to avoid damage. Avoid subjecting the transformers to impact, jolting, jarring and rough handling. Ensure that transformers are transported in the upright position. When possible, transport transformers to the installation site while still mounted on their shipping pallets.

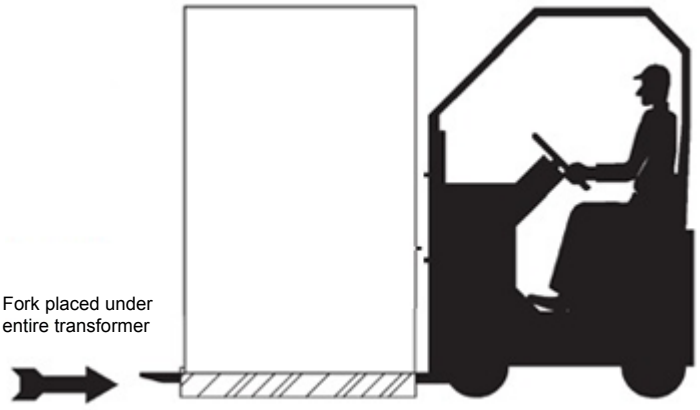
Verify that the weight of the transformer does not exceed the rated capacity of the handling equipment to be used.

Handling with Platform Dollies or Lifts, Pallet Jacks or Fork Trucks

Extreme care should be exercised when moving transformers from the bottom. See Figure 7.

- Use care to distribute the weight when transporting transformers using platform dollies, platform lifts, pallet jacks or fork trucks.
- Use hand trucks or forklifts only when the blades or forks are long enough to pass completely under the transformer enclosure or shipping pallet. Wider fork separation is preferred to distribute the weight of the unit evenly for increased stability.

Figure 7: Handling with a Fork Truck: Blades/Forks Placed under the Entire Transformer (Shipping Pallet Attached)



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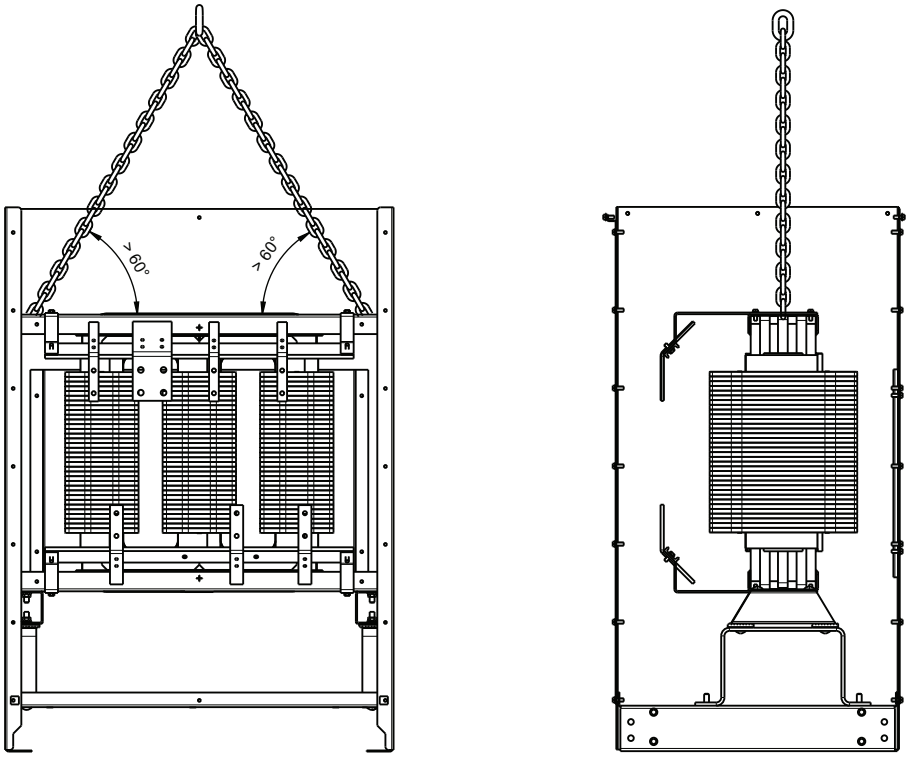
Handling with Cranes: Using Cables, Chains or Straps

When lifting the transformer from above, the use of spreader bars with cables or chains is permissible. This will help avoid damage to the enclosure or equipment.

The enclosure can be removed to allow the units to be transported through small openings, lifting as the same means as shown in Figure 8 on page 11, Figure 9 on page 12, and Figures 10 and 11 on page 13. Refer to Figures 34 and 35 in Replacement Parts and Accessories on page 41 for exploded views of parts and accessories.

Ensure that the lifting cable pull angles are not less than 60 degrees from horizontal. See Figure 8 on page 11.

Figure 8: Two-Point Lift: Cable Pull Angles (Not Less than 60 Degrees from Horizontal)

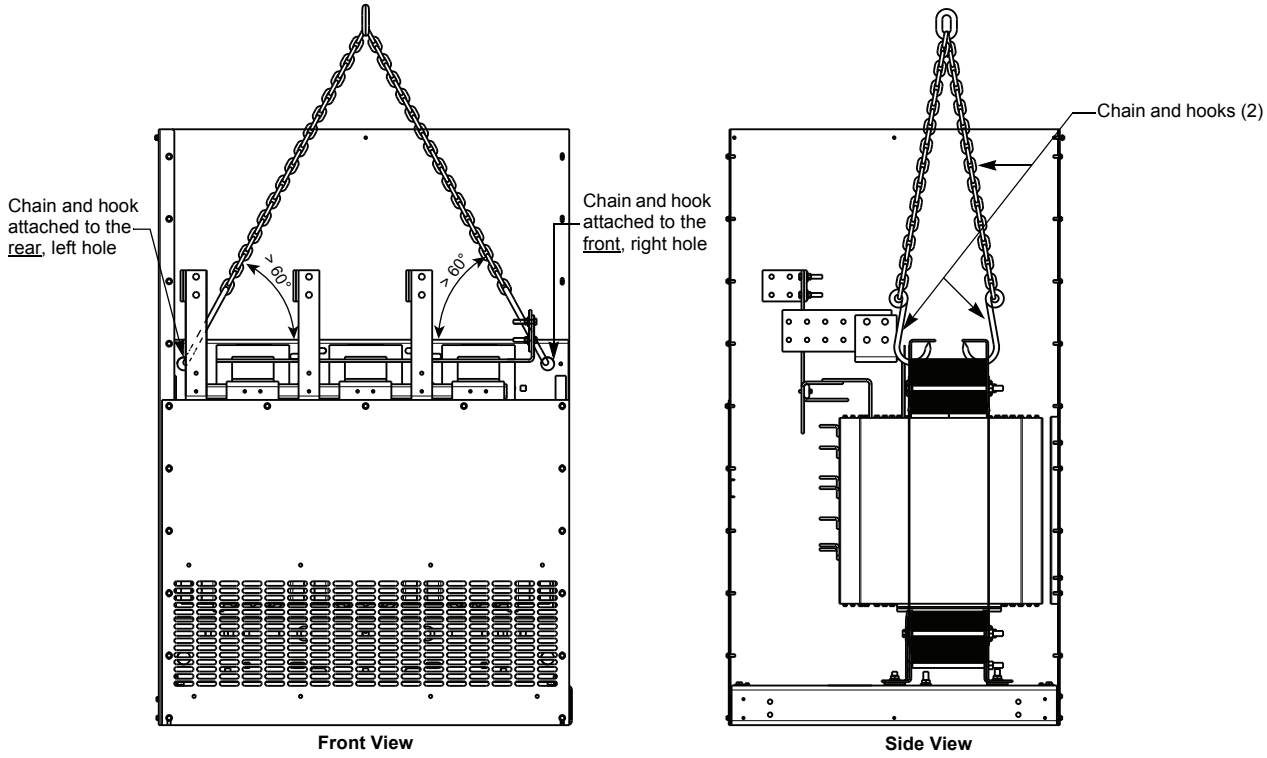


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Refer to Figures 9 –11 on pages 12 – 13 for other permissible lifting and handling options.

Figure 9: Two-Point Lift: Handling with Chains, Hooks and Cross Corners (Not Less than 60 Degrees from Horizontal)

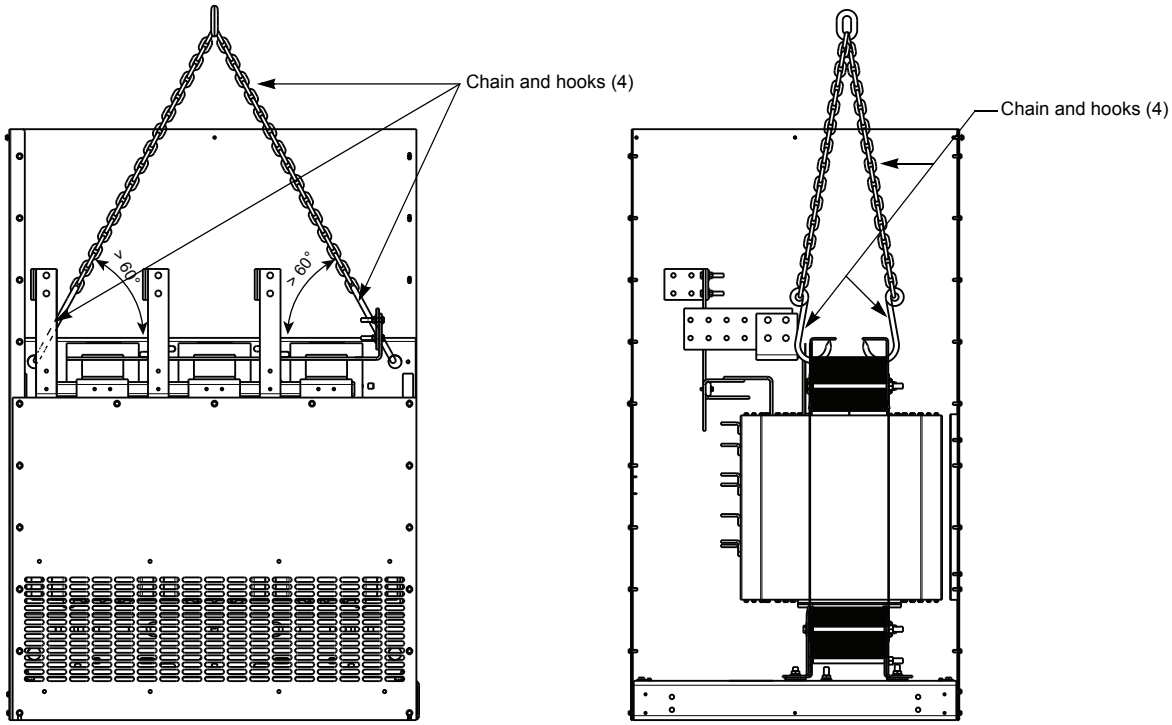


Two-point lift with chains and hooks: Top core bracket, right side and front hole. Rear bracket, left side and rear hole

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Figure 10: Four-Point Lift: Handling with Chains, Hooks and Four Corners (Not Less than 60 Degrees from Horizontal)

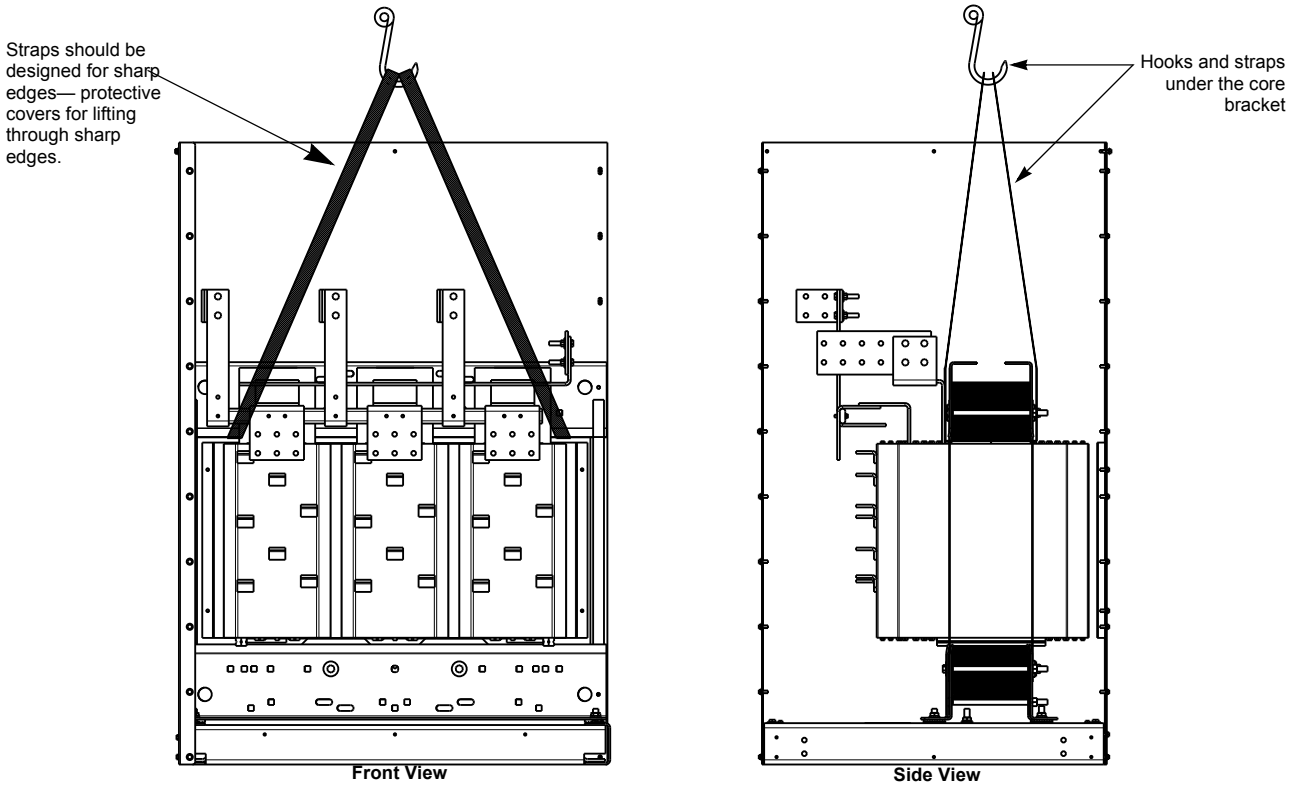


Four-point lift: The hooks are in the front and back holes of the core bracket (4), with chains lifting on the hooks.

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Figure 11: Four-Point Lift: Handling with a Strap and Hooks (Not Less than 60 Degrees from Horizontal)



Four-point lift: The straps are under the core brackets, with the front-to-back straps coming together at the top with a hook. Use straps with protective cover, core clamps edges are sharp.

Handling Enclosure Styles D, H and K after Removal of the Shipping Pallet

Hand trucks and forklifts can access and move the transformer via the front and rear openings below the bottom of the base. See Figure 12. Follow the same handling instructions (beginning on page 10) as if the pallet is still attached.

Figure 12: Handling with a Pallet Jack: Enclosure Styles D, E, H and K after Removing the Shipping Pallet



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Storing

Leave the packing material that encloses the transformer in place until the unit is ready for its final placement and wiring. This will help to protect the transformer enclosure and internal parts from dirt, water, moisture contamination and physical damage during storage. Provide extra measures to protect the transformer when the original packing material cannot be retained.

Store transformers indoors in a clean, dry, and heated building with uniform temperatures and adequate air circulation. If necessary, install electric heating to maintain a uniform temperature above the ambient temperature to prevent condensation.

Protect transformers from weather and contamination when it is not possible to store the transformers indoors.

Before energizing the transformer, complete the steps in Pre-commissioning/Pre-energizing Checks and Testing along with the following steps:

1. Test the insulation resistance if storage in a controlled environment was not feasible. Refer to Insulation Resistance on page 39.
2. Dry the unit if test levels are unacceptable:
   a. Use two heaters or lamps per coil at 120 V, 50 W to apply external heat to the coils.
   b. Mount the heater or lamp directly below the coils located at the front and rear of the core.

NOTE: Outdoor transformers are not weather resistant until they are properly and completely installed and energized. Treat outdoor transformers in exactly the same manner as indoor transformers until after they are installed.

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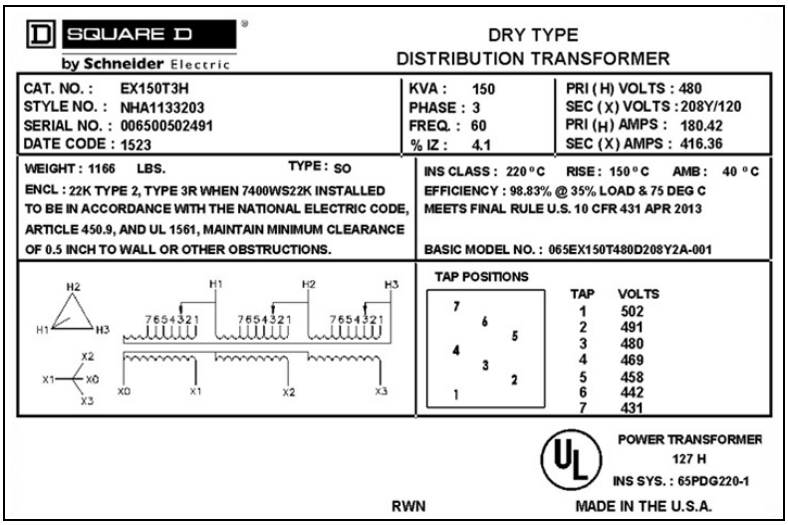
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Section 4—Installation

Locating/Placing Ventilated and Non-ventilated Transformers

1. Remove all packaging material. Keep the shipping pallet attached to the transformer to assist with moving the unit to its final installation location.
2. Verify that the nameplate matches the description from the building layout drawings (kVA, primary and secondary voltages, etc.). See Figure 13.

Figure 13: Sample Nameplate

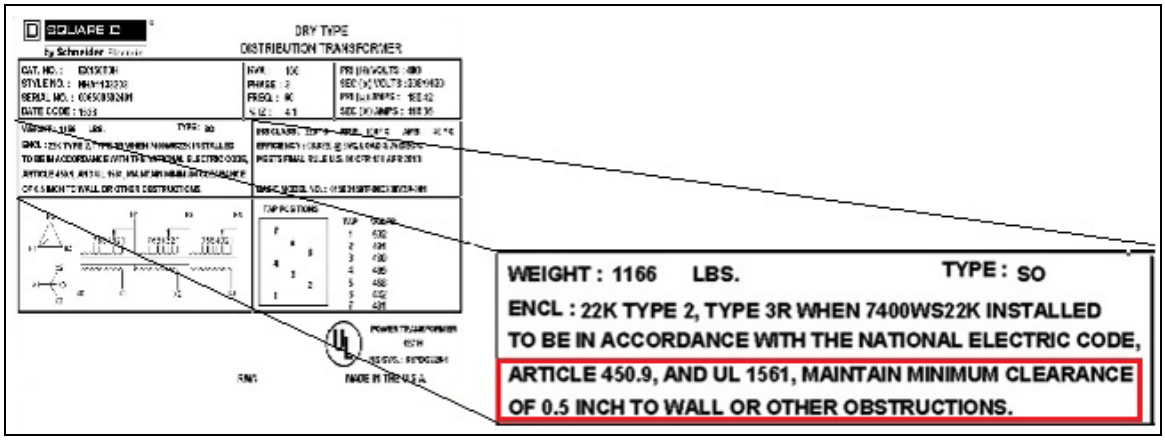


3. Locate the unit per the building's layout drawing.
4. Verify the environment is suitable for the enclosure type.
5. Ensure the location is readily accessible to qualified personnel (per NEC 450.13). Units located in the open can be mounted on walls, columns, or otherwise supported from structures.
6. Ensure adequate ventilation since it is essential to properly cool ventilated transformers. Refer to National Electrical Code (NEC®) Article 450.
   - The minimum distance is marked on Nameplate NEC 450.9. See Figure 14 on page 17.
   - Minimum distance varies by enclosure style. See the approval drawing from Schneider Electric for minimum distance.
   - Clean, dry air is desirable.
   - Filtered air may reduce maintenance if the location of the transformer presents a problem.

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Figure 14: Minimum Distance Marked on Nameplate NEC 450.9



7. Mount any accessories prior to installing the transformer when using wall or ceiling (trapeze) mounting.
   a. Observe the four mounting hole locations in each enclosure base.
   b. Obtain the actual dimensions via approval drawings from Schneider Electric.
   c. Secure the units using one of two mounting methods: without floor mounting brackets (Figures 15–16 and Figure 17 on page 18) or with floor mounting brackets (Figures 18 and 19 on page 18).
8. Place the transformer in final position.

Figure 15: Mounting: Enclosure Styles D, H, K, and E

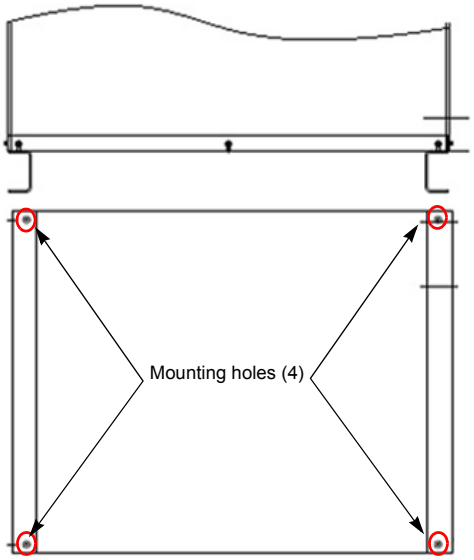
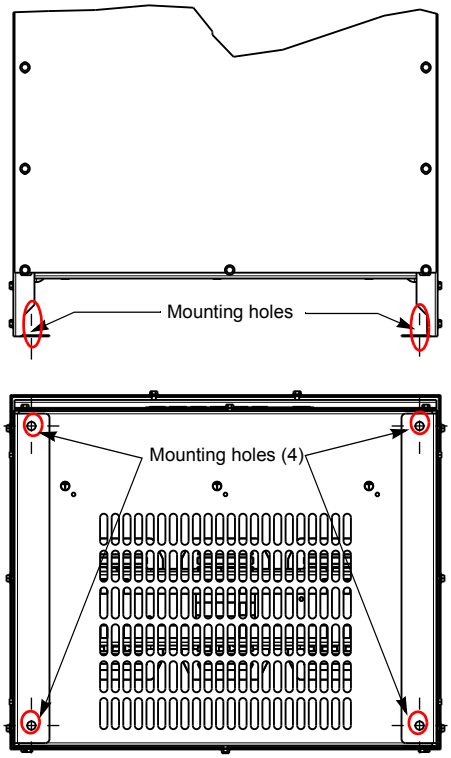


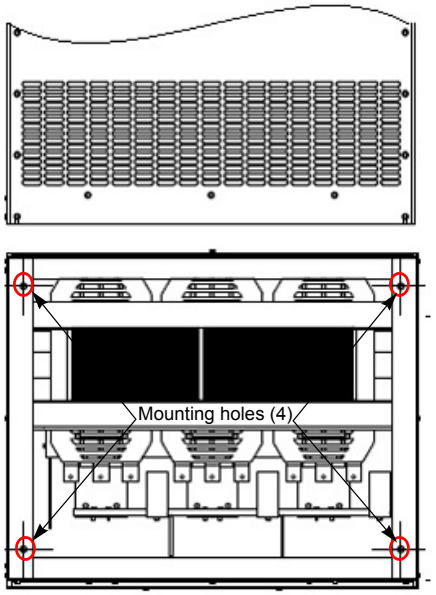
Figure 16: Enclosure D, H, K, and E



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Figure 17: Mounting Enclosure Style J: Ventilated



Units not for use on combustible floor (open bottom)

Figure 18: Floor Mounting Bracket: Enclosure Style K

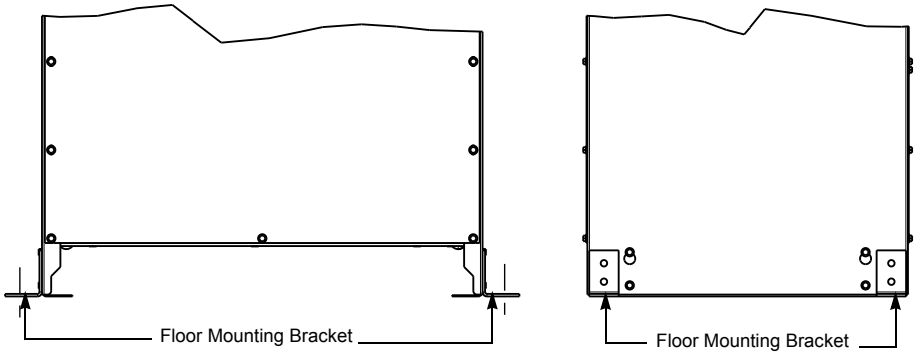
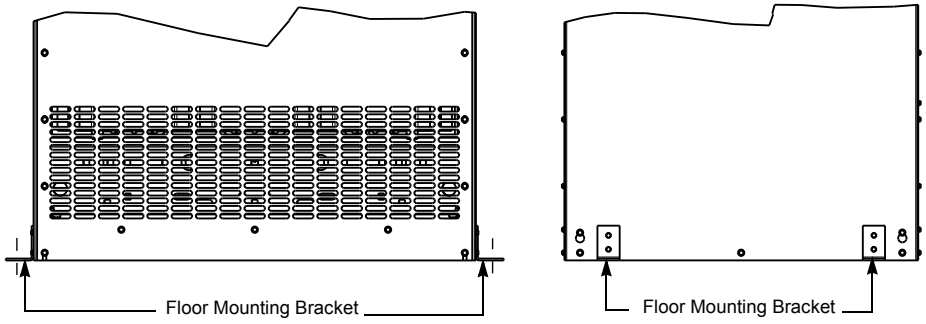


Figure 19: Floor Mounting Bracket: Enclosure Style K



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All Enclosure Styles (D, E, F, H, K and J)

- Transformers Installed Indoors (Styles D, E, F, H, K and J):
  - — Completely enclosed or completely enclosed with ventilated openings; complies with NEC 450.21 (A) Exception
  - — Units greater than 112.5 kVA
  - — Have 428°F (220°C) or 392°F (200°C) insulation systems; complies with 450.21 (B) Exception No. 2

See Figure 20.

Figure 20: Transformers Installed Indoors: NEC 450.21 Exceptions A or B from Sample Nameplate

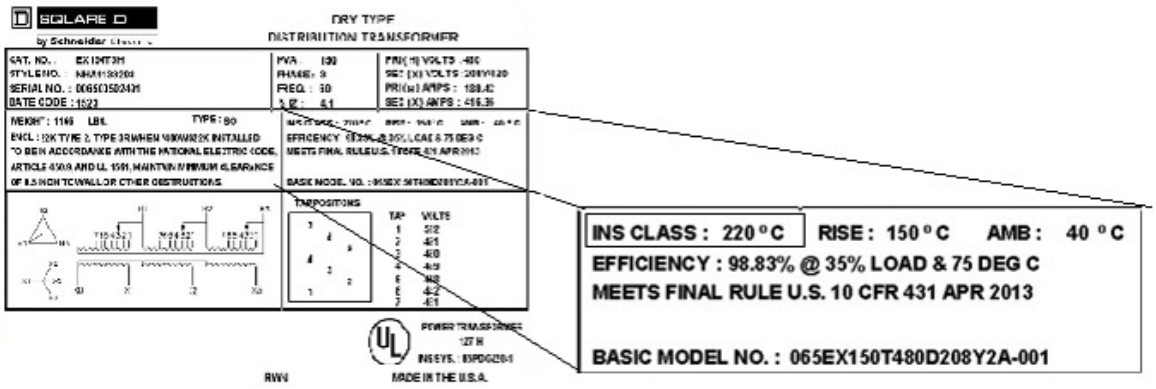


Table 1: Enclosure Clearances

Enclosure Style	Front Clearance	Side Clearance (in. / mm)	Rear Clearance (in. / mm)
D	Working Clearance for all styles vary substantially depending on voltage and specific application. Refer to NEC 110.26	0.50 / 12.7	Type EE – 3 / 76.2 All other styles – 6 / 152
H			3 / 76.2
E			3 / 76.2
K			0.50 / 12.7
J			0.50 / 12.7
F			12 / 305

Transformers can be converted from Floor to Wall mounted (See Table 2 below and Figure 21 on page 20) or Floor to Trapeze mounted (See Table 3 and Figure 22 on page 21) using factory available kits. The kits are pre-punched to align with enclosure mounting holes; and, when the transformer is installed, holds the minimum clearance for the units. New Style K wall mounting bracket allows for 6 in. (152 mm) and 3 in. (76 mm) clearances, all other styles require a 6 in. (152 mm) clearance.

The factory kits do not include hardware, hardware must be supplied by the customer. Hardware includes the thread rod for trapeze mounting the transformers. The designer of record must size and choose the anchors and hardware because of the large variety of construction materials and techniques. Schneider Electric can not advise on the anchoring, the wall mounting, or sizing of rods for trapeze mounting.

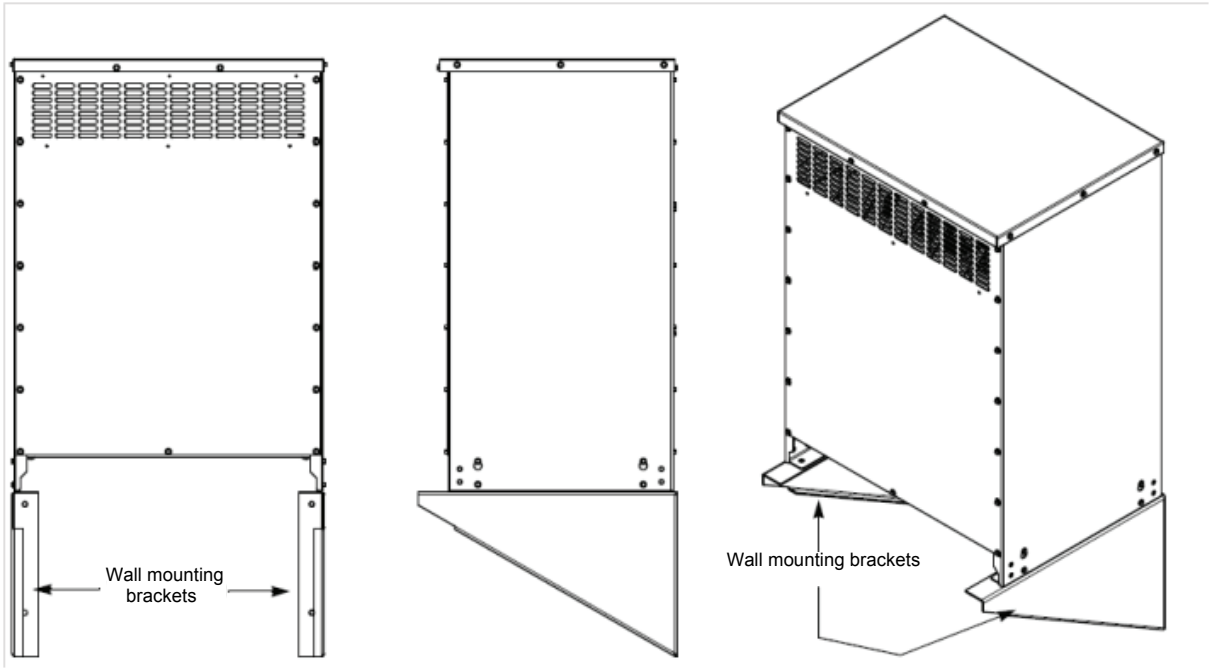
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Table 2: Converting from Floor to Wall Mounting (using factory kits)

Enclosure Style	Enclosure Number	Maximum Weight (lb. / kg)
D	17 – 20	700 / 317
H	17 – 18	700 / 317
E	17 – 20	700 / 317
K	17 – 20	850 / 386

Figure 21: Wall mounted transformer



Front View **Side View**

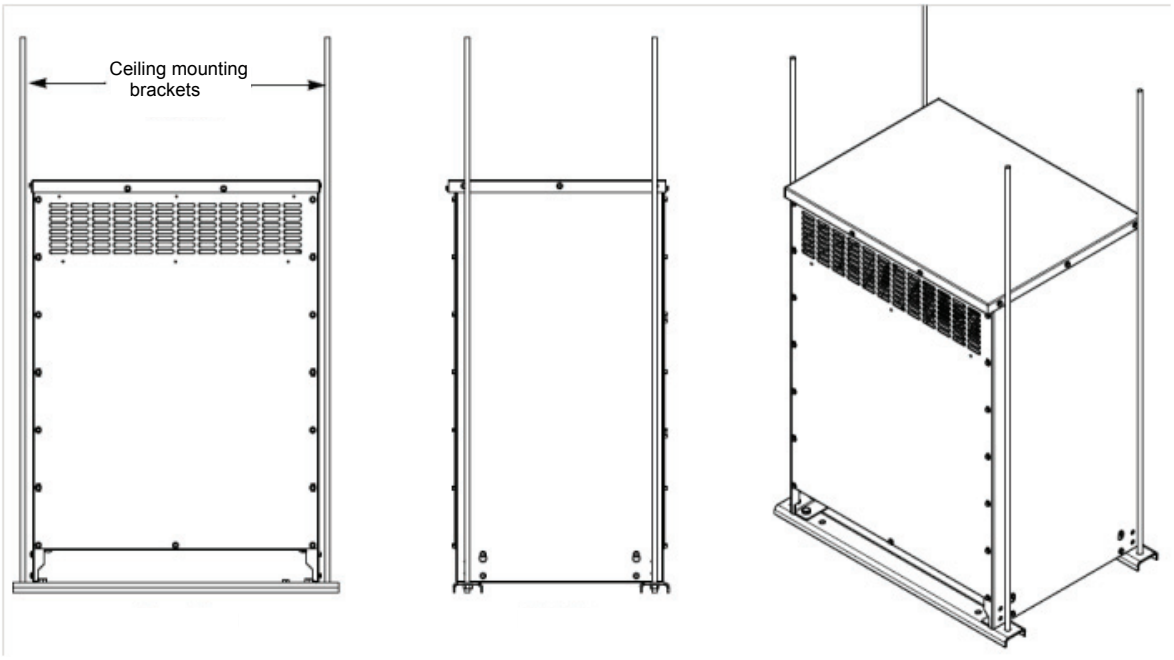
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Table 3: Converting from Floor to Trapeze (Ceiling) Mounting (using factory kits)

Enclosure Style	Enclosure Number	Maximum Weight (lb. / kg)
D	17 – 24	1200 / 544
H	17 – 18	1200 / 544
E	17 – 22	1200 / 544
K	17 – 22	1200 / 544

Figure 22: Trapeze (Ceiling) mounted transformer



Front View **Side View**

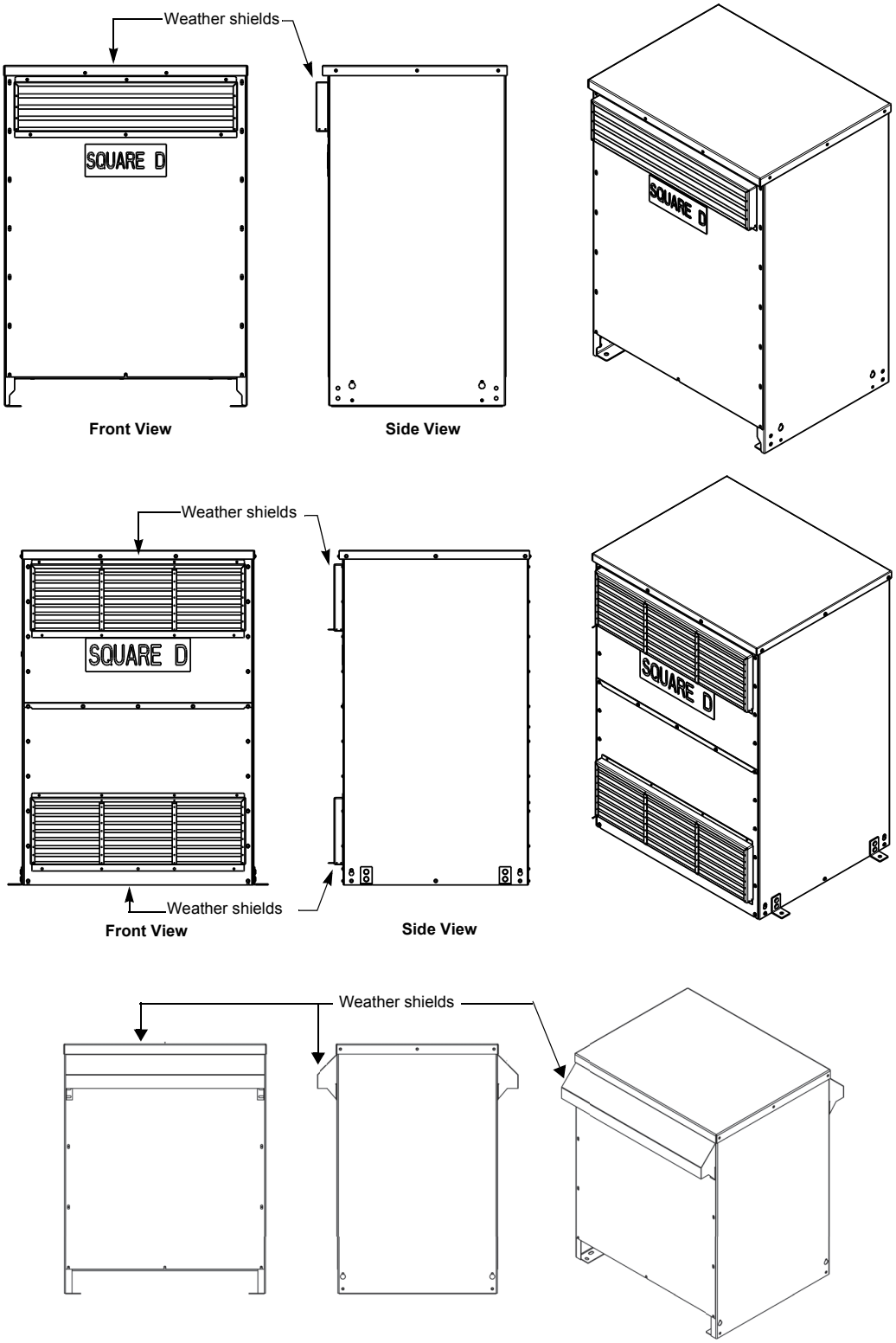
Enclosure D, E, H, K, J can be converted to Type 3R using field installed kits. See Figure 23 on page 22.

Type F enclosure – must be factory order if installed outdoors.

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Figure 23: Type 3R Enclosure Kits



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Grounding

1. Permanently and adequately ground the enclosure and core assembly of dry-type transformers in accordance with NEC requirements.
   - — Windings may be grounded with consideration given to local conditions and in accordance with the NEC.
   - — The ground terminal bar must be UL listed for this purpose.
   - — In accordance with NEC 450.10, the terminal bar shall be bonded to the enclosure in accordance with NEC 250.12 and shall not be installed on or over any ventilated openings.
2. Connect the transformer, related accessories and components to ground in accordance with NFPA 70 (NEC).
3. Terminate all grounding and bonding conductors at a common equipment ground point on the enclosure.
4. Remove paint from around the area where the ground terminal bar is mounted to increase contact with enclosure parts.
   - — Enclosure Styles D, E and H: An area is available in the transformer's base to drill and mount the ground terminal bar.
   - — Enclosure Style K: Three pre-drilled holes are stamped ground to mount the ground terminal bar.
   - — Enclosure Style J: Two pre-drilled holes are stamped ground to mount the ground terminal bar.

Square D brand secondary lug kits include a four-conductor ground terminal bar. The bar can also be obtained as a separate device from Schneider Electric. Refer to Table 6 on page 45 and see Figure 24.

Figure 24: Four-conductor Ground Terminal Bar



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Seismic Qualifications

Seismic limits for dry-type low voltage transformers are obtained from tri-axle shake table test results that are conducted in accordance with the AC156 test protocol. Certifications are based on the location where units are installed and building codes governing the installation.

Building codes results are available for CBC 2001, CBC 2007, CBC 2010, IBC 2000, IBS 2003, IBC 2006, IBC 2009, NBC 2005, NBCC 2005, NBCC 2010, NFPA 5000, UBC 94, CBC 95, UBC97 and UFC 3-310-04.

Contact your local Schneider Electric distributor, or call 1-888-Square D (1-888-778-2733) to obtain the specific level of Sds, z/h and Ip for each enclosure style.

The levels supplied are based on the units being mounted and the notes on the approval drawings of each part number. Drawings are available that include mounting dimensions, mounting hole dimensions, overall dimensions, unit weight and approximate center of gravity location to assist in a seismic qualification. Contact your local Schneider Electric distributor, or call 1-888-Square D (1-888-778-2733) to obtain these drawings.

Other parties are responsible for detailing the equipment connection and anchorage requirements (including the lateral restraint system, if appropriate) for the given transformer installation. The installer and manufacturers of the anchorage and lateral restraint system are responsible for ensuring that the mounting requirements are met.

Sound/Vibration Control

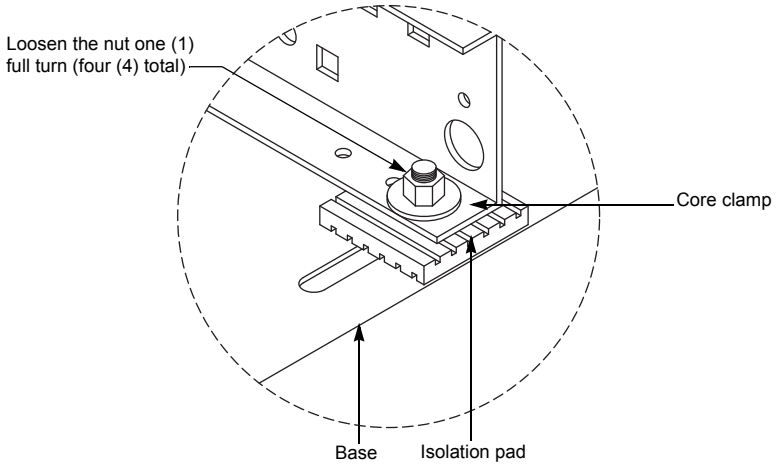
The transformer has been designed to minimize the amount of audible sound produced. Sound isolation pads are secured between the transformer mounting bracket and the enclosure using bolts and nuts. The mounting hardware is tightened prior to shipment to prevent damage.

Loosen the nut one full turn to float the transformer on the isolation pads, thereby isolating the transformer from the enclosure. This will reduce audible sound levels even further. See Figures 25 and 26.

Figure 25: Loosening the Nut One Full Turn (Four Places) Label



Figure 26: Floating the Transformer on the Isolation Pads/Sound Damper



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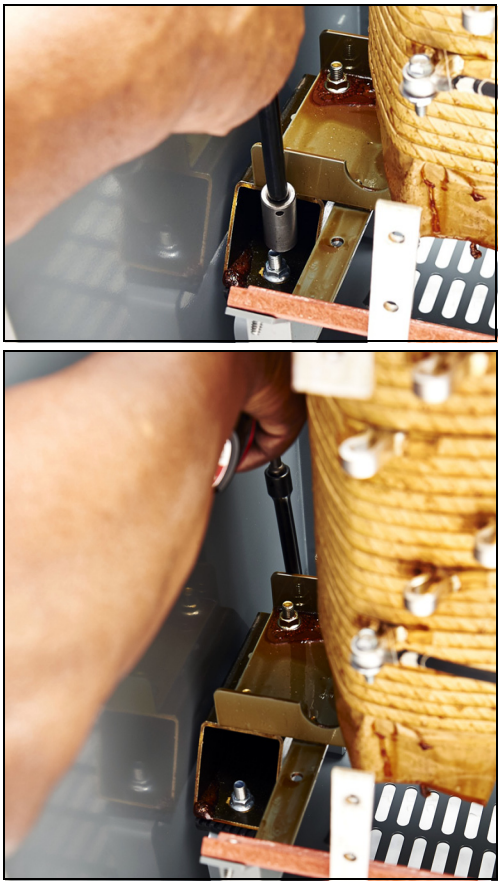
In addition, the area where the transformer is located can affect the sound level:

- ❑ Try to avoid installing the transformer in a corner, narrow hall or in an area with smooth surfaces. Doing so can result in the sound being reflected and amplified.
- ❑ Securely fasten all the enclosure panels. Loose panels can result in rattling, thereby increasing the sound produced.
- ❑ Use flexible conduit, if possible.
- ❑ Ensure that the type of structure on which the transformer is mounted is strong enough to support the weight of the transformer.

Enclosure Style K

Enclosure Style K bolts are accessible from the front with an extension. See Figure 27.

Figure 27: Enclosure Style K: Bolts Accessible from the Front of the Transformer



Enclosure Styles D, E, H and J

Enclosure Styles D, E, H and J bolts are accessible from the front.

See Figure 26 on page 24 for the access for these enclosures.

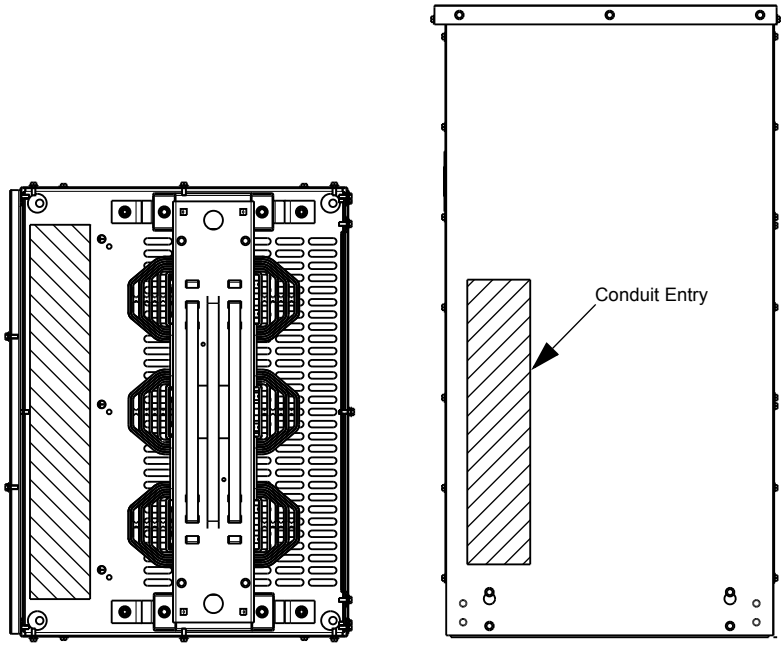
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Making Electrical Connections

- ❏ Use flexible raceways, conduits and connectors, when possible, as attachments to transformer enclosures. This will help to reduce audible noise generation.
- ❏ Adhere to NFPA 70 (NEC) and minimum wire bending space requirements for the transformer enclosure. As an industry standard, bundle associated phase, neutral and equipment grounding conductors together within the transformer enclosure.
- ❏ Always use a calibrated torque wrench to tighten electrical connectors and terminals. For additional guidance, refer to Standard UL468A.
- ❏ Ensure that raceways, conduits and connectors enter the enclosure only in an area shown on the drawings. Access points for each enclosure style are listed below:

- Enclosure Style D: (See Figure 28)
  - — Front section of the transformer
  - — Side and bottom access
- Enclosure Style E: (See Figure 28)
  - — Front section of the transformer
  - — Side and bottom access
- Enclosure Style H: (See Figure 28)
  - — Front section of the transformer
  - — Side and bottom access
- Enclosure Style K: (See Figure 28)
  - — Front section of the transformer
  - — Side and bottom access

Figure 28: Access Point: Enclosure Styles D, E, H and K



Looking Down (Front to the LEFT)

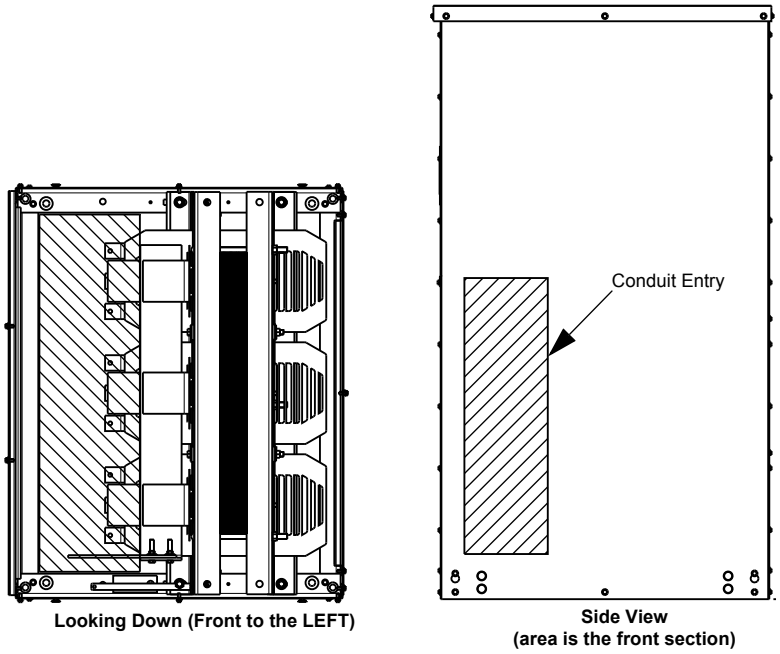
Side View (area is the front section)

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- Enclosure Style F:
  - — Bottom section of the transformer
  - — Air connection chambers offered if side access is needed
- Enclosure Style J: (See Figure 29)
  - — Front section of the transformer
  - — Side access
  - — Open bottom access front to the core clamps

Figure 29: Access Point: Enclosure Style J

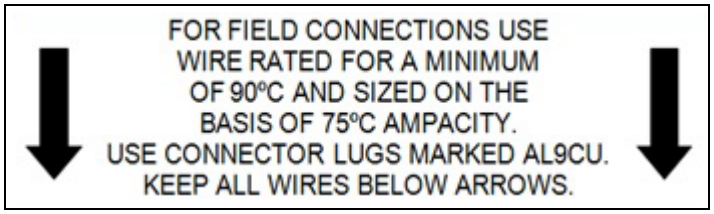


Looking Down (Front to the LEFT)

Side View
(area is the front section)

❑ Keep all access points below the top terminal board to prevent heat from exiting through the raceways, conduits and connectors. The sticker will show this top location on all enclosure styles (also shown on drawings). See Figure 30.

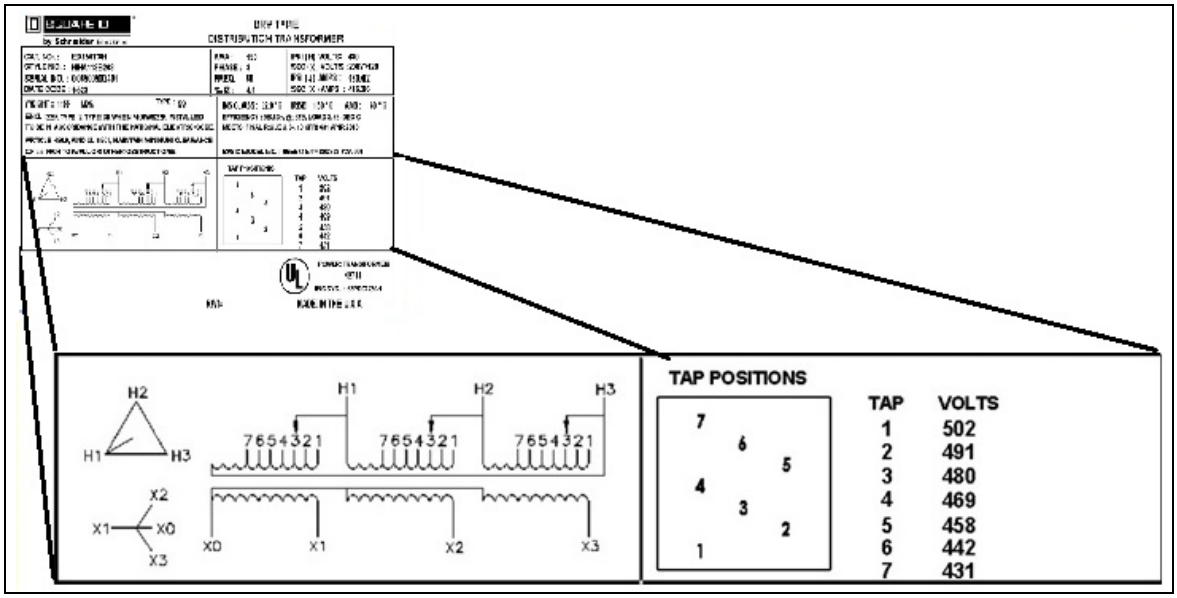
Figure 30: Label to Show Top Location on Enclosures (Access Points Below the Top Terminal Board)



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- ❏ Ensure that the side access complies with NEC 312.6 (A): Minimum Wire-Bending at Terminals. Bottom access must comply with NEC 312.6 (B): Minimum Wire-Bending Space at Terminals.
- ❏ Follow UL 1561 which requires that all lugs be suitable for 194°F (90°C). In addition, the conductors' temperature rating table must be 167°F (75°C) for the size to meet the current requirements of the overcurrent protection device and nameplate currents. Refer to Table 5 on page 44, Table 6 on page 45 and Table 7 on page 46 for a list of Square D lug kits, wire ranges by kVA and US voltage systems.
- ❏ Make sure that the contact surface is clean. This will minimize the possibility of a high resistance contact which could cause localized heating and possible premature failure. Refer to Connections and Contact Surfaces on page 38 for instructions to apply an approved electrical compound.
- ❏ Connect phases to proper terminals for proper motor-rotation. The phase diagram is shown on nameplate. The nameplate also shows the taps locations and voltage rating for each tap. See Figure 31.

Figure 31: Phase Diagram, Tap Locations and Voltage Rating Marked on Nameplate



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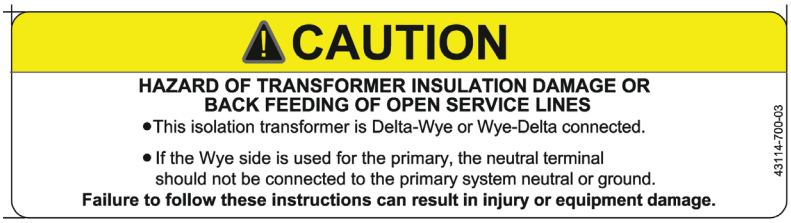
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❑ Connecting the source of supply to the transformer secondary is permitted by NE C450.11 where the installation conforms to the manufacturer's instructions.

When the source of supply is connected to the transformer secondary, the inrush current will increase. The overcurrent device should be selected based on NEC 450.3(B) using the 250% allowance in order to reduce the potential for nuisance tripping during energization. Secondary overcurrent protection will be required.

For source of supply side connections to a WYE configured transformer winding, do not make any connections to the supply side HO or XO terminals. See Figure 32.

Figure 32: Caution Label for Delta Wye or Wye Delta Connected Transformers



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Pre-commissioning/Pre-energizing Checks and Testing

Cleaning

1. Ensure that all of the packing material, including any packing material used inside the enclosure of the transformer used to support and protect the unit during shipping, have been removed.
2. Vacuum away as much dust as possible. Dust will act as a thermal insulating material which will increase the temperature of the unit and could possibly decrease operational life. Refer to Cleaning on page 38.

Visual and Mechanical Checks

Perform the following visual and mechanical checks below. In addition, refer to Performing Visual and Mechanical Checks on page 37 for a detailed listing of instructions.

- ❑ Visually inspect the transformer for physical damage. Repair any physical damage, if possible, and provide suitable protective barriers to prevent future damage.
- ❑ Compare the transformer nameplate information with the drawings and/or specifications for the installation.
- ❑ Verify proper connection of the taps in accordance with the nameplate information.
- ❑ Check the clearance of all electrical connections. Verify all connections for tightness with a calibrated torque wrench.
- ❑ Visually check the core, frame, enclosure, conduits, raceways and conductors for proper ground bonding. In addition, refer to Grounding and Bonding on page 39.

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Electrical Testing

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E. NOM-029-STPS-2011, or CSA Z462.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Perform such work only after reading and understanding all of the instructions contained in this bulletin.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Always practice lock-out/tag-out procedures according to OSHA requirements.
- Carefully inspect your work area, and remove any tools and objects left inside the equipment.
- Replace all devices, doors, and covers before turning on power to this equipment.
- All instructions in this manual are written with the assumption that the customer has taken these measures before performing maintenance or testing.

Failure to follow these instructions will result in death or serious injury.

Refer to Maintenance on page 37 to perform the following pre-commissioning electrical testing:

- ❑ Measure contact resistance using a low resistance ohmmeter. Refer to Contact Resistance on page 39.
- ❑ Perform insulation resistance tests with an appropriate device. Refer to Insulation Resistance on page 39.
- ❑ Perform a turns ratio test on all taps and on the full winding voltages for each phase. Refer to Turns Ratio on page 39.
- ❑ Measure and record the winding resistances on larger transformers (>500 kVA). Refer to Winding Resistance on page 39.

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Section 5—Operation

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, NOM-029-STPS-2011, or CSA Z462.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Perform such work only after reading and understanding all of the instructions contained in this bulletin.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume all circuits are live until they are completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always practice lock-out/tag-out procedures according to OSHA requirements.
- Carefully inspect your work area, and remove any tools and objects left inside the equipment.
- Replace all devices, doors, and covers before turning on power to this equipment.
- All instructions in this manual are written with the assumption that the customer has taken these measures before performing maintenance or testing.

Failure to follow these instructions will result in death or serious injury.

Effects of Humidity

The standard dip and baked varnish process does not support the growth of fungus. The only concern when units are stored in high humidity areas is retaining the integrity of the insulation material. If units are properly maintained and cleaned at shut down prior to long periods of de-energization there should be no issue with fungus.

Humidity conditions are unimportant as long as the transformer is energized. However, follow the precautionary steps listed below if the transformer is de-energized, is allowed to cool to ambient temperature, and will exceed a shutdown of 12 hours (especially in high humidity conditions).

1. Place small strip heaters in the bottom of the unit shortly after shutdown to maintain the temperature of the unit a few degrees above that of the outside air.
2. Inspect the unit for evidence of moisture before returning it to service.
3. Check the insulation resistance. If evidence of moisture exists, or if the insulation resistance is less than 1 megohm, dry out the transformer by placing it in an oven or by blowing heated air over it.

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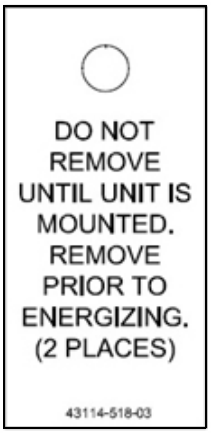
Enclosure Temperature

The temperature rise on the enclosure exterior for ventilated transformers should not exceed 122°F (50°C), except as indicated in UL 1561.

Prior to Energizing the Transformers

1. Remove any temporary braces. See Figure 33.
2. Check bolted electrical connections. Refer to Making Electrical Connections on page 26 for a detailed check list.
3. Remove excess dirt accumulations from the transformer windings and insulators to permit free circulation of air and to guard against the possibility of insulation breakdowns. Refer to Cleaning on page 38 for a detailed check list.
4. Perform insulation resistance tests with an appropriate device. Refer to Insulation Resistance on page 39 for a detailed instructions.
5. Perform a visual and mechanical check of the transformer and its surrounding environment. Refer to Performing Visual and Mechanical Checks on page 37 for a detailed check list.

Figure 33: Removing Temporary Braces



Energizing the Transformer

1. Follow all safety precautions and requirements for PPE as outlined in NFPA 70E and any other applicable standards and/or codes.
   a. Immediately de-energize the transformer if there is any indication of arcing (visual or audible) at any time during the initial start-up.
   b. Investigate and correct the cause of the arcing before re-energizing the unit.
2. Investigate and correct sources of excessive noise. When energized, the transformer will make some audible noise. Excessive mechanical noise, hums or rattles may be an indication of improperly installed or tightened hardware or enclosure parts.
3. Measure and verify the primary and secondary phase-to-phase and phase-to-ground voltages for all windings.
   a. Where applicable, measure and verify phase-to-neutral voltages, as well.
   b. Record and save the values for future reference.

   NOTE: Phase-to-phase, phase-to-ground and phase-to-neutral measurements will verify that the transformer is functioning per the nameplate voltages.

   c. Measure phase-to-ground voltages.
   d. Record and save the values for future reference.

   NOTE: Phase-to-ground voltages will verify that the unit has been installed correctly.

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4. Move one tap at a time, or verify that the jumper lands per the wiring diagram as shown on the nameplate. See Figure 31 on page 28.

   NOTE: Do not change taps while the transformer is energized.

   a. Adjust the transformer taps as necessary to match the actual voltage requirements.

   b. Ensure taps are cleaned of varnish or other insulating material.

5. Perform a phase rotation check with an appropriate device for loads that are phase sensitive (e.g., certain motor or drive applications).

   a. Follow the manufacturer's instructions for the device.

   b. Correct phase rotation errors before energizing the transformer.

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Section 6—Maintenance

Performing Visual and Mechanical Checks

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified personnel should clean, inspect maintain and test transformers.
- Turn off power supplying this equipment before working on it.
- Disconnect and electrically isolate power to the transformer so that no accidental contact can be made with energized parts.
- Discharge all static charges held by coils.

Failure to follow these instructions will result in death or serious injury.

1. Perform a visual inspection of the transformer and its surrounding environment.
   a. Inspect the enclosure for any physical damage.
   b. Repair any damage, if possible.
   c. Provide guards to prevent future damage.
2. Record operational data while the transformer is still energized and in service.
3. De-energize the transformer prior to performing work on the unit.
   a. Follow all safety procedures to place the unit into an electrically safe condition.
   b. Remove the access covers. Inspect for:
   — dirt on insulating surfaces and at areas which tend to restrict air flow.
   — loose connections.
   — the condition of tap changers or terminal boards.
   — the general condition of the transformer.
4. Inspect the enclosure, transformer, terminals, terminal boards, and insulators for signs of overheating from internal or external sources. Check for voltage creepage over insulating surfaces, evident by tracing or carbonization.
5. Check for evidence of rusting, corrosion and paint deterioration. Repair any rust and corrosion where necessary.

Frequency

The frequency at which transformers should be inspected depends on operating conditions.

For clean, dry locations, annual inspections may be sufficient. However, for other locations, such as where the air is contaminated with dust or chemical fumes, an inspection at three- or six-month intervals may be required. Usually after the first few inspection periods, a definite schedule can be set up based on the transformer's existing conditions.

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Severe, Environmental or Special Events

- ❑ Perform routine inspections, maintenance, and testing after any severe electrical short circuit, ground fault, or environmental event (e.g., flooding) to determine the operational status of the transformer.
- ❑ Perform the inspections, maintenance and testing if the transformer has been out of service for an extended period of time. Place strip heaters to maintain the transformer temperature above ambient to prevent condensation from forming in the transformer during extended down time.

Cleaning

Connections and Contact Surfaces

A clean contact surface area is necessary, and terminals must be clean. Where the transformers are installed indoors or outdoors or in a harsh environment, the connections must be sealed with an approved electrical joint compound.

Apply the compound to exposed connections and the surface area before making a bolted connection.

Enclosures, Windings and Insulators

1. De-energize the transformer.
2. Follow the check list below to permit free circulation of air and to guard against insulation breakdowns and thermal performance issues:

- ❑ Clean the transformer enclosure, windings and insulators by vacuuming or by blowing clean, dry, compressed air or nitrogen. Be sure to wear appropriate personal protective equipment (PPE) when cleaning.

  NOTE: Vacuuming is the preferred first step for cleaning. Compressed air should have a dew point of -50°F (-45.5°C) or less, and a pressure at or below 25 psi.
- ❑ Clean lead supports, tap changers, terminals boards, bushings and other major insulating surfaces with lint-free rags or soft bristle brushes.

  NOTE: Do not use liquids, solvents or detergents, as they may deteriorate insulating materials.
- ❑ Carefully inspect and thoroughly clean the ventilation openings (ducts) and winding assemblies. Remove any blockages.
- ❑ Remove any trash and/or combustible materials from the area around the unit.

Performing Electrical Testing

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified personnel should clean, inspect maintain and test transformers.
- Turn off power supplying this equipment before working on it.
- Disconnect and electrically isolate power to the transformer so that no accidental contact can be made with energized parts.
- Discharge all static charges held by coils.

Failure to follow these instructions will result in death or serious injury.

Perform the following electrical tests during maintenance:

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- ❑ Check all electrical contacts with a calibrated torque wrench.
- ❑ Verify proper spacing.
- ❑ Refer to the manufacturer's specifications for torque values.
- ❑ Check all external hardware for tightness.

Contact Resistance

- ❑ Use a low resistance ohmmeter to measure contact resistance.
  a. Compare values with similar connections looking for unusually high contact resistance points.
  b. Investigate any connections that may deviate from common values by more than 50% of the lowest values.
- ❑ An infrared scanning device may be used to look for abnormal temperatures at transformer contacts for energized units.

  NOTE: Take care to follow the manufacturer's procedures, as small errors in scanner operation can cause significant errors in detected temperatures.

Insulation Resistance

Insulation resistance checks may create a capacitive charge on a winding.

1. Ground each winding for at least one minute between tests to drain any static charge created during the test.
2. Perform insulation resistance tests with an appropriate device.
3. Test from winding-to-winding and winding-to-ground.
4. Record all test results for comparison for future readings.
   — Values are installation site dependent and not pre-set at the factory. All testing is compliant to NEMA ST-20.
   — Insulation resistance readings should be at least 1 megohm.
   — Lower readings may indicate the presence of moisture and require a drying procedure to correct.

Winding Resistance

On larger transformers (>500 kVA):

1. Measure the winding resistances and record for future reference.
2. Compare the results with the values obtained during the pre-commissioning checks. Readings should not vary by more than 5% with adjacent coils and the pre-commissioning checks.
3. Record the temperature at which these initial readings were taken.
   — Values are installation site dependent and not pre-set at the factory. All testing is compliant to NEMA ST-20.
4. Adjust the resistance values based on any differences in temperature between current readings and pre-commissioning values.

Grounding and Bonding

1. Check for proper values of resistance between the system ground lug (or point) and the transformer enclosure, core, frame and clamps.
2. Compare with pre-commissioning values, looking for trends that may indicate a compromise in the quality of the ground bond.

Turns Ratio

1. Perform a turns ratio test on all taps and on the full winding voltages for each phase. Significant changes may indicate a loss of winding continuity.
   a. Compare these values with those obtained during the pre-commissioning checks. Voltages between phases should not deviate by more than 0.5% from adjacent coils.
   b. Investigate abnormal readings found outside of this limit.
2. Verify input and output voltages are correct for the tap and output voltages expected. Investigate abnormal readings.

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Sound Isolation Pads

Inspect the sound isolation pads for signs of physical deterioration.

Coil Cooling Ducts

1. Inspect all coil cooling ducts for any accumulation of dust, dirt or other obstructions.
2. Follow standard cleaning procedures to ensure proper air flow.

Terminals

Ensure terminals are in good working condition for the proper operation of transformers.

- ❏ Inspect terminals for alignment, tightness (see torque requirements), pressure, burns or corrosion. Investigate and correct any signs of damage.
- ❏ Repair minor pitting, as long as the plating on the terminal has not been compromised.

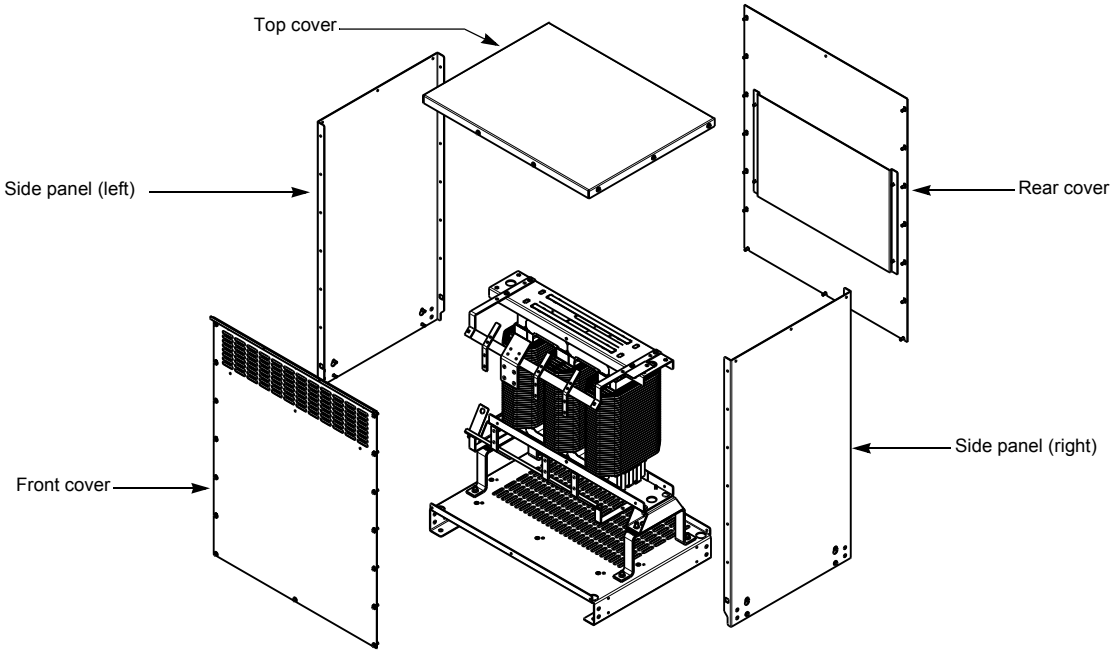
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Section 7—Replacement Parts and Accessories

See Figures 34 and 35 for transformer covers (top, rear and front) and side panels (left and right), and Figure 21 on page 20 and Figure 22 on page 21 for mounting brackets (wall and ceiling). Refer to Table 4 on page 43 for a listing of replacement and accessory parts.

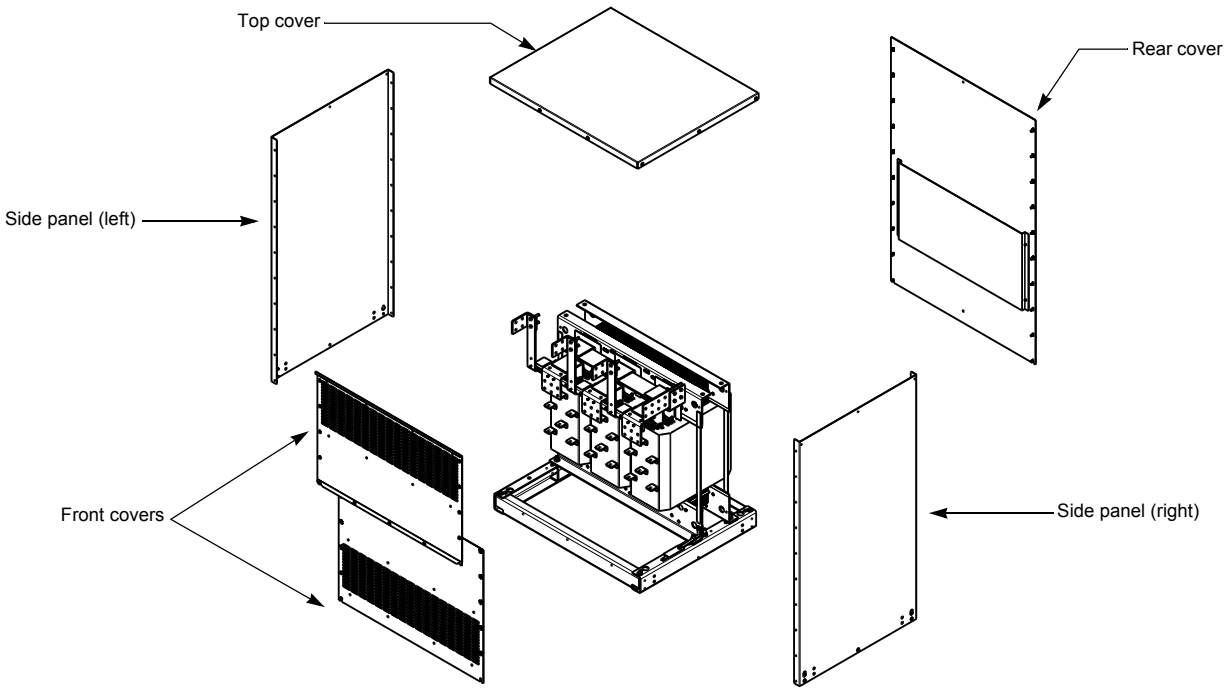
Figure 34: Exploded Assembly for EX75T3H Energy Efficient Transformer with Enclosure Style 20K Front



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Figure 35: Exploded Assembly for EX300T3H Energy Efficient Transformer with Enclosure Style 25J Front



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Refer to the Schneider Electric *Digest, Section 14,* Transformers or call 1-888-Square D (1-888-778-2733) to order replacement parts and accessories.

Refer to Table 4 for enclosure types (top, rear and front covers) side panels, weather-shields and mounting brackets (wall and ceiling).

Table 4: Covers, Side Panels, Weather Shields and Mounting Brackets

Enclosure	Top Cover	Rear Cover	Front Cover	Side Panel (Left and Right)	Weather-shield	Wall Mounting Bracket	Ceiling Mounting Bracket
	Catalog Number						
17D	4310191501	4310191601	4310191601	4310191701	WS363	WMB361362	CMB363
17E	4310191501	—	—	4310191701	—	WMB361362	CMB363
17H	4310191501	4305502003	4305502003	4310191702	WS363	WMB361362	CMB363
17K	7400TC17K	7400R17K	7400FNP17K	7400LR17K	7400WS17K	7400WMB17K	7400CMB17K
18D	4305502101	4305502001	4305502001	4305501001	WS363	WMB363364	CMB363
18E	4305502101	—	—	4305501001	—	WMB363364	CMB363
18H	4305502101	4305502003	4305502003	4310179701	WS363	WMB363364	CMB363
18K	7400TC18K	7400R18K	7400FNP18K	7400LR18K	7400WS18K	7400WMB18K	7400CMB18K
19D	4305501201	4305501101	4305501101	4305501001	WS364	WMB363364	CMB364
19E	—	—	—	—	—	—	—
19K	7400TC19K	7400R19K	7400FNP19K	7400LR19K	7400WS19K	7400WMB19K	7400CMB19K
20D	4305501201	4310192201	4310192201	4310179701	WS364	WMB363364	CMB364
20E	4305501201	—	—	4310179701	—	—	—
20K	7400TC20K	7400R20K	7400FNP20K	7400LR20K	7400WS20K	7400WMB20K	7400CMB20K
21D	4305512501	4300507404	4300507404	4305512601	WS364	—	CMB364
21E	4305512501	—	—	4305512601	—	—	CMB364
21K	7400TC21K	7400R21K	7400FNP21K	7400LR21K	7400WS21K	—	7400CMB21K
22D	4310189001	4310189102	4310189102	4310189201	WS380	—	CMB380
22E	4310189001	—	—	4310189201	—	—	CMB380
22K	7400TC22K	7400R22K	7400FNP22K	7400LR22K	7400WS22K	—	7400CMB22K
23E	—	—	—	—	—	—	—
24D	4310190701	4310190802	4310190802	4310190901	WS381	—	CMB381
24E	4310190701	—	—	4310190901	—	—	CMB381
24K	7400TC24K	7400R24K	7400FNP24K	7400LR24K	7400WS24K	—	7400CMB24K
25D	4310189901	4310190001	4310190001	4310190101	WS382	—	—
25E	4310189901	—	—	4310190101	—	—	—
25J	7400TC25J	7400R25J	7400FNP25J	7400LR25J	7400WS25J	—	—
26D	—	—	—	—	—	—	—
28D	—	—	—	—	—	—	—
28E	—	—	—	—	—	—	—
29D	—	—	—	—	—	—	—
30D	4310192601	(U)4310192901 (L)4310193001	(U)4310192901 (L)4310193001	4310192801	WS383	—	—
30E	4310192601	—	—	—	—	—	—
30J	7400TC30J	7400RU30J 7400RL30J	7400FU30J 7400FLNP30J	7400LR30J	7400WS30J	—	—
31D	—	—	—	—	—	—	—
31E	—	—	—	—	—	—	—
31J	7400TC31J	7400RU31J 7400RL31J	7400FU31J 7400FLNP31J	7400LR31J	7400WS31J	—	—

Touch-up Paint: Catalog Number PK49SP

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Refer to Table 5 for available transformer lug kits. For additional information regarding terminal connectors, refer to the label on the reverse side of the transformer front panel. See Figure 36.

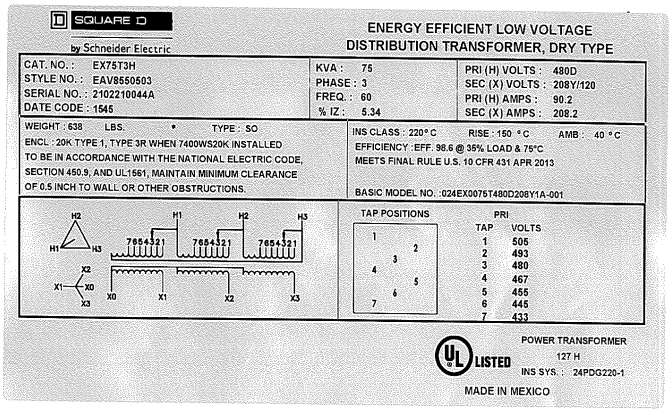
Table 5: VERSAtile™ Compression Lugs and Mechanical Set-Screw Types—UL Listed Lugs AL9CU

Transformer kVA Sizes	Kit Catalog Number	Terminal Lugs		Aluminum or Copper Conductor Range (AWG or kcmil)	Hardware Included	
		Qty.	Catalog Number		Qty.	Cap Screws
VERSAtile Compression Equipment Lugs						
15–37 1/2 1Ø	VCELSK1	8	VCEL02114S1	#8–1/0	8	1/4 in. x 1 in.
15–45 3Ø		5	VCEL030516H1	#4–300 kcmil	1	1/4 in. x 2 in.
50–75 1Ø	VCELSK2	13	VCEL030516H1	#4–300 kcmil	8	1/4 in. x 1 in.
75–112 1/2 3Ø					8	1/4 in. x 2 in.
100–167 1Ø 150–300 3Ø	VCELSK3	3 26	VCEL030516H1	#4–300 kcmil	3	1/4 in. x 3/4 in.
			VCEL07512H1	#500–750 kcmil Al #500 kcmil Cu	16	3/8 in. x 2 in.
500 3Ø	VCELSK4	34	VCEL07512H1	#500–750 kcmil Al #500 kcmil Cu	21	3/8 in. x 2 in.

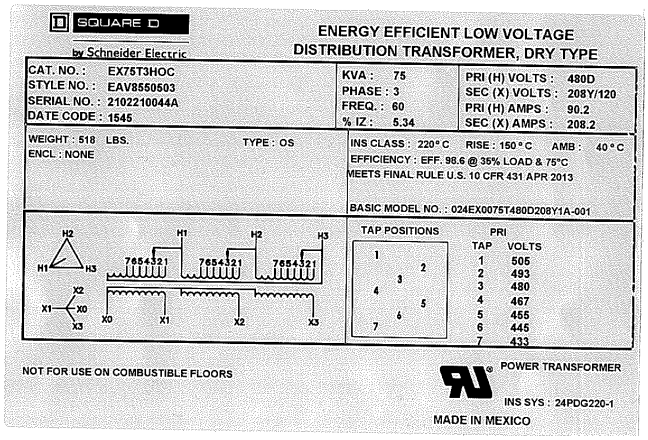
NOTE: Refer to UL 486A for torque values to be used with lug connection hardware.

Two nameplates are attached to each unit. See Figure 36. One on the front cover which is required by standards, the second nameplate is attached to the core and coil, providing installation information inside the unit. The second nameplate also carries a UR listing for the core and coil, allowing the enclosure to be removed and the device installed in the equipment.

Figure 36: Sample Nameplates



Attached to the Front Cover



Attached to the Core and Coil

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Refer to Table 6 for Square D lug kits for the following dry-type transformers:

- Single-phase primary, single-phase secondary, three-phase Delta primary, three-phase secondary
- Single-phase primary and secondary, three-phase Wye secondary, three-phase Delta with center tap

Table 6: Square D Lug Kits for Dry-type Transformers

Catalog Number	Lugs per Kit	Wire Range	Cap Screws	Current Range	Grounding Lugs per Kit	Wire Range	Bonding Lugs per Kit	Wire Range
Single-phase Primary, Single-phase Secondary, Three-phase Delta Primary, Three-phase Secondary								
DASKP100	3	1/0–14 STR.	1/4 in. x 1 in.	Up to 100 A	Not Applicable	Not Applicable	Not Applicable	Not Applicable
DASKP250	3	350 kcmil–6 STR.	3/8 in. x 2 in.	101–250 A				
DASKP400	3	600 kcmil–4 STR. (2) 250 kcmil–1/0 STR.	3/8 in. x 2 in.	201–400 A				
DASKP600	6	600 kcmil–4 STR. (2) 250 kcmil–1/0 STR.	3/8 in. x 2 in.	601–800 A				
DASKP1000	9	600 kcmil–2 STR.	3/8 in. x 2 in.	601–800 A				
DASKP1200	12	600 kcmil–2 STR.	3/8 in. x 2 in.	801–1200 A				
Single-phase Primary and Secondary, Three-phase Wye Secondary, Three-phase Delta with Center Tap								
DASKGS100	5	1/0–14 STR.	1/4 in. x 1 in.	Up to 100 A	1	(4) 2/0–14 STR.	1	2–14 STR.
DASKGS250	5	350 kcmil–6 STR.	3/8 in. x 2 in.	101–250 A	1	(4) 2/0–14 STR.	1	2–14 STR.
DASKGS400	5	600 kcmil–4 STR. (2) 250 kcmil–1/0 STR.	3/8 in. x 2 in.	201–400 A	1	(4) 2/0–14 STR.	1	1/0–14 STR.
DASKGS600	10	600 kcmil–4 STR. (2) 250 kcmil–1/0 STR.	3/8 in. x 2 in.	601–800 A	1	(4) 350 kcmil–6 STR.	1	250 kcmil–6 STR.
DASKGS1000	15	600 kcmil–2 STR.	3/8 in. x 2 in.	601–800 A	1	(4) 350 kcmil–6 STR.	1	250 kcmil–6 STR.
DASKGS1200	20	600 kcmil–2 STR.	3/8 in. x 2 in.	801–1200 A	1	(4) 350 kcmil–6 STR.	1	250 kcmil–6 STR.
DASKGS2000	25	600 kcmil–2 STR.	3/8 in. x 2 in.	1201–2000 A	1	(4) 350 kcmil–6 STR.	1	250 kcmil–6 STR.

NOTE: Lugs are not supplied with transformer units. They must be purchased separately.

Refer to UL 486A for torque values to be used with lug connection hardware.

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Refer to Table 7 for terminal mechanical and compression lugs and their appropriate wire ranges for dry-type transformers.

NOTE: All terminals allow for NEMA two-hole lugs.

Table 7: Terminal Sizes, Mechanical and Compression Lugs and Wire Ranges

kVA	300 Volts and Above		Below 300 Volts	
	Terminal Mechanical Lugs	Terminal Compression Lugs	Terminal Mechanical Lugs	Terminal Compression Lugs
15	2/0–14 AWG	(1) #12–10 AWG (1) #8–#1/0 AWG	2/0–14 AWG	(1) #8-#1/0 AWG
30	2/0–14 AWG	(1) #8–#1/0 AWG	350 kcmil–6 AWG	(1) #8-#1/0 AWG (1) #4-300 kcmil (1) 250–350 kcmil
45	2/0–14 AWG 350 kcmil–6 AWG	(1) #8–#1/0 AWG (1) #4–300 kcmil	350 kcmil–6 AWG (1) 600 kcmil–4 AWG or (2) Equal 250 kcmil–1/0 AWG	(1) 250–350kcmil (1) #2/0-500 kcmil (2) #4-300 kcmil
75	2/0–14 AWG 350 kcmil–6 AWG	(1) #8–#1/0 AWG (1) #4–300 kcmil (1) 250–350 kcmil	(1) 600 kcmil–4 AWG or (2) Equal 250 kcmil–1/0 AWG	(2) #2/0–500 kcmil (1) 400–600 kcmil Al (2) #4-300 kcmil (2) 250–350 kcmil
112.5	350 kcmil–6 AWG (1) 600 kcmil–4 AWG or (2) Equal 250 kcmil–1/0 AWG	(1) 250 kcmil–350 kcmil (1) #2/0–500 kcmil (2) #4-300 kcmil	(2) 350 kcmil–6 AWG (2) 600 kcmil–2 AWG	(3) 250–350 kcmil (3) #4–300 kcmil (2) 400–600 kcmil Al
150	(1) 600 kcmil–4 AWG or (2) Equal 250 kcmil–1/0 AWG	(1) 250–350 kcmil (2) #4-300 kcmil	(3) 350 kcmil–6 AWG (2) 600 kcmil–2 AWG	(3) #2/0–500 kcmil (3) #4–300 kcmil (3) 400–600 kcmil Al (4) 250–350 kcmil
225	1) 600 kcmil–2 AWG (2) 600 kcmil–2 AWG	(2) #2/0–500 kcmil (2) 400–600 kcmil Al (2) #4–300 kcmil	(3) 600 kcmil–2 AWG	(4) #4–300 kcmil (4) #2/0–500 kcmil
300	(2) 600 kcmil–2 AWG	(3) 250–350 kcmil (3) #2/0–500 kcmil (3) 400–600 kcmil Al	(4) 600 kcmil–2 AWG	(6) #2/0–500 kcmil (6) 400–600 kcmil Al
500	(3) 600 kcmil–2 AWG	(4) #4–300 kcmil (4) #2/0–500 kcmil	(6) 600 kcmil–2 AWG	(9) #2/0–500kcmil (9) 400–600 kcmil Al
750	(4) 600 kcmil–2 AWG	(6) #2/0–500 kcmil (6) 400–600 kcmil Al	(9) 600 kcmil–2 AWG	(15) #2/0–500 kcmil (15) 400–600 kcmil Al

NOTE: All terminals allow for NEMA two-hole lugs.

Refer to Table 8 for Square D ground bar kits.

Table 8: Square D Ground Bar Kits

Catalog Number	Grounding Lugs per Kit	Wire Range
DASKGTB100400	1	(4) 2/0–14 STR.
DASKGTB6002000	1	(4) 350 KCMIL–6 STR.

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43006-850-01 Rev. 02, 11/2015
Replaces 43006-850-01 Rev 01, 12/1992

PANELBOARDS

THIS SECTION CONTAINS DETAILED DRAWINGS ON THE FOLLOWING PANELS:

DESIGNATION	*TYPE*	*VOLTAGE*	*AIC*	*MOUNTING*	*PBA*	*NOTES AND REMARKS*
1GH1	I-LINE	480Y/277V 3Ph 4W 60Hz	22kA	Top Trim: Surface with Door	418	Standard Panel (Box Ahead),Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar,Standard Mains and Feeders Mechanically Restrained Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 1GH1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
BNH1	NF	480Y/277V 3Ph 4W 60Hz	22kA	Top Trim: Surface with Door	554	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: BNH1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
1NH1	NF	480Y/277V 3Ph 4W 60Hz	22kA	Top Trim: Surface with Door	553	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 1NH1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
1NH2	NF	480Y/277V 3Ph 4W 60Hz	22kA	Top Trim: Surface with Door	550	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 1NH2 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
2NH1	NF	480Y/277V 3Ph 4W 60Hz	22kA	Bottom Trim: Surface with Door	553	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 2NH1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
3NH1	NF	480Y/277V 3Ph 4W 60Hz	22kA	Bottom Trim: Surface with Door	553	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 3NH1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
4NH1	NF	480Y/277V 3Ph 4W 60Hz	22kA	Bottom Trim: Surface with Door	553T	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 4NH1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
4SH1	NF	480Y/277V 3Ph 4W 60Hz	22kA	Bottom Trim: Surface with Door	553T	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 4SH1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on

PANELBOARDS

THIS SECTION CONTAINS DETAILED DRAWINGS ON THE FOLLOWING PANELS:

DESIGNATION	*TYPE*	*VOLTAGE*	*AIC*	*MOUNTING*	*PBA*	*NOTES AND REMARKS*
BNL1	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Top Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: BNL1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
1NL2	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Top Trim: Surface with Door	701A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 1NL2 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
1NL1	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Top Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 1NL1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
1NL3	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Top Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 1NL3 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
2NL1	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 2NL1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
3NL1	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 3NL1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
4NL1	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 4NL1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
1LL1	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Top Trim: Surface with Door	701A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 1LL1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on

PANELBOARDS

THIS SECTION CONTAINS DETAILED DRAWINGS ON THE FOLLOWING PANELS:

DESIGNATION	*TYPE*	*VOLTAGE*	*AIC*	*MOUNTING*	*PBA*	*NOTES AND REMARKS*
1LL2	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Top Trim: Flush with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 1LL2 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
2LL1	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 2LL1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
2LL3	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 2LL3 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
2LL2	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 2LL2 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
2LL4	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 2LL4 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
3LL1	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 3LL1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
3LL3	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 3LL3 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
3LL2	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 3LL2 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on

PANELBOARDS

THIS SECTION CONTAINS DETAILED DRAWINGS ON THE FOLLOWING PANELS:

DESIGNATION	*TYPE*	*VOLTAGE*	*AIC*	*MOUNTING*	*PBA*	*NOTES AND REMARKS*
3LL4	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 3LL4 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
3LL5	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Flush with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 3LL5 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
4LL1	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 4LL1 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
4LL3	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 4LL3 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
4LL2	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 4LL2 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
4LL4	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 4LL4 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
4LL5	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 4LL5 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on
2LL5	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,SPD Model BIA,Copper Ground Bar Standard Nameplate: Engraved as Follows Line 1: 2LL5 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on

PANELBOARDS

THIS SECTION CONTAINS DETAILED DRAWINGS ON THE FOLLOWING PANELS:

DESIGNATION	*TYPE*	*VOLTAGE*	*AIC*	*MOUNTING*	*PBA*	*NOTES AND REMARKS*
1SL2	NQ	208Y/120V 3Ph 4W 60Hz	10kA	Bottom Trim: Surface with Door	707A	Standard Panel (Box Ahead),Blank Endwalls,Copper Solid Neutral,Seismic Qualification - IBC/ASCE7,Copper Ground Bar Branch User Placement Standard Nameplate: Engraved as Follows Line 1: 1SL2 Size: 3.50" Wide x 1.00" High (Std) Color: White Surface / Black Letters Plastic/Adhesive - Screw-on

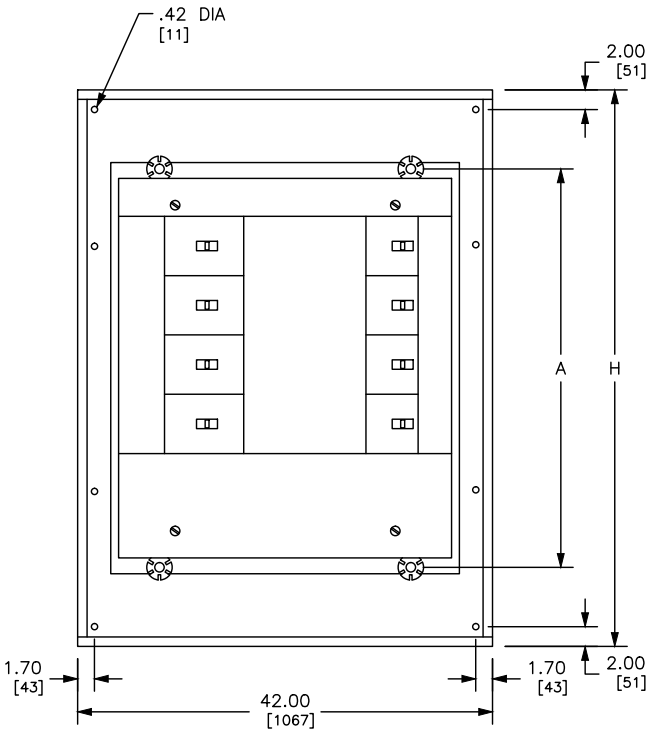
PLEASE CONFIRM THAT THE PANEL DETAILS MATCHES THE PLANS AND SPECIFICATIONS.

ALL LUGS ON PANELBOARDS AND CIRCUIT BREAKERS ARE RATED AT 75 DEGR C.

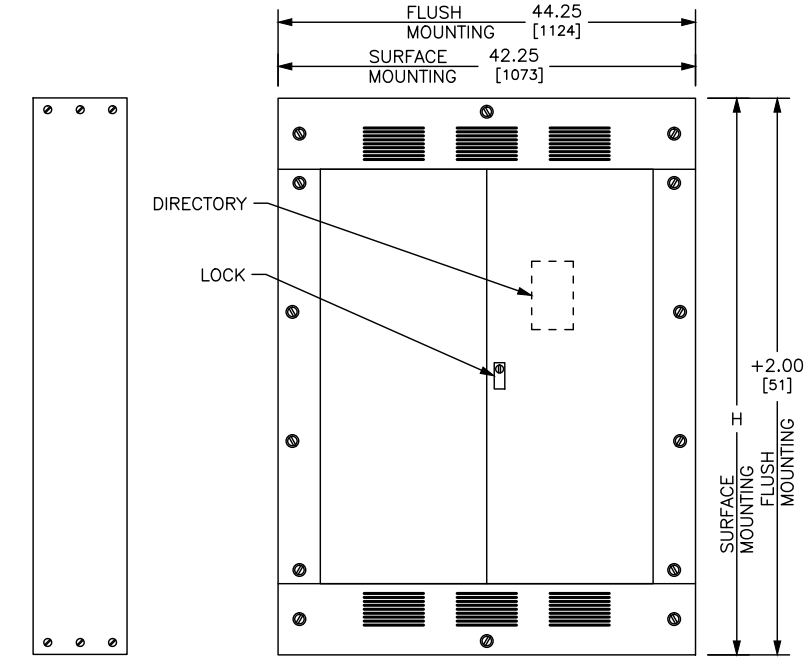
ALL LUGS ARE SIZED PER UL STANDARDS. PLEASE CONFIRM THAT THEY ARE APPROPRIATE FOR THE QUANTITY AND SIZE OF THE CABLE BEING CONNECTED.

PLEASE CONFIRM TOP OR BOTTOM FEED, AND SURFACE OR FLUSH COVERS.

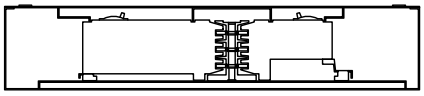
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–	----	--	--/--/--	–	----	--	--/--/--



TYPICAL BOX WITH INTERIOR

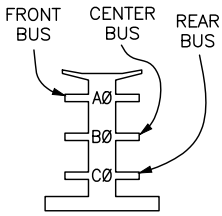


TYPICAL FRONT
(4 PIECE TRIM – WITH DOOR)

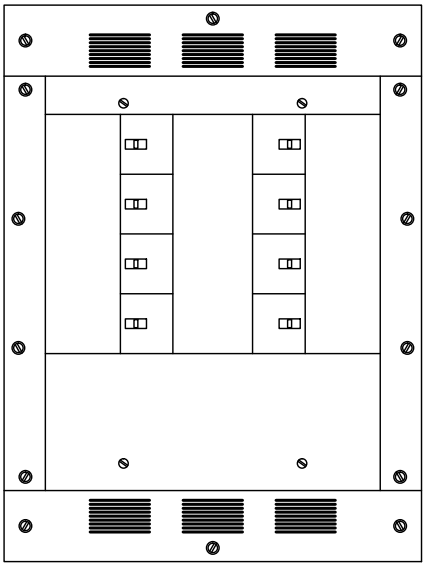


TYPICAL BOX SIDE VIEW

TYPICAL MOUNTING OF FA, FC, FD, FG, FH, FI, FJ, FK, FY, HD, HG, HJ, HL, JD, JG, JJ, JL, KA, KC, KH, KI, LA, LC, LE, LH, LI, LX, LXI, MG, MJ, PG, PJ, PK, PL, Q2, Q2H, Q2–H, QB, QD, QG, QJ, OR QO, BREAKERS



BRANCH CONNECTION PHASING IS DETERMINED BY CIRCUIT BREAKER SELECTION



TYPICAL SURFACE FRONT
(4 PIECE TRIM – NO DOOR)

REFER TO DP CATALOG CLASS 2110 FOR ADDITIONAL INFORMATION

I–LINE HCP PANELBOARDS MEET THE APPLICABLE REQUIREMENTS OF UL AND CSA.

BOX: CODE GAUGE GALVANIZED STEEL WITH REMOVABLE BLANK ENDWALLS.

FRONT: CODE GAUGE STEEL. GRAY BAKED ENAMEL FISHISH ELECTRODEPOSITED OVER CLEANED PHOSPHATIZED STEEL.

LOCK: (COVERS WITH DOORS) HAVE 3 POINT ESCUTCHEON FLUSH LOCK WITH NSR–251 KEY.

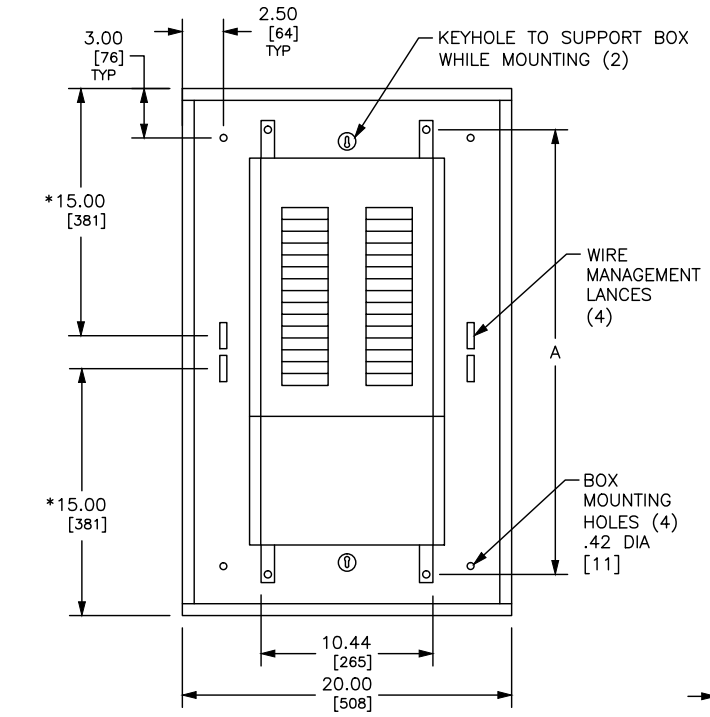
FOR NEMA TYPE 3R APPLICATIONS USE IN CONJUNCTION WITH PBA412.

DUAL DIMENSIONS: INCHES / MILLIMETERS

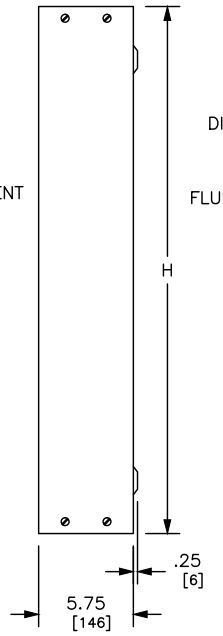
MAXIMUM MLO OR BF–MCB AMPERE RATING	BRANCH BREAKER MOUNTING SPACE (INCHES)	H		A	
		IN	MM	IN	MM
400 THRU 800	27	50.00	1270	20.40	518
	45	59.00	1499	38.40	975
	63	68.00	1727	47.40	1204
	99	86.00	2184	65.10	1654

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1GH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	I–Line (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	PAD DRAWING
ENGR:			
DATE:	September 27 2016		
DRAWING STATUS:	RECORD	DWG# A37999262–418–01	PG 1 OF 1 REV –

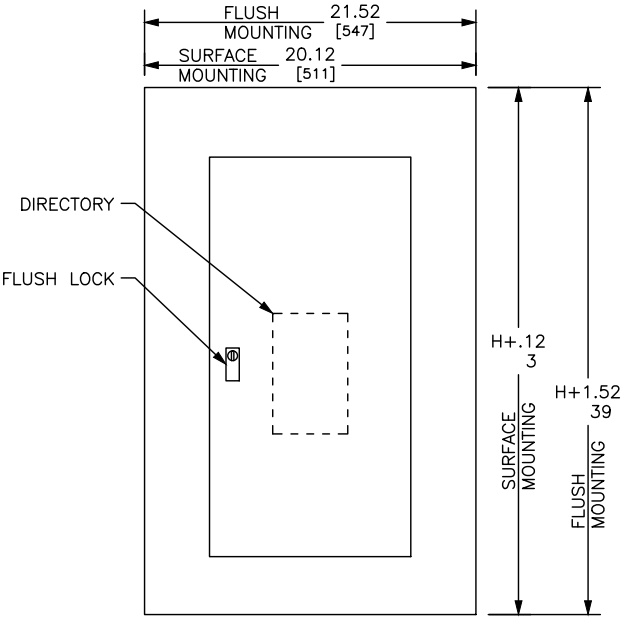
REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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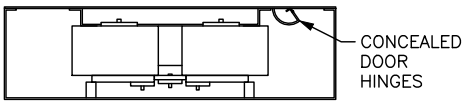
TYPICAL BOX WITH INTERIOR



TYPICAL BOX
SIDE VIEW

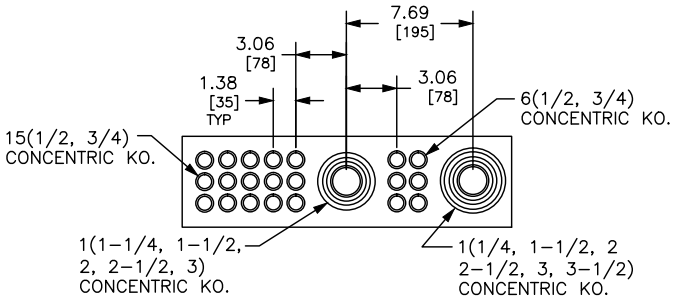


TYPICAL FRONT



TYPICAL MOUNTING OF
EDB OR ECB–G3 BREAKERS

*FOR ENCLOSURES
WHERE DIMENSION "H"
IS 26.00/[660], THIS
DIMENSION IS 11.00/[279]



ENDWALL WITH KNOCKOUTS
(OTHER ENDWALL IS BLANK)

DUAL DIMENSIONS: INCHES / MILLIMETERS

MAXIMUM MAIN LUG AMPERE RATING	MAXIMUM NUMBER OF CIRCUITS	H		A	
		IN	MM	IN	MM
125	18	**26.00**	660	21.00	533
	30	**32.00**	813	27.00	686
250	30	38.00	965	33.00	838
	42	44.00	1118	39.00	991
	54	50.00	1270	45.00	1143
	66	62.00	1575	57.00	1448
125 WITH SUB–FEED LUGS	18	26.00	660	21.00	533
	30	32.00	813	27.00	686
250 WITH SUB–FEED LUGS	30	38.00	965	33.00	838
	42	44.00	1118	39.00	991
	54	50.00	1270	45.00	1143
	66	62.00	1575	57.00	1448
125 WITH FEED–THRU LUGS	18	32.00	813	27.00	686
	30	38.00	965	33.00	838
250 WITH FEED–THRU LUGS	30	50.00	1270	45.00	1143
	42	56.00	1422	51.00	1295
	54	62.00	1575	57.00	1448
	66	74.00	1880	69.00	1753
250 WITH SUB–FEED BREAKERS	30	56.00	1422	51.00	1295
	42	62.00	1575	57.00	1448
	54	68.00	1727	63.00	1600
	66	74.00	1880	69.00	1753

REFER TO DP CATALOG CLASS 1670 FOR ADDITIONAL INFORMATION

FOR NEMA TYPE 3R APPLICATIONS USE IN CONJUNCTION WITH PBA555

NF PANELBOARDS MEET THE APPLICABLE REQUIREMENTS OF UL AND CSA.

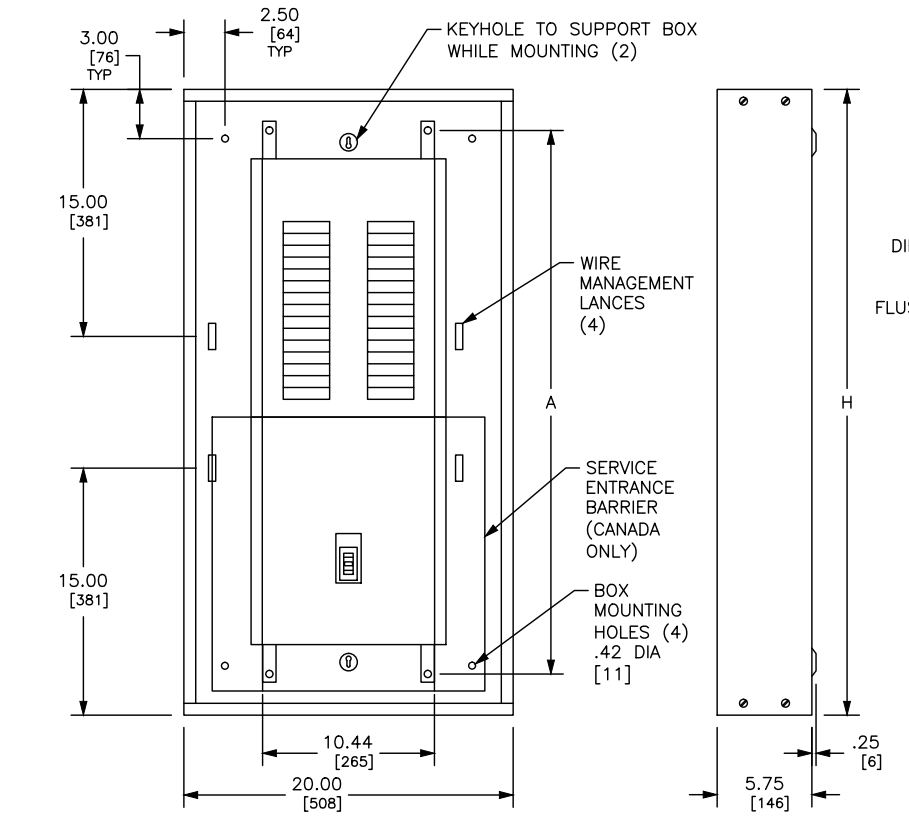
BOX: CODE GAUGE GALVANIZED STEEL. ONE ENDWALL IS BLANK, THE OTHER HAS KNOCKOUTS.

FRONT: MONO–FLAT CONSTRUCTION WITH CONCEALED TRIM SCREWS AND DOOR HINGES. ANSI 49 GRAY BAKED ENAMEL FINISH ELECTRODEPOSITED OVER CLEANED PHOSPHATIZED STEEL.

LOCK: FLUSH LOCK WITH BRUSHED STAINLESS STEEL ESCUTCHEON. NSR–251 KEY.

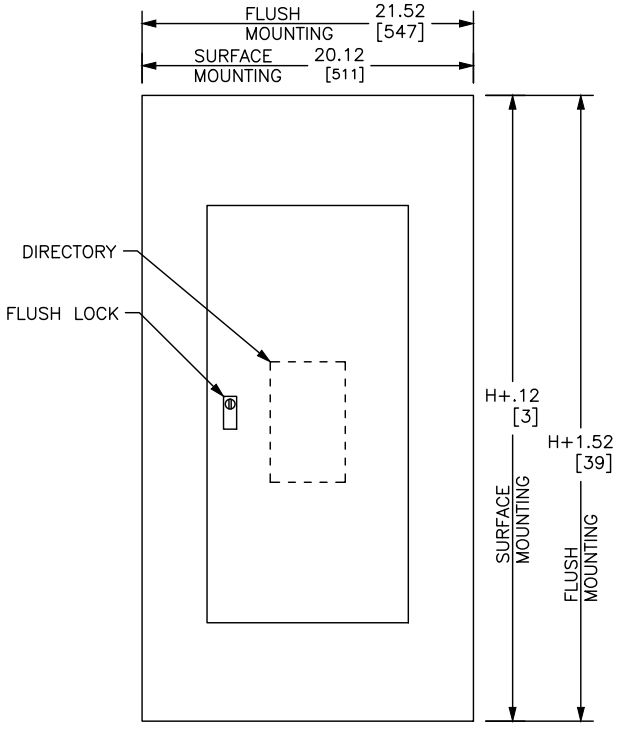
JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	**1NH2**
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	PAD DRAWING
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# **A37999262–550–01**	PG 1 OF 1 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

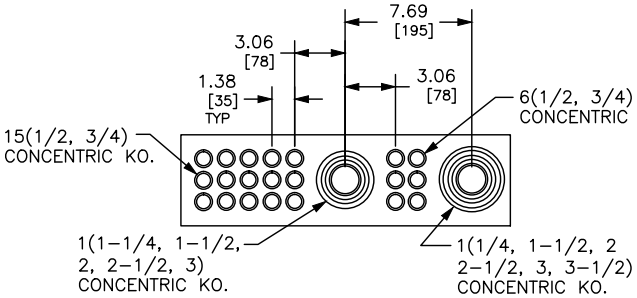


TYPICAL BOX WITH INTERIOR

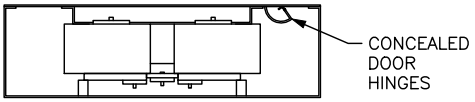
TYPICAL BOX SIDE VIEW



TYPICAL FRONT



ENDWALL WITH KNOCKOUTS
(OTHER ENDWALL IS BLANK)



TYPICAL MOUNTING OF EDB OR ECB–G3 BREAKERS

DUAL DIMENSIONS: INCHES / MILLIMETERS

MAXIMUM MAIN BREAKER AMPERE RATING	MAXIMUM NUMBER OF CIRCUITS	H		A	
		IN	MM	IN	MM
100	18	38.00	965	33.00	838
	30	44.00	1118	39.00	991
250	30	50.00	1270	45.00	1143
	42	56.00	1422	51.00	1295
	54	62.00	1575	57.00	1448
	66	74.00	1880	69.00	1753
100 WITH FEED–THRU LUGS	18	44.00	1118	39.00	991
	30	50.00	1270	45.00	1143
250 WITH FEED–THRU LUGS	30	62.00	1575	57.00	1448
	42	68.00	1727	63.00	1600
	54	74.00	1880	69.00	1753
	66	86.00	2184	81.00	2057
250 WITH SUB–FEED BREAKERS	30	68.00	1727	63.00	1600
	42	74.00	1880	69.00	1753
	54	80.00	2032	75.00	1905

REFER TO DP CATALOG CLASS 1670 FOR ADDITIONAL INFORMATION

FOR NEMA TYPE 3R APPLICATIONS USE IN CONJUNCTION WITH PBA555

NF PANELBOARDS MEET THE APPLICABLE REQUIREMENTS OF UL AND CSA.

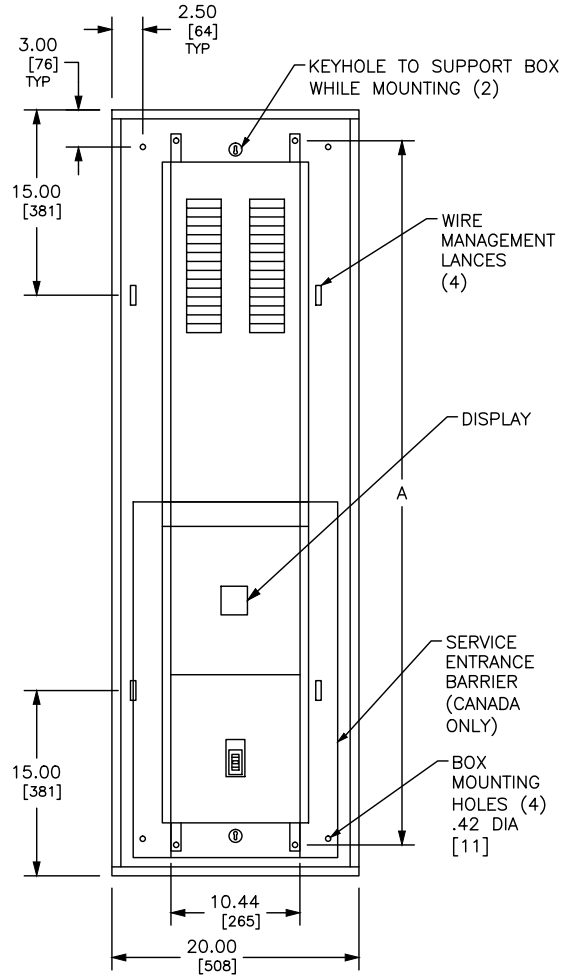
BOX: CODE GAUGE GALVANIZED STEEL. ONE ENDWALL IS BLANK, THE OTHER HAS KNOCKOUTS.

FRONT: MONO–FLAT CONSTRUCTION WITH CONCEALED TRIM SCREWS AND DOOR HINGES. ANSI 49 GRAY BAKED ENAMEL FINISH ELECTRODEPOSITED OVER CLEANED PHOSPHATIZED STEEL.

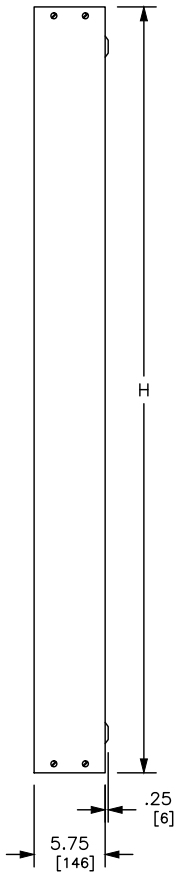
LOCK: FLUSH LOCK WITH BRUSHED, STAINLESS STEEL ESCUTCHEON. NSR–251 KEY.

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3NH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	PAD DRAWING
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# A37999262–553–01	PG 1 OF 1 REV –

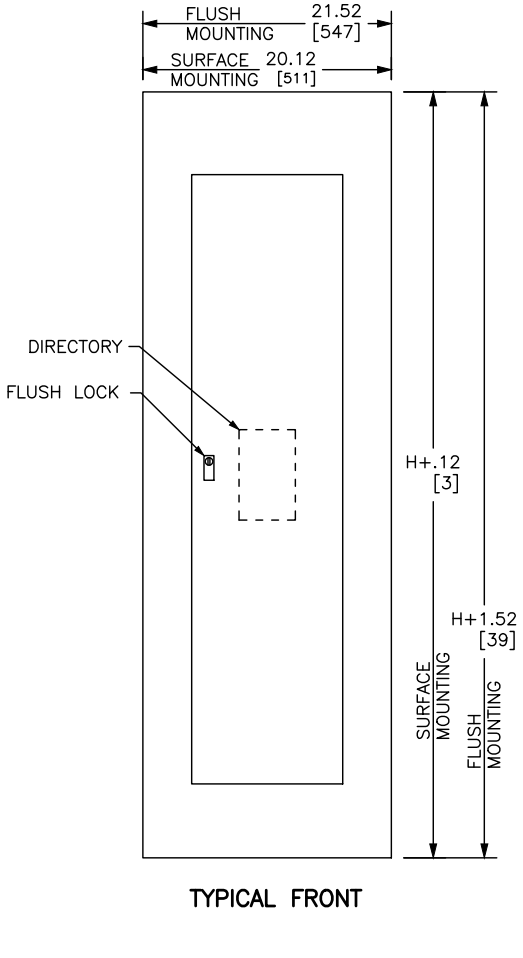
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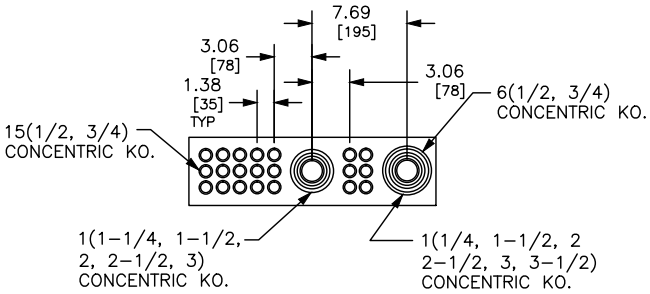
TYPICAL BOX WITH INTERIOR



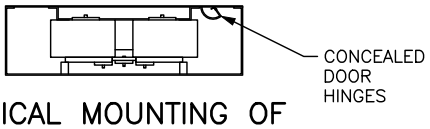
TYPICAL BOX
SIDE VIEW



TYPICAL FRONT



ENDWALL WITH KNOCKOUTS
(OTHER ENDWALL IS BLANK)



TYPICAL MOUNTING OF
EDB OR ECB-G3 BREAKERS

DUAL DIMENSIONS: INCHES
MILLIMETERS

REFER TO DP CATALOG CLASS 1670 FOR ADDITIONAL INFORMATION

FOR NEMA TYPE 3R APPLICATIONS USE IN CONJUNCTION WITH PBA555

NF PANELBOARDS MEET THE APPLICABLE REQUIREMENTS OF UL AND CSA.

BOX: CODE GAUGE GALVANIZED STEEL. ONE ENDWALL IS BLANK, THE OTHER HAS KNOCKOUTS.

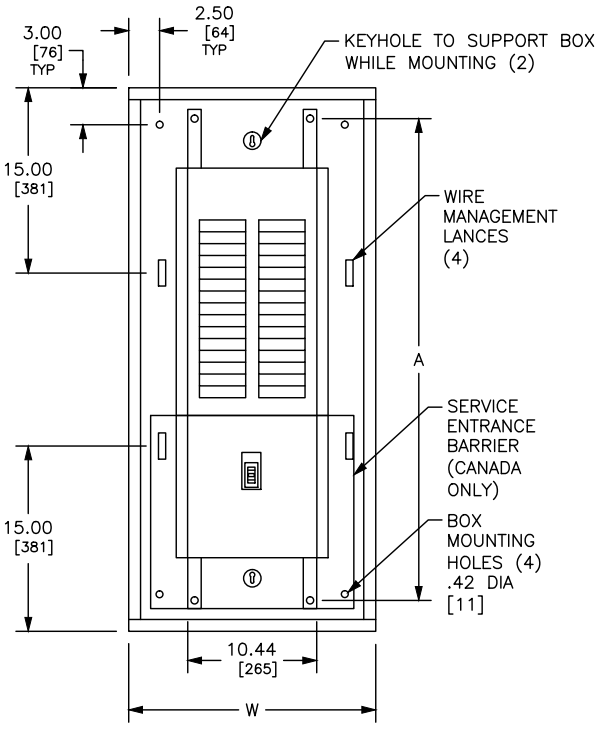
FRONT: MONO-FLAT CONSTRUCTION WITH CONCEALED TRIM SCREWS AND DOOR HINGES. ANSI 49 GRAY BAKED ENAMEL FINISH ELECTRODEPOSITED OVER CLEANED PHOSPHATIZED STEEL.

LOCK: FLUSH LOCK WITH BRUSHED, STAINLESS STEEL ESCUTCHEON. NSR-251 KEY.

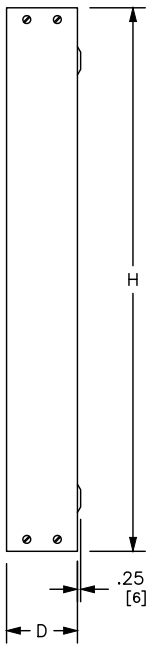
MAXIMUM MAIN BREAKER AMPERE RATING	MAXIMUM NUMBER OF CIRCUITS	H		A	
		IN	MM	IN	MM
100 WITH SPD	30	62.00	1575	57.00	1448
250 WITH SPD	30	62.00	1575	57.00	1448
	42	68.00	1727	63.00	1600
	54	74.00	1880	69.00	1753
100 WITH SPD AND FEED-THRU LUGS	30	68.00	1727	63.00	1600
250 WITH SPD AND FEED-THRU LUGS	30	74.00	1880	69.00	1753
	42	80.00	2032	75.00	1905
	54	86.00	2184	81.00	2057
250 WITH SPD AND SUB-FEED BREAKERS	30	80.00	2032	75.00	1905
	42	86.00	2184	81.00	2057

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4SH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	PAD DRAWING
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# A37999262-553T-01	PG 1 OF 1 REV –

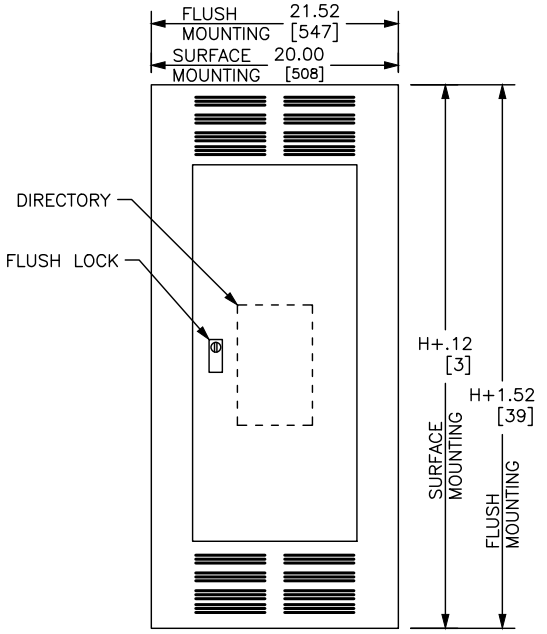
REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--



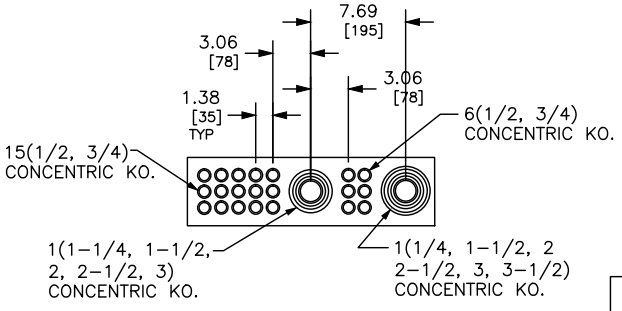
TYPICAL BOX WITH INTERIOR



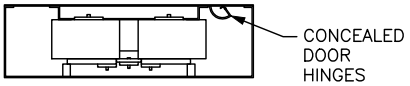
TYPICAL BOX
SIDE VIEW



TYPICAL FRONT



ENDWALL WITH KNOCKOUTS
(OTHER ENDWALL IS BLANK)



TYPICAL MOUNTING OF
EDB OR ECB–G3 BREAKERS

REFER TO DP CATALOG CLASS 1670 FOR ADDITIONAL INFORMATION

FOR NEMA TYPE 3R APPLICATIONS USE IN CONJUNCTION WITH PBA555

NF PANELBOARDS MEET THE APPLICABLE REQUIREMENTS OF UL AND CSA.

BOX: CODE GAUGE GALVANIZED STEEL. ONE ENDWALL IS BLANK, THE OTHER HAS KNOCKOUTS. BOTH ENDWALLS ARE BLANK ON 26.00/[660] WIDE BOXES AND 8.00/[203] DEEP BOXES.

FRONT: GRAY BAKED ENAMEL FINISH ELECTRODEPOSITED OVER CLEANED PHOSPHATIZED STEEL. FRONT IS VENTED AND MOUNTS TO ENCLOSURE WITH SCREWS. DOOR HINGES ARE CONCEALED.

LOCK: FLUSH LOCK WITH BRUSHED, STAINLESS STEEL ESCUTCHEON. NSR–251 KEY.

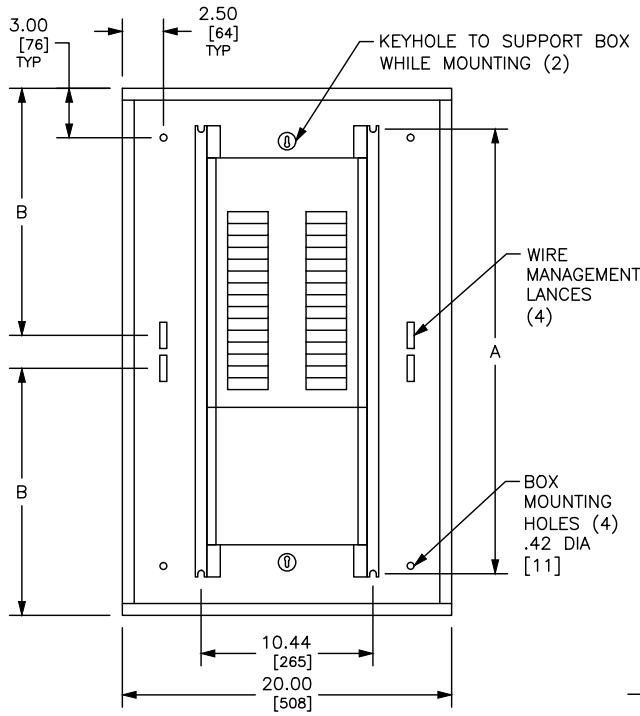
WIRE MANAGEMENT LANCES AND KEYHOLE SLOTS IN BACK OF BOX ARE AVAILABLE IN 20.00/[508] BOX WIDTHS ONLY.

DUAL DIMENSIONS: INCHES / MILLIMETERS

MAXIMUM MAIN BREAKER AMPERE RATING	MAXIMUM NO OF CIRCUITS	H		W		D		A	
		IN	MM	IN	MM	IN	MM	IN	MM
400 (LAL,LHL)	30 42 54 66	62.00 68.00 74.00 86.00	1575 1727 1880 2184	20.00	508	5.75	146	57.00 63.00 69.00 81.00	1448 1600 1753 2057
400/600 (LCL,LIL)	30 42 54	68.00 74.00 80.00	1727 1880 2032	20.00	508	8.75	203	63.00 69.00 75.00	1600 1753 1905
400 WITH FEED–THRU LUGS (LAL,LHL)	30 42 54	68.00 74.00 80.00	1727 1880 2032	20.00	508	5.75	146	63.00 69.00 75.00	1600 1753 1905
400 WITH FEED–THRU LUGS (LCL,LIL)	30 42 54	74.00 80.00 86.00	1880 2032 2184	20.00	508	8.75	203	69.00 75.00 81.00	1753 1905 2057
600 WITH FEED–THRU LUGS (LCL,LIL)	30 42 54	74.00 80.00 86.00	1880 2032 2184	26.00	660	8.75	203	69.00 75.00 81.00	1753 1905 2057
400 WITH SUB–FEED BREAKERS (LAL,LHL)	30 42	80.00 86.00	2032 2184	20.00	508	5.75	146	75.00 81.00	1905 2057
400/600 WITH SUB–FEED BREAKERS (LCL,LIL)	30	86.00	2184	26.00	660	8.75	203	81.00	2057

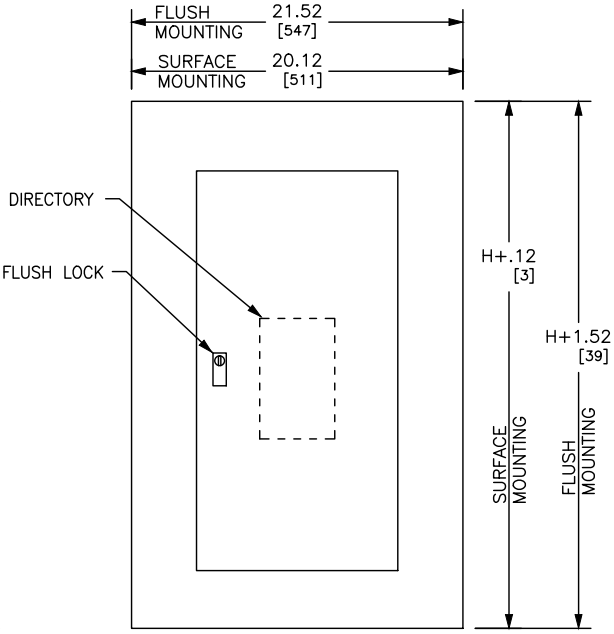
JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	**BNH1**
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	PAD DRAWING
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# **A37999262–554–01**	PG 1 OF 1 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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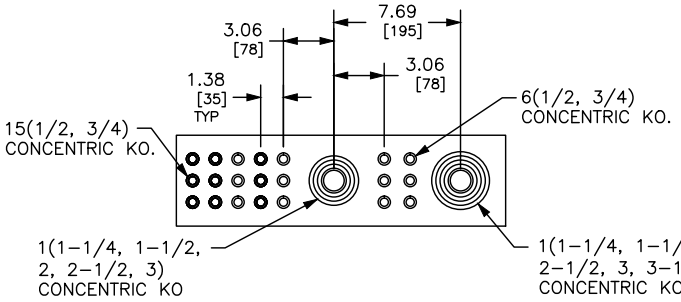


TYPICAL BOX WITH INTERIOR

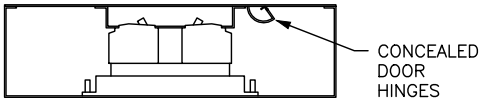
TYPICAL BOX SIDE VIEW



TYPICAL FRONT



ENDWALL WITH KNOCKOUTS
(OTHER ENDWALL IS BLANK)



TYPICAL MOUNTING OF QO, QOB BREAKERS

DUAL DIMENSIONS: INCHES / MILLIMETERS

MAXIMUM MAIN LUGS AMPERE RATING	MAXIMUM NUMBER OF CIRCUITS	H		A		B	
		IN	MM	IN	MM	IN	MM
100A	18	26.00	660	21.00	533	11.00	279
	30	32.00	813	27.00	686	15.00	381
225A	30	32.00	813	27.00	686	15.00	381
	42 & 54	38.00	965	33.00	838	15.00	381
	72	44.00	1118	39.00	991	15.00	381
	84	50.00	1270	45.00	1143	15.00	381
100A WITH SUB FEED LUGS OR FEED THRU LUGS	18	26.00	660	21.00	533	15.00	381
	30	32.00	813	27.00	686	15.00	381
225A WITH SUB FEED LUGS	30	38.00	965	33.00	838	15.00	381
	42 & 54	44.00	1118	39.00	991	15.00	381
	72	50.00	1270	45.00	1143	15.00	381
	84	56.00	1422	51.00	1295	15.00	381
225A WITH FEED THRU LUGS	30 & 42	38.00	965	33.00	838	15.00	381
	54	44.00	1118	39.00	991	15.00	381
	72	50.00	1270	45.00	1143	15.00	381
	84	56.00	1422	51.00	1295	15.00	381
225A WITH SUB FEED BREAKER	30	50.00	1270	45.00	1143	15.00	381
	42 & 54	56.00	1422	51.00	1295	15.00	381
	72	62.00	1575	57.00	1448	15.00	381
	84	68.00	1727	63.00	1600	15.00	381

REFER TO DP CATALOG CLASS 1640 FOR ADDITIONAL INFORMATION

FOR TYPE 3R APPLICATIONS USE IN CONJUNCTION WITH PBA711

NQ PANELBOARDS MEET THE APPLICABLE REQUIREMENTS OF UL AND CSA.

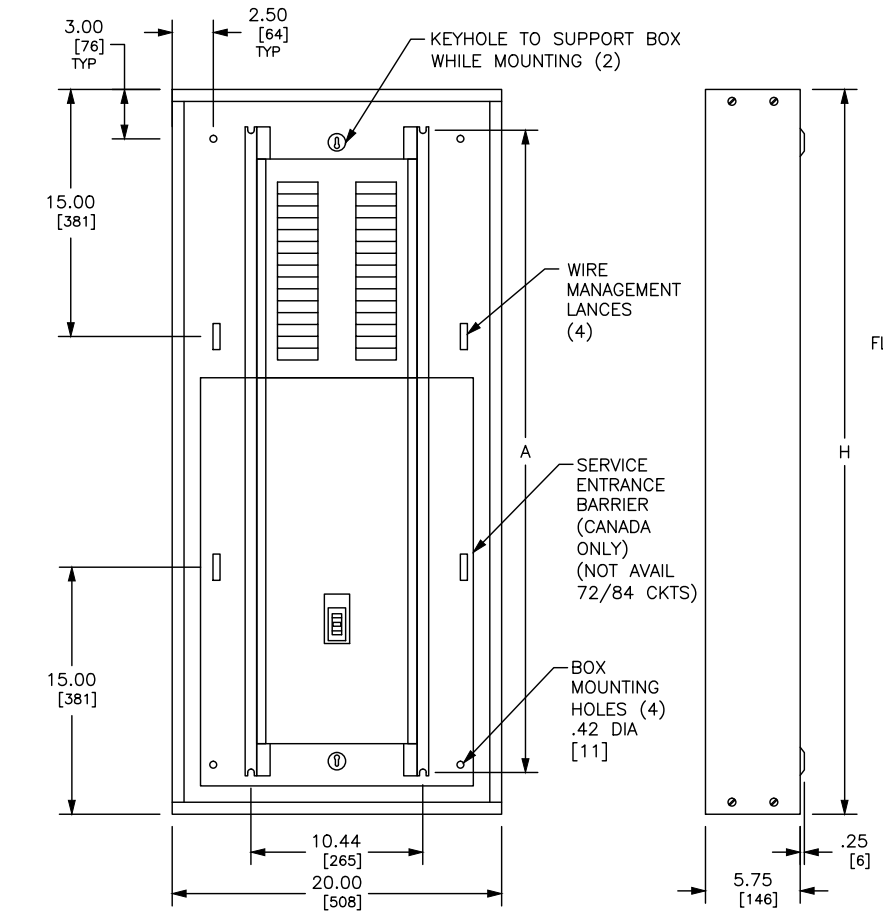
BOX: CODE GAUGE GALVANIZED STEEL. ONE ENDWALL IS BLANK, THE OTHER HAS KNOCKOUTS.

FRONT: MONO–FLAT CONSTRUCTION WITH CONCEALED TRIM SCREWS AND DOOR HINGES. ANSI 49 GRAY BAKED ENAMEL FINISH ELECTRODEPOSITED OVER CLEANED PHOSPHATIZED STEEL.

LOCK: FLUSH LOCK WITH BRUSHED STAINLESS STEEL ESCUTCHEON. NSR–251 KEY.

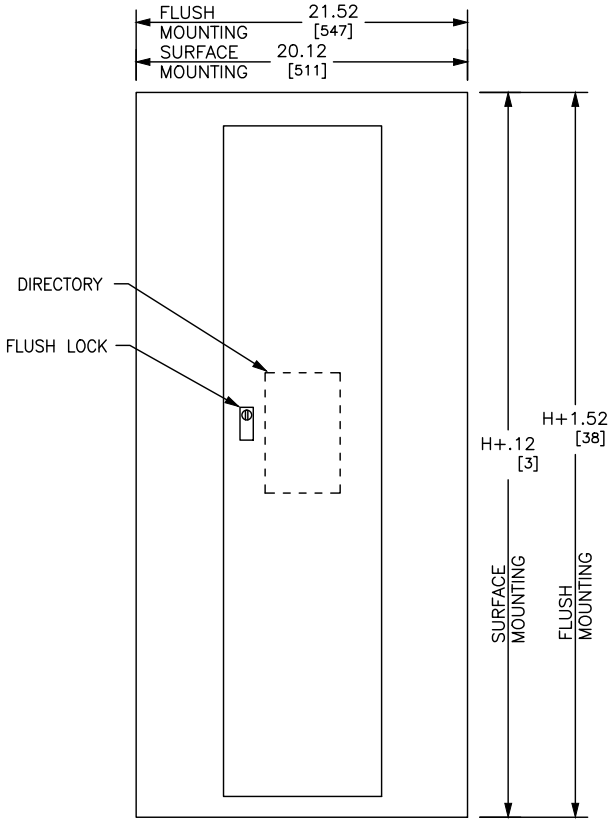
JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1LL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	PAD DRAWING
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# A37999262–701A–701	PG 1 OF 1 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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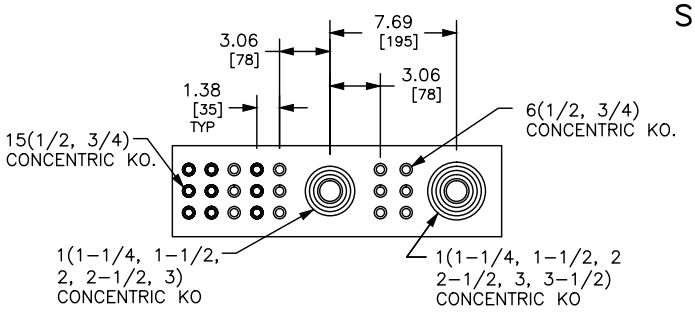


TYPICAL BOX WITH INTERIOR

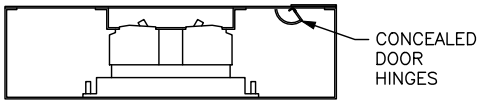
TYPICAL BOX SIDE VIEW



TYPICAL FRONT



ENDWALL WITH KNOCKOUTS
(OTHER ENDWALL IS BLANK)



TYPICAL MOUNTING OF QO, QOB BREAKERS

REFER TO DP CATALOG CLASS 1640 FOR ADDITIONAL INFORMATION

FOR TYPE 3R APPLICATIONS USE IN CONJUNCTION WITH PBA711

NQ PANELBOARDS MEET THE APPLICABLE REQUIREMENTS OF UL AND CSA.

BOX: CODE GAUGE GALVANIZED STEEL. ONE ENDWALL IS BLANK, HE OTHER HAS KNOCKOUTS.

FRONT: MONO-FLAT CONSTRUCTION WITH CONCEALED TRIM SCREWS AND DOOR HINGES. ANSI 49 GRAY BAKED ENAMEL FINISH ELECTRODEPOSITED OVER CLEANED PHOSPHATIZED STEEL.

LOCK: FLUSH LOCK WITH BRUSHED STAINLESS STEEL ESCUTCHEON. NSR-251 KEY.

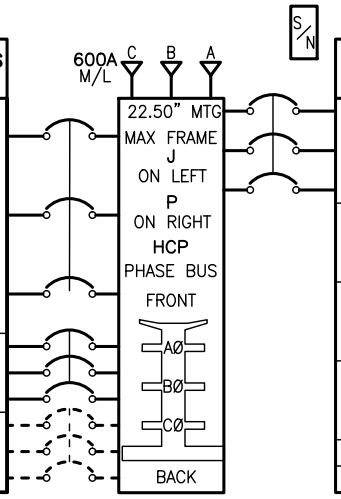
DUAL DIMENSIONS: INCHES / MILLIMETERS

MAXIMUM MAIN BREAKER AMPERE RATING	MAXIMUM NUMBER OF CIRCUITS	H		A	
		IN	MM	IN	MM
250A	30	44.00	1118	39.00	991
	42 & 54	50.00	1270	45.00	1143
	72	56.00	1422	51.00	1295
	84	62.00	1575	57.00	1448
250A WITH FEED THRU LUGS	30 & 42	50.00	1270	45.00	1143
	54	56.00	1422	51.00	1295
	72	62.00	1575	57.00	1448
	84	68.00	1727	63.00	1600
250A WITH SUB FEED BREAKER	30	62.00	1575	57.00	1448
	42 & 54	68.00	1727	63.00	1600
	72	74.00	1880	69.00	1753
	84	80.00	2032	75.00	1905

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1SL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	PAD DRAWING
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# A37999262-707A-01	PG 1 OF 1 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P	PHASE BUS CONN
	SPD	HL	60/3	ABC
1		JG	225/3	ABC
3	PS 4.50" FP	JG	225/3	ABC



PHASE BUS CONN	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
ABC	400/3	LA		2
			4.50" BLANK	
			4.50" BLANK	
			4.50" BLANK	
			1.50" BLANK	
			1.50" BLANK	

PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: HCW59TSD
BOX CAT#: HC4259DB
DIMENSIONS:
59''H x 42''W x 9.5''D
WIRE BENDING SPACE:
TOP – 15.22
BOTTOM – 16.78
LEFT SIDE – 8.77
RIGHT SIDE – 8.66
PBA: 418
BUSSING: Copper
Tin Plated
OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
COPPER SOLID NEUTRAL
SPD DRY CONTACTS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 480Y/277V 3Ph 4W 60Hz
System Ampacity: 600A
22kA SYMS. SCCR
MAIN: MAIN LUGS : 600A
Top FEED
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
(2) #2 – 500kcmil
BRANCH MOUNTING TYPE: PLUG-ON
----------BRANCH SUMMATION----------
1 – 225A/3P JG
1 – 225A/3P-PS JG
1 – 400A/3P LA

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1GH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	I-Line (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	September 27 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-009-01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

PHYSICAL DATA CONTINUED

SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 120kA
SPD LINE TO GRD PROTECT

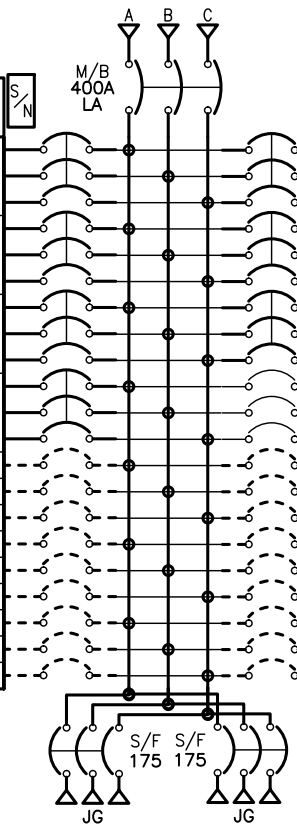
----------STANDARD EQUIPMENT NAMEPLATE----------

Engraved as Follows
LINE 1: 1GH1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1GH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	I–Line (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	September 27 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–009–01	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

CKT NO	ACCESSORIES	TYPE	RATING AMP/P	S/N	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1		EGB	70/3		70/3	EGB		2
3								4
5								6
7		EGB	45/3		45/3	EGB		8
9								10
11								12
13	AL–SPL	EGB	15/3		15/3	EGB	AL–SPL	14
15								16
17								18
19	AL–SPL	EGB	15/3		20/1	EGB		20
21					20/1	EGB		22
23					20/1	EGB		24
25	PREPARED SPACE	EGB	20/1		20/1	EGB	PREPARED SPACE	26
27	PREPARED SPACE	EGB	20/1		20/1	EGB	PREPARED SPACE	28
29	PREPARED SPACE	EGB	20/1		20/1	EGB	PREPARED SPACE	30
31	PREPARED SPACE	EGB	20/1		20/1	EGB	PREPARED SPACE	32
33	PREPARED SPACE	EGB	20/1		20/1	EGB	PREPARED SPACE	34
35	PREPARED SPACE	EGB	20/1		20/1	EGB	PREPARED SPACE	36
37	PREPARED SPACE	EGB	20/1		20/1	EGB	PREPARED SPACE	38
39	PREPARED SPACE	EGB	20/1		20/1	EGB	PREPARED SPACE	40
41	PREPARED SPACE	EGB	20/1		20/1	EGB	PREPARED SPACE	42



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC86VS
BOX CAT#: MH86BE
DIMENSIONS:
86''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 15
BOTTOM – 12.25
SIDE – 4.1
PBA: 554

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
BLANK ENDWALLS
COPPER SOLID NEUTRAL

----------STANDARD EQUIPMENT NAMEPLATE----------
Engraved as Follows
LINE 1: BNH1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

ELECTRICAL DATA

SYSTEM: 480Y/277V 3Ph 4W 60Hz
System Ampacity: 400A
22kA SYMS. SCCR
Panel Ampacity: 400A

MAIN: MAIN BREAKER LA 400A
Top FEED
30kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#1 – 600,(2)#1 – 250 kcml

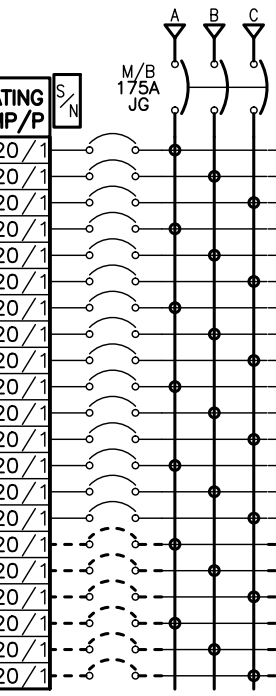
BRANCH MOUNTING TYPE: BOLT–ON

----------BRANCH SUMMATION----------

2 – 70A/3P EGB	2 – 45A/3P EGB
3 – 15A/3P EGB	18 – 20A/1P–PS EGB
3 – 20A/1P EGB	2 – 175A/3P JG

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	BNH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–010–01	PG 1 OF 1 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P	S/N	S/N	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1		EGB	20/1			20/1	EGB		2
3		EGB	20/1			20/1	EGB		4
5		EGB	20/1			20/1	EGB		6
7		EGB	20/1			20/1	EGB		8
9		EGB	20/1			20/1	EGB		10
11		EGB	20/1			20/1	EGB		12
13		EGB	20/1			20/1	EGB		14
15		EGB	20/1			20/1	EGB		16
17		EGB	20/1			20/1	EGB		18
19		EGB	20/1			20/1	EGB		20
21		EGB	20/1			20/1	EGB		22
23		EGB	20/1			20/1	EGB		24
25		EGB	20/1			20/1	EGB		26
27		EGB	20/1			20/1	EGB		28
29		EGB	20/1			20/1	EGB		30
31	PREPARED SPACE	EGB	20/1			20/1	EGB	PREPARED SPACE	32
33	PREPARED SPACE	EGB	20/1			20/1	EGB	PREPARED SPACE	34
35	PREPARED SPACE	EGB	20/1			20/1	EGB	PREPARED SPACE	36
37	PREPARED SPACE	EGB	20/1			20/1	EGB	PREPARED SPACE	38
39	PREPARED SPACE	EGB	20/1			20/1	EGB	PREPARED SPACE	40
41	PREPARED SPACE	EGB	20/1			20/1	EGB	PREPARED SPACE	42

PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC56S
BOX CAT#: MH56BE
DIMENSIONS:
56''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 12.75
BOTTOM – 5
SIDE – 4.1
PBA: 553

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
COPPER SOLID NEUTRAL

----------STANDARD EQUIPMENT NAMEPLATE----------
Engraved as Follows
LINE 1: 1NH1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

ELECTRICAL DATA

SYSTEM: 480Y/277V 3Ph 4W 60Hz
System Ampacity: 175A
22kA SYMS. SCCR

MAIN: MAIN BREAKER JG 175A
Top FEED
35kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 4/0 AWG

BRANCH MOUNTING TYPE: BOLT–ON
----------BRANCH SUMMATION----------
30 – 20A/1P EGB
12 – 20A/1P–PS EGB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1NH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–011–01	PG 1 OF 1 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P	S/N	225A M/L A B C	S/N	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1	AL–SPL	EGB	15/3							2
3							70/3	EGB		4
5										6
7	AL–SPL	EGB	15/3							8
9							40/3	EGB		10
11										12
13	PREPARED SPACE	EGB	20/1							14
15	PREPARED SPACE	EGB	20/1				15/3	EGB	AL–SPL	16
17	PREPARED SPACE	EGB	20/1							18
19	PREPARED SPACE	EGB	20/1							20
21	PREPARED SPACE	EGB	20/1				15/3	EGB	AL–SPL	22
23	PREPARED SPACE	EGB	20/1							24
25	PREPARED SPACE	EGB	20/1				20/1	EGB	PREPARED SPACE	26
27	PREPARED SPACE	EGB	20/1				20/1	EGB	PREPARED SPACE	28
29	PREPARED SPACE	EGB	20/1				20/1	EGB	PREPARED SPACE	30

PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC38S
BOX CAT#: MH38BE
DIMENSIONS:
38''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 13.25
BOTTOM – 5
SIDE – 4.1
PBA: 550
BUSSING: Copper
Silver/Tin Plated
OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
BLANK ENDWALLS
COPPER SOLID NEUTRAL
----------STANDARD EQUIPMENT NAMEPLATE----------
Engraved as Follows
LINE 1: 1NH2
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

ELECTRICAL DATA

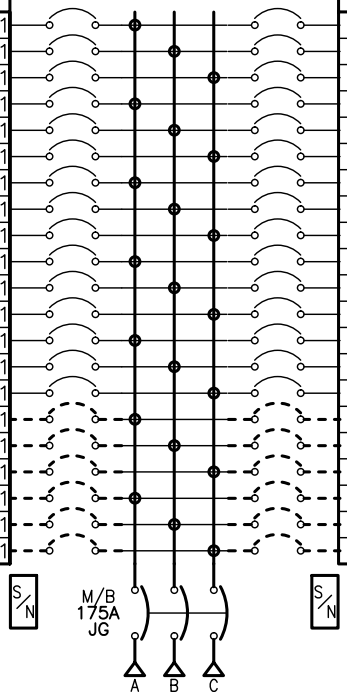
SYSTEM: 480Y/277V 3Ph 4W 60Hz
System Ampacity: 225A
22kA SYMS. SCCR
MAIN: MAIN LUGS : 225A
Top FEED
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#6 – 350 kcmil
BRANCH MOUNTING TYPE: BOLT–ON
----------BRANCH SUMMATION----------

4 – 15A/3P EGB	12 – 20A/1P–PS EGB
1 – 70A/3P EGB	1 – 40A/3P EGB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1NH2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–012–01	PG 1 OF 1 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1		EGB	20/1	20/1	EGB		2
3		EGB	20/1	20/1	EGB		4
5		EGB	20/1	20/1	EGB		6
7		EGB	20/1	20/1	EGB		8
9		EGB	20/1	20/1	EGB		10
11		EGB	20/1	20/1	EGB		12
13		EGB	20/1	20/1	EGB		14
15		EGB	20/1	20/1	EGB		16
17		EGB	20/1	20/1	EGB		18
19		EGB	20/1	20/1	EGB		20
21		EGB	20/1	20/1	EGB		22
23		EGB	20/1	20/1	EGB		24
25		EGB	20/1	20/1	EGB		26
27		EGB	20/1	20/1	EGB		28
29		EGB	20/1	20/1	EGB		30
31	PREPARED SPACE	EGB	20/1	20/1	EGB	PREPARED SPACE	32
33	PREPARED SPACE	EGB	20/1	20/1	EGB	PREPARED SPACE	34
35	PREPARED SPACE	EGB	20/1	20/1	EGB	PREPARED SPACE	36
37	PREPARED SPACE	EGB	20/1	20/1	EGB	PREPARED SPACE	38
39	PREPARED SPACE	EGB	20/1	20/1	EGB	PREPARED SPACE	40
41	PREPARED SPACE	EGB	20/1	20/1	EGB	PREPARED SPACE	42



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC56S
BOX CAT#: MH56BE
DIMENSIONS:
56''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 12.75
SIDE – 4.1
PBA: 553

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
BLANK ENDWALLS
COPPER SOLID NEUTRAL

----------STANDARD EQUIPMENT NAMEPLATE----------
Engraved as Follows
LINE 1: 2NH1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw-on

ELECTRICAL DATA

SYSTEM: 480Y/277V 3Ph 4W 60Hz
System Ampacity: 175A
22kA SYMS. SCCR

MAIN: MAIN BREAKER JG 175A
Bottom FEED
35kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 4/0 AWG

BRANCH MOUNTING TYPE: BOLT-ON

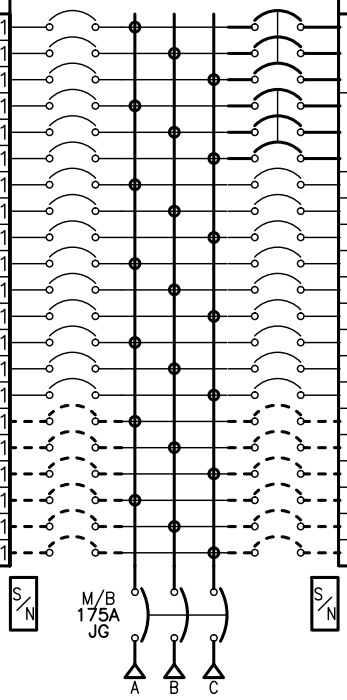
----------BRANCH SUMMATION----------
30 – 20A/1P EGB
12 – 20A/1P-PS EGB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2NH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-013-01	PG 1 OF 1 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		EGB	20/1
3		EGB	20/1
5		EGB	20/1
7		EGB	20/1
9		EGB	20/1
11		EGB	20/1
13		EGB	20/1
15		EGB	20/1
17		EGB	20/1
19		EGB	20/1
21		EGB	20/1
23		EGB	20/1
25		EGB	20/1
27		EGB	20/1
29		EGB	20/1
31	PREPARED SPACE	EGB	20/1
33	PREPARED SPACE	EGB	20/1
35	PREPARED SPACE	EGB	20/1
37	PREPARED SPACE	EGB	20/1
39	PREPARED SPACE	EGB	20/1
41	PREPARED SPACE	EGB	20/1

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
35/3	EGB		2
			4
			6
35/3	EGB		8
			10
			12
20/1	EGB		14
20/1	EGB		16
20/1	EGB		18
20/1	EGB		20
20/1	EGB		22
20/1	EGB		24
20/1	EGB		26
20/1	EGB		28
20/1	EGB		30
20/1	EGB	PREPARED SPACE	32
20/1	EGB	PREPARED SPACE	34
20/1	EGB	PREPARED SPACE	36
20/1	EGB	PREPARED SPACE	38
20/1	EGB	PREPARED SPACE	40
20/1	EGB	PREPARED SPACE	42



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC56S
BOX CAT#: MH56BE
DIMENSIONS:
56''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 12.75
SIDE – 4.1
PBA: 553

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
BLANK ENDWALLS
COPPER SOLID NEUTRAL

----------STANDARD EQUIPMENT NAMEPLATE----------
Engraved as Follows
LINE 1: 3NH1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw-on

ELECTRICAL DATA

SYSTEM: 480Y/277V 3Ph 4W 60Hz
System Ampacity: 175A
22kA SYMS. SCCR

MAIN: MAIN BREAKER JG 175A
Bottom FEED
35kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 4/0 AWG

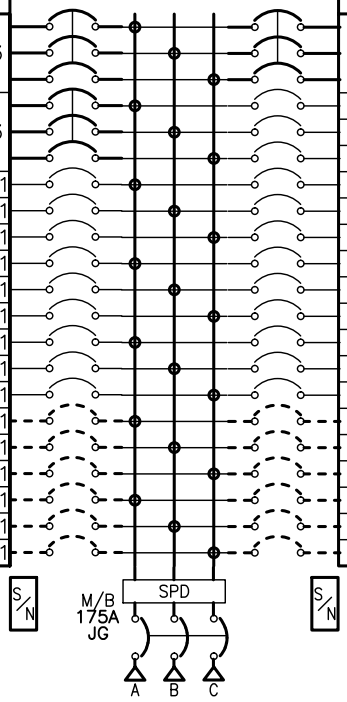
BRANCH MOUNTING TYPE: BOLT-ON
----------BRANCH SUMMATION----------
24 – 20A/1P EGB
12 – 20A/1P-PS EGB
2 – 35A/3P EGB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3NH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-014-01	PG 1 OF 1 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		EGB	20/3
3			
5			
7		EGB	15/3
9			
11			
13		EGB	20/1
15		EGB	20/1
17		EGB	20/1
19		EGB	20/1
21		EGB	20/1
23		EGB	20/1
25		EGB	20/1
27		EGB	20/1
29		EGB	20/1
31	PREPARED SPACE	EGB	20/1
33	PREPARED SPACE	EGB	20/1
35	PREPARED SPACE	EGB	20/1
37	PREPARED SPACE	EGB	20/1
39	PREPARED SPACE	EGB	20/1
41	PREPARED SPACE	EGB	20/1

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
15/3	EGB		2
			4
			6
20/1	EGB		8
20/1	EGB		10
20/1	EGB		12
20/1	EGB		14
20/1	EGB		16
20/1	EGB		18
20/1	EGB		20
20/1	EGB		22
20/1	EGB		24
20/1	EGB		26
20/1	EGB		28
20/1	EGB		30
20/1	EGB	PREPARED SPACE	32
20/1	EGB	PREPARED SPACE	34
20/1	EGB	PREPARED SPACE	36
20/1	EGB	PREPARED SPACE	38
20/1	EGB	PREPARED SPACE	40
20/1	EGB	PREPARED SPACE	42



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC68S
BOX CAT#: MH68BE
DIMENSIONS:
68''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 12.75
SIDE – 4.1
PBA: PBA553T

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
BLANK ENDWALLS
COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 120kA
SPD LINE TO GRD PROTECT

----------STANDARD EQUIPMENT NAMEPLATE----------
Engraved as Follows

(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 480Y/277V 3Ph 4W 60Hz
System Ampacity: 175A
22kA SYMS. SCCR

MAIN: MAIN BREAKER JG 175A
Bottom FEED
35kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 4/0 AWG

BRANCH MOUNTING TYPE: BOLT-ON

----------BRANCH SUMMATION----------

1 – 20A/3P EGB
2 – 15A/3P EGB
21 – 20A/1P EGB
12 – 20A/1P-PS EGB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4NH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-015-01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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PHYSICAL DATA CONTINUED

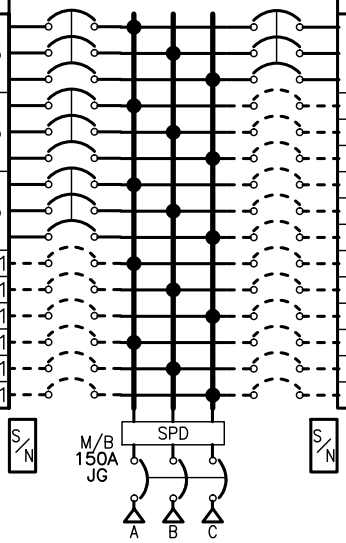
LINE 1: 4NH1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	**4NH1**
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# **037999262–015–01**	PG **2** OF **2** REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		EGB	70/3
3			
5			
7		EGB	70/3
9			
11			
13		EGB	70/3
15			
17			
19	PREPARED SPACE	EGB	20/1
21	PREPARED SPACE	EGB	20/1
23	PREPARED SPACE	EGB	20/1
25	PREPARED SPACE	EGB	20/1
27	PREPARED SPACE	EGB	20/1
29	PREPARED SPACE	EGB	20/1

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
15/3	EGB		2
			4
			6
20/1	EGB	PREPARED SPACE	8
20/1	EGB	PREPARED SPACE	10
20/1	EGB	PREPARED SPACE	12
20/1	EGB	PREPARED SPACE	14
20/1	EGB	PREPARED SPACE	16
20/1	EGB	PREPARED SPACE	18
20/1	EGB	PREPARED SPACE	20
20/1	EGB	PREPARED SPACE	22
20/1	EGB	PREPARED SPACE	24
20/1	EGB	PREPARED SPACE	26
20/1	EGB	PREPARED SPACE	28
20/1	EGB	PREPARED SPACE	30



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC62S
BOX CAT#: MH62BE
DIMENSIONS:
62''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 12.75
SIDE – 4.1
PBA: PBA553T

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
BLANK ENDWALLS
COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 120kA
SPD LINE TO GRD PROTECT

----------STANDARD EQUIPMENT NAMEPLATE----------
Engraved as Follows

(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 480Y/277V 3Ph 4W 60Hz
System Ampacity: 150A
22kA SYMS. SCCR

MAIN: MAIN BREAKER JG 150A
Bottom FEED
35kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 4/0 AWG

BRANCH MOUNTING TYPE: BOLT-ON

----------BRANCH SUMMATION----------

3 – 70A/3P EGB
1 – 15A/3P EGB
18 – 20A/1P-PS EGB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4SH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-016-01	PG 1 OF 2 REV –

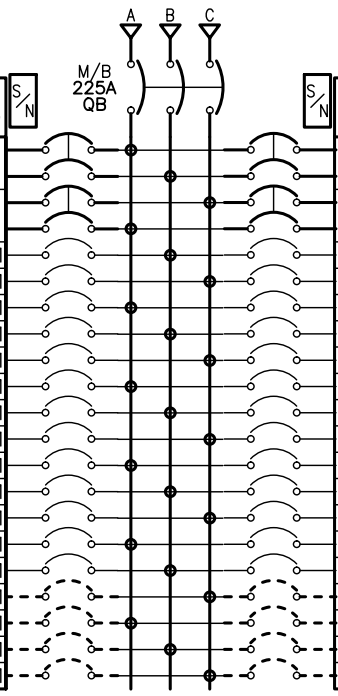
REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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PHYSICAL DATA CONTINUED

LINE 1: 4SH1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4SH1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NF (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–016–01	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1		QOB	25/2	25/2	QOB		2
3							4
5		QOB	25/2	25/2	QOB		6
7							8
9		QOB	30/1	20/1	QOB		10
11		QOB	20/1	20/1	QOB		12
13		QOB	20/1	20/1	QOB		14
15		QOB	20/1	20/1	QOB		16
17		QOB	20/1	20/1	QOB		18
19		QOB	20/1	20/1	QOB		20
21		QOB	20/1	20/1	QOB		22
23		QOB	20/1	20/1	QOB		24
25		QOB	20/1	20/1	QOB		26
27		QOB	20/1	20/1	QOB		28
29		QOB	20/1	20/1	QOB		30
31		QOB	20/1	20/1	QOB		32
33		QOB	20/1	15/1	QOB		34
35	PREPARED SPACE	QOB	20/1	20/1	QOB	PREPARED SPACE	36
37	PREPARED SPACE	QOB	20/1	20/1	QOB	PREPARED SPACE	38
39	PREPARED SPACE	QOB	20/1	20/1	QOB	PREPARED SPACE	40
41	PREPARED SPACE	QOB	20/1	20/1	QOB	PREPARED SPACE	42

PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 10.47
BOTTOM – 5
SIDE – 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
BLANK ENDWALLS
COPPER SOLID NEUTRAL

----------STANDARD EQUIPMENT NAMEPLATE----------
Engraved as Follows
LINE 1: BNL1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw-on

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A
Top FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

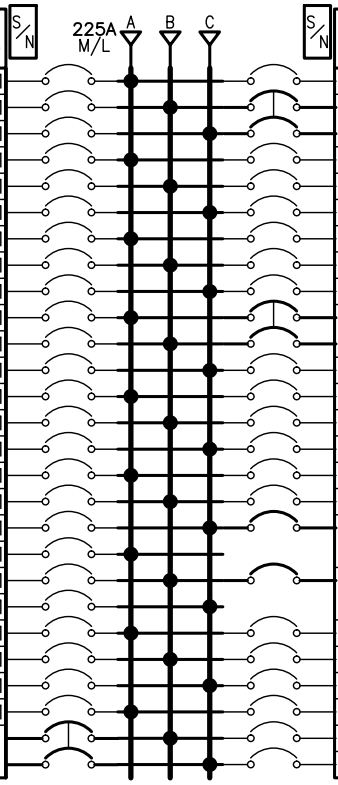
----------BRANCH SUMMATION----------

4 – 25A/2P QOB	1 – 30A/1P QOB
24 – 20A/1P QOB	8 – 20A/1P-PS QOB
1 – 15A/1P QOB	

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	BNL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-017-01	PG 1 OF 1 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P	S/N
1		QOB	20/1	
3		QOB	20/1	
5		QOB	20/1	
7		QOB	20/1	
9		QOB	20/1	
11		QOB	20/1	
13		QOB	20/1	
15		QOB	20/1	
17		QOB	15/1	
19		QOB	15/1	
21		QOB	20/1	
23		QOB	20/1	
25		QOB	15/1	
27		QOB	20/1	
29		QOB	20/1	
31		QOB	20/1	
33		QOB	20/1	
35		QOB	20/1	
37		QOB	20/1	
39		QOB	20/1	
41		QOB	20/1	
43		QOB	20/1	
45		QOB	20/1	
47		QOB	20/1	
49		QOB	20/1	
51		QOB	100/2	
53				



S/N	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
	20/1	QOB		2
	60/2	QOB		4
				6
	20/1	QOB		8
	20/1	QOB		10
	20/1	QOB		12
	20/1	QOB		14
	20/1	QOB		16
	20/1	QOB		18
	30/2	QOB		20
				22
	20/1	QOB		24
	20/1	QOB		26
	20/1	QOB		28
	20/1	QOB		30
	20/1	QOB		32
	20/1	QOB		34
	20/1	QOB	ST 120Vac	36
				38
	20/1	QOB	ST 120Vac	40
				42
	20/1	QOB		44
	20/1	QOB		46
	20/1	QOB		48
	20/1	QOB		50
	20/1	QOB		52
	20/1	QOB		54

PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC38S
BOX CAT#: MH38BE
DIMENSIONS:
38''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 9.26
BOTTOM – 5
SIDE – 6.13
PBA: 701A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR

(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR

MAIN: MAIN LUGS : 225A
Top FEED
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#6 – 350 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

----------BRANCH SUMMATION----------

41 – 20A/1P QOB	3 – 15A/1P QOB
1 – 100A/2P QOB	1 – 60A/2P QOB
1 – 30A/2P QOB	2 – 20A/1P QOB ST

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1NL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-018-01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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PHYSICAL DATA CONTINUED

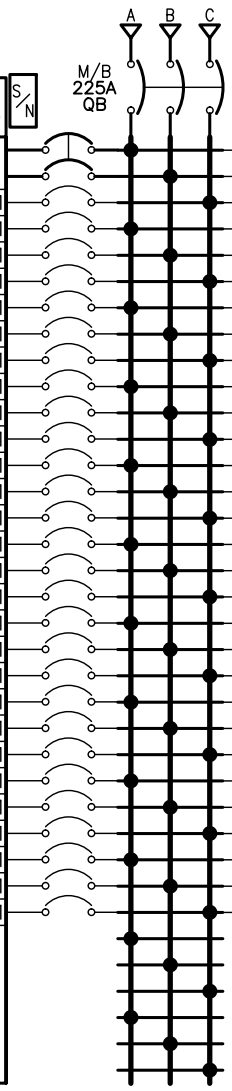
BLANK ENDWALLS
COPPER SOLID NEUTRAL

----------STANDARD EQUIPMENT NAMEPLATE----------

Engraved as Follows
LINE 1: 1NL2
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1NL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–018–01	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1		QOB	30/2	20/1	QOB		2
3				20/1	QOB		4
5		QOB	20/1	20/1	QOB		6
7		QOB	20/1	20/1	QOB		8
9		QOB	20/1	20/1	QOB		10
11		QOB	20/1	20/1	QOB		12
13		QOB	20/1	20/1	QOB		14
15		QOB	20/1	20/1	QOB		16
17		QOB	20/1	30/1	QOB		18
19		QOB	20/1	20/1	QOB		20
21		QOB	20/1	20/1	QOB		22
23		QOB	20/1	20/1	QOB		24
25		QOB	20/1	20/1	QOB		26
27		QOB	20/1	20/1	QOB		28
29		QOB	20/1	20/1	QOB		30
31		QOB	20/1	20/1	QOB		32
33		QOB	20/1	20/1	QOB		34
35		QOB	20/1	20/1	QOB		36
37		QOB	20/1	20/1	QOB		38
39		QOB	20/1	20/1	QOB		40
41		QOB	20/1	20/1	QOB		42
43		QOB	20/1	20/1	QOB		44
45		QOB	20/1	20/1	QOB		46
47		QOB	20/1	20/1	QOB		48
49		QOB	20/1	20/1	QOB		50
51		QOB	15/1	20/1	QOB		52
53		QOB	15/1	20/1	QOB		54
55		QOB	20/1	20/1	QOB		56
57		QOB	20/1	20/1	QOB		58
59		QOB	20/1	20/1	QOB		60
61							62
63							64
65							66
67							68
69							70
71	BLANK					BLANK	72

PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC56S
BOX CAT#: MH56BE
DIMENSIONS:
56''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 10.47
BOTTOM – 5
SIDE – 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR

(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A
Top FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil

BRANCH MOUNTING TYPE: BOLT–ON

----------BRANCH SUMMATION----------

1 – 30A/2P QOB
2 – 15A/1P QOB
55 – 20A/1P QOB
1 – 30A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1NL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–019–01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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PHYSICAL DATA CONTINUED

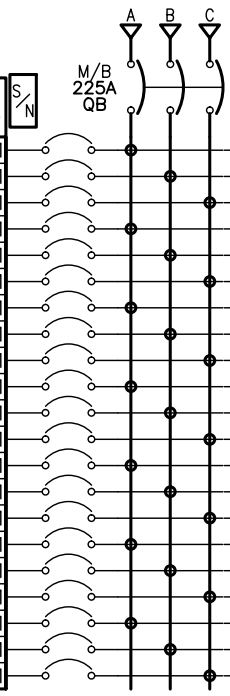
BLANK ENDWALLS
COPPER SOLID NEUTRAL

----------STANDARD EQUIPMENT NAMEPLATE----------

Engraved as Follows
LINE 1: 1NL1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1NL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–019–01	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P	S/N	S/N	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1		QOB	20/1			20/1	QOB		2
3		QOB	20/1			20/1	QOB		4
5		QOB	20/1			20/1	QOB		6
7		QOB	20/1			20/1	QOB		8
9		QOB	20/1			20/1	QOB		10
11		QOB	20/1			20/1	QOB		12
13		QOB	20/1			20/1	QOB		14
15		QOB	20/1			20/1	QOB		16
17		QOB	20/1			20/1	QOB		18
19		QOB	20/1			20/1	QOB		20
21		QOB	20/1			20/1	QOB		22
23		QOB	20/1			20/1	QOB		24
25		QOB	20/1			20/1	QOB		26
27		QOB	20/1			20/1	QOB		28
29		QOB	20/1			20/1	QOB		30
31		QOB	20/1			20/1	QOB		32
33		QOB	20/1			20/1	QOB		34
35		QOB	20/1			20/1	QOB		36
37		QOB	20/1			20/1	QOB		38
39		QOB	20/1			20/1	QOB		40
41		QOB	20/1			15/1	QOB		42

PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 10.47
BOTTOM – 5
SIDE – 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
BLANK ENDWALLS
COPPER SOLID NEUTRAL

----------STANDARD EQUIPMENT NAMEPLATE----------
Engraved as Follows
LINE 1: 1NL3
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw-on

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A
Top FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

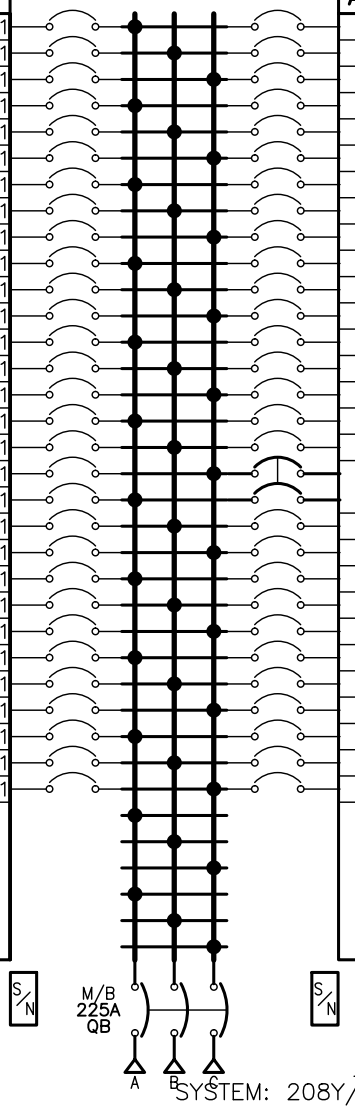
----------BRANCH SUMMATION----------
41 – 20A/1P QOB
1 – 15A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1NL3
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-020-01	PG 1 OF 1 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		QOB	20/1
3		QOB	20/1
5		QOB	20/1
7		QOB	20/1
9		QOB	20/1
11		QOB	20/1
13		QOB	20/1
15		QOB	20/1
17		QOB	20/1
19		QOB	20/1
21		QOB	20/1
23		QOB	20/1
25		QOB	20/1
27		QOB	20/1
29		QOB	20/1
31		QOB	20/1
33		QOB	20/1
35		QOB	20/1
37		QOB	20/1
39		QOB	20/1
41		QOB	20/1
43		QOB	20/1
45		QOB	20/1
47		QOB	20/1
49		QOB	20/1
51		QOB	15/1
53		QOB	20/1
55		QOB	20/1
57		QOB	20/1
59		QOB	20/1
61			
63			
65			
67			
69			
71	BLANK		

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/1	QOB		2
20/1	QOB		4
20/1	QOB		6
20/1	QOB		8
20/1	QOB		10
20/1	QOB		12
20/1	QOB		14
20/1	QOB		16
20/1	QOB		18
20/1	QOB		20
20/1	QOB		22
20/1	QOB		24
20/1	QOB		26
20/1	QOB		28
20/1	QOB		30
30/1	QOB		32
20/1	QOB		34
20/2	QOB		36
			38
20/1	QOB		40
20/1	QOB		42
15/1	QOB		44
20/1	QOB		46
20/1	QOB		48
20/1	QOB		50
20/1	QOB		52
20/1	QOB		54
20/1	QOB		56
20/1	QOB		58
20/1	QOB		60
			62
			64
			66
			68
			70
		BLANK	72



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC56S
BOX CAT#: MH56BE
DIMENSIONS:
56''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 10.47
SIDE – 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR

(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A
Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil

BRANCH MOUNTING TYPE: BOLT–ON

----------BRANCH SUMMATION----------

55 – 20A/1P QOB
1 – 30A/1P QOB
2 – 15A/1P QOB
1 – 20A/2P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2NL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–021–01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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PHYSICAL DATA CONTINUED

BLANK ENDWALLS
COPPER SOLID NEUTRAL

----------STANDARD EQUIPMENT NAMEPLATE----------

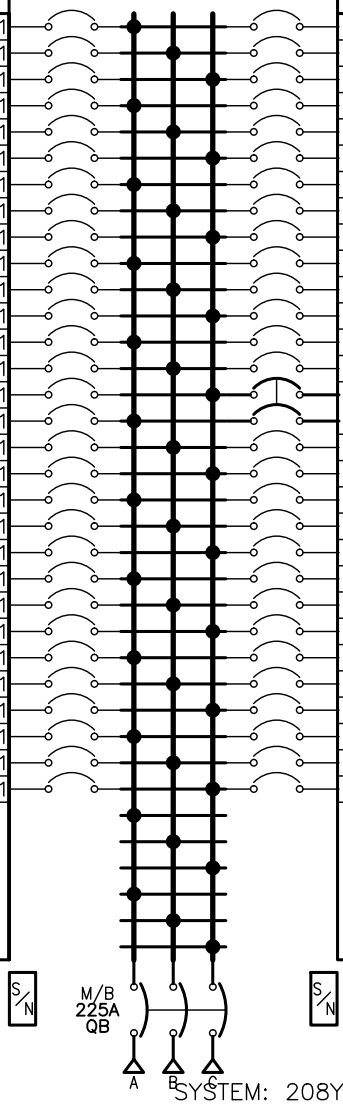
Engraved as Follows
LINE 1: 2NL1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	**2NL1**
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# **037999262–021–01**	PG **2** OF **2** REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		QOB	20/1
3		QOB	20/1
5		QOB	20/1
7		QOB	20/1
9		QOB	20/1
11		QOB	20/1
13		QOB	20/1
15		QOB	20/1
17		QOB	20/1
19		QOB	20/1
21		QOB	20/1
23		QOB	20/1
25		QOB	20/1
27		QOB	20/1
29		QOB	20/1
31		QOB	20/1
33		QOB	20/1
35		QOB	20/1
37		QOB	20/1
39		QOB	20/1
41		QOB	20/1
43		QOB	20/1
45		QOB	20/1
47		QOB	20/1
49		QOB	20/1
51		QOB	20/1
53		QOB	20/1
55		QOB	20/1
57		QOB	20/1
59		QOB	20/1
61			
63			
65			
67			
69			
71	BLANK		

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/1	QOB		2
20/1	QOB		4
20/1	QOB		6
20/1	QOB		8
20/1	QOB		10
20/1	QOB		12
20/1	QOB		14
20/1	QOB		16
20/1	QOB		18
20/1	QOB		20
20/1	QOB		22
30/1	QOB		24
20/1	QOB		26
20/1	QOB		28
20/2	QOB		30
			32
20/1	QOB		34
20/1	QOB		36
20/1	QOB		38
20/1	QOB		40
20/1	QOB		42
20/1	QOB		44
20/1	QOB		46
20/1	QOB		48
20/1	QOB		50
20/1	QOB		52
20/1	QOB		54
20/1	QOB		56
20/1	QOB		58
20/1	QOB		60
			62
			64
			66
			68
			70
		BLANK	72



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC56S
BOX CAT#: MH56BE
DIMENSIONS:
56''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 10.47
SIDE – 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR

(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A
Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil

BRANCH MOUNTING TYPE: BOLT–ON

----------BRANCH SUMMATION----------

57 – 20A/1P QOB
1 – 20A/2P QOB
1 – 30A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3NL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–022–01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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PHYSICAL DATA CONTINUED

BLANK ENDWALLS
COPPER SOLID NEUTRAL

----------STANDARD EQUIPMENT NAMEPLATE----------

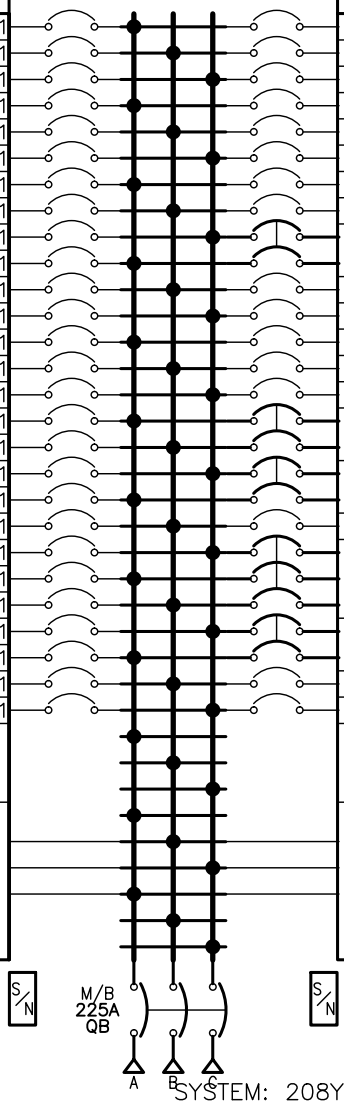
Engraved as Follows
LINE 1: 3NL1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3NL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–022–01	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		QOB	20/1
3		QOB	20/1
5		QOB	20/1
7		QOB	20/1
9		QOB	20/1
11		QOB	20/1
13		QOB	20/1
15		QOB	20/1
17		QOB	20/1
19		QOB	20/1
21		QOB	20/1
23		QOB	20/1
25		QOB	20/1
27		QOB	20/1
29		QOB	20/1
31		QOB	20/1
33		QOB	20/1
35		QOB	20/1
37		QOB	20/1
39		QOB	20/1
41		QOB	20/1
43		QOB	20/1
45		QOB	20/1
47		QOB	20/1
49		QOB	20/1
51		QOB	20/1
53		QOB	20/1
55			
57			
59	BLANK		
	Surge Counter Dry Contacts	SPD 100kA/3	

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/1	QOB		2
20/1	QOB		4
20/1	QOB		6
20/1	QOB		8
20/1	QOB		10
20/1	QOB		12
20/1	QOB		14
20/1	QOB		16
30/2	QOB		18
			20
20/1	QOB		22
20/1	QOB		24
20/1	QOB		26
20/1	QOB		28
20/1	QOB		30
25/2	QOB		32
			34
25/2	QOB		36
			38
20/1	QOB		40
15/3	QOB		42
			44
			46
20/2	QOB		48
			50
20/1	QOB		52
20/1	QOB		54
			56
			58
		BLANK	60
SPD 100kA/3		Surge Counter Dry Contacts	



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC56S
BOX CAT#: MH56BE
DIMENSIONS:
56''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 10.47
SIDE – 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR

(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A
Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil

BRANCH MOUNTING TYPE: BOLT–ON

----------BRANCH SUMMATION----------

43 – 20A/1P QOB
2 – 25A/2P QOB
1 – 20A/2P QOB
1 – 30A/2P QOB
1 – 15A/3P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4NL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–023–01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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PHYSICAL DATA CONTINUED

BLANK ENDWALLS
COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

----------STANDARD EQUIPMENT NAMEPLATE----------

Engraved as Follows
LINE 1: 4NL1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4NL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–023–01	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

CKT NO	ACCESSORIES	TYPE	RATING AMP/P	S/N	225A M/L A B C	S/N	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
	Surge Counter Dry Contacts	SPD 100kA/3						SPD 100kA/3	Surge Counter Dry Contacts	
13		QOB	20/1				20/1	QOB		14
15		QOB	20/1				20/1	QOB		16
17		QOB	20/1				20/1	QOB		18
19		QOB	20/1				20/1	QOB		20
21		QOB	20/1				20/1	QOB		22
23		QOB	20/1				20/1	QOB		24
25		QOB	20/1				20/1	QOB		26
27		QOB	20/1				20/1	QOB		28
29		QOB	20/1				20/1	QOB		30
31		QOB	20/1				20/1	QOB		32
33		QOB	20/1				20/1	QOB		34
35		QOB	20/1				20/1	QOB		36
37		QOB	20/1				20/1	QOB		38
39		QOB	20/1				20/1	QOB		40
41		QOB	20/1				20/1	QOB		42
43		QOB	20/1				20/1	QOB		44
45		QOB	20/1				20/1	QOB		46
47		QOB	20/1				20/1	QOB		48
49		QOB	20/1				20/1	QOB		50
51		QOB	20/1				20/1	QOB		52
53		QOB	20/1				20/1	QOB		54

PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC38S
BOX CAT#: MH38BE
DIMENSIONS:
38''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 9.26
BOTTOM – 5
SIDE – 6.13
PBA: 701A
BUSSING: Copper
Silver/Tin Plated
OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR
MAIN: MAIN LUGS : 225A
Top FEED
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#6 – 350 kcmil
BRANCH MOUNTING TYPE: BOLT-ON
----------BRANCH SUMMATION----------
42 – 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1LL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-024-01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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PHYSICAL DATA CONTINUED

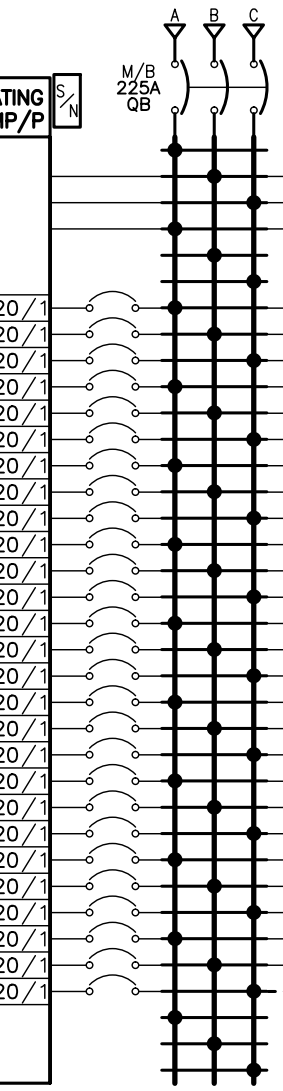
COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

----------STANDARD EQUIPMENT NAMEPLATE----------

Engraved as Follows
LINE 1: 1LL1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1LL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–024–01	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P	S/N	S/N	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
	Surge Counter Dry Contacts	SPD 100kA/3					SPD 100kA/3	Surge Counter Dry Contacts	
13		QOB	20/1			20/1	QOB		14
15		QOB	20/1			20/1	QOB		16
17		QOB	20/1			20/1	QOB		18
19		QOB	20/1			20/1	QOB		20
21		QOB	20/1			20/1	QOB		22
23		QOB	20/1			20/1	QOB		24
25		QOB	20/1			20/1	QOB		26
27		QOB	20/1			20/1	QOB		28
29		QOB	20/1			20/1	QOB		30
31		QOB	20/1			20/1	QOB		32
33		QOB	20/1			20/1	QOB		34
35		QOB	20/1			20/1	QOB		36
37		QOB	20/1			20/1	QOB		38
39		QOB	20/1			20/1	QOB		40
41		QOB	20/1			20/1	QOB		42
43		QOB	20/1			20/1	QOB		44
45		QOB	20/1			20/1	QOB		46
47		QOB	20/1			20/1	QOB		48
49		QOB	20/1			20/1	QOB		50
51		QOB	20/1			20/1	QOB		52
53		QOB	20/1			20/1	QOB		54
55		QOB	20/1			20/1	QOB		56
57		QOB	20/1			20/1	QOB		58
59		QOB	20/1			20/1	QOB		60
61		QOB	20/1			20/1	QOB		62
63		QOB	20/1			20/1	QOB		64
65		QOB	20/1			20/1	QOB	PREPARED SPACE	66
67									68
69									70
71	BLANK							BLANK	72

PHYSICAL DATA

ENCLOSURE Type 1
Flush with Door
FRONT CAT#: NC56F
BOX CAT#: MH56BE
DIMENSIONS:
56''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 10.47
BOTTOM – 5
SIDE – 6.13
PBA: 707A
BUSSING: Copper
Silver/Tin Plated
OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR
MAIN: MAIN BREAKER QB 225A
Top FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil
BRANCH MOUNTING TYPE: BOLT–ON
----------BRANCH SUMMATION----------
53 – 20A/1P QOB
1 – 20A/1P–PS QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1LL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–025–01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

----------STANDARD EQUIPMENT NAMEPLATE----------

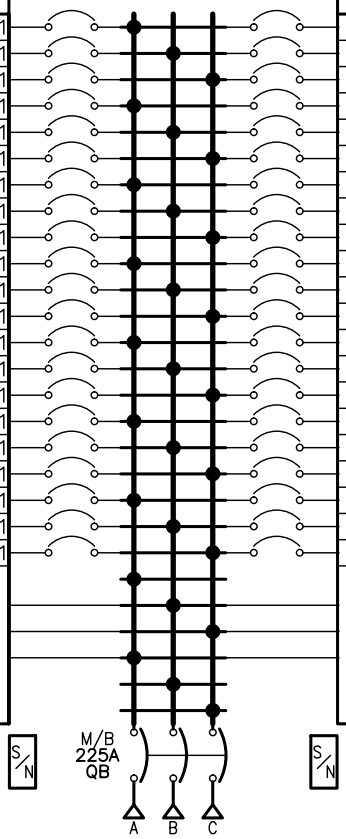
Engraved as Follows
LINE 1: 1LL2
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1LL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–025–01	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		QOB	20/1
3		QOB	20/1
5		QOB	20/1
7		QOB	20/1
9		QOB	20/1
11		QOB	20/1
13		QOB	20/1
15		QOB	20/1
17		QOB	20/1
19		QOB	20/1
21		QOB	20/1
23		QOB	20/1
25		QOB	20/1
27		QOB	20/1
29		QOB	20/1
31		QOB	15/1
33		QOB	20/1
35		QOB	20/1
37		QOB	20/1
39		QOB	20/1
41		QOB	20/1
	Surge Counter Dry Contacts	SPD 100kA/3	

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/1	QOB		2
20/1	QOB		4
20/1	QOB		6
20/1	QOB		8
20/1	QOB		10
20/1	QOB		12
20/1	QOB		14
20/1	QOB		16
20/1	QOB		18
20/1	QOB		20
20/1	QOB		22
20/1	QOB		24
20/1	QOB		26
20/1	QOB		28
20/1	QOB		30
20/1	QOB		32
20/1	QOB		34
20/1	QOB		36
20/1	QOB		38
20/1	QOB		40
20/1	QOB		42
	SPD 100kA/3	Surge Counter Dry Contacts	



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 10.47
SIDE – 6.13
PBA: 707A
BUSSING: Copper
Silver/Tin Plated
OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR
MAIN: MAIN BREAKER QB 225A
Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil
BRANCH MOUNTING TYPE: BOLT–ON
----------BRANCH SUMMATION----------
41 – 20A/1P QOB
1 – 15A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2LL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–026–01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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PHYSICAL DATA CONTINUED

BLANK ENDWALLS
COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

----------STANDARD EQUIPMENT NAMEPLATE----------

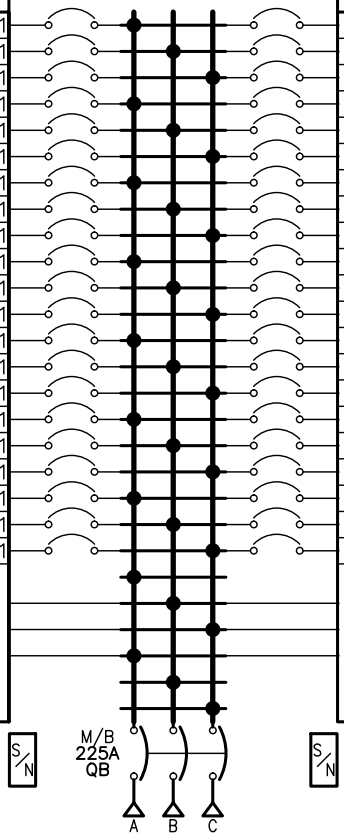
Engraved as Follows
LINE 1: 2LL1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2LL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–026–01	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		QOB	20/1
3		QOB	20/1
5		QOB	20/1
7		QOB	20/1
9		QOB	20/1
11		QOB	20/1
13		QOB	20/1
15		QOB	20/1
17		QOB	20/1
19		QOB	20/1
21		QOB	20/1
23		QOB	20/1
25		QOB	20/1
27		QOB	20/1
29		QOB	20/1
31		QOB	20/1
33		QOB	20/1
35		QOB	20/1
37		QOB	20/1
39		QOB	20/1
41		QOB	20/1
	Surge Counter Dry Contacts	SPD 100kA/3	

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/1	QOB		2
20/1	QOB		4
20/1	QOB		6
20/1	QOB		8
20/1	QOB		10
20/1	QOB		12
20/1	QOB		14
20/1	QOB		16
20/1	QOB		18
20/1	QOB		20
20/1	QOB		22
20/1	QOB		24
20/1	QOB		26
20/1	QOB		28
20/1	QOB		30
20/1	QOB		32
20/1	QOB		34
20/1	QOB		36
20/1	QOB		38
20/1	QOB		40
20/1	QOB		42
	SPD 100kA/3	Surge Counter Dry Contacts	



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 10.47
SIDE – 6.13
PBA: 707A
BUSSING: Copper
Silver/Tin Plated
OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
COPPER SOLID NEUTRAL
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR
MAIN: MAIN BREAKER QB 225A
Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil
BRANCH MOUNTING TYPE: BOLT–ON
----------BRANCH SUMMATION----------
42 – 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2LL3
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–027–01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

PHYSICAL DATA CONTINUED

SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

----------STANDARD EQUIPMENT NAMEPLATE----------

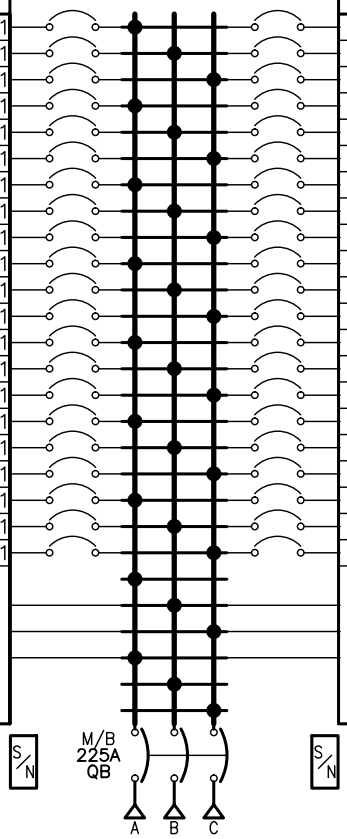
Engraved as Follows
LINE 1: 2LL3
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw-on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2LL3
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-027-01	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		QOB	20/1
3		QOB	20/1
5		QOB	20/1
7		QOB	20/1
9		QOB	20/1
11		QOB	20/1
13		QOB	20/1
15		QOB	20/1
17		QOB	20/1
19		QOB	20/1
21		QOB	20/1
23		QOB	20/1
25		QOB	20/1
27		QOB	20/1
29		QOB	20/1
31		QOB	20/1
33		QOB	20/1
35		QOB	20/1
37		QOB	20/1
39		QOB	20/1
41		QOB	20/1
	Surge Counter Dry Contacts	SPD 100kA/3	

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/1	QOB		2
20/1	QOB		4
20/1	QOB		6
20/1	QOB		8
20/1	QOB		10
20/1	QOB		12
20/1	QOB		14
20/1	QOB		16
20/1	QOB		18
20/1	QOB		20
20/1	QOB		22
20/1	QOB		24
20/1	QOB		26
20/1	QOB		28
20/1	QOB		30
20/1	QOB		32
20/1	QOB		34
20/1	QOB		36
20/1	QOB		38
20/1	QOB		40
20/1	QOB		42
	SPD 100kA/3	Surge Counter Dry Contacts	



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 10.47
SIDE – 6.13
PBA: 707A
BUSSING: Copper
Silver/Tin Plated
OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR
MAIN: MAIN BREAKER QB 225A
Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil
BRANCH MOUNTING TYPE: BOLT–ON
----------BRANCH SUMMATION----------
42 – 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2LL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–028–01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

----------STANDARD EQUIPMENT NAMEPLATE----------

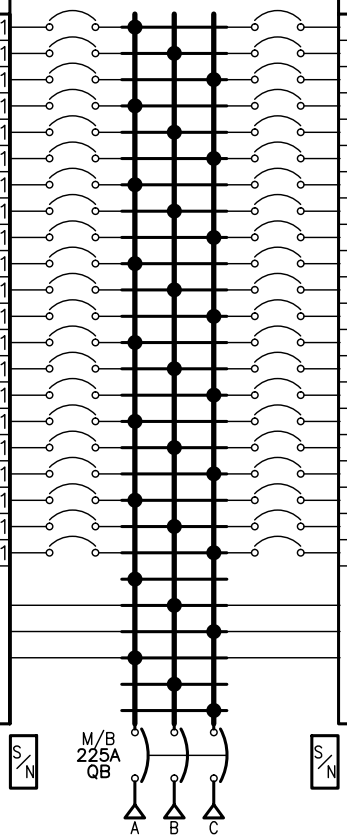
Engraved as Follows
LINE 1: 2LL2
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2LL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–028–01	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		QOB	20/1
3		QOB	20/1
5		QOB	20/1
7		QOB	20/1
9		QOB	20/1
11		QOB	20/1
13		QOB	20/1
15		QOB	20/1
17		QOB	20/1
19		QOB	20/1
21		QOB	20/1
23		QOB	20/1
25		QOB	20/1
27		QOB	20/1
29		QOB	20/1
31		QOB	20/1
33		QOB	20/1
35		QOB	20/1
37		QOB	20/1
39		QOB	20/1
41		QOB	20/1
	Surge Counter Dry Contacts	SPD 100kA/3	

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/1	QOB		2
20/1	QOB		4
20/1	QOB		6
20/1	QOB		8
20/1	QOB		10
20/1	QOB		12
20/1	QOB		14
20/1	QOB		16
20/1	QOB		18
20/1	QOB		20
20/1	QOB		22
20/1	QOB		24
20/1	QOB		26
20/1	QOB		28
20/1	QOB		30
20/1	QOB		32
20/1	QOB		34
20/1	QOB		36
20/1	QOB		38
20/1	QOB		40
20/1	QOB		42
	SPD 100kA/3	Surge Counter Dry Contacts	



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 10.47
SIDE – 6.13
PBA: 707A
BUSSING: Copper
Silver/Tin Plated
OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR
MAIN: MAIN BREAKER QB 225A
Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil
BRANCH MOUNTING TYPE: BOLT–ON
----------BRANCH SUMMATION----------
42 – 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2LL4
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–029–01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

----------STANDARD EQUIPMENT NAMEPLATE----------

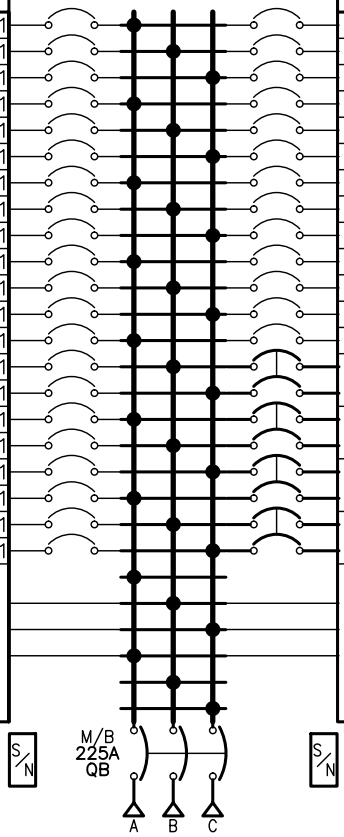
Engraved as Follows
LINE 1: 2LL4
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	**2LL4**
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# **037999262–029–01**	PG **2** OF **2** REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		QOB	20/1
3		QOB	20/1
5		QOB	20/1
7		QOB	20/1
9		QOB	20/1
11		QOB	20/1
13		QOB	20/1
15		QOB	20/1
17		QOB	20/1
19		QOB	20/1
21		QOB	20/1
23		QOB	20/1
25		QOB	20/1
27		QOB	20/1
29		QOB	20/1
31		QOB	20/1
33		QOB	20/1
35		QOB	20/1
37		QOB	20/1
39		QOB	20/1
41		QOB	20/1
	Surge Counter Dry Contacts	SPD 100kA/3	

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/1	QOB		2
20/1	QOB		4
20/1	QOB		6
20/1	QOB		8
20/1	QOB		10
20/1	QOB		12
20/1	QOB		14
20/1	QOB		16
20/1	QOB		18
20/1	QOB		20
20/1	QOB		22
20/1	QOB		24
20/1	QOB		26
30/2	QOB		28
			30
30/2	QOB		32
			34
30/2	QOB		36
			38
30/2	QOB		40
			42
	SPD 100kA/3	Surge Counter Dry Contacts	



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 10.47
SIDE – 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR

(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 225A
Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil

BRANCH MOUNTING TYPE: BOLT–ON

----------BRANCH SUMMATION----------

34 – 20A/1P QOB
4 – 30A/2P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3LL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–030–01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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PHYSICAL DATA CONTINUED

BLANK ENDWALLS
COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

----------STANDARD EQUIPMENT NAMEPLATE----------

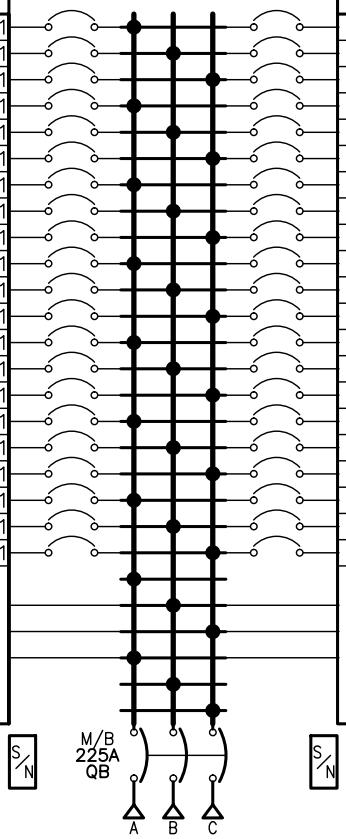
Engraved as Follows
LINE 1: 3LL1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3LL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–030–01	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		QOB	20/1
3		QOB	20/1
5		QOB	20/1
7		QOB	20/1
9		QOB	20/1
11		QOB	20/1
13		QOB	20/1
15		QOB	20/1
17		QOB	20/1
19		QOB	20/1
21		QOB	20/1
23		QOB	20/1
25		QOB	20/1
27		QOB	20/1
29		QOB	20/1
31		QOB	20/1
33		QOB	20/1
35		QOB	20/1
37		QOB	20/1
39		QOB	20/1
41		QOB	20/1
	Surge Counter Dry Contacts	SPD 100kA/3	

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/1	QOB		2
20/1	QOB		4
20/1	QOB		6
20/1	QOB		8
20/1	QOB		10
20/1	QOB		12
20/1	QOB		14
20/1	QOB		16
20/1	QOB		18
20/1	QOB		20
20/1	QOB		22
20/1	QOB		24
20/1	QOB		26
20/1	QOB		28
20/1	QOB		30
20/1	QOB		32
20/1	QOB		34
20/1	QOB		36
20/1	QOB		38
20/1	QOB		40
20/1	QOB		42
	SPD 100kA/3	Surge Counter Dry Contacts	



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 10.47
SIDE – 6.13
PBA: 707A
BUSSING: Copper
Silver/Tin Plated
OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR
MAIN: MAIN BREAKER QB 225A
Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil
BRANCH MOUNTING TYPE: BOLT–ON
----------BRANCH SUMMATION----------
42 – 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3LL3
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–031–01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

----------STANDARD EQUIPMENT NAMEPLATE----------

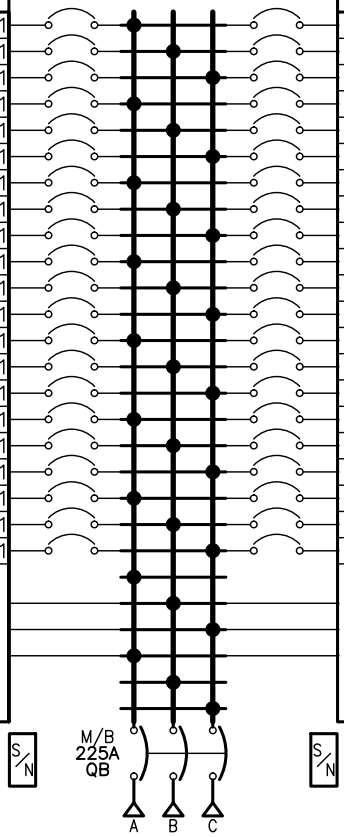
Engraved as Follows
LINE 1: 3LL3
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3LL3
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–031–01	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		QOB	20/1
3		QOB	20/1
5		QOB	20/1
7		QOB	20/1
9		QOB	20/1
11		QOB	20/1
13		QOB	20/1
15		QOB	20/1
17		QOB	20/1
19		QOB	20/1
21		QOB	20/1
23		QOB	20/1
25		QOB	20/1
27		QOB	20/1
29		QOB	20/1
31		QOB	20/1
33		QOB	20/1
35		QOB	20/1
37		QOB	20/1
39		QOB	20/1
41		QOB	20/1
	Surge Counter Dry Contacts	SPD 100kA/3	

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/1	QOB		2
20/1	QOB		4
20/1	QOB		6
20/1	QOB		8
20/1	QOB		10
20/1	QOB		12
20/1	QOB		14
20/1	QOB		16
20/1	QOB		18
20/1	QOB		20
20/1	QOB		22
20/1	QOB		24
20/1	QOB		26
20/1	QOB		28
20/1	QOB		30
20/1	QOB		32
20/1	QOB		34
20/1	QOB		36
20/1	QOB		38
20/1	QOB		40
20/1	QOB		42
	SPD 100kA/3	Surge Counter Dry Contacts	



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 10.47
SIDE – 6.13
PBA: 707A
BUSSING: Copper
Silver/Tin Plated
OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR
MAIN: MAIN BREAKER QB 225A
Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil
BRANCH MOUNTING TYPE: BOLT–ON
----------BRANCH SUMMATION----------
42 – 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3LL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–032–01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

----------STANDARD EQUIPMENT NAMEPLATE----------

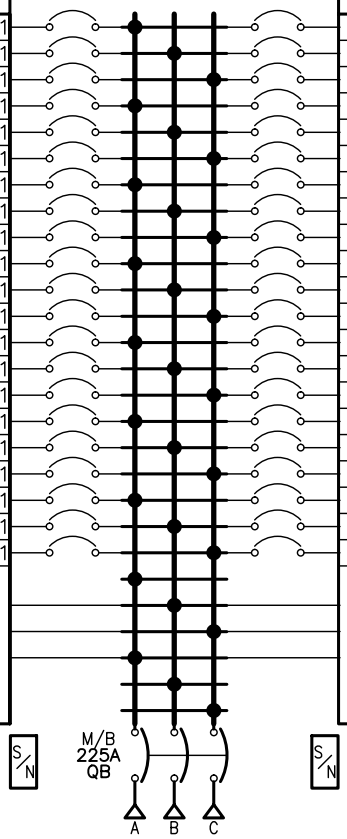
Engraved as Follows
LINE 1: 3LL2
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3LL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–032–01	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		QOB	20/1
3		QOB	20/1
5		QOB	20/1
7		QOB	20/1
9		QOB	20/1
11		QOB	20/1
13		QOB	20/1
15		QOB	20/1
17		QOB	20/1
19		QOB	20/1
21		QOB	20/1
23		QOB	20/1
25		QOB	20/1
27		QOB	20/1
29		QOB	20/1
31		QOB	20/1
33		QOB	20/1
35		QOB	20/1
37		QOB	20/1
39		QOB	20/1
41		QOB	20/1
	Surge Counter Dry Contacts	SPD 100kA/3	

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/1	QOB		2
20/1	QOB		4
20/1	QOB		6
20/1	QOB		8
20/1	QOB		10
20/1	QOB		12
20/1	QOB		14
20/1	QOB		16
20/1	QOB		18
20/1	QOB		20
20/1	QOB		22
20/1	QOB		24
20/1	QOB		26
20/1	QOB		28
20/1	QOB		30
20/1	QOB		32
20/1	QOB		34
20/1	QOB		36
20/1	QOB		38
20/1	QOB		40
20/1	QOB		42
	SPD 100kA/3	Surge Counter Dry Contacts	



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 10.47
SIDE – 6.13
PBA: 707A
BUSSING: Copper
Silver/Tin Plated
OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR
MAIN: MAIN BREAKER QB 225A
Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil
BRANCH MOUNTING TYPE: BOLT–ON
----------BRANCH SUMMATION----------
42 – 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3LL4
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–033–01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

----------STANDARD EQUIPMENT NAMEPLATE----------

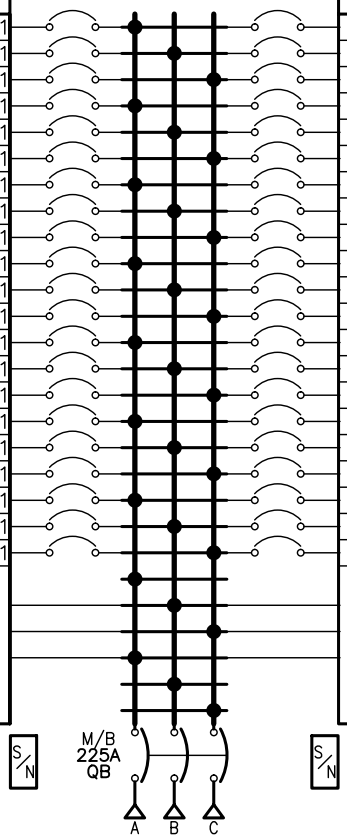
Engraved as Follows
LINE 1: 3LL4
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3LL4
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–033–01	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		QOB	20/1
3		QOB	20/1
5		QOB	20/1
7		QOB	20/1
9		QOB	20/1
11		QOB	20/1
13		QOB	20/1
15		QOB	20/1
17		QOB	20/1
19		QOB	20/1
21		QOB	20/1
23		QOB	20/1
25		QOB	20/1
27		QOB	20/1
29		QOB	20/1
31		QOB	20/1
33		QOB	20/1
35		QOB	20/1
37		QOB	20/1
39		QOB	20/1
41		QOB	20/1
	Surge Counter Dry Contacts	SPD 100kA/3	

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/1	QOB		2
20/1	QOB		4
20/1	QOB		6
20/1	QOB		8
20/1	QOB		10
20/1	QOB		12
20/1	QOB		14
20/1	QOB		16
20/1	QOB		18
20/1	QOB		20
20/1	QOB		22
20/1	QOB		24
20/1	QOB		26
20/1	QOB		28
20/1	QOB		30
20/1	QOB		32
20/1	QOB		34
20/1	QOB		36
20/1	QOB		38
20/1	QOB		40
20/1	QOB		42
	SPD 100kA/3	Surge Counter Dry Contacts	



PHYSICAL DATA

ENCLOSURE Type 1
Flush with Door
FRONT CAT#: NC50F
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 10.47
SIDE – 6.13
PBA: 707A
BUSSING: Copper
Silver/Tin Plated
OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR
MAIN: MAIN BREAKER QB 225A
Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil
BRANCH MOUNTING TYPE: BOLT–ON
----------BRANCH SUMMATION----------
42 – 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3LL5
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–034–01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

----------STANDARD EQUIPMENT NAMEPLATE----------

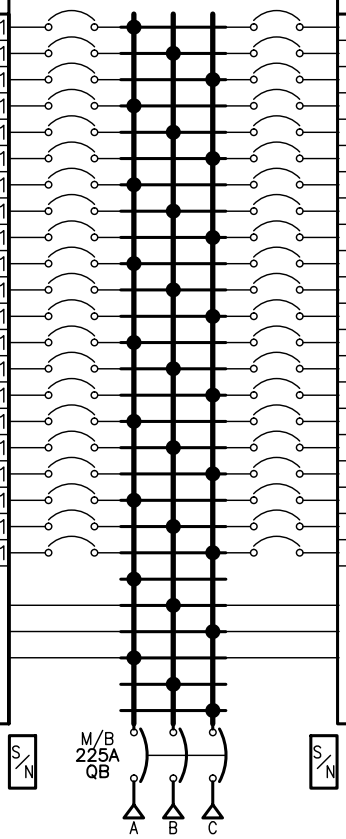
Engraved as Follows
LINE 1: 3LL5
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	3LL5
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–034–01	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		QOB	20/1
3		QOB	20/1
5		QOB	20/1
7		QOB	20/1
9		QOB	20/1
11		QOB	20/1
13		QOB	20/1
15		QOB	20/1
17		QOB	20/1
19		QOB	20/1
21		QOB	20/1
23		QOB	20/1
25		QOB	20/1
27		QOB	20/1
29		QOB	20/1
31		QOB	20/1
33		QOB	20/1
35		QOB	20/1
37		QOB	20/1
39		QOB	20/1
41		QOB	20/1
	Surge Counter Dry Contacts	SPD 100kA/3	

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/1	QOB		2
20/1	QOB		4
20/1	QOB		6
20/1	QOB		8
20/1	QOB		10
20/1	QOB		12
20/1	QOB		14
20/1	QOB		16
20/1	QOB		18
20/1	QOB		20
20/1	QOB		22
20/1	QOB		24
20/1	QOB		26
20/1	QOB		28
20/1	QOB		30
20/1	QOB		32
20/1	QOB		34
20/1	QOB		36
20/1	QOB		38
20/1	QOB		40
20/1	QOB		42
	SPD 100kA/3	Surge Counter Dry Contacts	



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 10.47
SIDE – 6.13
PBA: 707A
BUSSING: Copper
Silver/Tin Plated
OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR
MAIN: MAIN BREAKER QB 225A
Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil
BRANCH MOUNTING TYPE: BOLT–ON
----------BRANCH SUMMATION----------
42 – 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4LL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–035–01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

----------STANDARD EQUIPMENT NAMEPLATE----------

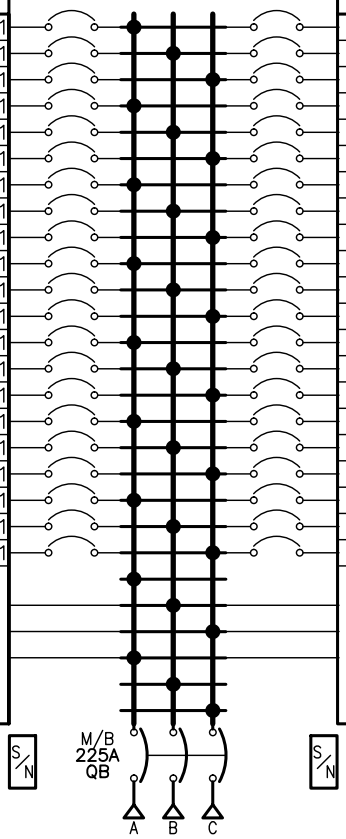
Engraved as Follows
LINE 1: 4LL1
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4LL1
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–035–01	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		QOB	20/1
3		QOB	20/1
5		QOB	20/1
7		QOB	20/1
9		QOB	20/1
11		QOB	20/1
13		QOB	20/1
15		QOB	20/1
17		QOB	20/1
19		QOB	20/1
21		QOB	20/1
23		QOB	20/1
25		QOB	20/1
27		QOB	20/1
29		QOB	20/1
31		QOB	20/1
33		QOB	20/1
35		QOB	20/1
37		QOB	20/1
39		QOB	20/1
41		QOB	20/1
	Surge Counter Dry Contacts	SPD 100kA/3	

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/1	QOB		2
20/1	QOB		4
20/1	QOB		6
20/1	QOB		8
20/1	QOB		10
20/1	QOB		12
20/1	QOB		14
20/1	QOB		16
20/1	QOB		18
20/1	QOB		20
20/1	QOB		22
20/1	QOB		24
20/1	QOB		26
20/1	QOB		28
20/1	QOB		30
20/1	QOB		32
20/1	QOB		34
20/1	QOB		36
20/1	QOB		38
20/1	QOB		40
20/1	QOB		42
	SPD 100kA/3	Surge Counter Dry Contacts	



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 10.47
SIDE – 6.13
PBA: 707A
BUSSING: Copper
Silver/Tin Plated
OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR
MAIN: MAIN BREAKER QB 225A
Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil
BRANCH MOUNTING TYPE: BOLT–ON
----------BRANCH SUMMATION----------
42 – 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4LL3
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–036–01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

----------STANDARD EQUIPMENT NAMEPLATE----------

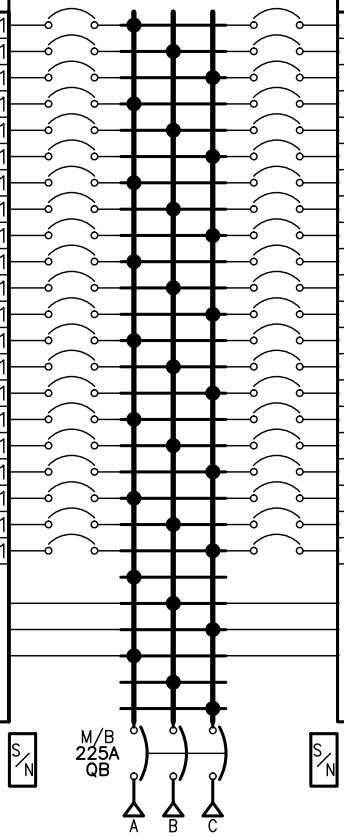
Engraved as Follows
LINE 1: 4LL3
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4LL3
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–036–01	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		QOB	20/1
3		QOB	20/1
5		QOB	20/1
7		QOB	20/1
9		QOB	20/1
11		QOB	20/1
13		QOB	20/1
15		QOB	20/1
17		QOB	20/1
19		QOB	20/1
21		QOB	20/1
23		QOB	20/1
25		QOB	20/1
27		QOB	20/1
29		QOB	20/1
31		QOB	20/1
33		QOB	20/1
35		QOB	20/1
37		QOB	20/1
39		QOB	20/1
41		QOB	20/1
	Surge Counter Dry Contacts	SPD 100kA/3	

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/1	QOB		2
20/1	QOB		4
20/1	QOB		6
20/1	QOB		8
20/1	QOB		10
20/1	QOB		12
20/1	QOB		14
20/1	QOB		16
20/1	QOB		18
20/1	QOB		20
20/1	QOB		22
20/1	QOB		24
20/1	QOB		26
20/1	QOB		28
20/1	QOB		30
20/1	QOB		32
20/1	QOB		34
20/1	QOB		36
20/1	QOB		38
20/1	QOB		40
20/1	QOB		42
	SPD 100kA/3	Surge Counter Dry Contacts	



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 10.47
SIDE – 6.13
PBA: 707A
BUSSING: Copper
Silver/Tin Plated
OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR
MAIN: MAIN BREAKER QB 225A
Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil
BRANCH MOUNTING TYPE: BOLT–ON
----------BRANCH SUMMATION----------
42 – 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4LL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–037–01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

----------STANDARD EQUIPMENT NAMEPLATE----------

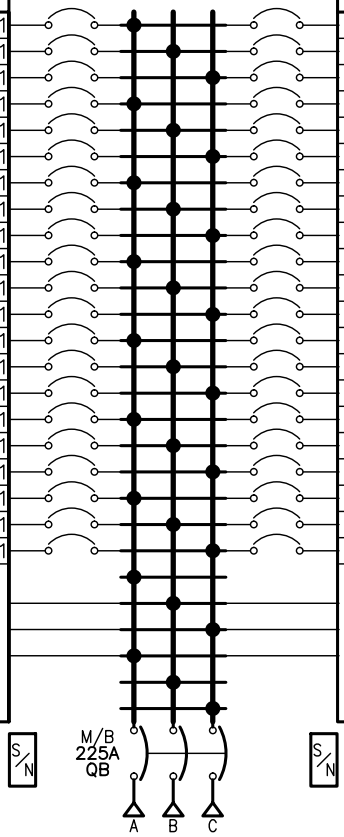
Engraved as Follows
LINE 1: 4LL2
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4LL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–037–01	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		QOB	20/1
3		QOB	20/1
5		QOB	20/1
7		QOB	20/1
9		QOB	20/1
11		QOB	20/1
13		QOB	20/1
15		QOB	20/1
17		QOB	20/1
19		QOB	20/1
21		QOB	20/1
23		QOB	20/1
25		QOB	20/1
27		QOB	20/1
29		QOB	20/1
31		QOB	20/1
33		QOB	20/1
35		QOB	20/1
37		QOB	20/1
39		QOB	20/1
41		QOB	20/1
	Surge Counter Dry Contacts	SPD 100kA/3	

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/1	QOB		2
20/1	QOB		4
20/1	QOB		6
20/1	QOB		8
20/1	QOB		10
20/1	QOB		12
20/1	QOB		14
20/1	QOB		16
20/1	QOB		18
20/1	QOB		20
20/1	QOB		22
20/1	QOB		24
20/1	QOB		26
20/1	QOB		28
20/1	QOB		30
20/1	QOB		32
20/1	QOB		34
20/1	QOB		36
20/1	QOB		38
20/1	QOB		40
20/1	QOB		42
	SPD 100kA/3	Surge Counter Dry Contacts	



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 10.47
SIDE – 6.13
PBA: 707A
BUSSING: Copper
Silver/Tin Plated
OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR
MAIN: MAIN BREAKER QB 225A
Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil
BRANCH MOUNTING TYPE: BOLT–ON
----------BRANCH SUMMATION----------
42 – 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4LL4
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–038–01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
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PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

----------STANDARD EQUIPMENT NAMEPLATE----------

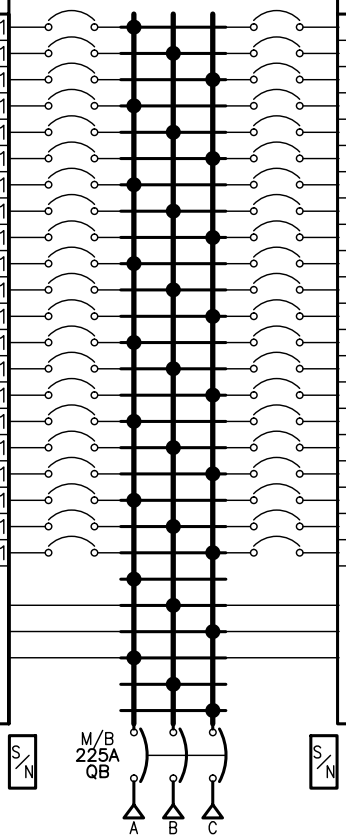
Engraved as Follows
LINE 1: 4LL4
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	**4LL4**
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# **037999262–038–01**	PG **2** OF **2** REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		QOB	20/1
3		QOB	20/1
5		QOB	20/1
7		QOB	20/1
9		QOB	20/1
11		QOB	20/1
13		QOB	20/1
15		QOB	20/1
17		QOB	20/1
19		QOB	20/1
21		QOB	20/1
23		QOB	20/1
25		QOB	20/1
27		QOB	20/1
29		QOB	20/1
31		QOB	20/1
33		QOB	20/1
35		QOB	20/1
37		QOB	20/1
39		QOB	20/1
41		QOB	20/1
	Surge Counter Dry Contacts	SPD 100kA/3	

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/1	QOB		2
20/1	QOB		4
20/1	QOB		6
20/1	QOB		8
20/1	QOB		10
20/1	QOB		12
20/1	QOB		14
20/1	QOB		16
20/1	QOB		18
20/1	QOB		20
20/1	QOB		22
20/1	QOB		24
20/1	QOB		26
20/1	QOB		28
20/1	QOB		30
20/1	QOB		32
20/1	QOB		34
20/1	QOB		36
20/1	QOB		38
20/1	QOB		40
20/1	QOB		42
	SPD 100kA/3	Surge Counter Dry Contacts	



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 10.47
SIDE – 6.13
PBA: 707A
BUSSING: Copper
Silver/Tin Plated
OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR
MAIN: MAIN BREAKER QB 225A
Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil
BRANCH MOUNTING TYPE: BOLT–ON
----------BRANCH SUMMATION----------
42 – 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4LL5
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–039–01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

----------STANDARD EQUIPMENT NAMEPLATE----------

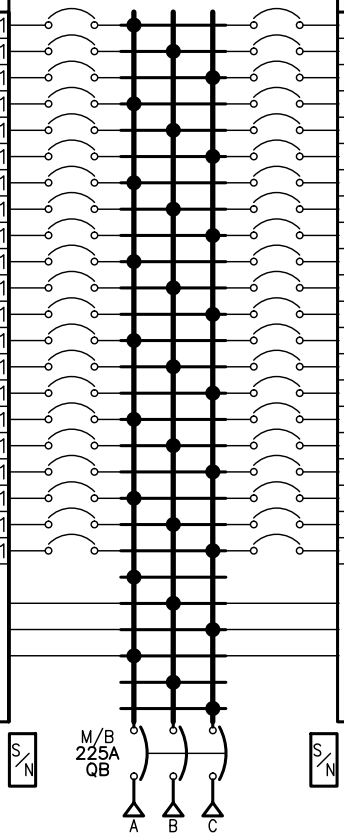
Engraved as Follows
LINE 1: 4LL5
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	4LL5
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–039–01	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		QOB	20/1
3		QOB	20/1
5		QOB	20/1
7		QOB	20/1
9		QOB	20/1
11		QOB	20/1
13		QOB	20/1
15		QOB	20/1
17		QOB	20/1
19		QOB	20/1
21		QOB	20/1
23		QOB	20/1
25		QOB	20/1
27		QOB	20/1
29		QOB	20/1
31		QOB	20/1
33		QOB	20/1
35		QOB	20/1
37		QOB	20/1
39		QOB	20/1
41		QOB	20/1
	Surge Counter Dry Contacts	SPD 100kA/3	

RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/1	QOB		2
20/1	QOB		4
20/1	QOB		6
20/1	QOB		8
20/1	QOB		10
20/1	QOB		12
20/1	QOB		14
20/1	QOB		16
20/1	QOB		18
20/1	QOB		20
20/1	QOB		22
20/1	QOB		24
20/1	QOB		26
20/1	QOB		28
20/1	QOB		30
20/1	QOB		32
20/1	QOB		34
20/1	QOB		36
20/1	QOB		38
20/1	QOB		40
20/1	QOB		42
	SPD 100kA/3	Surge Counter Dry Contacts	



PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 5
BOTTOM – 10.47
SIDE – 6.13
PBA: 707A
BUSSING: Copper
Silver/Tin Plated
OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
Copper GROUND BAR
BLANK ENDWALLS
(Continued on next page.)

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
10kA SYMS. SCCR
MAIN: MAIN BREAKER QB 225A
Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil
BRANCH MOUNTING TYPE: BOLT–ON
----------BRANCH SUMMATION----------
42 – 20A/1P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2LL5
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–040–01	PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

PHYSICAL DATA CONTINUED

COPPER SOLID NEUTRAL
SPD DRY CONTACTS
SPD SURGE COUNTER
SPD PEAK SURGE RATING/PHASE: 100kA
SPD LINE TO GRD PROTECT

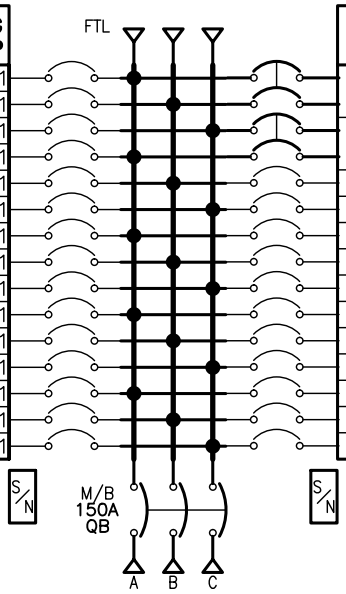
----------STANDARD EQUIPMENT NAMEPLATE----------

Engraved as Follows
LINE 1: 2LL5
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw–on

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	2LL5
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262–040–01	PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--

CKT NO	ACCESSORIES	TYPE	RATING AMP/P
1		QOB	20/1
3		QOB	20/1
5		QOB	20/1
7		QOB	20/1
9		QOB	20/1
11		QOB	20/1
13		QOB	20/1
15		QOB	20/1
17		QOB	20/1
19		QOB	20/1
21		QOB	20/1
23		QOB	20/1
25		QOB	20/1
27		QOB	20/1
29		QOB	20/1



RATING AMP/P	TYPE	ACCESSORIES	CKT NO
20/2	QOB		2
			4
20/2	QOB		6
			8
20/1	QOB		10
20/1	QOB		12
20/1	QOB		14
20/1	QOB		16
20/1	QOB		18
20/1	QOB		20
20/1	QOB		22
20/1	QOB		24
20/1	QOB		26
20/1	QOB		28
20/1	QOB		30

PHYSICAL DATA

ENCLOSURE Type 1
Surface with Door
FRONT CAT#: NC50S
BOX CAT#: MH50BE
DIMENSIONS:
50''H x 20''W x 5.75''D
WIRE BENDING SPACE:
TOP – 12.4
BOTTOM – 10.47
SIDE – 6.13
PBA: 707A

BUSSING: Copper
Silver/Tin Plated

OPTIONAL FEATURES:
SEISMICALLY QUALIFIED : IBC/ASCE7
BRANCH USER PLACEMENT
Copper GROUND BAR
BLANK ENDWALLS
COPPER SOLID NEUTRAL

----------STANDARD EQUIPMENT NAMEPLATE----------
Engraved as Follows
LINE 1: 1SL2
COLOR: White Surface / Black Letters
SIZE: 3.50" Wide x 1.00" High (Std)
TYPE: Plastic/Adhesive – Screw-on

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 150A
10kA SYMS. SCCR

MAIN: MAIN BREAKER QB 150A
ACC: FEED THRU LUGS
Bottom FEED
10kA AIR
INCOMING CONDUCTORS(S) PER NEC
Wire Bending Space:
#4 – 300 kcmil

BRANCH MOUNTING TYPE: BOLT-ON

----------BRANCH SUMMATION----------
26 – 20A/1P QOB
2 – 20A/2P QOB

JOB NAME:	WEBSTER UNIVERSITY ISB	EQUIPMENT DESIGNATION:	1SL2
JOB LOCATION:	WEBSTER GROVES MO	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:			
DATE:	October 10 2016		
DRAWING STATUS:	RECORD	DWG# 037999262-041-01	PG 1 OF 1 REV –

I-Line™ Circuit Breaker Power Distribution Panelboards

Information Manual
Class 2110

ENGLISH

Instruction Bulletin
80043-309-20

Retain for future use.



SQUARE D™

by Schneider Electric

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Hazard Categories and Special Symbols

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Introduction

This bulletin contains instructions for installing Square D™ brand I-Line™ circuit breaker panelboards. These panelboards are Underwriters Laboratories (cULus) listed and accept I-Line branch circuit breakers.



For technical support on the installation of this panelboard, contact the Schneider Electric at customer support 1-888-778-2733.



See the labels on the equipment for rating and safety information. Additional equipment labels are provided with this document.

Safety Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside the equipment.
- Always use a properly-rated voltage sensing device to confirm all power is off.
- Read and understand this entire instruction bulletin and the latest edition of the NEMA PB 1.1 standards publication included before installing, operating, or maintaining this equipment.
- Local codes vary, but are adopted and enforced to promote safe electrical installations. A permit may be needed to do electrical work, and some codes may require an inspection of the electrical work.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

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Installation

This section provides instructions for the following I-Line panelboard procedures:

- Interior Mounting into Square D Brand Enclosures, on page 9
- Neutral Bonding Strap Installation, on page 12
- I-Line Circuit Breaker Installation and Removal, on page 14
- Interior Trim Barrier Preparation, on page 18

Interior Mounting into Square D Brand Enclosures

A separate standards publication, titled “General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less” (NEMA PB1.1-2007), has been provided with this equipment. Familiarize yourself with the content of this document before proceeding with any of the following procedures.

If you did not receive a copy of this document, or if you have any questions regarding this equipment, contact your local distributor or Schneider Electric representative.

NOTICE

HAZARD OF EXCESSIVE HEAT DUE TO LOOSE CONNECTION

- Ensure all connections are properly tightened.
- Refer to the torque information label provided on the panelboard before tightening the connections.

Failure to follow these instructions can result in equipment damage.

To properly mount and install the I-Line panelboard enclosure, please refer to the NEMA PB 1.1-2007 standards publication, and follow the instructions below for either “Surface Mounting (Enclosure Mounted on Wall)” or “Flush Mounting (Enclosure Recessed in Wall).”

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Surface Mounting (Enclosure Mounted on Wall)

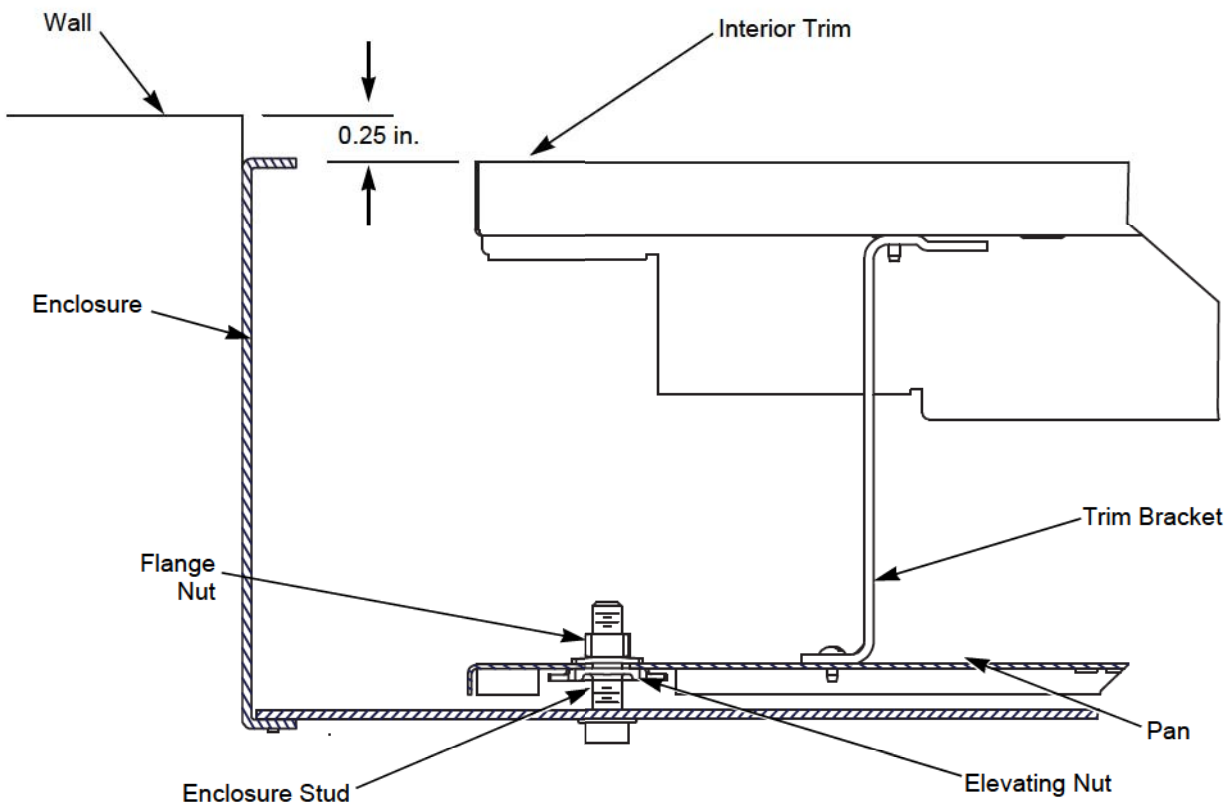
1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Install one elevating nut on each enclosure stud.
3. Remove the interior trim from the trim brackets.
4. Install the interior as described below:
   a. Set the interior on the enclosure studs and secure with flange nuts (see Figure 1). Screwdriver blade may be inserted in elevating nut slot to facilitate adjustment.
   b. Adjust each elevating nut to maintain a maximum distance of 0.125 in. between the interior trim and the front/door assembly.
   c. Tighten the flange nuts against the pan.
   d. Remount the interior trim after wiring.
5. If used as service entrance equipment, neutral bonding is required (see “Neutral Bonding Strap Installation” on page 12).
6. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

Flush Mounting (Enclosure Recessed in Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1-2007 standards publication.
2. Install one elevating nut on each enclosure stud.
3. Remove the interior trim from the trim brackets.
4. Install the interior as described below:
   a. Set the interior on the enclosure studs and secure with flange nuts (see Figure 1 on page 10). Screwdriver blade may be inserted in elevating nut slot to facilitate adjustment.
   b. Adjust each elevating nut to position the lip of the interior trim approximately 0.25 in. from the outside wall line.
   c. Tighten the flange nuts against the pan.
   d. Remount the interior trim after wiring.
5. If used as service entrance equipment, neutral bonding is required. See the “Neutral Bonding Strap Installation” instructions on page 12.
6. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

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Figure 1: Interior Mounting into Square D Brand Enclosures



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Neutral Bonding Strap Installation

The neutral bonding strap should be used only when the panelboard is **installed** as service equipment.

To properly bond the neutral to the panelboard, follow the instructions for either “Standard Neutral Bonding Strap Installation” or “Neutral with Current Transformer Bonding Strap Installation” on pages 13 and 14, respectively.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- Turn off all power supplying this equipment before working on or inside the equipment.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Always use a properly-rated voltage sensing device to confirm all power is off.
- The main bonding strap should be used only when the panelboard is installed as service equipment.
- Do not mix the mounting screws with the interior trim screws.

Failure to follow these instructions will result in death or serious injury.

NOTE: The bonding strap parts are found in the bag assembly provided with the interior.

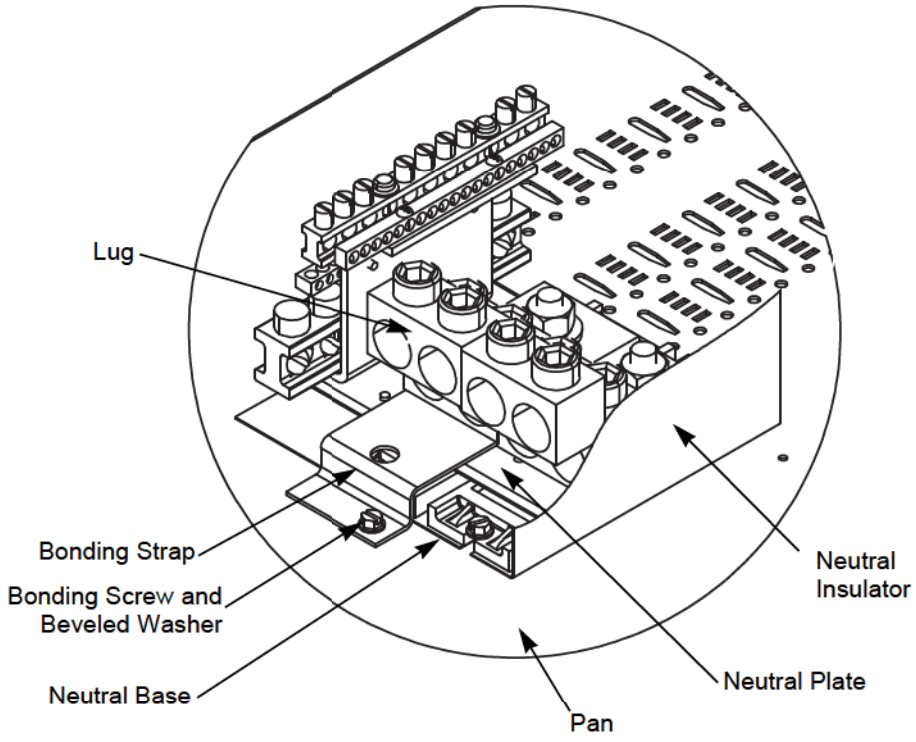
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Standard Neutral Bonding Strap Installation

To install a neutral bonding strap on an I-Line panelboard, refer to Figure 2 and follow the instructions below.

1. Remove lug. Retain lug and fastening hardware.
2. Place bonding strap between neutral plate and lug, as shown.
3. Secure bonding strap to pan with bonding screw and beveled washer. Tighten the bonding screw to 65–75 lb-in (7.3–8.5 N•m).
4. Reinstall lug with the hardware retained in step 1. Tighten to 60–70 lb-in (6.8–7.9 N•m).

Figure 2: Standard Neutral Bonding Strap Installation



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Neutral with Current Transformer Bonding Strap Installation

To install a neutral bonding strap on an I-Line panelboard with a current transformer, refer to Current Transformer Neutral Bonding Installation Instructions, Schneider Electric document 80043-706-xx or 80043-789-xx, that is supplied with the current transformer neutral.

I-Line Circuit Breaker Installation and Removal

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly-rated voltage sensing device to confirm that all power is off.
- All unused spaces must be filled with blank fillers.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

I-Line Circuit Breaker Installation

Refer to Figure 3 on page 16 for the following instructions:

1. Turn off all power to the panelboard.
2. Remove the interior trim barrier.
3. Turn the circuit breaker off. Position the circuit breaker jaws against the bus bar stack so the guiding boss on the bottom of the circuit breaker is oriented towards the alignment groove in the bus insulator base, and the “fingers” of the circuit breaker mounting bracket fit into the keyslots in the pan.

   NOTE: Install the main circuit breaker adjacent to the main lugs.
4. Place a screwdriver through the rectangular hole in the circuit breaker mounting bracket and into the screwdriver slot in the mounting pan. Ratchet the circuit breaker firmly into the bus bar stack and align the retaining screw with the 0.219 in. (5.6 mm) mounting hole in the pan.
5. Tighten the retaining screw securely to prevent the circuit breaker from moving.

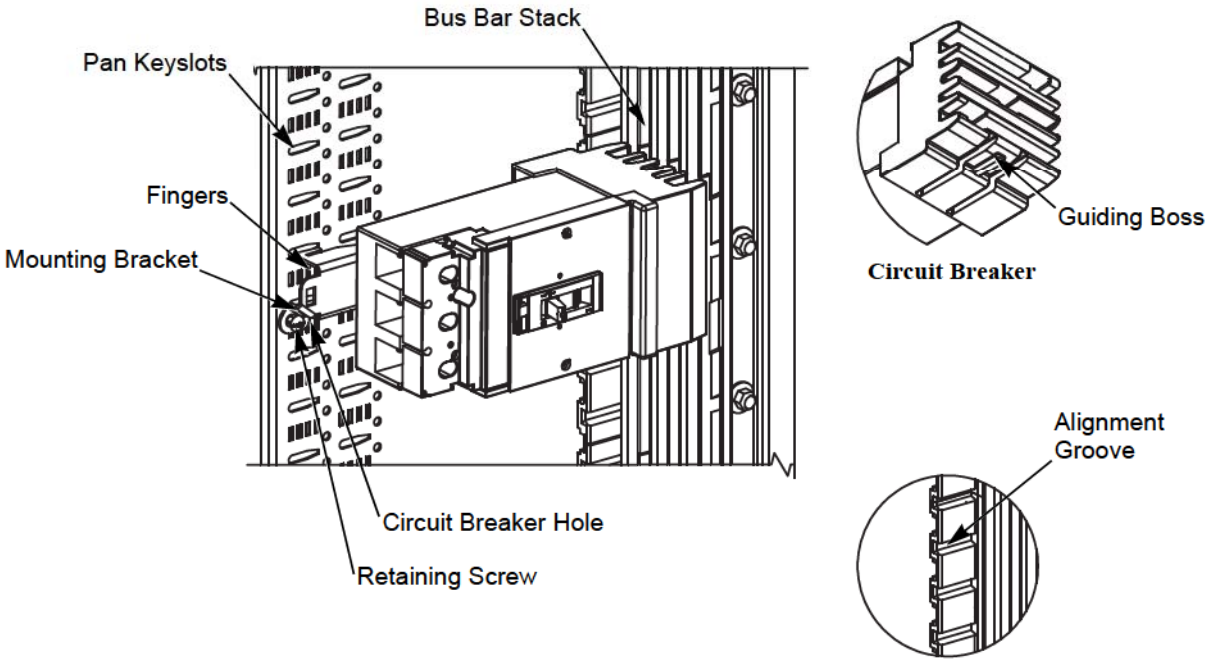
   NOTE: Ensure the retaining screw is tight, but do not tighten it enough to bend the mounting bracket.
6. **For main circuit breakers only:**
   Attach the “Main Breaker” label to the circuit breaker cover.
7. Reinstall the interior trim barrier.
8. Re-energize the panelboard.
9. Turn the circuit breaker on.

NOTE: I-Line circuit breakers are supplied with factory-applied joint compound on the plug-on connectors. The compound must not be removed because it contributes to the overall performance of the connection.

Whenever an I-Line circuit breaker is removed and reinstalled, the joint compound must be reapplied. A two-ounce container of compound especially formulated for I-Line plug-on connectors is available for purchase (catalog number PJC-7201).

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Figure 3: I-Line Circuit Breaker Installation and Removal



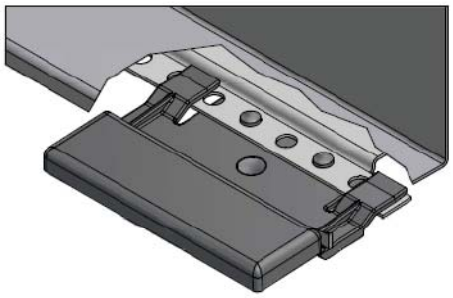
I-Line Circuit Breaker Removal

Refer to Figure 3 for the following instructions:

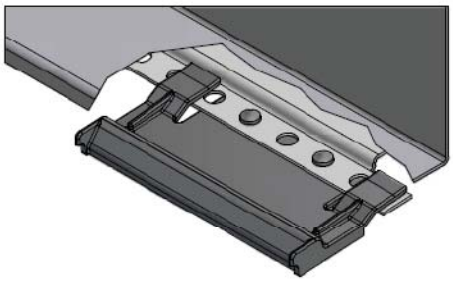
1. Turn off all power to the panelboard.
2. Turn the circuit breaker off.
3. Remove the interior trim barrier.
4. Loosen the retaining screw(s) in the circuit breaker mounting bracket until the screw(s) is completely removed from the 7/32 in. (5.6 mm) mounting hole in the mounting pan.
5. Place the screwdriver through the rectangular hole in the circuit breaker mounting bracket and into the screwdriver slot in the mounting pan. Ratchet the circuit breaker away from the bus bar stack.
6. Lift the circuit breaker away from the bus bars.
7. Install the blank fillers where the circuit breaker was removed, using Table 1 on page 18 as reference.
8. Secure the blank filler extensions to the interior trim barrier (HCPSU, HCP, and HCRU panelboards only), using Table 1 on page 18 for reference. Mount the extension over the mounting bracket in the deadfront as shown in Figure 4 on page 17.

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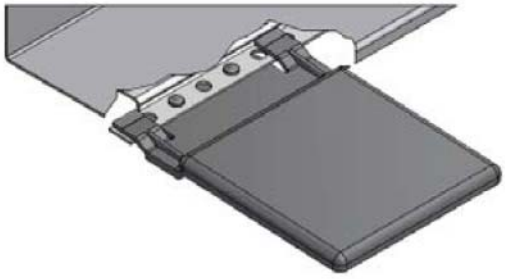
Figure 4: Blank Extension Installation



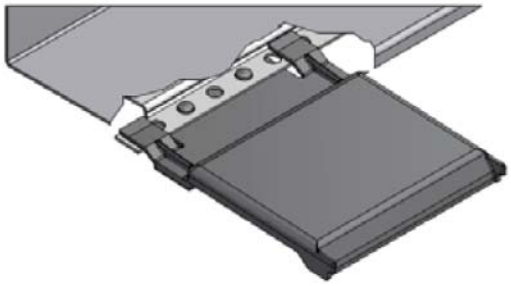
Blank Extension HLN4BL on narrow side



Blank Extension HLN4EBL on narrow side



Blank Extension HLW4BL on wide side



Blank Extension HLW4EBL on wide side

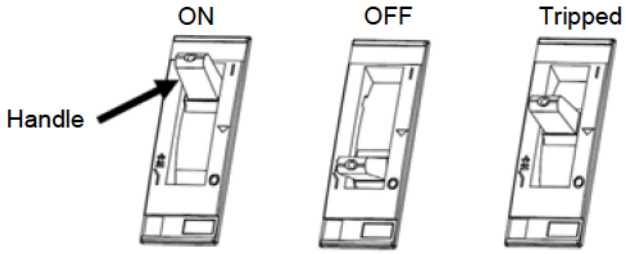


9. Reinstall the interior trim barrier.
10. Re-energize the panelboard.

Circuit Breaker Reset Instructions

If the circuit breaker is tripped, the handle will be at the mid-position between ON and OFF. To reset the circuit breaker, push the handle to the OFF position, then to the ON position.

Figure 5: Circuit Breaker Handle Positions



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Interior Trim Barrier Preparation

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Before energizing the panelboard, all unused spaces must be filled with blank fillers.
- Replace all devices, doors, and covers before energizing this equipment.

Failure to follow these instructions will result in death or serious injury.

Table 1: Blank Fillers and Blank Extensions Catalog Numbers

Blank Extensions

Circuit Breaker Frame	Circuit Breaker Mounting Height	Branch Circuit Side	Catalog Number
All applications except Powerpact H/J with Micrologic Trip Unit 5/6	1.5 in. (38.1 mm)	Wide Side	HLW1BL
	4.5 in. (114.3 mm)	Wide Side	HLW4BL
	1.5 in. (38.1 mm)	Narrow Side	HLN1BL
	4.5 in. (114.3 mm)	Narrow Side	HLN4BL
Only Powerpact H/J Frames with Micrologic Trip Unit 5/6	4.5 in. (114.3 mm)	Narrow Side	HLN4EBL
	4.5 in. (114.3 mm)	Wide Side	HLW4EBL

Blank Fillers

	Mounting Height	Catalog Number	
All Applications	1.5 in. (38.1 mm)	HNM1BL	—
	4.5 in. (114.3 mm)	HNM4BL	

I-Line Stack Assemblies

NOTICE

RISK OF IMPROPER ASSEMBLY

- Do not disassemble the I-Line Bus Stack Assembly.
- If maintenance is required, contact Schneider Electric.

Failure to follow these instructions can result in severe equipment damage and will void the warranty.

I-Line Solid Neutral Assemblies

Table 2: I-Line Solid Neutral Assembly Catalog Numbers

Amps	Catalog Number
225	HC2SN
400	HC4SN [1], HCW4SN [2]
600	HC6SN [1], HCW6SN [2]
800	HC8SN [1], HCW8SN [2]
	HCPSU8SN [3]
800 [7]	HCPSU8SNCW [5]
1200 [2]	HCW12SN
1200 [2, 8]	HCWM12SN [4]
1200 [2, 7]	HCR12SNCTW [6]

1 Used on type HCN and HCM panelboards only.

2 Used on 400 A, 600 A, 800 A, 1200 A HCP (main lugs), and 600 A, 800 A (main circuit breaker).

3 Used on type HCP-SU panelboards only.

4 Used on type HCR-U panelboards only.

5 Used on type HCP-SU panelboards only.
For use with circuit breaker types PG, PJ, PK, PL.

6 Used on type HCR-U panelboards only.
For use with circuit breaker types PG, PJ, PK, RG, RJ, RK.

7 Including neutral CT for 3Ø4W systems.

8 Used on type HCR-U universal panelboards only.

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Appendix 1: Specifications

Typical Wiring

Table 3: Panelboard Typical Wiring [1]

	1-Phase Panelboards		3-Phase Panelboards	
Voltage AC [2]	Phase	Wires	Phase	Wires
208Y/120 [3]	—	—	3	4
120/240 [3]	1	3	—	—
240 [4]	3	3	—	—
600	1	2	—	—
480Y/277 [3]	—	—	3	4
240/120 [3, 6]	—	—	3	4 Delta
600	—	—	3	3 Delta
600Y/347 [3, 5]	—	—	3	4
125/250 Direct Current	—	3	—	—
250 Direct Current	—	2	—	—

1 Additional information is provided on the panelboard. See the main circuit breaker rating, if used.

2 Unless otherwise specified.

3 Requires use of solid neutral assembly. See panelboard.

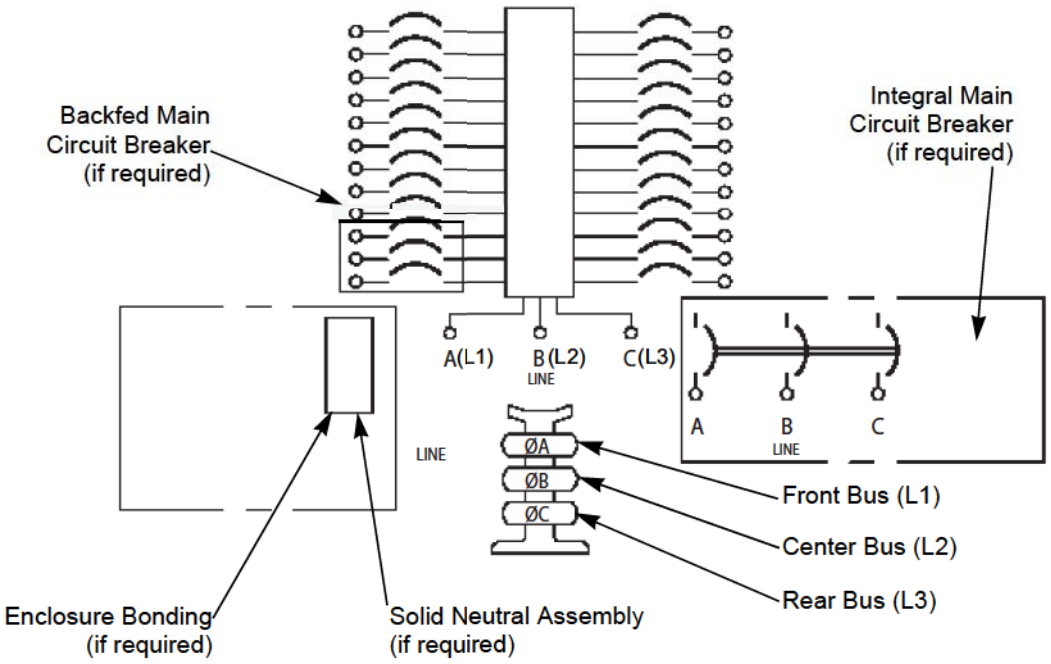
4 For grounded “B” phase system.

5 For use in Canada only.

6 When wiring for delta systems, phases “A” and “C” must be 120 V to neutral, with phase “B” 208 V to neutral. Connect only circuit breakers rated 240 V AC minimum, not 120 V or 120/240 V to “B” phase.

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Figure 6: Main Lugs / Main Circuit Breaker Wiring Diagram



NOTE: For 1Ø systems, the center bus is not used.

NOTE: Branch connections phasing is determined by the circuit breaker selected. See the latest catalog or the Digest for circuit breaker selection.

NOTE: Assure that the circuit breaker voltage rating is appropriate for the system. With the selection of proper units, any of the listed voltage systems can be used.

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Panelboard Ratings

Refer to NEC section 110-22, 2011 Edition and CEC rule 12-014, 2002 Edition for more information. The series rated system label is located in the bag assembly. Short circuit tests are conducted at 100–105% of the maximum panelboard voltage. Interiors with CE mark meet IEC 61439-1 and IEC 61439-2.

Table 4: Series Connected Circuit Breaker Ratings (RMS Symmetrical)

Maximum System Voltage AC [2]	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker [1]	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
120	42,000	MG	FY	1
	65,000	QG, LH	FA, FD	
	100,000	FJ, QJ	FD	
		QJ, LC	FA	
		LJ	FH	
	200,000	LR	FH, FY	
208Y/120	100,000	QJ	FA, FD	2, 3
		QJ, PH, PJ, RJ	QD, QG	
240	35,000	MG	FA	1
	42,000	KA	FD	1, 2, 3
		LA, MA	HD, JD, QD	2, 3
	50,000	MG	FA	
		MG	FA (25 A MAX.)	1
	65,000	HG, JG	FA, HD	2, 3
		JG	JD, QD	
		QG	FA, FD, QD	
		LH, MH, PA, PG, RG	HD, JD, QD	
		FG, FH, MH, MX, PJ	FD	1, 2, 3
		FC, KC, KH, LC, LH	FD, FG	
		LH	FA	
		LH	LA	2, 3
		MG	HD, JD, KA	
		DG	FH, HD, JD, KA, LA, MA	2, 3
		LG	HD, JD, KA, LA, MA	
		LG	LD	3
	85,000	RL	FH, KH	2, 3

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Table 4: Series Connected Circuit Breaker Ratings (RMS Symmetrical) *(Continued)*

Maximum System Voltage AC [2]	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker [1]	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
240	100,000	FC, KC, LC, LX	FD, FG, FJ	1
		PH, PJ, RJ	QD, QG	2, 3
		QJ	FD	2
		FJ	FD	2, 3
		LJ	HD, HG, JD, JG, FH, KA, LA, MA, MG	
		LJ	LD, LG	3
		FC, KC	FA, FH, FD, FG, FJ	2, 3
		LC, LX	FH, FD, FG, FJ	
		KC, LC, LX	KA	
		KC, LC	KH	
		LC	LA, LH, MG	
		LC	FA	1, 2, 3
		HJ, JJ	FA, FH, HD, HG	2, 3
		JJ	JD, JG	
		LC, LX, MJ, PJ, RJ	HD, HG, JD, JG	
		MJ	LA, LH	
		DJ	FH, HD, HG, JD, JG, KA, LA, MA, MG	
	125,000	RL	RG	
		HL, JL	HD, HG, HJ, FA, FH	
		JL	JD, JG, JJ	
		PC, PH, PL, RL	HD, HG, JD, JG	
		PC, PL, RL	HJ, JJ	
	200,000	FI, KI, LI, LXI	HD, HG, HJ	
		KI, LI, LXI	JD, JG, JJ	
		FI, KI, LI, LXI	FD, FG, FJ	1
		FI, KI	FA, FH, FC, FD, FG, FJ	2, 3
		LI, LXI	FH, FD, FG, FJ	
		LI	FC	
		KI, LI, LXI	KA, QD, QG, QJ	
		LI	KC	
		JR	QD	
		LR	FH, HJ, HL, JJ, JL, QD, QG, QJ, LA, LH	

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Table 4: Series Connected Circuit Breaker Ratings (RMS Symmetrical) *(Continued)*

Maximum System Voltage AC [2]	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker [1]	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
277	18,000	LD	FY	1
	25,000	FH, KA	FD	
	35,000	FG, KH, LH	FD	
		DG, LG	FH, FY	
	65,000	FJ	FD	
		FC, KC	FA, FH, FY, FD, FG	
		LC, LX (400 A MAX.)	FH	
		LC, LX (600 A MAX.)	FY, FD, FG	
		DJ	FH, FY	
		LL	FY	
		LJ	FH, FY	
	100,000	DL, LL	FH, FJ	
	200,000	FI, KI	FA, FH, FY, FD, FG, FJ	
		HR, JR	FA, FY, FJ	
		LI, LXI, (400 A MAX.)	FH	
		LI, LXI, (600 A MAX.)	FY, FD, FG, FJ	
		LR	FH, FY	
480	22,000	MG	FA	2, 3
	30,000	KH, LA, MA, MX, PA, PC, PX, PJ	FH	
		LA, MA, PA, PC, PX	KA	
		LA, MA, PA	HD, JD	
		MG	FA (25 A MAX.), FH, KA	
	35,000	MH, MX, PA	HD, JD	
		HG, JG	FA, HD	
		JG	JD	
		LH, MG, PG, RG	HD, JD	
		LH	HG, JG	2, 3
		DG	FH, HD, JD, KA, LA, MA	
		LG	LD	3
		LG	HD, JD, FH, KA, LA, MA	2, 3

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Table 4: Series Connected Circuit Breaker Ratings (RMS Symmetrical) *(Continued)*

Maximum System Voltage AC [2]	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker [1]	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
480	42,000	MJ	FH (25 A MAX.)	2, 3
		RL	RG	
	50,000	MJ	KA, KH	
	65,000	FC, KC	FA, FH	
		HJ, JJ	FA, FH, HD, HG	
		JJ	JD, JG	
		LC, LI, LX, LXI	HD, HG, JD, JG	
		LC, LX, (400 A MAX.)	FH	
		KC, LC, LX	KA	
		LC, LX	LA	
		DJ	FH, HD, HG, JD, JG, KA, LA, MA	
		LJ	LD, LG	3
		LJ	HD, HG, JD, JG, FH, KA, LA, MA	2, 3
	100,000	HL, JL	FA, FH, HD, HG, HJ	2, 3
		JL	JD, JG, JJ	
		JR	FA	
		LI, LXI (600 A MAX.)	KA	
		PC, PH, PL, RL	HJ, JJ	
		RL	RG	
		DL	FH, HD, HG, HJ, JD, JG, JJ, KA, LA, MA	
		LL	LD, LG, LJ	3
		LL	HD, HG, HJ, JD, JG, JJ, FH, KA, LA, MA	2, 3
	200,000	FI, KI	FA, FH, FC, HD, HG, HJ	
		HR	FA, HD, HG, HJ, HL	
		JR	HD, HG, HJ, HL, JD, JG, JJ, JL	
		KI	JD, JG, JJ, KA	
		LI	FC, KA, KC, LA, HJ, HL, JJ, JL	
		LXI	KA, HJ, HL, JJ, JL	
		LR	FH, HJ, HL, JJ, JL, LA, LH	

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Table 4: Series Connected Circuit Breaker Ratings (RMS Symmetrical) *(Continued)*

Maximum System Voltage AC [2]	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker [1]	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
480Y/277	25,000	FH, KA	FD	2, 3
	35,000	FG, KH, LH	FD	
	65,000	FJ	FD	
		FC, KC	FD, FG	
		LC, LX (600 A MAX.)	FD, FG	
	200,000	FI, KI	FD, FG, FJ	
		LI, LXI (600 A MAX.)	FD, FG, FJ	
600	18,000	HG, JG	FA, HD	
		JG	JD	
		MG, PG, RG	HD, JD	
		MG	FA	
		LG	LD	3
		LG	HD, JD	2, 3
	25,000	HJ, JJ	FA, HD, HG	
		JJ	JD	
		PJ, RJ	MG	
		LJ	LD, LG	3
		LJ	JD, JG, HD, HG, MA	2, 3
	35,000	LC	FH, HD, HG, HJ, JD, JG, JJ, LA	2, 3
	50,000	HL, JL	FA, HD, HG, HJ	
		JL	JD, JG, JJ	
		PK	HJ, JJ, MJ	
		LL	LD, LG, LJ	3
		LL	HD, HG, HJ, JD, JG, JJ, MA	2, 3
	100,000	FI, KI	HD, HG, HJ	
		KI	JD, JG, JJ	
		HR	FA, HD, HG, HJ, HL	
		JR	FA, HD, HG, HJ, HL, JD, JG, JJ, JL	
		KI, LI	FH	
		LI	LA	

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Table 4: Series Connected Circuit Breaker Ratings (RMS Symmetrical) *(Continued)*

Maximum System Voltage AC [2]	Maximum Short Circuit Current Rating	Square D Integral or Remote 2- or 3-Pole Main Circuit Breaker [1]	Square D Branch Circuit Breaker	
			Catalog Designation	Poles
600Y/347	18,000	MG	FA (25 A MAX.)	1
	25,000	MJ	FA (25 A MAX.)	
	50,000	HL, JL	FJ	

1 LD, LG, LJ, and LL are only available in 3-pole configurations.

2 For indicated circuit breakers rated less than this maximum voltage the indicated short circuit current rating also applies, but at the voltage rating of the circuit breaker.

Table 5: Series Connected Fuse Ratings (RMS Symmetrical)

Maximum System Voltage AC [1]	Maximum Short Circuit Current Rating	Remote Main Fuse		Square D Branch Circuit Breaker Catalog Designation (2- or 3-Pole) Unless Otherwise Stated
		Max A	Class	
120/240 1Ø 208Y/120	100,000	1200 A	L, T (300 V)	QD, QG
		800 A	T (600 V)	
		600 A	J, RK5	
240	65,000	1200 A	L, T (300 V)	QD
		800 A	T (600 V)	
		600 A	J, RK5	
	100,000	1200 A	L, T (300 V)	QD, QG (2-Pole)
		800 A	T (600 V)	
		600 A	J, RK5	
			J, T (600 V)	FA, FH, KA, KH, KC, LA, LH, MA, MH, MX, PG
			RK5	FH, KA, KH, LA, LH, MA, MH, MX, PG, HD, HG, HJ, HL, JD, JG, JJ, JL
			J	HD, HG, HJ, HL, JD, JG, JJ, JL
		800 A	T (600 V)	FH, KA, KH, LA, LH, MA, MH, MX, PG
			T (300 V)	PG
			L	FH, KA, KH, LA, LH, MA, MH, MX, PG
		1200 A	L	FH, KH, LA, LH, MA, MH, MX, PG
			T (600 V)	HD, HG, HJ, HL, JD, JG, JJ, JL
		1600/2000 A	L	KH, MA, MH, MX, PG
		4000 A	L	HD, HG, HJ, HL, JD, JG, JJ, JL

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Table 5: Series Connected Fuse Ratings (RMS Symmetrical) *(Continued)*

Maximum System Voltage AC [1]	Maximum Short Circuit Current Rating	Remote Main Fuse		Square D Branch Circuit Breaker Catalog Designation (2- or 3-Pole) Unless Otherwise Stated
		Max A	Class	
240	200,000	600 A	J, T (600 V)	FA(3 POLE ONLY) FH, FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
			RK5	FH, FC, HD, HG, HJ, HL, JD, JG, JJ, JL, KH, KC, LA, LH, LC, MA, MH, MX, NC, NX, PG,PJ, PL
			J	HD, HG, HJ, HL, JD, JG, JJ, JL
		800 A	T (600 V)	FH, FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
			T (300 V)	PG, PJ, PL
			L	FH, FC, KH, KC, LA, LH, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
		1200 A	L	FC, KH, KC, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
			T (600 V)	HD, HG, HJ, HL, JD, JG, JJ, JL
		1600/2000 A	L	NA, NC, NX, PJ, PL
		4000 A	L	HD, HG, HJ, HL, JD, JG, JJ, JL
480	100,000	400 A	J, T(600 V)	HD, HG, HJ, HL, JD, JG, JJ, JL
		600 A	J, RK5	HJ, HL, JJ, JL
			J, T (600 V)	FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, PG, PJ
			RK5	FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, PG, PJ
		800 A	L, T(600V)	FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, PG, PJ
		1200 A	L	FC, KH, KC, LA, LH, LC, MA, MH, MX, NA, PG, PJ
			T (600 V)	HJ, HL, JJ, JL
		1600 A	L	KC, LC, MA, MH, MX, NA, PG, PJ
		2000 A	L	KC, LC, MH, MG, MJ, MX, NA, PG, PJ
		4000 A	L	HJ, HL, JJ, JL
	200,000	200 A	RK5	HJ, HL
		400 A	J	FA, FH, FC, HJ, HL, JJ, JL, KA, KH, KC, LA, LH, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
			T (600 V)	FA, FH, FC, HJ, HL, JJ, JL, KA, KH, KC, LA, LH, MA, MH, MX, NA, NC, NX
		600 A	J	FC, KA, KH, KC, LA, LH, LC, MA, MH, MX, MG, MJ, NA, NC, NX, PG, PJ, PL
			T(600 V)	KA, KH, KC, LA, LH, MA, MH, MX, NA, NC, NX
			RK5	KC, LA, LH, LC, MA, MH, MX, MG, MJ, NC, NX, PG, PJ

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Table 5: Series Connected Fuse Ratings (RMS Symmetrical) *(Continued)*

Maximum System Voltage AC [1]	Maximum Short Circuit Current Rating	Remote Main Fuse		Square D Branch Circuit Breaker Catalog Designation (2- or 3-Pole) Unless Otherwise Stated
		Max A	Class	
480	200,000	800 A	T(300 V)	PG, PJ, PL
			T(600 V)	KA, KH, KC, LA, LH, MA, MH, MX, MG, MJ, NA, NC, NX, PG, PJ, PL
			L	KC, LA, LH, LC, MA, MH, MX, NA, NC, NX, PG, PJ, PL
		1200 A	L	KC, LC, MA, MH, MX, MG, MJ, NA, NC, NX, PG, PJ, PL
		1600/2000 A	L	NA, NC, NX
600	100,000	30 A	CC	HG, JG (Molded Case Switches)
		200 A	J	HD, HG, HJ, HL, JD, JG, JJ, JL
		400 A	J, T (600 V)	HJ, HL, JJ, JL
		600 A	R	MG, MJ
		1200 A	L	MG, MJ
	200,000	600 A	J	MG, MJ
		800 A	T (600 V)	MG, MJ

1 For indicated circuit breakers rated less than this maximum voltage. The indicated short circuit current rating also applies, but at the voltage rating of the circuit breaker.

Additional Short Circuit Current Ratings

Square D I-Line plug-on lugs installed in this panelboard and protected by indicated Square D circuit breakers are suitable for use where the available short circuit current is not greater than that shown in the following table. The short circuit current rating cannot exceed the rating marked on the protecting circuit breaker. The protecting circuit breakers may be the main, or if plugged onto the same I-Line bus stack, may be downstream from the plug-on lugs.

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Table 6: Short Circuit Current Ratings for Plug-On Lugs with Protective Circuit Breakers[1]

Catalog Number and Ampere Rating	Protecting Circuit Breakers			Maximum Available Short Circuit Current	
	Catalog Prefix	Number of Poles	Maximum Amperes	RMS Sym. kA	Volts AC
SL100, 100 A SL225, 225 A SL250, 250 A SL400, 400 A SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	FA	2, 3	100	25	240
				18	480
				14	600
	FH	2, 3	100	65	240
				25	480
				18	600
	FD	2, 3	100	25	240
				18	480Y
	FG	2, 3	100	65	240
				35	480Y
	FJ	2, 3	100	100	240
				65	480Y
SL225, 225 A SL400, 400 A SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	KA	2, 3	225	42	240
				25	480
				22	600
	KH	2, 3	225	65	240
				35	480
				25	600
	KC	2, 3	225	100	240
				65	480
	KI	2, 3	225	200	240
				200	480
				100	600
SL400, 400 A SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A SL33930, 1200 A SL33931, 1200 A	DG	3	400	65	240
				35	480
	DJ	3	400	100	240
				65	480
	DL	3	400	125	240
				100	480
SL800, 800 A SL800M5. 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	DG	3	600	65	240
				35	480
	DJ	3	600	100	240
				65	480
	DL	3	600	125	240
				100	480

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Table 6: Short Circuit Current Ratings for Plug-On Lugs with Protective Circuit Breakers[1] *(Continued)*

Catalog Number and Ampere Rating	Protecting Circuit Breakers			Maximum Available Short Circuit Current	
	Catalog Prefix	Number of Poles	Maximum Amperes	RMS Sym. kA	Volts AC
SL250, 250 A SL400, 400 A SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	HD/JD	2, 3	150/250	25	240
				18	480
				14	600
	HG/JG	2, 3	150/250	65	240
				35	480
				18	600
	HJ/JJ	2, 3	150/250	100	240
				65	480
				25	600
	HL/JL	2, 3	150/250	125	240
				100	480
				50	600
	HR/JR	2, 3	150/250	200	240
				200	480
				100	600
	KI	2, 3	250	200	240
				200	480
				100	600
SL400, 400 A SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	LA	2, 3	400	42	240
				30	480
				22	600
	LH	2, 3	400	65	240
				35	480
				25	600
	LD	3	400	25	240
				18	480
				14	600
	LG	3	400	65	240
				35	480
				18	600
	LJ	3	400	100	240
				65	480
				25	600
	LL	3	400	125	240
				100	480
				50	600
	LR	3	400	200	240
				200	480
				100	600
SL400, 400 A SL800, 800 A SL1200, 1200 A S33930, 1200 A S33931, 1200 A	LC/LX	2, 3	400	100	240
				65	480
				35	600
	LI/LXI	2, 3	400	200	240
				200	480
				100	600

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Table 6: Short Circuit Current Ratings for Plug-On Lugs with Protective Circuit Breakers[1] *(Continued)*

Catalog Number and Ampere Rating	Protecting Circuit Breakers			Maximum Available Short Circuit Current	
	Catalog Prefix	Number of Poles	Maximum Amperes	RMS Sym. kA	Volts AC
SL800, 800 A SL800M5, 800 A SL1200, 1200 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A S33930, 1200 A S33931, 1200 A	LD	3	600	25	240
				18	480
				14	600
	LG	3	600	65	240
				35	480
				18	600
	LJ	3	600	100	240
				65	480
				25	600
	LL	3	600	125	240
				100	480
				50	600
	LR	3	600	200	240
				200	480
				100	600
SL800, 800 A SL1200, 1200 A S33930, 1200 A S33931, 1200 A	LC/LX	2, 3	600	100	240
				65	480
				35	600
	LI/LXI	2, 3	600	200	240
				200	480
				100	600
	MA	2, 3	800	42	240
				30	480
				22	600
	MH/MX	2, 3	800	65	240
				65	480
				25	600
SL800M5, 800 A SL1200P5, 1200 A SL1200P6, 1200 A SL1200P7, 1200 A	MG, PG	2, 3	800	65	240
				35	480
				18	600
	MJ, PJ	2, 3	800	100	240
				65	480
				25	600
	PK	2, 3	800	65	240
				50	480
				50	600
	PL	2, 3	800	125	240
				100	480
				25	600
	MA/MH/MX	2, 3	800	65	240
				65	480
				25	600

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Table 6: Short Circuit Current Ratings for Plug-On Lugs with Protective Circuit Breakers[1] *(Continued)*

Catalog Number and Ampere Rating	Protecting Circuit Breakers			Maximum Available Short Circuit Current	
	Catalog Prefix	Number of Poles	Maximum Amperes	RMS Sym. kA	Volts AC
SL1200, 1200 A S33930, 1200 A	NA	2, 3	1200	100	240
				50	480
				25	600
	NC/NX	2, 3	1200	125	240
				100	480
				65	600
SL1200P5, 1200A SL1200P6, 1200A SL1200P7, 1200A	PG/RG	2, 3	1200	65	240
				35	480
				18	600
	PJ/RJ	2, 3	1200	100	240
				65	480
				25	600
	PK	2, 3	1200	65	240
				50	480
				50	600
	RK	2, 3	1200	65	240
				65	480
				65	600
	PL	2, 3	1200	125	240
				100	480
				25	600
	RL	2, 3	1200	125	240
				100	480
				50	600
S33930, 1200 A S33931, 1200 A	MG	2, 3	800	65	240
	PG	2, 3	1200	35	480
				18	600
	MJ	2, 3	800	100	240
	PJ	2, 3	1200	65	480
				25	600
	PK	2, 3	1200	65	240
				50	480
				50	600
	PL	2, 3	1200	125	240
				100	480
S33930, 1200 A	RG	2, 3	1200	65	240
				35	480
				18	600
	RJ	2, 3	1200	100	240
				65	480
				25	600
	RL	2, 3	1200	125	240
				100	480
				50	600
	RK	2, 3	1200	65	240/480/600

[1] S33930, S33931, SL1200P5, SL1200P6, SL1200P7, SL kits are rated 1200 A and may be applied to 1200 ampere loads when installed into HCRU panelboards restrictively on the wide side.

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CE Marking

Interiors with the "CE" mark meet the IEC 61439-1 and IEC 61439-2 standards. Main Lug interiors with the "CE" mark have been tested to withstand 42,000 RMS symmetrical amperes for 30 cycles. Only IEC rated circuit breakers may be used with "CE" marked interiors and the short circuit rating of the interior is limited to the lowest IEC rated branch breaker unless series rated with an IEC rated main breaker in Table 4. (See Digest for details)

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Appendix 2: Accessory Kits

An assortment of field-installable accessory kits are available for I-Line panelboards:

- Equipment Ground Bar Kits, on page 36
- Mechanical Interlock Kits, on page 36
- Main Lug Kits, on page 37
  - — Versa-Crimp Lugs and Versatile Compression Lug Kits — Aluminum, on page 37
  - — Versa-Crimp Lugs and Versatile Compression Lug Kits — Copper, on page 37
- Circuit Breaker Lug Kits, on page 38
  - — Versa-Crimp Lugs and Versatile Compression Lug Kits, on page 38
- Extension Kits, on page 40

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Equipment Ground Bar Kits

Equipment ground bar kits, suitable for copper or aluminum wire, meet the grounding needs of I-Line panelboards. Select the required kit according to the interior catalog number. Kits can be field installed.

Table 7: Equipment Ground Bar Kits Specifications

Panelboard	Use Ground Bar Kit Catalog Number	
	Aluminum [1]	Copper [2]
HCN	PK27GTA	PK27GTACU
HCM, HCP, HCRU	PK32DGTA	PK32DGTACU

1 Aluminum bars suitable for 60° C or 75° C Copper or Aluminum conductors.

2 Copper bars suitable for 60° C or 75° C Copper conductors.

NOTE: Ground bar mounting locations are identified by the ground symbol ⏚ stamped into the back wall of the enclosure.

Mechanical Interlock Kits

Kits can be field installed.

Table 8: Mechanical Interlocks Specifications

Catalog Number	Circuit Breaker Combinations		Panelboard Type
	Mains	Auxiliary	
HFK3DTI	FA	FA	HCN, HCM, HCP, HCRU
HFM3DTI	LA	FA	HCRU
HLM3DTI	LA	LA	HCP, HCRU
HPFK3DTI	MG/MJ	FA/KA	HCP, HCPSU, HCRU
HPHJ3DTI	MG/MJ	H/J	HCP, HCPSU, HCRU
HPL3DTI	MG/MJ	LA	HCP, HCPSU, HCRU
HPP3DTI	MG/MJ	MG/MJ	HCP, HCPSU, HCRU

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Main Lug Kits

Versa-Crimp® and Versatile™ Kits can be field installed.

Table 9: Versa-Crimp Lugs and Versatile Compression Lug Kits — Aluminum

Panelboard Amps	Wire Range	Kit Catalog Number	Versa-Crimp® Tool	Crimp Lug Adapter Kit
225 A	4–300 kcmil AL/CU 21.1–151 mm^2	VCEL-030-516H1	VC-6 Series	—
400 A				HCN400VCA HCM400VCA HCW400VCA
	500–750 kcmil AL 253–380 mm^2	VCEL-075-12H1	VC-6FT, VC-8	—
600 A	2/0–500 kcmil AL/CU 67.4–253 mm^2	VCEL-050-38H1	VC-6 FT	HCN600VCA HCM600VCA HCW600VCA
800 A		VCEL-050-12H1		HCM800VCA HCW800VCA
1200 A	500–750 kcmil AL 253–380 mm^2 500 kcmil CU 253 mm^2	VCEL-075-12H1 [1]	VC-6FT, VC-8	HCW1200VCA

[1] When this lug is installed, the box extension HC-4212-DEX (F or S) must be added to the incoming cable end of the enclosure.

Table 10: Versa-Crimp Lugs and Versatile Compression Lug Kits — Copper

Panelboard Amps	Wire Range	Kit Catalog Number	Versa-Crimp® Tool	Crimp Lug Adapter Kit
225 A	2/0–300 kcmil CU 67.4–151 mm^2	VCELC-030-38H1	VC-6-3 VC7 VC6-FT VC7-FT	—
400 A				HCN400VCA HCM400VCA HCW400VCA
	400–750 kcmil CU 203–380 mm^2	VCELC-075-12H1	VC-6FT VC7-FT VC8	—
600 A	250–500 kcmil CU 127–253 mm^2	VCELC-050-12H1	VC6-3 VC7 VC6-FT VC7-FT	HCN600VCA HCM600VCA HCW600VCA
800 A				HCM800VCA HCW800VCA
1200 A	400–750 kcmil CU 203–380 mm^2	VCELC-075-12H1	VC-6FT VC7-FT VC8	HCW1200VCA

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Circuit Breaker Lug Kits

Versa-Crimp® and Versatile™ Kits can be field installed.

Table 11: Versa-Crimp Lugs and Versatile Compression Lug Kits [1]

Aluminum	Wire Range [2]	Versa-Crimp Tool	Copper	Wire Range [2]	Versa-Crimp Tool
VC100FA VC100FD	8–1/0 8.36–53,5 mm²	VC-6	CVC100FA CVC100FD	6–1/0 CU 13.3–53.5 mm²	VC-6 Series
VC250KA3	4–300 kcmil 21.1–151 mm²		CVC250KA3	2/0–300 kcmil CU 67.4–151 mm²	
VC250KA35	250–350 kcmil 127–177 mm²		CVC400LA3	4–300 kcmil CU 21.1–151 mm²	
VC400LA35	250–350 kcmil 127–177 mm²		CVC400LA5 CVC600MA5	250–500 kcmil CU 127–253 mm²	
VC400LA3	4–300 kcmil 21.1–151 mm²		CVC1200NE5	2/0–500 kcmil 67.4–253 mm²	
VC400LA5	2/0–500 kcmil 67.4–253 mm²		CVC1200NE7	500–750 kcmil AL 253–380 mm² 500 kcmil CU 253 mm²	
VC400LA7	500–750 kcmil AL 253–380 mm² 500 kcmil CU 253 mm²	VC-6 FT VC-8			
VC400LA7	2/0-500 kcmil 67.4–253 mm²	VC-6 Series	—		
VC800MA7	500–750 kcmil AL 253–380 mm² 500 kcmil CU 253 mm²	VC-6 FT VC-8			
VC1200NE5	2/0–500 kcmil 67.4–253 mm²	VC-6 Series			
VC1200NE7	500–750 kcmil AL 253–380 mm² 500 kcmil CU 253 mm²	VC-6 FT VC-8			
YA060HD	# 6–#2 AWG	[3]	CYA060HD	# 6–1/0 AWG CU	[3]
YA150HD	# 1–4/0 AWG		CYA150JD	# 4–2/0 AWG CU	
YA150JD	# 1–3/0 AWG		CYA150HD	# 6–1/0 AWG CU	
YA250J35	3/0–350 kcmil		CYA250J3	1/0–350 kcmil CU	

1 Always ensure compression lugs are installed in panelboards that will provide wire bending space in accordance with NEC Article 312.6, 2011 Edition.

2 Unless otherwise specified, wire sizes apply to both aluminum and copper conductors.

3 Use crimp tools in accordance with instructions that are provided within each lug kit.

Table 12: Compression Lug Kits for L-, MG-, MJ-, P-, and R-Frame Circuit Breaker [1]

Aluminum	Wire Range [2]	Versa-Crimp Tool	Copper	Wire Range [2]	Versa-Crimp Tool
YA250P3	2/0–300 kcmil 67.4–151 mm²	4, 5	CYA400P5	4/0–500 kcmil CU 107–253 mm²	4, 5
YA300P5	4/0–500 kcmil 107–253 mm²		CYA600P5	4/0–500 kcmil CU 107–253 mm²	
YA400P3	2/0–300 kcmil 67.4–151 mm²		CYA800P7	500–750 kcmil CU 253–380 mm²	
YA400P7	500–750 kcmil 253–380 mm²		CYA1200R5	4/0–500 kcmil CU 107–253 mm²	
YA600P5	4/0–500 kcmil 107–253 mm²		CYA1200R7	500–750 kcmil CU 253–380 mm²	
YA800P7 [3]	500–750 kcmil 253–380 mm²		—		
YA1200R3	2/0–300 kcmil 67.4–151 mm²				
YA1200R5	4/0–500 kcmil 107–253 mm²				
YA1200R7	500–750 kcmil 253–380 mm²				
YA400L31K3 [7]	#4–300 kcmil 21–151 mm²	4	CYA400L31K3 [7]	2/0–300 kcmil 67.4–151 mm²	4
YA600L32K3 [7]			CYA600L32K3 [7]		
YA400L51K3 [7]	2/0–500 kcmil 67.4–253 mm²		CYA400L51K3 [7]	250–500 kcmil 127–253 mm²	
YA600L52K3 [7]			CYA600L52K3 [7]		
YA400L71K3 [6, 7]	500–750 kcmil 253–380 mm²		—		

1 Always ensure compression lugs are installed in panelboards that will provide wire bending space in accordance with NEC Article 312.6, 2011 Edition.

2 Unless otherwise specified, wire sizes apply to both aluminum and copper conductors.

3 When this lug is installed on a vertically mounted main circuit breaker, in an HCP interior, add box extension HC-4212-DEX (F or S) to the end of that enclosure.

4 Use crimp tools in accordance with instructions that are provided within each lug kit.

5 Always ensure compression lugs are installed in panelboards that will provide wire bending space in accordance with NEC Article 312.6, 2011 Edition. I-LINE panelboards with a Type 1 enclosure require a 5.0 in. extended width box when the branch breakers use these lugs (these compression lugs may not be used in weatherproof enclosures). Contact your local Schneider Electric representative for assistance.

6 This lug is only allowed in HCP/HCPSU panelboards with Type 1 enclosures with a 5.0 in. wide side extension.

7 For L-frame circuit breakers only.

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Extension Kits

Table 13: Extension Kits for HCN, HCM, HCRU and HCP Panelboards

Catalog Number	For Use With
HC2609EX [1]	HC26--B [2]
HC2609DEX [1]	HC26--DB [2]
HC3209EX [1]	HC32--B [2]
HC4212DEX [1]	HC42--DB [2]
HC4406DEX [1]	HC44--DB [2]
HC4412DEX [1]	HC44--DB [2]

[1] Add “F” for flush, “S” for surface as required.

[2] Series E1 Enclosures.

NOTE: Kits can be field installed. Extension kit must be attached to enclosure before mounting enclosure to wall.

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www.us.SquareD.com

80043-309-20
Replaces 80043-309-19

NF/NFOM Panelboards
Information Manual
Class 1670

Instruction Bulletin

80043-741-02

Retain in the directory card pocket for future use.



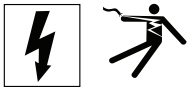
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HAZARD CATEGORIES AND SPECIAL SYMBOLS

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, can result in death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, can result in minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, can result in property damage.



Provides additional information to clarify or simplify a procedure.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Introduction

This bulletin contains instructions for installing Square D® brand NF and NFOM circuit breaker panelboards. These panelboards are Underwriters Laboratories (cULus) listed and accept ECB, EDB, EGB, and EJB branch circuit breakers.



For technical support on the installation of this panelboard, contact the Square D/Schneider Electric Customer Information Center at 1-888-SquareD (1-888-778-2733).



See the labels on the equipment for rating and safety information. Additional equipment labels are provided with this document.

Safety Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Read and understand this entire instruction bulletin and the included NEMA PB 1.1 standards publication before installing, operating, or maintaining this equipment.
- Local codes vary, but are adopted and enforced to promote safe electrical installations. A permit may be needed to do electrical work, and some codes may require an inspection of the electrical work.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside the equipment.
- Always use a properly-rated voltage sensing device to confirm all power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

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Installation

This section provides instructions for the following NF/NFOM panelboard procedures:

- “Interior Mounting for Square D Brand Enclosures” on page 8
- “Neutral Bonding Strap Installation” on page 11
- “ECB, EDB, EGB, and EJB Circuit Breaker Installation and Removal” on page 15
- “Circuit Breaker Reset Instructions” on page 17
- “Interior Trim Preparation” on page 18

Interior Mounting for Square D Brand Enclosures

A separate standards publication, titled “General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less” (NEMA PB1.1), has been provided with this equipment. Familiarize yourself with the content of this document before proceeding with any of the following procedures.

If you did not receive a copy of this document, or if you have any questions regarding this equipment, contact your local distributor or Schneider Electric representative.

CAUTION

HAZARD OF EQUIPMENT DAMAGE

- Ensure all connections are properly tightened.
- Refer to the torque information label provided on the panelboard before tightening the connections.

Failure to follow these instructions can result in equipment damage.

To properly mount and install the NF/NFOM panelboard interior, please refer to the NEMA PB 1.1 standards publication, and follow the instructions below for either “Surface Mounting (Enclosure Mounted on Wall)” or “Flush Mounting (Enclosure Recessed in Wall).”

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Surface Mounting (Enclosure Mounted on Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Remove the interior trim from the trim brackets.
3. Install the interior as described below:
   a. Thread the provided elevating nuts on the enclosure studs.
   b. Set the interior on the enclosure studs. (See Figure 1 on page 10).
   c. Tighten the flange nuts against the interior side rails until the rails are against the back of the enclosure.
   d. Remount the interior trim after wiring.
4. If used as service entrance equipment, neutral bonding is required. See the “Neutral Bonding Strap Installation” instructions on page 11.
5. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

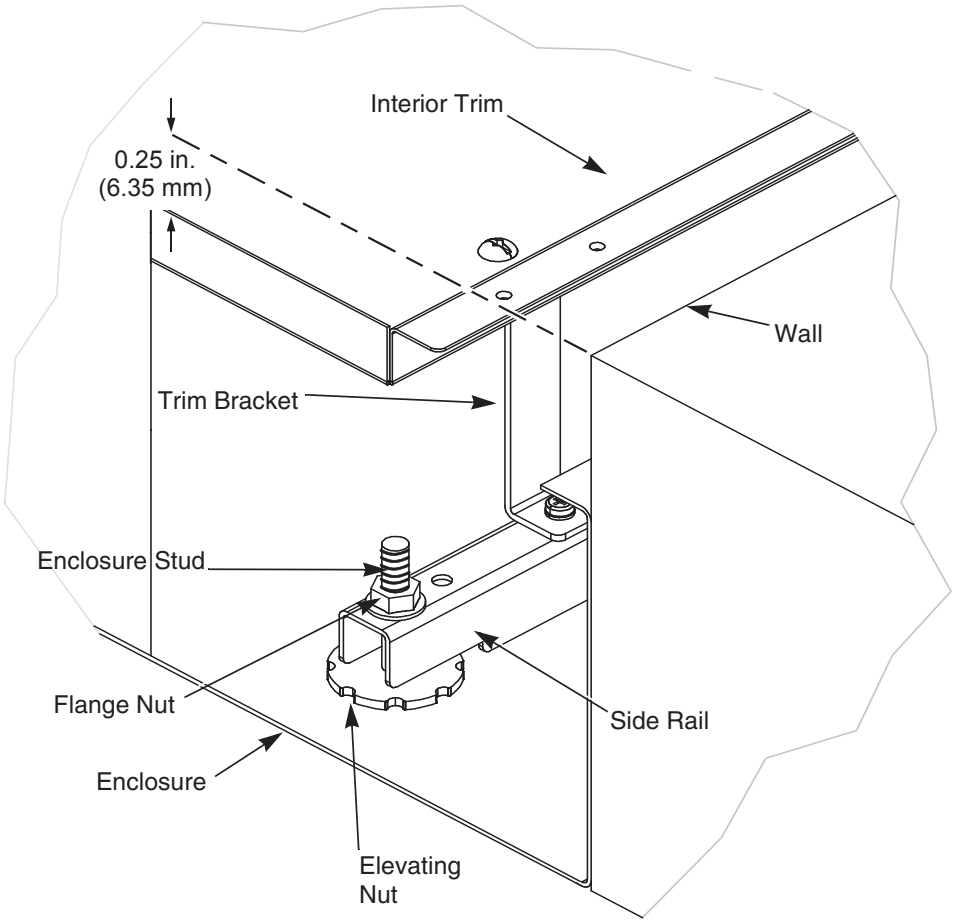
Flush Mounting (Enclosure Recessed in Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Remove the interior trim from the trim brackets.
3. Install the interior as described below:
   a. Thread the provided elevating nuts on the enclosure studs.
   b. Set the interior on the enclosure studs (see Figure 1 on page 10). Place the flange nuts onto the enclosure studs, but do not tighten.
   c. Adjust the elevating nuts so that the lip of the interior trim is approximately 0.25 inches (6.35 mm) from wall line.
   d. Tighten the flange nuts against the side rails.
   e. Remount the interior trim after wiring.
4. If used as service entrance equipment, neutral bonding is required. See the “Neutral Bonding Strap Installation” instructions on page 11.
5. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

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Figure 1: Interior Mounting of Square D Brand Enclosures



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Neutral Bonding Strap Installation

The neutral bonding strap should be used only when the panelboard is **installed** as service equipment.

To properly bond the neutral to the panelboard, follow the instructions for either “125 A or 250 A Maximum NF Panelboards”, “400 A or 600 A Maximum NF Panelboards”, or “800 A Maximum NF Panelboards” below, and on pages 12–14.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Turn off all power supplying this equipment before working on or inside the equipment.
- The main bonding strap should be used only when the panelboard is installed as service equipment.
- Do not mix the mounting screws with the interior trim screws.

Failure to follow these instructions will result in death or serious injury.

NOTE: The bonding strap parts are found in the bag assembly provided with the interior.

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125 A or 250 A Maximum NF Panelboards

To install a neutral bonding strap on a 125 A or 250 A maximum NF panelboard, refer to Figure 2 and follow the instructions below.

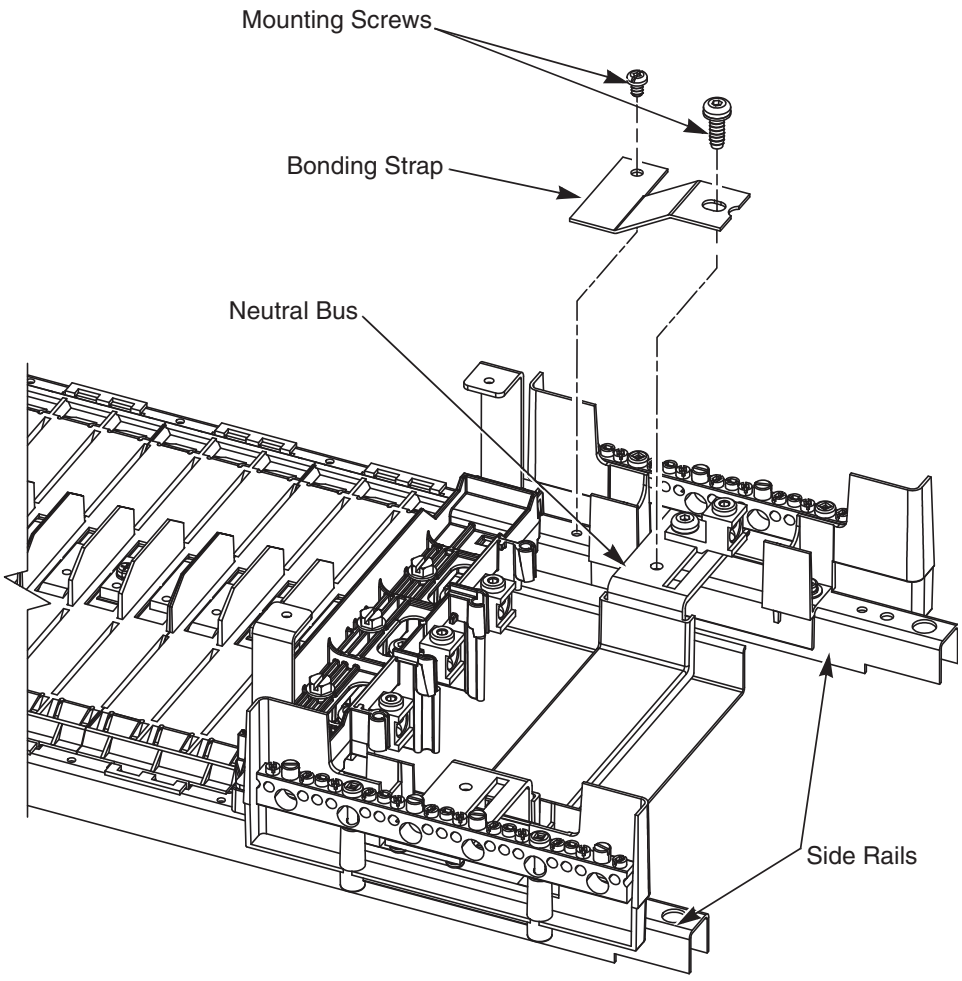
1. Align the bonding strap on the side rail, as pictured.

   NOTE: For some applications, it may be necessary to remove the lug (not pictured) before installing the bonding strap.

2. Insert the two mounting screws, as pictured. Tighten the 10-32 screw to 10–12 lb-in (1.1–1.4 N•m) and the 1/4-20 screw to 25–30 lb-in (2.8–3.4 N•m).

   NOTE: If the lug was removed in Step 1, reinstall it on top of the bonding strap. Use the 1/4-20 x 3/4 in. mounting screw. Lug mounting screws are provided in the bonding strap bag assembly.

Figure 2: Bonding Strap Installation — 125 A or 250 A Maximum NF Panelboards



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400 A or 600 A Maximum NF Panelboards

To install a neutral bonding strap on a 400 A or 600 A maximum NF panelboard, refer to Figure 3 and follow the instructions below.

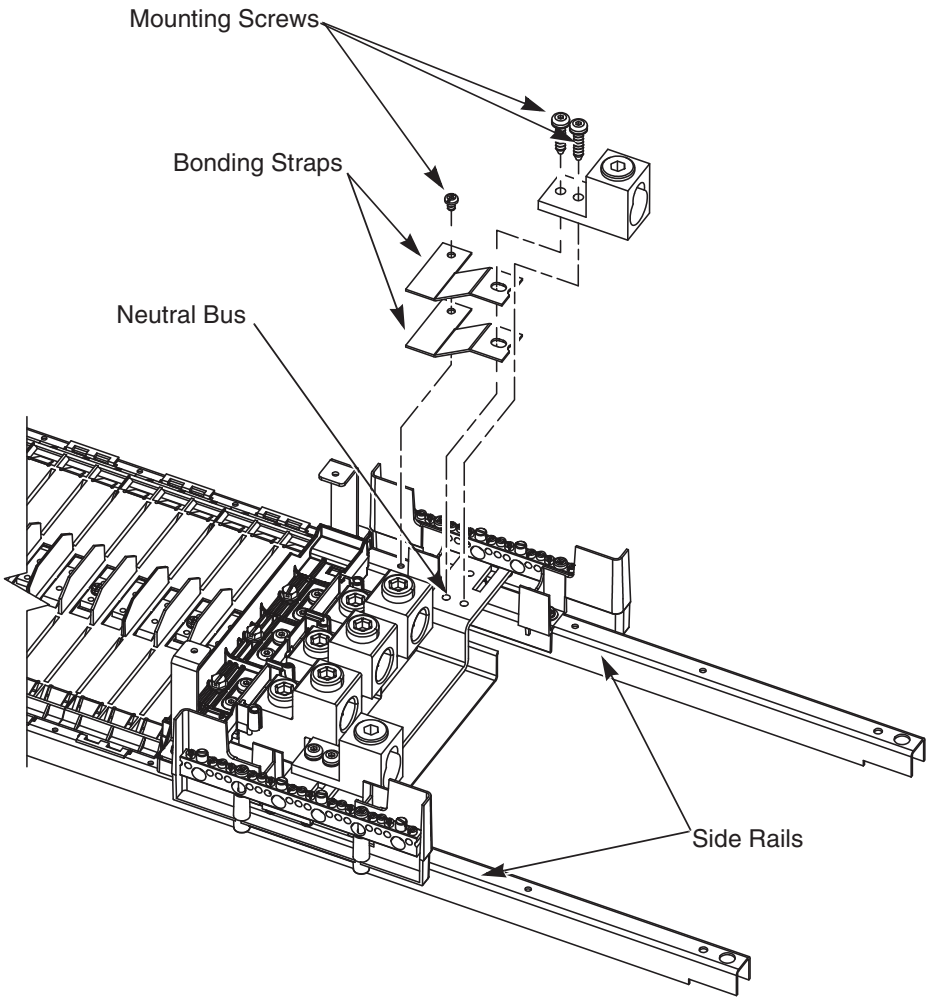
1. Align the two bonding straps on the side rail, as pictured.

   NOTE: For some applications, it may be necessary to remove the lug before installing the bonding strap.

2. Insert the three mounting screws, as pictured. Tighten the 10-32 screw to 10–12 lb-in (1.1–1.4 N•m) and the two 1/4-20 screws to 60–65 lb-in (6.8–7.3 N•m).

   NOTE: If the lug was removed in Step 1 above, reinstall it on top of the bonding strap. Use the 1/4-20 x 1 1/8 in. mounting screws. Lug mounting screws are provided in the bonding strap bag assembly.

Figure 3: Bonding Strap Installation — 400 A or 600 A Maximum NF Panelboards



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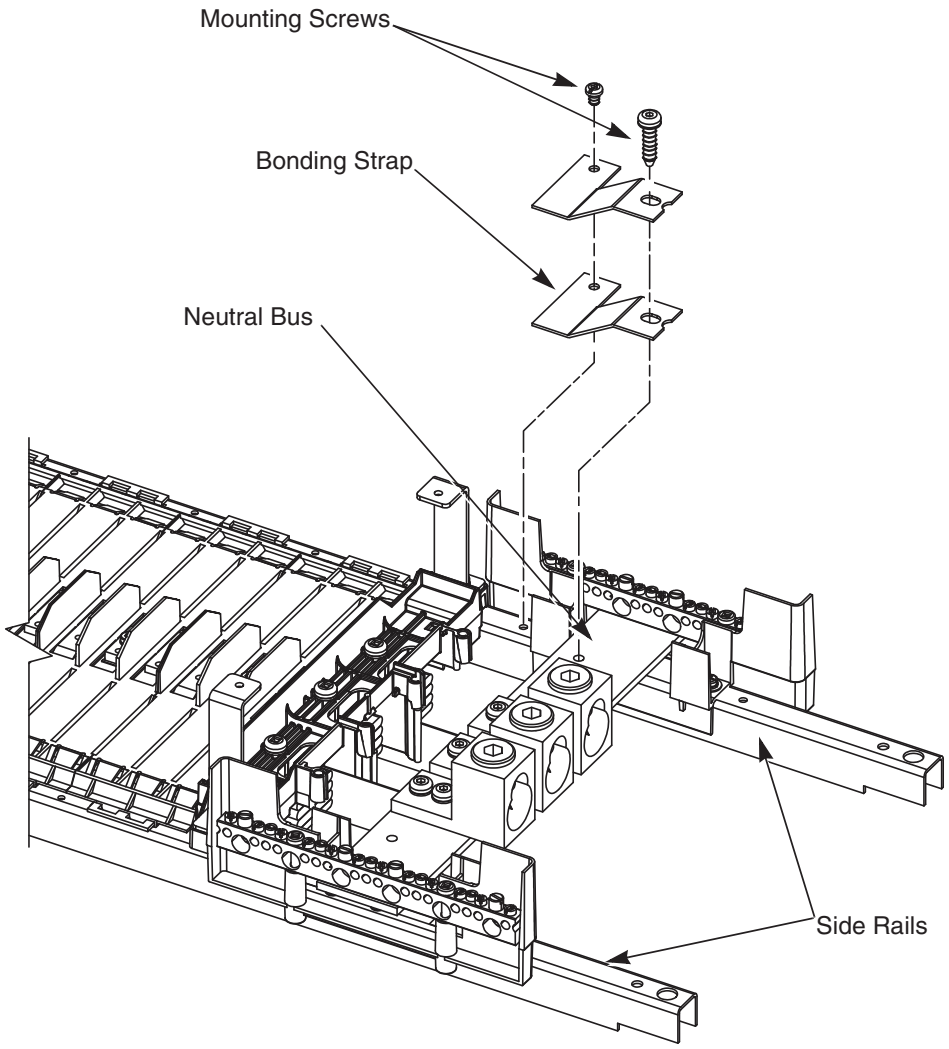
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800 A Maximum NF Panelboards

To install a neutral bonding strap on an 800 A maximum NF panelboard, refer to Figure 4 and follow the instructions below.

1. Align the two bonding straps on the side rail, as pictured.
2. Insert the two mounting screws, as pictured. Tighten the 10-32 screw to 10–12 lb-in (1.1–1.4 N•m) and the 1/4-20 screw to 60–65 lb-in (6.8–7.3 N•m).

Figure 4: Bonding Strap Installation — 800 A Maximum NF Panelboards



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ECB, EDB, EGB, and EJB Circuit Breaker Installation and Removal

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly-rated voltage sensing device to confirm that all power is off.
- All unused spaces must be filled with blank fillers.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

ECB, EDB, EGB, and EJB Circuit Breaker Installation

Refer to Figure 5 on page 16 for the following instructions:

1. Turn off all power to the panelboard.
2. Turn the breaker off.
3. Remove the interior trim.
4. With the bolt-on connector end of the circuit breaker slightly elevated, insert the mounting foot into the slot in the phase cover.
5. Rotate the breaker down and back until the captive screw(s) align with the tapped holes in the breaker connectors.
6. Engage the screws into the branch connector hole and tighten it to 20–30 lb-in (2.3–3.4 N•m).
7. Install the load wire.
8. Reinstall the interior trim.

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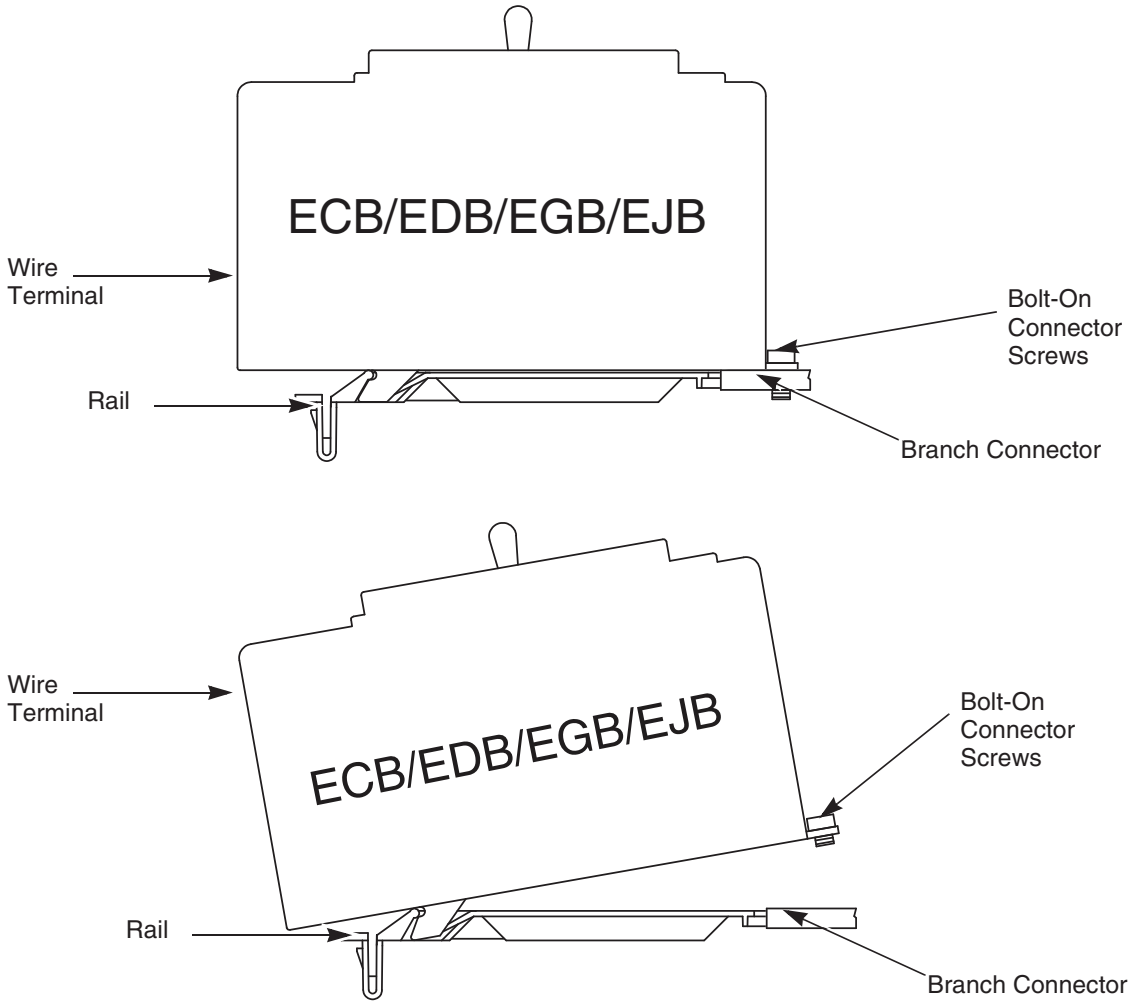
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ECB, EDB, EGB, and EJB Circuit Breaker Removal

Refer to Figure 5 on page 16 for the following instructions:

1. Turn off all power to the panelboard.
2. Remove the interior trim.
3. Turn the breaker off.
4. Remove the load wire.
5. Loosen the screw(s) in the breaker connector and lift the breaker off of the panelboard.
6. Reinstall the interior trim.

Figure 5: ECB, EDB, EGB, and EJB Circuit Breaker Installation and Removal

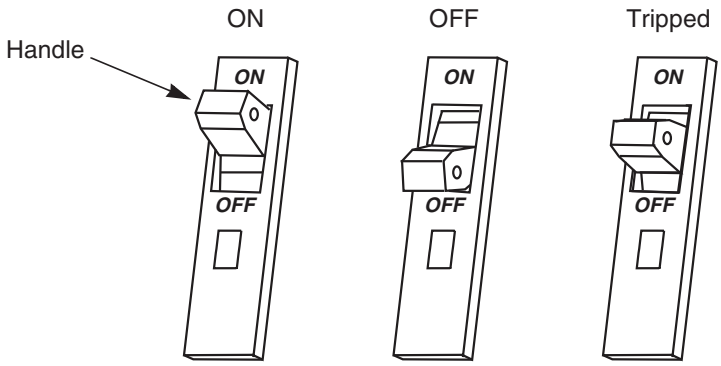


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Circuit Breaker Reset Instructions

If the circuit breaker is tripped, the handle will be at the mid-position between ON and OFF. To reset the circuit breaker, push the handle to the OFF position, then to the ON position.

Figure 6: Circuit Breaker Handle Positions



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Interior Trim Preparation

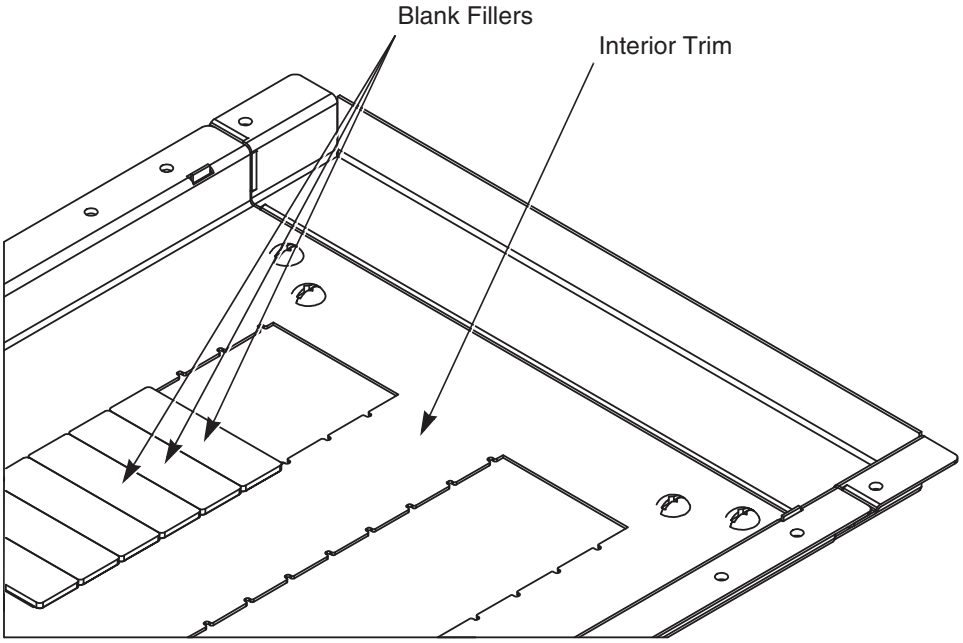
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Before energizing the panelboard, all unused spaces must be filled with blank fillers.
- Replace all devices, doors, and covers before energizing this equipment.

Failure to follow this instruction will result in death or serious injury.

Figure 7: Interior Trim Diagram



NOTE: The back of the interior trim lists the catalog number for its corresponding compatible blank fillers.

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Appendix 1: Specifications

Typical Wiring

NOTE: Do not use on 600 V or 480 V, 3-phase 3-wire delta systems.

Table 1: Panelboard Typical Wiring[1]

	1-Phase Panelboards		3-Phase Panelboards	
Voltage AC	**Phase**	**Wires**	**Phase**	**Wires**
600Y/347	1	3	3	4
480Y/277	1	3	3	4
208Y/120	1	3	3	4
120/240	1	3	—	—
240[2]	1	2	3	3
240	3	3	—	—
240/120[3]	—	—	3	4 Delta

1 Additional information is provided on the panelboard. See the main circuit breaker rating, if used.

2 For this system, the neutral is not used.

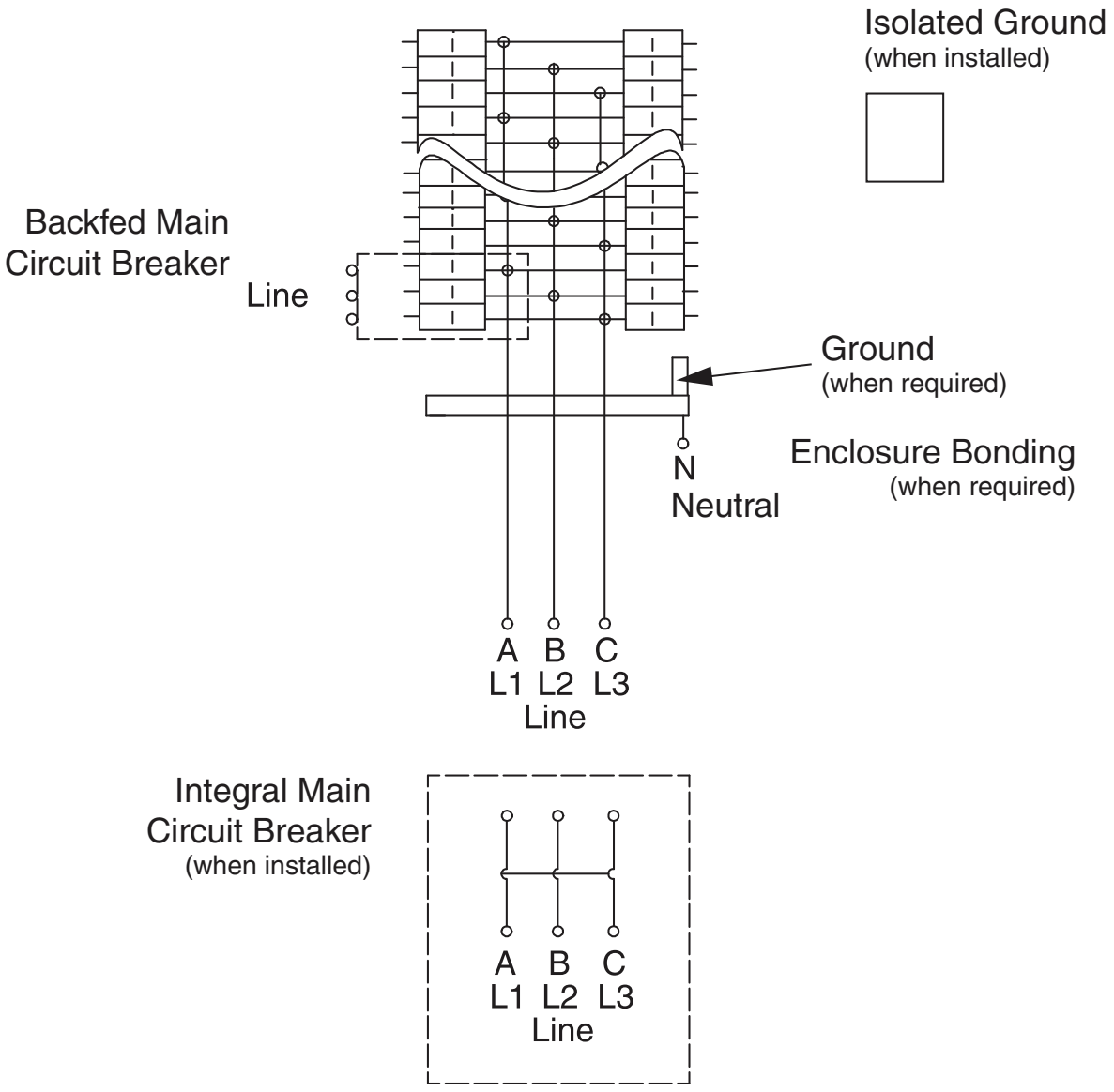
3 When wiring for a delta system, phases “A” and “C” must be 120 V to neutral, phase “B” 208 V to neutral.

Integral Main or Sub-Feed
(FI, KI, H, J, LA, LC, LH, EDB, EGB, EJB)

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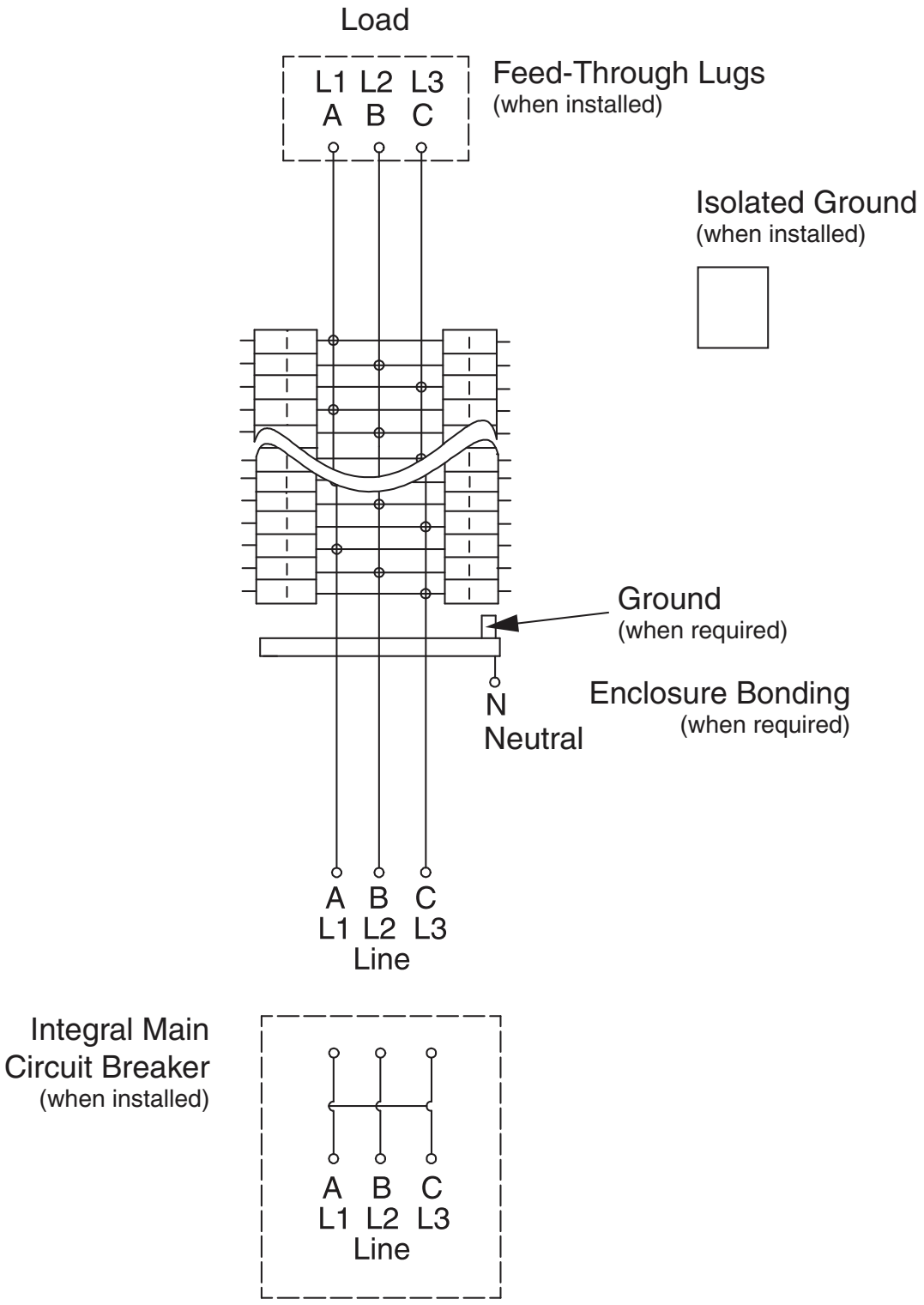
Figure 8: NF/NFOM 125–250 A Main Lugs or Main Breaker Diagram



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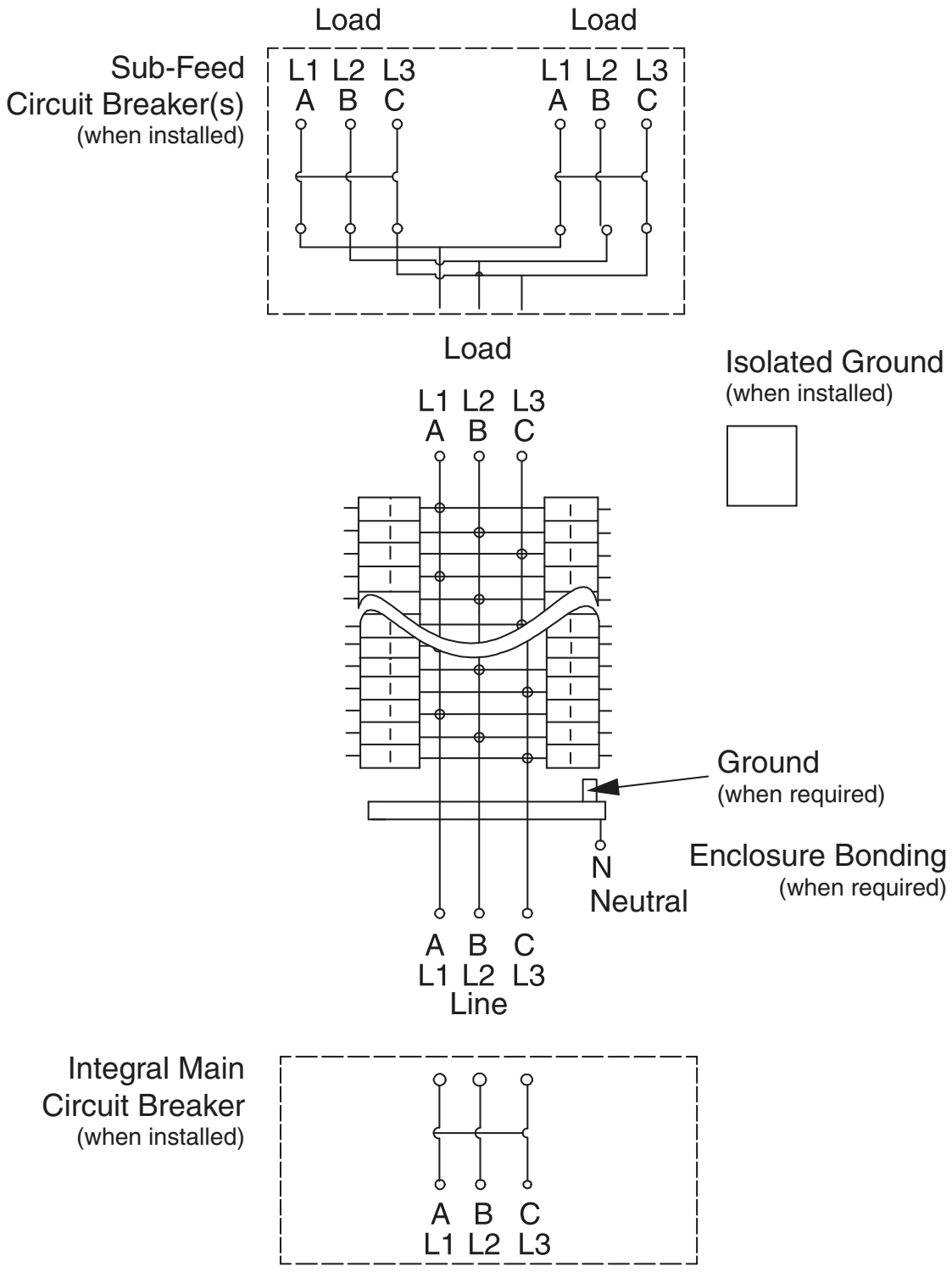
Figure 9: NF 400–800 A Main Lugs or Main Circuit Breaker with or without Feed-Through Lugs Diagram



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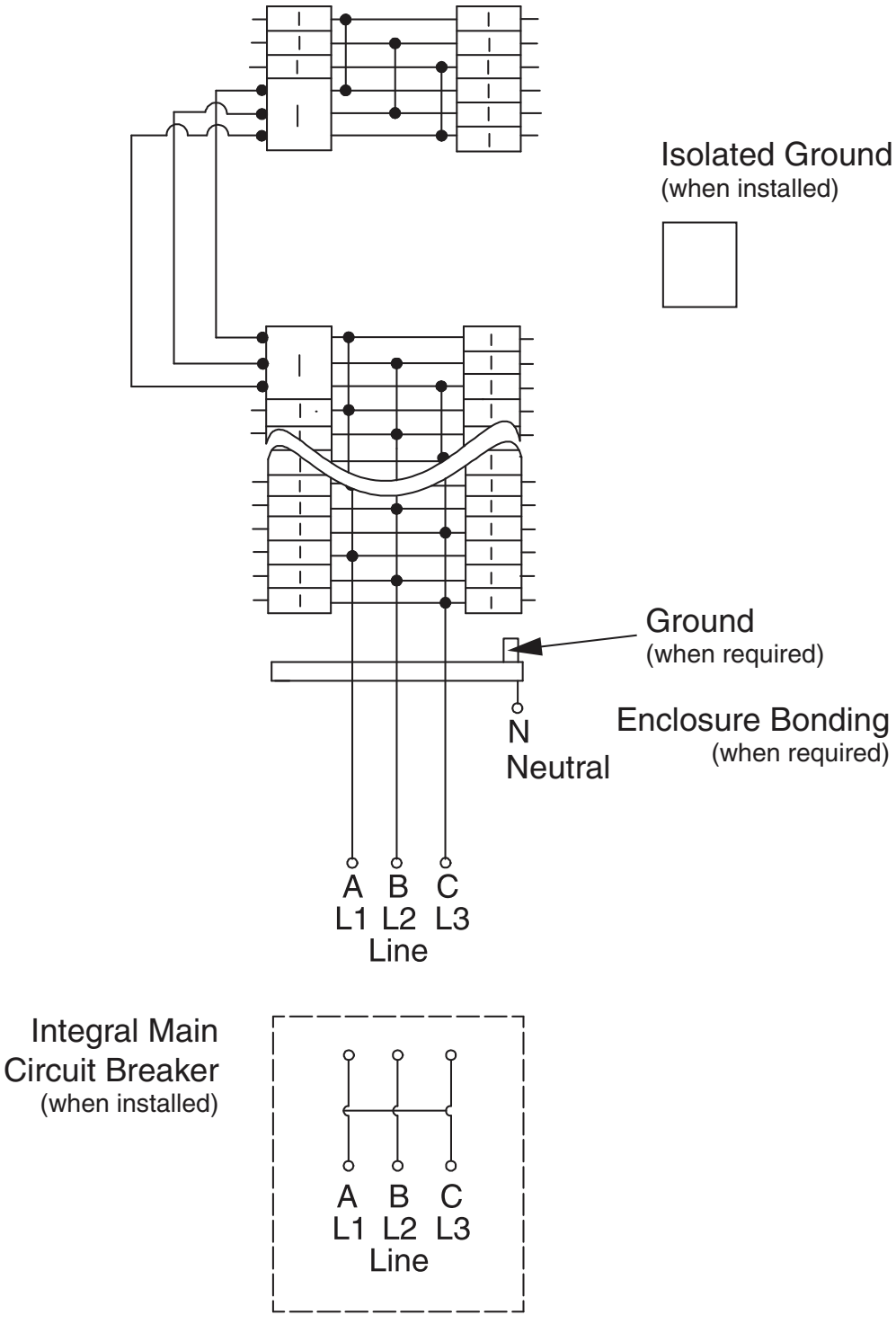
Figure 10: NF 400–800 A Main Circuit Breaker with Feed-Through Lugs or Sub-Feed Circuit Breakers Diagram



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Figure 11: Typical NF Panelboard with Split Bus Diagram



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Panelboard Ratings

Refer to NEC section 110-22 and CEC rule 14-014 for more information. The series rated system label is located in the bag assembly.

NOTE: 125 A ED/EG/EJ breakers are 480Y/277 Vac maximum only.

Table 2: Series Connected Breaker Ratings (RMS Symmetrical)

Max. System Voltage AC[1]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges
120 120/240 240	65,000	EG, FH, FG, KH, LH, MH, MX, HG, JG, DG	EDB, EDB–EPD
		EG	ECB–G3
	100,000	EJ, FC, FJ, KC, LC, LX, HJ, JJ	EDB, EDB–EPD, EGB
		DJ	EDB, EGB
		EJ, FC, KC, HJ, JJ	ECB–G3
	125,000	HL, JL	EDB, EDB–EPD, EGB, ECB–G3
	200,000	FI, KI, LI, LXI	EDB, EDB–EPD, EGB, EJB
		FI, KI	ECB–G3
		Class J or T (600 V) 200 A Max Fuses	ECB–G3
277 480Y/277	35,000	EG. FG, KH, LH, HG, JG, DG	EDB, EDB–EPD
		EG, HG, JG	ECB–G3
	65,000	EJ, FC, FJ, KC, LC, LX, HJ, JJ, DJ	EDB, EDB–EPD, EGB
		EJ, FC, KC, HJ, JJ	ECB–G3
	100,000	HL, JL	EDB, EDB–EPD, EGB, EJB
		DL	EDB, EGB, EJB
		400 A Max Fuses	EDB, EDB–EPD, EGB, EJB
	200,000	FI, KI, LI, LXI	EDB, EDB–EPD, EGB, EJB
		FI, KI	ECB–G3
		200 A Max Fuses	EDB, EDB–EPD, EGB, EJB, ECB–G3
600Y/347	18,000	HG, JG, MG	EDB
	25,000	EJ, FI, KH, KI, LC, LE, LX, LI, LXI, HJ, JJ	EDB, EGB
		LH	(15–70 A) EDB, EGB
	35,000	LC, LE, LX	EDB, EGB, EJB
	50,000	HL, JL	EDB, EGB, EJB
	65,000	FI, KI	EDB, EGB, EJB
		LI, LXI	EJB
	200,000	Class J or T (600 V) 200 A Max Fuses	EDB, EGB, EJB

[1] Short circuit tests are conducted at 100–105% of the maximum rated voltage of the panelboard.

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Short Circuit Current Rating for Main Lug Interiors with Sub-Feed or Feed-Through Lugs

Main lug interiors equipped with sub-feed or feed-through lugs, where the device feeding the interior is unknown or not a Square D device, are rated to 25,000 RMS symmetrical amperes at 600Y/347 Vac maximum for three cycles. Use of one of the Square D circuit breakers of the correct ampere rating, listed as main circuit breakers on page 19, ahead of these lugs will result in a rating equal to that of the circuit breaker.

CAUTION

HAZARD OF EQUIPMENT DAMAGE

Use only one wire per phase for incoming circuit breaker connections when the integral LH main circuit breaker is upstream of the feed-through lugs.

Failure to follow these instructions can result in equipment damage.

CE Marking

Interiors with the “CE” mark meet the IEC 60439-1 standard.

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Appendix 2: Accessory Kits

An assortment of field-installable accessory kits are available for NF panelboards:

- Equipment Ground Bar Kits, on page 27
- Sub-Feed Lug Kits 125–400 A Panelboards, on page 27
- Main Lug Kits
  - — Mechanical Lug Kits — Aluminum, on page 28
  - — Mechanical Lug Kits — Copper, on page 28
  - — Versa-Crimp® Compression Lug Kits — Aluminum, on page 29
  - — Versa-Crimp® Compression Lug Kits — Copper, on page 29

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Equipment Ground Bar Kits

Equipment ground bar kits, suitable for copper or aluminum wire, meet the grounding needs of NF panelboards.

Table 3: Equipment Ground Bar Kits Specifications

Panelboard		Use Ground Bar Kit Catalog Number	
Branch Circuit	**Mains Rating**	**Aluminum[1]**	**Copper[2]**
1–42	800 A Maximum	(1) PK27GTA	(1) PK27GTACU
54–84		(2) PK27GTA	(2) PK27GTACU

1 Aluminum bars suitable for 60° C or 75° C Copper or Aluminum conductors.

2 Copper bars suitable for 60° C or 75° C Copper conductors.

Ground bar mounting locations are identified by the ground symbol ⏚ stamped into the backwall of the enclosure.

Sub-Feed Lug Kits 125–400 A Panelboards

Sub-Feed main lugs are available for 125, 250, or 400 A applications.

Table 4: Sub-Feed Lugs kits for 125–400 A Panelboard Applications

Main Amps	Kit Catalog Number	Maximum Circuits
125	NF125SFL	18, 30
250	NF250SFL	30, 42, 54, 66, 84
400	NF400SFL	30, 42, 54, 66, 84

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Main Lug Kits

Table 5: Mechanical Lug Kits — Aluminum

Panelboard Amps	Kit Catalog Number	Wire Range
125	Standard	#6–350 kcmil 13.3–177.3 mm^2
250	Standard	
400	Standard	(1) 1/0–750 kcmil (2) 1/0–350 kcmil (1) 53.48–380 mm^2 (2) 53.48–177.3 mm^2
600	Standard	(2) 1/0–750 kcmil (2) 53.48–380 mm^2
800	Standard	(3) 1/0–750 kcmil (3) 53.48–380 mm^2

Table 6: Mechanical Lug Kits — Copper

Panelboard Amps	Kit Catalog Number	Wire Range
125	NFCUM1	#6–350 kcmil 13.3–177.3 mm^2
250	NFCUM2	
400	NFCUM4	(1) 1/0–750 kcmil (2) 1/0–350 kcmil (1) 53.48–380 mm^2 (2) 53.48–177.3 mm^2
600	NFCUM6	(2) 1/0–750 kcmil (2) 53.48–380 mm^2

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Table 7: Versa-Crimp® Compression Lug Kits — Aluminum

Panelboard Amps	Kit Catalog Number	Wire Range	Crimp Tool
125	NFALV1	#4–300 kcmil 21.15–152 mm^2	VC6
250	NFALV2	250–350 kcmil 126.7–177.3 mm^2	
400	NFALV4	(2) 2/0–500 kcmil (2) 67.43–253.4 mm^2	
600	NFALV6		

Table 8: Versa-Crimp® Compression Lug Kits — Copper

Panelboard Amps	Kit Catalog Number	Wire Range	Crimp Tool
125	NFCUV1	#6–1/0 kcmil 13.30–53.48 mm^2	VC6-3
250	NFCUV2	(1) 2/0–300 kcmil (1) 67.43–152 mm^2	VC6-FT, VC7, VC7-FT, VC8
400	NFCUV4	(1) 400–750 kcmil (1) 202.7–380 mm^2	
600	NFCUV6	(2) 250–500 kcmil (2) 126.7–253.4 mm^2	VC6 Series

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Notes

NF/NFOM Panelboards Information Manual
Boletín de instrucciones para tableros de alumbrado y distribución NF y NFOM
Directives d'utilisation pour panneaux de distribution NF/NFOM

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Solamente el personal especializado deberá instalar, hacer funcionar y prestar servicios de mantenimiento al equipo eléctrico. Schneider Electric no asume responsabilidad alguna por las consecuencias emergentes de la utilización de este material.

Seul un personnel qualifié doit effectuer l'installation, l'utilisation, l'entretien et la maintenance du matériel électrique. Schneider Electric n'assume aucune responsabilité des conséquences éventuelles découlant de l'utilisation de cette documentation.

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NQ/NQM Panelboards and QONQ Load Centers

Information Manual
Class 1640

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Instruction Bulletin

80043-712-06 Rev. 01
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Hazard Categories and Special Symbols

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Introduction

This bulletin contains instructions for installing Square D™ brand NQ circuit breaker panelboards and QONQ load centers. These panelboards and load centers are Underwriters Laboratories (cULus) listed and accept QO™ and QOB branch circuit breakers.



For technical support on the installation of this panelboard, contact the Square D/Schneider Electric Customer Information Center at (1-888-778-2733).



See the labels on the equipment for rating and safety information. Additional equipment labels are provided with this document.

Safety Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or NOM-029-STPS.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn OFF all power supplying this equipment before working on or inside the equipment.
- Always use a properly-rated voltage sensing device to confirm all power is OFF.
- Read and understand this entire instruction bulletin and the included NEMA PB 1.1 standards publication before installing, operating, or maintaining this equipment.
- Local codes vary, but are adopted and enforced to promote safe electrical installations. A permit may be needed to do electrical work, and some codes may require an inspection of the electrical work.
- Replace all devices, doors and covers before turning ON power to this equipment.

Failure to follow these instructions will result in death or serious injury.

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Installation

This section provides instructions for the following NQ panelboard and QONQ load center procedures:

- “Interior Mounting for Square D Brand Enclosures” on page 6
- “Neutral Bonding Strap/Cable Installation” on page 9
- “QO and QOB Circuit Breaker Installation and Removal” on page 12
- “Circuit Breaker Reset Instructions” on page 15
- “Interior Trim Preparation” on page 16

Interior Mounting for Square D Brand Enclosures

A separate standards publication, titled “General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less” (NEMA PB1.1), has been provided with this equipment. Familiarize yourself with the content of this document before proceeding with any of the following procedures.

If you did not receive a copy of this document, or if you have any questions regarding this equipment, contact your local distributor or Schneider Electric representative.

NOTICE

HAZARD OF EQUIPMENT DAMAGE DUE TO LOOSE CONNECTIONS

- Ensure all connections are properly tightened.
- Refer to the torque information label provided on the panelboard before tightening the connections.

Failure to follow these instructions can result in equipment damage.

To properly mount and install the NQ panelboard or QONQ load center interior, please refer to the NEMA PB 1.1 standards publication, and follow the instructions below for either ““Surface Mounting (Enclosure Mounted on Wall)” on page 7” or ““Flush Mounting (Enclosure Recessed in Wall)” on page 7.”

Surface Mounting (Enclosure Mounted on Wall)

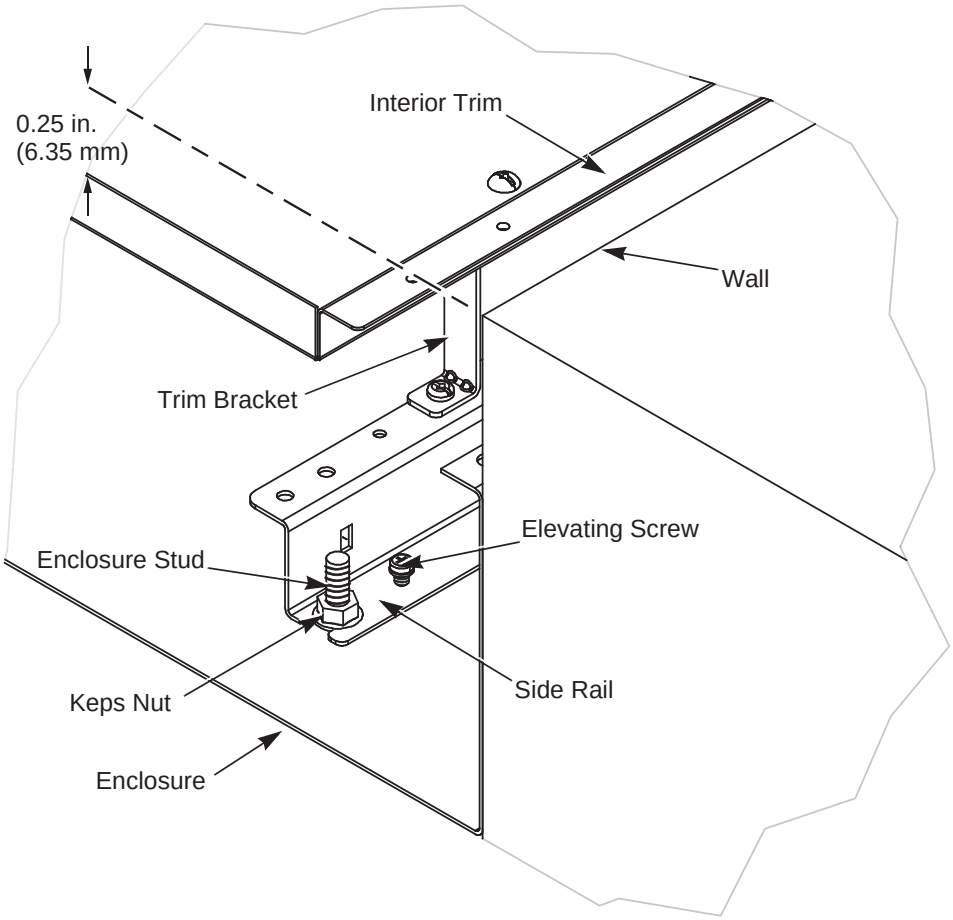
1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Remove the interior trim from the trim brackets.
3. Install the interior as described below:
   a. Set the interior on the enclosure studs. An elevating screw is not required (See Figure 1 on 8).
   b. Tighten the keps nuts against the interior side rails until the rails are against the back of the enclosure.
   c. Remount the interior trim after wiring.
4. If used as service entrance equipment, neutral bonding is required. See the “Neutral Bonding Strap/Cable Installation” instructions on page 9.
5. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

Flush Mounting (Enclosure Recessed in Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Remove the interior trim from the trim brackets.
3. Install the interior as described below:
   a. Thread the (4) 10-32 x .875 in. self-tapping, elevating screws provided with the flush trim into the side rails.
   b. Set the interior on the enclosure studs (see Figure 1 on 8). Place the keps nuts onto the enclosure studs, but do not tighten.
   c. Adjust the screws so that the lip of the interior trim is approximately 0.25 inches (6.35 mm) from wall line.
   d. Tighten the keps nuts against the side rails.
   e. Remount the interior trim after wiring.
4. If used as service entrance equipment, neutral bonding is required. See the “Neutral Bonding Strap/Cable Installation” instructions on page 9.
5. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

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Figure 1: Interior Mounting of Square D Brand Enclosures



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Neutral Bonding Strap/Cable Installation

The neutral bonding strap/cable should be used only when the panelboard is **installed** as service entrance equipment.

To properly bond the neutral to the panelboard, follow the instructions for either “100 or 250 A Maximum NQ Panelboards” or “400 or 600 A Maximum NQ Panelboards and QONQ Load Centers” below and on page 11, respectively.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or NOM-029-STPS.
- Turn OFF all power supplying this equipment before working on or inside the equipment.
- The main bonding strap/cable should be used only when the panelboard is installed as service entrance equipment.
- Do not mix the mounting screws with the interior trim screws.

Failure to follow these instructions will result in death or serious injury.

NOTE: The bonding strap/cable parts are found in the bag assembly provided with the interior.

100 or 250 A Maximum NQ Panelboards

To install a neutral bonding strap on a 100 or 250 A maximum NQ panelboard, refer to Figure 2 and follow the instructions below.

1. Align the bonding strap on the side rail, as pictured.

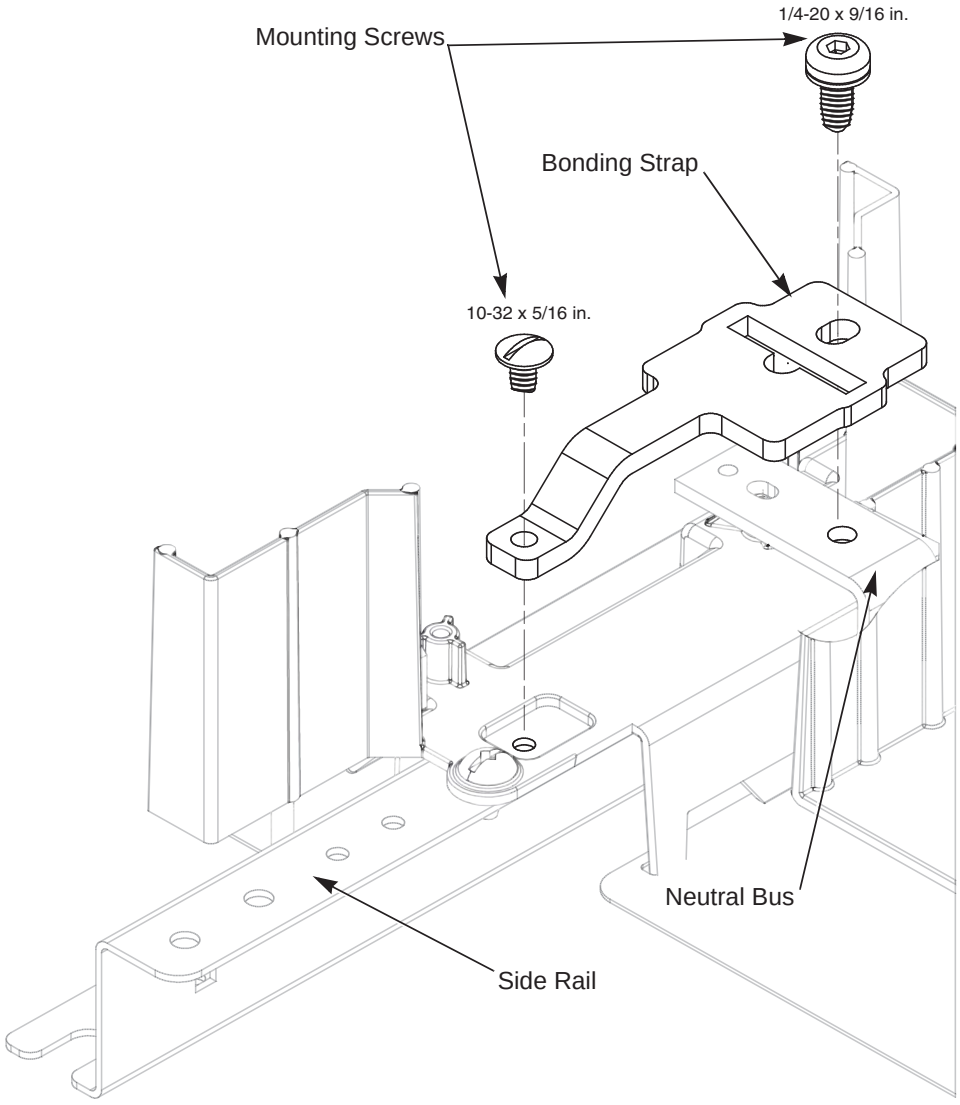
   NOTE: For some applications, it may be necessary to remove the lug (not pictured) before installing the bonding strap.

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2. Insert the two mounting screws, as pictured. Tighten the 10-32 screw to 10–12 lb-in (1.1–1.4 N•m) and the 1/4-20 to 25–30 lb-in (2.8–3.4 N•m).

   NOTE: If the lug was removed in Step 1 above, reinstall it on top of the bonding strap. Use the 1/4-20 x 11/16 in. mounting screw with feed-through lug, sub-feed lug, sub-feed breaker, or 200% neutral applications. Use the 1/4-20 x 7/8 in. lug mounting screw with 200% neutral on 225 A applications with feed-through lug, sub-feed lug, or sub-feed circuit breaker applications. Lug mounting screws are provided in the bonding strap bag assembly.

Figure 2: Bonding Strap Installation — 100 or 250 A Maximum NQ Panelboards



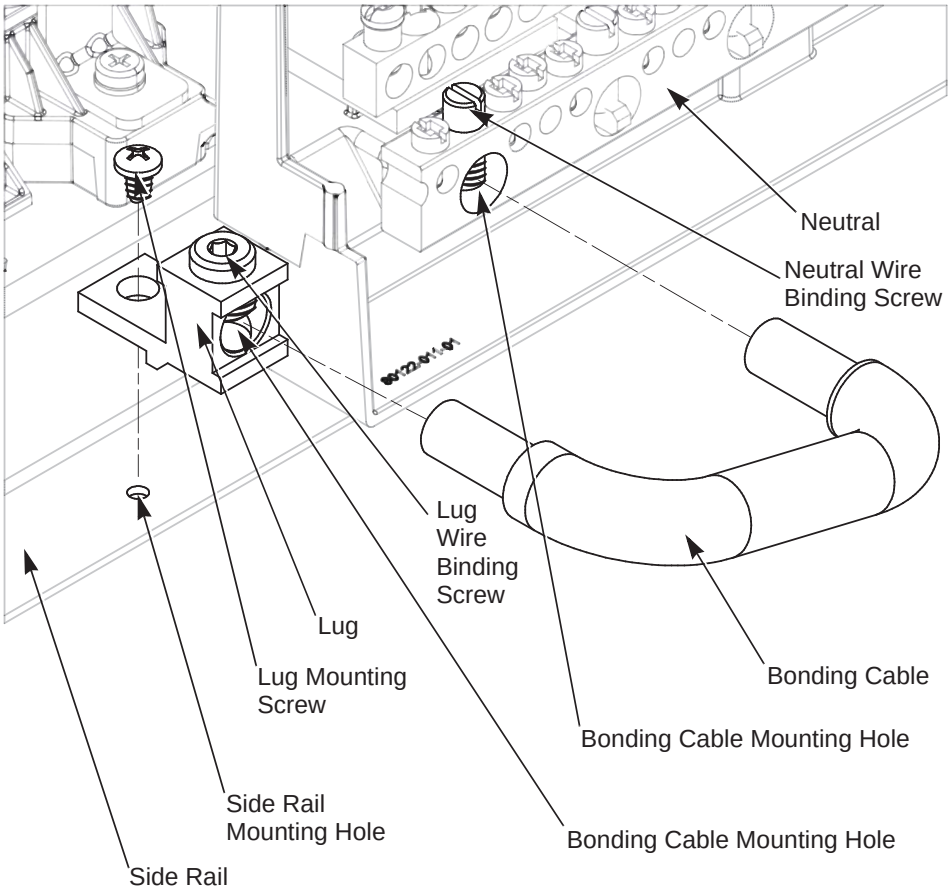
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400 or 600 A Maximum NQ Panelboards and QONQ Load Centers

To install a neutral bonding cable on a 400 or 600 A maximum NQ panelboard and QONQ load center, refer to Figure 3 and follow the instructions below.

1. Align the lug on the side rail mounting hole, as pictured.
2. Tighten the lug mounting screw against the side rail to 10–12 lb-in (1.1–1.4 N•m).
3. Align the bonding cable, as pictured, and insert it into the lug and neutral mounting holes.
4. Tighten both the lug wire binding screw and the neutral wire binding screw to 45–50 lb-in (5.1–5.6 N•m).

Figure 3: Bonding Cable Installation — 400 or 600 A Maximum NQ Panelboards and QONQ Load Centers



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QO and QOB Circuit Breaker Installation and Removal

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or NOM-029-STPS.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn OFF all power supplying this equipment before working on or inside equipment.
- Always use a properly-rated voltage sensing device to confirm that all power is OFF.
- All unused spaces must be filled with blank fillers.
- Replace all devices, doors and covers before turning ON power to this equipment.

Failure to follow these instructions will result in death or serious injury.

QO and QOB Breaker Installation

Refer to Figure 4 on 14 for the following instructions:

1. Turn OFF all power to the panelboard.
2. Turn the breaker OFF.
3. Remove the interior trim.
4. Snap the wire terminal end of the circuit breaker onto the mounting rail.
5. Engage the branch connector.

   For QO Circuit Breakers:

   a. Push inward until the plug-on jaws fully engage the branch connector.

   For QOB Circuit Breakers:

   a. Push inward until the breaker connector is centered on the branch connector mounting hole. Engage the screw into the branch connector hole and tighten it to the torque values shown on the interior wiring and torque diagram.

6. Install the load wire.
7. Reinstall the interior trim.

QO and QOB Breaker Removal

Refer to Figure 4 on 14 for the following instructions:

1. Turn OFF all power to the panelboard.
2. Remove the interior trim.
3. Remove the load wire.
4. Disengage the branch connector.

   For QO Circuit Breakers:

   a. Pull outward until the plug-on jaws fully disengage the branch connector.

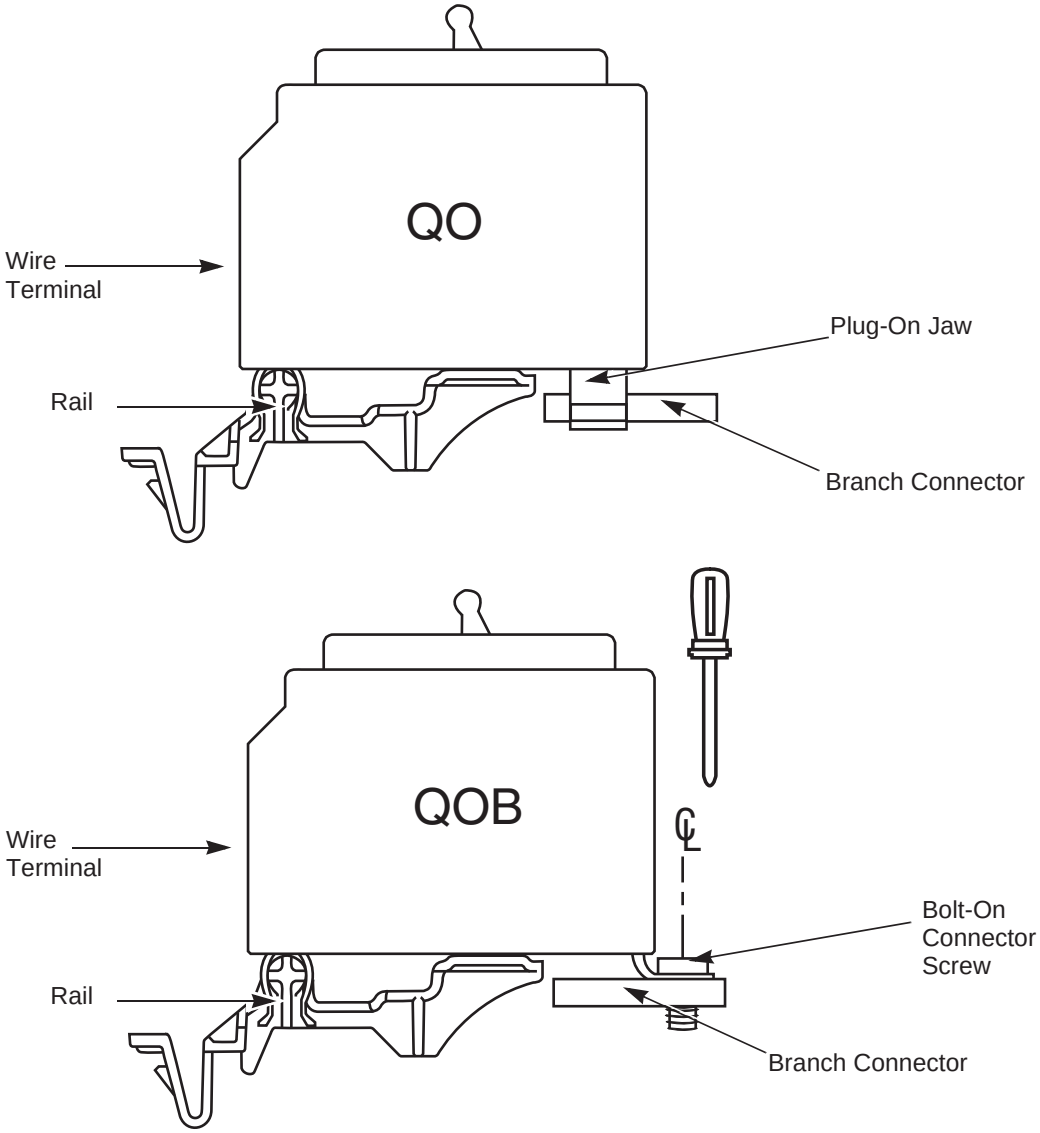
   For QOB Circuit Breakers:

   a. Loosen the screw in the breaker connector and pull the breaker off of the branch connector.

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5. Snap the wire terminal end of the circuit breaker off of the mounting rail.
6. Reinstall the interior trim.

Figure 4: QO and QOB Circuit Breaker Installation and Removal

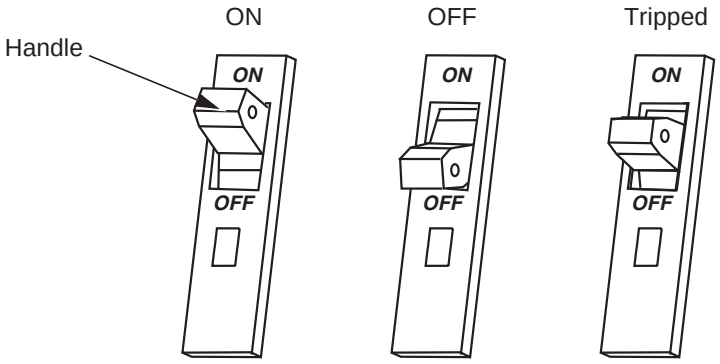


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Circuit Breaker Reset Instructions

If the circuit breaker is tripped, the handle will be at the mid-position between ON and OFF. To reset the circuit breaker, push the handle to the OFF position, then to the ON position.

Figure 5: Circuit Breaker Handle Positions



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Interior Trim Preparation

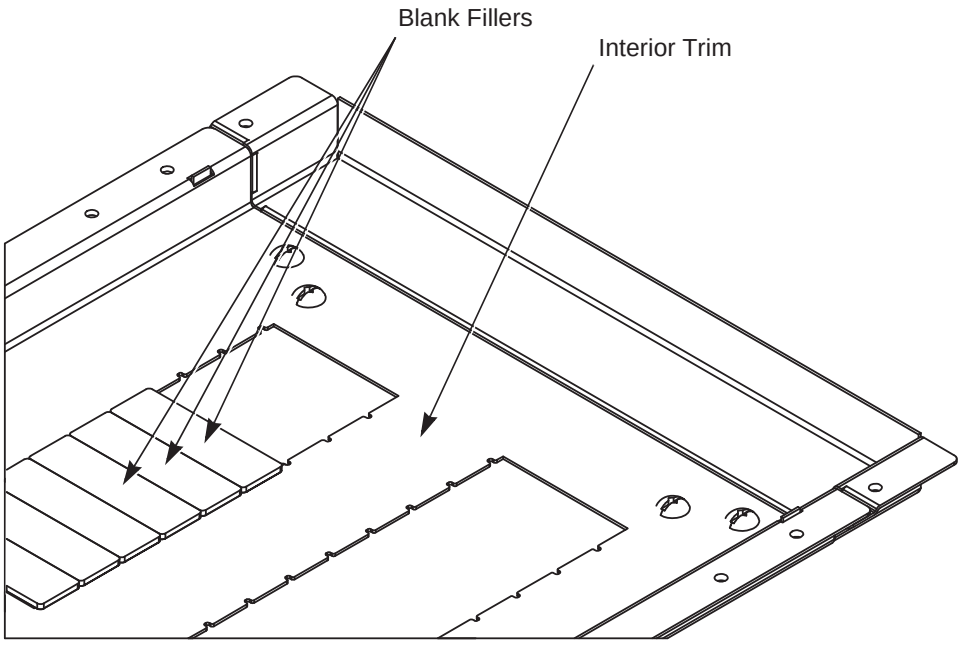
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or NOM-029-STPS.
- Before energizing the panelboard, all unused spaces must be filled with blank fillers.
- Replace all devices, doors, and covers before energizing this equipment.

Failure to follow this instruction will result in death or serious injury.

Figure 6: Interior Trim Diagram



NOTE: The back of the interior trim lists the catalog number for its corresponding compatible blank fillers.

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Appendix 1: Specifications

Typical Wiring

Table 1: Panelboard Typical Wiring[1]

	1-Phase Panelboards		3-Phase Panelboards	
Voltage AC	**Phase**	**Wires**	**Phase**	**Wires**
208Y/120	—	—	3	4
120/240	1	3	—	—
240[2]	1	2	3	3
240[3]	1	3	—	—
240/120[4]	—	—	3	4 Delta

1 Additional information is provided on the panelboard. See the main circuit breaker rating, if used.

2 For this system, the neutral is not used and only circuit breakers rated 240 V AC minimum should be used. Do not use circuit breakers rated 120 V or 120/240 V AC.

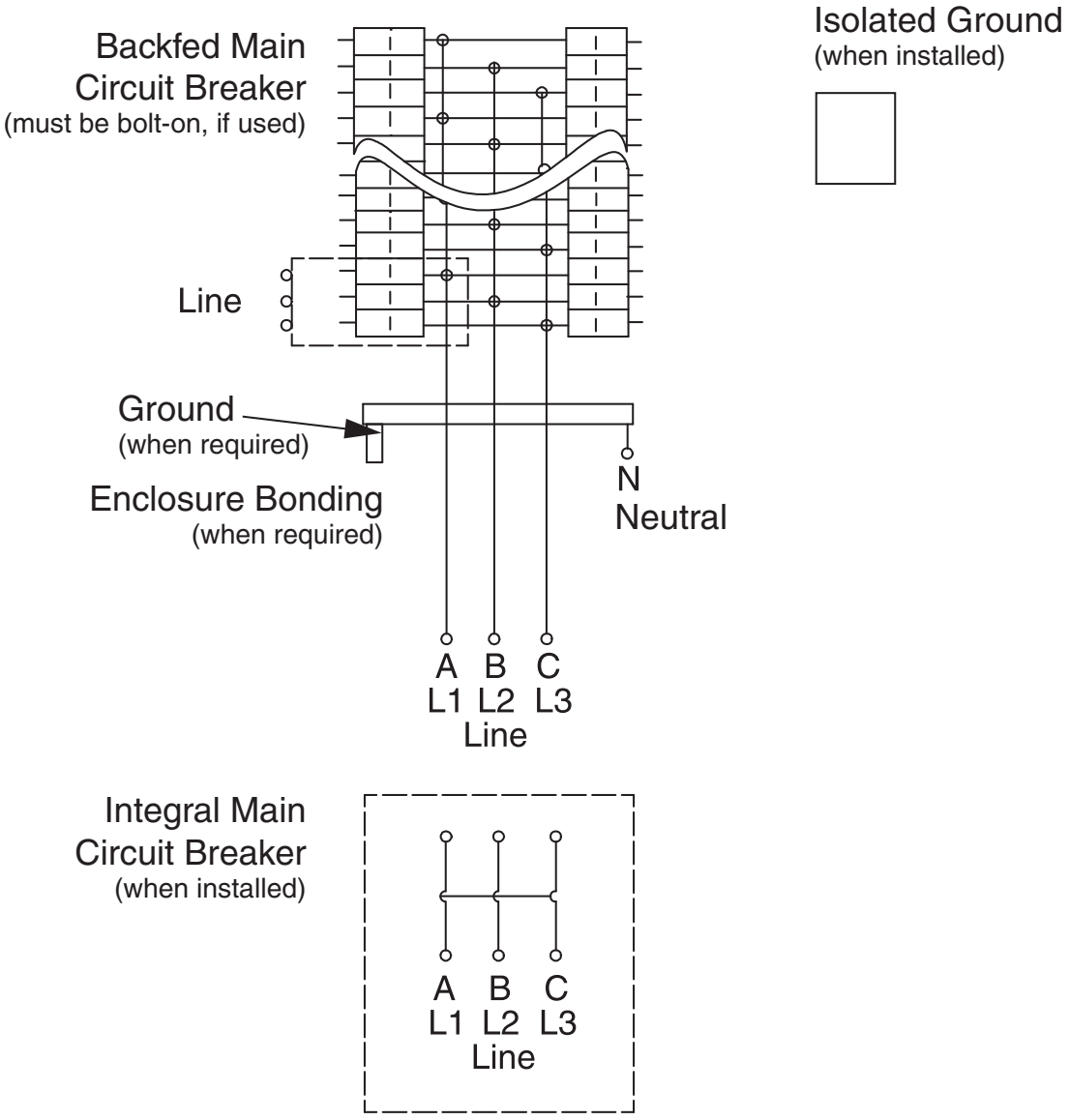
3 For a grounded “B” phase system, only circuit breakers rated 240 V AC minimum should be used. Do not use circuit breakers rated 120 V or 120/240 V AC.

4 When wiring for a delta system, phases “A” and “C” must be 120 V to neutral, phase “B” 208 V to neutral. Connect only circuit breakers rated 240 V AC minimum. Do not use circuit breakers rated 120 V or 120/240 V to “B” phase.

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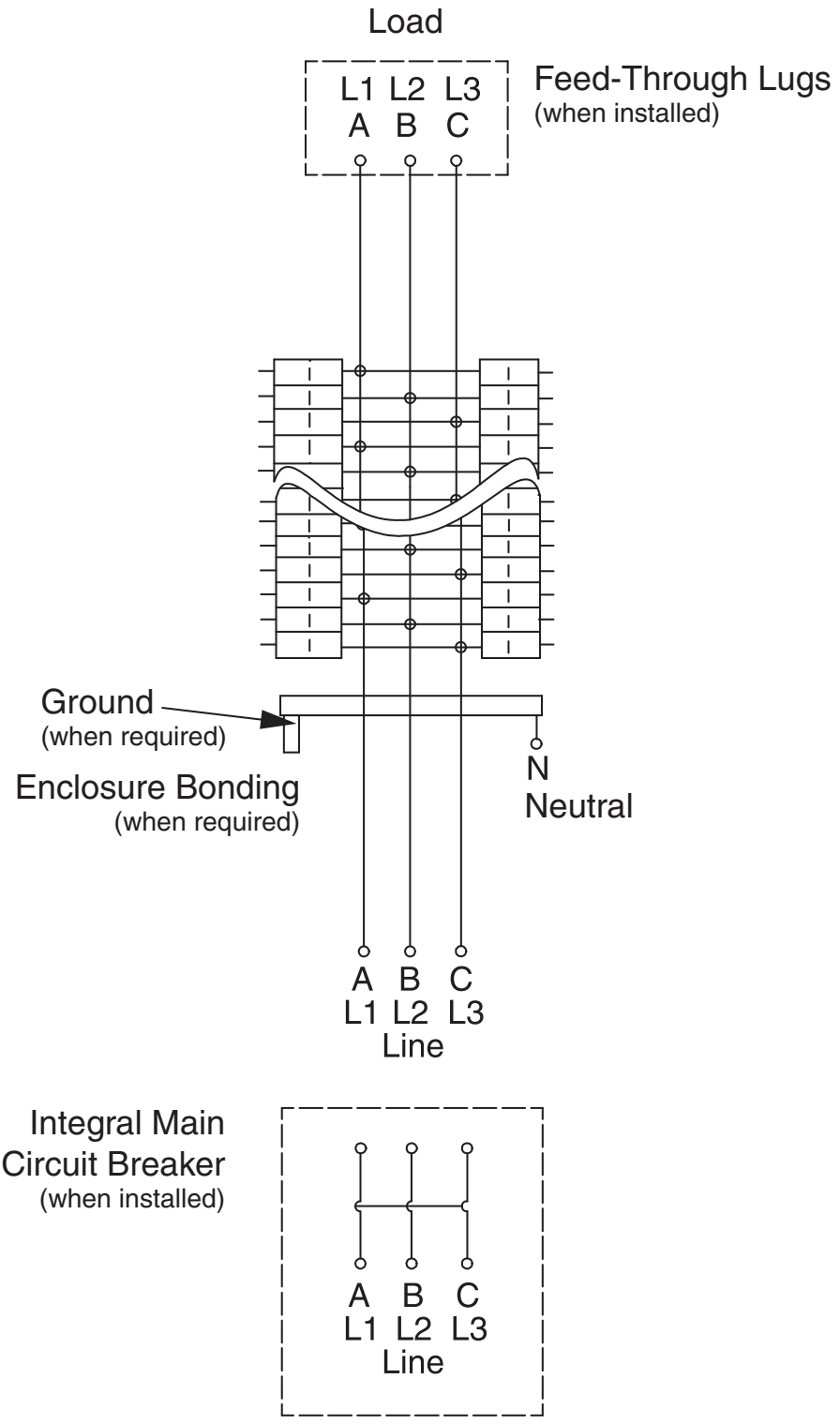
Integral Main or Sub-Feed:
DJ, FI, KI, H, J, LA, LC, LH, QB, QD, QG, QJ, QO(B)VH

Figure 7: NQ/NQM 100–225 A Main Lugs or 100–250 A Main Breaker Diagram



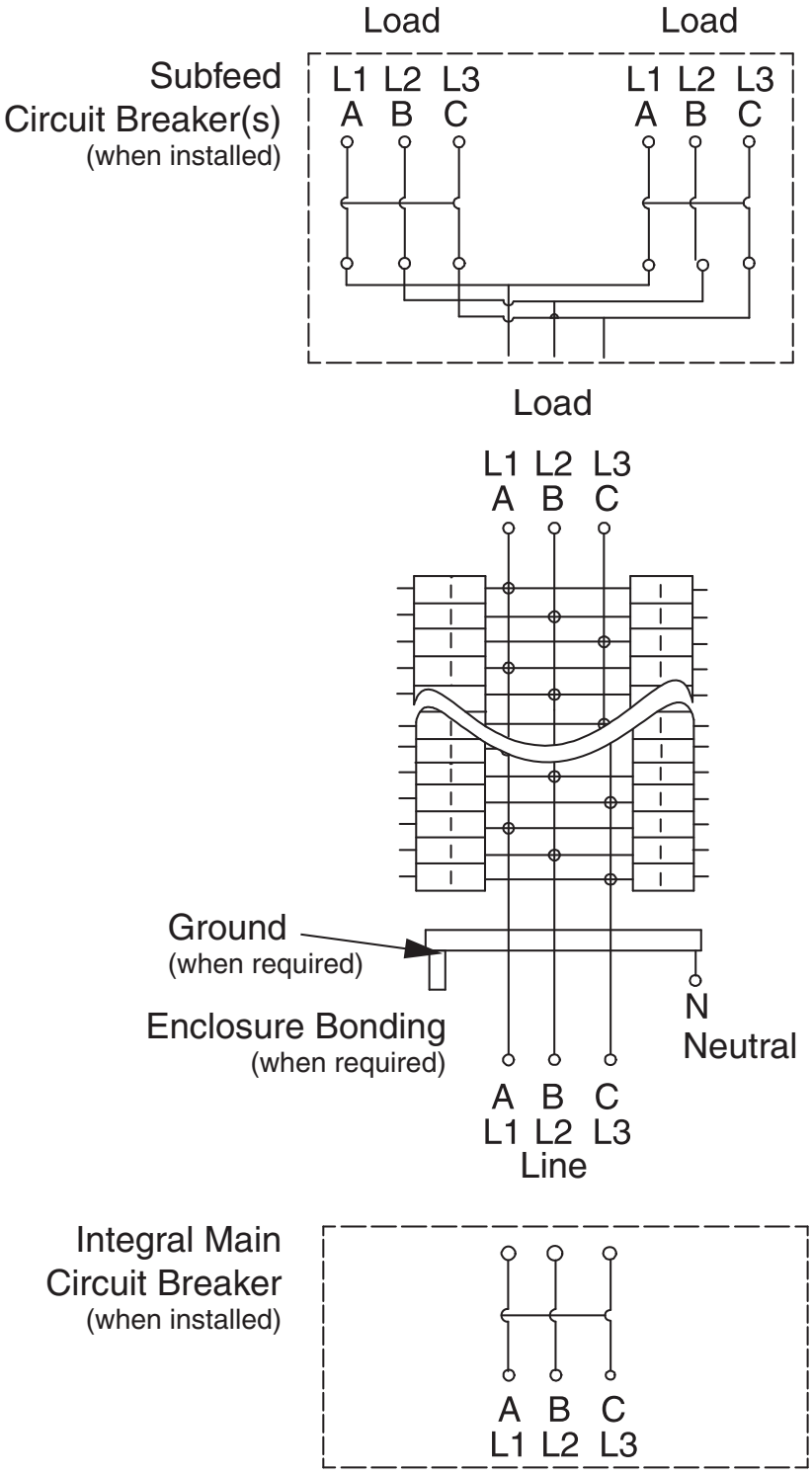
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Figure 8: NQ Panelboard or QONQ Load Center 400–600 A Main Lugs or Main Circuit Breaker with or without Feed-Through Lugs Diagram



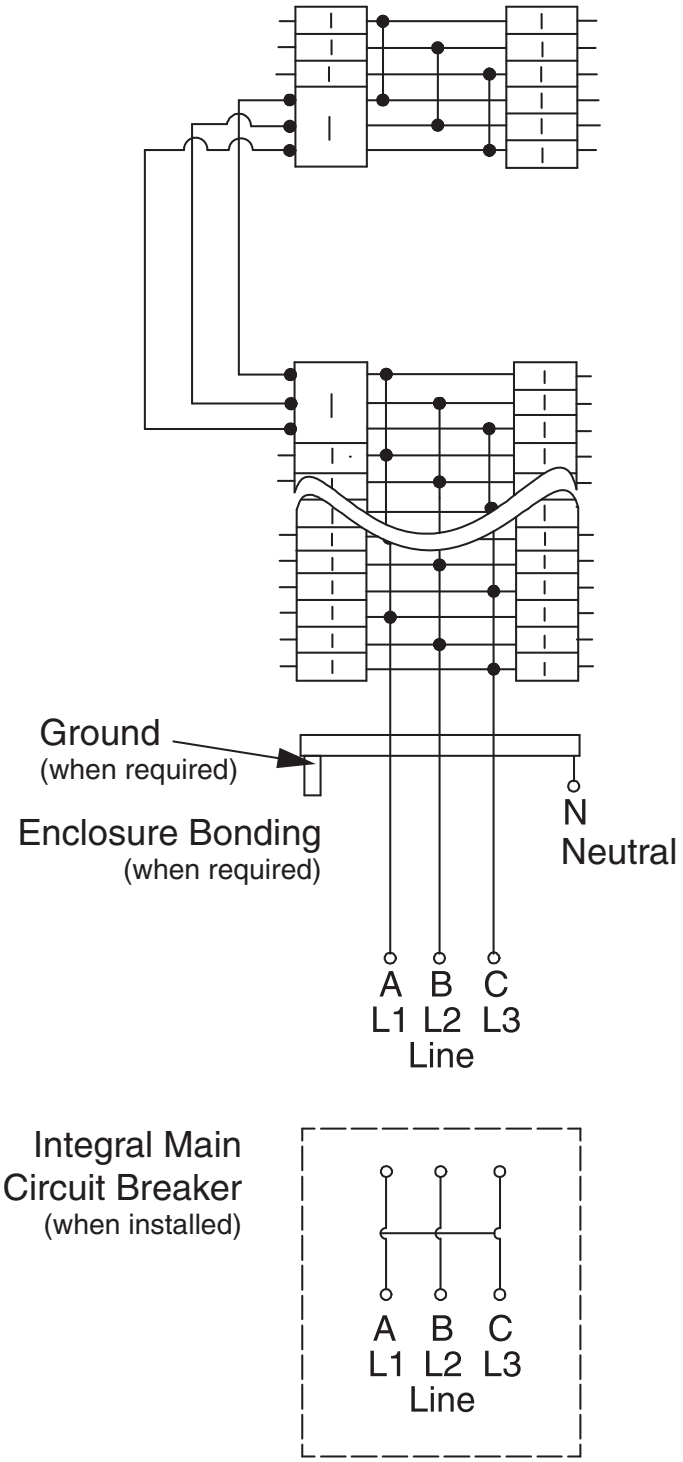
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Figure 9: NQ Panelboard or QONQ Load Center 400–600 A Main Circuit Breaker with Feed-Through Lugs or Sub-Feed Circuit Breakers Diagram



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Figure 10: Typical NQ Panelboard with Split Bus Diagram



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Panelboard Ratings

Refer to NEC section 110-22 and CEC rule 14-014 for more information. The series rated system label is located in the bag assembly.

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical)

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
120/240 1P/3W	22,000	MG	QO (B)	15–30 A	—	—
	25,000	LD, HD, JD	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	65,000	HG, JG	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LG	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LJ	QO (B) GFI	15–30 A	40–60 A	—
			QO (B) EPD	15–30 A	40–60 A	—
	100,000	HJ, JJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
120/240 1P/3W	100,000	LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) H	—	15–100 A	—
			QO (B) GFI	—	15–30 A	—
			QO (B) EPD	—	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		DJ 400 A	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	—	150 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		QJ	QO (B)	15–70 A	15–125 A	—
			QO (B) AS	15–30 A	15–30 A	—
			QO (B) VH	—	150 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	125,000	HL, JL	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
208Y/120 3P/4W	18,000	LA/LH (L) 34200MC	QO (B)	15–30 A	15–30 A	15–30 A
		LA/LH (L) 34225MC				
		LA/LH (L) 34250MC				
		LA/LH (L) 34400MC				

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
208Y/120 3P/4W	25,000	LD	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–30 A	15–125 A	15–150 A
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	30,000	DJ-W 150 A MC[7]	QO (B)	15–70 A	15–100 A	—
			QO (B) VH	—	15–125 A	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
		DJ-W 250 A MC[7]	QO (B)	15–70 A	15–100 A	—
			QO (B) VH	—	—	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
		DJ-W 600 A MC[7]	QO (B)	15–70 A	15–100 A	—
			QO (B) VH	—	—	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
	65,000	LG	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
208Y/120 3P/4W	65,000	LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LL	QO (B) GFI	—	—	15–30 A
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	100,000	DJ 400 A	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	—	—	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		QJ	QO (B)	15–70 A	15–125 A	15–30 A
			QO (B) VH	—	—	15–150 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	15–30 A	15–60 A	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	—	15–30 A	—
			QO (B) EPD	—	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	22,000	QO (B) VH	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	25,000	QD	QO (B)	15–70 A	15–125 A	15–30 A
			QO (B) VH	—	—	35–150 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		ED, FD	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		KD	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) AS	15–30 A	15–30 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
		HD, JD	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	25,000	LD	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–30 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	42,000	LA, MA	Q2L-H	—	100–225 A	100–225 A
			QDL	—	70–225 A	70–225 A
		LC 400 A	QO (B)	15–70 A	15–70 A	—
			QO (B) VH	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LC 600 A	QO (B) VH	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		MG	QO (B) VH	15–30 A	15–30 A	15–30 A
	65,000	LC 400 A	QO (B)	15–30 A	15–30 A	—
			QO (B) VH	15–30 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LC 600 A	QO (B) VH	15–30 A	15–125 A	15–150 A
			QO (B) GFI	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		DJ 400 A	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	—	—	15–150 A
			QO (B) H	—	15–100 A	—

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	65,000	DJ_W	QO (B)	15–70 A	15–150 A	—
			QO (B)-VH	—	110–125 A	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		DJ, DG, DL 150–600 A	QO (B) EPD	—	—	15–30 A
		EG, FG, KG	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		QG	QO (B)	15–70 A	15–125 A	15–30 A
			QO (B) VH	—	—	35–150 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		HG, JG	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		FC_ or KC_22___	QO (B)	15–70 A	15–100 A	15–100 A
		FC_ or KC_34___	QO (B) AS	15–30 A	15–30 A	15–30 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	65,000	LG	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) GFI	15–30 A	40–60 A	—
			QO (B) EPD	15–30 A	40–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
		LL	QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	100,000	FC_ or KC_22___	QO (B) GFI	15–30 A	15–30 A	—
		FC_ or KC_34___	QO (B) AFI	15–20 A	—	—
		DJ 400 A	QO (B)	15–70 A	15–125 A	—
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		EJ	QO (B)	15–70 A	15–125 A	15–100 A
		LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	—	15–30 A	—
			QO (B) EPD	—	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	100,000	HJ, JJ	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	35–150 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	125,000	HL, JL	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	35–150 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	200,000	FI, KI, HR, JR	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
240 3P/3W or 240 1P/2W (two pole only)	22,000	QO (B) VH	QO (B)	—	—	15–100 A
			QO (B) GFI	—	—	15–50 A
			QO (B) PL	—	15–30 A	—
		Q2-H	QO (B)	—	—	15–30 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240 3P/3W or 240 1P/2W (two pole only)	25,000	QD	QO (B)	—	—	15–30 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
			QO (B) PL	—	15–60 A	15–30 A
			QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) GFI	—	—	15–50 A
		ED, FD	QO (B)	—	—	15–100 A
			QO (B) GFI	—	—	15–50 A
		KD	QO (B)	—	—	15–100 A
		HD, JD	QO (B)	—	—	15–100 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	—	—	15–50 A
	25,000	LD	QO (B) VH	—	—	15–150 A
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	42,000	LA, MA	QDL	—	70–225 A	70–225 A
		LC 400 A	QO (B) VH	—	—	15–100 A
		LC 600 A	QO (B) VH	—	—	15–100 A
		MG	QO (B) VH	—	—	150 A
	65,000	LC 400 A	QO (B) VH	—	—	15–100 A
		LC 600 A	QO (B) VH	—	—	15–30 A
		DJ 400 A	QO (B) VH	—	—	15–150 A
			QO (B) H	—	15–100 A	—
		DJ, DG, DL 150–600 A	QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
		EG, FG, KG	QO (B)	—	—	15–100 A
			QO (B) GFI	—	—	15–50 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240 3P/3W or 240 1P/2W (two pole only)	65,000	QG	QO (B)	—	—	15–30 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
		QG, HG, JG	QO (B) PL	—	—	15–30 A
		HG, JG	QO (B)	—	—	15–100 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
		FC_ or KC_22___	QO (B)	—	—	15–100 A
		FC_ or KC_34___	QO (B) AS	—	15–30 A	15–30 A
		LG	QO (B) VH	—	—	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
		LJ	QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
		LL	QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	100,000	FC_ or KC_24___	QO (B) GFI	—	15–30 A	—
		FC_ or KC_34___				
		DJ 400 A	QO (B) H	—	15–100 A	—
	100,000	EJ, FJ	QO (B)	—	—	15–100 A
		LJ	QO (B) VH	—	—	15–100 A
			QO (B) H	—	15–100 A	—
		HJ, JJ	QO (B)	—	—	15–100 A
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	35–150 A
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240 3P/3W or 240 1P/2W (two pole only)	125,000	HL, JL	QO (B)	—	—	15–100 A
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	35–150 A
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	200,000	FI, KI, HR, JR	QO (B)	—	—	15–100 A
120/240 1P/3W	42,000	400 A Max. Class T3 Fuses	QO (B) VH	15–70 A	15–125 A	—
	65,000	400 A Max. Class J Fuses	QO (B) VH	15–70 A	15–150 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		400 A Max. Class T6 Fuses	QO (B) VH	15–70 A	15–150 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	100,000	200 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	200,000	400 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
208Y/120 3P/4W	200,000	200 A Max. Class T6, J Fuses	QO (B)	15–70 A	15–125 A	—
			QO (B) GFI	—	—	15–50 A
			QO (B) EPD	—	—	15–50 A
		400 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	42,000	400 A Max. Class T3 Fuses	QO (B) VH	15–30 A	15–125 A	—
	50,000	400 A Max. Class T3 Fuses	QO (B) VH	—	—	15–30 A
	65,000	400 A Max. Class J Fuses	QO (B) VH	15–70 A	15–125 A	—
			QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		400 A Max. Class T6 Fuses	QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) AFI	15–20 A	—	—
	100,000	200 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) VH	—	—	15–30 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
			QOT	15–30 A	15–30 A	—
	200,000	200 A Max. Class J or T6 Fuses	QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
		400 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240 3P/3W or 240 1P/2W (two pole only)	50,000	400 A Max. Class J or T6 Fuses	QO (B) VH	—	—	15–30 A
	65,000	400 A Max. Class J Fuses	QO (B) VH	—	—	15–30 A
			QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
		400 A Max. Class T6 Fuses	QO (B) VH	—	—	15–150 A
			QOB VH 1φ, 2W only	—	150 A	—
	100,000	200 A Max. Class T3 Fuses	QO (B)	—	—	15–100 A
			QO (B) VH	—	—	15–30 A
240 3P/3W or 240 1P/2W (two pole only)	200,000	200 A Max. Class J or T6 Fuses	QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
		400 A Max. Class T3 Fuses	QO (B)	—	—	15–100 A
			QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A

1 For shown circuit breakers rated less than this maximum voltage, the indicated short circuit current rating also applies, but at the voltage rating of the circuit breaker.

2 Short circuit tests are conducted at 100–105% of the maximum rated voltage of the panelboard.

3 Suffixes HID, SWD, and SWN may also be applied to the applicable branch circuit breakers shown above. Suffix SWN may **not** be applied in combination with LC main breakers.

4 Where QO (B) circuit breakers are shown above, QO (B) H, QO (B) VH, and QH (B) circuit breakers may also be used.

5 Where QO (B) GFI circuit breakers are shown above, QO (B) EPD and/or QO (B) EPE circuit breakers may also be used. QO-EPE only comes in 3 pole construction.

6 Where QO (B) AFI circuit breakers are shown above, QO (B) CAFI circuit breakers may also be used.

7 To achieve selective coordination, the rating of the DJ main circuit breaker must be at least two times greater than the ampere rating of any branch circuit breaker.

Table 3: NQ Panel Mission Critical Breaker Selectivity

Maximum SCCR (RMS Symmetrical)	Integral or Remote Main Circuit Breakers	Branch Circuit Breakers			
		Type	1-pole	2-pole	3-pole
Fully Rated and Selective to 10kA at 208Y/120 Vac or at 240/120 Vac	J-W, 250 A L-W, 250 A	QO(B)	10–70	10–125	10–125
		QO(B)-H			
		QO(B)-VH			
		QH			
Series Rated and Selective to 12kA at 208Y/120 Vac or at 240/120 Vac	J-W, 250 A	QO(B)	10–70	10–125	10–60
		QO(B)-H			
		QO(B)-VH			
		QH			
Series Rated and Selective to 15kA at 208Y/120 Vac or at 240/120 Vac	J-W, 250 A	QO(B)	10–60	10–60	10–30
		QO(B)-H			
		QO(B)-VH			
		QH			
Series Rated and Selective to 18kA at 208Y/120 Vac or at 240/120 Vac	J-W, 250 A	QO(B)	10–30	10–30	—
		QO(B)-H			
		QO(B)-VH			
		QH			
	L-W, 250 A	QO(B)	10–60	10–60	10–60
		QO(B)-H			
		QO(B)-VH			
		QH			
Series Rated and Selective to 30kA at 208Y/120 Vac or at 240/120 Vac	L-W, 400 A L-W, 600 A	QO(B)	15–70	15–150	15–150
		QO(B)-H			
		QO(B)-VH			
		QH			

Including AFI, CAFI, EPD and GFI Circuit Breakers

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Table 4: Short Circuit Current Rating[1] for Main Lug Interiors with Sub-Feed or Feed-Through Lugs

Maximum System Voltage AC	Maximum Current Rating	Branch Circuits	Application	Adder[2]	Maximum Short Circuit Current Rating[3]
240	100	18, 30	SFL and FTL	—	10,000
	225	30, 42, 54, 72, 84	SFL	6 inches (152.4 mm)	
		42	FTL	—	
		30, 54, 72, 84		6 inches (152.4 mm)	
	400	30, 42, 54, 72, 84	SFL	—	25,000
		30, 84	FTL	—	
		42, 54, 72		6 inches (152.4 mm)	
	600	30, 42, 54, 72, 84	FTL	12 inches (304.8 mm)	

1 This rating applies to main lug interiors, equipped with sub-feed or feed-through lugs, where the device feeding the interior is unknown or not a Square D brand device. Use of a Square D brand main circuit breaker ahead of these lugs will result in a rating equal to the rating of the breaker. Short circuit tests are conducted at 100–105% of the maximum rated voltage of the panelboard.

2 The adder is the additional length of the enclosure.

3 RMS symmetrical amperes, for three cycles.

CE Marking

Interiors with the "CE" mark meet the IEC 61439-1 and IEC 61439-2 standards.
Main lug interiors with the "CE" mark have been tested to withstand 10,000 RMS symmetrical amperes for 30 cycles.
Interiors with the "CE" mark are only approved for use with QOXD or QOBXD branch circuit breakers which carry the "CE" mark.

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Appendix 2: Accessory Kits

An assortment of field-installable accessory kits are available for NQ panelboards:

- Equipment Ground Bar Kits
- Oversized Lug Kits for 100–250 A Panelboards
- Sub-Feed Lug Kits for 100–400 A Panelboards
- Main Lug Kits
  - — Mechanical Lug Kits—Aluminum
  - — Mechanical Lug Kits—Copper
  - — Versa-Crimp® Compression Lug Kits—Aluminum
  - — Versa-Crimp Compression Lug Kits—Copper

Equipment Ground Bar Kits

Equipment ground bar kits, suitable for copper or aluminum wire, meet the grounding needs of NQ panelboards and QONQ load centers.

Table 5: Equipment Ground Bar Kits Specifications

Panelboard		Use Ground Bar Kit Catalog Number	
Branch Circuit	**Mains Rating**	**Aluminum[1]**	**Copper[2]**
1–42	600 A Maximum	(1) PK27GTA	(1) PK27GTACU
54–84		(2) PK27GTA	(2) PK27GTACU

1 Aluminum bars suitable for 60° C or 75° C Copper or Aluminum conductors.

2 Copper bars suitable for 60° C or 75° C Copper conductors.

NOTE: Ground bar mounting locations are identified by the ground symbol ⏚ stamped into the backwall of the enclosure.

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Oversized Lug Kits for 100–250 A Panelboards

Oversized lug kits are available for applications where termination conductors of 3 AWG or larger are required for the neutral.

Table 6: Oversized Lug Kits for 100–250 A Panelboards Specifications

Circuit Breaker Rating	Kit Catalog Number	Wire Range
70 A	QO70AN	(1) 10–2 Al ([1] 5.76–33.6 mm^2) (1)14–4 Cu ([1] 2.08–21.1 mm^2)
80–125 A	Q1100AN	(1) 4–1/0 Al/Cu ([1] 42.4–53.5 mm^2)
125–150 A	Q1150AN	(1) 1–4/0 Al/Cu ([1] 42.4–107 mm^2)

Sub-Feed Lug Kits for 100–400 A Panelboards

Sub-feed main lugs are available for 100, 225, or 400 A applications.

Table 7: Sub-Feed Lug Kits for 100–400 A Panelboards Specifications

Main Amps	Kit Catalog Number	Maximum Circuits
100	NQSFL1	18, 30
225	NQSFL2	30[1], 42[1], 54[1], 72[1], 84[1]
400	NQSFL4	30, 42, 54, 72, 84

[1] These panels require an additional 6 inches (152.4 mm) for the box and trim, for proper wire bending space.

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Main Lug Kits

Table 8: Mechanical Lug Kits — Aluminum

Panelboard Amps	Kit Catalog Number	Wire Range
100	Standard	#6–2/0 AWG (13.3–67.43 mm^2)
225	Standard	#6–350 kcmil (13.3–177.3 mm^2)
400	Standard	(1) 1/0–750 kcmil (2) 1/0–350 kcmil ([1] 53.48–380 mm^2) ([2] 53.48–177.3 mm^2)
600	Standard	(2) 1/0–750 kcmil ([2] 53.48–380 mm^2)
	NQALM6A	(3) #6–250 kcmil ([3] 13.3–127 mm^2)

Table 9: Mechanical Lug Kits — Copper

Panelboard Amps	Kit Catalog Number	Wire Range
100	NQCUM1	#6–2/0 AWG (13.3–67.43 mm^2)
225	NQCUM2	#6–250 kcmil (13.3–127 mm^2)
400	NQCUM4	(1) 1/0–750 kcmil (2) 1/0–350 kcmil ([1] 53.48–380 mm^2) ([2] 53.48–177.3 mm^2)
600	NQCUM6	

Table 10: Versa-Crimp® Compression Lug Kits — Aluminum

Panelboard Amps	Kit Catalog Number	Wire Range	Crimp Tool
100	NQALV1	#8–1/0 AWG (8.36–53.48 mm^2)	VC6 (All)
225	NQALV2	#4–300 kcmil (21.15–152 mm^2)	
400	NQALV4	(2) 2/0–500 kcmil ([2] 67.43–253.4 mm^2)	VC6-3, VC6-FT
600	NQALV6		

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Table 11: Versa-Crimp® Compression Lug Kits — Copper

Panelboard Amps	Kit Catalog Number	Wire Range	Crimp Tool
100	NQCUV1	#6–1/0 AWG (13.30–53.48 mm^2)	VC6 (All), VC7 (All)
225	NQCUV2	2/0–300 kcmil (67.43–152 mm^2)	VC6-3, VC7, VC6-FT, VC7-FT
400	NQCUV4	400–750 kcmil (202.7–380 mm^2)	VC6-FT, VC7-FT, VC8
600	NQCUV6	(2) 250–500 kcmil ([2] 126.7–253.4 mm^2)	VC6-3, VC7, VC6-FT, VC7-FT

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General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less

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Foreword

This publication is a guide of practical information containing instructions for the proper installation, operation, and maintenance of panelboards rated 600 volts or less.

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency regarding installation, operation, or maintenance.

It is recommended that work described in this set of instructions be performed only by qualified personnel familiar with the construction and operation of panelboards and that such work be performed only after reading this complete set of instructions. For specific information not covered by these instructions, you are urged to contact the manufacturer of the panelboard directly.

In the preparation of this standards publication input of users and other interested parties has been sought and evaluated. Inquiries, comments, and proposed or recommended revisions should be submitted to the concerned NEMA product section by contacting the following: These recommendations will be reviewed periodically and updated as necessary.

Senior Technical Director, Operations
National Electrical Manufacturers Association
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Rosslyn, Virginia 22209

Publication PB 1.1- 2013 revises and supersedes PB 1.1-2007.

This standards publication was developed by the Panelboard and Distribution Board Product Group of the LVDE Section. Product Group approval of the standard does not necessarily imply that all Product Group members voted for its approval or participated in its development. At the time it was approved, the Product Group was composed of the following members:

Eaton Corporation.—Pittsburgh, PA
GE Industrial Solutions—Plainville, CT
Hubbell, Inc.—Orange, CT
Milbank Manufacturing Company—Kansas City, MO
Penn Panel & Box Company—Collingdale, PA
Reliance Controls Corporation—Racine, WI
Siemens Industry, Inc.—Norcross, GA
Schneider Electric —Palatine, IL

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Section 1
SCOPE

This publication covers single panelboards or groups of panel units suitable for assembly in the form of single panelboards, including buses, and with or without switches or automatic overload protective devices (fuses or circuit breakers), or both. These units are used in the distribution of electricity at 600 volts and less with:

1600—ampere mains or less
1200—ampere branch circuits or less

Specifically excluded are live-front panelboards, panelboards employing cast enclosures for special service conditions, and panelboards designed primarily for residential and light commercial service equipment.

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Section 2
REFERENCES

National Fire Protection Association (NFPA)
Batterymarch Park
Quincy, MA 02269

NFPA 70 *National Electrical Code®*
NFPA 70E *Standard for Electrical Safety in the Workplace*

National Electrical Manufacturers Association (NEMA)
1300 North 17th Street, Suite 900
Rosslyn, Virginia 22209

AB 4 *Guidelines for Inspection and Preventative Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications*

PB 2.2 *Application Guide for Ground Fault Protective Devices for Equipment*

Guidelines for Handling Water Damaged Electrical Products

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Section 3
GENERAL

WARNING—HAZARDOUS VOLTAGES IN ELECTRICAL EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. UNLESS OTHERWISE SPECIFIED, INSPECTION AND MAINTENANCE SHOULD ONLY BE PERFORMED ON PANELBOARDS AND EQUIPMENT TO WHICH POWER HAS BEEN TURNED OFF, DISCONNECTED AND ELECTRICALLY ISOLATED SO THAT NO ACCIDENTAL CONTACT CAN BE MADE WITH ENERGIZED PARTS. FOLLOW ALL MANUFACTURER'S WARNINGS AND INSTRUCTIONS.

Safety-related work practices, as described in NFPA 70E, should be followed at all times.
All requirements of the *National Electrical Code*® NFPA 70 should be followed.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE PANELBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE COMPONENTS DURING INSTALLATION OR MAINTENANCE.

3.1 SUCCESSFUL OPERATION OF PANELBOARDS

The successful operation of panelboards is dependent upon proper installation, operation, and maintenance. Neglecting fundamental installation and maintenance requirements may lead to personal injury, death, or damage to electrical equipment or other property.

3.2 QUALIFIED PERSONNEL

Installation, operation, and maintenance of panelboards should be conducted only by qualified personnel.

3.3 DEFINITION OF QUALIFIED PERSONNEL

For purposes of these guidelines, a qualified person is one who is familiar with the installation, construction, and operation of the equipment and the hazards involved. In addition, the person is:

3.3.1 Requirements

Knowledgeable of the requirements of the *National Electrical Code*® and of all other applicable codes, laws, and standards.

3.3.2 Established Safety Practices

Trained and authorized to test, energize, clear, ground, tag, and lockout circuits and equipment in accordance with established safety practices.

3.3.3 Protective Equipment

Trained in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, and flash resistant clothing in accordance with established safety practices.

3.3.4 First Aid

Trained in rendering first aid.

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3.4 SUITABLE RATINGS

Verify that all equipment being installed has ratings suitable for the installation.

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Section 4
INSTALLATION OF PANELBOARD CABINETS (BOXES)

4.1 INSTALLATION INSTRUCTIONS

Installation of the cabinet in a neat and workmanlike manner. Follow the manufacturer's installation instructions.

4.2 LOCATION IN BUILDING

Locate the cabinet so that it is readily accessible and not exposed to physical damage.

4.3 FLAMMABLE MATERIAL

Locate the cabinet well away from flammable material.

4.4 UNUSUAL SERVICE CONDITIONS

Do not locate the cabinet where it will be exposed to ambient temperatures above 40°C (104°F), corrosive or explosive fumes, dust, vapors, dripping or standing water, abnormal vibration, mechanical shock, high humidity, tilting, or unusual operating conditions, unless the cabinet/panelboard combination has been designed and so identified by the manufacturer for these conditions.

4.5 INDOOR DAMP LOCATIONS

Locate or shield the cabinet so as to prevent moisture and water from entering and accumulating therein. Mount the cabinet so that there is at least 1/4 inch of air space between the cabinet and the wall or other supporting surface.

4.6 WET LOCATIONS

Cabinets should be specifically approved for wet locations. Mount the cabinet so that there is at least 1/4 inch of air space between the cabinet and the wall or other supporting surface.

4.7 CLEARANCE FROM CEILING

Do not locate the cabinet against a non-fireproof ceiling; allow a space of 3 feet between the ceiling and cabinet unless an adequate fireproof shield is provided.

4.8 SPACE AROUND THE CABINET

When selecting a location, provide sufficient access and working space around the cabinet (see Section 110.26 of the *National Electrical Code*®). The width of the working space in front of the panelboard should be at least 30 inches, or the width of the cabinet, whichever is greater, and this space should not be used as storage. The working space should have adequate lighting and a minimum head room of 6 feet 6 inches.

4.9 MOUNTING OF CABINET

The cabinet should be reliably secured to the mounting surface. Do not depend on wooden plugs driven into holes in masonry, concrete, plaster, or similar materials. (See Section 110.13 of the *National Electrical Code*®.)

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4.10 FLUSH MOUNTING IN WALL

In walls of concrete, tile, or other noncombustible material, install the cabinet so that its front edge will not set back more than 1/4 inch from the finished surface. In walls of wood or other combustible material, cabinets should be flush with or project beyond the finished surface. (See Section 312.3 of the *National Electrical Code*®.)

4.11 UNUSED OPENINGS IN CABINET

Effectively close unused openings in the cabinet to provide protection which is substantially equivalent to that afforded by the wall of the cabinet.

4.12 GROUNDING OF PANELBOARD CABINETS

Ground the cabinet as specified in Article 250 of the *National Electrical Code*®. When the cabinet contains service equipment, it is necessary to bond the cabinet to the grounded (neutral) service conductor.

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Section 5
INSTALLATION OF CONDUIT AND CONDUCTORS

5.1 CONDUITS INSTALLATION

Conduits should be installed so as to prevent moisture or water from entering and accumulating within the enclosure. Provision should be made to protect conductors from abrasion in accordance with Article 312 of the *National Electrical Code*®.

5.2 KNOCKOUTS REMOVAL

Knockouts should be removed as follows:

IMPORTANT—Remove knockouts, ONE AT A TIME, alternating INWARD and OUTWARD.

5.2.1 First Step—Remove Center Knockout

Remove center knockout INWARD.

5.2.1.1 Screwdriver Blade

Place screwdriver blade against point farthest from tie and strike INWARD (Figure 1). Bend back and forth to break tie.

5.2.2 Next Step—Remove Rings

Remove rings ONE AT A TIME without straining remaining rings.

5.2.2.1 Pry First Ring

Pry first ring OUTWARD with screwdriver midway between ties, using pliers flat against box under screwdriver (Figure 2). Bend ring sections OUTWARD with pliers, then back and forth to break ties (Figure 5-3).

5.2.2.2 Second Ring

Remove second ring INWARD by striking screwdriver (with blade against point midway between ties) then breaking ring sections inward and back and forth to break ties.

5.3 *NATIONAL ELECTRICAL CODE*®, ARTICLE 300

Refer to the *National Electrical Code*®, Article 300 for proper wiring methods. See 6.7 for making proper connections.

5.4 CONDUCTOR LENGTH

Keep conductor length to a minimum within the wiring gutter. Excessive conductor length will result in additional heating and may result in overheating. However, conductors should be long enough to reach the terminal location in a manner that avoids strain on the terminal.

5.5 EXERCISE CARE

Exercise care to maintain the largest practical bending radius of conductors; otherwise the insulation may be damaged and terminal connections may become loosened. Deflection of conductors shall comply with *NEC*® Section 312.6.

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5.6 *NATIONAL ELECTRICAL CODE*®, SECTION 725.136

Refer to the *National Electrical Code*®, Section 725.136 for the separation requirements for conductors of Class 2 and Class 3 remote-control, signaling and power-limited circuits.

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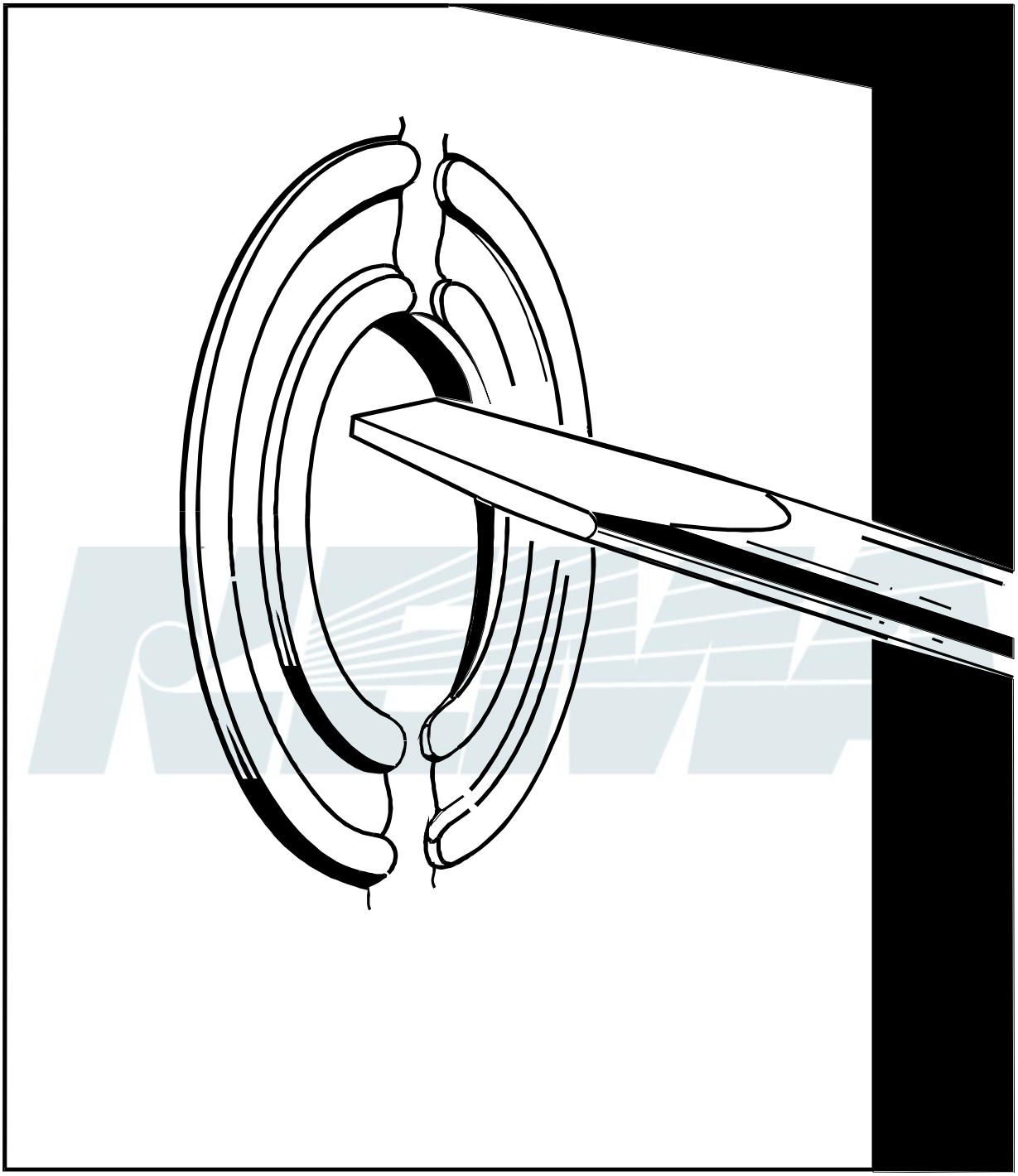


Figure 5–1
KNOCKOUT REMOVAL—STEP 1

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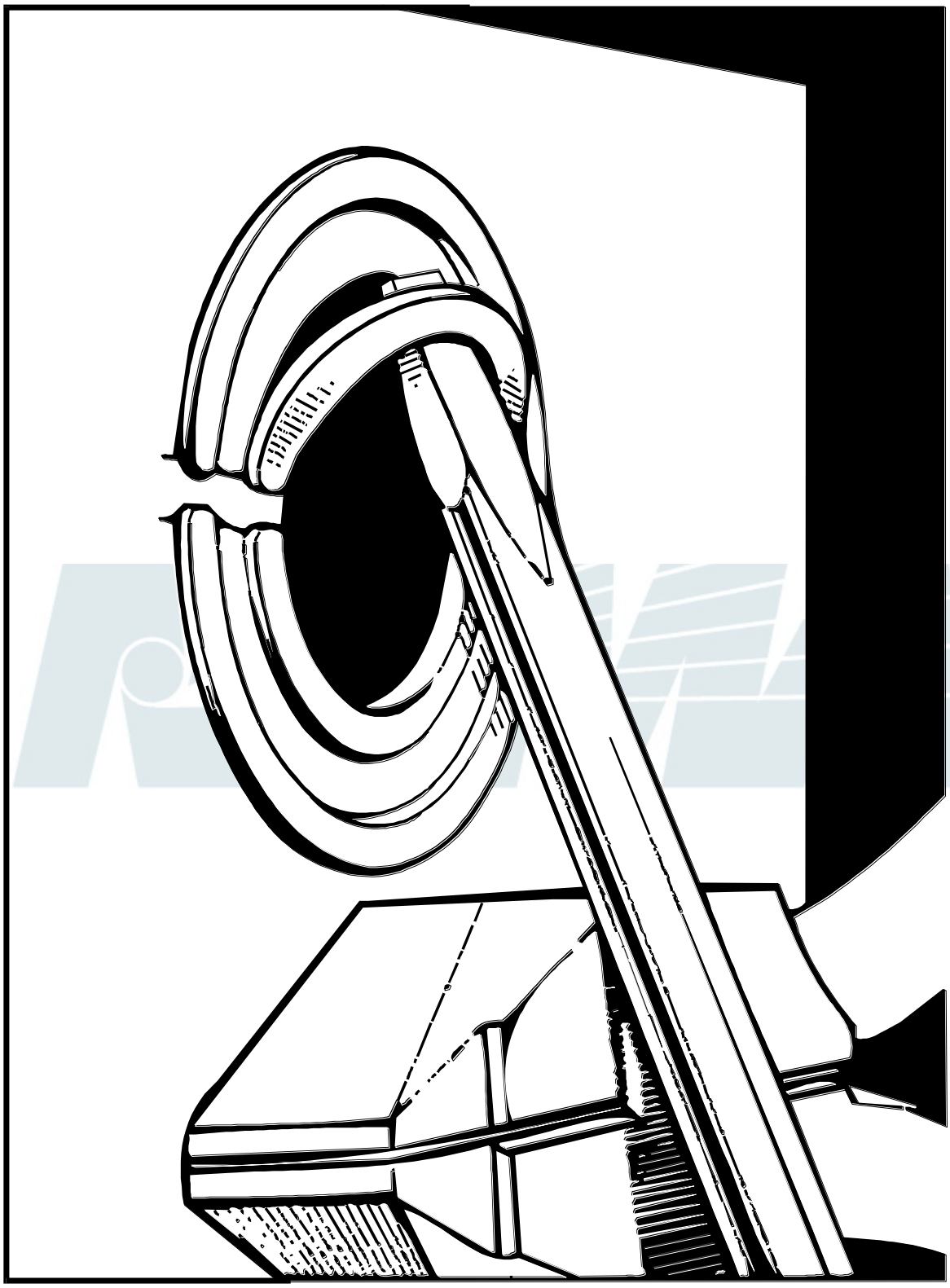


Figure 5–2
KNOCKOUT REMOVAL—STEP 2

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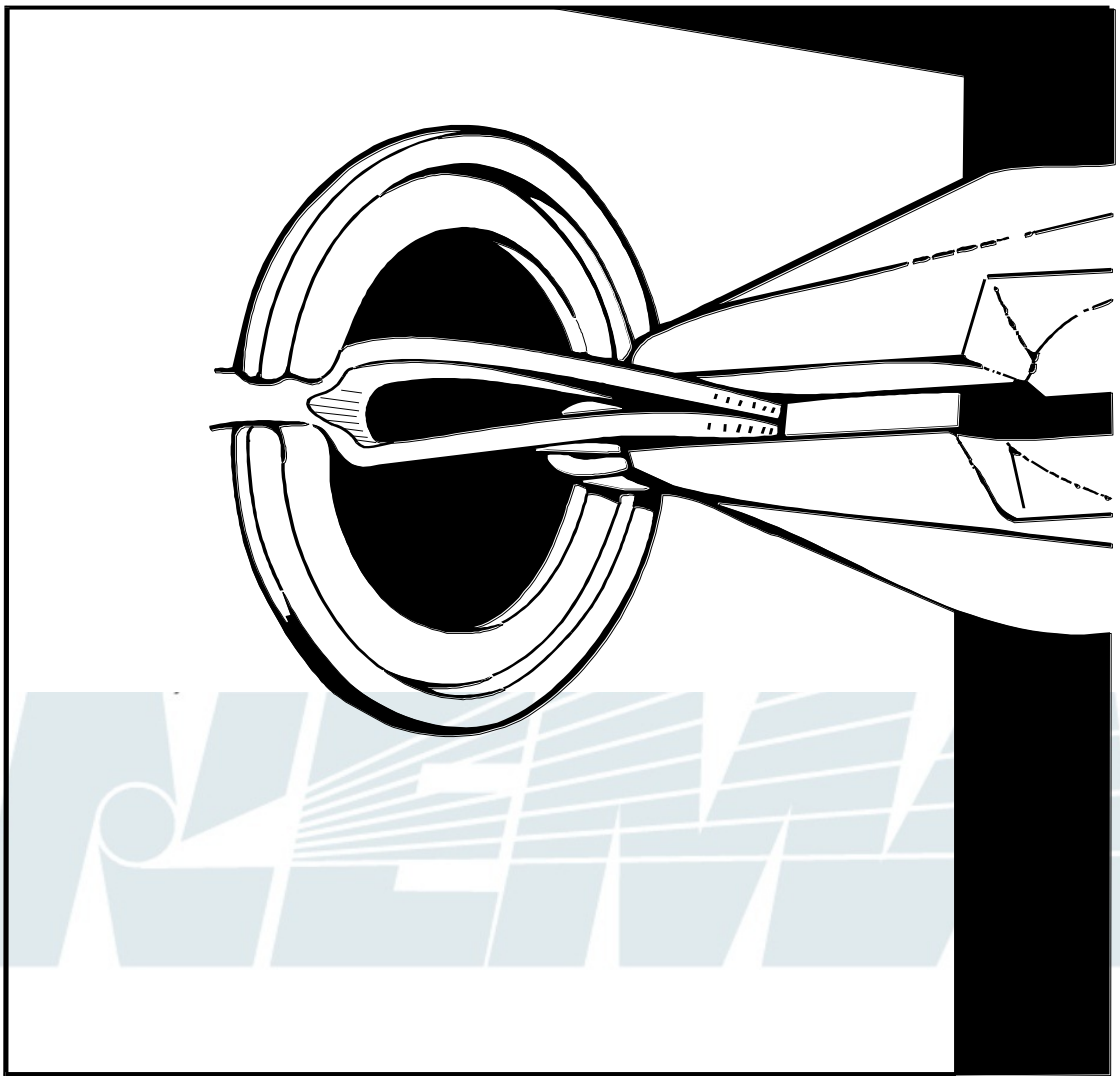


Figure 5–3
KNOCKOUT REMOVAL—STEP 3

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Section 6
INSTALLATION OF PANELBOARD

6.1 PROPER STORAGE

Store the panelboard in a clean, dry place located so that mechanical damage from work personnel in the area is not likely to happen.

6.2 UNPACKING

Care should be exercised in unpacking the panelboard to prevent damage and loss of instruction materials and loose parts.

6.3 INSPECTION

Check for shipping damage and check to make sure that the panelboard is the correct one for installation in the cabinet.

6.4 CARE

Care should be taken to protect the panelboard internal parts from contamination during the installation process.

6.4.1 Cleaning

Clean the cabinet of all foreign materials. If parts at connection points are spattered with cement, plaster, paint, or other foreign material, remove the foreign materials with great care to avoid damage to the plating.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE PANELBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE PANELBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

6.5 MANUFACTURER'S INSTRUCTIONS

Carefully follow the manufacturer's instructions and labels.

6.6 INSTALLATION

6.6.1 Alignment Devices

Adjust the alignment devices where provided.

6.6.2 Panelboard

Install the panelboard, finalize its alignment, and tighten it securely in the cabinet.

6.6.3 Flange of Deadfront Shield

Unless otherwise instructed by the manufacturer, adjust the panelboard so that the flange of the deadfront shield is no more than 3/16 inch from (1) the front of the cabinet for surface mounting or (2) the surrounding wall surfaces for flush mounting.

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6.7 LINE AND BRANCH CONDUCTORS

Connect Line and Branch Conductors

6.7.1 Conductors

Use care in stripping insulation from conductors so as not to nick or ring the conductor. For aluminum, clean all oxide from the stripped portion and apply an antioxide compound.

6.7.1.1 Wiring Gutters

Distribute and arrange conductors neatly in the wiring gutters. (See Section 5.)

6.7.1.2 Types and Temperature Ratings

Care should be exercised to ensure that the types and temperature ratings of conductors being installed in the panelboard are suitable for use with the terminals, which have been provided.

6.7.1.3 Tighten All Terminals

Use the manufacturer's torque values. (See 7.1).

6.8 PANELBOARD GROUNDING AND BONDING

Ground the panelboard cabinet in accordance with 4.12. (See Section 408.40 of the *National Electrical Code*®.)

6.8.1 Equipment Grounding Conductors

Where separate equipment grounding conductors are used, prepare equipment grounding conductors in accordance with 6.7.1 and connect them to the equipment grounding terminal bar. Check to be sure that the terminal bar is securely bonded to the cabinet or panelboard frame and that it is not connected to the neutral bar except at service equipment (as permitted in Section 250.28 of the *National Electrical Code*®) or at separately derived systems (as permitted in Section 250.30 of the *National Electrical Code*®).

NOTE—An equipment grounding terminal bar is not always required. For example, when a properly installed metallic raceway is used as the equipment grounding path or when the grounded conductor terminals (neutral bar) complies with the conditions of the last sentence of Section 408.40 of the *National Electrical Code*®.

6.9 PROPER TYPE OR CLASS AND RATING

When installing circuit breakers or fuses, ensure that they are of the proper type or class and rating.

6.10 DEBRIS

Clean the cabinet of all debris, which has accumulated during the panelboard installation Ensure that all foreign materials, including cement, plaster and paint (overspray) are cleaned and removed. Remove all such materials with great care to avoid damage to conductors, plating, etc. (see 6.4.1).

6.11 STEPS IN SECTION 7

If the job is complete, perform the steps in Section 7 and then install the cabinet front (see Section 8).

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Section 7
STEPS TO BE TAKEN BEFORE ENERGIZING

7.1 ACCESSIBLE ELECTRICAL CONNECTIONS

Tighten all accessible electrical connections to the manufacturer's torque specifications. If such information is not provided with the equipment, consult the manufacturer.

7.2 BLOCKS AND PACKING MATERIALS

Make certain that all blocks and packing materials used for shipment have been removed from all component devices and the panelboard.

7.3 SWITCHES, CIRCUIT BREAKERS, AND OTHER OPERATING MECHANISMS

Manually exercise all switches, circuit breakers, and other operating mechanisms to make certain they operate freely. If devices with self-test function are installed, perform test and verify proper operation per the manufacturer's instructions.

Check the integrity of all electrical and mechanical interlocks and padlocking mechanisms. For key interlocked systems, assure that only the required number of keys are accessible to the operator.

7.4 SHORT CIRCUITS AND GROUND FAULTS

To make sure that the system is free from short circuits and ground faults, conduct an insulation resistance test phase to ground and phase to phase with the switches or circuit breakers in both the open and closed positions. If the resistance reads less than 1 megohm while testing with the branch circuit devices in the open position, the system may be unsafe and should be investigated. If after investigation and possible correction, low readings are still observed, the manufacturer should be contacted. Some electronic equipment (metering, SPD, etc.) may be damaged by this testing. Refer to the manufacturers equipment markings for guidelines.

7.5 GROUND FAULT PROTECTION SYSTEM

Test the ground fault protection system (if furnished) in accordance with the manufacturer's instructions. See Section 230.95 of the *National Electrical Code*® and NEMA PB 2.2, *Application Guide for Ground Fault Protective Devices for Equipment*.

7.6 ADJUSTABLE TIME CURRENT TRIP DEVICE SETTINGS

Set any adjustable time current trip device settings to the proper values.

NOTE—Experience has indicated that damage from overcurrent can be reduced if the devices used for overload and short-circuit protection are set to operate instantaneously (that is, without intentional time delay) at 115 percent of the highest value of phase current which is likely to occur as the result of any anticipated motor starting or welding currents.

7.7 GROUNDING CONNECTIONS

Check to determine that all grounding connections are properly made. If the panelboard is used as service equipment, make certain that the neutral, if present, is properly bonded to the cabinet.

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7.8 FOREIGN MATERIAL

Remove all foreign material from the panelboard and cabinet before installing the cabinet front. Make certain that all deadfront shields are properly aligned and tightened. Install the cabinet front in accordance with Section 8.

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Section 8
INSTALLATION OF CABINET FRONT

8.1 CABINET FRONT OR TRIM PACKAGE

The cabinet front or trim package is designed to prevent damage to the front during shipment and handling.

8.2 UNPACKING

Care should be used when unpacking and handling the cabinet front.

8.3 COVERS AND DOORS

Install covers, close doors, and make certain that no conductors are pinched and that all enclosure parts are properly aligned and tightened. Hinged covers or doors must open a minimum of 90 degrees when installed.

8.4 TOUCH-UP

A suitable paint or other corrosion-resistant finish should be applied to those places where the finish is damaged.

8.5 FRONT ALIGNMENT

The cabinet front may be provided with an adjusting means to align it squarely with the building even though the cabinet may be slightly out of plumb with the building.

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Section 9
ENERGIZING EQUIPMENT

WARNING—HAZARDOUS VOLTAGES IN ELECTRICAL EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. ENERGIZING A PANELBOARD FOR THE FIRST TIME AFTER INITIAL INSTALLATION OR MAINTENANCE IS POTENTIALLY DANGEROUS.

9.1 QUALIFIED PERSONNEL

Only qualified personnel should energize equipment for the first time. If short circuit conditions caused by damage or poor installation practices have not been detected in the procedures specified in Section 7, serious personal injury and damage can occur when the power is turned on.

9.2 LOAD ON THE PANELBOARD

There should be no load on the panelboard when it is energized. Turn off all of the downstream loads.

9.3 ENERGIZED IN SEQUENCE

The equipment should be energized in sequence by starting at the source end of the system and working towards the load end. In other words, energize the main devices, then the feeder devices, and then the branch-circuit devices. Turn the devices on with a firm positive motion.

9.4 LOADS SUCH AS LIGHTING CIRCUITS, CONTACTORS, HEATERS, AND MOTORS

After all main, feeder, and branch circuit devices have been closed, loads such as lighting circuits, contactors, heaters, and motors may be turned on.

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Section 10
MAINTENANCE

10.1 MAINTENANCE PROGRAM

A maintenance program for panelboards should be conducted on a regularly scheduled basis in accordance with the following:

10.2 PANELBOARD WHICH HAS BEEN CARRYING ITS REGULAR LOAD FOR AT LEAST 3 HOURS

A panelboard which has been carrying its regular load for at least 3 hours just prior to inspection should be field tested by feeling the deadfront surfaces of circuit breakers, switches, interior trims, doors, and enclosure sides with the palm of the hand. If the temperature of these surfaces does not permit you to maintain contact for at least 3 seconds, this may be an indication of trouble and investigation is necessary. Thermographic (infrared) scanning has become a useful method of investigating thermal performance.

WARNING—HAZARDOUS VOLTAGES IN ELECTRICAL EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. UNLESS OTHERWISE SPECIFIED, INSPECTION AND MAINTENANCE SHOULD ONLY BE PERFORMED ON PANELBOARDS TO WHICH POWER HAS BEEN TURNED OFF, DISCONNECTED AND ELECTRICALLY ISOLATED SO THAT NO ACCIDENTAL CONTACT CAN BE MADE WITH ENERGIZED PARTS. FOLLOW ALL MANUFACTURER'S WARNINGS AND INSTRUCTIONS.

Safety related work practices, as described in NFPA 70E, should be followed at all times.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE PANELBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE PANELBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

10.3 INSPECT PANELBOARD ONCE EACH YEAR

Inspect the panelboard once each year or after any severe short circuit.

10.4 ACCUMULATION OF DUST AND DIRT

If there is an accumulation of dust and dirt, clean out the panelboard by using a brush, vacuum cleaner, or clean lint-free rags. Avoid blowing dust into circuit breakers or other components. Do not use a blower or compressed air.

10.4.1 Visible Electrical Joints and Terminals

Carefully inspect all visible electrical joints and terminals in the bus and wiring system.

10.4.2 Conductors and Connections

Visually check all conductors and connections to be certain that they are clean and secure. Loose and/or contaminated connections increase electrical resistance which can cause overheating. Such overheating is indicated by discoloration or flaking of insulation and/or metal parts. Pitting or melting of connecting surfaces is a sign of arcing due to a loose or otherwise poor connection. Parts which show evidence of overheating or looseness should be cleaned and re-torqued or replaced if damaged. Tighten bolts and nuts at bus joints to manufacturer's torque specifications.

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CAUTION—DO NOT REMOVE PLATING FROM ALUMINUM PARTS IN JOINTS OR TERMINATIONS. DAMAGE TO PLATING CAN RESULT IN OVERHEATING. REPLACE DAMAGED ALUMINUM PARTS.

10.4.3 Fuse Clip Contact Pressure and Contact Means

Examine fuse clip contact pressure and contact means. If there is any sign of overheating or looseness, follow the manufacturer's maintenance instructions or replace the fuse clips. Loose fuse clips can result in overheating.

10.4.4 Plug Fuses

Re-tighten plug fuses.

10.4.5 Conditions Which Caused Overheating

Be sure that all conditions which caused the overheating have been corrected.

10.5 PROPER AMPERE, VOLTAGE, AND INTERRUPTING RATINGS

Check circuit breakers, switches, and fuses to ensure they have the proper ampere, voltage, and interrupting ratings. Ensure that non-current-limiting devices are not used as replacements for current-limiting devices. Never attempt to defeat rejection mechanisms which are provided to prevent the installation of the incorrect class of fuse.

10.5.1 Mechanisms Free and in Proper Working Order

Operate each switch or circuit breaker several times to ensure that all mechanisms are free and in proper working order. Replace as required. See NEMA AB-4 for maintenance of molded case circuit breakers.

10.6 OPERATION OF ALL MECHANICAL COMPONENTS

Check the operation of all mechanical components. Replace as required.

10.6.1 Switch Operating Mechanisms

Exercise switch operating mechanisms and external operators for circuit breakers to determine that they operate freely to their full on and off positions.

10.6.2 Integrity of Electrical and Mechanical Interlocks

Check the integrity of all electrical and mechanical interlocks and padlocking mechanisms. For key interlocked systems, assure that only the required number of keys are accessible to the operator.

10.6.3 Missing or Broken Parts

Whenever practical, check all devices for missing or broken parts, proper spring tension, free movement, corrosion, dirt, and excessive wear.

10.6.4 Manufacturer's Instructions

Adjust, clean, and lubricate or replace parts according to the manufacturer's instructions.

10.6.4.1 Clean Nonmetallic Light Grease or Oil

Use *clean* nonmetallic light grease or oil as instructed.

10.6.4.2 Molded Case Circuit Breakers

Do *not* oil or grease parts of molded case circuit breakers.

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10.6.4.3 Clean, Light Grease

If no instructions are given on the devices, sliding copper contacts, operating mechanisms, and interlocks may be lubricated with clean, light grease.

10.6.4.4 Excess Lubrication

Wipe off excess lubrication to avoid contamination.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE PANELBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE PANELBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

10.6.5 Accessible Copper Electrical Contacts, Blades, and Jaws

Clean and dress readily accessible copper electrical contacts, blades, and jaws according to the manufacturer's instructions when inspection indicates the need.

10.7 DAMAGED INSULATING MATERIAL AND ASSEMBLIES

Look for and replace damaged insulating material and assemblies where sealing compounds have deteriorated.

10.8 MOISTURE OR SIGNS OF PREVIOUS WETNESS OR DRIPPING

Look for any moisture or signs of previous wetness or dripping inside the cabinet.

NOTE—Condensation in conduits or dripping from outside sources is one known cause of panelboard malfunction.

10.8.1 Conduits Which Have Dripped Condensate

Seal off any conduits which have dripped condensate, and provide means for further condensate to drain away from the panelboard.

10.8.2 Cracks or Openings

Seal off any cracks or openings which have allowed moisture to enter the enclosure. Eliminate the source of any dripping on the enclosure and any other source of moisture.

10.8.3 Insulating Material Which is Damp or Wet

Replace or thoroughly dry and clean any insulating material, which is damp or wet or shows an accumulation of deposited material from previous wettings.

10.8.4 Component Devices Which Show Evidence of Moisture Damage

Inspect all component devices. Replace any component device which shows evidence of moisture damage or has been subjected to water damage or flooding. Additional information may be found in the NEMA document “Guidelines for Handling Water Damaged Electrical Products.”

10.9 BEFORE CLEANUP AND CORRECTIVE ACTION IS ATTEMPTED

In the event of water damage, e.g., flooding or sprinkler discharge, the manufacturer should be consulted before clean up and corrective action is attempted.

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10.10 SEVERE ELECTRICAL SHORT CIRCUIT

If a severe electrical short circuit has occurred, the excessive currents may have resulted in structural component and/or bus and conductor damage due to mechanical distortion, thermal damage, metal deposits, or smoke. Examine all devices and bus supports for cracks or breakage. The manufacturer should be consulted before cleanup and correction is attempted.

10.11 GROUND FAULT PROTECTION SYSTEM

Test the ground fault protection system (if furnished) in accordance with the manufacturer's instructions. See Section 230.95 of the *National Electrical Code*® and NEMA PB 2.2 *Application Guide for Ground Fault Protective Devices for Equipment.*

10.12 INSULATION RESISTANCE

Check insulation resistance (see 7.4) under any of the following conditions:

10.12.1 Severe Short Circuit

If a severe short circuit has occurred (see 10.10);

10.12.2 Parts Replaced

If it has been necessary to replace parts or clean insulating surfaces;

10.12.3 Panelboard Exposed to High Humidity

If the panelboard has been exposed to high humidity, condensation, or dripping moisture.

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Section 11
PERMISSIBLE LOADING OF PANELBOARDS

11.1 *NATIONAL ELECTRICAL CODE®*

In compliance with the *National Electrical Code*®, the normal continuous loads (3 hours or more) of panelboard circuits should be not more than 80 percent of the rating of the overcurrent protective device, unless the marking of the device indicates that it is suitable for continuous duty at 100 percent of its rating.

11.2 HARMONICS IN ELECTRICAL SYSTEM

Some types of electrical equipment cause harmonics in the electrical system, which may result in overheating. This condition should be considered when determining panelboard loading.

§

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Rev. 02, 07/2016

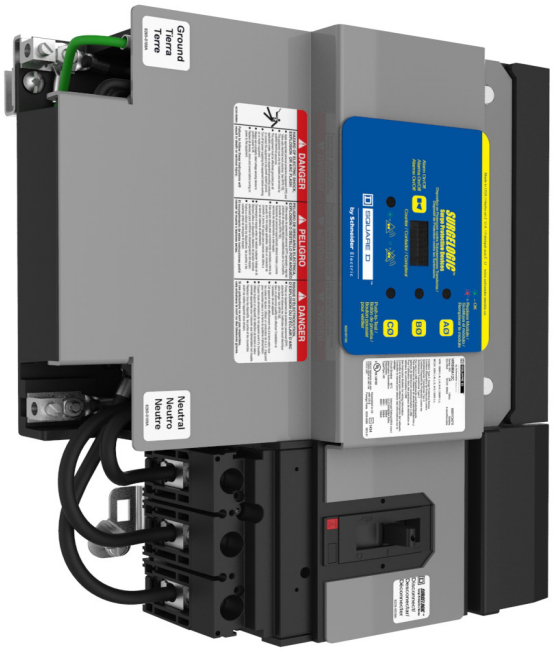
Replaces 8222-0015 Rev. 01, 04/2015

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Surgelogic™

I-Line™ Plug-on Surge Protective Device (SPD)

Retain for future use.



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Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

Introduction

This bulletin provides instructions for installing I-Line™ Plug-on Units with Surgelogic™ Surge Protective Devices (SPDs) into I-Line panelboards and switchboards.

This is a supplement to the information manual provided with each panelboard and the instruction bulletin provided with each switchboard.

Note: For troubleshooting, call the Surgelogic Technical Assistance Group at 1-800-577-7353.

Proper installation is imperative to maximize the surge protective device's effectiveness and performance. To ensure proper installation, follow the steps outlined in this instruction bulletin. Read the entire instruction bulletin before beginning the installation. These instructions are not intended to replace national or local electrical codes. Check all applicable electrical codes to verify compliance. Installation of modular surge suppressors should only be performed by qualified electrical personnel.

Unpacking and Preliminary Inspection

Inspect the entire shipping container for damage or signs of mishandling before unpacking the device. Remove the packing material and further inspect the device for any obvious shipping damage. If any damage is found and is a result of shipping or handling, immediately file a claim with the shipping company.

Storage

The device should be stored in a clean, dry environment. Storage temperature is -40 °F to +149 °F (-40 °C to +65 °C). All of the packaging materials should be left intact until the device is ready for installation.

Safety Labels

English, Spanish, and French versions of all safety labels (Danger, Warning, and Notice) are provided.

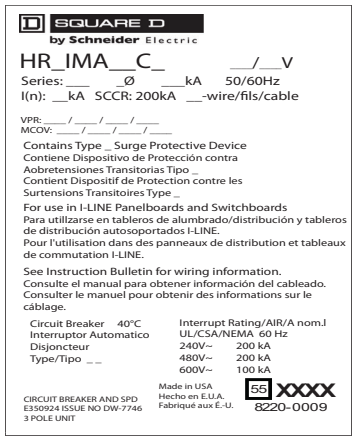
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Identification Nameplate

The identification nameplate is located on the front surface next to the diagnostic display.

Figure 1: Surge Protective Device Nameplate Example



⚠ CAUTION

LOSS OF BRANCH CIRCUIT POWER/LOSS OF SURGE SUPPRESSION

- Perform periodic inspection of the Surge Protective Device status indicator lights as part of the preventative maintenance schedule.
- Promptly service the Surge Protective Device when an alarm state exists.
- Use dry contacts to signal an alarm state to the central supervisory system for unmanned, inaccessible, or critical installations.
- Use multiple Surge Protective Devices to achieve redundancy for critical applications.

Failure to follow these instructions can result in injury or equipment damage.

At end-of-life conditions, Surge Protective Devices (SPDs) can lose their ability to block power system voltage and attempt to draw excessive current from the line. This SPD is equipped with overcurrent and overtemperature components that will automatically disconnect the surge suppression elements from the mains should the surge suppression elements reach end of life. Also, at that time, tripping of the branch circuit breaker or fuse feeding the SPD can occur.

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⚠ CAUTION

LOSS OF SURGE SUPPRESSION

- Do not energize the Surge Protective Devices until the electrical system is completely installed, inspected, tested, and all conductors have been connected and functional, including the neutral.
- Verify the voltage rating of the device and system before energizing the Surge Protective Device.
- Disconnect the Surge Protective Device, including the neutral, from the power source before performing high-potential insulation testing or any tests where Surge Protective Device components will be subjected to voltages higher than their rated turn-on voltage.

Failure to follow these instructions can result in injury or equipment damage.

Location Considerations

Environment

The device is designed to operate in an ambient temperature range of -4 °F to +149 °F (-20 °C to +65 °C) with a relative humidity of 0 to 95% non-condensing. The operating temperature of the LCD on the diagnostic display panel is +14 °F to +140 °F (-10 °C to +60 °C). Refer to the product catalog for further details on enclosures. All I-Line devices operate normally without reduction in performance when subjected to shock and vibrations described in IEC 60721-3-3, Class 3M4.

Audible Noise

The device background noise is negligible and does not restrict the location of the installation.

Service Clearance

The service clearance should meet all applicable code requirements.

Electrical

Voltage Rating

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Confirm the Surge Protective Device voltage rating on the module or nameplate label is the same as the operating voltage.

Failure to follow these instructions will result in death or serious injury.

Prior to mounting the SPD, verify that the device has the same voltage rating as the power distribution system in which it is installed. Compare the nameplate voltage or model number on the SPD with the nameplate of the electrical distribution equipment.

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The specifier or user of the device must be familiar with the configuration and arrangement of the power distribution system in which any SPD is to be installed. The system configuration of any power distribution system is based strictly on how the secondary windings of the transformer supplying the service entrance main or load are configured. This includes whether or not the transformer windings are referenced to earth via a grounding conductor. The system configuration is not based on how any specific load or equipment is connected to a particular power distribution system.
See Table 1 for the service voltage of each SPD.

Table 1: Voltage Ratings

Service Voltage	Peak Surge Current Rating Per Phase	Catalog Numbers [1]	
		HR Breaker SPD	HL Breaker SPD
120/240 V, 1-phase, 3-wire + ground	120	HR1IMA12C	HL1IMA12C
	160	HR1IMA16C	HL1IMA16C
	240	HR1IMA24C	HL1IMA24C
208Y/120 V, 3-phase, 4-wire + ground Wye [2]	120	HR2IMA12C	HL2IMA12C
	160	HR2IMA16C	HL2IMA16C
	240	HR2IMA24C	HL2IMA24C
240/120 V, 3-phase, 4-wire + ground High-leg Delta [3]	120	HR3IMA12C	HL3IMA12C
	160	HR3IMA16C	HL3IMA16C
	240	HR3IMA24C	HL3IMA24C
480Y/277 V, 3-phase, 4-wire + ground Wye [4]	120	HR4IMA12C	HL4IMA12C
	160	HR4IMA16C	HL4IMA16C
	240	HR4IMA24C	HL4IMA24C
480 V Delta, 3-phase, 3-wire + ground Delta [5]	100	HR5IMA10C	HL5IMA10C
	120	HR5IMA12C	HL5IMA12C
	160	HR5IMA16C	HL5IMA16C
	200	HR5IMA20C	HL5IMA20C
	240	HR5IMA24C	HL5IMA24C
240 V Delta, 3-phase, 3-wire + ground Delta	100	HR6IMA10C	HL6IMA10C
	120	HR6IMA12C	HL6IMA12C
	160	HR6IMA16C	HL6IMA16C
	200	HR6IMA20C	HL6IMA20C
	240	HR6IMA24C	HL6IMA24C
600Y/347 V, 3-phase, 4-wire + ground Wye	120	HR8IMA12C	–
	160	HR8IMA16C	–
	240	HR8IMA24C	–
600 V Delta, 3-phase, 3-wire + ground Delta [6]	100	HR9IMA10C	–
	120	HR9IMA12C	–
	160	HR9IMA16C	–
	180	HR9IMA18C	–

1 For Type 1 systems include a "1" at the end of the catalog numbers listed above.

2 208Y/120 series also applies to the following voltage 220Y/127.

3 Phase B modules are different than Phase A and Phase C modules.

4 480Y/277 series applies to the following voltages 380Y/220, 400Y/230, and 415Y/240.

5 480 V Delta series also applies to the following voltages: 480Y/277V HRG.

6 600 V Delta series also applies to the following voltages: 600Y/347V HRG.

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General

The I-Line device has SPD elements connected from phase to ground. To prevent hazardous touch voltage on the I-Line enclosure during normal operation or during SPD end-of-life, it is critical that there be a robust and effective connection to the building grounding structure. The grounding connection must utilize an equipment grounding conductor run with the phase and neutral (if present) connection of the power system. Do not connect the I-Line device to a separate isolated ground.

For best overvoltage suppression by the I-Line device, use a single-point ground system where the service entrance grounding electrode system is connected to and bonded to all other available electrodes, building steel, metal water pipes, driven rods, etc. (for reference, see NEC Art 250). The ground impedance measurement should be in compliance with all applicable codes.

Solidly-Grounded Power Systems

⚠ CAUTION

SURGE PROTECTIVE DEVICE DAMAGE AND POWER SYSTEM OVERVOLTAGE

- Do not connect devices rated for use on solidly-grounded power systems to resistance-grounded (for example, High Resistance Ground) or ungrounded power systems.
- Verify that the service entrance equipment is bonded to ground in accordance with all applicable codes.
- Verify that the neutral terminal of the power system transformer feeding the device is bonded to system ground in accordance with all applicable codes.

Failure to follow these instructions can result in equipment damage.

SPDs rated for use on solidly-grounded power systems must not be connected to resistance-grounded or ungrounded power systems. Such a connection can result in damage to the SPD.

Always verify the power system grounding configuration prior to application of power to the device. Confirm that all ground bonds are installed at both the service entrance equipment and power system transformer prior to application of power.

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Delta and Resistance-Grounded Power Systems

⚠ CAUTION

SURGE PROTECTIVE DEVICE DAMAGE AND POWER SYSTEM OVERVOLTAGE

- Ungrounded power systems are inherently unstable and can produce excessively high line-to-ground voltages during certain fault conditions. During these fault conditions any electrical equipment, including an SPD, may be subjected to voltages which exceed their designed ratings. This information is being provided to the user so that an informed decision can be made before installing any electrical equipment on an ungrounded power system.
- Resistance-grounded power systems must be maintained in an over-damped state to limit voltage overshoot and duration during operation.
- Perform verification and adjustment of correct power system damping:
  - — Periodically as part of normal system maintenance.
  - — Following power system modifications.

Failure to follow these instructions can result in equipment damage.

The I-Line product is intended for use on resistance-grounded power systems where the power system has been set for, and is maintained in, an over-damped state. For the power system to be over-damped, the current through the grounding resistor during a bolted phase-to-ground fault must be significantly greater than the total charging current of the system.

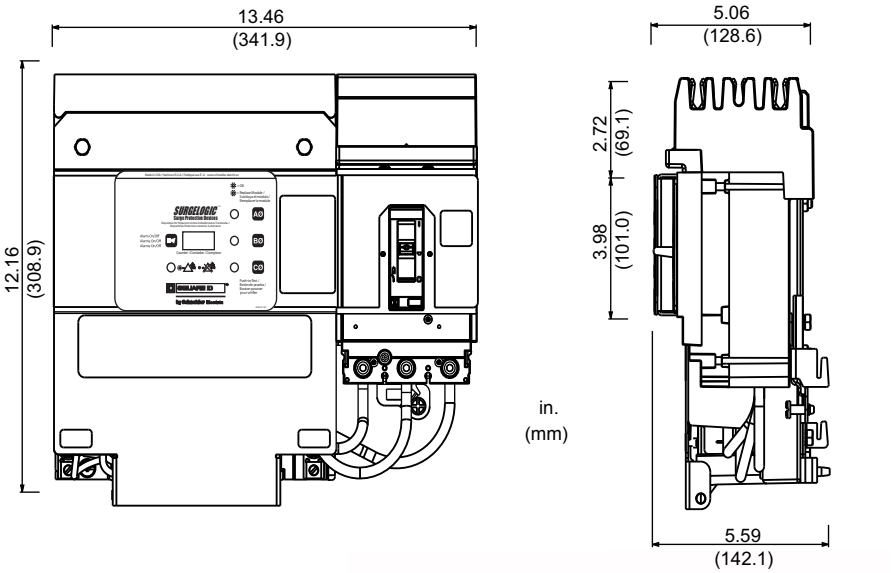
Periodic engineering evaluation of the power system is required to determine the worst-case charging current of the system and to adjust the grounding resistance accordingly. As the power system is modified, the value of the grounding resistor must be evaluated and adjusted to maintain the system in the over-damped state.

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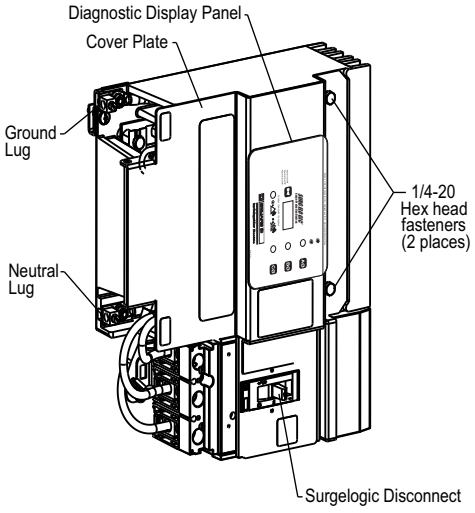
Dimensions

Figure 2: Dimensions.



I-Line Surgelogic Installation

Figure 3: I-Line Surgelogic Components



⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

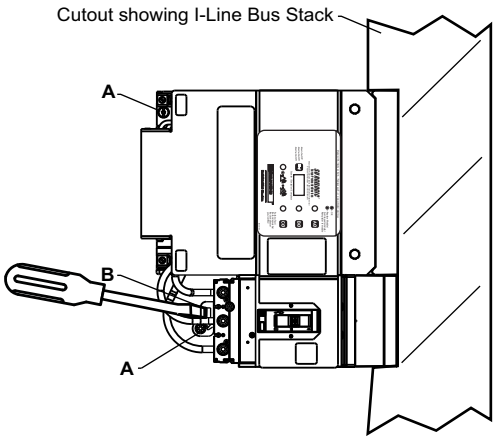
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

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Figure 4: Racking the Device onto the Bus



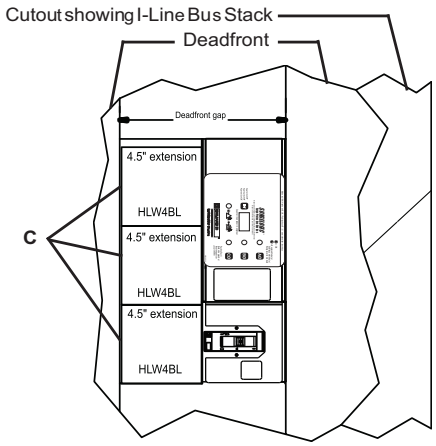
⚠CAUTION

LOSS OF SURGE SUPPRESSION

- Verify that the service entrance equipment is bonded to ground in accordance with all applicable codes.
- Verify that the neutral bonding jumper is installed at the service entrance in accordance with all applicable codes.
- When neutral is not present at the I-Line panel, connect Surge Protective Device neutral and ground together with a minimum 10 AWG wire.

Failure to follow these instructions can result in equipment damage.

Figure 5: Blank Extensions in Deadfront



Turn off all power supplying the panelboard or switchboard before working on or installing the I-Line Surgelogic device.

1. Turn off all power supplying the panelboard or switchboard before working on or installing the I-Line Surgelogic device.
2. Loosen the retaining screws (**A**) (see Figure 4).
3. Place the device on the I-Line pan with the jaws pushed against the bus.
4. Insert a flat-head screwdriver into the screwdriver slot (**B**). Rack the device onto the bus.
5. Tighten the two retaining screws (**A**).
6. Use 6 AWG copper wire to connect the ground and neutral assembly from the SPD to the panelboard or switchboard neutral and ground.

   Note: The wires should be as short as possible. Torque each neutral and ground connection to 35 lb-in. (4 N•m).
7. Close all openings around the Surgelogic device.
8. Ensure blank extensions (**C**) are installed into the deadfront whenever the I-Line Surgelogic device is placed on the wide side of the bus stack (see Figure 5).

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Access to MA Modules and Back of Diagnostic Display Panel

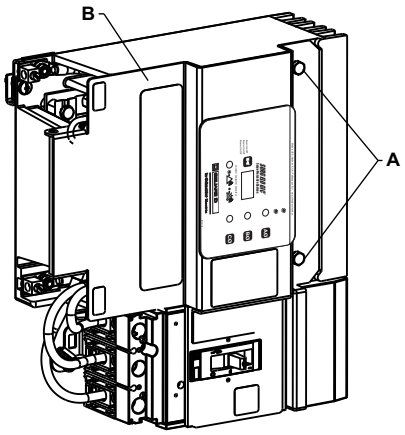
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

Figure 6: I-Line Surgelogic Components



1. Turn off all power supplying the panelboard or switchboard before working on the I-Line Surgelogic device.
2. Remove the two 1/4-20 hex head fasteners (**A**) shown in Figure 6 and open the cover plate (**B**).
3. When finished accessing the MA modules, close the cover plate and replace fasteners. Torque fasteners to 32 lb-in. (3.6 N•m).

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Operation

⚠ DANGER

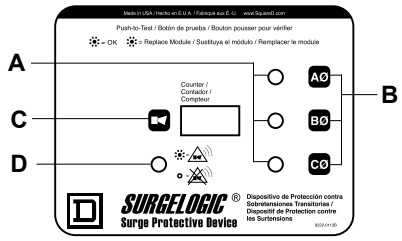
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

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- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

LED Status Indicators

Figure 7: Three-Phase Diagnostic Display Panel with Surge Counter (TVS3DSPHIC; TVS1DSPHIC for TVS1 series devices)

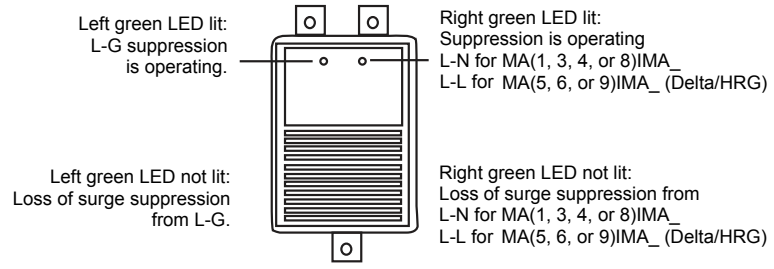


Note: Phase B is not present on single-phase application.

The SPD diagnostic display panel shows the status of each MA module with diagnostically controlled green/red LEDs (**A**). If a unit is operating correctly, all the phase LEDs will be illuminated green. To test the integrity of the diagnostics for each phase, push the corresponding phase button **(B)** on the diagnostic display panel. If the alarm is enabled, the green LEDs will turn red, the dry contacts will change state, and the alarm will sound. Releasing the test button (**B**) will complete the test; the LEDs will turn green, the dry contacts will change back to a normal state, and the alarm will shut off (see Figure 7).

If an inoperable condition occurs on any phase, the audible alarm sounds (if enabled), the dry contacts will switch to an error state and the corresponding phase LED (**A**) on the diagnostic display panel is illuminated red. This indicates that the device needs service by qualified electrical personnel. The audible alarm can be silenced by pressing the alarm enable/disable button (**C**). The alarm will silence and the green alarm LED (**D**) will not be illuminated. The red phase LED will continue to be illuminated until the inoperative condition has been cleared (see Figure 7).

Figure 8: MA Module LEDs



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On an MA module (see Figure 8), when the power is applied, if the left green LED is not lit, it indicates a loss of suppression from line-to-ground for that phase. If the right green LED is not lit, it indicates a loss of suppression from line-to-neutral for that phase. If either LED is not lit the module should be replaced.

When power is applied to the SPD and one or more of the diagnostic display panel LEDs are red, and one or more MA module LEDs are out, the appropriate MA module should be replaced. (see Table 2).

Refer to “Maintenance and Troubleshooting” on page 16 for proper troubleshooting procedures. If the module LEDs are green and the diagnostic display LEDs are red, please call SPD TAG at 1-800-577-7353.

Power System Grounding

In addition to the power system configuration and voltage, the power system grounding method must be considered when selecting the appropriate I-Line device. Refer to the following chart for information concerning the suitability of I-Line device to specific power system grounding method.

Table 2: I-Line Series Replacement Modules

Service Voltage	Peak Surge Current Rating Per Phase	Catalog Numbers[1]		
		A	B	C
120/240 V, 1-phase, 3-wire + ground	120	MA1IMA12	—	MA1IMA12
	160	MA1IMA16	—	MA1IMA16
	240	MA1IMA24	—	MA1IMA24
208Y/120 V, 3-phase, 4-wire + ground Wye [2]	120	MA1IMA12	MA1IMA12	MA1IMA12
	160	MA1IMA16	MA1IMA16	MA1IMA16
	240	MA1IMA24	MA1IMA24	MA1IMA24
240/120 V, 3-phase, 4-wire + ground High-leg Delta [3]	120	MA1IMA12	MA3IMA12	MA1IMA12
	160	MA1IMA16	MA3IMA16	MA1IMA16
	240	MA1IMA24	MA3IMA24	MA1IMA24
480Y/277 V, 3-phase, 4-wire + ground Wye [4]	120	MA4IMA12	MA4IMA12	MA4IMA12
	160	MA4IMA16	MA4IMA16	MA4IMA16
	240	MA4IMA24	MA4IMA24	MA4IMA24
480 V Delta, 3-phase, 3-wire + ground Delta [5]	100	MA5IMA10	MA5IMA10	MA5IMA10
	120	MA5IMA12	MA5IMA12	MA5IMA12
	160	MA5IMA16	MA5IMA16	MA5IMA16
	200	MA5IMA20	MA5IMA20	MA5IMA20
	240	MA5IMA24	MA5IMA24	MA5IMA24
240 V Delta, 3-phase, 3-wire + ground Delta	100	MA6IMA10	MA6IMA10	MA6IMA10
	120	MA6IMA12	MA6IMA12	MA6IMA12
	160	MA6IMA16	MA6IMA16	MA6IMA16
	200	MA6IMA20	MA6IMA20	MA6IMA20
	240	MA6IMA24	MA6IMA24	MA6IMA24
600Y/347 V, 3-phase, 4-wire + ground Wye	120	MA8IMA12	MA8IMA12	MA8IMA12
	160	MA8IMA16	MA8IMA16	MA8IMA16
	240	MA8IMA24	MA8IMA24	MA8IMA24
600 V Delta, 3-phase, 3-wire + ground Delta [6]	100	MA9IMA10	MA9IMA10	MA9IMA10
	120	MA9IMA12	MA9IMA12	MA9IMA12
	160	MA9IMA16	MA9IMA16	MA9IMA16
	180	MA9IMA18	MA9IMA18	MA9IMA18

1 For Type 1 systems include a "1" at the end of the catalog numbers listed above.

2 208Y/120 series also applies to the following voltage 220Y/127.

3 Phase B modules are different than Phase A and Phase C modules.

4 480Y/277 series applies to the following voltages 380Y/220, 400Y/230, and 415Y/240.

5 480 V Delta series also applies to the following voltages: 480Y/277V HRG.

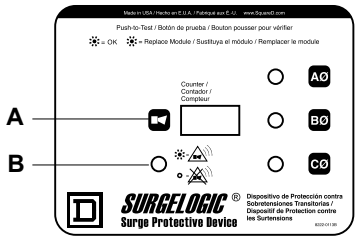
6 600 V Delta series also applies to the following voltages: 600Y/347V HRG.

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Audible Alarm

Figure 9: Alarm Enable/Disable



Note: Phase B is not present on single-phase application.

Push the alarm enable/disable button (**A**, Figure 9), to enable or disable the alarm.

- If the green LED (**B**) is illuminated the alarm is enabled.
- If the green LED (**B**) is not illuminated the alarm is disabled.

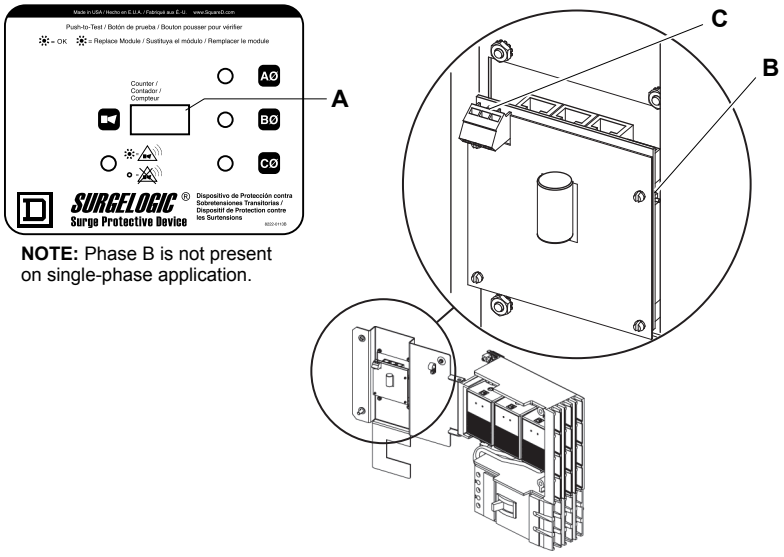
Surge Counter

Note: Refer to “Access to MA Modules and Back of Diagnostic Display Panel” on page 11, for instructions on accessing the rear of the diagnostic display panel to reset the surge counter.

The surge counter (**A**, Figure 10), displays the number of transient voltage surges since the counter was last reset. The counter is battery powered to retain memory in the event of a power loss to the diagnostic display panel.

To reset the counter to zero, press the counter reset button (**B**) located inside the unit on the underside of the diagnostic circuit board.

Figure 10: Three-Phase Diagnostic Display Panel with Surge Counter



NOTE: Phase B is not present on single-phase application.

Dry Contacts

The I-Line series Surge Protective Device (SPD) is provided with dry contacts. The connection for the dry contacts (**C**, Figure 10), is located and labeled on the back of the diagnostic display panel and will accept 22-14 AWG stranded or solid wire. The dry contacts are three-position, Form “C” type with Normally Open, Normally Closed and Common connections. The unpowered state shall be closed between terminals NC and COM. This is also the alarm condition. The opposite state, closed between terminals NO and COM, indicates that power is on to the unit and that no alarm condition exists (see Table 3).

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Table 3: Dry Contact Configuration

Alarm Contact Terminals	Contact State with Power Applied
NO to COM	Closed
NC to COM	Open

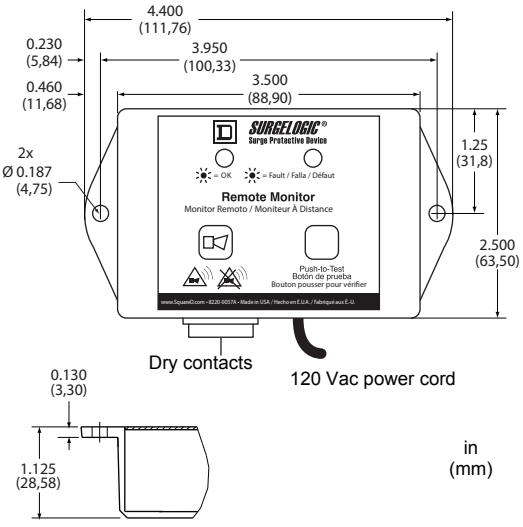
These contacts can be used for remote indication of the SPD's operating status to a computer interface board or emergency management system. Also, these contacts are designed to work with the SPD remote monitor option described below.

Care must be taken when installing the dry contact wiring because the terminals are on a moving door. Avoid the door hinge, any switches, and the high voltage areas of the enclosure when routing the wiring. To avoid the door hinge, tie wrap any dry contact wiring to the existing cable harness which crosses the hinge. Once the dry contact wiring is secured on a non-moving point of the enclosure, it is the user's responsibility to maintain at least 1.0 in. (25 mm) separation between 600 Vac rated dry contact wiring and the power wiring in the enclosure.

The contacts are designed for a maximum voltage of 24 Vdc / 24 Vac and a maximum current of 2 A. Higher energy applications may require additional relay implementation outside the SPD. Damage to the SPD's relay caused by use with energy levels in excess of those discussed in this instruction bulletin are not covered by warranty. For application questions, contact the Surgelogic Technical Assistance Group at 1-800-577-7353.

Remote Monitor Option

Figure 11: Remote Monitor Option (TVS12RMU)



The remote monitor option has two LEDs, one red and one green, and an audible alarm with an enable/disable switch. Normal status is an illuminated green LED, and no audible alarm. To test the integrity of the remote monitor, press the pushto-test switch. If the alarm is enabled, the green LED will turn off, the red LED will turn on, and the alarm will sound. Releasing the switch will complete the test; the red LED will turn off, the green LED will turn on and the alarm will shut off.

If suppression on any phase is lost, the green LED will turn off, the red LED will turn on and an alarm will sound. The audible alarm can be silenced by pushing the alarm enable/disable button. The alarm will silence and the green alarm LED will not be illuminated. The red LED will continue to be illuminated until the inoperative condition has been cleared.

The remote monitor includes a 120 Vac to 12 Vdc adapter with a six-foot power cord. Connections are made to the SPD diagnostic panel with Form "C", three-position dry contacts (provided), and the appropriate length of solid or stranded 22–14 AWG wire up to 1000 ft. (305 m), not provided.

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Maintenance and Troubleshooting

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

Preventive Maintenance

Inspect the SPD periodically to maintain reliable system performance and continued surge protection. Periodically check the state of the diagnostic display panel LED status indicators. Routinely use the built-in diagnostics to inspect for inoperative modules.

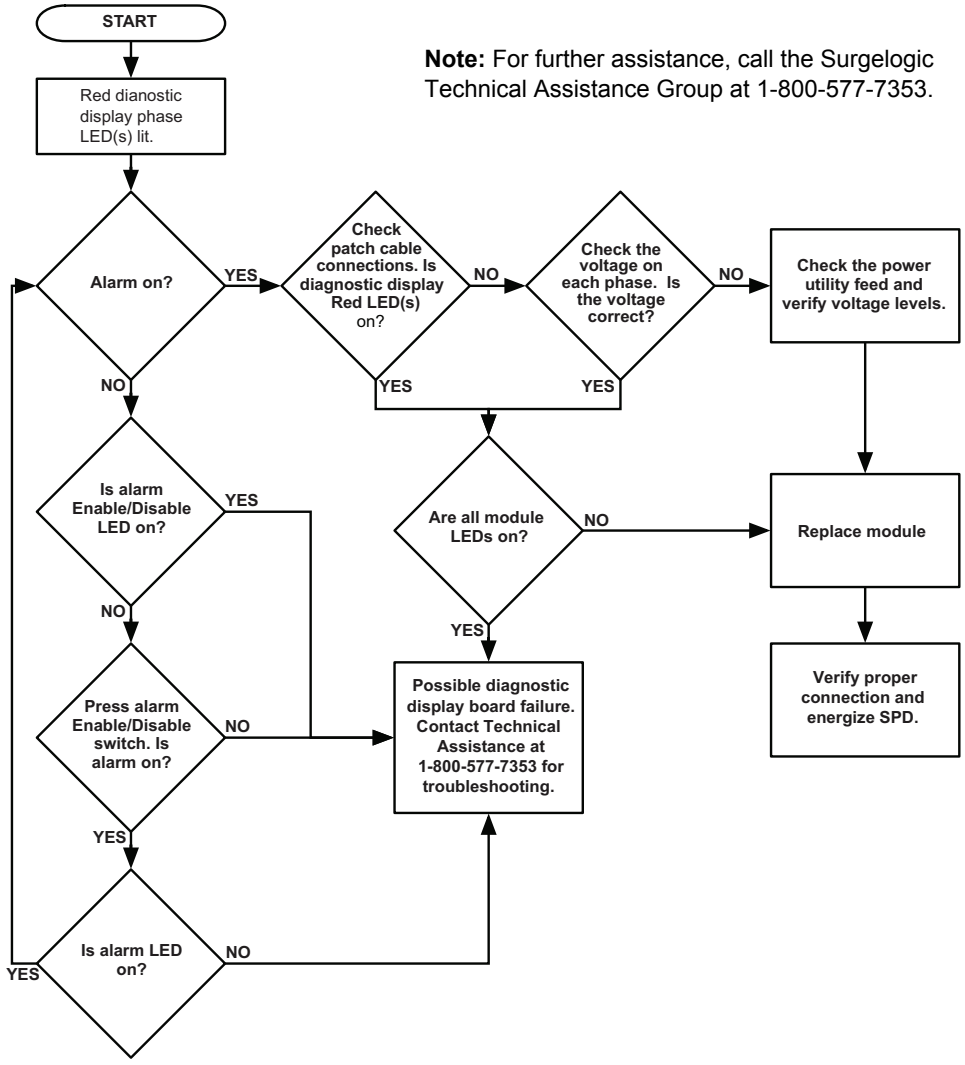
Troubleshooting

If a module shows two green indicator lights and the diagnostic display panel shows a red phase indicator light, follow the Troubleshooting Flow Chart in Figure 12 below.

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Figure 12: Troubleshooting Flowchart



Note: For further assistance, call the Surgelogic Technical Assistance Group at 1-800-577-7353.

Replacement Parts

The following replacement parts are available. For ordering information please contact your local distributor or refer to the product catalog.

- **MA modules**. Replacement instructions are included with the replacement parts.
- **Diagnostic display panel assemblies**. Replacement instructions are included with the replacement parts.

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Surgelogic®
IMA Surge Protective Device (SPD)

Instruction Bulletin

8222-0050E

Retain for Future Use.



SQUARE D

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Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

⚠ CAUTION

LOSS OF BRANCH CIRCUIT POWER/LOSS OF SURGE SUPPRESSION

- Ensure that the branch circuit breaker or fuse trip characteristic has been coordinated with the overcurrent components inside the SPD (See Tables 1 and 2).
- Perform periodic inspection of the SPD status indicator lights as part of the preventative maintenance schedule.
- Promptly service the SPD when an alarm state exists.
- Use dry contacts to signal an alarm state to the central supervisory system for unmanned, inaccessible, or critical installations.
- Use multiple SPDs to achieve redundancy for critical applications.

Failure to follow these instructions can result in injury or equipment damage.

Surge Protective Devices (SPDs) can lose their ability to block power system voltage and attempt to draw excessive current from the line.This SPD is equipped with overcurrent and overtemperature components that will automatically disconnect the surge suppression elements from the mains should the surge suppression elements reach end of life. Tripping of the branch circuit breaker or fuse feeding the SPD can occur when the surge suppression elements reach end of life. Mitigate the tripping of the branch circuit breaker or fuse feeding the SPD by coordinating the surge suppression elements with the branch circuits.

For the purposes of coordination, the SPD is equipped with overcurrent components that will limit the per phase I2t, Iapparent, Ip, and Ith values to those listed in tables 1 and 2 when connected to a power system with a short-circuit current rating not exceeding 200,000 A.

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Table 1: SPD Without Optional Sine Wave Tracking Module

SPD Device	Per Phase I^2t	$I_{apparent}$	I_p	I_{th}
TVS_IMA12 through TVS_IMA24	175 kA^2 seconds	17,000 A RMS	40,000 A RMS	220 A
TVS_IMA32 through TVS_IMA48	700 kA^2 seconds	34,000 A RMS	80,000 A RMS	440 A

Table 2: SPD With Optional Sine Wave Tracking Module

SPD Device	Per Phase I^2t	$I_{apparent}$	I_p	I_{th}
TVS_IMA12 through TVS_IMA24 and	240 kA^2 seconds	21,500 A RMS	48,000 A RMS	260 A
TVS_IMA32 through TVS_IMA48	825 kA^2 seconds	37,500 A RMS	88,000 A RMS	480 A

⚠ CAUTION

LOSS OF SURGE SUPPRESSION

- Do not energize the SPDs until the electrical system is completely installed, inspected, tested, and all conductors connected and functional, including the neutral.
- Verify the voltage rating of the device and system before energizing the surge protective device.
- Perform high-potential insulation testing, or any other tests where SPD components will be subjected to voltages higher than their rated turn-on voltage, with the neutral and SPD disconnected from the power source.

Failure to follow these instructions can result in injury or equipment damage.

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For troubleshooting, call the Surgelogic Technical Assistance Group at 1-800-577-7353.

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Operation

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

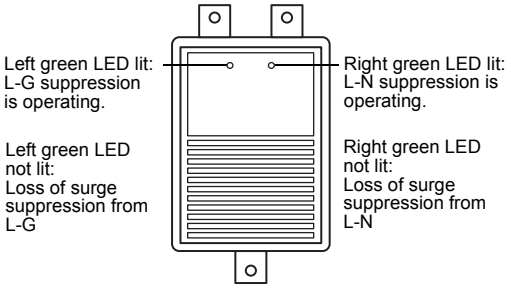
Failure to follow these instructions will result in death or serious injury.

LED Status Indicators

The SPD diagnostic display panel shows the status of each MA module with diagnostically controlled green/red LEDs. If a unit is operating correctly, all the phase LEDs will be illuminated green. To test the integrity of the diagnostics for each phase, push the button below the phase LEDs on the diagnostic display panel. The green LED will turn red and the alarm will sound, if the alarm is enabled. Releasing the test button will complete the test; the red LED will turn green and the alarm will shut off.

If an inoperable condition occurs on any phase, the audible alarm sounds and the corresponding phase LED on the diagnostic display panel is illuminated red. This indicates that the device needs service by qualified electrical personnel. The audible alarm can be silenced, until a qualified person is able to evaluate and service the SPD, by pressing the alarm enable/disable button. The alarm will silence and the green alarm LED will not be lit. The red phase LED will continue to be illuminated until the inoperative condition has been cleared.

Figure 1: MA Module LEDs



On an MA module (see Figure 1), if either LED is not lit, the module should be replaced. If both green LEDs are not lit and the diagnostic display panel has power, then power has been lost to that phase or the module should be replaced (refer to Table 4 on page 7). Refer to the final equipment instruction bulletin for MA module disconnection and access instructions.

When power is applied to the SPD and one or more of the diagnostic display panel LEDs are red, and one or more MA module LEDs are out, the appropriate MA module should be replaced. Refer to “Troubleshooting” on page 8 for proper troubleshooting procedures.

Surge Counter

The surge counter displays the number of transient voltage surges since the counter was last reset. The counter is battery powered to retain memory in the event of a power loss to the diagnostic display panel.

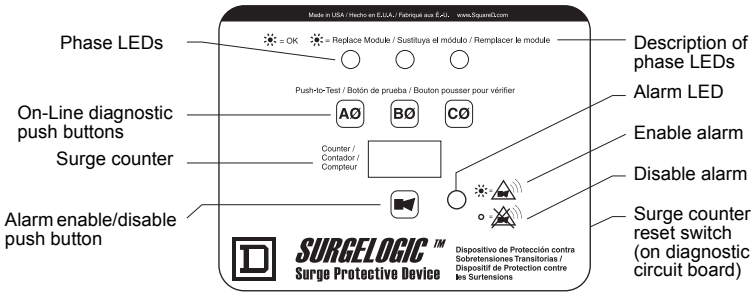
To reset the surge counter to zero:

1. Remove all power from this equipment.
2. Remove covers as necessary to gain access to the diagnostic circuit board.
3. Press the small switch located on the underside of the diagnostic circuit board (near the RJ45 connectors; see Figure 3:). This will reset the counter to zero.

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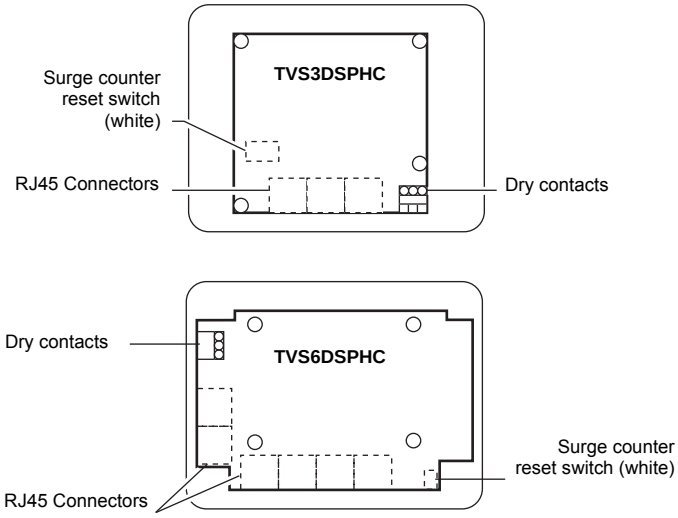
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Figure 2: Three-Phase Diagnostic Display Panel with Surge Counter



NOTE: Phase B is not present on single-phase applications.

Figure 3: Rear of Diagnostic Circuit Board



Dry Contacts

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Use 600 Vac rated dry contact wiring.
- Dry contact wiring must have less than 1/16 in. (1.6 mm) exposed wire from the dry contact block.
- Maintain at least 1.0 in. (25 mm) separation between dry contact wiring and the power wiring in the enclosure.

Failure to follow these instructions will result in death or serious injury.

The IMA series SPD is provided with dry contacts. The connection for the dry contacts is located on the back of the diagnostic display panel (lower right corner). The dry contacts are 3-position, Form “C” type with Normally Open, Normally Closed and Common connections. The unpowered state shall be closed between terminals NC and COM. This is also the alarm condition. The opposite state, closed between terminals NO and COM, indicates that power is on to the unit and that no alarm condition exists (See Table 3).

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For troubleshooting, call the Surgelogic Technical Assistance Group at 1-800-577-7353.

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Table 3: Dry Contact Configuration

Alarm Contact Terminals	Contact State with Power Removed
NC	Normally closed
COM	Common
NO	Normally open

These contacts can be used for remote indication of the SPD device's operating status to a computer interface board or emergency management system. Also, these contacts are designed to work with the SPD remote monitor option described below.

The contacts are designed for a maximum voltage of 24 Vdc / 24 Vac and a maximum current of 2 A. Higher energy applications may require additional relay implementation outside the SPD. Damage to the SPD's relay caused by use with energy levels in excess of those discussed in this instruction bulletin are not covered by warranty. For application questions, contact the Surgelogic Technical Assistance Group at 1-800-577-7353.

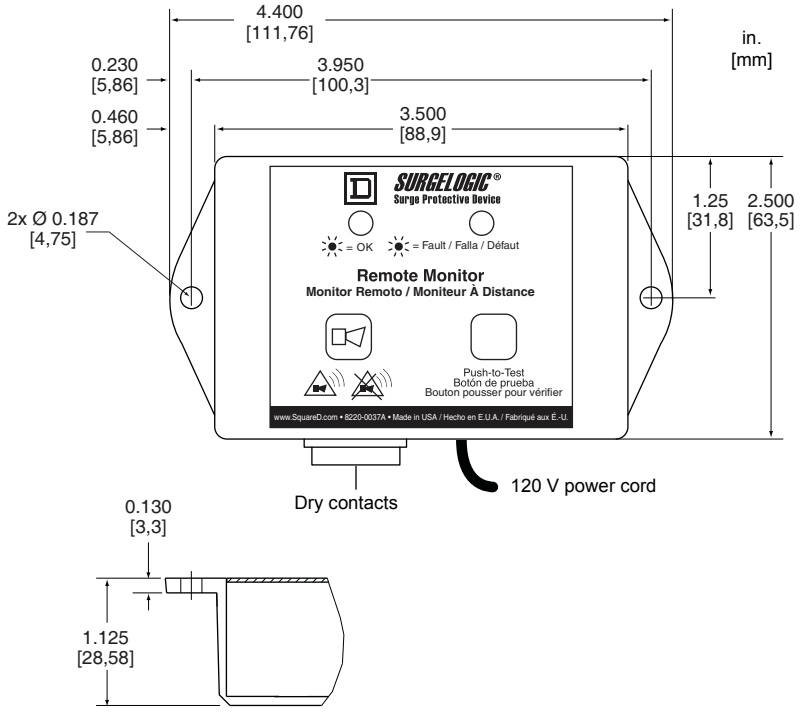
Remote Monitor Option

The option has two LEDs, one red and one green, and an audible alarm with an enable/disable switch. Normal status is a lit green LED, and no audible alarm. To test the integrity of the remote monitor, press the push-to-test switch.

The green LED will turn off, the red LED will turn on, and the alarm will sound, if the alarm is enabled. Releasing the switch will complete the test; the red LED will turn off, the green LED will turn on and the alarm will shut off. If suppression on any phase is lost, the green LED will turn off, the red LED will turn on and an alarm sounds. The audible alarm can be silenced by moving the alarm enable/disable switch to the disable position. The alarm will silence and the green alarm LED will not be lit. The red LED will continue to be illuminated until the inoperative condition had been cleared.

The remote monitor includes a 120 Vac to 12 Vdc adapter with a six-foot power cord. Connections are made to the SPD diagnostic display panel with Form "C", 3-position dry contacts (provided) and the appropriate length of solid or stranded 30 to 14 AWG wire (not provided).

Figure 4: Remote Monitor Option (TVS12RMU)



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Maintenance and Troubleshooting

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

Preventive Maintenance

Inspect the SPD periodically to maintain reliable system performance and continued transient voltage surge suppression. Periodically check the state of the diagnostic display panel LED status indicators. Routinely use the built-in diagnostics to inspect for inoperative modules.

Replacement Modules

Table 4: EMA Series Replacement Modules

System Voltage	Peak Surge Current Rating (kA)	Phase A	Phase B	Phase C
120/240 V, 1-phase, 3-wire	120	MA1IMA12	—	MA1IMA12
	160	MA1IMA16	—	MA1IMA16
	240	MA1IMA24	—	MA1IMA24
208Y/120 V, 3-phase, 4-wire [1]	120	MA1IMA12	MA1IMA12	MA1IMA12
	160	MA1IMA16	MA1IMA16	MA1IMA16
	240	MA1IMA24	MA1IMA24	MA1IMA24
120/240 V, 3-phase, 4-wire [2]	120	MA1IMA12	MA3IMA12	MA1IMA12
	160	MA1IMA16	MA3IMA16	MA1IMA16
	240	MA1IMA24	MA3IMA24	MA1IMA24
480Y/277 V, 3-phase, 4-wire [3]	120	MA4IMA12	MA4IMA12	MA4IMA12
	160	MA4IMA16	MA4IMA16	MA4IMA16
	240	MA4IMA24	MA4IMA24	MA4IMA24
600/347 V, 3-phase, 4-wire	120	MA8IMA12	MA8IMA12	MA8IMA12
	160	MA8IMA16	MA8IMA16	MA8IMA16
	240	MA8IMA24	MA8IMA24	MA8IMA24

1 208Y/120 series also applies to the following voltage 220Y/127.

2 High-leg delta (Phase B modules are different than Phase A and Phase C modules).

3 480Y/277 series applies to the following voltages 380Y/220, 400Y/230, and 415Y/240.

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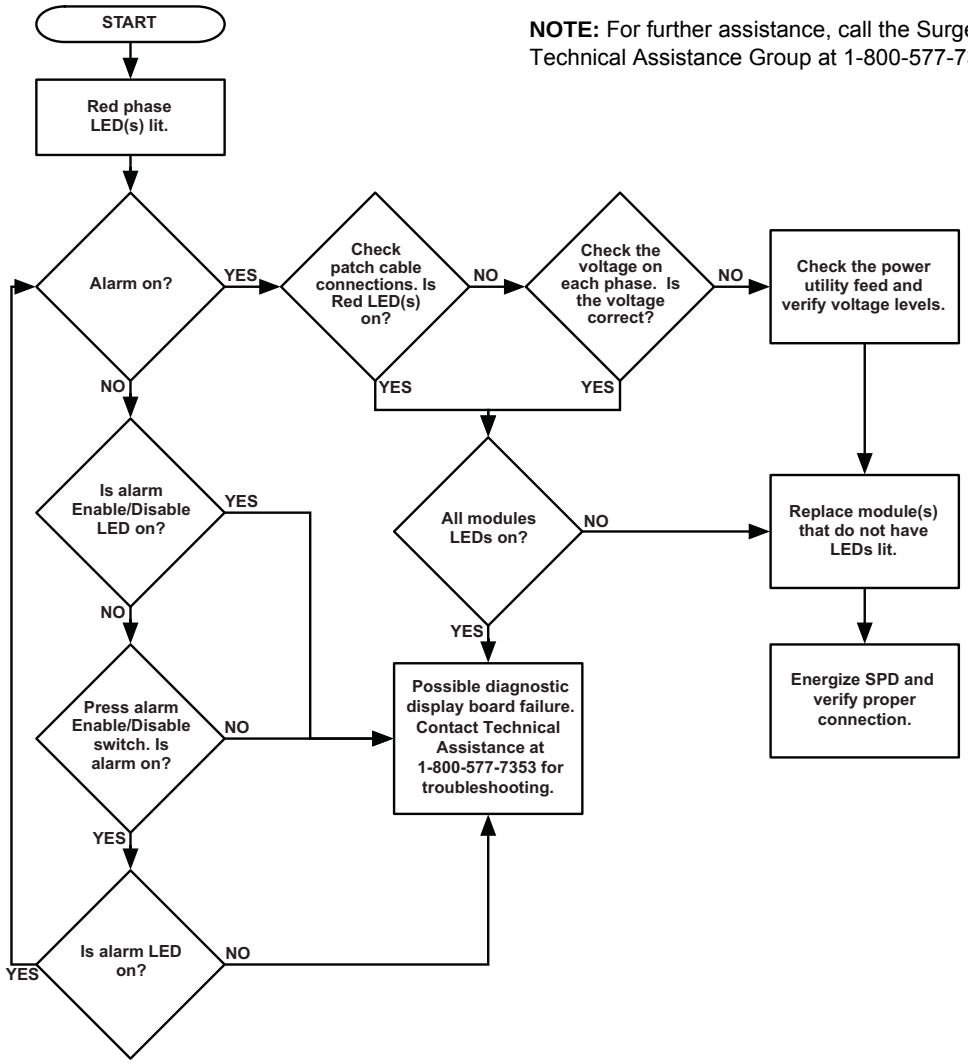
For troubleshooting, call the Surgelogic Technical Assistance Group at 1-800-577-7353.

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Troubleshooting

If a module shows two green indicator lights and the display panel shows a red phase indicator light, follow the Troubleshooting Flow Chart in Figure 5 below.

Figure 5: Troubleshooting Flow Chart



NOTE: For further assistance, call the Surgelogic Technical Assistance Group at 1-800-577-7353.

Replacement Parts

The following replacement parts are available. For ordering information please contact your local distributor or refer to the product catalog.

- MA modules. Replacement instructions are included with the replacement parts.
- Diagnostic display panel assemblies. Replacement instructions are included with the replacement parts.

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Surgelogic™
NQ SurgeLoc™ Brick Assembly Surge Protective Devices (SPDs)

Instruction Bulletin
Directives d'utilisation

8400-0002A

11/2014

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Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

⚠ CAUTION

LOSS OF BRANCH CIRCUIT POWER/LOSS OF SURGE SUPPRESSION

- Ensure that the branch circuit breaker or fuse trip characteristic has been coordinated with the overcurrent components inside the Surge Protective Device (See Tables 1 and 2).
- Perform periodic inspection of the Surge Protective Device status indicator lights as part of the preventative maintenance schedule.
- Promptly service the Surge Protective Device when an alarm state exists.
- Use dry contacts to signal an alarm state to the central supervisory system for unmanned, inaccessible, or critical installations.
- Use multiple Surge Protective Devices to achieve redundancy for critical applications.

Failure to follow these instructions can result in injury or equipment damage.

At end-of-life conditions, Surge Protective Devices (SPDs) can lose their ability to block power system voltage and attempt to draw excessive current from the line. This SPD is equipped with overcurrent and overtemperature components that disconnect the surge suppression elements from the electrical supply should the surge suppression elements reach end of life. Tripping of the branch circuit breaker or fuse feeding the SPD can occur when the surge suppression elements reach end of life.

The SPD is equipped with overcurrent components that will limit the per phase I^2t, $I_{apparent}$, I_p, and I_{th} values to those listed in Tables 1 and 2 when connected to a power system with a short-circuit current rating not exceeding 200,000 A.

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Table 1: SPD Operational Limits

SPD Device	Per Phase I^2t	$I_{apparent}$	I_p	I_{th}
SSP01BIA08 through[1] SSP01BIA24	153 kA^2 seconds	17,000 A RMS	43,000 A RMS	160 A
SSP02BIA08 through SSP02BIA24				
SSP03BIA08 through SSP03BIA24				

1 Catalog numbers are representational. Model numbers are not recognized in the Schneider Electric™ ordering system until a suffix code is applied.

⚠ CAUTION

LOSS OF SURGE SUPPRESSION

- Do not energize the Surge Protective Devices until the electrical system is completely installed, inspected, tested, and all conductors have been connected and functional, including the neutral.
- Verify the voltage rating of the device and system before energizing the Surge Protective Device.
- Perform high-potential insulation testing, or any other tests where Surge Protective Device components will be subjected to voltages higher than their rated turn-on voltage, with the neutral and Surge Protective Device disconnected from the power source.

Failure to follow these instructions can result in injury or equipment damage.

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Introduction

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

NOTE: For troubleshooting, call the Surgelogic Technical Assistance Group at 1-800-577-7353.

Proper installation is imperative to maximize the NQ SurgeLoc Assembly SPD's effectiveness and performance. The installer should follow the steps outlined in this instruction bulletin to ensure proper installation. Read the entire instruction bulletin before beginning the installation. These instructions are not intended to replace national or local electrical codes. Check all applicable electrical codes to verify compliance. Installation of NQ brick surge suppressors should only be performed by qualified electrical personnel.

Unpacking and Preliminary Inspection

Inspect the entire shipping container for damage or signs of mishandling before unpacking the device. Remove the packing material and further inspect the device for any obvious shipping damage. If any damage is found and is a result of shipping or handling, immediately file a claim with the shipping company.

Storage

The device should be stored in a clean, dry environment. Storage temperature is -40 °F to +149 °F (-40 °C to +65 °C). All of the packaging materials should be left intact until the device is ready for installation.

Safety Labels

English, Spanish, and French versions of all safety labels (Danger, Warning, and Notice) are provided.

Surge Protective Device (SPD) Location Considerations

Environment

The device is designed to operate in an ambient temperature range of -4 °F to +104 °F (-20 °C to +40 °C) with a relative humidity of 0 to 95% non-condensing. The operating temperature of the LCD on the diagnostic display panel is +14 °F to +140 °F (-10 °C to +60 °C). All NQ SurgeLoc devices operate normally without reduction in performance when subjected to shock and vibrations described in IEC 60721-3-3, Class 3M4.

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Audible Noise

The device background noise is negligible and does not restrict the location of the installation.

Mounting

Refer to Figure 11 found on page 17 for typical mounting dimensions and weight.

Service Clearance

The service clearance should meet all applicable code requirements.

Equipment Performance

To obtain the maximum system performance, locate the device as close to the circuit being addressed as possible, to minimize the interconnecting wiring length. For every foot of wire length, approximately 160 Volts (6 kV / 3 kA, 8/20 microsecond) is added to the suppressed voltage. The Voltage Protection Rating (VPR) is located on the device nameplate and is measured six inches from the enclosure sidewall, according to UL® 1449 Third Edition.

Electrical

Voltage Rating

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Confirm the Surge Protective Device voltage rating on the nameplate label is the same as the operating voltage.

Failure to follow these instructions will result in death or serious injury.

Prior to mounting the SPD, verify that the device has the same voltage rating as the power distribution system in which it is installed. Compare the nameplate voltage on the SPD with the nameplate of the electrical distribution equipment.

The specifier or user of the device must be familiar with the configuration and arrangement of the power distribution system in which any SPD is to be installed. The system configuration of any power distribution system is based strictly on how the secondary windings of the transformer supplying the service entrance main or load are configured. This includes whether or not the transformer windings are referenced to earth via a grounding conductor. The system configuration is not based on how any specific load or equipment is connected to a particular power distribution system. See Table 2 for the service voltage of each SPD.

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Table 2: Voltage Ratings

Service Voltage	Peak Surge Current Rating Per Phase	Catalog Number
120/240 V[1], 1-phase, 3-wire + ground	80 kA	SSP01BIA08PBQ1
	100 kA	SSP01BIA10PBQ1
	120 kA	SSP01BIA12PBQ1
	160 kA	SSP01BIA16PBQ1
	200 kA	SSP01BIA20PBQ1
	240 kA	SSP01BIA24PBQ1
120/208 V[1], 3-phase, 4 wire + ground	80 kA	SSP02BIA08PBQ1
	100 kA	SSP02BIA10PBQ1
	120 kA	SSP02BIA12PBQ1
	160 kA	SSP02BIA16PBQ1
	200 kA	SSP02BIA20PBQ1
	240 kA	SSP02BIA24PBQ1
240/120 V, High-leg Delta, 3-phase, 4-wire + ground	80 kA	SSP03BIA08PBQ1
	100 kA	SSP03BIA10PBQ1
	120 kA	SSP03BIA12PBQ1
	160 kA	SSP03BIA16PBQ1
	200 kA	SSP03BIA20PBQ1
	240 kA	SSP03BIA24PBQ1

1 Catalog numbers are representational. Model numbers are not recognized in the Schneider Electric ordering system until a suffix code is applied.

Terminals, Wire Size, and Installation Torque

This SPD is designed to work in Square D™ Type NQ panelboards. Only panelboard bus screws should be used to connect the phase ring terminals to the bus bar.

Table 3: Terminal Torque

Power Connection	Torque
AØ, BØ, CØ and N	18 lb-in. (2 N•m)
Ground	

Branch Circuit Overcurrent Protection

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARH FLASH

- Use conductors rated for the Overcurrent Protection Device (OCPD) per applicable codes.
- Use conductors rated for the application per applicable codes.

Failure to follow these instructions will result in death or serious injury.

UL 1449 Type 1 SPDs have been designed and approved for line side applications prior to the main service disconnect without supplemental overcurrent protection.

Type 1 SPDs can also be used in Type 2 applications (load side of OCPD). When either Type 1 or Type 2 SPDs are used on the load side, they must be installed per local codes.

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Since the current drawn by the SPD device during standby operation is negligible, the SPD device can be connected to a dedicated, separate branch circuit or connected to a suitable existing branch circuit.

- When connecting to a separate, dedicated branch circuit, the OCPD setting must be selected to protect the conductors feeding the SPD device.
- When connecting to an existing branch circuit, the conductors connected to the SPD device must have an ampacity not less than the setting of the existing OCPD. (No larger than 30 A).

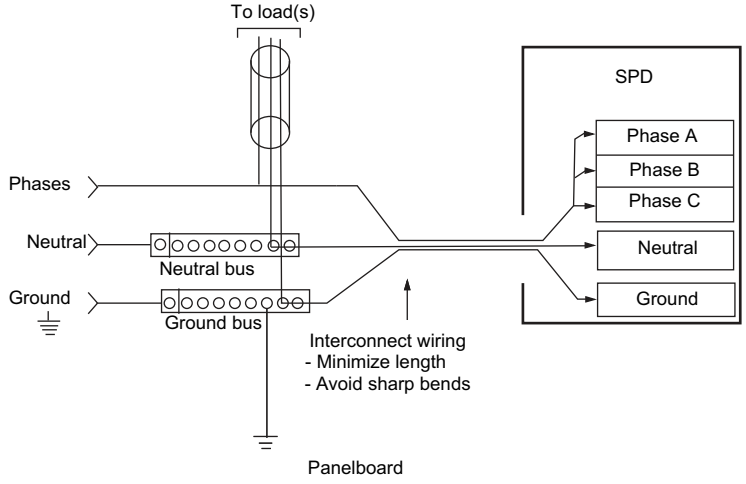
During overvoltage surge diversion, current will flow through the SPD device. The branch circuit OCPD must pass this current without tripping for the SPD device to function properly.

For further information concerning coordination of the OCPD with the SPD device, refer to Table 1.

Location of Surge Protective Device (SPD)

Locate the SPD as close as possible to the circuit being addressed to minimize the wire length and optimize SPD performance. Avoid long wire runs so that the device will perform as intended. Avoid sharp bends in the conductors. See Figure 1.

Figure 1: Surge Protective Device Wiring Practice



Grounding

⚠ WARNING

HAZARDOUS TOUCH VOLTAGE

- Connect the Surge Protective Device ground terminal to the building grounding grid structure.
- Use an appropriately sized equipment grounding conductor.
- Do not use a separate isolated ground for the NQ SurgeLoc Assembly device.
- Verify proper equipment connection to the grounding system.
- Verify ground grid continuity by performing regularly scheduled inspections. and testing as part of a comprehensive electrical maintenance program.

Failure to follow these instructions can result in death or serious injury.

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General

The NQ SPD has SPD elements connected from phase to ground. It is critical that there be a robust and effective connection to the building grounding structure. The grounding connection must utilize an equipment grounding conductor run with the phase and neutral (if present) connection of the power system. The SPD device should not be connected to a separate isolated ground.

For best overvoltage suppression by the NQ SPD, use a single-point ground system where the service entrance grounding electrode system is connected to and bonded to all other available electrodes, building steel, metal water pipes, driven rods, etc. (for reference, see IEEE 142-2007). The ground impedance measurement of the electrical system should be as low as possible, and in compliance with all applicable codes.

Solidly-Grounded Power Systems

NOTICE

SURGE PROTECTIVE DEVICE DAMAGE AND POWER SYSTEM OVERVOLTAGE

- Do not connect devices rated for use on solidly-grounded power systems to resistance-grounded (for example, High Resistance Ground) or ungrounded power systems.
- Verify that the service entrance equipment is bonded to ground in accordance with all applicable codes.
- Verify that the neutral terminal of the power system transformer feeding the device is bonded to system ground in accordance with all applicable codes.

Failure to follow these instructions can result in equipment damage.

SPDs rated for use on solidly-grounded power systems must not be connected to resistance-grounded (for example, HRG) or ungrounded power systems. Such a connection can result in damage to the SPD.

Always verify the power system grounding configuration prior to application of power to the device. Confirm that all ground bonds are installed at both the service entrance equipment and power system transformer prior to application of power.

Installation

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

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UL Conditions of Acceptability

For use only in equipment where the acceptability of the combination is determined by Underwriters Laboratories®. When installed in the end-use equipment, the following are among the considerations to be made:

1. A suitable electrical enclosure shall be provided in the end-use product.
2. The device is intended for factory and field installations with the suitability of the connections (including spacing's between factory connectors) determined in the end-use application.
3. The Voltage Protection Rating (VPR) shall be determined in the end-product where applicable.
4. The SPD unit has been subjected to the following tests of UL 1449, 3rd Edition:
   a. Surge Testing (VPR)
   b. Nominal Discharge Current Test (20 kA)
   c. Dielectric Voltage Withstand
   d. Current Testing (200 kA Short Circuit Current, Intermediate Protective Devices (OCPD) or external enclosures.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Confirm the Surge Protective Device voltage rating on the nameplate label is the same as the operating voltage.

Failure to follow these instructions will result in death or serious injury.

Follow the steps listed below when making wiring connections:

If you have any questions pertaining to the installation of this device, contact the Surgelogic Technical Assistance Group at 1-800-577-7353.

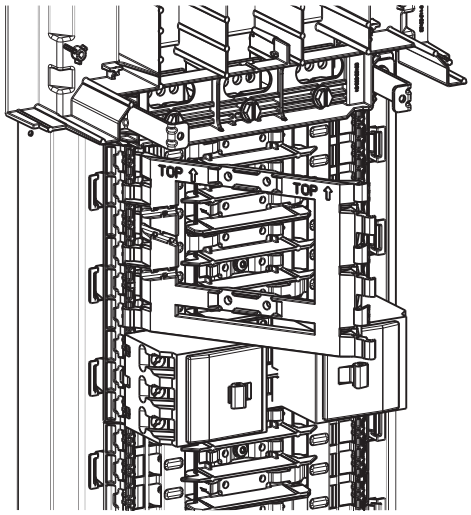
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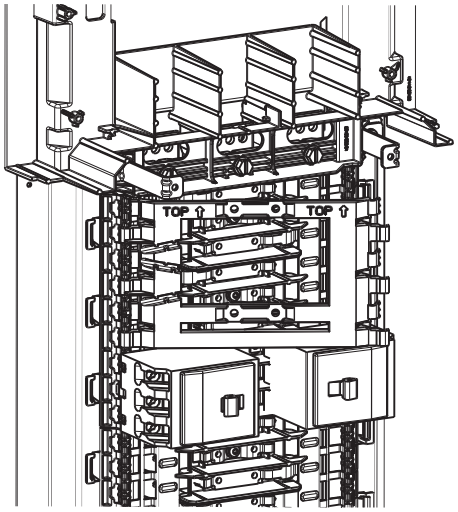
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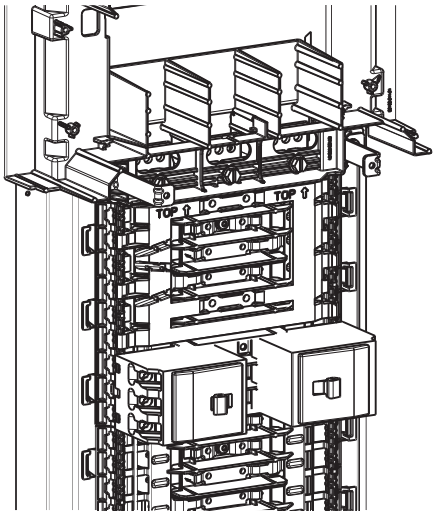
SurgeLoc Assembly Installation

1. Turn off all power supplying this equipment before working on or inside any enclosure containing this equipment.
2. Confirm the SPD assembly has the same voltage rating and configuration as the system voltage and power system configuration to which it will be connected.
3. Remove panel door, dead front, and trim.
4. For best performance locate the SPD immediately adjacent to the main bus terminals. Note, keep ground and neutral wires as short as possible.
5. Facing the panel snap in mounting bracket, leading with the left edge of the SPD. Rotate the mounting bracket into place. See Figure 2.
6. Install four mounting screws provided. See Figure 3.

Figure 2: Mount Installation





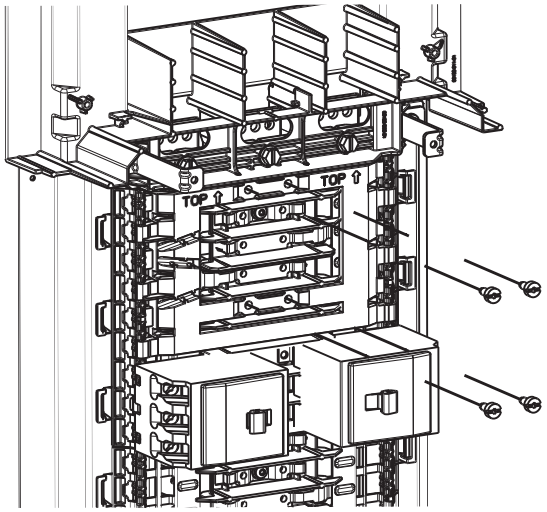


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For troubleshooting, call the Surgelogic Technical Assistance Group at 1-800-577-7353.

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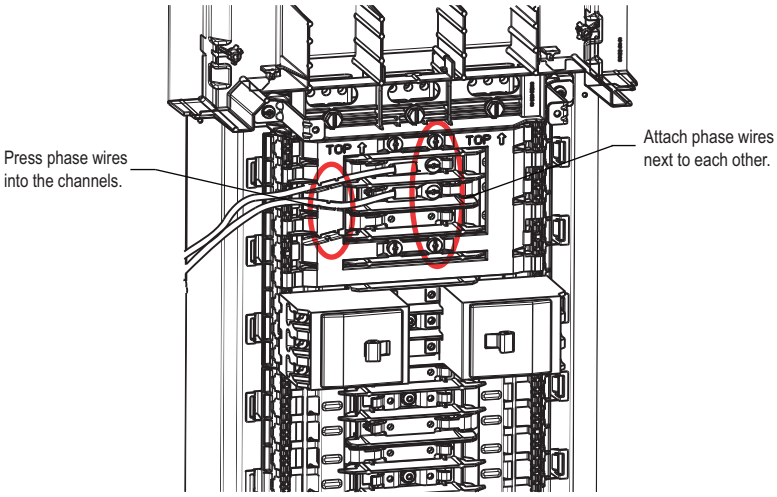
Figure 3: Mount Screws



Connecting SPD Directly to the Bus

7. Attach the phase wires per the phase requirements:
   a. Split phase direct bus installation.
      i. Attach phase wires to buses next to each other as shown in Figure 4.

Figure 4: Split Phase Wire Connection



ii. Ensure phase A and B wires are connected to the corresponding buses.

NOTE: The third row has no connection.

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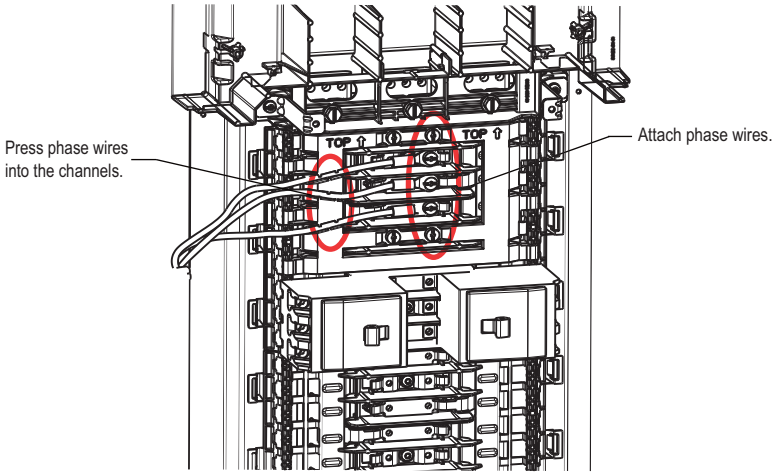
iii. Press phase wires into wire channels on mount bracket as shown in Figure 4.

NOTE: Ensure that the phase wires are not pinched between the mounting bracket and the SPD housing.

b. Three (3) phase WYE direct bus installation.

i. Attach phase wires to buses as shown in Figure 5.

Figure 5: WYE/Delta Phase Wire Connection



c. Three (3) phase high leg delta direct bus installation.

i. Attach phase wires to buses as shown in Figure 5.

NOTE: The orange wire must connect to the high leg bus.

ii. Ensure phase A, B, and C wires are connected to the corresponding buses.

Connecting SPD through an OCPD (Disconnect)

d. Connecting SPD through a OCPD (Disconnect)

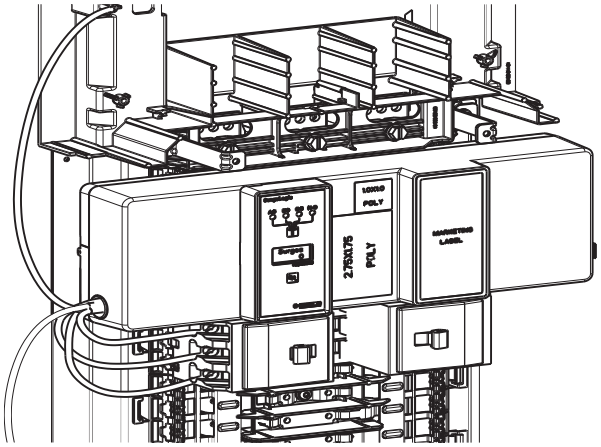
i. Cut phase wire to length and strip insulation per circuit breaker manufacture instructions.

ii. Ensure phase A, B, and C (as required) wires are connected to the dedicated OCPD. See Figure 6.

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Figure 6: Generic Circuit Breaker Connection

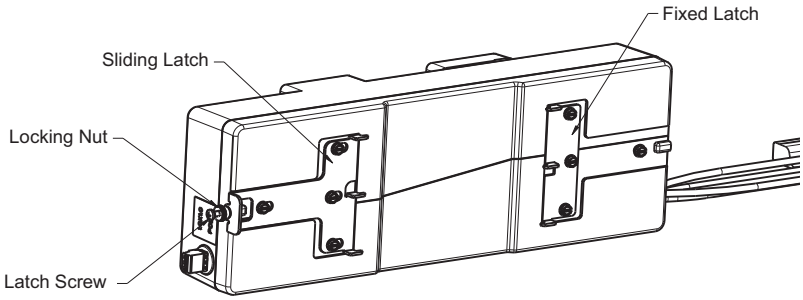


Installing SPD

e. Installing SPD

i. Refer to Figure 7 for instruction to secure SPD to the mount bracket.

Figure 7: SPD Mounting Brackets



ii. Unlock the sliding latch by turning the locking nut counterclockwise until it contacts the latch screw head.

NOTE: Do not loosen the latch screw.

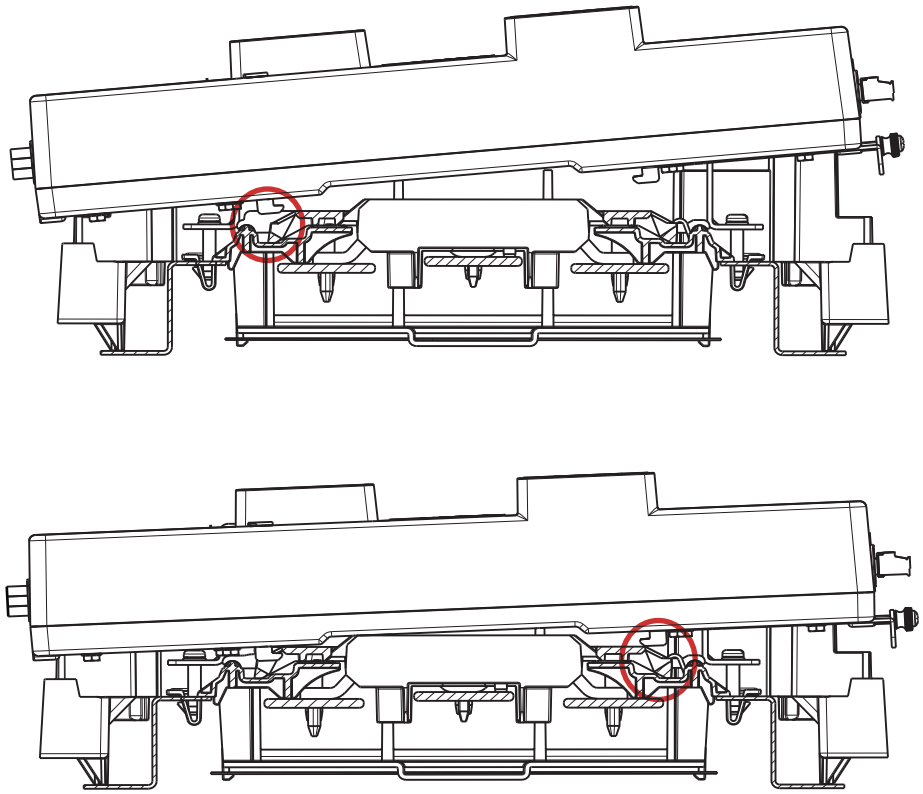
iii. Pull the sliding latch outward to the unlocked position approximately 1/4 in. (7 mm).

8. Engage the fixed latch with slots in the mount bracket. See Figure 8.

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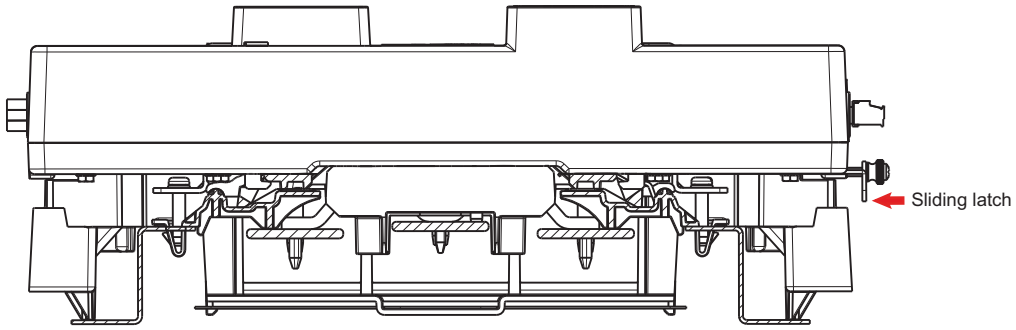
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Figure 8: SPD Mount Interlocks



9. Snap the SPD into the left hand slots of the mounting bracket.

Figure 9: Sliding Latch Engagement



10. Push the sliding latch inward into the locked position and tighten the nut.

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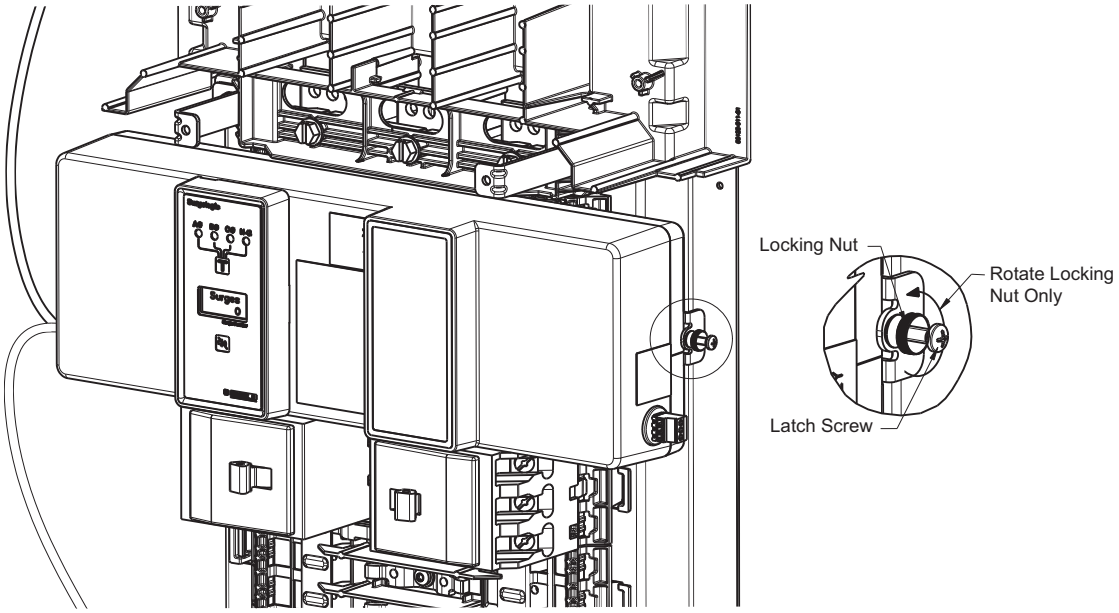
11. Connect the neutral wire to the neutral bus and the ground wire to the ground bus. For best performance keep wires as short as possible with no sharp bends.

    NOTE: This product will not work properly without neutral and ground connections.
12. Check that all connections are secure. Remove all tools and discarded hardware from the unit.
13. If necessary remove twelve (12) twist outs, six (6) per side, from the dead front to correlate with the SPD bezel.
14. Replace the deadfront, cover/door, and/or trim to the equipment.
15. Equipment may be re-energized after all of the above steps are complete.

SurgeLoc Assembly Removal

1. Turn off all power supplying this equipment before working on or inside any enclosure containing this equipment.
2. Remove any doors, trims, and the deadfront panel, per the panelboard instruction, so as to expose the SPD.
3. Loosen the locking nut by rotating it counter-clockwise until the nut reaches the latch screw head. Do not remove or loosen the latch screw. See Figure 10 and Figure 7 for part nomenclature. Pull the right side of the brick unit forward approximately 1/4 in. (7 mm) to release the sliding latch from the mount bracket slots.
4. Move the entire SPD to the left approximately 1/2 in. (13 mm) to release the fixed latch.
5. Remove the three phase screws to disconnect the three phase wires and secure the SPD.
6. Disconnect the ground and neutral wires.
7. Remove the SPD assembly.

Figure 10: Latch Nut Disengagement

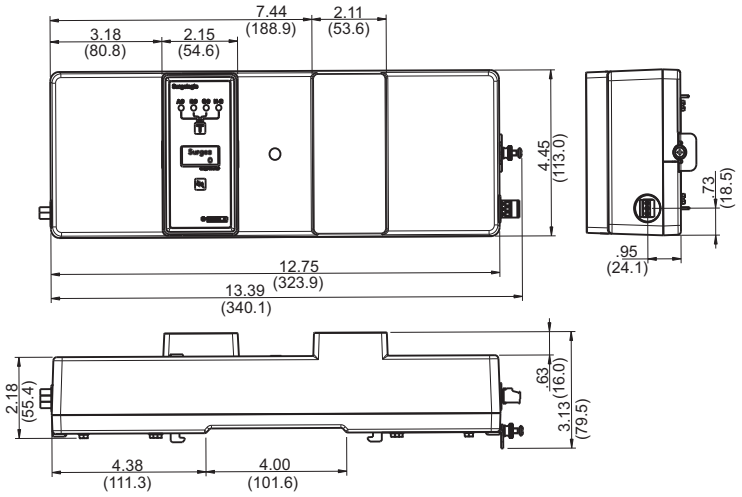


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Dimensions and Weights

Figure 11: 12 in. x 12 in. NEMA 1 / 3R / 12 Enclosures



Approximate Weight	7 lb. ± 1 lb.
Door Depth	0.5 in. [12.7 mm]
Total Depth	6.24 in. (158.5)

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For troubleshooting, call the Surgelogic Technical Assistance Group at 1-800-577-7353.

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Wiring Diagrams

Figure 12: Split-Phase Three-Wire Grounded Installation

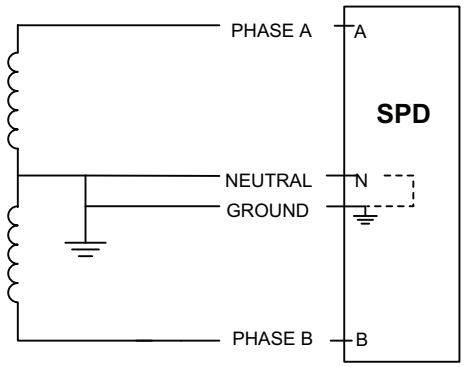


Figure 13: Three-Phase, Four-Wire, Grounded Wye Installation

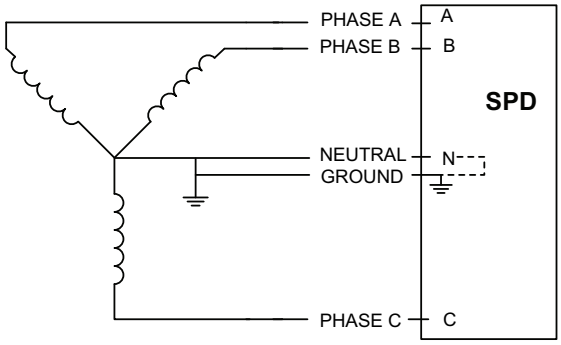
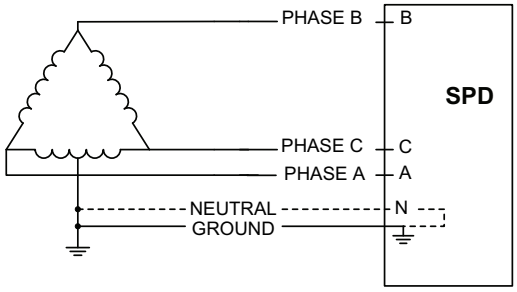


Figure 14: Three-Phase, Four-Wire, High-Leg Delta Installation



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Wiring Diagrams With Circuit Breaker Connection Switch

Figure 15: Split-Phase, Three-Wire, Grounded Installation Circuit Breaker Connection

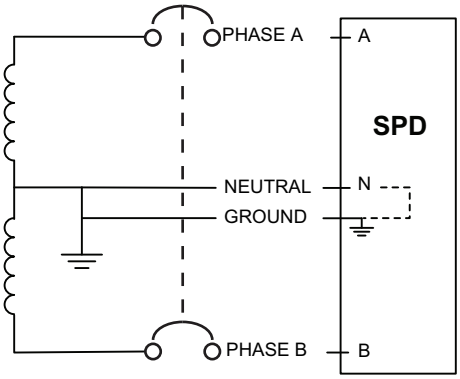


Figure 16: Three-Phase, Four-Wire, Grounded Wye Installation with Circuit Breaker Connection

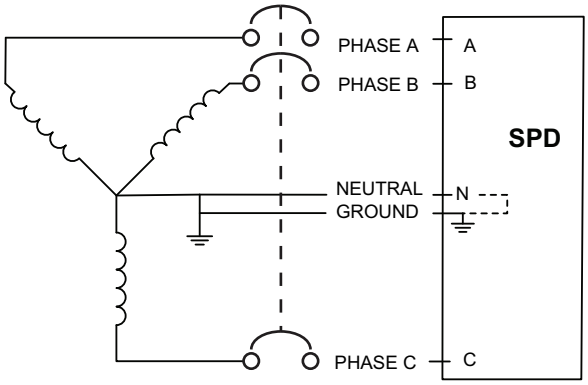
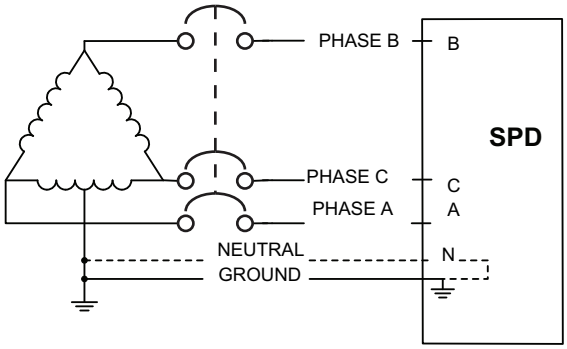


Figure 17: Three-Phase, Four-Wire, High-Leg Delta Installation with Circuit Breaker Connection



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For troubleshooting, call the Surgelogic Technical Assistance Group at 1-800-577-7353.

ENGLISH

Operation

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

LED Status Indicators

The SPD diagnostic display panel shows the status of each phase with green/red LEDs (see Figure 18). If the SPD is operating correctly, all of the phase LEDs will be illuminated green. If the LEDs are not illuminated in green follow the Troubleshooting flow chart, Figure 20.

Figure 18: MA Module LEDs



Audible Alarm

Push the alarm enable/disable button to enable or disable the alarm (see Figure 18). If the green alarm LED is lit the alarm is enabled. If the green alarm LED is not lit the alarm is disabled.

Surge Counter

The surge counter displays the number of transient voltage surges since the counter was last reset. To reset the surge counter press and hold the “Test” button for approximately 6 seconds.

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Dry Contacts

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Use 600 Vac rated dry contact wiring.
- Dry contact wiring must have less than 1/16 in. (1.6 mm) exposed wire from the dry contact block.
- Maintain at least 1.0 in. (25 mm) separation between dry contact wiring and the power wiring in the enclosure.

Failure to follow these instructions will result in death or serious injury.

The NQ SurgeLoc series SPD comes equipped with dry contacts. The dry contacts are three-position, Form “C” type with Normally Open, Normally Closed, and Common connections.

In the unpowered state the contact is closed between terminals NC and COM. This is also the alarm condition. The opposite state, closed between terminals NO and COM, indicates that power is on to the unit and that no alarm condition exists (See Table 4).

These contacts can be used for remote indication of the SPD’s operating status to a computer interface board or emergency management system. Also, these contacts are designed to work with the SPD remote monitor option described in the next section.

Table 4: Dry Contact Configuration

Alarm Contact Terminals	Contact State with Power Applied
NO to COM	Closed
NC to COM	Open

The dry contacts are designed for a maximum voltage of 250 Vac / 30 Vdc and a maximum current of 6 A. Minimum switching load is 10 mA at 5 Vdc. Higher energy applications may require additional relay implementation outside the SPD. Damage to the SPD relay caused by use with energy levels in excess of those discussed in this instruction bulletin are not covered by warranty. For application questions, contact the Surgelogic Technical Assistance Group at 1-800-577-7353.

Remote Monitor Option

The remote monitor option has two LEDs, one red and one green, and an audible alarm with an enable/disable switch. Normal status is a lit green LED, and no audible alarm. To test the integrity of the remote monitor, press the push-to-test switch. If the alarm is enabled, the green LED will turn off, the red LED will turn on, and the alarm will sound. Releasing the switch will complete the test; the red LED will turn off, the green LED will turn on and the alarm will shut off.

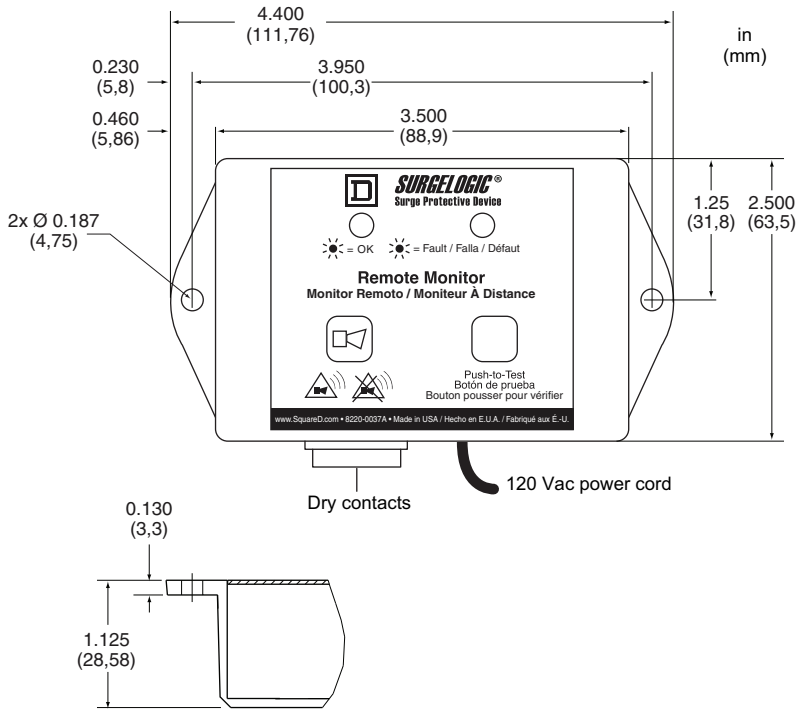
If suppression on any phase is lost, the green LED will turn off, the red LED will turn on and an alarm will sound. The audible alarm can be silenced by pushing the alarm enable/disable button. The alarm will silence and the green alarm LED will not be lit. The red LED will continue to be illuminated until the inoperative condition has been cleared.

The remote monitor includes a 120 Vac to 12 Vdc adapter with a six-foot power cord. Connections are made to the SPD diagnostic panel with Form “C”, 3-position dry contacts (provided) and the appropriate length of solid or stranded 22–14 AWG wire up to 1000 ft. (305 m) not provided.

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ENGLISH

Figure 19: Remote Monitor Option (TVS12RMU)



Maintenance and Troubleshooting

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

Preventative Maintenance

Inspect the SPD periodically to maintain reliable system performance and continued transient voltage surge suppression. Periodically check the state of the diagnostic display panel LED status indicators. Routinely use the built-in diagnostics to inspect for inoperative modules.

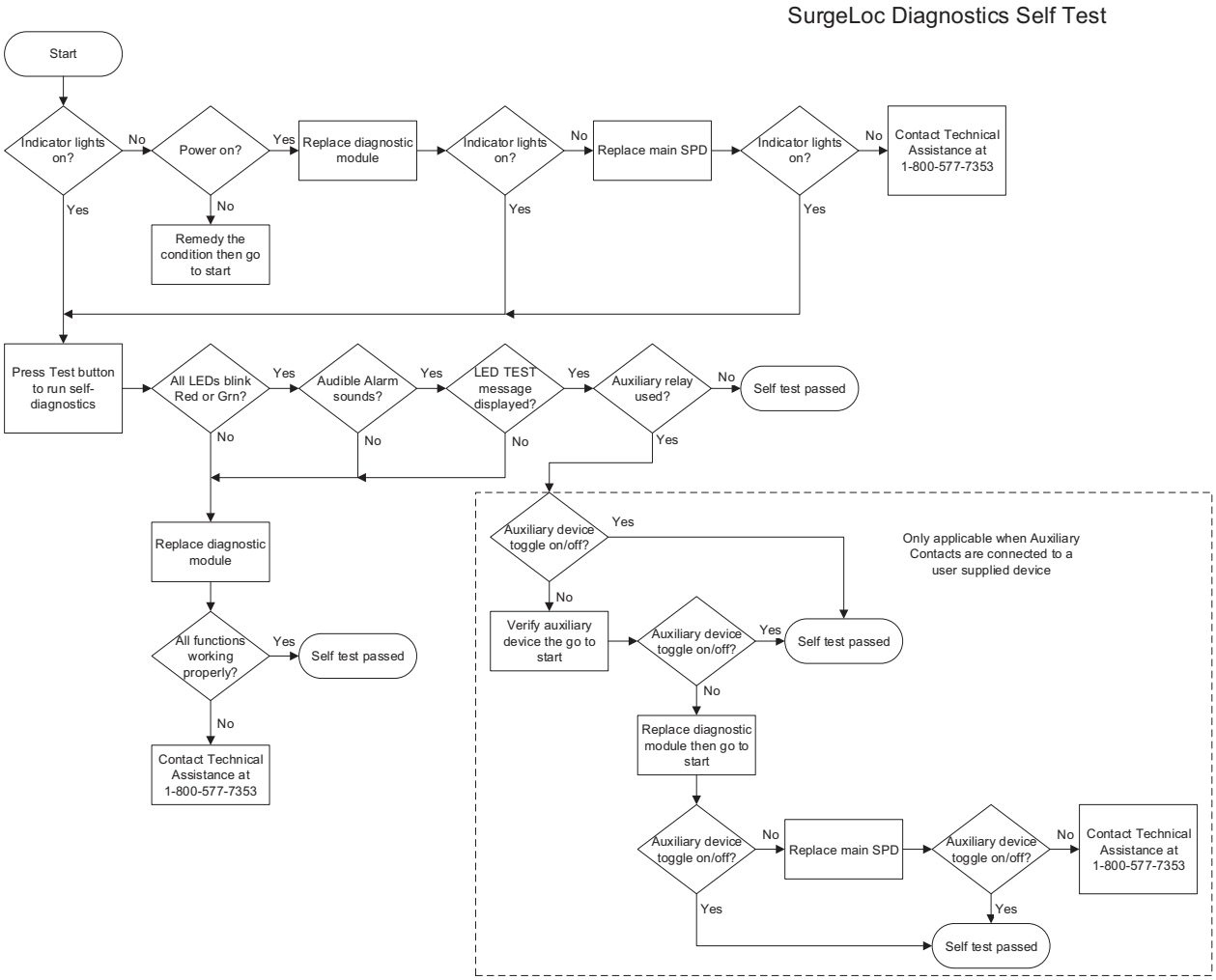
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Troubleshooting

If a module shows two green indicator lights and the display panel shows a red phase indicator light, follow the Troubleshooting Flow Chart in Figure 20.

Figure 20: Troubleshooting Flow Chart

NOTE: For further assistance, call the Surgelogic Technical Assistance Group at 1-800-577-7353.



Replacement Parts

The following replacement parts are available. For ordering information please contact your local distributor or refer to the product catalog.

- SSP1DSPBIA - Split phase 2 wire diagnostic
- SSP3DSPBIA - Three phase 3 & 4 wire diagnostic

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NQ SurgeLoc Assembly Surge Protective Devices (SPDs)
Instruction Bulletin

Schneider Electric USA, Inc.
800 Federal Street
Andover, MA 01810 USA
888-778-2733
www.schneider-electric.us

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8222-0002A, 11/2014

502 AS
SERVICE BULLETIN

30 Ampere Disconnect Switches with Flange Mounted Operating Mechanism Used in Classes 8538 and 8738 — Type SB Series C Size 0 and Type SC Series C Size 1 3-Pole AC Combination Starters

WARNING: Be sure to open the back-up disconnect device ahead of the combination starter before inspecting or servicing the disconnect switch. Do not operate starter or disconnect switch with arc chamber cover or arc suppressor removed.

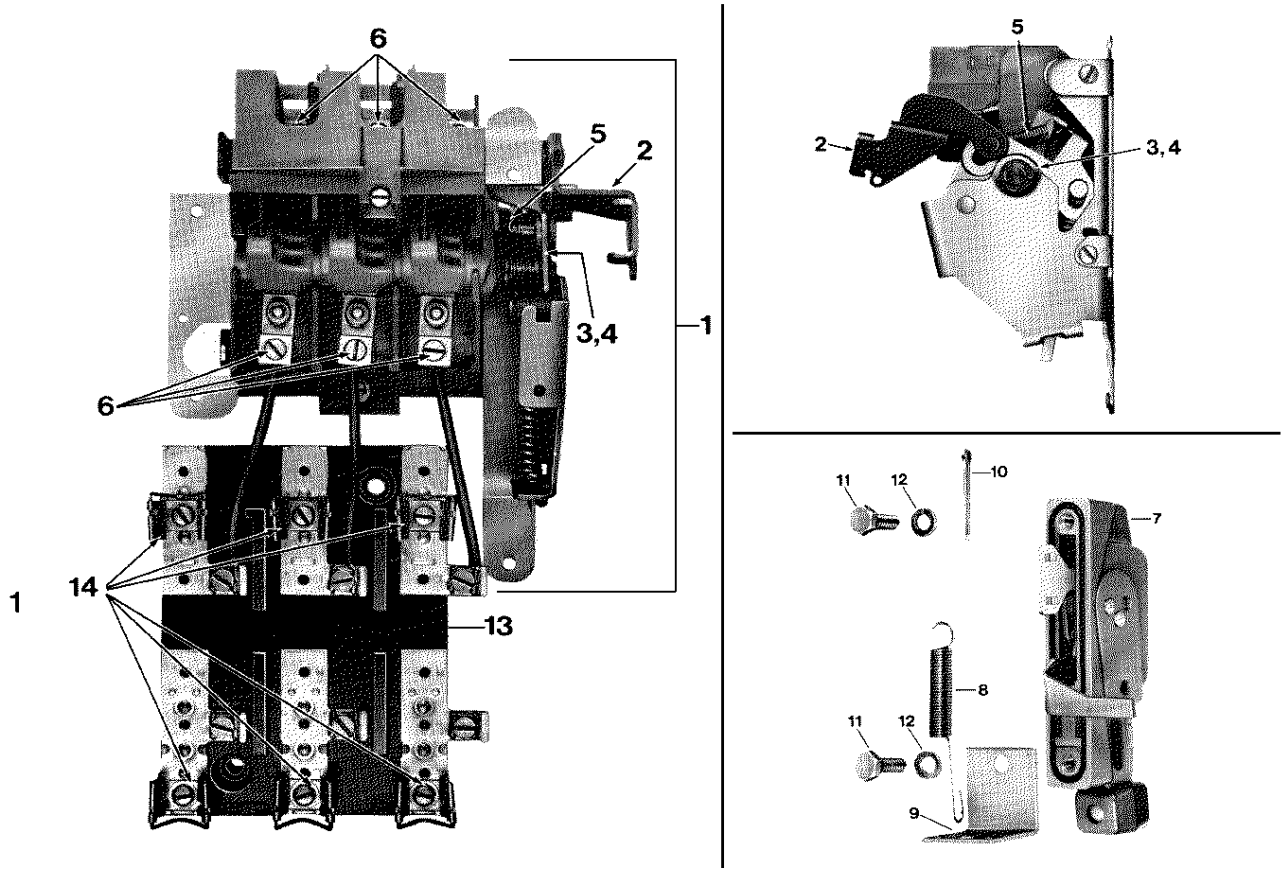


TABLE I PARTS LIST

Item No.	Description	Part Number	Quantity Required
1	Complete Disconnect Switch Assembly with operating mechanism — includes Items 2-6	31301-014-52	1
2	Link Assembly	31301-012-50	1
3	Washer	31301-006-01	2
4	E-Ring	29907-016-10	1
5	Spring	31301-010-01	1
6	Lug	25065-03800	6
7	Handle Assembly		
	For NEMA Type 1 or 12 enclosure	31055-229-51	1
	For NEMA Type 4 enclosure	31055-229-52	1
8	Return Spring	30017-143-01	1
9	Spring Holder	31055-249-01	1
10	Cotter Pin	24201-08400	1
11	Hex. Head Cap Screw	21401-20200	2
12	Lock Washer	23701-00200	2
13	Fuse Block	9999 SF-1	1
14	Fuse Clips	See Table 2	

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502 AS
SERVICE
BULLETIN

TABLE 2 FUSE CLIP KITS‡ — For use with 30 Ampere Disconnect Switch								
	INTERCHANGEABLE					NON-INTERCHANGEABLE		
NEMA Starter Size	Class H Fuses			Class J Fuses		Class R Fuses⊕		
	Fuse Clip Rating — Amps.		Class 9999 Type	Fuse Clip Rating — Amps. 600 V. Max.	Class 9999 Type	Fuse Clip Rating — Amps.		Class 9999 Type
	250 V. Max.	600 V. Max.				250 V. Max.	600 V. Max.	
0 & 1	0-30	. . .	S-1	. . .	. . .	0-30	. . .	SR-1
0	. . .	0-30	S-2	0-30	SJ-2	. . .	0-30	SR-2
1	31-60	0-30	S-2	0-30	SJ-2	31-60	0-30	SR-2

‡ Each kit includes six fuse clips, mounting hardware, and instruction sheet.
⊕ Clips cannot be removed, once installed.

ELECTRICAL INTERLOCK

A one or two pole electrical interlock kit may be added to the switch operating mechanism. The snap switch in the interlock kit may be replaced on existing installations. See table 3.

TABLE 3

Electrical Interlock Type	Electrical Interlock Mechanism Complete		Replacement Snap Switch Only	
	Class	Type	Class	Type
Single pole	9999	R45	9007	AO-1
Double pole	9999	R46	9007	CO-3

ORDERING INSTRUCTIONS

Specify quantity, part number and description of part.

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AC Magnetic Contactors and Starters
Contactores y arrancadores magnéticos de ca (~)
Contacteurs et démarreurs magnétiques CA

Class Clase Classe	Type Tipo Type	Series Serie Série	Size Tamaño Taille	Poles (P) Pôles (P) Polos (P)
8502 & 8536	SC	A & B	1 & 1P	2 & 3

INTRODUCTION

This bulletin provides assembly, modification, and parts ordering instructions.

INTRODUCCION

Este boletín incluye instrucciones de montaje, modificación y solicitud de piezas.

INTRODUCTION

Ce bulletin contient les directives pour assembler, modifier et commander des pièces.

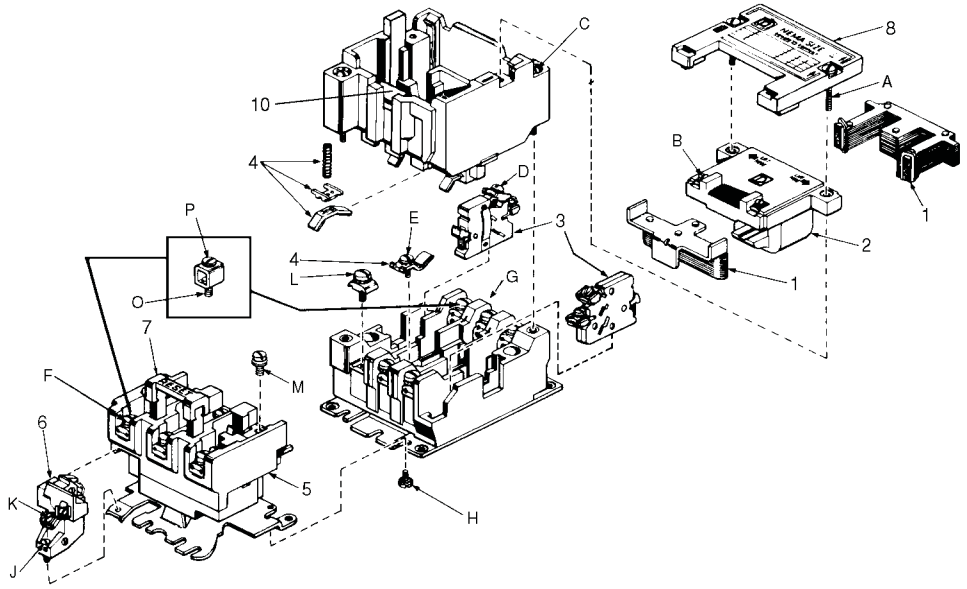


Figure / Figura / Figure 1 : Contactor and Starter Assembly / Montaje de contactores y arrancadores Assemblage de contacteur et de démarreur

⚠ DANGER / PELIGRO / DANGER

HAZARDOUS VOLTAGE

Disconnect all power before working on equipment.

Electric shock will result in death or serious injury.

TENSION PELIGROSA

Desconecte toda la alimentación antes de efectuar cualquier trabajo en el equipo.

Las descargas eléctricas podrán causar la muerte o lesiones serias.

TENSION DANGEREUSE

Coupez toute l'alimentation avant de travailler sur cet appareil.

Une électrocution entraînera la mort ou des blessures graves.

SERIES

Series B applies only to the Type S, Form B starter (three ambient-compensated overloads). All parts of Form B, Series A and B starters are interchangeable; only the overload relay block differs. If replacing the overload relay block of a Form B, Series A starter with a Series B block, the overload relay

SERIE

La serie B se aplica solamente a los arrancadores tipo S, forma B (tres sobrecargas compensadas por temperatura). Todas las piezas de los arrancadores forma B, series A y B son intercambiables; solamente el bloque del relevador de sobrecarga es diferente. Si reemplaza el bloque del relevador de sobrecarga de un arrancador forma B,

SÉRIE

La série B n'est destinée qu'aux démarreurs type S, forme B (trois surcharges stabilisées en température). Toutes les pièces des démarreurs de forme B sont interchangeables pour les séries A et B ; seul le bloc-relais de surcharge est différent. Si on remplace le bloc-relais de surcharge d'un démarreur de forme B, série A par un

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thermal units must be selected from the Series B tables for proper motor protection.

AUXILIARY CONTACTS

All contactors and starters feature a normally open (N.O.) holding circuit contact. N.O. or normally closed (N.C.) auxiliary contacts can be added in the field. Table 5 lists the Class and Type. Bulletin 30072-013-21 and the Square D Digest contain application information.

COVER-MOUNTED CONTROL UNITS

NEMA Type 1 general purpose enclosures with slip-on or hinged covers contain knockouts for field addition of the kits listed in Table 1.

OVERLOAD RELAYS

Standard

Melting alloy overload relay: incorporates one or three thermal units. Its contact unit (item 6 in Figure 1) is available with a N.O. or N.C. isolated alarm contact, in addition to the

serie A con un bloque de la serie B, deberá seleccionar los elementos térmicos del relevador de sobrecarga de la tabla de selección de elementos térmicos de la serie B para proporcionar una protección adecuada al motor.

CONTACTOS AUXILIARES

Todos los contactores y arrancadores contienen un contacto de circuito de sostén normalmente abierto (N.A.). Los contactos auxiliares normalmente cerrados (N.C.) o N.A. se pueden instalar en el local del cliente. La tabla 5 enumera su clase y tipo. El boletín 30072-013-21 y el Digest de Square D contienen información sobre su aplicación.

UNIDADES DE CONTROL PARA MONTAJE EN LA CUBIERTA

Los gabinetes NEMA tipo 1 para uso general con cubiertas deslizantes o abisagradas contienen agujeros ciegos para la adición de los accesorios enumerados en la tabla 1 los cuales pueden ser instalados en el local del cliente.

RELEVADORES DE SOBRECARGA

Estándar

Relevador de sobrecarga de aleación fusible: incorpora uno o tres elementos térmicos. Su unidad de contacto (artículo 6 en la figura 1) se encuentra disponible con un contacto de alarma aislado N.A. o N.C., además del contacto

bloc-relais de série B, les unités thermiques du relais de surcharge doivent être sélectionnées dans les tableaux de sélection des unités thermiques de série B pour assurer une protection adéquate du moteur.

CONTACTS AUXILIAIRES

Tous les contacteurs et démarreurs sont dotés d'un contact de circuit de retenue normalement ouvert (N.O.). Des contacts auxiliaires N.O. ou des contacts normalement fermés (N.F.) peuvent être ajoutés sur place. Le tableau 5 dresse la liste des classes et des types autorisés. Le bulletin 30072-013-21 et le Digest de Square D contiennent des renseignements relatifs aux applications.

UNITÉS DE COMMANDE MONTÉES SUR COUVERCLE

Les coffrets à usage général NEMA type 1 avec des couvercles à glissières ou à charnières contiennent des débouchures permettant l'ajout sur place des kits figurant au tableau 1.

RELAIS DE SURCHARGE

Standard

Relais de surcharge à fusion d'alliage : incorpore une ou trois unités thermiques. Son unité de contact (article 6, figure 1) est disponible avec un contact d'alarme isolé N.O. ou N.F. en plus du contact N.F. standard. L'unité

Table / Tabla / Tableau 1 : Field Modification Kits, Class 9999 / Accesorios para la modificación en el local del cliente, clase 9999 / Kits de modification sur place, classe 9999

Kit / Accesorio / Kits	**Slip-On Cover** **Cubierta deslizante** **Couvercle à glissières**	**Hinged Cover** **Cubierta abisagrada** **Couvercle à charnières**	**Form** (Factory Mod.) **Forma** (modelo de fábrica) **Forme** (mod. d'usine)
Push button, Start-Stop / Botón pulsador, arranque-parada Bouton-poussoir, Démarrage-Arrêt	SA2	SA3	A
Push button, On-Off / Botón pulsador, encendido-apagado Bouton-poussoir, Marche-Arrêt	SA10	SA3	A3
Selector switch, Hand-Off-Auto / Interuptor selector, manual-apagado-auto / Interrupteur de sélection, Manuel-Arrêt-Auto	SC2	SC8	C
Selector switch, On-Off / Interruptor selector, encendido-apagado Interrupteur de sélection, Marche-Arrêt	SC22	—	C6
Red pilot light / Lámpara piloto roja / Lampe témoin rouge	SP2R	SP28R [1]	P1

[1] For 120 V~ only. For other voltages, use Class 9001, Type KP units. / Para 120 V~ solamente. Para otras tensiones, utilice las unidades clase 9001, tipo KP. Pour 120 V~ seulement. Autres tensions : utiliser les unités de classe 9001, type KP.

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standard N.C. contact. The contact unit with alarm circuit contacts is field-installable (see Table 5).

Optional

Non-temperature compensated bimetallic overload relay: Form B1 incorporates two thermal units; Form B2 incorporates three thermal units.

Ambient-temperature compensated bimetallic overload relay (Form B): incorporates three thermal units.

SPDT contact (all Type S bimetallic overload relays): The N.O. contact can be used in an alarm circuit, and its wiring polarity must match that of the N.C. contact. Contacts are not replaceable. Use Table 5 to order replacement bimetallic overload relays.

Overload relays are not field-repairable. Do not disassemble them.

TERMINALS

*Use only **copper** wire* on device power and control terminals. Pressure wire power terminals are suitable for wire sizes 14–8 AWG (2.5–6 mm^2), solid or stranded. Pressure wire control terminals are suitable for wire sizes 16–12 AWG (1.5–4 mm^2), solid or stranded.

CONTACT INSPECTION AND REPLACEMENT

Discoloration and slight pitting do not harm contacts. ***Do not** file contacts*; this wastes contact material. Replace contacts (item 4 in Table 5) only when worn thin.

To inspect or replace contacts, disconnect all power. Do not remove any wiring. Loosen the two captive screws (C) holding the contact actuator to the contact block. Lift the contact actuator to expose the contacts.

estándar N.C. La unidad de contacto con los contactos de circuito de alarma se puede instalar en el local del cliente (vea la tabla 5).

Opcional

Relevador de sobrecarga bimetálico no compesado por temperatura: La forma B1 incorpora dos elementos térmicos; la forma B2 incorpora tres elementos térmicos.

Relevador de sobrecarga compensado por la temperatura ambiente (forma B): incorpora tres elementos térmicos.

Contacto 1P2T (todos los relevadores de sobrecarga bimetálicos tipo S): El contacto N.A. puede ser usado en un circuito de alarma y su polaridad de cableado debe corresponder con la polaridad del contacto N.C. Los contactos no se pueden reemplazar. Utilice la tabla 5 para solicitar repuestos de los relevadores de sobrecarga bimetálicos.

Los relavadores de sobrecarga no se pueden reparar en el local del cliente. No los desmonte.

TERMINALES

*Utilice sólo conductores de **cobre*** en las terminales de alimentación y control del dispositivo. Las terminales de alimentación de los conductores a presión son adecuadas para tamaños de cables calibre 14–8 (2,5–6 mm^2), sencillo o múltiple. Las terminales de control de los conductores a presión son adecuadas para tamaños de cables calibre 16–12 (1,5–4 mm^2), sencillo o múltiple.

INSPECCION Y REEMPLAZO DE CONTACTOS

La descoloración y picadura liviana no dañan los contactos. ***No** lime los contactos*; esto desperdicia el material del contacto. Reemplace los contactos (artículo 4 en la tabla 5) sólo cuando estén desgastados.

Para inspeccionar o reemplazar los contactos, desconecte toda la alimentación. No retire el cableado. Desatornille los dos tornillos imperdibles (C) sosteniendo el actuador de contacto

de contact avec les contacts de circuit d'alarme peut être installée sur place (voir le tableau 5).

En option

Relais de surcharge bimétallique non stabilisé en température : La forme B1 incorpore deux unités thermiques, la forme B2 incorpore trois unités thermiques.

Relais de surcharge bimétallique stabilisé en température (forme B) : incorpore trois unités thermiques.

Contact UPBD (tous les relais de surcharge bimétalliques de type S) : Le contact N.O. peut être utilisé dans un circuit d'alarme et la polarité de son câblage doit correspondre à celle du contact N.F. Les contacts ne peuvent pas être remplacés. Utiliser le tableau 5 pour commander des relais de surcharge bimétalliques de rechange.

Les relais de surcharge ne peuvent pas être réparés sur place. Ne pas les démonter.

BORNES

*Utiliser uniquement des fils de **cuivre*** sur les bornes d'alimentation et de commande du dispositif. Les bornes d'alimentation des fils à pression conviennent pour des fils de calibre 14–8 AWG (2,5 – 6 mm^2), à un ou plusieurs brins. Les bornes de commande des fils à pression conviennent pour des fils de calibre 16–12 AWG (1,5 – 4 mm^2), à un ou plusieurs brins.

INSPECTION ET REMPLACEMENT DES CONTACTS

La décoloration ou de légères piqûres de surface n'altèrent en rien les contacts. ***Ne pas** limer les contacts ;* ceci abîme le matériau du contact. Ne remplacer les contacts que lorsqu'ils sont usés (article 4, tableau 5).

Pour inspecter ou remplacer les contacts, mettre l'ensemble hors tension. Ne pas retirer le câblage. Desserrer les deux vis prisonnières (C) en maintenant l'actionneur de contact

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The Class 9998, Type SL22 kit contains replacement contacts and springs for **power pole** kits only**.** Each N.O. or N.C. contact requires one kit.

al bloque de contactos. Levante el actuador de contacto para exponer los contactos.

El accesorio clase 9998, tipo SL22 contiene contactos y resortes de repuesto solamente para los accesorios de los **polos de potencia.** Cada contacto N.A. o N.C. requiere un accesorio.

contre le bloc à contacts. Soulever l'actionneur des contacts pour faire apparaître ces derniers.

Le kit de classe 9998, type SL22 contient des contacts et des ressorts de rechange uniquement pour des kits de **pôles d'alimentation**. Chaque contact N.O. ou N.F requiert un kit.

MANUAL OPERATION

FUNCIONAMIENTO MANUAL

FONCTIONNEMENT MANUEL

⚠ WARNING / ADVERTENCIA / AVERTISSEMENT

UNINTENDED EQUIPMENT OPERATION

Disconnect all power before manually operating equipment to avoid contact arcing and unexpected load energization.

Failure to observe this precaution can result in death, serious injury, or equipment damage.

OPERACION INVOLUNTARIA DEL EQUIPO

Desconecte toda la alimentación antes de hacer funcionar manualmente el equipo, para evitar la formación de arcos en los contactos y la energización inesperada de carga.

El incumplimiento de esta precaución puede causar la muerte, lesiones serias o daños al equipo.

FONCTIONNEMENT INVOLONTAIRE DE L'APPAREIL

Coupez l'alimentation avant d'actionner manuellement cet appareil, pour éviter la formation d'arcs électriques sur les contacts ou une alimentation inattendue de la charge.

Si cette précaution n'est pas respectée, cela peut entraîner la mort, des blessures graves ou des dommages matériels.

Manually operate the contactor or starter with a screwdriver by pushing down the contact carrier. The coil cover has a slot for this use.

Haga funcionar manualmente el contactor o arrancador con un desarmador oprimiendo el portacontacto hacia abajo. La cubierta de la bobina tiene una ranura para este uso.

Actionner manuellement le contacteur ou le démarreur en poussant le porte-contact vers le bas avec un tournevis. Le couvercle de la bobine possède une fente réservée à cet usage.

COIL REPLACEMENT

To remove the coil, loosen the two captive cover screws (item A, Figure 1). Disconnect the wires from the coil terminals and remove the cover. Remove and disassemble the magnet, coil, and armature.

To replace the coil, first assemble the magnet, replacement coil, and armature. Manually operate the contact carrier (described in "Manual Operation") and insert the complete unit. Before installing the cover, manually operate the device to ensure that all parts function properly. Use the tightening torques listed in Table 2 when reassembling the device.

REEMPLAZO DE LA BOBINA

Para retirar la bobina, desatornille los dos tornillos imperdibles de la cubierta (artículo A en la figura 1). Desconecte los cables de las terminales de la bobina y quite la cubierta. Retire y desmonte la bobina, el imán y la armadura.

Para reemplazar la bobina, ensamble el imán, la bobina de repuesto y la armadura. Haga funcionar manualmente el portacontacto (descrito en "Funcionamiento manual") y coloque la unidad completa. Antes de instalar la cubierta, haga funcionar manualmente el dispositivo y asegúrese de que todos sus componentes estén funcionando adecuadamente. Utilice los pares de apriete enumerados en la tabla 2 cuando vuelva a montar el dispositivo.

REMPLACEMENT DE LA BOBINE

Pour retirer la bobine, desserrer les deux vis prisonnières du couvercle (article A, figure 1). Débrancher les fils des bornes de la bobine et ôter le couvercle. Enlever et démonter l'aimant, la bobine et l'armature.

Pour remplacer la bobine, assembler l'aimant, la bobine de rechange et l'armature. Actionner manuellement le porte-contact (comme décrit dans «Fonctionnement manuel») et insérer l'unité complète. Avant d'installer le couvercle, actionner manuellement le dispositif pour s'assurer que toutes les pièces fonctionnent correctement. Pour remonter le dispositif, utiliser les couples de serrage figurant au tableau 2.

ASSEMBLY

Figure 1 illustrates the contactor or starter assembly. Table 2 and the device instructions list factory-recommended

ENSAMBLE

La figura 1 ilustra el ensamble del arrancador o del contactor. La tabla 2 y las instrucciones del dispositivo

ASSEMBLAGE

La figure 1 représente l'assemblage du contacteur ou démarreur. Le tableau 2 et les directives du dispositif donnent la

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Table / Tabla / Tableau 2 : Factory Recommended Tightening Torques / Pares de apriete recomendados de fábrica Couples de serrage recommandés par l'usine

Item Art.	Description	Descripción	Description	Tightening Torque Par de apriete Couple de serrage	
				lb-in / lb-pulg lb-po	N•m
A	Cover screw (2 per cover)	Tornillo de la cubierta (2 por cubierta)	Vis de couvercle (2 par couvercle)	18–21	2,0–2,3
B	Coil terminal pressure wire connector (2 per coil)	Conector de los conductores a presión de la terminal de la bobina (2 por bobina)	Connecteur des fils à pression aux bornes de la bobine (2 par bobine)	9–12	1,0–1,3
C	Power plant screws (4 per device)	Tornillo de la planta de alimentación (4 por dispositivo)	Vis du groupe électrogène (4 par dispositif)	18–21	2,0–2,3
D	Internal auxiliary contact pressure wire connector (2 per contact)	Conector de los conductores a presión del contacto auxiliar interno (2 por contacto)	Connecteur des fils à pression du contact auxiliaire interne (2 par contact)	9–12	1,0–1,3
E	Stationary contact fastener (2 per pole)	Sujetador del contacto estacionario (2 por polo)	Attache du contact stationnaire (2 par pôle)	6–9	0,68–1,0
F	Lug screw (2 per pole)	Tornillo de la zapata (2 por polo)	Vis de cosse (2 par pôle)	[1]	[1]
G	Auxiliary wire binding screw	Tornillo de sujeción de los conductores auxiliar	Vis de fixation du fil auxiliaire	18–21	2,0–2,3
H	Overload relay fastening screw (2 per overload block)	Tornillo sujetador del relevador de sobrecarga (2 por bloque de sobrecarga)	Vis de fixation du relais de surcharge (2 par bloc de surcharge)	18–21	2,0–2,3
J	Overload switch module fastening screw (1 per module)	Tornillo sujetador del módulo del interruptor de sobrecarga (1 por módulo)	Vis de fixation du module d'interrupteur de surcharge (1 par module)	9–12	1,0–1,3
K	Switch module pressure wire connector (2 per module standard; 4 per module with alarm circuit contact)	Conector de los conductores a presión del módulo del interruptor (2 por módulo estándar; 4 por módulo con contacto de circuito de alarma)	Connecteur des fils à pression du module d'interrupteur (2 par module en standard; 4 par module avec contact de circuit d'alarme)	9–12	1,0–1,3
L	Overload-to-contactor fastening screw (1 per pole)	Tornillo sujetador del relevador de sobrecarga al contactor (1 por polo)	Vis de fixation du relais de surcharge au contacteur (1 par pôle)	18–21 [2]	2,0–2,3 [2]
M	Overload thermal unit fastening screw (2 per pole)	Tornillo sujetador del elemento térmico de sobrecarga (2 por polo)	Vis de fixation de l'unité thermique de surcharge (2 par pôle)	18–21	2,0–2,3 [2]
O	Lug retaining screw—Size 1P only (1 per pole)	Tornillo sostenedor de la zapata—Tamaño 1P solamente (1 por polo)	Vis de retenue de cosse—Taille 1P seulement (1 par pôle)	18–21	2,0–2,3 [2]

[1] See instructions supplied with the device. / Siga las instrucciones que vienen incluidas con el dispositivo. / Voir les directives accompagnant le dispositif.
[2] For contactor, see instructions supplied with the device. / Para el contactor, siga las instrucciones que vienen incluidas con el dispositivo. Pour le contacteur, voir les directives accompagnant le dispositif.

torques for mechanical, electrical, and pressure wire connections. Use these torques to ensure proper device operation.

SHORT-CIRCUIT PROTECTION

Provide branch-circuit overcurrent protection for starters, referring to the instructions supplied with the thermal unit selection table. Provide branch-circuit overcurrent protection for contactors (Class 8502 or 8702) in accordance with the National Electrical Code (NEC). Do not exceed the maximum protective device ratings listed in Table 3.

proporcionan los pares de apriete recomendados por el fabricante para las conexiones mecánicas, eléctricas y de los conductores a presión. Utilice estos pares de apriete para asegurar el funcionamiento correcto del dispositivo.

PROTECCION CONTRA CORTOCIRCUITO

Proporcione protección contra sobrecorriente de circuito de derivación a los arrancadores, consultando las instrucciones incluidas con la tabla de selección del elemento térmico. Proporcione protección contra sobrecorriente de circuito de derivación a los contactores (clase 8502 ó 8702) de acuerdo con el código nacional eléctrico de EUA (NEC). No exceda los valores nominales máx. del dispositivo protector que se enumeran en la tabla 3.

liste des couples de serrage recommandés par l'usine pour des connexions mécaniques, électriques et des fils à pression. Utiliser ces couples pour assurer un fonctionnement correct du dispositif.

PROTECTION CONTRE LES COURTS-CIRCUITS

Fournir un dispositif de protection d'artère pour démarreurs, conformément aux directives figurant dans le tableau de sélection de l'unité thermique. Fournir un dispositif de protection d'artère pour contacteurs (classe 8502 ou 8702) conformément au Code national de l'électricité (CNÉ). Ne pas dépasser l'intensité nominale maximale du dispositif de protection figurant au tableau 3.

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Provide overcurrent protection for control circuits in accordance with the NEC and/or other applicable electrical codes. For applications requiring compliance with I.E.C. 947-5-1, use only Class CC fuses or better, 30 A maximum.

DISTANT CONTROL

Depending upon the voltage, wire size, and number of control wires used, series impedance or shunt capacitance may limit the maximum distance of the wire run for remotely operated contactors and starters. If distances to start or stop stations exceed those listed in Table 4, analyze the wire-run configuration and materials. For further information, request data bulletin M379 from D-FAX (document #1188), the Square D website (www.squared.com), or your local Square D field office.

Proporcione protección contra sobrecorriente en los circuitos de control de acuerdo con el NEC y/u otros códigos eléctricos aplicables. Utilice solamente fusibles clase CC o mejores, de 30 A como máximo, en las aplicaciones que requieran el cumplimiento de la norma 947-5-1 de I.E.C.

CONTROL A DISTANCIA

Dependiendo de la tensión, del calibre del conductor y de la cantidad de conductores de control que se usan, la impedancia en serie o la capacitancia en derivación puede limitar la distancia máxima del tendido de cables de contactores y arrancadores que se hacen funcionar remotamente. Si las distancias a las estaciones de arranque o parada exceden aquéllas enumeradas en la tabla 4, analice la configuración del tendido de cables y los materiales. Para obtener más información, solicite el boletín de datos del producto M379 de su oficina local de ventas de Square D.

Fournir un dispositif de protection contre la surcharge aux circuits de commande selon le CNÉ et d'autres codes électriques applicables. Pour les applications devant être conformes à la norme 947-5-1 de I.E.C. (CEI : Commission électronique internationale) utiliser uniquement les fusibles Classe CC ou supérieurs, de 30 A au maximum.

COMMANDE À DISTANCE

Selon la tension, le calibre du fil et le nombre de fils de commande utilisés, l'impédance de série ou la capacité shunt peut limiter la longeur maximale du câblage des contacteurs et des démarreurs commandés à distance. Si les distances aux postes de départ ou d'arrêt dépassent celles figurant dans le tableau 4, analyser la configuration et les matériaux du câblage des conducteurs. Pour de plus amples informations, consulter le bulletin M379 sur les données des produits, auprès du bureau local de ventes de Square D.

Table / Tabla / Tableau 3 : Maximum Ampere Ratings / Valores nominales máx. en amperes Valeurs nominales maximales de courant

Maximum Voltage Tensión máxima Tension maximal	Class K5, RK5 or RK1 Fuse Fusible clase K5, RK5 o RK1 Fusible de classe K5, RK5 ou RK1	Class J or T Fuse Fusible clase J o T Fusible de classe J ou T	Inverse-Time Circuit Breaker Interruptor automático de retardo inverso Disjoncteur à retard inverse
600 V~	30 A	60 A	40 A
250 V~	40 A	60 A	60 A

Table / Tabla / Tableau 4 : Maximum Control Distance for Copper Wire / Distancia máxima de control del conductor de cobre / Distance de commande maximale pour fil de cuivre

Coil Voltage @ 60 Hz Tensión de la bobina @ 60 Hz Tension de bobine à 60 Hz	Maximum Control Distance / Distancia máxima de control / Distance maximale de commande			
	14 AWG (2,08 mm^2)		12 AWG (3,3 mm^2)	
	ft / pies / pieds	m	ft / pies / pieds	m
120 V~	845	258	1300	396
240 V~	595	181	495	151
480 V~	145	44	120	36

PARTS ORDERING

Specify the quantity, the part number or Class and Type, and the part description, giving complete nameplate data of the device (e.g., one armature and magnet kit 31041-605-50 for a Class 8536, Type SCO3, Series A starter).

SOLICITUD DE PIEZAS

Especifique la cantidad, el número de pieza o clase y tipo, y descripción de la pieza, proporcionando los datos completos de la placa de identificación del dispositivo (p.ej., un accesorio de imán y armadura 31041-605-50 para un arrancador clase 8536, tipo SCO3, serie A).

COMMANDE DE PIÈCES

Spécifier la quantité, le numéro de pièce ou la classe et le type, ainsi que la description de la pièce, en donnant tous les renseignements figurant sur la plaque signalétique du dispositif (par ex., kit d'armature et d'aimant 31041-605-50 pour un démarreur de classe 8536, type SCO3, série A).

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Table / Tabla / Tableau 5 : Parts List / Lista de piezas / Liste de pièces

Item Art.	Description	Descripción	Description	Part Number Número de pieza N° de pièce	Quantity / Cantidad Quantité				
					1 P	2 P	3 P	4 P	5 P
1	Armature and magnet kit	Accesorio de imán y armadura	Kit d'armature et d'aimant	31041-605-50	1	1	1	1	1
2	Coil	Bobina	Bobine	See Table 6 / Vea la tabla 6 Voir le tableau 6	1	1	1	1	1
3	Internal auxiliary contact N.O. N.C.	Contacto auxiliar interno N.A. N.C.	Contact auxiliaire interne N.O. N.F.	Class / Clase / Classe 9999 Type / tipo / type SX11 Type / tipo / type SX12	[3] —	[3] —	1 —	1 —	1 —
4	Contact kit	Accesorio de contacto	Kit de contact	Class / Clase / Classe 9998 Type / tipo / type SL3 Type / tipo / type SL13 Type / tipo SL13 & SL22	1 — —	1 — —	1 — —	— 1 —	— — 1
5 5 [1]	Melting alloy overload relay assembly 1 Element 2 or 3 Element Bimetallic overload relay	Ensamblaje del relevador de sobrecarga de aleación fusible 1 elemento 2 ó 3 elementos Relevador de sobrecarga bimetálico	Assemblage de relais de surcharge à fusion d'alliage 1 élément 2 ou 3 éléments Relais de surcharge bimétallique	Class / Clase / Classe 9065 Type / tipo / type SDO4 Type / tipo / type SDO5	1 —	1 —	— 1	— 1	— 1
	Non-compensated 2 Element (Form B1) 3 Element (Form B2) Compensated 3 Element (Form B)	No compensado 2 elementos (forma B1) 3 elementos (forma B2) Compensado 3 elementos (forma B)	Non compensé en température 2 éléments (forme B1) 3 éléments (forme B2) Compensé en température 3 éléments (forme B)	Class / Clase / Classe 9065 Type / tipo / type SDO5B1 Type / tipo / type SDO6B2 Class / Clase / Classe 9065 Type / tipo / type SDO6B	— — — —	— — — —	— — — —	— — — —	— — — —
6	Melting alloy overload contact unit	Unidad de contacto de sobrecarga de aleación fusible	Unité de contact de surcharge à fusion d'alliage	Class / Clase / Classe 9998 Type / tipo / type SO1	1	1	1	1	1
6 [1]	Melting alloy overload contact unit w/alarm circuit N.O. alarm contact N.C. alarm contact	Unidad de contacto de sobrecarga de aleación fusible con circuito de alarma Contacto de alarma N.A. Contacto de alarma N.C.	Unité de contact de surcharge à fusion d'alliage avec circuit d'alarme Contact d'alarme N.O. Contact d'alarme N.F.	Class / Clase / Classe 9999 Type / tipo / type SO4 Type / tipo / type SO5	— —	— —	— —	— —	— —
7	Reset bar	Barra de restablecimiento	Barre de réarmement	31034-042-01	1	1	1	1	1
8	Cover only (nameplate not included)	Cubierta solamente (placa de identificación no incluida)	Couvercle seulement (plaque signalétique non incluse)	31127-013-01	1	1	1	1	1
[1]	External auxiliary contact 1 N.O. 1 N.C. 1 N.O. and 1 N.C. 1 N.O., overlapping 1 N.C., overlapping	Contacto auxiliar externo 1 N.A. 1 N.C. 1 N.A. y 1 N.C. 1 N.A., con recubrimiento 1 N.C., con recubrimiento	Contact auxiliaire externe 1 N.O. 1 N.F. 1 N.O. et 1 N.F. 1 N.O., chevauchement 1 N.F., chevauchement	Class / Clase / Classe 9999 Type / tipo / type SX6 Type / tipo / type SX7 Type / tipo / type SX8 Type / tipo / type SX9 Type / tipo / type SX10	— — — — —	— — — — —	— — — — —	— — — — —	— — — — —
[1]	Power pole kit 1 N.O. 2 N.O.	Accesorio del polo de potencia 1 N.A. 2 N.A.	Kit de pôle d'alimentation 1 N.O. 2 N.O.	Class / Clase / Classe 9999 Type / tipo / type SB6 Type / tipo / type SB9	— —	— —	— —	1 —	— 1
10 [2]	Lever bearing	Cojinete de la palanca	Galet du levier	31041-032-01	1	1	1	1	1
A	Cover screw	Tornillo de la cubierta	Vis de couvercle	21937-14341	2	2	2	2	2
B	Coil terminal pressure wire connector	Conector de los conductores a presión de las terminales de la bobina	Connecteur des fils à pression aux bornes de la bobine	31051-007-50	2	2	2	2	2
C	Power plant screw	Tornillo de la planta de alimentación	Vis du groupe électrogène	21916-14501	2	2	2	2	2

[1] Not shown.

[2] To ensure proper device operation: when installing the lever bearing onto the lever, the oval concavity on the inside surface of one leg of the bearing must mate with the corresponding oval convexity on the bottom of the lever.

[3] Furnished on 2-pole starters; however, 1- and 2-pole contactors are furnished with a holding circuit contact rated the same as a power pole.

[1] No se muestra.

[2] Para asegurarse de que el dispositivo está funcionando adecuadamente al instalar el cojinete de la palanca en la misma; la concavidad ovalada en la superficie interior de uno de los pies del cojinete debe corresponder con la convexidad ovalada correspondiente en la parte inferior de la palanca.

[3] Incluida con los arrancadores de 2 polos; sin embargo, los contactores de 1 y 2 polos incluyen un contacto de circuito de sostén con el mismo valor nominal de un polo de potencia.

[1] Non montré.

[2] Pour assurer un fonctionnement correct du dispositif : lors de l'installation du galet du levier sur ce dernier, veiller à faire correspondre la cavité ovale située sur la surface interne d'un pied du galet avec la forme convexe située au bas du levier.

[3] Fourni sur les démarreurs à 2 pôles ; toutefois, les contacteurs à 1 et 2 pôles sont fournis avec un contact de circuit de retenue de la même valeur nominale qu'un pôle d'alimentation.

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Table / Tabla / Tableau 5 : Parts List / Lista de piezas / Liste de pièces (cont. / cont. / suite)

Item Art.	Description	Descripción	Description	Part Number Número de pieza N° de pièce	Quantity / Cantidad Quantité				
					1 P	2 P	3 P	4 P	5 P
F	Wire clamp and screw Size 1 contactor Size 1 starter	Pinza y tornillo del conductor Contactor tamaño 1 Arrancador de tamaño 1	Vis de fixation et serre-fil Contacteur de taille 1 Démarreur de taille 1	30018-018-50	— —	— 2	— 3	2 5	4 7
G	Auxiliary wire binding screw	Tornillo de sujeción del conductor auxiliar	Vis de fixation du fil auxiliaire	21819-25081	2	2	2	2	2
L	Wire clamp and screw Size 1 contactor Size 1 starter	Pinza y tornillo del conductor Contactor de tamaño 1 Arrancador de tamaño 1	Vis de fixation et serre-fil Contacteur de taille 1 Démarreur de taille 1	30018-070-50	2 —	4 4	6 6	6 6	6 6
M	Overload thermal unit fastening screw	Tornillo sujetador del elemento térmico de sobrecarga	Vis de fixation de l'unité thermique de surcharge	21920-16160	—	4	6	6	6
O	Screw assembly (Size 1P only)	Ensamble del tornillo (Tamaño 1P solamente)	Assemblage des vis (Taille 1P seulement)	30018-066-50	—	4	—	—	—
P	Lug screw (Size 1P only)	Tornillo de la zapata (Tamaño 1P solamente)	Vis de cosse (Taille 1P seulement)	25054-13600	—	4	—	—	—

The complete coil part number contains a prefix and a suffix (e.g., for a 120 V~, 60 Hz coil, select 31041-400-42). When ordering replacement coils, give the part number, voltage, and frequency of the coil being replaced.

El número de pieza completo de la bobina contiene un prefijo y un sufijo (es decir, una bobina de 120 V~, 60 Hz, el número de pieza es 31041-400-42). Cuando solicite las bobinas de repuesto, proporcione el número de pieza, la tensión y la frecuencia de la bobina que se está reemplazando.

Le numéro complet de la pièce de la bobine contient un préfixe et un suffixe (par ex., pour une bobine 120 V~, 60 Hz, sélectionner 31041-400-42). Pour commander des bobines de rechange, indiquer le numéro de pièce, la tension et la fréquence de la bobine à remplacer.

Table / Tabla / Tableau 6 : Magnet Coil Part Numbers / Números de piezas de la bobina magnética
Numéros de pièces des bobines d'aimant

Coil Prefix Prefijo de la bobina Préfixe de bobine	Hz	Coil Suffix / Sufijo de la bobina / Suffixe de bobine														VA~	
		24 V~	110 V~	120 V~	120/240 V~	208 V~	220 V~	240 V~	240/480 V~	277 V~	380 V~	440 V~	480 V~	550 V~	600 V~	Inrush Irrupción VA d'appel	Sealed Sellado Scellement
31041-400	60	20	Use Utilice Utiliser 120 V~	42	[1]	48	Use Utilice Utiliser 240 V~	51	[1]	52	56	Use Utilice Utiliser 480 V~	60	Use Utilice Utiliser 600 V~	62	245	27
	50	22	42	43	—	—	51	53	—	—	57	60	—	62	64	232	26

[1] Dual voltage coil. For 120/240 V~ 60 Hz, order 31041-402-02. For 240/480 V~ 60 Hz, order 31041-402-04.

[1] Bobina de tensión doble. Solicite 31041-402-02 para los modelos de 120/240 V~, 60 Hz. Solicite 31041-402-04 para los modelos de 240/480 V~, 60 Hz.

[1] Bobine à deux tensions. Commander 31041-402-02 pour les modèles à 120/240 V~, 60 Hz. Commander 31041-402-04 pour les modèles à 240/480 V~, 60 Hz.

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30072-013-19B
Raleigh, NC, USA 5/98

Replaces / Reemplaza / Remplace 30072-013-19A (9/95)

Manual Starters
Arrancadores manuales
Démarreurs manuels

Class Clase Classe	Type Tipo Type	Series Serie Série	Size Tamaño Taille
2510	M & T	A	M-0, M-1 & M-1P

INTRODUCTION

This bulletin provides assembly, modification, and parts ordering instructions.

INTRODUCCION

Este boletín incluye instrucciones de montaje y modificación del arrancador y de solicitud de piezas de repuesto.

INTRODUCTION

Ce bulletin contient des directives pour assembler et modifier le démarreur et pour commander des pièces de rechange.

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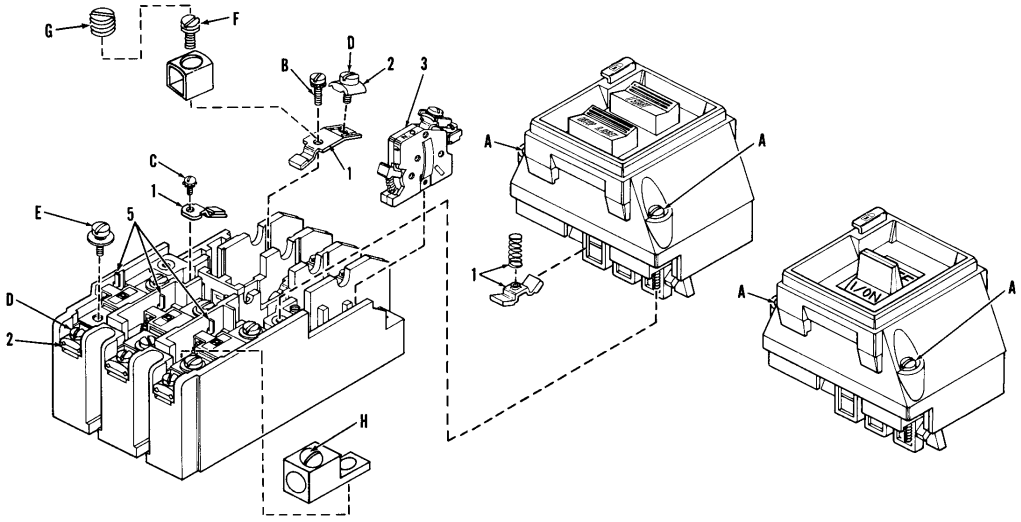


Figure / Figura / Figure 1 : Manual Starter Assembly / Montaje del arrancador manual / Assemblage du démarreur manuel

⚠ DANGER / PELIGRO / DANGER

HAZARDOUS VOLTAGE

Disconnect all power before working on equipment.

Failure to follow this instruction will result in death or serious injury.

TENSION PELIGROSA

Desconecte toda la alimentación antes de efectuar cualquier trabajo en el equipo.

El incumplimiento de esta precaución podrá causar la muerte o lesiones serias.

TENSION DANGEREUSE

Coupez l'alimentation avant de travailler sur cet appareil.

Si cette précaution n'est pas respectée, cela entraînera la mort ou des blessures graves.

CONTACT ACTUATOR

Movable contacts are operated by a push button or toggle operator.

ACTUADOR DE CONTACTOS

Los contactos móviles son activados por un operador, tipo botón pulsador o articulado.

ACTIONNEUR DE CONTACTS

Les contacts mobiles sont activés par un opérateur de type bouton-poussoir ou à bascule.

CONTACT INSPECTION

Loosen the two captive screws (A) holding the contact actuator mechanism to the contact block. Lift the contact actuator to expose the contacts.

INSPECCION DE CONTACTOS

Afloje los dos tornillos cautivos (A) sujetando el mecanismo del actuador de contactos contra el bloque de contactos. Levante el actuador de contactos para mostrar los contactos.

INSPECTION DES CONTACTS

Desserrer les deux vis imperdables (A) retenant le mécanisme de l'actionneur de contacts contre le bloc de contacts. Soulever l'actionneur pour exposer les contacts.

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Discoloration and slight pitting do not harm silver alloy contacts. **Do not file contacts**; this wastes contact material. Replace contacts only when worn thin. Table 5 lists replacement parts.

CONTACT REPLACEMENTS

See Figure 1. To replace the contacts, loosen the two captive screws (A) and remove the contact actuator. Remove the movable contacts (1) from the yoke bar by compressing the contact spring and sliding the contact sideways. Change the contact springs before inserting new movable contacts. Remove the stationary contacts by loosening the contact mounting screws (B and C). Reassemble in reverse order.

WIRING

Use only copper wire on device power and control terminals.

OVERLOAD RELAYS

Standard: *Melting alloy thermal overload relays:* incorporate one or three thermal units. (Three-phase manual starters manufactured before mid-1972 had a shorting strap installed in the center leg of the overload relay. To convert these devices from two to three thermal units, remove the shorting strap and install a third thermal unit.)

NOTE: Thermal units must be installed and the device reset before starter contacts will operate. Install thermal units so the type designation can be read and with the pawl (item 5) above the ratchet wheel as shown in Figure 1.

Continued overcurrent through the thermal unit raises its temperature,

La decoloración y picaduras moderadas no dañan los contactos de aleación de plata. **No lime los contactos;** esto degasta el material del contacto. Reemplace los contactos sólo una vez que estén desgastados. La tabla 5 lista las piezas de repuesto.

REEMPLAZO DE CONTACTOS

Vea la figura 1. Para reemplazar los contactos, afloje los dos tornillos cautivos (A) y retire el actuador de contactos. Para retirar los contactos móviles (1) del yugo, comprima el resorte del contacto y deslice el contacto lateralmente. Cambie los resortes de los contactos antes de insertar los nuevos contactos móviles. Para retirar los contactos fijos, afloje los tornillos de montaje (B y C) de los contactos. Vuelva a montarlos en el orden inverso al de su instalación .

CABLEADO

Utilice conductores de cobre solamente en las terminales de alimentación y control del dispositivo.

RELEVADORES DE SOBRECARGA

Estándar: *Relevadores de sobrecarga térmica de aleación fusible:* incorporan uno ó tres elementos térmicos. (Los arrancadores manuales de tres fases fabricados en la primera mitad de 1972 tenían una cinta cortocircuitadora instalada en la parte central del relevador de sobrecarga. Para convertir estos dispositivos de dos a tres elementos térmicos, retire la cinta cortocircuitadora e instale un tercer elemento térmico.)

NOTA: Es necesario instalar los elementos térmicos y restablecer el dispositivo antes de que los contactos del arrancador funcionen. Instale los elementos térmicos para que se pueda leer la designación de tipo y para que el trinquete (artículo 5) quede sobre la rueda dentada como se muestra en la figura 1.

La presencia de sobrecorriente continua en los elementos térmicos

La décoloration ou les légères piqûres de surface n'altèrent en rien les contacts à alliage d'argent. **Ne pas limer les contacts**; cela abîme le matériau des contacts. Remplacer les contacts seulement lorsqu'ils sont usés. Le tableau 5 donne la liste des pièces de rechange.

REMPLACEMENT DES CONTACTS

Voir la figure 1. Pour remplacer les contacts, desserrer les deux vis imperdables (A) et enlever l'actionneur de contacts. Retirer les contacts mobiles (1) de la barre de l'étrier en serrant le ressort du contact et en faisant glisser ce dernier latéralement. Remplacer les ressorts des contacts avant d'insérer les contacts mobiles neufs. Retirer les contacts fixes en desserrant les vis de montage (B et C). Les remonter dans l'ordre inverse.

CÂBLAGE

Utiliser seulement des fils en cuivre avec les bornes d'alimentation et de commande du dispositif.

RELAIS DE SURCHARGE

Standard : *Relais de surchage thermique à fusion d'alliage :* comprennent de une ou trois unités thermiques. (Les démarreurs manuels triphasés fabriqués avant la mi–1972 avaient une bande de court-circuit installée dans la branche centrale du relais de surcharge. Pour convertir les dispositifs à deux unités thermiques en dispositifs à trois unités, retirer la bande de court-circuit et installer une troisième unité thermique.)

REMARQUE : Pour que les contacts du démarreur soient fonctionnels les unités thermiques doivent être installées et le dispositif doit être réinitialisé. Installer les unités thermiques en s'assurant que l'indication du type est lisible et que le crochet (article 5) reste sur la roue à rochet conformément à la figure 1.

Une surintensité continue dans l'unité thermique élève la température et

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melting the alloy in its solder pot, allowing the ratchet wheel to rotate. This releases the overload relay pawl assembly, allowing the toggle spring to retract the contacts. This action also centers the push button or toggle operator, indicating the starter is tripped.

*NOTE: Before resetting the relay, allow one to two minutes for the alloy to solidify. **Do not** disassemble the overload relay block because motor protection could be disabled, possibly damaging equipment.*

ELECTRICAL INTERLOCKS (FORM X)

One internal interlock (item 3), either normally open (N.O.) or normally closed (N.C.), can be added to all manual starters. It occupies either the upper right-hand or left-hand corner of the device, and is field installable. Table 1 lists location and replacement part numbers for Class 2510 starter interlocks. Table 5 lists replacement parts.

eleva su temperatura lo cual funde la aleación en su depósito para soldadura y permite la rotación de la rueda dentada. Esto libera el ensamble del trinquete del relevador de sobrecarga, y permite que el resorte articulado retire los contactos. Esta acción también centra el botón pulsador u operador articulado, lo cual indica que se ha disparado el arrancador.

*NOTA: Antes de restablecer el relevador, deje pasar de uno a dos minutos para que se solidifique la aleación. **No** desmonte el bloque del relevador de sobrecarga ya que puede inhabilitar la protección del motor y posiblemente dañar el equipo.*

ENTRELACES ELECTRICOS (FORMA X)

Es posible agregar un entrelace interno (artículo 3), o normalmente abierto (N.A.) o normalmente cerrado (N.C.) a todos los arrancadores manuales. Este se coloca en la esquina superior derecha o izquierda del dispositivo y puede ser instalado en campo. La tabla 1 lista la ubicación y los números de las piezas de repuesto de los entrelaces de los arrancadores clase 2510. La tabla 5 lista las piezas de repuesto.

provoque la fusion de l'alliage dans le pot à souder, entraînant la rotation de la roue à rochet. Ceci libère l'assemblage du crochet du relais de surchage, permettant au ressort de la bascule de retirer les contacts. Cette action centre également le bouton-poussoir ou l'opérateur à bascule, indiquant que le démarreur est déclenché.

*REMARQUE : Avant de réarmer le relais, attendre une ou deux minutes que l'alliage se solidifie. **Ne pas** démonter le bloc de relais de surcharge car la protection du moteur serait désactivée et l'appareil pourrait être endommagé.*

INTERVERROUILLAGES ÉLECTRIQUES (FORME X)

Un interverrouillage interne (article 3), soit normalement ouvert (N.O.) ou normalement fermé (N.F.) peut être ajouté à tous les démarreurs manuels. Il est situé sur le coin supérieur droit ou gauche du dispositif et s'installe sur place. Le tableau 1 donne la liste des emplacements et des numéros des pièces de rechange des interverrouillages pour démarreurs de classe 2510. Le tableau 5 contient les pièces de rechange.

Table / Tableau / Tabla 1 Electrical Interlocks for Class 2510 Starters / Entrelaces eléctricos para arrancadores clase 2510 Interverrouillages électriques pour démarreurs classe 2510

Form [1] Forma [1] Forme [1]	Interlock Location / Ubicación del entrelace Emplacement de l'interverrouillage		Class 9999 Replacement Interlocks / Entrelaces de repuesto clase 9999 / Interverrouillages de rechange classe 9999	
	Left-hand / Izquierdo / Gauche	Right-hand / Derecho / Droite	Type / Tipo / Type SX11	Type / Tipo / Type SX12
X1	N.O. / N.A.	—	1	—
X2	—	N.C. / N.F.	—	1

[1] Consult sales office for form designations for Class 2511 reversing and 2512 two-speed starters.
Comuníquese con la oficina de ventas para obtener las designaciones de forma para los arrancadores reversibles clase 2511 y de dos velocidades clase 2512.
Consulter le centre de ventes pour les désignations des formes des démarreurs inversibles classe 2511 et à deux vitesses classe 2512.

LOCK OFF MECHANISM

The starter can be locked only in the OFF position, by lifting the metal tab with the lock symbol on the contact actuator and placing a padlock through the hole in this tab. In the ON position, withdrawing the lock tab opens the contacts of the device.

MECANISMO DE BLOQUEO

El arrancador puede ser bloqueado solamente en la posición de desconectado (O), levantando la lengüeta de metal con el símbolo de candado en el actuador de contactos y colocando un candado a través del agujero en esta lengüeta. En la posición de conectado (|), se abren los contactos del dispositivo al retirar la lengüeta de bloqueo.

MÉCANISME DE VERROUILLAGE

Le démarreur ne peut être verrouillé que dans la position d'arrêt (O), en soulevant la languette métallique avec le symbole de cadenas sur l'actionneur de contacts et en faisant passer un cadenas par le trou de cette languette. Dans la position de marche (|), le retrait de la languette de blocage ouvre les contacts du dispositif.

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PILOT LIGHT KIT (FORM P11)

A red pilot light usable on any voltage (110-600 V) may be factory installed. Kits may be field installed in the cover of Type 1 surface- and flush-mounting enclosures. Table 2 lists kits for field modification.

ACCESORIO DE LAMPARA PILOTO (FORMA P11)

Una lámpara piloto roja utilizable bajo cualquier tensión (110-600 V ~) puede haber sido instalada en la fábrica. Los accesorios pueden ser instalados en campo en la cubierta de los gabinetes de montaje para sobreponer o empotrar tipo 1. La tabla 2 lista los accesorios para la modificación en campo.

KIT DE LAMPE TÉMOIN (FORME P11)

Une lampe témoin rouge utilisable à toutes les tensions (110 à 600 V) peut avoir été installée en usine. Les kits peuvent être installés sur place dans le couvercle des coffrets type 1 montés en surface ou encastrés. Le tableau 2 contient la liste des kits à installer sur place.

Table / Table / Tableau 2 : Pilot Light Kits / Accesorios de lámpara piloto / Kits de lampe témoin

Class 9999 Kit / Accesorio clase 9999 / Kit de classe 9999		Voltage Range / Gama de tensión / Gamme de tension
Type	MP1	110 – 120 V
Tipo	MP2	208 – 240 V
Type	MP3	440 – 600 V

REPLACEMENT INTERIORS

Replacement interiors for Class 2510 NEMA 1 surface- and flush-mounted enclosures are available with either push button or toggle operation. Catalog 2510CT9701 and the Square D Digest list open-type replacement starters.

INTERIORES DE REPUESTO

Las interiores de repuesto se encuentran disponibles para gabinetes sobrepuestos y empotrados NEMA tipo 1 clase 2510 con un operador articulado o de botón pulsador. El catálogo 2510CT9701 y el compendiado de Square D listan los arrancadores de repuesto de tipo abierto.

INTÉRIEURS DE RECHANGE

Les intérieurs de rechange pour les coffrets NEMA type 1 classe 2510 montés en surface et encastrés sont disponibles avec un opérateur à bouton-poussoir ou à bascule. Le catalogue 2510CT9701 et le Digest Square D contiennent la liste des démarreurs de rechange de type ouvert.

Table / Table / Tableau 3 : Replacement Device Styles / Estilos de dispositivos de repuesto Styles des dispositifs de rechange

Operator Type Tipo de operador Type d'opérateur			Type 1 Tipo 1 Type 1	Type 4 S. Steel Tipo 4 Acero inox. Type 4 Acier inox.	Type 4X Polyester Tipo 4X Poliéster Type 4X Polyester	Type 7 & 9 Cast Iron Tipo 7 y 9 Hierro fundido Type 7 et 9 Fonte	Type 4X, 7 & 9 Cast Aluminum Tipo 4X, 7 y 9 Aluminio fundido Type 4X, 7 et 9 Fonte d'aluminium	Type 12 Tipo 12 Type 12
Push Button	Botón pulsador	Bouton-poussoir	X	X	X	X	—	X
Toggle	Articulado	À bascule	X	—	—	—	X	—

MANUAL STARTERS CLASS 2511/2512

Class 2511 (reversing) and 2512 (two-speed) manual starters are mechanically interlocked through an interference-type mechanism, part number 31085-070-01. It mounts between the starters and engages the movable contact carriers. Since Classes 2511 and 2512 use a special contact actuator, the standard Class 2510 starter cannot be used for replacement. If either unit (right-hand or left-hand) needs replacement, order a complete starter (see Table 4).

ARRANCADORES MANUALES CLASE 2511/2512

Los arrancadores manuales clase 2511 (reversibles) y 2512 (de dos velocidades) están entrelazados mecánicamente a través de un mecanismo de interposición, número de pieza 31085-070-01 que se monta entre los arrancadores y engancha los portacontactos móviles. Puesto que las clases 2511 y 2512 utilzan un actuador especial de contactos, el arrancador clase 2510 no se puede utilizar como repuesto. Si cualquiera de las unidades (derecha o izquierda) tiene que ser reemplazada, solicite un arrancador completo (vea la tabla 4).

DÉMARREURS MANUELS CLASSE 2511/2512

Les démarreurs manuels classe 2511 (inversibles) et ceux de classe 2512 (à deux vitesses) sont mécaniquement interverrouillés par un mécanisme de serrage, nº de pièce 31085-070-01. Il se monte entre les démarreurs et engage les porte-contacts mobiles. Comme les démarreurs classes 2511 et 2512 utilisent un actionneur de contacts spécial, le démarreur classe 2510 ne peut pas être utilisé comme démarreur de rechange. Pour remplacer une unité (de droite ou de gauche), commander un démarreur complet (voir le tableau 4).

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Table / Table / Tableau 4 : Complete Right-hand and Left-hand Replacement Starters / Arrancadores de repuesto derechos e izquierdos completos / Démarreurs de rechange de droite et gauche complets

Operator Type Tipo de operador Type d'opérateur			NEMA Size Tamaño Taille	For Reversing Manual Starter Para arrancadores manuales reversibles Pour démarreur manuel inversible Class / clase / classe 2511			For Two-Speed Manual Starter Para arrancadores manuales de dos velocidades Pour démarreur manuel à deux vitesses Class / clase/ classe 2512		
				Class / Clase Classe	Type/ Tipo Type	Form / Forma Forme	Class / Clase Classe	Type/ Tipo Type	Form / Forma Forme
Push Button	Botón pulsador	Bouton-poussoir	M-0	2510	MBO2	M3	2510	MBO2	M4
			M-1		MCO3			MCO3	
Toggle	Articulado	À bascule	M-0		TBO2			TBO2	
			M-1		TCO3			TCO3	

SHORT-CIRCUIT PROTECTION

Provide branch-circuit overcurrent protection for each contactor or starter. For contactors, provide branch circuit overcurrent protection in accordance with the National Electrical Code and local electrical codes. For starters, refer to instructions furnished with the thermal unit selection table.

PROTECCION CONTRA CORTOCIRCUITO

Proporcione protección contra sobrecorriente en los circuitos en derivación a cada uno de los contactores o arrancadores. Proporcione la protección contra sobrecorriente en los circuitos en derivación a los contactores de acuerdo con el código nacional eléctrico de EUA (NEA) y/o con los códigos eléctricos locales. Para los arrancadores, consulte las instrucciones provistas con la tabla de selección del elemento térmico.

PROTECTION CONTRE LES COURTS-CIRCUITS

Fournir une protection contre la surintensité des circuits d'artère pour chaque contacteur ou démarreur. Fournir aux contacteurs la protection contre la surintensité des circuits d'artère conformément au Code national de l'électricité (CNÉ) et aux normes locales de l'électricité. Pour les démarreurs, se reporter aux directives fournies avec le tableau de sélection de l'unité thermique.

ASSEMBLY

Table 6 and the device instruction sheet provide factory recommended tightening torques for mechanical, electrical and pressure wire connections. Follow these torques to ensure proper functioning of the device. If the contact actuator is removed for contact inspection or replacement, reset the device after reassembly.

MONTAJE

La tabla 6 y la hoja de instrucciones del dispositivo proporcionan los pares de apriete recomendados de fábrica para las conexiones mecánicas, eléctricas y del conductor de presión. Utilice estos pares de apriete para asegurar el funcionamiento adecuado del dispositivo. Si se retira el actuador de contactos para realizar una inspección o reemplazo de los contactos, restablezca el dispositivo después de volverlo a montar.

ASSEMBLAGE

Le tableau 6 et la feuille de directives du dispositif donnent les couples de serrage recommandés pour les raccordements mécaniques, électriques et du fil à pression. Respecter ces couples de serrage pour assurer un fonctionnement correct du dispositif. Si l'actionneur de contacts est enlevé pour l'inspection ou le remplacement des contacts, réarmer le dispositif après le remontage.

PARTS ORDERING

Specify the quantity, part number and description of the part, giving complete nameplate data of the device; e.g., 1 contact kit Class 9998 Type ML2 for Class 2510 Type MCG3, Series A manual starter.

SOLICITUD DE PIEZAS

Especifique la cantidad, número y descripción de la pieza, proporcionando los datos completos de la placa de identificación del dispositivo; por ejemplo, 1 accesorio de contactos clase 9998 tipo ML2 para arrancador manual serie A clase 2510 tipo MCG3.

COMMANDES DE PIÈCES

Spécifier la quantité, le numéro de pièce et la description de la pièce en donnant toutes les données de la plaque d'identification du dispositif (par ex., 1 kit de contact classe 9998 type ML2 pour démarreur manuel série A, classe 2510 type MCG3).

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Table / Table / Tableau 5 : Parts List [1] / Lista de piezas [1] / Liste des pièces [1]

Item Art.	Description / Descripción / Description	Part No No. de pieza Nº de pièce	Quantity / Contenido / Quantité				
			Size / Tamaño / Taille				
			M-0		M-1		M-1P
			2-P	3-P	2-P	3-P	2-P
1	Contact kit Accesorio de contactos Kit de contacts	Class / Clase / Classe 9998 Type / Tipo / Type ML1 Type / Tipo / Type ML2	1 —	1 —	— 1	— 1	— 1
2	Wire clamp screw assy. / Ensamble del tornillo de la pinza del conductor / Assemblage de vis du serre-fils	30018-070-50	4	6	4	6	—
3 [2]	Internal interlock (N.O.) / Entrelace interno (N.A.) Interverrouillage interne (N.O.)	Class / Clase / Classe 9999 Type / Tipo / Type SX11 [2]	—	—	—	—	—
	Internal interlock (N.C.) / Entrelace interno (N.C.) Interverrouillage interne (N.F.)	Class / Clase / Classe 9999 Type / Tipo / Type SX12 [2]	—	—	—	—	—
E	Overload thermal unit fastening screw / Tornillo de fijación de unidad térmica de sobrecarga / Vis de fixation d'unité thermique de surcharge	21920-16160	4	6	4	6	4

[1] For reversing and two-speed starters, refer to "MANUAL STARTERS CLASS 2511/2512" on page 4.
Para los arrancadores reversibles y de dos velocidades, vea la sección "ARRANCADORES MANUALES CLASE 2511/2512" en la página 4.
Pour démarreurs inversibles et à deux vitesses, se reporter à «DÉMARREURS MANUELS CLASSE 2511/2512» à la page 4.

[2] A maximum of either 1 N.O. or 1 N.C. interlock may be added per starter. / Se puede agregar un máximo de 1 entrelace N.A. o 1 N.C. por arrancador.
Un seul interverrouillage N.O. ou 1 N.F. peut être ajouté par démarreur.

Table / Table / Tableau 6 : Factory Recommended Tightening Torques / Pares de apriete recomendados de fábrica Couples de serrage recommandés par l'usine

Item Art.	Description / Descripción / Description			Tightening Torque / Par de apriete / Couple de serrage	
				lb-in / po / pulg	N•m
A	Contact actuator mechanism screws (2 per device)	Tornillos del mecanismo del actuador de contactos (2 por equipo)	Vis du mécanisme de l'actionneur de contacts (2 par dispositif)	18 – 21	2.0 – 2.4 2,0 – 2,4
B	Line side stationary contact fasteners (1 per pole)	Sujetadores de contactos fijos del lado de línea (1 por polo)	Attaches de contact fixe côté secteur (1 par pôle)	13 – 16	1.5 – 1.8 1,5 – 1,8
C	Load side stationary contact fasteners (1 per pole)	Sujetadores de contactos fijos del lado de carga (1 por polo)	Attaches de contact fixe côté charge (1 par pôle)	6 – 9	0.7 – 1.0 0,7 – 1,0
D	Pressure wire connector screw (2 per pole)	Tornillo conector del conductor de presión (2 por polo)	Vis connecteur du fil à pression (2 par pôle)	[1]	[1]
E	Overload thermal unit fastening screws (2 per element)	Tornillos sujetadores del elemento térmico de sobrecarga (2 por elemento)	Vis de fixation de l'unité thermique de surcharge (2 par élément)	18 – 21	2.0 – 2.4 2,0 – 2,4
F	Lug fastening screw (1 per pole)	Tornillo de sujeción de la zapata (1 por polo)	Vis de fixation de cosse (1 par pôle)	18 – 21	2.0 – 2.4 2,0 – 2,4
G	Wire pressure screw (1 per pole, line side)	Tornillo de presión del conductor (1 por polo, lado de línea)	Vis de pression de fils (1 par pôle, côté secteur)	[1]	[1]
H	Wire pressure screw (1 per pole, load side)	Tornillo de presión del conductor (1 por polo, lado de carga)	Vis de pression de fils (1 par pôle, côté charge)	[1]	[1]

[1] Torque as recommended on the device instruction sheet. / Par de apriete recomendado en la hoja de instrucciones del dispositivo.
Couple recommandé sur la fiche de directives du dispositif.

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Electrical equipment should be serviced only by qualified electrical maintenance personnel. No responsibility is assumed by Square D for any consequences arising out of the use of this material.

Solamente el personal de mantenimiento eléctrico especializado deberá prestar servicios de mantenimiento al equipo eléctrico. La Compañía no asume responsabilidad alguna por las consecuencias emergentes de la utilización de este material.

L'entretien du matériel électrique ne doit être effectué que par du personnel qualifié. La Société n'assume aucune responsabilité des conséquences éventuelles découlant de l'utilisation de ce matériel.

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Replaces / Replaces / Reemplaza / Remplace 40273-829-01 02/2003

30–1200 A Safety Switches Maintenance Instructions
Instrucciones de servicio de mantenimiento para los interruptores de seguridad de 30 a 1 200 A
Directives d'entretien pour interrupteurs de sécurité, 30 à 1 200 A

Class / Clase / Classe
3100

Retain for future use. / Conservar para uso futuro. / À conserver pour usage ultérieur.

INTRODUCTION

Safety switches are properly lubricated at the factory. However, periodic cleaning and lubrication may be required. The maintenance interval between lubrications depends on the amount of switch usage and the ambient operating conditions. The maximum maintenance interval should not exceed one year for mechanical or current-carrying parts.

For additional information, refer to publication NFPA-70B, “Recommended Practice for Electrical Equipment Maintenance”.

Unusual Performance Conditions

Contact Square D for information regarding performance under unusual conditions. Examples of unusual conditions are shown in Table 1 below:

INTRODUCCIÓN

Los interruptores de seguridad han sido lubricados correctamente en la fábrica; sin embargo, es necesario realizar limpieza y lubricación periódicamente. El intervalo de servicio de mantenimiento entre lubricaciones depende del uso del interruptor y de las condiciones ambientales de funcionamiento. El intervalo de servicio de mantenimiento máximo no debe exceder un año para las piezas mecánicas o conductoras de corriente.

Si desea obtener información adicional, consulte la publicación NFPA-70B, “Recomended Practice for Electrical Equipment Maintenance” (prácticas recomendadas de servicio de mantenimiento para el equipo eléctrico).

Condiciones de funcionamiento poco comunes

Póngase en contacto con Square D para obtener información con respecto al funcionamiento de este equipo bajo condiciones poco comunes. La tabla 1 muestra ejemplos de condiciones poco comunes:

INTRODUCTION

Les interrupteurs de sécurité sont lubrifiés de façon appropriée à l'usine. Toutefois, un nettoyage et une lubrification périodiques peuvent être nécessaires. L'intervalle d'entretien entre les lubrifications dépend de la fréquence d'utilisation de l'interrupteur et des conditions ambiantes de fonctionnement. L'intervalle d'entretien maximum ne doit pas dépasser un an pour les pièces mécaniques ou porteuses de courant.

Pour avoir d'autres renseignements, se reporter à la publication NFPA-70B, « Recommended Practice for Electrical Equipment Maintenance » (Pratique recommandée pour l'entretien des appareils électriques).

Conditions de performance inhabituelles

Contacter Square D pour avoir des informations sur la performance dans des conditions inhabituelles. Des exemples de conditions inhabituelles sont données au tableau 1 ci-dessous :

Table / Tabla / Tableau 1 : Unusual Conditions / Condiciones poco comunes / Conditions inhabituelles

• Ambient temperatures below -22 °F (-30 °C) or above 104 °F (40 °C) /	• Temperatura ambiente inferior a -30 °C (-22 °F) o superior a 40 °C (104 °F) /	• Températures ambiantes inférieures à -30 °C (-22 °F) ou supérieures à 40 °C (104 °F)
• Altitudes over 6600 ft (2012 m) /	• Altitudes de más de 2 012 m (6 600 pies) /	• Altitudes dépassant 2 012 m (6 600 pieds)
• Corrosive or explosive environments /	• Entornos corrosivos o explosivos /	• Environnements corrosifs ou explosifs
• Abnormal vibration, shock, or tilting /	• Vibración, sacudidas o inclinaciones anormales /	• Vibrations, chocs ou inclinaison anormaux
• Unusual operating duties /	• Servicio de funcionamiento poco común /	• Facteurs de fonctionnement inhabituels

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⚠ DANGER / PELIGRO / DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Never operate energized switch with door open.
- Turn off switch before removing or installing fuses or making load side connections.
- Always use a properly rated voltage sensing device at all line and load fuse clips to confirm switch is off.
- Turn off power supplying switch before doing any other work on or inside switch.
- Do not use renewable link fuses in fused switches.

Failure to follow these instructions will result in death or serious injury.

PELIGRO DE DESCARGA ELÉCTRICA, EXPLOSIÓN O DESTELLO POR ARQUEO

- Utilice equipo de protección personal (EPP) apropiado y siga las prácticas de seguridad eléctrica establecidas por su Compañía, consulte la norma 70E de NFPA.
- Solamente el personal eléctrico especializado deberá instalar y prestar servicio de mantenimiento a este equipo.
- Nunca haga funcionar el interruptor energizado con la puerta abierta.
- Desconecte el interruptor antes de retirar o instalar los fusibles o realizar las conexiones del lado de carga.
- Siempre utilice un dispositivo detector de tensión nominal adecuado en todos los clips para fusibles en los lados de línea y carga para confirmar la desenergización del interruptor.
- Desenergice el interruptor antes de realizar cualquier otro trabajo dentro o fuera de él.
- No use fusibles renovables en los interruptores fusibles.

El incumplimiento de estas instrucciones podrá causar la muerte o lesiones serias.

RISQUE D'ÉLECTROCUTION, D'EXPLOSION OU D'ÉCLAIR D'ARC

- Portez un équipement de protection personnelle (ÉPP) approprié et observez les méthodes de travail électrique sécuritaire. Voir NFPA 70E.
- Seul un personnel qualifié doit effectuer l'installation et l'entretien de cet appareil.
- Ne faites jamais fonctionner l'interrupteur sous tension avec la porte ouverte.
- Mettez L'inerrupteur hors tension avant d'enlever ou d'installer des fusibles ou de faire des faccordements sur le côté charge.
- Utilisez toujours un dispositif de détection de tension ayant une valeur nominale appropriée sur tous les porte-fusibles du côté ligne et charge pour s'assurer que l'interrupteur soit hors tension.
- Coupez l'alimentation de l'interrupteur avant d'y faire tout autre travail.
- N'utilisez pas de fusibles renouvelables dans les interrupteurs à fusibles..

Si ces directives ne sont pas respectées, cela entraînera la mort ou des blessures graves.

ANNUAL MAINTENANCE PROCEDURES

1. Turn off power supplying the switch before performing any work on or inside the switch.
2. Open the switch blades by moving the operating handle to the OFF (**O**) position.
3. Lock out or tag the switch, per local procedures.
4. Open the enclosure door.
5. Always use a properly rated voltage sensing device at all line and load-side lugs (teminals) to confirm power is off.

   NOTE: Do not remove any parts from the switch or operating mechanism unless specifically instructed to do so in the following procedures. Vacuum any loose material from inside the switch. Wipe internal parts and the inside of the enclosure with a damp, lint-free cloth.
6. Visually inspect the switch for loose parts or hardware:

   a. Retighten the hardware as needed. Refer to the wiring diagram.
   b. Do not re-energize the switch if any worn or damaged parts are found. Replace them before re-energizing the switch.

PROCEDIMIENTOS DE SERVICIOS DE MANTENIMIENTO ANUALES

1. Desenergice el interruptor antes de realizar cualquier trabajo dentro o fuera de él.
2. Abra las cuchillas del interruptor moviendo la palanca de funcionamiento a la posición de abierto (**O**).
3. Bloquee o etiquete el interruptor de acuerdo con los procedimientos locales.
4. Abra la puerta del gabinete.
5. Siempre utilice un dispositivo detector de tensión nominal adecuado en todas las zapatas (terminales) del lado de línea y carga para confirmar la desenergización del equipo.

   NOTA: No retire ninguna pieza del interruptor ni del mecanismo de funcionamiento a no ser que se le indique eso específicamente en los siguientes procedimientos. Aspire el material suelto que se encuentra dentro del interruptor. Limpie las piezas internas y el interior del gabinete con una tela húmeda sin pelusas.
6. Realice una inspección visual al interruptor para ver si encuentra piezas o herrajes sueltos:

   a. Vuelva a apretar los herrajes a medida que sea necesario. Consulte el diagrama de cableado.
   b. No vuelva a energizar el interruptor si encuentra piezas desgastadas o dañadas; sustitúyalas antes de volver a energizar el interruptor.

PROCÉDURES D'ENTRETIEN ANNUEL

1. Couper l'alimentation de l'interrupteur avant d'effectuer tout travail sur ou à l'intérieur de l'interrupteur.
2. Ouvrir les lames de l'interrupteur en plaçant la manette de fonctionnement sur la position d'ARRÊT (**O**).
3. Verrouiller ou étiqueter l'interrupteur, selon les procédures locales.
4. Ouvrir la porte du coffret.
5. Toujours utiliser un dispositif de détection de tension à valeur nominale appropriée sur toutes les cosses (bornes) du côté ligne et charge pour s'assurer que l'interrupteur est hors tension.

   REMARQUE : Ne retirer aucune pièce de l'interrupteur ou du mécanisme de fonctionnement sauf en cas d'instruction précise de le faire dans les procédures suivantes. Évacuer à l'aspirateur tous corps étrangers se trouvant à l'intérieur de l'interrupteur. Essuyer les pièces internes et l'intérieur du coffret à l'aide d'un chiffon mouillé, non pelucheux.
6. Inspecter visuellement l'interrupteur pour voir s'il y a des pièces ou de la quincaillerie désserrée :

   a. Resserrer la quincaillerie au besoin. Se reporter au schéma de câblage.
   b. Ne pas remettre l'interrupteur sous tension en présence de pièces usées ou abîmées. Les remplacer avant de remettre l'interrupteur sous tension.

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Parts Removal

1. Remove the arc supressor(s) or arc shield(s) from the switches by loosening the fastener(s) holding the suppressor(s) / shield(s) in place. See Figures 1 and 2.

Desmontaje de piezas

1. Retire el o los supresores o protectores de arco de los interruptores aflojando los sujetadores que los sostienen en su lugar. Vea las figuras 1 y 2.

Démontage des pièces

1. Retirer le ou les suppresseurs ou blindages d'arc des interrupteurs en desserrant les attaches qui les maintiennent en place. Voir les figures 1 et 2.

CAUTION / PRECAUCIÓN / ATTENTION

HAZARD OF EQUIPMENT DAMAGE

Do not disassemble the switch line base assembly or remove the blade rotor when cleaning the line-side jaw or the switch blade. See Figure 3 on page 4.

Failure to follow this instruction can result in equipment damage.

PELIGRO DE DAÑO AL EQUIPO

No desmonte el ensamble de la base de línea del interruptor o retire el rotor de cuchilla al limpiar la mordaza del lado de línea o la cuchilla del interruptor, vea la figura 3 en la página 4.

El incumplimiento de esta instrucción puede causar daño al equipo.

RISQUE DE DOMMAGES MATÉRIELS

Ne démontez pas l'assemblage de la base de ligne de l'interrupteur ou ne retirez pas le rotor à lame lorsque vous nettoyez la mâchoire côté ligne ou la lame de l'interrupteur. Voir la figure 3 à la page 4.

Si cette précaution n'est pas respectée, cela peut entraîner des dommages matériels.

2. Remove old grease and other contaminants from the line-side jaws and switchblades with a clean, lint-free cloth. If the lubricant has dried, remove it with CRC®-type HF Contact Cleaner, or equivalent, sprayed on a cloth.
3. Relubricate the cleaned areas with a thin film of Dow Corning® BG20 grease only.

   NOTE: Do not substitute any other lubricant. Other lubricants may not be suitable for electrical applications and could alter the performance of the switch. Dow Corning BG20 is available from Square D (part number SWLUB).
4. Exercise the operating mechanism to ensure proper operation by opening and closing the switch five times with the door closed. Open the switch blades.

2. Retire la grasa vieja y otros contaminantes de la mordaza del lado de línea y cuchillas del interruptor con una tela limpia sin pelusas. Si el lubricante se ha secado, retírelo con un limpiador de contacto CRC® tipo HF o uno equivalente, rociado en un pedazo de tela.
3. Vuelva a lubricar las áreas limpiadas con una capa delgada de grasa Dow Corning® BG20 solamente.

   NOTA: No utilice otro tipo de lubricante; es posible que no sean adecuados para aplicaciones eléctricas y pueden alterar el funcionamiento del interruptor. La grasa Dow Corning BG20 se encuentra disponible de Square D (número de pieza SWLUB).
4. Realice una prueba al mecanismo de funcionamiento y asegúrese de que funciona correctamente abriendo y cerrando el interruptor cinco veces con la puerta cerrada. Abra las cuchillas del interruptor.

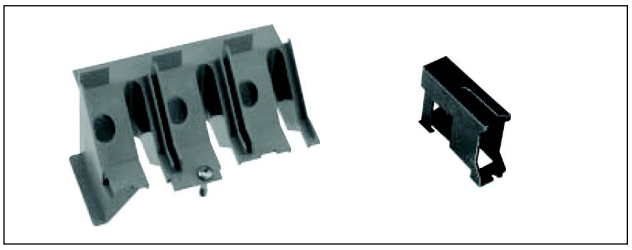
2. Retirer toute graisse ancienne et autres polluants des mâchoires côté ligne et des lames de l'interrupteur à l'aide d'un chiffon propre et non pelucheux. Si le lubrifiant a séché, l'enlever avec un nettoyant pour contact CRC® de type HF ou l'équivalent, vaporisé sur un chiffon.
3. Relubrifier les zones propres avec une fine pellicule de graisse Dow Corning® BG20 uniquement.

   REMARQUE : Ne substituer aucun autre lubrifiant. D'autres lubrifiants pourraient ne pas convenir pour des applications électriques et pourraient altérer le fonctionnement de l'interrupteur. Le Dow Corning BG20 est disponible chez Square D (n° de pièce SWLUB).
4. Manœuvrer le mécanisme de fonctionnement pour s'assurer qu'il fonctionne correctement, en ouvrant et fermant l'interrupteur cinq fois avec la porte fermée. Ouvrir les lames de l'interrupteur.

FIG. 1 : Examples of Arc Suppressors / Ejemplos de supresores de arco / Exemples de suppresseurs d'arc



FIG. 2 : Examples of Arc Shields / Ejemplos de protectores de arco / Exemples de blindages d'arc



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FIG. 3 : Examples of Line Base Assemblies / Ejemplos de ensambles de la base de línea / Exemples d'assemblages de la base de ligne

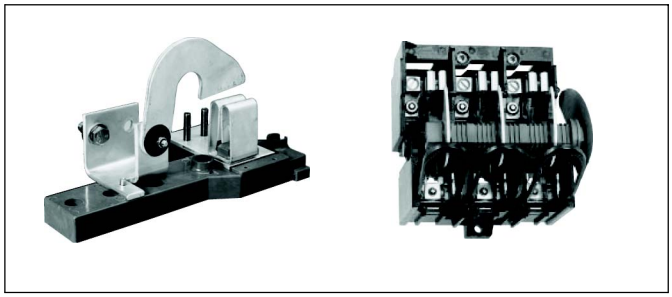
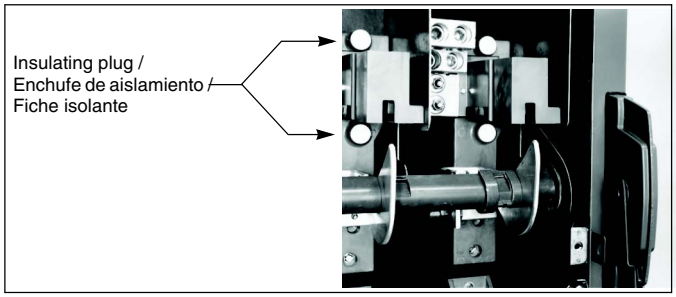


FIG. 4 : Insulating Plugs on Pole Unit / Enchufes de aislamiento en la unidad de polos / Fiches isolantes sur l'unité polaire



Parts Replacement

1. Reinstall the arc suppressor(s) or arc shield(s) according to the torque values in Table 2.
2. Ensure that the two insulating plugs in each phase (400–1200 A only) are firmly seated. See Figure 4.

Colocación de piezas

1. Vuelva a instalar el o los supresores o protectores de arco de acuerdo con los valores de par de apriete mostrados en la tabla 2.
2. Asegúrese de que los dos enchufes de aislamiento en cada fase (de 400 a 1 200 A solamente) estén bien apoyados, vea la figura 4.

Remise en place des pièces

1. Réinstaller le ou les suppresseurs ou blindages d'arc conformément aux valeurs de couple indiquées au tableau 2.
2. S'assurer que les deux fiches isolantes de chaque phase (400 à 1 200 A seulement) sont bien en place. Voir la figure 4.

Table / Tabla / Tableau 2 : Arc Suppressor Screw Torque Values / Valores de par de apriete del tornillo del supresor de arco / Valeurs de couple de serrage des vis des suppresseurs d'arc

Switch Type / Tipo de interruptor / Type d'interrupteur	Torque Value / Valor de par de apriete / Valeur de couple
30–100 A	5–10 lb-in / lbs-pulg / lb-po (0,57–1,13 N•m)
200 A, F Series / Serie F / Série F	10–20lb-in / lbs-pulg / lb-po (1,13–2,26 N•m)
200 A, E Series / Serie E / Série E	20–25 lb-in / lbs-pulg / lb-po (2,26–2,83 N•m)
400–800 A General Duty / 400 a 800 A de uso general / 400 à 800 A, universel	20–25 lb-in / lbs-pulg / lb-po (2,26–2,83 N•m)
400–1200 A Heavy Duty / 400 a 1 200 A de uso pesado / 400 à 1 200 A, service intensif	30–40 lb-in / lbs-pulg / lb-po (3,39–4,52 N•m)

RE-ENERGIZE THE SWITCH

1. Close and latch the door.
2. Turn off all downstream loads.
3. Turn on power supplying the switch.
4. Turn on the switch.
5. Turn on all downstream loads.

RE-ENERGIZACIÓN DEL INTERRUPTOR

1. Cierre y ponga seguro a la puerta.
2. Desconecte todas las cargas descendentes.
3. Energice el interruptor.
4. Coloque el interruptor en la posición de cerrado (I).
5. Conecte todas las cargas descendentes.

REMISE DE L'INTERRUPTEUR SOUS TENSION

1. Fermer la porte de l'interrupteur.
2. Mettre hors tension toutes les charges en aval.
3. Mettre l'interrupteur sous tension.
4. Mettre l'interrupteur en position de marche (I).
5. Mettre sous tension toutes les charges en aval.

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

Solamente el personal especializado deberá instalar, hacer funcionar y prestar servicios de mantenimiento al equipo eléctrico. Schneider Electric no asume responsabilidad alguna por las consecuencias emergentes de la utilización de este material.

Seul un personnel qualifié doit effectuer l'installation, l'utilisation, l'entretien et la maintenance du matériel électrique. Schneider Electric n'assume aucune responsabilité des conséquences éventuelles découlant de l'utilisation de cette documentation.

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EDB, EGB and EJB Circuit Breakers
Interruptores automáticos EDB, EGB y EJB
Disjoncteurs EDB, EGB et EJB

Retain for future use. / Conservar para uso futuro. / À conserver pour usage ultérieur.

⚠ DANGER / PELIGRO / DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

PELIGRO DE DESCARGA ELÉCTRICA, EXPLOSIÓN O DESTELLO POR ARQUEO

- Utilice equipo de protección personal (EPP) apropiado y siga las prácticas de seguridad eléctrica establecidas por su Compañía (consulte la norma NFPA 70E).
- Solamente el personal eléctrico especializado deberá instalar y prestar servicio de mantenimiento a este equipo.
- Desenergice el equipo antes de realizar cualquier trabajo en él.
- Siempre utilice un dispositivo detector de tensión nominal adecuado para confirmar la desenergización del equipo.
- Vuelva a colocar todos los dispositivos, las puertas y las cubiertas antes de volver a energizar el equipo.

El incumplimiento de estas instrucciones podrá causar la muerte o lesiones serias.

RISQUE D'ELECTROCUTION, D'EXPLOSION OU D'ECLAIR D'ARC

- Portez un équipement de protection personnel (ÉPP) approprié et observez les méthodes de travail électrique sécuritaire. Voir NFPA 70E.
- Seul un personnel qualifié doit effectuer l'installation et l'entretien de cet appareil.
- Coupez l'alimentation de l'appareil avant d'y travailler.
- Utilisez toujours un dispositif de détection de tension à valeur nominale appropriée pour s'assurer que l'alimentation est coupée.
- Replacez tous les dispositifs, les portes et les couvercles avant de mettre l'appareil sous tension.

Si ces précautions ne sont pas respectées, cela entraînera la mort ou des blessures graves.

CIRCUIT BREAKER INSTALLATION

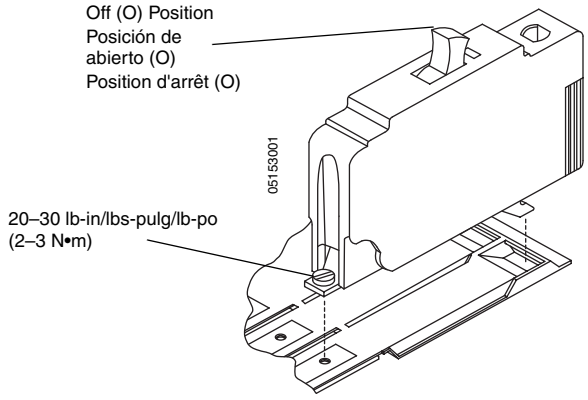
Turn off all power supplying this equipment before working on or inside equipment. Turn off circuit breaker.

INSTALACIÓN DEL INTERRUPTOR AUTOMÁTICO

Desenergice el equipo antes de realizar cualquier trabajo en él. Desconectar interruptor automático.

INSTALLATION DU DISJONCTEUR

Couper l'alimentation de l'appareil avant d'y travailler. Couper l'alimentation à disjoncteur.



WIRE INSTALLATION

INSTALACIÓN DE CABLES

INSTALLATION DES CÂBLES

CAUTION / PRECAUCIÓN / ATTENTION

HAZARD OF EQUIPMENT DAMAGE

Wire strands interfering with wire binding screws can cause false torque indication. Do not allow wire strands to interfere with threads of wire binding screws.

Failure to follow these instructions can result in equipment damage.

PELIGRO DE DAÑO AL EQUIPO

Los hilos del cable que interfieren con los tornillos de sujeción de cables pueden dar una indicación falsa de par de apriete. No permita que los hilos del cable interfieran con las roscas de los tornillos de sujeción de cables.

El incumplimiento de estas precauciones puede causar daño al equipo.

RISQUE DE DOMMAGES MATÉRIELS

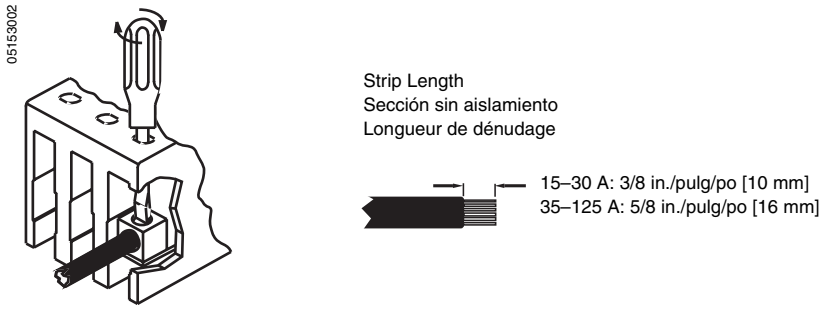
Les torons du conducteur interférant avec les vis de fixation de fils peuvent entraîner une indication erronée du couple. Ne laissez pas les torons du conducteur s'engager dans les filets des vis de fixation de fils.

Si ces précautions ne sont pas respectées, cela peut entraîner des dommages matériels.

See circuit breaker faceplate label or optional lug instructions for wire size and torque.

Consulte la etiqueta de la placa frontal del interruptor automático o las instrucciones que acompañan a las zapatas opcionales para obtener el calibre del cable y el par de apriete.

Voir l'étiquette de la plaque avant du disjoncteur ou les directives fournies avec les cosses optionnelles pour obtenir le calibre de fils et le couple.



CIRCUIT BREAKER REMOVAL

Remove circuit breaker in reverse order of installation.

DESMONTAJE DEL INTERRUPTOR AUTOMÁTICO

Desmonte el interruptor automático en el orden inverso al de la instalación.

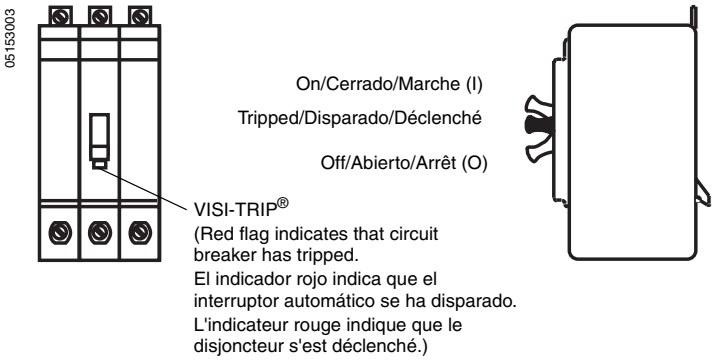
DÉMONTAGE DU DISJONCTEUR

Démonter le disjoncteur en ordre inverse de l'installation.

CIRCUIT BREAKER OPERATION

FUNCIONAMIENTO DEL INTERRUPTOR AUTOMÁTICO

FONCTIONNEMENT DU DISJONCTEUR



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ELECTRICAL ACCESSORIES

Options:

- Auxiliary switch/alarm switch package
- Shunt trip package
- Auxiliary switch/alarm switch/shunt trip package

1. Turn off all power supplying this equipment before working on or inside equipment. Turn off circuit breaker.
2. Use pull tab to remove connector from accessory receptacle.

ACCESORIOS ELÉCTRICOS

Opciones:

- Paquete de interruptor auxiliar e interruptor de alarma
- Paquete de disparo en derivación
- Paquete de interruptor auxiliar, interruptor de alarma y disparo en derivación

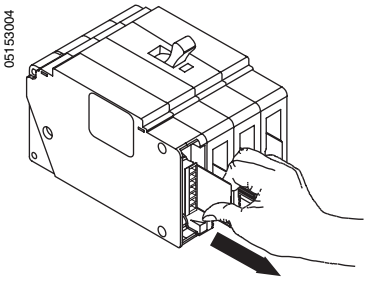
1. Desenergice el equipo antes de realizar cualquier trabajo en él. Descontar interuptor automático.
2. Utilice la lengüeta de extracción para retirar el conector del receptáculo del accesorio.

ACCESSOIRES ÉLECTRIQUES

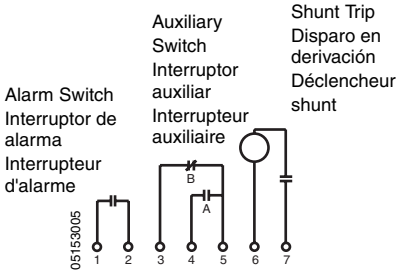
Options :

- Ensemble d'interrupteur auxiliaire/interrupteur d'alarme
- Ensemble de déclencheur shunt
- Ensemble d'interrupteur auxiliaire/interrupteur d'alarme/déclencheur shunt

1. Couper l'alimentation de l'appareil avant d'y travailler. Couper l'alimentation à disjoncteur.
2. Tirer sur la languette pour retirer le connecteur du réceptacle de l'accessoire.



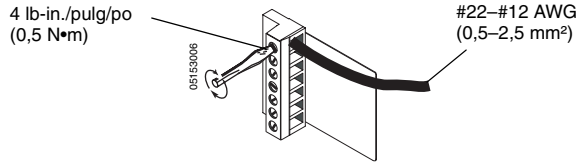
Factory-installed Electrical Accessories
Accesorios eléctricos instalados en la fábrica
Accessoires électriques installés en usine

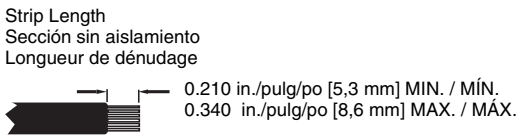


3. Insert connector wire(s) and tighten screws.

3. Inserte el(los) cable(s) del conector y apriete los tornillos.

3. Insérer le ou les fils du connecteur et serrer les vis.



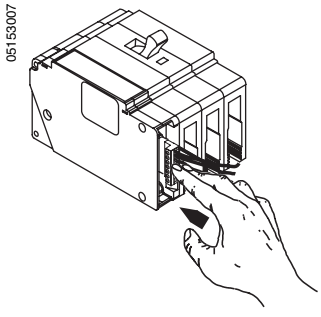


4. Replace connector in accessory receptacle

4. Vuelva a colocar el conector en el receptáculo del accesorio.

4. Replacer le connecteur dans le réceptacle de l'accessoire.

Table/Tabla/Tableau 1: Electrical Accessory Ratings/ Accesorio expecificaciones eléctricas/ Accessoire de valeur nominale électrique



Auxiliary Switch/Interruptor auxiliar/ Interrupteur auxiliaire	Alarm Switch/Interruptor de alarma/ Interrupteur d'alarme	Shunt Trip/Disparo en derivación/ Déclencheur shunt
Max. Load = 10 A @120 V~ 50/60 Hz Carga máx. = 10 A @120 V~ 50/60 Hz Charge max. = 10 A @120 V~ 50/60 Hz	Max. Load = 7 A @120 V~ 50/60 Hz Carga máx. = 7 A @120 V~ 50/60 Hz Charge max. = 7 A @120 V~ 50/60 Hz	Coil Burden Max. = 288 VA Minimum Recommended Supply Transformer = 50 VA Voltage = 120 V~ 50/60 Hz Carga máx. de la bobina = 288 VA Val. nom. mín. recomendado para el transformador de alimentación = 50 VA Tensión = 120 V~ 50/60 Hz Charge max. de la bobine = 288 VA Val. nom. min. recommandée pour le transformateur d'alimentation = 50 VA Tension = 120 V~ 50/60 Hz

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⚠ DANGER / PELIGRO / DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Troubleshooting may require energizing auxiliary devices with test power supply. Make sure that the power supply is OFF before connecting or disconnecting it to auxiliary device.
- Do not touch the terminals of the device during the test.

Failure to follow these instructions will result in death or serious injury.

PELIGRO DE DESCARGA ELÉCTRICA, EXPLOSIÓN O DESTELLO POR ARQUEO

- Utilice equipo de protección personal (EPP) apropiado y siga las prácticas de seguridad eléctrica establecidas por su Compañía (consulte la norma NFPA 70E).
- Solamente el personal eléctrico especializado deberá instalar y prestar servicio de mantenimiento a este equipo.
- Para realizar un diagnóstico de problemas es necesario energizar los dispositivos auxiliares con la fuente de alimentación de prueba. Asegúrese que la fuente de alimentación esté DESCONECTADA antes de conectar o desconectar el dispositivo auxiliar.
- No toque las terminales del dispositivo durante la prueba.

El incumplimiento de estas instrucciones podrá causar la muerte o lesiones serias.

RISQUE D'ELECTROCUTION, D'EXPLOSION OU D'ECLAIR D'ARC

- Portez un équipement de protection personnel (ÉPP) approprié et observez les méthodes de travail électrique sécuritaire. Voir NFPA 70E.
- Seul un personnel qualifié doit effectuer l'installation et l'entretien de cet appareil.
- Le dépannage peut nécessiter l'activation de dispositifs auxiliaires avec une alimentation d'essai. Assurez-vous que l'alimentation est désactivée (OFF) avant tout branchement ou débranchement avec le dispositif auxiliaire.
- Ne touchez pas aux bornes du dispositif penant l'essai.

Si ces précautions ne sont pas respectées, cela entraînera la mort ou des blessures graves.

TROUBLESHOOTING

If problems occur during installation, refer to the following guide. If trouble persists, contact the local field office.

REPARACIÓN DE AVERÍAS

En caso de que suceda algún problema durante la instalación, consulte la guía a continuación. Si el problema persiste, póngase en contacto con la oficina local.

DÉPANNAGE

Si des problèmes surviennent pendant l'installation, se reporter aux consignes suivantes. Si les problèmes persistent, contacter le bureau de service local.

CONDITION/CONDICION/CONDITION	POSSIBLE CAUSES/CAUSAS POSIBLES/CAUSES POSSIBLES	SOLUTION/SOLUCION/SOLUTION
Circuit breaker fails to stay closed. El interruptor automático no permanece cerrado. Le disjoncteur ne reste pas fermé.	1. Shunt trip energized. El disparo en derivación está energizado. Déclencheur shunt est sous tension. 2. Short circuit or overload on system. Existe un cortocircuito o sobrecarga en el sistema. Court-circuit ou surcharge dans le système.	1. De-energize shunt trip. Desenergice el disparo en derivación. Mettre le déclencheur shunt hors tension. 2. Check system for short circuit or overload. Revise el sistema para ver si encuentra un cortocircuito o una sobrecarga. Rechercher un court-circuit ou une surcharge dans le système.
Electrical accessories fail to operate or operate intermittently. Los accesorios eléctricos no funcionan o su funcionamiento es inconsistente. Les accessoires électriques ne fonctionnent pas ou fonctionnent d'une façon intermittente.	1. Connector has become partially or fully disengaged from receptacle. El conector se ha desenganchado parcial o completamente del receptáculo. Le connecteur s'est partiellement ou entièrement débra 2. Control wires have become disconnected from connector or the connection has become loose. Los cables de control se han desconectado del conector o la conexión se ha aflojado. Les fils de commande se sont détachés du connecteur ou la connexion est devenue lâche.nché du réceptacle.	1. Reinsert connector into receptacle. Vuelva a insertar el conector en el receptáculo. Réintroduire le connecteur dans le réceptacle. 2. Check for loose or disconnected control wires. Revise el sistema para ver si encuentra cables de control sueltos o desconectados. Rechercher des fils de commande lâches ou débranchés.

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Solamente el personal especializado deberá instalar, hacer funcionar y prestar servicios de mantenimiento al equipo eléctrico. Schneider Electric no asume responsabilidad alguna por las consecuencias emergentes de la utilización de este material.

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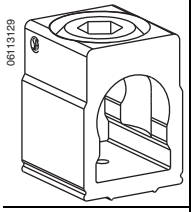
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Replaces / Reemplaza / Remplace 48940-221-02 ECN909D, 11/2008

Mechanical Lug Kits for H- and J-Frame Molded Case Circuit Breakers
Kits de zapatas mecánicas para los interruptores automáticos en caja moldeada marcos H y J
Kits de cosses mécaniques pour disjoncteurs à boîtier moulé à châssis H et J

Retain for future use. / Conservar para uso futuro. / À conserver pour usage ultérieur.

Table / Tabla / Tableau 1 : Lug Information / Información de zapatas / Renseignements sur les cosses

Lug / Zapata / Cosse	Catalog No. / Número de catálogo / Nº de catalogue	Lugs per Kit / Zapatas por kit / Cosses par kit	Frame / Marco / Châssis	Ampere Range / Gama en A / Gamme (A)	Conductor / Conductor / Conducteur				Wire Binding Screw Torque / Par de apriete del tornillo de sujeción del cable / Couple de la vis de fixation du fil
					Type / Tipo / Type	Number Per Lug / Cantidad por zapata / Nombre par cosses	Wire Range / Calibre del cable / Calibre des fils	Strip Length / Sección sin aislamiento / Longueur de dénudage	
 06113127	AL150HD, AL150HDS	3	HD, HG, HJ, HL	15–150	Al/Cu	1	14–10 AWG (2,5–6 mm²)	.65 in. / pulg / po (16 mm)	50 lb-in / lbs-pulg / lb-po (5 N•m)
						1	8–3/0 AWG (10–95 mm²)	.65 in. / pulg / po (16 mm)	120 lb-in / lbs-pulg / lb-po (14 N•m)
 06113128	CU150HD	3	HD, HG, HJ, HL	15–150	Cu	1	14–2/0 AWG (2,5–70 mm²)	.65 in. / pulg / po (16 mm)	120 lb-in / lbs-pulg / lb-po (14 N•m)
 06113129	AL175JD	3	JD, JG, JJ, JL	150–175	Al/Cu	1	4–4/0 AWG (20–95 mm²)	1 in. / pulg / po (25 mm)	225 lb-in / lbs-pulg / lb-po (26 N•m)
 06113130	AL250JD	3	JD, JG, JJ, JL	200–250	Al/Cu	1	3/0–350 kcmil (120–185 mm²)	1 in. / pulg / po (25 mm)	225 lb-in / lbs-pulg / lb-po (26 N•m)
 06113131	CU250JD	3	JD, JG, JJ, JL	150–250	Cu	1	1/0–300 kcmil (50–185 mm²)	1 in. / pulg / po (25 mm)	250 lb-in / lbs-pulg / lb-po (28 N•m)

Necessary Tools

Screwdriver, long-shanked slotted

Torque Wrench:

- 3/16 in. for AL150HD and CU150HD lug kits
- 5/32 in. (4 mm) for AL150HDS lug kits
- 5/16 in. (8 mm) for AL175JD, AL250JD and CU250JD lug kits

Herramientas necesarias

Destornillador de punta plana y cuerpo largo

Llave de apriete prefijado:

- de 5 mm (3/16 pulg) para los kits de zapatas AL150HD y CU150HD
- de 4 mm (5/32 pulg) para los kits de zapatas AL150HDS
- de 8 mm (5/16 pulg) para los kits de zapatas AL175JD, AL250JD y CU250JD

Outils nécessaires

Tournevis plat à longue tige

Clé dynamométrique :

- 5 mm (3/16 po) pour les kits de cosses AL150HD et CU150HD
- 4 mm (5/32 po) pour les kits de cosses AL150HDS
- 8 mm (5/16 po) pour les kits de cosses AL175JD, AL250JD et CU250JD

Installation

Instalación

Installation

⚠ DANGER / PELIGRO / DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

PELIGRO DE DESCARGA ELÉCTRICA, EXPLOSIÓN O DESTELLO POR ARQUEO

- Utilice equipo de protección personal (EPP) apropiado y siga las prácticas de seguridad en trabajos eléctricos establecidas por su Compañía, consulte la norma 70E de NFPA/Z462 de CSA y NOM-029-STPS.
- Solamente el personal eléctrico especializado deberá instalar y prestar servicio de mantenimiento a este equipo.
- Desenergice el equipo antes de realizar cualquier trabajo en él.
- Siempre utilice un dispositivo detector de tensión nominal adecuado para confirmar la desenergización del equipo.
- Vuelva a colocar todos los dispositivos, las puertas y las cubiertas antes de volver a energizar el equipo.

El incumplimiento de estas instrucciones podrá causar la muerte o lesiones serias.

RISQUE D'ÉLECTROCUTION, D'EXPLOSION OU D'ÉCLAIR D'ARC

- Portez un équipement de protection personnelle (ÉPP) approprié et observez les méthodes de travail électrique sécuritaire. Voir NFPA 70E ou CSA Z462.
- Seul un personnel qualifié doit effectuer l'installation et l'entretien de cet appareil.
- Coupez l'alimentation de l'appareil avant d'y travailler.
- Utilisez toujours un dispositif de détection de tension à valeur nominale appropriée pour s'assurer que l'alimentation est coupée.
- Replacez tous les dispositifs, les portes et les couvercles avant de mettre l'appareil sous tension.

Si ces directives ne sont pas respectées, cela entraînera la mort ou des blessures graves.

1. Turn off all power supplying this equipment before working on or inside equipment.
2. Verify circuit breaker is in off or tripped position.
3. Remove circuit breaker from enclosure, if installed.

1. Desenergice el equipo antes de realizar cualquier trabajo en él.
2. Asegúrese de que el interruptor esté en la posición de disparado o abierto (O).
3. Retire el interruptor automático del gabinete, si está instalado.

1. Couper l'alimentation de l'appareil avant d'y travailler.
2. S'assurer que le disjoncteur est en position d'arrêt (O) ou de déclenché.
3. Enlever le disjoncteur du coffret, s'il est installé.

Lug Installation

1. If installed, remove existing terminal plate assembly from circuit breaker using slotted screwdriver.

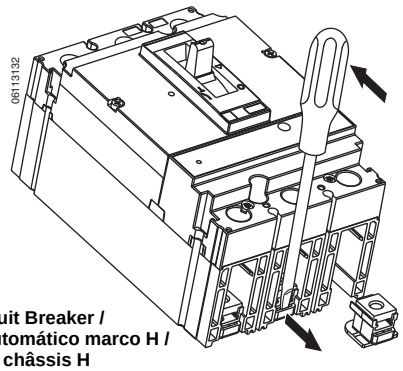
Instalación del ensamble de zapatas

1. Si está instalada, retire el ensamble de placa terminal existente del interruptor utilizando un destornillador de punta plana.

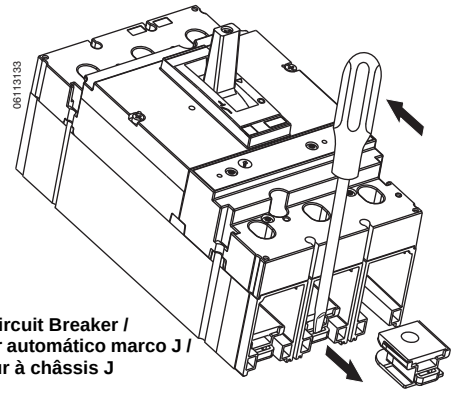
Installation de l'assemblage de cosses

1. S'il a été installé, retirer l'assemblage de plaque de bornes existant du disjoncteur à l'aide d'un tournevis plat.

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H-Frame Circuit Breaker /
Interruptor automático marco H /
Disjoncteur à châssis H

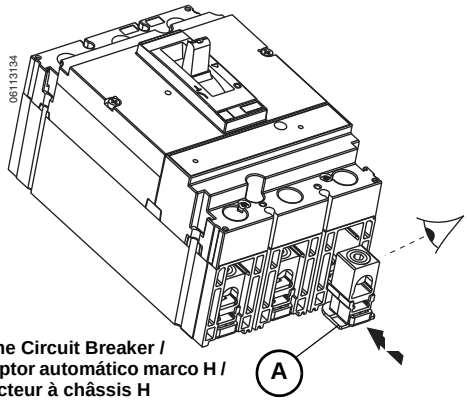


J-Frame Circuit Breaker /
Interruptor automático marco J /
Disjoncteur à châssis J

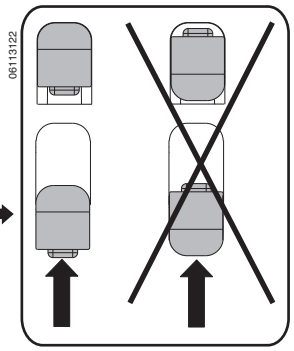
2. Install new lug assembly in circuit breaker. Align curved edge (A) of plastic lug retainer with curved edge of circuit breaker lug slot and snap into place.

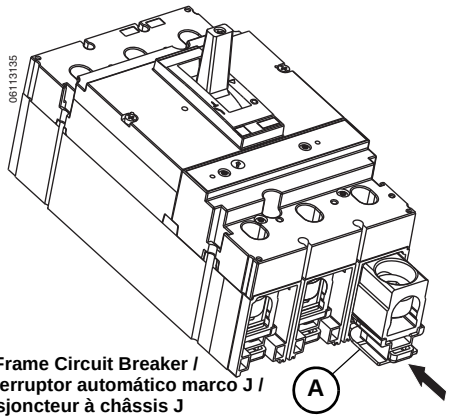
2. Instale el ensamble de zapatas nuevo en el interruptor. Alinee el reborde curvado (A) del retén de plástico de la zapata con el reborde curvado de la ranura de la zapata del interruptor y encaje en su lugar.

2. Installer le nouvel assemblage de cosses dans le disjoncteur. Aligner le bord recourbé (A) du dispositif de retenue des cosses en plastique avec le bord recourbé de la fente pour cosse du disjoncteur et emboîter en place.



H-Frame Circuit Breaker /
Interruptor automático marco H /
Disjoncteur à châssis H





J-Frame Circuit Breaker /
Interruptor automático marco J /
Disjoncteur à châssis J

Conductor Connections | Conexiones de los conductores | Raccordements des conducteurs

NOTICE / AVISO / AVIS

HAZARD OF FALSE TORQUE INDICATION

Do not allow conductor strands to interfere with threads of wire binding screw.

HAZARD OF OVERHEATING OR WIRE DISCONNECTION DURING SHORT CIRCUIT

Existing lug information may include incorrect wire torque for this lug. Install lug information label supplied with this kit over existing lug information.

Failure to follow these instructions can result in equipment damage.

PELIGRO DE INDICACIÓN FALSA DE PAR DE APRIETE

No permita que los hilos del conductor interfieran con las roscas del tornillo de sujeción del cable.

PELIGRO DE SOBRECALENTAMIENTO O DESCONEXIÓN DEL CABLE DURANTE UN CORTOCIRCUITO

La información de la zapata existente puede incluir un valor incorrecto de par de apriete del cable para esta zapata. Instale la etiqueta de datos de la zapata incluida con este kit sobre la etiqueta existente.

El incumplimiento de estas instrucciones puede causar daño al equipo.

RISQUE D'INDICATION ERRONÉE DU COUPLE

Ne laissez pas les torons du conducteur s'engager dans les filets de la vis de fixation.

RISQUE DE SURCHAUFFE OU DE DÉCONNEXION DE FILS DURANT UN COURT-CIRCUIT

Les informations existantes sur les cosses peuvent comprendre un couple de fil incorrect pour cette cosse. Installez l'étiquette de données sur les cosses fournies avec ce kit par-dessus celle existante.

Si ces directives ne sont pas respectées, cela peut entraîner des dommages matériels.

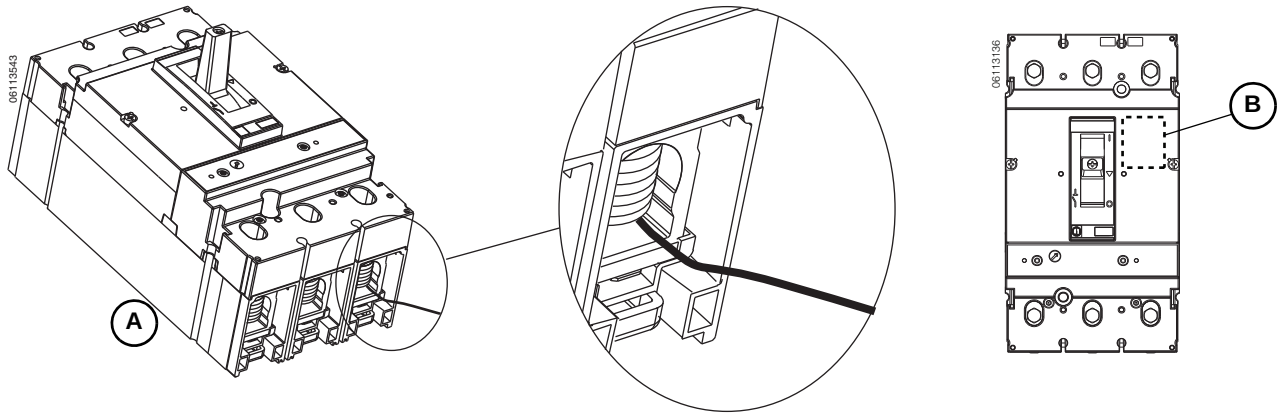
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1. Square conductor ends and preform conductors to final configuration. Using a proper insulation stripping tool, strip conductor ends as recommended in Table 1. Do not nick strands.
2. Install cables and tighten wire-binding screw as recommended in Table 1.
   - — Wire larger than 12 AWG may be installed in center of channel.
   - — Install smaller wire (14–12 AWG) on the side of channel (A) on all lugs as shown in Figure 1, to avoid damage to wire.
3. Install appropriate new lug data label (B), included in lug kit, over existing lug data on circuit breaker.

1. Corte las puntas de los conductores en forma cuadrada y prefórmelos en la configuración final. Con una herramienta de desforramiento adecuada, pele las puntas de los conductores según la recomendación de la tabla 1. Tenga cuidado de no dañar los hilos.
2. Instale los cables y apriete los tornillos de sujeción según las recomendaciones de la tabla 1.
   - — Es posible instalar un conductor más grande que 3,31 mm^2 (12 AWG) en el centro del canal.
   - — Instale el conductor más pequeño de 2,08 a 3,31 mm^2 (14 a 12 AWG) en el costado del canal (A) en todas las zapatas para no dañar el conductor (vea la figura 1).
3. Instale la nueva etiqueta de datos de las zapatas (B), incluida con el kit de zapata, sobre la etiqueta existente en el interruptor automático.

1. Couper les extrémités des conducteurs bien droit et leur donner leur configuration définitive. Au moyen d'un outil à dénuder l'isolation approprié, dénuder les extrémités des conducteurs comme recommandé au tableau 1. Ne pas entailler les torons.
2. Installer les câbles et serrer les vis de fixation des fils comme recommandé au tableau 1.
   - — Du fil d'un calibre plus gros que 3,31 mm^2 (12 AWG) peut être installé au centre du profilé.
   - — Installer le fil plus petit (calibre 2,08 à 3,31 mm^2 [14 à 12 AWG]) sur le côté du profilé (A), sur toutes les cosses pour éviter d'endommager les fils (voir la figure 1).
3. Installer la nouvelle étiquette de données des cosses (B), comprise avec le kit, sur les données de cosses existantes du disjoncteur.

Figure / Figura / Figure 1 :



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Terminating the Communications Link

For proper RS-485 communications performance, you must terminate the last device on the communications link using one of these methods:

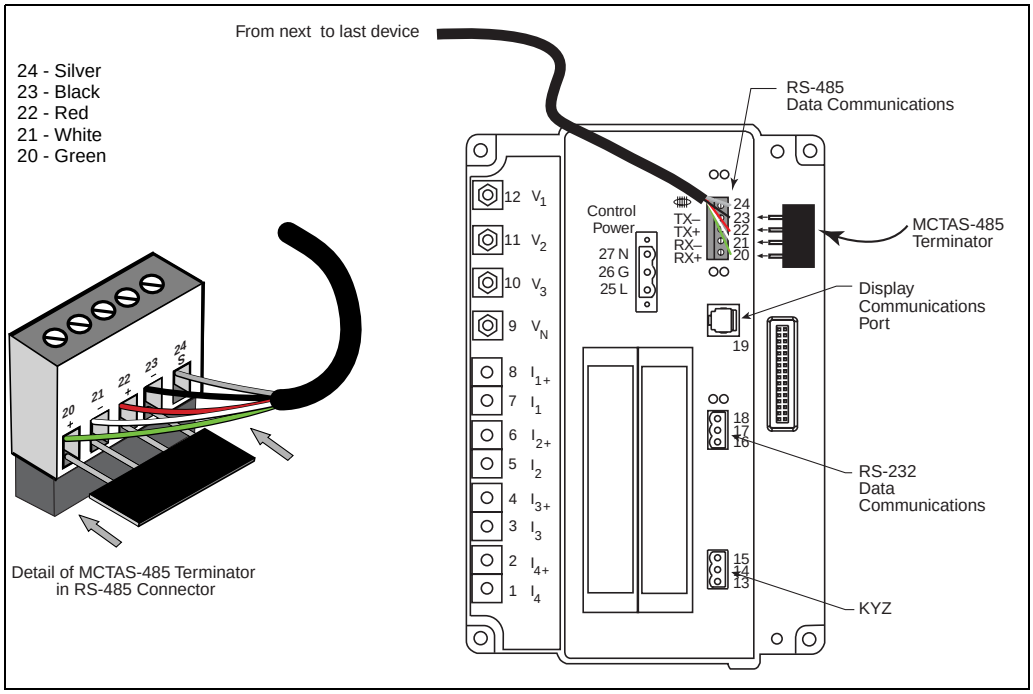
- Use the MCTAS-485 terminator, which inserts directly into the connector in the RS-485 port of the circuit monitor/power meter as illustrated in Figure 6–7.
- Use a terminal block and the MCT-485 terminator. In this method, communications wires route from the last device on a daisy chain to a 5-position terminal block. The terminator attaches to the terminal block. See Figure 6–8.

- Terminate **only the last device** on the link. If a link has only one device, terminate that device.
- Some PowerLogic devices use a removable communications connector. If the last device on the communications link is not a circuit monitor/power meter, refer to the instruction bulletin for that device for termination instructions.

Using the MCTAS-485 Terminator

To terminate the circuit monitor/power meter using the MCTAS-485 terminator, insert the wires of the terminator directly into terminals 20, 21, 22, and 23 of the RS-485 communications connector on the circuit monitor/power meter as shown in Figure 6–7.

Figure 6–7: Terminating the circuit monitor/power meter using the MCTAS-485 terminator



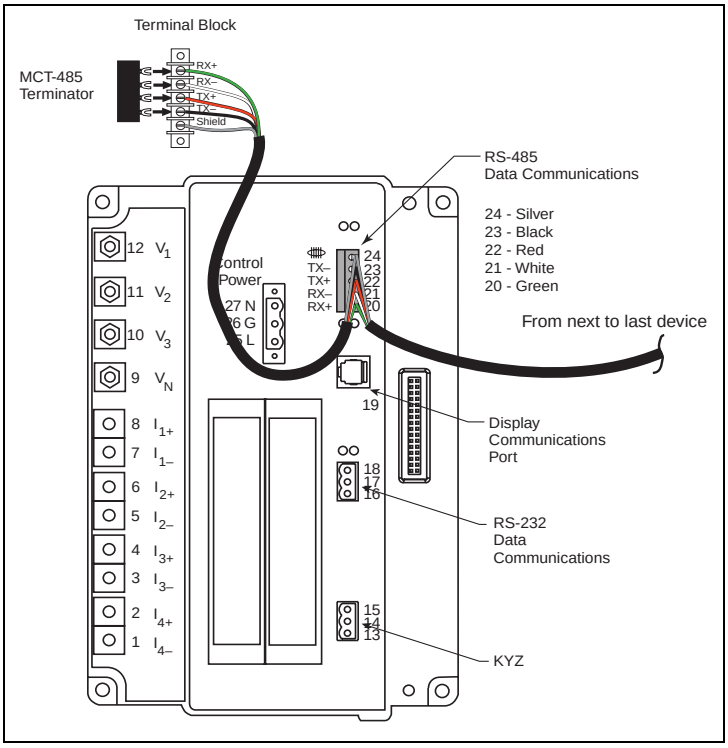
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Using the MCT-485 Terminator

If the circuit monitor/power meter is the last device on the communication link, follow these instructions to terminate it using the MCT-485 terminator:

1. Route the communications wires from the last circuit monitor/power meter on a daisy chain to a 5-position terminal block.
2. Attach the terminator to the terminal block as shown in Figure 6–8.

Figure 6–8: Terminating the circuit monitor/power meter using the MCT-485 terminator and a terminal block



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Schneider Electric Product Registration

Register today in **one easy step** to receive valuable benefits!

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> **Save** on Spare Parts

Minimize downtime and save money by having spare parts available when you need them.
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Without a proper maintenance strategy for your electrical distribution equipment, it's just a matter of time before costly breakdowns will occur. Having an Advantage Service Plan in place minimizes unplanned outages and remedial actions. Should an issue arise, we will ensure prompt response to get you back up and running. Best of all, our fixed-cost service plans take the guess-work out of your budget since there are no hidden charges.

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[1] Only applicable if Schneider Electric Field Services provide start-up and commissioning services.

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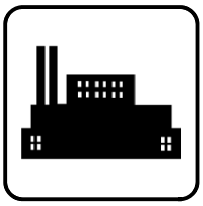
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California Proposition 65

⚠ WARNING

Engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

California Proposition 65

⚠ WARNING

This product contains and/or emits chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

California Proposition 65

⚠ WARNING

Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

- Always start and operate the engine in a well-ventilated area.
- If in an enclosed area, vent the exhaust to the outside.
- Do not modify or tamper with exhaust system.
- Do not idle the engine except as necessary.
  For more information go to www.P65warnings.ca.gov/diesel

Product Identification Information

Product identification numbers determine service parts. Record the product identification numbers in the spaces below immediately after unpacking the products so that the numbers are readily available for future reference. Record field-installed kit numbers after installing the kits.

Generator Set Identification Numbers

Record the product identification numbers from the generator set nameplate(s).

Model Designation _____

Specification Number _____

Serial Number _____

Accessory Number	Accessory Description

Controller Identification

Record the controller description from the generator set operation manual, spec sheet, or sales invoice.

Controller Description _____

Engine Identification

Record the product identification information from the engine nameplate.

Manufacturer _____

Model Designation _____

Serial Number _____

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IMPORTANT SAFETY INSTRUCTIONS. Electromechanical equipment, including generator sets, transfer switches, switchgear, and accessories, can cause bodily harm and pose life-threatening danger when improperly installed, operated, or maintained. To prevent accidents be aware of potential dangers and act safely. Read and follow all safety precautions and instructions. SAVE THESE INSTRUCTIONS.

This manual has several types of safety precautions and instructions: Danger, Warning, Caution, and Notice.

DANGER

Danger indicates the presence of a hazard that ***will cause severe personal injury, death***, or ***substantial property damage***.

WARNING

Warning indicates the presence of a hazard that ***can cause severe personal injury, death,*** or ***substantial property damage***.

CAUTION

Caution indicates the presence of a hazard that ***will*** or ***can cause minor personal injury*** or ***property damage***.

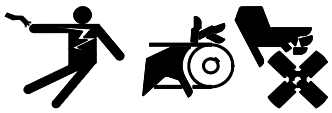
NOTICE

Notice communicates installation, operation, or maintenance information that is safety related but not hazard related.

Safety decals affixed to the equipment in prominent places alert the operator or service technician to potential hazards and explain how to act safely. The decals are shown throughout this publication to improve operator recognition. Replace missing or damaged decals.

Accidental Starting

WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

(Decision-Maker® 3+ and 550 Controllers)

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

(Decision-Maker® 3000, 3500, and 6000 Controllers)

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) If the controller is not already in the MAN (manual) mode, press the Controller Mode button and then press the MAN mode button. (2) If the generator set is running, press and hold the Manual–Stop button for at least 2 seconds to stop the generator set. (3) Press the Controller Mode button and then press the controller Off mode button. (4) Disconnect the power to the battery charger, if equipped. (5) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

(Decision-Maker® 8000 Controller)

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Shut down the generator set. (2) Place the controller in Out of Service mode. (3) Press the emergency stop button. (4) Disconnect the power to the battery charger, if equipped. (5) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

(APM802 Controller)

Battery

⚠ WARNING



Sulfuric acid in batteries.
Can cause severe injury or death.

Wear protective goggles and clothing. Battery acid may cause blindness and burn skin.

⚠ WARNING



Explosion.
Can cause severe injury or death.
Relays in the battery charger cause arcs or sparks.

Locate the battery in a well-ventilated area. Isolate the battery charger from explosive fumes.

Battery electrolyte is a diluted sulfuric acid. Battery acid can cause severe injury or death. Battery acid can cause blindness and burn skin. Always wear splashproof safety goggles, rubber gloves, and boots when servicing the battery. Do not open a sealed battery or mutilate the battery case. If battery acid splashes in the eyes or on the skin, immediately flush the affected area for 15 minutes with large quantities of clean water. Seek immediate medical aid in the case of eye contact. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.

Battery acid cleanup. Battery acid can cause severe injury or death. Battery acid is electrically conductive and corrosive. Add 500 g (1 lb.) of bicarbonate of soda (baking soda) to a container with 4 L (1 gal.) of water and mix the neutralizing solution. Pour the neutralizing solution on the spilled battery acid and continue to add the neutralizing solution to the spilled battery acid until all evidence of a chemical reaction (foaming) has ceased. Flush the resulting liquid with water and dry the area.

Battery gases. Explosion can cause severe injury or death. Battery gases can cause an explosion. Do not smoke or permit flames or sparks to occur near a battery at any time, particularly when it is charging. Do not dispose of a battery in a fire. To prevent burns and sparks that could cause an explosion, avoid touching the battery terminals with tools or other metal objects. Remove all jewelry before servicing the equipment. Discharge static electricity from your body before touching batteries by first touching a grounded metal surface away from the battery. To avoid sparks, do not disturb the battery charger connections while the battery is charging. Always turn the battery charger off before disconnecting the battery connections. Ventilate the compartments containing batteries to prevent accumulation of explosive gases.

Battery short circuits. Explosion can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Disconnect the battery before generator set installation or maintenance. Remove all jewelry before servicing the equipment. Use tools with insulated handles. Remove the negative (–) lead first when disconnecting the battery. Reconnect the negative (–) lead last when reconnecting the battery. Never connect the negative (–) battery cable to the positive (+) connection terminal of the starter solenoid. Do not test the battery condition by shorting the terminals together.

Engine Backfire/Flash Fire

⚠ WARNING



Risk of fire.
Can cause severe injury or death.

Do not smoke or permit flames or sparks near fuels or the fuel system.

Servicing the fuel system. A flash fire can cause severe injury or death. Do not smoke or permit flames or sparks near the fuel mixer, fuel line, fuel filter, or other potential sources of fuel vapors. When removing the fuel line or fuel system be aware that liquid propane can cause frostbite on contact.

(Gas-fueled Model)

Servicing the fuel system. A flash fire can cause severe injury or death. Do not smoke or permit flames or sparks near the fuel injection system, fuel line, fuel filter, fuel pump, or other potential sources of spilled fuels or fuel vapors. Catch fuels in an approved container when removing the fuel line or fuel system.

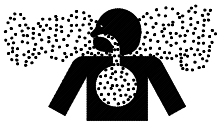
(Diesel-fueled Model)

Servicing the air cleaner. A sudden backfire can cause severe injury or death. Do not operate the generator set with the air cleaner removed.

Combustible materials. A fire can cause severe injury or death. Generator set engine fuels and fuel vapors are flammable and explosive. Handle these materials carefully to minimize the risk of fire or explosion. Equip the compartment or nearby area with a fully charged fire extinguisher. Select a fire extinguisher rated ABC or BC for electrical fires or as recommended by the local fire code or an authorized agency. Train all personnel on fire extinguisher operation and fire prevention procedures.

Exhaust System

⚠ WARNING



Carbon monoxide.
Can cause severe nausea, fainting, or death.

The exhaust system must be leakproof and routinely inspected.

Generator set operation. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Avoid breathing exhaust fumes when working on or near the generator set. Never operate the generator set inside a building unless the exhaust gas is piped safely outside. Never operate the generator set where exhaust gas could accumulate and seep back inside a potentially occupied building.

Carbon monoxide symptoms. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is a poisonous gas present in exhaust gases. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Carbon monoxide poisoning symptoms include but are not limited to the following:

- Light-headedness, dizziness
- Physical fatigue, weakness in joints and muscles
- Sleepiness, mental fatigue, inability to concentrate or speak clearly, blurred vision
- Stomachache, vomiting, nausea

If experiencing any of these symptoms and carbon monoxide poisoning is possible, seek fresh air immediately and remain active. Do not sit, lie down, or fall asleep. Alert others to the possibility of carbon monoxide poisoning. Seek medical attention if the condition of affected persons does not improve within minutes of breathing fresh air.

Fuel System

⚠ WARNING



Explosive fuel vapors.
Can cause severe injury or death.

Use extreme care when handling, storing, and using fuels.

⚠ WARNING



Avoid high pressure fluids.
Can cause severe injury or death.

Do not work on high pressure fuel or hydraulic systems without protective equipment to protect hands, eyes, and body. Avoid the hazard by relieving pressure before disconnecting fuel injection pressure lines. Search for leaks using a piece of cardboard. Always protect hands, eyes, and body from high pressure fluids. If an accident occurs, seek medical attention immediately.

The fuel system. Explosive fuel vapors can cause severe injury or death. Vaporized fuels are highly explosive. Use extreme care when handling and storing fuels. Store fuels in a well-ventilated area away from spark-producing equipment and out of the reach of children. Never add fuel to the tank while the engine is running because spilled fuel may ignite on contact with hot parts or from sparks. Do not smoke or permit flames or sparks to occur near sources of spilled fuel or fuel vapors. Keep the fuel lines and connections tight and in good condition. Do not replace flexible fuel lines with rigid lines. Use flexible sections to avoid fuel line breakage caused by vibration. Do not operate the generator set in the presence of fuel leaks, fuel accumulation, or sparks. Repair fuel systems before resuming generator set operation.

Explosive fuel vapors can cause severe injury or death. Take additional precautions when using the following fuels:

Gasoline—Store gasoline only in approved red containers clearly marked GASOLINE.

Propane (LPG)—Adequate ventilation is mandatory. Because propane is heavier than air, install propane gas detectors low in a room. Inspect the detectors per the manufacturer's instructions.

Natural Gas—Adequate ventilation is mandatory. Because natural gas rises, install natural gas detectors high in a room. Inspect the detectors per the manufacturer's instructions.

Fuel tanks. Explosive fuel vapors can cause severe injury or death. Gasoline and other volatile fuels stored in day tanks or subbase fuel tanks can cause an explosion. Store only diesel fuel in tanks.

Draining the fuel system. Explosive fuel vapors can cause severe injury or death. Spilled fuel can cause an explosion. Use a container to catch fuel when draining the fuel system. Wipe up spilled fuel after draining the system.

Gas fuel leaks. Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Check the LPG vapor or natural gas fuel system for leakage by using a soap and water solution with the fuel system test pressurized to 6–8 ounces per square inch (10–14 inches water column). Do not use a soap solution containing either ammonia or chlorine because both prevent bubble formation. A successful test depends on the ability of the solution to bubble.

LPG liquid withdrawal fuel leaks. Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Check the LPG liquid withdrawal fuel system for leakage by using a soap and water solution with the fuel system test pressurized to at least 90 psi (621 kPa). Do not use a soap solution containing either ammonia or chlorine because both prevent bubble formation. A successful test depends on the ability of the solution to bubble.

Hazardous Noise

⚠ CAUTION



Hazardous noise.
Can cause hearing loss.

Never operate the generator set without a muffler or with a faulty exhaust system.

Engine noise. Hazardous noise can cause hearing loss. Generator sets not equipped with sound enclosures can produce noise levels greater than 105 dBA. Prolonged exposure to noise levels greater than 85 dBA can cause permanent hearing loss. Wear hearing protection when near an operating generator set.

Hazardous Voltage/ Moving Parts

⚠ DANGER



Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

⚠ WARNING





Hazardous voltage. Moving parts.
Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

⚠ WARNING



Hazardous voltage.
Backfeed to the utility system can cause property damage, severe injury, or death.

If the generator set is used for standby power, install an automatic transfer switch to prevent inadvertent interconnection of standby and normal sources of supply.

⚠ CAUTION



Welding the generator set.
Can cause severe electrical equipment damage.

Never weld components of the generator set without first disconnecting the battery, controller wiring harness, and engine electronic control module (ECM).

Servicing the generator set when it is operating. Exposed moving parts can cause severe injury or death. Keep hands, feet, hair, clothing, and test leads away from the belts and pulleys when the generator set is running. Replace guards, screens, and covers before operating the generator set.

Grounding electrical equipment. Hazardous voltage can cause severe injury or death. Electrocution is possible whenever electricity is present. Ensure you comply with all applicable codes and standards. Electrically ground the generator set, transfer switch, and related equipment and electrical circuits. Turn off the main circuit breakers of all power sources before servicing the equipment. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

Welding on the generator set. Can cause severe electrical equipment damage. Before welding on the generator set perform the following steps: (1) Remove the battery cables, negative (–) lead first. (2) Disconnect all engine electronic control module (ECM) connectors. (3) Disconnect all generator set controller and voltage regulator circuit board connectors. (4) Disconnect the engine battery-charging alternator connections. (5) Attach the weld ground connection close to the weld location.

Installing the battery charger. Hazardous voltage can cause severe injury or death. An ungrounded battery charger may cause electrical shock. Connect the battery charger enclosure to the ground of a permanent wiring system. As an alternative, install an equipment grounding conductor with circuit conductors and connect it to the equipment grounding terminal or the lead on the battery charger. Install the battery charger as prescribed in the equipment manual. Install the battery charger in compliance with local codes and ordinances.

Connecting the battery and the battery charger. Hazardous voltage can cause severe injury or death. Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

Engine block heater. Hazardous voltage can cause severe injury or death. The engine block heater can cause electrical shock. Remove the engine block heater plug from the electrical outlet before working on the block heater electrical connections.

Electrical backfeed to the utility. Hazardous backfeed voltage can cause severe injury or death. Install a transfer switch in standby power installations to prevent the connection of standby and other sources of power. Electrical backfeed into a utility electrical system can cause severe injury or death to utility personnel working on power lines.

Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically.
(600 volts and under)

Heavy Equipment

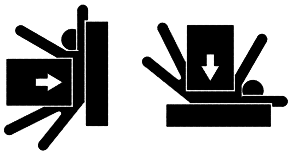
⚠ WARNING



Unbalanced weight.
Improper lifting can cause severe injury or death and equipment damage.

Do not use lifting eyes.
Lift the generator set using lifting bars inserted through the lifting holes on the skid.

⚠ WARNING



Unbalanced and elevated weight.
Improper lifting can cause severe injury or death and equipment damage.

Do not lift the generator set from the engine or alternator eyes. Never stand under a unit being lifted. Always maintain a safe distance from the unit being lifted.
See the lifting instructions in the installation manual that was provided with the unit.

Hot Parts

⚠ WARNING



Hot coolant and steam.
Can cause severe injury or death.

Before removing the pressure cap, stop the generator set and allow it to cool. Then loosen the pressure cap to relieve pressure.

⚠ WARNING



Hot engine and exhaust system.
Can cause severe injury or death.

Do not work on the generator set until it cools.

Servicing the exhaust system. Hot parts can cause severe injury or death. Do not touch hot engine parts. The engine and exhaust system components become extremely hot during operation.

Servicing the engine heater. Hot parts can cause minor personal injury or property damage. Install the heater before connecting it to power. Operating the heater before installation can cause burns and component damage. Disconnect power to the heater and allow it to cool before servicing the heater or nearby parts.

Notice

NOTICE

This generator set has been rewired from its nameplate voltage to

246242

NOTICE

Voltage reconnection. Affix a notice to the generator set after reconnecting the set to a voltage different from the voltage on the nameplate. Order voltage reconnection decal 246242 from an authorized service distributor/dealer.

NOTICE

Parallel Operation. This product includes features intended to support operation in parallel with the utility grid, but these features have not been evaluated for compliance with specific utility interconnection protection standards or requirements.

NOTICE

Canadian installations only. For standby service connect the output of the generator set to a suitably rated transfer switch in accordance with Canadian Electrical Code, Part 1.

NOTICE

Electrostatic discharge damage. Electrostatic discharge (ESD) damages electronic circuit boards. Prevent electrostatic discharge damage by wearing an approved grounding wrist strap when handling electronic circuit boards or integrated circuits. An approved grounding wrist strap provides a high resistance (about 1 megohm), *not a direct short*, to ground.

Notes

This manual provides installation instructions for industrial generator sets. Operation manuals and wiring diagram manuals are available separately.

Some additional model-specific installation information may be included in the respective generator set controller operation manual.

Information in this publication represents data available at the time of print. Kohler Co. reserves the right to change this publication and the products represented without notice and without any obligation or liability whatsoever.

Read this manual and carefully follow all procedures and safety precautions to ensure proper equipment operation and to avoid bodily injury. Read and follow the Safety Precautions and Instructions section at the beginning of this manual. Keep this manual with the equipment for future reference.

Abbreviations

This publication makes use of numerous abbreviations. Typically, the word(s) are spelled out along with the abbreviation in parentheses when shown for the first time in a section. Appendix A, Abbreviations, also includes many abbreviation definitions.

List of Related Materials

Separate literature contains, communication, firmware, and other additional information not provided in this manual. Figure 1 lists the available literature part numbers.

Manual Description	Literature Part No.
Generator Set/Controller Wiring Diagram Manual	Multiple Part Numbers Contact your Distributor/Dealer
Monitor III Converters, Connections, and Controller Setup	TT-1405
Monitor III Software Spec Sheet	G6-76
Monitor III Converter, Modbus®/Ethernet Spec Sheet	G6-79
Monitor III Software Operation Manual	TP-6347
Modbus® Communications Protocol Operation Manual	TP-6113
Program Loader Software Installation	TT-1285
SiteTech™ Software Operation Manual	TP-6701
Remote Serial Annunciator (RSA)	TT-1625
Decision-Maker® Paralleling System (DPS) Spec Sheet	G6-110
Decision-Maker® Paralleling System (DPS) Operation Manual	TP-6747
Battery Charger, 10 amp float/equalize	TT-680
Battery Charger, 6 amp float/equalize	TT-1342
Battery Charger, ESCR II	TP-7025
500–1000REZK Engine Installation Manual	TP-6995
1000REZCK Engine Installation Manual	TP-7022
1300REZCK Engine Installation Manual	TP-7023
Decision-Maker® 8000 Operation Manual	TP-6990
KD Model Operation Manual	TP-7070

Figure 1 Related Literature

Modbus® is a registered trademark of Schneider Electric.

Service Assistance

For professional advice on generator set power requirements and conscientious service, please contact your nearest Kohler distributor or dealer.

- Consult the Yellow Pages under the heading Generators—Electric.
- Visit the Kohler Power Systems website at KOHLERPower.com.
- Look at the labels and decals on your Kohler product or review the appropriate literature or documents included with the product.
- Call toll free in the US and Canada 1-800-544-2444.
- Outside the US and Canada, call the nearest regional office.

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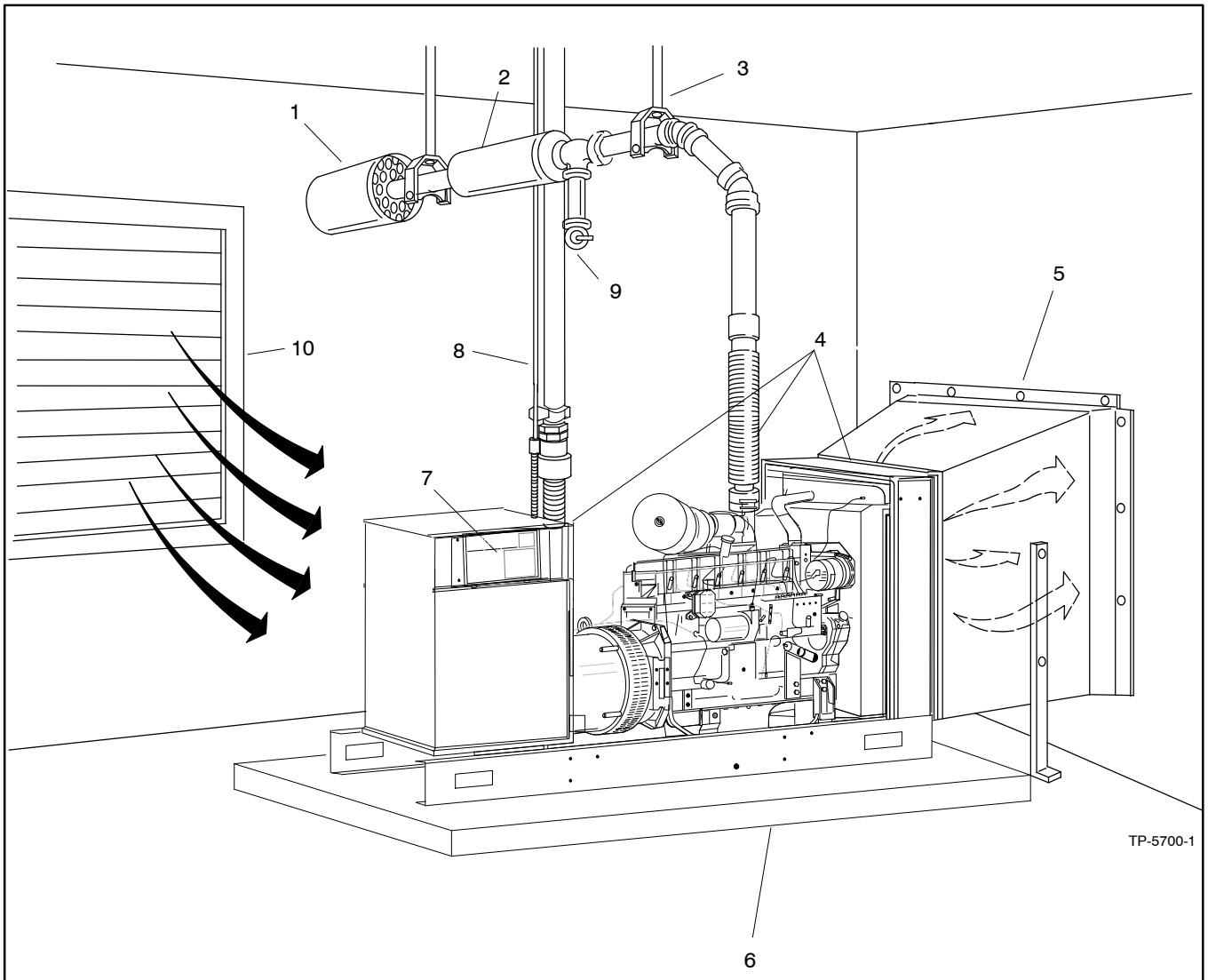
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Fax: (813) 3440-2727

Industrial power systems give years of dependable service if installed using the guidelines provided in this manual and in applicable codes. Incorrect installation can cause continuing problems. Figure 1-1 illustrates a typical installation.

Your authorized generator set distributor/dealer may also provide advice about or assistance with your installation.



1. Exhaust thimble (for wall or ceiling)
2. Silencer
3. Supports
4. Flexible sections
5. Duct work for cooling air outlet
6. Mounting base
7. Controller
8. Electrical conduit
9. Water trap with drain
10. Fresh air intake

Figure 1-1 Typical Stationary-Duty Generator Set Installation

This manual references several organizations and their codes that provide installation requirements and guidelines such as the National Fire Protection Association (NFPA) and Underwriter's Laboratories Inc. (UL).

- NFPA 54 National Fuel Gas Code
- NFPA 70 National Electrical Code®; the National Electrical Code is a registered trademark of the NFPA
- NFPA 99 Standard for Health Care Facilities
- NFPA 101 Life Safety Code
- NFPA 110 Emergency and Standby Power Systems
- UL 486A–486B Wire Connectors
- UL 486E Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
- UL 2200 Stationary Engine Generator Assemblies

These organizations provide information specifically for US installations. Installers must comply with all applicable national and local codes.

Before beginning generator set installation, record the following data from the generator set's specification sheet and keep this data accessible for reference during installation:

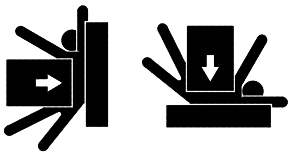
- Dimensions and weight (verify dimensions and weight using the submittal data)
- Exhaust outlet size and maximum allowable backpressure
- Battery CCA rating and quantity
- Fuel supply line size and fuel pressure requirement (gas models)
- Air requirements

The loading and transporting processes expose the generator set to many stresses and the possibility of improper handling. Therefore, after transporting industrial generator sets:

- Check the alignment of the radiator and supports to ensure that the radiator is evenly spaced from the generator and that supports are square and of even length. Check the radiator fan for uniform alignment and equal clearance within the radiator shroud. Adjust if necessary.
- After confirming the correct alignment, tighten the hardware to its specified torque. Reference Appendix C, General Torque Specifications.

2.1 Lifting

⚠ WARNING



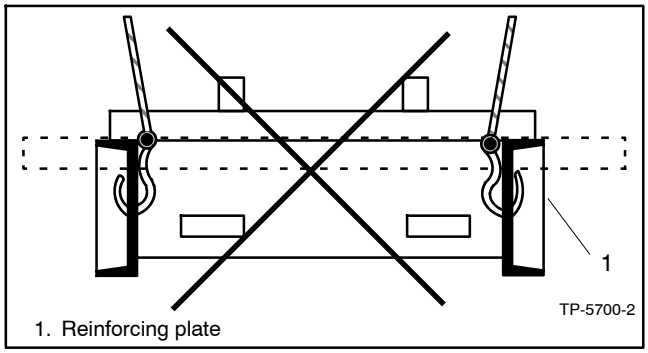
Unbalanced and elevated weight. Improper lifting can cause severe injury or death and equipment damage.

Do not lift the generator set from the engine or alternator eyes. Never stand under a unit being lifted. Always maintain a safe distance from the unit being lifted.
See the lifting instructions in the installation manual that was provided with the unit.

2.1.1 General Precautions

Follow these general precautions when lifting all generator sets and related equipment.

- Install proper size rigging at the skid lifting eyes providing a direct pull on the skid lifting eye. Make sure the rigging does not work as a pry bar lever against the lifting eye.
- Do not lift the generator set using the lifting eyes attached to the engine and/or alternator as these lifting eyes can not support the total weight of the generator set.
- Always protect cables, chains, and straps from sharp edges.



1. Reinforcing plate

Figure 2-1 Improper Lifting Hook Placement (above 1000 kW)

- Generator sets typically above 1000 kW may have reinforcing plates on the skid. Do not attach lifting hooks to the reinforcing plate. See Figure 2-1.
- Lifting should only be conducted by those trained and experienced in lifting and rigging to achieve a safe and effective lift. Consideration needs to be given to, but not necessarily limited to, the following items:
  - Weight and center of gravity of the equipment being lifted
  - Weight and center of gravity of the lifting device
  - Boom angles
  - Selection of rated rigging
  - Stability of lifting foundation
  - Wind and weather conditions
  - Local or regional codes that may require or restrict types of rigging.
- Use a spreader bar to prevent lifting cables from contacting air cleaners, shrouds, and other protruding components. If the cables still do not clear these components, remove the components.

2.1.2 Weight and Center of Gravity

Refer to the respective specification sheet and/or the submittal drawing for the weight and center of gravity of all components being lifted. The total combined weight and center of gravity must be known to select the proper rigging. If the weight and center of gravity is not readily available, contact your distributor/dealer.

As applicable, determine the weight and center of gravity of the following components:

- Generator set
- Enclosure system (includes silencer, inlet baffles, louvers, etc.)
- Subbase fuel tank (lift only empty fuel tanks).

2.1.3 Lifting the Generator Set

The distributor/lifting contractor should choose one of the following methods to lift the generator set depending upon the location circumstances and the generator set's weight and size. Remove cover plates as needed to access the generator set skid lifting eyes.

Single Spreader Bar and Hook Method

Refer to Figure 2-2.

Double Spreader Bar and Hook Method

Refer to Figure 2-3.

Single Spreader Bar and Skid Lifting Bar Method

Refer to Figure 2-4.

Double Spreader Bar and Skid Lifting Bar Method

Refer to Figure 2-5.

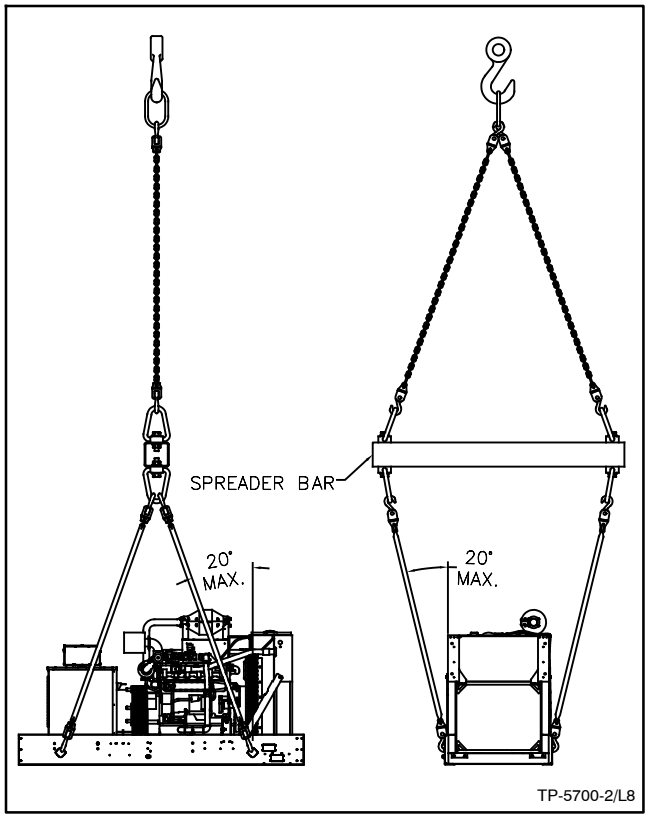


Figure 2-2 Single Spreader Bar and Hook Method

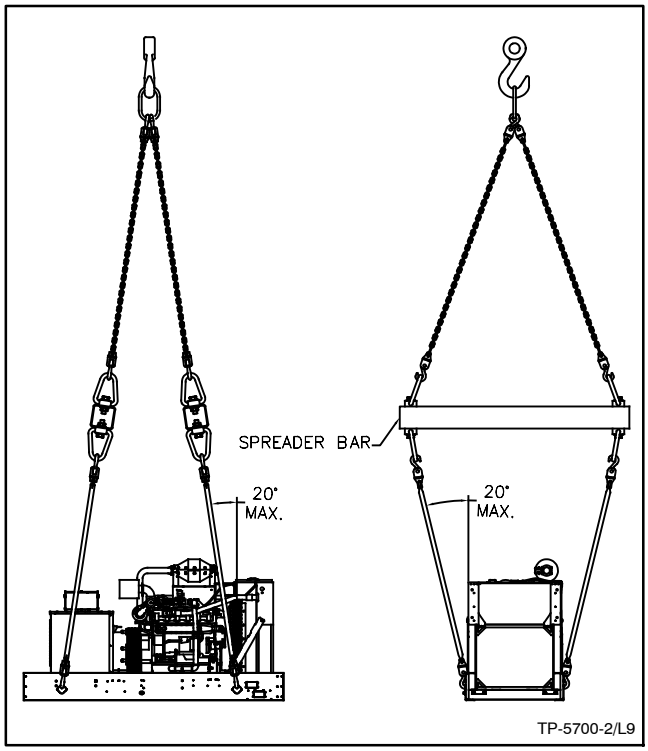


Figure 2-3 Double Spreader Bar and Hook Method

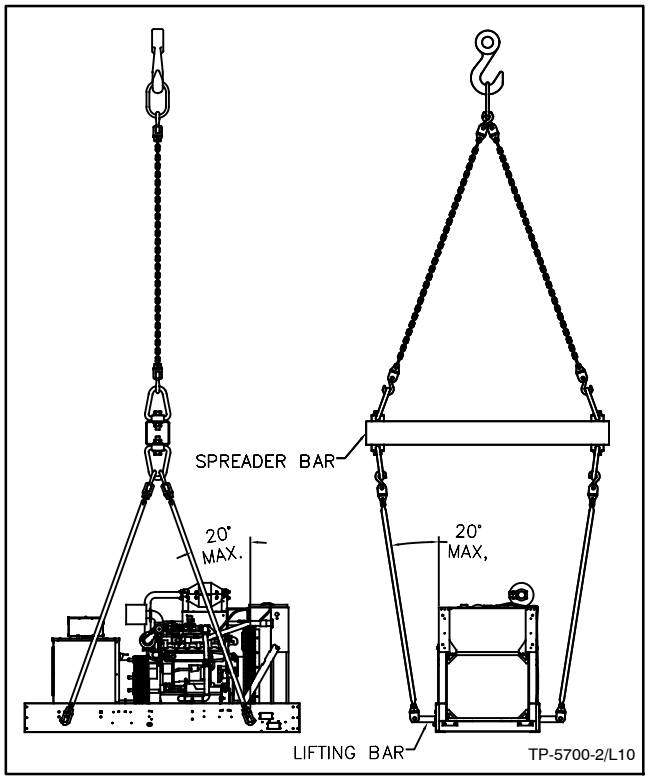


Figure 2-4 Single Spreader Bar and Skid Lifting Bar Method

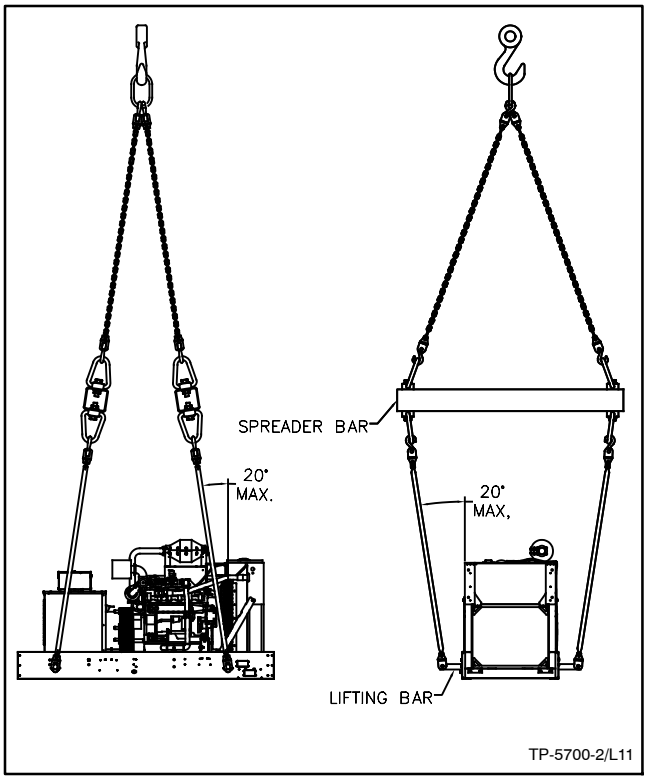


Figure 2-5 Double Spreader Bar and Skid Lifting Bar Method

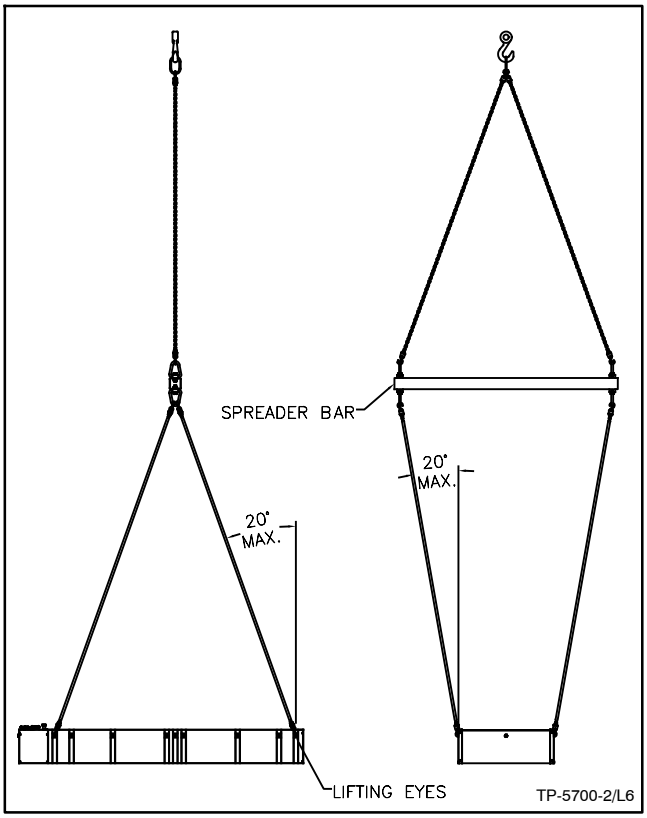


Figure 2-6 Fuel Tank with Single Spreader Bar Method

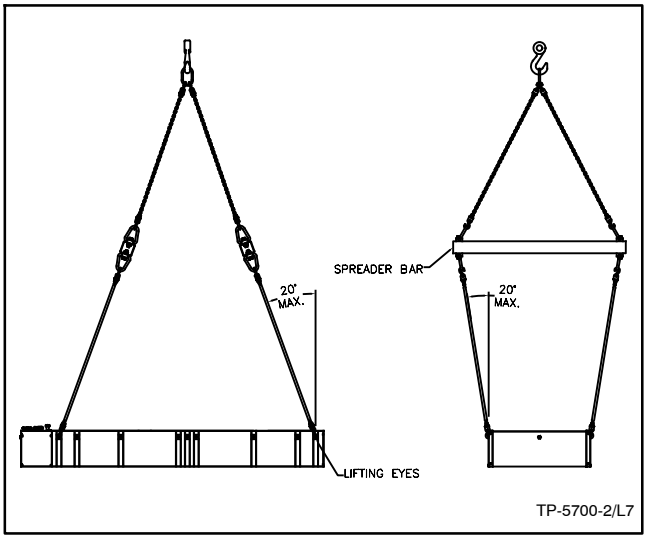


Figure 2-7 Fuel Tank with Double Spreader Bar Method

2.1.4 Lifting the Subbase Fuel Tank

This section deals with lifting the subbase fuel tank as a single unit.

- The subbase fuel tank *must* have lifting eyes in order to use the following methods.
- The subbase fuel tank must be empty. Do not lift a fuel tank containing fuel (or any liquid).
- Remove any vent piping longer than 1 m (3.3 ft.) from the fuel tank. Do not lift a fuel tank with attached vent piping longer than 1 m (3.3 ft.).
- Attach one or two spreader bars as shown.

Fuel Tank with Single Spreader Bar Method

Refer to Figure 2-6.

Fuel Tank with Double Spreader Bar Method

Refer to Figure 2-7.

2.1.5 Lifting the Generator Set with Attached Enclosure

Enclosure Attached Directly to the Generator Set Skid

Refer to Figure 2-8. Lift the assembly by lifting on the skid as shown in 2.1.3 Lifting Methods for Generator Set.

Do not attach hoisting equipment to the enclosure.

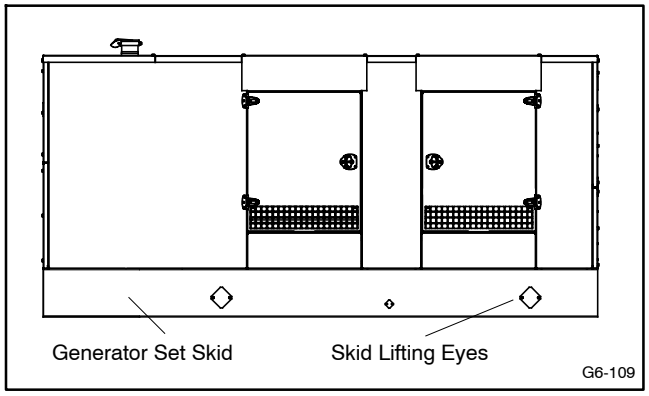


Figure 2-8 Typical Enclosure Attached Directly to the Generator Set Skid

Enclosure Attached Directly to the Subbase Fuel Tank

Refer to Figure 2-9. Lift the assembly by lifting on the subbase fuel tank lifting eyes. Lift using all of the lifting eyes provided on the subbase fuel tank. Select the procedure from the following illustrations based on the matching number of available subbase fuel tank lifting eyes.

Do not attach hoisting equipment to the enclosure.

Enclosure Attached to the Enclosure Base and Assembled to the Subbase Fuel Tank

Refer to Figure 2-10.

With the subbase fuel tank detached from the enclosure base, lift only the enclosure and generator set using the enclosure base lifting eyes. Lift using all of the lifting eyes provided on the enclosure base. Select the procedure from the following illustrations based on the matching number of available enclosure base lifting eyes.

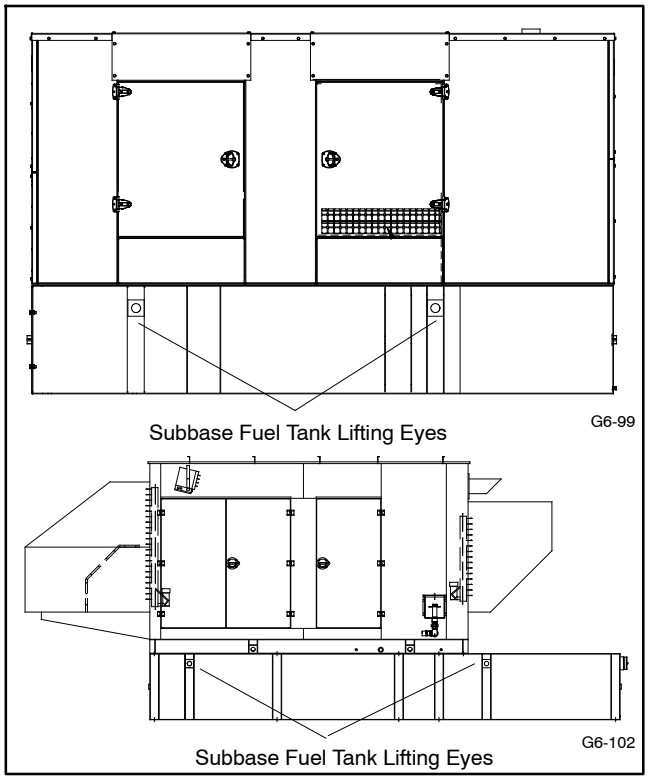


Figure 2-9 Typical Enclosure Attached Directly to the Subbase Fuel Tank

Lift the entire enclosure, generator set, and subbase fuel tank assembly by lifting on the subbase fuel tank lifting eyes. Lift using all of the lifting eyes provided on the subbase fuel tank. Select the procedure from the following illustrations based on the matching number of available subbase fuel tank lifting eyes. Do not attach hoisting equipment to the enclosure base.

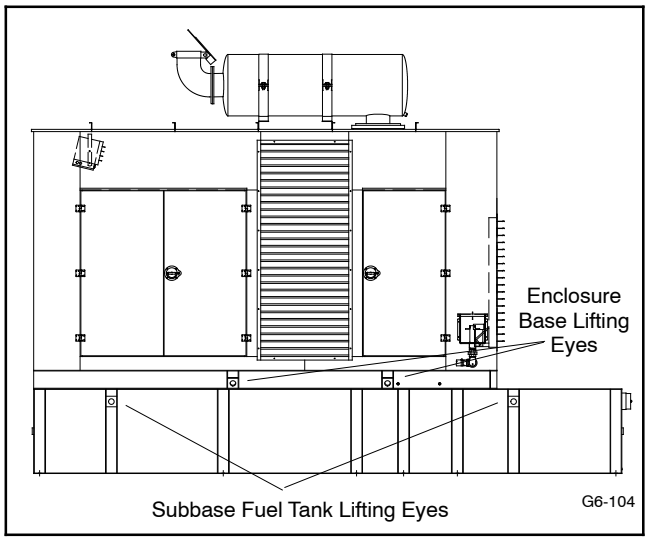


Figure 2-10 Typical Enclosure Attached to the Enclosure Base and Assembled to the Subbase Fuel Tank

2.1.6 Lifting the Generator Set, Enclosure, and Subbase Fuel Tank Assembly

When using the subbase fuel tank to lift the generator set and/or enclosure as a package, use ALL of the lifting eyes on the subbase fuel tank.

Hoisting using Four Eye Lifting Method

Apply the same lifting methods using single or double spreader bars as shown in 2.1.3 Lifting the Generator Set.

Hoisting using Six Eye Lifting Method

Apply one spreader bar and two chain falls (Figure 2-11) or three spreader bars and two chain falls (Figure 2-12) for six eye lifting.

- Install a pair of outer slings to the maximum angle as shown in Figure 2-11 and Figure 2-12.
- Remove the slack from the slings in the system but do not lift the unit.
- Install adjustable chain falls and strap or cable them from the spreader bar to the middle lifting eyes. Adjust to remove the slack.
- Check and remove any slack that has developed in the primary slings and check that all chains/straps/cables are carrying load.

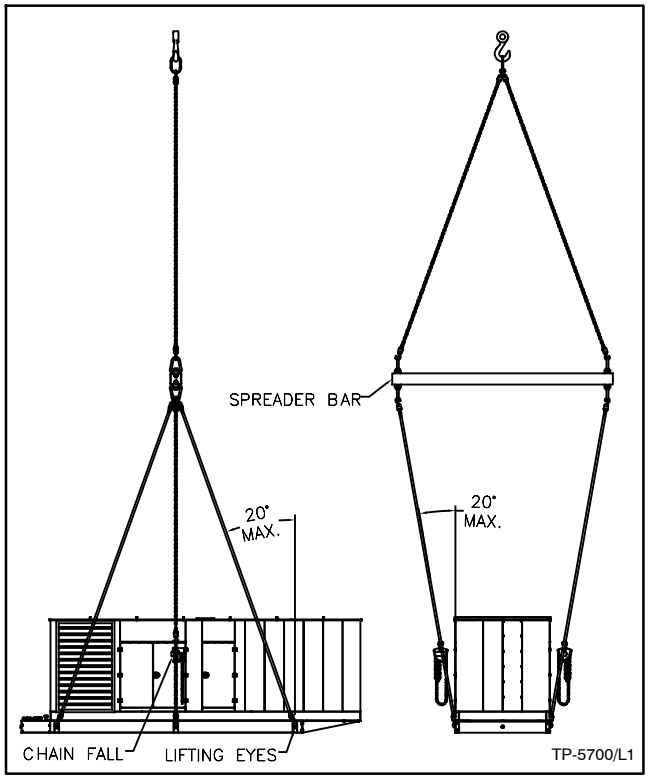


Figure 2-11 Six Eyes, Single Spreader Bar, and Two Chain Falls Lifting Method

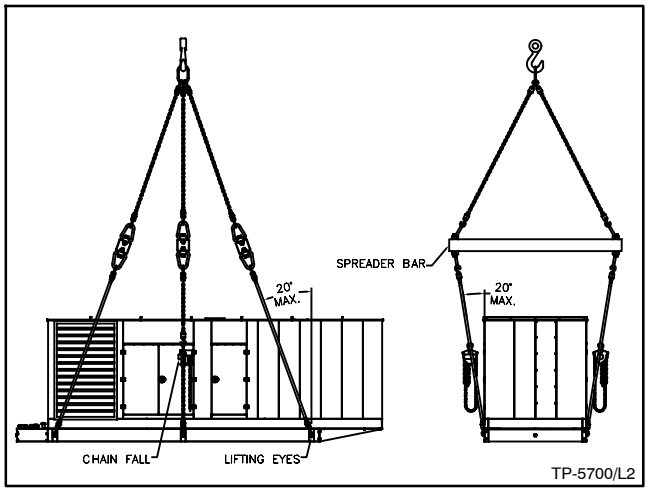


Figure 2-12 Six Eyes, Three Spreader Bars, and Two Chain Falls Lifting Method

Hoisting using Eight Eye Lifting Method

Apply two spreader bars and four chain falls (Figure 2-13) for eight eye lifting.

- Install a pair of outer slings up to the maximum angle as shown in Figure 2-13.
- Remove the slack from the slings in the system but do not lift the unit.
- Install adjustable chain falls and strap or cable them from the spreader bar to the middle lifting eyes. Adjust to remove the slack.
- Check and remove any slack that has developed in the primary slings and check that all chains/straps/cables are carrying load.

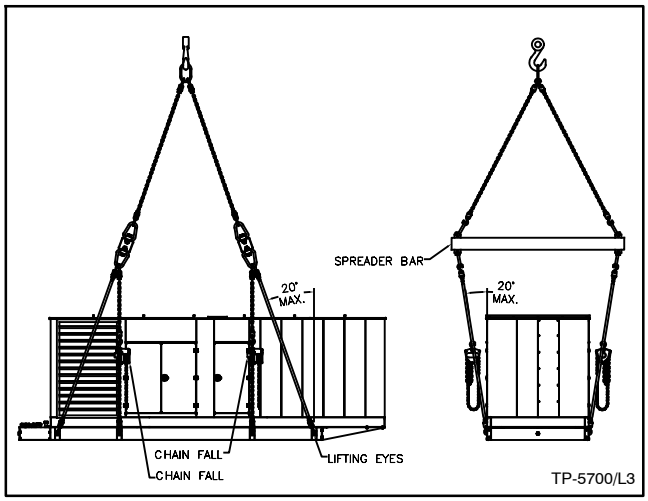


Figure 2-13 Eight Eyes, Two Spreader Bars, and Four Chain Falls Lifting Method

Hoisting using Ten Eye Lifting Method

Apply three spreader bars and six chain falls (Figure 2-14) for ten eye lifting.

- Install a pair of outer slings up to the maximum angle as shown in Figure 2-14.
- Remove the slack from the slings in the system but do not lift the unit.
- Install adjustable chain falls and strap or cable them from the spreader bar to the middle lifting eyes. Adjust to remove the slack.
- Check and remove any slack that has developed in the primary slings and check that all chains/straps/cables are carrying load.

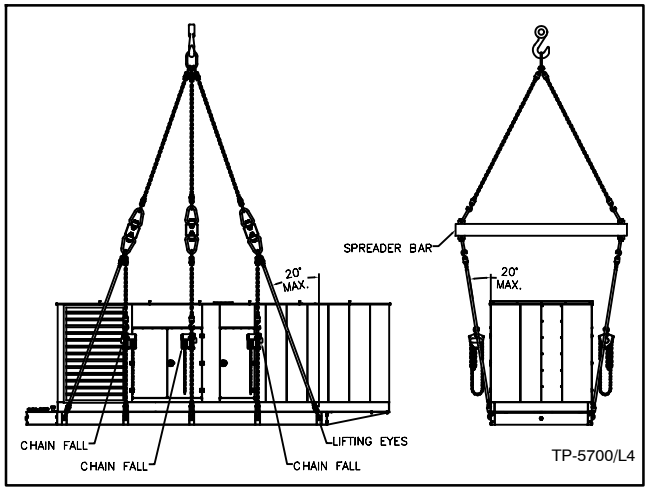


Figure 2-14 Ten Eyes, Three Spreader Bars, and Six Chain Falls Lifting Method

Hoisting using Twelve Eye Lifting Method

Apply three spreader bars and eight chain falls (Figure 2-15) for twelve eye lifting.

- Install a pair of outer slings up to the maximum angle as shown in Figure 2-15.
- Remove the slack from the slings in the system but do not lift the unit.
- Install adjustable chain falls and strap or cable them from the spreader bar to the middle lifting eyes. Adjust to remove the slack.
- Check and remove any slack that has developed in the primary slings and check that all chains/straps/cables are carrying load.

2.1.7 Lifting Single Point Lift Assemblies

Some units have an enclosure integral to the skid and attach a single point lifting eye located at the top and center of the enclosure. The entire assembly may be lifted with this eye.

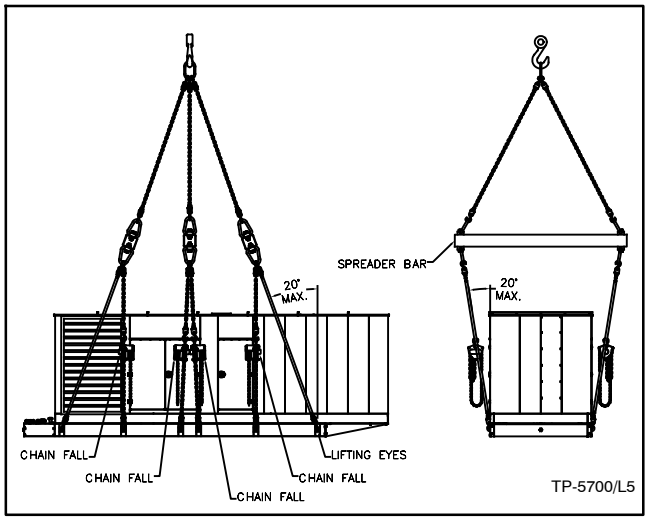


Figure 2-15 Twelve Eyes, Three Spreader Bars, and Eight Chain Falls Lifting Method

2.2 Generator Set Transporting

Follow these guidelines when transporting the generator set:

- Select the transporting vehicle/trailer based on the dimensions and weight of the generator set as specified in the generator set dimension drawing or specification sheet. Ensure that the gross weight and overall height of the generator set and vehicle/trailer in transport does not exceed applicable transportation codes.
- Use low boy-type trailers that meet clearance requirements when transporting units larger than 1000 kW. Load large (unboxed) radiator-equipped generator sets with the radiator facing the rear to reduce wind resistance during transit. Secure fans to prevent fan rotation in transit.
- Securely fasten the generator set to the vehicle/trailer. Even the heaviest of generator sets can move during shipment unless they are secured. Fasten the generator set to the vehicle/trailer bed with a correctly sized chain routed through the mounting holes of the generator set skid (or tank, if equipped). Use chain tighteners to remove slack from the mounting chain. Do not use strapping over the top of an enclosed generator set as damage to the enclosure may occur.
- Always cover a non-enclosed unit with a heavy-duty canvas or tarpaulin secured to the generator set or trailer.

3.1 Location Factors

Ideally, the generator set should be mounted on concrete at ground level. For above-ground installations, including roof installations, weight considerations are especially important. The building engineer determines whether the structure can support the weight of the generator set.

The location of the generator set must meet the following criteria.

General:

- Mounting surface is square and horizontally level at all four edges.
- Support the weight of the generator set and related equipment such as fuel storage tanks, batteries, radiators, and mounting pad(s). Keep in mind that the mounting pad weight may exceed the weight of the generator set.
- Mounting pad should be designed to prevent the vibration of a running unit from causing mounting pad distortion and affecting engine/alternator alignment.
- Meet applicable fire rating codes and standards.
- Install the unit so that the risk of contact by people with the hot generator set surfaces is minimized.
- Position the generator set over a noncombustible surface. If the mounting surface directly under or near the generator set is porous or deteriorates from exposure to engine fluids, construct a containment pan for spilled fuel, oil, coolant, and battery electrolyte. Do not allow accumulation of combustible materials under the generator set.
- Permit vibration isolation and dampening to reduce noise and prevent damage.
- Be clean, dry, and not subject to flooding.
- Provide easy access for service and repair.

Indoor Installations:

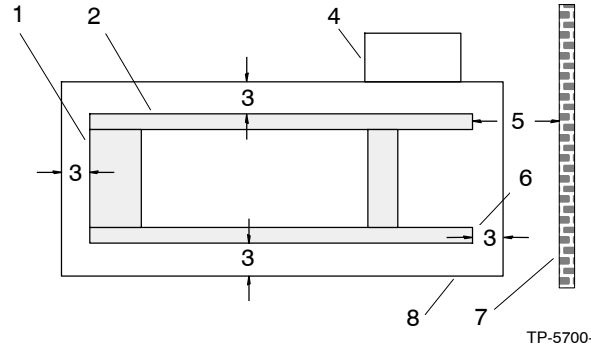
- Allow adequate ventilation with a minimum amount of ductwork.
- Allow safe expulsion of exhaust.
- Allow for storage of sufficient fuel to sustain emergency operation. See the generator set specification sheet for fuel consumption.
- Allow for locating the fuel tank within the vertical lift capabilities of the fuel pump and any auxiliary pumps. See Section 6, Fuel Systems.
- Minimize the risk of public or unauthorized access.
- Provide adequate protection to prevent injury in the stub-up area. If the stub-up area opening is exposed, provide a cover or fill in the area to avoid the risk of tripping or falling into the stub-up opening.

Outdoor Installations:

- Select a location that provides adequate air flow. Avoid locations next to tall buildings that block normal air flow and cause air vacuum pockets. Avoid areas that are subject to high winds, excessive dust, or other airborne contaminants. High dust areas may require more frequent air cleaner maintenance. High temperature conditions affect generator set efficiency. Select a shaded area away from direct sunlight and/or other heat-producing equipment when practical.
- Avoid areas with combustible materials, including but not limited to building materials as well as natural surroundings. Keep dry field grass, foliage, and combustible landscaping materials a safe distance from the exhaust system.
- The subsoil location must have a bearing strength capable of supporting the generator set and mounting pad combined weight. Analysis by a qualified technician or engineer is recommended to determine the proper excavation material required.
- If the generator set enclosure is mounted on multiple pads where it is elevated above the main surface it may cause discharge air recirculation underneath the unit. A typical location could be a building roof where the main surface is uneven for a single pad. Refer to 4.3.2 Installation Considerations for information to minimize discharge air recirculation.
- Select a location that provides adequate space to access and service the unit. Allow for adequate clearance to open and close access doors. Avoid locations on a hill or steep embankment unless provision is made to include a servicing platform.

3.2 Mounting Surface

Figure 3-1 shows typical mounting surface details for sizing the concrete surface beyond the generator set and allowing for clearances during generator set service. Follow the dimensional details provided in Figure 3-2, Figure 3-3, or Figure 3-4 depending upon the mounting method.



1. Engine end
2. Generator set skid
3. Extend the concrete surface a minimum of 152 mm (6 in.) beyond the generator set
4. Battery rack
5. Allow at least 457 mm (18 in.) between the generator set and adjacent walls or other obstructions *on all sides* for ease of servicing the generator set
6. Alternator end
7. Building wall
8. Mounting pad (concrete surface)

Figure 3-1 Mounting Surface Detail (top view)

3.2.1 Single-Pad Mounting

The manufacturer recommends a single, level concrete mounting pad as shown in Figure 3-2. This method provides maximum stability for the generator set; however, draining the oil and servicing the generator set may require raising the set from the pad.

Use an oil drain pump if clearance below the oil drain or extension is insufficient for a pan large enough to hold all the engine's oil.

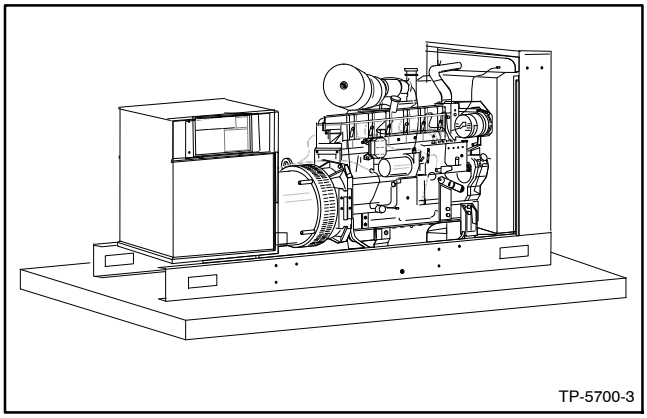


Figure 3-2 Single-Pad Mounting

3.2.2 Dual-Pad Mounting

The two-pad arrangement shown in Figure 3-3 provides easy access to conveniently drain the oil. Follow the oil draining considerations outlined in Section 3.2.1.

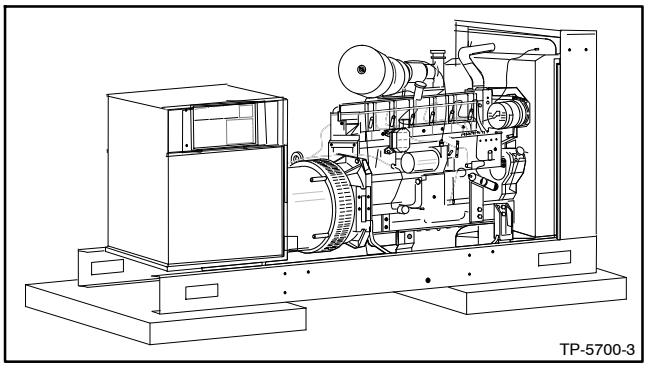


Figure 3-3 Dual-Pad Mounting

3.2.3 Four-Pad Mounting

The four-pad arrangement shown in Figure 3-4 provides more room under the engine for service than the previous two methods. Follow the oil draining considerations outlined in Section 3.2.1.

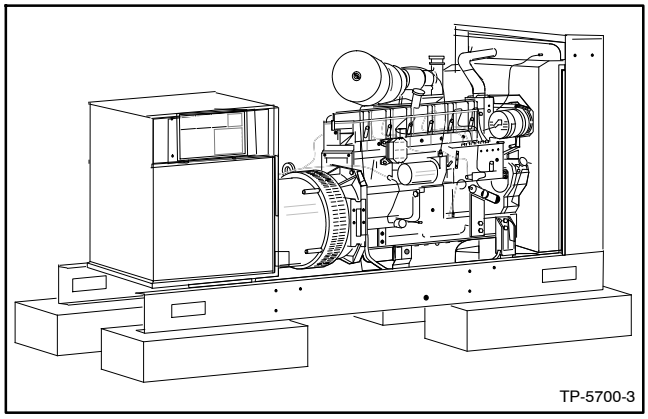


Figure 3-4 Four-Pad Mounting

3.2.4 Mounting Pad Specifications

Mounting pad weight. The weight of the single mounting pad or combined weight of multiple mounting pads should equal or exceed the combined weight of the generator set and attached accessories.

To determine the weight of the mounting pad(s), determine the volume (length x width x height) of each pad in cubic meters (cubic feet). Multiply this result by 2400 kg (150 lb.) to determine a pad's weight. In multiple-pad installations, add the weights of all pads to determine the total mounting pad weight.

Mounting pad specifications. Mounting pad composition should follow standard practice for the required loading. Typical specifications call for 17238–20685 kPa (2500–3000 psi) concrete reinforced with eight-gauge wire mesh or No. 6 reinforcing bars on 305 mm (12 in.) centers. The top surface of the mounting pad on which the generator set mounts should be within a flatness of 3 mm (1/8 in.).

The recommended concrete mixture by volume is 1:2:3 parts of cement, sand, and aggregate, respectively. Surround the pad with a 200–250 mm (8–10 in.) layer of sand or gravel for proper support and isolation of a pad located at or below grade.

Anchor the generator set to the concrete using bolts cast into the surface of the pad. Otherwise, drill holes in the mounting pad prior to generator set placement and use expansion anchor bolts. Anchor the generator set skid or fuel tank (if equipped) using all of the provided anchor holes on the bottom of the skid.

Note: Refer to the generator set and accessory dimension drawings for conduit and fuel-line placement. The drawings give dimensions for electrical and fuel connection roughins and stubups including model specific clearances.

3.3 IBC Seismic Installation

International Building Code (IBC) seismic installations involve additional mounting and installation considerations. Refer to respective seismic installation ADV drawing(s) for seismic isolator requirements.

3.4 Vibration Isolation

Use one of the vibration isolation types detailed in the following paragraphs. Also, connections between the generator set or its skid and any conduits, fuel lines, or exhaust piping must include flexible sections to prevent breakage and to isolate vibration. These connections are detailed in subsequent sections.

Isolator types. The two primary types of isolators are neoprene and spring-type. Figure 3-5 shows neoprene isolators between the engine-generator and the skid, referred to as integral vibration isolation mounting. Integral vibration isolation units come from the factory with neoprene vibration isolation. Neoprene isolators provide 90% vibration isolation efficiency and are often sufficient for installations at or below grade.

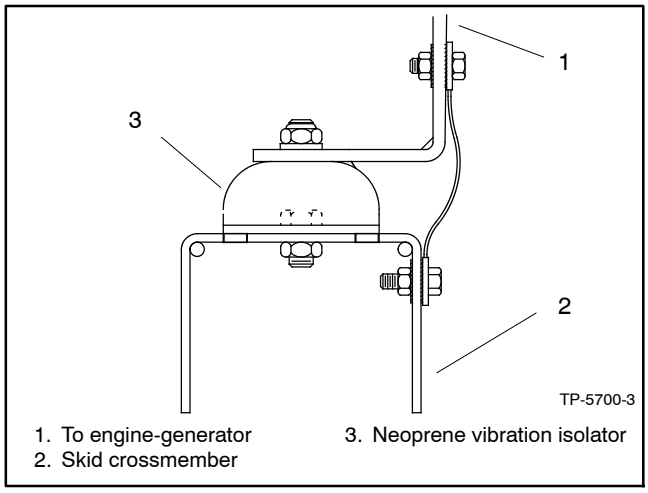


Figure 3-5 Neoprene-Type Integral Vibration Isolators

Figure 3-6 through Figure 3-10 shows the spring-type isolator kit installed *with* direct-mounted units. Direct-mounted units have no factory vibration isolation. Spring-type isolators provide 98% vibration efficiency and are recommended for above grade installations and other locations where vibration sensitivity could be an issue.

Generator sets with integral vibration isolation. Skids for generator sets 20 kW and larger use I or C section-fabricated steel with a width of 52–76 mm (2–3 in.) per channel. The length varies with the size of the unit, resulting in a static load on the generator set skid of 69–172 kPa (10–25 psi) if the total bottom surface of the channel is in contact with the mounting pad.

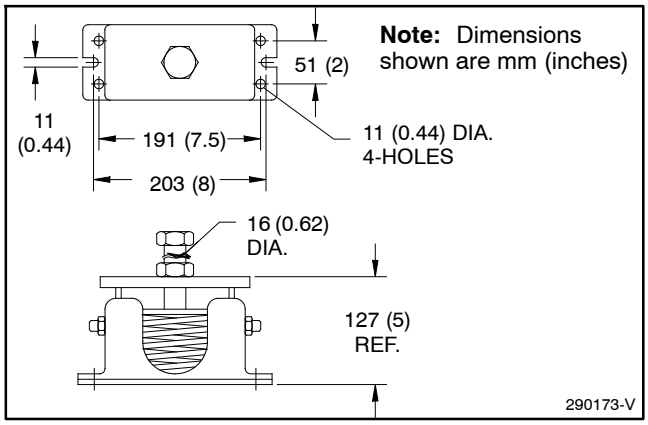


Figure 3-6 Vibration Isolators GM39515 and GM41122

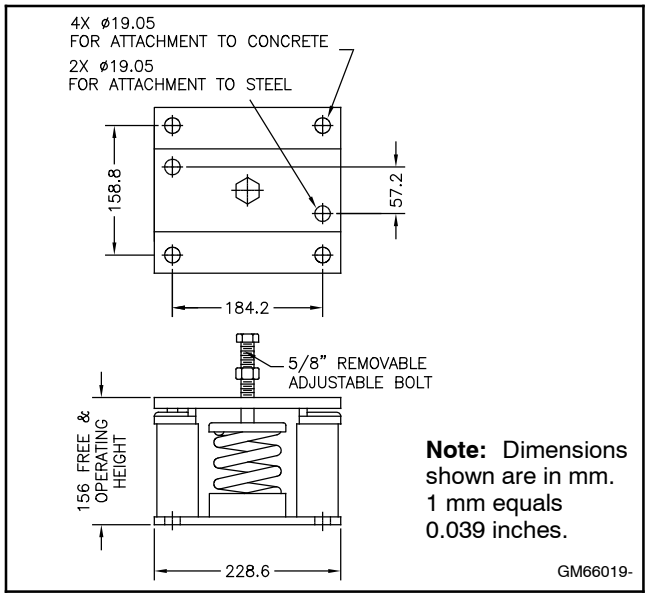


Figure 3-7 Vibration Isolators GM66019, GM66304, and GM76149

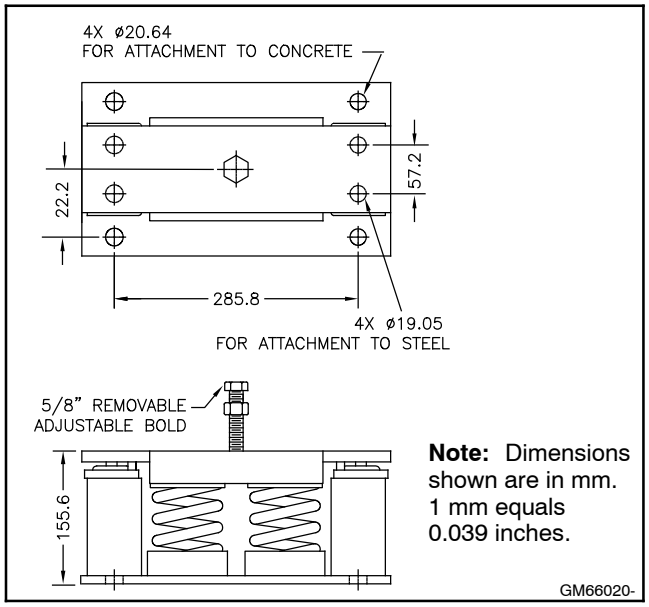


Figure 3-8 Vibration Isolators GM66020, GM66022, GM66023, GM66024, and GM66313

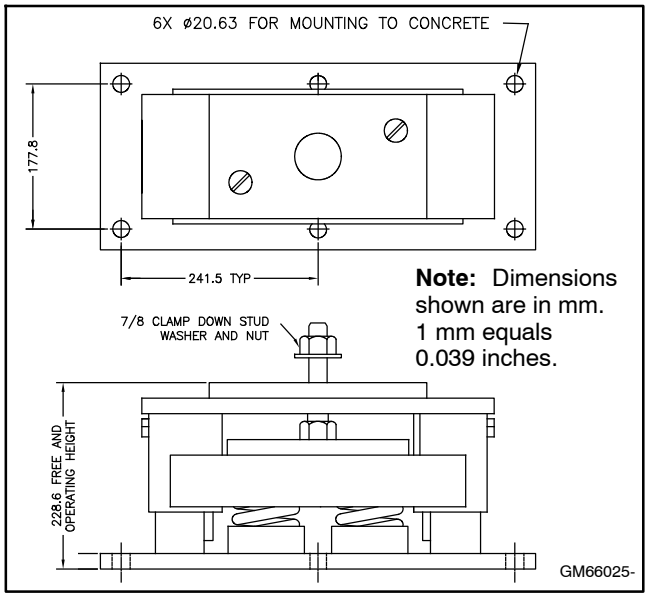


Figure 3-9 Vibration Isolator GM66025

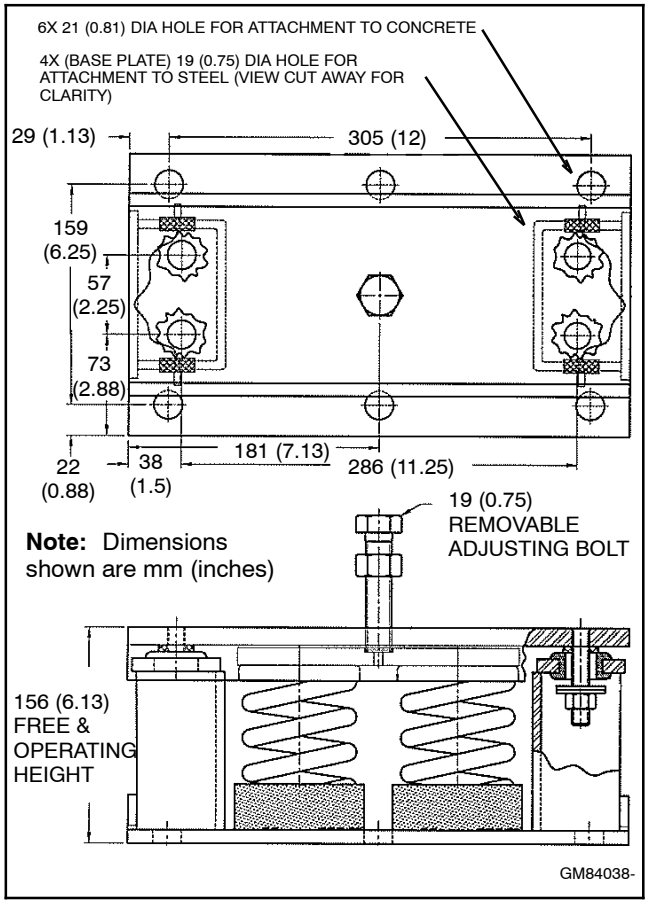


Figure 3-10 Vibration Isolator GM84038

Generator sets with direct mounting. Larger generator sets typically mount directly to a structural steel base. For these units, install the recommended vibration isolators between the base and the mounting pad in the holes provided. Because of the reduced mounting surface area of these individual mounts, the static load on the mounting surface increases to the range of 345–690 kPa (50–100 psi).

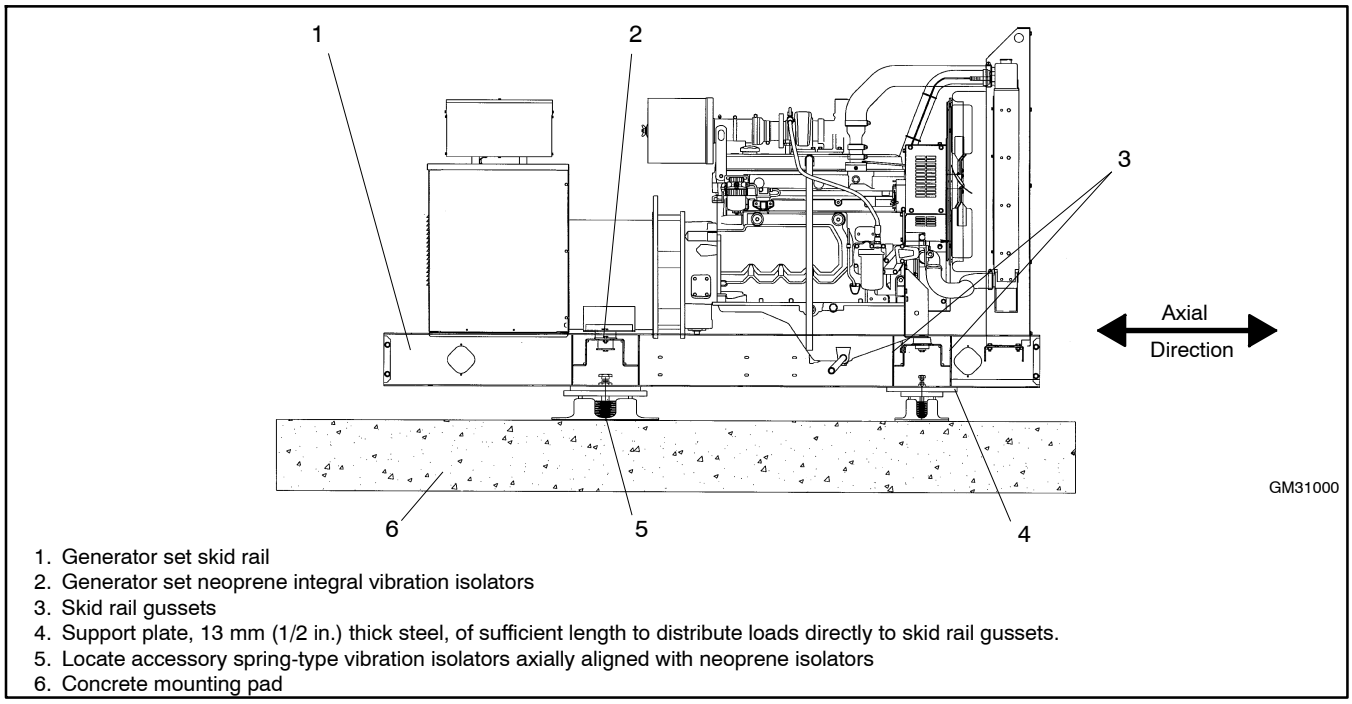
Generator sets mounted on subbase fuel tanks. Do not install vibration spring isolators under the subbase fuel tank.

Dual isolation. For applications involving integral vibration isolators and where the factory does not offer spring-type isolators as a standard accessory, spring-type isolators may be installed under the skid provided they equal the number of neoprene isolators, are inline front-to-back with the existing neoprene isolators, and additional support plates are installed, as required. See Figure 3-11.

3.5 Dual-Bearing Alternator Alignment

Generator sets equipped with dual-bearing alternators require alignment after mounting the generator set skid to a mounting pad. Refer to Service Bulletin SB-566 for details.

Note: Dual-bearing alternators used on REZCK model generator sets do not require alignment.



1. Generator set skid rail
2. Generator set neoprene integral vibration isolators
3. Skid rail gussets
4. Support plate, 13 mm (1/2 in.) thick steel, of sufficient length to distribute loads directly to skid rail gussets.
5. Locate accessory spring-type vibration isolators axially aligned with neoprene isolators
6. Concrete mounting pad

Figure 3-11 Accessory Vibration Mount Location

Notes

4.1 General

Combustion and heat dissipation require an ample flow of clean, cool air regardless of whether the generator set is air- or liquid-cooled. Approximately 70% of the heat value of fuel consumed by an engine is lost through the cooling and exhaust systems.

Battery compartment ventilation. To prevent the accumulation of explosive gases, ventilate compartments containing batteries.

4.2 Air-Cooled Engines

Refer to the generator set specification sheet for air requirements. Generally, airflow requirements do not present a problem since air-cooled models are designed for outside installation.

When planning outside installation, consider how buildings and landscaping affect airflow. Also consider seasonal changes such as snow or foliage accumulation and potential flooding conditions. Follow a regular maintenance routine to remove snow and foliage accumulations.

4.3 Liquid-Cooled Engines

4.3.1 System Features

Generator sets designed for interior installation feature liquid cooling systems. The three most common liquid cooling systems are unit-mounted radiator, remote radiator, and city-water cooling. Observe the common installation considerations outlined below as well as the installation considerations for your generator set's cooling system as detailed in subsequent sections.

4.3.2 Installation Considerations

Intake and outlet openings. Provide air intake and air outlet openings for generator sets located in a building or enclosure. Keep air inlets and outlets clean and unobstructed. Position the air inlet into the prevailing wind and the air outlet in the opposite direction.

Elevated outdoor installations. If the generator set enclosure is mounted on multiple pads, in cases where a single pad is not practical such as an uneven building roof, it may cause discharge air recirculation under the unit. Enclosures are constructed with the intent of single pad mounting where the unit is sealed to prevent discharge air recirculation. If multiple pad installation is unavoidable, use a single pad above the multiple pads and fabricate flashing/skirting around the multiple pads to minimize unwanted discharge air recirculation.

Ventilating fans. Some buildings tend to restrict airflow and may cause generator set overheating. Use ventilating fans and/or ductwork to increase airflow in the building if the generator set's cooling fan does not provide adequate cooling. See Figure 4-1. Remote radiator and city-water cooled models require ventilating fans. When using ductwork and ventilating fans, check the exhaust fan capacity in m^3/min. (cfm). If using exhaust fans, install fan-operated louvers with exhaust fans to regulate airflow. See Figure 4-2. Follow the fan manufacturer's recommendations to determine the size of the inlet and outlet openings.

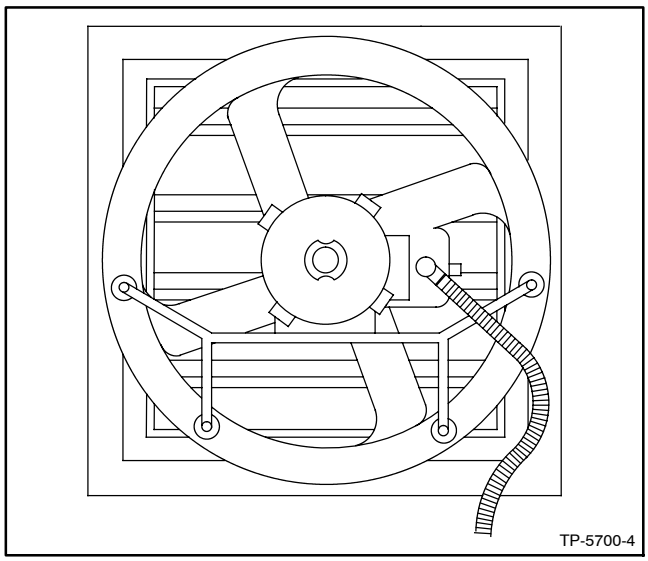


Figure 4-1 Ventilating Fan

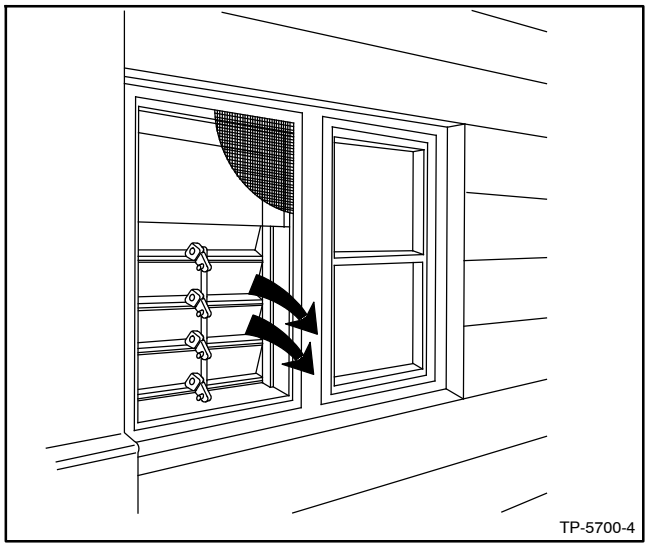


Figure 4-2 Exhaust Fan-Operated Louvers

Thermostatically-controlled louvers. Do not allow uncontrolled recirculation of air within an enclosure. The ventilation system must provide a temperature differential sufficient to prevent high engine temperature shutdown on even the hottest days.

In areas of great temperature variation, install movable louvers to thermostatically regulate airflow and room temperature. See Figure 4-3 and Figure 4-4. Refer to 4.4.2, Installation Considerations, Louver use for further information.

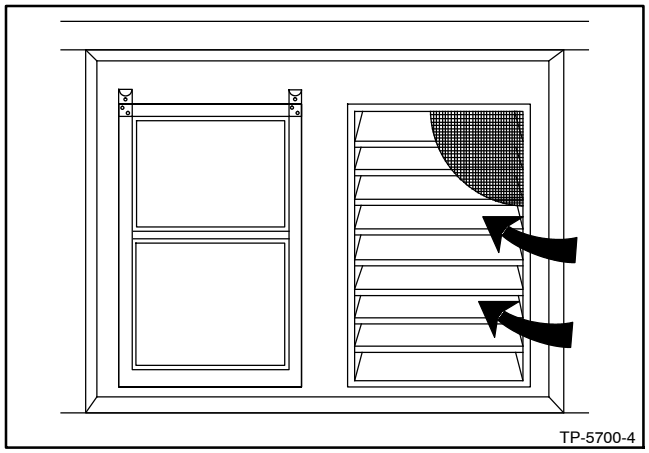


Figure 4-3 Stationary Air Inlet Louvers

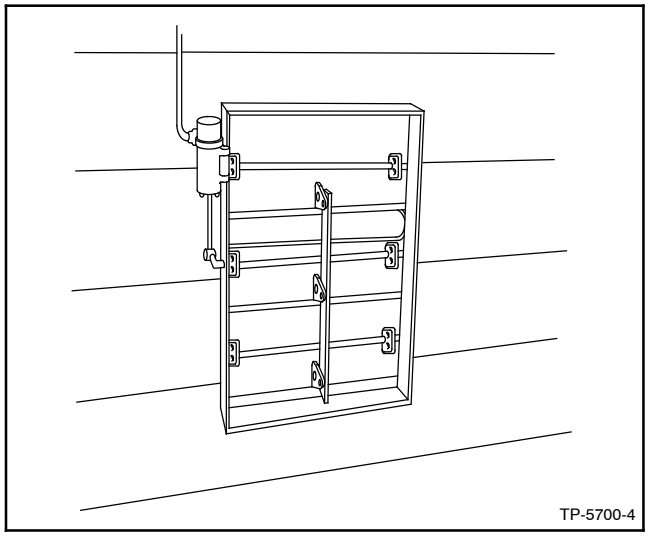


Figure 4-4 Moveable Air Inlet Louvers

In cold climate interior installations using controlled recirculation to recover heat, install thermostatically activated louvers and fans to prevent the generator set and engine room from overheating.

Electric louvers are usually connected to the optional generator set run relay. Typically, the louvers are energized to open when the generator set is operating. However, some louvers are energized to close and when deenergized are spring-actuated to open when the generator set is operating.

Filters. Install a furnace-type or similar filter in the inlet opening if the generator set operates in an atmosphere highly contaminated with impurities such as dust and chaff.

Air restrictions. When using a filter, screen, or other air restriction, increase the inlet opening size by the following amounts to compensate for diminished airflow:

- Louvers**:** Enlarge the opening 50%.
- Window screening: Enlarge the opening 80%.
- Furnace-type filters: Enlarge the opening 120%.

Some engines have maximum air intake restrictions. Refer to the respective generator set specification sheet for specific requirements.

4.3.3 Recommended Coolant

All applications require antifreeze/coolant protection. Add antifreeze/coolant before starting the generator set or energizing the block heater(s). Most diesel engine manufacturers require the use of an inhibitor additive to the antifreeze/coolant.

Use a proper mixture of glycol (ethylene, propylene, or extended life organic acid), water, and supplemental coolant additive (SCA) based on the engine manufacturer's recommendations. The antifreeze/coolant and additive mixture reduces corrosion, sludge formation, and cavitation erosion and provides boil and freeze protection.

Refer to the engine manufacturer's operation manual for engine antifreeze/coolant specifications, concentration levels, and inhibitor selection recommendations.

4.4 Unit-Mounted Radiator Cooling

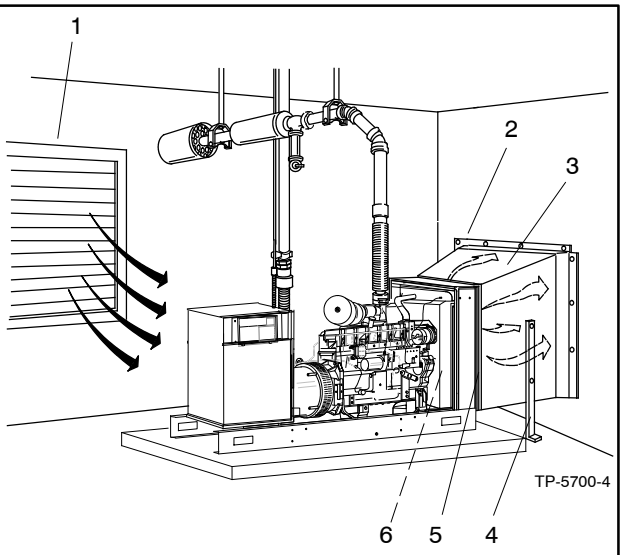
The unit-mounted radiator is the most common cooling system for engine-driven generator sets 20 kW and larger.

4.4.1 System Features

The system's major components include an engine-driven fan and circulating water pump, a radiator, and a thermostat. The pump circulates water through the engine until it reaches operating temperature. Then the engine thermostat opens, allowing water circulation through the radiator. The thermostat restricts water flow as necessary to prevent overcooling. The fan blows air from the engine side of the radiator across the cooling surface.

4.4.2 Installation Considerations

Figure 4-5 shows a typical unit-mounted radiator installation. Note the direction of airflow and refer to the figure as needed during installation.



1. Air inlet opening
2. Ductwork mounting flange
3. Air outlet duct
4. Support legs
5. Flexible section with radiator duct flange
6. Pusher fan

Figure 4-5 Radiator-Cooled Generator Set Installation

Avoid suction fan use. The alternator airflow should move in the same direction as the engine's standard pusher fan. Using a suction fan to reverse airflow is not recommended because it may interfere with the alternator cooling airflow. This in turn reduces the maximum engine power available because higher temperature combustion air is drawn into the air cleaner.

Use ductwork to direct airflow. Direct the radiator air outside the room or enclosure using sheet metal ductwork with structural supports. Keep ductwork as short, straight, and unobstructed as possible. Combined static pressure restrictions greater than 0.12 kPa or 13 mm (0.5 in.) water column on the radiator inlet and outlet openings cause reduced airflow and contribute to overheating especially in high ambient air temperatures. Use heavy canvas, silicone rubber, or similar flexible material for the connection between the radiator duct flange and the ductwork to reduce noise and vibration transmission.

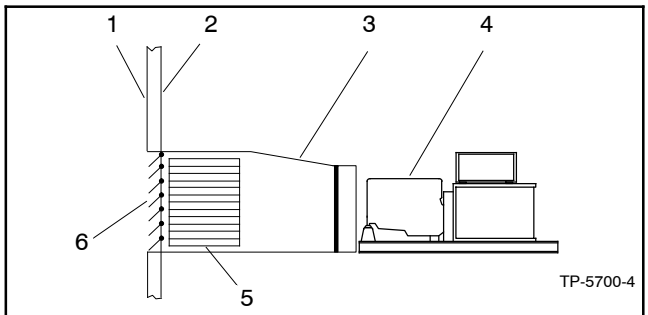
Outlet and inlet location and sizing. Size the outlet duct area 150% larger than the radiator duct flange area. Size the inlet air opening at least as large but preferably 50% larger than the outlet.

If screens, louvers, or filters are used on either the inlet or outlet, increase the inlet or outlet size according to the recommendations given in Section 4.3.2, Installation Considerations.

Since the exhaust air of larger units is both high volume and high velocity, direct the exhaust flow away from areas occupied by people or animals.

Louver use. Design temperature-controlling louvers to prevent air inlet restrictions and air pressure reductions inside the building. Low building pressure can extinguish pilot lights on gas-fired appliances or cause problems with the building ventilation system.

Additionally, bringing large quantities of winter air into a building wastes building heat and risks frozen water pipes in normally heated spaces. Use dampers and controlled air outlet louvers as shown in Figure 4-6 to eliminate these problems and allow recovery of engine heat to reduce building heat loss. Close the louvers to the exterior and open the interior louvers when the outdoor temperature is below 18°C–21°C (65°F–70°F). Reverse the louver settings when the outdoor temperature is above 21°C–24°C (70°F–75°F).



1. Exterior
2. Interior
3. Air outlet duct
4. Generator set
5. Dampers
6. Controlled air outlet louvers

Figure 4-6 Air Control Louvers

4.5 Remote Radiator Cooling

A remote radiator system allows installation of generator sets in locations where it would otherwise be difficult to bring the volume of air required to cool a unit-mounted radiator. In these systems, the engine water pump pushes coolant through a radiator mounted remotely from the generator set and, typically, in an open area. An electric motor-driven fan mounted on the radiator circulates air across the radiator's cooling fins.

The remote radiators have a Secondary Expansion Deaeration and Drawdown (SEDD) tank. This SEDD tank can be connected to the radiator either as an open or closed tank system. Closed SEDD tanks are typically used when the remote radiator is in close proximity to the generator set and open SEDD tanks are typically used when the remote radiator is located further away.

In order to assess a remote radiator cooling system, the cooling system designer needs the following data. From the respective generator set specification sheet, obtain the:

- Engine jacket water flow, Lpm (gpm)
- Cooling air required for generator set based on 14°C (25°F) rise and an ambient temperature of 29°C (85°F), m^3/min. (cfm)
- Maximum static (vertical) head allowable above engine, kPa (ft. H_2O)

From the engine and/or radiator data sheet, obtain the:

- Maximum water pump inlet restriction kPa (psi)
- Maximum allowable coolant pressure differential external to engine kPa (psi)

Note: The REZCK models are not equipped with an engine-driven water pump and primary/secondary thermostats. Selection, sourcing, and installation of the primary/secondary water pumps and primary/secondary thermostats must be provided by the design engineer based on the application requirements using the generator set spec sheet data and the water pump manufacturer's specifications.

The following subsections provide general design guidelines for a remote radiator system.

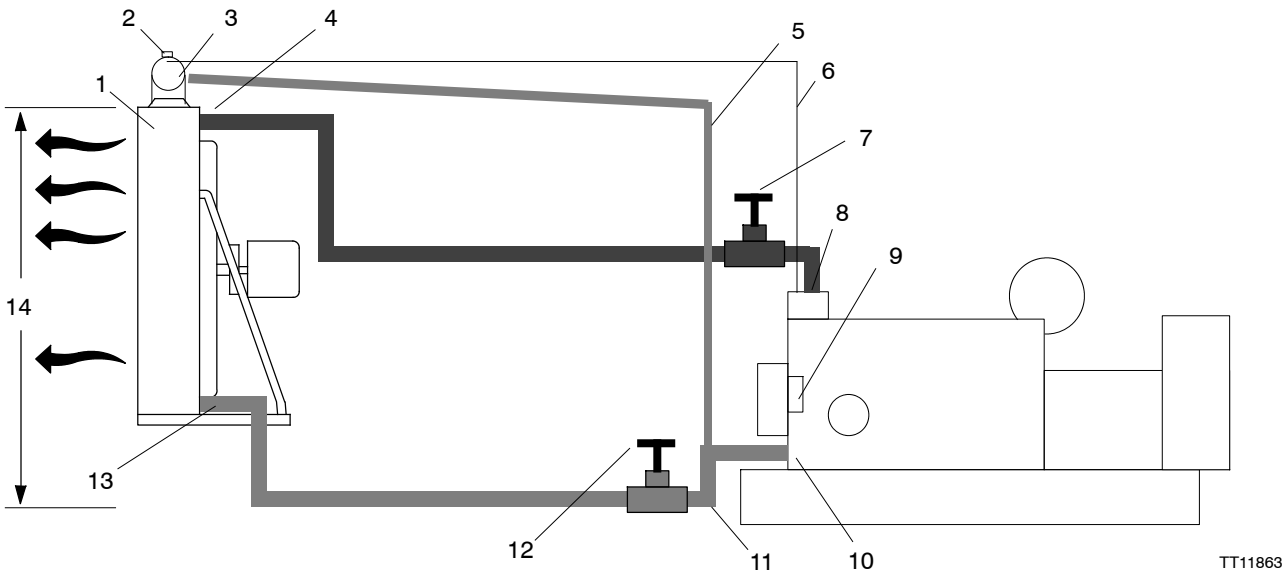
4.5.1 General

System limitations. Cooling systems are limited by radiator cap ratings. The maximum radiator operating pressure is 138 kPa (20 psi) and the maximum operating temperature is 121°C (250°F). Radiators are available for vertical or horizontal discharge. See Figure 4-7 and Figure 4-8.

Air requirements. Refer to the generator set specification sheet for radiator air and engine/alternator air requirements. Cooling air required for generator sets equipped with a remote radiator is based on a 14°C (25°F) rise and an ambient temperature of 29°C (85°F). The amount of air required to ventilate the generator set room or enclosure determines the size of the air inlet and outlet. Configure the ventilation air inlet and outlet so that air flows across the generator set.

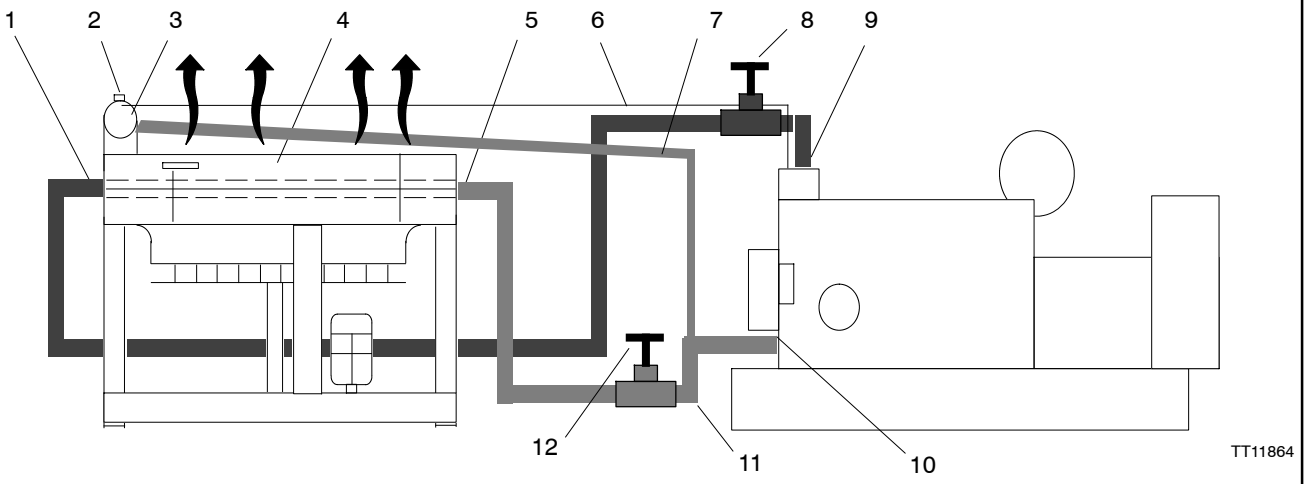
Use a ventilating fan, if necessary, to dissipate alternator and engine heat loss.

Note: All remote radiators are sized for mounting in an open area with no additional external devices attached. Attached devices, confined installation, louvers, dampers, ductwork, or other inlet or outlet air restriction require resizing the radiator to compensate for reduced airflow.



1. Remote vertical radiator (horizontal discharge)
2. Pressure cap
3. Surge tank/expansion tank
4. Radiator inlet
5. Fill line
6. Vent line
7. Shutoff Valve
8. Engine outlet
9. Engine water pump
10. Suction side
11. Fill/drain (lowest point of engine
12. Shutoff valve
13. Radiator outlet
14. Maximum allowable static (vertical) head (varies with engine)

Figure 4-7 Remote Vertical Radiator (Horizontal Discharge) System



1. Radiator inlet
2. Pressure cap
3. Surge tank/expansion tank
4. Horizontal radiator (vertical discharge)
5. Radiator outlet
6. Vent line(s)
7. Fill line
8. Shutoff valve
9. Engine outlet
10. Engine inlet
11. Fill/drain (lowest point of engine)
12. Shutoff valve

Figure 4-8 Remote Horizontal Radiator (Vertical Discharge) System

Static (vertical) head. If the vertical distance from the engine water pump to the radiator (known as *static head*) is within the engine manufacturer's recommendations, and the pressure drop through the piping and remote radiator does not exceed the engine manufacturer's limits, use the engine water pump to circulate water through the remote radiator. The allowable static head ranges from 5.2 m–15.2 m (17 ft.–50 ft.) and is listed on the generator set specification sheet. Exceeding the allowable static head causes excessive pressure on engine components resulting in problems such as leaking water pump seals.

Note: Size the pressure relief valve or cap to remain under the engine pressure limit.

Hot well tank/heat exchanger. When the static (vertical) head exceeds the distance stated in the specification sheet, use a hot well tank or heat exchanger and auxiliary circulating pump as shown in Figure 4-9 or Figure 4-10. Always wire the circulating pump in parallel with the remote radiator fan so that both operate whenever the generator set operates.

A partial baffle divides a hot well tank into two or more compartments. The engine pump forces heated water into the hot side, and the auxiliary pump then draws the water off and forces it into the radiator. After circulating through the radiator, coolant drains back to the cold side of the well where the engine water pump removes it. A hot well or heat exchanger also isolates head pressures from the engine.

Note: The water in the hot well tank drains into the radiator when the generator set is not running.

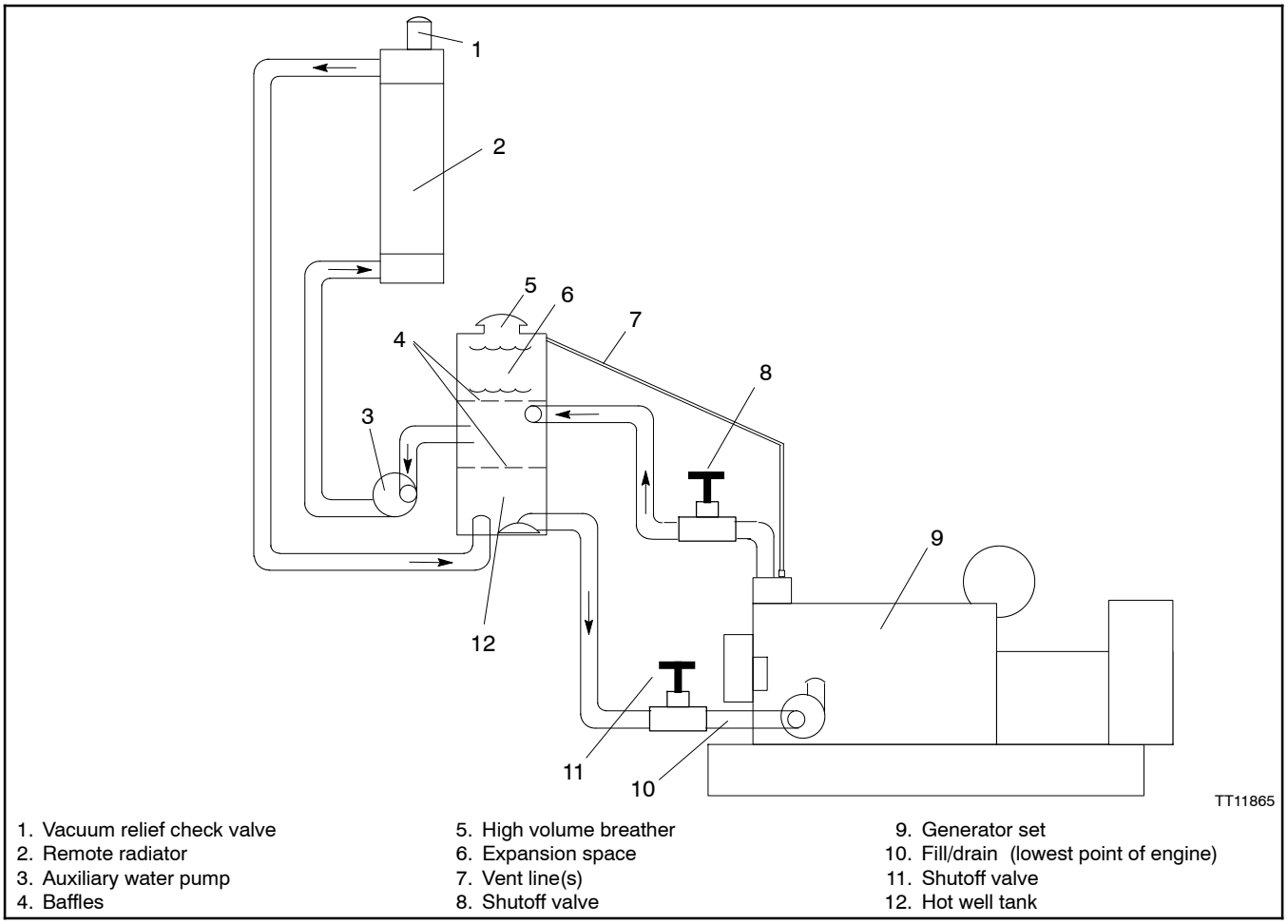
Note: Determine the size requirements of the remote radiator and hot well tank/heat exchanger for each application. Do not use a standard remote radiator with a hot well tank/heat exchanger.

4.5.2 Vent Lines

Route the vent lines at a continuous upward slope from the engine connection exit to the expansion tank. Port all vent lines individually into the expansion tank above the coolant level.

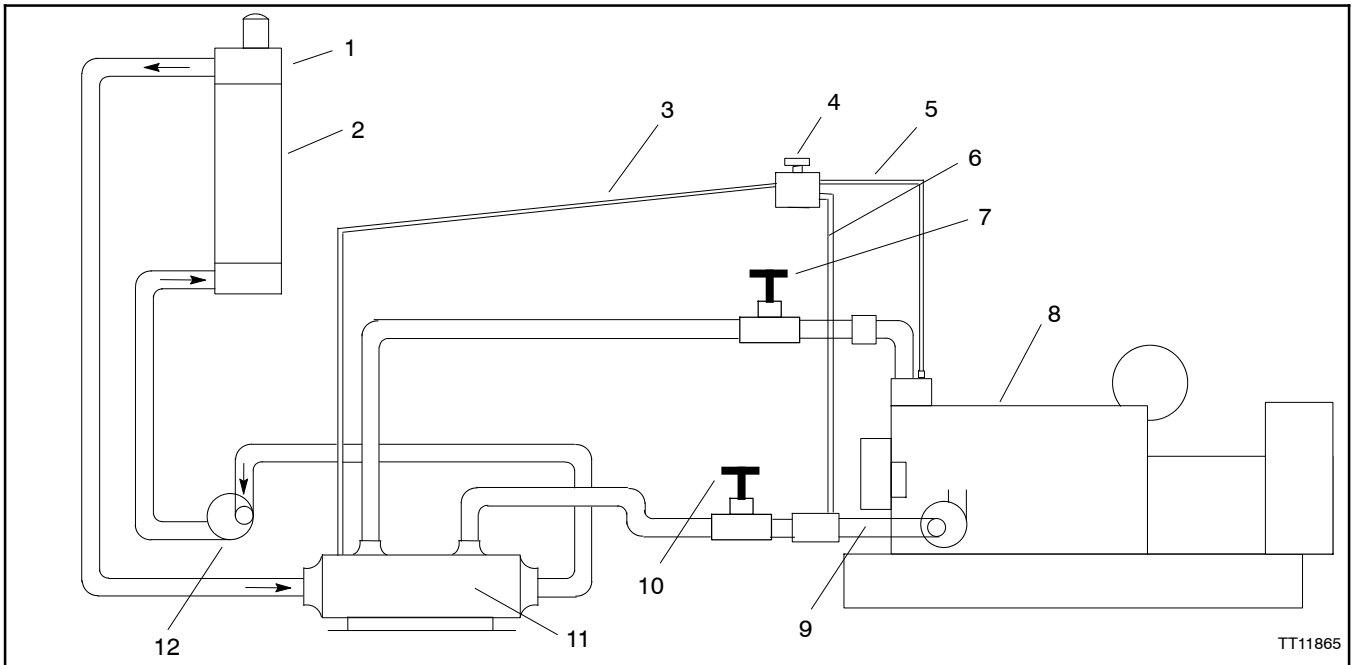
Locate the vent lines in the expansion tank to prevent splash on the coolant level sensor. Thoroughly vent the systems by installing vent lines to all the vent points on the engine and the charge air cooler circuits including the radiator core. Refer to the installation drawings for vent points.

Size the vent line the same as the connection point on the engine. The vent lines may be slightly larger; however, vent lines sized too large will increase fill line flow and possibly reduce head pressure applied to the engine water pump inlets.



1. Vacuum relief check valve
2. Remote radiator
3. Auxiliary water pump
4. Baffles
5. High volume breather
6. Expansion space
7. Vent line(s)
8. Shutoff valve
9. Generator set
10. Fill/drain (lowest point of engine)
11. Shutoff valve
12. Hot well tank

Figure 4-9 Compound Remote Radiator/Hot Well Tank Cooling System



1. Expansion/surge tank
2. Remote radiator
3. Vent line
4. Expansion/surge tank
5. Vent line(s)
6. Fill line
7. Shutoff valve
8. Generator set
9. Fill/drain (lowest point of engine)
10. Shutoff valve
11. Heat exchanger
12. Auxiliary water pump

Figure 4-10 Compound Remote Radiator/Heat Exchanger Cooling System

4.5.3 Fill Lines (Balance or Static)

Connect the fill line(s) to the bottom of the expansion tank. Make the lines as short as possible, continuously descending, and connected directly *before* the engine water pump(s). To provide a positive head pressure to the engine water pump inlet, properly locate the fill line (or makeup line). See the installation drawings for the fill line connection points.

Connect the vent and fill lines to the expansion tank at the greatest possible distance from each other to prevent aeration and preheating of the coolant returning down the fill line.

The minimum fill line sizes cannot be smaller than the connection point on the engine. Do not allow fittings on the fill lines to reduce the effective size. If other cooling system components vent too much coolant to the expansion tank, larger diameter fill lines may be needed.

4.5.4 Location Considerations

When choosing the radiator's location:

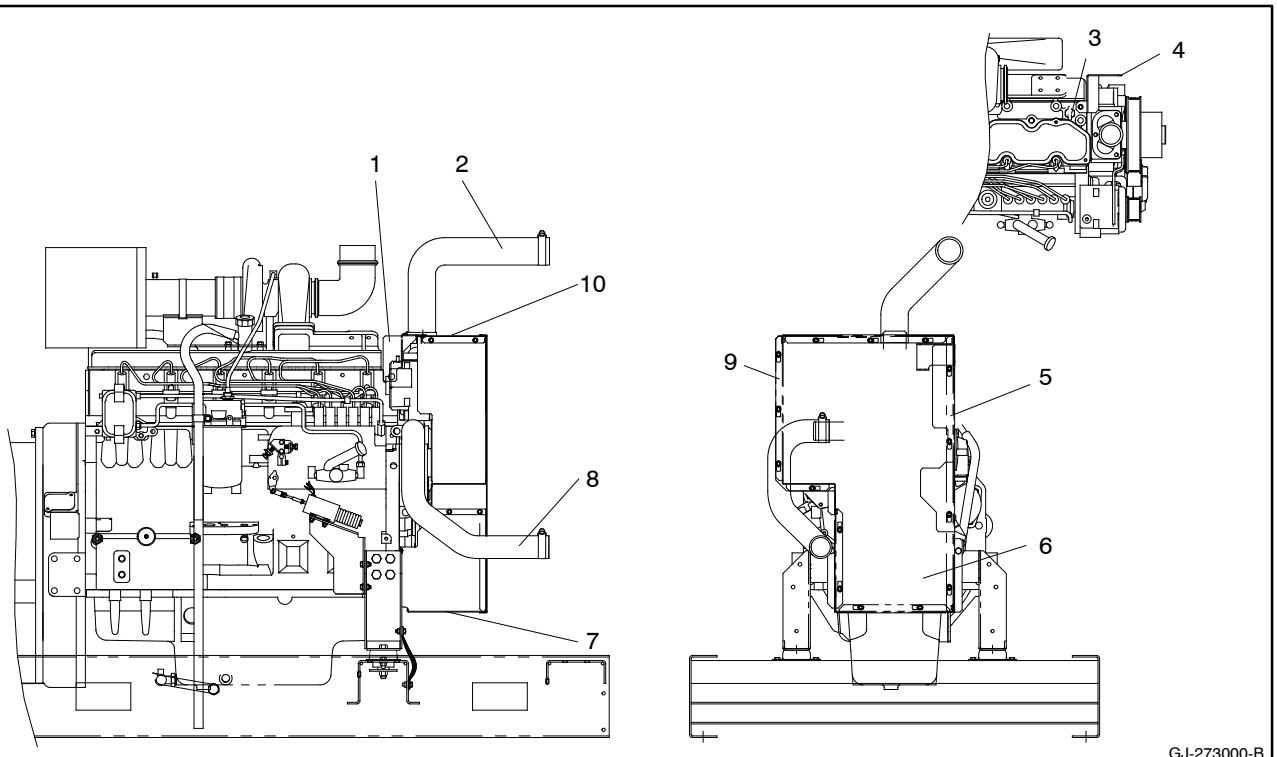
- For economical installation and operation, locate the radiator as close as practical to the engine and at the same elevation to reduce piping, coolant, and wiring costs.
- Locate the radiator surge tank fill opening and vent line(s) at the highest point in the cooling system.
- Position the radiator no closer than one fan diameter from a wall, another radiator, or any other obstruction that would restrict air movement and future service access.
- Locate the radiator to prevent recirculation of the heated exhaust air back into the intake stream.
- Mount the radiator in an area where prevailing winds do not hamper free airflow.
- Locate the radiator where it is not subject to deep snow or ice accumulation, flooding, industrial fallout, leaf accumulation, heavy dust and chaff, or other detrimental seasonal or environmental conditions.
- For rooftop installations, do not locate the radiator near critical sound areas, building ventilation, or hood exhausts.

4.5.5 Installation Considerations

Note: The REZCK models are not equipped with an engine-driven water pump and primary/secondary thermostats. Selection, sourcing, and installation of the primary/secondary water pumps and primary/secondary thermostats must be provided by the design engineer based on the application requirements using the generator set spec sheet data and the water pump manufacturer's specifications.

When installing the remote radiator:

- Use a remote radiator setup kit, if available, to aid installation. See Figure 4-11.
- Wire the cooling fan motor to the generator set output so that the fan operates whenever the generator set operates. There is no need for a thermostatic control of the fan motor because the engine thermostat prevents overcooling as it does on generator set-mounted radiator systems. Follow all applicable national and local codes when wiring the cooling fan.
- Follow the wiring diagram on the remote radiator's fan motor. The motor rotation must match the fan blade design. The manufacturer supplies most units with counterclockwise fan rotation as viewed from motor side. The fan is a blower type, moving air from the fan side of the radiator, through the core, and out the front side.
- Preferably, connect no devices to either side of the radiator. Resize the radiator if adding louvers or duct work to the radiator to compensate for reduced airflow.
- Ensure that the radiator is level and securely bolted to a firm, solid foundation.
- Brace the radiator as needed, especially in areas with strong winds.
- Use isolators to keep area vibration from affecting the radiator or to keep vibration produced by the radiator from affecting surrounding areas.
- Use hose clamps on all nonthreaded connections.



1. Top mounting bracket
2. Upper radiator hose outlet
3. Drain valve
4. Belt guard bracket
5. Left-hand belt guard
6. Front belt guard
7. Bottom belt guard
8. Lower radiator hose inlet
9. Right-hand belt guard
10. Top belt guard

Figure 4-11 Remote Radiator Setup Kit, Typical

4.5.6 Surge (Expansion) Tank for Horizontal Discharge Radiator

A horizontal discharge remote radiator requires the use of a surge (expansion) tank as shown in Figure 4-7. Locate the tank at the highest point in the cooling system. The surge tank provides venting, surge/expansion protection, and filling/makeup functions.

- Equip the surge tank with a sight-glass gauge, overflow tube, and pressure cap.
- Size the surge tank to handle at least 6%–10% of the total cooling system volume. Follow the engine manufacturer's recommendation when available.
- Connect the main line from the surge tank to the highest point of the remote radiator. Most vertical core radiators have the surge tank as part of the radiator top tank. The setup illustrated in Figure 4-7 provides for radiator and engine deaeration and a positive pressure at the pump suction inlet.
- Use a strainer to filter dirt, scale, and core sand from the coolant line.

Piping. Size water piping between the engine and the remote radiator large enough to eliminate the need for a booster pump. If the cooling system requires a booster pump, contact your distributor/dealer.

Use piping of ample size and with as few short sweep bends or elbows, tees, and couplings as possible. Use long sweep elbows or long bends, if bends are required.

Installation. Support piping externally, not from the radiator or engine.

On standard remote radiators, connect radiator bottom outlets only to the suction side of the pump. Plumb the lines to prevent air from becoming trapped in the lines. Route piping in one general direction, either upward or downward. A combination of both upward and downward piping creates air pockets in the piping. Route vent lines to the expansion/surge tank without creating low spots in the lines.

Flexible connections. Provide flexible connections when connecting piping to the radiator assembly. Use hose clamps at all nonthreaded connections.

Shutoff valves. Locate shutoff valves between the engine and cooling system to allow for isolation of both the radiator and the engine. A shutoff valve eliminates the need to drain the entire cooling system during service.

4.5.7 Procedure to Fill with Deaeration

For radiators designed for full deaeration, fill the radiator according to the following procedure.

1. Fill the cooling system from the bottom when possible. Otherwise, fill the radiator at the filler neck.
2. Next, fill the radiator through one of the top tank or expansion/surge tank inlets located before the final hose connection.
3. Continue filling the system to cover the filler neck bottom until coolant appears in the sight glass located in the radiator top tank.
4. Check and correct any leaks in the system.

4.5.8 Procedure to Fill without Deaeration

For radiators designed without deaeration, fill the radiator according to the following procedure.

1. Initially, fill the radiator through one of the top tank inlets located before the final hose connection for faster and more complete fillup.
2. Fill the cooling system from the bottom when possible. Otherwise, fill the radiator at the filler neck with coolant covering the filler neck bottom until coolant appears in the sight glass located in the radiator top tank.
3. Check for and correct any leaks in the system.

4.5.9 Checks after Initial Startup

If any problems arise during startup, immediately shut down the generator set. See Figure 4-12, Cooling System Checklist. Even after a successful startup, shut down the generator set after 5–10 minutes and recheck the belt tension to make sure no hardware has loosened during operation. Perform another recheck after 8–12 hours of operation.

✓	**Operation**
	Verify the cooling fan's position in the fan shroud.
	Check the mounting hardware.
	Check the fan motor for free rotation.
	Check V-belts for alignment and tension.
	Fill the system with coolant and check all connections for tightness and leaks.
	Verify that all electrical connections are secure and that the power source matches the motor nameplate.
	Verify that no loose foreign material is in the fan's air stream.
	With the unit running, check for:
	fan clearance
	excessive vibration
	excessive noise
	coolant leaks

Figure 4-12 Cooling System Checklist

4.6 City Water Cooling

4.6.1 System Features

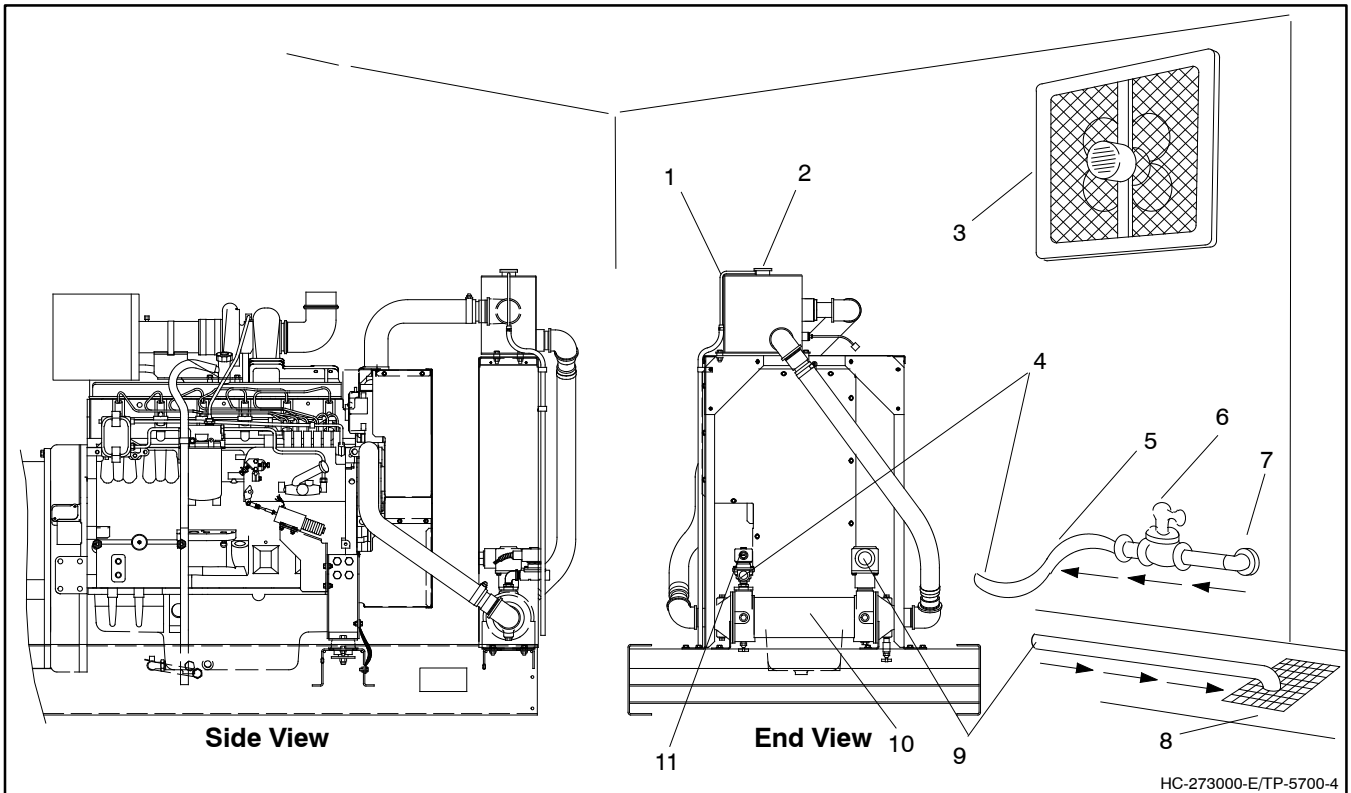
City water-cooling systems use city water and a heat exchanger for cooling. They are similar to remote radiator systems because they require less cooling air than unit-mounted radiator systems. Figure 4-13 shows some of the elements of a typical installation.

The heat exchanger limits the adverse effects of city water chemistry to one side of a heat exchanger, which is relatively easy to clean or replace, while engine coolant circulates in a closed system similar to the radiator system. The heat exchanger allows engine temperature control, permits the use of antifreeze and coolant conditioners, and is suited to the use of an engine block heater as a starting aid.

4.6.2 Installation Considerations

Vibration isolation requirements. Water inlet and outlet connections are mounted on the generator set skid and isolated from engine vibration by flexible sections. If the generator set is vibration-mounted to the skid and the skid is bolted directly to the mounting base, no additional flexible sections are needed between connection points on the skid and city water lines. If the generator set skid is mounted to the base with vibration isolators, use flexible sections between the connection points on the skid and city water lines.

Shutoff valve location. A solenoid valve mounted at the inlet connection point automatically opens when the generator set starts, providing the engine cooling system with pressurized water from city water mains. This valve automatically closes when the unit shuts down. Use an additional customer-supplied valve ahead of the entire system to manually shut off city water for generator set service.



1. Coolant expansion tank
2. Coolant expansion tank pressure cap
3. Ventilation fan (for heat rejected from exhaust and engine)
4. Connect heat exchanger inlet to city water supply
5. Flexible section
6. Manual shutoff valve
7. City water supply
8. Heated city water into floor drain
9. Connect heat exchanger outlet to floor drain
10. Heat exchanger
11. Solenoid valve

Figure 4-13 City-Water Cooling System with Heat Exchanger

4.7 Cooling Tower

A cooling tower system is a variation of a city water cooling with heat exchanger system. In warm, dry climates, a cooling tower is a suitable source of generator set cooling water.

A cooling tower system consists of the engine cooling system plus a raw-water system. The engine cooling system usually includes the engine water pump, a heat exchanger, a surge tank, and the engine water jacket. The raw-water system consists of the cooling tower, a raw-water pump, and the tube portion of the heat exchanger. A typical system is shown in Figure 4-14.

The engine cooling system circulates coolant through the heat exchanger outer shell. Raw water circulates through the heat exchanger tubes absorbing heat from the engine coolant. The heated raw water flows into a pipe at the top of the cooling tower and sprays down into the tower to cool by evaporation. Because some water is constantly being lost through evaporation, the system must provide makeup water.

4.8 Block Heaters

Block heaters are available as installed accessories on all generator sets. Generator sets installed in NFPA applications generally require use of a block heater. Equip generator sets with block heaters on all standby applications where the generator set is subject to temperatures below 0–20°C (32–68°F). See the respective generator set spec sheet for specific temperature recommendations. Connect the block heater to a power source that is energized when the generator set is not running. The block heater thermostat temperature is set for optimum operation based on the respective engine cooling characteristics.

Note: Block heater damage. The block heater will fail if the energized heater element is not immersed in coolant. Fill the cooling system before turning on the block heater. Run the engine until it is warm and refill the radiator to purge the air from the system before energizing the block heater.

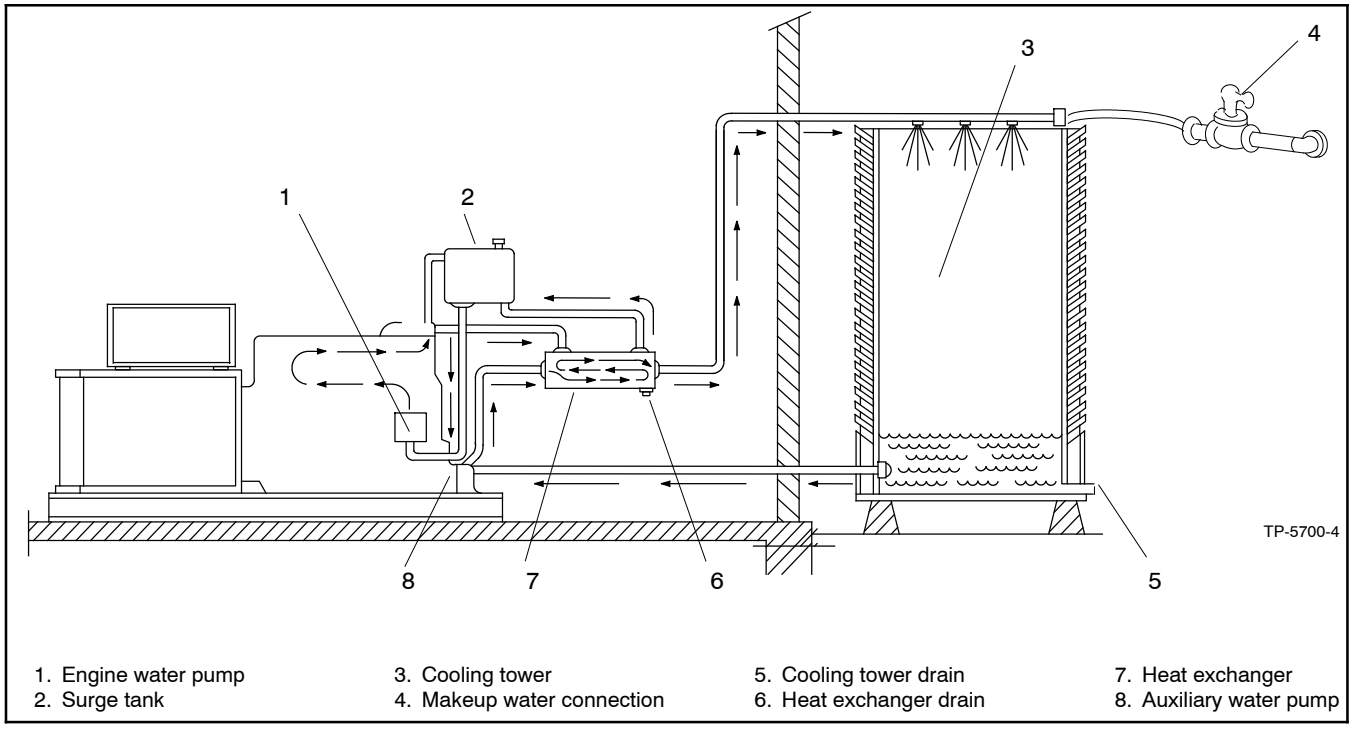


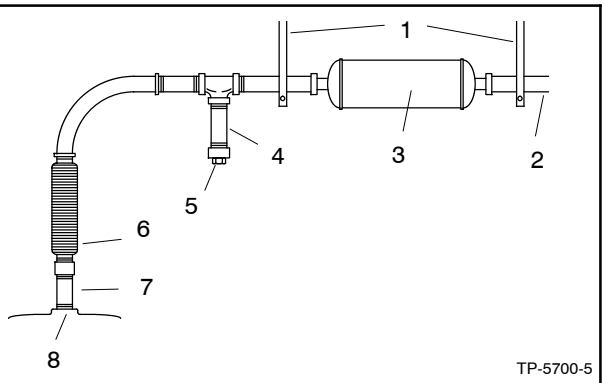
Figure 4-14 Cooling Tower System

Notes

Satisfactory generator set performance requires proper exhaust system installation. Figure 5-1 and Figure 5-2 show typical arrangements of recommended exhaust systems. The following sections detail exhaust system components.

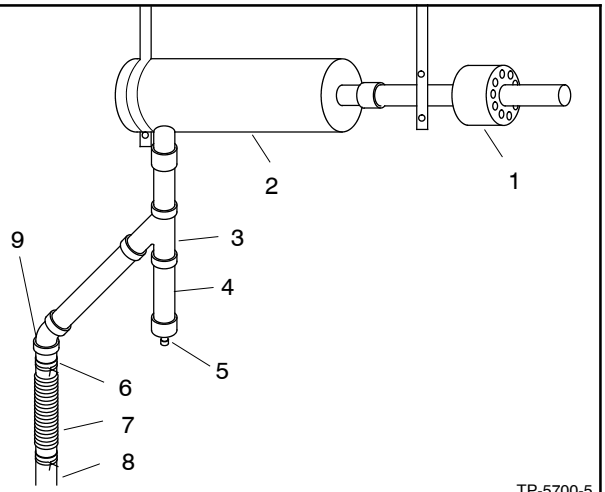
5.1 Flexible Exhaust Line

Install a section of seamless stainless steel flexible exhaust line at least 305 mm (12 in.) long within 610 mm (2 ft.) of the engine exhaust outlet. See Figure 5-1 and Figure 5-2.



1. Supports
2. Pitch line downward
3. Silencer
4. Water trap
5. Drain petcock
6. Flexible section
7. Solid section 152–203 mm (6–8 in.)
8. Manifold

Figure 5-1 Exhaust System, End Inlet Silencer



1. Exhaust wall thimble
2. Silencer
3. 45° Y fitting
4. Water trap
5. Drain petcock
6. Outer diameter adapter and clamp
7. Flexible section
8. Manifold
9. 45° elbow

Figure 5-2 Exhaust System, Side Inlet Silencer

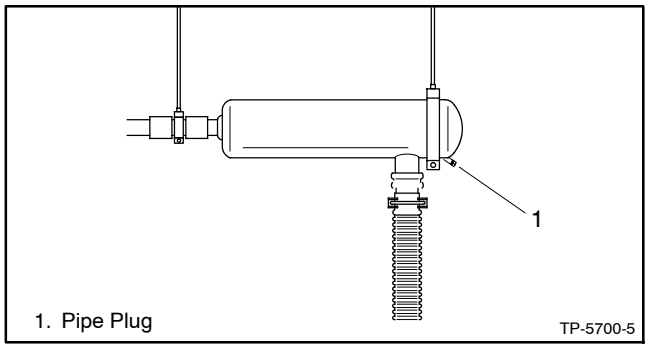
The flexible line limits stress on the engine exhaust manifold or turbocharger. Never allow the engine manifold or turbocharger to support the silencer or exhausting piping.

Note: Do not bend the flexible section or use it to compensate for misalignment between the engine exhaust and the exhaust piping.

When using threaded flexible exhaust connectors, place a 152–203 mm (6–8 in.) length of pipe between the flexible exhaust connectors and the exhaust manifold. See Figure 5-1. The pipe reduces the temperature of the flexible connection, simplifies flexible section removal, and reduces strain on the engine exhaust manifold.

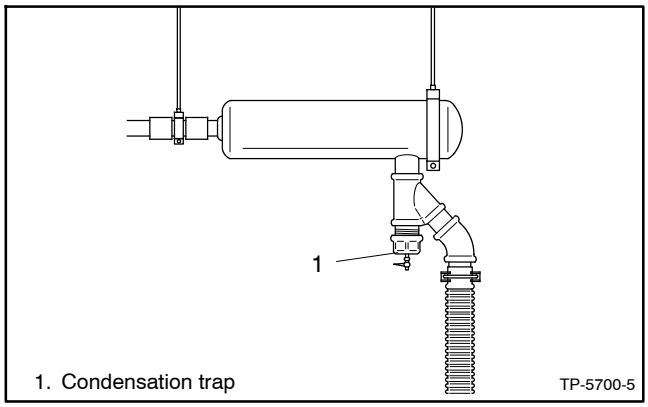
5.2 Condensation Trap

Some silencers are equipped with a drain pipe plug for draining condensation; see Figure 5-3. Otherwise, install a wye- or tee-type condensation trap with a drain plug or petcock between the engine and the exhaust silencer as shown in Figure 5-4. The trap prevents condensed moisture in the engine exhaust from draining into the engine after shutdown. Periodically drain collected moisture from the trap.



1. Pipe Plug

Figure 5-3 Silencer Condensation Drain Plug



1. Condensation trap

Figure 5-4 Condensation Trap

5.3 Piping

Note: Select piping with a diameter that is the same size as, or larger than, the manifold outlet's inside diameter.

- Keep exhaust lines as short and straight as possible.
- Use schedule 40 black-iron pipe.
- Use sweep elbows with a radius of at least three times the pipe diameter.
- Use exhaust piping that conforms to applicable codes.
- Support the exhaust piping securely, allowing for thermal expansion.
- Insulate the exhaust piping with high-temperature insulation to reduce the heat rejected by exhaust piping and consequently the amount of ventilating air required.

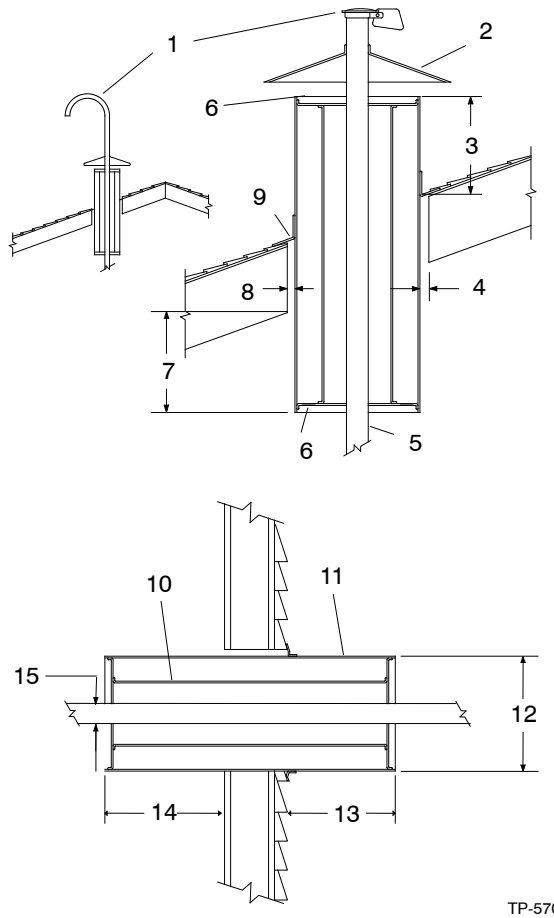
In general, exhaust temperatures measured at the engine's exhaust outlet are less than 538°C (1000°F), except for infrequent brief periods; therefore, low-heat appliance standards apply. Each generator set specification sheet provides exhaust temperatures.

For units with exhaust temperatures below 538°C (1000°F), route the exhaust piping a minimum of 457 mm (18 in.) from combustible material, including building materials and natural surroundings. If exhaust temperatures exceed 538°C (1000°F), the minimum distance is 914 mm (36 in.).

When planning exhaust silencer and piping placement, consider the location of combustible materials. If the proximity of the exhaust system to the combustible materials cannot be avoided, follow a regular maintenance schedule to ensure that combustible materials are kept away from the exhaust pipes after installation. Combustible materials include building materials as well as natural surroundings. Keep dry field grass, foliage, and combustible landscaping material a safe distance from the exhaust system.

5.4 Double-Sleeved Thimbles

If the exhaust pipe passes through a wall or roof, use a double-sleeved exhaust thimble to prevent the transmission of exhaust pipe heat to the combustible material. Figure 5-5 shows construction details of a typical double-sleeved thimble in which exhaust piping passes through a combustible structure. Sheet metal shops usually fabricate thimbles using installation engineer's specifications and drawings.



1. Rain cap (or gradual U bend)
2. Rain shield
3. 254 mm (10 in.) minimum
4. 25 mm (1 in.) minimum
5. Exhaust pipe
6. Ventilation holes at both ends
7. 254 mm (10 in.) minimum
8. 25 mm (1 in.) minimum
9. Flashing
10. Inner sleeve
11. Outer sleeve
12. Thimble outer diameter
13. 254 mm (10 in.) minimum outside
14. 254 mm (10 in.) minimum inside
15. Exhaust pipe diameter

Figure 5-5 Double-Sleeved Thimbles and Rain Cap

Construct the thimble so it extends at least 254 mm (10 in.) both inside and outside the structure's surface. Openings at both ends of the thimble allow cooling air to circulate through the thimble. If screening is used on the outer end to keep birds and animals from entering the thimble, use a mesh large enough to allow unrestricted air circulation through the thimble. See Section 5.5 for additional exhaust outlet location and protection considerations.

5.5 Exhaust Outlet

Outlet location. Engine performance and efficiency depend on the location of the exhaust outlet. Direct the exhaust outlet away from the air inlet to prevent exhaust gases from entering the air inlet and clogging the dry-type air filter elements. Hot exhaust drawn through the radiator adversely affects engine cooling. Locate the exhaust outlet to prevent exhaust fumes from entering a building or enclosure.

Noise reduction. The exhaust outlet configuration affects the apparent noise level for people or animals in the vicinity. An upward-directed outlet seems quieter than one directed downward or horizontally. Additionally, a 30- to 45-degree angled cut at the end of a horizontal exhaust outlet pipe reduces turbulence at the outlet, thereby reducing the noise level.

Rain cap. To prevent precipitation from entering the exhaust pipe, install a rain cap on vertical outlets. See Figure 5-5. In a climate where freezing is common, do not use a rain cap. Instead, extend the exhaust piping at least 610 mm (24 in.) beyond the roof line and create a gradual U bend at the end to direct the exhaust outlet downward. Keep the pipe outlet at least 457 mm (18 in.) from the roof to prevent hot exhaust from igniting the roof material.

Note: Do not use a rain cap in areas subject to freezing temperatures.

Generator set with enclosure. To avoid exceeding the engine manufacturer's maximum allowable backpressure specification, enclosure tail pipe extensions or attachments are not recommended.

5.6 Exhaust System Backpressure

Exhaust backpressure limits engine power and excessive backpressure causes serious engine damage. Excessive backpressure usually results from one or more of the following reasons:

- The exhaust pipe diameter is too small.
- The exhaust pipe is too long.
- The exhaust system has too many sharp bends.
- The exhaust silencer is too small.
- The exhaust silencer is not the correct design for the application.

Use the following procedure to verify that the installed exhaust system does not exceed the engine's maximum exhaust backpressure limit as specified in the generator set specification sheet.

Exhaust System Backpressure Calculation Procedure

Determine the total backpressure by calculating the effects of the individual exhaust system components and adding the results. Make calculations using either English or metric units. Exhaust pipe references are nominal pipe NPT (in.) sizes. The procedure shows an example with *italic* text. Calculations relate to end inlet silencers.

Note: When calculating backpressure drop for *side* inlet silencers, use the *end* inlet values shown and add 0.75 kPa (0.25 in. of mercury or 3.4 in. of water) to backpressure calculations.

1. Select the exhaust silencer type for the application—hospital, critical, residential, or industrial. See the silencer specification sheet for definitions for each exhaust silencer type. Confirm silencer type availability for your generator set with your authorized distributor/dealer, as some generator sets do not use all four types.

   Example: Determine the silencer backpressure for the recommended critical silencer on a 230 kW, 60 Hz diesel generator set.

2. Refer to the generator set specification sheet for:

   a. Engine exhaust flow at rated kW in m^3/min. (cfm)

      Example: 57.5 m^3/min. (2030 cfm)

   b. Maximum allowable backpressure in kPa (in. of Hg)

      Example: 10.2 kPa (3.0 in. Hg)

3. Refer to the submittal catalog for:

   a. The recommended critical silencer part number
      Example: 343616

   b. Silencer inlet diameter in mm (in.)
      Example: 152 mm (6 in.)

   c. Silencer inlet position (end or side)
      Example: end inlet

   d. The flexible exhaust adapter part number
      Example: 343605

   e. Flexible exhaust adapter, flexible section length
      Example: 857 mm (33.75 in.)

4. Determine the exhaust gas velocity through the silencer as follows:

   a. Using the exhaust silencer inlet diameter determined in step 3, determine corresponding inlet area using Figure 5-6.

      Example: 0.0187m^2 (0.201 sq. ft.)

   b. Use this data to calculate the exhaust gas velocity. Divide the engine exhaust flow from step 2 in m^3/min. (cfm) by the silencer inlet area m^2 (sq. ft.) to get flow velocity in m (ft.) per minute.

      Example:
      57.5 m^3/min. / 0.0187 m^2 = 3075 m/min.
      (2030 cfm / 0.201 sq. ft. = 10100 ft./min.)

Nominal Pipe Size, in. NPT	Inlet Area, m^2	Inlet Area, ft^2
1	0.00056	0.0060
1 1/4	0.00097	0.0104
1 1/2	0.00131	0.0141
2	0.00216	0.0233
2 1/2	0.00308	0.0332
3	0.00477	0.0513
4	0.00821	0.0884
5	0.0129	0.139
6	0.0187	0.201
8	0.0322	0.347
10	0.0509	0.548
12	0.0722	0.777
14	0.0872	0.939
16	0.1140	1.227
18	0.1442	1.553

Figure 5-6 Cross Sectional Area for Standard Silencer Sizes

5. Refer to Figure 5-7. Use the exhaust gas velocity determined in step 4 and find the exhaust gas velocity value in thousands on the bottom scale. Move vertically up until this value intersects the curve of the corresponding silencer type as determined in step 1. Move left on the horizontal axis and determine the backpressure drop value in kPa (in. of Hg).

   Example: Exhaust velocity, 3075 m/min. (10100 ft./ min.) intersects with critical silencer curve B and the corresponding backpressure value is approximately 2.8 kPa (0.85 in. of mercury). Silencer type is end inlet from step 3 information with no additional backpressure drop value per the following note.

   Note: When calculating backpressure drop for *side* inlet silencers, use the *end* inlet values shown and add 0.75 kPa (0.25 in. of mercury or 3.4 in. of water) to backpressure calculations.

   Note: Refer to Figure 5-8 to calculate in inches of water and feet per minute.

6. Total the number of elbows and flexible sections in the exhaust system between the engine and the exhaust system outlet. Compare the radius of the bend (R) to the pipe diameter where (D) is the nominal pipe diameter in inches. Determine the equivalent length in m (ft.) of straight pipe for the elbows and flexible sections from the following:

Bend Angle	Type	Bend Radius	Conversion Factor
90°	Close	R = D	32 x D* / 12
90°	Medium	R = 2D	10 x D* / 12
90°	Sweep	R = 4D	8 x D* / 12
45°	Close	R = D	15 x D* / 12
45°	Sweep	R = 4D	9 x D* / 12
	Flex Sections		2 x Length† / 12

* Use the diameter of the silencer inlet in *inches* from step 3 for the initial calculation. If the results from step 9 indicate excessive backpressure drop, then recalculate using the larger-diameter pipe size selected.

† Use the flexible exhaust adapter length from step 3 and add any additional flex sections in the exhaust system expressed in *inches*.

Convert the equivalent pipe length calculated in feet to meters using ft. x 0.305 = m, as needed.

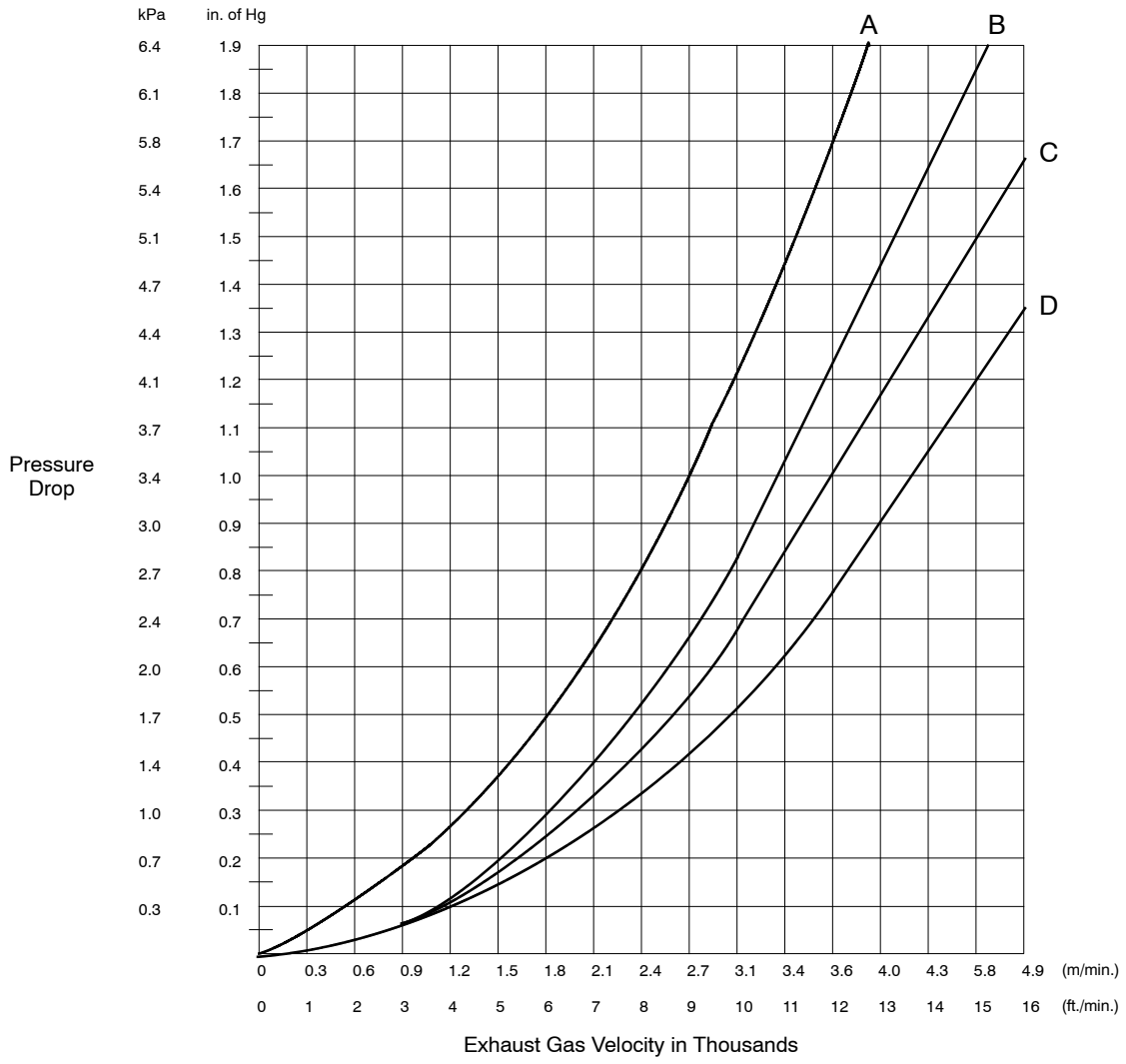
Examples:

45 ° sweep elbows:
9 x 6.0 in. / 12 = 4.5 equiv. ft. or 1.4 equiv. m

90 ° close elbows:
32 x 6.0 in. / 12 = 16.0 equiv. ft. or 4.9 equiv. m

Flexible sections:
2 x 33.75 in. / 12 = 5.6 equiv. ft. or 1.7 equiv. m

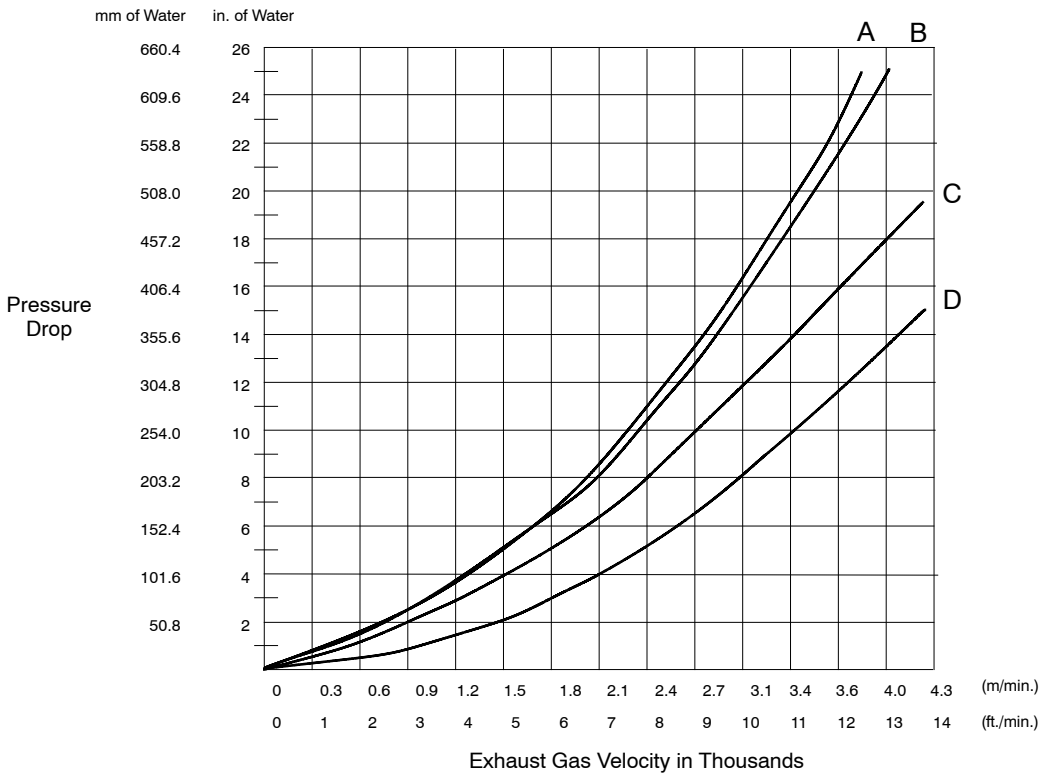
Equivalent of straight pipe:
4.5 + 16.0 + 5.6 = 26.1 equiv. straight ft.
1.4 + 4.9 + 1.7 = 8.0 equiv. straight m



A = Hospital Silencer
B = Critical Silencer
C = Residential Silencer
D = Industrial Silencer

Note: When figuring the silencer pressure drop for side inlet, add 0.75 kPa (0.25 in. of mercury or 3.4 in. of water) to the backpressure.

Figure 5-7 Silencer Backpressure Drop (in. of Hg)



A = Hospital Silencer
B = Critical Silencer
C = Residential Silencer
D = Industrial Silencer

Note: When figuring the silencer pressure drop for side inlet, add 0.75 kPa (86 mm of water or 3.4 in. of water) to the backpressure.

Figure 5-8 Silencer Backpressure Drop (in. of water)

7. Determine the total length of straight pipe used in the exhaust system. Add this calculation to the equivalent length for elbows and flexible sections obtained in step 6.

   Example:

   Straight pipe = 3.0 m (10 ft.).
   Equivalent straight pipe from step 6: 8.0 m (26.1 ft.)

   3.0 m + 8.0 m = 11.0 m or
   10 ft. + 26.1 ft. = 36.1 ft. total

8. Refer to Figure 5-9 if the pipe size is 102 mm (4 in.) or less or Figure 5-10 if the pipe size is 127 mm (5 in.) or larger.

   Place a straight edge across the chart with the edge in line with the pipe size in inches (D) on the right column from step 3 and the engine exhaust flow (Q) from step 2 on the left column.

   Read backpressure kPa/m or in. of Hg/ft. (ΔP) from the center column. Calculate the total piping system backpressure by multiplying the total equivalent straight pipe in m (ft.) from step 7 by the kPa/m or in. of Hg/ft. of pipe from this step.

   Example:

   11.0 equiv. m x 0.04 kPa/m =
   0.4 total system backpressure in kPa

   36.1 equiv. ft. x 0.004 in. Hg/ft. =
   0.14 total system backpressure in inches of Hg

9. Add the backpressure of the piping determined in step 8 to the backpressure of the silencer determined in step 5. The total should not exceed the engine manufacturer's maximum allowable system backpressure determined in step 2 or on the generator set's specification sheet. If the total exceeds the maximum, use a larger pipe size or silencer or both. Repeat the calculation if new components are selected to verify that the system backpressure would not exceed the limit using the larger component(s).

   Example:

   0.4 kPa (step 8) + 2.8 kPa (step 5) = 3.2 kPa
   Maximum allowable backpressure = 10.2 kPa
   3.2<10.2 backpressure drop is acceptable

   0.14 in. Hg. (step 8) + 0.85 in. Hg. (step 5) =
   0.99 in. Hg.
   Maximum allowable backpressure = 3.0 in. of Hg.
   0.99< 3.0 backpressure drop is acceptable

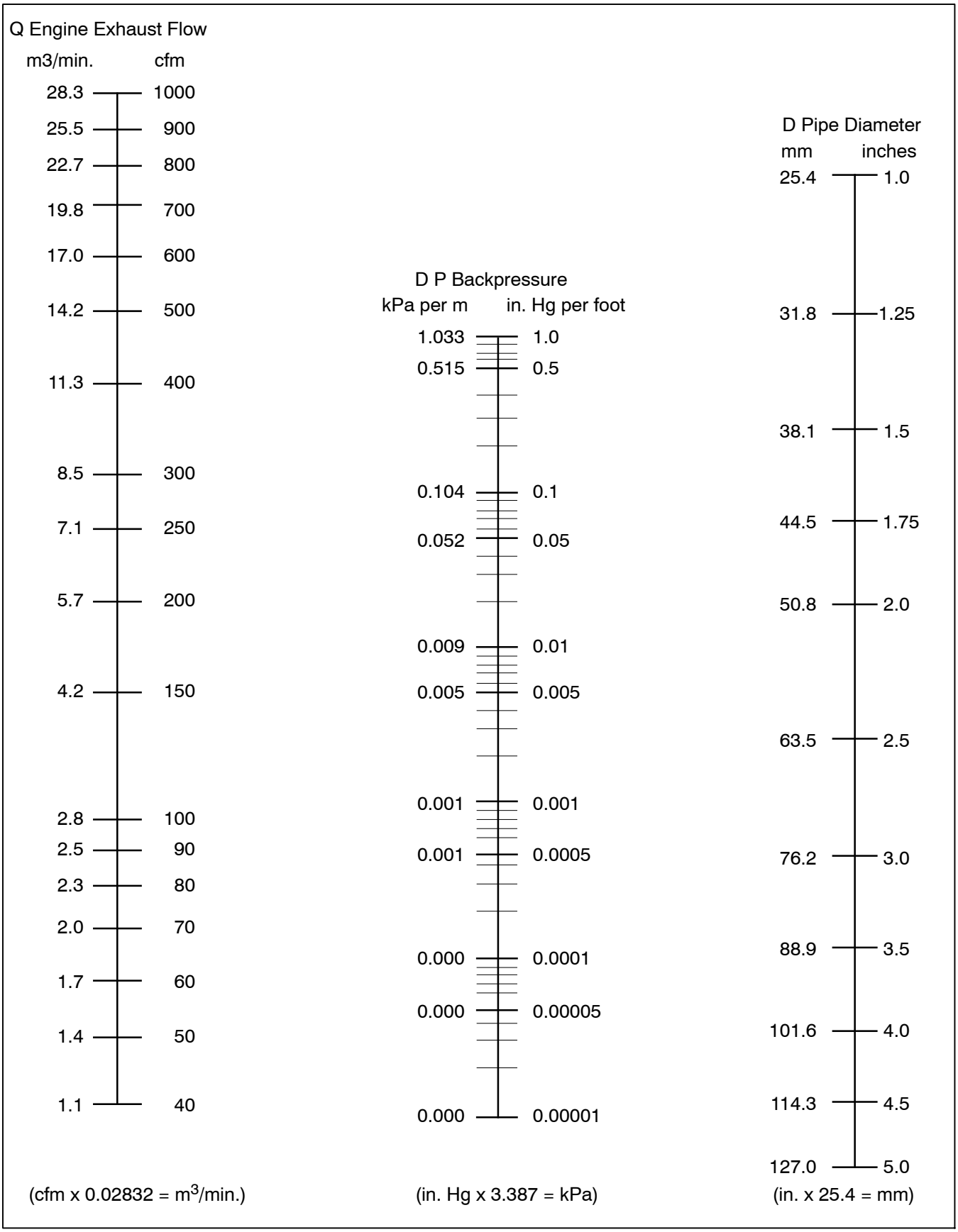


Figure 5-9 Backpressure using Pipe Size 4 in. (102 mm) or Less

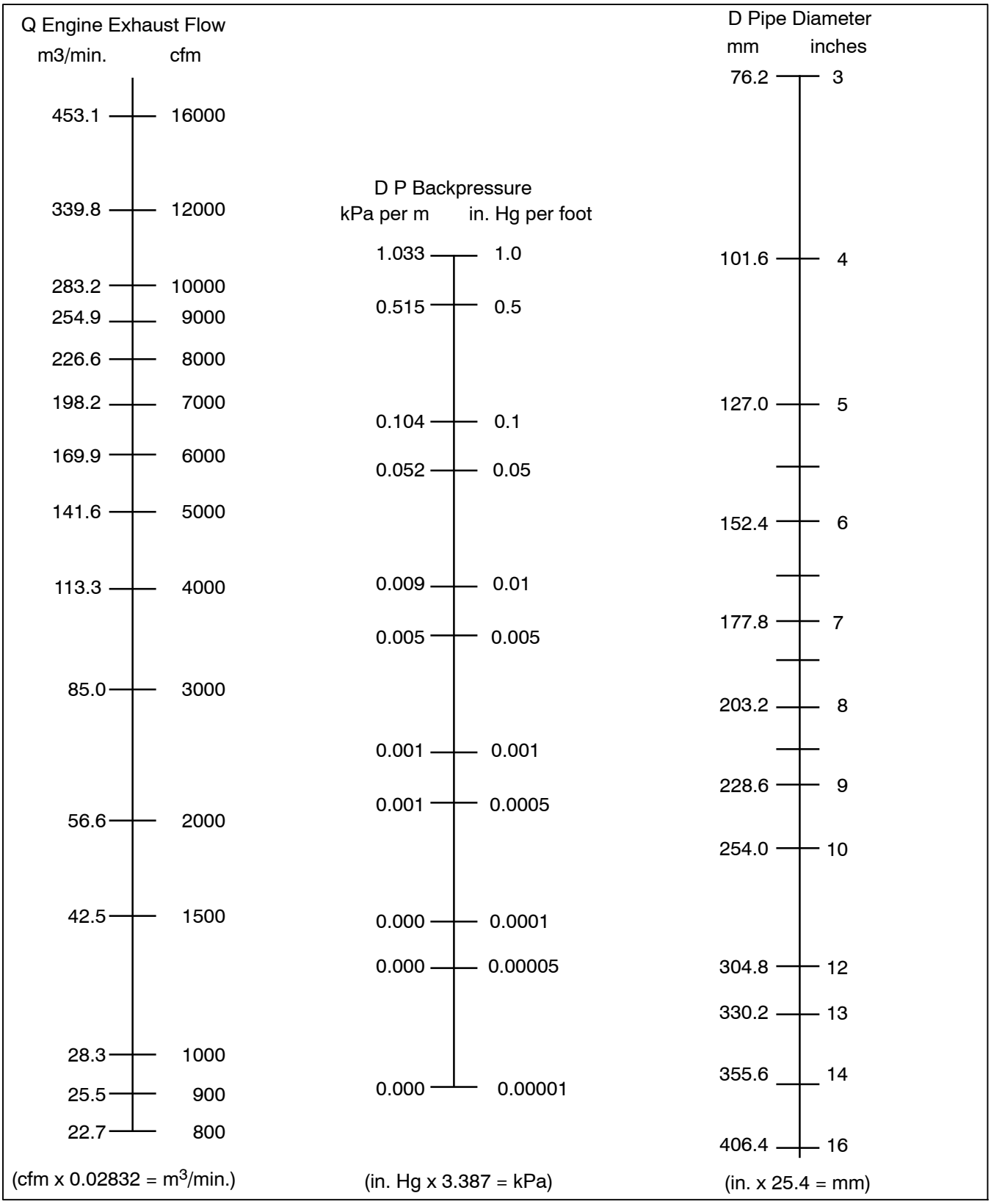


Figure 5-10 Backpressure using Pipe Size 5 in. (127 mm) or Larger

Notes

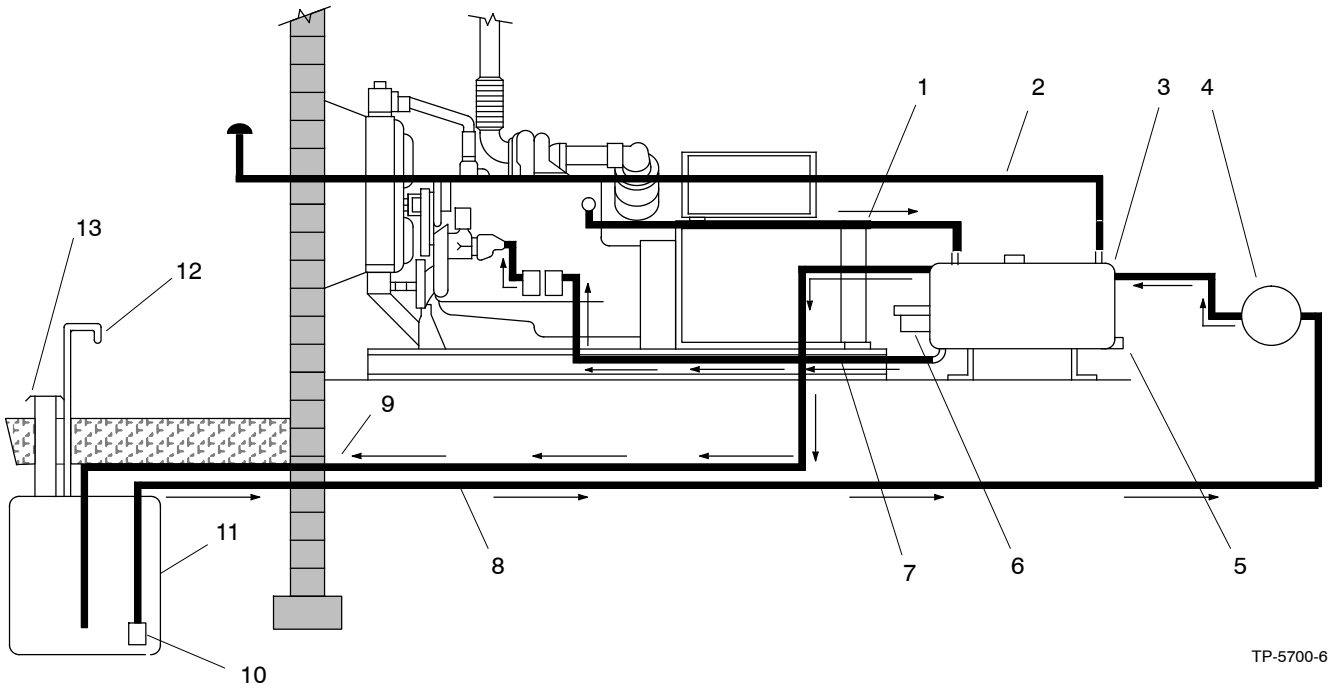
Comply with applicable state and local codes when installing any fuel system.

6.1 Diesel Fuel Systems

The main components of a typical diesel fuel system are a main fuel storage tank, a day tank, fuel lines, and an auxiliary fuel pump. See Figure 6-1.

6.1.1 Main Tank

Storage. Because it is less volatile than gas or gasoline, diesel fuel is safer to store and handle. Regulations for diesel storage tank placement are less stringent than the regulations for gas or gasoline storage. In some locations, large main tanks are permitted inside the building or enclosure.

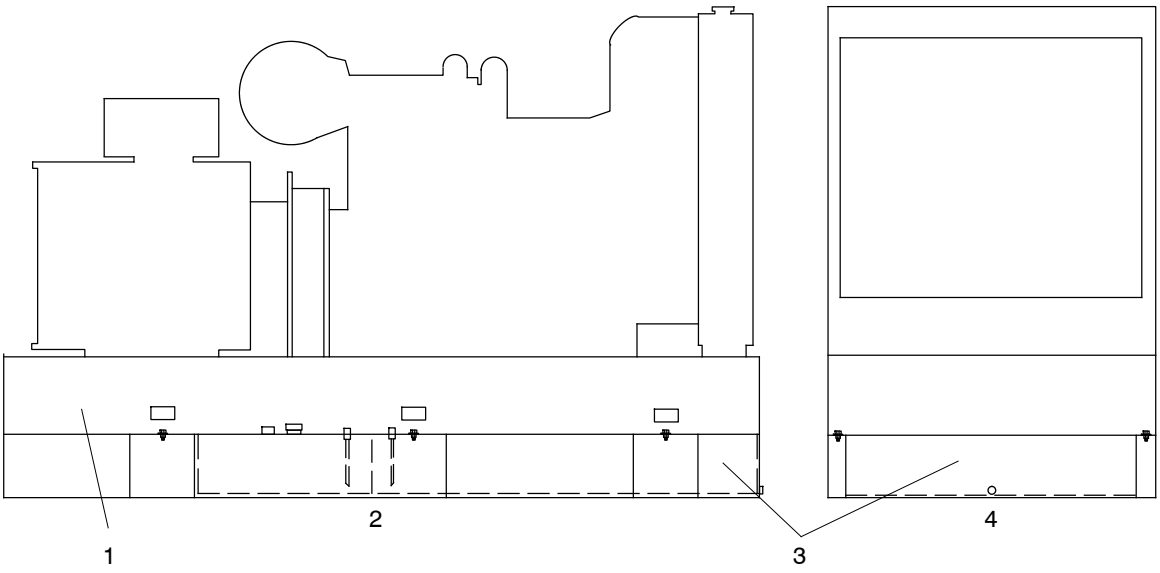


1. Injector return line
2. Day tank vent
3. Day tank
4. Auxiliary fuel pump
5. Tank drain
6. Electric fuel level control switch
7. Fuel supply line from day tank to engine connection
8. Fuel supply line from main fuel tank to day tank
9. Overflow line
10. Foot valve
11. Main fuel storage tank
12. Fuel tank vent
13. Tank filling inlet

Figure 6-1 Diesel Fuel System

Tank location. Locate fuel storage tanks above ground or bury them underground in accordance with applicable codes. Figure 6-2 shows a commonly used above-ground subbase tank contained in the generator set mounting base.

Provide easy access to fuel filters and sediment drains for regular and frequent service. Clean fuel is especially important to diesel engines, which have easily clogged fuel injectors and pumps.



1. Generator set skid
2. Side view
3. Subbase fuel tank
4. End view

Figure 6-2 Subbase Fuel Tank

Tank size. Codes requiring standby power often specify a minimum onsite fuel supply. Such requirements are included in NFPA 70, National Electrical Code, and NFPA 99, Standard for Health Care Facilities. Diesel fuel deteriorates if stored for more than one year; therefore, size the tank to ensure that regular generator set exercising will use the tank's contents within one year. If there are no applicable code requirements, the manufacturer recommends a tank sized for eight hours of operation at rated load. Refer to the generator set specification sheet for fuel consumption data.

Tank venting. Vent the main fuel tanks to allow air and other gases to escape to the atmosphere without allowing dust, dirt, and moisture to enter the tank.

Fuel expansion. Never fill the tank more than 95% full to allow for fuel expansion. On overhead main tanks, use a fuel shutoff solenoid to prevent hydraulic lock or tank overflow caused by excessive static head fuel pressures.

Fuel alternatives. Most diesel engines operate satisfactorily on No. 2 domestic burner oil available in most parts of the US. If the site heating system is oil-fired, consider supplying the engine with fuel from the same tank used for heating oil to reduce costs and to ensure a continually fresh fuel supply for the engine. This practice necessitates that the fuel oil meets the engine manufacturer's minimum requirements for wax point, pour point, sulfur content, and cetane number as these factors influence cold weather starting and generator set power output. When supplying multiple applications from the same main fuel tank, provide each with a separate supply line.

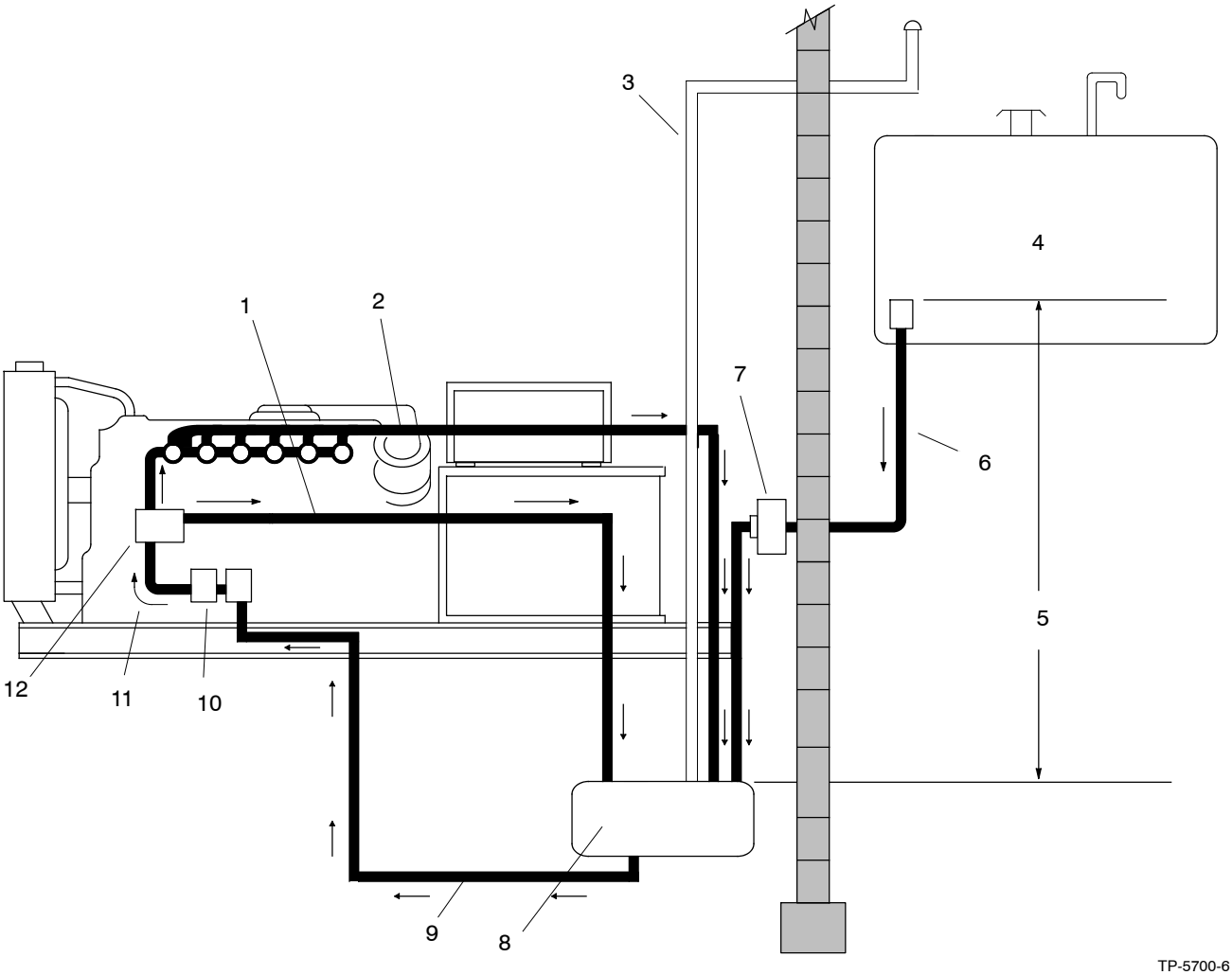
6.1.2 Day Tanks

The terms *day tank* and *transfer tank* are interchangeable. Having a day tank adjacent to the engine allows the engine fuel transfer pump to easily draw fuel during startup and provides a convenient location to connect fuel injector return lines. See Figure 6-3.

Connect a float-switch-controlled solenoid antisiphon valve or a float valve to prevent siphoning fuel from the main storage tank if the main tank fuel level is above the day tank inlet.

Tank size. Standard tanks are available in sizes from 38–3952 L (10–1044 gal.) with or without integral electric fuel transfer pumps. Because engines are subject to fuel temperature deration above 38°C (100°F) and are subject to damage if operated with fuel temperatures above 60°C (140°F), a day tank providing at least four hours of fuel consumption should be used to provide enough capacity to cool the fuel returning from the engine. If smaller day tanks are used, the generator set manufacturer may recommend installing a fuel cooler or routing engine fuel return lines to the main storage tank. See Figure 6-3.

Optional equipment includes fuel level gauges, manual priming pumps, float switches for pump control, float valves, rupture basins, and low level alarms. Remove the plastic shipping plugs and install metallic pipe plugs in all unused fuel tank ports to provide a liquid-tight seal.



1. Return line from fuel pump
2. Return line from fuel injectors/fuel rack
3. Vent (to outside)
4. Overhead main tank
5. Maximum 76 m (25 ft.), minimum 25 mm (1 in.)
6. Fuel supply line from main fuel tank to day tank
7. Fuel shutoff solenoid
8. Day tank
9. Fuel supply line from day tank to engine connection
10. Filter
11. Flexible line
12. Fuel pump

Figure 6-3 Diesel Fuel System with Overhead Main Tank and Day Tank

6.1.3 Fuel Lines

The following items describe fuel line selection and application. Never use the fuel piping or fuel line clamps to ground any electrical equipment.

Line type. Use Schedule 40 black-iron pipe, steel tubing, or copper tubing for diesel fuel systems. Diesel fuel reacts adversely with galvanized tanks and piping, producing flaking sediment that quickly clogs filters and causes fuel pump and fuel injector failure. Ensure that any flexible fuel lines used are approved for diesel fuel.

Line size. Use the smallest diameter fuel line that still delivers enough fuel to the engine with an acceptable pressure drop of 6.9 kPa (1.0 psi). Using oversize piping increases the chance of air introduction into the fuel system during engine priming, which increases the potential for fuel pump damage and hard starting.

Flexible connectors. Use flexible connections spanning a minimum of 152 mm (6 in.) between the stationary piping and the engine fuel inlet connection.

Return lines. A diesel system delivers more fuel to the injectors than the engine uses; therefore, a system has one supply line from the fuel tank and at least one return line from the fuel injectors. Size the fuel return lines no smaller than the fuel supply lines.

Route the return fuel line to either the day tank or the main storage tank. Place the return lines as far away from the pickup or fuel diptube as possible to prevent air entry and to keep warm fuel from being reintroduced to the engine. If fuel lines are routed to the day tank, note the day tank size requirements in Section 6.1.2, Day Tanks.

A properly designed fuel return line is unrestricted and as short as possible, and it allows gravity return of fuel to the storage tanks. In installations where gravity return is not possible, obtain approval of the design from the generator set supplier based upon the engine's specifications before installing a fuel system with static head pressure on the return lines. Fuel return line restriction can cause engine hydraulic lock or uncontrollable overspeed on some systems.

6.1.4 Auxiliary Fuel Pumps

Primary, engine-driven fuel pumps typically develop a maximum of 48 kPa (7 psi) pressure and draw fuel to approximately 1.2–1.4 m (4–5 ft.) vertically or 6 m (20 ft.) horizontally. When the main tank is located a greater distance from the engine or for a more reliable fuel system, use an auxiliary pump alone or in connection with a day tank. See Figure 6-3. Limit auxiliary fuel pump pressure to approximately 35 kPa (5 psi).

Use a shutoff solenoid valve wired into the engine run circuit or a check valve to help keep the fuel line primed. Install the check valve on the outlet side of the auxiliary fuel pump to minimize inlet restriction.

Auxiliary fuel pump options. On engines using less than 38 L (10 gal.) of fuel per hour (approximately 100 kW or less), connect an engine starting battery-powered electric fuel transfer pump in series with the engine-driven transfer pump. Locate the electric pump nearer to the fuel tank than to the engine. An auxiliary pump located at the fuel tank approximately doubles the horizontal and vertical distance limits of a single engine-driven pump.

On engines using more than 38 L (10 gal.) of fuel per hour or when drawing fuel more than 1.8 m (6 ft.) vertically or 12 m (40 ft.) horizontally, use an electric motor-driven positive displacement pump with a day tank and float switch. Electrically connect the fuel pump to the transfer switch load side for maximum reliability. This type of pump can typically lift fuel 5.5 m (18 ft.) or draw it horizontally up to 61 m (200 ft.).

Where vertical runs exceed 5.5 m (18 ft.) or horizontal runs exceed 61 m (200 ft.), remote-mount the pump adjacent to the fuel storage tank. This type of installation allows these pumps to push fuel over 305 m (1000 ft.) horizontally or more than 31 m (100 ft.) vertically and deliver adequate fuel for generator sets up to 2000 kW. Always connect a positive-displacement pump directly to a day tank and float switch to protect the engine fuel system from excessive fuel pressures.

6.2 Gas Fuel Systems, Common Components

Gas fuel systems operate on either LP (liquefied petroleum) or natural gas.

Note: Design and install gas fuel systems in accordance with NFPA 54, National Fuel Gas Code, and applicable local codes.

All gas systems include a carburetor, secondary gas regulator, electric gas fuel solenoid shutoff valve, and flexible fuel connector.

6.2.1 Gas Lines

Never use fuel piping to ground electrical equipment. The gas supplier is responsible for installation, repair, and alteration to gas piping.

Line type. Use Schedule 40 black-iron pipe for gas piping. Copper tubing may be used if the fuel does not contain hydrogen sulfide or other ingredients that react chemically with copper.

Line size. Size piping according to the requirements of the equipment. Refer to the generator set specification sheet or the dimension drawing for detailed information on your system. In addition to the actual fuel consumption, consider the following pressure loss factors:

- Pipe length
- Other appliances on the same fuel supply
- Number of fittings

Flexible connections. Rigid-mount the piping but protect it from vibration. Use flexible connections spanning a minimum of 152 mm (6 in.) between the stationary piping and the engine fuel inlet connection.

6.2.2 Gas Regulators

Gas regulators reduce high incoming fuel pressures to lower levels acceptable for engines. Refer to the generator set spec sheet for fuel supply pressures. Install a solenoid valve upstream from the gas regulator and the flexible fuel connector to prevent the accumulation of an explosive mixture of gas and air caused by leaks in the flexible connection or the gas regulator. The generator set installer normally wires the engine battery-powered solenoid valve to the engine starting controls to open the valve when the engine cranks or runs.

For UL compliance, the fuel solenoid valves are needed per UL 2200, Section 35.3.2.2.1.

The typical gas system uses two gas regulators:

- **Primary gas regulator.** Provides initial control of gas from the fuel supply. The primary gas regulator reduces the high pressure from a tank or transmission line to the low pressure required by the secondary gas regulator(s). Typically, the primary gas regulator is set at the higher pressure value when a range is given. The gas supplier typically provides the primary gas regulator, as conditions that dictate the type of gas regulator used vary depending on the method of supplying fuel. The supplier is also responsible for providing sufficient gas pressure to operate the primary gas regulator. Primary gas regulator must be vented to the outside if installed within any building.

- **Secondary gas regulator.** This low-pressure gas regulator is mounted on the engine and limits the maximum inlet pressure to the engine. The engine operates satisfactorily at the lower pressure value when a range is given, but these lower pressures may result in poor response to load changes or a lack of power if the primary gas regulator is not near the engine.

Modification for fuel type. Many gas regulators are compatible with both natural gas and LP gas. Typically, the user installs the spring and retainer in the gas regulator when connecting to natural gas and removes it from the gas regulator when connecting to LP vapor gas. Refer to the appropriate generator set's operation manual and/or the decal attached to the generator set for information regarding spring/adjustment screw usage for specific models. Some models may require new diaphragm kits and/or inverting the gas regulator when changing fuel type.

Rating change. Converting the fuel will change the generator set rating. See the generator set specification sheet for ratings with natural gas and LP. Order a new nameplate with the updated rating and fuel information from an authorized distributor/dealer, if necessary. Provide the following information from the original nameplate:

- Model number
- Spec number
- Serial number
- Fuel (original and new)
- kW
- kVA
- Amps
- Volts
- Hz

Attach the new nameplate over the old one. Do NOT cover the UL listing information on the old nameplate.

Installation position for fuel type. The gas regulator functions normally pointing downward for both natural gas and LP gas. If only natural gas fuel is used, the gas regulator should be installed pointing upward.

Pressure testing. Some gas regulators provide for installation of a pressure gauge to test inlet and outlet pressures. If no such provision is available, install pipe tees in the fuel line to test pressure and use pipe plugs to plug unused openings.

6.3 LP Fuel Systems

Fuel characteristics. LP fuel exists as a vapor and a liquid in pressurized tanks. Since LP fuel does not deteriorate in storage, a large supply of fuel can be kept onsite indefinitely for operation during emergency conditions. This makes LP gas ideal for applications with uninterrupted (onsite) fuel supply requirements.

Fuel mixture. LP gas is propane, butane, or a mixture of the two gases. The ratio of butane to propane is especially important when the fuel flows from a large outdoor tank. A fuel supplier may fill the tank in the warm summer months with a mixture composed mainly of butane; however, this mixture may not provide sufficient vaporized pressure at cold temperatures to start and operate the engine. A local fuel supplier is likely to be the best source of information on what size tank is necessary to provide adequate fuel vapor.

The fuel mixture and vaporization pressure at the anticipated temperatures influence the selection of gas regulator equipment. Pure butane gas has little or no vaporization pressure in temperatures below 4°C (40°F). Even at 21°C (70°F), the pressure is approximately 124 kPa (18 psi). Some primary gas regulators do not operate at tank pressures below 207 kPa (30 psi) while others operate at incoming pressures as low as 20.7–34.5 kPa (3–5 psi).

Fuel consumption and tank size. Since LP fuel is supplied in pressurized tanks in liquid form, it must be converted to a vapor state before being introduced into the carburetor. The amount of vapor contained in 3.8 L (1.0 gal.) of liquid (LP) fuel is:

Butane Gas	0.88 m^3 (31.26 cu. ft.)
Propane Gas	1.03 m^3 (36.39 cu. ft.)

See the generator set specification sheets for fuel consumption at different loads, and contact your fuel supplier for information regarding tank sizes.

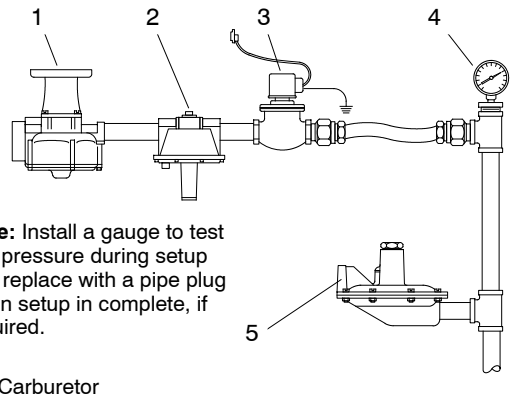
System types. Single-source gas fuel systems include LP gas vapor-withdrawal and LP gas liquid-withdrawal.

6.3.1 LP Gas Vapor-Withdrawal Systems

A vapor-withdrawal system draws on the fuel vapor that collects in the space above the liquid fuel. Consider the following during installation:

- Generally, allow 10%–20% of tank capacity for fuel expansion from a liquid to a vapor state. The liquid level in LP gas tanks must never exceed 90% of the tank capacity.
- Maintain air temperature surrounding the tank high enough to vaporize the liquid fuel.

Applications in colder climates may require an independent heat source to increase natural vaporization within the tank. Withdraw liquid fuel and vaporize it in an electrically heated, engine water jacket-heated, or LP gas-heated vaporizer. Figure 6-4 shows the components of the vapor-withdrawal system used in a typical stationary application. The LP gas regulator is typically installed in the inverted position (pointing downward).



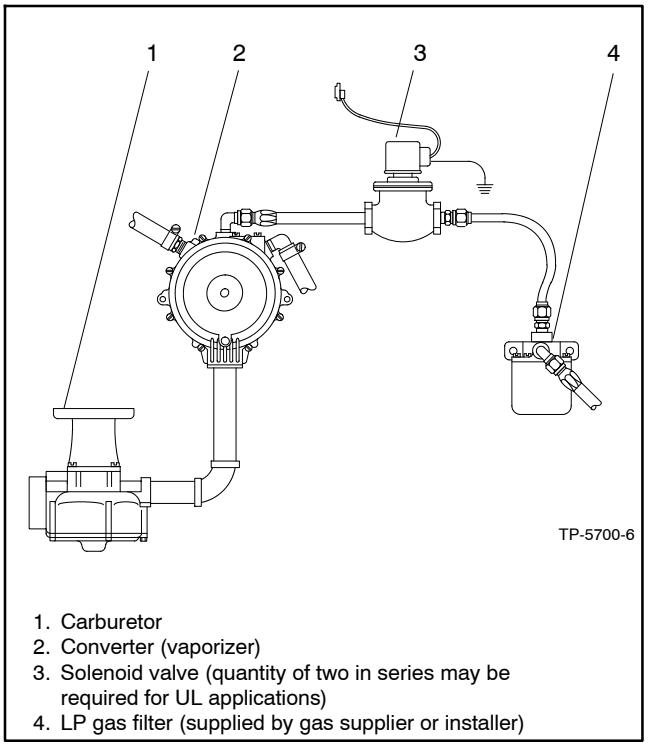
1. Carburetor
2. Secondary gas regulator
3. Solenoid valve (quantity of two in series may be required for UL applications)
4. Pressure gauge
5. Primary gas regulator (supplied by gas supplier or installer)

Figure 6-4 Typical LP Gas Vapor-Withdrawal System

6.3.2 LP Gas Liquid-Withdrawal Systems

LP liquid-withdrawal fuel systems are available for generator sets but are not recommended for automatic standby service. With liquid-withdrawal systems, liquid LP at 1034–1379 kPa (150–200 psi) flows to the engine. A combination of converters (vaporizers) and gas regulators then reduces the pressure to a usable level.

In Figure 6-5, a converter (a combination of a vaporizer and primary and secondary gas regulators) changes the liquid to vapor using heat from the engine's cooling system. For a period following startup, a liquid-withdrawal system may be unable to vaporize enough fuel for an engine running under load until the engine reaches operating temperature. The engine needs time to warm sufficiently to provide adequate heat to vaporize the fuel.



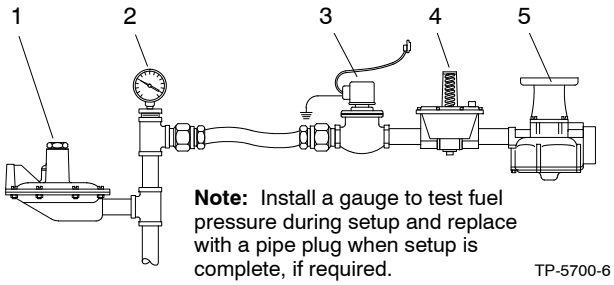
1. Carburetor
2. Converter (vaporizer)
3. Solenoid valve (quantity of two in series may be required for UL applications)
4. LP gas filter (supplied by gas supplier or installer)

Figure 6-5 LP Gas Liquid Withdrawal System

Some codes prohibit gas fuel pressurization greater than 34.5 kPa (5 psi) inside buildings. This might preclude the use of a liquid-withdrawal system. To ensure code compliance, converters are sometimes located outside the building housing the generator set. However, the great length of pipe between the converter and the carburetor does not allow sufficient heat buildup and heat retention to maintain the fuel in its vapor state, which can cause startup problems.

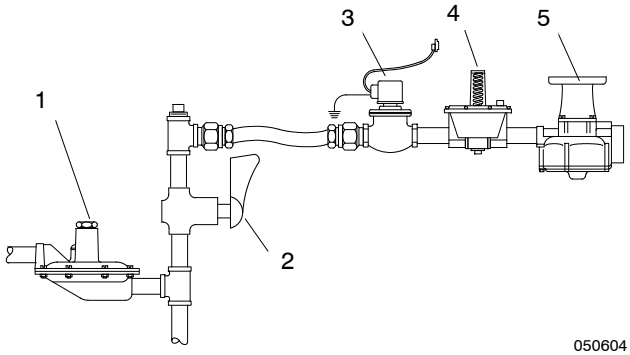
6.4 Natural Gas Systems

The utility supplies natural gas in a vapor state. A natural gas fuel system consists of the same basic components and operates with the same general sequence as LP gas vapor-withdrawal systems. See Figure 6-6 and Figure 6-7. Note that when the heat content of the fuel falls below 1000 Btu, as it does with sewage-derived and some other natural gas fuels, the generator set will not produce its rated power. The natural gas regulator is typically installed in the upright position (pointing upward).



1. Primary gas regulator (supplied by gas supplier or installer)
2. Pressure gauge
3. Solenoid valve (quantity of two in series may be required for UL applications)
4. Secondary regulator
5. Carburetor

Figure 6-6 Natural Gas Fuel System with Pressure Gauge



1. Primary gas regulator (supplied by gas supplier or installer)
2. Manual shutoff valve
3. Solenoid valve (quantity of two in series may be required for UL applications)
4. Secondary gas regulator
5. Carburetor

Figure 6-7 Natural Gas Fuel System without Pressure Gauge and with Manual Shutoff Valve

6.5 Combination Systems

Combination fuel source systems include:

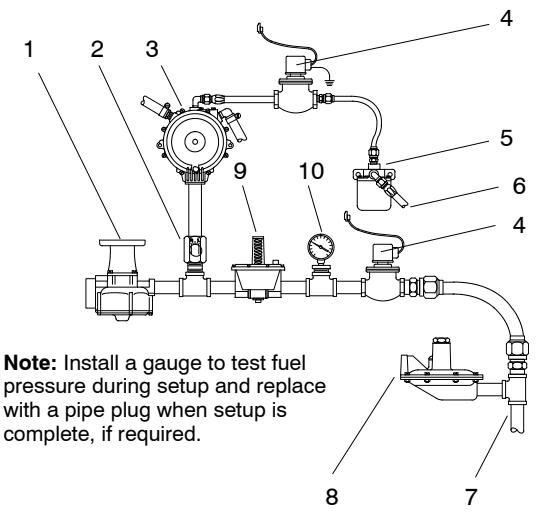
- Natural gas and LP gas

6.5.1 Combination Natural Gas and LP Gas

Some applications use natural gas as the main fuel and LP gas as the emergency fuel when natural gas is not available.

The natural gas and *LP gas, liquid withdrawal* system uses a converter (vaporizer) to change the LP liquid to gas vapor. A pressure switch on the primary fuel source closes when fuel pressure drops, which energizes a relay that closes the primary fuel solenoid and opens the secondary or emergency fuel solenoid.

A separate LP gas load adjustment valve ensures the right fuel-to-air mixture in the carburetor. The load adjustment valve is located inline between the converter (vaporizer) and the carburetor. See Figure 6-8.



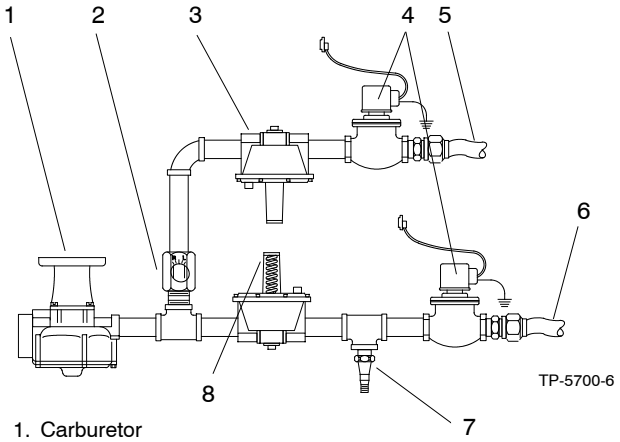
Note: Install a gauge to test fuel pressure during setup and replace with a pipe plug when setup is complete, if required.

1. Carburetor
2. Load adjustment valve
3. Converter (vaporizer)
4. Solenoid valve (quantity of two in series may be required for UL applications)
5. LP gas filter (supplied by gas supplier or installer)
6. LP gas supply
7. Natural gas supply
8. Primary gas regulator (supplied by gas supplier or installer)
9. Secondary natural gas regulator
10. Pressure gauge

Figure 6-8 Natural Gas and LP Gas System, Liquid Withdrawal

The natural gas and *LP gas, vapor withdrawal* system contains a separate secondary gas regulator and solenoid valve for each fuel. The LP gas regulator typically mounts in the inverted position. A pressure switch on the primary fuel source closes when fuel pressure drops, which energizes a relay that closes the primary fuel solenoid and opens the secondary or emergency fuel solenoid. A separate LP gas load adjustment valve ensures the right fuel-to-air mixture in the carburetor.

The load adjustment valve is located inline between the secondary gas regulator and the carburetor. See Figure 6-9.



1. Carburetor
2. Load adjustment valve
3. Secondary LP gas regulator
4. Solenoid valve (quantity of two in series may be required for UL applications)
5. LP gas supply
6. Natural gas supply
7. Low pressure switch
8. Secondary natural gas regulator

Figure 6-9 Natural Gas and LP Gas System, Vapor Withdrawal

6.6 Pipe Size Requirements for Gas Fuel Systems

The type of fuel, the distance it must travel from gas meter/tank to fuel shutoff solenoid, and the amount consumed by the engine must be considered when determining fuel line pipe size.

To find the correction necessary for the different specific gravity of the particular fuel used, refer to Figure 6-10.

Figure 6-11 is based on gas pressures of 3.4 kPa (0.5 psi, 13.8 in. water column) or less and a pressure drop of 0.12 kPa (0.018 psi, 0.5 in. water column) with a 0.60 specific gravity and with a normal amount of restriction from fittings. To calculate the correct pipe size for a specific installation, refer to the chart and follow the procedure outlined below.

Fuel	Specific Gravity	Correction Factor
Sewage Gas	0.55	1.040
Natural Gas	0.65	0.962
Air	1.00	0.775
Propane (LP)	1.50	0.633
Butane	2.10	0.535

Figure 6-10 Fuel Correction Factors

Nominal Iron Pipe Size (IPS), In.	Internal IPS Diameter, mm (in.)	Length of Pipe, m (ft.)													
		3.0 (10)		6.1 (20)		9.1 (30)		12.2 (40)		15.2 (50)		18.3 (60)		21.3 (70)	
		Fuel Consumption Value, m^3/hr. (ft^3/hr.)													
1/4	9.25 (0.364)	1.2	(43)	0.82	(29)	0.68	(24)	0.57	(20)	0.51	(18)	0.45	(16)	0.42	(15)
3/8	12.52 (0.493)	2.7	(95)	1.8	(65)	1.5	(52)	1.3	(45)	1.1	(40)	1.0	(36)	0.93	(33)
1/2	15.80 (0.622)	5.0	(175)	3.4	(120)	2.7	(97)	2.3	(82)	2.1	(73)	1.9	(66)	1.7	(61)
3/4	20.93 (0.824)	10.2	(360)	7.1	(250)	5.7	(200)	4.8	(170)	4.3	(151)	3.9	(138)	3.5	(125)
1	26.64 (1.049)	19.3	(680)	13.2	(465)	10.6	(375)	9.1	(320)	8.1	(285)	7.4	(260)	6.8	(240)
1 1/4	35.05 (1.380)	39.6	(1400)	26.9	(950)	21.8	(770)	18.7	(660)	16.4	(580)	13.9	(490)	13.0	(460)
1 1/2	40.89 (1.610)	59.5	(2100)	41.3	(1460)	33.4	(1180)	28.0	(990)	25.5	(900)	22.9	(810)	21.2	(750)
2	52.50 (2.067)	111.9	(3950)	77.9	(2750)	62.3	(2200)	53.8	(1900)	47.6	(1680)	43.0	(1520)	39.6	(1400)
2 1/2	62.71 (2.469)	178.4	(6300)	123.2	(4350)	99.7	(3520)	85.0	(3000)	75.0	(2650)	68.0	(2400)	63.7	(2250)
3	77.93 (3.068)	311.5	(11000)	218.0	(7700)	177.0	(6250)	150.0	(5300)	134.6	(4750)	121.8	(4300)	110.4	(3900)
4	102.26 (4.026)	651.2	(23000)	447.4	(15800)	362.5	(12800)	308.7	(10900)	274.7	(9700)	249.1	(8800)	229.4	(8100)

Nominal Iron Pipe Size (IPS), In.	Internal IPS Diameter, mm (in.)	Length of Pipe, m (ft.)													
		24.4 (80)		27.4 (90)		30.5 (100)		38.1 (125)		45.7 (150)		53.3 (175)		61.0 (200)	
		Fuel Consumption Value, m^3/hr. (ft^3/hr.)													
1/4	9.25 (0.364)	0.39	(14)	0.37	(13)	0.34	(12)	0.31	(11)	0.28	(10)	0.25	(9)	0.23	(8)
3/8	12.52 (0.493)	0.88	(31)	0.82	(29)	0.76	(27)	0.68	(24)	0.62	(22)	0.57	(20)	0.54	(19)
1/2	15.80 (0.622)	1.6	(57)	1.5	(53)	1.4	(50)	1.2	(44)	1.1	(40)	1.0	(37)	0.99	(35)
3/4	20.93 (0.824)	3.3	(118)	3.1	(110)	2.9	(103)	2.6	(93)	2.4	(84)	2.2	(77)	2.0	(72)
1	26.64 (1.049)	6.2	(220)	5.8	(205)	5.5	(195)	5.0	(175)	4.5	(160)	4.1	(145)	3.8	(135)
1 1/4	35.05 (1.380)	13.0	(460)	12.2	(430)	11.3	(400)	10.2	(360)	9.2	(325)	8.5	(300)	7.9	(280)
1 1/2	40.89 (1.610)	19.5	(690)	18.4	(650)	17.6	(620)	15.6	(550)	14.2	(500)	13.0	(460)	12.2	(430)
2	52.50 (2.067)	36.8	(1300)	34.5	(1220)	32.6	(1150)	28.9	(1020)	26.9	(950)	24.1	(850)	22.7	(800)
2 1/2	62.71 (2.469)	58.1	(2050)	55.2	(1950)	52.4	(1850)	46.7	(1650)	42.5	(1500)	38.8	(1370)	36.2	(1280)
3	77.93 (3.068)	104.8	(3700)	97.7	(3450)	92.0	(3250)	83.5	(2950)	75.0	(2650)	69.4	(2450)	64.6	(2280)
4	102.26 (4.026)	212.4	(7500)	203.9	(7200)	189.7	(6700)	169.9	(6000)	155.7	(5500)	141.6	(5000)	130.3	(4600)

Note: When the fuel has a specific gravity of 0.7 or less no correction factor is necessary—use this table without a correction factor.

Figure 6-11 Maximum Flow Capacity of Pipe in Cubic Meters (Cubic Feet) of Gas per Hour

1. Refer to the fuel consumption on the generator set specification sheet. Note type of fuel used, generator set application rating, and the m^3/hr. (ft^3/hr.) consumption at 100% load.

   Example:
   80 kW, propane gas, 60 Hz standby rating = 12.0 m^3/hr. (425 ft^3/hr.).

2. Refer to the Fuel Correction Factors in Figure 6-10. Locate the correction factor for specific gravity of the selected fuel.

   When the fuel has a specific gravity of 0.7 or less no correction factor is necessary—use Figure 6-11 without a correction factor.

   Example:
   propane gas specific gravity = 1.50
   fuel correction factor = 0.633.

3. Divide the consumption value from step 1 by the correction factor from step 2.

   Example:
   12.0 m^3/hr. (425 ft^3/hr.) divided by 0.633 = 19.0 m^3/hr. (671 ft^3/hr.).

4. Determine the length of pipe between the gas meter/tank and the fuel shutoff solenoid at the generator set.

   Example:
   34.7 m (114 ft.).

5. Find the value closest to pipe length in the Length of Pipe column in Figure 6-11.

   Example:
   38.1 m (125 ft.).

   Example:
   At 28.9 m^3/hr. (1020 ft^3/hr.) the pipe size = 2 in. IPS.

6. Move vertically down the table in Figure 6-11 from the determined value in Length of Pipe column.

   Example:
   38.1 m (125 ft.)

   Stop at the value that is equal to or greater than corrected consumption value from step 3.

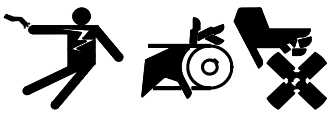
   Example:
   28.9m^3/hr. (1020 ft.^{3}/hr.).

7. Move to the left column from the value in step 6 to determine the correct pipe size.

Before installing the generator set, provide for electrical connections through conduit to the transfer switch and other accessories for the generator set. Carefully install the selected generator set accessories. Route wiring to the generator set through flexible connections. Regarding the application of bushings and grommets for the entry of wiring, use Class 1 wiring methods for field wiring connections to a Class 2 circuit. Comply with applicable national and local codes when installing a wiring system.

AC circuit protection. All AC circuits must include circuit breaker or fuse protection. Select a circuit breaker for up to 125% of the rated generator set output current. The circuit breaker must open all ungrounded conductors. The circuit breaker or fuse must be mounted within 7.6 m (25 ft.) of the alternator output terminals.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

(Decision-Maker® 3+ and 550 Controllers)

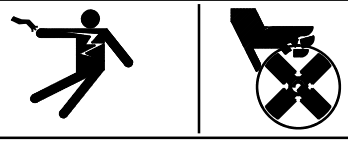
Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

(Decision-Maker® 3000, 3500, and 6000 Controllers)

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) If the controller is not already in the MAN (manual) mode, press the Controller Mode button and then press the MAN mode button. (2) If the generator set is running, press and hold the Manual-Stop button for at least 2 seconds to stop the generator set. (3) Press the Controller Mode button and then press the controller Off mode button. (4) Disconnect the power to the battery charger, if equipped. (5) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

(Decision-Maker® 8000 Controller)

⚠ WARNING



Hazardous voltage. Moving parts.
Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

7.1 Generator Set Voltage Reconnection

To change the voltage of 10- or 12-lead generator sets, *use the procedure shown in the operation manual containing the respective controller setup.* Adjust the governor and voltage regulator for frequency changes. Consult the generator set service manual for frequency adjustment information.

Voltage reconnection. Affix a notice to the generator set after reconnecting the set to a voltage different from the voltage on the nameplate. Order voltage reconnection decal 246242 from an authorized service distributor/ dealer.

Equipment damage. Verify that the voltage ratings of the transfer switch, line circuit breakers, and other accessories match the selected line voltage.

Reconnect the generator set stator leads to change the output phase or voltage. Reference the appropriate voltage reconnection drawing in the respective Wiring Diagram Manual..

Follow the safety precautions at the front of this manual and in the text and observe National Electrical Code (NEC) guidelines.

7.2 Electrical Connections

Several electrical connections must be made between the generator set and other components of the system for proper operation. Because of the large number of accessories and possible combinations, this manual does not address specific applications. Refer to the submittal catalog accessory drawings and wiring diagrams for connection and location. Most field-installed accessory kits include installation instructions.

For customer-supplied wiring, select the wire temperature rating in Figure 7-1 based upon the following criteria:

- Select row 1, 2, 3, or 4 if the circuit rating is 110 amperes or less or requires #1 AWG (42.4 mm^2) or smaller conductors.
- Select row 3 or 4 if the circuit rating is greater than 110 amperes or requires #1 AWG (42.4 mm^2) or larger conductors.

Comply with applicable national and local codes when installing a wiring system.

Row	Temp. Rating	Copper (Cu) Only	Cu/Aluminum (Al) Combinations	Al Only
1	60°C (140°F) or 75°C (167°F)	Use No. * AWG, 60°C wire or use No. * AWG, 75°C wire	Use 60°C wire, either No. * AWG Cu, or No. * AWG Al or use 75°C wire, either No. * AWG Cu or No. * AWG Al	Use 60°C wire, No. * AWG or use 75°C wire, No. * AWG
2	60°C (140°F)	Use No. * AWG, 60°C wire	Use 60°C wire, either No. * AWG Cu or No. * AWG Al	Use 60°C wire, No. * AWG
3	75°C (167°F)	Use No. *† AWG, 75°C wire	Use 75°C wire, either No. *† AWG Cu or No. *† AWG Al	Use 75°C wire, No.*† AWG
4	90°C (194°F)	Use No. *† AWG, 90°C wire	Use 90°C wire, either No. *† AWG Cu or No. *† AWG Al	Use 90°C wire, No.*† AWG

* The wire size for 60°C (140°F) wire is not required to be included in the marking. If included, the wire size is based on ampacities for the wire given in Table 310-16 of the National Electrical Code®, in ANSI/NFPA 70, and on 115% of the maximum current that the circuit carries under rated conditions. The National Electrical Code® is a registered trademark of the National Fire Protection Association, Inc.

† Use the larger of the following conductors: the same size conductor as that used for the temperature test or one selected using the guidelines in the preceding footnote.

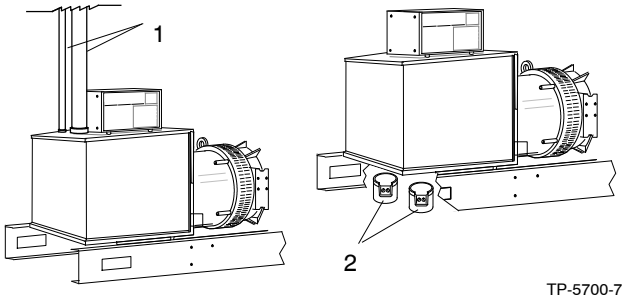
Figure 7-1 Terminal Markings for Various Temperature Ratings and Conductors

7.3 Load Lead Connections

Feed load leads to the generator junction box from one of several different areas. Generator sets rated 300 kW and below commonly use the bottom entry where conduit is stubbed up into the junction box from the concrete slab. Other methods include flexible conduit roughed into the sides or top of the junction box. When using flexible conduit, do not block the front or rear of the controller. See Figure 7-2.

Use a minimum of 13 mm (0.5 in.) spacing between the conduit bushing and any uninsulated live parts in the junction box. All conduit openings in the junction box must be made such that no metal particles including drill chips contaminate the components in the junction box.

Generator sets larger than 300 kW have the junction box mounted on the rear of the generator set. Larger sets may have oversized junction boxes supplied as an option or to accommodate bus bar connections. Refer to the generator set dimension drawing and/or the electrical contractor prints for detailed information including stub-up area recommendations.



1. Conduit from ceiling
2. Conduit *stubbed up* from below

Figure 7-2 Typical Load Lead Connection

The four bus bars contained in the optional bus bar kits simplify the connection process by offering a neutral bus bar in addition to the three load bars. Optional bus lugs offer an array of terminal and wire connections.

7.4 Grounding and Grounded Conductor (Neutral) Connections

Connect the electrical system grounding conductor to the equipment grounding connector on the alternator. See Figure 7-3. Depending upon code requirements, the grounded conductor (neutral) connection is typically grounded.

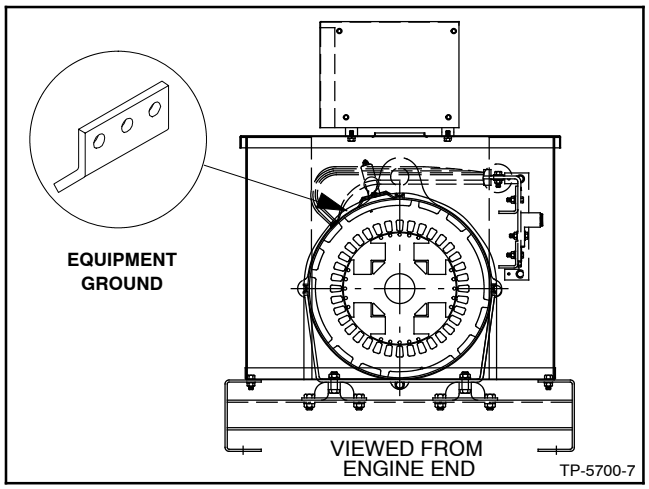


Figure 7-3 Generator Set Equipment Grounding Connection

Ungrounded neutral connections use an insulated standoff (not supplied) to isolate the neutral connection from the grounding connection. For grounding lug selection, see Figure 7-4.

The four bus bars contained in the optional bus bar kits simplify the connection process by offering a neutral bus bar in addition to the three load bars. Optional bus lugs offer an array of terminal and wire connections.

Generator sets are typically shipped from the factory with the neutral attached to the alternator in the junction box for safety reasons per NFPA 70. At installation, the neutral can remain grounded at the alternator or be lifted from the grounding stud and isolated if the installation requires an ungrounded neutral connection at the generator set. The generator set will operate properly in either configuration.

Various regulations and site configurations including the National Electrical Code® (NEC), local codes, and the type of transfer switch used in the application determine the grounding of the neutral at the generator set.

Allowable Ampacity, Amps	Min. Size of Equipment Copper Grounding Conductor, AWG or kcmil	Recommended Compression Lug, ILISCO Part No. or Equivalent (UL Listed)
20	12	SLUH-90
60	10	SLUH-90
90	8	SLUH-90/125
100	8	SLUH-90/125
150	6	SLUH-90/125/225
200	6	SLUH-90/125/225
300	4	SLUH-90/125/225
400	3	SLUH-90/125/225
500	1	SLUH-125/225
600	1	SLUH-125/225
800	1/0	SLUH-225/300/400
1000	2/0	SLUH-225/300/400
1200	3/0	SLUH-225/300/400
1600	4/0	SLUH-225/300/400/650
2000	250	SLUH-225/300/400/650
2500	350	SLUH-300/400/650
3000	400	SLUH-400/650
4000	500	SLUH-400/650
5000	700	SLUH-650
6000	800	SLUH-650

Figure 7-4 Grounding Lug Selection

The National Electrical Code® is a registered trademark of the National Fire Protection Association, Inc.

7.5 Terminal Connector Torque

Use torque values shown in Figure 7-5 or Figure 7-6 for terminal connectors. Refer to UL 486A–486B and UL 486E for information on terminal connectors for aluminum and/or copper conductors. See Section 7.2, Electrical Connections, for information on temperature rating of the customer-supplied wire. Comply with applicable national and local codes when installing a wiring system.

If a connector has a clamp screw such as a slotted, hexagonal head screw with more than one means of tightening, test the connector using both applicable torque values provided in Figure 7-6.

Socket Size Across Flats, mm (in.)	Tightening Torque, Nm (in. lb.)
3.2 (1/8)	5.1 (45)
4.0 (5/32)	11.4 (100)
4.8 (3/16)	13.8 (120)
5.6 (7/32)	17.0 (150)
6.4 (1/4)	22.6 (200)
7.9 (5/16)	31.1 (275)
9.5 (3/8)	42.4 (375)
12.7 (1/2)	56.5 (500)
14.3 (9/16)	67.8 (600)

Note: For values of slot width or length not corresponding to those specified, select the largest torque value associated with the conductor size. Slot width is the nominal design value. Slot length is to be measured at the bottom of the slot.

Figure 7-5 Tightening Torque for Pressure Wire Connectors with Internal-Drive Socket-Head Screws

Wire Size for Unit Connection	Tightening Torque, Nm (in. lb.)			
	Slot Head 4.7 mm (No. 10) or Larger*		Hexagonal Head—External Drive Socket Wrench	
AWG, kcmil (mm^2)	Slot Width <1.2 mm (0.047 in.) Slot Length <6.4 mm (0.25 in.)	Slot Width >1.2 mm (0.047 in.) Slot Length >6.4 mm (0.25 in.)	Split-Bolt Connectors	Other Connections
18–10 (0.82–5.3)	2.3 (20)	4.0 (35)	9.0 (80)	8.5 (75)
8 (8.4)	2.8 (25)	4.5 (40)	9.0 (80)	8.5 (75)
6–4 (13.3–21.2)	4.0 (35)	5.1 (45)	18.6 (165)	12.4 (110)
3 (26.7)	4.0 (35)	5.6 (50)	31.1 (275)	16.9 (150)
2 (33.6)	4.5 (40)	5.6 (50)	31.1 (275)	16.9 (150)
1 (42.4)	—	5.6 (50)	31.1 (275)	16.9 (150)
1/0–2/0 (53.5–67.4)	—	5.6 (50)	43.5 (385)	20.3 (180)
3/0–4/0 (85.0–107.2)	—	5.6 (50)	56.5 (500)	28.2 (250)
250–350 (127–177)	—	5.6 (50)	73.4 (650)	36.7 (325)
400 (203)	—	5.6 (50)	93.2 (825)	36.7 (325)
500 (253)	—	5.6 (50)	93.2 (825)	42.4 (375)
600–750 (304–380)	—	5.6 (50)	113.0 (1000)	42.4 (375)
800–1000 (406–508)	—	5.6 (50)	124.3 (1100)	56.5 (500)
1250–2000 (635–1016)	—	—	124.3 (1100)	67.8 (600)

* For values of slot width or length not corresponding to those specified, select the largest torque value associated with the conductor size. Slot width is the nominal design value. Slot length is to be measured at the bottom of the slot.

Note: If a connector has a clamp screw such as a slotted, hexagonal head screw with more than one means of tightening, test the connector using both applicable torque values.

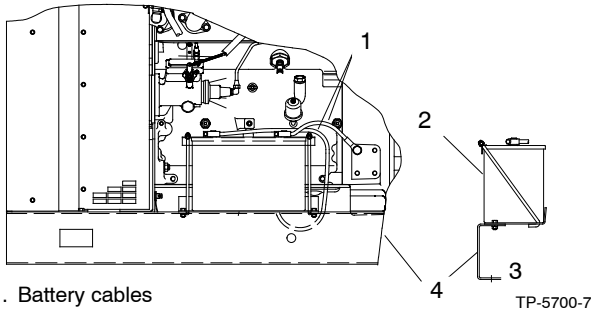
Figure 7-6 Tightening Torque for Screw-Type Pressure Wire Connectors

7.6 Batteries

Battery location. When determining the battery placement, ensure that the location:

- Is clean, dry, and not exposed to extreme temperatures
- Provides easy access to battery caps for checking the electrolyte level (when using maintenance type batteries)
- Is close to the generator set to keep cables short, ensuring maximum output

Refer to the submittal drawings for the generator set when choosing a battery rack. Figure 7-7 shows a typical battery system.



1. Battery cables
2. Battery secured in mounting rack
3. End view
4. Generator set skid

Figure 7-7 Typical Battery System, Side View

Battery type. Starting batteries are usually the lead-acid type and are sized according to the engine manufacturer's recommendation for a particular ambient temperature and required cranking time. NFPA 110 recommends cranking periods, including a single 45-second cycle for generator sets below 15 kW and three 15-second crank cycles separated by 15-second rests for larger models. Refer to the respective generator set specification sheet for the required battery cold-cranking ampere (CCA) rating.

Nickel-cadmium batteries are sometimes used for standby generator sets because of their long life (20 years). However, initial high cost, larger space requirements, and special charging requirements can offset this benefit. Therefore, conventional lead-acid batteries have proven satisfactory for the majority of generator set applications.

Battery cables. A UL 2200 listed generator set requires battery cables with positive (+) lead boots. Factory-supplied and optional battery cables include positive (+) lead boots. When battery cables are not factory-supplied, source battery cables with positive (+) lead boots for UL 2200 compliance.

Note: Some units are equipped with an insulating and reflective heat shield sleeve on the battery cables and other wires that are fastened to the starter solenoid. This sleeve is a conductive material and must be secured approximately 25 mm (1 in.) away from the exposed cable terminal.

7.7 Battery Chargers

Most industrial generator sets use an engine-driven, battery-charging alternator to charge the batteries whenever the generator set operates. Engine-driven systems are normally capable of charge rates of 30 amps or more and can quickly restore the charge used in a normal cranking cycle. When the engine is not operating, a very low charge rate from an AC-powered battery charger is usually sufficient to maintain a full charge on the batteries.

Some industrial generator sets have no battery-charging alternator and, therefore, require a separate AC- powered battery charger.

Select an automatic or manual battery charger with a high charge rate of 2 amps and a trickle charge rate up to 300 milliamps. The low maximum charge rate makes the charger ill-suited to restore fully discharged batteries. For full recovery capability independent of the engine-driven charging system, use an automatic float battery charger with a high charge rate of at least 10 amps.

Use separate, self-contained battery chargers or units built into the automatic transfer switch. Run leads from a transfer switch-mounted battery charger in conduit separate from the conduit that holds the generator load cables or remote engine-start circuits.

Note: Digital controllers with microprocessor circuitry and vacuum fluorescent displays typically draw more than 300 milliamps, making trickle charge battery chargers inappropriate for systems with these controllers. Select only automatic float/equalize battery chargers with a 3 amp or greater rating for units with digital controllers.

Battery failure is the most common reason for emergency generator set start failure. Two common battery failure causes are a manual charge rate set too low to maintain the battery and a manual charge rate set too high, resulting in loss of battery electrolyte. To avoid battery failure, use an automatic float charger, which varies the charge rate in response to battery condition.

For large engines with two starters, use either one bank of batteries and chargers for both starters or use separate battery systems. The latter system is preferable because it reduces the chance of a single component failure rendering the entire system inoperative.

7.8 Component and Accessory Power Source Requirements

Several components require a power source other than the engine starting batteries. The utility power supply outlet or electrical box should be in close proximity to the generator set. Some factory-supplied enclosures are available with electrical hook-up connections. Most accessories require a dedicated circuit with separate circuit breaker. Comply with applicable national and local codes when providing an electrical power source connection. These items include but are not limited to the following items:

- **Alternator Strip Heater** requires a 110–120 volt or 190–240 volt, 50/60 Hz, 15-amp power source. Check the component and instructions for specific information.
- **Battery Charger** typically requires a 110–120 volt or 190–240 volt, 50/60 Hz power source. Some generator set models require multiple battery chargers. Check the component for specific information as some battery chargers are only 110–120 volt, 50/60 Hz. See Section 7.7 Battery Chargers for additional information.
- **Battery Heater** requires a 110–120 volt, 50/60 Hz, 15-amp power source. Some kits require multiple outlets for the plate and wrap connections. Check the component and instructions for specific information.
- **Controller Heater (APM802 Controller only)** requires a 220–240 volt, 50/60 Hz power source. Check the component and instructions for specific information.
- **Crankcase Ventilation Heater (Some 125/150 kW Gas Models only)** require a 110–120 volt, 50/60 Hz, 37.5 watt power source. Check the component and instructions for specific information.
- **Engine Block Heater** typically requires a 110–120 or 190–240 volt, 50/60 Hz, 15- or 20-amp power source. Some kits require multiple outlet circuits. Check the component and instructions for specific information. See Section 4.8 Block Heaters for additional information.

7.9 Optional Accessories

The generator set manufacturer offers optional accessories that require connection to other components in the system. These accessories enable the generator set to meet standards for local and national codes, make operation and service more convenient, or satisfy specific customer installation requirements.

Accessories vary with each generator set model and controller. Accessories are available factory-installed and/or shipped loose. See Figure 7-8 for a list of available kits. Some accessories are available only with the microprocessor and digital controllers. Obtain the most current list of accessories from the respective generator set specification sheet or by contacting your local authorized service distributor/ dealer.

Kit Description
Bus Bar Kits/Bus Lugs
Gas Fuel Valve
Line Circuit Breaker
Run Relay
Wireless Monitor

Figure 7-8 Optional Accessories

Additional accessories and connections are shown in the following sections based on controller specific information. See Figure 7-9.

Controller	Section
Decision-Maker 3+	8
Decision-Maker 550	9
Decision-Maker 3000	10
Decision-Maker 6000	11
Decision-Maker 8000	Refer to TP-6990
APM802	Refer to TP-7070

Figure 7-9 Controller Accessories

Accessory kits generally include installation instructions. See the wiring diagrams manual for electrical connections not shown in this section. See the installation instructions and drawings supplied with the kit for information on the kit mounting location.

The instructions provided with the accessory kit supersede these instructions, if different. In general, run AC and DC wiring in separate conduit. Use shielded cable for all analog inputs. Observe all applicable national and local electrical codes during accessory installation.

Accessory wiring. To determine the appropriate size for the customer-supplied wiring of the engine battery-powered accessories, use the guidelines in Figure 7-10. Use 18–20 gauge wire for *signal wires* up to 305 m (1000 ft.).

Length, m (ft.)	Wire Gauge
30.5 (100)	18–20
152.4 (500)	14
304.8 (1000)	10

Figure 7-10 Wire Length and Size, Lead N and 42B

Match the wire terminals to the terminal strip conductor screw size. Use a maximum of two wire terminals per terminal strip screw unless otherwise noted on the respective accessory drawing or installation instruction.

Accessory connections. Do not direct-connect accessories to the controller terminal strip. Connect accessories to either a single-relay dry contact kit or ten-relay dry contact kit. Connect the dry contact kit(s) to the controller (customer) connection kit. Connect all accessories except the emergency stop kit to the connection kit terminal strip(s).

Terminal strips and available connections vary by controller. Refer to the respective controller operation manual and the accessory wiring diagrams in the wiring diagram manual for connection of kits. Field-installed accessories include installation instructions and/or wiring diagrams.

7.9.1 Bus Bar Kits/Bus Lugs

The four bus bars contained in the optional bus bar kits simplify the connection process by offering a neutral bus bar in addition to the three load bars. Optional bus lugs offer an array of terminal and wire connections. See Figure 7-11.

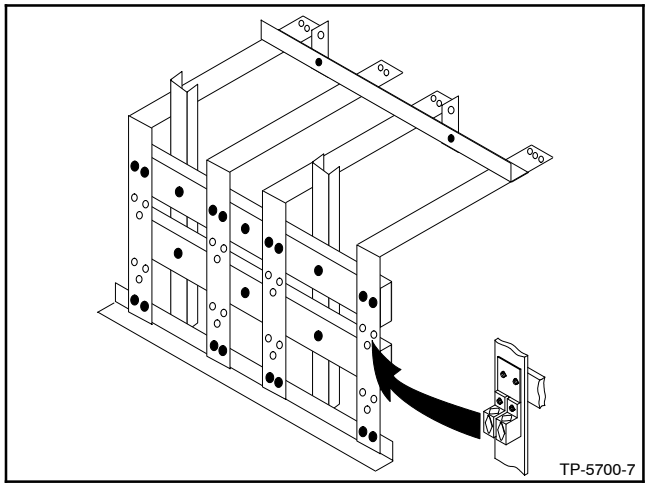


Figure 7-11 Bus Bar Kits/Bus Lugs

7.9.2 Gas Fuel Valve Kit

This section provides the wiring information for an *additional* gas fuel valve kit required for UL Approval. See Figure 7-12. Refer to the respective generator set wiring diagrams for additional information and for LP liquid applications.

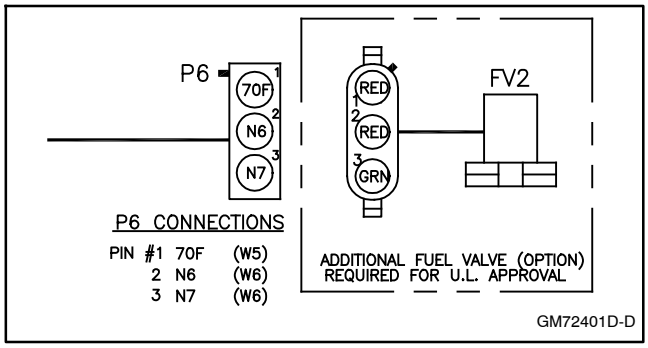


Figure 7-12 Gas Fuel Valve Kit Connections

7.9.3 Line Circuit Breaker

The line circuit breaker interrupts generator output if an overload or short circuit occurs. Use the line circuit breaker to manually disconnect the generator set from the load during generator set service. See Figure 7-13.

The circuit breaker must open all ungrounded connectors. Refer to Service Bulletin 611 for circuit breaker instantaneous overcurrent trip adjustment information.

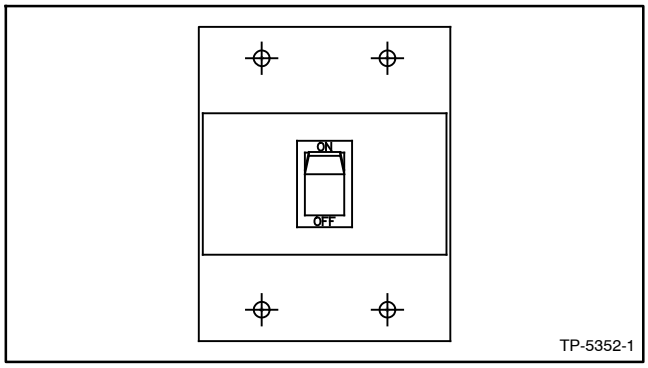


Figure 7-13 Line Circuit Breaker

7.9.4 Run Relay Kit

The run relay kit energizes only during generator set operation. The three sets of contacts typically control air intake and/or radiator louvers. However, alarms and other signaling devices can also connect to the contacts. See Figure 7-14.

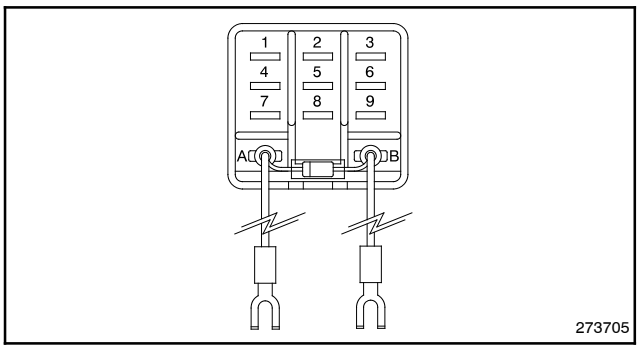


Figure 7-14 Run Relay Kit

7.9.5 Wireless Monitor

The wireless monitor system has two components: a wireless monitor unit and a website. The monitor unit transmits messages in response to signals received from the equipment controller and notifies designated recipients of selected operating conditions. The website monitors these messages.

There are three monitor models: GM23409-KP1 for use with hardwire inputs; GM23409-KP2 for use with a 550 controller using Modbus® communication; and GM23409-KP3 for use with a 550 controller using hardwire inputs that require a customer interface board.

Note: The 550 controller supports only one connection for Modbus® communication. If the controller's RS-485 connection is already used for Modbus® communication with other equipment, use wireless monitor model GM23409-KP1 or -KP3 with hardwire inputs through a customer connection board for monitoring.

Typical messages might include:

- Overcrank
- Low oil pressure
- Overspeed
- Common fault

At the website, the user configures which individuals will receive messages regarding selected operating conditions and the message delivery method. Delivery methods include pagers (alphanumeric, numeric), fax, XML, e-mail, PCS, or telephone (voice delivery). Each message sent will contain the condition that generated the transmission and also the make, model, and location of the equipment. Up to 40 messages each day can be delivered. Single or multiple messages can be sent to selected recipients via multiple delivery methods. More than one delivery method can be used for each recipient.

The wireless monitor is powered by the equipment power source or by the generator set and constantly monitors the inputs. When an input is triggered, the wireless monitor sends the condition over the North American AMPS (advanced mobile phone system). An operations center server receives the transmission and forwards the message to the selected recipients according to the configured delivery method.

Every 24 hours, the wireless monitor also sends information about itself and the system it is monitoring. This *heartbeat* transmission tells the Kohler center that the wireless monitor is properly functioning, powered, and able to generate messages. If a device fails to report a nightly heartbeat for more than a day, the system sends a *Unit Failed to Report Heartbeat* alarm message to the website.

Generator set run times and the number of cycles are reported. Models GM23409-KP1 and -KP3 accumulate run times over a 24-hour period and report the run times with the heartbeat message. Model GM23409-KP2 (for the 550 controller only) reports the total accumulated run time and the total number of starts. Run times for model GM23409-KP2 are also totaled using the Control Panel function and can be updated upon request.

Upon power loss, a rechargeable battery powers the wireless monitor. The monitor continues to transmit messages for 15 minutes, then transmits a loss of power signal and enters the *sleep* mode. The sleep mode can last up to 18 hours, until the battery completely discharges or power is restored. The wireless monitor continues to send scheduled heartbeat messages during the sleep mode until the battery discharges completely.

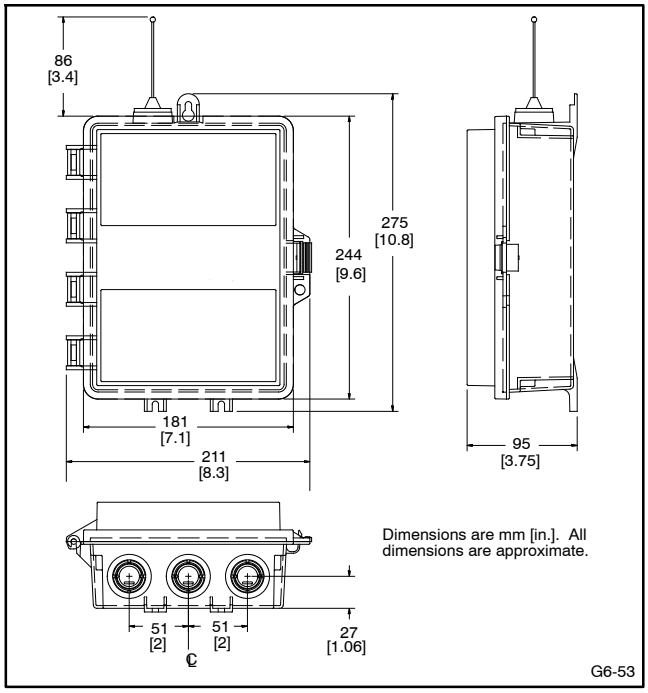


Figure 7-15 Wireless Monitor

7.10 Wiring Connections

Although equipment and connections vary, Figure 7-16 shows examples of the options and wire connections necessary to make an industrial system operational. Always refer to the wiring diagram for details of wire size, location, and number.

Modbus® is a registered trademark of Schneider Electric

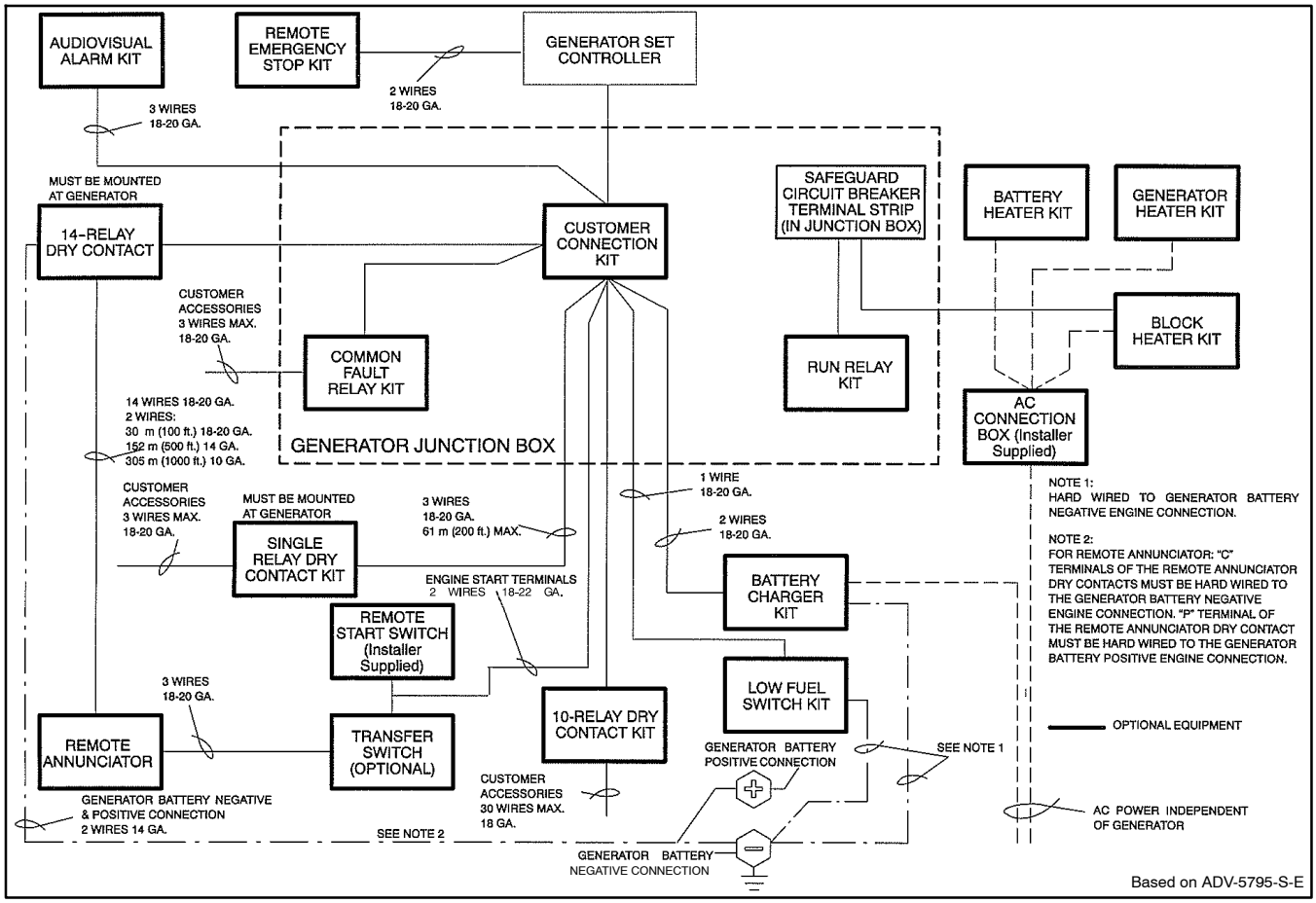


Figure 7-16 Generator Set Connections, Typical

Notes

8.1 Accessories and Connections

Several accessories help finalize installation, add convenience to operation and service, and establish state and local code compliance.

Accessories vary with each generator set model and controller. Select factory-installed and/or shipped-loose accessories. See Figure 8-1 for a list of available kits. Obtain the most current accessory information from your local authorized service distributor/dealer.

This section illustrates several accessories available at print time of this publication. Accessory kits generally include installation instructions. See wiring diagrams manual for electrical connections not shown in this section. See the installation instructions and drawings supplied with kit for information on kit mounting location.

The instructions provided with the accessory kit supersede these instructions where there are differences. In general, run AC and DC wiring in separate conduit. Use shielded cable for all analog inputs. Observe all applicable national, state, and local electrical codes during accessory installation.

Kit Description
Audiovisual Alarm
Common Failure Relay (Terminal 32A)
Controller (Customer) Connection
Float/Equalize Battery Charger (with alarms)
Ground Fault Annunciation
Idle (Speed) Mode Feature
Low Fuel (Level) Switch
Low Fuel (Pressure) Switch
Prime Power Switch
Remote Emergency Stop
Remote Reset Feature
Remote Serial Annunciator (RSA III)
Shunt-Trip Line Circuit Breaker and Shunt-Trip Wiring
Single-Relay Dry Contact
Ten-Relay Dry Contact
Twenty-Relay Dry Contact

Figure 8-1 Optional Accessories

8.1.1 Audiovisual Alarm Kit

An audiovisual alarm warns the operator at a remote location of fault shutdowns and prealarm conditions. Audiovisual alarms include an alarm horn, an alarm silence switch, and common fault lamp. See Figure 8-2 and Figure 8-3. See Section 8.2, Accessory Connections, for terminal identification.

Note: Use the audiovisual alarm with a dry contact kit.

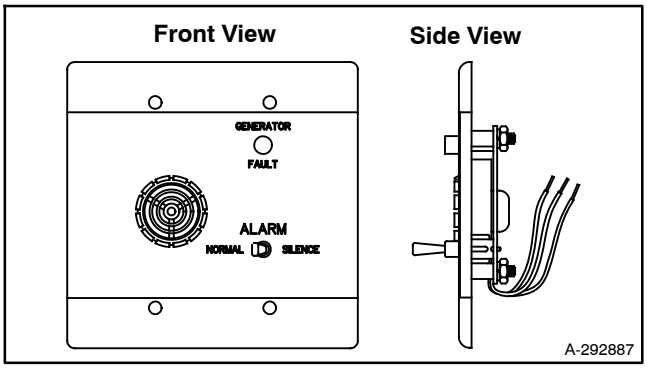


Figure 8-2 Audiovisual Alarm

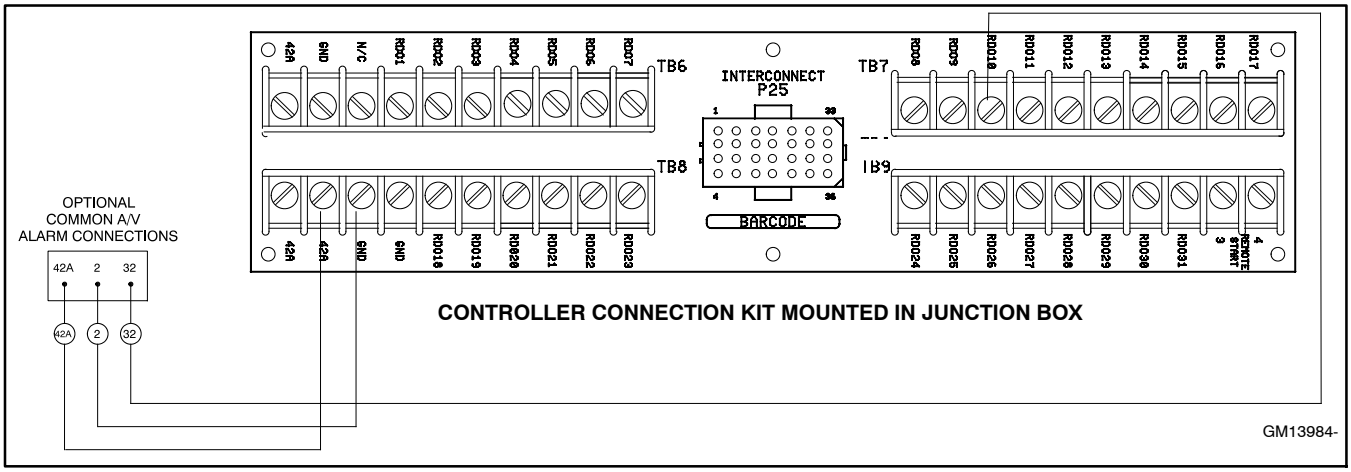


Figure 8-3 Audiovisual Alarm Connections

8.1.2 Common Failure Relay Kit

The common failure relay kit provides one set of contacts to trigger user-provided warning devices if a fault occurs. The common failure relay faults are user-defined. See the respective operation manual for status and faults available for this function.

Connect up to three common failure relay kits to the controller output. See Figure 8-4 and Figure 8-5. See Section 8.2, Accessory Connections, for terminal identification.

8.1.3 Controller (Customer) Connection Kit

The controller connection kit allows easy connection of controller accessories without accessing the controller terminal strip. The supplied wiring harness connects controller connector P23 and terminal strips TB1-3 and TB1-4 to the controller connection kit connector P25 and terminal strips TB6, TB7, TB8, and TB9. Connect all accessories (except the emergency stop kit) to the controller connection kit terminal strips. See Figure 8-6. See Section 8.2, Accessory Connections, for terminal identification.

8.1.4 Float/Equalize Battery Charger Kit with Alarm Option

The float/equalize battery charger with alarm option provides battery charging to the engine starting battery(ies) and connects to the controller for fault detection. Battery chargers for 12- or 24-volt models are available as a generator set accessory. See Figure 8-7. See Section 8.2, Accessory Connections, for terminal identification.

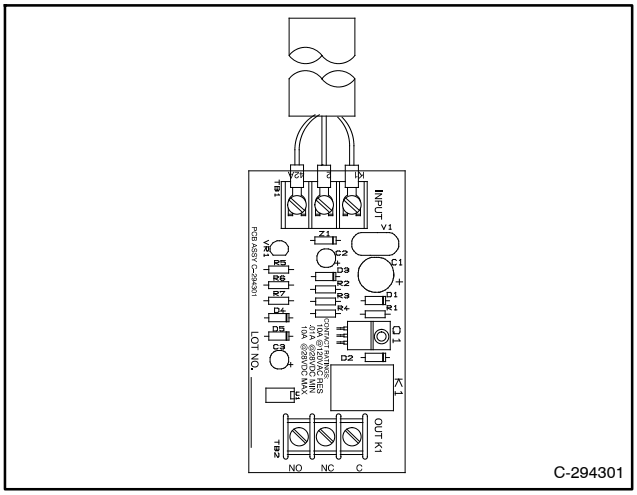


Figure 8-4 Common Failure Relay Kit

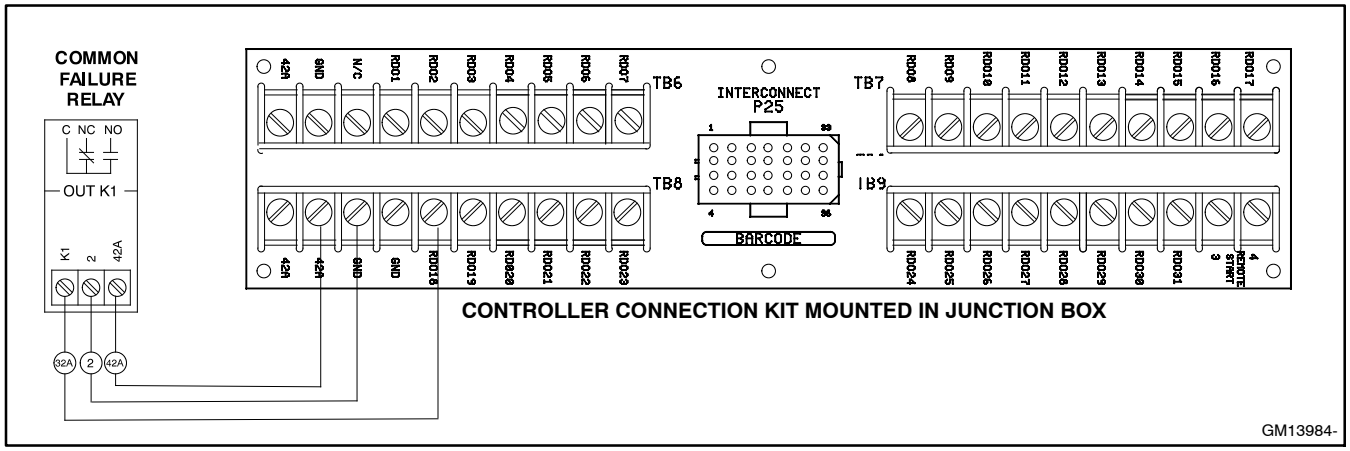


Figure 8-5 Common Failure Relay Kit Connections

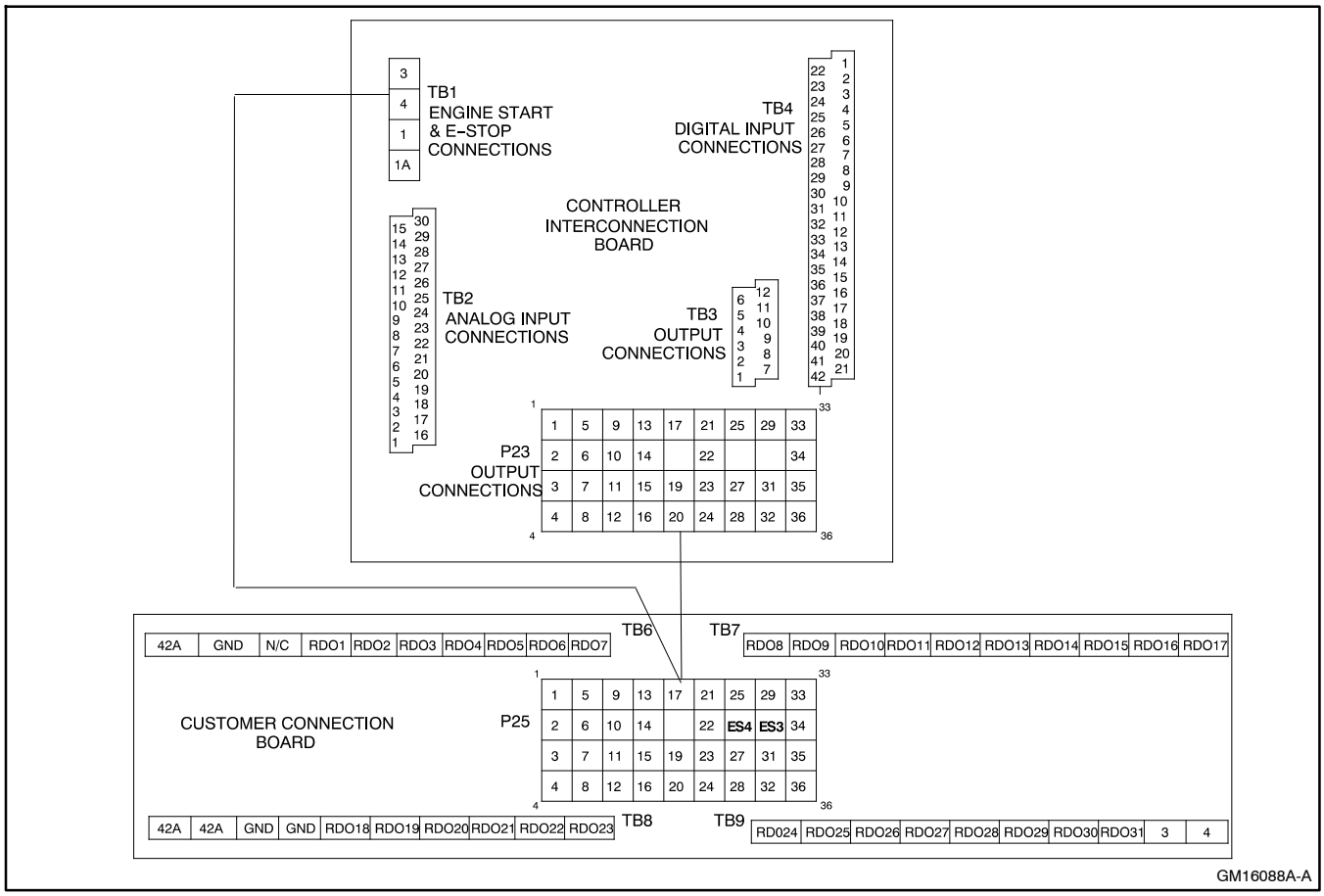


Figure 8-6 Controller (Customer) Connection Kit

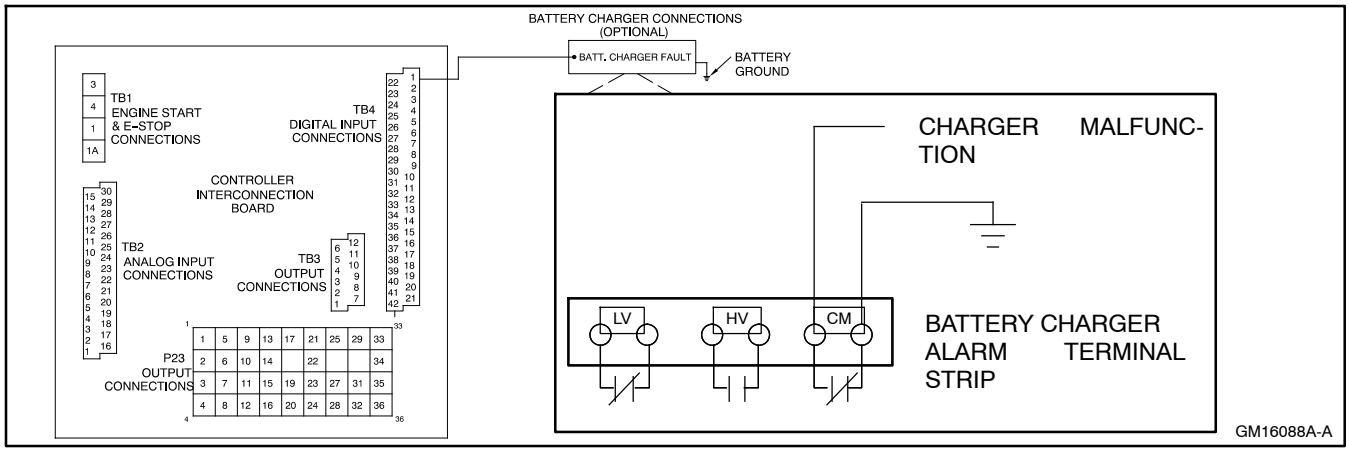


Figure 8-7 Float/Equalize Battery Charger Connections

8.1.5 Ground Fault Annunciation

A relay contact for customer connection indicates a ground fault condition and is part of a ground fault alarm. See Figure 8-8 for electrical connections and the following procedure for controller setup. Use the instructions with the kit when provided to install and setup this accessory.

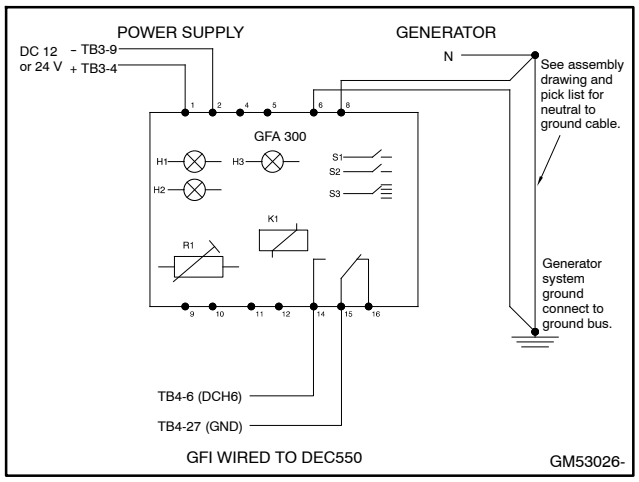
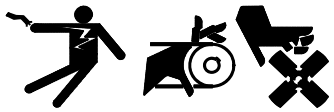


Figure 8-8 Ground Fault Connections

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (–) lead first when disconnecting the battery. Reconnect the negative (–) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (–) lead first. Reconnect the negative (–) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

Ground Fault Controller Setup Procedure

1. Reconnect battery, if not already done.
2. Place the controller master switch to the AUTO position.
3. Press the Alarm Off key to silence the alarm horn, if necessary.
4. If the programming mode LED is not flashing, go to the step 5. If the programming mode LED is flashing, go to step 6.
5. Set Programming Mode to Local.
   a. Press keys RESET MENU, 1, 4, ENTER, MENU.
   b. Press key MENU until *Programming Mode–Local* is displayed.
   c. Press the YES key 7 YES, ENTER.
   d. When the *Enter Code* displays, press the factory default 0 LAMP TEST, ENTER or the user password keys and ENTER. The programming mode LED should be flashing.
6. Set digital input #6 to ground fault.
   a. Press RESET MENU, 9, ENTER. *Menu 9 Input Setup* should be displayed.
   b. Press MENU until *Digital Input 06 Warning* is displayed.
   c. Press MENU once to select this input.
   d. Press MENU until *Ground Fault* is displayed.
   e. Press 7 YES, ENTER to define Digital Input #06 as ground fault. *Entry Accepted* is displayed.
   f. Press MENU to display *Digital Input #06 Inhibit Time*.
   g. Press 0 LAMP TEST, ENTER to enter the inhibit time. *Entry Accepted* is displayed and the inhibit time *0:00* is now displayed.

h. Press MENU to display *Digital Input #06 Delay TIme*.

i. Press 5 ENTER to enter delay time. *Entry Accepted* is displayed. Default delay time is 5 sec.

j. Press RESET MENU.

7. Verify Programming.

   a. Move handle of ground fault circuit breaker at generator set to simulate a ground fault.

   b. Verify that display shows *D06 Ground Fault*. The System Warning LED should be illuminated and the alarm horn should sound. If these indicators are not present, recheck steps 6a. through 6j.

   c. Return handle of ground fault circuit breaker to the non-ground fault position. *D06 Ground Fault* display should now be cleared.

8. Set Programming Mode to Off.

   a. Press RESET MENU 1 4 ENTER.

   b. Press key MENU until *Programming Mode Off* is displayed.

   c. Press the YES key 7 YES ENTER.

   d. When the *Enter Code* displays, press the factory default 0 LAMP TEST ENTER or the user password keys and ENTER. The programming mode LED should now be off.

9. Place the controller master switch to the OFF/ RESET position.

10. Disconnect the battery negative (-) lead to power down the generator set.

11. After 2-3 minutes, reconnect the battery negative (-) lead.

12. Reset the controller clock. See Menu 6—Time and Date.

8.1.6 Idle (Speed) Mode Feature

The idle (speed) mode feature provides the ability to start and run the engine at idle (reduced) speed for a selectable time period (0–10 minutes) during warm-up. The controller will override the idle speed mode if the engine reaches the preprogrammed engine warmed-up temperature before the idle mode times out. See Figure 8-9 for user-supplied switch connection.

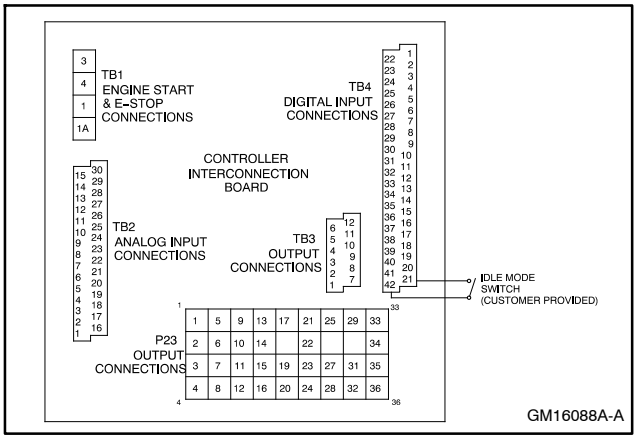


Figure 8-9 Idle (Speed) Mode Switch

8.1.7 Low Fuel (Level/Pressure) Switch

Some gaseous-fueled models offer a low fuel pressure switch. The low fuel pressure switch connects to the same terminal as the low fuel *level* switch on diesel- or gasoline-fueled models. See Figure 8-10 and Figure 8-11. See Section 8.2, Accessory Connections, for terminal identification.

Note: The main tank or the transfer/day tank includes the low fuel level switch. The fuel tank supplier typically provides the low fuel level switch.

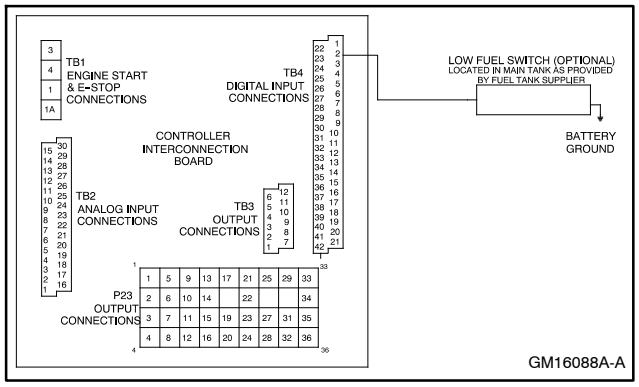


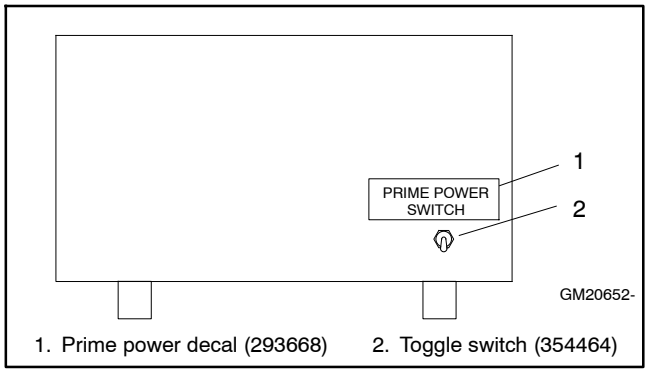
Figure 8-10 Low Fuel Switch (Level or Pressure)

Switch Rating	12 volts DC minimum, 0.5 amp minimum
Wiring Recommendation	
Gauge	**mm (ft.)**
18–20	30.5 (100)
14	153 (500)
10	305 (1000)

Figure 8-11 Switch Rating & Wiring Recommendation

8.1.8 Prime Power Switch Kit

The prime power switch kit prevents battery drain during generator set nonoperation periods and when the generator set battery cannot be maintained by an AC battery charger. See Figure 8-12 for an illustration of the kit and Figure 8-13 for the electrical connections.



1. Prime power decal (293668) 2. Toggle switch (354464)

Figure 8-12 Prime Power Switch Installation Location

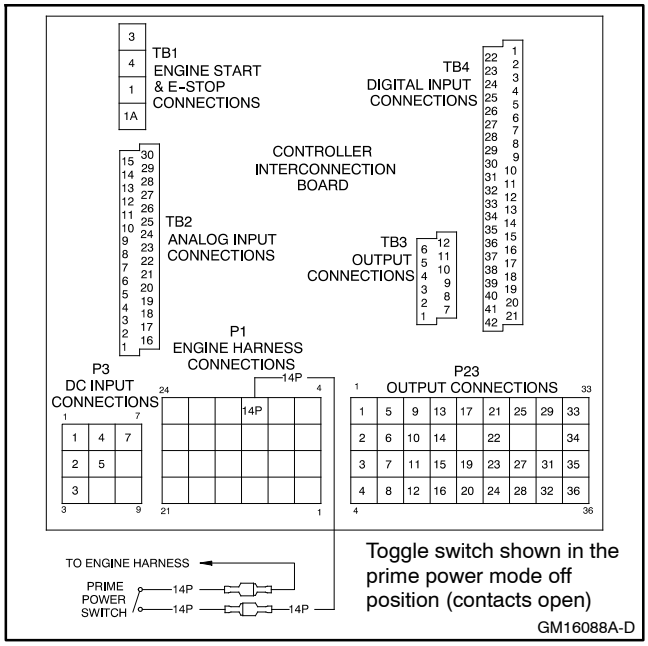


Figure 8-13 Prime Power Switch Connections

Stop the generator set using the stopping procedures in the respective operation manual before placing the generator set in the prime power mode. Move the prime power switch located on the back of the controller to the *DOWN* position. The controller including the digital display, LEDs, and alarm horn does not function when the generator set is in the prime power mode.

Move the prime power switch located on the back of the controller to the *UP* position and reset the controller time and date before attempting to start the generator set.

8.1.9 Remote Emergency Stop Kit

The emergency stop kit allows immediate shutdown of the generator set from a remote location. See Figure 8-14 and Figure 8-15. If the emergency stop switch activates, the EMERGENCY STOP lamp lights and the unit shuts down. Before attempting to restart the generator set, reset the emergency stop switch (by replacing the glass piece) and reset the generator set by placing the master switch in the OFF/RESET position.

Use the single glass piece located inside the switch for replacement and order additional glass pieces as service parts. See the respective operation manual for the Emergency Stop Switch Reset Procedure. See Section 8.2, Accessory Connections, for terminal identifications.

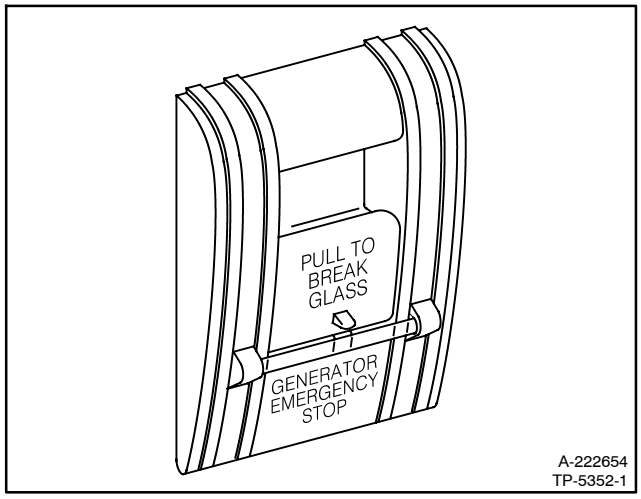


Figure 8-14 Emergency Stop Kit

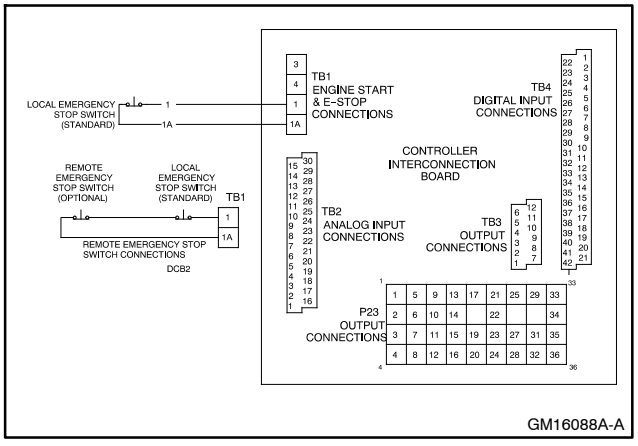


Figure 8-15 Remote Emergency Stop Kit Connections

8.1.10 Remote Reset Feature

The remote reset switch provides generator set resetting after a fault shutdown at a remote location. See Figure 8-16 and Figure 8-17 for user-supplied switch connection.

Press and hold the switch for 2–3 seconds and release to reset the generator set controller.

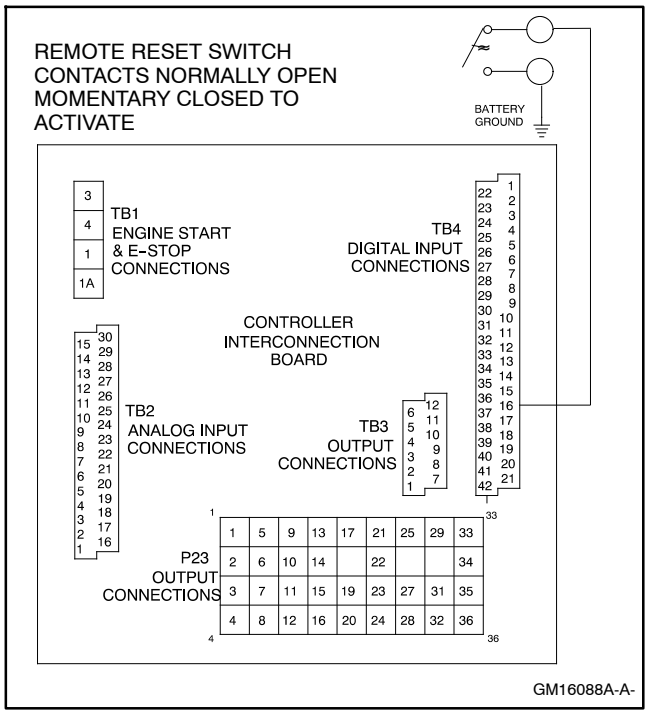


Figure 8-16 Remote Reset Switch Connections

Switch Rating	12 volts DC minimum, 1 amp minimum
Wiring Recommendation	
Gauge	**mm (ft.)**
18–20	30.5 (100)
14	153 (500)
10	305 (1000)

Figure 8-17 Switch Rating and Wiring Recommendations

8.1.11 Remote Serial Annunciator (RSA III)

Adapted from Instruction TT-1625 9/14b.

The following information summarizes the setup items when installing the remote serial annunciator. Refer to the RSA installation instructions TT-1625 for operation and function.

RSA III Features and Connections

RSA III is an annunciator panel offered in several kit configurations to support Kohler power equipment. The RSA III is a remote serial annunciator that monitors the condition of the generator set and/or ATS from a remote location. The RSA III alerts the operator through visual and audible signals using LED indication and a horn. An alarm silence and lamp test switch are included.

An RSA III annunciator can be used for a single generator set (Figure 8-18) or with a combination of a generator set and automatic transfer switch(es) (Figure 8-19 or Figure 8-20). In systems using more than a single RSA III, one must be designated as the master device to broadcast to additional RSA III annunciators, designated as slave devices. Up to five RSA III slave devices can be used with an RSA III master device. All RSA III annunciators are factory set as the master device, but can be changed to a slave device using a PC and SiteTech™ software that connects to the RSA III front panel via a universal serial bus (USB) connection.

The RSA II can be connected with the RSA III provided that the master remote annunciator is an RSA III.

The RSA III meets NFPA 110, Level 1 (2005) applications that require remote controls and alarms be powered by a storage battery such as the engine starting battery. AC adaptor kit GM62466-KP1 is available when NFPA is not required.

See Section 8.2, Accessory Connections, for terminal identifications.

A PC with SiteTech™ software is required to make the RSA III functional. Use your SecurID to access KOHLERnet, click on the TechTools button, and follow the instructions to download the files. See SiteTech™ Software Settings and refer to TP-6701 SiteTech™ Software Operation Manual for more information.

If a fault occurs, the RSA III horn activates and the corresponding LED illuminates. The following paragraphs describe specific features of the RSA III.

If the RSA III is used with an Ethernet communication network, order Modbus® Ethernet converter GM41143-KP2 and refer to TT-1405 Converters, Connections, and Controller Setup for Network Communication for system installation.

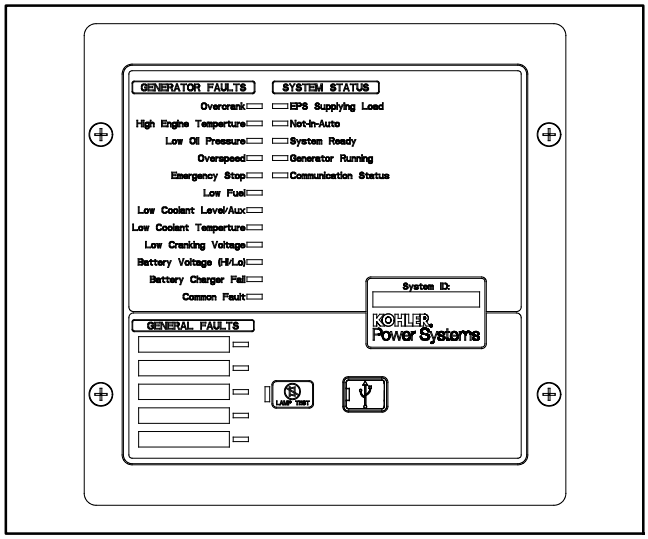


Figure 8-18 Remote Serial Annunciator (RSA III)

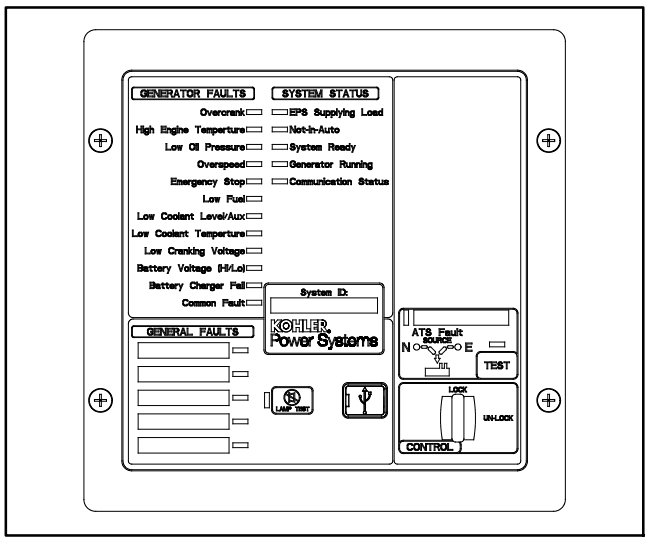


Figure 8-19 RSA III with Single ATS Control

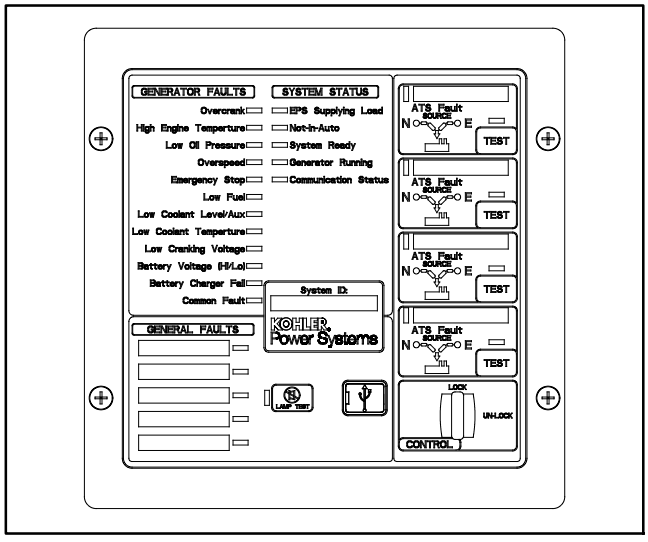


Figure 8-20 RSA III with Four ATS Controls

Modbus® is a registered trademark of Schneider Electric.

If there is only one RSA III, it is the master. If several RSA III are installed, choose either the RSA III closest to the generator set or determine which RSA III is more practical for use as a master and use a daisy chain wiring configuration for the remaining RSAs. The RSA III connected to the controller MUST be assigned as the RSA III master.

Note: When an RSA III is installed into a system with existing older RSAs, the RSA III must be configured as the master.

Note: Should any communication issues occur when adding RSA III slaves and/or transfer switches to the system, be sure to power down the RSA III master and then power up the RSA III master so that the RSA III master can recognize the changes.

Use the SiteTech™ software to select either that the generator set controller activates EPS Supplying Load LED or the transfer switch activates LED or local EPS supplying load.

Use the SiteTech™ software to select the high speed mode for direct connection to the DEC 550 controller. Select lower speed for network connection with the Modbus®/ Ethernet converter. The lower speed allows network functionality reducing loss of communication faults.

Terminating Resistor and Wiring

For communication between the controller and RSA III master, see Figure 8-21. For communication between RSA III Master and RSA III Slave, see Figure 8-22. Place the terminating resistor on the last RSA III slave in the daisy chain connection.

Note: When using RS-485 communication cable, connect the “shield” wire at either end but not at both ends.

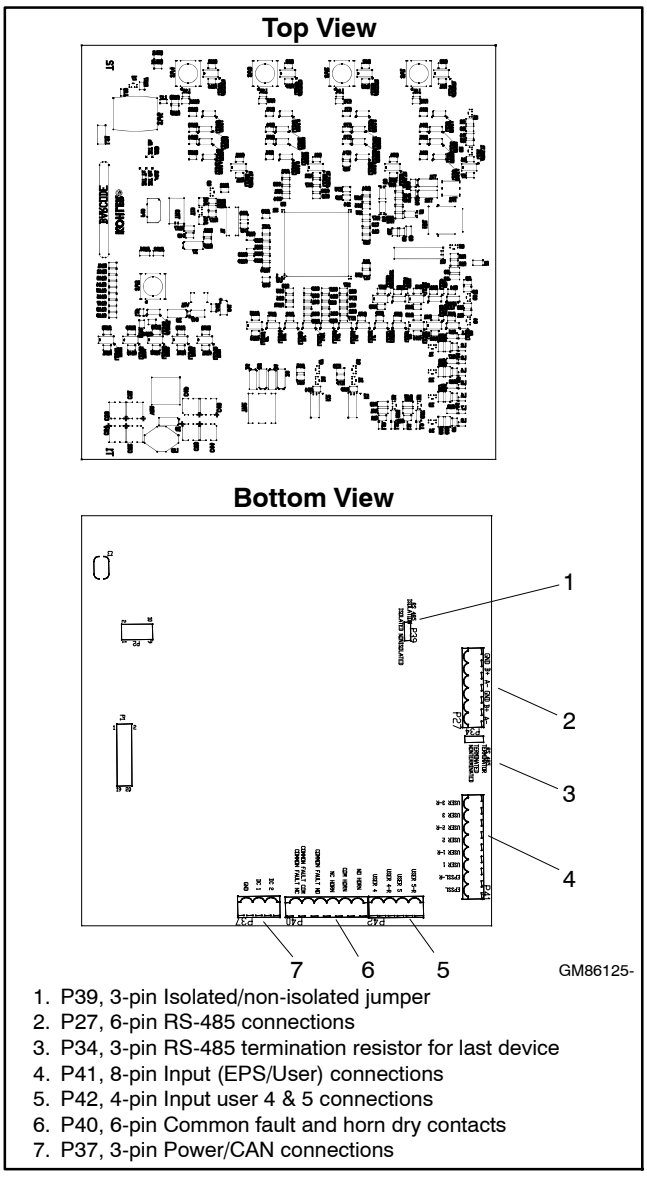
P27 RS-485 Connections (from Controller to Master)	
P27-1	(-) Black (from controller)
P27-2	(+) White (from controller)
P27-3	Shield (from controller)
P27-4	(-) Black (to slave or terminating resistor)
P27-5	(+) White (to slave or terminating resistor)
P27-6	Shield (to slave or open)
Note: When using RS-485 communication cable, connect the “shield” wire at either end but not at both ends.	

Figure 8-21 P27 Connector on Master RSA III

Communication between RSA III Master and RSA III Slave. Select and connect the RS-485 wiring from the RSA III master to the RSA III slave(s) in a daisy chain wiring configuration using Belden #9841 or equivalent. Figure 8-22 shows the master/slave RS-485 connections and Figure 8-23 shows the RSA III with P27 location.

P27 RS-485 Connections (from Master to Slave)	
P27-1	(-) Black (from master or previous slave)
P27-2	(+) White (from master or previous slave)
P27-3	Shield (from master or previous slave)
P27-4	(-) Black (to next slave or terminating resistor)
P27-5	(+) White (to next slave or terminating resistor)
P27-6	Shield (to next slave or open)
Note: When using RS-485 communication cable, connect the “shield” wire at either end but not at both ends.	

Figure 8-22 P27 Connection on RSA III Slave



1. P39, 3-pin Isolated/non-isolated jumper
2. P27, 6-pin RS-485 connections
3. P34, 3-pin RS-485 termination resistor for last device
4. P41, 8-pin Input (EPS/User) connections
5. P42, 4-pin Input user 4 & 5 connections
6. P40, 6-pin Common fault and horn dry contacts
7. P37, 3-pin Power/CAN connections

Figure 8-23 RSA III Circuit Board GM86125 Connectors

8.1.12 Shunt-Trip Line Circuit Breaker

A shunt-trip line circuit breaker provides a 12- or 24-DC volt solenoid within the line circuit breaker case that can energize the trip mechanism. This feature allows the circuit breaker to be tripped by a customer-selected fault such as alternator overload, overspeed, overvoltage, or defined common fault. Connection requires a shunt-trip wiring kit and a dry contact kit. See Figure 8-24.

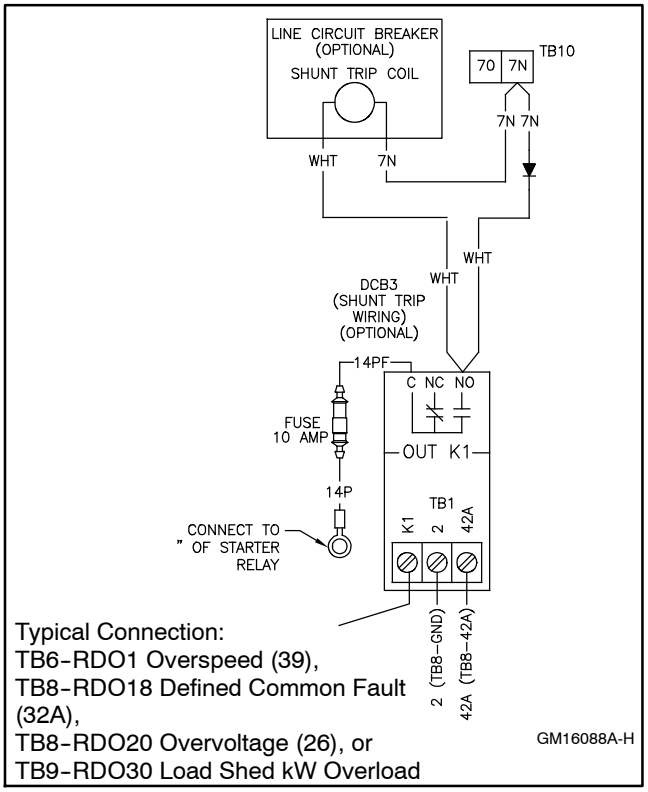


Figure 8-24 Shunt-Trip Line Circuit Breaker and Shunt-Trip Wiring Kit Connections

8.1.13 Single-Relay Dry Contact Kit

The single-relay dry contact kit provides normally open and normally closed contacts in a form C configuration to activate warning devices and other user- provided accessories allowing remote monitoring of the generator set. Typically, lamps, audible alarms, or other devices signal faults or status conditions. Connect any controller fault output to the single-relay dry contact kit.

A total of three dry contact kits may connect to a single controller output. See Figure 8-25 and Figure 8-26. See Section 8.2, Accessory Connections, for terminal identifications.

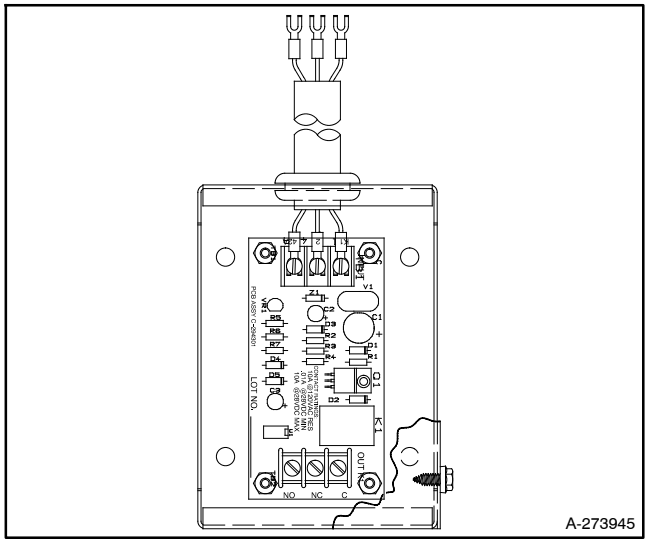


Figure 8-25 Single-Relay Dry Contact Kit, Typical

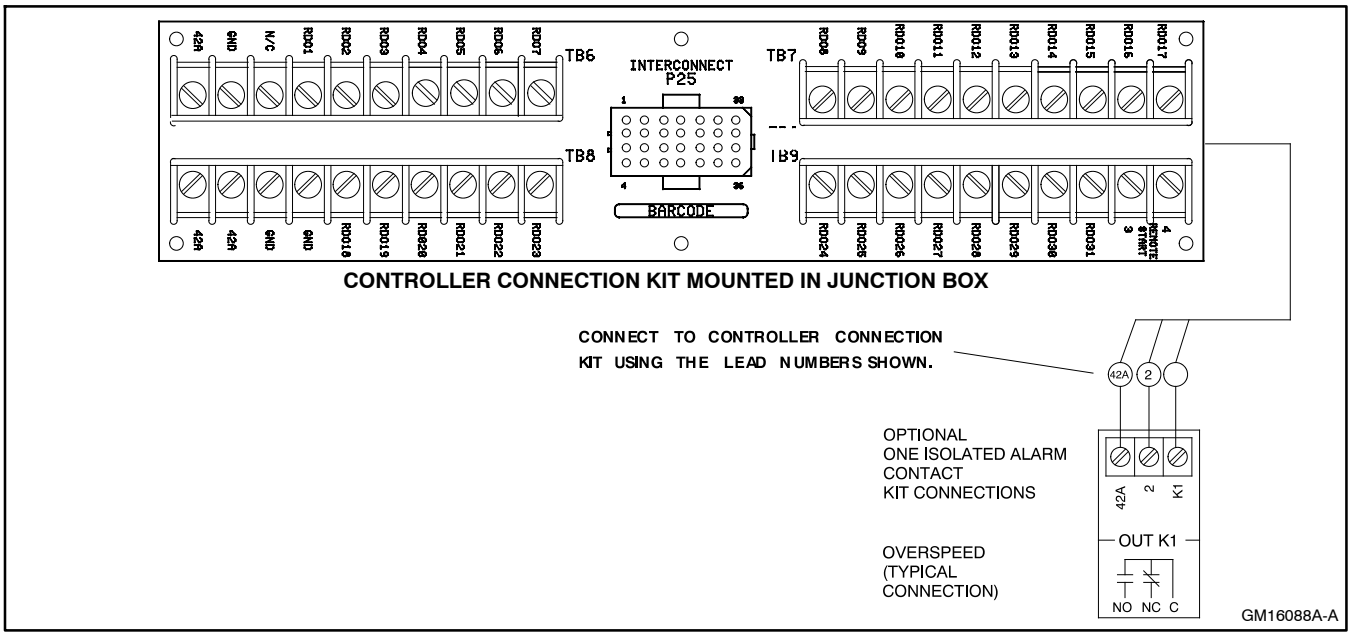


Figure 8-26 Single-Relay Dry Contact Kit Connections

8.1.14 Ten-Relay Dry Contact Kit

The ten-relay dry contact kit provides normally open and normally closed contacts in a form C configuration to activate warning devices and other user-provided accessories allowing remote monitoring of the generator set. Connect any controller fault output to the ten-relay dry contact kit. Typically, lamps, audible alarms, or other devices signal the fault conditions.

Refer to Figure 8-27 for an internal view of the contact kit. See Figure 8-28 for electrical connections. See Section 8.2, Accessory Connections, for terminal identifications.

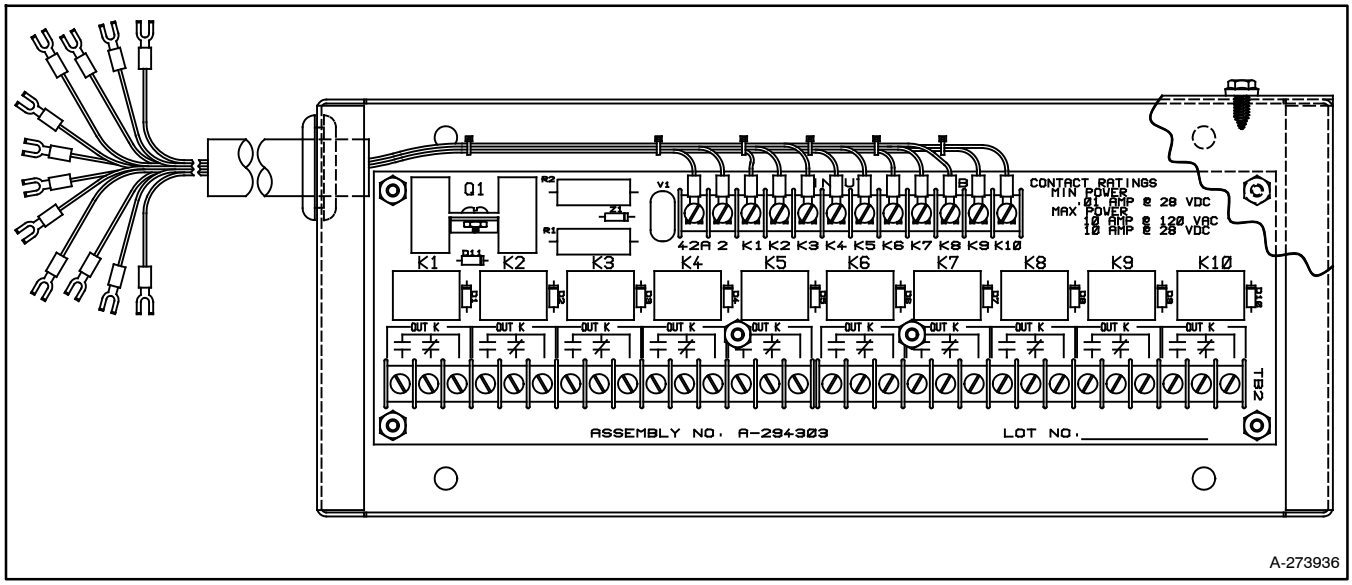


Figure 8-27 Ten-Relay Dry Contact Kit

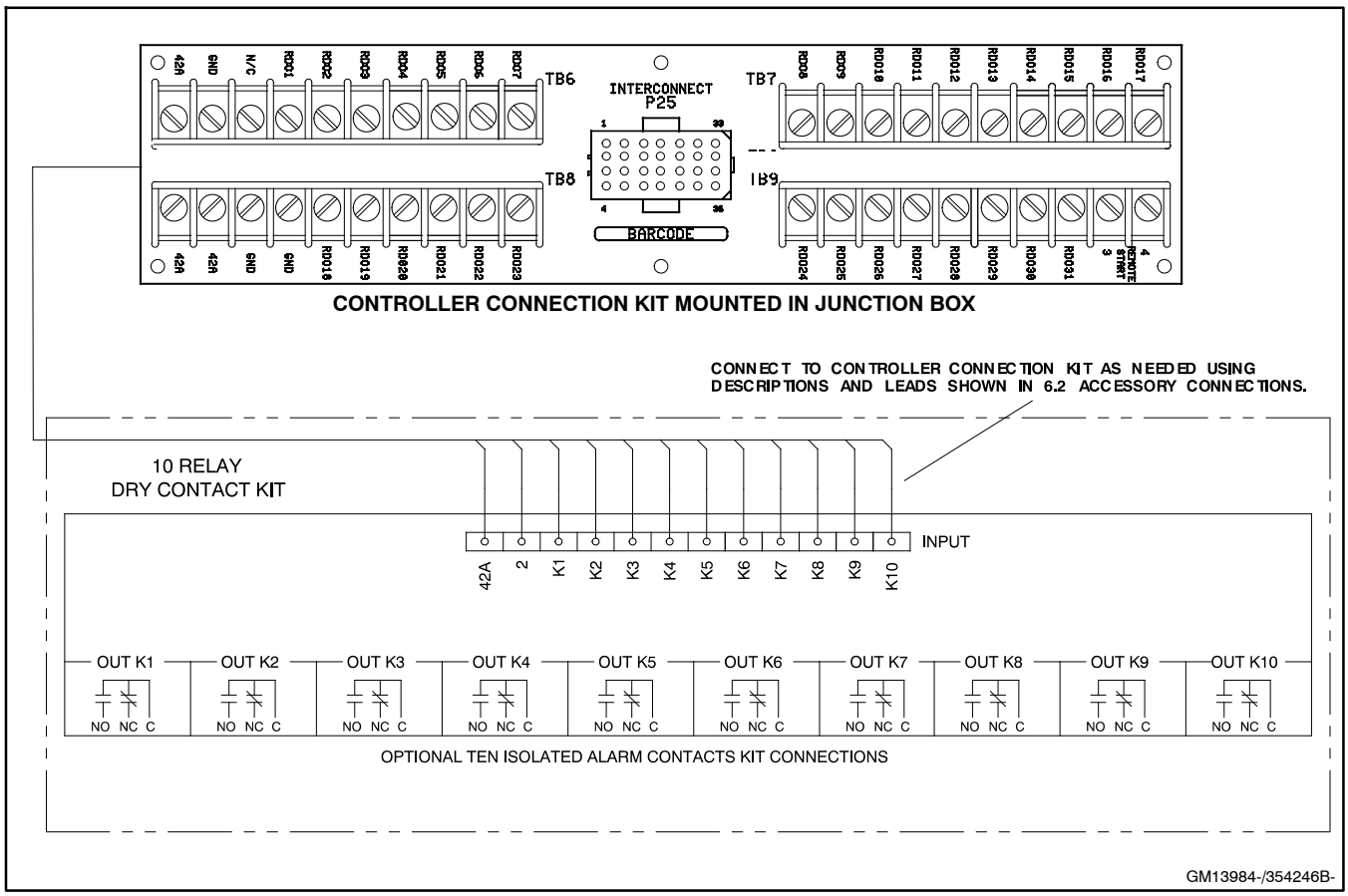


Figure 8-28 Ten-Relay Dry Contact Kit Connections

8.1.15 Twenty-Relay Dry Contact Kit

The twenty-relay dry contact kit provides normally open and normally closed contacts in a form C configuration to activate warning devices and other user-provided accessories allowing remote monitoring of the generator set. Typically, lamps, audible alarms, or other devices signal faults or status conditions. Connect any generator set fault output to the dry contact kit.

Refer to Figure 8-29 for an internal view of the contact kit. See Figure 8-30 for electrical connections. See Section 8.2, Accessory Connections, for terminal identifications.

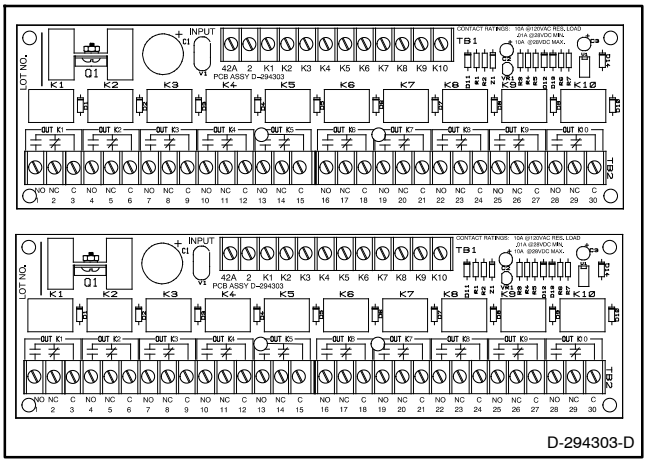


Figure 8-29 Twenty-Relay Dry Contact Kits

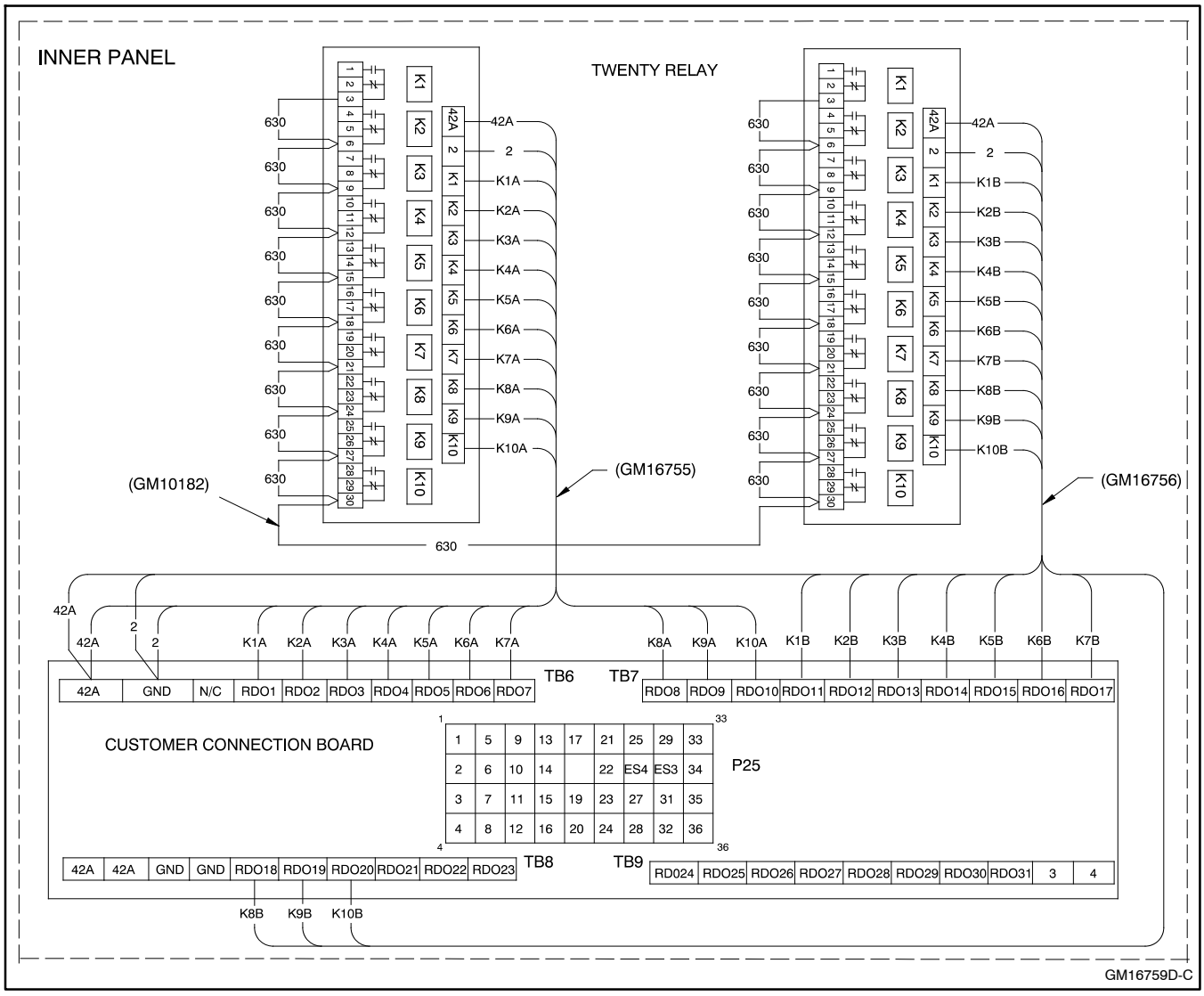
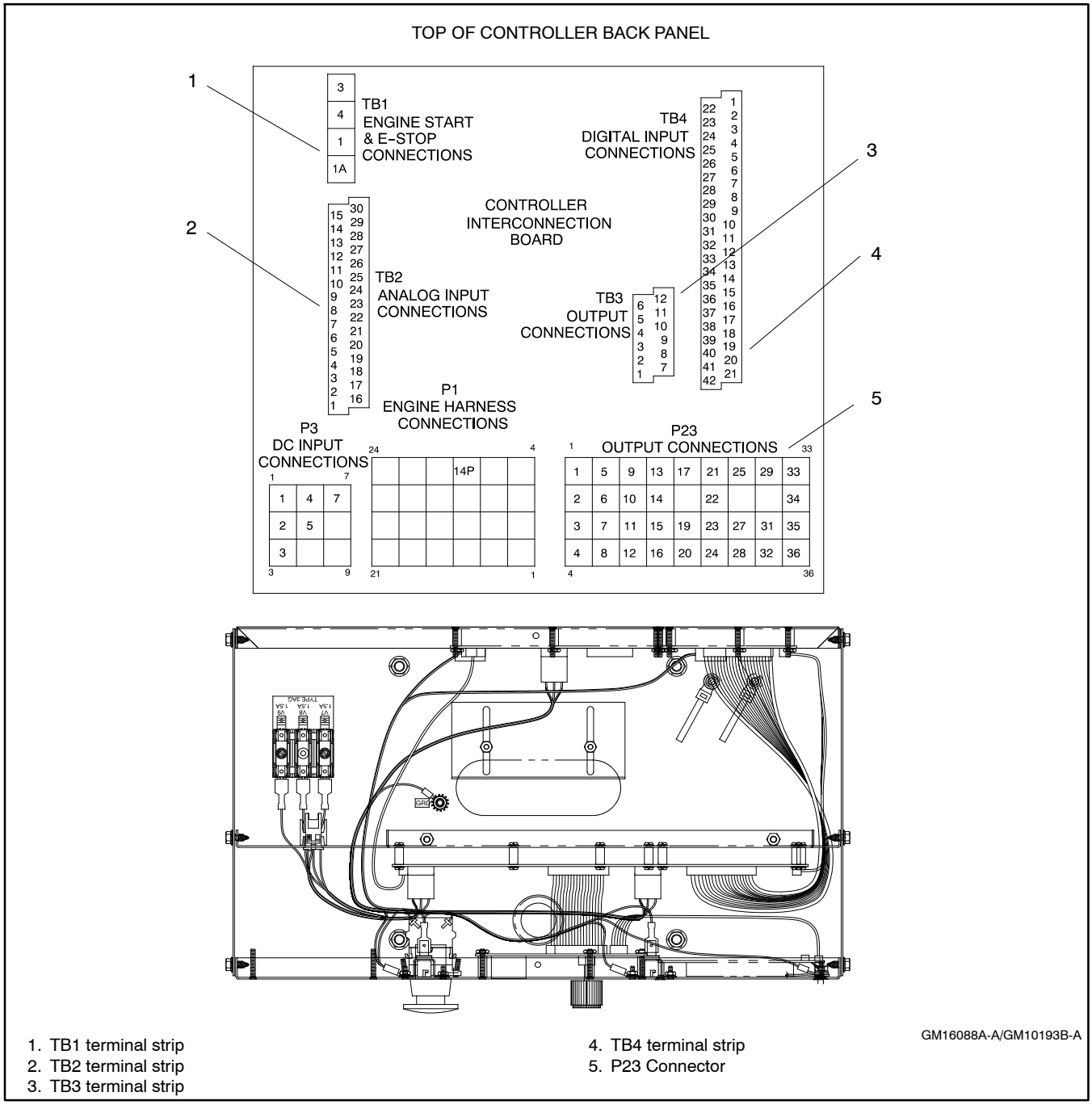


Figure 8-30 Twenty-Relay Dry Contact Relay Kit Connections

8.2 Accessory Connections

The 550 controller contains circuit boards equipped with terminal strip(s) for use in connecting a controller connection kit. Do not connect accessories directly to the controller terminal strip(s). Connect accessories to either a controller connection kit or a dry contact kit. Connect the dry contact kit(s) to the controller connection kit. Connect alarms, battery chargers, remote switches, and other accessories to the dry contact kit relay(s).

For specific information on accessory connections, refer to the accessory wiring diagrams in the wiring diagram manual and the instruction sheet accompanying the kit. See Figure 8-31 and Figure 8-32 for controller interconnection circuit board connections. See Figure 8-33 and Figure 8-34 for controller (customer) connection kit connections. See NO TAG, NO TAG, and Appendix G Wiring Diagrams for accessory connection wiring diagrams.



1. TB1 terminal strip
2. TB2 terminal strip
3. TB3 terminal strip
4. TB4 terminal strip
5. P23 Connector

Figure 8-31 Terminal Strips on Controller Interconnection Circuit Board (Controller Back Panel Folded Down)

TB1 Terminal Strip—Engine Start and Emergency Stop Connections

Term.	Description
1	Emergency stop ground
1A	Emergency stop
3	Remote start
4	Remote start

TB2 Terminal Strip—Analog Input Connections

Term.	Description
1	ACH1 (CTS) Signal (non-ECM including Waukesha)
2	ACH1 (CTS) Supply (non-ECM including Waukesha)
3	ACH2 (OPS) Signal (non-ECM including Waukesha)
4	ACH2 (OPS) Supply (non-ECM including Waukesha
5	ACH3 Signal (air intake temp. for Waukesha)
6	ACH3 Supply (air intake temp. for Waukesha)
7	ACH4 Signal (oil temp. for Waukesha)
8	ACH4 Supply (oil temp. for Waukesha)
9	ACH5 Signal
10	ACH5 Supply
11	ACH6 Signal
12	ACH6 Supply (VSG for Volvo, GM, Doosan)
13	ACH7 Signal (optional analog voltage adjust signal)
14	ACH7 Supply
15	N/C
16	ACH1 (CTS) Return (non-ECM)
17	ACH1 (CTS) Shield ground (non-ECM)
18	ACH2 (OPS or OPS2) Return (non-ECM)
19	ACH2 (OPS) Shield ground (non-ECM)
20	ACH3 (IAT or OPS1) Return
21	ACH3 Shield ground
22	ACH4 (Oil Temp) Return
23	ACH4 Shield ground
24	ACH5 Return
25	ACH5 Shield ground
26	ACH6 Return
27	ACH6 Shield ground
28	ACH7 Return
29	ACH7 Shield ground
30	N/C

TB3 Terminal Strip—Accessory Power Output Connections

Term.	Description
1	+12 VDC (OEM use only)
2	+12 VDC (OEM use only)
3	+12 VDC (OEM use only)
4	Fused battery (+) (42A) (5 amp)
5	Fused battery (+) (42A) (5 amp)
6	Fused battery (+) (42A) (5 amp)
7	Battery (–)
8	Battery (–)
9	Battery (–)
10	Battery (–)
11	Battery (–)
12	Panel lamp output

TB4 Terminal Strip—Input Factory Connections

Term.	Description
1	DCH1 Battery charger fault
2	DCH2 Low fuel
3	DCH3 Low coolant temp. with ECM models or warning default with non-ECM models
4	DCH4 Field overvoltage with M4/M5/M7 alternators or warning default with non-M4/M5/M7 alternators
5	DCH5 Breaker Closed, Paralleling Applications
6	DCH6 Enable Synch, Paralleling Applications
7	DCH7 Warning
8	DCH8 Warning
9	DCH9 Warning
10	DCH10 Warning
11	DCH11 AFM Shutdown, Waukesha engine
12	DCH12 Detonation Warning, Waukesha engine
13	DCH13 Detonation Shutdown, Waukesha engine
14	DCH14 Warning
15	DCH15 Remote shutdown
16	DCH16 Remote reset
17	DCH17 VAR PF mode
18	DCH18 Voltage lower
19	DCH19 Voltage raise
20	DCH20 Air damper
21	DCH21 Idle mode functional with ECM-equipped engines only
22	DCH1 Return
23	DCH2 Return
24	DCH3 Return
25	DCH4 Return
26	DCH5 Return
27	DCH6 Return
28	DCH7 Return
29	DCH8 Return
30	DCH9 Return
31	DCH10 Return
32	DCH11 Return
33	DCH12 Return
34	DCH13 Return
35	DCH14 Return
36	DCH15 Return
37	DCH16 Return
38	DCH17 Return
39	DCH18 Return
40	DCH19 Return
41	DCH20 Return
42	DCH21 Return

Note: TB4-1 through TB4-21 are user definable with factory defaults listed. Terminals TB4-3, TB4-4, TB4-14, and TB4-21 have different functions depending upon the generator set configuration. See comments above.
See Menu 9—Input Setup for changing inputs.

Figure 8-32 Controller Terminal Strip Identification

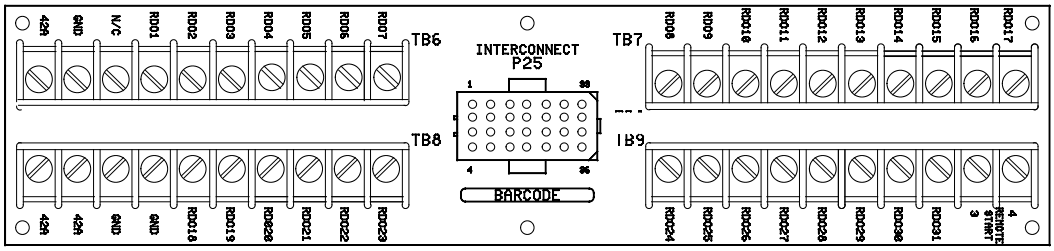


Figure 8-33 Terminal Strips TB6, TB7, TB8, and TB9 on the Controller Connection Kit in the Junction Box

TB6 Terminal Strip—RDOs 1-7

Term.	Description
42A	Battery (+)
GND	Battery (-)
N/C	
RDO1	Overspeed (lead 39)
RDO2	Overcrank (lead 12)
RDO3	High coolant temperature shutdown (lead 36)
RDO4	Low oil pressure shutdown (lead 38)
RDO5	Low coolant temperature (lead 35)
RDO6	High coolant temperature warning (lead 40)
RDO7	Low oil pressure warning (lead 41)

TB7 Terminal Strip—RDOs 8-17

Term.	Description
RDO8	Low fuel (lead 63)
RDO9	Master switch not in auto (lead 80)
RDO10	NFPA 110 common alarm (lead 32)*
RDO11	Battery charger fault (lead 61)
RDO12	Low battery voltage (lead 62)
RDO13	High battery voltage
RDO14	Emergency stop (lead 48)
RDO15	Generator set running (lead 70R)
RDO16	Time delay engine cooldown (TDEC) (lead 70C)
RDO17	System ready (lead 60)

TB8 Terminal Strip—RDOs 18-23

Term.	Description
42A	Battery (+)
42A	Battery (+)
GND	Battery (-)
GND	Battery (-)
RDO18	Defined common fault (lead 32A)
RDO19	Low coolant level
RDO20	Overvoltage (lead 26)
RDO21	Idle mode
RDO22	EPS supplying load
RDO23	Air damper indicator (lead 56)

TB9 Terminal Strip—RDOs 24-31

Term.	Description
RDO24	Speed sensor fault
RDO25	Loss of AC sensing
RDO26	ECM loss of communication
RDO27	Undervoltage
RDO28	Overfrequency
RDO29	Underfrequency
RDO30	Load shed kW overload
RDO31	Load shed underfrequency
3	Remote start
4	Remote start

Note: Lead numbers shown in parentheses are the factory default wire designations.

Note:RDO-1 though RDO-31 are user definable with the following factory defaults: emergency stop, high coolant temperature, low oil pressure, overcrank, and overspeed

***NFPA-110 common alarm faults include:**

Air damper indicator (RDO-23)
Battery charger fault (RDO-11)
EPS supplying load (RDO-22)
High battery voltage (RDO-13)
High coolant temperature warning (RDO-06)
High coolant temperature shutdown (RDO-03)
Low battery voltage (RDO-012)
Low coolant level (RDO-19)
Low coolant temperature warning (RDO-05)
Low fuel (level or pressure) (RDO-08)
Low oil pressure warning (RDO-07)
Low oil pressure shutdown (RDO-04)
Master switch not in auto (RDO-09)
Overcrank (RDO-02)
Overspeed (RDO-01)

Figure 8-34 Controller (Customer) Connection Kit Terminal Strip Identification with Relay Driver Outputs (RDOs)

Notes

9.1 Accessories and Connections

Several accessories help finalize installation, add convenience to operation and service, and establish state and local code compliance.

Accessories vary with each generator set model and controller. Select factory-installed and/or shipped-loose accessories. See Figure 9-1 for a list of available kits. Obtain the most current accessory information from your local authorized service distributor/dealer.

This section illustrates several accessories available at print time of this publication. Accessory kits generally include installation instructions. See wiring diagrams manual for electrical connections not shown in this section. See the installation instructions and drawings supplied with kit for information on kit mounting location.

The instructions provided with the accessory kit supersede these instructions where there are differences. In general, run AC and DC wiring in separate conduit. Use shielded cable for all analog inputs. Observe all applicable national, state, and local electrical codes during accessory installation.

See Section 9.2, Accessory Connections, for terminal identification.

Kit Description
Common Fault/Failure (32A) Connections
Float/Equalize Battery Charger (with alarms)
Input/Output Module Board
Low Fuel (Level) Switch
Low Fuel (Pressure) Switch
Prime Power Switch
Remote Emergency Stop
Remote Reset Feature
Remote Serial Annunciator (RSA III)
Shunt-Trip Line Circuit Breaker

Figure 9-1 Optional Accessories

9.1.1 Common Fault/Failure (32A) Relay

The common fault relay is standard on the controller circuit board and located at the TB2 terminal strip connections. Contacts are rated at 2 amps at 32 VDC or 0.5 amps at 120 VAC max. See Figure 9-2 and Figure 9-3.

The optional common fault relay shown in Figure 9-3 as DCB2 has contacts rated at 10 amps at 28 VDC or 120 VAC and can be connected to user-supplied accessories.

The optional common fault relay shown in Figure 9-3 as DCB1 has contacts rated at 10 amps at 28 VDC or 120 VAC and is used to trigger the shunt-trip line circuit breaker kit (mentioned later in this section).

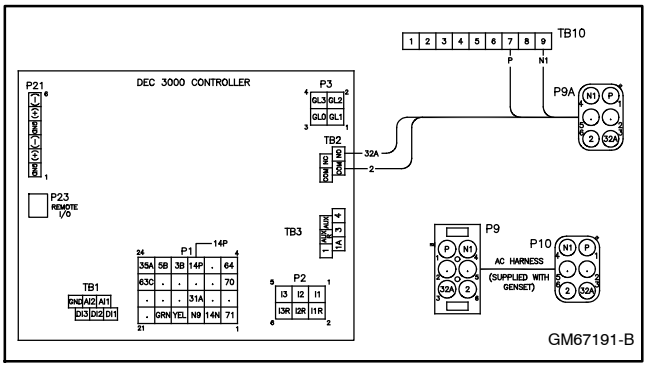


Figure 9-2 Common Fault Relay Wiring (Standard)

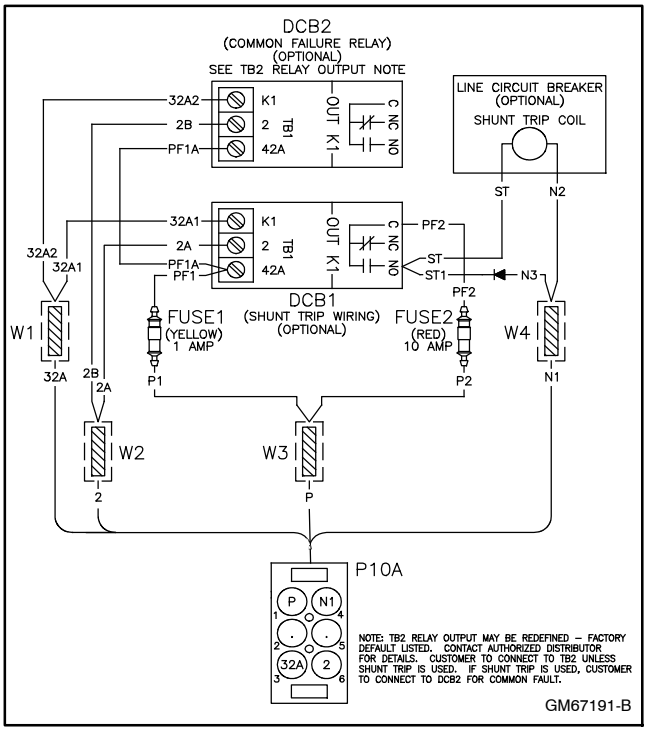


Figure 9-3 Common Fault Relay Kit and Shunt-Trip Relay Kit Wiring

9.1.2 Float/Equalize Battery Charger Kit with Alarm Option

The float/equalize battery charger with alarm option provides battery charging to the engine starting battery(ies) and connects to the controller for fault detection. Battery chargers for 12- or 24-volt models are available as a generator set accessory. See Figure 9-4 and Figure 9-5 for battery connections.

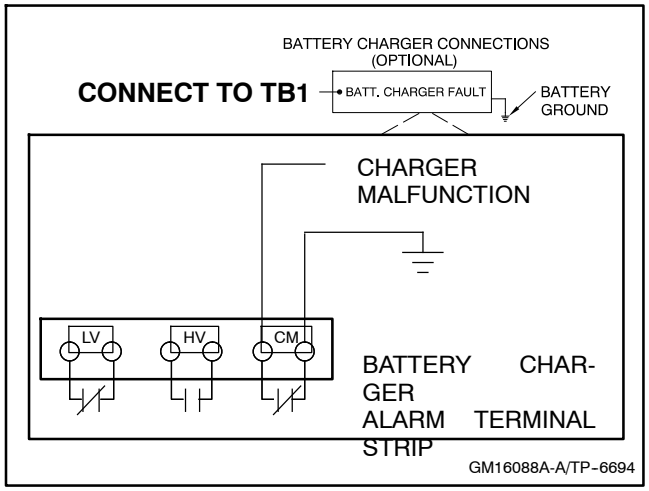


Figure 9-4 Float/Equalize Battery Charger Connections

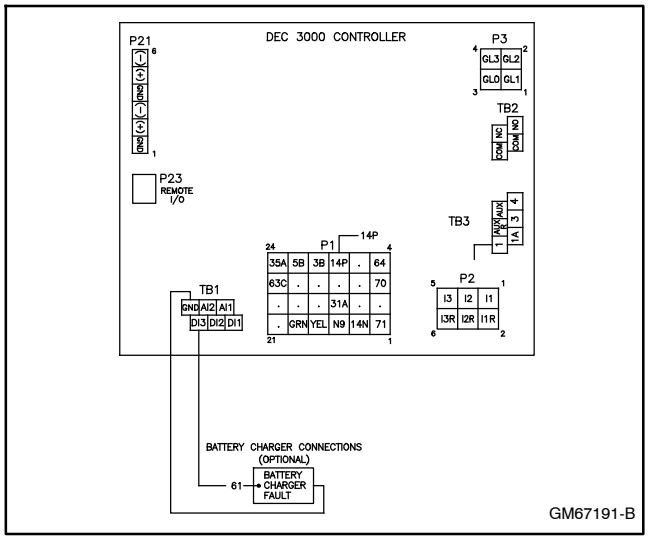
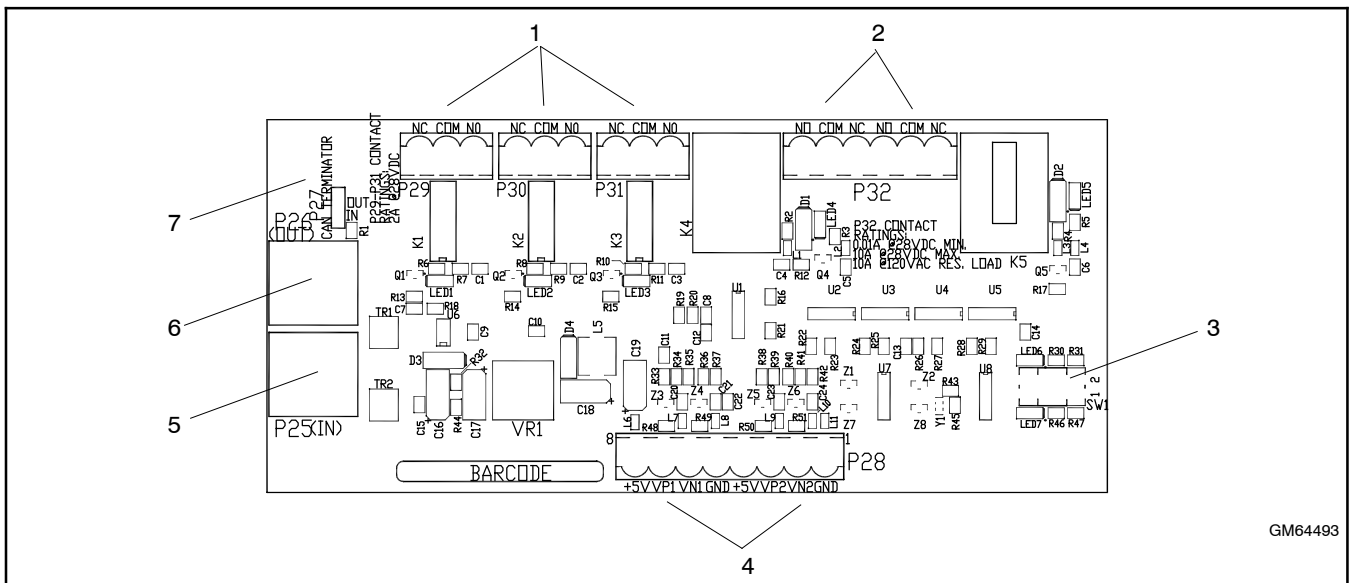


Figure 9-5 Battery Charger to Controller Connections

9.1.3 Input/Output (I/O) Module Board

The I/O module board provides a generator set mounted panel with two analog or digital inputs and five digital outputs. See Figure 9-6 for circuit board components and electrical connections to the controller. See Figure 9-7 for connections of analog inputs. Refer to Figure 9-27 for accessory connections.

See Section 9.2, Accessory Connections, for terminal identification.



1. P29/P30/P31 K1/K2/K3 2-amp relay outputs
2. P32 K4/K5 10-amp relay outputs
3. SW1 switch
4. P28 In1/In2 analog or digital inputs
5. P25 RJ45 In (DEC 3000 P23)
6. P26 RJ45 Out
7. P27 CAN terminator

Figure 9-6 Input/Output (I/O) Module Board Kit

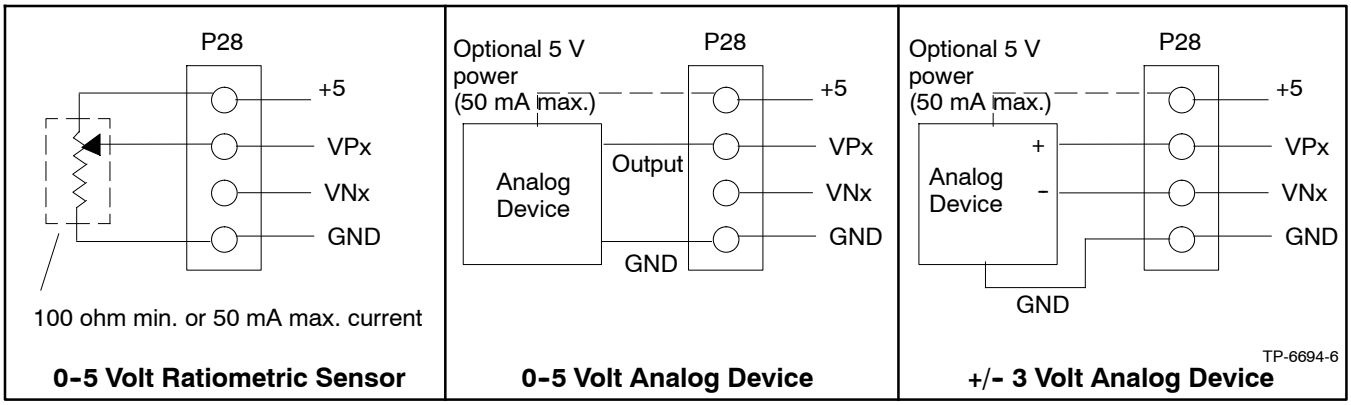


Figure 9-7 Analog Input Connections P28

9.1.4 Low Fuel (Level/Pressure) Switch

Some gas-fueled models offer a low fuel pressure switch. The low fuel pressure switch connects to the same controller terminal as the low fuel *level* switch on diesel-fueled models. See Figure 9-8, Figure 9-9, and Figure 9-10.

Note: The main tank or the transfer/day tank includes the low fuel level switch. The fuel tank supplier typically provides the low fuel level switch.

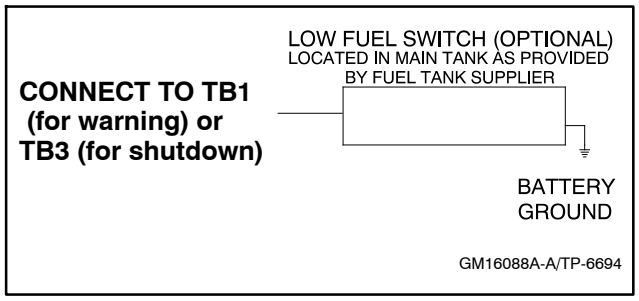


Figure 9-8 Low Fuel Switch (Level or Pressure)

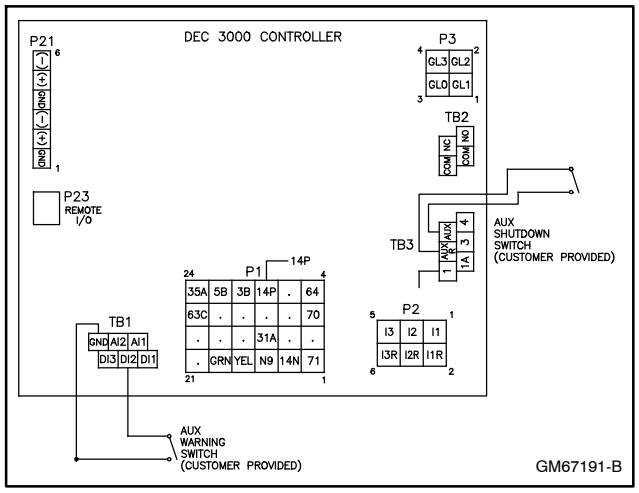


Figure 9-9 Low Fuel Switch Connection to Controller Connection

Switch Rating	12 volts DC minimum, 0.5 amp minimum
Wiring Recommendation	
Gauge	**mm (ft.)**
18–20	30.5 (100)
14	153 (500)
10	305 (1000)

Figure 9-10 Switch Rating & Wiring Recommendation

9.1.5 Prime Power Switch Kit

The prime power switch kit prevents battery drain during generator set non–operation periods and when the generator set battery cannot be maintained by an AC battery charger. See Figure 9-11 for an illustration of the kit and Figure 9-12 for the electrical connections.

Stop the generator set using the stopping procedures in respective operation manual before placing the generator set in the prime power mode. Move the prime power switch located on the junction box to the *DOWN* position. The controller including the digital display, LEDs, and alarm horn does not function when the generator set is in the prime power mode.

Move the prime power switch located on the junction box to the *UP* position. The generator set is now ready for starting.

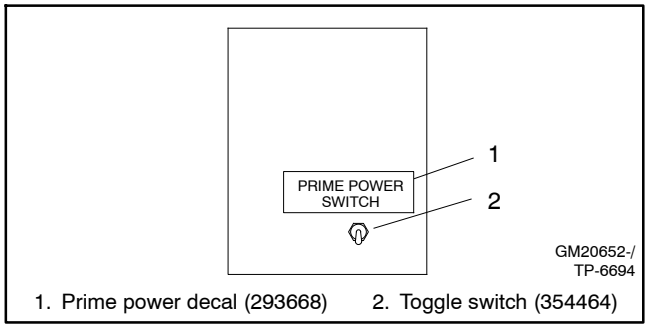


Figure 9-11 Prime Power Switch

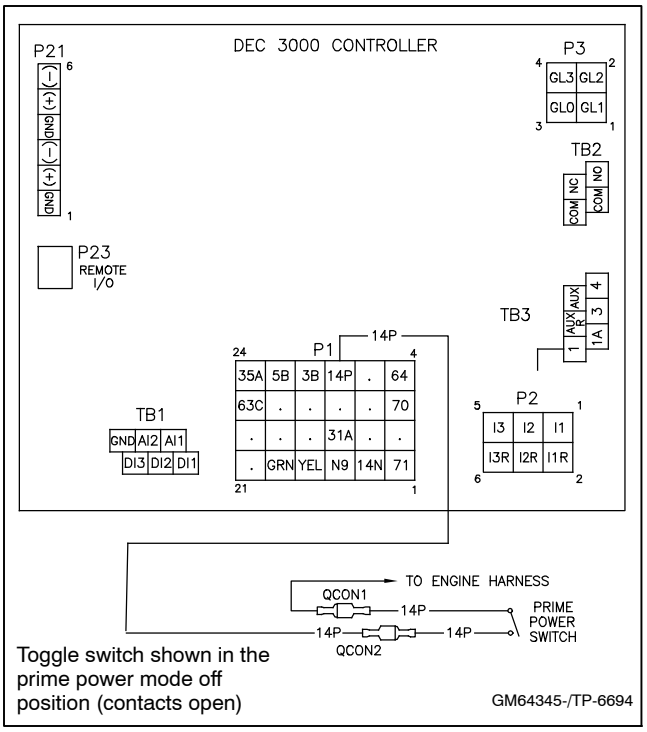


Figure 9-12 Prime Power Switch Connections

9.1.6 Remote Emergency Stop Kit

The emergency stop kit allows immediate shutdown of the generator set from a remote location. See Figure 9-13 and Figure 9-14. If the emergency stop switch activates, the EMERGENCY STOP lamp lights and the unit shuts down. Before attempting to restart the generator set, reset the emergency stop switch (by replacing the glass piece) and reset the generator set by pressing the master control switch OFF/RESET button.

Use the single glass piece located inside the switch for replacement and order additional glass pieces as service parts. See the respective operation manual for Emergency Stop Switch Resetting.

See Section 9.2, Accessory Connections, for terminal identifications.

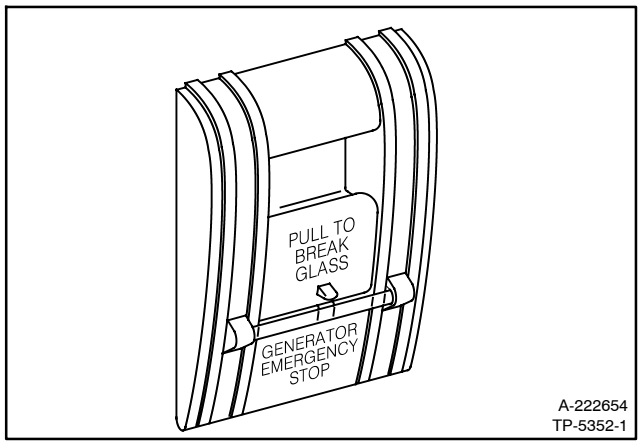


Figure 9-13 Emergency Stop Kit

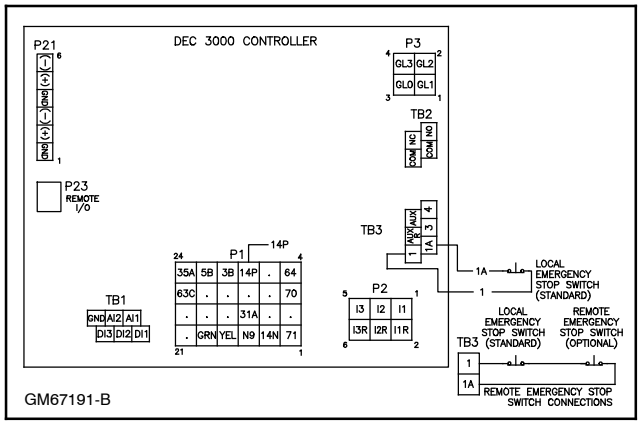


Figure 9-14 Remote Emergency Stop Kit Connections

9.1.7 Remote Reset Feature

The remote reset switch provides generator set controller resetting after a fault shutdown at a remote location. See Figure 9-15 and Figure 9-16 for user-supplied switch connection.

Press and hold the switch for 2–3 seconds and release to reset the generator set controller.

See Section 9.2, Accessory Connections, for terminal identifications.

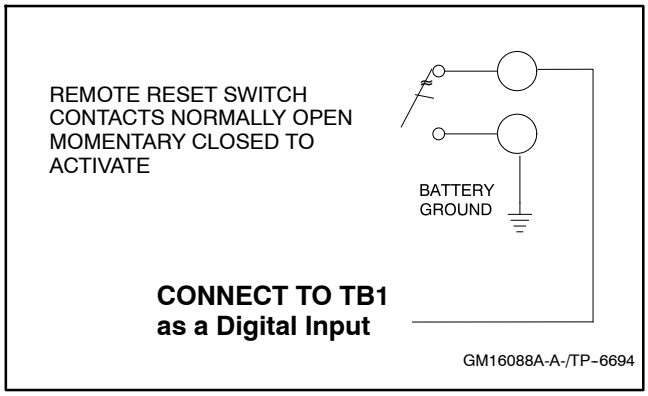


Figure 9-15 Remote Reset Switch Connections

Switch Rating	12 volts DC minimum, 1 amp minimum
Wiring Recommendation	
Gauge	**m (ft.)**
18–20	30.5 (100)
14	153 (500)
10	305 (1000)

Figure 9-16 Switch Rating and Wiring Recommendations

9.1.8 Remote Serial Annunciator (RSA III)

Adapted from Instruction TT-1625 9/14.

The following information summarizes the setup items when installing the remote serial annunciator. Refer to the RSA installation instructions TT-1625 for operation and function.

RSA III Features and Connections

RSA III is an annunciator panel offered in several kit configurations to support Kohler power equipment. The RSA III is a remote serial annunciator that monitors the condition of the generator set and/or ATS from a remote location. The RSA III alerts the operator through visual and audible signals using LED indication and a horn. An alarm silence and lamp test switch are included.

An RSA III annunciator can be used for a single generator set (Figure 9-17) or with a combination of a generator set and automatic transfer switch(es) (Figure 9-18 or Figure 9-19). In systems using more than a single RSA III, one must be designated as the master device to broadcast to additional RSA III annunciators, designated as slave devices. Up to five RSA III slave devices can be used with an RSA III master device. All RSA III annunciators are factory set as the master device, but can be changed to a slave device using a PC and SiteTech™ software that connects to the RSA III front panel via a universal serial bus (USB) connection.

The RSA II can be connected with the RSA III provided that the master remote annunciator is an RSA III.

The RSA III meets NFPA 110, Level 1 (2005) applications that require remote controls and alarms be powered by a storage battery such as the engine starting battery. AC adaptor kit GM62466-KP1 is available when NFPA is not required.

See Section 9.2, Accessory Connections, for terminal identifications.

A PC with SiteTech™ software is required to make the RSA III functional. Use your SecurID to access KOHLERnet, click on the TechTools button, and follow the instructions to download the files. See SiteTech™ Software Settings and refer to TP-6701 SiteTech™ Software Operation Manual for more information.

If a fault occurs, the RSA III horn activates and the corresponding LED illuminates. The following paragraphs describe specific features of the RSA III.

If the RSA III is used with an Ethernet communication network, order Modbus® Ethernet converter GM41143-KP2 and refer to TT-1405 Converters, Connections, and Controller Setup for Network Communication for system installation.

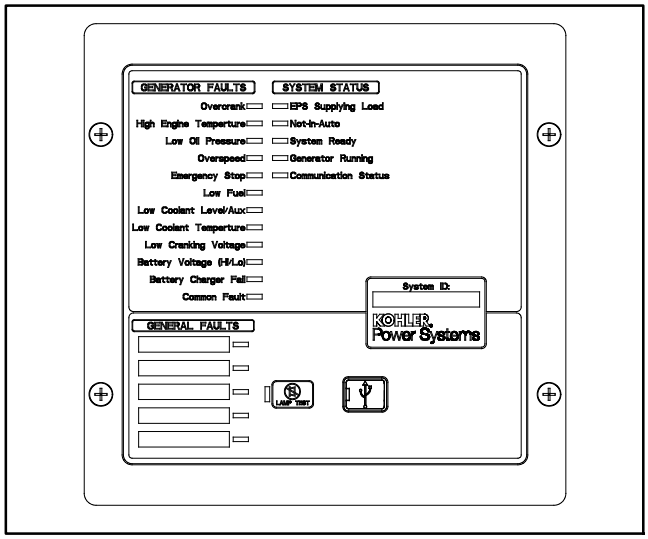


Figure 9-17 Remote Serial Annunciator (RSA III)

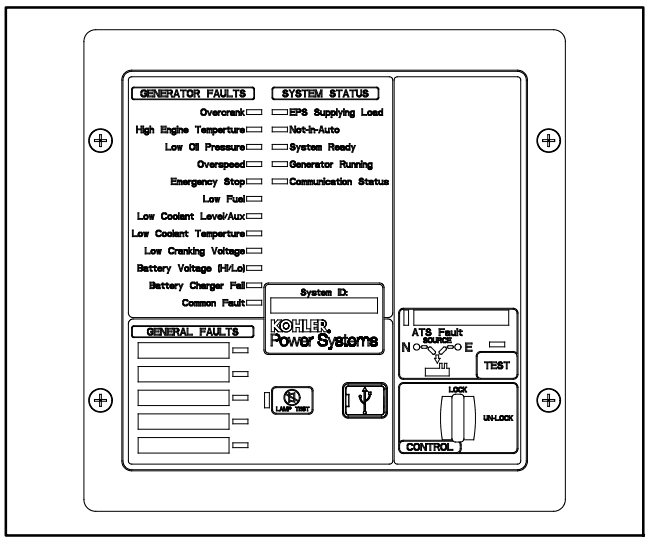


Figure 9-18 RSA III with Single ATS Control

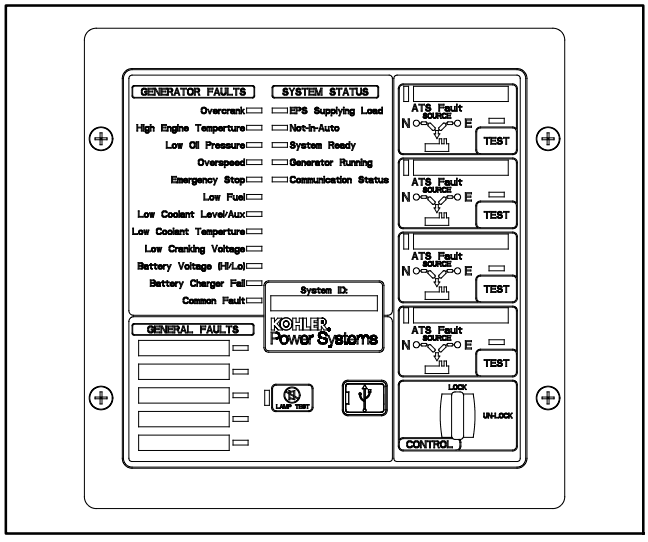


Figure 9-19 RSA III with Four ATS Controls

Modbus® is a registered trademark of Schneider Electric.

If there is only one RSA III, it is the master. If several RSA III are installed, choose either the RSA III closest to the generator set or determine which RSA III is more practical for use as a master and use a daisy chain wiring configuration for the remaining RSAs. The RSA III connected to the controller MUST be assigned as the RSA III master.

Note: When an RSA III is installed into a system with existing older RSAs, the RSA III must be configured as the master.

Note: Should any communication issues occur when adding RSA III slaves and/or transfer switches to the system, be sure to power down the RSA III master and then power up the RSA III master so that the RSA III master can recognize the changes.

Use the SiteTech™ software to select either that the generator set controller activates EPS Supplying Load LED or the transfer switch activates LED or local EPS supplying load.

Use the SiteTech™ software to select the high speed mode for direct connection to the DEC 3000 controller. Select lower speed for network connection with the Modbus®/Ethernet converter. The lower speed allows network functionality reducing loss of communication faults.

Terminating Resistor and Wiring

For communication between the controller and RSA III master, see Figure 9-20. For communication between RSA III Master and RSA III Slave, see Figure 9-21. Place the terminating resistor on the last RSA III slave in the daisy chain connection.

Note: When using RS-485 communication cable, connect the “shield” wire at either end but not at both ends.

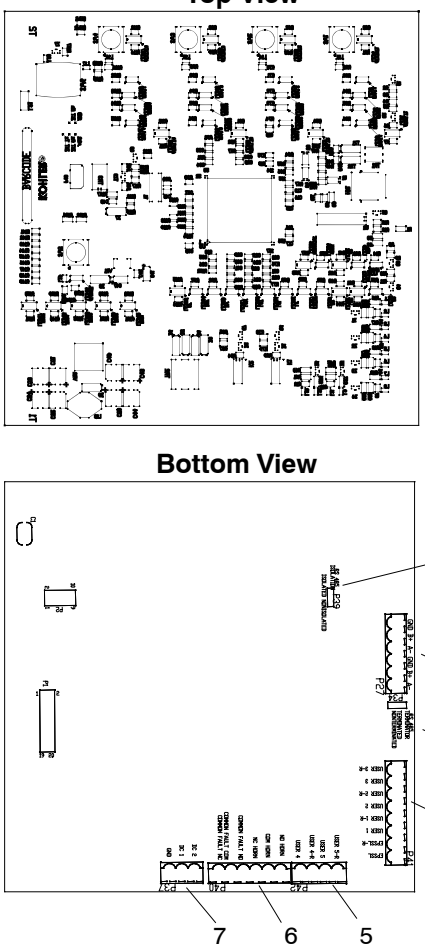
P27 RS-485 Connections (from Controller to Master)	
P27-1	(-) Black (from controller)
P27-2	(+) White (from controller)
P27-3	Shield (from controller)
P27-4	(-) Black (to slave or terminating resistor)
P27-5	(+) White (to slave or terminating resistor)
P27-6	Shield (to slave or open)
Note: When using RS-485 communication cable, connect the “shield” wire at either end but not at both ends.	

Figure 9-20 P27 Connector on Master RSA III

Communication between RSA III Master and RSA III Slave. Select and connect the RS-485 wiring from the RSA III master to the RSA III slave(s) in a daisy chain wiring configuration using Belden #9841 or equivalent. Figure 9-21 shows the master/slave RS-485 connections and Figure 9-22 shows the RSA III with P27 location.

P27 RS-485 Connections (from Master to Slave)	
P27-1	(-) Black (from master or previous slave)
P27-2	(+) White (from master or previous slave)
P27-3	Shield (from master or previous slave)
P27-4	(-) Black (to next slave or terminating resistor)
P27-5	(+) White (to next slave or terminating resistor)
P27-6	Shield (to next slave or open)
Note: When using RS-485 communication cable, connect the “shield” wire at either end but not at both ends.	

Figure 9-21 P27 Connection on RSA III Slave



1. P39, 3-pin Isolated/non-isolated jumper
2. P27, 6-pin RS-485 connections
3. P34, 3-pin RS-485 termination resistor for last device
4. P41, 8-pin Input (EPS/User) connections
5. P42, 4-pin Input user 4 & 5 connections
6. P40, 6-pin Common fault and horn dry contacts
7. P37, 3-pin Power/CAN connections

Figure 9-22 RSA III Circuit Board GM86125 Connectors

9.1.9 Shunt-Trip Line Circuit Breaker

A shunt-trip line circuit breaker provides a 12- or 24-DC volt solenoid within the line circuit breaker case that can energize the trip mechanism. This feature allows the circuit breaker to be tripped by the common fault (32A). Connection requires a shunt-trip wiring kit and a dry contact kit. See Figure 9-23 and Figure 9-24.

The optional common fault relay shown in Figure 9-24 as DCB1 has contacts rated at 10 amps at 28 VDC or 120 VAC and is used to trigger the shunt-trip line circuit breaker kit.

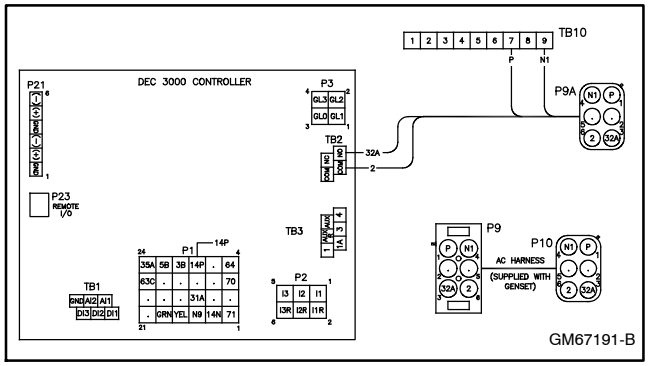


Figure 9-23 Shunt-Trip Wiring (Standard)

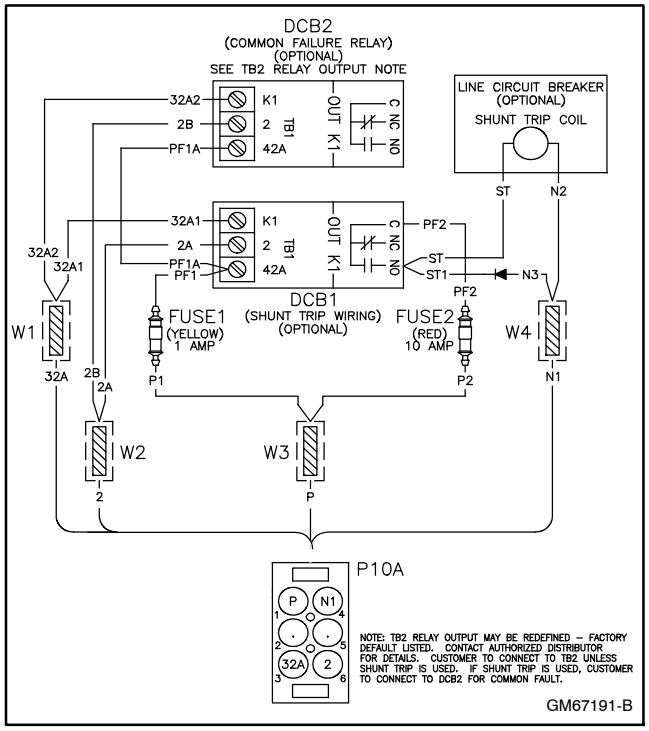
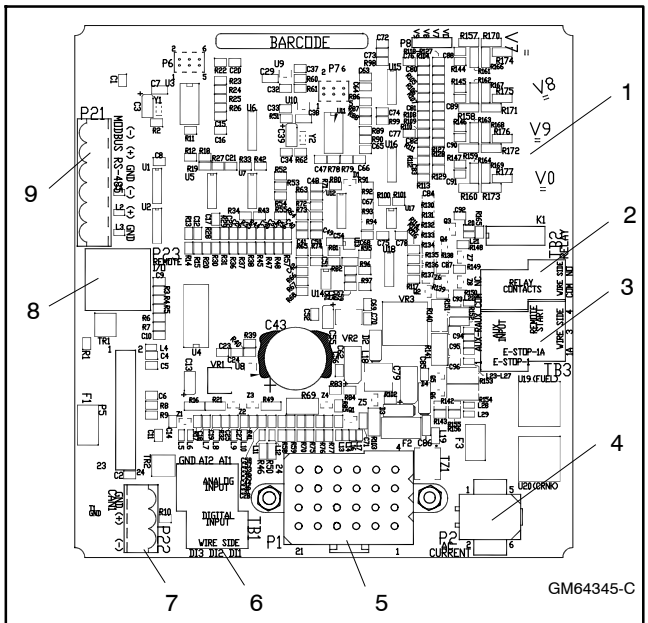


Figure 9-24 Shunt-Trip Relay Kit and Line Circuit Breaker Wiring (Shown with Common Fault/Failure Relay Kit)

9.2 Accessory Connections

The controller contains a circuit board equipped with terminal strip(s) for use in connecting external optional accessories including alarms, battery chargers, and remote switches. The optional I/O board provides an additional two analog or digital inputs and five digital outputs.

For specific information on accessory connections, refer to the accessory wiring diagrams in the wiring diagram manual and the instruction sheet accompanying the kit. See Figure 9-25, Figure 9-26, and NO TAG for controller circuit board connections.



1. (4) push-on terminal connectors
2. TB2 4-position terminal block
3. TB3 6-position terminal block
4. P2 6-pin connector
5. P1 24-pin connector
6. TB1 6-position terminal block
7. P22 3-pin connector
8. P23 8-pin connector (RJ45)
9. P21 6-pin connector

Figure 9-25 Controller Circuit Board Connections

TB1 Terminal Strip		
Analog and Digital Input Connections		
Terminal	**Description**	**Connection**
TB1–DI 1	DCH1	No Function
TB1–DI 2	DCH2	Aux. Warning Switch
TB1–DI 3	DCH3	Battery Charger Fault
TB1–AI 1	ACH1	No Function
TB1–AI 2	ACH2	No Function
TB1–GND	Ground	Common A/D Ground
TB2 Terminal Strip		
KI Relay Outputs		
Terminal	**Description**	**Connection**
TB2–COM	Common	User–Defined
TB2–COM	Common	Common Fault (2)
TB2–NO	Normally Open	Common Fault (32A)
TB2–NC	Normally Closed	User–Defined
TB3 Terminal Strip		
Accessory Power Output Connections		
Terminal	**Description**	**Connection**
TB3–1	E–Stop	E–Stop Ground
TB3–1A	E–Stop	E–Stop
TB3–3	Remote Start	Remote Start
TB3–4	Remote Start	Remote Start
TB3–AUX	Auxiliary	Aux. Shutdown Sw.
TB3–AUXR	Auxiliary–R	Aux. Shutdown Sw.

P1 24-Pin Connector		
Engine Wiring Harness		
Terminal	**Description**	**Connection**
P1–12	14P +12VDC	Prime Power Switch
P21 6-Pin Connector		
RS-485 (RSA II)		
Terminal	**Description**	**Connection**
P21–1	GND	Shield
P21–2	(+)	Red
P21–3	(–)	Black
P21–4	GND	Shield
P21–5	(+)	Red
P21–6	(–)	Black
TB1 Terminal Strip Designations		
Analog and Digital Input Connections		
Terminals on Board	**Controller Designation**	**SiteTech Designation**
TB1–DI 1	DIn A1	A1
TB1–DI 2	DIn A2	A2
TB1–DI 3	DIn A3	A3
TB1–AI 1	AIn A1	—
TB1–AI 2	AIn A2	A1
TB1–GND	—	—

Figure 9-26 Controller Connections

P25 Connector	
RJ45 Remote I/O In	
Connects to DEC 3000 P23	
P26 Connector	
RJ45 Remote I/O Out	
Open	
P27 Connector	
CAN Terminator	
Place the P27 jumper on the IN pins	
P28 Connector	
Single-Ended (0-5 V) Analog Input Connections	
Terminal	**Description**
P28-GND	AGND Analog Return
P28-VN1	NO Connection
P28-VP1	ACH1 Signal
P28-+5V	Supply (.05 amp max.)
P28-GND	AGND Analog Return
P28-VN2	NO Connection
P28-VP2	ACH2 Signal
P28-+5V	Supply (0.05 amp max.)
P28 Connector	
Differential (+/-3 V) Analog Input Connections	
Terminal	**Description**
P28-GND	AGND Analog Reference
P28-VN1	ACH1 Negative Differential Signal
P28-VP1	ACH1 Positive Differential Signal
P28-+5V	Supply (.05 amp max.)
P28-GND	AGND Analog Reference
P28-VN2	ACH2 Negative Differential Signal
P28-VP2	ACH2 Positive Differential Signal
P28-+5V	Supply (0.05 amp max.)
P29 Connector	
2 Amp. K1 Relay Output (2.1) Connections	
Terminal	**Description**
P29-NC	Normally Closed
P29-COM	Common
P29-NO	Normally Open

Figure 9-27 Input/Output Module Board Connections

P30 Connector	
2 Amp. K2 Relay Output (2.2) Connections	
Terminal	**Description**
P30-NC	Normally Closed
P30-COM	Common
P30-NO	Normally Open
P31 Connector	
2 Amp. K3 Relay Output (2.3) Connections	
Terminal	**Description**
P31-NC	Normally Closed
P31-COM	Common
P31-NO	Normally Open
P32 Connector	
10 Amp. K4 Relay Output (2.4) Connections	
Terminal	**Description**
P32-NC	Normally Closed
P32-COM	Common
P32-NO	Normally Open
10 Amp. K5 Relay Output (2.5) Connections	
Terminal	**Description**
P32-NC	Normally Closed
P32-COM	Common
P32-NO	Normally Open

P28 Connector Designations		
Terminals on Board	**Controller Designation**	**SiteTech Designation**
P28-GND	DIn B1	B1
P28-VN1		
P28-VP1		
P28-+5V		
P28-GND	Din B2	B2
P28-VN2		
P28-VP2		
P28-+5V		

Notes

10.1 Accessories and Connections

Several accessories help finalize installation, add convenience to operation and service, and establish state and local code compliance.

Accessories vary with each generator set model and controller. Select factory-installed and/or shipped-loose accessories. See Figure 7-8 for a list of available kits. Obtain the most current accessory information from your local authorized service distributor/dealer.

This section illustrates several accessories available at print time of this publication. Accessory kits generally include installation instructions. See wiring diagrams manual for electrical connections not shown in this section. See the installation instructions and drawings supplied with kit for information on kit mounting location.

The instructions provided with the accessory kit supersede these instructions where there are differences. In general, run AC and DC wiring in separate conduit. Use shielded cable for all analog inputs. Observe all applicable national, state, and local electrical codes during accessory installation.

See Section 8.2, Accessory Connections, for terminal identification.

Kit Description
Fifteen-Relay Dry Contact
Remote Emergency Stop
Remote Serial Annunciator (RSA III)

Figure 10-1 Optional Accessories

10.1.1 Fifteen-Relay Dry Contact

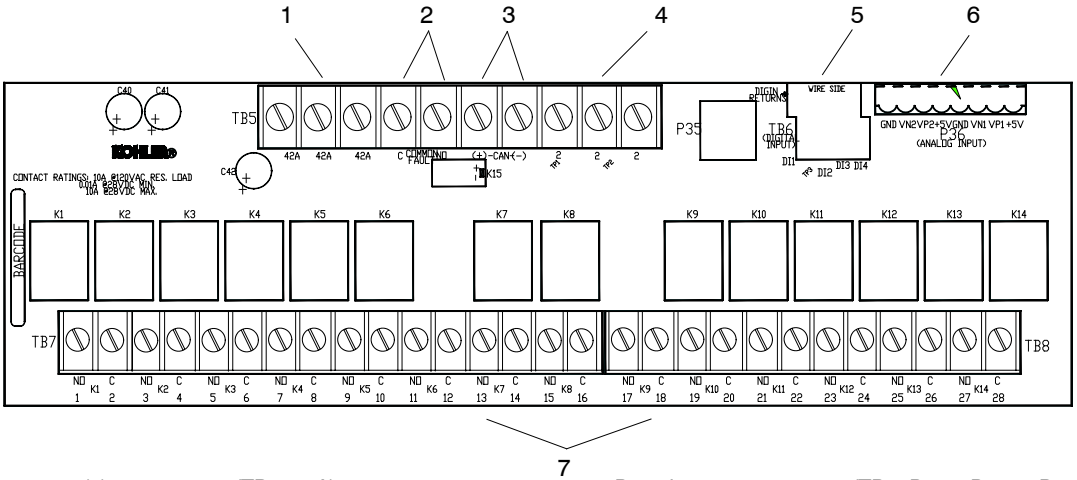
The 15-relay dry contact board has four digital inputs and two analog inputs. There are 14 individual relay driver outputs (RDOs) with one common fault RDO.

See Figure 9-6 for circuit board components and electrical connections to the controller. See Figure 9-7 for connections of analog inputs.

See Section 8.2, Accessory Connections, for terminal identification.

The normally open (NO) relay contacts are rated:

- 10 amp @ 120 VAC
- 10 amp @ 28 VDC (max.)
- 0.01 amp @ 28 VDC (min.)



1. Battery positive (+) connections (TB5-42A)
2. Common fault RDO K15 connections (TB5-C/NO)
3. CAN connections (TB5-CAN (+)/-CAN (-)
4. Battery negative (-) connections (TB5-2)
5. Digital input connections (TB6-D11, -D12, -D13, -D14)
6. Analog input connections (P36-V1/-V2)
7. RDOs K1-K14 (TB7-1 to TB7-28) (NO/C)

Figure 10-2 15-Relay Dry Contact Board

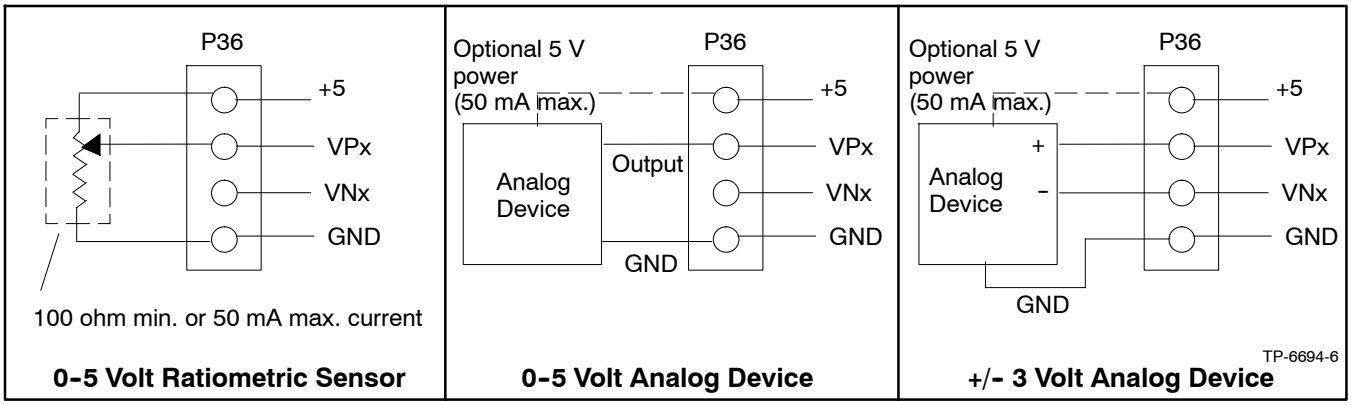


Figure 10-3 Analog Input Connections P36

10.1.2 Remote Emergency Stop Kit

The emergency stop (E-stop) kit allows immediate shutdown of the generator set from a remote location. See Figure 8-15. If the emergency stop switch activates, the EMERGENCY STOP lamp lights and the unit shuts down. Before attempting to restart the generator set, reset the emergency stop switch (by replacing the glass piece) and reset the generator set by pressing the master control switch OFF/RESET button.

Use the single glass piece located inside the switch for replacement and order additional glass pieces as service parts. See the respective operation manual for the Emergency Stop Switch Reset Procedure.

See Section 10.2, Accessory Connections, for terminal identifications.

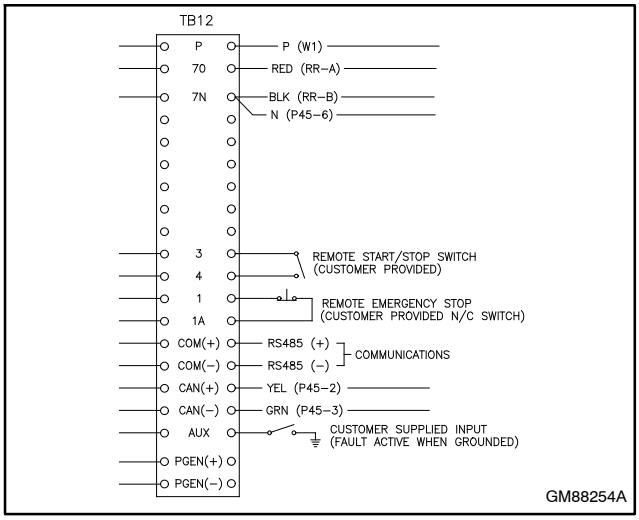


Figure 10-4 Remote E-Stop Kit Connections

10.1.3 Remote Serial Annunciator (RSA III)

Adapted from Instruction TT-1625 9/14b.

The following information summarizes the setup items when installing the remote serial annunciator. Refer to the RSA installation instructions TT-1625 for operation and function.

RSA III Features and Connections

RSA III is an annunciator panel offered in several kit configurations to support Kohler power equipment. The RSA III is a remote serial annunciator (Figure 10-5, Figure 10-6, and Figure 10-7) that monitors the condition of the generator set and/or ATS from a remote location. The RSA III alerts the operator through visual and audible signals using LED indication and a horn. An alarm silence and lamp test switch are included.

An RSA III annunciator can be used for a single generator set or with a combination of a generator set and automatic transfer switch. In systems using more than a single RSA III, one must be designated as the master device to broadcast to additional RSA III annunciators, designated as slave devices. Up to five RSA III slave devices can be used with an RSA III master device. All RSA III annunciators are factory set as the master device, but can be changed to a slave device using a PC and SiteTech™ software that connects to the RSA III front panel via a universal serial bus (USB) connection.

The RSA II can be connected with the RSA III provided that the master remote annunciator is an RSA III.

The RSA III meets NFPA 110, Level 1 (2005) applications that require remote controls and alarms be powered by a storage battery such as the engine starting battery. AC adaptor kit GM62466-KP1 is available when NFPA is not required.

See Section 10.2, Accessory Connections, for terminal identifications.

A PC with SiteTech™ software is required to make the RSA III functional. Use your SecurID to access KOHLERnet, click on the TechTools button, and follow the instructions to download the files. See SiteTech™ Software Settings and refer to TP-6701 SiteTech™ Software Operation Manual for more information.

If a fault occurs, the RSA III horn activates and the corresponding LED illuminates. The following paragraphs describe specific features of the RSA III.

If the RSA III is used with an Ethernet communication network, order Modbus® Ethernet converter GM41143-KP2 and refer to TT-1405 Converters, Connections, and Controller Setup for Network Communication for system installation.

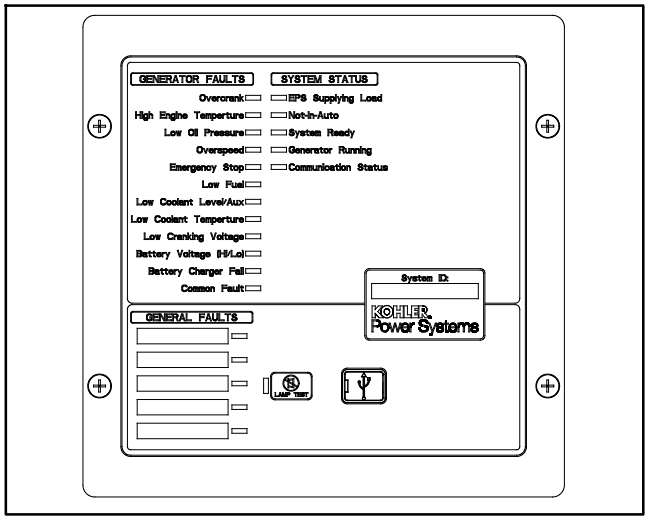


Figure 10-5 Remote Serial Annunciator (RSA III)

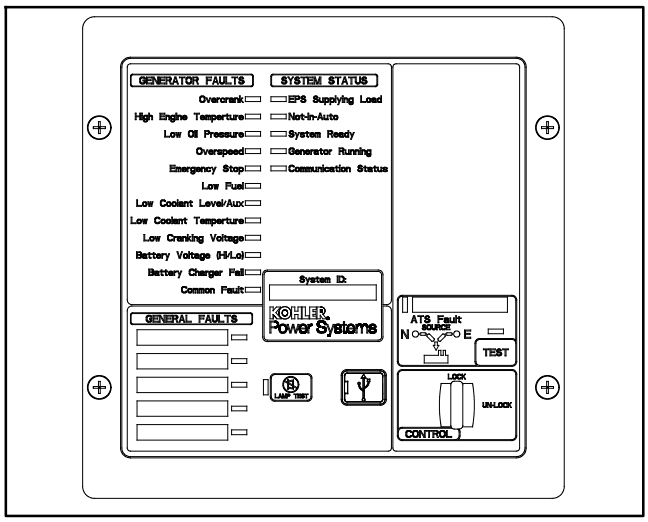


Figure 10-6 RSA III with Single ATS Control

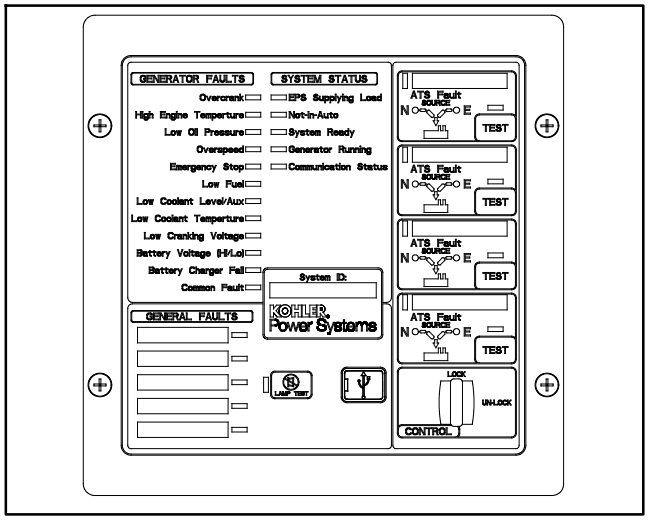


Figure 10-7 RSA III with Four ATS Controls

Modbus® is a registered trademark of Schneider Electric.

If there is only one RSA III, it is the master. If several RSA III are installed, choose either the RSA III closest to the generator set or determine which RSA III is more practical for use as a master and use a daisy chain wiring configuration for the remaining RSAs. The RSA III connected to the controller MUST be assigned as the RSA III master.

Note: When an RSA III is installed into a system with existing older RSAs, the RSA III must be configured as the master.

Note: Should any communication issues occur when adding RSA III slaves and/or transfer switches to the system, be sure to power down the RSA III master and then power up the RSA III master so that the RSA III master can recognize the changes.

Use the SiteTech™ software to select either that the generator set controller activates EPS Supplying Load LED or the transfer switch activates LED or local EPS supplying load.

Use the SiteTech™ software to select the high speed mode for direct connection to the DEC 6000 controller. Select lower speed for network connection with the Modbus®/ Ethernet converter. The lower speed allows network functionality reducing loss of communication faults.

Terminating Resistor and Wiring

For communication between the controller and RSA III master, see Figure 10-8. For communication between RSA III Master and RSA III Slave, see Figure 10-9. Place the terminating resistor on the last RSA III slave in the daisy chain connection.

Note: When using RS-485 communication cable, connect the “shield” wire at either end but not at both ends.

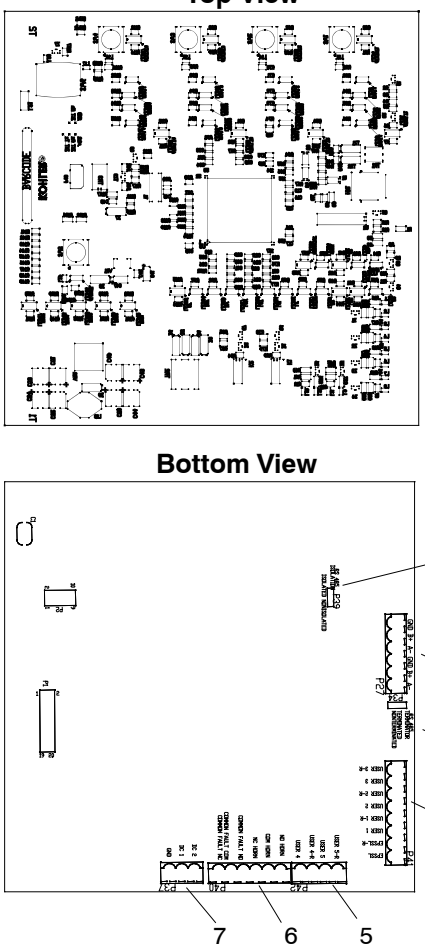
P27 RS-485 Connections (from Controller to Master)	
P27-1	(-) Black (from controller)
P27-2	(+) White (from controller)
P27-3	Shield (from controller)
P27-4	(-) Black (to slave or terminating resistor)
P27-5	(+) White (to slave or terminating resistor)
P27-6	Shield (to slave or open)
Note: When using RS-485 communication cable, connect the “shield” wire at either end but not at both ends.	

Figure 10-8 P27 Connector on Master RSA III

Communication between RSA III Master and RSA III Slave. Select and connect the RS-485 wiring from the RSA III master to the RSA III slave(s) in a daisy chain wiring configuration using Belden #9841 or equivalent. Figure 10-9 shows the master/slave RS-485 connections and Figure 10-10 shows the RSA III with P27 location.

P27 RS-485 Connections (from Master to Slave)	
P27-1	(-) Black (from master or previous slave)
P27-2	(+) White (from master or previous slave)
P27-3	Shield (from master or previous slave)
P27-4	(-) Black (to next slave or terminating resistor)
P27-5	(+) White (to next slave or terminating resistor)
P27-6	Shield (to next slave or open)
Note: When using RS-485 communication cable, connect the “shield” wire at either end but not at both ends.	

Figure 10-9 P27 Connection on RSA III Slave



1. P39, 3-pin Isolated/non-isolated jumper
2. P27, 6-pin RS-485 connections
3. P34, 3-pin RS-485 termination resistor for last device
4. P41, 8-pin Input (EPS/User) connections
5. P42, 4-pin Input user 4 & 5 connections
6. P40, 6-pin Common fault and horn dry contacts
7. P37, 3-pin Power/CAN connections

Figure 10-10 RSA III Circuit Board GM86125 Connectors

10.2 Accessory Connections

The controller contains a circuit board equipped with connectors for use in connecting external optional accessories including alarms, battery chargers, and remote switches. The optional fifteen relay dry contact board provides an additional four digital inputs and two analog inputs.

For specific information on accessory connections, refer to the accessory wiring diagrams in the wiring diagram manual and the instruction sheet accompanying the kit.

Circuit Board Connections (see Figure 10-11)

DEC 3500 Controller Front Panel (see Figure 10-12)

Panel Power Connections (see Figure 10-13)

P1 (35-Pin) Connector for engine/generator wiring harness.

P2 (14-Pin) Connector for sensor input connections and relay driver output connections.

P3 (8-Pin) Connector for generator set output voltage connection and paralleling bus voltage sensing connections.

P4 (Ethernet) RG 45 Connector connects to a network communication line**.**

P7 (10-Pin) Connector for factory use only.

Mini USB Connector for connection of a PC with SiteTech™ software programming or for firmware updates.

TB10 Terminal Strip for CAN, remote emergency stop, and remote start connections.

See Figure 10-14 for controller circuit board connections. See Appendix G, Wiring Diagrams for accessory connection wiring diagrams.

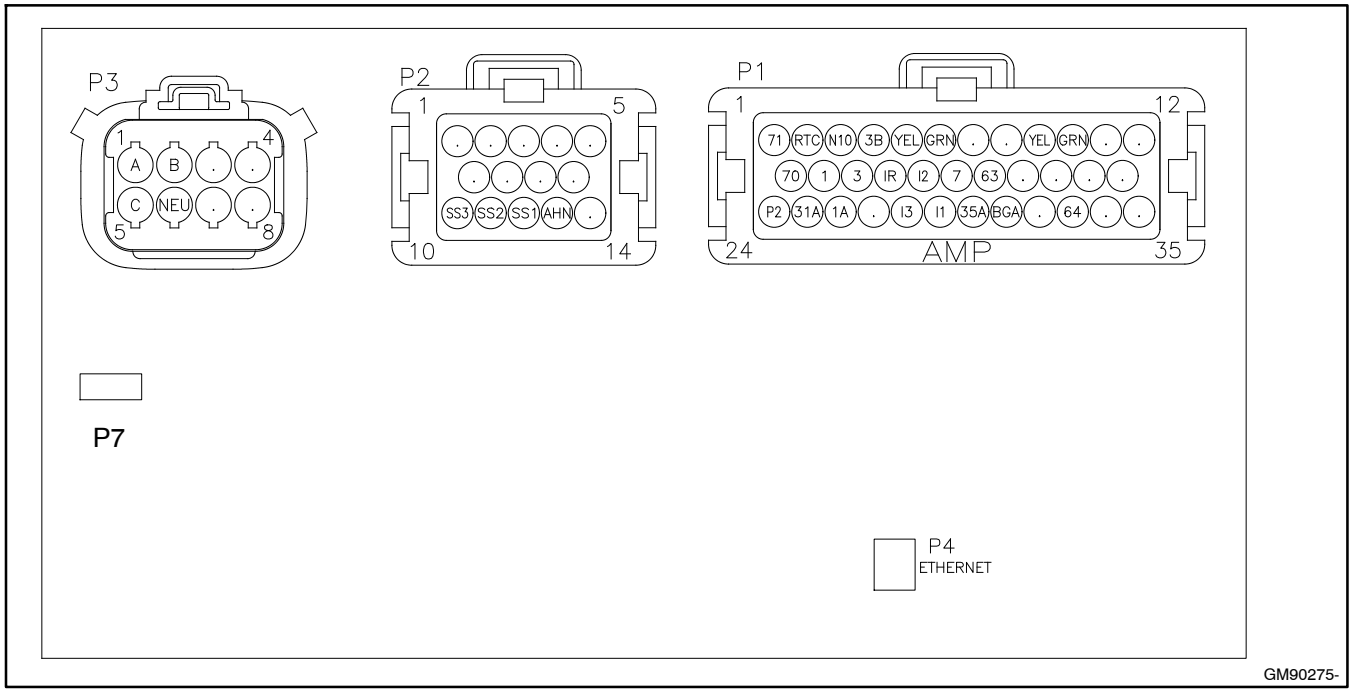


Figure 10-11
Main Circuit Board Connectors (Back of DEC 3500 Controller)

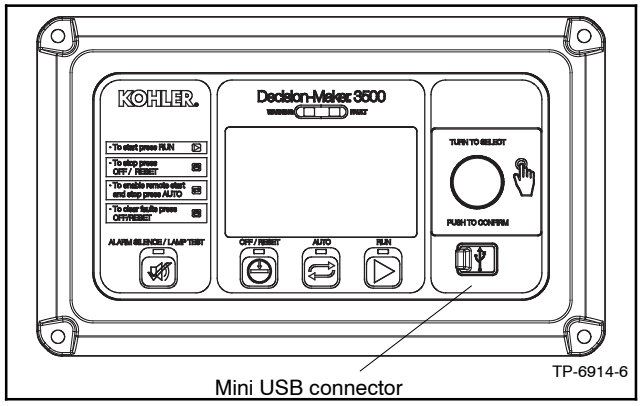


Figure 10-12 DEC 3500 Controller Front Panel

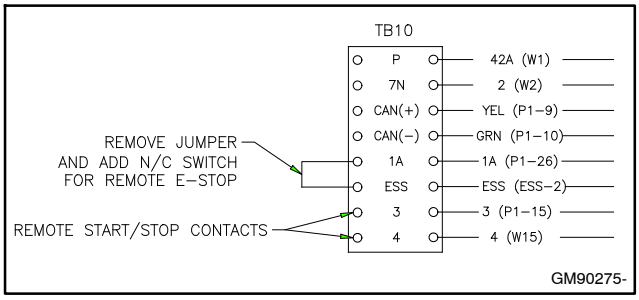


Figure 10-13 TB10 Terminal Strip (located inside the Power Panel)

P1 35-Pin Connector		
Engine/Generator Wiring Harness		
Terminal	**Description**	**Connection**
P1-1	71	P31-3 (71)
P1-2	RTC	P48-23 (RTC)
P1-3	N10	P48-31 (14N1)
P1-4	3B	P7-8 (3B)
P1-5	YEL	P48-34 (YEL)
P1-6	GRN	P48-33 (GRN)
P1-7	Open	–
P1-8	Open	–
P1-9	YEL	TB10-CAN(+)
P1-10	GRN	TB10-CAN(–)
P1-11	Open	–
P1-12	Open	–
P1-13	70	P30-3 (70)
P1-14	1	ESS-1 (local E–stop)
P1-15	3	TB10-3
P1-16	IR	P7-4 (IR)
P1-17	12	P7-2 (I2)
P1-18	7	P48-22 (7)
P1-19	63	P48-21 (63)
P1-20	Open	–
P1-21	Open	–
P1-22	Open	–
P1-23	Open	–
P1-24	P2	P4B-9 (P1)
P1-25	31A	P48-15 (31A)
P1-26	1A	TB10-1A
P1-27	Open	–
P1-28	13	P7-3 (I3)
P1-29	11	P7-1 (I1)
P1-30	35A	P48-14 (35A)
P1-31	BGA	P48-31 (14N1)
P1-32	Open	–
P1-33	64	P7-11 (64)
P1-34	Open	–
P1-35	Open	–

P4 Connector	
RJ45 Ethernet	
Open	Network communications

P2 14-Pin Connector		
Analog/Digital Input and Relay Driver Output Connections		
Terminal	**Description**	**Connection**
P2-1	Open	–
P2-2	Open	–
P2-3	Open	–
P2-4	Open	–
P2-5	Open	–
P2-6	Open	–
P2-7	Open	–
P2-8	Open	–
P2-9	Open	–
P2-10	SS3	P7-7
P2-11	SS2	P7-6
P2-12	SS1	P7-5
P2-13	AHN	P4B-1
P2-14	Open	–
P3 8-Pin Connector		
Output Voltage and Paralleling Bus Voltage Sensing Connections		
Terminal	**Description**	**Connection**
P3-1	A	IS15
P3-2	B	IS16
P3-3	Open	–
P3-4	Open	–
P3-5	C	IS17
P3-6	NEU	IS18
P3-7	Open	–
P3-8	Open	–
TB10 8-Position Terminal Strip		
CAN, Remote E-Stop, and Remote Start Connections		
Terminal	**Description**	**Connection**
TB10-1	P	42A Battery (+)
TB10-2	7N	2 Battery (–)
TB10-3	CAN(+)	P1-9
TB10-4	CAN(–)	P1-10
TB10-5	1A	Remote E-stop
TB10-6	ESS	Remote E-stop
TB10-7	3	Remote start (ATS)
TB10-8	4	Remote start (ATS)

Figure 10-14 Controller Connections

11.1 Accessories and Connections

Several accessories help finalize installation, add convenience to operation and service, and establish state and local code compliance.

Accessories vary with each generator set model and controller. Select factory-installed and/or shipped-loose accessories. See Figure 11-1 for a list of available kits. Obtain the most current accessory information from your local authorized service distributor/dealer.

This section illustrates several accessories available at print time of this publication. Accessory kits generally include installation instructions. See wiring diagrams manual for electrical connections not shown in this section. See the installation instructions and drawings supplied with kit for information on kit mounting location.

The instructions provided with the accessory kit supersede these instructions where there are differences. In general, run AC and DC wiring in separate conduit. Use shielded cable for all analog inputs. Observe all applicable national, state, and local electrical codes during accessory installation.

11.1.1 Audiovisual Alarm Kit

An audiovisual alarm warns the operator at a remote location of fault shutdowns and prealarm conditions. Audiovisual alarms include an alarm horn, an alarm silence switch, and common fault lamp. See Figure 11-2 and Figure 11-3. See Section 11.2, Accessory Connections, for terminal identification.

Note: Use the audiovisual alarm with a dry contact kit.

Kit Description
Audiovisual Alarm
Common Failure Relay (Terminal 32A)
Float/Equalize Battery Charger (with alarms)
Ground Fault Annunciation
Idle (Speed) Mode Feature
Low Fuel (Level) Switch
Low Fuel (Pressure) Switch
Prime Power Switch
Remote Emergency Stop
Remote Reset Feature
Remote Serial Annunciator (RSA III)
Shunt-Trip Line Circuit Breaker and Shunt-Trip Wiring
Single-Relay Dry Contact
Ten-Relay Dry Contact
Twenty-Relay Dry Contact

Figure 11-1 Available Accessories

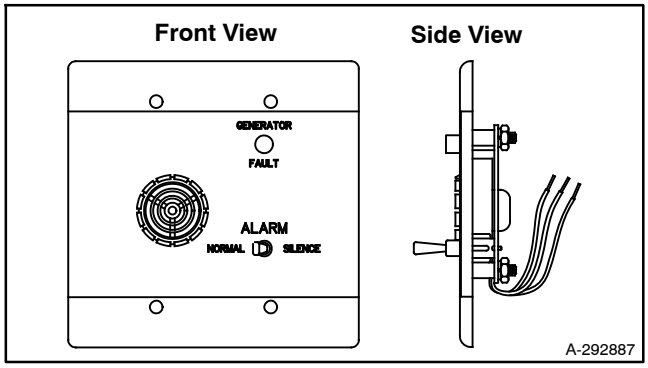


Figure 11-2 Audiovisual Alarm

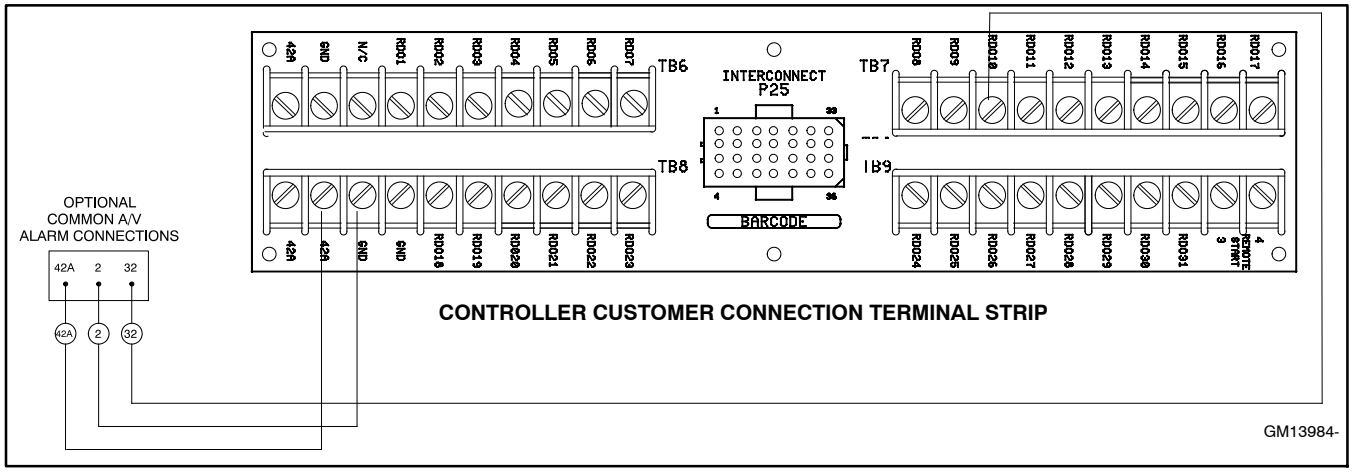


Figure 11-3 Audiovisual Alarm Connections

11.1.2 Common Failure Relay Kit

The common failure relay kit provides one set of contacts to trigger user-provided warning devices if a fault occurs. The common failure relay faults are user-defined. See Section 2, Operation, Menu 10—Output Setup, for status and faults available for this function.

Connect up to three common failure relay kits to the controller output. See Figure 11-4 and Figure 11-5. See Section 11.2, Accessory Connections, for terminal identification.

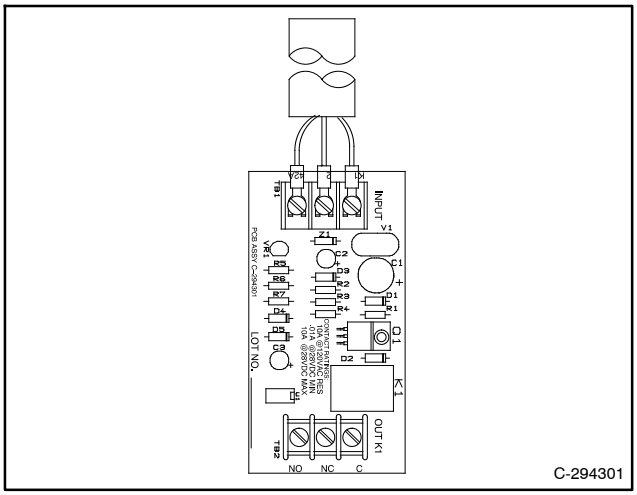


Figure 11-4 Common Failure Relay Kit

11.1.3 Float/Equalize Battery Charger Kit with Alarm Option

The float/equalize battery charger with alarm option provides battery charging to the engine starting battery(ies) and connects to the controller for fault detection. Battery chargers for 12- or 24-volt models are available as a generator set accessory. See Figure 11-6. See Section 11.2, Accessory Connections, for terminal identification.

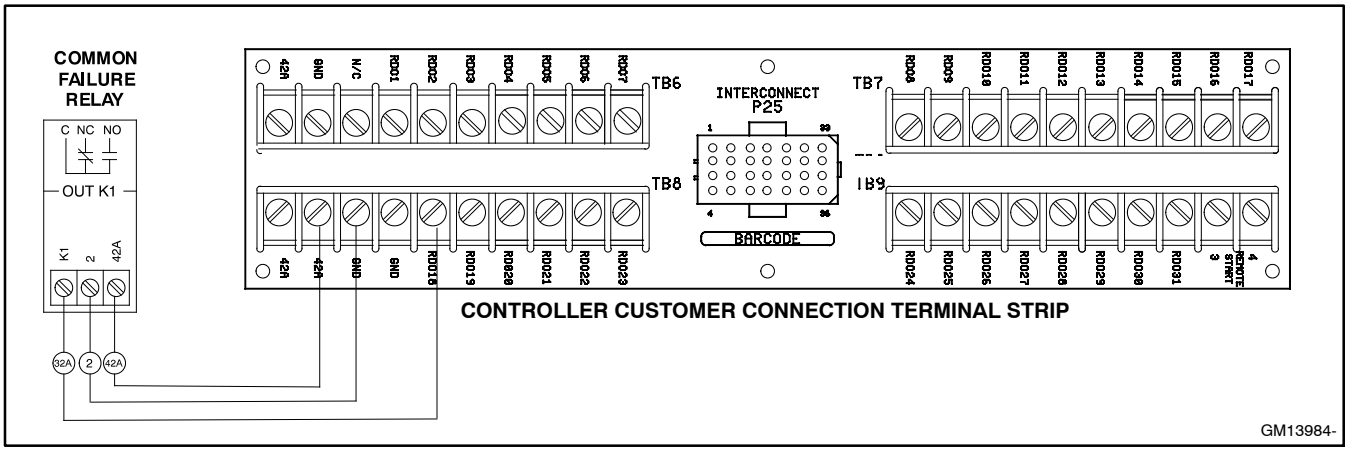


Figure 11-5 Common Failure Relay Kit Connections

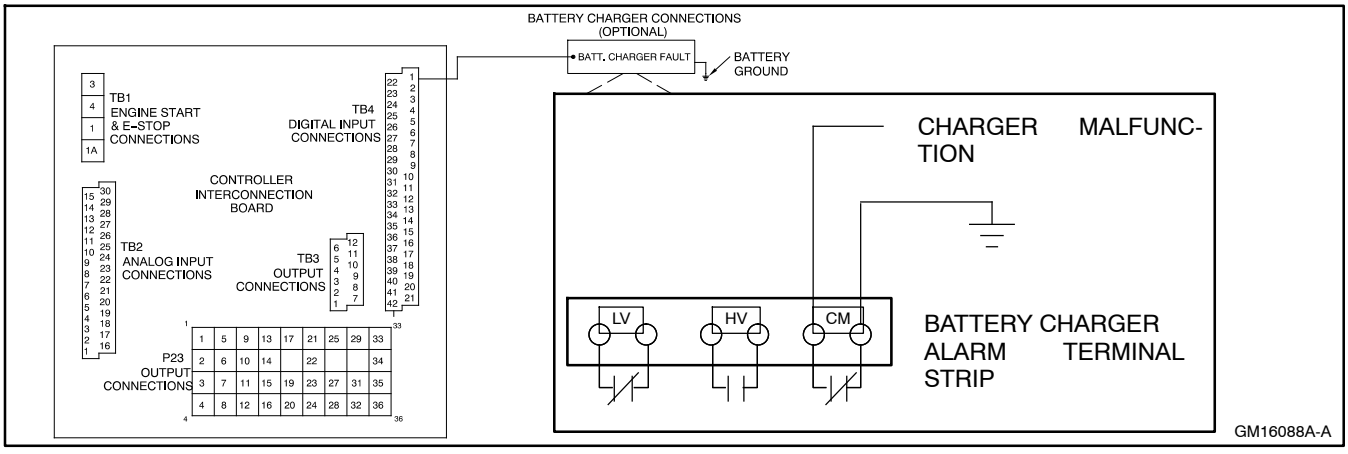


Figure 11-6 Float/Equalize Battery Charger Connections

11.1.4 Ground Fault Annunciation

A relay contact for customer connection indicates a ground fault condition and is part of a ground fault alarm. See Figure 11-7 for electrical connections and the following procedure for controller setup. Use the instructions with the kit when provided to install and setup this accessory.

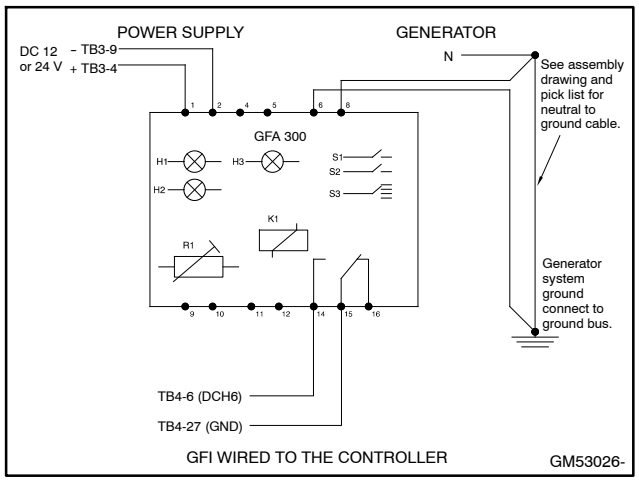
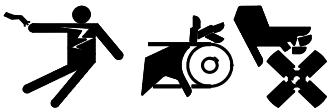


Figure 11-7 Ground Fault Connections

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

Ground Fault Controller Setup Procedure

1. Reconnect battery, if not already done.
2. Press the controller master switch AUTO button.
3. Press the Alarm Off key to silence the alarm horn, if necessary.
4. If the programming mode LED is not flashing, go to the step 5. If the programming mode LED is flashing, go to step 6.
5. Set Programming Mode to Local.
   a. Press keys RESET MENU, 1, 4, ENTER, MENU.
   b. Press key MENU until *Programming Mode-Local* is displayed.
   c. Press the YES key 7 YES, ENTER.
   d. When the *Enter Code* displays, press the factory default 0 LAMP TEST, ENTER or the user password keys and ENTER. The programming mode LED should be flashing.
6. Set digital input #6 to ground fault.
   a. Press RESET MENU, 9, ENTER. *Menu 9 Input Setup* should be displayed.
   b. Press MENU until *Digital Input 06 Warning* is displayed.
   c. Press MENU once to select this input.
   d. Press MENU until *Ground Fault* is displayed.
   e. Press 7 YES, ENTER to define Digital Input #06 as ground fault. *Entry Accepted* is displayed.
   f. Press MENU to display *Digital Input #06 Inhibit Time*.
   g. Press 0 LAMP TEST, ENTER to enter the inhibit time. *Entry Accepted* is displayed and the inhibit time *0:00* is now displayed.

h. Press MENU to display *Digital Input #06 Delay TIme*.

i. Press 5 ENTER to enter delay time. *Entry Accepted* is displayed. Default delay time is 5 sec.

j. Press RESET MENU.

7. Verify Programming.

   a. Move handle of ground fault circuit breaker at generator set to simulate a ground fault.

   b. Verify that display shows *D06 Ground Fault*. The System Warning LED should be illuminated and the alarm horn should sound. If these indicators are not present, recheck steps 6a. through 6j.

   c. Return handle of ground fault circuit breaker to the non-ground fault position. *D06 Ground Fault* display should now be cleared.

8. Set Programming Mode to Off.

   a. Press RESET MENU 1 4 ENTER.

   b. Press key MENU until *Programming Mode Off* is displayed.

   c. Press the YES key 7 YES ENTER.

   d. When the *Enter Code* displays, press the factory default 0 LAMP TEST ENTER or the user password keys and ENTER. The programming mode LED should now be off.

9. Press the controller master switch OFF button.

10. Disconnect the battery negative (–) lead to power down the generator set.

11. After 2-3 minutes, reconnect the battery negative (–) lead.

12. Reset the controller clock. See Menu 6—Time and Date.

11.1.5 Idle (Speed) Mode Feature

The idle (speed) mode feature provides the ability to start and run the engine at idle (reduced) speed for a selectable time period (0–10 minutes) during warm-up. The controller will override the idle speed mode if the engine reaches the preprogrammed engine warmed-up temperature before the idle mode times out. See Figure 11-8 for user-supplied switch connection.

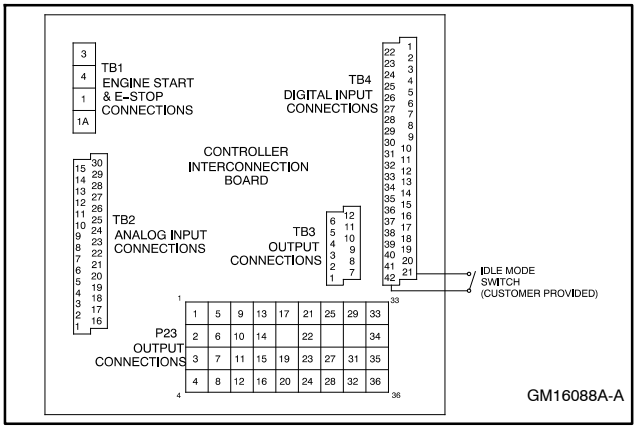


Figure 11-8 Idle (Speed) Mode Switch

11.1.6 Low Fuel (Level/Pressure) Switch

Some gaseous-fueled models offer a low fuel pressure switch. The low fuel pressure switch connects to the same terminal as the low fuel *level* switch on diesel- or gasoline-fueled models. See Figure 11-9 and Figure 11-10. See Section 11.2, Accessory Connections, for terminal identification.

Note: The main tank or the transfer/day tank includes the low fuel level switch. The fuel tank supplier typically provides the low fuel level switch.

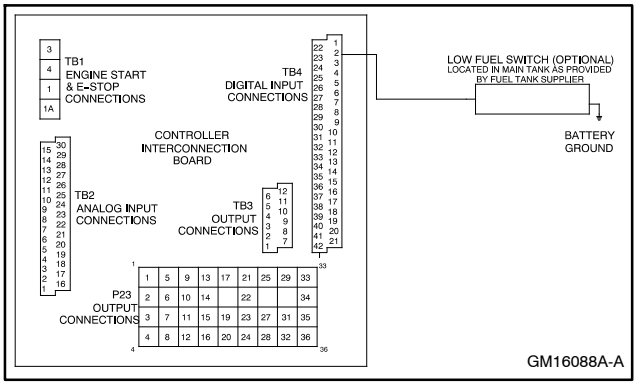


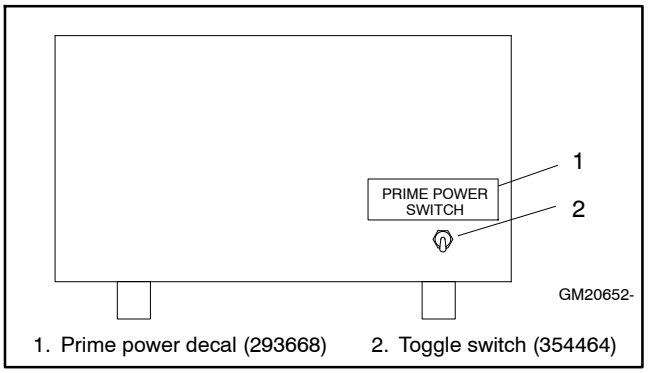
Figure 11-9 Low Fuel Switch (Level or Pressure)

Switch Rating	12 volts DC minimum, 0.5 amp minimum
Wiring Recommendation	
Gauge	**mm (ft.)**
18–20	30.5 (100)
14	153 (500)
10	305 (1000)

Figure 11-10 Switch Rating & Wiring Recommendation

11.1.7 Prime Power Switch Kit

The prime power switch kit prevents battery drain during generator set nonoperation periods and when the generator set battery cannot be maintained by an AC battery charger. See Figure 11-11 for an illustration of the kit and Figure 11-12 for the electrical connections.



1. Prime power decal (293668) 2. Toggle switch (354464)

Figure 11-11 Prime Power Switch Installation Location

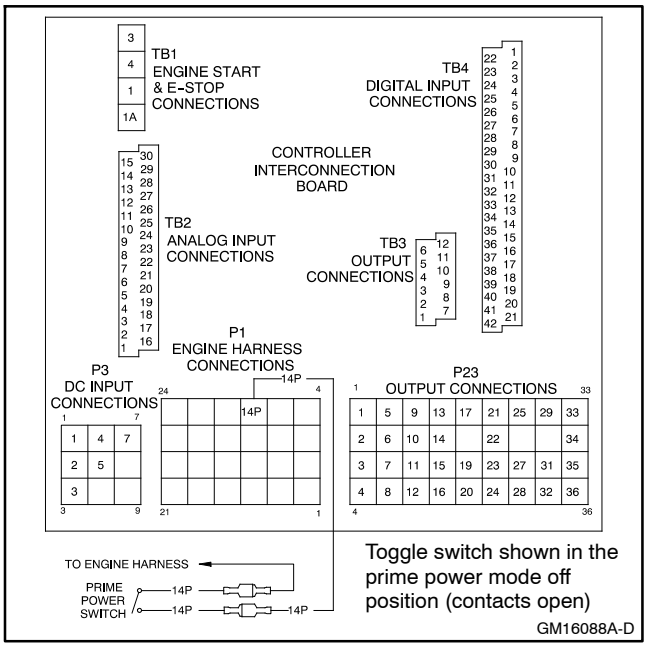


Figure 11-12 Prime Power Switch Connections

Stop the generator set using the stopping procedures in the respective operation manual before placing the generator set in the prime power mode. Move the prime power switch located on the back of the controller to the *DOWN* position. The controller including the digital display, LEDs, and alarm horn does not function when the generator set is in the prime power mode.

Move the prime power switch located on the back of the controller to the *UP* position and reset the controller time and date before attempting to start the generator set.

11.1.8 Remote Emergency Stop Kit

The emergency stop kit allows immediate shutdown of the generator set from a remote location. See Figure 11-13 and Figure 11-14. If the emergency stop switch activates, the EMERGENCY STOP lamp lights and the unit shuts down. Before attempting to restart the generator set, reset the emergency stop switch (by replacing the glass piece) and reset the generator set by placing the master switch in the OFF/RESET position.

Use the single glass piece located inside the switch for replacement and order additional glass pieces as service parts. See the respective operation manual for the Emergency Stop Switch Reset Procedure. See Section 11.2, Accessory Connections, for terminal identifications.

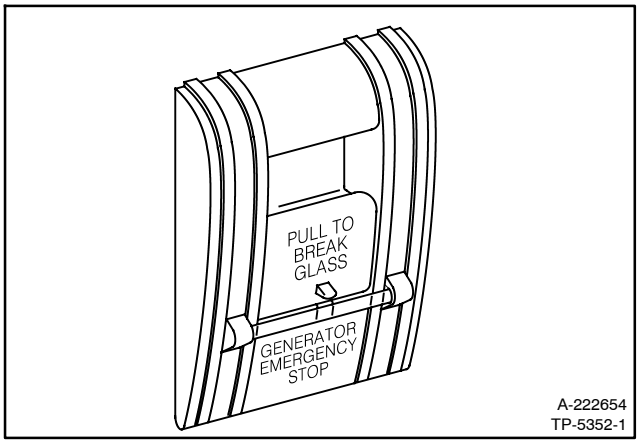


Figure 11-13 Emergency Stop Kit

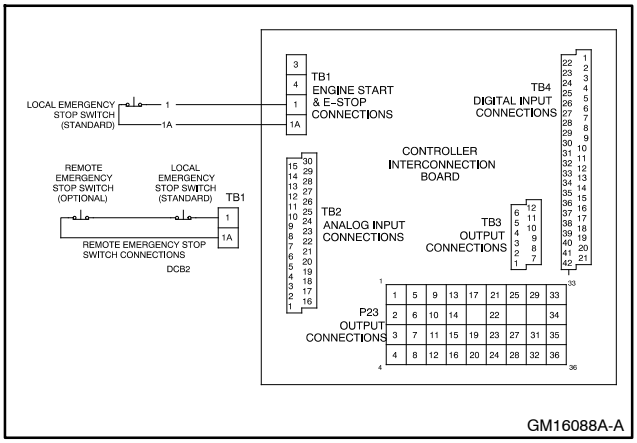


Figure 11-14 Remote Emergency Stop Kit Connections

11.1.9 Remote Reset Feature

The remote reset switch provides generator set resetting after a fault shutdown at a remote location. See Figure 11-15 and Figure 11-16 for user-supplied switch connection.

Press and hold the switch for 2–3 seconds and release to reset the generator set controller.

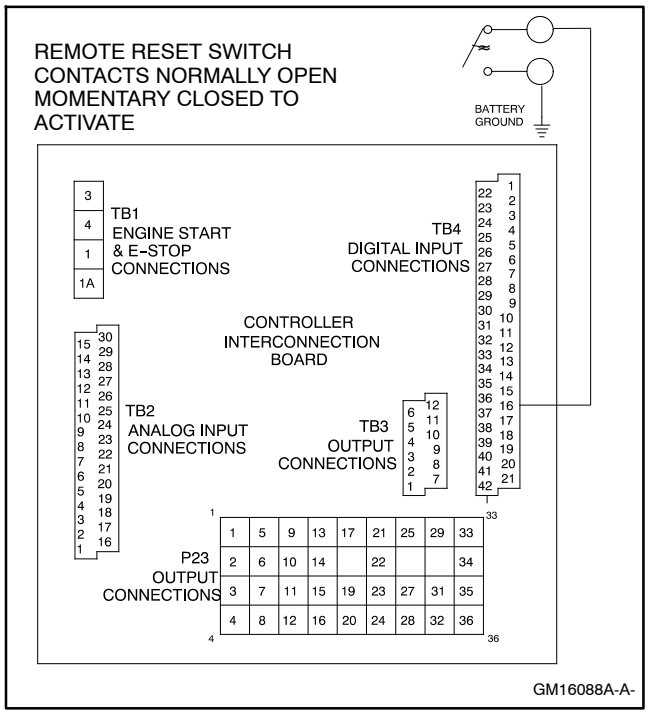


Figure 11-15 Remote Reset Switch Connections

Switch Rating	12 volts DC minimum, 1 amp minimum
Wiring Recommendation	
Gauge	**mm (ft.)**
18–20	30.5 (100)
14	153 (500)
10	305 (1000)

Figure 11-16 Switch Rating and Wiring Recommendations

11.1.10 Remote Serial Annunciator (RSA III)

Adapted from Instruction TT-1625 9/14b.

The following information summarizes the setup items when installing the remote serial annunciator. Refer to the RSA installation instructions TT-1625 for operation and function.

RSA III Features and Connections

RSA III is an annunciator panel offered in several kit configurations to support Kohler power equipment. The RSA III is a remote serial annunciator that monitors the condition of the generator set and/or ATS from a remote location. The RSA III alerts the operator through visual and audible signals using LED indication and a horn. An alarm silence and lamp test switch are included.

An RSA III annunciator can be used for a single generator set (Figure 11-17) or with a combination of a generator set and automatic transfer switch(es) (Figure 11-18 or Figure 11-19). In systems using more than a single RSA III, one must be designated as the master device to broadcast to additional RSA III annunciators, designated as slave devices. Up to five RSA III slave devices can be used with an RSA III master device. All RSA III annunciators are factory set as the master device, but can be changed to a slave device using a PC and SiteTech™ software that connects to the RSA III front panel via a universal serial bus (USB) connection.

The RSA II can be connected with the RSA III provided that the master remote annunciator is an RSA III.

The RSA III meets NFPA 110, Level 1 (2005) applications that require remote controls and alarms be powered by a storage battery such as the engine starting battery. AC adaptor kit GM62466-KP1 is available when NFPA is not required.

See Section 11.2, Accessory Connections, for terminal identifications.

A PC with SiteTech™ software is required to make the RSA III functional. Use your SecurID to access KOHLERnet, click on the TechTools button, and follow the instructions to download the files. See SiteTech™ Software Settings and refer to TP-6701 SiteTech™ Software Operation Manual for more information.

If a fault occurs, the RSA III horn activates and the corresponding LED illuminates. The following paragraphs describe specific features of the RSA III.

If the RSA III is used with an Ethernet communication network, order Modbus® Ethernet converter GM41143-KP2 and refer to TT-1405 Converters,

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Connections, and Controller Setup for Network Communication for system installation.

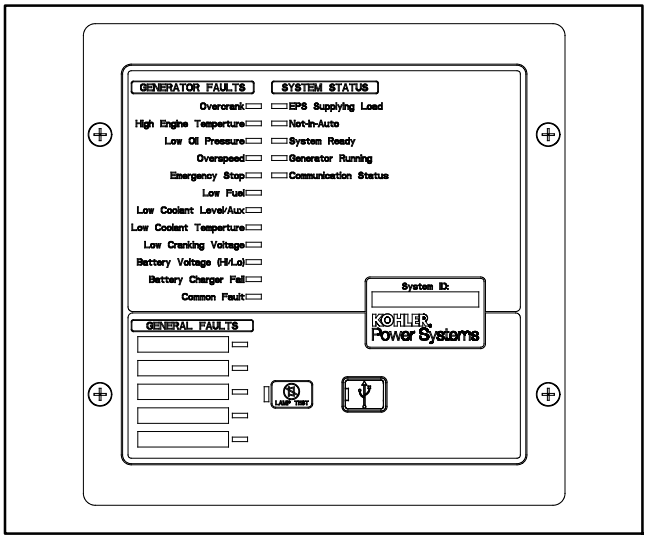


Figure 11-17 Remote Serial Annunciator (RSA III)

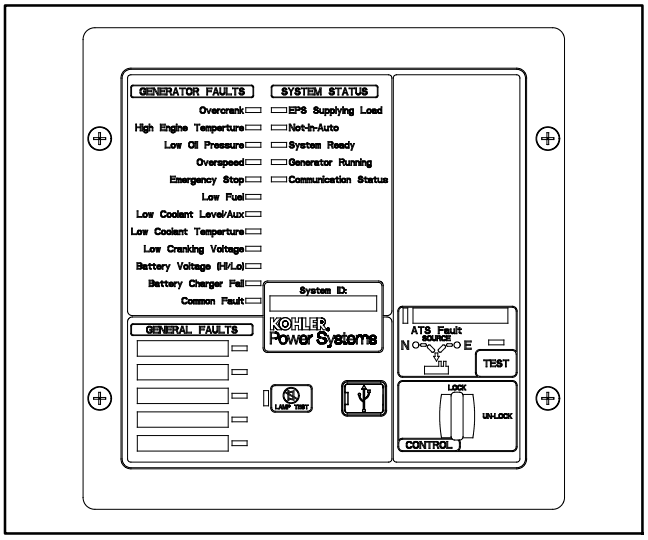


Figure 11-18 RSA III with Single ATS Control

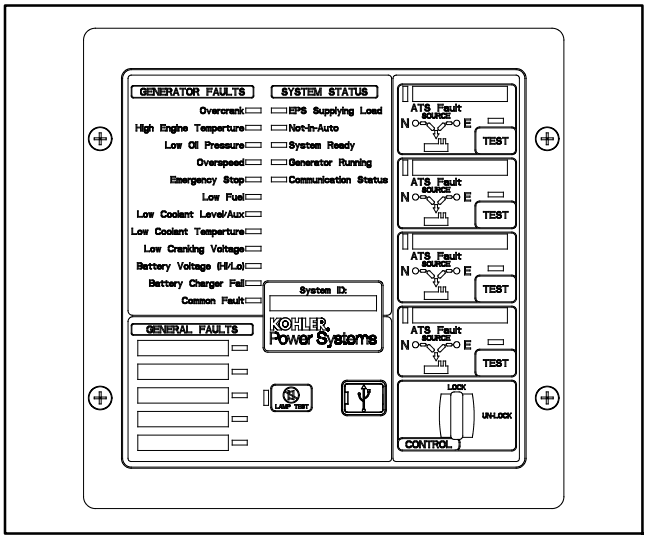


Figure 11-19 RSA III with Four ATS Controls

If there is only one RSA III, it is the master. If several RSA III are installed, choose either the RSA III closest to the generator set or determine which RSA III is more practical for use as a master and use a daisy chain wiring configuration for the remaining RSAs. The RSA III connected to the controller MUST be assigned as the RSA III master.

Note: When an RSA III is installed into a system with existing older RSAs, the RSA III must be configured as the master.

Note: Should any communication issues occur when adding RSA III slaves and/or transfer switches to the system, be sure to power down the RSA III master and then power up the RSA III master so that the RSA III master can recognize the changes.

Use the SiteTech™ software to select either that the generator set controller activates EPS Supplying Load LED or the transfer switch activates LED or local EPS supplying load.

Use the SiteTech™ software to select the high speed mode for direct connection to the DEC 6000 controller. Select lower speed for network connection with the Modbus®/ Ethernet converter. The lower speed allows network functionality reducing loss of communication faults.

Terminating Resistor and Wiring

For communication between the controller and RSA III master, see Figure 11-20. For communication between RSA III Master and RSA III Slave, see Figure 11-21. Place the terminating resistor on the last RSA III slave in the daisy chain connection.

Note: When using RS-485 communication cable, connect the “shield” wire at either end but not at both ends.

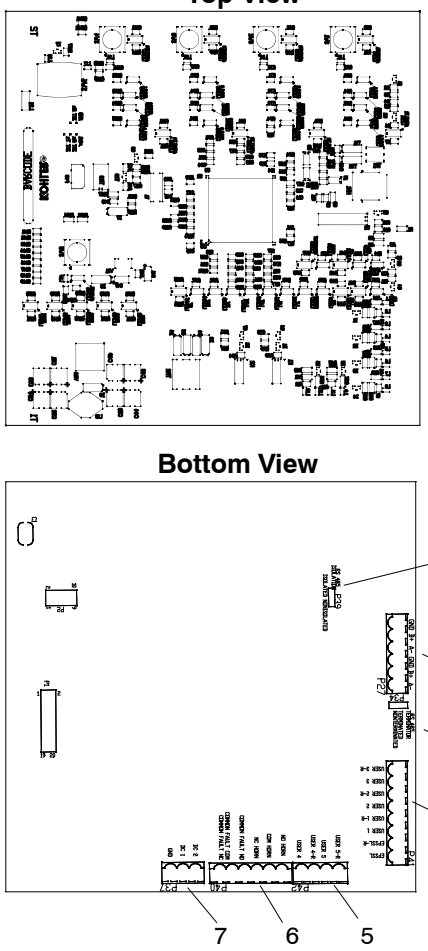
P27 RS-485 Connections (from Controller to Master)	
P27-1	(-) Black (from controller)
P27-2	(+) White (from controller)
P27-3	Shield (from controller)
P27-4	(-) Black (to slave or terminating resistor)
P27-5	(+) White (to slave or terminating resistor)
P27-6	Shield (to slave or open)
Note: When using RS-485 communication cable, connect the “shield” wire at either end but not at both ends.	

Figure 11-20 P27 Connector on Master RSA III

Communication between RSA III Master and RSA III Slave. Select and connect the RS-485 wiring from the RSA III master to the RSA III slave(s) in a daisy chain NO TAGwiring configuration using Belden #9841 or equivalent. Figure 11-21 shows the master/slave RS-485 connections and Figure 11-22 shows the RSA III with P27 location.

P27 RS-485 Connections (from Master to Slave)	
P27-1	(-) Black (from master or previous slave)
P27-2	(+) White (from master or previous slave)
P27-3	Shield (from master or previous slave)
P27-4	(-) Black (to next slave or terminating resistor)
P27-5	(+) White (to next slave or terminating resistor)
P27-6	Shield (to next slave or open)
Note: When using RS-485 communication cable, connect the "shield" wire at either end but not at both ends.	

Figure 11-21 P27 Connection on RSA III Slave



1. P39, 3-pin Isolated/non-isolated jumper
2. P27, 6-pin RS-485 connections
3. P34, 3-pin RS-485 termination resistor for last device
4. P41, 8-pin Input (EPS/User) connections
5. P42, 4-pin Input user 4 & 5 connections
6. P40, 6-pin Common fault and horn dry contacts
7. P37, 3-pin Power/CAN connections

Figure 11-22 RSA III Circuit Board GM86125 Connectors

11.1.11 Shunt-Trip Line Circuit Breaker

A shunt-trip line circuit breaker provides a 12- or 24-DC volt solenoid within the line circuit breaker case that can energize the trip mechanism. This feature allows the circuit breaker to be tripped by a customer-selected fault such as alternator overload, overspeed, overvoltage, or defined common fault. Connection requires a shunt-trip wiring kit and a dry contact kit. See Figure 11-23.

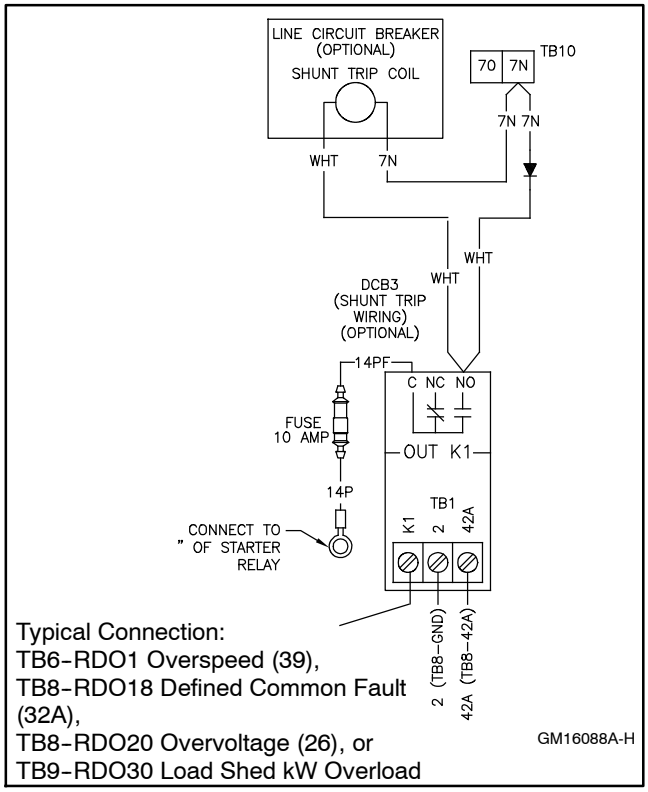


Figure 11-23 Shunt-Trip Line Circuit Breaker and Shunt-Trip Wiring Kit Connections

11.1.12 Single-Relay Dry Contact Kit

The single-relay dry contact kit provides normally open and normally closed contacts in a form C configuration to activate warning devices and other user- provided accessories allowing remote monitoring of the generator set. Typically, lamps, audible alarms, or other devices signal faults or status conditions. Connect any controller fault output to the single-relay dry contact kit.

A total of three dry contact kits may connect to a single controller output. See Figure 11-24 and Figure 11-25. See Section 11.2, Accessory Connections, for terminal identifications.

11.1.13 Ten-Relay Dry Contact Kit

The ten-relay dry contact kit provides normally open and normally closed contacts in a form C configuration to activate warning devices and other user-provided accessories allowing remote monitoring of the generator set. Connect any controller fault output to the ten-relay dry contact kit. Typically, lamps, audible alarms, or other devices signal the fault conditions.

Refer to Figure 11-26 for an internal view of the contact kit. See Figure 11-27 for electrical connections. See Section 11.2, Accessory Connections, for terminal identifications.

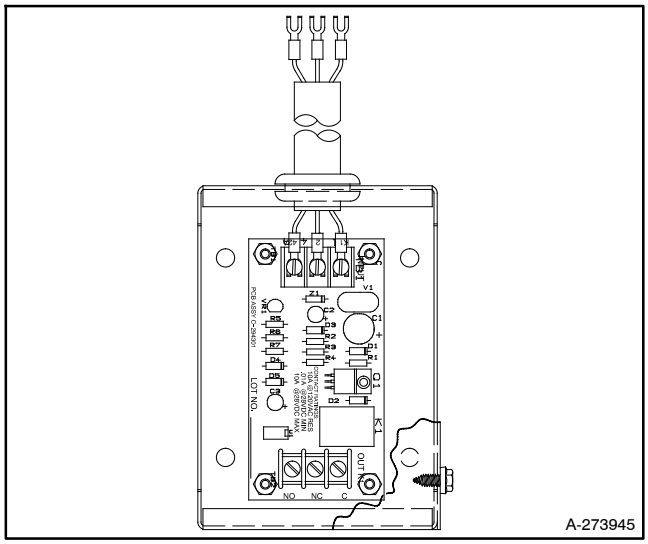


Figure 11-24 Single-Relay Dry Contact Kit, Typical

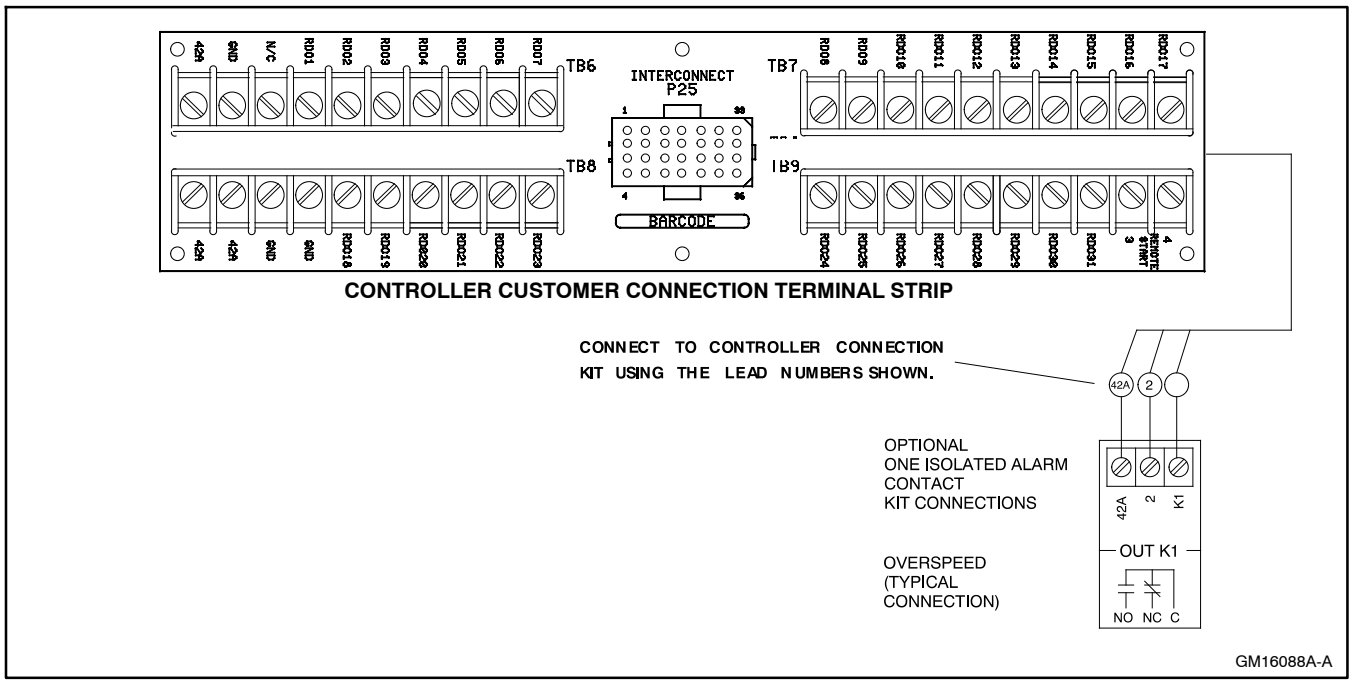


Figure 11-25 Single-Relay Dry Contact Kit Connections

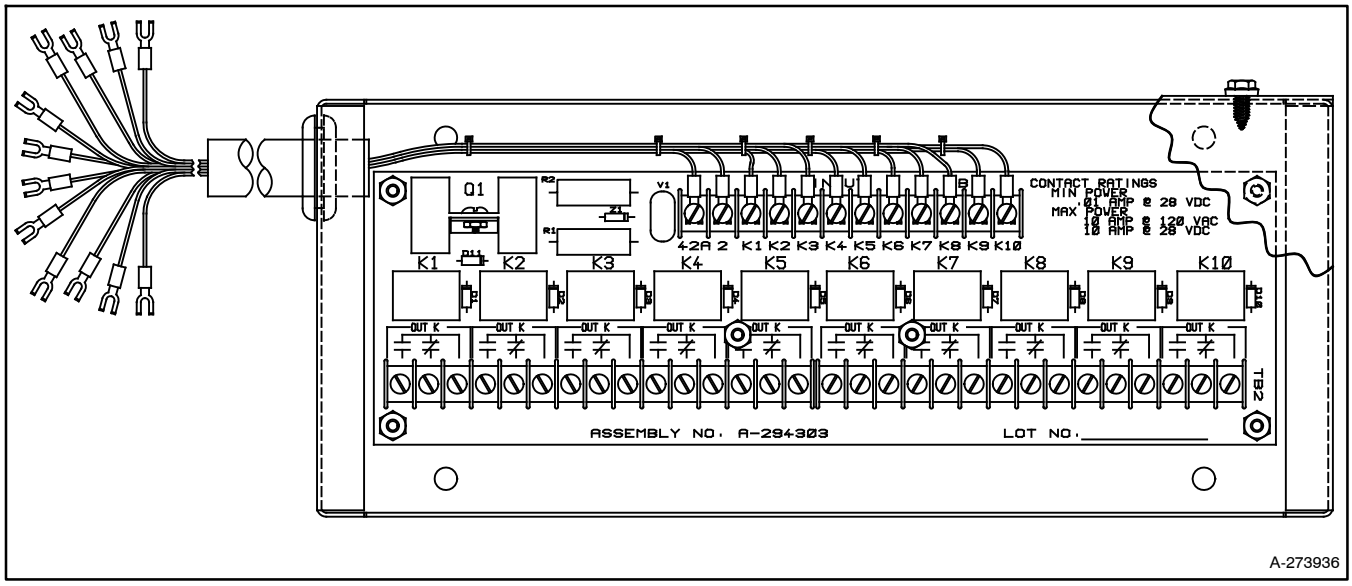


Figure 11-26 Ten-Relay Dry Contact Kit

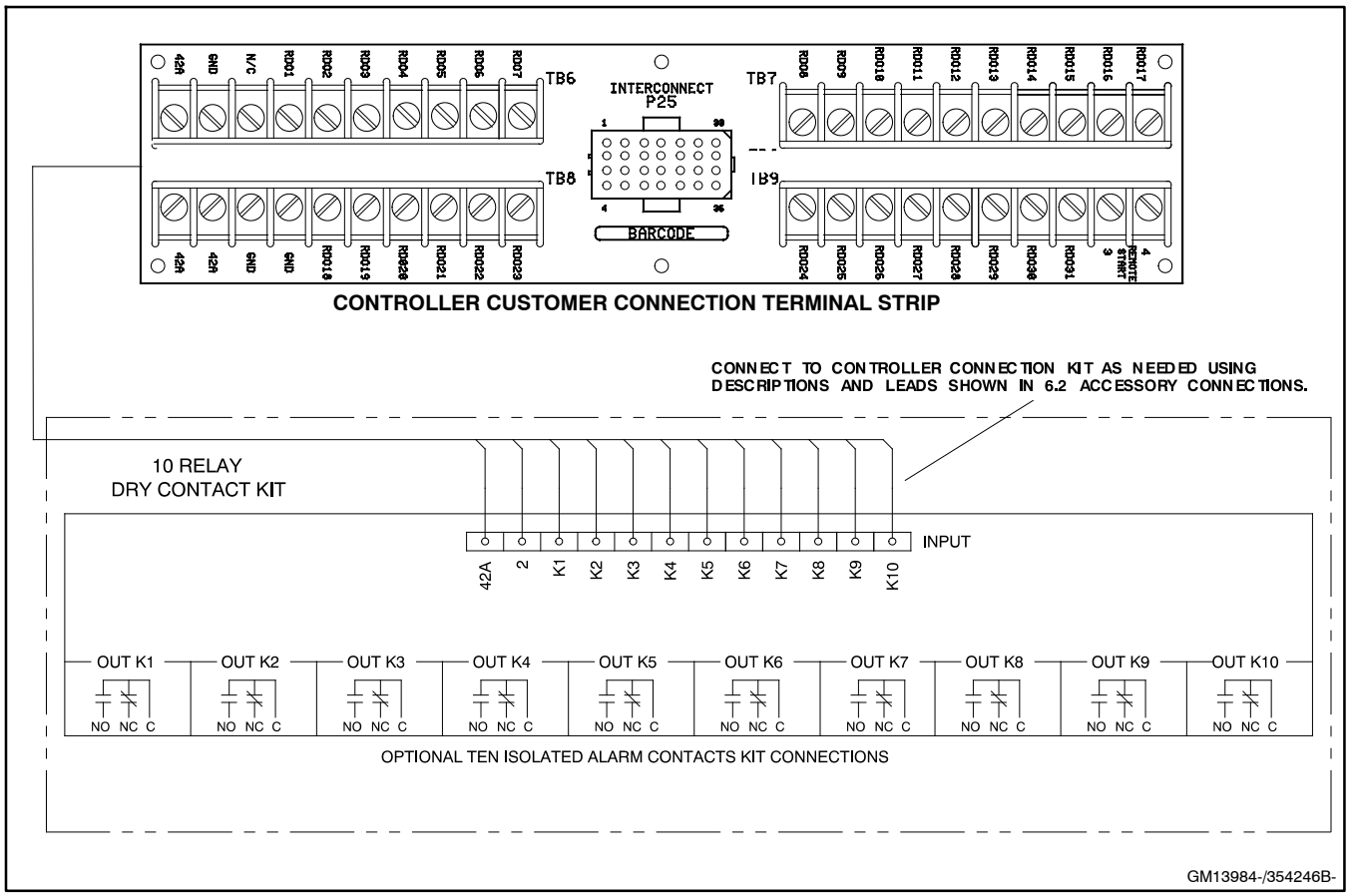


Figure 11-27 Ten-Relay Dry Contact Kit Connections

11.1.14 Twenty-Relay Dry Contact Kit

The twenty-relay dry contact kit provides normally open and normally closed contacts in a form C configuration to activate warning devices and other user-provided accessories allowing remote monitoring of the generator set. Typically, lamps, audible alarms, or other devices signal faults or status conditions. Connect any generator set fault output to the dry contact kit.

Refer to Figure 11-28 for an internal view of the contact kit. See Figure 11-29 for electrical connections. See Section 11.2, Accessory Connections, for terminal identifications.

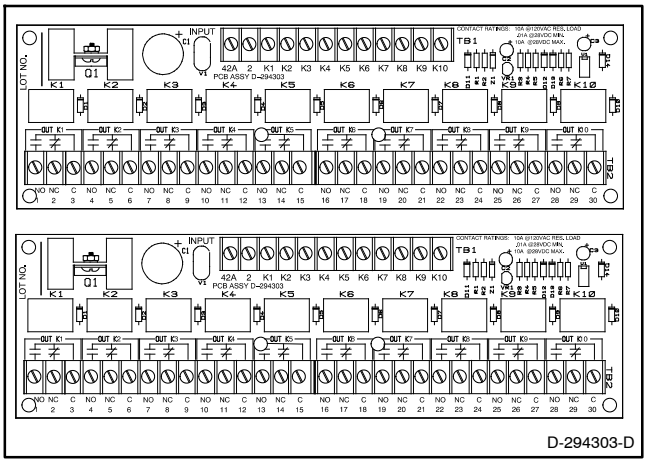


Figure 11-28 Twenty-Relay Dry Contact Kits

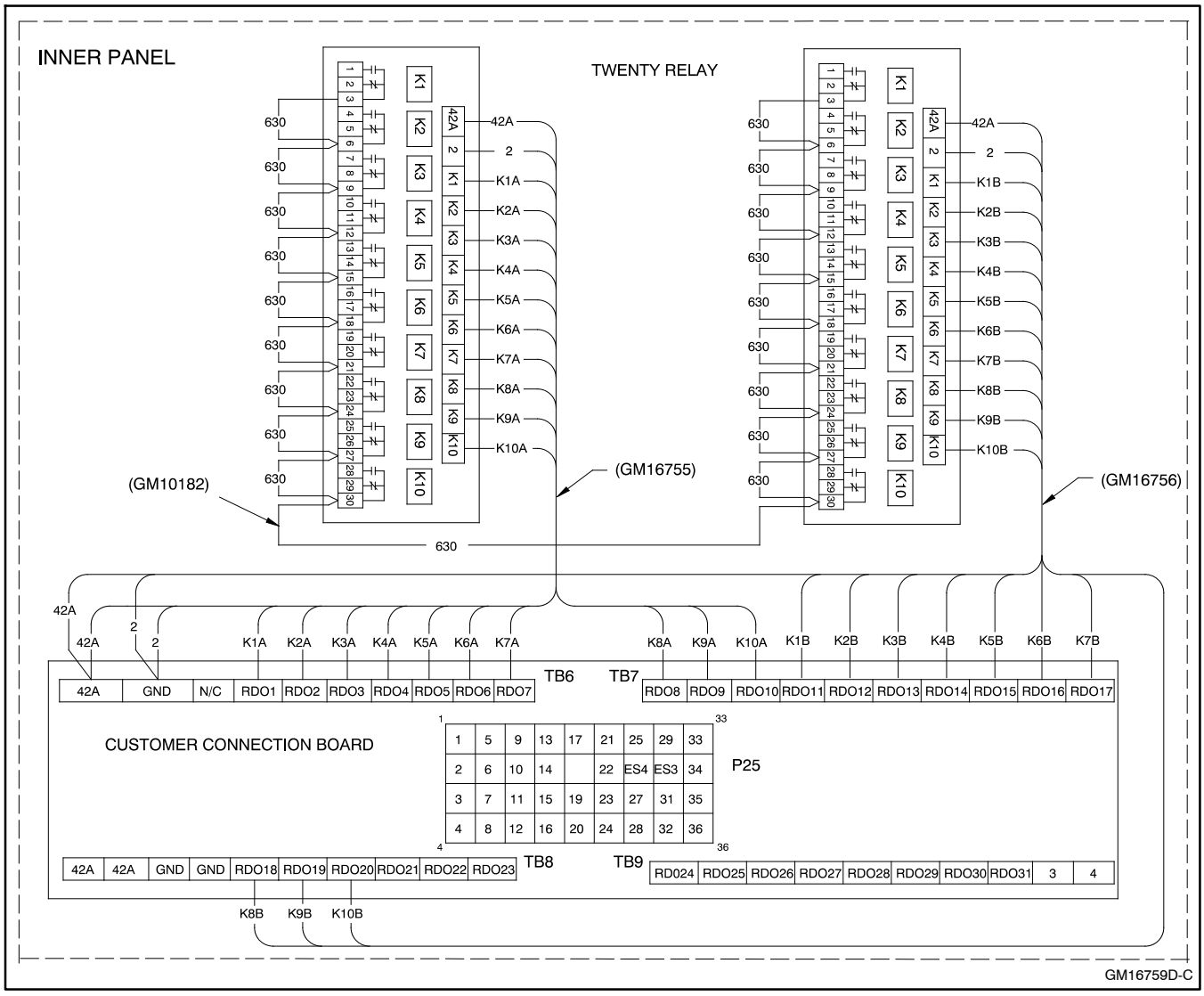
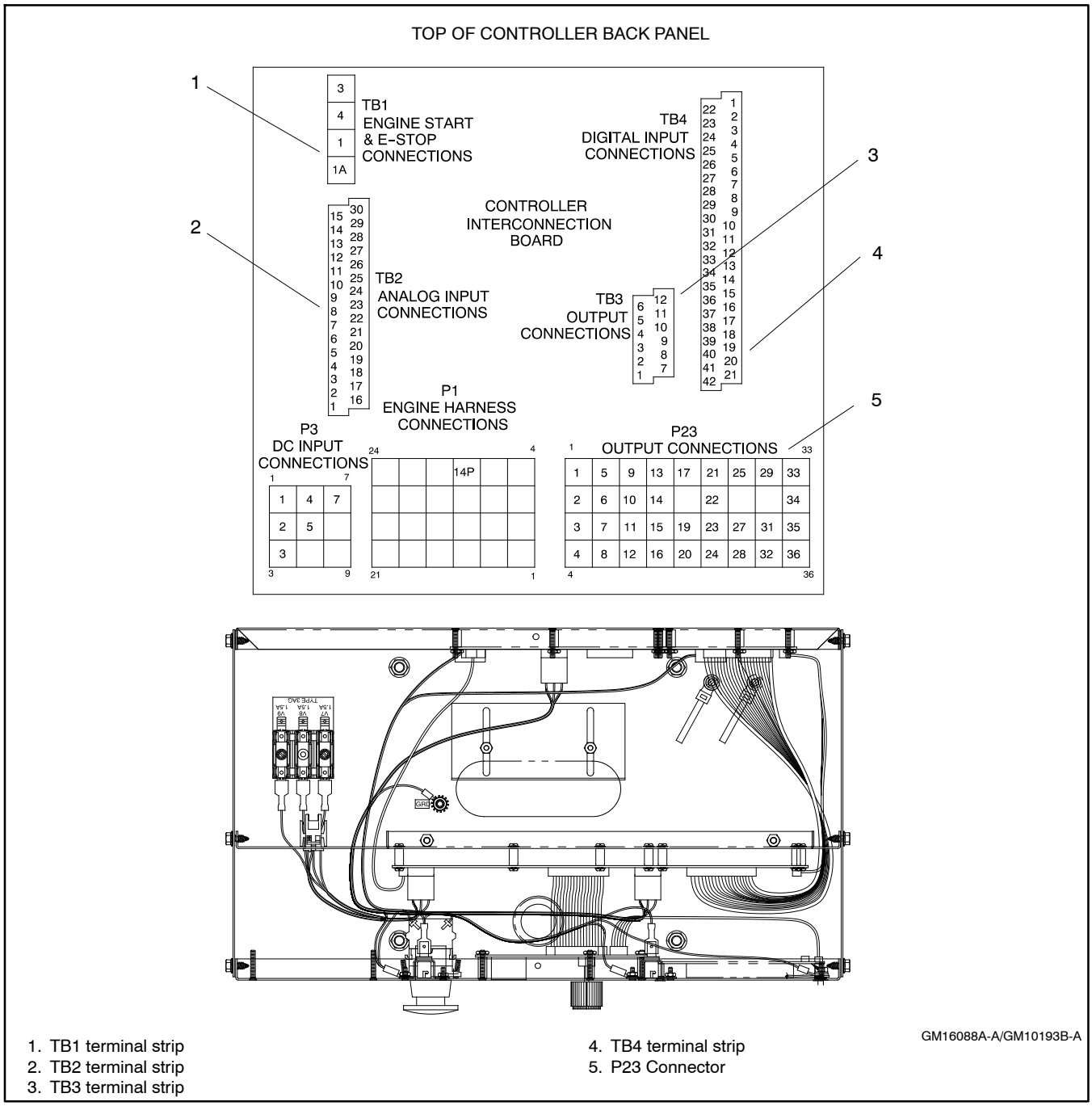


Figure 11-29 Twenty-Relay Dry Contact Relay Kit Connections

11.2 Accessory Connections

The controller contains circuit boards equipped with terminal strip(s) for use in connecting accessories. Connect accessories to either the controller customer connection terminal strip or a dry contact kit. Connect the dry contact kit(s) to the controller customer connection terminal strip. Connect alarms, battery chargers, remote switches, and other accessories to the dry contact kit relay(s).

For specific information on accessory connections, refer to the accessory wiring diagrams in the wiring diagram manual and the instruction sheet accompanying the kit. See Figure 11-30 and Figure 11-31 for controller interconnection circuit board connections. See Figure 11-32 and Figure 11-33 for controller (customer) connection terminal strip connections. See Appendix G, Wiring Diagrams for accessory connection wiring diagrams.



1. TB1 terminal strip
2. TB2 terminal strip
3. TB3 terminal strip
4. TB4 terminal strip
5. P23 Connector

Figure 11-30 Terminal Strips on Controller Interconnection Circuit Board (Controller Back Panel Folded Down)

TB1 Terminal Strip—Engine Start and Emergency Stop Connections

Term.	Description
1	Remote start (3)
2	Remote start (4)
3	Emergency stop ground (1)
4	Emergency stop (1A)

TB2 Terminal Strip—Analog Input Connections

Term.	Description
1	ACH1 Signal
2	ACH1 Supply
3	ACH2 Signal
4	ACH2 Supply
5	ACH3 Signal
6	ACH3 Supply
7	ACH4 Signal
8	ACH4 Supply
9	ACH5 Signal
10	ACH5 Supply
11	ACH6 Signal
12	ACH6 Supply
13	ACH7 Signal (optional analog voltage adjust signal)
14	ACH7 Supply
15	N/C
16	ACH1 Return
17	ACH1 Shield ground
18	ACH2 Return
19	ACH2 Shield ground
20	ACH3 Return
21	ACH3 Shield ground
22	ACH4 Return
23	ACH4 Shield ground
24	ACH5 Return
25	ACH5 Shield ground
26	ACH6 Return
27	ACH6 Shield ground
28	ACH7 Return
29	ACH7 Shield ground
30	N/C

TB3 Terminal Strip—Accessory Power Output Connections

Term.	Description
1	+12 VDC (OEM use only)
2	+12 VDC (OEM use only)
3	+12 VDC (OEM use only)
4	Fused battery (+) (42A) (5 amp)
5	Fused battery (+) (42A) (5 amp)
6	Fused battery (+) (42A) (5 amp)
7	Battery (–)
8	Battery (–)
9	Battery (–)
10	Battery (–)
11	Battery (–)
12	Panel lamp output

TB4 Terminal Strip—Input Factory Connections

Term.	Description
1	DCH1 Battery charger fault
2	DCH2 Low fuel
3	DCH3 Low coolant temp. with ECM models or warning default with non-ECM models
4	DCH4 Field over voltage with M4/M5/M7/M10 alternators or warning default with non-M4/M5/M7/M10 alternators
5	DCH5 Breaker closed, paralleling applications
6	DCH6 VAR/PF
7	DCH7 Base load mode
8	DCH8 I/E mode
9	DCH9 Low fuel shutdown (GM only)
10	DCH10 Load enable
11	DCH11 Synch auto, paralleling applications
12	DCH12 Synch permissive, paralleling applications
13	DCH13 Synch check test
14	DCH14 Low coolant level
15	DCH15 Remote shutdown
16	DCH16 Remote reset
17	DCH17 Voltage lower
18	DCH18 Voltage raise
19	DCH19 Speed lower
20	DCH20 Speed raise
21	DCH21 Breaker tripped
22	DCH1 Return
23	DCH2 Return
24	DCH3 Return
25	DCH4 Return
26	DCH5 Return
27	DCH6 Return
28	DCH7 Return
29	DCH8 Return
30	DCH9 Return
31	DCH10 Return
32	DCH11 Return
33	DCH12 Return
34	DCH13 Return
35	DCH14 Return
36	DCH15 Return
37	DCH16 Return
38	DCH17 Return
39	DCH18 Return
40	DCH19 Return
41	DCH20 Return
42	DCH21 Return

Note: TB4-1 through TB4-21 are user definable with factory defaults listed. Terminals TB4-3 and TB4-4 have different functions depending upon the generator set configuration. See comments above. See Menu 9—Input Setup for changing inputs.

Figure 11-31 Controller Terminal Strip Identification

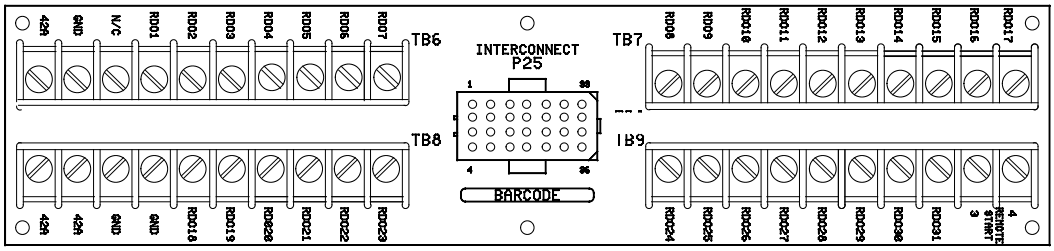


Figure 11-32 Terminal Strips TB6, TB7, TB8, and TB9 on the Controller Customer Connection Terminal Strip

TB6 Terminal Strip—RDOs 1-7

Term.	Description
42A	Battery (+)
GND	Battery (-)
N/C	
RDO1	System ready (lead 60)
RDO2	Emergency stop (lead 48)
RDO3	Defined common fault (lead 32A)
RDO4	Time delay engine cooldown (TDEC) (lead 70C)
RDO5	Low fuel (lead 63)
RDO6	High coolant temperature warning (lead 40)
RDO7	Low coolant temperature warning (lead 35)

TB7 Terminal Strip—RDOs 8-17

Term.	Description
RDO8	Low coolant level
RDO9	Low oil pressure warning (lead 41)
RDO10	NFPA 110 common alarm faults (lead 32)*
RDO11	Low battery voltage (lead 62)
RDO12	Battery charger fault (lead 61)
RDO13	Maintenance due
RDO14	Over current
RDO15	Delay engine start
RDO16	Starting aid
RDO17	Ground fault

TB8 Terminal Strip—RDOs 18-23

Term.	Description
42A	Battery (+)
42A	Battery (+)
GND	Battery (-)
GND	Battery (-)
RDO18	EPS supplying load
RDO19	Alternator protection shutdown
RDO20	Engine derate active
RDO21	Key switch locked
RDO22	Generator running (lead 70R)
RDO23	Master switch not in auto (lead 80)

TB9 Terminal Strip—RDOs 24-31

Term.	Description
RDO24	Defined common warning
RDO25	Common load shed
RDO26	Missing PGEN node
RDO27	In synch
RDO28	Circuit breaker common fault
RDO29	Common protective relay output
RDO30	Close breaker
RDO31	Breaker trip
3	Remote start
4	Remote start

Note: Lead numbers shown in parentheses are the factory default wire designations.

Note:RDO-1 though RDO-31 are user definable with the following factory defaults: emergency stop, high coolant temperature, low oil pressure, overcrank, and overspeed

***NFPA-110 common alarm faults typically include:**

Air damper indicator
Battery charger fault (RDO-12)
EPS supplying load (RDO-18)
High battery voltage
High coolant temperature warning (RDO-06)
High coolant temperature shutdown
Low battery voltage (RDO-11)
Low coolant level (RDO-08)
Low coolant temperature warning (RDO-07)
Low fuel (level or pressure) (RDO-05)
Low oil pressure warning (RDO-09)
Low oil pressure shutdown
Master switch not in auto (RDO-23)
Overcrank
Overspeed

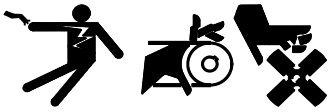
Figure 11-33 Controller Customer Connection Terminal Strip Identification with Relay Driver Outputs (RDOs)

This section provides information about changes and adjustments when the system involves remote starting/control systems, voltage regulation, and paralleling generator set applications. Use the respective switchgear literature as supplied with the unit. Some of the items mentioned are available generator set accessories.

Before installing the generator set, provide for electrical connections through conduit to the transfer switch and other accessories for the generator set. Carefully install the selected generator set accessories. Route wiring to the generator set through flexible connections. Comply with all applicable codes when installing a wiring system.

See Section 7, Electrical System for additional wiring information.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

(Decision-Maker® 3+ and 550 Controllers)

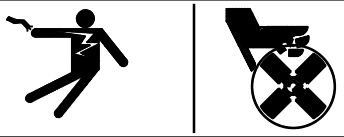
Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set off/reset button to shut down the generator set. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

(Decision-Maker® 3000, 3500, and 6000 Controllers)

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) If the controller is not already in the MAN (manual) mode, press the Controller Mode button and then press the MAN mode button. (2) If the generator set is running, press and hold the Manual–Stop button for at least 2 seconds to stop the generator set. (3) Press the Controller Mode button and then press the controller Off mode button. (4) Disconnect the power to the battery charger, if equipped. (5) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

(Decision-Maker® 8000 Controller)

⚠ WARNING



Hazardous voltage. Moving parts.
Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

12.1 Automatic Transfer Switches

A typical standby system has at least one automatic transfer switch connected to the generator set output to automatically transfer the electrical load to the generator set if the normal source fails. When normal power returns, the switch transfers the load back to the normal power source and then signals the generator set to stop.

The transfer switch uses a set of contacts to signal the engine/generator to start. When the normal source fails and the generator set master switch is in the AUTO position, the transfer switch contacts close to start the generator set.

The engine start terminals are usually located near the transfer switch contactor with an engine start decal identifying the terminals. Refer to the transfer switch decal, operation/installation manual, or wiring diagram manual to identify the engine start terminals prior to making connections.

Make connections to the transfer switch engine-start terminals and remote manual engine-start switch using wire run through conduit. Use separate conduits for engine-start leads, generator set load cables, battery charger leads, and remote annunciator wiring.

Use a minimum of 13 mm (0.5 in.) spacing between the conduit bushing and any uninsulated live parts in the ATS enclosure. All conduit openings in the ATS enclosure must be made such that no metal particles including drill chips contaminate the components in the ATS enclosure.

12.2 Decision-Maker® 550 Controller, Voltage Regulator and Paralleling Applications

The controller has a voltage regulation function that is internal to the processor.

See the Decision-Maker® 550 Controller Operation Manual for further details regarding voltage adjustment and paralleling operation setup.

12.3 Decision-Maker® 3000 Controller Voltage Regulator

The controller has a voltage regulation function that is internal to the processor.

See the Decision-Maker® 3000 Controller and SiteTech™ Operation Manuals for further details regarding voltage adjustment setup.

12.4 Decision-Maker® 3500 Controller Voltage Regulator

The controller has a voltage regulation function that is internal to the processor.

See the Decision-Maker® 3500 Controller and SiteTech™ Operation Manuals for further details regarding voltage adjustment setup.

12.5 Decision-Maker® 6000 Controller Voltage Regulator and Paralleling Applications

The controller has a voltage regulation function that is internal to the processor.

See the Decision-Maker® 6000 Controller, Decision-Maker® Paralleling (DPS), and SiteTech™ Operation Manuals for further details regarding voltage adjustment and paralleling operation setup.

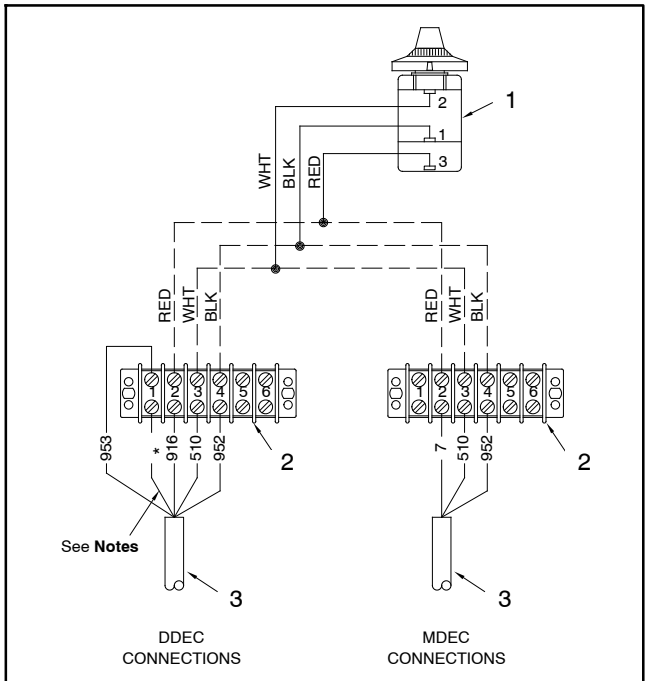
12.6 Decision-Maker® 8000 Controller Voltage Regulator and Paralleling Applications

The generator set uses a Marathon® DVR® 2000EC voltage regulator.

See the Decision-Maker® 8000 Controller Operation Manual and TP-5579 Operation Manual, DVR® 2000 Voltage Regulator for further details regarding voltage adjustment and paralleling operation setup.

12.7 Remote Speed Adjustment

This kit provides remote engine speed adjustments with an approximate range of ±5% at 1800 rpm. This kit requires a generator set with an electronic governor. See Figure 12-1 and Figure 12-2.



Notes:

- Wire number is 542 on 2000/4000 series engine or 545 on 60 series engine (for DDEC connections only).
- Remove and tape wire 542 (545) when installing manual speed adjust kits.

1. GM31213 potentiometer assembly ref.
2. Existing terminal block
3. Existing engine wiring harness

Figure 12-1 Remote Speed Adjusting Control Wiring Diagram

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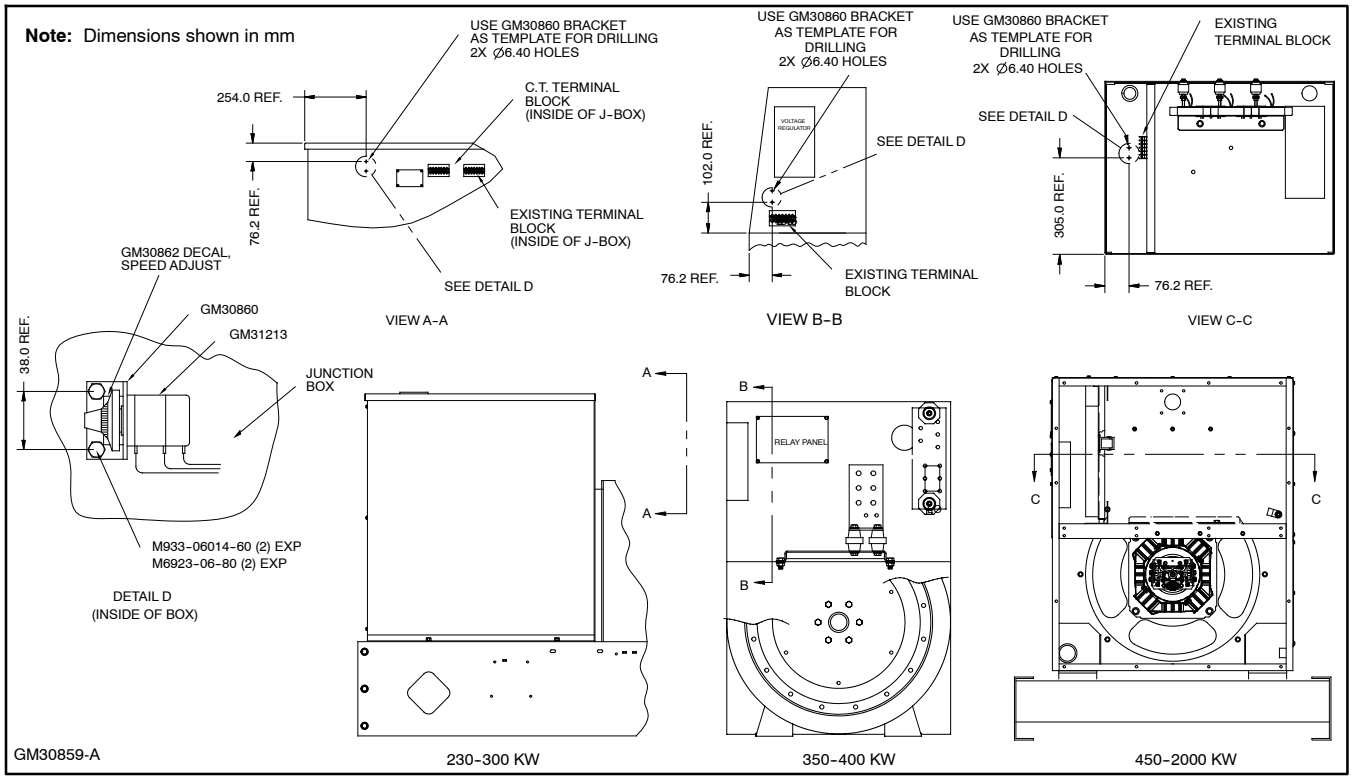


Figure 12-2 Remote Speed Potentiometer Installation

To program the 550 controller, MDEC-equipped DDC/MTU engines only, use the following instructions. See the 550 controller operation manual for further information, if necessary.

1. Go to Menu 14—PROGRAMMING MODE to enable LOCAL programming.
2. Go to Menu 7—GENERATOR SYSTEM.
3. Press MENU Down ↓ Key to access ENABLE VSG (variable governor speed) data.
4. Press the YES Key.
5. Press the ENTER ← Key to confirm entry.
6. Verify ENABLE VSG code YES appears on the display.
7. Go to Menu 14—PROGRAMMING MODE to change to programming mode OFF.

12.8 Remote Voltage Adjustment

This kit provides the ability to fine adjust the generator output voltage from a remote location. The maximum recommended wire length from the potentiometer to the generator set is 15 ft. (4.6 m); 18-gauge twisted pair wire is recommended. See Figure 12-3 and Figure 12-4.

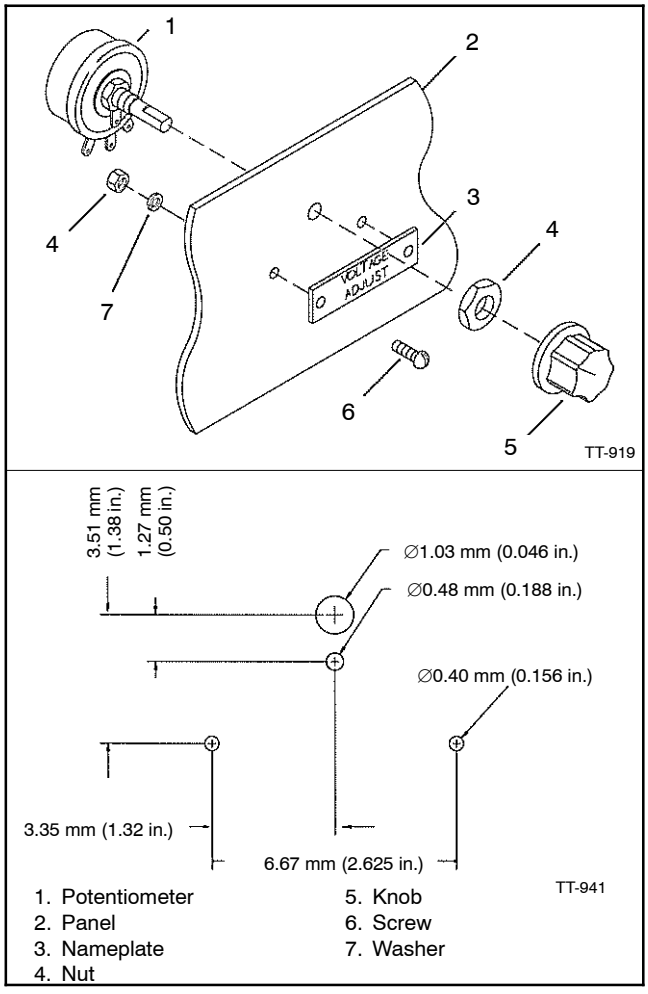


Figure 12-3 Potentiometer Installation

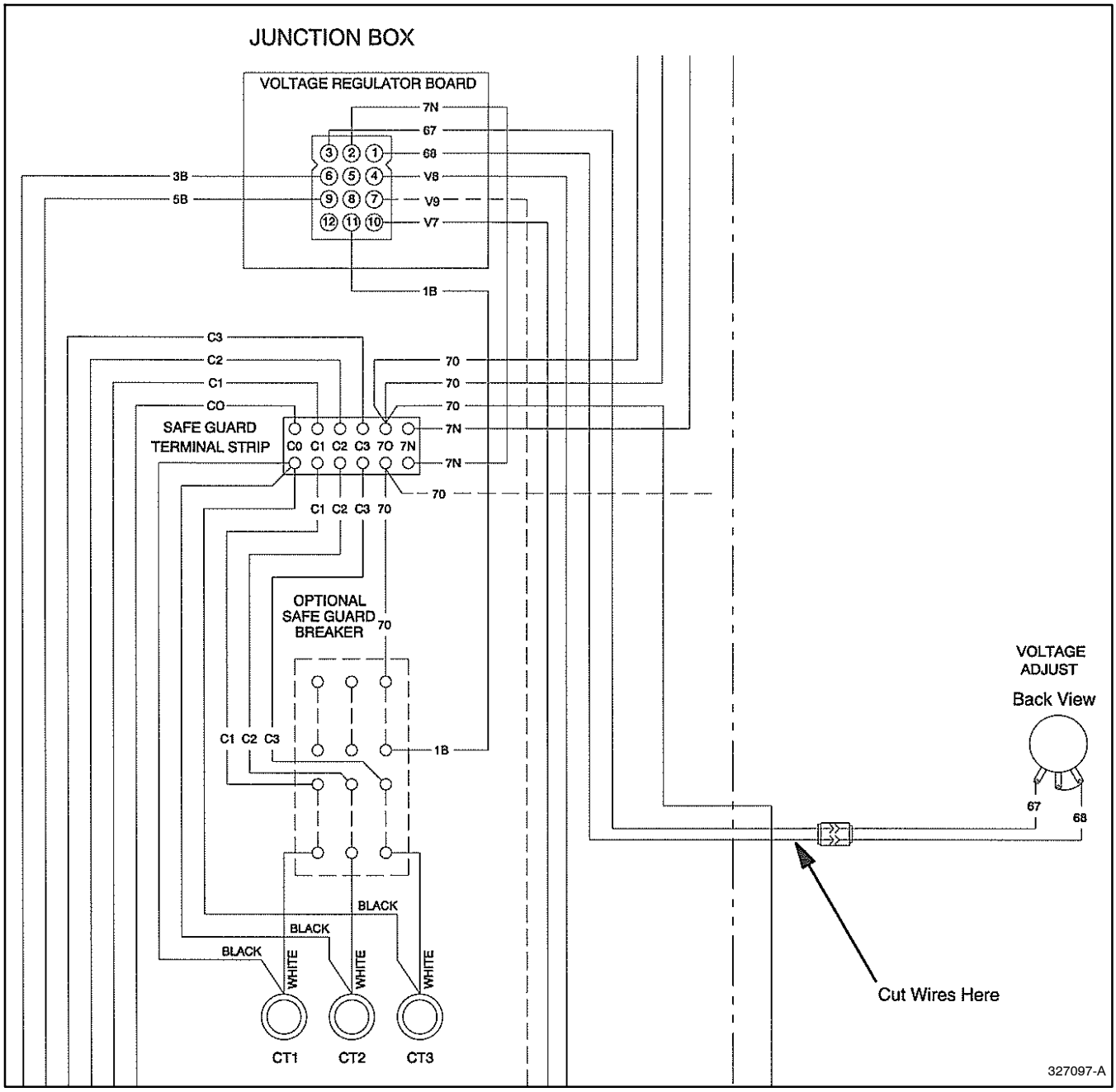


Figure 12-4 Disconnection of Controller Voltage Adjusting Potentiometer

12.9 Remote Wiring

Figure 12-5 is the accessory interconnection diagram showing the remote wiring for the 550 controller.

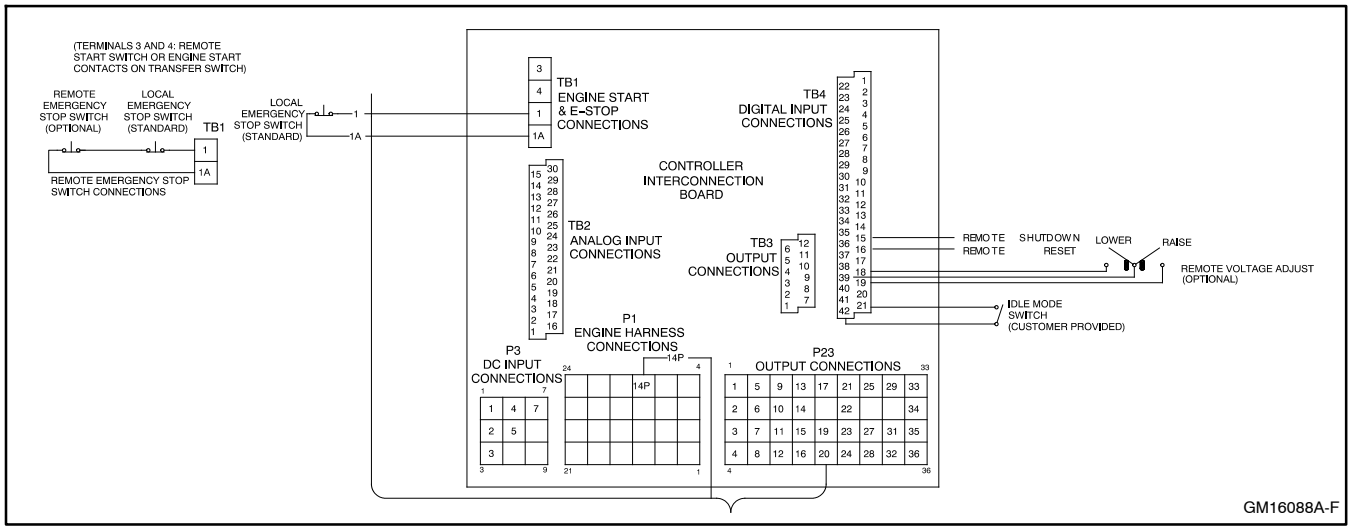


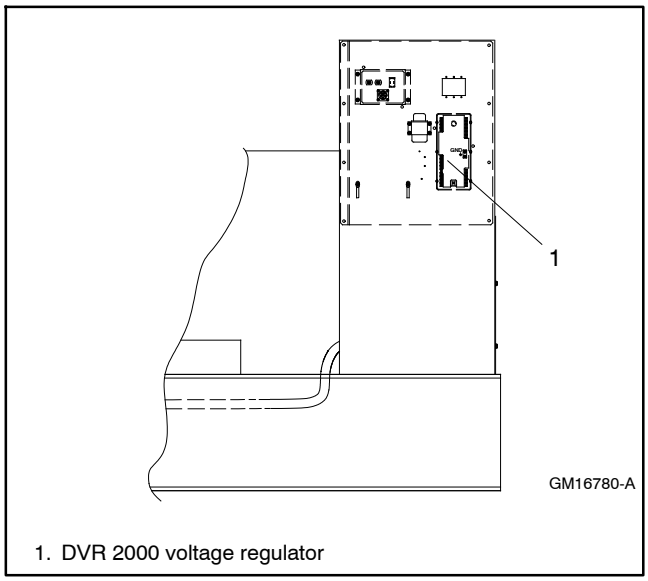
Figure 12-5 550 Controller Remote Wiring

12.10 Voltage Regulator DVR 2000/ Remote Voltage Regulator Kit, 350 kW and Above

The DVR® 2000E is used with nonparalleling applications and the DVR® 2000EC is used when paralleling is required.

If the voltage configuration is changed, make adjustments to the DVR® 2000 voltage regulator at the voltage regulator. Remove the junction box cover to adjust the DVR® 2000 voltage regulator. See Figure 12-6, Figure 12-7, and TP-5579 Operation Manual, DVR® 2000 Voltage Regulator for more information.

Use Figure 12-7 for installation and troubleshooting of the electrical wiring system.



1. DVR 2000 voltage regulator

Figure 12-6 DVR® 2000 Voltage Regulator Mounting Location

DVR® is a registered trademark of Marathon Electric Mfg. Corp.

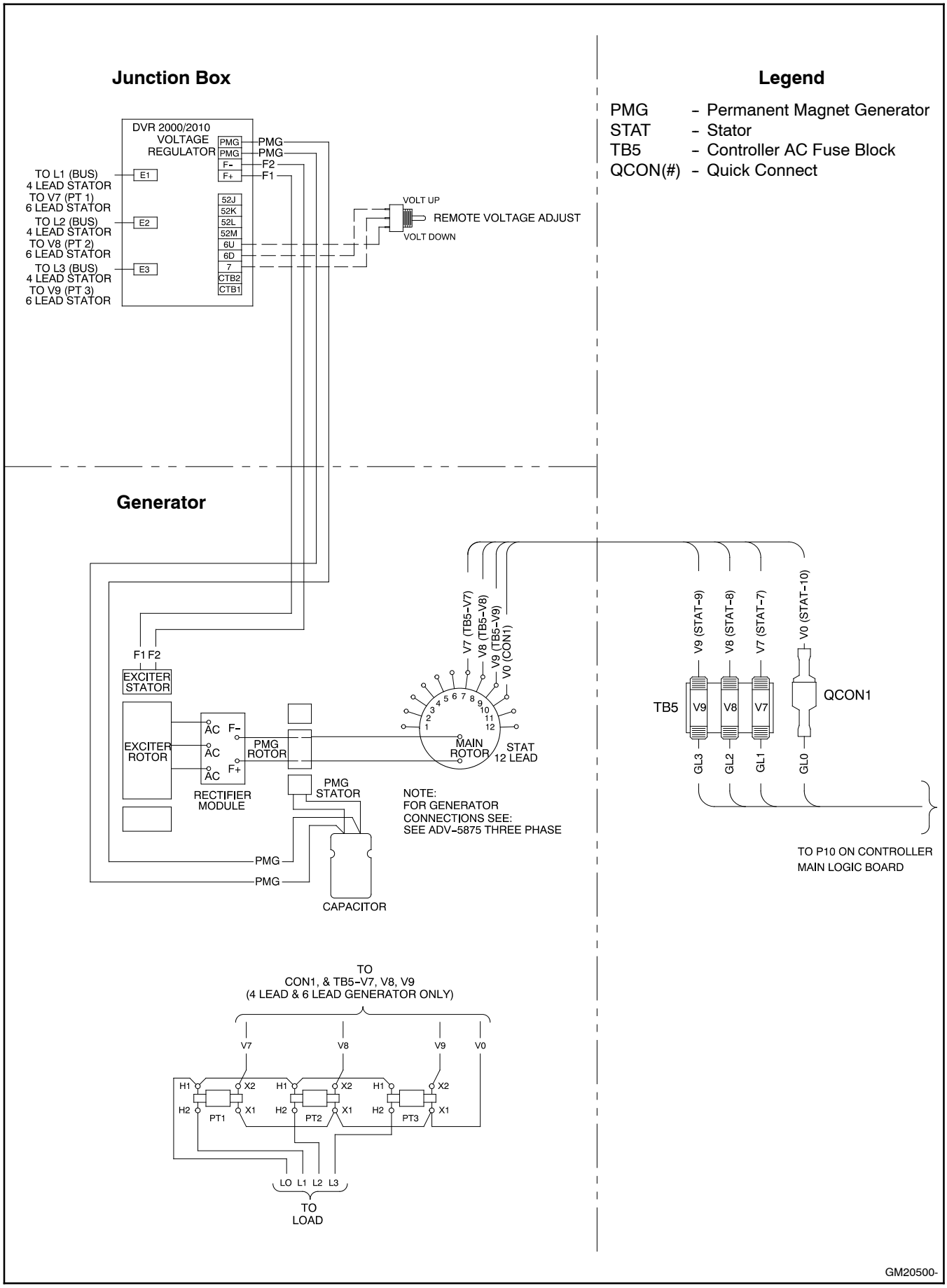


Figure 12-7 DVR® 2000 Voltage Regulator/Alternator Interconnection Wiring Diagram

Appendix A Abbreviations

The following list contains abbreviations that may appear in this publication.

A, amp	ampere
ABDC	after bottom dead center
AC	alternating current
A/D	analog to digital
ADC	advanced digital control; analog to digital converter
adj.	adjust, adjustment
ADV	advertising dimensional drawing
Ah	amp-hour
AHWT	anticipatory high water temperature
AISI	American Iron and Steel Institute
ALOP	anticipatory low oil pressure
alt.	alternator
Al	aluminum
ANSI	American National Standards Institute (formerly American Standards Association, ASA)
AO	anticipatory only
APDC	Air Pollution Control District
API	American Petroleum Institute
approx.	approximate, approximately
APU	Auxiliary Power Unit
AQMD	Air Quality Management District
AR	as required, as requested
AS	as supplied, as stated, as suggested
ASE	American Society of Engineers
ASME	American Society of Mechanical Engineers
assy.	assembly
ASTM	American Society for Testing Materials
ATDC	after top dead center
ATS	automatic transfer switch
auto.	automatic
aux.	auxiliary
avg.	average
AVR	automatic voltage regulator
AWG	American Wire Gauge
AWM	appliance wiring material
bat.	battery
BBDC	before bottom dead center
BC	battery charger, battery charging
BCA	battery charging alternator
BCI	Battery Council International
BDC	before dead center
BHP	brake horsepower
blk.	black (paint color), block (engine)
blk. htr.	block heater
BMEP	brake mean effective pressure
bps	bits per second
br.	brass
BTDC	before top dead center
Btu	British thermal unit
Btu/min.	British thermal units per minute
C	Celsius, centigrade
cal.	calorie
CAN	controller area network
CARB	California Air Resources Board
CAT5	Category 5 (network cable)
CB	circuit breaker
CC	crank cycle
cc	cubic centimeter
CCA	cold cranking amps
ccw.	counterclockwise
CEC	Canadian Electrical Code
cert.	certificate, certification, certified
cfh	cubic feet per hour
cfm	cubic feet per minute
CG	center of gravity
CID	cubic inch displacement
CL	centerline
cm	centimeter
CMOS	complementary metal oxide substrate (semiconductor)
com	communications (port)
coml	commercial
Coml/Rec	Commercial/Recreational
conn.	connection
cont.	continued
CPVC	chlorinated polyvinyl chloride
crit.	critical
CSA	Canadian Standards Association
CT	current transformer
Cu	copper
cUL	Canadian Underwriter's Laboratories
CUL	Canadian Underwriter's Laboratories
cu. in.	cubic inch
cw.	clockwise
CWC	city water-cooled
cyl.	cylinder
D/A	digital to analog
DAC	digital to analog converter
dB	decibel
dB(A)	decibel (A weighted)
DC	direct current
DCR	direct current resistance
deg., °	degree
dept.	department
dia.	diameter
DI/EO	dual inlet/end outlet
DIN	Deutsches Institut fur Normung e. V. (also Deutsche Industrie Normenausschuss)
DIP	dual inline package
DPDT	double-pole, double-throw
DPST	double-pole, single-throw
DS	disconnect switch
DVR	digital voltage regulator
E^2PROM, EEPROM	electrically-erasable programmable read-only memory
E, emer.	emergency (power source)
ECM	electronic control module, engine control module
EDI	electronic data interchange
EFR	emergency frequency relay
e.g.	for example (*exempli gratia)*
EG	electronic governor
EGSA	Electrical Generating Systems Association
EIA	Electronic Industries Association
EI/EO	end inlet/end outlet
EMI	electromagnetic interference
emiss.	emission
eng.	engine
EPA	Environmental Protection Agency
EPS	emergency power system
ER	emergency relay
ES	engineering special, engineered special
ESD	electrostatic discharge
est.	estimated
E-Stop	emergency stop
etc.	et cetera (and so forth)
exh.	exhaust
ext.	external
F	Fahrenheit, female
FHM	flat head machine (screw)
fl. oz.	fluid ounce
flex.	flexible
freq.	frequency
FS	full scale
ft.	foot, feet
ft. lb.	foot pounds (torque)
ft./min.	feet per minute
ftp	file transfer protocol
g	gram
ga.	gauge (meters, wire size)
gal.	gallon
gen.	generator
genset	generator set
GFI	ground fault interrupter
GND, ⏚	ground
gov.	governor
gph	gallons per hour
gpm	gallons per minute
gr.	grade, gross
GRD	equipment ground
gr. wt.	gross weight
H x W x D	height by width by depth
HC	hex cap
HCHT	high cylinder head temperature
HD	heavy duty
HET	high exhaust temp., high engine temp.
hex	hexagon
Hg	mercury (element)
HH	hex head
HHC	hex head cap
HP	horsepower
hr.	hour
HS	heat shrink
hsg.	housing
HVAC	heating, ventilation, and air conditioning
HWT	high water temperature
Hz	hertz (cycles per second)
IBC	International Building Code
IC	integrated circuit
ID	inside diameter, identification
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IMS	improved motor starting
in.	inch
in. H_2O	inches of water
in. Hg	inches of mercury
in. lb.	inch pounds
Inc.	incorporated
ind.	industrial
int.	internal
int./ext.	internal/external
I/O	input/output
IP	internet protocol
ISO	International Organization for Standardization
J	joule
JIS	Japanese Industry Standard
k	kilo (1000)
K	kelvin
kA	kiloampere
KB	kilobyte (2^{10} bytes)
KBus	Kohler communication protocol
kg	kilogram

kg/cm^2	kilograms per square centimeter
kgm	kilogram-meter
kg/m^3	kilograms per cubic meter
kHz	kilohertz
kJ	kilojoule
km	kilometer
kOhm, kΩ	kilo-ohm
kPa	kilopascal
kph	kilometers per hour
kV	kilovolt
kVA	kilovolt ampere
kVAR	kilovolt ampere reactive
kW	kilowatt
kWh	kilowatt-hour
kWm	kilowatt mechanical
kWth	kilowatt-thermal
L	liter
LAN	local area network
L x W x H	length by width by height
lb.	pound, pounds
lbm/ft^3	pounds mass per cubic feet
LCB	line circuit breaker
LCD	liquid crystal display
LED	light emitting diode
Lph	liters per hour
Lpm	liters per minute
LOP	low oil pressure
LP	liquefied petroleum
LPG	liquefied petroleum gas
LS	left side
L_{wa}	sound power level, A weighted
LWL	low water level
LWT	low water temperature
m	meter, milli (1/1000)
M	mega (10^6 when used with SI units), male
m^3	cubic meter
$m^3/hr.$	cubic meters per hour
$m^3/min.$	cubic meters per minute
mA	milliampere
man.	manual
max.	maximum
MB	megabyte (2^{20} bytes)
MCCB	molded-case circuit breaker
MCM	one thousand circular mils
meggar	megohmmeter
MHz	megahertz
mi.	mile
mil	one one-thousandth of an inch
min.	minimum, minute
misc.	miscellaneous
MJ	megajoule
mJ	millijoule
mm	millimeter
mOhm, mΩ	milliohm
MOhm, MΩ	megohm
MOV	metal oxide varistor
MPa	megapascal
mpg	miles per gallon
mph	miles per hour
MS	military standard
ms	millisecond
m/sec.	meters per second
mtg.	mounting
MTU	Motoren-und Turbinen-Union
MW	megawatt
mW	milliwatt
μF	microfarad
N, norm.	normal (power source)
NA	not available, not applicable
nat. gas	natural gas
NBS	National Bureau of Standards
NC	normally closed
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
Nm	newton meter
NO	normally open
no., nos.	number, numbers
NPS	National Pipe, Straight
NPSC	National Pipe, Straight-coupling
NPT	National Standard taper pipe thread per general use
NPTF	National Pipe, Taper-Fine
NR	not required, normal relay
ns	nanosecond
OC	overcrank
OD	outside diameter
OEM	original equipment manufacturer
OF	overfrequency
opt.	option, optional
OS	oversize, overspeed
OSHA	Occupational Safety and Health Administration
OV	overvoltage
oz.	ounce
p., pp.	page, pages
PC	personal computer
PCB	printed circuit board
pF	picofarad
PF	power factor
ph., ∅	phase
PHC	Phillips® head Crimptite® (screw)
PHH	Phillips® hex head (screw)
PHM	pan head machine (screw)
PLC	programmable logic control
PMG	permanent magnet generator
pot	potentiometer, potential
ppm	parts per million
PROM	programmable read-only memory
psi	pounds per square inch
psig	pounds per square inch gauge
pt.	pint
PTC	positive temperature coefficient
PTO	power takeoff
PVC	polyvinyl chloride
qt.	quart, quarts
qty.	quantity
R	replacement (emergency) power source
rad.	radiator, radius
RAM	random access memory
RDO	relay driver output
ref.	reference
rem.	remote
Res/Coml	Residential/Commercial
RFI	radio frequency interference
RH	round head
RHM	round head machine (screw)
rly.	relay
rms	root mean square
rnd.	round
RO	read only
ROM	read only memory
rot.	rotate, rotating
rpm	revolutions per minute
RS	right side
RTDs	Resistance Temperature Detectors
RTU	remote terminal unit
RTV	room temperature vulcanization
RW	read/write
SAE	Society of Automotive Engineers
scfm	standard cubic feet per minute
SCR	silicon controlled rectifier
s, sec.	second
SI	*Systeme international d'unites,* International System of Units
SI/EO	side in/end out
sil.	silencer
SMTP	simple mail transfer protocol
SN	serial number
SNMP	simple network management protocol
SPDT	single-pole, double-throw
SPST	single-pole, single-throw
spec	specification
specs	specification(s)
sq.	square
sq. cm	square centimeter
sq. in.	square inch
SMS	short message service
SS	stainless steel
std.	standard
stl.	steel
tach.	tachometer
TB	terminal block
TCP	transmission control protocol
TD	time delay
TDC	top dead center
TDEC	time delay engine cooldown
TDEN	time delay emergency to normal
TDES	time delay engine start
TDNE	time delay normal to emergency
TDOE	time delay off to emergency
TDON	time delay off to normal
temp.	temperature
term.	terminal
THD	total harmonic distortion
TIF	telephone influence factor
tol.	tolerance
turbo.	turbocharger
typ.	typical (same in multiple locations)
UF	underfrequency
UHF	ultrahigh frequency
UIF	user interface
UL	Underwriter's Laboratories, Inc.
UNC	unified coarse thread (was NC)
UNF	unified fine thread (was NF)
univ.	universal
URL	uniform resource locator (web address)
US	undersize, underspeed
UV	ultraviolet, undervoltage
V	volt
VAC	volts alternating current
VAR	voltampere reactive
VDC	volts direct current
VFD	vacuum fluorescent display
VGA	video graphics adapter
VHF	very high frequency
W	watt
WCR	withstand and closing rating
w/	with
WO	write only
w/o	without
wt.	weight
xfmr	transformer

Appendix B Common Hardware Application Guidelines

Use the information below and on the following pages to identify proper fastening techniques when no specific reference for reassembly is made.

Bolt/Screw Length: When bolt/screw length is not given, use Figure 1 as a guide. As a general rule, a minimum length of one thread beyond the nut and a maximum length of 1/2 the bolt/screw diameter beyond the nut is the preferred method.

Washers and Nuts: Use split lock washers as a bolt locking device where specified. Use SAE flat washers with whiz nuts, spiralock nuts, or standard nuts and preloading (torque) of the bolt in all other applications.

See Appendix C, General Torque Specifications, and other torque specifications in the service literature.

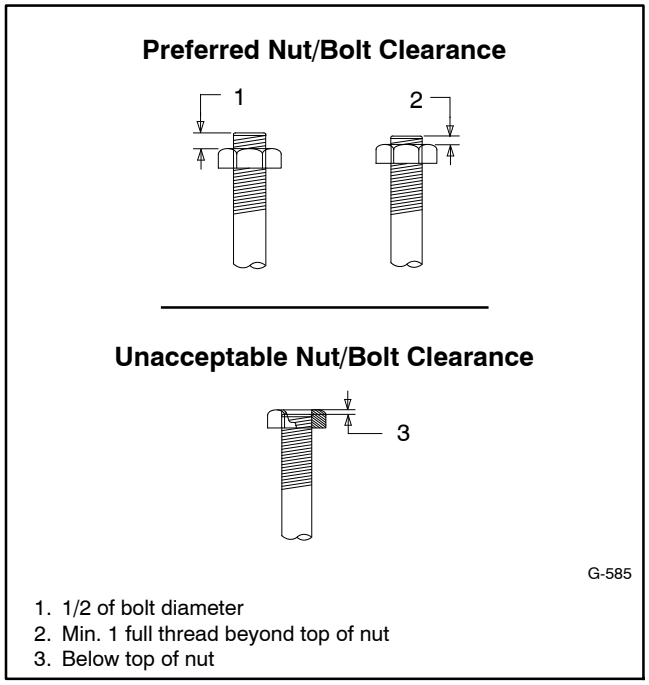


Figure 1 Acceptable Bolt Lengths

Steps for common hardware application:

1. Determine entry hole type: round or slotted.

2. Determine exit hole type: fixed female thread (weld nut), round, or slotted.

   For round and slotted exit holes, determine if hardware is greater than 1/2 inch in diameter, or 1/2 inch in diameter or less. Hardware that is *greater than 1/2 inch* in diameter takes a standard nut and SAE washer. Hardware *1/2 inch or less* in diameter can take a properly torqued whiz nut or spiralock nut. See Figure 2.

3. Follow these SAE washer rules after determining exit hole type:

   a. Always use a washer between hardware and a slot.

   b. Always use a washer under a nut (see 2 above for exception).

   c. Use a washer under a bolt when the female thread is fixed (weld nut).

4. Refer to Figure 2, which depicts the preceding hardware configuration possibilities.

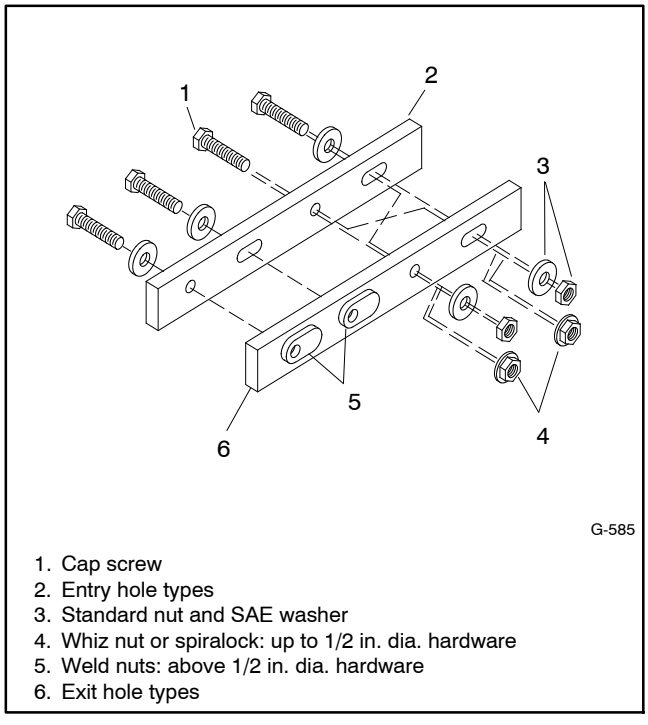


Figure 2 Acceptable Hardware Combinations

Appendix C General Torque Specifications

American Standard Fasteners Torque Specifications								
Size	Torque Measurement	Assembled into Cast Iron or Steel						Assembled into Aluminum Grade 2 or 5
		Grade 2		Grade 5		Grade 8		
8-32	Nm (in. lb.)	1.8	(16)	2.3	(20)	—		See Note 3
10-24	Nm (in. lb.)	2.9	(26)	3.6	(32)	—		
10-32	Nm (in. lb.)	2.9	(26)	3.6	(32)	—		
1/4-20	Nm (in. lb.)	6.8	(60)	10.8	(96)	14.9	(132)	
1/4-28	Nm (in. lb.)	8.1	(72)	12.2	(108)	16.3	(144)	
5/16-18	Nm (in. lb.)	13.6	(120)	21.7	(192)	29.8	(264)	
5/16-24	Nm (in. lb.)	14.9	(132)	23.1	(204)	32.5	(288)	
3/8-16	Nm (ft. lb.)	24	(18)	38	(28)	53	(39)	
3/8-24	Nm (ft. lb.)	27	(20)	42	(31)	60	(44)	
7/16-14	Nm (ft. lb.)	39	(29)	60	(44)	85	(63)	
7/16-20	Nm (ft. lb.)	43	(32)	68	(50)	95	(70)	
1/2-13	Nm (ft. lb.)	60	(44)	92	(68)	130	(96)	
1/2-20	Nm (ft. lb.)	66	(49)	103	(76)	146	(108)	
9/16-12	Nm (ft. lb.)	81	(60)	133	(98)	187	(138)	
9/16-18	Nm (ft. lb.)	91	(67)	148	(109)	209	(154)	
5/8-11	Nm (ft. lb.)	113	(83)	183	(135)	259	(191)	
5/8-18	Nm (ft. lb.)	128	(94)	208	(153)	293	(216)	
3/4-10	Nm (ft. lb.)	199	(147)	325	(240)	458	(338)	
3/4-16	Nm (ft. lb.)	222	(164)	363	(268)	513	(378)	
1-8	Nm (ft. lb.)	259	(191)	721	(532)	1109	(818)	
1-12	Nm (ft. lb.)	283	(209)	789	(582)	1214	(895)	

Metric Fasteners Torque Specifications, Measured in Nm (ft. lb.)								
Size (mm)	Assembled into Cast Iron or Steel						Assembled into Aluminum Grade 5.8 or 8.8	
	Grade 5.8		Grade 8.8		Grade 10.9			
M6 x 1.00	6.2	(4.6)	9.5	(7)	13.6	(10)	See Note 3	
M8 x 1.25	15	(11)	23	(17)	33	(24)		
M8 x 1.00	16	(11)	24	(18)	34	(25)		
M10 x 1.50	30	(22)	45	(34)	65	(48)		
M10 x 1.25	31	(23)	47	(35)	68	(50)		
M12 x 1.75	53	(39)	80	(59)	115	(85)		
M12 x 1.50	56	(41)	85	(63)	122	(90)		
M14 x 2.00	83	(61)	126	(93)	180	(133)		
M14 x 1.50	87	(64)	133	(98)	190	(140)		
M16 x 2.00	127	(94)	194	(143)	278	(205)		
M16 x 1.50	132	(97)	201	(148)	287	(212)		
M18 x 2.50	179	(132)	273	(201)	390	(288)		
M18 x 1.50	189	(140)	289	(213)	413	(305)		
M20 x 2.50	245	(181)	374	(276)	535	(395)		
M20 x 1.50	264	(195)	402	(297)	576	(425)		
M22 x 2.50	332	(245)	507	(374)	725	(535)		
M22 x 1.50	351	(259)	535	(395)	766	(565)		
M24 x 3.00	425	(314)	649	(479)	928	(685)		
M24 x 2.00	447	(330)	682	(503)	976	(720)		
M27 x 3.00	—		937	(692)	1341	(990)		
M27 x 2.00	—		985	(727)	1409	(1040)		
M30 x 3.50	—		1278	(943)	1829	(1350)		
M30 x 2.00	—		1349	(996)	1931	(1425)		

Notes:

1. The torque values above are general guidelines. Always use the torque values specified in the service manuals and/or assembly drawings when they differ from the above torque values.
2. The torque values above are based on new plated threads. Increase torque values by 15% if non-plated threads are used.
3. Hardware threaded into aluminum must have either two diameters of thread engagement or a 30% or more reduction in the torque to prevent stripped threads.
4. Torque values are calculated as equivalent stress loading on American hardware with an approximate preload of 90% of the yield strength and a friction coefficient of 0.125.

Physical Property @ 15°C (60°F)	Butane	Propane	Natural Gas	Manufactured or Sewage Gas	Gasoline	Diesel Fuel
Normal atmospheric state	Gas	Gas	Gas	Gas	Liquid	Liquid
Boiling point,						
Initial, °C (°F)	—	—	—	—	36 (97)	177 (350)
End, °C (°F)	0 (32)	42 (-44)	-162 (-259)	—	216 (420)	357 (675)
Heating value, Btu						
/gal. (net, LHV*)	94670	83340	63310	—	116400	130300
/gal. (gross)	102032	91500	—	—	124600	139000
/ft^3 (gas)	3264	2516	1000	600-700	6390	—
Density, Ft^3 of gas/gal.	31.26	36.39	57.75	—	19.5	—
Wt./gal. liquid, lb.	4.81	4.24	2.65	—	6.16	7.08
Octane Number						
Research	94	110+	110+	—	80-100	—
Motor	90	97	—	—	75-90	—
* Lower Heating Value						

Figure 3 Engine Fuels, Physical Properties

Characteristic, LP Gas*	Butane	Propane
Formula	C_4H_{10}	C_3H_8
Boiling point, °C (°F)	0 (32)	-42 (-44)
Specific gravity of gas (air = 1.00)	2.00	1.53
Specific gravity of liquid (water = 1.00)	0.58	0.51
Btu/lb. of gas	21221	21591
Ft.^{3} of vapor at 16°C (60°F)/lb. of liquid at 16°C (60°F)	6.506	8.547
Latent heat of vaporization at boiling point, Btu/gal.	808.0	785.0
Combustion Data:	31.02	23.86
Ft^3 air required to burn 1 ft.^{3} of gas	N/A	-104 (-156)
Flash point, °C (°F)	482-538	493-549
Ignition temperature in air, °C (°F)	(900-1000)	(920-1020)
Max. flame temperature in air, °C (°F)	1991 (3615)	1979 (3595)
Limits of inflammability, percentage of gas in air mixture:		
At lower limit, %	1.9	2.4
At upper limit, %	8.6	9.6
Octane Number (ISO-Octane = 100)	92	Over 100
* Commercial quality. Figures shown in this chart represent average values.		

Figure 4 Additional LP Gas Characteristics

Appendix E Gas Fuel Vapor Pressures

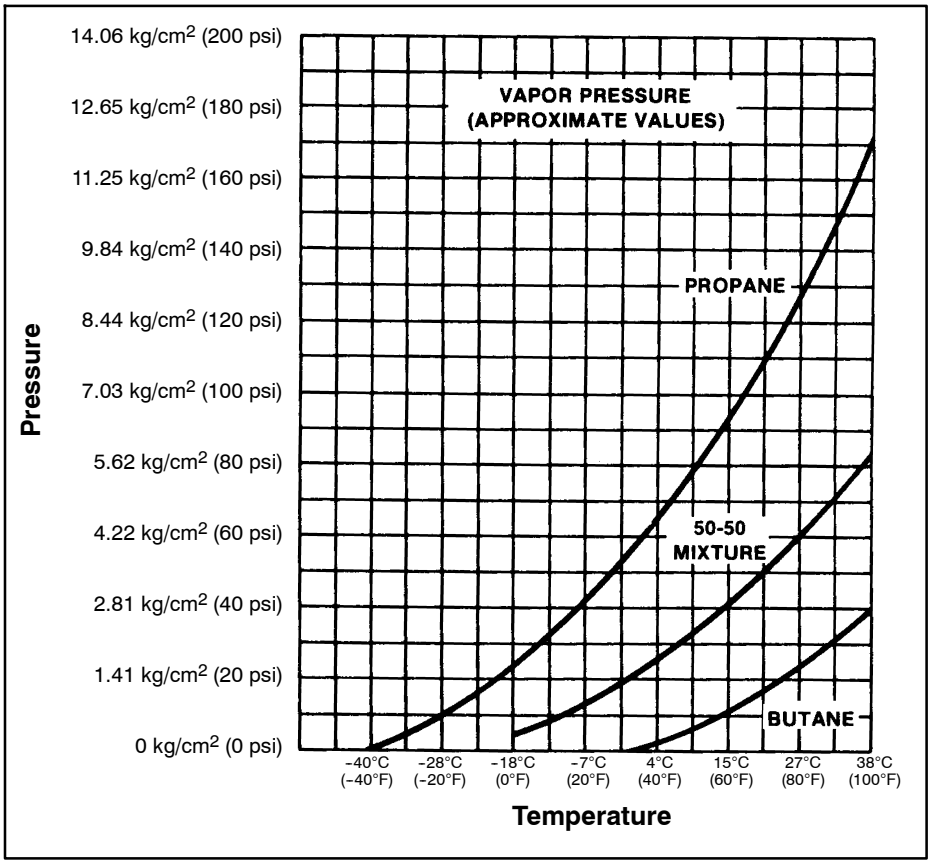


Figure 1 Vapor Pressures of LP Gases Graph

Temperature, °C (°F)	Approximate Pressure, kg/cm2 (PSIG)		
	Propane	50/50 Mixture	Butane
-40 (-40)	0.1 (1)	—	—
-36 (-33)	0.4 (5)	—	—
-28 (-20)	0.7 (10)	—	—
-23 (-10)	1.2 (17)	0.2 (3)	—
-18 (0)	1.7 (24)	0.4 (5)	—
-12 (10)	2.2 (32)	0.6 (8)	—
-7 (20)	3.0 (42)	0.9 (13)	—
-1 (30)	3.7 (52)	1.3 (19)	—
4 (40)	4.6 (65)	1.8 (26)	0.1 (2)
10 (50)	5.5 (78)	2.4 (34)	0.5 (7)
15 (60)	6.5 (93)	3.0 (42)	0.8 (12)
21 (70)	7.7 (109)	3.5 (50)	1.2 (17)
27 (80)	9.6 (136)	4.2 (60)	1.7 (24)
32 (90)	10.3 (147)	5.1 (72)	2.2 (32)
38 (100)	11.9 (169)	6.0 (85)	2.8 (40)
43 (110)	14.1 (200)	7.0 (100)	3.5 (50)

Figure 2 Vapor Pressures of LP Gases Table

Determining Propane Cylinder Quantity

Guide for Installing 100 lb. Cylinders

For continuous draws where temperatures may reach –18°C (0°F). Assume the vaporization rate of 100 lb. cylinder as approximately 50000 Btu/hr.

Number of cylinders/side = $\frac{\text{Total load in Btu}}{50000}$

Example:

Assume total load = 20000 Btu/hour.

Cylinders/side = $\frac{20000}{50000}$ = 4 cylinders/side

The chart in Figure 1 shows the vaporization rate of containers in terms of the temperature of the liquid and the wet surface area of the container. When the temperature is lower or if the container contains less liquid, the vaporization rate of the container is a lower value.

Lb. of Propane in Cyl.	Maximum Continuous Draw In Btu/Hour At Various Temperatures In °C (°F)				
	–18°C (0°F)	–7°C (20°F)	4°C (40°F)	16°C (60°F)	21°C (70°F)
100	113000	167000	214000	277000	300000
90	104000	152000	200000	247000	277000
80	94000	137000	180000	214000	236000
70	83000	122000	160000	199000	214000
60	75000	109000	140000	176000	192000
50	64000	94000	125000	154000	167000
40	55000	79000	105000	131000	141000
30	45000	66000	85000	107000	118000
20	36000	51000	68000	83000	92000
10	28000	38000	49000	60000	66000

Figure 1 Vaporization Rate, 100 lb. Propane Cylinders, Approximate

Determining Propane Vaporization Capacity

Guide for ASME LP Gas Storage Containers

% of Container Filled	K Equals	Propane* Vaporization Capacity at –18°C (0°F) in Btu/Hr.†
60	100	D x L x 100
50	90	D x L x 90
40	80	D x L x 80
30	70	D x L x 70
20	60	D x L x 60
10	45	D x L x 45

* These formulae allow for the temperature of the liquid to refrigerate to –29°C (–20°F), producing a temperature differential of –7°C (20°F) for the transfer of heat from the air to the container's *wetted* surface and then into the liquid. The vapor space area of the vessel is not considered since its effect is negligible.

† D=outside diameter in inches
L=overall length in inches
K=constant for percent volume of liquid in container.

Figure 2 Propane Vaporization Capacity

Vaporizing Capacities for Other Air Temperatures

Multiply the results obtained with the formulae in Figure 2 by one of the factors in the following table for the prevailing air temperature.

Prevailing Air Temperature	Multiplier
–26°C (–15°F)	0.25
–23°C (–10°F)	0.50
–21°C (–5°F)	0.75
–18°C (0°F)	1.00
–15°C (5°F)	1.25
–12°C (10°F)	1.50
–26°C (15°F)	1.75
–7°C (20°F)	2.00

Figure 3 Propane Vaporization Temperature

Notes

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Original Instructions (English)

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13.5 L OEM Diesel Engines (Tier 3/Stage III A Platform)

OPERATOR'S MANUAL

13.5 L OEM Diesel Engines (Tier 3/Stage III A Platform)

OMRG36873 ISSUE 13JAN17 (ENGLISH)

CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

If this product contains a gasoline engine:

⚠ WARNING

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

The State of California requires the above two warnings.

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John Deere Power Systems

Worldwide Edition

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TP-6787 01/17

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RG24614 —UN—21OCT13

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ZE59858,000025E -19-05NOV15-1/1

Foreword

READ THIS MANUAL carefully to learn how to operate and service your engine correctly. Failure to do so could result in personal injury or equipment damage.

THIS MANUAL SHOULD BE CONSIDERED a permanent part of your engine and should remain with the engine when you sell it.

MEASUREMENTS IN THIS MANUAL are given in both metric and customary U.S. unit equivalents. Use only correct replacement parts and fasteners. Metric and inch fasteners may require a specific metric or inch wrench.

RIGHT-HAND AND LEFT-HAND sides are determined by standing at the drive or flywheel end (rear) of the engine and facing toward the front of the engine.

WRITE ENGINE SERIAL NUMBERS and option codes in the spaces indicated in the Record Keeping section. Accurately record all the numbers. Your dealer also needs these numbers when you order parts. File the identification numbers in a secure place off the engine.

SETTING FUEL DELIVERY beyond published factory specifications or otherwise overpowering will result in loss of warranty protection for this engine.

CERTAIN ENGINE ACCESSORIES such as radiator, air cleaner, and instruments are optional equipment on John Deere OEM Engines. These accessories may be provided by the equipment manufacturer instead of John Deere. This operator's manual applies only to the engine and those options available through the John Deere distribution network.

NOTE: This operator's manual covers only engines provided to OEM (Original Equipment Manufacturers). For engines in Deere machines, refer to the machine operator's manual.

This manual covers primarily the PowerTech Plus 13.5 L (6135HF485) OEM engines. These engines meet emission standards for EPA Tier 3 and EU Stage III A. Other emission tiers of this engine size may be located in this manual based on the cover title.

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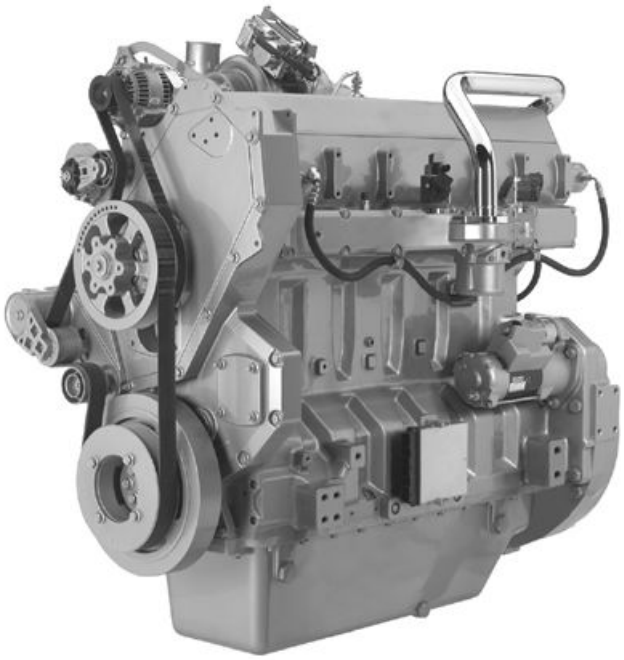
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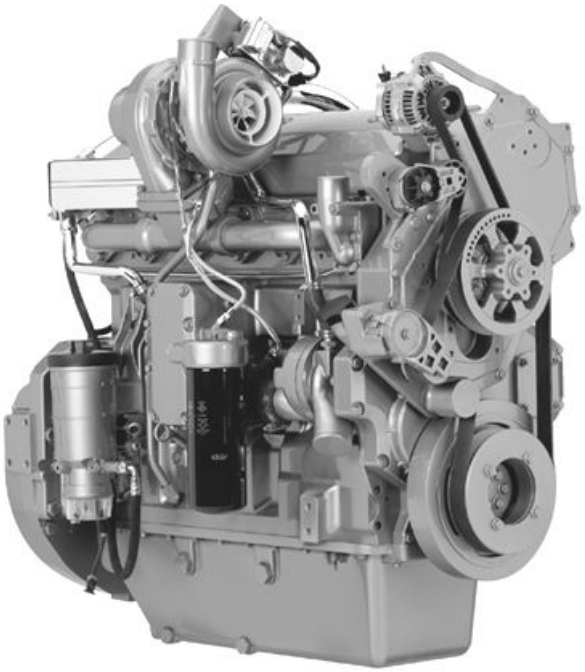
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Engine Identification Views



RG13885 —UN—19MAY05

13.5L Engine - Left Front View



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13.5L Engine - Right Front View

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Record Engine Serial Number

The engine serial number plate (C) is located on the left-hand side of engine block between intake manifold and starter motor.

Record all of the numbers and letters found on your engine serial number plate in the spaces provided below.

This information is very important for repair parts or warranty information.

Engine Serial Number (A)

_____

Engine Model Number (B)

_____

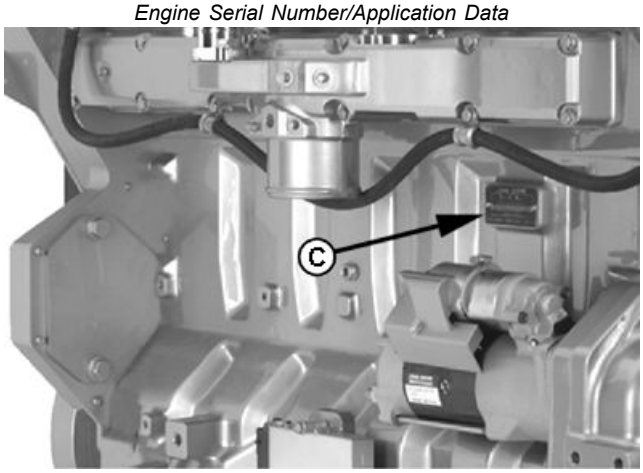
NOTE: On engine serial number (A) the 7th digit shows the emission level as follows:

- *"B" for non-certified engines*
- *"C" for Tier 1 / Stage I engines*
- *"G" for Tier 2 / Stage II engines*
- *"L" for Tier 3 / Stage IIIA engines*



RG14798 —UN—23JUN06

Engine Serial Number/Application Data



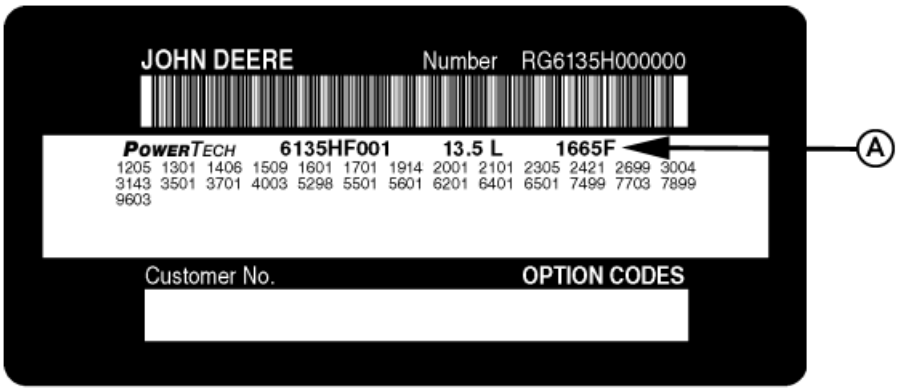
RG13887 —UN—26JUL05

Location of Engine Serial Number Plate

A—Engine Serial Number
B—Engine Model Number
C—Engine Serial Number Plate

OURGP11,000004B -19-12SEP06-1/1

Engine Option Codes



RG13880 —UN—06JUL05

Option Code Label

A—Base Engine Code

NOTE: Your engine option code label may not contain all option codes if an option has been added after the engine left the producing factory.

If option label is lost or destroyed, consult your servicing dealer or engine distributor selling the engine for a replacement.

In addition to the serial number plate, OEM engines have an engine option code label affixed to the valve cover. These codes indicate which of the engine options were installed on your engine at the factory. When in need of parts or service, furnish your authorized servicing dealer or engine distributor with these numbers.

The engine option code label includes an base engine code (A) (1665F, bold print in label above). Record this code along with option codes on following page.

The first two digits of each code identify a specific group, such as alternators. The last two digits of each code identify one specific option provided on your engine, such as a 24-volt, 60-amp alternator.

If an engine is ordered without a particular component, the last two digits of that functional group option code will be 99, 00, or XX. The list on the next page shows only the first two digits of the code numbers. For future reference, such as ordering repair parts, it is important to have these code numbers available. To ensure this availability, enter the third and fourth digits shown on your engine option code label in the spaces provided on the following page.

Base Engine Code_____(See "A" on previous page.)

Option Codes	Description	Option Codes	Description
11_____	Valve Cover	51_____	Cylinder Head With Valves
12_____	Oil Fill Inlet	52_____	Auxiliary Gear Drive
13_____	Crankshaft Pulley/Damper	53_____	Fuel Heater
14_____	Flywheel Housing	54_____	Air Intake for Turbocharger
15_____	Flywheel	55_____	Shipping Stand
16_____	Fuel Injection Pump	56_____	Paint Option
17_____	Air Inlet	57_____	Coolant Pump Inlet
18_____	Air Cleaner	59_____	Oil Cooler
19_____	Oil Pan	60_____	Add-on Auxiliary Drive Pulley
20_____	Coolant Pump	62_____	Alternator Mounting Bracket
21_____	Thermostat Cover	63_____	Low Pressure Fuel Line
22_____	Thermostat	64_____	Exhaust Elbow
23_____	Fan Drive	65_____	Turbocharger
24_____	Fan Belt	66_____	Coolant Temperature Switch
25_____	Fan	67_____	Electronic Sensors (Base Engine)
26_____	Engine Coolant Heater	68_____	Crankshaft Rear Damper
27_____	Radiator	69_____	Engine Serial Number Plate
28_____	Exhaust Manifold	71_____	Engine Oil Bypass Filter
29_____	Crankcase Ventilator System	72_____	ECU Electronic Software Option
30_____	Starter Motor	74_____	Air Conditioning (Freon) Compressor

Continued on next page

Option Codes	Description	Option Codes	Description
31	Alternator	75	Air Restriction Indicator
32	Instrument Panel	76	Pressure Switches and Sensors
33	Tachometer	77	Timing Gear Cover
35	Fuel Filters	78	Air Compressor
36	Front Plate	79	Engine Certification
37	Fuel Transfer Pump	81	Primary Fuel Filter And Water Separator
39	Thermostat Housing	83	Electronic Software (Vehicle Option)
40	Oil Dipstick	84	Electrical Wiring Harness
41	Belt-Driven Front Auxiliary Drive	86	Fan Pulley
43	Starting Aid	87	Belt Tensioner
44	Timing Gear Cover With Gears	88	Oil Filter
45	Balancer Shafts	89	Exhaust Gas Recirculating (EGR) System
46	Cylinder Block With Liners and Camshaft	95	Special Equipment (Factory Installed)
47	Crankshaft and Bearings	96	Engine Installation Kit
48	Connecting Rods and Pistons	97	Special Equipment (Field Installed)
49	Valve Actuating Mechanism	98	Shipping (Engine Hanger Straps)
50	Oil Pump	99	Service Only Items

NOTE: These option codes are based on the latest information available at the time of publication.

The right is reserved to make changes at any time without notice.

OURGP11,000007F -19-11OCT06-2/2

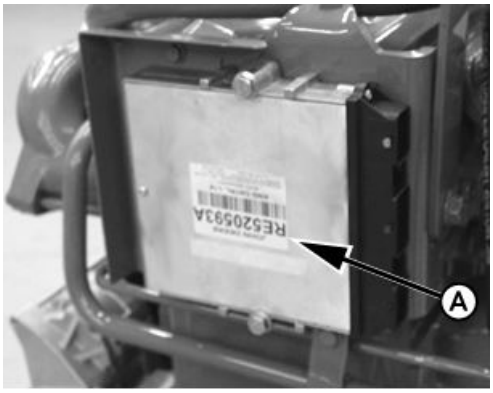
Record Engine Control Unit (ECU) Serial Number

Record the part number and serial number information found on the serial number label (A) on the Engine Control Unit (ECU) mounted on or near the engine.

Part No._____

Serial No._____

A—Serial Number Label



RG13891 —UN—14JUN05

Record Engine Control Unit (ECU) Serial Number

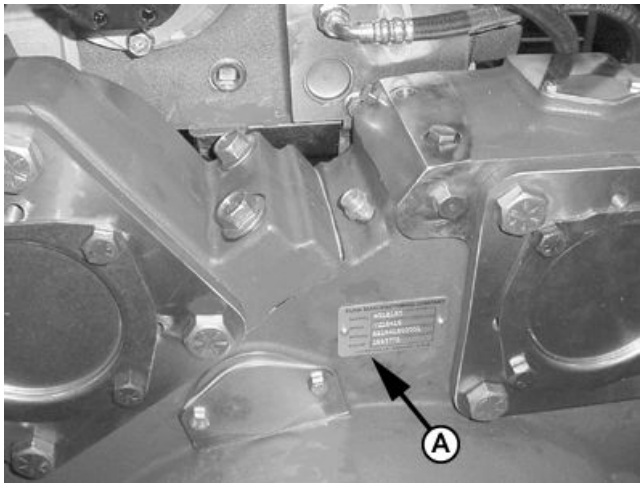
OURGP12,0000125 -19-12SEP06-1/1

Record Rear Power Take-Off (PTO) Serial Number (If Equipped)

Record the rear power take-off (PTO) serial number found on rear PTO serial number plate (A) (if equipped).

Rear PTO Serial Number

_____

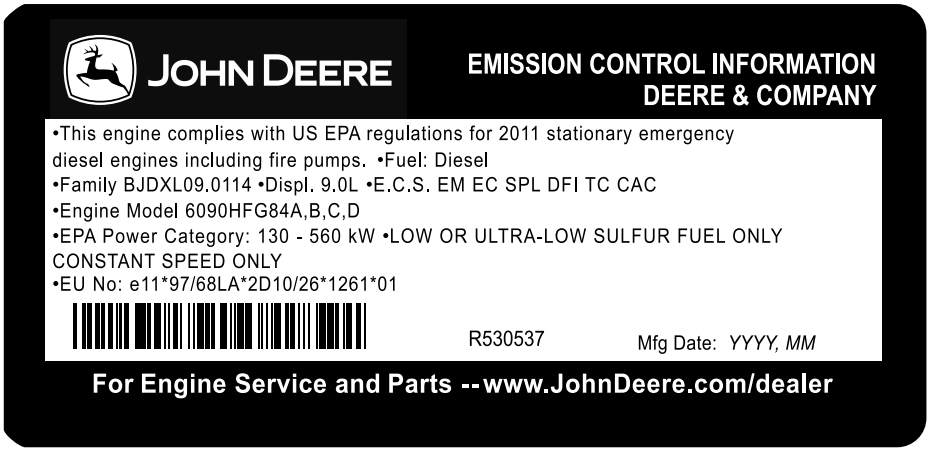


RG12594 —UN—24SEP02

Rear PTO Serial Number Plate

OUOD006,0000066 -19-12SEP06-1/1

Emergency Stationary Engine Rule



RG19597 —UN—20OCT10

Emissions Label

Emissions Label

After Tier 4 standards take effect, engine manufacturers of emergency stationary engines that do not meet the standards for non-emergency engines must add to each such emergency engine a permanent label (such as the emission label as shown) which states that the engine is limited to stationary emergency use. On John Deere engines this is stated in the EPA emission label on each engine.

Fuel Requirements

Beginning 01 Oct 10, owners and operators of stationary engines that use diesel fuel must only use diesel fuel meeting the requirements of 40 CFR 80.510 (b), which requires that diesel fuel have a maximum sulfur content of 15 PPM and either a minimum cetane index of 40 or a maximum aromatic content of 35 volume percent.

Operation, Maintenance and Testing

The operation of emergency engines is limited to emergency operations and required maintenance and testing.

There is no time limit on the use of emergency stationary engines in emergency situations.

Maintenance and testing is limited to 100 hours per year. The EPA has also included a provision that allows anyone to petition the Administrator for additional hours, beyond the allowed 100 hours per year, if such additional hours should prove to be necessary for maintenance and testing reasons. The EPA will not require a petition for additional hours if the hours beyond 100 hours per year for maintenance and testing purposes are mandated by regulation such as State or Local requirements.

KW40574,0000003 -19-12MAY16-1/1

Understand Signal Words



TS187 —19—30SEP88

DANGER; The signal word DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING; The signal word WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION; The signal word CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury. CAUTION may also be used to alert against unsafe practices associated with events which could lead to personal injury.

A signal word—DANGER, WARNING, or CAUTION—is used with the safety-alert symbol. DANGER identifies the most serious hazards. DANGER or WARNING safety signs are located near specific hazards. General precautions are listed on CAUTION safety signs. CAUTION also calls attention to safety messages in this manual.

DX,SIGNAL -19-05OCT16-1/1

Recognize Safety Information

This is a safety-alert symbol. When you see this symbol on your machine or in this manual, be alert to the potential for personal injury.

Follow recommended precautions and safe operating practices.



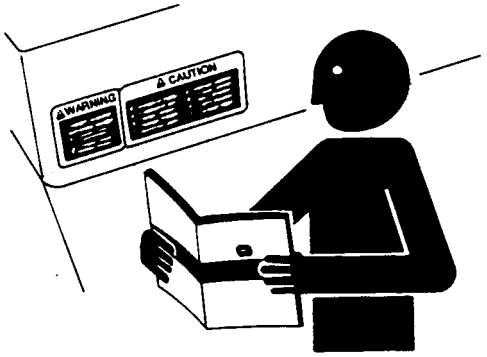
T81389 —UN—28JUN13

DX,ALERT -19-29SEP98-1/1

Replace Safety Signs

Replace missing or damaged safety signs. Use this operator's manual for correct safety sign placement.

There can be additional safety information contained on parts and components sourced from suppliers that is not reproduced in this operator's manual.



TS201 —UN—15APR13

DX,SIGNS -19-18AUG09-1/1

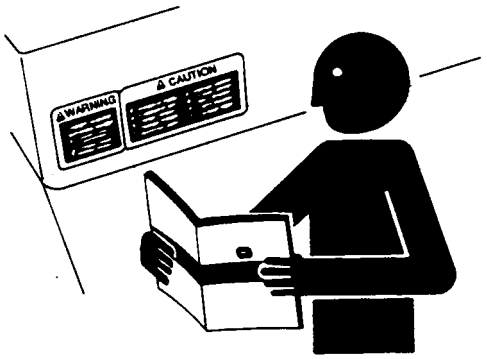
Follow Safety Instructions

Carefully read all safety messages in this manual and on your machine safety signs. Keep safety signs in good condition. Replace missing or damaged safety signs. Be sure new equipment components and repair parts include the current safety signs. Replacement safety signs are available from your John Deere dealer.

There can be additional safety information contained on parts and components sourced from suppliers that is not reproduced in this operator's manual.

Learn how to operate the machine and how to use controls properly. Do not let anyone operate without instruction.

Keep your machine in proper working condition. Unauthorized modifications to the machine may impair the function and/or safety and affect machine life.



TS201 —UN—15APR13

If you do not understand any part of this manual and need assistance, contact your John Deere dealer.

DX,READ -19-16JUN09-1/1

California Proposition 65 Warning

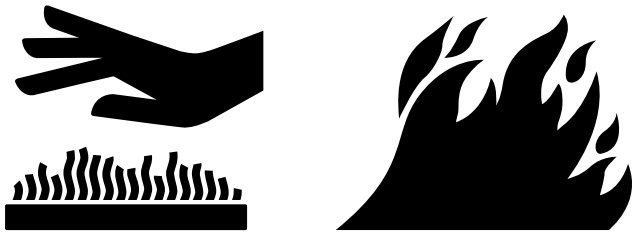
Diesel engine exhaust, some of its constituents, along with certain machine components contain or emit chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. In addition, certain fluids contained in the machine and certain products of component wear contain or emit chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

RG41061,000001F -19-12JAN10-1/1

Avoid Hot Exhaust

Servicing machine or attachments with engine running can result in serious personal injury. Avoid exposure and skin contact with hot exhaust gases and components.

Exhaust parts and streams become very hot during operation. Exhaust gases and components reach temperatures hot enough to burn people, ignite, or melt common materials.



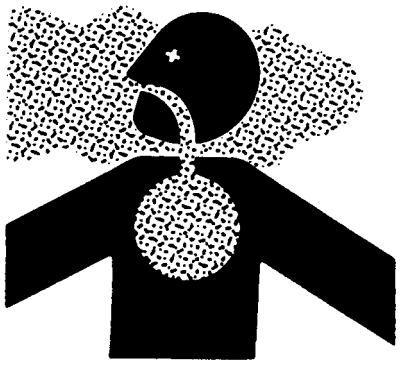
RG17488 —UN—21AUG09

DX,EXHAUST -19-20AUG09-1/1

Work In Ventilated Area

Engine exhaust fumes can cause sickness or death. If it is necessary to run an engine in an enclosed area, remove the exhaust fumes from the area with an exhaust pipe extension.

If you do not have an exhaust pipe extension, open the doors and get outside air into the area.



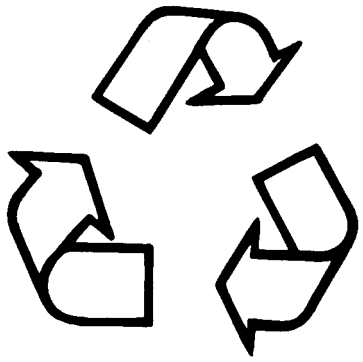
TS220 —UN—15APR13

DX,AIR -19-17FEB99-1/1

Decommissioning — Proper Recycling and Disposal of Fluids and Components

Safety and environmental stewardship measures must be taken into account when decommissioning a machine and/or component. These measures include the following:

- Use appropriate tools and personal protective equipment such as clothing, gloves, face shields or glasses, during the removal or handling of objects and materials.
- Follow instructions for specialized components.
- Release stored energy by lowering suspended machine elements, relaxing springs, disconnecting the battery or other electrical power, and releasing pressure in hydraulic components, accumulators, and other similar systems.
- Minimize exposure to components which may have residue from agricultural chemicals, such as fertilizers and pesticides. Handle and dispose of these components appropriately.
- Carefully drain engines, fuel tanks, radiators, hydraulic cylinders, reservoirs, and lines before recycling components. Use leak-proof containers when draining fluids. Do not use food or beverage containers.
- Do not pour waste fluids onto the ground, down a drain, or into any water source.
- Observe all national, state, and local laws, regulations, or ordinances governing the handling or disposal of waste fluids (example: oil, fuel, coolant, brake fluid);



TS1133 —UN—15APR13

filters; batteries; and, other substances or parts. Burning of flammable fluids or components in other than specially designed incinerators may be prohibited by law and could result in exposure to harmful fumes or ashes.

- Service and dispose of air conditioning systems appropriately. Government regulations may require a certified service center to recover and recycle air conditioning refrigerants which could damage the atmosphere if allowed to escape.
- Evaluate recycling options for tires, metal, plastic, glass, rubber, and electronic components which may be recyclable, in part or completely.
- Contact your local environmental or recycling center, or your John Deere dealer for information on the proper way to recycle or dispose of waste.

DX,DRAIN -19-01JUN15-1/1

Prevent Machine Runaway

Avoid possible injury or death from machinery runaway.

Do not start engine by shorting across starter terminals. Machine will start in gear if normal circuitry is bypassed.

NEVER start engine while standing on ground. Start engine only from operator's seat, with transmission in neutral or park.



TS177 —UN—11JAN89

DX,BYPAS1 -19-29SEP98-1/1

Practice Safe Maintenance

Understand service procedure before doing work. Keep area clean and dry.

Never lubricate, service, or adjust machine while it is moving. Keep hands, feet , and clothing from power-driven parts. Disengage all power and operate controls to relieve pressure. Lower equipment to the ground. Stop the engine. Remove the key. Allow machine to cool.

Securely support any machine elements that must be raised for service work.

Keep all parts in good condition and properly installed. Fix damage immediately. Replace worn or broken parts. Remove any buildup of grease, oil, or debris.

On self-propelled equipment, disconnect battery ground cable (-) before making adjustments on electrical systems or welding on machine.

On towed implements, disconnect wiring harnesses from tractor before servicing electrical system components or welding on machine.



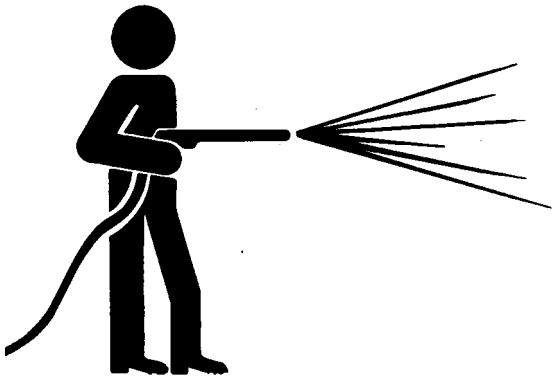
TS218 —UN—23AUG88

DX,SERV -19-17FEB99-1/1

Work in Clean Area

Before starting a job:

- Clean work area and machine.
- Make sure you have all necessary tools to do your job.
- Have the right parts on hand.
- Read all instructions thoroughly; do not attempt shortcuts.



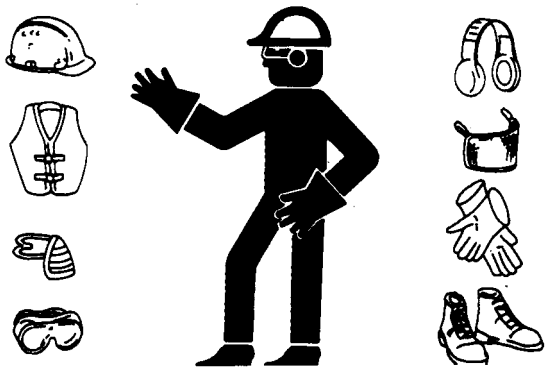
T6642EJ —UN—18OCT88

DX,CLEAN -19-04JUN90-1/1

Wear Protective Clothing

Wear close fitting clothing and safety equipment appropriate to the job.

Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating machine.



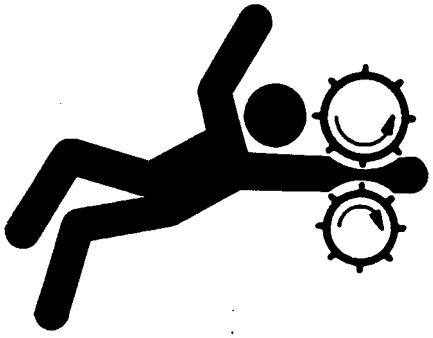
TS206 —UN—15APR13

DX,WEAR2 -19-03MAR93-1/1

Service Machines Safely

Tie long hair behind your head. Do not wear a necktie, scarf, loose clothing, or necklace when you work near machine tools or moving parts. If these items were to get caught, severe injury could result.

Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



TS228 —UN—23AUG88

DX,LOOSE -19-04JUN90-1/1

Use Proper Tools

Use tools appropriate to the work. Makeshift tools and procedures can create safety hazards.

Use power tools only to loosen threaded parts and fasteners.

For loosening and tightening hardware, use the correct size tools. DO NOT use U.S. measurement tools on metric fasteners. Avoid bodily injury caused by slipping wrenches.

Use only service parts meeting John Deere specifications.



TS779 —UN—08NOV89

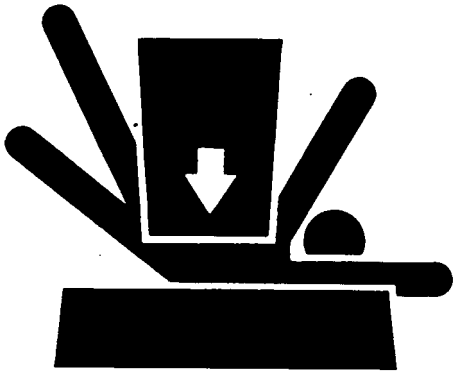
DX,REPAIR -19-17FEB99-1/1

Support Machine Properly

Always lower the attachment or implement to the ground before you work on the machine. If the work requires that the machine or attachment be lifted, provide secure support for them. If left in a raised position, hydraulically supported devices can settle or leak down.

Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load. Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.

When implements or attachments are used with a machine, always follow safety precautions listed in the implement or attachment operator's manual.



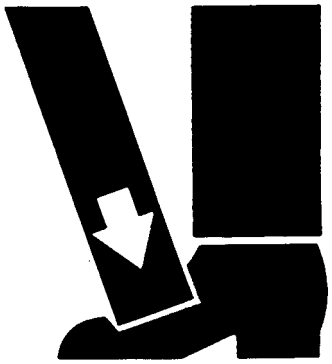
TS229 —UN—23AUG88

DX,LOWER -19-24FEB00-1/1

Use Proper Lifting Equipment

Lifting heavy components incorrectly can cause severe injury or machine damage.

Follow recommended procedure for removal and installation of components in the manual.



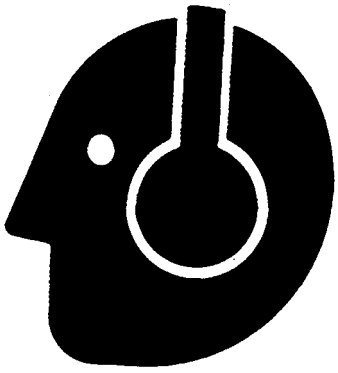
TS226 —UN—23AUG88

DX,LIFT -19-04JUN90-1/1

Protect Against Noise

Prolonged exposure to loud noise can cause impairment or loss of hearing.

Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

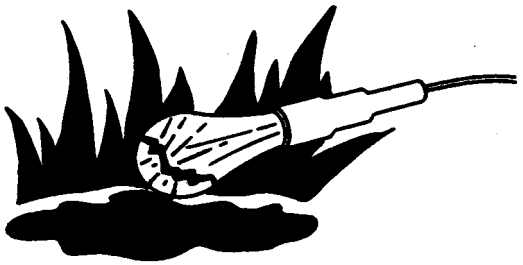


TS207 —UN—23AUG88

DX,NOISE -19-03MAR93-1/1

Illuminate Work Area Safely

Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.



TS223 —UN—23AUG88

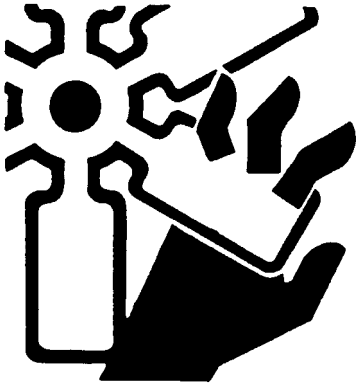
DX,LIGHT -19-04JUN90-1/1

Install All Guards

Rotating cooling system fans, belts, pulleys, and drives can cause serious injury.

Keep all guards in place at all times during engine operation.

Wear close-fitting clothes. Stop the engine and be sure fans, belts, pulleys, and drives are stopped before making adjustments, connections, or cleaning near fans and their drive components.



TS677 —UN—21SEP89

DX,GUARDS -19-18AUG09-1/1

Stay Clear of Rotating Drivelines

Entanglement in rotating driveline can cause serious injury or death.

Keep all shields in place at all times. Make sure rotating shields turn freely.

Wear close-fitting clothing. Stop the engine and be sure that all rotating parts and drivelines are stopped before making adjustments, connections, or performing any type of service on engine or machine driven equipment.



TS1644 —UN—22AUG95

DX,ROTATING -19-18AUG09-1/1

Protect Against High Pressure Spray

Spray from high pressure nozzles can penetrate the skin and cause serious injury. Keep spray from contacting hands or body.

If an accident occurs, see a doctor immediately. Any high pressure spray injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical Department in Moline, Illinois, U.S.A.



TS1343 —UN—18MAR92

DX,SPRAY -19-16APR92-1/1

Service Cooling System Safely

Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.



TS281 —UN—15APR13

DX,RCAP -19-04JUN90-1/1

Remove Paint Before Welding or Heating

Avoid potentially toxic fumes and dust.

Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.

Remove paint before heating:

- Remove paint a minimum of 100 mm (4 in.) from area to be affected by heating. If paint cannot be removed, wear an approved respirator before heating or welding.
- If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.
- If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

Do not use a chlorinated solvent in areas where welding will take place.



TS220 —UN—15APR13

Do all work in an area that is well ventilated to carry toxic fumes and dust away.

Dispose of paint and solvent properly.

DX,PAINT -19-24JUL02-1/1

Do Not Open High-Pressure Fuel System

High-pressure fluid remaining in fuel lines can cause serious injury. Do not disconnect or attempt repair of fuel lines, sensors, or any other components between the high-pressure fuel pump and nozzles on engines with High Pressure Common Rail (HPCR) fuel system.

Only technicians familiar with this type of system can perform repairs. (See your John Deere dealer.)



TS1343 —UN—18MAR92

DX,WW,HPCR1 -19-07JAN03-1/1

Avoid High-Pressure Fluids

Inspect hydraulic hoses periodically – at least once per year – for leakage, kinking, cuts, cracks, abrasion, blisters, corrosion, exposed wire braid or any other signs of wear or damage.

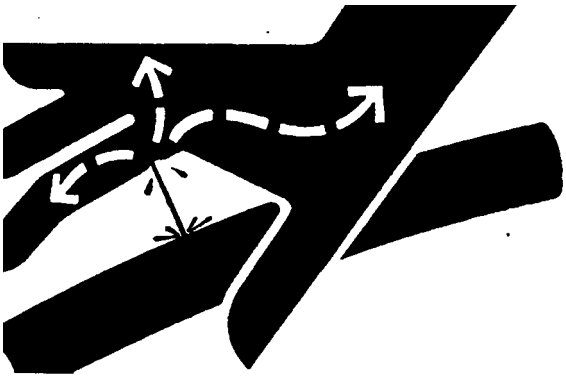
Replace worn or damaged hose assemblies immediately with John Deere approved replacement parts.

Escaping fluid under pressure can penetrate the skin causing serious injury.

Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available in English from Deere & Company Medical Department in Moline, Illinois, U.S.A., by calling 1-800-822-8262 or +1 309-748-5636.



X9811 —UN—23AUG88

DX,FLUID -19-12OCT11-1/1

Avoid Heating Near Pressurized Fluid Lines

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can accidentally burst when heat goes beyond the immediate flame area.



TS953 —UN—15MAY90

DX,TORCH -19-10DEC04-1/1

Avoid Static Electricity Risk When Refueling

The removal of sulfur and other compounds in Ultra-Low Sulfur Diesel (ULSD) fuel decreases its conductivity and increases its ability to store a static charge.

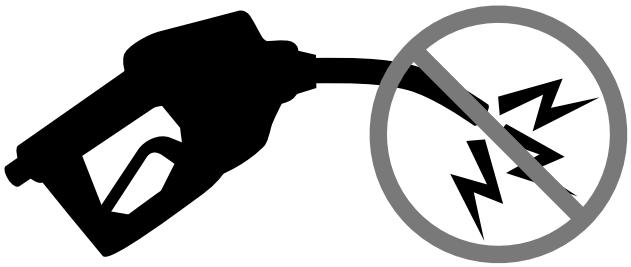
Refineries may have treated the fuel with a static dissipating additive. However, there are many factors that can reduce the effectiveness of the additive over time.

Static charges can build up in ULSD fuel while it is flowing through fuel delivery systems. Static electricity discharge when combustible vapors are present could result in a fire or explosion.

Therefore, it is important to ensure that the entire system used to refuel your machine (fuel supply tank, transfer pump, transfer hose, nozzle, and others) is properly grounded and bonded. Consult with your fuel or fuel system supplier to ensure that the delivery system is in compliance with fueling standards for proper grounding and bonding practices.



RG22142 —UN—17MAR14



RG21992 —UN—21AUG13

DX,FUEL,STATIC,ELEC -19-12JUL13-1/1

Handle Fuel Safely—Avoid Fires

Handle fuel with care: it is highly flammable. Do not refuel the machine while smoking or when near open flame or sparks.

Always stop engine before refueling machine. Fill fuel tank outdoors.

Prevent fires by keeping machine clean of accumulated trash, grease, and debris. Always clean up spilled fuel.

Use only an approved fuel container for transporting flammable liquids.

Never fill fuel container in pickup truck with plastic bed liner. Always place fuel container on ground before refueling. Touch fuel container with fuel dispenser nozzle before removing can lid. Keep fuel dispenser nozzle in contact with fuel container inlet when filling.



TS202 —UN—23AUG88

Do not store fuel container where there is an open flame, spark, or pilot light such as within a water heater or other appliance.

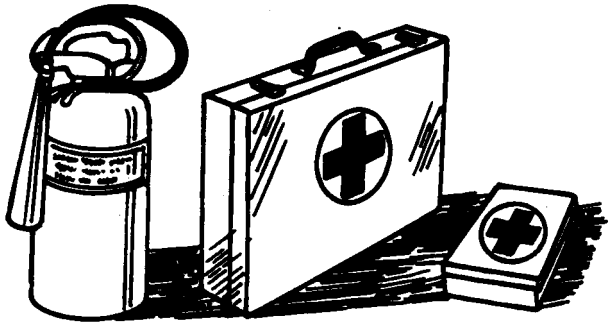
DX,FIRE1 -19-12OCT11-1/1

Prepare for Emergencies

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



TS291 —UN—15APR13

DX,FIRE2 -19-03MAR93-1/1

Handle Starting Fluid Safely

Starting fluid is highly flammable.

Keep all sparks and flame away when using it. Keep starting fluid away from batteries and cables.

To prevent accidental discharge when storing the pressurized can, keep the cap on the container, and store in a cool, protected location.

Do not incinerate or puncture a starting fluid container.

Do not use starting fluid on an engine equipped with glow plugs or an air intake heater.



TS1356 —UN—18MAR92

DX,FIRE3 -19-14MAR14-1/1

Handling Batteries Safely

Battery gas can explode. Keep sparks and flames away from batteries. Use a flashlight to check battery electrolyte level.

Never check battery charge by placing a metal object across the posts. Use a voltmeter or hydrometer.

Always remove grounded (-) battery clamp first and replace grounded clamp last.

Sulfuric acid in battery electrolyte is poisonous and strong enough to burn skin, eat holes in clothing, and cause blindness if splashed into eyes.

Avoid hazards by:

- Filling batteries in a well-ventilated area
- Wearing eye protection and rubber gloves
- Avoiding use of air pressure to clean batteries
- Avoiding breathing fumes when electrolyte is added
- Avoiding spilling or dripping electrolyte
- Using correct battery booster or charger procedure.

If acid is spilled on skin or in eyes:

1. Flush skin with water.
2. Apply baking soda or lime to help neutralize the acid.
3. Flush eyes with water for 15—30 minutes. Get medical attention immediately.

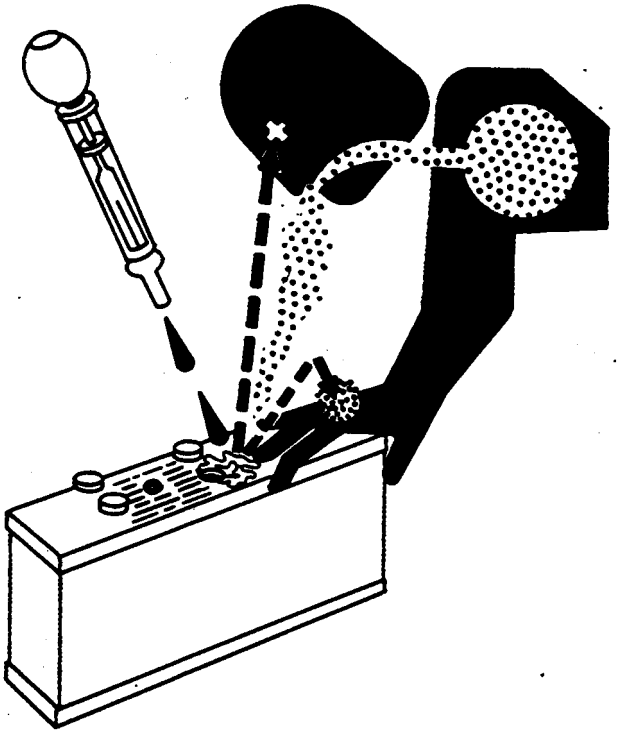
If acid is swallowed:

1. Do not induce vomiting.
2. Drink large amounts of water or milk, but do not exceed 2 L (2 qt.).
3. Get medical attention immediately.

WARNING: Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. **Wash hands after handling.**



TS204 —UN—15APR13



TS203 —UN—23AUG88

DX,WW,BATTERIES -19-02DEC10-1/1

Prevent Acid Burns

Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, eat holes in clothing, and cause blindness if splashed into eyes.

Avoid the hazard by:

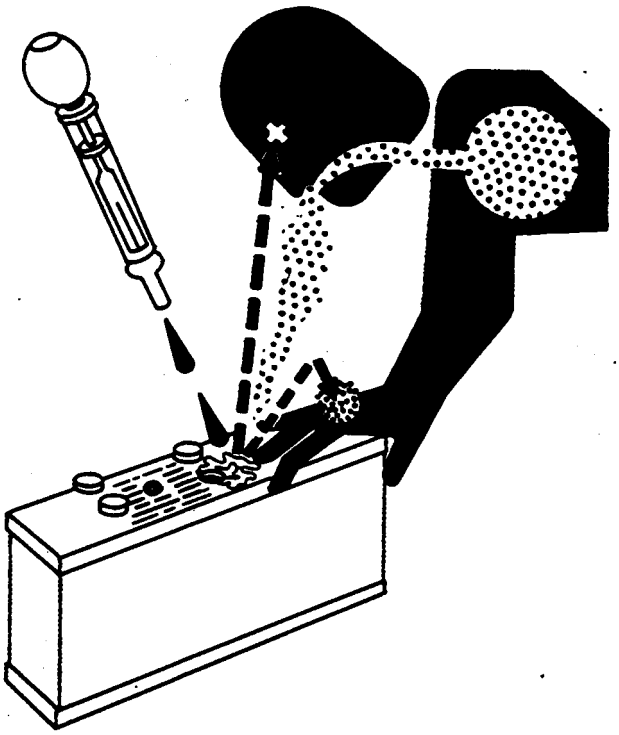
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

If you spill acid on yourself:

1. Flush your skin with water.
2. Apply baking soda or lime to help neutralize the acid.
3. Flush your eyes with water for 15—30 minutes. Get medical attention immediately.

If acid is swallowed:

1. Do not induce vomiting.
2. Drink large amounts of water or milk, but do not exceed 2 L (2 quarts).
3. Get medical attention immediately.



TS203 —UN—23AUG88

DX,POISON -19-21APR93-1/1

Prevent Battery Explosions

Keep sparks, lighted matches, and open flame away from the top of battery. Battery gas can explode.

Never check battery charge by placing a metal object across the posts. Use a volt-meter or hydrometer.

Do not charge a frozen battery; it may explode. Warm battery to 16°C (60°F).



TS204 —UN—15APR13

DX,SPARKS -19-03MAR93-1/1

Live With Safety

Before returning machine to customer, make sure machine is functioning properly, especially the safety systems. Install all guards and shields.



TS231 —19—07OCT88

DX,LIVE -19-25SEP92-1/1

Diesel Fuel

Consult your local fuel distributor for properties of the diesel fuel available in your area.

In general, diesel fuels are blended to satisfy the low temperature requirements of the geographical area in which they are marketed.

Diesel fuels specified to EN 590 or ASTM D975 are recommended. Renewable diesel fuel produced by hydrotreating animal fats and vegetable oils is basically identical to petroleum diesel fuel. Renewable diesel that meets EN 590, ASTM D975, or EN 15940 is acceptable for use at all percentage mixture levels.

Required Fuel Properties

In all cases, the fuel shall meet the following properties:

Cetane number of 40 minimum. Cetane number greater than 47 is preferred, especially for temperatures below –20 °C (–4 °F) or elevations above 1675 m (5500 ft.).

Cold Filter Plugging Point (CFPP) should be at least 5 °C (9 °F) below the expected lowest temperature or **Cloud Point** below the expected lowest ambient temperature.

Fuel lubricity should pass a maximum scar diameter of 0.52 mm as measured by ASTM D6079 or ISO 12156-1. A maximum scar diameter of 0.45 mm is preferred.

Diesel fuel quality and sulfur content must comply with all existing emissions regulations for the area in which the engine operates. DO NOT use diesel fuel with sulfur content greater than 10 000 mg/kg (10 000 ppm).

E-Diesel fuel

DO NOT use E-Diesel (Diesel fuel and ethanol blend). Use of E-Diesel fuel in any John Deere machine may void the machine warranty.

CAUTION: Avoid severe injury or death due to the fire and explosion risk from using E-Diesel fuel.

Sulfur content for Interim Tier 4, Final Tier 4, Stage III B, and Stage IV Engines

- Use ONLY ultra low sulfur diesel (ULSD) fuel with a maximum of 15 mg/kg (15 ppm) sulfur content.

Sulfur Content for Tier 3 and Stage III A Engines

- Use of diesel fuel with sulfur content less than 1000 mg/kg (1000 ppm) is RECOMMENDED.
- Use of diesel fuel with sulfur content 1000—2000 mg/kg (1000—2000 ppm) REDUCES the oil and filter change interval.
- BEFORE using diesel fuel with sulfur content greater than 2000 mg/kg (2000 ppm), contact your John Deere dealer.

Sulfur Content for Tier 2 and Stage II Engines

- Use of diesel fuel with sulfur content less than 2000 mg/kg (2000 ppm) is RECOMMENDED.
- Use of diesel fuel with sulfur content 2000—5000 mg/kg (2000—5000 ppm) REDUCES the oil and filter change interval.
- BEFORE using diesel fuel with sulfur content greater than 5000 mg/kg (5000 ppm), contact your John Deere dealer.

Sulfur Content for Other Engines

- Use of diesel fuel with sulfur content less than 5000 mg/kg (5000 ppm) is RECOMMENDED.
- Use of diesel fuel with sulfur content greater than 5000 mg/kg (5000 ppm) REDUCES the oil and filter change interval.

IMPORTANT: Do not mix used diesel engine oil or any other type of lubricating oil with diesel fuel.

Improper fuel additive usage may cause damage on fuel injection equipment of diesel engines.

DX,FUEL1 -19-13JAN16-1/1

Supplemental Diesel Fuel Additives

Diesel fuel can be the source of performance or other operational problems for many reasons. Some causes include poor lubricity, contaminants, low cetane number, and a variety of properties that cause fuel system deposits. These and others are referenced in other sections of this Operator's Manual.

To optimize engine performance and reliability, closely follow recommendations on fuel quality, storage, and handling, which are found elsewhere in this Operator's Manual.

To further aid in maintaining performance and reliability of the engine's fuel system, John Deere has developed a family of fuel additive products for most global markets. The primary products include Fuel-Protect Diesel Fuel Conditioner (full feature conditioner in winter and summer formulas) and Fuel-Protect Keep Clean (fuel injector deposit removal and prevention). Availability of these and other products varies by market. See your local John Deere dealer for availability and additional information about fuel additives that might be right for your needs.

DX,FUEL13 -19-07FEB14-1/1

Lubricity of Diesel Fuel

Most diesel fuels manufactured in the United States, Canada, and the European Union have adequate lubricity to ensure proper operation and durability of fuel injection system components. However, diesel fuels manufactured in some areas of the world may lack the necessary lubricity.

IMPORTANT: Make sure the diesel fuel used in your machine demonstrates good lubricity characteristics.

Fuel lubricity should pass a maximum scar diameter of 0.52 mm as measured by ASTM D6079 or ISO 12156-1. A maximum scar diameter of 0.45 mm is preferred.

If fuel of low or unknown lubricity is used, add John Deere Fuel-Protect Diesel Fuel Conditioner (or equivalent) at the specified concentration.

Lubricity of BioDiesel Fuel

Fuel lubricity can improve significantly with BioDiesel blends up to B20 (20% BioDiesel). Further increase in lubricity is limited for BioDiesel blends greater than B20.

DX,FUEL5 -19-07FEB14-1/1

Handling and Storing Diesel Fuel

CAUTION: Reduce the risk of fire. Handle fuel carefully. DO NOT fill the fuel tank when engine is running. DO NOT smoke while you fill the fuel tank or service the fuel system.

Fill the fuel tank at the end of each day's operation to prevent water condensation and freezing during cold weather.

Keep all storage tanks as full as practical to minimize condensation.

Ensure that all fuel tank caps and covers are installed properly to prevent moisture from entering. Monitor water content of the fuel regularly.

When using biodiesel fuel, the fuel filter may require more frequent replacement due to premature plugging.

Check engine oil level daily prior to starting engine. A rising oil level may indicate fuel dilution of the engine oil.

IMPORTANT: The fuel tank is vented through the filler cap. If a new filler cap is required, always replace it with an original vented cap.

When fuel is stored for an extended period or if there is a slow turnover of fuel, add a fuel conditioner to stabilize the fuel and prevent water condensation. Contact your fuel supplier or John Deere dealer for recommendations.

DX,FUEL4 -19-15FEB13-1/1

BioDiesel Fuel

BioDiesel fuel is comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats. BioDiesel blends are BioDiesel mixed with petroleum diesel fuel on a volume basis.

Before using fuel containing BioDiesel, review the BioDiesel Use Requirements and Recommendations in this Operator's Manual.

Environmental laws and regulations can encourage or prohibit the use of biofuels. Operators should consult with appropriate governmental authorities prior to using biofuels.

All John Deere Engines with Exhaust Filter (Released 2011 and After)

While 5% blends (B5) are preferred, BioDiesel concentrations up to a 20% blend (B20) in petroleum diesel fuel can be used. BioDiesel blends up to B20 can be used ONLY if the BioDiesel (100% BioDiesel or B100) meets ASTM D6751, EN 14214, or equivalent specification. Expect a 2% reduction in power and a 3% reduction in fuel economy when using B20.

BioDiesel concentrations above B20 can harm the engine's emission control systems and should not be used. Risks include, but are not limited to, more frequent stationary regeneration, soot accumulation, and increased intervals for ash removal.

John Deere approved fuel conditioners, which contain detergent and dispersant additives, are required when using BioDiesel blends from B10—B20, and are recommended when using lower BioDiesel blends.

All John Deere Engines Excluding Exhaust Filter (Primarily Released Prior to 2012)

While 5% blends (B5) are preferred, BioDiesel concentrations up to a 20% blend (B20) in petroleum diesel fuel can be used. BioDiesel blends up to B20 can be used ONLY if the BioDiesel (100% BioDiesel or B100) meets ASTM D6751, EN 14214, or equivalent specification. Expect a 2% reduction in power and a 3% reduction in fuel economy when using B20.

These John Deere engines can operate on BioDiesel blends above B20 (up to 100% BioDiesel). Operate at levels above B20 ONLY if the BioDiesel is permitted by law and meets the EN 14214 specification (primarily available in Europe). Engines operating on BioDiesel blends above B20 might not fully comply with or be permitted by all applicable emissions regulations. Expect up to a 12% reduction in power and an 18% reduction in fuel economy when using 100% BioDiesel.

John Deere approved fuel conditioners, which contain detergent and dispersant additives, are required when using BioDiesel blends from B10—B20, and are recommended when using lower BioDiesel blends.

BioDiesel Use Requirements and Recommendations

The petroleum diesel portion of all BioDiesel blends must meet the requirements of ASTM D975 (US) or EN 590 (EU) commercial standard.

BioDiesel users in the U.S. are strongly encouraged to purchase BioDiesel blends from a BQ-9000 Certified Marketer and sourced from a BQ-9000 Accredited Producer (as certified by the National BioDiesel Board). Certified Marketers and Accredited Producers can be found at the following website: http://www.bq9000.org.

BioDiesel contains residual ash. Ash levels exceeding the maximums allowed in either ASTM D6751 or EN14214 can result in more rapid ash loading and require more frequent cleaning of the Exhaust Filter (if present).

The fuel filter can require more frequent replacement, when using BioDiesel fuel, particularly if switching from diesel. Check engine oil level daily prior to starting engine. A rising oil level can indicate fuel dilution of the engine oil. BioDiesel blends up to B20 must be used within 90 days of the date of BioDiesel manufacture. BioDiesel blends above B20 must be used within 45 days from the date of BioDiesel manufacture.

When using BioDiesel blends up to B20, the following must be considered:

- Cold-weather flow degradation
- Stability and storage issues (moisture absorption, microbial growth)
- Possible filter restriction and plugging (usually a problem when first switching to BioDiesel on used engines)
- Possible fuel leakage through seals and hoses (primarily an issue with older engines)
- Possible reduction of service life of engine components

Request a certificate of analysis from your fuel distributor to ensure that the fuel is compliant with the specifications provided in this Operator's Manual.

Consult your John Deere dealer for approved fuel conditioners to improve storage and performance with BioDiesel fuels.

The following must also be considered if using BioDiesel blends above B20:

- Possible coking or blocked injector nozzles, resulting in power loss and engine misfire if John Deere approved fuel conditioners are not used
- Possible crankcase oil dilution (requiring more frequent oil changes)
- Possible lacquering or seizure of internal components
- Possible formation of sludge and sediments
- Possible thermal oxidation of fuel at elevated temperatures
- Possible compatibility issues with other materials (including copper, lead, zinc, tin, brass, and bronze) used in fuel handling equipment

Continued on next page

DX,FUEL7 -19-15MAY13-1/2

- Possible reduction in water separator efficiency
- Possible damage to paint if exposed to BioDiesel
- Possible corrosion of fuel injection equipment
- Possible elastomeric seal and gasket material degradation (primarily an issue with older engines)
- Possible high acid levels within fuel system
- Because BioDiesel blends above B20 contain more ash, using blends above B20 can result in more rapid ash loading and require more frequent cleaning of the Exhaust Filter (if present)

IMPORTANT: Raw pressed vegetable oils are NOT acceptable for use as fuel in any concentration in John Deere engines. Their use could cause engine failure.

DX,FUEL7 -19-15MAY13-2/2

Testing Diesel Fuel

A fuel analysis program can help to monitor the quality of diesel fuel. The fuel analysis can provide critical data such as cetane number, fuel type, sulfur content, water content, appearance, suitability for cold weather operations, bacteria, cloud point, acid number, particulate contamination, and whether the fuel meets specification.

Contact your John Deere dealer for more information on diesel fuel analysis.

DX,FUEL6 -19-14APR11-1/1

Fuel Filters

The importance of fuel filtration cannot be overemphasized with modern fuel systems. The combination of increasingly restrictive emission regulations and more efficient engines requires fuel system to operate at much higher pressures. Higher pressures can only be achieved using fuel injection components with very close tolerances. These close manufacturing tolerances have significantly reduced capacities for debris and water.

John Deere brand fuel filters have been designed and produced specifically for John Deere engines.

To protect the engine from debris and water, always change engine fuel filters as specified in this manual.

DX,FILT2 -19-14APR11-1/1

Minimizing the Effect of Cold Weather on Diesel Engines

John Deere diesel engines are designed to operate effectively in cold weather.

However, for effective starting and cold-weather operation, a little extra care is necessary. The following information outlines steps that can minimize the effect that cold weather may have on starting and operation of your engine. See your John Deere dealer for additional information and local availability of cold-weather aids.

Use Winter Grade Fuel

When temperatures fall below 0 °C (32 °F), winter grade fuel (No. 1-D in North America) is best suited for cold-weather operation. Winter grade fuel has a lower cloud point and a lower pour point.

Cloud point is the temperature at which wax begins to form in the fuel. This wax causes fuel filters to plug. **Pour point** is the lowest temperature at which movement of the fuel is observed.

NOTE: On average, winter grade diesel fuel has a lower Btu (heat content) rating. Using winter grade fuel may reduce power and fuel efficiency, but should not cause any other engine performance effects. Check the grade of fuel being used before troubleshooting for low-power complaints in cold-weather operation.

Air Intake Heater

An air intake heater is an available option for some engines to aid cold weather starting.

Ether

An ether port on the intake is available to aid cold weather starting.

CAUTION: Ether is highly flammable. Do not use ether when starting an engine equipped with glow plugs or an air intake heater.

Coolant Heater

An engine block heater (coolant heater) is an available option to aid cold weather starting.

Seasonal Viscosity Oil and Proper Coolant Concentration

Use seasonal grade viscosity engine oil based on the expected air temperature range between oil changes and a proper concentration of low silicate antifreeze as recommended. (See DIESEL ENGINE OIL and ENGINE COOLANT requirements in this section.)

Diesel Fuel Flow Additive

Use John Deere Fuel-Protect Diesel Fuel Conditioner (winter formula), which contains anti-gel chemistry, or equivalent fuel conditioner to treat non-winter grade fuel (No. 2-D in North America) during the cold-weather season. This generally extends operability to about 10 °C (18 °F) below the fuel cloud point. For operability at even lower temperatures, use winter grade fuel.

IMPORTANT: Treat fuel when outside temperature drops below 0 °C (32 °F). For best results, use with untreated fuel. Follow all recommended instructions on label.

BioDiesel

When operating with BioDiesel blends, wax formation can occur at warmer temperatures. Begin using John Deere Fuel-Protect Diesel Fuel Conditioner (winter formula) at 5 °C (41 °F) to treat BioDiesel fuels during the cold-weather season. Use B5 or lower blends at temperatures below 0 °C (32 °F). Use only winter grade petroleum diesel fuel at temperatures below -10 °C (14 °F).

Winterfronts

Use of fabric, cardboard, or solid winterfronts is not recommended with any John Deere engine. Their use can result in excessive engine coolant, oil, and charge air temperatures. This can lead to reduced engine life, loss of power and poor fuel economy. Winterfronts may also put abnormal stress on fan and fan drive components potentially causing premature failures.

If winterfronts are used, they should never totally close off the grill frontal area. Approximately 25% area in the center of the grill should remain open at all times. At no time should the air blockage device be applied directly to the radiator core.

Radiator Shutters

If equipped with a thermostatically controlled radiator shutter system, this system should be regulated in such a way that the shutters are completely open by the time the coolant reaches 93 °C (200 °F) to prevent excessive intake manifold temperatures. Manually controlled systems are not recommended.

If air-to-air aftercooling is used, the shutters must be completely open by the time the intake manifold air temperature reaches the maximum allowable temperature out of the charge air cooler.

For more information, see your John Deere dealer.

DX,FUEL10 -19-15MAY13-1/1

Diesel Engine Break-In Oil — Non-Emissions Certified and Certified Tier 1, Tier 2, Tier 3, Stage I, Stage II, and Stage III

New engines are filled at the factory with either John Deere Break-In™ or John Deere Break-In Plus™ Engine Oil. During the break-in period, add John Deere Break-In™ or Break-In Plus™ Engine Oil, respectively, as needed to maintain the specified oil level.

Operate the engine under various conditions, particularly heavy loads with minimal idling, to help seat engine components properly.

If John Deere Break-In™ Engine Oil is used during the initial operation of a new or rebuilt engine, change the oil and filter at a maximum of 100 hours.

If John Deere Break-In Plus™ Engine Oil is used, change the oil and filter at a minimum of 100 hours and a maximum equal to the interval specified for John Deere Plus-50™ II or Plus-50™ oil.

After engine overhaul, fill the engine with either John Deere Break-In™ or Break-In Plus™ Engine Oil.

If John Deere Break-In™ or Break-In Plus™ Engine Oil is not available, use an SAE 10W-30 viscosity grade diesel engine oil meeting one of the following and change the oil and filter at a maximum of 100 hours of operation:

- API Service Classification CE
- API Service Classification CD
- API Service Classification CC
- ACEA Oil Sequence E2
- ACEA Oil Sequence E1

IMPORTANT: Do not use Plus-50™ II, Plus-50™, or engine oils meeting any of the following for the initial break-in of a new or rebuilt engine:

API CK-4	**ACEA E9**
API CJ-4	**ACEA E7**
API CI-4 PLUS	**ACEA E6**
API CI-4	**ACEA E5**
API CH-4	**ACEA E4**
API CG-4	**ACEA E3**
API CF-4	
API CF-2	
API CF	

These oils do not allow the engine to break in properly.

John Deere Break-In Plus™ Engine Oil can be used for all John Deere diesel engines at all emission certification levels.

After the break-in period, use John Deere Plus-50™ II, John Deere Plus-50™, or other diesel engine oil as recommended in this manual.

Break-In is a trademark of Deere & Company.
Break-In Plus is a trademark of Deere & Company
Plus-50 is a trademark of Deere & Company.

DX,ENOIL4 -19-02NOV16-1/1

Diesel Engine Oil — Tier 3 and Stage III

Use oil viscosity based on the expected air temperature range during the period between oil changes.

John Deere Plus-50™ II oil is preferred.

John Deere Plus-50™ is also recommended.

Other oils may be used if they meet one or more of the following:

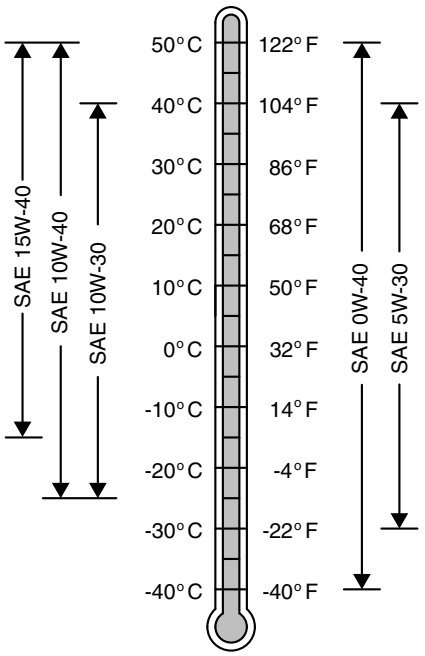
- John Deere Torq-Gard™
- API Service Category CK-4
- API Service Category CJ-4
- API Service Category CI-4 PLUS
- API Service Category CI-4
- ACEA Oil Sequence E9
- ACEA Oil Sequence E7
- ACEA Oil Sequence E6
- ACEA Oil Sequence E5
- ACEA Oil Sequence E4

Multi-viscosity diesel engine oils are preferred.

Diesel fuel quality and fuel sulfur content must comply with all existing emissions regulations for the area in which the engine operates.

DO NOT use diesel fuel with sulfur content greater than 10000 mg/kg (10000 ppm).

Plus-50 is a trademark of Deere & Company
Torq-Gard is a trademark of Deere & Company



Oil Viscosities for Air Temperature Ranges

DX,ENOIL11 -19-02NOV16-1/1

Engine Oil and Filter Service Intervals — Tier 3 and Stage IIIA — OEM Applications

Recommended oil and filter service intervals are based on a combination of oil pan capacity, type of engine oil and filter used, and sulfur content of the diesel fuel. Actual service intervals also depend on operation and maintenance practices.

Use oil analysis to evaluate the condition of the oil and to aid in selection of the proper oil and filter service interval. Contact your John Deere dealer for more information on engine oil analysis.

Change the oil and oil filter at least once every 12 months even if the hours of operation are fewer than the otherwise recommended service interval.

Diesel fuel sulfur content affects engine oil and filter service intervals.

- Use of diesel fuel with sulfur content less than 1000 mg/kg (1000 ppm) is RECOMMENDED.
- Use of diesel fuel with sulfur content 1000—2000 mg/kg (1000—2000 ppm) REDUCES the oil and filter service interval.
- BEFORE using diesel fuel with sulfur content greater than 2000 mg/kg (2000 ppm), contact your John Deere dealer.
- DO NOT use diesel fuel with sulfur content greater than 10000 mg/kg (10000 ppm).

- **Reduce oil and filter service intervals by 50% when using biodiesel blends greater than B20. Oil analysis may allow longer service intervals.**
- **Use only approved oil types.**

Approved Oil Types:

- "Plus-50 Oils" include John Deere Plus-50™ II and John Deere Plus-50™
- "Other Oils" include John Deere Torq-Gard™, API CK-4, API CJ-4, API CI-4 PLUS, API CI-4, ACEA E9, ACEA E7, ACEA E6, ACEA E5, and ACEA E4

NOTE: The 500 hour extended oil and filter change interval is only allowed if all of the following conditions are met:

- *Engine equipped with an extended drain interval oil pan*
- *Use of diesel fuel with sulfur content less than 2000 mg/kg (2000 ppm) for PowerTech™ Plus engines or 5000 mg/kg (5000 ppm) for PowerTech™ engine*
- *Use of John Deere Plus-50™ II or John Deere Plus-50™ oil*
- *Use of an approved John Deere oil filter*

IMPORTANT: To avoid engine damage:

	Tier 3 and Stage IIIA - PowerTech™ Plus				**Tier 3 and Stage IIIA - PowerTech™**		
	Oil Pan Size (L/kW)				Oil Pan Size (L/kW)		
Oil pan capacity	Greater than or equal to 0.10	Greater than or equal to 0.12	Greater than or equal to 0.14	Greater than or equal to 0.22	Greater than or equal to 0.10	Greater than or equal to 0.12	Greater than or equal to 0.14
Fuel Sulfur	Less than 1000 mg/kg (1000 ppm)				Less than 1000 mg/kg (1000 ppm)		
Plus-50 Oils	375 hours	500 hours	500 hours	500 hours	375 hours	500 hours	500 hours
Other Oils	250 hours	250 hours	250 hours	250 hours	250 hours	250 hours	250 hours
Fuel Sulfur	1000—2000 mg/kg (1000—2000 ppm)				1000—2000 mg/kg (1000—2000 ppm)		
Plus-50 Oils	300 hours	300 hours	500 hours	500 hours	300 hours	400 hours	500 hours
Other Oils	200 hours	200 hours	250 hours	250 hours	200 hours	200 hours	250 hours
Fuel Sulfur	2000—5000 mg/kg (2000—5000 ppm)				2000—5000 mg/kg (2000—5000 ppm)		
Plus-50 Oils	Not Recommended Contact John Deere dealer (dealer refers to DTAC solution)				275 hours	350 hours	500 hours
Other Oils	Not Recommended Contact John Deere dealer (dealer refers to DTAC solution)				150 hours	175 hours	250 hours
Fuel Sulfur	5000—10000 mg/kg (5000—10000 ppm)				5000—10000 mg/kg (5000—10000 ppm)		
Plus-50 Oils	Not Recommended Contact John Deere dealer (dealer refers to DTAC solution)				187 hours	250 hours	250 hours
Other Oils	Not Recommended Contact John Deere dealer (dealer refers to DTAC solution)				125 hours	125 hours	125 hours
Oil analysis may extend the service interval of "Other Oils", to a maximum not to exceed the interval for Plus-50 Oils. Oil analysis means taking a series of oil samples at 50-hour increments beyond the normal service interval until either the data indicates the end of useful oil life or the maximum service interval of John Deere Plus-50 oils is reached.							

Plus-50 is a trademark of Deere & Company
Torq-Gard is a trademark of Deere & Company
PowerTech is a trademark of Deere & Company

DX,ENOIL13,T3,OEM -19-02NOV16-1/1

Diesel Engine Oil and Filter Service Intervals

6135 (13.5 L) Engine Oil and Filter Service Intervals in Hours of Operation					
Power Rating		**Oil Pans**			
kW (hp)	**Fuel Sulfur Content** [a]	**1915, 1917, 1918**		**1914**	
		Interval		**Interval**	
		Other Oils	**Plus-50 Oils**	**Other Oils**	**Plus-50 Oils**
Industrial Ratings					
261 (350)	Less Than 0.10% (1000 ppm)	250	500	250	500
	0.10% - 0.20% (1000 - 2000 ppm)	250	500	250	500
	0.20% - 0.50% (2000 - 5000 ppm)	200	300	250	500
298-336 (400-451)	Less Than 0.10% (1000 ppm)	250	500	250	500
	0.10% - 0.20% (1000 - 2000 ppm)	200	300	250	500
	0.20% - 0.50% (2000 - 5000 ppm)	150	250	200	300
373-410 (500-550)	Less Than 0.10% (1000 ppm)	250	375	250	500
	0.10% - 0.20% (1000 - 2000 ppm)	200	300	250	500
	0.20% - 0.50% (2000 - 5000 ppm)	150	250	200	300
448 (600)	Less Than 0.10% (1000 ppm)	None	None	250	500
	0.10% - 0.20% (1000 - 2000 ppm)	None	None	200	300
	0.20% - 0.50% (2000 - 5000 ppm)	None	None	150	250
GenSet Ratings					
345-401 (463-538)	Less Than 0.10% (1000 ppm)	250	375	250	500
	0.10% - 0.20% (1000 - 2000 ppm)	200	300	250	500
	0.20% - 0.50% (2000 - 5000 ppm)	150	250	200	300
460 (617)	Less Than 0.10% (1000 ppm)	250	375	250	500
	0.10% - 0.20% (1000 - 2000 ppm)	200	300	200	300
	0.20% - 0.50% (2000 - 5000 ppm)	150	250	150	250
563 (755)	Less Than 0.10% (1000 ppm)	250	375	N/A	N/A
	0.10% - 0.20% (1000 - 2000 ppm)	200	300	N/A	N/A
	0.20% - 0.50% (2000 - 5000 ppm)	150	250	N/A	N/A
Perform engine oil analysis to determine the actual extended service life of ACEA E7 and ACEA E6 oils.					

[a] *BEFORE using diesel fuel with sulfur content greater than 0.50% (5000 ppm), contact your John Deere dealer. (Dealer to reference DTAC Solution 73203)*

OURGP11,000004D -19-07APR11-1/1

Mixing of Lubricants

In general, avoid mixing different brands or types of oil. Oil manufacturers blend additives in their oils to meet certain specifications and performance requirements.

Mixing different oils can interfere with the proper functioning of these additives and degrade lubricant performance.

Consult your John Deere dealer to obtain specific information and recommendations.

DX,LUBMIX -19-18MAR96-1/1

Alternative and Synthetic Lubricants

Conditions in certain geographical areas may require lubricant recommendations different from those printed in this manual.

Some John Deere brand coolants and lubricants may not be available in your location.

Consult your John Deere dealer to obtain information and recommendations.

Synthetic lubricants may be used if they meet the performance requirements as shown in this manual.

The temperature limits and service intervals shown in this manual apply to both conventional and synthetic lubricants.

Re-refined base stock products may be used if the finished lubricant meets the performance requirements.

DX,ALTER -19-11APR11-1/1

Lubricant Storage

Your equipment can operate at top efficiency only when clean lubricants are used.

Use clean containers to handle all lubricants.

Store lubricants and containers in an area protected from dust, moisture, and other contamination. Store containers on their side to avoid water and dirt accumulation.

Make certain that all containers are properly marked to identify their contents.

Properly dispose of all old containers and any residual lubricant they may contain.

DX,LUBST -19-11APR11-1/1

Oil Filters

Filtration of oils is critical to proper operation and lubrication.

Always change filters regularly as specified in this manual.

Use filters meeting John Deere performance specifications.

DX,FILT -19-18MAR96-1/1

Diesel Engine Coolant (engine with wet sleeve cylinder liners)

Preferred Coolants

The following pre-mix engine coolants are preferred:

- **John Deere COOL-GARD™II**
- **John Deere COOL-GARD II PG**

COOL-GARD II pre-mix coolant is available in several concentrations with different freeze protection limits as shown in the following table.

COOL-GARD II pre-mix	Freeze Protection Limit
COOL-GARD II 20/80	-9 °C (16 °F)
COOL-GARD II 30/70	-16 °C (3 °F)
COOL-GARD II 50/50	-37 °C (-34 °F)
COOL-GARD II 55/45	-45 °C (-49 °F)
COOL-GARD II PG 60/40	-49 °C (-56 °F)
COOL-GARD II 60/40	-52 °C (-62 °F)

Not all COOL-GARD II pre-mix products are available in all countries.

Use COOL-GARD II PG when a non-toxic coolant formulation is required.

Additional Recommended Coolants

The following engine coolant is also recommended:

- John Deere COOL-GARD II Concentrate in a 40—60% mixture of concentrate with quality water.

IMPORTANT: When mixing coolant concentrate with water, do not use less than 40% or greater than 60% concentration of coolant. Less than 40% gives inadequate additives for corrosion protection. Greater than 60% can result in coolant gelation and cooling system problems.

Other Coolants

Other ethylene glycol or propylene glycol base coolants may be used if they meet the following specification:

- Pre-mix coolant meeting ASTM D6210 requirements
- Coolant concentrate meeting ASTM D6210 requirements in a 40—60% mixture of concentrate with quality water

If coolant meeting one of these specifications is unavailable, use a coolant concentrate or pre-mix coolant that has a minimum of the following chemical and physical properties:

- Provides cylinder liner cavitation protection according to either the John Deere Cavitation Test Method or a fleet study run at or above 60% load capacity
- Is formulated with a nitrite-free additive package
- Protects the cooling system metals (cast iron, aluminum alloys, and copper alloys such as brass) from corrosion

Water Quality

Water quality is important to the performance of the cooling system. Distilled, deionized, or demineralized water is recommended for mixing with ethylene glycol and propylene glycol base engine coolant concentrate.

Coolant Drain Intervals

Drain and flush the cooling system and refill with fresh coolant at the indicated interval, which varies with the coolant used.

When COOL-GARD II or COOL-GARD II PG is used, the drain interval is 6 years or 6000 hours of operation.

If a coolant other than COOL-GARD II or COOL-GARD II PG is used, reduce the drain interval to 2 years or 2000 hours of operation.

IMPORTANT: Do not use cooling system sealing additives or antifreeze that contains sealing additives.

Do not mix ethylene glycol and propylene glycol base coolants.

Do not use coolants that contain nitrites.

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DX,COOL3 -19-15MAY13-1/1

Water Quality for Mixing with Coolant Concentrate

Engine coolants are a combination of three chemical components: ethylene glycol (EG) or propylene glycol (PG) antifreeze, inhibiting coolant additives, and quality water.

Water quality is important to the performance of the cooling system. Distilled, deionized, or demineralized water is recommended for mixing with ethylene glycol and propylene glycol base engine coolant concentrate.

All water used in the cooling system should meet the following minimum specifications for quality:

Chlorides	<40 mg/L
Sulfates	<100 mg/L
Total solids	<340 mg/L
Total dissolved I hardness	<170 mg/L
pH	5.5—9.0

IMPORTANT: Do not use bottled drinking water because it often contains higher concentrations of total dissolved solids.

Freeze Protection

The relative concentrations of glycol and water in the engine coolant determine its freeze protection limit.

Ethylene Glycol	Freeze Protection Limit
40%	-24 °C (-12 °F)
50%	-37 °C (-34 °F)
60%	-52 °C (-62 °F)
Propylene Glycol	**Freeze Protection Limit**
40%	-21 °C (-6 °F)
50%	-33 °C (-27 °F)
60%	-49 °C (-56 °F)

DO NOT use a coolant-water mixture greater than 60% ethylene glycol or 60% propylene glycol.

DX,COOL19 -19-15MAY13-1/1

Operating in Warm Temperature Climates

John Deere engines are designed to operate using recommended engine coolants.

Always use a recommended engine coolant, even when operating in geographical areas where freeze protection is not required.

IMPORTANT: Water may be used as coolant *in emergency situations only.*

Foaming, hot surface aluminum and iron corrosion, scaling, and cavitation occur when water is used as the coolant, even when coolant conditioners are added.

Drain cooling system and refill with recommended engine coolant as soon as possible.

DX,COOL6 -19-15MAY13-1/1

Testing Coolant Freeze Point

The use of a handheld coolant refractometer is the quickest, easiest, and most accurate method to determine coolant freeze point. This method is more accurate than a test strip or a float-type hydrometer which can produce poor results.

A coolant refractometer is available through your John Deere dealer under the SERVICEGARD™ tool program. Part number 75240 provides an economical solution to accurate freeze point determination in the field.

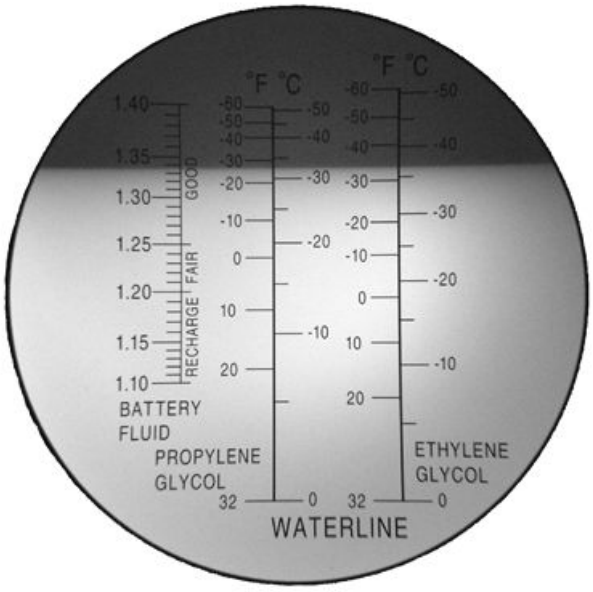
To use this tool:

1. Allow cooling system to cool to ambient temperatures.
2. Open radiator cap to expose coolant.
3. With the included dropper, collect a small coolant sample.
4. Open the lid of the refractometer, place one drop of coolant on the window and close the lid.
5. Look through the eyepiece and focus as necessary.
6. Record the listed freeze point for the type of coolant (ethylene glycol coolant or propylene glycol) being tested.



TS1732 —UN—04SEP13

SERVICEGARD™ Part Number 75240



TS1733 —UN—04SEP13

Image with a Drop of 50/50 Coolant Placed on the Refractometer Window

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DX,COOL,TEST -19-13JUN13-1/1

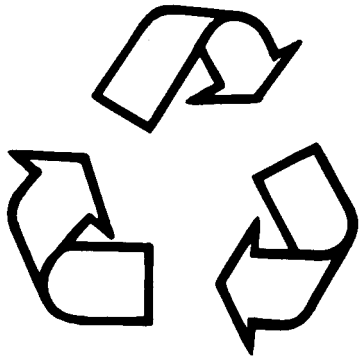
Disposing of Coolant

Improperly disposing of engine coolant can threaten the environment and ecology.

Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

Do not pour waste onto the ground, down a drain, or into any water source.

Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your John Deere engine distributor or servicing dealer.

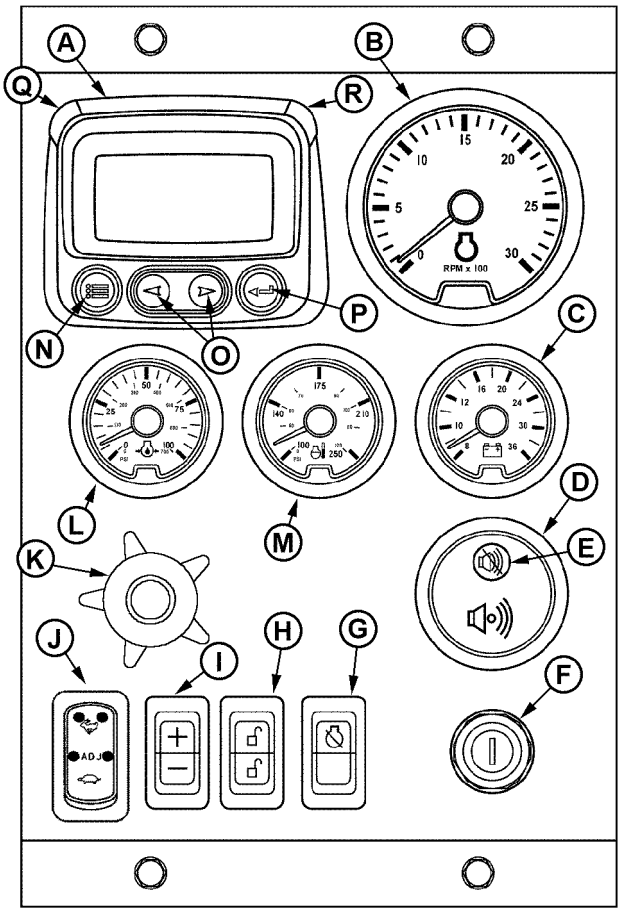


TS1133 —UN—15APR13

Recycle Waste

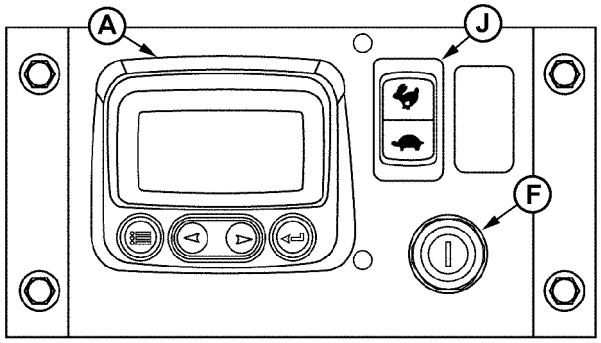
RG,RG34710,7543 -19-09JAN07-1/1

Instrument Panels



RG13276 —UN—28OCT03

Full-Featured Instrument Panel



RG13277 —UN—22OCT03

Basic Instrument Panel

A—Diagnostic Gauge/Hour Meter
B—Tachometer
C—Voltmeter (Optional)
D—Audible Alarm (Optional)
E—Audible Alarm Override Button
F—Key Switch
G—Override Shutdown Rocker Switch
H—Bump Enable Rocker Switch
I— Speed Select Rocker Switch
J—High-Low Speed Select Rocker Switch
K—Analog Throttle Control (Optional)
L—Oil Pressure Gauge
M—Coolant Temperature Gauge
N—Menu Key
O—Arrow Keys
P—Enter Key
Q—Amber "WARNING" Indicator Light
R—Red "STOP ENGINE" Indicator Light

John Deere PowerTech Plus™ OEM Engines have an electronic control system, which has the following controls and gauges as shown. The following information applies only to those controls and gauges supplied by John Deere. Refer to your engine application manual for specific guidelines if John Deere-sourced controls and instrumentation are not used.

Following is a brief description of the available optional electronic controls and gauges found on John Deere provided instrument panels. Refer to manufacturer's literature for information on controls not provided by Deere.

Instrument Panel (Continued)

A—Diagnostic Gauge/Hour Meter

The diagnostic gauge (A) displays diagnostic trouble codes (DTCs) as they are accessed. Other information on the engine can be accessed using the touch keys (N, O and P). The hour meter feature shows the operating hours of the engine and should be used as a guide for scheduling periodic maintenance. If the diagnostic gauge receives a trouble code from an engine control unit, the current display will switch to a warning or shutdown (depending on the severity of the code) screen that will display the trouble code number, the description of the code and the corrective action needed.

B—Tachometer

The tachometer (B) indicates engine speed in hundreds of revolutions per minute (rpm).

C—Voltmeter (Optional)

Continued on next page

The voltmeter (C) indicates system battery voltage. The amber “Warning” light (Q) will illuminate when battery voltage is too low for proper operation of the fuel injection system.

D—Audible Alarm (Optional)

The audible alarm (D) will sound whenever any of these abnormal conditions exist: low oil pressure, high coolant temperature, water-in-fuel, high fuel temperature, or high manifold temperatures. This includes all signals that light up the amber “warning” indicator (intermittent alarm) or the red “stop engine” indicator (steady alarm).

E—Audible Alarm Override Button

The optional audible alarm has an override button (E) that silences the audible alarm for approximately two minutes when pressed.

F—Key Start Switch

The three-position key start switch (F) controls the engine electrical system. When the key switch is turned clockwise to “START”, the engine will crank. When the engine starts, the key is released and returns to the “ON” (RUN) position.

G—Override Shutdown Rocker Switch

Switch will be present, but may not be active, depending on engine controller (ECU) options originally selected. If switch is active, pressing the upper half of the override shutdown switch (G) will override an engine shutdown signal. The switch must be pressed within 30 seconds to prevent undesired shutdown of engine. Pressing this switch will override the engine shutdown for 30 seconds at a time to move vehicle to a safe location.

H—Bump Speed Enable Rocker Switch

This is a three-position switch (H) with the center position as “OFF” (locked). With this switch in the “OFF” position, the speed select switch (I) is also locked, to prevent accidental changes in operating speed. Pressing upper or lower half of switch (H) will unlock or enable the bump speed switch to take effect using speed select switch (I).

I—Speed Select Rocker Switch

The speed select switch (I) is used to bump engine speed up (+) or down (-) in small increments during operation. This switch must be used with the bump speed enable switch (H) in the unlocked position (top or bottom half of button depressed).

J—High-Low Speed Select Rocker Switch

The high-low speed select switch (J) is used to set the engine operating speeds at slow (turtle) or fast (rabbit). Factory preset idle speeds can also be adjusted using bump speed enable switch (H) with speed select switch (I).

The basic instrument panel will have the high-low speed select switch only. Press and hold up (+) or down (-) to adjust engine speed as desired. The engine speed selected will not be held in the memory. To adjust engine speeds, See Changing Engine Speed in Section 20.

How To Select Preset Operating Speeds (Bump Speeds)

First select Turtle (Slow) or Adj by pressing speed select switch (J) to “Turtle” (slow) or “Adj”(center). Then you can press either the upper or lower portion of the bump speed enable switch (H) to unlock the setting. The bump speed enable must be held down as the speed select switch (J) is used to change the setting by pressing (+) to increase speed or (-) to decrease speed.

Once the slow idle speed has been set, the bump speed enable **switch must be pressed and released three times within two seconds to commit the new operating speed to memory.** If not done, the engine's new speed will only be effective until the key switch is shut off. Then the speed will revert back to the previous setting.

The fast idle speed is not adjustable. It will always go back to the factory preset fast idle speed.

K—Analog Throttle Control (Optional)

The throttle control (K) is used to control engine speed. This control is available only on engines with analog throttle.

L—Engine Oil Pressure Gauge

The oil pressure gauge (L) indicates engine oil pressure. An audible alarm (D) warns the operator if engine oil pressure falls below a safe operating pressure.

M—Engine Coolant Temperature Gauge

The engine coolant temperature gauge (M) indicates engine coolant temperature. An audible alarm (D) warns the operator if coolant temperature rises above the preset safe operating temperature.

N—Menu Key

The menu key is pressed to either enter or exit the menu screens on the diagnostic gauge.

O—Arrow Keys

Use the arrow keys (O) to change the display on the window of the diagnostic gauge and to access engine performance data.

Pressing the left arrow to scroll to the left or upward or the right arrow to scroll to the right or downward. This will allow you to view various engine parameters and any diagnostic trouble codes that occur.

Refer to the following story for accessing engine information on the diagnostic gauge using the touch keys.

P—Enter Key

The enter key is pressed to select the parameter that is highlighted on the screen.

Q—Amber “WARNING” Indicator Light

Continued on next page

When light comes on, an abnormal condition exists. It is not necessary to shutdown engine immediately, but problem should be corrected as soon as possible. Screen on diagnostic gauge will display the problem and the solution needed.

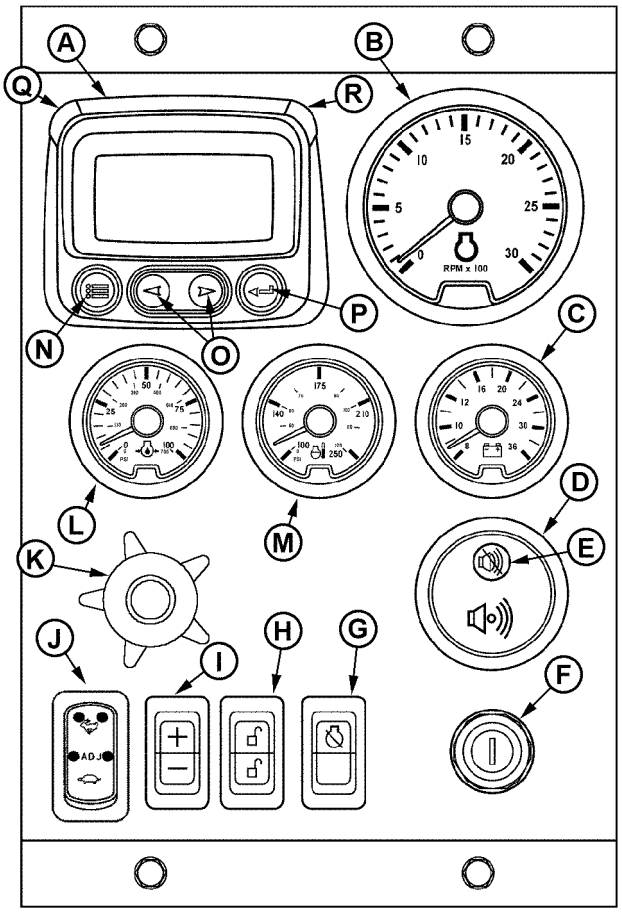
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R—Red “STOP ENGINE” Indicator Light

When light comes on, stop engine immediately or as soon as safely possible to prevent engine damage. Correct problem before restarting.

OMRGP15,0000120 -19-12SEP06-3/3

PV101 Instrument Panels



RG13276 —UN—28OCT03

Full-Featured Instrument Panel

A—Diagnostic Gauge/Hour Meter
B—Tachometer
C—Voltmeter (Optional)
D—Audible Alarm (Optional)
E—Audible Alarm Override Button
F—Key Switch
G—Override Shutdown Rocker Switch
H—Bump Enable Rocker Switch
I— Speed Select Rocker Switch
J—High-Low Speed Select Rocker Switch
K—Analog Throttle Control (Optional)
L—Oil Pressure Gauge
M—Coolant Temperature Gauge
N—Menu Key
O—Arrow Keys
P—Enter Key
Q—Amber "WARNING" Indicator Light
R—Red "STOP ENGINE" Indicator Light

Interim tier 4 / Stage III B John Deere PowerTech™ OEM Engines have an electronic control system, which has the following controls and gauges as shown. The following information applies only to those controls and gauges supplied by John Deere. Refer to your engine application manual for specific guidelines if John Deere-sourced controls and instrumentation are not used.

NOTE: This manual only covers operation of engine with a John Deere control system.

Following is a brief description of the available optional electronic controls and gauges found on John Deere provided instrument panels. Refer to manufacturer's literature for information on controls not provided by Deere.

Instrument Panels (Continued)

A—Diagnostic Gauge/Hour Meter

The diagnostic gauge (A) displays diagnostic trouble codes (DTCs) as they are accessed. Other information on the engine can be accessed using the touch keys (N, O and P). The hour meter feature shows the operating hours of the engine and should be used as a guide for scheduling periodic maintenance. If the diagnostic gauge receives a trouble code from an engine control unit, the current display will switch to a warning or shutdown (depending on the severity of the code) screen that will display the trouble code number, the description of the code and the corrective action needed.

B—Tachometer

The tachometer (B) indicates engine speed in hundreds of revolutions per minute (rpm).

C—Voltmeter (Optional)

Continued on next page

The voltmeter (C) indicates system battery voltage. The amber “Warning” light (Q) will illuminate when battery voltage is too low for proper operation of the fuel injection system.

D—Audible Alarm (Optional)

The audible alarm (D) will sound whenever low oil pressure, high coolant temperature, or water-in-fuel conditions exist. This includes all signals that light up the amber “warning” indicator (intermittent alarm) or the red “stop engine” indicator (steady alarm).

E—Audible Alarm Override Button

The optional audible alarm has an override button (E) that silences the audible alarm for approximately two minutes when pressed.

F—Key Start Switch

The three-position key start switch (F) controls the engine electrical system. When the key switch is turned clockwise to “START”, the engine will crank. When the engine starts, the key is released and returns to the “ON” (RUN) position.

G—Override Shutdown Rocker Switch

Switch will be present, but may not be active, depending on engine control unit (ECU) options originally selected. If switch is active, pressing the upper half of the override shutdown switch (G) will override an engine shutdown signal. The switch must be pressed within 30 seconds to prevent undesired shutdown of engine. Pressing this switch will override the engine shutdown for 30 seconds at a time to move vehicle to a safe location.

H—Bump Speed Enable Rocker Switch

This is a three-position switch (H) with the center position as “OFF” (locked). With this switch in the “OFF” position, the speed select switch (I) is also locked, to prevent accidental changes in operating speed. Pressing upper or lower half of switch (H) will unlock or enable the bump speed switch to take effect using speed select switch (I).

I—Speed Select Rocker Switch

The speed select switch (I) is used to bump engine speed up (+) or down (-) in small increments during operation. This switch must be used with the bump speed enable switch (H) in the unlocked position (top or bottom half of button depressed).

J—High-Low Speed Select Rocker Switch

The high-low speed select switch (J) is used to set the engine operating speeds at slow (turtle) or fast (rabbit). Factory preset idle speeds can also be adjusted using bump speed enable switch (H) with speed select switch (I).

The basic instrument panel will have the high-low speed select switch only. Press and hold up (+) or down (-) to adjust engine speed as desired. The engine speed selected will not be held in the memory. To adjust engine speeds, See Changing Engine Speeds in Section 20.

How To Select Preset Operating Speeds (Bump Speeds)

First select Turtle (Slow) or Adj by pressing speed select switch (J) to “Turtle” (slow) or “Adj”(center). Then you can press either the upper or lower portion of the bump speed enable switch (H) to unlock the setting. The bump speed enable must be held down as the speed select switch (J) is used to change the setting by pressing (+) to increase speed or (-) to decrease speed.

Once the slow idle speed has been set, the bump speed enable **switch must be pressed and released three times within two seconds to commit the new operating speed to memory.** If not done, the engine's new speed will only be effective until the key switch is shut off. Then the speed will revert back to the previous setting.

The fast idle speed is not adjustable. It will always go back to the factory preset fast idle speed.

K—Analog Throttle Control (Optional)

The throttle control (K) is used to control engine speed. This control is available only on engines with analog throttle.

L—Engine Oil Pressure Gauge

The oil pressure gauge (L) indicates engine oil pressure. An audible alarm (D) warns the operator if engine oil pressure falls below a safe operating pressure.

M—Engine Coolant Temperature Gauge

The engine coolant temperature gauge (M) indicates engine coolant temperature. An audible alarm (D) warns the operator if coolant temperature rises above the preset safe operating temperature.

N—Menu Key

The menu key is pressed to either enter or exit the menu screens on the diagnostic gauge.

O—Arrow Keys

Use the arrow keys (O) to change the display on the window of the diagnostic gauge and to access engine performance data.

Pressing the left arrow to scroll to the left or upward or the right arrow to scroll to the right or downward. This will allow you to view various engine parameters and any diagnostic trouble codes that occur.

Refer to the following story for accessing engine information on the diagnostic gauge using the touch keys.

P—Enter Key

The enter key is pressed to select the parameter that is highlighted on the screen.

Q—Amber “WARNING” Indicator Light

Continued on next page

When light comes on, an abnormal condition exists. It is not necessary to shut down the engine immediately, but the problem should be corrected as soon as possible.

When light comes on, stop engine immediately or as soon as safely possible to prevent engine damage. Correct problem before restarting.

R—Red “STOP ENGINE” Indicator Light

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JR74534,00002C7 -19-05APR16-3/3

PV101 Diagnostic Gauge — Using

The diagnostic gauge (A) allows the operator to monitor engine functions, view diagnostic trouble codes (DTC’s), and perform preliminary diagnostics. The gauge is linked to the electronic control system and sensors.

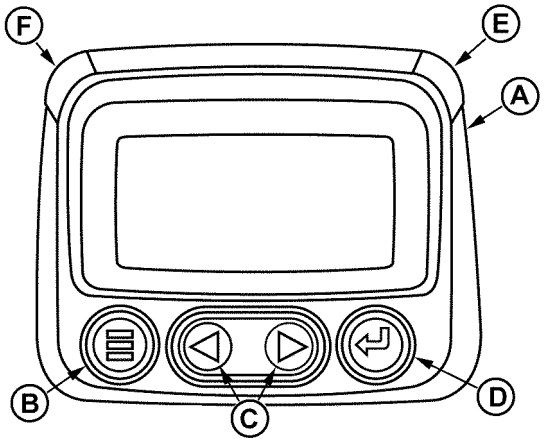
The menu key (B) allows the operator to access the main menu of the diagnostic gauge. For more information see PV101 Diagnostic Gauge — Main Menu. This key also allows the operator to cancel an option and go back to the previous menu or home menu.

The arrow keys (C) allows the operator to scroll between menu items. The arrow keys automatically change from up and down, to left and right depending on the menu item to be selected.

The select key (D) allows the operator to access menu items selected by the arrow keys (C) and confirm changes made by the operator.

The red “STOP ENGINE” indicator light (E) allows the operator to visually see when a condition exists which requires immediate operator action and service.

The amber “WARNING” indicator light (E) allows the operator to visually see when a condition exists which requires operator action.



RG13132 —UN—09SEP03

Diagnostic Gauge

A—Diagnostic Gauge
B—Menu Key
C—Arrow Keys
D—Select Key
E—Red “STOP ENGINE” Indicator Light
F—Amber “WARNING” Indicator Light

BL90236,000002A -19-23MAR16-1/1

PV101 Diagnostic Gauge — Main Menu

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens.

The main menu is the starting point in accessing engine information and configuring the diagnostic gauge. Press the menu key (B) to access the main menu.

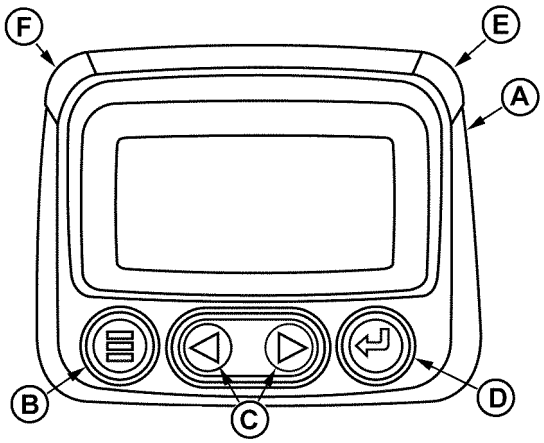
Use the arrow keys (C) and select key (D) to view menu items displayed:

- Go to 4-up dislpay
- Exhaust filter
- Engine speed control
- Languages
- Stored codes
- Engine configuration
- Setup 1-up display
- Setup 4-up display
- Select units
- Adjust backlight
- Adjust contrast
- Utilities

Listed are examples of features available in main menu items.

In Utilities:

- Gauge data
- Remove all gauges
- Software version
- Modbus setup
- Fault conversion



RG13132 —UN—09SEP03

Diagnostic Gauge

A—Diagnostic Gauge
B—Menu Key
C—Arrow Keys
D—Select Key
E—Red "STOP ENGINE" Indicator Light
F—Amber "WARNING" Indicator Light

- Select engine ECU
- Clear machine hours
- Performance data
- Interactive tests
- Reset trip
- Set function instance
- ECU software update

JR74534,00002C8 -19-02JUN16-1/1

PV101 Diagnostic Gauge — Essential Menus

Automatic Exhaust Filter Cleaning

To enable auto exhaust filter cleaning mode:
1. Press menu key on diagnostic gauge
2. Press arrow keys to scroll up or down to EXHAUST FILTER
3. Press select key
4. Press arrow keys to scroll up or down to AUTO EXH FLT CLEAN
5. Press select key to enable auto exhaust filter cleaning

Manual/Parked Exhaust Filter Cleaning

To request a manual/parked exhaust filter cleaning:
1. Reduce engine speed to slow idle
2. Press menu key
3. Press arrow keys to scroll up or down to EXHAUST FILTER
4. Press select key
5. Press arrow keys to scroll up or down to REQUEST EXH FLT CLEAN
6. Press select key to request a manual/parked exhaust filter cleaning
7. Follow directions on display and ensure all conditions are met
8. Press select key to CONFIRM all conditions are met

Disable Exhaust Filter Cleaning

To disable the auto exhaust filter cleaning mode:
1. Press menu key on diagnostic gauge
2. Press arrow keys to scroll up or down to EXHAUST FILTER
3. Press select key
4. Press arrow keys to scroll up or down to DISABLE EXH FLT CLEAN
5. Press select key to disable exhaust filter cleaning

Fault Codes — Active

To view active fault code information:
1. Press menu key on diagnostic gauge
2. Press arrow keys to scroll up or down to FAULTS
3. Press select key
4. Press arrow keys to scroll up or down to ACTIVE FAULTS
5. Press select key
6. Press arrow keys to scroll through available faults

Fault Codes — Stored

To view stored fault code information:
1. Press menu key on diagnostic gauge
2. Press arrow keys to scroll up or down to FAULTS
3. Press select key
4. Press arrow keys to scroll up or down to STORED FAULTS
5. Press select key
6. Press arrow keys to scroll up or down to VIEW
7. Press select key
8. Press arrow keys to scroll through available faults

BL90236,0000025 -19-02JUN16-1/1

DG14 Diagnostic Gauge — Using

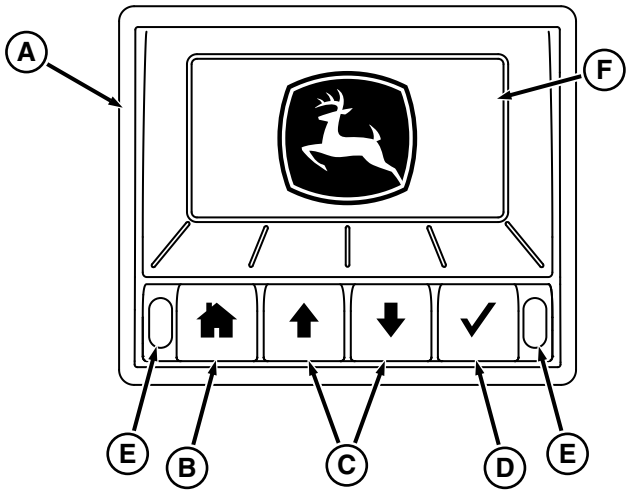
The diagnostic gauge (A) allows the operator to monitor engine functions, view diagnostic trouble codes (DTC's), and perform preliminary diagnostics. The gauge is linked to the electronic control system and sensors.

The (home) menu key (B) allows the operator to access the main menu of the diagnostic gauge. For more information see DG14 Diagnostic Gauge — Main Menu. This key also allows the operator to cancel an option and go back to the previous menu or home menu.

The arrow keys (C) allows the operator to scroll between menu items. The arrow keys automatically change from up and down, to left and right depending on the menu item to be selected.

The (check mark) select key (D) allows the operator to access menu items selected by the arrow keys (C) and confirm changes made by the operator.

The indicator lights (E) allows the operator to visually see the presence of an active trouble code.



Diagnostic Gauge

A—Diagnostic Gauge
B—(Home) Menu Key
C—Arrow Keys
D—(Check Mark) Select Key
E—Indicator Light
F—Display

BL90236,0000028 -19-02JUN16-1/1

DG14 Diagnostic Gauge — Main Menu

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens.

The main menu is the starting point in accessing engine information and configuring the diagnostic gauge. Press the menu key (B) to access the main menu.

Use the arrow keys (C) and select key (D) to view menu items displayed:
- Function
- Display
- Utility
- Setup

Listed are examples of features available in main menu items.

In Function:

- View fault code
- Reset trip (FT4 Only)
- Exhaust regeneration (IT4 & FT4 Only)
- Emission system override (if equipped)
- ECU software updates

In Display:

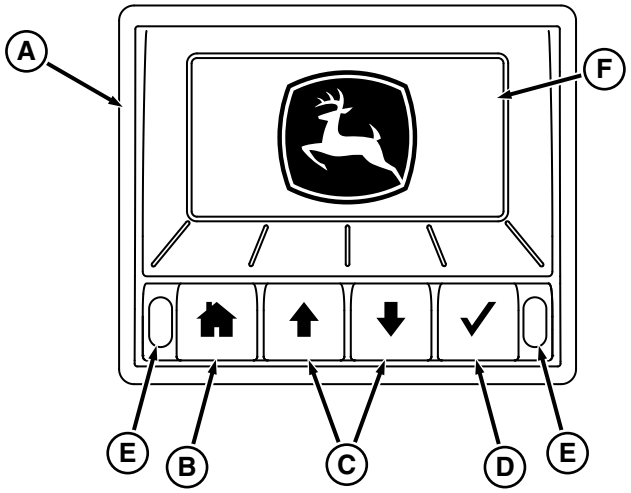
- Adjust backlight
- Adjust indicator brightness
- Display option setup

In Utility:

- Full parameter list
- Software data
- Select units
- Select language

In Setup:

- Select analog input
- Select digital input
- Select digital output



RG27904 —UN—25FEB16

Diagnostic Gauge

A—Diagnostic Gauge
B—(Home) Menu Key
C—Arrow Keys
D—(Check Mark) Select Key
E—Indicator Light
F—Display

- Alarm functionality
- Add J1939 gage
- Set RS485 messaging
- Set engine source address
- Set function instance
- Harness diagnostics
- TSC control (password protected)

Key Code for Password Protected Screens

Numeric values are assigned to keys on diagnostic gauge as identified below:

- 1 — (Home) Menu Key
- 2 — (Up) Arrow Key
- 3 — (Down) Arrow Key
- 4 — (Check Mark) Select Key

BL90236,0000029 -19-02JUN16-1/1

DG14 Diagnostic Gauge — Essential Menus

Automatic Exhaust Filter Cleaning

To enable auto exhaust filter cleaning mode:
1. Press (home) menu key on diagnostic gauge
2. Press arrow keys to scroll up or down to FUNCTION
3. Press (check mark) select key
4. Press arrow keys to scroll up or down to EXHAUST REGENERATION
5. Press (check mark) select key
6. Press arrow keys to scroll up or down to AUTOMATIC
7. Press (check Mark) select key to enable auto exhaust filter cleaning

Manual/Parked Exhaust Filter Cleaning

To request a manual/parked exhaust filter cleaning:
1. Reduce engine speed to slow idle
2. Press (home) menu key on diagnostic gauge
3. Press arrow keys to scroll up or down to FUNCTION
4. Press (check mark) select key
5. Press arrow keys to scroll up or down to EXHAUST REGENERATION
6. Press (check mark) select key
7. Press arrow keys to scroll up or down to FORCED
8. Press (check mark) select key to request a manual/parked exhaust filter cleaning
9. Follow directions on display and ensure all conditions are met
10. Press (check mark) select key to CONFIRM all conditions are met

Disable Exhaust Filter Cleaning

To disable the auto exhaust filter cleaning mode:
1. Press (home) menu key on diagnostic gauge
2. Press arrow keys to scroll up or down to FUNCTION
3. Press (check mark) select key
4. Press arrow keys to scroll up or down to EXHAUST REGENERATION
5. Press (check mark) select key
6. Press arrow keys to scroll up or down to INHIBIT
7. Press (check mark) select key to disable exhaust filter cleaning
8. Press (check mark) select key to continue after the warning has been acknowledged

Emission System Override — Activate

To activate an override during a derate:
1. Press (home) menu key on diagnostic gauge
2. Press arrow keys to scroll up or down to FUNCTION
3. Press (check mark) select key
4. Press Arrow keys to scroll up or down to EMERGENCY OVERRIDE
5. Press (check mark) select key
6. Press (check mark) select key to continue after the warning has been acknowledged
7. Press (check mark) select key
8. Using the keypad, input the PASSCODE: 3 – 2 – 1 – 4. The sequence is (down arrow key – up arrow key – (home) menu key – (check mark) select key
9. Press the (check mark) select key to “ACTIVATE” an emergency override

Emission System Override — Pause

To pause an override during a derate:
1. Press (home) menu key on diagnostic gauge
2. Press arrow keys to scroll up or down to FUNCTION
3. Press (check mark) select key
4. Press Arrow keys to scroll up or down to EMERGENCY OVERRIDE
5. Press (check mark) select key
6. Press the up arrow key to PAUSE an emergency override

Emission System Override — Resume

To resume an override during a derate:
1. Press (home) menu key on diagnostic gauge
2. Press arrow keys to scroll up or down to FUNCTION
3. Press (check mark) select key
4. Press Arrow keys to scroll up or down to EMERGENCY OVERRIDE
5. Press (check mark) select key
6. Press the up arrow key to RESUME an emergency override

Fault Codes — Active

To view active fault code information:
1. Press (home) menu key on diagnostic gauge
2. Press arrow keys to scroll up or down to FUNCTION
3. Press (check mark) select key
4. Press Arrow keys to scroll up or down to VIEW FAULT CODES
5. Press (check mark) select key
6. Press arrow keys to scroll up or down to ACTIVATE
7. Press (check mark) select key
8. Press Arrow keys to scroll through available faults

Fault Codes — Stored

To view stored fault code information:
1. Press (home) menu key on diagnostic gauge
2. Press arrow keys to scroll up or down to FUNCTION
3. Press (check mark) select key
4. Press Arrow keys to scroll up or down to VIEW FAULT CODES
5. Press (check mark) select key
6. Press arrow keys to scroll up or down to STORED
7. Press (check mark) select key
8. Press Arrow keys to scroll through available faults

BL90236,0000026 -19-22SEP16-1/1

PV480 Instrument Panel

John Deere PowerTech™ OEM engines have an electronic control system, which has controls and gauges as shown. The following information applies only to those controls and gauges supplied by John Deere. Refer to your engine application manual for specific guidelines if John Deere-sourced controls and instrumentation are not used.

The following is a brief description of the available optional electronic controls and gauges found on John Deere provided instrument panels. Refer to manufacturer's literature for information on controls not provided by John Deere.

Instrument Panel

A — Diagnostic Gauge

The diagnostic gauge (A) allows the operator to view fuel level, DEF level, engine parameters, diagnostic trouble codes (DTCs), and other engine functions. The gauge is linked to the electronic control system and its sensors. This allows the operator to monitor engine functions and to troubleshoot the engine systems when needed.

B — Arrow Keys

The arrow keys (B) allows the operator to select menu items

C — Menu Key

The menu key (C) allow the operator to access the main menu of the diagnostic gauge.

D — Select Key

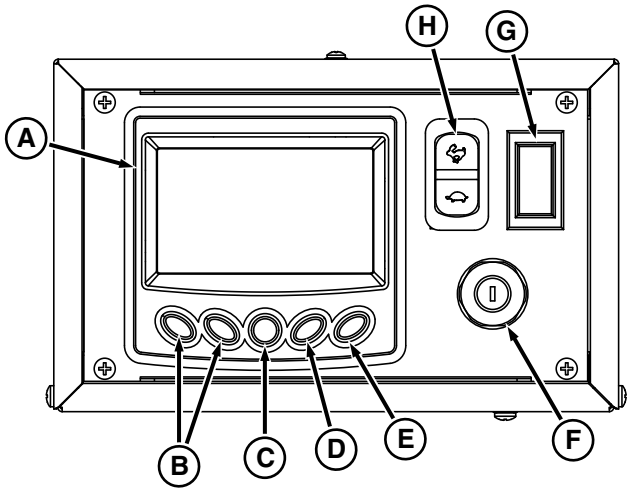
The select key (D) allows the operator to access menu items selected by the arrow keys (B) and confirm changes made by the operator.

E — Exit Key

The exit key (E) allows the operator to cancel an option and to go back to the previous menu.

F — Key Start Switch

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Instrument Panel

A—Diagnostic Gauge
B—Arrow Keys
C—Menu Key
D—Select Key
E—Exit Key
F—Key Switch
G—Cover
H—Speed Select Rocker Switch

The three-position key start switch (F) controls the engine electrical system. When the key switch is turned clockwise to "START", the engine will crank. When the engine starts, the key is released and returns to the "ON" (RUN) position.

G — Cover

The cover (G) hides an expansion slot for an additional switch.

H — Speed Select Rocker Switch

The speed select switch (H) is used to bump engine speed up (+) or down (-) in small increments during operation.

BL90236,0000003 -19-25APR16-1/1

PV480 Diagnostic Gauge — Using

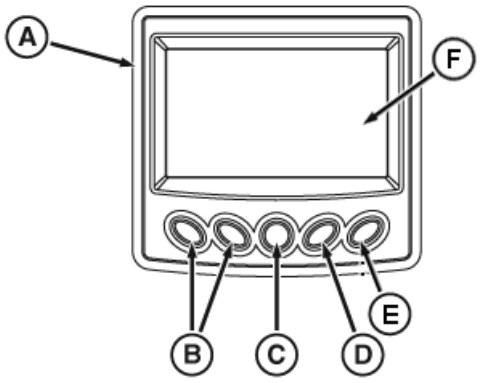
The diagnostic gauge (A) allows the operator to monitor engine functions, view diagnostic trouble codes (DTC's), and perform preliminary diagnostics. The gauge is linked to the electronic control system and sensors.

The arrow keys (B) allows the operator to scroll between menu items. The arrow keys automatically change from up and down, to left and right depending on the menu item to be selected.

The menu key (C) allows the operator to access the main menu of the diagnostic gauge. For more information see PV480 Diagnostic Gauge — Main Menu.

The select key (D) allows the operator to access menu items selected by the arrow keys (B) and confirm changes made by the operator.

The exit key (E) allows the operator to cancel an option and to go back to the previous menu.



RG23474 —UN—06JUN13

Diagnostic Gauge

A—Diagnostic Gauge
B—Arrow Keys
C—Menu Key
D—Select Key
E—Exit Key
F—Display

BL90236,0000006 -19-27MAY16-1/1

PV480 Diagnostic Gauge — Main Menu

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens.

The main menu is the starting point in accessing engine information and configuring the diagnostic gauge. Press the menu key (C) to access the main menu.

Use the arrow keys (B) and select key (D) to view menu items displayed:
- User Settings
- Faults
- Exhaust Filter
- Start Options
- Service
- Utilities

Listed are examples of features available in main menu items.

In User Settings:

- Date
- Time
- Language
- Units
- Brightness
- Ambient Light

In Check Faults:

- Active fault codes
- Stored fault codes

In Exhaust Filter:

- Status
- Auto exhaust filter clean
- Disable exhaust filter clean
- Request exhaust filter clean

In Start Options:

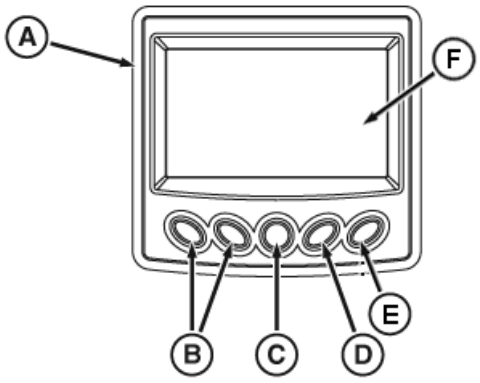
- Auto features
- Manual features
- Clock start
- Temperature start

In Service:

- Data list screens
- Engine hours
- Data logger
- Service reminders
- Harness diagnostics
- Component identification
- Emission system override (if equipped)

In Utilities:

- System settings
- Pressure governing
- ECU software update
- Advanced settings (password protected)



Diagnostic Gauge

RG23474 —UN—06JUN13

A—Diagnostic Gauge
B—Arrow Keys
C—Menu Key
D—Select Key
E—Exit Key
F—Display

BL90236,0000001 -19-02JUN16-1/1

PV480 Diagnostic Gauge — Essential Menus

Automatic Exhaust Filter Cleaning

To enable auto exhaust filter cleaning mode:
1. Press Menu key on diagnostic gauge
2. Press Arrow keys to scroll up or down to EXHAUST FILTER
3. Press Select key
4. Press Arrow keys to scroll up or down to AUTO EXH FLT CLEAN
5. Press Select key to enable auto exhaust filter cleaning

Manual/Parked Exhaust Filter Cleaning

To request a manual/parked exhaust filter cleaning:
1. Reduce engine speed to slow idle
2. Press Menu key
3. Press Arrow keys to scroll up or down to EXHAUST FILTER
4. Press Select key
5. Press Arrow keys to scroll up or down to REQUEST EXH FLT CLEAN
6. Press Select key to request a manual/parked exhaust filter cleaning
7. Follow directions on display and ensure all conditions are met
8. Press Select key to CONFIRM all conditions are met

Disable Exhaust Filter Cleaning

To disable the auto exhaust filter cleaning mode:
1. Press Menu key on diagnostic gauge
2. Press Arrow keys to scroll up or down to EXHAUST FILTER
3. Press Select key
4. Press Arrow keys to scroll up or down to DISABLE EXH FLT CLEAN
5. Press Select key to disable exhaust filter cleaning

Emission System Override — Activate

To activate an override during a derate:
1. Press Menu key on diagnostic gauge
2. Press Arrow keys to scroll up or down to SERVICE
3. Press Select key
4. Press Arrow keys to scroll up or down to DATA LIST
5. Press and hold the Menu key for 5 seconds
6. Press Select key
7. Press Arrow keys to scroll up or down to STATUS
8. Press Select key on the STATUS option
9. Press Arrow keys to ACTIVATE an emergency override
10. Press the Select key to CONFIRM selection
11. Follow directions on display and ensure all conditions have been acknowledged

Emission System Override — Pause

To pause an override during a derate:
1. Press Menu key on diagnostic gauge
2. Press Arrow keys to scroll up or down to SERVICE
3. Press Select key
4. Press Arrow keys to scroll up or down to DATA LIST
5. Press and hold Menu key for 5 seconds
6. Press Arrow keys to scroll up or down to EMERGENCY OVERRIDE
7. Press Select key
8. Press Select key on STATUS option
9. Press Arrow keys to PAUSE emergency override
10. Follow directions on display and ensure all conditions have been acknowledged

Emission System Override — Resume

To resume an override during a derate:
1. Press Menu key on diagnostic gauge
2. Press Arrow keys to scroll up or down to SERVICE
3. Press Select key
4. Press Arrow keys to scroll up or down to DATA LIST
5. Press and hold Menu key for 5 seconds
6. Press Arrow keys to scroll up or down to EMERGENCY OVERRIDE
7. Press Select key
8. Press Select key on STATUS option
9. Press Arrow keys to RESUME emergency override
10. Follow directions on display and ensure all conditions have been acknowledged

Fault Codes — Active

To view active fault code information:
1. Press Menu key on diagnostic gauge
2. Press Arrow keys to scroll up or down to FAULTS
3. Press Select key
4. Press Arrow keys to scroll up or down to ACTIVE FAULTS
5. Press Select key
6. Press Arrow keys to scroll through available faults

Fault Codes — Stored

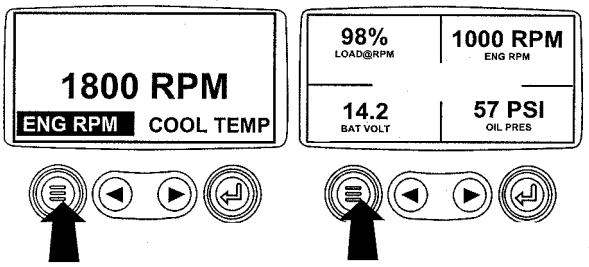
To view stored fault code information:
1. Press Menu key on diagnostic gauge
2. Press Arrow keys to scroll up or down to FAULTS
3. Press Select key
4. Press Arrow keys to scroll up or down to STORED FAULTS
5. Press Select key
6. Press Arrow keys to scroll up or down to VIEW
7. Press Select key
8. Press Arrow keys to scroll through available faults

BL90236,0000024 -19-02JUN16-1/1

Main Menu Navigation

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See Starting The Engine. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.

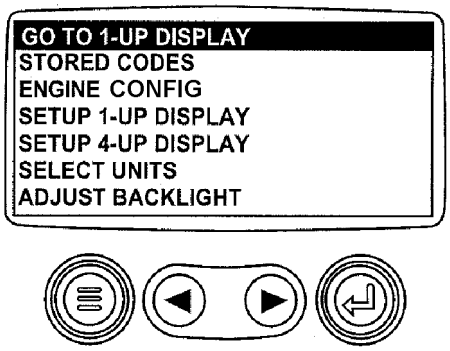


Menu Key

RG13159 —UN—26SEP03

OURGP11,00000A9 -19-27MAY16-1/5

2. The first seven items of the "Main Menu" will be displayed.

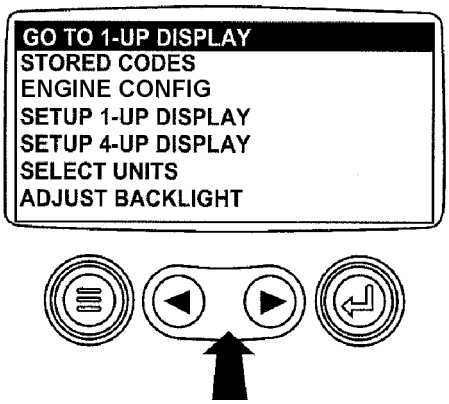


Menu Display

RG13160 —UN—02OCT03

OURGP11,00000A9 -19-27MAY16-2/5

3. Pressing the "Arrow" keys will scroll through the menu selections.



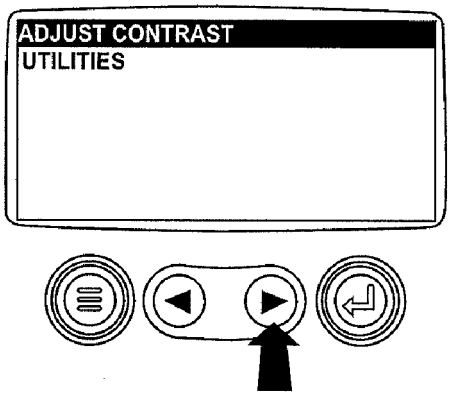
Main Menu Items

RG13161 —UN—02OCT03

Continued on next page

OURGP11,00000A9 -19-27MAY16-3/5

4. Pressing the right arrow key will scroll down to reveal the last items of "Main Menu" screen, highlighting the next item down.

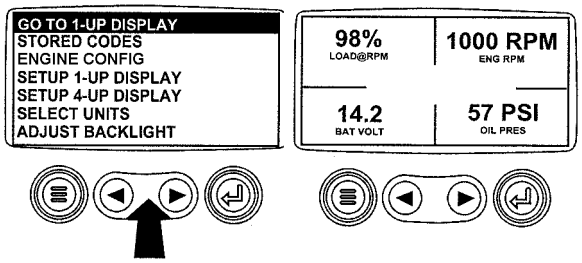


RG13162 —UN—26SEP03

Last Items On Main Menu

OURGP11,00000A9 -19-27MAY16-4/5

5. Use the arrow keys to scroll to the desired menu item or press the "Menu Button" to exit the main menu and return to the engine parameter display.



RG13163 —UN—02OCT03

Use Arrow Buttons To Scroll / Quadrant Display

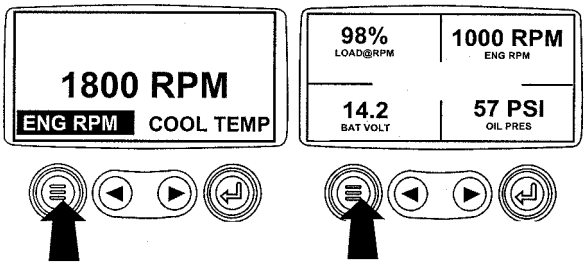
OURGP11,00000A9 -19-27MAY16-5/5

Engine Configuration Data

NOTE: The engine configuration data is a read only function.

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See Starting The Engine. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.



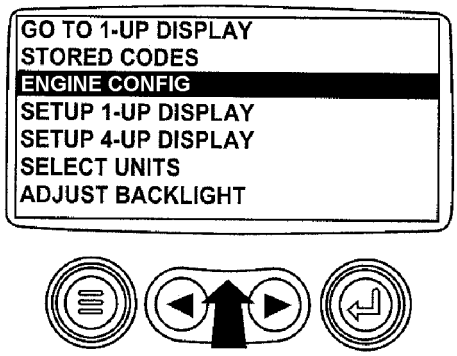
RG13159 —UN—26SEP03

Menu Key

Continued on next page

OURGP11,00000AB -19-12SEP06-1/6

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Engine Config" is highlighted.

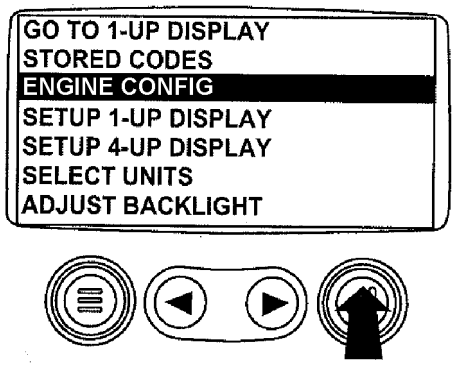


RG13164 —UN—07OCT03

Select Engine Configuration

OURGP11,00000AB -19-12SEP06-2/6

3. Once "Engine Config" menu item has been highlighted, press the "Enter" key to view the engine configuration data.

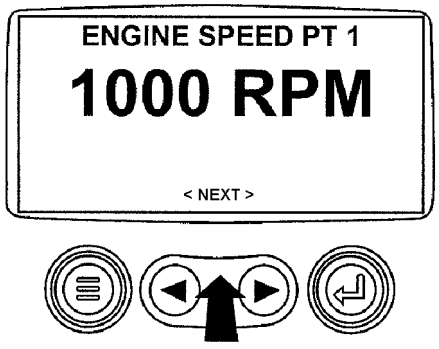


RG13165 —UN—02OCT03

Enter Key

OURGP11,00000AB -19-12SEP06-3/6

4. Use the "Arrow" keys to scroll through the engine configuration data.



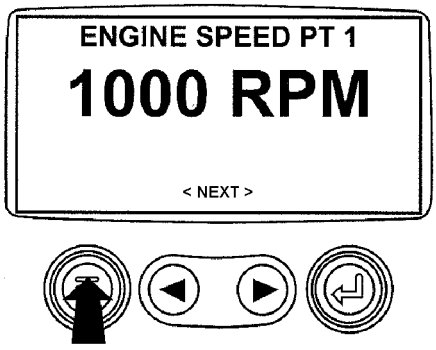
RG13166 —UN—29SEP03

Use Arrow Keys To Scroll

Continued on next page

OURGP11,00000AB -19-12SEP06-4/6

5. Press the "Menu" key to return to the main menu.

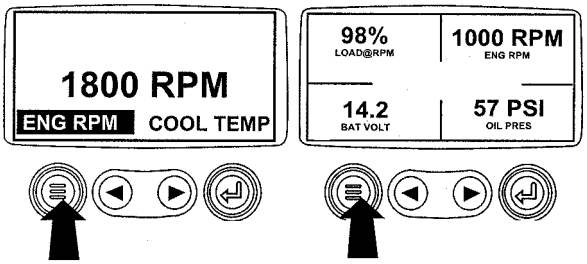


RG13167 —UN—29SEP03

Return To Main Menu

OURGP11,00000AB -19-12SEP06-5/6

6. Press the "Menu" key to exit the main menu and return to the engine parameter display.



RG13159 —UN—26SEP03

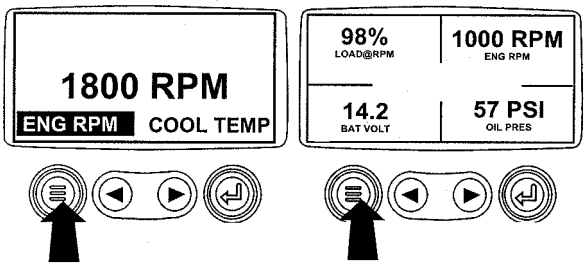
Exit Main Menu

OURGP11,00000AB -19-12SEP06-6/6

Accessing Stored Trouble Codes

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See Starting The Engine. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

For description of trouble codes, see chart in Troubleshooting Section.



RG13159 —UN—26SEP03

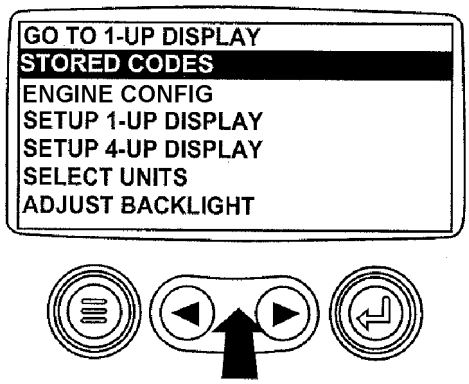
Menu Key

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.

Continued on next page

OURGP11,00000AC -19-12SEP06-1/6

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Stored Codes" is highlighted.

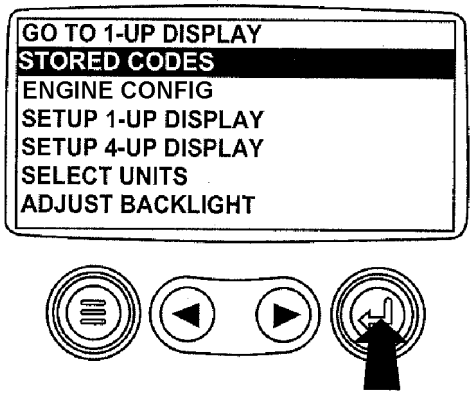


RG13168 —UN—02OCT03

Select Stored Codes

OURGP11,00000AC -19-12SEP06-2/6

3. Once the "Stored Codes" menu item has been highlighted press the "Enter" key to view the stored codes.

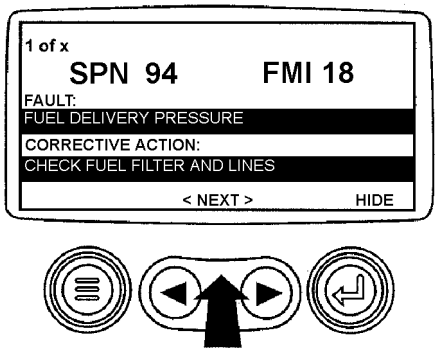


RG13169 —UN—02OCT03

Enter Key

OURGP11,00000AC -19-12SEP06-3/6

4. If the word "Next" appears above the "Arrow" keys, there are more stored codes that may be viewed. Use the "Arrow" key to scroll to the next stored code.



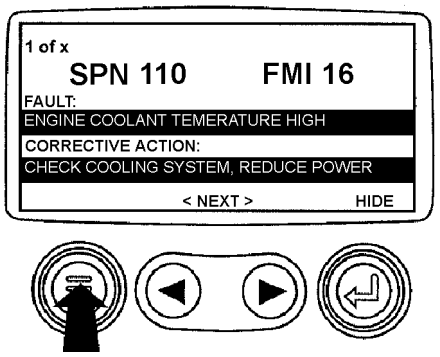
RG13245 —UN—02OCT03

Use Arrow Keys To Scroll

Continued on next page

OURGP11,00000AC -19-12SEP06-4/6

5. Press the "Menu" key to return to the main menu.

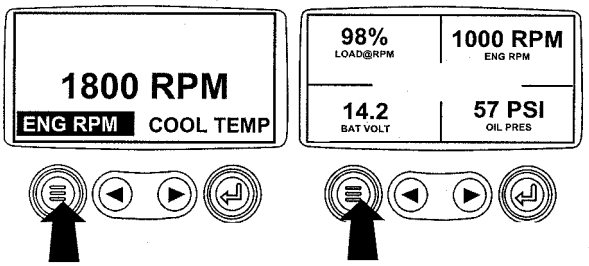


RG13246 —UN—02OCT03

Return To Main Menu

OURGP11,00000AC -19-12SEP06-5/6

6. Press the "Menu" key to exit the main menu and return to the engine parameter display.



RG13159 —UN—26SEP03

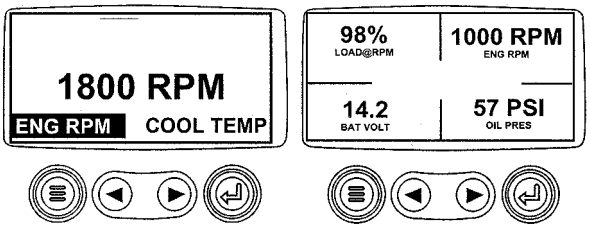
Exit Main Menu

OURGP11,00000AC -19-12SEP06-6/6

Accessing Active Trouble Codes

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See Starting The Engine. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

For description of trouble codes, see chart in Troubleshooting Section.



RG13172 —UN—26SEP03

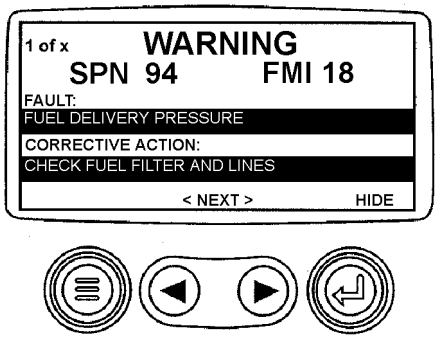
Normal Operation

1. During normal operation the single or four parameter screen will be displayed.

OURGP11,00000AD -19-27MAY16-1/7

2. When the diagnostic gauge receives a trouble code from an engine control unit, the single or four parameter screen will be replaced with the "Warning" message. The SPN and FMI number will be displayed along with a description of the problem and the corrective action needed.

IMPORTANT: Ignoring active trouble codes can result in severe engine damage.



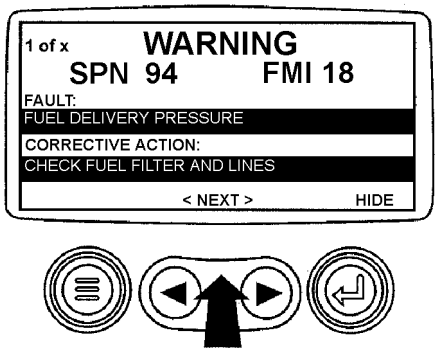
RG13240 —UN—30SEP03

Active Trouble Codes Displayed

Continued on next page

OURGP11,00000AD -19-27MAY16-2/7

3. If the word "Next" appears above the arrow keys, there are more trouble codes that can be viewed by using the arrow keys to scroll to the next trouble code.



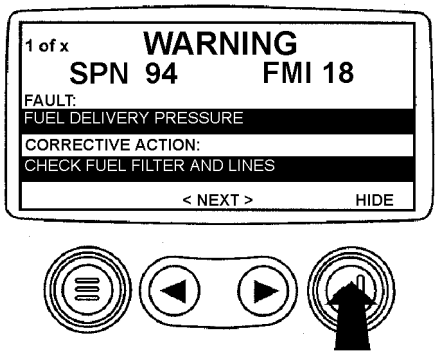
RG13241 —UN—30SEP03

Use Arrow Keys To Scroll

OURGP11,00000AD -19-27MAY16-3/7

IMPORTANT: Ignoring active trouble codes can result in severe engine damage.

4. To acknowledge and hide the code and return to the single or four parameter display, press the "Enter" Key.

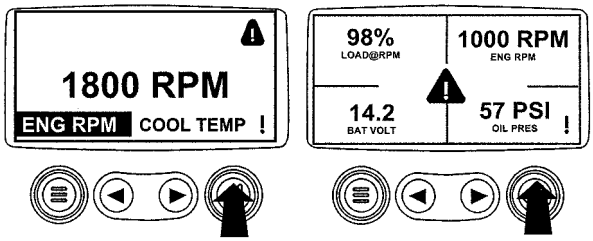


RG13242 —UN—30SEP03

Hide Trouble Codes

OURGP11,00000AD -19-27MAY16-4/7

5. The display will return to the single or four parameter display, but the display will contain the warning icon. Pressing the "Enter" key will redisplay the hidden trouble code.



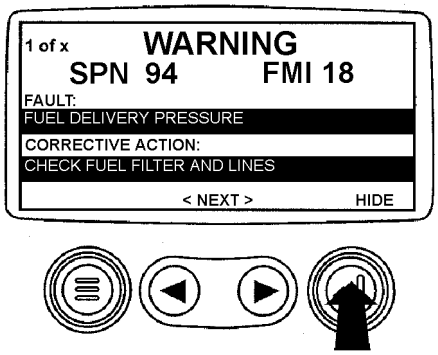
RG13176 —UN—26SEP03

Active Trouble Code Icon

OURGP11,00000AD -19-27MAY16-5/7

IMPORTANT: Ignoring active trouble codes can result in severe engine damage.

6. Pressing the "Enter" key once again will hide the trouble code and return the screen to the single or four parameter display.



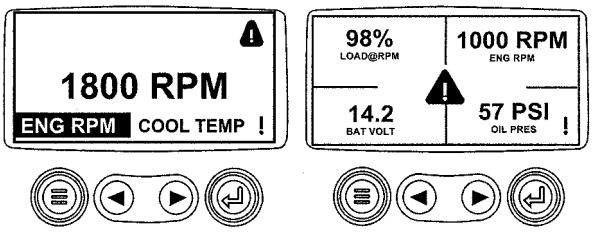
RG13242 —UN—30SEP03

Enter Key

Continued on next page

OURGP11,00000AD -19-27MAY16-6/7

7. The single or four parameter screen will display the warning icon until the trouble code condition is corrected.



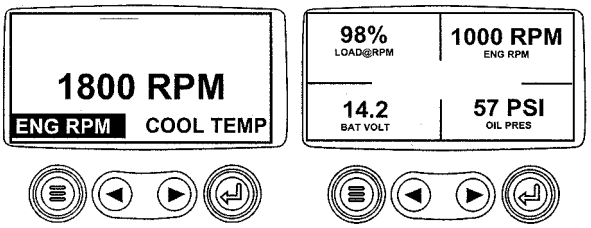
RG13243 —UN—01OCT03

Active Trouble Code Condition

OURGP11,00000AD -19-27MAY16-7/7

Engine Shutdown Codes

1. During normal operation the single or four parameter screen will be displayed.



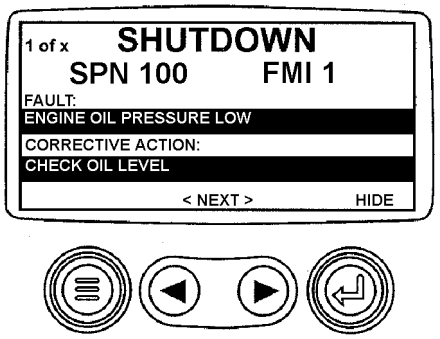
RG13172 —UN—26SEP03

Normal Operation

OURGP11,00000AE -19-27MAY16-1/6

2. When the diagnostic gauge receives a severe trouble code from an engine control unit, the single or four parameter screen will be replaced with the "Shutdown" message. The SPN and FMI number will be displayed along with a description of the problem and the corrective action needed.

   If the word "Next" appears above the arrow keys, there are more trouble codes that can be viewed by using the arrow keys to scroll to the next trouble code.



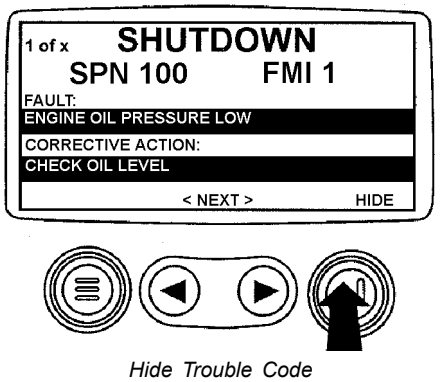
RG13238 —UN—29SEP03

Shutdown Message

OURGP11,00000AE -19-27MAY16-2/6

3. To acknowledge and hide the trouble code and return to the single or four parameter display, press the "Enter" key".

IMPORTANT: Ignoring the shutdown message can result in severe engine damage.



RG13239 —UN—29SEP03

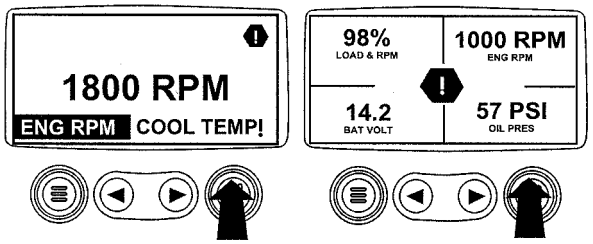
Hide Trouble Code

Continued on next page

OURGP11,00000AE -19-27MAY16-3/6

4. The display will return to the single or four parameter display, but the display will contain the "Shutdown" icon. Pressing the "Enter" key will redisplay the hidden trouble code.

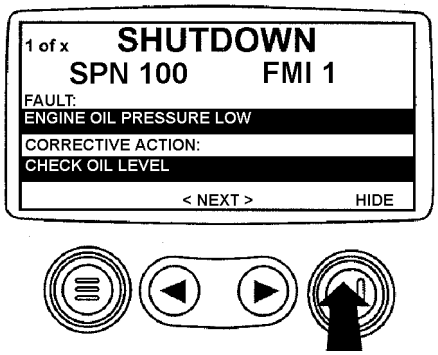
IMPORTANT: Ignoring the shutdown message can result in severe engine damage.



Flashing Shutdown Icon

OURGP11,00000AE -19-27MAY16-4/6

5. Pressing the "Enter" key once again will hide the trouble code and return the screen to the single or four parameter display.

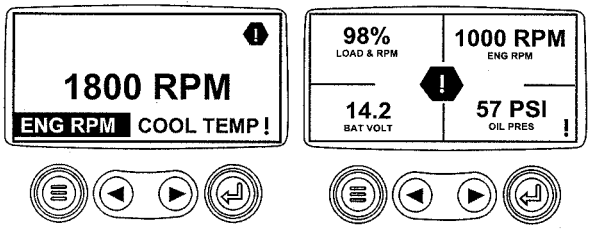


Redisplay Trouble Code

OURGP11,00000AE -19-27MAY16-5/6

6. The single or four parameter screen will display the shutdown icon until the trouble code condition is corrected.

IMPORTANT: Ignoring the shutdown message can result in severe engine damage.

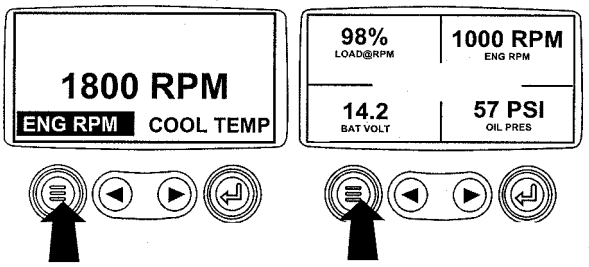


Shutdown Icon

OURGP11,00000AE -19-27MAY16-6/6

Adjusting Backlighting

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.

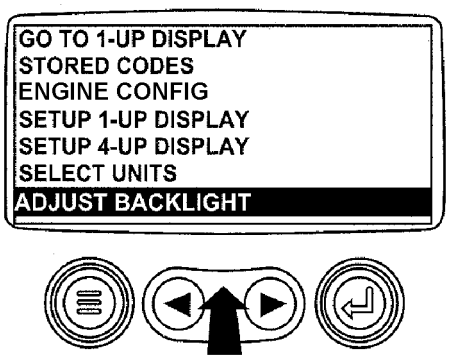


Menu Key

Continued on next page

OURGP11,0000237 -19-23AUG10-1/6

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Adjust Backlight" is highlighted.

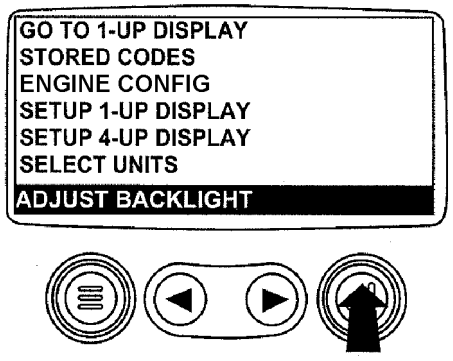


RG13181 —UN—02OCT03

Select Adjust Backlight

OURGP11,0000237 -19-23AUG10-2/6

3. Once the "Adjust Backlight" menu item has been highlighted, press the "Enter" key to activate the "Adjust Backlight" function.

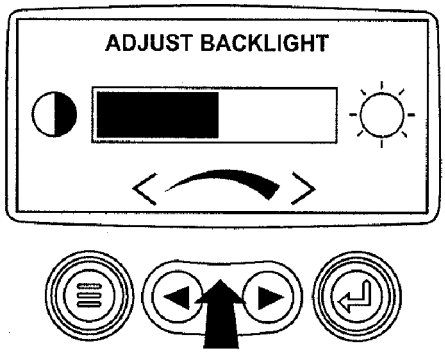


RG13182 —UN—02OCT03

Press Enter Key

OURGP11,0000237 -19-23AUG10-3/6

4. Use the "Arrow" keys to select the desired backlight intensity.



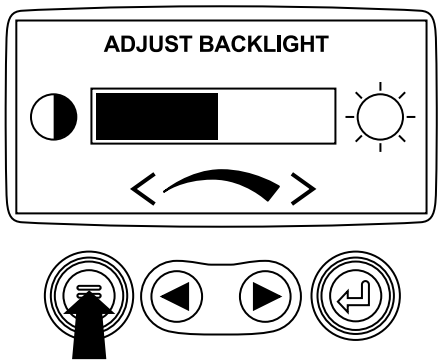
RG13183 —UN—29SEP03

Adjust Backlight Intensity

Continued on next page

OURGP11,0000237 -19-23AUG10-4/6

5. Press the "Menu" key to return to the main menu.

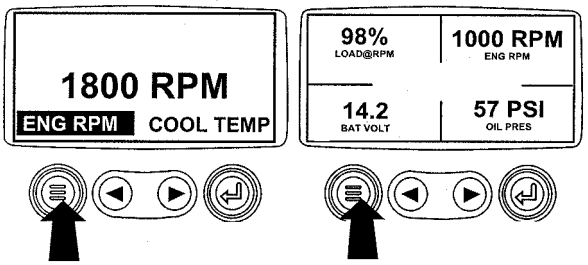


RG19048 —UN—23AUG10

Return to Main Menu

OURGP11,0000237 -19-23AUG10-5/6

6. Press the "Menu" key to exit the main menu and return to the engine parameter display.



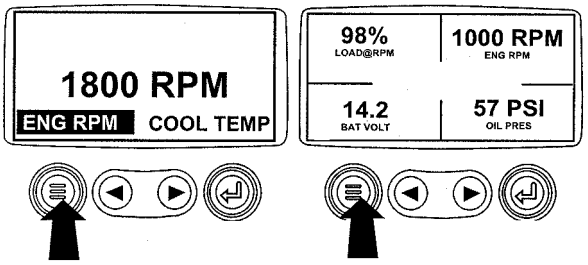
RG13159 —UN—26SEP03

Exit Main Menu

OURGP11,0000237 -19-23AUG10-6/6

Adjusting Contrast

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display press the "Menu" key.

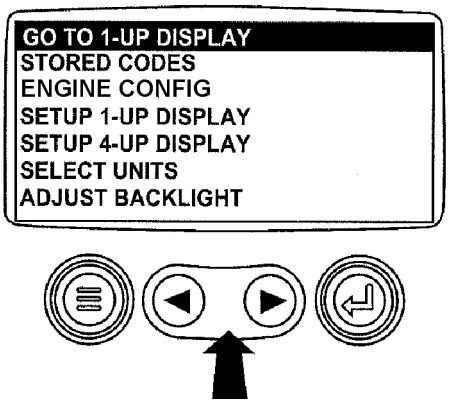


RG13159 —UN—26SEP03

Menu Key

OURGP11,00000AF -19-12SEP06-1/6

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Adjust Contrast" is highlighted.



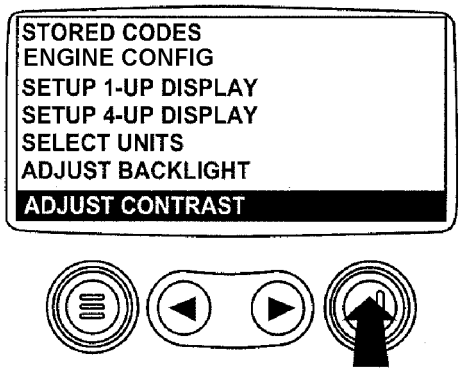
RG13161 —UN—02OCT03

Select Adjust Contrast

Continued on next page

OURGP11,00000AF -19-12SEP06-2/6

3. Once the "Adjust Contrast" menu item has been highlighted, press the "Enter" key to activate the "Adjust Contrast" function.

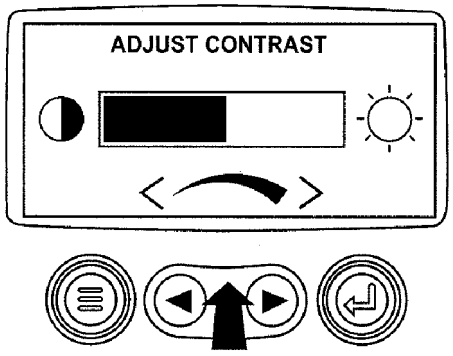


RG13185 —UN—02OCT03

Press Enter Key

OURGP11,00000AF -19-12SEP06-3/6

4. Use the "Arrow" keys to select the desired contrast intensity.

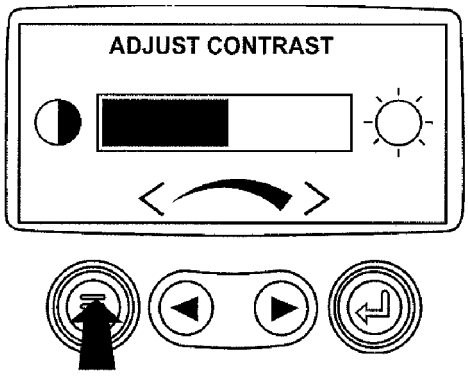


RG13186 —UN—29SEP03

Adjust Contrast Intensity

OURGP11,00000AF -19-12SEP06-4/6

5. Press the "Menu" key to return to the main menu.



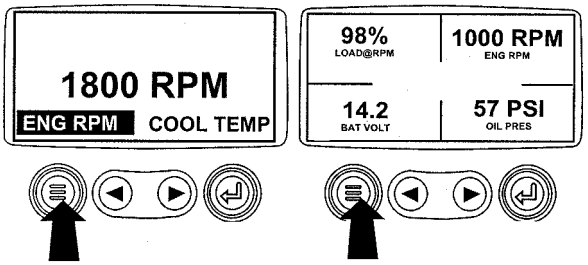
RG13187 —UN—26SEP03

Return To Main Menu

Continued on next page

OURGP11,00000AF -19-12SEP06-5/6

6. Press the "Menu" key to exit the main menu and return to the engine parameter display.



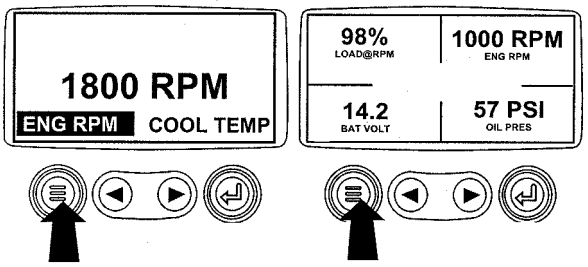
RG13159 —UN—26SEP03

Exit Main Menu

OURGP11,00000AF -19-12SEP06-6/6

Selecting Units Of Measurement

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.

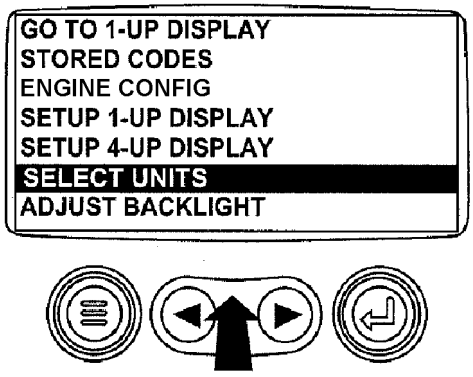


RG13159 —UN—26SEP03

Menu Key

OURGP11,00000B0 -19-27MAY16-1/7

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Select Units" is highlighted.

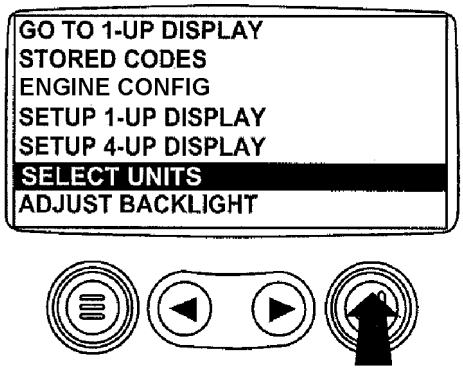


RG13188 —UN—02OCT03

Select Units

OURGP11,00000B0 -19-27MAY16-2/7

3. Once the "Select Units" menu item has been highlighted press the "Enter" key to access the "Select Units" function.



RG13189 —UN—02OCT03

Press Enter Key

Continued on next page

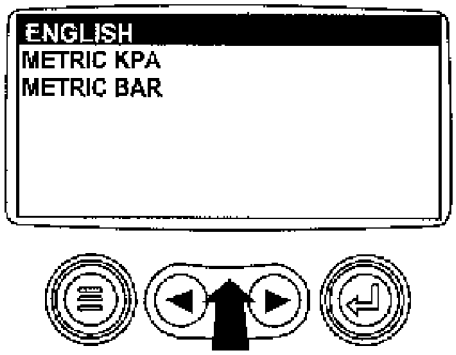
OURGP11,00000B0 -19-27MAY16-3/7

4. There are three choices for units of measurement, English, Metric kPa or Metric Bar.

   English is for Imperial units, with pressures displayed in PSI and temperatures in °F.

   Metric kPa and Metric bar are for IS units, with pressures displayed in kPa and bar respectively, and temperatures in °C.

   Use the "Arrow" keys to highlight the desired units of measurement.

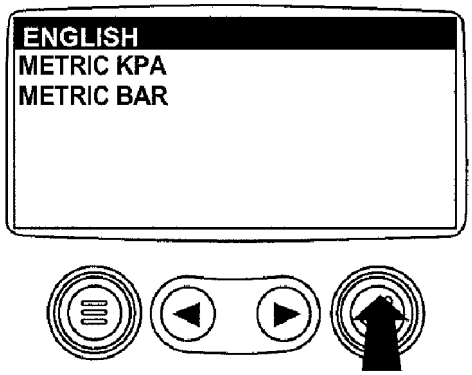


RG13190 —UN—26SEP03

Select Desired Units

OURGP11,00000B0 -19-27MAY16-4/7

5. Press the "Enter" key to select the highlighted units.

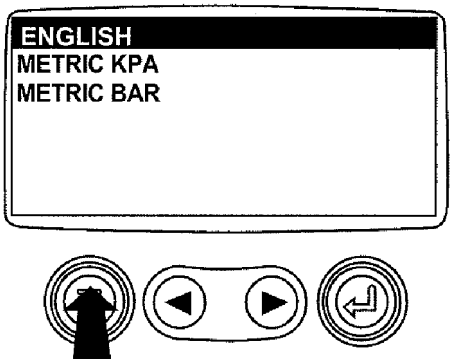


RG13191 —UN—30SEP03

Press Enter Key to Select

OURGP11,00000B0 -19-27MAY16-5/7

6. Press the "Menu" key to return to the main menu.



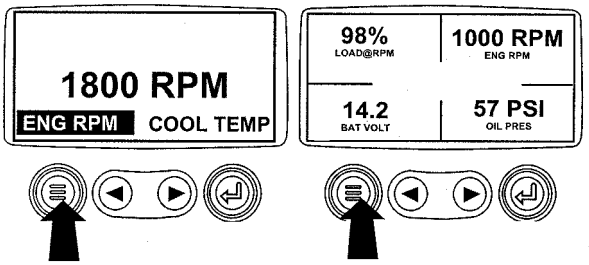
RG13192 —UN—26SEP03

Return To Main Menu

Continued on next page

OURGP11,00000B0 -19-27MAY16-6/7

7. Press the "Menu" key to return to the engine parameter display.

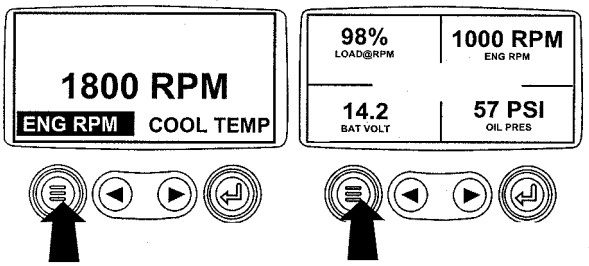


Press Menu Key

OURGP11,00000B0 -19-27MAY16-7/7

Setup 1-Up Display

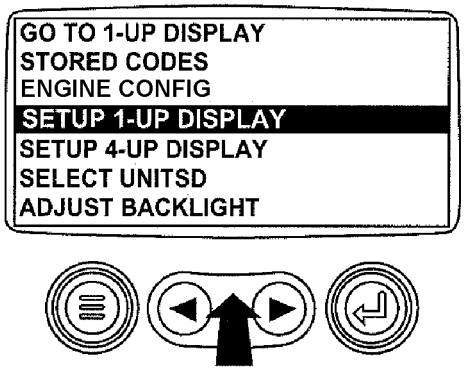
1. Turn the key switch to the ON position. Starting at the single engine parameter display, press the "Menu" key.



Menu Key

OURGP11,00000B1 -19-27MAY16-1/18

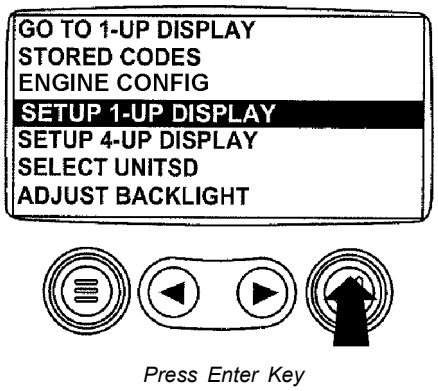
2. Use the "Arrow" keys to scroll through the menu until "Setup 1-Up Display" is highlighted.



Setup 1-Up Display

OURGP11,00000B1 -19-27MAY16-2/18

3. Once "Setup 1-Up Display" menu item has been highlighted press the "Enter" key to access the "Setup 1-Up Display" function.



Press Enter Key

Continued on next page

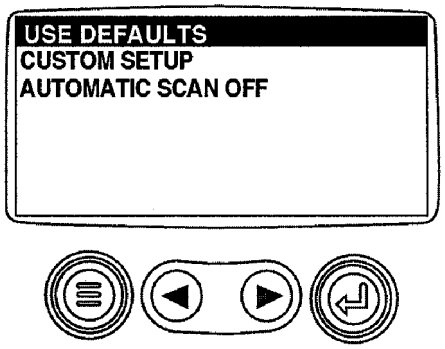
OURGP11,00000B1 -19-27MAY16-3/18

4. Three options are available for modification of the 1-Up Display.

   a. **Use Defaults** – This option contains the following engine parameters for display: Engine Hours, Engine Speed, Battery Voltage, % Load, Coolant Temperature and Oil Pressure.

   b. **Custom Setup** – This option contains a list of engine parameters. Engine parameters from this list can be selected to replace any or all of the default parameters. This option can be used to add parameters available for scrolling in the 1-Up Display.

   c. **Automatic Scan** – Selecting the scan function will allow the 1-Up Display to scroll through the selected set of parameters one at a time, momentarily pausing at each.

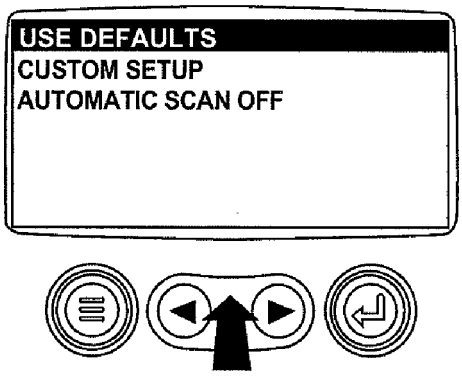


RG13196 —UN—26SEP03

1-Up Display Options

OURGP11,00000B1 -19-27MAY16-4/18

5. **Use Defaults** - To select "Use Defaults" use the Arrow keys to scroll to and highlight "Use Defaults" in the menu display.

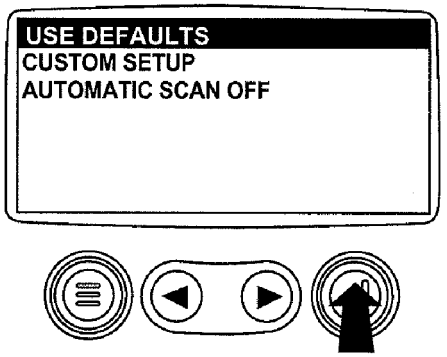


RG13195 —UN—26SEP03

Select Defaults

OURGP11,00000B1 -19-27MAY16-5/18

6. Press the "Enter" key to activate the "Use Defaults" function.



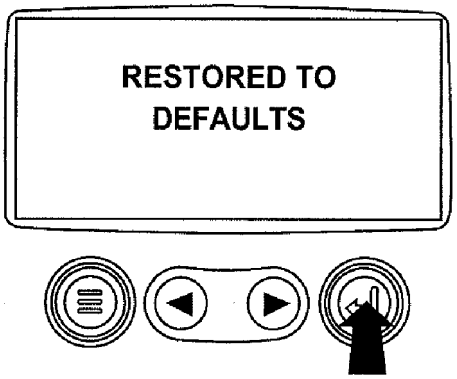
RG13197 —UN—29SEP03

Defaults Selected

Continued on next page

OURGP11,00000B1 -19-27MAY16-6/18

7. The display parameters are reset to the factory defaults, then the display will return to the "Setup 1-Up Display" menu.

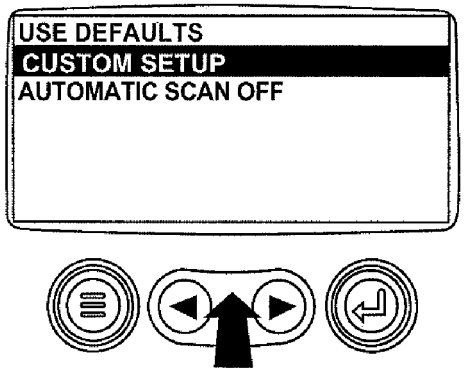


RG13149 —UN—24SEP03

Restored To Defaults

OURGP11,00000B1 -19-27MAY16-7/18

8. **Custom Setup** - To perform a custom setup of the 1-Up Display, use the arrow buttons to scroll to and highlight "Custom Setup" on the display.

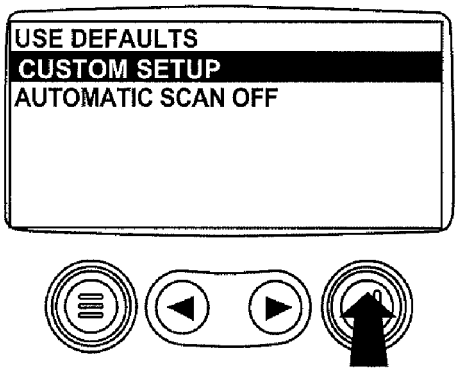


RG13198 —UN—26SEP03

Select Custom Setup

OURGP11,00000B1 -19-27MAY16-8/18

9. Press the "Enter" key to display a list of engine parameters.



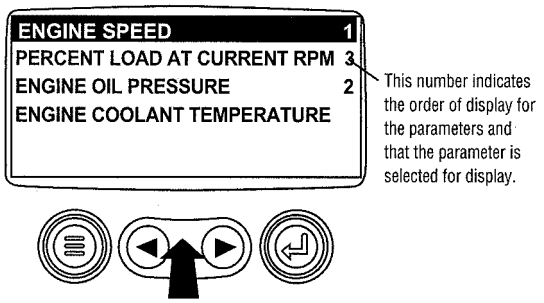
RG13199 —UN—26SEP03

Engine Parameters

Continued on next page

OURGP11,00000B1 -19-27MAY16-9/18

10. Use the "Arrow" keys to scroll to and highlight a selected parameter (parameter with a number to right of it).

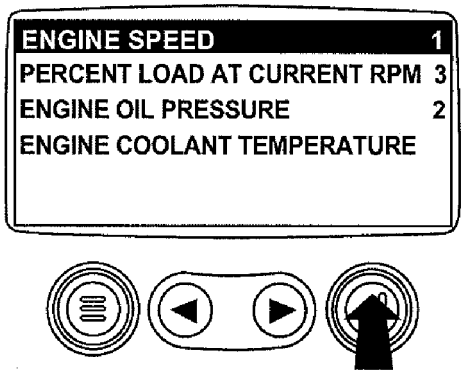


RG13150 —UN—24SEP03

Select Parameters

OURGP11,00000B1 -19-27MAY16-10/18

11. Press the "Enter" key to deselect the selected parameter, removing it from the list of parameters being displayed on the 1-Up Display.

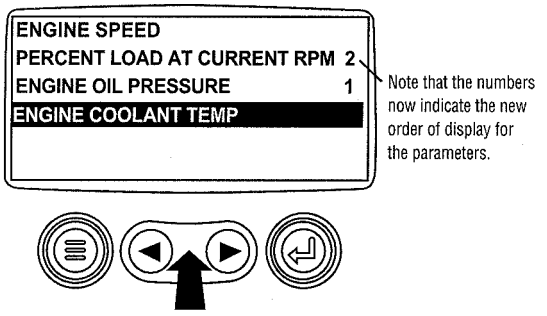


RG13219 —UN—26SEP03

Deselect Parameters

OURGP11,00000B1 -19-27MAY16-11/18

12. Use the "Arrow" keys to scroll and highlight the desired parameter that has not been selected for display (parameter without a number to right of it).



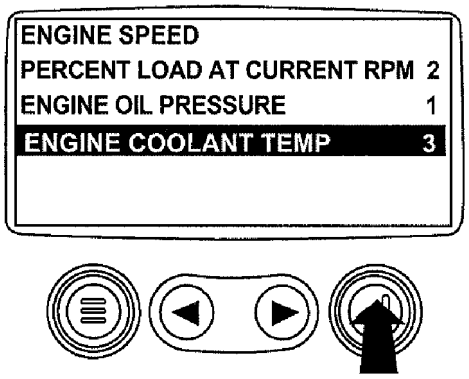
RG13151 —UN—24SEP03

Select Desired Parameters

Continued on next page

OURGP11,00000B1 -19-27MAY16-12/18

13. Press the "Enter" key to select the parameter for inclusion in the Single Engine Parameter Display.
14. Continue to scroll through and select additional parameters for the custom 1-Up Display. Press the "Menu" key at any time to return to the "Custom Setup" menu.

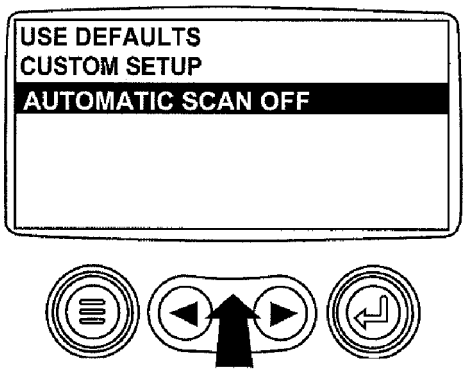


RG13220 —UN—26SEP03

Select Parameters For Display

OURGP11,00000B1 -19-27MAY16-13/18

15. **Automatic Scan** - Selecting the scan function will allow the 1- Up Display to scroll through the selected set of parameters one at a time. Use the "Arrow" keys to scroll to the "Automatic Scan" function.

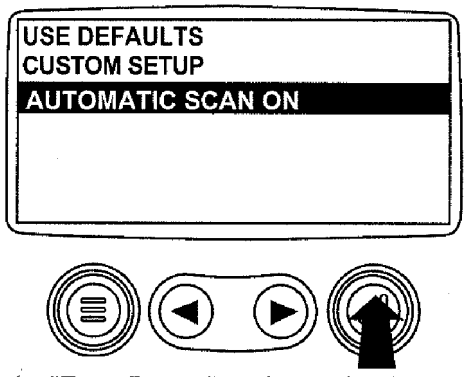


RG13221 —UN—26SEP03

Automatic Scan Off

OURGP11,00000B1 -19-27MAY16-14/18

16. Press the "Enter" key to toggle the "Automatic Scan" function on.



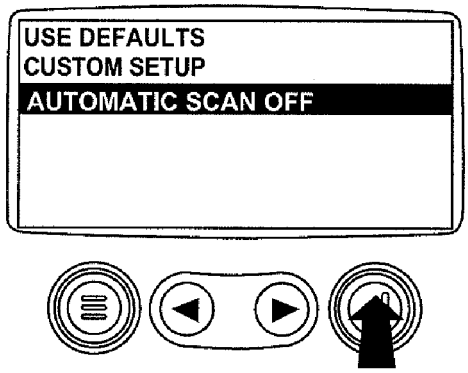
RG13222 —UN—26SEP03

Automatic Scan On

Continued on next page

OURGP11,00000B1 -19-27MAY16-15/18

17. Press the "Enter" key again to toggle the "Automatic Scan" function off.

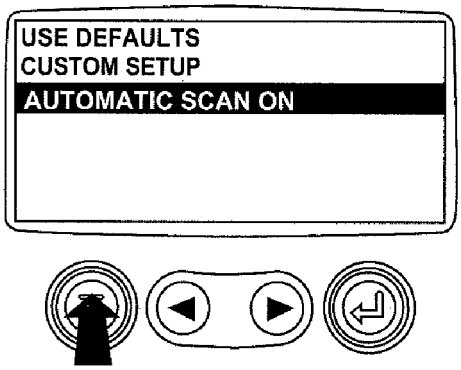


RG13223 —UN—26SEP03

Automatic Scan Off

OURGP11,00000B1 -19-27MAY16-16/18

18. Once the "Use Defaults", "Custom Setup" and "Automatic Scan" functions have been set, press the "Menu" key to return to the main menu.

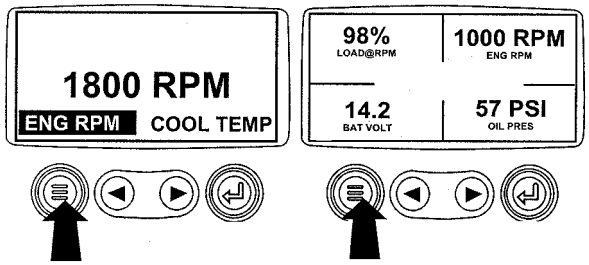


RG13224 —UN—26SEP03

Menu Key

OURGP11,00000B1 -19-27MAY16-17/18

19. Press the "Menu" key to exit the main menu and return to the engine parameter display.



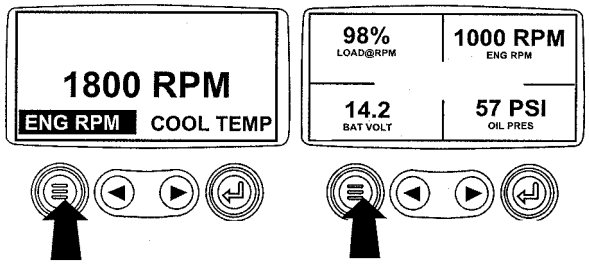
RG13159 —UN—26SEP03

Exit Main Menu

OURGP11,00000B1 -19-27MAY16-18/18

Setup 4-Up Display

1. Turn the key switch to the ON position. From the single or four engine parameter display, press the "Menu" key.



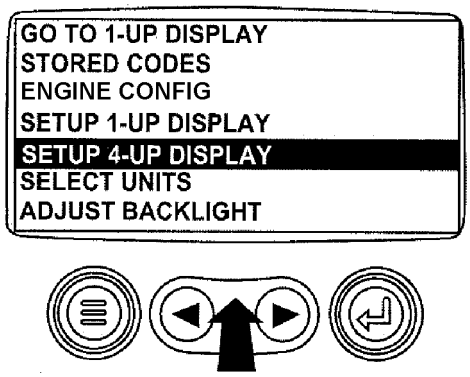
RG13159 —UN—26SEP03

Menu Key

Continued on next page

OURGP11,00000B2 -19-12SEP06-1/14

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Setup 4-Up Display" is highlighted.

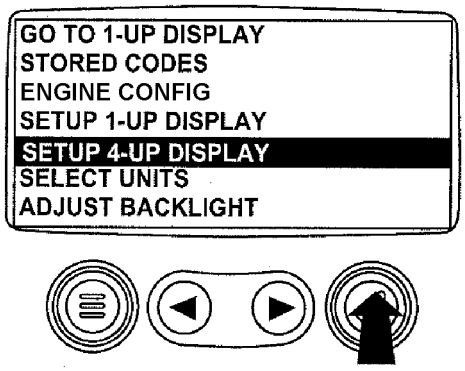


RG13225 —UN—02OCT03

Select Setup 4-Up Display

OURGP11,00000B2 -19-12SEP06-2/14

3. Once the "Setup 4-Up Display" menu item has been highlighted, press the "Enter" key to activate the "Setup 4-Up Display" menu.

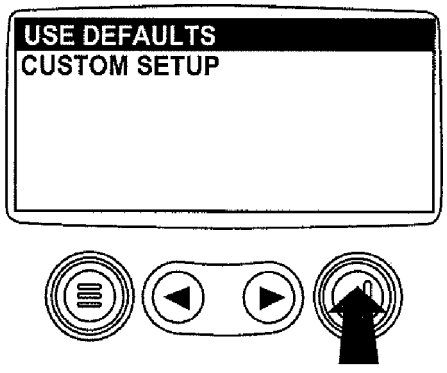


RG13226 —UN—02OCT03

Press Enter Key

OURGP11,00000B2 -19-12SEP06-3/14

4. Two options are available for the 4-Up Display.
   a. **Use Defaults** – This option contains the following engine parameters for display: Engine Speed, Battery Voltage, Coolant Temperature and Oil Pressure.
   b. **Custom Setup** – This option contains a list of engine parameters. Engine parameters from this list can be selected to replace any or all of the default parameters.



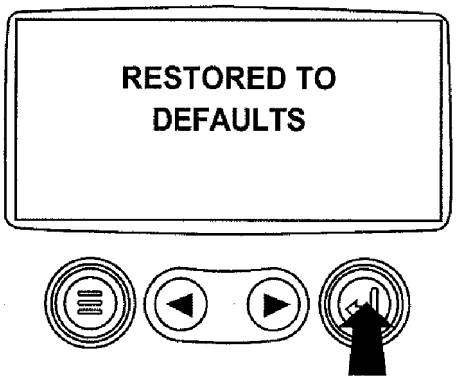
RG13244 —UN—02OCT03

Select Factory Defaults

Continued on next page

OURGP11,00000B2 -19-12SEP06-4/14

5. To reset the display parameters to the factory defaults, scroll to and highlight "Use Defaults". Press the "Enter" key to activate the "Use Defaults" function. A message indicating the display parameters are reset to the factory defaults will be displayed, then the display will return to the "Setup 4-Up Display" menu.

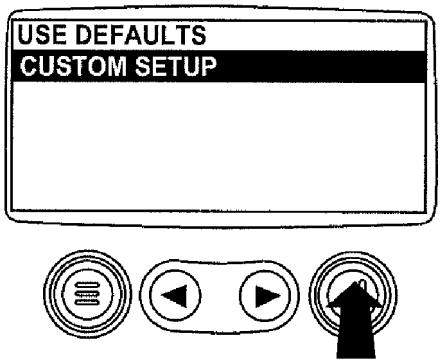


RG13149 —UN—24SEP03

Restored To Defaults

OURGP11,00000B2 -19-12SEP06-5/14

6. **Custom Setup** - To perform a custom setup of the 4-Up Display, use the arrow buttons to scroll to and highlight "Custom Setup" on the display.

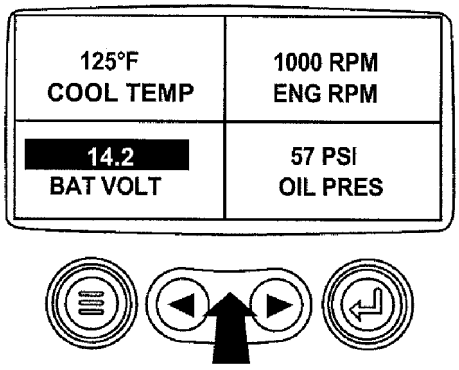


RG13227 —UN—26SEP03

Custom Setup

OURGP11,00000B2 -19-12SEP06-6/14

7. The quadrant with the highlighted parameter value is the current selected parameter. Use the "Arrow" keys to highlight the value in the quadrant you wish to change to a new parameter.



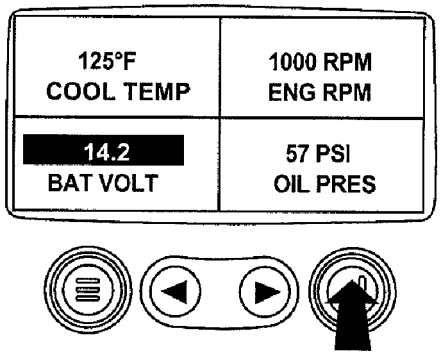
RG13228 —UN—26SEP03

Select Parameters

Continued on next page

OURGP11,00000B2 -19-12SEP06-7/14

8. Press the "Enter" key and a list of engine parameters will be displayed.

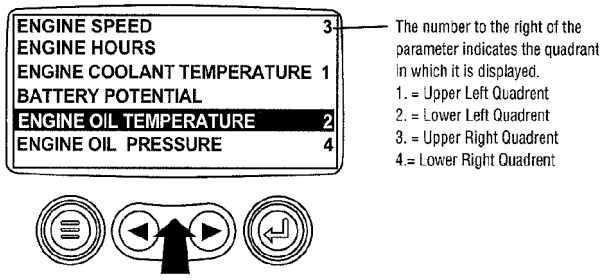


RG13229 —UN—26SEP03

List Of Engine Parameters

OURGP11,00000B2 -19-12SEP06-8/14

9. The parameter that is highlighted is the selected parameter for the screen. Use the "arrow" keys to highlight the new parameter to be placed in the "4-Up Display".

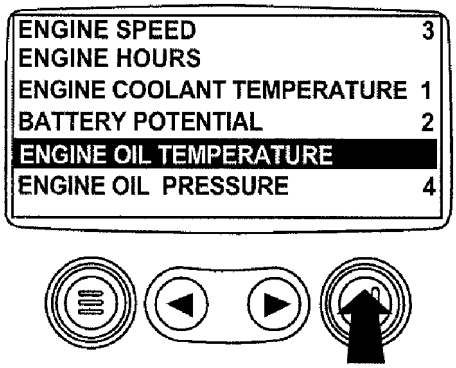


RG13230 —UN—26SEP03

Select Desired Engine Parameter

OURGP11,00000B2 -19-12SEP06-9/14

10. Press the "Enter" key to change the selected parameter in the quadrant to the new parameter.

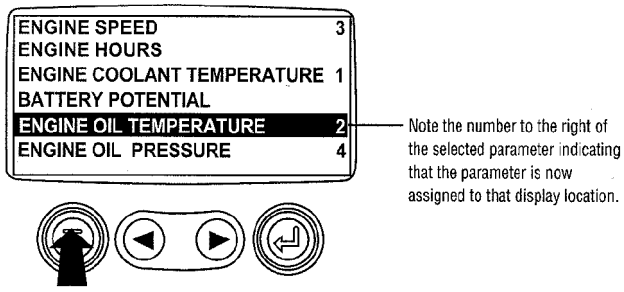


RG13231 —UN—26SEP03

Enter Selected Parameter

OURGP11,00000B2 -19-12SEP06-10/14

11. Use the "Menu" keys to return to the "4-Up Custom Setup" screen.



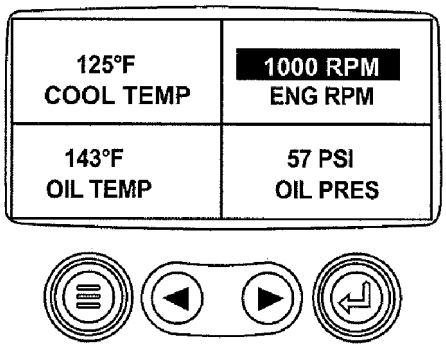
RG13232 —UN—26SEP03

Return To 4-Up Custom Setup

Continued on next page

OURGP11,00000B2 -19-12SEP06-11/14

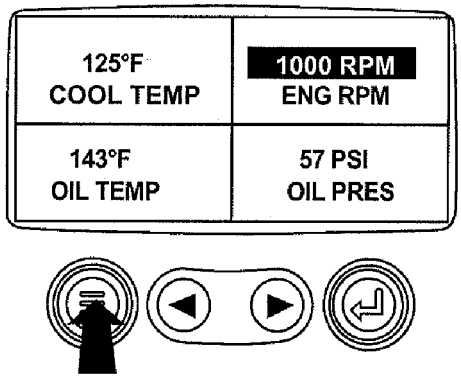
12. The selected quadrant has now changed to the new selected parameter.



4-Up Display

OURGP11,00000B2 -19-12SEP06-12/14

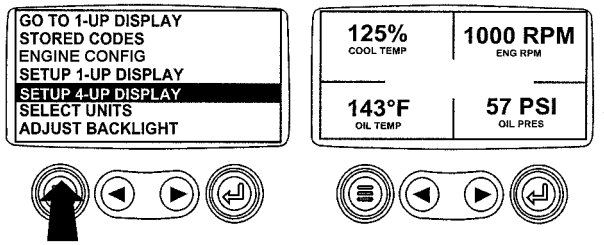
13. Repeat the parameter selection process until all spaces are as desired.
14. Press the "Menu" key to return to the main menu.



Return To Main Menu

OURGP11,00000B2 -19-12SEP06-13/14

15. Press the "Menu" key to exit the main menu and return to the engine parameter display.



Select Remaining Parameters

OURGP11,00000B2 -19-12SEP06-14/14

John Deere PowerSight

John Deere PowerSight is a web based service that allows remote access to machine data. John Deere PowerSight is accessible from a laptop, desktop or mobile device.

John Deere PowerSight works by combining a controller that includes cellular communication and GPS antennas. Machine data is collected by the controller and wirelessly transferred to a data server, where it is made available on a website.

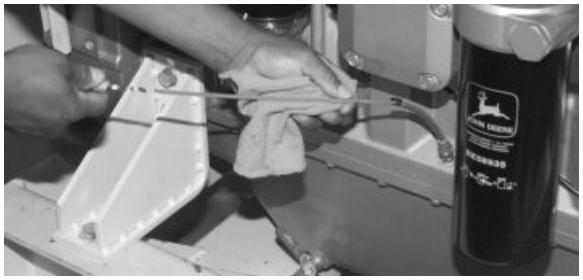
John Deere PowerSight allows you to:

- Stay informed on machine location and hours
- Protect assets with Geofence and Curfew alerts
- Keep assets running with maintenance tracking and preventive maintenance plans
- Track and analyze machine and fuel usage
- Conduct remote machine diagnostics and programming

For more information and availability, contact an authorized John Deere dealer or servicing dealer.

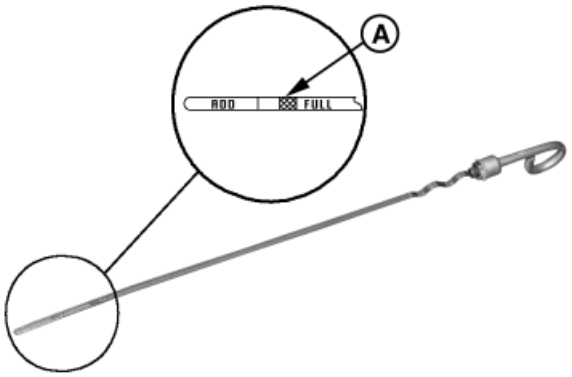
BL90236,0000031 -19-13FEB14-1/1

Engine Break-In Service



Check Engine Oil

RG9924 —UN—17NOV99



RG8707A —UN—03SEP99

Crosshatch Pattern on Dipstick

A—Crosshatch Pattern

The engine is ready for normal operation. However, extra care during the first 100 hours of operation will result in more satisfactory long-term engine performance and life. DO NOT exceed 100 hours of operation with break-in oil.

1. This engine is factory-filled with John Deere DIESEL ENGINE BREAK-IN OIL (SAE 10W-30). Operate the engine at heavy loads with minimal idling during the break-in period.
2. If the engine has significant operating time at idle, constant speeds, and/or light load usage, or makeup oil is required in the first 100 hour period, a longer break-in period may be required. In these situations, an additional 100 hour break-in period is recommended using a new change of John Deere DIESEL ENGINE BREAK-IN OIL and a new John Deere oil filter.

IMPORTANT: DO NOT add makeup oil until the oil level is BELOW the ADD mark on dipstick. John Deere ENGINE BREAK-IN OIL (TY22041) should be used to make up any oil consumed during the break-in period.

3. Check engine oil level more frequently during engine break-in period. If oil must be added during this period, John Deere DIESEL ENGINE BREAK-IN OIL is preferred. See DIESEL ENGINE BREAK-IN OIL, in Fuels, Lubricants, and Coolant Section for other oils allowed.

IMPORTANT: Do not use PLUS-50 oil or engine oils meeting any of the following during the first 100 hours of operation of a new or rebuilt engine:

API CJ-4	**API CF**
API CI-4 PLUS	**ACEA E7**
API CI-4	**ACEA E6**
API CH-4	**ACEA E5**
API CG-4	**ACEA E4**
API CF-4	**ACEA E3**
API CF-2	

These oils will not allow the engine to break-in properly.

DO NOT fill above the crosshatch pattern (A) or the FULL mark, whichever is present. Oil levels anywhere within the crosshatch are considered in the acceptable operating range.

Continued on next page

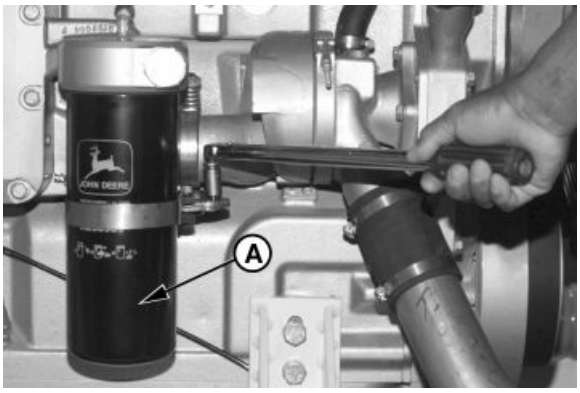
OURGP11,0000070 -19-01DEC14-1/3

4. During the first 20 hours, avoid prolonged periods of engine idling or sustained maximum load operation. If engine will idle longer than 5 minutes, stop engine.
5. Before the first 100 hours (maximum), change engine oil and replace engine oil filter (A). (See CHANGING ENGINE OIL AND REPLACING FILTER in Lubrication and Maintenance/500 Hour/12 Month Section.) Fill crankcase with the normal seasonal viscosity grade oil. (See DIESEL ENGINE OIL, in Fuels, Lubricants, and Coolant Section.)

NOTE: Some increase in oil consumption may be expected when low viscosity oils are used. Check oil levels more frequently.

If temperature is below 0°C (32°F), it may be necessary to use cold weather starting aids (See COLD WEATHER OPERATION, later in this section).

If air temperature is below -25°C (-13°F), use an engine block heater.



RG8709A —UN—03SEP99

Replace Engine Oil Filter

A—Oil Filter

OURGP11,0000070 -19-01DEC14-2/3

6. Watch coolant temperature gauge (A) closely. If coolant temperature rises above 100°C (212°F), reduce load on engine. Unless temperature drops quickly, stop the engine and determine the cause before resuming operation.

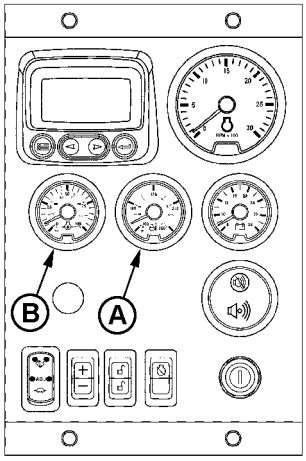
NOTE: When the coolant temperature gauge reads approximately 112°C (234°F), the engine will shutdown automatically, if equipped with safety controls.

7. Watch oil pressure gauge (B) for pressure within specification.

	Specification
Engine Oil[1]—Minimum Pressure at No Load (Idle)	138 kPa (1.38 bar) (20 psi)
Engine Oil—Maximum Pressure at Full Load (Rated Speed)	310 kPa (3.1 bar) (45 psi)
Engine Coolant—Temperature Range	82°—92°C (180°—197°F)

8. Check poly-vee belt for proper alignment and seating in pulley grooves.

[1] At normal operating sump temperature of 105°C (220°F).



RG13720 —UN—11NOV04

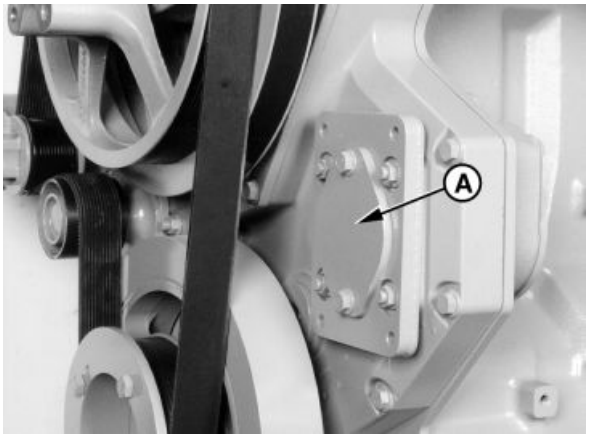
Watch Coolant Temperature and Oil Pressure on Panel

A—Engine Coolant Temperature Gauge

B—Oil Pressure Gauge

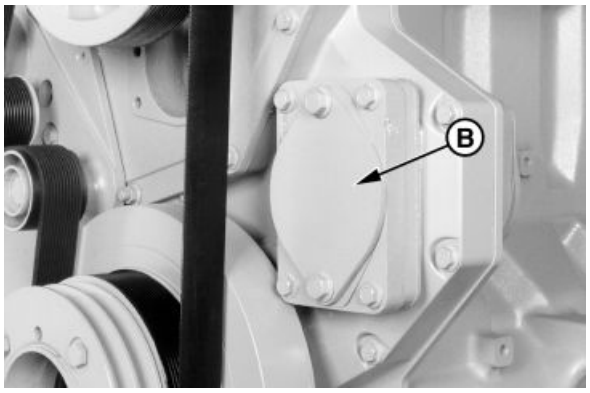
OURGP11,0000070 -19-01DEC14-3/3

Auxiliary Gear Drive Limitations



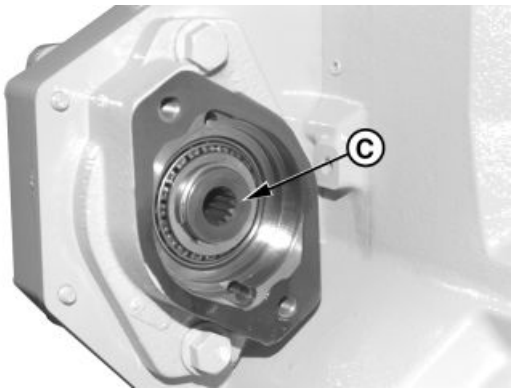
RG8715 —UN—03SEP99

SAE Drive "A"



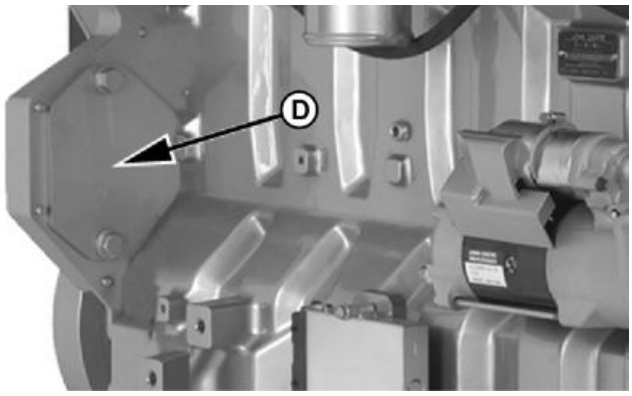
RG8750 —UN—03SEP99

SAE Drive "B" Front



RG10429A —UN—30NOV99

SAE Drive "B" Rear



RG13888 —UN—19MAY05

SAE Drive "C"

A—SAE "A"
B—SAE "B" Front
C—SAE "B" Rear
D—SAE "C"

IMPORTANT: When attaching an air compressor, hydraulic pump, or other accessory to be driven by the auxiliary gear drive (engine timing gear train at front of engine), power requirements of the accessory must be limited to values listed below:

SAE Drive	Continuous Power (Maximum)	Intermittent Power (Maximum)
A.....	26 kW (35 hp)	30 kW (40 hp)
B or (A + B) or (B + B).....	52 kW (70 hp)	60 kW (80 hp)
C	52 kW (70 hp)	60 kW (80 hp)

OURGP12,0000122 -19-12SEP06-1/1

Generator Set (Standby) And All Other OEM Engine Applications

To ensure that your engine will deliver efficient standby operation when needed, start engine and run at rated speed (with 50%—70% load) for 30 minutes every 2 weeks. DO NOT allow engine to run for an extended period of time with no load.

RK80614,0000558 -19-23FEB15-1/1

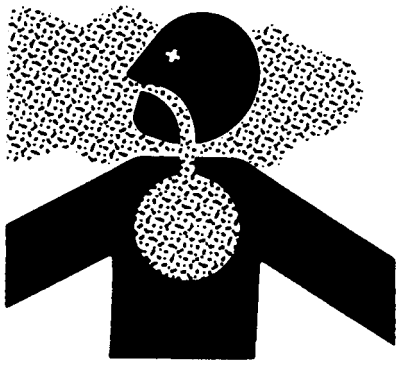
Starting the Engine

The following instructions apply to the optional controls and instruments available through the John Deere Parts Distribution Network. The controls and instruments for your engine may be different from those shown here; always follow manufacturer's instructions.

⚠ CAUTION: Before starting engine in a confined building, install proper outlet exhaust ventilation equipment. Always use safety approved fuel storage and piping.

NOTE: If temperature is below 0°C (32°F), it may be necessary to use cold weather starting aids. (See COLD WEATHER OPERATION in this group.)

1. Perform all prestarting checks outlined in Lubrication and Maintenance/Daily section later in this manual.



TS220 —UN—15APR13

Use Proper Ventilation

2. Open the fuel supply shut-off valve, if equipped.
3. Disengage power to any engine drivelines.

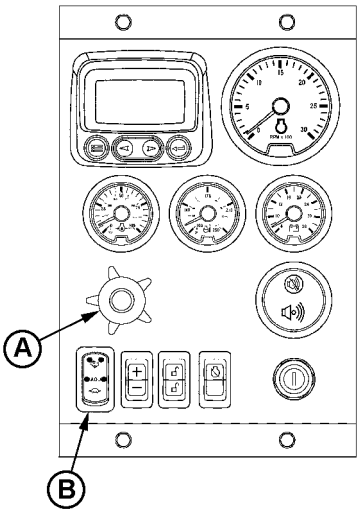
OMRGP15,0000122 -19-12SEP06-1/3

4. Set slow idle as follows:

   Panels with high-low speed select rocker switch (B) only: Set slow speed by pressing lower half of switch.

   Panels with optional analog throttle(s) (A) : Set high-low speed select rocker switch to slow (turtle), then push in on analog throttle handle or turn full counterclockwise to set analog throttle(s) to slow speed.

IMPORTANT: Do not operate the starter for more than 30 seconds at a time. To do so may overheat the starter. If the engine does not start the first time, wait at least 2 minutes before trying again. If engine does not start after four attempts, see Troubleshooting section.



RG13722 —UN—11NOV04

A—Analog Throttle Control (Optional)

B—Speed Select Rocker Switch

Analog Throttle Control and Speed Select Switch

Continued on next page

OMRGP15,0000122 -19-12SEP06-2/3

5. **All Engines** - Turn the key switch to the ON position. The "Wait To Start Preheating" message will be displayed when ambient temperatures require preheating (for engines with preheating options). The timer will display minutes and seconds, counting down to zero. Once the timer has reach 0:00 and the "Wait to Start" message is no longer displayed, you may start the engine.

   Turn the key start switch (A) clockwise to crank the engine. When the engine starts, release the key switch so that it returns to the “ON” position.

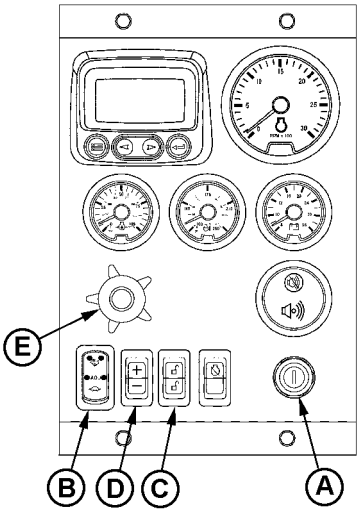
IMPORTANT: If the key switch is released before the engine starts, wait until the starter and the engine stop turning before trying again. This will prevent possible damage to the starter and/or flywheel.

6. After engine starts, idle engine at not more than 1200 rpm until warm. (See WARMING ENGINE later in this section).

   Panels with high-low speed select rocker switch (B) only: Set rpm using bump speed enable switch (C) with speed select rocker switch (D).

   Panels with optional analog throttle (E): Set either high-low speed select switch (B) or analog throttle (E) to slow speed, and set desired speed with remaining control.

NOTE: Engine control unit (ECU) reads the higher of the high-low speed select rocker switch or the analog throttle speed settings.



RG13723 —UN—11NOV04

Start And Idle On Panel

A—Key Start Switch
B—High-Low Speed Select Rocker Switch
C—Bump Speed Enable Rocker Switch
D—Speed Select Rocker Switch
E—Analog Throttle Control (Optional)

7. Check all gauges for normal engine operation. If operation is not normal, stop the engine and determine the cause. (For normal gauge pressures and temperatures, see BREAK-IN SERVICE earlier in this section.)

OMRGP15,0000122 -19-12SEP06-3/3

Restarting Engine Which Has Run Out Of Fuel

Fill the fuel tank and then bleed the fuel system before restarting engine (refer to Service as Required section, BLEEDING FUEL SYSTEM).

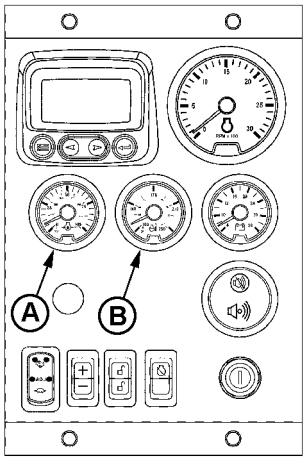
OURGP11,000004E -19-12SEP06-1/1

Warming Engine

IMPORTANT: To ensure proper lubrication, operate engine at or below 1200 rpm with no load for 1—2 minutes. Extend this period 2—4 minutes when operating at temperatures below freezing.

Engines used in generator set applications where the ECU is programmed to lock engine at a specified speed, may not have a slow idle function. Operate these engines at high idle for 1 to 2 minutes before applying the load. This procedure does not apply to standby generator sets where the engine is loaded immediately upon reaching rated speed.

1. Check oil pressure gauge (A) as soon as engine starts. If gauge needle does not rise to minimum oil pressure of 138 kPa (1.38 bar) (20 psi) within 5 seconds, stop the engine and determine the cause. Normal engine oil pressure is 310 ± 103 kPa (3.10 ± 1.03 bar) (45 ± 15 psi) at rated full-load speed (1500—2100 rpm) with oil at normal operating temperature of 115°C (240°F).
2. Watch coolant temperature gauge (B). Do not place engine under full load until it is properly warmed up. The normal engine coolant temperature range is 82°—92°C (180°—197°F).



RG13724 —UN—11NOV04

Oil Pressure and Coolant Temperature Gauges On Panel

A—Engine Oil Pressure Gauge **B—Engine Coolant Temperature Gauge**

NOTE: It is a good practice to operate the engine under a lighter load and at lower speeds than normal for the first few minutes after start-up.

OMRGP15,0000124 -19-12SEP06-1/1

Normal Engine Operation

Observe engine coolant temperature and engine oil pressure. Temperatures and pressures will vary between engines and with changing operating conditions, temperatures, and loads.

Normal engine coolant operating temperature range is 82°—92°C (180°—197°F). If coolant temperature rises above 100°C (212°F), reduce load on engine. Unless temperature drops quickly, stop engine and determine cause before resuming operation.

Normal engine oil pressure at slow idle should be at least 138 kPa (20 psi) and should rise to 310 kPa (45 psi) at rated speed.

Operate the engine under a lighter load and at slower than normal speed for first 15 minutes after start-up. DO NOT run engine at slow idle.

IMPORTANT: Should the engine die while operating under load, immediately remove load and restart the engine. Overheating of the turbocharger parts may occur when oil flow is stopped.

Stop engine immediately if there are any signs of part failure. Symptoms that may be early signs of engine problems are:

- Sudden drop in oil pressure
- Abnormal coolant temperatures
- Unusual noise or vibration
- Sudden loss of power
- Excessive black exhaust
- Excessive fuel consumption
- Excessive oil consumption
- Fluid leaks

NOTE: These engines meet emission standards with an exhaust gas recirculation system and a variable geometry turbocharger. A revving sound may be heard for an instant after starting, as the variable geometry turbocharger recycles. This is normal.

OURGP11,000004F -19-19SEP06-1/1

Cold Weather Operation

CAUTION: Ether injector starting fluid is highly flammable. DO NOT use starting fluid on engines equipped with air intake heaters.

DO NOT use starting fluid near fire, sparks, or flames. DO NOT incinerate or puncture a starting fluid container.

IMPORTANT: Engines with Rear PTO- Turn off or unload all pumps, auxiliary drives, and compressors before cold weather starting to reduce drag on engine.

Engines may be equipped with coolant heaters or ether injectors as cold weather starting aids.

Starting aids are required below 0°C (32°F). They will enhance starting performance above these temperatures and may be needed to start applications that have high parasitic loads during cranking and/or start acceleration to idle.

Using correct grade of oil (per engine and machine operator's manual) is critical to achieving adequate cold weather cranking speed. Synthetic oils have improved flow at low temperatures.

Other cold weather starting aids are required at temperatures below -25°C (-13°F) or at altitudes above 1500 m (5000 ft).

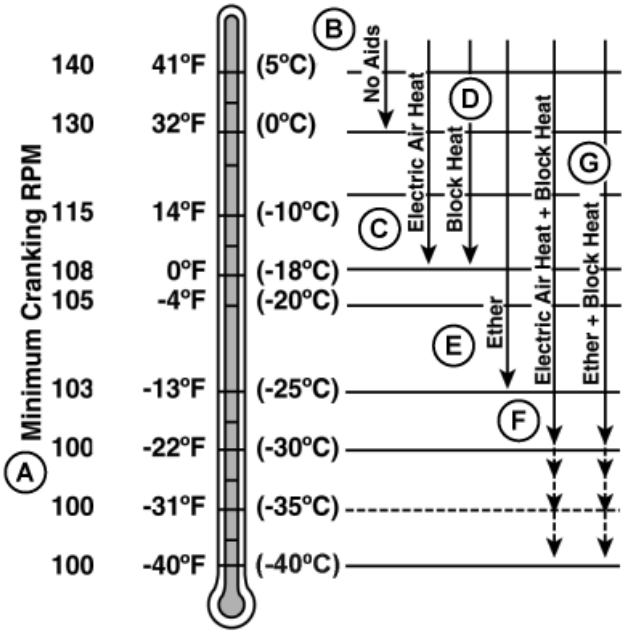
1. Follow steps 1—4 as listed under STARTING THE ENGINE, earlier in this section, then proceed as follows according to the instrument (gauge) panel on your engine.
2. Use cold weather starting aids as needed. Follow supplier instructions for starting aid provided on your engine. A booster battery can be connected if needed (see USING A BOOSTER BATTERY OR CHARGER, later in this section).
3. Follow remaining steps 5—7 as listed earlier in “Starting Engine” section.

   Additional information on cold weather operation is available from your authorized servicing dealer.



TS1356 —UN—18MAR92

Handle Starting Fluid with Care



RG19813 —UN—15DEC10

Cold Weather Starting Guidelines

A—Minimum Cranking RPM
B—No Aids
C—Electric Air Heat
D—Block Heat
E—Ether
F—Electric Air Heat and Block Heat
G—Ether and Block Heat

OURGP11,0000051 -19-16DEC10-1/1

Changing Engine Speed

NOTE: On engines with **2-position** *throttles, speeds are not adjustable. These throttles allows operation only at the preset rated speed or at idle using the single switch (A).*

Changing from slow to fast speed using Standard High-Low Speed Select Rocker Switch (A) (If Equipped):

- For slow speed, press lower half of switch (indicated by turtle symbol).
- For fast speed, press upper half of switch (indicated by rabbit symbol).

NOTE: To adjust preset fast or slow speeds for High-Low Speed Select Rocker Switch:

1. *Select fast (rabbit) or slow (turtle) position on High-Low Speed Select Rocker Switch (A).*
2. *Press and hold top or bottom half of Bump Speed Enable Rocker Switch (B) while using Speed Select Rocker Switch (C).*
3. *Use Speed Select Rocker Switch (C) to bump engine speed up (+) or down (-).*

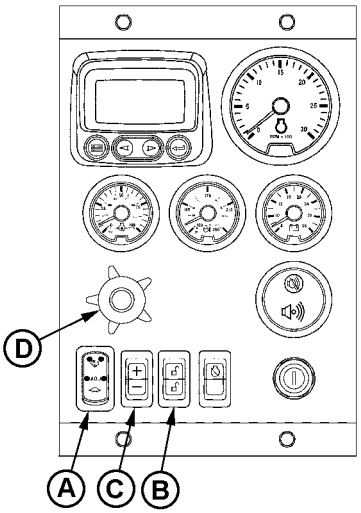
NOTE: Once the speed has been set, the Bump Speed Enable Switch (B) must be pressed and released three times within two seconds to commit the new slow or fast speed to memory. If not done, the engine's new slow or fast speed will only be effective until the key switch is shut off. Then the speed will revert to its previous setting.

Changing from slow to fast speed using Adjustable High-Low Speed Select Rocker Switch (A) (If Equipped):

Instrument panels have an adjustable **three-position** rocker switch (A) that can be used to select slow idle, fast idle, or an adjustable (“ADJ”) intermediate speed.

- For slow speed, press lower half of rocker switch (indicated by turtle symbol).
- For fast speed, press upper half of rocker switch (indicated by rabbit symbol).

NOTE: To adjust preset fast or slow speeds with adjustable High-Low Speed Select Rocker Switch:



RG13725 —UN—11NOV04

Changing Engine Speed with Full-Featured Panel

A—High-Low Speed Select Rocker Switch
B—Bump Speed Enable Rocker Switch
C—Speed Select Rocker Switch
D—Analog Throttle Control (Optional)

1. *Select middle position (ADJ) or slow (turtle) position on the optional Adjustable Three-State Speed Select Rocker Switch (A).*
2. *Press and hold top or bottom half of Bump Speed Enable Rocker Switch (B) while using Speed Select Rocker Switch (C).*
3. *Use Speed Select Rocker Switch (C) to bump engine speed up (+) or down (-).*

NOTE: Slow (turtle) position is factory preset at low engine idle, while middle (ADJ) position is factory set at high engine idle.

NOTE: Once the speed has been set, the Bump Speed Enable Switch (B) must be pressed and released three times within two seconds to commit the new slow or fast speed to memory. If not done, the engine's new slow or fast speed will only be effective until the key is shut off. Then the speed will revert to its previous setting.

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Changing engine speed using optional analog throttle control (D)

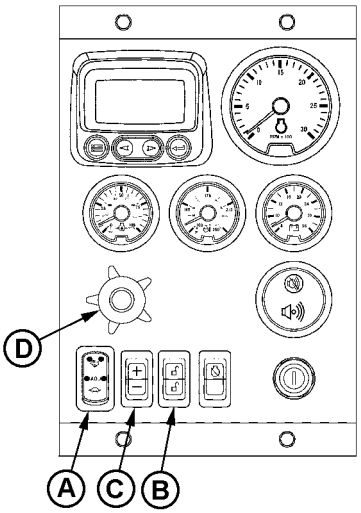
NOTE: Pushing in on analog throttle will immediately take engine to slow idle speed.

1. Set High-Low Speed Select Rocker Switch (A) to low speed position.

2. Turn analog throttle clockwise to increase speed or counterclockwise to decrease speed.

NOTE: Engine Control Unit (ECU) reads the higher of the High-Low Speed Select Rocker Switch or the Analog Throttle(s) Speed Settings. With High-Low switch at low speed, Analog Throttle(s) will control speed higher than low idle setting.

A—High-Low Speed Select Rocker Switch
B—Bump Speed Enable Rocker Switch
C—Speed Select Rocker Switch
D—Analog Throttle Control (Optional)



RG13725 —UN—11NOV04

Changing Engine Speed with Full-Featured Panel

OMRGP15,0000126 -19-12SEP06-2/3

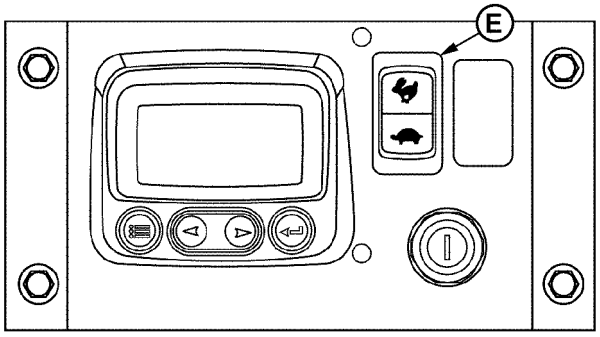
Changing engine speeds on engines equipped with the Basic Instrument Panel

The basic instrument panel has a “ramp” throttle switch (E) with a spring loaded return to the center rest position (Off).

To increase the engine speed, press and hold upper half of rocker switch (E) (indicated by rabbit symbol) to increase or ramp up the engine speed to desired speed. Release the rocker switch.

Press lower half of rocker switch (indicated by turtle symbol) to decrease or ramp down the engine speed to desired speed. Release the rocker switch.

The settings will not be stored.



RG13289 —UN—30OCT03

Changing Engine Speed With Basic Panel

E—High-Low Speed Select Rocker Switch

OMRGP15,0000126 -19-12SEP06-3/3

Avoid Excessive Engine Idling

Prolonged idling may cause the engine coolant temperature to fall below its normal range. This, in turn, causes crankcase oil dilution, due to incomplete fuel combustion, and permits formation of gummy deposits on valves, pistons, and piston rings. It also promotes rapid accumulation of engine sludge and unburned fuel in the exhaust system.

Once an engine is warmed to normal operating temperatures, engine should be idled at slow idle speed.

Slow idle speed for this engine is 850 rpm at factory. If an engine will be idling for more than 5 minutes, stop and restart later.

NOTE: Generator set applications where the ECU is locked at a specified speed may not have a slow idle function. These engines will idle at no-load governed speed (high idle).

RG,RG34710,7554 -19-12SEP06-1/1

Stopping the Engine

1. Pull PTO clutch lever rearward (away from engine) to disengage clutch, if equipped.

IMPORTANT: Before stopping an engine that has been operating at working load, idle engine at least 2 minutes at 1000—1200 rpm to cool hot engine parts.

Engines in generator set applications where the ECU is locked at a specified speed and no slow idle function is available, run engine for at least 2 minutes at fast idle and no load.

2. Run engine at 1000—1200 rpm for at least 2 minutes to cool.

   Panels with high-low speed select rocker switch (B) only: Set rpm using bump speed enable switch (C) with speed select rocker switch (D).

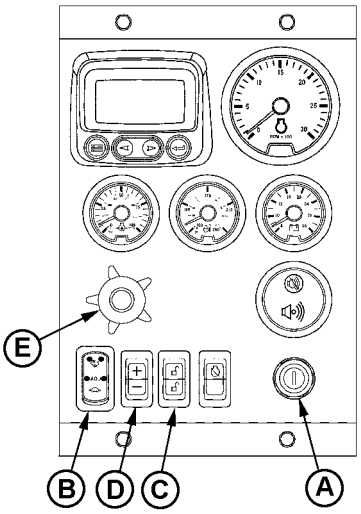
   Panels with optional analog throttle (E): Set either high-low speed select switch (B) or analog throttle control (E) to slow idle, and set desired speed with remaining control.

NOTE: Engine control unit (ECU) reads the higher of the high-low speed select rocker switch or the analog throttle speed settings.

3. Push in on analog throttle control handle (if equipped) so that engine goes to slow idle, or set slow speed with high-low speed select rocker switch.

4. Turn key start switch (A) to “OFF” position to stop the engine. Remove ignition key.

IMPORTANT: Make sure that exhaust stack rain cap (F) is installed when engine is not running. This will prevent water and dirt from entering engine.



RG13723 —UN—11NOV04

Stopping the Engine (Full-Featured Panel Shown)



RG9933 —UN—18NOV99

Exhaust Stack Rain Cap

A—Key Start Switch
B—High-Low Speed Select Rocker Switch
C—Bump Speed Enable Rocker Switch
D—Speed Select Rocker Switch
E—Analog Throttle Control (Optional)
F—Exhaust Stack Rain Cap

OMRGP15,0000127 -19-12SEP06-1/1

Using a Booster Battery or Charger

A 12 volt booster battery can be connected in parallel (B) with battery(ies) on the unit to aid in cold weather starting. ALWAYS use heavy-duty jumper cables.

Series:

- Amps = Same as single battery
- Volts = Twice as a single battery

Parallel:

- Amps = Twice as a single battery
- Volts = Same as a single battery

CAUTION: Gas given off by battery is explosive. Keep sparks and flames away from battery. Before connecting or disconnecting a battery charger, turn charger off. Make last connection and first disconnection at a point away from battery. Always connect NEGATIVE (—) cable last and disconnect this cable first.

IMPORTANT: Be sure that polarity is correct before making connections. Reversed polarity will damage electrical system. Always connect positive to positive and negative to ground. Always use 12 volt booster battery for 12 volt electrical systems and 24 volt booster battery(ies) for 24 volt electrical systems.

WARNING: Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. **Wash hands after handling.**

1. Connect booster battery or batteries to produce the required system voltage for your engine application.

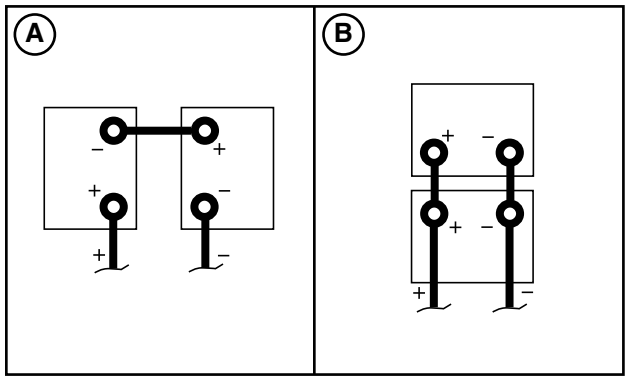
NOTE: To avoid sparks, DO NOT allow the free ends of jumper cables to touch the engine.

2. Connect one end of jumper cable to the POSITIVE (+) post of the booster battery.
3. Connect the other end of the jumper cable to the POSITIVE (+) post of battery connected to starter.



TS204 —UN—15APR13

Exploding Battery



RG24885 —UN—17DEC13

A—Series **B—Parallel**

4. Connect one end of the other jumper cable to the NEGATIVE (—) post of the booster battery.
5. ALWAYS complete the hookup by making the last connection of the NEGATIVE (—) cable to a good ground on the engine frame and away from the battery(ies).
6. Start the engine. Disconnect jumper cables immediately after engine starts. Disconnect NEGATIVE (—) cable first.

RG,RG34710,7556 -19-17DEC13-1/1

Required Emission-Related Information

Service Provider

A qualified repair shop or person of the owner's choosing may maintain, replace, or repair emission control devices and systems with original or equivalent replacement parts. However, warranty, recall, and all other services paid for by John Deere must be performed at an authorized John Deere service center.

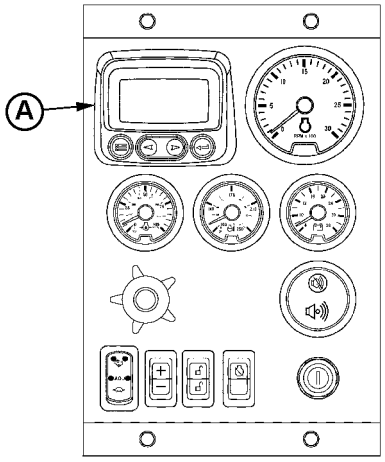
DX,EMISSIONS,REQINFO -19-12JUN15-1/1

Observe Service Intervals

Using hour meter (A) on diagnostic gauge as a guide, perform all services at the hourly intervals indicated on following pages. At each scheduled maintenance interval, perform all previous maintenance operations in addition to the ones specified. Keep a record of hourly intervals and services performed, using charts provided in Lubrication and Maintenance Records section.

IMPORTANT: Recommended service intervals are for normal operating conditions. Perform maintenance at interval which occurs first, for example, either at 500 hours of operation OR every 12 months. Service MORE OFTEN if engine is operated under adverse conditions. Neglecting maintenance can result in failures or permanent damage to the engine.

A—Hour Meter



RG13728 —UN—11NOV04

Hour Meter On Panel

OURGP12,0000136 -19-11OCT06-1/1

Use Correct Fuels, Lubricants, and Coolant

IMPORTANT: Use only fuels, lubricants, and coolants meeting specifications outlined in Fuels, Lubricants, and Coolant section when servicing your John Deere Engine.

Consult your John Deere engine distributor, servicing dealer or your nearest John Deere Parts Network for recommended fuels, lubricants, and coolant. Also available are necessary additives for use when operating engines in tropical, arctic, or any other adverse conditions.



TS100 —UN—23AUG88

John Deere Parts Network

RG,RG34710,7558 -19-12SEP06-1/1

Lubrication and Maintenance Service Interval Chart—Industrial Unit and Generator (Prime Power)

	Lubrication and Maintenance Service Intervals				
Item	Daily	500 Hours of Operation/or Every 12 Months	2000 Hours of Operation/or Every 24 Months	2500 Hours of Operation	As Required
Check Engine Oil and Coolant Level	•				
Check Fuel Filter/Water Separator Bowl	•				
Check Air Cleaner Dust Unloader Valve & Restriction Indicator Gauge [a]	•				
Visual Walkaround Inspection	•				
Service Fire Extinguisher		•			
Service Battery		•			
Change Engine Oil and Replace Oil Filter [b,c]		•			
Check Coolant Pump Weep Hole Foam Filter		•			
Replace Fuel Filters/Clean Water Separator [d]		•			
Check Engine Speeds		•			
Check Engine Mounts		•			
Clean Crankcase Vent Hose and Valve		•			
Check Air Intake Hoses, Connections, & System		•			
Check Engine Ground Connection		•			
Check Automatic Belt Tensioners and Belt Wear		•			
Check Cooling System		•			
Coolant Solution Analysis; Add SCAs as Required		•			
Pressure Test Cooling System		•			
Check Crankshaft Vibration Damper [e]			•		
Flush and Refill Cooling System [f]			•		
Test Thermostats			•		
Adjust Engine Valve Clearance & EUI Preload [g]				•	
Replace Air Cleaner Elements					•
Bleed Fuel System					•
Replace Alternator and Fan Belts					•
Check Fuses					•
Check Air Compressors (If Equipped)					•
Check Rear Power Take-Off (PTO) (If Equipped)					•

[a] Replace primary air cleaner element when restriction indicator shows a vacuum of 625 mm (25 in) H2O.
[b] During engine break-in, change the oil and filter for the first time after 100 hours of operation (maximum).
[c] Service intervals depend on sulfur content of the diesel fuel, oil pan capacity, and the oil and filter used. (See DIESEL ENGINE OIL AND FILTER SERVICE INTERVALS, in Fuels, Lubricants, and Coolant Section.)
[d] Replace fuel filters when audible alarm sounds and trouble codes indicate plugged fuel filter (low fuel pressure). If no alarm sounds during a 12 month interval, replace fuel filters at that time, or after every 500 hours of operation.
[e] Replace crankshaft damper at 4500 hours or 60 months, whichever occurs first.
[f] If John Deere COOL-GARD is used, the flushing interval may be extended to 3000 hours of operation or every 36 months. If John Deere COOL-GARD is used and the coolant is tested annually AND additives are replenished as needed by adding a supplemental coolant additive, the flushing interval may be extended to 5000 hours of operation or every 60 months, whichever occurs first.
[g] This one-time adjustment is required after first 2500 hours of operation for all new and overhauled engines.

OURGP11,0000052 -19-02NOV15-1/1

Lubrication and Maintenance Service Interval Chart—Generator (Standby) Applications

NOTE: The service intervals in the Lubrication and Maintenance sections that follow reflect standard engines. Use service intervals listed below for generator (standby) applications. Match service items below to titles in Lubrication and Maintenance sections for procedures.

	Lubrication and Maintenance Service Intervals				
Item	Every 2 Weeks	500 Hours of Operation/or Every 12 Months	2000 Hours of Operation/or Every 24 Months	2500 Hours of Operation	As Required
Operate Engine at Rated Speed and 50%—70% Load a Minimum of 30 Minutes	•				
Check Engine Oil and Coolant Level	•				
Check Fuel Filter/Water Separator Bowl	•				
Check Air Cleaner Dust Unloader Valve & Restriction Indicator Gauge [a]	•				
Visual Walkaround Inspection	•				
Service Fire Extinguisher		•			
Service Battery		•			
Change Engine Oil and Replace Oil Filter [b,c]		•			
Check Coolant Pump Weep Hole Foam Filter		•			
Check Engine Mounts		•			
Replace Fuel Filters/Clean Water Separator [d]		•			
Check Engine Ground Connection		•			
Clean Crankcase Vent Hose and Valve		•			
Check Air Intake Hoses, Connections, & System		•			
Check Engine Ground Connection		•			
Check Automatic Belt Tensioners and Belt Wear		•			
Check Cooling System		•			
Coolant Solution Analysis; Add SCAs as Required		•			
Pressure Test Cooling System		•			
Check Crankshaft Vibration Damper [e]			•		
Flush and Refill Cooling System [f]			•		
Test Thermostats			•		
Adjust Engine Valve Clearance and EUI Preload [g]				•	
Replace Air Cleaner Elements					•
Bleed Fuel System					•
Replace Alternator and Fan Belts					•
Check Fuses					•
Check Air Compressors (If Equipped)					•
Check Rear Power Take-Off (PTO) (If Equipped)					•

[a] Replace primary air cleaner element when restriction indicator shows a vacuum of 625 mm (25 in) H2O.
[b] During engine break-in, change the oil and filter for the first time after 100 hours of operation (maximum).
[c] Service intervals depend on sulfur content of the diesel fuel, oil pan capacity, and the oil and filter used. (See DIESEL ENGINE OIL AND FILTER SERVICE INTERVALS, in Fuels, Lubricants, and Coolant Section.)
[d] Replace fuel filters when audible alarm sounds and trouble codes indicate plugged fuel filter (low fuel pressure). If no alarm sounds during a 12 month interval, replace fuel filters at that time, or after every 500 hours of operation.
[e] Replace crankshaft damper at 4500 hours or 60 months, whichever occurs first.
[f] If John Deere COOL-GARD is used, the flushing interval may be extended to 3000 hours of operation or every 36 months. If John Deere COOL-GARD is used and the coolant is tested annually AND additives are replenished as needed by adding a supplemental coolant additive, the flushing interval may be extended to 5000 hours of operation or every 60 months, whichever occurs first.
[g] This one-time adjustment is required after first 2500 hours of operation for all new and overhauled engines.

OURGP11,0000053 -19-02NOV15-1/1

Daily Prestarting Checks

Do the following BEFORE STARTING THE ENGINE for the first time each day:

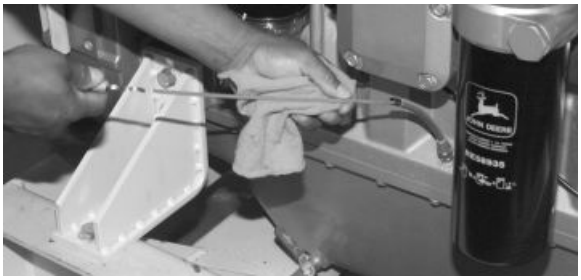
IMPORTANT: DO NOT add makeup oil until the oil level is BELOW the ADD mark.

1. Check engine oil level on dipstick. Add as required, using seasonal viscosity grade oil. (See DIESEL ENGINE OIL in Fuels, Lubricants, and Coolant section for oil specifications.)

   Oil may be added at timing gear cover filler cap (A) or oil pan filler adapter ports (B), if equipped.

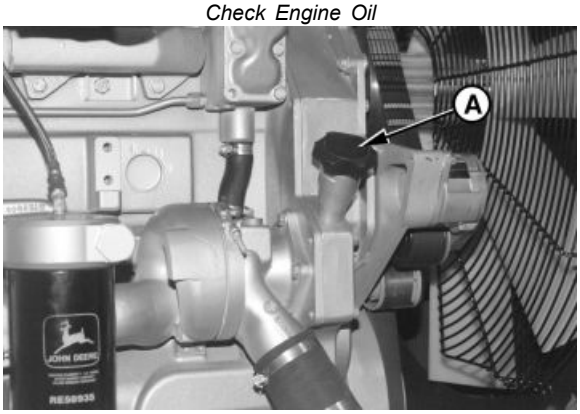
IMPORTANT: DO NOT fill above the top of crosshatch area (C) on the dipstick. Oil levels anywhere within crosshatch are considered in the acceptable operating range.

A—Timing Cover Filler Cap
B—Oil Pan Filler Adapter Port
C—Crosshatch Area of Dipstick



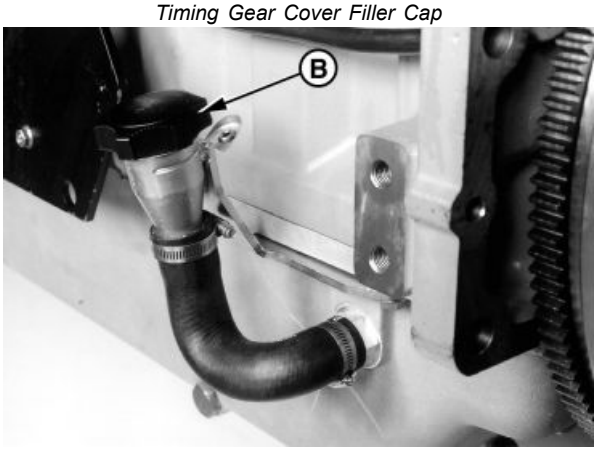
RG9924 —UN—17NOV99

Check Engine Oil



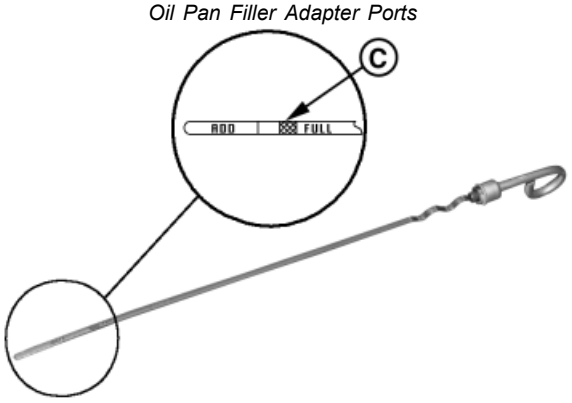
RG8724 —UN—03SEP99

Timing Gear Cover Filler Cap



RG8751 —UN—03SEP99

Oil Pan Filler Adapter Ports



RG8707B —UN—03SEP99

Do Not Fill Above Top Mark

Continued on next page

RG,RG34710,7561 -19-12SEP06-1/4

CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

Only remove filler cap when engine is cold or when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

2. Check the coolant level when engine is cold. Coolant level should be at bottom of filler neck. Fill radiator (A) with proper coolant solution if level is low. (See ADDING COOLANT in Service as Required section.) Check overall cooling system for leaks.

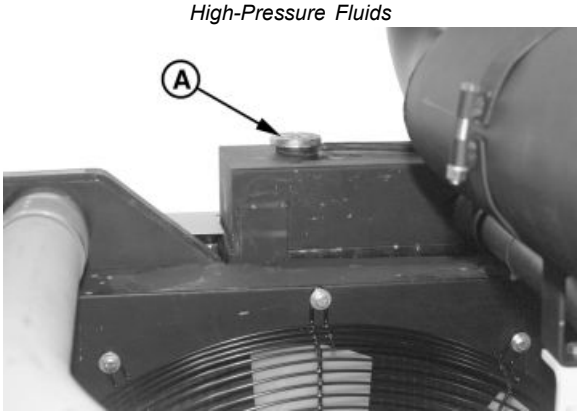
   Refer to your vehicle's operator's manual for recommendations for non-John Deere supplied accessories.

A—Radiator



TS281 —UN—15APR13

High-Pressure Fluids



RG8735A —UN—03SEP99

Fill Radiator

Continued on next page

RG,RG34710,7561 -19-12SEP06-2/4

3. If the air cleaner has an automatic dust unloader valve (A), squeeze the unloader valve on air cleaner assembly to clear away any dust buildup.

IMPORTANT: Do not exceed maximum air intake restriction. A clogged air cleaner element will cause excessive intake restriction and a reduced air supply to the engine.

If equipped with air intake restriction indicator gauge (B), check gauge and service air cleaner if air intake restriction exceeds specifications.

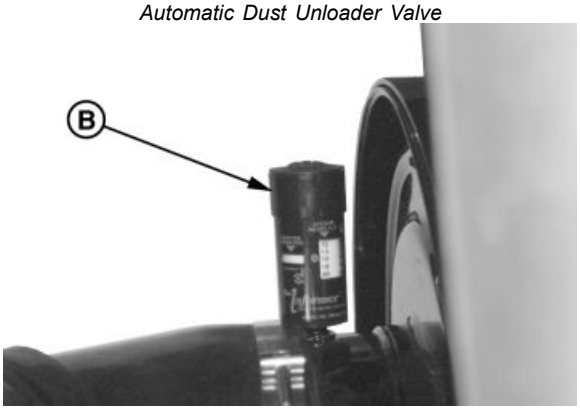
Specification	
Maximum Air Intake Restriction—Vacuum	25 in. (625 mm) H_2O (6.25 kPa) (0.06 bar) (1.0 psi)

A—Dust Unloader Valve **B—Restriction Indicator Gauge**



RG8717A —UN—12JUL99

Automatic Dust Unloader Valve



RG8719A —UN—12JUL99

Air Intake Restriction Indicator Gauge

RG,RG34710,7561 -19-12SEP06-3/4

NOTE: Amber warning indicator on instrument panel diagnostic gauge will flash if amount of water in fuel filter sediment bowl is excessive.

4. Loosen thumb screw (C) and drain water and debris from bowl into a suitable container, as needed.

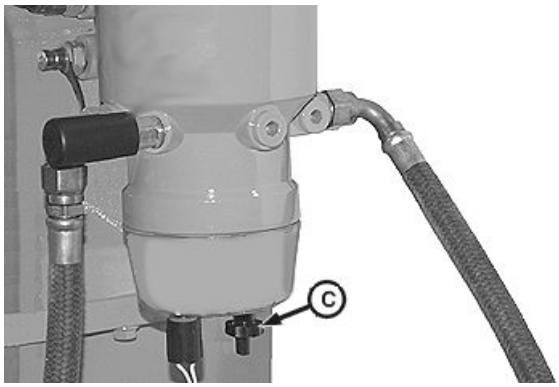
   Dispose of water and debris in an environmentally safe manner.

5. Make a thorough inspection of the engine compartment. Look for oil or coolant leaks, worn fan and accessory drive belts, loose connections and trash build-up. Remove trash build-up and have repairs made as needed if leaks are found.

NOTE: Wipe all fittings, caps, and plugs before performing any maintenance to reduce the chance of system contamination.

Inspect:

- Radiator for leaks and trash build-up.
- Engine shields and guards for trash build-up.
- Air intake system hoses and connections for cracks and loose clamps.
- Fan, alternator, and accessory drive belts for cracks, breaks or other damage.



RG12773 —UN—23JAN03

Draining Water Separator Bowl

C—Drain Valve

- Coolant pump for coolant leaks.

NOTE: It is normal for a small amount of leakage to occur as the engine cools down and parts contract. Excessive coolant leakage may indicate the need to replace the coolant pump seal. Contact your engine distributor or servicing dealer for repairs.

RG,RG34710,7561 -19-12SEP06-4/4

Servicing Fire Extinguisher

A fire extinguisher (A) is available from your authorized servicing dealer or engine distributor.

Read and follow the instructions which are packaged with it. The extinguisher should be inspected at least every 500 hours of engine operation or every 12 months. Once extinguisher is operated, no matter how long, it must be recharged. Keep record of inspections on the tag which comes with the extinguisher instruction booklet.

A—Fire Extinguisher



RW4918 —UN—15DEC88

Fire Extinguisher

OURGP12,00000B9 -19-12SEP06-1/1

Servicing Battery

CAUTION: Battery gas can explode. Keep sparks and flames away from batteries. Use a flashlight to check battery electrolyte level.

Never check battery charge by placing a metal object across the posts. Use a voltmeter or hydrometer.

Always remove grounded NEGATIVE (—) battery clamp first and replace it last.



TS204 —UN—15APR13

Exploding Battery

WARNING: Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. **Wash hands after handling.**

1. On regular batteries, check electrolyte level. Fill each cell to bottom of filler neck with distilled water.

NOTE: Low-maintenance or maintenance-free batteries should require little additional service. However, electrolyte level can be checked by cutting the center section of decal on dash-line, and removing cell plugs. If necessary, add clean, soft water to bring level to bottom of filler neck.

2. Keep batteries clean by wiping them with a damp cloth. Keep all connections clean and tight. Remove any corrosion, and wash terminals with a solution of 1 part baking soda and 4 parts water. Tighten all connections securely.

NOTE: Coat battery terminals and connectors with a mixture of petroleum jelly and baking soda to retard corrosion.

3. Keep battery fully charged, especially during cold weather. If a battery charger is used, turn charger off before connecting charger to battery(ies). Attach POSITIVE (+) battery charger lead to POSITIVE (+) battery post. Then attach NEGATIVE (—) battery charger lead to a good ground.

Continued on next page

OURGP11,0000054 -19-16SEP13-1/2

CAUTION: Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, eat holes in clothing, and cause blindness if splashed into eyes.

Avoid the hazard by:

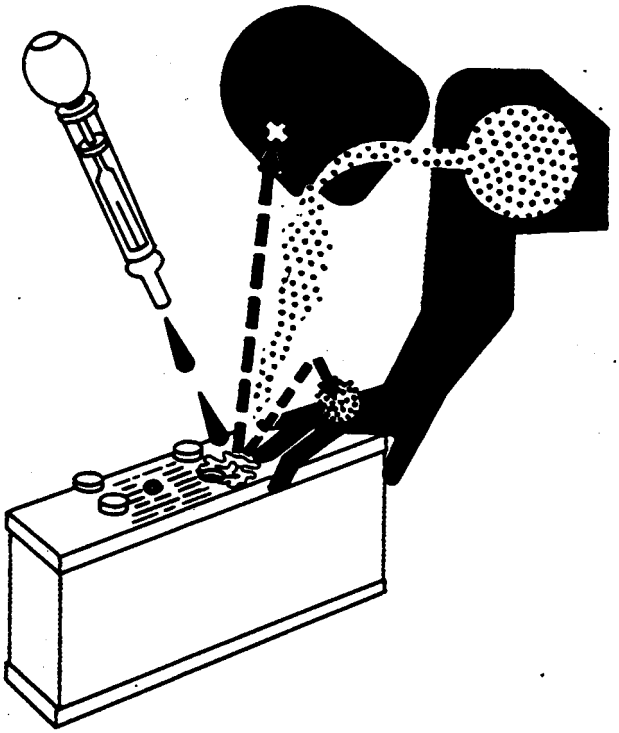
1. **Filling batteries in a well-ventilated area.**
2. **Wearing eye protection and rubber gloves.**
3. **Avoiding breathing fumes when electrolyte is added.**
4. **Avoiding spilling or dripping electrolyte.**
5. **Using proper jump start procedure.**

If you spill acid on yourself:

1. **Flush your skin with water.**
2. **Apply baking soda or lime to help neutralize the acid.**
3. **Flush your eyes with water for 10—15 minutes. Get medical attention immediately.**

If acid is swallowed:

1. **Drink large amounts of water or milk.**
2. **Then drink milk of magnesia, beaten eggs, or vegetable oil.**
3. **Get medical attention immediately.**



TS203 —UN—23AUG88

Sulfuric Acid

In freezing weather, run engine at least 30 minutes to ensure thorough mixing after adding water to battery.

Replacement battery(ies) must meet or exceed the following recommended capacities[1] at —18°C (0°F):

Specification	
12-Volt System—Minimum Battery Capacity—Cold Cranking Amps	1900 Minimum
Reserve Capacity (Minutes)	350 Minimum
24-Volt System—Minimum Battery Capacity—Cold Cranking Amps	925 Minimum
Reserve Capacity (Minutes)	275 Minimum

[1] Total recommended capacity based on batteries connected in series or parallel.

OURGP11,0000054 -19-16SEP13-2/2

Changing Engine Oil and Replacing Oil Filter

IMPORTANT: Changing engine oil and filter every 500 hours or 12 months depends on the following requirements:

- **Engine equipped with an extended drain interval oil pan.**
- **Use of diesel fuel with sulfur content less than 0.50% (5000 ppm) is strongly recommended.**
- **Use of premium oil John Deere PLUS-50, ACEA E7 or ACEA E6.**
- **Perform engine oil analysis to determine the actual extended service life of ACEA E7 and ACEA E6 oils.**
- **Use of the approved John Deere oil filter.**

The oil and filter change interval is reduced if ANY of the above listed requirements are not followed. (Refer to DIESEL ENGINE OIL AND FILTER SERVICE INTERVALS, in Fuels, Lubricants, and Coolant Section.)

NOTE: During **break-in***, change engine oil and filter for the first time before* **100** *hours maximum of operation.*

OILSCAN® and OILSCAN PLUS® are John Deere sampling programs to help you monitor machine performance and identify potential problems before they cause serious damage. OILSCAN™ and OILSCAN PLUS™ kits are available from your John Deere dealer. Oil samples should be taken prior to the oil change. Refer to instructions provided with kit.

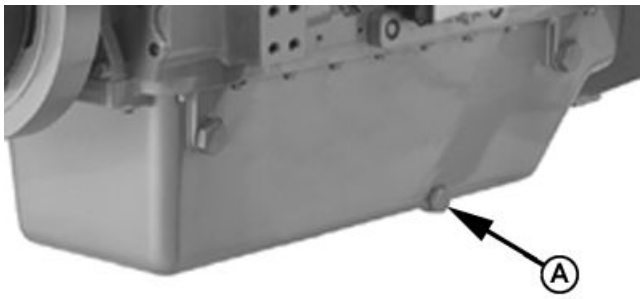
CAUTION: Metal surfaces of engine may be hot to the touch after shutdown.

Change engine oil as follows:

NOTE: Drain plug location may vary, depending on the application.

1. Run engine approximately 5 minutes to warm up oil. Shut off engine.
2. Remove oil pan drain plug (A).
3. Drain crankcase oil from engine while warm.

NOTE: For more complete draining of oil, wait to install oil pan drain plug until filter oil is drained back (see following procedure).



RG13884 —UN—19MAY05

Engine Oil Drain Plug

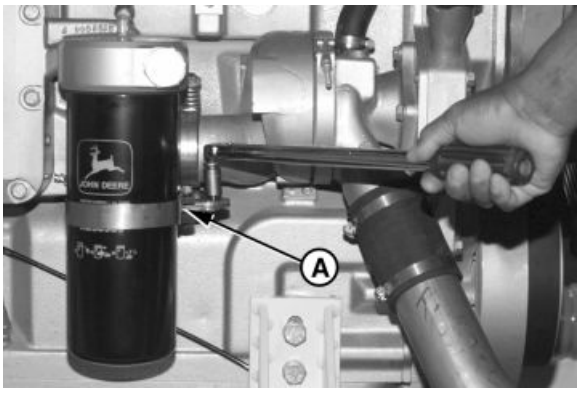
OILSCAN is a trademark of Deere & Company
OILSCAN PLUS is a trademark of Deere & Company

Continued on next page

4. Remove and discard oil filter element using a suitable filter wrench (A).
5. Remove oil filter packing and clean filter mounting pad.

IMPORTANT: Filtration of oils is critical to proper lubrication. Always change filter regularly. Use filter meeting John Deere performance specifications.

6. Oil new packing and install new filter element onto filter housing. Hand tighten element according to values printed on filter element. If values are not provided, tighten element approximately 1/2—3/4 turn after packing contacts filter housing. DO NOT overtighten filter element.



RG8709B —UN—03SEP99

Remove Filter Element Using Wrench

A—Filter Wrench

OURGP11,0000055 -19-13OCT06-2/3

7. Inspect drain plug O-ring. Replace if necessary.
8. Install oil pan drain plug. Torque plug to specifications.

Specification	
Oil drain plug (1-1/4 in.)—Torque	46 N·m (34 lb-ft)
Oil drain plug (1-1/2 in.)—Torque	64 N·m (47 lb-ft)

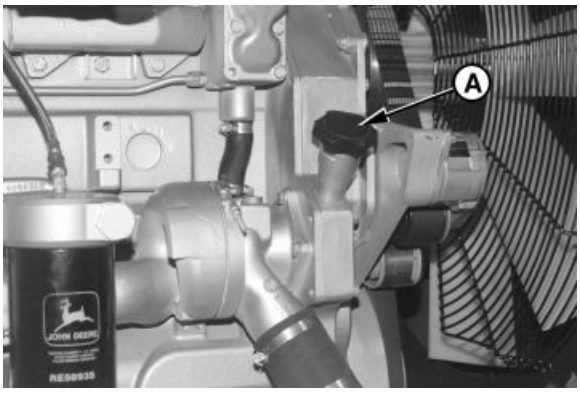
9. Fill engine crankcase with correct John Deere engine oil through timing gear cover fill port (A) or oil pan fill port (B) depending on engine application. (See DIESEL ENGINE OIL in Fuels, Lubricants, and Coolant section for determining correct engine oil.)

   To determine the correct oil fill quantity for your engine, see ENGINE CRANKCASE OIL FILL QUANTITIES in the Specifications section.

NOTE: Crankcase oil capacity may vary slightly. ALWAYS fill crankcase to full mark or within crosshatch on dipstick, whichever is present. DO NOT overfill.

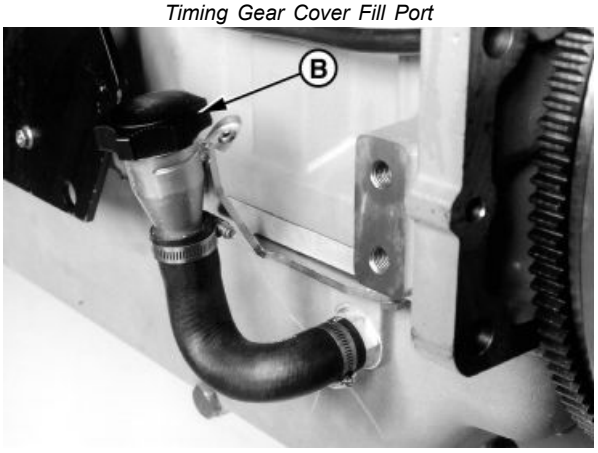
IMPORTANT: Immediately after completing any oil change, crank engine for 30 seconds without permitting engine to start. This will help ensure adequate lubrication to engine components before engine starts.

10. Start engine and run to check for possible leaks.
11. Stop engine and check oil level after 10 minutes. Oil level reading should be within crosshatch of dipstick.



RG8724 —UN—03SEP99

Timing Gear Cover Fill Port



RG8751 —UN—03SEP99

Oil Pan Adapter Fill Port

A—Timing Cover Fill Port **B—Oil Pan Adapter Fill Port**

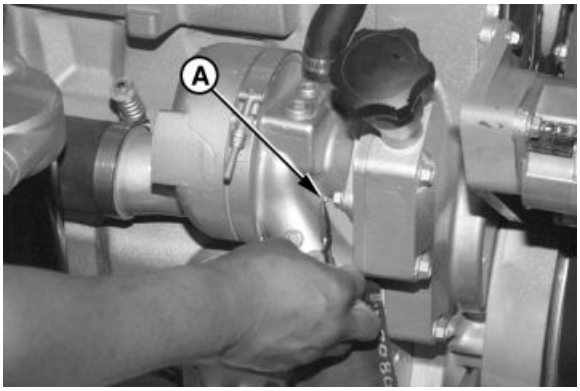
OURGP11,0000055 -19-13OCT06-3/3

Visually Inspecting Coolant Pump

Inspect Weep Hole

1. Remove foam filter (if equipped) from coolant pump weep hole (A) as shown.
2. Inspect weep hole for oil or coolant leakage.
   - Oil leakage indicates a damaged rear seal.
   - Coolant leakage indicates a damaged front seal.

   Repair or replace complete coolant pump assembly if leakage is detected.



RG8718A —UN—12JUL99

Coolant Pump Weep Hole

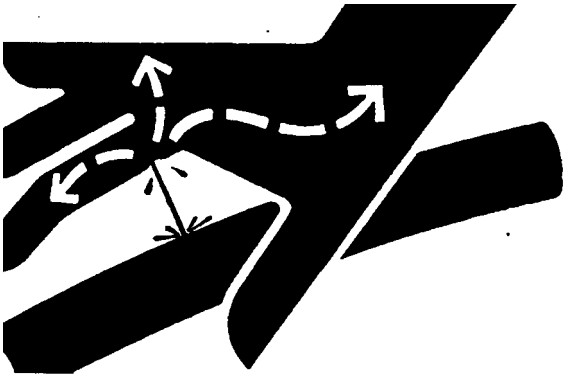
A—Weep Hole

OURGP11,0000080 -19-11OCT06-1/1

Replacing Fuel Filters/Cleaning Water Separator (Earlier Engines)

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

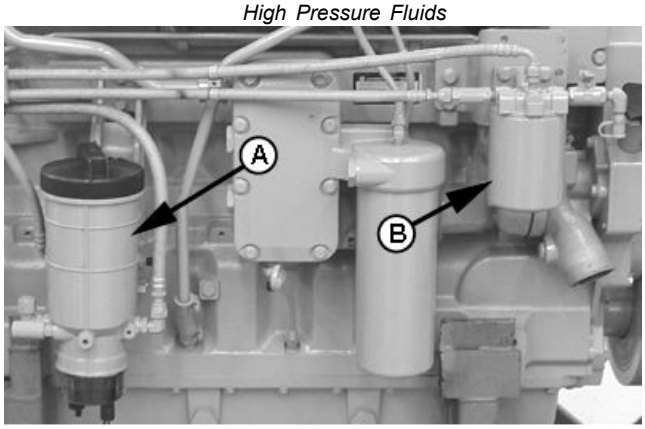
If any fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.



X9811 —UN—23AUG88

High Pressure Fluids

IMPORTANT: Primary fuel filter (A) and final fuel filter (B) must both be replaced whenever audible alarm sounds and trouble code indicates plugged filter (fuel supply pressure moderately/extremely low). Replace both fuel filters at 12 month intervals (or every 500 hours) if no alarm/code indications occur.



RG13899 —UN—14JUN05

Primary and Final Fuel Filters (Earlier Engines)

A—Primary Fuel Filter **B—Final Fuel Filter**

Continued on next page

OURGP12,000011B -19-26FEB08-1/7

Remove Primary Fuel Filter Element (Earlier Engines)

CAUTION: If engine has been running, engine and fuel filter housing may be hot.

1. Close fuel shut-off valve (if equipped).
2. Clean entire area surrounding fuel filter assembly to keep debris from entering fuel system.
3. Remove cap from fuel filter housing by turning counterclockwise by hand.

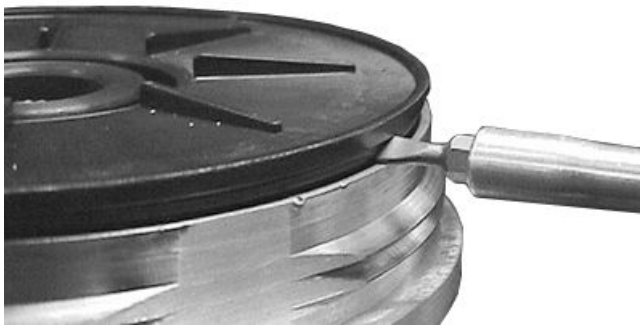


RG10302 —UN—27MAY04

Remove Primary Fuel Filter

OURGP12,000011B -19-26FEB08-2/7

4. Relieve vacuum in filter housing by operating hand primer until fuel filter “pops-up”. If filter does not “pop-up” after about 30 strokes of primer, a small screwdriver may be used as shown to **carefully** pry under filter flange to relieve vacuum in the housing.



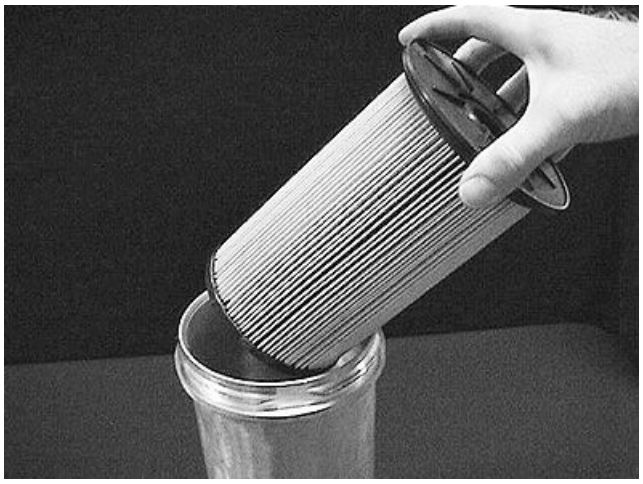
RG10303 —UN—27MAY04

Relieve Vacuum

OURGP12,000011B -19-26FEB08-3/7

5. Lift filter element up in housing until filter seal clears inlet tube inside housing. Continue to hold filter suspended straight up in top of housing to drain fuel from filter.
6. Allow fuel to drain completely from filter into housing. Carefully begin rotating filter from housing as shown until completely upside down to ensure minimum leakage from fuel filter.
7. Place filter in container suitable for diesel fuel.

IMPORTANT: Reusing fuel filter once removed from housing may result in trapped air in the filter. This may cause fuel to overflow from the filter housing during insertion of filter element, and/or cause the engine to stall and not restart without additional system purging.



RG10304 —UN—02SEP99

Remove Filter Element

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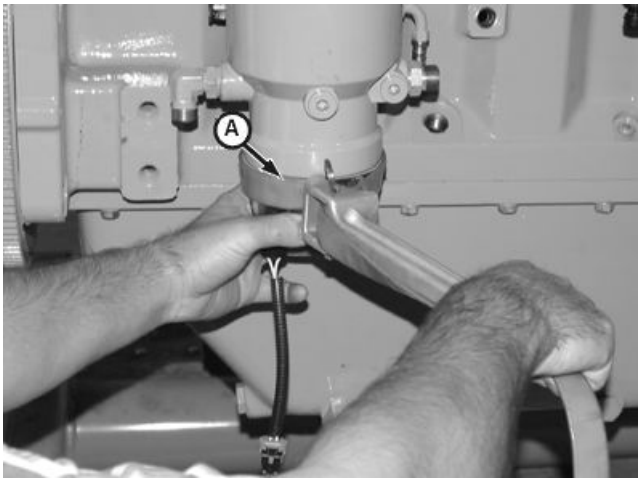
OURGP12,000011B -19-26FEB08-4/7

Remove And Clean Water Separator Bowl (Earlier Engines)

1. Disconnect wiring connector from water-in-fuel sensor.
2. Drain fuel from separator bowl.
3. Position a strap wrench (A) as close as possible to top edge of separator bowl. While applying pressure with strap wrench, grip bowl and twist with other hand as shown to remove bowl.
4. Clean separator bowl and dry it.
5. Install separator bowl and tighten by hand until seal makes contact. Hand tighten to the following specification:

Specification	
Water Separator Bowl-To-Filter Housing—Torque	5 N·m (44 lb-in.)

6. Connect wiring to water-in-fuel sensor.



RG10351 —UN—13SEP99

Removing Water Separator Bowl

A—Strap Wrench

OURGP12,000011B -19-26FEB08-5/7

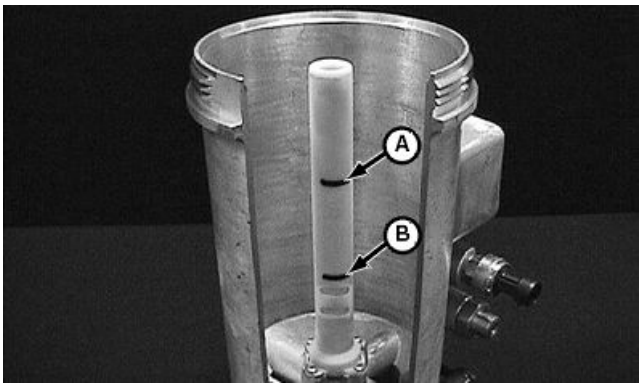
Install New Primary Fuel Filter Element (Earlier Engines)

1. Check to ensure that the fuel level in the filter housing is between the MIN (B) and MAX (A) fuel levels indicated on the outside of the housing and on the corresponding marks on the center tube. If the fuel is below the MIN level, then carefully open the fuel supply shut-off valve a small amount (if equipped) to add fuel.

   Operate the hand primer to add more fuel if required or if the unit is not equipped with a fuel supply shut-off valve.

IMPORTANT: Fuel level below the MIN indication may result in trapped air in the filter causing the engine to stall and not restart without additional system purging. Fuel level above the MAX indication may cause fuel to overflow from the filter housing during insertion of filter element.

2. Insert new (dry) fuel filter into filter housing.
3. Reinstall fuel filter cap and tighten to “handtight” condition.



RG10305 —UN—02SEP99

Fuel Level In Filter Housing

A—Maximum Level (2 1/2 Inches from Top of Housing)

B—Minimum Level (5 Inches from Top of Housing)

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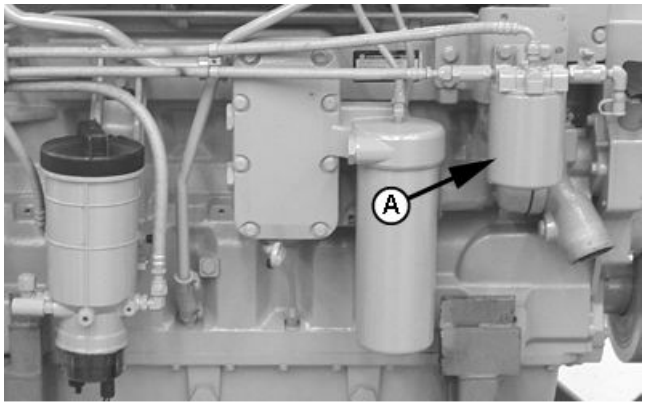
OURGP12,000011B -19-26FEB08-6/7

Replace Final Fuel Filter (Earlier Engines)

IMPORTANT: Always replace both filters at the same time.

1. Clean entire area surrounding fuel filter assembly to keep debris from entering fuel system.
2. Remove final fuel filter using a suitable filter wrench.
3. Lubricate packing on new final fuel filter with diesel fuel, and install filter onto base. Tighten 1/2 turn after packing contacts base.
4. Open fuel supply shut-off valve (if equipped).
5. Restart engine and allow to run for five minutes minimum.

NOTE: Under normal conditions, fuel system bleeding is not required. Priming system with hand primer is normally sufficient. If necessary to bleed the system, see BLEEDING FUEL SYSTEM in Service as Required section.



RG13900 —UN—14JUN05

Final Fuel Filter (Earlier Engines)

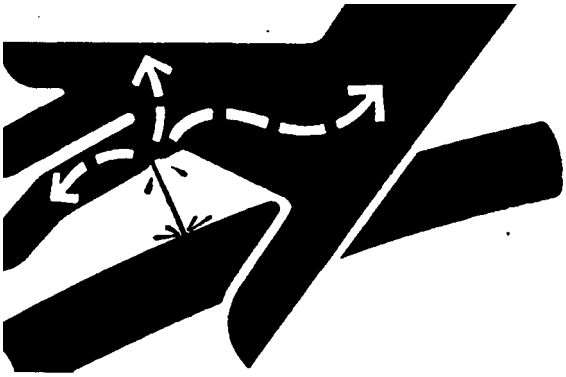
A—Final Fuel Filter

OURGP12,000011B -19-26FEB08-7/7

Replacing Fuel Filters/Cleaning Water Separator (Later Engines)

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If any fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.

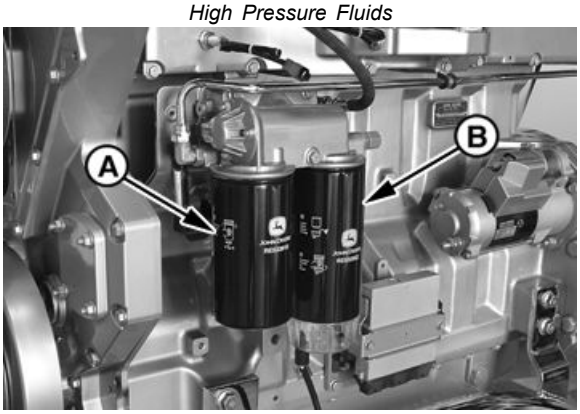


X9811 —UN—23AUG88

High Pressure Fluids

IMPORTANT: Primary fuel filter (B) and final fuel filter (A) must both be replaced whenever audible alarm sounds and trouble code indicates plugged filter (fuel supply pressure moderately/extremely low). Replace both fuel filters at 12 month intervals (or every 500 hours) if no alarm/code indications occur.

NOTE: The "ship away" final fuel filter that the engine is shipped with may be shorter compared to the "service" final fuel filter. The shorter filter is required to provide clearance during manufacturing.



RG15746 —UN—25FEB08

A—Final Fuel Filter **B—Primary Fuel Filter**

Remove Primary Fuel Filter (Later Engines)

CAUTION: If engine has been running, engine and fuel filter housing may be hot.

1. Close fuel shut-off valve (if equipped).
2. Clean entire area surrounding fuel filter assembly to keep debris from entering fuel system.
3. Disconnect wiring connector from water-in-fuel sensor.
4. Drain fuel from separator bowl into suitable container.
5. Remove primary fuel filter by turning counterclockwise by hand or using suitable filter wrench.

Continued on next page

Remove And Clean Water Separator Bowl (Later Engines)

1. Remove water separator bowl from primary fuel filter by turning counterclockwise by hand or using a suitable strap wrench.
2. Clean separator bowl and dry it.
3. Lubricate new water separator bowl seal with thin film of oil or fuel, and hand tighten to primary fuel filter.

Specification	
Water Separator Bowl-To-Primary Fuel Filter—Torque	Hand Tighten to Primary Fuel Filter

Install New Primary Fuel Filter (Later Engines)

1. Lubricate new primary fuel filter seal with thin film of oil or fuel.
2. Screw filter into header by turning clockwise until the seal contacts the header.
3. When seal contacts the header, tighten clockwise to the following specification:

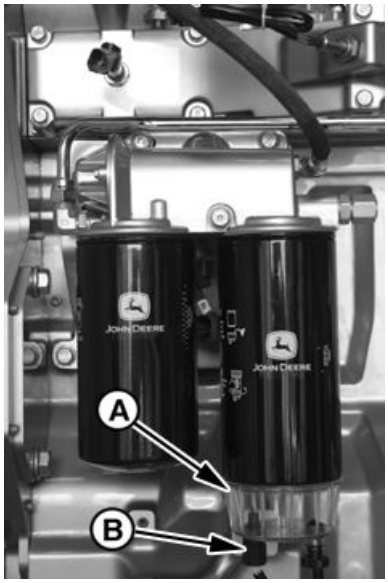
Specification	
Primary Fuel Filter—Torque	Seal Contact + 1/2 to 3/4 Turn, Lubricated with Oil or Fuel

4. Connect water-in-fuel sensor connector.

Replace Final Fuel Filter (Later Engines)

IMPORTANT: Always replace both filters at the same time.

1. Clean entire area surrounding fuel filter assembly to keep debris from entering fuel system.
2. Remove final fuel filter using a suitable filter wrench.
3. Lubricate new final fuel filter seal with thin film of oil or fuel, and screw filter into header by turning clockwise until the seal contacts the header.
4. When seal contacts the header, tighten clockwise to the following specification:



RG15747 —UN—26FEB08

A—Water Separator Bowl **B—Water-In-Fuel Sensor**

Specification	
Final Fuel Filter—Torque	Seal Contact + 1 Turn, Lubricated with Oil or Fuel

5. Open fuel supply shut-off valve (if equipped).
6. Turn ignition key to the ON position for 120 seconds to allow the system to prime itself.
7. Restart engine and allow to run for five minutes minimum.

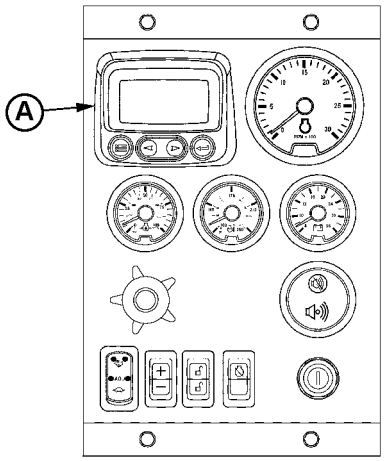
NOTE: Under normal conditions, fuel system bleeding is not required. The auto prime feature is normally sufficient. If necessary to bleed the system, see BLEEDING FUEL SYSTEM in Service as Required section.

BK34394,00000E1 -19-29FEB08-2/2

Checking and Adjusting Engine Speeds

Use tachometer on the diagnostic gauge (A) to verify engine speeds. (Refer to ENGINE POWER RATINGS AND FUEL SYSTEM SPECIFICATIONS in Specifications Section later in this manual for engine speed specifications.) If engine speed adjustment is required, see your authorized servicing dealer or engine distributor.

A—Diagnostic Gauge



RG13728 —UN—11NOV04

Using Tachometer to Check Engine Speeds

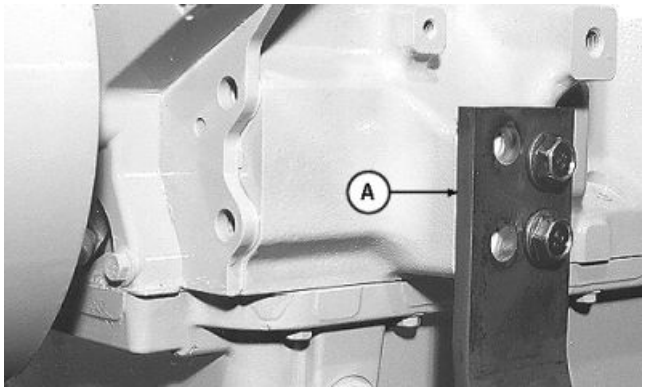
OURGP12,0000090 -19-12SEP06-1/1

Checking Engine Mounts

Engine mounting is the responsibility of the vehicle or generator manufacturer. Follow manufacturer's guidelines for mounting specifications.

IMPORTANT: Use only Grade SAE 8 or higher grade of hardware for engine mounting.

1. Check the engine mounting brackets (A), vibration isolators, and mounting bolts on support frame and engine block for tightness. Tighten as necessary.
2. Inspect overall condition of vibration isolators, if equipped. Replace isolators, as necessary, if rubber has deteriorated or mounts have collapsed.



RG9905 —UN—06JAN99

Engine Mounting

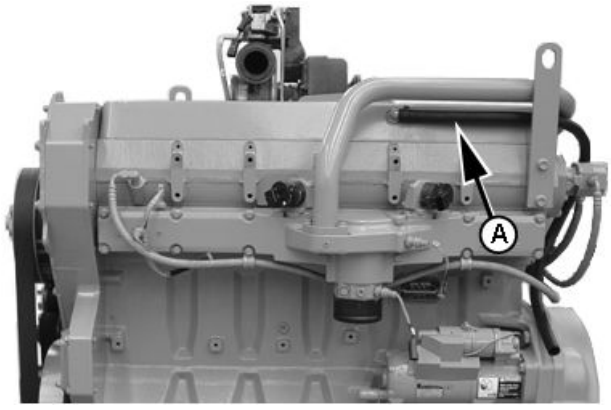
A—Mounting Bracket

OURGP11,0000110 -19-11OCT06-1/1

Checking Crankcase Vent Tube and Valve

1. Loosen clamp on crankcase vent hose (A).
2. Remove crankcase vent valve (not shown) from rocker arm cover.
3. Remove crankcase vent valve from crankcase vent hose and clean hose. Ensure hose is not plugged.
4. Shake crankcase vent valve. If free movement of valve is heard while shaking, valve can be reused. Replace valve if rattle is not heard.
5. Install the valve and vent hose. Attach valve with two screws. Tighten hose clamp securely.

A—Crankcase Vent Tube



RG14342 —UN—27JUL05

Crankcase Vent Tube

OURGP11,0000056 -19-11OCT06-1/1

Checking Air Intake System

IMPORTANT: The air intake system must not leak. Any leak, no matter how small, may result in internal engine damage due to abrasive dirt and dust entering the intake system.

1. Inspect all intake hoses (piping) for cracks. Replace as necessary.
2. Check clamps on piping which connect the air cleaner to the engine. Tighten clamps as necessary. This will help prevent dirt from entering the air intake system through loose connections, causing internal engine damage.
3. If engine has a rubber dust unloader valve (A), inspect the valve on bottom of air cleaner for cracks or plugging. Replace as necessary.



RG8717A —UN—12JUL99

Rubber Dust Unloader Valve

A—Dust Unloader Valve

RG,RG34710,7569 -19-16SEP13-1/2

4. Test air filter restriction indicator (B) for proper operation. Replace indicator as necessary.

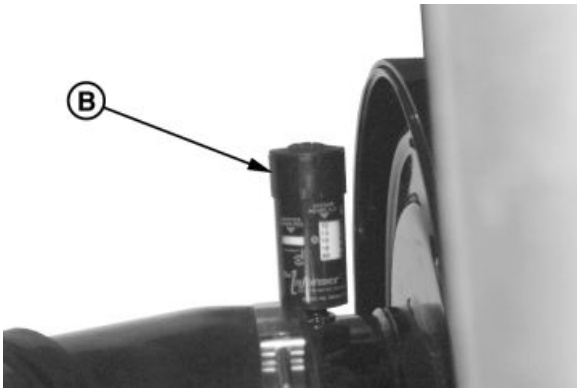
IMPORTANT: ALWAYS REPLACE primary air cleaner element when air filter restriction indicator is torn or visibly dirty, or when it exceeds specifications or service interval. A clogged air cleaner element will cause excessive intake restriction and a reduced air supply to the engine.

5. Remove and inspect primary air cleaner element. Service as necessary. (See Replacing Air Cleaner Filter Elements in the Service As Required Section.)

   If equipped with air intake restriction indicator gauge (B), check gauge and service air cleaner if it exceeds specifications.

Specification	
Maximum Air Intake Restriction—Vacuum	25 in. (625 mm) H_2O (6.25 kPa) (0.06 bar) (1.0 psi)

   If not equipped with air filter restriction indicator, replace air cleaner elements at 500 hours or 12 months, whichever occurs first.



RG8719A —UN—12JUL99

Air Restriction Indicator

B—Air Restriction Indicator

RG,RG34710,7569 -19-16SEP13-2/2

Check Engine Electrical Ground Connection

Check engine ground connection to ensure it is tight and clean. See ELECTRICAL SYSTEM LAYOUT in Troubleshooting Section for ground location.

This inspection is necessary to prevent electrical arc, which can result in engine damage.

OURGP11,0000111 -19-12SEP06-1/1

Checking Belt Tensioner Spring Tension and Belt Wear

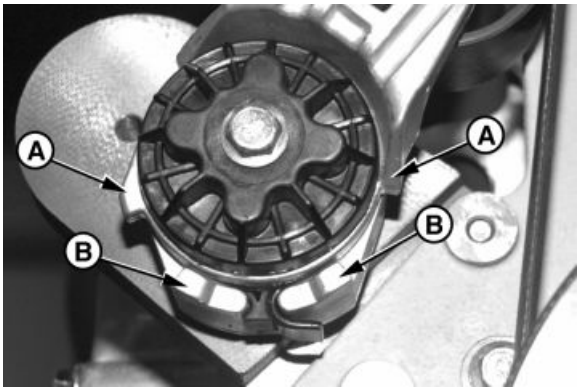
Belt drive systems equipped with automatic (spring) belt tensioners cannot be adjusted or repaired. The automatic belt tensioners are designed to maintain proper belt tension over the life of the belt. If tensioner spring tension is not within specification, replace tensioner assembly.

Checking Belt Wear

The belt tensioner is designed to operate within the limit of arm movement provided by the cast stops (A and B) when correct belt length and geometry is used.

Visually inspect cast stops (A and B) on belt tensioner assembly.

If the tensioner stop on swing arm (A) is hitting the fixed stop (B), check mounting brackets (alternator, belt tensioner, idler pulley, etc.) and the belt length. Replace belt as needed (see REPLACING FAN/ALTERNATOR V-BELTS in Service as Required section).



RG8742 —UN—03SEP99

Upper Tensioner Shown, Lower Tensioner Similar

A—Swing Arm Cast Stops **B—Fixed Cast Stops**

OURGP12,000013B -19-12SEP06-1/3

Checking Upper Tensioner Spring Tension

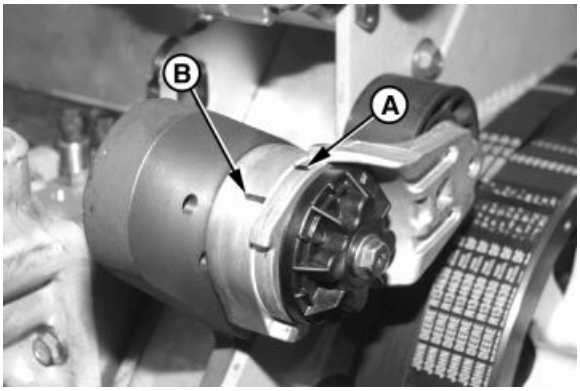
NOTE: While belt is loosened, inspect pulleys and bearings. Rotate and feel for hard turning or any unusual sounds. If pulleys or bearings need replacement, see your John Deere dealer.

A belt tension gauge will not give an accurate measure of the belt tension when automatic spring tensioner is used. Measure tensioner spring tension using a torque wrench and procedure outlined below:

1. Release tension on belt using a long-handled 1/2-in. drive tool in square hole in end of tensioner arm. Remove belt from pulleys.
2. Release tension on tensioner arm and remove drive tool.
3. Put a mark (A) on swing arm of tensioner as shown.
4. Measure 21 mm (0.83 in.) from first mark (A) and put a second mark (B) on tensioner mounting base.
5. Rotate the swing arm using a torque wrench until marks (A and B) are aligned.
6. Record torque wrench measurement and compare with specification below. Replace tensioner assembly as required.

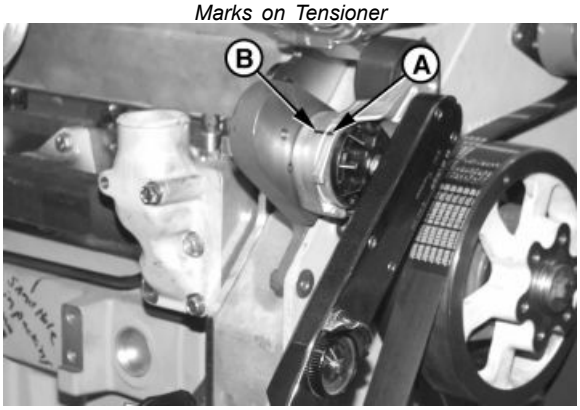
Specification

Upper Spring Tension—Torque..... 18–23 N·m (13–17 lb-ft)



RG8727 —UN—10DEC97

Marks on Tensioner



RG8726 —UN—10DEC97

Align Marks

A—Mark on Swing Arm **B—Mark on Tensioner Mounting Base**

Continued on next page

OURGP12,000013B -19-12SEP06-2/3

Checking Lower Tensioner Spring Tension

A belt tension gauge will not give an accurate measure of the belt tension when automatic spring tensioner is used. Measure tensioner spring tension using a torque wrench and procedure outlined below:

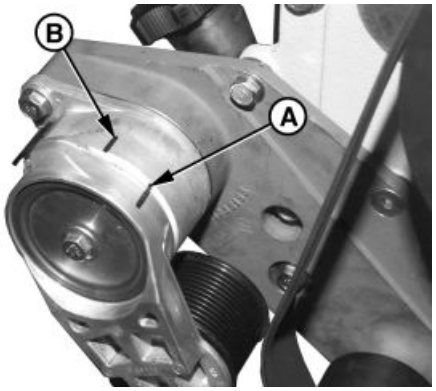
1. Release tension on belt using a long-handled 3/4-in. drive tool in tensioner arm. Remove belt from pulleys.
2. Release tension on tensioner arm and remove drive tool.
3. Put a mark (A) on swing arm of tensioner as shown.
4. Measure 25 mm (1.0 in.) from first mark (A) and put a second mark (B) on tensioner mounting base.
5. Rotate the swing arm using a torque wrench until marks (A and B) are aligned.
6. Record torque wrench measurement and compare with specification below. Replace tensioner assembly as required.

Specification

Lower Spring
Tension—Torque..... 81–99 N·m (60–73 lb-ft)

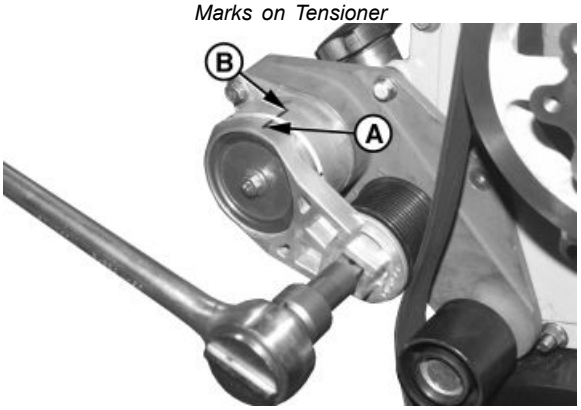
A—Mark on Swing Arm

B—Mark on Tensioner Mounting Base



Marks on Tensioner

RG8728 —UN—10DEC97



Align Marks

RG8729 —UN—10DEC97

OURGP12,000013B -19-12SEP06-3/3

Checking Cooling System

⚠ CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

IMPORTANT: Air must be expelled from cooling system when system is refilled. Loosen temperature sending unit fitting or plug in thermostat housing to allow air to escape when filling system. Retighten fitting or plug when all the air has been expelled. Cooling system must be free of air by time engine coolant temperature reaches 80°C (176°F) or damage to EGR cooler may result.

1. Visually check entire cooling system for leaks. Tighten all clamps securely.



High-Pressure Fluids

TS281 —UN—15APR13

2. Thoroughly inspect all cooling system hoses for hard, flimsy, or cracked condition. Replace hoses if any of the above conditions are found.

OURGP11,0000057 -19-12SEP06-1/1

Testing Diesel Engine Coolant

Maintaining adequate concentrations of glycol and inhibiting additives in the coolant is critical to protect the engine and cooling system against freezing, corrosion, and cylinder liner erosion and pitting.

Test the coolant solution at intervals of 12 months or less and whenever excessive coolant is lost through leaks or overheating.

Coolant Test Strips

Coolant test strips are available from your John Deere dealer. These test strips provide a simple, effective method to check the freeze point and additive levels of your engine coolant.

When Using John Deere COOL-GARD II

John Deere COOL-GARD II Premix™ , COOL-GARD II PG Premix and COOL-GARD II Concentrate are maintenance free coolants for up to six years or 6000 hours of operation, provided that the cooling system is topped off using only John Deere COOL-GARD II Premix or COOL-GARD II PG premix. Test the coolant condition annually with coolant test strips designed for use with John Deere COOL-GARD II coolants. If the test strip chart indicates that additive is required, add John Deere COOL-GARD II Coolant Extender as directed.

COOL-GARD is a trademark of Deere & Company

Add only the recommended concentration of John Deere COOL-GARD II Coolant Extender. DO NOT add more than the recommended amount.

When Using Nitrite-Containing Coolants

Compare the test strip results to the supplemental coolant additive (SCA) chart to determine the amount of inhibiting additives in your coolant and whether more John Deere Liquid Coolant Conditioner should be added.

Add only the recommended concentration of John Deere Liquid Coolant Conditioner. DO NOT add more than the recommended amount.

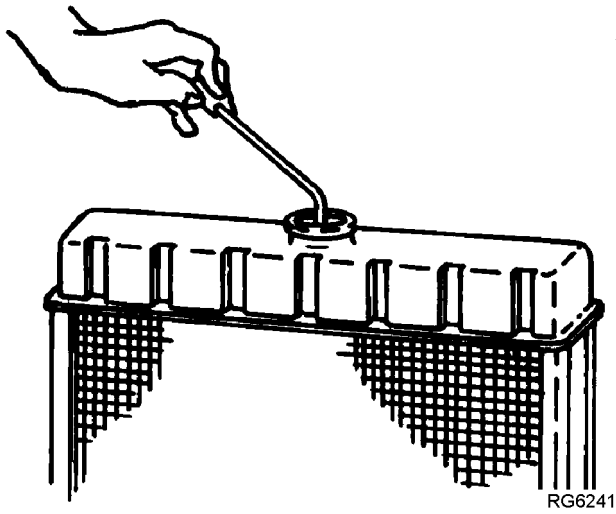
Coolant Analysis

For a more thorough evaluation of your coolant, perform a coolant analysis. The coolant analysis can provide critical data such as freezing point, antifreeze level, pH, alkalinity, nitrite content (cavitation control additive), molybdate content (rust inhibitor additive), silicate content, corrosion metals, and visual assessment.

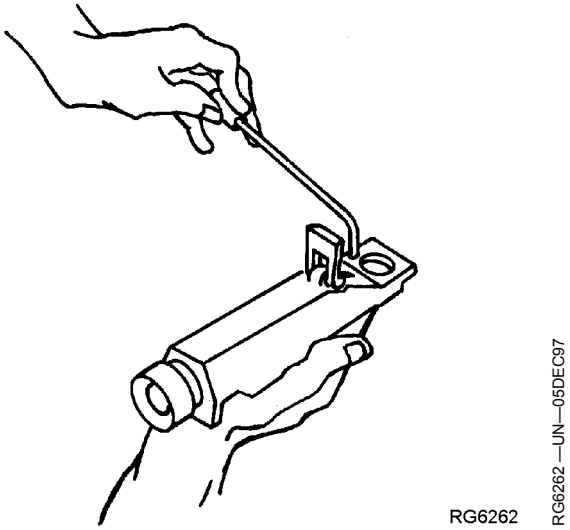
Contact your John Deere dealer for more information on coolant analysis.

DX,COOL9 -19-11APR11-1/1

Replenishing Supplemental Coolant Additives (SCAs) Between Coolant Changes



Radiator Coolant Check



JT07298 Coolant/Battery Tester

IMPORTANT: Do not add supplemental coolant additives when the cooling system is drained and refilled with John Deere ANTIFREEZE/SUMMER COOLANT or John Deere COOL-GARD®.

NOTE: If a system is to be filled with coolant that does not contain SCAs, the coolant must be precharged. Determine the total system capacity and premix with 3% John Deere Coolant Conditioner.

Through time and use, the concentration of coolant additives is gradually depleted during engine operation. Periodic replenishment of inhibitors is required, even when John Deere ANTIFREEZE/SUMMER COOLANT is used. The cooling system must be recharged with additional supplemental coolant additives available in the form of liquid coolant conditioner.

Maintaining the correct coolant conditioner concentration (SCAs) and freeze point is essential in your cooling system to protect against rust, liner pitting and corrosion, and freeze-ups due to incorrect coolant dilution.

John Deere LIQUID COOLANT CONDITIONER is recommended as a supplemental coolant additive in John Deere engines.

DO NOT mix one brand of SCA with a different brand.

Test the coolant solution at 500 hours or 12 months of operation using either John Deere coolant test strips or a COOLSCAN ® analysis. If a COOLSCAN ® analysis is not available, recharge system per instructions printed on label of John Deere Liquid Coolant Conditioner.

IMPORTANT: ALWAYS maintain coolant at correct level and concentration. DO NOT operate engine without coolant for even a few minutes.

If frequent coolant makeup is required, the glycol concentration should be checked with JT07298 Coolant/Battery Tester to ensure that the desired freeze point is maintained. Follow manufacturer's instructions provided with refractometer.

Add the manufacturer's recommended concentration of supplemental coolant additive. DO NOT add more than the recommended amount.

The use of non-recommended supplemental coolant additives may result in additive drop-out and gelation of the coolant.

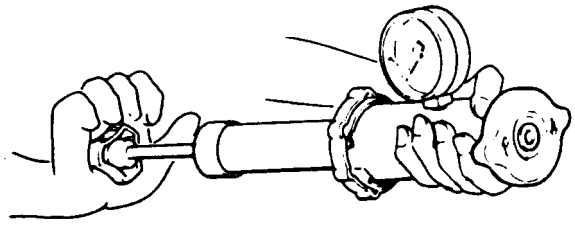
If other coolants are used, consult the coolant supplier and follow the manufacturer's recommendation for use of supplemental coolant additives.

See DIESEL ENGINE COOLANT and additional information on coolant additives in Fuels, Lubricants and Coolants earlier in this manual for proper mixing of coolant ingredients before adding to the cooling system.

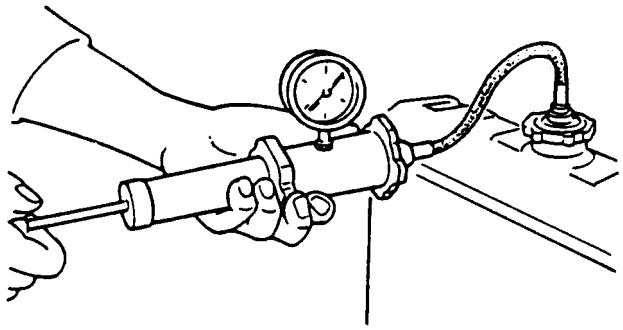
COOL-GARD is a registered trademark of Deere & Company
COOLSCAN is a registered trademark of Deere & Company.

OMRGP15,000012F -19-12SEP06-1/1

Pressure Testing Cooling System



D05104ST Tester



RG6557 —UN—20JAN93

RG6558 —UN—20JAN93

Connect Gauge and Adapter to Filler Neck

A pressurized cooling system is required to protect engine from cavitation and oxidizing of coolant.

⚠ CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

Test Radiator Cap

1. Remove radiator cap and attach to D05104ST Tester as shown.
2. Pressurize cap to following specifications.[1]

Specification	
Radiator Cap—Test Pressure	103 kPa (1.03 bar) (15 psi)

Gauge should hold pressure for 10 seconds within the normal range if cap is acceptable. If gauge does not hold pressure, replace radiator cap.

3. Remove the cap from gauge, turn it 180°, and retest cap. This will verify that the first measurement was accurate.

[1]Test pressures recommended are for Deere OEM cooling system for 13.5 L engines. On specific vehicle applications, test cooling system and pressure cap according to the recommended pressure for that vehicle.

Test Cooling System

NOTE: Engine should be warmed up to test overall cooling system.

1. Allow engine to cool; carefully remove radiator cap.
2. Fill radiator with coolant to normal operating level.

IMPORTANT: DO NOT apply excessive pressure to cooling system. Doing so may damage radiator and hoses.

3. Connect gauge and adapter to filler neck. Pressurize cooling system to the following specifications.[1]

Specification	
Cooling System—Test Pressure	103 kPa (1.03 bar) (15 psi)

4. With pressure applied, check all cooling system hose connections, radiator, and engine for leaks.

If leakage is detected, correct as necessary and pressure test system again. If no leakage is detected, but the gauge indicated a drop in pressure, contact your engine distributor or servicing dealer for further diagnostics.

OMRGP15,0000130 -19-12SEP06-1/1

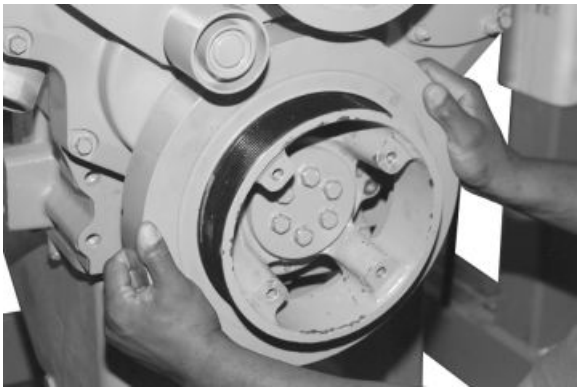
Checking Crankshaft Vibration Damper

IMPORTANT: Crankshaft vibration damper is not repairable and should be replaced every 4500 hours or 60 months, whichever occurs first

1. Remove belts (shown removed).
2. Carefully inspect crankshaft vibration damper for cracks.
3. Grasp crankshaft vibration damper with both hands and attempt to turn it in both directions. If rotation is felt, crankshaft vibration damper is defective and should be replaced.
4. Check crankshaft vibration damper radial runout by positioning dial indicator so probe (A) contacts crankshaft vibration damper outer diameter.
5. With engine at operating temperature, rotate crankshaft using JDG820 flywheel rotation tool.
6. Note dial indicator reading. If runout exceeds specification, replace crankshaft vibration damper.

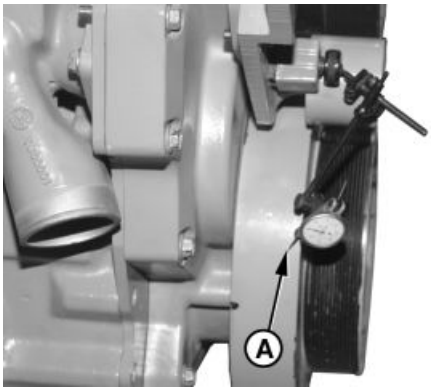
Specification	
Crankshaft Vibration Damper—Maximum Radial Runout	0.76 mm (0.030 in)

A—Dial Indicator Probe



RG8536 —UN—20MAY98

Check Crankshaft Vibration Damper



RG8537 —UN—10DEC97

Measure Crankshaft Vibration Damper Runout

OURGP12,000013C -19-06NOV15-1/1

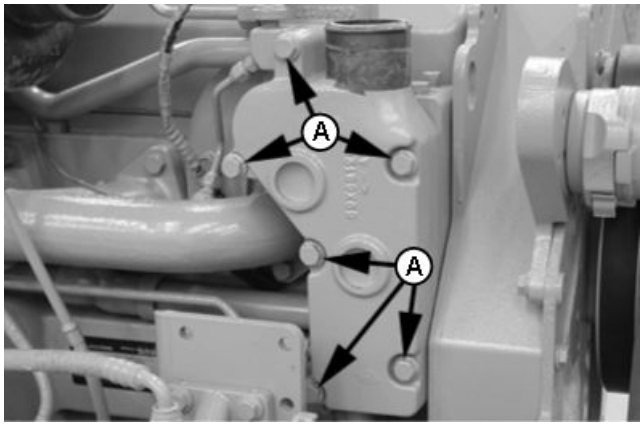
Testing Thermostats Opening Temperature

To Remove Thermostats

CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns. DO NOT drain coolant until it has cooled below operating temperature. Always loosen radiator pressure cap or drain valve slowly to relieve pressure.

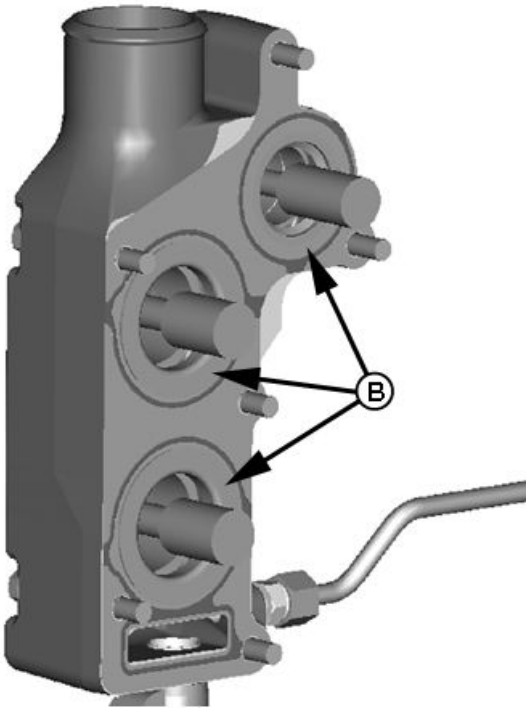
1. Visually inspect area around thermostat housing for leaks.
2. Remove radiator pressure cap and partially drain cooling system.
3. Remove six cap screws (A) from thermostat housing and remove housing (if not previously done).
4. Remove gasket and remove thermostats (B).
5. Test each thermostat for proper opening temperature.

A—Cap Screws **B—Thermostats**



RG14338 —UN—05JUL05

Remove Thermostat Housing



RG13896 —UN—14JUN05

Remove Gasket and Thermostats

Continued on next page

OURGP12,0000127 -19-29FEB08-1/3

Testing Thermostats Opening Temperature

1. Remove thermostats.
2. Visually inspect thermostats for corrosion or damage. Replace thermostats as a matched set as necessary.
3. Inspect thermostat with ball valve in vent notch. If ball valve movement is restricted, and cleaning does not free ball valve, replace thermostat.

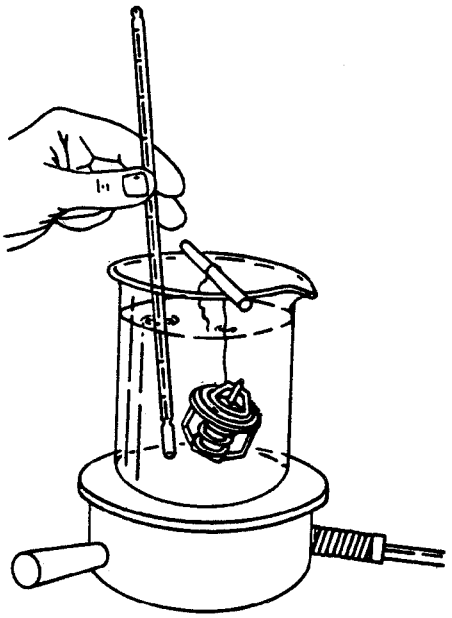
CAUTION: DO NOT allow thermostat or thermometer to rest against the side or bottom of container when heating water. Either may rupture if overheated.

4. Suspend thermostat and a thermometer in a container of water.
5. Stir the water as it heats. Observe opening action of thermostat and compare temperatures with specification given in chart below.

NOTE: Due to varying tolerances of different supplies, initial opening and full open temperatures may vary slightly from specified temperatures.

ENGINE/EGR THERMOSTAT TEST SPECIFICATIONS

Rating	Initial Opening (EGR/Engine)	Full Open (Nominal)
82°C (180°F)	80—83°C (176—182°F)/ 80—84°C (176—183°F)	92°C (197°F)



RG5971 —UN—23NOV97

Thermostat and Thermometer in Water

6. Remove thermostat and observe its closing action as it cools. In ambient air the thermostat should close completely. Closing action should be smooth and slow.
7. If any one thermostat is defective, replace all thermostats.

Continued on next page

To Install Thermostats

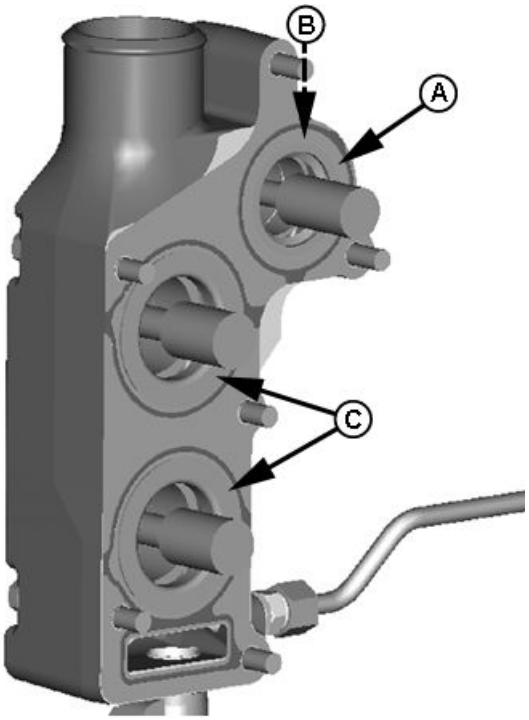
IMPORTANT: Top thermostat has a vent notch with ball valve for air bleeding. Ball valve MUST BE installed at 12 o'clock position.

1. Clean all gasket material from thermostat housing and housing mounting surfaces.
2. Install smaller (EGR) thermostat (A) in top position with ball valve at 12 o'clock position (B). Install two larger (engine) thermostats (C) in lower positions.
3. Install a **new** gasket on thermostat housing.
4. Install thermostat housing using cap screws (D) and tighten to specifications.

Specification	
Thermostat Housing Cap Screws—Torque	85±9 N·m (63±7 lb-ft)

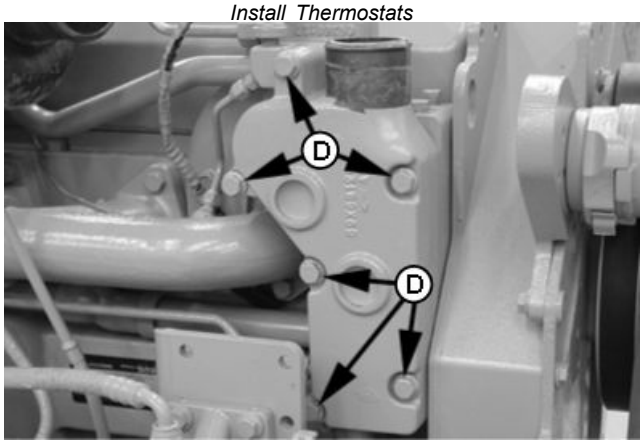
5. Pressure test the cooling system a second time to be sure thermostat cover gasket is sealing properly (See Pressure Test Cooling System in Lubrication And Maintenance 500 Hour/12 Months).

A—Smaller (EGR) Thermostat
B—Ball Valve at 12 O'Clock Position
C—Larger (Engine) Thermostats
D—Cap Screws



RG14339 —UN—15JUL05

Install Thermostats



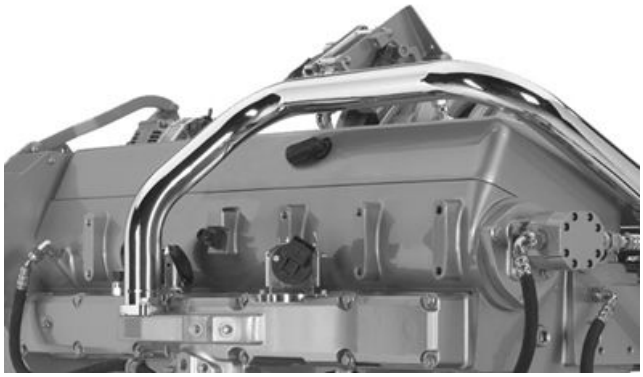
RG14340 —UN—15JUL05

Install Thermostat Housing

OURGP12,0000127 -19-29FEB08-3/3

Checking and Adjusting Engine Valve Clearance and Electronic Unit Injector Preload

Have your John Deere engine distributor or servicing dealer adjust intake and exhaust valve clearance and electronic unit injector (EUI) preload.



RG13889 —UN—19MAY05

Check Valve Clearance

OMRGP15,0000131 -19-19SEP13-1/1

Do Not Modify Fuel System

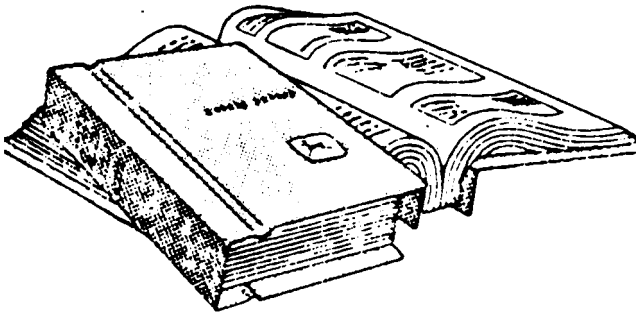
IMPORTANT: Modification or alteration of the unit fuel injectors in ways not recommended by the manufacturer will terminate the warranty obligation to the purchaser.

In addition, tampering with fuel system which alters emission-related equipment on engines may result in fines or other penalties, per EPA regulations or other local emission laws.

OMRGP15,0000132 -19-29OCT10-1/1

Additional Service Information

This is not a detailed service manual. If you want more detailed service information, contact your John Deere dealer or engine distributor.



RG4624 —UN—15DEC88

Component Technical Manuals

OURGP11,0000048 -19-23AUG10-1/1

Adding Coolant

CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

IMPORTANT: Never pour cold liquid into a hot engine, as it may crack cylinder head or block. DO NOT operate engine without coolant for even a few minutes.

John Deere Cooling System Sealer may be added to the radiator to stop leaks on a temporary or emergency basis only. DO NOT use any other stop-leak additives in the cooling system. Leaks should be permanently repaired as quickly as possible.

Air must be expelled from cooling system when coolant is added. Cooling system must be free of air by time engine coolant temperature reaches 80°C (176°F) or damage to EGR cooler may result.

1. Loosen temperature sending unit fitting or plug in thermostat housing to allow air to escape when filling system.

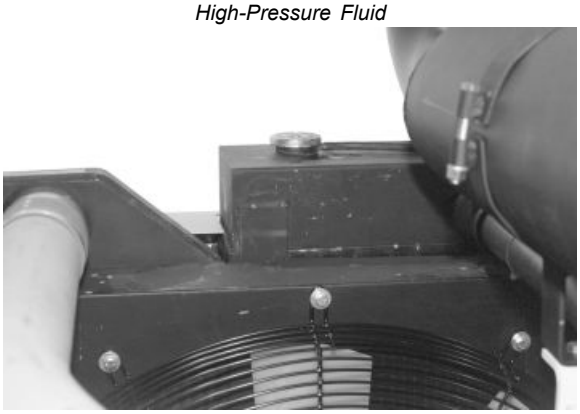
IMPORTANT: When adding coolant to the system, use the appropriate coolant solution. (See DIESEL ENGINE COOLANTS, SUPPLEMENTAL ADDITIVE INFORMATION in Fuels, Lubricants, and Coolant section for mixing of coolant ingredients before adding to cooling system.)

Do not overfill cooling system. A pressurized system needs space for heat expansion without overflowing at top of radiator.



TS281 —UN—15APR13

High-Pressure Fluid



RG8735 —UN—03SEP99

Fill Cooling System

2. Fill until coolant level touches bottom of radiator filler neck or to “FULL HOT” mark on coolant recovery tank..
3. Check freeze temperature protection.
4. Tighten plugs and fittings after filling cooling system.
5. Run engine for 10 minutes to remove any air from system. Top off coolant level if required.

OURGP11,000005A -19-12OCT06-1/1

Pre-Start Cleaning Guide

IMPORTANT: Before cleaning machine, allow ample time for hot surfaces to cool.

IMPORTANT: Do not direct high-pressure spray from hose output directly at or close to electrical connections and sensors.

Rigorous cleaning as needed is recommended. Clean more frequently during heavy machine use, and when weather conditions are dry.

- Check enclosed areas daily. Clean the engine and other enclosed areas of equipment to remove debris and any buildup of oil and grease. Keep the engine and engine compartment free of combustible material.
- Check for debris buildup daily on and around intake systems, exhaust systems, and intercooler piping systems. Verify that there are no holes or leaks in intake or exhaust systems. Do not allow debris to build up near hot exhaust components. Verify that hot exhaust components are cleaned as often as environmental conditions require.
- Inspect cooling system daily to determine whether cooling system needs cleaning. Visible buildup of residue that blocks airflow may degrade machine performance and requires more frequent cleaning depending on environmental conditions.
- Inspect difficult to observe areas daily as conditions may require additional cleaning care to remove debris.
- Check for oil and fuel leaks daily. Replace or repair any sources of leaks, including gaskets, seals, breather tubes, fittings, and fluid lines.

Maintenance and Service Reminders

- Keep surfaces free of grease and oil.
- Clean up after hydraulic and other fluid leaks.
- Fuel Lines — Check for leaks, cracks, and kinks that require service before use.
- Fuel Pumps — Check fittings, especially compression ring couplings, for cracks and leaks.
- Fuel Injectors — Check pressure and return lines for signs of leaks.
- When servicing fuel filter or draining water separator, avoid fuel spills. Immediately clean up any fuel spill.
- Handle transmission and power steering fluids with care. Immediately clean up any spills, especially around fill points.
- Check for transmission case venting system seepage, transmission case leakage, power steering cylinder leakage, or power steering line leakage.
- Check for loose electrical connectors, damaged wiring, corrosion, and poor connections.

ZE59858,0000009 -19-20MAY13-1/1

Flushing and Refilling Cooling System

CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

NOTE: Coolant drain intervals can vary greatly depending on coolant type used and maintenance preformed. Please see the section Fuels, Lubricants, and Coolants earlier in this manual for specific interval information.

Drain old coolant, flush the entire cooling system, test thermostats, and fill with recommended clean coolant.

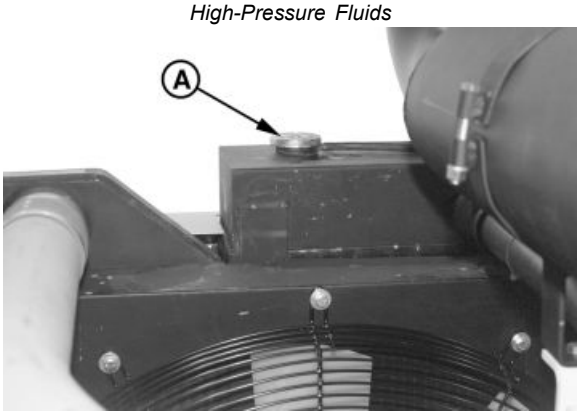
1. Pressure test entire cooling system and pressure cap if not previously done. (See PRESSURE TESTING COOLING SYSTEM, in Lubrication and Maintenance/500 Hour/12 Month section.)
2. Slowly open the engine cooling system filler cap or radiator cap (A) to relieve pressure and allow coolant to drain faster.

A—Radiator Cap



High-Pressure Fluids

TS281 —UN—15APR13



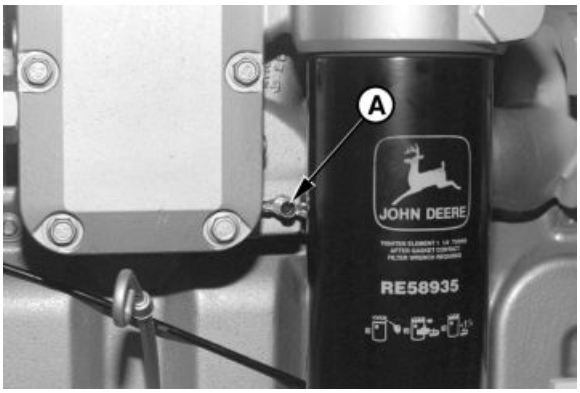
Radiator Cap

RG8735A —UN—03SEP99

JR74534,0000375 -19-13APR11-1/5

3. Open oil cooler housing drain valve (A) on right side of engine. Drain all coolant from engine block.

A—Drain Valve



Oil Cooler Housing Drain Valve

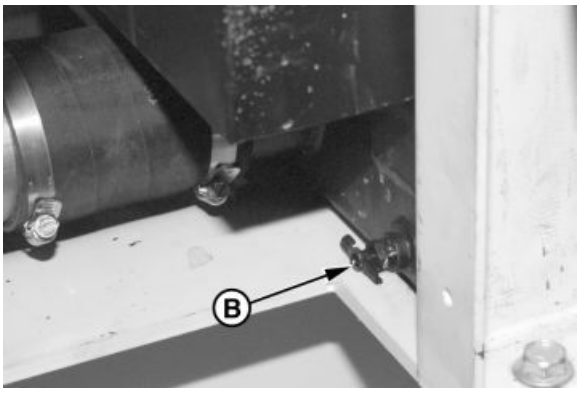
RG8708A —UN—21JUL99

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JR74534,0000375 -19-13APR11-2/5

4. Open radiator drain valve (B) and drain all coolant from radiator.

B—Drain Valve



RG8730 —UN—03SEP99

Radiator Drain Valve

JR74534,0000375 -19-13APR11-3/5

5. Remove six cap screws (A) from thermostat housing and remove housing. Remove three thermostats. Install housing (without thermostats) using old gasket and tighten cap screws to specifications.

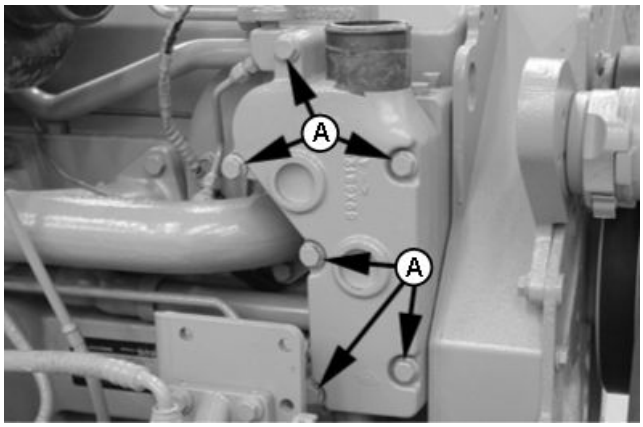
Specification

Thermostat Cover Cap Screws—Torque..... 50±10 N·m (37±7 lb-ft)

6. Test thermostat opening temperature. (See TESTING THERMOSTATS OPENING TEMPERATURE later in this section.)
7. Close all drain valves after coolant has drained.

⚠ CAUTION: Do not run engine longer than 10 minutes. Doing so may cause engine to overheat which may cause burns when radiator water is draining.

8. Fill the cooling system with clean water. Run the engine about 10 minutes to stir up possible rust or sediment.
9. Stop engine, pull off lower radiator hose and remove radiator cap. Immediately drain the water from system before rust and sediment settle.
10. After draining water, close drain valves. Reinstall radiator cap and radiator hose and clamp. Fill the cooling system with clean water and a heavy duty cooling system cleaner such as FLEETGUARD® RESTORE™ and RESTORE PLUS™. Follow manufacturer's directions on label.
11. After cleaning the cooling system, drain cleaner and fill with water to flush the system. Run the engine about 10 minutes, remove radiator cap and pull off lower radiator hose, then drain out flushing water.



RG14338 —UN—05JUL05

Remove Thermostats

A—Cap Screws

FLEETGUARD is a registered trademark of Cummins Engine Company, Inc.
RESTORE is a trademark of Fleetguard Inc.
RESTORE PLUS is a trademark of Fleetguard Inc.

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JR74534,0000375 -19-13APR11-4/5

12. Close all drain valves on engine and radiator. Reinstall radiator hose and tighten clamps securely. Install thermostats using a new gasket.

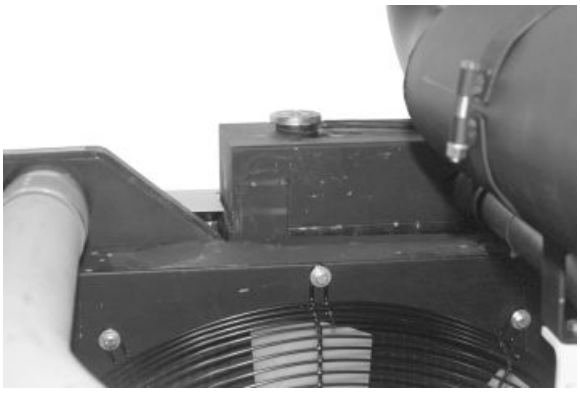
IMPORTANT: Air must be expelled from cooling system when system is refilled. Loosen temperature sending unit fitting or plug in thermostat housing to allow air to escape when filling system. Retighten fitting or plug after filling cooling system. Cooling system must be free of air by time engine coolant temperature reaches 80°C (176°F) or damage to EGR cooler may result.

13. Refill cooling system with fresh coolant until coolant touches bottom of filler neck. (See following specification for cooling system capacity.) Install radiator cap.

Specification

6135HF—Capacity..... 18.3 L (19.3 qt)

14. Run engine until it reaches operating temperature. This mixes the solution uniformly and circulates it through the entire system. The normal engine coolant temperature range is 82°—92°C (180°—197°F).



RG8735 —UN—03SEP99

Flush Cooling System

15. After running engine, check coolant level and entire cooling system for leaks.

16. Inspect fan belt for wear and check belt tension (See Checking Belt Tensioner in Lubrication And Maintenance 500 Hour/12 Months.

JR74534,0000375 -19-13APR11-5/5

Replacing Air Cleaner Filter Elements

IMPORTANT: ALWAYS REPLACE primary air cleaner element when air restriction indicator shows a vacuum of 625 mm (25 in.) H_2O, is torn, or visibly dirty.

NOTE: This procedure applies to John Deere air cleaner kits. Refer to manufacturer's instructions for servicing air cleaners not supplied by John Deere.

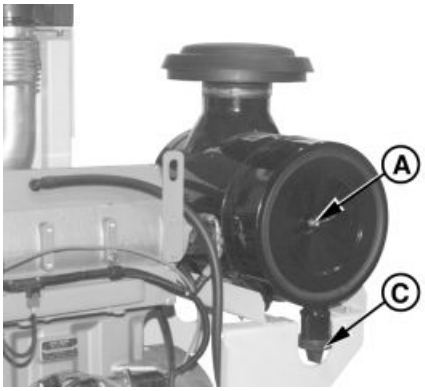
1. Remove wing nut (A) and remove canister cover and primary filter assembly (B) from canister.

IMPORTANT: Remove secondary (safety) air cleaner element (E) ONLY for replacement. DO NOT attempt to clean, wash, or reuse secondary element. Replacement of secondary element is usually necessary ONLY when primary element has a hole in it or restriction indicator green dot (•) has disappeared from window.

2. Thoroughly clean all dirt from inside canister.
3. Squeeze dust unloader valve (C) on canister to remove all dust.
4. Observe secondary (safety) element restriction indicator/retaining nut (D). If green dot (•) has disappeared from window, replace secondary element.
5. To replace secondary element, remove restriction indicator/retaining nut and secondary element. Immediately replace secondary element with new element to prevent dust from entering air intake system. Tighten restriction indicator/retaining nut to specifications.

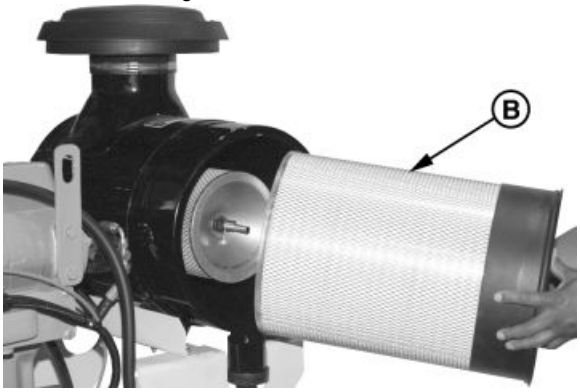
Specification	
Air Filter Restriction Indicator/Retaining Nut—Torque	14 N·m (10 lb-ft)

A—Wing Nut
B—Primary Filter Assembly
C—Unloader Valve
D—Restriction Indicator/Retaining Nut
E—Secondary Air Cleaner Element



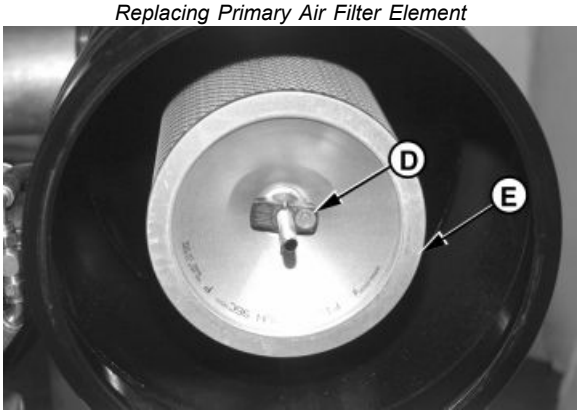
RG8731 —UN—03SEP99

Wing Nut and Unloader Valve



RG8732 —UN—03SEP99

Replacing Primary Air Filter Element



RG8733 —UN—03SEP99

Indicator/Retaining Nut for Replacing Secondary Air Filter Element

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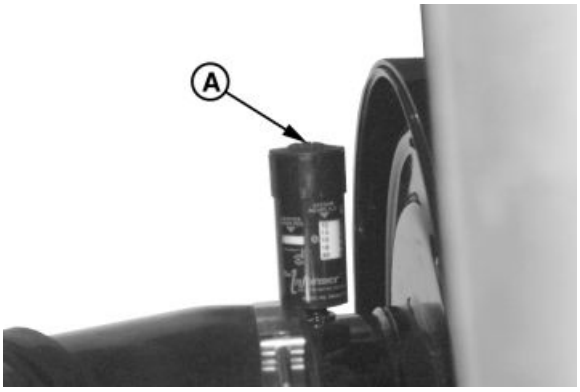
RG,RG34710,7591 -19-12SEP06-1/2

6. Install new primary assembly element and tighten wing nut securely.

IMPORTANT: Whenever the air cleaner has been serviced or had cover removed, ALWAYS fully depress the air restriction indicator reset button (if equipped) to assure accurate readings.

7. If equipped, fully depress air restriction indicator reset button (A) and release to reset indicator.

A—Air Restriction Indicator Reset Button



RG8719B —UN—03SEP99

Air Restriction Indicator Reset Button

RG,RG34710,7591 -19-12SEP06-2/2

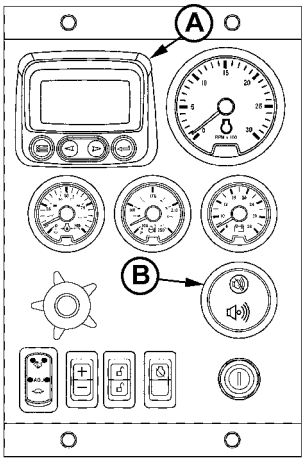
Draining Fuel Filter Water Separator Bowl

Your engine is equipped with a sensor that detects the presence of water in separator bowl mounted below fuel filter. This sensor will illuminate the red “STOP ENGINE” warning light (A) on instrument panel and also sound an audible alarm (B). A diagnostic trouble code (DTC) displayed on the diagnostic gauge will indicate that there is water in the fuel bowl (see LISTING OF DIAGNOSTIC TROUBLE CODES in Section 55).

ALWAYS STOP ENGINE IMMEDIATELY and drain water separator bowl when these warnings occur.

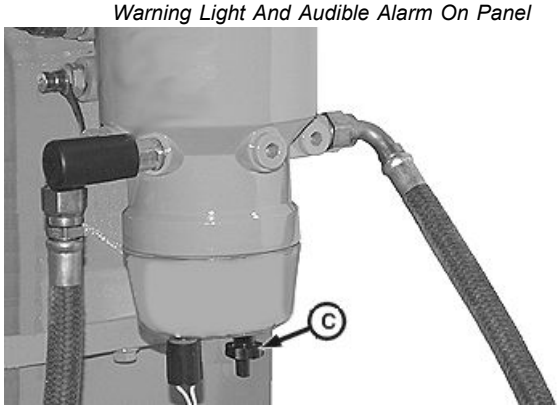
1. Drain water and contaminants from water separator sediment bowl by opening drain valve (C) and operating primer until fuel is clear of water.
2. Close drain valve.

A—Warning Light
B—Audible Alarm
C—Drain Valve



RG13882 —UN—06MAY05

Warning Light And Audible Alarm On Panel



RG12773 —UN—23JAN03

Draining Fuel Sediment Bowl (Earlier Engines shown)

OMRGP15,0000133 -19-29FEB08-1/1

Bleeding Fuel System (Earlier Engines)

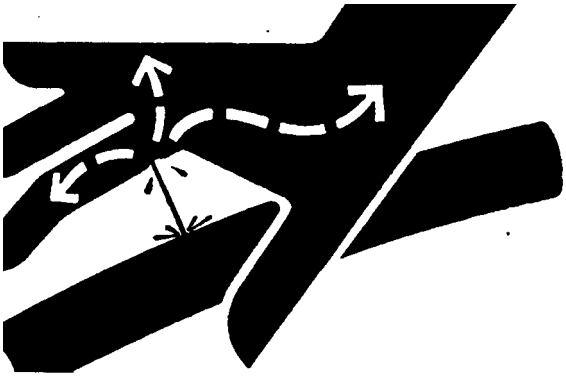
CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If any fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.

IMPORTANT: Fuel filter must be replaced whenever audible alarm sounds and trouble code indicates plugged filter (fuel supply pressure moderately/extremely low). Replace fuel filter at 12 month intervals (or every 500 hours) if no alarm/code indications occur.

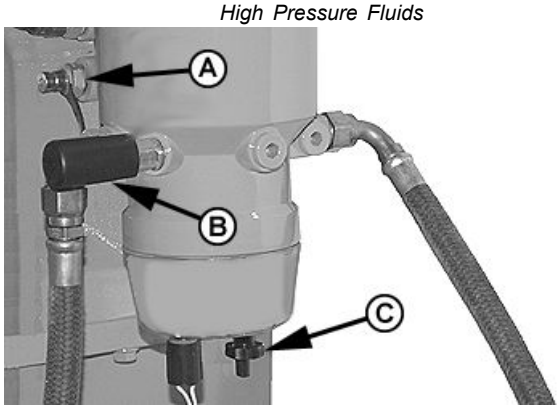
NOTE: Under normal conditions, fuel system bleeding is not required. Priming system with hand primer (B) is normally sufficient. If necessary to bleed the system, use the following procedure.

1. Drain water and contaminants from water separator sediment bowl by opening drain valve (C) and operating primer (B) until fuel is clear of water.
2. Attach an open line to diagnostic port (A) and place end of line in suitable container for diesel fuel.
3. Pump hand primer (B) until a steady flow of fuel (without bubbles) comes out of line.



X9811 —UN—23AUG88

High Pressure Fluids



RG12829 —UN—24JAN03

Bleeding Fuel System

A—Diagnostic Port
B—Hand Primer
C—Water Drain Valve

4. Disconnect line from diagnostic port.
5. Start engine and run for five minutes.

NOTE: If engine will not start after bleeding, contact your servicing dealer for an air bleed kit.

OURGP11,000005C -19-12SEP06-1/1

Bleeding Fuel System (Later Engines)

NOTE: Normally, the fuel system on these engines is self-priming and self-bleeding, and does not require a bleeding procedure by the operator.

If engine will not start after filter changes, turn ignition key ON for 60 seconds to prime the fuel system. It may be necessary to turn the key off and on again to reprime the system before starting.

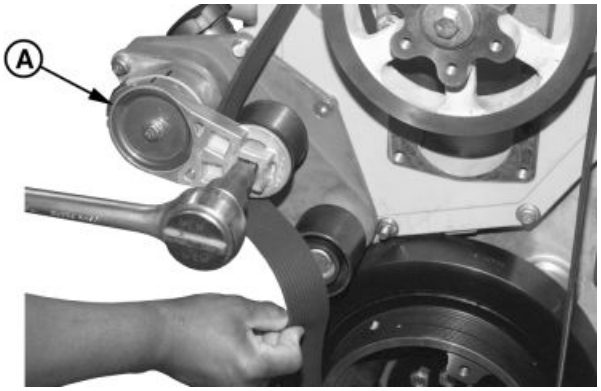
OURGP11,000005D -19-11OCT06-1/1

Replacing Fan/Alternator V-Belts

Refer to CHECKING BELT TENSIONER SPRING TENSION AND BELT WEAR in Lubrication and Maintenance/500 Hour/12 Month section to determine if V-belts need replacing.

NOTE: While belt is removed, inspect pulleys and bearings. Rotate and feel for hard turning or any unusual sounds. If pulleys or bearings need replacement, see your John Deere dealer.

NOTE: This engine is equipped with automatic belt tensioners which do not require adjustment.



RG8743 —UN—03SEP99

Lower Tensioner

A—Lower Tensioner Arm

To Replace Lower V-Belt

IMPORTANT: ALWAYS replace belts as a matched set.

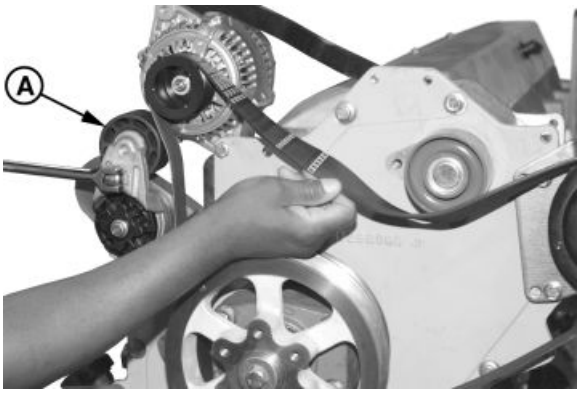
1. Release tension on lower belt using a 3/4-in. drive tool in square hole in end of lower tensioner arm (A).
2. Remove V-belt from pulleys and discard belt.
3. Install new belt; be sure that belt is correctly seated in all pulley grooves. (See V-BELT ROUTING, later in this section.)
4. Release belt tensioner to apply tension to belt. Remove drive tool.
5. Visually check belt alignment before starting engine.
6. Start engine and visually check belt alignment.

OURGP12,000013D -19-12SEP06-1/2

To Replace Upper V-Belt

IMPORTANT: ALWAYS replace belts as a matched set.

1. Remove lower V-belt as detailed earlier.
2. Release tension on upper V-belt using a 1/2-in. drive tool in upper tensioner arm (A).
3. Remove V-belt from pulleys and discard belt.
4. Install new belt; be sure that belt is correctly seated in all pulley grooves. (See V-BELT ROUTING, later in this section.)
5. Slowly release belt tensioner to apply tension to belt. Remove drive tool.
6. Check belt alignment before starting engine.
7. Install lower V-belt as detailed earlier.
8. Start engine and visually check belt alignment.



RG8744 —UN—03SEP99

Upper Tensioner

A—Upper Tensioner Arm

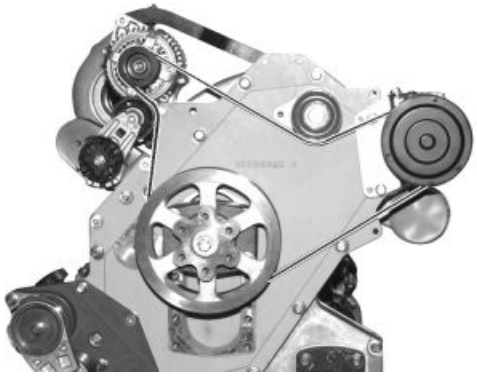
OURGP12,000013D -19-12SEP06-2/2

V-Belt Routing



RG8745 —UN—03SEP99

Lower V-Belt



RG8746 —UN—03SEP99

Upper V-Belt

Lower V-belt MUST BE removed before removing upper V-belt. Reverse sequence for V-belt installation.

RG,RG34710,7595 -19-12SEP06-1/1

Checking Fuses

The main system fuse is located in the engine wiring harness. See ENGINE WIRING DIAGRAM in Troubleshooting section.

1. Open fuse holder in wiring harness.
2. Check fuse and replace as necessary with appropriate fuse.

Fuses are also provided in wiring for engine control unit (ECU) (20-amp) and fuel filters (15-amp). (See ENGINE WIRING DIAGRAM in Troubleshooting Section.)

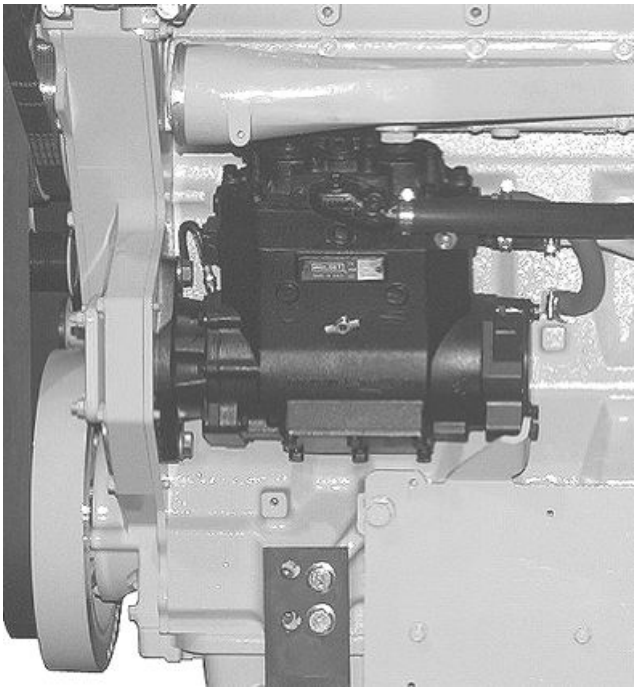
OMRGP15,0000134 -19-08NOV10-1/1

Air Compressors

Air compressors are offered as options with John Deere OEM engines to provide compressed air to operate air-powered devices like vehicle air brakes.

Air compressors are engine-driven piston types. They are either air cooled or cooled with engine coolant. The compressors are lubricated with engine oil. The compressor runs continuously as gear or spline driven by the auxiliary drive of the engine but has “loaded” and “unloaded” operating modes. This is controlled by the vehicle's air system (refer to vehicle technical manual for complete air system checks and services).

See your John Deere engine distributor or servicing dealer for diagnostic and troubleshooting information. If diagnosis leads to an internal fault in the compressor, replace the complete compressor as a new or remanufactured unit.



RG9530 —UN—24MAR99

Air Compressor (Optional)

DPSG,RG34710,104 -19-12SEP06-1/1

Rear Power Take-Off (PTO)

CAUTION: Entanglement in rotating driveline can cause serious injury or death. Keep shield on PTO driveshaft between clutch housing and the engine driven equipment at all times during engine operation. Wear close fitting clothing. Stop the engine and be sure PTO driveline is stopped before making adjustments.

If option 9201 or 9207 is ordered to make the rear PTO compatible with other manufacturer's drivelines, be sure that proper shielding is in place before operation.



TS1644 —UN—22AUG95

Rotating Drivelines

CAUTION: Metal surfaces of PTO housing may be hot to the touch during operation or at shutdown.

The optional engine rear power take-off (PTO) from John Deere transfers engine power to auxiliary equipment or moving components which may be mounted on the vehicle or trailed behind. It is an engine-driven PTO which operates whenever the engine is running.

IMPORTANT: An additional 4.0 L (4.2 qt.) of oil must be added to the crankcase for lubrication of the rear PTO option. (See ENGINE CRANKCASE OIL FILL QUANTITIES in the Specifications section.)



RG12593 —UN—06SEP02

John Deere Rear PTO (Optional)

Proper performance of the power take-off unit will be related to the care it is given. Periodically check for any oil leaks that may occur.

If the power take-off does not work properly, contact your authorized servicing dealer or engine distributor.

OUOD006,0000065 -19-12SEP06-1/1

General Troubleshooting Information

Troubleshooting engine problems can be difficult. A list of possible engine problems that may be encountered is provided in this section accompanied by possible causes and corrections.

An engine wiring diagram is provided later in this section to help isolate electrical problems on power units using John Deere wiring harness and instrument (gauge) panel. The illustrated diagrams and troubleshooting information are of a general nature; final design of the overall system for your engine application may be different. See your engine distributor or servicing dealer if you are in doubt.

The engine control unit (ECU) has the ability to detect problems internally and in the electronic control system. This includes determining if any of the sensor input voltages are too high or too low, if the camshaft and crankshaft position sensor inputs are valid, and if the unit injector solenoids are responding properly.

If the ECU detects a problem with the electronic control system a diagnostic trouble code (DTC) specific to the failed system will be stored in the ECU's memory.

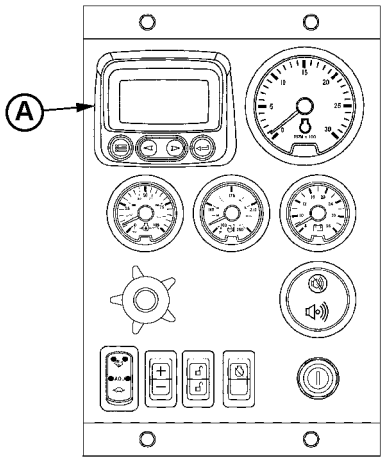
There are two types of DTC's:

- Active
- Inactive (stored)

Active DTCs indicate that the failure is occurring. These type of failures are sometimes called “hard” failures. They can be accessed on the diagnostic gauge (A) on the instrument panel.

Inactive DTCs indicate that a failure has occurred in the past, but is not currently occurring. This type of “stored” DTC can be caused by an “intermittent” failure. These could be problems such as a bad connection or a wire intermittently shorting to ground.

If a sensor or wiring fails and a DTC is active for the sensor, the ECU will use a substitute “limp home” value in its calculations to continue engine operation.



RG13728 —UN—11NOV04

Diagnostic Gauge On Panel

A—Diagnostic Gauge

NOTE: All engines have electronic control systems which may send diagnostic trouble codes to signal problems (see DISPLAYING OF DIAGNOSTIC TROUBLE CODES, later in this section).

To access DTC's with the diagnostic gauge, see Section 15 of this manual.

1. *If fault codes are present, perform the suggested corrective actions.*
2. *If this does not correct the engine problem, contact your servicing dealer.*
3. *If engine has problems but no fault codes are displayed, refer to ENGINE TROUBLESHOOTING later in this section for problems and solutions.*

OMRGP15,0000135 -19-12SEP06-1/1

Instrument Panel Method for Retrieving Diagnostic Trouble Codes

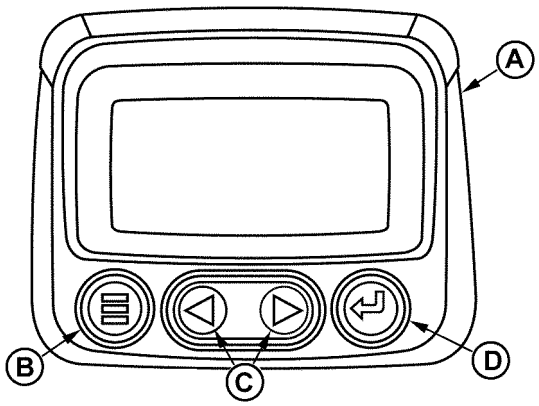
IMPORTANT: Care should be used during diagnostic procedures to avoid damaging the terminals of connectors, sensors, and actuators. Probes should not be poked into or around the terminals or damage will result. Probes should only be touched against the terminals to make measurements.

Diagnosis of the Deere electronic control system on engines with Deere electronic instrument panel should be performed as follows:

1. Make sure all engine mechanical and other systems not related to the electronic control system are operating properly. (See ENGINE TROUBLESHOOTING later in this section.)

NOTE: Diagnostic gauge (A) uses the menu key (B) to access various engine functions, two arrow keys (C) to scroll through the engine parameter list and view the menu list, and an enter key (D) for selecting highlighted items.

2. Read and record DTC(s) displayed on LCD of diagnostic gauge (A). For procedure to access diagnostic trouble codes, refer to “Using Diagnostic Gauge to Access Engine Information”, earlier in this manual.



RG13740 —UN—11NOV04

Trouble Code Display On Instrument Panel

A—Diagnostic Gauge
B—Menu Key
C—Arrow Keys
D—Enter Key

3. Go to the LISTING OF DIAGNOSTIC TROUBLE CODES (DTCs) later in this section, to interpret to the DTC(s) present.

4. Contact your nearest engine distributor or servicing dealer with a list of DTC(s) so that necessary repairs can be made.

OURGP12,000013E -19-12SEP06-1/1

Displaying Of Diagnostic Trouble Codes (DTCs)

SPN/FMI CODES

Stored and active diagnostic trouble codes are output on the diagnostic gauge on the Deere electronic instrument panel according to the J1939 standard as a two-part code as shown on the tables on the following pages.

The first part is a Suspect Parameter Number (SPN) followed by a Failure Mode Identifier (FMI) code. In order to determine the exact failure, both parts (SPN and FMI) of the code are needed.

The SPN identifies the system or the component that has the failure; for example SPN 000110 indicates a failure in the engine coolant temperature circuit.

The FMI identifies the type of failure that has occurred; for example FMI 03 indicates value above normal. Combining SPN 000110 with FMI 03 yields a fault code “engine coolant temperature input voltage too high”. A corrective action will also be displayed, “check sensor and wiring”. If this check does not solve the engine fault, contact your servicing dealer.

Always contact your servicing dealer for help in correcting unsolved diagnostic trouble codes which are displayed for your engine.

OURGP12,00000F0 -19-24AUG10-1/1

Listing of Diagnostic Trouble Codes (DTCs)

NOTE: Not all of these codes are used in all engine applications.

NOTE: If the corrective actions below do not solve the engine fault, contact your servicing dealer.

SPN	FMI	Fault	Corrective Action
000028	03	Throttle #3 Voltage Out of Range High	Check Sensor and Wiring
	04	Throttle #3 Voltage Out of Range Low	Check Sensor and Wiring
000029	03	Throttle #2 Voltage Out of Range High	Check Sensor and Wiring
	04	Throttle #2 Voltage Out of Range Low	Check Sensor and Wiring
000091	03	Throttle #1 Signal Out of Range High	Check Sensor and Wiring
	04	Throttle #1 Signal Out of Range Low	Check Sensor and Wiring
	09	Throttle #1 Communication Signal Erratic	Check Sensor and Wiring
000094	01	Fuel Pressure Voltage Out of Range-Most Low	Check Sensor and Wiring
	03	Low Pressure Fuel Signal Out of Range High	Check Sensor and Wiring
	04	Low Pressure Fuel Signal Out of Range Low	Check Sensor and Wiring
	10	When The Engine Is Motoring And The High Pressure Pump Is Off, The Rail Pressure Drops Too Fast	Check Sensor and Wiring
	13	Rail Pressure Test Has Failed	Check Sensor and Wiring
	17	Low Fuel Pressure Signal Slightly Low	Check Fuel Supply and Prime System
000097	03	Water in Fuel Signal Out Of Range High	Check Sensor and Wiring
	04	Water in Fuel Signal Out Of Range Low	Check Sensor and Wiring
	16	Water in Fuel Detected	Stop and Drain Water Separator
000100	01	Engine Oil Pressure Extremely Low	Check Oil Level
	03	Engine Oil Pressure Signal Out of Range High	Check Sensor and Wiring
	04	Engine Oil Pressure Signal Out of Range Low	Check Sensor and Wiring
	18	Engine Oil Pressure Signal Moderately Low	Check Oil Level
	31	Engine Oil Pressure Invalid	Contact Servicing Dealer
000102	02	Intake Manifold Pressure Signal Invalid	Check Sensor and Wiring
	03	Intake Manifold Pressure Signal Out of Range	Check Sensor and Wiring
	04	Intake Manifold Pressure Signal Out of Range Low	Check Sensor and Wiring
000103	00	Turbocharger Speed Signal Extremely High	Check Sensor and Wiring
	05	Turbocharger Speed Sensor Circuit Has High Resistance	Check Sensor and Wiring
	08	Turbocharger Speed Missing	Check Sensor and Wiring
	31	Turbocharger Speed Signal Missing	Check Sensor and Wiring
000105	00	Intake Manifold Air Temperature Signal Extremely High	Check Air Cleaner, Aftercooler, or Ambient Temperature
	03	Intake Manifold Air Temperature Signal Out Of Range High	Check Sensor and Wiring
	04	Intake Manifold Air Temperature Signal Out Of Range Low	Check Sensor and Wiring
	15	Intake Manifold Air Temperature Signal Slightly High	Check Sensor and Wiring
	16	Intake Manifold Air Temperature Signal Moderately High	Check Air Cleaner, Aftercooler, or Ambient Temperature
000107	00	Air Filter Pressure Differential Extremely High	Check for Plugged Air Filter
000108	02	Barometric Pressure Signal Invalid	Check for Plugged Air Filter
000110	00	Engine Coolant Temperature Signal Extremely High	Check Cooling System, Reduce Power
	03	Engine Coolant Temperature Signal Out Of Range High	Check Sensor and Wiring
	04	Engine Coolant Temperature Signal Out Of Range Low	Check Sensor and Wiring

Continued on next page

SPN	FMI	Fault	Corrective Action
	15	Engine Coolant Temperature Signal Slightly High	Check Cooling System, Reduce Power
	16	Engine Coolant Temperature Signal Moderately High	Check Cooling System, Reduce Power
	17	Engine Coolant Temperature Signal Slightly Low	Check Cooling System
000111	01	Loss Of Coolant Detected	Check Operator's Manual
000157	01	Low-Pressure Fuel Pressure Low - Most Severe Level	Check Sensor and Wiring
	03	Fuel Rail Pressure Signal Out of Range High	Check Sensor and Wiring
	04	Fuel Rail Pressure Signal Out of Range Low	Check Sensor and Wiring
	16	Low-Pressure Fuel Pressure High	Check Sensor and Wiring
	18	Low-Pressure Fuel Pressure Low - Moderately Severe Level	Check Sensor and Wiring
000158	17	ECU Power Down Error	Contact Servicing Dealer
000174	00	Fuel Temperature Signal Extremely High	Add Fuel or Switch Fuel Tanks
	03	Fuel Temperature Signal Out of Range High	Check Sensor and Wiring
	04	Fuel Temperature Signal Out of Range Low	Check Sensor and Wiring
	16	Fuel Temperature Signal Moderately High	Check Sensor and Wiring
000189	31	Engine Speed Derate Condition Exists	Contact Servicing Dealer
000190	00	Engine Speed Extremely High	Reduce Engine Speed
000237	02	VIN Security Data Invalid	Contact Servicing Dealer
	13	VIN Option Code Security Data Conflict	Contact Servicing Dealer
	31	VIN Security Data Missing	Contact Servicing Dealer
000412	00	EGR Temperature Signal Extremely High	Check Sensor and Wiring
	03	EGR Temperature Signal Out of Range High	Check Sensor and Wiring
	04	EGR Temperature Signal Out of Range Low	Check Sensor and Wiring
	15	EGR Temperature Signal Slightly High	Check Sensor and Wiring
	16	EGR Temperature Signal Moderately High	Check Sensor and Wiring
000611	03	Injector Shorted to Power	Check Wiring
	04	Injector Shorted to Ground	Check Wiring
000629	13	ECU Programming Error	Contact Servicing Dealer
	19	ECU Failure	Contact Servicing Dealer
000632	02	Fuel Shutoff Valve Error	Check Sensor and Wiring
	05	Fuel Shutoff Valve Failure	Check Sensor and Wiring
	11	Fuel Shutoff Valve Open or Shorted	Check Sensor and Wiring
000636	02	Engine Position Sensor Signal Invalid	Check Sensor and Wiring
	05	Engine Position Sensor Circuit Has High Resistance	Check Sensor and Wiring
	06	Engine Position Sensor Circuit Has Low Resistance	Check Sensor and Wiring
	08	Engine Position Sensor Signal Missing	Check Sensor and Wiring
	10	Engine Position Sensor Signal Rate Of Charge Abnormal	Check Sensor and Wiring
000637	02	Engine Timing Sensor Signal Invalid	Check Sensor and Wiring
	05	Engine Position Sensor Circuit Has High Resistance	Check Sensor and Wiring
	06	Engine Position Sensor Circuit Has Low Resistance	Check Sensor and Wiring
	07	Engine Timing And Position Signals Out Of Sync	Check Sensor and Wiring
	08	Engine Timing Sensor Signal Missing	Check Sensor and Wiring
	10	Crank Position Input Pattern Error	Check Sensor and Wiring

Continued on next page

SPN	FMI	Fault	Corrective Action
000639	13	CAN Bus Failure	Check Sensor and Wiring
000640	11	External Engine Protection Input	Check Sensor and Wiring
	13	External Derate Commanded	Check Sensor and Wiring
000641	04	VGT Actuator Supply Voltage Out of Range Low	Check Sensor and Wiring
	12	VGT Actuator Communication Error	Check Sensor and Wiring
	13	VGT Actuator Learn Error	Check Sensor and Wiring
	16	Turbo Actuator Temperature Moderately High	Check Sensor and Wiring
000644	02	External Speed Command Output	Check Sensor and Wiring
000651	05	Injector #1 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector #1 Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	The Injector Fuel Flow At Cylinder #1 Is Lower Than Expected.	Injector Failed or Flow Limiter Closed
	13	Injector #1 Calibration Fault	Check Injector Wiring or Injector Solenoid
000652	05	Injector #2 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector #2 Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	The Injector Fuel Flow At Cylinder #2 Is Lower Than Expected.	Injector Failed or Flow Limiter Closed
	13	Injector #2 Calibration Fault	Check Injector Wiring or Injector Solenoid
000653	05	Injector #3 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector #3 Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	The Injector Fuel Flow At Cylinder #3 Is Lower Than Expected.	Injector Failed or Flow Limiter Closed
	13	Injector #3 Calibration Fault	Check Injector Wiring or Injector Solenoid
000654	05	Injector #4 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector #4 Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	The Injector Fuel Flow At Cylinder #4 Is Lower Than Expected.	Injector Failed or Flow Limiter Closed
	13	Injector #4 Calibration Fault	Check Injector Wiring or Injector Solenoid
000655	05	Injector #5 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector #5 Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	The Injector Fuel Flow At Cylinder #5 Is Lower Than Expected.	Injector Failed or Flow Limiter Closed
	13	Injector #5 Calibration Fault	Check Injector Wiring or Injector Solenoid
000656	05	Injector #6 Circuit Has High Resistance	Check Injector Wiring or Injector Solenoid
	06	Injector #6 Has Low Resistance	Check Injector Wiring or Injector Solenoid
	07	The Injector Fuel Flow At Cylinder #6 Is Lower Than Expected.	Injector Failed or Flow Limiter Closed
	13	Injector #6 Calibration Fault	Check Injector Wiring or Injector Solenoid
000676	03	Glow Plug Relay	Contact Servicing Dealer
	05	Glow Plug Relay	Contact Servicing Dealer
000729	03	Inlet Air Heater Signal Received When Not Expected	Contact Servicing Dealer
	04	Inlet Air Heater Signal Not Received When Expected	Contact Servicing Dealer
000833	02	Rack Position Sensor Error	Contact Servicing Dealer
	03	Rack Position Sensor Voltage High	Contact Servicing Dealer

Continued on next page

SPN	FMI	Fault	Corrective Action
	04	Rack Position Sensor Voltage Low	Contact Servicing Dealer
000834	02	Rack Actuator Error	Contact Servicing Dealer
	03	Rack Actuator Voltage High	Contact Servicing Dealer
	05	Rack Actuator Voltage Open	Contact Servicing Dealer
	06	Rack Actuator Voltage Grounded	Contact Servicing Dealer
	07	Rack Actuator Position Error	Contact Servicing Dealer
000970	02	Auxiliary Engine Shutdown Switch Signal Invalid	Check Switch And Wiring
	11	External Engine Protection Shutdown Switch Signal Active	Check Switch And Wiring
	31	External Shutdown Commanded	Check Switch And Wiring
000971	31	External Derate Commanded	Check Switch And Wiring
001041	02	Start Signal Indicator Failure	Check Switch And Wiring
	03	Start Signal Indicator Active	Check Switch And Wiring
001075	05	Low Pressure Fuel Pump Circuit Has High Resistance	Contact Servicing Dealer
	06	Fuel Transfer Pump Current High or Grounded Circuit (Racor Fuel Pump Only)	Contact Servicing Dealer
	08	Fuel Transfer Pump Failure	Contact Servicing Dealer
	12	Low Pressure Fuel Pump Error Detected	Contact Servicing Dealer
001076	00	Fuel Injection Pump Control Error	Contact Servicing Dealer
	01	Fuel Injection Pump Control Error	Contact Servicing Dealer
	02	Fuel Injection Pump Control Error	Contact Servicing Dealer
	03	Fuel Injection Pump Control Error	Contact Servicing Dealer
	05	Fuel Injection Pump Control Error	Contact Servicing Dealer
	06	Fuel Injection Pump Control Error	Contact Servicing Dealer
	07	Fuel Injection Pump Control Error	Contact Servicing Dealer
	10	Fuel Injection Pump Control Error	Contact Servicing Dealer
	13	Fuel Injection Pump Control Error	Contact Servicing Dealer
001077	07	Fuel Injection Pump Controller	Contact Servicing Dealer
	11	Fuel Injection Pump Controller	Contact Servicing Dealer
	12	Fuel Injection Pump Controller	Contact Servicing Dealer
	19	Fuel Injection Pump Controller	Contact Servicing Dealer
	31	Fuel Injection Pump Controller	Contact Servicing Dealer
001078	07	Fuel Injection Pump Speed/Position Sensor Error	Contact Servicing Dealer
	11	Fuel Injection Pump Speed/Position Sensor Error	Contact Servicing Dealer
	31	Fuel Injection Pump Speed/Position Sensor Failure	Contact Servicing Dealer
001079	03	Sensor Supply Voltage 3 Out of Range High	Check Wiring
	04	Sensor Supply Voltage 3 Out of Range Low	Check Wiring
001080	03	The Sensor Supply Voltage To The Rail Pressure Sensor Is Too High	Check Wiring
	04	The Sensor Supply Voltage To The Rail Pressure Sensor Is Too Low	Check Wiring
001109	31	Engine Not Available or Condition Exists	Check Fault Codes
001110	31	Engine Protection Shutdown	Check Fault Codes
001136	00	ECU Temperature Signal Extremely High	Check Sensor and Wiring
	16	ECU Temperature Signal Moderately High	Check Sensor and Wiring

Continued on next page

SPN	FMI	Fault	Corrective Action
001172	03	Compressor Inlet Temperature Signal Out of Range High	Check Sensor and Wiring
	04	Compressor Inlet Temperature Signal Out of Range Low	Check Sensor and Wiring
001180	00	Turbine Inlet Temperature Signal Extremely High	Contact Servicing Dealer
	16	Turbine Inlet Temperature Signal Moderately High	Contact Servicing Dealer
001347	05	The Circuit To Pump Solenoid #1 Is Open, Shorted To Ground, Or Overloaded	Check Pump Wiring
	07	High Pressure Fuel Pump Not Able to Meet Required Rail Pressure	Check Fuel Filter and Lines
	10	Pump Element #1 Is Not Delivering Expected Fuel Flow	Check Fuel Filter and Lines
001348	05	The Circuit To Pump Solenoid #2Is Open, Shorted To Ground, Or Overloaded	Contact Servicing Dealer
	10	Pump Element #2 Is Not Delivering Expected Fuel Flow	Check Fuel Filter and Lines
001485	02	ECU Main Relay Pump Error	Contact Servicing Dealer
001568	02	Requested Torque Curve Signal Unreliable	Contact Servicing Dealer
001569	31	Engine In Derate Condition	Check Fault Codes
001639	01	Fan Speed Signal Missing	Contact Servicing Dealer
	16	Fan Speed Moderately High	Contact Servicing Dealer
	18	Fan Speed Moderately Low	Contact Servicing Dealer
002000	06	Fuel Injection Pump Control Valve Error	Contact Servicing Dealer
	13	Security Violation Controller Not Installed	Contact Servicing Dealer
002005	09	ACU Message Missing	Contact Servicing Dealer
	14	Communication Error	Contact Servicing Dealer
002030	09	VLC Message Missing	Contact Servicing Dealer
002071	09	CCU Message Missing	Contact Servicing Dealer
002630	00	Charge Air Cooler Outlet Temperature Signal Extremely High	Check Sensor and Wiring
	03	Charge Air Cooler Outlet Temperature Signal Out of Range High	Check Sensor and Wiring
	04	Charge Air Cooler Outlet Temperature Signal Out of Range Low	Check Sensor and Wiring
	15	Charge Air Cooler Outlet Temperature Signal Slightly High	Check Sensor and Wiring
	16	Charge Air Cooler Outlet Temperature Signal Moderately High	Check Sensor and Wiring
002659	02	EGR Mass Flow Rate Data Invalid	Contact Servicing Dealer
	15	EGR Mass Flow Rate Data Slightly High	Contact Servicing Dealer
	17	EGR Mass Flow Rate Data Slightly Low	Contact Servicing Dealer
002790	16	Calculated Turbine Outlet Temperature Moderately High	Contact Servicing Dealer
002791	02	EGR Valve Position Signal Invalid	Contact Servicing Dealer
	03	EGR Valve Position Signal Out of Range High	Check Sensor and Wiring
	04	EGR Valve Position Signal Out of Range Low	Check Sensor and Wiring
	07	EGR Valve Not Reaching Expected Position	Contact Servicing Dealer
	13	ERG Valve Calibration Change Error	Contact Servicing Dealer
	31	EGR Valve Calibration Change Over A Long Time	Contact Servicing Dealer
002795	07	VGT Actuator Not Reaching Expected Position	Contact Servicing Dealer

Continued on next page

SPN	FMI	Fault	Corrective Action
003509	03	Sensor Supply #1 Voltage Out of Range High	Check Sensor and Wiring
	04	Sensor Supply #1 Voltage Out of Range Low	Check Sensor and Wiring
003510	03	Sensor Supply #2 Voltage Out of Range High	Check Sensor and Wiring
	04	Sensor Supply #2 Voltage Out of Range Low	Check Sensor and Wiring
003511	03	Sensor Supply #3 Voltage Out of Range High	Check Sensor and Wiring
	04	Sensor Supply #3 Voltage Out of Range Low	Check Sensor and Wiring
003512	03	Sensor Supply #4 Voltage Out of Range High	Check Sensor and Wiring
	04	Sensor Supply #4 Voltage Out of Range Low	Check Sensor and Wiring
003513	03	Sensor Supply #5 Voltage Out of Range High	Check Sensor and Wiring
	04	Sensor Supply #5 Voltage Out of Range Low	Check Sensor and Wiring
003822	02	EGR Valve Position Signal Invalid	Check Sensor and Wiring
	03	Valve Position Signal Out of Range High	Check Sensor and Wiring
	04	EGR Valve Position Signal Out of Range Low	Check Sensor and Wiring
	07	EGR Valve Not Reaching Expected Position	Contact Servicing Dealer
	13	ERG Valve Calibration Change Error	Contact Servicing Dealer
	31	EGR Valve Calibration Change Over A Long Time	Contact Servicing Dealer
064981	02	EGR Valve Sensor] Voltage (Second)-Error	Check Wiring
	03	EGR Valve Sensor Voltage (Second)-High	Check Wiring
	04	EGR Valve Sensor Voltage (Second)-Low	Check Wiring
	05	EGR Valve Sensor Current (Second)-Low or Open Circuit	Check Wiring
	06	EGR Valve Sensor Voltage (Second)-Low or Grounded Circuit	Check Wiring
	07	EGR Valve (Second)-Error	Check Wiring
	13	EGR Valve Out of Calibration (Second)	Check Wiring
	14	EGR Valve Drive Current (Second)-High	Check Wiring
	31	EGR Valve Position (Second)-Error	Check Wiring

Fault Code Listing in Ascending SPN/FMI Codes

NOTE: Diagnostic gauge on instrument panel may also display text for communication faults, for example, "CAN BUS FAILURE". Contact your servicing dealer.

OURGP11,000005E -19-12OCT06-6/6

Intermittent Fault Diagnostics

Intermittent faults are problems that periodically “go away”. A problem such as a terminal that intermittently doesn't make contact can cause an intermittent fault. Other intermittent faults may be set only under certain operating conditions such as heavy load, extended idle etc. When diagnosing intermittent faults, take special note of the condition of wiring and connectors since a high percentage of intermittent problems originate here. Check for loose, dirty or disconnected connectors. Inspect the wiring routing looking for possible shorts caused by contact with external parts (for example, rubbing against sharp sheet metal edges). Inspect the connector vicinity looking for wires that have pulled out of connector terminals, damaged connectors, poorly positioned terminals, and corroded or damaged terminals. Look for broken wires, damaged splices, and wire-to-wire shorts. Use good judgement if component replacement is thought to be required.

NOTE: The Engine Control Unit (ECU) is the component LEAST likely to fail.

Suggestions for diagnosing intermittent faults:

If diagnostic charts on preceding pages indicate that the problem is intermittent, try to reproduce the operating conditions that were present when the Diagnostic Trouble Code (DTC) set.

If a faulty connection or wire is suspected to be the cause of the intermittent problem: clear DTCs, then check the connection or wire by wiggling it while watching the diagnostic gauge to see if the fault resets.

Possible Causes of Intermittent Faults:

1. Faulty connection between sensor or actuator and harness.
2. Faulty contact between terminals in connector.
3. Faulty terminal/wire connection.

Electromagnetic interference (EMI) from an improperly installed 2-way radio, etc. can cause faulty signals to be sent to the ECU.

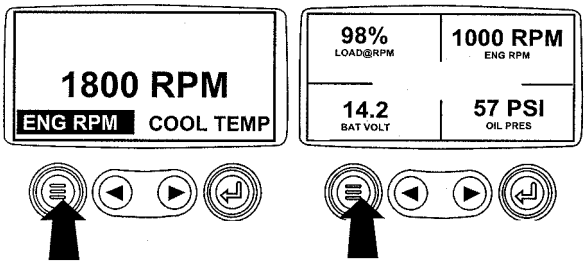
NOTE: Refer to wiring diagrams later in this section as a guide to connections and wires.

OURGP12,000011D -19-12SEP06-1/1

Displaying Diagnostic Gauge Software

NOTE: The following steps can be used to display the software version of the diagnostic gauge if needed by your dealer for troubleshooting. This is a read only function.

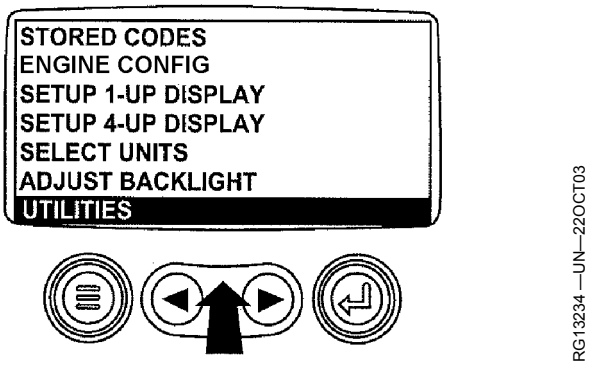
1. Starting at the single or four engine parameter display, press the "Menu" key.



Menu Key

OMRGP15,000013F -19-12NOV10-1/4

2. The main menu will be displayed. Use the "Arrow" key to scroll through the menu until "Utilities" is highlighted.

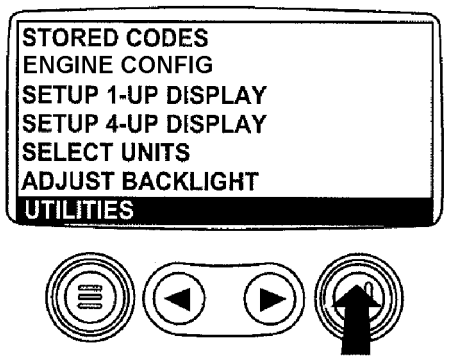


Select Utilities

Continued on next page

OMRGP15,000013F -19-12NOV10-2/4

3. Once "Utilities" is highlighted, press "Enter" to activate the utilities function.

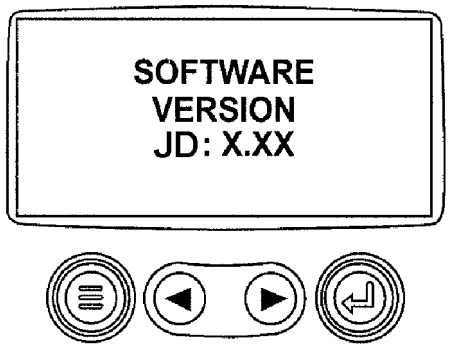


RG13237 —UN—22OCT03

Select Utilities

OMRGP15,000013F -19-12NOV10-3/4

4. Scroll to the "Software Version". Press "Enter" to view the software version. Press the menu button twice to return to the main menu.



RG13236 —UN—13OCT03

Software Version

OMRGP15,000013F -19-12NOV10-4/4

Engine Troubleshooting

NOTE: Before troubleshooting the engine, first retrieve any fault codes on the diagnostic gauge display and perform the corrective actions. (See earlier in this section.) If any problems remain, use the following charts to solve engine problems.

Symptom	Problem	Solution
Engine Will Not Crank	Weak battery	Replace battery.
	Corroded or loose battery connections	Clean battery terminals and connections.
	Defective main switch or start safety switch	Repair switch as required.
	Starter solenoid defective	Replace solenoid.
	Starter defective	Replace starter.
Hard to Start or Will Not Start	Poor fuel quality	Drain fuel and replace with quality fuel of the proper grade.
	Slow cranking speed	Check for problem in the charging/starting system.
	Too high viscosity crankcase oil	Drain crankcase oil and replace with correct viscosity oil.
	Electronic control system problem or basic engine problem	See your John Deere engine distributor or servicing dealer.
Engine Misfiring or Runs Irregularly	Electronic control system problem or basic engine problem	See your John Deere engine distributor or servicing dealer.
Lack of Engine Power	Poor fuel quality	Drain fuel and replace with quality fuel of the proper grade.
	Plugged fuel filter	Replace fuel filters.
	Engine overloaded	Reduce engine load.
	Improper crankcase oil	Drain crankcase oil and replace with correct viscosity oil.
	Electronic control system problem or basic engine problem	See your John Deere engine distributor or servicing dealer.
	Poor EGR valve (if equipped) wiring harness connection	Check EGR valve wiring harness for good connection (make sure it clicks).
Black or Gray Exhaust Smoke	Engine overloaded	Reduce engine load.
	Engine burning oil	See LUBRICATION SYSTEM TROUBLESHOOTING, later in this section.

Continued on next page

Symptom	Problem	Solution
	Air cleaner restricted or dirty	Replace air cleaner element as required.
	Defective muffler/exhaust piping (causing back-pressure)	Replace muffler or defective piping.
	Electronic control system problem or basic engine problem	See your John Deere engine distributor or servicing dealer.
White Exhaust Smoke	Engine compression too low	Determine cause of low compression and repair as required. See your John Deere engine distributor or servicing dealer.
	Defective thermostat(s) (does not close)	Test thermostats; replace thermostats as required. (See Service as Required section.)
	Coolant entering combustion chamber (failed cylinder head gasket or cracked cylinder head)	Repair or replace as required. See your John Deere engine distributor or servicing dealer.
Engine Idles Poorly	Poor fuel quality	Drain fuel and replace with quality fuel of the proper grade.
	Air leak on suction side of air intake system	Check hose and pipe connections for tightness; repair as required.
	Electronic control system problem or basic engine problem	See your John Deere engine distributor or servicing dealer.

OURGP11,0000073 -19-29FEB08-2/2

Engine Troubleshooting (Continued)

Symptom	Problem	Solution
Excessive Fuel Consumption	Poor fuel quality	Drain fuel and replace with quality fuel of the proper grade.
	Engine overloaded	Reduce engine load.
	Air cleaner restricted or dirty	Replace air cleaner element as required.
	Compression too low	Determine cause of low compression and repair as required.
	Leaks in fuel supply system	Locate source of leak and repair as required.
Abnormal Engine Noise	Worn main or connecting rod bearings	Determine bearing clearance. See your John Deere engine distributor or servicing dealer.
	Excessive crankshaft end play	Check crankshaft end play. See your John Deere engine distributor or servicing dealer.
	Loose main bearing caps	Check bearing clearance; replace bearings and bearing cap screws as required. See your John Deere engine distributor or servicing dealer.
	Worn connecting rod bushings and piston pins	Inspect piston pins and bushings. See your John Deere engine distributor or servicing dealer.
	Scored pistons	Inspect pistons. See your John Deere engine distributor or servicing dealer.
	Worn timing gears or excess backlash	Check timing gear backlash. See your John Deere engine distributor or servicing dealer.
	Excessive valve clearance	Check and adjust valve clearance. See your John Deere engine distributor or servicing dealer.

Continued on next page

Symptom	Problem	Solution
Abnormal Engine Noise *NOTE: Variable geometry turbocharger recycles after starting engine, causing a momentary revving sound in the engine. This is normal.* *Do not confuse the whine heard during turbocharger run down with noise which indicates a bearing failure. The whine heard during turbocharger run down is normal.*	Worn camshaft lobes	Inspect camshaft. See your John Deere engine distributor or servicing dealer.
	Worn rocker arm shaft(s)	Inspect rocker arm shafts. See your John Deere engine distributor or servicing dealer.
	Insufficient engine lubrication	See LUBRICATION SYSTEM TROUBLESHOOTING, later in this section.
	Turbocharger noise	See AIR INTAKE SYSTEM TROUBLESHOOTING, later in this section.

OMRGP15,000013A -19-11NOV10-2/2

Electrical Troubleshooting

Symptom	Problem	Solution
Undercharged system	Excessive electrical load from added accessories.	Remove accessories or install higher output alternator.
	Excessive engine idling.	Increase engine rpm when heavy electrical load is used.
	Poor electrical connections on battery, ground strap, starter, or alternator.	Inspect and clean as necessary.
	Defective battery.	Test batteries.
	Defective alternator.	Test charging system.
Battery used too much water	Cracked battery case.	Check for moisture and replace as necessary.
	Battery charging rate too high.	Test charging system.
Batteries will not charge	Loose or corroded connections.	Clean and tighten connections.
	Sulfated or worn-out batteries.	See your authorized servicing dealer or engine distributor.
	Stretched belt or defective belt tensioner.	Adjust belt tension or replace belts.
Starter will not crank	Engine drivelines engaged.	Disengage engine drivelines.
	Loose or corroded connections.	Clean and tighten loose connections.
	Low battery output voltage or discharged battery.	Charge or replace batteries.
	Faulty start circuit relay.	See your authorized servicing dealer or engine distributor.
	Blown fuse.	Replace fuse.
		Clean battery terminals and connections.
	Defective main switch or start safety switch	Repair switch as required.
	Starter solenoid defective	Replace solenoid.
	Starter defective	Replace starter.
Starter cranks slowly	Low battery output.	Charge batteries.
	Crankcase oil too heavy.	Use proper viscosity oil.
	Loose or corroded connections.	Clean and tighten loose connections.

Continued on next page

Symptom	Problem	Solution
Starter and hour meter functions; rest of electrical system does not function	Blown fuse on magnetic switch.	Replace fuse.
Entire electrical system does not function	Faulty battery connection.	Clean and tighten connections.
	Sulfated or worn-out batteries.	Replace batteries.
	Blown fuse.	Replace fuse.

OURGP11,0000074 -19-19SEP06-2/2

Lubrication System Troubleshooting

Symptom	Problem	Solution
Low Oil Pressure	Low crankcase oil level	Fill crankcase to proper oil level.
	Crankcase oil level too high	Fill crankcase to proper oil level.
	Faulty pressure sensor	Replace sensor. See your John Deere engine distributor or servicing dealer.
	Clogged oil cooler or filter	Remove and inspect oil cooler. See your John Deere engine distributor or servicing dealer.
	Excessive oil temperature	Remove and inspect oil cooler. See your John Deere engine distributor or servicing dealer.
	Defective oil pump	Remove and inspect oil pump. See your John Deere engine distributor or servicing dealer.
	Incorrect oil	Drain crankcase and refill with correct oil.
	Oil pressure regulating valve failure	Remove and inspect oil pressure regulating valve. See your John Deere engine distributor or servicing dealer.
	Broken piston spray nozzle	Replace piston spray nozzle. See your John Deere engine distributor or servicing dealer.
	Clogged oil pump screen or cracked pick-up tube	Remove oil pan and clean screen/replace pick-up tube.
	Excessive main or connecting rod bearing clearance	Determine bearing clearance. See your John Deere engine distributor or servicing dealer.
High Oil Pressure	Improper oil classification	Drain crankcase and refill with correct oil.
	Faulty pressure sensor	Replace sensor. See your John Deere engine distributor or servicing dealer.
	Oil pressure regulating valve bushing loose (wanders)	Remove and inspect oil pressure regulating valve. See your John Deere engine distributor or servicing dealer.
	Improperly operating regulating valve	Remove and inspect oil pressure regulating valve. See your John Deere engine distributor or servicing dealer.

Continued on next page

Symptom	Problem	Solution
	Plugged piston spray nozzle	Replace piston spray nozzle. See your John Deere engine distributor or servicing dealer.
	Stuck or damaged filter bypass valve	Remove and inspect filter bypass valve. See your John Deere engine distributor or servicing dealer.
	Stuck or damaged oil cooler bypass valve	Remove and inspect oil cooler bypass valve. See your John Deere engine distributor or servicing dealer.
Excessive Oil Consumption	Too low viscosity crankcase oil	Drain crankcase and refill with correct viscosity oil.
	Crankcase oil level too high	Drain oil until oil level is correct.
	External oil leak(s)	Determine source of oil leak(s) and repair as required.
	Oil control rings not seated	See your John Deere engine distributor or servicing dealer.
	Oil control rings worn or broken	Replace piston rings. See your John Deere engine distributor or servicing dealer.
	Scored cylinder liners or pistons	Remove and inspect cylinders and liners; replace as required. See your John Deere engine distributor or servicing dealer.
	Worn valve guides or stems	Inspect and measure valve stems and valve guides; repair as required. See your John Deere engine distributor or servicing dealer.
	Excessive oil pressure	See High Oil Pressure above.
	Piston ring grooves excessively worn	Remove and inspect pistons. See your John Deere engine distributor or servicing dealer.
	Piston rings sticking in ring grooves	Remove and inspect pistons. See your John Deere engine distributor or servicing dealer.
	Insufficient piston ring tension	Remove and inspect pistons. See your John Deere engine distributor or servicing dealer.
	Piston ring gaps not staggered	Remove and inspect pistons. See your John Deere engine distributor or servicing dealer.

Continued on next page

Symptom	Problem	Solution
	Front and/or rear crankshaft oil seal faulty	Replace oil seals. See your John Deere engine distributor or servicing dealer. See LOW PRESSURE FUEL SYSTEM TROUBLESHOOTING later in this section.
Fuel in Oil		See LOW PRESSURE FUEL SYSTEM TROUBLESHOOTING later in this section.
Coolant in Oil		See COOLING SYSTEM TROUBLESHOOTING later in this section.

OURGP11,0000075 -19-10NOV10-3/3

Cooling System Troubleshooting

Symptom	Problem	Solution
Engine Overheats	Lack of coolant in cooling system	Fill cooling system to proper level.
	Radiator core and/or side screens dirty	Clean radiator as required.
	Engine overloaded	Reduce engine load.
	Too low crankcase oil level	Fill crankcase to proper oil level.
	Loose or defective fan belt	Replace fan belt as required. Check belt tensioner. (See Lubrication and Maintenance 500 Hour/12 Month section.)
	Defective thermostat(s)	Test thermostat opening temperature; replace thermostats as required. (See Lubrication and Maintenance 2000 Hour/24 Month section.)
	Damaged cylinder head gasket	Replace cylinder head gasket. See your John Deere engine distributor or servicing dealer.
	Defective coolant pump	Replace coolant pump. See your John Deere engine distributor or servicing dealer.
	Defective radiator cap	Replace radiator cap as required.
Coolant in Crankcase	Cylinder head gasket defective	Replace cylinder head gasket. See your John Deere engine distributor or servicing dealer.
	Cylinder head or block cracked	Locate crack, repair/replace components as required.
	Cylinder liner seals leaking	Remove and inspect cylinder liners. See your John Deere engine distributor or servicing dealer.
	Leaking oil cooler	Pressure test oil cooler; repair/replace as required. See your John Deere engine distributor or servicing dealer.
	Defective oil cooler O-rings	Remove and inspect oil cooler O-rings; replace as required. See your John Deere engine distributor or servicing dealer.
	Faulty coolant pump seal; weep hole plugged; coolant leaking through bearing	Replace coolant pump seals. See your John Deere engine distributor or servicing dealer.

Continued on next page

Symptom	Problem	Solution
	Faulty injector sleeve O-ring and EUI O-rings faulty	Remove suspected EUI; replace O-rings as required. See your John Deere engine distributor or servicing dealer.
Coolant Temperature Below Normal	Defective thermostat(s)	Test thermostats; replace thermostats as required. (See Service as Required section.)

OMRGP15,000013B -19-10DEC10-2/2

Air Intake and Exhaust System Troubleshooting

If turbocharger requires replacement, determine what caused the failure of the defective unit, and correct the condition. This will prevent an immediate repeat failure of the replacement unit.

Symptom	Problem	Solution
Hard to Start or Will Not Start		See ENGINE TROUBLESHOOTING earlier in this section.
Engine Misfiring or Runs Irregularly		See ENGINE TROUBLESHOOTING earlier in this section.
Black or Grey Exhaust Smoke		See ENGINE TROUBLESHOOTING earlier in this section.
Lack of Engine Power		See ENGINE TROUBLESHOOTING earlier in this section.
Turbocharger "Screams"	Air leak in intake manifold.	Check intake manifold gasket and manifold; repair as required. See your John Deere engine distributor or servicing dealer.
Turbocharger Noise or Vibration *NOTE: Variable geometry turbocharger recycles after starting engine, causing a momentary revving sound in the engine. This is normal.* *Do not confuse the whine heard during run down with noise which indicates a bearing failure.*	Bearings not lubricated (insufficient oil pressure)	Determine cause of lack of lubrication; repair as required. See your John Deere engine distributor or servicing dealer.
	Air leak in engine intake or exhaust manifold	Check intake and exhaust manifold gaskets and manifolds; repair as required. See your John Deere engine distributor or servicing dealer.
	Improper clearance between turbine wheel and turbine housing	Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.
	Broken blades (or other wheel failures)	Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.
Oil on Turbocharger Compressor Wheel or in Compressor Housing (Oil Being Pushed or Pulled through Center Housing)	Excessive crankcase pressure.	Determine cause of excessive crankcase pressure; repair as required. See your John Deere engine distributor or servicing dealer.
	Air intake restriction	Determine cause of intake restriction; repair as required. See your John Deere engine distributor or servicing dealer.

Continued on next page

Symptom	Problem	Solution
	Drain tube restriction	Determine cause of drain tube restriction; repair as required. See your John Deere engine distributor or servicing dealer.
Oil in Intake Manifold or Dripping from Turbocharger Housing	Excessive crankcase pressure	Determine cause of excessive crankcase pressure; repair as required. See your John Deere engine distributor or servicing dealer.
	Air intake restriction	Determine cause of intake restriction; repair as required. See your John Deere engine distributor or servicing dealer.
	Drain tube restriction	Determine cause of drain tube restriction; repair as required. See your John Deere engine distributor or servicing dealer.
	Damaged or worn housing bearings	Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.
	Unbalance of rotating assembly	Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.
	Damage to turbine or compressor wheel or blade	Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.
	Dirt or carbon build-up on wheel or blade	Check for air intake leaks (post air filter). Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.
	Bearing wear	Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.
	Oil starvation or insufficient lubrication	Determine cause of lack of lubrication; repair as required. See your John Deere engine distributor or servicing dealer.
	Shaft seals worn	Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.
Turbocharger Turbine Wheel Drag	Carbon build-up behind turbine wheel caused by coked oil or combustion deposits	Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.

Continued on next page

Symptom	Problem	Solution
	Dirt build-up behind compressor wheel caused by air intake leaks	Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.
	Bearing seizure or dirty, worn bearings	Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.

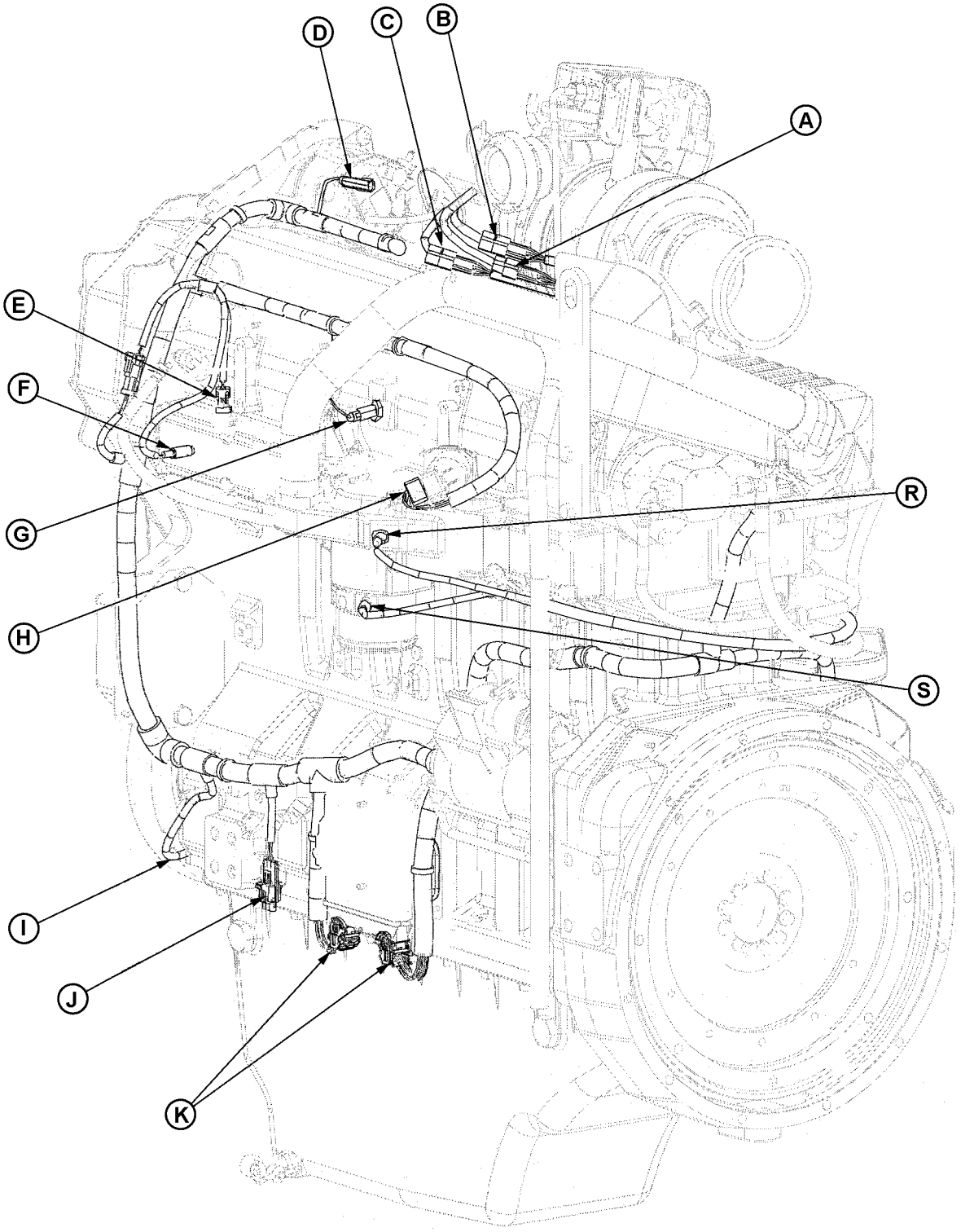
OURGP11,000005F -19-10NOV10-3/3

Low Pressure Fuel System Troubleshooting

Symptom	Problem	Solution
Fuel in Oil	Cracked or worn electronic unit injector (EUI) O-ring	Remove suspected EUI; replace EUI O-ring as required. See your John Deere engine distributor or servicing dealer.
	Cracked cylinder head	Locate crack; repair/replace components as required. See your John Deere engine distributor or servicing dealer.
Fuel Aeration	EUI hold-down clamp loose	Tighten hold-down clamp cap screw to proper torque. See your John Deere engine distributor or servicing dealer.
	Cracked or worn electronic unit injector (EUI) O-ring	Remove suspected EUI; replace EUI O-ring as required. See your John Deere engine distributor or servicing dealer.
Fuel Pressure Low	Plugged fuel filter	Replace fuel filter.
	Restricted fuel line	Locate restriction; repair as required.
	Faulty fuel transfer pump	Remove fuel transfer pump; repair/replace pump as required. See your John Deere engine distributor or servicing dealer.

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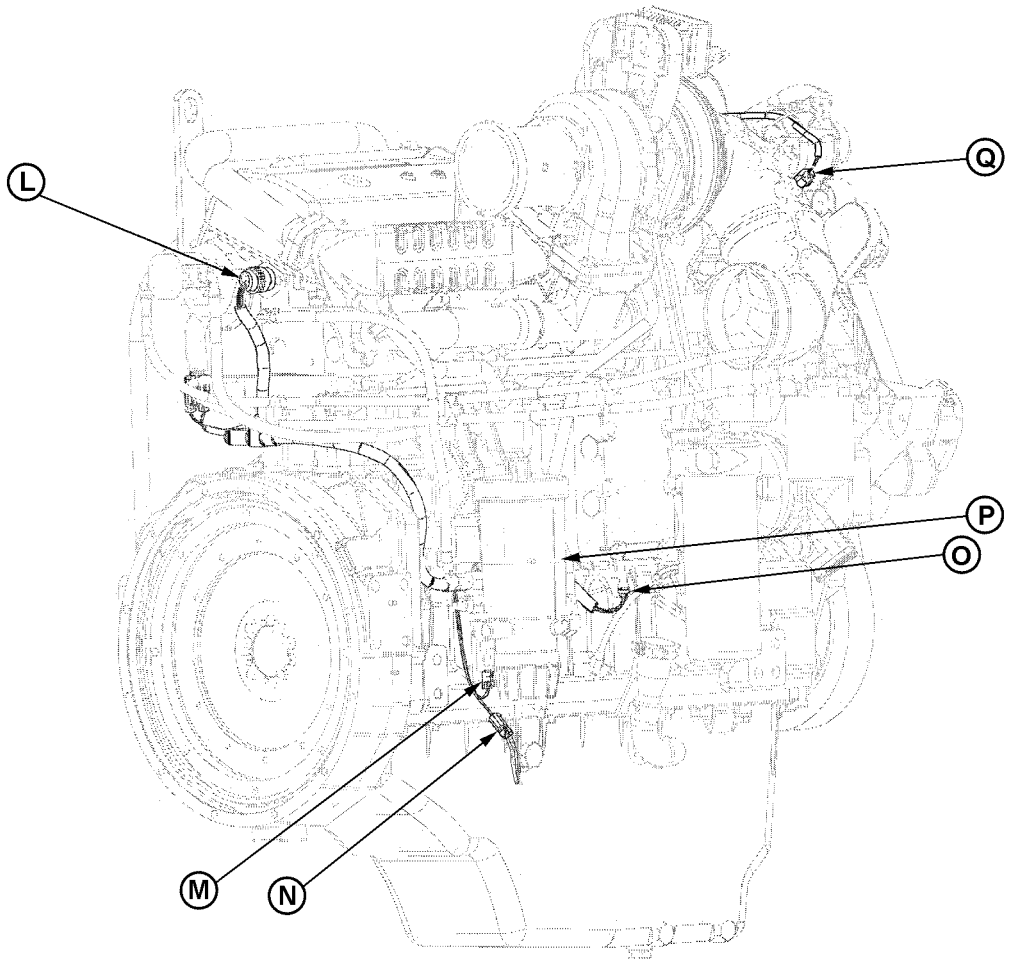
Electrical System Layout



Electrical System Layout- Left Side

OMRGP15,0000136 -19-12SEP06-1/1

Electrical System Layout- Continued



RG14344 —UN—05AUG05

Electrical System Layout- Right Side

A—Turbocharger Air Inlet Temperature Sensor Lead
B—Turbocharger Actuator Connector Lead
C—Turbocharger Speed Sensor Lead
D—Alternator Connector
E—Manifold Air Pressure (MAP) Sensor
F—EGR Temperature Sensor
G—Engine Position (Cam) Sensor
H—Rear EGR Valve Connector
I— Timing (Crank) Sensor
J—Auxiliary Connector
K—Engine Control Unit (ECU) Connectors
L—Unit Injection Connector
M—Fuel Temperature Sensor
N—Water-In-Fuel Sensor
O—Oil Pressure Sensor
P—Fuel Pressure Sensor
Q—Coolant Temperature Sensor
R—Exhaust Air Temperature Sensor
S—Manifold Inlet Air Sensor

OURGP11,0000079 -19-25SEP06-1/1

Precautions for Welding on Vehicles Equipped with Electronic Engine Control Unit (ECU)

IMPORTANT: ALWAYS disconnect engine control unit (ECU) connectors and engine control system-to-vehicle ground before welding. High currents or electrostatic discharge in electronic components from welding may cause permanent damage.

1. Remove the ground connection for the engine control system-to-vehicle frame.
2. Disconnect the connectors from the ECU.
3. Connect the welder ground close to the welding point and be sure ECU or other electronic components are not in the ground path.



TS953 —UN—15MAY90

Welding Precautions

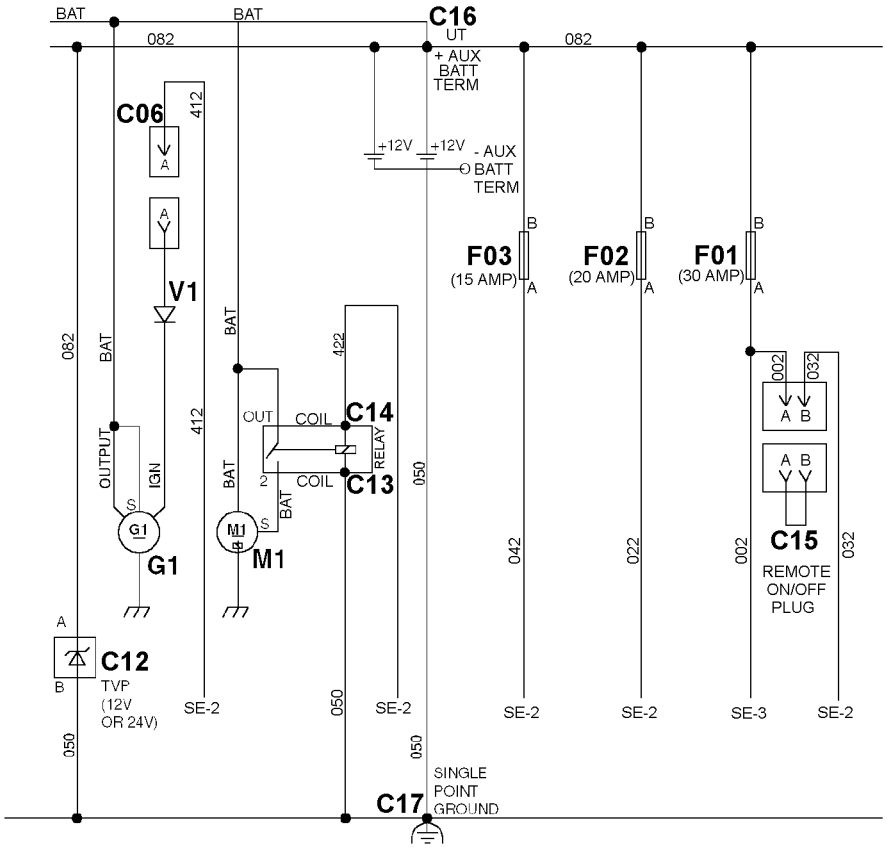
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Precautions for Electrical System When Steam Cleaning Engine

IMPORTANT: Do not steam clean any electrical or electronic components while steam cleaning the engine as it could damage sensitive parts.

OURGP11,000012A -19-24AUG10-1/1

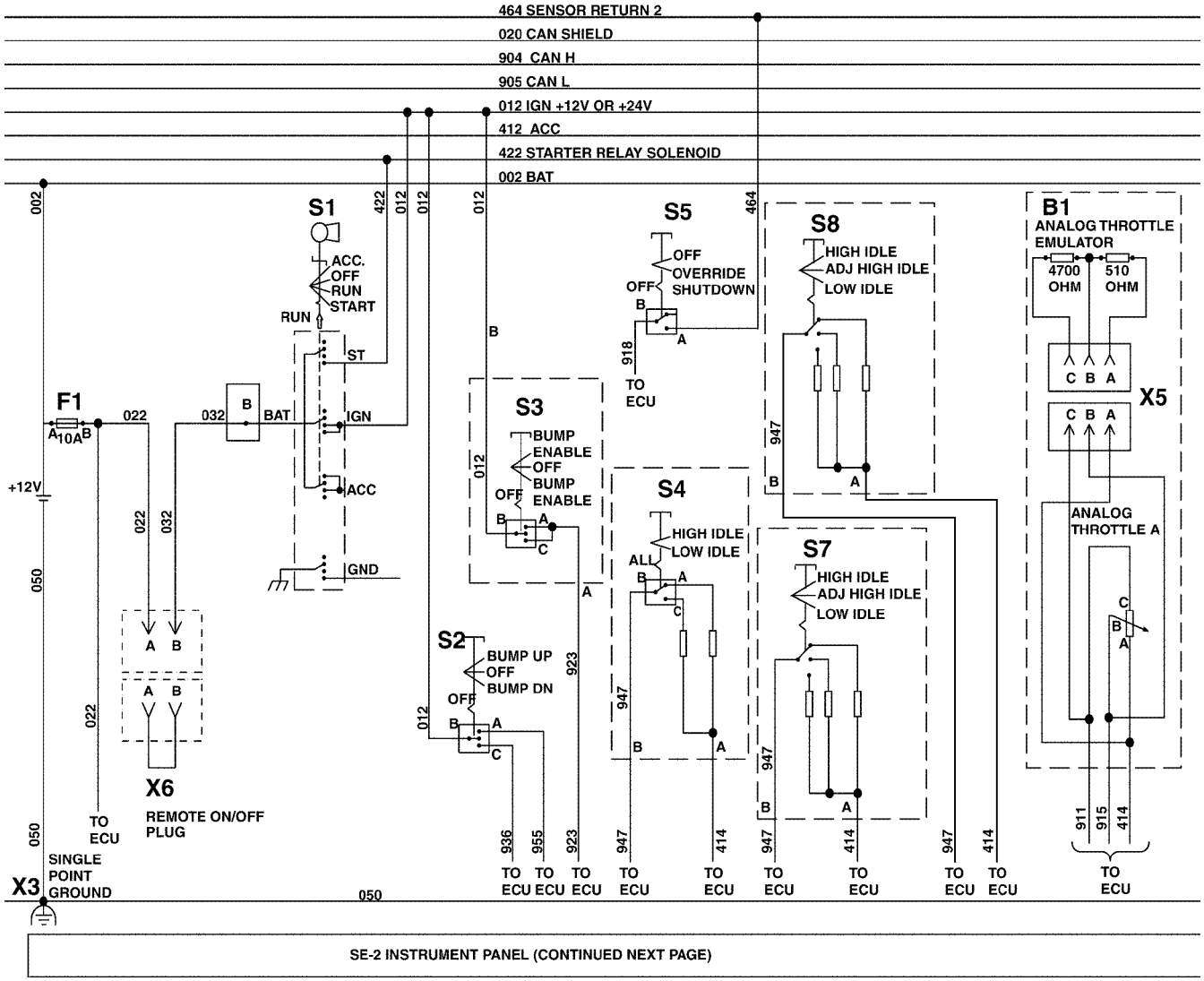
Engine Wiring Diagram (Engines With Full-Featured Instrument Panel)



B1—Analog Throttle
C06— Alternator Harness Connector
C12— Transient Voltage Protector
C13— Starter Relay
C14— Starter Relay
C15— Remote On/Off
C16— Battery
C17— Single Point Ground
F01— Fuse (30 Amp)(System)
F02— Fuse (20 Amp)(ECU)
F03— Fuse (15 Amp)(Fuel Filter)
G1—Alternator
M1—Starter Motor
P1—Optional Gauge
P2—Optional Gauge
P3—Oil Pressure Gauge
P4—Coolant Temperature Gauge
P5—Tachometer Display
P6—Hour Meter/Diagnostic Gauge
S1—Ignition Key Switch
S2—Speed Select Switch (Momentary)
S3—Bump Enable Switch (Momentary)
S4—High-Low Speed Select Switch
S5—Override Shutdown Switch (Momentary)
V1—Diode
X1—Vehicle Harness Connector
X4—CAN Terminator
X5—Analog Throttle Connector

OURGP12,00000EC -19-12SEP06-1/1

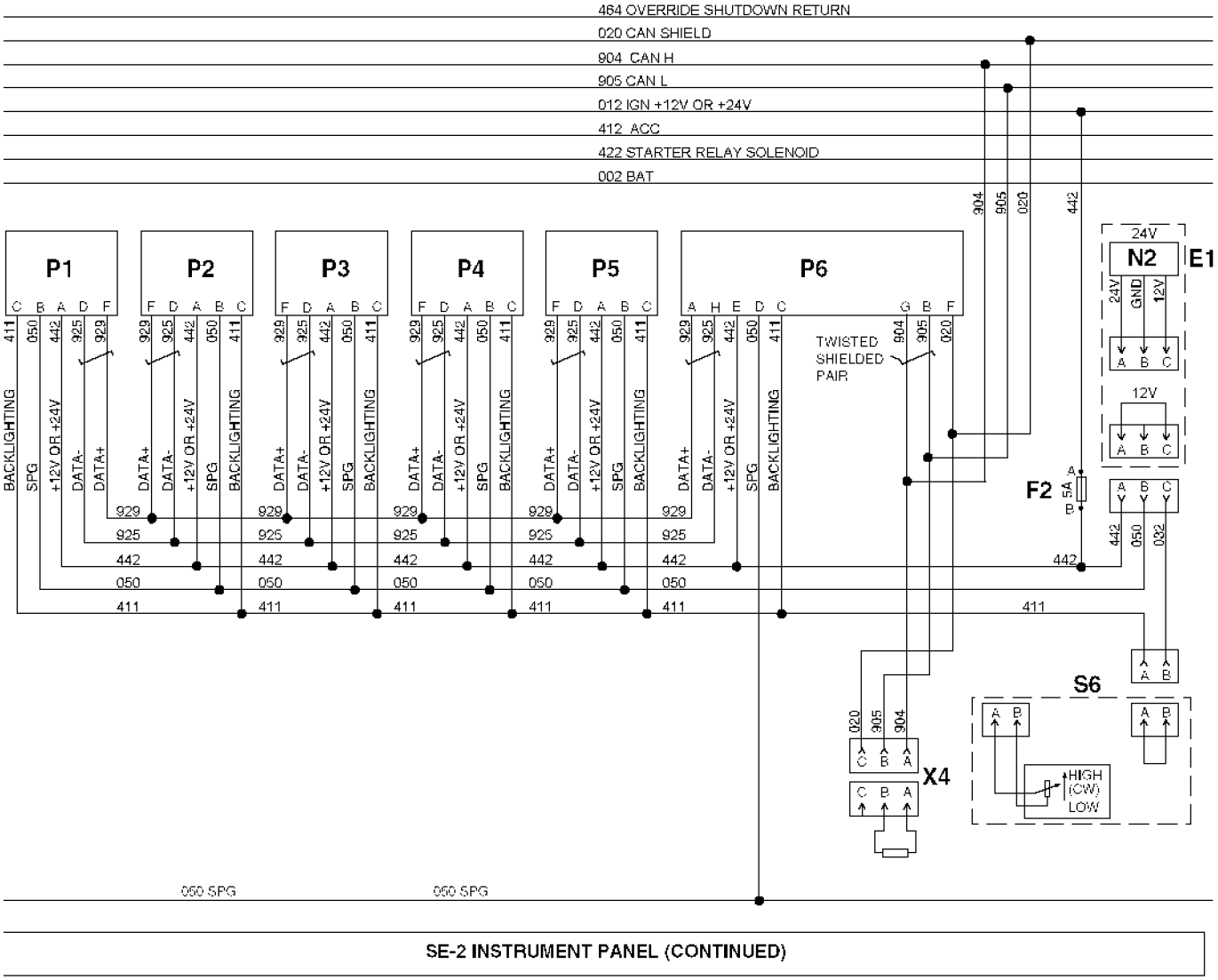
Engine Wiring Diagram (Engines With Full-Featured Instrument Panel) (Continued)



B1—Analog Throttle Emulator
F1—Fuse (10 Amp)
F2—Fuse (5 Amp)
S1—Ignition Key Switch
S2—Speed Select Switch (Momentary)
S3—Bump Enable Switch (Momentary
S4—Dual State Throttle Switch
S5—Override Shutdown Switch (Momentary)
S7—Tri-state Throttle Switch
S8—Ramp Throttle Switch
X3—Single Point Ground
X5—Analog Throttle Connector
X6—Remote On/Off Plug

OURGP11,0000071 -19-19SEP06-1/1

Engine Wiring Diagram (Engines With Full-Featured Instrument Panel) (Continued)



E1—Back Light Regulator (24V) or Plug (12V)
F2—Fuse (5 Amp)
N2—Voltage Regulator (for 24V Operation)
P1—Optional Gauge
P2—Optional Gauge
P3—Oil Pressure Gauge
P4—Coolant Temperature Gauge
P5—Tachometer Display
P6—Hourmeter/Diagnostic Meter
S5—Override Shutdown Switch (Momentary)
S6—Dimmer Control or Jumper Plug
X4—CAN Terminator

OURGP11,0000072 -19-25SEP06-1/1

Engine Storage Guidelines

IMPORTANT: Special considerations should be taken prior to storage when using BioDiesel. See BioDiesel Fuel in the Fuels, Lubricants, and Coolant Section.

1. John Deere engines can be stored outside for up to three months with no long-term preparation if covered by a waterproof covering. No outside storage is recommended without a waterproof covering.
2. John Deere engines can be stored in a standard overseas shipping container for up to three months with no long-term preparation.
3. John Deere engines can be stored inside for up to six months with no long-term preparation.
4. John Deere engines expected to be stored more than six months **must** have long-term storage preparation. See Preparing Engine for Long-Term Storage in the Storage Section.

OURGP12,00000DF -19-04FEB15-1/1

Preparing Engine for Long Term Storage

IMPORTANT: Any time your engine will not be used for over six months, the following recommendations for storing it and removing it from storage will help to minimize corrosion and deterioration.

IMPORTANT: Long-term storage is not advised when using BioDiesel. For storage longer than one year, use straight hydrocarbon fuel.

If BioDiesel must be used it is recommended the blend not exceed B7 and a high-quality fuel stabilizer be used. Storage should not exceed one year.

For more information see BioDiesel Fuel in the Fuels, Lubricants, and Coolants Section.

NOTE: The following storage preparations are used for long term engine storage up to one year. After that, the engine should be started, warmed up, and retreated for an extended storage period.

1. Change engine oil and replace filter. See Changing Engine Oil and Replacing Oil Filter in Lubrication and Maintenance/500 Hour Section. Used oil will not give adequate protection. Add one ounce of rust preventive oil to the engine crankcase for every quart of oil. This rust preventive oil should be an SAE 10W oil with 1-4 percent morpholine or equivalent vapor corrosion inhibitor, such as NOX RUST VCI-10 OIL from Daubert Chemical Company, Inc.
2. Service air cleaner. See Replacing Air Cleaner Filter Elements in the Service As Required Section.
3. Draining and flushing of cooling system is not necessary if engine is to be stored only for several months. However, for extended storage periods of a year or longer, it is recommended that the cooling system be drained, flushed, and refilled. Refill with appropriate coolant. See Adding Coolant in the Service As Required Section.
4. Pour three ounces of rust preventive oil into the turbocharger intake. (It may be necessary to temporarily install a short intake elbow on the turbocharger inlet to receive the oil.)
5. Prepare a tank with a solution of diesel fuel and rust preventive oil, at ten ounces of rust preventive oil per gallon of diesel fuel.
6. Remove existing lines/plugs as required, and run a temporary line from the tank to the engine fuel intake, and another temporary line from the fuel return to the tank, so rust preventive oil solution is circulated through the injection system during cranking.
7. Crank the engine several revolutions with starter (do not allow the engine to start). This will allow rust preventive oil solution to circulate.
8. Remove temporary lines installed in Step 6 above, and replace any lines/plugs previously removed.

NOTE: One gallon of fuel/oil solution can be used to treat 100 engines; two gallons to treat 200 engines, etc. The oil could then be replenished by adding an additional five ounces of rust preventive oil per gallon of solution. However, starting over with a new solution is recommended to dispose of any water or other impurities.

9. Loosen, or remove and store, fan/alternator poly-vee belt.
10. Remove and clean batteries. Store them in a cool, dry place and keep them fully charged.
11. Disengage the clutch for any driveline.
12. Clean the exterior of the engine with salt-free water and touch up any scratched or chipped painted surfaces with a good quality paint.
13. Coat all exposed (machined) metal surfaces with grease or corrosion inhibitor if not feasible to paint.
14. Seal all openings on engine with plastic bags and tape.
15. Store the engine in a dry protected place. If engine must be stored outside, cover it with a waterproof canvas or other suitable protective material and use a strong waterproof tape.

OURGP11,0000060 -19-28APR16-1/1

Removing Engine from Long-Term Storage

Refer to the appropriate section for detailed services listed below or have your authorized servicing dealer or engine distributor perform services that you may not be familiar with.

1. Remove all protective coverings from engine. Unseal all openings in engine and remove covering from electrical systems.
2. Remove the batteries from storage. Install batteries (fully charged) and connect the terminals.
3. Install fan/alternator belts if removed.
4. Fill fuel tank.
5. Perform all appropriate prestarting checks. (See DAILY PRESTARTING CHECKS in Engine Operating Guidelines Section.)

IMPORTANT: DO NOT operate starter more than 30 seconds at a time. Wait at least 2 minutes for starter to cool before trying again.

6. Crank engine for 20 seconds with starter (do not allow the engine to start). Wait 2 minutes and crank engine an additional 20 seconds to assure bearing surfaces are adequately lubricated.
7. Start engine and run at low idle and no load for several minutes. Warm up carefully and check all gauges before placing engine under load.
8. On the first day of operation after storage, check overall engine for leaks and check all gauges for correct operation.

RG,RG34710,4094 -19-12SEP06-1/1

General OEM Engine Specifications

ITEM	6135HF485 (13.5L)
Number of Cylinders	6
Bore	132 mm (5.2 in.)
Stroke	165 mm (6.5 in.)
Displacement	13.5 L (824 cu in.)
Compression Ratio	17.5:1 (Low Power Engines) 16.0:1 (High Power Engines)
Aspiration	Turbocharged
Engine Firing Order	1-5-3-6-2-4
Valves Per Cylinder	2 Intake 2 Exhaust
Battery 12-Volt System Capacity 12-Volt System Reserve 24-Volt System Capacity 24-Volt System Reserve	 1900 CCA 250 Minutes 925 CCA 275 Minutes
Thermostat Start To Open Temperature	80°C (176°F)
Thermostat Fully Open Temperature	92°C (197°F)
Coolant Capacity[a]	18 L (19 qt)
Recommended Radiator Pressure Cap	103 kPa (15 psi)
Crankcase Oil Fill Capacity	See “Engine Crankcase Oil Fill Quantities” later in this section.
Oil Pressure At Rated Speed With Oil Warmed to 105°C (220°F) (Maximum)	310 kPa (3.1 bar) (45 psi)
Oil Pressure At Low Idle (Minimum)	138 kPa (1.4 bar) (20 psi)
Length	1334 mm (52.5 in.)
Width	775 mm (30.5 in.)
Height	1350 mm (53.1 in.)
Weight (dry)	3292 kg (1493 lb)
ITEM	**6135HF475 (13.5L)**
Number of Cylinders	6
Bore	132 mm (5.2 in.)
Stroke	165 mm (6.5 in.)
Displacement	13.5 L (824 cu in.)
Compression Ratio	16.0:1
Aspiration	Turbocharged
Engine Firing Order	1-5-3-6-2-4
Valves Per Cylinder	2 Intake 2 Exhaust
Battery 12-Volt System Capacity 12-Volt System Reserve 24-Volt System Capacity 24-Volt System Reserve	 1900 CCA 250 Minutes 925 CCA 275 Minutes

Continued on next page

OMRGP15,0000141 -19-01DEC14-1/2

ITEM	6135HF475 (13.5L)
Thermostat Start To Open Temperature	80°C (176°F)
Thermostat Fully Open Temperature	92°C (197°F)
Coolant Capacity[a]	18 L (19 qt)
Recommended Radiator Pressure Cap	103 kPa (15 psi)
Crankcase Oil Fill Capacity	See “Engine Crankcase Oil Fill Quantities” later in this section.
Oil Pressure At Rated Speed With Oil Warmed to 105°C (220°F) (Maximum)	310 kPa (3.1 bar) (45 psi)
Oil Pressure At Low Idle (Minimum)	138 kPa (1.4 bar) (20 psi)
Length	1334 mm (52.5 in.)
Width	877 mm (34.5 in.)
Height	1512 mm (59.5 in.)
Weight (dry)	1493 kg (3292 lb)
ITEM	**6135HFG75 (13.5L)**
Number of Cylinders	6
Bore	132 mm (5.2 in.)
Stroke	165 mm (6.5 in.)
Displacement	13.5 L (824 cu in.)
Compression Ratio	16.0:1
Aspiration	Turbocharged
Engine Firing Order	1-5-3-6-2-4
Valves Per Cylinder	2 Intake 2 Exhaust
Battery 12-Volt System Capacity 12-Volt System Reserve 24-Volt System Capacity 24-Volt System Reserve	 1900 CCA 250 Minutes 925 CCA 275 Minutes
Thermostat Start To Open Temperature	82°C (180°F)
Thermostat Fully Open Temperature	92°C (197°F)
Coolant Capacity[a]	18 L (19 qt)
Recommended Radiator Pressure Cap	103 kPa (15 psi)
Crankcase Oil Fill Capacity	See “Engine Crankcase Oil Fill Quantities” later in this section.
Oil Pressure At Rated Speed With Oil Warmed to 105°C (220°F) (Maximum)	310 kPa (3.1 bar) (45 psi)
Length	1362 mm (54 in.)
Width	857 mm (34 in.)

OMRGP15,0000141 -19-01DEC14-2/2

ITEM	6135HF475 (13.5L)
Height	1210 mm (48 in.)
Weight (dry)	1334 kg (2941 lb)

[a]*Coolant capacity may vary with different engine applications.*

OMRGP15,0000141 -19-01DEC14-3/2

Engine Power Ratings And Fuel System Specifications

Engine speeds listed are preset to factory specification. Slow idle speed may be reset depending upon specific vehicle application requirements. Refer to your machine operator's manual for engine speeds that are different from those preset at the factory

Engine Model	Fuel System Option Codes	Electronic Software Option Codes	System Voltage	Power Rating @ Rated Speed kW (hp)	Rated Speed (rpm)	Slow Idle (rpm)	Fast Idle (rpm)
6135HF485 Industrial	1669	7219	12V	448 (600)	2100	900	2300
	1669	7220	24V	448 (600)	2100	900	2300
	1669	7221	12V	410 (550)	2100	900	2300
	1669	7222	24V	410 (550)	2100	900	2300
	1669	7223	12V	410 (550) [a]	2100	900	2300
	1669	7224	24V	410 (550) [a]	2100	900	2300
	1669	7225	12V	392 (525) [a]	2100	900	2300
	1669	7226	24V	392 (525) [a]	2100	900	2300
	1669	7227	12V	373 (500)	2100	900	2300
	1669	7228	24V	373 (500)	2100	900	2300
	1669	7229	12V	373 (500) [a]	2100	900	2300
	1669	7230	24V	373 (500) [a]	2100	900	2300
	1669	7231	12V	373 (500) [a]	1900	900	2100
	1669	7232	24V	373 (500) [a]	1900	900	2100
	1669	7233	12V	336 (450)	2100	900	2300
	1669	7234	24V	336 (450)	2100	900	2300
	1669	7235	12V	336 (450) [a]	2100	900	2300
	1669	7236	24V	336 (450) [a]	2100	900	2300
	1669	7237	12V	336 (450) [a]	1900	900	2100
	1669	7238	24V	336 (450) [a]	1900	900	2100
	1669	7239	12V	317 (425) [a]	2100	900	2300
	1669	7240	24V	317 (425) [a]	2100	900	2300
	1669	7241	12V	298 (400)	2100	900	2300
	1669	7242	24V	298 (400)	2100	900	2300
	1669	7243	12V	298 (400) [a]	2100	900	2300
	1669	7244	24V	298 (400) [a]	2100	900	2300
	1669	7245	12V	298 (400) [a]	1900	900	2100
	1669	7246	24V	298 (400) [a]	1900	900	2100
	1669	7247	12V	261 (350)	2100	900	2300
	1669	7248	24V	261 (350)	2100	900	2300
	1669	7249	12V	261 (350) [a]	2100	900	2300
	1669	7250	24V	261 (350) [a]	2100	900	2300
	1669	7251	12V	261 (350) [a]	1900	900	2100
	1669	7252	24V	261 (350) [a]	1900	900	2100
6135HF485 GenSet	1669	7253	12V	401 (538)	1800	900	1850
	1669	7254	24V	401 (538)	1800	900	1850
	1669	7255	12V	460 (617)	1800	900	1850
	1669	7256	24V	460 (617)	1800	900	1850
	1669	7266	12V	345 (463)	1800	900	1850
	1669	7267	24V	345 (463)	1800	900	1850
6135HF475 GenSet	1676	7268	12V	475 (354)	1500	1000	N/A
	1676	7269	24V	475 (354)	1500	1000	N/A

Continued on next page

Engine Model	Fuel System Option Codes	Electronic Software Option Codes	System Voltage	Power Rating @ Rated Speed kW (hp)	Rated Speed (rpm)	Slow Idle (rpm)	Fast Idle (rpm)
	1676	7270	12V	543 (405)	1500	1000	N/A
	1676	7271	24V	543 (405)	1500	1000	N/A
	1676	7272	12V	611 (456)	1500	1000	N/A
	1676	7273	24V	611 (456)	1500	1000	N/A
	1676	72DA	12V	443 (330)	1800	1000	N/A
	1676	72DB	24V	443 (330)	1800	1000	N/A
	1676	72DC	12V	483 (360)	1800	1000	N/A
	1676	72DD	24V	483 (360)	1800	1000	N/A
	1676	72DE	12V	563 (420)	1800	1000	N/A
	1676	72DF	24V	563 (420)	1800	1000	N/A
	1676	72DG	12V	617 (460)	1800	1000	N/A
	1676	72DH	24V	617 (460)	1800	1000	N/A
6135HFC75 GenSet	1676	72S1	12V	563 (420)	1800	1000	N/A
	1676	72S2	24V	563 (420)	1800	1000	N/A

[a] *These industrial engines have a power bulge which allows for INTERMITTENT operation above rated power.*

JR74534,0000373 -19-13APR11-2/2

Engine Crankcase Oil Fill Quantities



RG14341 —UN—26JUL05

Option Code Label

To determine the crankcase oil fill quantity for your engine, refer to the oil pan option code (A) located on the engine option code label affixed to the valve cover. The first two digits of the code (19) identify the oil pan group. The last two digits of each code identify the specific oil pan on your engine.

Listed below are engine crankcase oil fill quantities with filter change for each oil pan option code and PTO configuration:

Engine Model	Oil Pan Option Codes	Crankcase Oil Capacity [a]
6135HF (Without John Deere Rear PTO)	1915, 1917, 1918 1914	40.0 L (42.3 qt.) 60.0 L (63.4 qt.)

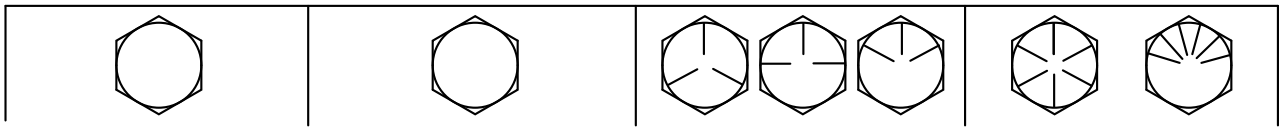
[a] *Crankcase oil capacity may vary slightly from amount shown. ALWAYS fill crankcase to within crosshatch area on dipstick. DO NOT overfill.*

NOTE: If engine is equipped with John Deere PTO, add an additional 4 L (4.2 qt) of oil to lubricate PTO gear train.

JR74534,0000372 -19-13APR11-1/1

Unified Inch Bolt and Screw Torque Values

TS1671 —UN—01MAY03



Bolt or Screw Size	SAE Grade 1				SAE Grade 2[a]				SAE Grade 5, 5.1 or 5.2				SAE Grade 8 or 8.2			
	Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]	
	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.
1/4	3.7	33	4.7	42	6	53	7.5	66	9.5	84	12	106	13.5	120	17	150
													N·m	lb.-ft.	N·m	lb.-ft.
5/16	7.7	68	9.8	86	12	106	15.5	137	19.5	172	25	221	28	20.5	35	26
									N·m	lb.-ft.	N·m	lb.-ft.				
3/8	13.5	120	17.5	155	22	194	27	240	35	26	44	32.5	49	36	63	46
			N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.								
7/16	22	194	28	20.5	35	26	44	32.5	56	41	70	52	80	59	100	74
	N·m	lb.-ft.														
1/2	34	25	42	31	53	39	67	49	85	63	110	80	120	88	155	115
9/16	48	35.5	60	45	76	56	95	70	125	92	155	115	175	130	220	165
5/8	67	49	85	63	105	77	135	100	170	125	215	160	240	175	305	225
3/4	120	88	150	110	190	140	240	175	300	220	380	280	425	315	540	400
7/8	190	140	240	175	190	140	240	175	490	360	615	455	690	510	870	640
1	285	210	360	265	285	210	360	265	730	540	920	680	1030	760	1300	960
1-1/8	400	300	510	375	400	300	510	375	910	670	1150	850	1450	1075	1850	1350
1-1/4	570	420	725	535	570	420	725	535	1280	945	1630	1200	2050	1500	2600	1920
1-3/8	750	550	950	700	750	550	950	700	1700	1250	2140	1580	2700	2000	3400	2500
1-1/2	990	730	1250	930	990	730	1250	930	2250	1650	2850	2100	3600	2650	4550	3350

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For plastic insert or crimped steel type lock nuts, for stainless steel fasteners, or for nuts on U-bolts, see the tightening instructions for the specific application. Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Replace fasteners with the same or higher grade. If higher grade fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

[a]Grade 2 applies for hex cap screws (not hex bolts) up to 6 in. (152 mm) long. Grade 1 applies for hex cap screws over 6 in. (152 mm) long, and for all other types of bolts and screws of any length.

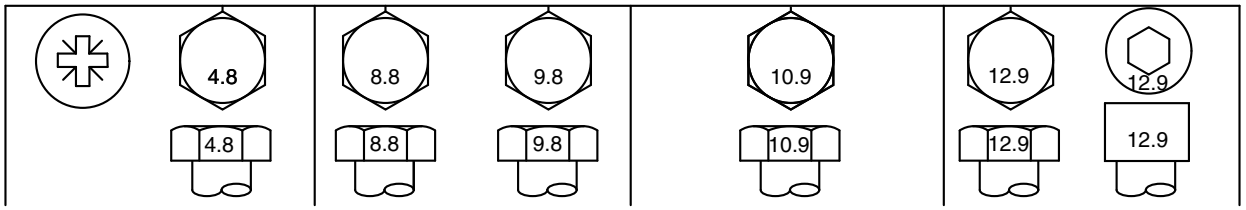
[b]"Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or 7/8 in. and larger fasteners with JDM F13C, F13F or F13J zinc flake coating.

[c]"Dry" means plain or zinc plated without any lubrication, or 1/4 to 3/4 in. fasteners with JDM F13B, F13E or F13H zinc flake coating.

DX,TORQ1 -19-12JAN11-1/1

Metric Bolt and Screw Torque Values

TS1670 —UN—01MAY03



Bolt or Screw Size	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
	Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]	
	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.
M6	4.7	42	6	53	8.9	79	11.3	100	13	115	16.5	146	15.5	137	19.5	172
									N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.
M8	11.5	102	14.5	128	22	194	27.5	243	32	23.5	40	29.5	37	27.5	47	35
			N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.								
M10	23	204	29	21	43	32	55	40	63	46	80	59	75	55	95	70
	N·m	lb.-ft.														
M12	40	29.5	50	37	75	55	95	70	110	80	140	105	130	95	165	120
M14	63	46	80	59	120	88	150	110	175	130	220	165	205	150	260	190
M16	100	74	125	92	190	140	240	175	275	200	350	255	320	235	400	300
M18	135	100	170	125	265	195	330	245	375	275	475	350	440	325	560	410
M20	190	140	245	180	375	275	475	350	530	390	675	500	625	460	790	580
M22	265	195	330	245	510	375	650	480	725	535	920	680	850	625	1080	800
M24	330	245	425	315	650	480	820	600	920	680	1150	850	1080	800	1350	1000
M27	490	360	625	460	950	700	1200	885	1350	1000	1700	1250	1580	1160	2000	1475
M30	660	490	850	625	1290	950	1630	1200	1850	1350	2300	1700	2140	1580	2700	2000
M33	900	665	1150	850	1750	1300	2200	1625	2500	1850	3150	2325	2900	2150	3700	2730
M36	1150	850	1450	1075	2250	1650	2850	2100	3200	2350	4050	3000	3750	2770	4750	3500

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For stainless steel fasteners or for nuts on U-bolts, see the tightening instructions for the specific application. Tighten plastic insert or crimped steel type lock nuts by turning the nut to the dry torque shown in the chart, unless different instructions are given for the specific application.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class. Replace fasteners with the same or higher property class. If higher property class fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

[a] *"Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or M20 and larger fasteners with JDM F13C, F13F or F13J zinc flake coating.*

[b] *"Dry" means plain or zinc plated without any lubrication, or M6 to M18 fasteners with JDM F13B, F13E or F13H zinc flake coating.*

DX,TORQ2 -19-12JAN11-1/1

Lubrication and Maintenance Records

Using Lubrication and Maintenance Records

Refer to specific Lubrication and Maintenance section for detailed service procedures.

1. Keep a record of the number of hours you operate your engine by regular observation of hour meter.
2. Check your record regularly to learn when your engine needs service.
3. DO ALL the services within an interval section. Write the number of hours (from your service records) and the date in the spaces provided. For a complete listing of all items to be performed and the service intervals required, refer to the quick-reference chart near the front of the Lubrication and Maintenance section.

IMPORTANT: The service recommendations covered in this manual are for the accessories that are provided by John Deere. Follow manufacturer's service recommendations for servicing engine-driven equipment not supplied by Deere.

RG,RG34710,7621 -19-12SEP06-1/1

Daily (Prestarting) Service

NOTE: Refer to DAILY PRESTARTING CHECKS in Lubrication and Maintenance/Daily section.

- Check engine oil level.
- Check coolant level.
- Check fuel filter/water separator.
- Check air cleaner dust unloader valve and air restriction indicator, if equipped.
- Visual walkaround inspection.

RG,RG34710,7622 -19-30SEP10-1/1

500 Hours of Operation/or 12 Months Service

- Service fire extinguisher.
- Service battery.
- Change engine oil and oil filter.[12]
- Check coolant pump weep hole.
- Replace fuel filters.
- Check and adjust engine speeds.
- Check engine mounts.
- Clean crankcase vent hose and valve.
- Check air intake hoses, connections, and system.
- Check engine ground connection.
- Check automatic belt tensioner and belt wear.
- Pressure test overall cooling system and radiator cap.

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[1]During engine break-in, change the oil and filter for the first time after a minumum of 100 hours of operation (500 hours maximum).
[2] Service intervals depend on sulfur content of the diesel fuel, oil pan capacity, and the oil and filter used. (See DIESEL ENGINE OIL AND FILTER SERVICE INTERVALS, in Fuels, Lubricants, and Coolant Section.)

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2000 Hours of Operation/or 24 Months Service

- Check crankshaft vibration damper.
- Test thermostats.

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Hours									
Date									
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2500 Hours of Operation Service

- Have your authorized servicing dealer or engine distributor check and adjust valve clearance and electronic unit injector (EUI) preload.

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Hours									
Date									
Hours									
Date									
Hours									
Date									

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Service as Required

- Flush and refill cooling system.[1]
- Add coolant.
- Replace air cleaner filter elements.
- Clean fuel filter water separator bowl.
- Bleed fuel system.
- Replace fan/alternator V-belts.
- Check fuses.
- Service air compressor. (See your John Deere dealer.)
- Service rear PTO (See your John Deere dealer.)

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[1] When John Deere COOL-GARD is used, the flushing interval is 3000 hours or 36 months. The drain interval may be extended to 5000 hours or 60 months of operation provided that the coolant is tested annually AND additives are replenished, as needed, by adding a supplemental coolant additive.

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John Deere Warranty in OEM Applications

Overview

This section focuses on John Deere engines marketed in products manufactured by companies other than John Deere or its affiliates, and on John Deere repower engines in all applications. Herein appears the original warranty applicable to the engine as delivered to the retail purchaser on or after 1 May 2010. The following is information about the warranty and warranty service.

NOTE: "John Deere" means John Deere Power Systems with respect to users in the United States, John Deere Limited with respect to users in Canada, and Deere & Company or its subsidiary responsible for making John Deere equipment in other countries where the user is located.

Promptly register your engine online at https://www.johndeere.com/enginewarranty

When Warranty Service Is Needed

The nearest dealer stands ready with genuine parts and trained and equipped personnel should the need arise. If following the Operator's Manual delivered with the engine/machine are not adequate to correct an engine problem, contact the nearest John Deere service dealer for assistance. Authorized engine service dealers can be found at: https://www.johndeere.com/ (click on "Dealer Locator").

NOTE: When requesting warranty service, the purchaser must be prepared to provide proof that the engine is within the warranty period.

The following information is always required: Engine serial number, date of delivery, engine owner, name and location of dealer and specific person contacted, date of contact, nature of engine problem, and outcome of the service dealer contact.

Given that normally it is the dealer contacted who in the end will provide the service required, maintaining a purchaser-dealer relationship of mutual respect from the beginning is always helpful.

Privacy Notice

At John Deere your privacy is important to us. We collect, use, and disclose your personal information in accordance with the John Deere privacy statement. For instance, we collect, use, and disclose your personal information to provide you with the products and services that you request; to communicate with you as our customer (examples include warranty and product improvement programs) and to meet safety and legal requirements; and for marketing and promotional purposes. Sometimes, we may ask our John Deere affiliates, dealers, or business partners to do work for us which involves your information. For complete details on your privacy rights and to obtain a copy of the John Deere Privacy Statement, please visit our website at https://www.johndeere.com/.

Warranty Duration

Unless otherwise provided in writing by John Deere, John Deere makes the following warranty to the first retail purchaser and each subsequent purchaser (if purchase is made prior to the expiration of applicable warranty) of each John Deere new off-highway engine marketed as part of a product manufactured by a company other than John Deere or its affiliates and on each John Deere engine used in an off-highway repower application:

- 12 months, unlimited hours of use, or
- 24 months and before the accumulation of 2000 hours of use.

NOTE: In the absence of a functional hourmeter, hours of use will be determined on the basis of 12 hours of use per calendar day.

Warranty Coverage

This warranty applies to the engine and to integral components and accessories sold by John Deere, and delivered to the first retail purchaser on or after 1 May 2010.

All John Deere-warranted parts and components of John Deere engines which, as delivered to the purchaser, are defective in materials and/or workmanship will be repaired or replaced, as John Deere elects. Warrantable repairs will be made without charge for parts or engine repair labor, including reasonable labor costs to remove and reinstall non-engine parts or components of the equipment in which the engine is installed. If required, reasonable labor costs for engine removal and reinstallation will also be included. All coverage is based on the defect appearing within the warranty period as measured from the date of delivery to the first retail purchaser.

Obtaining Warranty Service

Warranty service must be requested of the nearest authorized John Deere engine service outlet before the expiration of the warranty. An *authorized* service outlet is a John Deere engine distributor, a John Deere engine service dealer, or a John Deere equipment dealer selling and servicing equipment with an engine of the type covered by this warranty. (See When Warranty Service is Needed above.)

Authorized service outlets will use only new or remanufactured parts or components furnished or approved by John Deere.

NOTE: Authorized engine service locations are listed on the Internet at https://www.johndeere.com/ (Click on "Dealer Locator".)

At the time of requesting warranty service, the purchaser must be prepared to present evidence of the date of delivery of the engine.

Continued on next page

John Deere reimburses authorized service outlets for limited travel expenses incurred in making warranty service repairs in non-John Deere applications when travel is actually performed. The limit, as of the date of publication of this booklet, is US$400.00 (US$500.00 if engine is marine) or equivalent. **If distances and travel times are greater than reimbursed by John Deere, the service outlet will charge the purchaser for the difference.**

Warranty Exclusions

John Deere's obligations will not apply to components and accessories which are not furnished or installed by John Deere, nor to failures caused by such items, except as required by law.

Purchaser's Responsibilities

The cost of normal maintenance and depreciation.

Periodic cleaning of the diesel particulate filter (DPF).

Consequences of negligence, misuse, or accident involving the product, or improper application, installation, or storage.

Consequences of service performed by someone other than an authorized John Deere engine service outlet.

Consequences of any product modification or alteration not approved by John Deere, including, but not limited to, tampering with engine fuel and air delivery systems.

Consequences of failure of non-product components.

Consequences of fuels, lubricants, or coolants that fail to meet the specifications and requirements listed in the Operator's Manual.

The effects of cooling system neglect as manifested in cylinder liner or cylinder block cavitation ("pitting, "erosion", "electrolysis").

Any premium for overtime labor requested by the purchaser.

Costs of transporting the product or the equipment in which it is installed to and from the location at which the warranty service is performed, if such costs are in excess of the travel reimbursement payable to the dealer had the warranty service been performed at the product's location.

Costs incurred in gaining access; for example, overcoming physical barriers such as walls, fences, floors, decks, or similar structures impeding access to the product, rental of cranes or similar, or construction of ramps or lifts or protective structures for product removal and reinstallation.

Incidental travel costs including meals, lodging, and similar, and any travel time or mileage costs in excess of the maximum allowance.

Service outlet costs incurred in solving or attempting to solve non-warrantable problems.

Services performed by a party other than an authorized John Deere service dealer.

Charges by dealers for initial start-up and inspection deemed unnecessary by John Deere when an Operator's Manual is supplied with the product are followed.

Costs related to interpretation or translation services.

No Representations or Implied Warranty

Where permitted by law, neither John Deere nor any company affiliated with it makes any guaranties, warranties, conditions, representations or promises, express or implied, oral or written, as to the nonoccurrence of any defect or the quality of performance of its engines other than those set forth in this booklet, and DOES NOT MAKE ANY IMPLIED WARRANTY OR CONDITIONS OF MERCHANTABILITY OR FITNESS otherwise provided for in the Uniform Commercial Code or required by any Sale of Goods Act or any other statute. This exclusion includes fundamental terms. In no event will a John Deere engine distributor or engine service dealer, John Deere equipment dealer, or John Deere or any company affiliated with John Deere be liable for incidental or consequential damages or injuries including, but not limited to, loss of profits, loss of crops, rental of substitute equipment or other commercial loss, damage to the equipment in which the engine is installed or for damage suffered by purchaser as a result of fundamental breaches of contract or breach of fundamental terms, unless such damages or injuries are caused by the gross negligence or intentional acts of the foregoing parties.

Remedy Limitation

The remedies set forth in this warranty are the purchaser's exclusive remedies in connection with the performance of, or any breach of guaranty, condition, or warranty in respect of new John Deere engines. In the event the above warranty fails to correct purchaser's performance problems caused by defects in workmanship and/or materials, purchaser's exclusive remedy shall be limited to payment by John Deere of actual damages in an amount not to exceed the cost of the engine.

No Seller's Warranty

No person or entity, other than John Deere, who sells the engine or product in which the engine has been installed makes any guaranty or warranty of its own on any engine warranted by John Deere unless it delivers to the purchaser a separate written guaranty certificate specifically guaranteeing the engine, in which case John Deere shall have no obligation to the purchaser. Neither original equipment manufacturers, engine or equipment distributors, engine or equipment dealers, nor any other person or entity, has any authority to make any representation or promise on behalf of John Deere or to modify the terms or limitations of this warranty in any way.

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Replacement Parts Warranty

John Deere and John Deere Reman parts and components (excluding replacement engines) installed during engine warranty service are warranted for the remaining warranty period of the engine or the applicable warranty term for the installed service part, whichever is greater. A new or remanufactured engine replacing a failed engine under warranty is warranted for 90 days or the remaining warranty period of the original engine, whichever is greater.

Warranty Transfer

The remainder of the original engine warranty and the emissions control-related warranty may be transferred to a subsequent owner of the engine. The Engine Warranty Transfer card should be used to report the transfer to John Deere. If a card is not available, contact your Dealer or simply send the following Information to JDPS Warranty Administration at Diesel-US@JohnDeere.com.

1. The complete 13-character engine serial number.
2. The name and mailing address of the original purchaser.
3. Delivery date to the original purchaser.
4. Hours at the time of transfer.
5. Date of transfer to the new owner.
6. Name and mailing address of the new owner.
7. How the engine/drivetrain being used, i.e., what equipment it powers, by manufacturer and model.
8. Equipment it powers, by manufacturer and model.

Purchased Extended Warranty

Extended warranty may be purchased on most engines in many areas of the world. John Deere engine distributors and equipment dealers, and dealers of manufacturers using John Deere engines in their products, have details. John Deere may also be contacted at U.S.A. fax number 1-309-749-0816, or in Europe fax number 33.2.38.84.62.66.

Emissions Warranties

Emissions warranties appear in the Operator's Manual furnished with the engine/machine. **(Warning: Statutes providing severe penalties for tampering with emissions controls may apply at the user's location.)** John Deere may also be contacted at U.S.A. fax number 1-309-749-0816; or in Europe fax number 33.2.38.84.62.66.

Local Warranty Requirements

Warranties required by local statutes will be furnished by the seller.

Option Codes (Engine Manufacturing Configuration)

When in need of engine replacement parts, your authorized John Deere service dealer will need to know the corresponding "Option Codes" for your engine. The option code label on the engine rocker arm cover may become damaged over time. By recording the four-digit codes when the engine is new, and storing this manual where it can be found when parts are needed, fast, accurate parts ordering and service will be assured. (See Engine Option Codes in the Record Keeping Section).

Should there be a question about an engine option code, note the engine serial number and call 1-800-JDENGINE from the U.S.A. or Canada, or fax U.S.A. number 1-309-749-0816; or E-mail at diesel-us@johndeere.com, Attention: Warranty Administration; or in Europe fax number 33.2.38.84.62.66, or E-mail at saranservice@johndeere.com.

Registering The Engine For Warranty

Completion and submission of the John Deere Engine Warranty Registration form (cut out sheet found in this manual) is very important. John Deere will not deny warranty service on an engine within its warranty period if the engine has not been registered. However, registering your engine will assure your servicing dealer that the engine is within the warranty period.

The easiest way to register your engine is via the Internet. Go to website https://www.johndeere.com/enginewarranty You can use the sheet in this manual to gather the information needed to register the warranty.

NOTE: Information provided on the form must be legible!

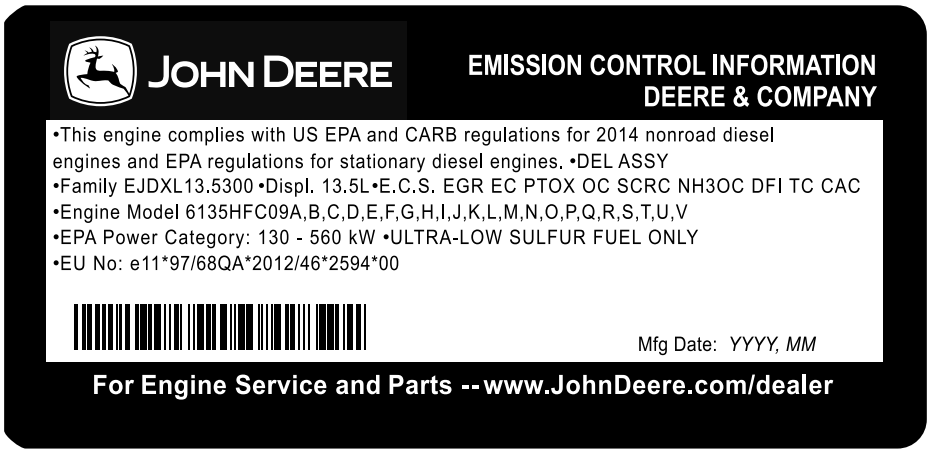
Typing is preferred, but legible handwritten reports are acceptable. "Block" numbers and Roman alphabet letters should be used. For example: 1,2,3,4 and A, B, C, D.

All requested information should be given. Much of it contributes to reports, including those required by governments.

The purchaser's telephone number or E-mail address allows John Deere to make contact should there be questions concerning the registration. The purchaser should sign and date the form.

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Emissions Control System Certification Label



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Engine Emissions Label

CAUTION: Statutes providing severe penalties for tampering with emissions controls may apply to the user or dealer.

The emissions warranty applies to those engines marketed by John Deere that have been certified by the United States Environmental Protection Agency (EPA) and/or California Air Resources Board (CARB); and used in the United States and Canada in Non-road equipment. The presence of an emissions label like the one shown signifies that the engine has been certified with the EPA and/or CARB. The EPA and CARB warranties only apply to new engines having the certification label affixed to the engine and sold as stated above in the geographic areas. The presence of an EU number signifies that the engine has been certified with the European Union countries per Directive 97/68/EC. The EPA and/or CARB emissions warranties do not apply to the EU countries.

The emissions label has applicable US EPA and/or CARB regulatory year. The regulatory year determines which warranty statement is applicable to engine. See “EPA Non-road Emissions Control Warranty Statement—Compression Ignition” and “CARB Non-road Emissions Control Warranty Statement—Compression Ignition”. For additional regulatory year warranty statements, see www.JohnDeere.com or contact the nearest John Deere service dealer for assistance.

Emission Control System(s) Laws

The U.S. EPA and California ARB prohibit the removal or rendering inoperative of any device or element of design installed on or in engines/equipment in compliance with applicable emission regulations prior to or after the sale and delivery of the engines/equipment to the ultimate purchaser.

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EPA Non-road Emissions Control Warranty Statement—Compression Ignition

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JOHN DEERE

U.S. AND CANADA EMISSION CONTROL WARRANTY STATEMENT
YOUR WARRANTY RIGHTS AND OBLIGATIONS

To determine if the John Deere engine qualifies for the additional warranties set forth below, look for the "Emissions Control Information" label located on the engine. If the engine is operated in the United States or Canada and the Emissions Control information label states: "This engine complies with US EPA regulations for nonroad and stationary diesel engines", or "This engine conforms to US EPA nonroad compression-ignition regulations", refer to the "U.S. and Canada Emission Control Warranty Statement." If the engine is operated in California, and the label states: "This engine complies with US EPA and CARB regulations for nonroad diesel engines", or "This engine conforms to US EPA and California nonroad compression-ignition emission regulations", also refer to the "California Emission Control Warranty Statement."

Warranties stated on this certificate refer only to emissions-related parts and components of your engine. The complete engine warranty, less emissions-related parts and components, is provided separately. If you have any questions about your warranty rights and responsibilities, you should contact John Deere at 1-319-292-5400.

JOHN DEERE'S WARRANTY RESPONSIBILITY

John Deere warrants to the ultimate purchaser and each subsequent purchaser that this off-road diesel engine including all parts of its emission-control system was designed, built and equipped so as to conform at the time of the sale with Section 213 of the Clean Air Act and is free from defects in materials and workmanship which would cause the engine to fail to conform with applicable US EPA regulations for a period of five years from the date the engine is placed into service or 3,000 hours of operation, whichever first occurs.

Where a warrantable condition exists, John Deere will repair or replace, as it elects, any part or component with a defect in materials or workmanship that would increase the engine's emissions of any regulated pollutant within the stated warranty period at no cost to you, including expenses related to diagnosing and repairing or replacing emission-related parts. Warranty coverage is subject to the limitations and exclusions set forth herein. Emission- related components include engine parts developed to control emissions related to the following:

Air-Induction System
Fuel System
Ignition System
Exhaust Gas Recirculation Systems
Aftertreatment Devices
Crankcase Ventilation Valves
Sensors
Engine Electronic Control Units

EMISSION WARRANTY EXCLUSIONS

John Deere may deny warranty claims for malfunctions or failures caused by:

- Non-performance of maintenance requirements listed in the Operator's Manual
- The use of the engine/equipment in a manner for which it was not designed
- Abuse, neglect, improper maintenance or unapproved modifications or alterations
- Accidents for which it does not have responsibility or by acts of God

The off-road diesel engine is designed to operate on diesel fuel as specified in the Fuels, Lubricants and Coolants section in the Operators Manual. Use of any other fuel can harm the emissions control system of the engine/equipment and is not approved for use.

To the extent permitted by law John Deere is not liable for damage to other engine components caused by a failure of an emission-related part, unless otherwise covered by standard warranty.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. REMEDIES UNDER THIS WARRANTY ARE LIMITED TO THE PROVISIONS OF MATERIAL AND SERVICES AS SPECIFIED HEREIN. WHERE PERMITTED BY LAW, NEITHER JOHN DEERE NOR ANY AUTHORIZED JOHN DEERE ENGINE DISTRIBUTOR, DEALER, OR REPAIR FACILITY OR ANY COMPANY AFFILIATED WITH JOHN DEERE WILL BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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JOHN DEERE

U.S. AND CANADA EMISSION CONTROL WARRANTY STATEMENT
YOUR WARRANTY RIGHTS AND OBLIGATIONS

To determine if the John Deere engine qualifies for the additional warranties set forth below, look for the "Emissions Control Information" label located on the engine. If the engine is operated in the United States or Canada and the Emissions Control information label states: "This engine complies with US EPA regulations for nonroad and stationary diesel engines", or "This engine conforms to US EPA nonroad compression-ignition regulations", refer to the "U.S. and Canada Emission Control Warranty Statement." If the engine is operated in California, and the label states: "This engine complies with US EPA and CARB regulations for nonroad diesel engines", or "This engine conforms to US EPA and California nonroad compression-ignition emission regulations", also refer to the "California Emission Control Warranty Statement."

Warranties stated on this certificate refer only to emissions-related parts and components of your engine. The complete engine warranty, less emissions-related parts and components, is provided separately. If you have any questions about your warranty rights and responsibilities, you should contact John Deere at 1-319-292-5400.

JOHN DEERE'S WARRANTY RESPONSIBILITY

John Deere warrants to the ultimate purchaser and each subsequent purchaser that this off-road diesel engine including all parts of its emission-control system was designed, built and equipped so as to conform at the time of the sale with Section 213 of the Clean Air Act and is free from defects in materials and workmanship which would cause the engine to fail to conform with applicable US EPA regulations for a period of five years from the date the engine is placed into service or 3,000 hours of operation, whichever first occurs.

Where a warrantable condition exists, John Deere will repair or replace, as it elects, any part or component with a defect in materials or workmanship that would increase the engine's emissions of any regulated pollutant within the stated warranty period at no cost to you, including expenses related to diagnosing and repairing or replacing emission-related parts. Warranty coverage is subject to the limitations and exclusions set forth herein. Emission- related components include engine parts developed to control emissions related to the following:

Air-Induction System
Fuel System
Ignition System
Exhaust Gas Recirculation Systems
Aftertreatment Devices
Crankcase Ventilation Valves
Sensors
Engine Electronic Control Units

EMISSION WARRANTY EXCLUSIONS

John Deere may deny warranty claims for malfunctions or failures caused by:

- Non-performance of maintenance requirements listed in the Operator's Manual
- The use of the engine/equipment in a manner for which it was not designed
- Abuse, neglect, improper maintenance or unapproved modifications or alterations
- Accidents for which it does not have responsibility or by acts of God

The off-road diesel engine is designed to operate on diesel fuel as specified in the Fuels, Lubricants and Coolants section in the Operators Manual. Use of any other fuel can harm the emissions control system of the engine/equipment and is not approved for use.

To the extent permitted by law John Deere is not liable for damage to other engine components caused by a failure of an emission-related part, unless otherwise covered by standard warranty.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. REMEDIES UNDER THIS WARRANTY ARE LIMITED TO THE PROVISIONS OF MATERIAL AND SERVICES AS SPECIFIED HEREIN. WHERE PERMITTED BY LAW, NEITHER JOHN DEERE NOR ANY AUTHORIZED JOHN DEERE ENGINE DISTRIBUTOR, DEALER, OR REPAIR FACILITY OR ANY COMPANY AFFILIATED WITH JOHN DEERE WILL BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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CARB Non-road Emissions Control Warranty Statement—Compression Ignition

Emissions Control Warranty Statement 2013 through 2015

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JOHN DEERE

CALIFORNIA EMISSIONS CONTROL WARRANTY STATEMENT
YOUR WARRANTY RIGHTS AND OBLIGATIONS

To determine if the John Deere engine qualifies for the additional warranties set forth below, look for the “Emission Control Information” label located on the engine. If the engine is operated in the United States or Canada and the engine label states: “This engine complies with US EPA regulations for nonroad and stationary diesel engines”, or “This engine complies with US EPA regulations for stationary emergency diesel engines”, refer to the “U.S. and Canada Emission Control Warranty Statement.” If the engine is operated in California, and the engine label states: “This engine complies with US EPA and CARB regulations for nonroad diesel engines” also refer to the “California Emissions Control Warranty Statement.”

Warranties stated on this certificate refer only to emissions-related parts and components of your engine. The complete engine warranty, less emission-related parts and components, is provided separately. If you have any questions about your warranty rights and responsibilities, you should contact John Deere at 1-319-292-5400.

CALIFORNIA EMISSIONS CONTROL WARRANTY STATEMENT:

The California Air Resources Board (CARB) is pleased to explain the emission-control system warranty on 2013 through 2015 off-road diesel engines. In California, new off-road engines must be designed, built and equipped to meet the State’s stringent anti-smog standards. John Deere must warrant the emission control system on your engine for the periods of time listed below provided there has been no abuse, neglect or improper maintenance of your engine.

Your emission control system may include parts such as the fuel injection system and the air induction system. Also included may be hoses, belts, connectors and other emission-related assemblies.

John Deere warrants to the ultimate purchaser and each subsequent purchaser that this off-road diesel engine was designed, built, and equipped so as to conform at the time of sale with all applicable regulations adopted by CARB and is free from defects in materials and workmanship which would cause the failure of a warranted part to be identical in all material respects to the part as described in John Deere's application for certification for a period of five years from the date the engine is delivered to an ultimate purchaser or 3,000 hours of operation, whichever occurs first for all engines rated at 19 kW and greater. In the absence of a device to measure hours of use, the engine shall be warranted for a period of five years.

EMISSIONS WARRANTY EXCLUSIONS:

John Deere may deny warranty claims for failures caused by the use of an add-on or modified part which has not been exempted by the CARB. A modified part is an aftermarket part intended to replace an original emission-related part which is not functionally identical in all respects and which in any way affects emissions. An add-on part is any aftermarket part which is not a modified part or a replacement part.

In no event will John Deere, any authorized engine distributor, dealer, or repair facility, or any company affiliated with John Deere be liable for incidental or consequential damage.

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JOHN DEERE'S WARRANTY RESPONSIBILITY:

Where a warrantable condition exists, John Deere will repair or replace, as it elects, your off-road diesel engine at no cost to you, including diagnosis, parts or labor. Warranty coverage is subject to the limitations and exclusions set forth herein. The off-road diesel engine is warranted for a period of five years from the date the engine is delivered to an ultimate purchaser or 3,000 hours of operation, whichever occurs first. The following are emissions-related parts:

Air Induction System

- Intake manifold
- Turbocharger
- Charge air cooler

Fuel Metering system

- Fuel injection system

Exhaust Gas Recirculation

- EGR valve

Catalyst or Thermal Reactor Systems

- Catalytic converter
- Exhaust manifold

Emission control labels

Particulate Controls

- Any device used to capture particulate emissions
- Any device used in the regeneration of the capturing system
- Enclosures and manifolding
- Smoke Puff Limiters

Positive Crankcase Ventilation (PCV) System

- PCV valve
- Oil filler cap

Advanced Oxides of Nitrogen (NOx) Controls

- NOx absorbers and catalysts

SCR systems and urea containers/dispensing systems

Miscellaneous Items used in Above Systems

- Electronic control units, sensors, actuators, wiring harnesses, hoses, connectors, clamps, fittings, gasket, mounting hardware

Any warranted emissions-related part scheduled for replacement as required maintenance is warranted by John Deere for the period of time prior to the first scheduled replacement point for the part. Any warranted emissions-related part not scheduled for replacement as required maintenance or scheduled only for regular inspection is warranted by John Deere for the stated warranty period.

OWNER'S WARRANTY RESPONSIBILITIES:

As the off-road diesel engine owner you are responsible for the performance of the required maintenance listed in your Operator's Manual. John Deere recommends that the owner retain all receipts covering maintenance on the off-road diesel engine, but John Deere cannot deny warranty solely for the lack of receipts or for the owner's failure to ensure the performance of all scheduled maintenance. However, as the off-road diesel engine owner, you should be aware that John Deere may deny you warranty coverage if your off-road diesel engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

The off-road diesel engine is designed to operate on diesel fuel as specified in the Fuels, Lubricants and Coolants section in the Operators Manual. Use of any other fuel may result in the engine no longer operating in compliance with applicable emissions requirements.

The owner is responsible for initiating the warranty process, and should present the machine to the nearest authorized John Deere dealer as soon as a problem is suspected. The warranty repairs should be completed by the authorized John Deere dealer as quickly as possible.

Emissions regulations require the customer to bring the unit to an authorized servicing dealer when warranty service is required. As a result, John Deere is NOT liable for travel or mileage on emissions warranty service calls.

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Emissions Control Warranty Statement 2013 through 2015

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JOHN DEERE

CALIFORNIA EMISSIONS CONTROL WARRANTY STATEMENT
YOUR WARRANTY RIGHTS AND OBLIGATIONS

To determine if the John Deere engine qualifies for the additional warranties set forth below, look for the “Emission Control Information” label located on the engine. If the engine is operated in the United States or Canada and the engine label states: “This engine complies with US EPA regulations for nonroad and stationary diesel engines”, or “This engine complies with US EPA regulations for stationary emergency diesel engines”, refer to the “U.S. and Canada Emission Control Warranty Statement.” If the engine is operated in California, and the engine label states: “This engine complies with US EPA and CARB regulations for nonroad diesel engines” also refer to the “California Emissions Control Warranty Statement.”

Warranties stated on this certificate refer only to emissions-related parts and components of your engine. The complete engine warranty, less emission-related parts and components, is provided separately. If you have any questions about your warranty rights and responsibilities, you should contact John Deere at 1-319-292-5400.

CALIFORNIA EMISSIONS CONTROL WARRANTY STATEMENT:

The California Air Resources Board (CARB) is pleased to explain the emission-control system warranty on 2013 through 2015 off-road diesel engines. In California, new off-road engines must be designed, built and equipped to meet the State’s stringent anti-smog standards. John Deere must warrant the emission control system on your engine for the periods of time listed below provided there has been no abuse, neglect or improper maintenance of your engine.

Your emission control system may include parts such as the fuel injection system and the air induction system. Also included may be hoses, belts, connectors and other emission-related assemblies.

John Deere warrants to the ultimate purchaser and each subsequent purchaser that this off-road diesel engine was designed, built, and equipped so as to conform at the time of sale with all applicable regulations adopted by CARB and is free from defects in materials and workmanship which would cause the failure of a warranted part to be identical in all material respects to the part as described in John Deere's application for certification for a period of five years from the date the engine is delivered to an ultimate purchaser or 3,000 hours of operation, whichever occurs first for all engines rated at 19 kW and greater. In the absence of a device to measure hours of use, the engine shall be warranted for a period of five years.

EMISSIONS WARRANTY EXCLUSIONS:

John Deere may deny warranty claims for failures caused by the use of an add-on or modified part which has not been exempted by the CARB. A modified part is an aftermarket part intended to replace an original emission-related part which is not functionally identical in all respects and which in any way affects emissions. An add-on part is any aftermarket part which is not a modified part or a replacement part.

In no event will John Deere, any authorized engine distributor, dealer, or repair facility, or any company affiliated with John Deere be liable for incidental or consequential damage.

RG25841 —UN—19MAY14

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DX,EMISSIONS,CARB -19-01AUG14-3/8

JOHN DEERE'S WARRANTY RESPONSIBILITY:

Where a warrantable condition exists, John Deere will repair or replace, as it elects, your off-road diesel engine at no cost to you, including diagnosis, parts or labor. Warranty coverage is subject to the limitations and exclusions set forth herein. The off-road diesel engine is warranted for a period of five years from the date the engine is delivered to an ultimate purchaser or 3,000 hours of operation, whichever occurs first. The following are emissions-related parts:

Air Induction System

- Intake manifold
- Turbocharger
- Charge air cooler

Fuel Metering system

- Fuel injection system

Exhaust Gas Recirculation

- EGR valve

Catalyst or Thermal Reactor Systems

- Catalytic converter
- Exhaust manifold

Emission control labels

Particulate Controls

- Any device used to capture particulate emissions
- Any device used in the regeneration of the capturing system
- Enclosures and manifolding
- Smoke Puff Limiters

Positive Crankcase Ventilation (PCV) System

- PCV valve
- Oil filler cap

Advanced Oxides of Nitrogen (NOx) Controls

- NOx absorbers and catalysts

SCR systems and urea containers/dispensing systems

Miscellaneous Items used in Above Systems

- Electronic control units, sensors, actuators, wiring harnesses, hoses, connectors, clamps, fittings, gasket, mounting hardware

Any warranted emissions-related part scheduled for replacement as required maintenance is warranted by John Deere for the period of time prior to the first scheduled replacement point for the part. Any warranted emissions-related part not scheduled for replacement as required maintenance or scheduled only for regular inspection is warranted by John Deere for the stated warranty period.

OWNER'S WARRANTY RESPONSIBILITIES:

As the off-road diesel engine owner you are responsible for the performance of the required maintenance listed in your Operator's Manual. John Deere recommends that the owner retain all receipts covering maintenance on the off-road diesel engine, but John Deere cannot deny warranty solely for the lack of receipts or for the owner's failure to ensure the performance of all scheduled maintenance. However, as the off-road diesel engine owner, you should be aware that John Deere may deny you warranty coverage if your off-road diesel engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

The off-road diesel engine is designed to operate on diesel fuel as specified in the Fuels, Lubricants and Coolants section in the Operators Manual. Use of any other fuel may result in the engine no longer operating in compliance with applicable emissions requirements.

The owner is responsible for initiating the warranty process, and should present the machine to the nearest authorized John Deere dealer as soon as a problem is suspected. The warranty repairs should be completed by the authorized John Deere dealer as quickly as possible.

Emissions regulations require the customer to bring the unit to an authorized servicing dealer when warranty service is required. As a result, John Deere is NOT liable for travel or mileage on emissions warranty service calls.

Emission_CI_CARB (19Sep12)

TS1723 —UN—15JUL13

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DX,EMISSIONS,CARB -19-01AUG14-4/8

Emissions Control Warranty Statement 2016 through 2018

DXLOGOV1 —UN—28APR09



JOHN DEERE

CALIFORNIA EMISSIONS CONTROL WARRANTY STATEMENT
YOUR WARRANTY RIGHTS AND OBLIGATIONS

To determine if the John Deere engine qualifies for the additional warranties set forth below, look for the “Emission Control Information” label located on the engine. If the engine is operated in the United States or Canada and the engine label states: “This engine complies with US EPA regulations for nonroad and stationary diesel engines”, or “This engine complies with US EPA regulations for stationary emergency diesel engines”, refer to the “U.S. and Canada Emission Control Warranty Statement.” If the engine is operated in California, and the engine label states: “This engine complies with US EPA and CARB regulations for nonroad diesel engines” also refer to the “California Emissions Control Warranty Statement.”

Warranties stated on this certificate refer only to emissions-related parts and components of your engine. The complete engine warranty, less emission-related parts and components, is provided separately. If you have any questions about your warranty rights and responsibilities, you should contact John Deere at 1-319-292-5400.

CALIFORNIA EMISSIONS CONTROL WARRANTY STATEMENT:

The California Air Resources Board (CARB) is pleased to explain the emission-control system warranty on 2016 through 2018 off-road diesel engines. In California, new off-road engines must be designed, built and equipped to meet the State’s stringent anti-smog standards. John Deere must warrant the emission control system on your engine for the periods of time listed below provided there has been no abuse, neglect or improper maintenance of your engine.

Your emission control system may include parts such as the fuel injection system and the air induction system. Also included may be hoses, belts, connectors and other emission-related assemblies.

John Deere warrants to the ultimate purchaser and each subsequent purchaser that this off-road diesel engine was designed, built, and equipped so as to conform at the time of sale with all applicable regulations adopted by CARB and is free from defects in materials and workmanship which would cause the failure of a warranted part to be identical in all material respects to the part as described in John Deere's application for certification for a period of five years from the date the engine is delivered to an ultimate purchaser or 3,000 hours of operation, whichever occurs first for all engines rated at 19 kW and greater. In the absence of a device to measure hours of use, the engine shall be warranted for a period of five years.

EMISSIONS WARRANTY EXCLUSIONS:

John Deere may deny warranty claims for failures caused by the use of an add-on or modified part which has not been exempted by the CARB. A modified part is an aftermarket part intended to replace an original emission-related part which is not functionally identical in all respects and which in any way affects emissions. An add-on part is any aftermarket part which is not a modified part or a replacement part.

In no event will John Deere, any authorized engine distributor, dealer, or repair facility, or any company affiliated with John Deere be liable for incidental or consequential damage.

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DX,EMISSIONS,CARB -19-01AUG14-5/8

JOHN DEERE'S WARRANTY RESPONSIBILITY:

Where a warrantable condition exists, John Deere will repair or replace, as it elects, your off-road diesel engine at no cost to you, including diagnosis, parts or labor. Warranty coverage is subject to the limitations and exclusions set forth herein. The off-road diesel engine is warranted for a period of five years from the date the engine is delivered to an ultimate purchaser or 3,000 hours of operation, whichever occurs first. The following are emissions-related parts:

Air Induction System

- Intake manifold
- Turbocharger
- Charge air cooler

Fuel Metering system

- Fuel injection system

Exhaust Gas Recirculation

- EGR valve

Catalyst or Thermal Reactor Systems

- Catalytic converter
- Exhaust manifold

Emission control labels

Particulate Controls

- Any device used to capture particulate emissions
- Any device used in the regeneration of the capturing system
- Enclosures and manifolding
- Smoke Puff Limiters

Positive Crankcase Ventilation (PCV) System

- PCV valve
- Oil filler cap

Advanced Oxides of Nitrogen (NOx) Controls

- NOx absorbers and catalysts

SCR systems and urea containers/dispensing systems

Miscellaneous Items used in Above Systems

- Electronic control units, sensors, actuators, wiring harnesses, hoses, connectors, clamps, fittings, gasket, mounting hardware

Any warranted emissions-related part scheduled for replacement as required maintenance is warranted by John Deere for the period of time prior to the first scheduled replacement point for the part. Any warranted emissions-related part not scheduled for replacement as required maintenance or scheduled only for regular inspection is warranted by John Deere for the stated warranty period.

OWNER'S WARRANTY RESPONSIBILITIES:

As the off-road diesel engine owner you are responsible for the performance of the required maintenance listed in your Operator's Manual. John Deere recommends that the owner retain all receipts covering maintenance on the off-road diesel engine, but John Deere cannot deny warranty solely for the lack of receipts or for the owner's failure to ensure the performance of all scheduled maintenance. However, as the off-road diesel engine owner, you should be aware that John Deere may deny you warranty coverage if your off-road diesel engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

The off-road diesel engine is designed to operate on diesel fuel as specified in the Fuels, Lubricants and Coolants section in the Operators Manual. Use of any other fuel may result in the engine no longer operating in compliance with applicable emissions requirements.

The owner is responsible for initiating the warranty process, and should present the machine to the nearest authorized John Deere dealer as soon as a problem is suspected. The warranty repairs should be completed by the authorized John Deere dealer as quickly as possible.

Emissions regulations require the customer to bring the unit to an authorized servicing dealer when warranty service is required. As a result, John Deere is NOT liable for travel or mileage on emissions warranty service calls.

Emission_CI_CARB (13Jun14)

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DX,EMISSIONS,CARB -19-01AUG14-6/8

Emissions Control Warranty Statement 2016 through 2018

DXLOGOV1 —UN—28APR09



JOHN DEERE

CALIFORNIA EMISSIONS CONTROL WARRANTY STATEMENT
YOUR WARRANTY RIGHTS AND OBLIGATIONS

To determine if the John Deere engine qualifies for the additional warranties set forth below, look for the “Emission Control Information” label located on the engine. If the engine is operated in the United States or Canada and the engine label states: “This engine complies with US EPA regulations for nonroad and stationary diesel engines”, or “This engine complies with US EPA regulations for stationary emergency diesel engines”, refer to the “U.S. and Canada Emission Control Warranty Statement.” If the engine is operated in California, and the engine label states: “This engine complies with US EPA and CARB regulations for nonroad diesel engines” also refer to the “California Emissions Control Warranty Statement.”

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CALIFORNIA EMISSIONS CONTROL WARRANTY STATEMENT:

The California Air Resources Board (CARB) is pleased to explain the emission-control system warranty on 2016 through 2018 off-road diesel engines. In California, new off-road engines must be designed, built and equipped to meet the State’s stringent anti-smog standards. John Deere must warrant the emission control system on your engine for the periods of time listed below provided there has been no abuse, neglect or improper maintenance of your engine.

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In no event will John Deere, any authorized engine distributor, dealer, or repair facility, or any company affiliated with John Deere be liable for incidental or consequential damage.

RG26035 —UN—24JUN14

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DX,EMISSIONS,CARB -19-01AUG14-7/8

JOHN DEERE'S WARRANTY RESPONSIBILITY:

Where a warrantable condition exists, John Deere will repair or replace, as it elects, your off-road diesel engine at no cost to you, including diagnosis, parts or labor. Warranty coverage is subject to the limitations and exclusions set forth herein. The off-road diesel engine is warranted for a period of five years from the date the engine is delivered to an ultimate purchaser or 3,000 hours of operation, whichever occurs first. The following are emissions-related parts:

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- Charge air cooler

Fuel Metering system

- Fuel injection system

Exhaust Gas Recirculation

- EGR valve

Catalyst or Thermal Reactor Systems

- Catalytic converter
- Exhaust manifold

Emission control labels

Particulate Controls

- Any device used to capture particulate emissions
- Any device used in the regeneration of the capturing system
- Enclosures and manifolding
- Smoke Puff Limiters

Positive Crankcase Ventilation (PCV) System

- PCV valve
- Oil filler cap

Advanced Oxides of Nitrogen (NOx) Controls

- NOx absorbers and catalysts

SCR systems and urea containers/dispensing systems

Miscellaneous Items used in Above Systems

- Electronic control units, sensors, actuators, wiring harnesses, hoses, connectors, clamps, fittings, gasket, mounting hardware

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The off-road diesel engine is designed to operate on diesel fuel as specified in the Fuels, Lubricants and Coolants section in the Operators Manual. Use of any other fuel may result in the engine no longer operating in compliance with applicable emissions requirements.

The owner is responsible for initiating the warranty process, and should present the machine to the nearest authorized John Deere dealer as soon as a problem is suspected. The warranty repairs should be completed by the authorized John Deere dealer as quickly as possible.

Emissions regulations require the customer to bring the unit to an authorized servicing dealer when warranty service is required. As a result, John Deere is NOT liable for travel or mileage on emissions warranty service calls.

Emission_CI_CARB (13Jun14)

RG26036 —UN—24JUN14

DX,EMISSIONS,CARB -19-01AUG14-8/8

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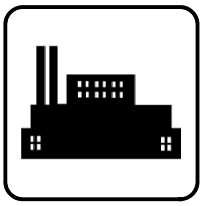
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Engine



Engine Models:

John Deere
6135HF485
6135HFG75
6135HFG84

Generator Models:
350–500REOZJ
350–500REOZJB

ISO 9001
KOHLER POWER SYSTEMS
NATIONALLY REGISTERED

KOHLER®
Power Systems

TP-6786 1/15c

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Introduction

This manual lists service replacement parts for John Deere engine models 6135HF.

At the time of print this manual applied to the engine models listed in the Model Index. On occasion this manual may apply to engines not listed in the Model Index.

Information in this publication represents data available at the time of print. The generator set manufacturer reserves the right to change this publication and the products represented without notice and without any obligation or liability whatsoever.

This manual includes the following main sections:

Table of Contents. Lists the sections of the manual.

Introduction (and other information sections). Contains introductory material about part numbers, illustrations, and hardware.

Index. Lists the engine models and groups.

Group Parts Lists. List the part numbers of parts in the groups.

Numbering System Significance

This manual uses the following numbering systems:

Engine Model. The product identification number located on the engine nameplate. Engines break down into groups.

Group Number. A unique number representing a parts group needed to assemble an engine function. For example, Group 1 is the Air Intake group.

Variation Number. A group might have several variations. Each variation performs the same function with different parts lists. For example, a 12-volt alternator and 24-volt alternator both perform the same function, but, with different parts. Each difference requires a group variation or module number.

Part Number. The part number identifies an individual assembly, subassembly, component, or accessory kit.

Illustrations

Illustrations (or exploded-view drawings) best representing the widest range of variations accompany most groups in this manual. Illustrations do not depict all details and may not show all parts. Do not use illustrations for assembly or disassembly.

How to Find Part Numbers

Use the following steps to locate a service replacement part.

1. Locate the engine nameplate to **identify the engine model number**.
2. **Turn to the Model Index**. The first column lists the engine model numbers. The headings identify the groups of parts that make up the engine.
3. **Identify the group** most likely to include the service part number.
4. **Find the group variation number** at the intersection of the model row and the group column. Note the variation number.
5. **Page forward to locate the group** identified in step 3 or find the appropriate page in the Table of Contents.
6. **Find the part on the illustration** and note the item number of the part or **find the part description in the parts list**.
7. Select **the part number that corresponds to your group variation**. The first column lists the illustration item number. Find the variation identified in the Model Index in the appropriate column on the right side of the parts list table. Find the quantity used at the intersection of the item number row and the variation column. A blank space at the intersection means the variation/module does not use that part number.

Hardware References

Many common hardware items do not appear in parts manuals or will appear as common hardware entries. A common hardware entry lists the size of the hardware. For example, an item that appears as “Hardware, 3/8-16” in the text means that the piece is 3/8-16 size. Obtain common hardware locally.

Some hardware items require a specific size or some other characteristic. In that case, use the part number listed in the text.

When replacing hardware, do not substitute inferior grade hardware. Replacement hardware grade should be equal to or better than the grade of the manufacturer’s original hardware.

Specification Number Index

Group Title	Air Intake	Water Pump	Thermostat Housing	Thermostat Cover	Thermostat	Fan Belt	Fan Drive	Crankshaft Damper	Vent Tube	Valve Train	Rocker Arm Cover	Fuel Injection System	Fuel Transfer Pump	Fuel Filter
Group No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**10**	**12**	**13**	**14**	**15**	**18**
	Variation Number													
Spec No.														
350/400 kW (6135HF485)														
GM76156-GA1	1730	2007	3906	2106	2202	2421	234G	6802	2908	4903	1104	1676	3701 or 3711*	3525
GM76156-GA2	1730	2007	3906	2106	2202	2421	234G	6802	2908	4903	1104	1676	3701 or 3711*	3525
GM85455-GA1	1730	2007	3906	2106	2202	2421	234G	6802	2908	4903	1104	1676	3701 or 3711*	3525
GM85455-GA2	1730	2007	3906	2106	2202	2421	234G	6802	2908	4903	1104	1676	3701 or 3711*	3525
350/400 kW (6135HFG84)														
GM85455-GA4	1732	2007	3907	2106	2202	2421	234G	6814	2908	4903	1104	1676	3711	3525
GM85455-GA5	1732	2007	3907	2106	2202	2421	234G	6814	2908	4903	1104	1676	3711	3525
500 kW (6135HFG75)														
GM76157-GA2	1732	2007	3907	2106	2202	2421	234G	6814	2908	4903	1104	1676	3711	3525
GM85455-GA3	1732	2007	3907	2106	2202	2421	234G	6814	2908	4903	1104	1676	3711	3525

* Engine serial number 018524 and after use variation code 3711.

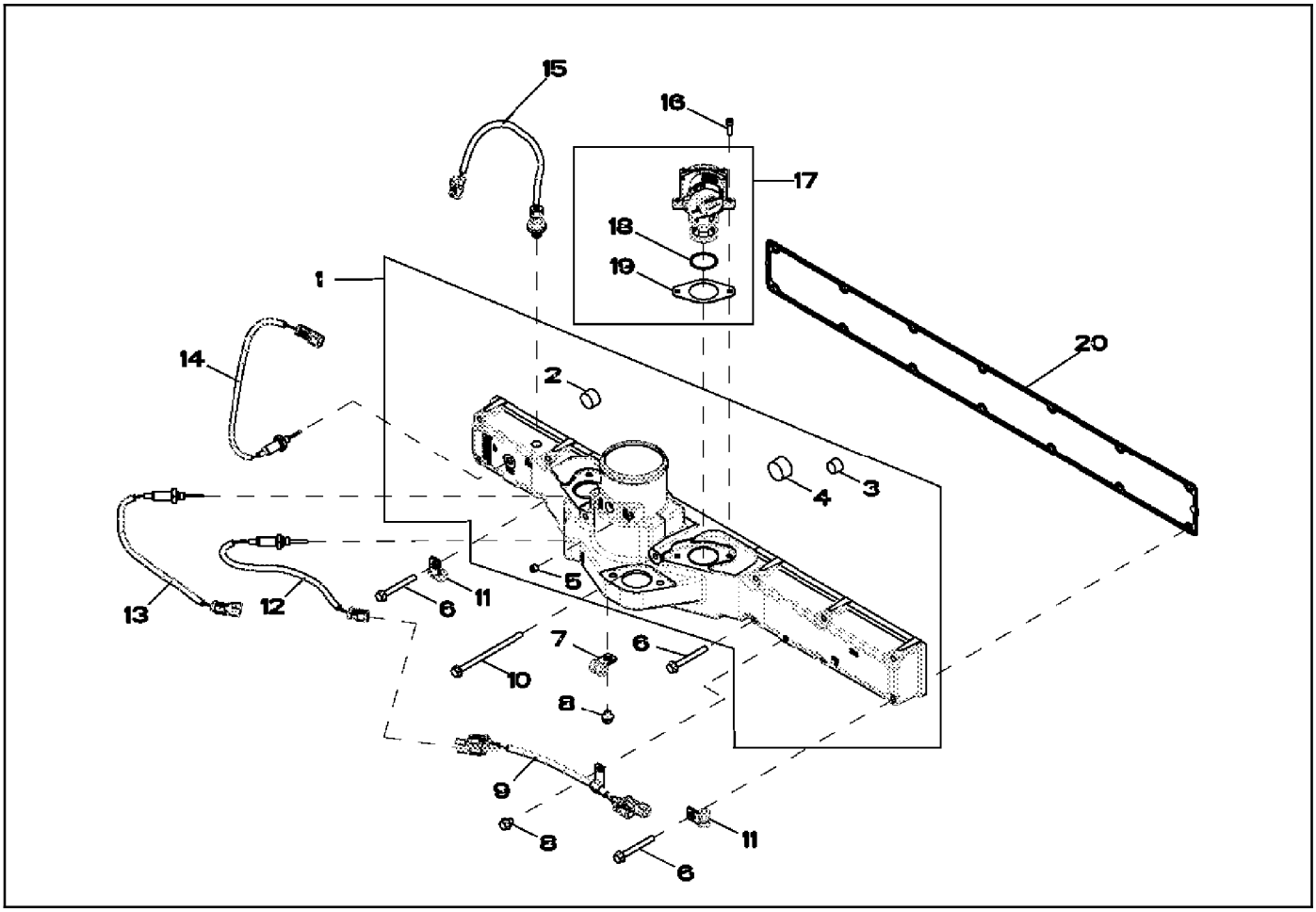
Group Title	Crankshaft	Crankshaft Pulley	Piston & Connecting Rod	Flywheel	Flywheel Housing	Cylinder Head & Camshaft	Exhaust Manifold	Exhaust Outlet	Oil Filler	Dipstick	Oil Pan	Oil Filter	Oil Pump
Group No.	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**
	Variation Number												
Spec. No.													
350/400 kW (6135HF485)													
GM76156-GA1	4702	1341	4803	1506	1401	5107	2804	6405	1204	4003	1915	5912	5002
GM76156-GA2	4702	1341	4803	1506	1401	5107	2804	6405	1204	4003	1915	5912	5002
GM85455-GA1	4702	1341	4803	1506	1401	5107	2804	6405	1204	4003	1915	5912	5002
GM85455-GA2	4702	1341	4803	1506	1401	5107	2804	6405	1204	4003	1915	5912	5002
350/400 kW (6135HFG84)													
GM85455-GA4	4702	1398	4803	1506	1414	5113	2814	-	1204	4003	1915	5917	5002
GM85455-GA5	4702	1398	4803	1506	1414	5113	2814	-	1204	4003	1915	5917	5002
500 kW (6135HFG75)													
GM76157-GA2	4702	1398	4803	1506	1414	5107	2814	-	1204	4003	1915	5917	5002
GM85455-GA3	4702	1398	4803	1506	1414	5107	2814	-	1204	4003	1915	5917	5002

Specification Number Index

Group Title	Cylinder Block	Timing Gear Cover	Turbocharger & Oil Lines	Starter Motor	Alternator	Alternator Brackets	Cylinder Head Gasket Set	Overhaul Gasket Set	Wiring Harness	Turbo Air Inlet	Exhaust Gas Recirculation
Group No.	**32**	**34**	**35**	**36**	**37**	**38**	**40**	**41**	**43**	**45**	**47**
	Variation Number										
Spec No.											
350/400 kW (6135HF485)											
GM76156-GA1	4606	7701	6550	3014	3119	6201	9901	9901	8417	5403	8901
GM76156-GA2	4606	7701	6550	3014	3119	6201	9901	9901	8417	5403	8901
GM85455-GA1	4606	7701	6550	3014	3119	6201	9901	9901	8417	5403	8901
GM85455-GA2	4606	7701	6550	3014	3119	6201	9901	9901	8417	5403	8901
350/400 kW (6135HFG84)											
GM85455-GA4	4606	7701	6579	3014	3119	6201	9901	9901	8429	-	-
GM85455-GA5	4606	7701	6579	3014	3119	6201	9901	9901	8429	-	-
500 kW (6135HFG75)											
GM76157-GA2	4606	7701	6562	3014	3119	6201	9901	-	8429	-	8901
GM85455-GA3	4606	7701	6562	3014	3119	6201	9901	-	8429	-	8901

Group Title	Electronic Sensors	Oil Pressure Sensor	Lift Straps	Short Block							
Group No.	**48**	**49**	**50**	**51**							
	Variation Number										
Spec No.											
350/400 kW (6135HF485)											
GM76156-GA1	4422	7601	9811	9901							
GM76156-GA2	4422	7601	9811	9901							
GM85455-GA1	4422	7601	9811	9901							
GM85455-GA2	4422	7601	9811	9901							
350/400 kW (6135HFG84)											
GM85455-GA4	4422	7601	9811	9901							
GM85455-GA5	4422	7601	9811	9901							
500 kW (6135HFG75)											
GM76157-GA2	4422	7601	9811	9901							
GM85455-GA3	4422	7601	9811	9901							

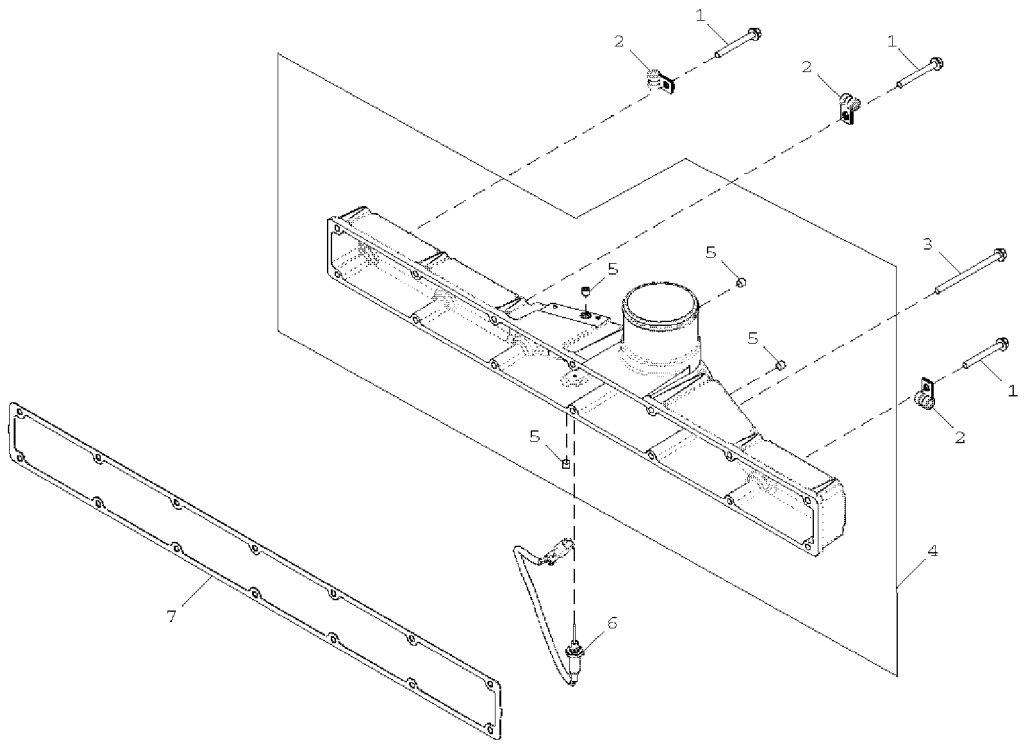
Group 1: Air Intake



Item	Part Number	Description	Qty. Variation 1730
1	GM80481	Manifold	1
2	GM53024	Plug, pipe	2
3	#	Pipe Plug	2
4	#	Pipe Plug	1
5	GM18873	Pipe plug	1
6	#	Screw, M8 x 70	10
7	GM80499	Clamp	1
8	GM50033	Cap screw	2
9	GM80415	Wiring Harness	1
10	#	Screw, M8 x 140	4
11	GM50293	Clamp	2
12	GM80418	Sensor	1
13	GM80417	Sensor	1
14	GM80417	Sensor	1
15	GM80419	Manifold Air Press. Sensor	1
16	#	Screw, M6 x 20	4
17	GM80480	Exhaust Gas Recycling Valve	2
18	GM49878	O-ring	2
19	GM49849	Gasket	1
20	GM80342	Gasket	1

Common hardware; procure locally.

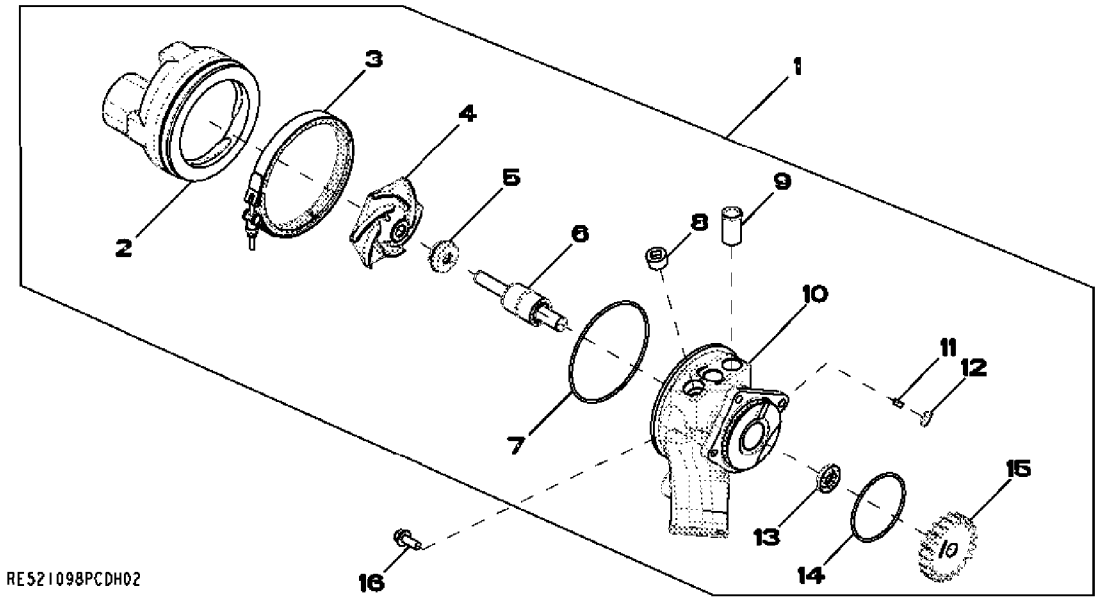
Group 1: Air Intake



Item	Part Number	Description	Qty. Variation 1732
1	#	Screw, M8 X 70	10
2	GM50293	Clamp	3
3	#	Screw, M8 X 120	4
4	GM83044	Air Intake	1
5	GM18873	Pipe Plug	4
6	GM80417	Sensor	1
7	GM83045	Gasket	1

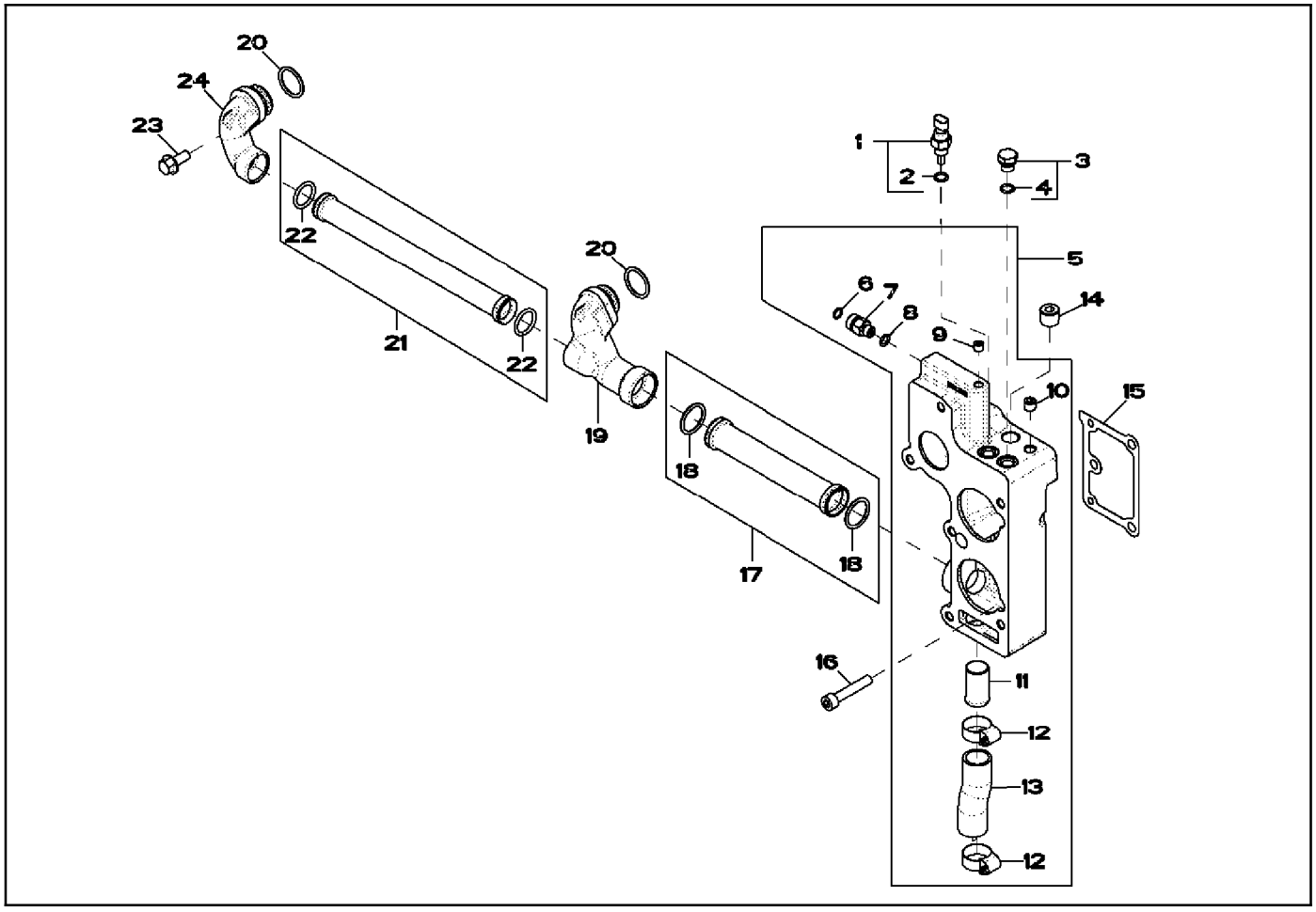
Common hardware; procure locally.

Group 2: Water Pump



Item	Part Number	Description	Qty. Variation 2007
1	GM80483	Water Pump	1
2	-	Housing (order pump assy.)	1
3	GM80263	Clamp	1
4	-	Impeller (not sold separately)	1
5	-	Seal (not sold separately)	1
6	-	Bearing (not sold separately)	1
7	GM80238	O-Ring	1
8	GM53024	Plug, pipe	2
9	GM80370	Tube	2
10	-	Water Pump Connection (not sold separately)	1
11	GM17443	Filter	1
12	-	Plug (not sold separately)	1
13	-	Seal (not sold separately)	1
14	GM80369	O-Ring	1
15	-	Gear (not sold separately)	1
16	GM80243	Screw	3

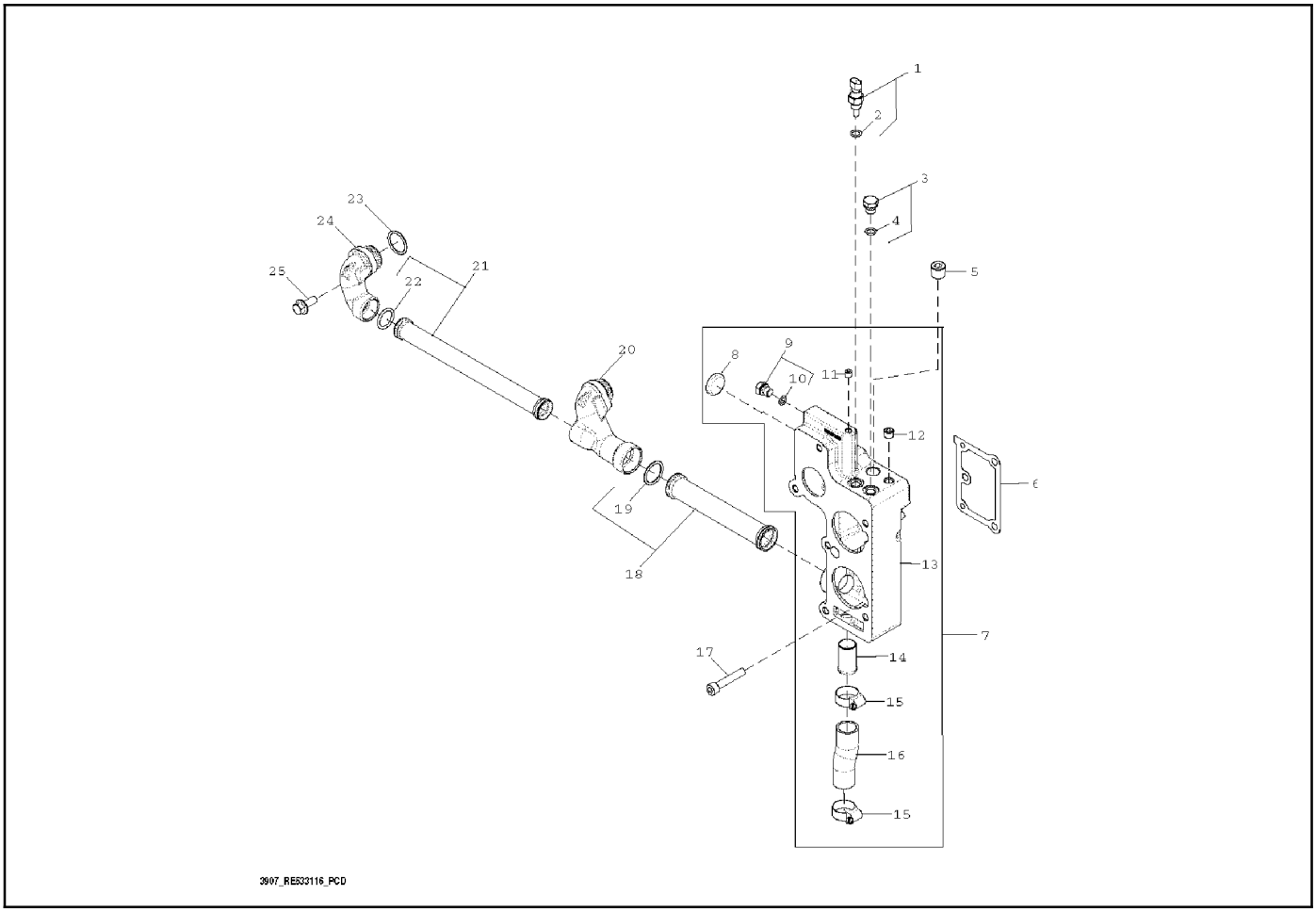
Group 3: Thermostat Housing



Item	Part Number	Description	Qty. Variation 3906
1	GM50195	Sensor	1
2	GM21508	O-ring	1
3	360013	Plug	1
4	GM21508	O-ring	1
5	GM80421	Housing	1
6	360555	O-ring	1
7	GM49819	Fitting, adapter	1
8	360178	O-ring	1
9	GM18873	Pipe plug	2
10	#	Pipe Plug	1
11	GM80370	Tube	1
12	336705	Clamp, Hose	2
13	GM80336	Hose	1
14	GM18862	Pipe plug, 1/2”	1
15	GM80345	Gasket	1
16	#	Screw, M10 x 55	3
17	GM49935	Tube	1
18	GM46594	O-ring	2
19	GM80333	Coolant Manifold	1
20	GM46594	O-ring	2
21	GM80420	Tube	1
22	GM80232	O-Ring	2
23	#	Screw, M10 x 25	2
24	GM80334	Manifold	1

Common hardware; procure locally.

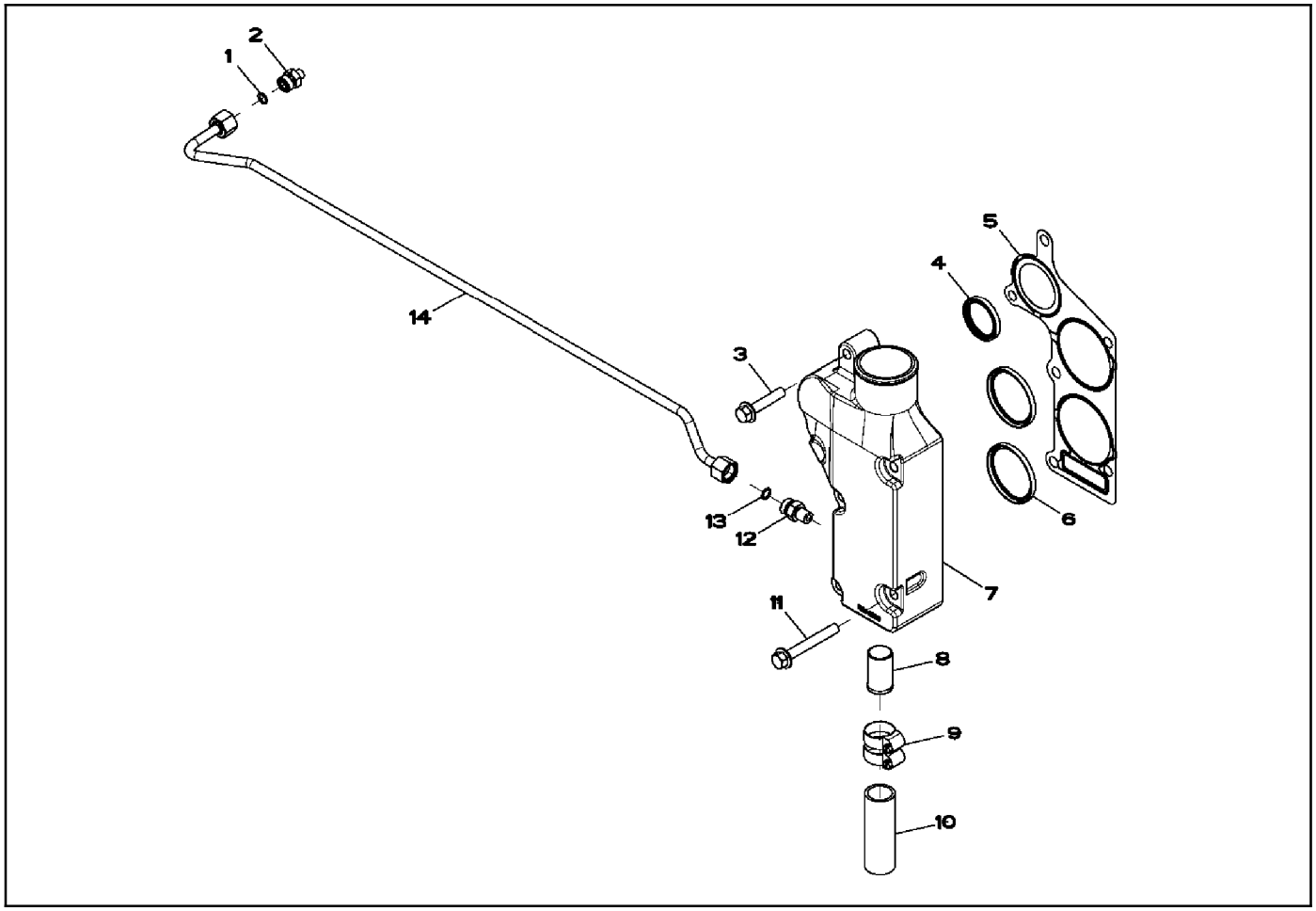
Group 3: Thermostat Housing, continued



Item	Part Number	Description	Qty. Variation 3907
1	GM50195	Sensor	1
2	GM21508	O-Ring, 11.300 X 2.200 MM	1
3	360013	Fitting Plug	1
4	GM21508	O-Ring, 11.300 X 2.200 MM	1
5	GM18862	Pipe plug, 1/2”	1
6	GM80345	Gasket	1
7	GM83049	Housing	1
8	360093	Plug	1
9	360015	Fitting Plug	1
10	360178	O-Ring, 9.300 X 2.200 MM	1
11	GM18873	Pipe Plug	2
12	#	Pipe Plug, 1/4”	1
13	GM83050	Housing	1
14	GM80370	Tube	1
15	336705	Clamp	1
16	GM80336	Hose	1
17	#	Screw, M10 X 55	3
18	GM49935	Tube	1
19	GM46594	O-Ring	2
20	GM80333	Coolant Manifold	1
21	GM80420	Tube	1
22	GM80232	O-Ring	2
23	GM46594	O-Ring	2
24	GM80334	Manifold	1
25	#	Screw, M10 X 25	2

Common hardware; procure locally.

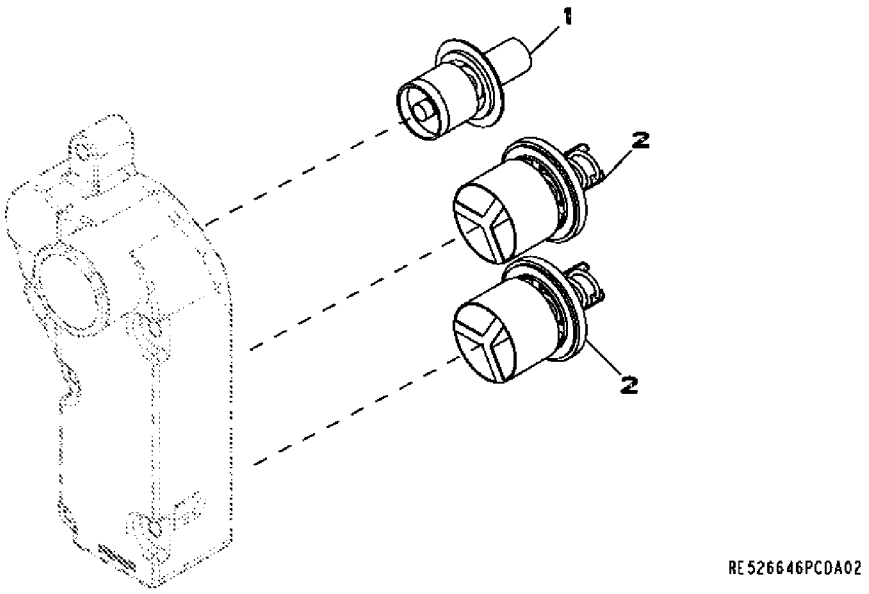
Group 4: Thermostat Cover



Item	Part Number	Description	Qty. Variation 2106
1	360555	O-ring	1
2	GM80241	Adapter Fitting	1
3	#	Screw, M10 x 50	2
4	GM80426	Seal	1
5	GM80350	Gasket	1
6	GM80425	Seal	2
7	GM80422	Housing	1
8	GM80370	Tube	1
9	GM18881	Clamp	2
10	GM80330	Hose	1
11	#	Screw	4
12	360006	Adapter	1
13	360555	O-ring	1
14	GM80427	Line	1

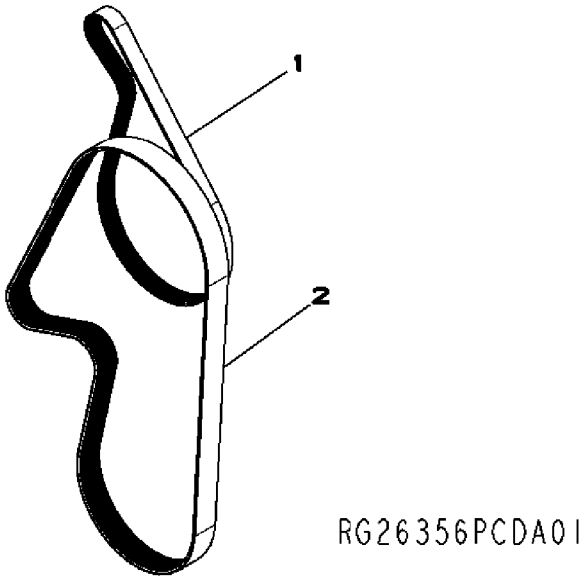
Common hardware; procure locally.

Group 5: Thermostat



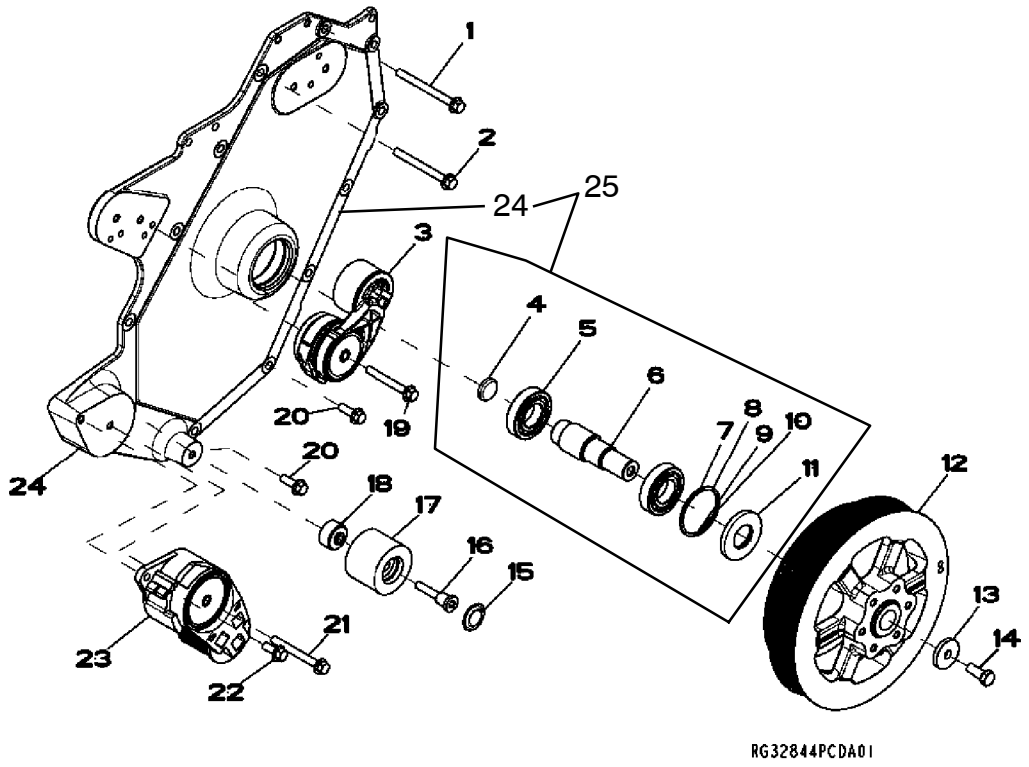
Item	Part Number	Description	Qty. Variation 2202
1	GM80423	Thermostat	1
2	GM80424	Thermostat	2

Group 6: Fan Belt



Item	Part Number	Description	Qty. Variation 2421
1	GM80275	V-Belt (1159 MM)	1
2	GM80277	V-Belt (1922 MM)	1

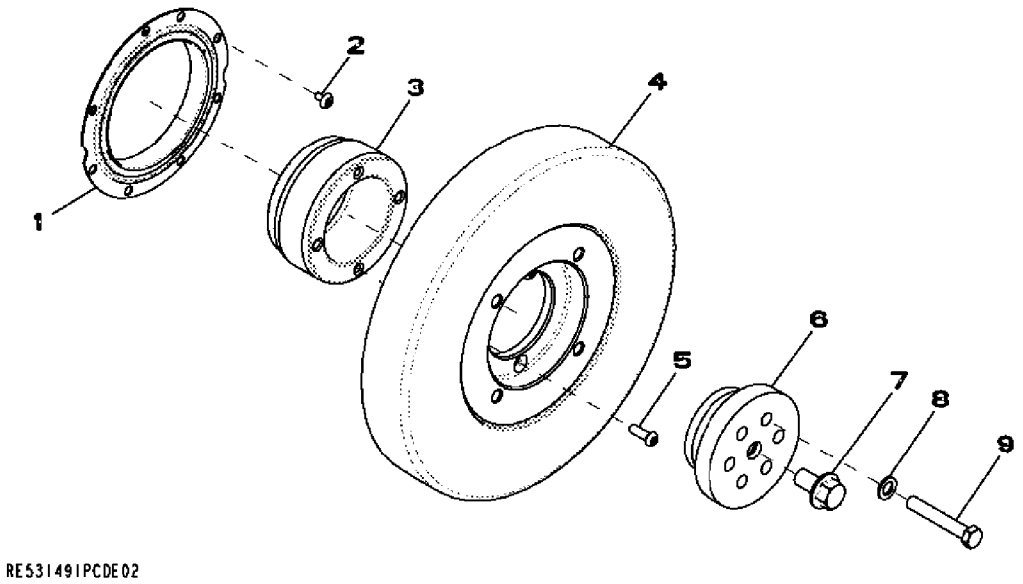
Group 7: Fan Drive



Item	Part Number	Description	Qty. Variation 234G
1	#	Screw, M12 x 110	1
2	GM70547	Screw	6
3	GM80385	Belt Tensioner	1
4	360093	Plug	1
5	GM80244	Ball Bearing	2
6	GM80378	Shaft	1
7	GM80373	Snap Ring (red)	1
8	GM80376	Snap Ring (white)	1
9	GM80374	Snap Ring (green)	1
10	GM80375	Snap Ring (blue)	1
11	GM80386	Seal	1
12	GM80272	Pulley	1
13	GM80495	Washer	1
14	336753	Screw, hex head	1
15	GM80382	Cover	1
16	GM80269	Screw	1
17	GM80388	Idler	1
18	GM23835	Spacer	1
19	M931-10080-82	Screw, hex cap M10 x 80mm	1
20	M933-10030-82	Screw, hex cap M10 x 30mm	2
21	#	Screw, M10 x 90	1
22	#	Screw, M10 x 25	1
23	GM80384	Tightener	1
24	GM80302	Cover	1
25	GM83046	Housing (includes items 4-11, 24)	1

Common hardware; procure locally.

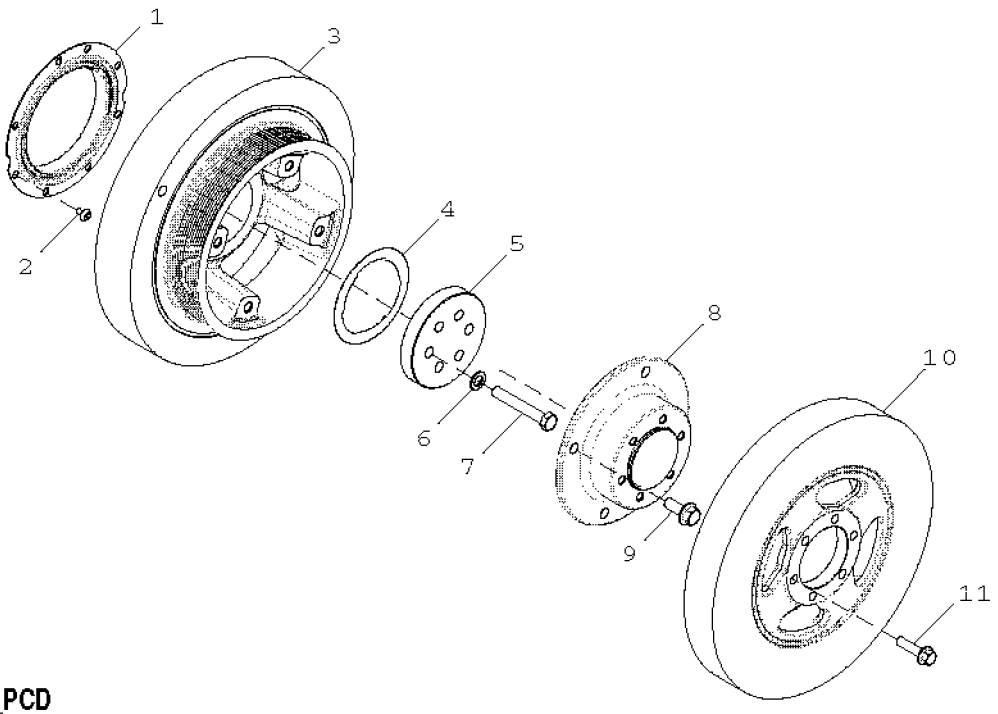
Group 8: Crankshaft Damper



Item	Part Number	Description	Qty. Variation 6802
1	GM80484	Seal	1
2	GM77151	Screw	8
3	GM83067	Hub	1
4	GM80393	Torsional Damper	1
5	GM83068	Torx Head Bolt, M8 x125 x 25	2
6	GM80262	Hub	1
7	#	Screw, M16 x 30	1
8	224089	Washer	6
9	#	Cap Screw, M12 x 75	6

Common hardware; procure locally.

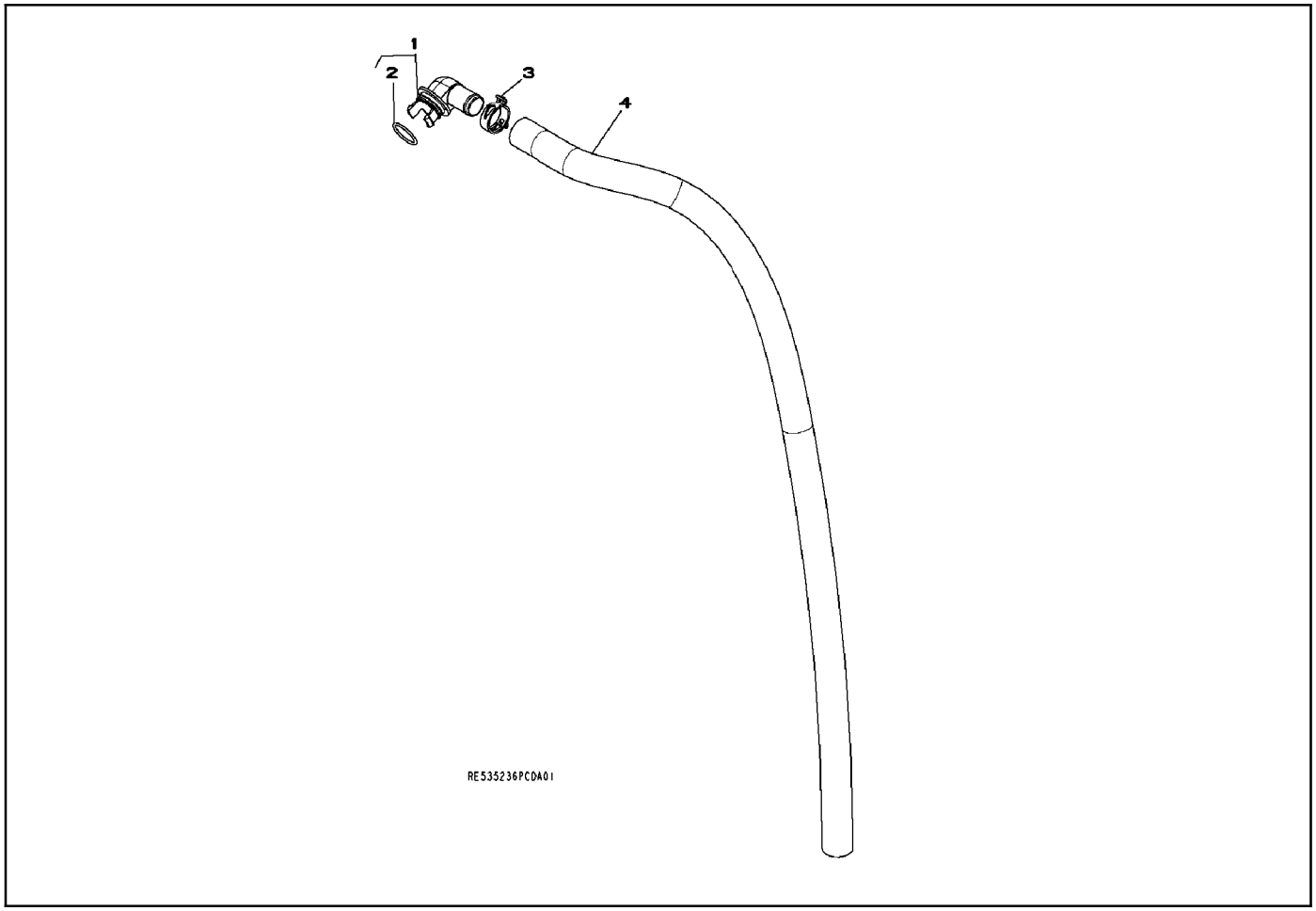
Group 8: Crankshaft Damper, continued



Item	Part Number	Description	Qty. Variation 6814
1	GM80484	Seal	1
2	GM77151	Screw	8
3	GM83061	Torsional Damper	1
4	GM83062	Shim	1
5	GM83063	Spacer	1
6	224089	Washer	6
7	-	Cap Screw	6
8	GM83064	Adapter	1
9	#	Screw, M12 X 30	4
10	GM50231	Torsional Damper	1
11	#	Screw	6

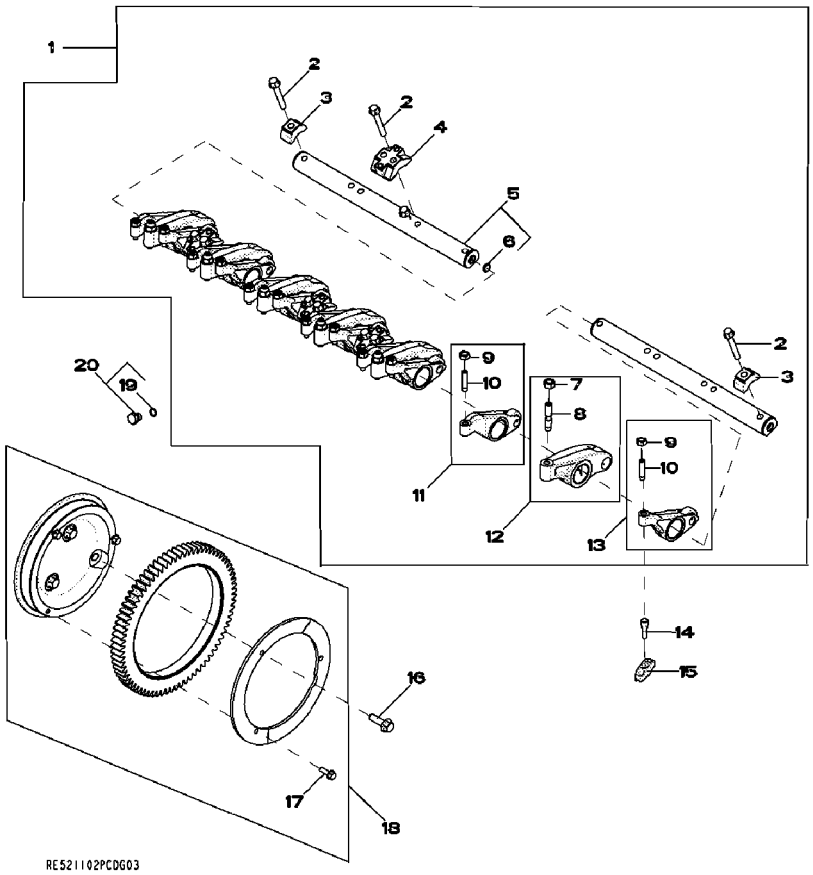
Common hardware; procure locally.

Group 10: Vent Tube



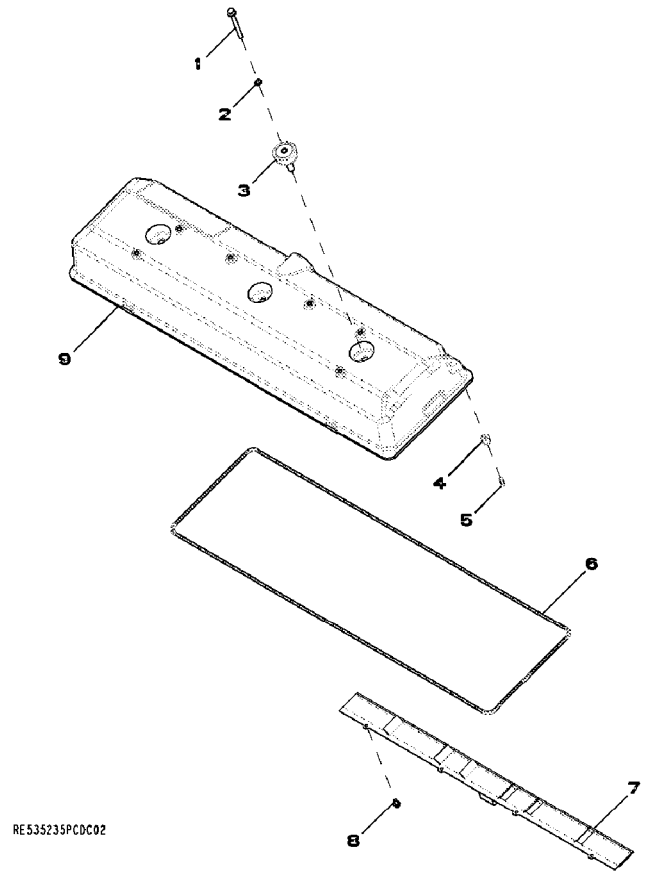
Item	Part Number	Description	Qty. Variation 2908
1	GM50285	Fitting, elbow	1
2	360170	O-ring	1
3	GM79815	Clamp	1
4	GM79814	Hose	1

Group 12: Valve Mechanism, Rocker Arm



Item	Part Number	Description	Qty. Variation 4903
1	GM80474	Rocker Arm	1
2	GM80282	Screw	12
3	GM80297	Clamp	2
4	GM80298	Clamp	5
5	GM80397	Rocker Arm Shaft	2
6	GM80221	Plug	2
7	GM80270	Nut	6
8	GM80249	Screw	6
9	GM80287	Nut	12
10	GM80252	Screw	12
11	GM80395	Rocker Arm (Exhaust)	6
12	GM80391	Rocker Arm (Injector)	6
13	GM80396	Rocker Arm (Intake)	6

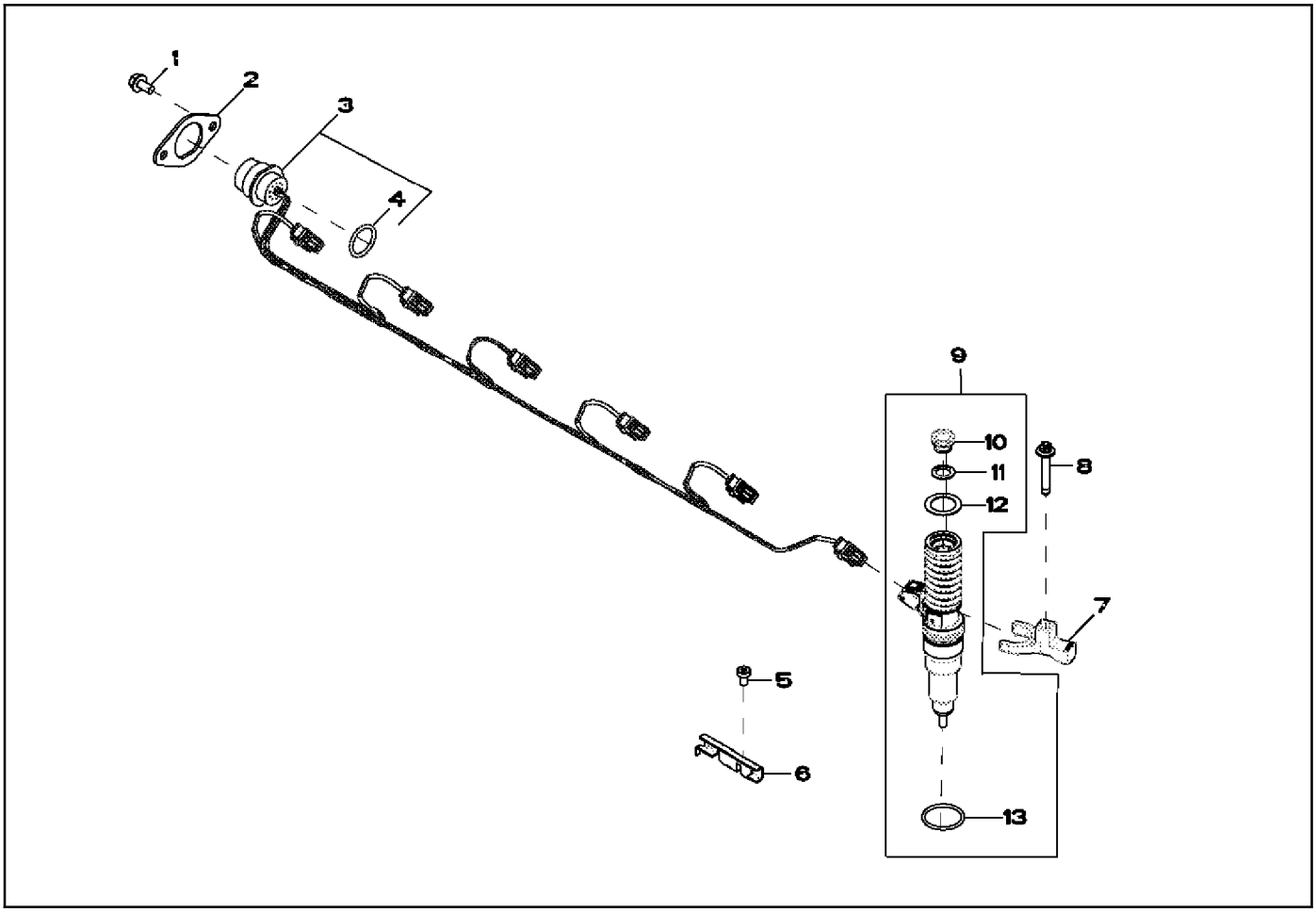
Group 13: Rocker Arm Cover



Item	Part Number	Description	Qty. Variation 1104
1	#	Screw, M8 x 80	3
2	GM80349	Sealing Washer	3
3	GM80492	Isolator	3
4	GM80295	Grommet	2
5	GM80253	Needle Roller	2
6	GM80329	Gasket	1
7	GM80457	Panel	1
8	GM50057	Screw	4
9	GM80343	Valve Cover	1

Common hardware; procure locally.

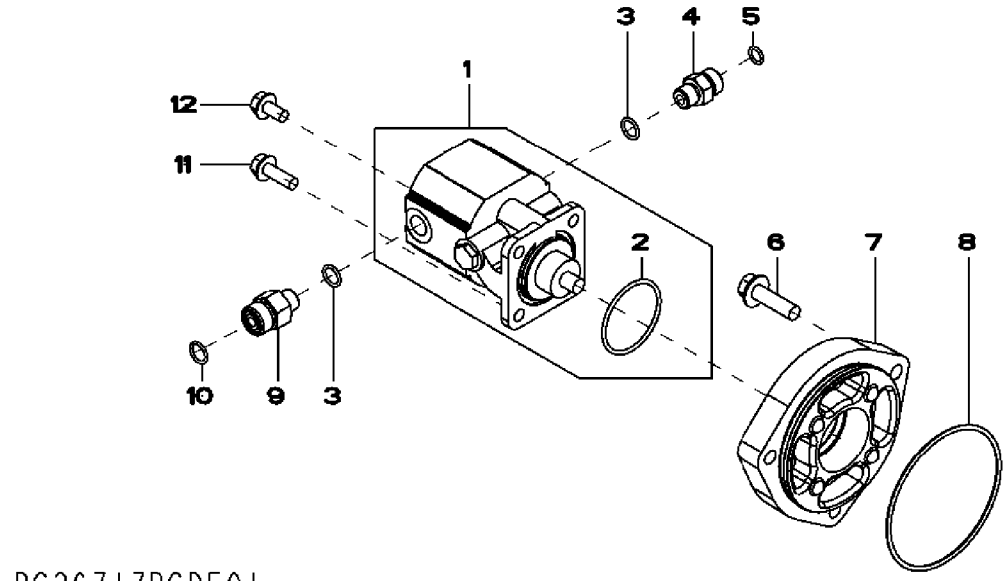
Group 14: Fuel Injection System



Item	Part Number	Description	Qty. Variation 1676
1	#	Screw, M8 x 16	2
2	GM80266	Bracket	1
3	GM80471	Wiring Harness	1
4	224028	O-ring	1
5	GM80414	Socket Head Screw	5
6	GM80320	Clip	5
7	GM80306	Clamp	6
8	GM80359	Screw	6
9	GM80467	Electronic Unit Injector	6
10	GM80300	Socket	1
11	GM80346	Pad	1
12	GM80301	Snap Ring	1
13	GM80274	Packing	1

Common hardware; procure locally.

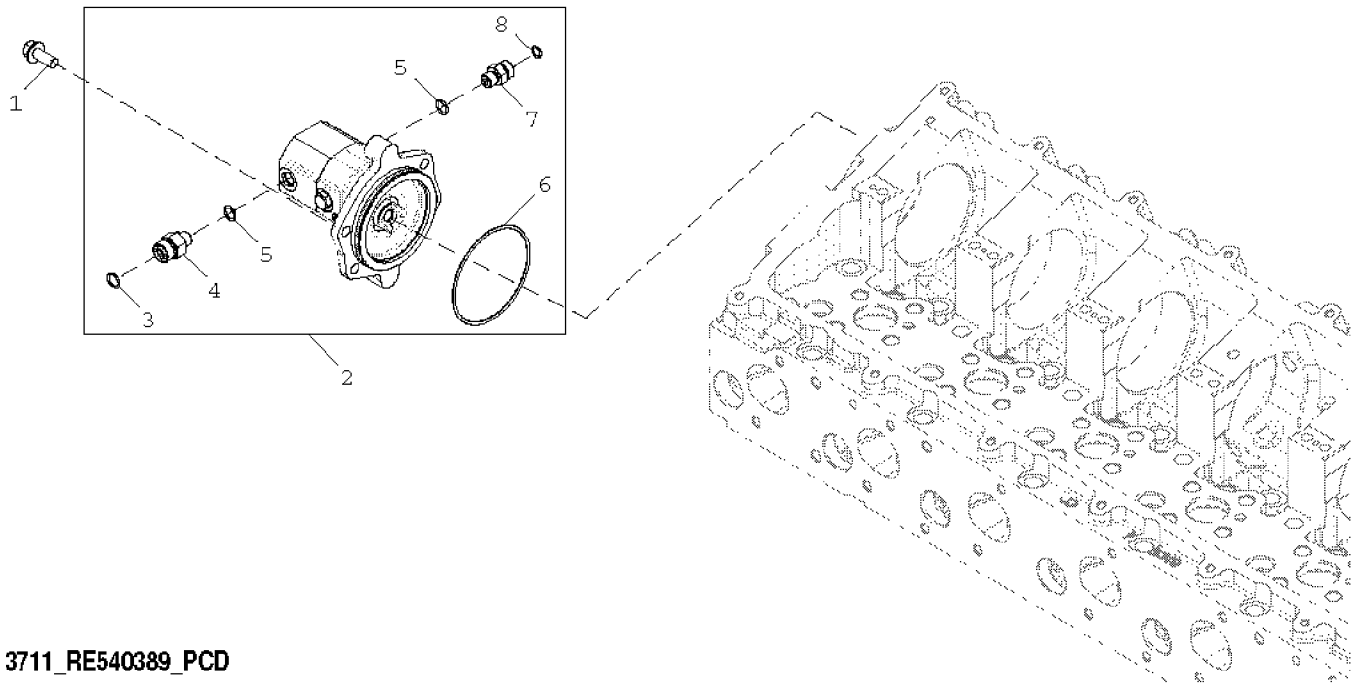
Group 15: Fuel Transfer Pump



Item	Part Number	Description	Qty. Variation 3701
1	GM80465	Fuel Pump	1
2	GM80496	O-Ring	1
3	GM80497	O-Ring	2
4	GM67272	Adapter fitting	1
5	360555	O-ring	1
6	M933-10035-82	Screw, hex cap M10 x 35mm	3
7	GM80258	Bracket	1
8	GM80293	O-Ring	1
9	GM80224	Adapter Fitting	1
10	GM80494	O-Ring	1
11	#	Screw, M8 x 25	2
12	#	Screw, M8 x 16	2

Common hardware; procure locally.

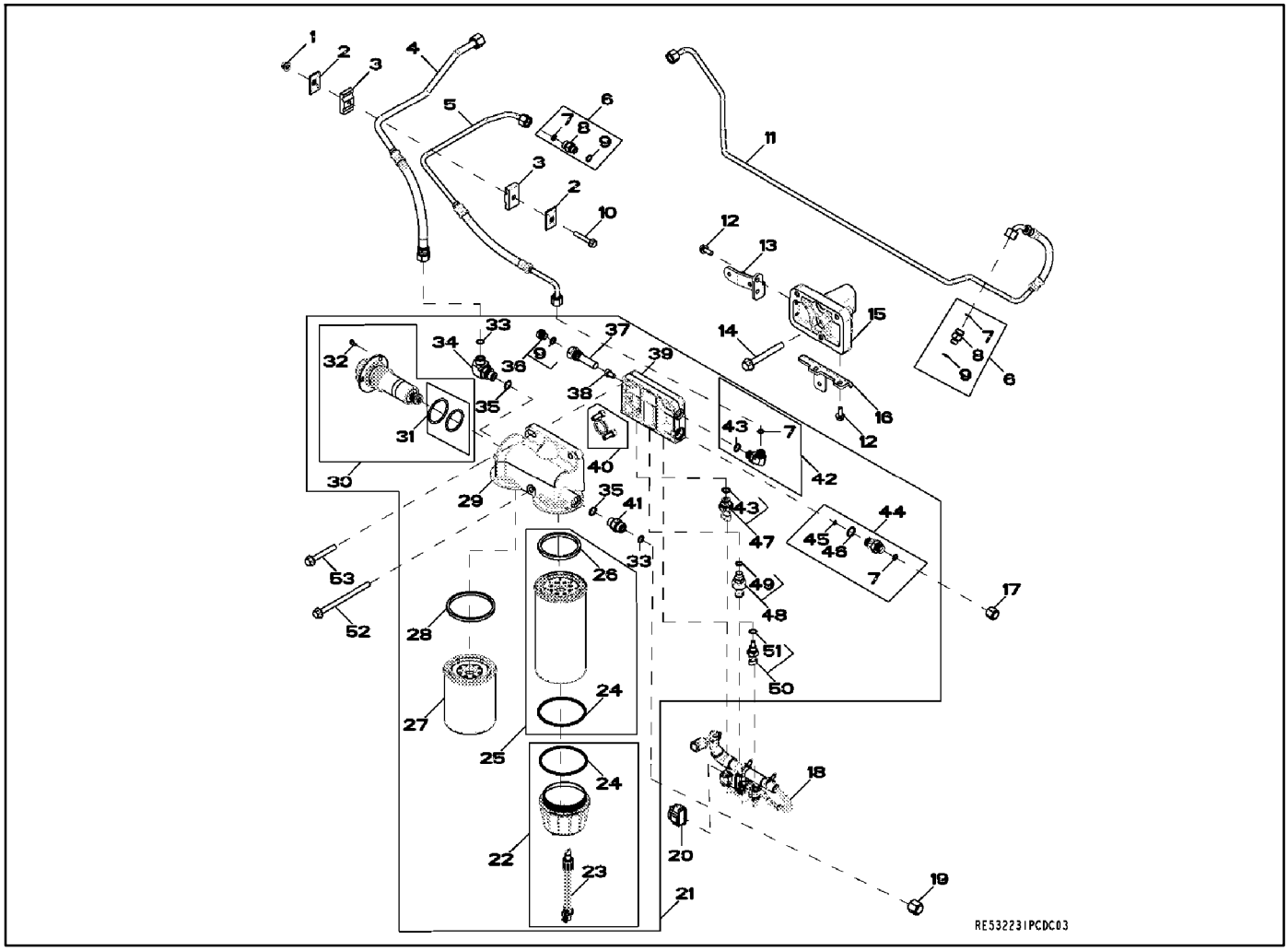
Group 15: Fuel Transfer Pump, continued



Item	Part Number	Description	Qty. Variation 3711
1	#	Screw, M10 X 25	4
2	GM83055	Fuel Pump	1
3	GM80494	O-Ring	1
4	GM83056	Adapter Fitting	1
5	GM80497	O-Ring	2
6	GM80293	O-Ring	1
7	GM83057	Adapter Fitting	1
8	360165	O-Ring	1

Common hardware; procure locally.

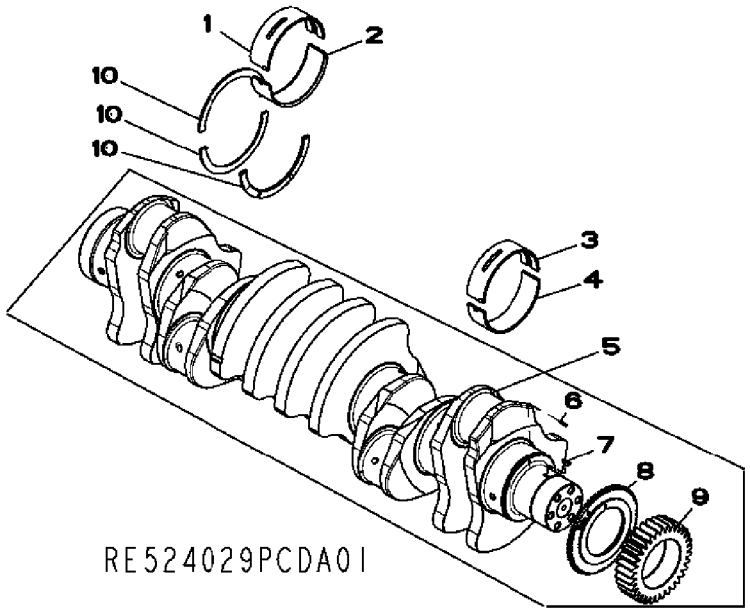
Group 18: Fuel Filter



Item	Part Number	Description	Qty. Variation 3525
1	#	Lock Nut, M8	1
2	GM80240	Plate	2
3	GM80239	Clamp	2
4	GM80455	Fuel Line	1
5	GM80458	Fuel Line	1
6	GM52807	Fitting	2
7	360165	O-ring	4
8	GM50106	Fitting, adapter	1
9	GM50114	O-ring	3
10	#	Screw, M8 x 50	1
11	GM80488	Fuel Line	1
12	#	Screw, M8 x 20	4
13	GM80352	Bracket	1
14	#	Screw, M12 x 100	2
15	GM80354	Bracket	1
16	GM80355	Bracket	1
17	GM80225	Fitting	1
18	GM80472	Wiring Harness	1
19	GM80226	Fitting	1
20	#	Electrical Connector Assy	1
21	GM80487	Fuel Filter	1
22	GM80459	Sediment Bowl	1
23	GM80429	Sensor	1
24	GM80357	Packing	2
25	GM80460	Filter Element	1
26	GM80365	Packing	1
27	GM80469	Filter Element	1
28	GM80364	Packing	1
29	GM80464	Filter Head	1
30	GM80482	Fuel Pump	1
31	GM80462	O-Ring	1
32	GM80223	Screw	3
33	GM80494	O-Ring	2
34	GM80228	Elbow Fitting	1
35	GM80381	O-Ring	2
36	GM52830	Drain plug	1
37	GM80412	Valve	1
38	GM80303	Insert	1
39	GM80353	Manifold	1
40	GM80466	Manifold Kit	1
41	GM80227	Adapter Fitting	1
42	GM52838	Adapter	1
43	GM50115	O-ring	2
44	GM80468	Check Valve	1
45	223858	O-ring	1
46	GM80367	O-Ring	1
47	GM80461	Pressure Sensor	1
48	GM80383	Pressure Sensor	1
49	GM18757	O-ring	1
50	GM50195	Sensor	1
51	GM21508	O-ring	1
52	#	Screw, M10 x 150	1
53	#	Screw, M10 x 70	2

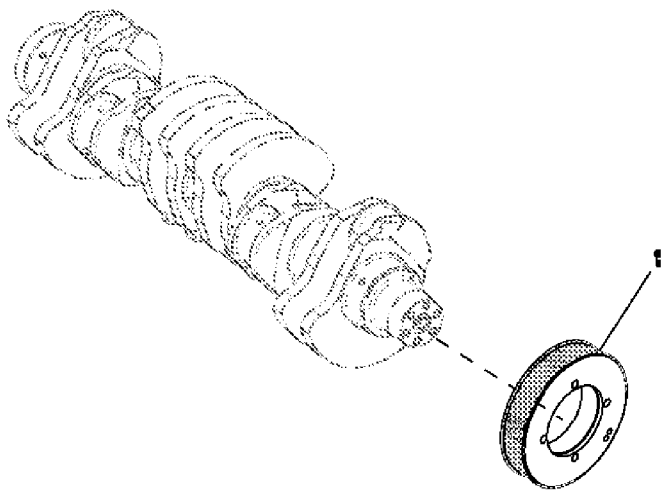
Common hardware; procure locally.

Group 19: Crankshaft



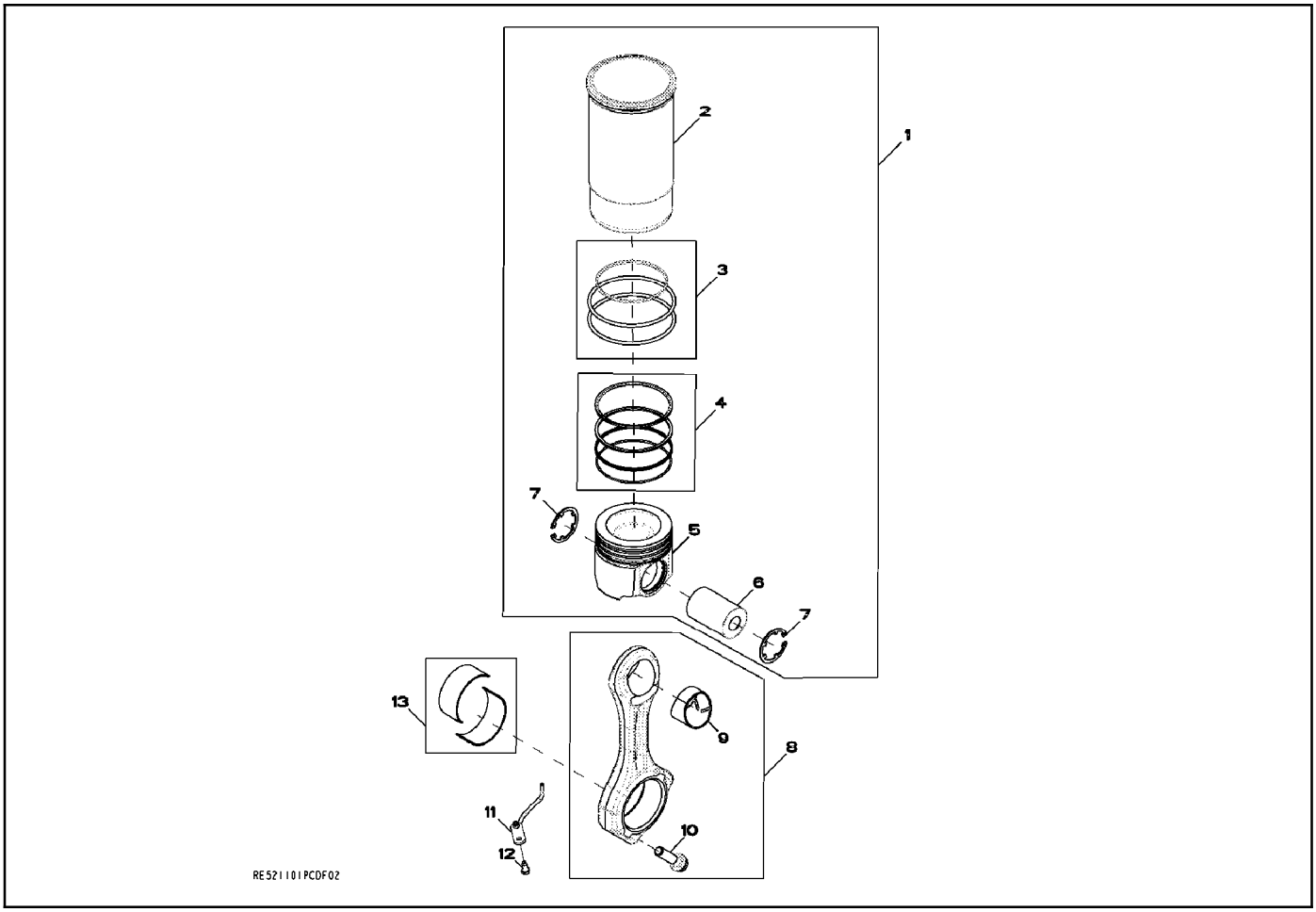
Item	Part Number	Description	Qty. Variation 4702
1	GM80439	Bearing Kit, Main Thrust	1
2	-	Bearing	1
3	GM80438	Bearing Kit, Main	6
4	-	Bearing	6
5	GM80402	Crankshaft	1
6	GM80222	Spring Pin	1
7	360503	Shaft key	1
8	GM80265	Wheel Speed Sensor	1
9	GM80318	Gear	1
10	GM80446	Washer Kit, Thrust (Std.)	1
10	GM80452	Thrust Washer US 0.180 MM (.007)	1

Group 20: Crankshaft Pulley



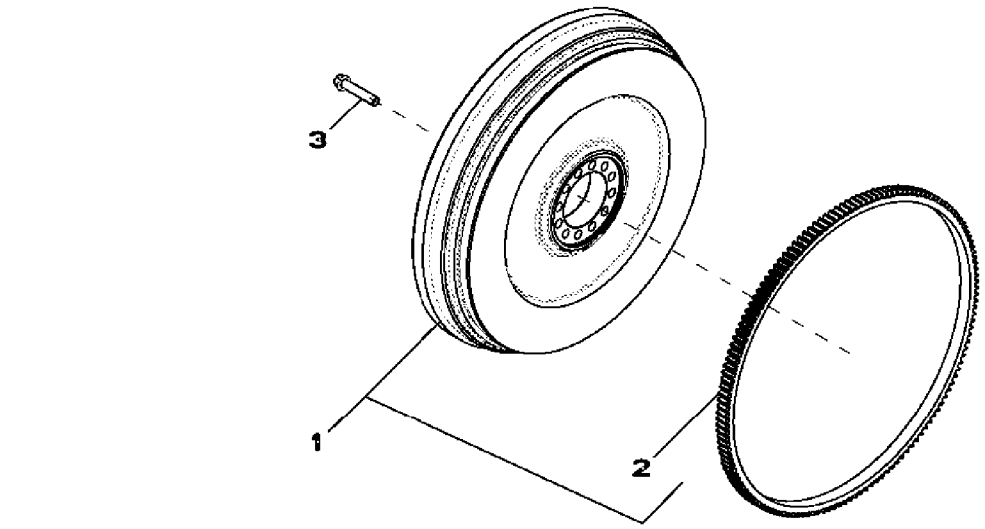
Item	Part Number	Description	Qty. Variation 1341	Qty. Variation 1398
1	GM80308	Pulley	1	
1	-	Pulley (See Group 8)		1

Group 21: Piston & Connecting Rod



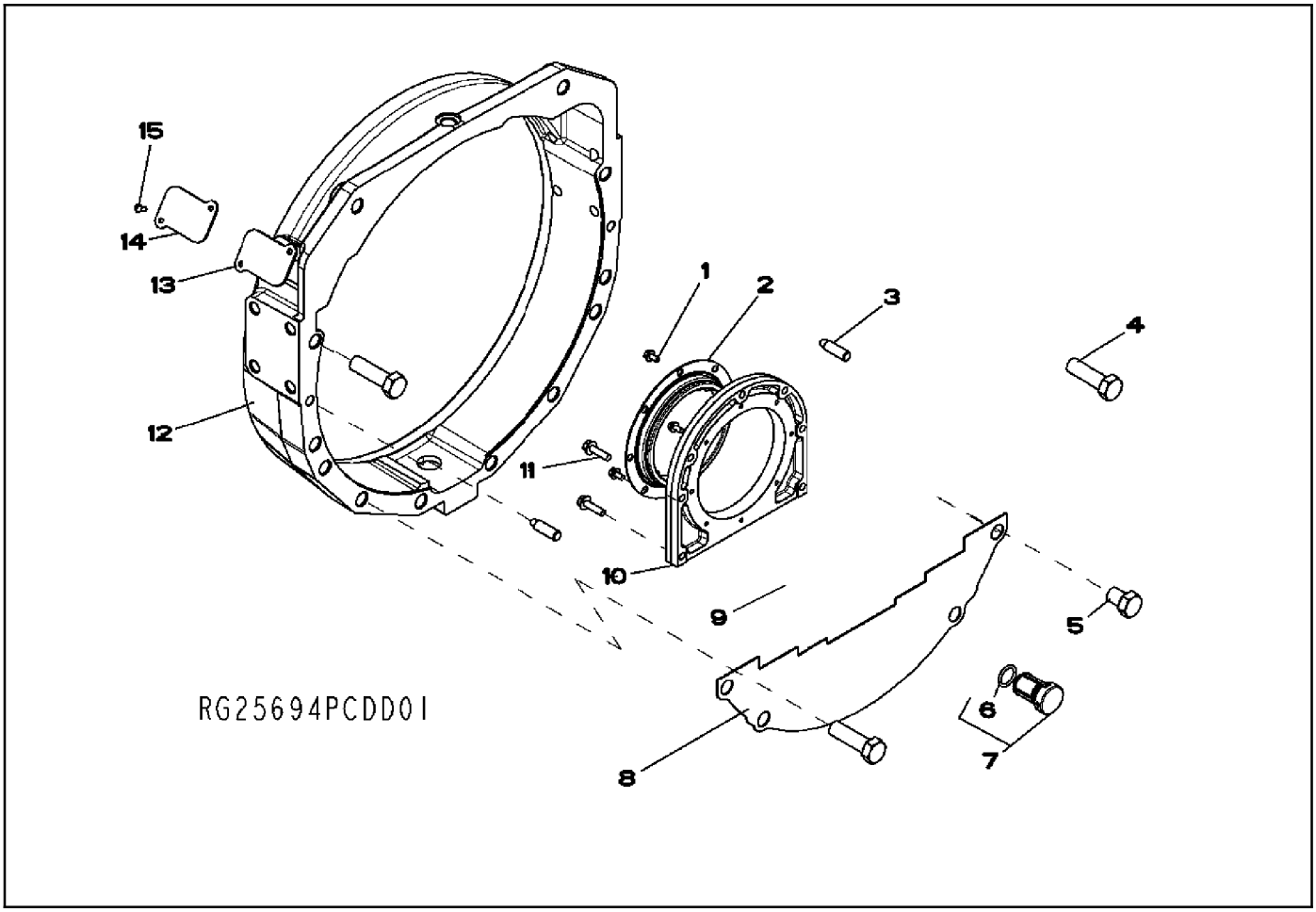
Item	Part Number	Description	Qty. Variation 4803
1	GM80441	Piston-Liner Kit	6
2	-	Cylinder Liner (Order Piston-Liner Kit)	1
3	GM80235	O-Ring Kit	1
4	GM80436	Piston Ring Kit	1
5	-	Piston (Order Piston-Liner Kit)	1
6	GM80310	Piston Pin	1
7	GM80230	Snap Ring	2
8	GM80394	Connecting Rod	6
9	-	Bushing (Order Connecting Rod)	1
10	GM80296	Cap Screw	2
11	GM80433	Nozzle	6
12	GM80435	Self-Locking Screw	6
13	GM80440	Bearing Kit, Connecting Rod	6
13	GM80450	Bearing Kit, Conn Rod 0.25 MM US	6
13	GM80451	Bearing Kit, Conn Rod 0.50 MM US	6

Group 22: Flywheel



Item	Part Number	Description	Qty. Variation 1506
1	GM80479	Flywheel	1
2	GM80380	Gear	1
3	GM80255	Cap Screw	12

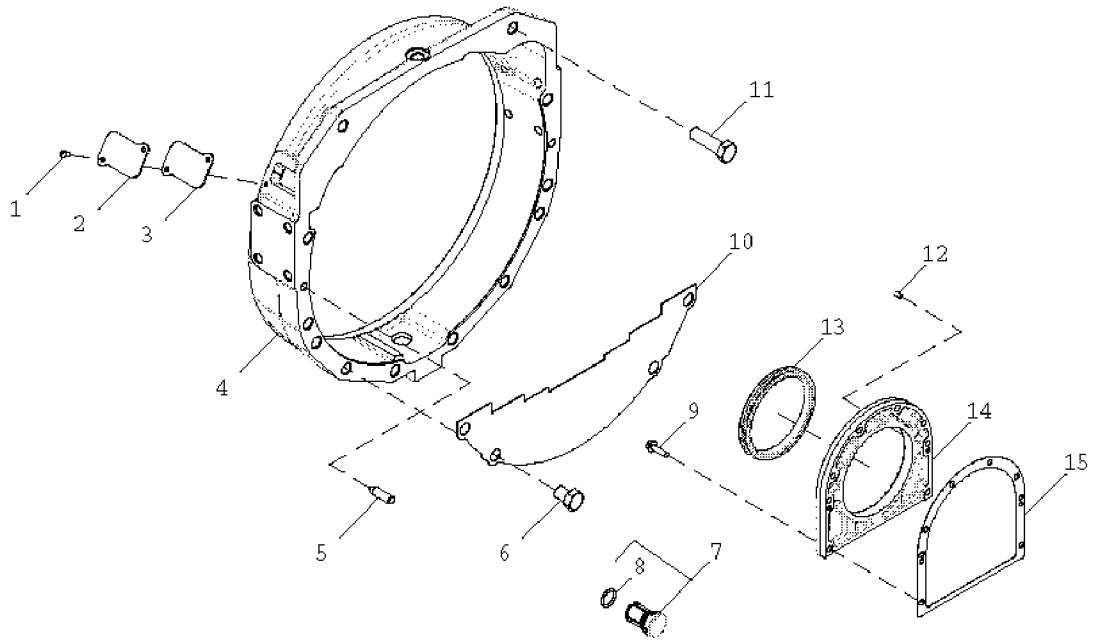
Group 23: Flywheeling Housing



Item	Part Number	Description	Qty. Variation 1401
1	GM80268	Screw	8
2	GM80478	Seal	1
3	352707	Dowel Pin	2
4	#	Cap Screw	6
5	#	Cap Screw	4
6	223747	O-ring	1
7	223683	Plug	1
8	GM80273	Cover	1
9	GM80323	Gasket	1
10	GM80250	Housing	1
11	#	Screw, M8 x 30	7
12	GM80264	Housing (SAE 1)	1
13	GM52593	Gasket	1
14	GM80317	Cover	1
15	GM80220	Screw	2

Common hardware; procure locally.

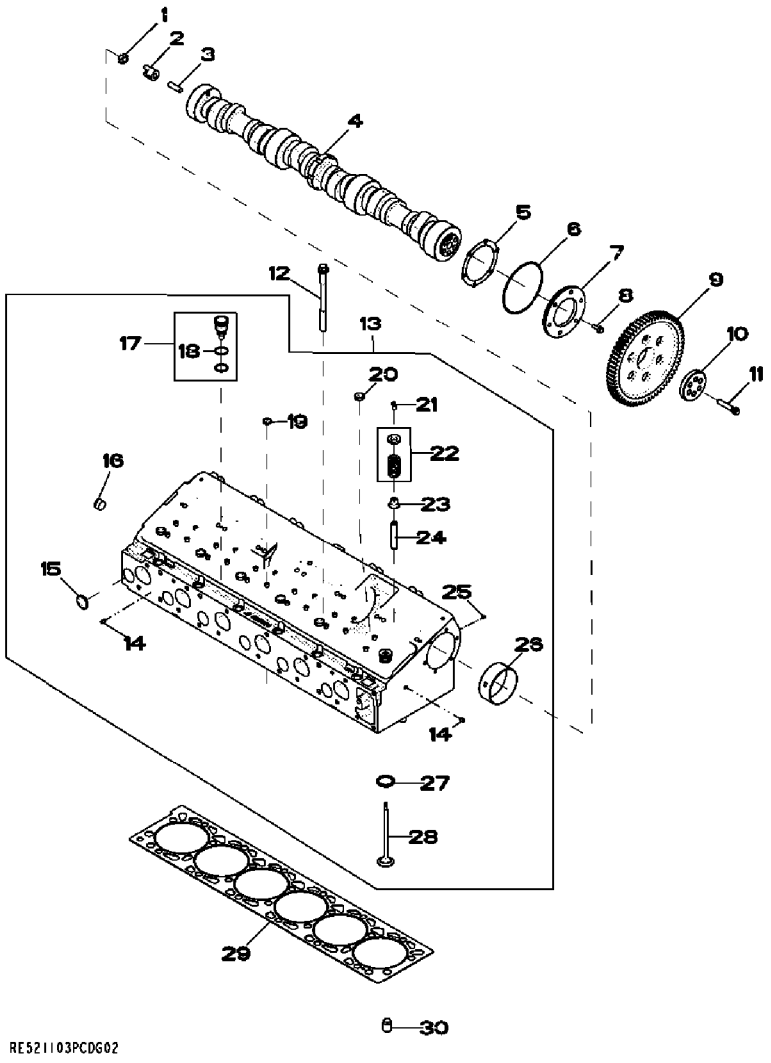
Group 23: Flywheeling Housing



Item	Part Number	Description	Qty. Variation 1414
1	GM80220	Screw, 0.216 X 1/2”	2
2	GM80317	Cover	1
3	GM52593	Gasket	1
4	GM80264	Housing	1
5	352707	Dowel Pin	2
6	#	Cap Screw, 3/4 X 1”	4
7	223683	Plug	1
8	223747	O-Ring	1
9	#	Screw, M8 X 30	8
10	GM80273	Cover	1
11	#	Cap Screw, 3/4 X 2-1/2”	6
12	223731	Dowel Pin	2
13	GM79799	Seal	1
14	GM83042	Housing	1
15	GM83043	Gasket	1

Common hardware; procure locally.

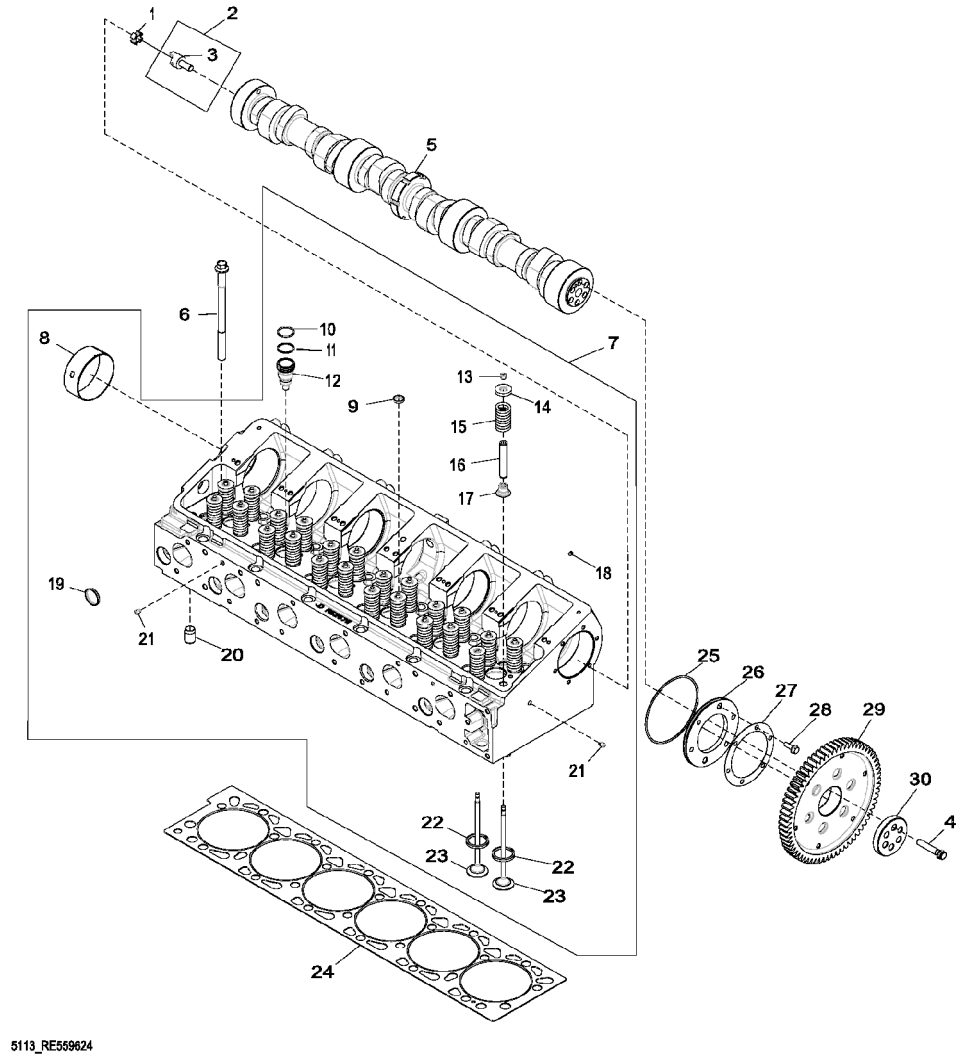
Group 24: Cylinder Head & Camshaft



Item	Part Number	Description	Qty. Variation 5107
1	GM80299	Spider	1
2	GM80257	Coupling	1
3	GM80256	Shaft	1
4	GM80341	Camshaft	1
5	GM80290	Gasket	1
6	GM80377	O-Ring	1
7	GM80260	Ring	1
8	#	Screw, M8 x 25	6
9	GM80251	Gear	1
10	GM80363	Spacer	1
11	360081	Cap Screw	6
12	GM80445	Kit, Cylinder Head Bolts	1
13	GM80442	Cylinder Head	1
14	GM80351	Plug	3
15	GM80245	Plug	5
16	GM53024	Plug, pipe	1
17	GM80449	Sleeve	6
18	360170	O-ring	1
19	GM63925	Plug	6
20	223409	Plug	6
21	GM50173	Retainer	48
22	GM80389	Kit, Valve Spring/Rotator	12
23	GM80406	Seal	24
24	GM80309	Guide	24
25	352704	Plug	1
26	GM80335	Bushing	4
27	GM80311	Valve Seat Insert	24
28	GM80312	Valve	24
29	GM80400	Engine Cyl. Head Gasket	1
30	GM80254	Dowel Pin	2

Common hardware; procure locally.

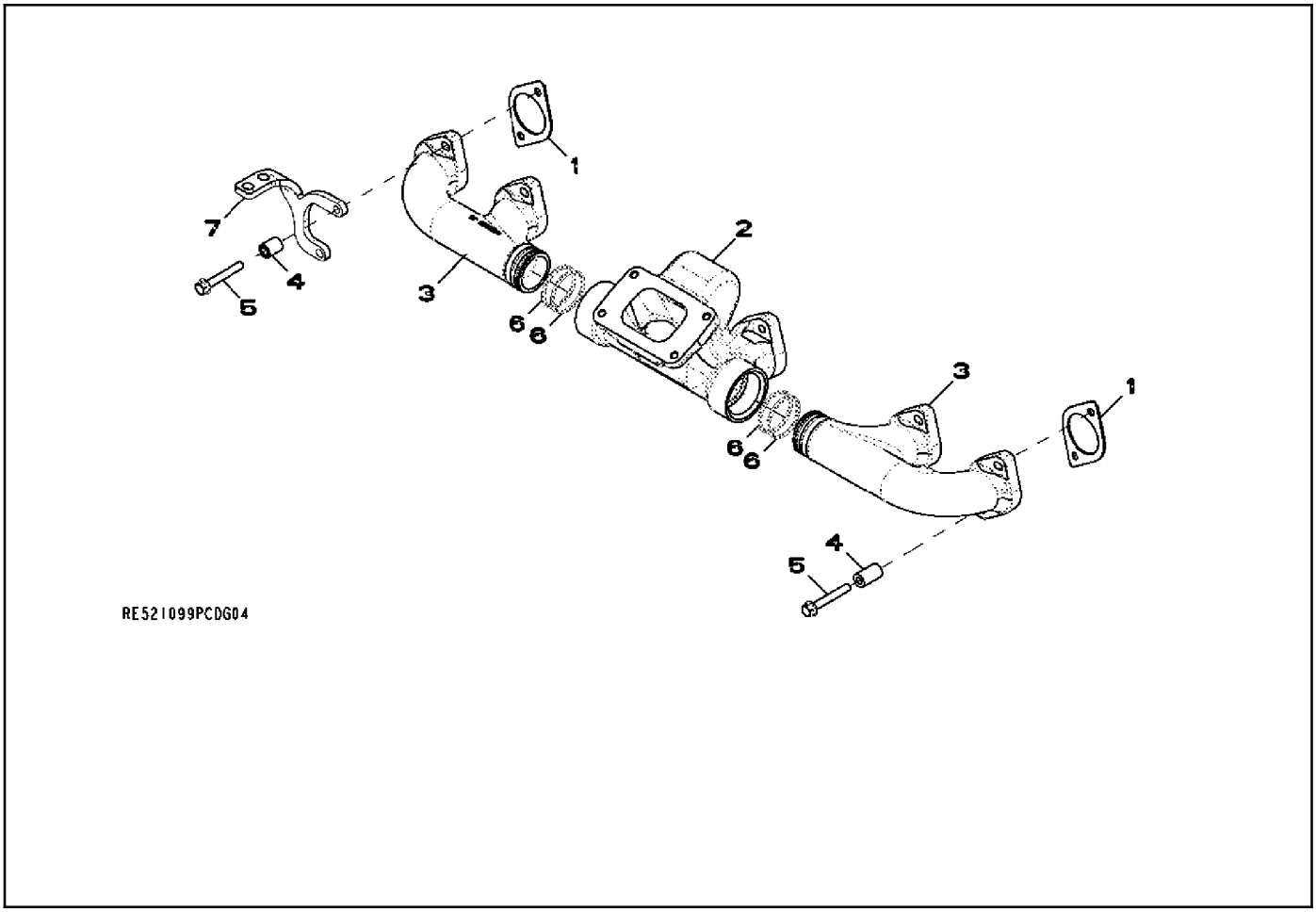
Group 24: Cylinder Head & Camshaft



Item	Part Number	Description	Qty. Variation 5113
1	GM80299	Spider	1
2	GM80256	Shaft	1
3	GM80257	Coupling	1
4	360081	Cap Screw	6
5	GM95166	Camshaft	1
6	GM95167	Cap Screw	26
7	GM95168	Cylinder Head	1
8	GM95169	Bushing	4
9	GM63925	Plug	6
10	360170	O-ring	1
11	GM95170	O-ring	1
12	GM80449	Sleeve	6
13	GM50173	Retainer	48
14	GM80389	Kit, Valve Spring/Rotator	24
15	GM95171	Spring	24

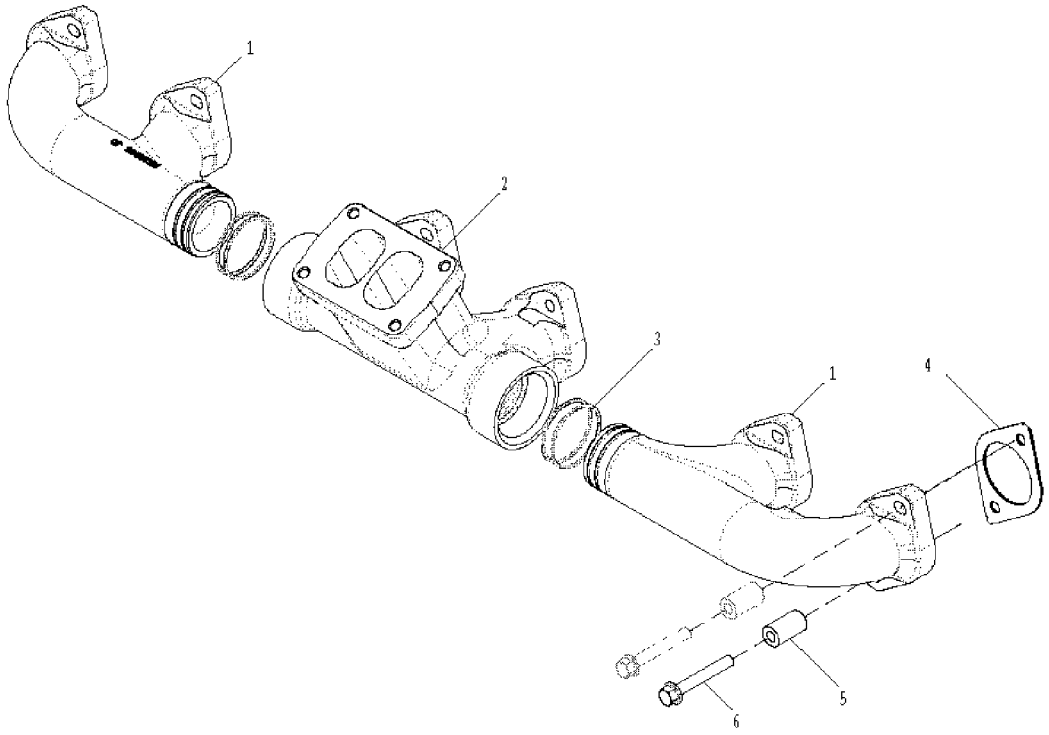
Item	Part Number	Description	Qty. Variation 5113
16	GM80309	Guide	24
17	GM80406	Seal	24
18	352704	Plug	1
19	GM80245	Plug	5
20	GM80254	Dowel Pin	2
21	GM80351	Plug	3
22	GM80311	Valve Seat Insert	24
23	GM80312	Valve	24
24	GM80400	Engine Cyl. Head Gasket	1
25	GM80377	O-Ring	1
26	GM80260	Ring	1
27	GM80290	Gasket	1
28	#	Screw, M8 x 25	6
29	GM95172	Gear	1
30	GM80363	Spacer	1

Group 25: Exhaust Manifold



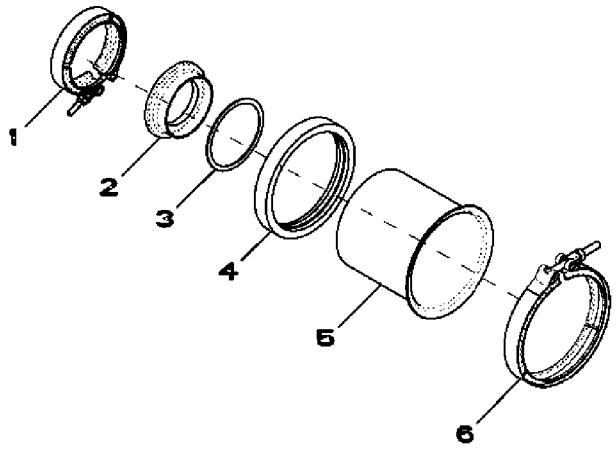
Item	Part Number	Description	Qty. Variation 2804
1	GM80361	Gasket	6
2	GM80313	Exhaust Manifold	1
3	GM80339	Exhaust Manifold	2
4	GM80379	Spacer	10
5	GM80282	Screw	1
6	GM80344	Ring	4
7	GM80362	Bracket	1

Group 25: Exhaust Manifold, continued



Item	Part Number	Description	Qty. Variation 2814
1	GM80339	Exhaust Manifold	2
2	GM83047	Exhaust Manifold	1
3	GM80344	Ring	4
4	GM80361	Gasket	6
5	GM80379	Spacer	12
6	GM80282	Screw	12

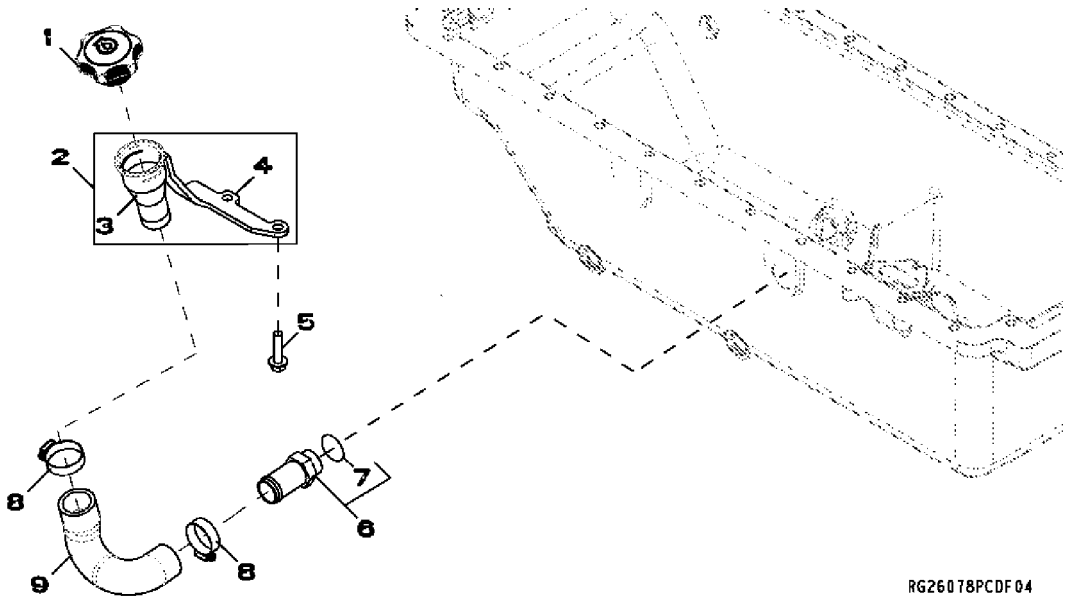
Group 26: Exhaust Outlet



RE528362PCDB02

Item	Part Number	Description	Qty. Variation 6405
1	GM80416	Clamp	1
2	GM80331	Flange	1
3	GM80332	Gasket	1
4	GM80279	Adapter Fitting	1
5	GM80324	Exhaust Pipe	1
6	GM80454	Clamp	1

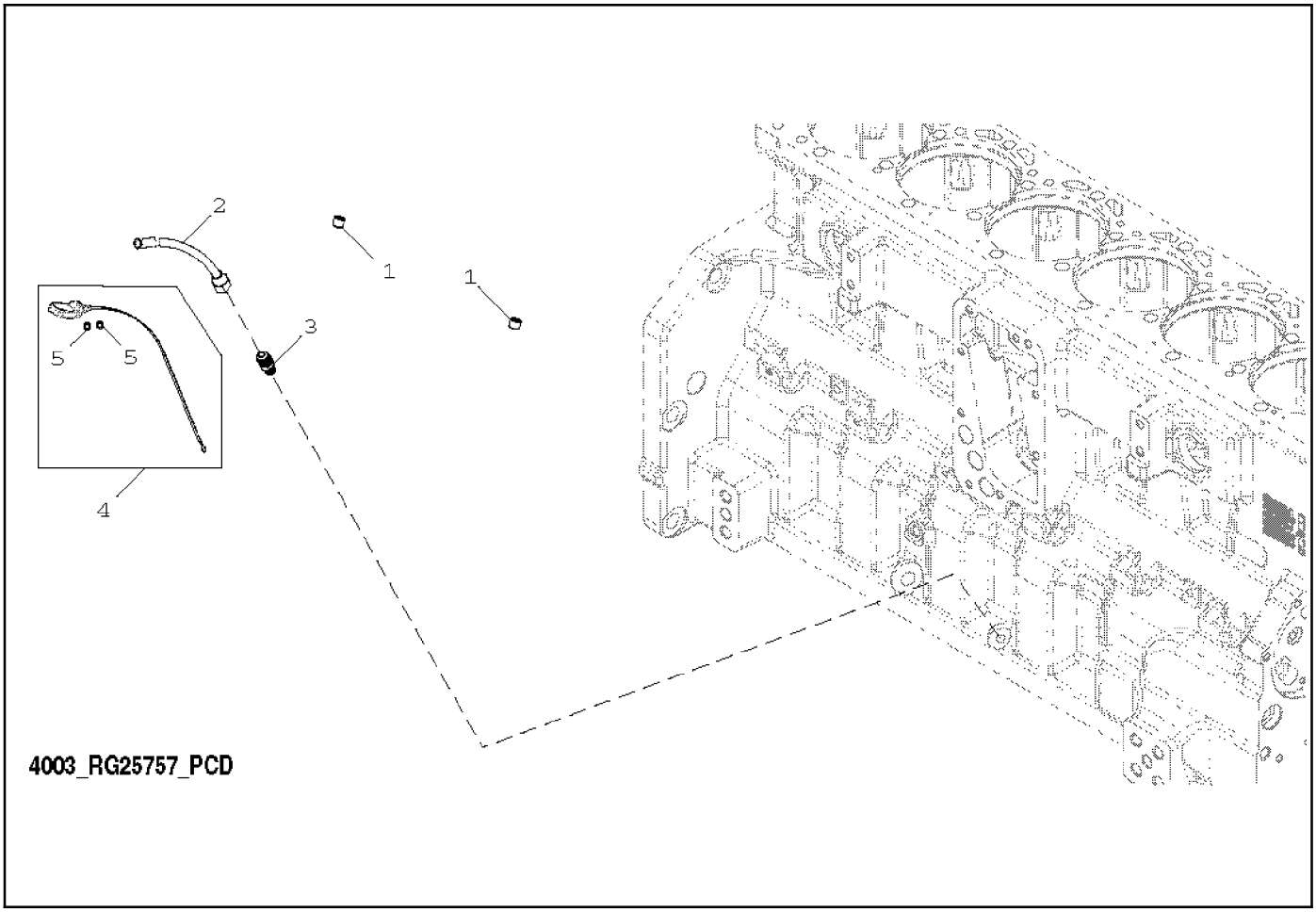
Group 27: Oil Filler



Item	Part Number	Description	Qty. Variation 1204
1	GM80473	Filler Cap	1
2	GM80390	Tube	1
3	GM18688	Dipstick tube	1
4	-	Bracket (not sold separately)	1
5	#	Screw, M10 x 40	2
6	GM80237	Hose Fitting	1
7	GM80284	O-Ring	1
8	GM80234	Clamp	2
9	GM80276	Hose	1

Common hardware; procure locally.

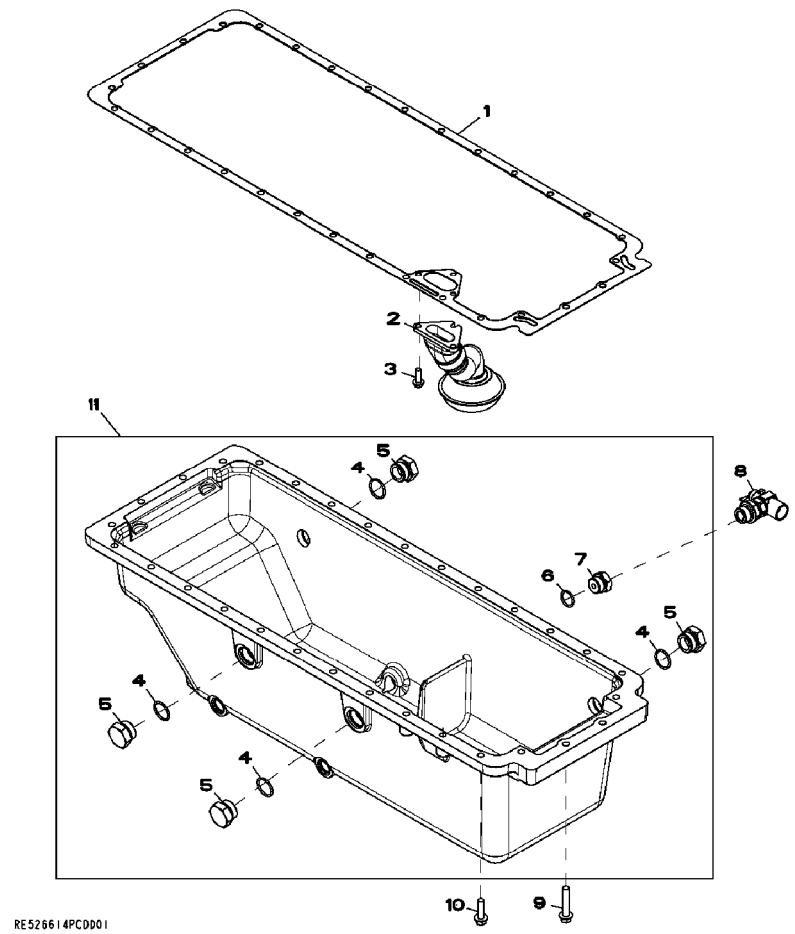
Group 28: Dipstick



Item	Part Number	Description	Qty. Variation 4003
1	#	Pipe Plug, 1/4”	2
2	GM80413	Dipstick Tube	1
3	GM18658	Adapter Fitting	1
4	GM83051	Dipstick	1
5	GM83052	O-Ring	2

Common hardware; procure locally.

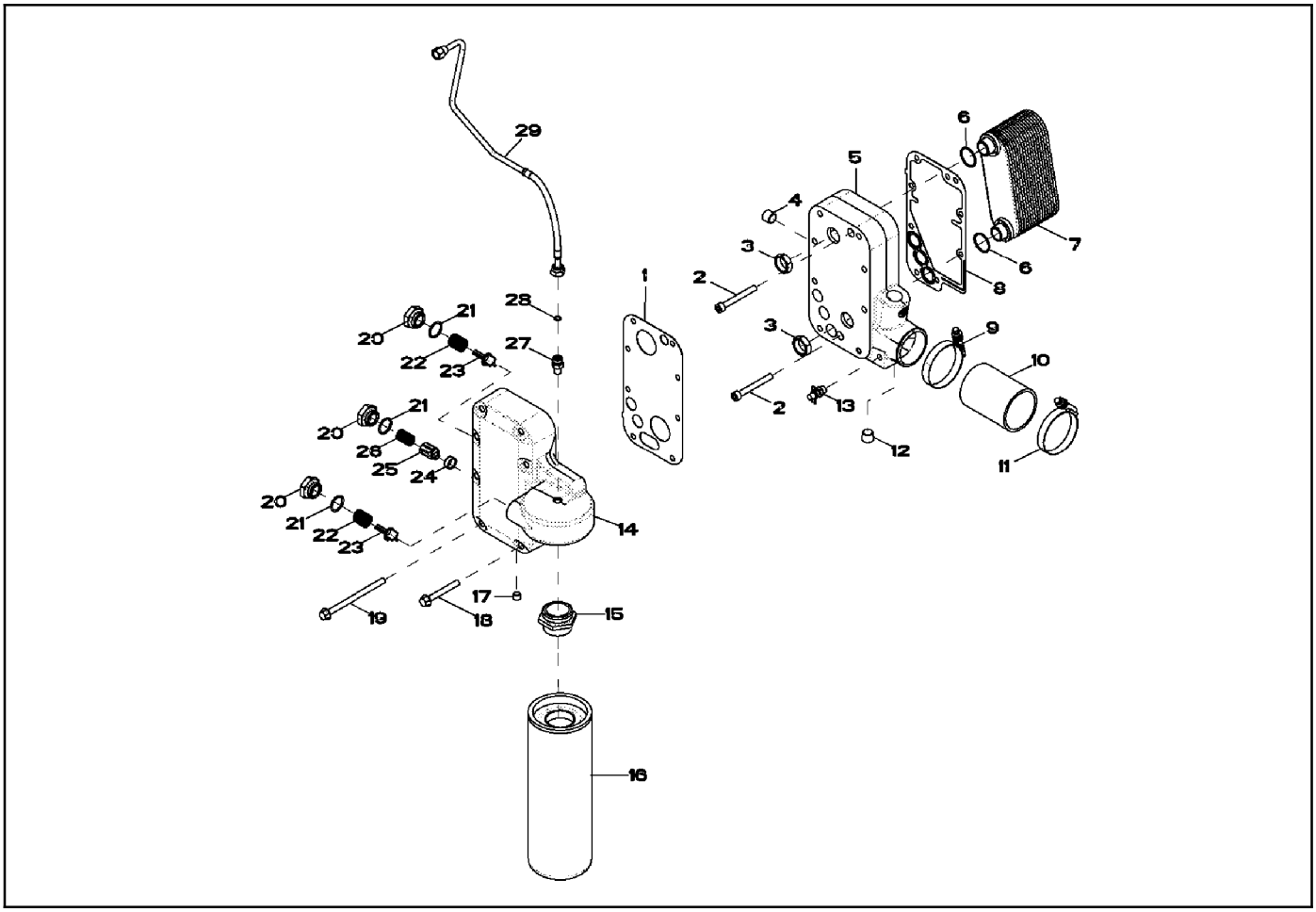
Group 29: Oil Pan



Item	Part Number	Description	Qty. Variation 1915
1	GM80321	Gasket	1
2	GM80432	Oil Pump Intake	1
3	#	Screw	3
4	GM80284	O-Ring	4
5	GM80285	Fitting Plug	4
6	GM80368	O-Ring	4
7	223748	Pipe Plug	4
8	GM80392	Drain Valve	1
9	#	Screw, M10 x 55	8
10	M933-10035-82	Screw, hex cap M10 x 35mm	20
11	GM80401	Oil Pan	1

Common hardware; procure locally.

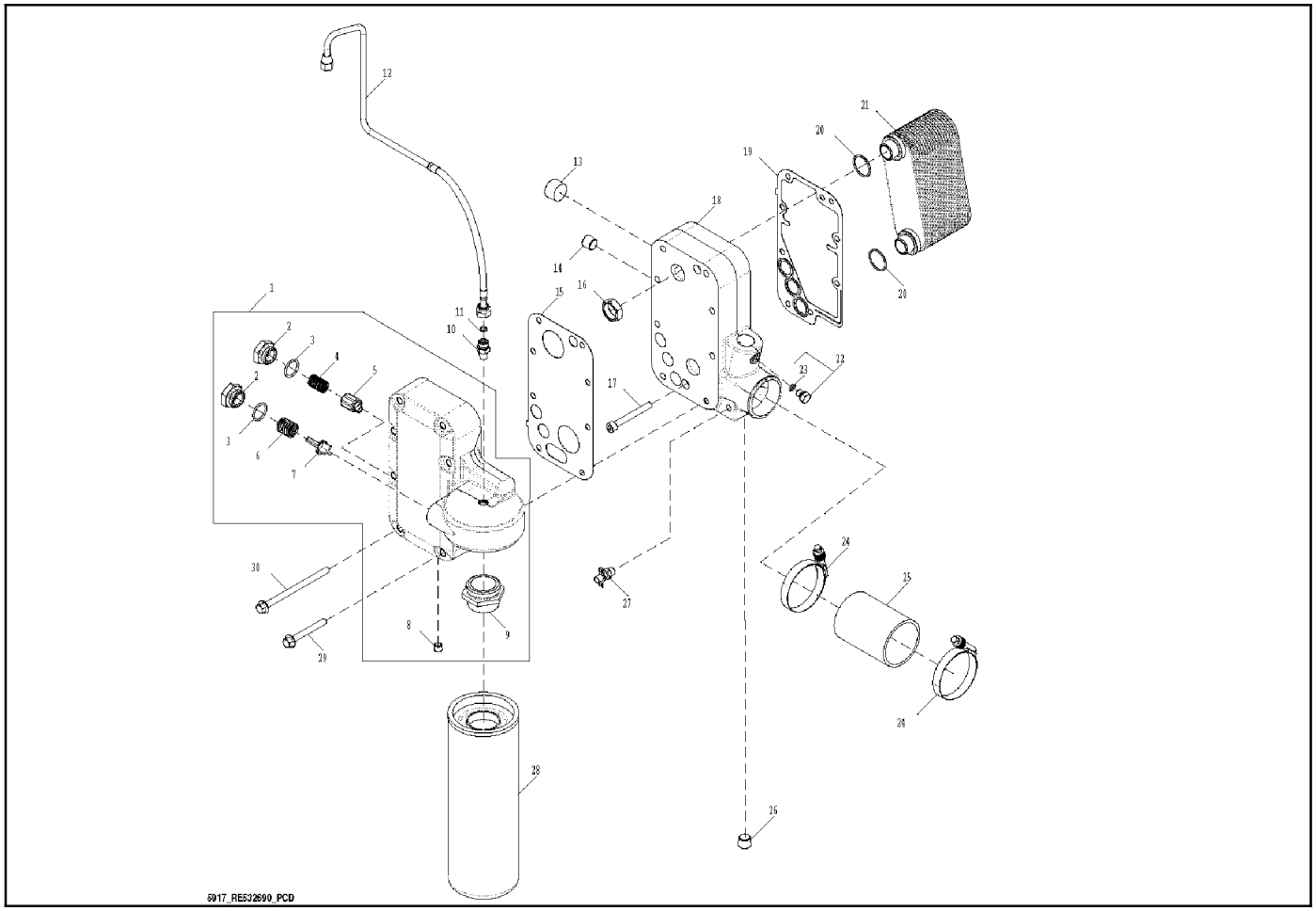
Group 30: Oil Filter



Item	Part Number	Description	Qty. Variation 5912
1	GM80289	Gasket	1
2	#	Screw, M10 x 85	2
3	GM80281	Nut	2
4	GM18862	Pipe plug, 1/2”	1
5	GM80307	Housing	1
6	GM80278	O-Ring	2
7	GM80387	Oil Cooler	1
8	GM80288	Gasket	1
9	GM18851	Clamp	1
10	GM80259	Hose	1
11	GM18851	Clamp	1
12	GM18862	Pipe plug, 1/2”	1
13	223435	Drain valve	1
14	-	Housing (not sold separately)	1
15	GM80267	Adapter Fitting	1
16	GM80434	Oil Filter	1
17	#	Pipe Plug	1
18	M931-10080-82	Screw, hex cap M10 x 80mm	1
19	#	Screw, M10 x 150	7
20	GM80291	Fitting Plug	3
21	223989	O-ring	3
22	352811	Spring, bypass	2
23	352722	Valve	2
24	GM80292	Bushing	1
25	352767	Relief valve	1
26	GM80271	Compression Spring	1
27	360006	Adapter	1
28	360555	O-ring	1
29	GM80407	Line	1

Common hardware; procure locally.

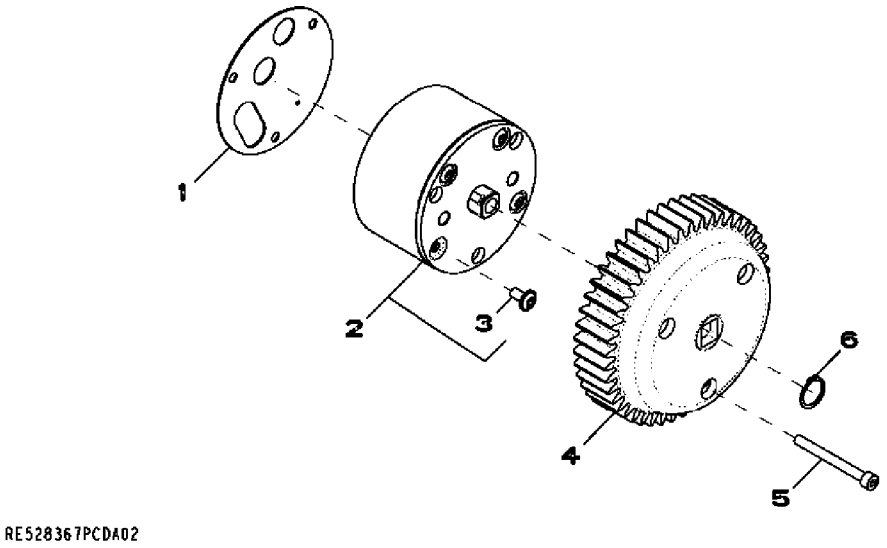
Group 30: Oil Filter, continued



Item	Part Number	Description	Qty. Variation 5917
1	GM83053	Filter Housing	1
2	GM80291	Fitting Plug	3
3	223989	O-Ring	3
4	GM80271	Compression Spring	1
5	352767	Pressure Relief Valve	1
6	352811	Spring	2
7	352722	Valve	2
8	#	Pipe Plug, 1/4”	1
9	GM80267	Adapter Fitting	1
10	360006	Adapter Fitting	1
11	360555	O-Ring	1
12	GM83054	Oil Line	1
13	#	Pipe Plug, 1”	1
14	GM18862	Pipe Plug	1
15	GM80289	Gasket	1
16	GM80281	Nut	2
17	#	Screw, M10 X 85	2
18	GM80307	Housing	1
19	GM80288	Gasket	1
20	GM80278	O-Ring	2
21	GM80387	Oil Cooler	1
22	360015	Fitting Plug	1
23	360178	O-Ring, 9.3 X 2.2 MM	1
24	GM18851	Clamp	2
25	GM80259	Radiator Hose	1
26	GM18862	Pipe Plug	1
27	223435	Drain Valve	1
28	GM80434	Oil Filter	1
29	M931-10080-82	Screw, M10 X 80	1
30	#	Screw, M10 X 150	7

Common hardware; procure locally.

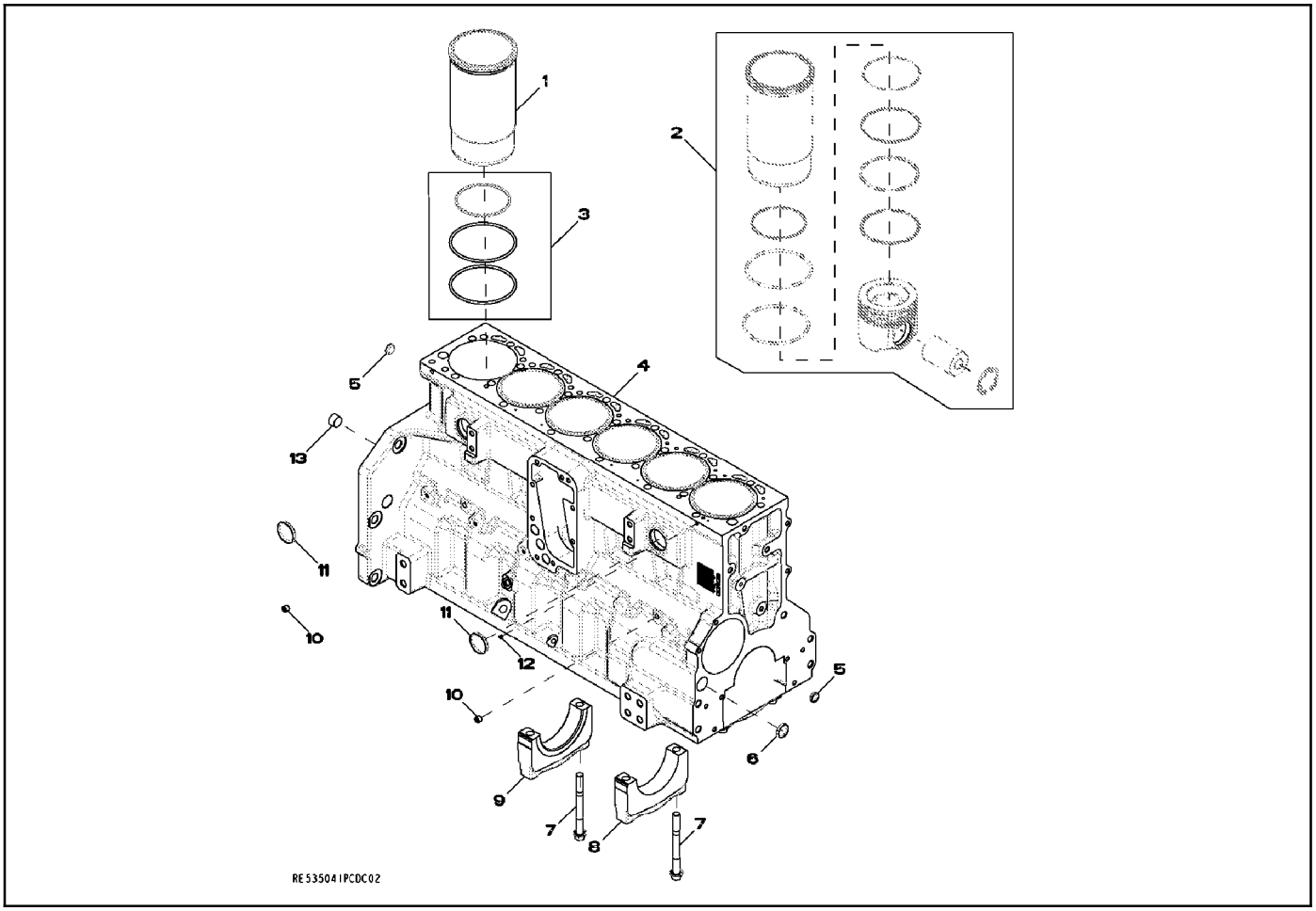
Group 31: Oil Pump



Item	Part Number	Description	Qty. Variation 5002
1	GM80294	Gasket	1
2	GM80428	Oil Pump	1
3	#	Screw, M8 x 16	4
4	GM80477	Gear	1
5	#	Screw, M8 x 80	3
6	GM80229	Snap Ring	1

Common hardware; procure locally.

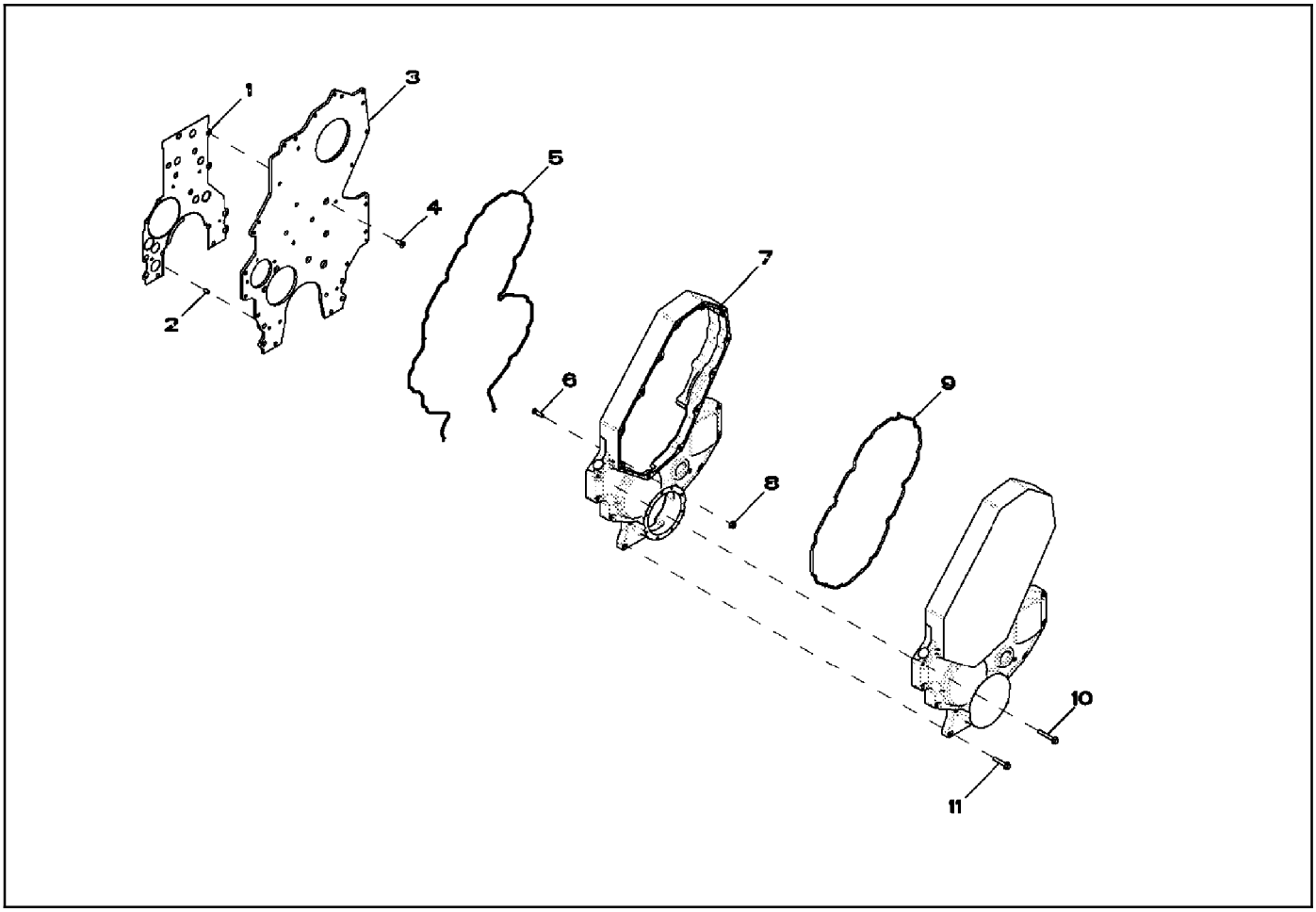
Group 32: Cylinder Block



Item	Part Number	Description	Qty. Variation 4606
1	-	Cylinder Liner (Order Piston-Liner Kit)	1
2	GM80441	Piston-Liner Kit	6
3	GM80235	O-Ring Kit	1
4	-	Cylinder Block (Order Short Block Assembly)	1
5	GM63925	Plug	2
6	360093	Plug	1
7	GM80316	Cap Screw	14
8	GM80314	Bearing Cap Main	6
9	GM80315	Bearing Cap Thrust	1
10	#	Pipe Plug	2
11	GM80304	Plug	2
12	352704	Plug	1
13	GM53024	Plug, pipe	1

Common hardware; procure locally.

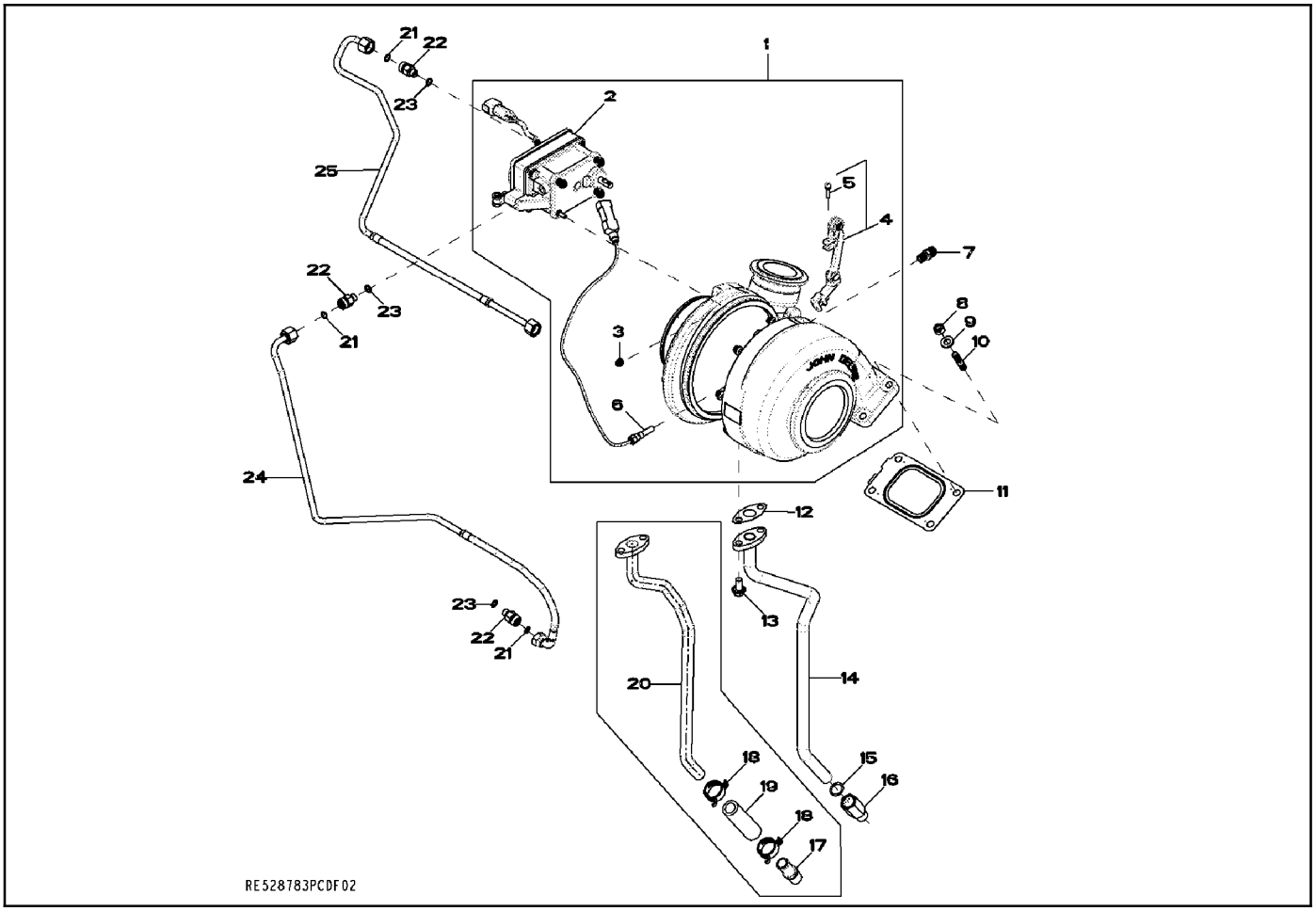
Group 34: Timing Gear Cover



Item	Part Number	Description	Qty. Variation 7701
1	GM80360	Gasket	1
2	223737	Dowel pin	2
3	GM80358	Plate	1
4	#	Screw, M10 x 25	5
5	GM80347	V-Ring Seal	1
6	GM80261	Bolt	1
7	GM80325	Cover	1
8	GM30375	Flange Nut, M10	1
9	GM80348	V-Ring Seal	1
10	#	Screw, M10 x 70	1
11	#	Screw, M10 x 55	9

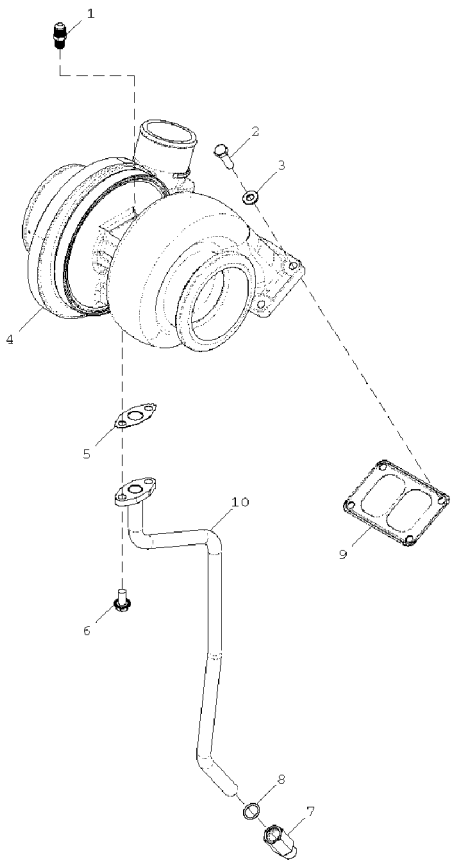
Common hardware; procure locally.

Group 35: Turbocharger



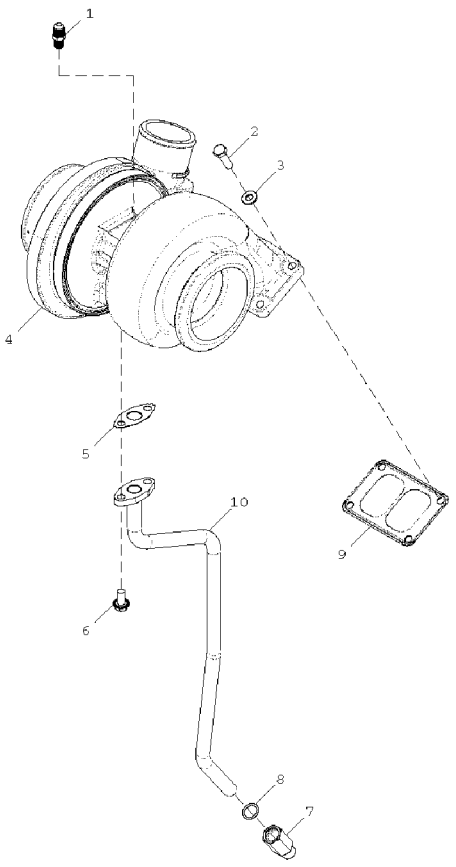
Item	Part Number	Description	Qty. Variation 6550
1	GM80475	Turbocharger	1
2	GM80404	Actuator	1
3	GM49824	Nut	4
4	GM80405	Linkage	1
5	GM50062	Screw with washer	2
6	GM50015	Sensor	1
7	GM18658	Fitting	1
8	GM80491	Nut	4
9	222767	Washer, Hardened	4
10	GM80372	Stud	4
11	GM80366	Gasket	1
12	GM80328	Gasket	1
13	GM80247	Screw, M10 x 20	2
14	GM80453	Oil Tube	1
15	223851	O-ring	1
16	223753	Adapter	1
17	223461	Hose fitting	1
18	GM50270	Hose clamp	2
19	224055	Hose	1
20	GM80408	Line	1
21	360555	O-ring	3
22	GM49819	Fitting, adapter	3
23	360178	O-ring	3
24	GM80409	Line	1
25	GM80410	Line	1

Group 35: Turbocharger



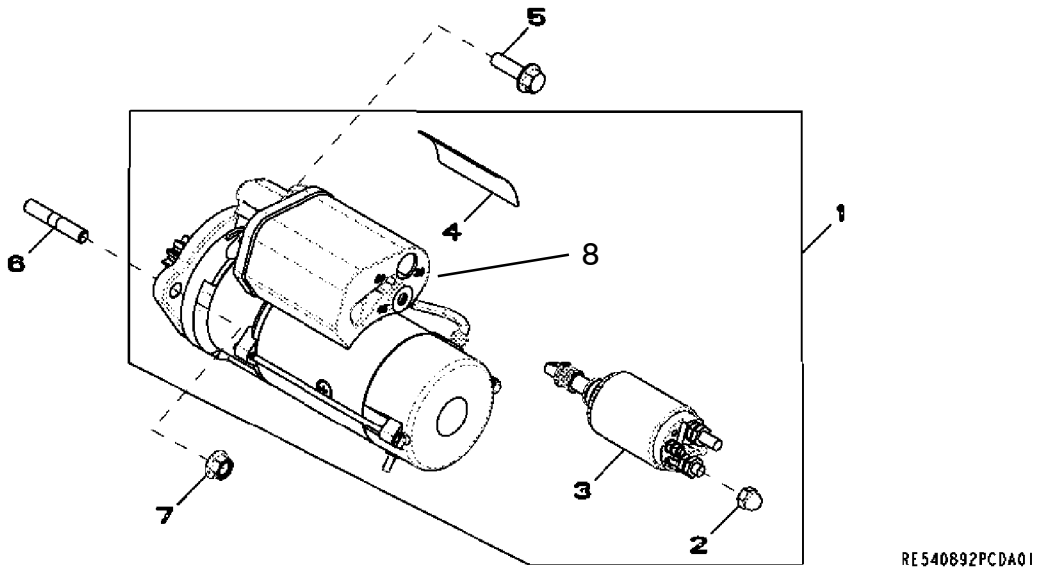
Item	Part Number	Description	Qty. Variation 6562
1	GM18658	Adapter Fitting	1
2	GM18696	Cap Screw	4
3	222767	Washer, 10.700 X 21 X 2.500 MM	4
4	GM83058	Turbocharger	1
5	GM80328	Gasket	1
6	GM80247	Screw	2
7	223753	Adapter Fitting	1
8	223851	O-Ring	1
9	GM83059	Gasket	1
10	GM83060	Oil Line	1

Group 35: Turbocharger



Item	Part Number	Description	Qty. Variation 6579
1	GM18658	Adapter Fitting	1
2	GM18696	Cap Screw	4
3	222767	Washer, 10.700 X 21 X 2.500 MM	4
4	GM95163	Turbocharger	1
5	GM80328	Gasket	1
6	GM80247	Screw	2
7	223753	Adapter Fitting	1
8	223851	O-Ring	1
9	GM95164	Gasket	1
10	GM95165	Oil Line	1

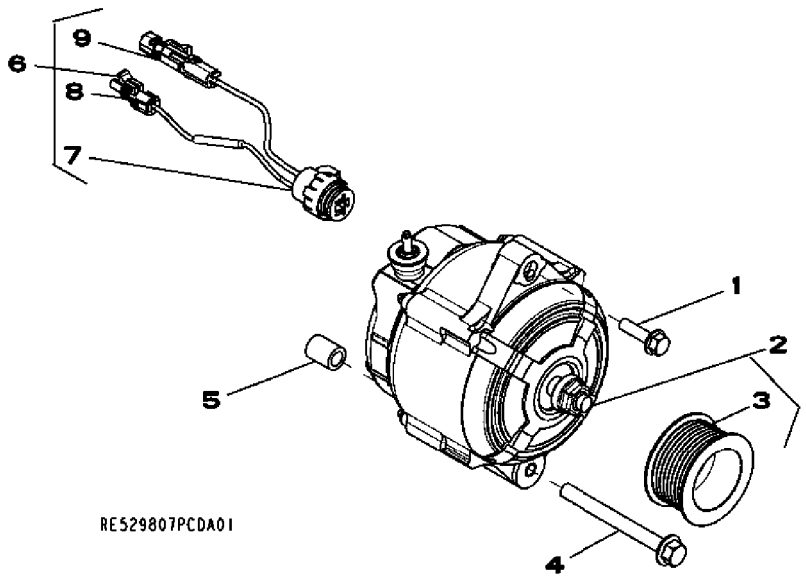
Group 36: Starter Motor



Item	Part Number	Description	Qty. Variation 3014
1	GM80485	Starter Motor Kit	1
2	GM80280	Nut	1
3	GM80486	Solenoid	1
4	GM17554	Label	1
5	#	Bolt, M12 x 40	1
6	GM80231	Stud	2
7	#	Flange Nut, M12	2
8	GM83048	Cover	1

Common hardware; procure locally.

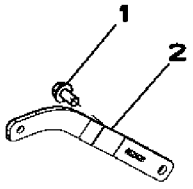
Group 37: Alternator



Item	Part Number	Description	Qty. Variation 3119
1	#	Screw, M8 x 30	1
2	GM18868	Alternator	1
2	GM80236	Diode (not shown)	1
3	GM18677	Pulley	1
4	GM70547	Screw	1
5	GM80242	Bushing	1
6	GM18840	Harness, wiring	1
7	#	Elec. Connector Terminal	1
8	GM32805	Connector	1
9	GM32804	Connector	1

Common hardware; procure locally.

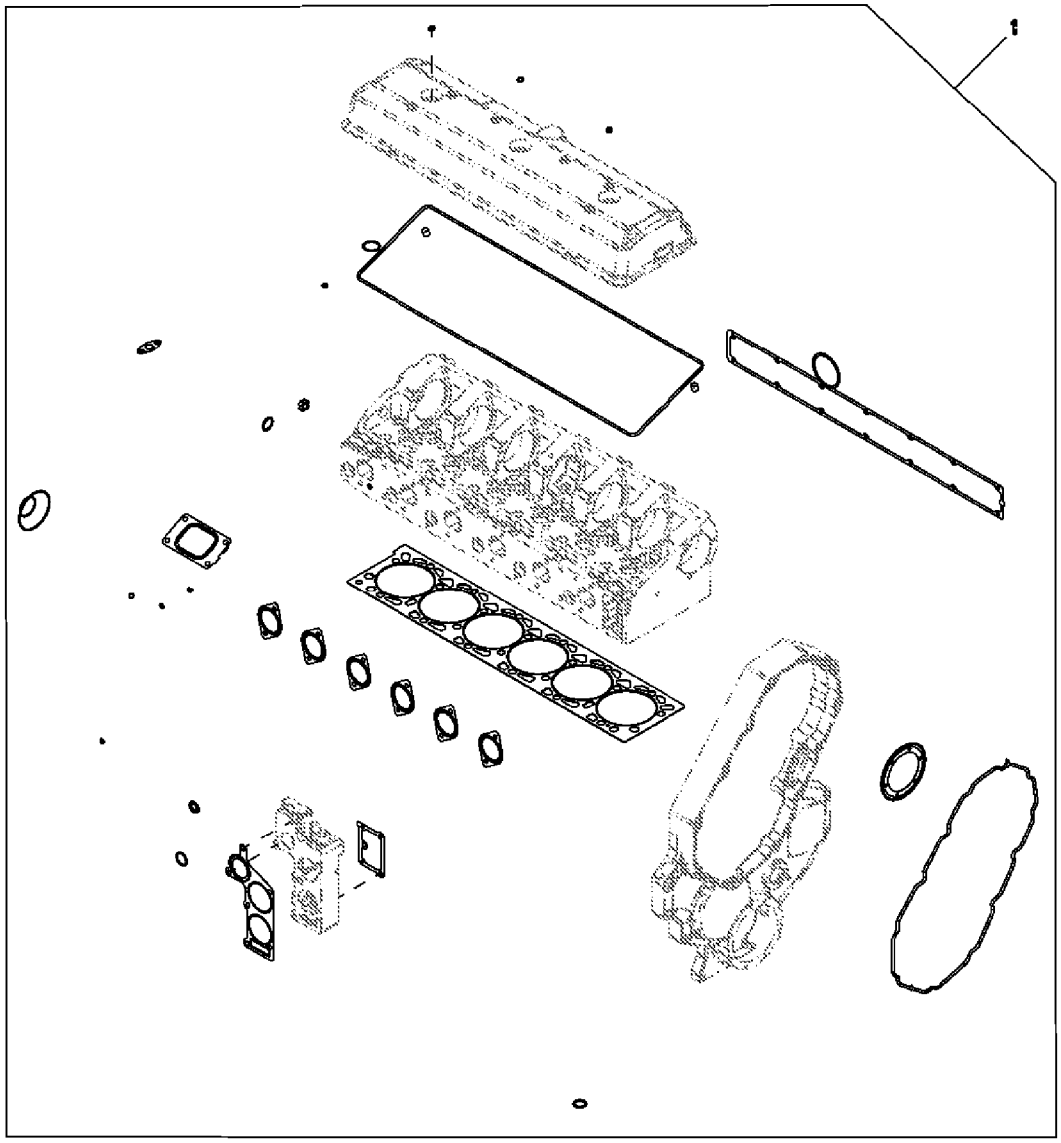
Group 38: Alternator Brackets



RG25788PCDD01

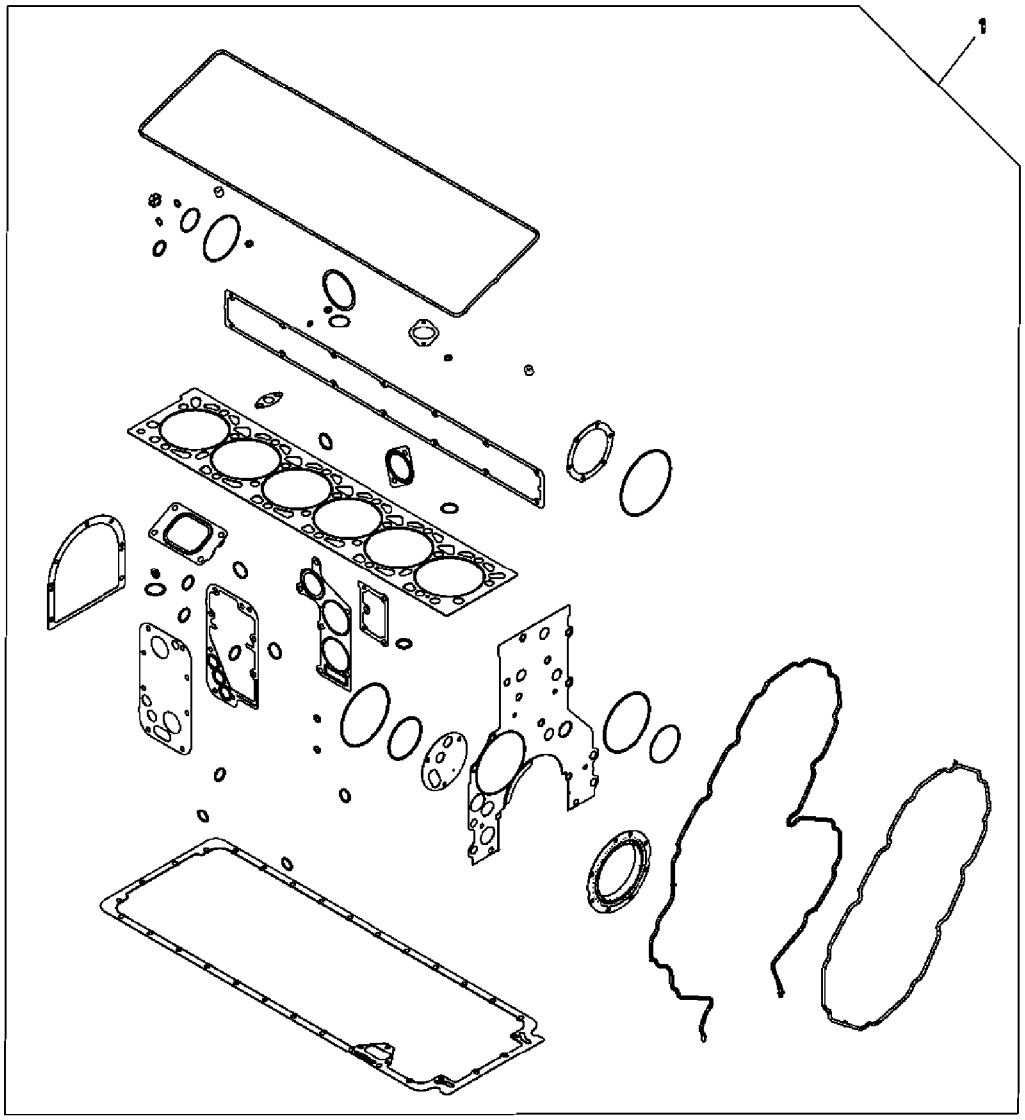
Item	Part Number	Description	Qty. Variation 6201
1	GM32765	Screw	1
2	GM80283	Adjusting Strap	1

Group 40: Cylinder Head Gasket Set



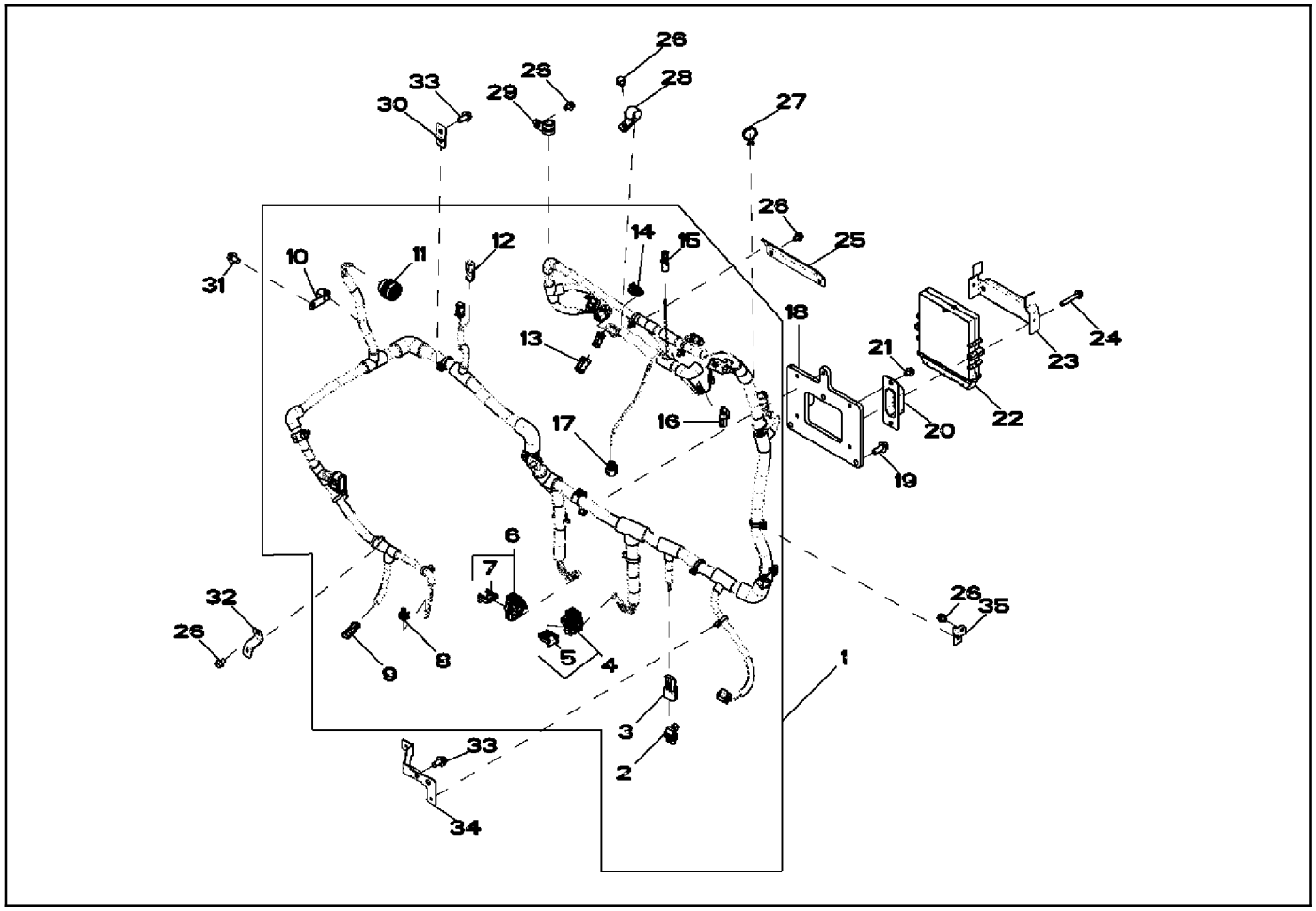
Item	Part Number	Description	Qty. Variation 9901
1	GM80444	Gasket Kit, Cylinder Head	1

Group 41: Overhaul Gasket Set



Item	Part Number	Description	Qty. Variation 9901
1	GM80443	Gasket Kit, Engine Rebuild	1

Group 43: Wiring Harness

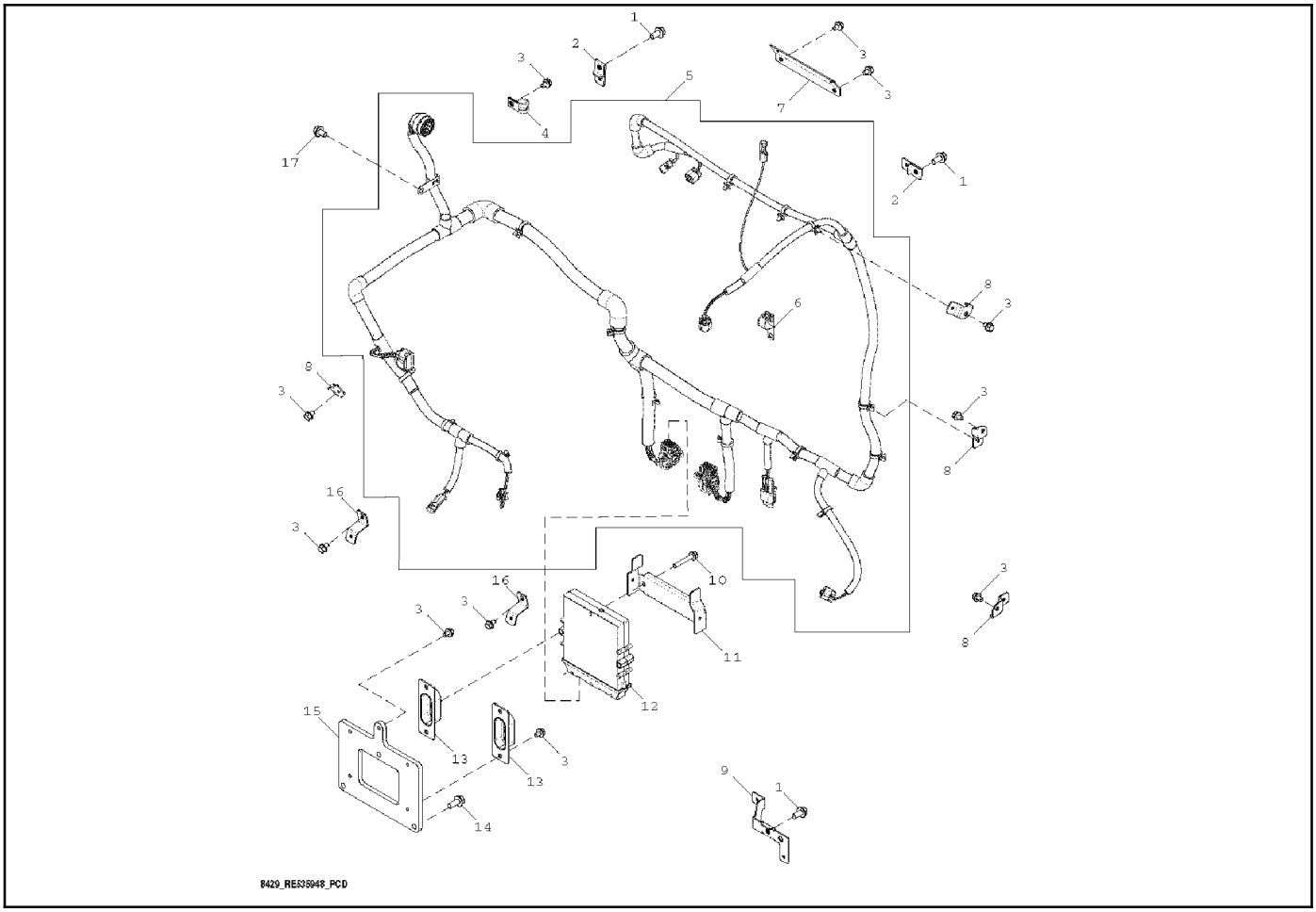


Item	Part Number	Description	Qty. Variation 8417
1	GM80463	Wiring Harness	1
2	GM50700	Connector	1
3	GM32770	Connector	1
4	#	Elec. Connector Housing	1
5	#	Electrical Connector Cap	1
6	GM63499	Connector, 32 Position (LH-Blue)	1
7	#	Electrical Connector Cap	1
8	#	Elec. Connector Housing	1
9	#	Electrical Connector Assy	1
10	#	Elec. Connector Accessory	2
11	#	Electrical Connector Assy	1
12	#	Electrical Connector Assy	1
13	#	Elec. Connector Housing	1
14	#	Elec. Connector Housing	1
15	GM32804	Connector	1
16	#	Elec. Connector Housing	2
17	#	Elec. Connector Housing	3

Item	Part Number	Description	Qty. Variation 8417
18	GM80338	Hanger	1
19	#	Screw, M10 x 25	3
20	GM50053	Isolator	2
21	GM50033	Cap screw	4
22	GM80398	Engine Controller	1
23	GM67278	Strap	1
24	#	Screw, M8 x 50	2
25	GM80326	Bracket	1
26	GM50033	Cap screw	12
27	GM80286	Tie Band	3
28	GM80493	Clamp	1
29	GM80498	Clamp	1
30	GM80340	Bracket	2
31	#	Screw, M10 x 16	1
32	GM80337	Bracket	2
33	GM32765	Screw	3
34	GM80356	Bracket	1
35	GM80327	Bracket	4

Common hardware; procure locally.

Group 43: Wiring Harness, continued

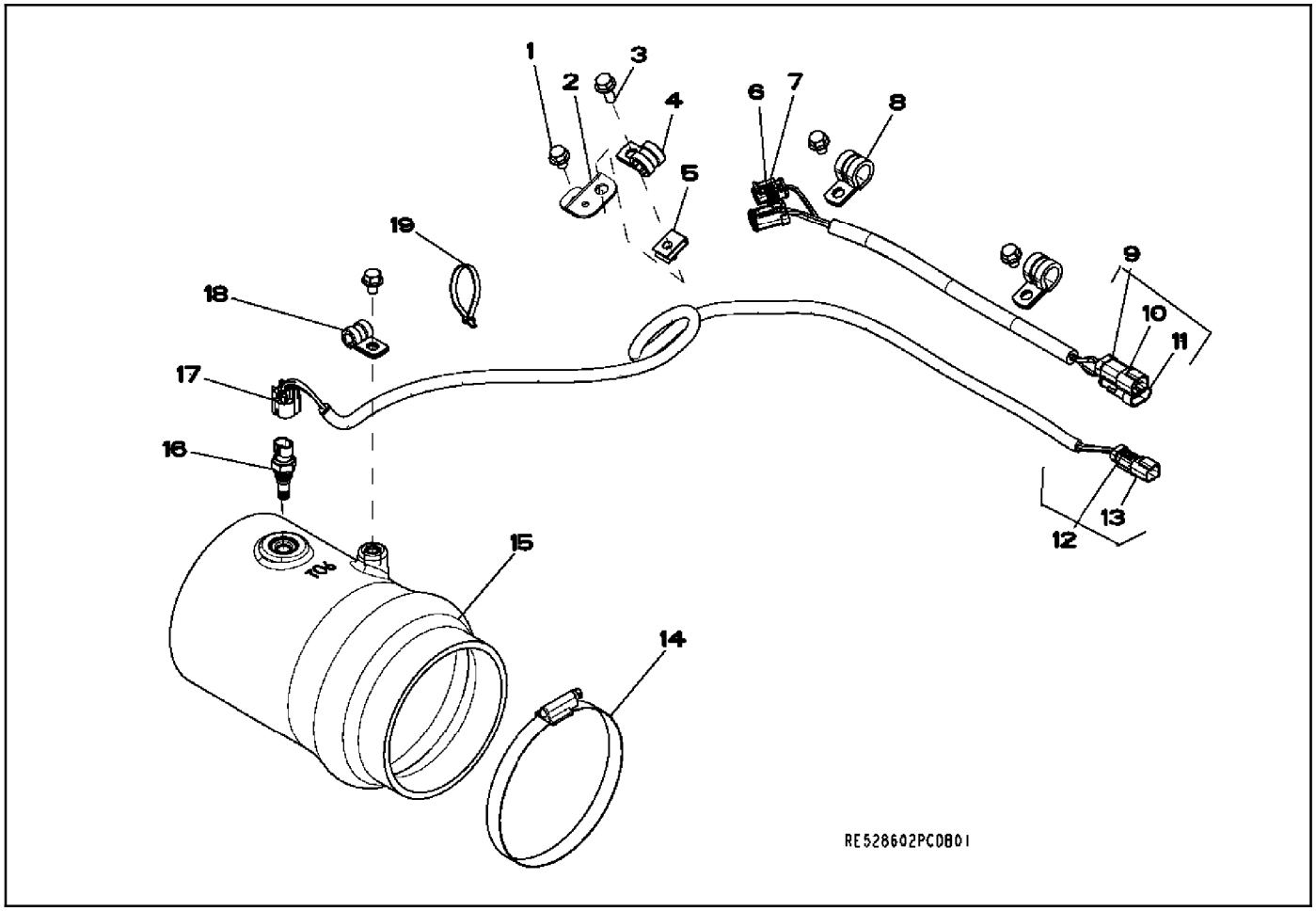


Item	Part Number	Description	Qty. Variation 8429
1	GM32765	Screw	3
2	GM80340	Bracket	2
3	GM50033	Cap Screw	15
4	GM50086	Clamp	1
5	GM83065	Wiring Harness	1
6	GM83066	Clamp	1
7	GM80326	Bracket	1
8	GM80327	Bracket	4

Item	Part Number	Description	Qty. Variation 8429
9	GM80356	Bracket	1
10	#	Screw, M8 X 50	2
11	GM67278	Strap	1
12	GM80398	Engine Controller	1
13	GM50053	Isolator	2
14	#	Screw, M10 X 25	3
15	GM80338	Hanger	1
16	GM80337	Bracket	2
17	#	Screw, M10 X 16	1

Common hardware; procure locally.

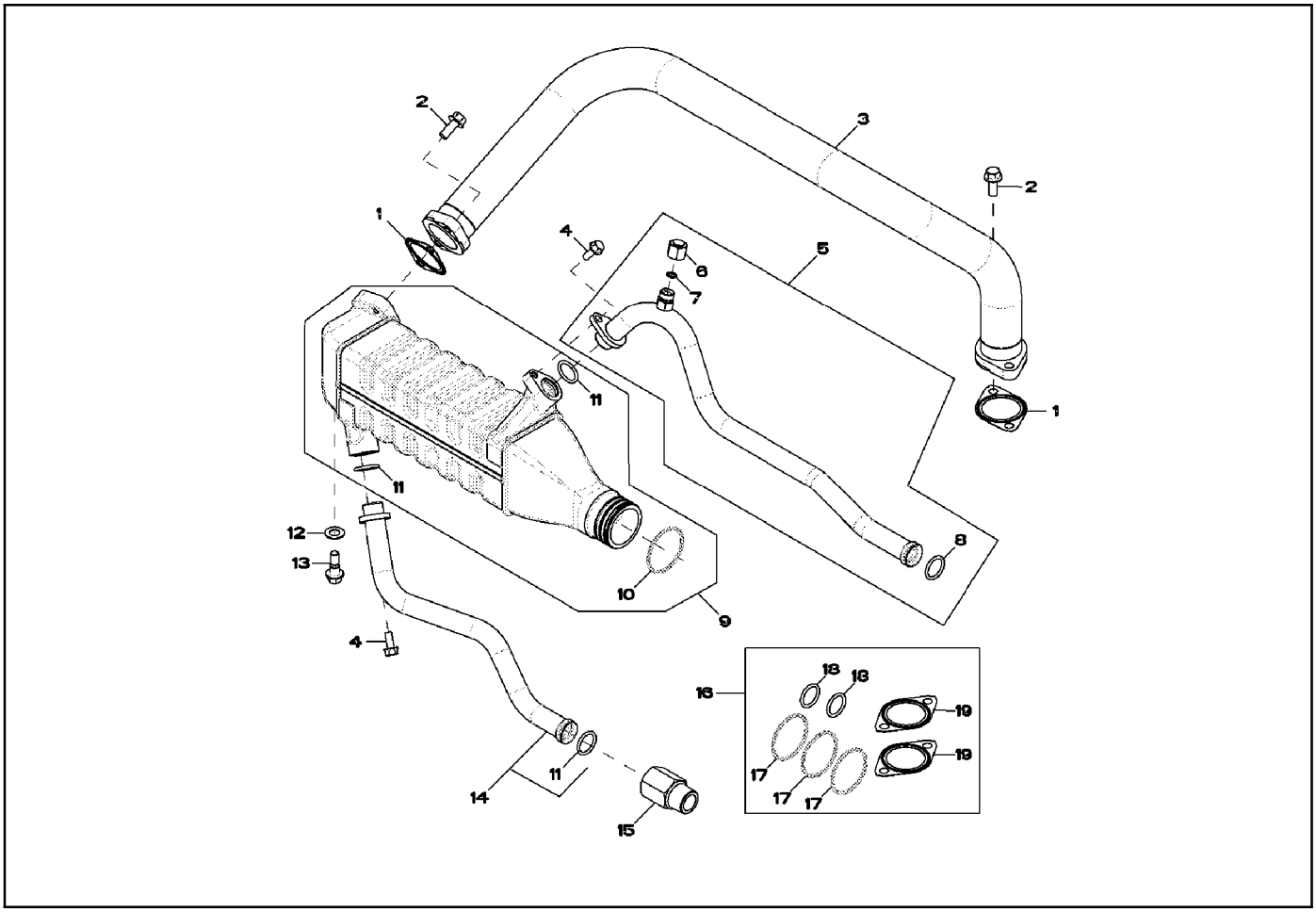
Group 45: Turbo Air Inlet



Item	Part Number	Description	Qty. Variation 5403
1	GM50033	Cap screw	4
2	GM50186	Bracket	1
3	GM24536	Screw	1
4	GM50086	Clamp	1
5	GM80246	Nut	1
6	#	Elec. Connector Housing	1
7	#	Elec. Connector Housing	1
8	GM80498	Clamp	2
9	GM80448	Wiring Harness	1
10	#	Elec. Connector Housing	1
11	#	Elec. Connector Housing	1
12	GM80447	Wiring Harness	1
13	#	Electrical Connector Assy	1
14	GM80490	Clamp	1
15	GM80430	Hose	1
16	GM50034	Thermocouple (air temperature)	1
16	GM21508	O-ring	1
17	#	Elec. Connector Housing	1
18	GM50293	Clamp	1
19	GM80248	Tie Band	1

Common hardware; procure locally.

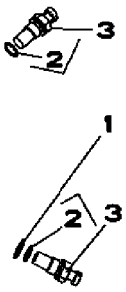
Group 47: Exhuast Gas Recirculation



Item	Part Number	Description	Qty. Variation 8901
1	GM80319	Gasket	2
2	#	Screw, M10 x 25	4
3	GM80403	Pipe	1
4	#	Screw, M8 x 20	2
5	GM80470	Line	1
6	GM80225	Fitting	1
7	360555	O-ring	1
8	GM80232	O-Ring	3
9	GM80399	Heat Exchanger	1
10	GM80344	Ring	3
11	GM80232	O-Ring	2
12	#	Washer	2
13	GM80489	Screw	2
14	GM80456	Line	1
15	GM80431	Fitting	1
16	GM80437	Kit, ECR Service	1
17	GM80344	Ring	3
18	GM80232	O-Ring	2
19	GM80319	Gasket	2

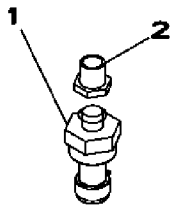
Common hardware; procure locally.

Group 48: Electronic Sensors (Tachometer)



Item	Part Number	Description	Qty. Variation 4422
1	GM80371	Washer	1
2	360180	O-ring, 17.3 X 2.2 MM	2
3	GM49939	Sensor (crankshaft,camshaft)	2

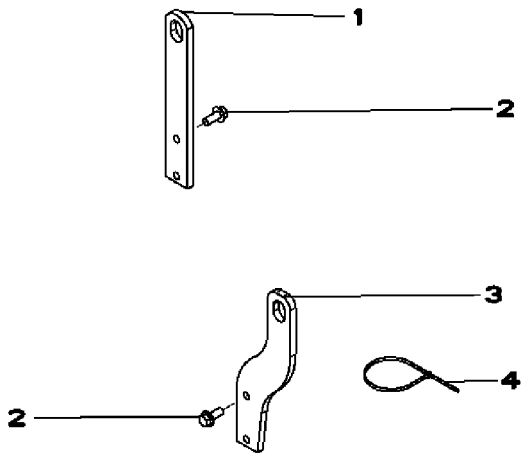
Group 49: Oil Pressure Sensor



Item	Part Number	Description	Qty. Variation 7601
1	GM32919	Sensor, pressure	1
2	#	Pipe Bushing	1

Common hardware; procure locally.

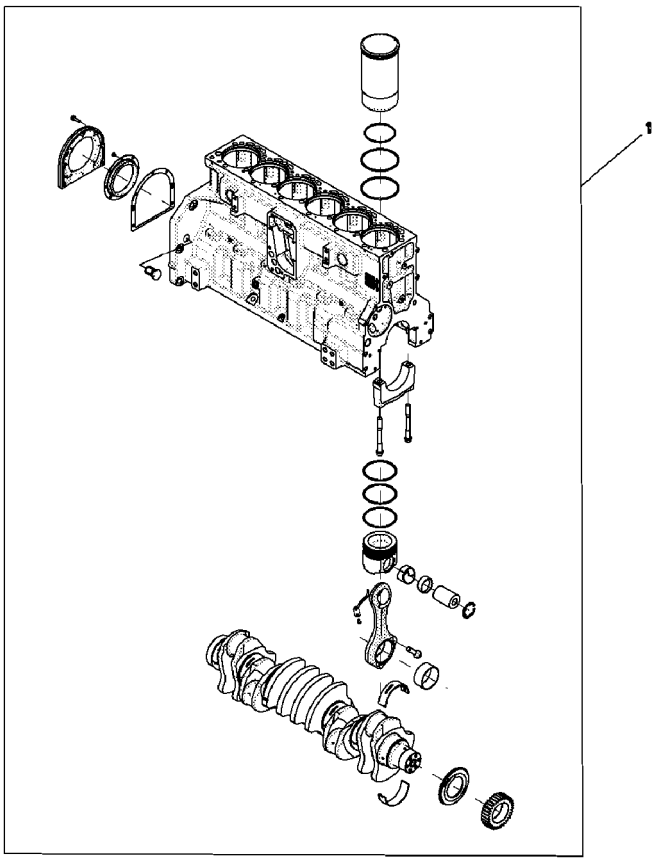
Group 50: Lift Straps



Item	Part Number	Description	Qty. Variation 9811
1	GM80322	Strap	1
2	#	Screw, M12 x 30	4
3	GM80305	Strap	1
4	GM80248	Tie Band	1

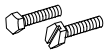
Common hardware; procure locally.

Group 51: Short Block

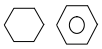


Item	Part Number	Description	Qty. Variation 9901
1	GM80476	Short Block Assembly	1

Appendix A Common Hardware Identification

Screw/Bolts/Studs	
Head Styles	
Hex Head or Machine Head	
Hex Head or Machine Head with Washer	
Flat Head (FHM)	
Round Head (RHM)	
Pan Head	
Hex Socket Head Cap or Allen™ Head Cap	
Hex Socket Head or Allen™ Head Shoulder Bolt	
Sheet Metal Screw	
Stud	
Drive Styles	
Hex	
Hex and Slotted	
Phillips®	
Slotted	
Hex Socket	

Nuts	
Nut Styles	
Hex Head	
Lock or Elastic	
Square	
Cap or Acorn	
Wing	
Washers	
Washer Styles	
Plain	
Split Lock or Spring	
Spring or Wave	
External Tooth Lock	
Internal Tooth Lock	
Internal-External Tooth Lock	

Hardness Grades	
American Standard	
Grade 2	
Grade 5	
Grade 8	
Grade 8/9 (Hex Socket Head)	
Metric	
Number stamped on hardware; 5.8 shown	

Allen™ head screw is a trademark of Holo-Krome Co.

Phillips® screw is a registered trademark of Phillips Screw Company.

Sample Dimensions

American Standard (Screws, Bolts, Studs, and Nuts)

1/4-20 x 1

- 1 — Length In Inches (Screws and Bolts)
- 20 — Threads Per Inch
- 1/4 — Major Thread Diameter In Fractional Inches Or Screw Number Size

Metric (Screws, Bolts, Studs, and Nuts)

M8-1.25 x 20

- 20 — Length In Millimeters (Screws and Bolts)
- 1.25 — Distance Between Threads In Millimeters
- M8 — Major Thread Diameter In Millimeters

Plain Washers

9/32 x 5/8 x 1/16

- 1/16 — Thickness
- 5/8 — External Dimension
- 9/32 — Internal Dimension

Lock Washers

5/8

- 5/8 — Internal Dimension

Appendix B Common Hardware List

The Common Hardware List lists part numbers and dimensions for common hardware items.

American Standard

Part No.	Dimensions
Hex Head Bolts (Grade 5)	
X-465-17	1/4-20 x .38
X-465-6	1/4-20 x .50
X-465-2	1/4-20 x .62
X-465-16	1/4-20 x .75
X-465-18	1/4-20 x .88
X-465-7	1/4-20 x 1.00
X-465-8	1/4-20 x 1.25
X-465-9	1/4-20 x 1.50
X-465-10	1/4-20 x 1.75
X-465-11	1/4-20 x 2.00
X-465-12	1/4-20 x 2.25
X-465-14	1/4-20 x 2.75
X-465-21	1/4-20 x 5.00
X-465-25	1/4-28 x .38
X-465-20	1/4-28 x 1.00
X-125-33	5/16-18 x .50
X-125-23	5/16-18 x .62
X-125-3	5/16-18 x .75
X-125-31	5/16-18 x .88
X-125-5	5/16-18 x 1.00
X-125-24	5/16-18 x 1.25
X-125-34	5/16-18 x 1.50
X-125-25	5/16-18 x 1.75
X-125-26	5/16-18 x 2.00
230578	5/16-18 x 2.25
X-125-29	5/16-18 x 2.50
X-125-27	5/16-18 x 2.75
X-125-28	5/16-18 x 3.00
X-125-22	5/16-18 x 4.50
X-125-32	5/16-18 x 5.00
X-125-35	5/16-18 x 5.50
X-125-36	5/16-18 x 6.00
X-125-40	5/16-18 x 6.50
X-125-43	5/16-24 x 1.75
X-125-44	5/16-24 x 2.50
X-125-30	5/16-24 x .75
X-125-39	5/16-24 x 2.00
X-125-38	5/16-24 x 2.75
X-6238-2	3/8-16 x .62
X-6238-10	3/8-16 x .75
X-6238-3	3/8-16 x .88
X-6238-11	3/8-16 x 1.00
X-6238-4	3/8-16 x 1.25
X-6238-5	3/8-16 x 1.50
X-6238-1	3/8-16 x 1.75
X-6238-6	3/8-16 x 2.00
X-6238-17	3/8-16 x 2.25
X-6238-7	3/8-16 x 2.50
X-6238-8	3/8-16 x 2.75
X-6238-9	3/8-16 x 3.00
X-6238-19	3/8-16 x 3.25
X-6238-12	3/8-16 x 3.50
X-6238-20	3/8-16 x 3.75
X-6238-13	3/8-16 x 4.50
X-6238-18	3/8-16 x 5.50
X-6238-25	3/8-16 x 6.50

Part No.	Dimensions
Hex Head Bolts, cont.	
X-6238-14	3/8-24 x .75
X-6238-16	3/8-24 x 1.25
X-6238-21	3/8-24 x 4.00
X-6238-22	3/8-24 x 4.50
X-6024-5	7/16-14 x .75
X-6024-2	7/16-14 x 1.00
X-6024-8	7/16-14 x 1.25
X-6024-3	7/16-14 x 1.50
X-6024-4	7/16-14 x 2.00
X-6024-11	7/16-14 x 2.75
X-6024-12	7/16-14 x 6.50
X-129-15	1/2-13 x .75
X-129-17	1/2-13 x 1.00
X-129-18	1/2-13 x 1.25
X-129-19	1/2-13 x 1.50
X-129-20	1/2-13 x 1.75
X-129-21	1/2-13 x 2.00
X-129-22	1/2-13 x 2.25
X-129-23	1/2-13 x 2.50
X-129-24	1/2-13 x 2.75
X-129-25	1/2-13 x 3.00
X-129-27	1/2-13 x 3.50
X-129-29	1/2-13 x 4.00
X-129-30	1/2-13 x 4.50
X-463-9	1/2-13 x 5.50
X-129-44	1/2-13 x 6.00
X-129-51	1/2-20 x .75
X-129-45	1/2-20 x 1.25
X-129-52	1/2-20 x 1.50
X-6021-3	5/8-11 x 1.00
X-6021-4	5/8-11 x 1.25
X-6021-2	5/8-11 x 1.50
X-6021-1	5/8-11 x 1.75
273049	5/8-11 x 2.00
X-6021-5	5/8-11 x 2.25
X-6021-6	5/8-11 x 2.50
X-6021-7	5/8-11 x 2.75
X-6021-12	5/8-11 x 3.75
X-6021-11	5/8-11 x 4.50
X-6021-10	5/8-11 x 6.00
X-6021-9	5/8-18 x 2.50
X-6239-1	3/4-10 x 1.00
X-6239-8	3/4-10 x 1.25
X-6239-2	3/4-10 x 1.50
X-6239-3	3/4-10 x 2.00
X-6239-4	3/4-10 x 2.50
X-6239-5	3/4-10 x 3.00
X-6239-6	3/4-10 x 3.50
X-792-1	1-8 x 2.25
X-792-5	1-8 x 3.00
X-792-8	1-8 x 5.00

Part No.	Dimensions	Type
Hex Nuts		
X-6009-1	1-8	Standard
X-6210-3	6-32	Whiz
X-6210-4	8-32	Whiz
X-6210-5	10-24	Whiz
X-6210-1	10-32	Whiz
X-6210-2	1/4-20	Spiralock
X-6210-6	1/4-28	Spiralock
X-6210-7	5/16-18	Spiralock
X-6210-8	5/16-24	Spiralock
X-6210-9	3/8-16	Spiralock
X-6210-10	3/8-24	Spiralock
X-6210-11	7/16-14	Spiralock
X-6210-12	1/2-13	Spiralock
X-6210-15	7/16-20	Spiralock
X-6210-14	1/2-20	Spiralock
X-85-3	5/8-11	Standard
X-88-12	3/4-10	Standard
X-89-2	1/2-20	Standard

Washers

Part No.	ID	OD	Thick.	Bolt/ Screw
X-25-46	.125	.250	.022	#4
X-25-9	.156	.375	.049	#6
X-25-48	.188	.438	.049	#8
X-25-36	.219	.500	.049	#10
X-25-40	.281	.625	.065	1/4
X-25-85	.344	.687	.065	5/16
X-25-37	.406	.812	.065	3/8
X-25-34	.469	.922	.065	7/16
X-25-26	.531	1.062	.095	1/2
X-25-15	.656	1.312	.095	5/8
X-25-29	.812	1.469	.134	3/4
X-25-127	1.062	2.000	.134	1

Metric

Hex head bolts are hardness grade 8.8 unless noted.

Part No.	Dimensions
Hex Head Bolts (Partial Thread)	
M931-05055-60	M5-0.80 x 55
M931-06040-60	M6-1.00 x 40
M931-06055-60	M6-1.00 x 55
M931-06060-60	M6-1.00 x 60
M931-06060-SS	M6-1.00 x 60
M931-06070-60	M6-1.00 x 70
M931-06070-SS	M6-1.00 x 70
M931-06075-60	M6-1.00 x 75
M931-06090-60	M6-1.00 x 90
M931-06145-60	M6-1.00 x 145
M931-06150-60	M6-1.00 x 150
M931-08035-60	M8-1.25 x 35
M931-08040-60	M8-1.25 x 40
M931-08045-60	M8-1.25 x 45
M931-08050-60	M8-1.25 x 50
M931-08055-60	M8-1.25 x 55
M931-08055-82	M8-1.25 x 55*
M931-08060-60	M8-1.25 x 60
M931-08070-60	M8-1.25 x 70
M931-08070-82	M8-1.25 x 70*
M931-08075-60	M8-1.25 x 75
M931-08080-60	M8-1.25 x 80
M931-08090-60	M8-1.25 x 90
M931-08095-60	M8-1.25 x 95
M931-08100-60	M8-1.25 x 100
M931-08110-60	M8-1.25 x 110
M931-08120-60	M8-1.25 x 120
M931-08130-60	M8-1.25 x 130
M931-08140-60	M8-1.25 x 140
M931-08150-60	M8-1.25 x 150
M931-08200-60	M8-1.25 x 200
M931-10040-82	M10-1.25 x 40*
M931-10040-60	M10-1.50 x 40
M931-10045-60	M10-1.50 x 45
M931-10050-60	M10-1.50 x 50
M931-10050-82	M10-1.25 x 50*
M931-10055-60	M10-1.50 x 55
M931-10060-60	M10-1.50 x 60
M931-10065-60	M10-1.50 x 65
M931-10070-60	M10-1.50 x 70
M931-10080-60	M10-1.50 x 80
M931-10080-82	M10-1.25 x 80*
M931-10090-60	M10-1.50 x 90
M931-10090-82	M10-1.50 x 90*
M931-10100-60	M10-1.50 x 100
M931-10110-60	M10-1.50 x 110
M931-10120-60	M10-1.50 x 120
M931-10130-60	M10-1.50 x 130
M931-10140-60	M10-1.50 x 140
M931-10180-60	M10-1.50 x 180
M931-10235-60	M10-1.50 x 235
M931-10260-60	M10-1.50 x 260
M960-10330-60	M10-1.25 x 330
M931-12045-60	M12-1.75 x 45
M960-12050-60	M12-1.25 x 50
M960-12050-82	M12-1.25 x 50*
M931-12050-60	M12-1.75 x 50
M931-12050-82	M12-1.75 x 50*
M931-12055-60	M12-1.75 x 55
M931-12060-60	M12-1.75 x 60
M931-12060-82	M12-1.75 x 60*
M931-12065-60	M12-1.75 x 65
M931-12075-60	M12-1.75 x 75
M931-12080-60	M12-1.75 x 80
M931-12090-60	M12-1.75 x 90
M931-12100-60	M12-1.75 x 100
M931-12110-60	M12-1.75 x 110

Part No.	Dimensions
Hex Head Bolts (Partial Thread), continued	
M960-16090-60	M16-1.50 x 90
M931-16090-60	M16-2.00 x 90
M931-16100-60	M16-2.00 x 100
M931-16100-82	M16-2.00 x 100*
M931-16120-60	M16-2.00 x 120
M931-16150-60	M16-2.00 x 150
M931-20065-60	M20-2.50 x 65
M931-20090-60	M20-2.50 x 90
M931-20100-60	M20-2.50 x 100
M931-20120-60	M20-2.50 x 120
M931-20140-60	M20-2.50 x 140
M931-20160-60	M20-2.50 x 160
M931-22090-60	M22-2.50 x 90
M931-22120-60	M22-2.50 x 120
M931-22160-60	M22-2.50 x 160
M931-24090-60	M24-3.00 x 90
M931-24120-60	M24-3.00 x 120
M931-24160-60	M24-3.00 x 160
M931-24200-60	M24-3.00 x 200
Hex Head Bolts (Full Thread)	
M933-04006-60	M4-0.70 x 6
M933-05030-60	M5-0.80 x 30
M933-05035-60	M5-0.80 x 35
M933-05050-60	M5-0.80 x 50
M933-06010-60	M6-1.00 x 10
M933-06012-60	M6-1.00 x 12
M933-06014-60	M6-1.00 x 14
M933-06016-60	M6-1.00 x 16
M933-06020-60	M6-1.00 x 20
M933-06025-60	M6-1.00 x 25
M933-06030-60	M6-1.00 x 30
M933-06040-60	M6-1.00 x 40
M933-06050-60	M6-1.00 x 50
M933-07025-60	M7-1.00 x 25
M933-08010-60	M8-1.25 x 10
M933-08012-60	M8-1.25 x 12
M933-08016-60	M8-1.25 x 16
M933-08020-60	M8-1.25 x 20
M933-08025-60	M8-1.25 x 25
M933-08030-60	M8-1.25 x 30
M933-08030-82	M8-1.25 x 30*
M933-10012-60	M10-1.50 x 12
M961-10020-60	M10-1.25 x 20
M933-10020-60	M10-1.50 x 20
M933-10025-60	M10-1.50 x 25
M961-10025-60	M10-1.25 x 25
M933-10025-82	M10-1.50 x 25*
M961-10030-60	M10-1.25 x 30
M933-10030-60	M10-1.50 x 30
M933-10030-82	M10-1.50 x 30*
M961-10035-60	M10-1.25 x 35
M933-10035-60	M10-1.50 x 35
M933-10035-82	M10-1.50 x 35*
M961-10040-60	M10-1.25 x 40

Part No.	Dimensions
Hex Head Bolts (Full Thread), continued	
M933-12016-60	M12-1.75 x 16
M933-12020-60	M12-1.75 x 20
M961-12020-60F	M12-1.50 x 20
M933-12025-60	M12-1.75 x 25
M933-12025-82	M12-1.75 x 25*
M961-12030-60	M12-1.25 x 30
M933-12030-82	M12-1.75 x 30*
M961-12030-82F	M12-1.50 x 30*
M933-12030-60	M12-1.75 x 30
M933-12035-60	M12-1.75 x 35
M961-12040-82	M12-1.25 x 40*
M933-12040-60	M12-1.75 x 40
M933-12040-82	M12-1.75 x 40*
M961-14025-60	M14-1.50 x 25
M933-14025-60	M14-2.00 x 25
M961-14050-82	M14-1.50 x 50*
M961-16025-60	M16-1.50 x 25
M933-16025-60	M16-2.00 x 25
M961-16030-82	M16-1.50 x 30*
M933-16030-82	M16-2.00 x 30*
M933-16035-60	M16-2.00 x 35
M961-16040-60	M16-1.50 x 40
M933-16040-60	M16-2.00 x 40
M961-16045-82	M16-1.50 x 45*
M933-16045-82	M16-2.00 x 45*
M933-16050-60	M16-2.00 x 50
M933-16050-82	M16-2.00 x 50*
M933-16060-60	M16-2.00 x 60
M933-16070-60	M16-2.00 x 70
M933-18035-60	M18-2.50 x 35
M933-18050-60	M18-2.50 x 50
M933-18060-60	M18-2.50 x 60
M933-20050-60	M20-2.50 x 50
M933-20055-60	M20-2.50 x 55
M933-24060-60	M24-3.00 x 60
M933-24065-60	M24-3.00 x 65
M933-24070-60	M24-3.00 x 70
Pan Head Machine Screws	
M7985A-03010-20	M3-0.50 x 10
M7985A-03012-20	M3-0.50 x 12
M7985A-04010-20	M4-0.70 x 10
M7985A-04016-20	M4-0.70 x 16
M7985A-04020-20	M4-0.70 x 20
M7985A-04050-20	M4-0.70 x 50
M7985A-04100-20	M4-0.70 x 100
M7985A-05010-20	M5-0.80 x 10
M7985A-05012-20	M5-0.80 x 12
M7985A-05016-20	M5-0.80 x 16
M7985A-05020-20	M5-0.80 x 20
M7985A-05025-20	M5-0.80 x 25
M7985A-05030-20	M5-0.80 x 30
M7985A-05080-20	M5-0.80 x 80
M7985A-05100-20	M5-0.80 x 100
M7985A-06100-20	M6-1.00 x 100
Flat Head Machine Screws	
M965A-04012-SS	M4-0.70 x 12
M965A-05012-SS	M5-0.80 x 12
M965A-05016-20	M5-0.80 x 16
M965A-06012-20	M6-1.00 x 12

* This metric hex bolt's hardness is grade 10.9.

Metric, continued

Hex Nuts

Part No.	Dimensions	Type
M934-03-50	M3-0.50	Standard
M934-04-50	M4-0.70	Standard
M934-04-B	M4-0.70	Brass
M934-05-50	M5-0.80	Standard
M934-06-60	M6-1.00	Standard
M934-06-64	M6-1.00	Std. (green)
M6923-06-80	M6-1.00	Spiralock
M982-06-80	M6-1.00	Elastic Stop
M934-08-60	M8-1.25	Standard
M6923-08-80	M8-1.25	Spiralock
M982-08-80	M8-1.25	Elastic Stop
M934-10-60	M10-1.50	Standard
M934-10-60F	M10-1.25	Standard
M6923-10-80	M10-1.50	Spiralock
M6923-10-62	M10-1.50	Spiralock†
M982-10-80	M10-1.50	Elastic Stop
M934-12-60	M12-1.75	Standard
M934-12-60F	M12-1.25	Standard
M6923-12-80	M12-1.75	Spiralock
M982-12-80	M12-1.75	Elastic Stop
M982-14-60	M14-2.00	Elastic Stop
M6923-16-80	M16-2.00	Spiralock
M982-16-80	M16-2.00	Elastic Stop
M934-18-80	M18-2.5	Standard
M982-18-60	M18-2.50	Elastic Stop
M934-20-80	M20-2.50	Standard
M982-20-80	M20-2.50	Elastic Stop
M934-22-60	M22-2.50	Standard
M934-24-80	M24-3.00	Standard
M982-24-60	M24-3.00	Elastic Stop
M934-30-80	M30-3.50	Standard

Washers

Part No.	ID	OD	Thick.	Bolt/ Screw
M125A-03-80	3.2	7.0	0.5	M3
M125A-04-80	4.3	9.0	0.8	M4
M125A-05-80	5.3	10.0	1.0	M5
M125A-06-80	6.4	12.0	1.6	M6
M125A-08-80	8.4	16.0	1.6	M8
M125A-10-80	10.5	20.0	2.0	M10
M125A-12-80	13.0	24.0	2.5	M12
M125A-14-80	15.0	28.0	2.5	M14
M125A-16-80	17.0	30.0	3.0	M16
M125A-18-80	19.0	34.0	3.0	M18
M125A-20-80	21.0	37.0	3.0	M20
M125A-24-80	25.0	44.0	4.0	M24

† This metric hex nut's hardness is grade 8.

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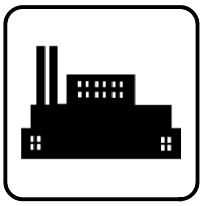
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TP-6786 1/15c

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Service Parts

Industrial Generator Sets



Models:

350-500REOZJ
350-500REOZJB

See Group 701: Literature inside this manual for part numbers of engine and controller parts catalogs

ISO 9001 KOHLER POWER SYSTEMS NATIONALLY REGISTERED

KOHLER® Power Systems

TP-6785 2/14c

Common Replacement Parts

Figure 1 identifies common replacement parts for your generator set. Refer to the groups on the following pages and the engine parts manual listed in Group 701: Literature for a complete list of maintenance and service parts.

Engine Description	Engine Part Number	Fan Belt	Oil Filter	Fuel Filter	Fuel Filter (primary)
350/400REOZJ/B 6135HF485/ 6135HFG84	GM76154/ GM88213	GM80275, GM80277	GM80434	GM80469	GM80460
500REOZJ/B 6135HFG75	GM76155	GM80275, GM80277	GM80434	GM80469	GM80460

Figure 1 Common Replacement Parts

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Introduction

This manual lists service replacement parts for generator set models as listed on the front cover.

Information in this publication represents data available at the time of print. Kohler Co. reserves the right to change this publication and the products represented without notice and without any obligation or liability whatsoever.

This manual includes the following main sections:

Table of Contents. Lists the sections of the manual.

Introduction (and other information sections). Contains introductory material about part numbers, illustrations, and hardware.

Specification Number Index. Lists the generator set specs and groups.

Group Parts Lists. List the part numbers of parts in the groups.

Kit Sections. List modules and accessories and their parts.

Appendices. Include Abbreviations, Common Hardware Application Guidelines, General Torque Specifications, Common Hardware Identification, and Common Hardware List.

Numbering System Significance

This manual uses the following numbering systems:

Specification Number. The product identification number located on the generator set nameplate. Specification numbers break down into groups.

Group Number. A unique number representing a parts group needed to assemble a generator set function. For example, Group 101 is the Air Intake group.

Variation or Module Number. A group might have several variations. Each variation performs the same function with different parts lists. For example, a 50 Hz generator alternator and a 60 Hz generator alternator both perform the same function; however, with different parts. Each difference requires a group variation or module number.

Part Number. The part number identifies an individual assembly, subassembly, component, or accessory kit.

Illustrations

Illustrations (or exploded-view drawings) best representing the widest range of variations accompany most groups in this manual. Illustrations do not depict all details and may not show all parts. Do not use illustrations for assembly or disassembly.

How to Find Part Numbers

Use the following steps to locate a service replacement part.

1. Locate the generator set nameplate to **identify the generator set spec number**.
2. Locate a second generator set nameplate listing accessories to **identify installed modules**. On some models the accessory nameplate is mounted inside the generator junction box.
3. **Turn to the Specification Number Index**. The first column lists the generator set spec numbers. The headings identify the groups of parts that make up the generator set.
4. **Identify the group** most likely to include the service part number.
5. **Find the group variation number** at the intersection of the spec number row and the group column. Note the variation number.
6. **Page forward to locate the group** identified in step 4 or find the appropriate page in the Table of Contents.
7. **Find the part on the illustration** and note the item number of the part or **find the part description in the parts list**.
8. Select **the part number that corresponds to your group variation**. The first column lists the illustration item number. Find the variation identified in the Specification Number Index or the module number found on the generator set nameplate in the appropriate column on the right side of the parts list table. Find the quantity used at the intersection of the item number row and the variation column. A blank space at the intersection means the variation/module does not use that part number.

Hardware References

Many common hardware items do not appear in parts manuals or will appear as common hardware entries. A common hardware entry lists the size of the hardware. For example, an item that appears as *Hardware, 3/8-16* in the text means that the piece is 3/8-16 size. Obtain common hardware locally or, if contacting the factory, use the Common Hardware List in the appendix to identify the common hardware part number and specifications. See Common Hardware Application Guidelines in the appendix for mating hardware instructions.

Some hardware items require a specific size or some other characteristic. In that case, use the part number listed in the text.

When replacing hardware, do not substitute inferior grade hardware. Replacement hardware grade should be equal to or better than the grade of the manufacturer's original hardware. Use the Common Hardware List in the appendix to identify the common hardware hardness.

Specification Number Index

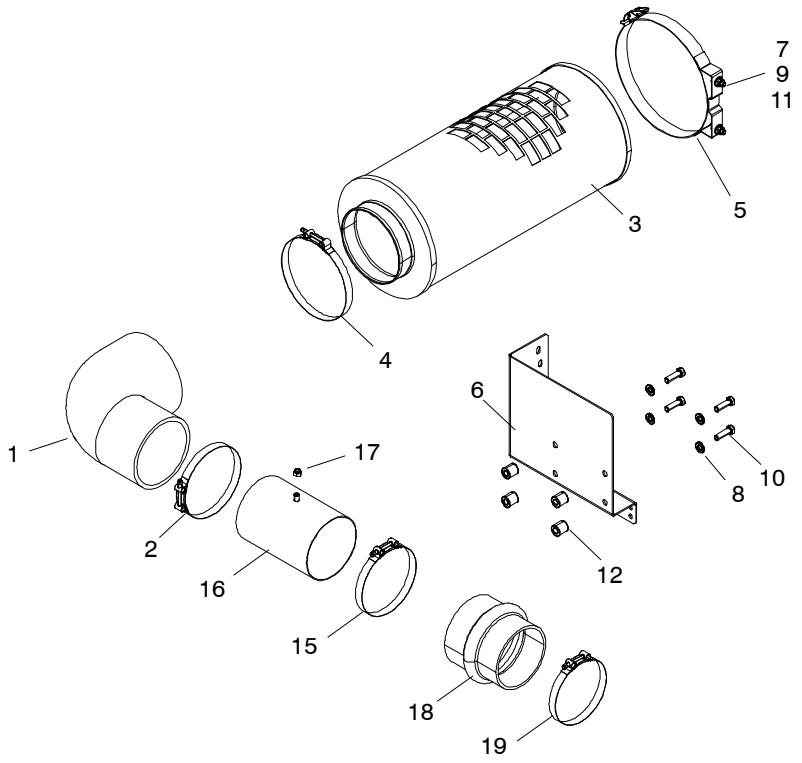
Group Title	Air Intake	Cooling System	Engine	Nameplates and Decals	Skid and Plant Mounting	Generator and Mounting	Controller and Mounting	Literature
Group No.	**101**	**104**	**105**	**107**	**109**	**201**	**301**	**701**
Spec No.	**Variation Number**							
350REOZJ								
GM76156-GA1	*	*	1	GR1	*	*	†	452
350REOZJB								
GM85455-GA1	*	*	1	GR1	*	*	†	495
GM85455-GA4	*	*	3	GR1	*	*	†	495
400REOZJ								
GM76156-GA2	*	*	1	GR1	*	*	†	453
400REOZJB								
GM85455-GA2	*	*	1	GR1	*	*	†	496
GM85455-GA5	*	*	3	GR1	*	*	†	496
500REOZJ								
GM76157-GA2	*	*	2	GR1	*	*	†	480
500REOZJB								
GM85455-GA3	*	*	2	GR1	*	*	†	497

* Configured group. Refer to the generator set nameplate for the module number. Turn to the respective group on the following pages for parts breakdowns.

† Configured group. Refer to the generator set nameplate for the module number. See Group 701: Literature for list of controller parts manuals.

Air Intake

Standard Duty



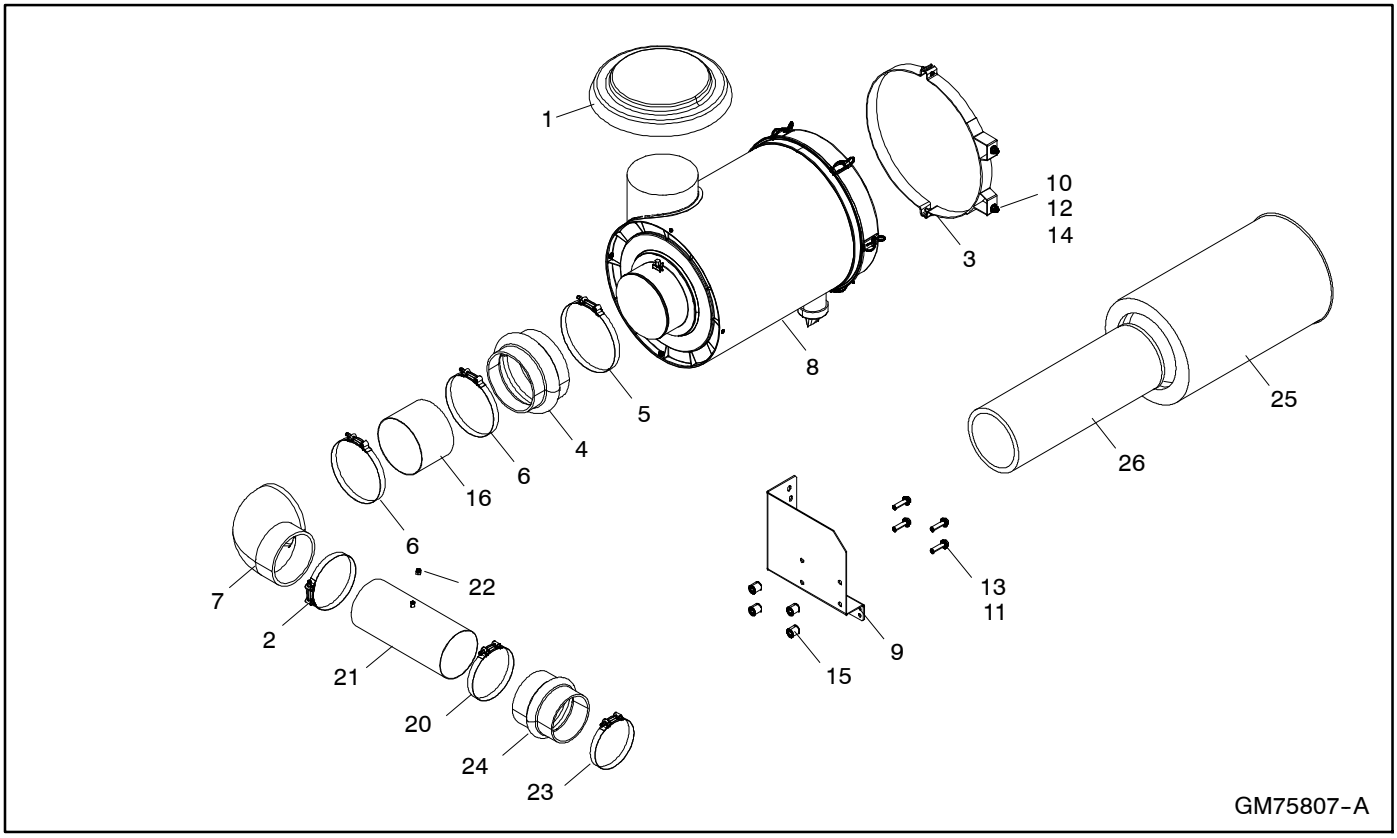
GM75806-A

Find the installed module number on the generator set nameplate.

Item	Part Number	Description	Quantity Module Number GM75806-MA1	Quantity Module Number GM75806-MA2
1	272663	Hose, 90 deg. reducer (7.00 - 6.00” ID)	1	1
2	272960	Clamp, hose, 6.56/6.87 in.	2	2
3	272982	Element, Air Indust	1	1
4	280998	Clamp, hose, 7.5/7.81 in.	1	1
5	343530	Clamp, air cleaner (11.00” ID)	1	1
6	GM77329	Bracket, Air Cleaner, 4M	1	1
7	M125A-10-80	Washer, Plain, 10.5 ID x 20.0 OD	2	2
8	M125A-12-80	Washer, Plain	4	4
9	M6923-10-80	Nut, Hex 10mm	2	2
10	M933-12040-60	Screw, Hex Cap	4	4
11	M933-10025-60	Screw, hex cap,fully thrd M10 x 25mm	2	2
12	X-400-230	Spacer, .531 ID x 1 OD x 1 in.	4	4
15	272960	Clamp, hose, 6.56/6.87 in.	1	
15	254013	Clamp, hose, 6.25/6.56 in.		1
16	274623	Tube assembly	1	
16	279754	Tube assembly		1
17	X-268-7	Cap, pipe (1/8”npt)	1	1
18	274221	Hose, hump reducer (6.00 to 5.50” ID)		1
19	291504	Clamp, hose, 5.81/6.12 in.		1

Air Intake

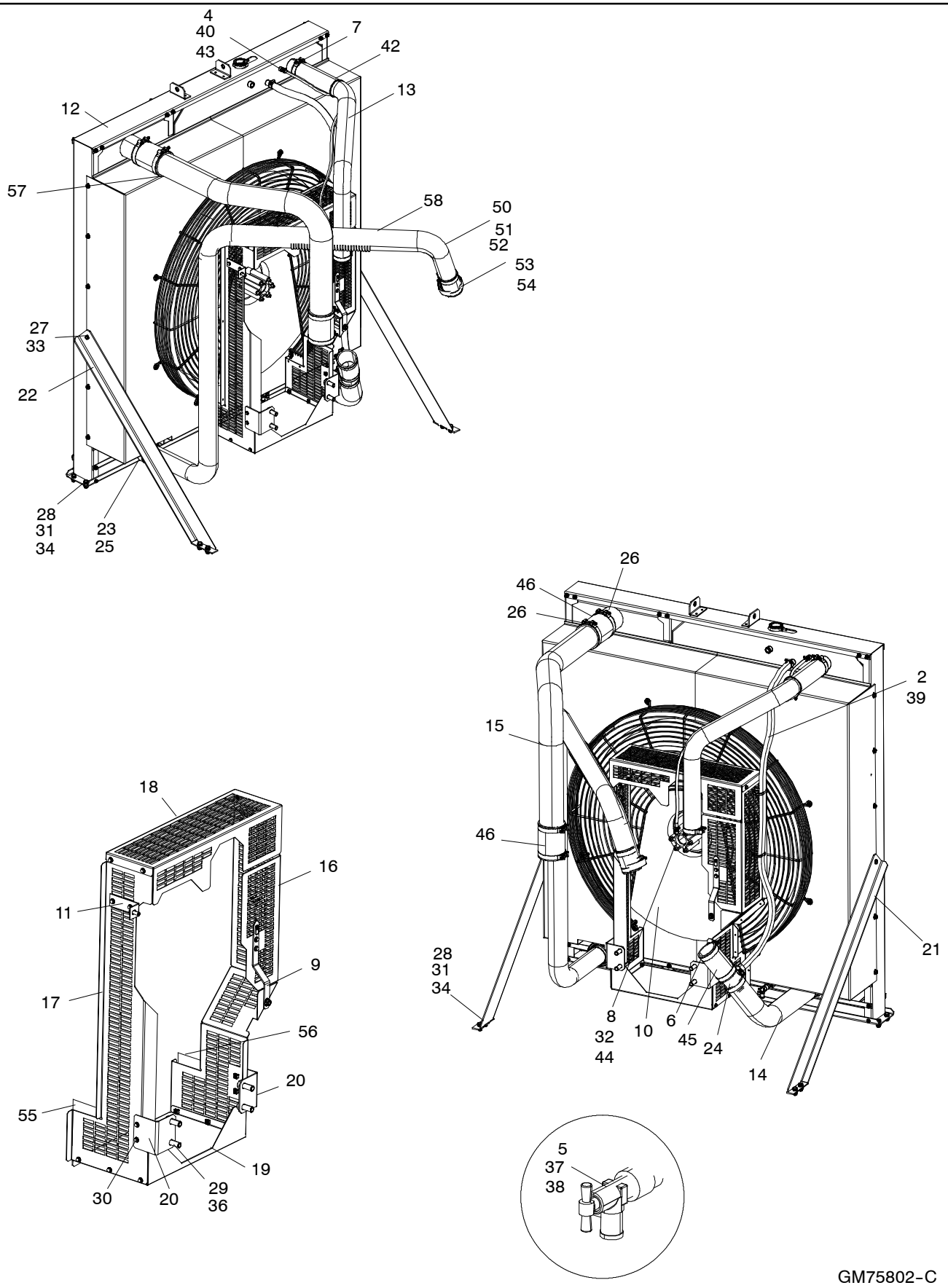
Heavy Duty



Find the installed module number on the generator set nameplate.

Item	Part Number	Description	Quantity	
			Module Number	
			GM75807-MA1	GM75807-MA2
1	272675	Cap, rain	1	1
2	272960	Clamp, hose, 6.56/6.87 in.	1	1
3	279715	Mount, Air Cleaner/Exhaust (18.00” ID)	1	1
4	279720	Hose, hump reducer (8.00 to 7.00” ID)	1	1
5	279743	Clamp, hose, 8.38/8.69 in.	1	1
6	280998	Clamp, hose, 7.5/7.81 in.	2	2
7	GM23198	Hose, 90 Deg. Reducer (7.00” to 6.00”)	1	1
8	GM69932	Cleaner Ass’y, Air	1	1
9	GM77329	Bracket, Air Cleaner, 4M	1	1
10	M125A-10-80	Washer, Plain, 10.5 ID x 20.0 OD	2	2
11	M125A-12-80	Washer, Plain	4	4
12	M6923-10-80	Nut, Hex 10mm	2	2
13	M931-12050-60	Screw, Hex Cap	4	4
14	M933-10025-60	Screw, hex cap,fully thrd M10 x 25mm	2	2
15	X-400-230	Spacer, .531 ID x 1 OD x 1 in.	4	4
16	X-522-66	Tube, steel	1	1
20	272960	Clamp, hose, 6.56/6.87 in.	1	
20	254013	Clamp, hose, 6.25/6.56 in.		1
21	361278	Tube assembly	1	
21	347959	Tube assembly		1
22	X-268-7	Cap, pipe (1/8”npt)	1	1
23	291504	Clamp, hose, 5.81/6.12 in.		1
24	274221	Hose, hump reducer (6.00 to 5.50” ID)		1
25	GM69997	Element, Primary (Outer)	1	1
26	GM69998	Element, Secondary (Inner)	1	1

Cooling System

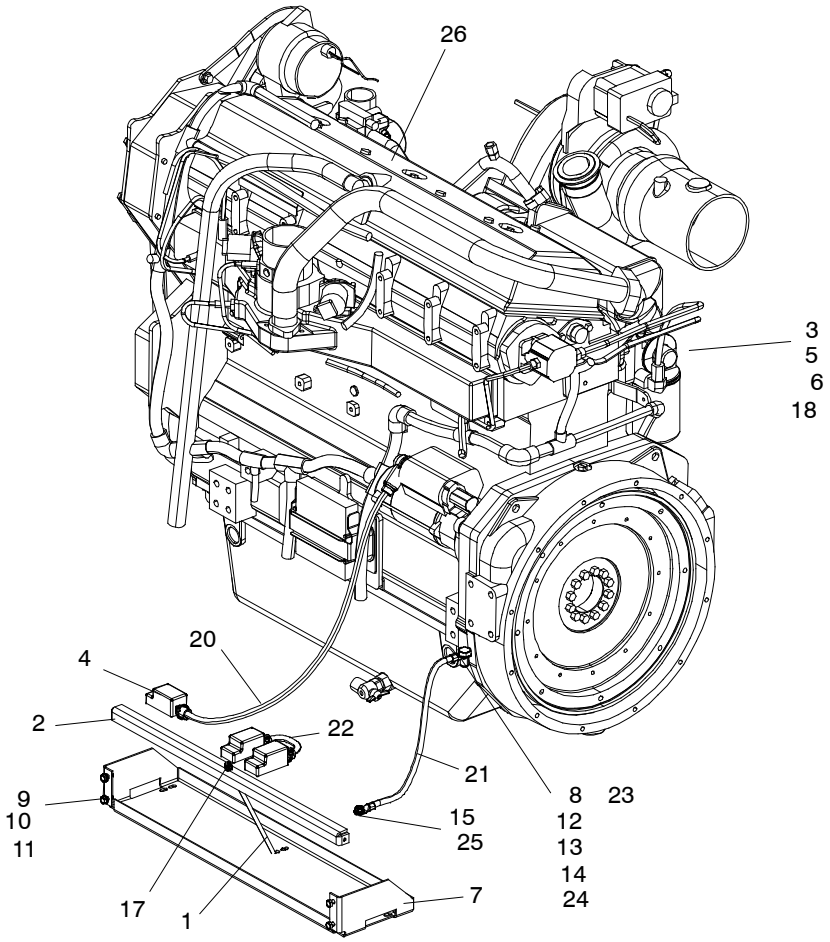


Cooling System

Find the installed module number on the generator set nameplate.

Item	Part Number	Description	Quantity			
			Module			
			GM75802-MA1	GM75802-MA2	GM84898-MA1	GM84898-MA2
2	X-356-33	Hose, radiator, straight, 1 in. ID	1	1	1	1
4	X-6359-6	Hose, rubber, straight, .25 in. ID	1	1	1	1
5	278788	Valve, drain (3/8”nptf)	1	1	1	1
6	291542	Clamp, hose, 3.25/3.56 in.	4	4	4	4
7	336228	Clamp, hose, 2.63/2.94 in.	2	2	2	2
8	336668	Spacer, fan, 4 in.	1	1	1	1
9	365237	Bracket, support	1	1	1	1
10	GM21337	Fan	1	1	1	1
11	GM64267	Bracket, Belt Guard	1	1	1	1
12	GM75788	Radiator/CAC Assy, 50C	1	1		
12	GM84821	Radiator Assembly			1	1
13	GM77292	Hose, Radiator (Upper)	1	1		
13	GM84897	Hose, Radiator (Upper)			1	1
14	GM77293	Hose, Radiator (Lower)	1	1	1	1
15	GM77294	Tube, Intake	1	1		
15	GM84895	Tube, Intake			1	1
16	GM77297	Guard, Belt (RH)	1	1	1	1
17	GM77298	Guard, Belt (LH)	1	1	1	1
18	GM77299	Guard, Belt (Top)	1	1	1	1
19	GM77300	Guard, Belt (Bottom)	1	1	1	1
20	GM77301	Bracket, Belt Guard Mtg.	2	2	2	2
21	GM77303	Support, Radiator (RH)	1	1	1	1
22	GM77304	Support, Radiator (LH)	1	1	1	1
23	GM77635	Gasket, CAC Graphite	1	1	1	1
24	GM77637	Connector, Hose	1	1	1	1
25	GM77638	Clamp, Exhaust (5.25 In.)	1	1	1	1
26	GM78800	Clamp, Hose	4	4	4	4
27	M125A-08-80	Washer, Plain, 8.4 ID x 16.0 OD	2	2	2	2
28	M125A-10-80	Washer, Plain, 10.5 ID x 20.0 OD	9	9	9	9
29	M125A-16-80	Washer, Plain	4	4	4	4
30	M6921-06016-60	Screw, Hex Flnge M6x16mm flly thrd js500	18	18	20	20
31	M6923-10-80	Nut, Hex 10mm	9	9	9	9
32	M931-10120-82	Screw, Hex Cap	6	6	6	6
33	M933-08020-60	Screw, Hex Cap	2	2	2	2
34	M933-10025-60	Screw, hex cap,fully thrd M10 x 25mm	8	8	8	8
35	M933-10030-60	Screw, Hex Cap	1	1	1	1
36	M933-16040-60	Screw, Hex Cap	4	4	4	4
37	X-220-6	Pipe (1/4”npt x 1.50”)	1	1	1	1
38	X-250-2	Coupling, reducer (3/8” x 1/4”npt)	1	1	1	1
39	X-426-12	Clamp, hose, .69/1.25 in.	2	2	2	2
40	X-426-9	Clamp, hose, .25/.70 in.	2	2	2	2
43	X-652-3	Connector, hose	2	2	2	2
44	X-801-3	Washer,hardened, .406 ID x .812 in.OD	6	6	6	6
45	X-6014-53	Hose, Radiator Wire Inset 3.00 ID	1	1	1	1
46	X-6014-91	Hose, Radiator Wire Inset 4.00 ID	2	2	2	2
50	GM77295	Tube, Turbo CAC	1			
50	GM78799	Tube, Turbo CAC		1		
50	GM84896	Tube, Turbo CAC			1	
50	GM85634	Tube, Turbo CAC				1
51	GM77635	Gasket, CAC Graphite	1			1
52	GM77638	Clamp, Exhaust (5.25 In.)	1			1
53	343175	Clamp, hose, 3.06/3.38 in.		2	2	
54	GM85118	Hose, Charged Air Cooler		1	1	
55	GM80658	Bracket, Belt Guard (LH)	1	1	1	1
56	GM80659	Bracket, Belt Guard (RH)	1	1	1	1
57	GM84769	Bracket, Tube CAC (not shown)	1	1	1	1
57	289372	Clamp, muffler, 4.12 in. (not shown)	1	1	1	1
58	286283	Clamp, muffler, 3.12 in. (not shown)	1	1	1	1
58	GM84770	Bracket, CAC Tube (not shown)	1	1	1	1

Engine



GM75801-C

Engine

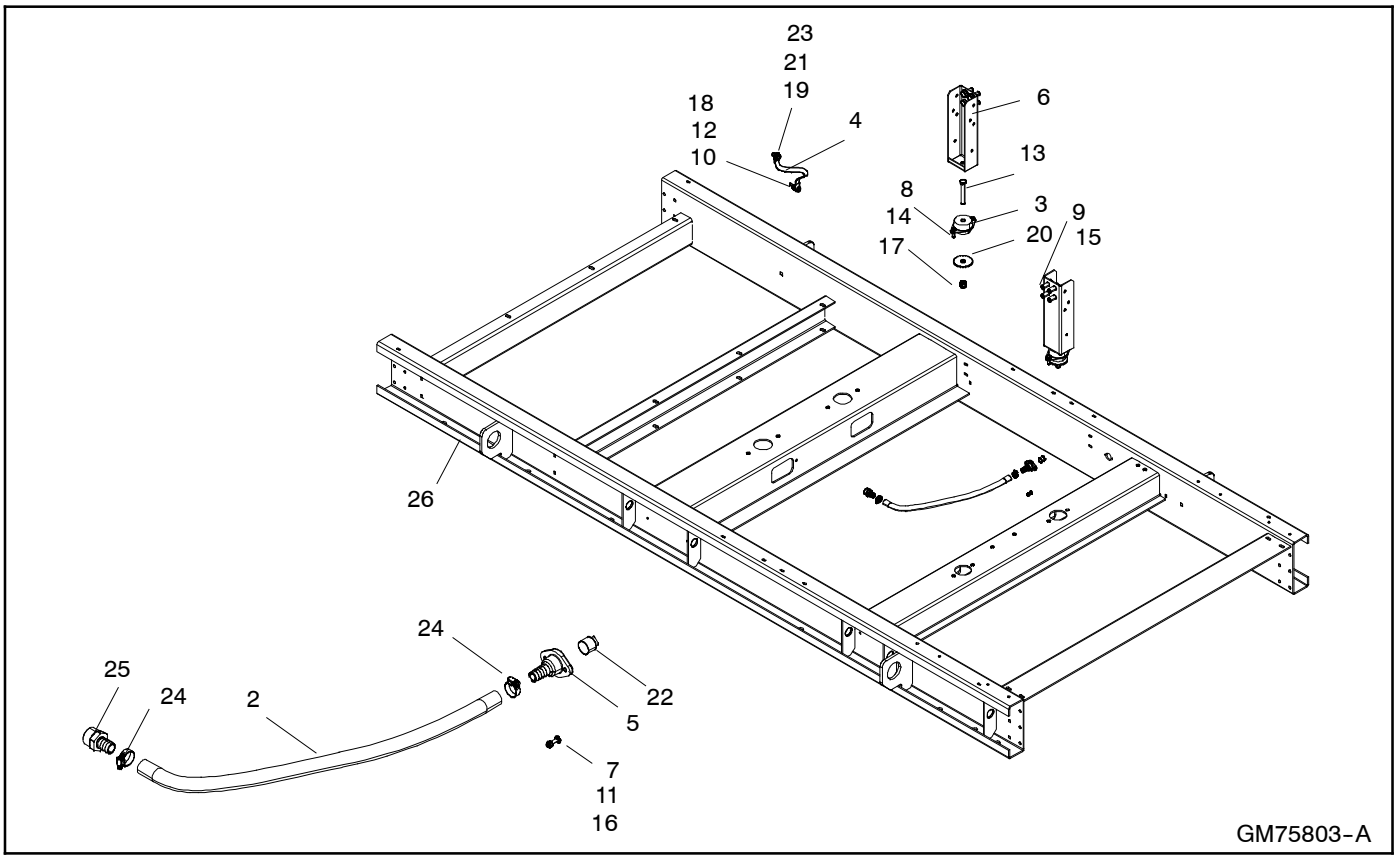
Item	Part Number	Description	Quantity Variation Number 1	2	3
1	GM13268	Bolt, Angle (NRP)	1	1	1
2	343221	Clamp, battery	1	1	1
3	GM11694	O-ring, ISO 6149 (15.3mm ID)	1	1	1
4	GM20745	Boot, Battery Lug	1	1	1
5	GM22991	Bushing, Adapter	1	1	1
6	GM39538	Fitting, Fuel	1	1	1
7	GM63164	Rack, Battery	1	1	1
8	GM74535	Terminal, Ground	1	1	1
9	M125A-08-80	Washer, Plain, 8.4 ID x 16.0 OD	5	5	5
10	M6923-08-80	Nut, Hex 8mm	4	4	4
11	M933-08020-60	Screw, Hex Cap	4	4	4
12	M933-12040-60	Screw, Hex Cap	1	1	1
13	M934-12-60	Nut, Hex 12mm	1	1	1
14	X-25-26	Washer, Plain, .531 IDx1.062 in.OD	2	2	2
15	X-25-37	Washer, plain, .406 ID x.812 in. OD	4	4	4
17	M982-08-80	Nut, hex elastic stop, 8MM	1	1	1
18	X-211-1	Elbow, Street(90 deg x 1/2”nptf)	1	1	1
19	X-468-2	Cable Tie	3	3	3
20	X-545-129	Cable, battery (No.0 x 30”) red+	1	1	1
21	X-545-167	Cable, Battery	1	1	1
22	X-545-73	Cable, battery (No.0 x 8”) black	1	1	1
23	X-6021-3	Screw, hex head machine	1	1	1
24	X-6086-5	Washer, spring, .515 ID x 1.06 in.OD	1	1	1
25	X-6210-9	Nut, flange spiralock, 3/8-16	4	4	4
26	GM76154	Engine, JD6135HF485, 350/400kW 60Hz,24V	1		
26	GM76155	Engine, JD6135HFG75, 450/500kW 60Hz,24V		1	
26	GM88213	Engine, 24V 6135HFG84			1

Nameplate and Decals

Nameplate and Decals are not illustrated.

Item	Part Number	Description	Quantity Var. Number GR1
1	226917	Decal, Negative Battery Conn	1
2	238402	Decal, Caution Positive Term.Only	1
3	249808	Decal, Warning Rotating Parts	1
4	249809	Decal, Caution Hot Engine	2
5	249810	Decal, Warning Hot Coolant	1
6	273780	Decal, Warning Explosion	1
7	343165	Decal, Caution-Not A Step	1
8	345211	Decal, Ground	1
9	364116	Decal, Caution Welding Disconnect	2
10	GM15300	Decal, Exhaust Piping	1
11	GM19296	Decal, Fuel Type	1
12	GM20171	Decal, Warning Fan	1
13	GM78897	Decal, Lift Warning	1
14	224233	Decal, 1-800 Number	1
15	255882	Decal, Caution Stdby Svc Connect	2
16	257438	Decal, Danger Moving Rotor	2
17	258815	Decal, Warning Voltage Backfeed	2
18	294520	Decal, Danger, High Voltage	2
19	345211	Decal, Ground	1
20	GM39683	Tag, Hang Lug Selection	1
21	GM49352	Tag, Hang	1
22	GM60531	Decal, Control Height	1
23	GM79042	Decal, Phasing A-B-C	2
24	GM79043	Decal, Phasing C-B-A	2
25	X-6232-6	Decal, Stripe	2
26	X-6246-1	Decal, Kohler Power System	2

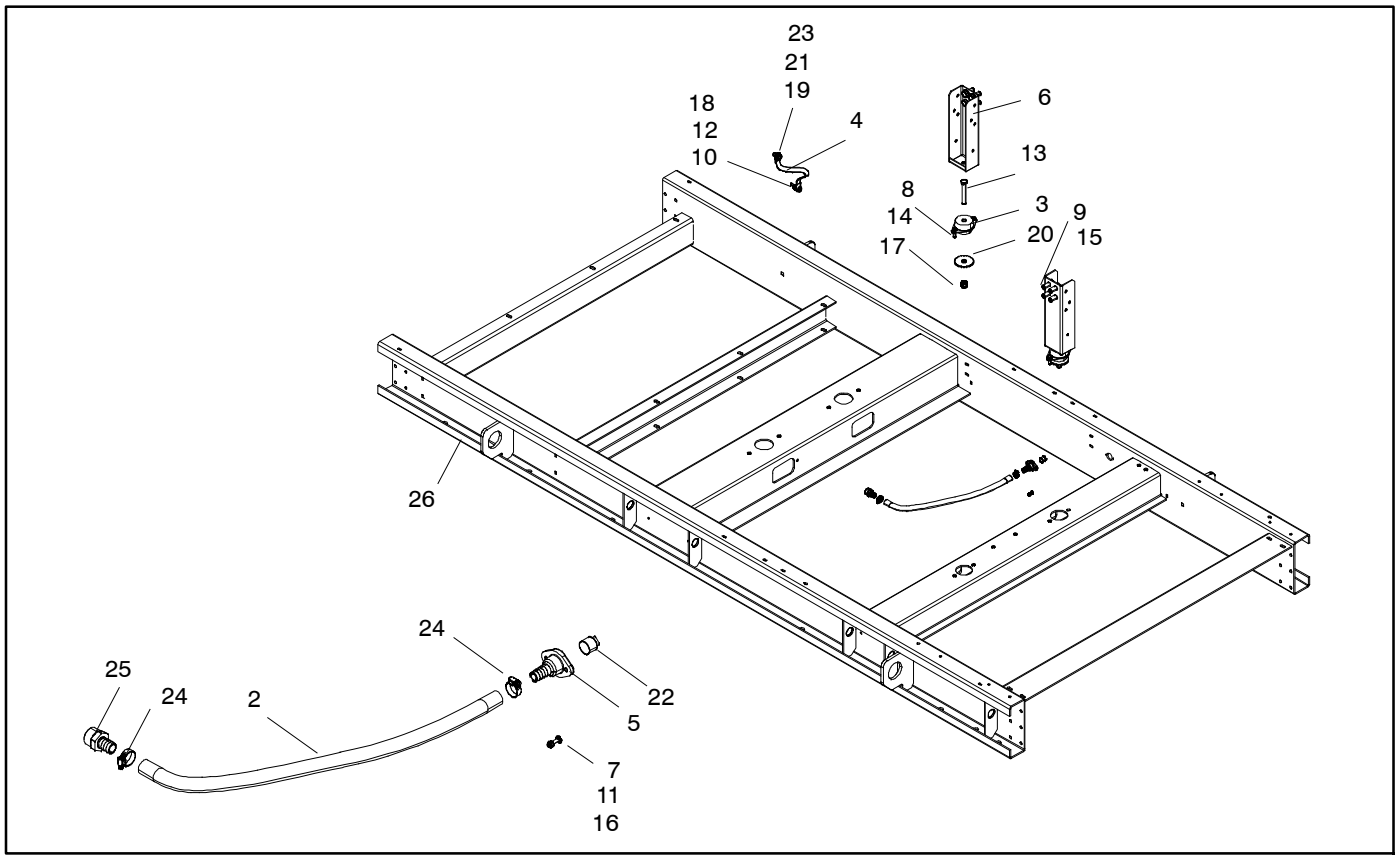
Skid and Plant Mounting



Find the installed module number on the generator set nameplate.

Item	Part Number	Description	Quantity Module GM75803-MA1	GM75803-MA2	GM85632-MA1	GM85632-MA2
2	X-577-35	Hose, rubber, straight, .62 in. ID	1	1	1	1
3	336024	Vibromount	2	2	2	2
4	GM21085	Strap, ground (16 in.)	1	1	1	1
5	GM59015	Fitting, Bulkhead Drain	1	1	1	1
6	GM64142	Bracket, Engine Mounting	2	2	2	2
7	M125A-05-80	Washer, Plain	2	2	2	2
8	M125A-10-80	Washer, Plain, 10.5 ID x 20.0 OD	6	6	6	6
9	M125A-16-80	Washer, Plain	8	8	10	10
10	M6923-10-80	Nut, Hex 10mm	1	1	1	1
11	M7985A-05020-20	Screw, Pan Head Machine	2	2	2	2
12	M931-10045-60	Screw, Hex Cap	1	1	1	1
13	M931-16100-60	Screw, Hex Cap	2	2		
13	M931-16120-82	Screw, Hex Cap			2	2
14	M933-10030-60	Screw, Hex Cap	4	4	4	4
15	M933-16040-60	Screw, Hex Cap	8	8	8	8
16	M934-05-50	Nut, Hex 5mm	2	2	2	2
17	M982-16-80	Nut, hex elastic stop	2	2	2	2
18	X-22-15	Washer,lock, .456 ID x 1.058 in.OD	2	2	2	2
19	X-22-26	Washer,lock, .521 ID x 1.24 in. OD	1	1	1	1
20	X-25-112	Washer, plain	2	2	2	2
21	X-25-26	Washer, Plain, .531 IDx1.062 in.OD	1	1	1	1
22	X-75-58	Plug, Pipe	1	1	1	1
23	X-129-17	Bolt, Hex Cap (1/2-13 x 1") Gr5	1	1	1	1
24	X-426-10	Clamp, hose, .5/1 in.	2	2	2	2
25	X-582-3	Connector, hose + Vibra Seal	1	1	1	1
26	GM78894	Skid, 4M	1			
26	GM78895	Skid, 5M		1		
26	GM84830	Skid, 4M			1	
26	GM84831	Skid, 5M				1

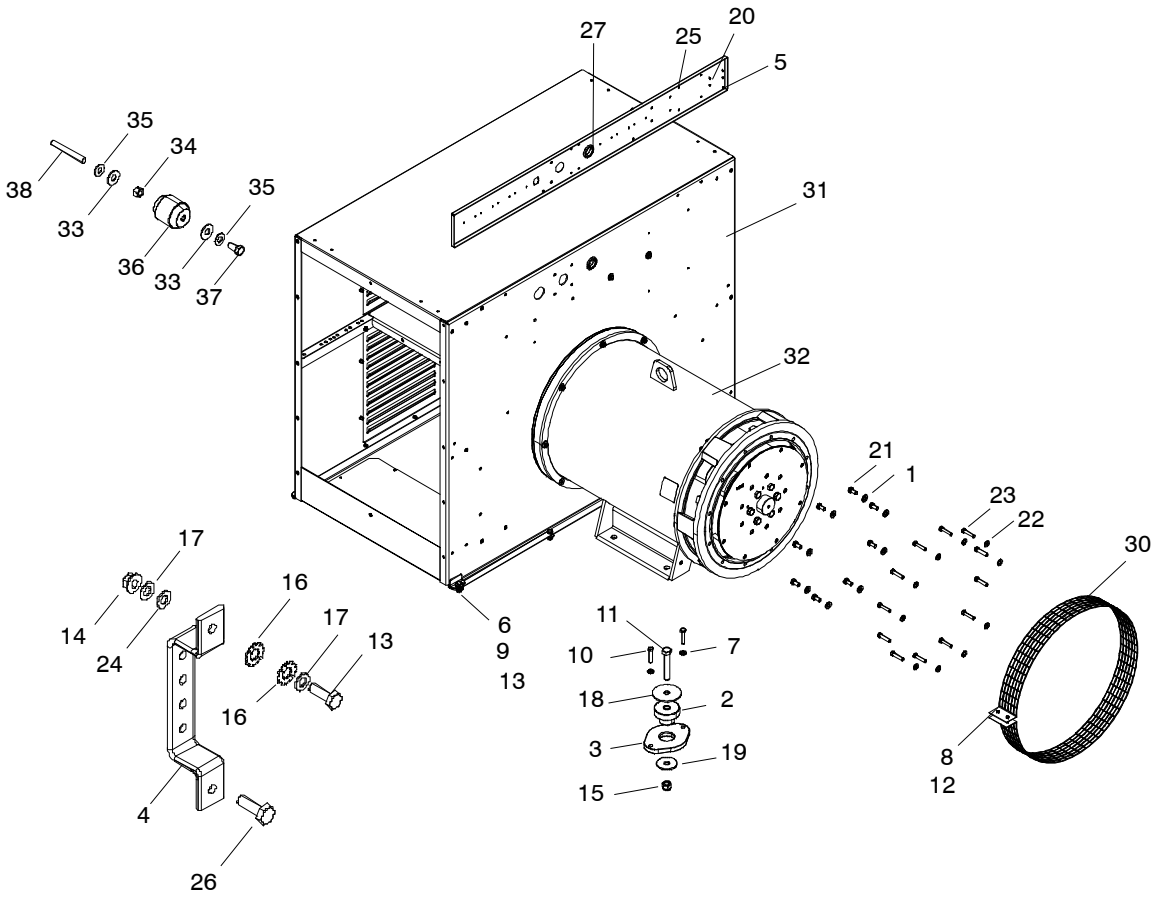
Skid and Plant Mounting



Find the installed module number on the generator set nameplate.

Item	Part Number	Description	Quantity Module GM84173-MA1	GM84173-MA2	GM84829-MA1	GM84829-MA2
2	X-577-35	Hose, rubber, straight, .62 in. ID	1	1	1	1
3	GM86134	Engine Mount, Seismic	2	2		
3	GM84169	Engine Mount, Seismic			2	2
4	GM21085	Strap, ground (16 in.)	1	1	1	1
5	GM59015	Fitting, Bulkhead Drain	1	1	1	1
6	GM84174	Bracket, Engine Mounting Seismic	2	2	2	2
7	M125A-05-80	Washer, Plain	2	2	2	2
8	M125A-10-80	Washer, Plain, 10.5 ID x 20.0 OD	6	6	2	2
9	M125A-16-80	Washer, Plain	8	8	10	10
10	M6923-10-80	Nut, Hex 10mm	1	1	1	1
11	M7985A-05020-20	Screw, Pan Head Machine	2	2	2	2
12	M931-10045-60	Screw, Hex Cap	1	1	1	1
13	M931-16120-82	Screw, Hex Cap	2	2	2	2
14	M933-10030-60	Screw, Hex Cap	4	4	4	4
15	M933-16040-60	Screw, Hex Cap	8	8	8	8
16	M934-05-50	Nut, Hex 5mm	2	2	2	2
17	M982-16-80	Nut, hex elastic stop	2	2	2	2
18	X-22-15	Washer,lock, .456 ID x 1.058 in.OD	2	2	2	2
19	X-22-26	Washer,lock, .521 ID x 1.24 in. OD	1	1	1	1
20	X-25-112	Washer, plain	2	2	2	2
21	X-25-26	Washer, Plain, .531 IDx1.062 in.OD	1	1	1	1
22	X-75-58	Plug, Pipe	1	1	1	1
23	X-129-17	Bolt, Hex Cap (1/2-13 x 1") Gr5	1	1	1	1
24	X-426-10	Clamp, hose, .5/1 in.	2	2	2	2
25	X-582-3	Connector, hose + Vibra Seal	1	1	1	1
26	GM78894	Skid, 4M	1			
26	GM78895	Skid, 5M		1		
26	GM84830	Skid, 4M			1	
26	GM84831	Skid, 5M				1

Alternator and Mounting



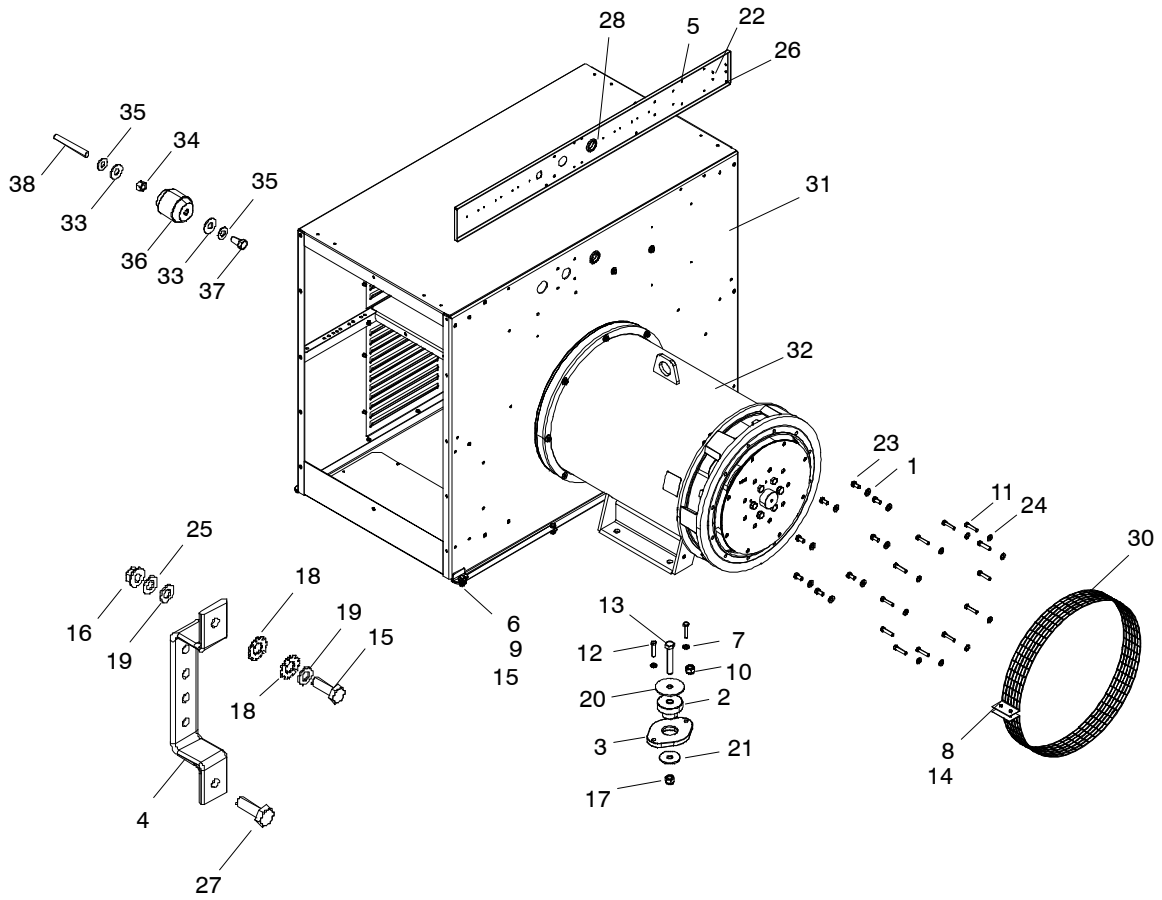
GM75808-B

Alternator and Mounting

Find the installed module number on the generator set nameplate.

Item	Part Number	Description	Quantity					
			Module					
			GM75808-MA1	GM75808-MA2	GM75808-MA3	GM75808-MA4	GM75808-MA5	GM75808-MA6
1	290945	Washer, hardened,.531 IDx1.06 in.OD	8	8	8	8	8	8
2	354634	Vibromount	2	2	2	2	2	2
3	354717	Plate, generator mounting	2	2	2	2	2	2
4	361271	Bus, ground	1	1	1	1	1	1
5	GM75910	Panel, Component Mtg.	1	1	1	1	1	1
6	M125A-10-80	Washer, Plain	7	7	7	7	7	7
7	M125A-12-80	Washer, Plain	4	4	4	4	4	4
8	M6923-06-80	Nut, Hex 6mm	2	2	2	2	2	2
9	M6923-10-80	Nut, Hex	8	8	8	8	8	8
10	M931-12055-60	Screw, Hex Cap	4	4	4	4	4	4
11	M931-20120-60	Screw, Hex Head	2	2	2	2	2	2
12	M933-06050-60	Screw, Hex Cap	2	2	2	2	2	2
13	M933-10035-60	Screw, Hex Cap	9	9	9	9	9	9
14	M934-10-60	Nut, hex 10mm	3	3	3	3	3	3
15	M982-20-80	Nut, hex elastic stop	2	2	2	2	2	2
16	X-22-14	Washer, lock, .391 ID x .975 in. OD	7	7	7	7	7	7
17	X-25-118	Washer, plain, .406 ID x 1 in. OD	5	5	5	5	5	5
18	X-25-150	Washer, plain, .8 ID x 4.25 in. OD	2	2	2	2	2	2
19	X-25-151	Washer, plain, .8 ID x 3 in. OD	2	2	2	2	2	2
20	X-67-59	Screw, hex washer, thread-forming	4	4	4	4	4	4
21	X-129-59	Bolt, Hex Cap	8	8	8	8	8	8
22	X-801-6	Washer,hardened, .469 ID x .922 in. OD	12	12	12	12	12	12
23	X-6024-16	Bolt, Hex Cap	12	12	12	12	12	12
24	X-6086-6	Washer,spring, .39 ID x .81 in. OD	2	2	2	2	2	2
25	X-6210-2	Nut, flange spiralock, 1/4-20	8	8	8	8	8	8
26	M931-10045-60	Screw, Hex Cap	1	1	1	1	1	1
27	X-284-25	Grommet	1	1	1	1	1	1
30	328902	Screen	1			1		1
30	328903	Screen		1			1	
31	GM75930-1	Junction Box Assembly 4M (See page 24)	1			1		1
31	GM75930-2	Junction Box Assembly 5M (See page 24)		1			1	
32	GM77505-2	Alternator Assy, 4M4021, Reconn, SAE14	1					
32	GM77506-2	Alternator Assy, 5M4027, Reconn, SAE14		1				
32	GM77506-3	Alternator Assy, 5M4028, Reconn, SAE14			1			
32	GM77505-4	Alternator Assy, 4M4266, 600V, SAE14				1		
32	GM77506-11	Alternator Assy, 5M4272, 600V, SAE14					1	
32	GM77505-1	Alternator Assy, 4M4019, Reconn, SAE14						1
33	X-25-118	Washer, plain, .406 ID x 1 in. OD	6	6	6			6
34	X-83-7	Nut, hex, 3/8-16, zinc	3	3	3			3
35	X-6086-6	Washer,spring, .39 ID x .81 in. OD	6	6	6			6
36	X-6128-29	Standoff insulator, 3/8-16 x 2 in.	3	3	3			3
37	X-6238-10	Bolt, Hex Cap	3	3	3			3
38	X-6274-7	Stud	3	3	3			3

Alternator and Mounting, continued



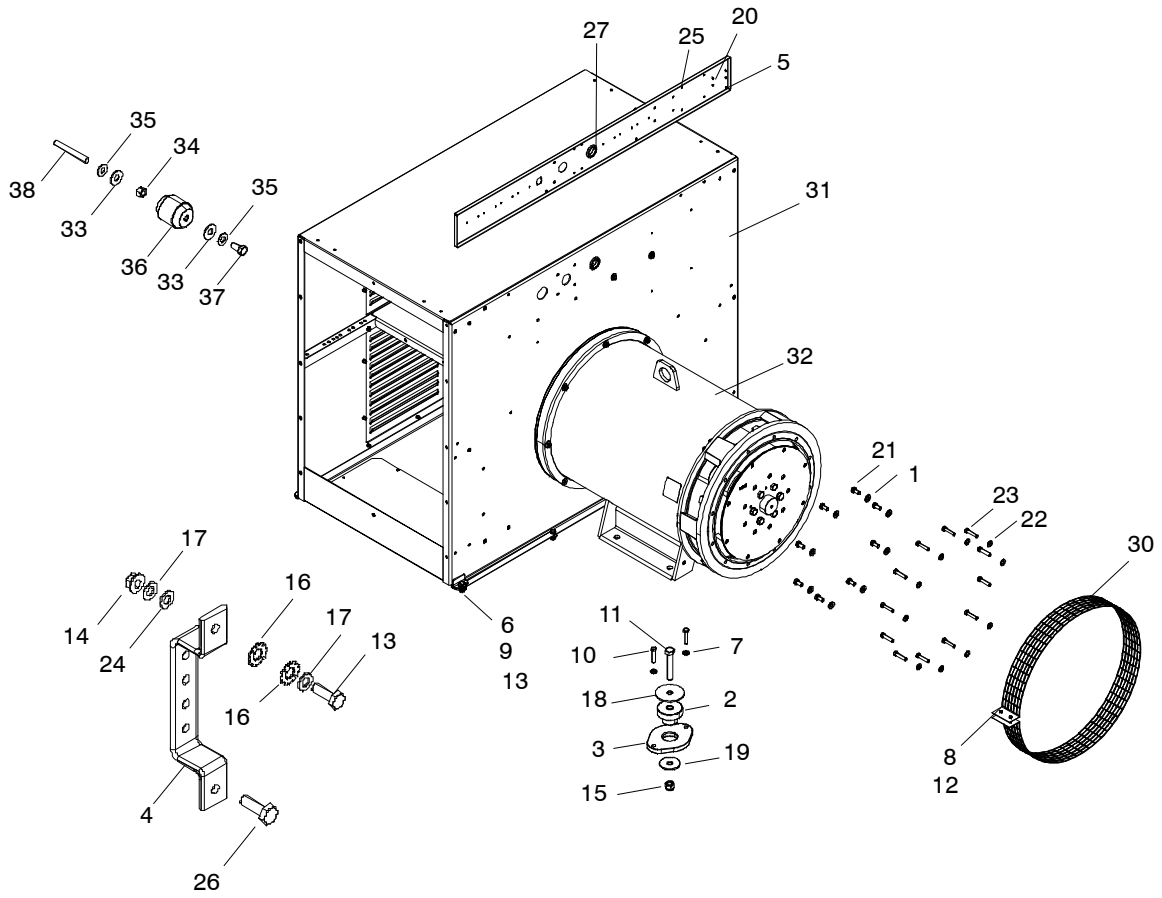
GM78808-B

Alternator and Mounting, continued

Find the installed module number on the generator set nameplate.

Item	Part Number	Description	Quantity							
			Module							
			GM78808-MA1	GM78808-MA2	GM78808-MA3	GM78808-MA4	GM78808-MA5	GM78808-MA6	GM78808-MA7	GM78808-MA8
1	290945	Washer, hardened,.531 IDx1.06 in.OD	8	8	8	8	8	8	8	8
2	354634	Vibromount	2	2	2	2	2	2	2	2
3	354717	Plate, generator mounting	2	2	2	2	2	2	2	2
4	361271	Bus, ground	1	1	1	1	1	1	1	1
5	GM75910	Panel, Component Mtg.	1	1	1	1	1	1	1	1
6	M125A-10-80	Washer, Plain	7	7	7	7	7	7	7	7
7	M125A-12-80	Washer, Plain	4	4	4	4	4	4	4	4
8	M6923-06-80	Nut, Hex 6mm	2	2	2	2	2	2	2	2
9	M6923-10-80	Nut, Hex	8	8	8	8	8	8	8	8
10	M6923-12-80	Nut, Hex	4	4	4	4	4	4	4	4
11	X-6024-17	Bolt, Hex Cap	12	12	12	12	12	12	12	12
12	M931-12055-60	Screw, Hex Cap	4	4	4	4	4	4	4	4
13	M931-20120-60	Screw, Hex Head	2	2	2	2	2	2	2	2
14	M933-06050-60	Screw, Hex Cap	2	2	2	2	2	2	2	2
15	M933-10035-60	Screw, Hex Cap	9	9	9	9	9	9	9	9
16	M934-10-60	Nut, hex 10mm	3	3	3	3	3	3	3	3
17	M982-20-80	Nut, hex elastic stop	2	2	2	2	2	2	2	2
18	X-22-14	Washer, lock, .391 ID x .975 in. OD	7	7	7	7	7	7	7	7
19	X-25-118	Washer, plain, .406 ID x 1 in. OD	5	5	5	5	5	5	5	5
20	X-25-150	Washer, plain, .8 ID x 4.25 in. OD	2	2	2	2	2	2	2	2
21	X-25-151	Washer, plain, .8 ID x 3 in. OD	2	2	2	2	2	2	2	2
22	X-67-59	Screw, hex washer, thread-forming	4	4	4	4	4	4	4	4
23	X-129-59	Bolt, Hex Cap	8	8	8	8	8	8	8	8
24	X-801-6	Washer,hardened,.469 ID x .922 in.OD	12	12	12	12	12	12	12	12
25	X-6086-6	Washer,spring, .39 ID x .81 in. OD	2	2	2	2	2	2	2	2
26	X-6210-2	Nut, flange spiralock, 1/4-20	8	8	8	8	8	8	8	8
27	M931-10045-60	Screw, Hex Cap	1	1	1	1	1	1	1	1
28	X-284-25	Grommet	1	1	1	1	1	1	1	1
30	328903	Screen	1	1	1	1	1			
30	328902	Screen						1	1	1
31	GM75930-2	Junction Box Assembly 5M (See page 24)	1	1	1	1	1			
31	GM75930-1	Junction Box Assembly 4M (See page 24)						1	1	1
32	GM77506-1	Alternator Assy, 5M4024, Reconn, SAE14	1							
32	GM77506-2	Alternator Assy, 5M4027, Reconn, SAE14		1						
32	GM77506-3	Alternator Assy, 5M4028, Reconn, SAE14			1					
32	GM77506-10	Alternator Assy, 5M4270, 600V, SAE14				1				
32	GM77506-11	Alternator Assy, 5M4272, 600V, SAE14					1			
32	GM77505-2	Alternator Assy, 4M4021								
32	GM77505-4	Alternator Assy, 4M4266								
32	GM77505-1	Alternator Assy, 4M4019								
33	X-25-118	Washer, plain, .406 ID x 1 in. OD	6	6	6	6		6		6
34	X-83-7	Nut, hex, 3/8-16, zinc	3	3	3	3		3		3
35	X-6086-6	Washer,spring, .39 ID x .81 in. OD	6	6	6	6		6		6
36	X-6128-29	Standoff insulator, 3/8-16 x 2 in.	3	3	3	3		3		3
37	X-6238-10	Bolt, Hex Cap	3	3	3	3		3		3
38	X-6274-7	Stud	3	3	3	3		3		3

Alternator and Mounting, continued



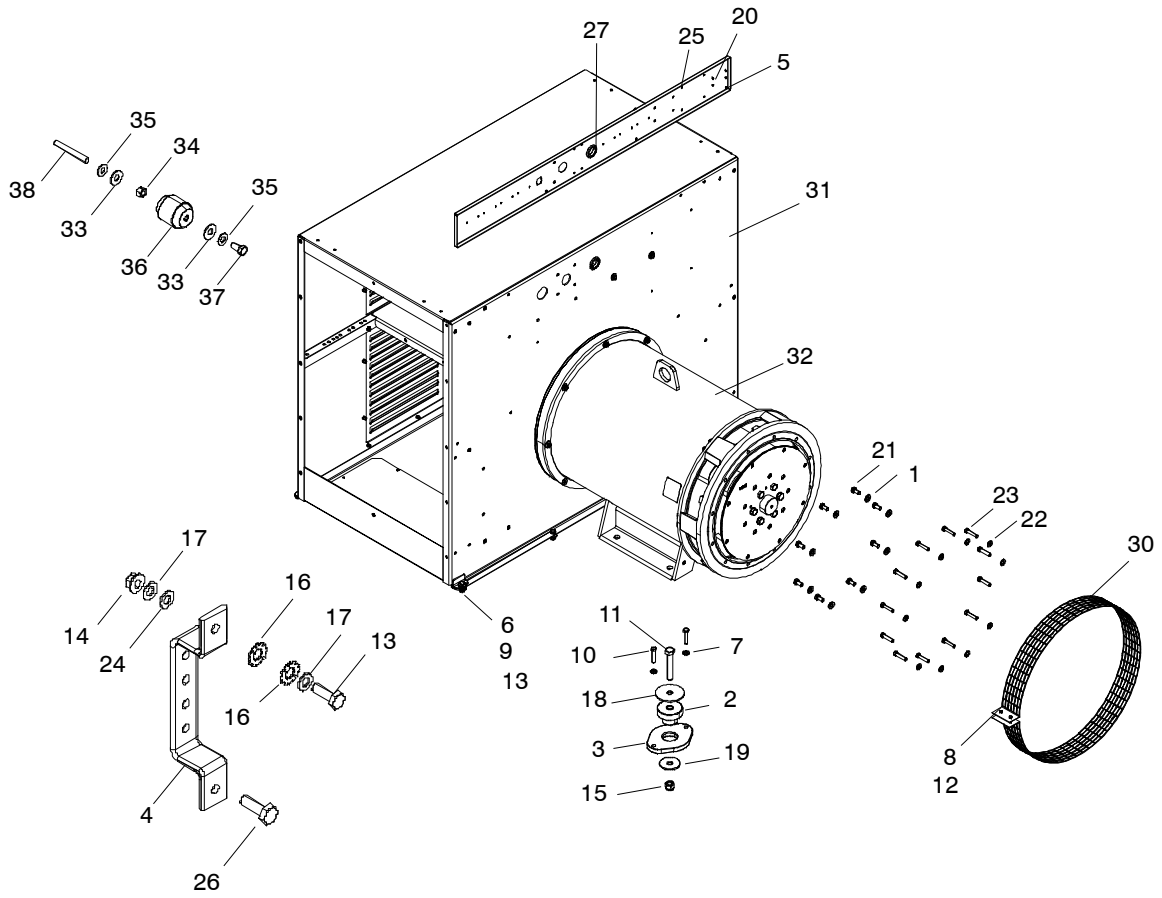
GM75808-B

Alternator and Mounting, continued

Find the installed module number on the generator set nameplate.

Item	Part Number	Description	Quantity							
			Module							
			GM84175-MA1	GM84175-MA2	GM84175-MA3	GM84175-MA4	GM84175-MA5	GM84175-MA6	GM84175-MA7	GM84175-MA8
1	290945	Washer, hardened,.531 IDx1.06 in.OD	8	8	8	8	8	8	8	8
2	GM84170	Alternator Mount, Seismic	2	2	2	2	2	2	2	2
3	GM84170	Alternator Mount, Seismic	2	2	2	2	2	2	2	2
4	361271	Bus, ground	1	1	1	1	1	1	1	1
5	GM75910	Panel, Component Mtg.	1	1	1	1	1	1	1	1
6	M125A-10-80	Washer, Plain	7	7	7	7	7	7	7	7
7	M125A-12-80	Washer, Plain	4	4	4	4	4	4	4	4
8	M6923-06-80	Nut, Hex 6mm	2	2	2	2	2	2	2	2
9	M6923-10-80	Nut, Hex	8	8	8	8	8	8	8	8
10	M931-12055-60	Screw, Hex Cap	4	4	4	4	4	4	4	4
11	M931-20140-60	Screw, Hex Head	2	2	2	2	2	2	2	2
12	M933-06050-60	Screw, Hex Cap	2	2	2	2	2	2	2	2
13	M933-10035-60	Screw, Hex Cap	9	9	9	9	9	9	9	9
14	M934-10-60	Nut, hex 10mm	3	3	3	3	3	3	3	3
15	M982-20-80	Nut, hex elastic stop	2	2	2	2	2	2	2	2
16	X-22-14	Washer, lock, .391 ID x .975 in. OD	7	7	7	7	7	7	7	7
17	X-25-118	Washer, plain, .406 ID x 1 in. OD	5	5	5	5	5	5	5	5
18	X-25-150	Washer, plain, .8 ID x 4.25 in. OD	2	2	2	2	2	2	2	2
20	X-67-59	Screw, hex washer, thread-forming	4	4	4	4	4	4	4	4
21	X-129-59	Bolt, Hex Cap	8	8	8	8	8	8	8	8
22	X-801-6	Washer,hardened, .469 ID x .922 in. OD	12	12	12	12	12	12	12	12
23	X-6024-17	Bolt, Hex Cap	12	12	12	12	12	12	12	12
24	X-6086-6	Washer,spring, .39 ID x .81 in. OD	2	2	2	2	2	2	2	2
25	X-6210-2	Nut, flange spiralock, 1/4-20	8	8	8	8	8	8	8	8
26	M931-10045-60	Screw, Hex Cap	1	1	1	1	1	1	1	1
27	X-284-25	Grommet	1	1	1	1	1	1	1	1
30	328902	Screen						1	1	1
30	328903	Screen	1	1	1	1	1			
31	GM75930-1	Junction Box Assembly 4M (See page 24)						1	1	1
31	GM75930-2	Junction Box Assembly 5M (See page 24)	1	1	1	1	1			
32	GM77506-1	Alternator Assy, 5M4024	1							
32	GM77506-2	Alternator Assy, 5M4027, Reconn, SAE14		1						
32	GM77506-3	Alternator Assy, 5M4028, Reconn, SAE14			1					
32	GM77506-10	Alternator Assy, 5M4270, 600V, SAE14				1				
32	GM77506-11	Alternator Assy, 5M4272, 600V, SAE14					1			
32	GM77505-2	Alternator Assy, 4M4021, Reconn, SAE14						1		
32	GM77505-4	Alternator Assy, 4M4266, 600V, SAE14							1	
32	GM77505-1	Alternator Assy, 4M4019, Reconn, SAE14								1
33	X-25-118	Washer, plain, .406 ID x 1 in. OD	6	6	6	6		6		6
34	X-83-7	Nut, hex, 3/8-16, zinc	3	3	3	3		3		3
35	X-6086-6	Washer,spring, .39 ID x .81 in. OD	6	6	6	6		6		6
36	X-6128-29	Standoff insulator, 3/8-16 x 2 in.	3	3	3	3		3		3
37	X-6238-10	Bolt, Hex Cap	3	3	3	3		3		3
38	X-6274-7	Stud	3	3	3	3		3		3

Alternator and Mounting, continued



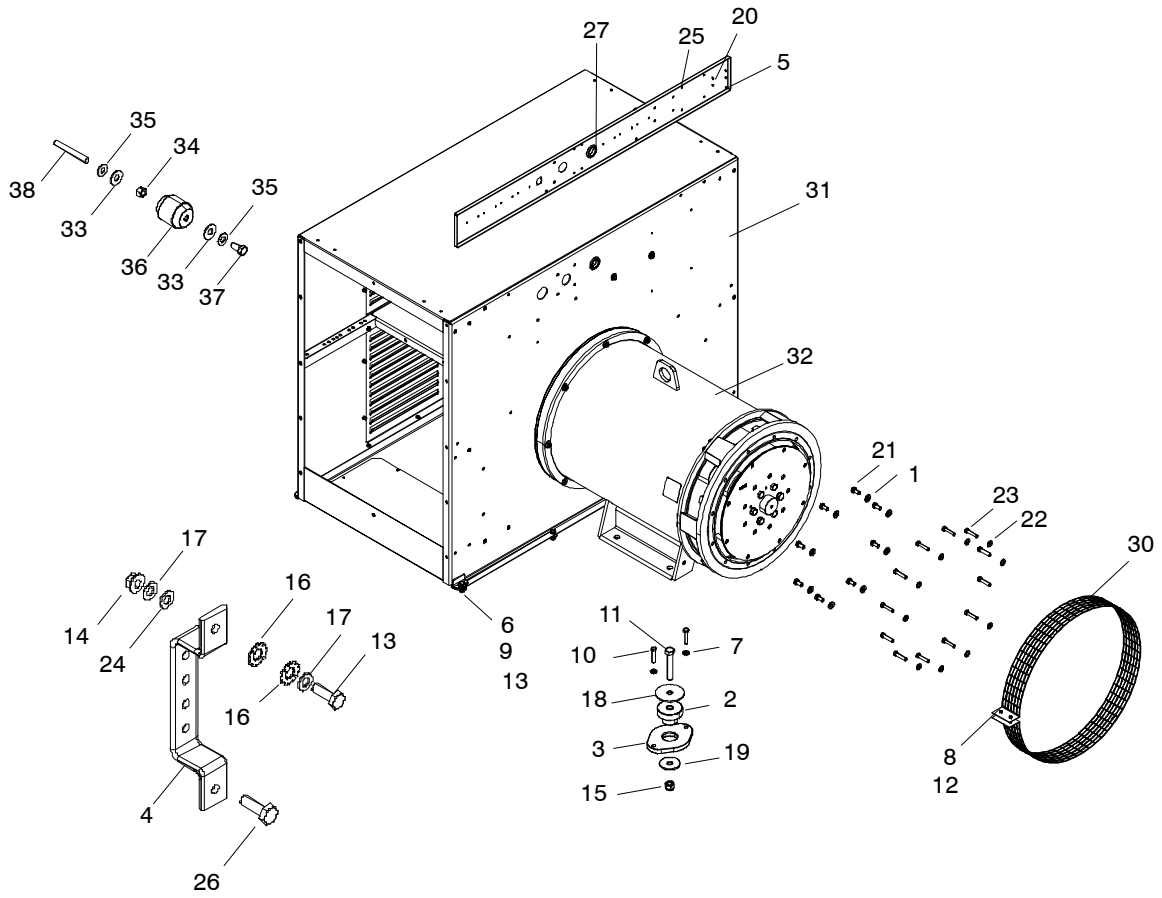
GM75808-B

Alternator and Mounting, continued

Find the installed module number on the generator set nameplate.

Item	Part Number	Description	Quantity							
			Module							
			GM84918-MA1	GM84918-MA2	GM84918-MA3	GM84918-MA4	GM84918-MA5	GM84918-MA6	GM84918-MA7	GM84918-MA8
1	290945	Washer, hardened,.531 IDx1.06 in.OD	8	8	8	8	8	8	8	8
2	GM84170	Alternator Mount, Seismic	2	2	2	2	2	2	2	2
3	GM84170	Alternator Mount, Seismic	2	2	2	2	2	2	2	2
4	361271	Bus, ground	1	1	1	1	1	1	1	1
5	GM84527	Panel, Component Mtg.	1	1	1	1	1	1	1	1
6	M125A-10-80	Washer, Plain	7	7	7	7	7	7	7	7
7	M125A-12-80	Washer, Plain	4	4	4	4	4	4	4	4
8	M6923-06-80	Nut, Hex 6mm	2	2	2	2	2	2	2	2
9	M6923-10-80	Nut, Hex	8	8	8	8	8	8	8	8
10	M931-12055-60	Screw, Hex Cap	4	4	4	4	4	4	4	4
11	M931-20140-60	Screw, Hex Head	2	2	2	2	2	2	2	2
12	M933-06050-60	Screw, Hex Cap	2	2	2	2	2	2	2	2
13	M933-10035-60	Screw, Hex Cap	9	9	9	9	9	9	9	9
14	M934-10-60	Nut, hex 10mm	3	3	3	3	3	3	3	3
15	M982-20-80	Nut, hex elastic stop	2	2	2	2	2	2	2	2
16	X-22-14	Washer, lock, .391 ID x .975 in. OD	7	7	7	7	7	7	7	7
17	X-25-118	Washer, plain, .406 ID x 1 in. OD	5	5	5	5	5	5	5	5
18	X-25-150	Washer, plain, .8 ID x 4.25 in. OD	2	2	2	2	2	2	2	2
20	X-67-59	Screw, hex washer, thread-forming	4	4	4	4	4	4	4	4
21	X-129-59	Bolt, Hex Cap	8	8	8	8	8	8	8	8
22	X-801-6	Washer,hardened, .469 ID x .922 in. OD	12	12	12	12	12	12	12	12
23	X-6024-17	Bolt, Hex Cap	12	12	12	12	12	12	12	12
24	X-6086-6	Washer,spring, .39 ID x .81 in. OD	2	2	2	2	2	2	2	2
25	X-6210-2	Nut, flange spiralock, 1/4-20	8	8	8	8	8	8	8	8
26	M931-10045-60	Screw, Hex Cap	1	1	1	1	1	1	1	1
27	X-284-25	Grommet	1	1	1	1	1	1	1	1
30	328902	Screen						1	1	1
30	328903	Screen	1	1	1	1	1			
31	GM85248-1	Junction Box Assembly 4M (See page 25)						1	1	1
31	GM85248-2	Junction Box Assembly 5M (See page 25)	1	1	1	1	1			
32	GM77506-1	Alternator Assy, 5M4024	1							
32	GM77506-2	Alternator Assy, 5M4027, Reconn, SAE14		1						
32	GM77506-3	Alternator Assy, 5M4028, Reconn, SAE14			1					
32	GM77506-10	Alternator Assy, 5M4270, 600V, SAE14				1				
32	GM77506-11	Alternator Assy, 5M4272, 600V, SAE14					1			
32	GM77505-2	Alternator Assy, 4M4021, Reconn, SAE14						1		
32	GM77505-4	Alternator Assy, 4M4266, 600V, SAE14							1	
32	GM77505-1	Alternator Assy, 4M4019, Reconn, SAE14								1
33	X-25-118	Washer, plain, .406 ID x 1 in. OD	6	6	6	6		6		6
34	X-83-7	Nut, hex, 3/8-16, zinc	3	3	3	3		3		3
35	X-6086-6	Washer,spring, .39 ID x .81 in. OD	6	6	6	6		6		6
36	X-6128-29	Standoff insulator, 3/8-16 x 2 in.	3	3	3	3		3		3
37	X-6238-10	Bolt, Hex Cap	3	3	3	3		3		3
38	X-6274-7	Stud	3	3	3	3		3		3

Alternator and Mounting, continued



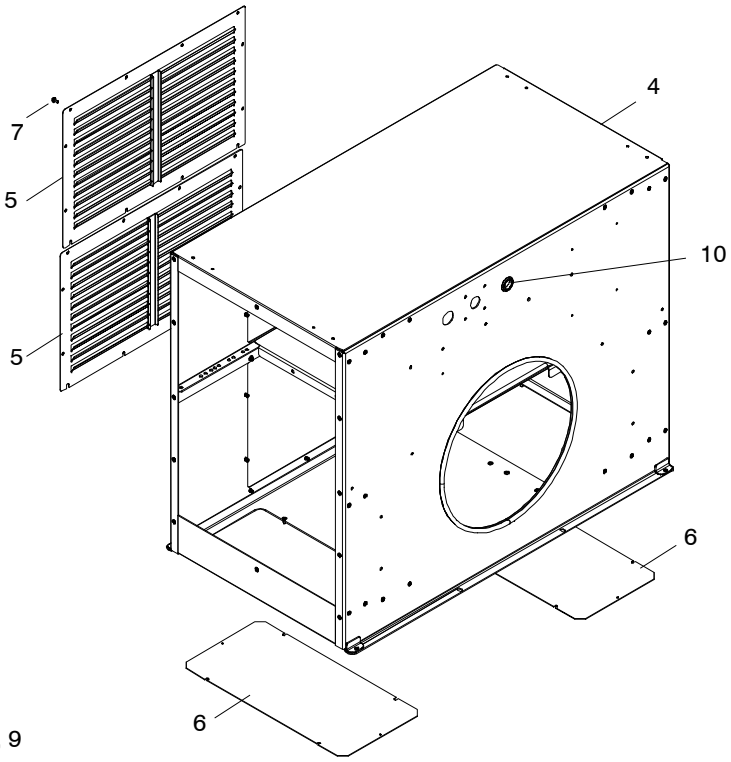
GM75808-B

Alternator and Mounting, continued

Find the installed module number on the generator set nameplate.

Item	Part Number	Description	Quantity							
			Module							
			GM85633-MA1	GM85633-MA2	GM85633-MA3	GM85633-MA4	GM85633-MA5	GM85633-MA6	GM85633-MA7	GM85633-MA8
1	290945	Washer, hardened,.531 IDx1.06 in.OD	8	8	8	8	8	8	8	8
2	354634	Vibromount	2	2	2	2	2	2	2	2
3	354717	Plate, generator mounting	2	2	2	2	2	2	2	2
4	361271	Bus, ground	1	1	1	1	1	1	1	1
5	GM84527	Panel, Component Mtg.	1	1	1	1	1	1	1	1
6	M125A-10-80	Washer, Plain	7	7	7	7	7	7	7	7
7	M125A-12-80	Washer, Plain	4	4	4	4	4	4	4	4
8	M6923-06-80	Nut, Hex 6mm	2	2	2	2	2	2	2	2
9	M6923-10-80	Nut, Hex	8	8	8	8	8	8	8	8
10	M931-12055-60	Screw, Hex Cap	4	4	4	4	4	4	4	4
11	M931-20140-60	Screw, Hex Head	2	2	2	2	2	2	2	2
12	M933-06050-60	Screw, Hex Cap	2	2	2	2	2	2	2	2
13	M933-10035-60	Screw, Hex Cap	9	9	9	9	9	9	9	9
14	M934-10-60	Nut, hex 10mm	3	3	3	3	3	3	3	3
15	M982-20-80	Nut, hex elastic stop	2	2	2	2	2	2	2	2
16	X-22-14	Washer, lock, .391 ID x .975 in. OD	7	7	7	7	7	7	7	7
17	X-25-118	Washer, plain, .406 ID x 1 in. OD	5	5	5	5	5	5	5	5
18	X-25-150	Washer, plain, .8 ID x 4.25 in. OD	2	2	2	2	2	2	2	2
19	X-25-151	Washer, plain, .8 ID x 3 in. OD	2	2	2	2	2	2	2	2
20	X-67-59	Screw, hex washer, thread-forming	4	4	4	4	4	4	4	4
21	X-129-59	Bolt, Hex Cap	8	8	8	8	8	8	8	8
22	X-801-3	Washer,hardened,.406 ID x .812 in.OD	12	12	12	12	12	12	12	12
23	M931-10040-82	Bolt, Hex Cap	12	12	12	12	12	12	12	12
24	X-6086-6	Washer,spring, .39 ID x .81 in. OD	2	2	2	2	2	2	2	2
25	X-6210-2	Nut, flange spiralock, 1/4-20	8	8	8	8	8	8	8	8
26	M931-10045-60	Screw, Hex Cap	1	1	1	1	1	1	1	1
27	X-284-25	Grommet	1	1	1	1	1	1	1	1
30	328902	Screen						1	1	1
30	328903	Screen	1	1	1	1	1			
31	GM85248-1	Junction Box Assembly 4M (See page 25)						1	1	1
31	GM85248-2	Junction Box Assembly 5M (See page 25)	1	1	1	1	1			
32	GM77505-2	Alternator Assy, 4M4021, Reconn, SAE14						1		
32	GM77506-1	Alternator Assy, 5M4024	1							
32	GM77506-2	Alternator Assy, 5M4027, Reconn, SAE14		1						
32	GM77506-3	Alternator Assy, 5M4028, Reconn, SAE14			1					
32	GM77505-4	Alternator Assy, 4M4266, 600V, SAE14							1	
32	GM77506-10	Alternator Assy, 5M4270				1				
32	GM77506-11	Alternator Assy, 5M4272, 600V, SAE14					1			
32	GM77505-1	Alternator Assy, 4M4019, Reconn, SAE14								1
33	X-25-118	Washer, plain, .406 ID x 1 in. OD	6	6	6	6		6		6
34	X-83-7	Nut, hex, 3/8-16, zinc	3	3	3	3		3		3
35	X-6086-6	Washer,spring, .39 ID x .81 in. OD	6	6	6	6		6		6
36	X-6128-29	Standoff insulator, 3/8-16 x 2 in.	3	3	3	3		3		3
37	X-6238-10	Bolt, Hex Cap	3	3	3	3		3		3
38	X-6274-7	Stud	3	3	3	3		3		3

Alternator and Mounting, continued

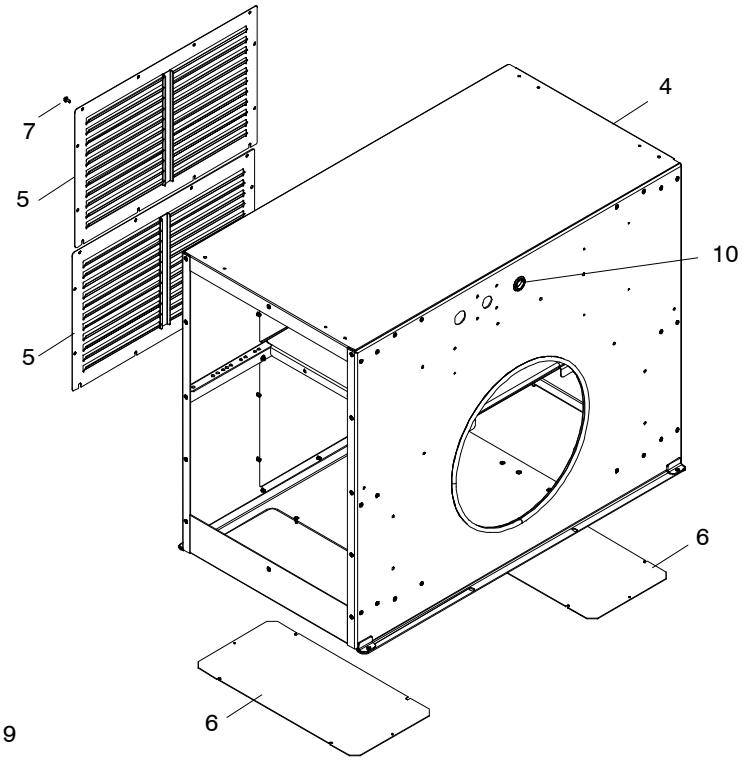


Items not shown: 3, 8, 9

GM75930-B

Item	Part Number	Description	Quantity Module Number GM75930-1	GM75930-2	GM75930-3
3	GM11040-7	Insert, Threaded (M6 x 1.0 Hex)	76	76	76
4	GM75889	Box, Junction (4M)	1		
4	GM75890	Box, Junction (5M)		1	
4	GM75891	Box, Junction (7M)			1
5	GM75892	Panel, J-Box (Louvered)	2	2	2
6	GM75895	Panel, J-Box (Cable Entry)	2	2	2
7	M6921-06016-60	Screw, Hex Flnge M6x16mm flly thrd js500	32	32	32
8	X-284-2	Grommet, round	1	1	1
9	361567	Base, tie wrap snapin	5	5	5
10	X-284-25	Grommet, round	1	1	1

Alternator and Mounting, continued

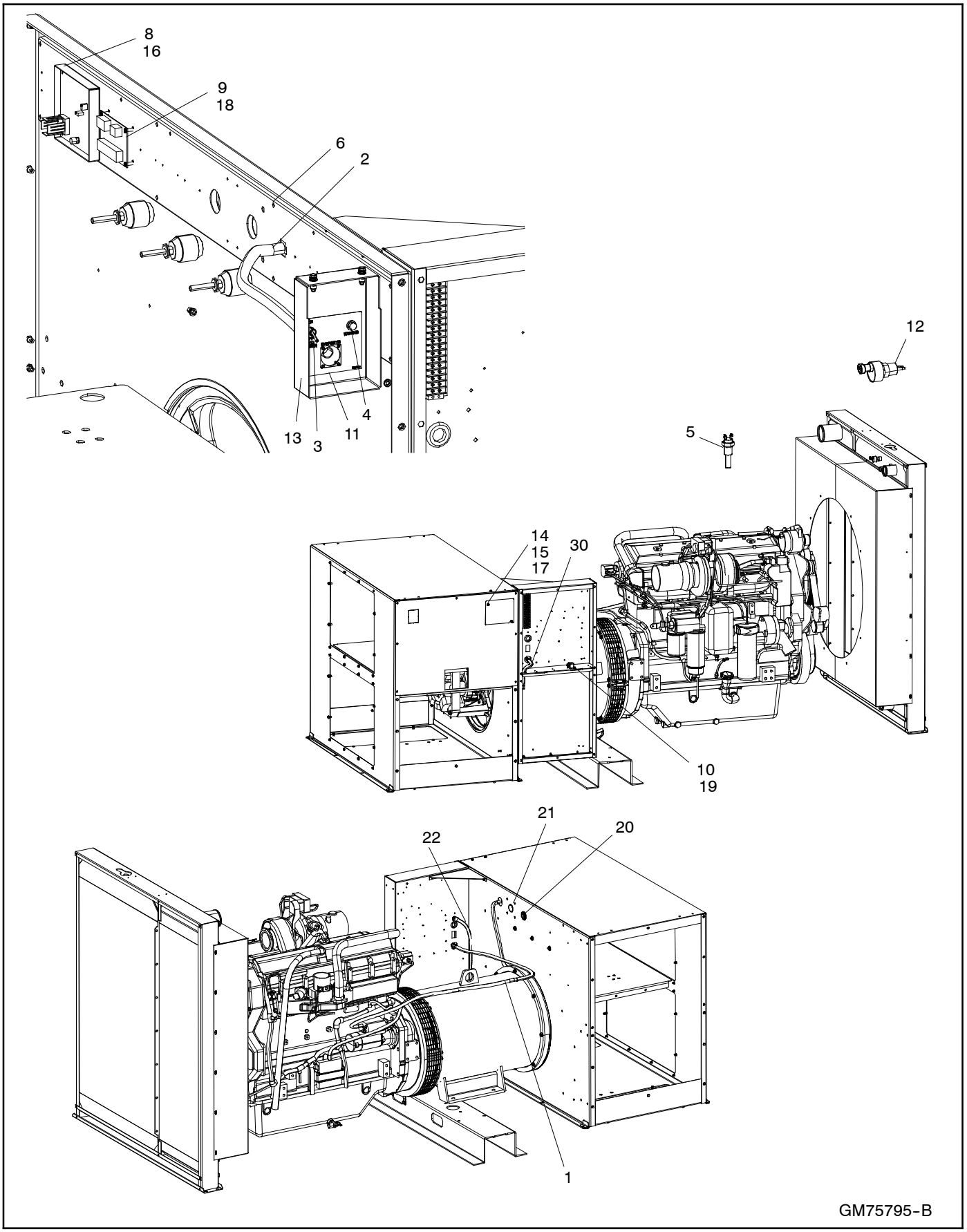


Items not shown: 8, 9

GM85248-A

Item	Part Number	Description	Quantity Module Number GM85248-1	Quantity Module Number GM85248-2
4	GM84524	Box, Junction (4M)	1	
4	GM84525	Box, Junction (5M)		1
5	GM75892	Panel, J-Box (Louvered)	2	2
6	GM75895	Panel, J-Box (Cable Entry)	2	2
7	GM78761-1	Screw, Sheetmetal	32	32
8	X-284-2	Grommet, round	1	1
9	361567	Base, tie wrap snapin	5	5
10	X-284-25	Grommet, round	1	1

Control and Harness



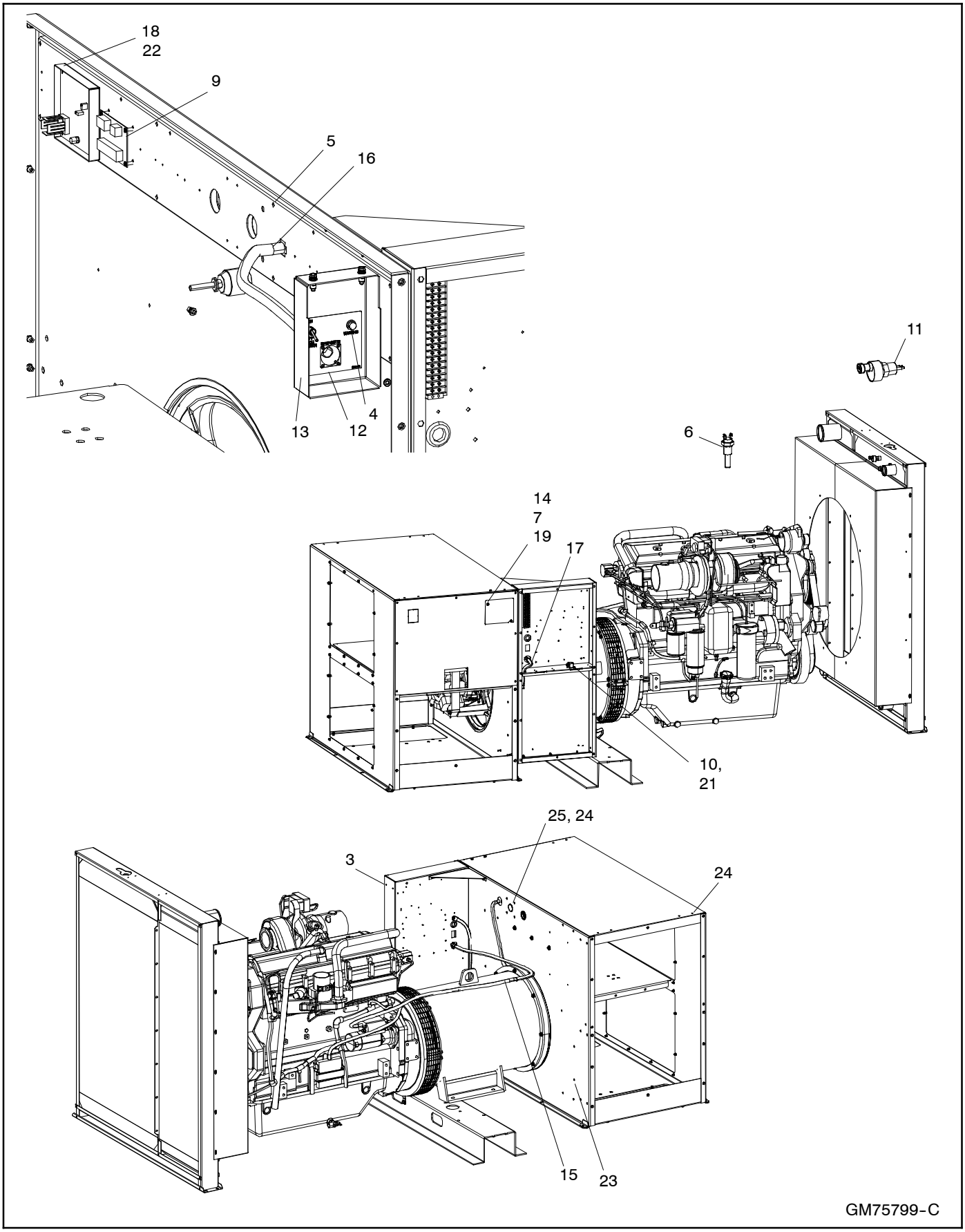
Control and Harness

Find the installed module number on the generator set nameplate.

Item	Part Number	Description	Quantity		
			Module Number		
			GM75795-MA1	GM75795-MA2	GM85393-MA1
1	GM77970	Harness, Engine 350-500 kW JD Tier III	1	1	1
2	GM77977	Harness, Diagnostic 350-500 kW JD	1	1	1
3	295030	Switch, toggle, 1 pole	1	1	1
	324861	Plug, Black Plastic	12	12	12
4	343684	Lamp assy 28VDC yel/amb led	1	1	1
5	GM51705	Switch, low water temp	1	1	1
6	361567	Base, tie wrap snapin	5	5	5
8	GM79677	PCB assy Marathon excitation interface	1	1	1
9	GM13980	PCB Assy CT Burden Resistor	1	1	1
10	GM49747	Relay, 24V DC	1	1	1
11	GM62565	Decal, Diagnostic	1	1	1
12	GM66270	Sensor, Low Coolant Level	1	1	1
13	GM77904	Bracket, Mtg (Diagnostic)	1	1	1
14	GM77909	Cover, Diagnostic	1	1	1
15	M6921-06016-60	Screw	10	10	10
17	GM11040-7	Insert, Threaded (M6 x 1.0 Hex)	4	4	4
18	M7985A-04010-20	Screw, Pan Head Machine	4	4	4
19	X-67-155	Screw, Tapping	1	1	1
20	X-67-156	Screw, Tapping	4	4	4
21	X-301-34	Plug, Button	7	7	7
22	X-301-47	Plug, Button	10	10	10
23	X-301-48	Plug, Button	1	1	1
30	GM77981	Harness, Control Box 350-500 kW JD	1		
30	GM77976	Harness, Control Box 350-500 kW JD		1	
30	GM85395	Harness, Control Box 350-500 kW JD			1

Control and Harness, continued

Decision-Maker 3000 Controller



Control and Harness, continued

Find the installed module number on the generator set nameplate.

Item	Part Number	Description	Quantity Module Number GM75799-MA1
1	GM77978	Harness, A/C Control Box	1
3	324861	Plug, black plastic	12
4	343684	Lamp assy 28VDC yel/amb led	1
5	361567	Base, tie wrap snapin	5
6	GM39458	Sender, Temperature	1
7	GM11040-7	Insert, Threaded (M6 x 1.0 Hex)	4
9	GM13980	PCB Assy CT Burden Resistor	1
10	GM49747	Relay, 24V DC	1
11	GM66270	Sensor, Low Coolant Level	1
12	GM69565	Decal, Diagnostic	1
13	GM77903	Bracket, Mtg (Diagnostic)	1
14	GM77909	Cover, Diagnostic	1
15	GM77970	Harness, Engine 350-500 kW JD Tier III	1
16	GM77977	Harness, Diagnostic 350-500 kW JD	1
17	GM77979	Harness, Control Box 350-500 kW JD	1
18	GM79677	PCB assy Marathon excitation interface	1
19	M6921-06016-60	Screw, Hex Flnge M6x16mm flly thrd js500	10
20	M7985A-04010-20	Screw, Pan Head Machine	4
21	X-67-155	Screw, Tapping	1
22	X-67-156	Screw, Tapping	4
23	X-301-34	Plug, Button	7
24	X-301-47	Plug, Button	10
25	X-301-48	Plug, Button	1

Literature

Item	Part Number	Description	Quantity					
			Variation Number					
			452	453	480	495	496	497
1	TP-5374	Warranty 1-Year Limited, Industrial	1	1	1	1	1	1
2	TP-5700	I/M 20-3250kW, Industrial	1	1	1	1	1	1
3	TP-6140	O/I/M Cntrlr Setup & Appl, DecMaker550	1	1	1	1	1	1
3	TP-6200	O/M 20-3250 kW, DecMaker550, Ver 2.10+	1	1	1	1	1	1
3	TP-6694	O/M DEC3000 Controller	1	1	1	1	1	1
3	TP-6747	O/I/M DPS System Installation and Setup	1	1	1	1	1	1
3	TP-6750	O/M DEC 6000 Controller	1	1	1	1	1	1
4	TP-6373	S/M Pilot-Excited PM Altrntr, 350-3250kW	1	1	1	1	1	1
4	TP-6356	S/M Controllers, 20-3250 kW, Ind.	1	1	1	1	1	1
5	TP-6785	P/C 350/400REOZJ, Ind	1	1	1	1	1	1
5	TP-6746	P/C DPS System	1	1	1	1	1	1
5	TP-6780	P/C DEC 550 Controller (J-Box Panel Mt)	1	1	1	1	1	1
5	TP-6781	P/C DEC 3000 Controller	1	1	1	1	1	1
6	TP-6797	W/D 350-500REOZJ, Industrial	1	1	1	1	1	1
7	TP-6787	O/M John Deere 6135HF485 Engine	1	1	1	1	1	1
8	TP-6371	S/M JD Alt & Starting Motors, (CTM77)	1	1	1	1	1	1
8	TP-6788	S/M John Deere 6135HF485 Engine	1	1	1	1	1	1
8	TP-6789	S/M John Deere 6135HF485 Engine Electronic Fuel System	1	1	1	1	1	1
9	TP-6786	P/C John Deere 6135HF485 Engine	1	1	1	1	1	1
10	TP-5578	O/I/S/M Marathon Altntr MmaxDVR (GPN008)	1	1	1	1	1	1

Kit List

This section lists the part numbers of modules/kits not listed in the group parts lists. Refer to the generator set nameplate or the list below to identify the module/kit number installed on your generator set. See the sections following this page for the parts list of the module/kit.

	350/400 kW	500 kW
Controllers		
See Group 701: Literature for list of controller parts manuals.		
Cooling Systems		
Heater, block		
90-120 V	GM75809-KA1	GM75809-KA1
190-208 V	GM75809-KA2	GM75809-KA2
210-240 V	GM75809-KA3	GM75809-KA3
380-480 V	GM75809-KA4	GM75809-KA4
Duct flange, radiator	GM75810-KA1	GM75810-KA1
	GM85627-KA1	GM85627-KA1
Remote Radiator Setup	GM78803-MA1	GM78803-MA2

Cooling System Kits

Qty.	Description	Part No.
Block Heater, 2500W, 90/120V, 1Ph		**GM75809-KA1**
1	Heater, Block	GM76113
	1 Block Heater Service Element 120V/2500W	GM29477
1	Tag, hang	279047
2	Valve, Shutoff (3/4-14npt)	GM19666
1	Tag, Hang	GM39752
1	Bracket, Block Heater	GM51263
2	Washer, Plain, 8.4 ID x 16.0 OD	M125A-08-80
2	Washer, Plain, 10.5 ID x 20.0 OD	M125A-10-80
4	Nut, Hex 6mm	M6923-06-80
1	Nut, Hex 8mm	M6923-08-80
4	Screw, Hex Cap	M933-06025-60
1	Screw, Hex Cap	M933-08025-60
2	Screw, hex cap,fully thrd M10 x 25mm	M933-10025-60
3	Pipe, Nipple (3/4" npt x 1.38")	X-206-9
1	Pipe (3/4"npt x 3.50")	X-206-6
4	Washer, Plain	M125A-06-80
4	Clamp, hose, .69/1.25 in.	X-426-12
2	Connector, hose + Vibra Seal	X-582-8
1	Hose, Coolant 44"	X-6367-1
1	Clamp, insulated, 1.25 in.	X-672-20
1	Hose, Coolant 65"	X-6367-9
2	Elbow, pipe (90 deg x 3/4"npt)	X-215-2
Block Heater, 2500W, 190/208V, 1 Ph		**GM75809-KA2**
1	Heater, Block	GM76114
	1 Block Heater Service Element 208V/2500W	GM29478
1	Tag, hang	279047
2	Valve, Shutoff (3/4-14npt)	GM19666
1	Tag, Hang	GM39752
1	Bracket, Block Heater	GM51263
2	Washer, Plain, 8.4 ID x 16.0 OD	M125A-08-80
2	Washer, Plain, 10.5 ID x 20.0 OD	M125A-10-80
4	Nut, Hex 6mm	M6923-06-80
1	Nut, Hex 8mm	M6923-08-80
4	Screw, Hex Cap	M933-06025-60
1	Screw, Hex Cap	M933-08025-60
2	Screw, hex cap,fully thrd M10 x 25mm	M933-10025-60
3	Pipe, Nipple (3/4" npt x 1.38")	X-206-9
1	Pipe (3/4"npt x 3.50")	X-206-6
4	Washer, Plain	M125A-06-80
4	Clamp, hose, .69/1.25 in.	X-426-12
2	Connector, hose + Vibra Seal	X-582-8
1	Hose, Coolant 44"	X-6367-1
1	Clamp, insulated, 1.25 in.	X-672-20
1	Hose, Coolant 65"	X-6367-9
2	Elbow, pipe (90 deg x 3/4"npt)	X-215-2

Qty.	Description	Part No.
Block Heater, 2500W, 210/240V, 1Ph		**GM75809-KA3**
1	Heater, Block	GM76115
	1 Block Heater Service Element 240V/2500W	GM29474
1	Tag, hang	279047
2	Valve, Shutoff (3/4-14npt)	GM19666
1	Tag, Hang	GM39752
1	Bracket, Block Heater	GM51263
2	Washer, Plain, 8.4 ID x 16.0 OD	M125A-08-80
2	Washer, Plain, 10.5 ID x 20.0 OD	M125A-10-80
4	Nut, Hex 6mm	M6923-06-80
1	Nut, Hex 8mm	M6923-08-80
4	Screw, Hex Cap	M933-06025-60
1	Screw, Hex Cap	M933-08025-60
2	Screw, hex cap,fully thrd M10 x 25mm	M933-10025-60
3	Pipe, Nipple (3/4" npt x 1.38")	X-206-9
1	Pipe (3/4"npt x 3.50")	X-206-6
4	Washer, Plain	M125A-06-80
4	Clamp, hose, .69/1.25 in.	X-426-12
2	Connector, hose + Vibra Seal	X-582-8
1	Hose, Coolant 44"	X-6367-1
1	Clamp, insulated, 1.25 in.	X-672-20
1	Hose, Coolant 65"	X-6367-9
2	Elbow, pipe (90 deg x 3/4"npt)	X-215-2
Block Heater, 2500W, 380/480V, 1Ph		**GM75809-KA4**
1	Heater, Block	GM76116
	1 Block Heater Service Element 480V/2500W	GM29479
1	Tag, hang	279047
2	Valve, Shutoff (3/4-14npt)	GM19666
1	Tag, Hang	GM39752
1	Bracket, Block Heater	GM51263
2	Washer, Plain, 8.4 ID x 16.0 OD	M125A-08-80
2	Washer, Plain, 10.5 ID x 20.0 OD	M125A-10-80
4	Nut, Hex 6mm	M6923-06-80
1	Nut, Hex 8mm	M6923-08-80
4	Screw, Hex Cap	M933-06025-60
1	Screw, Hex Cap	M933-08025-60
2	Screw, hex cap,fully thrd M10 x 25mm	M933-10025-60
3	Pipe, Nipple (3/4" npt x 1.38")	X-206-9
1	Pipe (3/4"npt x 3.50")	X-206-6
4	Washer, Plain	M125A-06-80
4	Clamp, hose, .69/1.25 in.	X-426-12
2	Connector, hose + Vibra Seal	X-582-8
1	Hose, Coolant 44"	X-6367-1
1	Clamp, insulated, 1.25 in.	X-672-20
1	Hose, Coolant 65"	X-6367-9
2	Elbow, pipe (90 deg x 3/4"npt)	X-215-2

Qty.	Description	Part No.
Duct Flange, Radiator		**GM75810-KA1**
2	Frame, Air Duct (Vertical)	GM70150
2	Frame, Air Duct (Horizontal)	GM70151
Duct Flange, Radiator		**GM85627-KA1**
2	Frame, Air Duct (Vertical)	GM85625
2	Frame, Air Duct (Horizontal)	GM85626

Qty.	Description	Part No.
Remote Radiator Setup		**GM78803-MA1**
1	Tube, Turbo CAC	GM77295
1	Gasket, CAC Graphite	GM77635
1	Clamp, Exhaust (5.25 in.)	GM77638
1	Bracket, Support	365237
1	Hose, Radiator (Upper)	GM39269
1	Bracket, Belt Guard	GM64267
1	Hose, Radiator Lower	GM77293
1	Tube, Intake	GM77294
1	Guard, Belt (RH)	GM77297
1	Guard, Belt (LH)	GM77298
1	Guard, Belt (Top)	GM77299
1	Guard, Belt (Bottom)	GM77300
2	Bracket, Belt Guard Mtg	GM77301
2	Clamp, Hose, 4.13/4.44	GM78800
1	Guard, Pulley Cover	GM78805
1	Guard, Belt	GM79503
1	Washer, Plain 10.5 Id X 20.0 OD	M125A-10-80
4	Washer, Plain	M125A-16-80
18	Screw, Hex Flnge M6x16mm Flly Thrd Js500	M6921-06016-60
1	Nut, Hex 10mm	M6923-10-80
16	Screw, Metric Thread Forming 12mm	M7500D-06012-81
1	Screw, Hex Cap,Fully Thrd M10 X 25mm	M933-10025-60
4	Screw, Hex Cap	M933-16040-60
2	Clamp, hose, .69/1.25 in.	X-426-12
1	Hose, Radiator Wire Inset 4.00 ID	X-6014-91
1	Connector, Hose + Vibra Seal 6.4	X-652-3
Remote Radiator Setup		**GM78803-MA2**
1	Clamp, muffler, 3.12 in.	286283
2	Clamp, Hose, 3.06/3.38 in.	343175
1	Tube, Turbo CAC	GM78799
1	Bracket, CAC Tube	GM84770
1	Hose, Charged Air Cooler	GM85118
1	Bracket, Support	365237
1	Hose, Radiator (Upper)	GM39269
1	Bracket, Belt Guard	GM64267
1	Hose, Radiator Lower	GM77293
1	Tube, Intake	GM77294
1	Guard, Belt (RH)	GM77297
1	Guard, Belt (LH)	GM77298
1	Guard, Belt (Top)	GM77299
1	Guard, Belt (Bottom)	GM77300
2	Bracket, Belt Guard Mtg	GM77301
2	Clamp, Hose, 4.13/4.44	GM78800
1	Guard, Pulley Cover	GM78805
1	Guard, Belt	GM79503
1	Washer, Plain 10.5 Id X 20.0 OD	M125A-10-80
4	Washer, Plain	M125A-16-80
18	Screw, Hex Flnge M6x16mm Flly Thrd Js500	M6921-06016-60
1	Nut, Hex 10mm	M6923-10-80
16	Screw, Metric Thread Forming 12mm	M7500D-06012-81
1	Screw, Hex Cap,Fully Thrd M10 X 25mm	M933-10025-60
4	Screw, Hex Cap	M933-16040-60
2	Clamp, hose, .69/1.25 in.	X-426-12
1	Hose, Radiator Wire Inset 4.00 ID	X-6014-91
1	Connector, Hose + Vibra Seal 6.4	X-652-3

Appendix A Abbreviations

The following list contains abbreviations that may appear in this publication.

A, amp	ampere
ABDC	after bottom dead center
AC	alternating current
A/D	analog to digital
ADC	advanced digital control; analog to digital converter
adj.	adjust, adjustment
ADV	advertising dimensional drawing
Ah	amp-hour
AHWT	anticipatory high water temperature
AISI	American Iron and Steel Institute
ALOP	anticipatory low oil pressure
alt.	alternator
Al	aluminum
ANSI	American National Standards Institute (formerly American Standards Association, ASA)
AO	anticipatory only
APDC	Air Pollution Control District
API	American Petroleum Institute
approx.	approximate, approximately
AQMD	Air Quality Management District
AR	as required, as requested
AS	as supplied, as stated, as suggested
ASE	American Society of Engineers
ASME	American Society of Mechanical Engineers
assy.	assembly
ASTM	American Society for Testing Materials
ATDC	after top dead center
ATS	automatic transfer switch
auto.	automatic
aux.	auxiliary
avg.	average
AVR	automatic voltage regulator
AWG	American Wire Gauge
AWM	appliance wiring material
bat.	battery
BBDC	before bottom dead center
BC	battery charger, battery charging
BCA	battery charging alternator
BCI	Battery Council International
BDC	before dead center
BHP	brake horsepower
blk.	black (paint color), block (engine)
blk. htr.	block heater
BMEP	brake mean effective pressure
bps	bits per second
br.	brass
BTDC	before top dead center
Btu	British thermal unit
Btu/min.	British thermal units per minute
C	Celsius, centigrade
cal.	calorie
CAN	controller area network
CARB	California Air Resources Board
CB	circuit breaker
cc	cubic centimeter
CCA	cold cranking amps
ccw.	counterclockwise
CEC	Canadian Electrical Code
cert.	certificate, certification, certified
cfh	cubic feet per hour
cfm	cubic feet per minute
CG	center of gravity
CID	cubic inch displacement
CL	centerline
cm	centimeter
CMOS	complementary metal oxide substrate (semiconductor)
cogen.	cogeneration
com	communications (port)
coml	commercial
Coml/Rec	Commercial/Recreational
conn.	connection
cont.	continued
CPVC	chlorinated polyvinyl chloride
crit.	critical
CRT	cathode ray tube
CSA	Canadian Standards Association
CT	current transformer
Cu	copper
cUL	Canadian Underwriter's Laboratories
CUL	Canadian Underwriter's Laboratories
cu. in.	cubic inch
cw.	clockwise
CWC	city water-cooled
cyl.	cylinder
D/A	digital to analog
DAC	digital to analog converter
dB	decibel
dB(A)	decibel (A weighted)
DC	direct current
DCR	direct current resistance
deg., °	degree
dept.	department
DFMEA	Design Failure Mode and Effects Analysis
dia.	diameter
DI/EO	dual inlet/end outlet
DIN	Deutsches Institut fur Normung e. V. (also Deutsche Industrie Normenausschuss)
DIP	dual inline package
DPDT	double-pole, double-throw
DPST	double-pole, single-throw
DS	disconnect switch
DVR	digital voltage regulator
E, emer.	emergency (power source)
ECM	electronic control module, engine control module
EDI	electronic data interchange
EFR	emergency frequency relay
e.g.	for example (*exempli gratia)*
EG	electronic governor
EGSA	Electrical Generating Systems Association
EIA	Electronic Industries Association
EI/EO	end inlet/end outlet
EMI	electromagnetic interference
emiss.	emission
eng.	engine
EPA	Environmental Protection Agency
EPS	emergency power system
ER	emergency relay
ES	engineering special, engineered special
ESD	electrostatic discharge
est.	estimated
E-Stop	emergency stop
etc.	et cetera (and so forth)
exh.	exhaust
ext.	external
F	Fahrenheit, female
fglass.	fiberglass
FHM	flat head machine (screw)
fl. oz.	fluid ounce
flex.	flexible
freq.	frequency
FS	full scale
ft.	foot, feet
ft. lb.	foot pounds (torque)
ft./min.	feet per minute
ftp	file transfer protocol
g	gram
ga.	gauge (meters, wire size)
gal.	gallon
gen.	generator
genset	generator set
GFI	ground fault interrupter
GND, ⏚	ground
gov.	governor
gph	gallons per hour
gpm	gallons per minute
gr.	grade, gross
GRD	equipment ground
gr. wt.	gross weight
H x W x D	height by width by depth
HC	hex cap
HCHT	high cylinder head temperature
HD	heavy duty
HET	high exhaust temp., high engine temp.
hex	hexagon
Hg	mercury (element)
HH	hex head
HHC	hex head cap
HP	horsepower
hr.	hour
HS	heat shrink
hsg.	housing
HVAC	heating, ventilation, and air conditioning
HWT	high water temperature
Hz	hertz (cycles per second)
IC	integrated circuit
ID	inside diameter, identification
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IMS	improved motor starting
in.	inch
in. H_2O	inches of water
in. Hg	inches of mercury
in. lb.	inch pounds
Inc.	incorporated
ind.	industrial
int.	internal
int./ext.	internal/external
I/O	input/output
IP	iron pipe
ISO	International Organization for Standardization
J	joule
JIS	Japanese Industry Standard
k	kilo (1000)
K	kelvin
kA	kiloampere

KB	kilobyte (2^{10} bytes)
KBus	Kohler communication protocol
kg	kilogram
kg/cm^2	kilograms per square centimeter
kgm	kilogram-meter
kg/m^3	kilograms per cubic meter
kHz	kilohertz
kJ	kilojoule
km	kilometer
kOhm, kΩ	kilo-ohm
kPa	kilopascal
kph	kilometers per hour
kV	kilovolt
kVA	kilovolt ampere
kVAR	kilovolt ampere reactive
kW	kilowatt
kWh	kilowatt-hour
kWm	kilowatt mechanical
kWth	kilowatt-thermal
L	liter
LAN	local area network
L x W x H	length by width by height
lb.	pound, pounds
lbm/ft^3	pounds mass per cubic feet
LCB	line circuit breaker
LCD	liquid crystal display
ld. shd.	load shed
LED	light emitting diode
Lph	liters per hour
Lpm	liters per minute
LOP	low oil pressure
LP	liquefied petroleum
LPG	liquefied petroleum gas
LS	left side
L_{wa}	sound power level, A weighted
LWL	low water level
LWT	low water temperature
m	meter, milli (1/1000)
M	mega (10^6 when used with SI units), male
m^3	cubic meter
m^3/hr.	cubic meters per hour
m^3/min.	cubic meters per minute
mA	milliampere
man.	manual
max.	maximum
MB	megabyte (2^{20} bytes)
MCCB	molded-case circuit breaker
MCM	one thousand circular mils
meggar	megohmmeter
MHz	megahertz
mi.	mile
mil	one one-thousandth of an inch
min.	minimum, minute
misc.	miscellaneous
MJ	megajoule
mJ	millijoule
mm	millimeter
mOhm, mΩ	milliohm
MOhm, MΩ	megohm
MOV	metal oxide varistor
MPa	megapascal
mpg	miles per gallon
mph	miles per hour
MS	military standard
ms	millisecond
m/sec.	meters per second
MTBF	mean time between failure
MTBO	mean time between overhauls
mtg.	mounting
MTU	Motoren-und Turbinen-Union
MW	megawatt
mW	milliwatt
μF	microfarad
N, norm.	normal (power source)
NA	not available, not applicable
nat. gas	natural gas
NBS	National Bureau of Standards
NC	normally closed
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
Nm	newton meter
NO	normally open
no., nos.	number, numbers
NPS	National Pipe, Straight
NPSC	National Pipe, Straight-coupling
NPT	National Standard taper pipe thread per general use
NPTF	National Pipe, Taper-Fine
NR	not required, normal relay
ns	nanosecond
OC	overcrank
OD	outside diameter
OEM	original equipment manufacturer
OF	overfrequency
opt.	option, optional
OS	oversize, overspeed
OSHA	Occupational Safety and Health Administration
OV	overvoltage
oz.	ounce
p., pp.	page, pages
PC	personal computer
PCB	printed circuit board
pF	picofarad
PF	power factor
ph., ∅	phase
PHC	Phillips® head Crimptite® (screw)
PHH	Phillips® hex head (screw)
PHM	pan head machine (screw)
PLC	programmable logic control
PMG	permanent magnet generator
pot	potentiometer, potential
ppm	parts per million
PROM	programmable read-only memory
psi	pounds per square inch
psig	pounds per square inch gauge
pt.	pint
PTC	positive temperature coefficient
PTO	power takeoff
PVC	polyvinyl chloride
qt.	quart, quarts
qty.	quantity
R	replacement (emergency) power source
rad.	radiator, radius
RAM	random access memory
RDO	relay driver output
ref.	reference
rem.	remote
Res/Coml	Residential/Commercial
RFI	radio frequency interference
RH	round head
RHM	round head machine (screw)
rly.	relay
rms	root mean square
rnd.	round
ROM	read only memory
rot.	rotate, rotating
rpm	revolutions per minute
RS	right side
RTU	remote terminal unit
RTV	room temperature vulcanization
RW	read/write
SAE	Society of Automotive Engineers
scfm	standard cubic feet per minute
SCR	silicon controlled rectifier
s, sec.	second
SI	*Systeme international d'unites,* International System of Units
SI/EO	side in/end out
sil.	silencer
SN	serial number
SNMP	simple network management protocol
SPDT	single-pole, double-throw
SPST	single-pole, single-throw
spec	specification
specs	specification(s)
sq.	square
sq. cm	square centimeter
sq. in.	square inch
SS	stainless steel
std.	standard
stl.	steel
tach.	tachometer
TD	time delay
TDC	top dead center
TDEC	time delay engine cooldown
TDEN	time delay emergency to normal
TDES	time delay engine start
TDNE	time delay normal to emergency
TDOE	time delay off to emergency
TDON	time delay off to normal
temp.	temperature
term.	terminal
THD	total harmonic distortion
TIF	telephone influence factor
TIR	total indicator reading
tol.	tolerance
turbo.	turbocharger
typ.	typical (same in multiple locations)
UF	underfrequency
UHF	ultrahigh frequency
UL	Underwriter's Laboratories, Inc.
UNC	unified coarse thread (was NC)
UNF	unified fine thread (was NF)
univ.	universal
US	undersize, underspeed
UV	ultraviolet, undervoltage
V	volt
VAC	volts alternating current
VAR	voltampere reactive
VDC	volts direct current
VFD	vacuum fluorescent display
VGA	video graphics adapter
VHF	very high frequency
W	watt
WCR	withstand and closing rating
w/	with
w/o	without
wt.	weight
xfmr	transformer

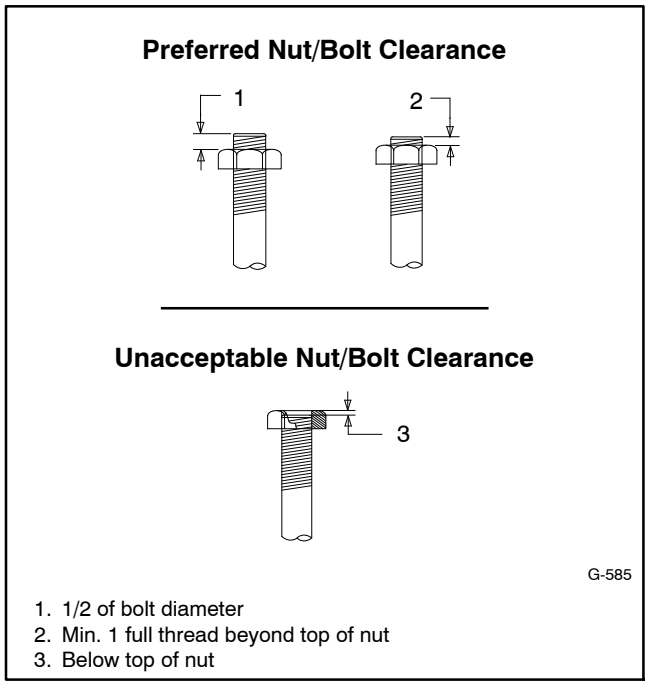
Appendix B Common Hardware Application Guidelines

Use the information below and on the following pages to identify proper fastening techniques when no specific reference for reassembly is made.

Bolt/Screw Length: When bolt/screw length is not given, use Figure 1 as a guide. As a general rule, a minimum length of one thread beyond the nut and a maximum length of 1/2 the bolt/screw diameter beyond the nut is the preferred method.

Washers and Nuts: Use split lock washers as a bolt locking device where specified. Use SAE flat washers with whiz nuts, spiralock nuts, or standard nuts and preloading (torque) of the bolt in all other applications.

See Appendix C, General Torque Specifications, and other torque specifications in the service literature.



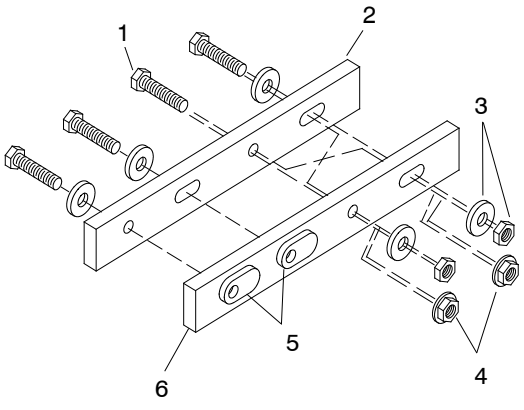
1. 1/2 of bolt diameter
2. Min. 1 full thread beyond top of nut
3. Below top of nut

Figure 1 Acceptable Bolt Lengths

Steps for common hardware application:

1. Determine entry hole type: round or slotted.
2. Determine exit hole type: fixed female thread (weld nut), round, or slotted.

   For round and slotted exit holes, determine if hardware is greater than 1/2 inch in diameter, or 1/2 inch in diameter or less. Hardware that is *greater than 1/2 inch* in diameter takes a standard nut and SAE washer. Hardware *1/2 inch or less* in diameter can take a properly torqued whiz nut or spiralock nut. See Figure 2.
3. Follow these SAE washer rules after determining exit hole type:
   a. Always use a washer between hardware and a slot.
   b. Always use a washer under a nut (see 2 above for exception).
   c. Use a washer under a bolt when the female thread is fixed (weld nut).
4. Refer to Figure 2, which depicts the preceding hardware configuration possibilities.



1. Cap screw
2. Entry hole types
3. Standard nut and SAE washer
4. Whiz nut or spiralock: up to 1/2 in. dia. hardware
5. Weld nuts: above 1/2 in. dia. hardware
6. Exit hole types

Figure 2 Acceptable Hardware Combinations

Appendix C General Torque Specifications

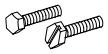
American Standard Fasteners Torque Specifications								
Size	Torque Measurement	Assembled into Cast Iron or Steel						Assembled into Aluminum Grade 2 or 5
		Grade 2		Grade 5		Grade 8		
8-32	Nm (in. lb.)	1.8	(16)	2.3	(20)	—		See Note 3
10-24	Nm (in. lb.)	2.9	(26)	3.6	(32)	—		
10-32	Nm (in. lb.)	2.9	(26)	3.6	(32)	—		
1/4-20	Nm (in. lb.)	6.8	(60)	10.8	(96)	14.9	(132)	
1/4-28	Nm (in. lb.)	8.1	(72)	12.2	(108)	16.3	(144)	
5/16-18	Nm (in. lb.)	13.6	(120)	21.7	(192)	29.8	(264)	
5/16-24	Nm (in. lb.)	14.9	(132)	23.1	(204)	32.5	(288)	
3/8-16	Nm (ft. lb.)	24.0	(18)	38.0	(28)	53.0	(39)	
3/8-24	Nm (ft. lb.)	27.0	(20)	42.0	(31)	60.0	(44)	
7/16-14	Nm (ft. lb.)	39.0	(29)	60.0	(44)	85.0	(63)	
7/16-20	Nm (ft. lb.)	43.0	(32)	68.0	(50)	95.0	(70)	
1/2-13	Nm (ft. lb.)	60.0	(44)	92.0	(68)	130.0	(96)	
1/2-20	Nm (ft. lb.)	66.0	(49)	103.0	(76)	146.0	(108)	
9/16-12	Nm (ft. lb.)	81.0	(60)	133.0	(98)	187.0	(138)	
9/16-18	Nm (ft. lb.)	91.0	(67)	148.0	(109)	209.0	(154)	
5/8-11	Nm (ft. lb.)	113.0	(83)	183.0	(135)	259.0	(191)	
5/8-18	Nm (ft. lb.)	128.0	(94)	208.0	(153)	293.0	(216)	
3/4-10	Nm (ft. lb.)	199.0	(147)	325.0	(240)	458.0	(338)	
3/4-16	Nm (ft. lb.)	222.0	(164)	363.0	(268)	513.0	(378)	
1-8	Nm (ft. lb.)	259.0	(191)	721.0	(532)	1109.0	(818)	
1-12	Nm (ft. lb.)	283.0	(209)	789.0	(582)	1214.0	(895)	

Metric Fasteners Torque Specifications, Measured in Nm (ft. lb.)								
Size (mm)	Assembled into Cast Iron or Steel						Assembled into Aluminum Grade 5.8 or 8.8
	Grade 5.8		Grade 8.8		Grade 10.9		
M6 x 1.00	6.2	(4.6)	9.5	(7)	13.6	(10)	See Note 3
M8 x 1.25	15.0	(11)	23.0	(17)	33.0	(24)	
M8 x 1.00	16.0	(11)	24.0	(18)	34.0	(25)	
M10 x 1.50	30.0	(22)	45.0	(34)	65.0	(48)	
M10 x 1.25	31.0	(23)	47.0	(35)	68.0	(50)	
M12 x 1.75	53.0	(39)	80.0	(59)	115.0	(85)	
M12 x 1.50	56.0	(41)	85.0	(63)	122.0	(90)	
M14 x 2.00	83.0	(61)	126.0	(93)	180.0	(133)	
M14 x 1.50	87.0	(64)	133.0	(98)	190.0	(140)	
M16 x 2.00	127.0	(94)	194.0	(143)	278.0	(205)	
M16 x 1.50	132.0	(97)	201.0	(148)	287.0	(212)	
M18 x 2.50	179.0	(132)	273.0	(201)	390.0	(288)	
M18 x 1.50	189.0	(140)	289.0	(213)	413.0	(305)	

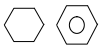
Notes:

1. The torque values above are general guidelines. Always use the torque values specified in the service manuals and/or assembly drawings when they differ from the above torque values.
2. The torque values above are based on new plated threads. Increase torque values by 15% if non-plated threads are used.
3. Hardware threaded into aluminum must have either two diameters of thread engagement or a 30% or more reduction in the torque to prevent stripped threads.
4. Torque values are calculated as equivalent stress loading on American hardware with an approximate preload of 90% of the yield strength and a friction coefficient of 0.125.

Appendix D Common Hardware Identification

Screw/Bolts/Studs	
Head Styles	
Hex Head or Machine Head	
Hex Head or Machine Head with Washer	
Flat Head (FHM)	
Round Head (RHM)	
Pan Head	
Hex Socket Head Cap or Allen™ Head Cap	
Hex Socket Head or Allen™ Head Shoulder Bolt	
Sheet Metal Screw	
Stud	
Drive Styles	
Hex	
Hex and Slotted	
Phillips®	
Slotted	
Hex Socket	

Nuts	
Nut Styles	
Hex Head	
Lock or Elastic	
Square	
Cap or Acorn	
Wing	
Washers	
Washer Styles	
Plain	
Split Lock or Spring	
Spring or Wave	
External Tooth Lock	
Internal Tooth Lock	
Internal-External Tooth Lock	

Hardness Grades	
American Standard	
Grade 2	
Grade 5	
Grade 8	
Grade 8/9 (Hex Socket Head)	
Metric	
Number stamped on hardware; 5.8 shown	

Allen™ head screw is a trademark of Holo-Krome Co.

Phillips® screw is a registered trademark of Phillips Screw Company.

Sample Dimensions

American Standard (Screws, Bolts, Studs, and Nuts)

1/4-20 x 1

- 1 — Length In Inches (Screws and Bolts)
- 20 — Threads Per Inch
- 1/4 — Major Thread Diameter In Fractional Inches Or Screw Number Size

Metric (Screws, Bolts, Studs, and Nuts)

M8-1.25 x 20

- 20 — Length In Millimeters (Screws and Bolts)
- 1.25 — Distance Between Threads In Millimeters
- M8 — Major Thread Diameter In Millimeters

Plain Washers

9/32 x 5/8 x 1/16

- 1/16 — Thickness
- 5/8 — External Dimension
- 9/32 — Internal Dimension

Lock Washers

5/8

- 5/8 — Internal Dimension

Appendix E Common Hardware List

The Common Hardware List lists part numbers and dimensions for common hardware items.

American Standard

Part No.	Dimensions
Hex Head Bolts (Grade 5)	
X-465-17	1/4-20 x .38
X-465-6	1/4-20 x .50
X-465-2	1/4-20 x .62
X-465-16	1/4-20 x .75
X-465-18	1/4-20 x .88
X-465-7	1/4-20 x 1.00
X-465-8	1/4-20 x 1.25
X-465-9	1/4-20 x 1.50
X-465-10	1/4-20 x 1.75
X-465-11	1/4-20 x 2.00
X-465-12	1/4-20 x 2.25
X-465-14	1/4-20 x 2.75
X-465-21	1/4-20 x 5.00
X-465-25	1/4-28 x .38
X-465-20	1/4-28 x 1.00
X-125-33	5/16-18 x .50
X-125-23	5/16-18 x .62
X-125-3	5/16-18 x .75
X-125-31	5/16-18 x .88
X-125-5	5/16-18 x 1.00
X-125-24	5/16-18 x 1.25
X-125-34	5/16-18 x 1.50
X-125-25	5/16-18 x 1.75
X-125-26	5/16-18 x 2.00
230578	5/16-18 x 2.25
X-125-29	5/16-18 x 2.50
X-125-27	5/16-18 x 2.75
X-125-28	5/16-18 x 3.00
X-125-22	5/16-18 x 4.50
X-125-32	5/16-18 x 5.00
X-125-35	5/16-18 x 5.50
X-125-36	5/16-18 x 6.00
X-125-40	5/16-18 x 6.50
X-125-43	5/16-24 x 1.75
X-125-44	5/16-24 x 2.50
X-125-30	5/16-24 x .75
X-125-39	5/16-24 x 2.00
X-125-38	5/16-24 x 2.75
X-6238-2	3/8-16 x .62
X-6238-10	3/8-16 x .75
X-6238-3	3/8-16 x .88
X-6238-11	3/8-16 x 1.00
X-6238-4	3/8-16 x 1.25
X-6238-5	3/8-16 x 1.50
X-6238-1	3/8-16 x 1.75
X-6238-6	3/8-16 x 2.00
X-6238-17	3/8-16 x 2.25
X-6238-7	3/8-16 x 2.50
X-6238-8	3/8-16 x 2.75
X-6238-9	3/8-16 x 3.00
X-6238-19	3/8-16 x 3.25
X-6238-12	3/8-16 x 3.50
X-6238-20	3/8-16 x 3.75
X-6238-13	3/8-16 x 4.50
X-6238-18	3/8-16 x 5.50
X-6238-25	3/8-16 x 6.50

Part No.	Dimensions
Hex Head Bolts, cont.	
X-6238-14	3/8-24 x .75
X-6238-16	3/8-24 x 1.25
X-6238-21	3/8-24 x 4.00
X-6238-22	3/8-24 x 4.50
X-6024-5	7/16-14 x .75
X-6024-2	7/16-14 x 1.00
X-6024-8	7/16-14 x 1.25
X-6024-3	7/16-14 x 1.50
X-6024-4	7/16-14 x 2.00
X-6024-11	7/16-14 x 2.75
X-6024-12	7/16-14 x 6.50
X-129-15	1/2-13 x .75
X-129-17	1/2-13 x 1.00
X-129-18	1/2-13 x 1.25
X-129-19	1/2-13 x 1.50
X-129-20	1/2-13 x 1.75
X-129-21	1/2-13 x 2.00
X-129-22	1/2-13 x 2.25
X-129-23	1/2-13 x 2.50
X-129-24	1/2-13 x 2.75
X-129-25	1/2-13 x 3.00
X-129-27	1/2-13 x 3.50
X-129-29	1/2-13 x 4.00
X-129-30	1/2-13 x 4.50
X-463-9	1/2-13 x 5.50
X-129-44	1/2-13 x 6.00
X-129-51	1/2-20 x .75
X-129-45	1/2-20 x 1.25
X-129-52	1/2-20 x 1.50
X-6021-3	5/8-11 x 1.00
X-6021-4	5/8-11 x 1.25
X-6021-2	5/8-11 x 1.50
X-6021-1	5/8-11 x 1.75
273049	5/8-11 x 2.00
X-6021-5	5/8-11 x 2.25
X-6021-6	5/8-11 x 2.50
X-6021-7	5/8-11 x 2.75
X-6021-12	5/8-11 x 3.75
X-6021-11	5/8-11 x 4.50
X-6021-10	5/8-11 x 6.00
X-6021-9	5/8-18 x 2.50
X-6239-1	3/4-10 x 1.00
X-6239-8	3/4-10 x 1.25
X-6239-2	3/4-10 x 1.50
X-6239-3	3/4-10 x 2.00
X-6239-4	3/4-10 x 2.50
X-6239-5	3/4-10 x 3.00
X-6239-6	3/4-10 x 3.50
X-792-1	1-8 x 2.25
X-792-5	1-8 x 3.00
X-792-8	1-8 x 5.00

Part No.	Dimensions	Type
Hex Nuts		
X-6009-1	1-8	Standard
X-6210-3	6-32	Whiz
X-6210-4	8-32	Whiz
X-6210-5	10-24	Whiz
X-6210-1	10-32	Whiz
X-6210-2	1/4-20	Spiralock
X-6210-6	1/4-28	Spiralock
X-6210-7	5/16-18	Spiralock
X-6210-8	5/16-24	Spiralock
X-6210-9	3/8-16	Spiralock
X-6210-10	3/8-24	Spiralock
X-6210-11	7/16-14	Spiralock
X-6210-12	1/2-13	Spiralock
X-6210-15	7/16-20	Spiralock
X-6210-14	1/2-20	Spiralock
X-85-3	5/8-11	Standard
X-88-12	3/4-10	Standard
X-89-2	1/2-20	Standard

Washers

Part No.	ID	OD	Thick.	Bolt/ Screw
X-25-46	.125	.250	.022	#4
X-25-9	.156	.375	.049	#6
X-25-48	.188	.438	.049	#8
X-25-36	.219	.500	.049	#10
X-25-40	.281	.625	.065	1/4
X-25-85	.344	.687	.065	5/16
X-25-37	.406	.812	.065	3/8
X-25-34	.469	.922	.065	7/16
X-25-26	.531	1.062	.095	1/2
X-25-15	.656	1.312	.095	5/8
X-25-29	.812	1.469	.134	3/4
X-25-127	1.062	2.000	.134	1

Metric

Hex head bolts are hardness grade 8.8 unless noted.

Hex Head Bolts (Partial Thread)

Part No.	Dimensions
M931-05055-60	M5-0.80 x 55
M931-06040-60	M6-1.00 x 40
M931-06055-60	M6-1.00 x 55
M931-06060-60	M6-1.00 x 60
M931-06060-SS	M6-1.00 x 60
M931-06070-60	M6-1.00 x 70
M931-06070-SS	M6-1.00 x 70
M931-06075-60	M6-1.00 x 75
M931-06090-60	M6-1.00 x 90
M931-06145-60	M6-1.00 x 145
M931-06150-60	M6-1.00 x 150
M931-08035-60	M8-1.25 x 35
M931-08040-60	M8-1.25 x 40
M931-08045-60	M8-1.25 x 45
M931-08050-60	M8-1.25 x 50
M931-08055-60	M8-1.25 x 55
M931-08055-82	M8-1.25 x 55*
M931-08060-60	M8-1.25 x 60
M931-08070-60	M8-1.25 x 70
M931-08070-82	M8-1.25 x 70*
M931-08075-60	M8-1.25 x 75
M931-08080-60	M8-1.25 x 80
M931-08090-60	M8-1.25 x 90
M931-08095-60	M8-1.25 x 95
M931-08100-60	M8-1.25 x 100
M931-08110-60	M8-1.25 x 110
M931-08120-60	M8-1.25 x 120
M931-08130-60	M8-1.25 x 130
M931-08140-60	M8-1.25 x 140
M931-08150-60	M8-1.25 x 150
M931-08200-60	M8-1.25 x 200
M931-10040-82	M10-1.25 x 40*
M931-10040-60	M10-1.50 x 40
M931-10045-60	M10-1.50 x 45
M931-10050-60	M10-1.50 x 50
M931-10050-82	M10-1.25 x 50*
M931-10055-60	M10-1.50 x 55
M931-10060-60	M10-1.50 x 60
M931-10065-60	M10-1.50 x 65
M931-10070-60	M10-1.50 x 70
M931-10080-60	M10-1.50 x 80
M931-10080-82	M10-1.25 x 80*
M931-10090-60	M10-1.50 x 90
M931-10090-82	M10-1.50 x 90*
M931-10100-60	M10-1.50 x 100
M931-10110-60	M10-1.50 x 110
M931-10120-60	M10-1.50 x 120
M931-10130-60	M10-1.50 x 130
M931-10140-60	M10-1.50 x 140
M931-10180-60	M10-1.50 x 180
M931-10235-60	M10-1.50 x 235
M931-10260-60	M10-1.50 x 260
M960-10330-60	M10-1.25 x 330
M931-12045-60	M12-1.75 x 45
M960-12050-60	M12-1.25 x 50
M960-12050-82	M12-1.25 x 50*
M931-12050-60	M12-1.75 x 50
M931-12050-82	M12-1.75 x 50*
M931-12055-60	M12-1.75 x 55
M931-12060-60	M12-1.75 x 60
M931-12060-82	M12-1.75 x 60*
M931-12065-60	M12-1.75 x 65
M931-12075-60	M12-1.75 x 75
M931-12080-60	M12-1.75 x 80
M931-12090-60	M12-1.75 x 90
M931-12100-60	M12-1.75 x 100
M931-12110-60	M12-1.75 x 110

Hex Head Bolts (Partial Thread), continued

Part No.	Dimensions
M960-16090-60	M16-1.50 x 90
M931-16090-60	M16-2.00 x 90
M931-16100-60	M16-2.00 x 100
M931-16100-82	M16-2.00 x 100*
M931-16120-60	M16-2.00 x 120
M931-16150-60	M16-2.00 x 150
M931-20065-60	M20-2.50 x 65
M931-20090-60	M20-2.50 x 90
M931-20100-60	M20-2.50 x 100
M931-20120-60	M20-2.50 x 120
M931-20140-60	M20-2.50 x 140
M931-20160-60	M20-2.50 x 160
M931-22090-60	M22-2.50 x 90
M931-22120-60	M22-2.50 x 120
M931-22160-60	M22-2.50 x 160
M931-24090-60	M24-3.00 x 90
M931-24120-60	M24-3.00 x 120
M931-24160-60	M24-3.00 x 160
M931-24200-60	M24-3.00 x 200

Hex Head Bolts (Full Thread)

M933-04006-60	M4-0.70 x 6
M933-05030-60	M5-0.80 x 30
M933-05035-60	M5-0.80 x 35
M933-05050-60	M5-0.80 x 50
M933-06010-60	M6-1.00 x 10
M933-06012-60	M6-1.00 x 12
M933-06014-60	M6-1.00 x 14
M933-06016-60	M6-1.00 x 16
M933-06020-60	M6-1.00 x 20
M933-06025-60	M6-1.00 x 25
M933-06030-60	M6-1.00 x 30
M933-06040-60	M6-1.00 x 40
M933-06050-60	M6-1.00 x 50
M933-07025-60	M7-1.00 x 25
M933-08010-60	M8-1.25 x 10
M933-08012-60	M8-1.25 x 12
M933-08016-60	M8-1.25 x 16
M933-08020-60	M8-1.25 x 20
M933-08025-60	M8-1.25 x 25
M933-08030-60	M8-1.25 x 30
M933-08030-82	M8-1.25 x 30*
M933-10012-60	M10-1.50 x 12
M961-10020-60	M10-1.25 x 20
M933-10020-60	M10-1.50 x 20
M933-10025-60	M10-1.50 x 25
M961-10025-60	M10-1.25 x 25
M933-10025-82	M10-1.50 x 25*
M961-10030-60	M10-1.25 x 30
M933-10030-60	M10-1.50 x 30
M933-10030-82	M10-1.50 x 30*
M961-10035-60	M10-1.25 x 35
M933-10035-60	M10-1.50 x 35
M933-10035-82	M10-1.50 x 35*
M961-10040-60	M10-1.25 x 40

Hex Head Bolts (Full Thread), continued

Part No.	Dimensions
M933-12016-60	M12-1.75 x 16
M933-12020-60	M12-1.75 x 20
M961-12020-60F	M12-1.50 x 20
M933-12025-60	M12-1.75 x 25
M933-12025-82	M12-1.75 x 25*
M961-12030-60	M12-1.25 x 30
M933-12030-82	M12-1.75 x 30*
M961-12030-82F	M12-1.50 x 30*
M933-12030-60	M12-1.75 x 30
M933-12035-60	M12-1.75 x 35
M961-12040-82	M12-1.25 x 40*
M933-12040-60	M12-1.75 x 40
M933-12040-82	M12-1.75 x 40*
M961-14025-60	M14-1.50 x 25
M933-14025-60	M14-2.00 x 25
M961-14050-82	M14-1.50 x 50*
M961-16025-60	M16-1.50 x 25
M933-16025-60	M16-2.00 x 25
M961-16030-82	M16-1.50 x 30*
M933-16030-82	M16-2.00 x 30*
M933-16035-60	M16-2.00 x 35
M961-16040-60	M16-1.50 x 40
M933-16040-60	M16-2.00 x 40
M961-16045-82	M16-1.50 x 45*
M933-16045-82	M16-2.00 x 45*
M933-16050-60	M16-2.00 x 50
M933-16050-82	M16-2.00 x 50*
M933-16060-60	M16-2.00 x 60
M933-16070-60	M16-2.00 x 70
M933-18035-60	M18-2.50 x 35
M933-18050-60	M18-2.50 x 50
M933-18060-60	M18-2.50 x 60
M933-20050-60	M20-2.50 x 50
M933-20055-60	M20-2.50 x 55
M933-24060-60	M24-3.00 x 60
M933-24065-60	M24-3.00 x 65
M933-24070-60	M24-3.00 x 70

Pan Head Machine Screws

M7985A-03010-20	M3-0.50 x 10
M7985A-03012-20	M3-0.50 x 12
M7985A-04010-20	M4-0.70 x 10
M7985A-04016-20	M4-0.70 x 16
M7985A-04020-20	M4-0.70 x 20
M7985A-04050-20	M4-0.70 x 50
M7985A-04100-20	M4-0.70 x 100
M7985A-05010-20	M5-0.80 x 10
M7985A-05012-20	M5-0.80 x 12
M7985A-05016-20	M5-0.80 x 16
M7985A-05020-20	M5-0.80 x 20
M7985A-05025-20	M5-0.80 x 25
M7985A-05030-20	M5-0.80 x 30
M7985A-05080-20	M5-0.80 x 80
M7985A-05100-20	M5-0.80 x 100
M7985A-06100-20	M6-1.00 x 100

Flat Head Machine Screws

M965A-04012-SS	M4-0.70 x 12
M965A-05012-SS	M5-0.80 x 12
M965A-05016-20	M5-0.80 x 16
M965A-06012-20	M6-1.00 x 12

* This metric hex bolt's hardness is grade 10.9.

Metric, continued

Part No.	Dimensions	Type
Hex Nuts		
M934-03-50	M3-0.50	Standard
M934-04-50	M4-0.70	Standard
M934-04-B	M4-0.70	Brass
M934-05-50	M5-0.80	Standard
M934-06-60	M6-1.00	Standard
M934-06-64	M6-1.00	Std. (green)
M6923-06-80	M6-1.00	Spiralock
M982-06-80	M6-1.00	Elastic Stop
M934-08-60	M8-1.25	Standard
M6923-08-80	M8-1.25	Spiralock
M982-08-80	M8-1.25	Elastic Stop
M934-10-60	M10-1.50	Standard
M934-10-60F	M10-1.25	Standard
M6923-10-80	M10-1.50	Spiralock
M6923-10-62	M10-1.50	Spiralock†
M982-10-80	M10-1.50	Elastic Stop
M934-12-60	M12-1.75	Standard
M934-12-60F	M12-1.25	Standard
M6923-12-80	M12-1.75	Spiralock
M982-12-80	M12-1.75	Elastic Stop
M982-14-60	M14-2.00	Elastic Stop
M6923-16-80	M16-2.00	Spiralock
M982-16-80	M16-2.00	Elastic Stop
M934-18-80	M18-2.5	Standard
M982-18-60	M18-2.50	Elastic Stop
M934-20-80	M20-2.50	Standard
M982-20-80	M20-2.50	Elastic Stop
M934-22-60	M22-2.50	Standard
M934-24-80	M24-3.00	Standard
M982-24-60	M24-3.00	Elastic Stop
M934-30-80	M30-3.50	Standard

Washers

Part No.	ID	OD	Thick.	Bolt/ Screw
M125A-03-80	3.2	7.0	0.5	M3
M125A-04-80	4.3	9.0	0.8	M4
M125A-05-80	5.3	10.0	1.0	M5
M125A-06-80	6.4	12.0	1.6	M6
M125A-08-80	8.4	16.0	1.6	M8
M125A-10-80	10.5	20.0	2.0	M10
M125A-12-80	13.0	24.0	2.5	M12
M125A-14-80	15.0	28.0	2.5	M14
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M125A-18-80	19.0	34.0	3.0	M18
M125A-20-80	21.0	37.0	3.0	M20
M125A-24-80	25.0	44.0	4.0	M24

† This metric hex nut's hardness is grade 8.

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